135. The system of claim 134, wherein the network server module signals the corresponding addresses of the first and second media network resource to the terminal with control signals to automatically playback the first media network resource and then the second media network resource on the terminal.

136. The system of claim 134, further comprising a database including the corresponding addresses of the one or more media network resources on each of the first and second network sites, wherein the network server module selects the first media network resource and the second media network resource from the database using a selection criteria.

137. The system of claim 134, wherein the network server module is coupleable to the user terminal through the network.

138. The system of claim 134, wherein the network server module is located on the user terminal.

139. The system of claim 136, wherein the database is coupleable to the user terminal through the network.

140. The system of claim 136, wherein the database is located on the user terminal.

141. The system of claim 136, wherein the database includes metadata about each of the media network resources, and wherein the network server module selects the first network media resource and the second network media resource using metadata associated with the corresponding address of the first media network resource and the second media network resource.

142. The system of claim 141, wherein the network server module identifies the first and second media network resources by matching a criteria signaled from the terminal to metadata information provided in the database.

143. The system of claim 134, wherein the network server module identifies the first media network resource and the second media network resource through a random selection.

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144. The system of claim 134, wherein the network server module signals the first media network resource, the second media network resource, and other media network resources to the terminal in a predetermined order, the other media network resources being located on the first network site, the second network site, or an other network site.

145. The system of claim 144, wherein the network server module signals the terminal to access a next media network resource in the predetermined order automatically if any of the first media network resource, the second media network resource, or the other media network resources are unavailable.

146. The system of claim 134, wherein the first media network resource and the second media network resource are locatable over the Internet.

147. The system of claim 146, wherein the first media network resource includes an Internet addresses having a first domain, and the second media network resource includes an Internet address having a second domain.

148. The system of claim 134, wherein the first media network resource and the second media network resource include a combination of music and/or video.

149. The system of claim 134, wherein the corresponding addresses of the one or more media network resources on the first network site and on the second network site each contain no internal links.

150. A media playback system for the Internet, the system comprising:
an end terminal including a media playback component; and
a web server module coupleable to the end terminal through the Internet,
the web server module having access to one or more media web resources on a first web site, and to one or more media web resources on a second web site,
the web server module signaling a first link that locates a first media web resource on the first web site, and a second link

that locates a second media web resource on the second web site;

the web server module providing control signals to the end terminal to cause the end terminal to access and load the first media web resource and the second media web resource into the media playback component.

151. The system of claim 150, wherein the web server module provides control signals to the playback component of the end terminal to cause the end terminal to playback the first media web resource after loading the first media web resource, and to playback the second media web resource after loading the second media web resource.

152. The system of claim 151, wherein the end terminal includes a web browser, the web browser receiving the first link and the control signals from the web server module to cause the web server module to display a web page of the first web site concurrently while the first media web resource is being played back, the web browser receiving the second link and the control signals from the web server module to cause the web server module to display a web page of the second web site concurrently while the second web media resource is being played back.

153. A media playback system for the Internet, the system comprising:

a user terminal including a media playback component; and

a web server module coupleable to the user terminal through the Internet, the web server module having access to a plurality of web sites including a first web site and a second web site, each of the plurality of web sites including one or more media web resources, the web server module signaling a first link to a first media web resource on the first web site and a second link to a second media web resource on the second web site, the web server module providing control signals to the user terminal to cause the user terminal to access and load the first media web resource and the second media web resource; and

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a database including links to each of the plurality of media web resources, the web server module identifying the first link and the second link from the database.

154. The system of claim 153, wherein each of the plurality of links in the database are selectable to open a corresponding media web resource in the plurality of media web resources.

155. The system of claim 154, wherein the database includes metadata about each of the plurality of media web resources, and wherein the web server module identifies the first link by using metadata associated with the first media web resource, and the web server module identifies the second link by using metadata associated with the second media web resource.

156. The system of claim 155, wherein the web server module identifies at least the first link by matching a criteria signaled from the terminal to metadata information in the database corresponding to the first media web resource.

157. The system of claim 155, wherein the web server module identifies at least the first link to the first media web resource and the second link to the second media web resource through a random selection.

158. The system of claim 153, wherein the web server module signals the terminal to access another media web resource automatically if an accessed media web resource is unavailable, the other media web resource being located on either the first web site, the second web site, or a third web site.

159. A media playback system for the Internet, the system comprising:
a terminal including a media playback component and a user-interface;
a web server module coupleable to the user terminal through the Internet, the web server module having access to a plurality of links, each of the plurality of links locating a media web resource, the plurality of links being accessible on a plurality of web sites, the web server module signaling the plurality of links to the user terminal in a designated order to cause the terminal to load the media web

resource located by each of the plurality of links into the media playback component; and

a database comprising the plurality of links, the database being accessible to signal the plurality of links to the web server module in the designated order;

wherein the user-interface signals one or more inputs from a user to the web server module, the one or more inputs directing the web server to alter the designated order in which the database signals the plurality of links to the web server module.

160. The system of claim 159, wherein the user-interface signals a first input from the user to skip a subsequent link in the designated order.

161. The system of claim 160, wherein the user-interface signals a second input from the user to cause the web server module to replace a first designated order with a second designated order.

162. The system of claim 161, wherein the first designated order includes a selection of links stored in the database belonging to a first category, and the second designated order includes a selection of links stored in the database belonging to a second category.

163. The system of claim 162, wherein the web server module selects at least some of the plurality of media web resources by matching a criteria signaled from the terminal to metadata information stored in the database, the metadata being sorted to correspond to one or more of the plurality links.

164. The system of claim 159, wherein the web server module randomly selects at least some of the plurality of links.

165. The system of claim 159, wherein the web server module signals another link in the plurality of links to the terminal to as to cause the terminal to access another media web resource automatically if an accessed media web resource is unavailable.

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166. A system for providing media play-back on a network, the system comprising:

a terminal coupleable to the network;

a play-list module coupleable to the terminal, the play-list module storing a first play-list signaled from the terminal, the first play-list comprising a plurality of network addresses, including a first network address that locates a first media network resource on a first network site, and a second network address that locates a second media network resource on a second network site;

a network server module coupleable to the terminal and to the play-list module, the network server module signaling the first play-list to the terminal, the network server module controlling the terminal to cause the terminal to access the media network resource associated with each network address in the first play-list, and to automatically load each respective media network resources into the media playback component.

167. The system of claim 166, wherein the play-list module receives and stores a plurality of play-lists from a plurality of terminals, each play-list comprising a plurality of network addresses, including a first network address that locates a first media network resource on a first network site, and a second network address that locates a second media network resource on a second network site, wherein the network server module responds to a request from a second terminal for a select play-list in the plurality of play-lists by signaling the plurality of network address in the select play-list to the second terminal.

168. The system of claim 167, wherein the media network resource located by each network address in one of the plurality of play-lists is loaded into a playback component on the requesting terminal to playback media having a combination of music and/or video.

169. A method for providing media to a terminal coupled to a network, the terminal comprising a media playback component, the method comprising:

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programmatically directing the terminal to access a first network site in the plurality of network sites;

causing the media playback component on the terminal to automatically load a first media web resource located at the first network site to playback a first media;

programmatically directing the terminal to access a second network site in the plurality of network sites; and

causing the media playback component on the terminal to automatically load a second media web resource located at the second network site to playback a second media.

170. The method of claim 169, further comprising:

programmatically directing the terminal to access one or more additional network sites in the plurality of network sites; and

causing the media playback component on the terminal to automatically load each media web resource located on each of the one or more additional network sites so as to sequentially playback media from each of the network sites accessed by the media playback component.

171. The method of claim 170, wherein programmatically directing the terminal to access a first network site in the plurality of network sites includes loading a first web address for the first network site into a web browser component of the terminal, and wherein programmatically directing the terminal to access a second network site in the plurality of network sites includes loading a second web address for the second network site into the web browser component of the terminal.

172. The method of claim 169, wherein programmatically directing the terminal to access a second network site in the plurality of network sites includes programmatically directing the terminal to access the second network site having an address that is external to the first address.

173. The method of claim 169, wherein programmatically directing the terminal to access the first and second network sites in the plurality of network

sites includes programmatically directing a web browser component and the media playback component from a web server module coupled to the terminal via the network.

174. A method for providing media to a terminal coupled to the Internet, the method comprising:

accessing a database comprising a plurality of links, each link opening a corresponding media web resource;

selecting a first link from the database, the first link being located on a first network site;

selecting a second link from the database, the second link being located in a second network site, the second network site being external to the first network site;

signaling the selected links to a media playback component on the terminal to sequentially access the media web resources associated with the selected links; and

automatically signaling the media playback component on the terminal to load each of the media web resource accessed from the selected links so as to playback a media corresponding to each media web resource.

175. The method of claim 174, wherein accessing a database comprising a plurality of links to media web resources includes accessing the database comprising metadata information about the plurality of links, and selecting the first and second links from the database includes selecting the one or more links using the metadata information.

176. The method of claim 174, further comprising detecting if the media playback component fails to load one of the media web resource in the selected media web resources, and then signaling the media playback component to use another selected link from the database to load another media web resource.

177. The method of claim 175, further comprising detecting if the media playback component fails to playback a media corresponding to one of the media web resource in the selected media web resources, and then signaling the

media playback component use another link to load another selected link from the database to load another media web resource.

178. A system for providing media to a terminal coupled to a network, the method comprising:

means for accessing a plurality of links, each link opening a corresponding media network resource;

selecting a first link from the database, the first link being located on a first network site;

selecting a second link from the database, the second link being located on a second network site;

means for sequentially accessing the media network resources associated with the selected links; and

means for automatically playing back media from the media network resources.

179. A rating system for rating media network resources on a network, the network being coupleable to a plurality of terminals, the rating system comprising:

a database comprising a plurality of addresses, each address locating a corresponding media network resource on the network;

a network server module coupleable to the plurality of terminals, the network server module being able to access the database to signal one or more addresses from the database to the plurality of terminals; and

a rating module coupleable to the plurality of terminals, the rating module being able to receive a rating input from each of the plurality of terminals, the rating module associating the rating input with a selected address in the database.

180. The rating system of claim 179, wherein the database includes a rating associated with each of the plurality of addresses

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181. The rating system of claim 179, wherein the rating module accesses the database and reconfigures the rating associated with the selected address in response to receiving the rating input for the selected address.

182. The rating system of claim 179, wherein the database further includes one or more classes of information associated with each of the plurality of addresses.

183. The rating system of claim 179, further comprising a play-list module, the play-list module selecting a combination of the plurality of addresses to form a play-list, the network server module accessing the play-list to signal the combination of addresses to one or more of the terminals.

184. The rating system of claim 183, wherein the rating module receives the rating input from one or more of the terminals for each address that comprises the play-list signaled to that terminals.

185. The rating system of claim 183, wherein the rating module receives a play-list rating input for the play-list from one or more of the terminals receiving the play-list.

186. The system of claim 183, wherein the play-list module selects the combination of addresses using the rating associated with each address in the database.

187. The system of claim 183, wherein the play-list module selects the combination of addresses using the rating of each address in the database that share a same class of information.

188. The system of claim 187, wherein the same class of information is selected from a class group consisting of genre, sub-genre, title, and artist.

189. The system of claim 187, wherein the play-list module selects the combination of addresses using the rating of each address in the database that share two or more of the same classes of information, each same class of

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information being selected from a group consisting of genre, sub-genre, title, and artist.

190. The rating system of claim 179, wherein the rating associated with each of the plurality of addresses is a ranking, including a maximum ranking and a minimum ranking.

191. The rating system of claim 190, wherein the rating module receives the ranking from one of the terminals, accesses an existing ranking from the database, and uses an averaging formula to reconfigure the ranking in the database.

192. The rating system of claim 191, wherein the averaging formula is a weighted average.

193. The rating system of claim 191, wherein the averaging formula is a moving average.

194. A rating system for rating media network resources on a network, the network being coupleable to a plurality of terminals, the rating system comprising:

a database comprising a plurality of addresses, each address locating a corresponding media network resource on the network, the database including one or more classes of information associated with each of the plurality of addresses;

a network server module coupleable to the plurality of terminals, the network server module communicating with each of the plurality of terminals to receive a search request, the network server module signaling the database to retrieve one or more addresses from the database in response to the search request, the retrieved addresses being associated with a class of information matching the search request; and

a rating module coupleable to the plurality of terminals, the rating module being able to receive a rating input from each of the plurality

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of terminals, the rating module associating the rating input with a selected address in the database.

195. The rating system of claim 194, wherein the network module signals the database to retrieve one or more addresses from the database in response to the search request by matching a criteria in the search request with a parameter included with the one or more classes of information.

196. The rating system of claim 195, wherein the one or more classes of information stored in the database with the plurality of addresses is a rating.

197. The rating system of claim 194, wherein the search request also includes a rating standard that selects addresses in the database using a rating associated with each address.

198. A rating system for rating media network resources available over a network, the media network resources being located on the network by a plurality of terminals, the rating system comprising:

a database comprising a plurality of addresses, each address locating a corresponding media network resource on the network, the database including a rating associated with each of the plurality of addresses;

a network server module coupleable to each of the plurality of terminals, the network server module being able to access the database to signal one or more addresses from the database to the plurality of terminals;

a rating module coupleable to each of the plurality of terminals, the rating module being able to receive a rating input from one of the terminals for each of the plurality of addresses in the database, wherein in response to receiving the rating input from one of the plurality of terminals for a selected address in the database, the rating module accesses the database and reconfigures the rating associated with the selected address; and

a play-list module, the play-list module accessing the addresses to select one or more combinations of addresses, each combination of addresses forming a play-list, wherein the play-list module signals

the play-list to the network server module as addresses to be signaled to one or more of the plurality of terminals.

199. The rating system of claim 198, wherein the play-list module forms the play-list by using the ranking of the addresses in the database.

200. The rating system of claim 198, wherein the play-list module forms the play-list by arranging each address in the play-list in a designated order so that the addresses in the play-list are accessed by the one or more terminals in the designated order.

201. The rating system of claim 199, wherein the designated order is determined by a ranking of each of the addresses in the play-list relative to rankings of the other addresses in the play-list.

202. The rating system of claim 200, wherein the designated order is determined by arranging each of the addresses in the play-list according to a ranking from highest to lowest.

203. The rating system of claim 198, wherein the database further includes one or more classes of information associated with each of the plurality of addresses, and the play-list module forms a plurality of play-lists using the one or more classes of information.

204. The rating system of claim 198, wherein the play-list module forms a plurality of play-lists by arranging a combination of addresses in the plurality of addresses together in one play-list, wherein the combination of addresses share a same parameter of the one or more classes of information.

205. The rating system of claim 199, wherein the play-list module arranges the addresses in the play-list according to an order determined by a ranking of each of the addresses forming the play-list.

206. A method for ranking media sources on a network, the method comprising:

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accessing a database comprising a plurality of addresses, each address locating a media resource on the network and each address being associated with a rating;

signaling a selected address from the database to a terminal coupled to the network;

receiving a rating input from the terminal after signaling the selected address to the terminal; and

adjusting the rating associated for the selected address in response to receiving the rating input.

207. The method of claim 206, wherein adjusting the rating associated for the selected address in response to receiving the rating input includes averaging the rating input with an existing rating for the selected address in the database.

208. The method of claim 207, wherein averaging the rating input with an existing rating includes implementing a weighted average between the rating input and the existing rating.

209. The method of claim 206, further comprising signaling one or more selected addresses to a plurality of terminals coupled to the network, and receiving a rating input from each of the plurality of the terminals after signaling the one or more selected addresses to the terminal.

210. The method of claim 209, further comprising adjusting the rating associated for each of the one or more selected addresses in response to receiving a rating input from each terminal by calculating a weighted average reflecting an aggregate of the plurality of terminals.

211. The method of claim 206, wherein each address locates a music source on the Internet.

212. The method of claim 206, wherein the rating input corresponds to a ranking.

213. A method for ranking media sources on a network, the method comprising:

accessing a database comprising a plurality of addresses, each address locating a media resource on the network and each address being associated with a rating;

selecting a combination of addresses to form a play-list;

signaling the play-list to a terminal coupled to the network;

receiving a ranking from the terminal after signaling the one or more of the addresses in the play-list to the terminal; and

adjusting the rating of each address signaled to the terminal from the play-list in response to receiving the ranking.

214. The method of claim 213, wherein selecting a combination of addresses for a play-list includes selecting multiple addresses from the database that share one or more classes of information.

215. The method of claim 213, wherein selecting a combination of addresses for a play-list includes arranging each address in the play-list in an order, the order being determined by the ranking of each address in the play-list.

216. A method for ranking media sources on a network, the method comprising:

accessing a database comprising a plurality of addresses, each address locating a media resource on the network and each address being associated with a rating;

signaling a selected address from the database to a terminal coupled to the network;

receiving a ranking from the terminal after signaling the selected address to the terminal; and

adjusting the rating associated for the selected address in response to receiving the ranking.

217. The method of claim 216, wherein each address locates a music source.

218. The method of claim 216, wherein each address locates a video or animation source.

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219. A rating system for rating media network resources available over a network, the media network resources being located on the network by a plurality of terminals, the rating system comprising:

means for accessing a database comprising a plurality of addresses, each address locating a media resource on the network and each address being associated with a rating;

means for signaling a selected address from the database to a terminal coupled to the network;

means for receiving a ranking from the terminal after signaling the selected address to the terminal; and

means for adjusting the rating associated for the selected address in response to receiving the ranking.

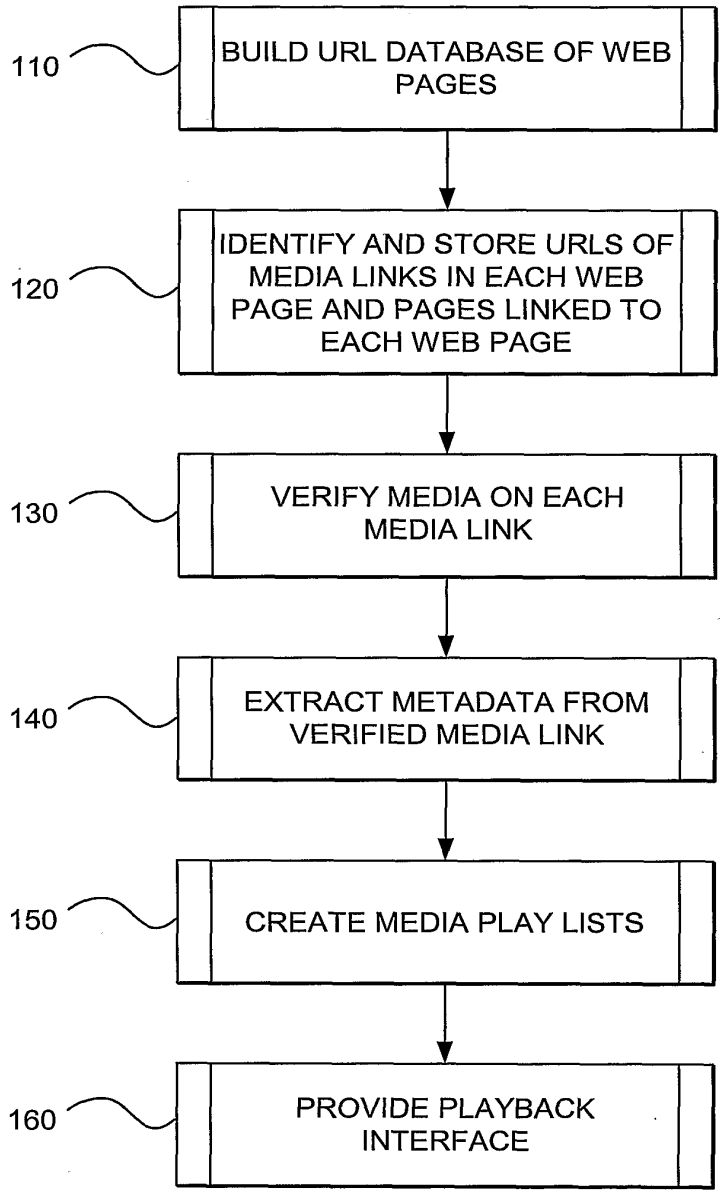

110
BUILD URL DATABASE OF WEB PAGES
120
IDENTIFY AND STORE URLS OF MEDIA LINKS IN EACH WEB PAGE AND PAGES LINKED TO EACH WEB PAGE
130
VERIFY MEDIA ON EACH MEDIA LINK
140
EXTRACT METADATA FROM VERIFIED MEDIA LINK
150
CREATE MEDIA PLAY LISTS
160
PROVIDE PLAYBACK INTERFACE

FIG. 1

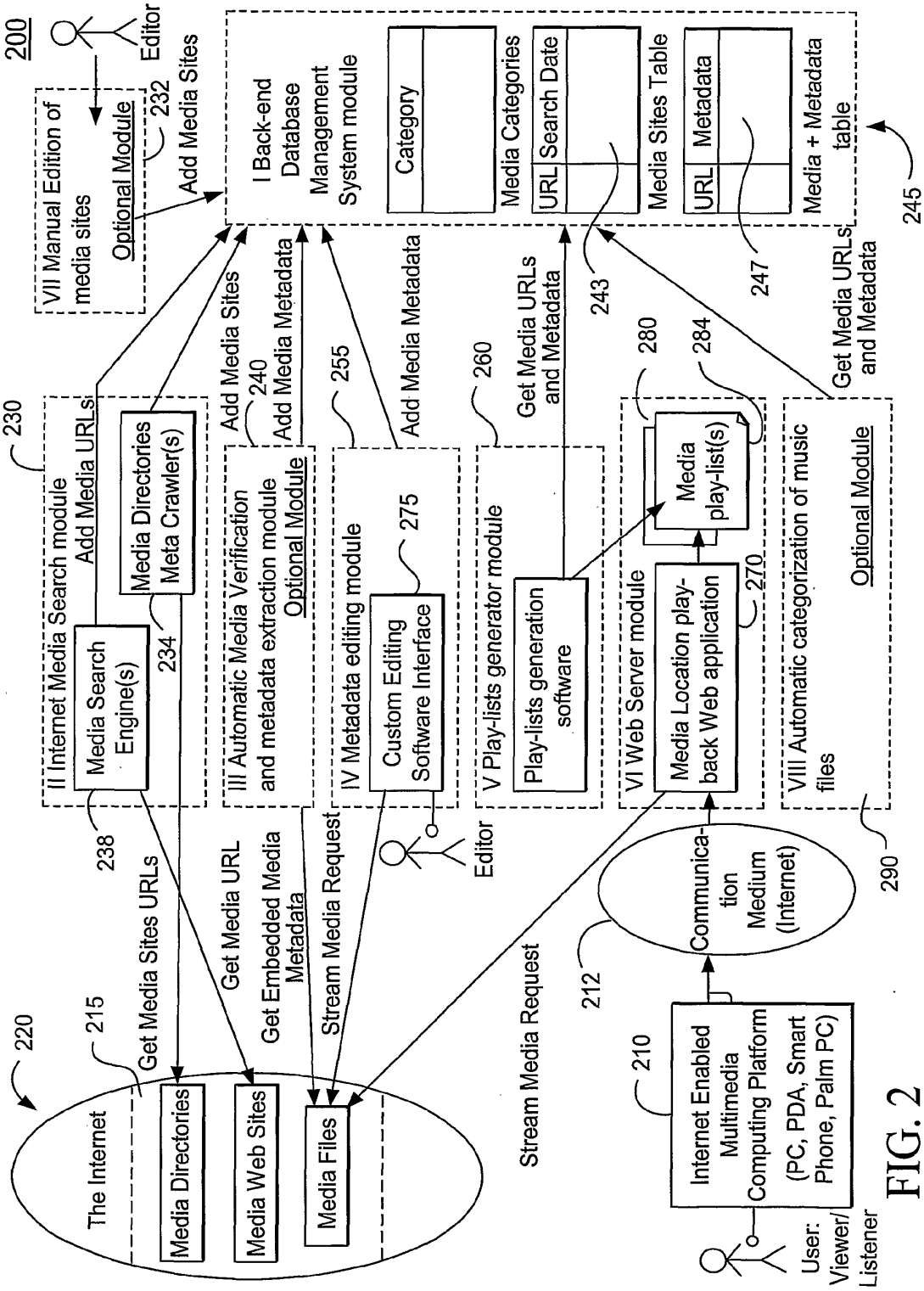

200
Editor
VII Manual Edition of media sites
Optional Module
232
Add Media Sites
I Back-end Database Management System module
Category
Media Categories
URL
Search Date
Media Sites Table
URL
Metadata
Media + Metadata table
245
230
II Internet Media Search module
Add Media URLs
Media Search Engine(s)
238
Media Directories Meta Crawler(s)
234
Add Media Sites
Add Media Metadata
240
III Automatic Media Verification and metadata extraction module
Optional Module
255
Add Media Metadata
IV Metadata editing module
Custom Editing Software Interface
275
Editor
260
Get Media URLs and Metadata
V Play-lists generator module
Play-lists generation software
243
280
284
Media play-list(s)
VI Web Server module
Media Location play-back Web application
270
247
Get Media URLs and Metadata
VIII Automatic categorization of music files
Optional Module
290
Communication Medium (Internet)
212
220
The Internet
215
Media Directories
Media Web Sites
Media Files
Get Media Sites URLs
Get Media URL
Get Embedded Media Metadata
Stream Media Request
Stream Media Request
210
Internet Enabled Multimedia Computing Platform
(PC, PDA, Smart Phone, Palm PC)
User: Viewer/ Listener

FIG. 2

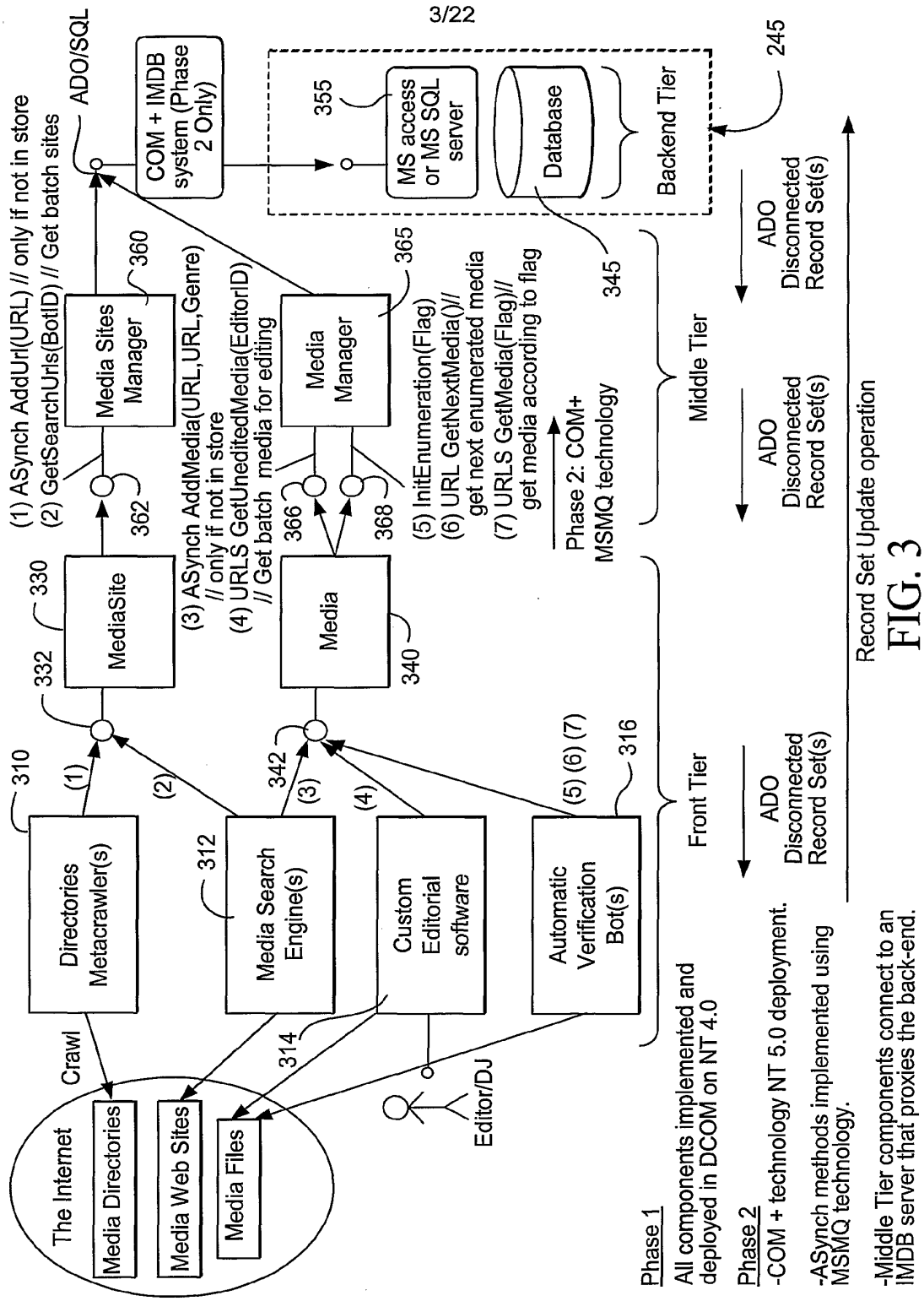
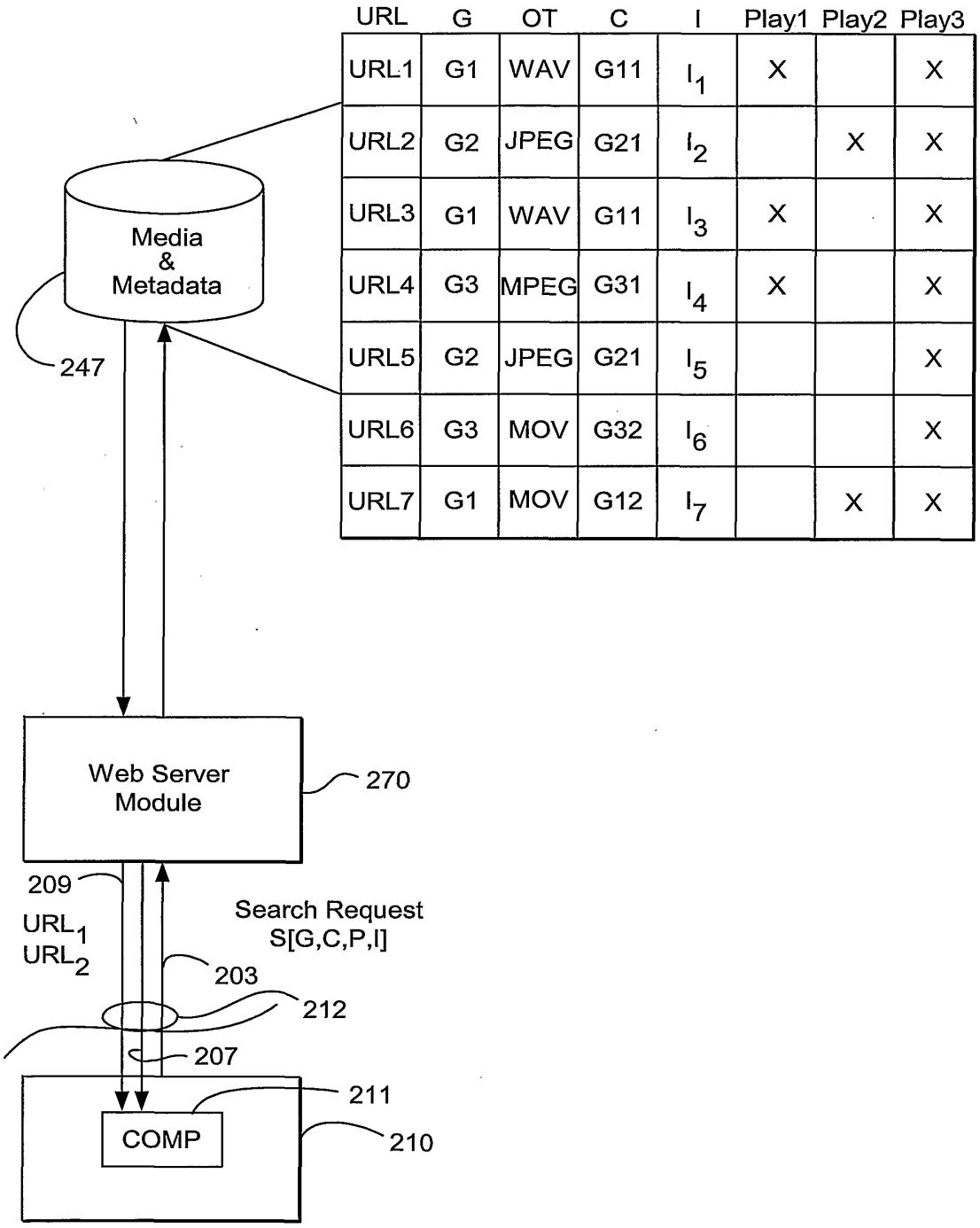

The Internet
Media Directories
Media Web Sites
Media Files
Crawl
Directories Metacrawler(s)
310
(1)
Media Search Engine(s)
312
314
(2)
MediaSite
332
330
Media Sites Manager
360
362
(1) ASynch AddUrl(URL) // only if not in store
(2) GetSearchUrls(BotID) // Get batch sites
ADO/SQL
COM + IMDB system (Phase 2 Only)
(3) ASynch AddMedia(URL,URL,Genre) // only if not in store
(4) URLS GetUneditedMedia(EditorID) // Get batch media for editing
342
(3)
(4)
Media
340
Media Manager
365
366
368
(5) InitEnumeration(Flag)
(6) URL GetNextMedia()// get next enumerated media
(7) URLS GetMedia(Flag)// get media according to flag
Phase 2: COM+ MSMQ technology
Editor/DJ
Custom Editorial software
Automatic Verification Bot(s)
(5) (6) (7)
316
355
MS access or MS SQL server
Database
Backend Tier
345
245
Front Tier
Middle Tier
ADO Disconnected Record Set(s)
ADO Disconnected Record Set(s)
ADO Disconnected Record Set(s)
Record Set Update operation
Phase 1
All components implemented and deployed in DCOM on NT 4.0
Phase 2
-COM + technology NT 5.0 deployment.
-ASynch methods implemented using MSMQ technology.
-Middle Tier components connect to an IMDB server that proxies the back-end.

FIG. 3



URL	G	OT	C	I	Play1	Play2	Play3
URL1	G1	WAV	G11	I_1	X		X
URL2	G2	JPEG	G21	I_2		X	X
URL3	G1	WAV	G11	I_3	X		X
URL4	G3	MPEG	G31	I_4	X		X
URL5	G2	JPEG	G21	I_5			X
URL6	G3	MOV	G32	I_6			X
URL7	G1	MOV	G12	I_7		X	X

FIG. 4

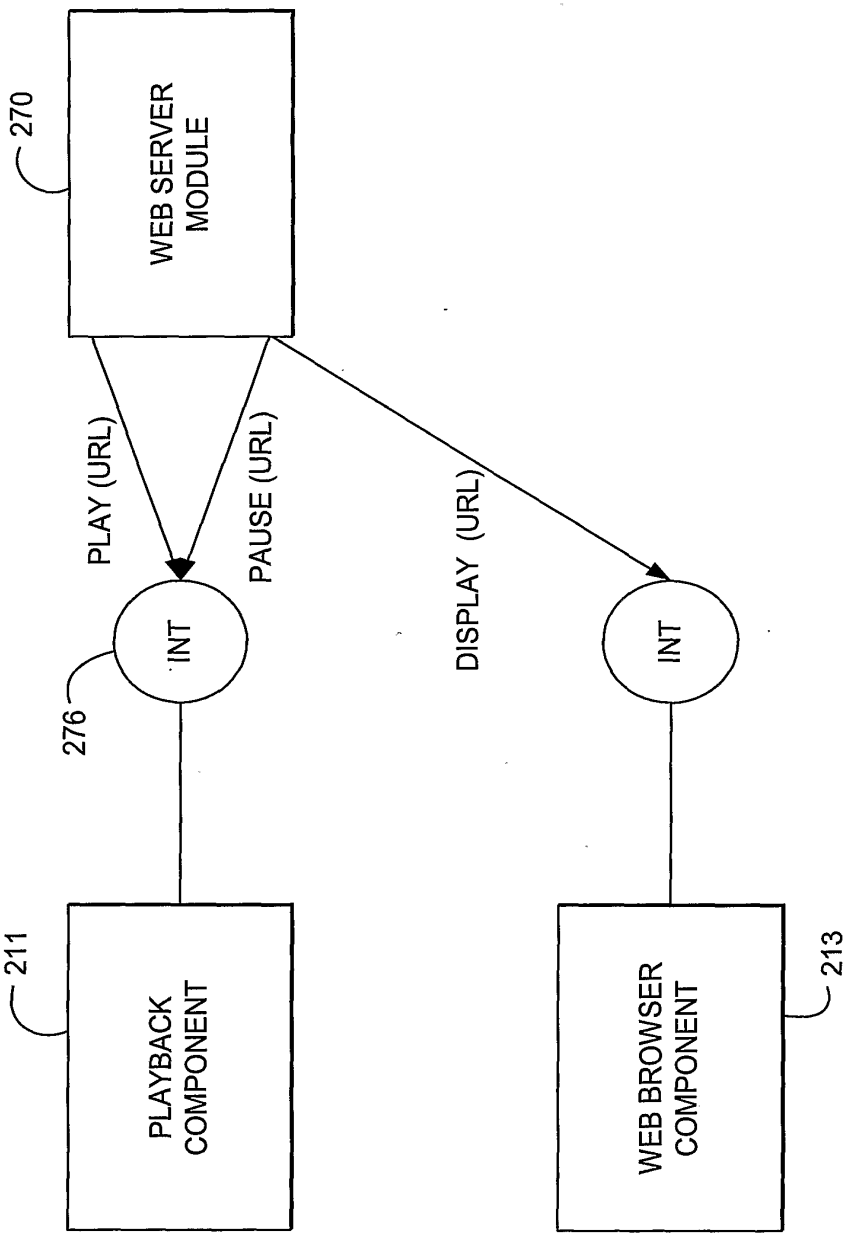

270
WEB SERVER MODULE
PLAY (URL)
PAUSE (URL)
DISPLAY (URL)
INT
276
INT
211
PLAYBACK COMPONENT
WEB BROWSER COMPONENT
213

FIG. 5

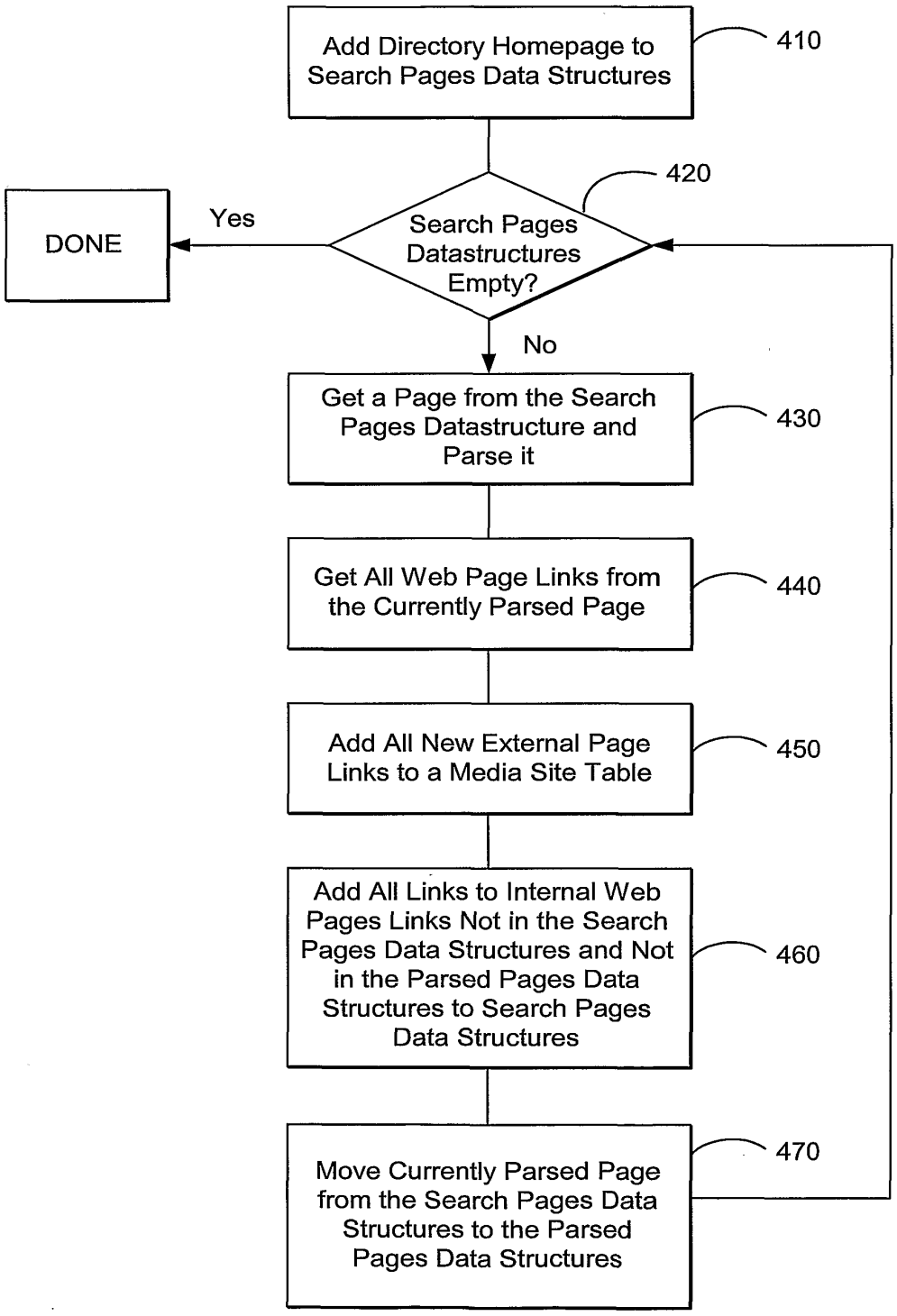

Add Directory Homepage to Search Pages Data Structures
410
420
Search Pages Datastructures Empty?
Yes
DONE
No
Get a Page from the Search Pages Datastructure and Parse it
430
Get All Web Page Links from the Currently Parsed Page
440
Add All New External Page Links to a Media Site Table
450
Add All Links to Internal Web Pages Links Not in the Search Pages Data Structures and Not in the Parsed Pages Data Structures to Search Pages Data Structures
460
Move Currently Parsed Page from the Search Pages Data Structures to the Parsed Pages Data Structures
470

FIG. 6

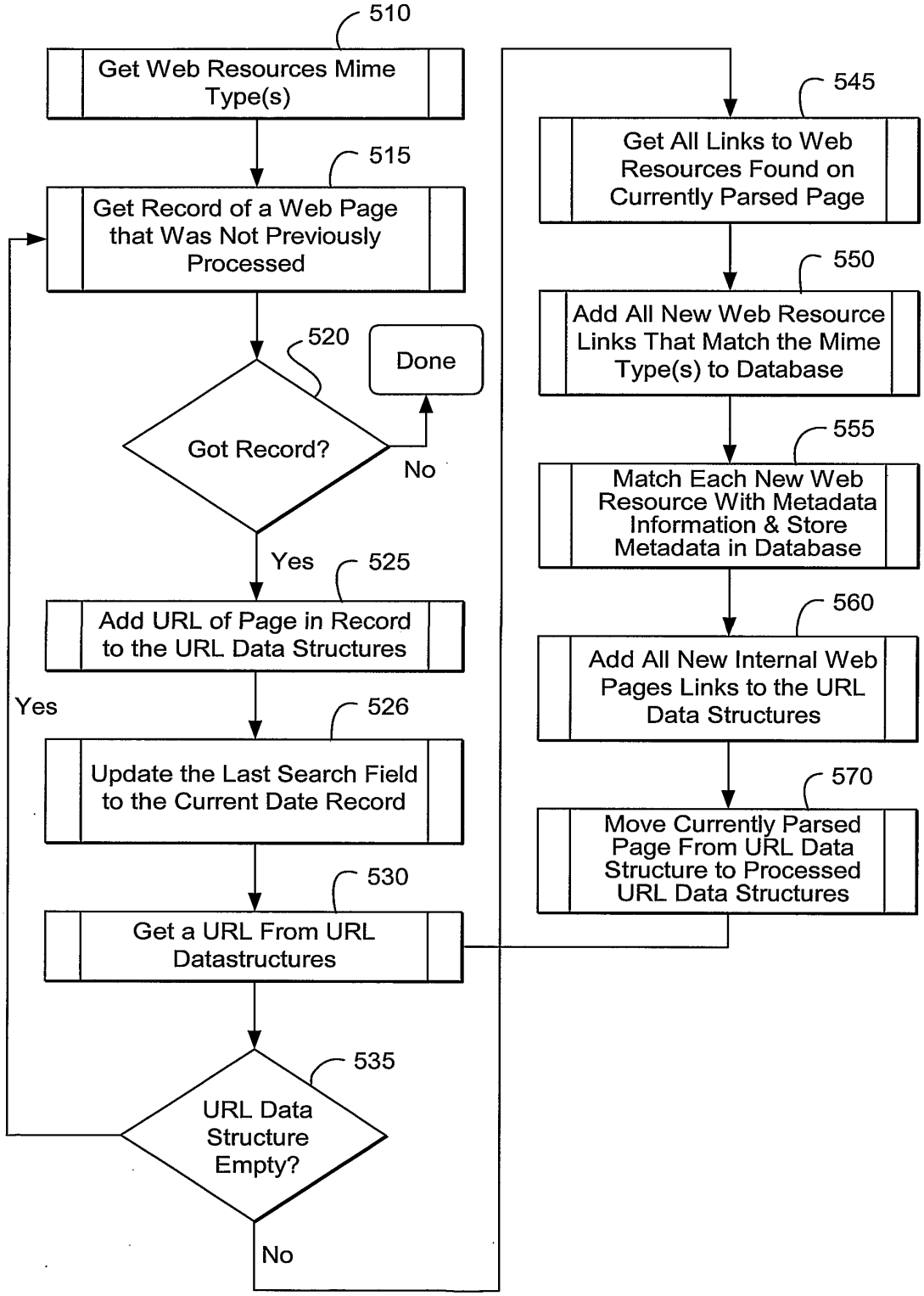

510
Get Web Resources Mime Type(s)
515
Get Record of a Web Page that Was Not Previously Processed
520
Got Record?
Done
No
Yes
525
Add URL of Page in Record to the URL Data Structures
526
Update the Last Search Field to the Current Date Record
530
Get a URL From URL Datastructures
535
URL Data Structure Empty?
Yes
No
545
Get All Links to Web Resources Found on Currently Parsed Page
550
Add All New Web Resource Links That Match the Mime Type(s) to Database
555
Match Each New Web Resource With Metadata Information & Store Metadata in Database
560
Add All New Internal Web Pages Links to the URL Data Structures
570
Move Currently Parsed Page From URL Data Structure to Processed URL Data Structures

FIG. 7

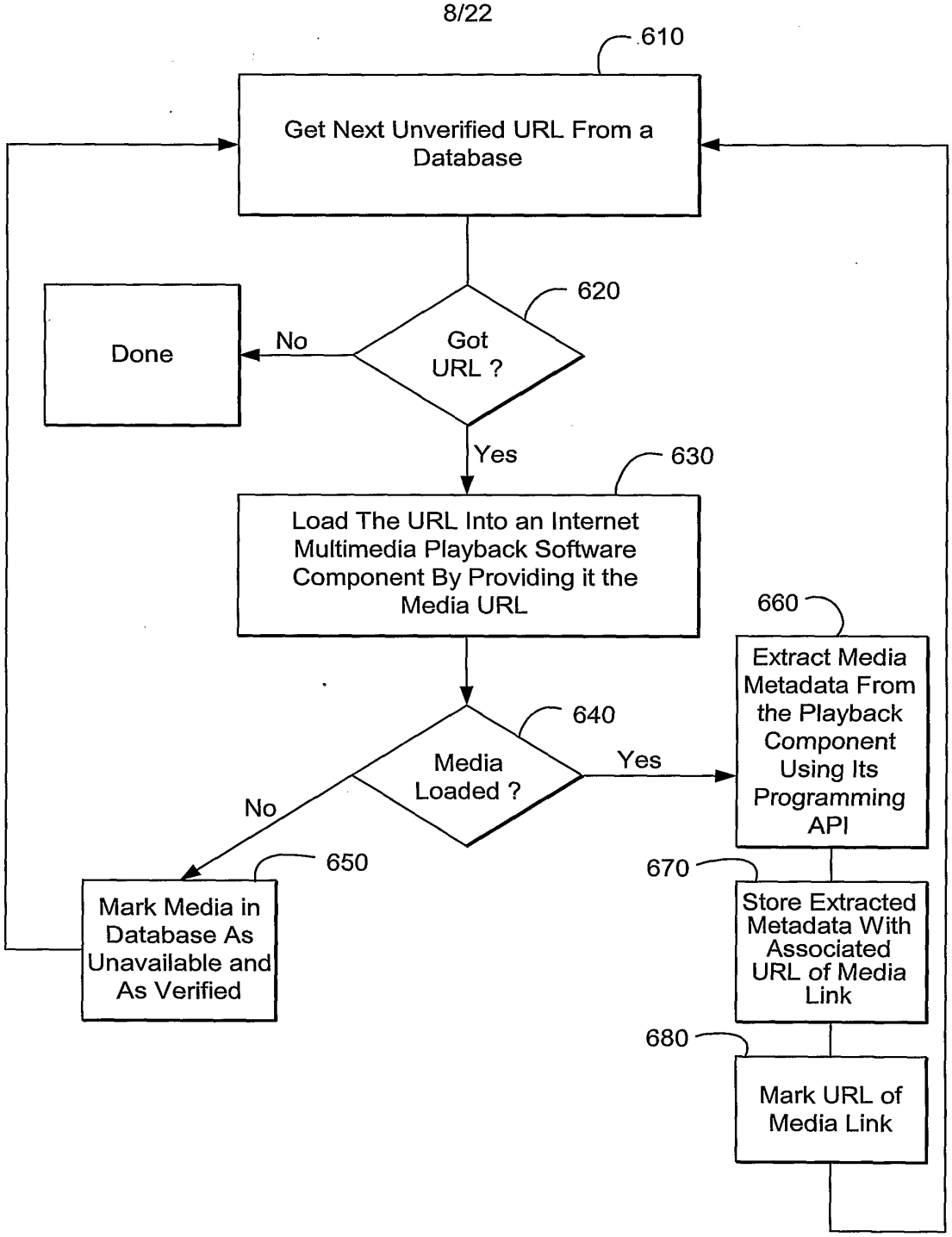

610
Get Next Unverified URL From a Database
620
Got URL ?
No
Done
Yes
630
Load The URL Into an Internet Multimedia Playback Software Component By Providing it the Media URL
640
Media Loaded ?
Yes
No
650
Mark Media in Database As Unavailable and As Verified
660
Extract Media Metadata From the Playback Component Using Its Programming API
670
Store Extracted Metadata With Associated URL of Media Link
680
Mark URL of Media Link

FIG. 8

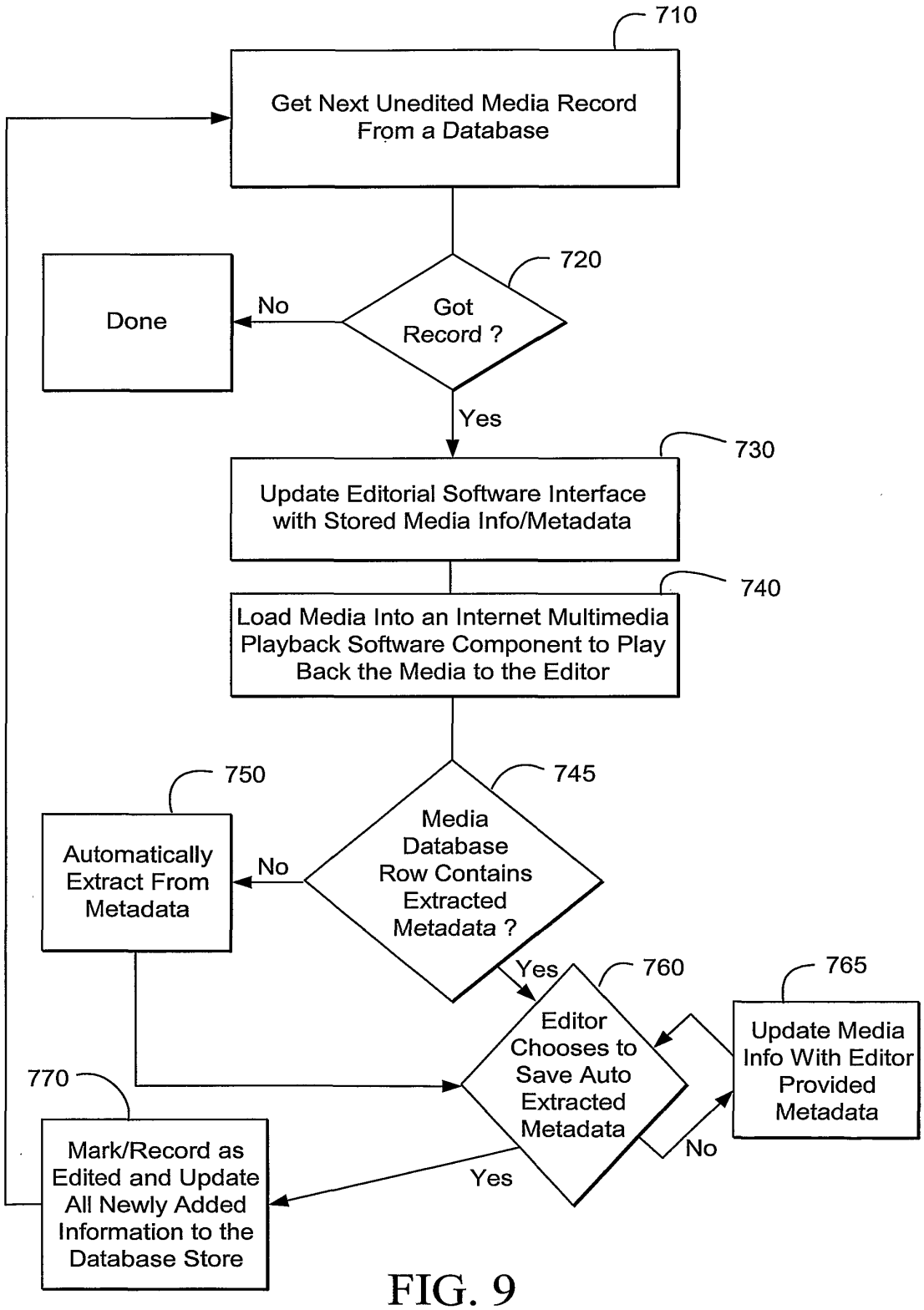

710
Get Next Unedited Media Record From a Database
720
Got Record ?
No
Done
Yes
730
Update Editorial Software Interface with Stored Media Info/Metadata
740
Load Media Into an Internet Multimedia Playback Software Component to Play Back the Media to the Editor
745
Media Database Row Contains Extracted Metadata ?
No
750
Automatically Extract From Metadata
Yes
760
Editor Chooses to Save Auto Extracted Metadata
765
Update Media Info With Editor Provided Metadata
No
Yes
770
Mark/Record as Edited and Update All Newly Added Information to the Database Store

FIG. 9

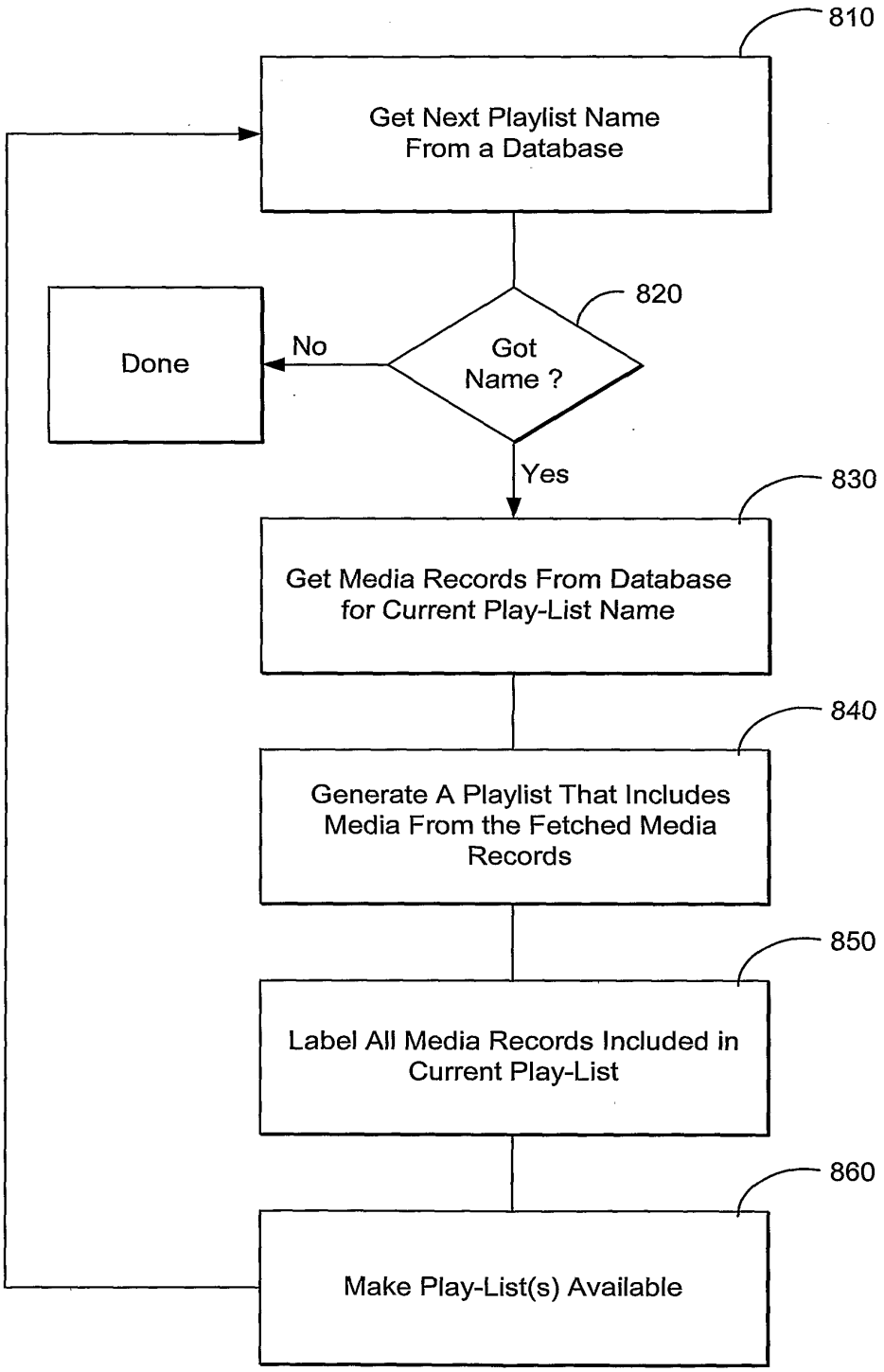

810
Get Next Playlist Name From a Database
820
Got Name ?
No
Done
Yes
830
Get Media Records From Database for Current Play-List Name
840
Generate A Playlist That Includes Media From the Fetched Media Records
850
Label All Media Records Included in Current Play-List
860
Make Play-List(s) Available

FIG. 10

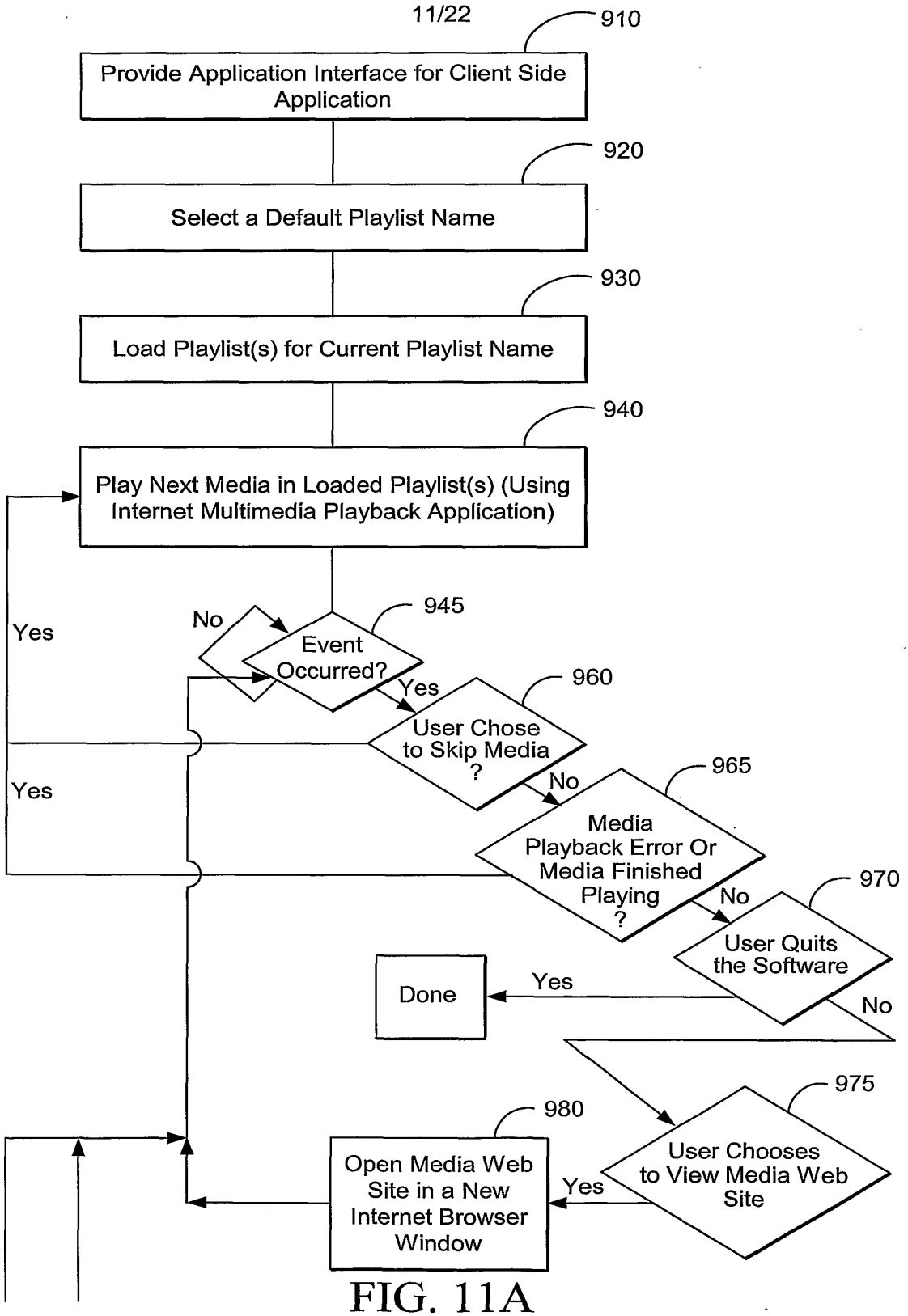

910
Provide Application Interface for Client Side Application
920
Select a Default Playlist Name
930
Load Playlist(s) for Current Playlist Name
940
Play Next Media in Loaded Playlist(s) (Using Internet Multimedia Playback Application)
945
Event Occurred?
No
Yes
960
User Chose to Skip Media ?
Yes
No
965
Media Playback Error Or Media Finished Playing ?
Yes
No
970
User Quits the Software
Yes
No
Done
975
User Chooses to View Media Web Site
Yes
980
Open Media Web Site in a New Internet Browser Window

FIG. 11A

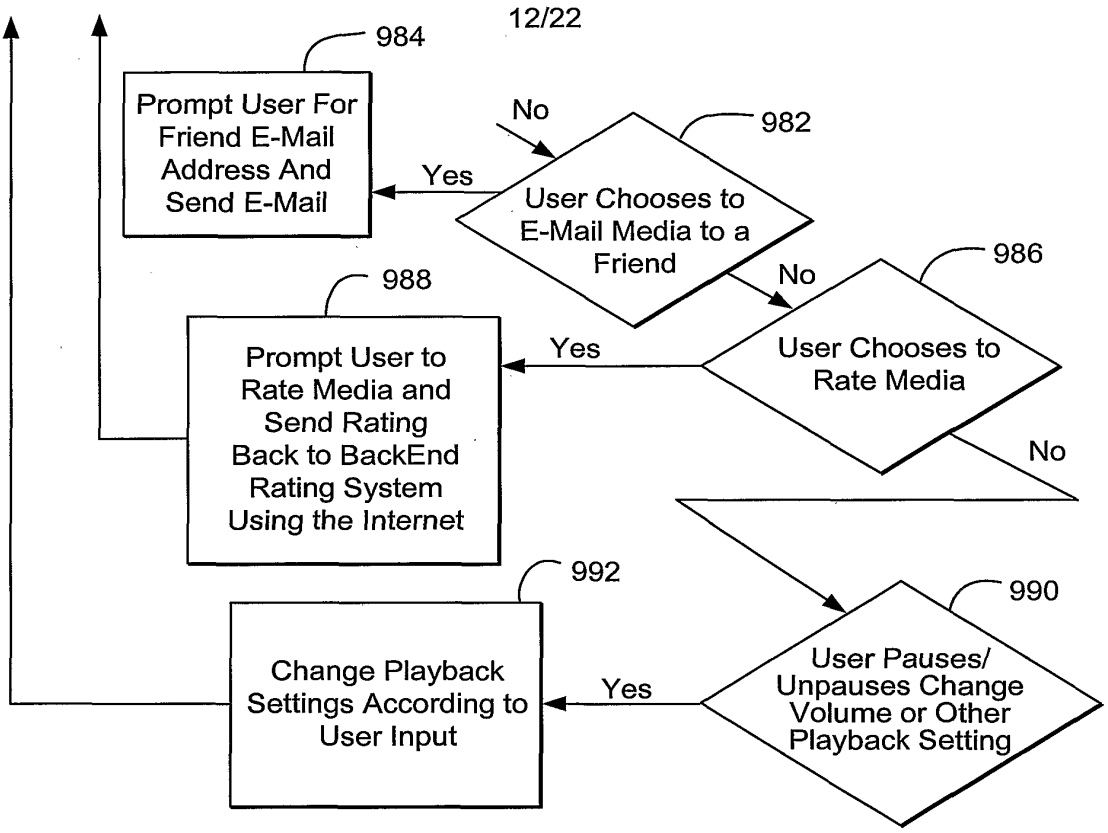

984
Prompt User For Friend E-Mail Address And Send E-Mail
No
982
Yes
User Chooses to E-Mail Media to a Friend
986
No
988
Prompt User to Rate Media and Send Rating Back to BackEnd Rating System Using the Internet
Yes
User Chooses to Rate Media
No
992
990
Change Playback Settings According to User Input
Yes
User Pauses/ Unpauses Change Volume or Other Playback Setting

FIG. 11B

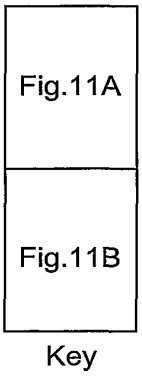


Fig.11A
Fig.11B
Key

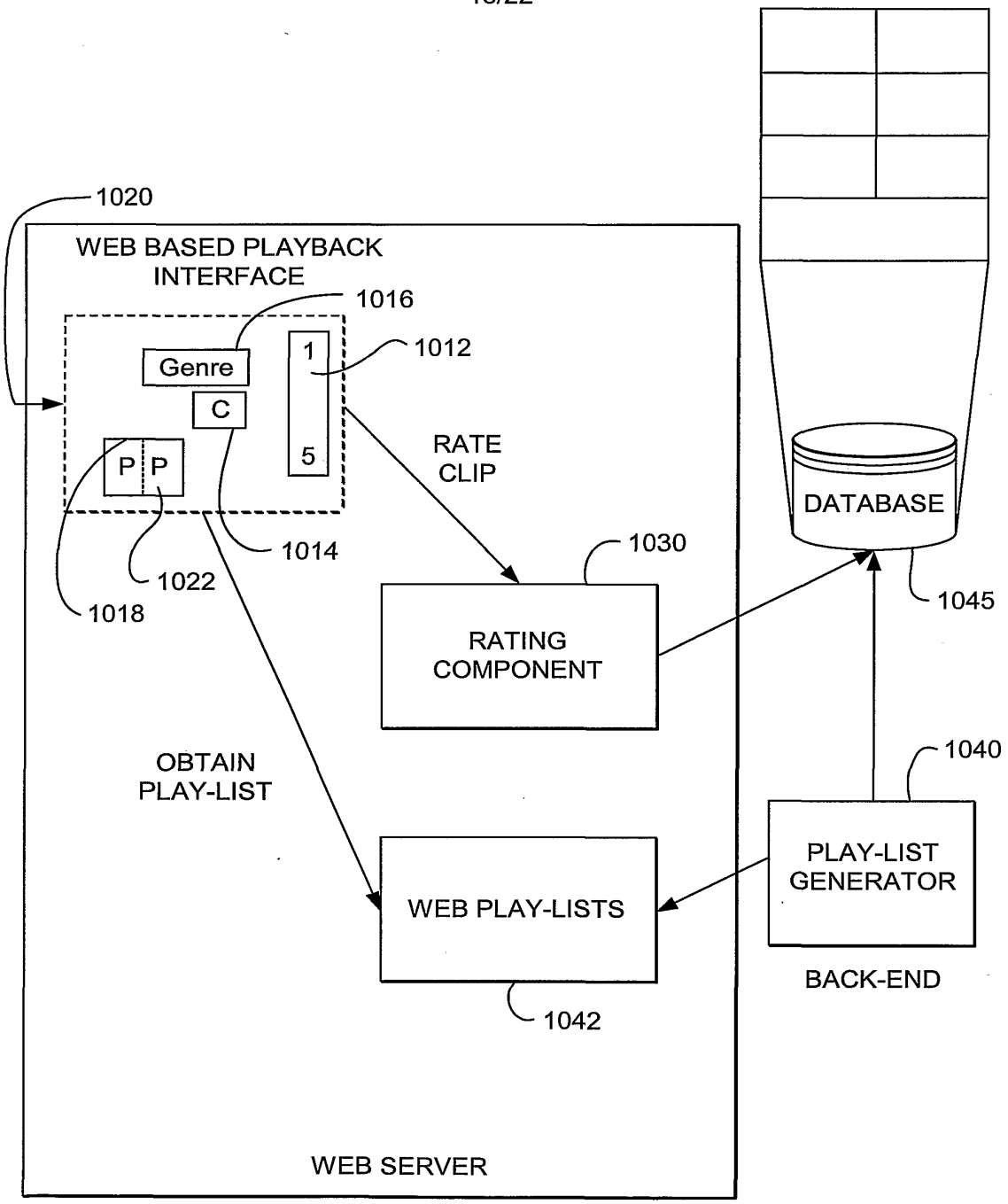

1020
WEB BASED PLAYBACK INTERFACE
1016
Genre
C
1
5
1012
P
P
RATE CLIP
1014
1022
1018
1030
RATING COMPONENT
DATABASE
1045
OBTAIN PLAY-LIST
1040
PLAY-LIST GENERATOR
WEB PLAY-LISTS
BACK-END
1042
WEB SERVER

FIG. 12

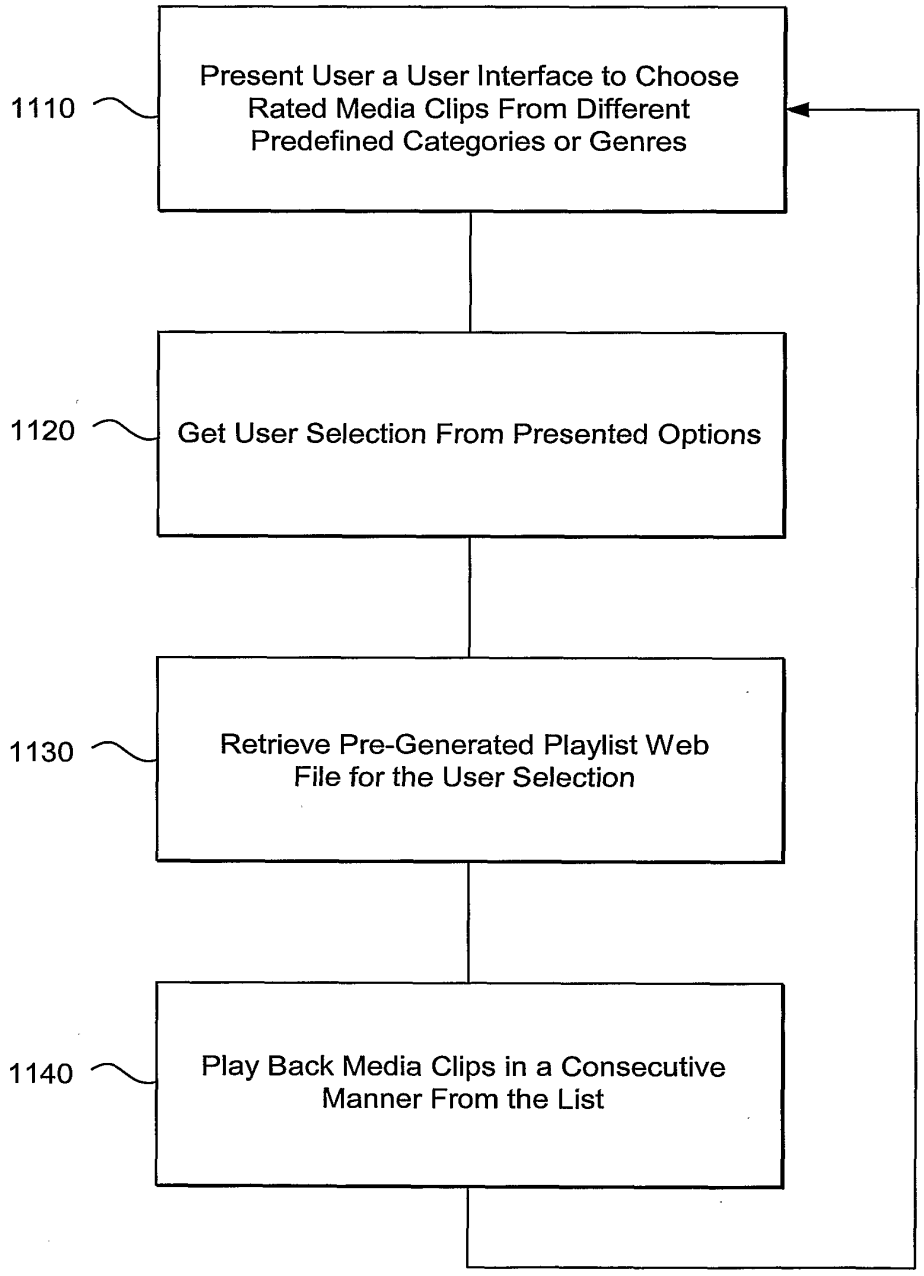

1110
Present User a User Interface to Choose Rated Media Clips From Different Predefined Categories or Genres
1120
Get User Selection From Presented Options
1130
Retrieve Pre-Generated Playlist Web File for the User Selection
1140
Play Back Media Clips in a Consecutive Manner From the List

FIG. 13

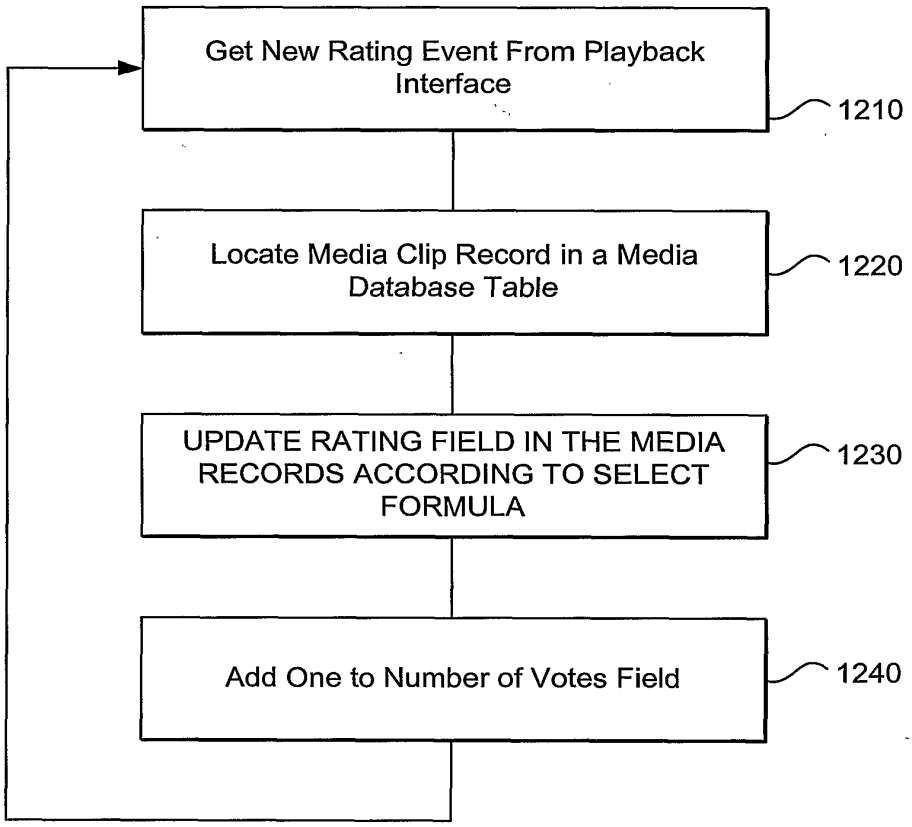


FIG. 14

MEDIA DATABASE TABLE

Media URL	Number of Votes	Rating	Additional Info
URL	O . . . N	O . . . Max Rating	

FIG. 15

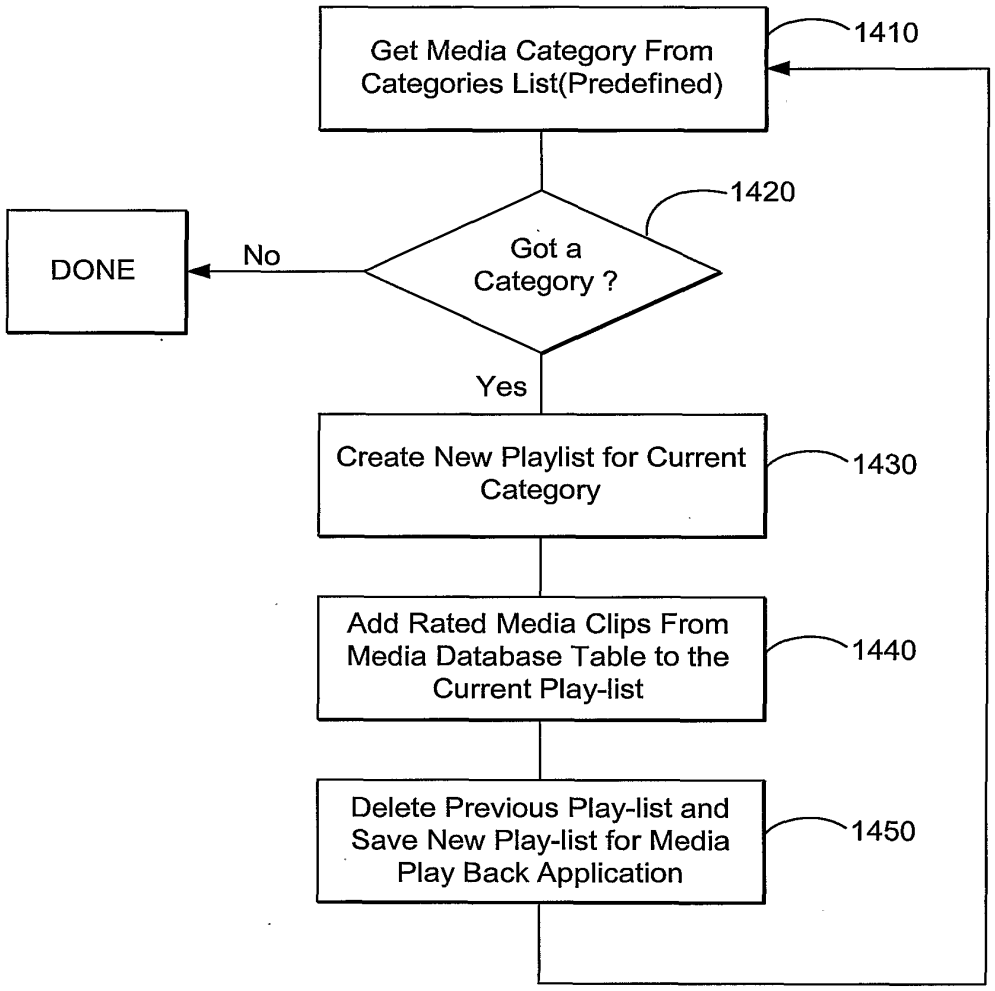

Get Media Category From Categories List(Predefined)
1410
Got a Category ?
1420
No
DONE
Yes
Create New Playlist for Current Category
1430
Add Rated Media Clips From Media Database Table to the Current Play-list
1440
Delete Previous Play-list and Save New Play-list for Media Play Back Application
1450

FIG. 16

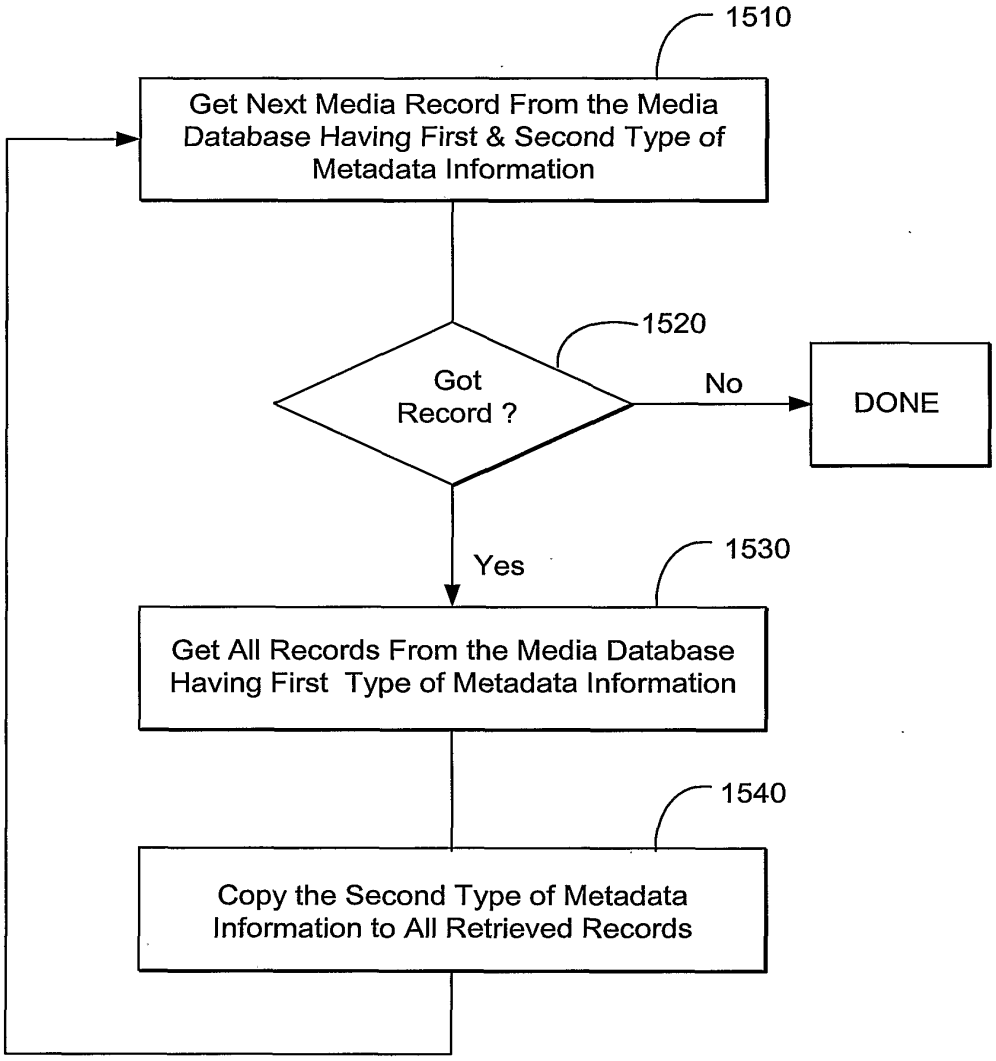

1510
Get Next Media Record From the Media Database Having First & Second Type of Metadata Information
1520
Got Record ?
No
DONE
Yes
1530
Get All Records From the Media Database Having First Type of Metadata Information
1540
Copy the Second Type of Metadata Information to All Retrieved Records

FIG. 17

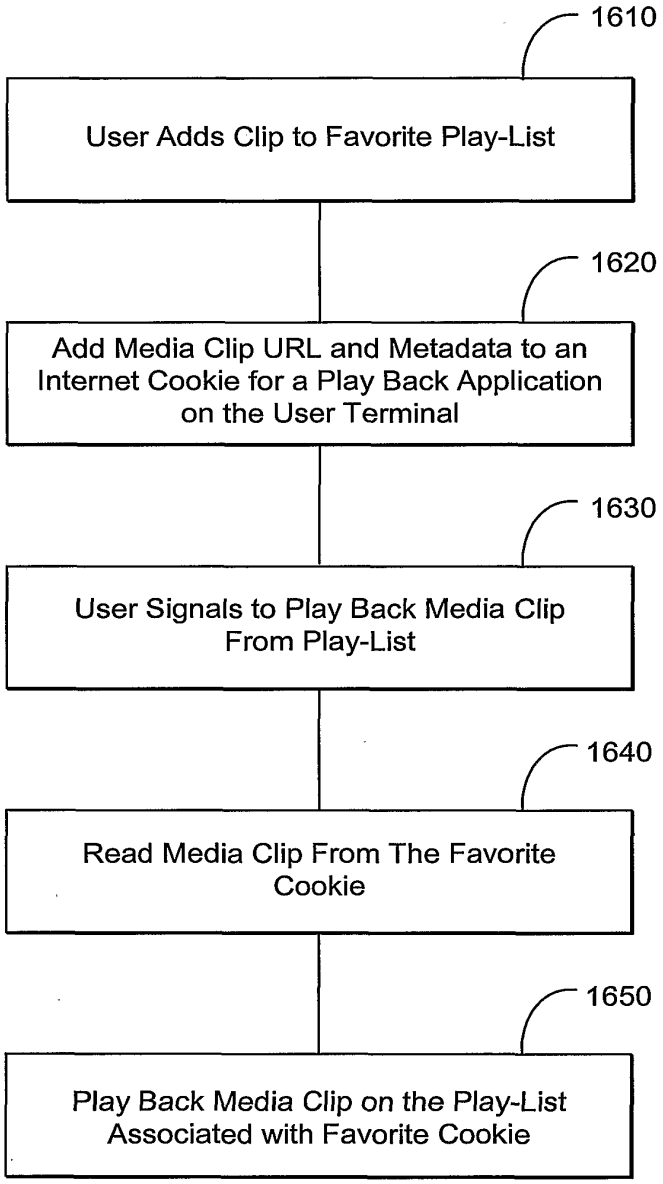

1610
User Adds Clip to Favorite Play-List
1620
Add Media Clip URL and Metadata to an Internet Cookie for a Play Back Application on the User Terminal
1630
User Signals to Play Back Media Clip From Play-List
1640
Read Media Clip From The Favorite Cookie
1650
Play Back Media Clip on the Play-List Associated with Favorite Cookie

FIG. 18

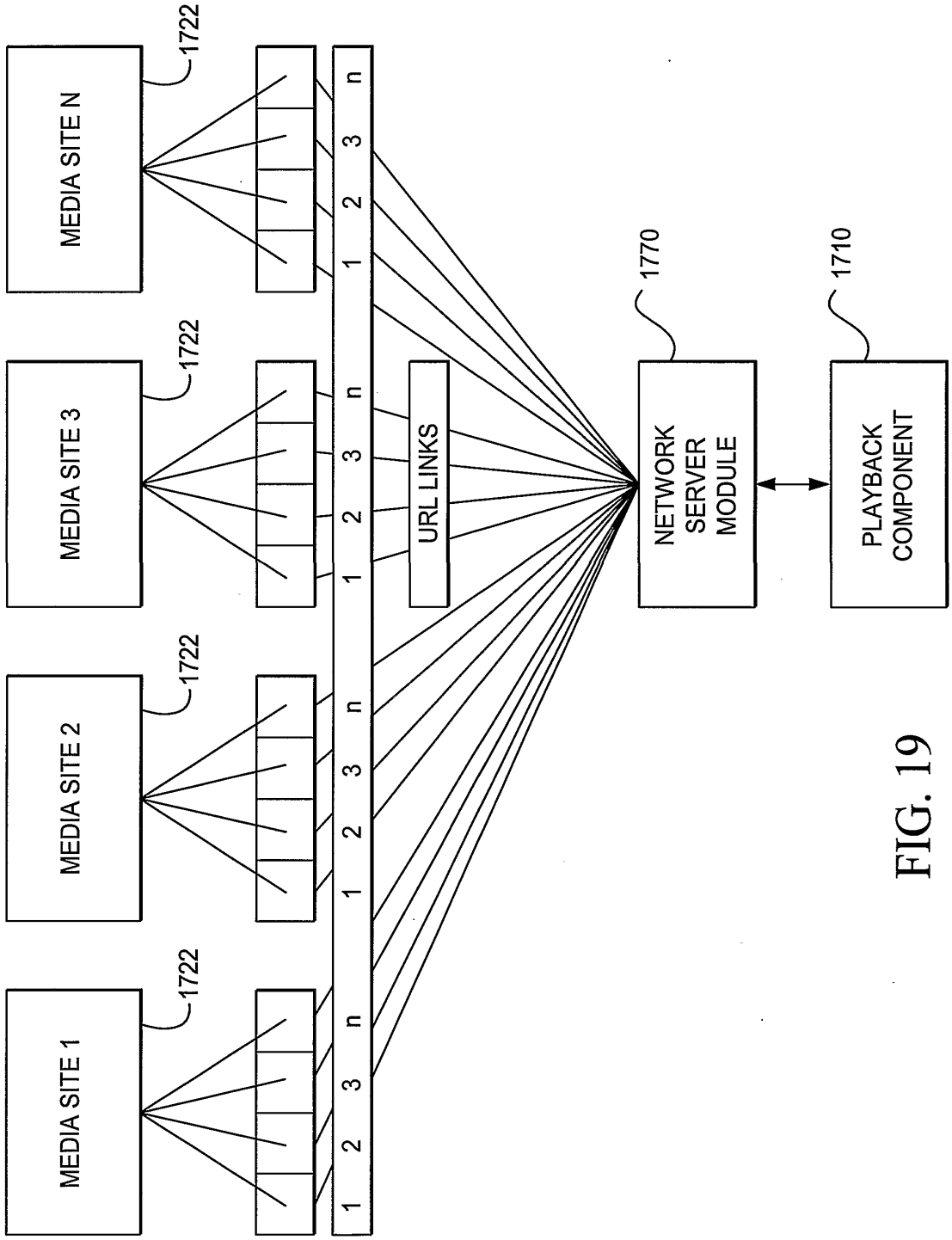

MEDIA SITE 1
MEDIA SITE 2
MEDIA SITE 3
MEDIA SITE N
1722
1722
1722
1722
1 2 3 n
1 2 3 n
1 2 3 n
1 2 3 n
URL LINKS
NETWORK SERVER MODULE
1770
PLAYBACK COMPONENT
1710

FIG. 19

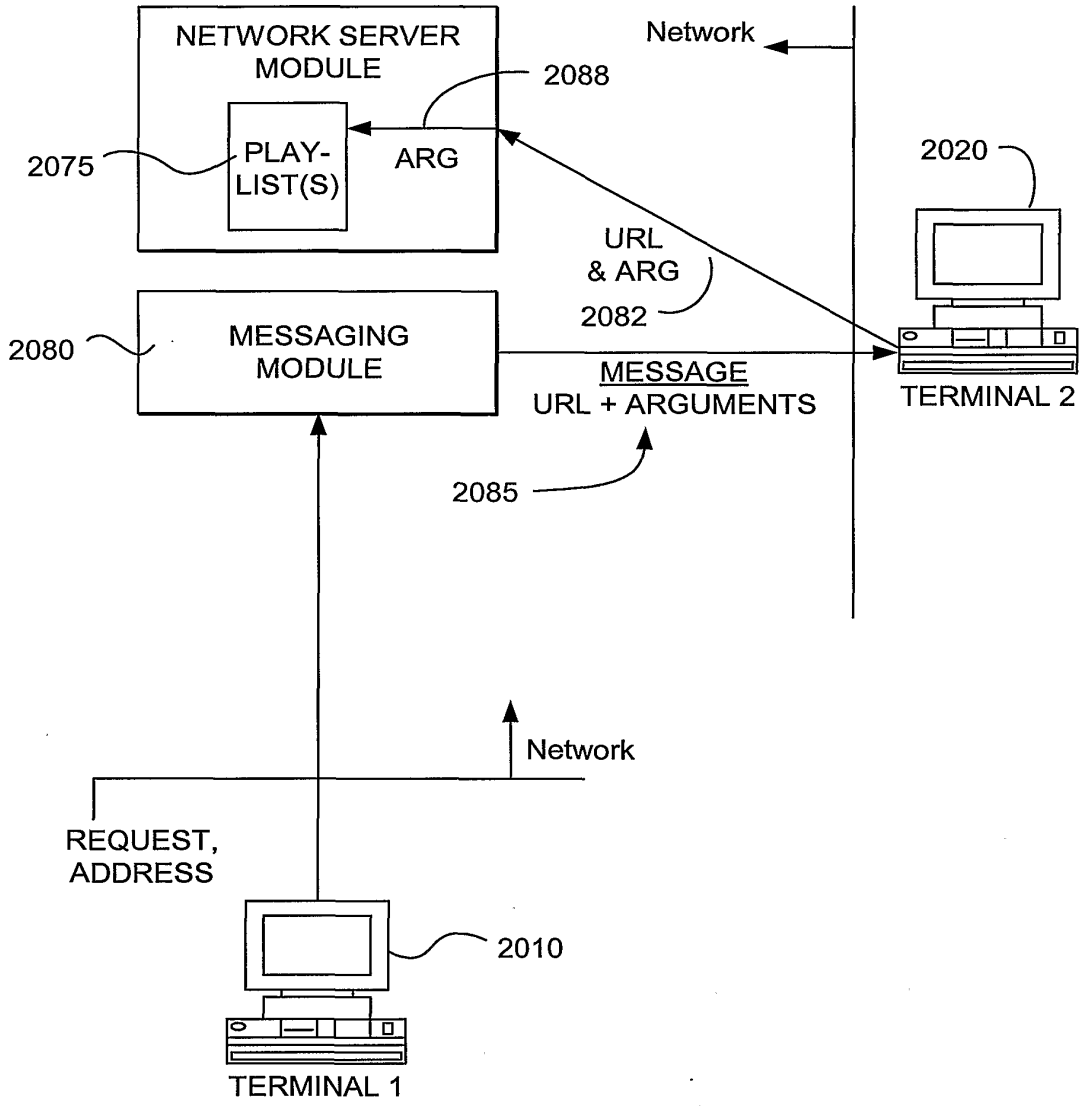

NETWORK SERVER MODULE
PLAY-LIST(S)
ARG
2088
2075
Network
2020
URL & ARG
2082
2080
MESSAGING MODULE
MESSAGE
URL + ARGUMENTS
TERMINAL 2
2085
Network
REQUEST, ADDRESS
2010
TERMINAL 1

FIG. 20

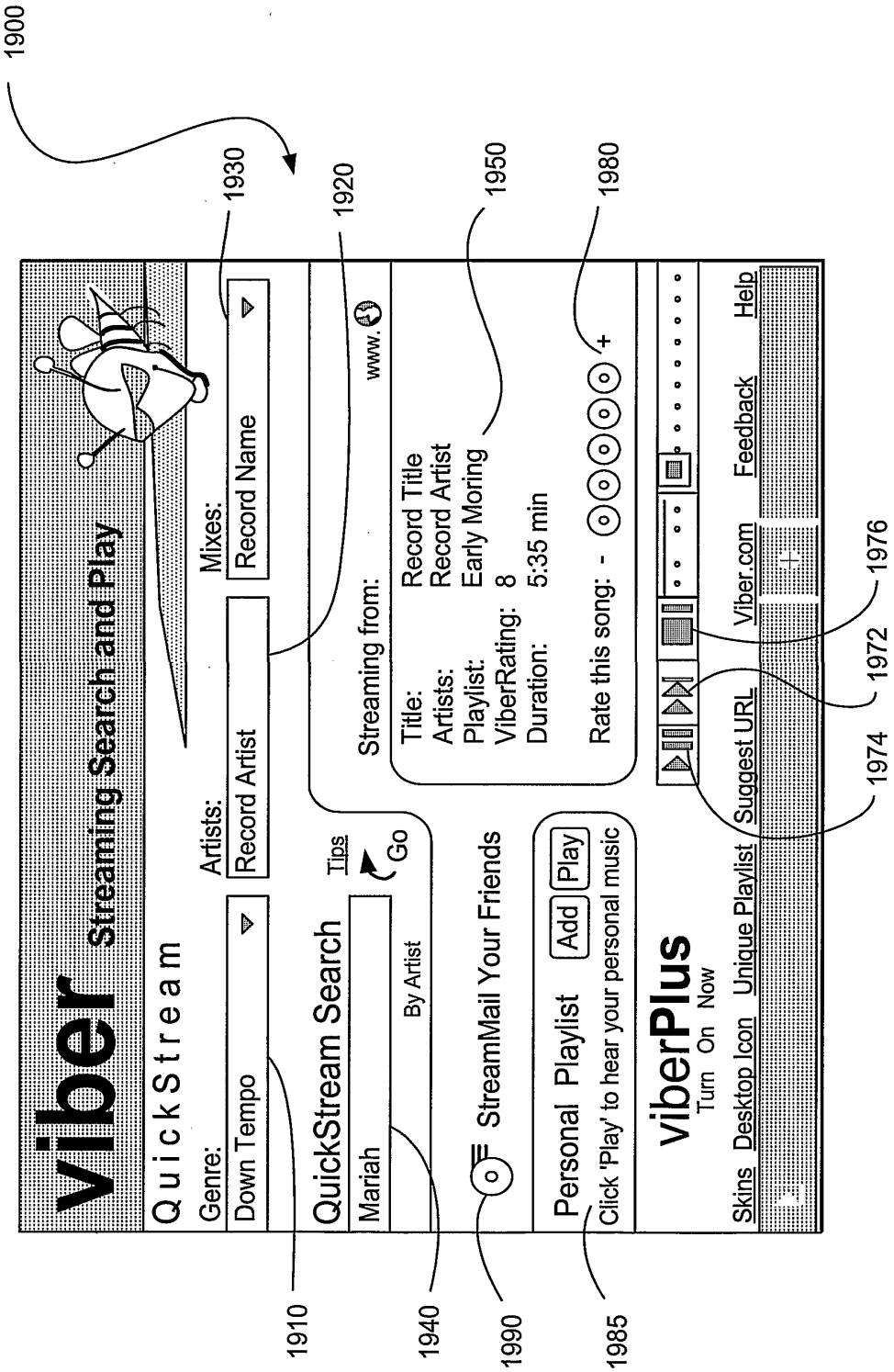

1900
viber
Streaming Search and Play
QuickStream
Genre:
Down Tempo
Artists:
Record Artist
Mixes:
Record Name
1930
1920
1950
1980
QuickStream Search
Mariah
By Artist
Tips
Go
Streaming from:
www.
Title: Record Title
Artists: Record Artist
Playlist: Early Moring
ViberRating: 8
Duration: 5:35 min
Rate this song: -
+
StreamMail Your Friends
Personal Playlist
Add
Play
Click 'Play' to hear your personal music
viberPlus
Turn On Now
Skins
Desktop Icon
Unique Playlist
Suggest URL
Viber.com
Feedback
Help
1976
1972
1974
1910
1940
1990
1985

FIG. 21

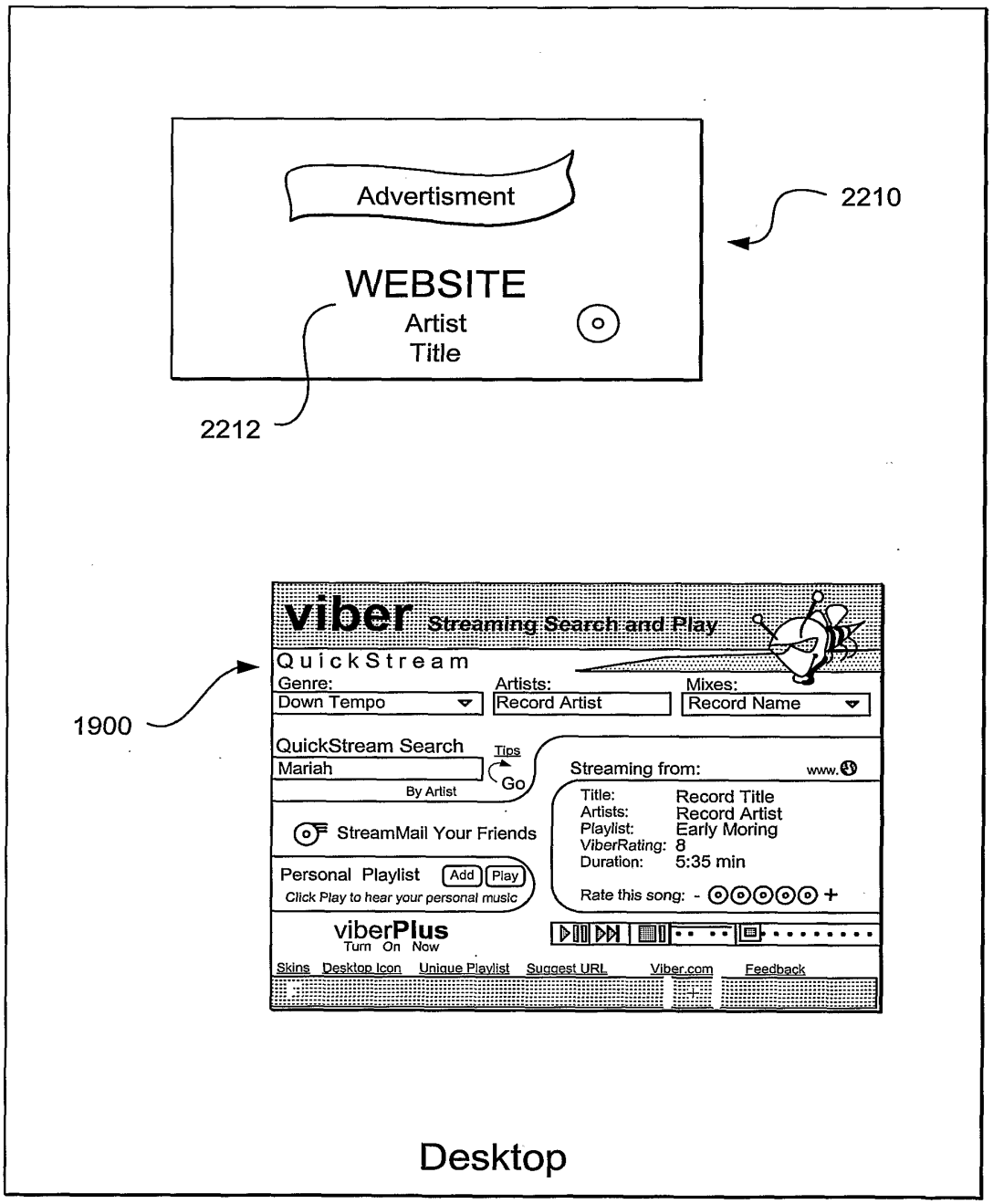

Advertisment
WEBSITE
Artist
Title
2210
2212
1900
viber Streaming Search and Play
QuickStream
Genre:
Down Tempo
Artists:
Record Artist
Mixes:
Record Name
QuickStream Search
Mariah
By Artist
Tips
Go
Streaming from:
www.
Title: Record Title
Artists: Record Artist
Playlist: Early Moring
ViberRating: 8
Duration: 5:35 min
Rate this song: - +
StreamMail Your Friends
Personal Playlist
Add
Play
Click Play to hear your personal music
viberPlus
Turn On Now
Skins
Desktop Icon
Unique Playlist
Suggest URL
Viber.com
Feedback
Desktop

FIG. 22

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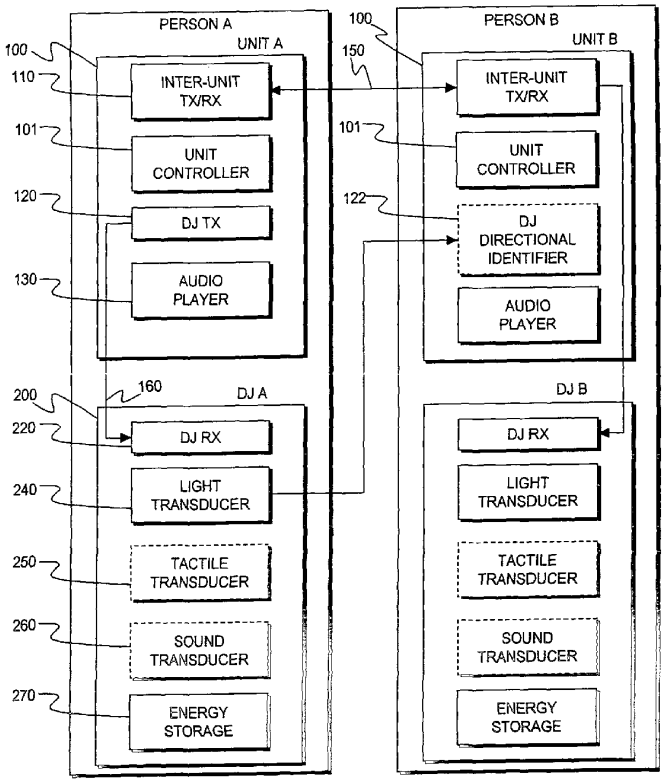
[Continued on next page]

(54) Title: LOCALIZED AUDIO NETWORKS AND ASSOCIATED DIGITAL ACCESSORIES



(57) Abstract: Individuals share music through portable audio devices that synchronously play music by transmitting music signals from one device to the other. Upon request, other individuals can join such a sharing group as a member, and these new members can either be accepted automatically, or through voting by existing group members. So that members of a group can converse, the fraction of ambient sound admitted by the earphones of the portable device can be manually set. In order to enhance the enjoyment of the music, wearable transducers, such as light emitting diodes, respond to signals related to the beat of the music. Signals can be automatically generated, or manually specified, and signals thereafter stored for playback with the music to which it is related. Wearable transducers associated with individuals at a large music event can be set to receive common signals such that the transducers respond in synchrony with one another

WO 03/093950 A2

ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

LOCALIZED AUDIO NETWORKS AND ASSOCIATED DIGITAL ACCESSORIES

Cross Reference To Related Patent Applications

This application is related to and claims priority from Provisional Patent Application No. 60/378,415, filed May 6, 2002, titled "Localized Audio Networks and Associated Digital Accessories," and from Provisional Patent Application No. 60/388,887, filed June 14, 2002, titled " Localized Audio Networks and Associated Digital Accessories," and from Provisional Patent Application No. 60/452,230, filed March 4, 2003, titled " Localized Audio Networks and Associated Digital Accessories," the contents of each of which are incorporated herein by reference.

Technical Field

The present invention relates to localized wireless audio networks for shared listening of recorded music, and wearable digital accessories for public music-related display, which can be used in conjunction with one another.

Background

Portable audio players are popular consumer electronic products, and come in a variety of device formats, from cassette tape "boom boxes" to portable CD players to digital flash-memory and hard-disk MP3 players. While boom boxes are meant to make music to be shared among people, most of the portable audio players are designed for single person use. While some of this orientation to personal music listening is due to personal preference, other important considerations are the technical difficulties of reproducing music for open area listening with small, portable devices, as well as the social imposition of listening to music in public places with other people who do not wish to listen to the same music, or who are listening to different music that would interfere with one's own music.

There are numerous audio devices that are designed to allow the transfer of music from one portable audio device to another, especially through those that store music in the MP3 audio format. These devices suffer from two main difficulties: firstly, listeners still do not hear the music simultaneously, which is the optical manner to share music, and secondly, there are serious copyright issues associated with the transfer of music files. Thus, it would be preferable for the transfer of the music for simultaneous enjoyment, and which did not

result in a permanent transfer of the music files between the devices, so as not to infringe on the intellectual property rights of the music owners.

Given the sharing of music, listeners will on occasion want to purchase the music for themselves. In such case, it would be beneficial for the user to have a way to obtain the music with minimal effort. It would further be desirable for there to be a way to keep track of the person from whom the listener heard the music, so that the person could be in some way encouraged or compensated.

The earphones associated with a portable music player admit a relatively constant fraction of ambient sound. If listening to music with a shared portable music device, however, one might at times want to talk with a friend, and at times listen to music without outside audible distraction. In such case, it would be desirable to have an earphone for which the amount of external ambient sound could be manually set.

Furthermore, many people like to show their individual preferences, to exhibit themselves, and to demonstrate their group membership. Furthermore, music preferences and listening to music together are among the more important means by which individuals express their individual and group identities. It would be beneficial for there to be a way for individuals to express themselves through their music, and for groups of individuals listening to music together, to be able to demonstrate their group enjoyment of the music.

One means for a person to express their identity through motion would be through having wearable transducers wherein the transduction signal is related to the music. If the transducer were a light transducer, this would result in a display of light related to the music that was being listened to. It would be further beneficial if there were means by which a person could generate control signals for the transducer so that instead of a wholly artificial response to the music, the transducer showed a humanly interpreted display. It would be preferable if these signals could be shared between people along with music files, so that others could entertain or appreciate the light display so produced.

At popular music concerts, there is often a "light show" that pulsates in rough relation to the music. In contrast to the generally vigorous light show, the patrons at the concerts often have light bracelets or other such static displays which are used to join with the displays on the stage. It would be beneficial for there to be a way in which patrons could participate in the light show in order to enhance their enjoyment of the concert.

It is to the solution of these and other problems that the present invention is directed.

Summary of the Invention

It is an object of the present invention to provide users a means of listening to music together using mobile devices.

It is also an object of the present invention to provide users a means of choosing with whom to listen to music.

It is additionally an object of the present invention to provide users the ability to monitor the people that are listening together.

