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(54) SYSTEM, METHOD AND APPARATUS FOR UTILIZING TRANSACTION DATABASES IN A CLIENT - SERVER ENVIRONMENT

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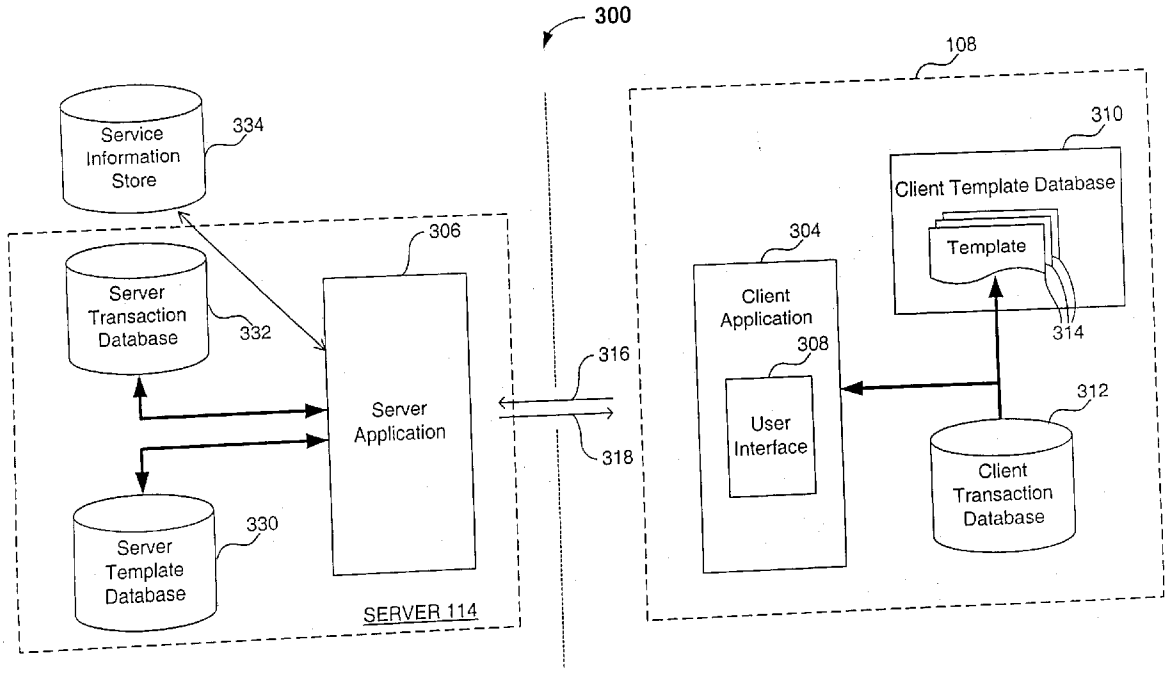
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(52) **U.S. Cl.** **707/10**

(57) **ABSTRACT**

A system, method and apparatus for utilizing transaction databases in a client-server environment. The transaction databases can be used to receive and retain multiple server responses to consecutive client requests regardless of the temporal relationship between the multiple responses and consecutive requests. One method of the invention relates to how a client device displays information. This method is for use in a client-server system including one or more servers and a client device having a client transaction database, a client template database, and a user interface adapted to enable a user to enter requests. The method includes the steps of receiving a user request from the user via the user interface and retrieving a template from the client template database based on the user request. The template includes one or more data fields. The method also includes the step of retrieving information from the client transaction database based on the template, wherein the information relates to the one or more data fields of the template. A page is then displayed based on the template and the information relating to the one or more data fields.



