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(54) SYSTEMS AND METHODS FOR MANAGING MULTIMEDIA OPERATIONS IN REMOTE SESSIONS

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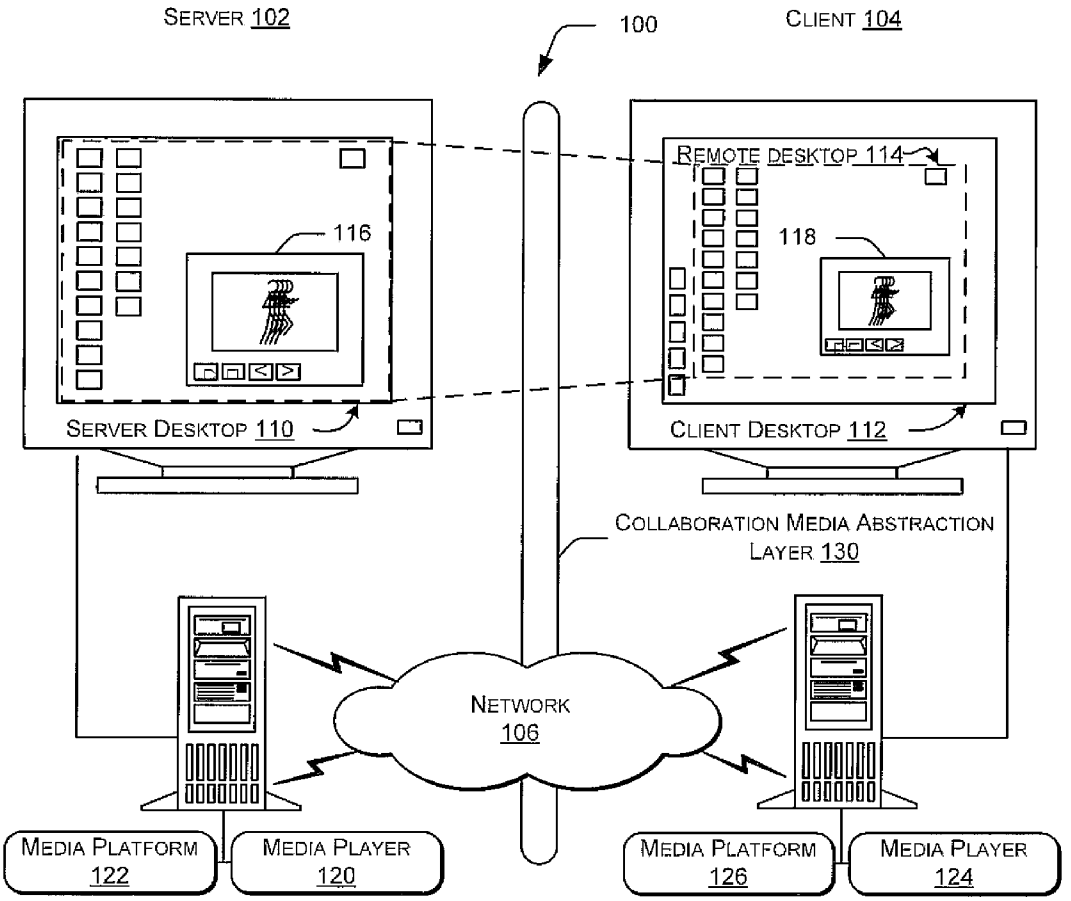
(57) **ABSTRACT**

Techniques relating to managing multimedia transmissions in terminal services scenarios are described. In an example, a method sends a user-interface component from a server to a remote client. The exemplary method further streams a media component for presentation on the remote client in combination with the user-interface component and the media presentation is tracked but not displayed by the server.



Charter Ex. 1114

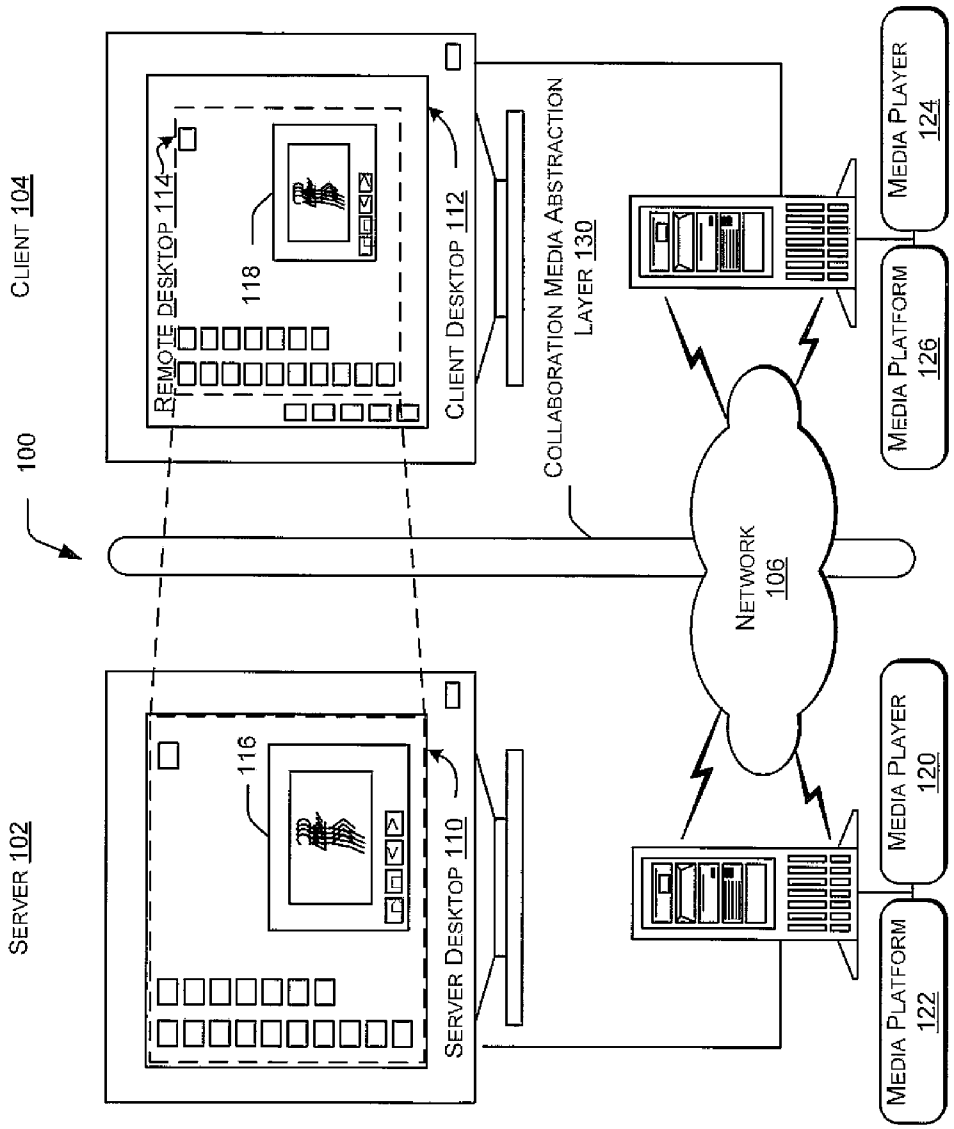

100
CLIENT 104
REMOTE DESKTOP 114
118
CLIENT DESKTOP 112
COLLABORATION MEDIA ABSTRACTION LAYER 130
MEDIA PLAYER 124
MEDIA PLATFORM 126
NETWORK 106
SERVER 102
116
SERVER DESKTOP 110
MEDIA PLAYER 120
MEDIA PLATFORM 122

