SCALABLE ARCHITECTURE FOR TRANSMISSION OF MESSAGES OVER A NETWORK

Inventors: Anand Narasimhan, Beverly Hills, CA (US); Yaacov Shemesh, Los Angeles, CA (US); Amit Kumar, Los Angeles, CA (US)

Assignee: j2 Global Communications, Inc., Hollywood, CA (US)

(A) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

Related U.S. Application Data

Continuation of application No. 09/097,307, filed on Jun. 12, 1998, now Pat. No. 6,597,688.

References Cited

U.S. PATENT DOCUMENTS

4,941,170 A 7/1990 Herbst
5,339,156 A 8/1994 Ishii
5,406,557 A 4/1995 Baudoin
5,479,411 A 12/1995 Klein

ABSTRACT

A method and apparatus is disclosed for delivering messages that utilizes a message queue and a router/filter within a private data network. The private network is connected to an external data network such as the Internet, and has separate outbound resource servers to provide a high degree of scalability for handling a variety of message types.

20 Claims, 8 Drawing Sheets
U.S. PATENT DOCUMENTS

5,761,201 A 6/1998 Vaudreuil
5,812,786 A 9/1998 Seazholtz et al.
5,870,435 A 6/1999 Dahlen
5,937,161 A 8/1999 Mulligan et al.
5,940,476 A 8/1999 Morganstein et al.

FOREIGN PATENT DOCUMENTS

GB 2 157 117 A 10/1985

OTHER PUBLICATIONS

Oracle & NT Software Library, Faxmail Networks for Windows v5.13 Fax over a network; Search results of online search, Dec. 5, 1996 12:05 p.m. (pp. 1-3).

Alta Vista Search, SHAREWARE.COM: Search results, Dec. 5, 1995 11:41 a.m. (pp. 1-2).


Electronics, Jan. 18 1997 (379-100), S9054 0063 (pp. 69-70).


j2 Global Communications, Inc. v. Venali, Inc. United States District Court Central District of California, Case No. CV04-01172 DDP (AjWx), Defendant Venali, Inc.’s Objections and Responses to Plaintiff j2 Global Communications, Inc.’s First Set of Interrogatories (Nos. 1-7) (19 pages).


* cited by examiner
FIG. 1
(PRIOR ART)
FIG. 2
POLL MESSAGE QUEUE TABLE FOR PENDING REQUESTS (TABLE 1)

MESSAGE FOUND?

YES

DETERMINE MESSAGE TYPE FROM TABLE 2

VALIDATE CUSTOMER USING TABLE 3

CHECK CURRENCY USING TABLE 4

FILTER THE MESSAGE IF APPROPRIATE FROM NOTES IN TABLE 5

CHECK FOR AVAILABLE RESOURCES TO DELIVER THE MESSAGE USING TABLE 7

FIG. 4A
CHECK RATES OF AVAILABLE RESOURCES TO DETERMINE LEAST COST RESOURCE USING TABLE 8

DELIVER THE MESSAGE USING THE DETERMINED LEAST COST RESOURCE

AFTER MESSAGE DELIVERY (OR ERROR) COMPOSE RESPONSE/RECEIPT USING TABLE 6

DELIVER RESPONSE/RECEIPT

FIG. 4B
START

RECEIVE INCOMING CALL SIGNAL.

DETECT DESTINATION ADDRESS.

VALIDATE ACCOUNT.

ALLOCATE RESOURCES.

ANSWER INCOMING CALL.

FACSIMILE CALL?

YES

PERFORM FACSIMILE TRANSFER.

TERMINATE CALL.

PROCESS FACSIMILE/AUDIO MESSAGE.

ROUTE MESSAGE TO DESTINATION.

NO

PERFORM AUDIO TRANSFER.

END

FIG. 7
SCALABLE ARCHITECTURE FOR TRANSMISSION OF MESSAGES OVER A NETWORK

This is a continuation of Ser. No. 09/097,307, now U.S. Pat. No. 6,597,688 filed on Jun. 12, 1998.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of message receipt/transmission and delivery using computer, phone, wireless and other communications networks. Specifically, the present invention relates to the transmission of e-mail messages which may be text only, text plus an audio file, text plus a video file, text plus a fax file or any combination thereof to a phone, pager or fax machine or other receiving device suitable for the message content, over appropriate communications networks using an architecture which enables easy expansion to handle additional message traffic as well as to connect to additional communications networks, including networks which do not presently exist which may become available in the future.

2. Description of Related Art

Voice and data communications systems such as the public switched telephone network (PSTN) are currently used to transfer image and text data transmitted by facsimile ("fax") machines in addition to the normally carried voice traffic. These faxed images are usually transmitted through the PSTN and received for printout or storage of the image on a destination fax machine or computer for the use by the recipient.

