US 20020099842A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2002/0099842 A1

Jennings et al. (43) Pub. Date: Jul. 25, 2002

(54) SYSTEM AND METHOD FOR ROUTING MEDIA

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(21) Appl. No.: 10/051,406

(22) Filed: Jan. 18, 2002

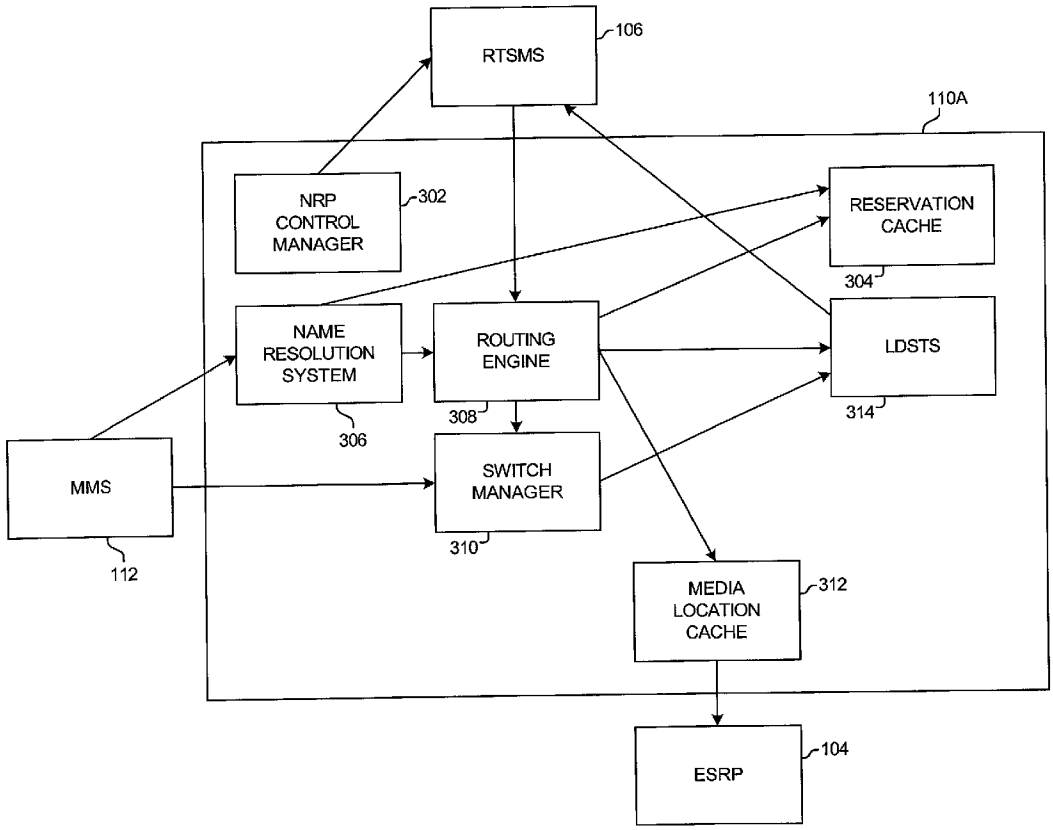
Publication Classification

(51) Int. Cl.[7] G06F 15/16

(52) U.S. Cl. 709/231

(57) ABSTRACT

The system and method for streaming media to a viewer and managing the media comprises and an enhanced service routing processor (ESRP), a real time switch management system (RTSMS), a name routing processor (NRP), and a managed media switch (MMS). The RTSMS has a reservation system. The ESRP receives media from an owner, manages the media according to media rules and order rules defined by the owner, and distributes the media to one or more switches, such as the MMS, according to the media rules and the order rules. The RTSMS is configured to receive the media rules and to receive a viewer's media request via the reservation server. The reservation system of the RTSMS processes the media request according to the media rules and builds a reservation for the requested media. The RTSMS generates the reservation to the viewer and to the NRP. The NRP receives the reservation data from the viewer and from the RTSMS. The NRP processes the reservation data and locates an MMS that can stream the media to the viewer. The NRP transmits the IP address of the MMS to the viewer and transmits the reservation data to the MMS. The viewer initiates a session or connection with the MMS using the reservation number. If the reservation data from the viewer matches the reservation data from the NRP, the MMS streams the media to the viewer.



FreeWheel, Ex. 1050

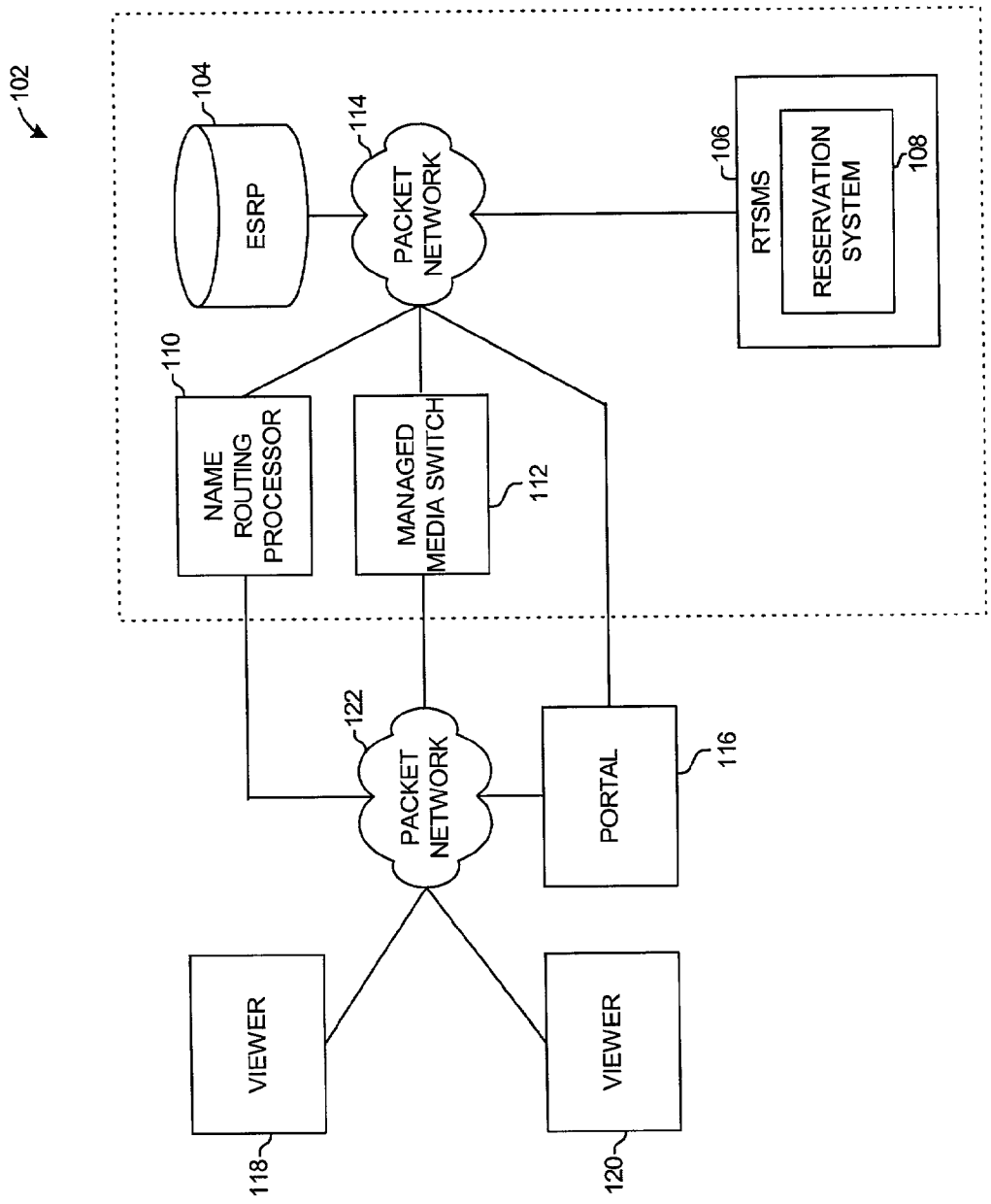

102
104
ESRP
114
PACKET NETWORK
106
RTSMS
RESERVATION SYSTEM
108
110
NAME ROUTING PROCESSOR
MANAGED MEDIA SWITCH
112
122
PACKET NETWORK
PORTAL
116
VIEWER
118
VIEWER
120

FIG. 1

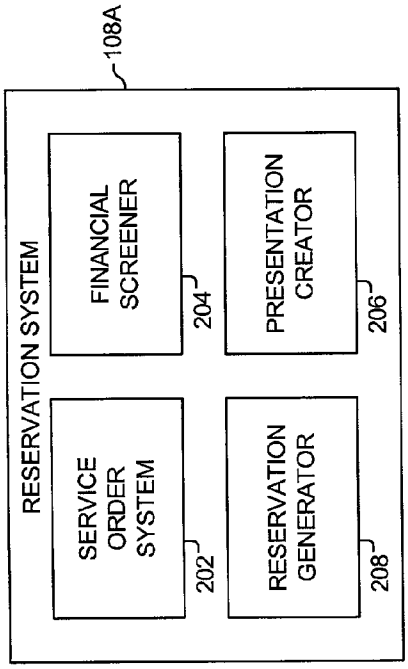

108A
RESERVATION SYSTEM
SERVICE ORDER SYSTEM
202
FINANCIAL SCREENER
204
RESERVATION GENERATOR
208
PRESENTATION CREATOR
206

FIG. 2

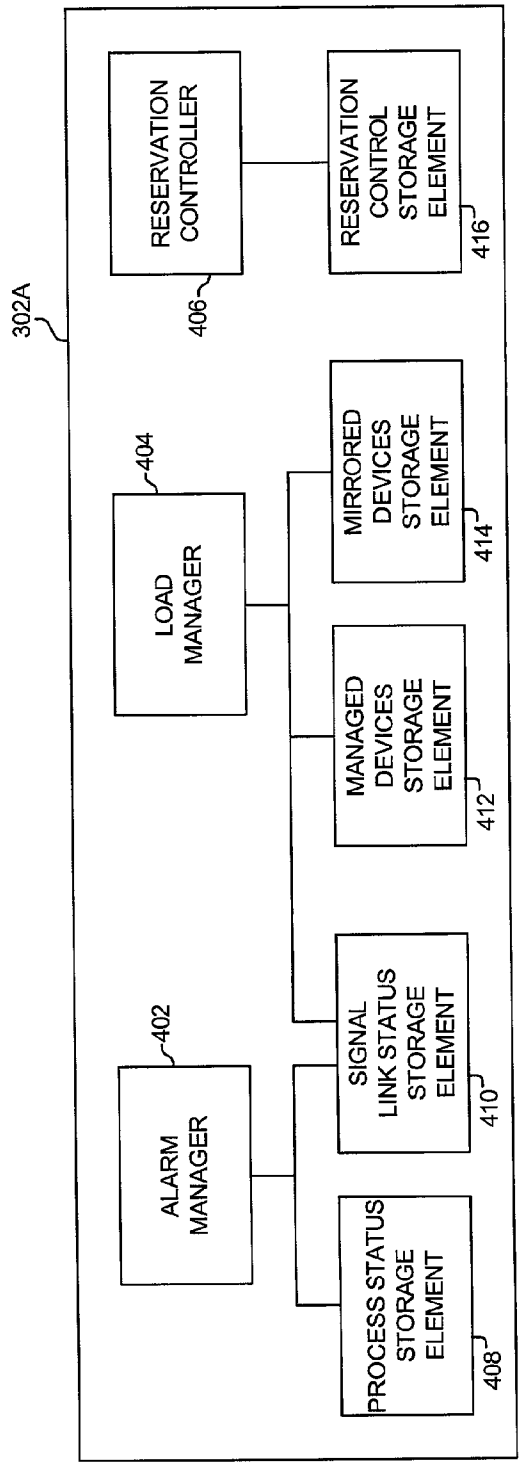

302A
ALARM MANAGER
402
LOAD MANAGER
404
RESERVATION CONTROLLER
406
PROCESS STATUS STORAGE ELEMENT
408
SIGNAL LINK STATUS STORAGE ELEMENT
410
MANAGED DEVICES STORAGE ELEMENT
412
MIRRORED DEVICES STORAGE ELEMENT
414
RESERVATION CONTROL STORAGE ELEMENT
416

FIG. 4

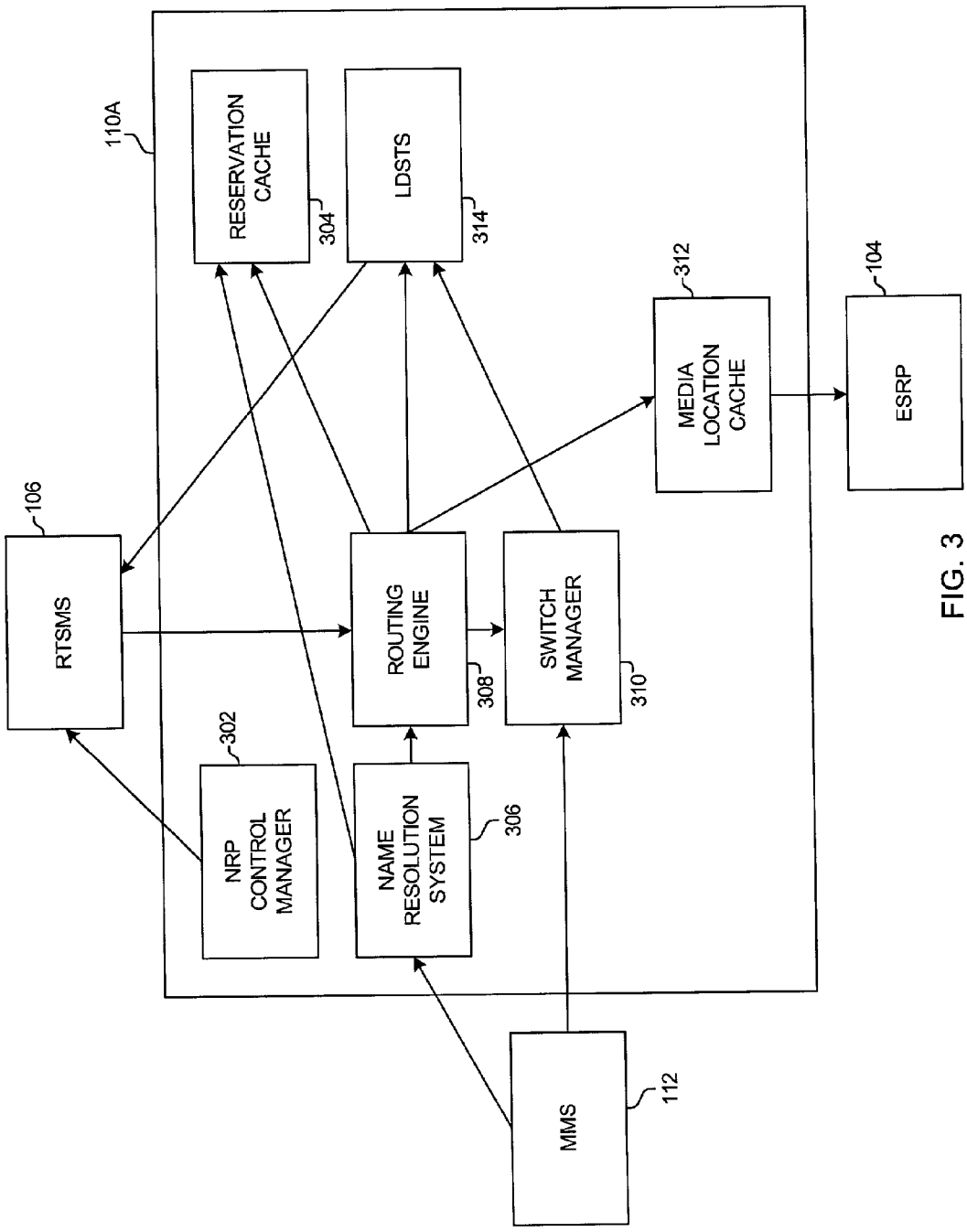

110A
RESERVATION CACHE
304
LDSTS
314
312
MEDIA LOCATION CACHE
104
ESRP
106
RTSMS
ROUTING ENGINE
308
SWITCH MANAGER
310
302
NRP CONTROL MANAGER
NAME RESOLUTION SYSTEM
306
MMS
112

FIG. 3

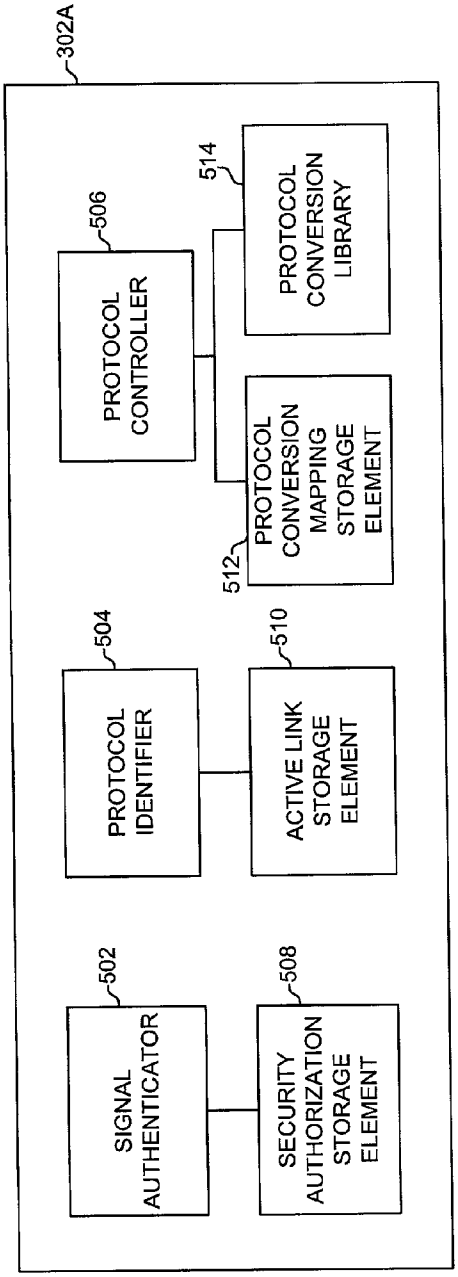

302A
SIGNAL AUTHENTICATOR
502
PROTOCOL IDENTIFIER
504
PROTOCOL CONTROLLER
506
SECURITY AUTHORIZATION STORAGE ELEMENT
508
ACTIVE LINK STORAGE ELEMENT
510
PROTOCOL CONVERSION MAPPING STORAGE ELEMENT
512
PROTOCOL CONVERSION LIBRARY
514

FIG. 5

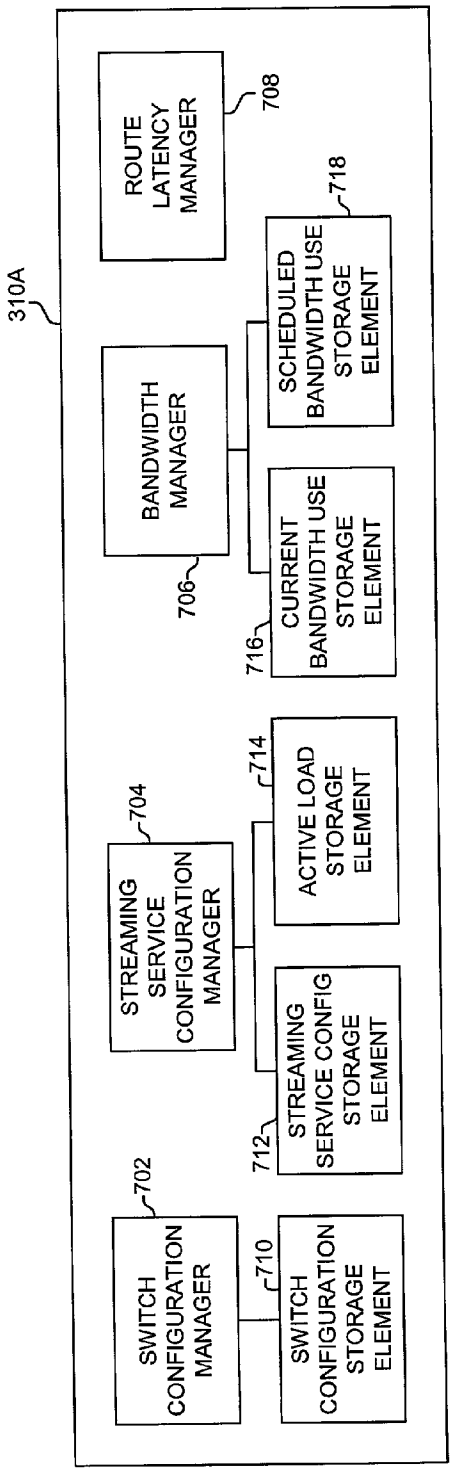

310A
SWITCH CONFIGURATION MANAGER
702
SWITCH CONFIGURATION STORAGE ELEMENT
710
STREAMING SERVICE CONFIGURATION MANAGER
704
STREAMING SERVICE CONFIG STORAGE ELEMENT
712
ACTIVE LOAD STORAGE ELEMENT
714
BANDWIDTH MANAGER
706
CURRENT BANDWIDTH USE STORAGE ELEMENT
716
SCHEDULED BANDWIDTH USE STORAGE ELEMENT
718
ROUTE LATENCY MANAGER
708

FIG. 7

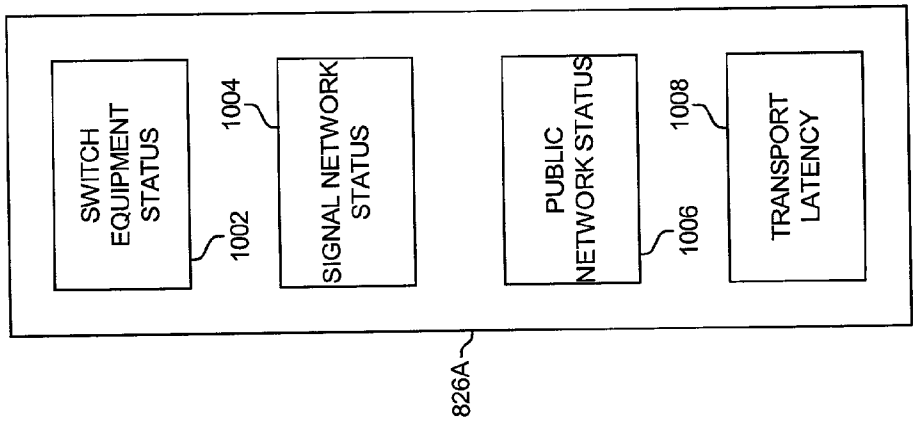


FIG. 10

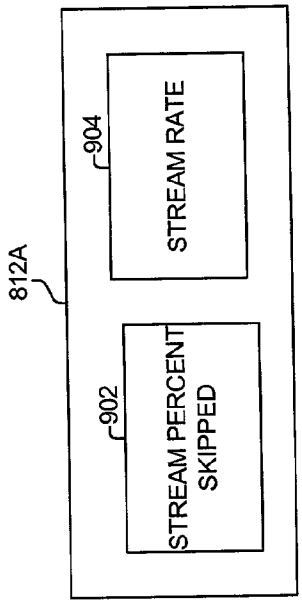


FIG. 9

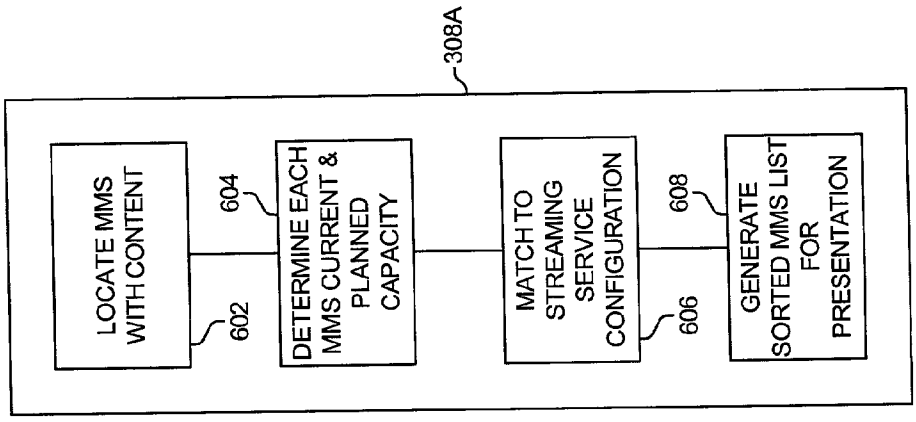


FIG. 6

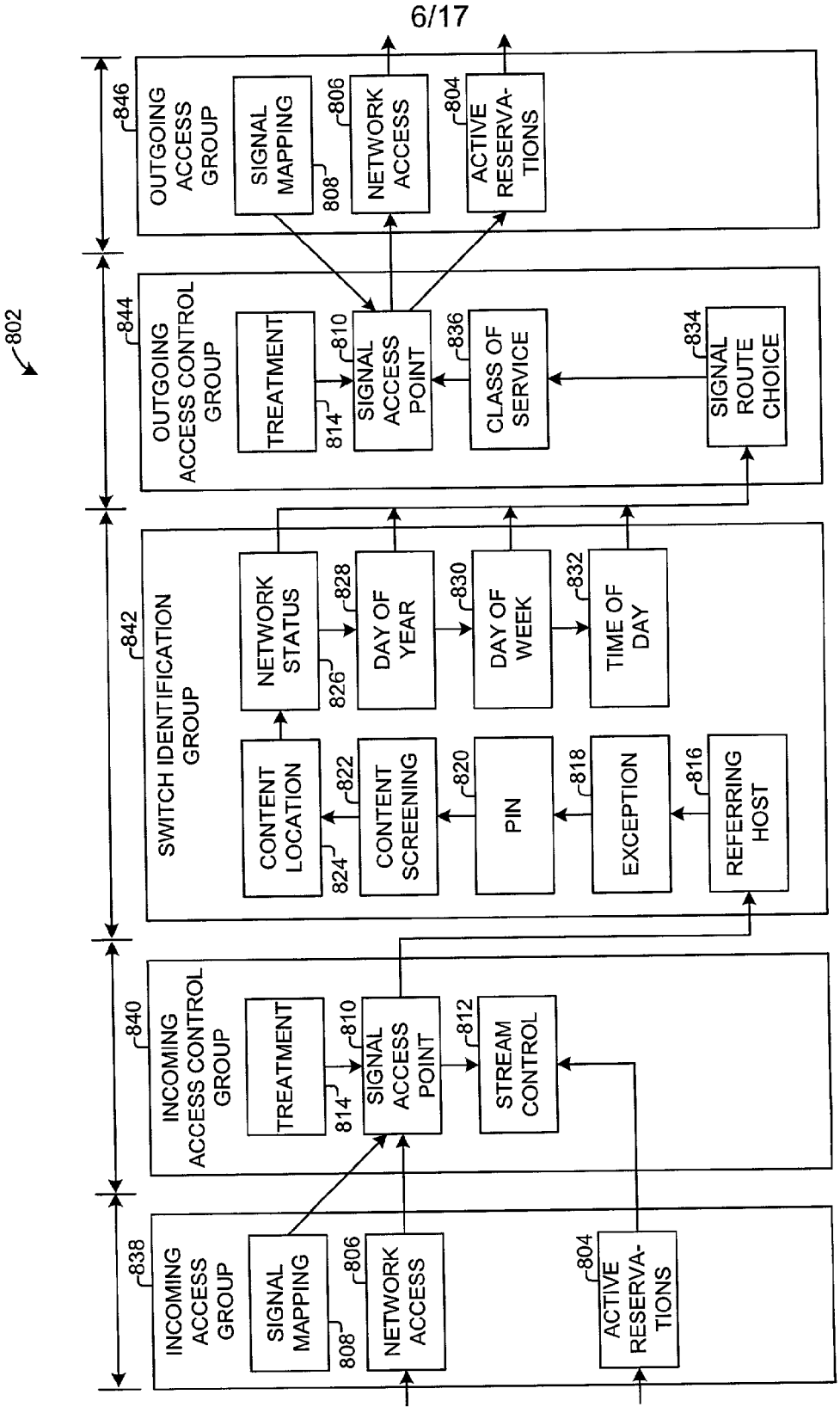

6/17
802
838
INCOMING ACCESS GROUP
SIGNAL MAPPING
808
NETWORK ACCESS
806
ACTIVE RESERVA-TIONS
804
840
INCOMING ACCESS CONTROL GROUP
TREATMENT
814
SIGNAL ACCESS POINT
810
STREAM CONTROL
812
842
SWITCH IDENTIFICATION GROUP
CONTENT LOCATION
824
CONTENT SCREENING
822
PIN
820
EXCEPTION
818
REFERRING HOST
816
NETWORK STATUS
826
DAY OF YEAR
828
DAY OF WEEK
830
TIME OF DAY
832
844
OUTGOING ACCESS CONTROL GROUP
TREATMENT
814
SIGNAL ACCESS POINT
810
CLASS OF SERVICE
836
SIGNAL ROUTE CHOICE
834
846
OUTGOING ACCESS GROUP
SIGNAL MAPPING
808
NETWORK ACCESS
806
ACTIVE RESERVA-TIONS
804

