SYSTEM FOR TERMINATING MULTICAST CHANNEL AND DATA BROADCAST WHEN AT LEAST TWO SECOND ENDPOINTS DO NOT TRANSMIT POSITIVE ACKNOWLEDGMENT MESSAGE TO FIRST ENDPOINT

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Notice: This patent is subject to a terminal disclaimer.

Appl. No.: 10/857,806
Filed: May 28, 2004

Related U.S. Patent Documents

Reissue of:
Patent No.: 5,999,977
Issued: Dec. 7, 1999
Appl. No.: 08/987,332
Filed: Dec. 9, 1997

U.S. Applications:
Continuation of application No. 10/020,515, filed on Dec. 7, 2001, which is a continuation of application No. 08/468,715, filed on Jun. 5, 1995, now abandoned, which is a continuation of application No. 08/396,198, filed on Feb. 24, 1995, now Pat. No. 5,854,898.

Int. Cl.
G06F 15/16 (2006.01)

U.S. Cl.
USPC 709/227, 709/204; 709/231; 709/237; 709/228

Field of Classification Search
USPC 709/227, 228, 231, 204; 370/261, 370/262, 263, 264, 265

See application file for complete search history.

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ABSTRACT
A method and apparatus for optimizing transmission of data to a plurality of second endpoints in a system wherein a first endpoint is providing data to the plurality of second endpoints each connected by a point-to-point communication channel. This may be useful in teleconferencing applications with a plurality of participants (endpoints) or broadcast server applications. The first endpoint activates a multicast communication channel having a first multicast address and communicates broadcast of the data over the multicast communication channel. The first endpoint transmits a request message to each of the plurality of second endpoints in order to query each of the second endpoints whether they can receive transmissions broadcast to the first multicast address. Certain of the plurality of second endpoints transmit an acknowledgment message if they can receive transmissions broadcast to the first multicast address, and the first endpoint receives the acknowledgment message. Then, for each acknowledgment message received from certain of the plurality of second endpoints, the first endpoint deactivates the point-to-point communication channel and the certain of the plurality of second endpoints.

115 Claims, 27 Drawing Sheets
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FIG. 4
Conference Component: Member Initialization

702 Set Capabilities

704 Set Mode

706 Set Timeout

708 Register & Publish Address

710 Listen for Conference Callers

Fig. 7
FIG. 8

PLACING A CALL

ENDPOINT 1

CAPABILITIES

HELLO

CALL

ENDPOINT 2

CAPABILITIES

HELLO

RESPONSE

FIG. 9

JOINING A CONFERENCE

ENDPOINT 1

CAPABILITIES

HELLO

JOIN

ENDPOINT 2

CAPABILITIES

HELLO

RESPONSE

FIG. 10

TERMINATE

OR

TERMINATE
Establishing a Conference (Transmitter)

1102 Look up Address of Party to be Called

1104 Call Party

or

1106 Failed Event

1108 Ringing Event

Get Capabilities Get Name

"Required" capabilities check

or

1112 MemberRefusedEvent

1114 MemberTerminatedEvent

1115 ConferenceReady Event

1116 MemberReadyEvent

1118 Start Conference

Fig. 11
Receive Incoming Call

1202 Incoming Call Event

1204 Get Capabilities
   Get User Name
   Get Return Address
   Get Conference Name

1206 Check Mode

1208 Time-Out Check if Any

1209 User Interaction

1210 Reply

1212 Refuse

1214 Answer

1218 MemberReadyEvent

1220 MemberTerminatedEvent

Start Conference

Fig. 12
**FIG. 20**

CAPABILITY 1

CAPABILITIES LIST

CONFIG 1 \n
... \n
VERSION \n
... \n
TAB \n
... \n
DEPRED \n
... \n
TAB \n
... \n
'1/n'

CAPABILITY 2

CAPABILITY n

**FIG. 21**

MEMBER LIST

CONFIG 1 \n
... \n
'1/n'

... \n
CONF IDN \n
... \n
'1/n'

**FIG. 22**

UNIQUE ID \n
... \n
n

SP \n
... \n
n

NAME \n
... \n
n

CONF ID

**FIG. 23**

TERMINATE

T \n
... \n
'1/n'

NULL

**FIG. 24**

BROADCAST REQUEST

'B' \n
... \n
R

TAB \n
... \n
MULTICAST ADOR \n
... \n
'1/n'

NULL

**FIG. 25**

BROADCAST ACK

'B' \n
... \n
'A'

TAB \n
... \n
BROADCAST RESPONSE \n
... \n
'1/n'

NULL
Join (Initiator)

2602 Make Join Message

2603 Add destConfID and calling ConfID

2604 Append Members

2605 Establish Transport Level Connection

2606 Send Join Message

Fig. 26a
Append Members to a Member List

Start

2610 Am I a Joiner?

No → End

Yes → 2612 Get Next Member

2614 Any More Members?

No → 2616 Shareable?

Yes → Add to Member List

Fig. 26b
Join (Receiver)

2652 Look up Dest ConflD

2654 Can't Find Dest ConflD?

Yes → 2656 Send Refuse

No →

2660 Add This Connection to List of Participants for this Conference

2662 Send Answer to Sender

2664 Merge membership of members in member list

2658 End

Fig. 26c
Start

2678 Am I shareable?  No → End

Yes →

2680 Any more members in member list?  No

Yes →

2682 Get next member

2684 This Participant Already Connected, Myself or is My Own Auxiliary Source?  No

Yes →

2686 Is Another Participant Going to Call Me to Join (MyConfID > Merged ConfID)?  No

Yes →

2688 Establish Transport Connections

2690 Send Capabilities or Auxillary Send Hello Send Join

2692 Wait for Response, and if Received, Issue MemberReady

Fig. 26d
Merge Conf D₂ into D₁

Fig. 27a

Fig. 27b
Conference Merge
(Transmitter)

2802
Combine Two Conferences
Old ConfID = New ConfID

2804
Create Merge Message

2604
Append Members

2806
Send Merge to All in Conference

Fig. 28a
Conference Merge (Receiver)

2812 Merge Message?

No → End

Yes

2814 Remember New confID and Caller's confID

2664 Merge Membership

2816 Done

Fig. 28b
### CURRENT CONFERENCES HISTORY TABLE

<table>
<thead>
<tr>
<th>CONF ID.1</th>
<th>OTHER CONF ID'S</th>
</tr>
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<tbody>
<tr>
<td>CONF ID.2</td>
<td>OTHER CONF ID'S</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>CONF ID.N</td>
<td>OTHER CONF ID'S</td>
</tr>
</tbody>
</table>

**FIG. 29**
FIG. 30A
A

No

3018
Receive BroadcastAck?

Yes

3020
Positive BroadcastAck?

Yes

3022
Turn off Point-to-Point

No

3024
BroadcastAck for each Broadcast Request Sent?

Yes

3026
Any Participants for Multicast?

Yes

3028
Turn off Multicast

No

Done

Fig. 30b
Fig. 31

Fig. 32
Auxiliary Source (Source)

3302 Retrieve Next Participant in Parent Conference

3304 Any More Participants?

3306 Send Auxiliary, Send Hello, Send Join

Fig. 33
Auxiliary (Receiver)

3402
Send Capabilities
Send Hello

3404
Receive Auxiliary

3406
Save ID of Parent

3408
Associate Parent ID with Conference ID of Auxiliary

Fig. 34
Outgoing Messages

| to B48C90 | K | pau 1 | 0
|          |   | shar 1 | 0
|          |   | recr 1 | 0
|          |   | recall 1 | 0
|          |   | recd 1 | 0
|          |   | reccl 1 | 0

Incoming Messages

| from B48C90 | K | pau 1 | 0
|            |   | shar 1 | 0
|            |   | recr 1 | 0
|            |   | recall 1 | 0
|            |   | recd 1 | 0
|            |   | reccl 1 | 0

| to B8C9B0 | K | pau 1 | 0
|          |   | shar 1 | 0
|          |   | recr 1 | 0
|          |   | recall 1 | 0
|          |   | recd 1 | 0
|          |   | reccl 1 | 0

| to B8C9B0 | H 3:3 | 15
|          | James

| to B48C90 | C 19392 Some Conference 672 mtkatlkJarines: VideoPhone: Video Zone

| from B48C90 | H 3:3 | 15
|            | Hillary

| from B48C90 | R 0 139 mtkatlkHillary: VideoPhone: Video Zone

| from B48C90 | J 1950 mtkatlkNew York: VideoPhone: Video Zone 672 mtkatlkJames: VideoPhone: Video Zone 137 mtkatlkHillary: VideoPhone: Video Zone

Fig 35a
Outgoing Messages

3524
3526
3528

Incoming Messages

from B8C9B0
K
paus 1 0
shar 1 0
recr 1 0
reca 1 0
recd 1 0
reccl 1 0

H 3:3
15
New York

from B8C9B0
R 0
1950
mtlkatlkNew York: VideoPhone: Video Zone
137 mtlkatlkHillary: VideoPhone: Video Zone

Fig 35b
SYSTEM FOR TERMINATING MULTICAST CHANNEL AND DATA BROADCAST WHEN AT LEAST TWO SECOND ENDPOINTS DO NOT TRANSMIT POSITIVE ACKNOWLEDGMENT MESSAGE TO FIRST ENDPOINT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to teleconferencing systems. More specifically, the present invention relates to the addition of a data stream, such as an auxiliary data stream to a teleconference.

2. Background Information

Teleconferencing is increasingly becoming a popular application in personal computer systems. Such applications typically allow the transfer of audio and video data between users so that they can speak and otherwise communicate with one another. Such applications sometimes also include data sharing wherein various types of data such as documents, spreadsheets, graphic data, or other types of data, can be shared and manipulated by all participants in the teleconference. Different teleconference applications perhaps residing on different hardware platforms have different capabilities. Moreover, a wide variety of features and the proliferation of different types of computer systems with different capacities, and different networking media has created challenges for teleconferencing.

For example, for most teleconference applications, it is assumed that the sender and the receiver have certain minimum capabilities. However, with the wide diversity of systems having different computation capacities, and in addition, the wide variety of networking media, that certain systems may not have certain capabilities. For example, the first system may be a high performance workstation coupled to a high performance communication medium whereas a second system may employ an earlier generation processor, operate at a substantially slower clock rate, and/or be coupled to a lower capacity communication medium. Certain network capabilities such as multicast or other optimization features, may not be present in certain networking media. Thus, in order for some teleconference applications to function, the participants in the conference can only operate at the fastest possible configuration provided by any minimum system which may participate in the teleconference. Of course, this results in certain inefficiencies, especially if both of the participants are capable of transmitting in a higher capacity than the system with the least possible capability.

Another issue in teleconference applications is the ability of certain stations to participate in more than one teleconference. In fact, in certain circumstances, multiple individual conferences may be desired to be merged by a user according to the operating circumstances. Due to the distributed nature of certain networks, during this merge operation, certain circumstances may change. That is, that while a single station is merging more than one conference it is participating in, a second station at a remote location may further have other operating circumstances changing (e.g., participants leaving, entering, or otherwise joining an on-going teleconference), and thus, the management of such merging operations becomes unduly burdensome.

Yet another shortcoming of certain prior art teleconference applications is the ability to associate an independent data stream with an on-going teleconference. For example, a source participant may desire to provide an additional data stream to other participants in a teleconference. This additional source may include, but not be limited to, video, data, audio or any other type of data available to the source participant. For example, such an additional source may include audio information for a receiver. Other types of data may also be desired to be associated with an on-going teleconference, which may be accessible to other participants in the teleconference. Certain prior art teleconferencing applications lack these abilities.

SUMMARY

A method and apparatus for optimizing transmission of data to a plurality of second endpoints in a system wherein a first endpoint is providing data to the plurality of second endpoints each connected by point-to-point communication channels. This may be useful in teleconferencing applications with a plurality of participants (endpoints) or broadcast server applications. The first endpoint activates a multicast communication channel having a first multicast address and commence broadcast of the data over the multicast communication channel. The first endpoint transmits a request message to each of the plurality of second endpoints in order to query each of the second endpoints whether they can receive transmissions broadcast to the first multicast address. Certain of the plurality of second endpoints transmit an acknowledgement message if they can receive transmissions broadcast to the first multicast address, and the first endpoint receives the acknowledgement message. Then, for each acknowledgement message received from certain of the plurality of second endpoints, the first endpoint deactivates the point-to-point communication channel and the certain of the plurality of second endpoints.