Fig. 1

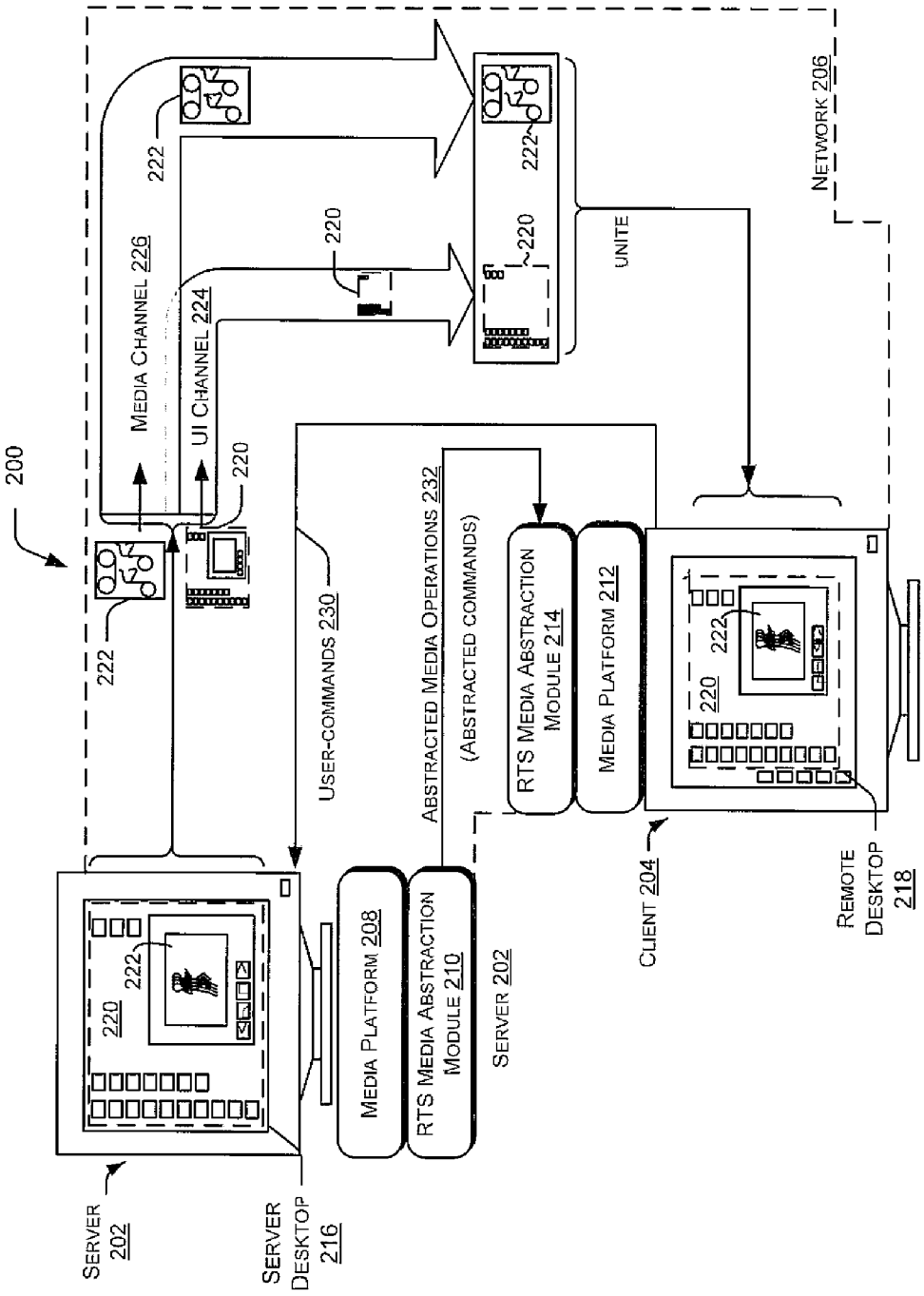

200
222
MEDIA CHANNEL 226
UI CHANNEL 224
220
USER-COMMANDS 230
ABSTRACTED MEDIA OPERATIONS 232
(ABSTRACTED COMMANDS)
RTS MEDIA ABSTRACTION MODULE 214
MEDIA PLATFORM 212
UNITE
NETWORK 206
CLIENT 204
REMOTE DESKTOP 218
SERVER 202
SERVER DESKTOP 216
MEDIA PLATFORM 208
RTS MEDIA ABSTRACTION MODULE 210
SERVER 202

Fig. 2

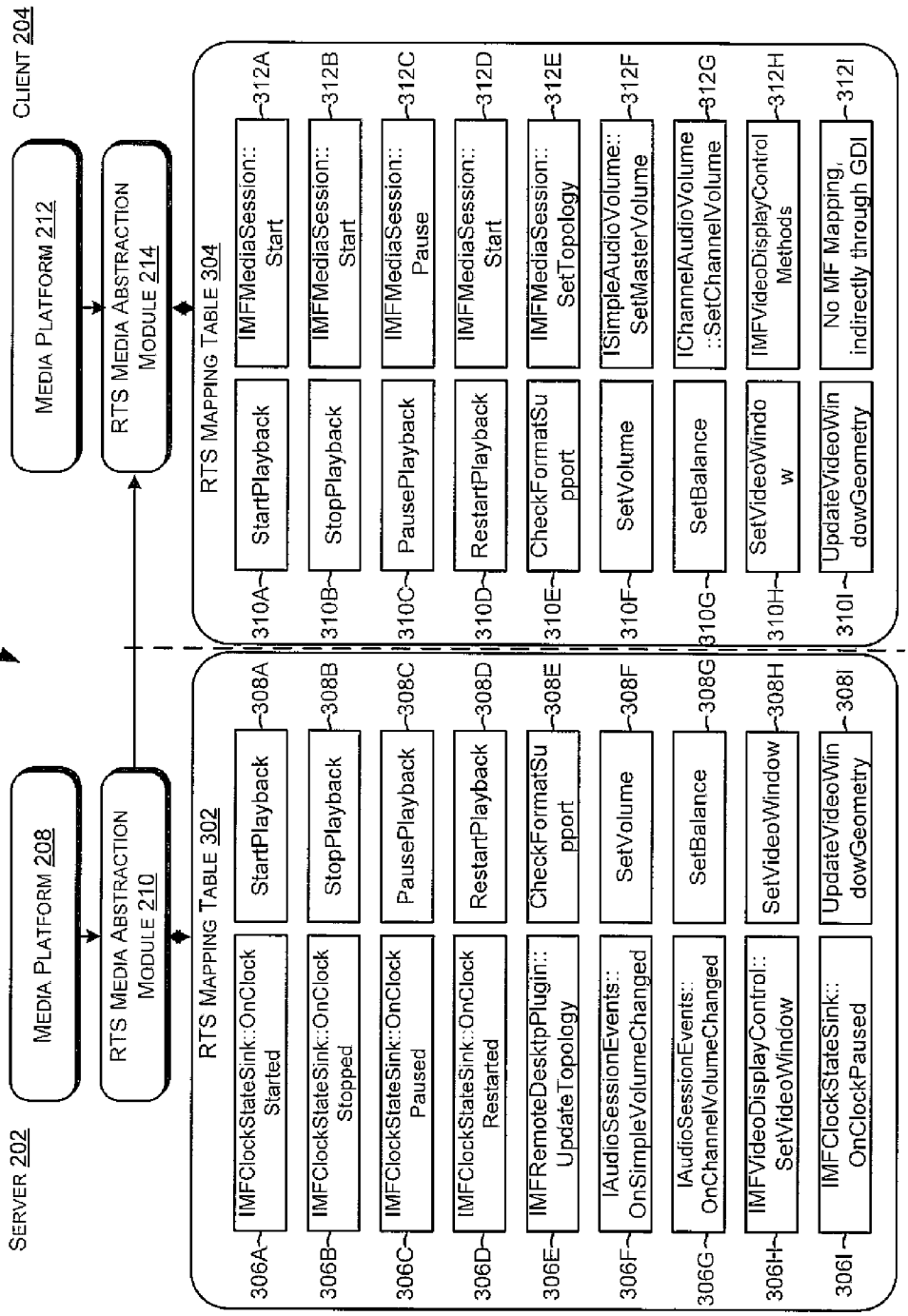

300
SERVER 202
MEDIA PLATFORM 208
RTS MEDIA ABSTRACTION MODULE 210
RTS MAPPING TABLE 302
306A IMFClockStateSink::OnClock Started
308A StartPlayback
306B IMFClockStateSink::OnClock Stopped
308B StopPlayback
306C IMFClockStateSink::OnClock Paused
308C PausePlayback
306D IMFClockStateSink::OnClock Restarted
308D RestartPlayback
306E IMFRemoteDesktpPlugin:: UpdateTopology
308E CheckFormatSu pport
306F IAudioSessionEvents:: OnSimpleVolumeChanged
308F SetVolume
306G IAudioSessionEvents:: OnChannelVolumeChanged
308G SetBalance
306H IMFVideoDisplayControl:: SetVideoWindow
308H SetVideoWindow
306I IMFClockStateSink:: OnClockPaused
308I UpdateVideoWin dowGeometry
CLIENT 204
MEDIA PLATFORM 212
RTS MEDIA ABSTRACTION MODULE 214
RTS MAPPING TABLE 304
310A StartPlayback
312A IMFMediaSession:: Start
310B StopPlayback
312B IMFMediaSession:: Start
310C PausePlayback
312C IMFMediaSession:: Pause
310D RestartPlayback
312D IMFMediaSession:: Start
310E CheckFormatSu pport
312E IMFMediaSession:: SetTopology
310F SetVolume
312F ISimpleAudioVolume:: SetMasterVolume
310G SetBalance
312G IChannelAudioVolume ::SetChannelVolume
310H SetVideoWindo w
312H IMFVideoDisplayControl Methods
310I UpdateVideoWin dowGeometry
312I No MF Mapping, indirectly through GDI

