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(54) METHOD AND APPARATUS FOR MESSAGE FLOW AND TRANSACTION QUEUE MANAGEMENT

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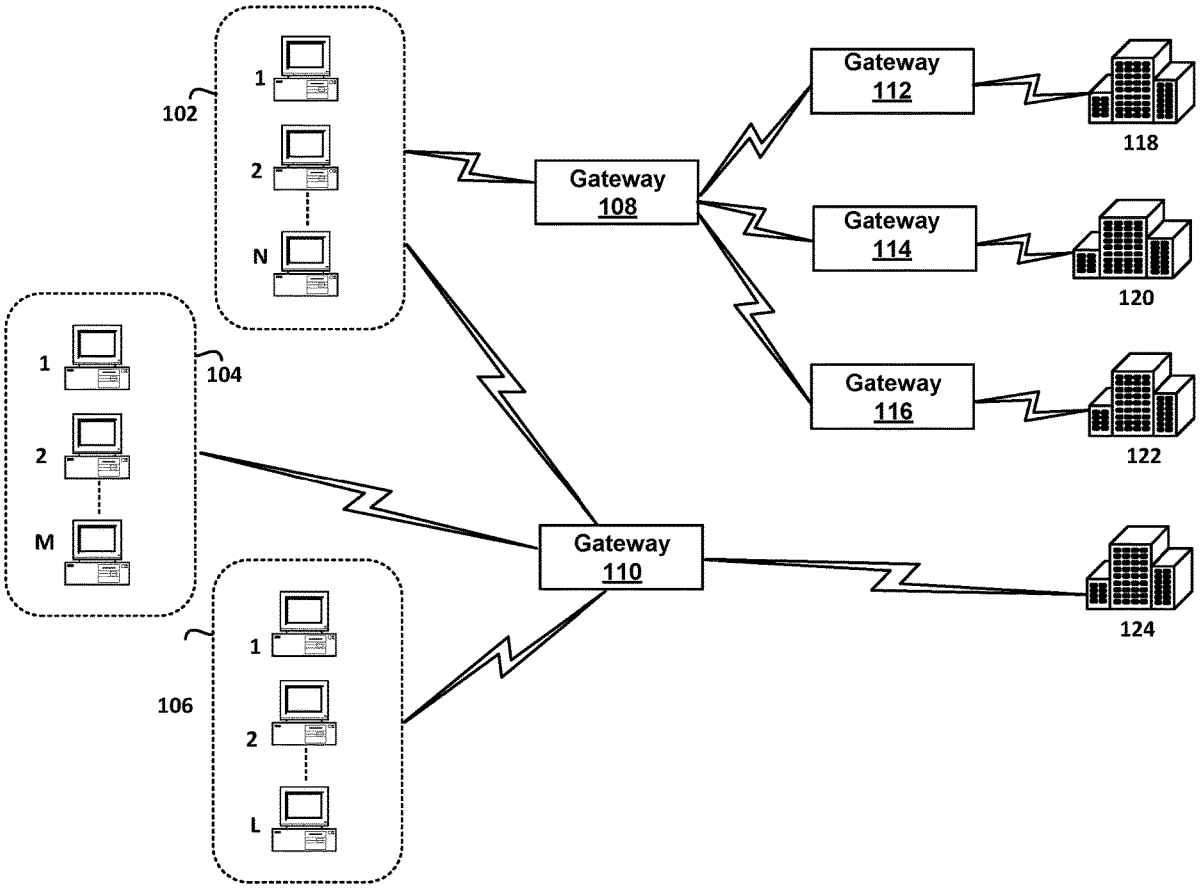
(57) **ABSTRACT**

Management of transaction message flow utilizing a transaction message queue. The system and method are for use in financial transaction messaging systems. The system is designed to enable an administrator to monitor, distribute, control and receive alerts on the use and status of limited network and exchange resources. Users are grouped in a hierarchical manner, preferably including user level and group level, as well as possible additional levels such as account, tradable object, membership, and gateway levels. The message thresholds may be specified for each level to ensure that transmission of a given transaction does not exceed the number of messages permitted for the user, group, account, etc.