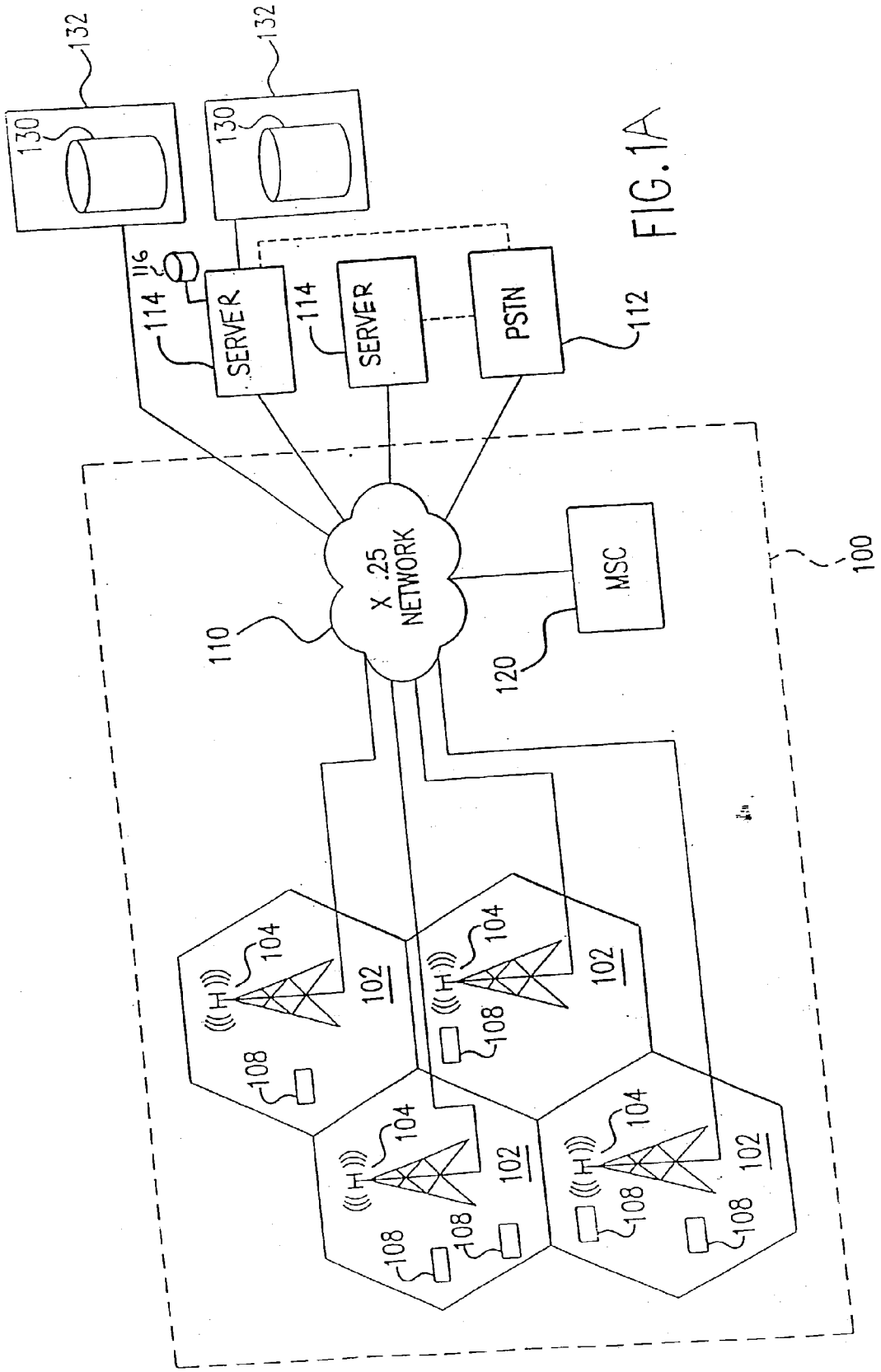

132
132
130
130
116
114
114
SERVER
SERVER
PSTN
112
X .25 NETWORK
110
MSC
120
100
104
102
108

FIG. 1A

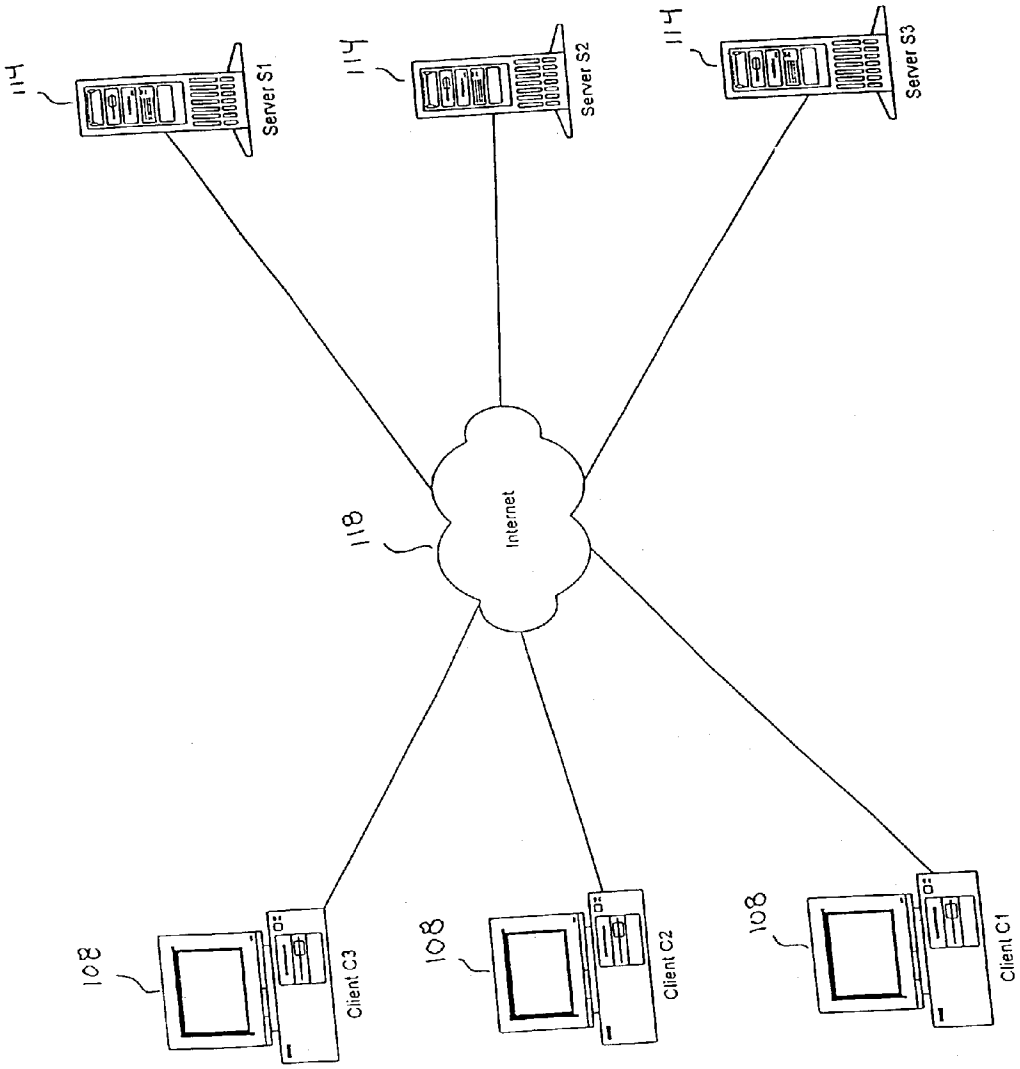

114
Server S1
114
Server S2
114
Server S3
118
Internet
108
Client C3
108
Client C2
108
Client C1

FIG. 1B

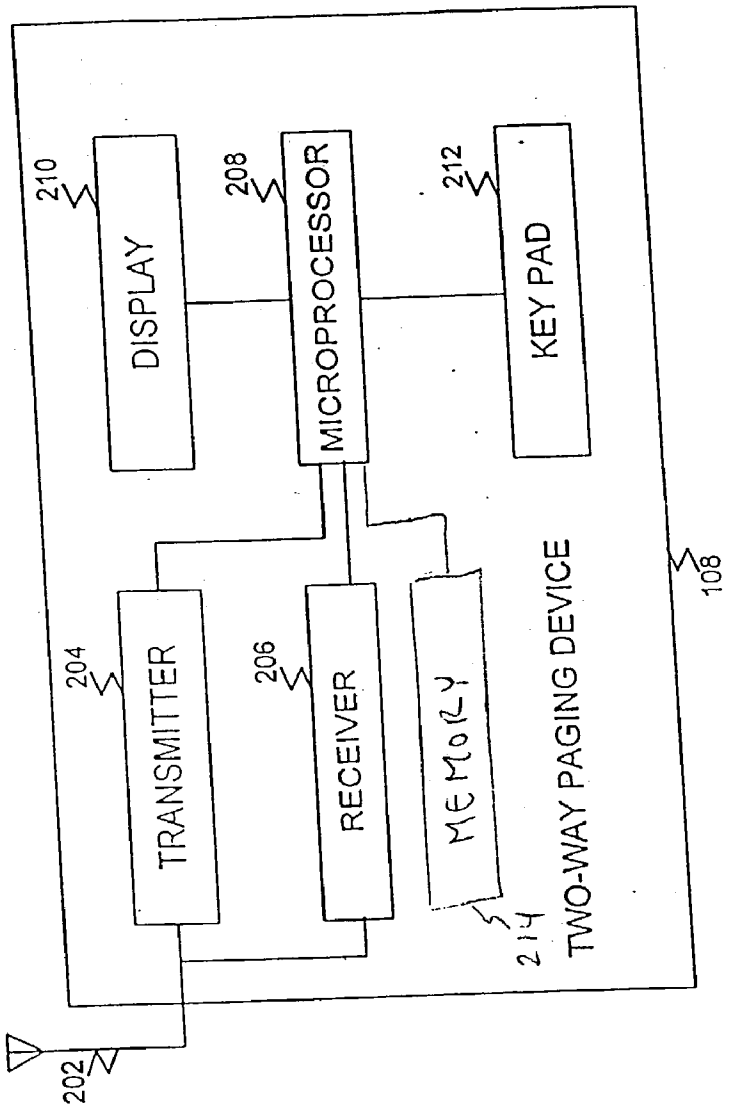

210
DISPLAY
208
MICROPROCESSOR
212
KEY PAD
204
TRANSMITTER
206
RECEIVER
MEMORY
214
TWO-WAY PAGING DEVICE
108
202

FIG. 2A

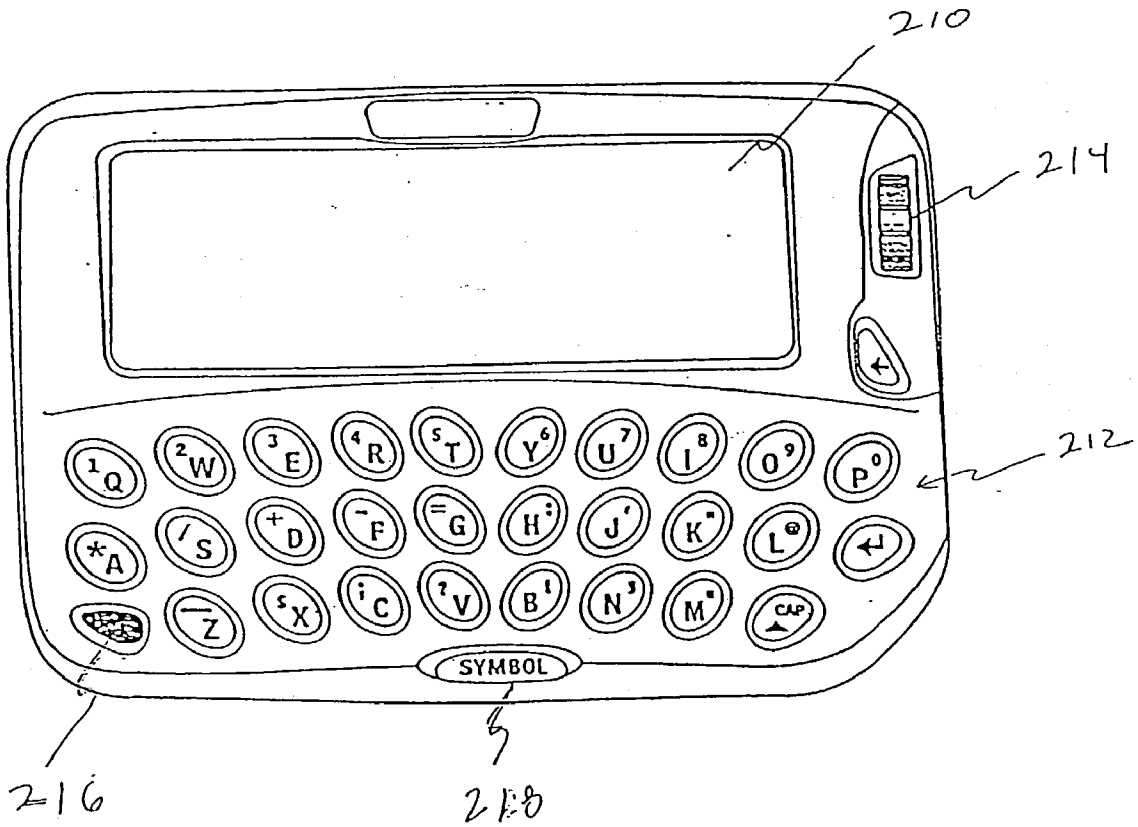


FIG 2B

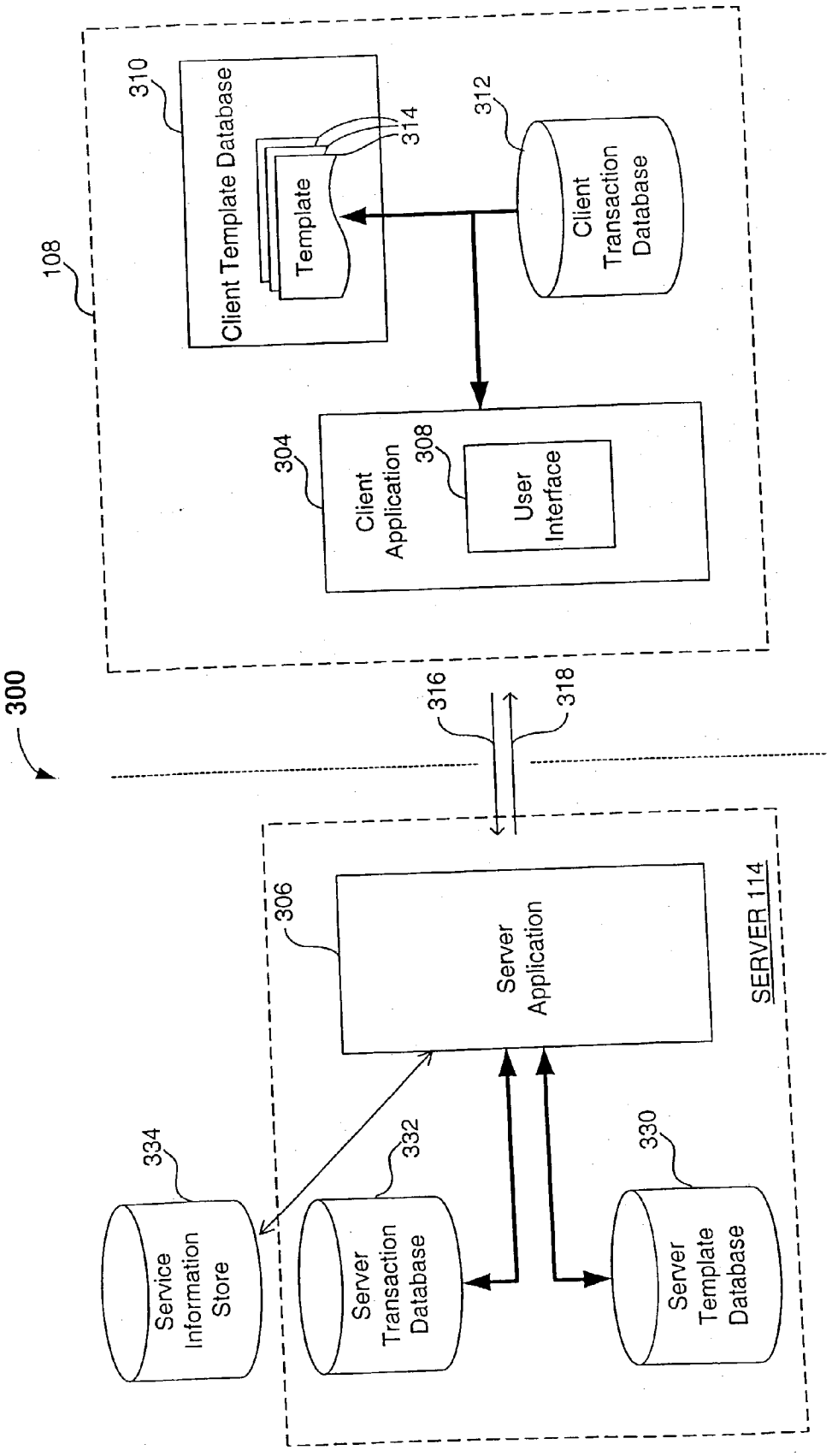

300
108
310
Client Template Database
Template
314
312
Client Transaction Database
304
Client Application
308
User Interface
316
318
306
Server Application
SERVER 114
334
Service Information Store
332
Server Transaction Database
330
Server Template Database

FIG.3

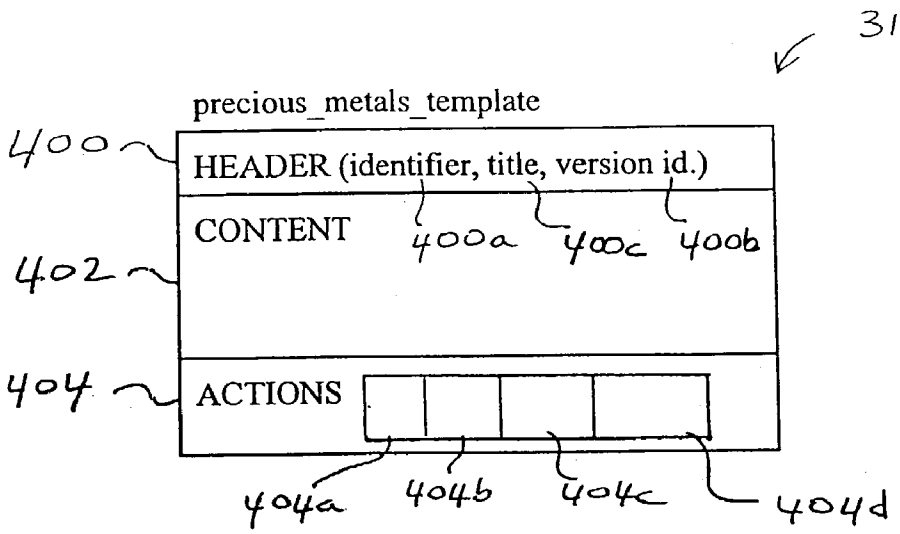

314
precious_metals_template
400
HEADER (identifier, title, version id.)
CONTENT
400a
400c
400b
402
404
ACTIONS
404a
404b
404c
404d

FIG. 4A

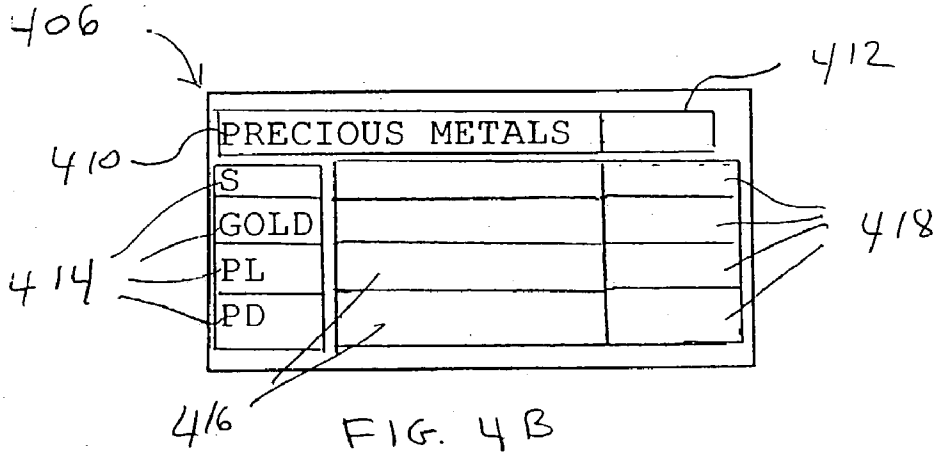

406
412
PRECIOUS METALS
410
S
GOLD
PL
PD
414
418
416

FIG. 4B

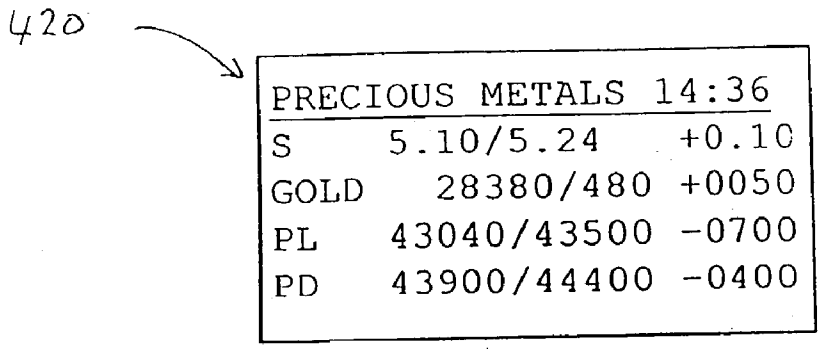

420
PRECIOUS METALS 14:36
S 5.10/5.24 +0.10
GOLD 28380/480 +0050
PL 43040/43500 -0700
PD 43900/44400 -0400

FIG. 4C

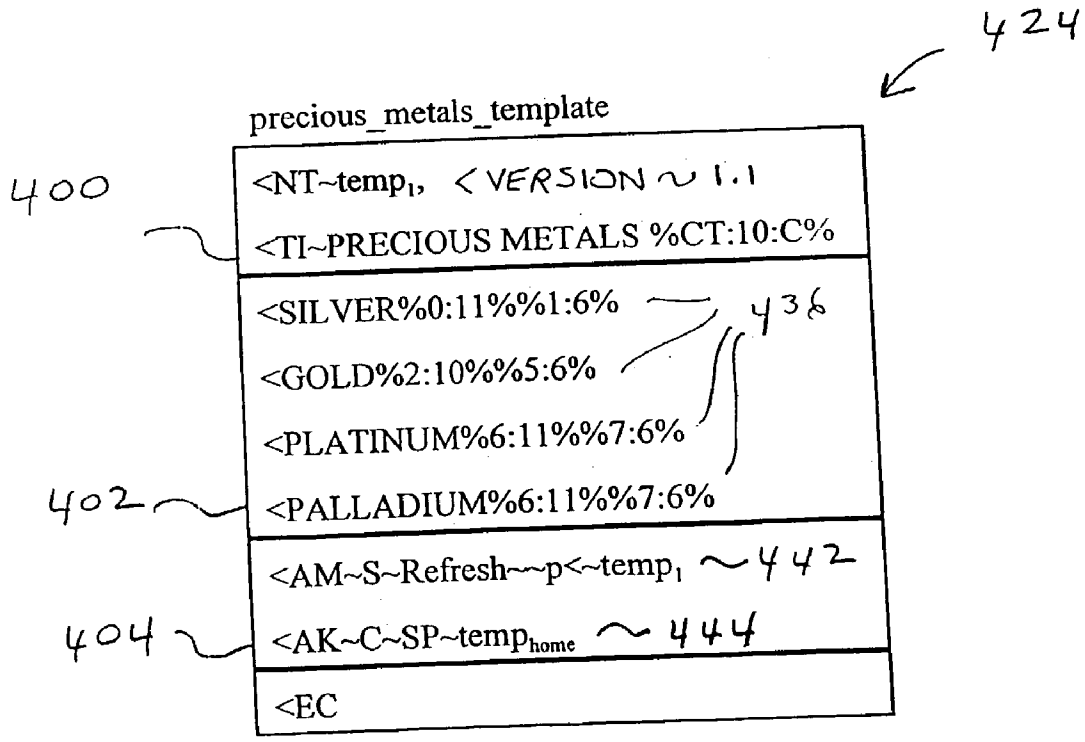

424
precious_metals_template
400
<NT~temp1, <VERSION~1.1
<TI~PRECIOUS METALS %CT:10:C%
<SILVER%0:11%%1:6%
<GOLD%2:10%%5:6%
<PLATINUM%6:11%%7:6%
436
402
<PALLADIUM%6:11%%7:6%
<AM~S~Refresh~~p<~temp1 ~442
404
<AK~C~SP~temphome ~444
<EC