FIG. 8

1102

TABLE NUMBER	TABLE NAME	TREATMENT TABLE ACCESS POINT				
		INCOMING ACCESS	INCOMING ACCESS CONTROL	SWITCH IDENTIFICATION & SELECTION	OUTGOING ACCESS CONTROL	OUTGOING ACCESS
804	ACTIVE RESERVATIONS	X				X
806	NETWORK ACCESS					
808	SIGNAL MAPPING		X		X	
810	SIGNAL ACCESS POINT		X		X	
812	STREAM CONTROL		X			
816	REFERRING HOST			X		
818	EXCEPTION			X		
820	PERSONAL IDENTIFICATION NUMBER			X		
822	CONTENT SCREENING			X		
824	CONTENT LOCATION			X		
826	NETWORK STATUS			X		
828	DAY OF YEAR			X		
830	DAY OF WEEK			X		
832	TIME OF DAY			X		
834	SIGNAL ROUTE CHOICE				X	
836	CLASS OF SERVICE				X	

FIG. 11

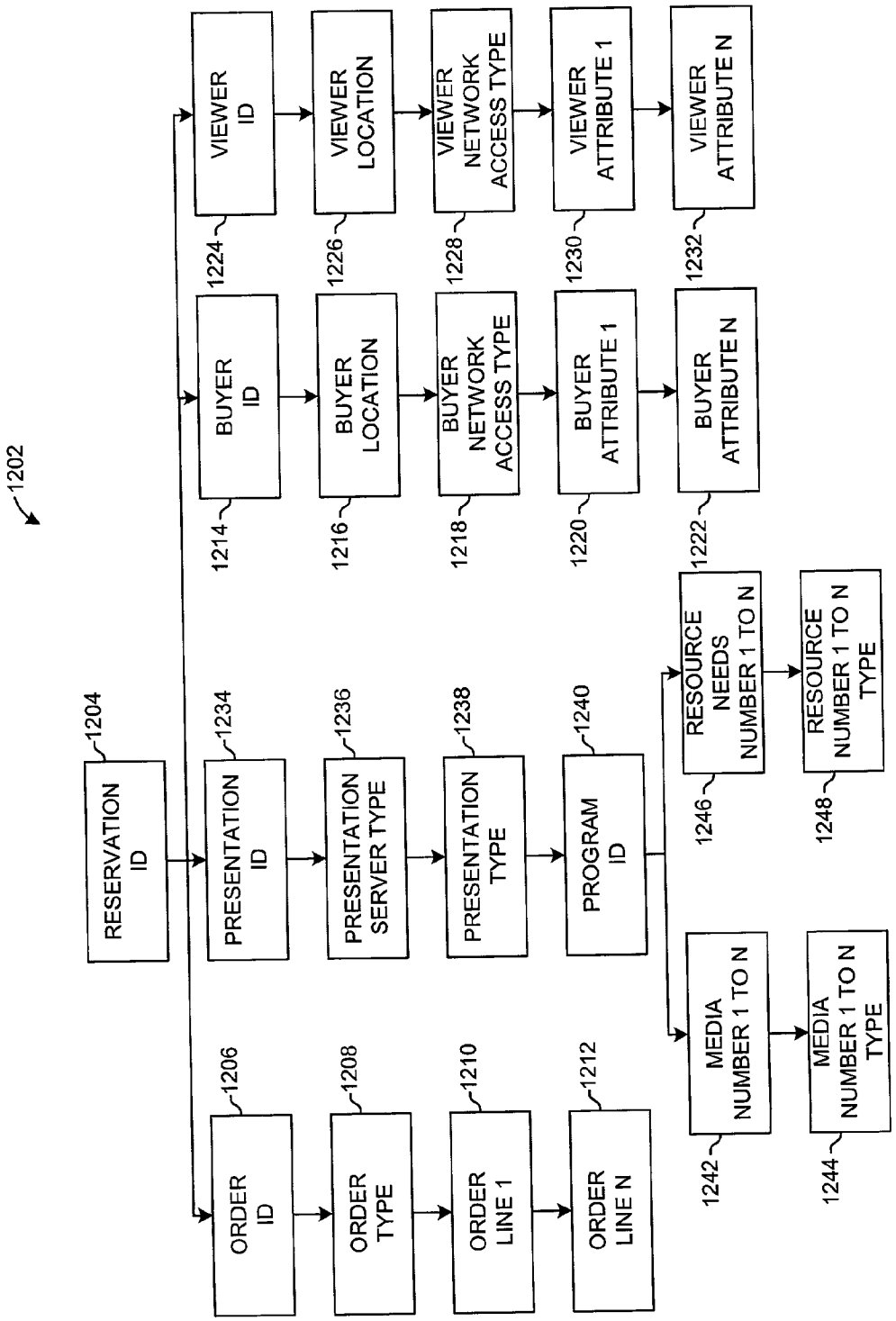

1202
RESERVATION ID
1204
ORDER ID
1206
ORDER TYPE
1208
ORDER LINE 1
1210
ORDER LINE N
1212
PRESENTATION ID
1234
PRESENTATION SERVER TYPE
1236
PRESENTATION TYPE
1238
PROGRAM ID
1240
BUYER ID
1214
BUYER LOCATION
1216
BUYER NETWORK ACCESS TYPE
1218
BUYER ATTRIBUTE 1
1220
BUYER ATTRIBUTE N
1222
VIEWER ID
1224
VIEWER LOCATION
1226
VIEWER NETWORK ACCESS TYPE
1228
VIEWER ATTRIBUTE 1
1230
VIEWER ATTRIBUTE N
1232
MEDIA NUMBER 1 TO N
1242
MEDIA NUMBER 1 TO N TYPE
1244
RESOURCE NEEDS NUMBER 1 TO N
1246
RESOURCE NUMBER 1 TO N TYPE
1248

FIG. 12

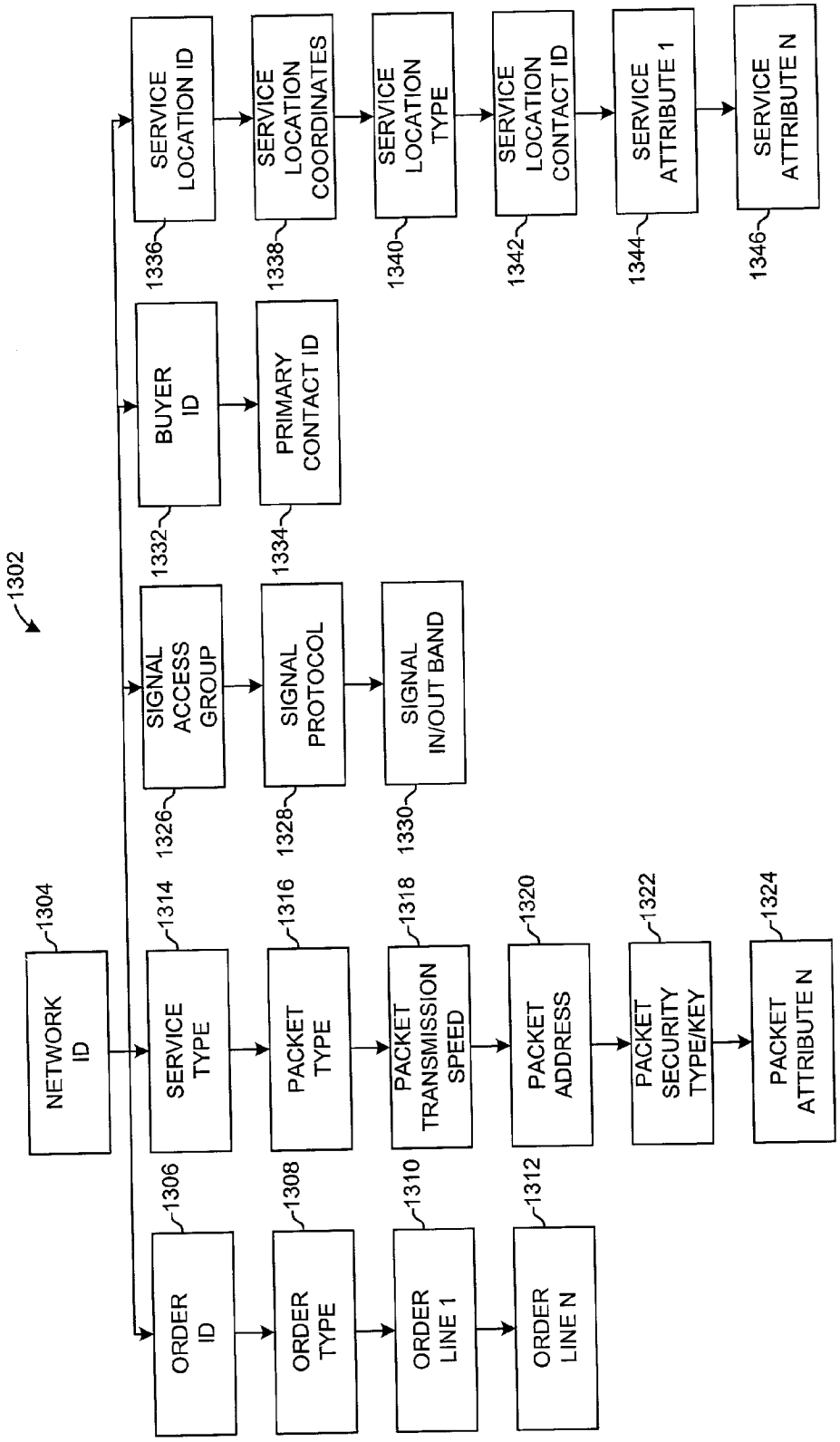

1302
NETWORK ID
1304
ORDER ID
1306
ORDER TYPE
1308
ORDER LINE 1
1310
ORDER LINE N
1312
SERVICE TYPE
1314
PACKET TYPE
1316
PACKET TRANSMISSION SPEED
1318
PACKET ADDRESS
1320
PACKET SECURITY TYPE/KEY
1322
PACKET ATTRIBUTE N
1324
SIGNAL ACCESS GROUP
1326
SIGNAL PROTOCOL
1328
SIGNAL IN/OUT BAND
1330
BUYER ID
1332
PRIMARY CONTACT ID
1334
SERVICE LOCATION ID
1336
SERVICE LOCATION COORDINATES
1338
SERVICE LOCATION TYPE
1340
SERVICE LOCATION CONTACT ID
1342
SERVICE ATTRIBUTE 1
1344
SERVICE ATTRIBUTE N
1346

FIG. 13

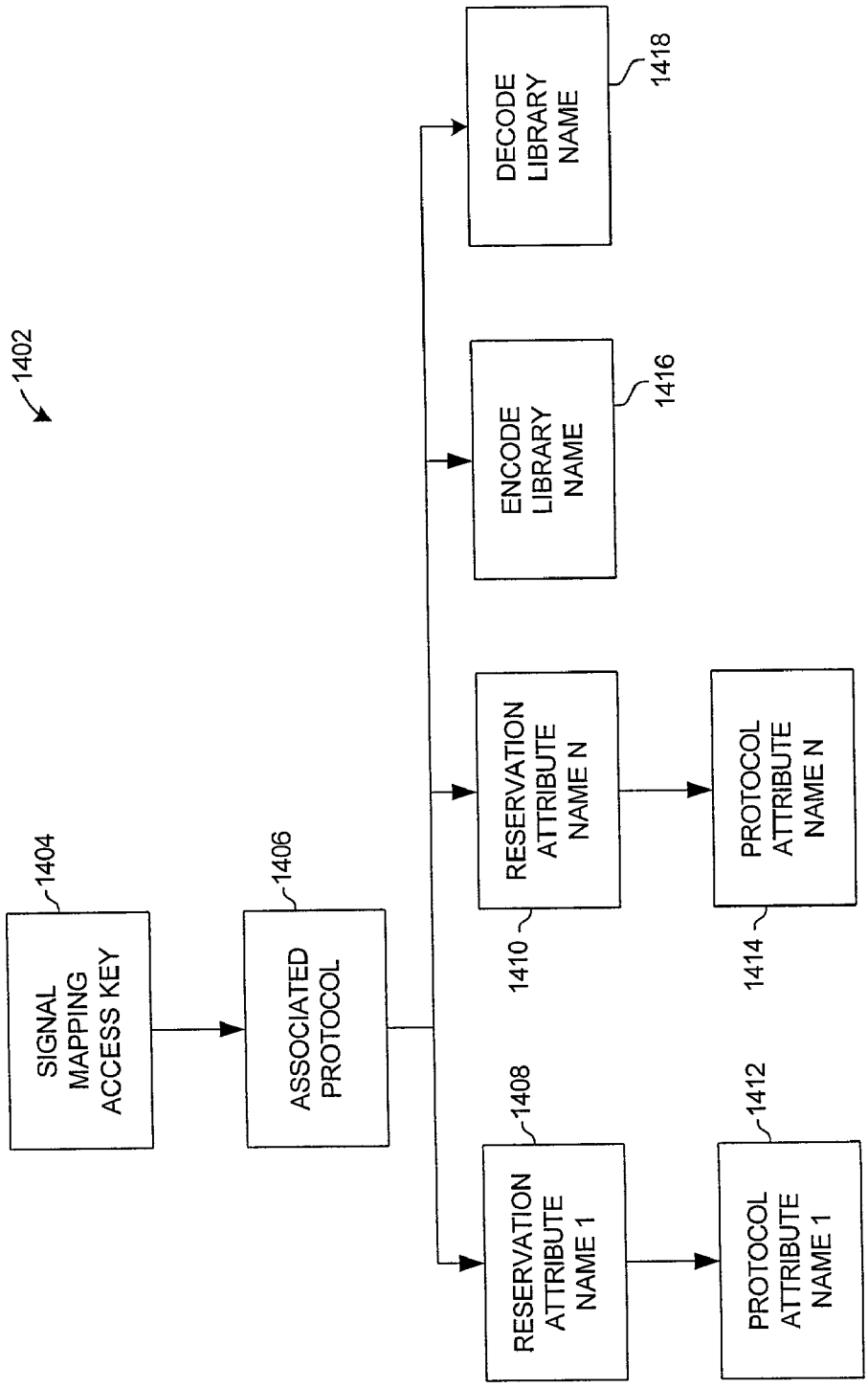

1402
1404
SIGNAL MAPPING ACCESS KEY
1406
ASSOCIATED PROTOCOL
1408
RESERVATION ATTRIBUTE NAME 1
1410
RESERVATION ATTRIBUTE NAME N
1412
PROTOCOL ATTRIBUTE NAME 1
1414
PROTOCOL ATTRIBUTE NAME N
1416
ENCODE LIBRARY NAME
1418
DECODE LIBRARY NAME

FIG. 14

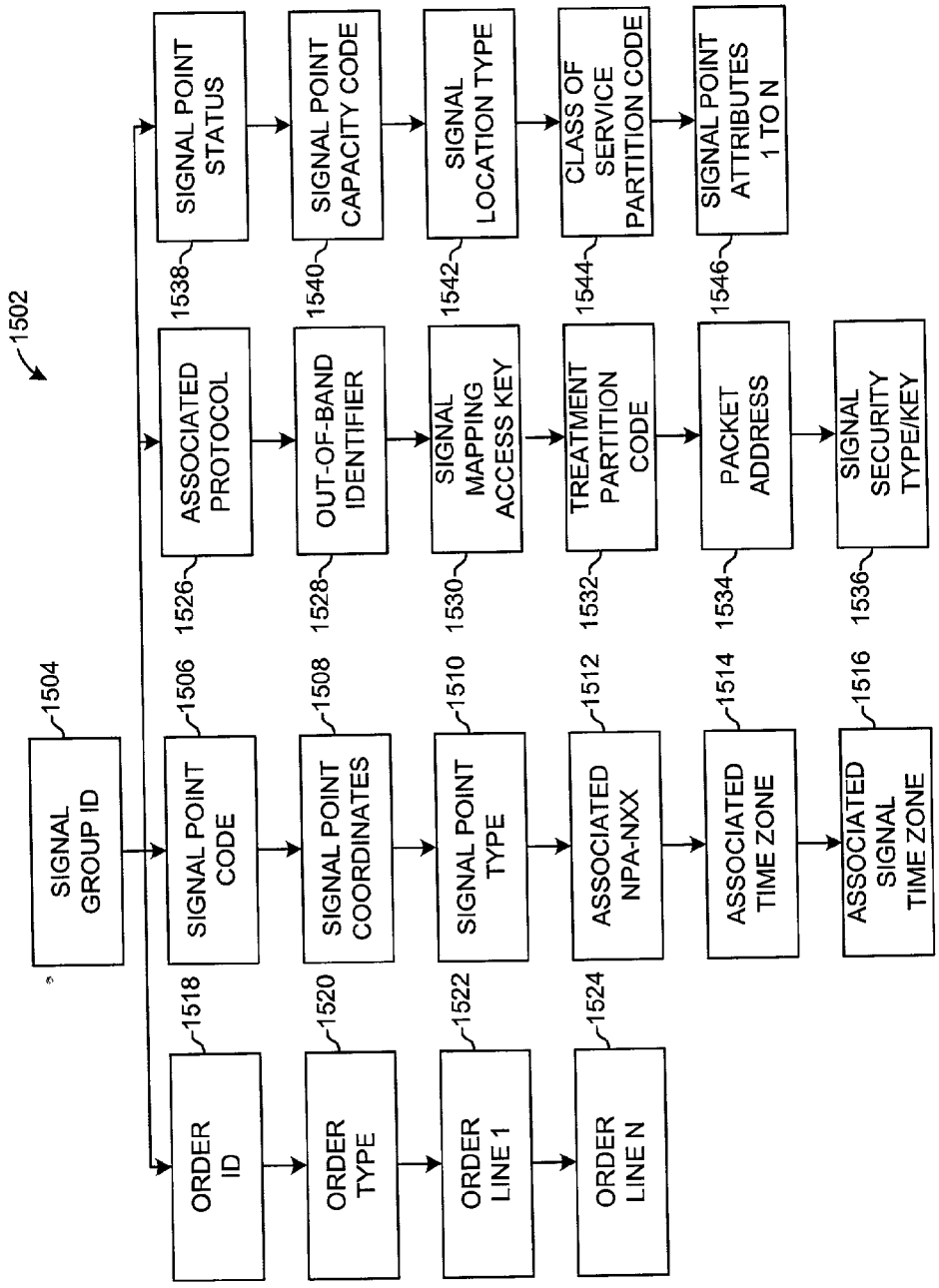

1502
SIGNAL GROUP ID
1504
ORDER ID
1518
ORDER TYPE
1520
ORDER LINE 1
1522
ORDER LINE N
1524
SIGNAL POINT CODE
1506
SIGNAL POINT COORDINATES
1508
SIGNAL POINT TYPE
1510
ASSOCIATED NPA-NXX
1512
ASSOCIATED TIME ZONE
1514
ASSOCIATED SIGNAL TIME ZONE
1516
ASSOCIATED PROTOCOL
1526
OUT-OF-BAND IDENTIFIER
1528
SIGNAL MAPPING ACCESS KEY
1530
TREATMENT PARTITION CODE
1532
PACKET ADDRESS
1534
SIGNAL SECURITY TYPE/KEY
1536
SIGNAL POINT STATUS
1538
SIGNAL POINT CAPACITY CODE
1540
SIGNAL LOCATION TYPE
1542
CLASS OF SERVICE PARTITION CODE
1544
SIGNAL POINT ATTRIBUTES 1 TO N
1546

FIG. 15

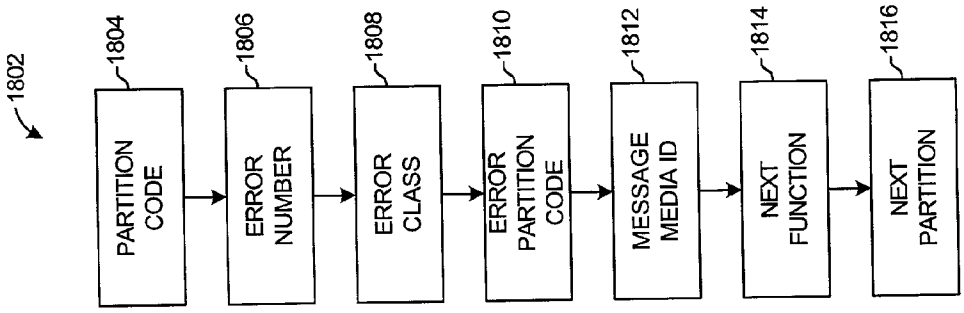


FIG. 18

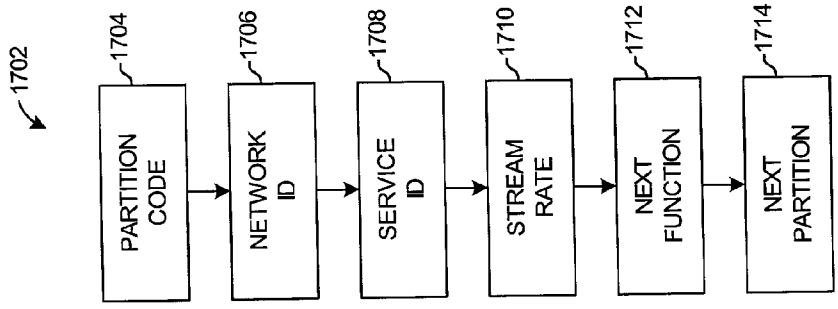


FIG. 17

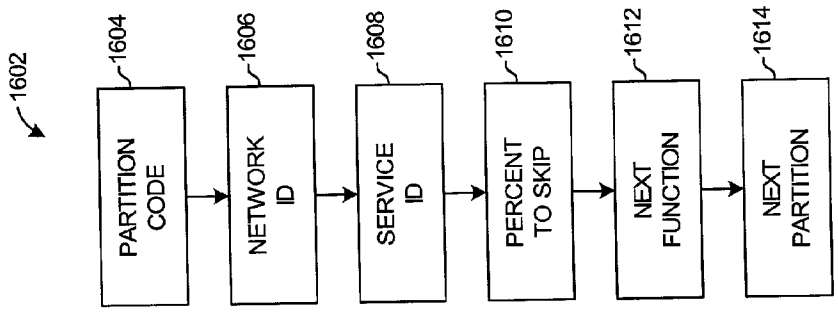


FIG. 16

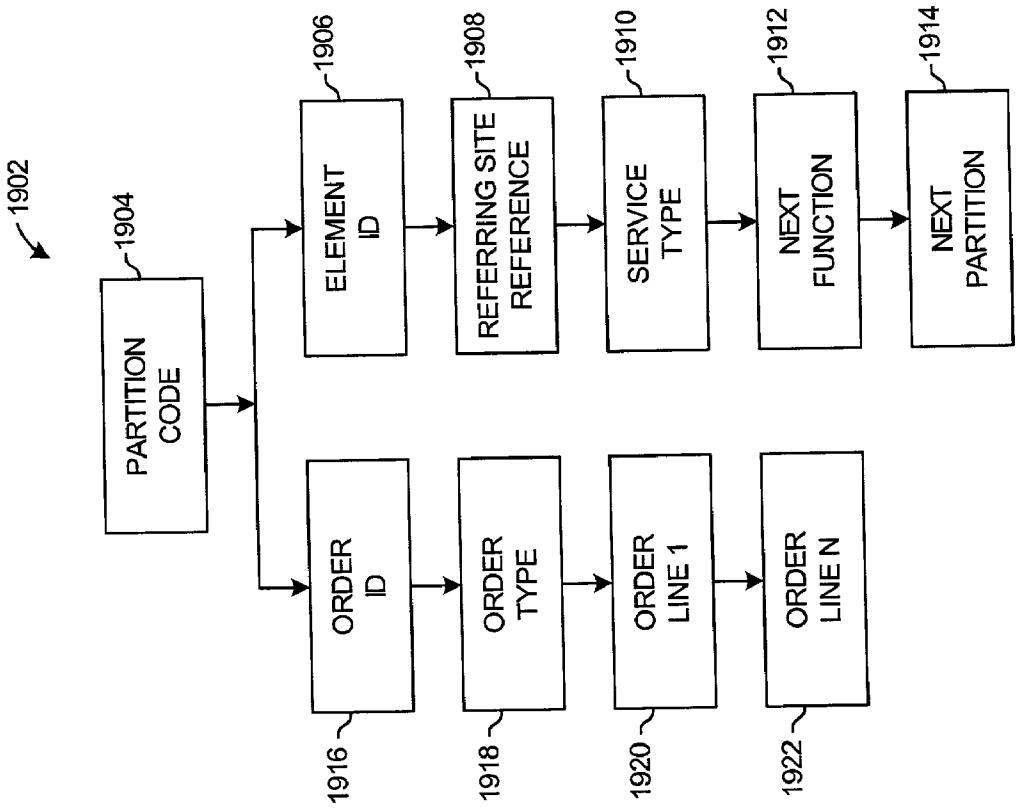

1902
1904
PARTITION CODE
ELEMENT ID
1906
REFERRING SITE REFERENCE
1908
SERVICE TYPE
1910
NEXT FUNCTION
1912
NEXT PARTITION
1914
ORDER ID
1916
ORDER TYPE
1918
ORDER LINE 1
1920
ORDER LINE N
1922