Fig. 3

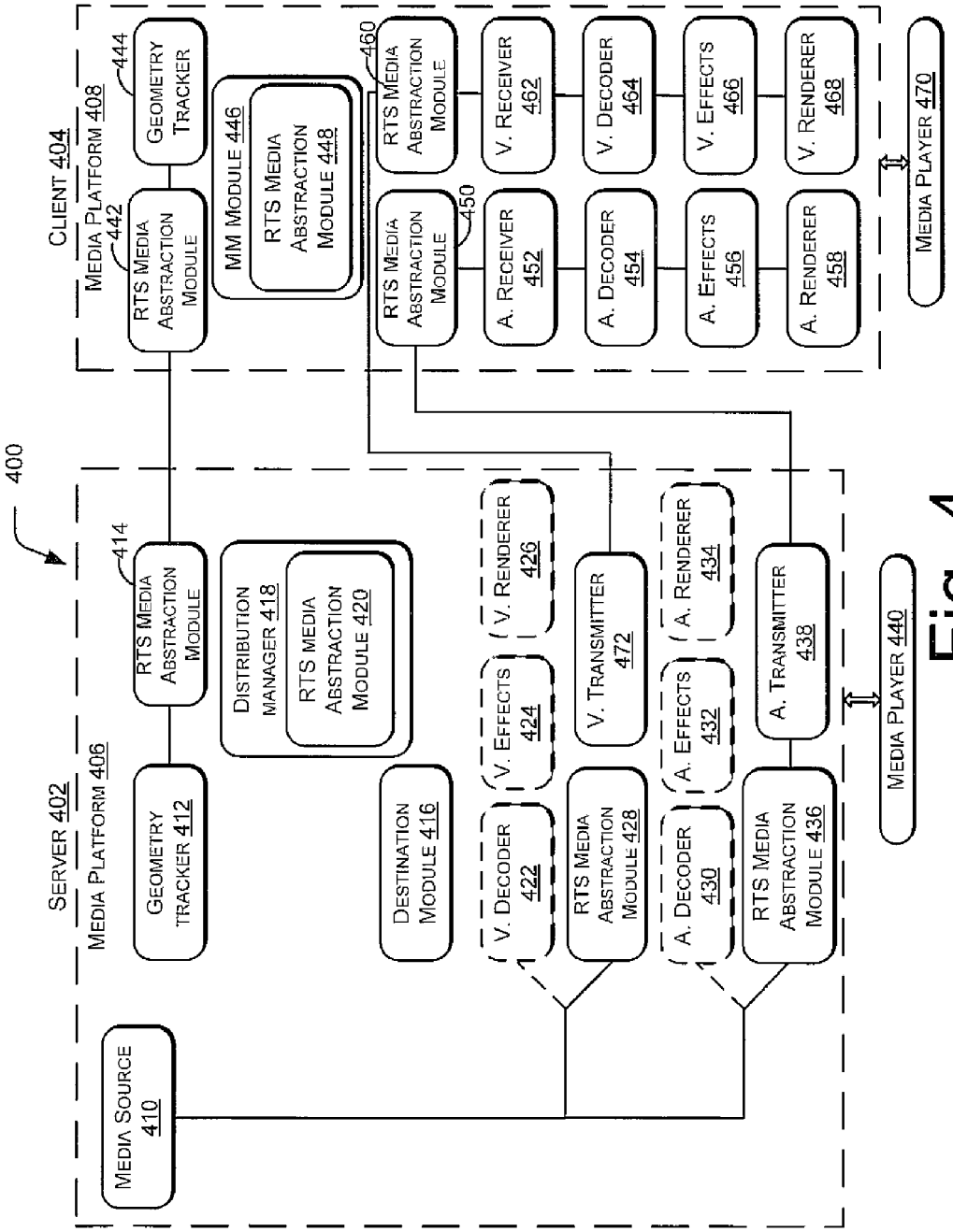

400
CLIENT 404
MEDIA PLATFORM 408
RTS MEDIA ABSTRACTION MODULE 442
GEOMETRY TRACKER 444
MM MODULE 446
RTS MEDIA ABSTRACTION MODULE 448
RTS MEDIA ABSTRACTION MODULE 450
RTS MEDIA ABSTRACTION MODULE 460
A. RECEIVER 452
A. DECODER 454
A. EFFECTS 456
A. RENDERER 458
V. RECEIVER 462
V. DECODER 464
V. EFFECTS 466
V. RENDERER 468
MEDIA PLAYER 470
SERVER 402
MEDIA PLATFORM 406
RTS MEDIA ABSTRACTION MODULE 414
GEOMETRY TRACKER 412
DISTRIBUTION MANAGER 418
RTS MEDIA ABSTRACTION MODULE 420
DESTINATION MODULE 416
MEDIA SOURCE 410
V. DECODER 422
V. EFFECTS 424
V. RENDERER 426
RTS MEDIA ABSTRACTION MODULE 428
V. TRANSMITTER 472
A. DECODER 430
A. EFFECTS 432
A. RENDERER 434
RTS MEDIA ABSTRACTION MODULE 436
A. TRANSMITTER 438
MEDIA PLAYER 440

Fig. 4

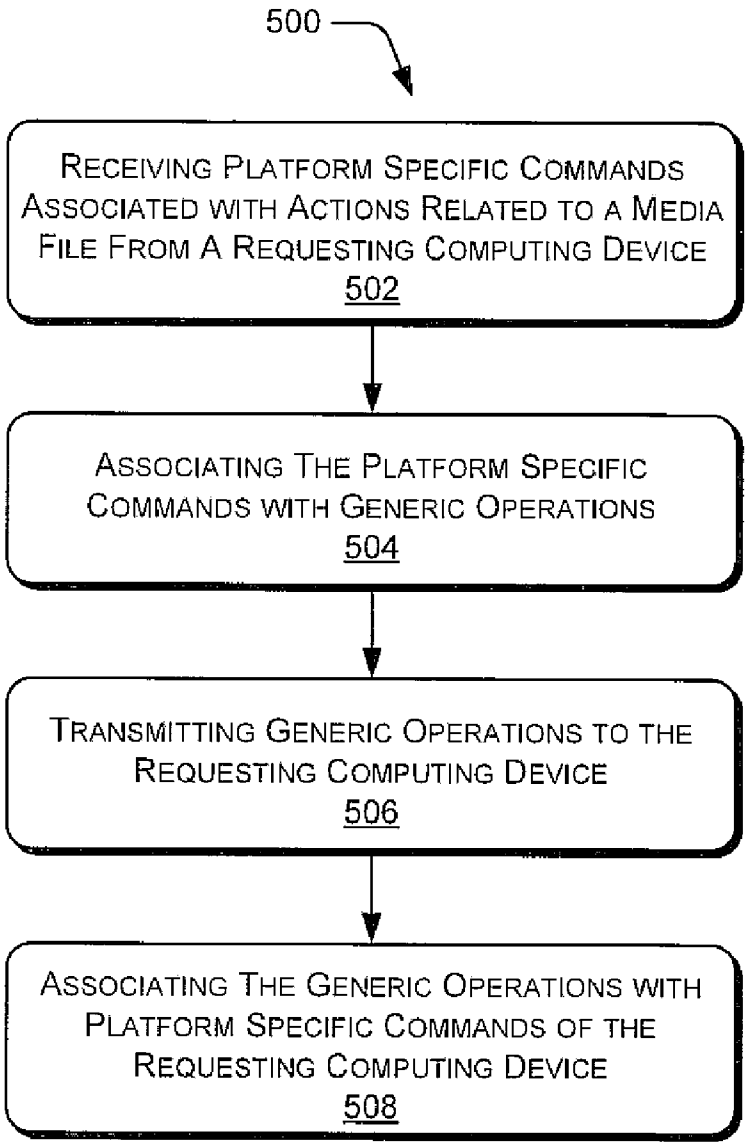

500
RECEIVING PLATFORM SPECIFIC COMMANDS ASSOCIATED WITH ACTIONS RELATED TO A MEDIA FILE FROM A REQUESTING COMPUTING DEVICE
502
ASSOCIATING THE PLATFORM SPECIFIC COMMANDS WITH GENERIC OPERATIONS
504
TRANSMITTING GENERIC OPERATIONS TO THE REQUESTING COMPUTING DEVICE
506
ASSOCIATING THE GENERIC OPERATIONS WITH PLATFORM SPECIFIC COMMANDS OF THE REQUESTING COMPUTING DEVICE
508