FIG 4D

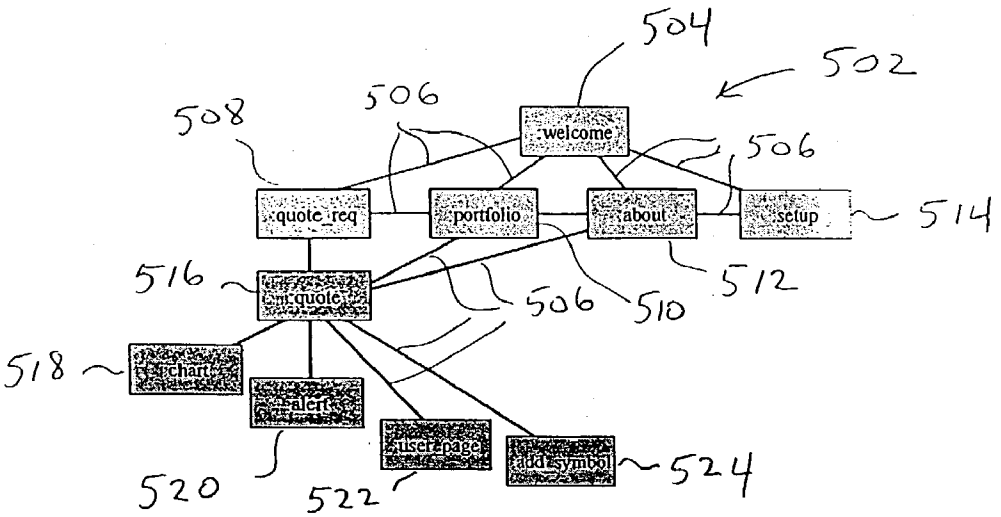


FIG. 5

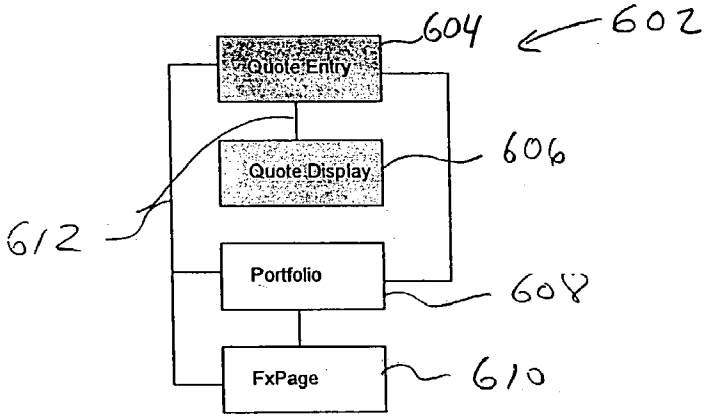


FIG. 6A

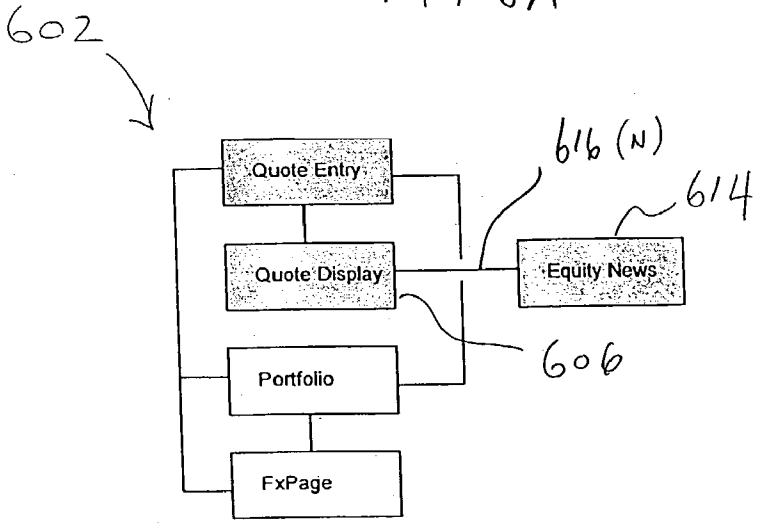


FIG. 6B

SERVER TRANSACTION DATABASE TABLE 700

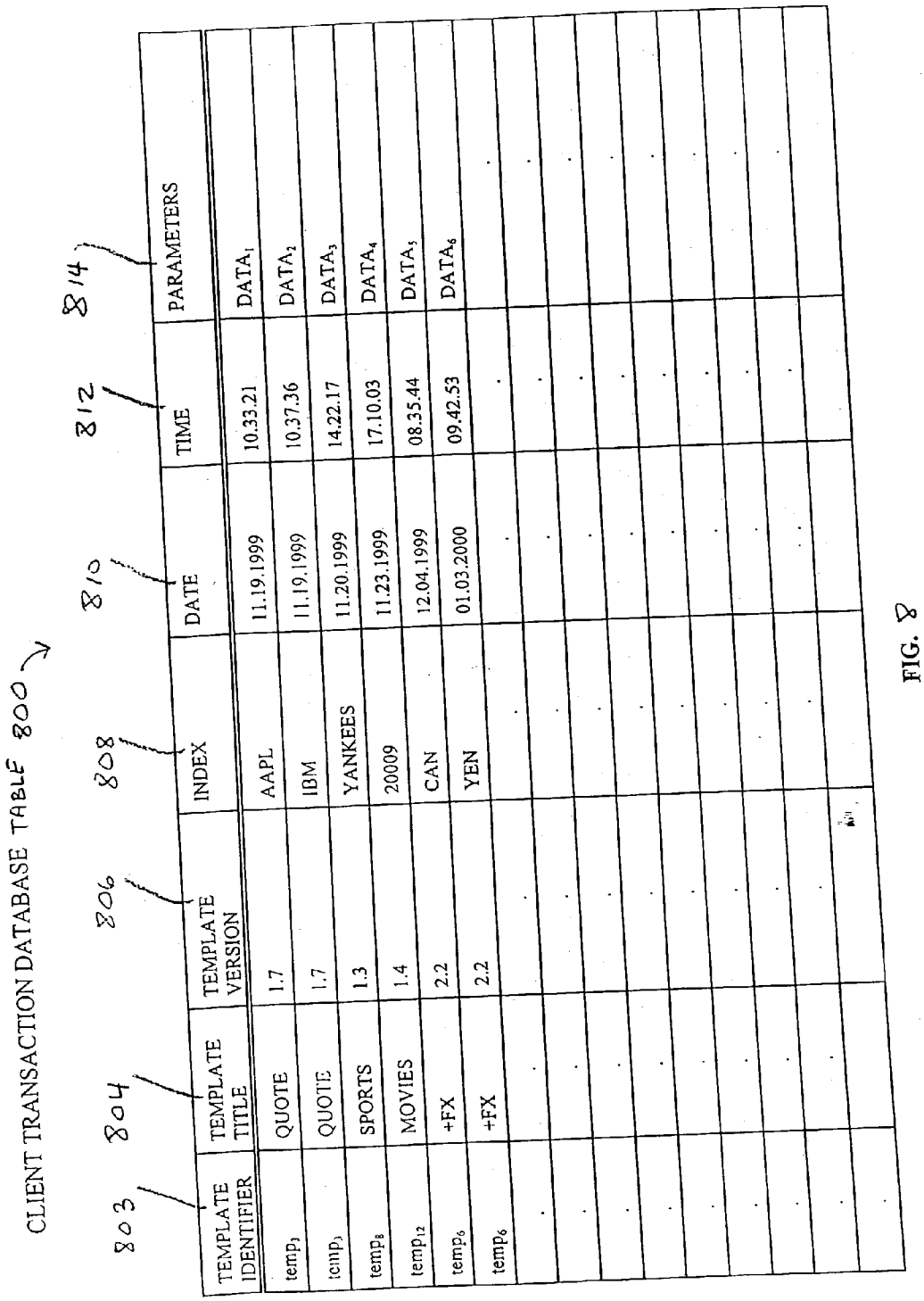
702 CLIENT	703 TEMPLATE IDENTIFIER	704 TEMPLATE TITLE	706 TEMPLATE VERSION	708 INDEX	710 DATE	712 TIME	714 PARAMETERS
MAN_1	$temp_3$	QUOTE	1.7	AAPL	11.19.1999	10.33.21	$DATA_1$
MAN_1	$temp_3$	QUOTE	1.7	IBM	11.19.1999	10.37.36	$DATA_2$
MAN_1	$temp_8$	SPORTS	1.3	YANKEES	11.20.1999	14.22.17	$DATA_3$
MAN_1	$temp_{12}$	MOVIES	1.4	20009	11.23.1999	17.10.03	$DATA_4$
MAN_1	$temp_6$	+FX	2.2	CAN	12.04.1999	08.35.44	$DATA_5$
MAN_1	$temp_6$	+FX	2.2	YEN	01.03.2000	09.42.53	$DATA_6$
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
MAN_2	.	.	.	.	.	.	.
MAN_2	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
MAN_N	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.

FIG. 7A

754 756 758 750

TEMPLATE I.D.	VERSION	DEFINITIONS
$temp_{home}$	1.1	(header, content, actions)
$temp_1$	1.7	(header, content, actions)
$temp_2$	1.6	(header, content, actions)

FIG. 7B



TEMPLATE IDENTIFIER	TEMPLATE TITLE	TEMPLATE VERSION	INDEX	DATE	TIME	PARAMETERS
$temp_3$	QUOTE	1.7	AAPL	11.19.1999	10.33.21	$DATA_1$
$temp_7$	QUOTE	1.7	IBM	11.19.1999	10.37.36	$DATA_2$
$temp_8$	SPORTS	1.3	YANKEES	11.20.1999	14.22.17	$DATA_3$
$temp_{12}$	MOVIES	1.4	20009	11.23.1999	17.10.03	$DATA_4$
$temp_5$	+FX	2.2	CAN	12.04.1999	08.35.44	$DATA_5$
$temp_6$	+FX	2.2	YEN	01.03.2000	09.42.53	$DATA_6$
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.

FIG. 8

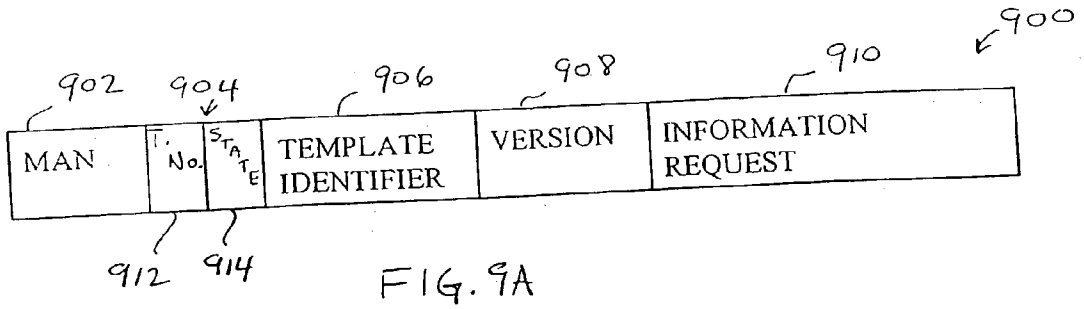

900
902
904
906
908
910
MAN
T. No.
STATE
TEMPLATE IDENTIFIER
VERSION
INFORMATION REQUEST
912
914

FIG. 9A

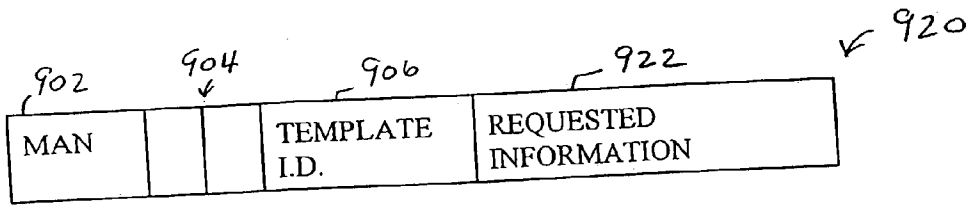

920
902
904
906
922
MAN
TEMPLATE I.D.
REQUESTED INFORMATION

FIG. 9B

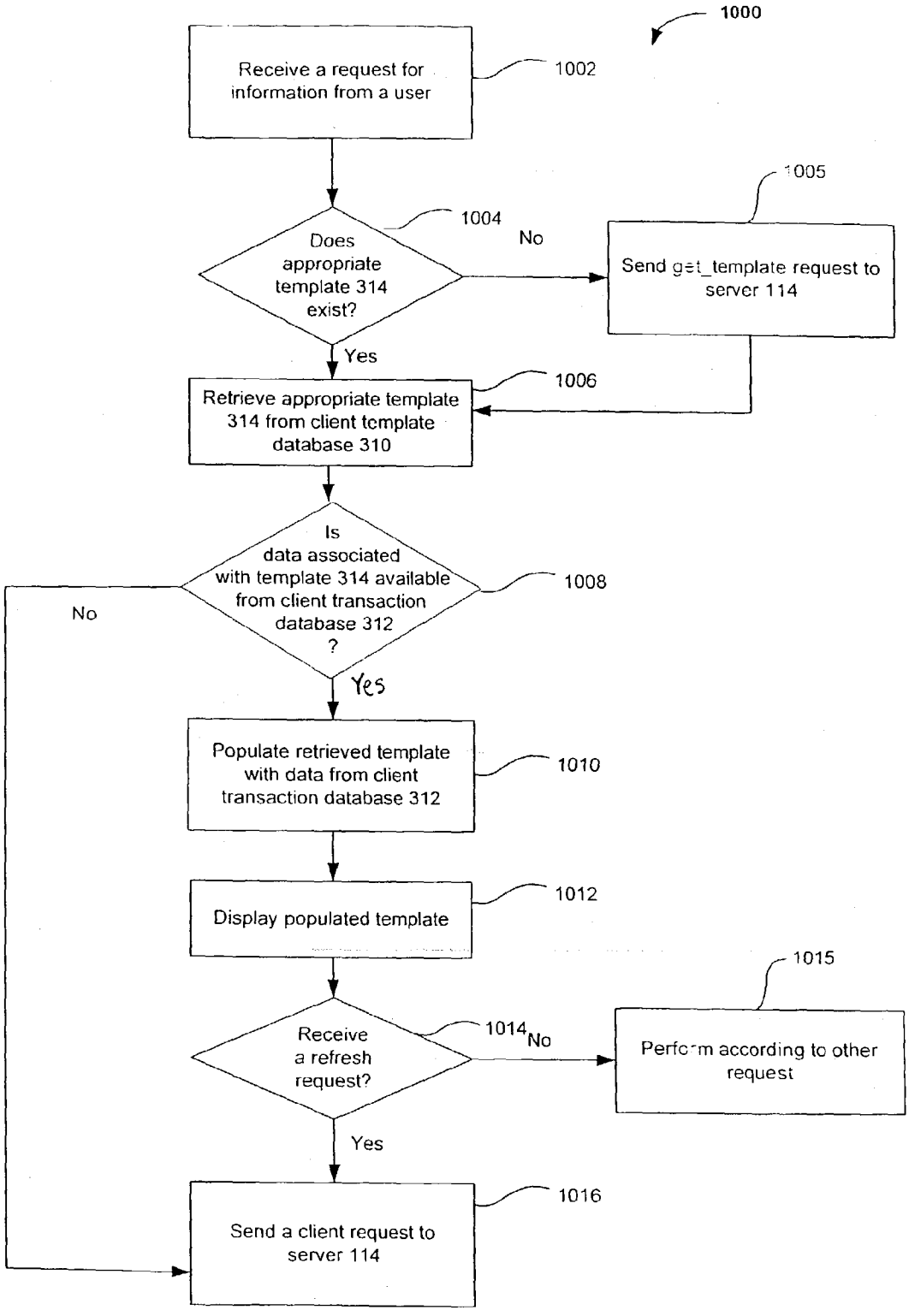

1000
Receive a request for information from a user
1002
Does appropriate template 314 exist?
1004
No
1005
Send get_template request to server 114
Yes
Retrieve appropriate template 314 from client template database 310
1006
Is data associated with template 314 available from client transaction database 312 ?
1008
No
Yes
Populate retrieved template with data from client transaction database 312
1010
Display populated template
1012
Receive a refresh request?
1014
No
1015
Perform according to other request
Yes
Send a client request to server 114
1016

FIG. 10

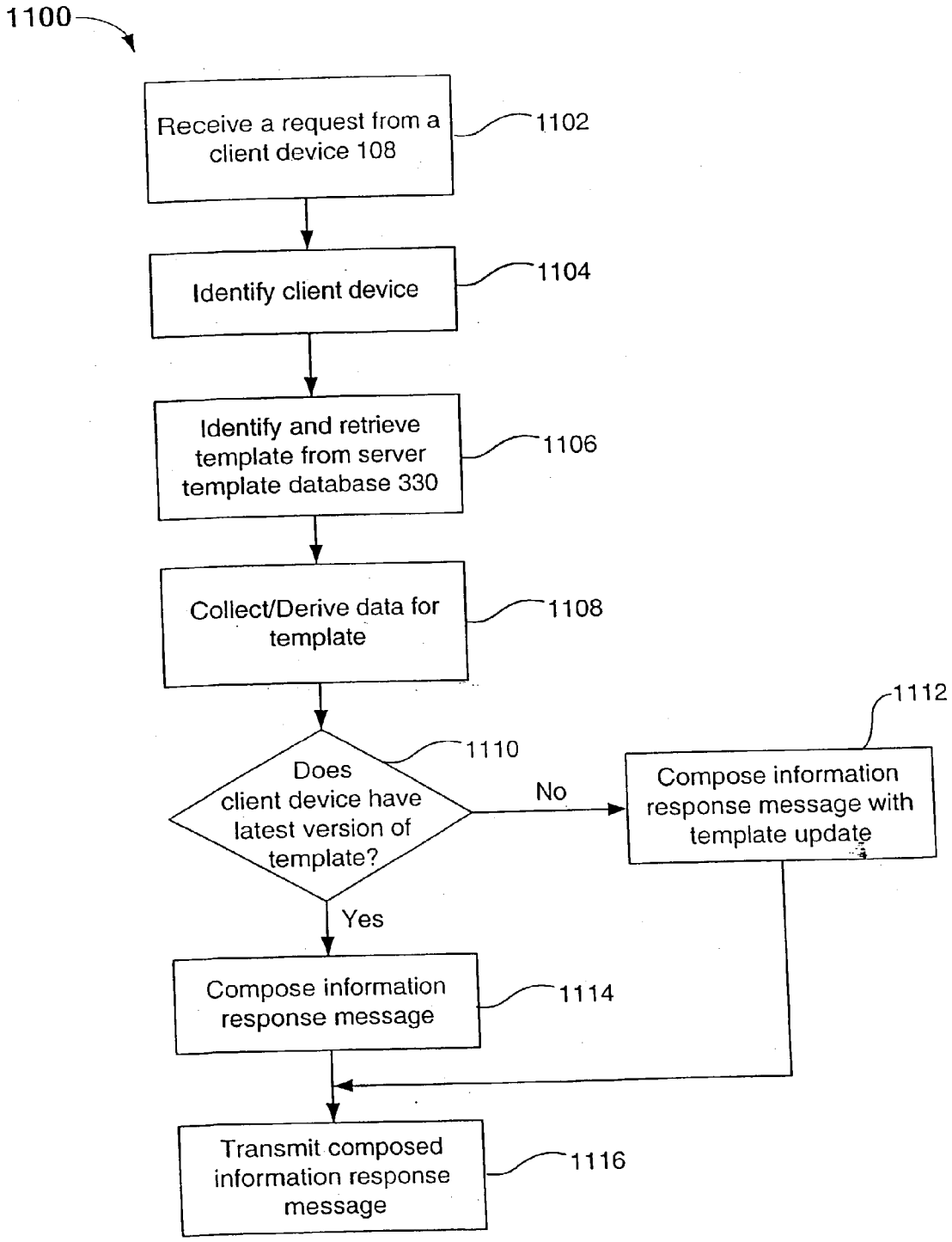

1100
Receive a request from a client device 108
1102
Identify client device
1104
Identify and retrieve template from server template database 330
1106
Collect/Derive data for template
1108
Does client device have latest version of template?
1110
No
Yes
Compose information response message with template update
1112
Compose information response message
1114
Transmit composed information response message
1116