FIG. 19

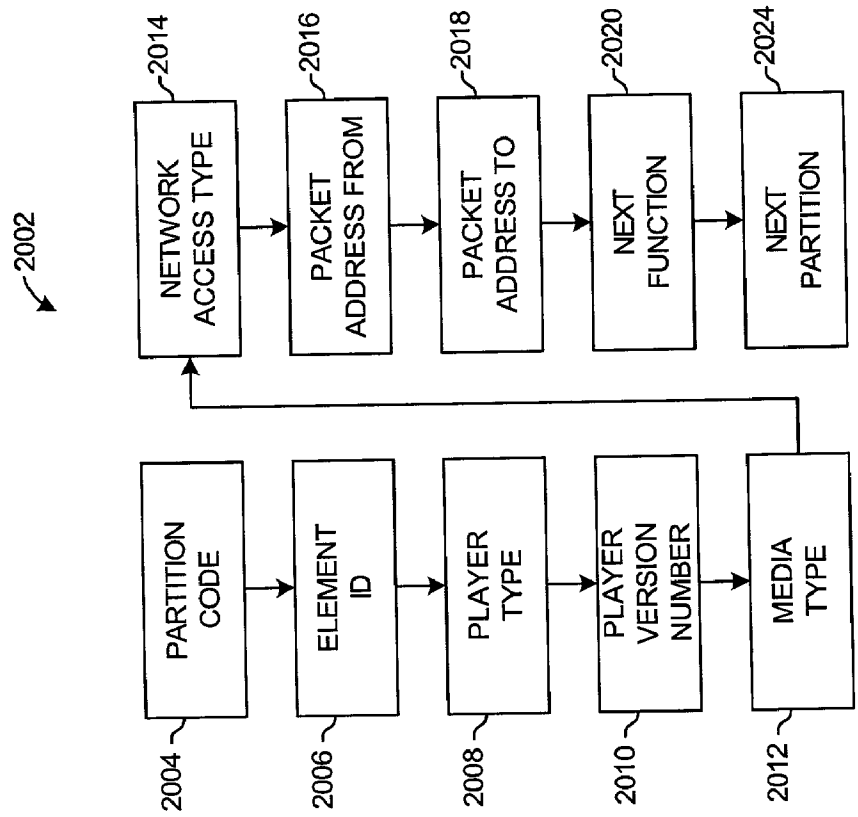

2002
PARTITION CODE
2004
ELEMENT ID
2006
PLAYER TYPE
2008
PLAYER VERSION NUMBER
2010
MEDIA TYPE
2012
NETWORK ACCESS TYPE
2014
PACKET ADDRESS FROM
2016
PACKET ADDRESS TO
2018
NEXT FUNCTION
2020
NEXT PARTITION
2024

FIG. 20

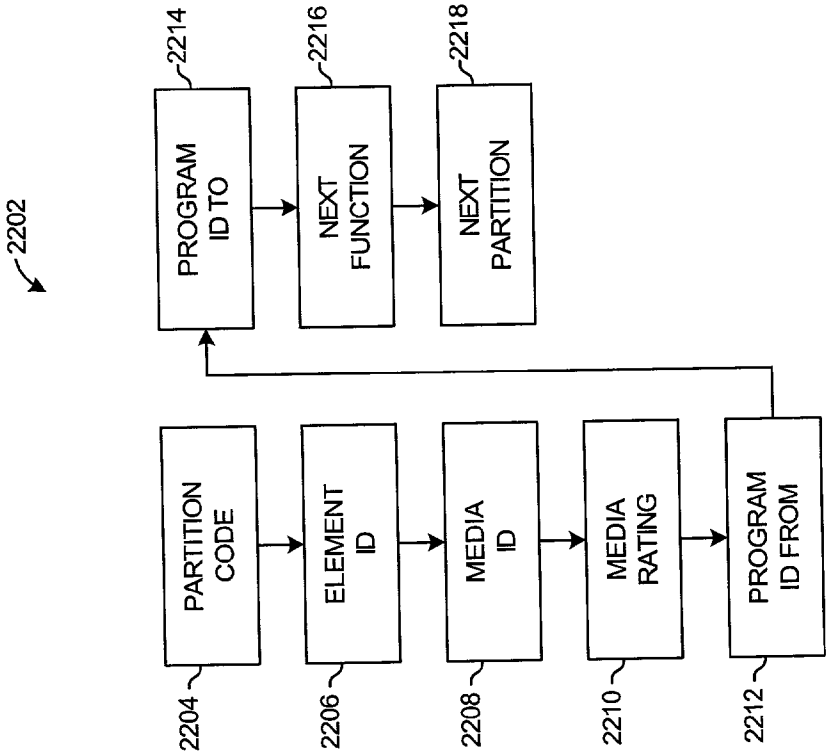

2202
PARTITION CODE
2204
ELEMENT ID
2206
MEDIA ID
2208
MEDIA RATING
2210
PROGRAM ID FROM
2212
PROGRAM ID TO
2214
NEXT FUNCTION
2216
NEXT PARTITION
2218

FIG. 22

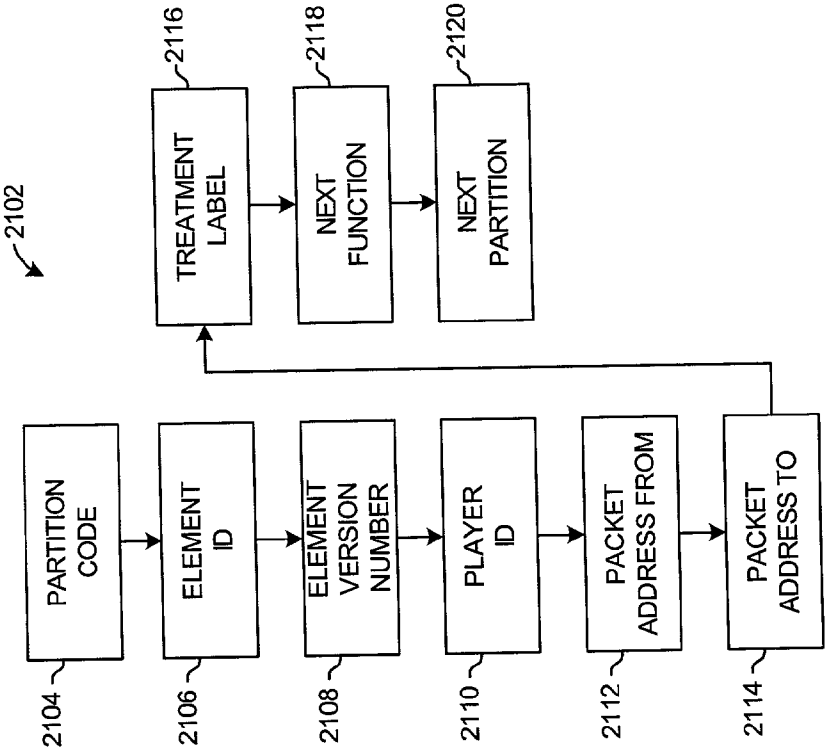

2102
PARTITION CODE
2104
ELEMENT ID
2106
ELEMENT VERSION NUMBER
2108
PLAYER ID
2110
PACKET ADDRESS FROM
2112
PACKET ADDRESS TO
2114
TREATMENT LABEL
2116
NEXT FUNCTION
2118
NEXT PARTITION
2120

FIG. 21

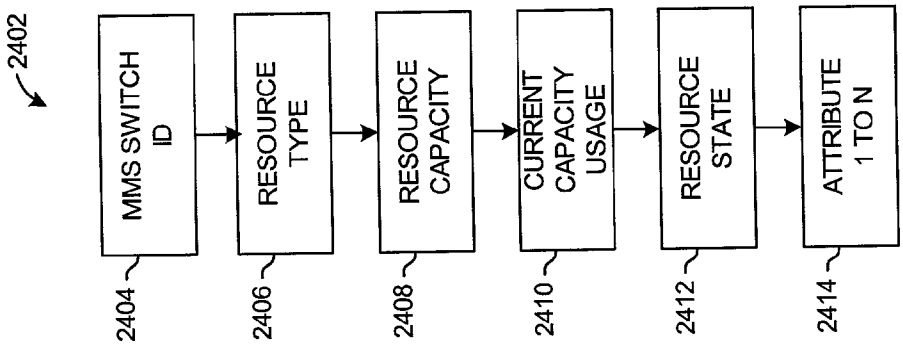

2402
MMS SWITCH ID
2404
RESOURCE TYPE
2406
RESOURCE CAPACITY
2408
CURRENT CAPACITY USAGE
2410
RESOURCE STATE
2412
ATTRIBUTE 1 TO N
2414

FIG. 24

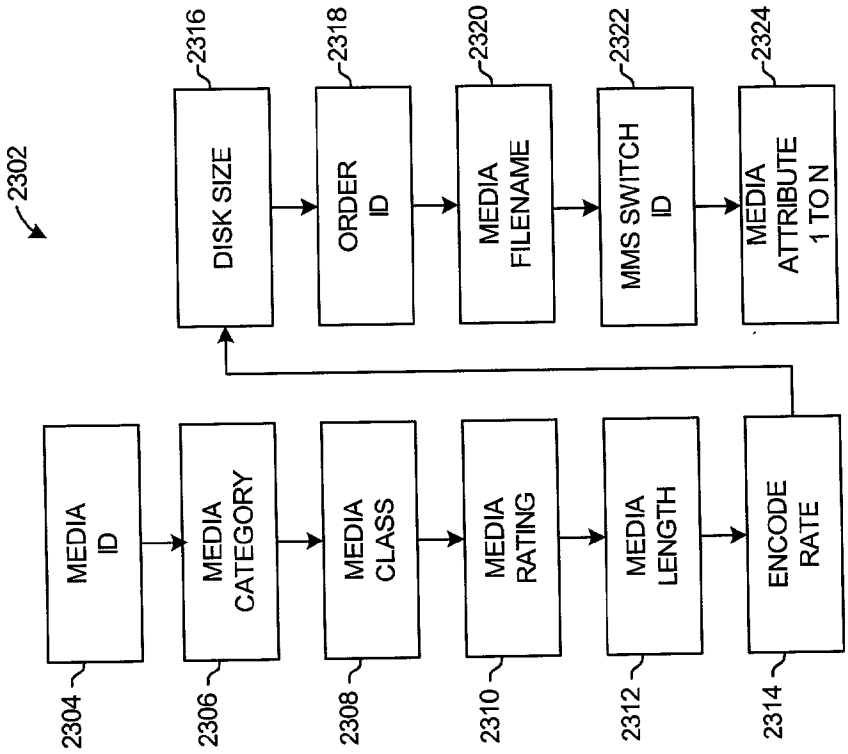

2302
MEDIA ID
2304
MEDIA CATEGORY
2306
MEDIA CLASS
2308
MEDIA RATING
2310
MEDIA LENGTH
2312
ENCODE RATE
2314
DISK SIZE
2316
ORDER ID
2318
MEDIA FILENAME
2320
MMS SWITCH ID
2322
MEDIA ATTRIBUTE 1 TO N
2324

FIG. 23

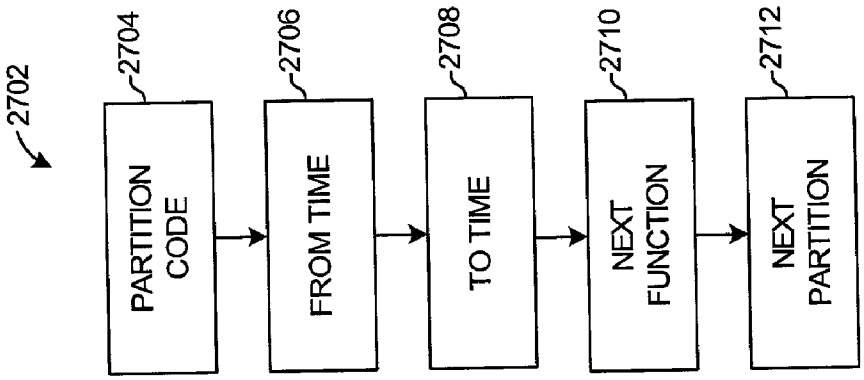


FIG. 27

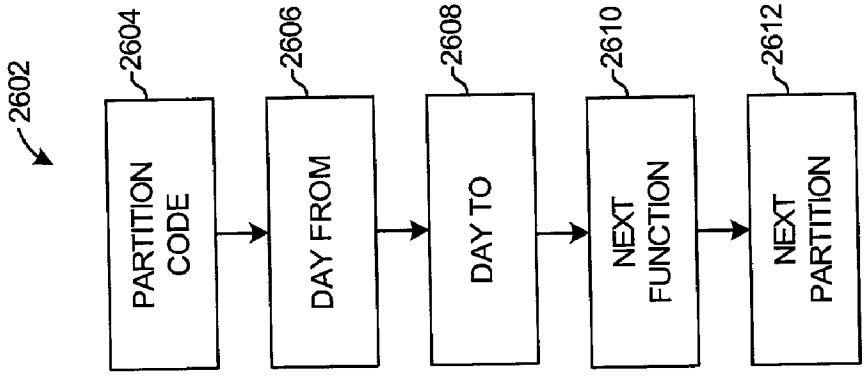


FIG. 26

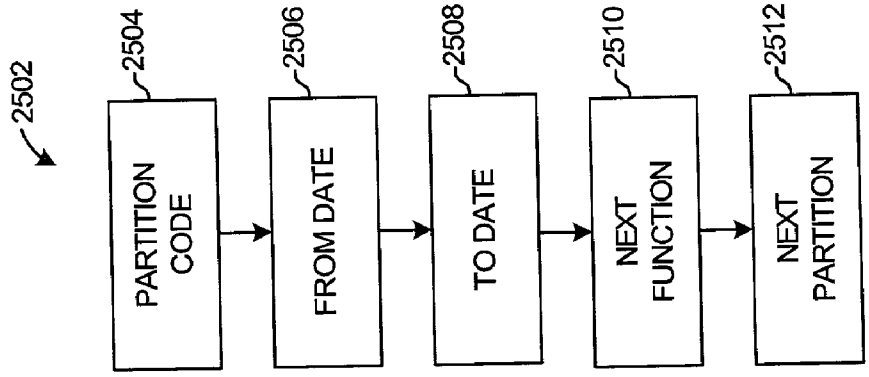


FIG. 25

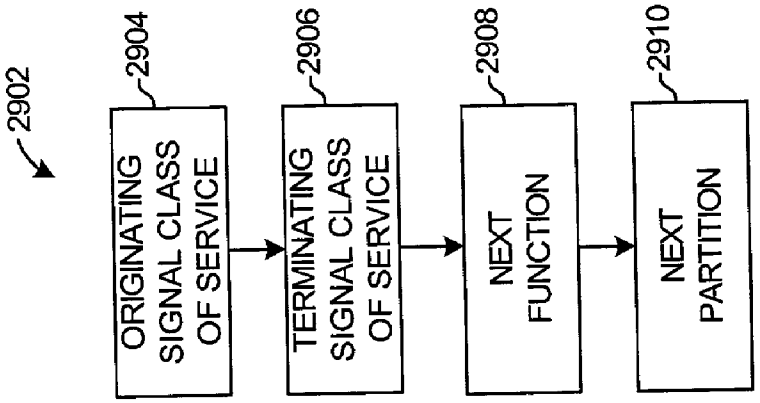

2902
2904
ORIGINATING SIGNAL CLASS OF SERVICE
2906
TERMINATING SIGNAL CLASS OF SERVICE
2908
NEXT FUNCTION
2910
NEXT PARTITION

FIG. 29

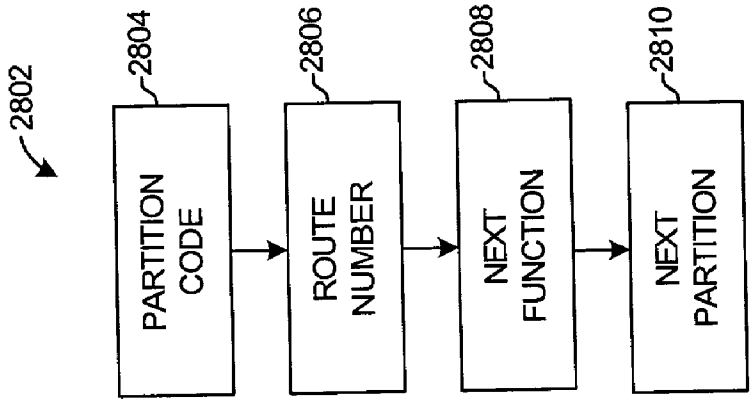

2802
2804
PARTITION CODE
2806
ROUTE NUMBER
2808
NEXT FUNCTION
2810
NEXT PARTITION

FIG. 28

SYSTEM AND METHOD FOR ROUTING MEDIA

RELATED APPLICATIONS

[0001] The present application is a continuation-in-part of U.S. patent application Ser. No. 09/838,993, filed Apr. 20, 2001, and entitled System and Method for Streaming Media, which is a continuation-in-part of U.S. patent application Ser. No. 09/766,519, filed Jan. 19, 2001, and entitled System and Method for Streaming Media, and takes priority to U.S. patent application Ser. No. 60/263,044, filed Jan. 19, 2001, entitled Media Routing Algorithm, the contents of which all are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention is related to the fields of management and administration of media streaming.

BACKGROUND OF THE INVENTION

[0003] Real time transport of audio, video, and other data commonly referred to as "media" may be manipulated and rendered using computers and/or digital appliances, such as a set top box. A digital appliance is a product that uses computer based technology and/or a telecommunication network or other packet based network to access, retrieve, interact with, report, and/or handle media or other information.

[0004] As computers and computer based appliances gain popularity, the demand for digital media streaming services also increases. This occurs, for example, because digital media streaming can be used to create enhanced consumer and business services. For example, a manufacturer of a refrigerator may install a digital appliance that connects the refrigerator's digital appliance to the Internet. A consumer can use the refrigerator's digital appliance to receive digital audio/video explaining how to prepare a favorite recipe.

[0005] The digital appliances and other computers can use real time media streaming services to render media while it is streamed from the media's server computer. Real time media streaming often is preferred over pure downloading since media streaming permits a consumer to view video and/or hear audio shortly after it is requested instead of waiting for a delayed download of the complete media and a subsequent playing of the media by the digital appliance.

[0006] Real time media streaming is difficult to implement on diverse networks, such as the Internet, corporate private networks, corporate intranets, and other packet based networking solutions. This is because real-time media applications typically are resource intensive and lack sufficient state control models to ensure proper quality of service.

[0007] Enhanced media streaming services generally compound the difficulties because multiple digital media streams are transmitted for enhanced services instead of a single digital media stream, such as for non-enhanced services. In the instances of enhanced services, current technologies treat each digital media stream as an individual session with little or no association to the viewer. Moreover, existing digital media streaming devices focus on the technical transmission and delivery of media, and place little control over the viewer management and media content management. Finally, the current streaming video networks lack sufficient notions of network-wide and multi-level resource allocation and control, trouble detection and automatic failover transparent to the viewer, and sophisticated anti-spoofing, denial of service prevention, and unauthorized access prevention techniques.

SUMMARY OF THE INVENTION

[0008] In one aspect, the present invention is directed to a method for routing media comprising receiving a request for media and determining a program in which the requested media is identified. A presentation having a presentation identification is created based on the program. A reservation comprising a reservation identification and the presentation is generated. A play script comprising the reservation identification and at least one media identification for the requested media is generated. The reservation, the reservation identification, and the media identification are received at a routing processor. At the routing processor, the reservation identification is validated with the reservation and a media switch configured to stream the media identified by the media identification is determined. An address for the media switch is generated upon validating the reservation identification and determining the media switch. The media identified by the media identification is streamed from the media switch upon a session being initiated at the address.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1** is a block diagram of a streaming system in accordance with an embodiment of the present invention.

[0010] **FIG. 2** is a block diagram of a reservation system in accordance with an embodiment of the present invention.

[0011] **FIG. 3** is a block diagram of a name routing processor in accordance with an embodiment of the present invention.

[0012] **FIG. 4** is a block diagram of a control manager for a name routing processor in accordance with an embodiment of the present invention.

[0013] **FIG. 5** is a block diagram of the name resolution system for a name routing processor system in accordance with an embodiment of the present invention.

[0014] **FIG. 6** is a block diagram of the routing engine for a name routing processor in accordance with an embodiment of the present invention.

[0015] **FIG. 7** is a block diagram of the switch manager for a name routing processor in accordance with an embodiment of the present invention.

[0016] **FIG. 8** is a block diagram of a routing data structure used in a name routing processor in accordance with an embodiment of the present invention.

[0017] **FIG. 9** is a block diagram of a stream control table in accordance with an embodiment of the present invention.

[0018] **FIG. 10** is a block diagram of a network status table in accordance with an embodiment of the present invention.

[0019] **FIG. 11** is a table diagram of treatment table access points in accordance with an embodiment of the present invention.

[0020] **FIG. 12** is a block diagram of an active reservation table in accordance with an embodiment of the present invention.

[0021] **FIG. 13** is a block diagram of a network access table in accordance with an embodiment of the present invention.

[0022] **FIG. 14** is a block diagram of a signal mapping table in accordance with an embodiment of the present invention.

[0023] **FIG. 15** is a block diagram of a signal access point table in accordance with an embodiment of the present invention.

[0024] **FIG. 16** is a block diagram of a stream percent skipped table in accordance with an embodiment of the present invention.

[0025] **FIG. 17** is a block diagram of a stream rate table in accordance with an embodiment of the present invention.

[0026] **FIG. 18** is a block diagram of a treatment table in accordance with an embodiment of the present invention.

[0027] **FIG. 19** is a block diagram of a referring host table in accordance with an embodiment of the present invention.

[0028] **FIG. 20** is a block diagram of an exception table in accordance with an embodiment of the present invention.

[0029] **FIG. 21** is a block diagram of a personal identification number table in accordance with an embodiment of the present invention.

[0030] **FIG. 22** is a block diagram of a content screening table in accordance with an embodiment of the present invention.

[0031] **FIG. 23** is a block diagram of a content location table in accordance with an embodiment of the present invention.

[0032] **FIG. 24** is a block diagram of a network status table in accordance with an embodiment of the present invention.

[0033] **FIG. 25** is a block diagram of a day of year table in accordance with an embodiment of the present invention.

[0034] **FIG. 26** is a block diagram of a day of week table in accordance with an embodiment of the present invention.

[0035] **FIG. 27** is a block diagram of a time of day table in accordance with an embodiment of the present invention.

[0036] **FIG. 28** is a block diagram of a signal route choice table in accordance with an embodiment of the present invention.

[0037] **FIG. 29** is a block diagram of a class of service table in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

[0038] Media streaming, both live and on-demand, also provides an environment for viewers to experience multimedia by establishing a logical, one-to-one connection between the media and the audience (a "session"). Sessions enable a rich media, interactive experience and provide a foundation for a reliable streaming service platform. Media may include audio, video, images, moving text messages such as stock ticker tapes, and other data. Media may include one or more media clips or a part of a media clip. A session may include an internet protocol session, a broadband connection, or other session parameters. For simplicity, "session" may be used in some instances to mean only an internet protocol (IP) session, only a broadband connection, or both, depending on verbiage. In a different embodiment, more than one session can exist to a given audience member simultaneously. However, improved systems and methods are needed for implementing control features, such as real time routing of requests for media service, dynamic matching of content to the viewer, and enforcement of media content owners' rights and distribution criteria.

[0039] In one embodiment, the present invention is directed to an overall integrated and distributed media routing algorithm (MRA) that correlates the diverse needs of a media content owner and/or an agent ("content owner" or "media owner"), a packet distribution network owner, one or more viewers, and the health of a network traversed in the media delivery process. The MRA enables the content owner to control who views its content and what content is actually streamed for viewing. In another embodiment, the MRA enables a network owner to efficiently control the network and its devices to maximize quality of service while enabling the devices to respond automatically and transparently to viewer problems.