It is furthermore an object of the present invention to provide users a means of expressing their enjoyment of the music they are listening to through visual displays of wearable accessories.

It is yet another object of the present invention to provide users a means of demonstrating their identity with other people they are listening to music with.

It is still further an object of the present invention to provide users to provide users with means to choreograph the visual displays.

Additional objects, advantages and novel features of this invention shall be set forth in part in the description that follows, and will become apparent to those skilled in the art upon examination of the following specification or may be learned through the practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities, combinations, and methods particularly pointed out in the appended claims.

To achieve the foregoing and other objects and in accordance with the purposes of the present invention, as embodied and broadly described therein, the present invention is directed to a method for sharing music from stored musical signals between a first user with a first music player device and at least one second user with at least one second music player device. The method includes the step of playing the musical signals for the first user on the first music player device while essentially simultaneously wirelessly transmitting the musical signals from the first music player device to the at least one second music player device. The method additionally includes receiving the musical signals by the at least one second player device, such that the musical signals can be played on the at least one second player device essentially simultaneously with the playing of the musical signals on the first music player device. In this method, the first and the at least one second users are mobile and maintain less than a predetermined distance.

The present invention is also related to a system of music sharing for a plurality of users. The system includes a first sharing device and at least one second sharing device, each comprising a musical signal store, a musical signal transmitter, a musical signal receiver, and a musical signal player. Furthermore, the system comprises a broadcast user operating the first sharing device and at least one member user operating the at least one second sharing device. The broadcast user plays the musical signal for his own enjoyment on the first sharing device and simultaneously transmits the musical signal to the receiver of the at least one second sharing device of the at least one member user, on which the musical signal is played for the at least one member user. The broadcast user and the at least one member user hear the musical signal substantially simultaneously.

The present invention yet further is related to a wireless communications system for sharing audio entertainment between a first mobile device and a second mobile device in the presence of a non-participating third mobile device. The system includes an announcement signal transmitted by the first mobile device for which the second mobile device and the third mobile device are receptive. In addition, the system includes a response signal transmitted by the second mobile device in response to the announcement signal for which the first mobile device is receptive and for which the third mobile device is not receptive. Also, the system includes an identifier signal transmitted by the first mobile device to the second mobile device in response to the response signal, and which is not receptive to the third mobile device. Finally, the system includes a broadcast signal comprising audio entertainment that is transmitted by the first mobile device, and which is receptive by the second mobile device on the basis of the reception of the identifier signal.

The present invention additionally is related to an audio entertainment device. The device includes a signal store that stores an audio entertainment signal, a transmitter that can transmit the stored audio entertainment signal, a receiver that can receive the transmitted audio entertainment signal from a transmitter of another such device, and a player that can play audio entertainment from a member selected from the group of stored audio entertainment signals or audio entertainment signals transmitted from the transmitter of another such device.

The present invention yet still is related to a system for identifying a first device that introduces a music selection to a second device. The system includes a mobile music transmitter operated by the first device and a mobile music receiver operated by the second device. In addition, the system includes a music signal comprising the music selection transmitted by the transmitter and received by the receiver, an individual musical identifier

that is associated with the music selection, and an individual transmitter identifier that identifies the transmitter. The transmitter identifier and the individual music identifier are stored in association with each other in the receiver.

The present invention is still further related to an audio entertainment device. The device includes a wireless transmitter for the transmission of audio entertainment signals and a wireless receiver for the reception of the transmitted audio entertainment signals from a transmitter of audio entertainment signals. A first manually-separable connector for electrically connecting with an audio player allows transfer of audio entertainment signals from the player to the device. The device also includes a second connector for connecting with a speaker and a control to manually switch between at least three states. In the first state the speaker plays audio entertainment signals from the audio player and the transmitter does not transmit the audio entertainment signals. In the second state the speaker plays audio entertainment signals from the audio player and the transmitter essentially simultaneously transmits the audio entertainment signals. In the third state the speaker plays audio entertainment signals received by the receiver.

The present invention also still is related to a system for the sharing of stored music between a first user and a second user. The system includes a first device for playing music to the first user, comprising a store of musical signals. A first controller prepares musical signals from the first store for transmission and playing, and a first player takes musical signals from the first controller and plays the signals for the first user. A transmitter is capable of taking the musical signals from the controller and transmitting the musical signals via wireless broadcast. A second device for playing music to the second user comprises a receiver receptive of the transmissions from the transmitter of the first device, a second controller that prepares musical signals from the receiver for playing, and a second player that takes musical signal from the second controller and plays the signals for the second user. The first user and the second user hear the musical signals at substantially the same time.

The present invention also is related to an earphone for listening to audio entertainment allowing for the controlled reception of ambient sound by a user. The earphone includes a speaker that is oriented towards the user's ear and an enclosure that reduces the amount of ambient noise perceptive to the user. In addition, a manually-adjustable characteristic of the enclosure adjusts the amount of ambient sound perceptive to the user.

The present invention is further related to a mobile device for the transmission of audio entertainment signals. The mobile device includes an audio signal store for the storage

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of the audio entertainment signals, and an audio signal player for the playing of the audio entertainment signals. The device also includes a wireless transmitter for the transmission of the audio entertainment signals and a transmitter control to manually switch between two states consisting of the operation and the non-operation of the audio transmitter.

The present invention yet still is related to a mobile device for the reception of digital audio entertainment signals. The mobile device includes an audio signal store for the storage of the digital audio entertainment signals and an audio receiver for the reception of external digital audio entertainment signals from a mobile audio signal transmitter located within a predetermined distance of the audio receiver. The device also includes a receiver control with at least a first state and a second state. An audio signal player plays digital audio entertainment signals from the audio signal store when the receiver control is in the first state, and plays digital audio entertainment signals from the audio receiver when the receiver control is in the second state.

The present invention furthermore relates to a method for the shared enjoyment of music from stored musical signals between a first user with a first music player device and at least one second user with at least one second music player device. The method includes the step of playing the musical signals for the first user on the first music player device while essentially simultaneously wirelessly transmitting synchronization signals from the first music player device to the at least one second music player device. The method also includes receiving the synchronization signals by the at least one second player device. The synchronization signals allow the musical signals on the at least one second player device to be played essentially simultaneously with the playing of the musical signals on the first music player device. The first and the at least one second users are mobile.

The present invention yet furthermore relates to a wireless communications system for sharing audio entertainment between a first mobile device and a second mobile device. The system includes a broadcast identifier signal transmitted by the first mobile device to the second mobile device. A personal identifier signal is transmitted by the second mobile device to the first mobile device. A broadcast signal comprising audio entertainment is transmitted by the first mobile device of which the second device is receptive. The first mobile device and the second mobile device have displays which can display the identifier signal that they receive and the second mobile device can play the audio entertainment from the broadcast signal that it receives.

The present invention also relates to a method for enhancing enjoyment of a musical selection. The method includes the steps of obtaining control signals related to the musical

selection, transmitting the control signals wirelessly, receiving the control signals, and converting the control signals to a humanly-perceptible form.

The present invention further yet relates to a method for generating and storing control signals corresponding to musical signals. The method includes the steps of playing musical signals for a user and receiving manual input signals from the user that are produced substantially in synchrony with the music. The method also includes the steps of generating control signals from the input signals, and storing the control signals so that they can be retrieved with the musical signals.

The present invention still additionally relates to a wearable personal accessory. The accessory includes an input transducer taken from the group consisting of a microphone and an accelerometer. The transducer generates a time-varying input transduction signal. The accessory also includes a controller that accepts the input transduction signal, and generates an output transducer signal whose signal varies in amplitude with time. An output transducer receptive of the output transducer signal provides a humanly-perceptible signal. An energy source powers the input transducer, controller and output transducer.

The present invention also still relates to a wearable personal accessory controlled via wireless communications. The accessory includes a wireless communications receiver that is receptive of an external control signal. The accessory also includes a controller that accepts the external control signal and that generates a time-varying visual output transducer signal. A visual output transducer is receptive of the output transducer signal, and provides a humanly-perceptible visual signal. An energy store powers the receiver, controller and output transducer. The visual output transducer generates visually-perceptive output.

The present invention still further relates to a device for converting user tactile responses to stored music into a stored control signal. The device includes a player that plays stored music audible to the user and a manually-operated transducer that outputs an electrical signal. The transducer is actuated by the user in response to the music. A controller receives the electrical signal and outputs a control signal and a store receives the control signal and stores it.

The present invention furthermore relates to a music player that wirelessly transmits control signals related to the music, wherein the control signals control a wearable electronic accessory. The music player includes a store of music signal files and a controller that reads a musical signal file from the store and generates audio signals. The controller further generates the control signals. A transducer converts the audio signals into sound audible to

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the user and a wireless transmitter transmits the control signal to the wearable electronic accessory.

The present invention yet relates to a music player that wirelessly transmits control signals related to the music, wherein the control signals control a wearable electronic accessory. The music player includes a store of music signal files and a second store of control signal files associated with the music signal files. A controller reads a musical signal file from the store and generates audio signals. The controller further reads an associated control signal file. A transducer converts the audio signals into sound audible to the user, and a wireless transmitter transmits the control signals from the associated control signal file to the wearable electronic accessory.

The present invention also relates to a system for exhibition of music enjoyment. The system includes a source of music signals, a controller that generates control signals from the music signals, and a transmitter of the control signals. The transmission of the control signals is synchronized with the playing of the music signals. In addition, the system includes a receiver of the control signals and a transducer that responds to the control signals.

The present invention further relates to a method for transferring a wearable-accessory control file stored on a first device to a second device in which an associated music file is stored. The method includes the steps of storing on the first device the name of the music file in conjunction with the control file with which it is associated and requesting by the second device of the first device for a control file stored in conjunction with the name of the music file. In addition, the method includes the step of transferring the control file from the first device to the second device. The control file is stored on the second device in conjunction with the name of the associated music file.

The present invention also relates to a device for transmitting control signals to a wearable accessory receptive of such control signals. The device includes a manually-separable input connector for connecting to an output port of an audio player. Audio signals are conveyed from the audio player to the device across the connector. The device also includes a controller for generating control signals from the audio signals and a transmitter for transmitting the control signals.

Brief Description Of The Drawings

Figure 1 is a schematic block diagram of a local audio network comprised of two linked audio units operated by two persons, and associated digital jewelry conveyed by the two persons.

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Figure 2A is a schematic block diagram of a DJ with multiple independently controlled LED arrays.

Figure 2B is a schematic block diagram of a DJ with an LED array with independently controlled LEDs.

Figures 3A-C are schematic block diagrams of unit elements used in inter-unit communications.

Figure 4 is a schematic flow diagram of DJ entraining.

Figures 5A-B are schematic block diagrams of DJs associated with multiple people bound to the same master unit.

Figure 6 is a schematic block diagram of a cluster comprising a broadcast unit and multiple receive units, with an external search unit.

Figure 7 is a schematic diagram of a broadcast unit transmission.

Figure 8A is a schematic block diagram of audio units with self-broadcast so that audio output is highly synchronized.

Figure 8B is a schematic flow diagram for synchronous audio playing with multiple rebroadcast.

Figures 9A and 9B are schematic block diagrams of hierarchically-related clusters.

Figure 10 is a top perspective view of an earphone with manually adjustable external sound ports.

Figures 11 A and B are cross-sectional diagrams of a earpiece with an extender to admit additional ambient sound.

Figure 12A is a schematic diagram of a modular audio unit.

Figure 12B is a schematic diagram of modular digital jewelry.

Figure 12C is a schematic block diagram of a modular transmitter that generates and transmits control signals for digital jewelry from an audio player.

Figure 13A is a schematic cross-section through a search unit and a broadcast unit in which communications are provided via visible or infrared LED emission in search transmission mode.

Figure 13B is a schematic cross-section through a search unit and a broadcast unit n which communications are provided via a visible or infrared laser in search transmission mode.

Figure 13C is a schematic cross-section through a search unit and a broadcast unit in which communications are provided via visible or infrared emission from a digital jewelry element in broadcast transmission mode.

Figure 13D is a schematic cross-section through a search unit and a broadcast unit in which communications are provided via contact in mutual transmission mode.

Figure 13E is a schematic cross-section through a search unit and a broadcast unit in which communications are provided via sonic transmissions in broadcast transmission mode.

Figure 13F is a schematic cross-section through a search unit and a broadcast unit in which communications are provided via radio frequency transmissions in broadcast transmission mode.

Figure 14A is a schematic block diagram of the socket configurations on the broadcast unit and the receive unit.

Figure 14B is a schematic block flow diagram of using IP sockets for establishing and maintaining communications between a broadcast unit and the receive unit, according to the socket diagram of Figure 14A.

Figure 15 is a schematic block diagram of the IP socket organization used with clusters comprising multiple members.

Figure 16 is a schematic block flow diagram of transfer of control between the broadcast unit and the first receive unit.

Figure 17 is a matrix of DJ and searcher preferences and characteristics, illustrating the matching of DJ and searcher in admitting a search to a cluster.

Figure 18A is a screenshot of an LCD display of a unit, taken during normal operation.

Figure 18B is a screenshot of an LCD display of a unit, taken during voting for a new member.

Figure 19 is a table of voting schemes for the acceptance of new members into a cluster.

Figure 20 is a time-amplitude trace of an audio signal automatically separated into beats.

Figure 21A is a block flow diagram of a neural network method of creating DJ transducer control signals from an audio signal as shown in Figure 20.

Figure 21B is a block flow diagram of a deterministic signal analysis method of creating DJ transducer control signals from an audio signal as shown in Figure 20.

Figure 21C is a schematic flow diagram of a method to extract fundamental musical patterns from an audio signal to create DJ control signals.

Figure 21D is a schematic flow diagram of an algorithm to identify a music model resulting in a time signature.

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Figure 22A is a top-view diagram of an audio unit user interface, demonstrating the use of buttons to create DJ control signals.

Figure 22B is a top-view diagram of a hand-pad for creating DJ control signals.

Figure 22C is a schematic block diagram of a set of drums used for creating DJ control signals.

Figure 23A is a schematic block flow diagram of the synchronized playback of an audio signal file with a DJ control signal file, using transmission of both audio and control signal information.

Figure 24 is a schematic block diagram of a DJ unit with associated input transducers.

Figure 25 is a schematic flow diagram indicating music sharing using audio devices, providing new means of distributing music to customers.

Figure 26 is a schematic diagram of people at a concert, in which DJs conveyed by multiple individuals are commonly controlled.

Figure 27 is a schematic block flow diagram of using a prospective new member's previous associations to determine whether the person should be added to an existing cluster.

Figure 28 is a block flow diagram indicating the steps used to maintain physical proximity between the broadcast unit and the receive unit via feedback to the receive unit user.

Figures 29A is a schematic block diagram of the connection of an Internet-enabled audio unit with an Internet device through the Internet cloud, using an Internet access point.

Figures 29B is a schematic block diagram of the connection of an Internet-enabled audio unit with an Internet device through the Internet cloud, with an audio unit directly connected to the Internet cloud.

Figure 30 comprises tables of ratings of audio unit users.

Figure 31 is tables of DJ, song and transaction information according to the methods of Figure 25.

Figure 32A is a schematic block diagram of maintaining privacy in open transmission communications.

Figure 32B is a schematic block diagram of maintaining privacy in closed transmission communication.

Figure 33 is a schematic block diagram of a hierarchical cluster, as in Figure 9A, in which communications between different units is cryptographically or otherwise restricted to a subset of the cluster members.

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Figure 34A is a schematic block flow diagram of the synchronization of music playing from music files present on the units 100.

Figure 34B is a schematic layout of a synchronization record according to Figure 34A.

Figure 35 is a schematic block diagram of DJ switch control for both entraining and wide-area broadcast.

Figure 36 is a schematic block diagram of mode switching between peer-to-peer and infrastructure modes.

Best Mode for Carrying-Out the Invention

Overview

Figure 1 is a schematic block diagram of a local audio network comprised of two linked audio units 100 operated by two persons, and associated digital jewelry 200 conveyed by the two persons. The persons are designated Person A and Person B, their audio units 100 are respectively Unit A and Unit B, and their digital jewelry 200 are denoted respectively DJ A and DJ B. In this patent specification, "DJ" is used to denote either the singular "digital jewel" or the plural "digital jewelry".

Each unit 100 is comprised of an audio player 130, and an inter-unit transmitter/receiver 110. In addition, each unit 100 comprises a means of communication with the digital jewelry, which can be either a separate DJ transmitter 120 (Unit A), or which can be part of the inter-unit transmitter/receiver 110 (Unit B). Furthermore, unit 100 can optionally comprise a DJ directional identifier 122, whose operation will be described below. Also, unit 100 will generally comprise a unit controller 101, which performs various operational and executive functions of intra-unit coordination, computation, and data transfers. The many functions of the controller 101 will not be discussed separately below, but will be described with respect to the general functioning of the unit 100.

In operation, Unit A audio player 130 is playing recorded music under the control of a person to be designated User A. This music can derive from a variety of different sources and storage types, including tape cassettes, CDs, DVDs, magneto-optical disks, flash memory, removable disks, hard-disk drives or other hard storage media. Alternatively, the audio signals can be received from broadcasts using analog (e.g. AM or FM) or digital radio receivers. Unit A is additionally broadcasting a signal through DJ transmitter 120, which is received by DJ 200 through a DJ receiver 220 that is worn or otherwise conveyed by User A.

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It should be noted that the audio signals can be of any sound type, and can include spoken text, symphonic music, popular music or other art forms. In this specification, the terms audio signal and music will be used interchangeably.

The DJ 200 transduces the signal received by the DJ receiver 220 to a form perceptible to the User A or other people near to him. This transduced form can include audio, visual or tactile elements, which are converted to their perceptible forms via a light transducer 240, and optionally a tactile transducer 250 or an audio transducer 260. The transducers 240, 250 and 260 can either directly generate the perceptible forms directly from the signals received by the DJ receiver 220, or can alternatively incorporate elements to filter or modify the signals prior to their use by the transducers.

When a second individual, User B, perceives the transduced forms produced by User A DJ 200, he can then share the audio signal generated by the audio player 130 of Unit A, by use of the inter-unit transmitter/receiver 110 of Unit A and a compatible receiver 110 of Unit B. Audio signals received by Unit B from Unit A are played using the Unit B audio player 130, so that User A and User B hear the audio signals roughly simultaneously. There are a variety of means by which the Unit B can select the signal of Unit A, but a preferred method is for there to be a DJ directional identifier 122 in Unit B, which can be pointed at the DJ of User A and which receives information needed to select the Unit A signal from the User A DJ, whose transduced signal is perceptible to User B.

Given the audio signal now being exchanged between Unit A and Unit B, User A and User B can experience the same audio signal roughly simultaneously. Within the spirit of the present invention, it is preferable for the two users to hear the audio signals within 1 second of one another, and more preferable for the users to hear the audio signals within 200 milliseconds of one another, and most preferable for the users to hear the audio signals within 50 milliseconds of one another. Furthermore, DJs 200 being worn by User A and User B can receive signals from their respective units, each emitting perceptible forms of their signals. Preferably, the transduced forms expressed by the DJs 200 are such as to enhance the personal or social experience of the audio being played.

Unit 100 Structure

Units 100 comprise a device, preferably of a size and weight that is suited for personal wearing or transport, which is preferably of a size and format similar to that of a conventional portable MP3 player. The unit can be designed on a "base" of consumer electronics products

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such as cell phones, portable MP3 players, or personal digital assistants (PDAs), and indeed can be configured as an add-on module to any of these devices.

In general, the unit 100 will comprise, in addition to those elements described in Figure 1, other elements such as a user interface (e.g. an LCD or OLED screen, which can be combined with a touch-sensitive screen, keypad and/or keyboard), communications interfaces (e.g. Firewire, USB, or other serial communications ports), permanent or removable digital storage, and other components.

The audio player 130 can comprise one or more modes of audio storage, which can include CDs, tape, DVDs, removable or fixed magnetic drives, flash memory, or other means. Alternatively, the audio can be configured for wireless transmission, including AM/FM radio, digital radio, or other such means. Output of the audio signal so generated can comprise wireless or wired headphones or wired or wireless external speakers.

It is also within the spirit of the present invention that the unit 100 can have only receive capabilities, without having separate audio information storage or broadcast capabilities. In concept, such a device can have as little user interface as an on/off button, a button to cause the unit 100 to receive signals from a new "host", and a volume control. Such devices can be very small and be built very inexpensively.

Unit 100 Audio Output

One of the goals of the present invention is to assist communications between groups of people. In general, with mobile audio devices, the music is listened to through headphones. Many headphones are designed so as to reduce to the extent possible the amount of sound which is heard from outside of the headphones. This, however, will have the general effect of reducing the verbal communications between individuals.

In order to avoid this potential problem, it is within the teachings of the present invention that headphones or earphones be provided that allow ambient sound, including a friend's voice, to be easily perceptible to the wearer of the headphones, and that such headphones can be provided that variably allow such sound to be accessible for the headphone's wearer. Such arrangement of the headphones can be obtained either through physical or electronic means. If through electronic means, the headphones can have a microphone associated with them, through which signals received are played back in proportion through the headphone speakers, said proportion being adjustable from substantially all sound being from the microphone to substantially no sound being from the microphone. This microphone can also be a part of a noise cancellation system, such that the

phase of the playback is adjustable -- if the phase is inverted relative to the ambient sound signal, then the external noise is reduced, whereas if the phase is coincident with the ambient sound signal, then the ambient sounds are enhanced.

Figure 10 is a top perspective view of an earphone 900 with adjustable external sound ports. A speaker element 940 is centrally located, and the outside circumferential surface is a rotatable sound shield 910 in which sound ports 930 are placed. The sound ports 930 are open holes to admit sound. Beneath the sound shield 930 is a non-rotatable sound shield in which fixed sound ports 920 are placed in a similar arrangement. As the sound shield 910 is rotated manually by the user, the sound ports 930 and the fixed sound ports 920 come into registration, so that open ports between sources of ambient noise and the outer ear chamber is created, increasing the amount of ambient sound that the user perceives.

Figures 11 A and B are cross-sectional diagrams of an earpiece with an extender 980 that admits additional ambient sound. In Figure 11A, the face of a speaker 960 with a cord 970 is covered with a porous foam block 950 that fits snugly into the ear. While some ambient sound is accessible to the ear through the foam block 950, the majority of the sound is input is impeded. In Figure 11B, the foam extender 980 is placed over the foam block 950 so that a formed shape at the distal end of the extender 980 fits snugly into the ear. A hollow cavity 982 can be allowed in the extender 980 so as to reduce the sound impedance from the speaker 960 to the ear. Ambient sound is allowed into the space between the speaker 960 and the distal end of the extender 980 (shown by the arrows).

Many other arrangements are allowed within the spirit of the present invention to allow ambient sound to more easily access the user's ear, including adjustable headphones or earplugs as in Figure 10, or accessories that can modify the structure of existing earphones and headphones, as in Figure 11B. Such effects can include increasing the number of apertures admitting ambient sound, increasing the size of an aperture (e.g. by adjusting the overlap between two larger apertures), changing the thickness or number of layers in the enclosure, or by placing a manually detachable cup that covers the earphone and ear channel so as to reduce ambient sound.

DJ 200 Transducers

DJs 200 will have a number of common elements, including communications elements, energy storage elements, and control elements (e.g. a manual ON/OFF switch or a switch to signal DJ entraining, as will be described below). In this section, the structure and function of transducers will be described.

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Light Transducers 240

The DJ 200 transducers are used to create perceptible forms of the signals received by the receiver 220. Light transduction can include the use of one or more light-emitting devices, which can conveniently be colored LEDs, OLEDs, LCDs, or electroluminescent displays, which can be supplemented with optical elements, including mirrors, lenses, gratings, and optical fibers. Additionally, motors, electrostatic elements or other mechanical actuators can be used to mechanically alter the directionality or other properties of the light transducers 240. There can be either a single device or an array of devices, and if more than a single device, can display in synchrony, or can be "choreographed" to display in a temporal and/or spatial pattern.

Figure 2A is a schematic block diagram of a DJ 200 with multiple independently controlled LED arrays, wherein the number of LED arrays is preferably between 2 and 8, and is even more preferably between 2 and 4. The signal received from unit 100 via the DJ receiver 220 is passed to a multi-port controller 242 with two ports 294 and 296 connected respectively with two separate arrays 290 and 292 of LEDs 246. These arrays 290 and 292 can be distinguished by spatial placement, color of emitted light, or the temporal pattern of LED illumination. The signal is converted via analog or digital conversion into control signals for the two arrays 290 and 292, which are illuminated in distinct temporal patterns.

It should be noted that the signal received by receiver 220 from the unit 100 can comprise either a signal already in the form required to specify the array and temporal pattern of LED 246 activity, or it can alternatively be converted from a differently formatted signal into temporal pattern signals. For example, the unit 100 can transmit a modulated signal whose amplitude specifies the intensity of LED light amplitude. For multiple LED arrays, signals for the different arrays can be sent together and decoded by the DJ receiver 220, such as through using time multiplexing, or transmission on different frequencies.

Alternatively, the signal could be not directly related to the transduction intensity, such as in the direct transmission of the audio signal being played by the unit 100. In such case, the controller 242 can modify the signal so as to generate appropriate light transduction signals. For example, low frequency bandpass filters could provide the signals for the first array 290, whereas high-frequency bandpass filters could provide the signals for the second array 292. Such filtering could be accomplished by either analog circuitry or digital software within a microprocessor in the controller 242. It is also within the spirit of the present

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invention for the different arrays to respond differently to the amplitude of the signal within a frequency band or the total signal.

An alternative control of LED arrays is presented in Figure 2B, a schematic block diagram of a DJ 200 with an LED array with independently controlled LEDs. In this case, the control signal received by the receiver 200 is passed through a single-port, multiple ID controller 243 to a single array of LEDs, each responsive only to signals with a particular characteristic or identifier. One or more of the LEDs 246 can have the same identifier or be responsive to the same characteristic so as to constitute a virtual array of LEDs.

As mentioned above, the transduced light signal can alternatively or additionally comprise multi-element arrays, such as an LED screen. In such case, the signal received by the receiver 220 can be either a specification of image elements to be displayed on the LED screen, or can be as before, a signal unrelated to the light transduction output. For example, many audio players on computers (e.g. Windows Media player) come with pattern generators that are responsive to the frequency and amplitude of the audio signal. Such pattern generators could be incorporated into the controllers 242 or 243.

Alternatively, the light transducer 240 can be a single color illuminated panel, whose temporal pattern of illumination was similar to that of the LEDs of Figures 2A and 2B. In such case, users can partially cover the panel with opaque or translucent patterns, such as a dog or a skull or a representation of a favorite entertainer.

Whereas the receiver 220 and the light controllers 242 or 243 can be hidden from view, either behind the light transducers or separated from the transducers by a wire, for example, the light transducers are meant to be perceptible to other people. For this purpose, the light transducers can be fashioned into fashion accoutrements such as bracelets, brooches, necklaces, pendants, earrings, rings, hair clips (e.g. barrettes), ornamental pins, netting to be worn over clothing, belts, belt buckles, straps, watches, masks, or other objects. Additionally, the light transducers can be fashioned into clothing, such as arrays of lighting elements sewn onto the outside of articles of clothing such as backpacks, wallets, purses, hats, or shoes. For those articles of clothing that are normally washed, however, the lighting transducers and associated electronics will preferably be able to withstand cleaning agents (e.g. water or dry cleaning chemicals), or will be used in clothing such as scarves and hats that do not need to be washable.

It is also convenient for there to be modular lighting arrangements in which the configuration can easily changed by a user. One example of such a modular arrangement is a light pipe made of a flexible plastic cable or rod, at one or both ends of which is positioned

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a light source that directs light into the rod. At predetermined locations along the rod, the rod surface can be roughened so as to allow a certain amount of light to escape, on which transparent glass or plastic pieces can be clipped, and that are lighted when the pipe is lighted. Alternatively, the light can be uniformly smooth, and transparent pieces of roughly index of refraction matching material can be clipped onto the rod, allowing some fraction of the light to be diverted from the rod into the pieces. The light sources and associated energy sources used in such an arrangement can be relatively bulky and be carried in a backpack, pouch or other carrying case, and can brightly illuminate a number of separate items.

It should be noted that the transducers require an energy store 270, which is conveniently in the form of a battery. The size of the battery will be highly dependent on the transduction requirements, but can conveniently be a small "watch battery". It is also convenient for the energy store 270 to be rechargeable. Indeed, all of the electric devices of the present invention will need energy stores or generators of some sort, which can comprise non-rechargeable batteries, rechargeable batteries, motion generators that can convert energy from the motion of the user into electrical energy that can be used or stored, fuel cells or other such energy stores or converters as are convenient.

Sound Transducers 260

Sound transducers 260 can supplement or be the primary output of the audio player of the unit 100. For example, the unit 100 can wirelessly transmit the audio signal to DJ 200 comprising a wireless headphone sound transducer. This would allow a user to listen to the audio from the audio player without the need for wires connecting the headphones to the unit 100. Such sound transducers can comprise, for example, electromagnetic or piezoelectric elements.

Alternative to headphone or earphone audio production, external speakers, which can be associated with light transducers 240 or tactile transducers 250, can be used to enhance audio reproduction from external speakers associated with the unit 100. In addition or alternative to simple reproduction of the audio signal output by the audio player 130, the sound transducers 260 can play modified or accompanying signals. For example, frequency filters can be used to select various frequency elements from the music (for low bass), so as to emphasize certain aspects of the music. Alternatively, musical elements not directly output from the audio player 130 can be output to complete all instrumental channels of a piece of music, for example.

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Tactile Transducers 250

DJs 200 can be configured with tactile transducers, which can provide vibrational, rubbing, or pressure sensation. As before, signals of a format that control these transducers can be sent directly from the DJ transmitter 120, or can be filtered, modified or generated from signals of an unrelated format that are sent from the transmitter 120. As before, the signal can be the audio signal from the audio player 130, which can, for example, be frequency filtered and possibly frequency converted so that the frequency of tactile stimulation is compatible with the tactile transducer. Alternatively, signals that are of the sort meant for light transduction can be modified so as to be appropriate for tactile transduction. For example, signals for light of a particular color can be used to provide vibrational transduction of a particular frequency, or light amplitudes can be converted into pressure values.

The tactile transducer can comprise a pressure cuff encircling a finger, wrist, ankle, arm, leg, throat, forehead, torso, or other body part. The tactile transducer can alternatively comprise a rubbing device, with an actuator that propels a tactile element tangentially across the skin. The tactile transducer can also alternatively comprise a vibrational device, with an actuator that drives an element normally to the skin. The tactile transducer can further alternatively comprise elements that are held fixed in relation to the skin, and which comprise moving internal elements that cause the skin to vibrate or flex in response to the movement of the internal element.

The tactile transducer can lack any moveable element, and can confer tactile sensation through direct electrical stimulation. Such tactile elements are best used where skin conductivity is high, which can include areas with mucus membranes.

Tactile transduction can take place on any part of the body surface with tactile sensation. In addition, tactile transduction elements can be held against the skin overlying bony structures (skull, backbone, hips, knees, wrists), or swallowed and conveyed through the digestive tract, where they can be perceived by the user.

Input Transducers

It should also be understood that the DJ 200 can comprise input transducers in order to create control signals from information or stimuli in the local environment. Figure 24 is a schematic block diagram of a DJ unit 200 with associated input transducers. The input-enabled DJ 1320 comprises energy storage 270, a controller 1322, output transducers 1324, a

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DJ receiver 220 and input transducers 1326. The input transducers 1326 can comprise one or more of a microphone 1328 and an accelerometer 1330.

In operation, the energy storage 270 provides energy for all other functions in the DJ 1320. The controller 1322 provides control signals for the output transducers 1324, which can comprise tactile transducers 250, sound transducers 260, and/or light transducers 240. Input to the controller can be provided via the input transducers 1326, optionally along with input from the DJ receiver 220.

For example, on a dance floor, the microphone 1328 can provide electrical signals corresponding to the ambient music. These signals can be converted into transducer 1324 control signals in a manner similar to that described below for the automatic generation of control signals according to Figures 21 A-C, as will be described below. This allows the use of the DJ functionality in the absence of an accompanying audio unit 100, expanding the applications of the DJ 200. An automatic gain filter can be applied so as to compensate for the average volume level – because the user can be close or far from the sources of ambient music and the music can vary in volume, the strength of the DJ 200 transduction can be normalized. In addition, it can also be preferable for there to be a manual amplitude control 1323, such as a dial or two position rocker switch, by which the average intensity of the DJ 200 control signals can be varied to suit the taste of the user. The amplitude control 1323 can operate through modulating the input transducer 1326 output or as an input to the controller 1322 as it generates the signals for the output transducers 1324.

Alternatively, the accelerometer 1330 can track the movement of the person wearing the DJ 100, such that a signal indicating acceleration in one direction can be converted by the controller 1322 into signals for a channel of output transducers 1324. The accelerometer 1330 can be outfitted with sensors for monitoring only a single axis of motion, or alternatively for up to three independent directions of acceleration. Thus, the controller 1322 can convert sensed acceleration in each direction into a separate channel, horizontal axes of acceleration could be combined into a single channel and the vertical axis into a second channel, or other such linear or non-linear combination of sensed acceleration can be combined in aesthetic fashion.

It is also within the spirit of the present invention that multiple input signals be combined by the controller 1322 to create control signals for aesthetic output from the output transducers 1324. For example, one channel can be reserved for control signals generated from accelerometer signals, another channel for control signals generated from microphone signals, and yet a third channel from control signals generated from DJ receiver 220 input. In

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general, the information from the DJ receiver 220 and from the microphone 1328 will be of the same type (i.e. generated from audio signals), so that the most common configurations will be control signals from a combination of the microphone 1328 and accelerometer 1330, and signals from a combination of the DJ receiver 220 and the accelerometer 1330.

The input transducers 1326 can further comprise a light sensor, such that the DJ would mimic light displays in its environment, making it appear that the DJ is part of the activity that surrounds it. In this case, the controller 1322 would preferably generate control signals based on rapid changes in the ambient lighting, since it would be less aesthetic to have the DJ transducers provide constant illumination. Furthermore, slowly changing light (on the order of tens or hundreds of milliseconds) will be created naturally by the movement of the user, whereas changes in the lighting (e.g. strobes, laser lights, disco balls) will be of much faster change (on the order of milliseconds). Thus, to match the ambient dance lighting, it is aesthetic for the DJ 200 to respond most actively to ambient light that is changing in intensity a predetermined percentage in a predetermined time, wherein the predetermined percentage is at least 20% and the predetermined time is 20 milliseconds or less, and even more preferably for the predetermined percentage to be at least 40% and the predetermined time is 5 milliseconds or less.

Unit to Unit Communication

Units 100 transfer audio signals from the audio player in one unit 100 to the audio player 130 of another unit 100. Figures 3A-C are schematic block diagrams of unit 100 elements used in inter-unit communications. Each diagram presents communications between a Unit A and a Unit B, with Unit A transmitting audio signals to Unit B. Dashed connectors and elements indicate elements or transfers that are not being utilized in that unit 100, but are placed to indicate the equivalence of the transmitting and receiving units 100.

In Figure 3A, compressed audio signals (e.g. in MP3 format or MPEG4 format for video transfers, as described below) stored in a compressed audio storage 310 are transferred to a signal decompressor 302, where the compressed audio signal is converted into an uncompressed form suitable for audio output. In Unit A, this decompressed signal is passed both to the local speaker 300, as well as to the inter-unit transmitter/receiver 110. The Unit B inter-unit transmitter-receiver 110 receives the uncompressed audio signal, which is sent to its local speaker for output. Thus, both Unit A and Unit B play the same audio from the Unit A storage, in which uncompressed audio is transferred between the two units 100.

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In Figure 3B, compressed audio signals from the Unit A compressed audio storage 310 are sent both to the local signal decompressor 302 and to the inter-unit transmitter/receiver 110. The Unit A decompressor 302 conditions the audio signal so that it is suitable for output through the Unit A speaker 300. The compressed audio signal is sent via Unit A transmitter-receiver 110 to the Unit B transmitter/receiver 110, where it is passed to the Unit B decompressor 302 and thence to the Unit B speaker 300. In this embodiment, because compressed audio signals are transmitted between the units 100 transmitter/receivers 302, lower bandwidth communications means can be used in comparison with the embodiment of Figure 3A.

In Figure 3C, compressed audio signals from the Unit A compressed audio storage 310 are sent to the Unit A signal decompressor 302. These decompressed signals are sent to both the local speaker 300 as well as to a local compressor 330, which recompresses the audio signal to a custom format. In addition to decompressed audio signal input, the compressor also optionally utilizes information from a DJ signal generator 320, which generates signals to control DJ transducers 240, 250 and 260, which can be sent in conjunction with the audio signal. The signal generator 320 can include analog and/or digital filtering or other algorithms that analyze or modify the audio signals, or can alternatively take manually input transducer control signals input as described below. The custom compression can include multiplexing of the audio signals with the transducer control signals.

The custom compressed audio signals, are then passed to the Unit A inter-unit transmitter/receiver 110, which are then transferred to the Unit B inter-unit transmitter/receiver 110, and thence to the Unit B signal decompressor 302 and speaker 300.

Given the time delays in signal transfer between the units 100, custom compression that takes place in the sending unit, and any subsequent decompression that takes place in the receiving unit 100, it can be convenient to place a delay on the local (i.e. Unit A) speaker output of tens of milliseconds, so that both units 100 play the audio through their speakers at roughly the same time. This delay can include limited local digital storage between the local signal decompression and speaker 300 output.

Various hardware communications protocols will be discussed below with respect to unit-to-unit communications, but in general it is required that the distance between the units that must be maintained be preferably at least 40 feet, and more preferably at least 100 feet, and most preferably 500 feet, in order to allow units 100 sharing music to be able to move reasonably with respect to one another (e.g. for a user to go to the bathroom without losing contact), or to find each other in a large venue such as a shopping mall.

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Communications Protocols

Communication between the inter-unit transmitter/receivers 110 can involve a variety of protocols within the teachings of the present invention, and can include IP protocol-based transmissions mediated by such physical link layers as 802.11a, b or g, WDCT, HiperLAN, ultra-wideband, 2.5 or 3G wireless telephony communications, custom digital protocols such as Bluetooth or Millennial Net i-Beans. Indeed, it is not even necessary for the transmissions to be based on Internet protocol, and conventional analog radio-frequency or non-IP infrared transmissions are also within the spirit of the present invention. Each unit 100 will generally have both transmission and reception capabilities, though it is possible for a unit to have only reception capabilities. While the bandwidth of the broadcast is dependent on the compression of the audio signal, it is preferable for the transmission bandwidth to be larger than 100 kb/sec, and even more preferable for the transmission bandwidth to be greater than 250 kb/sec.

While the distance of transmission/reception is not bounded within the teachings of the present invention, it will generally be less than a few hundred meters, and often less than 50 meters. The distance of communication is limited in general by the amount of power required to support the transmission, the size of antennae supported by portable devices, and the amount of power allowed by national regulators of broadcast frequencies. Preferably, however, the range of transmission will be at least 10 meters, and even more preferably at least 30 meters, in order to allow people sharing communications to move some distance from one another without communications being lost.

The unit 100 is characterized generally by four sets of roughly independent characteristics: playing audio or not playing audio, transmitting or not transmitting, receiving or not receiving, searching or not searching.

Units 100 will often function in conditions with large numbers of other units 100 within the communications range. For example, in a subway car, a classroom, bicycling, or at a party, a unit 100 can potentially be within range of dozens of other units. A unit 100 that is playing audio from local compressed audio storage 310 can, at the user's prerogative, choose to broadcast this audio to other units 100. A unit 100 that is currently "listening" to a broadcast or is searching for a broadcast to "listen" to will require a specific identifier roughly unique to a broadcaster in order to select that broadcaster signal from among the other possible broadcasters. Some of the communications protocols listed above, such as those based on IP protocols, 2.5G or 3G wireless, or Bluetooth communications, have such

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identifiers as part of the protocols. Custom radio frequency based protocols will require protocols to allow signals to be tagged with specific identifiers.

A unit 100 that is transmitting signals can, within the spirit of the present invention, be prevented from simultaneously receiving signals. Preferably, however, units 100 can both transmit and receive simultaneously. One example of the use of simultaneous transmission and reception is for a unit 100 that is receiving a signal to send a signal indicating its reception to the transmitting unit 100. This allows the transmitting unit to determine the number of units 100 that are currently receiving its broadcast. In return, this information could be sent, along with the audio signal, so that all of the users with units 100 receiving the broadcast can know the size of the current reception group. Alternatively, a user with a unit 100 that is currently broadcasting can be searching for other broadcasting units, so that the user can decide whether to continue broadcasting or whether to listen to the broadcast of another unit.

Unit to DJ Communication

Communication between the unit 100 and the DJ 200 can be either through the inter-unit transmitter/receiver 110, or through a separate system. In general, the requirement of the DJ 200 is for reception only, although it is permissible for the DJ 200 to include transmission capabilities (e.g. to indicate to the unit 100 when the DJ 200 energy storage 270 is near depletion).

The signals for which the DJ 200 is receptive is dependent on how the transduction control signals are generated. For example, for a controller 242 that incorporates a filter or modifier that takes the audio signal as its input, the DJ receiver 220 would receive all or a large fraction of the audio signal. In this case, the communication between the unit 100 and the DJ 200 would require a bandwidth comparable to that of inter-unit communication, as described above.

However, if the signals are either generated in the unit 100, or pre-stored along with the stored compressed audio signal, then the communications bandwidth can be quite modest. Consider a DJ 200 with 2 arrays 290 and 292 of LEDs 246, which flash with a frequency of no more than 10 Hertz, and that the LEDs are in either an ON or an OFF state, without intermediate amplitudes. In such case, the maximum bandwidth required would be only 20 bits/second, in addition to the DJ control signals.

The range of unit to DJ communications need not be far. In general, the unit 100 and the DJ 200 will be carried by the same user, so communications ranges of 10 feet can be

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adequate for many applications. Some applications (see below) can require, however, somewhat larger ranges. On the other hand, longer communications ranges will tend to confer the possibility of overlap and interference between two different units 100 to their respective DJs 200. In general, for the application of unit to DJ communications, it is preferable for the minimum range of communications to be at least 1 foot, and more preferably for the minimum range of communications to be at least 10 feet, and most preferably for the minimum range of communications to be at least 20 feet. Also, for the application of unit to DJ communications, it is preferable for the maximum range of communications to be no more than 500 feet, and more preferably for the maximum range of communications to be no more than 100 feet, and most preferably for the maximum range of communications to be no more than 40 feet. It should be noted that these communications ranges refer primarily to the transmission distance of the units 100, especially with regard to the maximum transmission distance.

Because there can be multiple unit 100/DJ 200 ensembles within a relatively short distance, communications between a unit 100 and a DJ 200 preferably comprise both a control signal as well as a unit identification signal, so that each DJ 200 receives its control signals from the correct unit 100. Because the unit 100 and the DJ 200 will not, in general, be purchased together, or that a user can buy a new unit 100 to be compatible with already owned DJs 200, it is highly useful to have a means of "entraining" a DJ 200 to a particular unit 100, called its "master unit", and a DJ 200 entrained to a master unit is "bound" to that unit.

Figure 4 is a schematic flow diagram of DJ entraining. To entrain a DJ 200, the DJ is set into entraining mode, preferably by a physical switch on the DJ 200. The master unit 100 to which the DJ 200 is to be entrained is then placed within communications range, and the unit 100 transmits through the DJ transmitter 120 an entraining signal that includes the master unit 100 identifier. Even should there be other units 100 transmitting in the vicinity, it is unlikely that they would be transmitting the entraining signal, so that entraining can often take place in a location with other active units 100. Verification that the entraining took place can involve a characteristic sequence of light output (for light transduction), audio output (for sound transduction) or motion (for tactile transduction). After verification, the DJ 100 is reset to its normal mode of operation, and will respond only to control signals accompanied by the identifier of its master unit 200.

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It should be noted that there can be multiple DJ's 200 bound to the same master unit 100. Thus, a single person can have multiple light transducing DJs 200, or DJs 200 of various modes (light, sound, tactile) transduction.

While DJs 200 will generally be bound to a master unit associated with the same person, this is not a requirement of the present invention. Figures 5A-B are schematic block diagrams of DJs 200 associated with multiple people bound to the same master unit. In Figure 5A, DJ A 200and DJ B 200 are both bound to the same DJ transmitter 120, even though DJ A 200 and DJ B 200 are carried by different persons. This is particularly useful if the control signals are choreographed manually or through custom means by one person, so that multiple people can then share the same control signals. Such a means of synchronization is less necessary if the DJ 200 control signals are transmitted between units 100 through the inter-unit transmitter/receiver 110 along with the audio signals. Furthermore, in this case, it is better for the range of unit-to-DJ communication to be in the range of the inter-unit communication described above.

In the case of sound transducers 260, the DJ B 200 can comprise a wireless audio earpiece, allowing users to share music, played on a single unit 100, privately. Consider Figure 5A, configured with sound transducers 260 (see, for example, Figure 1) in DJ A 200 and DJ B 200. Signals from the audio player 130 are transmitted by the DJ transmitter 120, where they are received by DJs 200 – DJ A and DJ B – that are carried by Person A and Person B, respectively. In this case, both persons can listen to the same music.

Figure 5B shows the operation of a wide-area broadcast unit 360, which is used primarily to synchronize control of a large number of DJs 200, such as might happen at a concert, party or rave. In this case, the audio player 130 is used to play audio to a large audience, many of whom are wearing DJs 200. In order to synchronize the DJ output, a relatively high-power broadcast transmitter 125 broadcasts control signals to a number of different DJs 200 carried by Person A, Person B and other undesignated persons. The entraining signal can be automatically sent on a regular basis (e.g. whenever music is not being played, such as between songs, or interspersed within compressed or decompressed songs) so that patrons or partygoers could entrain their DJs 200 to the broadcast unit 360. The broadcast unit 360 can also transmit inter-unit audio signals, or can only play the audio through some public output speaker that both Person A and Person B can enjoy.

Figure 26 is a schematic diagram of people at a concert, in which DJs 200 conveyed by multiple individuals are commonly controlled. At a concert venue 1370, music is produced on a stage 1372, and concert patrons 1376 are located on the floor of the venue.

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Many of the patrons have DJs 200 which are receptive to signals generated by a broadcast DJ controller 1374. The broadcast DJ controller creates signals as described below, in which the music is automatically converted into beats, where microphones are used to pick up percussive instruments, and/or where individuals use a hand-pad to tap out control signals. These control signals are either broadcast directly from the area of the broadcast DJ controller 1374, or alternatively are broadcast from a plurality of transmitters 1380 placed around the venue 1370, and which are connected by wires 1378 to the controller 1374 (although the connection can also be wireless within the spirit of the present invention). It should be understood that the protocol for transmitting DJ control signals can be limited either by hardware requirements or by regulatory standards to a certain distance of reception. Thus, to cover a sufficiently large venue, multiple transmitters can be necessary to provide complete coverage over the venue 1370. In general, it is preferable for the maximum transmission distance of transmission from the transmitters to be at least 100 feet, and more preferably at least 200 feet, and most preferably at least 500 feet, so as to be able to cover a reasonable venue 1370 size without needing too many transmitters 1380.

An alternative embodiment of unit 100 to DJ 200 communications is the use of radio frequency transmitters and receivers, such as those used in model airplane control, which comprise multi-channel FM or AM transmitters and receivers. These components can be very small (e.g. the RX72 receivers from Sky Hooks and Riggings, Oakville, Ontario, Canada), and are defined by the crystal oscillators that determine the frequency of RF communications. Each channel can serve for a separate channel of DJ control signals. In such cases, an individual can place a specific crystal in their audio unit 100, and entraining the DJ 200 is then carried out through the use of the same crystal in the DJ 200. Because of the large number of crystals that are available (e.g. comprising approximately 50 channels in the model aircraft FM control band), interference with other audio units 100 can be minimized. Furthermore, control of many DJs 200 within a venue, as described above, can take place by simultaneously transmitting over a large number of frequencies.

As described above, the wide-area broadcast transmitter 125 can transmit entriaing signals to which the DJs 200 can be set to respond. However, there are a number of other preferred means by which DJs 200 can be used to respond to control signals to which they have not been entrained. For example, the DJs 200 can be set to respond to controls signals to which they have not been entrained should there be no entrained control signals present (e.g. the corresponding unit 100 is not turned on).

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Figure 35 is a schematic block diagram of DJ 200 switch control for both entraining and wide-area broadcast. The DJ 200 comprises a three-way switch 1920. In a first state 1922, the DJ 200 is entrained to the current control signal as described above. Thereafter, in a second state 1924, the DJ 200 responds to control signals corresponding to the entraining signal encountered in the step 1922. In a third state 1926, the DJ 200 responds to any control signal for which its receiver is receptive, and can therefore respond to a wide-area broadcast, thereby providing the user with manual control over the operational state of the DJ 200. It should be noted that the switch 1920 can be any physical switch with at least three discreet positions, or can alternatively be any manual mechanism by which the user can specify at least three states, including a button presses that have a visible user interface or a voice menu.

Figure 12B is a schematic drawing of modular digital jewelry 201. The modular jewelry 201 is comprised of two components: an electronics module 1934 and a display module 1932. These modules 1934 and 1932 can be electrically joined or separated through an electronics module connector 1936 and a display module connector 1938. The value of the modular arrangement is that the electronics module 1934 comprises, in general, relatively expensive components, whose combined price can be many-fold that of the display module 1932. Thus, if a user wants to change the appearance of the jewelry 201 without having to incur the cost of additional electronics components such as the energy storage 270, receiver 220 or controller 1322, they can simply replace the display module 1932 with its arrangement of output transducers 1324 with an alternative display module 1933 with a different arrangement of output transducers 1325.

The transmitter for DJ 200 control signals has been previously discussed primarily in terms of its incorporation within a unit 100. It should be understood, however, that the transmitter can be used in conjunction with a standard audio player unrelated to unit-to-unit communications. Figure 12C is a schematic block diagram of a modular digital jewelry transmitter 143 that generates and transmits control signals from an audio player 131. The modular transmitter 143 is connected to the audio player 131 via audio output port 136 through the cable 134 to the audio input port 138 of the modular transmitter 143. The modular transmitter 143 comprises the the DJ transmitter 120, which can send unit-to-DJ communications. The output audio port 142 is connected to the earphone 901 via cable 146. The earphone 901 can also be a wireless earphone, perhaps connected via the DJ transmitter 120.

The audio output from the player 131 is split both to the earphone 901 and to the controller 241 (except, perhaps where the DJ transmitter transmits to a wireless earphone).

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The controller 241 automatically generates control signals for the DJ 200 in a manner to be described in detail below. These signals are then conveyed to the DJ transmitter 120. It should be understood that this arrangement has the advantage that the digital jewelry functionality can be obtained without the const of the components for the audio player 131, and in addition, that the modular transmitter 143 can then be used in conjunction with multiple audio players 131 (either of different types or as the audio players are lost or broken).

Inter-unit Audio Sharing

Overview

Inter-unit communication involves the interactions of multiple users, who may or may not be acquaintances of each other. That is, the users can be friends who specifically decide to listen to music together, or it can be strangers who share a transient experience on a subway train. The present invention supports both types of social interaction.

An important aspect of the present invention is the means by which groups of individuals join together. Figure 6 is a schematic block diagram of a cluster 700 of units 100, indicating the nomenclature to be used. The cluster 700 is comprised of a single broadcast unit 710, and its associated broadcast DJ 720, as well as one or more receive units 730 and their associated DJs 740. The broadcast unit 710 transmits music, while the receive unit 730 receives the broadcasted music. A search unit 750 and its associated search DJ 760 are not part of the cluster 700, and comprise a unit 100 that is searching for a broadcast unit 710 to listen to or a cluster 700 to become associated with.

It should be noted that many communications systems can be operated alternatively in two modes: one that supports peer-to-peer communications and one that requires a fixed infrastructure such as an access point. Figure 35 is a schematic block diagram of mode switching between peer-to-peer and infrastructure modes. A mode switch 1950 is made by the user, either manually, or automatically – for example, that the user chooses between different functions (listening or broadcasting, file transfers, browsing the Internet) and the system determine the optimal mode to use. A peer-to-peer mode 1952 is well configured for mutual communications between mobile units 100 that are within a predetermined distance, and is well-suited for short-range wireless communications and audio data streaming 1954. Alternatively, the mode switch 1950 enables an infrastructure mode 1956, which is of particular usefulness in gaining access to a wide area network such as the Internet, through

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which remote file transfer 1958 (e.g. downloading and uploading) and remote communications such as Internet browsing can be made through access points to the fixed network.local wireless audio streaming.

It should be noted, however, that certain communications systems, such as many modes of telephony, do not distinguish between mobile communications and communications through fixed access points, and that both file transfer 1958 and audio streaming 1954 can be available through the same mode. Even in those cases, however, it can be convenient to have two modes in order to make optimal use of the advantages of the different modes. In such cases, however, the two modes can alternatively be supported by multiple hardware and software systems within the same device – for example, for remote communications to be made through a telephony system (e.g. GSM or CDMA), while the local audio streaming 1954 can be made through a parallel communications system (e.g. Bluetooth or 802.11) – indeed, the two systems can operate simultaneously with one another.

Inter-unit Transmission Segmentation

Preferably, the broadcast unit 710 and the receive units 730 exchange information in addition to the audio signal. For example, each user preferably has indications as to the number of total units (broadcast units 710 and receive units 730) within a cluster, since the knowledge of cluster 700 sizes is an important aspect of the social bond between the users. This also will help search units 750 that are not part of the cluster determine which of the clusters 700 that might be within their range are the most popular.

The additional information shared between members of a cluster 700 would include personal characteristics that a person might allow to be shared (images, names, addresses, other contact information, or nicknames). For example, the broadcast unit 710 will preferably, along with the music, transmit their nickname, so that other users will be able to identify the broadcast unit 710 for subsequent interactions, and a nickname is significantly easier to remember than a numerical identifier (however, such numerical identifier can be stored in the unit 100 for subsequent searching).

Such additional information can be multiplexed along with the audio signal. For example, if the audio signal is transferred as an MP3 file, assuming that there is additional bandwidth beyond that of the MP3 file itself, the file can be broken into pieces, and can be interspersed with other information. Figure 7 is a schematic diagram of a broadcast unit 710 transmission 820. The transmission is comprised of separate blocks of information, each represented in the figure as a separate line. In the first line, a block code 800 is transmitted,

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which is a distinctive digital code indicating the beginning of a block, so that a search unit 750 receiving from the broadcast unit 710 for the first time can effectively synchronize itself to the beginning of a digital block. Following the block code 800 is a MP3 block header 802, which indicates that the next signal to be sent will be from a music file (in this case an MP3 file). The MP3 block header 802 includes such information as is needed to interpret the following block of MP3 file block 804, including such information as the length of the MP3 block 804, and characteristics of the music (e.g. compression, song ID, song length, etc.) that are normally located at the beginning of a MP3 file. By interspersing this file header information at regular intervals, a user can properly handle music files that are first received in the middle of the transmission of an MP3 file. Next, the MP3 block 804 containing a segment of a compressed music file is received.

Dependent on the amount of music compression and the bandwidth of the inter-unit communications, other information can be sent, such as user contact information, images (e.g. of the user), and personal information that can be used to determine the "social compatibility" of the user with the broadcast unit 710 and the receive unit 730. This information can be sent between segments of MP3 files or during "idle" time, and is generally preceded by a block code 800, that is used to synchronize transmission and reception. Next, a header file is transmitted, which indicates the type of information to follow, as well as characteristics that will aid in its interpretation. Such characteristics could include the length of information, descriptions of the data, parsing information, etc. In Figure 7, an ID header 806 is followed by an ID block 808, which includes nicknames, contact information, favorite recording artists, etc. Later, an image header 810 can be followed by an image block with an image of the user. The image header 810 includes the number of rows and columns for the image, as well as the form of image compression.

It should be understood that the communications format described in Figure 7 is only illustrative of a single format, and that a large number of different formats are possible within the present invention. Also, the use of MP3 encoding is just an example, and other forms of digital music encoding are within the spirit of the present invention, and can alternatively comprise streaming audio formats such as Real Audio, Windows Media Audio, Shockwave streaming audio, QuickTime audio or even streaming MP3 and others. Furthermore, these streaming audio formats can be modified so as to incorporate means for transmitting DJ 200 control signals and other information.

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Transmitting Dynamic Data and Control Information

As described above, there are benefits to two-way communications between the broadcast unit 710 and the receive unit 730. There are many methods of carrying out this communication, even if the inter-unit transmitter/receiver 110 does not permit simultaneous transmission and reception. For example, additional transmission and reception hardware could be included in each unit 100. Alternatively, in the transmission 820 above, specific synchronization signals such as the block code 800 can be followed by specific intervals during which the inter-unit transmitter/receiver 110 that is transmitting switches into receive mode, while the inter-unit transmitter/receiver 110 that was receiving switches to transmit mode. This switch in communications direction can be for a specific interval, or can be mediated through conventional handshake methods of prior art communications protocols.

It should be noted that in addition to transfer of static information (e.g. identifiers, contact information, or images), dynamic information and control information can also be transferred. For example, the user at the receive unit 730 can be presented with a set of positive and negative comments (e.g. "Cool!" "This is awful!") that can be passed back to the broadcast unit 710 with the press of a button. Such information can be presented to the user of the broadcast unit 710 either by visual icon on, for example, an LCD screen, by a text message on this screen, or by artificial voice synthesis generated by the broadcast unit 710 and presented to the user in conjunction with the music.

Alternatively, the user of the receive unit 730 can speak into a microphone that is integrated into the receive unit 730, and the user voice can be sent back to the broadcast unit 710. Indeed, the inter-unit communications can serve as a two-way or multi-way communications method between all units 100 within range of one another. This two-way or multi-way voice communication can be coincident with that of the playing of the audio entertainment, and as such, it is convenient for there to be separate amplitude control over the audio entertainment and the voice communication. This can be implemented either as two separate amplitude controls, or alternatively as an overall amplitude control, with a second control that sets the voice communications amplitude as a ratio to that of the audio entertainment. In this latter mode, the overall level of audio output by the unit is relatively constant, and the user then selects only the ability to hear the voice communication over the audio entertainment.

In order to express their feelings and appreciation about the music they are hearing, users within a cluster 700 can also press buttons on their units 100 that will interrupt or

supplement the control signals being sent to their respective DJs 200, providing light shows that can be made to reflect their feelings. For example, it can be that all lights flashing together (and not in synchrony with the music) can express dislike for music, whereas intricate light displays could indicate pleasure.

It is also possible to send control requests between units 710. For example, a receive unit 730 can make song requests (e.g. "play again", "another by this artist") that can show on the broadcast unit 710 user interface. Alternatively, the user of a receive unit 730 can request that control be switched, so that the receive unit 730 becomes the broadcast unit 710, and the broadcast unit 710 becomes a receive unit 730. Such requests, if accepted by the initial broadcast unit 710 user, will result in the memory storage of the identifier of the broadcast unit 710 being set in all units in the cluster 700 to that of the new broadcast unit 730. Descriptions of the communications resulting in such a transfer of control will be provided below.

Additionally, it is also possible for users of units 100 to privately "chat" with other users while they are concurrently receiving their audio broadcasts. Such chat can be comprised of input methods including keyboard typing, stylus free-form writing/sketching, and quickly selectable icons.

It should be understood that within the spirit of the present invention that the functional configuration can be supported by the extension of certain existing devices. For example, the addition of certain wireless transmitter and receiver, as well as various control and possibly display functionality to a portable audio player would satisfy some embodiments of the present invention. Alternatively, by the addition of music storage and some wireless transmitter and receiver functionality, a mobile telephone would also allow certain embodiments of the present invention. In such case, the normal telephony communications, perhaps supported by expanded 3G telephony capabilities, could serve to replace aspects of the IP communications described elsewhere in this specification.

IP Socket Communication Embodiments

A standard set of protocols for inter-unit communications is provided through IP socket communications, which is widely supported by available wireless communications hardware, including 820.11a, b and g (Wi-Fi). An embodiment of inter-unit communications is provided in Figures 14A-B. Figure 14A is a schematic block diagram of the socket configurations on the broadcast unit 710 and the receive unit 730.

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In the discussion below, transfer of the different messages and audio information are provided, generally but not always, through an Internet protocol. At the transport layer of such protocols, there will generally be used either a connectionless protocol or a connection-oriented protocol. Among the most common of these protocols are respectively the User Datagram Protocol (UDP) and the Transmission Control Protocol (TCP), and wherever these protocols are used below, it should be noted that any like protocol (connectionless or connection-oriented), or the entire class of protocol can generally be substituted in the discussion.

The broadcast unit 710, prior to the membership of the receive unit 730, broadcasts the availability of the broadcast on a broadcast 1050, which is generally a TCP socket. The annunciator 1050 broadcasts on a broadcast address with a predetermined IP address and port. The receive unit 730 has a client message handler 1060 that is also a TCP socket that is looking for broadcasts on the predetermined IP address and port. When it receives the broadcast, a handshake creates a private server message handler 1070 on a socket with a new address and port on the broadcast unit 710. The broadcast unit 710 and the receive unit 730 can now exchange a variety of different messages using the TCP protocol between the server message handler 1070 and the client message handler 1060. This information can comprise personal information about the users of the broadcaster unit 710 and the receive unit 730. Alternatively or additionally, the broadcast unit 710 can transfer a section of the audio signal that is currently being played, so that the user of the receive unit 730 can "sample" the music that is being played on the broadcast unit 710. It should be noted that, in general, the broadcast unit 710 continues its broadcast on the broadcast annunciator 1050 for other new members.

Once it is established that the broadcast unit 710 and the receiver unit 730 are mutually desirous of providing and receiving an audio broadcast, respectively, sockets optimized for broadcast audio are created both on the broadcast unit 710 and the receiver unit 730. These sockets will often be UDP sockets – on the broadcast unit 710, a multicast out socket 1080 and on the receiver unit 730, a multicast in socket 1090.

Figure 14B is a schematic block flow diagram of using IP sockets for establishing and maintaining communications between a broadcast unit 710 and the receive unit 730, according to the socket diagram of Figure 14A. In a step 1100, the broadcast annunciator 1050 broadcasts the availability of audio signals. In a step 1102, the receiver unit 730 searches for a broadcast annunciator 1050 on the client message handler 1060 socket. Once a connection is initiated in a step 1104, the broadcast unit 710 creates the message handler

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socket 1070 in a step 1106, and the receiver unit 730 retasks the message handler socket 1060 for messaging with the broadcast unit 730. The broadcast annunciator 1050 continues to broadcast availability through the step 1100.

In a step 1110, the broadcast unit 710 and the receiver unit 730 exchange TCP messages in order to establish the mutual interest in audio broadcasting and reception. Should there not be mutual acceptance, then the system returns to the original state in which the broadcast unit 710 is transmitting the broadcast annunciation in the step 1100, and the receive unit 730 searches for broadcasts in the step 1102. Given that the receive unit 730 and the broadcast unit 710 will be within communications distance, and that the broadcast unit 710 is transmitting an annunciation for which the receive unit 730 is receptive, the broadcast unit 710 will be set into a state where it will not establish communications with the receive unit 730 in the step 1106. This can occur either by not creating the message socket in the step 1106 when connection is made with the receiver unit 730, or that the annunciator 1050 remains silent for a predetermined period, perhaps for a period of seconds.

If the broadcast unit 710 and the receiver unit 730 do mutually accept a multicasting relationship, the broadcast unit 710 creates the multicast out UDP socket 1080 in a step 1112 and the receiver unit 730 creates the multicast in UDP socket 1090 in the step 1114, and multicast audio transmission and reception is initiated in a step 1116. It should be noted that should the broadcast unit 710 already be multicasting audio to a receiver unit 730 prior to the step 1112, the multicast out socket 1080 is not created, but that the address of this existing socket 1080 is communicated to the new cluster member.

Given that a cluster can comprise many members, the system of Figures 14A-B must be able to expand to include multiple members. Figure 15 is a schematic block diagram of the IP socket organization used with clusters comprising multiple members. The broadcast unit 710 includes a broadcast annunciator 1050 indicating broadcast availability for new members. For each member in the cluster, the broadcast unit further comprises a message handler 1070 dedicated to the specific member, whose receive unit 730 in turn comprises a message handler 1060, generally in a one-to-one relationship. The broadcast unit comprises N messaging sockets 1070 for the N receive units of the cluster, while each member has only a single socket 1060 connected to the broadcast unit. Thus, when a member wishes to send a message to the other members of the cluster, the message is sent via the receive unit message handler 1060 to the broadcast unit message handler 1070, and which is then multiply sent to the other receive unit message handlers 1060. It is also within the teachings of the present invention for each member of the cluster to have direct messaging capabilities with each

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other member, assisted in the creation of the communications by the broadcast unit 710, which can share the socket addresses of each member of the cluster, such that each member can assure that it is making connections with other members of the cluster rather than units of non-members. The broadcast unit 710 also comprises a multicast out socket 1080 which transfers audio to individual receiver sockets 1090 on each of the members of the cluster.

Members of the cluster may come and go, especially since members will frequently move physically outside of the transmission range of the broadcast unit 710. In order for the broadcast unit 710 to determine the current number of members of its cluster, it is within the teachings of the present invention for the broadcast unit 710 to use the messaging sockets 1060 and 1070 to "ping" the receive units 730 from time to time, or otherwise attempt to establish contact with each member of the cluster 700. Such communications attempts will generally be done at a predetermined rate, which will generally be more frequent than once every ten seconds. Information about the number of members of a cluster can be sent by the broadcast unit 710 to the other members of the cluster, so that the users can know how many members there are. Such information is conveniently placed on a display on the unit (see, for example, Figures 18A-B).

Music Synchronization

It will be generally desirable that the synchronicity of the audio playback on the broadcast unit 710 and the receive units 730 be highly synchronized, preferably within 1 second (i.e. this provides a low level functionality of listening to music together), more preferably within 100 milliseconds (i.e. near-simultaneous sharing of music, but an observer would be able to hear – or see through DJ 200 visible cues – the non-synchronicity), and most preferably within 20 milliseconds of one another. In a simple embodiment of the present invention, all members of a cluster 700 must communicate directly with the broadcast unit 710, without any rebroadcast. In such cases, making playback on the two units 710 and 730 as similar as possible will tend to synchronize their audio production.

Figure 8A is a schematic block diagram of audio units 100 with self-broadcast so that audio output is highly synchronized. Two audio units 100 are depicted, including a broadcast unit 710 and a receive unit 730. The organization of audio unit 100 elements is chosen to highlight the self-broadcast architecture. The audio media 1500, which can be compressed audio storage 310, stores the audio signals for broadcast. The output port 1502, which can comprise the inter-unit transmitter/receiver 110, transmits a broadcast audio signal, provided by the audio media 1500. The audio media comprise a variety of different storage protocols

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and media, including mp3 files, .wav files, or .au files which are either compressed or uncompressed, monoaural or stereo, 8-bit, 16-bit or 24-bit, and stored on tapes, magnetic disks, or flash media. It should be understood that the spirit of the present invention is applicable to a wide variety of different audio formats, characteristics, and media, of which the ones listed above are given only by way of example. This broadcast audio signal transmitted from the output port 1502 is received at the input port 1504, which can also comprise aspects of the inter-unit transmitter/receiver 110. The signal so received is then played to the associated user via the audio output 1508.

It should be noted that the audio output is normally connected to the audio media 1500 for audio playing when the unit 710 is not broadcasting to a receive unit 730. In such case, there is no need for the audio signals to go to the output port 1502 and thence to the input port 1504. Indeed, even when broadcasting, the audio signal within the broadcast unit 710 can go both directly to the audio output 1508 as well as to be broadcast from the output port 1502.

However, in order to assure the synchronicity of the audio output on the broadcast unit 710 and the receive unit 730, the broadcast unit 710 can present all audio signal from the audio media 1500 for output on the output port 1502. The signal will be received not only on the receiver 730 input port 1504, but also on the input port 1504 of the broadcast unit 710. This can take place either through the physical reception of the broadcast audio signal on a radio frequency receiver, or through local feedback loops within the audio unit 100 (e.g. through employment of IP loopback addresses).

In the receive unit 730, the audio signal received at the input port 1504 goes directly to the audio output 1508, and the other elements of the unit 100 depicted are not active. In the broadcast unit 710, however, if means are used to transfer audio signal between the output port 1502 and the input port 1504 are utilized, and if such transfer means requires less time than that taken for transmitting signal from the output port 1502 of the broadcast unit 710 to the input port 1504 of the receive unit 730, then a delay means 1506 is introduced to provide a constant delay between the input port 1504 and the audio output 1508. This delay can comprise a digital buffer if the signal is digitally encoded, or an analog delay circuit if the signal is analog. Generally, the delay introduced into the audio playback will be a predetermined amount based on the characteristics of the unit hardware and software.

Alternatively, in the case of a digital signal, the delay can be variably set according to the characteristics of the communications system. For example, if there are IP-based communications between the units, the units can "ping" one another in order to establish the

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time needed for a "round-trip" communications between the systems. Alternatively, each receive unit 730 of a cluster 700 can transmit to the broadcast unit 710 a known latency of the unit based on its hardware and transmission characteristics. It should be noted that in order to handle different delays between multiple members of a cluster, a delay can be introduced into both the broadcast unit 710 and the receive unit 730, should a new member to the cluster have a very long latency in communications.

Note that the delay 1506 can serve a second purpose, which is to buffer the music should there be natural interruptions in the connections between the members of the cluster 700 (for example, should the receive units 730 move temporarily outside of the range of the broadcaster unit 710). In such case, should enough audio signal be buffered in the delay 1506, there would not be interruption of audio signal in the receive unit 730. Even in such cases, however, in order to accommodate the differences in time to play audio between units and within a unit, the delays in the broadcast unit 710 can be larger than those in the receive unit 730.

If the music compression and the bandwidth of the inter-unit communications are large enough, it can be that the broadcast unit 710 will broadcast less than half of the time. This will generally allow the receive unit 730 to rebroadcast the information from an internal memory store, allowing the effective range of the broadcast signal to potentially double. This can allow, through multiple rebroadcasts, for a very large range even if each individual unit 100 has a small range, and therefore for a potentially large number of users to listen to the same music.

In order to synchronize those that listen to the music through first, second and Nth rebroadcast, a scheme for multi-broadcast synchronization is presented in Figure 8B, a schematic flow diagram for synchronous audio playing with multiple rebroadcast. In such a case, the cluster 700 is considered to be all units 100 that synchronize their music, whether from an original broadcast or through multiple rebroadcasts. In a first step 780, a unit 100 receives a music broadcast along with two additional data. The first data is the current "N", or "hop" of the broadcast it receives, where "N" represents the number of rebroadcasts from the original broadcast unit 710. Thus, a unit 100 receiving music from the original broadcast unit 710 would have an "N" of "1" (i.e. 1 hop), while a unit 100 that received from that receiving unit 100 would have an "N" of "2" (2 hops), and so on. A second piece of information would be the "largest N" that was known to a unit 100. That is, a unit 100 is in contact generally with all units 100 with which it either receives or transmits music, and each send the "largest N" with which it has been in contact.

In a second step 782, the unit 100 determines the duration between signals in the broadcasts it is receiving. Then, two actions are taken. In a step 786, the unit 100 rebroadcasts the music it has received, marking the music with both its "N" and the largest "N" it knows of (either from the unit from which it received its broadcast or from a unit to which it has broadcast).

Also, in a step 784, the music that has been received is played after a time equal to the duration between signals and the "largest N" minus the unit's "N". This will allow for all units 100 to play the music simultaneously. Consider, for example the original broadcast unit 710. It's "N" is "0", and its "largest N" is the maximum number of rebroadcasts in the network. It will store music for a period of "largest N" (equals "largest N" minus "0") times the duration of a rebroadcast cycle, and then play it. For a unit 100 at the furthest rebroadcast, it's "N" and "largest N" will be equal to one another, so that it will store music for no time (i.e. "largest N" minus "N" = 0), but will play it immediately. This will allow all units 100 in the cluster to play music simultaneously. The limitation, however, is that there is memory in each unit 100 to store the music for a sufficient period of time. The units 100 on the system, however, can transfer the amount of storage that is available with the other information, and the number of rebroadcasts can be limited to the amount of memory available within the units 100 that comprise the cluster 700.

As the size of this multi-broadcast cluster 700 changes, the "largest N" can vary, and it will take generally on the order of "largest N" steps for the system to register "largest N". In such cases, there can be temporary gaps in the music on the order of the duration between signals, which will generally be on the order of tens of milliseconds, but which can be longer.

It should be noted that the synchronization of music does not need to accompany the transfer of an actual music signal. Figure 34A is a schematic block flow diagram of the synchronization of music playing from music files present on the units 100. In this embodiment, in a step 1900, the broadcast unit establishes the presence or absence of the music file comprising the music signals to be played on the receive unit. The music file can be referenced either with respect to the name of the file (e.g. "Ooops.mp3"), or a digital identifier that is associated with the music file.

If the music file is not present, then transfer of the music file from the broadcast unit to the receive units can automatically proceed through a file transfer mechanism such as peer-to-peer transfer in a step 1904. If the file was already present, or if the file has been transferred, or alternatively, if the file transfer has begun and enough of the file is present to

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allow the simultaneous playing of music between the two units 100, transmission of synchronization signals between the two units 100 can commence in a step 1902.

These synchronization signals can comprise many different forms. For example, the synchronization signal can be the time stamp from the beginning of the music file to the current position of the music file being played on the broadcast unit. Alternatively, the broadcast unit can send the sample number that is currently being played on the broadcast unit 100. In order to allow receiving units to begin synchronous playing in the middle of a transmission from a broadcast unit, the synchronization signals will preferably include information about the song being played, such as the name of the file or the digital identifier associated with the file.

Transmission of this synchronization signal continues until the termination of the song, or until a manual termination (e.g. by actuating a Pause or Stop key) is caused (the frequency of transmission of the synchronization signal will be discussed below). At this point, the broadcast unit can send a termination, pause or other signal in a step 1906. Note that this method of synchronization can operate when the receiving unit establishes connection with the broadcast unit even in the middle of a song.

Figure 34B is a schematic layout of a synchronization signal record 1910 according to Figure 34A. The order and composition of the fields can vary according to the types of music files used, the means of establishing position, the use of digital jewelry, the desire for privacy, and more.

The position field 1912 (SAMPLE#) which contains an indicator of position in a music file – in this case the sample number within the file. The music file identifier field 1914 (SONGID) comprises a textual or numerical identifier of the song being played. The third field is the sample rate field 1916 (SAMPLERATE), and is primarily relevant if the position field 1912 is given in samples, which allows a conversion into time. Given that the same audio entertainment can be recorded or saved at different sample rates, this allows the conversion from a potentially relative position key (samples) to one independent of sample rate (time). The jewelry signal field 1918 (JEWELSIGNAL) is used to encode a digital jewelry 200 control signal for controlling the output of the digital jewelry 200, should the receiver unit be associated with jewelry 200. The order and composition of the fields can vary according to the types of music files used, the means of establishing position, the use of digital jewelry, the desire for privacy, and more.

The frequency with which the record 1910 is broadcast can vary. The time of reception of the record 1910 sets a current time within the song that can adjust the position of

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the music playing on the receiver unit. It is possible for the record to be broadcast only once, at the beginning of the song, to establish synchronization. This, however, will not allow others to join in the middle of the music file. Furthermore, if the record 1910 is received or processed at different times for the single record, the music can be poorly synchronized. With multiple synchronization signals, the timing can be adjusted to account for the most advanced reception of the signal – that is, the music playing will be adjusted forward for the most advanced signal, but not be adjusted back for a more laggard signal.

If the record further contains a jewelry signal field 1918, the frequency with which the record 1910 should be sent should be comparable or faster than the rate with which these signals change, and should be preferably at least 6 times a second, and even more preferably at least 12 times a second. If less frequent record 1910 transmission is desired, then multiple jewel signal fields 1918 can be included in a single record 1910.

It should be noted that given units 100 of different design or manufacture, there can be different intrinsic delays between reception of music and/or synchronization signals and the playing of the music. Such delays can result from different speeds of MP3 decompression, different sizes of delay buffers (such as delay 1506), different speeds of handling wireless transmission, differing modes of handling music (e.g. directly from audio media 1500 to audio output 1508 on the broadcast unit, but requiring transmission through an output port 1502 and input port 1504 for the receiver unit), and more. In such cases, it is preferable for receiver units to further comprise a manual delay switch that can adjust the amount of delay on the receiver unit. This switch will generally have two settings: to increase the delay and to decrease the delay, and can conveniently be structured as two independent switches, a rocker switch, a dial switch or equivalent. It is useful for the increments of delay determined by the switch be adjustable so as to allow users to sense the music from the broadcast unit and the receiver unit as being synchronous, and it is preferable for the increments of delay to be less than 50 milliseconds, and even more preferable for the increments of delay to be less than 20 milliseconds, and most preferable for the units of delay to be less than 5 milliseconds.

Creation and Maintenance of Clusters

Search units 750 can be playing music themselves, or can be scanning for broadcast units 710. Indeed, search units 750 can be members of another cluster 700, either as broadcast unit 710 or receive unit 730. To detect a different cluster 700 in which it might desire membership, the search unit 750 can either play the music of the broadcast unit 710 to

the search unit 750 user, or it can scan for personal characteristics of the broadcast unit 710 user that are transmitted in the ID block 808. For example, a user can establish personal characteristic search criteria, comprising such criteria as age, favorite recording artists, and interest in skateboarding, and respond when someone who satisfies these criteria approaches.

Alternatively, the search unit 750 user can also identify a person whose cluster he wishes to join through visual contact (e.g. through perceiving the output of the person's light transducer 240).

Before a search unit 750 user can establish contact, it is preferable for a broadcast unit 710 user, or a receive unit 730 user, to provide permissions for others to join the cluster. For example, each unit 100 will generally be able to changeably set whether no one can join with their unit 100, whether anyone can join with their unit 100, or whether permission is manually granted for each user who wishes to join with their unit into a cluster. For a cluster 700, membership in the cluster can be provided either if any one member of the cluster 700 permits a search unit 750 user to join, or it can be set that all members of a cluster 700 need to permit other users to join, or through a variety of voting schemes. The permissions desired by each member will generally be sent between units 100 in a cluster as part of the ID block 808 or other inter-unit communications. Furthermore, these permissions can be used to establish the degree to which others can eavesdrop on a unit 100 transmission. This can be enforced either through the use of cryptography, which can only provide decryption keys as part of becoming a cluster 700 member, through provision of a private IP socket address or password, through standards agreed by manufacturers of unit 100 hardware and software, or by unit 100 users limiting the information that is sent through the ID block 808 through software control.

The search unit 750 user can then establish membership in the group in a variety of ways. For example, if the search unit 750 is scanning music or personal characteristics of the unit 100 user, it can alert the search unit 750 user about the presence of the unit 100. The search unit 750 user can then interact with the search unit 750 interface to send the unit 100 user a message requesting membership in the cluster 700, which can be granted or not. This type of request to join a cluster 700 does not require visual contact, and can be done even if the search unit 750 and cluster are separated by walls, floors, or ceilings.

Another method of establishing contact between a search unit 750 user and a cluster 700 member is for the search unit 750 user to make visual contact with the cluster 700 member. In such case that physical contact or physical proximity is easily made between the unit 100 of the cluster member and the search unit 750, digital exchange can be easily made

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either through direct unit 100 contact through electrical conductors, or through directional signals through infra-red LEDs, for example. For example, the search unit 750 user can point his unit 100 at the cluster 700 member unit, and then if the cluster member wishes the search unit 750 user to join the cluster, could point his unit 100 at the search unit 100, and with both pressing buttons, effect the transfer of IDs, cryptography keys, IP socket addresses or other information that allows the search unit 750 user to join the cluster 700.

Alternatively, the broadcast DJ 720 (or the receive DJ 740) can present digital signals through the light transducer. For example, most DJ 720 light transduction will be modulated at frequencies of 1-10 Hz, with human vision not being able to distinguish modulation at 50 Hz or faster. This means that digital signals can be displayed through the light transducer 240 at much higher frequencies (kHz) that will not perceived by the human eye, even while lower frequency signals are being displayed for human appreciation. Thus, the broadcast DJ 720 can receive a signal from the broadcast unit 710 DJ transmitter 120 containing information needed for a search unit 750 to connect to the broadcast unit's cluster 700. This information will be expressed by the light transducer 240 of the broadcast DJ 720 in digital format. The search unit 750 can have an optical sensor, preferably with significant directionality, that will detect the signal from the light transducer 240, so that the search unit 750 is pointed in the direction of the broadcast DJ 720, and the identifier information required for search unit 750 to become a member of cluster 700. This optical sensor serves as the DJ directional identifier 122 of Figure 1. At this point, if desired, the broadcast unit 710 user can determine if they want the search unit 750 user to join the cluster 700.

A summary of means to effect joining of a cluster is provided in Figures 13A through E, which display means for a search unit 750 to exchange information prior to joining a cluster 700 via a broadcast unit 710. It is also within the teachings of the present invention for the search unit 750 to institute communications with a receive unit 730 for the purposes of joining a cluster in a similar fashion, particularly since it may be difficult for a person outside of the cluster 700 to determine which of the cluster 700 members is the broadcast unit 710, and which is a receiver unit 730.

If should be noted in the Figures 13A-G that limited range and directionality are preferred. That is, there can be a number of broadcast units 710 within an area, and being able to select that one broadcast unit 710 whose cluster one wishes to join requires some means to allow the search unit 750 user to select a single broadcast unit 710 among many. This functionality is generally provided either by making a very directional communication between the two devices, or by depending on the physical proximity of the search unit 750

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and the desired broadcast unit 710 (i.e. in a greatly restricted range, there will be fewer competing broadcast units 710). In the following description, the "broadcaster" denotes the user using the broadcast unit 710, and the "searcher" denotes the user using the search unit 750.

In the Figures 13A-G, the selection of the cluster by the searcher occurs in three ways, that will referred to as "search transmission mode", "broadcast transmission mode", and "mutual transmission mode", according to the entity that is conveying information. In search transmission mode, the searcher sends an ID via the search unit 750 to the broadcast unit 710. This ID can comprise a unique identifier, or specific means of communication (e.g. an IP address and port for IP-based communication). With this ID, the broadcast unit can either request the searcher to join, or can be receptive to the searcher when the searcher makes an undifferentiated request to join local units within its wireless range. In broadcast transmission mode, the broadcaster sends an ID via the broadcast unit 710 to the search unit 750. With this ID, the searcher unit can then make an attempt to connect with the broadcast unit 710 (e.g. if the ID is an IP address and port), or the search unit can respond positively to a broadcast from the broadcast unit 710 (e.g. from a broadcast annunciator 1050), wherein the ID is passed and checked between the units early in the communications process. Mutual transmission mode comprises a combination of broadcast transmission mode and search transmission mode, in that information and communication is two way between the broadcaster and the searcher.

Figure 13A is a schematic cross-section through a search unit 750 and a broadcast unit 710 in which communications are provided via visible or infrared LED emission in search transmission mode. On the right of the figure, a LED 1044 with an associated lens 1046 (the two of which can be integrated) transmits a directional signal from the unit case 1000. This light can optionally pass thorough a window 1048 that is transparent to the light. On the left of the figure, a lens element 1040 collects light through a broad solid angle and directs it onto a light sensing element 1042, which is conveniently a light-sensing diode or resistor. The directionality of the communication is conferred by the transmitting lens 1046 and the collecting lens 1040.

Alternatively, the LED 1044 can be replaced by a visible laser. Figure 13B is a schematic cross-section through a search unit 750 and a broadcast unit 710 in which communications are provided via a visible or infrared laser in search transmission mode. The search unit 750 comprises a diode laser 1041 that is conditioned by a lens 1043 to form a beam that is sensed by the light sensing element 1042 on the broadcast unit 710. Because a

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collimated laser beam can be difficult to aim with precision at a photosensing element carried by a person, the optics can comprise a two focus lens 1043 that has a portion that produces a collimated beam 1045, and a second portion that produces a diverging beam 1047. The collimated beam is used by the user of the search unit 750 as a guide beam to direct the pointing of the unit 750, while the divergent beam provides a spread of beam so that the human pointing accuracy can be relatively low. The means for creating the two focus lens 1043 can include the use of a lens with two different patterns of curvature across its surface, or the use of an initial diverging lens whose output intersects a converging lens across only a part of its diameter, where the light that encounters the second lens is collimated, and the light that does not encounter the second lens remains diverging. It is also within the teachings of the present invention for the lens to be slowly diverging without a collimating portion, such that the user does not get visible feedback of their pointing accuracy. In such case, the laser can emit infrared rather than visible wavelengths.

Figure 13C is a schematic cross-section through a search unit 750 and a broadcast unit 710 in which communications are provided via visible or infrared emission from a digital jewelry element 200 in broadcast transmission mode. The digital jewelry 200 is carried by the broadcaster on a chain 1033, with the digital jewelry 200 visible. The digital jewelry is emitting through a light transducer 1031 a high frequency signal multiplexed within the visible low frequency signal. The search unit 750 is pointed in the direction of the digital jewelry 200, and receives a signal through the light-sensing element 1042. This manner of communication is convenient because the searcher knows, via the presence of the visible signal on the digital jewelry 200, that the broadcaster is receptive to cluster formation.

Figure 13D is a schematic cross-section through a search unit 750 and a broadcast unit 710 in which communications are provided via contact in mutual transmission mode. In this case, the broadcast unit 710 and the search unit 750 both comprise a contact transmission terminus 1030, and electronic means by which contact transmission is performed. This means can operate either inductively (via an alternative current circuit), through direct electrical contact with alternating or direct current means, or other such means that involves a direct physical contact (indicated by the movement of the search unit 750 to the position of the unit depicted in dotted lines). The search unit 750 or the broadcast unit 710 can, via automatic sensing of the contact or manual control, initiate communications transfer. Given the mutuality of contact as well as the physical equivalence of the two units 710 and 750, information transfer is possible in both directions. It should be noted that in the case of direct

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current connection, the termini 1030 will comprise two contact points, both of which must make electrical contact in order for communications to occur.

Figure 13E is a schematic cross-section through a search unit 750 and a broadcast unit 710 in which communications are provided via sonic transmissions in broadcast transmission mode. The broadcaster (or receivers) will be listening to the audio information generally through headphones 1020 or earphones, all of which comprise speakers 1022 that, to one extent or another, leak sonic energy. The use of audio output devices as depicted in Figure 10 and Figures 11A and 11B that admit external sound, will also increase the amount of sound energy lost. This sound energy can be detected by the searcher via a directional speaker comprising a sound collector 1024 and a microphone 1026. This system requires that the sound output of the broadcast unit 710 and the receiver unit 750 also output an ID encoded in the sound. Such sound can be conveniently output at inaudible frequencies, such as 3000-5000 Hz, which carry sufficient bandwidth to encode short messages or identifiers (e.g. an IP address and port number can be carried in 5 bytes). Sound energy, especially at higher frequencies, can be quite directional, depending on the shape of the collector 1024 and the structure of the microphone 1024, allowing good directional selection by the searcher.

Figure 13F is a schematic cross-section through a search unit 750 and a broadcast unit 710 in which communications are provided via radio frequency transmissions in broadcast transmission mode. The radio frequency transmissions are not strongly directional (and for the purposes of the broadcast of audio information, are designed to be as directionless as possible). In order to distinguish a desired cluster 700 to join and an undesired cluster 700, a number of strategies can be employed. For example, the strengths of the various signals can be measured and the strongest chosen for connection. Alternatively, if there are multiple broadcast connections available, the search unit 750 can sequentially attempt a connection with each broadcast unit 710. When the attempt is made, the broadcast unit 710 can, prior to alerting the broadcaster of the attempted joining by a new member, cause the digital jewelry 200 associated with the broadcast unit 710 to visibly flash a characteristic signal. The searcher can then verify by pressing the appropriate button on the search unit 750 his desire to join the cluster 700 of the broadcast digital jewelry 200 that had just flashed. If the searcher decided not to join that cluster 700, the search unit 750 could search for yet another unit broadcast unit 750 within range, and attempt to join.

At any time, the members of a cluster 700 can share personal characteristics (nickname, real name, address, contact information, face or tattoo images, favorite recording artists, etc.) through selection of choices of the unit 100 interface, with all such characteristics

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or a subset thereof to be stored on the units 100. In order to assist cluster 700 members in determining whether or not to accept a person into their cluster 700, a search unit 750 member can display either the total number of people with whom he has shared personal characteristics, or he can alternatively allow the cluster members to probe his store of persons with whom personal characteristics have been stored to see whether a particular trusted person or group of common acquaintances are present therein. It is also within the spirit of the present invention for individuals to rate other individual members of their cluster, and such ratings can be collated and passed from person to person or cluster to cluster, and can be used for a cluster 700 to determine whether a search unit 750 person should be added to the cluster 700.

Figure 17 is a matrix of broadcaster and searcher preferences and characteristics, illustrating the matching of broadcaster and searcher in admitting a searcher to a cluster. A broadcaster preference table 1160 includes those characteristics that the broadcaster wishes to see in a new member of a cluster. These characteristics can include gender, age, musical "likes" and "dislikes", the school attended, and more. The searcher similarly has a preference table 1166. The searcher preference table 1166 and broadcaster preference table 1160 are not different in form, as the searcher will at another time function as the broadcaster for another group, and his preference table 1166 will then serve as the broadcaster preference table.

The broadcaster preference table 1160 can be automatically matched with a searcher characteristics table 1162. This table 1162 comprises characteristics of the searcher, wherein there will be characteristics that overlap in type (e.g. age, gender, etc.) which can then be compared with the parameters in the broadcaster preference table. This matching occurs during the period when the searcher is interrogating the cluster with interest in joining. Similarly, there is a broadcaster characteristics table 1164 indicating the characteristics of the broadcaster, which can be matched against the searcher preferences tale 1166.

The algorithm used in approving or disapproving of an accord between a preference table and a characteristics table can be varied and set by the user – whether by the broadcaster to accept new members into a cluster, or by a searcher to join a new cluster. For example, the user could require that the gender be an exact match, the age within a year, and the musical preferences might not matter. The user can additionally specify that an accord is acceptable if any one parameter matches, specify that an accord be unacceptable if any one parameter does not match, specify an accord be acceptable based on the overlap of a majority of the individual matches, or other such specification.

It should be noted that the broadcaster preferences table 1160 and the broadcaster characteristics table 1164 (and likewise with the searcher tables 1162 and 1166) can be a single table, according to the notion that a person will prefer people who are like themselves. Each user could then express the acceptable range of characteristics of people with which to join as a difference from their own values. For example, the parameter "same" could mean that the person needs to match closely, whereas "similar" could indicate a range (e.g. within a year) and "different" could mean anyone. In this way, there would not be the burden on the user to define the preference table 1160 or 1166 in a very detailed manner.

In the case of a cluster, the transfer of information between the searcher and the cluster can, as mentioned above, involve not only the broadcaster, but also other members of the cluster (especially since the searcher may not know the identity of a cluster's broadcaster from external observation). The cluster can also make communal decisions about accepting a new member. That is, if there are 4 members of a cluster, and a searcher indicates an interest in joining the cluster, there can be voting among the members of a cluster regarding the acceptance of the new member. The procedure of voting will normally be done by messaging among the members, which can be assisted by structured information transfer as will be described below.

A number of such voting schemes are described in Figure 19, a table of voting schemes for the acceptance of new members into a cluster. The first column is the name of the rule, and the second column describes the algorithm for evaluation according to the rule. In the "BROADCASTER" rule, the broadcaster decides whether or not the new member will be accepted. The new member is accepted when the broadcaster indicates "yes" and is otherwise rejected.

In the "Majority" rule, the members are polled, and whenever a majority of the members vote either acceptance or rejection, the new member is accordingly accepted or rejected. It should be noted that this rule (as well as the rules to follow) depends on the broadcaster or other member of the cluster having knowledge of the number of members in the cluster, which will generally be the case (e.g. in an IP socket based system, the broadcaster can simply count the number of socket connections). Thus, if the number of members in a cluster is given as N_{mem}, as soon as $(N_{mem}/2) + 1$ members have indicated the same result, that result is then communicated to the broadcaster, the members and the prospective new member. If the number of members is even, and there is a split vote, the result goes according to the broadcaster's vote.

According to the "Unanimous" rule, a new member is accepted only on unanimous decision of the members. Thus, the prospective new member is rejected as soon as the first "no" vote is received, and is accepted only when the votes of all members of the cluster are received, and all of the votes are positive.

The "Timed Majority" rule is similar to that of the "Majority" rule, except that a timer is started when the vote is announced, the timer being of a predetermined duration, and in a preferred embodiment, is indicated as a count down timer on the unit 100 of each member of the cluster 700. The vote is completed when $(N_{mem}/2)+1$ members vote with the same indication ("yes" or "no") if the timer has not completed its predetermined duration. If all of the members have voted, and the vote is a tie, the result goes in accordance with that of the broadcaster. If the timer has expired, and the vote has not been decided, the number of members that have voted is considered a quorum of number Q. If $(Q/2)+1$ members have voted in some fashion, that is the result of the vote. Otherwise, in the case of a tie, the result goes according to the vote of the broadcaster. If the broadcaster has not voted, the vote goes according to the first vote received.

The "Synchronized Majority" rule is similar to the Timed Majority rule, but instead of initiating the vote, and then waiting a predetermined period for members to vote, the vote is announced, and then there is a predetermined countdown period to the beginning of voting. The voting itself is very limited in time, generally for less than 10 seconds, and preferably for less than 3 seconds. Counting votes is performed only for the quorum of members that vote, and is performed according to the rules for the Timed Majority.

There are many different voting schemes consistent with creating, growing and maintaining clusters within the spirit of the present invention. For instance, in cases where there are close votes, the voting can be reopened for individuals to change their vote. In cases, members can request a new round of voting. Furthermore, the voting can be closed ballot, in which the votes of individuals are not known to the other members, or open voting, in which the identity of each member's vote is publicly displayed on each unit 100.

In addition, the voting can be supported and enhanced by information made available to each member through displays on the units 100. Figure 18A is a screenshot of an LCD display 1170 of a unit 100, taken during normal operation. The display 1170 is comprised of two different areas, an audio area 1172 and a broadcaster area 1174. The audio area 1172 includes information about the status of the audio output and the unit 100 operation, which can include battery status, the name of the performer, the title of the piece of music, the time the audio has been playing, the track number and more. The broadcaster area 1174 comprises

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information about the status of the cluster 700. In the example given, the broadcaster area includes the number "5", which represents the number of people current in the cluster, the text "DJ", which indicates that the unit 100 on which the display 1170 is shown is currently the broadcaster of the cluster 700, and the text "OPEN", which indicates that the cluster is open for new members to join (the text "CLOSED" would indicate that no new members are being solicited or allowed).

Figure 18B is a screenshot of an LCD display 1170 of a unit 100, taken during voting for a new member. The audio area 1172 is replaced by a new member characteristics area 1176, in which characteristics of the prospective new member are displayed. Such characteristics can include the name (or nickname) of the prospective new member, their age, and their likes (hearts) and dislikes (bolts). In the broadcaster area 1174, the digit "3" indicates that there are three current members of the cluster 700, and an ear icon indicates that the current unit 100 is being used to receive from the broadcaster rather than being a broadcaster, and the name [ALI] indicates the name of the current broadcaster. The text "VOTE-MAJ" indicates that the current vote is being done according to the Majority rule. The broadcaster area 1174 and the new member characteristics areas 1176 provide the information needed by the existing member to make a decision about whether to allow the prospective new member to join.

The displays 1170 of Figures 18A-B are indicative only of the types of information that can be placed on a display 1170, but it should be appreciated that there are many pieces of information that can be placed onto the displays 1170 and that the format of the display can be very widely varied. Furthermore, there need not be distinct audio areas 1172 and broadcaster areas 1174, but the information can be mixed together. Alternatively, especially with very small displays 1170, the display 1170 can be made to cycle between different types of information.

It is also within the spirit of the present invention for individuals to rate other individual members of their cluster, and such ratings can be collated and passed from person to person or cluster to cluster, and can be used for a cluster 700 to determine whether a search unit 750 person should be added to the cluster 700. Figure 27 is a schematic block flow diagram of using a prospective new member's previous associations to determine whether the person should be added to an existing cluster.

In a step 1400, from a search unit 750, the prospective new member places an external communication request with an operational broadcast annunciator 1050 by a broadcast unit 710. In a step 1402, a temporary message connection is established through which

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information can be passed mutually between the search unit 750 and the broadcast unit 710. The broadcast unit 710 requests personal and cluster ID's from the search unit 750. The personal ID is a unique identifier that can be optionally provided to every audio unit 100, and which can further be optionally hard-encoded into the hardware of the unit 100. The cluster IDs represent the personal ID's of other units 100 with which the search unit 750 has been previously associated in a cluster. In a step 1406, the broadcast unit 710 matches the incoming personal IDs and cluster IDs with personal ID's and cluster IDs that are stored in the memory of the broadcast unit 710. If there exist a sufficient number of matches, which can be computed as a minimum number or as a minimum fraction of the IDs stored in the broadcast unit 710, the new member of the search unit 750 can be accepted into the cluster. In a step 1412, the search unit 750 can then store the ID of the broadcast unit 710 and the other members of the existing cluster 700 into his cluster IDs, and the broadcast unit 750 and the other receive units 730 of the cluster can then store the personal ID of the search unit 750 into their cluster IDs. If there does not exist a sufficient number or quality of matches, the broadcast unit 710 will reject the prospective new member, optionally send a message of rejection, and then close the socket connection (or other connection that had been created) between the broadcast unit 710 and the search unit 750. No new IDs are stored on either unit 710 or 750.

It is also within the spirit of the present invention for other information associated with the personal and cluster IDs to be shared and used in the algorithm for determining whether to accept or reject a prospective new member into a cluster 700. This information can include rating information, the duration of association with another cluster 700 (i.e. the longer the association, the more suitable the social connection of that person with the cluster 700 would have been), the size of the cluster 700 when the searcher was a member of a particular cluster 700, the popularity of a cluster 700 (measured by the number of cluster IDs carried by the broadcast unit 710), and more. The matching program, likewise, would weight the existence of a match by some of these quality factors in order to determine the suitability of the searcher to join the cluster.

While the comparisons can be made between a search unit 750 personal and cluster IDs and those from the broadcast unit 710, representing the personal experience of the owners of the respective units, it is also possible that the reputation or desirability of individuals with a given personal ID can be posted to or retrieved from trusted people. For example, two friends can swap the information of which IDs are to be trusted or not between two units 100, or alternatively, can be posted onto or retrieved from the Internet. For

example, after a bad personal experience with a unit 100 with a personal ID of 524329102, a person could post that ID on the Internet to share with friends, so that the friends could avoid allowing that person to join, or avoid joining a cluster with that person.

It should be noted that publishing a list of personal IDs allows people to establish the breadth of their contacts. By posting their contacts on web sites, people can demonstrate their activity and popularity. This also encourages people to join clusters, in order to expand the number of people with whom they have been associated. Furthermore, the personal ID serves as a "handle" by which people can further communicate with one another. For example, on the Internet, a person can divulge a limited amount of information (e.g. an email address) that would allow other people with whom they have been in a cluster together to contact them.

It should be noted that the formation and maintenance of a cluster 700 requires the initial and continued physical proximity of the broadcast unit 710 and the receive unit 730. In order to help maintain such physical proximity conducive to cluster maintenance, feedback mechanisms can be used to alert the users to help them maintain the required physical proximity, as will be discussed below.

Figure 28 is a block flow diagram indicating the steps used to maintain physical proximity between the broadcast unit 710 and the receive unit 730 via feedback to the receive unit user. In a step 1530, the wireless connection between the broadcast unit 710 and the receive unit 730 is established. In a step 1532, the connection between the two units 710 and 730 is tested. There are a number of different means by which this testing can take place. For example, in IP-based communications, the receive unit 730 can from time to time – though generally less than every 10 seconds, and even more preferably less than every 1 second – use the "ping" function to test the presence and speed of connection with the broadcast unit 710. Alternatively, the receive unit 730 will be receiving audio signals wirelessly almost continuously from the broadcast unit 710, and a callback alert function can be instituted such that loss of this signal determined at a predetermined repeat time – which is conveniently less than 5 seconds, and even more preferably less than every 1 second – and which is then reported to the system.

While the methods above determine the absolute loss of a signal, they do not anticipate loss of signal. A method that does anticipate signal issues prior to loss is the measurement of signal strength. This can be done directly in the signal reception hardware by measuring the wireless signal induced current or voltage.

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In a step 1534, the results of the connection testing performed in the step 1532 is analyzed in order to determine whether the signal is adequate. It should be noted that a temporary loss of signal, lasting even seconds, may or may not be of importance. For example, the broadcast unit 710 user and receive unit 730 users could walk on opposite sides of a metallic structure, enter a building at different times, change their body posture such that the antennae are not optimally situated with respect to one another, etc. Thus, an algorithm is generally used to time average the results of the step 1532, with the results conveniently time averaged over a matter of seconds.

Whatever the results of the signal test of the step 1534, the step 1532 is continuously repeated as long as the connection between the broadcast unit 710 and the receive unit 730 is present. If the signal is deemed inadequate, however, feedback to that effect is provided to the receive unit 730 user in a step 1536. The user feedback can occur through a variety of mechanisms, including visual (flashing lights) and tactile (vibration) transducers, emanating either from the audio unit 100 or the digital jewelry 200. For example, the receiver unit 730 can send a signal to the associated digital jewelry 200 to effect a special sequence of light transducer output.

It is most convenient, however, for the audio output of the receiver unit 730 as heard by the user to be interrupted or overlain with an audio signal to alert the user to the imminent or possible loss of audio signal. This audio signal can include clicks, beeps, animal sounds, closed doors, or other predetermined or user selected signals heard over silence or the pre-existing signal, with the signal possibly being somewhat reduced in volume such that the combination of the pre-existing signal and the feedback signal is not unpleasantly loud.

It should be noted that the flow diagram of Figure 28 refers specifically to alerting the receive unit 730 user of potential communications issues. Such alerting can also be usefully transferred to or used by the broadcast unit 710. For example, with knowledge of the communications issues, the broadcast unit 710 user can move more slowly, make sure that the unit is not heavily shielding, that any changes in posture that could relate to the problems are reversed, etc. The broadcast unit 710 can perform communications tests (as in the step 1532) or analyze the tests to determine if the communications are adequate (as in the step 1534) – particularly through use of the messaging TCP channels. Given that there can be multiple receive units 730 connected to s single broadcast unit 710, it is generally preferable for the tests to be performed on the receive units 730, and problems to be communicated to the broadcast unit 710 – provided, however, that communications still exist for such communication.

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In order to overcome this deficiency, it is possible for the receiver unit 730 to communicate potential problems in communications to the broadcast unit 710 at an early indication. The broadcast unit 710 then starts a timer of predetermined length. If the broadcast unit 710 does not receive a "release" from the receive unit 730 before the timer has completed its countdown, it can then assume that communications with the receive unit 730 have been terminated, and it can then send feedback to the broadcast unit 710 user.

It is also within the teachings of the present invention for both the broadcast unit 710 and the receive unit 730 to independently monitor the connections with each other, and alert their respective users of communications problems.

It should be noted that the use of audio alerts can be used more generally within the user interface of the audio units 100. Thus, audio alerts can be conveniently used to inform the user of the joining of new members to the cluster 700, the initiation of communications with search units 750 outside of the group, the leaving of the group by existing cluster 700 members, the request by a receive unit 730 to become the broadcast unit 710, the transfer of cluster control from a broadcast unit 710 to a receive unit 730, and more. These alerts can be either predetermined by the hardware (e.g. stored on ROM), or can be specified by the user. Furthermore, it can be convenient for the broadcast unit 710 to temporarily transfer to new members of the cluster custom alerts, so that the alerts are part of the experience that the broadcast unit 710 user shares with the other members of the cluster. Such alerts would be active only as long as the receive units were members of the cluster 700, and then would revert back to the alerts present before becoming cluster members.

Cluster Hierarchy

A receive unit 730 can also be the broadcast unit 710 of a separate cluster 700 from the cluster 700 of which it is a member. This receive unit is called a broadcasting receiver 770. In such case, it is convenient for the receive units 730 that are associated with the broadcasting receiver 770 to become associated with the cluster 700 of which the broadcasting receiver 770 is a member. This can conveniently be accomplished in two different ways. In a first manner, the receive units 730 that are associated with the broadcasting receiver 770 can become directly associated with the broadcast unit 710, so that they are members only of the cluster 700, and are no longer associated with the broadcasting receiver 770. In a second manner, the receive units 730 associated with the broadcasting receiver 770 can remain primarily associated with the broadcasting receiver 770, as shown in Figures 9A and 9B, which are schematic block diagrams of hierarchically-related clusters. In

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Figure 9A, the receive units 730 that are members of a sub-cluster 701 of which the broadcast unit is a broadcast receive unit 770, can receive music directly from the broadcast receive unit 710, while retaining their identification with the broadcasting receiver 770, such that if the broadcasting receiver 770 removes itself or is removed from the cluster 700, these receive units 730 similarly are removed from the cluster 700. In order to provide this form of hierarchical control, the sub-cluster 701 receive units 730 can obtain an identifier, which can be an IP socket address, from the broadcast receive unit 770, indicating the desired link to the broadcast unit 710. The sub-cluster receive units 730, however, maintain direct communications with the broadcast receive unit 770, such that on directive from the unit 770, they break their communications with the unit 710, and reestablish normal inter-unit audio signal communications with the broadcast receive unit 770. In an embodiment using IP addressing and communications, this can involve the maintenance of TCP messaging communications between the sub-cluster 701 receive units 730 with the broadcast receive unit 770, during the time that the sub-cluster 701 is associated with the cluster 700.

In Figure 9B, the receive units 730 of the sub-cluster 701 receive music directly from the broadcasting receiver 770, which itself receives the music from the broadcast unit 710. In such case, as the broadcasting receiver 770 is removed from the cluster 700, the receive units 730 of the sub-cluster 701 would also not be able to hear music from the cluster 700.

It would be apparent that such an arrangement can be hierarchically arranged, such that the receive unit 730 of the sub-cluster 701 can itself be the broadcast receiver 770 of another sub-cluster 701, and so forth. The advantage of this arrangement is that people that are associated with one another, forming a cluster 700, can move as a group from cluster to cluster, maintaining a separate identity.

It should be also noted that the configuration of communications between members of a hierarchical cluster can be variously arranged, not only as shown in Figures 9A and 9B. For example, every member of the cluster 700 can have a direct link between every other member of the cluster 700, such that no re-broadcast of messages needs to take place. Furthermore, given that there are different inter-unit communications (for example, messaging versus audio broadcast), it is within the teachings of the present invention that the configuration for the different modes of communication can be different – for example direct communications between the broadcast unit 710 for audio broadcast, but peer-to-peer communications between individual units for messaging.

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Maintaining Private Communications

In order to restrict membership in a cluster 700, either the information transfer must be restricted, such as by keeping private the socket IP addresses or passwords or other information that is required for a member to receive the signal, or the signal can be transmitted openly in encrypted form, such that only those members having been provided with the encryption key can properly decode the signal so sent. Both of these mechanisms are taught within the present invention, and are described at various points within this specification.

Figure 32A is a schematic block diagram of maintaining privacy in open transmission communications. In this case, the transmission is freely available to search units 750 in a step 1830, such as would occur with a digital RF broadcast, or through a multicast with open a fixed, public socket IP address available in certain transmission protocols. In this case, the broadcast audio signal or information signal is made in encrypted form, and membership in the cluster is granted through transfer of a decoding key in a step 1832.

Figure 32B is a schematic block diagram of maintaining privacy in closed transmission communication. In a step 1834, the broadcast unit 710 makes a closed transmission broadcast, such as through a socket IP address, that is not publicly available. In a step 1836, the broadcast unit 710 provides the private address to the search unit 750, which can now hear the closed transmission from the step 1834, which is not encrypted. Alternatively, or in addition to the provision of the private address in the step 1836, the establishment of the connection through the private, closed transmission is effected via a password provided in a step 1838. This password can, for example, be used in the step 1110 (e.g. see Figure 14B) to determine whether the broadcast unit 710 accepts the search unit 750 for audio multicasting.

In this section, the encryption of the musical signal and/or associated information about personal characteristics of members of the cluster 700 is described. The custom compressor 330 of the unit 100 can perform the encryption. In such a case, before joining a cluster, the search unit 750 can only receive some limited information, such as characteristics of the music being heard or some limited characteristics of the users in the cluster 700. If the search unit 750 user requests permission to join the cluster 700 and it is granted, the broadcast unit 710 can then provide a decryption key to the search unit 750 that can be used to decrypt the music or provide a private IP address for multicasting, as well as supply additional information about the current members of cluster 700.

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It should be noted that in certain cases, it can be useful to have multiple forms of privacy protection. For example, a broadcast unit 710 can provide a search unit 750 access to audio signals and information for the cluster 700, but can reserve certain information based on encryption to only some members of the cluster 700. For example, if a group of friends comprise a cluster 700, and accept some new members into the cluster 700, access to more private information about the friends, or communications between friends, can be restricted on the basis of shared decryption keys.

Figure 33 is a schematic block diagram of a hierarchical cluster, as in Figure 9A, in which communications between different units is cryptographically or otherwise restricted to a subset of the cluster members. Thus, there are three types of communication that are used in the communication: channel A, which takes place between the members of the original cluster; channel B, which takes place between the members of the original cluster (mediated through the broadcast unit 710) and members of the sub-cluster 701; and channel C, which takes place between the members of the sub-cluster 701. Thus, a communications originating from the broadcast unit 710 can be directed either through channel A or channel B, and likewise, a communications originating from the broadcast receive unit 770 can be directed either at members only of the sub-cluster 701 through channel C, or to all members of the cluster 700 through both channels C and B, which is then communicated trough channel A.

A number of means can be used to maintain such independent channels. For example, separate socket communications can be established, and the originators of the communications can determine that information which is carried on each separate channel. For example, given an open transmission scheme such as digital RF signal, the information can be encoded with separate keys for the different channels of communication – thus, the cryptographic encoding determines each channel. A given unit 100 can respond to more than one encoding. Indeed, a channel identifier can be sent with each piece of information indicating the ID of the decoding key. If a unit 100 does not have the appropriate decoding key, then it is not privy to that channel communications.

Alternatively, if the communications is IP socket based, then each channel is determined by IP socket addresses. Furthermore, access to those addresses can be, for example, password controlled. Also, the socket communications can be broadcast so that any unit 100 can receive such broadcast, but that decoding of the broadcast can be mediated through cryptographic decoding keys.