The broadcast of the data and the multicast communication channel is terminated if at least two of the plurality of second endpoints do not transmit the acknowledgement messages containing a positive acknowledgement. In this instance, communication channels are maintained as point-to-point. Subsequent to commencing broadcast of the data to the multicast address, the first endpoint can receive detach messages from certain of the plurality of second endpoints, and if at least two of the plurality of second endpoints are not receiving the data, then the first endpoint can terminate the broadcast of the data and the multicast communication channel. Communication of the data in this instance also reverts to point-to-point communication channels.
In implemented embodiments, the acknowledgement message includes a response code which indicates whether the second endpoint can receive transmissions broadcast to the first multicast address. Also, in implemented embodiments, prior to the first endpoint activating the multicast communication channel having the first multicast address, it is determined whether the single communication medium supports broadcasting to the first multicast address, and if not, multicast cannot be activated.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example and not limitation in the figures of the accompanying in which like references indicate similar elements and in which:

FIG. 1 illustrates an example configuration in which various embodiments of the present invention may be implemented.

FIG. 2 shows a typical teleconferencing display which has both media and non-media sources displayed during the course of the teleconference.

FIG. 3 shows a single system in which embodiments of the present invention may be implemented.

FIG. 4 shows an architecture of a system employing various embodiments of the present invention.

FIG. 5 shows a more detailed view of the conference component illustrated in FIG. 4.

FIG. 6 shows a sequence of typical conference events in a conference component which are issued to an application.

FIG. 7 shows a typical sequence of steps performed for member initialization within the conference component.

FIGS. 8-10 show typical exchanges of messages for different operations.

FIG. 11 shows a detail of a first endpoint establishing a teleconference.

FIG. 12 shows a sequence of steps performed in a second endpoint receiving the messages sent from a first endpoint during the establishment of a teleconference.

FIGS. 13-25 show details of the messages transmitted between endpoints during various teleconferencing applications.

FIGS. 26a, 26b, 26c, and 26d show the steps taken for performing merge operations.

FIGS. 27a and 27b show the conferences before and after a merge operation between teleconferences.

FIGS. 28a-b show a sequence of steps performed by the conference component during a merge operation.

FIG. 29 shows an example of a merged conferences table within a single participant.

FIGS. 30a-30b shows a sequence of steps performed for converting point to point connections to multicast connections for a teleconference.

FIGS. 31 and 32 show the adding of an auxiliary source and the messages during the adding of the source to an existing teleconference.

FIGS. 33-34 show the details of a sequence of steps performed within a participant for adding an auxiliary source.

FIGS. 35a-35b show an example sequence of messages which are sent between a first endpoint and a plurality of other endpoints in a networking system, and showing various messages transmitted therebetween.

DETAILED DESCRIPTION

The present invention relates to networking systems, more specifically, the present invention describes a messaging protocol for establishing and maintaining teleconference connections between a plurality of participants in a networking system. Applications for this include, transmitting application and/or system capabilities between participants or potential participants in a teleconference, notifying participants of a teleconference that more than one teleconference should be merged, and addition of an auxiliary data stream to an ongoing teleconference. Although the present invention will be described with reference to certain specific embodiments thereof, especially, with relation to certain hardware configurations, data structures, packets, method steps, and other specific details, these should not be viewed as limiting the present invention. Various modifications and other may be made by one skilled in the art, without departing from the overall spirit and scope of the present invention.

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A typical system configuration in which a teleconference may take place is illustrated as 100 in FIG. 1. For example, a first workstation 150 may communicate via teleconference with a second workstation 155, as illustrated. System 150 may include a central processing unit 150c which is coupled to a display 150d a video input device 150a, and a sound input device 150b. The system 150 may communicate with over system 155 over networking medium 170 via network connection module 160. 160 may include any number of network adapters commercially available such as using Ethernet, Token Ring, or any other networking standard commercially available. Note that network adapter 160 may also include a wireless network adapter which allows transmission of data between components without a medium 170. Communication is thus provided via network adapter 165 coupled to system 155, and bi-directional communications may be established between two systems. System 150 further has a keyboard 150e and a pointing device 150f, such as a mouse, track ball, or other device for allowing user selections and user input.

A teleconference display is shown at 200 at FIG. 2. In implemented embodiments of the present invention, there is a source window, such as 201, showing a monitor of the local media source, and there are other media windows, such as 202 or 203 for each other user with which a participant is having communication. In the illustrated example, each of the windows 201-203 provides media information, that is, real-time audio and/or video information for bi-directional teleconferencing. In alternate embodiments of the present invention, non-media information such as 204 may also be displayed within the teleconferencing display. As will become apparent in the description below, in addition to media and non-media information, messaging information may also be transmitted between stations. In addition, an auxiliary media source (e.g. audio or video information) may be transmitted with a specified conference. The details of this will be discussed in more detail below.

In implemented embodiments of the present invention, a general purpose computer system is used for implementing the teleconferencing applications and associated processes to be described here. Although certain of the concepts to be described here will be discussed with reference to teleconferencing, it is apparent that the methods and associated apparatus can be implemented for other applications, such as file sharing, real time data acquisition, or other types of applications which sends data from a first participant to a second
participant or set of participants. A computer system such as that used for implementing embodiments of the present invention will now be described.

A computer system, such as a workstation, personal computer or other processing apparatus 150c or 155c as shown in FIG. 1 is illustrated in more detail in FIG. 3. 150c comprises a bus or other communication means 301 for communicating information, and a processing means 302 coupled with bus 301 for processing information. System 150c further comprises a random access memory (RAM) or other volatile storage device 304 (referred to as main memory), coupled to bus 301 for storing information and instructions to be executed by processor 302. Main memory 304 also may be used for storing temporary variables or other intermediate information during execution of instructions by processor 302. Included in memory 304 during run-time may be the conference component module which operates according to the communication protocols to be described below. System 150c also comprises a read only memory (ROM) and/or other static storage device 306 coupled to bus 301 for storing static information and instructions for processor 302, and a data storage device 307 such as a magnetic disk or optical disk and its corresponding disk drive. Data storage device 307 is coupled to bus 301 for storing information and instructions.

System 150c may further be coupled to a display device adapter display 321 such as a cathode ray tube (CRT) or liquid crystal display (LCD) coupled to bus 301 for displaying information to a computer user. Such a display 321 may further be coupled to bus 301 for the receipt of video or image information. An alphanumeric input device 322, including alphanumeric and other keys may also be coupled to bus 301 for communicating information and command selections to processor 302. An additional user input device is cursor control 323, such as a mouse, a trackball, stylus, or cursor direction keys, coupled to bus 301 for communicating direction information and command selections to processor 302, and for controlling cursor movement on display 321. For teleconferencing applications, system 150c may also have coupled to it a sound output device 324, a video input device 325, and sound input device 326, along with the associated D/A (Digital-to-Analog) and A/D (Analog-to-Digital) converters for inputting or outputting media signal bitstreams. System 150c may further be coupled to communication device 327 which is coupled to network adapter 160 for communicating with the teleconferencing stations.

Note also, that any or all of the components of system 150c and associated hardware may be used in various embodiments, however, it can be appreciated that any configuration of the system may be used for various purposes according to the particular implementation.

In one embodiment, system 150c is one of the Apple Computer® brand family of personal computers such as the Macintosh 8100 brand personal computer manufactured by Apple Computer, Inc. of Cupertino, Calif. Processor 302 may be one of the PowerPC brand microprocessors manufactured by Motorola, Inc. of Schaumberg, Ill.

Note that the following discussion of various embodiments discussed herein will refer specifically to a series of routines which are generated in a high-level programming language (e.g., the C or C++ programming language) and compiled, linked, and then run as object code in system 150c during run-time within main memory 304 by processor 302. For example the object code may be generated by the C++ Compiler available from Symantec, Inc. of Cupertino, Calif.

Although a general purpose computer system has been described, it can be appreciated by one skilled in the art, however, that the following methods and apparatus may be implemented in special purpose hardware devices, such as discrete logic devices, large scale integrated circuits (LSI's), application-specific integrated circuits (ASIC's), or other specialized hardware. The description here has equal application to apparatus having similar function.

FIG. 4 illustrates a plurality of processors and/or apparatus which may be operative within system 150c. At the highest level, for example, at the highest level in the ISO/OSI networking model, an application program 401, such as a teleconferencing application, an audio/video server, or a data server, communicates with conference component process 400 in the form of Application Program Interface (API) calls. The conference component 400 allows the application to establish communications between two or more teleconference stations. Control information, and media information can be transmitted between the first participant system and a second participant system. The conference component will be shown in more detail in FIG. 5. Conference component 400 communicates with the transport component 402 by sending MovieTalk messages for other teleconferencing stations which are encapsulated and placed into a form that the transport component 402, the network component 403, and the system network component 404 can packetize and transmit over networking medium 170. For the purposes of the remainder of this disclosure, certain of the MovieTalk API calls and MovieTalk messages which are transmitted between conference components in a teleconferencing system will be described in more detail.

The transport component 402 and the networking component 403 provide the necessary operations for communication over the particular type of network adapter 160 and networking medium 170 according to implementation. For example, networking component 402 may provide the TCP or ADSP protocols and packetizing, according to those respective standards.

A more detailed view of the conference component 400 is shown in FIG. 5. Specifically, the conference component 400 is shown in two portions 400a and 400b which show input and output portions of the conference component. Although illustrated as a separate transmitter and receiver, each conference component in the system has both capabilities, so that full bi-directional communication between conference components in respective participant teleconference systems in a network may communicate with one another. As illustrated, the input portion of the teleconference component 400a receives video and sound information over media input channels 510 and 520. The video channel component and sound channel component 504 present media data at regular intervals to sequence grabber 502. The real-time sound and video data (hereinafter referred to as “media data”) are provided to a source stream director 500 from sequence grabber 502 which then provides the media messages to the transport component 402. Flow Control 501 then lets the video and sound data flow through at an implementation-dependent frequency. The video channel component 503, sound channel component 504, and sequence grabber 502 all are implemented using prior art products such as those commercially available (e.g., the QuickTime video channel, sound channel components, and sequence grabbers, available from Apple Computer, Inc. of Cupertino, Calif.). Flow control 501 may be implemented using known flow control apparatus and/or method as are commercially available, such as those which regulate flow based on bandwidth, and other constraints in the source participant system. The conference component further comprises a sink stream director 510 which comprises a portion of the component 400b of the conference component for receipt of media data from transport component 402. Corresponding
flow control 511, video and sound stream players 512 and 513, and compression and sound manager 514 and 515, for output of video streams 530 and 540, also form part of the conference component for full bi-directional conferencing capabilities.

The conference component’s main function is to establish and maintain a bi-directional connection between every member of a conference. Conferencing applications use a pre-established control channel to exchange control data that is pertinent to the conference. This data might include user identification information or other information that is germane to the application’s operation. Conferencing applications (e.g., 401) define the format and content of these control messages by establishing their own control protocols. The conferencing component further establishes communication channels between a first endpoint and a second endpoint, using the underlying transport component 402. Thus, once a media channel has been established, the conference component uses the transport component 402’s media channel which is provided for transmission of media and non-media information. For the remainder of this application, however, the focus will be on the establishment of communication between a first and second participant (referred to as endpoints) or group of participants which may participate in a teleconference.

Application Program Interface (API)

The application program 401 controls the conference component 400 by the issuance of MovieTalk application API calls. The conference component operates using an event-driven model wherein events pertinent to the application are issued to the application program. The application program can then take appropriate action either by modifying internal data structures within (creating a source or sink), and/or issuance of appropriate messages over the network to other connected participants, or potential participants. According to messages received by the conference component, a current context and API calls from the application, the conference component can take appropriate action.