[0040] In another embodiment, the present invention enables content owners to create viewing programs that can be targeted at viewers based on the amount of information known about an individual viewer. The content owner may create a program having one or more media items. A viewer may desire to receive one or more of the media identified in the program. The viewing programs and viewer information may be used to dynamically create a presentation tailored for that viewer. For example, the presentation may contain a list of media from the program, possibly with or without one or more other media items, that is to be streamed to the viewer and that is combined to make a single viewing experience. In another example, a movie trailer followed by a full-length movie may combine two different media to make a simple program.

[0041] A program, however, can contain media selectors that identify a set of media. A media selector is used in the presentation creation process when the content owner desires to target different media at an audience, based on audience characteristics, and to create different presentations for different groups of audiences. Examples of audience characteristics may include the individual's sex, age, hobbies, historical viewing habits, or other data the viewer would provide.

[0042] In another embodiment, systems and methods of the present invention control a state model, such as a basic streaming state model (BSSM), for streaming media through enhanced communications between communication devices coupled over disparate packet networks, such as the Internet, intranets, virtual private networks, cable systems, frame relay networks, asynchronous transfer mode (ATM) networks, satellite networks, and/or any combination of interconnected, data communication networks.

[0043] The state model data identifies a viewer using a reservation, identifies the switch or switches from which

media is streamed, the media that is streamed, the duration the media is streamed, and other state changes in the streaming, such as whether a stream is paused, canceled, forwarded, or reversed. If a presentation is streamed, the state model data identifies the presentation and the media in the presentation. The state model data includes stream state changes, viewing session state changes, device mode changes from a switch or signaling routing processor and error and alarm conditions for any switch, signaling routing processor, management system, service routing processor, or other communication device in the streaming system. A state model is kept for each NRP and each MMS as described more fully below. Multiple levels of the BSSM enable event generation, tracking information, and storing information for transitions within a presentation from its initial generation to its completion or termination.

[**0044**] **FIG. 1** depicts an exemplary embodiment of a streaming system of the present invention. The streaming system **102** of **FIG. 1** comprises a service processor, a management system, a reservation system, a routing processor, and a media switch, such as an enhanced service routing processor (ESRP) **104**, a real time switch management system (RTSMS) **106**, a reservation system **108**, a name routing processor (NRP) **110**, and a managed media switch (MMS) **112**, respectively, each communicating through a packet network **114**. A portal **116** may communicate with the reservation system **108** of the RTSMS **106** via the packet network **114**, and one or more viewers **118** and **120** may communicate with the NRP **110**, the MMS **112**, and/or the portal **116** via a packet network **122**.

[**0045**] The streaming system **102** has a network owner that controls the streaming system and controls what entities use network operators to perform work on the streaming system. For example, a network provider may build a streaming system and sell streaming services to a publishing customer. The network provider is the network owner. The network owner and the publishing customer sell a product, i.e. media, to customers via a website or a contract with a web portal using the streaming system.

[**0046**] In some instances, the publishing customer also may be the network provider. This may occur, for example, where a corporate enterprise is streaming media to its employees or customers directly. Other examples exist.

[**0047**] Identifying the network owner of the streaming system **102** or another network enables the streaming system to track legal, financial, contractual, and service auditing issues associated with crossing signaling and/or other communications, such as media, from one network to another. For example, a first streaming network and a second streaming network may agree to inter-connect their networks to build a large viewing audience. This may occur, for example, if a media owner desires as many viewers as possible to see its media, and the media owner is less concerned with what network owner the viewer uses to receive the media.

[**0048**] In this example, the first network owner and the second network owner may agree on a revenue sharing, based on what the viewer receives, and the revenue generated from that viewer receiving the media may be split according to the revenue sharing agreement. In this example, the first network owner and the second network owner cannot control each other's service, network distribution rules, and/or other routing or operational processes. Thus, the first network owner and the second network owner are required to agree on the revenue sharing and how their networks will interconnect in order to provide distribution of media and receive revenue based on that distribution.

[**0049**] The streaming system **102** also enables a media owner to identify a program or a portion of a program that is made available for streaming. The program typically identifies the sequencing, whether sequential, parallel, timing, or other, in which media clips are to be streamed, where the media clips are to be placed, and, in some instance, to whom the media clips can be transmitted.

[**0050**] A program may have a list of media, an order, and/or other media rules. The program may also have program creation rules and/or program routing rules. Network distribution rules generated by the owner and/or operator of the streaming system **102** (hereafter, "network owner") or one or more other packet network suppliers also may be associated with the program. The network distribution rules, the media list, the order, and any other special media rules, such as program creation rules and/or program routing rules, govern the transmission of the media for a program.

[**0051**] Program creation rules are defined by a media owner. Program creation rules may identify if a program can be created from one or more other programs and how the one or more other programs may be combined. For example, a program may have program creation rules identifying which individuals are allowed to alter the program rules, listings of identifications of other media owners that have agreed to share media, and other administrative data.

[**0052**] Program routing rules are defined by the media owner. Program routing rules define where and/or how media may be routed. Program routing rules may be superceded by network distribution rules.

[**0053**] Network distribution rules are defined by the network owner and/or one or more other packet network suppliers. Network distribution rules are used to manage capacity, load, bandwidth, switch resources, and/or other events and/or resources, including resources for sessions and connections. For example, a program can be configured to stream ten minutes of a sitcom based media, insert an advertisement, and then return to the sitcom based media. The publisher may define the program rules to transmit greater than 30 frames per second, but the network distribution rules may be restricted to 30 viewing frames per second by the network supplier. The program would not be streamed since it violated the network distribution rules. The network distribution rules may manage and/or identify resources needed to transfer media between the streaming system **102** and one or more other packet networks.

[**0054**] The media list may include one or more different media references identifying one or more media clips and one or more different types of media. For example, the media list may contain media names or other media references. The media list may include references to one or more of recorded media, live media, a media alias, a media selector including an advertising selector, and/or other media.

[**0055**] Recorded media typically directly references a media file name. Live media typically has connection

instructions to a live ingress switch. A media alias typically references one or more other media clips. A media selector typically contains rules identifying how to select one or more of several possible media clips. An advertising selector is a type of media selector used to select an advertising media clip.

[0056] Each type of media may contain one or more of the above-stated identifiers or other identifiers. Additionally, each media clip may have a title assigned to it by the media owner.

[0057] An order is a request by a paying or collecting entity for the network owner to provide some sort of streaming or related service, such as storage. Typically, the order is made by a paying or collecting entity, such as a publisher, another streaming network service provider, a viewer, a private company, an advertising service, or another entity that desires to enter into a contract with the network owner for streaming service or related services, such as real time usage reporting.

[0058] An order may be associated between multiple entities. For example, a publisher may be primarily responsible for payment to the network owner for streaming services, but an advertiser has agreed to pay the network owner based upon the number of people viewing their ads. Thus, two paying entities and one collecting entity are associated with the order. In this example, an entity can be both a paying entity and a collecting entity. For example, a publisher can pay for streaming services and also collect a portion of the fee generated by streaming media.

[0059] An order can contain several order components, such as service billing rules, storage billing rules, collection rules, viewing rules, settlement rules, and other fiscally important information. This fiscal information allows a network owner to generate an invoice for streaming services rendered. The associated invoiced revenue may be collected based on the fiscal information, and other collection entities, such as publishers and other networks, may be paid based on that fiscal information.

[0060] Service billing rules normally are related to making the media available for viewing. Multiple media items can be associated to a single service rule. Service rules allow the publisher to describe to the network owner how the media viewing will be paid. For example, pay-per view media may require the viewer to pay for the service. A fee for service may require the publisher to pay a fee based on the number of data bytes transmitted to all viewers for a defined period of time. An advertising revenue share may require the network owner to collect a percentage of the advertising revenue generated by the program being viewed. Other payment methods and combination of payments may be used.

[0061] An order also can contain storage rules for determining where the media or program will be located and the costs associated with the physical storage of the media. Storage rules allow the publisher to target media to MMS locations that they believe will provide the most streaming service. For example, advertising media that is localized to the mid-west of the United States of America could be located on only MMSs within that region. Storage rules can specify a single MMS device, an offline storage location that is not attached to any MMS, multiple MMS devices, all MMS devices, and other networks that can provide the same media, if needed. Storage rules also allow the network owner to bill for the amount of storage a publisher uses on a periodic basis, such as an average daily storage use. A storage order can have multiple media and programs attached to it.

[0062] An order may contain collection rules identifying which entity or entities are collecting a payment for services rendered. For example, a service rule that designates pay-per-view might require an immediate credit card payment by the viewer. The collection rule may identify the credit card collection agency, collection account, and other vital settlement data for the processing of the viewer's credit card. In another example, the viewer may select pay-per-view and simply be billed the amount on their monthly cable bill. Collection rules also apply to the invoicing of charges to corporate type accounts, such as how soon payment is due after the invoice is printed. Collection rules focus on receiving the payment portion of the transaction. Multiple collection rules may be applied to a single order.

[0063] An order may contain viewing rules for the media and/or programs that are attached to it. Viewing rules associated with an order allow the publisher to determine who sees the media or program based on the viewer's account status. For example, a viewing rule for a subscription based service in which a viewer is 90 days or more behind in payments might block the service.

[0064] In another example, if a viewer selects a pay-per-view media item that requires a credit card payment, and the credit card collection agency returns a code declaring the card is over its limit, the viewing rule might block the service. Order viewing rules typically are associated to a credit rating or current collection status of an account for the person requesting to view the media or the publisher wishing to make the media available for distribution.

[0065] An order can contain settlement rules for determining how collections are divided and which entities participate in the settlement. For example, a program may be created by a publisher in which advertisers agree to pay the publisher and the network owner for targeting their advertising to a specific set of viewers. The viewer is allowed to view the program free of charge, except the viewer will receive advertisements. The settlement rules would describe the agreed upon advertising rates that will be applied on a per viewer basis, the percentage or fixed fee being supplied to the network owner for each viewer, and other settlement data.

[0066] There may be a many-to-many relationship between an order and a program. That is, one program or multiple programs may appear in a single service order, and a single program may appear in a one order or multiple orders. For example, in the former instance, an order may associate multiple programs that are the publisher's $4.99 pay-per-view programs for distribution in the United States. Whereas, in the latter instance for example, a single program may be associated with one order for pay-per-view customers and another order for subscribers.

[0067] In some embodiments, the program has a program identification. The program identification may be used to track use of the program, such as how many times the media for a program is streamed and the number of users receiving

that program. Additionally, the program identification may be used to track other attributes associated with the program, such as viewer attributes associated with the viewer receiving the media, streaming times, other media or programs streamed with a particular program, and/or other tracking purposes.

[**0068**] When a program and its order are complete, it may be published. Publishing is the act of making a program available on the streaming network **102** for distribution to one or more viewers via a switch, such as the MMS **110**.

[**0069**] After a program is published, a presentation may be generated based on the program. A presentation results from applying a viewer profile to a program, including the program's order and any other media rules, at the time a reservation is made for the program by the viewer. A viewer profile may be any set of attributes of interest for a viewer and their values. Thus, the presentation typically is customized for an individual viewing session, and the program and the viewer profile are what are used to generate the presentation.

[**0070**] The presentation may identify the media to be streamed to a viewer for the requested program and the resources needed to stream the media. The presentation also may include special instructions, such as special media sequencing instructions, late binding media instructions, and/or special routing instructions.

[**0071**] In one embodiment, the presentation contains one or more program identifications. The program identification may be used to track one or more programs identified for the presentation and/or other attributes for the viewer, the resources used for the presentation or its streaming, reporting associated with the program or other media or programs associated with the program, and/or other purposes. For example, a viewer may attempt to view multiple programs within a single reservation. However, a media owner for one of the programs may want reports identifying how many people received the program and the statistics for that streaming. Therefore, the program identification is used to provide tracking and reporting on the program level, as opposed to the reservation level. The program identification enables the streaming system **102** to track and report individual programs and their usage.

[**0072**] The presentation typically is transmitted to an NRP in a reservation along with the reservation identification. In some instances, the viewer profile and/or a reservation window may be included in the reservation. The reservation window is the starting time and the ending time for which a reservation and the resources for a reservation are valid and available for a viewing session. Preferably, a viewing session should be started and completed within the reservation window. Although, enforcement may be configured as a matter of network owner policy.

[**0073**] At the time a reservation is made for the program by the viewer, a play script also is created. The play script contains a list of one or more media references for the presentation and a reservation identification. In one embodiment, the play script contains one or more universal resource locators (URLs), and each URL identities a media clip and contains the reservation identification.

[**0074**] The play script may be formatted according to the type of player the viewer is using and may contain information identifying how to contact a resource, such as the MMS **110** or a device on the MMS, to receive the media. In some instances, such as some configurations where the viewer is a set-top box, the device streaming the media to the set-top box may initiate the connection to the set-top box, and information identifying how to connect to the resource is not needed. The play script typically is transmitted to a viewer.

[**0075**] The ESRP **104** enables media owners to place media on the ESRP for distribution to various switches, such as to various multimedia switches in the streaming system **102**. The ESRP **104** allows each media owner to create a program for the media, including creating a list of media, with one or more different types of media or one or more different media clips and the media rules to determine the sequence in which the media clips are to be streamed, where the media clips are to be placed, and in some instances to whom the media clips can be transmitted.

[**0076**] The ESRP **104** also enables a media owner and/or a publishing agent of the owner (hereafter "media owner") to generate the settlement rules that define who will be billed or credited when media is transmitted to a viewer or another device and the terms of the bill or credit. For example, a media owner may have a contract with a service provider, and the service provider will share in the revenue generated by viewers viewing the content. Alternately, the media owner may have to pay the service provider for use of an amount of bandwidth when the media is transmitted. In addition, part of the media sent to a viewer may include advertisements, and the media owner can define a rule to bill the advertising entity a dollar amount each time the media is transmitted.

[**0077**] The ESRP **104** also enables a media owner to create special viewing rules and/or routing rules for the program. The viewing rules and/or routing rules may identify any restrictions or other customizations, such as geographic or age restrictions, preferred language, or substitutions on the streaming of the program. For example, if a football game is a program, the game may be blocked from a specific region when the streaming is free, but not blocked if the game is part of a subscription or pay-per-view service. In this instance, the media owner may generate two or more different orders for the same program, and a viewer **118** or **120** would be blocked or not blocked from the program depending on which order the viewer was attempting to use.

[**0078**] The ESRP **104** publishes programs when the programs and the orders for the programs are complete. Thus, when a program and its order are complete, the ESRP **104** may transmit the media identified in the program to one or more switches, such as the MMS **112**, according to one or more media rules so that the program is available to be streamed to a viewer. The ESRP **104** also publishes the program, including a program identification, a media list for the program, and the media rules for the program, to the RTSMS **106**.

[**0079**] One or more ESRP devices may exist in the streaming system **102**. One ESRP is depicted in **FIG. 1** for clarity.

[**0080**] The RTSMS **106** accepts programs and their respective orders from the ESRP **104** when the programs are published. The RTSMS **106** determines the switches or other communication devices on which the programs reside. The

RTSMS **106** receives the media list, the media rules, the program identification, and any associated orders for the program from the ESRP **104**.

[**0081**] The RTSMS **106** receives signaling from a viewer **118** or **120**. This signaling may be routed to the RTSMS **106** via a portal **116** or another type of communication device. The initial signaling from the viewer **118** or **120** typically is a request for a program or programs. However, a simple request for an individual media or list of media may be honored in some embodiments.

[**0082**] The RTSMS **106** processes the signaling to determine if the requested program is available (or the media can be found in, and an appropriate match for, a program) and if the program has restrictions applied by the media owner and/or network operator and locates an NRP **110** within the streaming system **102** that is capable of processing the viewer's request. The RTSMS **106** then generates a customized play script for the requested program to the viewer. The play script may include the requested media, such as one or more media clips, and additional media, such as one or more advertisements, either as media clips, banner advertisements, or other types of advertisements. The play script is formatted as the output of a presentation generator process and is formatted for the language/format of the viewer **118** or **120**. For example, a viewer **118** or **120** using the Real Network's Real Player may require a synchronized multimedia integrated language (SMIL) file based play scripts, and the play script would be formatted as such.

[**0083**] The RTSMS **106** builds a reservation for the viewer **118** or **120** for the customized play script and temporarily reserves the resources identified by the presentation generator process for use by the viewer **118** or **120**. The RTSMS **106** transmits the reservation along with its presentation to the selected NRP **110** and transmits the customized play script to the viewer **118** or **120**.

[**0084**] The reservation uniquely identifies the viewer **118** or **120** and the customized play script. In one embodiment, a separate URL identifies each name on a play script for a presentation, and the reservation has a unique reservation identification that is located in each URL. The URLs are transmitted to the viewer **118** or **120** using the play script, and the viewer can use the play script to initiate a session with a switch. A reservation is a feature that enables the streaming system **102** to reserve system resources, such as switches, processors, or media, either now or in the future, to ensure a quality media experience.

[**0085**] The reservation system **108** receives a request from the portal **116** on behalf of the viewer **118** or **120** for viewing a media and/or presentation. The reservation system can receive additional information from the RTSMS **106**, such as past history of the viewer **118** or **120** or products/services in which the viewer has used or participated. The incoming request can be tailored by the RTSMS **106** to append any available data it has on the viewer **118** or **120**. The incoming data is processed through the program rules to generate the presentation. For example, the viewer **118** or **120** may desire to view a training video for an investment. The RTSMS **106** may append the current financial value of the viewer **118** or **120** and use the media selectors in the presentation's supplemental programs for investment vehicles that are offered.

[**0086**] The reservation system **108** generates the reservation and forwards it to the NRP **110** along with log information. The reservation system **108** generates and maintains the unique identifiers for every request it receives. Requests that are not fully processed also are recorded and logged for record keeping purposes. The reservation system **108** enables the network owner to establish the time period in which a reservation will be valid for the viewer **118** or **120** to completely view the media.

[**0087**] The RTSMS **106** maintains historical, current, and future views of processing tables that reside in all NRPs in the streaming system **102**, including the NRP **110**. These tables and the associated data stored by the RTSMS **106** enable the NRPs to determine a switch or switches, such as the MMS **112**, that can provide the requested program to a viewer **118** and **120**.

[**0088**] The RTSMS **106** collects state model data, such as BSSM data, from all NRPs and switches in the streaming system **102**, including the NRP **110** and the MMS **112**. The state model data identifies a viewer using a reservation, identifies the switch or switches from which it is streamed, identifies the media that is streamed, the duration the media is streamed, and other state changes in the streaming, such as whether a stream is paused, canceled, forwarded, or reversed. If a presentation is streamed, the state model data identifies the presentation and the media in the presentation. The state model data includes stream state changes, viewing session state changes, device mode changes from the NRP **110** and the MMS **112**, and error and alarm conditions for any MMS, NRP, RTSMS, ESRP, or other communication devices in the streaming system **102**. A state model is kept for each NRP and each MMS as described more fully below.

[**0089**] The RTSMS **106** can be configured to dynamically select advertising or other content. For example, the RTSMS **106** may be configured for use by an investment management company that manages several different funds and has several different analysts associated with each fund. For example, a person using a viewer may have money in funds A and B but not C or D, and the total value of the viewer's ownership in funds A and B is between $100,000 and $200,000. The RTSMS **106** may use the rule set in the monthly fund program to dynamically place media clips that contain the A and B fund managers discussing recent performance, analysts discussing the outlook for the goals of the A and B funds, and advice customized for that investment level in the presentation. Whereas, if the person using the viewer has $50,000 in an IRA in fund C, the RTSMS **106** may use the rule set in the same monthly fund program to dynamically place media clips showing the C fund managers discussing recent performance, analysts discussing the outlook for the fund's goals, and a tax expert discussing the implications of IRA tax law changes that affect IRAs at that level in the presentation.

[**0090**] The ability to dynamically select content can result in a different cost basis for different presentations. For example, in the above examples, expenses of three dollars may be incurred for the A and B analysts' media clips, and revenue of two dollars may be incurred for the C analyst's media clip.

[**0091**] In one embodiment, the RTSMS **106** is configured to dynamically select content using statistical information. The RTSMS **106** also may be configured to bill or credit entities according to order rules and/or the statistical information.

[0092] Statistical identification is the determination of the value of one or more different possible attributes of a viewer. For example, statistical identification may be used to create a viewer profile, or attributes from an already created viewer profile may be used for a statistical identification. The identification of viewer could be, for example, that the viewer is within a geographic area, such as a zip code or an NPA-NXX, that the viewer is within an age group, such as 18-23 years, that the viewer can watch movies of a designated media rating, such as PG, PG-13, or Y-14, that the viewer is male or female, the viewer's marital status, what funds the viewer has invested in, what departments the viewer works for, and/or other personal data relevant to the publisher of the program.

[0093] In one embodiment, if the program requires statistical identification of the viewer, the RTSMS **106** may look up previously collected information about the viewer. If no information exists, the RTSMS **106** may instruct the portal **116** to collect the required information or supply defaults if the information is not required. If the viewer does not supply the required information, the RTSMS **106** can be configured to reject the viewing request.

[0094] The RTSMS **106** provides reporting capabilities. The reports may include near real-time reports of what media is streamed and the associated statistical information, including demographics, on the entire network. The RTSMS **106** may provide network management capabilities, including operational measurement collection, threshold alarming, and trend analysis.

[0095] The RTSMS **106** also collects logs and billing data from the ESRP **104**, the NRP **110**, and the MMS **112**. The billing data may include the order data and the reservation data and may include state model data. The logs are a record of the events that have occurred and are viewable and auditable. Logs are generated by many processes, such as one or more media servers on one or more stream casters of one or more MMSs, one or more NRPs, one or more MMSs, one or more portals, and one or more ESRPs.

[0096] The RTSMS **106** processes the logs, the billing data, and the state model data and creates a message sequence detail record (MSDR). The MSDR is a collated view of log and state model data for a reservation. The RTSMS **106** creates an MSDR for every reservation by obtaining information from the reservation order log, the MMS **112** logs, and the NRP **110**. This typically is accomplished using the reservation identification that is contained in every entry for log and billing data. The MSDR represents a billable event record that will be used for revenue settlement purposes.

[0097] The RTSMS **106** processes the MSDRs and creates bills in accordance with the media rules and orders identified in the programs. Logs, state model data, and billing data for a single viewer **118** or **120** may come from more than one NRP, more than one MMS, and more than one ESRP.

[0098] The RTSMS **106** collates all of this data into a single MSDR for a reservation identifying the viewer **118** or **120** using the reservation data and the state model data. By using reservation data for a viewer **118** or **120** and/or a program, the streaming system **102** is able to service a media request from more than one switch or more than one stream caster on a switch. Prior systems could not adequately use multiple switches to provide media programs to a single viewer and clearly identify billing data because the prior systems could not adequately track and collate billing information from multiple switches. Prior systems typically service a media request from a single media server in these instances.

[0099] The RTSMS **106** receives from the MMS **112** and any other switches streaming information blocks (SIBs) comprising signaling, event and billing information associated with each streaming session. The RTSMS **106** combines the information in the SIB with fixed attributes, such as a viewer identification associated with a reservation identification, a viewer profile, a viewer location, a media category being viewed, and other data to create the MSDR. The RTSMS **106** uses the reservation identification in the SIBs as the key to determining all SIBs for a presentation or a streaming event. The RTSMS **106** uses the reservation identification to collate all SIBs for that presentation or streaming event into the MSDR. The MSDR therefore represents the data used for billing records and reports for a presentation or other streaming event. The MSDR creates an auditable event record that is used for operational measurements and billing. The RTSMS **106** can use the MSDR with rules identified in an order to determine bills and credits to be appropriated to various entities.

[0100] The RTSMS **106** receives from the NRP **110** and the other routing processors pertinent NRP log records comprising reservation routing requests and their granting, refusal, transfers, and forwarding, including identification of switches streaming media and the associated session data. The RTSMS **106** stores the NRP log records and retrieves the NRP log records, such as if needed for auditing purposes.

[0101] The RTSMS **106** may be configured with a human machine interface (HMI) that enables a network operator to access the RTSMS or another communication device in the streaming system **102**. The network operator can use the HMI to load new software to, for example, the MMS **112**, to upgrade configurations, or to provide other maintenance, such as to execute functions specifying capacity to be used, to identify when switch components will be taken out of service for maintenance, to create new products or services for use by a media owner, and/or to issue test presentations to specific media servers on an MMS.

[0102] An RTSMS **106** may be a local or regional RTSMS. The RTSMS **106** of **FIG. 1** is depicted as a local RTSMS. One or more RTSMS devices may exist in the streaming system **102**. One RTSMS **106** is depicted in **FIG. 1** for clarity.

[0103] The NRP **110** receives a request from a viewer **118** and **120** and processes the request. The request contains the identification of the NRP to which it is sent, and the reservation identification generated by the RTSMS **106**. For example, the NRP **110** reservation may be an NRP host name or an NRP IP address, and the reservation identification may be a reservation number. The NRP **110** also receives the reservation from the RTSMS **106**.

[0104] The NRP **110** processes the request and compiles a list of switches that may be able to provide the requested media to the requesting viewer **118** or **120**. The NRP **110** identifies an ordered list of switches, and attempts to select a switch based on network distribution rules. For example,

the network supplier can choose to route on the best possible quality of service that can be provided to the viewer **118** or **120**, to route on geographic factors, the time of day, the day of the week, the day of the year, or the access provider, or to route on overall network conditions.

[**0105**] The NRP **110** communicates with the switches to determine which switch, if any, can provide the requested media. For example, the NRP **110** may start with the best identified switch and, if not available, communicate with the next-best identified switch. The NRP **110** transmits to the viewer **118** or **120** an address, such as an IP address, of the switch that can provide the requested media. In one embodiment, if no switch can be found in the first pass, then a bumping algorithm can be invoked that may bump a current stream from a switch. The rules for bumping can be established by the network operator, for example, according to service agreements with publishers.