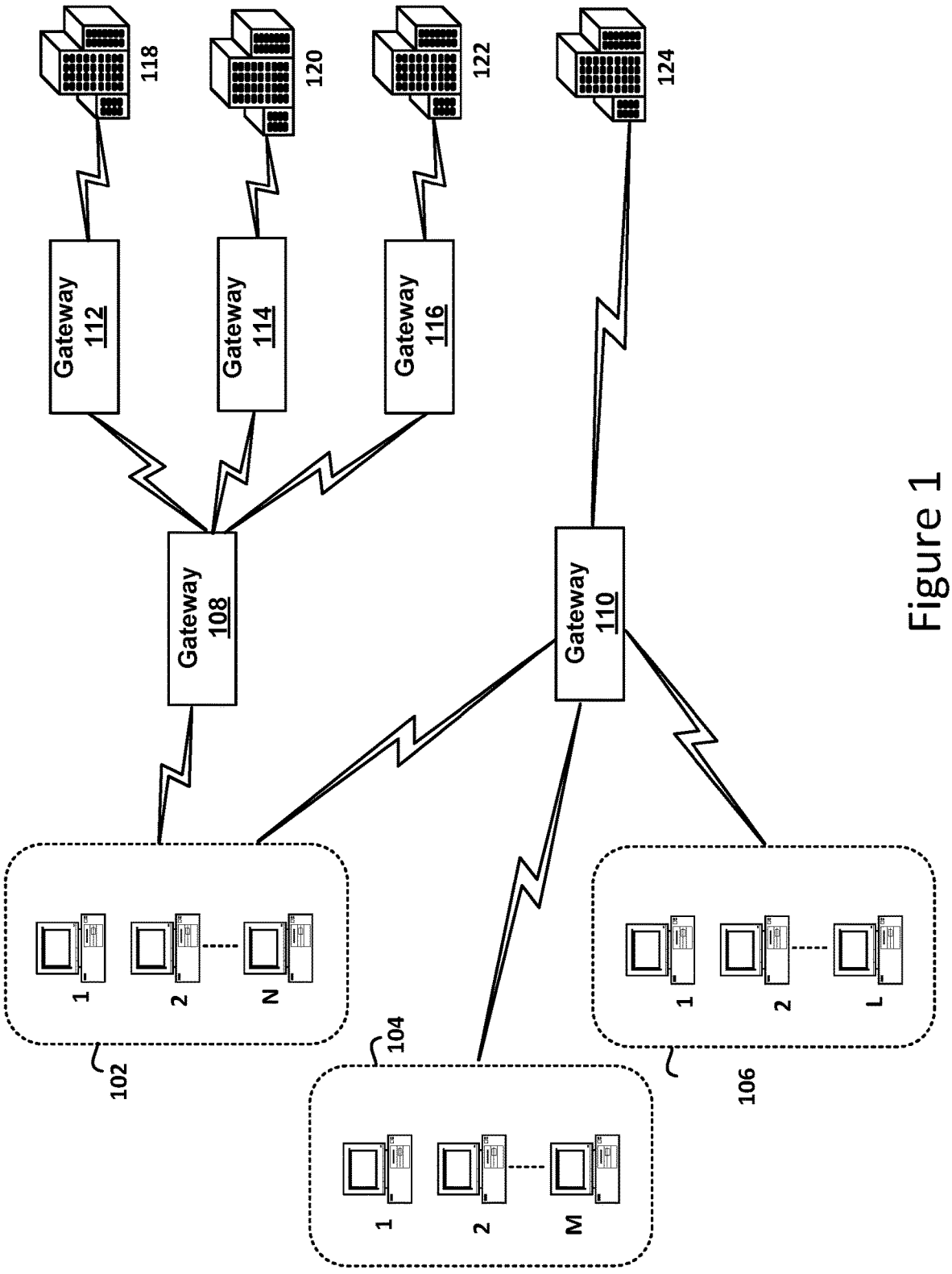

118
120
122
124
Gateway 112
Gateway 114
Gateway 116
Gateway 108
Gateway 110
1
2
N
102
104
1
2
M
1
2
L
106