FIG. 11

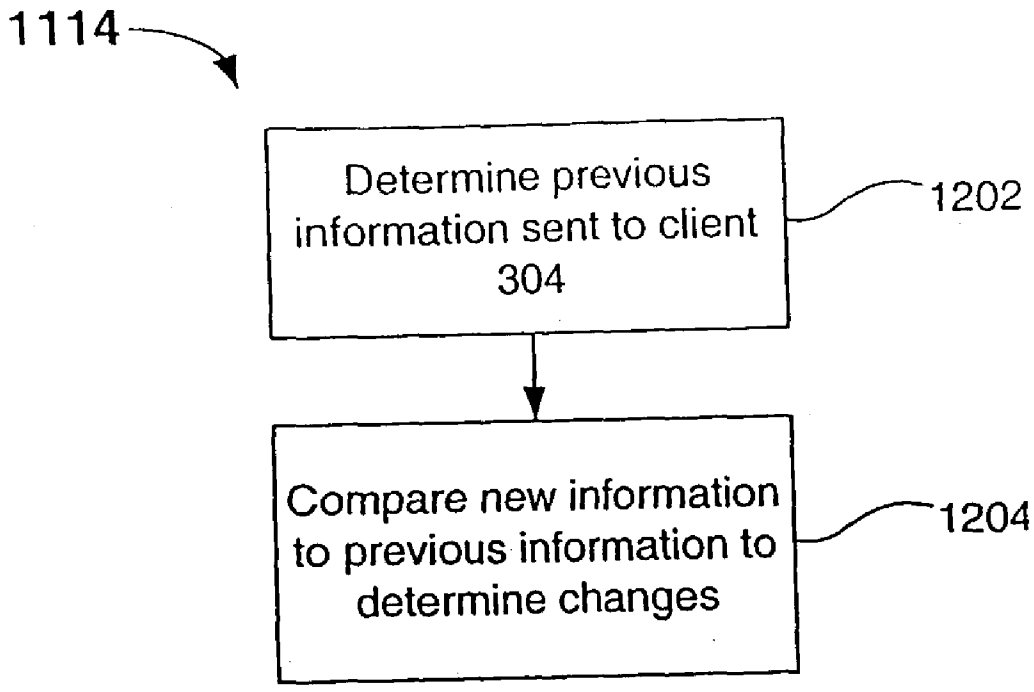

1114
Determine previous information sent to client 304
1202
Compare new information to previous information to determine changes
1204

FIG. 12

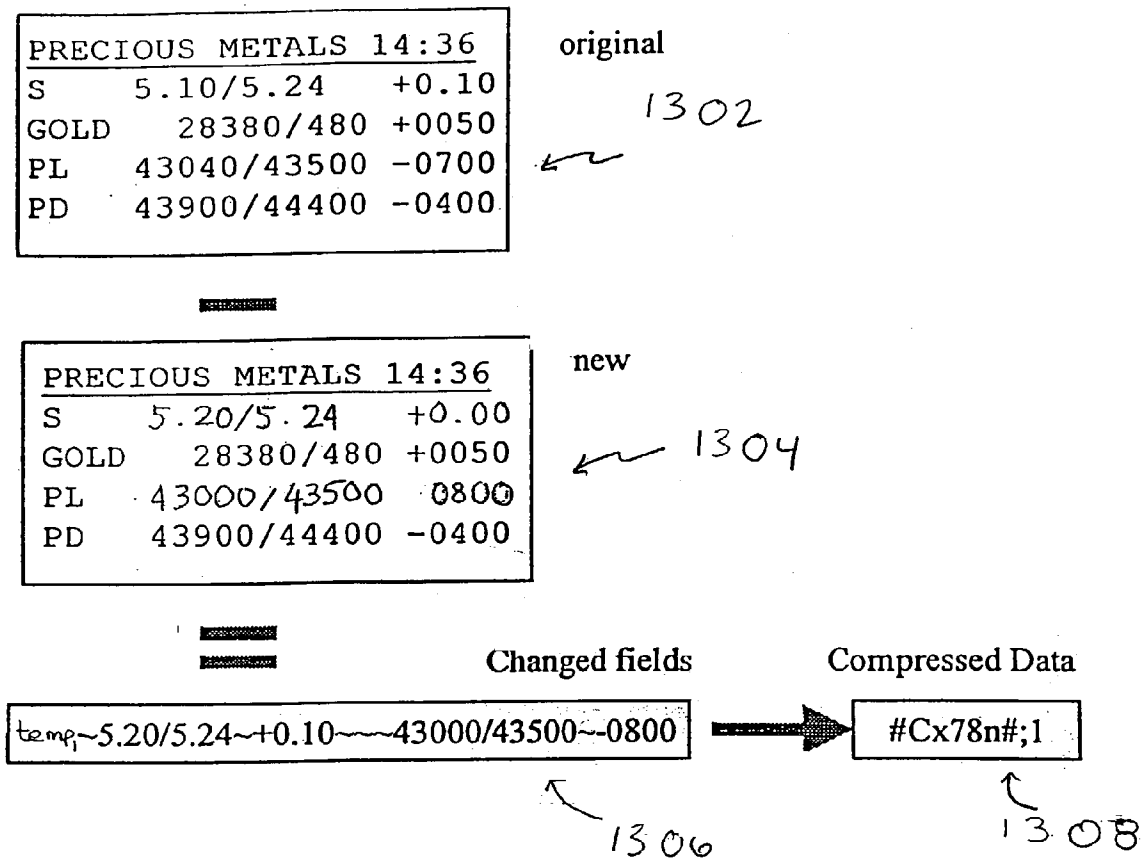

PRECIOUS METALS 14:36
S 5.10/5.24 +0.10
GOLD 28380/480 +0050
PL 43040/43500 -0700
PD 43900/44400 -0400
original
1302
PRECIOUS METALS 14:36
S 5.20/5.24 +0.00
GOLD 28380/480 +0050
PL 43000/43500 -0800
PD 43900/44400 -0400
new
1304
Changed fields
Compressed Data
temp1~5.20/5.24~+0.10~~~43000/43500~-0800
#Cx78n#;1
1306
1308

FIG. 13

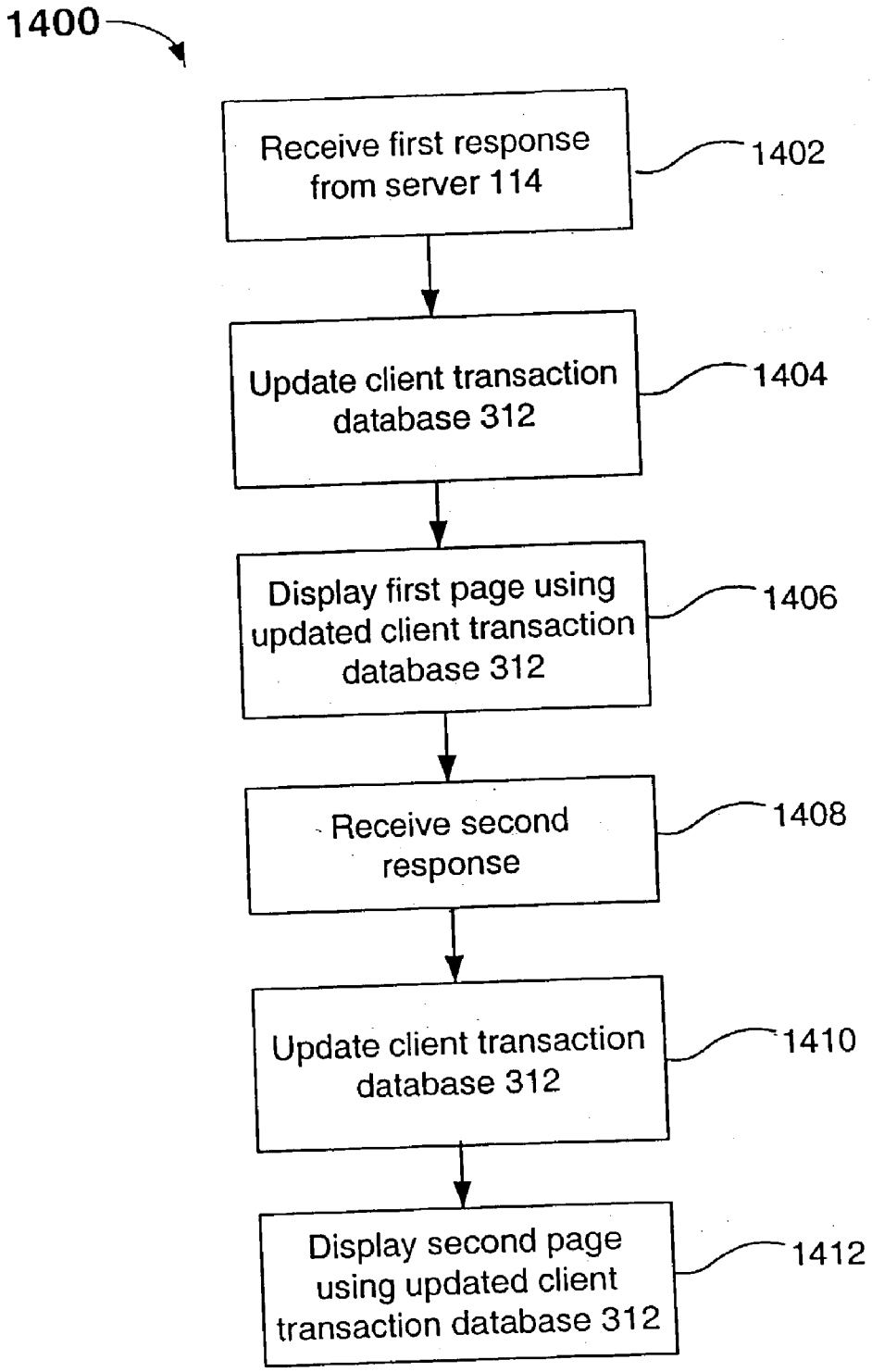

1400
Receive first response from server 114
1402
Update client transaction database 312
1404
Display first page using updated client transaction database 312
1406
Receive second response
1408
Update client transaction database 312
1410
Display second page using updated client transaction database 312
1412

FIG. 14

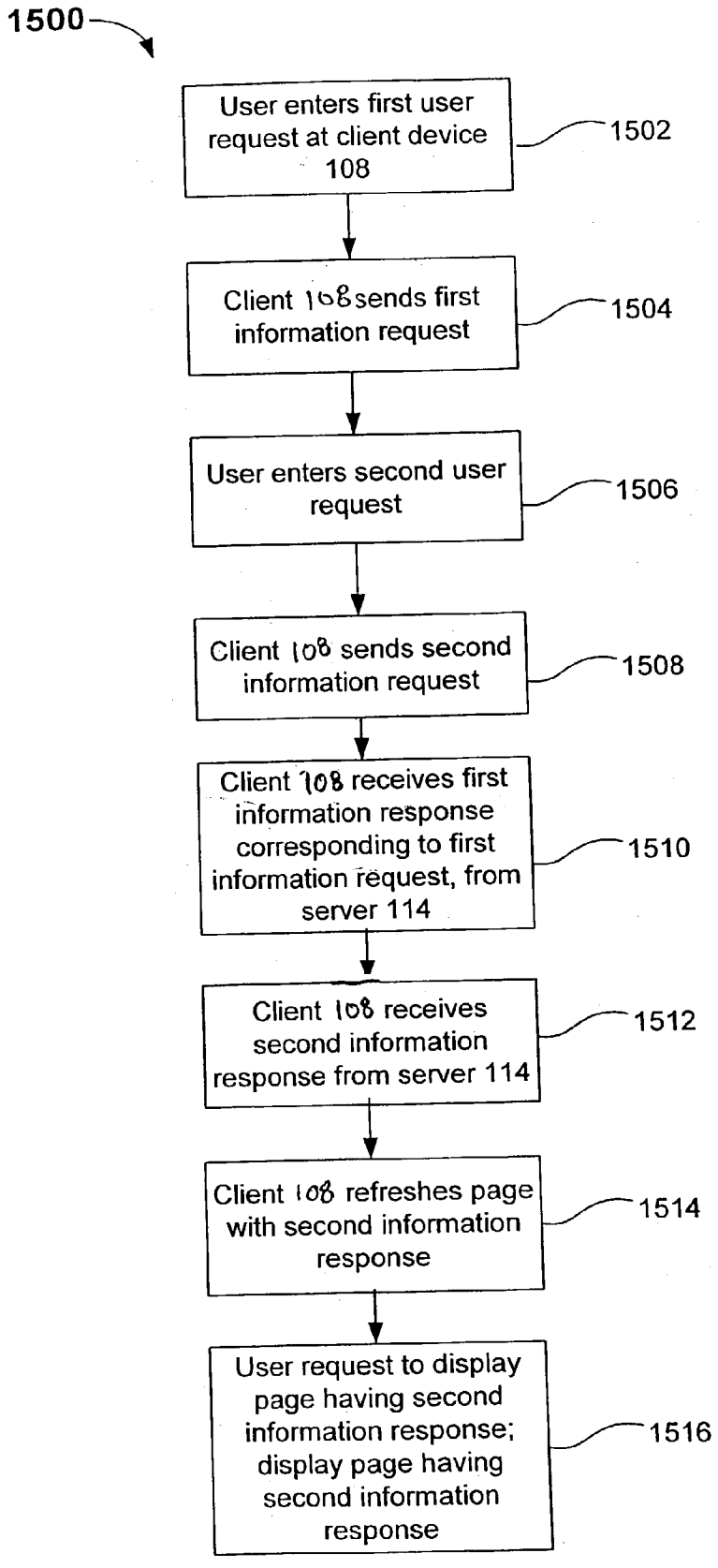

1500
User enters first user request at client device 108
1502
Client 108 sends first information request
1504
User enters second user request
1506
Client 108 sends second information request
1508
Client 108 receives first information response corresponding to first information request, from server 114
1510
Client 108 receives second information response from server 114
1512
Client 108 refreshes page with second information response
1514
User request to display page having second information response; display page having second information response
1516