In U.S. Pat. No. 6,208,638 entitled Method and Apparatus for Transmission and Retrieval of Facsimile and Audio Messages Over a Circuit or Packet Switched Network, it is disclosed that to provide for the receipt and transmission of audio and fax information by a first user over a circuit switched network such as the public switched telephone network (PSTN) to a second user over a packet switched network such as the Internet, a communications server is connected both to the circuit switched network and a packet switched network.

The communications server contains resources to receive and process incoming audio and facsimile calls from the circuit switched network into a format suitable for transmission over the packet switched network to the second user’s address. In addition, a link is first determined between the second user’s address on the circuit switched network and the second user’s address on the packet switched network, and then an appropriate route to the second user’s address on the packet network is determined. With the system being maintained in a distributed and redundant fashion, reliable receipt and transfer of all messages is ensured. A copy of the specification and drawings of U.S. Pat. No. 6,208,638 is attached hereto.

However, the architecture utilized as described in U.S. Pat. No. 6,208,638 is not easily scalable to handle increasingly higher levels of message traffic or to easily connect to networks in addition to the PSTN and the Internet. FIG. 1 shows the essence of the architecture of U.S. Pat. No. 6,208,638. An e-mail message is passed to an outbound resource 11 (communications server 550 in U.S. Pat. No. 6,208,638) which converts the e-mail message to a fax format or to audio for transmission to a fax machine or telephone connected to the PSTN. A database 13 stores customer information necessary for processing of messages (an unnumbered part of communications server 550 in U.S.

Pat. No. 6,208,638 which is also contained in database server 595 in U.S. Pat. No. 6,208,638). After processing of an e-mail message by outbound resource 11, a fax or voice mail message is sent over the PSTN or more generally, a generalized switched telephone network (GSTN) which includes cellular telephone networks as well as the PSTN. Optionally, a pager message may also be sent informing a user of the fax which has been sent or availability of a voice mail message as described in U.S. Pat. No. 6,073,165 entitled Processing and Forwarding Messages From a Computer Network to a Forwarding Service.

SUMMARY OF THE INVENTION

A method and apparatus is disclosed for delivering messages that utilizes a message queue and a router/filter within a private data network. The private network is connected to an external data network such as the Internet, and has separate outbound resource servers to provide a high degree of scalability for handling a variety of message types.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a prior art architecture which performs the functions, but not the scalability of the architecture of the present invention.

FIG. 2 is a block diagram illustrating the architecture of the present invention.

FIG. 3 is a block diagram showing the data/control flow through message queue 21, router/filter 23 and database 27.

FIG. 4 (4a and 4b) is a flow diagram of the processing performed by router/filter 23.

FIG. 5 is a system diagram of a network containing a message server.

FIG. 6 is a block diagram illustrating the message server.

FIG. 7 is a flow diagram illustrating some operations.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a method and apparatus for allowing the receipt and transmission of audio, video and fax information between a circuit switched network and a packet switched network. For purposes of explanation, specific embodiments are set forth to provide a thorough understanding of the present invention. However, it will be understood by one skilled in the art, that the invention may be practiced without these details. Further, although the present invention is described through the use of circuit switched and packet switched networks, most, if not all, aspects of the invention apply to all networks in general. Moreover, well-known elements, devices, process steps and the like are not set forth in detail in order to avoid obscuring the present invention.

Referring now to FIG. 2, e-mail messages for a customer are sent to/through an external data network 15 (e.g., the Internet) and routed to an appropriate SMTP/HTTP (or SHTTP) server 17 as determined by a domain name server (DNS) 18 according to well known techniques. The e-mail message may be a text message or it may include a file, the content of which may be audio, video or bitmapped (e.g., a fax) or other data. Again, the techniques for creating and sending e-mail messages with these characteristics are well known.

A processing server 19, which includes a message queue 21 and a router/filter 23 first verifies that the message is from or is to a customer using information in database 27. After
successful verification, the message is broken into fragments (in the case of files with multiple attachments) and written to message queue 21. Router/filter 23 obtains messages from the message queue and handles least call routing/billing/prioritization/filtering of messages. Filtering is primarily for notification messages for pager delivery. After billing verification and determination of a least cost route, the message is assigned to one or more outbound resources 31 for delivery to the intended recipient by a method or methods selected by the customer as previously recorded in database 27.

In the case of faxes, the outbound resource is a server which dials the destination fax number and sends the fax. In the case of voice messages, the outbound resource is a server which dials the destination telephone number and plays the voice message. In the case of notification messages, the outbound resource is a server which dials out to the paging terminal or delivers notification messages for pager delivery. After successfully delivering a receipt with details and an error log (if any) is sent back via a secure protocol to the message queue 21.

The receipt/error log messages are then processed by the router/filter which interfaces with a billing system (not shown) for customer account update.

FIG. 3 is a block diagram showing the data/control flow through message queue 21, router/filter 23 and database 27 using information contained in the following tables as explained with reference to FIGS. 4a and 4b.