A typical series of events which occur after the establishment of a teleconference by the conference component in an application is illustrated in FIG. 6 as 600. For example, upon an initial desire by an application to enter into a conference (as expressed by an API call) or a call from another participant, a conference-ready event 601 (e.g., mtConferenceReadyEvent) is generated. The application then creates a media source in the conference component (e.g., member A) which is to provide the conference information. Subsequent to that, any auxiliary media sources may also be attached to the main conference at step 610 for second media source (e.g., by the call MTConferenceAttachAuxiliary Source). Then, any members that are new to the conference are recognized as being ready by the receipt of MemberReady (e.g., mtMemberReady events (e.g., 602 and 603 of FIG. 6). This establishes the media sinks such as b and c illustrated in FIG. 6. Then, during the teleconference session, a variety of other events 604 may be issued and acted upon by the conference component. These may include message events, mode events, incoming call events, data transmission events, etc. Members leaving the conference result in the issuance of MemberTerminated (e.g., mtMemberTerminatedEvent) events to the application program such as 605 or 606. Thus, for every MemberReady event for any member participating in a conference, there is a corresponding MemberTerminated (e.g., mtMemberTerminatedEvent) event prior to the end of the conference. In addition, the auxiliary source and the conference itself is terminated via the Auxiliary Terminated (e.g., mtAuxiliaryTerminatedEvent) event 611 and the conference terminated event 607 as illustrated in 600 of FIG. 6. This notifies the application that the conference is terminated, and teleconference data should no longer be transmitted. Any additional clean up operations are then performed by the application, and the source may be discarded.

A typical application’s initialization is shown as process 700 of FIG. 7. The application program makes a number of API calls in order to set various parameters associated with the member or potential participant. First, an application may cause the conference component to set its capability at step 702 if it is different than the default. The call to “MTConferenceSetMessageCapabilites” causes the conference component to recall in a store the specific application capabilities within the conference component for the specific conference which are later used during transmission of messages to alert recipients that the sender application has certain functional capabilities prior to the establishment of a connection between the sender and the receiver. Each capability has associated with it a type, version, and “desire” of the capability. Each desire for each capability type may be flagged as: 1. optional; 2. desired; 3. required; or 4. a negotiation message. These types of capabilities are included in a capabilities list which is transmitted to endpoints, as will be described below.

An “optional” capability is a message which is not required to be exchanged before setting up a conference. A “desired” capability is one which is not required that it be exchanged before setting up a conference, however, it is preferred that it is. A “required” capability is one which requires that a message be exchanged before setting up a conference. This may include access control or other messages which are transferred prior to setting up a conference. An access control capability may include the transmission of an account number and password prior to the commencement of a teleconference. A “negotiation message” is a capability which indicates that the application wishes to query the receiving application.

In the case of a negotiation message capability, the type field associated with the capability allows the requests of information about the applications prior to the establishment of a conference (e.g. about the type of software and hardware components the application is interested in, such as sound). Any other types of exchanges which require negotiated information between applications may be set.

Once all individual capabilities have been set by the issuance of “Set Capabilities” API calls (e.g., MTConferenceSetCapabilities) to the conference component at step 702, a member may set its operating mode at step 704. The mode will be contained within a mode mask value which is sent in the API call to the conference component, and moreover, is included in certain messages transmitted from the conference component in the sender to the conference component in the receiver. The mode mask specifies the characteristics of a conference that the member makes available. Different capabilities, modes, and other initialization operations shown in FIG. 7 may be set for any number of conference types which are made available by the member. At any rate, the default mode includes the following values:

1. send media;
2. receive media;
3. shareable; and
4. joiner

The “send media” mode flag indicates that the member intends to send media data in its conferences. Most members
will want to send media, however, there will be instances where the member will be a receive-only member, thus the send media mode flag will not be set. The receive media mode flag indicates that the member intends to receive media in conferences. In the case of a send-only member (e.g., a server providing a real-time video and/or audio source), will have the receive media mode flag set to "off" (e.g., a numeric value '0'). The "shareable" mode flag indicates that the member is willing to share the conference media data with new conference members. Thus, in the instance of a send-only media server, the shareable mode flag would be set indicating that new members can receive the conference data.

The "joiner" mode flag indicates that all conference members are allowed to interact. This would allow two-way transmission between each of the conference members. However, the setting of this flag to "off" (e.g., a numeric value '0') results in broadcast type conferences wherein one member sends media data to other conference members, but the individual conference members do not exchange any media data among themselves. Each of these mode flags is transmitted at the beginning of a connection (e.g., contained within the "hello" message 1400 in FIG. 14).

By default, the conference component establishes conferences that are fully two-way media data capable, shareable, and joinable. If different characteristics are desired, then the application must call "set mode" (e.g. MTCreservationSetMode) at step 704, along with the appropriate flag(s) set. Conference mode settings are stored and associated with a particular conference ID in the sender’s conference component so that when messages are created for that conference ID, the appropriate mode flags are transmitted along with the initialization or other messages sent before any other communications.

In addition to the capabilities and mode settings at steps 702 and 704, a time-out value associated with calls placed from the member may be set (e.g., using the API call MTCreservationSetTimeOut). The time-out value is then included at the beginning of certain messages preceding a conference in order to enable a recipient to determine when the caller will stop listening for responses. This allows certain features to be incorporated into participant conference components such as the smart triggering of events based upon context. For example, if the recipient is receiving a call, but a user does not wish to take the call at that time, the recipient’s conference knows the time-out occurs and can take certain context-dependent action (e.g., forward the call, send a message, etc.).

The application can then invoke an API call “Listen for Call” (e.g. MTCReservationListen) which implements steps 708 and 710. At step 708, using the underlying transport to which the system is connected, a high level address is registered and published. This then allows other potential participants in the system to call the member. The registration and publication of the address is implementation-dependent, depending upon the media to which the system is connected. Then, at step 710, the conference component waits for incoming calls.

The conference component in the member enters an idle state wherein incoming messages, alerts for the transport component, API and calls will be detected and acted upon. Note that the capabilities, mode, and time-out values are all optional, and the default settings may be used by the member if none of these functions is required by the application. In the call to the MTCReservationListen function, the application must specify the networks on which the member is willing to accept calls. The conference component proceeds to register the member on those networks, doing whatever is appropriate in the various network contexts, and sends an mtListenerStatusEvent to the application to specify whether the registration attempt was successful. After listeners are operational, if another application desires to establish communication with the application, then an mtIncomingCallEvent is forwarded to the application.

FIGS. 8-10 show examples of the various message exchanges between two endpoints. Messages are generated by conference component 400 depending upon operating context, and application calls. FIG. 8 shows an example of a calling sequence for setting up a conference between two endpoints. Upon the commencement of a call from a first endpoint such as 810 shown in FIG. 8, and a second endpoint such as 820 shown in FIG. 8, a "capabilities" message 802 is transmitted from the endpoint 810 to the endpoint 820 if they have been set by the caller. The exchange of "capabilities" messages 802 and 812 between endpoint 1 810 and endpoint 2 820 are exchanged after a control channel has been opened on the transmission medium between the participants in an implementation-dependent manner (e.g. by invoking MTCConferenceCall). This identifies the capabilities of each of the endpoints, if the capabilities of the application are desired to be transmitted. Once capabilities have been transmitted from each endpoint, each endpoint further transmits Hello messages 804 and 814 to identify themselves. The details of the capabilities, Hello, and other messages illustrated in the figure will be discussed below. The Hello message is the first step in establishing a conference, and allows conference components in different systems to exchange basic identification and mode information. Subsequent to the exchange of Capabilities messages (if any), and the Hello messages 804 and 814, the endpoint 1 810 wishing to establish the conference sends a call message 806 to endpoint 2 820. Subsequent thereto, if endpoint 820 desires to engage in the teleconference with endpoint 1 810, it sends a response message 816 to endpoint 1 810. Then, upon the transmission of the call message 806 and the receipt of the response message 816, a teleconference is then established between endpoint 1 810 and endpoint 2 820. The details of the process steps performed within each endpoint are discussed with reference to FIGS. 11 and 12.

FIG. 9 illustrates a “Join” protocol process. This is similar to the calling process, however, a “Join” message 906 is sent to the second endpoint instead of the “call” message 806. The details of a Join are discussed with reference to FIGS. 26a-26c below.

FIG. 10 illustrates the messages exchanged for a terminate message. As illustrated, an endpoint may issue a terminate message to terminate a teleconference. No response is required for any receivers.

FIG. 11 shows the process steps performed by a first participant (e.g., endpoint 1 810) wishing to establish communication with a second participant system (e.g., endpoint 2 820). First, at step 1102, the caller via implementation-dependent means, accesses the address of the party it wishes to call, either by reference to an internal store, referencing a server or other implementation-dependent manner. Once this has been performed, the application invokes the API call MTCConferenceCall in order to call the party at step 1104. Responsive thereto, either a failed event 1106 (mtFailedEvent) is received by the caller, or a ringing event 1108 (mtPhoneRingingEvent) when the call message has been transmitted to the second participant. In the event of a ringing event, the endpoint can then get the capabilities, mode and the name of the endpoint such as by examining the data contained in the Capabilities message 812 and/or the Hello messages 814. Any “required” communication between the caller and receiver may also be performed. Then, the first sender can
appropriately configure itself for the second endpoint. Once any necessary message exchanges and/or configurations have been performed in the caller, then the caller will either receive a MemberRefused event 1112 (e.g., mتنRefusedEvent), for example, if the calling member does not provide the necessary access control subsequent to the call message, or, a MemberReady event 1116. Also, a failed event 1106 can be detected at any time, followed by a MemberTerminated event 1114. In the case of a MemberRefused event 1112, then the conference component will generate a MemberTerminated event 1114, and a conference terminated event will then be issued indicating the end of the conference. Once capabilities have been obtained, any required capabilities are checked for at step 1113 (e.g., such as any actions that must be performed before the receiver accepts the call). Subsequent thereto, a ConferenceReadyEvent 1115 (e.g., MTCOnfReadyEvent) and a MemberReady event 1116 (e.g., mتنMemberReadyEvent) can be received by the application, then the endpoint can then engage in the exchange of messages typical during a conference, thus commencing the conference at step 1118.

As shown in FIG. 12, the sequence of steps performed by the receiver is illustrated. For example, at step 1202, the receiver application will detect an incoming call event 1202. Subsequent thereto, the receiver can then determine mode, capabilities, caller’s name, conference name, and/or return address of the party wishing to engage in the conference. The mode can also be checked for at step 1206. Once this has been done, then a time-out check, if any, at 1208 can be performed in the receiver. The time-out check may be performed, depending upon an application’s implementation, by checking the time-out field shown at field 1504 in FIG. 15, which indicates how long the transmitter will wait prior to timing out and generating a CallFailed event (e.g., mتنCallFailedEvent) in order to terminate the call. In this case, according to implementation, the receiver may do a variety of things, for example, issuing a busy signal to the transmitter, issuing a message to the caller or, taking some action, such as forwarding the call to another party. Thus, the embedding of the time-out field 1504, within the initial connection message “Hello,” provides for certain intelligent features in the potential participants of a teleconference. Once any mode checks, if any, have been performed at step 1206, then at step 1208 a timeout check, if any, may be performed. Any user interaction may take place at step 1209. The receiver will then issue a reply at step 1210. The reply may indicate either refusal to answer the call (e.g., due to access control, or the participant already engaging in another conference), or choose to respond to the call in the affirmative indicating that the teleconference may commence. In the case of a refusal, the MemberTerminated 1220 event (mتنMemberTerminatedEvent) is issued to the application. In the case of the member answering, the MemberReady event 1218 (mتنMemberReadyEvent) is issued indicating that the medium channel is open and the conference can commence.

**Conferencing Messages**

Conference components exchange a number of messages in order to establish, maintain, and terminate conferences. Conference components also send messages that encapsulate user data, that is, the data that is exchanged by the programs that are using the conference.