FIG. 15

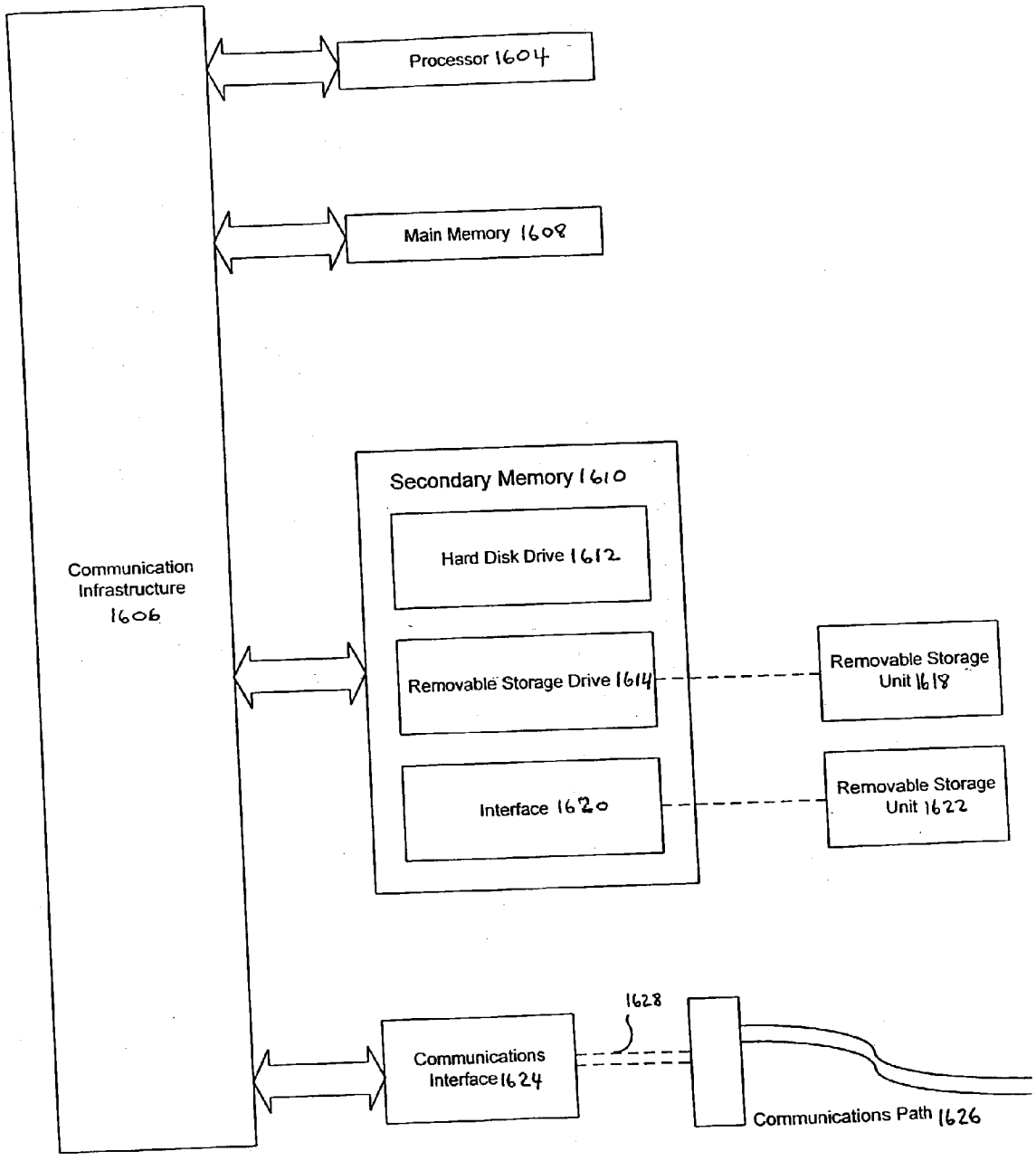

Processor 1604
Main Memory 1608
Secondary Memory 1610
Hard Disk Drive 1612
Removable Storage Drive 1614
Interface 1620
Removable Storage Unit 1618
Removable Storage Unit 1622
Communication Infrastructure 1606
1628
Communications Interface 1624
Communications Path 1626

FIG. 16

SYSTEM, METHOD AND APPARATUS FOR UTILIZING TRANSACTION DATABASES IN A CLIENT - SERVER ENVIRONMENT

RELATED APPLICATIONS

[0001] This application is a divisional of U.S. patent application No. 09/523,165, filed on Mar. 10, 2000, entitled SYSTEM, METHOD AND APPARATUS FOR UTILIZING TRANSACTION DATABASES IN A CLIENT—SERVER ENVIRONMENT, by Anthony C. Fascenda.

[0002] The following applications of common assignee may contain some common disclosure and may relate to the present invention:

[0003] U.S. patent application No. 09/195,483, entitled "Method and System for Providing Localized Information", filed Nov. 17, 1998; and

[0004] U.S. patent application No. 09/195,482, entitled "Method And System For Providing Formatted Information via a Two-way Communications System", filed Nov. 17, 1998, each of which is incorporated herein by reference in its entirety.

[0005] Additionally, the following applications of common assignee may contain some common disclosure, and are believed to have an effective filing date identical with that of the present invention:

[0006] U.S. patent application No. 09/___,___, entitled "System and Method for Providing Focused Information Based on Implicit and Explicit Information Derived From User Histories (Attorney Docket No. 1753.0040000);

[0007] U.S. patent application No. 09/___,___, entitled "System, Method and Apparatus for Automatically and Dynamically Updating Options, Features, and/or Services Available to a Client Device" (Attorney Docket No. 1753.0050000);

[0008] U.S. patent application No. 09/___,___, entitled "System and Method for Providing Information that is Responsive to a Freeform Request" (Attorney Docket No. 1753.0060000);

[0009] U.S. patent application No. 09/___,___, entitled "System, Method, and Apparatus for Initial Configuration of a Client Device" (Attorney Docket No. 1753.0080000);

[0010] U.S. patent application No. 09/___,___ entitled "System, Method, and Apparatus for Providing Value Added to Specific Users" (Attorney Docket No. 1753.0090000); and

[0011] U.S. patent application No. 09/___,___, entitled "Method and Apparatus for Providing Services to a User of a Client Device Configured by Templates that Reference other Templates" (Attorney Docket No. 1753.0100000), each of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

[0012] 1. Field of the Invention

[0013] The present invention relates generally to a system including intercommunicating client and server applications, and more particularly, to such a system, a method and an apparatus for maintaining a database of past transactions in a client device.

[0014] 2. Related Art

[0015] A typical client-server environment includes a client application, such as an Internet web-browser, and a server application respectively executing on independent computer based platforms and communicating with one another. The client application submits information requests to the server application in response to user input at the client end. In response, the server transmits information responses to the client application. A user interacts with the client-server environment using a Graphical User Interface (GUI) of the client application.

[0016] Often, a user interacts with a browser such that the browser submits numerous consecutive information and/or branch requests over a relatively short period of time to retrieve information and/or navigate through a plurality of service provider sites (such as an Internet web pages). Using a conventional browser (such as Microsoft Explorer), each of the consecutive requests can effectively cancel or negate a previous request, whereby one or more information and/or branch requests are disadvantageously lost to the user. For example, When the user issues a first requests for a first Internet file (e.g., by designating a Uniform Resource Locator (URL)) and then issues a second request for a different Internet file prior to receiving a response to the first request, the conventional browser fails to display a response to the first request even when such a request is received. From the user's perspective, the second request negates the first request. This can also occur when the user navigates through web sites. For example, if the user "clicks" on a first hypertext link and then "clicks" on a second hypertext link prior to a jump to the first link, a jump to the first link fails to occur; thus, initiating the second link effectively negated initiating the first link.

[0017] There are many reasons that a user may make consecutive subsequent requests after an initial request. The user may decide that even though the initial request is important, subsequent requests are more important. Alternatively, the user may grow impatient while waiting for a response to the initial request. Whatever the reason, there is a good chance the first request is still of interest to the user.

[0018] Therefore, there is a need in a client application to receive and retain multiple server responses to consecutive client requests regardless of the temporal relationship between the multiple responses and consecutive requests. There is a related need in the client to provide the user with a mechanism for retrieving the retained response information and to display such information as necessary.

[0019] A large number of client or browser applications can operate in a distributed service environment. A distributed service environment is one in which the numerous client applications interact with one or more server applications, each of the server applications hosting a wide variety of data services provided by a variety of "private"

and possibly public service providers. Wireless client devices including the above mentioned client applications can operate in such a distributed service environment.

[0020] Therefore, the above mentioned needs also pertain to wireless devices operating in the distributed environment.

SUMMARY OF THE INVENTION

[0021] The present invention is directed to a system, method and apparatus for utilizing transaction databases in a client-server environment. In one embodiment, the present invention uses transaction databases to receive and retain multiple server responses to consecutive client requests regardless of the temporal relationship between the multiple responses and consecutive requests.

[0022] One embodiment of the present invention is a method used in a client-server system including one or more servers and a client device having a client transaction database and a user interface adapted to enable a user to enter requests. The method enables the client device to accept multiple user requests, receive multiple server responses, and display pages relating to the multiple server responses. The method includes the steps of receiving a first user request from the user via the user interface and sending a first client request based on the first user request. The method also includes the steps of receiving a second user request from the user via the user interface, prior to receiving a response to the first client request, and sending a second client request based on the second user request. When a server response to the first request is received, first information based on the server response (to the first request) is stored in the client transaction database. When a server response to the second request is received, second information based on the server response (to the second request) is stored in the client transaction database.

[0023] The method further includes the steps of retrieving one of the first information and the second information from the client transaction database and displaying one of a first display page relating to the first information and a second display page relating to the second information. Then, in response to a further user request from the user via the user interface, the other one of the first information and the second information is retrieved from the client transaction database, and the other one of the first display page and the second display page is displayed. More specifically, in one embodiment, if the server response to the first request is received prior to the server response to the second request, then the first information is retrieved from the client transaction database, and the first display page is displayed. The user can then cause the second information to be retrieved from the client transaction database and displayed by entering a further user request via the user interface. Alternatively, if the server response to the second request is received prior to the server response to the first request, then the second information is retrieved from the client transaction database, and the second display page is displayed. The user can then cause the first information to be retrieved from the client transaction database and displayed by entering a further user request via the user interface. In another embodiment, the display page (i.e., the second display page) relating to the last made client request (i.e., the second client request) is displayed first, regardless of which response was received first. In still another embodiment, a display page relating to the first made client request (i.e., the first client request) is displayed first, regardless of which response was received first.

[0024] Another embodiment of the present invention is a method for use in a client-server system including one or more servers and a client device having a client transaction database, a client template database, and a user interface adapted to enable a user to enter requests. The method includes the steps of receiving a user request from the user via the user interface and retrieving a template from the client template database based on the user request. The template includes one or more data fields. The method also includes the step of retrieving information from the client transaction database based on the template, wherein the information relates to the one or more data fields of the template. A page based on the template and the information relating to the one or more data field is then displayed.

[0025] The method also includes the steps of receiving a refresh request from the user via the user interface and sending a client request based on the refresh request. Additionally, the method includes the steps of receiving a server response to the client request and storing further information in the client transaction database based on the server response, wherein the further information relates to at least one of the data fields. An updated page is then displayed based on the template and the further information. The updated page can additionally be based on the original information retrieved from the client transaction database.

[0026] In another embodiment, the present invention relates to a method for responding to a request from a client device. This method includes the steps of receiving a client request from a client device, wherein the client request includes a template identifier and a client identifier. The method also includes the step of retrieving a template including one or more data fields from a server template database based on the template identifier. The method further includes the steps of collecting first information (e.g., from an information store) relating to the one or more data fields, determining a server response to the request based on the first information, and sending the server response to the client device.

[0027] According to another embodiment, the method also includes the steps of retrieving second information from a server transaction database based on the template identifier and the client identifier. In this embodiment the response to the request is determined based on the first information and the second information. For example, in this embodiment the response can be based on differences between the first information and the second information.

[0028] A further embodiment of the present invention is directed to a client-server based system for providing a user with information in response to user requests. The system includes a server controller that receives information requests over a communication network and transmits server responses over the communication network in response to the information requests. A client device, coupled to the communication network, is adapted to receive user requests and then transmit the information requests based on the user requests. The client device includes a display for displaying information, wherein the client device is adapted to receive, retain, and display multiple server responses corresponding to consecutive information requests regardless of a temporal

relationship between the multiple responses and the consecutive information requests.

[0029] Advantages and additional features of the present invention, as well as the structure and operation of various embodiments of the present invention, are described in detail below with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

[0030] The features, objects, and advantages of the present invention will become more apparent from the detailed description set fourth below when taken in conjunction with the drawings in which like reference characters identify corresponding elements throughout and wherein:

[0031] **FIGS. 1A and 1B** illustrate exemplary communications systems in which the present invention is useful;

[0032] **FIG. 2A** illustrates an exemplary two-way communications client device for use with the present invention;

[0033] **FIG. 2B** is an illustration of a paging device manufactured by Research In Motion (RIM), Limited, of Waterloo, Ontario, Canada.

[0034] **FIG. 3** is an illustration of a logical architecture corresponding to the communication system of **FIGS. 1A and 1B** and the communications device of **FIG. 2A**.

[0035] **FIG. 4A** is an illustration at a high level of an embodiment of a template used in the logical architecture of **FIG. 3**.

[0036] **FIG. 4B** is a diagrammatic representation of an exemplary content portion of a template used in the logical architecture of **FIG. 3**.

[0037] **FIG. 4C** is an illustration of a completed template or display page corresponding to the template of **FIG. 4B**.

[0038] **FIG. 4D** is an illustration of a list of exemplary definitions or descriptors defining the template of **FIG. 4**B and the display page of **FIG. 4C**.

[0039] **FIG. 5** is an illustration of an exemplary hierarchy of display pages.

[0040] **FIG. 6A** is an illustration of an exemplary user interface including linked pages defined by a hierarchy of templates, before a template update.

[0041] **FIG. 6B** is an illustration of the exemplary user interface of **FIG. 6**B, after the template update.

[0042] **FIG. 7B** is an illustration of an exemplary information table stored in a server transaction database used in the logical architecture of **FIG. 3**.

[0043] **FIG. 7B** is an illustration of an exemplary information table stored in a server template database used in the logical architecture of **FIG. 3**.

[0044] **FIG. 8** is an illustration of an exemplary information table stored in a client transaction database of the client device of **FIG. 2A**.

[0045] **FIG. 9A** is an illustration of an exemplary information request message transmitted by a client application used in the logical architecture of **FIG. 3**.

[0046] **FIG. 9B** is an illustration of an exemplary information response message transmitted by a server application used in the logical architecture of **FIG. 3**.

[0047] **FIG. 10** is a flow chart of an exemplary method of requesting information at a client in the logical architecture of **FIG. 3**, according to an embodiment of the present invention.

[0048] **FIG. 11** is a flow chart of an exemplary method of responding to an information request of **FIG. 10** at a server in the logical architecture of **FIG. 3**, according to an embodiment of the present invention.

[0049] **FIG. 12** is a flow chart of exemplary method steps expanding on the method of **FIG. 11**.

[0050] **FIG. 13** is a illustration of exemplary display pages at a client device before and after receipt of an information response at the client device.

[0051] **FIG. 14** is a flow chart of an exemplary method of receiving multiple responses to multiple requests at a client device.

[0052] **FIG. 15** is a flow chart of another exemplary method of receiving multiple responses to multiple requests at a client device.

[0053] **FIG. 16** is an exemplary computer system which may be used to perform the operations of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0054] I. Introduction

[0055] The present invention relates to a method and system for automatically initializing and configuring a client device (e.g., a two-way paging device, a wireless phone, a personal data assistant, or a desk top computer). The present invention can be used in a two-way wireless communications system. Additionally, the present invention can be used in various other types of communications system. For example, the present invention can be used with the Internet. In an embodiment where the present invention is used with the Internet, a client device can be, for example, a wireless device that wirelessly accesses the Internet (e.g., a PalmPilot® or a wireless phone) or a personal computer that is wired to the Internet.

[0056] Preferred embodiments of the present invention are discussed in detail below. While specific steps, configurations and arrangements are discussed, it should be understood that this is done for illustrative purposes only.

[0057] II. Exemplary Communications Systems

[0058] An exemplary wireless communication system **100** in which the present invention is useful is illustrated in **FIG. 1A**. Communications system **100** includes a plurality of cell sites **102** each having a coverage area that is typically about 5 to 10 miles in diameter. A coverage area of one cell site often overlaps a portion of a coverage area of another cell site, which are illustrated for exemplary purposes by the hexagonal regions. Each cell site **102** includes an antenna **104** for transmitting and receiving messages to and from two-way wireless client devices **108** (e.g., a two-way pager, a wireless phone, a hand held computing device) that are

located within a geographic coverage area of the cell site **102**. Alternatively, separate antennas may be used for sending and receiving messages, as would be apparent to a person skilled in the relevant art. Each cell **102** is coupled to communications network **110**, which can be, for example, an X.25 packet switched network. Communications network **110** may include, but is not limited to land based links such as fiber optics or terrestrial microwave, and/or satellite based links, as would also be apparent to a person skilled in the relevant art.

[**0059**] Each cell site **102** is in communications with a message system center (MSC) **120** that includes a subscriber database (also referred to as a user database) that maintains records of all subscribers (also referred to as users) on the system, a unique identity sequence for the subscriber's client device, and an indication of the cell site from which the client device last sent a message (such as an acknowledgment message or a request message). Preferably, communications between each cell cite **102** and MSC **120** is accomplished through communications network **110**. Alternatively, each cell site **102** can have a dedicated link to MSC **120**.

[**0060**] Communications network **110** can be coupled to a public switched telephone network (PSTN) **112** so that a message can be sent to and from client device **108** via PSTN **112**.

[**0061**] A message can also be sent from one client device **108** to another client device **108** using communications system **100**.