**TABLE 1**

<table>
<thead>
<tr>
<th>MESSAGE_ID</th>
<th>This is a unique number assigned to each message that arrives in the system.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESOURCE_ID</td>
<td>Unique number assigned to each outbound resource.</td>
</tr>
<tr>
<td>RESOURCE_TYPE</td>
<td>Each resource is identified by the type of messages it can deliver (e.g., FAX, VOICE, NOTIFY, etc.)</td>
</tr>
<tr>
<td>RESOURCE_ADDRESS</td>
<td>Location of the resource (such as IP address)</td>
</tr>
<tr>
<td>MESSAGE_TO_EP_EMAIL_ADDRESS</td>
<td>To: address of the message</td>
</tr>
<tr>
<td>MESSAGE_FROM_EP_EMAIL_ADDRESS</td>
<td>From: address of the message</td>
</tr>
<tr>
<td>MESSAGE_LOCATION</td>
<td>Location of actual message on the Message Queue 21</td>
</tr>
<tr>
<td>MESSAGE_SIZE</td>
<td>Size of the message in bytes</td>
</tr>
<tr>
<td>MESSAGE_PRIORITY</td>
<td>Priority of the message (e.g., low, medium, high)</td>
</tr>
<tr>
<td>MESSAGE_CREATION_DATE</td>
<td>Timestamp identifying the date/time that the message was received by the system</td>
</tr>
<tr>
<td>MESSAGE_EXPIRY_DURATION</td>
<td>Amount of time after which the message becomes stale</td>
</tr>
<tr>
<td>MESSAGE_SCHEDULED_DATE</td>
<td>Scheduled delivery timestamp for the message</td>
</tr>
<tr>
<td>MESSAGE_STATUS</td>
<td>Current status of the message (Active, Pending, Sent, etc.)</td>
</tr>
<tr>
<td>MESSAGE_ESTIMATED_COST</td>
<td>Estimated cost for the delivery of the message</td>
</tr>
<tr>
<td>CUSTOMER_KEY</td>
<td>Unique number identifying the customer in the database</td>
</tr>
<tr>
<td>MESSAGE_PART_OF_BROADCAST</td>
<td>Flag identifying if the message is part of a larger broadcast list waiting to be delivered</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th>FILETYPE_MESSAGE_TYPE</th>
<th>Identifier of a message type (FAX, VOICE, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILETYPERESOURCE_TYPE</td>
<td>Identifier to determine a resource that can handle a particular file type</td>
</tr>
<tr>
<td>FILETYPE_EXTENSION</td>
<td>The filename extension that identifies a file type (e.g., WAV, TIF, JFIF, AU, GSM, etc.)</td>
</tr>
</tbody>
</table>

**TABLE 3**

<table>
<thead>
<tr>
<th>CUSTOMER_KEY</th>
<th>Unique number identifying a customer in the database</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRSTNAME</td>
<td>First name of the customer</td>
</tr>
<tr>
<td>LASTNAME</td>
<td>Last name of the customer</td>
</tr>
<tr>
<td>COMPANY</td>
<td>Company name of the customer</td>
</tr>
<tr>
<td>ADDRESSLINE1</td>
<td>Company address</td>
</tr>
<tr>
<td>ADDRESSLINE2</td>
<td>Company address</td>
</tr>
<tr>
<td>CITY</td>
<td>Company city</td>
</tr>
<tr>
<td>MAILREGION</td>
<td>Company state or equivalent</td>
</tr>
<tr>
<td>MAILCODE</td>
<td>Zipcode or equivalent</td>
</tr>
<tr>
<td>COUNTRY</td>
<td>Company country</td>
</tr>
<tr>
<td>WORKNUMBER</td>
<td>Customer work phone number</td>
</tr>
<tr>
<td>HOMENUMBER</td>
<td>Customer home phone number</td>
</tr>
<tr>
<td>EMAILADDRESS</td>
<td>Email address of the customer</td>
</tr>
<tr>
<td>COLLECTIONMETHOD</td>
<td>Collection method such as Credit card, Debit, etc.</td>
</tr>
<tr>
<td>BILLTYPE</td>
<td>e.g., Customer, Demo, free, corporate, etc.</td>
</tr>
<tr>
<td>STATUS</td>
<td>Status of the customer</td>
</tr>
<tr>
<td>LANGUAGECODE</td>
<td>Language of the customer</td>
</tr>
<tr>
<td>CURRENCYCODE</td>
<td>Currency for billing the customer</td>
</tr>
</tbody>
</table>
**TABLE 5**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUSTOMERKEY</td>
<td>Unique number identifying a customer in the database</td>
</tr>
<tr>
<td>PAGERTYPECODE</td>
<td>Code to determine the kind of pager service</td>
</tr>
<tr>
<td>BBSNUMBER</td>
<td>Modem number for pager notification delivery, based on the pager type</td>
</tr>
<tr>
<td>PAGERNUMBER</td>
<td>Identifier number of the pager unit</td>
</tr>
<tr>
<td>PIN</td>
<td>PIN code for the pager unit</td>
</tr>
<tr>
<td>DISPLAYTYPE</td>
<td>Display type of the pager (numeric, alphanumeric, etc.)</td>
</tr>
</tbody>
</table>