It should be noted that there can be multiple forms of communication, which can comprise messaging communications using the TCP/IP protocols, versus multicasting using

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UDP protocols, and also DJ 200 control signals using yet another protocol. The access to each of these communications can be controlled via different privacy hierarchies and techniques. For example, the audio multicasting will be available to all members within a cluster, while the messaging may retain different groupings of privacy (e.g. hierarchical), while the DJ control signals will generally be limited to communications between a given unit 100 and its corresponding DJs 200.

Broadcast Control Transfer

The dynamics of cluster 700 can be such that it will be desirable for a receive unit 730 to become the broadcast unit for the cluster. Such a transfer of broadcast control will generally require the acquiescence of the broadcast unit 710 user. To effect such a transfer, the user of the receiver unit 730 desiring such control will send a signal to the broadcast unit 710 expressing such intention. If the user of the broadcast unit 710 agrees, a signal is sent to all of the members of the cluster indicating the transfer of broadcast control, and providing the identifier associated with the receive unit 730 that is to become the broadcast unit 710. The broadcast unit 710 that is relinquishing broadcast control now becomes a receive unit 730 of the cluster 700.

It should be noted that the transfer of control as described above requires the manual transfer of control, such as actuation of a DJ switch. This switch can be limited to this function, or can be part of a menu system, in which the switch is shared between different functions. It is also within the spirit of the present invention that there be voice-activated control of the unit 100, in which the unit 100 further comprises a microphone for input of voice signals to a suitable controller within the unit 100, wherein the controller has voice-recognition capabilities.

In the case of a cluster 700 whose broadcast unit 710 is no longer broadcasting (e.g. it is out of range of the receive units 730, or it is turned off), the cluster can maintain its remaining membership by selecting one of the receive units 730 to become the new broadcast unit 710. Such a choice can happen automatically, for example by random choice, by a voting scheme, or by choosing the first receive unit 730 to have become associated with the broadcast unit 710. If the users of the cluster-associated units deem this choice to be wrong, then they can change the broadcast unit 710 manually as described above.

The receive unit 730 that is chosen to become the broadcast unit 710 of the cluster 700 will generally prompt its user of the new status, so that the newly designated broadcast unit 710 can make certain that it is playing music to the rest of the cluster 700. It can be

further arranged so that a newly-designated broadcast unit 710 will play music at random, from the beginning, or a designated musical piece in such case.

An embodiment of a transfer of broadcast control using IP socket communications protocols is described here. Figure 16 is a schematic block flow diagram of transfer of control between the broadcast unit 710 and the first receive unit 730. In a step 1130, the receive unit 730 requests broadcast control (designated here as "DJ" control). In a step 1132, the user of the broadcast unit 710 decides whether control will be transferred. The decision is then transferred back to the first receive unit 730 via the TCP messaging socket. If the decision is affirmative, the first receive unit 730 severs its UDP connection to the broadcast unit 710 multicast. The reason for this is to allow the receive unit 730 opportunity to prepare the beginning of its broadcast, if such time is required, and the user cannot both listen to the multicast as well as prepare its own audio selections, which occurs in a step 1136. In a step 1138, the receive unit 730 creates a multicast UDP socket with which it will later broadcast audio to other members of the cluster, while in a step 1140, the receive unit 730 creates a broadcast annunciator TCP socket with which to announce availability of the cluster, as well as to accept transfers of members from the broadcast unit 710 to itself as the new broadcast unit.

When the two new sockets (multicast and annunciator) are created, the receive unit 730 transmits the new socket addresses to the broadcast unit 710 in a step 1142. Since the other members of the cluster are guaranteed to be in contact with the broadcast unit, they can get addresses of the new, soon-to-be broadcast unit from the existing broadcast unit. In a step 1144, the original broadcast unit 710 transmits to the other cluster members (receive units 730 numbers 2-N) the addresses of the sockets on the receive 1 unit 730 that is now the new broadcast unit 710, and terminates its own multicast. The termination is performed here because the other receive units will be transferring to the new multicast, and because the original broadcast unit 710 is now becoming a receive unit 730 in the reconstituted cluster. In the step 1148, multicast of audio is now provided by the receive 1 unit 730 that has now become the new broadcast unit 710), and the original broadcast unit is listening to audio provided not by itself, but rather by the new broadcast unit.

In a step 1146, performed roughly synchronously with the step 1144, the original broadcast unit 710 transmits the socket addresses of the message handler TCP sockets of the other members of the cluster 700 (i.e. the receive units 730 numbers 2-N). In the subsequent step 1150, the original broadcast unit 710 and the receive units 730 numbers 2-N establish new messaging connections with the receive 1 unit 730 that is now the new broadcast unit

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710. While there can be a set of criteria for the acceptance of a new member to a cluster, because the receive 1 unit 730 has received the message socket addresses of the other members of the cluster in the step 1144, the receive 1 unit 730 accepts new members with the socket addresses received. It should be noted that instead of socket addresses being the identifiers passed, the identifiers can also be unique machine IDs, random numbers, cryptograpically encoded numbers, or other such identifiers that can be transmitted from one member of the cluster to another.

It should be noted in certain embodiments, that there can be insufficient time for the new broadcast unit 710 to determine a set of music to broadcast to the members of its cluster. It is within the spirit of the present invention for a user to set a default collection of music that is broadcast when no other music has been chosen. This set of music can comprise one or more discrete audio files.

Audio and DJ Choreography

One of the attractions of the present invention is that it allows users to express themselves and share their expressions with others in public or semi-public fashion. Thus, it is highly desirable for users to be able to personalize aspects of both the audio programming as well as the displays of their DJs 200.

Audio

Audio personalization comprises the creation of temporally linked collections of separate musical elements in "sets." These sets can be called up by name or other identifier, and can comprise overlapping selections of music, and can be created either on the unit 100 through a visual or audio interface, or can be created on a computer or other music-enabled device for downloading to the unit 100.

In addition, the unit 100 or other device from which sets are downloaded can comprise a microphone and audio recording software whereby commentary, personal music, accompaniment, or other audio recordings can be recorded, stored, and interspersed between commercial or pre-recorded audio signals, much in the manner that a radio show host or "disc jockey" might alter or supplement music. Such downloads can be accessible from a variety of sources including Internet web sites and private personal computers.

Automatic Generation of DJ 200 Control Signals

In this section, we will describe the automatic and manual generation of control signals for the DJ 200 transducers. The control signals are generally made to correspond to

audio signals played on the units 100, although it is within the spirit of the present invention for such control signals to be made separate from audio signals, and to be displayed on the digital jewelry independently of audio signals played on the unit 100. Figure 20 is a time-amplitude trace of an audio signal automatically separated into beats. Beats 1180, 1182 and 1183 are denoted by vertical dashed and dotted lines and, as described below, are placed at locations on the basis of their rapid rise in low-frequency amplitude relative to the rest of the trace. As can be seen, the beats 1180 are generally of higher amplitude than the other beats 1182 and 1183, and represent the primary beats of a 4/4 time signature. The beat 1183 is of intermediate nature between the characteristics of the beats 1180 and 1182. It represents the third beat of the second measure. Overall, the audio signal thus displayed can be orally represented as ONE-two-Three-four-ONE-two-Three-four ("one" is heavily accented, and the "three" is more lightly accented), which is common in the 4/4 time signature.

Processing of this data can proceed via a number of different methods. Figure 21A is a block flow diagram of a neural network method of creating DJ 200 transducer control signals from an audio signal as shown in Figure 20. In a step 1200, audio data is received either at the unit 100 or the DJ 200. It should be noted that the creation of control signals from audio signals can, within the present invention, take place at either the unit 100 or the DJ 200, or even at a device or system not part of or connected to the unit 100 or DJ 200 (as will be described in more detail below). In an optional step 1202, the data is low pass filtered and/or decimated so that the amount of data is reduced for computational purposes. Furthermore, the data can be processed for automatic gain to normalize the data for recording volume differences. Furthermore, the automatic gain filtering can provide control signals of significant or comparable magnitude throughout the audio data.

In general, the creation of the audio signal depends on audio representing a period of time, which can be tens of milliseconds to tens of seconds, depending on the method. Thus, the audio data from the step 1202 is stored in a prior data array 1204 for use in subsequent processing and analysis. At the same time, the current average amplitude, computed over an interval of preferably less than 50 milliseconds, is computed in a step 1208. In broad outline, the analysis of the signal compares the current average amplitude against the amplitude history stored in the prior data analysis. In the embodiment of Figure 21A, the comparison takes places through neural network processing in a step 1206, preferably with a cascading time back propagation network which takes into account a slowly varying time signal (that is, the data in the prior data array changes only fractionally at each computation, with most of the data remaining the same). The use of prior steps of neural network processing in the

current step of neural network processing is indicated by the looped arrow in the step 1206. The output of the neural network is a determination whether the current time sample is a primary or a secondary beat. The neural network is trained on a large number of different music samples, wherein the training output is identified manually as to the presence of a beat.

The output of the neural network is then converted into a digital jewelry signal in a step 1210, in which the presence of a primary or secondary beat determines whether a particular light color, tactile response, etc., is activated. This conversion can be according to either fixed, predetermined rules, or can be determined by rules and algorithms that are externally specified. Such rules can be according to the aesthetics of the user, or can alternatively be determined by the specific characteristics of the transducer. For example, some transducers can have only a single channel or two or three channels. While light transducers will generally work well with high frequency signals, other transducers, such as tactile transducers, will want signals that are much more slowly varying. Thus, there can be algorithm parameters, specified for instance in configuration files that accompany DJ 200 transducers, that assist in the conversion of beats to transducer control signals that are appropriate for the specific transducer.

Figure 21B is a block flow diagram of a deterministic signal analysis method of creating DJ 200 transducer control signals from an audio signal as shown in Figure 20. The data is received in the step 1200. In this case, a running average over a time sufficient to remove high frequencies, and preferably less than 50 milliseconds, is performed in a step 1212. Alternatively, a low pass filter and/or data decimation as in the step 1202 can be performed.

In a step 1214, the system determines whether there has been a rise of X-fold in average amplitude over the last Y milliseconds, where X and Y are predetermined values. The value of X is preferably greater than two-fold and is even more preferably three-fold, while the value of Y is preferably less than 100 milliseconds and is even more preferably less than 50 milliseconds. This rise relates to the sharp rises in amplitude found in the signal at the onset of a beat, as shown in Figure 20 by the beat demarcations 1180, 1182, and 1183. If there has not been a rise meeting the criteria, the system returns to the step 1200 for more audio input.

If the signal does meet the criteria, it is checked to ensure that the rise in amplitude is not the "tail end" of a previously identified beat. For this, in a step 1216, the system determines whether there has been a previous beat in the past Z milliseconds, where Z is a predetermined value preferably less than 100 milliseconds, and even more preferably less

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than 50 milliseconds. If there has been a recent beat, the system returns to the step 1200 for more audio input. If there has not been a recent beat, then a digital jewelry signal is used to activate a transducer. The level of transduction can be modified according to the current average amplitude which is determined in a step 1208 from, in this case, the running average computed in the step 1212.

The embodiment of Figure 21B provides transducer activation signals at each rapid rise in amplitude, with the activation signal modulated according to the strength of the amplitude. This will capture much of the superficial musical quality of the audio signal, but will not capture or express more fundamental patterns within the audio signal.

Figure 21C is a schematic flow diagram of a method to extract fundamental musical patterns from an audio signal to create DJ 200 control signals. In the step 1200, the audio data is received into a buffer for calculations. In a step 1220, a low pass filter is applied to remove high frequency signal. Such high frequency signals can alternatively be removed via decimation, running averages, and other means as set forth in the embodiments of Figures 21A and B. As in the embodiment of Figure 21B, beat onsets are extracted from the audio signal in the steps 1214 and 1216, and a current average amplitude is computed in a step 1208.

The amplitudes and times of the onsets of beats are placed into an array in a step 1222. From this array, a musical model is created in a step 1224. This model is based on the regularity of beats and beat emphasis – as seen in the amplitudes – that is independent of the beats and amplitudes in any one short section of music (corresponding, for instance, to a measure of music).

In general, music is organized into repeating patterns, as represented in a time signature such as 3/4, 4/4, 6/8 and the like. Within each time signature, there are primary and secondary beats. In general, the downbeat to a measure is the first beat, representing the beginning of the measure. The downbeat is generally the strongest beat within a measure, but in any given measure, another beat may be given more emphasis. Indeed, there will be high amplitude beats that may not be within the time signature whatsoever (such as an eighth note in ¾ time that is not on one of the beats). Thus, by correlating the beats to standard amplitude patterns, the output to the music model identifies the primary (down) beats, secondary beats (e.g. the third beat in 4/4 time) and the tertiary beats (e.g. the second and fourth beats in 4/4/ time).

Figure 21D is a schematic flow diagram of an algorithm to identify a music model, resulting in a time signature. In a step 1600, the minimum repeated time interval is

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determined, using the array of beat amplitude and onset 1222. This is, over a period of time, the shortest interval for a quarter note equivalent is determined, wherein the time signature beat frequency (i.e. the note value of the denominator of the time signature, such as 8 in 6/8) is preferably limited to between 4 per second and one every two seconds, and even more preferably limited to between 3 per second and 1.25 per second. This is considered the beat time.

From the array of beat amplitudes and onsets 1222, the average and maximum amplitudes over a time period of preferably 3-10 seconds is computed in a step 1604. For the beginning of the audio signal, shorter periods of time can be used, though they will tend to give less reliable DJ 200 control signals. Indeed, in this embodiment, the initial times of an audio signal will tend to follow audio signal amplitude and changes in amplitude more than fundamental musical patterns until the patterns are elicited.

In a step 1606, the amplitude of a beat is compared with the maximum amplitude determined in the step 1604. If the beat is within a percentage threshold of the maximum amplitude, wherein the threshold is preferably 50% and more preferably 30% of the maximum amplitude, the beat is designated a primary beat in a step 1612. In a step 1608, the amplitude of non-primary beats is compared with the maximum amplitude determined in the step 1604. If the beat is within a percentage threshold of the maximum amplitude, wherein the threshold is preferably 75% and more preferably 50% of the maximum amplitude, and the beat is greater than a predetermined fraction of the average amplitude, wherein the fraction is preferably greater than 40% and even more preferably greater than 70% of the average beat amplitude, the beat is designated a secondary beat in a step 1614. The remaining beats are denoted tertiary beats in the step 1610.

In a step 1616, the sequence of the three types of beats is compared with that of established time signatures, such as 4/4, 3/4, 6/8, 2/4 and others, each with their own preferred sequence of primary, secondary and tertiary beats, in order to determine the best fit. This best fit is identified as the time signature in a step 1618.

Returning to Figure 21C, the channels of the DJ are pre-assigned to four different beats in a step 1225. Thus, if there are four channels, each channel is given a separate assignment. With a smaller number of channels, a single channel is assigned multiple beats. Some beats can also be unassigned, thus not being represented in a DJ 200 transducer output. Thus, a high jewelry signal, medium jewelry signal, low jewelry signal and an amplitude dependent signal are each assigned to a channel for DJ 200 transduction.

In a step 1226, a beat determined to be a primary/down beat is assigned to a high jewelry signal 1228. In a step 1230, a beat determined to be a secondary beat is assigned to a medium jewelry signal 1232. In a step 1234, a beat determined to be a tertiary beat is assigned to a low jewelry signal 1236. Beats which are then unassigned, and which will generally be beats that occur not within the music model of the step 1224 (e.g. rapid beats not falling on beats of the time signature) are then assigned in a step 1238 to an amplitude dependent (and not music model dependent) signal 1240.

It should be noted that the computations performed in the flow methods of Figures 21A-C may take time on the order of milliseconds, such that if the computations are made in real time during the playing of music, the activation of the transducers in the DJ 200 are "behind" in time relative to the audio playing of the corresponding music in the audio unit 100. This can be compensated for by carrying out the computations while the audio signal is still in buffers prior to being played in the unit 100, as is described above for numerous embodiments of the present invention. Thus, signals to the DJ 200 can then be made simultaneously with respect to the audio signal to which it corresponds.

It should be noted that many of the parameters described above can conveniently be affected by manual controls either on the DJ 200 or the unit 100 that transmits signals to the DJ 200. For example, if can be convenient for the user to be able to set, for a given DJ 200 response amplitude, the threshold audio amplitude level at which the output transducer (e.g. light transducer 240) responds, or to set the output transducer amplitude corresponding to a maximum audio amplitude, or to set the frequency bands for which different DJ 200 channels respond, or to set other similar parameters. The manual controls for such parameters can comprise dials, rocker switches, up/down button, voice or display menu choices, or other such controls as are convenient for users. Alternatively, these choices can be set on a computer or other user input device, for download onto the unit 100 or DJ 200.

A preferable means of setting the parameters is for the parameters to be stored in a configuration file that can be altered either on the unit 100, the DJ 200 or a computer, so that the same DJ 200 can take on different characteristics dependent on the configuration settings within the file. The configuration settings can then be optimized for a particular situation, or set to individual preference, and be traded or sold between friends or as commercial transactions, for instance over the Internet. For a most preferable use of these configuration files, each file with its set of configurations can be considered to represent a "mode" of operation, and multiple configuration files can be set on the DJ 200 or the unit 100, depending on where the automatic generation of control signals is performed. The user can

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then select from the resident configuration files, appearing to the user as different modes, for use of his system, and can change the mode at will. This can be arranged as a series of choices on a voice or display menuing system, as a list toggled through by pressing a single button, or through other convenient user interfaces.

Manual Generation of DJ 200 Control Signals

In the description above, the use of filtering and digital modification of audio signals can be used to create control signals for DJ 200 transducers 240, 250, and 260. In addition, manual choreography of DJ 200 signals can be accomplished. For example, buttons or other interface features (e.g. areas on a touch-screen) on the unit 100 can correspond to different arrays of transducers, such as the LED arrays 290 and 292 of Figure 2A. While playing the audio signal, the user can press the buttons, where pressing of the buttons can correspond to a control signal for a transducer being ON, and otherwise the signal can be off. To aid in choreography where rapid changes in transducers are desired, the audio can be played at less than normal speed.

Figure 22A is a top-view diagram of an audio unit 100 user interface 1250, demonstrating the use of buttons to create DJ 200 control signals. The interface 1250 comprises a display screen (e.g. LCD or oLED), which can display information to the user, such as shown in Figures 18 A-B. Standard music control buttons 1254 for playing, stopping, pausing, and rewinding allow the user to control the audio signal musical output. Buttons 1252 further control aspects of the music output, such as volume control, musical tracks, and downloading and uploading of music. The number of buttons 1252 is conveniently three as shown, but can be more or less than three.

In addition, buttons are provided to allow the user to input DJ 200 control signals, comprising a record button 1256, a first channel button 1258, a second channel button 1260 and a third channel button 1262. The channel buttons 1258, 1260 and 1262 are prominent and accessible, since the user will want to easily depress the buttons. A record button 1256 allows the user to activate the channel buttons 1258, 1260 and 1262, and has a low profile (even below the nominal surface of the interface 1250) so that it is not accidentally activated. The record button can serve various purposes, including recording into a permanent storage file the sequence of DJ control signals relative to music being played, or controlling the DJ transducers in realtime, synchronously with music being played on the audio unit 100.

Pressing the buttons 1258, 1260 and 1262 create DJ control signals for the corresponding channels. The number of buttons is conveniently three as shown, but can also

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be two or four or more buttons. If a telephone is being used as the unit 100, keys on the telephone keypad can alternatively be used. The channel buttons will generally be used with thumbs, and the buttons are spaced so that two of the buttons can be depressed with a single thumb, so that all three buttons can be activated with only two fingers. In is also convenient for the two secondary buttons 1260 and 1262 to be spaced more closely together, as it will be a preferred mode of operation that the secondary buttons be operated together from time to time.

To further aid in the choreography of the DJs 200, a separate "keyboard" with the number of keys related to the number of possible arrays can be used. The amplitude of the corresponding transducer signal can be modified either according to the pressure on the keys, according to the length of time that a key is depressed, or according to a foot pedal. Figure 22B is a top-view diagram of a hand-pad 1270 for creating DJ control signals. The hand-pad 1270 comprises a platform 1271, a primary transducer 1272, a secondary transducer 1274 and a tertiary transducer 1276. The platform 1271 has a generally flat top and bottom, and can conveniently be placed on a table, or held in the user's lap. The size of the platform is such that two hands are conveniently placed across it, being preferably more than 6 inches across, and even more preferably more than 9 inches across. The pressure transducers 1272, 1274 and 1276 respond to pressure by creating a control signal, with said control signal preferably capturing both the time and amplitude of the pressure applied to the corresponding transducer. The primary transducer 1272 creates a primary control signal, the secondary transducer 1274 creates a secondary control signal and the tertiary transducer 1276 creates a tertiary control signal. The sizes and placements of the transducers can be varied within the spirit of the present invention, but it is convenient for the primary transducer 1272 to be larger and somewhat separate from that of the other transducers 1274 and 1276. In one more method of user interaction, both hands can be rapidly and alternately used to make closely spaced control signals on the primary transducer 1272. In addition, it can be convenient on occasion for the user to activate both the secondary transducer 1274 and the tertiary transducer 1276 with different fingers on one hand, and thus these can be conveniently placed relatively near to one another. In general, while a single transducer will provide minimal function, it is preferable for there to be at least two transducers, and even more preferable that there be three transducers.

The control signals can be transferred to the audio unit 100 for playing and/or storage, or to the DJ 200 unit directly for playing, either wirelessly, or through wired communication. In addition, the hand-pad can also be configured to create percussive or other sounds, either

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directly through the incorporation of hollow chambers in the manner of a drum, or preferably by the synthesis of audio waveform signals that can be played through the audio unit 100 (and other audio units 100 participating in a cluster 700), or directly through speakers within the hand-pad 1270 or attached to the hand-pad 1270 through wired or wireless communications. Such audible, percussive feedback can aid the user in the aesthetic creation of control signals.

It is within the spirit of the present invention for the hand-pad to take on various sizes and configurations. For instance, it is also convenient for the hand-pad 1270 to be configured for the use of index and middle fingers, being of dimensions as small as two by four inches or less. Such a hand-pad is highly portable, and can be battery powered.

Additionally, DJ 200 control signals can also be manually generated live, during broadcast at a party, for example, by a percussionist playing a set of digital drums. Figure 22C is a schematic block diagram of a set of drums used for creating DJ control signals. The set of drums comprises four percussive instruments 1280, 1282, 1284 and 1286, which can include snare drums, foot drums, cymbals, foot cymbals and other percussive musical instruments, such as might be found with a contemporary musical "band". Microphones 1290 are positioned so as to receive audio input primarily from instruments to which they are associated. One microphone can furthermore be associated with multiple instruments, as with the drums 1282 and 1284. The microphones 1290 are connected with a controller 1292 that takes the input and creates DJ control signals therefrom. For example, the drums 1282 and 1284 can be associated with the primary channel, the drum 1280 can be associated with the secondary channel, and the drum 1286 can be associated with the tertiary channel. The association of the microphone input with the channel can be determined in many ways. For example, the jack in the controller 1292 to which each microphone 1290 attaches can correspond to a given channel. Alternatively, the user can associate the jacks in the controller to different channels, with such control being manual through a control panel with buttons or touch control displays, or even through prearranged "sets". That is, a set is a pre-arranged configuration of associations of microphones to channels, and thus a set can be chosen with a single choice that instantiates a group of microphone-channel associations.

In general, the inputs from the microphones 1290 will be filtered in frequency and also to enhance audio contrast. For instance, control signals can be arranged to be the highest when the low-frequency envelope is rising the quickest (i.e. the beat or sound onset). The algorithms for conversion of audio signal to DJ control signal can be pre-configured in the controller 1292, or can be user selectable.

It should be noted that the methods and systems of Figures 22 A-C need to synchronize the control signals so generated with the audio files to which they correspond. This can be accomplished in many ways. For example, the first control signal can be understood to correspond to the first beat within the audio file. Alternatively, the audio unit 100 or other device that is playing the audio signal to which the control signal is to correspond can send a signal to the device that is creating the control signals indicating the onset of playing of the audio file. The control signal can then be related to the time from the onset of the audio file. In addition, with regards to this synchronization, the user manually inputting the control signals will always be listening to the music during the control signal input. If the device on which control signals are being input is the same as the device that is playing the music, a control signal input cam be easily related to the sound that is currently being played by the audio output – many such devices allow information to within less than a millisecond of what sample or time within the audio files is currently being output by the audio device. With the arrangement of the control signal input device being also an audio player, close calibration of the control signals and the audio output is easily accomplished.

DJ 200 Control Signal Files

The control signals can be in a variety of formats within the spirit of the present invention. Such formats include pairs of locations within the associated music file and the corresponding amplitudes of the various DJ channels, and pairs of locations and the amplitudes of those DJ channels which are different from before. The locations can be either time from the start of the song (e.g. in milliseconds) or in terms of sample number. If the location is given in terms of sample number, the sample rate of the music will generally also be provided, since the same song can be recorded at different sample rates, and the invariant in terms of location will generally be time from onset of the music.

Other formats include an amplitude stream, corresponding to each DJ channel, provided in a constant stream with a fixed sample rate, which may be equal to or different from that of the corresponding music file. This format can be stored, for example, as additional channels into the music file, such that one channel corresponds to monoaural sound, two channels correspond to stereo sound, three channels correspond to stereo sound and one channel of control signals, and additional channels correspond to stereo sound plus additional channels of DJ control signals. Another arrangement is to allow for only a small number of states of the transduction in the control signal, so that multiple channels of control signal can be multiplexed into a single transmitted channel for storage and transmission with

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the audio signal. For example, if the audio is stored as a 16-bit signal, 3 channels of 5 bit DJ 200 control signal could be stored in a single channel along side the one or two audio channels normally used.

It should be appreciated that these different control signal storage formats are largely interchangeable. For instance, as described above, control signals can be stored as if they are additional audio channels within a music file, but then be extracted from the file for separate transfer (e.g. over the Internet), and then be reintegrated into an audio file at the destination location.

It should be appreciated that there are a number of means by which DJ 200 control signals can be generated, either automatically or manually, and can include the use of devices other than the unit 100 that can have sophisticated digital or analog filtering and modification hardware and software. The control signals so created can be stored in files that are associated with the music files (e.g. MP3) that the control signals are meant to accompany. To aid in their distribution, particularly in reference to limitations on the commercial and private distribution of the corresponding music files, the signal files will generally be separate from the music files, and transferable between units 100 either through inter-unit communication mediated by the inter-unit transmitter/receiver 110, or alternatively through computers or computer networks to which the unit 100 can be connected.

The audio signals and the DJ control signals should also be well synchronized during playback. Figure 23 is a schematic block flow diagram of the synchronized playback of an audio signal file with a DJ control signal file, using transmission of both audio and control signal information. For purposes of convenience in discussion, the audio signal file will be called a "song file" and the "control signal file" will be called a "dance file." In a step 1300, the user is provided a list of song files for display, preferably on the display 1170. In a step 1302, the user then selects a song from the display to play. In a step 1304, the dance files that are associated with the selected song file from the step 1302 are displayed for the user. These song files can be either locally resident on the unit 100, or can alternatively be present on other audio units 100 to which the audio unit 100 is connected, as in a cluster, or can alternatively be on the Internet, if the audio unit 100 is connected to the Internet. If there is a dance file that has been previously preferred in association with the song file, this file can be more prominently displayed than other associated dance files.

In a step 1306, the user selects the dance file to play along with the song file. This association is stored in a local database of song file/dance file associations in a step 1307, to be later used in a subsequent step 1304, should such an association not have been previously

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made, or if the preferred association is different from the previously preferred association. If the dance file is not locally resident, it can be copied to the audio unit 100 to ensure that the dance file is available throughout the duration of the song file playback.

In a step 1308, a timer is initialized at the beginning of the song file playback. In the step 1310, the song file is played on the local unit 100, and is also streamed to the other units 100 within the cluster 700. The corresponding DJ control signal accompanies the streaming song, either multiplexed within the song file audio signal, on another streaming socket, or through other communications (e.g. a TCP socket) channels between the two units. In a step 1312, the time advances along with the playback of the music. In a step 1314, this timer information is used to obtain current control signals from the dance file – that is, the dance file is arranged so that at each moment, the status of the different transducer channels can be determined. The control signals to be streamed along with the song file information can be either the current status of each transducer, or alternatively, can only send changes from the current transducer state.

The matching of the files in the database of song file and dance file associations of the step 1307 can be performed both within a machine, but also over a local or wide area network. In such cases, the association can either be external to the file – that is, using the name of the file, that is available the normal system file routines – or can use information internal to one or both files. For example, the dance file can have stored within it a reference to the song to which it is associated, either as the name of the song file, the name and/or other characteristics of the song (such as the recording artist, year of publication, music publisher) or alternatively as a numerical or alphanumerical identifier associated with the song. Then, given a song file, the relationship of the dance file with the song file can be easily determined.

For ease in creating an association, it is convenient for the names of the song files and the associated dance files to have a relationship with one another that is easily understood by casual users. For example, given a song file with the name "oops.mp3", it is convenient for an associated dance file to share the same root (in this case "oops") with a different extension, creating for example the dance file name "oops.dnc". Because of the multiplicity of dance files that will often be associated with a particular song file, the root itself can be extended to allow for either a numerical or descriptive filename, which can be preferably done in conjunction with a known punctuation mark to separate the song file root from the dance file description, such as the file names "oops.david2.dnc" or "oops$wild.dnc". It is

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preferable to use a punctuation mark that is allowed within a range of different operating systems.

Dance files can be stored on the Internet or other wide area network in a store for access by users who want dance files associated with a particular song file. In such case, if the storage is through the root of the filename, the user, requesting dance files corresponding to "oops.mps" would then be returned the names of related files such as "oops$wild.dnc". If the dance file internally carries the relationship with "oops.mps" as described above, either through the name or other characteristics, or alternatively, through a numerical or alphanumerical identifier, it is preferable to store the information in a database on the storage computer or unit 100, so that it is not necessary to open the file each time for perusal of the dance file information. Thus, if the music file has a substantially unique identifier associated with it internally, it is also useful for the dance file to also have the same identifier associated internally as well. In such case, the identifier is conveniently used to reference both files within a database.

In operation, a remote user would request a dance file for a particular song file by providing the name of the song file, along possibly with other information about the song file, which could include the name of the choreographer, the number of channels of DJ 200 transduction, the specific brand or type of DJ 200, or other information. The database would then return a listing of the various dance file that met the criteria requested. The remote user would then choose one or more of the files to download to the remote computer, and then the database would retrieve the dance files from storage and then transmits the dance file over the wide area network. On the remote computer or unit 100, the dance file would become associated with the corresponding song file through means such as naming the dance file appropriately or making an association between the song file and the dance file in a database or indexing file. Alternatively, the dance file can be integrated into the song file as mentioned elsewhere within this specification.

It can be useful to preview a dance file for its desirability or suitability. Since the dance files can be retrieved from a wide area network such as the Internet, it is convenient for such an emulator to operate on a computer that may not be portable or have the proper transmitter that allows communications with a DJ 200. In such case, it is preferable to have an emulator which places an image or drawing of a DJ 200 on the screen, and which is provided the name of a song file and a dance file, and which then plays the song file through the audio of the computer and displays appropriate images or drawings of transducers being activated within the emulator image or drawing. The characteristics of the DJ 200 being

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emulated (e.g. colors of lights, frequency responses, levels of illumination, arrangement of lights, response to amplitude, etc.) can be simulated by a number of means. For example, the user can move slider controls, set checkboxes and radio boxes, enter numerical values, click-and-drag icons and use other standard user interface controls to make the DJ 200 operate as desired. Alternatively, manufacturers of DJ 200s can create configuration files (including, for example, bitmaps of photos of the actual DJ 200) that can be downloaded for this purpose (and which can also be used by prospective purchasers to view the "virtual" operation of the DJ 200 prior to purchase, for example, through an Internet merchant). The configuration files would contain the information necessary for the emulator to properly display the operation of the specific DJ.

Alternatively, as described above, the dance file information can be stored within the song file as, for example, another channel in place of an audio channel, or alternatively within MP3 header or other file information. In such case, the step 1307 would have the alternative function of looking through song files to find the song file with the particular desired embedded dance file within.

In addition to sending dance files from computers to units 100 or between units 100, the dance files can be streamed from unit 100 to unit 100 through the normal unit-to-unit communications, in the manners described above for audio communications. This is particularly convenient given that DJ 200 displays can be used to show group identification, and such displays can be more effective if the DJs for each user are nearly identical (which might not be the case if the users were using, for example, different dance files). The dance file control signal information can be transmitted in a variety of ways, including multiplexing the control signals into the same packets as the audio information as if it were a different audio channel, alternating packets of control signals with packets of the audio information, or broadcasting control signals on a different UDP socket as the audio. Alternatively, if the receiving unit has a copy of the dance file corresponding to the song file being transferred by unit-to-unit communication, the receiving unit can determine the current time being played, and to extract from the local dance file the control signals for the receiving unit DJ 200.

It should be known that most streaming protocols have relatively small data packets that are communicated, due to the fact that reception at the source is not guaranteed and it is not desirable to lose a large amount of information in any one stream. Thus, it is possible with smaller transmission buffers and higher data rates to send a single DJ control signal in each transmission. For example, with a buffer size of 600 bytes, and an audio rate of 22,050 Hz with two single byte channels, each transmission covers only about 12 milliseconds, and

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any signal would therefore be at most 13 milliseconds from its correct time. Alternatively, each control signal can be accompanied by an offset in time from the beginning of the transmitted audio signal. Also, the time or packet number of each transmission buffer can be sent, as well as the time or packet number of the DJ audio signals, so that the audio unit 100 can compute the proper offset.

Stationary Transducers

DJs 200 that have been previously described are portable devices, usually associated with a particular user and unit 100. Figures 5A and 5B indicate the ways in which DJs 200 associated with multiple users can be controlled by a single unit 100.

It is also convenient for transducers to be non-portable and stationary. Consider, for example, a user who is at home listening to music. Instead of a DJ 200 worn by the user, the user can alternatively have a bank of lights or other transducers in fixed locations through the room that operate under the same or similar control signals as to which DJs respond. Such fixed transducers can operate at far higher power than portable DJs 200, and can each incorporate a large number of separate transducers.

Furthermore, in a party, concert or other large social gathering, the effects of portable DJs worn by guests can be supplemented by large transducers that are generally perceptible by most guests. For example, such transducers can include spark or smoke generators, strobe lights, laser painters, arrays of lights similar to Christmas light strings, or mechanical devices with visible (e.g. a flag waving device) or tactile effects (e.g. a machine that pounds the floor). In general, transducers for large gatherings will not communicate with a unit 100, but will be directed by a wide-area broadcast unit 360, as in Figure 5B.

Because of the large area over which such stationary transducers can operate, the communications between the unit 100 and the stationary transducers can be through wired rather than wireless transmission. Furthermore, there can be mixed communication, such as wireless transmission of control signals from a portable unit 100 to a stationary receiver, and thence wired transmission to one or multiple transducers.

Modular Configurations

In the embodiments above, the audio player 130 is directly integrated with the inter-unit and unit-to-DJ communications. This requires both a re-engineering of existing audio players (e.g. CD, MP3, MO and cassette players), and furthermore does not allow the communications functionality to be reused between players.

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An alternative embodiment of the present invention is to place the communications functions external to the audio playing functions, and to adjustably connect the two via the audio output port of the audio player. Figure 12A is a schematic diagram of a modular audio unit 132. Audio player 131 is a conventional audio player (e.g. CD or MP3 player) without the functionality of the present invention. Analog audio output is sent via audio output port 136 through the cable 134 to the audio input port 138 of the modular audio unit 132. The modular audio unit 132 comprises the inter-unit transmitter/receiver 110 and the DJ transmitter 120, which can send and receive inter-unit and unit-to-DJ communications in a manner similar to an audio unit 100. A switch 144 chooses between audio signals from the audio player 131 and from the inter-unit transmitter/receiver 110 for output to the output audio port 142 to the earphone 901 via cable 146 (the earphone 901 can also be a wireless earphone, wherein the output port 142 can be a wireless transmitter, which can also be a DJ transmitter 120). A convenient configuration for the switch 144 is a three way switch. In an intermediate position, the unit 132 acts simply as a pass-through, in which output from the audio player 131 is conveyed directly to the earphone 901, and the transmitter/receiver functions of the unit 132 do not operate. In another position, the unit 132 operates as a receiver, and audio from the inter-unit transmitter/receiver 110 is conveyed to the earphone 901.

When the combined system operates as a broadcast unit 710, audio input from the audio unit 131 is directed to the inter-unit transmitter/receiver 110 for transmission to receive units 730, as well as for output to the earphone 901 (which can be direct to the earphone 901 through the switch, or indirectly through the inter-unit transmitter/receiver 110).

When the combined system operates as a conventional audio player, the switch directs audio signals from the input port 138 directly through to the output port 142. In this mode of operation, it can be arranged for the audio output to traverse the modular audio unit 132 without the unit being powered up. In case there is a transmission delay to the receive unit 730 such that audio played locally through the earphone 901 and audio played remotely on the receive unit 730 are not in synchrony, the system can incorporate a time delay in the output port 142 such that the local and remote audio output play with a common time delay, and are thus in synchrony.

When the combined system operates as a receiver unit 730, audio input from the input port 138 is ignored, and signals to the audio output port are delivered solely through the inter-unit transmitter/receiver 110.

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It is convenient for the modular audio unit 132 to be able to operate independently of the associated audio player 131. In such a case, the unit 132 must have an independent energy store, such as one or more batteries, which can be rechargeable. In that case, the unit 132 has no audio signals locally to listen to through the earphone 901 or to transmit over the transmitter/receiver 110. However, the unit 132 can in that case receive external audio signals sent by other units 132 or units 100 for listening.

The audio player 131 can be placed in a backpack, purse, or other relatively inaccessible storage location, while the modular audio unit is, like a "remote control", accessible for interaction with other users.

Video

While the units 100 described above have comprised audio players 130, within the spirit of the present invention, such units can also comprise video or audio/visual players (both of which are referred to below as video players). Such video players would be used generally for different entertainment and educational purposes, not limited to films, television, industrial training and music videos. Such video enabled units can operate similarly to audio units, including the capability of sharing video signals, synchronously played, with nearby units through inter-unit communication, as well as the use of DJ's that can produce human-perceptible signals (such as light transduction for accompaniment of audio signals in music videos). It should be noted, however, that there is a larger bandwidth requirement for the inter-unit transmitter/receiver 110 for the communication of video signals as compared with audio signals. In the case of shared video, wire connections (e.g. FireWire) between two units can allow simultaneous viewing of a single video signal.

In addition, text, including language-selectable closed caption and video subtitling, can accompany such video, as well as chat or dubbing to allow the superposition of audio over the audio normally accompanying such video.

Music Distribution Using Audio Units

The music industry is suffering from reduced sales due to the advent of Internet-based music file sharing; in addition, the manufacturers of personal audio devices are bringing to market audio devices that can wirelessly transfer music files between the devices. Such sharing-enabled devices could significantly reduce the sales of music. Audio units of the present invention, however, can be used to provide new means of music distribution and thereby increase the sales of music.

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Figure 25 is a schematic flow diagram indicating music sharing using audio devices, providing new means of distributing music to customers. Three entities are involved in the transactions – the DJ (operating a broadcast unit 710), the cluster member (operating a receive unit 730), and the music distributor, and their actions are tracked in separate columns. In this case, the term DJ is used to indicate the person operating a broadcast unit 710, and has no meaning with respect to a DJ unit 200. Indeed, the DJ unit 200 is a part of the system only inasmuch as it provides for heightened pleasure of the DJ and the member in enhancing their experience of the music. For the rest of this section, DJ will refer specifically to the person operating the broadcast unit 710.

In a first step 1340, the DJ registers with the distributor, who places information about the DJ into a database in a step 1342. Part of this information is a DJ identifier (the DJ ID), which is unique to the DJ, and which DJ ID is provided to the DJ as part of the registration process. This ID is stored in the unit 100 for later retrieval. The DJ at some later time broadcasts music of the type distributed by the distributor, in a step 1344. The broadcast of the music by the DJ can be adventitious (that is, without respect to the prior registration of the DJ with the distributor), or the distributor can provide the music to the DJ either free of charge, at a reduced charge, or free of charge for a limited period of time.

In a step 1346, the member becomes a part of the cluster 700 of which the DJ is the broadcaster broadcasting the distributor's music, and has thereby an opportunity to listen to the music. Along with the transfer of the audio signal of the music, in a step 1348, the DJ can send information about the song, which can include a numerical identifier of the music or album from which the music is derived. Furthermore, the DJ ID is provided to the member, and is associated with the music ID and stored in a database on the member unit 100 in a step 1350. In order to prevent this database from becoming too sizable, music IDs and DJ IDs can be purged from it on a regular basis (for example, IDs which are older than 60 or 120 days can be removed).

If the member requests purchase of the music from the distributor in a step 1352, in a step 1354, the distributor stores the member information, the music ID, and the DJ ID associated with the music (i.e. the person who introduced the member to the music). The distributor then completes the transaction with the member, providing a copy of the music in exchange for money, in a step 1356. As the member receives the music copy, he also becomes registered as a DJ as well in a step 1358. Thus, if the member now becomes the DJ of his own cluster, and introduces people to this music, he will also be known to the distributor as an introducer of the music.

In a step 1360, the distributor provides points to the DJ who introduced the member to the music and facilitated the sale of the music. In a step 1362, the DJ accumulates points related to the sale of the music to the member, as well as points related to the sale of other music to other members. These points can at that point or later be redeemed for money, discounted music, free music, gifts, access to restricted activities (e.g. seats at a concert) or other such real or virtual objects of value to the DJ.

In a step 1364, the DJ is optionally further linked to the music and member for whom he has received points. If this member introduces the music to yet other members, who are induced to buy the music from the distributor, the DJ is further awarded points in a step 1366, given that the "chain" of members introduced directly or indirectly to the music includes the original DJ.

This set of interactions does not decrease music sales as does file sharing, but rather increases sales of music, as the DJ has incentives to encourage others to buy the music, and the offering of the music by the DJ through his broadcasts introduces music to people who may not have already had the opportunity to hear the music.

Figure 31 contains tables of DJ, song and transaction information according to the methods of Figure 25. A USER table 1810 comprises information about the USER, which can include the name of the person (Alfred Newman), their nickname/handle ("WhatMeWorry"), their email address (AEN@mad.com), and the machine ID of their unit 100 (B1B25C0). This information is permanently stored in the audio unit 100. A second set of information relates to music that the USER has heard while in other clusters 700 that the USER liked, and which is indicated as the USER's "wish list". This set of information includes a unique ID associated with the song (or other music or audio signal), which is transmitted by the broadcast unit 710 of the cluster 700. This information can alternatively or additionally include other information about the music, such as an album name, an artist name, a track number, or other such information that can uniquely identify the music of interest.

Along with each song ID is a DJ identifier, indicating the unique ID associated with the DJ who introduced the desired music to the USER. Additionally or alternatively, the information can comprise the DJ's email address, personal nickname/handle, name, or other uniquely identifying information.

The Wish List can either be permanent, or it can be that each song entry is dated, and that after a predetermined amount of time, which can be set by the user, the songs that are still on the Wish List are removed. It is also convenient that songs that are purchased

according to the methods of the present invention, such as Figure 25, are also removed from the list automatically.

A DISTRIBUTOR table 1812 comprises information about purchases made by USERS with the DISTRIBUTOR. The table 1812 has numerous records keyed according to unique USER identifiers, which in this case is the MAC ID of the unit 100. A single record from the table is provided, of which there can be hundreds of thousands or millions of such records stored.

The record can include contact information about the USER, including name, email address, or other business related information such as credit card number. In addition, each record comprises a list of all of the songs known to have been purchased through the DISTRIBUTOR, as identified by a unique song ID. In addition, the DJ associated with the purchase of the given song by the USER is also noted. This information was previously transmitted from the USER table 1810, which includes the associated DJ identifier along with the song identifier, at the time of purchase of the song. This association allows the DISTRIBUTOR to compensate the DJ for his part in introducing the USER to the song.

It should also be noted that such an arrangement of information allows the compensation, if desired, of the individual who introduced the DJ to the song, prior to the DJ introducing the USER to the song. For example, when the user purchased the song with song ID 230871C40, points were credited with the DJ whose ID is 42897DD. Looking in the record for the DJ 42897DD, one can determine whether there is another individual (DJ) associated with the purchase of the song 230871C40 by the DJ. If so, that individual can also receive compensation for the purchase of the song by the USER.

Use of Internet Connections

It is within the teachings of the present invention to allow normal Internet connections of the audio unit 100 with non-mobile devices connected with the Internet. Figure 29A is a schematic block diagram of the connection of an Internet-enabled audio unit 100 with an Internet device through the Internet cloud 1708, using an Internet access point 1704. An Internet-enabled audio unit 1700, unit A, is wirelessly connected to an audio unit 100, denoted unit B, as members in a cluster 700. The dashed line connecting the two units A and B indicates that the connection is wireless, whereas the solid connecting lines indicate wired connections. The unit A is connected to a wireless access point 1704, such as an 802.11 access point, which is connected to an Internet device 1706 via wired connections through the Internet cloud 1708.

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Figure 29B is a schematic block diagram of the connection of an Internet-enabled audio unit 1702 with an Internet device through the Internet cloud, with an audio unit 1702 directly connected to the Internet cloud 1708. In this case the audio unit 1702 is capable of directly connecting to the Internet cloud 1708, and thence to the Internet device 1706, through a wired connection. This could be through a high speed connection (such as a twisted wire Ethernet connection) or through a lower speed connection (e.g. a serial port connection, or a dial-up modem).

The connection of the unit 1700 or unit 1702 is illustrated in Figure 30, tables of ratings of audio unit 100 users. As described above, members of a cluster can decide whether or not to admit a new member to the cluster using a variety of automatic or manual methods. One method of determining the suitability of a user to become a member of the cluster 700 is to determine the user's ratings by members of other clusters to which the user has previously been a member. In this case, the Internet device 1706 is a computer hosting a database, which can be queried and to which information can be supplied by the unit A (either 1700 or 1702). On the Internet device 1706 are stored ratings of units 100, as indicated by the table 1802. The left hand column is the primary key of the database, and is a unique identifier associated with each unit 100. This ID can be a numerical MAC ID, associated with the hardware and software of each unit 100, a unique nickname or word handle (e.g. "Jen412smash") associated with each audio unit user, or other such unique identifier.

The second and third columns, indicated as numbers with dollar signs, are the total summed positive ratings (column two) and the negative ratings (column three) registered with each user by another member of a cluster 700 with which the user has been associated, and in which the user was operating the broadcast unit 710. This rating can, for example, reflect the perceived quality of music provided by the user. The fourth and fifth columns are the total, summed ratings of the user by other members of clusters 700 with which the user has been associated, in which the user was the operator of a receive unit 730. This rating can, for example, indicate the good spirits, friendliness, dress or other characteristics of the user as perceived by other members of the cluster. The sixth column indicates the largest cluster 700 for which the user has been the broadcaster. This is a good indicator of a broadcaster's popularity, since a poor or unpopular broadcaster would not be able to attract a large group of members for a cluster.

There are many other characteristics that can be stored in such a database, and can also include IDs of other members of groups with which the user has been associated (so that members can accept new members who have been associated with friends of those in the

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cluster), specific music that the user has played (in order to determine musical compatibility), information on the individuals making each rating (in order to determine rating reliability), and gradations of ratings (rather than simply a positive or negative response).

The cluster members can access the ratings of the user requesting membership in the cluster 700 in order to determine their desirability and suitability. This would require a connection with the Internet device 1706 at the time that the user was requesting to join, and would preferably involve a wireless connection through an access point, as in Figure 29A. The information from the database on the device 1706 can either be displayed to the members of the cluster 700, or can be used by an automatic algorithm to determine whether the person can join.

The table 1800 represents the ratings of a cluster 700 of 5 total members (comprising a broadcaster with ID 12089AD, and four additional members with IDs E1239AC, F105AA3, B1B25C0, and ED5491B). The ratings are supplied by ED5491B (whose ID is preceded by a zero), and then specific ratings of each member are made. The DJ is indicated by a dollar sign preceding his ID. These ratings can be made by putting the nicknames/handles of the cluster members on a screen, and allowing the member to indicate positive or negative ratings by pressing one of two buttons. A plus in the first column indicates a positive response, and a minus sign indicates a negative response. These ratings can then be sent during either wired communications directly to the Internet device 1706 or via the access point 1704. It should be noted that the ratings, once made, can be stored on the unit 1700 or 1702 indefinitely, until connection with the Internet cloud 1708 can be made. As indicated by the arrow, the information for B1B25C0 can be added to the table 1802 – in this case, by incrementing the value in the fourth column (a positive rating for a user who is not the broadcaster).

Other applications of connections to Internet devices 1706 include exchanging (via uploading and downloading) dance files with distant individuals, and obtaining music via downloading , which can include transactions with distributors similar to that seen in Figure 25. Such connections also allow the integration of other connectivity, such as telephone and messaging capabilities, expanding the usefulness and attractiveness of audio units 100.

Many Embodiments Within the Spirit of the Present Invention

It should be apparent to one skilled in the art that the above-mentioned embodiments are merely illustrations of a few of the many possible specific embodiments of the present invention. For example, the elements of a unit 100, including the inter-unit transmitter/receiver 110 protocol and hardware, the DJ transmitter 120 and the audio player

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130 can be chosen from a range of available technologies, and can be combined with user interface elements (keyboards, keypads, touch screens, and cursor buttons, without significantly affecting the operation of the unit 100. Furthermore, many different transducers can be combined into DJs 200, which can further comprise many decorative and functional pieces (e.g. belt clasps, functional watches, microphones, or wedding rings) within the spirit of the present invention. Indeed, the unit 100, itself, can comprise transducers 240, 250 or 260.

It should also be appreciated that communications protocols provide a nearly uncountable number of arrangements of communications links between units in a cluster, that the links can be of mixed software protocols (e.g. comprising both TCP and UDP protocols, and even non-IP protocols) over a variety of hardware formats, including DECT, Bluetooth, 802.11 a, b, and g, Ultra-Wideband, 3G/GPRS, and i-Beans, and that communications can include not only digital but also analog communications modes. Furthermore, communications between audio units and digital jewelry can further comprise analog and digital communications, and a variety of protocols (both customized as well as well-established IP protocols).

It is important, as well, to note that the inter-unit communication and the unit-to-DJ communication can operate and provide significant benefits independently of one another. For example, members listening to music together gain the benefits of music sharing, even without the use of DJs 200. Alternatively, an individual's appreciation of music and personal expression can be augmented through use of a DJ 200, even in the absence of music sharing. However, the combination of music sharing along with enhanced personal expression through a DJ 200 provides a synergistic benefit to all members sharing the music.

Numerous and varied other arrangements can be readily devised by those skilled in the art without departing from the spirit and scope of the invention. Moreover, all statements herein reciting principles, aspects and embodiments of the present invention, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e. any elements developed that perform the same function, regardless of structure.

In the specification hereof any element expressed as a means for performing a specified function is intended to encompass any way of performing that function. The invention as defined by such specification resides in the fact that the functionalities provided by the various recited means are combined and brought together in the manner which the

specification calls for. Applicant thus regards any means which can provide those functionalities as equivalent as those shown herein.

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Claims

What is claimed is:

1. A method for sharing music from stored musical signals between a first user with a first music player device and at least one second user with at least one second music player device, comprising:

playing the musical signals for the first user on the first music player device while essentially simultaneously wirelessly transmitting the musical signals from the first music player device to the at least one second music player device; and

receiving the musical signals by the at least one second player device, wherein the musical signals can be played on the at least one second player device essentially simultaneously with the playing of the musical signals on the first music player device;

wherein the first and the at least one second users are mobile and maintain less than a predetermined distance.

2. The method of claim 1 wherein the predetermined distance is 40 feet.

3. The method of claim 1 wherein the predetermined distance is 100 feet.

4. The method of claim 1 wherein the predetermined distance is 500 feet.

5. The method of claim 1 wherein the transmitting and receiving involve the use of an Internet protocol.

6. The method of claim 5 wherein the Internet protocol uses a connection-less transport layer.

7. The method of claim 5 wherein the Internet protocol uses a link layer involving a protocol chosen from the group consisting of 802.11, Bluetooth, ultrawideband, HiperLAN and WDCT.

8. The method of claim 1 wherein the transmitting and receiving use analog radio frequency transmission.

9. The method of claim 1 wherein the transmitted music signals are digital.

10. The method of claim 9 wherein the transmitted digital music signals are compressed.

11. The method of claim 1 wherein the first music player device is carried by the first user.

12. The method of claim 1, additionally comprising displaying by the first user a humanly-perceptible light display that is roughly synchronized with the beat of the musical signals.

13. The method of claim 1, additionally comprising communicating an identifier of the at least one second user to the first music player device, and indicating the identifier to the first user on a display located on the first music player device.

14. The method of claim 1, additionally comprising transferring a substantially unique music identifier of the musical signal wherein the personal identifier is stored on the at least one second music player device in association with the musical identifier.

15. The method of claim 14 wherein the user of the at least one second music player device retrieves the musical signal from a remote system by using the music identifier.

16. The method of claim 15 wherein the remote system is located on the Internet.

17. The method of claim 15, additionally comprising a substantially unique personal identifier of the first user wherein the personal identifier is transferred to the at least one second music player device and stored in association with the music identifier of the music transmitted by the first music player device to the at least one second music player device.

18. The method of claim 1, additionally comprising monitoring the strength of the musical signal received by the at least one second music player device and communicating with the at least one second user the strength of the musical signal.

19. A system of music sharing for a plurality of users, comprising:

a first sharing device and at least one second sharing device, each comprising a musical signal store, a musical signal transmitter, a musical signal receiver, and a musical signal player;

a broadcast user operating the first sharing device; and

at least one member user operating the at least one second sharing device, wherein the broadcast user plays the musical signal for his own enjoyment on the first sharing device and simultaneously transmits the musical signal to the receiver of the at least one second sharing device of the at least one member user, on which the musical signal is played for the at least one member user, wherein the broadcast user and the at least one member user hear the musical signal substantially simultaneously.

20. The system of claim 19, additionally comprising a manual switch on at least one second sharing device, wherein actuation of the switch causes the first sharing device to cease transmitting the musical signal and for the second sharing device to begin transmitting musical signal from the musical signal store of the second sharing device, wherein the broadcast user and the at least one member user hear the musical signal from the second sharing device substantially simultaneously.

21. The system of claim 19 wherein the first sharing device and the at least one second sharing device additionally comprise a substantially unique identifier, wherein the first sharing device communicates its substantially unique identifier to the at least one second sharing device and the at least one second sharing device communicates its substantially unique identifier to the first sharing device.

22. The system of claim 21, wherein the identifier includes a least one piece of information about the user of the sharing device taken from the group consisting of the name of the user, the nickname of the user, a numerical identifier, an alphanumerical identifier, the musical preferences of the user, the age of the user, and the educational institution that the user attends.

23. The system of claim 22 wherein the first sharing device and the at least one second sharing device additionally comprise a visual display on which the substantially unique identifiers which have been communicated to the respective device are displayed.

24. The system of claim 19 additionally comprising at least one requesting member user operating an at least one requesting sharing device, wherein the at least one requesting member user requests to receive transmission of the musical signal from the first sharing device.

25. The system of claim 24 wherein the at least one requesting sharing device is associated with a substantially unique identifier which is communicated by the requesting sharing device to the first sharing device and wherein the first sharing device additionally comprises a display on which the identifier is displayed.

26. The system of claim 25 wherein the broadcast user elects whether to transmit the musical signal from the first sharing device to the requesting sharing device.

27. The system of claim 25 wherein the broadcast user and the at least one member user elect through voting whether to transmit the musical signal from the first sharing device, wherein a majority vote is determinative.

28. The system of claim 25 wherein the broadcast user and the at least one member user elect through voting whether to transmit the musical signal from the first sharing device, wherein a unanimous vote is required for transmitting.

29. The system of claim 25 wherein the identifier of the requesting sharing device is compared with identifiers stored in the first device, such that the match of the identifier of the requesting sharing device with a stored identifier allows the first sharing device to transmit the musical signal to the requesting sharing device.

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30. The system of claim 29 wherein the stored identifiers are retrieved from the Internet.

31. The system of claim 19 wherein the first sharing device additionally comprises a visual display.

32. The system of claim 31 wherein the visual display indicates the number of member users receiving the musical signal.

33. The system of claim 31 wherein the visual display can display whether the musical being played by the sharing device comes from the musical signal store of the same device, or from the musical signal store another sharing device.

34. The system of claim 19 wherein the first sharing device is mobile.

35. The system of claim 19 wherein the first sharing device is carried by the user.

36. The system of claim 19 wherein the first sharing device and at least one sharing device maintain less than a predetermined distance.

37. The system of claim 36 wherein the predetermined distance is 40 feet.

38. The system of claim 36 wherein the predetermined distance is 100 feet.

39. The system of claim 36 wherein the predetermined distance is 500 feet.

40. The system of claim 19, additionally comprising a substantially unique user identifier associated with the broadcast user and a substantially unique musical signal identifier associated with each musical signal, wherein the user identifier and the musical signal identifier are transmitted from the first sharing device to the at least one second sharing device and stored in association with one another on the at least one second sharing device.

41. A wireless communications system for sharing audio entertainment between a first mobile device and a second mobile device in the presence of a non-participating third mobile device, comprising:

an announcement signal transmitted by the first mobile device for which the second mobile device and the third mobile device are receptive;

a response signal transmitted by the second mobile device in response to the announcement signal for which the first mobile device is receptive and for which the third mobile device is not receptive;

an identifier signal transmitted by the first mobile device to the second mobile device in response to the response signal, and which is not receptive to the third mobile device; and

a broadcast signal comprising audio entertainment that is transmitted by the first mobile device, and which is receptive by the second mobile device on the basis of the reception of the identifier signal.

42. The system of claim 41 wherein the announcement signal is transmitted via an Internet protocol.

43. The system of claim 42 wherein the Internet protocol is a connection-oriented transport protocol.

44. The system of claim 43 wherein the connection-oriented protocol is TCP.

45. The system of claim 42 wherein the Internet protocol further comprises a link layer protocol selected from the group consisting of 802.11, Bluetooth, ultrawideband, HiperLAN and WDCT.

46. The system of claim 41 wherein the broadcast signal is transmitted via an Internet protocol.

47. The system of claim 46 wherein the Internet protocol is a connectionless transport protocol.

48. The system of claim 47 wherein the connectionless transport protocol is UDP.

49. The system of claim 46 wherein the Internet protocol further comprises a link layer protocol selected from the group consisting of 802.11, Bluetooth, ultrawideband, HiperLAN and WDCT.

50. The system of claim 41 wherein the broadcast signal is an analog radio frequency signal.

51. The system of claim 41 wherein the broadcast signal is transmitted via telephony.

52. The system of claim 41 wherein the broadcast signal is compressed.

53. The system of claim 52 wherein the compression is MP3.

54. The system of claim 41 wherein the broadcast signal is encrypted.

55. The system of claim 41 wherein the identifier signal is an IP socket address.

56. The system of claim 41 wherein the identifier signal is a decryption code.

57. The system of claim 41 wherein the identifier signal is a digital password.

58. The system of claim 41 wherein the announcement signal and the broadcast signal use different IP transport protocols.

59. The system of claim 41 additionally comprising a transfer signal that is transmitted by the first mobile device upon halting the transmission of its broadcast signal, and which transfer signal is receptive by the second mobile device, such that reception by the second mobile device causes the device to transmit a second broadcast signal comprising audio entertainment for which the first unit is receptive.

60 The system of claim 41 wherein the broadcast signal is transmitted via peer-to-peer communications.

61 The system of claim 60, additionally comprising a switch, wherein actuation of the switch causes the device to toggle between peer-to-peer communications and infrastructure-based communications.

62 The system of claim 41 wherein the broadcast signal is transmitted via infrastructure-based communications.

63. An audio entertainment device, comprising:

a signal store that stores an audio entertainment signal;

a transmitter that can transmit the stored audio entertainment signal;

a receiver that can receive the transmitted audio entertainment signal from a transmitter of another such device; and

a player that can play audio entertainment from a member selected from the group of stored audio entertainment signals or audio entertainment signals transmitted from the transmitter of another such device.

64. The device of claim 63 wherein the transmitter transmits to the receiver of the same device in order to play through the player of that device.

65. The device of claim 63 wherein the player can play audio entertainment from signals obtained from either the receiver or from the audio store.

66. The device of claim 63 additionally comprising a visual display that is perceptive to the user of the device, indicating information about the audio entertainment signal.

67. The device of claim 66 wherein a third device can receive the transmitted audio signal, wherein all such devices transmitting and receiving the same audio entertainment signal constitute a sharing group.

68. The device of claim 67 additionally comprising a substantially unique identifier that identifies the user of the device, wherein at least one device of the sharing group displays the identifier of the user of another device within the sharing group.

69. The device of claim 68 wherein the identifier includes a least one piece of information about the user taken from the group consisting of the name of the user, the nickname of the user, the musical preferences of the user, a numerical identifier, an alphanumerical identifier, the age of the user, or the educational institution that the user attends.

70. The device of claim 68 wherein the identifier is interspersed within the transmitted audio entertainment signal.

71. The device of claim 66 wherein the visual display can display the number of devices in the sharing group.

72. The device of claim 66 wherein the visual display can display whether the audio entertainment being played by a device comes from the audio store of the device of which the display is a part, or from another device.

73. The device of claim 63 wherein the second device provides information to the second user about the strength of the audio signal received by the receiver.

74. The device of claim 73 additionally comprising a visual display, wherein the signal strength information is provided in the visual display

75. The device of claim 73 wherein the signal strength information is provided secondary audio signals played substantially simultaneously with the audio entertainment signal through the player of the device.

76. The device of claim 63 wherein the signal store stores a compressed audio signal.

77. The device of claim 63 wherein the compressed audio signal is transmitted through the transmitter.

78. The device of claim 63 wherein the compressed audio signal is decompressed prior to being transmitted through the transmitter.

79. The device of claim 63 wherein the identifier is interspersed within the transmitted audio signal.

80. The device of claim 63 additionally comprising a delay circuit.

81. The device of claim 80 wherein the playing of the audio entertainment signal is delayed in each device so that the audio entertainment signal in all devices playing from the same stored audio entertainment signal is played substantially simultaneously.

82. The device of claim 63 additionally comprising a manual control with at least three states, wherein in the first state the player plays a stored audio entertainment signal and does not transmit the stored entertainment signal, wherein in the second state the player plays a stored audio entertainment signal and substantially simultaneously transmits the same audio entertainment signal, and wherein in the third state the player plays an audio entertainment signal received by the receiver.

83. The device of claim 63 wherein the ambient sound admitted by the earphone can be manually controlled.

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84. The device of claim 63 additionally comprising a microphone wherein the device can transmit vocal sounds from the user of the device.

85. The device of claim 63 additionally comprising a manual control such that actuation transmits a message.

86. The device of claim 63 wherein the device can connect with the telephone network.

87. The device of claim 63 wherein the device is mobile and can be carried by a user.

88. The device of claim 63 additionally comprising a control signal transmitter that transmits control signals that controls a humanly-perceptible display in a wearable accessory.

89. The device of claim 88 wherein the control signal transmitter is the same as the transmitter that transmits stored audio entertainment signals.

90. The device of claim 88, additionally comprising a store of control signals.

91. The device of claim 88, additionally comprising a generator wherein the generator coverts stored audio entertainment signals into control signals.

92. An audio entertainment device comprising:

a wireless transmitter for the transmission of audio entertainment signals;

a wireless receiver for the reception of the transmitted audio entertainment signals from a transmitter of audio entertainment signals;

a first manually-separable connector for electrically connecting with an audio player, wherein the connector allows transfer of audio entertainment signals from the player to the device;

a second connector for connecting with a speaker; and

a control to manually switch between at least three states, wherein in the first state the speaker plays audio entertainment signals from the audio player and the transmitter does not transmit the audio entertainment signals, wherein in the second state the speaker plays audio entertainment signals from the audio player and the transmitter essentially simultaneously transmits the audio entertainment signals, and wherein in the third state the speaker plays audio entertainment signals received by the receiver.

93. The device of claim 92 wherein the first connector connects to the audio player through the audio output jack.

94. The device of claim 92 wherein the speaker is chosen from the group consisting of earphone and headphone.

95. The device of claim 92 wherein the device additionally comprises a control signal generator that converts audio entertainment signals into control signals that control a humanly-perceptible display in a wearable accessory.

96. The device of claim 92 additionally comprising a second transmitter that transmits control signals that control a humanly-perceptible display in a wearable accessory.

97. The device of claim 92 additionally comprising a display that indicates the state of the device.

98. The device of claim 92 wherein the receiver is receptive of the audio entertainment signals transmitted by the transmitter.

99. The device of claim 92 wherein the receiver is operational when the first connector is manually separated from the audio player.

100. A system for the sharing of stored music between a first user and a second user, comprising:

a first device for playing music to the first user, comprising a store of musical signals, a first controller that prepares musical signals from the first store for transmission and playing, a first player that takes musical signals from the first controller and plays the signals for the first user, and a transmitter, that is capable of taking the musical signals from the controller and transmitting the musical signals via wireless broadcast; and

a second device for playing music to the second user, comprising a receiver receptive of the transmissions from the transmitter of the first device, a second controller that prepares musical signals from the receiver for playing, and a second player that takes musical signal from the second controller and plays the signals for the second user;

wherein the first user and the second user hear the musical signals at substantially the same time.

101. The system of claim 100 wherein the store of musical signals comprises compressed digital audio files.

102. The system of claim 100 wherein the compressed digital audio files are in formats taken from the group consisting of mp3, wav, cda, wma, and au.

103. The system of claim 100 wherein the preparation of the musical signals by the first controller comprises decompression of compressed binary files.

104. The system of claim 100 wherein the transmitter transmits via an Internet protocol.

105. The system of claim 104 wherein the Internet protocol has a link level selected from the group consisting of 802.11, Bluetooth, ultrawideband, HiperLAN and WDCT.

106. The system of claim 100 wherein the first device is a telephone.

107. The system of claim 100 wherein the first device transmits compressed musical signals and the second controller decompresses the compressed musical signals received by the receiver.

108. The system of claim 100 wherein the transmitter additionally transmits an annunciator signal indicating the presence of a transmitter of musical signals.

109. The system of claim 100 wherein the second device receiver becomes receptive of transmissions from the first device by obtaining an identifier from the first device.

110. The system of claim 109 wherein the first device additionally comprises an associated visual transducer and the second device additionally comprises a visual receiver, wherein the visual transducer outputs a visual identifier signal that is received by the visual receiver.

111. The system of claim 109 wherein the first device additionally comprises a first electrical connector and the second device additionally comprises a second electrical connector, wherein the identifier is communicated via an electrical signal passed from the first electrical connector to the second electrical connector.

112. The system of claim 111 wherein the communication of the identifier signal occurs via an inductive coupling between the first connector and the second connector.

113. The system of claim 109 wherein the second device additionally comprises a microphone, wherein the identifier is communicated in an audio signal that is produced by the first player and which is received by the microphone.

114. The system of claim 109 wherein the identifier is transmitted by the transmitter and received by the receiver.

115. The system of claim 100 wherein the second device receiver becomes receptive of transmissions from the first device by transmitting an identifier to the first device.

116. The system of claim 115 wherein the second device additionally comprises a visual transducer and the first device additionally comprises a visual receiver, wherein the visual transducer outputs a visual identifier signal that is received by the visual receiver.

117. The system of claim 115 wherein the first device additionally comprises a first electrical connector and the second device additionally comprises a second electrical connector, wherein the identifier is communicated via an electrical signal passed from the second electrical connector to the first electrical connector.

118. The system of claim 117 wherein the communication of the identifier signal occurs via an inductive coupling between the first connector and the second connector.

119. The system of claim 115 wherein the first device additionally comprises a microphone, wherein the identifier is communicated in an audio signal that is produced by the second player and which is received by the microphone.

120. The system of claim 115 wherein the identifier is transmitted by the transmitter and received by the receiver.

121. The system of claim 100 wherein the first controller additionally generates control signals related to the musical signals.

122. The system of claim 121 wherein the store additionally comprises stored control signals that are used by the first controller.

123. The system of claim 121 wherein the controller generates control signals from the musical signals.

124. The system of claim 123 wherein the controller performs frequency analysis of the musical signals in order to generate the control signals.

125. The system of claim 121 wherein the first device additionally transmits the control signals to the second device using the first transmitter.

126. The system of claim 125 wherein the control signals and the musical signals transmitted by the first device are interspersed within a single digital stream.

127. The system of claim 125 wherein the control signals and the musical signals are transmitted in two digital streams.

128. The system of claim 121 wherein the first device additionally comprises a second transmitter that transmits control signals.

129. The system of claim 128 wherein the second transmitter uses an IP protocol.

130. The system of claim 129 wherein the Internet protocol uses a link layer selected from the group consisting of 802.11, Bluetooth, and ultrawideband.

131. The system of claim 121 wherein the second transmitter uses analog radio frequency transmissions.

132. The system of claim 100, additionally comprising a wearable accessory, comprising a control signal receiver that is receptive of control signals transmitted by the first device, an accessory controller that generates transducer signals from the received control signals, and a transducer that generates humanly-perceptive music accompaniment signals from the transducer signals.

133. The system of claim 132 wherein the music accompaniment signals are visual signals.

134. The system of claim 133 wherein the visual signals are generated by a light emitting diode

135. The system of claim 132 wherein the music accompaniment signals are tactile signals.

136. The system of claim 132 wherein the accessory controller performs frequency analysis on the received control signals.

137. The system of claim 132 wherein the wearable accessory additionally comprises a switch, wherein actuation of the switch causes the accessory to be receptive to an entraining signal from the first device, such that the accessory will accept signals from the first device.

138. An earphone for listening to audio entertainment allowing for the controlled reception of ambient sound by a user, comprising

a speaker that is oriented towards the user's ear;

an enclosure that reduces the amount of ambient noise perceptive to the user; and

a manually-adjustable characteristic of the enclosure that adjusts the amount of ambient sound perceptive to the user.

139. The earphone of claim 138 wherein the manually-adjustable characteristic is the size of apertures in the enclosure that admit ambient sound.

140. The earphone of claim 138 wherein the manually-adjustable characteristic is the number of apertures in the enclosure that admit ambient sound.

141. The earphone of claim 138 wherein the manually-adjustable characteristic is the surface area of the enclosure.

142. The earphone of claim 138 wherein the manually-adjustable characteristic is the thickness of the enclosure.

143. The earphone of claim 138, additionally comprising a spacer that attaches to the earphone and which increases the distance between the speaker and the user's ear.

144. The earphone of claim 138, additionally comprising a secondary enclosure that encloses the enclosure and the speaker, and which is detachable from the earphone.

145. A mobile device for the transmission of audio entertainment signals comprising

an audio signal store for the storage of the audio entertainment signals;

an audio signal player for the playing of the audio entertainment signals;

an wireless transmitter for the transmission of the audio entertainment signals; and

a transmitter control to manually switch between two states consisting of the operation and the non-operation of the audio transmitter.

146. The device of claim 145 wherein the transmitter is connected to the audio jack of the audio signal player.

147. The device of claim 146 wherein the audio signal that is transmitted via the audio jack is subsequently divided between the transmitter and the headphone.

148. The device of claim 146 wherein the transmitter additionally comprises a second jack to which the earphone plug can connect, such that the insertion of the earphone plug into the second jack allows the audio signal to be heard in the earphone

149. A mobile device for the reception of digital audio entertainment signals comprising:

an audio signal store for the storage of the digital audio entertainment signals;

an audio receiver for the reception of external digital audio entertainment signals from a mobile audio signal transmitter located within a predetermined distance of the audio receiver;

a receiver control with at least a first state and a second state; and

an audio signal player that plays digital audio entertainment signals from the audio signal store when the receiver control is in the first state, and that plays digital audio entertainment signals from the audio receiver when the receiver control is in the second state.

150. The device of claim 149, additionally comprising a jack to which a listening device chosen from the group consisting of earphone and headphone can be connected.

151. A method for the shared enjoyment of music from stored musical signals between a first user with a first music player device and at least one second user with at least one second music player device, comprising:

playing the musical signals for the first user on the first music player device while essentially simultaneously wirelessly transmitting synchronization signals from the first music player device to the at least one second music player device; and

receiving the synchronization signals by the at least one second player device, wherein the synchronization signals allow the musical signals on the at least one second player device to be played essentially simultaneously with the playing of the musical signals on the first music player device;

wherein the first and the at least one second users are mobile.

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152. The method of claim 151 wherein the same musical signals are stored on the first music player device and the at least one second music player device.

153. The method of claim 152 wherein the musical signals are stored as compressed audio files.

154. The method of claim 151 wherein the synchronization signals comprise the current sample number being played on the first music player device.

155. The method of claim 154 wherein the synchronization signals further comprise the sample rate of the musical signal being played on the first music player device.

156. The method of claim 151 wherein the synchronization signals comprise the current time relative to the beginning of the musical signal being played on the first music player device.

157. The method of claim 151, additionally comprising transferring the musical signals from the first music player device to the at least one second music player device.

158. A wireless communications system for sharing audio entertainment between a first mobile device and a second mobile device, comprising:

a broadcast identifier transmitted by the first mobile device to the second mobile device;

a personal identifier transmitted by the second mobile device to the first mobile device; and

a broadcast signal comprising audio entertainment that is transmitted by the first mobile device of which the second device is receptive;

wherein the first mobile device and the second mobile device have displays which can display the identifier signal that they receive and the second mobile device can play the audio entertainment from the broadcast signal that it receives.

159. The system of claim 158 wherein the identifier signals are transmitted via an Internet protocol.

160. The system of claim 159 wherein the Internet protocol is a connection-oriented transport protocol.

161. The system of claim 159 wherein the Internet protocol further comprises a link layer protocol selected from the group consisting of 802.11, Bluetooth, ultrawideband, HiperLAN and WDCT.

162. The system of claim 158 wherein the broadcast signal is transmitted via an Internet protocol.

163. The system of claim 162 wherein the Internet protocol is a connectionless transport protocol.

164. The system of claim 162 wherein the Internet protocol further comprises a link layer protocol selected from the group consisting of 802.11, Bluetooth, ultrawideband, HiperLAN and WDCT.

165. The system of claim 158 wherein the broadcast signal is an analog radio frequency signal.

166. The system of claim 158 wherein the broadcast signal is transmitted via telephony.

167. The system of claim 158 wherein the broadcast signal is compressed.

168. The system of claim 158 wherein the broadcast signal is encrypted.

169. The system of claim 158, additionally comprising a transfer signal that is transmitted by the first mobile device upon halting the transmission of its broadcast signal, and which transfer signal is receptive by the second mobile device, such that reception by the second mobile device causes the device to transmit a second broadcast signal comprising audio entertainment for which the first unit is receptive.

170. The system of claim 158 wherein the broadcast signal is transmitted via peer-to-peer communications.

171. The system of claim 170 additionally comprising a switch, wherein actuation of the switch causes the device to toggle between peer-to-peer communications and infrastructure-based communications.

172. The system of claim 158 wherein the broadcast signal is transmitted via infrastructure-based communications.

173. The system of claim 158 wherein the personal identifier includes a least one piece of information about the user of the second mobile device taken from the group consisting of the name of the user, the nickname of the user, a numerical identifier, an alphanumerical identifier, the musical preferences of the user, the age of the user, and the educational institution that the user attends.

174. The system of claim 158 additionally comprising a third mobile device whose user requests to receive the broadcast signal and additionally comprising a requester identifier signal transmitted by the third mobile device to the first mobile device.

175. The system of claim 174 wherein the requester identifier signal is additionally transmitted by the third mobile device to the second mobile device.

176. The system of claim 174 wherein the requester identifier signal is additionally transmitted by the first mobile device to the second mobile device.

177. The system of claim 174 wherein the requester identifier is displayed on the display of the first mobile device.

178. The system of claim 174 wherein the third mobile device receives the broadcast signal without the affirmative action of the first mobile device.

179. The system of claim 174 wherein the third mobile device must receive the affirmative action of the first mobile device in order to receive the broadcast signal.

180. The system of claim 174 wherein the third mobile device must receive the affirmative action of the first mobile device and all other mobile devices receptive of the broadcast signal.

181. The system of claim 180 wherein the affirmative action is a unanimous vote.

182. The system of claim 180 wherein the affirmative action is a majority vote.

183. The system of claim 158, additionally comprising a substantially unique musical identifier related to the audio entertainment, wherein the musical identifier is transmitted by the first mobile device to the second mobile device in association with the broadcast signal, and the musical identifier is stored on the second mobile device in association with the broadcast identifier.

184. A system for identifying a first device that introduces a music selection to a second device, comprising:

a mobile music transmitter operated by the first device;

a mobile music receiver operated by the second device;

a music signal comprising the music selection transmitted by the transmitter and received by the receiver;

an individual musical identifier that is associated with the music selection; and

an individual transmitter identifier that identifies the transmitter, wherein the transmitter identifier and the individual music identifier are stored in association with each other in the receiver.

185. A method for enhancing enjoyment of a musical selection, comprising:

obtaining control signals related to the musical selection;

transmitting the control signals wirelessly;

receiving the control signals; and

converting the control signals to a humanly-perceptible form.

186. The method of claim 185 wherein the distance over which the control signals are transmitted has a minimum range of at least 1 foot.

187. The method of claim 185 wherein the distance over which the control signals are transmitted has a maximum range of less than 500 feet.

188. The method of claim 185 wherein the humanly-perceptible form is a visually-perceptible form.

189. The method of claim 185 wherein the humanly-perceptible form is a tactilely-perceptible form.

190. The method of claim 185 wherein the transmitting and receiving use radio frequency communications.

191. The method of claim 185 wherein the radio frequency communications use an Internet protocol.

192. The method of claim 185 wherein the Internet protocol involves a link layer chosen from the group consisting of 802.11, Bluetooth, ultrawideband, HiperLAN and WDCT.

193. The method of claim 185 wherein obtaining additionally comprises extracting the musical beat from the musical selection.

194. The method of claim 185 wherein obtaining additionally comprises retrieving the control signals from a store of control signals.

195. The method of claim 185 wherein the control signals are divided into multiple channels.

196. The method of claim 195 wherein the step of converting comprises a step of demultiplexing the control signals.

197. The method of claim 185 wherein the steps of transmitting and receiving are performed using means conveyed by a single person.

198. The method of claim 197 wherein the user is mobile.

199. The method of claim 185 wherein the step of transmitting is performed by a stationary user and the step of receiving is performed by a mobile user.

200. The method of claim 185 wherein the musical selection is provided by musicians in concert playing essentially simultaneously with obtaining control signals.

201. The method of claim 185 wherein the control signals are transmitted with a substantially unique identifier.

202. The method of claim 185 wherein the control signals control the appearance of a wearable device.

203. A method for generating and storing control signals corresponding to musical signals, comprising:

playing musical signals for a user;

receiving manual input signals from the user that are produced substantially in synchrony with the music;

generating control signals from the input signals; and

storing the control signals so that they can be retrieved with the musical signals.

204. The method of claim 203 wherein receiving comprises transducing tactile input from the user.

205. The method of claim 204 wherein the tactile input is produced using a user appendage selected from the group consisting of hand, finger and foot.

206. The method of claim 203 wherein receiving comprises transducing sound output produced by the user.

207. The method of claim 203 wherein storing comprises interleaving control signals within the musical signals.

208. The method of claim 203 wherein storing additionally comprises creating a digital file.

209. The method of claim 203 wherein storing additionally comprises associating the digital file with the musical signals.

210. A wearable personal accessory, comprising:

an input transducer taken from the group consisting of a microphone and an accelerometer, said transducer generating a time-varying input transduction signal;

a controller which accepts the input transduction signal, and which generates an output transducer signal whose signal varies in amplitude with time;

an output transducer receptive of the output transducer signal, and which provides a humanly-perceptible signal; and

an energy source for powering the input transducer, controller and output transducer.

211. The accessory of claim 210 wherein the accelerometer responds to the movements of the user in one axis of movement.

212. The accessory of claim 210 wherein the accelerometer responds to the movements of the user in more than one axis of movement.

213. The accessory of claim 210 wherein the controller performs automatic gain control on the signal from the input transducer.

214. The accessory of claim 210 wherein the output transducer is a light transducer.

215. The accessory of claim 214 wherein the output transducer comprises a light emitting diode.

216. The accessory of claim 214 wherein the output transducer comprises a liquid crystal display.

217. The accessory of claim 214 wherein the output transducer comprises an organic light emitting diode.

218. The accessory of claim 210 wherein the output transducer is a tactile transducer.

219. The accessory of claim 210 wherein the output transducer comprises a first and a second transduction element.

220. The accessory of claim 219 wherein the first transduction element responds preferentially to a first band of frequencies of the input transduction signal and the second transduction element responds preferentially to a second band of frequencies of the input transduction signal.

221. The accessory of claim 219 wherein the first transduction element responds preferentially to a first band of amplitudes of the input transduction signal and the second transduction element responds preferentially to a second band of amplitudes of the input transduction signal.

222. A wearable personal accessory controlled via wireless communications, comprising:

a wireless communications receiver, receptive of an external control signal;

a controller that accepts the external control signal and that generates a time-varying visual output transducer signal;

a visual output transducer that is receptive of the output transducer signal, and which provides a humanly-perceptible visual signal; and

an energy store for powering the receiver, controller and output transducer;

wherein the visual output transducer generates visually-perceptive output.

223. The accessory of claim 222 wherein the external control signal is a time-varying amplitude signal.

224. The accessory of claim 223 wherein the amplitude signal is analog.

225. The accessory of claim 223 wherein the amplitude signal is digital.

226. The accessory of claim 223 wherein the amplitude signal is substantially a musical signal.

227. The accessory of claim 226 wherein the controller performs frequency filtering of the external control signal.

228. The accessory of claim 226 wherein the controller determines the primary beat of the music.

229. The accessory of claim 228 wherein the primary beat of the music is determined according to the positions in the music where the amplitude rises at least a predetermined factor over less than a predetermined time.

230. The accessory of claim 222 wherein the external control signal is a digital signal of pairs comprising positions within the music and the amplitudes to which the output transducers are set at such times.

231. The accessory of claim 230 wherein the positions are chosen from the group of characteristics consisting of samples and times.

232. The accessory of claim 222 wherein the receiver is an analog radio frequency receiver.

233. The accessory of claim 232 wherein the analog radio frequency communications are at a frequency set by a crystal oscillator, wherein the crystal oscillator can be manually exchanged in order to change the frequency of operation.

234. The accessory of claim 222 wherein the receiver receives Internet protocol signals.

235. The accessory of claim 234 wherein the Internet protocol further comprises a link layer selected from the group consisting of Bluetooth, 802.11 and ultrawideband.

236. The accessory of claim 222 wherein the visual output transducer comprises a first light transducer and a second light transducer.

237. The accessory of claim 236 wherein the external control signal comprises a multiplexed first signal and second signal, and wherein the first signal relates to the first light transducer and the second signal relates to a second light transducer.

238. The accessory of claim 237 wherein the controller comprises at least two ports, wherein the first port relates to the first light generating element and the second port related to the second light generating element.

239. The accessory of claim 236 wherein the first light transducer responds preferentially to a first range of frequency in the musical signal, and the second light transducer responds preferentially to a second range of frequency in the musical signal.

240. The accessory of claim 236 wherein the first light transducer responds preferentially to a first range of amplitude in the musical signal, and the second light transducer responds preferentially to a second range of amplitude in the musical signal.

241. The accessory of claim 222 wherein the visual output transducer comprises a light emitting diode.

242. The accessory of claim 222 wherein the visual output transducer comprises an organic light emitting diode.

243. The accessory of claim 222 wherein the visual output transducer comprises a liquid crystal display.

244. The accessory of claim 222 additionally comprising a tactile transducer responsive to the external control signal.

245. The accessory of claim 222 additionally comprising a sound transducer responsive to the external control signal.

246. The accessory of claim 222 wherein the external control signal additional comprises a digital identifier.

247. The accessory of claim 246 wherein the visual output transducer additionally provides an identifier signal that corresponds to the digital identifier, wherein such identifier signal is higher frequency than is humanly perceptible, and wherein the identifier signal is output substantially simultaneously with the humanly-perceptible visual signal.

248. The accessory of claim 222 additionally comprising a manually-separable electrical connection, wherein the connection connects the receiver to the controller.

249. The accessory of claim 222 additionally comprising a manually-separable electrical connection, wherein the connection connects the controller to the output transducer.

250. The accessory of claim 222 wherein the accessory functions as an accoutrement selected from the group consisting of a ring, a pendant, a hair clip, an earring, a necklace, a brooch, a belt buckle, watches, and a bracelet.

251. The accessory of claim 222 wherein the accessory is incorporated into an article of clothing selected from the group consisting of a backpack, a wallet, a purse, a hat and a shoe.

252. The accessory of claim 222 additionally comprising a manual control whose operation sets either a first state and a second state and wherein in the first state the accessory responds exclusively to external control signals comprising a substantially unique identifier.

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253. The accessory of claim 252 wherein the identifier to which the accessory responds in the first state is received by the receiver when the accessory is set to the second state.

254. The accessory of claim 253 additionally comprising a third state which is manually set, wherein in the third state, the accessory responds to external control signals in the absence of a substantially unique identifier.

255. A device for converting user tactile responses to stored music into a stored control signal, comprising:

a player that plays stored music audible to the user;

a manually-operated transducer that outputs an electrical signal, wherein the transducer is actuated by the user in response to the music;

a controller that receives the electrical signal and outputs a control signal; and

a store that receives the control signal and stores it.

256. The device of claim 255 wherein the control signal comprises a list of positions, wherein the positions are chosen from the set of characteristics consisting of samples and time relative to the beginning of the stored music.

257. The device of claim 255 wherein the control signal further comprises a list of amplitudes corresponding to the positions.

258. The device of claim 257 additionally comprising a second manually-operated transducer that outputs a second electrical signal, wherein the controller additionally receives the second electrical signal.

259. The device of claim 255 wherein the transducer comprises a musical drum operated by the user whose audible output is received by a microphone that generates the electrical signal received by the controller.

260. The device of claim 255 wherein the controller performs frequency filtering on the electrical signal.

261. The device of claim 255 wherein the transducer is a tactile transducer that is operated by an appendage of the user selected from the group consisting of finger, hand, and foot.

262. The device of claim 255 wherein the store is a file system and the control signal is stored as control file and the stored music is stored as a music file, wherein the control file and the music file are stored in association with each other.

263. The device of claim 255 wherein the control signals are stored in an interleaved fashion with the stored music.

264. The device of claim 71 additionally comprising a visual display on which a visual representation of the control signals is displayed.

265. A music player that wirelessly transmits control signals related to the music, wherein the control signals control a wearable electronic accessory, comprising:

a store of music signal files;

a controller that reads a musical signal file from the store and generates audio signals and that further generates the control signals;

a transducer that converts the audio signals into sound audible to the user; and

a wireless transmitter that transmits the control signal to the wearable electronic accessory.

266. The player of claim 265 wherein the music signal files comprise compressed audio files.

267. The player of claim 265 wherein the controller performs frequency filtering of the external control signal.

268. The player of claim 265 wherein the controller determines the primary beat of the music.

269. The player of claim 268 wherein the primary beat of the music is determined according to the positions in the music where the amplitude rises at least a predetermined factor over less than a predetermined time.

270. The player of claim 265 wherein the control signals are pairs comprising positions within the music and the amplitudes to which the output transducers are set at such times.

271. The player of claim 265 wherein the positions are chosen from the set of characteristics consisting of samples and times.

272. The player of claim 265 wherein the transmitter is an analog radio frequency transmitter.

273. The player of claim 265 wherein the transmitter transmits according to an Internet protocol.

274. The player of claim 273 wherein the Internet protocol has a link layer selected from the group consisting of 802.11, Bluetooth, ultrawideband, HiperLAN and WDCT.

275. The player of claim 265 additionally comprising a visual transducer that generates visually-preceptive output in response to the control signal, wherein the visual transducer receives the control signal from the controller.

276. The player of claim 275 wherein the visual transducer is a light emitting diode.

277. The player of claim 275 wherein the visual transducer is a liquid crystal display.

278. The player of claim 265 additionally comprising a store of configuration files wherein the configuration files include parameters read by the controller that affect the generation of control signals from the musical signals.

279. A music player that wirelessly transmits control signals related to the music, wherein the control signals control a wearable electronic accessory, comprising:

a store of music signal files;

a second store of control signal files associated with the music signal files;

a controller that reads a musical signal file from the store and generates audio signals and that further reads an associated control signal file;

a transducer that converts the audio signals into sound audible to the user, and

a wireless transmitter that transmits the control signals from the associated control signal file to the wearable electronic accessory.

280. The player of claim 279 wherein the music signal files comprise compressed audio files.

281. The player of claim 279 wherein the transmitter is an analog radio frequency transmitter.

282. The player of claim 279 wherein the transmitter transmits according to an Internet protocol.

283. The player of claim 282 wherein the Internet protocol has a link layer selected from the group consisting of 802.11, Bluetooth, ultrawideband, HiperLAN and WDCT.

284. The player of claim 279 wherein the store of control information comprises at least one binary data file that relates to a single music signal file.

285. The player of claim 279 wherein the store of control information is interleaved with a related music signal file in binary data format.

286. The player of claim 279 additionally comprising a visual transducer that generates visually-preceptive output in response to the electrical control signal, wherein the visual transducer receives the electrical control signal from the controller.

287. A system for exhibition of music enjoyment, comprising:

a source of music signals;

a controller that generates control signals from the music signals;

a transmitter of the control signals, wherein the transmission of the control signals is synchronized with the playing of the music signals;

a receiver of the control signals; and

a transducer that responds to the control signals.

288. The system of claim 287 wherein the source of music signals are stored binary music files.

289. The system of claim 288 wherein the stored binary data files are compressed audio files.

290. The system of claim 288 wherein the music signals are stored on a medium selected from the group consisting of compact disk, digital video disk, hard disk drive, removable disks, flash memory, magneto-optical disk, and audio tape.

291. The system of claim 287 wherein the source of music signals are musicians playing live music.

292. The system of claim 287 wherein the receiver and transducer are worn by a user.

293. The system of claim 287 wherein the receiver and the transducer are physically separated from the transmitter by more than 5 feet.

294. The system of claim 287 wherein the transducer is a visual transducer that generates humanly-perceptible visual signals.

295. The system of claim 294 wherein the visual transducer is a light emitting diode

296. The system of claim 294 wherein the visual transducer is a liquid crystal display

297. The system of claim 287 wherein the transducer is a tactile transducer.

298. The system of claim 287 wherein the minimum range of the transmitter for which the receiver is receptive is at least 1 foot.

299. The system of claim 287 wherein the maximum range of the transmitter for which the receiver is receptive is less than 500 feet.

300. The system of claim 287 wherein the controller determines the primary beat of the music.

301. The system of claim 287 wherein the controller performs frequency filtering.

302. The system of claim 287, additionally comprising a second controller that is electrically connected to the receiver, and which generates transducer control signals from the control signals received by the receiver, wherein the transducer control signals directly control the transducer.

303. The system of claim 302 wherein the control signals are time-varying amplitude signals and wherein the second controller performs frequency filtering.

304. The system of claim 302 additionally comprising a switch that is electrically connected to the second controller such that actuation of the switch places the second controller into entraining mode, wherein the receiver becomes receptive of entraining signals from the transmitter.

305. The system of claim 304 wherein a receiver that is entrained will receive control signals other than from the transmitter in the absence of signals from the transmitter.

306. The system of claim 304 wherein additional actuation of the switch will allow reception of control signals by the receiver from a transmitter to which it is not entrained.

307. The system of claim 287 wherein the transmitter and receiver communicate via an Internet protocol.

308. The system of claim 287 wherein the transmitter and receiver communicate via digital radio frequency communications.

309. The system of claim 287 wherein the transmitter and receiver communicate via analog radio frequency communications.

310. The system of claim 309 wherein the analog radio frequency communications are at a frequency set by a crystal oscillator and wherein the crystal oscillator can be manually replaced.

311. The system of claim 287 additionally comprising a transferror for the transmission of music signals.

312. The system of claim 311 wherein the transmitter and the transferror are the same.

313. The system of claim 311 wherein the transmitter and the transferror are different, and communicate via different communications protocols.

314. The system of claim 287 additionally comprising a second receiver for the reception of music signals, wherein the music signals that are received are played by the music player.

315. A method for transferring a wearable-accessory control file stored on a first device to a second device in which an associated music file is stored, comprising:

storing on the first device the name of the music file in conjunction with the control file with which it is associated;

requesting by the second device of the first device for a control file stored in conjunction with the name of the music file; and

transferring the control file from the first device to the second device, wherein the control file is stored on the second device in conjunction with the name of the associated music file.

316. The method of claim 315 additionally comprising the step of extracting, wherein the control file is stored on the first device interspersed with the music file as a combined file, and the control file is extracted from the music file prior to being transferred to the second device.

317. The method of claim 315 wherein the requesting is performed over a wide area network.

318. The method of claim 315 wherein the name of the control file comprises the root of the name of the associated music file appended with a predetermined extension that is different from that of the music file.

319. The method of claim 315 wherein the control file and the associated music file both comprise the same substantially unique identifier.

320. A device for transmitting control signals to a wearable accessory receptive of such control signals, comprising:

a manually-separable input connector for connecting to an output port of an audio player, wherein audio signals are conveyed from the audio player to the device across the connector;

a controller for generating control signals from the audio signals; and

a transmitter for transmitting the control signals.

321. The device of claim 320 additionally comprising a second connector, wherein a portion of the audio signal conveyed to the device is conveyed to the second connector, and wherein an earphone can connect to the second connector.

322. The player of claim 320 wherein the controller performs frequency filtering of the audio signal.

323. The player of claim 320 wherein the controller determines the primary beat of the audio signal.

324. The player of claim 320 additionally comprising a visual transducer that generates visually-preceptive output in response to the control signals, wherein the visual transducer receives the control signals from the controller.

325. The system of claim 320 wherein the transmitter transmits via an Internet protocol.

326. The system of claim 320 wherein the transmitter transmits via digital radio frequency communications.

327. The system of claim 320 wherein the transmitter transmits via analog radio frequency communications.

328. The system of claim 327 wherein the analog radio frequency communications are at a frequency set by a crystal oscillator and wherein the crystal oscillator can be manually replaced.