After establishing a transport connection but prior to establishing a conference channel with a remote system, a conference member may send either a Capabilities message 1300 or an Auxiliary message 1700. The member then sends a Hello message 1400 to identify itself, specifically its mode of operation (send media, receive media, shareable, or joiner) followed by a Call message 1500 (to set up a conference) or a Join message 1800 (to join to an ongoing conference). The remote member sends a Response message 1600 in answer to the Call or a Join message 1800. Once a conference is established, a member can combine calls or conferences by sending a Merge message 1900. Conference members may send or receive a Terminate message 2300 to end a conference. Connections initially are point-to-point between members of a conference. If the transport medium supports multicast addresses and more than one member is participating in a conference, a broadcast to a multicast address can be used as an optimization. The conference component uses the BroadcastRequest and BroadcastAck messages 2400 and 2500 to negotiate the transition from point-to-point to multipoint connections using multicast addresses.

All messages supported in the conference messaging protocol are preceded by a 2-byte character identifying the message type. For example for a capabilities message shown in FIG. 13, field 1302 contains a “K.” All messages are further terminated by a NULL, such as that shown in field 1308 of FIG. 13. The Capabilities message 1300 allows a potential member to tell other potential conference members what it can and cannot do in a conference. Each member sends this message before sending the “Hello” message (1400 of FIG. 14) if capabilities other than the default are supported.

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>type 1302</td>
<td>2 bytes</td>
<td>&quot;K&quot;</td>
</tr>
<tr>
<td>delimiter 1304</td>
<td>1 byte</td>
<td>newline</td>
</tr>
<tr>
<td>capabilitiesList 1306</td>
<td>0-n bytes</td>
<td>(alphanumeric)</td>
</tr>
<tr>
<td>terminator 1308</td>
<td>1 byte</td>
<td>NULL</td>
</tr>
</tbody>
</table>

capabilitiesList 1306

The member’s capabilities. This field is optional. If specified, it contains a list of the member’s capabilities. An application specifies its capabilities by calling the conference component’s MTCOnferenceSetMessageCapabilities function.

The Capabilities message 1300 shown in FIG. 13 informs other potential conference participants about a member’s capabilities. These capabilities relate directly to messages the member either supports or requires, one capability for each conferencing message type that the component supports. The messages themselves are defined by the type of application the member is running. For example, video-phone applications and chat lines deliver different services, and use different messages to do so. As a result, the capabilities a member supports will change in light of the application that is participating in the conference. Entries in the capabilitiesList field may request information from the remote system. By setting an entry’s “desires” field (2010 of FIG. 20) mتنNegotiationMessageCapabilities ("N"), a conference member can query for specific information (e.g. about a given component type, such as a codec, hardware/software features supported, etc.). The type field can contain the component type value.

In response to a negotiation Capabilities message, the remote member formats a user data message, for example, containing available component subtypes. Note that this list may contain duplicate entries and entries with a value of NULL. To parse this array, a member must determine the array’s size. After sending a Capabilities message 1300, the member sends a Hello message 1400 to establish a conference.
A Hello message (e.g., 1400 of FIG. 14) is sent at the start of a conference by each endpoint. The Hello message identifies basic capabilities of the sender and the mode in which it will operate. It contains the following:

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>1402</td>
<td>2 bytes</td>
</tr>
<tr>
<td>type</td>
<td>1404</td>
<td>1-n bytes</td>
</tr>
<tr>
<td>type</td>
<td>1406</td>
<td>1 byte</td>
</tr>
<tr>
<td>type</td>
<td>1408</td>
<td>1-n bytes</td>
</tr>
<tr>
<td>type</td>
<td>1410</td>
<td>1 byte</td>
</tr>
<tr>
<td>type</td>
<td>1412</td>
<td>1-n bytes</td>
</tr>
<tr>
<td>type</td>
<td>1414</td>
<td>1 byte</td>
</tr>
<tr>
<td>type</td>
<td>1416</td>
<td>1-n bytes</td>
</tr>
<tr>
<td>type</td>
<td>1418</td>
<td>1 byte</td>
</tr>
<tr>
<td>type</td>
<td>1420</td>
<td>1 byte</td>
</tr>
</tbody>
</table>

minimumVersion 1404
The oldest version of the conference protocol supported by the sending component.

maximumVersion 1408
The newest version of the conference protocol supported by the sending component.

conferenceMode 1412
The desired conference operating mode. This field contains a value that corresponds to the operating mode the sender desires for this conference. Applications specify their desired mode by a SetMode API call (e.g., MTConferenceSetMode discussed above).

name 1414
The name of the prospective conference member. This name identifies the entity that wants to join the conference, and may represent either an auxiliary data source or a new user. Applications specify a user name by calling the MTConferenceListen API call. The auxiliary name is specified in a MTAuxiliary API call.

The Hello message 1400 is the first step in establishing a conference. This message allows conference components on different systems to exchange basic identification and capability information. Before sending a Hello message 1400, a conference component may send either a Capabilities 1300 or an Auxiliary message 1700. The type of message sent depends upon the role the member anticipates playing in the conference. If the member is looking to join or start a conference, the conference component sends a Capabilities message. If the member is setting up an auxiliary media data source, the component sends an Auxiliary message 1700. Following this message, the conference component can enter the call setup phase by sending the Call message 1500. If the member wants to provide an auxiliary data source to an existing conference, or join an existing conference, the component sends the Join message 1800.

Call message 1500 of FIG. 15 begins the process of establishing a conference connection between two possible participants. This is akin to dialing a number from a phone directory.

callTime-out 1504
The amount of time the calling component is willing to wait for an answer. This field specifies the number of ticks (¼ of a second) the calling component will wait before deciding that the call has not been answered. Called components must respond within this time period. This value may be used by a potential responder for taking some automatic action if the user doesn’t answer before the timeout.

ConferenceName 1508
The conference name. If the caller is establishing a conference, this is the name the caller has assigned to the conference. If the caller is connecting to a conference server, this is the name of the server’s conference. Applications set the conference name by calling the MTConference function.

callID 1512
The caller’s unique conference identifier. This field uniquely identifies the caller’s conference endpoint on the network. Conference components create conference identifiers on behalf of calling applications which are unique within the conference component. Call ID’s are discussed with reference to 2200 of FIG. 22.

The Call message 1500 shown in FIG. 15 begins the process of establishing a conference between two participants. This message can be used in two ways. First, this message can create a conference between two participants. In this scenario, the caller assigns a name to the conference, so that other possible participants may join later. Alternatively, this message can request to join a conference that is managed by a conference server on a network. For example, the server will allow incoming calls, but the function of the server is to merge the new conference due to the call with other ongoing conferences. In other words, the server acts exclusively as a “joiner” and does not supply media data. Once the call is set up, the caller can begin exchanging user data with other conference participants.

The response message 1600 of FIG. 16 is sent in response to Call or Join messages 1500 or 1800.

callResponse 1604
The result. This field indicates the result of the preceding Call request. This field is set to '0' if the request was successful. Otherwise, it contains an appropriate result code.

destinationConfID 1608
The other endpoint’s unique identifier. This field identifies the other participant in the conference.

The Response message 1600 allows the caller to determine the success of a Call or Join request. The Response message
1600 indicates how the user at the remote system reacted to the call (for example, whether the user answered the call). The callResponse field 1604 contains the request’s result code. If non-zero, an error occurred and the request was not successful. Otherwise, the destinationConfID field 1608 identifies the endpoint with which the caller may now communicate.

The auxiliary message 1700 allows one member to alert the other members of a conference that it is about to provide an auxiliary media data source (a source associated with an ongoing conference). This message may be used in place of the Capabilities message 1300 if a participant is being alerted about the presence of an auxiliary media source. The member sends this message before sending the Hello and Join Messages 1400 and 1800, and then proceeds to adding an auxiliary data source to the conference.

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>type 1702</td>
<td>2 bytes</td>
<td>A</td>
</tr>
<tr>
<td>parentConfID 1704</td>
<td>1-n bytes (alphanumeric)</td>
<td>delimiter 1706</td>
</tr>
</tbody>
</table>

parentConfID 1704
The member’s conference identifier. This field identifies the member’s existing conference endpoint (the conference identifier the member supplied in the Call message when it first joined the conference). This allows other conference participants to identify the source of the auxiliary data within each participant.

The Auxiliary message 1700 informs other conference participants that a member is about to provide an auxiliary conference data source. For auxiliary data sources, this message replace the Capabilities message during early interactions. The member must send this message to each conference participant. The member then sends a Hello 1400 and a Join message 1800 to each participant. Other participants then accept the new data source by accommodating the Join request.

A Join message 1800 of FIG. 18 allows a member to join an existing conference, given that conference’s identifier. This message is useful for adding auxiliary data sources to an existing conference, and for merging two existing conferences.

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>type 1802</td>
<td>2 bytes</td>
<td>J</td>
</tr>
<tr>
<td>destinationConfID 1804</td>
<td>1-n bytes (alphanumeric)</td>
<td>delimiter 1806</td>
</tr>
<tr>
<td>callingConfID 1808</td>
<td>1-n bytes (alphanumeric)</td>
<td>delimiter 1810</td>
</tr>
<tr>
<td>memberList 1812</td>
<td>0-n bytes (alphanumeric)</td>
<td>terminator 1814</td>
</tr>
</tbody>
</table>

destinationConfID 1804
The remote endpoint’s unique conference identifier. This field identifies the conference to join on.

callingConfID 1808
Unique conference identifier. This field uniquely identifies the caller’s conference endpoint on the network. Conference components create conference identifiers on behalf of calling applications. If the message is adding an auxiliary media data source, this is the auxiliary’s identifier.

1000 memberList 1812
A list of other conference participants. This list identifies all other known conference participants that are willing to exchange data with new participants (that is, they have the Joiner Mode flag set). The conference component can connect with each participant with whom it is not already connected. If the message is adding an auxiliary (via the issuance of an auxiliary message 1700), this list contains the endpoint identifier of each participant to which the caller is making the auxiliary available. It is up to each of them to respond.

This is a list of conference endpoint identifiers; each element in the list is followed by a newline character.

The Join message 1800 allows a member to add an auxiliary data source to an existing conference or to merge two existing conferences. The caller sends this message to members of the conference in response to a merge or join request instead of a call message.

The Merge message 1900 of FIG. 19 combines two conferences. Recipients of this message connect with the listed members with whom they are not already connected.

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>type 1902</td>
<td>2 bytes</td>
<td>M</td>
</tr>
<tr>
<td>conferenceName 1904</td>
<td>1-n bytes (alphanumeric)</td>
<td>delimiter 1906</td>
</tr>
<tr>
<td>myConfID 1908</td>
<td>1-n bytes (alphanumeric)</td>
<td>delimiter 1910</td>
</tr>
<tr>
<td>memberList 1912</td>
<td>0-n bytes (alphanumeric)</td>
<td>terminator 1914</td>
</tr>
</tbody>
</table>

conferenceName 1904
The new conference name resulting from the merge. This is the name that was assigned to the conference when the conference was established. Applications specify the conference name by calling the MTConferenceCreate API function.

myConfID 1908
Unique conference identifier. This field uniquely identifies the caller’s conference endpoint in the target conference. Conference components create conference identifiers on behalf of calling applications.

memberList 1912
A list of other conference participants. This list identifies other current conference participants. This list contains the endpoint identifier of each new participant. This is a list of conference endpoint identifiers; each element in the list is followed by a newline character.

The Merge message causes the combination of two conferences. This is the mechanism for creating conferences with more than two participants. The caller sends this message to each existing conference member, specifying the conference’s name. Each endpoint establishes communications with any new endpoints. By convention, the endpoint with the higher conference identifier value establishes the connection (to avoid duplicate or missed connections). Members of the conference receive a Join message 1900 instead of a Call message 1500 when contacted by each new member.