Fig. 5

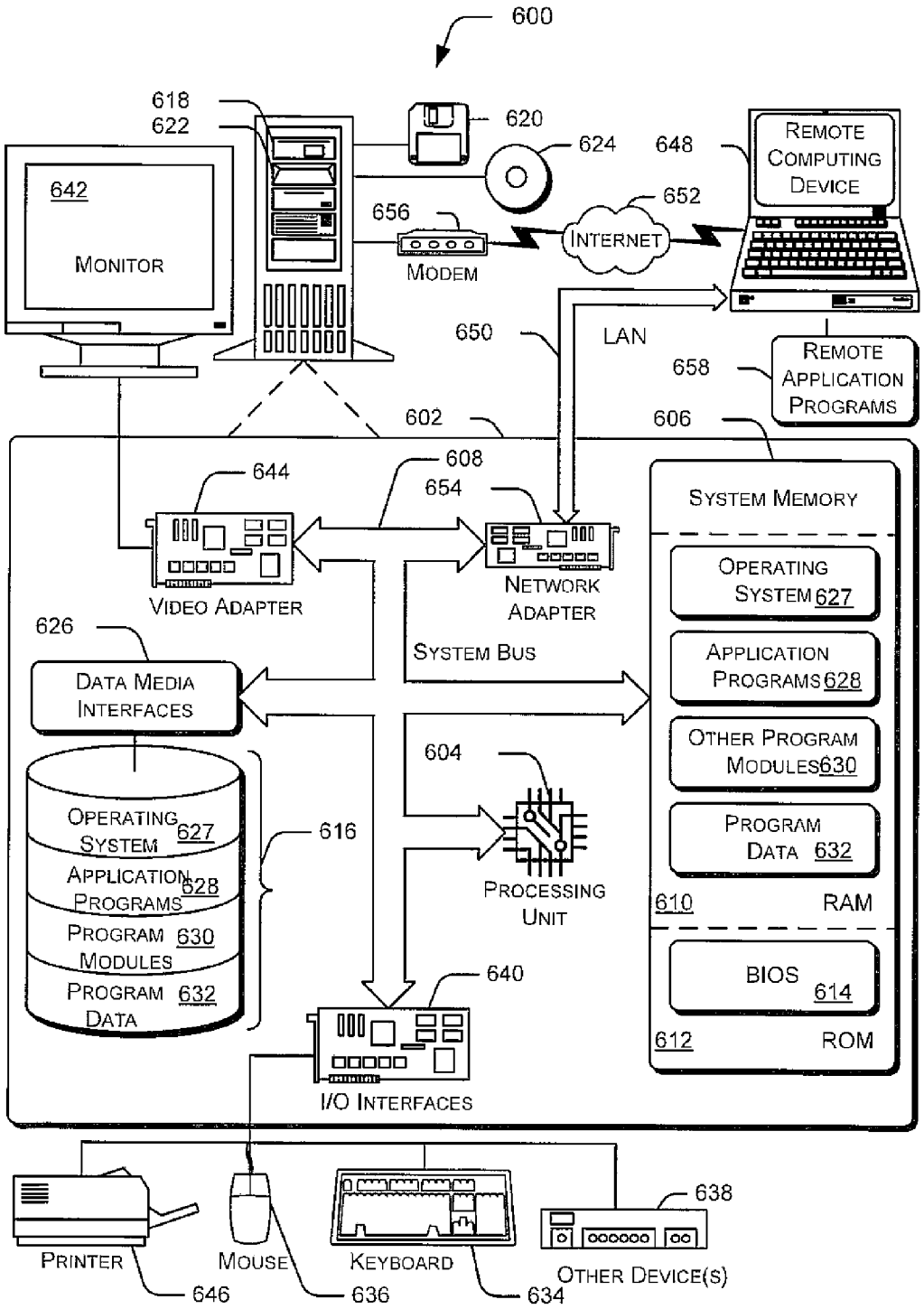

600
618
622
620
624
648
REMOTE COMPUTING DEVICE
642
MONITOR
656
MODEM
652
INTERNET
650
LAN
658
REMOTE APPLICATION PROGRAMS
602
606
644
608
654
SYSTEM MEMORY
VIDEO ADAPTER
NETWORK ADAPTER
OPERATING SYSTEM 627
626
SYSTEM BUS
APPLICATION PROGRAMS 628
DATA MEDIA INTERFACES
OTHER PROGRAM MODULES 630
604
OPERATING SYSTEM 627
616
PROGRAM DATA 632
APPLICATION PROGRAMS 628
PROCESSING UNIT
610
RAM
PROGRAM 630 MODULES
BIOS 614
640
PROGRAM 632 DATA
612
ROM
I/O INTERFACES
638
PRINTER
MOUSE
KEYBOARD
OTHER DEVICE(S)
646
636
634

Fig. 6

SYSTEMS AND METHODS FOR MANAGING MULTIMEDIA OPERATIONS IN REMOTE SESSIONS

BACKGROUND

[0001] Remote session, which can include collaboration sessions can provide for a remoting experience between a local computer and a remote computer. Collaboration can involve recreating an appearance of a portion, or all, of the local computer's graphical user-interface on the remote computer. The graphical user-interface can be recreated on the remote computer using one or more techniques, such as remoting. The collaboration sessions that are finally recreated on the remote computer can be governed by one or more parameters that may be associated with the portion of the local computer, being recreated at the remote computer.

[0002] A common example of a collaboration session can be operations relating to media operations for playing back multimedia files. Techniques for remoting such sessions may involve transferring media data from the local computer to the remote computer. The media data may include data associated with the multimedia files that are intended to be played, processing data, rendering data, and so on. The multimedia files on the local computer, can be remotely played back on the remote computer by remoting media data to the remote computer. The media data, instead of being rendered onto the local computer, is rendered onto the remote computer.

SUMMARY

[0003] This summary is provided to introduce concepts for managing multimedia operation in remote sessions. These concepts are further described below in the detailed description. This summary is not intended to identify essential features of the claimed subject matter, nor is it intended for use in determining the scope of the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The detailed description is described with reference to the accompanying figures. In the figures, the left most digit(s) of a reference number identifies the figure in which the reference number first appears. The same numbers are used throughout the drawings to reference like features and components.

[0005] FIG. **1** is a block diagram illustrating an exemplary network for managing multimedia operations in a collaborative session.

[0006] FIG. **2** is a flow diagram illustrating the managing multimedia operations in a collaborative session in a computer based network.

[0007] FIG. **3** is an exemplary illustration of mapping tables for managing multimedia operations in a collaborative session.

[0008] FIG. **4** is a block diagram illustrating one or more exemplary components of a media platform.

[0009] FIG. **5** is a flowchart illustrating an exemplary process for managing multimedia operations in a collaborative session.

[0010] FIG. **6** is a block diagram illustrating an exemplary general computer environment.

DETAILED DESCRIPTION

[0011] The methods and systems described below relate to collaboration sessions and handling media playback operations in collaboration sessions. Collaboration sessions can provide a remoting experience between a client computer (hereinafter, "client") and a server computer (hereinafter, "server"). Collaboration can involve representing a portion, or all, of the server's graphical user-interface (GUI) on the client. In some collaboration scenarios, media operations, such as media playback commands, can be handled separately from the remainder of the GUI for various reasons. For instance, media playback commands can be handled separately to conserve network bandwidth between the server and the client. In such cases, media can be redirected from the server to the client in an unprocessed or partially processed form. The client can then process the media and integrate the processed media with a remainder of the GUI to create a representation of the server GUI.

[0012] Media or media files can be stored according to different formats such as formats in conformance with MPEG, etc. among others. Processing the media files can be accomplished by a media player that employs one or more media platforms configured to handle the format of the media file. Media processing can involve media operations such as media playback commands. Such media operations can be platform specific. In a collaboration scenario, the client and server may or may not support the same media platforms. For example, media playback commands specific to a media platform supported on a server may be meaningless for a media platform supported on the client.

[0013] The exemplary implementations can provide an abstraction functionality allowing media operations to be effectively conveyed in a collaboration session between server and client. For example, abstraction of the media operations can facilitate execution of a user's media playback command in a collaboration session. In such cases, some implementations can translate a platform specific media playback command of the server into a generic media playback command. The generic media playback command can then be translated into a platform specific media playback command for a media platform supported on the client. The client can then execute the media playback command and integrate the results with the remainder of the GUI of the client.

[0014] In an implementation, the media is sent to the client for processing rather than being processed on the server, the platform specific commands can be intercepted at the server. As discussed, the server and the client may or may not have the same platforms. Accordingly, the server's platform specific commands may be not understood on the client. The present implementations can facilitate effective communication between the server and client such that the user's media playback commands are executable on the client independent of platforms employed on the server and client. For example, some of the present implementations can translate the server's platform specific commands into generic media playback commands. The generic media playback commands can then be sent to the client. The client can convert the generic commands into commands that are specific to a platform supported by the client. The client's platform can then process the commands to achieve the desired effect (i.e., play, pause, stop, etc.) on the client device.

Exemplary Systems

[0015] FIG. **1** illustrates an exemplary system **100** for implementing collaboration sessions and to handle media operations in those collaboration sessions. The system **100** can include a server **102** coupled to a client **104** via a network

106. A server desktop **110** can be displayed on server **102**. Similarly, a client desktop **112** can be displayed on client **104**.

[0016] The implementations described are in the context of a computing environment as commonly encountered at the present point in time. Various examples can be implemented by computer-executable instructions or code means, such as program modules, that are executed by a computer, such as a personal computer or PC. Generally, program modules include routines, programs, objects, components, data structures, and the like, that perform particular tasks or implement particular abstract data types.

[0017] Various examples may be implemented in computer system configurations other than a PC. For example, various embodiments may be realized in hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, cell phones and the like. Further, as technology continues to evolve, various implementations may be realized on yet to be identified classes of devices. For example, as the cost of a unit of processing power continues to drop and wireless technologies expand, computing devices resembling today's cell phones may perform the functionalities of today's PC, video camera, cell phone, and more in a single mobile device. This single device may in one scenario act as a server and in another scenario act as a client. This is but one of many existing and developing examples for the described implementations.