[**0106**] In one embodiment, a request is sent from the viewer **118** or **120** to the NRP **110** for each media clip on the play script. Thus, the NRP **110** must determine a switch that can stream the particular media clip of the play script to the viewer **118** or **120** separately for each media clip on the play script. Each time the NRP **110** determines the switch that can provide the media clip, the NRP transmits an IP address of the switch or a communication device, such as a stream caster on the switch, to the viewer **118** or **120**.

[**0107**] For example, if a play script identifies two media clips, the viewer **118** or **120** transmits a media locator request to the NRP **110** for the first media clip. The NRP **110** determines a switch that can provide the first media clip and transmits an IP address of that switch to the viewer **118** or **120**. After the viewer **118** or **120** receives the first media clip in a session with that switch, the viewer could send another media locator request to the NRP **110** for the second media clip. The NRP **110** determines a switch that can provide the second media clip and transmits an IP address of that switch to the viewer **118** or **120**. The viewer **118** or **120** then receives the second media clip in a session with that switch.

[**0108**] The switch that streams the first media clip may be the same as or different from the switch that streams the second media clip. Also, multiple devices on one switch, such as two different stream casters on a switch, each may stream one of the media clips, or one device on the switch may stream both media clips.

[**0109**] In another embodiment, the NRP **110** can be configured to determine a switch that can provide all media clips on a play script. In this embodiment, a single determination is completed by the NRP **110** in which the NRP locates a single switch that can stream all media clips on the play script to the viewer **118** or **120**.

[**0110**] The NRP **110** receives and processes signaling from each MMS and each other switch before, during, and after media is streamed. If a switch or part of a switch fails or can no longer maintain stream quality during a media streaming, the switch may notify the NRP **110**, and the NRP may determine a different, second switch that can provide the requested media. The NRP **110** then may direct the failing switch to route the streaming session to the second switch.

[**0111**] The NRP **110** initiates a state model for each viewer and each streamed media. The state model comprises a view of an entire media streaming event to a viewer **118** or **120**, including which switch or switches streamed media to the viewer, the time each media request is sent to each switch, any alarm or error events for a switch, such as alarms or events that may require another switch to provide the requested media, and transfers or re-connections to another switch to provide the requested media. The state model may include an identification of devices within the switch that provide the requested media to the viewer **118** or **120**, such as which stream caster or stream casters within an MMS **112** stream media to the viewer.

[**0112**] The state model in the NRP **110** includes a switch identification and the major states of a session or a connection, sometimes referred to as persistent states. Major states may include the reservation acceptance, an initiation of a session or connection, a termination of a session or connection, and other persistent states. The state changes may be received when setup or teardown messages are received by the MMS **112** and at other states. Each state change preferably is identified with the reservation identification.

[**0113**] The NRP **110** transmits an NRP log to the RTSMS **106** when the media for a presentation has been streamed to a viewer **118** or **120**, if an error occurs during a streaming session, and periodically during a streaming session. The period during the streaming session is configurable. In one embodiment, the period is every five minutes. Another period or default mechanism may be used, such as the occurrence of an event.

[**0114**] The NRP **110** may use the domain name server (DNS) protocol to receive a media locator request from the viewer **118** and **120** and to return an IP address of the stream caster in the MMS to which the viewer will connect for a session. Other protocols, such as session initiation protocol (SIP) or H.323, may be used.

[**0115**] One or more NRP devices may exist in the streaming system **102**. One NRP is depicted in **FIG. 1** for clarity.

[**0116**] The MMS **112** streams media to a viewer **118** or **120**. The MMS **112** has communication devices, such as one or more stream casters and one or more media servers, that provide requested media to a viewer **118** or **120**. The MMS **112** monitors the communication devices, such as one or more stream casters and one or more media servers, within the MMS so that the MMS can determine if it can provide a requested media.

[**0117**] The MMS **112** processes signaling from the NRP **110** and returns signaling to the NRP **110**. The MMS **112** receives signaling messages inquiring if the MMS can stream media to a viewer **118** or **120**. The MMS **112** processes that inquiry, determines if it has the resources, such as a stream caster type, network bandwidth, disk space, and a media server, to stream the media, and responds with a message to the NRP **110** accepting or denying the inquiry.

[**0118**] The MMS **112** receives reservation data from the NRP **110** for a media clip in a presentation. The MMS **112** may be configured to receive reservation data from the NRP **110** and a reservation identification from the viewer **118** or **120**. In that instance, the MMS **112** may authenticate the reservation identification using the reservation data from the NRP **110** to determine if the reservation identification is valid. In one embodiment, if the MMS **112** receives the reservation identification for the presentation from the

viewer **118** or **120** within a configurable period of time, and the reservation identification is valid when compared to the reservation data from the NRP **110**, the MMS **112** will stream the media to the viewer. In another embodiment, if the viewer **118** or **120** does not transmit the valid reservation identification to the MMS **112** for that presentation, fails authentication, or if the viewer transmits the correct reservation identification but not within the configurable period of time, the MMS will not stream the media to the viewer. In that instance, the MMS **112** will reject the request from the viewer **118** or **120**, and a session will not be initiated. The rejection is transmitted to the RTSMS **106**.

[**0119**] The MMS **112** may have a stream routing processor (SRP) or another type of processor or monitor that processes requests for media using the current state of the switch, such as available bandwidth, bandwidth necessary to provide a requested media, hardware and software version compatibility, disk space capacity, the current operating mode of the MMS, and/or other state factors. The MMS **112** monitors the delivery of each media stream and the status of switch systems. The MMS **112** may detect an imminent failure of one or more communication devices in the MMS if such a failure occurs, such as a failure of a stream caster's media server. The MMS **112** can transmit this data to the NRP **110**.

[**0120**] If a stream caster, a media server on the stream caster, or another communication device in the MMS **112** fails, the MMS can transparently transfer all streams in-progress to another stream caster or to another media server on the stream caster, if one is available. The transfer and the continued streaming of the media are not recognizable by the viewer **118** and **120**.

[**0121**] If a communication device on the MMS **112** fails and another is not available on that MMS, the MMS notifies the NRP **110** and the RTSMS **106**. In response, the MMS **112** will receive and process from the NRP **110** a message instructing the MMS to route the stream to another MMS. The MMS **112** then will route the stream to the identified MMS. The transfer and the continued streaming of the media are transparent to the viewer **118** and **120**.

[**0122**] The MMS **112** has a state model in which the MMS stores information and state changes for a viewing session of a presentation. The MMS **112** stores and reports each state change at the appropriate level. For example, the state model stores information and state changes for the initiation of a session, the termination of a session, and viewing events. Viewing events are events triggered by a viewer that affect the media streaming of the presentation. Viewing events may be, for example, a play, a pause, a stop, a forward, a cancel, a complete, or a rewind.

[**0123**] If the MMS **112** transfers a stream to a different stream caster or media server within the MMS, that event is noted in the state model, and the state model stores the information and state changes for the new stream caster or media server. If the MMS **112** transfers a stream to a different MMS, that event is noted in the state model.

[**0124**] The MMS **112** transmits to the RTSMS **106** stream information blocks (SIBs) for each stream session event and for each viewing session event. The SIB comprises information associated with the streaming session from the MMS **112** to the viewer **118** or **120**, including the reservation identification, an identification of the MMS or other switch, the stream caster and media server used, the media streamed, the presentation identification, the packet data path for each session, the equipment used for the streaming, and/or viewing events, such as a pause or rewind. One or more of the previous items may be used or not used in the SIB. If more than one stream caster or media server on one or more stream casters is used, that information also may be specified in an SIB.

[**0125**] An SIB is created when a viewing session is initiated, when a viewing session is terminated, when new media is presented, during a streaming session at configurable periods, and/or when other viewing events occur, such as a pause, stop, rewind, forward, or error. The SIBs are subsequently transmitted. In one embodiment, the period is configured at five minutes. Other periods, different periods, or defaults, such as an event, can be used.

[**0126**] One or more MMS devices may exist in the streaming system **102**. One MMS **112** is depicted in **FIG. 1** for clarity.

[**0127**] The packet networks **114** and **122** each are a communication network capable of transmitting data, such as signaling or media streaming, to or from a communication device in the streaming system **102**, such as to or from the ESRP **104**, the RTSMS **106**, the NRP **110**, the MMS **112**, the portal **116**, and/or the viewers **118** and/or **120**. The packet networks **114** and **122** may be the Internet, an intranet, a virtual private network, a cable system, a frame relay network, an ATM network, a satellite network, and/or other packet based networking solutions. In one embodiment, the packet network **114** is a private network accessible by the ESRP **104**, the RTSMS **106**, the NRP **110**, the MMS **112**, and an authorized portal **116**. In another embodiment, the packet network **122** is a public network.

[**0128**] The portal **116** is a processor, such as a server, configured to communicate with a viewer **118** or **120**. The portal **116** manages communications between the viewer **118** or **120** and the RTSMS **106**. For example, the portal **116** may transmit viewer media selections to the RTSMS **106** and may transmit reservation data originating from the RTSMS to the viewer **118** or **120**. The portal **116** may be a web-based processor, a set top processor, or another type of processor.

[**0129**] The viewer **118** or **120** may use the hypertext mark-up language (HTML) IP protocol via IP sessions using a web browser that can be serviced by a web-based server. The viewer **118** or **120** also may use broadband protocols via a broadband connection using a set top box appliance communicating with a set top server. A set top server can process various protocols, including session initiation protocol (SIP), which is an International Telecommunications Union (ITU) H.323 series protocol. The portal **116** of **FIG. 1** is authorized to transmit messages to the RTSMS **106**.

[**0130**] The viewers **118** and **120** are any communication device capable of transmitting and/or receiving signaling and/or media. The viewers **118** and **120** may be broadband based viewers or narrowband based viewers. For example, the viewers **118** and **120** may have a browser configured to communicate using a web based protocol such as hypertext transfer protocol (HTTP). Also, the viewers **118** and **120** may have a media player configured to play media that is streamed to the viewers. In addition, the viewers **118** and **120** may have a set top box or another digital appliance

configured to play media streamed from a cable television provider, a digital satellite provider, or another type of provider.

[0131] In some embodiments, the NRP **110** requests the MMS **112** to provide a media clip. In this embodiment, if the MMS **112** can provide the requested media clip, the MMS responds to the NRP **110** that it can provide the requested media clip. The NRP **110** transmits a message to the viewer **118** or **120** identifying the MMS **112** as providing the media clip. The viewer **118** or **120** initiates a session or a connection to the MMS **112**, and the MMS provides the requested media clip.

[0132] In other embodiments, the NRP **110** requests the MMS **112** to provide multiple media clips. In this embodiment, if the MMS **112** can provide the requested media clips, the MMS responds to the NRP **110** that it can provide the requested media clips. The NRP **110** transmits a message to the viewer **118** or **120** identifying the MMS **112** as providing the media clips. The viewer **118** or **120** initiates a session or a connection to the MMS **112**, and the MMS provides all of the requested media clips without further action from the NRP **110**. In this embodiment, in one instance, the viewer **118** or **120** initiates a single session or connection with a single setup message, and the MMS **112** streams all requested media clips before the session or connection is terminated. In another instance, the viewer **118** or **120** transmits a separate setup message and teardown message for each media clip, and the MMS **112** stops streaming media after the last requested media clip is streamed.

[0133] In other embodiments, the NRP **110** requests the MMS **112** to provide multiple media clips. In this embodiment, if the MMS **112** can provide the requested media clips, the MMS responds to the NRP **110** that it can provide the requested media clips. The NRP **110** transmits a message to the viewer **118** or **120** identifying the MMS **112** as providing the media clips. The viewer **118** or **120** initiates a session or a connection to the MMS **112**, and the MMS provides all of the requested media clips. However, after each media clip is streamed, the viewer **118** or **120** communicates with the NRP **110** to receive authorization to initiate a session with the MMS **112**. The NRP **110** communicates with the MMS **112** to confirm that the MMS **112** can provide the next media clip. The MMS **112** acknowledges to the NRP **110** that it can provide the next media clip, and the NRP acknowledges to the viewer **118** or **120** that the MMS **112** can provide the next media clip. The viewer **118** or **120** then transmits another setup message to the MMS **112** to obtain the next media clip.

[0134] In some embodiments, the NRP **110** requests the MMS **112** to provide a presentation. In this embodiment, if the MMS **112** can provide the requested presentation, the MMS responds to the NRP **110** that it can provide the requested presentation. The NRP **110** transmits a message to the viewer **118** or **120** identifying the MMS **112** as providing the presentation. The viewer **118** or **120** initiates a session or a connection to the MMS **112**, and the MMS provides the requested presentation.

[0135] In some instances in this embodiment, the viewer **118** or **120** transmits a setup message for each media identified in the presentation play script, receives the media, and tears down the session or connection for that media. The viewer **118** or **120** then immediately transmits another setup message to the MMS **112** to get the next media on the play script. The viewer **118** or **120** receives the media and tears down the session or connection. This process continues until the viewer **118** or **120** has received all media on the play script. In other instances in this embodiment, the viewer **118** or **120** transmits a setup message to the MMS **112**, receives the media, transmits a teardown message to the MMS, and communicates with the NRP **110** prior to transmitting another setup message to the MMS to confirm that the MMS will provide the next media clip on the play script.

[0136] The examples for the Figures below may reference one or more of a publication by an owner, a distribution by the ESRP **104**, a request and/or selection by a viewer **118** or **120** processing a reservation request by the RTSMS **106**, a reservation made by the reservation system **108**, communication between the RTSMS and the NRP **110**, a request from the NRP to an MMS, an acknowledgement or denial of service by an MMS, a communication from the NRP to the viewer denying or accepting a presentation streaming, and/or a subsequent session or connection from the viewer to the MMS. In the examples, reference to one or more of these actions may identify the embodiment as distributing, requesting, or providing media in accordance with a presentation embodiment or a media clip embodiment described above. However, this discussion uses a presentation embodiment and a media clip embodiment for clarity and conciseness. It should be appreciated that any of the above stated embodiments, or any combinations thereof, may be used.

[0137] The streaming system **102** of **FIG. 1** operates as follows. In a first example, a media owner generates a program with an order that is placed on the ESRP **104**. The program has multiple media items, including a media clip for a movie and an advertisement. The program includes a time restriction that it is not to be played between the hours of 7:00 p.m. and 9:00 p.m. Pacific Time. The program further includes a geographic restriction requiring the program to be placed on a switch in the western region of the United States, including California.

[0138] The order for the program includes billing information, such as the media owner is to be credited with 80% of the revenue generated from the program, and the network owner is to be credited with the remaining 20%. The media owner publishes the program with the respective order to the ESRP **104**.

[0139] The ESRP **104** processes the program with its respective media rules and order. The ESRP **104** distributes the program to multiple switches in the western United States, including California. The ESRP **104** also transmits to the RTSMS **106** the publication data, including an identification of the media clips in the program, the media rules, and the order.

[0140] A viewer **118** selects an option to obtain one or more programs which, for example, contain movie media clips. In this example, the option is a link on the portal **116**. When the link is selected, the portal **116** calls the reservation system **108** on the RTSMS **106**.

[0141] The reservation system **108** is notified that the viewer **118** requested access to the program. The reservation system **108** determines that the program is active within the network. The order may request additional viewer billing information, such as a credit card for a pay-per-view event

or a subscription password to be supplied for billing authorization. The reservation system **108** determines if the program contains media rules that require a statistical identification of the viewer. If required by the media rules, the reservation system **108** collects the statistical information.

[**0142**] The reservation system **108** creates a customized presentation for the viewer based on the program, including the play script of the media clips and the media rules, if any. The reservation system **108** builds a reservation having the identification of the viewer **118** and the identification of an NRP **110** selected to identify a switch to provide the presentation. In this example, the NRP identification is the host name of the NRP **110**. The reservation also includes the presentation identification, including the customized play script of the presentation. The customized play script includes media selected based upon the statistical identification data, time of day, day of week, personal viewing preferences, or any other attributes that the publisher deems pertinent. In this example, the presentation includes a movie media clip and an advertisement.

[**0143**] The reservation system **108** transmits the reservation to the NRP **110**. In addition, the reservation system **108** transmits to the viewer **118** the play script with each entry on the play script having the host name of the NRP, the reservation identification, and the presentation identification.

[**0144**] The viewer **118** transmits a media locator request to the NRP **110**. The media locator request in this example comprises at least one name on the play script, the NRP host name, and the reservation identification.

[**0145**] The NRP **110** uses the received reservation identification to obtain the presentation identification and additional data about the reservation. The NRP **110** processes the media locator request and the reservation data to determine if an MMS within the streaming system **102** can service the request. The NRP **110** compiles a list of MMSs that have the program and that can provide the presentation according to the media rules. In this example, the NRP **110** determines, based on load balancing factors and network distribution rules, that the MMS **112** is the best selection to provide the presentation.

[**0146**] The NRP **110** communicates with the MMS **112** to determine if the MMS can provide the presentation. The MMS **112** responds that it can provide the presentation to the viewer **118**. In this example, the MMS **112** has a stream caster that can stream the presentation to the viewer **118**.

[**0147**] The NRP **110** transmits to the viewer **118** an IP address of a stream caster on the MMS **112**. In addition, the NRP **110** transmits the reservation data to the MMS **112**. Also, the NRP **110** saves information in a state model identifying the reservation identification, the presentation identification, that the MMS **112** will stream the presentation to the viewer **118**, and the time the MMS accepted the streaming request.

[**0148**] The viewer **118** receives the IP address and initiates a session with the MMS **112**. The MMS **112** streams the presentation to the viewer **118**, including the movie media clip and the advertisement. The MMS **112** retains information in a state model identifying the reservation identification, the presentation identification, the start and stop times of each media on the play script, and any viewing events, such as a pause, a forward, a reverse, or other events.

[**0149**] When each media on the play script has been streamed to the viewer **118**, the viewer initiates an end to the session. The MMS **112** stores information in its state model identifying the end of the session. The MMS **112** transmits its logs, SIB information, and state model information to the RTSMS **106**.

[**0150**] The MMS **112** notifies the NRP **110** that the presentation streaming is complete. The NRP **110** stores information in its state model identifying that the presentation streaming is complete and transmits the state model data to the RTSMS **106**.

[**0151**] The RTSMS **106** processes the logs, the SIB information, and any additional data that originated from state models from both the NRP **110** and the MMS **112**. The RTSMS **106** collates the data using the reservation identification to produce the MSDR data identifying billable events, including the presentation that was streamed to the viewer **118**, the amount of media streamed to the viewer, and the streaming time.

[**0152**] The RTSMS **106** applies the order rules to the MSDRs. In this example, the RTSMS **106** produces a financial settlement and report identifying a credit of 80% of the revenue generated by the presentation to the media owner and a credit of 20% of the revenue generated by the presentation to the network owner.

[**0153**] In another example, the viewer **120** requests media and receives a play script from the RTSMS **106** for viewing a presentation. The presentation has three media clips. In addition, the NRP **110** receives the corresponding reservation from the RTSMS **106**. In this example, the MMS **112** has two stream casters.

[**0154**] The viewer **120** transmits a request containing the reservation identification to the NRP **110**. The NRP **110** processes the request with the reservation received from the RTSMS **106** to compile a list of switches that can provide the requested presentation. The NRP **110** communicates with the MMS **112** to determine if the MMS can provide the presentation to the viewer **120**. The MMS **112** responds to the NRP **110** that it has a stream caster that can stream the presentation to the viewer **120**. The NRP **110** transmits an IP address of the first stream caster on the MMS **112** to the viewer **120**.

[**0155**] The viewer **120** initiates a session with the first stream caster on the MMS at the IP address provided by the NRP **110**. In addition, the MMS **112** notifies the NRP **110** that the streaming session has been initiated. The MMS **112** stores all information regarding the streaming and the state model.

[**0156**] The NRP **110** stores information in a state model identifying the MMS **112** as providing the presentation. This information is transmitted in an NRP event log to the RTSMS **106** as it occurs or at a specified configurable time. In this example, the NRP **110** transmits the NRP log to the RTSMS **106** every five minutes. In other examples, the NRP **110** can be configured to transmit the NRP log to the RTSMS when a session is initiated between a viewer and a particular switch and when that session is terminated. In addition, in

other examples the NRP **110** can be configured to transmit the NRP log at other configurable times or at different configurable events.

[**0157**] When the session is initiated between the viewer **120** and the MMS **112**, the MMS creates an SIB and subsequently transmits the SIB to the RTSMS **106**. In addition, while the media is streamed from the MMS **112** to the viewer **120**, an SIB is created and transmitted to the RTSMS **106** at a configurable time. In this example, the configurable time is every five minutes. In other examples, the time may be configured to different periods of duration. In addition, in this example, the MMS **112** transmits an SIB to the RTSMS **106** when viewing events occur, such as a stop, a pause, a forward, or a rewind. Also, when the presentation streaming is complete and the session is terminated, the MMS **112** transmits an SIB to the RTSMS **106**.

[**0158**] When the session is complete and terminated, the MMS **112** notifies the NRP **110**. The NRP **110** transmits a final NRP log to the RTSMS **106**.

[**0159**] In this example, the RTSMS **106** collates all of the SIBs into an MSDR using the reservation identification in each SIB. The MSDR then can be used to provide billing records to billing entities according to billing rules, such as those that may be in an order associated with the program. In other examples, the RTSMS **106** may use the NRP logs in conjunction with the SIBs to create the MSDR.

[**0160**] In another example, the viewer **118** receives a play script with a reservation identification from the RTSMS **106**. In addition, the NRP **110** receives the reservation from the RTSMS **106**. The viewer **118** transmits a media locator request to the NRP **110**, and the NRP **110** processes the media locator request with the reservation data received from the RTSMS **106**. The NRP **110** compiles a list of switches, including the MMS **112**, that can provide the presentation identified in the reservation. The NRP **110** communicates in turn with the MMS **112** to determine if the MMS can provide the presentation. The MMS **112** replies to the NRP **110** specifying that it can provide the presentation. The NRP **110** transmits an IP address of a stream caster on the MMS **112** to the viewer **118**.

[**0161**] The viewer **118** initiates a session with the MMS **112**. The MMS **112** streams the presentation to the viewer **118** as requested.

[**0162**] While the MMS **112** is streaming the presentation to the viewer **118**, an error occurs, and the MMS is not able to continue streaming the presentation to the viewer. The MMS **112** notifies the NRP **110** that it cannot continue streaming the presentation to the viewer **118**.

[**0163**] The NRP **110** determines that the session for the presentation must be re-routed and communicates with a second MMS identified on the list of switches capable of providing the presentation (not shown). The second MMS notifies the NRP **110** that it can provide the presentation. The NRP **110** notifies the first MMS **112** to route the session to the second MMS.

[**0164**] The session is routed to the second MMS. The second MMS provides the rest of the presentation to the viewer **118**. When the presentation has completed, the session is terminated by the viewer **118**. The second MMS notifies the NRP **110** that the streaming for the presentation is complete and the session is terminated.

[**0165**] In this example, the MMS **112** transmits SIBs to the RTSMS **106** when the session is initiated, during the configurable periods of time while the presentation is streaming, during any viewing events, when the stream caster fails, and when the session is routed to the second MMS. Likewise, the second MMS transmits SIBs to the RTSMS **106** when the session is routed to the second MMS and the second MMS starts streaming the media for the presentation, during the configurable periods of time while the presentation is streaming, when any viewing events occur, and when the session is terminated. Each of the SIBs contains the reservation identification for the presentation. In addition, the NRP **110** transmits NRP logs to the RTSMS **106** identifying both the MMS **112** and the second MMS when the respective MMSs provide the media streaming for the presentation.

[**0166**] The RTSMS **106** receives the SIBs from the MMS **112** and the second MMS. The RTSMS **106** collates the SIBs to create an MSDR using the reservation identification contained in each SIB. The MSDR then can be used for settlement purposes.

[**0167**] In another example, the viewer **120** requests access to media. The RTSMS **106** returns a play script to the viewer **120**. The play script identifies two media clips, in addition to the reservation identification and the NRP identification. In this example, the media clips are identified by URLs, and the reservation identification is a reservation number attached to the URL. Also, the NRP identification in this example is a host name for the NRP **110**. The RTSMS **106** also transmits the reservation to the NRP **110**.

[**0168**] The viewer **120** transmits a request to the NRP **110**. In this example, the request is a media locator request. The media locator request identifies the play script and the reservation identification. The NRP **110** processes the media locator request and the reservation received from the RTSMS **106**. The NRP **110** compiles a list of all possible switches that can handle the presentation identified by the play script.

[**0169**] The NRP **110** communicates with the MMS **112** to determine if the MMS can provide the presentation. The MMS **112** transmits a message back to the NRP **110** identifying that it can provide the presentation. The NRP **110** transmits an IP address of a stream caster on the MMS **112** to the viewer **120**.

[**0170**] The viewer **120** initiates a session with the MMS **112**. The MMS **112** streams the media for the first media clip identified on the play script to the viewer **120**.

[**0171**] In this example, when the viewer **120** has received all of the media for the first media clip, the viewer terminates the streaming session by initiating a tear down message. This may occur, for example, when the next media clip on the play script requires a different media server type.

[**0172**] The viewer **120** determines that there is a second media clip of a different media server type on the play script for the presentation. The viewer **120** contacts the NRP **110** to determine if a switch is able to provide the second media clip for the presentation.

[**0173**] The NRP **110** communicates with the MMS **112** to determine if the MMS can provide the second media clip on

the play script for the presentation. The MMS **112** communicates back to the NRP **110** with a message stating that the MMS **112** cannot provide the second media clip on the play script for the presentation because the MMS does not have the required media server.

[**0174**] The NRP **110** receives the message from the first MMS **112**. The NRP **110** communicates with a second MMS (not shown) to determine if the second MMS can provide the second media clip on the play script for the presentation. The second MMS communicates a message to the NRP **110** that it can provide the second media clip on the play script for the presentation. The NRP **110** transmits a message to the viewer **120** identifying an IP address of a stream caster on the second MMS.