[**0062**] In one embodiment, communications system **100** is the Bell South Wireless Data network (also known as the RAM Mobile Data network) or the ARDIS network, which are both well known two-way nationwide wireless packet data networks.

[**0063**] A client device (e.g., two-way wireless communications device) **108** typically identifies itself to MSC **120** by sending a registration or identification signal. Such signals include a data field including at least one unique identifier, such as a Mobile Identification Number (MIN) and/or Electronic Serial Number (ESN). A MIN, which can be reprogrammed, is analogous to a telephone number. An ESN is hard-coded and fixed such that it difficult, if not impossible to change. Some devices include both a MIN and an ESN. The client device used in an embodiment of the present invention, discussed in more detail below, only includes one unique identifier, known as a Mobile Access Number (MAN), which is similar to an ESN in that it is hard-coded and fixed. The identification signal sent by client device **108** can include one or more of the above discussed unique identifiers, or any other similar unique identifier. Such identification information can be periodically transmitted by client device **108** and/or included with other types of messages sent by client device **108**. Such unique identifiers are also sent with each request sent by a client device **108**.

[**0064**] An optional function of MSC **120** is to determine whether the unique identifier of a client device is valid. A received unique identifier, such as a unique identity sequence comprising a string of digitally represented alphanumeric characters, can be compared to a maintained database of unique identifiers (i.e., MINs, ESNs, MANs) to detect fraud.

[**0065**] MSC **120** can keep track of the approximate whereabouts of each client device **108** by keeping track of which cell site **102** a message, sent by a client device **108**, originated. When MSC **120** is thus informed of the approximate whereabouts of each individual client device **108**, it can later limit the number of cell sites **102** from which it transmits a message addressed to a particular client device **108**. MSC **120** can even limit the transmission of a message to only one cell site **120** having a coverage area within which the particular client device **108** is believed to be located. The coverage area of a limited number of cell cites **102** (possibly only a single cell site or a last know site and its adjacent sites) shall be referred to as a targeted coverage area. Thus, the targeted area can be the area covered by a single cell site or a slightly larger area that is also covered by a few adjacent cell sites. This limited or "targetted" transmission is much more efficient than broadcast-type transmission where a message is transmitted from every cell site, regardless of a location of a client device **108** to which the message is addressed.

[**0066**] Servers **114** (typically controlled by a service provider) are supported by communications system **100**. That is, communications system **100** provides for message delivery between a server **114** and one or more client devices **108**. Servers **114** can communicate directly with client devices **108** or indirectly with client devices **108** via communications network **110**. Alternatively, servers **114** can communicate with communications network **110** through PSTN **112**. In one embodiment, a server **114** provides information to a client device **108** upon receiving a request from the client device **108**. Additionally, servers **114** can initiate the sending of information (e.g., unsolicited information) to a client device **108**. This can be done periodically or upon a triggering event. Additional details about the types of services and the information provided by services providers **114** are discussed below.

[**0067**] The present invention is also useful in data networks such as a local area network (LAN), a home area network (HAN), and a wide area network (WAN). For example, the present invention is useful in the largest present day WAN known as the Internet, and in smaller WANs. The Internet is a world-wide set of interconnected computer networks that can be used to access a growing amount and variety of information electronically. One method of accessing information on the Internet is known as the World Wide Web (www, or the "web"). The web is a distributed, hypermedia system, and functions as a client-server based information presentation system. Information that is intended to be accessible over the web is generally stored in the form of "pages" on servers (e.g., general purpose computers). Users can access a web site using general-purpose computers, wireless hand held computing devices, Internet capable wireless phones (e.g., a Wireless Application Protocol (WAP) Internet enabled telephone), and the like, referred to as clients, by specifying the uniform resource locator (URL) of the site. **FIG. 1B** is a network block diagram showing a plurality of clients **108** and servers **114** connected to the Internet **118**.

[**0068**] When a client sends a request to a server the request specifies, among other things, a destination address (e.g., a URL) and a source address that can be used to identify a user. A part of the URL known as the Domain Name is passed to a domain server (DNS) to be translated to a network address. The network address specifies the Inter-

net protocol (IP) address of the intended server. The client request is passed to the server having the network address.

[0069] Servers **114** maintain or otherwise have access to local or remote databases that store and/or provide various types of data. For example, referring to **FIG. 1**A, remote databases **130** are maintained by data sources **132**. **FIG. 1A** also shows a local database **116** that is maintained by server **114**. Servers **114** can communicate with data sources **132** through dedicated links or through communications network **110**, for example. The type and number of databases, and the form of communication of data between the servers **114** and the databases, is implementation specific.

[0070] The invention covers the ability of a server system to provide information to client devices via a wireless communications system, which typically has a plurality of cell sites that are coupled to a communications network. The invention also covers the ability of a server system to provide information to client devices via a wired communications system, or via a communications system consisting of a combination of wired and wireless links. The functions performed by the server system can comprise software running on one or more general purpose computers or on telecommunications-specific hardware. Alternatively, the combination of the software and hardware to accomplish the functions of the present invention can be conceptualized as a union of server controllers that each perform a discrete task, such as: sending a request from a client device in response to user input at the client device; receiving the request at a server over the communications network; identifying a user based on the request; determining a response based on the request; sending the response to the client device of the user, or the like. One, two, or more of these discrete tasks can be performed by a single server controller. That is, the tasks performed by a first server controller and a second server controller can be performed by a single server controller and still be within the spirit and scope of the present invention. Alternatively, the discrete tasks can be performed by any number of server controllers. A further description of exemplary software and hardware controllers is provided below.

[0071] III. Exemplary Client Devices

[0072] An exemplary two-way wireless communications client device **108** is illustrated in **FIG. 2A**. Client device **108** includes an antenna **202**, a transmitter **204**, a receiver **206**, a microprocessor **208**, a display **210** and a keypad **212**. Transmitter **204** is controlled by microprocessor **208** and transmits messages using antenna **202**. Messages received from a transmitter of the communications system **100** are received through antenna **202** or a separate antenna (not shown). The received messages are routed from antenna **202** to receiver **206** and processed by microprocessor **208**, for example. Display **210** can be a liquid crystal display and is used for displaying, to a user (also referred to as subscriber) of client device **108**, information received via communications system **100**. Display **210** can also display lists and/or menus from which a subscriber can make selections and perform various functions. Other methods of presenting the received information, such as aurally through a speaker or through another type of display, are not precluded. Keypad **212** can include as few as one button, but may also include an entire alphanumeric keypad, touch pad, or can be integrated with a display, such as a touch-screen display. Client device **108** also includes a memory **214** that can store software and/or data. Microprocessor **208** can write to and read from memory **214**.

[0073] In one embodiment, client device **108** is an Inter@ctive™ Pager **950** manufactured by Research In Motion (RIM), Limited, of Waterloo, Ontario, Canada. The RIM Inter@ctive pager (RIM pager) is a commercially available device that provides for two-way wireless communications. The RIM pager, shown in **FIG. 2**B, includes a 31-key keypad **212**, roller wheel **214** that is similar to a mouse, and screen display **210** with 8 lines of text by approximately 28 characters per line. The RIM page also includes a built-in internal radio modem for two-way wireless communications over a cellular network such as the BellSouth network. In another embodiment, client device **108** is a Palm Pilot™ computing device, manufacture by 3Com Corporation, of Santa Clara, Calif. Client device **108** can also be a wireless communication device such as, but not limited to, a wireless telephone, a data transceiver, and a paging receiver. Client device **108** can be fixed, portable, or mobile, such as a mobile telephone. Of course the use of other two-way communications devices is within the spirit and scope of the present invention.

[0074] For some embodiments, client device **108** can be a personal computer that, for example, communicates with servers **114** via a network such as the Internet **118**. Client device **108** can also be a personal computing device that wirelessly accesses the Internet. Those of ordinary skill in the art will envision other implementations of client device **108** and appreciate that they are encompassed by the present invention.

[0075] IV. Embodiments of the Invention

[0076] A.1. Client-Server Architecture

[0077] The system described in connection with **FIGS. 1A, 1B, 2**A and 2B provides a plurality of ever expanding information services to a user of client device **108**. In an example application, a user requests stock prices from server **114**, using client device **108**. In response, server **114** transmits the requested stock prices to client device **108**. Client device **108** then displays the stock prices to the user on display **210**.

[0078] A logical architecture **300** of an embodiment of the present invention is depicted in **FIG. 3**. Logical architecture **300** corresponds to the system of **FIGS. 1A and 1B**. Logical architecture **300** includes a client application **304** residing in client device **108**, and a server application **306** residing in server **114**. Client application **304** (also referred to as client **304**) and server application **306** are, for example, computer programs respectively supported by computer controllers and memories of client device **108** and server **114**.

[0079] For example, server **114** (also referred to as server controller **114**) comprises the hardware and/or software required to accomplish specific functions of the present invention. Server **114** can be conceptualized as a union of servers that each perform a discrete task. One, two, or more of these discrete tasks can be performed by a single server **114**. That is, the tasks performed by a first server **114** and a second server **114** can be performed by a single server **114** and still be within the spirit and scope of the present invention. Alternatively, the discrete tasks can be performed

by any number of servers **114**. That is, the task performed by a single server **114** can be performed by a plurality of servers.

[**0080**] Similarly, client **304** (also referred to as client controller **304**) comprises the hardware and/or software required to accomplish specific functions of the present invention. Client **304** can be conceptualized as a union of clients that each perform a discrete task. One, two, or more of these discrete tasks can be performed by a single client **304**. That is, the tasks performed by a first client **304** and a second client **304** can be performed by a single client **304** and still be within the spirit and scope of the present invention. Alternatively, the discrete tasks can be performed by any number of clients **304**. That is, the task performed by a single client **304** can be performed by a plurality of clients.

[**0081**] A.2. Client Overview

[**0082**] Client **304** includes a user interface **308** at client device **108** for allowing a user to interact with one or more information services supported by the system of the present invention. User interface **308** displays formatted information pages on display **210** and permits the user to navigate between such display pages. User interface **308** also provides the user with a mechanism to enter requests and/or commands using, for example, keypad **212** (see **FIG. 2B**).

[**0083**] Client **304** interfaces with a client template database **310** and an client transaction database **312** stored in a memory of client device **108**. Client template database **310** includes a plurality of individual templates **314**, typically associated with one or more information services provided by the system of the present invention. In the present invention, client **304** and user interface **308** are defined and configured, and can be updated, in accordance with individual templates **314**. As will be further described below, each template **314** is typically associated with a display page, and uniquely defines the type of information and a layout or format of information presented to the user on the display page. Each template **314** can also define a set of available actions a user can take when viewing an associated display page, thereby allowing, for example, the user to request information from the display page and to navigate between display pages.

[**0084**] Client device **108** can transmit information request message **316** to server **114** when appropriate. Client device **108** also receives response message **318** and can stores information in the response message in client transaction database **312**, so as to preserve the information for later retrieval. Also, user interface **308** can display requested information to the user.

[**0085**] A.3. Server and Server Database Overview

[**0086**] Server **114** can communicate with a plurality of client devices **108**. Server **114** distributes requested information to client devices **108**, and maintains configuration control over the client devices. To perform such tasks, server **114** interfaces with a plurality of information stores, including a server template database **330**, a server transaction database **332**, and an exemplary services information store **334**.

[**0087**] Services information store **334** includes real-time data from data sources **132** (not shown in **FIG. 3**; see **FIG. 1A**). Services information store **334** can include data relating to finance and stocks, sports, weather, airline schedules, and the like. Services information store **334** can be a local database **116** or a remote database **130**. When server **114** receives information request **316** from client device **108**, server **114** retrieves the requested information from information store **334**, and transmits the information to client device **108** using information response message **318**.

[**0088**] Server transaction database **332** includes tables mapping individual client device unique identifiers (for example, MANs, MINs, or ESNs) to authorized services and associated templates. Server **114** uses such mapping tables to validate/authorize client requests. Server **114** maintains transaction event data for past and on-going transactions between server **114** and clients **304** in server transaction database **332**. Such data is used to track and control the various transactions in the system of the present invention and to build transaction history tables for each of the client devices **108**.

[**0089**] Server template database **330** includes the latest or most current versions of all of the available templates in the system of the present invention. Server template database **330** also includes tables mapping individual client device unique identifiers to the most current template versions authorized for client devices **108** associated with the unique identifiers. As new services, features and options are added to the system of the present invention, new templates are stored in server template database **330** and/or existing stored templates are updated, to reflect the additions. Therefore, at any given time, it is possible a client device **108** includes an old version of a template, that is, an out-of-date template that requires updating. When server **114** receives information request message **316** from client device **108**, server **114** determines whether the template (at client device **108**) associated with the request message is the most current template (for example, an updated template). If the template is an old version, server **114** retrieves the most current template from server template database **330**, and then transmits an appropriate template update, along with the requested information, to client device **108** using response message **318**. In this manner, server **114** distributes the most current template versions to client devices **108** on a per access and an as needed basis. Thus, server **114** efficiently distributes template updates to client devices **108** to render new service features and options available to the users, and maintain configuration control over the clients. Further details regarding initially configuring and reconfiguring/updating a client device with templates are respectively provided in: U.S. patent application No. 09/___,___, entitled "System, Method and Apparatus for Initial Configuration of a Client Device" (Attorney Docket No. 1753.0080000); and U.S. patent application No. 09/___,___, entitled "System, Method and Apparatus for Automatically and Dynamically Updating Options, Features, and/or Services Available to a Client Device" (Attorney Docket No. 1753.0050000), each of which was wholly incorporated by reference above.

[**0090**] B.1. Template Overview

[**0091**] In the present invention, the templates stored in client device **108** define a configuration of the client device. The configuration of client device **108** can determine the data services a user can access using client device **108**, including various data service options and/or features. Also, the configuration can determine the way in which client

device **108** interacts with the user to provide data services to the user. This can include, but is not limited to, the types of pages displayed to the user, the appearance of the display pages, the types and/or arrangements of information displayed on the pages, the navigable hierarchy of display pages presented to the user, the types and/or operations of actions the user can initiate when the user is presented with the display pages, the types of requests a user can enter via client device **108** and/or the content of client requests resulting from such entered user requests. The configuration of client device **108** can also determine how client device **108** responds to various user requests.

[**0092**] **FIG. 4A** is an illustration at a high level of an embodiment of template **314**. Template **314** includes a template header **400** having a template identifier **400***a*, a template version identifier or number **400***b*, and an optional template title **400***c*. Template **314** also includes a content portion **402** and an action portion **404**. Content portion **402** includes definitions or descriptors (such as textual, symbolic and/or graphical descriptors) that define a layout and appearance of an associated display page on display **210**. In other words, content portion **402** specifies an arrangement of information fields on the associated display page.

[**0093**] On the other hand, action portion **404** includes definitions (such as textual, symbolic, and/or graphical descriptors) specifying a set of actions a user can take with respect to the associated display page. For instance, action portion **404** can include: menu action definitions **404***a*, such as menu pull-down actions and scroll-wheel shortcuts; keyboard action definitions **404***b*, such as keyboard shortcuts (e.g., press "W" for weather service requests); branching action definitions **404***c*, allowing the user to branch from the current template and display page to a next template and display page linked with the current template; and external references **404***d*, such as URLs. Such actions are available to the user at the display page associated with template **314**.

[**0094**] Content portion **402** is now further described. Content portion **402** tropically includes text (for example, header or title information, and field labels) and variable descriptors (for example, stock quote information). Content portion **402** defines a format for the variable information and text within the display page. Content portion **402** can also include references to tables and graphical entities stored in the client device memory.

[**0095**] A diagrammatic representation of the content portion of an exemplary template **406** is depicted in **FIG. 4B**. The content portion of template **406** includes the following definitions:

[**0096**] a title **410** for displaying the text "PRECIOUS METALS";

[**0097**] a field **412** for displaying current time;

[**0098**] a plurality of information field identifiers or labels **414** arranged in a column; and

[**0099**] a first set of information fields **416** for displaying variable information (such as stock prices) and a second set of variable fields **418** for displaying further variable information corresponding to the information field identifiers.