Figure 1

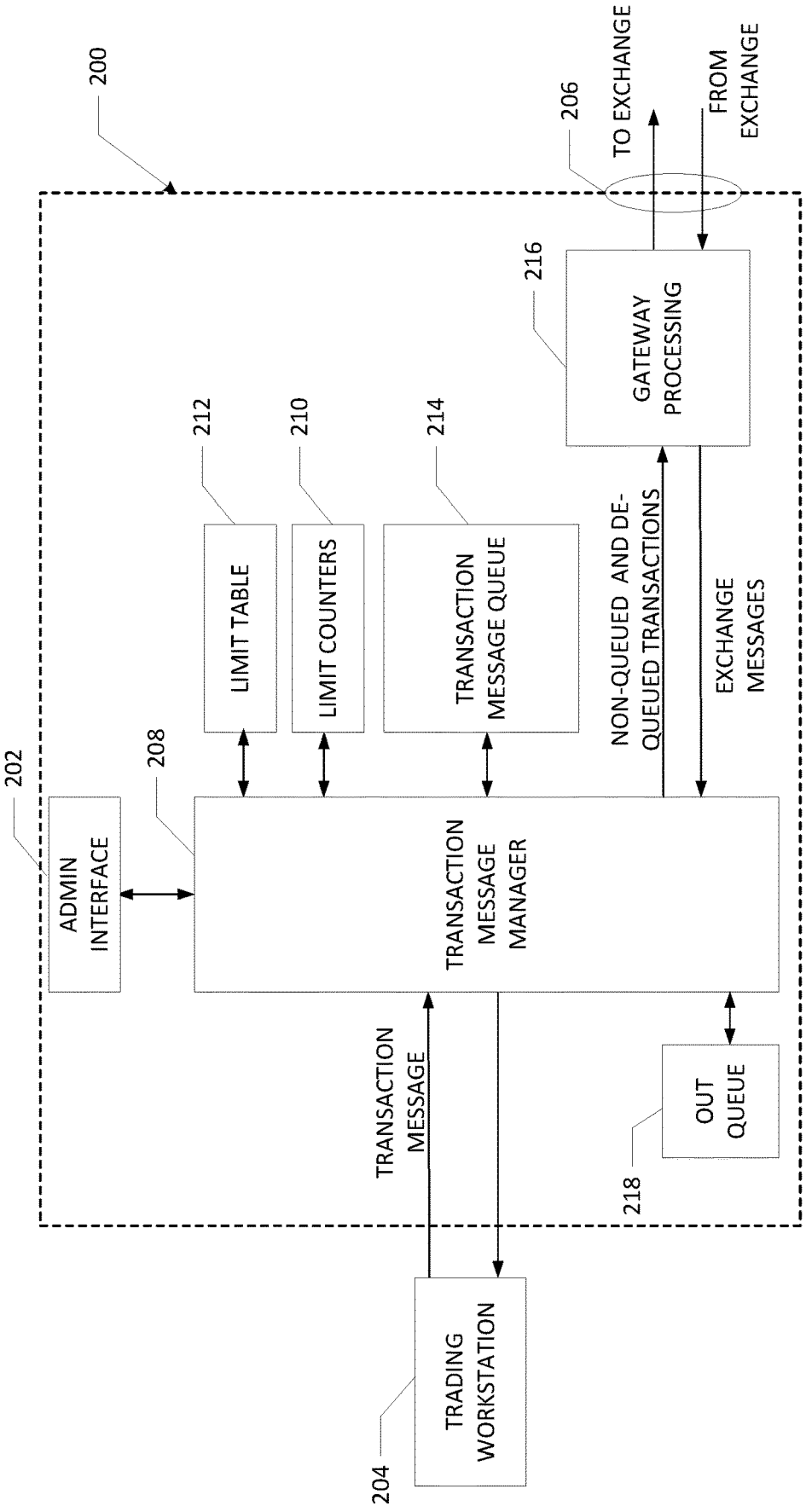

200
206
TO EXCHANGE
FROM EXCHANGE
216
GATEWAY PROCESSING
212
210
214
LIMIT TABLE
LIMIT COUNTERS
TRANSACTION MESSAGE QUEUE
NON-QUEUED AND DE-QUEUED TRANSACTIONS
EXCHANGE MESSAGES
202
208
ADMIN INTERFACE
TRANSACTION MESSAGE MANAGER
TRANSACTION MESSAGE
OUT QUEUE
218
204
TRADING WORKSTATION