**TABLE 6**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESPONSE_ID</td>
<td>Unique ID for a response/receipt message to be sent to a customer</td>
</tr>
<tr>
<td>RESPONSE_SUBJECT</td>
<td>Subject line of the response message</td>
</tr>
<tr>
<td>RESPONSE_FROM_EMAIL</td>
<td>From: line of the response message</td>
</tr>
<tr>
<td>RESPONSE_BODY</td>
<td>Actual text of the response message</td>
</tr>
</tbody>
</table>

**TABLE 7**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESOURCE_ID</td>
<td>Unique identifier for the resource</td>
</tr>
<tr>
<td>RESOURCE_TYPE</td>
<td>Type of resource (FAX, VOICE, etc.)</td>
</tr>
<tr>
<td>RESOURCE_STATUS</td>
<td>Status of resource (Active, Inactive, etc.)</td>
</tr>
<tr>
<td>RESOURCE_QUEUE_STATUS</td>
<td>Status of the Queue, number of messages in queue</td>
</tr>
<tr>
<td>RESOURCE_TIME_ZONE</td>
<td>Time zone for the resource</td>
</tr>
<tr>
<td>RESOURCE_QUEUE_MAX</td>
<td>Maximum size of the resource queue</td>
</tr>
<tr>
<td>RESOURCE_ADDRESS</td>
<td>Address of the resource (IP address, etc.)</td>
</tr>
<tr>
<td>RESOURCE_NAME</td>
<td>Name of the resource</td>
</tr>
<tr>
<td>RESOURCE_EXPIRY_DURATION</td>
<td>Expiry duration for any message sent to the specified resource</td>
</tr>
<tr>
<td>RESOURCE_QUEUE_IN_STATUS</td>
<td>Number of messages waiting to be delivered by the resource</td>
</tr>
<tr>
<td>RESOURCE_COMMUNICATION_TYPE</td>
<td>Method used to communicate with resource (HTTP, SHTTP, etc.)</td>
</tr>
</tbody>
</table>

**TABLE 8**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESOURCE_ID</td>
<td>Unique identifier for the resource</td>
</tr>
<tr>
<td>RESOURCE_PREFIX</td>
<td>Any digits to be dialed before an actual number</td>
</tr>
<tr>
<td>RESOURCE_CITY_NAME</td>
<td>Name of destination city for the message to be delivered</td>
</tr>
<tr>
<td>RESOURCE_PROVIDER_RATE</td>
<td>Rate for a particular city (dollars per second, etc.)</td>
</tr>
<tr>
<td>RESOURCE_MAX_DIGITS</td>
<td>Max number of digits allowed to be dialed</td>
</tr>
<tr>
<td>RESOURCE_AREA_CODE</td>
<td>Area code for the particular city</td>
</tr>
</tbody>
</table>

As noted above outbound resource 31 is equivalent to communications server 550 as described in U.S. Pat. No. 6,208,638. The modifications made to outbound resource to enable it to operate in a system having an architecture as described herein are as follows. These changes will be described with reference to the message structure of received messages.

**Message Structure**

Each field has a value following an "=" sign and is terminated by a newline character. The exception to this is the "Message" field where a newline immediately follows the "=" sign and the actual message follows on the next line. The fields of a message are as follows:

- Password=
- MessageID=
- MessageStatus=
- MessageSentTimeStamp=
- Message Duration=
- MessageLength=
- Message RemoteCSID=
- MessageSourceCSID=
- MessageAttachStatus=
- MessageDestination=
- MessageBody=
- Message=

In the following explanation of the above fields, the text in brackets at the end indicates the entity providing the value for the field in the forward/reverse direction (i.e., from
router/filter \( \text{23} \) (RF) to outbound resource \( \text{31} \) (RESOURCE), and from RESOURCE to RF, respectively. “NA” indicates that no value is applicable, and the text “NA” is used to populate the field. “Same” indicates that the same value is used in the reverse direction, i.e., the RESOURCE does not modify the value; it only echoes the value it receives in that field.

**Password**—There is a fixed password pair for each RESOURCE and RF combination. RESOURCE stores the RF password in a flat text password file in a directory (\( \text{faxcom} \)), and RF stores the RESOURCE password in the database. (RF/RESOURCE).