[**0100**] Template **406** is incomplete because none of the information fields are populated with the specified variable information. When client device **108** receives requested information corresponding to template **406**, client device **108** populates an instance of template **406** with the requested information, thereby, creating a completed template. User interface **308** displays the completed template to the user as a display page. A display page/completed template **420** corresponding to template **406**, is depicted in **FIG. 4C**. In display page **420**, field **412**, fields **416**, and fields **418** are respectively populated with current time, hi/low stock prices, and stock price deviations.

[**0101**] In the present invention, each template can incorporate a unique set of actions available to the user when the template is displayed as a display page, as mentioned above. In other words, actions can vary from template to template and page to page in the present invention. Template actions are further described below.

[**0102**] **FIG. 4D** is an illustration of a list of exemplary definitions or descriptors that define template **406** (**FIG. 4B**), and thus display page **420** (**FIG. 4C**), as the template can be stored in either client or server template databases **310** or **330**. The illustrated list of definitions correspond to a data service for precious metal prices. In header **400**, "NT", "VERSION", and "TI" respectively specify the template name "temp1", version "1.1", and title "PRECIOUS METALS".

[**0103**] Content portion **402** (corresponding to labels **414**, and fields **416** and **418** of **FIG. 4B**) includes a plurality of content definitions **436** for metal pricing information. A spaced pair of percent symbols (%) delimits each information field. For example, the definition "<SILVER %0:11%%1:6%" causes two variable fields of information to be displayed after the text "SILVER" on the display of client device **108**. Action portion **404** includes exemplary action definitions **442** and **444**. The actions defined by action definitions **442** and **444** are available to the user when the display page associated with the template (for example, display page **420** of **FIG. 4C**) is being displayed.

[**0104**] Action definition **442** defines a menu choice "refresh" in a list of displayed menu items. When "refresh" is selected in one embodiment, client device **108** retrieves the most recently received information relating to template temp, from client transaction database **319**, and refreshes the display with the retrieved data. In another embodiment, selecting "refresh" causes client device **108** to first update the display with information retrieved form client transaction database **312** as just described, and then transmit an information request for new information to refresh the displayed information. In still another embodiment, the first step is omitted from the just described two-step embodiment.

[**0105**] Action definition **444** defines a shortcut key as "SP", the "space bar" key (also referred to as the "symbol key") on keypad **212**, which when pressed, causes a branch to a predetermined home template or page called $temp_{home}$. Client device **108** then displays the home page associated with $temp_{home}$.

[**0106**] The templates of the present invention provide a powerful and convenient mechanism for configuring, reconfiguring, and updating client device **108** and user interface **308**. As the system of the present invention adds new services and/or expands existing service options and fea-

tures, correspondingly new and/or updated templates are automatically distributed to and stored in client devices **108**. The new and/or updated templates correspondingly expand the service features and options available to the user so that the user can access the new and expanded services.

[**0107**] In the present invention, templates **314** stored in template data base **310**, and the actions specified in each of the templates, define an interconnected hierarchy of user navigable display pages at client device **108**. **FIG. 5** is an illustration of an exemplary hierarchy of display pages **502**. In the example hierarchy, user interface **308** displays a home or welcome page **504** to the user when client device **108** is first powered-on. Home page **504** is a service starting page. Using actions, represented by connectors **506**, defined for the home page by the associated home page template, the user can branch to a quote request page **508**, a portfolio page **510**, an informative "about" page **512**, and a set-up page **514**. The user can navigate between the aforementioned pages and a quote display page **516**, a chart page **518**, a user alert page **520**, user page **522** and an add symbol page **524**.

[**0108**] Templates and the actions defined thereby advantageously provide a convenient mechanism for altering user interface **308** and associated applications in accordance with expanding services, without changing the underlying user interface or client computer programs. An exemplary update to user interface **308** is now described with reference to **FIGS. 6A and 6B**. With reference to **FIG. 6A, a** user interface **602** is defined by a quote entry page **604**, a quote display page **606**, a portfolio page **608** and an FxAlert page **610** (e.g., for current precious metal prices) linked together by actions **612**.

[**0109**] With reference to **FIG. 6**B, to add a new service or user capability, for example, the ability of obtaining the latest news for a particular stock, a new template, defining a new page **614** called "Equity News," can be composed for accessing such latest new stock information. New page/template **614** can be linked to and thus only accessible from quote display page **606**, assuming new page **614** should be accessible only after a particular stock quote is displayed on quote display page **606**. To effect such a link, an action **616** can be added to quote display page (template) **606**. For example, the added action **616** can define a branch key N, which when pressed, causes a branch from quote display page **606** to Equity News page **614** in accordance with the above assumption.

[**0110**] C.1. Server Transaction Database

[**0111**] As described above in connection with **FIG. 3**, server **114** accesses server transaction database **330** to manage transactions with numerous clients **304**. **FIG. 7A** is an illustration of an exemplary transaction table **700** stored in server transaction database **330**. Exemplary table **700** includes a client identification column **702**, a template identifier column **703**, an optional template title column **704**, a template version column **706**, an index column **708**, a date column **710**, a time column **712**, and a parameters column **714**. Each row of client identification column **702** includes a unique identifier of a client device **108** (e.g., MAN, ESN, MIN). Each row of template identifier column **703** includes a unique identifier of a template (e.g., $temp_1$, $temp_2$, $temp_3$). Each row of template version column **706** specifies the version of the template in the corresponding row of column **703**. Accordingly, entries in template version column **706** specify the version of a template (i.e., identified in column **703**) that a specific client (i.e., identified in column **702**) currently has stored in its client template database **310**. Each row of index column **708** identifies the data type that is used to populate the corresponding template in column **703**. The data included in parameters column **714** is the data that was sent to the corresponding client (in column **702**) the last time server **114** provided that client with the data type of column **708**. Each row of date column **710** and time column **712** specifies when server **114** last provided the client device of column **702** with the data included in parameters column **714**.

[**0112**] C.2. Server Template Database

[**0113**] As described above in connection with **FIG. 3**, server **114** accesses server template database **330** to maintain configuration control over client devices **108**. **FIG. 7B** is an illustration of an exemplary table **750** stored in server template database **330**. Table **750** includes a column **754** listing the identifiers of current templates stored in database **330**, a column **756** listing template version numbers for the identified templates, and a column **758** listing the definitions of the identified templates. Each row **760** corresponds to an identified template, for example, template $temp_1$. In another embodiment, version column **756** is deleted since a template version can be determined from a template header included in the template definition.

[**0114**] C.3. Client Transaction Database

[**0115**] **FIG. 8** is an illustration of an exemplary table **800** stored in client transaction database **312** of client device **108**. Table **800** is essentially the same as server transaction table **700** of **FIG. 7**A and discussed above, except that table **800** does not include a client identifier column (e.g., column **702**). This is because client transaction database **312**, and thus table **800**, are specific to only one client device **108**.

[**0116**] D.1. Information Request and Response Messages

[**0117**] **FIG. 9A** is an illustration of an exemplary information request message **900** (corresponding to information request message **316** of **FIG. 3**) transmitted by client device **108**. The information request message (e.g., **900**) is also referred to as a client request, since it is initiated by client device **108**. The fields of message **900** are arranged in accordance with an exemplary message format, and it is to be understood that message **900** can be arranged in other formats. Message **900** includes a client device identifier (such as a MAN) **902**, transaction information **904** used by client device **108** and server **114** to track the current transaction, a template identifier or name **906**, a template version identifier **908** identifying the version of the named template stored in template database **310**, and a specific information request **910**.

[**0118**] In one embodiment, transaction information **904** includes a transaction number **912** and a client state **914**. Client **108** tracks each request using transaction number **912**, which only client **108** can increment. Client state number **914** specifies the last successfully received update for the template identified by template identifier **906**. In one embodiment, client **108** can store transaction number **912** and client state number **914** in, and retrieve transaction number **912** and client state number **914** from, additional columns (not shown) of server transaction database table **700**. Use of transaction number **912** and client state number **914** are discussed below.

[0119] Client device **108** increments transaction number **912** every time it sends a client request to server **114**. Only client device **108** can increment transaction number **912**. However, client device **108** never increments client state number **914**. Rather, server **114** increments client state number **914** when it sends a server response to client device **108**.

[0120] If client device **108** issues multiple client requests (e.g., multiple requests for stock quotes AAPL, MSFT, GE, INTC, etc.), each request (e.g., **900**) includes a transaction number **914**. Server **114** responds to each request individually and echoes back the appropriate transaction number **914** in each server response (e.g., **920**). Each server response received by client device **108** is stored in client transaction database **310**. Additionally, in one embodiment, a display page associated with the server response to the last (i.e., in time) client request is displayed to the user.

[0121] Client state **914** is used by server **114** to determine the last successfully received (by client device **108**) server response to a particular client request. This is important because client device **108** may fail to receive a server response sent by server **114**. Thus, server **114** should save the last sent server response in, for example, a suspense file. Only when sever **114** receives a new client request (i.e., for the same information) with the same state number does it write the data of the last server response (which was stored in the suspense file) to server transaction database **332**. For example, server **114** may receive a "state 6" client request and return a new "state 7" server response to client device **108**. If client device **108** never receives the server response with "state 7", then the next time client device **108** makes the same client request it will again be a "state 6" client request. In this manner, server **114** will know that client device **108** never received the "state 7" server response. This enables server **114** to use old "state 6" data (rather than the data last sent to client device **108**, that is associated with "state 7") when performing a comparison of old data to new data to thereby produce a server response.

[0122] In one embodiment, either client device **108** or server **114** can reset client state **914** to zero when a server response includes a full update (as opposed to a server response that only includes changes).

[0123] **FIG. 9B** is an illustration of an exemplary information response message **920** (corresponding to information response message **318**) transmitted by server **114**. The information response message (e.g., **920**) is also referred to as a server response, since it is initiated by server **114**. Message **920** (also referred to as server response **920**) includes requested information **922**, provided in response to specific information request **910** of information request message **900**.

[0124] Another exemplary information response message (not shown) includes template update information to update a template in client device **108**.

[0125] E.1. Requesting Information—Client

[0126] Exemplary methods of requesting and responding to information requests are now described. **FIG. 10** represents a series of method steps **1000** performed by client device **108** in response to a request for information from a user. The method begins at a step **1002** when the user of client device **108** issues a request for information from a displayed page, via user interface **308**.

[0127] At a next step **1004**, client device **108** queries client template database **310** to determine whether an appropriate template **314** associated with the request is locally available. If client device **108** determines that the appropriate template is not locally available (i.e., if the answer to step **1004** is NO). then, at a step **1005**, client device **108** sends a get_template command to server **114**. Further details of the get_template command and step **1005** are discussed in U.S. patent application No. (09/___,___), entitled "System, Method and Apparatus for Automatically and Dynamically Updating Options, Features, and/or Services Available to a Client Device" (Attorney Docket No. 1753.0050000), incorporated herein by reference above. If the appropriate template is locally available, then at a step **1006**, client device **108** retrieves the appropriate template from client template database **310**.

[0128] If the appropriate template is locally available, then at a step **1006**, the appropriate template is retrieved from client template database **310**. At a next step **1008**, there is a determination whether data associated with the appropriate template is available from client transaction database **312**. If the answer to step **1008** is YES, then flow continues to a step **1010**, where the template is populated with data from client transaction database **312**. The data retrieved from client transaction database **312** is the data last received from server **114** to populate the retrieved template (e.g., data from an earlier transaction). If the answer to step **1008** is NO, then flow jumps directly to a step **1016**, which is discussed below.

[0129] In one embodiment, after step **1010**, in a step **1012**, the populated template is displayed (i.e., an associated page) on display **210** of client device **108**. Preferably a status (e.g., date and time) of the displayed information is also displayed. Accordingly, the appropriate template preferably includes a status field that can be populated with status data (e.g., date and time). The information displayed to the user can be stale, for example, the data can be days, hours, or seconds old, depending on when client **108** last received the information to populate the appropriate template.

[0130] If the user directs client device **108** to do something other than refresh the information (i.e., if the answer to step **1014** is NO), then client device **108** functions accordingly. For example, the user may initiate a branch action that causes client device **108** to display a different page.

[0131] At a decision step **1014**, if the user requests that the information (i.e., that populates the template) be refreshed with the "new" information (i.e., if the answer to step **1014** is YES), client device **108** composes and transmits an appropriate information request message to server **114**, at a step **1016**. In one embodiment, a user can request refreshed information by pressing a predefined action key, such as the "enter" key or "space bar" key. An example request message **900** is described above in connection with **FIG. 9A**.

[0132] In an alternative embodiment, flow jumps directly from step **1008** to step **1016**, such that client device **108** sends a request message to server **114** after client device **108** retrieves data from client transaction database **312**. In another embodiment, flow jumps directly from step **1006** to step **1016**, such that client device **108** sends a request message to server **114** after client **204** retrieves the appropriate template from client template database **310**.

[0133] E.2. Responding to an Information Request—Server

[0134] **FIG. 11** represents a series of method steps **1100** performed by server **114** in response to a request for information from client device **108**. The process begins at a step **1102** when server **114** receives a request message (e.g., request **900**) sent from client device **108**. At a step **1104**, server **114** identifies client device **108**. This is accomplished using a unique identifier (e.g. **902**) included in the request. In this example, server **114** recognizes that the client device **108** that sent the request message has a template for displaying the requested information, because the request (e.g., **900**) includes a template identifier (e.g., **906**). At this point, server **114** can also determine whether the specific information request is authorized for the requesting MAN.

[0135] At a next step **1106**, server **114** retrieves the latest (i.e., most current or up-to-date) version of the identified template (e.g., the template identified by template identifier **906**) from server template database **330**. At a step **1108**, server **114** retrieves/derives the requested information required to populate the data fields of the template that was retrieved at step **1106**. For example, at step **1108**, server **114** retrieves the requested information from information store **334** in accordance with the most current template definition.

[0136] In a step **1110**, server **114** determines whether client **108** has the most current template. To make this determination, server **114** compares template version identifier **906** of the template named in information request message **900** against the version identifier for the same named template just retrieved from server template database **330** (e.g., in column **756** of table **750** of **FIG. 7B**) at step **1106**.

[0137] If server **114** determines that the identified client device **108** does not have the latest version of the appropriate template (i.e., the answer to step **1110** is NO), then client device **108** has an "old" template that requires updating with a "new" template, namely, the template just retrieved from server template database **330**. Accordingly, at a step **1112**, server **114** composes an information response message including:

[0138] a) information retrieved from information store **334** at step **1108**; and

[0139] b) template update information from the "new" template.

[0140] Further details regarding step **1112** and template updating are discussed in U.S. patent application No. (09/___,___), entitled "System, Method and Apparatus for Automatically and Dynamically Updating Options, Features, and/or Services Available to a Client Device" (Attorney Docket No. 1753.0050000), incorporated herein by reference above.

[0141] On the other hand, if server **114** determines at step **1110** that client device **108** does not require a template update (i.e., the answer to step **1110** is YES), then server **114** composes an information response message using only the information retrieved from information store **334** (e.g., message **920**), since a template update is unnecessary. At a next step **1116**, server **114** transmits the composed information response message to client **108**. For example, server **114** transmits response message **920** or **930** composed respectively at steps **1114** or **1112**.

[0142] An advantage of the present invention is that if the client device **108** (to which the response message is being sent) has the most current template, then the composed and transmitted response message (e.g., message **920**, composed in step **1114**) only includes the information required to populate and thus refresh a template. This significantly reduces the size of the response message (or messages) that is transmitted from server **114** to client device **108**. Minimizing the size of response messages reduces the cost and/or response time (also referred to as latency) for providing information services. For example, where a communications system provider charges on a volume basis, the less data transmitted means less cost to the user. Additionally, since latency is typically proportional to the amount of data being transmitted, the less data transmitted means lower latency. A further advantage is the reduction in a system transmission bandwidth, such that more users can be supported by the services of the system.

[0143] In one embodiment, the message that server **114** composes at step **1114** (and sends at step **1116**) includes all the data necessary to populate a template.

[0144] In another embodiment, the message that server **114** composes at step **1114** (and sends at step **1116**) includes the information that has changed since client device **108** last successfully received a server response (i.e., to populate the particular template) from server **114**, but does not include the information that has not changed since server **114** last sent a successfully received server response message. Accordingly, an advantage of this embodiment is that the size of the response message (or messages) is further reduced.