329. The system of claim 320 wherein the transmitter additionally transmits the audio signal to wireless earphones.

LINKPLAY EXHIBIT 1004
Page 3603 of 4822

Fig. 1

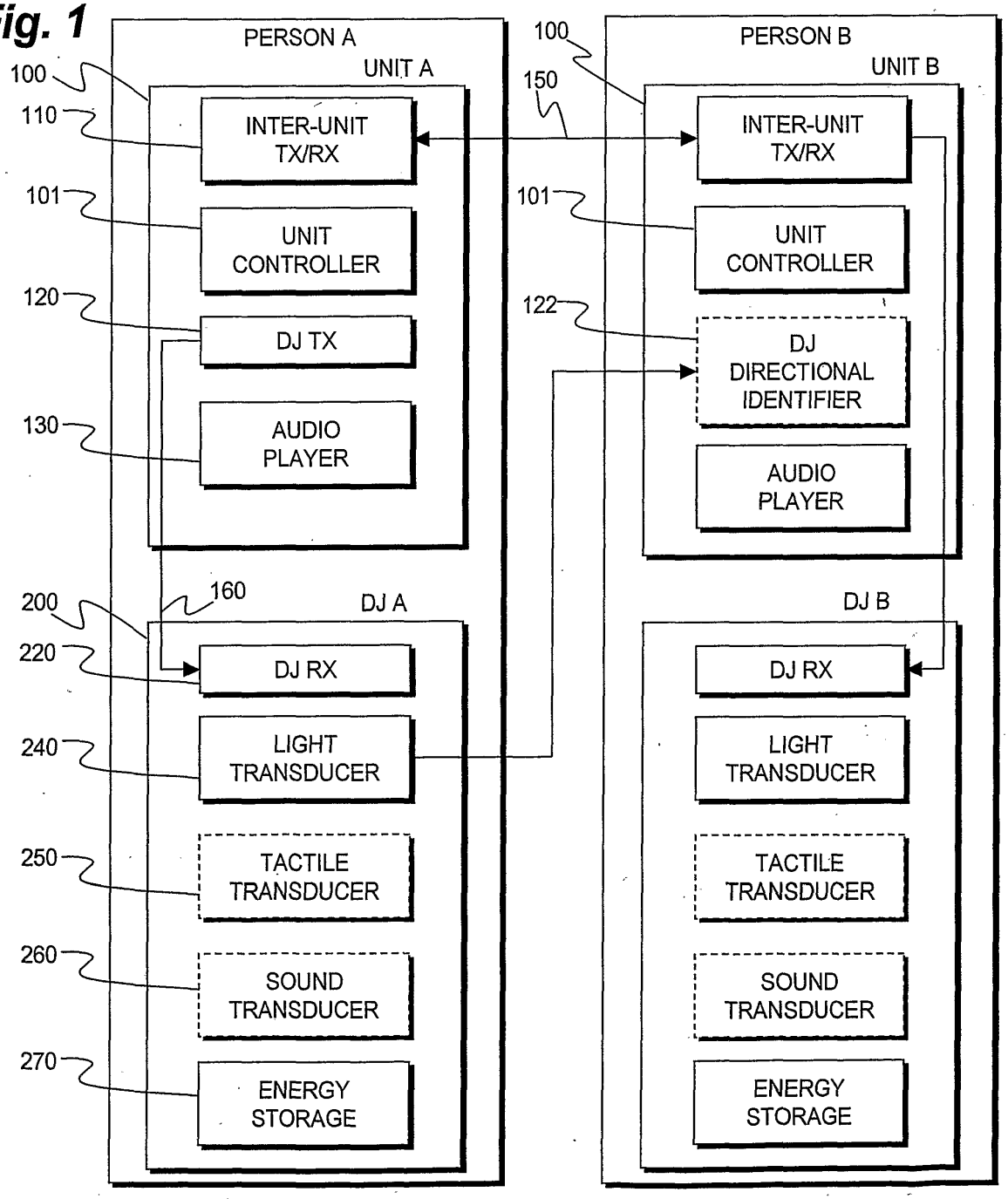

PERSON A
UNIT A
100
110
INTER-UNIT TX/RX
101
UNIT CONTROLLER
120
DJ TX
130
AUDIO PLAYER
200
160
DJ A
220
DJ RX
240
LIGHT TRANSDUCER
250
TACTILE TRANSDUCER
260
SOUND TRANSDUCER
270
ENERGY STORAGE
100
150
PERSON B
UNIT B
INTER-UNIT TX/RX
101
UNIT CONTROLLER
122
DJ DIRECTIONAL IDENTIFIER
AUDIO PLAYER
DJ B
DJ RX
LIGHT TRANSDUCER
TACTILE TRANSDUCER
SOUND TRANSDUCER
ENERGY STORAGE

Fig. 2A

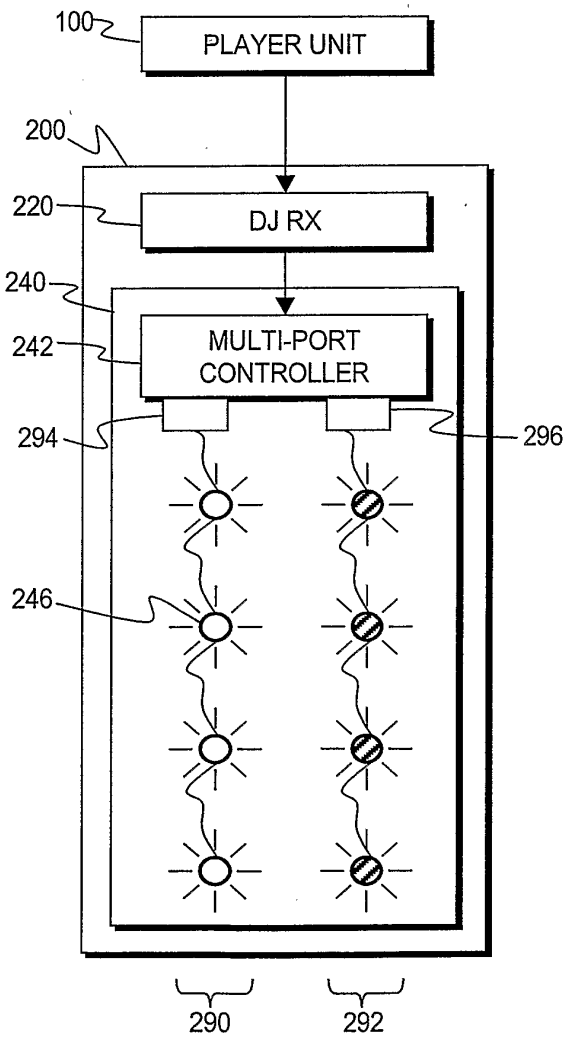

100
PLAYER UNIT
200
220
DJ RX
240
242
MULTI-PORT CONTROLLER
294
296
246
290
292

Fig. 2B

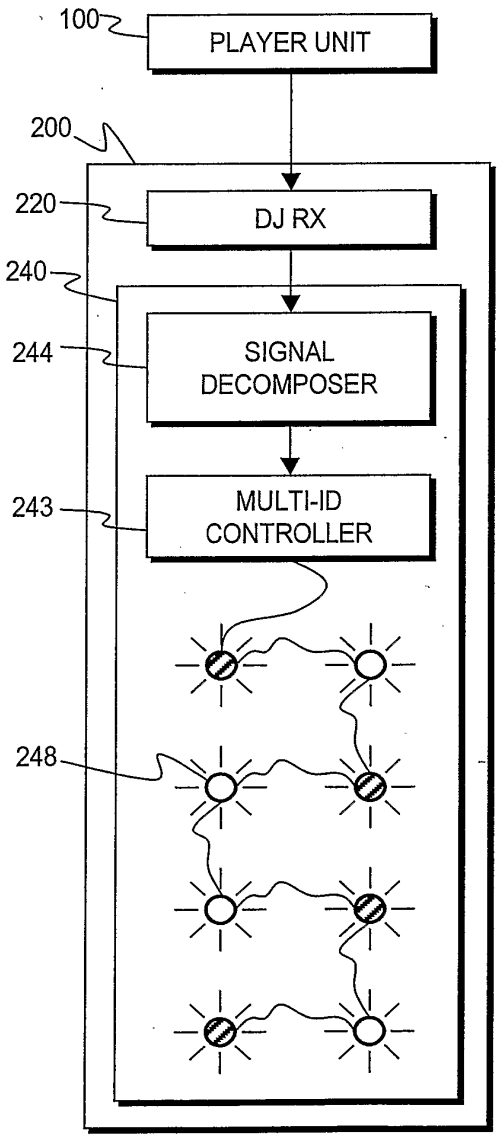

100
PLAYER UNIT
200
220
DJ RX
240
244
SIGNAL DECOMPOSER
243
MULTI-ID CONTROLLER
248

Fig. 3A

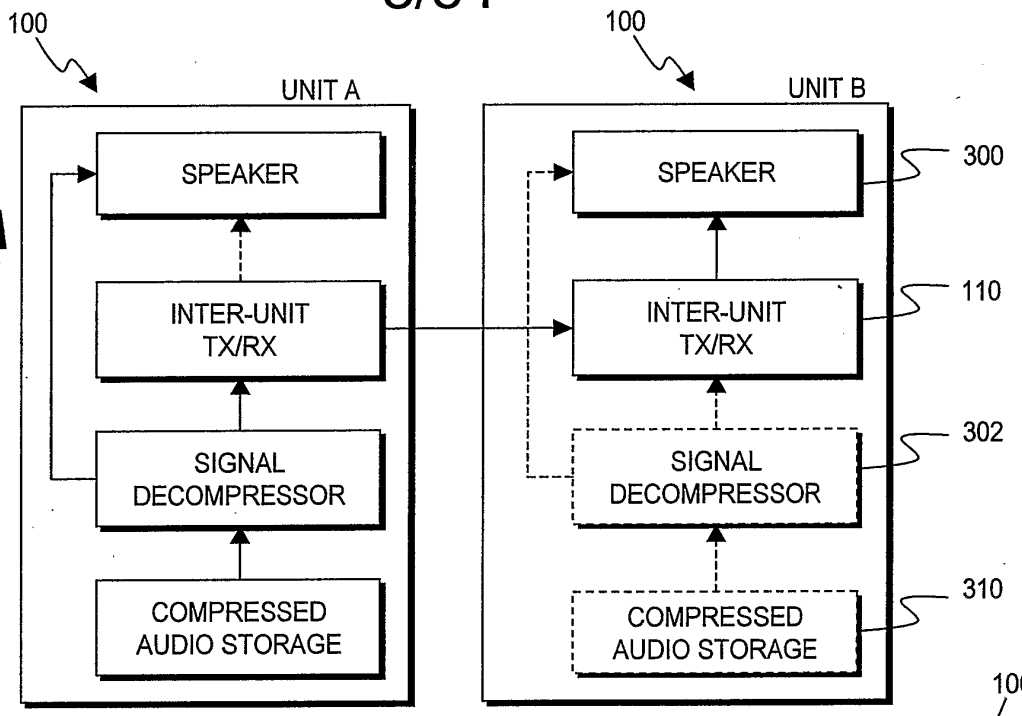

100
UNIT A
SPEAKER
INTER-UNIT TX/RX
SIGNAL DECOMPRESSOR
COMPRESSED AUDIO STORAGE
100
UNIT B
SPEAKER
INTER-UNIT TX/RX
SIGNAL DECOMPRESSOR
COMPRESSED AUDIO STORAGE
300
110
302
310

Fig. 3B

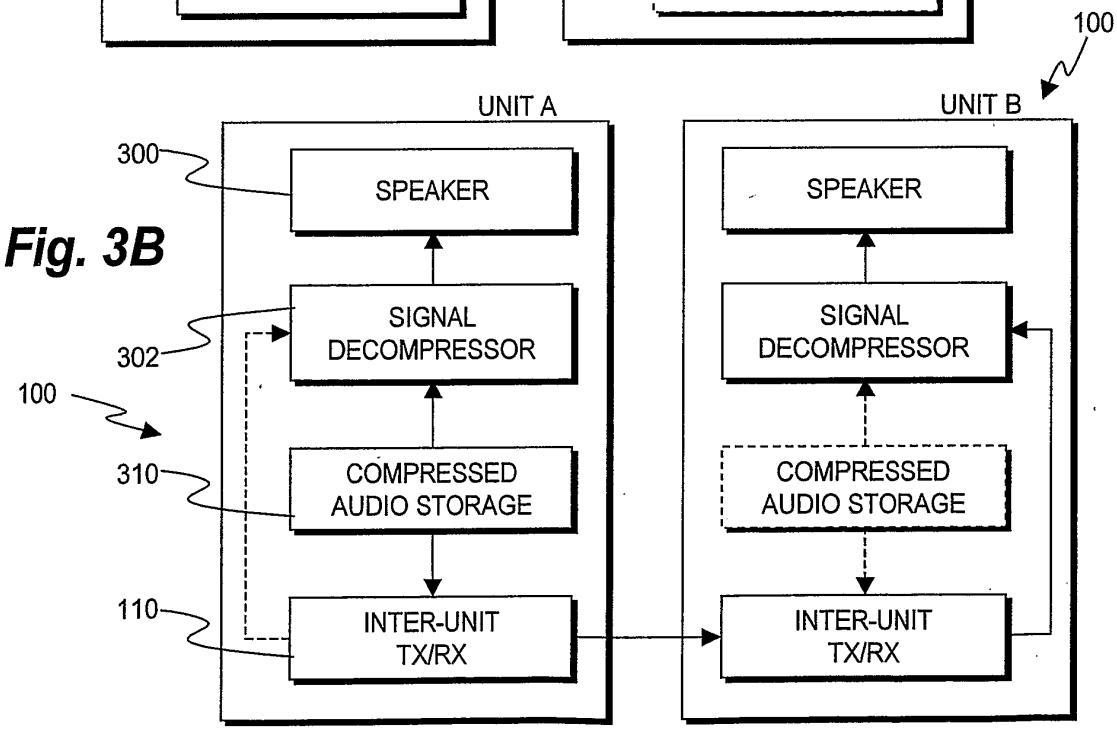

100
UNIT A
UNIT B
300
302
310
110
SPEAKER
SIGNAL DECOMPRESSOR
COMPRESSED AUDIO STORAGE
INTER-UNIT TX/RX
SPEAKER
SIGNAL DECOMPRESSOR
COMPRESSED AUDIO STORAGE
INTER-UNIT TX/RX

Fig. 3C

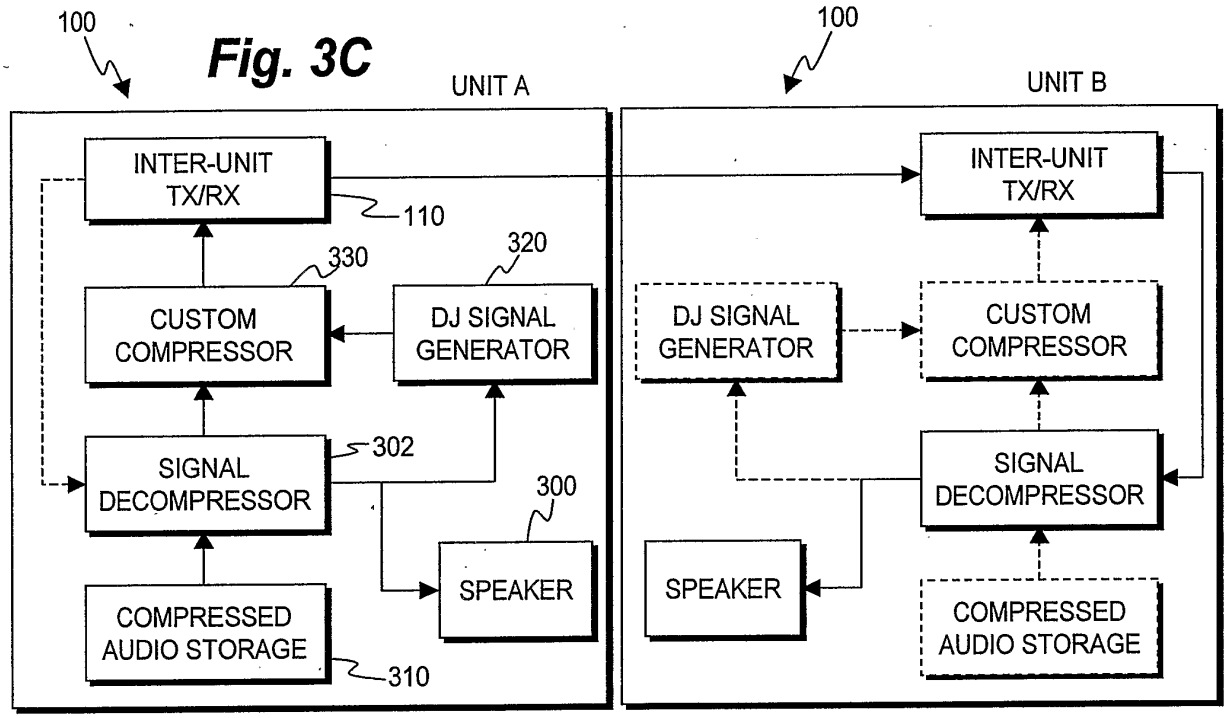

100
UNIT A
INTER-UNIT TX/RX
110
330
320
CUSTOM COMPRESSOR
DJ SIGNAL GENERATOR
302
SIGNAL DECOMPRESSOR
300
SPEAKER
COMPRESSED AUDIO STORAGE
310
100
UNIT B
INTER-UNIT TX/RX
DJ SIGNAL GENERATOR
CUSTOM COMPRESSOR
SIGNAL DECOMPRESSOR
SPEAKER
COMPRESSED AUDIO STORAGE

Fig. 4

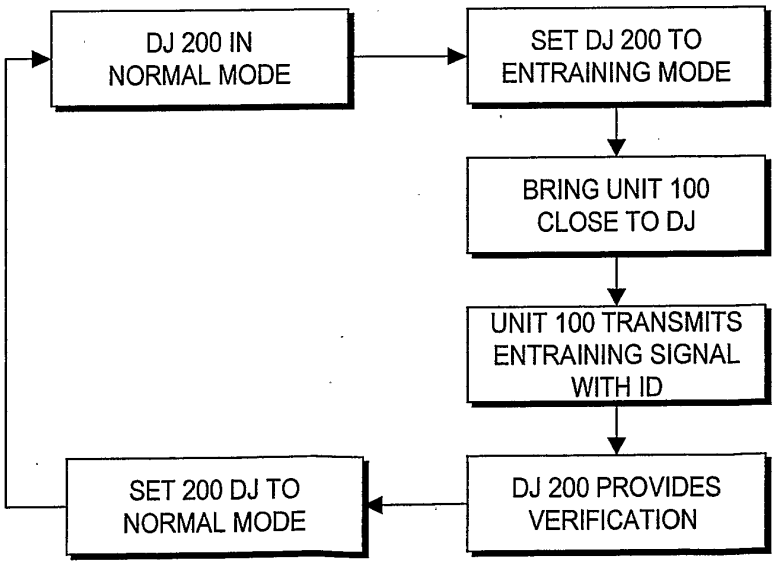

DJ 200 IN NORMAL MODE
SET DJ 200 TO ENTRAINING MODE
BRING UNIT 100 CLOSE TO DJ
UNIT 100 TRANSMITS ENTRAINING SIGNAL WITH ID
DJ 200 PROVIDES VERIFICATION
SET 200 DJ TO NORMAL MODE

Fig. 5A

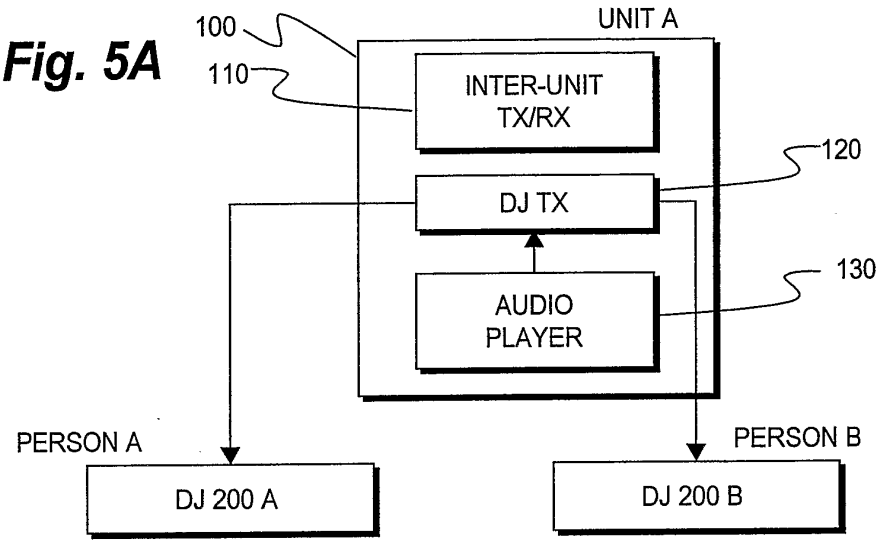

100
UNIT A
110
INTER-UNIT TX/RX
120
DJ TX
130
AUDIO PLAYER
PERSON A
PERSON B
DJ 200 A
DJ 200 B

Fig. 5B

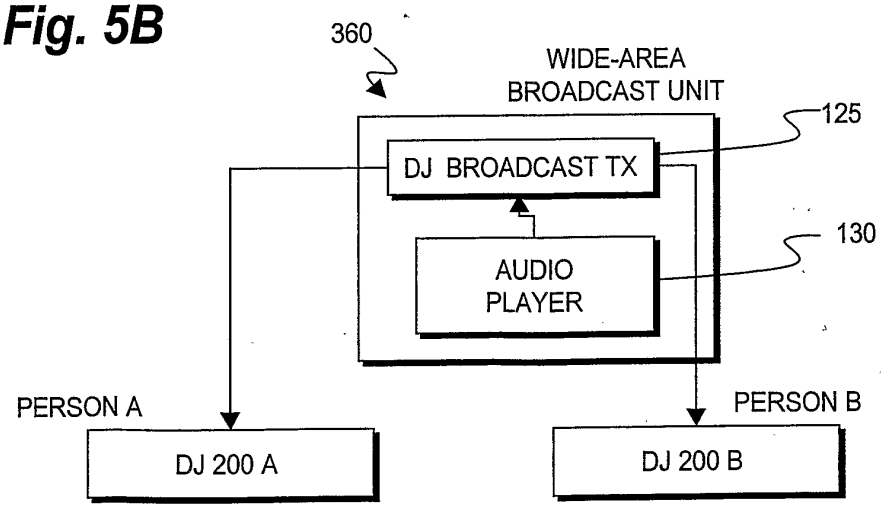

360
WIDE-AREA BROADCAST UNIT
125
DJ BROADCAST TX
130
AUDIO PLAYER
PERSON A
PERSON B
DJ 200 A
DJ 200 B

Fig. 6

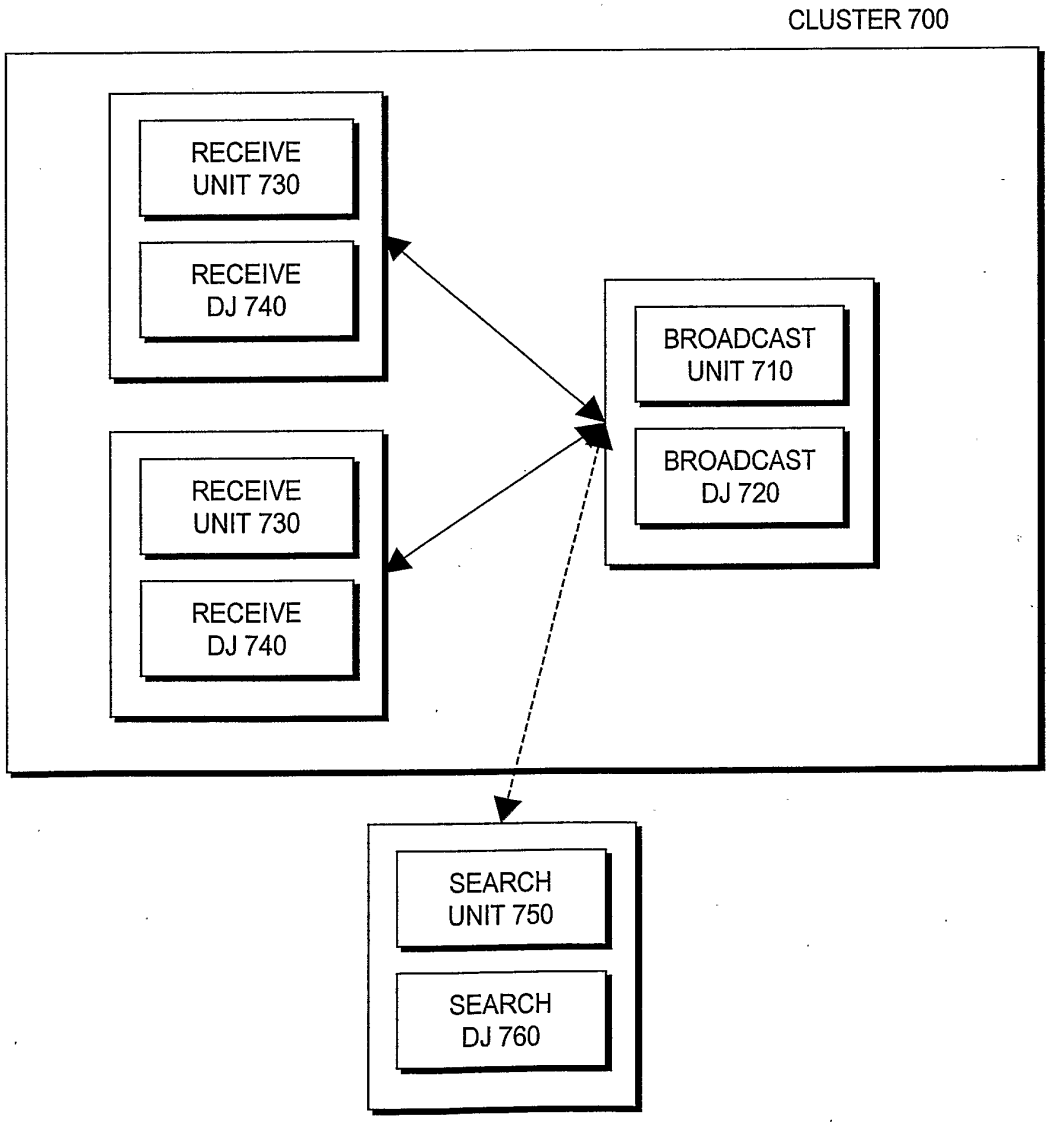

CLUSTER 700
RECEIVE UNIT 730
RECEIVE DJ 740
RECEIVE UNIT 730
RECEIVE DJ 740
BROADCAST UNIT 710
BROADCAST DJ 720
SEARCH UNIT 750
SEARCH DJ 760

Fig. 7

```
    800                 802                 804
BLOCK CODE ... MP3 BLOCK HEADER ...MP3 BLOCK ...

    800              806              808
BLOCK CODE ... ID HEADER ... ID BLOCK ...

    800                 802                 804
BLOCK CODE ... MP3 BLOCK HEADER ...MP3 BLOCK ...

    800                810                812
BLOCK CODE ... IMAGE HEADER ... IMAGE BLOCK ...

...
```

820

Fig. 36

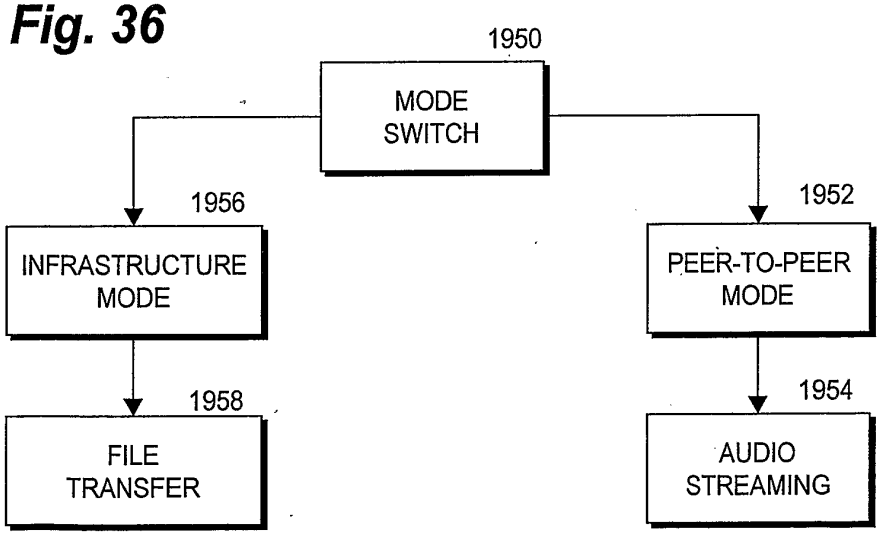


Fig. 8A

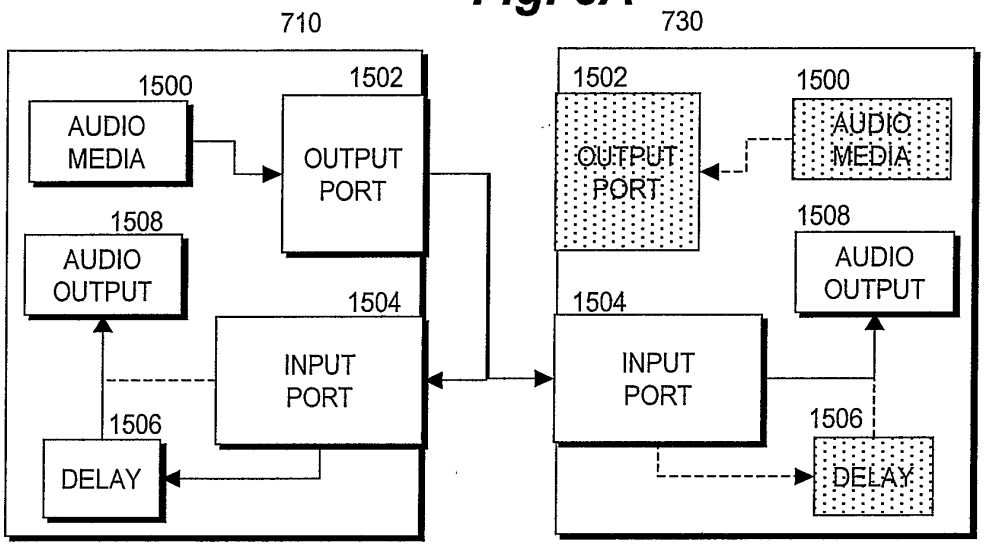

710
730
1500
AUDIO MEDIA
1502
OUTPUT PORT
1508
AUDIO OUTPUT
1504
INPUT PORT
1506
DELAY
1502
OUTPUT PORT
1500
AUDIO MEDIA
1508
AUDIO OUTPUT
1504
INPUT PORT
1506
DELAY

Fig. 8B

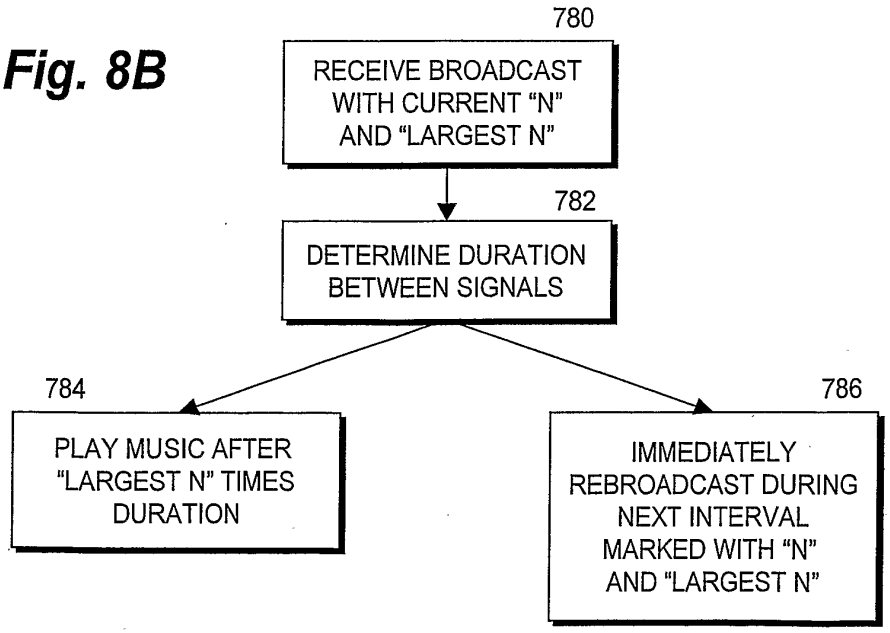

780
RECEIVE BROADCAST WITH CURRENT "N" AND "LARGEST N"
782
DETERMINE DURATION BETWEEN SIGNALS
784
PLAY MUSIC AFTER "LARGEST N" TIMES DURATION
786
IMMEDIATELY REBROADCAST DURING NEXT INTERVAL MARKED WITH "N" AND "LARGEST N"

Fig. 9A

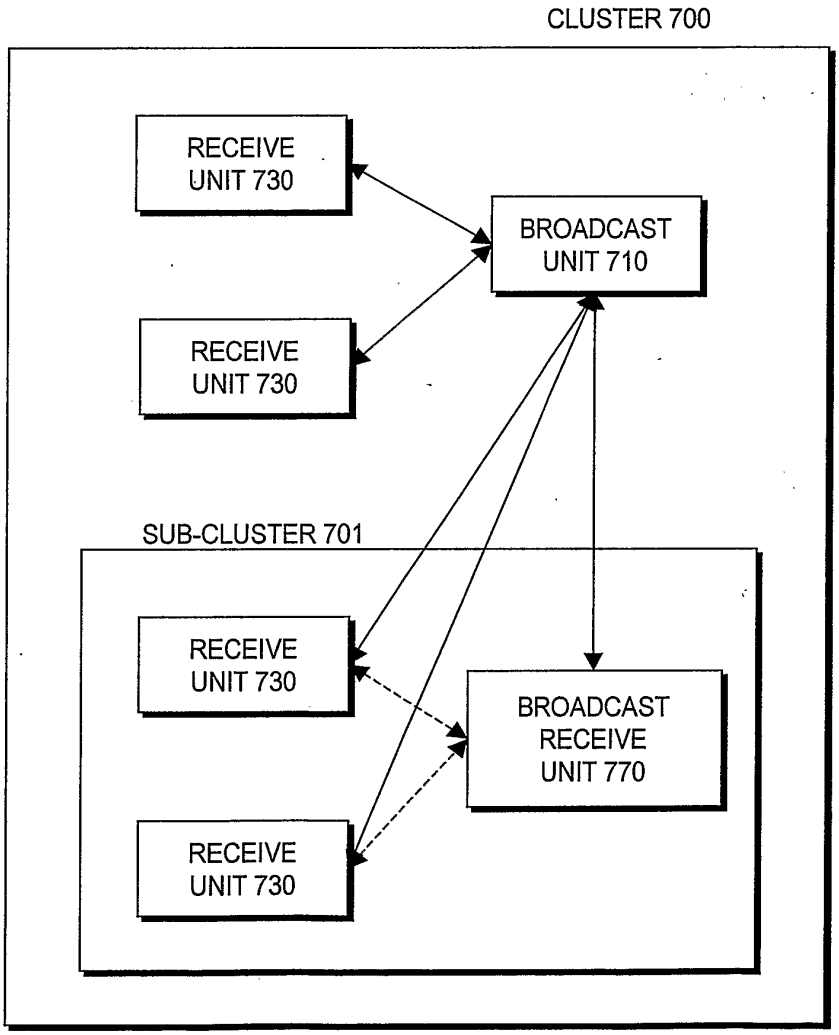

CLUSTER 700
RECEIVE UNIT 730
BROADCAST UNIT 710
RECEIVE UNIT 730
SUB-CLUSTER 701
RECEIVE UNIT 730
BROADCAST RECEIVE UNIT 770
RECEIVE UNIT 730

Fig. 9B

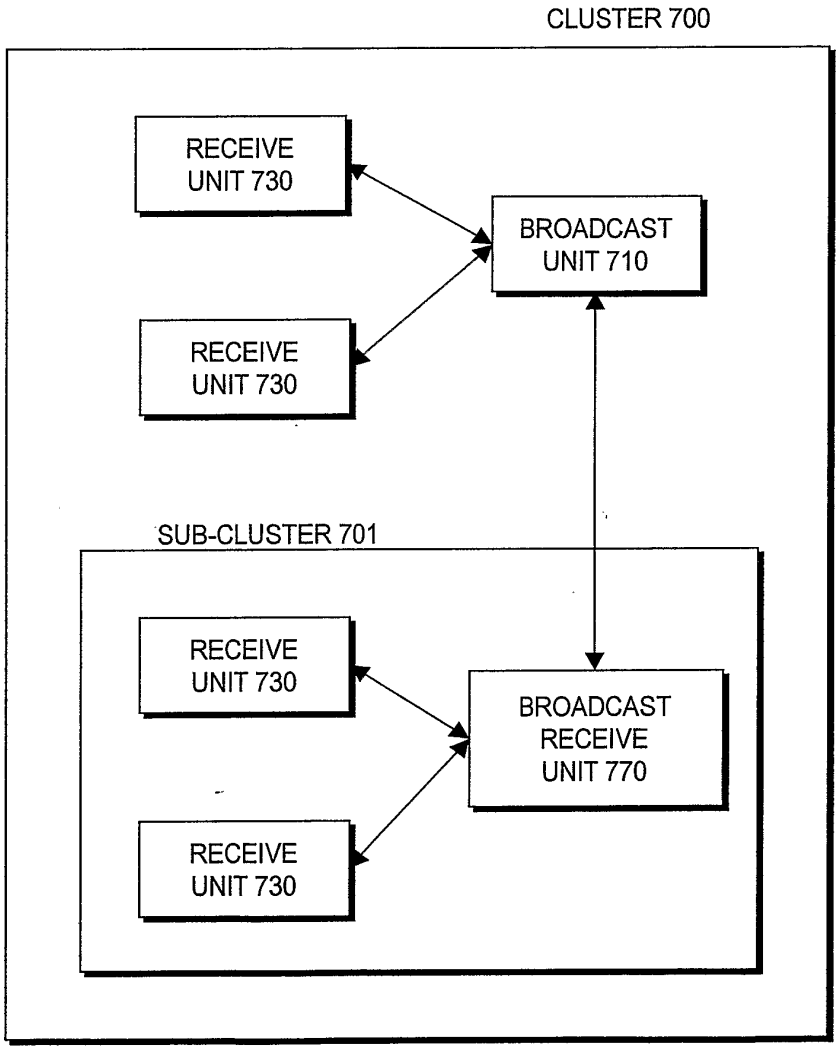

CLUSTER 700
RECEIVE UNIT 730
BROADCAST UNIT 710
RECEIVE UNIT 730
SUB-CLUSTER 701
RECEIVE UNIT 730
BROADCAST RECEIVE UNIT 770
RECEIVE UNIT 730

Fig. 10

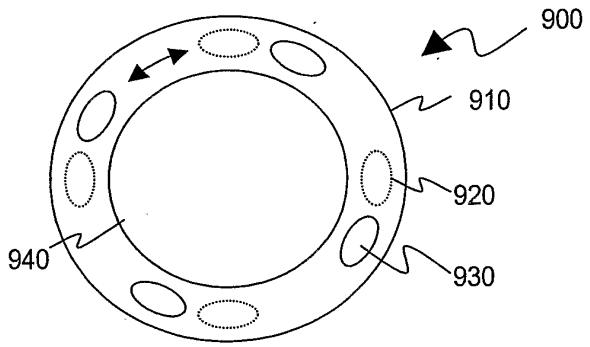


Fig. 11A

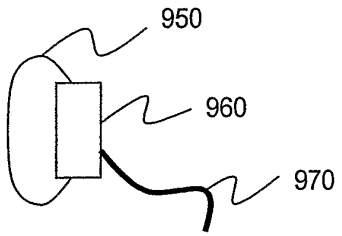


Fig. 11B

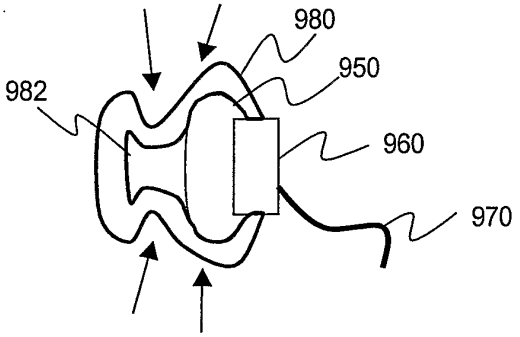


Fig. 12A

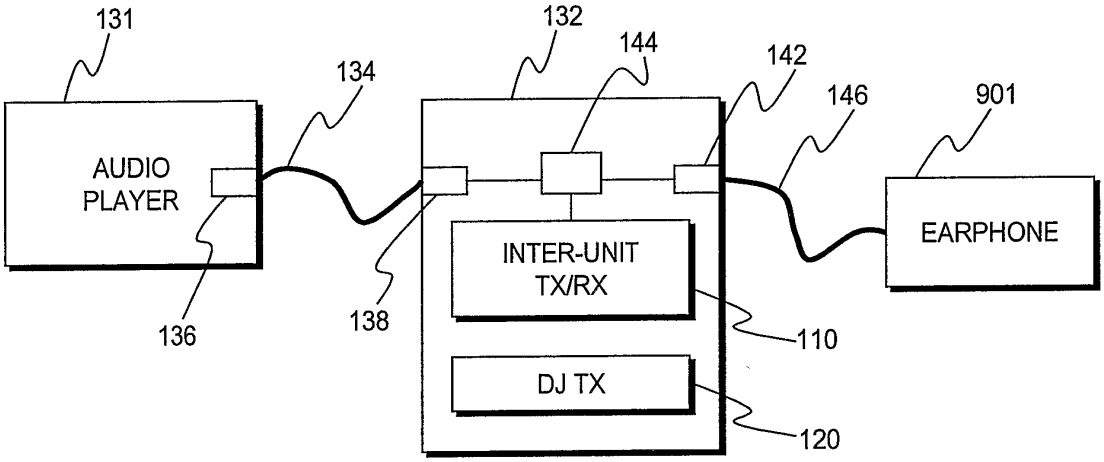


Fig. 12B

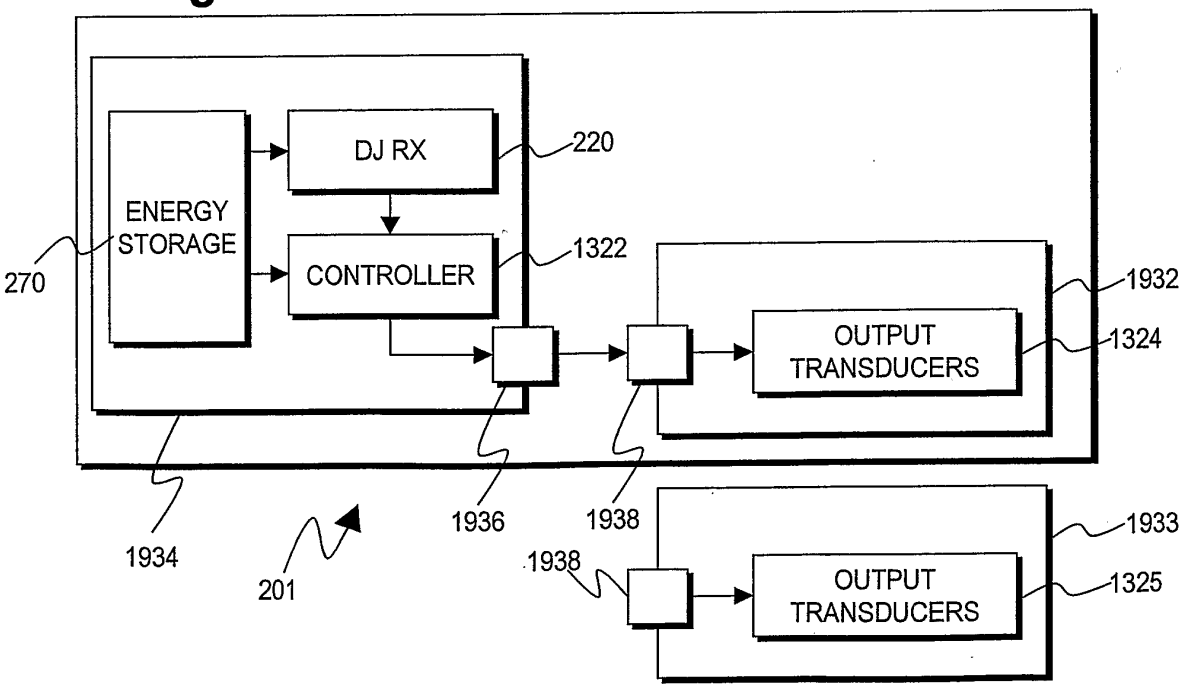
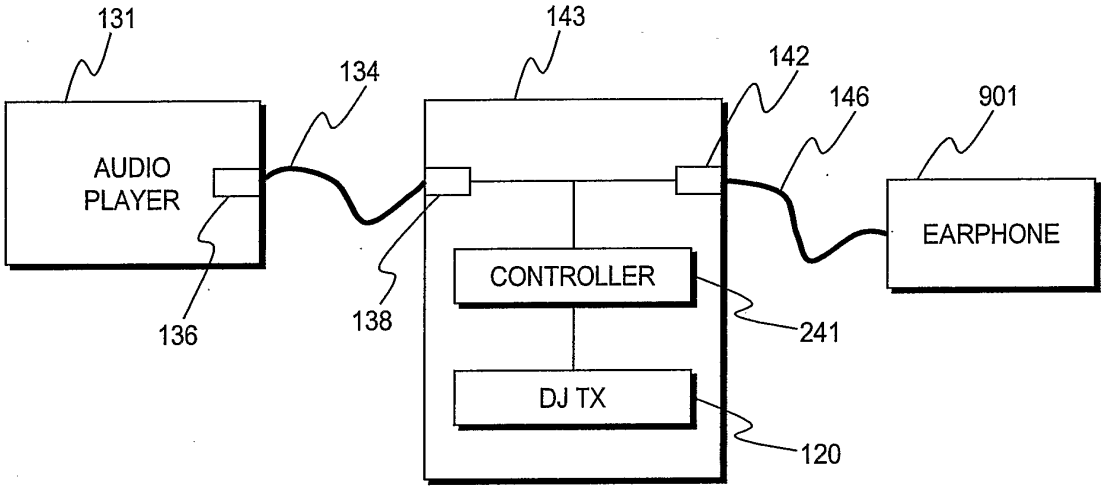


Fig. 12C


131
AUDIO PLAYER
136
134
138
143
CONTROLLER
DJ TX
142
146
241
120
901
EARPHONE

BROADCAST UNIT 710 SEARCH UNIT 750

Fig. 13A

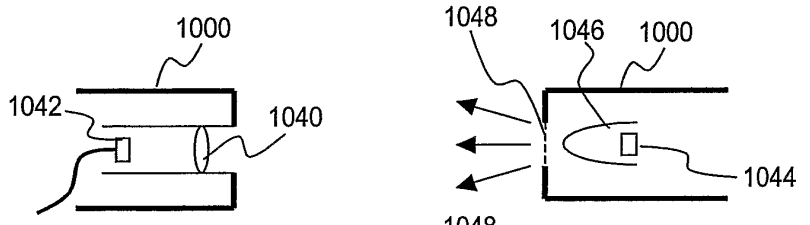


Fig. 13B

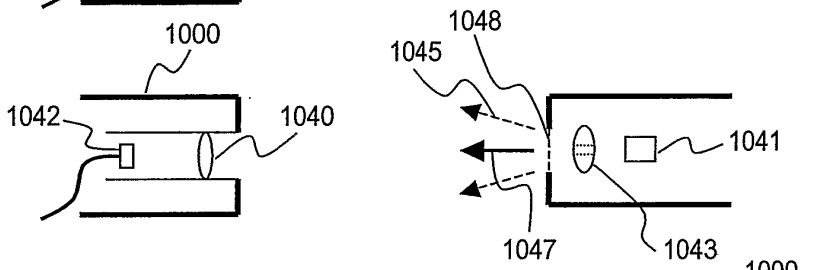


Fig. 13C

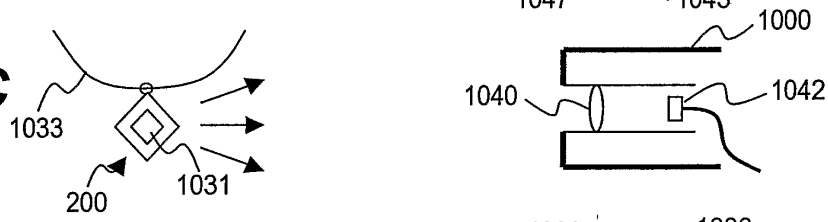


Fig. 13D

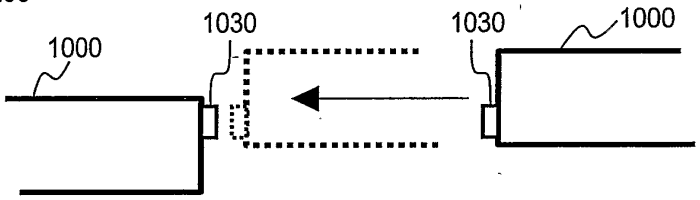


Fig. 13E

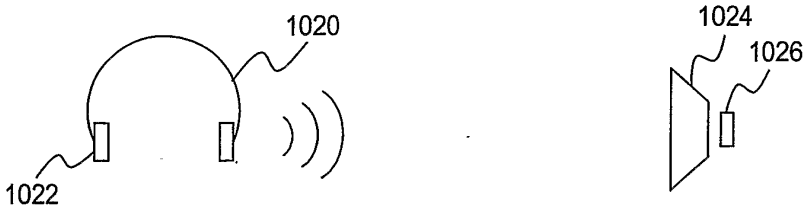


Fig. 13F

Fig. 14A

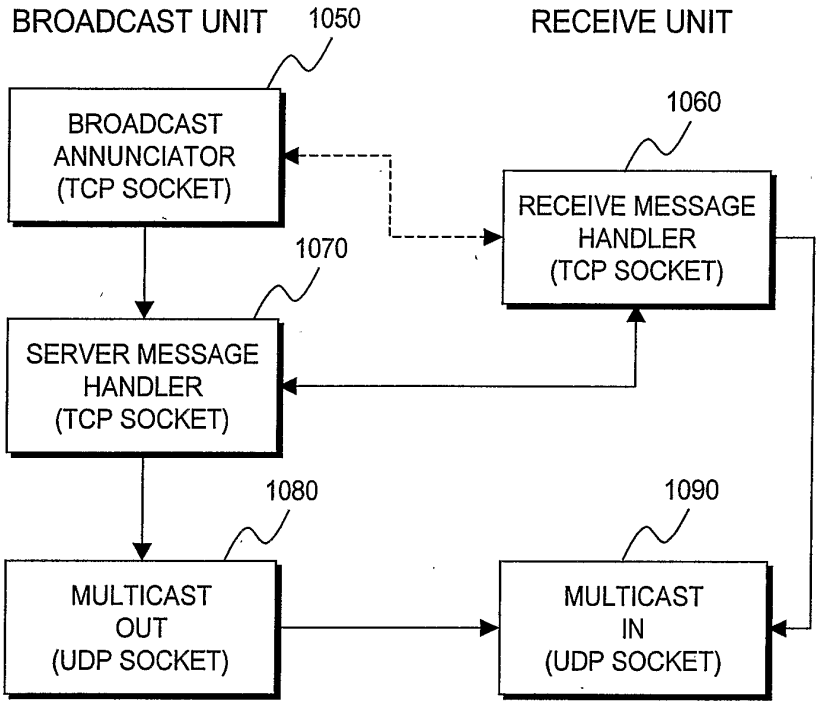

BROADCAST UNIT
1050
RECEIVE UNIT
1060
BROADCAST ANNUNCIATOR (TCP SOCKET)
RECEIVE MESSAGE HANDLER (TCP SOCKET)
1070
SERVER MESSAGE HANDLER (TCP SOCKET)
1080
1090
MULTICAST OUT (UDP SOCKET)
MULTICAST IN (UDP SOCKET)

Fig. 14B

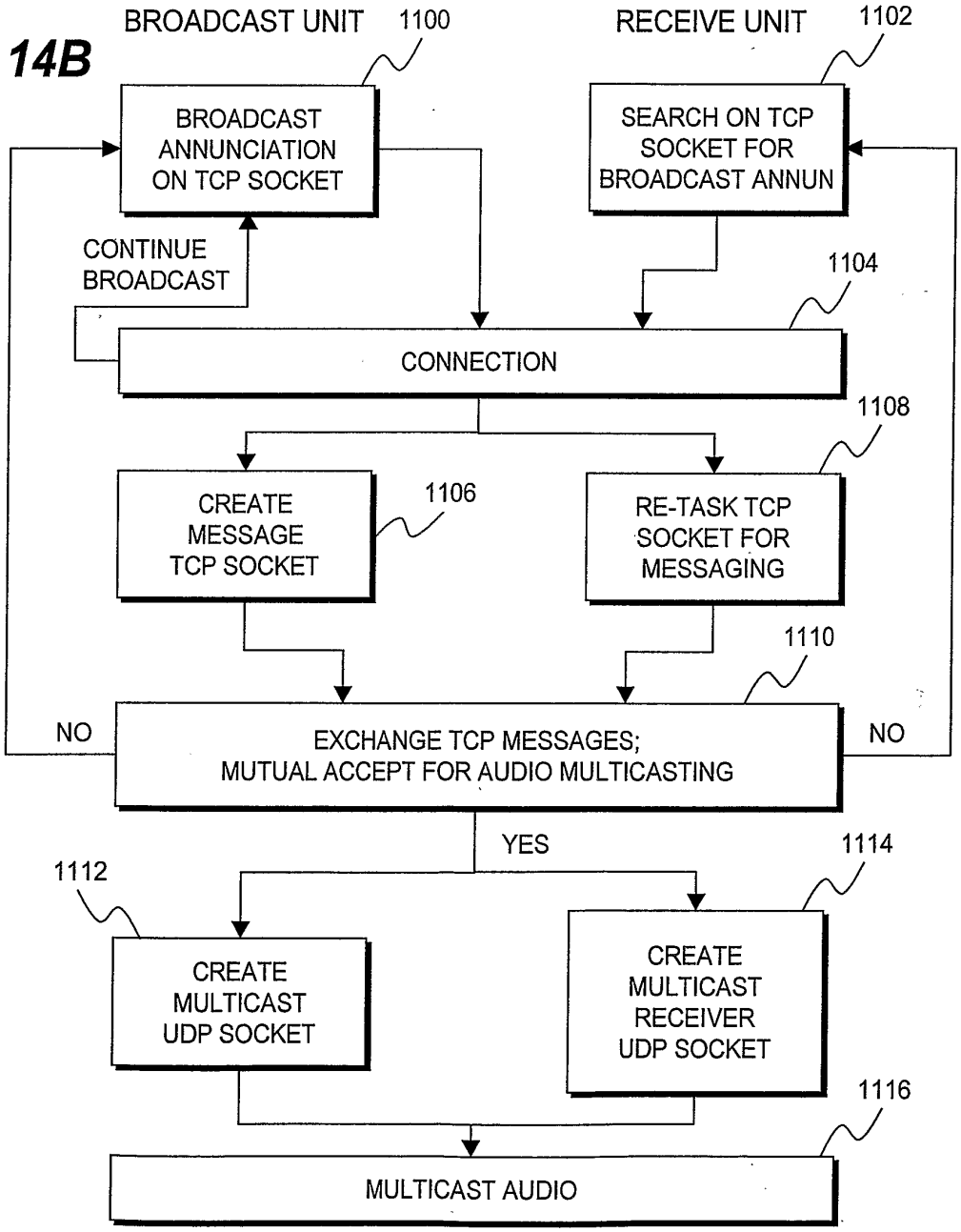

BROADCAST UNIT
1100
RECEIVE UNIT
1102
BROADCAST ANNUNCIATION ON TCP SOCKET
SEARCH ON TCP SOCKET FOR BROADCAST ANNUN
CONTINUE BROADCAST
1104
CONNECTION
1108
CREATE MESSAGE TCP SOCKET
1106
RE-TASK TCP SOCKET FOR MESSAGING
1110
NO
EXCHANGE TCP MESSAGES; MUTUAL ACCEPT FOR AUDIO MULTICASTING
NO
YES
1112
1114
CREATE MULTICAST UDP SOCKET
CREATE MULTICAST RECEIVER UDP SOCKET
1116
MULTICAST AUDIO

Fig. 15

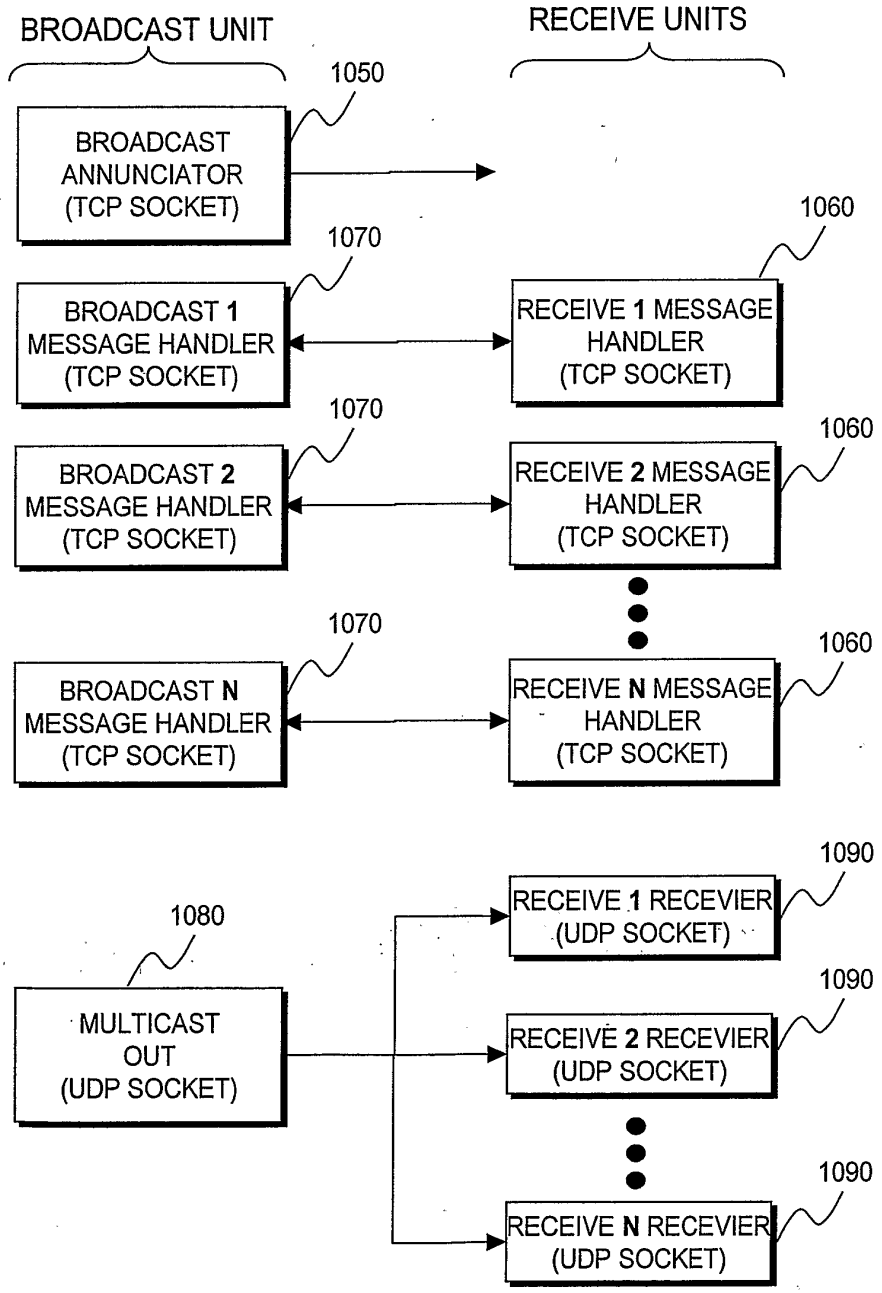

BROADCAST UNIT
RECEIVE UNITS
1050
BROADCAST ANNUNCIATOR (TCP SOCKET)
1070
BROADCAST 1 MESSAGE HANDLER (TCP SOCKET)
1060
RECEIVE 1 MESSAGE HANDLER (TCP SOCKET)
1070
BROADCAST 2 MESSAGE HANDLER (TCP SOCKET)
1060
RECEIVE 2 MESSAGE HANDLER (TCP SOCKET)
1070
BROADCAST N MESSAGE HANDLER (TCP SOCKET)
1060
RECEIVE N MESSAGE HANDLER (TCP SOCKET)
1080
MULTICAST OUT (UDP SOCKET)
1090
RECEIVE 1 RECEVIER (UDP SOCKET)
1090
RECEIVE 2 RECEVIER (UDP SOCKET)
1090
RECEIVE N RECEVIER (UDP SOCKET)

Fig. 16

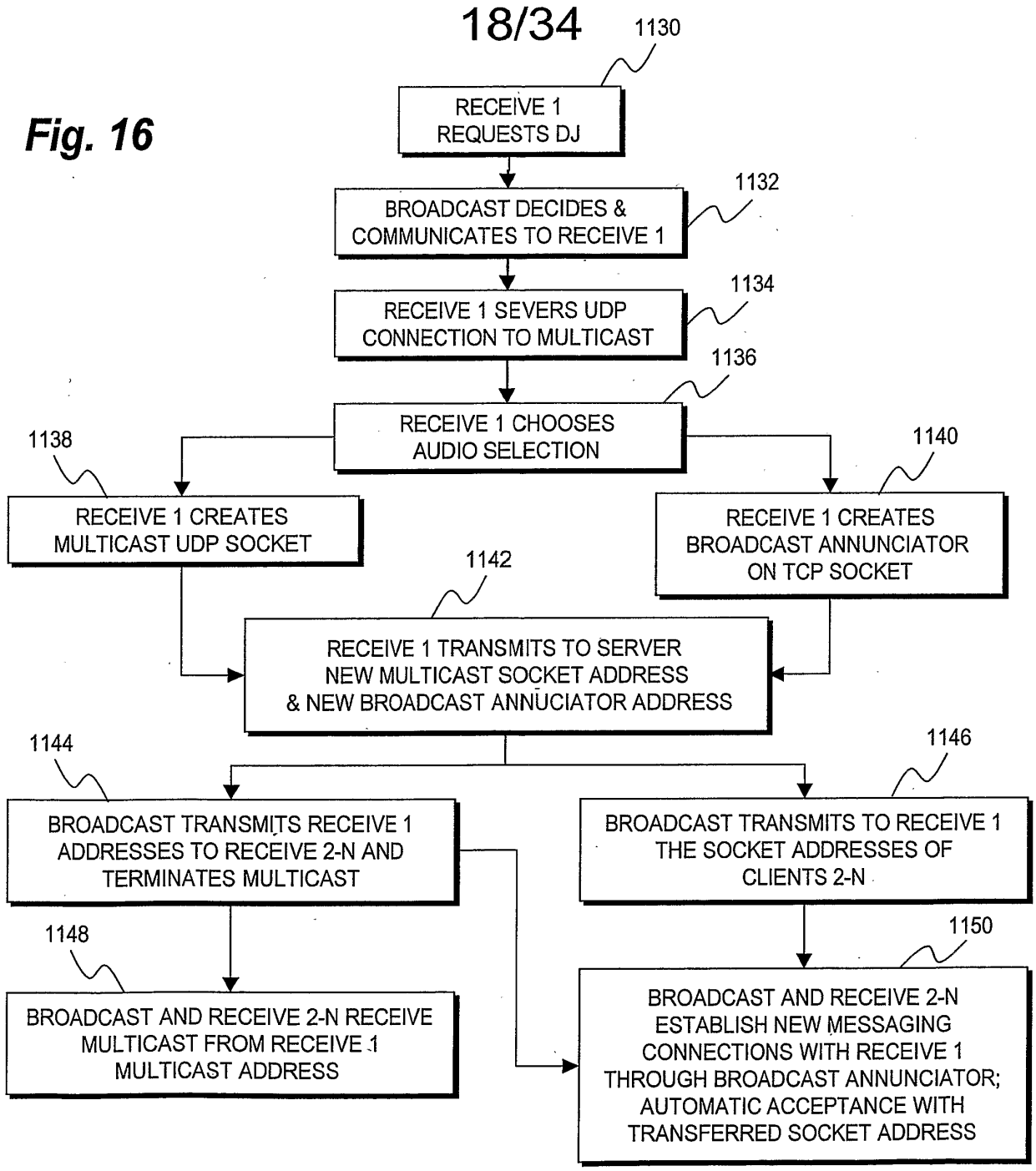

1130
RECEIVE 1 REQUESTS DJ
1132
BROADCAST DECIDES & COMMUNICATES TO RECEIVE 1
1134
RECEIVE 1 SEVERS UDP CONNECTION TO MULTICAST
1136
RECEIVE 1 CHOOSES AUDIO SELECTION
1138
RECEIVE 1 CREATES MULTICAST UDP SOCKET
1140
RECEIVE 1 CREATES BROADCAST ANNUNCIATOR ON TCP SOCKET
1142
RECEIVE 1 TRANSMITS TO SERVER NEW MULTICAST SOCKET ADDRESS & NEW BROADCAST ANNUCIATOR ADDRESS
1144
BROADCAST TRANSMITS RECEIVE 1 ADDRESSES TO RECEIVE 2-N AND TERMINATES MULTICAST
1146
BROADCAST TRANSMITS TO RECEIVE 1 THE SOCKET ADDRESSES OF CLIENTS 2-N
1148
BROADCAST AND RECEIVE 2-N RECEIVE MULTICAST FROM RECEIVE 1 MULTICAST ADDRESS
1150
BROADCAST AND RECEIVE 2-N ESTABLISH NEW MESSAGING CONNECTIONS WITH RECEIVE 1 THROUGH BROADCAST ANNUNCIATOR; AUTOMATIC ACCEPTANCE WITH TRANSFERRED SOCKET ADDRESS

Fig. 17

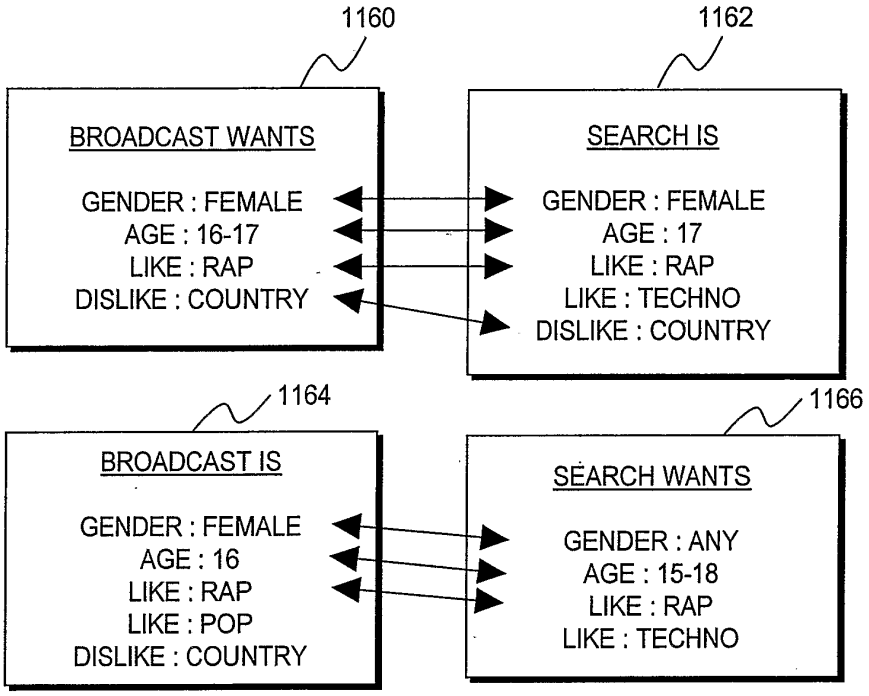


Fig. 18A

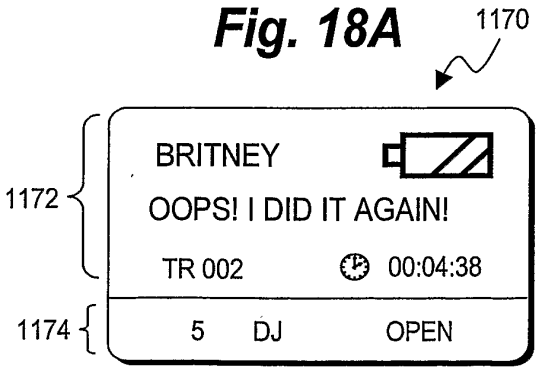


Fig. 18B

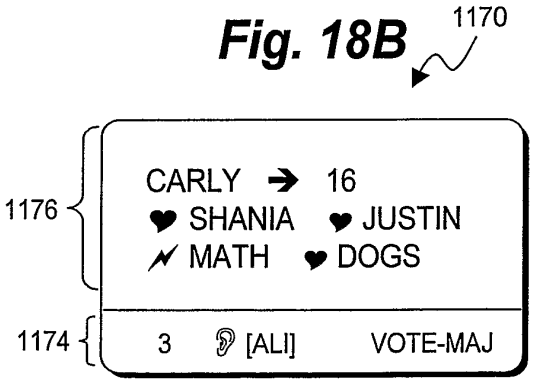


Fig. 19

RULE	METHOD
BROADCASTER	ACCEPTED WHEN BROADCASTER INDICATES "YES". REJECTED WHEN BROADCASTER INDICATES "NO"
MAJORITY	ACCEPTED WHEN (N/2)+1 INDICATE "YES". REJECTED WHEN (N/2) INDICATE "NO".
UNANIMOUS	ACCEPTED WHEN N MEMBERS INDICATE "YES". REJECTED WHEN 1 MEMBER INDICATES "NO".
TIMED MAJORITY	MACHINE INDICATES ONSET OF VOTING, AND COUNTS DOWN TO VOTING TERMINATION. ACCEPTED IF (Q/2)+1 INDICATE "YES" BEFORE TERMINATION; OTHERWISE "NO".
SYNCHRONIZED MAJORITY	MACHINE COUNTS DOWN TO VOTE. ACCEPTED IF (Q/2)+1 INDICATE "YES" WITHIN PREDETERMINED TIME OF COUNTDOWN. OTHERWISE "NO".

Fig. 20

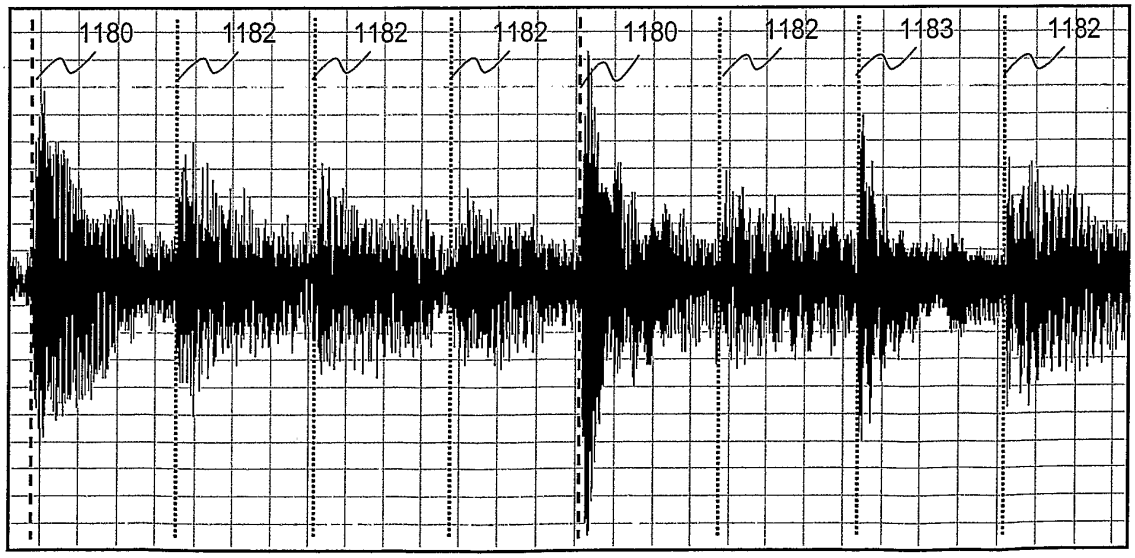


Fig. 21A

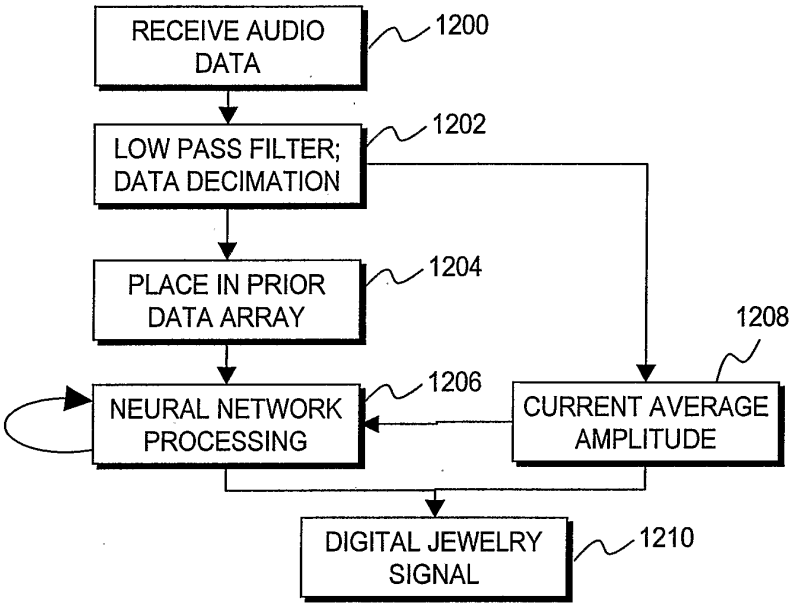
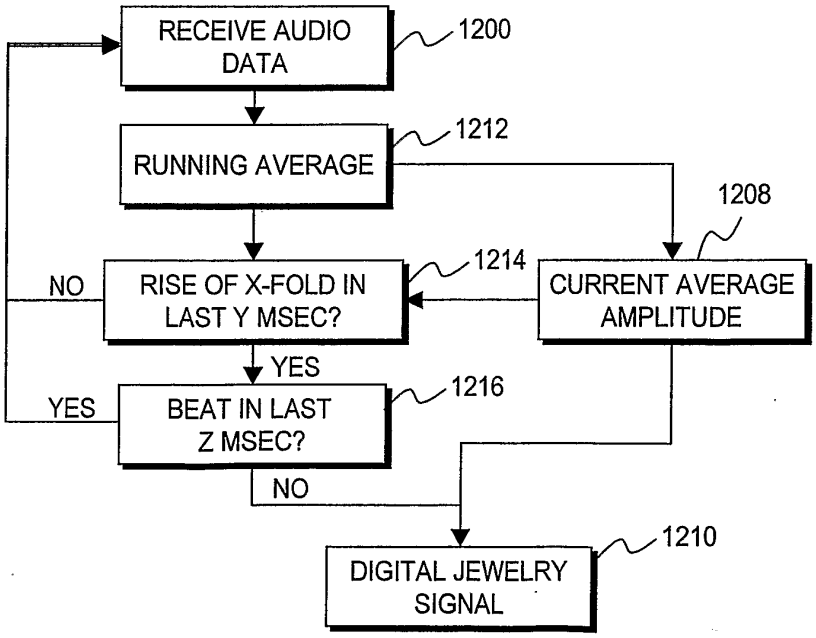


Fig. 21B



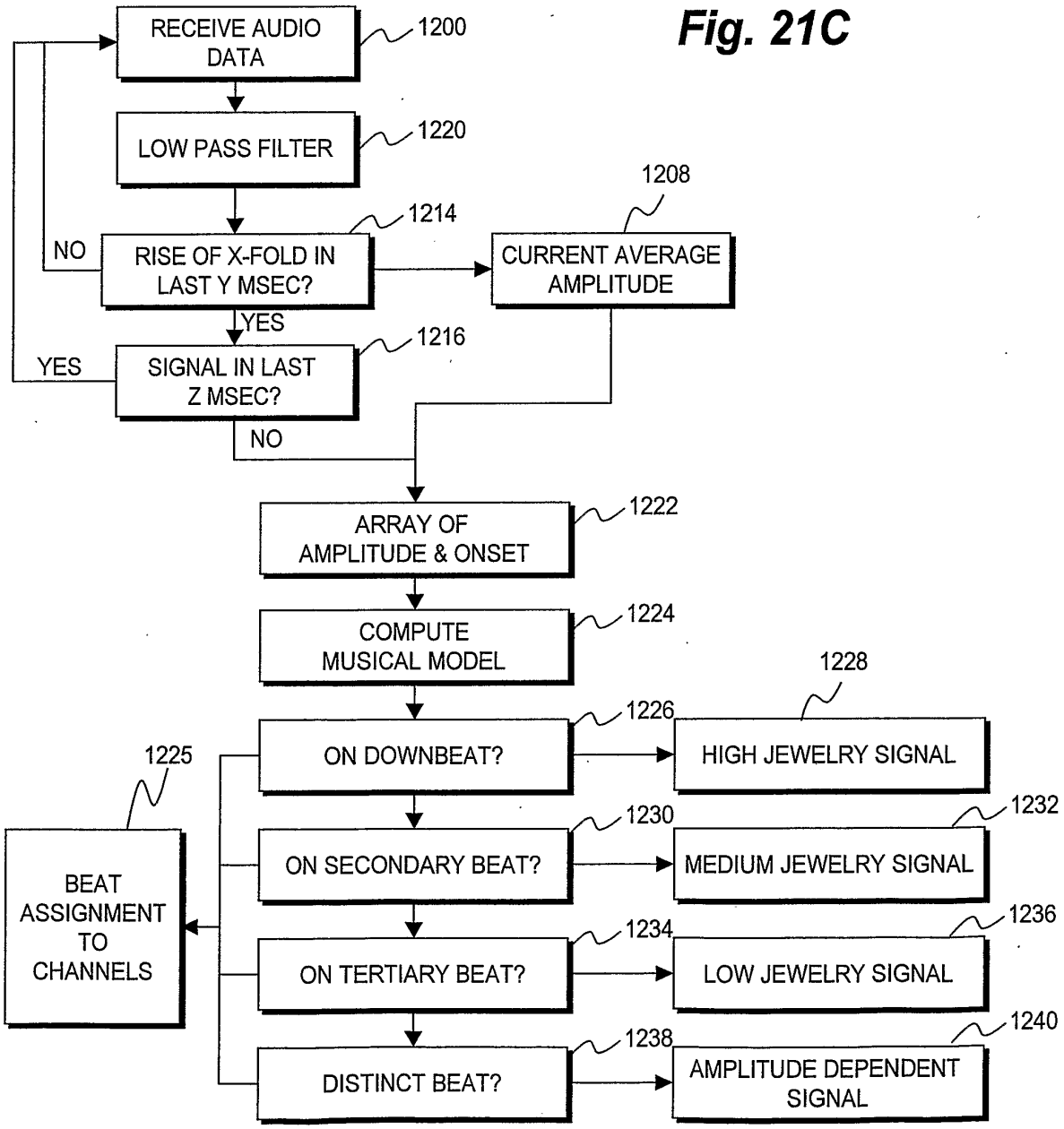
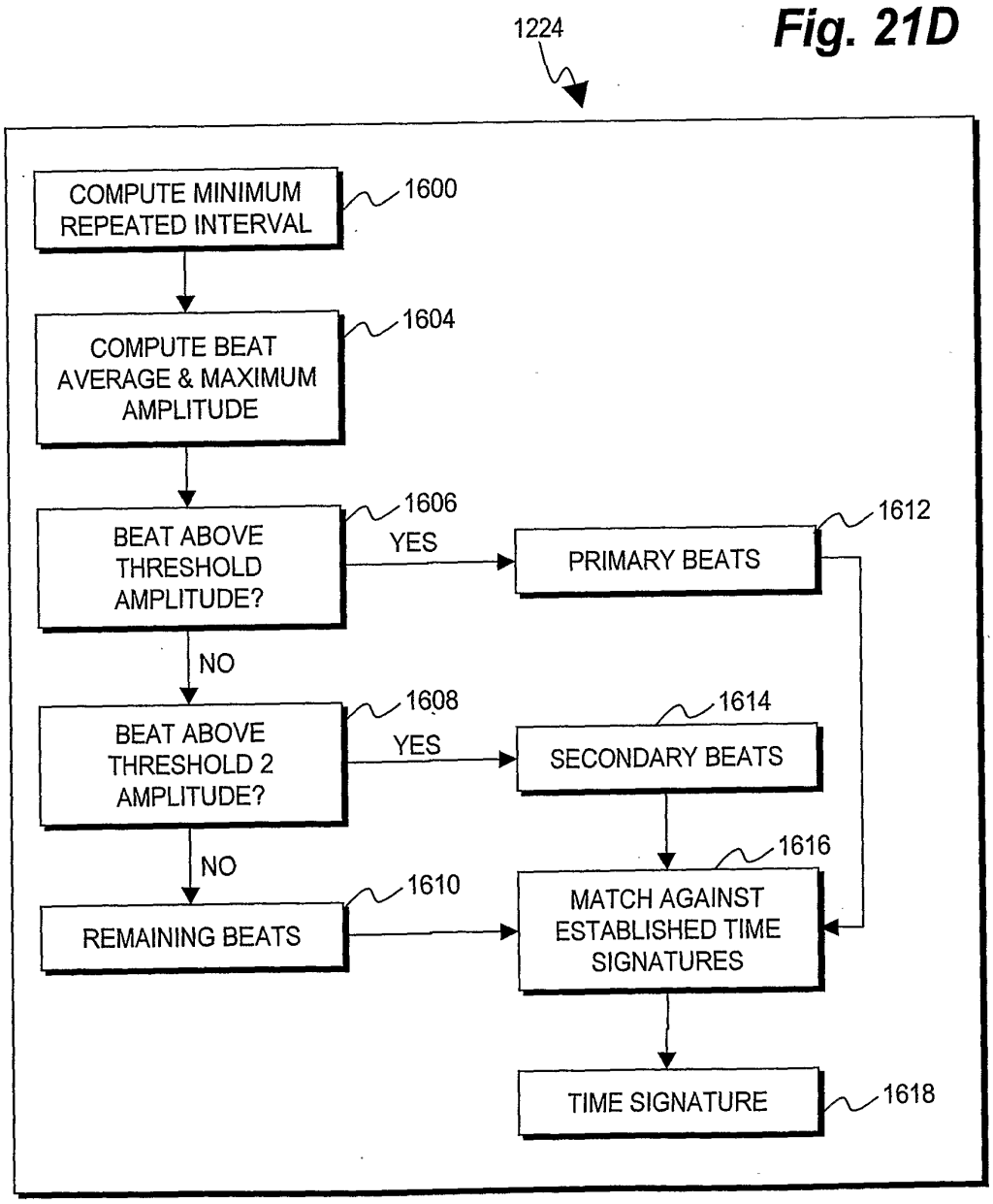

RECEIVE AUDIO DATA
1200
LOW PASS FILTER
1220
1208
1214
NO
RISE OF X-FOLD IN LAST Y MSEC?
CURRENT AVERAGE AMPLITUDE
YES
1216
YES
SIGNAL IN LAST Z MSEC?
NO
ARRAY OF AMPLITUDE & ONSET
1222
COMPUTE MUSICAL MODEL
1224
1228
1226
1225
ON DOWNBEAT?
HIGH JEWELRY SIGNAL
1230
1232
BEAT ASSIGNMENT TO CHANNELS
ON SECONDARY BEAT?
MEDIUM JEWELRY SIGNAL
1234
1236
ON TERTIARY BEAT?
LOW JEWELRY SIGNAL
1238
1240
DISTINCT BEAT?
AMPLITUDE DEPENDENT SIGNAL

Fig. 21C

Fig. 21D


1224
COMPUTE MINIMUM REPEATED INTERVAL
1600
COMPUTE BEAT AVERAGE & MAXIMUM AMPLITUDE
1604
BEAT ABOVE THRESHOLD AMPLITUDE?
1606
YES
PRIMARY BEATS
1612
NO
BEAT ABOVE THRESHOLD 2 AMPLITUDE?
1608
YES
SECONDARY BEATS
1614
NO
REMAINING BEATS
1610
MATCH AGAINST ESTABLISHED TIME SIGNATURES
1616
TIME SIGNATURE
1618

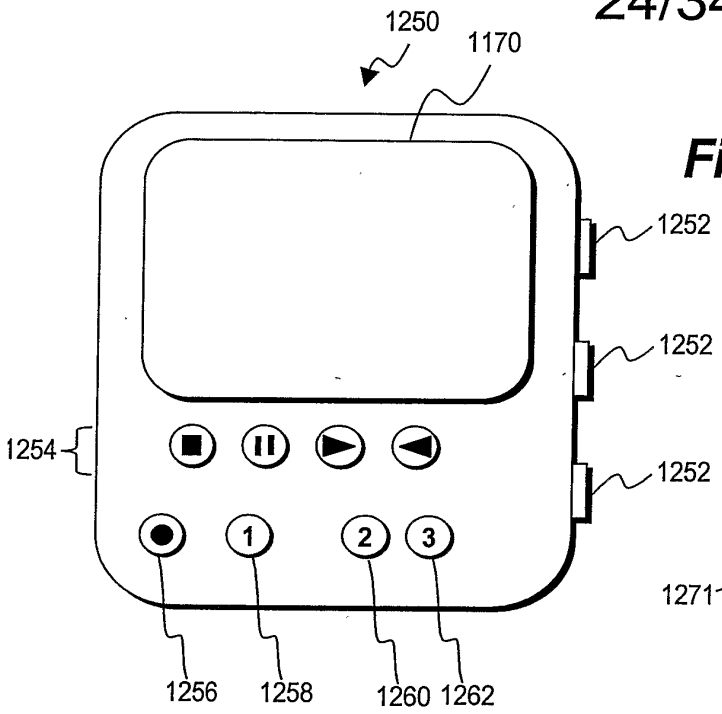


Fig. 22A

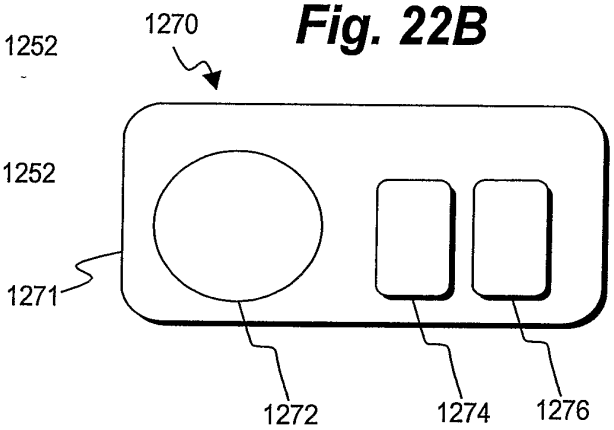


Fig. 22B

Fig. 22C

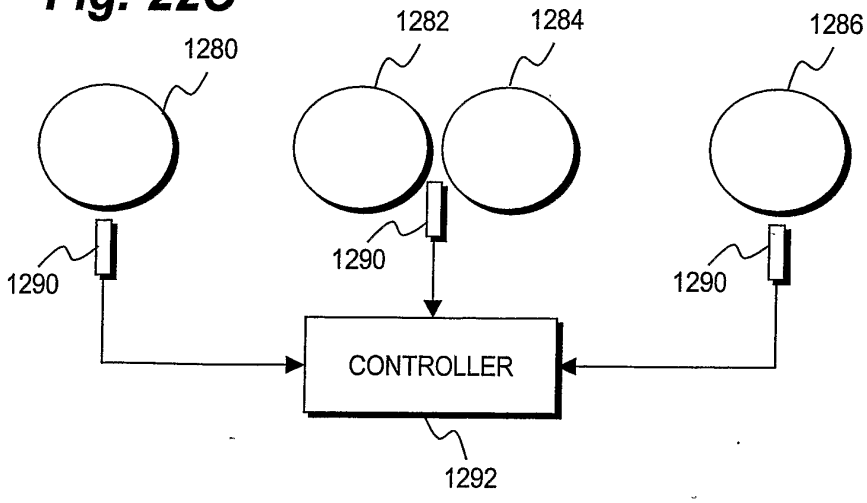


Fig. 23

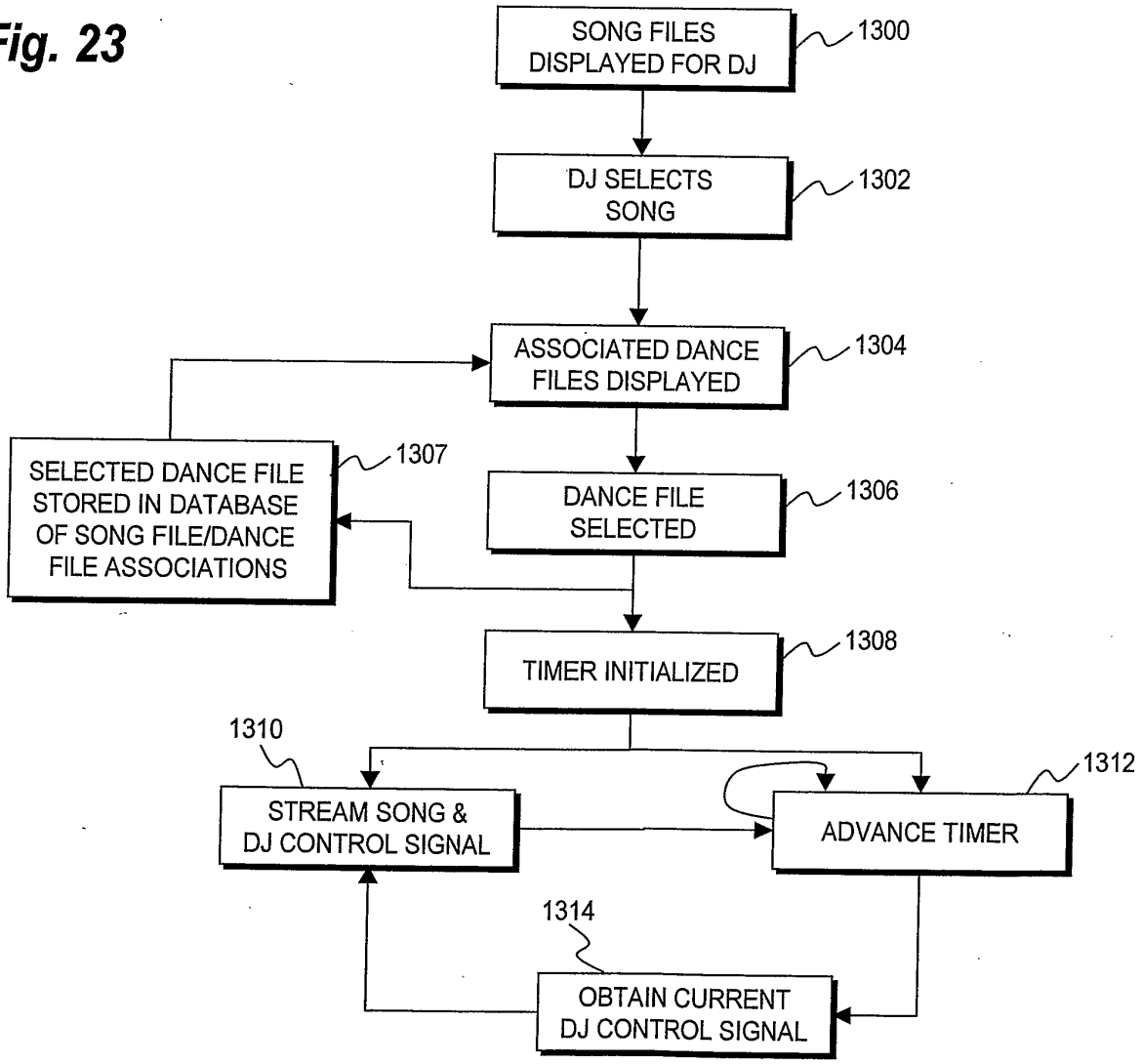

SONG FILES DISPLAYED FOR DJ
1300
DJ SELECTS SONG
1302
ASSOCIATED DANCE FILES DISPLAYED
1304
SELECTED DANCE FILE STORED IN DATABASE OF SONG FILE/DANCE FILE ASSOCIATIONS
1307
DANCE FILE SELECTED
1306
TIMER INITIALIZED
1308
1310
STREAM SONG & DJ CONTROL SIGNAL
ADVANCE TIMER
1312
1314
OBTAIN CURRENT DJ CONTROL SIGNAL

Fig. 24

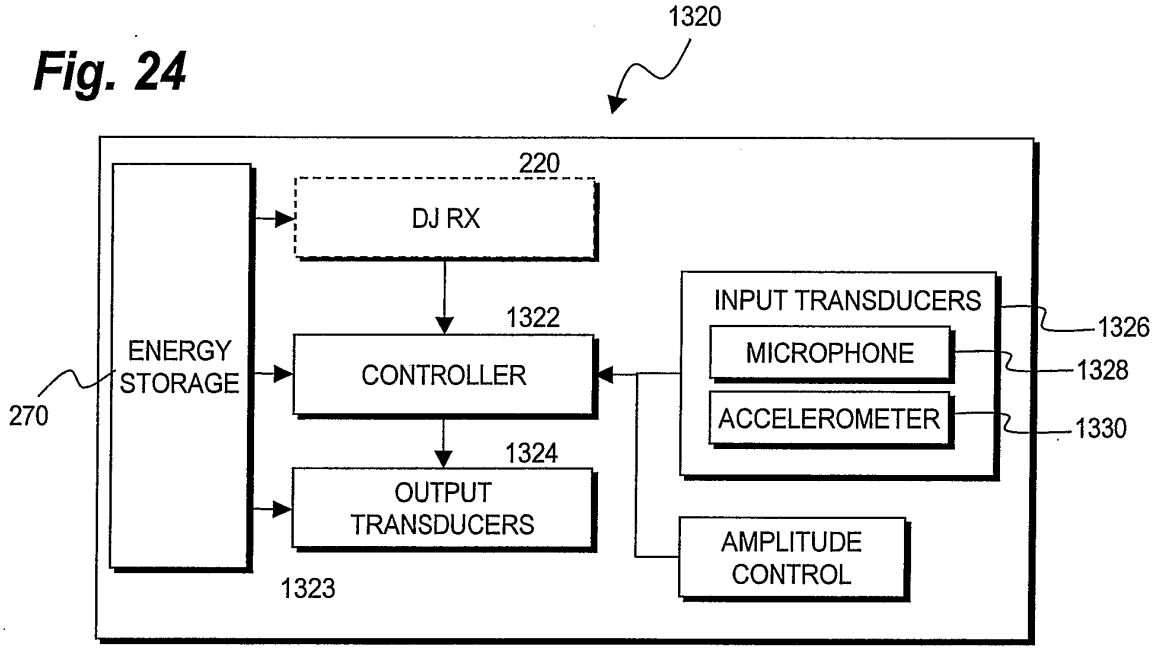

1320
220
DJ RX
1322
ENERGY STORAGE
CONTROLLER
270
1324
OUTPUT TRANSDUCERS
1323
INPUT TRANSDUCERS
MICROPHONE
ACCELEROMETER
AMPLITUDE CONTROL
1326
1328
1330

Fig. 25

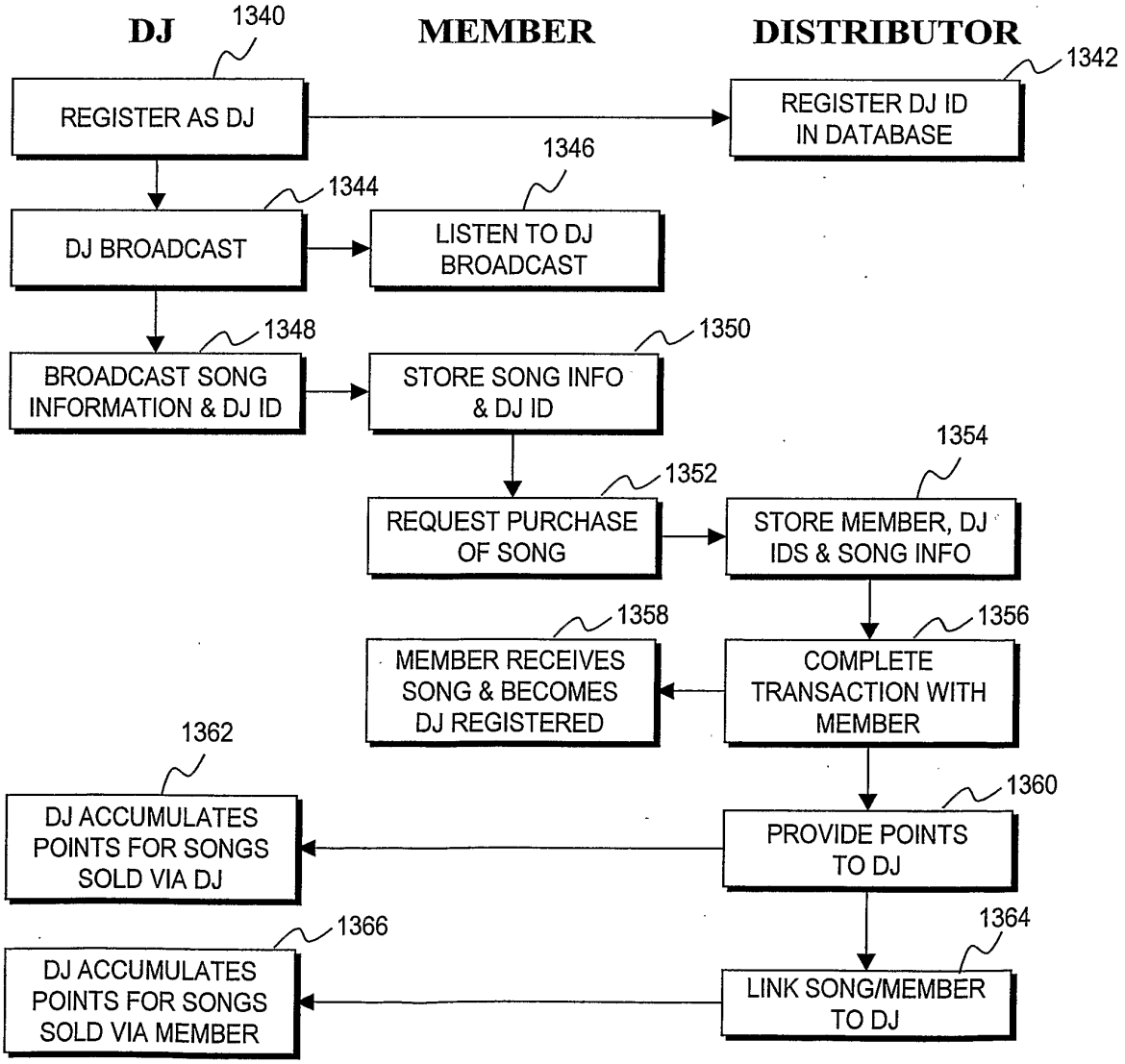

DJ
MEMBER
DISTRIBUTOR
1340
REGISTER AS DJ
1342
REGISTER DJ ID IN DATABASE
1344
DJ BROADCAST
1346
LISTEN TO DJ BROADCAST
1348
BROADCAST SONG INFORMATION & DJ ID
1350
STORE SONG INFO & DJ ID
1352
REQUEST PURCHASE OF SONG
1354
STORE MEMBER, DJ IDS & SONG INFO
1358
MEMBER RECEIVES SONG & BECOMES DJ REGISTERED
1356
COMPLETE TRANSACTION WITH MEMBER
1362
DJ ACCUMULATES POINTS FOR SONGS SOLD VIA DJ
1360
PROVIDE POINTS TO DJ
1366
DJ ACCUMULATES POINTS FOR SONGS SOLD VIA MEMBER
1364
LINK SONG/MEMBER TO DJ

Fig. 26

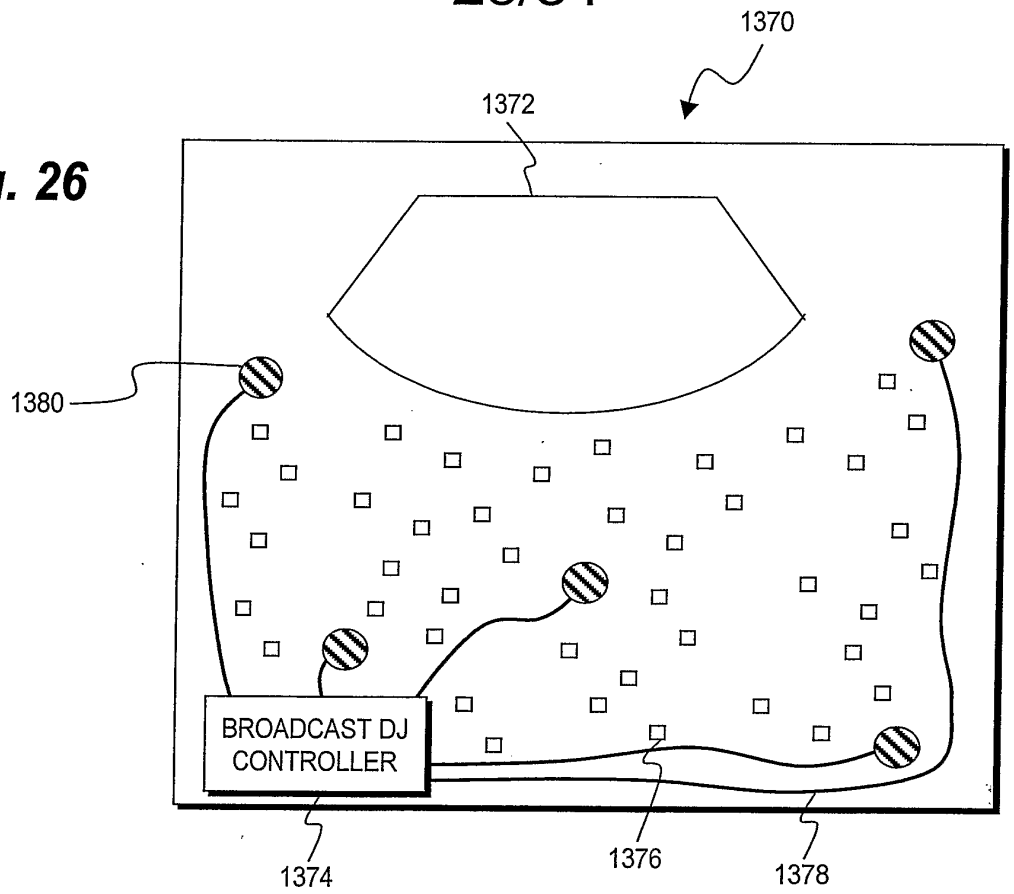

1370
1372
1380
BROADCAST DJ CONTROLLER
1374
1376
1378

Fig. 35

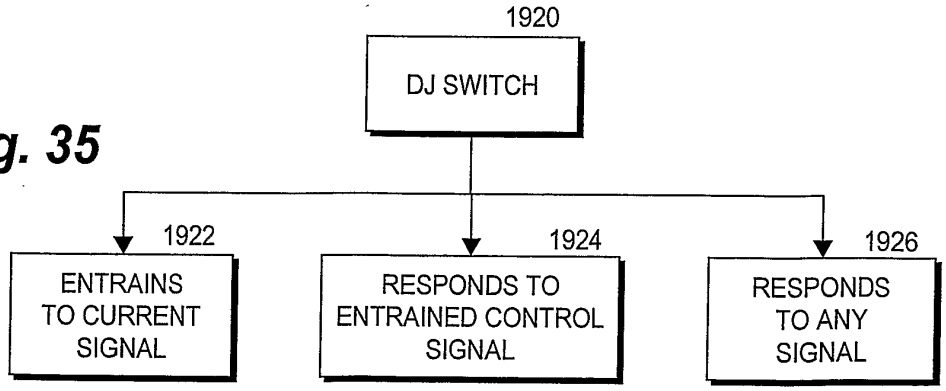

1920
DJ SWITCH
1922
ENTRAINS TO CURRENT SIGNAL
1924
RESPONDS TO ENTRAINED CONTROL SIGNAL
1926
RESPONDS TO ANY SIGNAL

Fig. 27

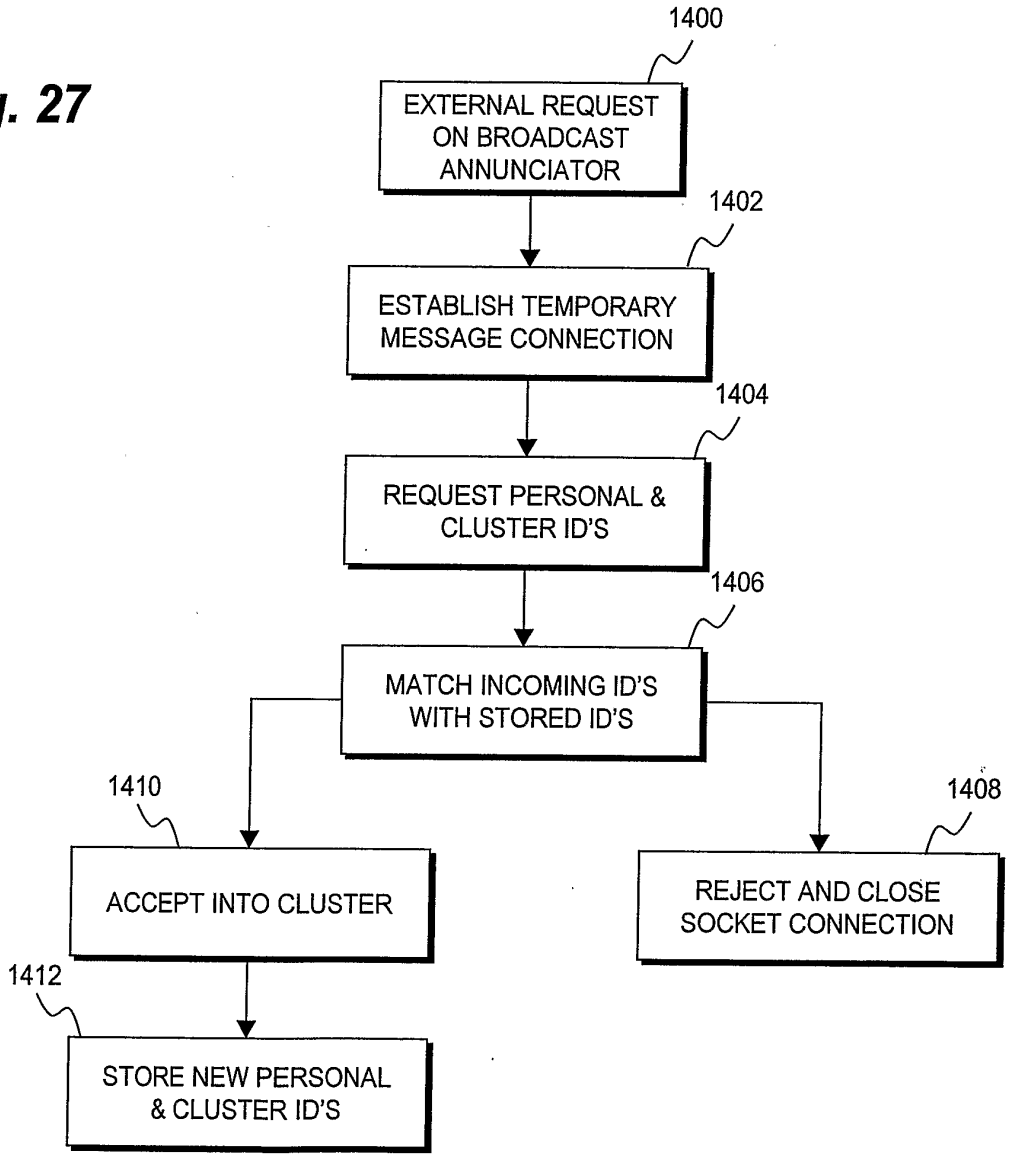

1400
EXTERNAL REQUEST ON BROADCAST ANNUNCIATOR
1402
ESTABLISH TEMPORARY MESSAGE CONNECTION
1404
REQUEST PERSONAL & CLUSTER ID'S
1406
MATCH INCOMING ID'S WITH STORED ID'S
1410
ACCEPT INTO CLUSTER
1408
REJECT AND CLOSE SOCKET CONNECTION
1412
STORE NEW PERSONAL & CLUSTER ID'S

Fig. 28

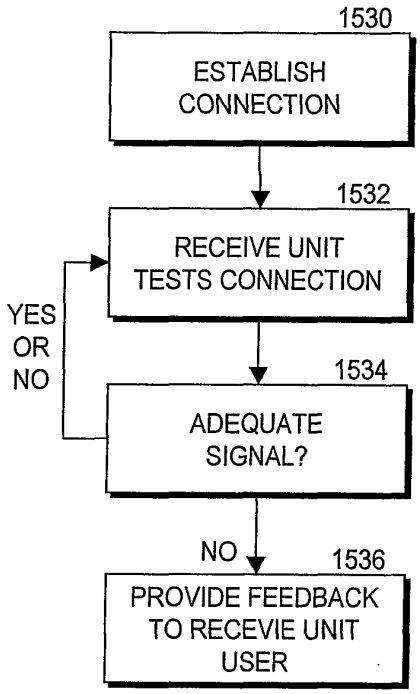

1530
ESTABLISH CONNECTION
1532
RECEIVE UNIT TESTS CONNECTION
YES OR NO
1534
ADEQUATE SIGNAL?
NO
1536
PROVIDE FEEDBACK TO RECEVIE UNIT USER

Fig. 29A

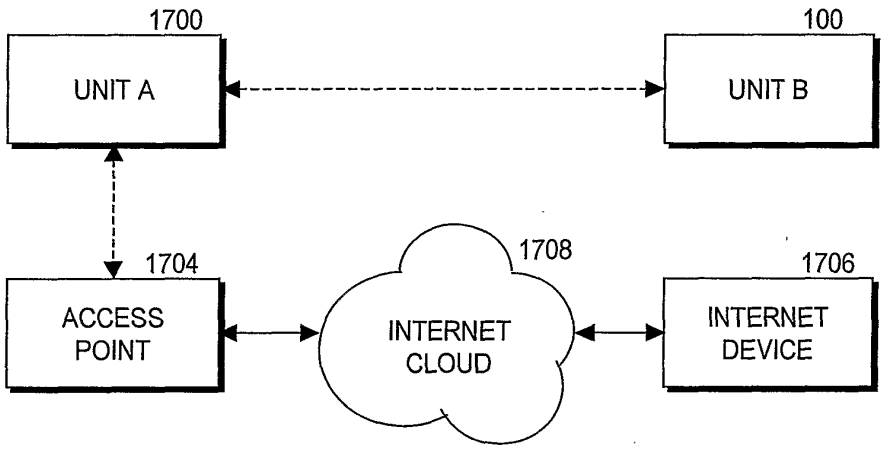


Fig. 29B

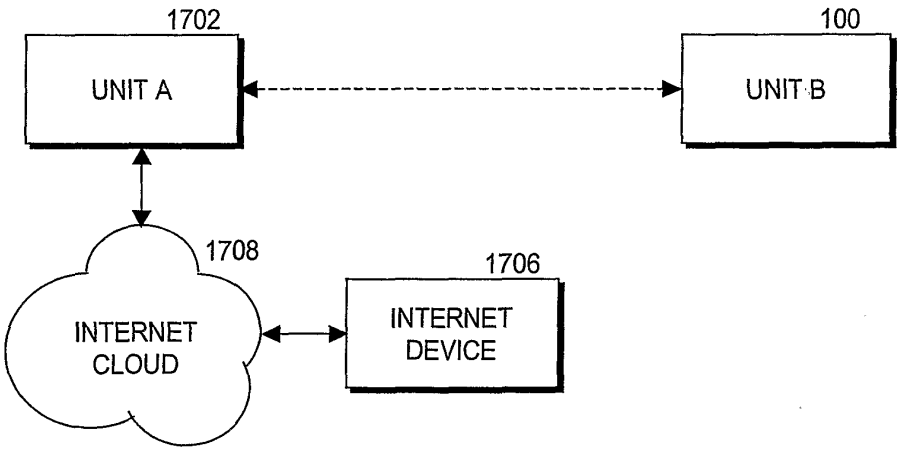


Fig. 30

1800

+$	12089AD
-	E1239AC
+	F105AA3
+	**B1B25C0**
0	ED5491B

1802

3134FF2	+$5	-$7	+21	-8	5
2190AB9	+$86	-$2	+517	-62	5
B1B25C0	+$23	-$17	+81	-5	12
D19A043	+$3	-$0	+37	-0	2
B3278EC	+$15	-$3	+54	-4	9
3C4AB3F	+$52	-$14	+106	-8	5
06EAB3E	+$2	-$0	+70	-12	4
4789A0R	+$9	-$9	+10	-0	3
2C43218	+$41	-$0	+22	-6	7
9FA4829	+$11	-$8	+19	-1	3

Fig. 31

USER

1810

```
MACID = B1B25C0
ALFRED NEWMAN
"WhatMeWorry"
AEN@MAD.COM

WISH LIST...
SONG ID = 5234AB433
  DJ = 8913AEC
SONG ID = 23590A9F1
  DJ = 8A81EC2
SONG ID = 532409AB2
  DJ = 8913AEC
SONG ID = 9024890EF
  DJ = 7A1BE34
```

DISTRIBUTOR

1812

```
MACID = B1B25C0
ALFRED NEWMAN
AN@MAD.COM

SONGS PURCHASED...
SONG ID = 2876BA129
  DJ = 8913AEC
SONG ID = 230871C40
  DJ = 42897DD
SONG ID = A4289B319
  DJ = 8913AEC
SONG ID = 9827ADD01
  DJ = 8913AEC
```

Fig. 32A

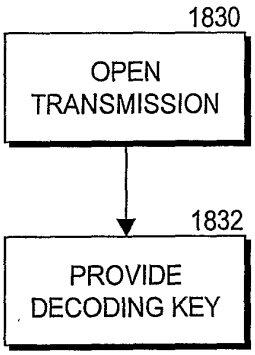


Fig. 32B

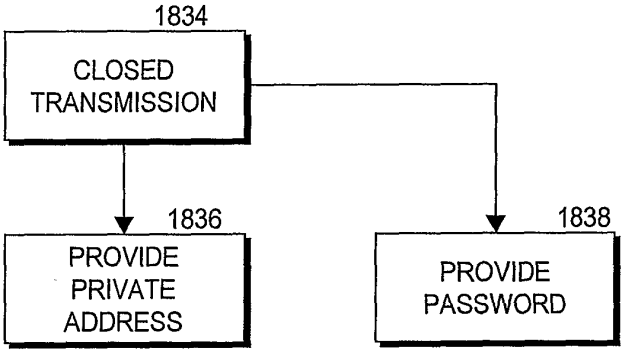


Fig. 33

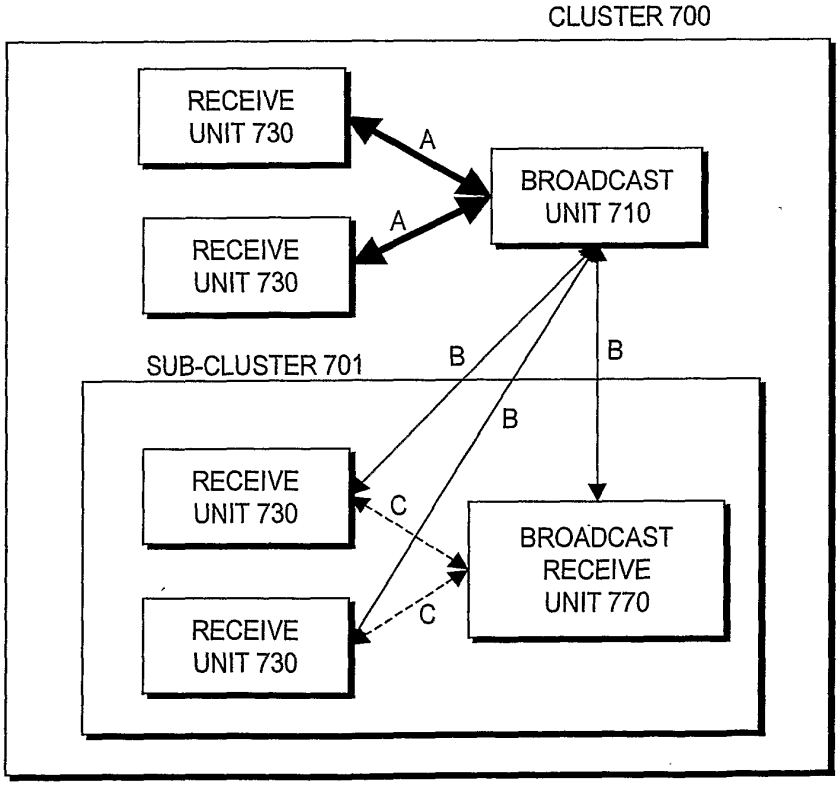


Fig. 34A

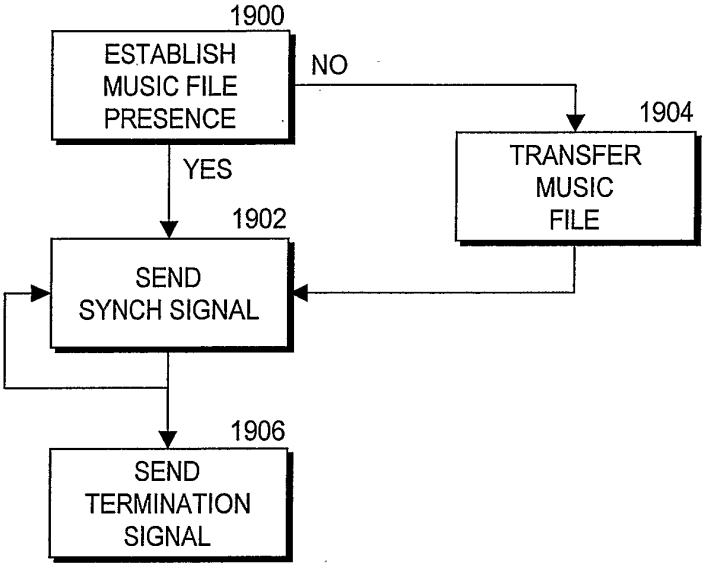
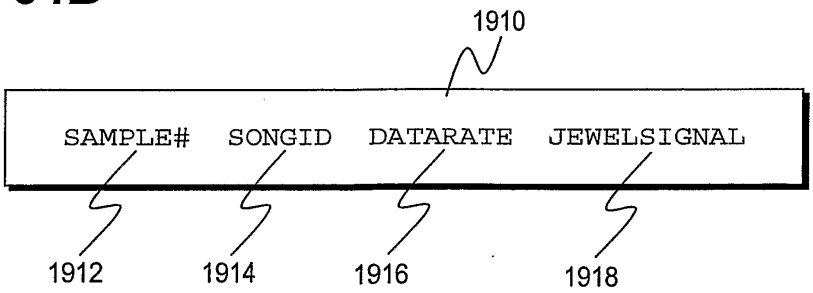


Fig. 34B



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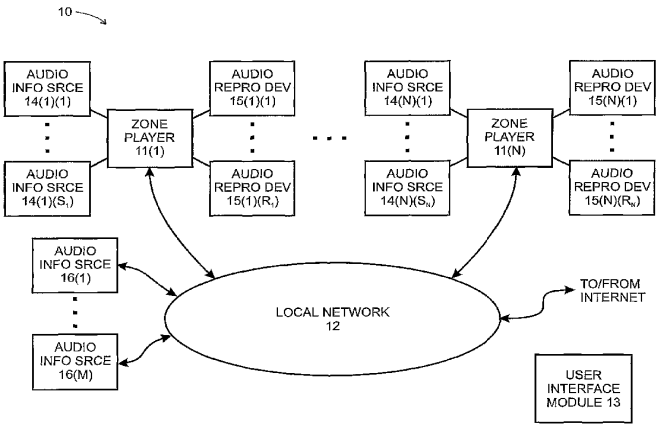
(54) Title: SYSTEM AND METHOD FOR SYNCHRONIZING OPERATIONS AMONG A PLURALITY OF INDEPENDENTLY CLOCKED DIGITAL DATA PROCESSING DEVICES



(57) Abstract: A system is described for maintaining synchrony of operations among a plurality of devices hat have independent clocking arrangements. The system includes a task distribution device that distributes tasks to a synchrony group comprising a plurality of devices that are to perform the tasks distributed by the task distribution device in synchrony. The task distribution device distributes each task to the members of the synchrony group over a network. Each task is associated with a time stamp that indicates a time, relative to a clock maintained by the task distribution device, at which the members of the synchrony group are to execute the task. Each member of the synchrony group periodically obtains from the task distribution device an indication of the current time indicated by its clock, determines a time differential between the task distribution device's clock and its respective clock and determines therefrom a time at which, according to its respective clock, the time stamp indicates that it is to execute the task.

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System and Method For Synchronizing Operations Among A Plurality Of Independently Clocked Digital Data Processing Devices

Field Of The Invention

The present invention relates generally to the field of digital data processing devices, and more particularly to systems and methods for synchronizing operations among a plurality of independently-clocked digital data processing devices. The invention is embodied in a system for synchronizing operations among a plurality of devices, in relation to information that is provided by a common source. One embodiment of the invention enables synchronizing of audio playback as among two or more audio playback devices that receive audio information from a common information source, or channel.

More generally, the invention relates to the field of arrangements that synchronize output generated by a number of output generators, including audio output, video output, combinations of audio and video, as well as other types of output as will be appreciated by those skilled in the art, provided by a common channel. Generally, the invention will find utility in connection with any type of information for which synchrony among independently-clocked devices is desired.

Background Of The Invention

There are a number of circumstances under which it is desirable to maintain synchrony of operations among a plurality of independently-clocked digital data processing devices in relation to, for example, information that is provided thereto by a common source. For example, systems are being developed in which one audio information source can distribute audio information in digital form to a number of audio playback devices for playback. The audio playback devices receive the digital information and convert it to analog form for playback. The audio playback devices may be located in the same room or they may be distributed in different rooms in a residence such as a house or an apartment, in different offices in an office building, or the like. For example, in a system installed in a residence, one audio playback device may be located in a living room, while another audio playback device is be located in a kitchen, and yet other audio playback devices may be located in various bedrooms of a house. In such an arrangement, the audio information that is distributed to various audio playback devices may relate to the same audio program, or the information may relate to different audio programs. If the audio information source provides audio information relating to the same audio program to two or more audio playback devices at the same time, the audio playback devices will generally contemporaneously play the same program. For

example, if the audio information source provides audio information to audio playback devices located in the living room and kitchen in a house at the same time, they will generally contemporaneously play the same program.

One problem that can arise is to ensure that, if two or more audio playback devices are contemporaneously attempting to play back the same audio program, they do so simultaneously. Small differences in the audio playback devices' start times and/or playback speeds can be perceived by a listener as an echo effect, and larger differences can be very annoying. Differences can arise because for a number of reasons, including delays in the transfer of audio information over the network. Such delays can differ as among the various audio playback devices for a variety of reasons, including where they are connected into the network, message traffic and other reasons as will be apparent to those skilled in the art.

Another problem arises from the following. When an audio playback device converts the digital audio information from digital to analog form, it does so using a clock that provides timing information. Generally, the audio playback devices that are being developed have independent clocks, and, if they are not clocking at precisely the same rate, the audio playback provided by the various devices can get out of synchronization.

SUMMARY OF THE INVENTION

The invention provides a new and improved system and method for synchronizing operations among a number of digital data processing devices that are regulated by independent clocking devices. Generally, the invention will find utility in connection with any type of information for which synchrony among devices connected to a network is desired. The invention is described in connection with a plurality of audio playback devices that receive digital audio information that is to be played back in synchrony, but it will be appreciated that the invention can find usefulness in connection with any kind of information for which coordination among devices that have independent clocking devices would find utility.

In brief summary, the invention provides, in one aspect, a system for maintaining synchrony of operations among a plurality of devices that have independent clocking arrangements. The system includes a task distribution device that distributes tasks to a synchrony group comprising a plurality of devices that are to perform the tasks distributed by the task distribution device in synchrony. The task distribution device distributes each task to the members of the synchrony group over a network. Each task is associated with a time stamp that indicates a time, relative to a clock maintained by the task distribution device, at which the members of the synchrony group are to execute the task. Each

member of the synchrony group periodically obtains from the task distribution device an indication of the current time indicated by its clock, determines a time differential between the task distribution device's clock and its respective clock and determines therefrom a time at which, according to its respective clock, the time stamp indicates that it is to execute the task.

In one embodiment, the tasks that are distributed include audio information for an audio track that is to be played by all of the devices comprising the synchrony group synchronously. The audio track is divided into a series of frames, each of which is associated with a time stamp indicating the time, relative to the clock maintained by an audio information channel device, which, in that embodiment, serves as the task distribution device, at which the members of the synchrony group are to play the respective frame. Each member of the synchrony group, using a very accurate protocol, periodically obtains the time indicated by the audio information channel device, and determines a differential between the time as indicated by its local clock and the audio information channel device's clock. The member uses the differential and the time as indicated by the time stamp to determine the time, relative to its local clock, at which it is to play the respective frame. The members of the synchrony group do this for all of the frames, and accordingly are able to play the frames in synchrony.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention is pointed out with particularity in the appended claims. The above and further advantages of this invention may be better understood by referring to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 schematically depicts an illustrative networked audio system, constructed in accordance with the invention;

FIG. 2 schematically depicts a functional block diagram of a synchrony group utilizing a plurality of zone players formed within the networked audio system depicted in FIG. 1;

FIG. 2A schematically depicts two synchrony groups, illustrating how a member of one synchrony group can provide audio information to the members of another synchrony group;

FIG. 3 depicts an functional block diagram of a zone player for use in the networked audio system depicted in FIG. 1; and

FIG. 4 is useful in understanding an digital audio information framing methodology useful in the network audio system depicted in FIG. 1.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

FIG. 1 depicts an illustrative network audio system 10 constructed in accordance with the invention. With reference to FIG. 1, the network audio system 10 includes a plurality of zone players 11(1) through 11(N) (generally identified by reference numeral 11(n)) interconnected by a local network 12, all of which operate under control of one or more user interface modules generally identified by reference numeral 13. One or more of the zone players 11(n) may also be connected to one or more audio information sources, which will generally be identified herein by reference numeral 14(n)(s), and/or one or more audio reproduction devices, which will generally be identified by reference numeral 15(n)(r). In the reference numeral 14(n)(s), index "n" refers to the index "n" of the zone player 11(n) to which the audio information source is connected, and the index "s" ($s=1,\ldots,S_n$) refers to the "s-th" audio information source connected to that "n-th" zone player 11(n). Thus, if, for example, a zone player 11(n) is connected to four audio information sources 14(n)(1) through 14(n)(4), the audio information sources may be generally identified by reference numeral 14(n)(s), with $S_n=4$. It will be appreciated that the number of audio information sources S_n may vary as among the various zone players 11(n), and some zone players may not have any audio information sources connected thereto. Similarly, in the reference numeral 15(n)(r), index "n" refers to the index "n" of the zone player 11(n) to which the audio reproduction device is connected, and the index "r" ($r=1,\ldots,R_n$) refers to the "r-th" audio information source connected to that "n-th" zone player 11(n). In addition to the audio information sources 14(n)(s), the network audio system 10 may include one or more audio information sources 16(1) through 16(M) connected through appropriate network interface devices (not separately shown) to the local network 12. Furthermore, the local network may include one or more network interface devices (also not separately shown) that are configured to connect the local network 12 to other networks, including a wide area network such as the Internet, the public switched telephony network (PSTN) or other networks as will be apparent to those skilled in the art, over which connections to audio information sources may be established.