**MessageID**—Unique ID, per message, generated by RESOURCE. (RESOURCE/Same).

**MessageStatus**—Code indicating current status of the message. See Status codes below. (RF/RESOURCE)

**MessageSentTimeStamp**—Time stamp indicating date/time the message was delivered to the final destination by RESOURCE. (NA/RESOURCE)

**MessageDuration**—Time (in seconds) to transmit message from RESOURCE. (NA/RESOURCE)

**MessageLength**—Number of pages transmitted by RESOURCE. (NA/RESOURCE)

**MessageRemoteCSID**—Called subscriber identification (CSID) of fax machine to which message was transmitted. (NA/RESOURCE)

**MessageSourceCSID**—Source CSID. This may be customized per customer. (RF/Same)

**MessageAttachStatus**—Value of “A” indicates a message is attached for delivery. (RF/RESOURCE)

**MessageDestination**—Destination phone number. (RF/ Same)

**ResourceId**—Unique ID, per resource, stored in the database. (RF/Same)

**ResourceStatus**—Code indicating the current status of the resource, i.e., whether it is active or not. RF uses this to determine whether further messages should be sent to RESOURCE for delivery. See Status codes below. (NA/RESOURCE)

**ResourceLastCommTimeStamp**—Date/time of last communication between RF and RESOURCE. (RF/RESOURCE)

**ResourceExpireDuration**—Life of message (in minutes) on RESOURCE. If a message has not been delivered to the final destination by RESOURCE within this amount of time, the message is considered “expired” and is discarded.

**ResourceQueueInStatus**—Number of messages waiting to be processed in an Inbox directory on RESOURCE. (NA/RESOURCE)

**ResourceQueueOutStatus**—Number of messages waiting to be processed in an Outbox directory on RESOURCE. (NA/RESOURCE)

**ResourceChannelMax**—Number of channels available for use on RESOURCE. (NA/RESOURCE)

**ResourceChannelStatus**—Channel activity status, e.g., \( \text{000000011100001} \), where 0’s indicate an idle channel and 1’s indicate a busy channel. (NA/RESOURCE)

**MessageBoundary**—Text for MIME boundary. (RF/NA)

**Message**—Actual MIME message sent by RF. If MessageAttachStatus=NA, no message follows this tag. All fields are NA if not used.

Date fields are expressed in MMDDYYhhmmss format.

**Resource Status Codes** are:

- **A**—Active
- **I**—Inactive

**Message Status Codes** are:

- **P**—Pending
- **H**—On Hold
- **D**—Deferred
- **R**—Ready for sending to RESOURCE
- **X**—Exchanged, i.e., sent to RESOURCE but not acknowledged by it.
- **A**—Sent to RESOURCE and acknowledged by it.
- **S**—Sent (i.e., receipt for final delivery received from RESOURCE)

Normal sequence for Message delivery by RESOURCE is:

- RF receives a request in its queue (message queue \( \text{21} \)).
- RF sends the message to RESOURCE.
- RESOURCE gets message, authenticates password, and creates a new message in the Inbox directory.
- RESOURCE acknowledges receipt of message.
- RESOURCE processes the message in Inbox (MessageStatus=A, Message.AttachStatus=A).
- RESOURCE moves message to a Process directory for further processing.
- RESOURCE finishes processing message and delivers it to final destination.
- RESOURCE removes the message from the Process directory.
- RESOURCE creates a message in Outbox directory. (MessageStatus=S). If a “reply message” is to be delivered to the original sender, MessageAttachStatus=A, else MessageAttachStatus=NA. MessageID remains the same in either case.
- RESOURCE delivers receipt (with “reply message,” if applicable) to RF.
- RF receives the message and puts it in the Queue for database processing.

Processing server 19 with the above described functionality may be implemented using readily available systems such as a Windows NT server or a UNIX server. Database 27 may be implemented as a database server using readily available systems such as a Windows NT server or a UNIX server running, for example a SQL database.

What follows is a detailed description of FIGS. 5-7 which set forth a method and apparatus for allowing the receipt and transmission of audio and fax information between a circuit switched network and a packet switched network, as described in U.S. Pat. No. 6,208,638. For purposes of explanation, specific embodiments are set forth to provide a thorough understanding of the present invention. However, it will be understood by one skilled in the art, from reading this disclosure, that the invention may be practiced without these details. Further, although the system is described through the use of circuit switched and packet switched networks, most, if not all, aspects apply to all networks in general.

FIG. 5 contains a block diagram illustrating an embodiment of a system containing a communications server 550 connected to a circuit switched network 530 and a wide area network (WAN) 580. In an embodiment, the circuit switched network 530 is a circuit switched network such as the PSTN while WAN 580 is a packet switched network such as the Internet. It is to be noted that circuit switched network 530 can also be a network such as the generalized switched telephone network (GSTN), which encompasses PSTN networks, cellular telephone networks, and the other networks with which they are in communication.

Communications server 550 is connected to circuit switched network 530 via a switch 540 and to WAN 580 through the use of a router 585. As described in further detail.
below, in an embodiment, switch 540 and router 585 are interfaced to communications server 550 using two separate hardware interfaces. In an alternate embodiment, switch 540 and router 585 can be interfaced to communications server 550 through the use of one hardware unit.