[0018] Various examples may be practiced in distributed computing environments, where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices. Further, the terms server and client as used herein do not connotate any relative capabilities of the two devices. The client may have more, less, or equal processing capabilities than the server. Rather, in this description, the names server and client describes the relative relationship of the two components. For example, a computing environment of a first or server device is remoted to a second or client device. For ease of explanation the examples provided in this document relate to a single server and a single client; however, this is but one potential configuration. It is to be appreciated that in other implementations may include one or more servers supporting multiple clients. In some implementations a first computer may act as a server for a second computer, which acts as a server for a third computer.

[0019] As discussed, collaboration sessions can provide for a remoting experience between server **102** and client **104**. Collaboration can involve representing a portion, or all, of the server's graphical user-interface (GUI) on the client. In this case, the GUI is represented as server desktop **110**. In particular, collaboration can create the impression that one or more applications that are running on the server **102** are actually running on the client **104**.

[0020] Examples of collaboration sessions can include remote terminal session scenarios and one or more presentation scenarios, among others. In a remote terminal session scenario, the GUI from the server's display area (e.g., server desktop **110**) can be generated on the client **104** as representation or remote desktop **114**. A presentation scenario can involve remoting a GUI of a particular application running on the server rather than the whole desktop **110**. In such a scenario, the server's GUI (e.g., a graphical window) of the application can be utilized for generating a representation of the application on the client. For example, server desktop **110** includes a media player graphical window **116**. A presentation session can generate a representation **118** on the client **104** of graphical window **116** without the remainder of the server's desktop **110**. Media processing can be accomplished on the server **102** by a media player **120** via a media platform **122**, stored on the server **102**. Similarly, media processing can be accomplished on the client **104** by a media player **124** via a media platform **126**, stored on the client **104**.

[0021] As discussed, most of the processes corresponding to the collaboration session can occur on the server **102**; however, in the collaboration session, media operation can be, at least partially, processed on the client **104**. For example, media playback commands can represent one or more types of media operations. Media playback commands generated by the user (i.e., user-commands) at the client **104** can be forwarded to the server **102** for processing. The server **102** processes user-commands according to the configuration of the server **102**. For example, the server **102** processes the user-commands based on the media platform **122**. In such a case, the processing of the user-commands can generate specific media playback commands based upon the user-commands that are specific to the media platform **122**.

[0022] The collaboration session can intercept the platform specific media playback commands and can send the commands to the client for execution. In certain cases, the client's media platform **126**, may not understand the media playback commands specific to the server's media platform **122**. To this end, the system **100** can include a collaboration media abstraction layer **130** that can facilitate media-related communications between the server **102** and client **104**. For example, in the present example the collaboration media abstraction layer **130** can abstract or genericize the media playback commands specific to media platform **122**. The genericized media playback commands can then be translated into media playback commands specific to the client's media platform **126**.

[0023] Accordingly, the collaboration media abstraction layer **130** can facilitate execution of user-commands in a collaboration session. Furthermore, beyond the media playback command example, the collaboration media abstraction layer **130** can facilitate communicating media operations between the server **102** and the client **104** in a collaboration session.

[0024] In certain cases, the generic media playback commands can be understood by the client **104** regardless of configuration differences of the server **102** and the client **104**. For instance, the client **104** and the server **102** may have different operating systems, different versions of the same operating system, or different media platforms, among others. The working of the system implementing managing multimedia operations in a collaborative session is further described in detail in conjunction with FIG. **2** and FIG. **3**.

[0025] FIG. **2** shows a system **200** that builds upon the concepts introduced in relation to FIG. **1**. In this case, the system **200** is described in relation to a remote terminal session. It is to be appreciated that similar concepts could be equally applicable to other collaboration sessions. In the present implementation, the system **200** includes a server **202** and a client **204** that can communicate over a network **206**. The server **202** includes a media platform **208** and a remote terminal session or "RTS" media abstraction module **210**. The client **204** includes a media platform **212** and a RTS media abstraction module **214**.

[0026] In this implementation, the server **202** can send data relating to server's desktop **216** to the client **204** for generating a remote representation, such as remote desktop **218**, at the client **204**. Data associated with the remote desktop **218** can include a user-interface component **220** and a media component **222**.

[0027] User-interface-component **220** can include graphics and images that typically compose a user-interface. User-interface component **220** can include icons, host audio, background images and applications representations such as the GUI associated with word-processing applications, spreadsheet applications, database applications, media applications, etc. Virtually any components that are not media component **222** are part of user-interface component **220**. When compared to the media component **222**, the user-interface component **220** can be relatively static and relatively low data intensive. In contrast, the media component **222** may be relatively dynamic and highly data intensive.

[0028] As discussed, media component **222** can be highly data intensive as they include media-rich elements that compose a media presentation or media event. Transmission of data associated with the media component **222** can be bandwidth-intensive. Examples of media component **222** include, but are not limited to, streaming media presentations including a video and/or audio presentation, television broadcasts, such as a cable television (CATV), satellite, pay-per-view, or broadcast program; digitally compressed media experiences; radio programs; recorded media events (e.g., sourced by a VCR, DVD player, CD player, Personal Video Recorder and the like); real-time media events; and camera feeds, among others.

[0029] For purposes of explanation, media component **222** is illustrated both on the server desktop **216** and on the client's remote desktop **218**. It is to be appreciated that portions or the whole of the server desktop **216** may not necessarily be displayed on the display device of the server **202**. In such implementations, the media component **222** (or a portion thereof) may only appear on the client. For instance, the server desktop can be remoted to the client even if the server is not connected to a display device.

[0030] The data for the remote desktop **218** can be sent from server **202** to client **204** over network **206**. In an implementation, data associated with the user-interface component **220** and the media component **222** can be transmitted over user-interface channel **224** and media channel **226** respectively.

[0031] User-interface channel **224** can communicate user-interface component **220** to client **204**. In an implementation, Terminal Server and Terminal Client Services, offered by the Microsoft® Corporation of Redmond, Wash., can provide an exemplary user-interface channel **224**. A remotable protocol can be used to transmit data through user-interface channel **224**. Exemplary protocols and data formats include, remote desktop protocols (RDP), the T-120 series protocol or HTML (hypertext markup language and its many variations), among others. Independent Computing Architecture (ICA) developed by Citrix® Systems offers another example that can support remote terminal session.

[0032] The media channel **226** can be separate from, or integrated with, user-interface channel **224**. The media channel **226** can be used to transmit bandwidth-intensive experiences such as video and other media types as listed above. In this instance, the media channel **226** can provide a communication conduit for media component **222** to flow separately from user-interface component **220**. Therefore, the media component **222** can be sent out of band with respect to the user-interface component, but synchronized. An exemplary protocol to transmit data through media component **226** can include, but is not limited to, Transmission Control Protocol (TCP), and a virtual channel over an RDP connection.

[0033] In other words, the present implementations can bifurcate data delivery relating to the remote desktop. Relatively low data-intensive components of the server desktop **216**, such as user-interface component **220**, can be processed on the server **202** and then transmitted to the client **204**. Relatively highly data-intensive components, such as media component **222**, can be transmitted to the client **204** in an unprocessed or a less processed form. The processing can then be completed by the client **204**, and combined with the low data intensive components to create the remote desktop **218** at the client **204**. Events (i.e., media operations) which affect the media presentation can be tracked at the server so that a relative relationship of the media presentation to other portions of the remote desktop **218** can be maintained.

[0034] In the present exemplary scenario, the user-interface component **220** is combined or united with the media component **222** to generate the remote desktop **218** at the client **204**. A user at client **204** can remotely operate server **202** by interacting with remote desktop **218**. For instance, the user at client **204** can move a mouse cursor over an application on the remote desktop **218** and open an application by clicking on a corresponding icon. Likewise, the user can issue commands to an application through the remote desktop. For example, in relation to a media application, the user may utilize mouse clicks to issue user-commands such as start playback (start), stop playback (stop), fast forward, rewind, pause, and set volume, among others. The present implementations facilitate execution of the user-commands in the remote terminal session scenario.

[0035] For purposes of explanation consider a hypothetical scenario where a user at the client **204** enters user media playback commands (user-commands) relating to the remote desktop **218**. The user-commands can be relayed from the client **204** to the server **202** as part of the remote terminal session via network **206** as indicated generally as commands **230**. The commands **230** can be sent over the UI channel **224** or over a different channel. The commands **230** can be processed on the server **202** by media platform **208** into platform specific media commands. As discussed, the media processing of media platform **208** can be intercepted as part of the remote terminal session and sent to the client **204** for further processing.