Figure 2

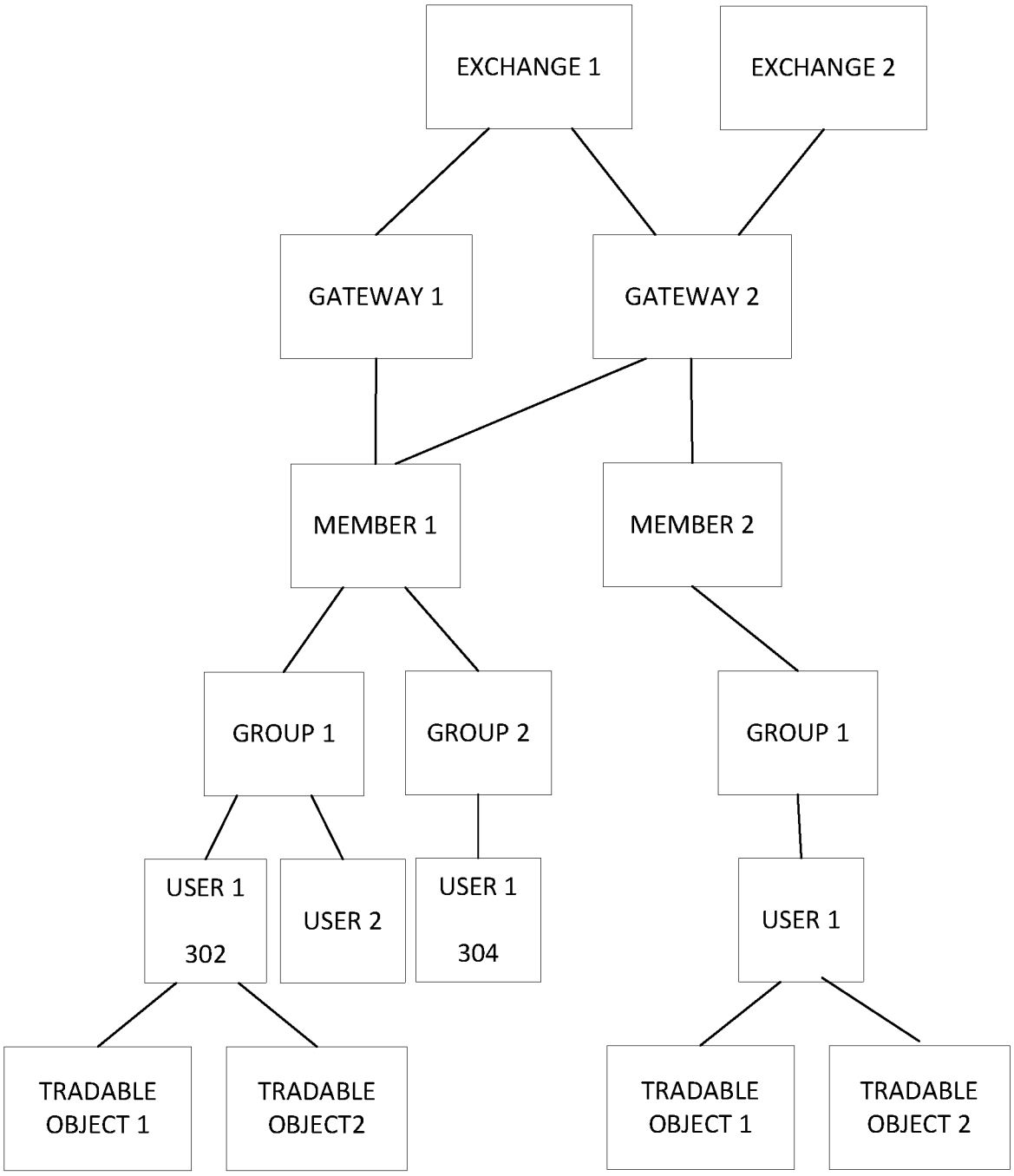

EXCHANGE 1
EXCHANGE 2
GATEWAY 1
GATEWAY 2
MEMBER 1
MEMBER 2
GROUP 1
GROUP 2
GROUP 1
USER 1
302
USER 2
USER 1
304
USER 1
TRADABLE OBJECT 1
TRADABLE OBJECT2
TRADABLE OBJECT 1
TRADABLE OBJECT 2

Figure 3

EXCHANGE: EXCH-1 ADDRESS 172.17.19.11 STATUS: ACTIVE												
MEMBER	GROUP	TRADER	OBJ. TYPE	TRDBL OBJ.	GATEWAY LIMIT	MBR LIMIT	GROUP LIMIT	TRDR LIMIT	GW T/O	MBR T/O	TRDR FLOOR	TRDR FACTOR
TTMBR	GRP-1	TRD			15	5		1	6			
TT-TST	GRP-1	OO1			15			5	6			
TTMBR	GRP-2	TRD			15	5		2	6	2		
TTSIM	SIM	OO1	FUTURE	FDAX	15	10	8	6	6	5	200	10
TTSIM	SIM	OO1	FUTURE	FESX	15	10	8	6	6	5	100	5
TTSIM	SIM	OO1	FUTURE	FGBL	15	10	8	6	6	5	100	5
TTSIM	SIM	OO2			15	10	8	3	6	5		
TTSIM	SMA	OO1			15	10	6	4	6	5		
TTSIM	SMO	OO1			15	10		7	6	5		
TTTRN					15	5			6			

Figure 4A

400

GATEWAY STATUS								