Connected to circuit switched network 530 is both a telephone unit 510 and a facsimile unit 520. Telephone unit 510 is a standard telephone capable of converting audio signals into electrical signals suitable for transmission over circuit switched network 530. Similarly, facsimile unit 520 is a standard facsimile machine capable of transmitting and receiving facsimile messages over circuit switched network 530. Each of these devices can be connected to circuit switched network 530 using either wired or wireless technology.

Connected to WAN 580 is a database server 595, a system management unit 597, a mail server 560, and a client 590. Each of these systems communicate with each other and with communications server 550 via WAN 580 using such protocols such as simple network management protocol (SNMP) and hyper-text transport protocol (HTTP) packetized using a protocol such as the transmission control protocol/internet protocol (TCP/IP).

In an embodiment, each one of database server 595, system management unit 597, mail server 560, and client 590, are stand-alone computers or workstations containing the hardware and software resources to enable operation. In alternate embodiments, the functions provided by each one of database server 595, system management unit 597, mail server 560, and client 590, are provided by any number of computer systems.

In an embodiment, mail server 560 is a server providing e-mail receipt and transmission using a protocol such as the simple mail transfer protocol (SMTP) and post office protocol (POP). Moreover, client 590 is configured to be able to communicate over WAN 580 using SMTP or POP in order to retrieve e-mail from mail server 560 or another suitably configured server.

System management unit 597 communicates with communications server 550 to monitor: (1) the processes on communications server 550; (2) the status of the trunk line connected to communications server 550; and (3) the connection between the various servers connected to WAN 580. As described below, if any processes on communications server 550 or connection to the circuit switched network 530 is interrupted, system management unit 597 can allocate resources, or cause the re-routing of a call or message via one or more redundant resources or connections, ensuring that the call or message is routed to the final destination.

Communications server 550 contains user data needed to receive and route incoming messages received from circuit switched network 530. The same information is also stored on database server 595. In an embodiment, communications server 550 stores an inbound address, a set of final destination addresses; an account status for each user. The inbound address corresponds to the telephone number assigned to the user. As further discussed below, the inbound address is the number that a message sender dials on telephone unit 510 or facsimile unit 520 to leave a message for the user. The set of final destination address contain one or more e-mail addresses where the user account status information indicates whether the inbound address is either active and or inactive—i.e, whether the user is able to receive messages using the system.

Database server 595 stores a duplicate copy of the inbound address, the set of final destination addresses; and the account status for each user. Database server 595 also stores additional information for each user such as mailing address and billing information which are not used in the operation of the present invention but are note herein for completeness only. Thus, the information that is stored on communications server 550 is a subset of the information that is stored on database server 595, and if communications server 550 were to become inoperable or otherwise unable to handle incoming messages, database server 595 can configure another communications server to accept those calls.

In an embodiment, system management unit 597 is responsible for monitoring the status of communications server 550 and re-assigning the users being handled by communications server 550 if communications server malfunctions or becomes overloaded with incoming calls. In the former case, system management unit 597 would re-assign all users being handled by communications server 550 to another communications server. In the latter case, system management unit 597 would only off-load the only those incoming calls for which communications server 550 does not have the available resources to process.

FIG. 6 is a block diagram of communications server 550 configured in accordance with an embodiment containing a processor 651 coupled to a memory subsystem 653 through the use of a system bus 655. Also coupled to system bus 655 is a network interface 656; a trunk interface 652; and a set of fax/voice processing resources 654. Set of fax/voice processing resources 654 and trunk interface 652 are also coupled to a bus 657.

Bus 657 is a bus that supports time division multiplex access (TDMA) protocols to optimize the flow of real time traffic between set of fax/voice processing resources 654 and trunk interface 652.

Memory subsystem 653 is used to store information and programs needed by communications server 550. The functioning of memory subsystems in computer design are well known to those of ordinary skill in the art and thus will not be further discussed herein.

In an embodiment, trunk interface 652 is a trunk line interface, such as a T-1 or E-1 line, to switch 540 and can handle up to 24 channels of communications. Trunk line signaling is well known to those of ordinary skill in the art of telecommunication and thus will not be further discussed herein except as necessary for describing the invention.

Set of fax/voice processing resources 654 are made up of multiple fax/voice processing cards. Each of these processing cards contain processing units which are capable of receiving and transmitting facsimiles according to established protocols, and which are capable of digitizing voice or other audio data, also according to established protocols. In an embodiment, there are three fax/voice processing cards in set of fax/voice processing resources 654, each fax/voice processing card containing eight processing units capable of handling a channel from trunk interface 652. Thus, communications server 550 can communicate on twenty-four channels concurrently.