Field Specifics
A capabilities list such as shown in FIG. 20 (e.g., field 1306) contains information about the message supported by a conferencing application. The list consists of zero or more
lines of information; each line specifies a single capability
and consists of the following fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>type 2002</td>
<td>4 bytes</td>
<td>alphanumeric</td>
</tr>
<tr>
<td>delimiter 2004</td>
<td>1 byte</td>
<td>tab</td>
</tr>
<tr>
<td>version 2006</td>
<td>1-n bytes</td>
<td>numeric</td>
</tr>
<tr>
<td>delimiter 2008</td>
<td>1 byte</td>
<td>tab</td>
</tr>
<tr>
<td>desires 2100</td>
<td>1 byte</td>
<td>(alphanumeric)</td>
</tr>
<tr>
<td>delimiter 2102</td>
<td>1 byte</td>
<td>newline</td>
</tr>
</tbody>
</table>

**type 2002**
Identifies a message by reference to a unique type value.

**version 2006**
Message version number. Specifies the most-recent version
of the message that the application supports.

**desires 2100**
Support level. This field indicates the level of support
required by the application. Possible values are:

- **mtMessageOptionalCapability**
  - Optional. Indicates that the message is optional. The
  value corresponding to this option is ‘O’.

- **mtMessageRequiredCapability**
  - Required. The application must receive this message.
  The value corresponding to this option is ‘D’.

- **mtMessageRequiredCapability**
  - Required. The application must receive this message.

- **mtNegotiationMessageCapability**
  - Negotiate. The application wants to learn about the
  recipient’s facilities. The value corresponding to this
  option is ‘N’.

Conference identifiers such as 2200 shown in FIG. 22
uniquely identify a conference endpoint. Each endpoint rep-
resent a data source or sink for the conference. Note that
a single system may have more than one conference endpoint
(e.g., an auxiliary) in a given conference, and may have more
than one conference at a time. A conference endpoint consists of the
following fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UniqueID 2202</td>
<td>1-n bytes</td>
<td>numeric</td>
</tr>
<tr>
<td>separator 2204</td>
<td>1 byte</td>
<td>space</td>
</tr>
<tr>
<td>name 2206</td>
<td>1-n bytes</td>
<td>(alphanumeric)</td>
</tr>
</tbody>
</table>

**UniqueID 2202**
Unique numeric identifier. This field contains a unique
numeric endpoint identifier. Each conference compo-
ent assigns its own identifiers in order to guarantee
uniqueness within the context of a given name specified in
the name field 2206.

**name 2206**
A unique name. Identifies the system on the network. The
name is unique within the context of a given transport
interface. It includes the type of the selected transport
and network interface.

A member list such as 1812 of FIG. 21 is an array of zero
or more conference identifiers 2102, 2110, etc. Each entry in
the array is delimited by a newline character.

The Terminate message 2300 of FIG. 23 ends a conference,
closing a member’s communications with the participants to
which it sends the message.

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>type 2302</td>
<td>2 bytes</td>
<td>‘T’</td>
</tr>
<tr>
<td>delimiter 2304</td>
<td>1 byte</td>
<td>newline</td>
</tr>
<tr>
<td>terminator 2306</td>
<td>1 byte</td>
<td>NULL</td>
</tr>
</tbody>
</table>

The Terminate message 2300 is the last step in ending a
member’s participation in a conference. This message ends
the member’s conference communication with all partici-
pants to which it sends the message. If a member is leaving a
conference altogether, it must send this message to each con-
ference participant.

The BroadcastRequest message 2400 allows a member to
find out if another conference member can accept broadcast
(multicast) messages.

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>type 2402</td>
<td>2 bytes</td>
<td>‘B’</td>
</tr>
<tr>
<td>subtype 2406</td>
<td>1 byte</td>
<td>‘R’</td>
</tr>
<tr>
<td>delimiter 2408</td>
<td>1 byte</td>
<td>tab</td>
</tr>
<tr>
<td>multicastAddress 2410</td>
<td>1-n bytes</td>
<td>(numeric)</td>
</tr>
<tr>
<td>delimiter 2412</td>
<td>1 byte</td>
<td>newline</td>
</tr>
<tr>
<td>terminator 2414</td>
<td>1 byte</td>
<td>NULL</td>
</tr>
</tbody>
</table>

**subtype 2406**
The broadcast message subtype. This field must be set to
‘R’.

**multicastAddress 2410**
The proposed multicast address. This field contains the
multicast address on which the member proposes to send
broadcast messages.

The BroadcastRequest message 2400 allows a member to
determine whether another conference member can accept
broadcast messages over a given multicast network address.
The recipient indicates its ability to support the broadcast
messages by sending a BroadcastAck message 2500 (de-
scribed below). If the recipient cannot support broadcast mes-
saging or cannot access this particular broadcast transmis-
sion, the calling member should continue to send point-to-
point messages to the recipient.

The BroadcastRequest message 2400 is typically uses as
part of the negotiation process that follows merging two con-
ferences or the joining of any new members to a conference.
As an optimization, conference participants may choose to set
up broadcast capabilities as a more-efficient alternative to
maintaining several different point-to-point connections.

The BroadcastAck message 2500 allows a member to
respond to a BroadcastRequest message 2400.

<table>
<thead>
<tr>
<th>Field</th>
<th>Size</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>type 2502</td>
<td>2 bytes</td>
<td>‘B’</td>
</tr>
<tr>
<td>subtype 2504</td>
<td>1 byte</td>
<td>‘A’</td>
</tr>
<tr>
<td>delimiter 2506</td>
<td>1 byte</td>
<td>tab</td>
</tr>
<tr>
<td>broadcastResponse 2508</td>
<td>1-n bytes</td>
<td>(signed numeric)</td>
</tr>
<tr>
<td>delimiter 2510</td>
<td>1 byte</td>
<td>newline</td>
</tr>
<tr>
<td>terminator 2512</td>
<td>1 byte</td>
<td>NULL</td>
</tr>
</tbody>
</table>
subtype 2504
The broadcast message subtype. This field must be set to
'\(^{15}\)A'.

broadcastResponse 2508
The result. This field indicates whether the member can
support the multicast address proposed in the Broadcast-
Request message 2500.

The BroadcastAck message 2500 allows a member to indi-
cate whether it can receive messages over a proposed mul-
ticast address. Another conference participant proposes a mul-
ticast address by sending a BroadcastRequest message 2408.
If the recipient can support that address, it sets the broadcas-
tResponse field 2508 to '0'. Otherwise, the broadcastRes-
ponse field 2508 contains an appropriate non-zero result
code. This message is typically used as part of the negotiation
process that follows merging two conferences. As an optimi-
zation, conference participants may choose to set up broad-
cast capabilities as a more-efficient alternative to maintaining
several different point-to-point connections.

Join operations have the protocol illustrated in FIG. 9.
FIGS. 26a-26c illustrate the process steps performed in a
transmitter and receiver during join operations. FIG. 26a
shows a process 2600 which includes the process steps per-
fomed by a transmitter of a join message or any message
containing a member list. This may occur, for example,
responsive to an auxiliary or merge message. First, the trans-
mitter creates a join message at step 2602. The destination
conference ID and calling conference ID's are added to the
message at step 2603. Then, at step 2604, a member is
added to the members list in the join message. This is
shown in more detail in FIG. 26b. A transport level connection
with the member to receive the join is then performed at step
2605. Subsequent thereto, the message is then sent to any
recipients at step 2606.

FIG. 26b illustrates the "append members" function 2604
shown in FIG. 26a for appending members to a member list.
The function starts at step 2610 which determines whether the
member is a "joiner." If so, then additional members can be
appended to the join. If not, then the function ends and the join
message with the single member is transmitted as shown on
FIG. 26a. At 2612, the next member is retrieved according to
the conference ID. At step 2614 it is determined whether there
are any more members in the specified conference ID. If not,
the process is complete. If there are more members and the
shareable mode flag is set, as detected at step 2616, then the
member is added to the member list at step 2618. In this
manner, during a merge operation, other participants receiving
join messages can determine if conference membership has
changed, requiring additional join messages to be trans-
mitted by receiving members.

FIG. 26c shows the steps performed by a receiver of a join
message. First, at step 2652, the destination conference ID
contained in the join message is looked up by the receiver in
a locally-stored current conferences history table (e.g. 2900
of FIG. 29). This keeps track of previously used conference
ID's for any currently active conferences. If the conference
ID has changed, the member can then complete the join by
referring to an old conference ID and the current conference
ID in the member. This allows for conference merge and
auxiliary messages from widely distributed members in a
network. If the conference ID can't be found, as detected at
step 2654, the connection is refused at step 2656, by the
issuance of an appropriate response message, and the join
fails. If the conference ID has been found, then, at step 2660,
the connection is added to the list of participants for the
conference. At step 2662, a Response message that the join
can be performed is sent to the sender of the join. Then, the
membership of the members contained in the member list of
the join can then be performed as shown in FIG. 26d.

The merge membership function 2664 is shown in more
detail in FIG. 26d. First, it is determined at step 2678 whether
the member merging membership is shareable. If so, then at
step 2680, it is determined whether there are any more mem-
bers in the member list. If not, the function is complete. If so,
the next member from the membership list is retrieved at step
2682. If the participant is already connected, is the member or
is the member's own auxiliary source, as detected at step 2684
then the process returns to step 2680. It is determined, at step
2686, whether this party is going to initiate the join with this
member in the member list. This prevents conflicting join
messages from being received and acted upon in the network.
This is accomplished by determining whether the recipient's
conference ID is greater than the calling party's conference
ID. In this case, this party will take action on the join (e.g.
place the call to the other party to accomplish the join).
Operations necessary to accomplish the join then take place
starting at step 2688. At this step, transport level connections
are established. Once established, capabilities, if any, (or
an auxiliary message, in the case of an auxiliary source), hello,
and join messages are sent at step 2690. The member then
waits for a response to the join, and if received in the affir-
mative, the conference component issues MemberReady to
the application. This process continues until all members in
the member list have been processed.

Merge Operations

Merge operations are initiated using a "Merge" message
(e.g., 1900 of FIG. 19) which indicates to a participant that
two existing conferences should be merged. This is according
to the conference ID contained within the field 1900 of Mes-
 sage 1900. Each Merge message contains within it a mem-
berList 1912 which allows the participating members to trans-
mit Join messages to all the members which have been
listed in the memberList. This further allows changing mem-
bership and conference ID during the course of a merge
operation to be tracked so that correct conference ID's and
conference membership may be maintained until after the
merge. A merge operation is graphically illustrated with refer-
ce to FIGS. 26a and 26b. For example, at a first time
period as illustrated in FIG. 26a, conference member ID may
be engaging in two conferences denoted 1 and 2 with several
other members, A, B, and C. The member then proceeds to
issue Merge messages to the members of conferences. That is,
member D issues join messages to members A, B and C to
Merge the conference 2 (denoted B1 and C1). At the end of the
operation, members A, B, C, and D all have point-to-point
communication channels and the new conference ID is the
same, (A1, B1, C1, D1, respectively in each of the members).
The mechanics of this operation are described briefly with refer-
ce to FIGS. 28a-28b. That is, the two separate confer-
ces are now denoted by the same conference ID’s in each of
the members.

FIGS. 28a-28b show the steps taken during a merge op-
eration by the conference component in the transmitter and
receivers (if any) of a merge message. FIG. 28a shows the
process steps taken by a transmitter of a merge request. The
member first combines the conference ID’s of the old and new
conference in it’s internal store at step 2802. Then, at step
2804, the member creates the merge message and appends
each of the members of the conference to the members list in
the message via the append members routine 2804 (discussed
above) in order to ensure full connectivity among all confer-
ence members. Then, at step 2806, the merge message is sent to all participants in the merge.

FIG. 28b shows process steps taken in a receiver receiving a merge message. Once a merge message has been detected (step 2812), the merge recipient recalls in a local store for example, the conference name and the conference ID at step 2814. Then, as discussed with reference to FIG. 26d, above, a merger of membership is performed (e.g. process 2664), and the process is thus complete at step 2816.