EXCHANGE	IP ADDRESS	CURRENT QUEUED	TOTAL QUEUED	MAX QUEUED	CURRENT IN-FLIGHT	TOTAL TRANS	MAX IN-FLIGHT	IN FLIGHT ALARM
EXCH-1	172.17.19.11	0	5	1	0	127	5	2
EXCH-2	172.18.20.11	1	3	2	1	89	5	2

Figure 4B

TRADER STATUS										
EXCHANGE	IP ADDRESS	MEMBER	GROUP	TRADER	CURRENT QUEUED	TOTAL QUEUED	MAX QUEUE	CURRENT IN-FLIGHT	TOTAL TRANS	MAX IN-FLIGHT
EXCH 1	172.17.19.11	TTSIM	SIM	OO1	0	0	0	0	0	0
EXCH 1	172.17.19.11	TTMBR	GRP-1	TRD	0	6	2	2	72	5
EXCH 2	172.18.20.11	TT-CME	GRP-1	TRD1	0	0	0	0	12	3

Figure 4C

TRADABLE OBJECT STATUS										
EXCHANGE	IP ADDRESS	MEMBER	GROUP	TRADER	OBJECT TYPE	TRDBL OBJECT	TOTAL FILLS	TOTAL RATIO	TRDR TRANS	TRDR FILLS
EXCHANGE 1	172.17.19.11	TTSIM	SIM	OO1	FUTURE	FDAX	0	0	0	0
EXCHANGE 1	172.17.19.11	TTSIM	SMA	OO1	FUTURE	FESX	0	0	0	0
EXCHANGE 2	172.18.20.11	TT-CME	GRP-1	TRD1	FUTURE	FGBL	0	0	0	0