The storage of destination addresses on both circuit switched network 530 and WAN 580 is controlled by a database located either on communications server 550 or on database server 595. Keeping this information separate from communications server 550 allows communications server 550 to be a resource that can be allocated on demand. Hence, a number of communications servers could be used, along with one or more database servers, to allow a fully redundant and scalable system. In addition, system management unit 597 monitors the status and connection of all the communication and database servers.
If the inbound address to determine if the account of that user is in the inbound address list, processor 550 searches the list of inbound addresses contained in memory subsystem 651 for the destination address. If processor 651 finds the destination address in the inbound address list, processor 651 will then look up the account status for the user who owns the inbound address to determine if the account of that user is a valid user account. In an alternate embodiment, the validation is performed through the use of a database maintained by a separate entity such as database server 595.

In block 704, to determine whether or not to process the incoming call, processor 651 searches the list of inbound addresses contained in memory subsystem 653 for the destination address. If processor 651 finds the destination address in the inbound address list, processor 651 will then look up the account status for the user who owns the inbound address to determine if the account of that user is a valid user account. In an alternate embodiment, the validation is performed through the use of a database maintained by a separate entity such as database server 595.

In block 706, once the validity of the user account has been established, processor 651 will attempt to allocate one fax/voice processing resource from set of fax/voice processing resources 654 and also determine the availability of other resources required for the receipt and processing of the incoming call. These resources include the processing capacity of processor 651, the storage capacity of memory subsystem 653.

Process 651 will play a prepared message indicating that the number to which the incoming message was sent is an invalid account.

In block 708, the incoming call is being received and processed by processor 651. In an embodiment, the temporary file is processed according to the type of the incoming call. If the incoming call was a fax transmission, then the temporary file, which has been stored as a group 3 facsimile file, will be converted into a file which follows the tagged image file format (TIFF), or a format that is suitable for transmission over WAN 580. Optionally, the temporary fax file can also be compressed at this stage. If the incoming call was an audio message, then the temporary file would be compressed using a compression scheme such as the scheme defined in the global system for mobile-communications (GSM) standard. In alternate operations, compressing and other processing of the incoming message is performed at the same time the incoming message is being received and being placed in memory subsystem 653.

In block 720, communications server 550 uses the inbound address to determine the set of final destination addresses, which are destinations on WAN 580 (i.e., the packet switched network), to send the processed incoming message. Communications server 550 then sends an electronic mail (e-mail) with the processed incoming message as an attachment to all the destinations in the set of final destination addresses.

In block 710, if the fax/voice processing resource of set of fax/voice processing resources 654 responsible for processing the incoming call determines that the incoming call is a fax transmission, then the call will be terminated with block 712. Otherwise, operation will continue with block 714. For example, if the call is a fax, a fax protocol is initiated, and the fax is received by one of the fax/voice processing resources of set of fax/voice processing resources 654. If the call is a voice call, the voice is recorded by one of the fax/voice processing resources of set of fax/voice processing resources 654.

In block 712, the fax/voice processing resource of set fax/voice processing resources 654 responsible for processing the incoming call will perform the fax transfer and store the incoming message as a temporary file in memory subsystem 653. If an embodiment, the incoming fax is saved into a file which follows the group 3 facsimile file format. Operation will then continue with block 716.

In block 714, where it is determined that the incoming message is an audio message, the fax/voice processing resource of set of fax/voice processing resources 654 will attempt to process the call and initiate an audio recording of the incoming voice message. In an embodiment, the audio message is digitized and stored in memory subsystem 653 as a temporary file in a pulse code modulated format. After the incoming call has been digitized and stored, operation will then continue with block 716.

In block 716, trunk interface 652 will terminate the call. Operation will then continue with block 718.

In block 718, the incoming message, which has been stored as a temporary file in memory subsystem 653, is processed by processor 651. In an embodiment, the temporary file is processed according to the type of the incoming call. If the incoming call was a fax transmission, then the temporary file, which has been stored as a group 3 facsimile file, will be converted into a file which follows the tagged image file format (TIFF), or a format that is suitable for transmission over WAN 580. Optionally, the temporary fax file can also be compressed at this stage. If the incoming call was an audio message, then the temporary file would be compressed using a compression scheme such as the scheme defined in the global system for mobile-communications (GSM) standard. In alternate operations, compressing and other processing of the incoming message is performed at the same time the incoming message is being received and being placed in memory subsystem 653.

In block 720, communications server 550 uses the inbound address to determine the set of final destination addresses, which are destinations on WAN 580 (i.e., the packet switched network), to send the processed incoming message. Communications server 550 then sends an electronic mail (e-mail) with the processed incoming message as an attachment to all the destinations in the set of final destination addresses.

For example, the e-mail containing the attachment is transferred to, and stored in, a server such as mail server 560. The e-mail is then retrieved by client 590 whenever the user wishes. In an alternate embodiment, client 590 can retrieve the e-mail directly from communications server 550, without the storing operation of mail server 560.