In addition to using conference ID’s for performing merge and subsequent join operations, contained within each Merge and Join message is a list of members of the conferences being merged or joined. These are included in the memberlist fields 1812 or 1912 of messages 1800 or 1900. For example, due to propagation delays in a networking system, old conference ID’s may still exist in peripheral participants, and therefore during merging and or joining operations, conference ID’s may become invalid due to members merging conferences, etc. , . . . , or reference conference ID’s which no longer exist. Thus, contained within each conference component in a member is a current conferences table such as 2900 shown in FIG. 29. The current conferences history table allows a member performing a merge or join operation to determine whether in fact conferences to be merged use old conference ID’s. If so, then the new conference ID may be used to transmit to the participants receiving the join messages, and/or be matched to the appropriate conference ID. Thus, the member performing the merge operation can reference by way of the current conference ID 2901 contained within the merged conferences table, or other conference ID values 2902, containing a variable length list of conference ID’s, to which the current conference ID refers. Conference entries are deleted at the end of a conference by the conference component. If a merge occurs at a peripheral location and a conference ID becomes invalid, then the list of conference ID’s for an existing conference ID can be referenced by referencing the merged conferences history table.

Multicast

FIGS. 30a and 30b illustrate a process which is performed as an optimization if multiple participants within a conference support multicast address broadcast capabilities. First, it is detected at step 3001 whether there are any more transport media to be examined. If so, then the next is retrieved at step 3002, and at step 3003 it is determined whether two or more participants are in the same conference and are on the same transport medium. If so, and the transport medium supports multicast at step 3004, then the multicast capabilities of the transport medium are activated at step 3006. If so, and the multicast capabilities are working at step 3008, then step 3008 proceeds to step 3012. If it is not working, as detected at step 3008, then the process is aborted at step 3010. At step 3012 a multicast address which may be used for the transport medium is retrieved at step 3012. Then, at 3014, Broadcast Requests are sent in substantially the format as shown in Message 2400 of FIG. 24, to all the participants detected at step 3002 supporting multicast. The process then awaits Broadcast Ack (in the format 2500 shown in FIG. 25) in order to determine whether the multicast address is available for each at step 3016. If so, then reply from Broadcast Ack determined to be received at step 3018, and it is determined whether the Broadcast Ack was positive (due to the response value contained in field 2508 of FIG. 25). At step 3022, if the response is positive, then the point-to-point connection is deactivated. Once all the Broadcast Ack’s have been received (or have timed-out), then it is determined at step 3024 whether there was a Broadcast Ack received for each Broadcast Request message sent. If not, then the process is complete. If so, however, step 3026 determines whether there were any positive Broadcast Ack for the multicast. If not, then multicast is deactivated, and point-to-point communication continues to be used for communication with the other members (this optimization cannot be performed). The process is thus complete.

Auxiliary Operations

An auxiliary media source can become part of an ongoing conference. The media source is associated with an ongoing conference by invoking reference to the main conference stored in each conference component (e.g. by the API call MTCConferenceAttachAuxiliarySource), however, it is treated as a separate conference in each conference component. For example, as illustrated with reference to FIG. 31, a first conference referred to by conference ID 23b in member B, may be notified of an auxiliary source having conference ID 17a from member A. Note that similar to the protocol illustrated with reference to the Capabilities and Hello messages in FIGS. 8 and 9 above, the Auxiliary message may be sent in place of a Capabilities message between a first endpoint and a second endpoint as illustrated in FIG. 32. The timing of the messages is illustrated with reference to FIG. 32. Similar to the capability and call protocol illustrated with reference to FIG. 8 above, the Auxiliary message 3202 is received from the first endpoint 3210, to notify endpoint 3220 that an auxiliary source is available from the parent conference ID, as specified in parentConfID field 1704 of Auxiliary message 1700 of FIG. 17. Then, a Hello message 3204 is transmitted from endpoint 1 3210 to endpoint 2 3220. Responsive thereto, endpoint 2 3220 transmits capabilities message 3222 and Hello message 3224. Subsequent thereto, a Join message 3226 with the conference ID 23b is issued from the endpoint to 3220 with the conference ID of the source in order to indicate that the endpoint 3220 wishes to receive the auxiliary source AA, shown in FIG. 31. Subsequent thereto, all messages from source A to recipient B as illustrated in FIG. 31 reference the same conference ID 23b for the ongoing conference between A and B. As illustrated in FIG. 31, the “receive media” mode flag is set to not receive (!Receive) and furthermore, the mode of the auxiliary source is not joiner (Joiner) since it is a receive-only media source. Subsequent thereto, the second endpoint 3220 sends a response message 3216 indicating that the auxiliary source has been successfully joined with the conference 23b. Subsequent thereto, both media messages for the conference ID 23b, and the auxiliary source having conference ID 17a are treated as from the same source (A) by the application. The details and mechanics of a member receiving an auxiliary source message are illustrated with reference to FIGS. 33 and 34.

FIG. 33 shows the process steps performed within a source of an auxiliary source. At step 3302, the next participant in the conference to which the auxiliary source will be attached is retrieved. It is determined, at step 3304, whether there are any more participants in the conference to which the auxiliary source will be attached. If any, then, at step 3306, auxiliary hello and join messages are sent to the participant. If accepted via a positive response message (as shown in FIG. 32), the auxiliary then becomes available to the participant at the receiver of the message. The process continues until step 3304 determines that no additional participants in the conference should join in to monitoring of the auxiliary.
FIG. 34 shows the steps taken by a receiver upon receipt of the initial auxiliary message. At step 3402, capabilities (if any), and hello are sent. At step 3404, the auxiliary source media starts to be received, and the conf ID of the parent conference is saved in the conference component of the receiver at step 3406. This allows the application to determine that the auxiliary is associated with the parent media source by storage in the conference component for later retrieval at step 3408. If the auxiliary is received prior to the receipt of a join message, then the association of the auxiliary with the parent conf ID allows the later association of the two from the application's standpoint.

An Example Session (FIGS. 35a and 35b)

An example session using the protocols described above is shown in FIGS. 35a and 35b. The figures illustrate the flow of messages, from the view of a first endpoint. After establishment of the connection between the stations using the transport component, the originating station sends capabilities message 3502, and hello message 3504, specifying the calling station's name “James Watt” with the mode mask set to 15 (all bits set—send, receive, joiner, sharer). Then, a call message 3506 is transmitted to the receiver along with the timeout value=19392 confname=“some conference,” and the confID=672 mtkatklJames Watt: Video Phone: Video Zone”. Simultaneously with the establishment of the connect, corresponding capabilities, hello, and response are sent from the station entitled “Hilary Rodham” as illustrated by packets 3508-3512, having the same mode.

Subsequent to the exchange of capabilities, hello, and call and response, a merge message 3514 is received by the first endpoint including the conference name “Some Conference”, a conf ID=137 “mtkatkl Hilary Rodham: Video Phone: Video Zone” and a member list. The endpoint then processes the merge, placing a call sending capabilities, and hello to a member of the old conference, and a join along with the member list as shown by messages 3516, 3518, and 3520. Once the connection has been established, capabilities and hello messages 3524 and 3526 are received from the recipient. Responsive to the join the recipient sends a response message 3528 with the result=0 (request successful). Subsequent thereto, the endpoint then attempts to use a multicast address by transmitting broadcast request messages 3530 and 3532. The other members respond with broadcast Acks 3534 and 3536, allowing the use of multicast. The conference can then be terminated at any time by any of the members via the transmission of terminate messages to all of the members, such as 3538 and 3540.

Thus, by use of the foregoing, connections between endpoints, such as for teleconferences between teleconferencing systems, can be enabled. This includes, but is not limited to, the exchange of capabilities and notification of connections between endpoints, the addition of auxiliary data streams to such connections, and the merging of existing connections. It will be appreciated that though the foregoing has been described especially with reference to FIGS. 1-35b, that many modifications made be made, by one skilled in the art, without departing from the scope of the invention as described here. The invention is thus to be viewed as limited only by the appended claims which follow.

What is claimed is:

1. In a system wherein a first endpoint is providing data to a plurality of second endpoints each connected by a point-to-point communication channel with said first endpoint, an automatic method for optimizing the transmission of said data to said plurality of second endpoints comprising the following steps:
   a. said first endpoint activating a multicast communication channel having a first multicast address and commencing broadcast of said data over said multicast communication channel;
   b. Said first endpoint transmitting a request message to each of said plurality of second endpoints in order to query each of said second endpoints whether they can receive transmissions broadcast to said first multicast address;
   c. Certain of said plurality of second endpoints transmitting an acknowledgment message and said first endpoint receiving said acknowledgment message;
   d. For each said acknowledgment message received from said certain of said plurality of second endpoints which indicates that said certain of said plurality of second endpoints can receive transmissions broadcast to said first multicast address, deactivating said point-to-point communication channel with said first endpoint and said certain of said plurality of second endpoints; and
   e. Terminating said broadcast of said data and said multicast communication channel if at least two of said plurality of second endpoints, do not transmit said acknowledgment messages containing a positive acknowledgment.

2. The method of claim 1 further comprising the step of receiving detach messages from certain of said plurality of second endpoints, and if at least two of said plurality of second endpoints are not receiving said data, then terminating said broadcast of said data and said multicast communication channel.

3. The method of claim 1 wherein said each acknowledgment message includes a response code.

4. The method of claim 3 wherein said response code indicates whether each said certain of said plurality of second endpoints can receive transmissions broadcast to said first multicast address.

5. The method of claim 1 wherein said data includes teleconference data.

6. The method of claim 1 further comprising, prior to said step of said first endpoint activating said multicast communication channel having a first multicast address, determining whether more than one of said plurality of second endpoints is coupled to said first endpoint on a single communication medium, and if not, aborting said method.

7. The method of claim 6 further comprising, prior to said first endpoint activating said multicast communication channel having said first multicast address, determining whether said single communication medium supports broadcasting to said first multicast address.

8. The method of claim 1 wherein said data includes teleconference data between said first endpoint and said plurality of second endpoints.

9. An apparatus in a first endpoint for transmitting data to a plurality of second endpoints receiving said data from said first endpoint on point-to-point communication channels comprising:
   a. A circuit for activating a multicast communication channel having a first multicast address and commencing broadcast of said data over said multicast communication channel;
   b. A circuit for transmitting a request message to each of said plurality of second endpoints in order to query each of said second endpoints whether they can receive transmissions broadcast to said first multicast address;
c. a circuit for receiving acknowledgment messages, if any, from certain of said plurality of second endpoints;  
d. a circuit for deactivating each said point-to-point communication channel with said certain of said plurality of second endpoints responsive to receiving each said acknowledgment message; and  
e. a circuit for terminating said broadcast of said data and said multicast communication channel if at least two of said acknowledgment messages containing a positive acknowledgment are not received.

[10. The apparatus of claim 9 further comprising a circuit for receiving detach messages from others of said plurality of second endpoints, and if at least two of said plurality of second endpoints are not receiving said data, then terminating said broadcast of said data and said multicast communication channel.

[11. The apparatus of claim 9 wherein said each acknowledgment message includes a response code.

[12. The apparatus of claim 11 wherein said response code indicates whether each of said certain of said plurality of second endpoints can receive transmissions broadcast to said first multicast address.

[13. The apparatus of claim 9 wherein said data includes teleconference data.

[14. The apparatus of claim 9 further comprising a detection circuit operative prior to said first endpoint activating said multicast communication channel having said first multicast address for determining whether more than one of said plurality of second endpoints is coupled to said first endpoint on a single communication medium, and if not, not activating said circuits b and c.

[15. The apparatus of claim 14 further comprising, prior to activation of said detection circuit a circuit for determining whether said single communication medium supports broadcasting to said first multicast address.

16. An automatic method in a teleconferencing system for merging at least two ongoing teleconferences comprising: performing at least one of transmitting or receiving a first message comprising a request by an initiating member of a first teleconference to communicate with members of a second teleconference; receiving a list of members in said second teleconference; for each of at least a subset of the members in said list; comparing a first conference identifier (ID) of the respective member and a second conference ID of a second member; and if said first conference ID has a first relationship with said second conference ID, then transmitting, by said second member, a second message to the respective member to request participation by the member in the first teleconference, wherein the member is not the initiating member, said second message causing the transmitting of a response message, said response message comprising an indication of said member’s participation level in the requested merging of conferences; and establishing a merged teleconference with at least a subset of the members in said list, based at least in part on said indication.