Figure 4D

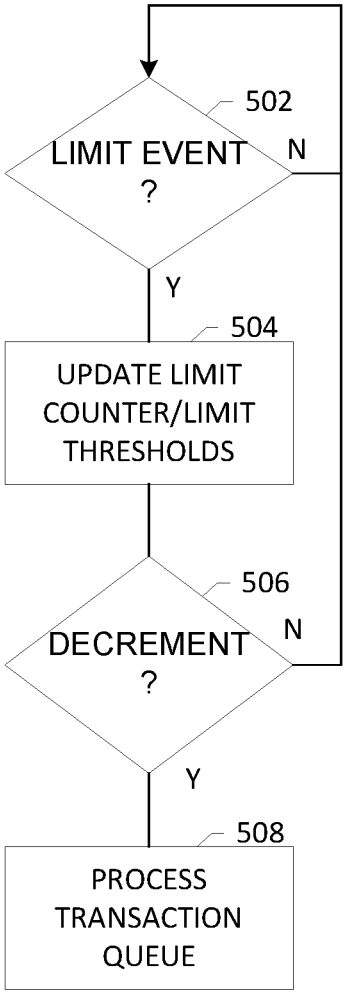

502
LIMIT EVENT ?
N
Y
504
UPDATE LIMIT COUNTER/LIMIT THRESHOLDS
506
DECREMENT ?
N
Y
508
PROCESS TRANSACTION QUEUE

Figure 5

METHOD AND APPARATUS FOR MESSAGE FLOW AND TRANSACTION QUEUE MANAGEMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 16/691,121, filed Nov. 21, 2019, which is a continuation of U.S. patent application Ser. No. 16/152,915, filed Oct. 5, 2018, now U.S. Pat. No. 10,540,719, which is a continuation of U.S. patent application Ser. No. 14/460,337, filed Aug. 14, 2014, now U.S. Pat. No. 10,134,089, which is a continuation of U.S. patent application Ser. No. 14/056,463, filed Oct. 17, 2013, now U.S. Pat. No. 8,839,269, which is a continuation of U.S. patent application Ser. No. 11/417,513, filed May 3, 2006, now U.S. Pat. No. 8,589,948, which is a continuation of U.S. patent application Ser. No. 10/196,056, filed Jul. 15, 2002, now U.S. Pat. No. 7,124,110, entitled "Method and Apparatus for Message Flow and Transaction Queue Management," the contents of each of which are fully incorporated herein by reference for all purposes.

FIELD OF THE INVENTION

[0002] The present invention relates generally to the field of financial systems and financial transaction messaging. More particularly, the present invention relates to a method and apparatus for managing a financial transaction message queue.

BACKGROUND OF THE INVENTION

[0003] At the most general level, a trading entity is any entity with a membership to an exchange, or an entity that shares a membership in some manner. Trading entities may be a trading house, an individual trader, or one or more groups of traders sharing a membership and otherwise sharing certain resources. Generally speaking then, a trading entity may be an individual trader or group of traders that desire to access markets and engage in market transactions via an exchange.

[0004] An electronic exchange typically provides a matching process between traders—buyers and sellers. Typical exchanges are EUREX®, LIFFE®, EURONEXT®, CME®, CBOT®, XETRA® and ISLAND®. Trading entities are typically connected to an electronic exchange by way of a communication link to facilitate electronic messaging between the trading entities and the exchange. The messaging may include orders, quotes (which are essentially two-sided orders), acknowledgements, fills, cancels, deletes, cancel and replace, and other well-known financial transaction messages.