While the present invention has been particularly described with reference to the various figures, it should be understood that the figures are for illustration only and should not be taken as limiting the scope of the invention. Many changes and modifications may be made to the invention, by one having ordinary skill in the art, without departing from the spirit and scope of the invention.
What is claimed is:

1. A system for supporting a message delivery service, comprising:
   a server coupled to communicate with a plurality of first outbound resources and a database server, over an internal packet-switched data network, the database server containing account information on customers of the message delivery service, the server implements a router-filter and a message queue, the message queue to store a request message received from a customer of the message delivery service over an external packet-switched data network, the router-filter to obtain a request message from the queue, validate said request message by accessing the account information in the database server, and determine to which of the plurality of first outbound resources to assign said request message, each of the first resources being capable of converting an input request message into a format capable of being received by a fax machine over a circuit switched network, wherein the route-filter is to determine which of the plurality of first outbound resources said request message is to be assigned, based on a message type of said request message.

2. The system of claim 1 wherein the internal data network is a private data network.

3. The system of claim 2 wherein the external data network is the Internet.

4. The system of claim 3 wherein the request message is received from the customer via one of a mail transport protocol server and a hypertext transport protocol server on the Internet.

5. The system of claim 1 wherein the router-filter is to prioritize a plurality of request messages that have been obtained from the queue and that are assigned to an outbound resource.

6. The system of claim 1 wherein the router-filter is to determine which of the plurality of first outbound resources to assign said request message to, based on which resource offers the least cost of delivering said request message.

7. The system of claim 1 wherein the router-filter is to generate an error message that indicates an error in delivering said request message as reported by the outbound resource to which said request message was assigned.

8. The system of claim 1 further comprising:
   a plurality of second outbound resources each being capable of converting an input request message into a format capable of being played back to a telephone over a circuit switched network, wherein the router-filter is to determine to which of the first and second resources said request message is to be assigned, based on a message type of said request matching a capability of one of a first resource and a second resource.

9. The system of claim 1 further comprising:
   a plurality of second outbound resources each being capable of converting an input request message into a format capable of being transmitted to a paging terminal over one of (1) a circuit switched network and (2) a paging gateway over an external packet-switched network, wherein the route-filter is to determine to which of the first and second resources said request message is to be assigned, based on a message type of said request matching a capability of one of a first resource and second resource.

10. The system of claim 1 wherein a location of each outbound resource is given by an Internet Protocol address.

11. The system of claim 1 wherein the message is received from the customer via one of a mail transport protocol server and a hypertext transport protocol server on the Internet.

12. The system of claim 1 wherein a protocol used by the router-filter to communicate with the plurality of outbound resources is one of HTTP and SMTP.

13. The system of claim 1 wherein the router-filter is to send a MIME message.

14. An article of manufacture for supporting a message delivery system, comprising:
   a machine accessible medium containing data that, when accessed by a machine, cause a server to communicate with an outbound resource and a database all as part of an internal packet-switched data network, the server to store a request message received from a customer of the message delivery service over an external packet switched data network, verify that the request message is from the customer using information in the database, and assign said request message to the resource which converts data associated with said request message into a format capable of being received by a fax machine over a circuit switched network.

15. The article of manufacture of claim 14 wherein the medium includes further data which allows the request message to be received from a customer over the Internet.

16. The article of manufacture of claim 14 wherein the medium includes further data which, when executed by the machine, cause the server to determine which of a plurality of first outbound resources to assign said request message to, based on which resource offers the least cost of delivering said request message.

17. A method comprising:
   receiving an email message from an external packet data network;
   performing a database lookup in an internal packet data network to correlate the email message with a user account;
   verifying within the internal network the email message is associated with a valid user account;
   performing within the internal network one of a least cost routing calculation, a billing calculation, a prioritization calculation, and a message filtering operation;
   converting within the internal network the email message into a fax format for transmission to a machine; and
   transmitting the converted email message into a public switched telephone network to a destination telephone number.

18. A method comprising:
   receiving an email message from the Internet;
   performing within an internal packet data network a database lookup to correlate the email message with a user account;
   determining within the internal packet data network if the email message passes a filter screening criterion;
   converting the email message into a fax format for transmission to a fax machine; and
   transmitting the converted email message into a public switched telephone network to a destination telephone number.

19. A method comprising:
   receiving an email message from the Internet;
   performing a database lookup within an internal packet data network to correlate the email message with a user account;
   queuing the email message within the internal packet data network;
   reading the queued message based on a prioritized ordering rule within the internal packet data network;
   converting the read message into a fax format for transmission; and
transmitting the converted message into a public switched telephone network to a destination telephone number associated with the user account.

20. A method comprising:

receiving in an internal packet data network an email message from the Internet;
correlating the email message with a user account in the internal packet data network;

queuing the email message in the internal packet data network;
performing a routing operation to determine a destination to forward the email message;
converting the routed message into a fax format; and
transmitting the converted message into a public switched telephone network to a destination telephone number associated with the user account and determined in said routing.