17. The method of claim 16 further comprising determining whether it is permissible to join other individuals to said merged teleconference, and if not, not transmitting said second message.

18. The method of claim 17 wherein determining whether it is permissible to join other individuals to said merged teleconference comprises determining whether a mode for the teleconference indicates whether it is permissible to join other individuals to the teleconference.

19. The method of claim 16 further comprising, prior to transmitting said second message, determining whether a first member in said list of members will transmit said second message, and if so, not transmitting said second message to said first member.

20. The method of claim 16 wherein said first relationship comprises said first conference ID being less than said second conference ID.

21. The method of claim 16 further comprising, prior to transmitting said second message, transmitting an initialization message indicating application capabilities to each of at least a subset of the members in said list.

22. The method of claim 16 further comprising, prior to transmitting said second message, transmitting an initialization message including communication capabilities.

23. The method of claim 16 further comprising, prior to transmitting said second message, determining if a first member in said list of members is already in the first teleconference, and if so, not transmitting said second message to said first member.

24. The method of claim 16 wherein said first message comprises a name identifying a teleconference resulting from a merger of said at least two teleconferences.

25. The method of claim 16 further comprising retrieving identifiers stored in a merged conferences history table to reference said members.

26. The method of claim 25 further comprising consulting said merged conferences history table to detect out-of-date messages.

27. The method of claim 16 wherein establishing a merged teleconference comprises establishing point-to-point communication channels.

28. The method of claim 27 further comprising each of at least a subset of the members in said list establishing point-to-point communication channels with other members in said list.

29. The method of claim 28 further comprising converting a plurality of point-to-point communication channels to a single broadcast communication channel to a first multicast address.

30. An automatic method in a teleconferencing system for merging at least two teleconferences, wherein a first of said teleconferences has a first set of members, and a second of said teleconferences has a second set of members, comprising:

performing at least one of transmitting or receiving a first message comprising a request by an initiating member of the first teleconference to communicate with members of the second teleconference;  
responsive to the first message, transmitting a second message to at least one member of the second teleconference, wherein the at least one member is not the initiating member, said second message configured to cause the transmission of a response message that includes a numeric code that indicates the response of said at least one member to said request by said initiating member; retrieving identifiers stored in a merged conferences history table to reference said members; and establishing a merged teleconference including the first and second sets of members.

31. The method of claim 30, further comprising determining whether it is permissible to join other individuals to said merged teleconference, and if not, not transmitting the second message.

32. The method of claim 31 wherein determining whether it is permitted to join other individuals to said merged telecon-
ference comprises determining whether a mode for the teleconference indicates whether it is permissible to join other individuals to a conference.

33. The method of claim 30 further comprising, prior to transmitting said second message, determining whether a first member in said first and said second sets of members will transmit said second message, and if so, not sending said second message to said first member.

34. The method of claim 33 wherein determining whether said first member in said first and said second sets of members will transmit said second message comprises: comparing a first conference identifier (ID) of a second member and a second conference ID of said first member; and

if said first conference ID has a first relationship with said second conference ID, then transmitting, by said first member, said second message to said second member.

35. The method of claim 34 wherein said first relationship comprises said first conference ID being less than said second conference ID.

36. The method of claim 30 further comprising, prior to transmitting said second message, transmitting a message indicating application capabilities to each of at least a subset of the members in said first and said second sets.

37. The method of claim 30 further comprising, prior to transmitting said second message, transmitting a message including communication capabilities.

38. The method of claim 30 further comprising, prior to transmitting said second message, determining if a first member in said first and said second sets of members is already in the first teleconference, and if so, not transmitting said second message to said first member.

39. The method of claim 38 wherein determining whether a member in said first and said second sets of members can be shared with others in said at least two ongoing teleconferences comprises checking mode information stored with an identifier of each member.

40. The method of claim 30 wherein said first message comprises a name identifying a teleconference resulting from a merger of said at least two teleconferences.

41. The method of claim 30 further comprising consulting said merged conferences history table to detect out-of-date messages.

42. The method of claim 30 wherein establishing one teleconference comprises establishing point-to-point communication channels.

43. The method of claim 42 further comprising each member in said first and said second sets of members establishing point-to-point communication channels with other members in at least one of said first and said second sets of members.

44. The method of claim 43 further comprising converting a plurality of point-to-point communication channels to a single broadcast communication channel to a first multicast address.

45. An automatic apparatus in a teleconferencing system for merging at least two ongoing teleconferences comprising: a first circuit for performing at least one of transmitting or receiving a first message comprising a request by an initiating member of a first teleconference to communicate with members of a second teleconference, and for transmitting a list of members in one of said at least two ongoing teleconferences; a second circuit for transmitting a second message to each of at least a subset of the members in said list of members to request participation by the member in a teleconference wherein the member is not the initiating member; said second message causing the transmitting of a response message that indicates the reaction of the receiving member to said second message; and a third circuit for establishing one teleconference responsive at least in part to said response message; and a detection circuit for determining whether a first member in said list of members will transmit said second message, and wherein, if the detection circuit determines that the first member will transmit said second message, said second circuit does not transmit said second message to said first member, wherein said detection circuit determines whether said first member in said list of members will transmit said second message by comparing a first conference identifier (ID) of a second member and a second conference ID of said first member, and wherein, if said first conference ID has a first relationship with said second conference ID, then said second circuit transmits said second message to said second member.

46. The apparatus of claim 45 further comprising a circuit for determining whether it is permissible to join other individuals to said one teleconference, and if not, not transmitting said second message.

47. The apparatus of claim 46 wherein said circuit for determining whether it is permissible to join other individuals to said one teleconference comprises a circuit for determining whether a mode for the teleconference indicates whether it is permissible to join other individuals to a conference.

48. The apparatus of claim 45 further comprising, operative prior to said second circuit, a fourth circuit for transmitting a message indicating application capabilities to each of at least a subset of the members in said list.

49. The apparatus of claim 42 further comprising, operative prior to said second circuit, a fourth circuit for transmitting a message including communication capabilities.

50. The apparatus of claim 45 further comprising, operative prior to said second circuit, a fourth circuit for determining if a first member in said list of members is already connected, and wherein, if the fourth circuit determines that said first member is already connected, the second circuit does not transmit said second message to said first member.

51. The apparatus of claim 45 further comprising a merged conferences history table, wherein said first and second circuits use current identifiers stored in said merged conferences history table to reference said members.

52. The apparatus of claim 51 wherein said second circuit further uses said merged conferences history table to detect out-of-date messages.

53. The apparatus of claim 45 wherein said third circuit establishes a teleconference by establishing point-to-point communication channels.

54. The apparatus of claim 53 further comprising a circuit for each of at least a subset of said members in said list for establishing point-to-point communication channels with other of said members in said list.

55. An automatic apparatus in a teleconferencing system for merging at least two teleconferences, wherein one of said teleconferences has a first set of members, and a second of said teleconferences has a second set of members, comprising:

a first circuit for performing at least one of transmitting or receiving a first message comprising a request by an initiating member of a first teleconference to communicate with members of a second teleconference; a second circuit for transmitting a second message to at least one member, wherein the at least one member is not the initiating member;
a third circuit for receiving a response message from said at least one member, wherein said response message includes a numeric code that answers said request for communication; and
a fourth circuit for establishing one teleconference and a merged conferences history table, wherein said first and second circuits use current identifiers stored in said merged conferences history table to reference said members.

56. The apparatus of claim 55 further comprising a circuit for determining whether it is permissible to join other individuals to said one teleconference, and if not, not transmitting said second message.

57. The apparatus of claim 56 wherein said circuit for determining whether it is permissible to join other individuals to said one teleconference comprises a circuit for determining whether a mode for the teleconference indicates whether it is permissible to join other individuals to a conference.

58. The apparatus of claim 55 further comprising a detection circuit determining whether a first member in said first and second sets of members will transmit said second message, and wherein, if the detection circuit determines that the first member will transmit said second message, said second circuit does not transmit said second message to said first member.

59. The apparatus of claim 58 wherein said detection circuit determines whether said first member in said first and said second sets of members will transmit said second message by comparing a first conference identifier (ID) of a second member and a second conference ID of said first member, and wherein, if said first conference ID has a first relationship with said second conference ID, said second circuit transmits said second message to said second member.

60. The apparatus of claim 55 further comprising, operative prior to said second circuit, a fourth circuit for transmitting a message indicating application capabilities to each of at least a subset of members in said first and said second sets of members.

61. The apparatus of claim 55 further comprising, operative prior to said second circuit, a fourth circuit for transmitting a message including communication capabilities.

62. The apparatus of claim 55 further comprising, operative prior to said second circuit, a fourth circuit for determining if a first member in said first and said second sets of members is already connected, and wherein, if the fourth circuit determines that said first member is already connected, the second circuit does not transmit said second message to said first member.

63. The apparatus of claim 55 wherein said second circuit further uses said merged conferences history table to detect out-of-date messages.

64. The apparatus of claim 55 wherein said third circuit establishes a teleconference by establishing point-to-point communication channels.

65. The apparatus of claim 64 further comprising a circuit for each of at least a subset of said members in said first and said second sets of members for establishing point-to-point communication channels with other of said members in said first and said second sets.

66. The apparatus of claim 65 further comprising a circuit for converting a plurality of point-to-point communication channels to a single broadcast communication channel to a first multicast address in a member.

67. A method for merging a first teleconference call including a first member and one or more other members with a second teleconference call including the first member and a second member, comprising:

a conference component of the first member transmitting a merge request message to a conference component of the second member requesting merger of the first teleconference call with the second teleconference call, the merge request message identifying the one or more other members of the first teleconference call;
a conference component of the second member receiving the merge request message and transmitting a join message to conference components of the one or more other members;
a conference component of the second member retrieving identifiers stored in a merged conferences history table to reference the one or more other members of the first teleconference call;
a conference component of the second member receiving a merge accept message, wherein said merge accept message indicates participants' non-participation of said one or more other members in said merger of the first teleconference with the second teleconference; and the conference components of the first member, the second member and the one or more other members establishing one teleconference call.

68. Circuitry in a conference component of a member of a first teleconference call for merging the first teleconference call with a second teleconference call, comprising:
circuitry for receiving a merge request message from a common member of both the first and second teleconference calls, the merge request message identifying one or more other members of the second teleconference call;
circuitry for, responsive to the merge request message, transmitting a join message to the one or more other members;
circuitry for receiving a merge accept message, wherein said merge accept message indicates the success or failure of said join message; and
circuitry for establishing a single teleconference call with the common member and the one or more other members of the second teleconference call; and
merged conferences history table, wherein the circuitry uses current identifiers stored in said merged conferences history table to reference the one or more other members of the second teleconference call.

69. An apparatus for merging a first teleconference call including a first member and one or more other members with a second teleconference call including the first member and a second member, comprising:
circuitry in a conference component of the first member for transmitting a merge request message to a conference component of a second member requesting merger of the first teleconference call with the second teleconference call, the merge request message identifying the one or more other members of the first teleconference call;
circuitry in the conference component of the second member for receiving the merge request message and transmitting a join message to conference components of the one or more other members;
circuitry in the conference components of the first member, the second member and the one or more other members, for receiving the join message and determining participation within a merged teleconference call; and
circuitry in the conference components of the first member, the second member and the one or more other members for establishing said merged teleconference call responsive to the determined participation; and
merged conferences history table, wherein the conference component of the second member uses current
identifiers stored in said merged conferences history table to reference the one or more other members of the first teleconference call.

70. An automatic method in a conferencing system for merging at least two conferences, wherein a first of said conferences has a first set of members, and a second of said conferences has a second set of members, comprising:

receiving a first message comprising a request by an initiating member of the first conference to communicate with members of the second conference;

responsive to the first message, transmitting a second message indicating at least one of application and system capabilities to each of at least a subset of the members in said first and said second sets and transmitting a join request message to at least one member of the second conference, wherein the at least one member is not the initiating member, said join request message causing the transmitting of a response message, said response message indicating the at least one member’s intention to join in a merge of said first and second conference, wherein said second message is not transmitted to a particular member in said first and second sets if a first conference identifier (ID) of the particular member has a first relationship with a second conference ID of the transmitting member; and

establishing a merged conference including the first and second sets of members.