The zone players 11(n) associated with system 10 may be distributed throughout an establishment such as residence, an office complex, a hotel, a conference hall, an amphitheater or auditorium, or other types of establishments as will be apparent to those skilled in the art or the like. For example, if the zone players 11(n) and their associated audio information source(s) and/or audio reproduction device(s) are distributed throughout a residence, one, such as zone player 11(1) and its associated audio information source(s) and audio reproduction device(s) may be located in a living room, another may be located in a kitchen, another may be located in a dining room, and yet others

may be located in respective bedrooms, to selectively provide entertainment in those rooms. On the other hand, if the zone players 11(n) and their associated audio information source(s) and/or audio reproduction device(s) are distributed throughout an office complex, one may, for example, be provided in each office to selectively provide entertainment to the employees in the respective offices. Similarly, if the zone players 11(n) and associated audio information source(s) and/or audio reproduction device(s) are used in a hotel, they may be distributed throughout the rooms to provide entertainment to the guests. Similar arrangements may be used with zone players 11(n) and associated audio information source(s) and/or audio reproduction device(s) used in an amphitheater or auditorium. Other arrangements in other types of environments will be apparent to those skilled in the art. In each case, the zone players 11(n) can be used to selectively provide entertainment in the respective locations, as will be described below.

The audio information sources 14(n)(s) and 16(m) may be any of a number of types of conventional sources of audio information, including, for example, compact disc ("CD") players, AM and/or FM radio receivers, analog or digital tape cassette players, analog record turntables and the like. In addition, the audio information sources 14(n)(s) and 16(m) may comprise digital audio files stored locally on, for example, personal computers (PCs), personal digital assistants (PDAs), or similar devices capable of storing digital information in volatile or non-volatile form. As noted above, the local network 12 may also have an interface (not shown) to a wide area network, over which the network audio system 10 can obtain audio information. Moreover, one or more of the audio information sources 14(n)(s) may also comprise an interface to a wide area network such as the Internet, the public switched telephony network (PSTN) or any other source of audio information. In addition, one or more of the audio information sources 14(n)(s) and 16(m) may comprise interfaces to radio services delivered over, for example, satellite. Audio information obtained over the wide area network may comprise, for example, streaming digital audio information such as Internet radio, digital audio files stored on servers, and other types of audio information and sources as will be appreciated by those skilled in the art. Other arrangements and other types of audio information sources will be apparent to those skilled in the art.

Generally, the audio information sources 14(n)(s) and 16(m) provide audio information associated with audio programs to the zone players for playback. A zone player that receives audio information from an audio information source 14(n)(s) that is connected thereto can provide playback and/or forward the audio information, along with playback timing information, over the local network 12 to other zone players for playback. Similarly, each audio information source 16(m)

that is not directly connected to a zone player can transmit audio information over the network 12 to any zone player 11(n) for playback. In addition, as will be explained in detail below, the respective zone player 11(n) can transmit the audio information that it receives either from an audio information source 14(n)(s) connected thereto, or from an audio information source 16(m), to selected ones of the other zone players 11(n'), 11(n"),... (n not equal to n', n",...) for playback by those other zone players. The other zone players 11(n'), 11(n"),... to which the zone player 11(n) transmits the audio information for playback may be selected by a user using the user interface module 13. In that operation, the zone player 11(n) will transmit the audio information to the selected zone players 11(n'), 11(n"),... over the network 12. As will be described below in greater detail, the zone players 11(n), 11(n'), 11(n"),... operate such that the zone players 11(n'), 11(n"),... synchronize their playback of the audio program with the playback by the zone player 11(n), so that the zone players 11(n), 11(n'), 11(n") provide the same audio program at the same time.

Users, using user interface module 13, may also enable different groupings or sets of zone players to provide audio playback of different audio programs synchronously. For example, a user, using a user interface module 13, may enable zone players 11(1) and 11(2) to play one audio program, audio information for which may be provided by, for example, one audio information source 14(1)(1). The same or a different user may, using the same or a different user interface module 13, enable zone players 11(4) and 11(5) to contemporaneously play another audio program, audio information for which may be provided by a second audio information source, such as audio information source 14(5)(2). Further, a user may enable zone player 11(3) to contemporaneously play yet another audio program, audio information for which may be provided by yet another audio information source, such as audio information source 16(1). As yet another possibility, a user may contemporaneously enable zone player 11(1) to provide audio information from an audio information source connected thereto, such as audio information source 14(1)(2), to another zone player, such as zone player 11(6) for playback.

In the following, the term "synchrony group" will be used to refer to a set of one or more zone players that are to play the same audio program synchronously. Thus, in the above example, zone players 11(1) and 11(2) comprise one synchrony group, zone player 11(3) comprises a second synchrony group, zone players 11(4) and 11(5) comprise a third synchrony group, and zone player 11(6) comprises yet a fourth synchrony group. Thus, while zone players 11(1) and 11(2) are playing the same audio program, they will play the audio program synchronously. Similarly, while zone players 11(4) and 11(5) are playing the same audio program, they will play the audio program

synchronously. On the other hand, zone players that are playing different audio programs may do so with unrelated timings. That is, for example, the timing with which zone players 11(1) and 11(2) play their audio program may have no relationship to the timing with which zone player 11(3), zone players 11(4) and 11(5), and zone player 11(6) play their audio programs. It will be appreciated that, since "synchrony group" is used to refer to sets of zone players that are playing the same audio program synchronously, zone player 11(1) will not be part of zone player 11(6)'s synchrony group, even though zone player 11(1) is providing the audio information for the audio program to zone player 11(6).

In the network audio system 10, the synchrony groups are not fixed. Users can enable them to be established and modified dynamically. Continuing with the above example, a user may enable the zone player 11(1) to begin providing playback of the audio program provided thereto by audio information source 14(1)(1), and subsequently enable zone player 11(2) to join the synchrony group. Similarly, a user may enable the zone player 11(5) to begin providing playback of the audio program provided thereto by audio information source 14(5)(2), and subsequently enable zone player 11(4) to join that synchrony group. In addition, a user may enable a zone player to leave a synchrony group and possibly join another synchrony group. For example, a user may enable the zone player 11(2) to leave the synchrony group with zone player 11(1), and join the synchrony group with zone player 11(6). As another possibility, the user may enable the zone player 11(1) to leave the synchrony group with zone player 11(2) and join the synchrony group with zone player 11(6). In connection with the last possibility, the zone player 11(1) can continue providing audio information from the audio information source 14(1)(1) to the zone player 11(2) for playback thereby.

A user, using the user interface module 13, can enable a zone player 11(n) that is currently not a member of a synchrony group to join a synchrony group, after which it will be enabled to play the audio program that is currently being played by that synchrony group. Similarly, a user, also using the user interface module 13, can enable a zone player 11(n) that is currently a member of one synchrony group, to disengage from that synchrony group and join another synchrony group, after which that zone player will be playing the audio program associated with the other synchrony group. For example, if a zone player 11(6) is currently not a member of any synchrony group, it, under control of the user interface module 13, can become a member of a synchrony group, after which it will play the audio program being played by the other members of the synchrony group, in synchrony with the other members of the synchrony group. In becoming a member of the synchrony group, zone player 11(6) can notify the zone player that is the master device for the synchrony group

that it wishes to become a member of its synchrony group, after which that zone player will also transmit audio information associated with the audio program, as well as timing information, to the zone player 11(6). As the zone player 11(6) receives the audio information and the timing information from the master device, it will play the audio information with the timing indicated by the timing information, which will enable the zone player 11(6) to play the audio program in synchrony with the other zone player(s) in the synchrony group.

Similarly, if a user, using the user interface module 13, enables a zone player 11(n) associated with a synchrony group to disengage from that synchrony group, and if the zone player 11(n) is not the master device of the synchrony group, the zone player 11(n) can notify the master device, after which the master device can terminate transmission of the audio information and timing information to the zone player 11(n). If the user also enables the zone player 11(n) to begin playing another audio program using audio information from an audio information source 14(n)(s) connected thereto, it will acquire the audio information from the audio information source 14(n)(s) and initiate playback thereof. If the user enables another zone player 11(n') to join the synchrony group associated with zone player 11(n), operations in connection therewith can proceed as described immediately above.

As yet another possibility, if a user, using the user interface module 13, enables a zone player 11(n) associated with a synchrony group to disengage from that synchrony group and join another synchrony group, and if the zone player is not the master device of the synchrony group from which it is disengaging, the zone player 11(n) can notify the master device of the synchrony group from which it is disengaging, after which that zone player will terminate transmission of audio information and timing information to the zone player 11(n) that is disengaging. Contemporaneously, the zone player 11(n) can notify the master device of the synchrony group that it (that is, zone player 11(n)) is joining, after which the master device can begin transmission of audio information and timing information to that zone player 11(n). The zone player 11(n) can thereafter begin playback of the audio program defined by the audio information, in accordance with the timing information so that the zone player 11(n) will play the audio program in synchrony with the master device.

As yet another possibility, a user, using the user interface module 13, may enable a zone player 11(n) that is not associated with a synchrony group, to begin playing an audio program using audio information provided to it by an audio information source 14(n)(s) connected thereto. In that case, the user, also using the user interface module 13 or a user interface device that is specific to the audio information source 14(n)(s), can enable the audio information source 14(n)(s) to provide audio information to the zone player 11(n). After the zone player 11(n) has begun playback, or

contemporaneously therewith, the user, using the user interface module 13, can enable other zone players 11(n'), 11(n"),... to join zone player 11(n)'s synchrony group and enable that zone player 11(n) to transmit audio information and timing information thereto as described above, to facilitate synchronous playback of the audio program by the other zone players 11(n'), 11(n")....

A user can use the user interface module 13 to control other aspects of the network audio system 10, including but not limited to the selection of the audio information source 14(n)(s) that a particular zone player 11(n) is to utilize, the volume of the audio playback, and so forth. In addition, a user may use the user interface module 13 to turn audio information source(s) 14(n)(s) on and off and to enable them to provide audio information to the respective zone players 11(n).

Operations performed by the various devices associated with a synchrony group will be described in connection with FIG. 2, which schematically depicts a functional block diagram of a synchrony group in the network audio system 10 described above in connection with FIG. 1. With reference to FIG. 2, a synchrony group 20 includes a master device 21 and zero or more slave devices 22(1) through 22 (G) (generally identified by reference numeral 22(g)), all of which synchronously play an audio program provided by an audio information channel device 23. Each of the master device 21, slave devices 22(g) and audio information channel device 23 utilizes a zone player 11(n) depicted in FIG. 1, although it will be clear from the description below that a zone player may be utilized both for the audio information channel device for the synchrony group 20, and the master device 21 or a slave device 22(g) of the synchrony group 20. As will be described below in more detail, the audio information channel device 23 obtains the audio information for the audio program from an audio information source, adds playback timing information, and transmits the combined audio and playback timing information to the master device 21 and slave devices 22(g) over the network 12 for playback. The playback timing information that is provided with the audio information, together with clock timing information provided by the audio information channel device 23 to the various devices 21 and 22(g) as will be described below, enables the master device 21 and slave devices 22(g) of the synchrony group 20 to play the audio information simultaneously.

The master device 21 and the slave devices 22(g) receive the audio and playback timing information, as well as the clock timing information, that are provided by the audio information channel device 23, and play back the audio program defined by the audio information. The master device 21 is also the member of the synchrony group 20 that communicates with the user interface module 13 and that controls the operations of the slave devices 22(g) in the synchrony group 20. In addition, the master device 21 controls the operations of the audio information channel device 23 that

provides the audio and playback timing information for the synchrony group 20. Generally, the initial master device 21 for the synchrony group will be the first zone player 11(n) that a user wishes to play an audio program. However, as will be described below, the zone player 11(n) that operates as the master device 21 can be migrated from one zone player 11(n) to another zone player 11(n'), which preferably will be a zone player that is currently operating as a slave device 22(g) in the synchrony group.

In addition, under certain circumstances, as will be described below, the zone player 11(n) that operates as the audio information channel device 23 can be migrated from one zone player to another zone player, which also will preferably will be a zone player that is currently operating as a member of the synchrony group 20. It will be appreciated that the zone player that operates as the master device 21 can be migrated to another zone player independently of the migration of the audio information channel device 23. For example, if one zone player 11(n) is operating as both the master device 21 and the audio information channel device 23 for a synchrony group 20, the master device 21 can be migrated to another zone player 11(n') while the zone player 11(n) is still operating as the audio information channel device 23. Similarly, if one zone player 11(n) is operating as both the master device 21 and the audio information channel device 23 for a synchrony group 20, the audio information channel device 23 can be migrated to another zone player 11(n') while the zone player 11(n) is still operating as the master device 21. In addition, if one zone player 11(n) is operating as both the master device 21 and the audio information channel device 23 for a synchrony group 20, the master device 21 can be migrated to another zone player 11(n') and the audio information channel device can be migrated to a third zone player 11(n").

The master device 21 receives control information from the user interface module 13 for controlling the synchrony group 20 and provides status information indicating the operational status of the synchrony group to the user interface module 13. Generally, the control information from the user interface module 13 enables the master device 21 to, in turn, enable the audio information channel device 23 to provide audio and playback timing information to the synchrony group to enable the devices 21 and 22(g) that are members of the synchrony group 20 to play the audio program synchronously. In addition, the control information from the user interface module 13 enables the master device 21 to, in turn, enable other zone players to join the synchrony group as slave devices 22(g) and to enable slave devices 22(g) to disengage from the synchrony group. Control information from the user interface module 13 can also enable the zone player 11(n) that is currently operating as the master device 21 to disengage from the synchrony group, but prior to

doing so that zone player will enable the master device 21 to transfer from that zone player 11(n) to another zone player11(n'), preferably to a zone player 11(n') that is currently a slave device 22(g) in the synchrony group 20. The control information from the user interface module 13 can also enable the master device 21 to adjust its playback volume and to enable individual ones of the various slave devices 22(g) to adjust their playback volumes. In addition, the control information from the user interface module 13 can enable the synchrony group 20 to terminate playing of a current track of the audio program and skip to the next track, and to re-order tracks in a play list of tracks defining the audio program that is to be played by the synchrony group 20.

The status information that the master device 21 may provide to the user interface module 13 can include such information as a name or other identifier for the track of the audio work that is currently being played, the names or other identifiers for upcoming tracks, the identifier of the zone player 11(n) that is currently operating as the master device 21, and identifiers of the zone players that are currently operating as slave devices 22(g). In one embodiment, the user interface module 13 includes a display (not separately shown) that can display the status information to the user.

It will be appreciated that the zone player 11(n) that is operating as the audio information channel device 23 for one synchrony group may also comprise the master device 21 or any of the slave devices 22(g) in another synchrony group. This may occur if, for example, the audio information source that is to provide the audio information that is to be played by the one synchrony group is connected to a zone player also being utilized as the master device or a slave device for the other synchrony group. This will be schematically illustrated below in connection with FIG. 2A. Since, as noted above, the zone player 11(n) that is operating as the audio information channel device 23 for the synchrony group 20 may also be operating as a master device 21 or slave device 22(g) for another synchrony group, it can also be connected to one or more audio reproduction devices 15(n)(r), although that is not depicted in FIG. 2. Since the master device 21 and slave devices 22(g) are all to provide playback of the audio program, they will be connected to respective audio reproduction devices 15(n)(r). Furthermore, it will be appreciated that one or more of the zone players 11(n) that operate as the master device 21 and slave devices 22(g) in synchrony group 20 may also operate as an audio information channel device for that synchrony group or for another synchrony group and so they may be connected to one or more audio information sources 14(n)(s), although that is also not depicted in FIG. 2. In addition, it will be appreciated that a zone player 11(n) can also operate as a audio information channel device 23 for multiple synchrony groups.

If the audio information channel device 23 does not utilize the same zone player as the master device 21, the master device 21 controls the audio information channel device by exchanging control information over the network 12 with the audio information channel device 23. The control information is represented in FIG. 2 by the arrow labeled CHAN_DEV_CTRL_INFO. The control information that the master device 21 provides to the audio information channel device 23 will generally depend on the nature of the audio information source that is to provide the audio information for the audio program that is to be played and the operation to be enabled by the control information. If, for example, the audio information source is a conventional compact disc, tape, or record player, broadcast radio receiver, or the like, which is connected to a zone player 11(n), the master device 21 may merely enable the zone player serving as the audio information channel device 23 to receive the audio information for the program from the audio information source. It will be appreciated that, if the audio information is not in digital form, the audio information channel device 23 will convert it to digital form and provide the digitized audio information, along with the playback timing information, to the master device 21 and slave devices 22(g).

On the other hand, if the audio information source is, for example, a digital data storage device, such as may be on a personal computer or similar device, the master device 21 can provide a play list to the audio information channel device 23 that identifies one or more files containing the audio information for the audio program. In that case, the audio information channel device 23 can retrieve the files from the digital data storage device and provide them, along with the playback timing information, to the master device 21 and the slave devices 22(g). It will be appreciated that, in this case, the audio information source may be directly connected to the audio information channel device 23, as, for example, an audio information source 14(n)(s), or it may comprise an audio information source 16(m) connected to the network 12. As a further alternative, if the audio information source is a source available over the wide area network, the master device 21 can provide a play list comprising a list of web addresses identifying the files containing the audio information for the audio program that is to be played, and in that connection the audio information channel device 23 can initiate a retrieval of the files over the wide area network. As yet another alternative, if the audio information source is a source of streaming audio received over the wide area network, the master device 21 can provide a network address from which the streaming audio can be received. Other arrangements by which the master device 21 can control the audio information channel device 23 will be apparent to those skilled in the art.

The master device 21 can also provide control information to the synchrony group's audio information channel device 23 to enable a migration from one zone player 11(n) to another zone player 11(n'). This may occur if, for example, the audio information source is one of audio information sources 16 or a source accessible over the wide area network via the network 12. The master device 21 can enable migration of the audio information channel device 23 for several reasons, including, for example, to reduce the loading of the zone player 11(n), to improve latency of message transmission in the network 12, and other reasons as will be appreciated by those skilled in the art.

As noted above, the audio information channel device 23 provides audio and playback timing information for the synchrony group to enable the master device 21 and slave devices 22(g) to play the audio program synchronously. Details of the audio and playback timing information will be described in detail below in connection with FIGS. 3 and 4, but, in brief, the audio information channel device 23 transmits the audio and playback timing information in messages over the network 12 using a multi-cast message transmission methodology. In that methodology, the audio information channel device 23 will transmit the audio and playback timing information in a series of messages, with each message being received by all of the zone players 11(n) comprising the synchrony group 20, that is, by the master device 21 and the slave devices 22(g). Each of the messages includes a multi-cast address, which the master device 21 and slave devices 22(g) will monitor and, when they detect a message with that address, they will receive and use the contents of the message. The audio and playback timing information is represented in FIG. 2 by the arrow labeled "AUD+PBTIME_INF0," which has a single tail, representing a source for the information at the audio information channel device 23, and multiple arrowheads representing the destinations of the information, with one arrowhead extending to the master device 21 and other arrowheads extending to each of the slave devices 22(g) in the synchrony group 20. The audio information channel device 23 may make use of any convenient multi-cast message transmission methodology in transmitting the audio and playback timing information to the synchrony group 20. As will be described in detail in connection with FIG. 4, the audio and playback timing information is in the form of a series of frames, with each frame having a time stamp. The time stamp indicates a time, relative to the time indicated by a clock maintained by the audio information channel device 23, at which the frame is to be played. Depending on the size or sizes of the messages used in the selected multi-cast message transmission methodology and the size or sizes of the frames, a message may contain one frame, or multiple frames, or, alternatively, a frame may extend across several messages.

The audio information channel device 23 also provides clock time information to the master device 21 and each of the slave devices 22(g) individually over network 12 using a highly accurate clock time information transmission methodology. The distribution of the clock time information is represented in FIG. 2 by the arrows labeled "AICD_CLK_INF (M)" (in the case of the clock time information provided to the master device 21) and "AICD_CLK_INF (S_1)" through "AICD_CLK_INF (S_G)" (in the case of audio information channel device clock information provided to the slave devices 22(g)). In one embodiment, the master device 21 and slave devices 22(g) make use of the well-known SNTP (Simple Network Time Protocol) to obtain current clock time information from the audio information channel device 23. The SNTP makes use of a unicast message transfer methodology, in which one device, such as the audio information channel device 23, provides clock time information to a specific other device, such as the master device 21 or a slave device 22(g), using the other device's network, or unicast, address. Each of the master device 21 and slave devices 22(g) will periodically initiate SNTP transactions with the audio information channel device 23 to obtain the clock time information from the audio information channel device 23. As will be described below in more detail, the master device 21 and each slave device 22(g) make use of the clock time information to determine the time differential between the time indicated by the audio information channel device's clock and the time indicated by its respective clock, and use that time differential value, along with the playback time information associated with the audio information and the respective device's local time as indicated by its clock to determine when the various frames are to be played. This enables the master device 21 and the slave devices 22(g) in the synchrony group 20 to play the respective frames simultaneously.

As noted above, the control information provided by the user to the master device 21 through the user interface module 13 can also enable the master device 21 to, in turn, enable another zone player 11(n') to join the synchrony group as a new slave device 22(g). In that operation, the user interface module 13 will provide control information, including the identification of the zone player 11(n') that is to join the synchrony group to the master device 21. After it receives the identification of the zone player 11(n') that is to join the synchrony group, the master device 21 will exchange control information, which is represented in FIG. 2 by the arrows labeled SLV_DEV_CTRL_INF (S_1) through SLV_DEV_CTRL_INF (S_G) group slave control information, over the network 12 with the zone player 11(n') that is identified in the control information from the user interface module 13. The control information that the master device 21 provides to the new zone player 11(n') includes the network address of the zone player 11(n) that is operating as the audio information channel

device 23 for the synchrony group, as well as the multi-cast address that the audio information channel device 23 is using to broadcast the audio and playback timing information over the network. The zone player that is to operate as the new slave device 22(g') uses the multi-cast address to begin receiving the multi-cast messages that contain the audio information for the audio program being played by the synchrony group.

It will be appreciated that, if the zone player 11(n) that is operating as the master device 21 for the synchrony group 20 is also operating the audio information channel device 23, and if there are no slave devices 22(g) in the synchrony group 20, the audio information channel device 23 may not be transmitting audio and playback timing information over the network. In that case, if the new slave device 22(g') is the first slave device in the synchrony group, the zone player 11(n) that is operating as both the master device 21 and audio information channel device 23, can begin transmitting the audio and playback timing information over the network 12 when the slave device 22(g') is added to the synchrony group 20. The zone player 11(n) can maintain a count of the number of slave devices 22(g) in the synchrony group 20 as they join and disengage, and, if the number drops to zero, it can stop transmitting the audio and playback timing information over the network 12 to reduce the message traffic over the network 12.

The new slave device 22(g') added to the synchrony group 20 uses the network address of the audio information channel device 23 for several purposes. In particular, the new slave device 22(g') will, like the master device 21 (assuming the zone player 11(n) operating as the master device 21 is not also the audio information channel device 23), engage in SNTP transactions with the audio information channel device 23 to obtain the clock timing information from the audio information channel device 23. In addition, the new slave device 22(g') can notify the audio information channel device 23 that it is a new slave device 22(g') for the synchrony group 20 and provide the audio information channel device 23 with its network address. As will be described below, in one embodiment, particularly in connection with audio information obtained from a source, such as a digital data storage device, which can provide audio information at a rate that is faster than the rate at which it will be played, the audio information channel device 23 will buffer audio and timing information and broadcast it over the network 12 to the synchrony group 20 generally at a rate at which it is provided by the source. Accordingly, when a new slave device 22(g') joins the synchrony group 20, the playback timing information may indicate that the audio information that is currently being broadcast by the audio information channel device 23 using the multi-cast methodology is to be played back some time in the future. To reduce the delay with which the new slave device 22(g')

will begin playback, the audio information channel device 23 can also retransmit previously transmitted audio and timing information that it had buffered to the new slave device 22(g') using the unicast network address of the slave device 22(g').

The master device 21 can also use the slave device control information exchanged with the slave devices 22(g) for other purposes. For example, the master device 21 can use the slave device control information to initiate a migration of the master from its zone player 11(n) to another zone player 11(n'). This may occur for any of a number of reasons, including, for example, that the master device 21 is terminating playback by it of the audio program and is leaving the synchrony group 20, but one or more of the other devices in the synchrony group is to continue playing the audio program. The master device 21 may also want to initiate a migration if it is overloaded, which can occur if, for example, the zone player 11(n) that is the master device 21 for its synchrony group is also operating as an audio information channel device 23 for another synchrony group.

The user can also use the user interface module 13 to adjust playback volume by the individual zone players 11(n) comprising the synchrony group. In that operation, the user interface module 13 provides information identifying the particular device whose volume is to be adjusted, and the level at which the volume is to be set to the master device 21. If the device whose volume is to be adjusted is the master device 21, the master device 21 can adjust its volume according to the information that it receives from the user interface module 13. On the other hand, if the device whose volume is to be adjusted is a slave device 22(g), the master device 21 can provide group slave control information to the respective slave device 22(g), to enable it to adjust its volume.

The user can also use the user interface module 13 to enable a synchrony group 20 to cancel playing of the track in an audio program that is currently being played, and to proceed immediately to the next track. This may occur, for example, if the tracks for the program is in the form of a series of digital audio information files, and the user wishes to cancel playback of the track that is defined by one of the files. In that case, when the master device 21 receives the command to cancel playback of the current track, it will provide channel device control information to the audio information channel device 23 so indicating. In response, the audio information channel device 23 inserts control information into the audio and playback timing information, which will be referred to as a "resynchronize" command. In addition, the audio information channel device 23 will begin transmitting audio information for the next track, with timing information to enable it to be played immediately. The resynchronize command can also enable playback of a track to be cancelled before it has been played. Details of these operations will be described below.

As noted above, there may be multiple synchrony groups in the network audio system 10, and further that, for example, a zone player 11(n) may operate both as a master device 21 or a slave device 22(g) in one synchrony group, and as the audio information channel device 23 providing audio and playback timing information and clock timing information for another synchrony group. An illustrative arrangement of this will be described in connection with FIG. 2A. With reference to FIG. 2A, that FIG. depicts elements of two synchrony groups, identified by reference numerals 20(1) and 20(2), respectively. For clarity, FIG. 2A does not show a number of elements, the presence of which would be evident from FIGS. 1 and 2 as described above. For example, FIG. 2A does not depict the audio information sources from which audio information is obtained for the synchrony groups or the audio reproduction devices that are used to produce sound for the master and slave devices, which are depicted in both FIGS. 1 and 2. In addition, FIG. 2A does not depict arrows that represent control information provided by the respective master devices to the slave devices in the respective synchrony groups, or to the audio information channel devices that provide audio and timing information for the respective synchrony groups, which are depicted in FIG. 2. In addition, FIG. 2A does not depict the arrows that represent the clock timing information provided by the audio information channel devices to the respective members of the respective synchrony groups, which are also depicted in FIG. 2. As will be noted below, however, FIG. 2A does depict arrows representing the audio and playback timing information provided by the respective audio information channel devices for the respective synchrony groups 20(1), 20(2), to the master and slave devices comprising the respective synchrony groups 20(1), 20(2).

Each synchrony group 20(1), 20(2) comprises elements of a number of zone players. A functional block diagram of a zone player will be described below in connection with FIG. 3. Synchrony group 20(1) includes a master device 21(1) and "K" slave devices 22(1)(1) through 22(K)(1) (the index "1" in reference numeral 21(1) and the last index in reference numeral 22(1)(1) through 21(K)(1) corresponds to the index of the synchrony group 20(1) to which they belong) utilize zone players 11(1) and 11(K+1) respectively. Similarly, synchrony group 20(2) includes a master device 21(2) and "L" slave devices 22(1)(2) through 22(L)(2) that utilize zone players 11(K+2) through 11(K+L+2). In the illustrative arrangement depicted in FIG. 2A, both synchrony groups 20(1) and 20(2) are controlled by the user interface module 13, which can provide control information to, and receive status information from, the master devices 21(1) and 21(2) independently. It will be appreciated that separate user interface modules may be provided to

provide control information to, and receive status information from, the respective master devices 21(1), 21(2).

As noted above, the slave device 22(1)(2) in synchrony group 20(2) utilizes zone player 11(K+3). In the illustrative arrangement depicted in FIG. 2A, the audio information channel device 23(1) that provides audio and playback timing information to the master and slave devices 21(1), 22(1)(1),..., 22(K)(1) of synchrony group 20(1) also utilizes zone player 11(K+3). As noted above, this may occur if, for example, the audio information source that is to provide audio information to be played by the synchrony group 20(1) is connected to the zone player 11(K+3). Thus, when the master device 21(1) of synchrony group 20(1) exchanges channel device control information with the audio information channel device 23(1), it is effectively exchanging channel device control information with the zone player 11(K+3). Similarly, when the master and slave devices 21(1), 22(1)(1),..., 22(K)(1) of synchrony group 20(1) receive audio and playback timing information, as well as clock timing information, from the audio information channel device 23(1), they are effectively receiving the information from the zone player 11(K+3). FIG. 2A depicts a multi-headed arrow representing audio and playback timing information transmitted by the zone player 11(K+3), as audio information channel device 23(1), to the master and slave devices 21(1), 22(1)(1),...,11(K)(1) comprising synchrony group 20(1).

On the other hand, in the illustrative arrangement depicted in FIG. 2A, the synchrony group 20(2) utilizes a zone player 11(K+L+3) as its audio information channel device 23(2). As with synchrony group 20(1), when the master device 21(2) of synchrony group 20(2) exchanges channel device control information with the audio information channel device 23(2), it is effectively exchanging channel device control information with the zone player 11(K+L+3). Similarly, when the master and slave devices 21(2), 22(1)(2),..., 22(L)(2) of synchrony group 20(2) receive audio and playback timing information, as well as clock timing information, from the audio information channel device 23(2), they are effectively receiving the information from the zone player 11(K+L+3). FIG. 2A depicts a multi-headed arrow representing audio and playback timing information transmitted by the zone player 11(K+3) as audio information channel device 23(2) to the master and slave devices 21(2), 22(1)(2),...,22(L)(2) comprising synchrony group 20(2).

In the illustrative arrangement depicted in FIG. 2A, zone player 11(K+L+3), which is the audio information channel device 23(2) for synchrony group 20(2), is not shown as being either a master or a slave device in another synchrony group. However, it will be appreciated that zone player 11(K+L+3) could also be utilized as the master device or a slave device for another synchrony

group. Indeed, it will be appreciated that the zone player that is utilized as the audio information channel device for synchrony group 20(2) may also be a zone player that is utilized as the master device 21(1) or a slave device 22(1)(1),..., 22(K)(1) in the synchrony group 20(1).

A zone player 11(n) that is utilized as a member of one synchrony group may also be utilized as the audio information channel device for another synchrony group if the audio information source that is to supply the audio information that is to be played by the other synchrony group is connected to that zone player 11(n). A zone player 11(n) may also be utilized as the audio information channel device for the other synchrony group if, for example, the audio information source is an audio information source 16(m) (FIG. 1) that is connected to the network 12 or an audio information source that is available over a wide area network such as the Internet. The latter may occur if, for example, the zone player 11(n) has sufficient processing power to operate as the audio information channel device and it is in an optimal location in the network 12, relative to the zone players comprising the other synchrony group (that is the synchrony group for which it is operating as audio information channel device) for providing the audio and playback timing information to the members of the other synchrony group. Other circumstances under which the zone player 11(n) that is utilized as a member of one synchrony group may also be utilized as the audio information channel device for another synchrony group will be apparent to those skilled in the art.

As was noted above, the master device 21 for a synchrony group 20 may be migrated from one zone player 11(n) to another zone player 11(n'). As was further noted above, the audio information channel device 23 for a synchrony group 20 may be migrated from one zone player 11(n) to another zone player 11(n'). It will be appreciated that the latter may occur if, for example, the audio information source that provides the audio program for the synchrony group is not connected to the zone player 11(n) that is operating as the audio information channel device 23, but instead is one of the audio information sources 16(m) connected to the network 12 or a source available over a wide area network such as the Internet. Operations performed during a migration of an audio information channel device 23 from one zone player 11(n) to another zone player 11(n') will generally depend on the nature of the audio information that is being channeled by the audio information channel device 23. For example, if the audio information source provides streaming audio, the zone player 11(n) that is currently operating as the audio information channel device 23 for the synchrony group 20, can provide the following information to the other zone player 11(n') that is to become the audio information channel device 23 for the synchrony group 20:

(a) the identification of the source of the streaming audio information,

(b) the time stamp associated with the frame that the zone player 11(n) is currently forming, and

(c) the identifications of the zone players that are operating as the master device 21 and slave devices 22(g) comprising the synchrony group 20.

After the zone player 11(n') receives the information from the zone player 11(n), it will begin receiving the streaming audio from the streaming audio information source identified by the zone player 11(n), assemble the streaming audio information into frames, associate each frame with a time stamp, and transmit the resulting audio and playback timing information over the network 12. The zone player 11(n') will perform these operations in the same manner as described above, except that, instead of using the time indicated by its digital to analog converter clock 34 directly in generating the time stamps for the frames, the initial time stamp will be related to the value of the time stamp that is provided by the zone player 11(n) (reference item (b) above), with the rate at which the time stamps are incremented corresponding to the rate at which its (that is, the zone player 11(n')'s) clock increments. In addition, the zone player 11(n') will notify the zone players that are operating as the master device 21 and slave devices 22(g) of the synchrony group 20 that it is the new audio information channel device 23 for the synchrony group 20, and provide the multi-cast address that it will be using to multi-cast the audio and playback timing information, as well as its unicast network address. After the members of the synchrony group 20 receive the notification from the zone player 11(n') indicating that it is the new audio information channel device 23 for the synchrony group 20, they will receive the audio and playback timing information from the zone player 11(n') instead of the zone player 11(n), using the multi-cast address provided by the zone player 11(n'). In addition, they can utilize the zone player 11(n')'s unicast network address to obtain current time information therefrom. It will be appreciated that the zone player 11(n') will determine its current time in relation to the time stamp that is provided by the zone player 11(n) (reference item (b) above) or the current time information that it received from the zone player 11(n) using the SNTP protocol as described above.

Generally similar operations can be performed in connection with migrating the audio information channel device from one zone player 11(n) to another zone player 11(n') if the audio information is from one or more audio information files, such as may be the case if the audio information comprises MP3 or WAV files that are available from sources such as sources 16(m) connected to the network 12 or over from sources available over a wide area network such as the Internet, except for differences to accommodate the fact that the audio information is in files. In that

case, the zone player 11(n) that is currently operating as the audio information channel device 23 for the synchrony group 20 can provide the following information to the zone player 11(n') that is to become the audio information channel device 23 for the synchrony group 20:

(d) a list of the audio information files containing the audio information that is to be played;

(e) the identification of the file for which the zone player 11(n) is currently providing audio and playback timing information, along with the offset into the file for which the current item of audio and playback timing information is being generated and the time stamp that the zone player 11(n) is associating with that frame, and

(f) the identifications of the zone players that comprise the master device 21 and slave devices 22(g) comprising the synchrony group 20.

After the zone player 11(n') receives the information from the zone player 11(n), it will begin retrieving audio information from the file identified in item (e), starting at the identified offset. In addition, the zone player 11(n') can assemble the retrieved audio information into frames, associate each frame with a time stamp and transmit the resulting audio and playback timing information over the network 12. The zone player 11(n') will perform these operations in the same manner as described above, except that, instead of using the time indicated by its digital to analog converter clock 34 directly in generating the time stamps for the frames, the value of the initial time stamp will be related to the time stamp that is provided by the zone player 11(n) (reference item (e) above), with the rate at which the time stamps are incremented corresponding to the rate at which its (that is, the zone player 11(n')'s) clock increments. In addition, the zone player 11(n') will notify the zone players that are operating as the master device 21 and slave devices 22(g) of the synchrony group 20 that it is the new audio information channel device 23 for the synchrony group 20, and provide the multi-cast address that it will be using to multi-cast the audio and playback timing information, as well as its unicast network address. After the members of the synchrony group 20 receive the notification from the zone player 11(n') indicating that it is the new audio information channel device 23 for the synchrony group 20, they will receive the audio and playback timing information from the zone player 11(n') instead of the zone player 11(n), using the multi-cast address provided by the zone player 11(n'). In addition, they can utilize the zone player 11(n')'s unicast network address to obtain current time information therefrom. It will be appreciated that the zone player 11(n') will determine its current time in relation to the time stamp that is provided by the zone player 11(n) (reference item (b) above) or the current time information that it received from the zone player 11(n) using the SNTP

protocol as described above. The zone player 11(n') will process successive audio information files in the list that it receives from the zone player 11(n) (reference item (d)).

Operations performed by the zone players 11(n) and 11(n') in connection with migration of the audio information channel device 23 for other types of audio information will be apparent to those skilled in the art. In any case, preferably, the zone player 11(n) will continue operating as an audio information channel device 23 for the synchrony group 20 for at least a brief time after it notifies the zone player 11(n') that it is to become audio information channel device for the synchrony group, so that the zone player 11(n') will have time to notify the zone players in the synchrony group 20 that it is the new audio information channel device 23 for the synchrony group.

Before proceeding further in describing operations performed by the network audio system 10, it would be helpful to provide a detailed description of a zone player 11(n) constructed in accordance with the invention. FIG. 3 depicts a functional block diagram of a zone player 11(n) constructed in accordance with the invention. All of the zone players in the network audio system 10 may have similar construction. With reference to FIG. 3, the zone player 11(n) includes an audio information source interface 30, an audio information buffer 31, a playback scheduler 32, a digital to analog converter 33, an audio amplifier 35, an audio reproduction device interface 36, a network communications manager 40, and a network interface 41, all of which operate under the control of a control module 42. The zone player 11(n) also has a device clock 43 that provides timing signals that control the general operations of the zone player 11(n). In addition, the zone player 11(n) includes a user interface module interface 44 that can receive control signals from the user interface module 13 (FIGS. 1 and 2) for controlling operations of the zone player 11(n), and provide status information to the user interface module 13.

Generally, the audio information buffer 31 buffers audio information, in digital form, along with playback timing information. If the zone player 11(n) is operating as the audio information channel device 23 (FIG. 2) for a synchrony group 20, the information that is buffered in the audio information buffer 31 will include the audio and playback timing information that will be provided to the devices 21 and 22(g) in the synchrony group 20. If the zone player 11(n) is operating as the master device 21 or a slave device 22(g) for a synchrony group, the information that is buffered in the audio information buffer 31 will include the audio and playback timing information that the zone player 11(n) is to play.

The audio information buffer 31 can receive audio and playback timing information from two sources, namely, the audio information source interface 30 and the network communications

manager 40. In particular, if the zone player 11(n) is operating as the audio information channel device 23 for a synchrony group 20, and if the audio information source is a source 14(n)(s) connected to the zone player 11(n), the audio information buffer 31 will receive and buffer audio and playback timing information from the audio information source interface 30. On the other hand, if the zone player 11(n) is operating as the audio information channel device 23 for a synchrony group 20, and if the audio information source is a source 16(m) connected to the network 12, or a source available over the wide area network, the audio information buffer 31 will receive and buffer audio and playback timing information from the network communications manager 40. It will be appreciated that, if the zone player 11(n) is not a member of the synchrony group, the zone player 11(n) will not play this buffered audio and playback timing information.

On yet another hand, if the zone player 11(n) is operating as the master device 21 or a slave device 22(g) in a synchrony group, and if the zone player 11(n) is not also the audio information channel device 23 providing audio and playback timing information for the synchrony group 20, the audio information buffer 31 will receive and buffer audio and playback timing information from the network communications manager 40.

The audio information source interface 30 connects to the audio information source(s) 14(n)(s) associated with the zone player 11(n). While the zone player 11(n) is operating as audio information channel device 23 for a synchrony group 20, and if the audio information is to be provided by a source 14(n)(s) connected to the zone player 11(n), the audio information source interface 30 will selectively receive audio information from one of the audio information source(s) 14(n)(s) to which the zone player is connected and store the audio information in the audio information buffer 21. If the audio information from the selected audio information source 14(n)(s) is in analog form, the audio information source interface 30 will convert it to digital form. The selection of the audio information source 14(n)(s) from which the audio information source interface 30 receives audio information is under control of the control module 42, which, in turn, receives control information from the user interface module through the user interface module interface 44. The audio information source interface 30 adds playback timing information to the digital audio information and buffers the combined audio and playback timing information in the audio information buffer 21.

More specifically, as noted above, the audio information source interface 30 receives audio information from an audio information source 14(n)(s), converts it to digital form if necessary, and buffers it along with playback timing information in the audio information buffer 21. In addition,

the audio information source interface 30 will also provide formatting and scheduling information for the digital audio information, whether as received from the selected audio information source 14(n)(s) or as converted from an analog audio information source. As will be made clear below, the formatting and scheduling information will control not only playback by the zone player 11(n) itself, but will also enable other zone players 11(n'), 11(n"),... that may be in a synchrony group for which the zone player 11(n) is the master device, to play the audio program associated with the audio information in synchrony with the zone player 11(n).

In one particular embodiment, the audio information source interface 30 divides the audio information associated with an audio work into a series of frames, with each frame comprising digital audio information for a predetermined period of time. As used herein, an audio track may comprise any unit of audio information that is to be played without interruption. On the other hand, an audio program may comprise a series of one or more audio tracks that are to be played in succession. It will be appreciated that the tracks comprising the audio program may also be played without interruption, or alternatively playback between tracks may be interrupted by a selected time interval. FIG. 4 schematically depicts an illustrative framing strategy used in connection with one embodiment of the invention for a digital audio stream comprising an audio work. More specifically, FIG. 4 depicts a framed digital audio stream 50 comprising a sequence of frames 51(1) through 51(F) (generally identified by reference numeral 51(f)). Each frame 51(f), in turn, comprises a series of audio samples 52(f)(1) through 52(f)(S) (generally identified by reference numeral 52(f)(s)) of the audio track. Preferably all of the frames will have the same number "S" of audio samples, although it will be appreciated from the following that that is primarily for convenience. On the other hand, it will be appreciated that, the number of audio samples may differ from "S"; this may particularly be the case if the frame 51(f) contains the last audio samples for the digital audio stream for a particular audio work. In that case, the last frame 51(F) will preferably contain samples 52(F)(1) through 52(F)(x), where "x" is less than "S." Generally, it is desirable that the number of samples be consistent among all frames 51(f), and in that case padding, which will not be played, can be added to the last frame 51(F).

Associated with each frame 51(f) is a header 55(f) that includes a number of fields for storing other information that is useful in controlling playback of the audio samples in the respective frame 51(f). In particular, the header 55(f) associated with a frame 51(f) includes a frame sequence number field 56, an encoding type field 57, a sampling rate information field 58, a time stamp field 60, an end of track flag 61, and a length flag field 62. The header 55(f) may also include fields (not shown)

for storing other information that is useful in controlling playback. Generally, the frame sequence number field 56 receives a sequence number "f" that identifies the relative position of the frame 51(f) in the sequence of frames 51(1)..51(f)...51(F) containing the digital audio stream 50. The encoding type field 57 receives a value that identifies the type of encoding and/or compression that has been used in generating the digital audio stream. Conventional encoding or compression schemes include, for example, the well-known MP3 and WAV encoding and/or compression schemes, although it will be appreciated that other schemes may be provided for as well. The sampling rate information field 58 receives sampling rate information that indicates the sampling rate for the audio samples 52(f)(s). As will be apparent to those skilled in the art, the sampling rate determines the rate at which the zone player 11(n) is to play the audio samples 52(f)(s) in the frame, and, as will be described below, determines the period of the digital to analog converter clock 34.

The condition of the end of work flag 61 indicates whether the frame 51(f) contains the last digital audio samples for the audio track associated with the framed digital audio work 50. If the frame 51(f) does not contain the audio samples that are associated with the end of the digital audio stream 50 for a respective audio work, the end of work flag will be clear. On the other hand, if the frame 51(f) does contain the audio samples that are associated with the end of the digital audio stream 50 for a respective audio work, the end of work flag 61 will be set. In addition, since the number of valid audio samples 52(F)(s) in the frame 51(F), that is, the samples that are not padding, may be less than "S," the default number of audio samples in a frame 51(f), the length flag field 62 will contain a value that identifies the number of audio samples in 52(F)(s) in the last frame 51(F) of the audio work 50. If, as noted above, the frames have a consistent number "S" of samples, the samples 52(F)(x+1) through 52(F)(S) will contain padding, which will not be played.

The time stamp field 60 stores a time stamp that identifies the time at which the zone player 11(n) is to play the respective frame. More specifically, for each frame of a framed digital audio stream 50 that is buffered in the audio information buffer 21, the audio information source interface 30, using timing information from the digital to analog converter clock 34, will determine a time at which the zone player 11(n) is to play the respective frame, and stores a time stamp identifying the playback time in the time stamp field 60. The time stamp associated with each frame will later be used by the playback scheduler 32 to determine when the portion of the digital audio stream stored in the frame is to be coupled to the digital to analog converter 33 to initiate play back. It will be appreciated that the time stamps that are associated with frames in sequential frames 51(1), 51(2),...,51(F), will be such that they will be played back in order, and without an interruption

between the sequential frames comprising the digital audio stream 50. It will further be appreciated that, after a time stamp has been determined for the first frame, stored in frame 51(1), of a digital audio stream 50, the audio information source interface 30 can determine time stamps for the subsequent frame 51(2), 51(3),....,51(F) in relation to the number of samples "S" in the respective frames and the sample rate. The time stamps will also preferably be such that frames will be played back after some slight time delay after they have been buffered in the audio information buffer 21; the purpose for the time delay will be made clear below.

Returning to FIG. 3, in addition to dividing the digital audio information into frames, the audio information source interface 30 also aggregates and/or divides the frames 51(f) as necessary into packets, each of which will be of a length that would fit into a message for transmission over the network, and associates each packet with a packet sequence number. For example, if a packet will accommodate multiple frames 51(f), 51(f+1),... 51(f+y-1), it will aggregate them into a packet and associate them with a packet number, for example p(x). If the entire frames 51(f) and 51(f+y-1) was accommodated in packet p(x), where "x" is the sequence number, which will occur if the size of a packet is an exact multiple of the frame size, the next packet, p(x+1) will begin with frame 51(f+y) and will include frames 51(f+y),..., 51(f+2y-1). Subsequent packets p(x+2),.... will be formed in a similar manner. On the other hand, if the packet length will not accommodate an exact multiple of the frame size, the last frame in the packet will be continued at the beginning of the next packet.

If the audio information source interface 30 is aware of track boundaries, which may be the case if the tracks are divided into files, the packets will reflect the track boundaries, that is, the packets will not contain frames from two tracks. Thus, if the last frames associated with a track are insufficient to fill a packet, the packet will contain padding from the last frame associated with the track to the end of the packet, and the next packet will begin with the first frames associated with the next track.

In one embodiment, the audio information source interface 30 stores the packets in the audio information buffer 31 in a ring buffer. As is conventional, a ring buffer includes a series of storage locations in the buffer. Each entry will be sufficient to store one packet. Four pointers are used in connection with the ring buffer, a first pointer pointing to the beginning of the ring buffer, a second pointer pointing to the end of the ring buffer, an third "write" pointer pointing to the entry into which a packet will be written and a fourth "read" pointer pointing to the entry from which packet will be read for use in playback. When a packet is read from the ring buffer for playback, it will be read

from the entry pointed to by the read pointer. After the packet has been read, the read pointer will be advanced. If the read pointer points beyond the end of the ring buffer, as indicated by the end pointer, it will be reset to point to the entry pointed to by the beginning pointer, and the operations can be repeated.

On the other hand, when the audio information source interface 30 stores a packet in the ring buffer, first determine whether the entry pointed to by the write pointer points to the same entry as the entry pointed to by the read pointer. If the write pointer points to the same entry as the entry pointed to by the read pointer, the entry contains at least a portion of a packet that has not yet been read for playback, and the audio information source interface 30 will delay storage of the packet until the entire packet has been read and the read pointer advanced. After the read pointer has been advanced, the audio information source interface 30 can store the packet in the entry pointed to by the write pointer. After the packet has been stored, the audio information source interface 30 will advance the write pointer. If the write pointer points beyond the end of the ring buffer, as indicated by the end pointer, it will be reset to point to the entry pointed to by the beginning pointer, and the operations can be repeated.

As noted above, the zone player 11(n) can operate both as an audio information channel device 23 and a member of the synchrony group 20 of which it is a member. In that case, the audio information buffer 31 can contain one ring buffer. On the other hand, the zone player 11(n) can operate as an audio information channel device 23 for one synchrony group 20(1) (FIG. 2A) and a member of another synchrony group 20(2). In that case, the audio information buffer 31 would maintain two ring buffers, one for the audio and timing information associated with synchrony group 20(1), and the other for the audio and timing information associated with synchrony group 20(2). It will be appreciated that, in the latter case, the zone player 11(n) will only use the audio and timing information that is associated with synchrony group 20(2) for playback.

The playback scheduler 32 schedules playback of the audio information that is buffered in the audio information buffer 31 that is to be played by the zone player 11(n). Accordingly, under control of the playback scheduler 32, the digital audio information that is buffered in the audio information buffer 21 that is to be played by the zone player 11(n) is transferred to the digital to analog converter 33 for playback. As noted above, if the zone player 11(n) is operating as an audio information channel device 23 for a synchrony group 20 for which it is not a member, the playback scheduler 32 will not schedule the digital audio information that is to be played by that synchrony group 20 for playback. The playback scheduler 32 only schedules the digital audio information, if

any, that is buffered in the audio information buffer 31 that is associated with a synchrony group for which the zone player 11(n) is a member, whether as master device 21 or a slave device 22(g).

Essentially, the playback scheduler 32 makes use of the read pointer associated with the circular buffer that contains the audio and playback timing information that is to be played by the zone player 11(n). The playback scheduler 32 retrieves the packet information from the entry of the ring buffer pointed to by the read pointer, and then advances the ring pointer as described above. The playback scheduler 32 determines the boundaries of the frames in the packet and uses the time stamps in the time stamp fields 60 associated with the respective frame 51(f), along with timing information provided by the zone player 11(n)'s digital to analog converter clock 34, to determine when the respective frame is to be transferred to the digital to analog converter 33. Generally, when the time stamp associated with a buffered digital audio information frame corresponds to the current time as indicated by the digital to analog converter clock 34, the playback scheduler 32 will enable the respective frame to be transferred to the digital to analog converter 33.

The digital to analog converter 33, also under control of the digital to analog converter clock 34, converts the buffered digital audio information to analog form, and provides the analog audio information to the audio amplifier 35 for amplification. The amplified analog information, in turn, is provided to the audio reproduction devices 15(n)(r) through the audio reproduction device interface 36. The audio reproduction devices 15(n)(r) transform the analog audio information signal to sound thereby to provide the audio program to a listener. The amount by which the audio amplifier 35 amplifies the analog signal is controlled by the control module 42, in response to volume control information provided by the user through the user interface module 13.

The network communications manager 40 controls network communications over the network 12, and the network interface 41 transmits and receives message packets over the network 12. The network communications manager 40 generates and receives messages to facilitate the transfer of the various types of information described above in connection with FIG. 2, including the channel device control information, slave device control information, audio and playback timing information and the audio information channel device's clock timing information. In connection with the channel device control information and the slave device control information, the network communications manager 40 will generate messages for transfer over the network 12 in response to control information from the control module 42. Similarly, when the network communications manager 40 receives messages containing channel device control information and slave device

control information, the network communications manager will provide the information to the control module 42 for processing.

With regards to the audio information channel device's clock timing information, as noted above, the master device 21 and slave devices 22(g) of the synchrony group 20 obtain the clock timing information from the audio information channel device 23 using the well-known SNTP. If the zone player 11(n) is operating as the audio information channel device 23 for a synchrony group, during the SNTP operation, it will provide its current time, particularly a current time as indicated by its digital to analog converter clock 34. On the other hand, if the zone player 11(n) is operating as the master device 21 or slave device 22(g) of a synchrony group 20, it will receive the clock timing information from the audio information channel device 23. After the respective device 21, 22(g) has obtained the audio information channel device's clock timing information, it will generate a differential time value ΔT representing the difference between the time T indicated by its digital to analog converter clock 34 and the current time information from the audio information channel device 23. The differential time value will be used to update the time stamps for the frames of the digital audio stream 50 (FIG. 4) that are received from the audio information channel device.

With regards to the audio and playback timing information, operations performed by the network communications manager 40 will depend on whether

(i) the audio and playback timing information has been buffered in the audio information buffer 31 for transmission, as audio information channel device 23, over the network 12 to the master device 21 and/or slave devices 22(g) of a synchrony group, or

(ii) the audio and playback timing information has been received from the network 12 to be played by the zone player 11(n) as either the master device 21 for a synchrony group or a slave device in a synchrony group.

It will be appreciated that the network communications manager 40 may be engaged in both (i) and (ii) contemporaneously, since the zone player 11(n) may operate both as the audio information channel device 23(1) for a synchrony group 20(1) (reference FIG. 2A) of which it is not a member, and a member of another synchrony group 20(2) for which another zone player 11(n') is the audio information channel device 23(2). With reference to item (i) above, after a packet that is to be transmitted has been buffered in the respective ring buffer, the network communications manager 40 retrieves the packet, packages it into a message and enables the network interface 41 to transmit the message over the network 12. If the control module 42 receives control information from the user interface module 13 (if the master device 21 is also the audio information channel device 23 for

the synchrony group 20) or from the master device (if the master device 21 is not the audio information channel device 23 for the synchrony group 20) that would require the transmission of a "resynchronize" command as described above, the control module 42 of the audio information channel device 23 enables the network communications manager 40 to insert the command into a message containing the audio and playback timing information. Details of the operations performed in connection with the "resynchronize" command will be described below. As noted above, the "resynchronize" command is used if the user enables a synchrony group to terminate the playback of a track that is currently being played, or cancel playback of a track whose playback has not begun.

On the other hand, with reference to item (ii) above, if network interface 41 receives a message containing a packet containing frames of audio and playback timing information that the zone player 11(n) is to play either as a master device 21 or a slave device for a synchrony group 20, the network interface 41 provides the audio and playback timing information to the network communications manager 40. The network communications manager 40 will determine whether the packet contains a resynchronize command and, if so, notify the control module 42, which will enable operations to be performed as described below. In any case, the network communications manager 40 will normally buffer the various frames comprising the audio and playback timing information in the audio information buffer 31, and in that operation will generally operate as described above in connection with the audio information source interface 30. Before buffering them, however, the network communications manager 40 will update their time stamps using the time differential value described above. It will be appreciated that the network communications manager 40 will perform similar operations whether the messages that contain the packets were multi-cast messages or unicast messages as described above

The updating of the time stamps by the master device 21 and the slave devices 22(g) in the synchrony group 20 will ensure that they all play the audio information synchronously. In particular, after the network communications manager 40 has received a frame 51(f) from the network interface 41, it will also obtain, from the digital to analog converter clock 34, the zone player 11(n)'s current time as indicated by its digital to analog converter clock 34. The network communications manager 40 will determine a time differential value that is the difference between the slave device's current clock time, as indicated by its digital to analog converter 34, and the audio information channel device's time as indicated by the audio information channel device's clock timing information. Accordingly, if the master or slave device's current time has a value T_S and the audio information channel device's current time, as indicated by the clock timing information, has a value T_C, the time

differential value $\Delta T=T_S-T_C$. If the current time of the master or slave device in the synchrony group 20, as indicated by its digital to analog converter clock 34, is ahead of the audio information channel device's clock time as indicated by the clock timing information received during the SNTP operation, the time differential value will have a positive value. On the other hand, if the master or slave device's current time is behind the audio information channel device's clock time, the time differential value ΔT will have a negative value. If the zone player 11(n) obtains clock timing information from the audio information channel device 23 periodically while it is a member of the synchrony group 20, the network communications manager 40 can generate an updated value for the time differential value ΔT when it receives the clock timing information from the audio information channel device 23, and will subsequently use the updated time differential value.

The network communications manager 40 uses the time differential value ΔT that it generates from the audio information channel device timing information and zone player 11(n)'s current time to update the time stamps that will be associated with the digital audio information frames that the zone player 11(n) receives from the audio information channel device. For each digital audio information frame that is received from the audio information channel device, instead of storing the time stamp that is associated with the frame as received in the message in the audio information buffer 21, the network communications manager 40 will store the updated time stamp with the digital audio information frame. The updated time stamp is generated in a manner so that, when the zone player 11(n), as a member of the synchrony group plays back the digital audio information frame, it will do so in synchrony with other devices in the synchrony group.

More specifically, after the zone player 11(n)'s network interface 41 receives a message containing a packet that, in turn, contains one or more frames 51(f), it will provide the packet to the network communications manager 40. For each frame 51(f) in the packet that the network communications manager 40 receives from the network interface 41, the network communications manager 40 will add the time differential value ΔT to the frame's time stamp, to generate the updated time stamp for the frame 51(f), and store the frame 51(f), along with the header 55(f) with the updated time stamp in the audio information buffer 31. Thus, for example, if a frame's time stamp has a time value T_F, the network communications manager 40 will generate an updated time stamp T^U_F having a time value $T^U_F = T_F + \Delta T$. Since time value T^U_F according to the slave device's digital to analog converter clock 34 is simultaneous to the time value T_F according to the audio information channel device's digital to analog converter clock 34, the zone player 11(n) device will play the digital audio information frame at the time determined by the audio information channel device 23.

Since all of the members of the synchrony group 20 will perform the same operations, generating the updated time stamps T^U_F for the various frames 51(f) in relation to their respective differential time values, all of the zone players 11(n) in the synchrony group 20 will play them synchronously. The network communications manager 40 will generate updated time stamps T^U_F for all of the time stamps 60 in the packet, and then store the packet in the audio information buffer 31.

It will be appreciated that, before storing a packet in the audio information buffer 21, the network communications manager 40 can compare the updated time stamps T^U_F associated with the frames in the packet to the slave device's current time as indicated by its digital to analog converter clock 34. If the network communications manager 40 determines the time indicated by the updated time stamps of frames 51(f) in the packet are earlier than the zone player's current time, it can discard the packet instead of storing it in the audio information buffer 21, since the zone player 11(n) will not play them. That is, if the updated time stamp has a time value T^U_F that identifies a time that is earlier than the zone player's current time T_S as indicated by the zone player's digital to analog converter clock 34, the network communications manager 40 can discard the packet.

If the zone player 11(n) is operating as the master device 21 of a synchrony group 20, when the user, through the user interface module 13, notifies the zone player 11(n) that another zone player 11(n') is to join the synchrony group 20 as a slave device 22(g), the control module 42 of the zone player 11(n) enables the network communications manager 40 to engage in an exchange of messages, described above in connection with FIG. 2, to enable the other zone player 11(n') to join the synchrony group 20 as a slave device. As noted above, during the message exchange, the messages generated by the network communications manager 40 of the zone player 11(n) will provide the network communications manager of the zone player 11(n') that is to join the synchrony group 20 with information such as the multi-cast address being used by the audio information channel device 23 that is providing the audio program to the synchrony group 20, as well as a unicast network address for the audio information channel device 23. After receiving that information, the network communications manager and network interface of the zone player 11(n') that is to join the synchrony group 20 can begin receiving the multi-cast messages containing the audio program for the synchrony group, engage in SNTP transactions with the audio information channel device 23 to obtain the latter's current time, and also enable the audio information channel device 23 to send the zone player 11(n') frames 51(f) that it had previously broadcast using the unicast message transmission methodology as described above.

On the other hand, if the network communications manager 40 and network interface 41 of the zone player 11(n) receive a message over the network 12 indicating that it is to become a slave device 22(g) of a synchrony group for which another zone player 11(n') is the master device, the network communications manager 40 for zone player 11(n) will provide a notification to the control module 42 of zone player 11(n). Thereafter, the control module 42 of zone player 11(n) can enable the network communications manager 40 of zone player 11(n) to perform the operations described above to enable it to join the synchrony group 20.

As noted above, the user, using user interface module 13, can enable the synchrony group to terminate playback of a track of an audio program that is currently being played. After playback of a track that is currently being played has been terminated, playback will continue in a conventional manner with the next track that has been buffered in the audio information buffer 31. It will be appreciated that that could be the next track that is on the original play list, or a previous track. In addition, the user can enable the synchrony group 20 to cancel playback of a track that it has not yet begun to play, but for which buffering of packets has begun in the synchrony group 20. Both of these operations make use of the "resynchronize" command that the master device 21 of the synchrony group 20 can enable the audio information channel device 23 to include in the multi-cast message stream that it transmits to the synchrony group 20. Generally, in response to receipt of the resynchronize command, the members of the synchrony group 20 flush the ring buffer containing the packets that they are to play in the future. In addition, if the members of the synchrony group provide separate buffers for their respective digital to analog converters 33, the members will also flush those buffers as well. After the audio information channel device transmits a packet containing the resynchronize command:

(i) in the case of the use of the resynchronize command to terminate playing of a track that is currently being played, the audio information channel device 23 will begin multi-casting packets for the next track, to begin play immediately, and will continue through the play list in the manner described above; and

(ii) in the case of the use of the resynchronize command to cancel play of a track for which buffering has begun, but which is to be played in the future, the audio information channel device 23 will begin multi-casting packets for the track after the track that has been cancelled, to be played beginning at the time the cancelled track was to begin play, and will also continue through the play list in the manner described above.

It will be appreciated that,

(a) in the first case (item (i) directly above), the resynchronize command can enable the read pointer to be set to point to the entry in the circular buffer into which the first packet for the next track will be written, which will correspond to the entry to which the write pointer points, but

(b) in the second case (item (ii) directly above), the resynchronize command can enable the write pointer for the circular buffer to be set to point to the entry that contains the first packet for the track whose play is being cancelled.

It will further be appreciated that, if a track is cancelled for which buffering has not begun, the resynchronize command will generally not be necessary, since the audio information channel device 23 for the synchrony group 20 need only delete that track from the play list.

Operations performed in connection with use of the resynchronize command to cancel playback of a track that is currently being played will be described in connection with Packet Sequence A below, and operations performed in connection with the use of the resynchronize command to cancel playback of a track that is has not yet begun to play, but for which buffering of packets has begun, will be described in connection with Packet Sequence B below.

<u>Packet Sequence A</u>

(A1.0) [packet 57]

(A1.1 [continuation of frame 99]

(A1.2) [frame 100, time = 0:00:01, type = mp3 audio]

(A1.3) [frame 101, time = 0:00:02, type = mp3 audio]

(A1.4) [frame 102, time = 0:00:03, type = mp3 audio]

(A2.0) [packet 58]

(A2.1) [continuation of frame 102]

(A2.2) [frame 103, time = 0:00:04, type = mp3 audio]

(A2.3) [frame 104, time = 0:00:05, type = mp3 audio]

(A2.4) [frame 105, time = 0:00:06, type = mp3 audio]

(A3.0) [packet 59]

(A3.1) [continuation of frame 105]

(A3.2) [frame 106, time = 0:00:07, type = mp3 audio]

(A3.3) [frame 107, time = 0:00:08, type = mp3 audio]

(A3.4) [frame 108, time = 0:00:09, type = mp3 audio]

(A4.0) [packet 60]

(A4.1) [continuation of frame 108]

(A4.2) [frame 109, time = 0:00:10, type = mp3 audio]

(A4.3) [Resynchronize command]

(A4.4) [Padding, if necessary]

(A5.0) [packet 61]

(A5.1) [frame 1, time = 0:00:07, type = mp3 audio]

(A5.2) [frame 2, time = 0:00:08, type = mp3 audio]

(A5.3) [frame 3, time = 0:00:09, type = mp3 audio]

(A5.4) [frame 4, time = 0.00.10, type = mp3 audio]

(A6.0) [packet 62]

(A6.1) [continuation of frame 4]

(A6.2) [frame 5, time = 0:00:11, type = mp3 audio]

(A6.3) [frame 6, time = 0:00:12, type = mp3 audio]

(A6.4) [frame 7, time = 0:00:13, type = mp3 audio]

Packet Sequence A comprises a sequence of six packets, identified by packet 57 through packet 62, that the audio information channel device 23 multi-casts in respective messages to the members of a synchrony group 20. It will be appreciated that the series of messages that the audio information channel device 23 may multi-cast to the synchrony group 20 may include a messages prior to the packet 57, and may also include messages after packet 62. Each packet comprises a packet header, which is symbolized by lines (A1.0), (A2.0),...(A6.0) in Packet Sequence A, and will generally also include information associated with at least a portion of a frame. In the packets represented in Packet Sequence A, each packet includes information associated with a plurality of frames. Depending on the lengths of the packets, each packet may contain information associated with a portion of a frame, an entire frame, or multiple frames. In the illustration represented by Packet Sequence A, it is assumed that each packet may contain information associated with multiple frames. In addition, it is assumed that a packet does not necessarily contain information associated with an integral number of frames; in that case, a packet may contain information associated with

a portion of a frame, and the next packet will contain the information associated with the rest of a frame.

The frames and associated header playback timing information contained in the various packets are symbolized by lines (A1.1), (A1.2),...,(A1.4), (A2.1),....(A6.4) of Packet Sequence A. Thus, for example, line (A1.2) of packet 57 represents the one-hundredth frame, that is, frame 51(100) (reference FIG. 4), of the track whose audio information is being transmitted in the sequence of packets that includes packet 57. The frame 51(100) is to be played at an illustrative time, according to the audio information channel device's digital to analog converter clock, of "time = 0:00:01," and the frame is encoded and/or compressed using the well-known MP3 encoding and compression methodology. In that case, the legend"time = 0:00:01" represents the time stamp that would be included in field 60 (FIG. 4) of the header associated with the frame 50(100) as multi-cast by the audio information channel device for the synchrony group. It will be appreciated that the playback time and encoding/compression methodology will be referred in the header 55(100) that is associated with the frame 51(100). It will also be appreciated that the header may also contain additional information as described above.

Similarly, line (A1.3) of packet 57 represents the one-hundred and first frame, that is, frame 51(101), of the track whose audio information is being transmitted in the sequence of packets that includes packet 57. The frame 51(101) is to be played at an illustrative time, according to the audio information channel device's digital to analog converter clock, of "0:00:02," and the frame is also encoded and/or compressed using the MP3 encoding and compression methodology. Line (A1.4) of packet 57 represents similar information, although it will be appreciated that, depending on the length of packet 57, the line may not represent the information for an entire frame 51(102) and/or its associated header. If the length of packet 57 is not sufficient to accommodate the information for the entire frame 51(102) and/or associated header, the information will continue in packet 58, as represented by line (A2.1) in Packet Sequence A. Similarly, if the length of packet 56 was not sufficient to contain the information for an entire frame 51(99) preceding frame 51(100), packet 57 (lines (A1.0) through 1.4) may contain any information from frame 51(99) that packet 56 was unable to accommodate.

As noted above, when the master device 21 or a slave device 22(g) in the synchrony group 20 receives the packet 57, its respective network communications manager 40 will update the time stamps associated with the various frames 51(f) as described above before buffering the respective frames in the respective audio information buffer 31.

Packets 58 and 59 contain information that is organized along the lines described above in connection with packet 57.

Packet 60 also contains, as represented by lines (A4.1) and (A4.2), information that is organized along the lines of the information represented by lines (Ax.1) and (Ax.2) ("x" equals an integer) described above in connection with packets 57 through 59. On the other hand, packet 60 contains a resynchronize command, as represented by line (A4.3). Packet 60 also may contain padding, as represented by line 4.4, following the resynchronize command. As noted above, the master device 21 of a synchrony group 20 will enable the audio information channel device 23 that is providing audio information to the synchrony group 20 to multi-cast a message containing the resynchronize command when it receives notification from the user interface module 13 that the user wishes to cancel playback of a track that is currently being played. In the example depicted in Packet Sequence A, as will be described below, the audio information channel device 23 receives notification from the master device 21 that the user wishes to cancel playback of a track at a time corresponding to "time = 0:00:07" according to its digital to analog converter clock 34, and, in line (A4.3) of packet 60 it will provide the resynchronize command, followed by padding, if necessary.

As will be apparent from examining lines (A3.1) through (A3.4) of packet 59 and lines (A4.1) and (A4.2) of packet 60, although the audio information channel device 23 has received the notification from the synchrony group's master device 21 to multi-cast the resynchronize command at a time corresponding to "time = 0:00:07" according to the clock time indicated by its digital to analog converter clock 34, it (that is, the audio information channel device 23) has already multi-cast messages containing frames that are to be played at that time and subsequently. That is, the audio information channel device 23 has, multi-cast in packet 59, frames 51(106) through 51(108) that contain time stamps "time = 0:00:07," "time = 0:00:08" and "time = 0:00:09," respectively, and, in packet 60, in addition to the continuation of frame 51(108), frame 51(109) that contains time stamp "time = 0:00:10." (It will be appreciated that the times indicated by the illustrative time stamps are for illustration purposes only, and that in an actual embodiment the time stamps may have different values and differentials.)

As noted above, the audio information channel device 23 multi-casts a message containing a packet that, in turn, contains the resynchronize command when it receives the notification from the master device 21 to do so. In the example depicted in Packet Sequence A, the packet will be multi-cast when the audio information channel device's digital to analog converter clock time corresponds to "0:00:07." Subsequently, two things happen. In one, aspect, when the master device 21 and slave

devices 22(g) receive the packet that contains the resynchronize command, they will stop playing the audio program that they are playing.

In addition, the audio information channel device 23 will begin transmitting frames containing audio information for the next track, including therewith time stamps immediately following the digital to analog converter clock time at which the packet including the resynchronize command was transmitted. Accordingly, and with further reference to Packet Sequence A, the audio information channel device 23 will multi-cast a message containing packet 61. As indicated above, packet 61 contains, as represented in lines (A5.1) through (A5.3), frames 51(1) through 51(3), which are the first three frames of the next track of the audio program that is to be played. It is also compressed and encoded using the MP3 encoding and compression scheme, and it is accompanied by time stamps "time = 0:00:07," "time = 0:00:08" and "time = 0:00:10." As noted above, the time stamp "time = 0:00:07" corresponds to the clock time at which the audio information channel device 23 multi-casts the resynchronize command, and, when the master device 21 and slave devices 22(g) receive these frames, they would be expected to begin playing them very shortly, if not immediately after the audio information channel device 23 multi-casts the message containing the packet that, in turn, contains the resynchronize command. Packet 61 also includes at least a portion of the next frame, that is, frame 51(4), for that track. In addition, Packet Sequence A depicted above further includes a subsequent packet, namely, packet 62, that contains any necessary continuation of frame 51(4), as well as three subsequent frames. If any additional packets are required for the track, as well as for subsequent tracks, they can be multi-cast in a similar manner.

As further noted above, the resynchronize command can also be used to cancel playing of one or more tracks for which playback has begun. This will be illustrated in connection with Packet Sequence B:

<u>Packet Sequence B</u>

(B1.0) [packet 157]

(B1.1) [continuation of frame 99]

(B1.2) [frame 100, time = 0:00:01, type = mp3 audio]

(B1.3) [frame 101, time = 0:00:02, type = mp3 audio]

(B1.4) [frame 102, time = 0:00:03, type = mp3 audio]

(B2.0) [packet 158]

(B2.1) [continuation of frame 102]

(B2.2) [frame 103, time = 0:00:04, type = mp3 audio]

(B2.3) [frame 104, time = 0:00:05, type = mp3 audio]

(B2.4) [frame 105, time = 0:00:06, type = mp3 audio]

(B3.0) [packet 159]

(B3.1) [continuation of frame 105]

(B3.2) [frame 106, time = 0:00:07, type = mp3 audio]

(B3.3) [track boundary notification]

(B3.4) [Padding, if necessary]

(B4.0) [packet 160]

(B4.1) [frame 1, time = 0:00:08, type = mp3 audio]

(B4.2) [frame 2, time = 0:00:09, type = mp3 audio]

(B4.3) [frame 3, time = 0:00:10, type = mp3 audio]

(B5.0) [packet 161]

(B5.1) [continuation of frame 3]

(B5.2) [frame 4, time = 0:00:11, type = mp3 audio]

(B5.3) [Resynchronize, after packet 159]

(B5.4) [Padding, if necessary]

(B6.0) [packet 162]

(B6.1) [frame 1, time = 0:00:08, type = mp3 audio]

(B6.2) [frame 2, time = 0:00:09, type = mp3 audio]

(B6.3) [frame 3, time = 0:00:10, type = mp3 audio]

(B6.4) [frame 4, time = 0:00:11, type = mp3 audio]

(B7.0) [packet 163]

(B7.1) [continuation of frame 4]

(B7.2) [frame 5, time = 0:00:12, type = mp3 audio]

(B7.3) [frame 6, time = 0:00:13, type = mp3 audio]

(B7.4) [frame 7, time = 0:00:14, type = mp3 audio]

Packet Sequence B comprises a series of seven packets, identified by packet 157 through 163 , that the audio information channel device 23 multi-casts to the members of a synchrony group 20. As with Packet Sequence A, it will be appreciated that the series of packets that the audio information channel device 23 may multi-cast to the synchrony group 20 may include packets prior to the packet 157, and may also include packets after packet 162. Each packet comprises a packet header, which is symbolized by lines (B1.0), (B2.0),...(B7.0) in Packet Sequence B. As in Packet Sequence A, each packet will also generally include information associated with at least a portion of a frame 51(f)along with its associated frame 55(f). As in the packets represented in Packet Sequence A, each packet includes information associated with a plurality of frames. Depending on the lengths of the packets, each packet may contain information associated with a portion of a frame, an entire frame, or multiple frames. Further, as with Packet Sequence A, it is assumed that each packet may contain information associated with multiple frames. In addition, it is assumed that a packet does not necessarily contain information associated with an integral number of frames; in that case, a packet may contain information associated with a portion of a frame, and the next packet will contain the information associated with the rest of a frame.

The structures of the packets represented by Packet Sequence B are similar to those described above in connection with Packet Sequence A, and will not be repeated here. Generally, Packet Sequence B illustratively contains a sequence of packets that represent at least portions of three tracks that may have been selected from, for example, a play list. In particular, packets 157 through 159 represent frames from a portion of one track, packets 160 and 161 represent frames from a second track and packets 162 and 163 represent frames from a third track. The play list indicated that the first, second and third tracks were to be played in that order. With particular reference to Packet Sequence B, it should be noted that line (B3.3) indicates that packet 159 includes an indication that that packet contains the last frame for the track, and line (B3.4) provides for padding to the end of the packet. The first frame of the next track begins in packet 160.

In connection with the use of the resynchronize command to cancel playback of a track, at least a portion of which the audio information channel device 23 has multi-cast to the members of the synchrony group, packet 161, in line (B5.3) represents a resynchronize command that indicates that resynchronization is to occur after packet 159, that is, immediately after the packet that contains the last frame of the first of the three tracks represented by the packets in Packet Sequence B. It should be noted that the resynchronize command is in the packet 161, while the resynchronization is to occur at packet 160, that is, the synchrony group is to not play the track starting with packet

160, but instead is to begin playing the track frames for which begin with the next packet, that is, packet 162. As with Packet Sequence A, in Packet Sequence B the audio information channel device 23, in packet 162 and 163, multi-casts frames whose time stamps indicate that they are to be played when the frames that were multi-cast in packets 160 and 161 were to be played. By use of the resynchronize command and specifying a packet in this manner, the audio information channel device can cancel playback of a track for which playback has not yet begun.

It will be appreciated that the resynchronize command is generally not necessary for cancelling play back of a track that the audio information channel device 23 has not started multi-casting to the synchrony group 20, since the audio information channel device 23 itself can re-order the play list to accommodate the cancellation.

The invention provides a number of advantages. In particular, the invention provides a network audio system in which a number of devices share information can reproduce audio information synchronously, notwithstanding the fact that packets, which may contain digital audio information, transmitted over the network to the various zone players connected thereto may have differing delays and the zone players operate with independent clocks. Moreover, although the invention has been described in connection with audio information, it will be appreciated that the invention will find utility in connection with any type of isochronous information for which synchrony among devices is desired. The system is such that synchrony groups are created and destroyed dynamically, and in such a manner as to avoid requiring a dedicated device as the master device.

It will be appreciated that a number of changes and modifications may be made to the network audio system 10 as described above. For example, although the invention has been described as providing that the audio information channel device 23 provides digital audio information to the members synchrony group 20 that has been encoded using particular types of encoding and compression methodologies, it will be appreciated that the audio information channel device 23 can provide digital audio information to various members of the synchrony group 20 that have been encoded and compressed using different types of encoding and compression methodologies, and, moreover, for which different sampling rates have been used. For example, the audio information channel device 23 may provide digital audio information to the master device 21 and slave devices 22(1) through 22(g_1) using the MP3 methodology at a specified sampling rate, the digital audio information for the same program to slave devices 22(g_1+1) through 22(g_2) using the WAV methodology at one specified sampling rate, and to slave devices 22(g_2+1) through 22(G)

using the WAV methodology at another specified sampling rate. In that case, the audio information channel device 23 can specify the particular encoding and compression methodology that has been used in the encoding type field 57 associated with each frame and the sampling rate in the sampling rate field 58. Moreover, since the encoding and compression type and sampling rate are specified for each frame, the encoding and compression type and sampling rate can be changed from frame to frame. The audio information channel device 23 may use different multi-cast addresses for the different encoding and compression types and sampling rates, but it will be appreciated that that would not be required.

It will be appreciated that two advantages of providing that the encoding and compression methodology and the sampling rate is provided on a frame-by-frame basis, instead of on, for example, a track-by-track basis, is that that would facilitate a slave device joining the synchrony group 20 at a frame mid-track, without requiring, for example, the master device 21 or the audio information channel device 23 to notify it of the encoding and compression methodology or the sampling rate.

Another modification is that, instead of the network communications manager 40 of a member of a synchrony group 20 generating the updated time stamp T^u_F for a digital audio information frame by adding the time differential value ΔT to the time stamp T_F associated with a frame, the network communications manager 40 may instead generate the updated time stamp T^U_F by subtracting the differential time value ΔT from the member's current time T_S as indicated by the member's digital to analog converter clock 34 at the time at which the digital audio information is received. It will be appreciated, however, that there may be variable time delays in processing of messages by the slave device's network communications manager 40, and so it may be preferable to generate the time differential value ΔT using the time stamp T_F provided by the audio information channel device 23.

In addition, instead of the network communications manager 40 of a member of a synchrony group generating an updated time stamp to reflect the difference between the times indicated by the member's digital to analog converter clock and the audio information channel device's digital to analog converter clock, the network communications manager 40 can generate the time differential value ΔT and provide it to the member's playback scheduler 32. In that case, the member's network communications manager 40 can store each digital audio information frame along with the time stamp T_F as received from the master device in the audio information buffer 21. The playback scheduler 32 can utilize the time differential value ΔT, and the time stamps T_F associated with the

digital audio information frames, to determine when the respective digital audio information frames are to be played. In determining when a digital audio information frame is to be played, the playback scheduler can add the time differential value to the time stamp T_F associated with the digital audio frame, and enable the digital audio frame to be coupled to the digital to analog converter 33 when the time indicated by the sum corresponds to the current time as indicated by the slave device's digital to analog converter clock 34. Alternatively, when the member's digital to analog converter clock 34 updates its current time T_S, the playback scheduler can generate an updated current time T'_S by subtracting the differential time value ΔT from the current time T_S, and using the updated current time T'_S to determine when to play a digital audio information frame.

As described above, the members of a synchrony group 20 periodically obtain the audio information channel device's current time value and uses the current time value that it receives from the audio information channel device to periodically update the time differential value ΔT that it uses in updating the time stamps associated with the various frames. It will be appreciated that, if the digital to analog converter clock(s) associated with the member(s) of a synchrony group 20 are ensured to have the same rate as the digital to analog converter clock, a member need only obtain the current time value from the audio information channel device once, at the beginning of playback.

As another alternative, if the zone players are provided with digital to analog converter clock 34 whose time and rate can be set by an element such as the network communications manager 40, when a zone player 11(n) is operating as a member of a synchrony group 20, its network communications manager 40 can use the various types of timing information that it receives from the audio information channel device 23, including the current time information and the playback timing information indicated by the time stamps that are associated with the various frames 51(f) comprising the audio and playback timing information that it receives, to adjust the synchrony group member's digital to analog converter clock's time value and/or the clock rate that it uses for playback. If the clock's time value is to be adjusted, when the synchrony group member's network communications manager 40 initially receives the current time information from the audio information channel device 23 for the synchrony group 20, the network communications manager 40 can set the synchrony group member's digital to analog converter clock 34 to the current time value as indicated by the audio information channel device's current time information. The network communications manager 40 can set the clock 34 to the current time value indicated by the audio information channel device's current time information once, or periodically as it receives the current time information.

Alternatively or in addition, the synchrony group member's network communications manager 40 can use one or both of the current time information and/or the playback timing information in the time stamps associated with the respective frames 51(f) to adjust the clock rate of the clock 34 that it uses for playback. For example, when the synchrony group member's network communications manager 40 receives a frame 51(f_X) having a time stamp having a time value T_{f_X}, it can generate the updated time value $T^U{}_{f_X} = T_{f_X} + \Delta T$ as described above, and store the frame with the time stamp with the updated time value in the audio information buffer 30. In addition, since both the number of samples in a frame and the sampling rate, which determines the rate at which the frame is to be played, are known to the network communications manager 40, it can use that information, along with the updated time value $T^U{}_{F_X}$ that is to be used for frame 51(f_X) to generate an expected updated time value $T^E{}_{f_{X+1}}$ that is expected for the updated time stamp of the next frame 51(f_{X+1}). After the synchrony group member's network communications manager 40 receives the next frame 51(f_{X+1}), it can generate the updated time value $T^U{}_{f_{X+1}}$ and compare that value to the expected updated time value $T^E{}_{f_{X+1}}$. If the two time values do not correspond, or if the difference between them is above a selected threshold level, the clock that is used by the audio information channel device 23 to generate the time stamps is advancing at a different rate than the synchrony group member's digital to analog converter clock 34, and so the network communications manager 40 can adjust the rate of the digital to analog converter clock 34 to approach that of the clock used by the audio information channel device 23 so that the differential time value ΔT is constant. On the other hand, if the two time values do correspond, then the time differential value ΔT is constant, or the difference is below a threshold level, and the network communications manager 40 need not change the clock rate of the digital to analog converter clock 34. It will be appreciated that, if the clock rate is to be adjusted, the rate adjustment can be fixed, or it can vary based on, for example, the difference between the updated time value $T^U{}_{f_{X+1}}$ and the expected updated time value $T^E{}_{f_{X+1}}$.

It will also be appreciated that, if no rate adjustment is performed for one frame 51(f_{X+1}), the synchrony group member's network communications manager 40 can generate an expected updated

time value $T^E{}_{f_{X+2}}$ that is expected for the updated time stamp of the next frame 51(f_{X+2}) using the updated time value $T^U{}_{F_X}$ determined for frame 51(f_X), along with the number of samples in a frame and the sampling rate, and compare the expected updated time value $T^E{}_{f_{X+2}}$ to the updated time value $T^U{}_{f_{X+2}}$ that it generates when it receives frame 51(f_{X+2}). At that point, if the network communications manager 41 determines that two time values do not correspond, or if the difference between them is above a selected threshold level, it can adjust the rate of the digital to analog converter clock 34. Similar operations can be performed if no rate adjustment is performed for several successive frames 51(f_{X+1}), 51(f_{X+2}),.... This will accommodate the possibility that the rate differential between the clock 34 and the clock used by the audio information channel device 23 in generating the time stamps have rates that differ by an amount sufficiently small that it cannot be detected using time stamps of two or more successive frames.

Instead or in addition to adjusting the clock rate as described above, the synchrony group member's network communications manager 40 can perform similar operations in connection with adjusting the clock rate in connection with the current time information that it receives from the audio information channel device 23.

Furthermore, although the network audio system 10 has been described such that the master device 21 of a synchrony group 20 can, in response to control information provided thereto by a user through the user interface module 13, provide a notification to a zone player 11(n) that it is to become a member of its synchrony group 20 as a slave device 22(g), it will be appreciated that the user interface module 13 can provide the notification directly to the zone player 11(n) that is to become a member of the synchrony group 20. In that case, the zone player 11(n) can notify the master device 21 that it is to become a slave device 22(g) in the synchrony group 20, after which the master device 21 can provide information regarding the synchrony group 20, including the multi-cast and unicast addresses of the audio information channel device and other information as described above.

Similarly, although the network audio system 10 has been described such that the master device 21 of a synchrony group 20 can, in response to control information provided thereto by a user through the user interface module 13, provide a command to a slave device 22(g) to enable the slave device 22(g) to adjust its volume, it will be appreciated that the user interface module 13 can provide

control information directly to the slave device 22(g) to enable the slave device 22(g) to adjust its volume.

In addition, although the network audio system 10 has been described such that each frames 51(f) is associated with a frame sequence number (reference field 56, FIG. 4), it will be appreciated that, if the packets described above in connection with Packet Sequence A and Packet Sequence B are provided with packet sequence numbers, the frame sequence numbers need not be provided, since the packet sequence numbers can suffice for defining the frame sequencing.

Furthermore, although the network audio system 10 has been described such that the zone players 11(n) are provided with an audio amplifier 35 for amplifying the analog signal provided by the respective digital to analog converters 33, it will be appreciated that a zone player may be provided that does not itself include an audio amplifier. In that case, the analog signal may be coupled to an external amplifier for amplification as necessary before being provided to the audio reproduction device(s) 15(n)(r). It will be appreciated that a single zone player 11(n) may be provided with multiple audio amplifiers and audio reproduction device interfaces, and, if necessary, multiple digital to analog converters 33, to provide audio programs for corresponding numbers of synchrony groups.

Similarly, although the zone players 11(n) have been described such that they may be connected to one or more audio information sources, it will be appreciated that an audio information source may form part of and be integrated into a zone player 11(n). For example, a zone player may include a compact disk player, cassette tape player, broadcast radio receiver, or the like, that has been integrated into it. In addition, as noted above, an individual zone player 11(n) may be connected to multiple audio information sources and may contemporaneously operate as the audio information channel device 23 for multiple synchrony groups .

In addition, although FIG. 1 shows the network audio system 10 as including one user interface module 13, it will be appreciated that the system 10 may include a plurality of user interface modules. Each user interface module be useful for controlling all of the zone players as described above, or alternatively one or more of the user interface modules may be useful for controlling selected subsets of the zone players.

Moreover, it will be appreciated that, although the invention has been described in connection with audio information, it will be appreciated that the invention will find utility in connection with any type of information for which synchrony among devices connected to a network is desired.

As noted above, while a zone player 11(n) is operating as audio information channel device 23 for a synchrony group 20, when the zone player 11(n)'s audio information source interface 30 or network communications manager 40 stores digital audio information frames based on audio information from an audio information source 14(n)(s) in the audio information buffer 31, it will provide time stamps for the respective frames to schedule them for playback after some time delay after they have been buffered in the audio information buffer 31. The delay is provided so that, for other zone players 11(n'), 11(n"),... that are operating as members of a synchrony group, there will be sufficient time for the audio and playback timing information to be transferred over the network 12 to those other zone players 11(n'), 11(n"),... so that it can be processed and played by them at the appropriate time as described above. The time period that is selected for the time delay may be fixed or variable, and in either case may be based on a number of factors. If the time period selected for the time delay is fixed, it may be based on, for example, factors such as an estimate of the maximum latency in the network 12, the estimated maximum loading of the various components comprising the zone players 11(n), and other estimates as will be appreciated by those skilled in the art.

The time delay may be the same for audio information from all types of audio information sources, and may be constant over the entire period that the synchrony group 20 is playing an audio work. Alternatively, different time delays may be utilized based on various criteria. For example, if the audio information is to be played independently of information associated with other types of media, the time delay may be selected to be relatively long, on the order of a significant fraction of a second, or longer. On the other hand, if the audio information is to be played contemporaneously with, for example, video information, which may be supplied by, for example, a video disk, video tape cassette, over cable, satellite, or broadcast television, which may not be buffered or which may be displayed independently of the network audio system 10, it may be undesirable to provide for such a lengthy delay, since the time delay of the audio playback, in relation to the video display, may be noticeable. In that case, the zone player 11(n) may provide for a much shorter time delay. In one embodiment, the time delay provided for audio information to be played concurrently with video information is selected to be generally on the order of fifty milliseconds, which would barely, if at all, be perceptible to someone viewing the video. Other desirable time delays for information from other types of sources will be apparent to those skilled in the art.

As yet a further possibility, the zone player 11(n), when operating as an audio information channel device 23 for a synchrony group 20, can dynamically determine the time delay based on a number of conditions in the network audio system 10, including, for example, the message transfer

latency in network 12, the loading of microprocessors or other components that are used in the various zone players 11(n'), 11(n''),... that may comprise a synchrony group 20, as well as other factors. For example, if the audio information channel device 23 determines that the latency in the network 12 has increased beyond a selected threshold, the audio information channel device 23 can adjust the delay to increase the likelihood that the members of the synchrony group 20 will be able to receive the packets and process the frames so that they will be able to play them at the appropriate times. Similarly, if the audio information channel device 23 is notified that a member of the synchrony group 20 to which it provides audio information requires additional time to receive and process the frames that it transmits, the audio information channel device 23 can adjust the delay accordingly. It will be appreciated that, to reduce or minimize possible discontinuities in the audio playback by the members of the synchrony group, the audio information channel device 23 can, instead of adjusting the time delay during a particular audio track, adjust the time delay between tracks, during silent periods of a track or otherwise as will be appreciated by those skilled in the art. In addition, the audio information channel device 23 can use conventional audio compression methodologies to facilitate a speeding up and/or slowing down of playback of an audio track while it is in the process of providing additional time delay. Generally, the members of the synchrony group 20 can provide notifications to the audio information channel device 23 if they determine that they will need an additional time delay, and the audio information channel device 23 can adjust the time delay in accordance with the notifications from the members of the synchrony group 20.

It will be appreciated that a system in accordance with the invention can be constructed in whole or in part from special purpose hardware or a general purpose computer system, or any combination thereof, any portion of which may be controlled by a suitable program. Any program may in whole or in part comprise part of or be stored on the system in a conventional manner, or it may in whole or in part be provided in to the system over a network or other mechanism for transferring information in a conventional manner. In addition, it will be appreciated that the system may be operated and/or otherwise controlled by means of information provided by an operator using operator input elements (not shown) which may be connected directly to the system or which may transfer the information to the system over a network or other mechanism for transferring information in a conventional manner.

The foregoing description has been limited to a specific embodiment of this invention. It will be apparent, however, that various variations and modifications may be made to the invention, with the attainment of some or all of the advantages of the invention. It is the object of the appended

claims to cover these and such other variations and modifications as come within the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent is:

CLAIMS

1. A system comprising plurality of devices, one of the devices operating as a task source device and at least one other device operating as a member of a synchrony group,

A. the task source device being configured to distribute a series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to a clock maintained by the task source device, at which the devices comprising the synchrony group are to execute the respective task;

B each member device being configured to:

(i) periodically obtain from the task source device an indication of a current time value indicated by the task source device's clock, and

(ii) determine, from the time stamp associated with each respective task and a time differential value representing a difference between the current time value indicated by the task source device's clock, and a current time value indicated by its respective clock, a time, relative to its respective clock, at which it is to execute the task.

2. A system as defined in claim 1 in which the synchrony group comprises a plurality of member devices.

3. A system as defined in claim 2 in which each device comprising a member of the synchrony group is further configured to execute each task that it receives from the task source device at the determined time, thereby to facilitate execution by them of respective tasks in the series in respective timing relationships relative to the time indicated by the task source device's clock.

4. A system as defined in claim 3 in which the member devices are configured to execute respective tasks in synchrony.

5. A system as defined in claim 2 in which one of the member devices operates as a master device for the synchrony group, any other member devices comprising respective slave devices, the master device being configured to perform at least one type of synchrony group management operation in connection with the member devices comprising the synchrony group.

6. A system as defined in claim 5 further including a user interface module configured to control the master device's performance of said at least one type of synchrony group management operation, the master device being further configured to provide status information relating to the status of the synchrony group to the user interface module.

7. A system as defined in claim 6 in which the status information includes identifications of the devices comprising the synchrony group.

8. A system as defined in claim 6 in which the status information includes an identification of the task currently being executed.

9. A system as defined in claim 5, the system comprising at least one additional device, in which, in one type of synchrony group management operation, the master device is configured to enable the at least one additional device to join the synchrony group as a slave device.

10. A system as defined in claim 9 in which the task source device is configured to distribute tasks to the member devices using a selected multi-cast transmission methodology, the member devices being configured to buffer the tasks until they are to be executed, and further in which, when the at least one additional device joins the synchrony group as a slave device, the task source device is enabled to transmit at least one previously distributed task to the slave device using a selected unicast transmission methodology.

11. A system as defined in claim 5 in which, in at least one type of synchrony group management operation, the master device is configured to enable the task source device to join the synchrony group as a slave device, the task source device continuing to operate as the task source device for the synchrony group.

12. A system as defined in claim 5 in which, in at least one type of synchrony group management operation, the master device is configured to enable a slave device to disengage from the synchrony group, the disengaged slave device thereafter not being a member device in the synchrony group.

13. A system as defined in claim 5 in which, in at least one type of synchrony group management operation, the master device is configured to control the series of tasks to be distributed by the task source device.

14. A system as defined in claim 5 in which, in at least one type of synchrony group management operation, the master device is further configured to control execution by the member devices of the tasks that have been distributed by the task source device.

15. A system as defined in claim 14 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, and further in which in at least one type of synchrony group management operation, the master device is configured to enable the member devices to terminate execution of a task sequence that is currently being executed.

16. A system as defined in claim 15 in which, in the synchrony group management operation enabling the member devices to terminate execution of a task sequence that is currently being executed, the master device enables the task source device to distribute a command to enable the

member devices to terminate execution of the task sequence, the member devices being configured to, after receiving the command, terminate execution of the task sequence.

17. A system as defined in claim 14 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, and further in which at least one type of synchrony group management operation, the master device is configured to enable the member devices to cancel execution of a task sequence that has been previously distributed, but for which execution has not begun.

18. A system as defined in claim 17 in which, in the synchrony group management operation enabling the member devices to cancel execution of a task sequence that has been previously distributed but for which execution has not begun, the master device enables the task source device to distribute a command to enable the member devices to cancel execution of the task sequence, the member devices being configured to, after receiving the command, cancel execution of the task sequence.

19. A system as defined in claim 5 in which, in at least one type of synchrony group management operation, the member device operating as the master device is configured to enable the master device to migrate from one member device to another member device in the synchrony group.

20. A system as defined in claim 5 in which, in at least one type of synchrony group management operation, the master device is configured to enable the task source device to migrate from one device to another device in the system.

21. A system as defined in claim 20 in which

A. the device operating as the task source device is configured to, after being enabled to migrate the task source device to said other device, provide migration information to the other device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices,

B. the other device being configured to, after receiving the migration information,

   i. distribute the series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the task source device, at which the devices comprising the synchrony group are to execute the respective task, and

   ii. notify the members of the synchrony group that it is to thereafter operate as the task source device.

22. A system as defined in claim 21 in which the information respecting the tasks that are to be distributed is a source of streaming information, the other device being configured to, after receiving the migration information, assemble the streaming information into tasks and associate each task with a said time stamp.

23. A system as defined in claim 21 in which the information respecting the tasks that are to be distributed is in a file identified in the migration information, the other device being configured to obtain information from the identified file, assemble the information into tasks and associate each task with a said time stamp.

24.A system as defined in claim 23 in which the information respecting the tasks that are to be distributed begins at an offset, identified in the migration information, into the identified file, the other device being configured to assemble the information from a position in the file associated with the identified offset.

25. A system as defined in claim 23 in which the information respecting the tasks that are to be distributed is in a series of files identified in the migration information, the other device being configured to obtain information from successive files in the series assemble the information into tasks and associate each task with as said time stamp.

26. A system as defined in claim 1 in which the task source device is further configured to distribute the tasks using a selected multi-cast message transmission methodology.

27. A system as defined in claim 1 in which the task source device is configured to provide, associated with at least one task, a time stamp indicating a task execution time later than the time currently indicated by the clock maintained by the task source device.

28. A system as defined in claim 27 in which the task source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be executed by the member devices at the time indicated by the time stamp.

29. A system as defined in claim 28 in which the task source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be distributed to the member devices for execution at the time indicated by the time stamp

30. A system as defined in claim 27 in which task source device is configured to obtain information associated with the tasks from at least two types of information sources, the task source device being further configured to select, for each task the delay interval between the time indicated by the time

stamp and the current time based on the information source type that is associated with the respective task.

31. A system as defined in claim 1 in which at least one member device is further configured to adjust its clock rate in relation to a clock rate value maintained by the task source device's clock.

32. A system as defined in claim 31 in which the at least one member device is configured to adjust its clock rate in relation to time stamps associated with respective ones of the tasks received from the task source device.

33. A system as defined in claim 1 in which at least one other device operates as a task source device configured to distribute tasks to a second synchrony group, the device operating as the task source device for the first synchrony group also operating as a member device of a second synchrony group.

34. A system as defined in claim 1 in which at least one member device comprises:

A. a task receiving module configured to receive the series of tasks,

B. a current time retrieval module configured to obtain, from the task source device, the current time value as indicated by the task source's clock;

C. an execution time determination module configured to determine, from the time stamp associated with each respective task and a time differential value representing a difference between the current time value obtained by the current time retrieval module and a current time value indicated by a clock maintained by the device, a time, relative to the member device's respective clock at which the task is to be executed; and

D. a task execution module configured to execute each respective task at the time determined by the execution time determination module.

35. A system as defined in claim 34 further including a control module for controlling execution of commands received by said interface module.

36. A system as defined in claim 35 in which the at least one member device further comprises a buffer configured to buffer tasks that the task receiving module receives from the task source device until they are to be executed, the task execution module being configured to execute the buffered tasks at the times determined by the execution time determination module.

37. A system as defined in claim 36 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the interface module being further configured to receive task execution control commands for controlling task execution, the control module being configured to, in response to receipt of at least one task execution control command for controlling task execution, enable the task execution module to terminate execution of a task

sequence currently being executed, being configured to not execute subsequent tasks in the task sequence that have been buffered.

38. A system as defined in claim 37 in which the control module is configured to enable the task execution module to resume execution of at least one task associated with a subsequent task sequence at a time determined by the execution time determination module.

39. A system as defined in claim 36 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the interface module being further configured to receive task execution control commands for controlling task execution, the control module being configured to, in response to receipt of at least one task execution control command to cancel execution of a task sequence for which at least one task has been buffered but for which execution has not begun, enable the task execution module to not execute tasks from that task sequence that have been buffered.

40. A system as defined in claim 39 in which the control module is configured to enable the task execution module to resume execution of at least one task associated with a task sequence subsequent to the task sequence for which at least one task has been buffered but for which execution has not begun.

41. A system as defined in claim 34 in which the member device includes:

A. a migration information receiving module configured to receive migration information from the task source device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group, and

B. a migration control module configure to, after the migration information has been received.,

   i. distribute the series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the task source device, at which the devices comprising the synchrony group are to execute the respective task, and

   ii. notify the members of the synchrony group that it is to thereafter operate as the task source device.

42. A system as defined in claim 41 in which the information respecting the tasks that are to be distributed is a source of streaming information, the migration control module being configured to, after the migration information has been received, assembling the streaming information into tasks and associate each task with a said time stamp.

43. A system as defined in claim 41 in which the information respecting the tasks that are to be distributed is in a file identified in the migration information, the migration control module being configured to obtain information from the identified file, assemble the information into tasks and associate each task with a said time stamp.

44.A system as defined in claim 43 in which the information respecting the tasks that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control module being configured to assemble the information from a position in the file associated with the identified offset.

45. A system as defined in claim 43 in which the information respecting the tasks that are to be distributed is in a series of files identified in the migration information, the migration control module being configured to obtain information from successive files in the series assemble the information into tasks and associate each task with as said time stamp.

46. A system as defined in claim 34 in which the member device further includes a clock rate adjustment module configured to adjust the member device's clock rate in relation to a clock rate value maintained by the task source device's clock.

47. A system as defined in claim 46 in which the clock rate adjustment module is configured to adjust the clock rate in relation to time stamps associated with respective ones of the tasks received from the task source device.

48. A system as defined in claim 1 in which the task source device comprises:

A. a task acquisition module configured to obtain respective ones of the tasks;

B. a task execution time determination module configured to determine a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission module configured to transmit the series of tasks to said at least one other device; and

D. an execution control command generation module configured to, in response to a predetermined event, enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to modify the execution sequence of the tasks transmitted thereto.

49. A system as defined in claim 48 in which the task transmission module is configured to utilize a selected multi-cast transmission methodology.

50. A system as defined in claim 48 in which the predetermined event comprises input indicia provided by an operator.

51. A system as defined in claim 50 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to control execution of at least one task in relation to the time the predetermined event occurs.

52. A system as defined in claim 51 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to terminate execution of a task that it is currently executing and/or to not execute at least one task that is to be executed subsequent to the predetermined event.

53. A system as defined in claim 51 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation module being configured to, in response to said predetermined event,

(i) enable the task transmission module to insert into the series of tasks transmitted by the task transmission module, a command enabling the at least one other device to terminate execution of the currently executing task and/or to not execute at least one subsequent task, if any, in the task sequence including the currently executing task; and

(ii) enable

(a) the task execution time determination module to provide that time stamps associated with tasks of task sequences subsequent to the task sequence currently being executed will reflect the termination and/or non-execution of tasks from the task sequence of the task that is currently being executed, and

(b) the task transmission module to transmit the tasks of the subsequent task sequences to the at least one other device.

54. A system as defined in claim 53 in which the task transmission module is configured to insert a command to enable the at least one other device to not execute all tasks in the task sequence subsequent to the terminated and/or non-executed task.

55. A system as defined in claim 48 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert

into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to control execution of a task in relation to the task's position in the series of tasks.

56. A system as defined in claim 55 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to cancel execution of a task in relation to the task's position in the series of tasks.

57. A system as defined in claim 55 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted task in relation to the task's position in the series of tasks.

58. A system as defined in claim 57 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted task, in relation to the task's position in the series of tasks, for which execution has not begun.

59. A system as defined in claim 55 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation module being configured to, in response to said predetermined event,

(i) enable the task transmission module to insert into the series of tasks transmitted by the task transmission module, a command enabling the at least one other device to cancel execution of a task sequence for which execution has not begun; and

(ii) enable

  (a) the task execution time determination module to provide that time stamps associated with tasks of task sequences subsequent to the task sequence whose execution was cancelled will reflect the cancellation, and

  (b) the task transmission module to transmit the tasks of the subsequent task sequences to the at least one other device.

60 A system as defined in claim 1 in which the task source device comprises:

A. a task acquisition module configured to obtain respective ones of the tasks;

B. a task execution time determination module configured to determine a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission module configured to transmit the series of tasks to said at least one other device; and

D. a task source device migration control module configured to, in response to a predetermined event, provide migration information to another device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group.

61. A system as defined in claim 60 in which the task source device is configured to provide, associated with at least one task, a time stamp indicating a task execution time later than the time currently indicated by the clock maintained by the task source device.

62. A system as defined in claim 61 in which the task source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be executed by the member devices at the time indicated by the time stamp.

63. A system as defined in claim 62 in which the task source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be distributed to the member devices for execution at the time indicated by the time stamp

64. A system as defined in claim 62 in which task source device is configured to obtain information associated with the tasks from at least two types of information sources, the task source device being further configured to select, for each task the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective task.

65. A device for executing a series of tasks provided by a task source at times specified by the task source in relation to a clock maintained by the task source, the device comprising

A. an interface module configured to receive the series of tasks, each task being associated with a time stamp, each time stamp indicating a time value relative to a time indicated a clock maintained by the task source, at which the device is to execute the respective task;

B. a current time retrieval module configured to obtain, from the task source, a current time value as indicated by the task source's clock;

C. an execution time determination module configured to determine, from the time stamp associated with each respective task and a time differential value representing a difference between the current time value obtained by the current time retrieval module and a current time value indicated by a clock maintained by the device, a time, relative to the device's respective clock, at which the task is to be executed; and

D. a task execution module configured to execute each respective task at the time determined by the execution time determination module.

66. A device as defined in claim 65 further including a control module for controlling execution of commands received by said interface module.

67. A device as defined in claim 65 further comprising a buffer configured to buffer tasks that the interface module has received until they are to be executed, the task execution module being configured to execute the buffered tasks at the times determined by the execution time determination module.

68. A device as defined in claim 67 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the interface module being further configured to receive task execution control commands for controlling task execution, the control module being configured to, in response to receipt of at least one task execution control command for controlling task execution, enable the task execution module to terminate execution of a task sequence currently being executed, being configured to not execute subsequent tasks in the task sequence that have been buffered.

69. A device as defined in claim 68 in which the control module is configured to enable the task execution module to resume execution of at least one task associated with a subsequent task sequence at a time determined by the execution time determination module.

70. A device as defined in claim 69 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the interface module being further configured to receive task execution control commands for controlling task execution, the control module being configured to, in response to receipt of at least one task execution control command to cancel execution of a task sequence for which at least one task has been buffered but for which execution has not begun, enable the task execution module to not execute tasks from that task sequence that have been buffered.

71. A device as defined in claim 70 in which the control module is configured to enable the task execution module to resume execution of at least one task associated with a task sequence subsequent to the task sequence for which at least one task has been buffered but for which execution has not begun.

72. A device as defined in claim 66, the control module being configured to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive tasks for execution by the task execution module.

73. A device as defined in claim 72 in which the control module is configured to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive tasks currently being transmitted using a selected multi-cast transmission methodology, and further to retrieve at least one previously distributed task using a selected unicast transmission methodology.

74. A device as defined in claim 65 in which the control module is configured to, in receipt of a command to disengage from a synchrony group, disable the interface module from receiving tasks and the task execution module from executing previously received tasks that have not yet been executed.

75. A device as defined in claim 65 further comprising a user interface module interface module configured to receive control information from a user interface module, the control module being configured to enable selected operations to be performed in response to the control information.

76. A device as defined in claim 75 in which, in response to control information to enable another device to become a member of the device's synchrony group, the control module enables the interface module to transmit a command to the other device to enable the other device to become a member of the synchrony group.

77. A device as defined in claim 75 in which, in response to control information to enable another device that is a member of the device's synchrony group to disengage from the synchrony group, the control module enables the interface module to transmit a command to the other device to enable the other device to disengage from the synchrony group.

78. A device as defined in claim 75 in which, in response to control information to enable the task source to begin operating, the control module performs selected operations to enable the task source to begin operating.

79. A device as defined in claim 78, the device also operating as the task source, the device including a task generator module configured to, under control of the control module, obtain information from which the tasks are to be generated and generate the tasks.

80. A device as defined in claim 79 in which the interface module is further configured to transmit the tasks to at least one other device.

81. A device as defined in claim 79 in which the device is not the task source, the control module being configured to enable the interface module to transmit a command to enable the task source to operate.

82. A device as defined in claim 81 in which tasks are divided into a series of task sequences, and, in response to receipt of control information enabling execution of a sequence of tasks currently being executed to be terminated , the control module is configured to enable the interface module to transmit a command to enable the task source to insert a resynchronize command in the series of tasks associated with the task sequence to enable termination of execution of the task sequence.

83. A device as defined in claim 81 in which tasks are divided into a series of task sequences, and, in response to receipt of control information enabling execution of a sequence of tasks at least a portion of which have been received, but which are not being executed, the control module is configured to enable the interface module to transmit a command to enable the task source to insert a resynchronize command in the series of commands to disable execution of the task sequence.

84. A device as defined in claim 75 in which the control module is configured to enable the user interface module interface module to transmit status information to the user interface module.

85. A device as defined in claim 84 in which the status information includes the execution status of at least one task.

86. A device as defined in claim 65 further including:

A. a migration information receiving module configured to receive migration information from the task source device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group, and

B. a migration control module configured to, after the migration information has been received.,

   i. distribute the series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the task source device, at which the devices comprising the synchrony group are to execute the respective task, and

ii. notify the members of the synchrony group that it is to thereafter operate as the task source device.

87. A device as defined in claim 86 in which the information respecting the tasks that are to be distributed is a source of streaming information, the migration control module being configured to, after the migration information has been received, assembling the streaming information into tasks and associate each task with a said time stamp.

88. A device as defined in claim 86 in which the information respecting the tasks that are to be distributed is in a file identified in the migration information, the migration control module being configured to obtain information from the identified file, assemble the information into tasks and associate each task with a said time stamp.

89. A device as defined in claim 88 in which the information respecting the tasks that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control module being configured to assemble the information from a position in the file associated with the identified offset.

90. A device as defined in claim 89 in which the information respecting the tasks that are to be distributed is in a series of files identified in the migration information, the migration control module being configured to obtain information from successive files in the series assemble the information into tasks and associate each task with as said time stamp.

91. A device as defined in claim 65 further including a clock rate adjustment module configured to adjust the member device's clock rate in relation to a clock rate value maintained by the task source device's clock.

92. A task source device for distributing a series of tasks for execution by at least one other device at respective execution times, the task source device comprising:

A. a task acquisition module configured to obtain respective ones of the tasks;

B. a task execution time determination module configured to determine a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission module configured to transmit the series of tasks to said at least one other device; and

D. an execution control command generation module configured to, in response to a predetermined event, enable the task transmission module to insert into the series of tasks

transmitted by the task transmission module a command to enable the at least one other device to modify the execution sequence of the tasks transmitted thereto.