[0036] The client's media platform **212** may or may not be the same as the server's media platform, such as media platform **208**, and as such may or may not understand the intercepted platform-specific media commands of the server **202**. The server's RTS abstraction module **210** can receive the intercepted platform specific media commands. The RTS abstraction module **210** can translate the intercepted platform specific media commands into generic or abstracted media commands. The generic media commands can be sent from the server's RTS media abstraction module **210** to the client's RTS media abstraction module **214** as indicated generally as commands **232**. The client's RTS media abstraction module **214** can translate the generic media commands, such as commands **232**, into media commands that are specific to the client's media platform **212**. The client's media platform **212** can then execute the client specific media commands to

accomplish the user-command. A more detailed example for accomplishing the media command abstraction in a remote terminal session is described below in relation to FIG. **3**.

[0037] FIG. **3** provides an example of how the system **200** can accomplish the media operation abstraction described above in relation to FIG. **2**. In this case, RTS media abstraction modules **210**, **214** at the server **202** and the client **204** respectively, accomplish the media operation abstraction by means of remote terminal session (RTS) mapping tables **302**, **304**. For example, the server's RTS media abstraction module **210** can receive media commands that are specific to the server's media platform **208**. In an implementation, the commands received by the server's RTS media abstraction module **210** can be in response to one or more actions that may be specific to events associated with the playback of media files. For example, the server's RTS media abstraction module **210** can receive commands when a media file is accessed for playback by one or more users at the client **204**.

[0038] The server's RTS media abstraction module **210** can utilize RTS mapping table **302** to map the received media operations into generic or abstract media operations. The abstracted media operations from RTS mapping table **302** can be sent to the client's RTS media abstraction module **214**. The client's RTS media abstraction module **214** can employ another RTS mapping table **304**. The RTS mapping table **304** can translate the abstracted media operations into media operations that are specific to the client's media platform **212**. The client's media platform **212** can then execute the media operations.

[0039] For purposes of explanation, assume that the server's media platform **208** is a Media Foundation® platform, while the client's media platform **212** is a DShow® platform. In this example, RTS mapping table **302** can translate Media Foundation® platform specific operations designated generally at **306**A-**306**I into corresponding generic media operations designated generally at **308**A-**308**I, respectively. Similarly, RTS mapping table **304** can translate generic media operations designated generally at **310**A-**310**I into corresponding DShow® platform specific operations designated generally at **312**A-**312**I. For instance, assume that RTS media abstraction module **210** based on a Media Foundation platform, receives an operation **306**A, namely "IMFClockStateSink::OnClockStarted" from the media platform **208**. The RTS media abstraction module **210** can utilize the mapping table **302** to translate the operation **306**A into generic media operation command **308**A, namely "StartPlayback". The RTS media abstraction module **210** can send the generic media operation command "StartPlayback" **308**A to RTS Media abstraction module **214** on the client **204**.

[0040] The generic media operation command, such as generic command **308**A can be mapped onto a corresponding command of the client's media platform **212** based on the RTS mapping table **304**. For instance, the RTS media abstraction module **214** can locate the generic media operation command "StartPlayback" received from the server **202** in the RTS mapping table **304**. In this case, the generic media operation command "StartPlayback" is designated as **310**A. The RTS mapping table **304** can translate the generic media operation command "StartPlayback" **310** into a DShow® platform specific media operation "IMediaControl::Run" designated as command **312**A. The RTS media abstraction module **214** can send the DShow® platform specific media operation "IMFMediaSession::Start" **312**A to the client platform **212**, which is a DShow® platform, allowing the client's platform **212** to understand and execute the DShow specific media operation. Other mappings can be made by moving horizontally across an individual row of the mapping tables **302**, **304**. It is to be appreciated that the RTS mapping table **302**, **304** at the server **202** and the client **204** respectively, can include other commands and mappings associating platform specific commands to generic commands and vice versa.

[0041] In an implementation, the RTS mapping tables **302**, **304** can be configured to translate between yet to be developed media platforms. While the RTS mapping tables **302**, **304** illustrated herein include a translation between two specific media platforms, other mapping tables can include multiple translations. For example, the server's media platforms **208** might be DShow and Media Foundation, while the client's media platforms might be a Quick Time® platform and an Ogg® platform. Accordingly, in some implementations, the RTS mapping tables **302**, **304** can provide translations between a server media platform and a client media platform.

[0042] Furthermore, by abstracting the media operations, the RTS mapping tables **302**, **304** can be simpler than other potential solutions. For example, the server RTS mapping table **302** may not need to take into account all the possible media platforms that can be employed on the client **204**. In other words, the server's media table, such as RTS mapping table **302** can be independent of the client's media platform **212** (i.e., the server's media table does not need to be configured based upon the client's media platform configuration). The same can be said of the client's media table **212**. Furthermore, the server's RTS mapping table **302** may not need to be updated as new media platforms are developed that could be employed on the client **204**. Instead, the server RTS mapping table **302** can translate media operations, such as operations **306**A-**306**I specific to whatever media platform(s) exists on the server **202** to the corresponding abstract or generic media operations, such **308**A-**308**I. The client RTS mapping table **304** can then translate the generic media operations, such as **308**A-**308** to media operations, such as operations **310**A-**310**I specific to the media platform(s) **212** on the client **204**. The client RTS mapping table **304** does not need to take into account all the different media platforms that are or may be employed on the server **202**. Instead, the client RTS mapping table **304** can simply translate from generic media operations **310**A-**310**I to media operations specific to the media platform (s) **212** operating on the client **204**.

[0043] The RTS mapping tables **302**, **304** as illustrated represent but one possible implementation that can be accomplished utilizing a word processing document.

[0044] FIG. **4** is an exemplary representation of selective components of system **400** for supporting media operation abstraction in a remote terminal session. FIG. **4** relates to a media component of a remote terminal session between a server **402** and a client **404**. In this implementation, the terminal services session entails a remote desktop protocol (RDP) configuration, examples of which are illustrated above. The system **400** can alternatively or additionally be utilized for other collaboration scenarios beyond remote terminal sessions.

[0045] Server **400** can include a first media platform **406** and a second media player **408**. Media platform **406** is associated with a media source **410**. The media platform **406** includes a geometry tracker module **412**, an RTS media abstraction module **414**, a destination module **416**, and a distribution manager module **418** that includes an RTS media abstraction module **420**. Media platform **406** also includes a

video decoder **422**, a video effects module **424**, a video renderer **426**, an RTS media abstraction module **428**, an audio decoder **430**, an audio effects module **432**, an audio renderer **434**, an RTS media abstraction module **436**, and an audio transmitter **438**. The server also includes a media player **440** that can communicate with the media platform **406**.

[0046] The client's media platform **408** can include an RTS media abstraction module **442**, a geometry tracking module **444**, and a multimedia module **446** that includes an RTS media abstraction module **448**. The client's media platform **408** can also include an RTS media abstraction module **450**, an audio receiver module **452**, an audio decoder **454**, an audio effects module **456**, and an audio renderer **458**. Media platform **408** can further include an RTS media abstraction module **460**, a video receiver **462**, a video decoder **464**, a video effects module **466**, and a video renderer **468**. The client also includes a media player **470** that can communicate with the media platform **408**.

[0047] In this example, the server's media platform **406** can exist as part of a server operating system (not shown) to allow playback of media so that applications that interact with the operating system may control playback of media without "knowing" the particular details of formats of the media. Similarly, the client's media platform **408** can exist as part of a client operating system (not shown) to allow playback of media so that applications that interact with the operating system can control playback of media without a knowledge of the media. For instance, media platform **406** can allow an application, such as media player **440** to run without the media player **440** knowing the details regarding the formats of media being played back. In a similar fashion, the client's media platform **408** can allow media player **470** to run as part of a server operating system to allow playback of media so that applications that interact with the operating system may control playback of media without knowing the particular details of media formats. The media platform **406** running on the server **402** may be identical to the media platform **408** running on the client **404**. In other instances the media platform **406** on the server **402** may be a different product and/or version than the media platform **408** operating on the client **404**. The components described below can enable media operations to be effectively communicated between server and client in both the former and latter cases.

[0048] In this example, the server's media platform **406** can detect whether it is running in a remote terminal session via destination module **416**. The destination module **416** can be an object that defines where a presentation is to be presented (e.g. a window, disk file, and the like) and what happens to the presentation. Further, the server media platform **406** can determine that the source is connected to a client, such as the client **404** that has the capabilities to render media locally. The distribution manager **418** can determine that the server's media platform **406** is connected to client **404**, and that the client **404** has the capabilities to render the media locally. The distribution manager **418** can further establish remote terminal session policies to enable remoting the media to the client **404**. The distribution manager **418** can establish a virtual channel connection with a multimedia client plug-in such as the multimedia component module **444** on the client **404**. The virtual channel connection can allow for the exchange of control information relating to the remote terminal session between the server **402** and the client **404**.

[0049] One aspect of the control information exchanged over the virtual channel connection between the distribution manager **418** and the multimedia component module **444** involves media operations in the remote terminal session. The distribution manager **418** and the multimedia component module **444** can employ their respective RTS media abstraction modules **420**, **446** to negotiate how to handle media operations in the remote terminal session. Either of the server **402** and the client **404** can initiate negotiations over the media operations. In some implementations, the media operation negotiations can be initiated as part of the start-up procedures for establishing a remote terminal session. In other implementations the media operation negotiations may be started responsive to a media operation, such as a user's media playback command being received in a remote terminal session.