71. The method of claim 70, further comprising establishing a control channel between at least two members of said first and second sets of members.

72. The method of claim 71, wherein said transmitting said second message indicating at least one of application and system capabilities is performed after said establishing said control channel.

73. The method of claim 70, further comprising transmitting at least one message between at least one member of said first set and at least one member of said second set, said at least one message providing identification and mode information.

74. The method of claim 70, wherein said first message comprising said request by said initiating member of the first conference to communicate with members of the second conference is received via a wireless interface.

75. An automatic method in a conferencing system for merging at least two conferences, wherein a first of said conferences has a first set of members, and a second of said conferences has a second set of members, comprising:

receiving a first message comprising a request by an initiating member of the first conference to communicate with members of the second conference;

responsive to the first message, transmitting a second message including communication capabilities and transmitting a join request message to at least one member of the second conference, wherein the at least one member is not the initiating member, said join request message requesting the joining of said first and second conferences, and causing the transmitting of a response message indicating the recipient’s action with respect to said join request;

retrieving identifiers stored in a merged conferences history table to reference said members of the first conference; and

establishing a merged conference including the first and second sets of members.

76. The method of claim 75, further comprising establishing a control channel between at least two members of said first and second sets of members.

77. The method of claim 76, wherein said transmitting said second message including communication capabilities is performed after said establishing said control channel.

78. The method of claim 75, further comprising transmitting at least one message between at least one member of said first set and at least one member of said second set, said at least one message providing identification and mode information.

79. The method of claim 75, wherein said first message comprising said request by said initiating member of the first conference to communicate with members of the second conference is received via a wireless interface.

80. The method of claim 75, wherein said first and second sets of members comprise a member in common.

81. An automatic method in a conferencing system for merging at least two conferences, wherein a first of said conferences has a first set of members, and a second of said conferences has a second set of members, comprising:

receiving a first message comprising a request by an initiating member of the first conference to communicate with members of the second conference;

responsive to the first message, transmitting a first join request message to at least one member of the second conference, wherein the at least one member is not the initiating member;

transmitting at least one additional join request message; for each join request message, receiving a response message that includes a numeric code that indicates the recipient accepting said request for communication with said initiating member of the first conference;

retrieving identifiers stored in a merged conferences history table to reference at least said first set of members or said second set of members; and

establishing a merged conference including the first and second sets of members.

82. The method of claim 81, wherein said additional join request message identifies a member to be joined in said merged conference.

83. The method of claim 81, further comprising, prior to transmitting said additional join request message, transmitting an initialization message indicating at least one of application and system capabilities to each of at least a subset of the members in said first and said second sets.

84. The method of claim 83, further comprising establishing a control channel between at least two members of said first and second sets of members.

85. The method of claim 84, wherein said transmitting said initialization message indicating at least one of application and system capabilities is performed after said establishing said control channel.

86. The method of claim 81, further comprising transmitting at least one message between at least one member of said first set and at least one member of said second set, said at least one message providing identification and mode information.

87. The method of claim 81, wherein said first message comprising said request by said initiating member of the first conference to communicate with members of the second conference is received via a wireless interface.

88. An automatic method in a conferencing system for merging at least two conferences, wherein a first of said conferences has a first set of members, and a second of said conferences has a second set of members, comprising:

an apparatus receiving a first message comprising a request by an initiating member of the first conference to communicate with members of the second conference;
responsive to the first message, the apparatus transmitting a first join request message to at least one member of the second conference, wherein the at least one member is not the initiating member;
the apparatus transmitting a second join request message to at least one member of the first conference;
the apparatus receiving a first response message, indicating the success or failure of said first join request message;
the apparatus receiving a second response message, indicating the success or failure of said second join request message;
the apparatus retrieving identifiers stored in a merged conferences history table to reference at least said first set of members or said second set of members, and the apparatus establishing a merged conference including the first and the second sets of members based at least in part on said first and second response messages.
89. The method of claim 88, wherein said receiving said first message comprises at least one member of the second conference receiving said first message.
90. The method of claim 88, further comprising said initiating member transmitting said first message.
91. The method of claim 88, further comprising, prior to transmitting said second join request message, transmitting a message indicating at least one of application and system capabilities to each of at least a subset of the members in at least one of said first and said second sets.
92. The method of claim 91, further comprising establishing a control channel between at least two members of at least one of said first and second sets of members.
93. The method of claim 92, wherein said transmitting said message indicating at least one of application and system capabilities is performed after said establishing said control channel.
94. The method of claim 88, further comprising transmitting at least one message between at least one member of said first set and at least one member of said second set, said at least one message providing identification and mode information.
95. The method of claim 88, wherein said first message comprising said request by said initiating member of the first conference to communicate with members of the second conference is received via a wireless interface.
96. An automatic method in a conferencing system for merging at least two conferences, wherein a first of said conferences has a first set of members, and a second of said conferences has a second set of members, comprising:
auxiliary apparatus receiving a first message comprising a request by an initiating member of the first conference to communicate with members of the second conference; responsive to the first message, the apparatus transmitting a first join request message to at least one member of the second conference, wherein the at least one member is not the initiating member; said first join request message causing the transmission of a first response message that indicates the acceptance of said at least one member of the second conference to join a merged conference;
the apparatus receiving a second message comprising a request by said initiating member to communicate with at least one member of the first conference;
responsive to the second message, the apparatus transmitting a second join request message to at least one member of the first conference, wherein the at least one member is not the initiating member; said second join request message causing the transmission of a second
response message that indicates the acceptance of said at least one member of the first conference to join said merged teleconference;
the apparatus retrieving identifiers stored in a merged conferences history table to reference at least said first set of members or said second set of members, and the apparatus establishing said merged conference including the first and the second sets of members.
97. The method of claim 96, wherein said receiving said first message comprises at least one member of the second conference receiving said first message.
98. The method of claim 97, further comprising said initiating member transmitting said first message.
99. The method of claim 96, further comprising, prior to transmitting said join request message, transmitting a message indicating at least one of application and system capabilities to each of at least a subset of the members in said first and said second sets.
100. The method of claim 99, further comprising establishing a control channel between at least two members of said first and second sets of members.
101. The method of claim 100, wherein said transmitting said message indicating at least one of application and system capabilities is performed after said establishing said control channel.
102. The method of claim 96, further comprising transmitting at least one message between at least one member of said first set and at least one member of said second set, said at least one message providing identification and mode information.
103. The method of claim 102, wherein said first message comprising said request by said initiating member of the first conference to communicate with members of the second conference is received via a wireless interface.
104. An automatic method in a conferencing system for merging at least two conferences, wherein a first of said conferences has a first set of members, and a second of said conferences has a second set of members, comprising:
auxiliary apparatus receiving a first message comprising a request by an initiating member of the first conference to communicate with members of the second conference; responsive to the first message, the apparatus transmitting a first join request message to at least one member of the second conference, wherein the at least one member is not the initiating member; said first join request message causing the transmitting of a first response message that indicates the acceptance of said at least one member of the second conference to join said merging of at least two conferences;
the apparatus retrieving identifiers stored in a merged conferences history table to reference at least said first set of members or said second set of members, and the apparatus establishing a merged conference including the first and the second sets of members.
105. The method of claim 104, wherein said receiving comprises at least one member of the second conference receiving said first message.
106. The method of claim 104, further comprising said initiating member transmitting said first message.
107. The method of claim 104, further comprising, prior to transmitting said second join request message, transmitting a message indicating at least one of application and system capabilities to each of at least a subset of the members in at least one of said first and said second sets.

108. The method of claim 107, further comprising establishing a control channel between at least two members of said first and second sets of members.

109. The method of claim 108, wherein said transmitting said message indicating at least one of application and system capabilities is performed after said establishing said control channel.

110. The method of claim 109, further comprising transmitting at least one message between at least one member of said first set and at least one member of said second set, said at least one message providing identification and mode information.

111. The method of claim 104, wherein said first message comprising said request by said initiating member of the first conference to communicate with members of the second conference is received via a wireless interface.

112. An automatic method in a conferencing system for merging at least two conferences, wherein a first of said conferences has a first set of members, and a second of said conferences has a second set of members, comprising:

transmitting a first message comprising a request by an initiating member of the first conference to communicate with members of the second conference;

responsive to the first message, transmitting a second message indicating at least one of application and system capabilities to each of at least a subset of the members in said first and said second sets and transmitting a join request message to at least one member of the second conference, wherein at least one member of said second conference is not the initiating member, said join request message requesting the joining of said first and second teleconferences and causing the transmitting of a response message that indicates agreement to join said first and second teleconferences;

retrieving identifiers stored in a merged conferences history table to reference at least said first set of members or said second set of members; and

establishing a merged conference including the first and second sets of members.

113. The method of claim 112, further comprising establishing a control channel between at least two members of said first and second sets of members.

114. The method of claim 113, wherein said transmitting said second message indicating at least one of application and system capabilities is performed after said establishing said control channel.

115. The method of claim 112, further comprising transmitting at least one message between at least one member of said first set and at least one member of said second set, said at least one message providing identification and mode information.

116. The method of claim 112, wherein said first message comprising said request by said initiating member of the first conference to communicate with members of the second conference is transmitted via a wireless interface.

117. An automatic method in a conferencing system for merging at least two conferences, wherein a first of said conferences has a first set of members, and a second of said conferences has a second set of members, comprising:

transmitting a first message comprising a request by an initiating member of the first conference to communicate with members of the second conference;

responsive to the first message, transmitting a second message including communication capabilities and transmitting a join request message to at least one member of the second conference, wherein the at least one member is not the initiating member, said join request message causing the transmitting of a response message that indicates the success or failure of said join request message;

retrieving identifiers stored in a merged conferences history table to reference at least said first set of members or said second set of members; and

establishing a merged conference including the first and second sets of members based at least in part on said response message.

118. The method of claim 117, further comprising establishing a control channel between at least two members of said first and second sets of members.

119. The method of claim 118, wherein said transmitting said second message including communication capabilities is performed after said establishing said control channel.

120. The method of claim 117, further comprising transmitting at least one message between at least one member of said first set and at least one member of said second set, said at least one message providing identification and mode information.

121. The method of claim 117, wherein said first message comprising said request by said initiating member of the first conference to communicate with members of the second conference is transmitted via a wireless interface.

122. The method of claim 117, wherein said first and second sets of members comprise a member in common.

123. An automatic method in a conferencing system for merging at least two conferences, wherein a first of said conferences has a first set of members, and a second of said conferences has a second set of members, comprising:

an apparatus transmitting a first message comprising a request by an initiating member of the first conference to communicate with members of the second conference;

responsive to the first message, the apparatus transmitting a first join request message to at least one member of the second conference, wherein the at least one member is not the initiating member;

the apparatus transmitting at least one additional join request message, said first join request message and said at least one additional join request message causing the transmitting of response messages that indicate the success or failure of respective ones of said first join request and at least one additional join request message;

the apparatus retrieving identifiers stored in a merged conferences history table to reference at least said first set of members or said second set of members; and

the apparatus establishing a merged conference including the first and the second sets of members, based at least in part on said indications in response to said first and at least one additional join request messages.

124. The method of claim 123 wherein said additional join request message identifies a member to be joined in said merged conference.

125. The method of claim 123, further comprising, prior to transmitting said additional join request message, transmitting a second message indicating at least one of application and system capabilities to each of at least a subset of the members in said first and said second sets.

126. The method of claim 125, further comprising establishing a control channel between at least two members of said first and second sets of members.
127. The method of claim 126, wherein said transmitting said message indicating at least one of application and system capabilities is performed after said establishing said control channel.

128. The method of claim 123, further comprising transmitting at least one message between at least one member of said first set and at least one member of said second set, said at least one message providing identification and mode information.

129. The method of claim 123, wherein said first message comprising said request by said initiating member of the first conference to communicate with members of the second conference is transmitted via a wireless interface.

130. The method of claim 70 further comprising determining whether it is permissible to join other individuals to said merged teleconference, and if not, not transmitting said second message.