[**0175**] The viewer **120** initiates a session with the second MMS at the identified IP address. The second MMS streams the second media clip in the play script for the presentation to the viewer **120**. When the streaming for the second media clip is complete, the viewer **120** terminates the session. The second MMS notifies the NRP **110** that the streaming for the second media clip is complete, and that the session is terminated.

[**0176**] The first MMS **112** and the second MMS transmit SIBs to the RTSMS **106** at the initiation of each session, at the termination of each session, upon viewing events, and at configurable periods of time. In addition, the NRP **110** transmits NRP logs to the RTSMS **106**. The SIBs and the NRP logs identify the reservation identification for the presentation.

[**0177**] The RTSMS **106** collates the SIBs from each of the first MMS **112** and the second MMS to create an MSDR. The MSDR can be used for billing records and other settlement purposes.

[**0178**] **FIG. 2** depicts an exemplary embodiment of a reservation system for a streaming system. The reservation system **122**A comprises a service order system **202**, a financial screener **204**, a presentation creator **206**, and a reservation generator **208**. Systems and processes may be combined or separated.

[**0179**] The service order system **202** identifies the viewer from which a request is received. The service order system **202** authenticates the viewer **118** or **120** to determine whether the viewer is authorized to make a request for the desired program. In one embodiment, the service order system **202** compares the viewer profile against service rules provided by the media owner in the order. The service order system **202** may verify that the order for the program is in effect and that the program is available at a viewing time requested by the viewer **118** or **120**. In another embodiment, the service order system **202** may authorize any viewer **118** or **120** and/or any request for a program. In this instance, a service rule requiring validation may not be present or may provide that any viewer may receive the program. Other examples exist.

[**0180**] The service order system **202** may be configured to validate that a request is received from a valid communication system, such as a valid portal **116** of **FIG. 1**. In some embodiments, the validation of the communication system may not be required.

[**0181**] It will be appreciated that in other embodiments, authentication of the viewer **118** or **120** and/or validation of the communication system providing the request may involve external systems. For example, a media owner may make an arrangement with a portal site to allow viewing of all of the media owner's content on a fee for service basis where the portal **116** owner pays the bill. No viewer identification or payment collection is involved. When the request for service comes to the network owner, the service order system **202** can be defmed to access the network owner's accounts receivable system to determine if the portal **116** is more than 90 days late in payment. If the portal **116** owner has not made a bill payment in the last 90 days, the service request can be rejected.

[**0182**] The financial screener **204** validates financial transactions with a viewer **118** or **120**, such as by determining whether a viewer can pay for a program or whether a viewer has paid for a program, if payment is required from the viewer for a requested program. For example, a financial transaction may be required for a pay-per-view program, a subscription, a gift certificate, discounted events, promotions, and/or combinations of the above or other events.

[**0183**] In some embodiments, external systems may be used during a financial screening process. For example, a viewer **118** or **120** requesting a pay-per view, non-subscription service may require an immediate credit card payment. In order for the viewer **118** or **120** to access the content, the viewer must provide valid credit card data that is passed to an external credit card processing system for payment authorization. If the credit card processing system returns a credit accepted status, the viewer's transaction continues to be processed. If the external credit card application rejects the credit card, a message is forwarded to the viewer **118** or **120**, and the viewer's transaction continues pending until a valid payment is made or the viewer cancels the request.

[**0184**] The presentation creator **206** creates a tailored presentation for a viewer **118** or **120** based upon the requested program and its associated service rules and settlement rules, if any. In some instances, the presentation creator **206** may process the viewer profile, if the viewer profile is available, with the viewer's request and the program rules to generate the presentation. Thus, a presentation is customized for an individual viewing session by the presentation creator **206**. Additionally, in other embodiments, the presentation creator **206** may reject a request instead of creating a presentation for the viewer **118** or **120**.

[**0185**] The presentation creator **206** may be configured to generate different presentations based upon different viewer profiles. For example, different advertisements may be selected for a presentation based upon a viewer profile. Alternately, a movie may have a different ending that may be selected for a different market, a different language, closed captioning, letter box format, or another selection.

[**0186**] The different selections for a media clip are based on a selection criteria provided by a media owner in the program, may specify directly which media clip to provide in the presentation, may provide a media alias that is resolved at a later time, including after a viewing session has started, or provide another presentation criteria. Additionally, any portion of the presentation selection may be based on attributes and respective values identified for a viewer profile for a specified program. The attributes may be demographics, such as age, gender, marital status, income, or other demographics, geographic location, such as a city,

a state, a country, a college, a region, or other geographic location attributes, hobbies, such as basketball, tennis, rowing, crafts, or other hobbies for showing a product placement, preferences, such as drama, comedy, religious preferences, or other preferences, job grades, such as enterprising, management, union, non-union, local law enforcement, or other job grades, and/or other attributes for which a media owner identifies for a viewer profile.

[**0187**] The reservation generator **208** determines whether the streaming system has the necessary resources to stream a presentation for a requested program to a viewer. The reservation generator **208** processes the presentation generated by the presentation creator and the request to identify whether a resource in the streaming system, such as a switch, can provide the presentation for a requested program and the generated reservation. If the necessary resource or resources are not available to stream the presentation, the reservation generator **208** may reject the request, put the request on a waiting list, or pass the request to another system that may be able to provide the requested program, such as to another RTSMS or an external system. If the reservation generator **208** determines that the resources are available, the reservation generator may accept the request and create the reservation for the presentation, including assigning a reservation identification to the reservation. The reservation generator **208** tracks the reservation identification for each reservation.

[**0188**] The reservation generator **208** selects an NRP, such as the NRP **110**, to handle routing requests for the reservation and transmits the reservation to the selected NRP. The reservation may be transmitted to the selected NRP at any time before the start time of the presentation, including immediately after the reservation is assigned to the viewer and the presentation, immediately prior to the assigned starting time for the presentation, or anytime in between. The reservation generator **208** creates a play script for the viewer and transmits the play script to the viewer. The reservation generator **208** creates a customized play script for each customized presentation, including a play script for the media clips in the presentation and the reservation identification. In one embodiment, the play script contains one or more URLs, with each URL containing a media reference and the reservation identification. It will be appreciated that the reservation may be for a single reservation for a viewer or part of a block of reservations. The single reservation and/or the block of reservations may be prior-established reservations or future reservations.

[**0189**] **FIG. 3** depicts an exemplary embodiment of an NRP of the present invention. The NRP **110**A of **FIG. 3** comprises an NRP control manager **302**, a reservation cache **304**, a name resolution system **306**, a routing engine **308**, a switch manager **310**, a media location cache **312**, and an NRP LDSTS **314**.

[**0190**] The NRP control manager **302** monitors and stores the events and the status of each subsystem and device within the NRP **110**A. The control manager **302** also monitors messages transferred between subsystems on the NRP **110**A and processing of those messages by subsystems in the NRP. The control manager **302** generates an alarm upon detection of an error event. The control manager **302** also monitors and stores configuration changes made from a network operator or another source. The control manager **302** manages the NRP **110**A at an aggregate level.

[**0191**] The control manager **302** maintains in memory the total bandwidth used by the NRP **110**A, the total number of active requests, the current not to exceed bandwidth capacity, the current not to exceed active requests capacity, the current processing capacity, and the current not to exceed processing capacity. The memory enables the control manager **302** to reject name resolution requests, such as a DNS lookup request or a broadband SIP connection request, when the name resolution request will place the NRP **110**A above the desired thresholds.

[**0192**] The reservation cache **304** maintains reservations identifying current and imminent reservations in the streaming system **102**. The reservation is used to feed the routing engine **308** and to validate whether a reservation exists.

[**0193**] The name resolution system **306** is the entry point to the routing engine **308**. The name resolution system **306** receives the NRP identification signaling in a translatable protocol and provides the mapping back for a reply. In one embodiment, the name resolution system **306** receives an NRP host name in a DNS protocol format as the NRP identification and, after the routing engine **308** has processed the request and an MMS that can provide the media is located, maps the response as an IP address to the MMS, a stream caster, or other device on the MMS. The name resolution system **306** also resolves NRP identification requests from broadband communication devices.

[**0194**] The name resolution system **306** manages communications with other NRPs and/or other signaling systems controlled by other networks. The latter usually requires conversion between various protocols.

[**0195**] The name resolution system **306** operates as a signal gateway and is configured to process in-band signaling or out-of-band signaling. In-band signaling is signaling that is contained within a transmission path of a streaming service. For example, the SIP protocol can be in-band signaling. Additionally, the real-time transport protocol (RTP) is configured to contain RTP control protocol (RTCP) data embedded within the RTP transmission.

[**0196**] Out-of-band signaling is signaling that is transported via a transmission path separate from the media streaming path. The separate transmission path may be via different physical links, via a different internet protocol (IP) port number on a same physical path, via a virtual private network (VPN), or another method transmitting data via a separate logical or physical path.

[**0197**] The routing engine **308** determines whether to accept or to deny a request for media. If the routing engine **308** determines that an MMS can and should provide the requested media, the routing engine will accept the request. The routing engine **308** can reroute a media request. This can occur, for example, if the stream caster or its media server on an MMS fails or otherwise cannot begin or continue streaming the requested media. Other examples exist.

[**0198**] The routing engine **308** collects additional information for a connection or a session based on how the connection or session is established over what is provided in the initial reservation. For example, if a viewer is connecting via a directly managed broadband network, the routing engine **308** collects detailed information on the actual logical virtual path/virtual circuit. The routing engine **308** can update reservation information or NRP logs with this addi-

tional information and have the updated information transferred to the RTSMS **106** for future use.

[**0199**] The switch manager **310** monitors and stores the state of the MMSs and their communication links. The switch manager **310** also transmits the reservation to the MMSs, receives requests from an MMS to reroute a media stream, and responds to reroute requests.

[**0200**] The media location cache **312** caches program information, such as the identification of the media in a program, on what MMS devices the media is located, the anticipated streaming time of the media, the playing time of streamed media, the average bandwidth needed to stream media of a program, the maximum bandwidth needed to stream media of a program, and the quality of the media encoding. This program information is used by the routing engine **308** to make routing decisions.

[**0201**] The NRP LDSTS **314** collects event data, such as state change data and reservation data, from other subsystems of the NRP **110**A. The LDSTS **314** transmits the event data, including NRP logs, to the RTSMS **106** for billing, reporting, and network management.

[**0202**] **FIG. 4** depicts an exemplary embodiment of an NRP control manager of the present invention. The control manager **302**A of **FIG. 4** comprises an alarm manager **402**, a load manager **404**, and a reservation controller **406**. The alarm manager **402** operates with a process status storage element **408** and a signaling link status storage element **410**. The load manager **404** operates with the signal link status storage element **410**, a managed devices storage element **412**, and a mirrored devices storage element **414**. The reservation controller **406** operates with a reservation control storage element **416**. The storage elements **408-416** each may be, for example, a database, a table, an array, a programming object, a computer process monitoring event that can be called via an inter process or remote process communication, and/or another storage element. For simplicity, the storage elements **408-416** may be referred to as databases.

[**0203**] The alarm manager **402** operates to centrally control and monitor an NRP. The alarm manager **402** enables an operator to define one or more objects for the streaming system **102** that can be managed, for example, by simple network management protocol (SNMP) or common management information protocol (CMIP). For example, an operator may define a managed object for network management of the streaming system **102**.

[**0204**] Additionally, the alarm manager **402** enables an operator to define alerts that may be unique to implementing the streaming system **102**. For example, an alert may be defined by specifying the managed object and a threshold value for the managed object or an attribute of the managed object. If the value of the managed object or the attribute exceeds, either by meeting, going below, or going above the threshold of the managed object as specified by the threshold value, an alert may be triggered and generated to a console of the network operator and/or to an alarm log. For example, an invalid reservation identification count may be specified for the NRP and measured every five minutes. If the count reaches a specified number, such as ten, then an alarm may be generated.

[**0205**] Also, the alarm manager **402** monitors signaling processes operating on the NRP and generates an alert to a network operator and/or to an alarm log as to a possible and/or actual degradation of service. These signaling processes may be referred to as mission critical signaling processes. If a signaling process such as this halts, crashes, consumes an unreasonable amount of a resource, or otherwise causes an alert condition, signaling processing may be halted. This may occur, for example, where a name resolution system, such as the name resolution system **306** of **FIG. 3**, temporarily halts. In this instance, reservations that were assigned to that NRP can no longer be routed by that NRP, and a secondary NRP will have to process current and future reservations until the problem with the current NRP has been resolved. Reservations that already were routed may continue to be streamed.

[**0206**] The alarm manager **402** monitors the signaling processes and predicts potential and/or imminent failures. In some instances, the alarm manager **402** may auto correct a detected problem. For example, the alarm manager **402** may divert a reservation to another NRP and attempt to restart the name resolution system of the current NRP so as to restore the name resolution system to full operation.

[**0207**] In one embodiment, the alarm manager **402** is configured to generate forecasts. In this embodiment, the alarm manager **402** is configured to detect whether a selected MMS is approaching its capacity or is over capacity, even when the normal hardware SNMP device manager does not detect an over capacity event. The alarm manager **402** may be configured in this instant to determine the impact of scheduled reservations on the selected MMS and report if planned and current usage exceeds its capacity. Forecasting provides an advantage, for example, where forecasting of bandwidth use enables the streaming system to provide a high quality of service (QoS) for streaming high bandwidth, long duration media.

[**0208**] The alarm manager **402** monitors the data in the NRP process status storage element **408**. The NRP process status storage element **408** contains the current and past status and records from the internal NRP processes. The alarm manager **402** may be configured to alert an operator and/or an alarm log if an internal NRP process is in an actual or potential alarm condition. In another embodiment, the alarm manager **402** may be configured to detect if a routing engine, such as the routing engine **308** of the NRP **110**A (see **FIG. 3**), has halted. This may occur, for example, if routing software in the routing engine is not operating correctly. In this instance, the alarm manager **402** may be configured to alert a network operator and/or an alarm log to stop the routing engine and to restart the routing engine.

[**0209**] The alarm manager **402** also may be configured to monitor the signal link status storage element **410**. The signal link status storage element **410** contains information identifying the current status and past records of the signal link transports for the signaling system **102**. A signaling link may be one link on a communication path between devices in the signaling system **102**, such as in an out-of-band signaling network. A signaling link may be, for example, a virtual path/virtual circuit connection, an IP connection, or another signaling link. The signaling link status may be dependant on the technology used. Signaling link status may include, for example, up/down, percent use, error rate, and other status attributes. The signaling link status may be accessed, for example, by SNMP or CMIP.

[0210] The alarm manager **402** monitors the signaling links and records the status of each signaling link in the signaling link status storage element **410**. If a given signaling link is not operational, the alarm manager **402** may be configured to alert a network operator and/or an alarm log. The alarm manager **402** may be configured to attempt to re-establish a communication on the signaling link or establish communications to an alternate link to the same destination.

[0211] The alarm manager **402** also may be configured to enable a network operator to set attribute conditions, such as a signaling link load limit to ensure that signaling data is transported through the streaming system **102** on an efficient basis. The alarm manager **402** enables the operator to set the load limit level from zero to one hundred percent.

[0212] The load manager **404** controls the use of one or more MMS devices that are assigned to the primary control domain of that NRP. The primary control domain of a selected NRP are those MMSs or MMS devices that communicate with the selected NRP and that receive and follow instructions from the selected NRP, including instructions for streaming media to a viewer. The load manager **404** stores the status and statistics of each MMS and MMS device in that NRP's primary control domain in the managed devices storage element **412**.

[0213] The load manager **404** also manages a secondary control domain set of MMSs and MMS devices. The secondary control domain includes one or more MMSs or MMS devices that are under the secondary control domain of another NRP. In the event the primary NRP for those devices fails, the load manager **404** of the current NRP will read the data located in the mirrored devices storage element **414** to identify and control the devices that were assigned to the failed NRP. The load manager **404** will read the data from the mirrored devices storage element **414** upon receiving an instruction to service the secondary control domain.

[0214] The load manager **404** monitors the state model of each reservation accepted by an MMS within its primary or secondary control domain. The load manager **404** updates the state model and the streaming use statistics and measures in the managed devices storage element **412**. Examples of a streaming use statistic include the overall bandwidth use of an MMS, an individual streaming server bandwidth use within an MMS, an individual streaming server memory use, an individual streaming server disk use, an individual streaming server signaling link use, and other statistics.

[0215] The load manager **404** may be configured to compute the available capacity of an MMS or an individual streaming server by media server type. A streaming media server type may include Microsoft's Windows Media Server, Real Server, Apple's Quick Time/Darwin server, Oracle Video Server, and others. Available capacity may be classified over a time period in configurable time increments, such as five minutes. Classifying available capacity over a time period reflects scheduled reservations that have not yet connected.

[0216] The reservation controller **406** operates with a reservation control storage element **416**. The reservation controller **406** handles communications between one or more NRPs within the signaling system **102** and communications to and/or from a signaling device of another packet network to fulfill a reservation request. The reservation controller **406** stores the reservation request and associated information where necessary in the reservation control storage element **416**. Associated information may include the destination to which the reservation controller **406** routed the reservation request, the time the reservation request was routed, and other data required to process the reservation request.

[0217] The reservation controller **406** maintains timers on remotely routed reservation requests and can cancel those reservation requests and/or reroute the reservation requests to another NRP or to a different network provider. The timers typically are kept for a reservation request forwarded to a destination NRP. The destination NRP is provided a configurable amount of time in which to respond to the reservation request with a positive or negative response. If the destination NRP does not respond within the allotted time, a different NRP may be selected to process the reservation request. However, if another NRP cannot be located, the reservation request may be refused.

[0218] The reservation request has a format referred to herein as the reservation format. The reservation format is used by one or more devices within the NRP and/or one or more other devices within the signaling system **102** to process the reservation request. In some instances, external networks may or may not use the reservation format used by the streaming system **102**. Thus, in some instances, a message received from an external network may require conversion to the reservation format. In other instances, a message to be transmitted to an external system may require conversion from the reservation format to a format receivable by that external network. Conversion may also be required if two or more NRPs exist in the streaming system **102**, and at least one of the NRPs is operating a different version of software, firmware, and/or operating systems than the version used by one or more other NRPs in the streaming system.

[0219] In those instances in which the format of the reservation request requires conversion, either between one or more devices within the streaming system **102** or between a device within the streaming system and a device outside of the streaming system, the reservation controller **406** controls converting the format of the reservation request between the one or more formats and/or other protocols. Examples of some signaling protocols include the Internet Engineering Task Force (IETF) session initiation protocol (SIP), the International Telecommunications Union (ITU) H.323, the World Wide Web Consortium (W3C) Extensible Hyper Text Markup Language (XHTML), Extensive Markup Language (XML), and other protocols and private application interfaces.

[0220] **FIG. 5** depicts an exemplary embodiment of a name resolution system. The name resolution system **306A** of **FIG. 5** includes a signal authenticator **502**, a protocol identifier **504**, and a protocol converter **506**. The signal authenticator **502** operates with a security authorization storage element **508**, the protocol identifier **504** operates with an active link protocol storage element **510**, and the protocol converter **506** operates with a protocol conversion mapping storage element **512** and a protocol conversion library **514**. The storage elements **508-514** each may be, for example, a database, a table, an array, a programming object,

a computer process monitoring event that can be called via an inter process or remote process communication, and/or another storage element. For simplicity, the storage elements **508-514** may be referred to as databases.

[**0221**] The signal authenticator **502** operates with the security authorization storage element **508**. The signal authenticator **502** determines if signaling as received from various locations is valid. The signal authenticator **502** uses data stored in the security authorization storage element **508** to verify the validity of communications received within the streaming system **102** and/or another network.

[**0222**] For example, the signal authenticator **502** may validate a communication by identifying the IP address of the device sending the communication and verifying that the sending IP address is valid, reading embedded security key data within the communication and validating the security key data, identifying physical device serial numbers and validating the serial numbers, identifying the signaling link as a secure link, and/or other security schemes. In another example, two internet service providers (ISPs) may agree to transmit communications between their networks. In this example, the security authorization storage element **508** may contain the IP addresses of the devices of both networks and a security key to be used when processing communications from another network, and the signal authenticator **502** will validate the communications.

[**0223**] The signal authenticator **502** may receive and process a communication, identify the sending IP address and a security key, and use a process and/or lookup to the security authorization storage element **508** to identify whether the IP address is listed in the security authorization storage element, to decode the security key, and to match the decoded security key to validate the information identified in the security authorization storage element. In another example, the security authorization storage element **508** may be configured as a cache of recently used security keys. In this example, the signal authenticator **502** may be configured to access a public key data store or certificate verification service to validate a security key.

[**0224**] In addition to the information identified above, the security authorization storage element **508** also may contain data identifying signaling network points including signaling end-points, the company that owns the signaling network point, contact information identifying the manager of the signaling network point, and/or other data. A signaling network point is a device that is addressable from a signaling standpoint. A signaling end-point identifies a signaling network point that is at one end of a communication.

[**0225**] The protocol identifier **504** operates in conjunction with the active link protocol storage element **510**. The protocol identifier **504** maintains a list of active signaling links and information used to communicate services on each link. The protocol identifier **504** stores the signaling link information in the active link protocol storage element **510**. Signaling link information may include whether the signaling link uses in-band or out-of-band signaling, protocols that may be used on or with the signaling link, what signaling links may be used as back-up signaling links to a signaling network point, including a signaling end-point, whether the signaling link is not operational and the reason therefore, whether the signaling link is active, the desired not to exceed link load limits, signaling link prioritization to a given signaling network point, a transport type, and other data useful for managing signaling links and communication paths.

[**0226**] The protocol converter **506** operates in conjunction with the protocol conversion mapping storage element **512** and the protocol conversion library **514**. The protocol converter **506** converts communications between the reservation format and other protocols, as explained more completely above with respect to **FIG. 4**. The protocol converter **506** obtains protocol information from the protocol conversion mapping storage element **512**, such as by identifying data elements and other protocol elements for the SIP protocol. The protocol converter **506** then can map data elements from the reservation format to the desired protocol. The protocol conversion mapping storage element **512** contains protocol identifiers for mapping protocols that have similar attributes as the reservation format, but different formatting and naming conventions.

[**0227**] If the conversion between the reservation format and anther protocol requires more than a simple mapping, the protocol converter **506** calls routines stored in the protocol conversion library **514**. These routines typically define application programming interfaces (APIs) using an open standard, such as XHTML, XML, or another standard. APIs normally are negotiated between networks and may be considered signaling network point specific. For example, protocol conversions may be required for a routing request made on the ingress side, for a communication to the forwarding protocol, for a communication from a forwarding reply, and/or for a communication returning the results of a routing request on the egress side.

[**0228**] The routines in the protocol conversion library **514** may be configured to determine the protocol to be used for converting the communication and to then perform the conversion. If the protocol conversion library **514** does not contain data for the received communication, the protocol conversion library **514** and the protocol converter **506** may be configured to default to a native protocol of the streaming system **102**, such as the reservation format.

[**0229**] **FIG. 6** depicts an exemplary embodiment of a routing process for a routing engine. The routing engine **308**A of **FIG. 6** depicts a logical default process for routing media. However, other default processes may exist.

[**0230**] The routing engine **308**A locates one or more MMSs and/or MMS devices that have the requested media identified by a reservation request at step **602**. For example, the routing engine **308**A may locate those MMSs that contain 100% of the media identified for a requested reservation. In another example, the routing engine **308**A may be configured to locate the MMSs that contain the first media item to be viewed for a requested reservation and the presentation generated therefore, and subsequent media items requested in the reservation (and to be generated for the presentation) are transported to the selected MMS while the viewer receives the first media item.

[**0231**] At step **604**, the routing engine **308**A determines if the MMSs that contained the requested media have the capacity to stream the media to the viewer. The capacity is measured in current usage and future scheduled usage. For example, a viewer may request a two hour movie to be generated in the moving pictures experts group (MPEG)

format requiring 4 megabytes of constant bandwidth. The routing engine **308**A determines if the MMS currently has 4 megabytes of bandwidth, the appropriate processing capacity, and other capacity items.

[**0232**] The routing engine **308**A also reviews future scheduled activity and forecasts the impact of the future scheduled activity on the capacity measures. In one embodiment, the routing engine **308**A also may be configured to then generate an overall weighted average rating the ability of each MMS to stream the requested media. In one example, the MMSs scheduled to be used heavily in a live broadcast of a future event are ranked lower than the MMSs that are not transmitting the live broadcast of a future event.

[**0233**] At step **606**, the routing engine **308**A matches the selected MMSs to the streaming service configuration. As used in this paragraph, the streaming service configuration is identified by the network distribution rules and, in some instances, rules identified in an order of a program (hereafter, "program rules"). The routing engine **308**A then prioritizes the MMSs that meet the network distribution rules and the program rules to determine the order in which the MMSs may be contacted to locate an MMS that can service the reservation request.

[**0234**] For example, a routing preference of next-sequential may prioritize a list of MMSs based upon what MMS last serviced a reservation request. In this example, a streaming system **102** may have seven MMSs. If a previous reservation request was serviced by MMS **4**, then the current reservation will be serviced by the next available MMS greater than MMS **4** that can handle the reservation (i.e. the presentation generated for the reservation request). For example, MMS **5** does not have the required media requested, and MMS **6** contains all of the required media but does not have available capacity. Additionally, MMS **7** contains all of the required media and has the capacity available to stream the media. In this example, MMS **7** is the next available MMS greater than MMS **4**. Thus, MMS **7** is prioritized to the top of the routing list. This prioritization in routing is referred to herein as next-sequential routing.

[**0235**] In another example, the streaming system **102** may be configured to use most-idle routing, thereby selecting the most-idle MMS. In this example, the list of available MMS devices that are configured to service the requested media are prioritized in order of the MMSs that have the least current and planned activity.

[**0236**] In another example, the routing engine **308**A is configured to enable bumping for the routing process and identifies the precedents to be given to other networks over bumping. Bumping refers to a reservation request or other message being bumped for another reservation request or message. Bumping may be based on network owner policy. For example, a per-per-view viewer might have priority over a non-paying viewer. A revenue producing stream might have priority over a test stream. A company/publisher might agree to have a lower priority to obtain a lower rate. Priorities might be agreed to in a service order. Emergency-based streams might have priority over normal streams. Other examples exist.