[0050] In an illustrative example, responsive to a user's media playback command, the server **402** may determine the media format of media from media source **410**. Assume for purposes of this explanation that the server **402** determines the sources media format to be MPEG IV. The server's RTS media abstraction module **420** can query whether the client, such as the client **404**, supports the MPEG IV media format. For example, the server's RTS media abstraction module **420** can query the client's RTS abstraction module **448** whether the client supports a particular media format, such as MPEG IV. An example of such a query is provided in RTS mapping tables **302**, **304** as the generic media operation "check format support" evidenced at **308**E and **310**E. The client's RTS media abstraction module **448** can query back asking the server **402** what media platform can be utilized to support the media format. The client **404** can then utilize information from the server **402** to determine whether the client **404** supports the media format. Alternatively, the client **404** may determine that it has a media platform, such as media platform **408** that supports the media format. In the latter case, the client **404** can instruct the server **402** to proceed with streaming the media. For example, the client **404** through the client's RTS media abstraction module **448** may have a media platform **408** that differs completely in from the media platform **406** on the server **402**. In such cases, before the operations, such as playback, pause, and so on, of the collaboration sessions proceed, a check can be performed for the platform being supported by the client **404**. In another case, rather than waiting for the server, the client's RTS media abstraction module **448** can proactively inform the server **402** of the capabilities associated with the client **404** relating to the media formats supported by the client **404** and/or the media platforms operating on the client **404**.

[0051] Furthermore, utilizing the virtual channel connection allows the distribution manager **418** and the multimedia component **446** to establish a distributed topology. The distributed topology can perform various functionalities. For example, the distributed topology can include a network transmitter at the server **402** and a network receiver at the client **404**. The network receiver is connected in turn to audio and/or video renderers **458**, **468** respectively at the client **404**. In this particular configuration a video transmitter **472** and an audio transmitter **438** are illustrated on server **402** while a corresponding video receiver **462** and an audio receiver **452** are illustrated on the client **404**.

[0052] During a remote desktop media presentation scenario, media can be directed to the client **404**, in an unprocessed or partially processed form, as a stream. For example, at the server **402**, the media platform **406** can intercept media that would otherwise be processed at the server **402**, such as by the video decoder **422**, the video effects module **424**, the

video renderer **438**, the audio decoder **430**, the audio effects **432** and the audio renderer **434**. The media may be redirected to the respective video and audio transmitters **472**, **438** for streaming to the client **404**. Streaming may be over various channels. For example, the media may be streamed in band with the RDP over a virtual channel. Such a configuration re-uses the existing RDP connection and allows RDP to handle various details of punching thru firewalls, and establishing a secure, authenticated context, among other tasks. Alternatively or additionally, the media may be streamed over a side-band user datagram protocol (UDP) or transmission control protocol (TCP) connection. In certain implementations, an out of band configuration may be used. For example, in a particular configuration, an out of band connection may be available with greater bandwidth over that connection, than is available in the connection through RDP.

[0053] On the client **404**, the streamed media is received at the multimedia module **446** which in turn passes the streamed media to video and audio receivers **462**, **452** respectively. The video and audio receivers **462**, **452** respectively pass the media to the client-side transforms and sinks, which include the video decoder **464**, the video effect **466**, the video renderer **468**, the audio decoder **454**, the audio effects **456** and the audio renderer **458**. The media is then decoded and rendered at the client **404**. Since the audio and video are streamed in encoded form, any synchronization tools contained in the encoded media may be available at the client **404** for maintaining proper audio video synchronization. For ease of explanation, unprocessed media is streamed from the server **402** to the client **404**.

[0054] Some processing of the media may occur in other implementations. For example, assume that consistent with the above described remote desktop scenario, a user requests to play media which is encoded at the source in hypothetical codec AA. In this example, the source may contain the components to decode hypothetical codec AA, but the client may not; however, both the source and the client may have codec capability for a second hypothetical codec format BB. In such an instance, the source may decode the media and then recode the media into BB format before streaming the media to the client **404**. This is but one example, which represents various levels of processing to the media which may occur at system components consistent with the concepts described above and below.

[0055] A geometry tracking component or geometry tracker **412**, **444** can register and track any changes relating to a target window of the terminal services session. For example, geometry tracker **412** can register a unique identifier for a target window and track the target window on the remote desktop described above. The geometry tracker **412** can track changes relating to clipping of the target window by another window, position of the target window, and size of the target window at the server side. These changes are then relayed to the client **404** by the remote desktop protocols where the changes are directed to the client side multimedia module **446**.

[0056] Geometry tracking may be a feature of a platform, such as Terminal Services® platform that provides a notification system for window geometry changes. Whenever a window's geometry changes, events containing the new geometry may be generated and sent to notification sinks at the source. In this example, the client acts as the source. Window geometry can change when a window is moved, minimized/maximized, or clipped by another window.

[0057] In certain cases, an application may decide to render media on the client instead of transmitting a pre-rendered bitmaps from the server. In order to do this, the application creates a window on both the server and client ends. The server window acts as a placeholder, and is able to accept all input, and the actual media may be rendered and painted by the application on the client end. The client window is painted right over the server window for the distribution to be transparent to the user. Since all input actually acts upon the server window, geometry changes will be reflected at the server. The application tracks these changes to the server window and updates the client window accordingly for both windows to be geometrically synchronized.

Exemplary Method(s)

[0058] Exemplary processes for collaboration sessions and handling media operations in collaboration sessions are described with reference to FIGS. **1-4**. These processes may be described in the general context of computer executable instructions. Generally, computer executable instructions can include routines, programs, objects, components, data structures, procedures, modules, functions, and the like that perform particular functions or implement particular abstract data types. The processes may also be practiced in a distributed computing environment where functions are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, computer executable instructions may be located in both local and remote computer storage media, including memory storage devices.

[0059] FIG. **5** illustrates an exemplary method **500** for collaboration sessions and handling media playback operations in collaboration sessions. The order in which the method is described is not intended to be construed as a limitation, and any number of the described method blocks can be combined in any order to implement the method. Furthermore, the method can be implemented in any suitable hardware, software, firmware, or combination thereof.

[0060] At block **502**, commands associated with one or more actions related to media files are received. The received commands are specific to the media platform associated with the computing device receiving the commands. The commands may be generated from another computing device that may be accessing the media files over a network. For example, the server's RTS media abstraction module **210** can receive media commands that are specific to the server's media platform **208**. Such commands can be generated responsive to certain actions, such as the media file being accessed.

[0061] At block **504**, the received platform specific commands are associated with one or more generic media operations. The generic operations may be common to a variety of applications for playing back of media files. In one implementation, the platform specific commands are associated with one or more generic operations based on a mapping. For example, the server's RTS media abstraction module **210** can utilize RTS mapping table **302** to map the received media operations (as indicated by commands **306**A-**306**I) into generic or abstract media operations (as indicated by **308**A-**308**I). An example of a platform based on the server **202** includes but is not limited to, Media Foundation.

[0062] At block **506**, the generic operations are sent to the computing device requesting access to a media file. For example, the generic operations can be sent to the client **204**

from the server **202**. In one implementation, the server's RTS media abstraction module **210** sends the generic commands from the server **202** to the client **204**.

[0063] At block **508**, the generic commands are received by the requesting device and are associated with platform specific commands. For example, the client's RTS media abstraction module **214** receives the generic commands sent by the server's RTS media abstraction module **210**. The client's RTS media abstraction module **214** can employ another RTS mapping table **304**. The RTS mapping table **304** can translate the abstracted media operations into media operations that are specific to the client's media platform **212**. The client's media platform **212** can then execute the media operations. Examples of media platform on the client **204** include but are not limited to the DShow(g platform. Hence platform specific commands of the server **202** can be translated into platform specific commands of the client **204**, through abstraction of the platform specific commands as generic operations.

An Exemplary Computing Environment

[0064] FIG. **6** illustrates an exemplary general computer environment **600**, which can be used to implement the techniques described herein, and which may be representative, in whole or in part, of elements described herein. The computer environment **600** is only one example of a computing environment and is not intended to suggest any limitation as to the scope of use or functionality of the computer and network architectures. Neither should the computer environment **600** be interpreted as having any dependency or requirement relating to any one or combination of components illustrated in the example computer environment **600**.

[0065] Computer environment **600** includes a general-purpose computing-based device in the form of a computer **602**. Computer **602** can be, for example, a desktop computer, a handheld computer, a notebook or laptop computer, a server computer, a game console, and so on. The components of computer **602** can include, but are not limited to, one or more processors or processing units **604**, a system memory **606**, and a system bus **608** that couples various system components including the processor **604** to the system memory **606**.