[0005] The communication link may utilize numerous telecommunication technologies, including frame relay, X.25, DS-0, T-1, T-3, DS-3 (45 Mb), multiple DS-3 connections, DSL, cable or analog phone lines. The communications links are preferably provided by tier 1 telecom providers and DS-3 ATM connections. The message format and messaging protocols are specific to the particular exchange, and can utilize any protocol. Many exchanges conform to the TCP/IP protocol suite for the transport and network layers. Typically, the exchange provides a standardized communication interface to which the member may connect a workstation, or more typically, a computer network gateway device, through which a number of users may communicate with the exchange.

[0006] Many exchanges impose limits or restrictions on the communication messages received from their members or member firms. The limits are generally intended to ensure that the exchange computer system is not overburdened, and to dissuade members from submitting excessive or unnecessary messages. Limits may be enforced in various manners. For example, some limits may be enforced by the exchange queuing (or delaying) transaction messages once a limit has been reached. Another example involves an exchange charging fees or penalties for transaction messages once a limit has been reached. For example, the limits may include a cap on the number of "in-flight" transactions. In-flight transactions are those transactions that have been submitted to the exchange for which the exchange has not provided a return confirmation of receipt.

[0007] A further type of limit may be on the number of transactions submitted by a member in a given time period. Orders and quotes indicate a willingness to buy and/or sell, and are often revised and resubmitted by traders to reflect changes in their desired positions. Traders may revise their transactions to reflect even small changes in the market, and when prices in the market move rapidly, this may result in large numbers of transactions being submitted to the exchange. Excessive quoting (which refers to any type of transaction including orders and quotes) can place a burden on the exchange.

[0008] Another type of limit that is often imposed by exchanges is the overall aggregate measure of message traffic as measured in bytes in a given period of time. This is commonly referred to as data transmission rate, or bandwidth usage. This limit may simply be a result of the physical limitation imposed by the particular communication link, or it may be a measured quantity.

[0009] With the increased use of automated trading tools, reaching or exceeding these limits (e.g., five in-flight transactions on the Chicago Mercantile Exchange, or CME®) may occur rather easily. Indeed, the use of such tools can easily over-burden an exchange's message handling capacity. As such, some exchanges require the use of software at gateways that prevents the message traffic from exceeding specified limits. Some exchanges even provide the software utilities for gateways that connect a member to the exchange. Two example consequences of poor transaction messaging resource use are end user experience delay and transaction costs.

[0010] Currently, gateway owners don't have the ability to control how the limited messaging resources are distributed among the various users that share the gateway. Thus, software that limits the message traffic without regard to the individual trading entities that may be sharing the communication link has the potential to result in a single user or group of users tying up most or all communications to an exchange. Thus, there is a need to more precisely control the transaction message traffic in view of the limited resources available.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Exemplary embodiments of the present invention are described with reference to the following drawings, in which:

[0012] FIG. **1** is an example network configuration for a communication system utilized to access one or more exchanges;

[0013] FIG. **2** is a preferred embodiment of a financial transaction message management system;

[0014] FIG. **3** is a preferred embodiment of a hierarchical grouping of traders;

[0015] FIGS. **4**A through **4**D is a preferred embodiment of displaying transaction messaging resource allocations; and

[0016] FIG. **5** is a preferred method of managing financial transaction messages.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0017] A method and system for managing transaction message flow utilizing a transaction message queue is provided. The system and method are for use in financial transaction messaging systems. The system is designed to enable an administrator to monitor, distribute, control and receive alerts on the use and status of limited network and exchange resources. The system preferably runs on a communication gateway between users' trading workstations and a communications interface to a trading exchange (e.g., CBOT®, CME®, EUREX®, etc.). The gateway may reside on the trading workstations, or it may be located on a separate physical device on a computer network. Similarly, a single physical device may provide more than one instantiation of a gateway. The system to tracks message flow and system usage parameters to ensure the amount of message traffic does not exceed predetermined message thresholds.