93. A task source device as defined in claim 92 in which the task transmission module is configured to utilize a selected multi-cast transmission methodology.

94. A task source device as defined in claim 92 in which the predetermined event comprises input indicia provided by an operator.

95. A task source device as defined in claim 94 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to control execution of at least one task in relation to the time the predetermined event occurs.

96. A task source device as defined in claim 95 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to terminate execution of a task that it is currently executing and/or to not execute at least one task that is to be executed subsequent to the predetermined event.

97. A task source device as defined in claim 95 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation module being configured to, in response to said predetermined event,

(i) enable the task transmission module to insert into the series of tasks transmitted by the task transmission module, a command enabling the at least one other device to terminate execution of the currently executing task and/or to not execute at least one subsequent task, if any, in the task sequence including the currently executing task; and

(ii) enable

(a) the task execution time determination module to provide that time stamps associated with tasks of task sequences subsequent to the task sequence currently being executed will reflect the termination and/or non-execution of tasks from the task sequence of the task that is currently being executed, and

(b) the task transmission module to transmit the tasks of the subsequent task sequences to the at least one other device.

98. A task source device as defined in claim 97 in which the task transmission module is configured to insert a command to enable the at least one other device to not execute all tasks in the task sequence subsequent to the terminated and/or non-executed task.

99. A task source device as defined in claim 92 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to control execution of a task in relation to the task's position in the series of tasks.

100. A task source device as defined in claim 99 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to cancel execution of a task in relation to the task's position in the series of tasks.

101. A task source device as defined in claim 99 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted task in relation to the task's position in the series of tasks.

102. A task source device as defined in claim 101 in which, in response to said predetermined event, the execution control command generation module is configured to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted task, in relation to the task's position in the series of tasks, for which execution has not begun.

103. A task source device as defined in claim 99 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation module being configured to, in response to said predetermined event,

(i) enable the task transmission module to insert into the series of tasks transmitted by the task transmission module, a command enabling the at least one other device to cancel execution of a task sequence for which execution has not begun; and

(ii) enable

(a) the task execution time determination module to provide that time stamps associated with tasks of task sequences subsequent to the task sequence whose execution was cancelled will reflect the cancellation, and

(b) the task transmission module to transmit the tasks of the subsequent task sequences to the at least one other device.

104. A task source device for distributing a series of tasks for execution by at least one other device at respective execution times, the task source device comprising:

A. a task acquisition module configured to obtain respective ones of the tasks;

B. a task execution time determination module configured to determine a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time, the task execution time determination module being configured to provide, associated with at least one task, a time stamp indicating a task execution time later than the time currently indicated by a clock maintained by the task source device; and

C. a task transmission module configured to transmit the series of tasks to said at least one other device.

105. A system as defined in claim 104 in which the task source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be executed by the member devices at the time indicated by the time stamp.

106. A system as defined in claim 105 in which the task source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be distributed to the member devices for execution at the time indicated by the time stamp

107. A system as defined in claim 104 in which task source device is configured to obtain information associated with the tasks from at least two types of information sources, the task source device being further configured to select, for each task the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective task.

108. A task source device for distributing a series of tasks for execution by at least one other device, the task source device comprising:

A. a task acquisition module configured to obtain respective ones of the tasks;

B. a task execution time determination module configured to determine a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission module configured to transmit the series of tasks to said at least one other device; and

D. a task source device migration control module configured to, in response to a predetermined event, provide migration information to another device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group.

109. A method of operating a system comprising plurality of devices, one of the devices operating as a task source device and at least one other device operating as a member of a synchrony group,

A. the task source device being enabled to distribute a series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to a clock maintained by the task source device, at which the devices comprising the synchrony group are to execute the respective task;

B each member device being enabled to:

(i) periodically obtain from the task source device an indication of a current time value indicated by the task source device's clock, and

(ii) determine, from the time stamp associated with each respective task and a time differential value representing a difference between the current time value indicated by the task source device's clock, and a current time value indicated by its respective clock, a time, relative to its respective clock, at which it is to execute the task.

110. A method as defined in claim 109 in which the synchrony group comprises a plurality of member devices.

111. A method as defined in claim 110 in which each device comprising a member of the synchrony group is further enabled to execute each task that it receives from the task source device at the determined time, thereby to facilitate execution by them of respective tasks in the series in respective timing relationships relative to the time indicated by the task source device's clock.

112. A method as defined in claim 111 in which the member devices are enabled to execute respective tasks in synchrony.

113. A method as defined in claim 110 in which one of the member devices operates as a master device for the synchrony group, any other member devices comprising respective slave devices, the master device being enabled to perform at least one type of synchrony group management operation in connection with the member devices comprising the synchrony group.

114. A method as defined in claim 113 further including a user interface module enabled to control the master device's performance of said at least one type of synchrony group management operation, the master device being further enabled to provide status information relating to the status of the synchrony group to the user interface module.

115. A method as defined in claim 114 in which the status information includes identifications of the devices comprising the synchrony group.

116. A method as defined in claim 114 in which the status information includes an identification of the task currently being executed.

117. A method as defined in claim 113, the method comprising at least one additional device, in which, in one type of synchrony group management operation, the master device is enabled to enable the at least one additional device to join the synchrony group as a slave device.

118. A method as defined in claim 117 in which the task source device is enabled to distribute tasks to the member devices using a selected multi-cast transmission methodology, the member devices being enabled to buffer the tasks until they are to be executed, and further in which, when the at least one additional device joins the synchrony group as a slave device, the task source device is enabled to transmit at least one previously distributed task to the slave device using a selected unicast transmission methodology.

119. A method as defined in claim 113 in which, in at least one type of synchrony group management operation, the master device is enabled to enable the task source device to join the synchrony group as a slave device, the task source device continuing to operate as the task source device for the synchrony group.

120. A method as defined in claim 113 in which, in at least one type of synchrony group management operation, the master device is enabled to enable a slave device to disengage from the synchrony group, the disengaged slave device thereafter not being a member device in the synchrony group.

121. A method as defined in claim 113 in which, in at least one type of synchrony group management operation, the master device is enabled to control the series of tasks to be distributed by the task source device.

122. A method as defined in claim 113 in which, in at least one type of synchrony group management operation, the master device is further enabled to control execution by the member devices of the tasks that have been distributed by the task source device.

123. A method as defined in claim 122 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, and further in which in at least one type of synchrony group management operation, the master device is enabled to enable the member devices to terminate execution of a task sequence that is currently being executed.

124. A method as defined in claim 123 in which, in the synchrony group management operation enabling the member devices to terminate execution of a task sequence that is currently being executed, the master device enables the task source device to distribute a command to enable the member devices to terminate execution of the task sequence, the member devices being enabled to, after receiving the command, terminating execution of the task sequence.

125. A method as defined in claim 122 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, and further in which at least one type of synchrony group management operation, the master device is enabled to enable the member devices to cancel execution of a task sequence that has been previously distributed, but for which execution has not begun.

126. A method as defined in claim 125 in which, in the synchrony group management operation enabling the member devices to cancel execution of a task sequence that has been previously distributed but for which execution has not begun, the master device enables the task source device to distribute a command to enable the member devices to cancel execution of the task sequence, the member devices being enabled to, after receiving the command, cancel execution of the task sequence.

127. A method as defined in claim 113 in which, in at least one type of synchrony group management operation, the member device operating as the master device is enabled to enable the master device to migrate from one member device to another member device in the synchrony group.

128. A method as defined in claim 113 in which, in at least one type of synchrony group management operation, the master device is enabled to perform the step of enabling the task source device to migrate from one device to another device in the system.

129. A method as defined in claim 128 in which

A. the device operating as the task source device is enable to perform the step of, after being enabled to migrate the task source device to said other device, providing migration

information to the other device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices,

B. the other device is enabled to, after receiving the migration information, perform the steps of

i. distributing the series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the task source device, at which the devices comprising the synchrony group are to execute the respective task, and

ii. notifying the members of the synchrony group that it is to thereafter operate as the task source device.

130. A method as defined in claim 129 in which the information respecting the tasks that are to be distributed is a source of streaming information, the other device being enabled to, after receiving the migration information, perform the steps of assembling the streaming information into tasks and associating each task with a said time stamp.

131. A method as defined in claim 129 in which the information respecting the tasks that are to be distributed is in a file identified in the migration information, the other device being enabled to perform the steps of obtaining information from the identified file, assembling the information into tasks and associating each task with a said time stamp.

132.A method as defined in claim 131 in which the information respecting the tasks that are to be distributed begins at an offset, identified in the migration information, into the identified file, the other device being enabled to perform the step of assembling the information from a position in the file associated with the identified offset.

133. A method as defined in claim 131 in which the information respecting the tasks that are to be distributed is in a series of files identified in the migration information, the other device being enabled to perform the step of obtaining information from successive files in the series assemble the information into tasks and associate each task with as said time stamp.

134. A method as defined in claim 109 in which the task source device is further enabled to distribute the tasks using a selected multi-cast message transmission methodology.

135. A method as defined in claim 109 in which the task source device is enabled to perform the step of providing, provide, associated with at least one task, a time stamp indicating a task execution time later than the time currently indicated by the clock maintained by the task source device.

136. A method as defined in claim 135 in which the task source device is enabled to perform the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be executed by the member devices at the time indicated by the time stamp.

137. A method as defined in claim 136 in which the task source device is enabled to perform the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be distributed to the member devices for execution at the time indicated by the time stamp

138. A method as defined in claim 135 in which task source device is enabled to perform the steps of obtaining information associated with the tasks from at least two types of information sources, and selecting, for each task, the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective task.

139. A method as defined in claim 109 in which at least one member device is further enabled to perform the step of adjusting its clock rate in relation to a clock rate value maintained by the task source device's clock.

140. A method as defined in claim 139 in which the at least one member device is enabled to perform the step of adjusting its clock rate in relation to time stamps associated with respective ones of the tasks received from the task source device.

141. A method as defined in claim 109 in which at least one other device operates as a task source device enabled to distribute tasks to a second synchrony group, the device operating as the task source device for the first synchrony group also operating as a member device of a second synchrony group.

142. A method as defined in claim 109 including, within a member device,

A. a task receiving step of receiving the series of tasks,

B. a current time retrieval step of obtaining, from the task source device, the current time value as indicated by the task source's clock;

C. an execution time determination step of determining, from the time stamp associated with each respective task and a time differential value representing a difference between the current time value obtained during the current time retrieval step and a current time value indicated by a clock maintained by the device, a time, relative to the member device's respective clock at which the task is to be executed; and

D. a task execution step of executing each respective task at the time determined during the execution time determination step.

143. A method as defined in claim 142 further including a control step for controlling execution of commands received during the task receiving step

144. A method as defined in claim 143 in which the at least one member device further comprises a buffer configured to buffer tasks received from the task source device during the task receiving step until they are to be executed, the task execution step including the step of executing the buffered tasks at the times determined during the execution time determination step.

145. A method as defined in claim 144 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the task receiving step being further enabled to receive task execution control commands for controlling task execution, the control step including the step of, in response to receipt of at least one task execution control command for controlling task execution, controlling the task execution step to terminate execution of a task sequence currently being executed, and further to not execute subsequent tasks in the task sequence that have been buffered.

146. A method as defined in claim 145 in which the control step includes the step of enabling the task execution step to resume execution of at least one task associated with a subsequent task sequence at a time determined during the execution time determination step.

147. A method as defined in claim 144 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the task receiving step including the step of receiving task execution control commands for controlling task execution, the control step including the step of, in response to receipt of at least one task execution control command to cancel execution of a task sequence for which at least one task has been buffered but for which execution has not begun, providing that tasks from that task sequence that have been buffered not be executed.

148. A method as defined in claim 147 in which the control step includes the step of enabling execution to resume of at least one task associated with a task sequence subsequent to the task sequence for which at least one task has been buffered but for which execution has not begun.

149. A method as defined in claim 142 in which the member device performs:

A. migration information receiving step of receiving migration information from the task source device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group, and

B. a migration control step of, after the migration information has been received.,

i. distributing the series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the task source device, at which the devices comprising the synchrony group are to execute the respective task, and

ii. notifying the members of the synchrony group that it is to thereafter operate as the task source device.

150. A method as defined in claim 149 in which the information respecting the tasks that are to be distributed is a source of streaming information, the migration control step includes the steps of, after the migration information has been received, assembling the streaming information into tasks and associating each task with a said time stamp.

151. A method as defined in claim 149 in which the information respecting the tasks that are to be distributed is in a file identified in the migration information, the migration control step including the steps of obtaining information from the identified file, assembling the information into tasks and associating each task with a said time stamp.

152. A method as defined in claim 151 in which the information respecting the tasks that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control step including the step of assembling the information from a position in the file associated with the identified offset.

153. A method as defined in claim 151 in which the information respecting the tasks that are to be distributed is in a series of files identified in the migration information, the migration control step including the steps of obtaining information from successive files in the series assemble the information into tasks and associating each task with as said time stamp.

154. A method as defined in claim 142 in which the member device is further enabled to perform a clock rate adjustment step including the step of adjusting the member device's clock rate in relation to a clock rate value maintained by the task source device's clock.

155. A method as defined in claim 154 in which the clock rate adjustment step includes the step of determining adjust the clock rate in relation to time stamps associated with respective ones of the tasks received from the task source device.

156. A method as defined in claim 109 including, within a task source device,

A. a task acquisition step of obtaining respective ones of the tasks;

B. a task execution time determination step of determining a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission step of transmitting the series of tasks to said at least one other device; and

D. an execution control command generation step of, in response to a predetermined event and during the task transmission step, the insertion into the series of tasks transmitted by the task transmission module of a command to enable the at least one other device to modify the execution sequence of the tasks transmitted thereto.

157. A method as defined in claim 156 in which the task transmission step includes the step of utilizing a selected multi-cast transmission methodology.

158. A method as defined in claim 156 in which the predetermined event includes the step of receiving input indicia provided by an operator.

159. A method as defined in claim 158 in which the execution control command generation step includes the step of enabling, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to control execution of at least one task in relation to the time the predetermined event occurs.

160. A method as defined in claim 159 in which, the execution control command generation step includes the step of enabling, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to terminate execution of a task that it is currently executing and/or to not execute at least one task that is to be executed subsequent to the predetermined event.

161. A method as defined in claim 159 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation step including the steps of, in response to said predetermined event,

(i) enabling during the task transmission step the insertion, into the series of tasks, of a command enabling the at least one other device to terminate execution of the currently executing task and/or to not execute at least one subsequent task, if any, in the task sequence including the currently executing task; and

(ii) enabling

(a) during the task execution time determination step, that time stamps associated with tasks of task sequences subsequent to the task sequence currently being executed will

reflect the termination and/or non-execution of tasks from the task sequence of the task that is currently being executed, and

(b) during the task transmission step, the transmission of the tasks of the subsequent task sequences to the at least one other device.

162. A method as defined in claim 161 in which the task transmission step includes the step of inserting a command into the task sequence to enable the at least one other device to not execute all tasks in the task sequence subsequent to the terminated and/or non-executed task.

163. A method as defined in claim 159 in which the execution control command generation step include the step of enabling, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to control execution of a task in relation to the task's position in the series of tasks.

164. A method as defined in claim 163 in which the execution control command generation step includes the step of, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to cancel execution of a task in relation to the task's position in the series of tasks.

165. A method as defined in claim 163 in which the execution control command generation step includes the step of enabling, in response to said predetermined event and during the task transmission step, the inserting into the series of tasks of a command to enable the at least one other device to cancel execution of a previously-transmitted task in relation to the task's position in the series of tasks.

166. A method as defined in claim 165 in which, the execution control command generation step includes the step of, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to cancel execution of a previously-transmitted task, in relation to the task's position in the series of tasks, for which execution has not begun.

167. A method as defined in claim 163 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation step including the steps of, in response to said predetermined event,

(i) enabling, during the task transmission step, the insertion, into the series of tasks, of a command enabling the at least one other device to cancel execution of a task sequence for which execution has not begun; and

(ii) enabling

(a) during the task execution time determination step, that time stamps associated with tasks of task sequences subsequent to the task sequence whose execution was cancelled will reflect the cancellation, and

(b) during the task transmission step, the transmission of the tasks of the subsequent task sequences to the at least one other device.

168. A method as defined in claim 109 in which the task source device is enabled to perform

A. a task acquisition step of obtaining respective ones of the tasks;

B. a task execution time determination step of determining a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission step of transmitting the series of tasks to said at least one other device; and

D. a task source device migration control step of, in response to a predetermined event, providing migration information to another device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group.

169. A method as defined in claim 109 in which the task source device is enabled to perform the step of providing, associated with at least one task, a time stamp indicating a task execution time later than the time currently indicated by the clock maintained by the task source device.

170. A method as defined in claim 169 in which the task source device is enabled to perform the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be executed by the member devices at the time indicated by the time stamp.

171. A method as defined in claim 170 in which the task source device is enabled to perform the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be distributed to the member devices for execution at the time indicated by the time stamp

172. A method as defined in claim 169 in which task source device is enabled to perform the step of obtaining information associated with the tasks from at least two types of information sources, and selecting for each task the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective task.

173. A method of operating a device for executing a series of tasks provided by a task source at times specified by the task source in relation to a clock maintained by the task source, the method including

A. a task receiving step of receiving the series of tasks, each task being associated with a time stamp, each time stamp indicating a time value relative to a time indicated a clock maintained by the task source, at which the device is to execute the respective task;

B. a current time retrieval module of obtaining, from the task source, a current time value as indicated by the task source's clock;

C. an execution time determination step of determining, from the time stamp associated with each respective task and a time differential value representing a difference between the current time value obtained during the current time retrieval step and a current time value indicated by a clock maintained by the device, a time, relative to the device's respective clock, at which the task is to be executed; and

D. a task execution module step of executing each respective task at the time determined during the execution time determination step.

174. A method as defined in claim 173 further including a control step for controlling execution of commands received by said interface module.

175. A method as defined in claim 174 further comprising a buffer configured to buffer tasks that have been received until they are to be executed, the task execution step including the step of executing the buffered tasks at the times determined during the execution time determination step.

176. A method as defined in claim 175 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the interface module being further enabled to receive task execution control commands for controlling task execution, the control module being enabled to, in response to receipt of at least one task execution control command for controlling task execution, enable the task execution module to terminate execution of a task sequence currently being executed, being enabled to not execute subsequent tasks in the task sequence that have been buffered.

177. A method as defined in claim 176 in which the control step includes the step of enabling task execution to resume execution with at least one task associated with a subsequent task sequence at a time determined during the execution time determination step.

178. A method as defined in claim 175 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the task receiving step including

the step of receiving task execution control commands for controlling task execution, the control step, in response to receipt of at least one task execution control command to cancel execution of a task sequence for which at least one task has been buffered but for which execution has not begun, including the step of providing that task execution not including execution of tasks from that task sequence that have been buffered.

179. A method as defined in claim 178 in which the control step includes the step of enabling task execution to resume execution of at least one task associated with a task sequence subsequent to the task sequence for which at least one task has been buffered but for which execution has not begun.

180. A method as defined in claim 173, the control step including the step of, in response to receipt of a command to become a member of a synchrony group, receiving tasks during the task receiving step for execution during the task execution step.

181. A method as defined in claim 180 in which the control step includes the step of, in response to receipt of a command to become a member of a synchrony group, enable the task receiving step to include the step of receiving tasks currently being transmitted using a selected multi-cast transmission methodology, and further to include the step of retrieving at least one previously distributed task using a selected unicast transmission methodology.

182. A method as defined in claim 173 in which the control step includes the steps of, in receipt of a command to disengage from a synchrony group, disabling the receipt of tasks and the execution of previously-received tasks that have not yet been executed.

183. A method as defined in claim 173 further comprising a user interface module control information receiving step of receiving control information from a user interface module, the control step including the step of enabling selected operations to be performed in response to the control information.

184 A method as defined in claim 183 in which, in response to control information to enable another device to become a member of the device's synchrony group, the control step includes the step of transmitting a command to the other device to enable the other device to become a member of the synchrony group.

185. A method as defined in claim 183 in which, in response to control information to enable another device that is a member of the device's synchrony group to disengage from the synchrony group, the control module enables the interface module to transmit a command to the other device to enable the other device to disengage from the synchrony group.

186. A method as defined in claim 185 in which, in response to control information to enable the task source to begin operating, the control step includes the step of performing selected operations to enable the task source to begin operating.

187. A method as defined in claim 186, the device also operating as the task source, the method including a task generation steps of, under control of the control step, obtaining information from which the tasks are to be generated and generating the tasks.

188. A method as defined in claim 187 further including the step of transmitting the tasks to at least one other device.

189. A method as defined in claim 187 in which the device is not the task source, the control step including the step of enabling the transmission of a command to enable the task source to operate.

190. A method as defined in claim 189 in which tasks are divided into a series of task sequences, and, in response to receipt of control information enabling execution of a sequence of tasks currently being executed to be terminated , the control step includes the step of transmitting a command to enable the task source to insert a resynchronize command in the series of tasks associated with the task sequence to enable termination of execution of the task sequence.

191. A method as defined in claim 189 in which tasks are divided into a series of task sequences, and, in response to receipt of control information enabling execution of a sequence of tasks at least a portion of which have been received, but which are not being executed, the control step includes the step of transmitting a command to enable the task source to insert a resynchronize command in the series of commands to disable execution of the task sequence.

192. A method as defined in claim 174 in which the control step includes the step of transmitting status information to the user interface module.

193. A method as defined in claim 192 in which the status information includes the execution status of at least one task.

194. A method as defined in claim 173 in which the member device performs:

A. migration information receiving step of receiving migration information from the task source device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group, and

B. a migration control step of, after the migration information has been received.,

   i. distributing the series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to the timing information that it receives

from the device operating as the task source device, at which the devices comprising the synchrony group are to execute the respective task, and

ii. notifying the members of the synchrony group that it is to thereafter operate as the task source device.

195. A method as defined in claim 194 in which the information respecting the tasks that are to be distributed is a source of streaming information, the migration control step includes the steps of, after the migration information has been received, assembling the streaming information into tasks and associating each task with a said time stamp.

196. A method as defined in claim 194 in which the information respecting the tasks that are to be distributed is in a file identified in the migration information, the migration control step including the steps of obtaining information from the identified file, assembling the information into tasks and associating each task with a said time stamp.

197. A method as defined in claim 196 in which the information respecting the tasks that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control step including the step of assembling the information from a position in the file associated with the identified offset.

198. A method as defined in claim 196 in which the information respecting the tasks that are to be distributed is in a series of files identified in the migration information, the migration control step including the steps of obtaining information from successive files in the series assemble the information into tasks and associating each task with as said time stamp.

199. A method as defined in claim 173 in which the member device is further enabled to perform a clock rate adjustment step including the step of adjusting the member device's clock rate in relation to a clock rate value maintained by the task source device's clock.

200. A method as defined in claim 199 in which the clock rate adjustment step includes the step of determining adjust the clock rate in relation to time stamps associated with respective ones of the tasks received from the task source device.

201. A method of operating a device for distributing a series of tasks for execution by at least one other device at respective execution times, the method comprising:

A. a task acquisition step of obtaining respective ones of the tasks;

B. a task execution time determination step of determining a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission step of transmitting the series of tasks to said at least one other device; and

D. an execution control command generation step of, in response to a predetermined event and during the task transmission step, the insertion into the series of tasks transmitted by the task transmission module of a command to enable the at least one other device to modify the execution sequence of the tasks transmitted thereto.

202. A method as defined in claim 201 in which the task transmission step includes the step of utilizing a selected multi-cast transmission methodology.

203. A method as defined in claim 201 in which the predetermined event includes the step of receiving input indicia provided by an operator.

204. A method as defined in claim 203 in which the execution control command generation step includes the step of enabling, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to control execution of at least one task in relation to the time the predetermined event occurs.

205. A method as defined in claim 204 in which, the execution control command generation step includes the step of enabling, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to terminate execution of a task that it is currently executing and/or to not execute at least one task that is to be executed subsequent to the predetermined event.

206. A method as defined in claim 203 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation step including the steps of, in response to said predetermined event,

(i) enabling during the task transmission step the insertion, into the series of tasks, of a command enabling the at least one other device to terminate execution of the currently executing task and/or to not execute at least one subsequent task, if any, in the task sequence including the currently executing task; and

(ii) enabling

(a) during the task execution time determination step, that time stamps associated with tasks of task sequences subsequent to the task sequence currently being executed will reflect the termination and/or non-execution of tasks from the task sequence of the task that is currently being executed, and

(b) during the task transmission step, the transmission of the tasks of the subsequent task sequences to the at least one other device.

207. A method as defined in claim 206 in which the task transmission step includes the step of inserting a command into the task sequence to enable the at least one other device to not execute all tasks in the task sequence subsequent to the terminated and/or non-executed task.

208. A method as defined in claim 201 in which the execution control command generation step include the step of enabling, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to control execution of a task in relation to the task's position in the series of tasks.

209. A method as defined in claim 208 in which the execution control command generation step includes the step of, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to cancel execution of a task in relation to the task's position in the series of tasks.

210. A method as defined in claim 208 in which the execution control command generation step includes the step of enabling, in response to said predetermined event and during the task transmission step, the inserting into the series of tasks of a command to enable the at least one other device to cancel execution of a previously-transmitted task in relation to the task's position in the series of tasks.

211. A method as defined in claim 210 in which, the execution control command generation step includes the step of, in response to said predetermined event and during the task transmission step, the insertion into the series of tasks of a command to enable the at least one other device to cancel execution of a previously-transmitted task, in relation to the task's position in the series of tasks, for which execution has not begun.

212. A method as defined in claim 208 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation step including the steps of, in response to said predetermined event,

(i) enabling, during the task transmission step, the insertion, into the series of tasks, of a command enabling the at least one other device to cancel execution of a task sequence for which execution has not begun; and

(ii) enabling

(a) during the task execution time determination step, that time stamps associated with tasks of task sequences subsequent to the task sequence whose execution was cancelled will reflect the cancellation, and

(b) during the task transmission step, the transmission of the tasks of the subsequent task sequences to the at least one other device.

213. A method of operating a device for distributing a series of tasks for execution by at least one other device at respective execution times, the method comprising:

A. a task acquisition step of obtaining respective ones of the tasks;

B. a task execution time determination step of determining a time at which each respective task is to be executed, and to associating the respective task with a time stamp indicating its execution time, the task execution time determination step including the step of providing, associated with at least one task, a time stamp indicating a task execution time later than the time currently indicated by a clock maintained by the task source device; and

C. a task transmission step of transmitting the series of tasks to said at least one other device.

214. A method as defined in claim 213 in which the task execution time determination step includes the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the device can be executed by at least one other device at the time indicated by the time stamp.

215. A method as defined in claim 214 in which the task execution time determination step includes the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the device can be distributed to other devices over a network for execution by the other devices at the time indicated by the time stamp.

216. A method as defined in claim 213 in which task acquisition step includes the step of obtaining information associated with the tasks from at least two types of information sources, the task execution time determination step including the step of selecting, for each task the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective task.

217. A method of operating a device for distributing a series of tasks for execution by at least one other device, the method comprising:

A. a task acquisition module configured to obtain respective ones of the tasks;

B. a task execution time determination module configured to determine a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission module configured to transmit the series of tasks to said at least one other device; and

D. a task source device migration control module configured to, in response to a predetermined event, provide migration information to another device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group.

218. A computer program product for use in connection with a computer to provide a device for executing a series of tasks provided by a task source at times specified by the task source in relation to a clock maintained by the task source, the computer program product comprising a computer-readable medium having encoded thereon:

A. an interface module configured to enable the computer to receive the series of tasks, each task being associated with a time stamp, each time stamp indicating a time value relative to a time indicated a clock maintained by the task source, at which the device is to execute the respective task;

B. a current time retrieval module configured to enable the computer to obtain, from the task source, a current time value as indicated by the task source's clock;

C. an execution time determination module configured to enable the computer to determine, from the time stamp associated with each respective task and a time differential value representing a difference between the current time value obtained by the current time retrieval module and a current time value indicated by a clock maintained by the device, a time, relative to the device's respective clock, at which the task is to be executed; and

D. a task execution module configured to enable the computer to execute each respective task at the time determined by the execution time determination module.

219. A computer program product as defined in claim 218 further including a control module for enabling said computer to control execution of commands received by the interface module.

220. A computer program product as defined in claim 219 further comprising a buffer module configured to enable the computer to buffer tasks received by the interface module until they are to

be executed, the task execution module being configured to enable the computer to execute the buffered tasks at the times determined by the execution time determination module.

221. A computer program product as defined in claim 220 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the interface module being further configured to enable the computer to receive task execution control commands for controlling task execution, the control module being configured to enable the computer to, in response to receipt of at least one task execution control command for controlling task execution, enable the task execution module to terminate execution of a task sequence currently being executed, being configured to enable the computer to not execute subsequent tasks in the task sequence that have been buffered.

222. A computer program product as defined in claim 220 in which the control module is configured to enable the computer to enable the task execution module to resume execution of at least one task associated with a subsequent task sequence at a time determined by the execution time determination module.

223. A computer program product as defined in claim 219 in which the series of tasks includes a series of task sequences with each task sequence including a subset of the series of tasks, the interface module being further configured to enable the computer to receive task execution control commands for controlling task execution, the control module being configured to enable the computer to, in response to receipt of at least one task execution control command to cancel execution of a task sequence for which at least one task has been buffered but for which execution has not begun, enable the task execution module to not execute tasks from that task sequence that have been buffered.

224. A computer program product as defined in claim 223 in which the control module is configured to enable the computer to enable the task execution module to resume execution of at least one task associated with a task sequence subsequent to the task sequence for which at least one task has been buffered but for which execution has not begun.

225. A computer program product as defined in claim 219, the control module being configured to enable the computer to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive tasks for execution by the task execution module.

226. A computer program product as defined in claim 225 in which the control module is configured to enable the computer to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive tasks currently being transmitted using a selected

multi-cast transmission methodology, and further to retrieve at least one previously distributed task using a selected unicast transmission methodology.

227. A computer program product as defined in claim 219 in which the control module is configured to enable the computer to, in receipt of a command to disengage from a synchrony group, disable the interface module from receiving tasks and the task execution module from executing previously received tasks that have not yet been executed.

228. A computer program product as defined in claim 219 further comprising a user interface module interface module configured to receive control information from a user interface module, the control module being configured to enable the computer to enable selected operations to be performed in response to the control information.

229. A computer program product as defined in claim 228 in which, in response to control information to enable another device to become a member of the device's synchrony group, the control module enables the interface module to transmit a command to the other device to enable the other device to become a member of the synchrony group.

230. A computer program product as defined in claim 228 in which, in response to control information to enable another device that is a member of the device's synchrony group to disengage from the synchrony group, the control module enables the interface module to transmit a command to the other device to enable the other device to disengage from the synchrony group.

231. A computer program product as defined in claim 228 in which, in response to control information to enable the task source to begin operating, the control module performs selected operations to enable the task source to begin operating.

232. A computer program product as defined in claim 231, the device also operating as the task source, the device including a task generator module configured to enable the computer to, under control of the control module, obtain information from which the tasks are to be generated and generate the tasks.

233. A computer program product as defined in claim 232 in which the interface module is further configured to enable the computer to transmit the tasks to at least one other device.

234. A computer program product as defined in claim 232 in which the device is not the task source, the control module being configured to enable the computer to enable the interface module to transmit a command to enable the task source to operate.

235. A computer program product as defined in claim 234 in which tasks are divided into a series of task sequences, and, in response to receipt of control information enabling execution of a sequence

of tasks currently being executed to be terminated , the control module is configured to enable the computer to enable the interface module to transmit a command to enable the task source to insert a resynchronize command in the series of tasks associated with the task sequence to enable termination of execution of the task sequence.

236. A computer program product as defined in claim 234 in which tasks are divided into a series of task sequences, and, in response to receipt of control information enabling execution of a sequence of tasks at least a portion of which have been received, but which are not being executed, the control module is configured to enable the computer to enable the interface module to transmit a command to enable the task source to insert a resynchronize command in the series of commands to disable execution of the task sequence.

237. A computer program product as defined in claim 228 in which the control module is configured to enable the computer to enable the user interface module interface module to transmit status information to the user interface module.

238. A computer program product as defined in claim 237 in which the status information includes the execution status of at least one task.

239. A computer program product as defined in claim 218 further including:

A. a migration information receiving module configured to enable the computer to receive migration information from the task source device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group, and

B. a migration control module configured to enable the computer to, after the migration information has been received.,

   i. distribute the series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the task source device, at which the devices comprising the synchrony group are to execute the respective task, and

   ii. notify the members of the synchrony group that it is to thereafter operate as the task source device.

240. A computer program product as defined in claim 239 in which the information respecting the tasks that are to be distributed is a source of streaming information, the migration control module

being configured to enable the computer to, after the migration information has been received, assemble the streaming information into tasks and associate each task with a said time stamp.

241. A computer program product as defined in claim 239 in which the information respecting the tasks that are to be distributed is in a file identified in the migration information, the migration control module being configured to enable the computer to obtain information from the identified file, assemble the information into tasks and associate each task with a said time stamp.

242. A computer program product as defined in claim 241 in which the information respecting the tasks that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control module being configured to enable the computer to assemble the information from a position in the file associated with the identified offset.

243. A computer program product as defined in claim 241 in which the information respecting the tasks that are to be distributed is in a series of files identified in the migration information, the migration control module being configured to enable the computer to obtain information from successive files in the series assemble the information into tasks and associate each task with as said time stamp.

244. A computer program product as defined in claim 218 further including a clock rate adjustment module configured to enable the computer to adjust the member device's clock rate in relation to a clock rate value maintained by the task source device's clock.

245. A computer program product as defined in claim 244 in which the clock rate adjustment module is configured to enable the computer to adjust the clock rate in relation to time stamps associated with respective ones of the tasks received from the task source device.

246. A computer program product for use in connection with a computer to provide a task source device for distributing a series of tasks for execution by at least one other device at respective execution times, the computer program product comprising a computer readable medium having encoded thereon:

A. a task acquisition module configured to enable the computer to obtain respective ones of the tasks;

B. a task execution time determination module configured to enable the computer to determine a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission module configured to enable the computer to transmit the series of tasks to said at least one other device; and

D. an execution control command generation module configured to enable the computer to , in response to a predetermined event, enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to modify the execution sequence of the tasks transmitted thereto.

247. A computer program product as defined in claim 246 which the task transmission module is configured to enable the computer to utilize a selected multi-cast transmission methodology.

248. A computer program product as defined in claim 246 in which the predetermined event comprises input indicia provided by an operator.

249. A computer program product as defined in claim 246 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to control execution of at least one task in relation to the time the predetermined event occurs.

250. A computer program product as defined in claim 249 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to terminate execution of a task that it is currently executing and/or to not execute at least one task that is to be executed subsequent to the predetermined event.

251. A computer program product as defined in claim 249 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation module being configured to enable the computer to , in response to said predetermined event,

(i) enable the task transmission module to insert into the series of tasks transmitted by the task transmission module, a command enabling the at least one other device to terminate execution of the currently executing task and/or to not execute at least one subsequent task, if any, in the task sequence including the currently executing task; and

(ii) enable

(a) the task execution time determination module to provide that time stamps associated with tasks of task sequences subsequent to the task sequence currently being executed will reflect the termination and/or non-execution of tasks from the task sequence of the task that is currently being executed, and

(b) the task transmission module to transmit the tasks of the subsequent task sequences to the at least one other device.

252. A computer program product as defined in claim 251 in which the task transmission module is configured to enable the computer to insert a command to enable the at least one other device to not execute all tasks in the task sequence subsequent to the terminated and/or non-executed task.

253. A computer program product as defined in claim 246 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to control execution of a task in relation to the task's position in the series of tasks.

254. A computer program product as defined in claim 253 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to cancel execution of a task in relation to the task's position in the series of tasks.

255. A computer program product as defined in claim 254 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted task in relation to the task's position in the series of tasks.

256. A computer program product as defined in claim 255 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the task transmission module to insert into the series of tasks transmitted by the task transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted task, in relation to the task's position in the series of tasks, for which execution has not begun.

257. A computer program product as defined in claim 253 in which the series of tasks includes a series of task sequences with each task sequence including a sub-set of the series of tasks, the execution control command generation module being configured to enable the computer to , in response to said predetermined event,

(i) enable the task transmission module to insert into the series of tasks transmitted by the task transmission module, a command enabling the at least one other device to cancel execution of a task sequence for which execution has not begun; and

(ii) enable

(a) the task execution time determination module to provide that time stamps associated with tasks of task sequences subsequent to the task sequence whose execution was cancelled will reflect the cancellation, and

(b) the task transmission module to transmit the tasks of the subsequent task sequences to the at least one other device.

258. A computer program product for use in connection with a computer to provide a task source device for distributing a series of tasks for execution by at least one other device at respective execution times, the computer program product comprising a computer readable medium having encoded thereon:

A. a task acquisition module configured to enable the computer to obtain respective ones of the tasks;

B. a task execution time determination module configured to enable the computer to determine a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time, the task execution time determination module being configured to enable the computer to provide, associated with at least one task, a time stamp indicating a task execution time later than the time currently indicated by a clock maintained by the task source device; and

C. a task transmission module configured to enable the computer to transmit the series of tasks to said at least one other device.

259. A computer program product as defined in claim 258 in which the task execution time determination module is configured to enable the computer to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one task distributed by the task source device can be executed by the member devices at the time indicated by the time stamp.

260. A computer program product as defined in claim 259 in which the task execution time determination module is configured to enable the computer to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least

one task distributed by the task source device can be distributed to the member devices for execution at the time indicated by the time stamp.

261. A computer program product as defined in claim 258 in which task acquisition module is configured to enable the computer to obtain information associated with the tasks from at least two types of information sources, the task execution time determination module being configured to enable the computer to select, for each task the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective task.

262. A computer program product for use in connection with a computer to provide a task source device for distributing a series of tasks for execution by at least one other device, the computer program product comprising a computer readable medium having encoded thereon:

A. a task acquisition module configured to enable the computer to obtain respective ones of the tasks;

B. a task execution time determination module configured to enable the computer to determine a time at which each respective task is to be executed, and to associate the respective task with a time stamp indicating its execution time;

C. a task transmission module configured to enable the computer to transmit the series of tasks to said at least one other device; and

D. a task source device migration control module configured to enable the computer to, in response to a predetermined event, provide migration information to another device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group.

263. A system comprising a plurality of devices,

A one device being enabled to operate as a task source device, the task source device being enabled to transmit a series of tasks to the other devices, each task being associated with execution time information;

B. at least one device being enabled to operate as a task execution device, the task execution device being enabled to receive the series of tasks from the network and executing each respective task at a time in relation to the timing information associated with the respective task; and

C. one device being enabled to operate as a control device, the control device being enabled to control operations of the task source device and the task execution device.

264. A system as defined in claim 263 in which the device that is enabled to operate as the control device is also enabled to operate as a task execution device.

265. A system as defined in claim 263 in which the device that is enabled to operate as the control device is also enabled to operate as the task source device.

266. A system as defined in claim 263 in which the device that is enabled to operate as the task source device is also enabled to operate as a task execution device.

267. A system for facilitating processing of data by device operating as a member of a synchrony group, synchronously with a clock maintained by a data source device that provides the data to the synchrony group,

A. the data source device being configured to divide the data into a series of frames for distribution to the synchrony group, each frame being associated with a time stamp indicating a time, relative to a clock maintained by the data source device, at which the devices comprising the synchrony group are to process the frame;

B each member device in the synchrony group being configured to:

(i) periodically obtain from the data source device an indication of a current time value indicated by the data source device's clock;

(ii) receive the series of frames from the data source device;

(iii) determine, from the time stamp associated with each respective frame and a time differential value representing a difference between the current time value indicated by the data source device's clock, a current time value indicated by the member device's respective clock, a time, relative to the member device's respective clock, at which the member device is to process the frame; and

(iv) process the respective frame at the determined time.

268. A system as defined in claim 267 in which at least one frame comprises audio data, each member device, while processing each frame, producing sound represented by the respective frame.

269. A system as defined in claim 267 comprising a plurality of member devices, the member devices processing each frame synchronously in relation to the clock maintained by the data source device so that they all produce sound represented by the respective frame synchronously.

270. A system as defined in claim 269 in which the data source device is configured to provide time stamps for at least two successive frames so that the member devices will play them with a selected time interval therebetween.

271. A system as defined in claim 270 in which the time interval is zero.

272. A system as defined in claim 269 in which one of the member devices operates as a master device for the synchrony group, any other member devices comprising respective slave devices, the master device being configured to perform at least one type of synchrony group management operation in connection with the member devices comprising the synchrony group.

273. A system as defined in claim 272 in which the master device is further configured to provide status information relating to the status of the synchrony group to the user interface module.

274. A system as defined in claim 273 in which the status information includes identifications of the devices comprising the synchrony group.

275. A system as defined in claim 273 in which each frame is associated with a frame sequence, each frame sequence comprising at least one frame, the frame or frames comprising each frame sequence being associated with an audio track, each audio track being associated with an identifier, the status information including the identification of the audio track currently being played.

276. A system as defined in claim 272, the system comprising at least one additional device, in which, in one type of synchrony group management operation, the master device is configured to enable the at least one additional device to join the synchrony group as a slave device.

277. A system as defined in claim 276 in which the data source device is configured to distribute frames to the member devices using a selected multi-cast transmission methodology, the member devices being configured to buffer the frames until they are to be played, and further in which, when the at least one additional device joins the synchrony group as a slave device, the data source device is enabled to transmit at least one previously distributed frame to the slave device using a selected unicast transmission methodology.

278. A system as defined in claim 272 in which, in at least one type of synchrony group management operation, the master device is configured to enable the data source device to join the synchrony group as a slave device, the data source device continuing to operate as the data source device for the synchrony group.

279. A system as defined in claim 272 in which, in at least one type of synchrony group management operation, the master device is configured to enable a slave device to disengage from the synchrony

group, the disengaged slave device thereafter not being a member device in the synchrony group and not playing frames distributed by the data source device.

280. A system as defined in claim 272 in which, in at least one type of synchrony group management operation, the master device is configured to control the series of frames to be distributed by the data source device.

281. A system as defined in claim 280 in which each frame is associated with a frame sequence, each frame sequence comprising at least one frame, the frame or frames comprising each frame sequence being associated with an audio track, the master device being configured to control the frames to be distributed by the data source device on a track-by-track basis.

282. A system as defined in claim 281 in which, in at least one type of synchrony group management operation, the master device is further configured to control playback by the member devices of the frames associated with the respective audio tracks that have been distributed by the data source device in response to control information from the user interface module.

283. A system as defined in claim 282 in which, in response to control information from the user interface module to facilitate control of playback by the member devices, the master device is configured to enable the data source device to distribute a playback control command to the member devices.

284. A system as defined in claim 283 in which a playback control command enables the member devices to terminate playback of a track that is currently being played back.

285. A system as defined in claim 284 in which the playback control command enables the member devices to terminate playback of a track with a frame subsequent to a frame currently being played.

286. A system as defined in claim 283 in which the playback control command enables the member devices to cancel playback of a track at least one of whose frames has been previously distributed, but for which playback has not begun.

287. A system as defined in claim 272 in which, in at least one type of synchrony group management operation, the member device operating as the master device is configured to enable the master device to migrate from itself to another member device in the synchrony group.

288. A system as defined in claim 272 in which, in at least one type of synchrony group management operation, the master device is configured to enable the data source device to migrate from one device to another device in the system.

289. A system as defined in claim 288 in which

A. the device operating as the data source device is configured to, after being enabled to migrate the data source device to said other device, provide migration information to the other device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices,

B. the other device being configured to, after receiving the migration information,

   i. distribute the series of frames to the synchrony group, each frame being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the data source device, at which the devices comprising the synchrony group are to execute the respective frame, and

   ii. notify the members of the synchrony group that it is to thereafter operate as the data source device.

290. A system as defined in claim 289 in which the information respecting the frames that are to be distributed is a source of streaming information, the other device being configured to, after receiving the migration information, assemble the streaming information into frames and associate each frame with a said time stamp.

291. A system as defined in claim 289 in which the information respecting the frames that are to be distributed is in a file identified in the migration information, the other device being configured to obtain information from the identified file, assemble the information into frames and associate each frame with a said time stamp.

292.A system as defined in claim 291 in which the information respecting the frames that are to be distributed begins at an offset, identified in the migration information, into the identified file, the other device being configured to assemble the information from a position in the file associated with the identified offset.

293. A system as defined in claim 291 in which the information respecting the frames that are to be distributed is in a series of files identified in the migration information, the other device being configured to obtain information from successive files in the series assemble the information into frames and associate each frame with as said time stamp.

294. A system as defined in claim 267 in which the data source device is further configured to distribute the frames using a selected multi-cast message transmission methodology.

295. A system as defined in claim 267 in which the data source device is configured to provide, associated with at least one frame, a time stamp indicating a frame execution time later than the time currently indicated by the clock maintained by the data source device.

296. A system as defined in claim 295 in which the data source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be executed by the member devices at the time indicated by the time stamp.

297. A system as defined in claim 296 in which the data source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be distributed to the member devices for execution at the time indicated by the time stamp

298. A system as defined in claim 295 in which data source device is configured to obtain information associated with the frames from at least two types of information sources, the data source device being further configured to select, for each frame the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective frame.

299. A system as defined in claim 267 in which at least one member device is further configured to adjust its clock rate in relation to a clock rate value maintained by the data source device's clock.

300. A system as defined in claim 299 in which the at least one member device is configured to adjust its clock rate in relation to time stamps associated with respective ones of the frames received from the data source device.

301. A system as defined in claim 267 in which at least one other device operates as a data source device configured to distribute frames to a second synchrony group, the device operating as the data source device for the first synchrony group also operating as a member device of a second synchrony group.

302. A system as defined in claim 267 in which at least one member device comprises:

A. an interface module configured to receive the series of frames, each frame being associated with a time stamp, each time stamp indicating a time value relative to a time indicated a clock maintained by the data source, at which the device is to process the respective frame;

B. a current time retrieval module configured to obtain, from the data source, a current time value as indicated by the data source's clock;

C. an processing time determination module configured to determine, from the time stamp associated with each respective frame and a time differential value representing a difference between the current time value obtained by the current time retrieval module and a current time value indicated by a clock maintained by the device, a time, relative to the device's respective clock, at which the frame is to be processed; and

D. a frame processing module configured to process each respective frame at the time determined by the processing time determination module.

303. A system as defined in claim 302 in which the at least one frame comprises audio data, each member device, while processing each frame, producing a signal representing sound represented by the respective frame.

304. A system as defined in claim 302 further including a control module for controlling execution of commands received by said interface module.

305. A device as defined in claim 304 further comprising a buffer configured to buffer frames that the interface module has received until they are to be processed, the frame processing module being configured to process the buffered frames at the times determined by the processing time determination module.

306. A system as defined in claim 305 in which the each frame is associated with a track, each track including at least one frame, the interface module being further configured to receive playback control commands for controlling processing of tracks, the control module being configured to execute at least one playback control command controlling track processing.

307. A system as defined in claim 306 in which at least one type of playback control command enables the control module to, in turn, enable the frame processing module to terminate playback of a track that is currently being played back.

308. A system as defined in claim 307 in which the playback control command enables the control module to terminate playback of a track with a frame subsequent to a frame currently being played.

309. A system as defined in claim 306 in which the playback control command enables the control module to cancel playback of a track at least one of whose frames has been previously distributed, but for which playback has not begun.

310. A system as defined in claim 306 in which the control module is configured to enable the frame processing module to resume processing of at least one frame associated with a subsequent track at a time determined by the processing time determination module.

311. A system as defined in claim 302 in which the member device includes:

A. a migration information receiving module configured to receive migration information from the task source device, the migration information including a source for information respecting the tasks to be distributed, timing information relative to the clock maintained by the task source device and identifications of the member devices of the synchrony group, and

B. a migration control module configure to, after the migration information has been received.,

i. distribute the series of tasks to the synchrony group, each task being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the task source device, at which the devices comprising the synchrony group are to execute the respective task, and

ii. notify the members of the synchrony group that it is to thereafter operate as the task source device.

312. A system as defined in claim 311 in which the information respecting the frames that are to be distributed is a source of streaming information, the migration control module being configured to, after the migration information has been received, assembling the streaming information into frames and associate each frame with a said time stamp.

313. A system as defined in claim 311 in which the information respecting the frames that are to be distributed is in a file identified in the migration information, the migration control module being configured to obtain information from the identified file, assemble the information into frames and associate each frame with a said time stamp.

314. A system as defined in claim 313 in which the information respecting the frames that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control module being configured to assemble the information from a position in the file associated with the identified offset.

315. A system as defined in claim 313 in which the information respecting the frames that are to be distributed is in a series of files identified in the migration information, the migration control module being configured to obtain information from successive files in the series assemble the information into frames and associate each frame with as said time stamp.

316. A system as defined in claim 302 in which the member device further includes a clock rate adjustment module configured to adjust the member device's clock rate in relation to a clock rate value maintained by the data source device's clock.

317. A system as defined in claim 316 in which the clock rate adjustment module is configured to adjust the clock rate in relation to time stamps associated with respective ones of the frames received from the data source device.

318. A system as defined in claim 267 in which the data source device comprises:

A. a frame acquisition module configured to obtain respective ones of the frames;

B. a frame execution time determination module configured to determine a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission module configured to transmit the series of frames to said at least one other device; and

D. an execution control command generation module configured to, in response to a predetermined event, enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to modify the execution sequence of the frames transmitted thereto.

319. A system as defined in claim 318 in which at least one frame comprises audio data, each member device, while processing each frame, producing generating a signal representing sound represented by the respective frame.

320. A system as defined in claim 318 in which the frame transmission module is configured to utilize a selected multi-cast transmission methodology.

321. A system as defined in claim 318 in which the predetermined event comprises input indicia provided by an operator.

322. A system as defined in claim 321 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to control execution of at least one frame in relation to the time the predetermined event occurs.

323. A system as defined in claim 322 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to terminate execution of a frame that it is currently executing and/or to not execute at least one frame that is to be executed subsequent to the predetermined event.

324. A data source device as defined in claim 323 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation module being configured to, in response to said predetermined event,

(i) enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module, a command enabling the at least one other device to terminate execution of the currently executing frame and/or to not execute at least one subsequent frame, if any, in the frame sequence including the currently executing frame; and

(ii) enable

(a) the frame execution time determination module to provide that time stamps associated with frames of frame sequences subsequent to the frame sequence currently being executed will reflect the termination and/or non-execution of frames from the frame sequence of the frame that is currently being executed, and

(b) the frame transmission module to transmit the frames of the subsequent frame sequences to the at least one other device.

325. A system as defined in claim 324 in which the frame transmission module is configured to insert a command to enable the at least one other device to not execute all frames in the frame sequence subsequent to the terminated and/or non-executed frame.

326. A system as defined in claim 267 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to control execution of a frame in relation to the frame's position in the series of frames.

327. A system as defined in claim 326 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to cancel execution of a frame in relation to the frame's position in the series of frames.

328. A system as defined in claim 326 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted frame in relation to the frame's position in the series of frames.

329. A system as defined in claim 328 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted frame, in relation to the frame's position in the series of frames, for which execution has not begun.

330. A system as defined in claim 327 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation module being configured to, in response to said predetermined event,

(i) enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module, a command enabling the at least one other device to cancel execution of a frame sequence for which execution has not begun; and

(ii) enable

  (a) the frame execution time determination module to provide that time stamps associated with frames of frame sequences subsequent to the frame sequence whose execution was cancelled will reflect the cancellation, and

  (b) the frame transmission module to transmit the frames of the subsequent frame sequences to the at least one other device.

331. A system as defined in claim 267 in which the data source device comprises:

A. a frame acquisition module configured to obtain respective ones of the frames;

B. a frame execution time determination module configured to determine a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission module configured to transmit the series of frames to said at least one other device; and

D. a data source device migration control module configured to, in response to a predetermined event, provide migration information to another device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices of the synchrony group.

332. A system as defined in claim 331 in which the data source device is configured to provide, associated with at least one frame, a time stamp indicating a frame execution time later than the time currently indicated by the clock maintained by the data source device.

333. A system as defined in claim 332 in which the data source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be executed by the member devices at the time indicated by the time stamp.

334. A system as defined in claim 333 in which the data source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be distributed to the member devices for execution at the time indicated by the time stamp

335. A system as defined in claim 333 in which data source device is configured to obtain information associated with the frames from at least two types of information sources, the data source device being further configured to select, for each frame the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective frame.

336. A device for processing a series of frames of data provided by a data source at times specified by the data source in relation to a clock maintained by the data source, the device comprising

A. an interface module configured to receive the series of frames, each frame being associated with a time stamp, each time stamp indicating a time value relative to a time indicated a clock maintained by the data source, at which the device is to process the respective frame;

B. a current time retrieval module configured to obtain, from the data source, a current time value as indicated by the data source's clock;

C. an processing time determination module configured to determine, from the time stamp associated with each respective frame and a time differential value representing a difference between the current time value obtained by the current time retrieval module and a current time value indicated by a clock maintained by the device, a time, relative to the device's respective clock, at which the frame is to be processed; and

D. a frame processing module configured to process each respective frame at the time determined by the processing time determination module.

337. A device as defined in claim 336 in which the frame comprises audio data, each member device, while processing each frame, producing a signal representing sound represented by the respective frame.

338. A device as defined in claim 336 further including a control module for controlling execution of commands received by said interface module.

333. A system as defined in claim 332 in which the data source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be executed by the member devices at the time indicated by the time stamp.

334. A system as defined in claim 333 in which the data source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be distributed to the member devices for execution at the time indicated by the time stamp

335. A system as defined in claim 333 in which data source device is configured to obtain information associated with the frames from at least two types of information sources, the data source device being further configured to select, for each frame the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective frame.

336. A device for processing a series of frames of data provided by a data source at times specified by the data source in relation to a clock maintained by the data source, the device comprising

A. an interface module configured to receive the series of frames, each frame being associated with a time stamp, each time stamp indicating a time value relative to a time indicated a clock maintained by the data source, at which the device is to process the respective frame;

B. a current time retrieval module configured to obtain, from the data source, a current time value as indicated by the data source's clock;

C. an processing time determination module configured to determine, from the time stamp associated with each respective frame and a time differential value representing a difference between the current time value obtained by the current time retrieval module and a current time value indicated by a clock maintained by the device, a time, relative to the device's respective clock, at which the frame is to be processed; and

D. a frame processing module configured to process each respective frame at the time determined by the processing time determination module.

337. A device as defined in claim 336 in which the frame comprises audio data, each member device, while processing each frame, producing a signal representing sound represented by the respective frame.

338. A device as defined in claim 336 further including a control module for controlling execution of commands received by said interface module.

339. A device as defined in claim 336 further comprising a buffer configured to buffer frames that the interface module has received until they are to be processed, the frame processing module being configured to process the buffered frames at the times determined by the processing time determination module.

340. A device as defined in claim 339 in which the each frame is associated with a track, each track including at least one frame, the interface module being further configured to receive playback control commands for controlling processing of tracks, the control module being configured to execute at least one playback control command controlling track processing.

341. A device as defined in claim 340 in which at least one type of playback control command enables the control module to, in turn, enable the frame processing module to terminate playback of a track that is currently being played back.

342. A device as defined in claim 341 in which the playback control command enables the control module to terminate playback of a track with a frame subsequent to a frame currently being played.

343. A device as defined in claim 340 in which the playback control command enables the control module to cancel playback of a track at least one of whose frames has been previously distributed, but for which playback has not begun.

344. A device as defined in claim 340 in which the control module is configured to enable the frame processing module to resume processing of at least one frame associated with a subsequent track at a time determined by the processing time determination module.

345. A device as defined in claim 338, the control module being configured to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive frames for processing by the frame processing module.

346. A device as defined in claim 345 in which the control module is configured to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive frames currently being transmitted using a selected multi-cast transmission methodology, and further to retrieve at least one previously distributed frame using a selected unicast transmission methodology.

347. A device as defined in claim 346 in which the control module is configured to, in receipt of a command to disengage from a synchrony group, disable the interface module from receiving frames and the frame processing module from processing previously received frames that have not yet been processed.

348. A device as defined in claim 336 further comprising a user interface module interface module configured to receive control information from a user interface module, the control module being configured to enable selected operations to be performed in response to the control information.

349. A device as defined in claim 348 in which, in response to control information to enable another device to become a member of the device's synchrony group, the control module enables the interface module to transmit a command to the other device to enable the other device to become a member of the synchrony group.

350. A device as defined in claim 349 in which, in response to control information to enable another device that is a member of the device's synchrony group to disengage from the synchrony group, the control module enables the interface module to transmit a command to the other device to enable the other device to disengage from the synchrony group.

351. A device as defined in claim 348 in which, in response to control information to enable the data source to begin operating, the control module performs selected operations to enable the data source to begin operating.

352. A device as defined in claim 351, the device also operating as the data source, the device including a frame generator module configured to, under control of the control module, obtain information from which the frames are to be generated and generate the frames.

353. A device as defined in claim 342 in which the interface module is further configured to transmit the frames to at least one other device.

354. A device as defined in claim 343 in which the device is not the data source, the control module being configured to enable the interface module to transmit a command to enable the data source to operate.

355. A device as defined in claim 354 in which each frame is associated with a track, each track including at least one frame, and, in response to receipt of control information enabling processing of a track currently being processed to be terminated , the control module is configured to enable the interface module to transmit a command to enable the data source to insert a resynchronize command in the series of frames associated with the track to enable termination of processing of the track.

356. A device as defined in claim 354 in which each frame is associated with a track, each track including at least one frame, and, in response to receipt of control information enabling processing of a track at least a portion of which has been received, but for which processing has not begun, the control module is configured to enable the interface module to transmit a command to enable the data

source to insert a resynchronize command in the series of commands to disable processing of the track.

357. A device as defined in claim 344 in which the control module is configured to enable the user interface module interface module to transmit status information to the user interface module.

358. A device as defined in claim 357 in which the status information includes the processing status of at least one frame.

359. A device as defined in claim 336 further including:

A. a migration information receiving module configured to receive migration information from the data source device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices of the synchrony group, and

B. a migration control module configured to, after the migration information has been received.,

   i. distribute the series of frames to the synchrony group, each frame being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the data source device, at which the devices comprising the synchrony group are to execute the respective frame, and

   ii. notify the members of the synchrony group that it is to thereafter operate as the data source device.

360. A device as defined in claim 359 in which the information respecting the frames that are to be distributed is a source of streaming information, the migration control module being configured to, after the migration information has been received, assembling the streaming information into frames and associate each frame with a said time stamp.

361. A device as defined in claim 359 in which the information respecting the frames that are to be distributed is in a file identified in the migration information, the migration control module being configured to obtain information from the identified file, assemble the information into frames and associate each frame with a said time stamp.

362. A device as defined in claim 361 in which the information respecting the frames that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control module being configured to assemble the information from a position in the file associated with the identified offset.

363. A device as defined in claim 361 in which the information respecting the frames that are to be distributed is in a series of files identified in the migration information, the migration control module being configured to obtain information from successive files in the series assemble the information into frames and associate each frame with as said time stamp.

364. A device as defined in claim 336 further including a clock rate adjustment module configured to adjust the member device's clock rate in relation to a clock rate value maintained by the data source device's clock.

365. A data source device for distributing a series of frames for execution by at least one other device at respective execution times, the data source device comprising:

A. a frame acquisition module configured to obtain respective ones of the frames;

B. a frame execution time determination module configured to determine a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission module configured to transmit the series of frames to said at least one other device; and

D. an execution control command generation module configured to, in response to a predetermined event, enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to modify the execution sequence of the frames transmitted thereto.

366. A data source device as defined in claim 365 in which the frame transmission module is configured to utilize a selected multi-cast transmission methodology.

367. A data source device as defined in claim 365 in which the predetermined event comprises input indicia provided by an operator.

368. A data source device as defined in claim 367 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to control execution of at least one frame in relation to the time the predetermined event occurs.

369. A data source device as defined in claim 368 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command

to enable the at least one other device to terminate execution of a frame that it is currently executing and/or to not execute at least one frame that is to be executed subsequent to the predetermined event.

370. A data source device as defined in claim 368 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation module being configured to, in response to said predetermined event,

(i) enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module, a command enabling the at least one other device to terminate execution of the currently executing frame and/or to not execute at least one subsequent frame, if any, in the frame sequence including the currently executing frame; and

(ii) enable

(a) the frame execution time determination module to provide that time stamps associated with frames of frame sequences subsequent to the frame sequence currently being executed will reflect the termination and/or non-execution of frames from the frame sequence of the frame that is currently being executed, and

(b) the frame transmission module to transmit the frames of the subsequent frame sequences to the at least one other device.

371. A data source device as defined in claim 370 in which the frame transmission module is configured to insert a command to enable the at least one other device to not execute all frames in the frame sequence subsequent to the terminated and/or non-executed frame.

372. A data source device as defined in claim 362 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to control execution of a frame in relation to the frame's position in the series of frames.

373. A data source device as defined in claim 372 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to cancel execution of a frame in relation to the frame's position in the series of frames.

374. A data source device as defined in claim 371 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command

to enable the at least one other device to cancel execution of a previously-transmitted frame in relation to the frame's position in the series of frames.

375. A data source device as defined in claim 374 in which, in response to said predetermined event, the execution control command generation module is configured to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted frame, in relation to the frame's position in the series of frames, for which execution has not begun.

376. A data source device as defined in claim 371 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation module being configured to, in response to said predetermined event,

(i) enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module, a command enabling the at least one other device to cancel execution of a frame sequence for which execution has not begun; and

(ii) enable

  (a) the frame execution time determination module to provide that time stamps associated with frames of frame sequences subsequent to the frame sequence whose execution was cancelled will reflect the cancellation, and

  (b) the frame transmission module to transmit the frames of the subsequent frame sequences to the at least one other device.

377. A data source device for distributing a series of frames for execution by at least one other device at respective execution times, the data source device comprising:

A. a frame acquisition module configured to obtain respective ones of the frames;

B. a frame execution time determination module configured to determine a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time, the frame execution time determination module being configured to provide, associated with at least one frame, a time stamp indicating a frame execution time later than the time currently indicated by a clock maintained by the data source device; and

C. a frame transmission module configured to transmit the series of frames to said at least one other device.

377. A system as defined in claim 377 in which the data source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient

to provide that the at least one frame distributed by the data source device can be executed by the member devices at the time indicated by the time stamp.

379. A system as defined in claim 378 in which the data source device is configured to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be distributed to the member devices for execution at the time indicated by the time stamp

380. A system as defined in claim 377 in which data source device is configured to obtain information associated with the frames from at least two types of information sources, the data source device being further configured to select, for each frame the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective frame.

381. A data source device for distributing a series of frames for execution by at least one other device, the data source device comprising:

A. a frame acquisition module configured to obtain respective ones of the frames;

B. a frame execution time determination module configured to determine a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission module configured to transmit the series of frames to said at least one other device; and

D. a data source device migration control module configured to, in response to a predetermined event, provide migration information to another device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices of the synchrony group.

382. A method for operating a system to facilitate processing of data by device operating as a member of a synchrony group, synchronously with a clock maintained by a data source device that provides the data to the synchrony group, the method including the steps of

A. enabling the data source device being to divide the data into a series of frames for distribution to the synchrony group, each frame being associated with a time stamp indicating a time, relative to a clock maintained by the data source device, at which the devices comprising the synchrony group are to process the frame;

B enabling each member device in the synchrony group to:

(i) periodically obtain from the data source device an indication of a current time value indicated by the data source device's clock;

(ii) receive the series of frames from the data source device;

(iii) determine, from the time stamp associated with each respective frame and a time differential value representing a difference between the current time value indicated by the data source device's clock, a current time value indicated by the member device's respective clock, a time, relative to the member device's respective clock, at which the member device is to process the frame; and

(iv) process the respective frame at the determined time.

383. A method as defined in claim 382 in which at least one frame comprises audio data, each member device, while processing each frame, being enabled to generate a signal representing sound represented by the respective frame.

384. A method as defined in claim 382, the system comprising a plurality of member devices, the method including the steps of enabling the member devices to process each frame synchronously in relation to the clock maintained by the data source device so that they all produce sound represented by the respective frame synchronously.

385. A method as defined in claim 384 including the step of enabling the data source device to provide time stamps for at least two successive frames so that the member devices will play them with a selected time interval therebetween.

386. A method as defined in claim 385 in which the time interval is zero.

387. A method as defined in claim 382 in which one of the member devices operates as a master device for the synchrony group, any other member devices comprising respective slave devices, the method including the step of enabling the master device to perform at least one type of synchrony group management operation in connection with the member devices comprising the synchrony group.

388. A method as defined in claim 387, the method including the step of enabling the master device to perform at least one type of synchrony group management operation in response to control information provided thereto by a user interface module.

389. A method as defined in claim 388 further including the step of enabling the master device to provide status information relating to the status of the synchrony group to the user interface module.

390. A method as defined in claim 389 in which the status information includes identifications of the devices comprising the synchrony group.

391. A method as defined in claim 389 in which each frame is associated with a frame sequence, each frame sequence comprising at least one frame, the frame or frames comprising each frame sequence being associated with an audio track, each audio track being associated with an identifier, the status information including the identification of the audio track currently being played.

392. A method as defined in claim 388 the method comprising at least one additional device, in which, in one type of synchrony group management operation, the master device is configured to enable the at least one additional device to join the synchrony group as a slave device.

393. A method as defined in claim 392 in which the data source device is configured to distribute frames to the member devices using a selected multi-cast transmission methodology, the member devices being configured to buffer the frames until they are to be played, the method including the step of, when the at least one additional device joins the synchrony group as a slave device, the enabling the data source device to transmit at least one previously distributed frame to the slave device using a selected unicast transmission methodology.

394. A method as defined in claim 387 in which, in at least one type of synchrony group management operation, the method includes the step of enabling the master device to enable the data source device to join the synchrony group as a slave device, the data source device continuing to operate as the data source device for the synchrony group.

395. A method as defined in claim 387 in which, in at least one type of synchrony group management operation, the method includes the step of enabling the master device to enable a slave device to disengage from the synchrony group, the disengaged slave device thereafter not being a member device in the synchrony group and not playing frames distributed by the data source device.

396. A method as defined in claim 387 in which, in at least one type of synchrony group management operation, the method includes the step of enabling the master device to control the series of frames to be distributed by the data source device.

397. A method as defined in claim 387 in which each frame is associated with a frame sequence, each frame sequence comprising at least one frame, the frame or frames comprising each frame sequence being associated with an audio track, the method including the step of enabling the master device being configured to control the frames to be distributed by the data source device on a track-by-track basis.

398. A method as defined in claim 387 in which, in at least one type of synchrony group management operation, the method includes the step of enabling the master device to control playback by the member devices of the frames associated with the respective audio tracks that have

been distributed by the data source device in response to control information from the user interface module.

399. A method as defined in claim 387 in which, in response to control information from the user interface module to facilitate control of playback by the member devices, the method includes the step of enabling the master device to enable the data source device to distribute a playback control command to the member devices.

400. A method as defined in claim 399 in which a playback control command enables the member devices to terminate playback of a track that is currently being played back.

401. A method as defined in claim 399 in which the playback control command enables the member devices to terminate playback of a track with a frame subsequent to a frame currently being played.

402. A method as defined in claim 399 in which the playback control command enables the member devices to cancel playback of a track at least one of whose frames has been previously distributed, but for which playback has not begun.

403. A method as defined in claim 387 in which, in at least one type of synchrony group management operation, the method includes the step of enabling the member device operating as the master device to enable the master device to migrate from itself to another member device in the synchrony group.

404. A method as defined in claim 403 in which, in at least one type of synchrony group management operation, the method includes the step of enabling the master device to enable the data source device to migrate from one device to another device in the system.

405. A method as defined in claim 404 in which

A. the device operating as the data source device is enable to perform the step of, after being enabled to migrate the data source device to said other device, providing migration information to the other device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices,

B. the other device is enabled to, after receiving the migration information, perform the steps of

   i. distributing the series of frames to the synchrony group, each frame being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the data source device, at which the devices comprising the synchrony group are to execute the respective frame, and

ii. notifying the members of the synchrony group that it is to thereafter operate as the data source device.

406. A method as defined in claim 405 in which the information respecting the frames that are to be distributed is a source of streaming information, the other device being enabled to, after receiving the migration information, perform the steps of assembling the streaming information into frames and associating each frame with a said time stamp.

407. A method as defined in claim 405 in which the information respecting the frames that are to be distributed is in a file identified in the migration information, the other device being enabled to perform the steps of obtaining information from the identified file, assembling the information into frames and associating each frame with a said time stamp.

408.A method as defined in claim 407 in which the information respecting the frames that are to be distributed begins at an offset, identified in the migration information, into the identified file, the other device being enabled to perform the step of assembling the information from a position in the file associated with the identified offset.

409. A method as defined in claim 407 in which the information respecting the frames that are to be distributed is in a series of files identified in the migration information, the other device being enabled to perform the step of obtaining information from successive files in the series assemble the information into frames and associate each frame with as said time stamp.

410. A method as defined in claim 382 including the step in which the data source is further configured to distribute the frames using a selected multi-cast message transmission methodology, the device being enabled to receive the frames using the selected multi-cast message transmission methodology.

411. A method as defined in claim 382 in which the data source device is enabled to perform the step of providing, provide, associated with at least one frame, a time stamp indicating a frame execution time later than the time currently indicated by the clock maintained by the data source device.

412. A method as defined in claim 411 in which the data source device is enabled to perform the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be executed by the member devices at the time indicated by the time stamp.

413. A method as defined in claim 411 in which the data source device is enabled to perform the step of selecting the delay interval between the time indicated by the time stamp and the current time so

to be sufficient to provide that the at least one frame distributed by the data source device can be distributed to the member devices for execution at the time indicated by the time stamp

414. A method as defined in claim 411 in which data source device is enabled to perform the steps of obtaining information associated with the frames from at least two types of information sources, and selecting, for each frame, the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective frame.

415. A method as defined in claim 382 in which at least one member device is further enabled to perform the step of adjusting its clock rate in relation to a clock rate value maintained by the data source device's clock.

416. A method as defined in claim 415 in which the at least one member device is enabled to perform the step of adjusting its clock rate in relation to time stamps associated with respective ones of the frames received from the data source device.

417. A method as defined in claim 382 in which at least one other device operates as a data source device configured to distribute frames to a second synchrony group, the method including the steps of enabling the device to operate both as the data source device for the first synchrony group and also operating as a member device of a second synchrony group.

418. A method as defined in claim 382 including, within a member device,

A. a frame receiving step of receiving the series of frames,

B. a current time retrieval step of obtaining, from the data source device, the current time value as indicated by the frame source's clock;

C. an execution time determination step of determining, from the time stamp associated with each respective frame and a time differential value representing a difference between the current time value obtained during the current time retrieval step and a current time value indicated by a clock maintained by the device, a time, relative to the member device's respective clock at which the frame is to be executed; and

D. a frame execution step of executing each respective frame at the time determined during the execution time determination step.

419. A method as defined in claim 418 further including a control step for controlling execution of commands received during the frame receiving step

420. A method as defined in claim 419 in which the at least one member device further comprises a buffer configured to buffer frames received from the data source device during the frame receiving

step until they are to be executed, the frame execution step including the step of executing the buffered frames at the times determined during the execution time determination step.

420. A method as defined in claim 420 in which the series of frames includes a series of frame sequences with each frame sequence including a subset of the series of frames, the frame receiving step being further enabled to receive frame execution control commands for controlling frame execution, the control step including the step of, in response to receipt of at least one frame execution control command for controlling frame execution, controlling the frame execution step to terminate execution of a frame sequence currently being executed, and further to not execute subsequent frames in the frame sequence that have been buffered.

422. A method as defined in claim 421 in which the control step includes the step of enabling the frame execution step to resume execution of at least one frame associated with a subsequent frame sequence at a time determined during the execution time determination step.

423. A method as defined in claim 420 in which the series of frames includes a series of frame sequences with each frame sequence including a subset of the series of frames, the frame receiving step including the step of receiving frame execution control commands for controlling frame execution, the control step including the step of, in response to receipt of at least one frame execution control command to cancel execution of a frame sequence for which at least one frame has been buffered but for which execution has not begun, providing that frames from that frame sequence that have been buffered not be executed.

424. A method as defined in claim 423 in which the control step includes the step of enabling execution to resume of at least one frame associated with a frame sequence subsequent to the frame sequence for which at least one frame has been buffered but for which execution has not begun.

425. A method as defined in claim 418 in which the member device performs:

A. migration information receiving step of receiving migration information from the data source device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices of the synchrony group, and

B. a migration control step of, after the migration information has been received.,

   i. distributing the series of frames to the synchrony group, each frame being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the data source device, at which the devices comprising the synchrony group are to execute the respective frame, and

ii. notifying the members of the synchrony group that it is to thereafter operate as the data source device.

426. A method as defined in claim 425 in which the information respecting the frames that are to be distributed is a source of streaming information, the migration control step includes the steps of, after the migration information has been received, assembling the streaming information into frames and associating each frame with a said time stamp.

427. A method as defined in claim 425 in which the information respecting the frames that are to be distributed is in a file identified in the migration information, the migration control step including the steps of obtaining information from the identified file, assembling the information into frames and associating each frame with a said time stamp.

428. A method as defined in claim 427 in which the information respecting the frames that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control step including the step of assembling the information from a position in the file associated with the identified offset.

429. A method as defined in claim 427 in which the information respecting the frames that are to be distributed is in a series of files identified in the migration information, the migration control step including the steps of obtaining information from successive files in the series assemble the information into frames and associating each frame with as said time stamp.

430. A method as defined in claim 418 in which the member device is further enabled to perform a clock rate adjustment step including the step of adjusting the member device's clock rate in relation to a clock rate value maintained by the data source device's clock.

431. A method as defined in claim 430 in which the clock rate adjustment step includes the step of determining adjust the clock rate in relation to time stamps associated with respective ones of the frames received from the data source device.

432. A method as defined in claim 382 of operating a device for distributing a series of frames for execution by at least one other device at respective execution times, the method comprising:

A. a frame acquisition step of obtaining respective ones of the frames;

B. a frame execution time determination step of determining a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission step of transmitting the series of frames to said at least one other device; and

D. an execution control command generation step of, in response to a predetermined event and during the frame transmission step, the insertion into the series of frames transmitted by the frame transmission module of a command to enable the at least one other device to modify the execution sequence of the frames transmitted thereto.

433. A method as defined in claim 432 in which the frame transmission step includes the step of utilizing a selected multi-cast transmission methodology.

434. A method as defined in claim 432 in which the predetermined event includes the step of receiving input indicia provided by an operator.

435. A method as defined in claim 434 in which the execution control command generation step includes the step of enabling, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to control execution of at least one frame in relation to the time the predetermined event occurs.

436. A method as defined in claim 435 in which, the execution control command generation step includes the step of enabling, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to terminate execution of a frame that it is currently executing and/or to not execute at least one frame that is to be executed subsequent to the predetermined event.

437. A method as defined in claim 434 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation step including the steps of, in response to said predetermined event,

(i) enabling during the frame transmission step the insertion, into the series of frames, of a command enabling the at least one other device to terminate execution of the currently executing frame and/or to not execute at least one subsequent frame, if any, in the frame sequence including the currently executing frame; and

(ii) enabling

(a) during the frame execution time determination step, that time stamps associated with frames of frame sequences subsequent to the frame sequence currently being executed will reflect the termination and/or non-execution of frames from the frame sequence of the frame that is currently being executed, and

(b) during the frame transmission step, the transmission of the frames of the subsequent frame sequences to the at least one other device.

438. A method as defined in claim 437 in which the frame transmission step includes the step of inserting a command into the frame sequence to enable the at least one other device to not execute all frames in the frame sequence subsequent to the terminated and/or non-executed frame.

439. A method as defined in claim 435 in which the execution control command generation step include the step of enabling, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to control execution of a frame in relation to the frame's position in the series of frames.

440. A method as defined in claim 439 in which the execution control command generation step includes the step of, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to cancel execution of a frame in relation to the frame's position in the series of frames.

441. A method as defined in claim 439 in which the execution control command generation step includes the step of enabling, in response to said predetermined event and during the frame transmission step, the inserting into the series of frames of a command to enable the at least one other device to cancel execution of a previously-transmitted frame in relation to the frame's position in the series of frames.

442. A method as defined in claim 441 in which, the execution control command generation step includes the step of, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to cancel execution of a previously-transmitted frame, in relation to the frame's position in the series of frames, for which execution has not begun.

443. A method as defined in claim 439 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation step including the steps of, in response to said predetermined event,

(i) enabling, during the frame transmission step, the insertion, into the series of frames, of a command enabling the at least one other device to cancel execution of a frame sequence for which execution has not begun; and

(ii) enabling

  (a) during the frame execution time determination step, that time stamps associated with frames of frame sequences subsequent to the frame sequence whose execution was cancelled will reflect the cancellation, and

(b) during the frame transmission step, the transmission of the frames of the subsequent frame sequences to the at least one other device.

444. A method as defined in claim 382 in which the data source device is enabled to perform

A. a frame acquisition step of obtaining respective ones of the frames;

B. a frame execution time determination step of determining a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission step of transmitting the series of frames to said at least one other device; and

D. a data source device migration control step of, in response to a predetermined event, providing migration information to another device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices of the synchrony group.

445. A method as defined in claim 382 in which the data source device is enabled to perform the step of providing, associated with at least one frame, a time stamp indicating a frame execution time later than the time currently indicated by the clock maintained by the data source device.

446. A method as defined in claim 445 in which the data source device is enabled to perform the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be executed by the member devices at the time indicated by the time stamp.

447. A method as defined in claim 446 in which the data source device is enabled to perform the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be distributed to the member devices for execution at the time indicated by the time stamp.

448. A method as defined in claim 445 in which data source device is enabled to perform the step of obtaining information associated with the frames from at least two types of information sources, and selecting for each frame the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective frame.

449. A method of enabling a device to process a series of frames of data provided by a data source at times specified by the data source in relation to a clock maintained by the data source, the device comprising

A. an interface step of receiving the series of frames, each frame being associated with a time stamp, each time stamp indicating a time value relative to a time indicated a clock maintained by the data source, at which the device is to process the respective frame;

B. a current time retrieval step of obtaining, from the data source, a current time value as indicated by the data source's clock;

C. an processing time determination step of determining, from the time stamp associated with each respective frame and a time differential value representing a difference between the current time value obtained during the current time retrieval step and a current time value indicated by a clock maintained by the device, a time, relative to the device's respective clock, at which the frame is to be processed; and

D. a frame processing step of processing each respective frame at the time determined during the processing time determination step.

450. A method as defined in claim 449 in which at least one frame comprises audio data, each member device, while processing said at least one frame, generating a signal representing sound represented by the respective frame.

451. A method as defined in claim 449 further including a control step for controlling execution of commands received by said device.

452. A method as defined in claim 451 further comprising a buffer configured to buffer frames that the interface module has received until they are to be processed, the frame processing step including the step of processing the buffered frames at the times determined during the processing time determination step.

453 . A method as defined in claim 451 in which the each frame is associated with a track, each track including at least one frame, the interface module being further configured to receive playback control commands for controlling processing of tracks, the method including the step of enabling the control module to execute at least one playback control command controlling track processing.

454. A method as defined in claim 453 including the step of, in response to at least one type of playback control command, enabling the control module to, in turn, enable the frame processing module to terminate playback of a track that is currently being played back.

455. A method as defined in claim 454 including the step of, in response to the playback control command, enabling the control module to terminate playback of a track with a frame subsequent to a frame currently being played.

456. A method as defined in claim 452 including the step of, in response to the playback control command, enabling the control module to cancel playback of a track at least one of whose frames has been previously distributed, but for which playback has not begun.

457. A method as defined in claim 453 including the step of enabling the control module to enable the frame processing module to resume processing of at least one frame associated with a subsequent track at a time determined by the processing time determination module.

458. A method as defined in claim 449 including the step of enabling the control module to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive frames for processing by the frame processing module.

459. A method as defined in claim 458 including the step of enabling the control module to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive frames currently being transmitted using a selected multi-cast transmission methodology, and further to retrieve at least one previously distributed frame using a selected unicast transmission methodology.

460. A method as defined in claim 449 including the step of enabling the control module to, in receipt of a command to disengage from a synchrony group, disable the interface module from receiving frames and the frame processing module from processing previously received frames that have not yet been processed.

461. A method as defined in claim 449, further including the steps of receiving control information from a user interface module, and enabling the control module to enable selected operations to be performed in response to the control information.

462. A method as defined in claim 461 including the step of, in response to control information to enable another device to become a member of the device's synchrony group, enabling the control module to enable the interface module to transmit a command to the other device to enable the other device to become a member of the synchrony group.

463. A method as defined in claim 461 including the step of, in response to control information to enable another device that is a member of the device's synchrony group to disengage from the synchrony group, enabling the control module to enable transmission of a command to the other device to enable the other device to disengage from the synchrony group.

464. A method as defined in claim 461 including the step of, in response to control information to enable the data source to begin operating, enabling the control module to perform selected operations to enable the data source to begin operating.

465. A method as defined in claim 464, the device also operating as the data source, the method including a frame generator step of, under control of the control module, obtaining information from which the frames are to be generated and generating the frames.

466. A method as defined in claim 465 further comprising the step of transmitting the frames to at least one other device.

467. A method as defined in claim 465 in which the device is not the data source, the method including the step of enabling the control module to enable transmission of a command to enable the data source to operate.

468. A method as defined in claim 467 in which each frame is associated with a track, each track including at least one frame, and, in response to receipt of control information enabling processing of a track currently being processed to be terminated , the method including the step of enabling the control module to enable transmission of a command to enable the data source to insert a resynchronize command in the series of frames associated with the track to enable termination of processing of the track.

469. A method as defined in claim 467 in which each frame is associated with a track, each track including at least one frame, and, in response to receipt of control information enabling processing of a track at least a portion of which has been received, but for which processing has not begun, the method including the step of enabling the control module to enable transmission of a command to enable the data source to insert a resynchronize command in the series of commands to disable processing of the track.

470. A method as defined in claim 451 further including the step of enabling the control module to enable the user interface module interface module to transmit status information to the user interface module.

471. A method as defined in claim 470 in which the status information includes the processing status of at least one frame.

472. A method as defined in claim 469 in which the member device performs:

A. migration information receiving step of receiving migration information from the data source device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices of the synchrony group, and

B. a migration control step of, after the migration information has been received.,

i. distributing the series of frames to the synchrony group, each frame being associated with a time stamp indicating a time, relative to the timing information that it receives from the device operating as the data source device, at which the devices comprising the synchrony group are to execute the respective frame, and

ii. notifying the members of the synchrony group that it is to thereafter operate as the data source device.

473. A method as defined in claim 472 in which the information respecting the frames that are to be distributed is a source of streaming information, the migration control step includes the steps of, after the migration information has been received, assembling the streaming information into frames and associating each frame with a said time stamp.

474. A method as defined in claim 472 in which the information respecting the frames that are to be distributed is in a file identified in the migration information, the migration control step including the steps of obtaining information from the identified file, assembling the information into frames and associating each frame with a said time stamp.

475. A method as defined in claim 474 in which the information respecting the frames that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control step including the step of assembling the information from a position in the file associated with the identified offset.

476. A method as defined in claim 474 in which the information respecting the frames that are to be distributed is in a series of files identified in the migration information, the migration control step including the steps of obtaining information from successive files in the series assemble the information into frames and associating each frame with as said time stamp.

477. A method as defined in claim 449 in which the member device is further enabled to perform a clock rate adjustment step including the step of adjusting the member device's clock rate in relation to a clock rate value maintained by the data source device's clock.

478. A method as defined in claim 477 in which the clock rate adjustment step includes the step of determining adjust the clock rate in relation to time stamps associated with respective ones of the frames received from the data source device.

479. A method of operating a device for distributing a series of frames for execution by at least one other device at respective execution times, the method comprising:

A. a frame acquisition step of obtaining respective ones of the frames;

B. a frame execution time determination step of determining a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission step of transmitting the series of frames to said at least one other device; and

D. an execution control command generation step of, in response to a predetermined event and during the frame transmission step, the insertion into the series of frames transmitted by the frame transmission module of a command to enable the at least one other device to modify the execution sequence of the frames transmitted thereto.

480. A method as defined in claim 479 in which at least one frame comprises audio data.

481. A method as defined in claim 479 in which the frame transmission step includes the step of utilizing a selected multi-cast transmission methodology.

482. A method as defined in claim 479 in which the predetermined event includes the step of receiving input indicia provided by an operator.

483. A method as defined in claim 482 in which the execution control command generation step includes the step of enabling, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to control execution of at least one frame in relation to the time the predetermined event occurs.

484. A method as defined in claim 483 in which, the execution control command generation step includes the step of enabling, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to terminate execution of a frame that it is currently executing and/or to not execute at least one frame that is to be executed subsequent to the predetermined event.

485. A method as defined in claim 482 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation step including the steps of, in response to said predetermined event,

(i) enabling during the frame transmission step the insertion, into the series of frames, of a command enabling the at least one other device to terminate execution of the currently executing frame and/or to not execute at least one subsequent frame, if any, in the frame sequence including the currently executing frame; and

(ii) enabling

(a) during the frame execution time determination step, that time stamps associated with frames of frame sequences subsequent to the frame sequence currently being executed will reflect the termination and/or non-execution of frames from the frame sequence of the frame that is currently being executed, and

(b) during the frame transmission step, the transmission of the frames of the subsequent frame sequences to the at least one other device.

486. A method as defined in claim 485 in which the frame transmission step includes the step of inserting a command into the frame sequence to enable the at least one other device to not execute all frames in the frame sequence subsequent to the terminated and/or non-executed frame.

487. A method as defined in claim 479 in which the execution control command generation step include the step of enabling, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to control execution of a frame in relation to the frame's position in the series of frames.

488. A method as defined in claim 487 in which the execution control command generation step includes the step of, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to cancel execution of a frame in relation to the frame's position in the series of frames.

489. A method as defined in claim 487 in which the execution control command generation step includes the step of enabling, in response to said predetermined event and during the frame transmission step, the inserting into the series of frames of a command to enable the at least one other device to cancel execution of a previously-transmitted frame in relation to the frame's position in the series of frames.

490. A method as defined in claim 489 in which, the execution control command generation step includes the step of, in response to said predetermined event and during the frame transmission step, the insertion into the series of frames of a command to enable the at least one other device to cancel execution of a previously-transmitted frame, in relation to the frame's position in the series of frames, for which execution has not begun.

491. A method as defined in claim 488 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation step including the steps of, in response to said predetermined event,

(i) enabling, during the frame transmission step, the insertion, into the series of frames, of a command enabling the at least one other device to cancel execution of a frame sequence for which execution has not begun; and

(ii) enabling

(a) during the frame execution time determination step, that time stamps associated with frames of frame sequences subsequent to the frame sequence whose execution was cancelled will reflect the cancellation, and

(b) during the frame transmission step, the transmission of the frames of the subsequent frame sequences to the at least one other device.

492. A method of operating a device for distributing a series of frames for execution by at least one other device at respective execution times, the method comprising:

A. a frame acquisition step of obtaining respective ones of the frames;

B. a frame execution time determination step of determining a time at which each respective frame is to be executed, and to associating the respective frame with a time stamp indicating its execution time, the frame execution time determination step including the step of providing, associated with at least one frame, a time stamp indicating a frame execution time later than the time currently indicated by a clock maintained by the data source device; and

C. a frame transmission step of transmitting the series of frames to said at least one other device.

493. A method as defined in claim 492 in which at least one frame comprises audio data.

494. A method as defined in claim 492 in which the frame execution time determination step includes the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the device can be executed by at least one other device at the time indicated by the time stamp.

495. A method as defined in claim 494 in which the frame execution time determination step includes the step of selecting the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the device can be distributed to other devices over a network for execution by the other devices at the time indicated by the time stamp.

496. A method as defined in claim 492 in which frame acquisition step includes the step of obtaining information associated with the frames from at least two types of information sources, the frame execution time determination step including the step of selecting, for each frame the delay interval

between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective frame.

497. A method of operating a device for distributing a series of frames for execution by at least one other device, the method comprising:

A. a frame acquisition module configured to obtain respective ones of the frames;

B. a frame execution time determination module configured to determine a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission module configured to transmit the series of frames to said at least one other device; and

D. a data source device migration control module configured to, in response to a predetermined event, provide migration information to another device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices of the synchrony group.

498. A method as defined in claim 497 in which at least one frame comprises audio data.

499. A computer program product for use in connection with a computer to provide a device for processing a series of frames of data provided by a data source at times specified by the data source in relation to a clock maintained by the data source, the computer program product comprising a computer-readable medium having encoded thereon

A. an interface module configured to enable the computer to receive the series of frames, each frame being associated with a time stamp, each time stamp indicating a time value relative to a time indicated a clock maintained by the data source, at which the device is to process the respective frame;

B. a current time retrieval module configured to enable the computer to obtain, from the data source, a current time value as indicated by the data source's clock;

C. an processing time determination module configured to enable the computer to determine, from the time stamp associated with each respective frame and a time differential value representing a difference between the current time value obtained by the current time retrieval module and a current time value indicated by a clock maintained by the device, a time, relative to the device's respective clock, at which the frame is to be processed; and

D. a frame processing module configured to enable the computer to process each respective frame at the time determined by the processing time determination module.

500. A computer program product as defined in claim 499 in which at least one frame comprises audio data, the computer, while processing said frame, generating a signal representing sound represented by the respective frame.

501. A computer program product as defined in claim 499 further including a control module a control module for enabling said computer to control execution of commands received by the interface module.

502. A computer program product as defined in claim 501 further comprising a buffer configured to enable the computer to buffer frames that the interface module has received until they are to be processed, the frame processing module being configured to enable the computer to process the buffered frames at the times determined by the processing time determination module.

503. A computer program product as defined in claim 502 in which the each frame is associated with a track, each track including at least one frame, the interface module being further configured to enable the computer to receive playback control commands for controlling processing of tracks, the control module being configured to enable the computer to execute at least one playback control command controlling track processing.

504. A computer program product as defined in claim 503 in which at least one type of playback control command enables the control module to, in turn, enable the frame processing module to terminate playback of a track that is currently being played back.

505. A computer program product as defined in claim 504 in which the playback control command enables the control module to terminate playback of a track with a frame subsequent to a frame currently being played.

506. A computer program product as defined in claim 503 in which the playback control command enables the control module to cancel playback of a track at least one of whose frames has been previously distributed, but for which playback has not begun.

507. A computer program product as defined in claim 503 in which the control module is configured to enable the computer to enable the frame processing module to resume processing of at least one frame associated with a subsequent track at a time determined by the processing time determination module.

508. A computer program product as defined in claim 501, the control module being configured to enable the computer to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive frames for processing by the frame processing module.

509. A computer program product as defined in claim 508 in which the control module is configured to enable the computer to, in response to receipt of a command to become a member of a synchrony group, enable the interface module to receive frames currently being transmitted using a selected multi-cast transmission methodology, and further to retrieve at least one previously distributed frame using a selected unicast transmission methodology.

510. A computer program product as defined in claim 501 in which the control module is configured to enable the computer to, in receipt of a command to disengage from a synchrony group, disable the interface module from receiving frames and the frame processing module from processing previously received frames that have not yet been processed.

511. A computer program product as defined in claim 501 further comprising a user interface module interface module configured to receive control information from a user interface module, the control module being configured to enable the computer to enable selected operations to be performed in response to the control information.

512. A computer program product as defined in claim 511 in which, in response to control information to enable another device to become a member of the device's synchrony group, the control module enables the interface module to transmit a command to the other device to enable the other device to become a member of the synchrony group.

513. A computer program product as defined in claim 511 in which, in response to control information to enable another device that is a member of the device's synchrony group to disengage from the synchrony group, the control module enables the interface module to transmit a command to the other device to enable the other device to disengage from the synchrony group.

514. A computer program product as defined in claim 511 in which, in response to control information to enable the data source to begin operating, the control module performs selected operations to enable the data source to begin operating.

515. A computer program product as defined in claim 514, the device also operating as the data source, the device including a frame generator module configured to enable the computer to, under control of the control module, obtain information from which the frames are to be generated and generate the frames.

516. A computer program product as defined in claim 515 in which the interface module is further configured to enable the computer to transmit the frames to at least one other device.

517. A computer program product as defined in claim 515 in which the device is not the data source, the control module being configured to enable the computer to enable the interface module to transmit a command to enable the data source to operate.

518. A computer program product as defined in claim 517 in which each frame is associated with a track, each track including at least one frame, and, in response to receipt of control information enabling processing of a track currently being processed to be terminated , the control module is configured to enable the computer to enable the interface module to transmit a command to enable the data source to insert a resynchronize command in the series of frames associated with the track to enable termination of processing of the track.

519. A computer program product as defined in claim 517 in which each frame is associated with a track, each track including at least one frame, and, in response to receipt of control information enabling processing of a track at least a portion of which has been received, but for which processing has not begun, the control module is configured to enable the computer to enable the interface module to transmit a command to enable the data source to insert a resynchronize command in the series of commands to disable processing of the track.

520. A computer program product as defined in claim 517 in which the control module is configured to enable the computer to enable the user interface module interface module to transmit status information to the user interface module.

521. A computer program product as defined in claim 520 in which the status information includes the processing status of at least one frame.

522. A computer program product as defined in claim 499 further including:

A. a migration information receiving module configured to enable the computer to receive migration information from the data source device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices of the synchrony group, and

B. a migration control module configured to enable the computer to, after the migration information has been received.,

   i. distribute the series of frames to the synchrony group, each frame being associated with a time stamp indicating a time, relative to the timing information that it receives

from the device operating as the data source device, at which the devices comprising the synchrony group are to execute the respective frame, and

ii. notify the members of the synchrony group that it is to thereafter operate as the data source device.

523. A computer program product as defined in claim 522 in which the information respecting the frames that are to be distributed is a source of streaming information, the migration control module being configured to enable the computer to, after the migration information has been received, assemble the streaming information into frames and associate each frame with a said time stamp.

524. A computer program product as defined in claim 522 in which the information respecting the frames that are to be distributed is in a file identified in the migration information, the migration control module being configured to enable the computer to obtain information from the identified file, assemble the information into frames and associate each frame with a said time stamp.

525. A computer program product as defined in claim 524 in which the information respecting the frames that are to be distributed begins at an offset, identified in the migration information, into the identified file, the migration control module being configured to enable the computer to assemble the information from a position in the file associated with the identified offset.

526. A computer program product as defined in claim 524 in which the information respecting the frames that are to be distributed is in a series of files identified in the migration information, the migration control module being configured to enable the computer to obtain information from successive files in the series assemble the information into frames and associate each frame with as said time stamp.

527. A computer program product as defined in claim 499 further including a clock rate adjustment module configured to enable the computer to adjust the member device's clock rate in relation to a clock rate value maintained by the data source device's clock.

528. A computer program product as defined in claim 527 in which the clock rate adjustment module is configured to enable the computer to adjust the clock rate in relation to time stamps associated with respective ones of the frames received from the data source device.

529. A computer program product for use in connection with a computer to provide a data source device for distributing a series of frames for execution by at least one other device at respective execution times, the computer program product comprising a computer readable medium having encoded thereon:

A. a frame acquisition module configured to enable the computer to obtain respective ones of the frames;

B. a frame execution time determination module configured to enable the computer to determine a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission module configured to enable the computer to transmit the series of frames to said at least one other device; and

D. an execution control command generation module configured to enable the computer to , in response to a predetermined event, enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to modify the execution sequence of the frames transmitted thereto.

530. A computer program product as defined in claim 529 in which at least one frame comprises audio data.

531. A computer program product as defined in claim 529 in which the frame transmission module is configured to enable the computer to utilize a selected multi-cast transmission methodology.

532. A computer program product as defined in claim 529 in which the predetermined event comprises input indicia provided by an operator.

533. A computer program product as defined in claim 529 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to control execution of at least one frame in relation to the time the predetermined event occurs.

534. A computer program product as defined in claim 533 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to terminate execution of a frame that it is currently executing and/or to not execute at least one frame that is to be executed subsequent to the predetermined event.

535. A computer program product as defined in claim 533 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation module being configured to enable the computer to , in response to said predetermined event,

(i) enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module, a command enabling the at least one other device to terminate execution of the currently executing frame and/or to not execute at least one subsequent frame, if any, in the frame sequence including the currently executing frame; and

(ii) enable

(a) the frame execution time determination module to provide that time stamps associated with frames of frame sequences subsequent to the frame sequence currently being executed will reflect the termination and/or non-execution of frames from the frame sequence of the frame that is currently being executed, and

(b) the frame transmission module to transmit the frames of the subsequent frame sequences to the at least one other device.

536. A computer program product as defined in claim 535 in which the frame transmission module is configured to enable the computer to insert a command to enable the at least one other device to not execute all frames in the frame sequence subsequent to the terminated and/or non-executed frame.

537. A computer program product as defined in claim 529 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to control execution of a frame in relation to the frame's position in the series of frames.

538. A computer program product as defined in claim 537 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to cancel execution of a frame in relation to the frame's position in the series of frames.

539. A computer program product as defined in claim 537 in which, in response to said predetermined event, the execution control command generation module is configured to enable the computer to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted frame in relation to the frame's position in the series of frames.

540. A computer program product as defined in claim 539 in which, in response to said predetermined event, the execution control command generation module is configured to enable the

computer to enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module a command to enable the at least one other device to cancel execution of a previously-transmitted frame, in relation to the frame's position in the series of frames, for which execution has not begun.

541. A computer program product as defined in claim 537 in which the series of frames includes a series of frame sequences with each frame sequence including a sub-set of the series of frames, the execution control command generation module being configured to enable the computer to , in response to said predetermined event,

(i) enable the frame transmission module to insert into the series of frames transmitted by the frame transmission module, a command enabling the at least one other device to cancel execution of a frame sequence for which execution has not begun; and

(ii) enable

  (a) the frame execution time determination module to provide that time stamps associated with frames of frame sequences subsequent to the frame sequence whose execution was cancelled will reflect the cancellation, and

  (b) the frame transmission module to transmit the frames of the subsequent frame sequences to the at least one other device.

542. A computer program product for use in connection with a computer to provide a data source device for distributing a series of frames for execution by at least one other device at respective execution times, the computer program product comprising a computer readable medium having encoded thereon:

A. a frame acquisition module configured to enable the computer to obtain respective ones of the frames;

B. a frame execution time determination module configured to enable the computer to determine a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time, the frame execution time determination module being configured to enable the computer to provide, associated with at least one frame, a time stamp indicating a frame execution time later than the time currently indicated by a clock maintained by the data source device; and

C. a frame transmission module configured to enable the computer to transmit the series of frames to said at least one other device.

543. A computer program product as defined in claim 542 in which the data is audio data.

544. A computer program product as defined in claim 542 in which the frame execution time determination module is configured to enable the computer to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be executed by the member devices at the time indicated by the time stamp.

545. A computer program product as defined in claim 544 in which the frame execution time determination module is configured to enable the computer to select the delay interval between the time indicated by the time stamp and the current time so to be sufficient to provide that the at least one frame distributed by the data source device can be distributed to the member devices for execution at the time indicated by the time stamp.

546. A computer program product as defined in claim 542 in which frame acquisition module is configured to enable the computer to obtain information associated with the frames from at least two types of information sources, the frame execution time determination module being configured to enable the computer to select, for each frame the delay interval between the time indicated by the time stamp and the current time based on the information source type that is associated with the respective frame.

547. A computer program product for use in connection with a computer to provide a data source device for distributing a series of frames for execution by at least one other device, the computer program product comprising a computer readable medium having encoded thereon:

A. a frame acquisition module configured to enable the computer to obtain respective ones of the frames;

B. a frame execution time determination module configured to enable the computer to determine a time at which each respective frame is to be executed, and to associate the respective frame with a time stamp indicating its execution time;

C. a frame transmission module configured to enable the computer to transmit the series of frames to said at least one other device; and

D. a data source device migration control module configured to enable the computer to, in response to a predetermined event, provide migration information to another device, the migration information including a source for information respecting the frames to be distributed, timing information relative to the clock maintained by the data source device and identifications of the member devices of the synchrony group.