[**0237**] In still another example, program rules may be entered by a media owner. However, the network owner may override the program rules if the program rules violate or are inconsistent with contractual provisions agreed upon by the parties or network distribution rules. In yet another example, a media owner may need to change a program rule but is not able to physically connect to the streaming system **102** to make the program rule change. In this example, the media owner may request the network owner to directly enter the program rule, thereby overriding routing according to that program rule. Other examples exist.

[**0238**] Thus, the routing engine **308**A identifies the MMSs that can service requested media for a presentation at step **606**. The routing engine **308**A identifies these MMSs based on which MMSs have the media and the capacity and provides a selection probability based on the selected configuration according to the network distribution rules and the program rules.

[**0239**] At step **608**, the routing engine **308**A generates an overall sorted list from 1 to N of the MMSs that can generate the requested media to the viewer. The sorted list may, for example, be based on the selection probability determined at step **606**. The routing engine **308**A may apply a weighted average algorithm, such as the location of each MMS with respect to the viewer, the relative capacity of each MMS, including current and planned capacity, contractual factors, and/or other selected factors. The sorted list then may be used to communicate with each MMS according to the listed prioritization to ensure that at least one MMS may stream the requested media to the viewer. If the first MMS on the list rejects the request, the second MMS on the list is contacted and so on. This process continues until at least one MMS accepts the reservation or until a treatment process is applied to the reservation request. A treatment process identifies a reason and a result for abnormal routing of a reservation request or some other signaling or communication. The treatment processes are described more completely below.

[**0240**] **FIG. 7** depicts an exemplary embodiment of a switch manager. The switch manager **310**A of **FIG. 7** comprises a switch configuration manager **702**, a streaming service configuration manager **704**, a bandwidth manager **706**, and a route latency manager **708**.

[**0241**] The switch configuration manager **702** operates with a switch configuration storage element **710**. The streaming service configuration manager **704** primarily operates with a streaming service configuration (config) storage element **712** and an active load storage element **714**. Secondarily, the streaming service configuration manager **704** may operate with a current bandwidth use storage element **716** and a scheduled bandwidth use storage element **718**. The bandwidth manager **706** operates with the current bandwidth use storage element **716** and the scheduled bandwidth use storage element **718**. The storage elements **710-718** each may be, for example, a database, a table, an array, a programming object, a computer process monitoring event that can be called via an inter process or remote process communication, and/or another storage element. For simplicity, the storage elements **710-718** may be referred to as databases.

[**0242**] The switch configuration manager **702** operates with the switch configuration storage element **710** to store and retrieve configuration data for one or more MMSs. The switch configuration manager **702** uses SNMP and CMIP management information base (MIB) objects and/or pro-

cesses to determine the hardware configuration of one or more MMSs and/or MMS devices. The hardware configuration data is stored in the switch configuration storage element **710** and is viewable from the RTSMS **106** (see **FIG. 1**) for authorized users.

[**0243**] The switch configuration manager **702** uses the MIBs to determine if the MMS and/or the MMS devices are available for use, are in an alarm state, are otherwise awaiting repair, and/or are in a maintenance state for which the MMS or the MMS equipment is unavailable for use. The switch configuration manager **702** stores the configuration data in the switch configuration storage element **710** for each event that causes a state change in the equipment status or a service impairment status.

[**0244**] The streaming service configuration manager **704** stores and accesses data in the streaming service configuration storage element **712** and the active load storage element **714**. The streaming service configuration manager **704** also accesses data in the current bandwidth use storage element **716** and the scheduled bandwidth use storage element **718**.

[**0245**] The steaming service configuration manager **704** enables authorized users to view and update routing data and tables, such as the routing tables identified in FIGS. **8-11**. The streaming service configuration storage element **712** contains data identifying network distribution rules, such as for how media should be routed for the entire streaming system **102**, data used to control a group of MMSs, data used to determine switch prioritization to determine a list of MMSs that can provide requested media to a viewer, and other data.

[**0246**] For example, a sort algorithm in the streaming service configuration manager **704** may be set to next-sequential switch, least idle switch, most idle switch, switch closest to the viewer, lowest transport latency, and other approaches. In each instance, the streaming service configuration manager **704** reads the sort algorithm setting and the associated routing processing data from the streaming service configuration storage element **712**.

[**0247**] In another example, an algorithm is set to stream media from a switch that is the closest point of service to the viewer. In still another example, a network owner may select a transport path that has the lowest transport latency through the streaming system. This switch may not necessarily be the closest switch. Transport latency is the time between when a transport communication/message is sent from a first device and when the communication/message is received at another device.

[**0248**] The streaming service configuration storage element **712** also maintains data identifying load factors for the streaming system **102** as a whole. The load factor data is used by the streaming service configuration manager **704** to monitor the collective load and to prevent the streaming system **102** or an individual MMS from being overloaded.

[**0249**] For example, the streaming service configuration manager **704** may be configured to randomly reject reservation requests when the streaming system **102** is 80% currently used. In this example, once the 80% threshold is reached, a selected random rejection rate, such as 40%, may be specified so that 40% of the new reservation requests are rejected while the streaming system **102** remains at 80% capacity. In this manner, the quality of service may be maintained for those viewers already connected to the streaming system **102**. Additionally, the streaming service configuration manager **704** uses the streaming service configuration storage element **712** data to establish and maintain real-time stream controls and pre-established stream controls.

[**0250**] The active load storage element **714** contains data identifying the media server types operating on respective MMSs. For example, a media server may be a Microsoft Windows Media Server, an Apple Darwin Server, a Real Network Real Time Server, an Oracle Video Server, or another type of media server. For each media server, the active load storage element **714** may contain media server type, current media server status, activation start time, planned media server termination time, media server software capacity settings, media server version number, media server log settings, media server publication points for content, content file types the media server can process, and other data relevant to supplying streaming service. The streaming service configuration manager **704** also stores current streaming capacity for the media server type and identifies the time and date when changes are to be made to a media server, such as hardware or software upgrades, maintenance, or other service impairment events.

[**0251**] The bandwidth manager **706** monitors bandwidth use and forecasts needed bandwidth based on scheduled reservations. The bandwidth manager **706** may obtain information for future reservations, thereby identifying scheduled bandwidth use, from the scheduled bandwidth use storage element **718**.

[**0252**] The bandwidth manager **706** accesses current streaming information from the state model to determine bandwidth currently being used. The bandwidth manager **706** also communicates with the streaming service configuration manager **704** to determine the current available capacity. The bandwidth manager **706** then generates a rolling forecast of bandwidth use and stores that bandwidth use forecast data in the current bandwidth use storage element **716**. For example, the bandwidth manager **706** may identify bandwidth currently being used and identify forecasted bandwidth use based on requested and/or to be processed reservations. The bandwidth manager **706** may use this data to forecast for configurable periods of time, such as 4 hours, 24 hours, 48 hours, 5 days, or another forecast range. The bandwidth manager **706** will update the rolling forecast as additional data becomes available, such as actual bandwidth use and/or additional requested and/or accepted reservations.

[**0253**] The bandwidth manager **706** also may forecast the bandwidth use for each MMS based on a transport traffic pattern. A transport traffic pattern is used to measure each segment of a specified signaling link, transport path, device, and/or another segment, to determine bandwidth use so that end-to-end bandwidth use may be measured. Once usage patterns and bottlenecks are recognized, optimizations can be implemented to improve performance and bandwidth use. For example, the number of IP route locations, from a designated MMS to a desired end point are required to reach that end point. To fully identify the transport traffic pattern, the bandwidth manager **706** also may identify the millisecond delay to that location, the start/end forecast time for the

pattern, actual test results recorded during the identified time period, the designation of one or more IP address types, such as a full IP address, a part of a CIDR block, and/or other transport traffic pattern attributes.

[0254] The route latency manager **708** executes tests between a selected MMS and a pre-determined network point. The route latency manager **708** may execute a test on an on-going, periodic, or one time basis and provide that information to the bandwidth manager **706**. The route latency manager **708** may be configured to execute tests on a packet based transport, such as TCP/IP, ATM, frame relay, and other packet based transports. In one embodiment, the route latency manager **708** executes a test to process a TCP/IP ping and trace route command to each TCP/IP address that made a connection or session to a specific MMS in a configurable period of time, such as 24 weeks. In another example, the route latency manager **708** executes a TCP/IP ping and trace route test to each viewer that is a member of a subscription service. The test may be based upon the viewer's full IP address.

[0255] **FIG. 8** depicts an exemplary embodiment of a data structure used by an NRP to execute a state machine. The data structure is comprised as a series of tables that point to one another in various ways. The pointers may have a next function and next partition designation. The next function points to a next routing process, and the next partition points to an entry or a range of entries in the tables used for that process. While the pointers for an exemplary media processing are illustrated in **FIG. 8**, other examples exist. The routing data structure **802** embodiment of **FIG. 8** depicts an active reservations table **804**, a network access table **806**, a signal mapping table **808**, a signal access point table **810**, a stream control table **812**, a treatment table **814**, a referring host table **816**, an exception table **818**, a personal identification number (PIN) table **820**, a content screening table **822**, a content location table **824**, a network status table **826**, a day of year table **828**, a day of week table **830**, a time of day table **832**, a signal route choice table **834**, and a class of service table **836**.

[0256] **FIG. 8** depicts one embodiment in which a reservation request flows through the tables of the data structure between incoming access of the reservation request through the outgoing access in which a reply is transmitted to the viewer.

[0257] The routing data structure **802** is depicted as flowing from tables in an incoming access group **838** to an incoming access control group **840**. Routing then passes through a switch identification group **842** to an outgoing access control group **844**. In the example of **FIG. 8**, the routing next flows through an outgoing access group **846**. It will be appreciated that **FIG. 8** depicts an exemplary embodiment in which tables for the routing data structure **802** are grouped for one exemplary routing. In other examples the tables of the routing data structure **802** may be grouped differently, one or more of the tables depicted in **FIG. 8** may not be used on a particular routing, or all of the tables depicted in **FIG. 8** may be used for the particular routing.

[0258] In the embodiment of **FIG. 8**, the incoming access group **838** receives reservations from the RTSMS **106** at the active reservations table **804**. The network access table **806** receives the reservation request from the viewer. Signal mapping data from the signal mapping table **808** and reservation and viewer information from the network access table **806** passes through to the signal access point table **810**. Active reservation data from the active reservations table **804** may pass to the stream control table **812**. Additionally treatment information may pass from the treatment table **814** to the signal access point **810**.

[0259] As a default, routing then is transmitted to the referring host table **816** in the switch identification group **842**. Following, routing may pass through the exception table **818**, the personal identification (PIN) table **820**, the content screening table **822**, the content location table **824**, and to the network status table **826**. In some instances, routing may then pass through time and date tables, such as the day view table **828**, the day of week table **830**, and the time of day table **832**. Routing may pass from any of the network status table **826**, the day view table **828**, the day of week table **830**, and the time of day table **832** to the signal route choice table **834** of the outgoing access control group **844**.

[0260] The outgoing access control group **844** generally formulates information for a reply to the viewer. From the signal route choice table **834**, routing may pass to the class of service table **836**, to the signal access point table **810**. Treatment information may be received from the treatment table **814** at the signal access point **810**. Additionally, signal mapping data from the signal mapping table **808** may be received at the signal access point table **810**.

[0261] The signal access point table **810** then routes reply data through the network access table **806** of the outgoing access group **846** to be transmitted to the viewer. Additionally, reservation data may be transmitted from the signal access point **810** to the active reservations table **804** of the outgoing access group **846** to be transmitted onto another network device or to another device in the streaming system **102**.

[0262] It will be appreciated that the routing identified in **FIG. 8** is an exemplary embodiment. Other examples exist.

[0263] The active reservations table **804** contains information required to map a presentation to an executable play script that will be processed by an MMS. Each reservation generated by the reservation system **108** of the RTSMS **106** (see **FIG. 1**) has an entry in the active reservations table **804**. Each reservation request that has not fully executed or cancelled is depicted in the active reservation table **804**.

[0264] The network access table **806** contains information used to provide the public transportation side of a connection or a session. The public transportation side typically refers to a part of the streaming system **102** or another network that is available to viewers that are not on a private, out-of-band signaling network. Typically, one record appears in the network access table **806** for each network access adapter that can stream media found on an MMS. A network access adapter typically refers to the hardware that connects a media server in an MMS to the rest of the streaming system **102** or to another media server in another network.

[0265] The network access table **806** also can be configured to hold records for private network access adapters, and the routing data structure **802** also can be configured for private network access adapters. The network access table

806 typically is accessed from the signal access point table **808**, the signal route choice table **834**, or an external media routing process via an internal routing process that controls media routing to and/or from an external network.

[**0266**] The signal mapping table **808** enables the NRP to decode incoming signaling messages from protocols other than the reservation format into the reservation format for processing by the NRP. The signal mapping table **808** also enables the NRP to alter formatting for outgoing signaling messages from the reservation format to a protocol required to be received by the destination device. When the incoming signal record is converted to the common reservation format, a signal decode message mapping type is used as a key to the signal mapping table. When an outgoing signaling record is converted from the reservation format to another format, a signal encode message mapping type is used as the key to the signal mapping table **808**.

[**0267**] The signal mapping table **808** contains information and rules identifying the attribute names from the reservation format and how they are mapped to and from attribute data of the desired protocol to which it will be converted or from which the message will be converted. The signal mapping table **808** also identifies programming libraries that are to be called for the data conversion.

[**0268**] The signal access point table **810** contains information used to identify signaling network points and data links. The signal access point table **810** also contains information related to devices from which a reservation can originate, such as from a network security standpoint, devices to which the reservation request can be routed, such as from a network security and capacity/availability standpoint. The signal access point table **810** also contains information identifying signaling protocols used to communicate with other signaling network points. The signal access point table **810** may point to any switch identification group **842** table, the class of service table **836**, the signal mapping table **808**, the stream control table **812**, and the signal route choice table **834**.

[**0269**] The stream control table **812** enables the NRP to manage network overload conditions without fully processing a reservation request. This prevents the NRP and the MMS from shutting down fully and not providing service at all. A network/streaming system overload condition may occur when all available resources in a device nears capacity. For example, in the event of a disaster, there may be a spike in viewer interest for a particular piece of news footage of the event. The number of results and requests may cause the MMS to fail thereby causing everyone currently viewing any media to be disconnected and causing all new reservation requests to be rejected.

[**0270**] The stream control table **812** enables a network owner to throttle reservation requests, thereby maintaining service to viewers currently connected. The stream control table **812** further enables a network owner to reject a portion of new reservation requests with minimal NRP resources needed. The amount by which reservations may be throttled is configurable.

[**0271**] The treatment table **814** contains information identifying protocol errors, network operation errors, and other events identifying why a streaming service is not provided. The treatment table **814** may identify the reason for the error and provide the reason to the viewer with an adequate explanation of the error. For example, if a reservation request identifies media requiring an access code, but the access code is not provided within the reservation or a subsequent communication, the reservation request will be sent to the treatment table **814** causing a message to be generated to the viewer that the code has not been entered or is incorrect.

[**0272**] The treatment table **814** identifies special actions to be taken in the course of processing a reservation request. For example, a cable operator may want to stream a media clip for a message stating that their video-on-demand ordering system is not operational because of maintenance, instead of sending a text error message to the set top box to be displayed on the viewer's television. In another example, the treatment table **814** might be accessed from the PIN table **820** to block media that contains unacceptable subject matter. The owner of the set top box could request that specific media be blocked from the set top box in the living room, but allowed to be viewed on the set top box in another room. In this instance, the set top box identification is used in the PIN table **820** to treat the living room set top box with a video message stating that the customer has forbidden this material to be displayed via that particular set top box.

[**0273**] The referring host table **816** contains information identifying routing for a reservation request based on which entity referred the reservation request to the streaming system **102**. For example, an internet based reservation request may use a URL of the hypertext transfer protocol (HTTP). The URL may contain the name of the referring web portal. An agreement between the web portal owner and the network owner of the streaming system **102** may require routing to a specific MMS, to another device, or other specific routing instructions. The referring host table **816** typically defaults to the exception table **818**. Although, the referring host table **812** may point to other tables.

[**0274**] The exception table **818** is used to identify various exception conditions related to the reservation request. The exception conditions may influence the routing or handling of media identified in the reservation request. A reservation request may be screened resulting in the routing taking a different path through the routing data structure **802**. This may occur based on multiple factors, such as a special contractual agreement between one or more of a viewer, a network owner, another network owner, a media owner, and/or another entity. For example, if a reservation request is an internet originated request coming from a specific party, special routing directly to a specified MMS may be required.

[**0275**] The exception table **818** contains information enabling a reservation request to be specially handled, that is screened, based, at least in part, on the identification of the originating network owner. The identification of the originating network owner may be determined from a full or partial IP address, the viewer's media player software version information, and/or access network packet type information, such as ATM, frame relay, cable, and/or IP. The exception table **818** typically defaults to the PIN table **820**. Although, the exception table **818** also may point to any other switch identification group **842** table, the signal route choice table **834**, or the class of service table **836**.

[**0276**] The PIN table **820** is used to identify any special characteristics or requirements related to a viewer, such as a

protocol required to communicate to the viewer's media player, screening required to block fraudulent account use, default time zone information, content rating blocking, and other characteristics. The PIN table **820** can identify a single viewer or a group of viewers, and the identified viewer characteristics may be configurable by the network operator. The PIN table **820** typically defaults to the content screening table **822**. Although, the PIN table **820** may point to any other switch identification group **842** table, the signal route choice table **834**, and the signal mapping table **808**.

[**0277**] The content screening table **822** is used to screen a program or individual media during a routing process. A media owner may place media on the streaming system **102** that the network owner does not desire or that violates or is inconsistent with an agreement with the network owner. The content screening table **822** contains information that enables the media to be screened for those undesirable or inconsistent attributes. The content screening table **822** contains media information, such as a program identification, media identification, media format type, media rating type, agreement based information, and other data generated by the ESRP **106**. The content screening table **822** enables a network owner to override instructions of a media owner located in a program. The content screening table **822** typically defaults to the content location table **824**. Although, the content screening table **822** may point to any other switch identification group **842** table and the treatment table **814**.

[**0278**] The content location table **824** identifies the media located at specific MMSs within the streaming system **102** or in another streaming network. The content location table **824** contains information identifying media, such as a maximum transmission bandwidth required, an estimated play time of the media, a digital media file size, a content rating, and other media information. The content location table **824** typically defaults to the network status table **826**. Although, the content location table can point to any other switch identification group **842** table and the treatment table **814**.

[**0279**] The network status table **826** determines the current MMS capacity available and the transport latency from each MMS to one or more viewer locations. The network status table **826** may contain network information, such as current usage of a processor of an MMS, available and used media storage, in-use and planned bandwidth, and in-use and planned media transport. The network status table **826** also identifies capacity. The capacity is adjusted for any hardware failures that currently are open and that impact media distribution to viewers. The network status table **826** typically defaults to the signal route choice table **834**. Although, the network status table **826** also may point to any other switch identification group **842** table and the treatment table **814**.

[**0280**] The day of year table **828** contains information that causes media or programs to be routed differently based on the day of the year. The day of the year table **828** typically defaults to the signal route choice table **834**. Although, the day of year table **828** also may point to any other switch identification group **842** table or the treatment table **814**.

[**0281**] The day of week table **830** contains information that causes media or programs to be routed differently based on the day of the week. The day of the week table **830** typically defaults to the signal route choice table **834**. Although, the day of week table **830** also can point to any other switch identification group **842** table and the treatment table **814**.

[**0282**] The time of day table **832** contains information that causes media or programs to be routed differently based on the time of day. The time of day table typically points to the signal route choice table **834**. The time of day table also may point to any other switch identification group **842** table and the treatment table **814**.

[**0283**] The signal route choice table **834** identifies alternative signal access points that may be used to complete a reservation request. The signal route choice table **834** identifies one or more NRPs within the streaming system **102** and/or another network that are interconnected to each other and/or other networks.

[**0284**] The signal route choice table **834** may select a secondary NRP, for example, when a first selected NRP cannot process a reservation request because all of the MMSs that the first NRP controls are busy. Thus, if a first NRP cannot service a reservation request, such as when all MMSs for which the NRP has primary control are not able to process the reservation request, the signal route choice table **834** may select another NRP and/or MMS. The signal route choice table **834** typically points to the treatment table **814** or the signal access point table **810**. Although, the signal route choice table **834** may point to the class of service table **836**, the signal mapping table **808**, the stream control table **812**, and other tables.

[**0285**] The class of service table **836** identifies protocols that are not compatible with each other. The class of service table **836** may be accessed using a class of service partition code provided by the signal access point table **810**. The class of service partition code typically is required from the access point records for both the originating signaling network point and the terminating signaling network point. If the protocols on the two signaling network points are incompatible, the class of service table **836** typically will point to the signal route choice table **834**, thereby enabling another terminating signaling network point to be selected. Although, the class of service table **836** may point to the treatment table **814**, the exception table **818**, and other tables.

[**0286**] An initial reservation request typically is processed by the active reservations table **804**. The active reservations table **804** points to the signal access point table **810** or the stream control table **812**. The signal access point table **810** will identify if the reservation data is being received from a valid source, if signaling is in-band or out-of-band, identify the network owner of the sending signaling network point, the signaling protocol type, and other information about the signaling network point sending the reservation request. The state machine described above and the routing data structure **802** uses this information to decode the reservation request and the signaling data received. Typically, the decoding is completed in the signal mapping table **808** and the network access table **806**. Once the reservation request, the originating signaling network point, and the originating transport network are determined and recorded, the next default table to be accessed is the referring host table **816**.

[**0287**] **FIG. 9** depicts an exemplary embodiment of a stream control table **812**A. The stream control table **812**A of

FIG. 9 comprises a stream percent skipped table **902** and a stream rate table **904**. The stream percent skipped table **902** and the stream rate table **904** are used to control the number of reservation attempts made on the streaming system **102** or an individual MMS within the streaming system.

[**0288**] The stream percent skipped table **902** is used to control streamed connection attempts based on a percent value of the traffic that is processed through the state machine. The stream percent skipped table **902** typically defaults to the signal access point table **810** or the treatment table **814**.

[**0289**] The stream rate table **904** is used to control stream attempts on an attempt per second basis. Preferably, attempts within a range of 100 per second to 1 per minute are programmable. Although, ranges above and below that are configurable. The stream rate table **904** typically defaults to the signal access point table **810** or the treatment table **814**.

[**0290**] **FIG. 10** depicts an exemplary embodiment of a network status table **826**A. The network status table **826**A of **FIG. 10** comprises a switch equipment status table **1002**, a signal network status table **1004**, a public network status table **1006**, and a transport latency table **1008**. It will be appreciated that other tables may be included in other embodiments of the network status table **826**A.

[**0291**] The switch equipment status table **1002** identifies components within each MMS that are used to supply streaming and signaling services to one or more network devices, such as to one or more viewers. The switch equipment status data may be collected via a common systems management approach, such as SNMP, CMIP/CMISE, or a vendor specific management system. The switch equipment status may be collected by a management system, such as the RTSMS **106** (see **FIG. 1**), and transmitted to the NRP **110** for storage in the switch management status table **1002** and other tables where necessary. Switch equipment status data may include, for example, disk size, order numbers, media file names and sizes, switch identification numbers, and/or other media and/or switch attributes.

[**0292**] The signal network status table **1004** identifies packet signaling and transport links and devices. For example, a signaling link may be IP based communicating via an ethernet card in a computer. The ethernet card and its status would be identified in the signal network status table **1004**. Also identified would be the status of other signaling network points and their devices. For example, a signaling network point may be unavailable due to maintenance activity. The inactive status of the signaling network point will be identified in the signal network status table **1004**.

[**0293**] The public network status table **1006** identifies packet routing devices that are within a physical facility in which the MMS is located, but are not solely dedicated for use by the MMS. For example, an MMS may be installed at an ISP location, which would require all IP requests to be routed through the ISP's routing equipment. This equipment may be used by multiple services at the ISP site. In this example, the public network status table **1006** identifies the service status of this equipment, including any degradation of service status for the equipment. The data identified in the public network status table **1006** may be obtained, for example, via a common systems management approach, such as SNMP, CMIP/CMISE, specific test routines contained within an MMS, and other methods.

[**0294**] The transport latency table **1008** identifies data for latency between an MMS and various points within the streaming system **102** or another packet network. The latency data may be created and/or obtained by one or more MMSs and forwarded to the NRP **110** (see **FIG. 1**) on a configurable basis. For example, an MMS might use an IP based ping test to test every IP class C address that the MMS serviced within the last 7 days. This test may be repeated on a 5 minute basis, and the results would be forwarded to the NRP **110** and, possibly, to the RTSMS **106** (see **FIG. 1**). The transport latency table **1008** also may contain latency forecasts generated from the RTSMS **106**.

[**0295**] **FIG. 11** depicts an exemplary embodiment of a treatment table access point **1102** for the tables depicted in **FIG. 8**. The access point to the treatment table **814** is depicted by incoming access for a reservation request, incoming access control for a reservation request, switch identification and selection, outgoing access control for a reply, and outgoing access for a reply. The treatment table access point table **1102** identified in **FIG. 11** depicts typical access points. However, in some instances, the tables may access the treatment table at other access points.

[**0296**] In the example of **FIG. 11**, the active reservations table **804** accesses the treatment table **814** at the incoming access point. The network access table **806** accesses the treatment table at the outgoing access point. The signal mapping table **808** and the signal access point table **810** typically may access the treatment table **814** at the incoming access control point and the outgoing access control point. The stream control table **812** typically accesses the treatment table **814** at the incoming access control point. The referring host table **816**, the exception table **818**, the PIN table **820**, the content screening table **822**, the content location table **824**, the network status table **826**, the day of year table **828**, the day of week table **830**, and the time of day table **832** typically access the treatment table **814** at the switch identification and selection access point. The signal route choice table **834** and the class of service table **836** typically access the treatment table **814** at the outgoing access control point.