[0066] The system bus **608** represents one or more of any of several types of bus structures, including a memory bus or memory controller, a peripheral bus, an accelerated graphics port, and a processor or local bus using any of a variety of bus architectures. By way of example, such architectures can include an Industry Standard Architecture (ISA) bus, a Micro Channel Architecture (MCA) bus, an Enhanced ISA (EISA) bus, a Video Electronics Standards Association (VESA) local bus, and a Peripheral Component Interconnects (PCI) bus also known as a Mezzanine bus.

[0067] Computer **602** typically includes a variety of computer readable media. Such media can be any available media that is accessible by computer **602** and includes both volatile and non-volatile media, removable and non-removable media.

[0068] The system memory **606** includes computer readable media in the form of volatile memory, such as random access memory (RAM) **610**, and/or non-volatile memory, such as read only memory (ROM) **612**. A basic input/output system (BIOS) **614**, containing the basic routines that help to transfer information between elements within computer **602**, such as during start-up, is stored in ROM **612** is illustrated. RAM **610** typically contains data and/or program modules that are immediately accessible to and/or presently operated on by the processing unit **604**.

[0069] Computer **602** may also include other removable/non-removable, volatile/non-volatile computer storage media. By way of example, FIG. **6** illustrates a hard disk drive **616** for reading from and writing to a non-removable, non-volatile magnetic media (not shown). Furthermore FIG. **6** illustrates a magnetic disk drive **618** for reading from and writing to a removable, non-volatile magnetic disk **620** (e.g., a "floppy disk"), additionally FIG. **6** illustrates an optical disk drive **622** for reading from and/or writing to a removable, non-volatile optical disk **624** such as a CD-ROM, DVD-ROM, or other optical media. The hard disk drive **616**, magnetic disk drive **618**, and optical disk drive **622** are each connected to the system bus **608** by one or more data media interfaces **626**. Alternately, the hard disk drive **616**, magnetic disk drive **618**, and optical disk drive **622** can be connected to the system bus **608** by one or more interfaces (not shown).

[0070] The disk drives and their associated computer-readable media provide non-volatile storage of computer readable instructions, data structures, program modules, and other data for computer **602**. Although the example illustrates a hard disk **616**, a removable magnetic disk **620**, and a removable optical disk **624**, it is to be appreciated that other types of computer readable media which can store data that is accessible by a computer, such as magnetic cassettes or other magnetic storage devices, flash memory cards, CD-ROM, digital versatile disks (DVD) or other optical storage, random access memories (RAM), read only memories (ROM), electrically erasable programmable read-only memory (EEPROM), and the like, can also be utilized to implement the exemplary computing system and environment.

[0071] Any number of program modules can be stored on the hard disk **616**, magnetic disk **620**, optical disk **624**, ROM **612**, and/or RAM **610**, including by way of example, an operating system **626**, one or more application programs **628**, other program modules **630**, and program data **632**. Each of such operating system **626**, one or more application programs **628**, other program modules **630**, and program data **632** (or some combination thereof) may implement all or part of the resident components that support the distributed file system.

[0072] A user can enter commands and information into computer **602** via input devices such as a keyboard **634** and a pointing device **636** (e.g., a "mouse"). Other input devices **638** (not shown specifically) may include a microphone, joystick, game pad, satellite dish, serial port, scanner, and/or the like. These and other input devices are connected to the processing unit **604** via input/output interfaces **640** that are coupled to the system bus **608**, but may be connected by other interface and bus structures, such as a parallel port, game port, or a universal serial bus (USB).

[0073] A monitor **642** or other type of display device can also be connected to the system bus **608** via an interface, such as a video adapter **644**. In addition to the monitor **642**, other output peripheral devices can include components such as speakers (not shown) and a printer **646**, which can be connected to computer **602** via the input/output interfaces **640**.

[0074] Computer **602** can operate in a networked environment using logical connections to one or more remote computers, such as a remote computing-based device **648**. By way of example, the remote computing-based device **648** can be a personal computer, portable computer, a server computer, a router, a network computer, a peer device or other common network node, and the like. The remote computing-based

device **648** is illustrated as a portable computer that can include many or all of the elements and features described herein relative to computer **602**.

[0075] Logical connections between computer **602** and the remote computer **648** are depicted as a local area network (LAN) **660** and a general wide area network (WAN) **652**. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets, and the Internet.

[0076] When implemented in a LAN networking environment, the computer **602** is connected to a local network **660** via a network interface or adapter **654**. When implemented in a WAN networking environment, the computer **602** typically includes a modem **656** or other means for establishing communications over the wide network **652**. The modem **656**, which can be internal or external to computer **602**, can be connected to the system bus **608** via the input/output interfaces **640** or other appropriate mechanisms. It is to be appreciated that the illustrated network connections are exemplary and that other means of establishing communication link(s) between the computers **602** and **648** can be employed.

[0077] In a networked environment, such as that illustrated with computing environment **600**, program modules depicted relative to the computer **602**, or portions thereof, may be stored in a remote memory storage device. By way of example, remote application programs **658** reside on a memory device of remote computer **648**. For purposes of illustration, application programs and other executable program components such as the operating system are illustrated herein as discrete blocks, although it is recognized that such programs and components reside at various times in different storage components of the computing-based device **602**, and are executed by the data processor(s) of the computer.

[0078] Various modules and techniques may be described herein in the general context of computer-executable instructions, such as program modules, executed by one or more computers or other devices. Generally, program modules include routines, programs, objects, components, data structures, etc. that performs particular tasks or implement particular abstract data types. Typically, the functionality of the program modules may be combined or distributed as desired in various embodiments.

[0079] An implementation of these modules and techniques may be stored on or transmitted across some form of computer readable media. 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 "communications media."

[0080] "Computer storage media" includes volatile and non-volatile, 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, or any other medium which can be used to store the desired information and which can be accessed by a computer.

[0081] Alternately, portions of the framework may be implemented in hardware or a combination of hardware, software, and/or firmware. For example, one or more application specific integrated circuits (ASICs) or programmable logic devices (PLDs) could be designed or programmed to implement one or more portions of the framework.

CONCLUSION

[0082] Although embodiments for managing multimedia operations in a collaborative session have been described in language specific to structural features and/or methods, it is to be understood that the subject of the appended claims is not necessarily limited to the specific features or methods described. Rather, the specific features and methods are disclosed as exemplary implementations for managing multimedia operations in a collaborative session.

What is claimed is:

1. A computer-readable storage media comprising computer-executable instructions that, when executed, perform acts, comprising:

receive a media playback command specific to a media platform supported on a server in a collaboration session; and,

translate the platform specific media playback command into a generic media playback command for transmission to a client.

2. A method as recited in claim **1** further comprising presenting a user interface at the client, in a media presentation window, and tracking changes to the media presentation window.

3. A method as recited in claim **1**, wherein a media application is instantiated as a media presentation window on a user-interface component and wherein said tracking comprises assigning a unique identifier to the media presentation window and wherein changes to the media presentation window are relayed to the client to allow the media presentation window to be oriented relative to the user-interface component.

4. A method as recited in claim **1** further comprising sending commands over a first network channel established by the collaboration session, and streaming data over a second different channel.

5. A method as recited in claim **4**, wherein the second different channel is established by the collaboration session.

6. A method as recited in claim **1** further comprising prior to said streaming:

determining a format of the media;

evaluating a capacity of the client to decode and render the media in the format.

7. A method as recited in claim **6**, in an event that the client lacks a capacity to decode and render the media in the existing format, further comprising decoding the media and re-encoding the media in a second different format which the client is configured to handle.

8. A method as recited in claim **1** further comprising, responsive to the presentation command:

establishing a virtual channel connection with the client,

negotiating formats which are supported by both the source and the client; and,

setting up a distributed topology with the client.

9. A method as recited in claim **8**, wherein the setting-up a distributed topology comprises inserting a network transmitter at the source and a network receiver at the client.

10. A server comprising:

a user-interface-component that includes graphics and images that compose a user-interface; and

a media component that includes media presentation data to be played through the user-interface-component, wherein a platform specific command is translated to a generic media playback command or a media platform supported on a remote terminal session client.

11. The server as recited in claim **10**, wherein the user-interface component comprises a media application window.

12. The server as recited in claim **11**, wherein the media component is configured to be presented in a media presentation target window within the media application window.

13. The server as recited in claim **12**, wherein the media presentation data is tracked by tracking the media presentation target window relative to the media application window.

14. The server as recited in claim **13**, wherein the tracking comprises relaying the relative position of the media presentation target window relative to the media application window to the remote client.

15. The server as recited in claim **13**, wherein the tracking comprises inserting a placeholder on the server desktop which represents the media presentation target window and tracking any changes affecting the placeholder.

16. The server as recited in claim **10** further comprising determining what media formats are supported by the remote client.

17. The server as recited in claim **10** further comprising establishing a distributed topology with the remote client.

18. The server as recited in claim **10**, wherein the sending and the streaming occur in a terminal services session.

19. A system, comprising:

a mechanism for receiving a platform specific media playback command generated responsive to a user-entered media playback command in a collaboration session; and,

a mechanism for abstracting the platform specific media playback command into a platform generic media playback command.

* * * * *