548. A computer program product as defined in claim 547 in which the data is audio data.

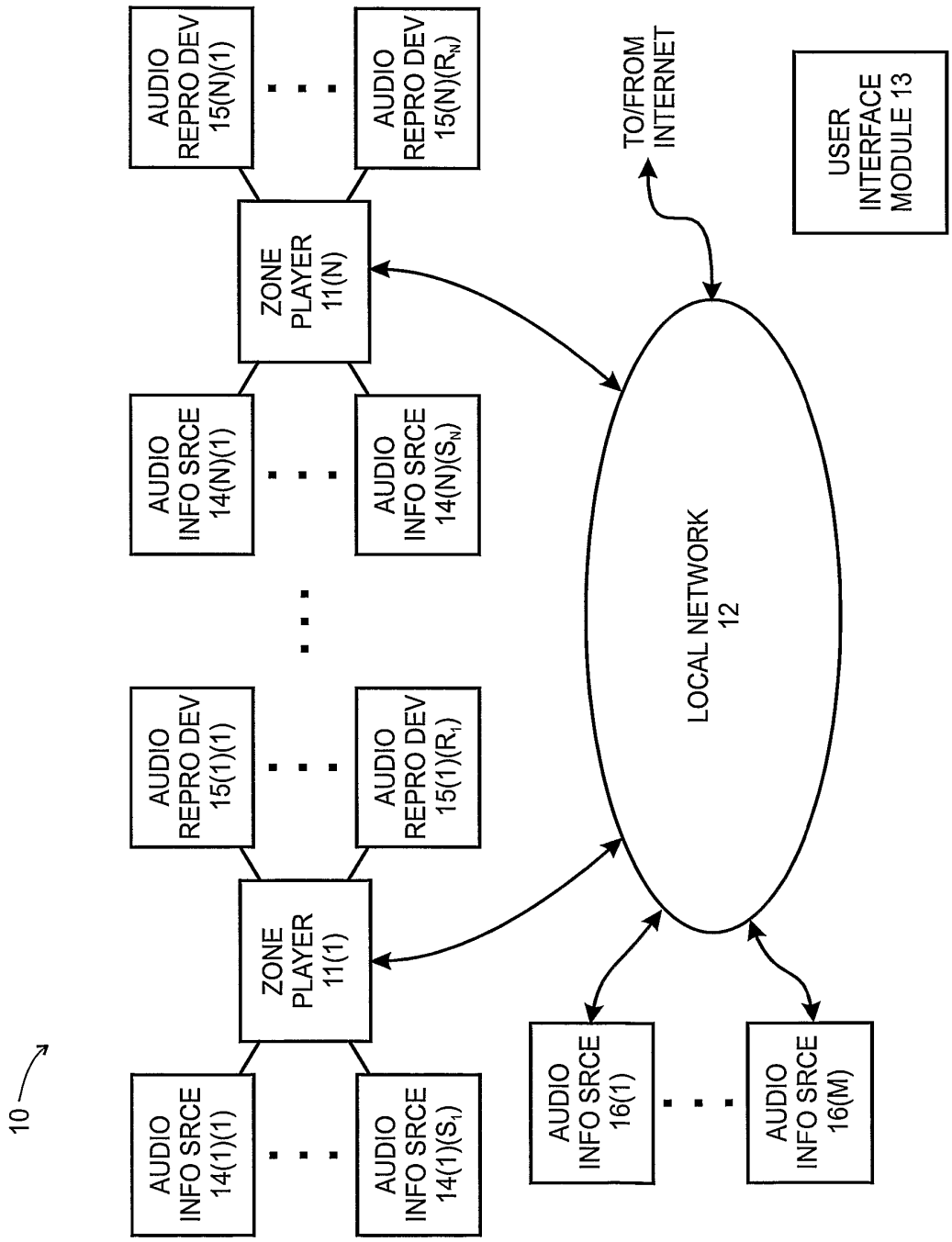
10
AUDIO INFO SRCE 14(1)(1)
AUDIO INFO SRCE 14(1)(S_1)
ZONE PLAYER 11(1)
AUDIO REPRO DEV 15(1)(1)
AUDIO REPRO DEV 15(1)(R_1)
AUDIO INFO SRCE 14(N)(1)
AUDIO INFO SRCE 14(N)(S_N)
ZONE PLAYER 11(N)
AUDIO REPRO DEV 15(N)(1)
AUDIO REPRO DEV 15(N)(R_N)
LOCAL NETWORK 12
TO/FROM INTERNET
USER INTERFACE MODULE 13
AUDIO INFO SRCE 16(1)
AUDIO INFO SRCE 16(M)

FIG. 1

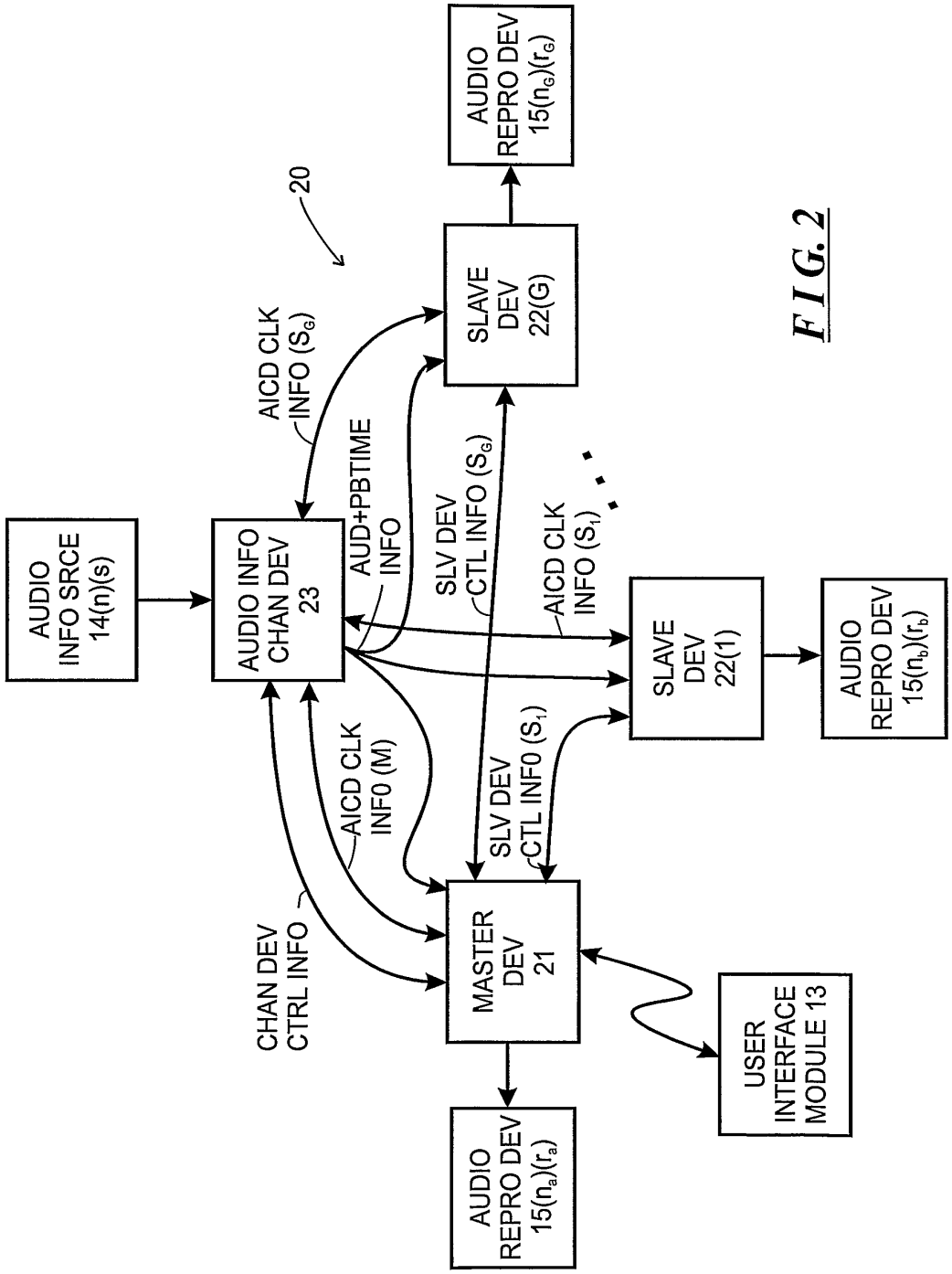
AUDIO INFO SRCE 14(n)(s)
AUDIO INFO CHAN DEV 23
20
AICD CLK INFO (S_G)
AUD+PBTIME INFO
SLAVE DEV 22(G)
AUDIO REPRO DEV 15(n_G)(r_G)
SLV DEV CTL INFO (S_G)
AICD CLK INFO (S_1)
SLAVE DEV 22(1)
AUDIO REPRO DEV 15(n_b)(r_b)
AICD CLK INF0 (M)
SLV DEV CTL INF0 (S_1)
CHAN DEV CTRL INFO
MASTER DEV 21
USER INTERFACE MODULE 13
AUDIO REPRO DEV 15(n_a)(r_a)

FIG. 2

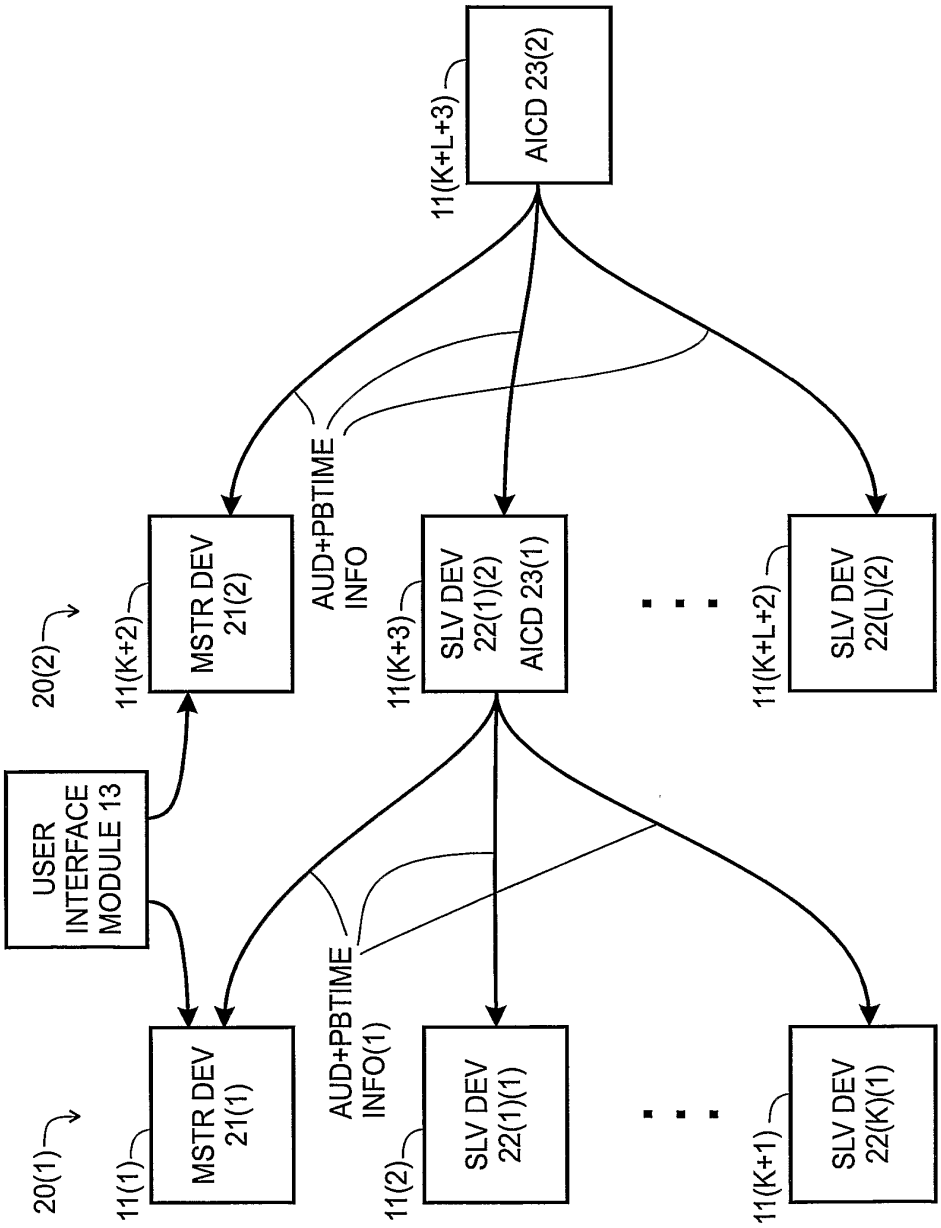
USER INTERFACE MODULE 13
20(1)
20(2)
11(1)
MSTR DEV 21(1)
11(2)
SLV DEV 22(1)(1)
11(K+1)
SLV DEV 22(K)(1)
AUD+PBTIME INFO(1)
11(K+2)
MSTR DEV 21(2)
11(K+3)
SLV DEV 22(1)(2) AICD 23(1)
11(K+L+2)
SLV DEV 22(L)(2)
AUD+PBTIME INFO
11(K+L+3)
AICD 23(2)

FIG. 2A

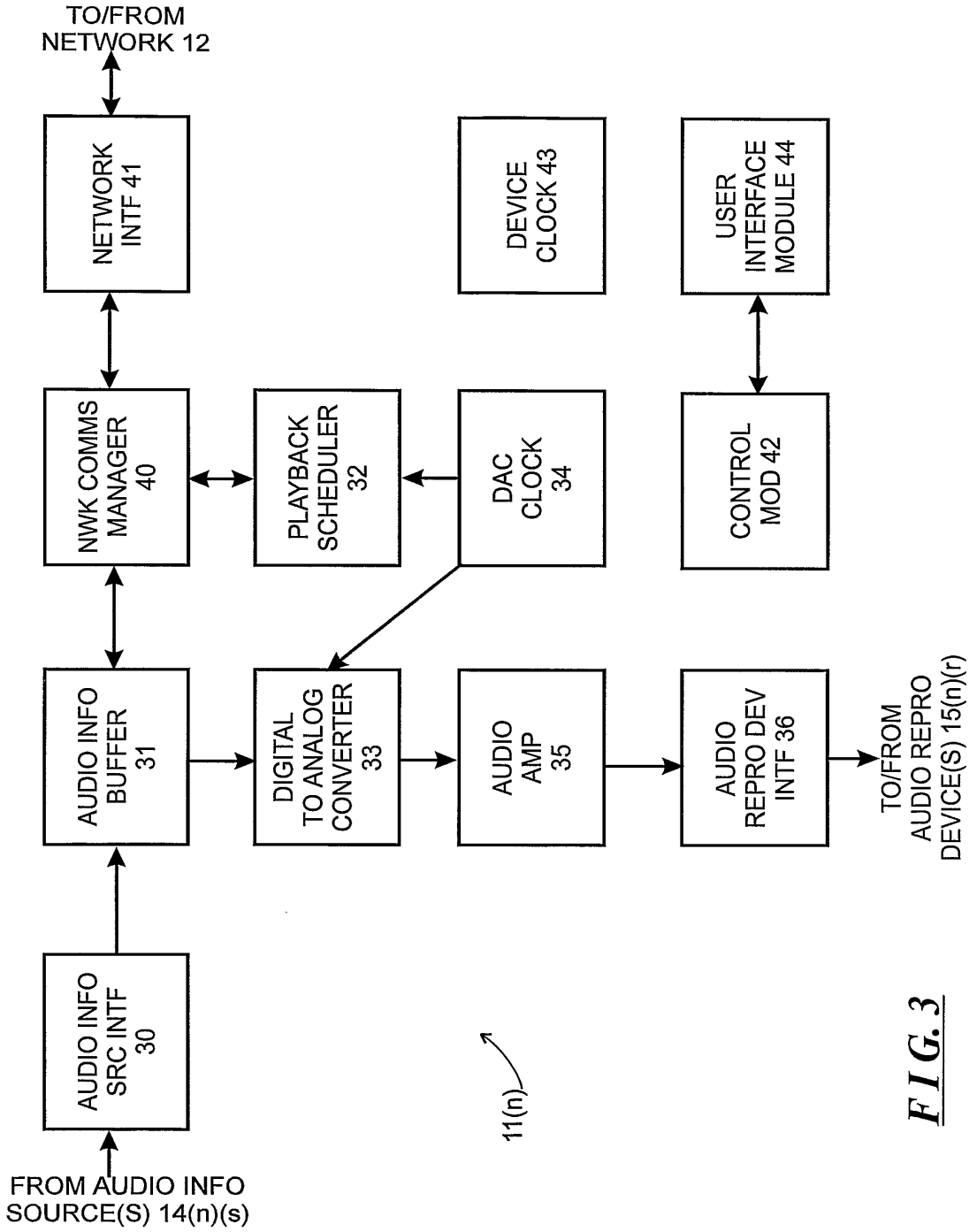
TO/FROM NETWORK 12
NETWORK INTF 41
NWK COMMS MANAGER 40
AUDIO INFO BUFFER 31
AUDIO INFO SRC INTF 30
FROM AUDIO INFO SOURCE(S) 14(n)(s)
PLAYBACK SCHEDULER 32
DIGITAL TO ANALOG CONVERTER 33
DEVICE CLOCK 43
DAC CLOCK 34
AUDIO AMP 35
USER INTERFACE MODULE 44
CONTROL MOD 42
AUDIO REPRO DEV INTF 36
TO/FROM AUDIO REPRO DEVICE(S) 15(n)(r)
11(n)

FIG. 3

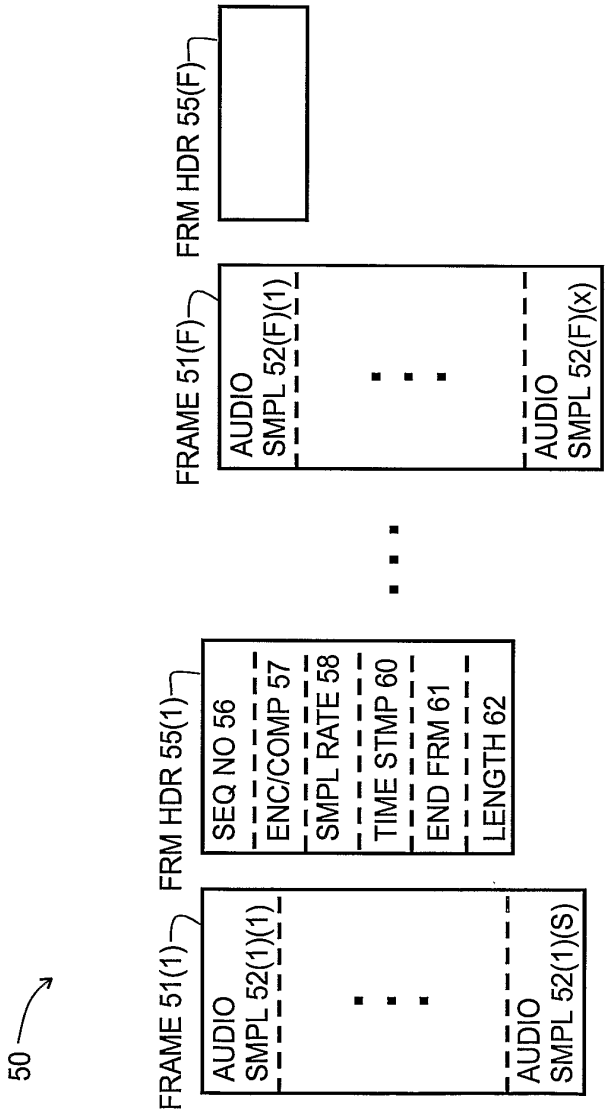
50
FRAME 51(1)
AUDIO SMPL 52(1)(1)
AUDIO SMPL 52(1)(S)
FRM HDR 55(1)
SEQ NO 56
ENC/COMP 57
SMPL RATE 58
TIME STMP 60
END FRM 61
LENGTH 62
FRAME 51(F)
AUDIO SMPL 52(F)(1)
AUDIO SMPL 52(F)(x)
FRM HDR 55(F)

FIG. 4

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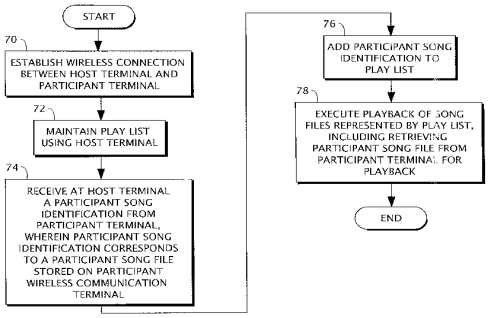
(54) Title: MOBILE WIRELESS COMMUNICATION TERMINALS, SYSTEMS, METHODS, AND COMPUTER PROGRAM PRODUCTS FOR PROVIDING A SONG PLAY LIST



(57) Abstract: A mobile wireless communication terminal includes a wireless communication module and a controller. The wireless communication module is configured to communicate with other communication terminals over a wireless interface. The controller is configured to establish a connection with a participant wireless communication terminal via the wireless communication module, to maintain a play list representing song files to be played, to receive a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal, to add the participant song identification to the play list, and to thereafter execute playback of the song files represented by the play list, including retrieving the participant song file from the participant wireless communication terminal for playback.

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MOBILE WIRELESS COMMUNICATION TERMINALS, SYSTEMS, METHODS, AND COMPUTER PROGRAM PRODUCTS FOR PROVIDING A SONG PLAY LIST

FIELD OF THE INVENTION

[001] The present invention relates to electronic devices and, more particularly, to electronic devices, methods and computer program products for playing song files.

BACKGROUND OF THE INVENTION

[002] Mobile electronic devices, such as wireless communication terminals (*e.g.*, cellular telephones), are widely used to store and playback song files. A user may wish to play a song file on another device such as a media center (*e.g.*, a PC or laptop, a television, an audio receiver, etc.) or another wireless communication terminal. This may be accomplished by connecting the electronic device to the other device via a cable or a wireless link (*e.g.*, a Bluetooth connection) if the other device is equipped with a suitable communication module, which may be an integrated module or an auxiliary (*e.g.*, plug- in) module. Song files may be sent, one by one, from one or more mobile electronic devices to the playback device(s).

SUMMARY OF THE INVENTION

[003] According to embodiments of the present invention, a mobile wireless communication terminal includes a wireless communication module and a controller. The wireless communication module is configured to communicate with other communication terminals over a wireless interface. The controller is configured to establish a connection with a participant wireless communication terminal via the wireless communication module, to maintain a play list representing song files to be played, to receive a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal, to add the participant song identification to the play list, and to thereafter execute playback

of the song files represented by the play list, including retrieving the participant song file from the participant wireless communication terminal for playback.

[004] The controller may be configured to establish a connection with a plurality of participant wireless communication terminals, to receive a plurality of participant song identifications from the plurality of participant wireless communication terminals, wherein each participant song identification corresponds to a respective participant song file stored on a respective one of the plurality of participant wireless communication terminals, to add each of the participant song identifications to the play list, and to retrieve the participant song files from each of the respective participant wireless communication terminals for playback.

[005] According to some embodiments, the controller is configured to retrieve and execute the participant song file from the participant wireless communication terminal as a streaming music file.

[006] According to some embodiments, the controller is configured to retrieve the participant song file from the participant wireless communication terminal, to store the participant song file on the wireless communication terminal, and to thereafter execute playback of the stored participant song file.

[007] The controller may be configured to send a playback signal to a media center for playback of the song files represented by the play list on the media center.

[008] According to some embodiments, the wireless communication terminal includes a sound transducer. The controller is configured to play the song files represented by the play list using the sound transducer.

[009] The controller may be configured to send a playback signal to at least one participant wireless communication terminal for playback of the song files represented by the play list on the at least one participant wireless communication terminal.

[010] The controller may be configured to receive a song catalog listing from the participant wireless communication terminal representing available song files stored on the participant wireless communication terminal, to receive user input selecting from the available song files, and to add the selected available song files to the play list.

[011] According to some embodiments, the controller is configured to send a listing signal to the participant wireless communication terminal representing the play list for display of the play list on the participant wireless communication terminal.

[012] The controller may be configured to modify the play list responsive to user input.

[013] According to some embodiments, the wireless communication module is configured to communicate with other communication terminals over a direct point-to-point wireless interface. The controller is configured to establish the connection with the participant wireless communication terminal, receive the participant song identification from the participant wireless communication terminal, and retrieve the participant song file from the participant wireless communication terminal for playback all via the direct point-to-point wireless interface.

[014] According to some embodiments, the wireless communication module comprises a short range transmitter. The controller is configured to establish the connection with the participant wireless communication terminal, receive the participant song identification from the participant wireless communication terminal, and retrieve the participant song file from the participant wireless communication terminal for playback all via the short range transmitter. The short range transmitter may be a Bluetooth™ transmitter.

[015] The wireless communication terminal may include a cellular telephone.

[016] According to further embodiments of the present invention, a system for providing a song play list includes a host mobile wireless communication terminal and a participant wireless communication terminal. The host wireless communication terminal includes a wireless communication module and a controller. The wireless communication module is configured to communicate with other communication terminals over a wireless interface. The controller is configured to establish a connection with the participant wireless communication terminal via the wireless communication module, to maintain a play list representing song files to be played, to receive a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal, to add the participant song identification to the play list, and to thereafter execute playback of the song files

represented by the play list, including retrieving the participant song file from the participant wireless communication terminal for playback.

[017] According to some embodiments, the system includes a plurality of participant wireless communication terminals. The controller is configured to establish a connection with each of the plurality of participant wireless communication terminals, to receive a plurality of participant song identifications from the plurality of participant wireless communication terminals, wherein each participant song identification corresponds to a respective participant song file stored on a respective one of the plurality of participant wireless communication terminals, to add each of the participant song identifications to the play list, and to retrieve the participant song files from each of the respective participant wireless communication terminals for playback.

[018] According to further embodiments of the present invention, methods for providing a song play list using a host wireless communication terminal includes: establishing a wireless connection between the host wireless communication terminal and a participant wireless communication terminal; maintaining a play list using the host wireless communication terminal, the play list representing song files to be played; receiving at the host wireless communication terminal a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal; adding the participant song identification to the play list; and thereafter executing playback of the song files represented by the play list, including retrieving the participant song file from the participant wireless communication terminal for playback.

[019] According to further embodiments of the present invention, a computer program product for providing a song play list using a host wireless communication terminal includes a computer usable medium having computer usable program code embodied therein, the computer usable program code comprising: computer usable program code configured to establish a wireless connection between the host wireless communication terminal and a participant wireless communication terminal; computer usable program code configured to maintain a play list using the host wireless communication terminal, the play list representing song files to be played; computer usable program code configured to receive at the host wireless communication

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terminal a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal; computer usable program code configured to add the participant song identification to the play list; and computer usable program code configured to thereafter execute playback of the song files represented by the play list, including retrieving the participant song file from the participant wireless communication terminal for playback.

[020] Further features, advantages and details of the present invention will be appreciated by those of ordinary skill in the art from a reading of the figures and the detailed description of the preferred embodiments that follow, such description being merely illustrative of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[021] **Figure 1** is a schematic diagram of a mobile wireless communication terminal according to some embodiments of the present invention and an exemplary base station transceiver.

[022] **Figure 2** is a flowchart illustrating methods in accordance with some embodiments of the present invention.

[023] **Figure 3** is a schematic diagram of a song file playback system according to some embodiments of the present invention including the mobile wireless communication terminal of **Figure 1**.

[024] **Figure 4** is a schematic diagram illustrating a display of the mobile wireless communication terminal of **Figure 1** in accordance with some embodiments of the present invention.

[025] **Figure 5** is a schematic diagram of a song file playback system according to further embodiments of the present invention including the mobile wireless communication terminal of **Figure 1**.

[026] **Figure 6** is a schematic diagram of a song file playback system according to further embodiments of the present invention including the mobile wireless communication terminal of **Figure 1**.

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DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[027] The present invention now will be described more fully with reference to the accompanying drawings, in which embodiments of the invention are shown. However, this invention should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[028] As used herein, the term "comprising" or "comprises" is open-ended, and includes one or more stated features, integers, elements, steps, components or functions but does not preclude the presence or addition of one or more other features, integers, elements, steps, components, functions or groups thereof.

[029] As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[030] As used herein, the common abbreviation "*e.g.*", which derives from the Latin phrase "exempli gratia," may be used to introduce or specify a general example or examples of a previously mentioned item, and is not intended to be limiting of such item. If used herein, the common abbreviation "*i.e.*", which derives from the Latin phrase "id est," may be used to specify a particular item from a more general recitation.

[031] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[032] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[033] It will be understood that when an element is referred to as being "coupled" or "connected" to another element, it can be directly coupled or connected to the other element or intervening elements may also be present. In contrast, when

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an element is referred to as being "directly coupled" or "directly connected" to another element, there are no intervening elements present. Furthermore, "coupled" or "connected" as used herein may include wirelessly coupled or connected.

[034] Well-known functions or constructions may not be described in detail for brevity and/or clarity.

[035] The present invention may be embodied as methods, electronic devices, and/or computer program products. Accordingly, the present invention may be embodied in hardware and/or in software (including firmware, resident software, micro-code, *etc.*), which may be generally referred to herein as a "circuit" or "module". Furthermore, the present invention may take the form of a computer program product on a computer-usable or computer-readable storage medium having computer-usable or computer-readable program code embodied in the medium for use by or in connection with an instruction execution system. In the context of this document, a computer-usable or computer-readable medium may be any medium that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device.

[036] Embodiments according to the present invention are described with reference to block diagrams and/or operational illustrations of methods and communication terminals. In this regard, each block may represent a module, segment, or portion of code, which comprises one or more executable instructions for implementing the specified logical function(s). It is to be understood that each block of the block diagrams and/or operational illustrations, and combinations of blocks in the block diagrams and/or operational illustrations, can be implemented by radio frequency, analog and/or digital hardware, and/or program instructions. These program instructions may be provided to a controller, which may include one or more general purpose processors, special purpose processors, ASICs, and/or other programmable data processing apparatus, such that the instructions, which execute via the controller and/or other programmable data processing apparatus, create means for implementing the functions/acts specified in the block diagrams and/or operational block or blocks. In some alternate implementations, the functions/acts noted in the blocks may occur out of the order noted in the operational illustrations. For example, two blocks shown in succession may in fact be executed substantially concurrently or

the blocks may sometimes be executed in the reverse order, depending upon the functionality/acts involved.

[037] These computer program instructions may also be stored in a computer-usable or computer-readable memory that may direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer usable or computer-readable memory produce an article of manufacture including instructions that implement the function specified in the flowchart and/or block diagram block or blocks.

[038] The computer-usable or computer-readable medium may be, for example but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, device, or propagation medium. More specific examples (a nonexhaustive list) of the computer-readable medium include the following: hard disks, optical storage devices, a transmission media such as those supporting the Internet or an intranet, magnetic storage devices, an electrical connection having one or more wires, a portable computer diskette, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, and a compact disc read-only memory (CD-ROM).

[039] Computer program code for carrying out operations of the present invention may be written in an object oriented programming language such as Java®, Smalltalk or C++. However, the computer program code for carrying out operations of the present invention may also be written in conventional procedural programming languages, such as the "C" programming language and/or a lower level assembler language. It will be further appreciated that the functionality of any or all of the program modules may also be implemented using discrete hardware components, one or more application specific integrated circuits (ASICs), or a programmed digital signal processor or microcontroller.

[040] As used herein, "electronic component" means an active device as contrasted with a passive electrical connector or the like. An electronic component may include a processor.

[041] As used herein, "streamed" or "streaming" means that a file, such as an audio or song file, is continuously sent via a digital signal to a receiving device where

the audio or song file is concurrently played via a suitable receiving application. The digital signal is typically buffered.

[042] As used herein, a "communication terminal" includes, but is not limited to, a terminal that is configured to receive/transmit communication signals via a wireline connection, such as via a public-switched telephone network (PSTN), digital subscriber line (DSL), digital cable, or another data connection/network, and/or via a wireless interface with, for example, a cellular network, a satellite network, a wireless local area network (WLAN), and/or another communication terminal.

[043] When the communication terminal is configured to communicate over a wireless interface, it is referred to herein as a "wireless communication terminal" or a "wireless terminal." Examples of wireless terminals include, but are not limited to, a cellular telephone, personal data assistant (PDA), pager, and/or a computer that is configured to communicate data over a wireless communication interface that can include a cellular telephone interface, a Bluetooth interface, a wireless local area network interface (*e.g.*, 802.11), another RF communication interface, and/or an optical/infra-red communication interface.

[044] As used herein, "mobile terminals" may be portable, transportable, installed in a vehicle (aeronautical, maritime, or land-based), or situated and/or configured to operate locally and/or in a distributed fashion at any other location(s) on earth and/or in space.

[045] Some embodiments of the present invention will now be described below with respect to **Figures 1-6**. Some embodiments of the present invention provide mobile wireless communication terminals capable of providing a song play list including one or more song identifications from another wireless communication terminal.

[046] Referring now to **Figure 1**, an exemplary mobile wireless communication terminal **10A** in accordance with some embodiments of the present invention is illustrated. The wireless terminal **10A** is configured to communicate data with one or more other wireless terminals over a direct wireless communication interface therebetween, over another wireless communication interface through one or more cellular base stations, and/or over another wireless communication interface through a wireless local area network (WLAN) router.

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[047] The wireless terminal **10A** may be a mobile radiotelephone forming a part of a radiotelephone communication system **2** as illustrated in **Figure 1**. The system **2** includes the mobile wireless communication terminal **10A** and a base station transceiver, which is part of a wireless communications network **5**. In some embodiments of the present invention, the network **5** includes a base station transceiver that includes the radio transceiver(s) that define an individual cell in a cellular network and communicates with the mobile terminal **10A** (via an interface **7**) and other mobile terminals in the cell using a radio-link protocol. It will be understood that, in some embodiments of the present invention, many base station transceivers may be connected through, for example, a mobile switching center and other devices to define the wireless communications network **5**.

[048] The mobile terminal **10A** in the illustrated embodiments includes a portable housing assembly **12**, a display **20**, a user interface **22** (*i.e.*, a man machine interface (MMI)) including a speaker **24** (*i.e.*, a sound transducer), a controller **30**, a communication module **32**, and a memory **34**. The foregoing components of the mobile terminal **10A** may be included in many conventional mobile terminals and their functionality is generally known to those skilled in the art. The mobile terminal **10A** further includes a song management module **40**, which may be stored in the memory **34**.

[049] The display **20** may be any suitable display screen assembly. For example, the display screen **28** may be a liquid crystal display (LCD) with or without auxiliary lighting (*e.g.*, a lighting panel).

[050] The user interface **22** may include any suitable input device(s) including, for example, a touch activated or touch sensitive device (*e.g.*, a touch screen), a joystick, a keyboard/keypad, a dial, a directional key or keys, and/or a pointing device (such as a mouse, trackball, touch pad, etc.). The speaker **24** generates sound responsive to an input audio signal. The user interface **22** can also include a microphone coupled to an audio processor that is configured to generate an audio data stream responsive to sound incident on the microphone.

[051] The controller **30** may support various functions of the mobile terminal **10A**. The controller **30** can be any commercially available or custom microprocessor, for example. In use, the controller **30** of the mobile terminal **10A** generates a display image on the display **20**.

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[052] The memory **34** is configured to store digital information signals and data such as a digital audio signal and/or digital audio files.

[053] The communication module **32** is configured to communicate data over one or more wireless interfaces (*e.g.*, wireless interfaces **7**, **112**, **114**, **116**, **122**, and **134** as discussed herein (**Figures 1** and **3**)) to another remote wireless terminal as discussed herein. The communication module **32** can include a cellular communication module, a direct point-to-point connection module, and/or a WLAN module.

[054] With a cellular communication module, the wireless terminal **10A** can communicate via the base station(s) of the network **5** using one or more cellular communication protocols such as, for example, Advanced Mobile Phone Service (AMPS), ANSI-136, Global Standard for Mobile (GSM) communication, General Packet Radio Service (GPRS), enhanced data rates for GSM evolution (EDGE), code division multiple access (CDMA), wideband-CDMA, CDMA2000, and Universal Mobile Telecommunications System (UMTS). The cellular base stations may be connected to a Mobile Telephone Switching Office (MTSO) wireless network, which, in turn, can be connected to a PSTN and/or another network.

[055] A direct point-to-point connection module may include a direct RF communication module or a direct IR communication module. The direct RF communication module may include a Bluetooth module. With a Bluetooth module, the wireless terminal **10A** can communicate via an ad-hoc network through a direct point-to-point interface.

[056] With a WLAN module, the wireless terminal **10A** can communicate through a WLAN (*e.g.*, a router **120** (**Figure 3**)) using a communication protocol that may include, but is not limited to, 802.11a, 802.11b, 802.11e, 802.11g, and/or 802.11i.

[057] The communication module **32** can include a transceiver typically having a transmitter circuit and a receiver circuit, which respectively transmit outgoing radio frequency signals (*e.g.*, to the network **5**, a router or directly to another terminal) and receive incoming radio frequency signals (*e.g.*, from the network **5**, a router or directly to another terminal), such as voice and data signals, via an antenna. The communication module **32** may include a short range transmitter and receiver, such as a Bluetooth transmitter and receiver. The antenna may be an embedded

antenna, a retractable antenna or any antenna known to those having skill in the art without departing from the scope of the present invention. The radio frequency signals transmitted between the mobile terminal **10A** and the network **5**, router or other terminal may include both traffic and control signals (*e.g.*, paging signals/messages for incoming calls), which are used to establish and maintain communication with another party or destination. The radio frequency signals may also include packet data information, such as, for example, cellular digital packet data (CDPD) information. In addition, the transceiver may include an infrared (IR) transceiver configured to transmit/receive infrared signals to/from other electronic devices via an IR port.

[058] The mobile terminal **10A** may also be configured to electrically couple with another terminal via a wireline or cable for the transmission of digital communication signals therebetween. The mobile terminal **10A** may include further components such as a camera device configured to generate a still image and/or video data stream based on incident light.

[059] According to some embodiments, the mobile terminal **10A** is a handheld mobile terminal. By "handheld mobile terminal," it is meant that the outer dimensions of the mobile terminal are adapted and suitable for use by a typical operator using one hand. According to some embodiments, the total volume of the handheld mobile terminal **10A** is less than about 200 cc. According to some embodiments, the total volume of the handheld terminal **10A** is less than about 100 cc. According to some embodiments, the total volume of the handheld mobile terminal **10A** is between about 50 and 100 cc. According to some embodiments, no dimension of the handheld mobile terminal **10A** exceeds about 200 mm.

[060] A method for providing a song play list using a wireless communication terminal (*e.g.*, the mobile terminal **10A**) according to some embodiments of the present invention will now be described with reference to the flowchart of **Figure 2**. Referring to the embodiments of **Figure 2**, the method includes establishing a wireless connection between the host wireless communication terminal and a participant wireless communication terminal (**Block 70**). A play list is maintained using the host wireless communication terminal (**Block 72**). The play list represents song files to be played. A participant song identification from the participant wireless communication terminal is received at the host wireless

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communication terminal (**Block 74**). The participant song identification corresponds to or designates a participant song file stored on the participant wireless communication terminal. The participant song identification is added to the play list (**Block 76**). Thereafter, playback of the song files represented by the play list is executed (**Block 78**). Execution of playback of the song file includes retrieving the participant song file from the participant wireless communication terminal for playback.

[061] According to some embodiments, connections are established between the host wireless communication terminal and a plurality of participant wireless communication terminals, and the host wireless communication terminal receives a plurality of participant song identifications from the plurality of participant wireless communication terminals, adds each of the participant song identifications to the play list, and retrieves the participant song files from each of the respective participant wireless communication terminals for playback. According to some embodiments, communication between the host wireless communication terminal and the participant wireless communication terminal is accomplished via a direct point-to-point interface, such as a Bluetooth wireless RF connection. According to some embodiments, communication between the host wireless communication terminal and the participant wireless communication terminal is accomplished via an indirect interface, such as through a WLAN or cellular-based system. Further aspects and embodiments of the present invention will be apparent from the following descriptions of further embodiments.

[062] With reference to **Figure 3**, a song file playback system **100A** according to embodiments of the present invention is shown therein. The system **100A** includes the mobile wireless communication terminal **10A** (also referred to herein as the "host wireless communication terminal" or "host terminal"), a plurality of additional participant wireless communication terminals **10B**, **10C**, **10D**, and **10E** (also referred to herein as the "participant wireless communication terminals" or "participant terminals"), and a media center **130**.

[063] The terminals **10B-E** may be configured as described above with regard to the terminal **10A**. The terminals **10B-E** each include a wireless communication module **32** and a song management module **40**. However, the respective song management modules may be differently configured for each terminal

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10A-E depending on the intended functionality of the device. According to some embodiments, all or some of the terminals **10B-E** are mobile wireless communication terminals. According to some embodiments, all or some of the terminals **10A-E** are handheld mobile wireless communication terminals.

[064] The media center **130** includes apparatus adapted to convert an audio signal (*e.g.*, a digital audio signal) to corresponding sound. The media center **130** may include, for example, a PC or laptop, a television, an audio receiver, stereo equipment, etc. The illustrated media center **130** includes a wireless communication module **132** and sound transducers (speakers) **136**. The wireless communication module **132** may be integrated with the media center **130** or may be an auxiliary or plug-in wireless communication module such as the Bluetooth Media Viewer MMV-100 module or Bluetooth Media Viewer MMV-200 module, each available from Sony Ericsson of Sweden.

[065] The system **100A** will now be described using an illustrative example of use. A group of users at a gathering each have a respective one of the terminals **10A-E**. Various songs are stored on one or more (typically two or more) of the terminals **10A-E**. The users may wish to share the songs stored on their mobile terminals with the other users at the gathering by playing their songs on the media center **130**. With known and available technology, this can be accomplished by having each user send (via Bluetooth, etc.) his or her songs (*i.e.*, music audio files) to the media center **130** one at a time, song by song. However, this method requires substantial and active interaction from each contributing user. Such involvement may be inconvenient and/or not conducive to the setting (*e.g.*, a party).

[066] In accordance with embodiments of the present invention, the foregoing shortcomings can be overcome by creating and maintaining a play list of songs and executing playback of the songs (*i.e.*, the music audio files) using the host terminal **10A**. Typically, each terminal **10A-E** will have the appropriate song management module **40** (*e.g.*, software or firmware application) installed thereon.

[067] The host terminal **10A** is chosen to be the master or host terminal and the participant terminals **10B-E** are each designated as slave or participant terminals. The controller **30** of the host terminal **10A** establishes a wireless connection (*i.e.*, communicatively couples) with each of the participant terminals **10B-E**. According to some embodiments the wireless connection is a direct wireless communication

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interface connection, according to some embodiments, a direct RF connection and, according to some embodiments, a Bluetooth connection. The connections may be established in known manner. For example, in the case of Bluetooth connections, the participant (slave) terminals **10B-E** may be set to a searchable/discoverable state and the host (master) terminal **10A** emits an inquiry to identify the available participant (slave) terminals **10B-E** to form a piconet or personal area network.

[068] As illustrated, the host terminal **10A** communicates with the participant terminals **10B**, **10C** and **10D** via direct point-to-point wireless interfaces or links **112**, **114** and **116**, respectively, and with the participant terminal **10E** via wireless interfaces or links **118**, **122** through a WLAN router **120**. It will be appreciated that, according to some embodiments, the interfaces may be various combinations of wireless interfaces that are direct (*e.g.*, Bluetooth) or indirect (*e.g.*, via a WLAN router or a cellular network **5**). According to some contemplated embodiments, all of the signals provided between the host terminal **10A** and the participant terminals **10B-E** to execute the song sharing procedure are provided via direct point-to-point wireless interfaces. According to some contemplated embodiments, all of the signals provided between the host terminal **10A** and the participant terminals to execute the song sharing procedure are provided via direct wireless radio frequency (RF) interfaces such as Bluetooth interfaces.

[069] Before or after establishing the connections, the host terminal **10A** may identify and designate valid participant terminals by any suitable method. According to some embodiments, the host terminal **10A** will poll or send an invitation to all or a selected group of potential participant terminals (*e.g.*, those within operational range of the host terminal's Bluetooth signal). The potential participant terminals may then opt in by replying with an acceptance of the invitation. Alternatively or additionally, the host terminal **10A** may accept unsolicited requests from participant terminals to participate. The host terminal **10A** may be used to define specific groups such as a listing of the potential participant terminals that will be permitted to participate (*i.e.*, contribute songs to the play list).

[070] The host terminal **10A** is also communicatively coupled to the media center **130** to provide wireless song data signals via a wireless interface or link **134** to the communication module **132**. Alternatively, the host terminal **10A** can be connected to the media center **130** using a wireline or signal cable.

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[071] Once the connections are established between the host terminal **10A** and the participant terminals **10B-E**, each participant can send a participant song identification designating a song stored on the participant's terminal **10B-E**. The song management module **40** of the sending participant terminal **10B-E** may provide a user interface to facilitate the selection and sending of the song identification(s). For example, the module **40** may generate a list of the available stored songs and check boxes for selecting the song(s) to send to the host terminal **10A**.

[072] The host terminal **10A** receives the participant song identifications from the participant terminals **10B-E**. The song management module **40** of the host terminal **10A** creates and maintains a host play list of these song identifications. The host play list represents song files to be played.

[073] Each song management module **40** provides a display **150** on the associated terminal **10A-E** as shown in **Figure 4**. The display provided on the host terminal **10A** may differ from the display provided on the participant terminals **10B-E**. For example, the portions of the display **150** related to management functionality may be omitted from the participant terminal displays. Alternatively, the song management module **40** may provide no display on the participant terminals **10B-E**.

[074] In the illustrated embodiment, the display **150** includes a play list field **152** and control buttons **154** (*e.g.*, soft keys). The control buttons **154** will typically only be displayed on the host terminal display. A play list **156** is displayed in the play list field **152**. The play list **156** includes a row-by-row series of song identifications **156A**, each corresponding to a respective song file. As illustrated, each song identification includes a song artist, a song name, and a song play time corresponding to the associated song file, as well as an identification of the participant that has submitted the song identification. It will be appreciated that more, less and/or different information may be provided as well.

[075] The host may selectively manage play of the songs represented by the song list **156** using the control buttons **154**, for example. For example, the "PLAY" and "STOP" buttons may be used to start and stop transmission of the song files to the media center **130**. The "MOVE" button may be used to prioritize or change the order of the song identifications **156A** in the play list **156** (*i.e.*, to change the order in which the associated song files will be played). The "DELETE" button may be used to delete a song identification **156A** from the play list **156**. The "DETAILS" button may

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be used to delete a song identification **156A** from the play list **156** so that the associated song file will not be played. The "RANDOM MIX" button may be used to cause the host terminal **10A** to execute playback of the song files (*i.e.*, send the song files to the media center **130**) in a random or other non-sequential order. Typically, the host terminal **10A** will execute playback of the song files in the listed sequence unless the random or other non-sequential mode is in effect.

[076] Other functionality could also be provided. For example, the host terminal **10A** may allow the user to change the order of the song identifications **156A** according to one or more selected attributes (*e.g.*, contributing participant, song length, etc.). The host terminal **10A** may be configured to designate which of the participant terminals **10B-E** are permitted to add song identifications to the play list **156**. The participant terminals **10B-E** may be enabled to edit or modify the song list **156** in addition to adding song identifications. In this case, the host terminal **10A** may be configured to allow the host to select which of the participant terminals **10B-E** are and are not authorized to modify the song play list **156** (*i.e.*, enable and disable the play list edit capability of the participant terminals).

[077] When the host terminal **10A** is in play mode, the controller **30** of the host terminal **10A** will identify the song identification **156A** that is to be played thereafter. The song identification identified may be the song identification that is to be played next. The host terminal **10A** will then send a song file request to the corresponding one of the participant terminals **10B-E** to retrieve the song file corresponding to the song identification.

[078] The corresponding participant terminal will then send a copy of the identified song file (which is stored on the participant terminal) to the host terminal **10A**. According to some embodiments, the participant terminal sends the song file to the host terminal **10A** as a copy of the song file that is then temporarily stored on the host terminal **10A** (*e.g.*, in the memory **34**). According to other embodiments, the participant terminal sends the song file to the host terminal **10A** as a streaming song file. According to some embodiments, the request and song file signals between the host terminal and the participant terminal are sent wirelessly and, according to some embodiments, via a direct wireless RF connection such as Bluetooth.

[079] The controller **30** of the host terminal **10A** then executes playback of the retrieved song file by sending the song file to the media center **130**. The song file

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may be stored on the media center **130** for playback. Alternatively, the song file may be streamed to the media center **130**, for example, as the song file is streamed from the originating participant terminal to the host terminal **10A**. It may be preferable or necessary to stream the song file from the participant terminal to the host terminal and/or from the host terminal to the media center **130** if the allocated memory space on the host terminal **10A** is insufficient and/or storage of the song file on the host terminal **10A** is prevented or illegal. According to some embodiments, the song file, whether streamed or stored in whole, will be automatically erased (*i.e.*, without user intervention) from the host terminal **10A** during or after playback.

[080] The controller **30** of the host terminal **10A** may execute the foregoing steps for each song identification **156A** in turn and automatically (*i.e.*, without user intervention). As the host terminal **10A** runs through the song list **156** in this fashion, the host may modify the play list **156** as desired. Also, according to some embodiments, the participant terminals **10B-E** can add new song identifications to the song list **156** as the controller **30** of the host terminal **10A** runs through the play list **156**. According to some embodiments, new participant terminals can join the group and submit song identifications as the host terminal **10A** runs through the play list **156**.

[081] The system **100A** can provide a convenient and enjoyable mechanism for playing songs selected by a group of people. The system **100A** provides playback execution functionality and also allows the host terminal (and, in some cases, the participant terminals) to create, coordinate, control and/or manage the song play list. In practice, for example, partygoers can add songs from their own participant terminals to a song play list maintained on a host terminal (*e.g.*, the party host's own mobile terminal). When their song's turn arrives in the playback sequence, a copy of the song file will automatically be sent to the host terminal and played. Thus, the partygoer need not take any further action. When, in accordance with some embodiments, the request and song transfer signals are communicated between the host terminal and the participant terminal via a direct wireless connection (*e.g.*, an RF interface such as a Bluetooth connection), the partygoer may simply place his or her participant terminal in a pocket or handbag. Participants may be added and removed as the procedure is executed. For example, when a participant leaves the Bluetooth range, his or her songs may be deleted from or moved down the play list.

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[082] Referring now to **Figure 5**, a system **100B** according to further embodiments of the present invention is shown therein including the host terminal **10A** and the participant terminals **10B-E**. The system **100B** differs from the system **100A** (**Figure 2**) in that the media center **130** is omitted and playback of the song files from the song play list **156** is conducted via the speaker **24** of the host terminal **10A**.

[083] Referring now to **Figure 6**, a system **100C** according to further embodiments of the present invention is shown therein including the host terminal **10A** and the participant terminals **10B-E**. The system **100C** differs from the system **100B** (**Figure 5**) in that playback of the song files from the song play list **156** is conducted via the speaker **24** of the host terminal **10A** and, additionally, through the respective speakers of the participant terminals **10B-E** and/or through one or more headsets (*e.g.*, in-ear stereo headsets) operatively connected to the participant terminals **10B-E**. More particularly, the controller **30** of the host terminal **10A** plays each song file in the same manner as described above and also sends the song file to the participant terminals **10B-E** for simultaneous playback. Thus, the host terminal **10A** creates and manages a song play list that may include song identifications from the participant terminals **10B-E**, retrieves copies of the song files from the appropriate participant terminals **10B-E** as needed, and distributes the copies of the song files to the participant terminals **10B-E** for playback. According to some embodiments, the song transfer signal is sent from the host terminal **10A** to the participant terminals **10B-E** wirelessly and, according to some embodiments via a direct wireless RF connection such as Bluetooth. According to some embodiments, the song files are streamed to the participant terminals **10B-E**. The host terminal **10A** may be configured to permit the host to designate which of the participant terminals **10B-E** will receive playback signals and which of the participant terminals **10B-E** are authorized to submit song identifications to the play list **156**, and these two groups may differ.

[084] The host terminal **10A** may be configured to allow the user to selectively choose the device or combination of devices for playback from the various options discussed above. For example, the host terminal **10A** may be configured to execute playback via only the speaker **24** of the host terminal **10A**, via the speaker of the host terminal **10A** and the speakers of the participant terminals **10B-E**, via the speakers of the participant terminals **10B-E** and the media center **130**, etc. It will be

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appreciated that, when the song files are played back via the speakers of the participant terminals **10B-E**, the user of a given one of the participant terminals may disable the speaker thereof and/or may relay the song file for playback on another device (*e.g.*, an associated further media center or the like).

[085] According to further embodiments, the controller **30** of the host terminal **10A** may request and/or accept unsolicited a song catalog listing from a participant terminal. The song catalog listing includes song identifications representing each of the song files on the participant terminal or song identifications for all such song files the participant wishes to make available. The host terminal **10A** may thereafter enable the host to select the song identifications of the song catalog listing the host wishes to add to the play list.

[086] The application programs described herein, including the song management module **40**, are illustrative of programs that implement various features according to embodiments of the present invention. It will be appreciated that other and/or additional application programs may be employed in accordance with embodiments of the present invention.

[087] Although **Figure 1** illustrates an exemplary hardware/software architecture that may be used in mobile terminals and/or other electronic devices for management and playback of song files, it will be understood that the present invention is not limited to such a configuration but is intended to encompass any configuration capable of carrying out operations described herein. For example, although the memory **34** is illustrated as separate from the controller **30**, the memory **34** or portions thereof may be considered as a part of the controller **30**. More generally, while particular functionalities are shown in particular blocks by way of illustration, functionalities of different blocks and/or portions thereof may be combined, divided, and/or eliminated. Moreover, the functionality of the hardware/software architecture of **Figure 1** may be implemented as a single processor system or a multi-processor system in accordance with various embodiments of the present invention.

[088] Many alterations and modifications may be made by those having ordinary skill in the art, given the benefit of present disclosure, without departing from the spirit and scope of the invention. Therefore, it must be understood that the illustrated embodiments have been set forth only for the purposes of example, and that

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it should not be taken as limiting the invention as defined by the following claims. The following claims, therefore, are to be read to include not only the combination of elements which are literally set forth but all equivalent elements for performing substantially the same function in substantially the same way to obtain substantially the same result. The claims are thus to be understood to include what is specifically illustrated and described above, what is conceptually equivalent, and also what incorporates the essential idea of the invention.

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THAT WHICH IS CLAIMED IS:

1. A mobile wireless communication terminal comprising:

a wireless communication module that is configured to communicate with other communication terminals over a wireless interface; and

a controller that is configured to establish a connection with a participant wireless communication terminal via the wireless communication module, to maintain a play list representing song files to be played, to receive a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal, to add the participant song identification to the play list, and to thereafter execute playback of the song files represented by the play list, including retrieving the participant song file from the participant wireless communication terminal for playback.

2. The wireless communication terminal of Claim 1 wherein the controller is configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, to receive a plurality of participant song identifications from the plurality of participant wireless communication terminals, wherein each participant song identification corresponds to a respective participant song file stored on a respective one of the plurality of participant wireless communication terminals, to add each of the participant song identifications to the play list, and to retrieve the participant song files from each of the respective participant wireless communication terminals for playback.

3. The wireless communication terminal of Claim 1 or 2 wherein the controller is configured to retrieve and execute the participant song file from the participant wireless communication terminal as a streaming music file.

4. The wireless communication terminal of Claim 1 or 2 wherein the controller is configured to retrieve the participant song file from the participant

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wireless communication terminal, to store the participant song file on the wireless communication terminal, and to thereafter execute playback of the stored participant song file.

5. The wireless communication terminal of any previous Claim wherein the controller is configured to send a playback signal to a media center for playback of the song files represented by the play list on the media center.

6. The wireless communication terminal of any previous Claim including a sound transducer and wherein the controller is configured to play the song files represented by the play list using the sound transducer.

7. The wireless communication terminal of any previous Claim wherein the controller is configured to send a playback signal to at least one participant wireless communication terminal for playback of the song files represented by the play list on the at least one participant wireless communication terminal.

8. The wireless communication terminal of any previous Claim wherein the controller is configured to receive a song catalog listing from the participant wireless communication terminal representing available song files stored on the participant wireless communication terminal, to receive user input selecting from the available song files, and to add the selected available song files to the play list.

9. The wireless communication terminal of any previous Claim wherein the controller is configured to send a listing signal to the participant wireless communication terminal representing the play list for display of the play list on the participant wireless communication terminal.

10. The wireless communication terminal of any previous Claim wherein the controller is configured to modify the play list responsive to user input.

11. The wireless communication terminal of any previous Claim wherein:

the wireless communication module is configured to communicate with other communication terminals over a direct point-to-point wireless interface; and

the controller is configured to establish the connection with the participant wireless communication terminal via the wireless communication module, receive the participant song identification from the participant wireless communication terminal, and retrieve the participant song file from the participant wireless communication terminal for playback all via the direct point-to-point wireless interface.

12. The wireless communication terminal of any previous Claim wherein the wireless communication module comprises a short range transmitter, and the controller is configured to establish the connection with the participant wireless communication terminal, receive the participant song identification from the participant wireless communication terminal, and retrieve the participant song file from the participant wireless communication terminal for playback all via the short range transmitter.

13. The wireless communication terminal of Claim 12 wherein the short range transmitter is a Bluetooth transmitter.

14. The wireless communication terminal of any previous Claim wherein the wireless communication terminal includes a cellular telephone.

15. A system for providing a song play list, the system comprising:

a host mobile wireless communication terminal;

a participant wireless communication terminal;

wherein the host wireless communication terminal includes:

a wireless communication module that is configured to communicate with other communication terminals over a wireless interface; and

a controller that is configured to establish a connection with the participant wireless communication terminal via the wireless

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communication module, to maintain a play list representing song files to be played, to receive a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal, to add the participant song identification to the play list, and to thereafter execute playback of the song files represented by the play list, including retrieving the participant song file from the participant wireless communication terminal for playback.

16. The system of Claim 15 including a plurality of participant wireless communication terminals, and wherein the controller is configured to establish a connection with each of the plurality of participant wireless communication terminals, to receive a plurality of participant song identifications from the plurality of participant wireless communication terminals, wherein each participant song identification corresponds to a respective participant song file stored on a respective one of the plurality of participant wireless communication terminals, to add each of the participant song identifications to the play list, and to retrieve the participant song files from each of the respective participant wireless communication terminals for playback.

17. A method for providing a song play list using a host wireless communication terminal, the method comprising:

establishing a wireless connection between the host wireless communication terminal and a participant wireless communication terminal;

maintaining a play list using the host wireless communication terminal, the play list representing song files to be played;

receiving at the host wireless communication terminal a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal;

adding the participant song identification to the play list; and thereafter

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executing playback of the song files represented by the play list, including retrieving the participant song file from the participant wireless communication terminal for playback.

18. A computer program product for providing a song play list using a host wireless communication terminal, the computer program product comprising:

a computer usable medium having computer usable program code embodied therein, the computer usable program code comprising:

computer usable program code configured to establish a wireless connection between the host wireless communication terminal and a participant wireless communication terminal;

computer usable program code configured to maintain a play list using the host wireless communication terminal, the play list representing song files to be played;

computer usable program code configured to receive at the host wireless communication terminal a participant song identification from the participant wireless communication terminal, wherein the participant song identification corresponds to a participant song file stored on the participant wireless communication terminal;

computer usable program code configured to add the participant song identification to the play list; and

computer usable program code configured to thereafter execute playback of the song files represented by the play list, including retrieving the participant song file from the participant wireless communication terminal for playback.

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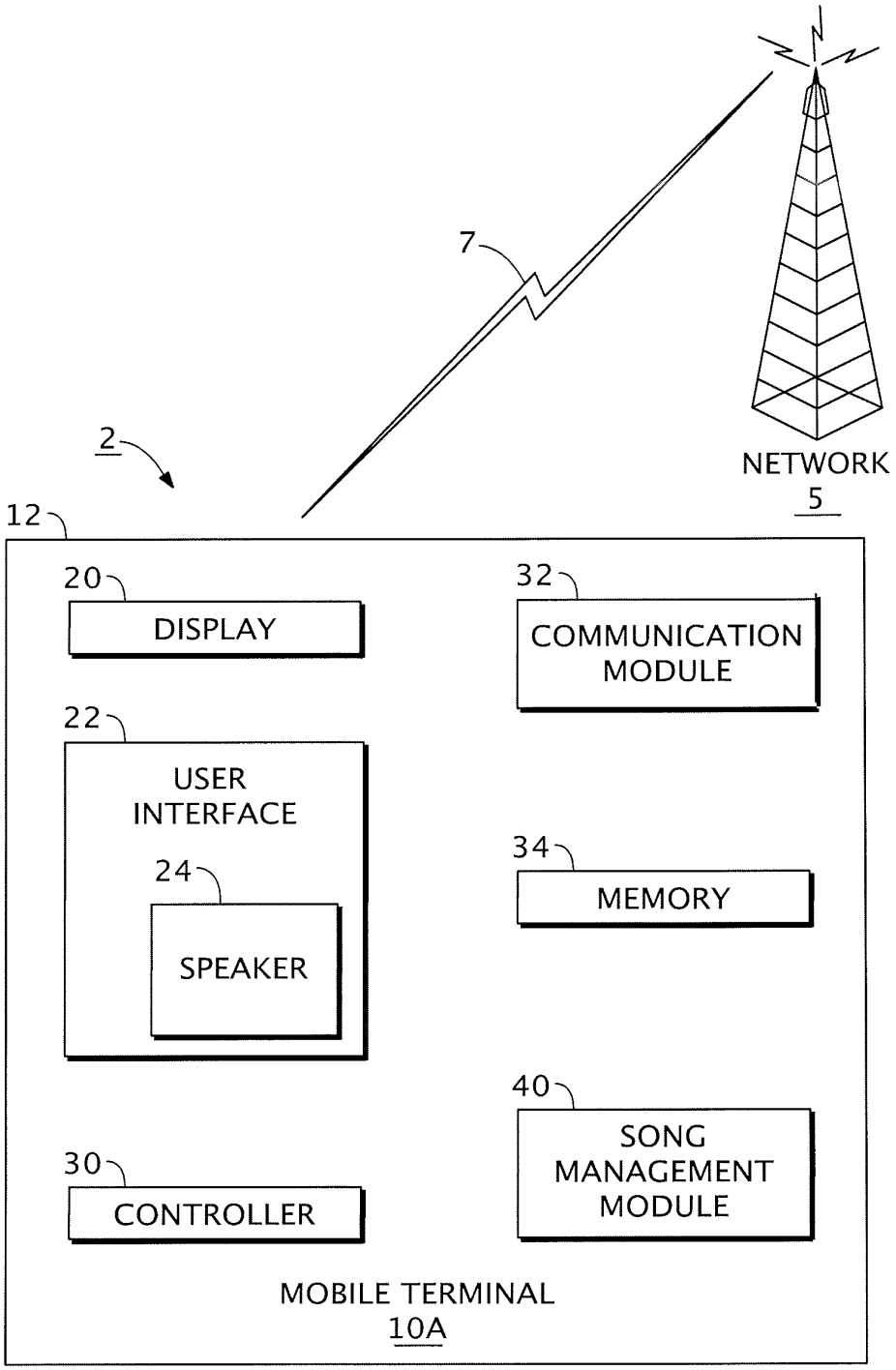

7
2
NETWORK
5
12
20
DISPLAY
32
COMMUNICATION MODULE
22
USER INTERFACE
24
SPEAKER
34
MEMORY
40
SONG MANAGEMENT MODULE
30
CONTROLLER
MOBILE TERMINAL
10A

FIG. 1

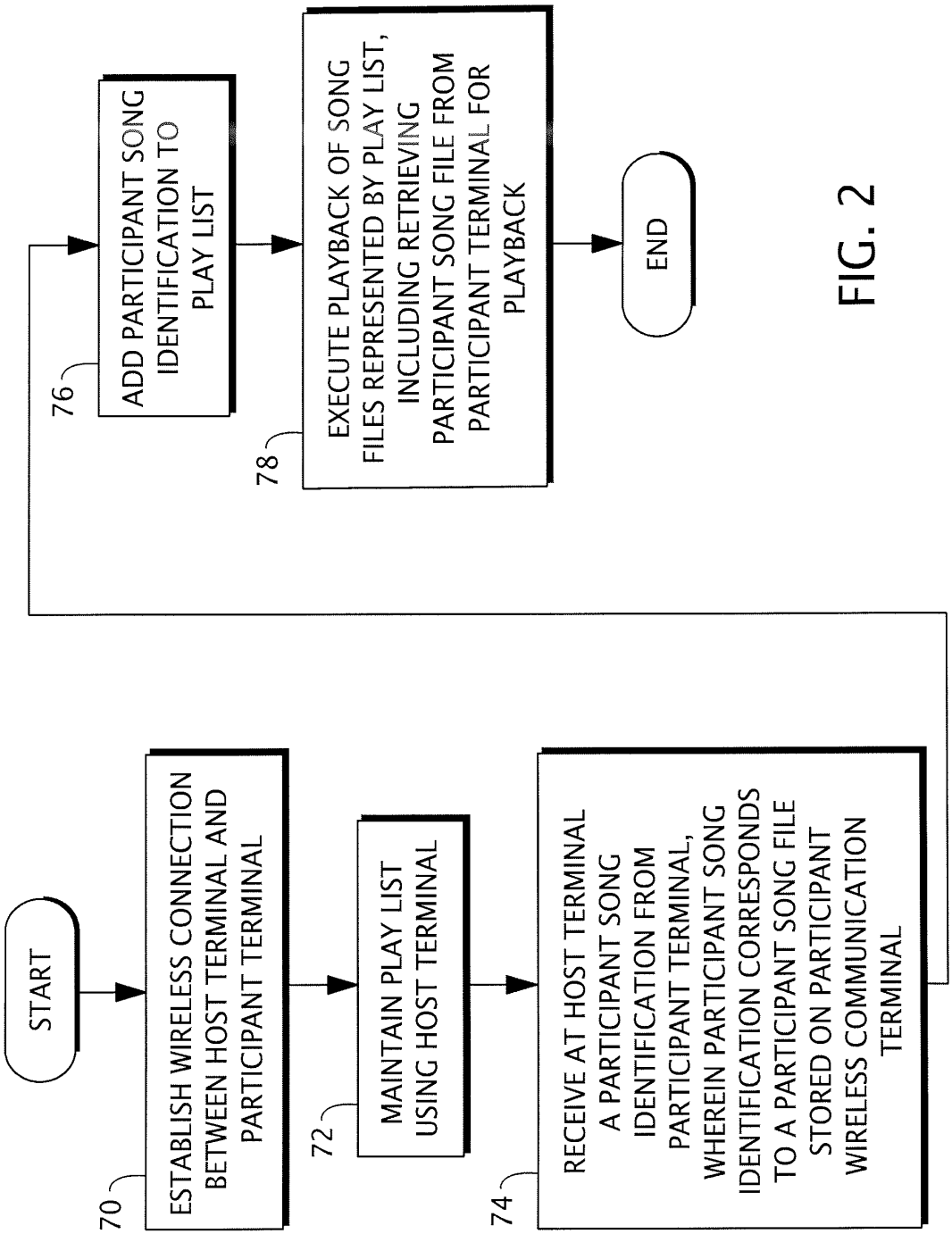
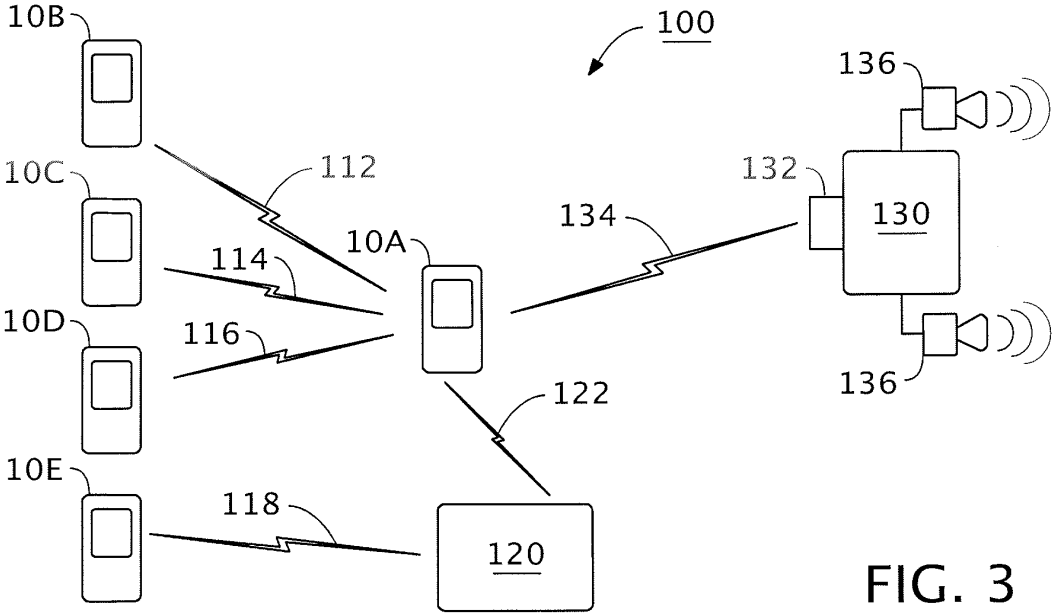

START
ESTABLISH WIRELESS CONNECTION BETWEEN HOST TERMINAL AND PARTICIPANT TERMINAL
70
MAINTAIN PLAY LIST USING HOST TERMINAL
72
RECEIVE AT HOST TERMINAL A PARTICIPANT SONG IDENTIFICATION FROM PARTICIPANT TERMINAL, WHEREIN PARTICIPANT SONG IDENTIFICATION CORRESPONDS TO A PARTICIPANT SONG FILE STORED ON PARTICIPANT WIRELESS COMMUNICATION TERMINAL
74
ADD PARTICIPANT SONG IDENTIFICATION TO PLAY LIST
76
EXECUTE PLAYBACK OF SONG FILES REPRESENTED BY PLAY LIST, INCLUDING RETRIEVING PARTICIPANT SONG FILE FROM PARTICIPANT TERMINAL FOR PLAYBACK
78
END

FIG. 2


10B
100
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10C
112
132
134
130
10A
114
10D
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136
122
10E
118
120

FIG. 3

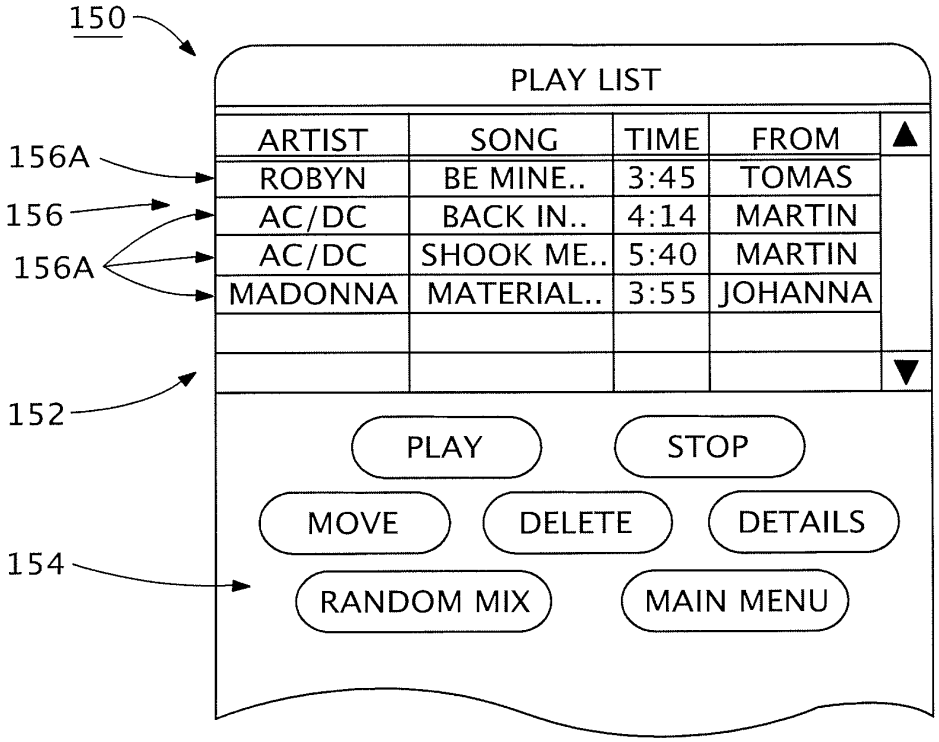
150
PLAY LIST
ARTIST
SONG
TIME
FROM
156A
ROBYN
BE MINE..
3:45
TOMAS
156
AC/DC
BACK IN..
4:14
MARTIN
156A
AC/DC
SHOOK ME..
5:40
MARTIN
MADONNA
MATERIAL..
3:55
JOHANNA
152
PLAY
STOP
MOVE
DELETE
DETAILS
154
RANDOM MIX
MAIN MENU

FIG. 4

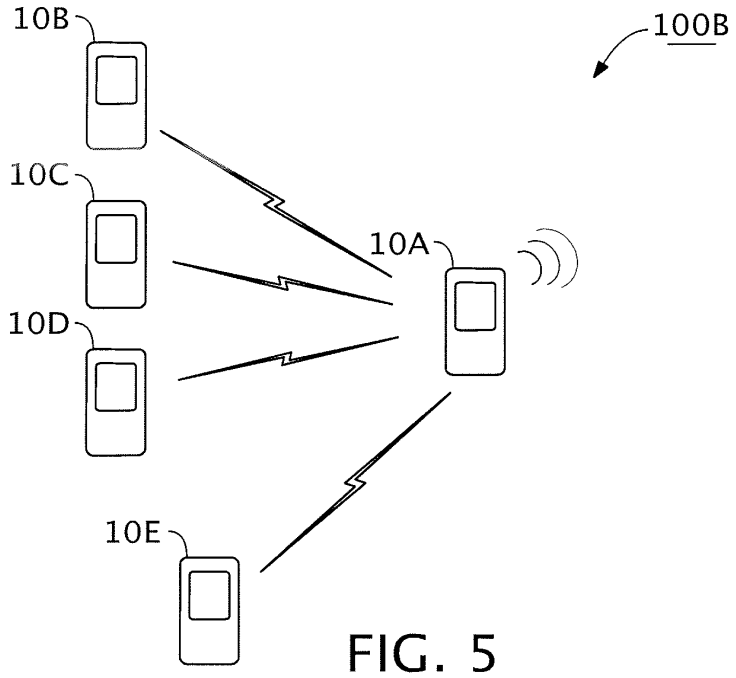

FIG. 5

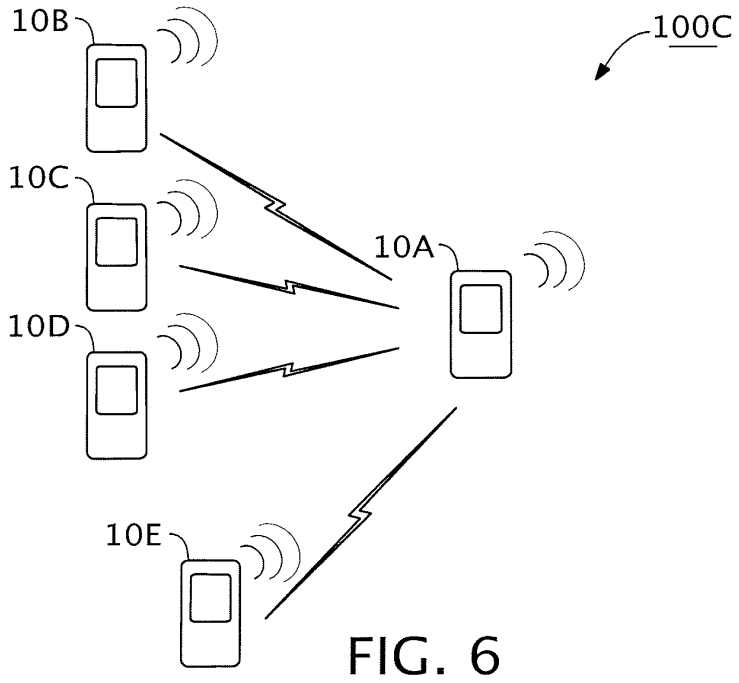

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/065350

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L29/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/037157 A1 (PESTONI FLORIAN [US] ET AL) 20 February 2003 (2003-02-20) paragraph [0020] - paragraph [0021] paragraph [0034] - paragraph [0040] paragraph [0046] paragraph [0051] paragraph [0058] - paragraph [0065] paragraph [0074] figures 4,5 -----	1-18
X	WO 2005/073856 A2 (KONINKL PHILIPS ELECTRONICS NV [NL]; PHILIPS CORP [US]; GUILLORIT FABI) 11 August 2005 (2005-08-11) page 1, line 20 - page 2, line 6 page 2, line 15 - line 31 page 3, line 9 - page 6, line 21 -----	1-18

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 November 2006	24/11/2006

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Homan, Peter

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2006/065350

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003037157 A1	20-02-2003	NONE	
WO 2005073856 A2	11-08-2005	EP 1711895 A2	18-10-2006

Form PCT/ISA/210 (patent family annex) (April 2005)

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(19) World Intellectual Property Organization
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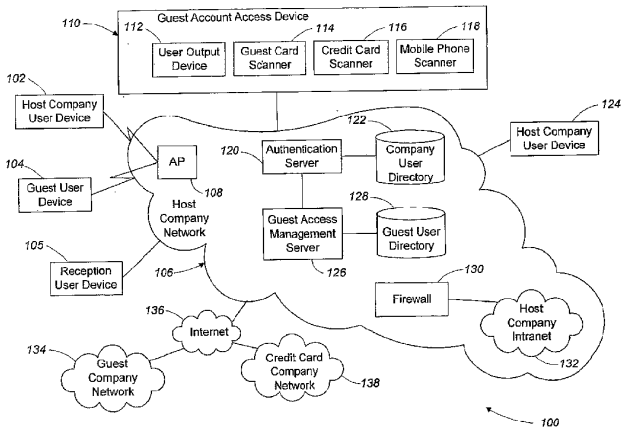
(54) Title: PROVIDING GUEST USERS ACCESS TO NETWORK RESOURCES THROUGH AN ENTERPRISE NETWORK



(57) Abstract: Guest user are enabled to access network resources through an enterprise network using a guest user account. A guest user account may be created for a guest for a limited time. Guest account credentials of the guest account may be provided to the guest to use the guest account using any of a variety of techniques described herein, for example, by scanning a guest access card, credit card or mobile telephone of guest user, and providing the guest account credentials to the user based on the information obtained. A guest access management server may be configured to generate and maintain guest accounts, authenticate guest users, and track and log guest activity. A VLAN technology may be used to separate guest traffic from host enterprise traffic on the host enterprise network. After a guest user is authenticated, communications to and from the guest user may be routed to a guest VLAN.

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PROVIDING GUEST USERS ACCESS TO NETWORK RESOURCES THROUGH AN ENTERPRISE NETWORK

BACKGROUND

In today's world, enterprises often serve as hosts to visitors, for example, vendors, partners, clients, members, colleagues, students, etc., for any of a variety of purposes. These guests often desire to access the Internet or another network (e.g., the networks of their own enterprises) using their mobile user devices, such as, for example, laptop computers, notebook computers, telephones, Blackberry™ brand devices, PCS devices, personal digital assistance (PDAs), etc. Thus, host enterprises often provide guests access to network resources through the host enterprise's network. As used herein, enterprises include, but are not limited to: companies; corporations; partnerships; sole proprietorships, other types of business entities; organizations; non-profit organizations; governmental bodies and/or agencies; educational institutions; other types of enterprises; and any suitable combination of the foregoing.

Providing guests access to network resources (e.g., a portion of the host network, the Internet, a guest enterprise network, etc.) often requires the use of dedicated hardware and/or software, and the installment and the maintenance of same. These dedicated solutions are not simple. Most require information technology (IT) support and/or the assistance of one or more administrators or receptionists. Thus, in order to provide guests with access to network resources, host enterprises typically incur the costs of dedicated hardware and/or software, IT support, and/or administrative assistance.

SUMMARY

This Summary provides an illustrative context for aspects of the invention, in a simplified form. It is not intended to be used to determine the scope of the claimed subject matter. Aspects of the invention are described more fully below in the Detailed Description.

Described herein are systems and methods enabling guests to access network resources through an enterprise network using a guest user account. A guest user account may be created for a guest for a limited time (a day, a couple days, certain times during certain days (e.g., 9:00 a.m. to 5:00 p.m.), a week, or even longer). Guest account

credentials (e.g., a guest account ID and password) of the guest account may be provided to the guest, which allow the guest to use the guest account. Any of a variety of techniques, including those described herein, may be used to provide the guest account credentials to the user. Providing the credentials may involve obtaining information from the guest user, and providing guest access credentials in response to obtaining the information. Obtaining the information about the guest user may include scanning a guest access card, credit card or mobile telephone of the guest user, receiving an email or letter, or orally in person or by telephone. A guest access management server may be configured to generate and maintain guest accounts, authenticate guest users, and track and log guest activity.

In some embodiments, virtual LAN (i.e., VLAN) technology may be used to separate guest traffic from host enterprise traffic on the host enterprise network. By using VLAN technology, the host enterprise's existing network infrastructure may be used, as opposed to having to modify the infrastructure. After a guest user is authenticated, communications to and from the guest user may be routed to a guest VLAN. Within the guest VLAN, the user may be allowed to access network resources such as the Internet or the guest enterprise's network.

In an embodiment of the invention, a guest user to enabled to access network resources through an enterprise network. Information read from an object (e.g., a credit card, a guest access card, a mobile telephone, etc.) in the possession of the guest user. is received. One or more guest account credentials for accessing the network resources through the enterprise network are determined based on the read information, and the one or more guest account credentials are indicated to the guest user.

In another embodiment, a system is provided for enabling a guest user to access network resources through an enterprise network. The system includes a guest access management server to determine, based on the information read from an object (e.g., a credit card, a guest access card, a mobile telephone, etc.) in the possession of the guest user, one or more guest account credentials for accessing the network resources through the enterprise network, and to initiate an indicating of the one or more guest account credentials to the guest user.

In yet another embodiment, a computer program product is provided, which includes a computer-readable medium and computer-readable signals stored on the computer-readable medium. The signals define instructions that, as a result of being

executed by a computer, control the computer to perform a method of a method of enabling a guest user to access network resources through an enterprise network. The method includes acts of: (a) receiving information read from a guest access card of the guest user; (b) determining, based on the read information, one or more guest account credentials for accessing the network resources through the enterprise network; and (c) indicating the one or more guest account credentials to the guest user.

In another embodiment, a guest user is enabled to access network resources through an enterprise network. Information from a credit card vendor verifying an identity of the guest user is received. One or more guest account credentials for accessing the network resources through the enterprise network are determined based on the received information, and the one or more guest account credentials are indicated to the guest user.

In another embodiment, a system is provided for enabling a guest user access to network resources through an enterprise network. The system includes a guest access management server to receive information from a credit card vendor verifying an identity of the guest user, to determine, based on the received information, one or more guest account credentials for accessing the network resources through the enterprise network, and to initiate an indication of the one or more guest account credentials to the guest user.

In yet another embodiment, a user is enabled to access network resources through an enterprise network. At a server of a credit card vendor, information read from a credit card of the user by a credit card scanner on premises of the enterprise is received. An identity of the user is verified based on the received information, and verification information about the user is sent to a guest access server of the enterprise, the guest access server being responsible for guest user access to network resources through a network of the entity.

In another embodiment, system is provided to enable a guest user to access network resources through an enterprise network. The system includes a server of a credit card vendor, operative to receive information read from a credit card of the user by a credit card scanner on premises of the enterprise, to verify an identity of the user based on the received information, and to send verification information about the user to a guest access server of the enterprise, the guest access server being responsible for guest user access to network resources through a network of the enterprise.

Other advantages, novel features, and objects of the invention, and aspects and embodiments thereof, will become apparent from the following detailed description of the invention, including aspects and embodiments thereof, when considered in conjunction with the accompanying drawings, which are schematic and which are not intended to be drawn to scale. In the figures, each identical or nearly identical component that is illustrated in various figures is represented by a single numeral. For purposes of clarity, not every component is labeled in every figure, nor is every component of each embodiment or aspect of the invention shown where illustration is not necessary to allow those of ordinary skill in the art to understand the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram illustrating an example of a system for enabling a guest user to access network resources through a host enterprise network, according to some embodiments of the invention;

Fig. 2 is a flow chart illustrating an example of a method of enabling a guest user to access network resources through an enterprise network, according to some embodiments of the invention;

Fig. 3 is a flowchart illustrating an example of a method of enabling a guest user to access network resources through an enterprise network using a guest access card, according to some embodiments of the invention;

Fig. 4 is a flowchart illustrating an example of a method of enabling a user to access network resource through an enterprise network using a credit card, according to some embodiments of the invention;

Fig. 5 is a flowchart illustrating an example of a method of providing a user access to network resources through an enterprise network using a mobile telephone, according to some embodiments of the invention;

Fig. 6 is a block diagram illustrating an example of a computer system on which some embodiments of the invention may be implemented; and

Fig. 7 is a block diagram illustrating an example of a storage system that may be used as part of the computer system to implement some embodiments of the invention.

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DETAILED DESCRIPTION

Although embodiments of the invention are described below in relation to providing guest users wireless access to network resources through a host enterprise network, the invention is not so limited, but rather, may be implemented for non-wireless (e.g., wireline) access.

The function and advantage of the above embodiments and other embodiments of the present invention will be more fully understood from the examples described below. The following examples are intended to facilitate a better understanding and illustrate the benefits of the present invention, but do not exemplify the full scope of the invention.

As used herein, whether in the written description or the claims, the terms "comprising", "including", "carrying", "having", "containing", "involving", and the like are to be understood to be open-ended, i.e., to mean including but not limited to. Only the transitional phrases "consisting of" and "consisting essentially of", respectively, shall be closed or semi-closed transitional phrases, as set forth, with respect to claims, in the United States Patent Office Manual of Patent Examining Procedures (Eighth Edition, Revision 2, May 2004), Section 2111.03.

Examples

In some embodiments, a guest user is granted guest access through a host enterprise using a guest access card issued by the host enterprise. Prior to, or at the time of, the guest's arrival at the host enterprise, the guest may be provided a guest access card. The guest access card may encode (in clear text or encrypted form) guest account credentials for a guest account, such as, for example, a guest access ID and password, or may encode a value that is associated with a guest account and/or guest account credentials. Guest account credentials and/or other information may be stored on a magnetic strip or in semiconductor memory on the guest access card.

Upon arrival at the host enterprise (e.g., a lobby or reception area), the guest user may attempt to access network resources (e.g., the Internet and/or the guest's corporate network) using a user device (e.g., a laptop or PDA) and may be prompted for guest account credentials (e.g., a guest account ID and password). Prior to, during or after attempting to access network resources, the guest user may scan the guest access card (e.g., magnetically, optically or using RF technology) using a scanner on the host enterprise's premises (e.g., in a reception area or lobby), which may be specifically

designed for this purpose. A guest access management server on the host network may receive the scanned information and determine guest account credentials. This determination may be made simply by reading the guest account credentials provided by the guest access card, by decrypting encrypted account information on the card or by mapping information provided by the card to a guest account ID and password. The guest account credentials may be sent to a device capable of indicating them to the guest user, for example, a device in the vicinity of the guest user and/or scanner. Such a device may be or include any of the following: a display device (e.g., a monitor); a printer; a device that produces badges and/or ID cards, a speaker; a telephone; another type of device; or any suitable combination of the foregoing.

The guest user then may log into the host enterprise network using the guest credentials, for example, using a user device (e.g., a laptop or PDA). The host enterprise network may be configured to limit guest user access, for example, to the Internet and/or the guest's enterprise network. For example, the host enterprise network may employ virtual local area network (VLAN) technologies to limit the guest's access based on the guest access account of the guest user. The host enterprise network then may monitor the network activity of the guest and, if necessary, bill the guest user for access to particular network resources such as, for example, the Internet.

Further, the guest account may be configured to have a limited duration such as, for example, a certain (e.g., predefined) number of hours, days, weeks, months, or a combination thereof. The guest account may further be configured for use only during specific times within the limited duration, for example, from 9:00 a.m. to 5:00 p.m. over a three-day duration.

In some embodiments of the invention, rather than using a guest access card issued by the host enterprise, the guest user may use a credit card issued by a credit card vendor such as, for example, Visa, MasterCard, American Express, Discover, etc., to obtain access to network resources through a host enterprise's network. Prior to, during or after attempting to access network resources using a laptop or other user device, the guest user may scan the credit card using a scanner on the host enterprise's premises. Information resulting from the scan may be sent to a network of the credit card enterprise, which may verify the identity of the guest user. The credit card enterprise then may send verification information about the guest user to the host enterprise network, for example, to a guest access management server on the host enterprise

network. In response to receiving the verification information, a guest access management server may generate a guest account and guest account credentials, and send the credentials to a device that indicates (e.g., displays) them to the guest user (e.g., as described above). The guest user can then use the credentials to log into the host enterprise network. The guest's access to network resources may be limited and the guest's activity may be monitored and billed, for example, as described above. Further, the duration and specific times of access using the guest account also may be limited.

In some embodiments, rather than using a guest access card or existing credit card, the guest user may use a mobile telephone to obtain access to network resources through a host enterprise's network. Using a mobile telephone scanner provided on the host enterprise's site, the guest user may scan information stored on the guest's mobile telephone, for example, on a subscriber identity module (SIM) card of the mobile telephone. This information may be sent to the guest access management server, which may generate a guest account and guest account credentials in response to receiving the scanned information. The guest account credentials may be sent to a device and indicated (e.g., displayed) to the user, for example, as described above. Using a laptop or other user device, the guest user then may access the network resources through the host enterprise network by entering the guest credentials. Similar to as described above, the guest user's access may be limited to certain network resources, and to a certain duration and specific times within the duration, and the activities of the guest user may be monitored and billed as appropriate.

In some embodiments, a guest user may be provided guest account credentials before arriving at the host enterprise, or a receptionist or another administrator at the guest enterprise may provide the guest account credentials to the guest user upon the guest's arrival. In such embodiments, the guest user may simply log into the network using the guest account credentials without having to first scan a guest card, credit card, mobile telephone or other item.

Fig. 1 is a block diagram illustrating an example of a system 100 for enabling a guest user to access network resources through a host enterprise network, according to some embodiments of the invention. System 100 is merely an illustrative embodiment of a system for enabling a guest user to access network resources through a host enterprise network, and is not intended to limit the scope of the invention. Any of numerous of

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implementation to such a system, for example, variations of system 100, are possible and are intended to fall within the scope of the invention.

System 100 may include any of: one or more host enterprise user devices (e.g., 102 and 124); one or more guest user devices (e.g., 104); one or more reception user devices (e.g., 105); one or more guest account access devices (e.g., 110); a host enterprise network 106; the Internet 136; one or more guest enterprise networks (e.g., 134); one or more credit card enterprise networks (e.g., 138); and any suitable combination of the foregoing.

As used herein, a "network" is a group of two or more components interconnected by one or more segments of transmission media over which communications may be exchanged between the components. Each segment may be any of a plurality of types of transmission media, including one or more electrical or optical wires or cables made of metal and/or optical fiber, air (e.g., using wireless transmission over carrier waves) or any combination of these transmission media. As used herein, "plurality" means two or more. It should be appreciated that a network may be as simple as two components connected by a single wire, bus, wireless connection, or other type of segment. Further, it should be appreciated that when a network is illustrated in a drawing of this application as being connected to an element in the drawing, the connected element itself is considered part of the network.

As used herein, a "network device" is a device operative to communicate on a network, including, but not limited to: workstations, personal computers, terminals, laptop computers, end stations, user devices, servers, gateways, registers, switches, routers, hubs, bridges, directories, transmitters, receivers, transceivers, wireless access points (APs), repeaters, and any combinations thereof. As used herein, a "user device" is a network device from/to which a user may send/receive communications, and which may serve as an endpoint to communications on a communications network. User devices include, but are not limited to: workstations; personal computers (e.g., PCs); laptop computers, notebook computers; telephones (e.g., landline or mobile); pagers; Blackberry™ brand devices, PCS devices, personal digital assistants (PDAs), smartphones, two-way radios (e.g., "walkie-talkies"), other types of user devices, and any suitable combination of the foregoing.

A network (e.g., any of networks 106, 132, 134, 136 and 138) may be or include any of a variety of types of networks including, but not limited to, a local area network

(LAN), a metropolitan area network (MAN), a wide-area network (WAN), a wireless network, a Public Land Mobile Network (PLMN), a Global System for Mobile Communications (GSM) network, a General Packet Radio Service (GPRS) network, a Universal Mobile Telecommunications System (UMTS) network, a Code-Division Multiple Access (CDMA) network, an optical network, a data network, an enterprise-wide network, a wireless personal area network (PAN), a home network, a telecommunications network, a public switched telephone network (PSTN), a broadband network, another type of network, or any suitable combination of the foregoing.

Host enterprise network 106 may include one or more network devices of any of the types described above and may include any of: one or more wireless access points (APs) (e.g., 108), one or more authentication servers (e.g., 120); one or more enterprise user directories (e.g., 122); one or more guest access management servers (e.g., 126); one or more guest user directories (e.g., 128); one or more firewalls (e.g., 130); a host enterprise Intranet (132); other network devices; or any suitable combination of the foregoing.

One or more components of host enterprise network 106 such as, for example, routers, switches and/or combination thereof (not shown) may be configured to define one or more VLANs. One or more of these VLANs (i.e., a guest VLAN) may be defined to include one or more guest access accounts and one or more network resources. The one or more network resources included within a guest VLAN may include the Internet, a guest enterprise network and perhaps one or more network resources residing on host network 106, so that guest users are limited to accessing only these resources. One or more other VLANs may be associated with host enterprise users (e.g., employees and officers). These host enterprise VLANs should be defined to include more resources on host enterprise network 106 than guest VLANs, thus providing enterprise users access to more resources on the enterprise network than guest users, who may be given access to no resources on the enterprise network. For example, the host enterprise VLAN may be configured to include host enterprise Intranet 132.

AP 108 may be configured to provide wireless access to host enterprise network 106 for user devices, including host enterprise user devices (e.g., 102 and 124) and guest user devices (e.g., 104). AP 108 may be configured to pass user credentials received from a user device to authentication server 120. Authentication server 120 may be configured to determine whether the user credentials identify a host enterprise user, for

example, by accessing enterprise user directory 122. If the user credentials identify a user as an authorized user of a host enterprise, the user may be given access to resources of host enterprise network 106, according to one or more VLANs to which the user belongs.

If the authentication server 120 determines that user credentials provided by a user device are not those of a host enterprise user, the authentication server 120 may pass the user credentials to guest access management server 126. Alternatively, server 126 may receive the credentials from AP 108 without first going through authentication server 120. Server 126 may determine whether the user credentials identify a guest user, for example, by accessing guest user directory 128. If the user credentials identify the user as a guest user, the guest user may be provided access only to those network resources to which members of the guest VLAN are permitted access.

In some embodiments of the invention, a user device (e.g., any of 102, 104 or 124) may be configured to discover any networks in the vicinity of the user device, for example, by establishing communications with an AP in the vicinity of the user device. For example, a user device may include an operating system (e.g., one of the operating systems available from Microsoft Corporation, specified below) configured to discover networks in its vicinity, e.g., in response to the operating system being launched when the user device is booted (i.e., powered on). If the user device is a host enterprise user device (e.g., 102), then the user device may be permitted to exchange information with host enterprise network 106 based on previous communications exchanged between the user device and an AP. For example, the operating system of the host enterprise user device may automatically provide user credentials previously exchanged between the user device and the AP to establish connectivity.

The AP and/or the guest user device may be configured to recognize when a guest user device has not previously been authenticated. In such cases, the operating system of the guest user device may be configured to prompt the user for guest account credentials (i.e., a guest account ID and a password). The guest user device may only be permitted access to the host enterprise network by providing valid guest user credentials.

In some embodiments of the invention, the user of the guest user device may be provided guest account credentials prior to arriving on the premises of the host enterprise (e.g., by email, paper mail, telephone, etc.), or upon arrival on the premises by a receptionist or other administrator. For example, upon arrival, a receptionist or other

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administrator may use reception user device 105 to contact guest access management server 106 to obtain guest account credentials.

Obtaining guest account credentials prior to arrival on the enterprise premises may be desirable when a large amount of guest users will be visiting the host enterprise. In such situations, an IT staff or administrator from the host enterprise can use the guest access management server 126 to import information for all of the guests who will be visiting the host enterprise. Such information may include names, job titles, the length of time for which guest access will be necessary, etc.. The guest access management server 126 may provide different guest account credentials for each future guest. Upon arrival on the host enterprise premises, each guest user may log onto the host enterprise network 106 through AP 108 or another access point, using the previously provided guest account credentials. The guest access management server 126 then may authenticate each of the guest users, for example, by comparing the user credentials provided with those stored in guest user directory 128.

In some embodiments of the invention, guest users acquire guest user credentials after they arrive on the host enterprise premises, for example, through the use of a guest account access device such as device 110. Device 110 may include any of: user output device 112; guest card scanner 114; credit card scanner 116; mobile telephone scanner 118; other components; and any suitable combination of the foregoing. It should be appreciated that one or more of user output device 112, guest card scanner 114, credit card scanner 116 and mobile telephone scanner 118 may reside on separate guest account access devices, and that one or more of these components may be integrated as a single component.

User output device 112 may include one or more of any type of output device suitable to display information to a user, for example, a monitor, printer or badge-generating device, or to indicate information to the user in some other manner (e.g., through audio), for example, a speaker or telephone. It should be appreciated that user output device 112 is not limited to being part of guest account access device 110, but may be separate and distinct from device 112.

Guest card scanner 114 may be configured to scan a guest card provided by a guest user. A guest card may have guest account credentials, or a value mapping to an account encoded thereon, for example, in clear text or encrypted format. The guest access card may store information on a magnetic strip, a semiconductor memory or on

some other form of media. Further, the guest access card may include a transmitter or other means for transmitting/receiving signals and/or information. The guest access card scanner 114 may be configured with one or more components (e.g., heads) to read magnetically-stored information and/or with a receiver or transceiver for receiving information transmitted from a guest card. Further, scanner 114 may be configured to send information scanned from a guest access card to guest access management server 126, for example, across one or more segments of host enterprise network 106.

Credit card scanner 116 may be configured with one or more components (e.g., heads) to scan a credit card and send the scanned information to the appropriate credit card enterprise network (e.g., 138) and/or a component of host enterprise network 106 (e.g., guest access management server 126) configured to send the information along to the credit card enterprise network 138.

In some embodiments of the invention, the host enterprise has a partnership with one or more credit card enterprises. The host enterprise may pay a certain amount of money for each enterprise's validation service. If the host enterprise needs to charge the guest access, a credit card enterprise can charge for access on the credit card.

It should be appreciated that, in some embodiments, scanners 114 and 116 may be integrated as part of a same device, and the same components may be used to read information from guest access cards and credit cards. In such embodiments, the scanning device may be configured to determine from the scanned information (e.g., it's format and/or content) whether the card scanned is a credit card or a guest access card, and to proceed accordingly. For example, the scanning device may send the scanned information to the guest access management server 126 if it determines the card scanned is a guest access card, and may send the scanned information to the appropriate credit card vendor otherwise.

Mobile telephone scanner 118 may be configured to read information about a mobile telephone user from a guest user's mobile telephone, for example, from a SIM card of a user's mobile telephone. The mobile telephone scanner 118 may be configured to read this information electromagnetically and/or optically from the mobile telephone, and to send the information about the user to the guest access management server 126.

Guest access management server 126 may be configured to receive: guest account credentials (e.g., a guest account ID and password) in clear text or encrypted form; information corresponding to guest account credentials; information corresponding

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to a user, other information, or any suitable combination of the foregoing. In response to receiving such information, server 126 may determine guest account credentials and provide them to one or more other network components such as, for example, user output device 112. For example, guest access management server 126 may be configured to receive verification information about a user from credit enterprise network 138, information about a mobile telephone user from mobile telephone scanner 118 and/or guest account credentials for information corresponding to guest account credentials from guest card scanner 114.

Server 126 may be configured to determine guest account credentials included in information it receives (e.g., from guest card scanner 114) and/or create guest account credentials in response to user information or user verification information it receives from mobile telephone scanner 118 and credit card enterprise network 138, respectively. The guest access management server 126 may store guest account credentials in guest user directory 128, and use these credentials to authenticate guest users.

System 100, and components thereof, may be implemented using any of a variety of technologies, including software (e.g., C, C#, C++, Java, or a combination thereof), hardware (e.g., one or more application-specific integrated circuits), firmware (e.g., electrically-programmed memory) or any combination thereof. One or more of the components of system 100 may reside on a single device (e.g., a computer), or one or more components may reside on separate, discrete devices. Further, each component may be distributed across multiple devices, and one or more of the devices may be interconnected.

Further, on each of the one or more devices that include one or more components of system 100, each of the components may reside in one or more locations on the system. For example, different portions of the components of these systems may reside in different areas of memory (e.g., RAM, ROM, disk, etc.) on the device. Each of such one or more devices may include, among other components, a plurality of known components such as one or more processors, a memory system, a disk storage system, one or more network interfaces, and one or more busses or other internal communication links interconnecting the various components. System 100, and components thereof, may be implemented using a computer system such as that described below in relation to Figs. 6 and 7.

Fig. 2 is a flow chart illustrating an example of a method 200 of enabling a guest user (e.g., a user of guest user device 104) to access network resources through an enterprise network (e.g., network 106), according to some embodiments of the invention. Method 200 is merely an illustrative embodiment of a method of enabling a guest user to access network resources through an enterprise network, and is not intended to limit the scope of the invention. Any of numerous other implementations of such a method, for example, variations of method 200, are possible and are intended to fall within the scope of the invention.

In Act 202, a guest user arrives at the premises of an enterprise, for example, in the reception area or a lobby of the enterprise offices. In Act 204, the user may acquire one or more guest account credentials, for example, as described below in relation to Figs. 3-5. It should be appreciated that, in some embodiments, the guest account credentials may be acquired before the guest user arrives on the premises of the host enterprise, as described above.

In Act 206, the guest user may provide the guest account credentials to an enterprise network. For example, the guest user may enter the guest account credentials through a user device (e.g., device 105), for example, in response to prompts. These guest account credentials may be passed to an authentication component of the network such as, for example, guest access management server 126.

In Act 208, the enterprise network may provide the guest user access to network resources through the enterprise network based on the guest account credentials. For example, the guest account credentials may be passed to the guest access management server 126, which may verify the credentials using guest user directory 128. If the guest account credentials are authenticated, the guest may be provided access to network resources such as, for example, the Internet 136, the guest enterprise network 134, and perhaps resources on host enterprise network 106 itself. Access to these network resources may be regulated using VLAN technologies. That is, one or more VLANs may be defined that include the Internet and the guest enterprise network, a limited amount of resources of network 106, and/or one or more guest accounts. One or more components on host enterprise network 106 (e.g., routers, switches, or suitable combinations thereof) may be configured to control access to network resources defined for one or more such VLANs based on the guest account ID provided by a guest user. Other technologies may be used to regulate guest user access.

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In Act 210, the host enterprise network may monitor activities of the guest user, for example, the network resources that it accesses and/or with which it exchanges communications. In Act 212, the host enterprise network may bill the guest user for certain activities, for example, accessing particular network resources such as, for example, Internet.

The guest account provided for the guest user may be configured to be of limited duration and for use only during specific times during this duration. For example, the user account may be configured to be for use during a three day period (e.g., Monday-Wednesday) only during business hours, e.g., 9:00 am - 5:00 pm. Accordingly, the guest management access server and the network components responsible for routing traffic on the host enterprise network may be configured to deny access to the guest user when the duration of the guest account expires and when the guest user attempts to access network resources outside of the specific times designated for guest access. The guest access management server and these other components may be configured to do so based on the guest account credentials provided by the guest user when logging in and/or when transmitting packets on the guest enterprise network. An entry (e.g. record) for the guest account in guest user directory 128 may include one or more information elements that specify the duration and/or specific access times for a guest access account.

Method 200 may include additional acts. Further, the order of the acts performed as part of method 200 is not limited to the order illustrated in Fig. 2, as the acts may be performed in other orders and/or one or more of the acts may be performed in series or in parallel, at least partially. For example, Act 204 may be performed before Act 202 and Acts 210 and 212 may be performed in parallel, at least partially.

Fig. 3 is a flowchart illustrating an example of a method 300 of enabling a guest user to access network resources through an enterprise network using a guest access card, according to some embodiments of the invention. Method 300 is merely an illustrative embodiment of a method of enabling a user to access network resources through an enterprise network using a guest access card, and is not intended to limit the scope of the invention. Other implementations of such a method, for example, variations of method 300, are possible and are intended to fall within the scope of the invention.

In Act 302, information may be read from a guest access card of the user, for example, as described above in relation to guest card scanner 114. Next, in Act 304, based on the information read from the guest access card, one or more guest account

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credentials may be determined, for example, as described above in relation to guest access management server 126. In Act 306, the one or more guest account credentials may be indicated (e.g., displayed or played as audio) to the guest user, for example, as described above in relation to user output device 112. Method 300 may include additional acts.

Fig. 4 is a flowchart illustrating an example of a method 400 of enabling a user to access network resources through an enterprise network using a credit card, according to some embodiments of the invention. Method 400 is merely an illustrative embodiment of a method of enabling a user to access network resources through an enterprise network using a credit card, and is not intended to limit the scope of the invention. Other implementations of such a method, for example, variations of method 400 are possible and are intended to fall within the scope of the invention.

In Act 402, information may be read from the credit card of the guest user, for example, as described above in relation to credit card scanner 116. In Act 404, the information read from the credit card may be sent to the credit card vendor, for example, credit card enterprise network 138 as described above, and the credit card enterprise may verify the identify of the guest user in Act 406. In Act 408, the credit card vendor may send verification information about the guest user to the enterprise network, for example, to guest access management server 126 as described above. In Act 410, one or more guest account credentials may be created based on the verification information, for example, as described above in relation to guest access management server 126. Method 400 may include additional acts.

Fig. 5 is a flowchart illustrating an example of a method 500 of providing a user access to network resources through an enterprise network using a mobile telephone, according to some embodiments of the invention. Method 500 is merely an illustrative embodiment of a method of providing a user access to network resources through an enterprise network using a mobile telephone, and is not intended to limit the scope of the invention. Other implementations of such a method, for example, variations of method 500 are possible and are intended to fall within the scope of the invention.

In Act 502, information that identifies the guest user is read from the mobile telephone, for example, from the SIM of the mobile telephone, e.g., as described above in relation to mobile telephone scanner 118. In Act 504, one or more guest account credentials may be created based on the information read from the mobile telephone, for

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example, as described above in relation to guest access management server 126. In Act 506, the one or more guest account credentials may be indicated (e.g., displayed or played as audio) to the guest user, for example, as described above in relation to user output device 112. Method 500 may include additional acts.

The embodiments described herein for providing guest users network access are relatively simple and secure. Each meets the market demands of providing easy Internet access to partners, customers, vendors and other enterprise visitors. These solutions may be cost saving, and add less overhead to an enterprise's IT department than known solutions because they use existing network infrastructure. The IT department may only need to maintain a guest VLAN instead of adding a new guest network infrastructure. Further, guest traffic and employee traffic may be separated. Also, guest activities may be logged and monitored, providing a relatively secure solution for the host enterprise. Several of the embodiments described herein provide easy billing mechanisms, and enterprises may be willing to deploy these solutions.

Methods 200-500, and acts thereof, and various embodiments and variations of these methods and these acts, individually or in combination, may be defined by computer-readable signals tangibly embodied on one or more computer-readable media, for example, non-volatile recording media, integrated circuit memory elements, or a combination thereof. Computer readable media can be any available media that can be accessed by a computer. By way of example, and not limitation, computer readable media may comprise computer storage media and communication media. Computer storage media includes volatile and nonvolatile, removable and non-removable media implemented in any method or technology for storage of information such as computer readable instructions, data structures, program modules or other data. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, other types of volatile and non-volatile memory, any other medium which can be used to store the desired information and which can accessed by a computer, and any suitable combination of the foregoing.

Communication media typically embodies computer-readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any information delivery media. The

term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, wireless media such as acoustic, RF, infrared and other wireless media, other types of communication media, and any suitable combination of the foregoing.

Computer-readable signals embodied on one or more computer-readable media may define instructions, for example, as part of one or more programs, that, as a result of being executed by a computer, instruct the computer to perform one or more of the functions described herein (e.g., methods 200-500 or any acts thereof), and/or various embodiments, variations and combinations thereof. Such instructions may be written in any of a plurality of programming languages, for example, Java, J#, Visual Basic, C, C#, or C++, Fortran, Pascal, Eiffel, Basic, COBOL, etc., or any of a variety of combinations thereof. The computer-readable media on which such instructions are embodied may reside on one or more of the components of any of systems 100, 600 and 600 described herein, may be distributed across one or more of such components, and may be in transition therebetween.

The computer-readable media may be transportable such that the instructions stored thereon can be loaded onto any computer system resource to implement the aspects of the present invention discussed herein. In addition, it should be appreciated that the instructions stored on the computer-readable medium, described above, are not limited to instructions embodied as part of an application program running on a host computer. Rather, the instructions may be embodied as any type of computer code (e.g., software or microcode) that can be employed to program a processor to implement the above-discussed aspects of the present invention.

It should be appreciated that any single component or collection of multiple components of a computer system, for example, any of the computer systems described in relation to Figs. 1, 6 and 7, that perform the functions described herein can be generically considered as one or more controllers that control such functions. The one or more controllers can be implemented in numerous ways, such as with dedicated hardware and/or firmware, using a processor that is programmed using microcode or software to perform the functions recited above or any suitable combination of the foregoing.

Various embodiments according to the invention may be implemented on one or more computer systems. These computer systems, may be, for example, general-purpose computers such as those based on Intel PENTIUM-type processor, Motorola PowerPC, Sun UltraSPARC, Hewlett-Packard PA-RISC processors, any of a variety of processors available from Advanced Micro Devices (AMD) or any other type of processor. It should be appreciated that one or more of any type of computer system may be used to implement various embodiments of the invention.

A general-purpose computer system according to one embodiment of the invention is configured to perform one or more of the functions described above. It should be appreciated that the system may perform other functions and the invention is not limited to having any particular function or set of functions.

For example, various aspects of the invention may be implemented as specialized software executing in a general-purpose computer system 600 such as that shown in Fig. 6. The computer system 600 may include a processor 603 connected to one or more memory devices 604, such as a disk drive, memory, or other device for storing data. Memory 604 is typically used for storing programs and data during operation of the computer system 600. Components of computer system 600 may be coupled by an interconnection mechanism 605, which may include one or more busses (e.g., between components that are integrated within a same machine) and/or a network (e.g., between components that reside on separate discrete machines). The interconnection mechanism 605 enables communications (e.g., data, instructions) to be exchanged between system components of system 600. Computer system 600 also includes one or more input devices 602, for example, a keyboard, mouse, trackball, microphone, touch screen, and one or more output devices 601, for example, a printing device, display screen, speaker. In addition, computer system 600 may contain one or more interfaces (not shown) that connect computer system 600 to a communication network (in addition or as an alternative to the interconnection mechanism 605).

The storage system 706, shown in greater detail in Fig. 6, typically includes a computer readable and writeable nonvolatile recording medium 701 in which signals are stored that define a program to be executed by the processor or information stored on or in the medium 701 to be processed by the program. The medium may, for example, be a disk or flash memory. Typically, in operation, the processor causes data to be read from the nonvolatile recording medium 701 into another memory 702 that allows for faster

access to the information by the processor than does the medium 701. This memory 702 is typically a volatile, random access memory such as a dynamic random access memory (DRAM) or static memory (SRAM). It may be located in storage system 606, as shown, or in memory system 604, not shown. The processor 603 generally manipulates the data within the integrated circuit memory 604, 702 and then copies the data to the medium 701 after processing is completed. A variety of mechanisms are known for managing data movement between the medium 701 and the integrated circuit memory element 604, 702, and the invention is not limited thereto. The invention is not limited to a particular memory system 604 or storage system 606.

The computer system may include specially-programmed, special-purpose hardware, for example, an application-specific integrated circuit (ASIC). Aspects of the invention may be implemented in software, hardware or firmware, or any combination thereof. Further, such methods, acts, systems, system elements and components thereof may be implemented as part of the computer system described above or as an independent component.

Although computer system 600 is shown by way of example as one type of computer system upon which various aspects of the invention may be practiced, it should be appreciated that aspects of the invention are not limited to being implemented on the computer system shown in Fig. 6. Various aspects of the invention may be practiced on one or more computers having a different architecture or components that that shown in Fig. 6.

Computer system 600 may be a general-purpose computer system that is programmable using a high-level computer programming language. Computer system 600 also may be implemented using specially-programmed, special-purpose hardware. In computer system 600, processor 603 is typically a commercially available processor such as the well-known Pentium class processor available from the Intel Corporation. Many other processors are available. Such a processor usually executes an operating system which may be, for example, the Windows® 95, Windows® 98, Windows NT®, Windows® 2000 (Windows® ME) or Windows® XP operating systems available from the Microsoft Corporation, MAC OS System X available from Apple Computer, the Solaris Operating System available from Sun Microsystems, Linux available from various sources or UNIX available from various sources. Any of a variety of other operating systems may be used.

The processor and operating system together define a computer platform for which application programs in high-level programming languages are written. It should be understood that the invention is not limited to a particular computer system platform, processor, operating system, or network. Also, it should be apparent to those skilled in the art that the present invention is not limited to a specific programming language or computer system, and that other appropriate programming languages and other appropriate computer systems could also be used.

One or more portions of the computer system may be distributed across one or more computer systems (not shown) coupled to a communications network. These computer systems also may be general-purpose computer systems. For example, various aspects of the invention may be distributed among one or more computer systems configured to provide a service (e.g., servers) to one or more client computers, or to perform an overall task as part of a distributed system. For example, various aspects of the invention may be performed on a client-server system that includes components distributed among one or more server systems that perform various functions according to various embodiments of the invention. These components may be executable, intermediate (e.g., IL) or interpreted (e.g., Java) code which communicate over a communication network (e.g., the Internet) using a communication protocol (e.g., TCP/IP).

It should be appreciated that the invention is not limited to executing on any particular system or group of systems, and that the invention is not limited to any particular distributed architecture, network, or communication protocol.

Various embodiments of the present invention may be programmed using an object-oriented programming language, such as SmallTalk, Java, J# (J-Sharp), C++, Ada, or C# (C-Sharp). Other object-oriented programming languages may also be used. Alternatively, functional, scripting, and/or logical programming languages may be used. Various aspects of the invention may be implemented in a non-programmed environment (e.g., documents created in HTML, XML or other format that, when viewed in a window of a browser program, render aspects of a graphical-user interface (GUI) or perform other functions). Various aspects of the invention may be implemented as programmed or non-programmed elements, or any combination thereof. Further, various embodiments of the invention may be implemented using Microsoft®.NET technology available from Microsoft Corporation.

Having now described some illustrative embodiments of the invention, it should be apparent to those skilled in the art that the foregoing is merely illustrative and not limiting, having been presented by way of example only. Numerous modifications and other illustrative embodiments are within the scope of one of ordinary skill in the art and are contemplated as falling within the scope of the invention. In particular, although many of the examples presented herein involve specific combinations of method acts or system elements, it should be understood that those acts and those elements may be combined in other ways to accomplish the same objectives. Acts, elements and features discussed only in connection with one embodiment are not intended to be excluded from a similar role in other embodiments. Further, for the one or more means-plus-function limitations recited in the following claims, the means are not intended to be limited to the means disclosed herein for performing the recited function, but are intended to cover in scope any equivalent means, known now or later developed, for performing the recited function.

Use of ordinal terms such as "first", "second", "third", etc., in the claims to modify a claim element does not by itself connote any priority, precedence, or order of one claim element over another or the temporal order in which acts of a method are performed, but are used merely as labels to distinguish one claim element having a certain name from another element having a same name (but for use of the ordinal term) to distinguish the claim elements.

What is claimed is:

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CLAIMS

1. A method of enabling a guest user to access network resources through an enterprise network, comprising acts of:

(a) receiving information read from an object in the possession of the guest user;

(b) determining, based on the read information, one or more guest account credentials for accessing the network resources through the enterprise network; and

(c) indicating the one or more guest account credentials to the guest user.

2. The method of claim 1, wherein the object is a guest access card.

3. The method of claim 1, wherein the object is a credit card.

4. The method of claim 1, wherein the object is a mobile telephone.

5. The method of claim 1, further comprising acts of:

(d) receiving the one or more guest account credentials from a user device of the guest user; and

(e) providing the guest user access to the network resources through the enterprise network based on the one or more guest account credentials.

6. The method of claim 5, wherein a guest account corresponding to the guest account credentials is configured to have a duration of a limited time, the method further comprising:

(f) denying the guest user access to the network resources after an expiration of the limited time.

7. The method of claim 5, wherein a guest account corresponding to the guest account credentials is configured to allow the guest user access to network resources only during one or more specific time intervals, the method further comprising an act of:

(f) denying the guest user access to the network resources outside of the one or more specific time intervals.

8. The method of claim 5, wherein the enterprise network is configured to define a plurality of virtual local area networks, including a first virtual local area network for guest users, and

wherein the act (e) comprises providing the guest user access to only network resources defined as part of the first virtual local area network.

9. The method of claim 8, wherein the first virtual local area network is defined to include the Internet.

10. The method of claim 1, wherein the act (b) comprises determining a guest account identity and password based on the read information, and

wherein the act (c) comprises indicating the guest account identity and password to the guest user.

11 The method of claim 10, wherein the act (a) comprises receiving the guest account identity and the password, which were read from the guest access card.

12. The method of claim 1, further comprising an act of:

(d) reading the information from the guest access card.

13. The method of claim 1, wherein the act (c) comprises displaying the one or more guest account credentials to the guest user.

14. A system for enabling a guest user to access network resources through an enterprise network, comprising:

a guest access management server to determine, based on the information read from an object in the possession of the guest user, one or more guest account credentials for accessing the network resources through the enterprise network, and to initiate an indicating of the one or more guest account credentials to the guest user.

15. The system of claim 14, wherein the object is one of the following: a guest access card; a credit card, or a mobile telephone.

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16. The system of claim 14, further comprising:

a guest access account device to receive the information read from the object.

17. The system of claim 16, further comprising:

a user output device to indicate the one or more guest account credentials to the guest user.

18. The system of claim 14, wherein the guest access management server is operative to receive the one or more guest account credentials from a user device of the guest user, and to authorize access for the guest user access to the network resources through the enterprise network based on the one or more guest account credentials.

19. A computer program product comprising:

a computer-readable medium; and

computer-readable signals, stored on the computer-readable medium, that define instructions that, as a result of being executed by a computer, control the computer to perform a method of a method of enabling a guest user to access network resources through an enterprise network, the method comprising acts of:

(a) receiving information read from a guest access card of the guest user;

(b) determining, based on the read information, one or more guest account credentials for accessing the network resources through the enterprise network; and

(c) indicating the one or more guest account credentials to the guest user.

20. The computer-readable medium of claim 19, wherein the method further comprises acts of:

(d) receiving the one or more guest account credentials from a user device of the guest user; and

(e) providing the guest user access to the network resources through the enterprise network based on the one or more guest account credentials.