[**0297**] FIGS. **12-29** depict examples of tables described in FIGS. **8-11**. It will be appreciated that other versions of the tables may exist. In addition, information identified in the tables of FIGS. **12-29** may be combined or changed to form different, additional, or fewer tables.

[**0298**] **FIG. 12** depicts an exemplary embodiment of an active reservations table. The active reservations table **1202** of **FIG. 12** is used to access information identifying one or more reservations for one or more presentations. The active reservations table **1202** also is used to provide information identifying a terminating signaling network point for streams originating at other network signaling points or NRPs within a same network, such as the streaming system **102**. The reservation identification (ID) **1204** of the presentation is used to enter the active reservations table **1202**.

[**0299**] The active reservations table **1202** contains the order and presentation information generated during the reservation process. In the embodiment of **FIG. 12**, the order information includes the order identification (ID) **1206**, the order type **1208**, and the individual order line **11210** to order line N **1212**. An order line, for example, may reference a program for a service order or may reference a media for a storage order. Other examples for other orders exist. Specific

rules may exist for the order line above what the order as a whole contains. For example, a program may combine several pay-per-view events. This may include a first event where the service is charged every 30 minutes of viewing time and the viewer orders an hour. In another example, a viewer is a subscriber on a monthly basis and purchases a pay-per-view program at a special promotion rate because that viewer is a subscriber.

[**0300**] The order lines **1210-1212** can be associated on a one-to-one basis with the media being streamed to a viewer. For example, if an originating network cannot deliver a presentation or the remainder of a presentation, the originating network may try to locate one or more other networks to broker the delivery of the media to the viewer. The order data may be used to inform the other network the pricing value of the reservation and the estimated fee for providing a streaming service to the viewer. Other uses, for example, include determining the routing through one or more other networks based on a selected fee structure. In one embodiment, the presentations that generate more revenue for a network owner receive priority during the table processing.

[**0301**] The active reservations table **1202** also contains information identifying the buyer of the media. The buyer may be an individual or organization that is purchasing media or services, such as a pay-per-view presentation, a subscription service, a registration with a portal to view advertising supported content, and/or other media and/or services. The buyer data includes the buyer's identification (ID) **1214**, the buyer's location **1216**, and the buyer's network access type **1218**. The buyer location **1216** may be, for example, an NPA-NXX or a zip code. The buyer's network access type **1218** may be, for example, internet, cable, broadband wireless, ATM, or another type.

[**0302**] The buyer data also includes a buyer attribute **11220** to buyer attribute N **1222**. The buyer attributes **1220-1222** may be configurable by the network owner. For example, the network owner may create buyer profiles based on data, including age, sex, income level, the amount of business occurring between the buyer and the network owner in a period of time, the buyer's viewing and/or purchasing history, and/or other attributes.

[**0303**] The active reservations table **1202** also contains information identifying the viewer of the presentation. The viewer may be the same individual or entity as the buyer or another individual or entity. The buyer may establish viewer accounts and profiles. For example, a buyer may be a head of a household and may establish viewers for each of the buyer's children and set their viewing profiles accordingly. The viewer information may include the viewer identification (ID) **1224**, the viewer location **1226**, and the viewer network access type **1228**. The viewer information also may include a viewer attribute **11230** to a viewer attribute N **1232**. The viewer attributes **1230-1232** may include, for example, age, sex, income level, content screening level, the viewer's viewing history, and/or other viewer attributes.

[**0304**] The active reservations table **1202** also contains information identifying the presentation requirements. The presentation data includes the presentation identification (ID) **1234**, the presentation media server type **1236**, the presentation type **1238**, and the program identification (ID) **1240**. Alternately, a media identification may be included in place of the presentation identification in some embodiments. The presentation type **1238** may be, for example, audio, video, images, a combination thereof, or another type. The presentation data also includes for each piece of media, the media number **1242** and the associated media number type **1244** for each media 1 to N. The media number and media number type will be included for each media in a presentation. Likewise, an associated resource number **1246** and an associated resource number type **1248** will exist for each resource **1** to N.

[**0305**] **FIG. 13** depicts an exemplary embodiment of a network access table. The network access table **1302** of **FIG. 13** is used to identify information for packet network connections. The network access table **1302** is accessed via a network ID **1304** from the active reservations table **804**. The packet address closest to the viewer may be used as a default. Although, other packet addresses may be used. For example, a buyer's packet address or a referring portal packet address may be used.

[**0306**] A packet address format may be dependant upon the type of transport and the protocol being used. For example, an internet access would use an IP address format.

[**0307**] In another example, a cable network using ATM to the home may use a packet address format identifying a virtual path/virtual circuit (VP/VC).

[**0308**] The network access table **1302** may contain order information generated during a customer set-up process. The order information may contain an order identification (ID) **1306**, and order type **1308**, and individual order lines from order line **11310** to order line N **1312**. The order lines **1310-1312** may be associated on a one-to-one basis with the network ID **1304**. For example, if the network ID **1304** identifies a buyer's home address, the order lines **1310-1312** might identify the buyer as a subscription customer that is paying for advertising/free viewing. In another example, the packet address might identify an internet portal site and reflect the fee arrangements with that site. The order data typically reflects the default billing arrangements for the packet address that is provided. If no other billing data is generated via other processes, the default data is used.

[**0309**] The network access table **1302** also contains packet service information that is associated with the network ID **1304**. In the example of **FIG. 13**, only one packet service is associated with the network ID **1304**. However, multiple packet services and multiple packet protocols may exist and may be supported. For example, an ATM packet network may use a native transport for a VP/VC and also use TCP/IP as an upper protocol layer for its transport device. In this example, two sets of service data would be entered.

[**0310**] Service data may include a transport service type **1314**, packet type **1316**, packet transmission speed **1318**, and packet address **1320**. The packet service type **1314** may include, for example, ATM, frame relay, internet, intranet, cable, and/or another service type. A packet type **1316** may identify the packet protocol associated with a network ID **1304**, such as high speed digital subscriber line (HSDSL), VP/VC, IP address, and others. The packet transmission speed **1318** identifies the maximum transport bit rate.

[**0311**] The packet address **1320** may identify the full packet addressing scheme needed to reach a network end point, such as a VP/VC for an ATM connection or an IP address for an internet connection. Although, it is not

necessary that the full packet addressing scheme be provided. The packet network sometimes dynamically controls the last portion of the addressing assignment. In that event, the packet address may be only a partial. For example, if an ATM network dynamically assigns the virtual circuit, then the data contained in the packet address **1320** is the virtual path. In another example, if an internet customer's ISP uses a dynamic host configuration protocol (DHCP) option of the IP protocol, then the packet address **1320** is the IP class C address.

[**0312**] The service information also may contain the packet security type and key **1322**. If the packet address is using a secure connection, the security type and security key, if existent, will be required for encryption and/or decryption. Thus, the security type and any existent security key is stored.

[**0313**] Other packet attributes **1324** may be included. For example, a network owner might want to add the last time point and quality of service test results or an indicator that a service is always on.

[**0314**] The network access table **1302** also contains data that associates the network ID to a signal access group. The signal access group **1326** is the key to enter the signal access point table shown in **FIG. 15**. Additional signal data may include the signal protocol **1328** and an in-band/out-of-band signal indicator **1330**. The signal data identifies where the billing and service control information for the network ID **1304** is transported and in what format.

[**0315**] The network access table **1302** also may contain key data referencing a buyer. The buyer data may include the buyer identification (ID) **1332** and a primary contact identification (ID) **1334**. The buyer ID **1332** and the primary contact ID **1334** may be used for default billing arrangements and contact information for a location. This buyer information enables a network operator to access the information stored in the RTSMS **106** (see **FIG. 1**) to obtain a complete set of information identifying the network ID **1304**, such as a street address, a billing cycle cut off date, and other general information.

[**0316**] The network access table **1302** also contains data referencing a service location. The service location information may include a service location identification (ID) **1336**, service location coordinates **1338**, a service location type **1340**, a service location contact identification (ID) **1342**, and service attributes 1 to N **1344-1346**. The service location ID **1336** and the primary contact ID **1334** are used for contact information for the service location. This enables multiple service locations to be established under one buyer ID **1332**. This service location data also enables a network operator to access data in the RTSMS **106** (see **FIG. 1**) to obtain a complete set of information identifying the service location, such as a street address or other general information.

[**0317**] **FIG. 14** depicts an exemplary embodiment of a signal mapping table. The signal mapping table **1402** of **FIG. 14** is entered using a signal mapping access key **1404**. The signal mapping access key **1404** may be identified using a signal access point table **810**. The signal mapping table **1402** will be processed if the signal access mapping key **1404** and an associated protocol (such as shown in **FIG. 15**) below contain valid data for the signal group ID being selected from the signal access point table **810**.

[**0318**] The signal mapping table **1402** maps data attributes from one protocol to another. For example, an originating signaling network point may use the IETF RTSP protocol, and a terminating network signaling point may use the IETF SIP protocol. The signal mapping table **1402** will map data attributes from the internal reservation format used by the signaling system **102** to the corresponding data attribute names for the SIP protocol and/or the RTSP protocol.

[**0319**] In another embodiment, an incoming signaling protocol might use a proprietary API, and the signal mapping table **1402** will map data attributes from the API protocol to the internal reservation format used by the signaling system **102**. Signal message conversion may occur on inbound signaling, outbound signaling, or in both directions if needed. Thus, the signal mapping table **1402** contains the first reservation attribute name **1408** to the Nth reservation attribute name **1410**. Likewise, the signal mapping table **1402** contains the corresponding first protocol attribute name **1412** to the Nth protocol attribute name **1414**.

[**0320**] The signal mapping table **1402** also identifies routines for encoding and decoding protocols. The routines are located in the encode library name **1416** and the decode library name **1418**. Routines are processes that convert data attributes from one protocol to another protocol and provide other protocol rule enforcement. For example, a protocol, such as the IETF SIP protocol, may specify time frames for a response and send data in multiple transmissions. The routines monitor these types of rules and handle any signaling errors that might result from improper message formats, improper send/receive timing of messages, such as a time out, and other protocol specific logic that is required.

[**0321**] **FIG. 15** depicts an exemplary embodiment of a signal access point table. The signal access point table **1502** provides signaling data for one or more groups of network access points. Entries are made into the signal access point table **1502** using a signal group identification (ID) **1504**.

[**0322**] The signal access point table **1502** assigns one or more unique signal point codes **1506** to each signaling device registered to provide streaming service. A signal point code is associated with every record in the network access table **806** that transmits any form of signaling data. Information identifying the physical location of a signaling point is collected. In the example of **FIG. 15**, the physical location information may include signal point coordinates **1508**, such as vertical and horizontal coordinates that normally would be present in an IP based signaling device, such as a router or a DNS server. Optionally, an NPA-NXX **1512** associated with a service site phone number, a time zone **1514**, and a signal time zone **1516** associated with the location of the signaling device may be stored.

[**0323**] The signal access point table **1502** includes order reference information and default billing information. The order reference and default billing information may be used to determine how streaming costs are to be allocated. The order reference and billing information identified in **FIG. 15** includes an order identification (ID) **1518**, an order type **1520**, and order lines **1** to N **1522-1524**. In one example, the order ID **1518**, order type **1520**, and order lines **1522-1524** may be used during a stream connection processing to inform another signaling network point how billing for this streaming service transaction is to take place between two separate networks that are being required to deliver the streaming service. In another example, the order information may be used within the streaming system **102** to assign costs to different departments for a profit/loss analysis.

[**0324**] The signal access point table **1502** also includes information identifying the protocols used for signaling over

a packet link. The example of **FIG. 15** depicts only one protocol. However, multiple protocols and multiple protocol attributes may be used for a single packet link or multiple packet links. The protocol information includes an identification of the signal access point associated protocol **1526**. The associated protocol defines what protocol is being referred to for the protocol attributes. An out-of-band identifier **1528** is set when a protocol uses a separate packet link or communication transport than is being used to deliver the streaming service. A signal mapping access key **1530** identifies a link to the signal mapping table **808**. A treatment of the partition code **1532** identifies the link into the treatment table **814** for error handling or a rejection of service. The packet address **1534** and the signal security type/key **1536** also may be obtained for the signaling network point.

[**0325**] The signal access point table **1502** also includes operational data for a signaling network point. The operational data may be used by a network operator to manage signaling traffic links. The signal point status **1538** informs a network operator if the signal link is operational, not operational due to a scheduled maintenance or other reason, or is in an alarm status. The signal point capacity load **1540** typically identifies a percentage variable that a network operator sets to establish the bytes per second to be transmitted across the signaling link. For example, a network owner may set the signal point capacity load **1540** to between 33-38 percent. Once a signaling link reaches the identified capacity, another signaling route will be selected unless none exist. Other ranges may be selected.

[**0326**] The signal location type **1542** is identified as well as a class of service partition code **1544**. The class of service partition code typically is one-half of a key to a class of service table **836**. The second half of the key to the class of service table **836** typically is found on a corresponding signal group record for the other signaling network point. This enables the routing data structure **802** to determine if the signaling protocols on each signaling network point are compatible either directly or via a conversion process. The network owner also can configure other signal point attributes 1 to N **1546** to be placed in the signal access point table **1502** to aid in the management of the signaling network.

[**0327**] **FIG. 16** depicts an exemplary embodiment of a stream percent skipped table. In the stream percent skipped table **1602** of **FIG. 16, a** partition code **1604** is used to enter the table. The network identification (ID) **1606** is the second portion of the key to enter the table and can enable the identified percent to skip control to be applied only to that network. If the network ID **1606** is left blank, the control will be applied to all traffic accessed by the partition code **1604**. The percent to skip **1610** is the control percentage that specifies the percentage of incoming streams that will be affected by the control. The next function **1612** allows attempts for a stream connection to be routed to another table during stream processing. The next partition **1614** points to an area within the next function table for further stream processing.

[**0328**] **FIG. 17** depicts an exemplary embodiment of a stream rate table. The stream rate table **1702** uses a partition code **1704** to enter the table. The network identification (ID) **1706** can be used as a secondary key that enables the stream rate control to be applied only to those streams originating from the network ID. If the network ID **1706** is left blank, the stream rate control will be applied to all traffic that accesses the stream rate partition code **1704**. The stream rate **1710** specifies the number of streams that will be passed by the control on or for completion of processing. This information will be used to determine if an incoming reservation falls within the stream rate control. The next function **1712** allows attempts for a stream connection to be routed to another table during stream processing. The next partition **1714** points to an area within the next function table for further stream processing.

[**0329**] **FIG. 18** depicts an exemplary embodiment of a treatment table. The treatment table **1802** of **FIG. 18** is entered using a partition code **1804**. The error number **1806** specifies an error code received during processing. The error number **1806** will be processed for a given partition code **1804**. This enables the network owner the ability to handle the same error differently depending on error conditions. For example, a viewer attempting to view restricted content may be handled using a variety of approaches. In a first example, the viewer may attempt to see restricted content during peak network load hours. The network owner may send the reservation request to treatment so that a text message requiring fewer network resources is displayed. In another example, the viewer may attempt to see restricted content during non-peak load hours. The network owner may send the reservation request to treatment so that a video-based message is streamed to the viewer explaining that the buyer of the service has restricted the content from being viewed.

[**0330**] The exception table **1802** also contains an error class **1808** for the partition code **1804**. The error class **1808** may be used when sending an error message via an open system network management standard, such as with SNMP or CMIP. The error partition code **1810** combined with the error class **1808** may be used to access a detailed description of the error. The message media identification (ID) **1812** identifies the message that will be streamed by an MMS if a network owner desires a video and/or audio message to be generated to the viewer. The next function **1814** and next partition **1816** identify the next table and area within the table for further stream processing.

[**0331**] **FIG. 19** depicts an exemplary embodiment of a referring host table. The referring host table **1902** is used to route traffic based on the originating network owner or a URL. The referring host partition code **1904** is used to enter the referring host table **1902**. Different routing algorithms may be created and stored for the same referring location by creating multiple referring host partition codes for the same location.

[**0332**] The referring host table **1902** contains an element identification (ID) **1906** that is generated as an identifier by the RTSMS **106** (see **FIG. 1**). The element ID **1906** describes the type of referring device for this record. A referring device may be, for example, a website URL, a set top box, a cable network head, or another packet network capable of originating streaming requests. The referring site reference **1908** is the identification of the location originating the streaming request. The referring site reference may be, for example, a web portal, a pay-per-view cable head, the medium access control (MAC) address of the set top box at a customer's home, or another identification.

[**0333**] The referring host service type **1910** designates whether the referring host is a public internet service, a corporate intranet service, a private network delivery service, such as a cable or satellite network, or another type of service. The next function **1912** allows attempts to be routed to another table during stream processing. The next partition **1914** points to an area within the next function table for further stream processing.

[0334] The referring host table **1902** also contains order information generated during the referring host customer set up process. The order information contains the order identification (ID) **1916**, the order type **1918**, and order lines **1** to N **1920-1922**. The order information can be associated on a one-to-one basis with the referring host partition code **1904**. The order information typically reflects the default billing arrangement for the partition code **1904**. If no other billing data is generated via other processes, the billing data in the referring host table **1902** is used. For example, information designating a URL referral fee may be contained in the order information if the reservation request has to be passed to another network. In this example, the other network signaling point may be informed of the costs of processing the reservation request.

[0335] **FIG. 20** depicts an exemplary embodiment of an exception table. The exception table **2002** is accessed by using an exception partition code **2004**. The exception table **2002** is used to route streaming requests around default routing. The exception element identification (ID) **2006** defines the type of element. For example, the element may be a media player type, a packet address, a content type, or another element type. These items may require special handling, such as when an older media player version is not compatible with installed media server software.

[0336] The player type **2008** identifies the type of media player being used on the device streaming the media. The player type may be, for example, a Windows Media Server or a proprietary set top box player used by a satellite company or a cable company. The player version number **2010** identifies the media player version. The media type **2012** identifies routing based upon the type of file being requesting. The media type may be, for example, MPEG standard 1, MPEG standard 2 (MPEG-2), MPEG standard 4 (MEG-4), Microsoft ASF, or other encoding standards for media.

[0337] The network access type **2014** identifies the type of originating access the viewer is using. The network access type **2014** may be, for example, a cable modem, a cable set top box, an ISP for the internet, or another type. The packet address from range **2016** and packet address to range **2018** are used to route a stream reservation request based upon the packet address. For example, a cable company may deny a pay-per-view request from a set top box owner that is in arrears for the owner's billing account. The set top box packet addresses for all boxes installed in the house may be blocked using this feature. The next function **2020** allows streaming attempts to be routed to another table during stream processing. The next partition **2024** points to an area within the next function table for further stream processing.

[0338] **FIG. 21** depicts an exemplary embodiment of a PIN table. The PIN table **2102** is used to provide information identifying a viewer's equipment and/or media player software. The PIN table **2102** is accessed via the PIN partition code **2104**. A different routing algorithm may be created and stored for the same referring location by creating multiple PIN partition codes for the same location. The element identification (ID) **2106** is an identifier generated by the RTSMS **106** (see **FIG. 1**). The element identification describes the type of PIN device or software for which this record was generated. The PIN device or software may be, for example, a Real Network Real Player, a set top box software key, a packet address, a web cookie identifier, or another device identification technique. The identifier further may include the element version number **2108** and/or the player identification (ID) **2110**.

[0339] The packet address from range **2112** and packet address to range **2114** are used to route stream requests based upon packet addresses. For example, a company might insert an advertisement for a video game. It must be compatible with the device or software identified by the element ID **2106**. In some cases, a treatment label **2116** may be provided for access to the treatment table **814**. Additionally, other attributes may be added to the table where needed. The next function **2118** allows attempts to be routed to another table during streaming processing. The next partition **2120** points to an area within the next function table for further stream processing.

[0340] **FIG. 22** depicts an exemplary embodiment of a content screening table. The content screening table **2202** performs functions similar to the reservation system described in **FIG. 2**. However, the content screening table **2202** performs functions that are directly controlled by devices of the network operator in the event that a management system, such as the RTSMS **106** (see **FIG. 1**), fails. The content screening table **2202** is accessed using a content screen partition code **2204**. A different routing algorithm may be created and stored for the same location by creating multiple content screening partition codes for a same location.

[0341] An element identification (ID) **2206** is an identifier generated by the RTSMS. The identifier describes the type of content being screened. The content being screened may be, for example, a program, a media rating type, such as the Motion Picture Association's (MPA) NC-17 rating, picture images, and other content types. The media identification (ID) **2208** allows a specific media to be identified within all presentations. Special routing may be applied for such media. For example, if a network owner receives consumer complaints regarding a particular media, the network owner may block access to the media using the media ID **2208**, even though the media may be listed in numerous programs and presentations.

[0342] The media rating **2210** enables routing content based upon its rating assigned by, for example, independent monitoring groups, such as the MPA. The program ID from range **2212** and the program ID to range **2214** are used to route programs within the identified range of IDs. The next function **2216** enables attempts to be routed to another table during stream processing. The next partition **2218** points to an area within the next function table for further stream processing.

[0343] **FIG. 23** depicts an exemplary embodiment of a content location table. The content location table **2302** may be cached in memory and used to locate where media is stored throughout a network, such as the streaming system **102**. The content location table **2302** stores information identifying individual media and media clips that are to be delivered to a viewer. The media identification (ID) **2304** is used as a key to enter the content location table **2302**.

[0344] The media category **2306**, media class **2308**, media rating **2310**, and media length **2312** also are included. The media category **2306** may be, for example, a television series, a movie, a music video, or other media categories. The media class **2308** represents a second level of classification. For example, the television series category might have financial programs, world news, soap operas, comedies, or other classifications. The media rating **2310** may be, for example, a rating based on a monitoring group, such as the MPA. The media length **2312** identifies how long the media takes to stream, such as an estimated number of seconds.

[0345] The encode rate **2314** identifies the bytes per second of a packet transmission required to view the media. The disk size **2316** is the amount of disk space required to store the media. The content location order identification (ID) **2318** refers to a storage order that can be located in a management system, such as the RTSMS **106**. The storage order refers to how much a media owner is being charged to store the media on the signaling system **102**. A media file name **2320** may be associated with the storage order and the order ID **2318**. The switch identification (ID) **2322** identifies one or more MMSs that contain the media identified by the media file name **2320**. The network owner may append other media attributes 1 to N **2324** to use for the content location table **2302**.

[0346] **FIG. 24** depicts an exemplary embodiment of a network status table. The network status table **2402** typically is cached in memory and reflects the current status of all devices required to connect a streaming service. A switch identification (ID) **2404** is used to enter the network status table **2402**. Multiple resources are monitored for each switch, causing multiple entries per switch to be entered into the table. Although, in the example of **FIG. 24, a** single row is depicted.

[0347] The secondary key for the network status table **2402** for each row is the resource type **2406**. The resource type identifies the resource being monitored and may include, for example, the public packet to bandwidth, signaling bandwidth, disk storage, processor use, and/or other resources. Each resource has an available resource capacity **2408** and a current capacity use **2410** of the resource. The current resource state **2412** also is depicted, such as whether the resource is in a maintenance state, an alarm state, or is available for use. The network owner may append other attributes from **1** to N **2414** to the network status table.

[0348] **FIG. 25** depicts an exemplary embodiment of a day of year table. The day of year table **2502** is accessed by using a day of year partition code **2504**. The from date **2506** and to date **2508** indicates the local date as applicable to the action to be taken during the processing of this table. The next function **2510** enables attempts to be routed to another table during stream processing. The next partition **2512** points to an area within the next function table for further stream processing.

[0349] **FIG. 26** depicts an exemplary embodiment of a day of week table. The day of week table **2602** is entered using a day of week partition code **2604**. The from day **2606** and to day **2608** indicate the local days of the week on which the action to be taken is to occur. The next function **2610** enables attempts to be routed to another table during stream processing. The next partition **2612** points to an area within the next function table for further stream processing.

[0350] **FIG. 27** depicts an exemplary embodiment of a time of day table. The time of day table **2702** is accessed using a time of day partition code **2704**. The from time **2706** and to time **2708** indicate the local times during which an action is to be taken. That is, the entries indicate-the time in which an action is to start and a time at which an action is to stop. The next function **2710** enables attempts to be routed to another table during stream processing. The next partition **2712** points to an area within the next function table for further stream processing.

[0351] **FIG. 28** depicts an exemplary embodiment of a signal route choice table. The signal route choice table **2802** is accessed using a signal route choice partition code **2804**. The route number **2806** specifies a route within a routing list. The route choices for a given route label will be processed in the order indicated by the route numbers. Therefore, the signal route choice table **2802** is used to prioritize route choices. For example, a first network, such as the streaming system **102**, may be connected to two other networks and delivery terms have been negotiated with each. The network providing the most favorable billing rate to the first network may be selected as the first route choice. The next function **2808** enables attempts to be routed to another table during stream processing. The next partition **2810** points to an area within the next function table for further stream processing.

[0352] **FIG. 29** depicts an exemplary embodiment of a class of service table. The class of service table **2902** is accessed using an originating signal class of service partition code **2904** and a terminating signal class of service partition code **2906**. The next function **2908** enables attempts to be routed to another table during stream processing. The next partition **2910** points to an area within the next function table for further stream processing.

[0353] Those skilled in the art will appreciate that variations from the specific embodiments disclosed above are contemplated by the present invention. The invention should not be restricted to the above embodiments, but should be measured by the following claims.

What is claimed is:

1. A method for routing media comprising:

receiving a request for media;

determining a program in which the requested media is identified;

creating a presentation having a presentation identification based on the program;

generating a reservation comprising a reservation identification and the presentation;

generating a play script comprising the reservation identification and at least one media identification for the requested media;

receiving the reservation, the reservation identification, and the media identification at a routing processor;

validating at the routing processor the reservation identification with the reservation and determining a media switch configured to stream the media identified by the media identification;

generating an address for the media switch upon validating the reservation identification and determining the media switch; and

streaming the media identified by the media identification from the media switch upon a session being initiated at the address.

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