[0145] Further details of step **1114**, according to an embodiment of the present invention, are discussed with reference to **FIG. 12**. In a step **1202**, server **114** queries server transaction database **332** to determine the information, for the particular template, that client device **108** has stored in client transaction database **312**. For example, server **114** searches table **700**, of **FIG. 7A**, based on client identifier **902** and template identifier **906** to determine what information was last sent to client device **108** for the identified template.

[0146] In a step **1204**, server **114** then compares the information in each data field (i.e., the information retrieved in step **1108** of **FIG. 11**) against the record of what was last successfully received by client device **108** (i.e.. determined in step **1202**), to thereby determine the information that has changed (also referred to as the changed fields).

[0147] Steps **1202** and **1204** can be illustrated with reference to **FIG. 13**. An "old" page **1302** represents the information (populating a precious metals template) that client device **108** has stored in client transaction database **312** (i.e., at step **1202**). Server **114** determines that client device **108** has such an "old"page of information using server transaction database **332**. A "new" page **1304** represents up-to-date or current information (populating the same precious metals template) retrieved by server **114** at step **1108**. A change definition **1306** represents a change in information between old page **1302** and new page **1304**. Server **114** determines change definition **1306** by comparing the information in old page **1302** to the information in new page **1304**. Server **114** compresses change definition **1306** using a data compression technique to produce a compressed change definition **1308**, thereby further reducing the size of the response message.

[0148] In one embodiment, at step **1202**, server **114** queries server transaction database **332**, based also on client state number **912** (i.e., in addition to client identifier **902** and template identifier **906**) to ensure that server **114** actually compares the up-to-date information (i.e., the information retrieved in step **1108**) against what client device **108** actually has stored in its client transaction database **312**. If this query is not based also on client state number **912**, there is a possibility that server **114** will perform the comparison using information that was last sent to client device **108**, but never received by client device **108**.

[0149] Referring again to **FIG. 11**, after server **114** transmits the information response message (e.g., **900**) in step **1116**, client device **108** receives the response message. Client device **108** then updates client transaction database **312** with information from the response message. For example, client device **108** replaces a row of client transaction table **800** containing "old" information with "new" information received from the response message. In another example, if the response message only includes a change definition, then client device **108** only replaces those columns of a row of transaction table **800** specified in the change definition. Client device **108** can then refresh the current display page by retrieving the "new" information from client transaction database **312**. For example, client device **108** can use the "new" information to populate the data field(s) of the template retrieved at step **1006**.

[0150] An advantage of the present invention is realized when client device **108** sends one or more additional request messages to server **114** prior to receiving a response message(s) to one or more previous requests (i.e.. back from server **114**). This advantage is also present when client device **108** sends the first request message to a first server **114** and a second request message to a second (i.e., different) server **114**. A series of exemplary method steps **1400** performed at client device **108** are now described to illustrate this advantage.

[0151] E.3. Multiple Consecutive Client Requests and Server Responses

[0152] Assume client device **108** sends a first request message to server **114** and then a second request message to server **114** prior to receiving a response message to the first request message. Referring to **FIG. 14**, at an initial step **1402**, client device **108** receives a response to the first request. In a step **1404**, client device **108** updates a row of client transaction database table **800** based on the response to the first request. For example, client device **108** updates a first row of transaction database table **800** using first information that is based on the response to the first request. Client device **108** uses the template identifier (e.g., **906**) in the response message (e.g., **920**) to determine which row to update. Next, in a step **1406**, client device **108** displays a first page using the first information in the updated first row of client transaction database table **800**.

[0153] Next, in a step **1408**, client device **108** receives a response to the second request. In a step **1410**, client device **108** updates a row of client transaction database table **800** based on the response to the second request. For example, client device **108** updates a second row of transaction database table **800** using second information that is based on the response to the second request. Again, client device **108** uses the template identifier (e.g., **906**) in the second response message (e.g., **920**) to determine which row to update. At a step **1412**, client device **108** can then display a second page using the second information in the updated second row of client transaction database table **800**, in response to a request by the user via the user interface **312** (e.g., in response to the pressing of a back arrow key). Accordingly, the use of client transaction database **312** enables client device **108** to send one or more additional request messages to server **114** (or multiple servers **114**), prior to receiving response message(s) to one or more previous requests (i.e., back from server **114**), without the additional request(s) negating the previous request(s).

[0154] In one embodiment, the display page relating to the last made client request is displayed first, regardless of which server response is first received at client device **108**. In still another embodiment, a display page relating to the first made client request is displayed first, regardless of which server response is first received at client device **108**.

[0155] The present invention can be used to improve many systems and applications. For example, when the present invention is used in a browser application, and a user (i.e., of the browser) submits numerous consecutive information and/or branch requests over a relatively short period of time, the transaction database of the present invention stores multiple responses to the numerous requests. The user of the browser can then peruse the pages associated with the numerous responses at his or her convenience. That is, the present invention stores the numerous responses in a transaction database enabling the user to retrieve information and/or navigate through a plurality of service provider sites (such as an Internet web pages) one after another (without requiring either further user action, except, for example, a next or previous request, or the browser to again retrieve information and/or navigate to a site).

[0156] In contrast, when using a conventional browser (such as Microsoft Internet Explorer), each consecutive request effectively cancels or negates a previous request, whereby one or more information and/or branch requests are disadvantageously lost to the user. For example, when a user of a conventional browser issues a first request for a first Internet file (e.g.. by designating a Uniform Resource Locator (URL)) and then issues a second request for a different Internet file, prior to receiving a response to the first request, the conventional browser will never display a response to the first request. Accordingly, from the user's perspective, the second request negates the first request. This can also occur when the user navigates through web sites. For example, if the user "clicks" on a first hypertext link and then "clicks" on a second hypertext link prior to a jump to the first link, a jump to the first link fails to occur. Thus, initiating the second link effectively negated initiating the first link. The present invention can be used to overcome these disadvantages of a conventional browser, as is now described with reference to **FIG. 15**.

[0157] **FIG. 15** is a flow chart **1500** of an exemplary method overcoming the above mentioned disadvantages of a conventional browser. The method steps in **FIG. 15** correspond to steps at client device **108**. At a first step **1502**, the user enters a first user request, for example, a page refresh command, via user interface **108**. In response to the first user request, at a next step **1504**, client device **108** sends a first information request to server **114**.

[0158] At a next step **1506**, the user enters a second user request via user interface **108**. The first and second user requests can be issued from respective first and second display pages. Also, the time separation between the first and second user requests can range between milliseconds and hours or even days. In response to the second user request, at a next step **1508**, client device **108** sends a second information request to server **114**.

[0159] At a next step (not shown) server **114** composes first and second information responses corresponding to the first and second information requests and then transmits the first and second information responses. At a next step **1510**, client device **108** receives the first information response and stores first information associated with the first information response in client transaction database **310**. At a next step **1512**, client device **108** receives the second information response and stores second information associated with the second information response in client transaction database **310**. The time separation between receipt of the first and second server responses can range between milliseconds and hours or even days. Also, in another embodiment, the order of receipt of the first and second responses is reversed.

[0160] At a next step **1514**, client device **108** refreshes a display page associated with the second user request with the second information. In response to another user request, at a next step **1516**, client device **108** retrieves the first information from client transaction database **312** and displays the first information to a display page.

[0161] In this manner, client device **108** receives, retains, and displays as required, multiple server responses to multiple, consecutive information requests, regardless of the order in which the requests were issued or the responses were received.

[0162] F.1. Hardware and Software Implementations

[0163] Server **114** can perform specific features of the present invention using server controllers, which in effect comprise a computer system. Although communication-specific hardware can be used to implement the present invention, the following description of a general purpose computer system is provided for completeness. The present invention is preferably implemented in software. Alternatively, the invention may be implemented using hardware or a combination of hardware and software. Consequently, the invention may be implemented in a computer system or other processing system. An example of such a computer system **1600** is shown in **FIG. 16**. In the present invention, for example, client and server applications **304** and **306** each executes on distinct computer systems **1600**. The computer system **1600** includes one or more processors, such as processor **1604**. The processor **1604** is connected to a communication infrastructure **1606** (for example, a bus or network). Various software implementations are described in terms of this exemplary computer system. After reading this description, it will become apparent to a person skilled in the relevant art how to implement the invention using other computer systems and/or computer architectures.

[0164] Computer system **1600** also includes a main memory **1608**, preferably random access memory (RAM), and may also include a secondary memory **1610**. The secondary memory **1610** may include, for example, a hard disk drive **1612** and/or a removable storage drive **1614**, representing a floppy disk drive, a magnetic tape drive, an optical disk drive, etc. The removable storage drive **1614** reads from and/or writes to a removable storage unit **1618** in a well known manner. Removable storage unit **1618**, represents a floppy disk, magnetic tape, optical disk, etc. which is read by and written to by removable storage drive **1614**. As will be appreciated, the removable storage unit **1618** includes a computer usable storage medium having stored therein computer software and/or data.

[0165] In alternative implementations, secondary memory **1610** may include other similar means for allowing computer programs or other instructions to be loaded into computer system **1600**. Such means may include, for example, a removable storage unit **1622** and an interface **1620**. Examples of such means may include a program cartridge and cartridge interface (such as that found in video game devices), a removable memory chip (such as an EPROM, or PROM) and associated socket, and other removable storage units **1622** and interfaces **1620** which allow software and data to be transferred from the removable storage unit **1622** to computer system **1600**.

[0166] Computer system **1600** may also include a communications interface **1624**. Communications interface **1624** allows software and data to be transferred between computer system **1600** and external devices. Examples of communications interface **1624** may include a modem, a network interface (such as an Ethernet card), a communications port, a PCMCIA slot and card, etc. Software and data transferred via communications interface **1624** are in the form of signals **1628** which may be electronic, electromagnetic, optical or other signals capable of being received by communications interface **1624**. These signals **1628** are provided to communications interface **1624** via a communications path **1626**. Communications path **1626** carries signals **1628** and may be implemented using wire or cable, fiber optics, a phone line, a cellular phone link, an RF link and other communications channels.

[0167] In this document, the terms "computer program medium" and "computer usable medium" are used to generally refer to media such as removable storage drive **1614**, a hard disk installed in hard disk drive **1612**, and signals **1628**. These computer program products are means for providing software to computer system **1600**.

[0168] Computer programs (also called computer control logic) are stored in main memory **1608** and/or secondary memory **1610**. Computer programs may also be received via communications interface **1624**. Such computer programs, when executed, enable the computer system **1600** to implement the present invention as discussed herein. In particular, the computer programs, when executed, enable the processor **1604** to implement the process of the present invention. Accordingly, such computer programs represent controllers of the computer system **1600**. In a preferred embodiment of the invention, the processes performed by server **114** and server application **306**, and by client device **108** and client application **304**, are all performed by computer control logic. Also, client and server template databases **310** and **330**, and client and server transaction databases **312** and **332** are stored in respective memories **1608** and/or respective memories **1610**. Where the invention is implemented using software, the software may be stored in a computer program

product and loaded into computer system **1600** using removable storage drive **1614**, hard drive **1612** or communications interface **1624**.

[**0169**] In another embodiment, features of the invention are implemented primarily in hardware using, for example, hardware components such as application specific integrated circuits (ASICs). Implementation of the hardware state machine so as to perform the functions described herein will be apparent to persons skilled in the relevant art(s).

[**0170**] V. Conclusion

[**0171**] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example, and not limitation. It will be apparent to persons skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention.

[**0172**] The present invention has been described above with the aid of functional building blocks illustrating the performance of specified functions and relationships thereof. The boundaries of these functional building blocks have been arbitrarily defined herein for the convenience of the description. Alternate boundaries can be defined so long as the specified functions and relationships thereof are appropriately performed. Any such alternate boundaries are thus within the scope and spirit of the claimed invention. One skilled in the art will recognize that these functional building blocks can be implemented by discrete components, application specific integrated circuits, processors executing appropriate software and the like or any combination thereof. Thus, the breadth and scope of the present invention should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

[**0173**] All cited patent documents and publications in the above description are incorporated herein by reference.

What is claimed is:

1. In a client-server system including one or more servers and a client device having client transaction database, a client template database, and a user interface adapted to enable a user to enter requests, a method for displaying pages on the client device comprising the steps of:

receiving a user request from the user via the user interface;

retrieving a template from the client template database based on said user request, said template including one or more data fields;

retrieving information from said client transaction database based on said template, said information relating to said one or more data fields; and

displaying a page based on said template and said information relating to said one or more data fields.

2. The method of claim 1, further comprising the steps of:

receiving a refresh request from the user via the user interface;

sending a client request based on said refresh request;

receiving a server response to said client request; and

storing further information in the client transaction database based on said server response, said further information relating to at least one of said one or more data fields.

3. The method of claim 2, further comprising the step of:

displaying an updated page based on said template and said further information.

4. The method of claim 2, wherein said template includes at least two data fields, and further comprising the step of:

displaying an updated page based on said template, said information, and said further information.

5. The method of claim 4, wherein said further information relates to less than all of said at least two data fields.

6. In a client-server system including one or more client devices having unique client identifiers and a server having a server template database, a method for responding to a request from a client device comprising the steps of:

receiving a client request from a client device, said client request including a template identifier and a client identifier;

retrieving a template from the server template database based on the template identifier, said template including one or more data fields;

collecting first information related to said one or more data fields;

determining a server response to said request based on said first information; and

sending said server response to said client device.

7. The method of claim 6, wherein the server also has a server transaction database, and the method further comprising the step of retrieving second information from the server transaction database based on the template identifier and the client identifier, and wherein the step of determining a server response comprises determining said response to said request based on said first information and said second information.

8. The method of claim 7, wherein the step of determining a server response comprises determining said response based on differences between said first information and said second information.

9. The method of claim 6, the step of collecting first information comprises collecting said first information from an information store.

10. A client apparatus that communicates with one or more servers via a communications system, the apparatus comprising:

a client transaction database;

a client template database;

a user interface adapted to enable a user to enter requests;

a first client controller adapted to receive a user request from the user via said user interface;

a second client controller adapted to retrieve a template from said client template database based on said user request, said template including one or more data fields;

a third client controller adapted to retrieve information from said client transaction database based on said template, said information relating to said one or more data fields; and

a fourth client controller adapted to display a page based on said template and said information relating to said one or more data fields.

11. The apparatus of claim 10, further comprising:

a fifth client controller adapted to send a client request in response to receiving a refresh request from the user via the user interface;

a sixth client controller adapted to receive a server response to first client request; and

a seventh client controller adapted to store further information in the client transaction database based on said server response, said further information relating to at least one of said one or more data fields.

12. The apparatus of claim 11, further comprising:

an eighth client controller adapted to display an updated page based on said template and said further information.

13. The apparatus of claim 11, wherein said template includes at least two data fields, further comprising:

an eighth client controller adapted to display an updated page based on said template, said information, and said further information.

14. The apparatus of claim 13, wherein said further information relates to less than all of said at least two data fields.

15. A server apparatus that communicates with one or more client devices having unique identifiers via a communications system, the apparatus comprising:

a server template database,

a first server controller adapted to receive a client request from a client device, said client request including a template identifier and a client identifier;

a second server controller adapted to retrieve a template from said server template database based on the template identifier, said template including one or more data fields;

a third server controller adapted to collect first information related to said one or more data fields;

a fourth server controller adapted to determine a server response to said request based on said first information; and

a fifth server controller adapted to send said server response to said client device.

16. The apparatus of claim 15, further comprising:

a server transaction database, a sixth server controller adapted to retrieve second information from said server transaction database based on said template identifier and said client identifier, and

wherein said fourth server controller determines said response to said request based on said first information and said second information.

17. The apparatus of claim 16, wherein said fourth server controller determines said response based on differences between said first information and said second information.

18. The apparatus of claim 15, wherein said third server controller collects said first information from an information store.

19. A client-server based system for providing a user with information in response to user requests, comprising:

a server controller that receives information requests over a communication network and transmits server responses over said communication network in response to said information requests; and

a client device, coupled to said communication network, adapted to receive user requests and then transmit said information requests based on said user requests, said client device including a display for displaying information, wherein said client device is adapted to receive, retain, and display multiple server responses corresponding to consecutive information requests regardless of a temporal relationship between said multiple responses and said consecutive information requests.

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