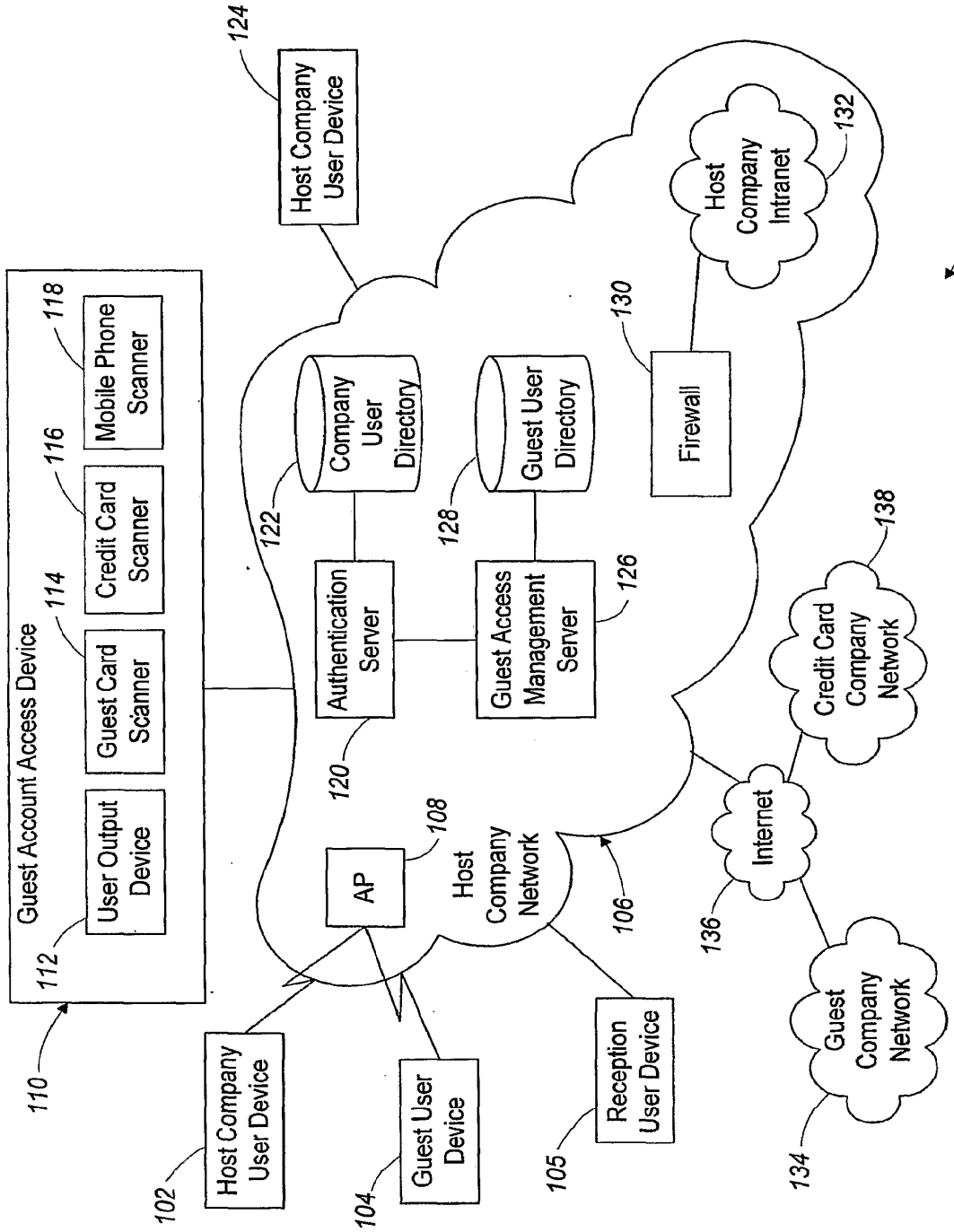
Guest Account Access Device
User Output Device
Guest Card Scanner
Credit Card Scanner
Mobile Phone Scanner
110
112
114
116
118
Host Company User Device
102
Guest User Device
104
AP
108
Host Company Network
106
Reception User Device
105
Authentication Server
120
Company User Directory
122
Guest Access Management Server
126
Guest User Directory
128
Firewall
130
Host Company User Device
124
Host Company Intranet
132
Internet
136
Credit Card Company Network
138
Guest Company Network
134
100

FIG. 1

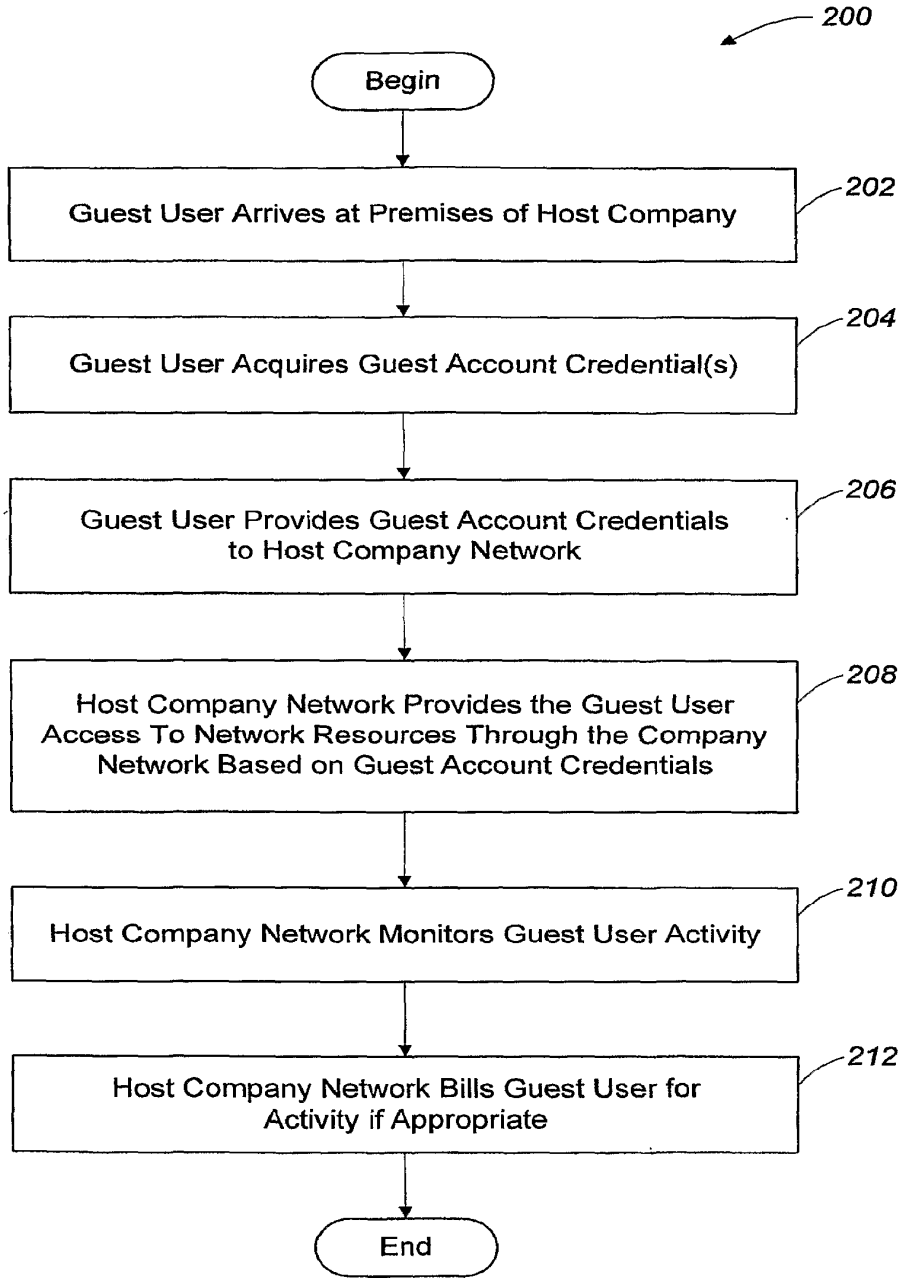
200
Begin
Guest User Arrives at Premises of Host Company
202
Guest User Acquires Guest Account Credential(s)
204
Guest User Provides Guest Account Credentials to Host Company Network
206
Host Company Network Provides the Guest User Access To Network Resources Through the Company Network Based on Guest Account Credentials
208
Host Company Network Monitors Guest User Activity
210
Host Company Network Bills Guest User for Activity if Appropriate
212
End

FIG. 2

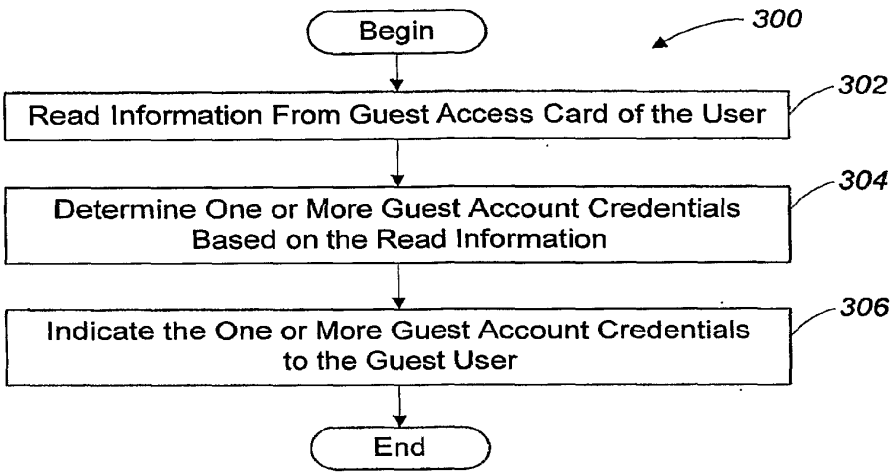
300
Begin
302
Read Information From Guest Access Card of the User
304
Determine One or More Guest Account Credentials Based on the Read Information
306
Indicate the One or More Guest Account Credentials to the Guest User
End

FIG. 3

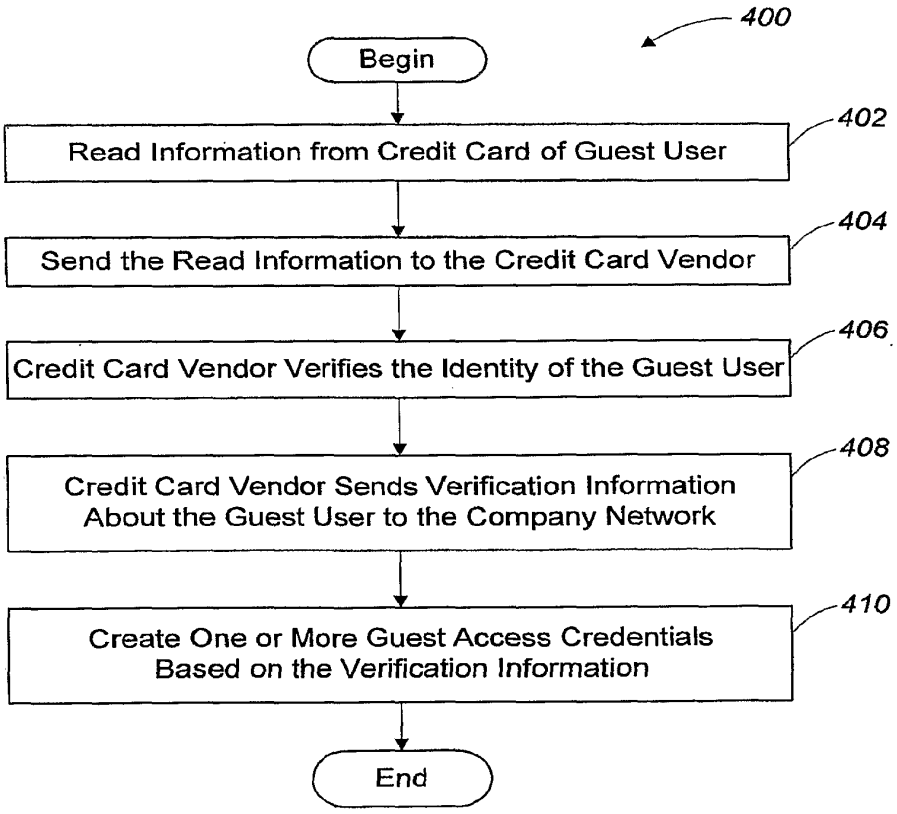
400
Begin
402
Read Information from Credit Card of Guest User
404
Send the Read Information to the Credit Card Vendor
406
Credit Card Vendor Verifies the Identity of the Guest User
408
Credit Card Vendor Sends Verification Information About the Guest User to the Company Network
410
Create One or More Guest Access Credentials Based on the Verification Information
End

FIG. 4

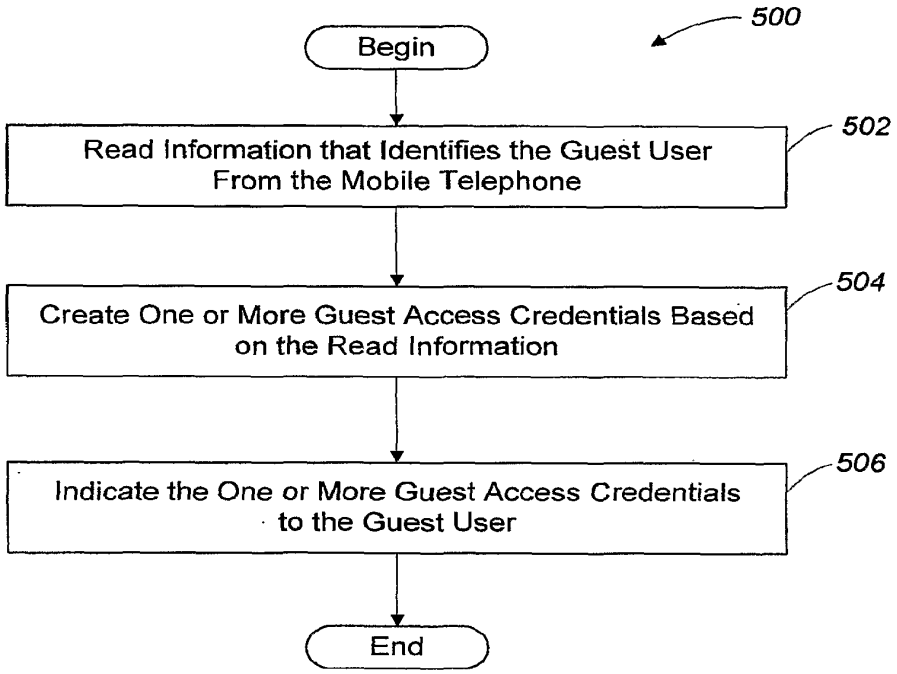
500
Begin
Read Information that Identifies the Guest User From the Mobile Telephone
502
Create One or More Guest Access Credentials Based on the Read Information
504
Indicate the One or More Guest Access Credentials to the Guest User
506
End

FIG. 5

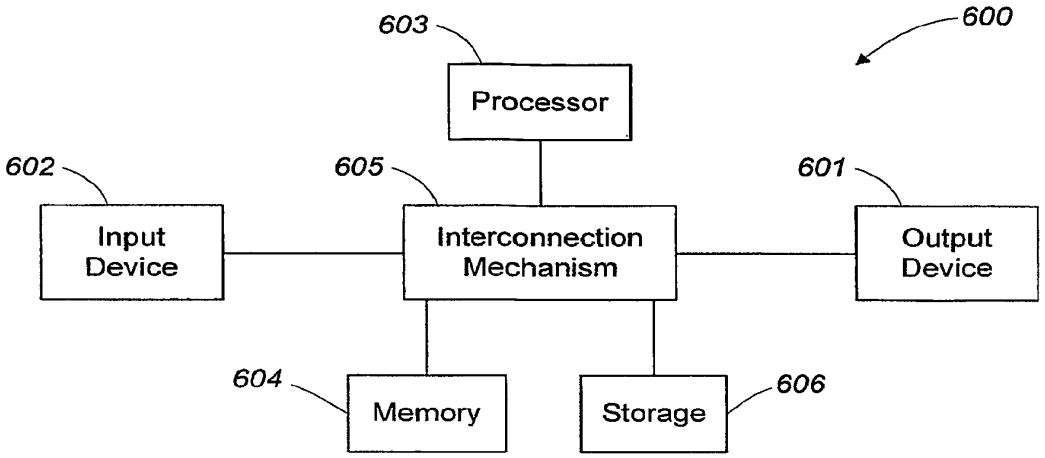
603
600
Processor
602
605
601
Input Device
Interconnection Mechanism
Output Device
604
606
Memory
Storage

FIG. 6

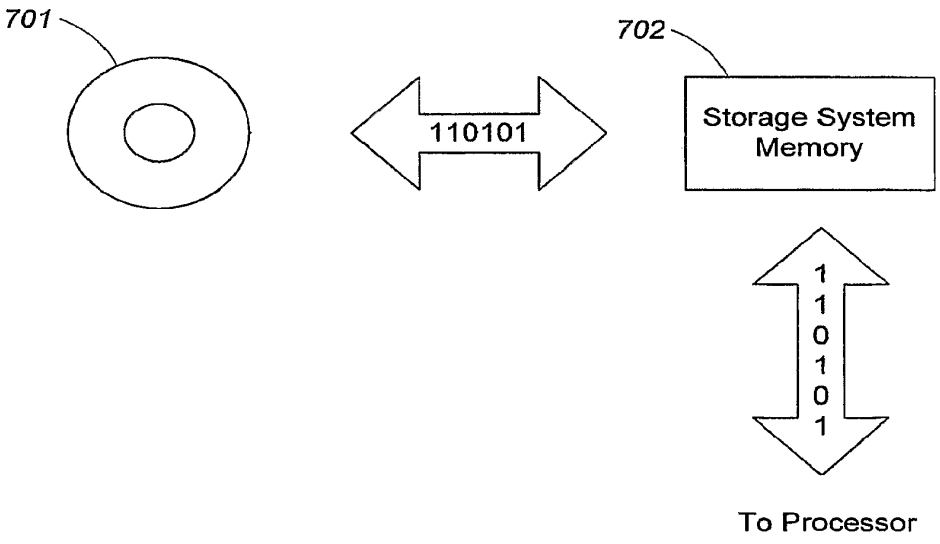
701
702
110101
Storage System Memory
1
1
0
1
0
1
To Processor

FIG. 7

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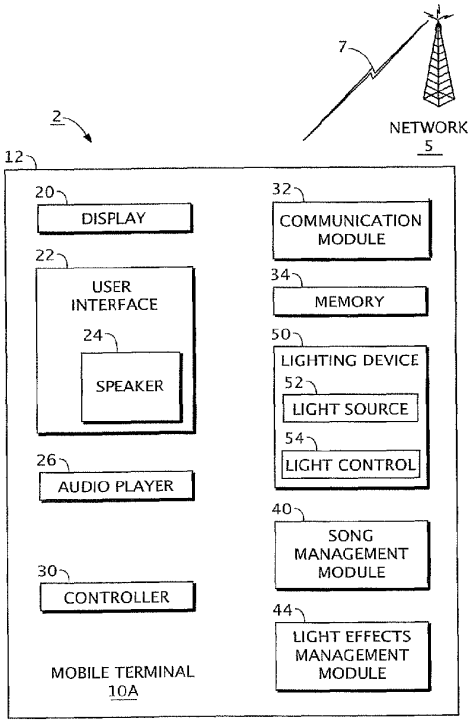
(54) Title: MOBILE WIRELESS COMMUNICATION TERMINALS, SYSTEMS, METHODS, AND COMPUTER PROGRAM PRODUCTS FOR MANAGING PLAYBACK OF SONG FILES



(57) Abstract: A mobile wireless communication terminal includes a wireless communication module that is configured to communicate with other communication terminals over a wireless interface, and a controller. The controller is configured to establish a connection with at least one participant wireless communication terminal via the wireless communication module, to receive from the at least one participant wireless communication terminal an identification of a compliant song file stored on the at least one participant wireless communication terminal and having a metadata tag associated therewith indicating that the compliant song file is classified in a prescribed song file category, and to execute playback of the compliant song file.

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MOBILE WIRELESS COMMUNICATION TERMINALS, SYSTEMS, METHODS, AND COMPUTER PROGRAM PRODUCTS FOR MANAGING PLAYBACK OF SONG FILES

FIELD OF THE INVENTION

[001] The present invention relates to electronic devices and, more particularly, to electronic devices, methods and computer program products for playing song files.

BACKGROUND OF THE INVENTION

[002] Mobile electronic devices, such as wireless communication terminals (*e.g.*, cellular telephones), are widely used to store and playback song files. A user may wish to play a song file on another device such as a media center (*e.g.*, a PC or laptop, a television, an audio receiver, etc.) or another wireless communication terminal. This may be accomplished by connecting the electronic device to the other device via a cable or a wireless link (*e.g.*, a Bluetooth connection) if the other device is equipped with a suitable communication module, which may be an integrated module or an auxiliary (*e.g.*, plug- in) module. Song files may be sent, one by one, from one or more mobile electronic devices to the playback device(s).

SUMMARY OF THE INVENTION

[003] According to some embodiments of the present invention, a mobile wireless communication terminal includes a wireless communication module that is configured to communicate with other communication terminals over a wireless interface, and a controller. The controller is configured to establish a connection with at least one participant wireless communication terminal via the wireless communication module, to receive from the at least one participant wireless communication terminal an identification of a compliant song file stored on the at least one participant wireless communication terminal and having a metadata tag associated therewith indicating that the compliant song file is classified in a prescribed song file category, and to execute playback of the compliant song file.

[004] The controller may be configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to receive identifications of compliant songs from at least two of the plurality of participant wireless communication terminals.

[005] According to some embodiments, the controller is configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to execute playback of the compliant song file simultaneously on the plurality of participant wireless communication terminals.

[006] The controller may be configured to retrieve the compliant song file from the at least one participant wireless communication terminal for playback.

[007] According to some embodiments of the present invention, the wireless communication module is configured to communicate with other communication terminals over a direct point-to-point wireless interface, and the controller is configured to establish the connection with the at least one participant wireless communication terminal via the wireless communication module via the direct point-to-point wireless interface, and to receive the identification of a compliant song file from the at least one participant wireless communication terminal via the direct point-to-point wireless interface. The wireless communication module may comprise a Bluetooth transmitter. The wireless communication terminal may include a cellular telephone.

[008] According to further embodiments of the present invention, a mobile wireless communication terminal includes a wireless communication module that is configured to communicate with other communication terminals over a wireless interface, and a controller. The controller is configured to establish a connection with at least one participant wireless communication terminal via the wireless communication module, to maintain a list of nominated song files, to receive at least one vote message from the at least one participant wireless communication terminal, to determine an elected song file from the list of nominated song files based on the at least one vote message, and to execute playback of the elected song file.

[009] According to some embodiments, the controller is configured to receive an identification of a nominated song file from the at least one participant wireless communication terminal, and to add the identification of the nominated song file to the list of nominated song files.

[010] According to some embodiments, the controller is configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to receive vote messages from at least two of the plurality of participant wireless communication terminals.

[011] The controller may be configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to execute playback of the elected song file simultaneously on the plurality of participant wireless communication terminals.

[012] The controller may be configured to retrieve the elected song file from the at least one participant wireless communication terminal for playback.

[013] According to some embodiments of the present invention, the wireless communication module is configured to communicate with other communication terminals over a direct point-to-point wireless interface, and the controller is configured to establish the connection with the at least one participant wireless communication terminal via the wireless communication module via the direct point-to-point wireless interface, and to receive the at least one vote message from the at least one participant wireless communication terminal via the direct point-to-point wireless interface. The wireless communication module may comprise a Bluetooth transmitter. The wireless communication terminal may include a cellular telephone.

[014] According to further embodiments of the present invention, a mobile wireless communication terminal includes a wireless communication module that is configured to communicate with other communication terminals over a wireless interface, and a controller. The controller is configured to establish a connection with at least one participant wireless communication terminal via the wireless communication module, and to send at least one light effect signal to the at least one participant wireless communication terminal instructing the at least one participant wireless communication terminal to control at least one lighting device of the at least one participant wireless communication terminal in correspondence with playback of a song file.

[015] According to some embodiments, the controller is configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to send light effect signals to each of the plurality of participant wireless communication terminals instructing each of the plurality of

participant wireless communication terminals to control a lighting device thereof in correspondence with playback of the song file.

[016] According to some embodiments, the controller may be configured to send light effect signals to each of the plurality of participant wireless communication terminals instructing the plurality of participant wireless communication terminals to control the lighting devices thereof differently from one another.

[017] The controller may be configured to send light effect signals to each of the plurality of participant wireless communication terminals so as to cause the plurality of participant wireless communication terminals to display on respective displays thereof an image that moves over time from the display of a first of the plurality of participant wireless communication terminals to the display of a second of the plurality of participant wireless communication terminals.

[018] According to some embodiments, the controller is configured to send light effect signals to each of the plurality of participant wireless communication terminals so as to cause a lighting device of a first of the plurality of participant wireless communication terminals to respond to audio signals in a first audio frequency range and to cause a lighting device of a second of the plurality of participant wireless communication terminals to respond to audio signals in a second audio frequency range different from the first audio frequency range.

[019] The controller may be configured to execute playback of the song file simultaneously on the plurality of participant wireless communication terminals.

[020] According to some embodiments, the wireless communication module is configured to communicate with other communication terminals over a direct point-to-point wireless interface, and the controller is configured to establish the connection with the at least one participant wireless communication terminal via the wireless communication module via the direct point-to-point wireless interface, and to send the at least one light effect signal to the at least one participant wireless communication terminal via the direct point-to-point wireless interface. The wireless communication module may comprise a Bluetooth transmitter. The wireless communication terminal may include a cellular telephone.

[021] Further features, advantages and details of the present invention will be appreciated by those of ordinary skill in the art from a reading of the figures and the

detailed description of the preferred embodiments that follow, such description being merely illustrative of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[022] **Figure 1** is a schematic diagram of a mobile wireless communication terminal according to some embodiments of the present invention and an exemplary base station transceiver.

[023] **Figure 2** is a flowchart illustrating methods in accordance with some embodiments of the present invention.

[024] **Figure 3** is a schematic diagram of a song file playback system according to some embodiments of the present invention including the mobile wireless communication terminal of **Figure 1**.

[025] **Figure 4** is a schematic diagram of a song file playback system according to further embodiments of the present invention including the mobile wireless communication terminal of **Figure 1**.

[026] **Figure 5** is a schematic diagram of a song file playback system according to further embodiments of the present invention including the mobile wireless communication terminal of **Figure 1**.

[027] **Figure 6** is a schematic diagram illustrating a display of the mobile wireless communication terminal of **Figure 1** in accordance with some embodiments of the present invention.

[028] **Figure 7** is a flow chart illustrating methods in accordance with further embodiments of the present invention.

[029] **Figure 8** is a flow chart illustrating methods in accordance with further embodiments of the present invention.

[030] **Figure 9** is a schematic diagram of a song file playback system according to further embodiments of the present invention.

[031] **Figures 10A-C** are schematic diagrams of a system according to embodiments of the present invention illustrating an animation sequence displayed on three mobile wireless communication terminals of the system.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[032] The present invention now will be described more fully with reference to the accompanying drawings, in which embodiments of the invention are shown. However, this invention should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[033] As used herein, the term "comprising" or "comprises" is open-ended, and includes one or more stated features, integers, elements, steps, components or functions but does not preclude the presence or addition of one or more other features, integers, elements, steps, components, functions or groups thereof.

[034] As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[035] As used herein, the common abbreviation "*e.g.*", which derives from the Latin phrase "exempli gratia," may be used to introduce or specify a general example or examples of a previously mentioned item, and is not intended to be limiting of such item. If used herein, the common abbreviation "*i.e.*", which derives from the Latin phrase "id est," may be used to specify a particular item from a more general recitation.

[036] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[037] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[038] It will be understood that when an element is referred to as being "coupled" or "connected" to another element, it can be directly coupled or connected to the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly coupled" or "directly connected" to another element, there

are no intervening elements present. Furthermore, "coupled" or "connected" as used herein may include wirelessly coupled or connected.

[039] Well-known functions or constructions may not be described in detail for brevity and/or clarity.

[040] The present invention may be embodied as methods, electronic devices, and/or computer program products. Accordingly, the present invention may be embodied in hardware and/or in software (including firmware, resident software, micro-code, *etc.*), which may be generally referred to herein as a "circuit" or "module". Furthermore, the present invention may take the form of a computer program product on a computer-usable or computer-readable storage medium having computer-usable or computer-readable program code embodied in the medium for use by or in connection with an instruction execution system. In the context of this document, a computer-usable or computer-readable medium may be any medium that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device.

[041] Embodiments according to the present invention are described with reference to block diagrams and/or operational illustrations of methods and communication terminals. In this regard, each block may represent a module, segment, or portion of code, which comprises one or more executable instructions for implementing the specified logical function(s). It is to be understood that each block of the block diagrams and/or operational illustrations, and combinations of blocks in the block diagrams and/or operational illustrations, can be implemented by radio frequency, analog and/or digital hardware, and/or program instructions. These program instructions may be provided to a controller, which may include one or more general purpose processors, special purpose processors, ASICs, and/or other programmable data processing apparatus, such that the instructions, which execute via the controller and/or other programmable data processing apparatus, create means for implementing the functions/acts specified in the block diagrams and/or operational block or blocks. In some alternate implementations, the functions/acts noted in the blocks may occur out of the order noted in the operational illustrations. For example, two blocks shown in succession may in fact be executed substantially concurrently or the blocks may sometimes be executed in the reverse order, depending upon the functionality/acts involved.

[042] These computer program instructions may also be stored in a computer-usable or computer-readable memory that may direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer usable or computer-readable memory produce an article of manufacture including instructions that implement the function specified in the flowchart and/or block diagram block or blocks.

[043] The computer-usable or computer-readable medium may be, for example but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, device, or propagation medium. More specific examples (a nonexhaustive list) of the computer-readable medium include the following: hard disks, optical storage devices, a transmission media such as those supporting the Internet or an intranet, magnetic storage devices, an electrical connection having one or more wires, a portable computer diskette, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, and a compact disc read-only memory (CD-ROM).

[044] Computer program code for carrying out operations of the present invention may be written in an object oriented programming language such as Java®, Smalltalk or C++. However, the computer program code for carrying out operations of the present invention may also be written in conventional procedural programming languages, such as the "C" programming language and/or a lower level assembler language. It will be further appreciated that the functionality of any or all of the program modules may also be implemented using discrete hardware components, one or more application specific integrated circuits (ASICs), or a programmed digital signal processor or microcontroller.

[045] As used herein, "electronic component" means an active device as contrasted with a passive electrical connector or the like. An electronic component may include a processor.

[046] As used herein, "streamed" or "streaming" means that a file, such as an audio or song file, is continuously sent via a digital signal to a receiving device where the audio or song file is concurrently played via a suitable receiving application. The digital signal is typically buffered.

[047] As used herein, a "communication terminal" includes, but is not limited to, a terminal that is configured to receive/transmit communication signals via a wireline connection, such as via a public-switched telephone network (PSTN), digital subscriber

line (DSL), digital cable, or another data connection/network, and/or via a wireless interface with, for example, a cellular network, a satellite network, a wireless local area network (WLAN), and/or another communication terminal.

[048] When the communication terminal is configured to communicate over a wireless interface, it is referred to herein as a "wireless communication terminal" or a "wireless terminal." Examples of wireless terminals include, but are not limited to, a cellular telephone, personal data assistant (PDA), pager, and/or a computer that is configured to communicate data over a wireless communication interface that can include a cellular telephone interface, a Bluetooth interface, a wireless local area network interface (*e.g.*, 802.11), another RF communication interface, and/or an optical/infra-red communication interface.

[049] As used herein, "mobile terminals" may be portable, transportable, installed in a vehicle (aeronautical, maritime, or land-based), or situated and/or configured to operate locally and/or in a distributed fashion at any other location(s) on earth and/or in space.

[050] Referring now to **Figure 1**, an exemplary mobile wireless communication terminal **10A** in accordance with some embodiments of the present invention is illustrated. The wireless terminal **10A** is configured to communicate data with one or more other wireless terminals over a direct wireless communication interface therebetween, over another wireless communication interface through one or more cellular base stations, and/or over another wireless communication interface through a wireless local area network (WLAN) router.

[051] The wireless terminal **10A** may be a mobile radiotelephone forming a part of a radiotelephone communication system **2** as illustrated in **Figure 1**. The system **2** includes the mobile wireless communication terminal **10A** and a base station transceiver, which is part of a wireless communications network **5**. In some embodiments of the present invention, the network **5** includes a base station transceiver that includes the radio transceiver(s) that define an individual cell in a cellular network and communicates with the mobile terminal **10A** (via an interface **7**) and other mobile terminals in the cell using a radio-link protocol. It will be understood that, in some embodiments of the present invention, many base station transceivers may be connected through, for example, a mobile switching center and other devices to define the wireless communications network **5**.

[052] The mobile terminal **10A** in the illustrated embodiments includes a portable housing assembly **12**, a display **20**, a user interface **22** (*i.e.*, a man machine interface (MMI)) including a speaker **24** (*i.e.*, a sound transducer), an audio player **26**, a controller **30**, a communication module **32**, a memory **34**, and a lighting device **50**. The foregoing components of the mobile terminal **10A** may be included in many conventional mobile terminals and their functionality is generally known to those skilled in the art. The mobile terminal **10A** further includes a song management module **40** and a light effects management module **44**, which may be stored in the memory **34**. The mobile terminal **10A** is capable of processing and playing song files (*e.g.*, MP3 files).

[053] The display **20** may be any suitable display screen assembly. For example, the display screen **28** may be a liquid crystal display (LCD) with or without auxiliary lighting (*e.g.*, a lighting panel).

[054] The user interface **22** may include any suitable input device(s) including, for example, a touch activated or touch sensitive device (*e.g.*, a touch screen), a joystick, a keyboard/keypad, a dial, a directional key or keys, and/or a pointing device (such as a mouse, trackball, touch pad, etc.). The speaker **24** generates sound responsive to an input audio signal. The user interface **22** can also include a microphone coupled to an audio processor that is configured to generate an audio data stream responsive to sound incident on the microphone.

[055] The controller **30** may support various functions of the mobile terminal **10A**. The controller **30** can be any commercially available or custom microprocessor, for example. In use, the controller **30** of the mobile terminal **10A** generates a display image on the display **20**. The controller **30** may control the audio player **26** and various other components of the mobile terminal **10A**.

[056] The memory **34** is configured to store digital information signals and data such as a digital audio signal and/or digital audio files.

[057] The communication module **32** is configured to communicate data over one or more wireless interfaces (*e.g.*, wireless interfaces **7**, **112**, **114**, **116**, **122**, and **134** as discussed herein (**Figures 1** and **3**)) to another remote wireless terminal as discussed herein. The communication module **32** can include a cellular communication module, a direct point-to-point connection module, and/or a WLAN module.

[058] With a cellular communication module, the wireless terminal **10A** can communicate via the base station(s) of the network **5** using one or more cellular

communication protocols such as, for example, Advanced Mobile Phone Service (AMPS), ANSI-136, Global Standard for Mobile (GSM) communication, General Packet Radio Service (GPRS), enhanced data rates for GSM evolution (EDGE), code division multiple access (CDMA), wideband-CDMA, CDMA2000, and Universal Mobile Telecommunications System (UMTS). The cellular base stations may be connected to a Mobile Telephone Switching Office (MTSO) wireless network, which, in turn, can be connected to a PSTN and/or another network.

[059] A direct point-to-point connection module may include a direct RF communication module or a direct IR communication module. The direct RF communication module may include a Bluetooth module. With a Bluetooth module, the wireless terminal **10A** can communicate via an ad-hoc network through a direct point-to-point interface.

[060] With a WLAN module, the wireless terminal **10A** can communicate through a WLAN (*e.g.*, a router **120** (**Figure 3**)) using a communication protocol that may include, but is not limited to, 802.11a, 802.11b, 802.11e, 802.11g, and/or 802.11i.

[061] The communication module **32** can include a transceiver typically having a transmitter circuit and a receiver circuit, which respectively transmit outgoing radio frequency signals (*e.g.*, to the network **5**, a router or directly to another terminal) and receive incoming radio frequency signals (*e.g.*, from the network **5**, a router or directly to another terminal), such as voice and data signals, via an antenna. The communication module **32** may include a short range transmitter and receiver, such as a Bluetooth transmitter and receiver. The antenna may be an embedded antenna, a retractable antenna or any antenna known to those having skill in the art without departing from the scope of the present invention. The radio frequency signals transmitted between the mobile terminal **10A** and the network **5**, router or other terminal may include both traffic and control signals (*e.g.*, paging signals/messages for incoming calls), which are used to establish and maintain communication with another party or destination. The radio frequency signals may also include packet data information, such as, for example, cellular digital packet data (CDPD) information. In addition, the transceiver may include an infrared (IR) transceiver configured to transmit/receive infrared signals to/from other electronic devices via an IR port.

[062] The mobile terminal **10A** may also be configured to electrically couple with another terminal via a wireline or cable for the transmission of digital communication

signals therebetween. The mobile terminal **10A** may include further components such as a camera device configured to generate a still image and/or video data stream based on incident light.

[063] According to some embodiments, the mobile terminal **10A** is a handheld mobile terminal. By "handheld mobile terminal," it is meant that the outer dimensions of the mobile terminal are adapted or configured and suitable for use by a typical operator using one hand. According to some embodiments, the total volume of the handheld mobile terminal **10A** is less than about 200 cc. According to some embodiments, the total volume of the handheld terminal **10A** is less than about 100 cc. According to some embodiments, the total volume of the handheld mobile terminal **10A** is between about 50 and 100 cc. According to some embodiments, no dimension of the handheld mobile terminal **10A** exceeds about 200 mm.

[064] A method for selecting and playing back a song file using mobile wireless communication terminals (*e.g.*, mobile terminals **10A-E**) according to embodiments of the present invention will now be described in reference to the flowchart of **Figure 2**. The method includes establishing a wireless connection between a host wireless communication terminal and at least one participant wireless communication terminal (**Block 280**). The host terminal maintains a list of nominated song files (**Block 282**). The host terminal receives at least one vote message from the at least one participant terminal (**Block 284**). The host terminal determines an elected song file from the list of nominated song files based on the at least one vote message (**Block 286**). The host terminal executes playback of the elected song file (**Block 288**). According to some embodiments, the host terminal also receives a song nomination from the at least one participant terminal and adds the song nomination to the list of nominated song files. The various method steps and operations as described herein for selecting and playing back nominated song files may be enabled and executed by the suitably configured controller **30** and song management module **40** of the implementing mobile terminal(s).

[065] According to some embodiments, connections are established between the host wireless communication terminal and a plurality of participant wireless communication terminals, and the host wireless communication terminal receives a plurality of vote messages from the plurality of participant wireless communication terminals and determines the elected song based on the plurality of vote messages.

[066] According to some embodiments, communication between the host wireless communication terminal and the participant wireless communication terminal is accomplished via a direct point-to-point interface, such as a Bluetooth wireless RF connection. According to some embodiments, communication between the host wireless communication terminal and the participant wireless communication terminal is accomplished via an indirect interface, such as through a WLAN or cellular-based system. Further aspects and embodiments of the present invention will be apparent from the following descriptions of further embodiments.

[067] With reference to **Figure 3**, an exemplary song file playback system **100A** according to embodiments of the present invention is shown therein. The system **100A** includes the mobile wireless communication terminal **10A** (also referred to herein as the "host wireless communication terminal" or "host terminal"), a plurality of additional participant wireless communication terminals **10B**, **10C**, **10D**, and **10E** (also referred to herein as the "participant wireless communication terminals" or "participant terminals"), and a media center **130**. The media center **130** includes apparatus adapted or configured to convert an audio signal (*e.g.*, a digital audio signal) to corresponding sound. The media center **130** may include, for example, a PC or laptop, a television, an audio receiver, stereo equipment, etc. The illustrated media center **130** includes a wireless communication module **132** and sound transducers (speakers) **136**. The wireless communication module **132** may be integrated with the media center **130** or may be an auxiliary or plug-in wireless communication module such as the Bluetooth Media Viewer MMV-100 module or Bluetooth Media Viewer MMV-200 module, each available from Sony Ericsson of Sweden. The terminals **10B-E** may be configured as described above with regard to the terminal **10A**. The terminals **10B-E** each include a wireless communication module **32** and a song management module **40**. However, the respective song management modules **40** may be differently configured for each terminal **10A-E** depending on the intended functionality of the device. According to some embodiments, all or some of the terminals **10B-E** are mobile wireless communication terminals. According to some embodiments, all or some of the terminals **10A-E** are handheld mobile wireless communication terminals.

[068] Referring now to **Figure 4**, a further exemplary system **100B** according to embodiments of the present invention is shown therein including the host terminal **10A** and the participant terminals **10B-E**. The system **100B** differs from the system **100A**

(**Figure 3**) in that the media center **130** is omitted and playback of the song files from the song play list **156** is conducted via the speaker **24** of the host terminal **10A**.

[069] Referring now to **Figure 5**, a further exemplary system **100C** according to embodiments of the present invention is shown therein including the host terminal **10A** and the participant terminals **10B-E**. The system **100C** differs from the system **100B** (**Figure 5**) in that playback of the song files from the song play list **156** is conducted via the speaker **24** of the host terminal **10A** and, additionally, through the respective speakers of the participant terminals **10B-E** and/or through one or more headsets (*e.g.*, in-ear stereo headsets) operatively connected to the terminals **10A-E**. More particularly, the controller **30** of the host terminal **10A** plays each song file thereon and also sends the song file to the participant terminals **10B-E** for simultaneous playback. According to some embodiments, the playback is synchronized between the mobile terminals **10A-E**.

[070] Various combinations and aspects of the exemplary systems **100A**, **100B**, **100C** may be employed and the host terminal **10A** may be configured to allow the user to selectively choose the device or combination of devices for playback from the various options discussed above. For example, the host terminal **10A** may be configured to execute playback via only the speaker **24** of the host terminal **10A**, via the speakers of the participant terminals **10B-E** but not the host terminal **10A**, via the speakers of the participant terminals **10B-E** and the media center **130**, etc. It will be appreciated that, when the song files are played back via the speakers of the terminals **10A-E**, the user of a given one of the participant terminals may disable the speaker thereof and/or may relay the song file for playback on another device (*e.g.*, an associated further media center or the like).

[071] Mobile terminals, methods and systems in accordance with embodiments of the present invention will now be described using an illustrative example of use. The host terminal **10A** is chosen to be the master or host terminal and the participant terminals **10B-E** are each designated as slave or participant terminals. The controller **30** of the host terminal **10A** establishes a wireless connection (*i.e.*, communicatively couples) with each of the participant terminals **10B-E**. According to some embodiments, the wireless connection is a direct wireless communication interface connection, according to some embodiments, a direct RF connection and, according to some embodiments, a Bluetooth connection. The connections may be established in known manner. For example, in the case of Bluetooth connections, the participant (slave) terminals **10B-E** may be set to a

searchable/discoverable state and the host (master) terminal **10A** emits an inquiry to identify the available participant (slave) terminals **10B-E** to form a piconet or personal area network.

[072] As illustrated, in the system **100A** (**Figure 3**) the host terminal **10A** communicates with the participant terminals **10B**, **10C** and **10D** via direct point-to-point wireless interfaces or links **112**, **114** and **116**, respectively, and with the participant terminal **10E** via wireless interfaces or links **118**, **122** through a WLAN router **120**. In the systems **100B (Figure 4)** and **100C** (**Figure 5**), the host terminal **10A** communicates with the participant terminals **10B-E** via direct point-to-point links **112**, **114**, **116**, **119**. In the case of the system **100A**, the host terminal **10A** is also communicatively coupled to the media center **130** to provide wireless song data signals via a wireless interface or link **134** to the communication module **132**. Alternatively, the host terminal **10A** can be connected to the media center **130** using a wireline or signal cable. It will be appreciated that, according to some embodiments, the interfaces may be various combinations of wireless interfaces that are direct (*e.g.*, Bluetooth) or indirect (*e.g.*, via a WLAN router or a cellular network **5**). According to some contemplated embodiments, all of the signals provided between the host terminal **10A** and the participant terminals **10B-E** to execute the song sharing procedure are provided via direct point-to-point wireless interfaces. According to some contemplated embodiments, all of the signals provided between the host terminal **10A** and the participant terminals to execute the song sharing procedure are provided via direct wireless radio frequency (RF) interfaces such as Bluetooth interfaces.

[073] Before or after establishing the connections, the host terminal **10A** may identify and designate valid participant terminals by any suitable method. According to some embodiments, the host terminal **10A** will poll or send an invitation to all or a selected group of potential participant terminals (*e.g.*, those within operational range of the host terminal's Bluetooth signal). The potential participant terminals may then opt in by replying with an acceptance of the invitation. Alternatively or additionally, the host terminal **10A** may accept unsolicited requests from participant terminals to participate. The host terminal **10A** may be used to define specific groups such as a listing of the potential participant terminals that will be permitted to participate (*e.g.*, to contribute song nominations and/or votes).

[074] Each song management module **40** provides a display **150** on the associated terminal **10A-E** as shown in **Figure 4**. The display provided on the host terminal **10A**

may differ from the display provided on the participant terminals **10B-E**. For example, the portions of the display **150** related to management functionality may be omitted from the participant terminal displays. Alternatively, the song management module **40** may provide no display on the participant terminals **10B-E**.

[075] Once the connections are established between the host terminal **10A** and the participant terminals **10B-E**, the host terminal **10A** may send a request to the participant terminals **10B-E** for song file nominations. For example, the host may actuate a "NOMINATIONS" button (**Figure 6**) on the display **150**. Each participant may use his or her respective participant terminal to send a nominee song identification to the host terminal **10A**. The nominee song identification designates a song file the participant wishes to add to the nominated song list. The nominee song identification may designate a song file stored on the participant's terminal **10B-E**. The song management module **40** of the sending participant terminal **10B-E** may provide a user interface to facilitate the selection and sending of the nominee song identification(s). For example, the module **40** may generate a list of the available stored songs and check boxes for selecting the song(s) to send to the host terminal **10A**. Additionally or alternatively, the nominated song list may comprise song identifications designating song files stored on the host terminal **10A**. According to some embodiments, only the host terminal **10A** may nominate song files. According to some embodiments, the host terminal **10A** and/or the participant terminals **10B-E** can nominate song files stored on mobile terminals other than themselves. The nominated song files constitute the nominated song list.

[076] The host terminal **10A** receives the nominee song identifications from the participant terminals **10B-E**. The song management module **40** of the host terminal **10A** creates and maintains a host nominated song list of these song identifications. The host nominated song list represents song files that are candidates to be played.

[077] According to some embodiments, the host terminal **10A** compiles the nominated song list and sends the nominated song list to the participant terminals **10B-E** for display thereon. According to some embodiments, each of the participant terminals **10B-E** receives nominations from other participant terminals (and, if applicable, the host terminal **10A**) and itself compiles and displays the nominated song list.

[078] In the illustrated embodiment, the display **150** includes a play list field **152** and control buttons **154** (*e.g.*, soft keys). The control buttons **154** will typically only be displayed on the host terminal display. The nominated song list **156** is displayed in the

play list field **152**. The nominated song list **156** includes a row-by-row series of song identifications **156A**, each corresponding to a respective song file. As illustrated, each song identification includes a song artist, a song name, and a song play time corresponding to the associated song file, as well as an identification of the participant that has submitted the song identification as a nominee. It will be appreciated that more, less and/or different information may be provided as well. A vote counter field **156B** may also be provided for each nominated song identification **156A**.

[079] The host may initiate an election by actuating an "ELECTION" button (**Figure 6**) on the display **150**, for example. The election may be initiated for a single selected song, for a slate of songs less the full nominated song list, or for a slate including all of the nominated songs. The participants can vote on the nominated song(s) using their mobile terminals **10B-E**. The votes are sent as vote messages by the participant terminals **10B-E** to the host terminal **10A**. The host may also be enabled to vote using his or her mobile terminal **10A**. The host terminal **10A** counts or tallies the vote messages and determines the "winning" or "elected" song file or files (*i.e.*, the nominated song file or files receiving the most votes).

[080] In some cases, only a single song file is elected for playback. In other cases, a plurality of nominated song files may be elected and placed in a play list in vote rank order for playback. According to some embodiments, the host terminal **10A** may originally configure a play list that is thereafter reordered by voting of the participant terminals **10B-E** (and, optionally, the host terminal **10A**).

[081] The host may selectively manage play of the songs represented by the song list **156** using the control buttons **154**, for example. For example, the "PLAY" and "STOP" buttons may be used to start and stop transmission of the song files to the media center **130** and/or the audio players of the mobile terminals **10A-E**. The "MOVE" button may be used to prioritize or change the order of the song identifications **156A** in the play list **156** (*i.e.*, to change the order in which the associated song files will be played). The "DELETE" button may be used to delete a song identification **156A** from the play list **156**. The "DETAILS" button may be used to delete a song identification **156A** from the play list **156** so that the associated song file will not be played. The "RANDOM MIX" button may be used to cause the host terminal **10A** to execute playback of the song files (*i.e.*, send the song files to the media center **130**) in a random or other non-sequential order.

Typically, the host terminal **10A** will execute playback of the song files in the listed sequence unless the random or other non-sequential mode is in effect.

[082] When the host terminal **10A** is in play mode, the controller **30** of the host terminal **10A** will identify the elected song identification **156A** that is to be played. The host terminal **10A** will then execute playback of the elected song file. The host terminal **10A** may execute playback by any suitable method.

[083] According to some embodiments, the host terminal **10A** will execute playback of the elected song by sending a song file request to the participant terminal **10B-E** that nominated the song identification to retrieve the song file corresponding to the song identification. The corresponding participant terminal will then send a copy of the identified song file (which is stored on the participant terminal) to the host terminal **10A**. According to some embodiments, the participant terminal sends the song file to the host terminal **10A** as a copy of the song file that is then temporarily stored on the host terminal **10A** (*e.g.*, in the memory **34**). According to other embodiments, the participant terminal sends the song file to the host terminal **10A** as a streaming song file. According to some embodiments, the request and song file signals between the host terminal and the participant terminal are sent wirelessly and, according to some embodiments, via a direct wireless RF connection such as Bluetooth.

[084] The controller **30** of the host terminal **10A** then executes playback of the retrieved song file by sending the song file to the media center **130** and/or the mobile terminals **10B-E**. The song file may be stored on the media center **130** and/or the mobile terminals **10B-E** for playback. Alternatively, the song file may be streamed to the media center **130** and/or the mobile terminals **10B-E**, for example, as the song file is streamed from the originating participant terminal to the host terminal **10A**. It may be preferable or necessary to stream the song file from the participant terminal to the host terminal and/or from the host terminal to the media center **130** and/or the mobile terminals **10B-E** if the allocated memory space on the host terminal **10A** is insufficient and/or storage of the song file on the host terminal **10A** is prevented or illegal. According to some embodiments, the song file, whether streamed or stored in whole, will be automatically erased (*i.e.*, without user intervention) from the host terminal **10A** during or after playback.

[085] Additionally or alternatively, the host terminal **10A** may execute playback of the song file by instructing the participant terminal on which the selected song file is

stored to play the selected song file and/or distribute the selected song file to other devices (*e.g.*, the other mobile terminals **10A-E** and/or the media center **130**) for playback.

[086] The controller **30** of the host terminal **10A** may execute the foregoing steps for each song identification **156A** in turn and automatically (*i.e.*, without user intervention). As the host terminal **10A** runs through the song list **156** in this fashion, the host may modify the play list **156** as desired. Also, according to some embodiments, the participant terminals **10B-E** can add new nominated song identifications to the song list **156** and vote on the nominated songs as the controller **30** of the host terminal **10A** runs through the play list **156**. According to some embodiments, new participant terminals can join the group and submit nominee song identifications and votes as the host terminal **10A** runs through the play list **156**.

[087] According to some embodiments, the host terminal may request nominations and/or only add to the nominated song list nominations of song files in a prescribed song file category or categories (*i.e.*, song files having associated therewith appropriate metadata tags as described herein). For example, the host terminal may request and limit the nominated song list to song files bearing a "disco" metadata tag.

[088] Various further modifications to the methods and apparatus may be made in accordance with embodiments of the present invention. According to some embodiments, some participant terminals can vote on nominated song files but cannot nominate song files. According to some embodiments, some participant terminals can nominate song files, but cannot vote on the nominated song files. According to some embodiments, some participant terminals can nominate and/or vote, but cannot play back the elected song files (*i.e.*, do not receive the song file from the host terminal or the originating participant terminal). According to some embodiments, some participant terminals can play back the elected song files, but cannot nominate or vote.

[089] Other functionality could also be provided. For example, the host terminal **10A** may allow the user to change the order of the song identifications **156A** according to one or more selected attributes (*e.g.*, contributing participant, song length, etc.). The host terminal **10A** may be configured to designate which of the participant terminals **10B-E** are permitted to add song identifications to the play list **156**. The participant terminals **10B-E** may be enabled to edit or modify the song list **156** in addition to adding song identifications. In this case, the host terminal **10A** may be configured to allow the host to select which of the participant terminals **10B-E** are and are not authorized to modify the

song play list **156** (*i.e.*, enable and disable the play list edit capability of the participant terminals).

[090] The mobile terminals, systems, and methods as described herein can provide a convenient and enjoyable mechanism for enabling a group of people to select and play back songs. The mobile terminals, systems, and methods can provide playback execution functionality and also allow the host terminal (and, in some cases, the participant terminals) to create, coordinate, control and/or manage a song play list. In practice, for example, partygoers can add songs from their own participant terminals to a nominated song list maintained on a host terminal (*e.g.*, the party host's own mobile terminal). If their song is elected, when their song's turn arrives in the playback sequence, a copy of the song file will automatically be sent to the host terminal and played. Thus, the partygoer need not take any further action. When, in accordance with some embodiments, the request and song transfer signals are communicated between the host terminal and the participant terminal via a direct wireless connection (*e.g.*, an RF interface such as a Bluetooth connection), the partygoer may simply place his or her participant terminal in a pocket or handbag. Participants may be added and removed as the procedure is executed. For example, when a participant leaves the Bluetooth range, his or her songs may be deleted from or moved down the play list.

[091] With reference to **Figure 7**, according to further embodiments of the present invention, mobile wireless communications terminals, methods, systems and computer program products are provided that enable selection and playback of files according to prescribed classifications or categories. Such mobile wireless communication terminals, methods, systems and computer program products may be employed with voting functionality and/or light effects functionality as described herein or independently thereof. The mobile terminal, etc., may be configured as otherwise discussed above with reference to the mobile terminals **10A-E** with suitable modifications to the song management module(s) **40** of the mobile terminals **10A-E** to enable the mobile terminals **10A-E** to function as described herein.

[092] A method for selecting and playing back a song file using mobile wireless communications terminals (*e.g.*, the mobile terminals **10A-E**) according to some embodiments of the present invention will now be described with reference to **Figure 7**. The method includes establishing a wireless connection between a host wireless communication terminal and at least one participant wireless communication terminal

(**Block 310**). The host terminal receives from the at least one participant terminal an identification of a song file that is stored on the at least one participant terminal and also has a metadata tag associated therewith that indicates the song file (with may be referred to a "compliant song file") is classified in a prescribed song file category (**Block 312**). The host terminal thereafter executes playback of the compliant song file (**Block 314**).

[093] The various method steps and operations as described herein for selecting and playing back compliant song files may be enabled and executed by the suitably configured controller **30** and song management module **40** of the implementing mobile terminal(s) **10A-E**.

[094] According to some embodiments, the host terminal establishes a wireless connection with a plurality of participant wireless communication terminals, requests identification of compliant songs from the plurality of participant terminals, and executes playback of one or more of the compliant songs on the plurality of participant terminals.

[095] According to some embodiments, the wireless connections is/are direct wireless communication interface connections, according to some embodiments, direct RF connections and, according to some embodiments, Bluetooth connections, as described herein. According to some embodiments, all of the signals provided between the host terminal and the participant terminal(s) to execute the compliant song identification procedure are provided via direct wireless RF interfaces such as Bluetooth interfaces. Similarly, according to some embodiments, the execution of playback of the compliant song files is accomplished by transferring the song files via direct wireless RF connections such as Bluetooth. More particularly, the communications between the terminals and song file transfers may be executed using the various apparatus methods and techniques described above with regard to the playlist management and playback function.

[096] According to more particular embodiments, a host terminal **10A** is designated and the controller **30** of the host terminal **10A** establishes wireless connections with one or more participant terminals such as the participant terminals **10B-E** as described above. At least some of the participant terminals **10B-E** have song files stored thereon. At least some of the participant song files include metadata tags assigned thereto. The metadata tag or tags correspond to some aspect of the associated song file by which the song file may be classified or categorized. Examples of aspects of song files and metadata tags are provided below.

[097] The host terminal **10A** selects or designates a song file category for playback. The designated category corresponds with a metadata tag or tags. The host terminal **10A** sends a message to the participant terminals **10B-E** requesting an identification of the song files on the participant terminals **10B-E** that have the designated metadata tag associated therewith (*i.e.*, the compliant song files).

[098] The participant terminals **10B-E** send response messages to the host terminal **10A** each including a respective listing of song files stored on the respective responding participant terminal having the prescribed metadata tag. According to some embodiments, the participant can modify the reply list to include only a compliant song file or files that the participant wishes to offer.

[099] The host terminal **10A** selects or is used by the host to select a compliant song file from the compliant song file identifications received from the participant terminals **10B-E**. The host terminal **10A** may select the song file manually or according to further criteria (*e.g.*, using the voting functionality described hereinbelow), for example. The selected song file may be added to a play list on the host terminal **10A** if one is maintained.

[0100] The host terminal **10A** then executes playback of the selected compliant song. The host terminal **10A** may execute playback by any suitable method as those disclosed herein above with regard to the voting function. According to some embodiments, the host terminal **10A** retrieves and plays the selected song file on its own speaker **24** and/or the host terminal **10A** retrieves and distributes the selected compliant song file for playback on one or more of the participant terminals **10B-E** and/or the media center **130**, for example. According to some embodiments, the host terminal **10A** distributes the compliant song file for simultaneous (and, optionally, synchronized) playback on a plurality of the participant terminals **10B-E**. Additionally or alternatively, the host terminal **10A** may instruct the participant terminal on which the selected song file is stored to play the selected song file and/or distribute the selected song file to another device (*e.g.*, the other mobile terminals and/or the media center) for playback.

[0101] The host terminal **10A** may request and/or accept song catalog listings from one or more participant terminals as discussed above. According to some embodiments, the song catalog listings include metadata tag data. The song file catalogs may include compliant and non-compliant song files. According to some embodiments, the host terminal controller **30** searches the received song catalogs to identify and list the compliant

song files. The host terminal **10A** may thereafter select a compliant song file for playback as described herein.

[0102] The metadata tag may take any suitable form and may be associated with the song files in any suitable manner. For example, the metadata tags can be embedded in, attached to or assigned to the song files by the originator of the song file (*e.g.*, a party or entity such as a music media vendor which constructed or configured the song file prior to distribution of the song file to the participant terminal). The metadata tag may be assigned to the song file by the participant (*e.g.*, using the participant terminal or otherwise).

[0103] As discussed above, the metadata tag indicates that the compliant song file is classified in a prescribed song file category. The prescribed song file category may be any suitable category. According to some embodiments, the metadata tag indicates that the song file includes a song of a particular genre (*e.g.*, rock, techno, country/western, alternative country, disco, R&B, Hip Hop, World, Religious, Punk, Classical, Acoustic, Folk, etc.). According to some embodiments, the metadata tag indicates that the song file includes a song of a particular type (*e.g.*, mood, meditation, light music, background music, etc.). According to some embodiments, the metadata tag indicates that the song file includes a song for a particular occasion or event (*e.g.*, dance party, dinner party, birthday, wedding, graduation, etc.). According to some embodiments, the metadata tag indicates that the song file includes a song by a specified musician or artist (*e.g.*, the compliant songs are all songs by The Beatles). According to some embodiments, the metadata tag indicates that the song file includes a song having a tempo in a particular range (*e.g.*, slow, medium, fast). According to some embodiments, the metadata tag indicates that the song file includes a song that has received or is assigned a particular certification or rating (*e.g.*, a "parental advisory" rating or, alternatively, a non-parental advisory rating). The metadata tag may indicate an operational or usage status of the song file. The operational or usage status may be determined by the actual use of the song file. By way of example and in accordance with some embodiments, the metadata tag may indicate that a song file has previously won votes (as discussed herein, for example), has been played at least a prescribed number of times previously, or has been played less than a prescribed number of times (*e.g.*, never been played back within a prescribed timeframe such as the current session). Thus, for example, a play list could be constructed of popular songs or songs that have never been played.

[0104] The search and selection criteria employed to identify and select compliant songs for playback may be suitably modified or augmented. Multiple search or request parameters can be set. For example, the host may request via the host terminal **10A** an identification of all song files having both a "dance party" metadata tag and also a "non-parental advisory" metadata tag. By way of further example, the host may request via the host terminal **10A** an identification of all song files having, in combination for each song file, a metadata tag indicating the song has not been played back in the current session, a "disco" metadata tag, and a metadata tag indicating the song file has received votes. The search or request parameters may indicate negative criteria, such as a request for all songs not having a "parental advisory rating" metadata tag.

[0105] With reference to **Figure 8** according to further embodiments of the present invention, mobile wireless communications terminals, methods, systems and computer program products are provided that provide light effects corresponding to playback of a song file. In particular, the mobile terminals, methods, systems and computer program products may provide distributed light effects. Such mobile wireless communication terminals, methods, systems, and computer program products may be employed with the play list, metadata tag, voting or other functionality as described herein or independently thereof. The mobile terminal, etc., may be configured as otherwise described above with respect to the mobile terminals **10A-E** with suitable modifications to enable the mobile terminals **10A-E** to function as described herein.

[0106] A method for providing light effects on at least one participant wireless communication terminal and in correspondence with playback of a song file according to some embodiments of the present invention will now be described with reference to **Figure 8**. The method includes establishing a wireless connection between a host wireless communication terminal and at least one participant wireless communication terminal (**Block 410**). The host wireless communication terminal sends at least one light effect signal to the at least one participant wireless communication terminal instructing the at least one participant wireless communication terminal to control at least one lighting device of the at least on participant wireless communication terminal in correspondence with playback of a song file (**Block 412**). The various method steps and operations as described herein for providing light effects may be enabled and executed by the suitably configured controller **30** and the light effects management module **44** (**Figure 1**) of the implementing mobile terminals.

[0107] According to some embodiments, the host terminal establishes a wireless connection with a plurality of participant wireless communication terminals, and sends light effect signals to each of the plurality of participant terminals.

[0108] According to some embodiments, the wireless connection is/are direct wireless communication interface connections, according to some embodiments, direct RF connections and, according to some embodiments, Bluetooth connections, as described herein. According to some embodiments, all of the signals provided between the host terminal and the participant terminal(s) to execute the light effects thereon are provided via direct wireless RF interfaces such as Bluetooth interfaces. Similarly, according to some embodiments, the execution of playback of the song files is accomplished by transferring the song files via direct wireless RF connections such as Bluetooth. More particularly, the communications between the terminals and song file transfers may be executed using the various apparatus methods and techniques described above with regard to the playlist management and playback function.

[0109] According to more particular embodiments and with reference to **Figure 9**, there may be provided a system **400** including a host wireless communication terminal such as the mobile terminal **10A** and one or more participant wireless communications terminals such as the mobile terminals **10B-E** each having a respective lighting device or devices **50**. According to some embodiments, multiple participant wireless communication terminals **10B-E** are employed each having lighting devices **50**. The host wireless communication terminal **10A** may likewise include a lighting device **50**. With reference to **Figure 1**, each such lighting device **50** includes light source **52** and a light control **54** and is configured to selectively provide two different, mutually distinguishable light states. The light source **52** may include a suitable light source such as a light emitting diode (LED), a liquid crystal display (LCD), an incandescent lamp, or a phosphorescent material. For example, according to some embodiments, the light sources **52** include keypad LEDs and/or LCD displays of the mobile terminals **10A-E**. The light control **54** is adapted to selectively control the lighting device **50**. The light control **54** may itself be controlled by the controller **30** or the like of the associated terminal. The light control **54** may be an electrical switch or circuit capable of selectively actuating and deactuating the light source **52**, or a moveable element such as a shutter or a lens. The at least two light states may include different light intensities (including on/off or varying (continuous or step wise) degrees of intensity) and/or different colors.

[0110] In use during playback of a song file from or via the host terminal **10A**, the host terminal **10A** sends light effect orders or signals **422**, **424**, **426**, and **428** to each of the participant terminals **10B-E**, respectively. The light effect signals embody or represent light control orders or instructions from the host terminal **10A**. The light effect signals are dependent on, based on or correspond with the playback of the song file.

[0111] The participant terminals **10B-E** receive the light effect signals **422**, **424**, **426**, and **428** and the respective light controls **54** of the participant terminals **10B-E** operate the associated light sources **52** in accordance therewith. Accordingly, the host terminal **10A** governs the light effects displayed on the participant terminals **10B-E**. For example, the light effect signals **422**, **424**, **426**, and **428** from the host terminal **10A** may cause the light sources **52** to turn on and off. According to some embodiments, the participant terminals **10B-E** receiving the light effect signals **422**, **424**, **426**, and **428** and displaying the light effects also simultaneously playback the audio of the song file. According to some embodiments, the accompanying audio signals trigger the light effects so that the light effects are synchronized and dependent on the audio signals.

[0112] The host terminal may dynamically control the light effects on a given participant terminal or may order or instruct the participant terminal to enter an appropriate mode after which the participant terminal's own controller **30** executes a corresponding light effects program. For example, the host terminal may send a series of light effect signals that directly order or cause the participant terminal to blink a light source **52** on and off. Alternatively, the host terminal may instruct the participant terminal to enter a mode wherein the participant terminal's light effect management module **44** causes its light source **52** to blink or the like in synchrony with the audio signal.

[0113] The light effects may be any suitable light actuation, modulation, display, etc. According to some embodiments, the light effects include blinking or pulsing of one more light sources **52** and, according to some embodiments, blinking or pulsing of one or more LEDs. According to some embodiments, the light effects include video or animation. In particular, the light effects may include video or animation displayed on the participant terminal's display **20** (*e.g.*, an LCD). The video or animation may be generated from a video file pre-stored on the participant mobile terminal or a video file transmitted (*e.g.*, streamed) from the host terminal **10A**.

[0114] The host terminal **10A** may also govern the distribution of light effects across the participant terminals **10B-E**. According to some embodiments, the host

terminal **10A** sends different light effect signals to different participant terminals. Thus, over the course of playback of a given song file the light source **52** of the participant terminal **10B** may turn on and off at different times than the light source **52** of the participant terminal **10C**, for example. The host terminal **10A** may thereby cause the participant terminals **10B-E** to simultaneously display synchronized light effects in dynamic patterns that differ from one another. For example, the distributed light effects on the multiple mobile terminals may provide a disco light effect.

[0115] According to some embodiments, the host terminal sends light effect signals to one or more participant terminals that cause their lighting devices to actuate (*e.g.*, pulse on and off) in response to audio frequencies of the song file in a first range (*e.g.*, a high frequency range) and sends light effect signals to one or more other participant terminals that cause their lighting devices **50** to actuate (*e.g.*, pulse on and off) in response to audio frequencies of the song file in a second range (*e.g.*, low audio frequency range) different from the first range.

[0116] According to some embodiments, the host terminal causes the participant terminals to playback the song file in multi-channel audio with different audio channels being played on different participant terminals. For example, a first set of participant terminals (*e.g.*, the participant terminals **10B** and **10C**) receive from the host terminal **10A** and play back a first audio channel (*e.g.*, a left stereo channel) of the song file, and a second set of the participant terminals (*e.g.*, the participant terminals **10D** and **10E**) receive from the host terminal **10A** and play back a second, different audio channel (*e.g.*, a right stereo channel) of the song file. According to some embodiments, the light effect signals sent to the first set of participant terminals are paired with or correspond to the first audio channel and the light effect signals sent to the second set of participant terminals are paired with or correspond to the second audio channel. For example, the lighting devices **50** of the first set of participant terminals may blink in tempo or cadence with the first audio channel while the lighting devices **50** of the second set of participant terminals may blink in tempo or cadence with the second audio channel.

[0117] According to further embodiments, the multi-channel audio song file includes more than two audio channels and more than two separate channels are simultaneously respectively played back on different participant terminals. For example, the song file may be played back in a surround sound mode with three or more participant

terminals playing different channels and displaying different corresponding light effects from one another.

[0118] According to some embodiments, the relative positions or locations of the host terminal and/or the participant terminals are determined and the host terminal assigns the light effects to the participant terminals in accordance with their relative locations. Any suitable techniques can be used to distribute audio channels and determine the relative spatial locations of the terminals. According to some embodiments, the multi-channel audio playback distribution is accomplished as described in Applicant's European Patent Application No. 04103212.9, filed July 7, 2004, published as EP 1615464A1 on January 11, 2006, the disclosure of which is incorporated herein by reference. Moreover, the relative positions of the host terminal and the participant terminals may be determined and utilized as described in European Patent Application No. 0403312.9. Additionally, calibration may be accomplished as described in European Patent Application No. 04033129 or using any other suitable techniques to compensate for radio link delays.

[0119] According to some embodiments, the light effects coordinated or governed by the host terminal **10A** include a dynamic pattern that travels from mobile terminal to mobile terminal. For example, a light source (*e.g.*, an LED or an LCD display) may be pulsed on each mobile terminal **10A-E** in series so that the light pulse appears to travel along (*e.g.*, up and down) a row of the mobile terminals **10A-E**. To facilitate such operations, the relative spatial locations of the mobile terminals **10A-E** may be determined as discussed above and the light effects assigned to the several mobile terminals **10A-E** in accordance with their determined positions.

[0120] According to further embodiments, the dynamic patterned light effects include video or animation displayed on multiple mobile terminals **10A-E** such that it appears to travel from display screen **20** (*e.g.*, LCD) to display screen **20** of the mobile terminals **10A-E**. For example, in **Figure 10A**, three participant terminals **10B-D** are shown having respective display screens **20** at a first point in time to provide a collective or combined image **448A**. The displays **20** are controlled such that, at a later time, the respective images **442A**, **444A**, **446A** are replaced with new images **442B**, **444B**, **446B** as shown in **Figure 10B** to provide a new combined image **448B**, and, at a still later time, the images **442B**, **44B**, **446B** are replaced with new images **442C**, **444C**, **446C** to provide a new combined image **448C** (**Figure 10C**) giving the appearance that the objects in the combined images **448A**, **448B**, **448C** have traveled over time along the displays **20**

between the mobile terminals **10B-D**. Thus, in the embodiment of **Figures 10A-C**, the light effects are distributed across the several mobile terminals **10B-D** in a dynamic pattern that gives the impression of an animated person walking from display screen **20** to display screen **20** of the mobile terminals **10B-D**. This operation may be paired with and facilitated by determining the relative spatial positions of the mobile terminals as discussed above.

[0121] The light effects as controlled by the host terminal may also include use of the screens or displays of multiple mobile terminals without screen-to-screen traveling animation. For example, the screens **20** may be used as a collective screen to display a still image.

[0122] Various of the invention embodiments disclosed herein can be used with or independently of other invention embodiments as disclosed herein. For example, a song file or song files may be selected for playback using the metadata tag procedure or voting procedure described herein, with the song files being played back one at a time without creation of a song file play list. According to some embodiments, the host terminal may only coordinate selection of song files for playback and instruct selected participant terminals to send song files (*e.g.*, via streaming or as a complete file) to one or more playback device(s) (*e.g.*, other participant terminals, the host terminal, or the media player) or to play the song file on the originating participant terminal only. According to some embodiments, the "host" status may shift among the mobile terminals **10A-E**.

[0123] The application programs described herein, including the song management module **40** and the light effects management module **44**, are illustrative of programs that implement various features according to embodiments of the present invention. It will be appreciated that other and/or additional application programs may be employed in accordance with embodiments of the present invention.

[0124] Although **Figure 1** illustrates an exemplary hardware/software architecture that may be used in mobile terminals and/or other electronic devices for management and playback of song files, it will be understood that the present invention is not limited to such a configuration but is intended to encompass any configuration capable of carrying out operations described herein. For example, although the memory **34** is illustrated as separate from the controller **30**, the memory **34** or portions thereof may be considered as a part of the controller **30**. More generally, while particular functionalities are shown in particular blocks by way of illustration, functionalities of different blocks and/or portions

thereof may be combined, divided, and/or eliminated. Moreover, the functionality of the hardware/software architecture of **Figure 1** may be implemented as a single processor system or a multi-processor system in accordance with various embodiments of the present invention.

[0125] Many alterations and modifications may be made by those having ordinary skill in the art, given the benefit of present disclosure, without departing from the spirit and scope of the invention. Therefore, it must be understood that the illustrated embodiments have been set forth only for the purposes of example, and that it should not be taken as limiting the invention as defined by the following claims. The following claims, therefore, are to be read to include not only the combination of elements which are literally set forth but all equivalent elements for performing substantially the same function in substantially the same way to obtain substantially the same result. The claims are thus to be understood to include what is specifically illustrated and described above, what is conceptually equivalent, and also what incorporates the essential idea of the invention.

CLAIMS

1. A mobile wireless communication terminal comprising:

a wireless communication module that is configured to communicate with other communication terminals over a wireless interface; and

a controller that is configured to establish a connection with at least one participant wireless communication terminal via the wireless communication module, to receive from the at least one participant wireless communication terminal an identification of a compliant song file stored on the at least one participant wireless communication terminal and having a metadata tag associated therewith indicating that the compliant song file is classified in a prescribed song file category, and to execute playback of the compliant song file.

2. The wireless communication terminal according to claim 1, wherein the controller is configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to receive identifications of compliant songs from at least two of the plurality of participant wireless communication terminals.

3. The wireless communication terminal according to any of the claims 1-2, wherein the controller is configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to execute playback of the compliant song file simultaneously on the plurality of participant wireless communication terminals.

4. The wireless communication terminal according to any of the claims 1-3, wherein the controller is configured to retrieve the compliant song file from the at least one participant wireless communication terminal for playback.

5. The wireless communication terminal according to any of the claims 1-4, wherein:

the wireless communication module is configured to communicate with other communication terminals over a direct point-to-point wireless interface; and

the controller is configured to establish the connection with the at least one participant wireless communication terminal via the wireless communication module via the direct point-to-point wireless interface, and to receive the identification of a compliant song file from the at least one participant wireless communication terminal via the direct point-to-point wireless interface.

6. The wireless communication terminal according to any of the claims 1-5, wherein the wireless communication module comprises a Bluetooth transmitter.

7. The wireless communication terminal according to any of the claims 1-6, wherein the wireless communication terminal includes a cellular telephone.

8. A mobile wireless communication terminal comprising:

a wireless communication module that is configured to communicate with other communication terminals over a wireless interface; and

a controller that is configured to establish a connection with at least one participant wireless communication terminal via the wireless communication module, to maintain a list of nominated song files, to receive at least one vote message from the at least one participant wireless communication terminal, to determine an elected song file from the list of nominated song files based on the at least one vote message, and to execute playback of the elected song file.

9. The wireless communication terminal according claim 8, wherein the controller is configured to receive an identification of a nominated song file from the at least one participant wireless communication terminal, and to add the identification of the nominated song file to the list of nominated song files.

10. The wireless communication terminal according to any of the claims 8-9, wherein the controller is configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to receive vote messages from at least two of the plurality of participant wireless communication terminals.

11. The wireless communication terminal according to any of the claims 8-10, wherein the controller is configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to execute playback of the elected song file simultaneously on the plurality of participant wireless communication terminals.

12. The wireless communication terminal according to any of the claims 8-11, wherein the controller is configured to retrieve the elected song file from the at least one participant wireless communication terminal for playback.

13. The wireless communication terminal according to any of the claims 8-12, wherein:

the wireless communication module is configured to communicate with other communication terminals over a direct point-to-point wireless interface; and

the controller is configured to establish the connection with the at least one participant wireless communication terminal via the wireless communication module via the direct point-to-point wireless interface, and to receive the at least one vote message from the at least one participant wireless communication terminal via the direct point-to-point wireless interface.

14. The wireless communication terminal according to any of the claims 8-13, wherein the wireless communication module comprises a Bluetooth transmitter.

15. The wireless communication terminal according to any of the claims 8-14, wherein the wireless communication terminal includes a cellular telephone.

16. A mobile wireless communication terminal comprising:

a wireless communication module that is configured to communicate with other communication terminals over a wireless interface; and

a controller that is configured to establish a connection with at least one participant wireless communication terminal via the wireless communication module, and to send at least one light effect signal to the at least one participant wireless communication terminal instructing the at least one participant wireless communication terminal to control at least

one lighting device of the at least one participant wireless communication terminal in correspondence with playback of a song file.

17. The wireless communication terminal according claim 16, wherein the controller is configured to establish a connection with a plurality of participant wireless communication terminals via the wireless communication module, and to send light effect signals to each of the plurality of participant wireless communication terminals instructing each of the plurality of participant wireless communication terminals to control a lighting device thereof in correspondence with playback of the song file.

18. The wireless communication terminal according to claim 17, wherein the controller is configured to send light effect signals to each of the plurality of participant wireless communication terminals instructing the plurality of participant wireless communication terminals to control the lighting devices thereof differently from one another.

19. The wireless communication terminal according to claim 18, wherein the controller is configured to send light effect signals to each of the plurality of participant wireless communication terminals so as to cause the plurality of participant wireless communication terminals to display on respective displays thereof an image that moves over time from the display of a first of the plurality of participant wireless communication terminals to the display of a second of the plurality of participant wireless communication terminals.

20. The wireless communication terminal according to any of the claims 18-19, wherein the controller is configured to send light effect signals to each of the plurality of participant wireless communication terminals so as to cause a lighting device of a first of the plurality of participant wireless communication terminals to respond to audio signals in a first audio frequency range and to cause a lighting device of a second of the plurality of participant wireless communication terminals to respond to audio signals in a second audio frequency range different from the first audio frequency range.

21. The wireless communication terminal according to any of the claims 17-20, wherein the controller is configured to execute playback of the song file simultaneously on the plurality of participant wireless communication terminals.

22. The wireless communication terminal according to any of the claims 16-21, wherein:

the wireless communication module is configured to communicate with other communication terminals over a direct point-to-point wireless interface; and

the controller is configured to establish the connection with the at least one participant wireless communication terminal via the wireless communication module via the direct point-to-point wireless interface, and to send the at least one light effect signal to the at least one participant wireless communication terminal via the direct point-to-point wireless interface.

23. The wireless communication terminal according to any of the claims 16-22, wherein the wireless communication module comprises a Bluetooth transmitter.

24. The wireless communication terminal according to any of the claims 16-23, wherein the wireless communication terminal includes a cellular telephone.

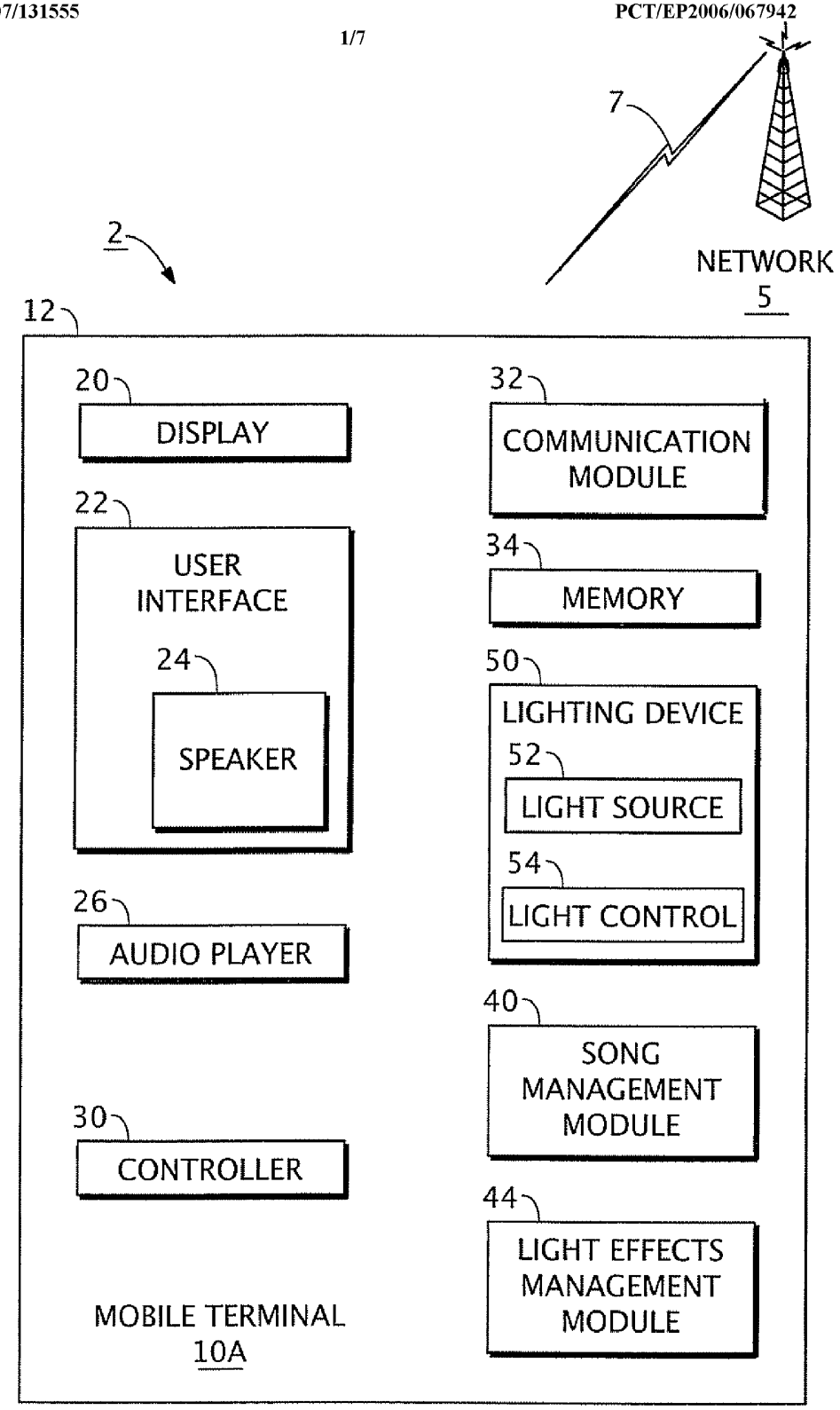

7
NETWORK
5
2
12
20
DISPLAY
22
USER INTERFACE
24
SPEAKER
26
AUDIO PLAYER
30
CONTROLLER
MOBILE TERMINAL
10A
32
COMMUNICATION MODULE
34
MEMORY
50
LIGHTING DEVICE
52
LIGHT SOURCE
54
LIGHT CONTROL
40
SONG MANAGEMENT MODULE
44
LIGHT EFFECTS MANAGEMENT MODULE

FIG. 1

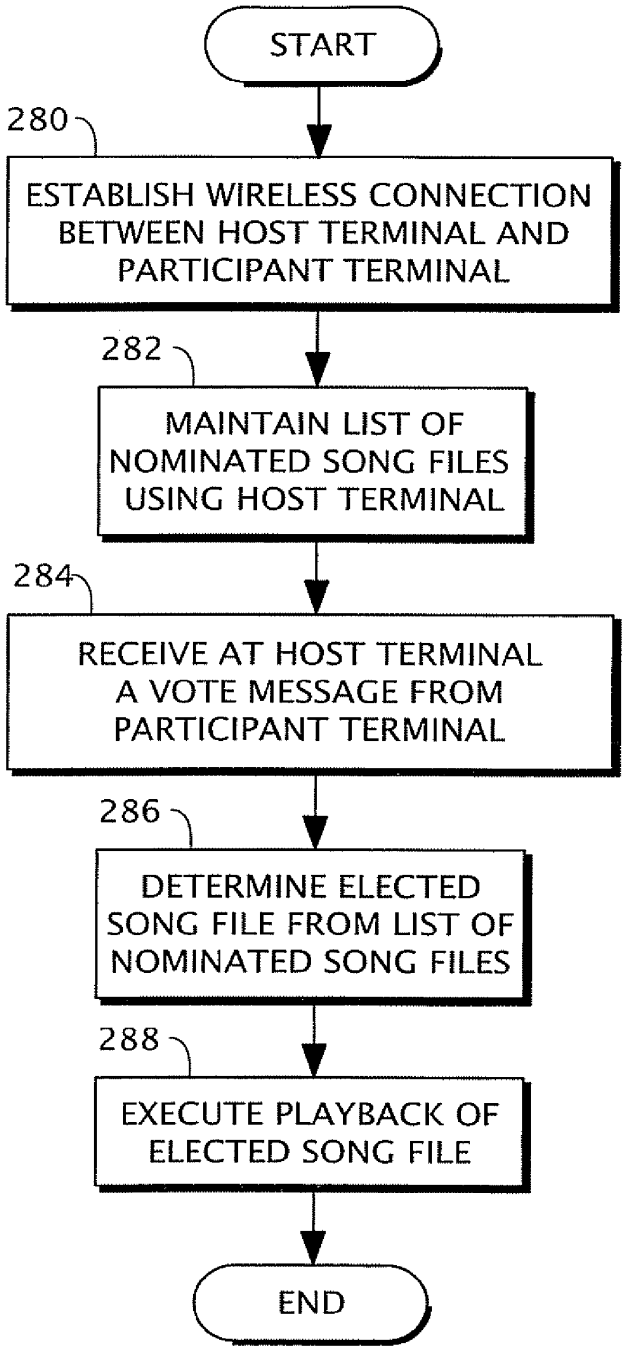

START
280
ESTABLISH WIRELESS CONNECTION BETWEEN HOST TERMINAL AND PARTICIPANT TERMINAL
282
MAINTAIN LIST OF NOMINATED SONG FILES USING HOST TERMINAL
284
RECEIVE AT HOST TERMINAL A VOTE MESSAGE FROM PARTICIPANT TERMINAL
286
DETERMINE ELECTED SONG FILE FROM LIST OF NOMINATED SONG FILES
288
EXECUTE PLAYBACK OF ELECTED SONG FILE
END

FIG. 2

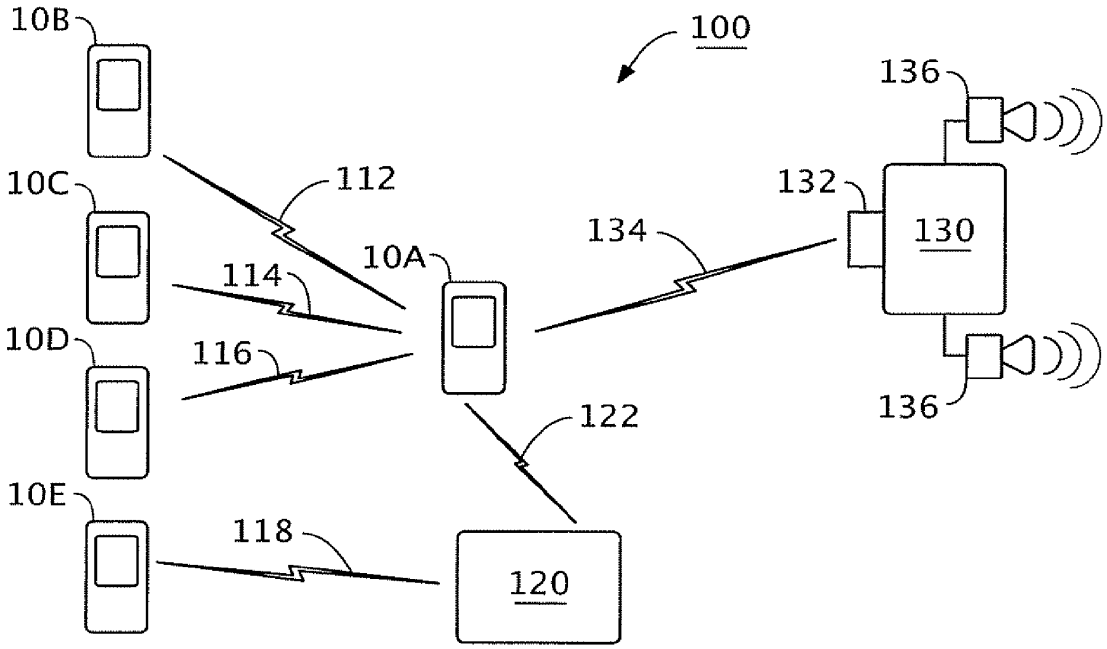
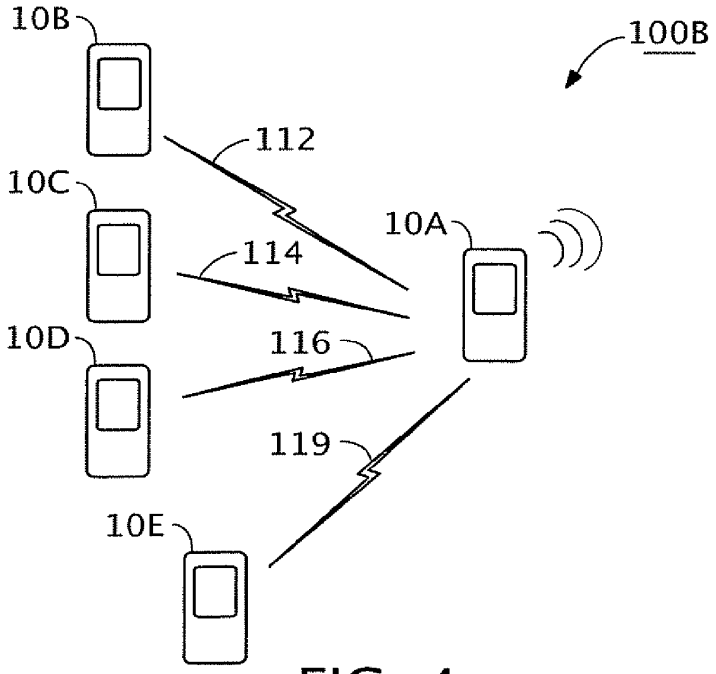

10B
100
136
10C
112
132
134
130
10A
114
10D
116
136
122
10E
118
120

FIG. 3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112
10C
10A
114
10D
116
119
10E

FIG. 4

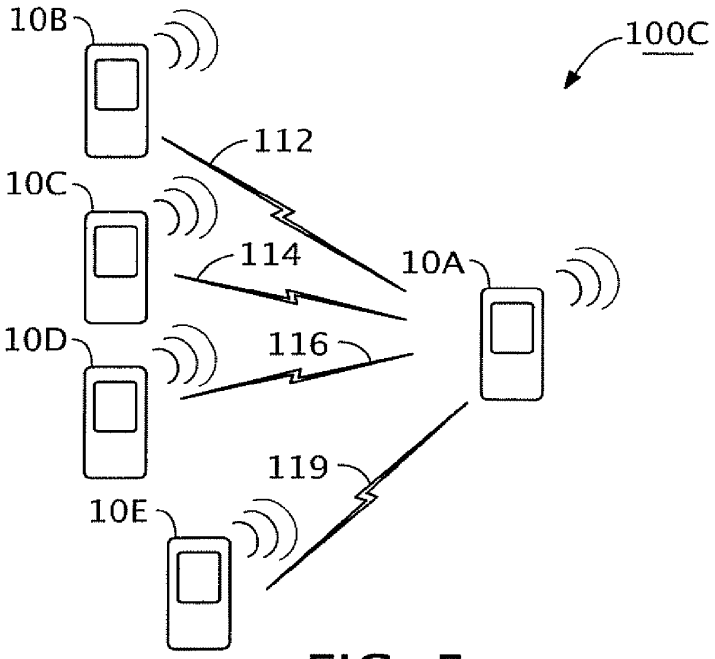

10B
100C
112
10C
114
10A
10D
116
119
10E

FIG. 5

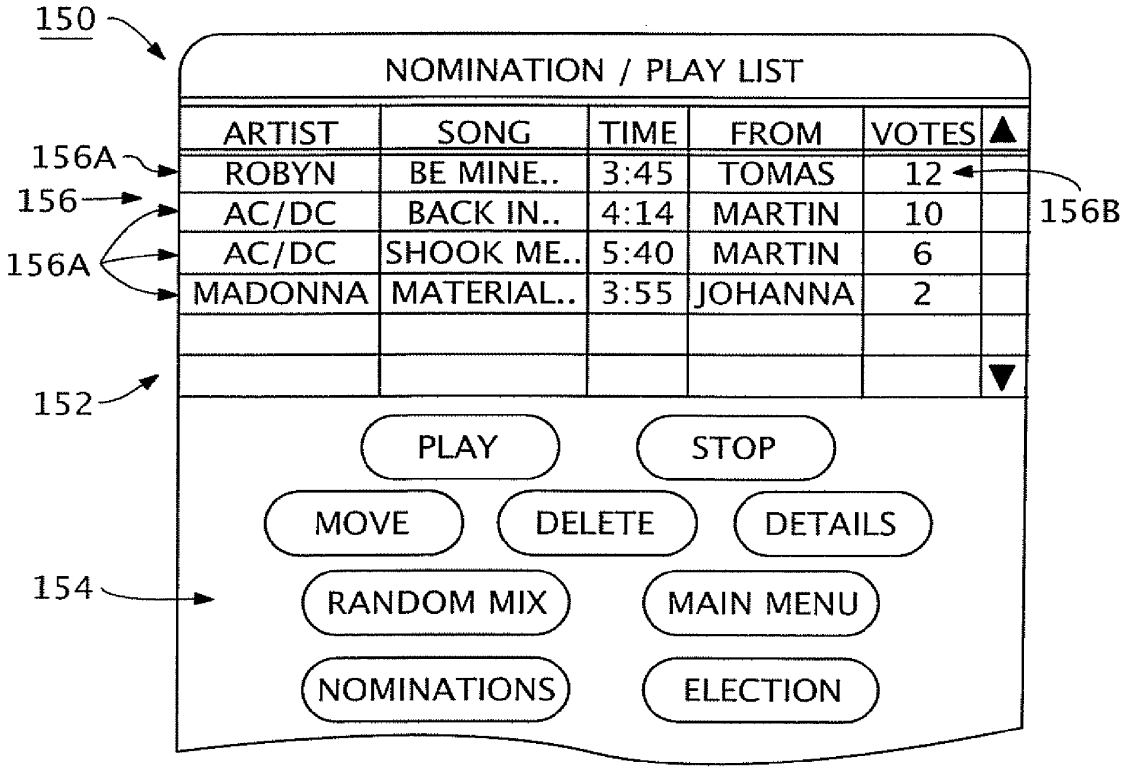

150
NOMINATION / PLAY LIST
ARTIST
SONG
TIME
FROM
VOTES
156A
ROBYN
BE MINE..
3:45
TOMAS
12
156
AC/DC
BACK IN..
4:14
MARTIN
10
156B
156A
AC/DC
SHOOK ME..
5:40
MARTIN
6
MADONNA
MATERIAL..
3:55
JOHANNA
2
152
PLAY
STOP
MOVE
DELETE
DETAILS
154
RANDOM MIX
MAIN MENU
NOMINATIONS
ELECTION

FIG. 6

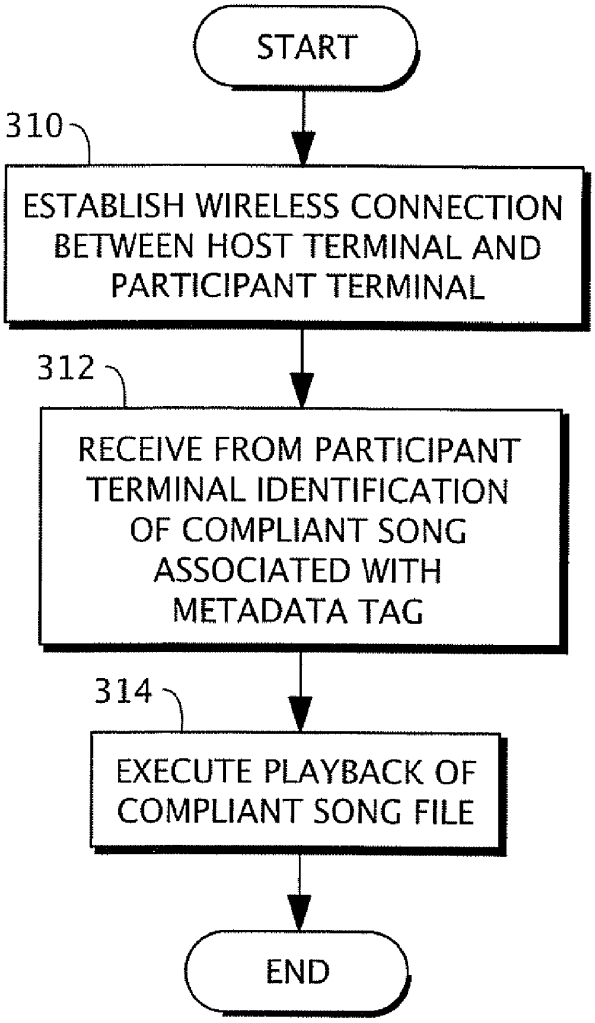

START
310
ESTABLISH WIRELESS CONNECTION BETWEEN HOST TERMINAL AND PARTICIPANT TERMINAL
312
RECEIVE FROM PARTICIPANT TERMINAL IDENTIFICATION OF COMPLIANT SONG ASSOCIATED WITH METADATA TAG
314
EXECUTE PLAYBACK OF COMPLIANT SONG FILE
END

FIG. 7

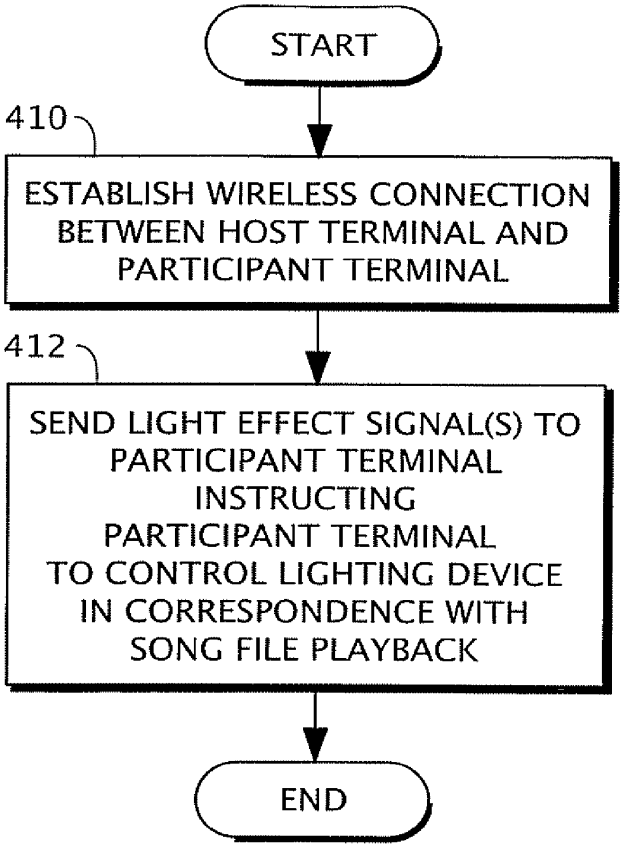
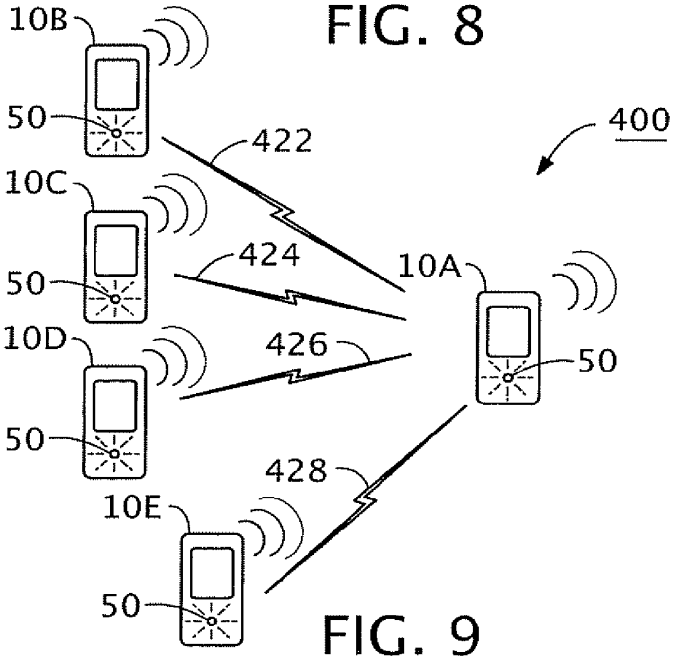

START
410
ESTABLISH WIRELESS CONNECTION BETWEEN HOST TERMINAL AND PARTICIPANT TERMINAL
412
SEND LIGHT EFFECT SIGNAL(S) TO PARTICIPANT TERMINAL INSTRUCTING PARTICIPANT TERMINAL TO CONTROL LIGHTING DEVICE IN CORRESPONDENCE WITH SONG FILE PLAYBACK
END

FIG. 8


10B
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422
400
10C
50
424
10A
10D
426
50
50
428
10E
50

FIG. 9

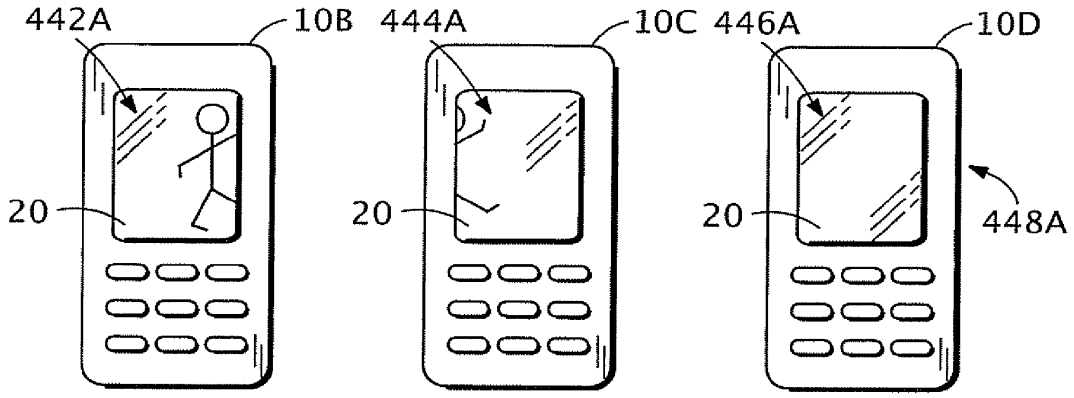

FIG. 10A

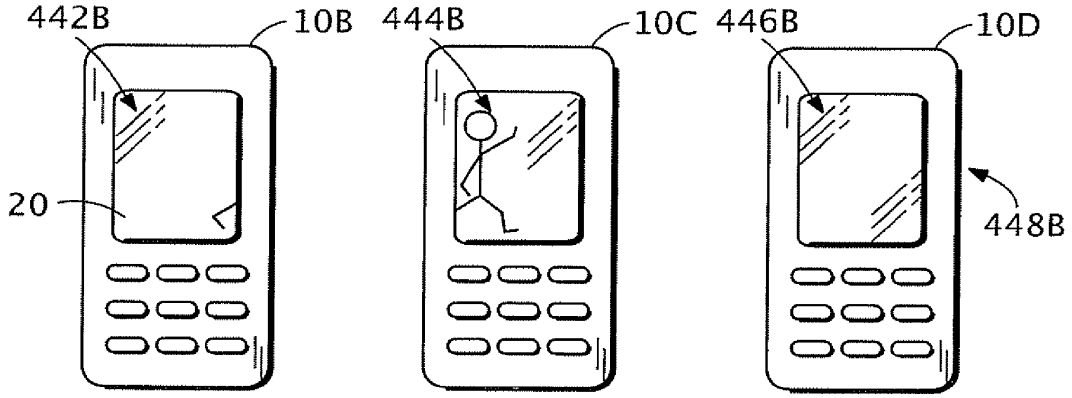

FIG. 10B

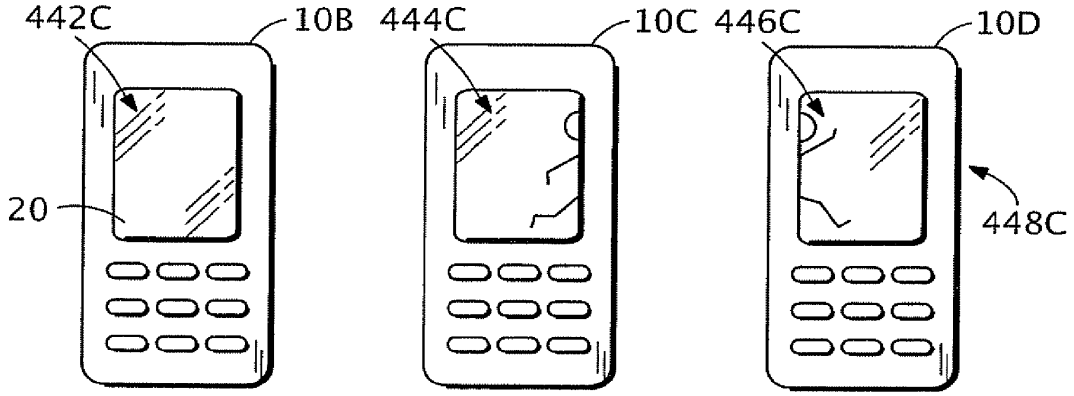

FIG. 10C

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/067942

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L29/06 H04L12/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/075169 A2 (KONINKL PHILIPS ELECTRONICS NV [NL]; PHILIPS CORP [US]; VAN DE SLUIS B) 2 September 2004 (2004-09-02) abstract page 1, line 14 - line 30	1,2,4-7
Y	page 11, line 21 - line 27 page 16, line 13 - line 26 page 21, line 8 - page 22, line 11 -----	3
Y	US 2002/168938 A1 (CHANG CHIN-CHI [TW]) 14 November 2002 (2002-11-14) abstract page 1, paragraphs 9,10 page 2, paragraph 24 -----	3,11

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 April 2007	26/04/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	BLANCO CARDONA, P

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/067942

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/032419 A1 (SHIBASAKI HIROAKI [JP] ET AL) 13 February 2003 (2003-02-13) abstract page 9, paragraphs 138,139 page 10, paragraphs 145,149 page 11, paragraphs 158,159 -----	1
X Y	US 2003/037157 A1 (PESTONI FLORIAN [US] ET AL) 20 February 2003 (2003-02-20) abstract page 1, paragraphs 3,4,11 page 2, paragraphs 21,35,36 page 4, paragraphs 51,59 page 5, paragraphs 67,68 page 6, paragraphs 78,80,85,87 -----	8-10, 12-15 11
X A	US 2005/160270 A1 (GOLDBERG DAVID [US] ET AL) 21 July 2005 (2005-07-21) abstract page 2, paragraph 18 page 3, paragraph 33 page 12, paragraph 172 page 29, paragraph 330-333 page 30, paragraph 340 page 34, paragraphs 377,378 -----	16-18, 20-24 19

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

International application No.
PCT/EP2006/067942

INTERNATIONAL SEARCH REPORT

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [ ] Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. [ ] Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. [X] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[X] No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-7

   Mobile terminal executing playback of a song file simultaneously on a plurality of wireless terminals

   ---

2. claims: 8-15

   Mobile terminal receiving vote messages for nominated song files

   ---

3. claims: 16-24

   Mobile terminal sending a signal to other wireless terminals instructing to control a lighting device in correspondence with the playback of a song file

   ---

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2006/067942

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
WO 2004075169	A2	02-09-2004	EP	1597895	A2	23-11-2005
			JP	2006518507	T	10-08-2006
			KR	20050104382	A	02-11-2005
US 2002168938	A1	14-11-2002	US	2004248601	A1	09-12-2004
US 2003032419	A1	13-02-2003	EP	1303077	A2	16-04-2003
			JP	2003050589	A	21-02-2003
US 2003037157	A1	20-02-2003	NONE			
US 2005160270	A1	21-07-2005	NONE			

Form PCT/ISA/210 (patent family annex) (April 2005)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 November 2007 (29.11.2007)

PCT

(10) International Publication Number
WO 2007/135581 A2

(51) International Patent Classification: Not classified

(21) International Application Number: PCT/IB2007/051626

(22) International Filing Date: 2 May 2007 (02.05.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
06114055.4 16 May 2006 (16.05.2006) EP

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(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **MACOURS, Christophe, M.** [BE/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

(74) Agents: **GROENENDAAL, Antonius, W., M.** et al.; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

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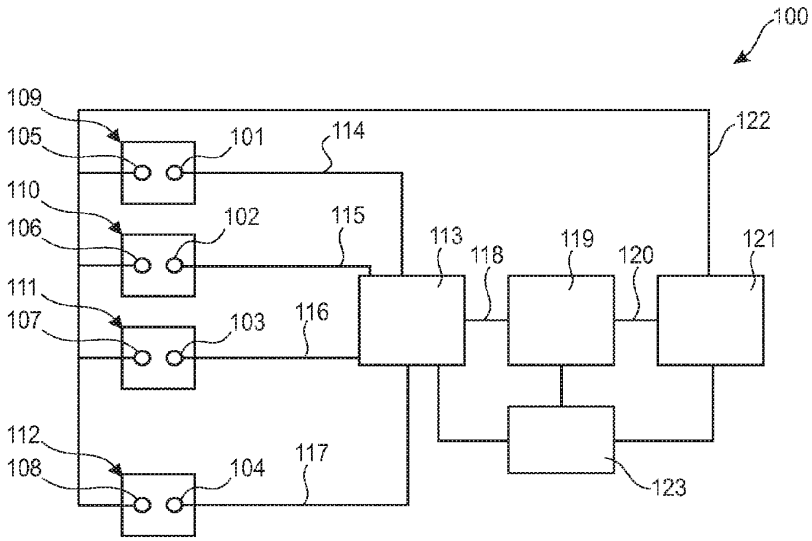
(54) Title: A DEVICE FOR AND A METHOD OF PROCESSING AUDIO DATA



(57) Abstract: A device (100) for processing audio data, wherein the device (100) comprises a plurality of microphones (101 to 104) each adapted to detect audio data (114 to 117), a plurality of speakers (105 to 108) each adapted to emit acoustic waves and each equipped with an assigned one of the plurality of microphones (101 to 104), a calculation unit (113) adapted to calculate acoustical transfer functions (118) between the plurality of speakers (105 to 108) based on the audio data (114 to 117) detected by the plurality of microphones (101 to 104), and a determining unit (119) adapted to determine orientation information (120) indicative of the relative orientation of the plurality of speakers (105 to 108) based on the calculated acoustical transfer functions (120).

WO 2007/135581 A2

A device for and a method of processing audio data

FIELD OF THE INVENTION

The invention relates to a device for processing audio data.

Beyond this, the invention relates to a method of processing audio data.

Moreover, the invention relates to a program element.

Furthermore, the invention relates to a computer-readable medium.

BACKGROUND OF THE INVENTION

Audio playback devices become more and more important. Particularly, an increasing number of users buy audio surround systems comprising multiple loudspeakers.

US 2005/0254662 A1 discloses automatic calibration of an acoustic system. The acoustic system may include a source A/V device, calibration computing device, and multiple rendering devices. The calibration system may include a calibration component attached to each rendering device and a source calibration module. The calibration component on each rendering device includes a microphone. The source calibration module includes distance and optional angle calculation tools for automatically determining a distance between the rendering device and a specified reference point upon return of the test signal from the calibration component.

WO 2005/076912 A2 discloses a network including an audio signal producing device, a content distributor communicatively coupled to the audio signal producing device, a router, a network communication medium communicatively coupling the content distributor and the router, and a plurality of addressable loudspeakers communicatively coupled to the network communication medium, wherein each of the addressable loudspeakers are configured to function as a network peripheral in the home network.

However, conventional audio systems comprising multiple loudspeakers may be difficult to install, since many consumers are not familiar with the mounting of complex audio systems.

OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to provide a user-friendly audio system.