[0018] The preferred embodiments are directed to a system and method for use in financial transaction messaging systems, particularly with respect to transaction messages. The term "transaction messages" refers to any number of different types of messages, including orders, quotes, acknowledgements, fills, cancels, deletes, cancel and replace, and other well-known financial transaction messages. The system is preferably configured to manage any and all transaction messages. The system preferably acts to throttle transaction message flow from different traders based on various limits. Thus, in one preferred embodiment, the system manages transaction messages originating from an automated trading system (which is capable of generating numerous transactions at a high rate) as well as manually generated messages (e.g., specific order or quote messages resulting from direct user interaction with a trading software interface).

[0019] In alternative embodiments, the system may be used to regulate only those messages generated by an automated trading program operating on a trading workstation, and manually generated messages will not be subject to the limit thresholds, and such messages will not be queued in the transaction message queue of a present embodiment (the message may still be queued in the exchange queue). The term workstation as used herein can include any computing device, including a personal computer, a handheld device, etc. Preferably the system is configurable so the administrator can select whether or not to exempt manually generated transactions.

[0020] FIG. **1** shows an example system for managing transaction message flow. Generally, the system, as shown, includes trading houses **102-106** that are connected to exchanges **118-124** through one or more gateways **108-116**. Each trading house **102-106** has one or more trading workstations. For example, trading house **102** can have up to N workstations, whereas trading houses **104** and **106** can support up to M and L workstations, respectively (where N, M and L can be any number). Although not shown for clarity, individual traders or one or more groups of traders may also be included in the system, in which each trader or group of traders would connect to the exchange in a similar fashion as the trading houses.

[0021] The system shows two possible configurations, although any number of configurations is possible. In one configuration, trading house **102** is connected to gateway **108** that communicates with exchanges **118-122** through gateways **112-116**. The assignee of the present application sells one such gateway, referred to as TT Relay™, that connects to multiple gateways. Additionally, trading house **102** communicates with exchange **124** through gateway **110**. According to this configuration, the trading house **102** communicates with the exchange through more than one gateway. Of course, more network devices such as routers may exist along the path between the trading house **102** and exchanges **118-124**. In another configuration, trading houses **104**, **106** are connected to exchange **124** through gateway **110**. According to this second configuration, the trading house communicates with the exchange through one gateway.

[0022] As with the first configuration, more network devices may exist along the path between the trading houses and exchanges. It should also be understood that there are many possible variations beside the system shown in the Figure. For example, gateway **110** may connect with gateways **112-116** so that trading houses **104**, **106** can connect with exchanges **118-122**. Moreover, the gateway(s) may reside on the trading workstations, or it may be located on a separate physical device on a computer network. Similarly, a single physical device may provide more than one instantiation of a gateway.

[0023] One or more groups of traders may exist within each trading house. The number or type of groups may depend on the trading house itself. For example, sometimes when a trading house divides its traders into one or more groups, it may be done for organizational reasons, or any other reason the house may have. Traders may be grouped in additional ways such as by their workstations, the tradable objects that they trade, or even by the trading house. There are many ways to group the traders, from an exchange perspective or a trading house perspective, in a hierarchical manner. Based on the hierarchical manner, which can be programmed in any way, the system tracks message flow and system usage parameters to ensure the amount of message traffic does not exceed predetermined message thresholds.

[0024] Traders and related objects are preferably grouped in a hierarchical manner, including a user level and group level, as well as possible additional levels such as tradable object, software tool or application, account, membership, and gateway levels. Each level can have one or more elements. In one embodiment, these elements could include particular members, particular trader groups, particular traders (identified by trader IDs), particular accounts, particular tradable objects, particular types of tradable objects, particular classes of tradable objects, and particular software trading applications. An "entity" may be defined as including a single element, a single level or any combination of elements or levels from the hierarchical structure. The transaction message thresholds may be specified for any

entity to ensure that transmission of a given transaction does not exceed the number of messages permitted.

[0025] Limits for any entity may include, but are not limited to, such things as the number of transaction messages per second (e.g., using a "sliding window" to count messages transmitted with the last second), the total number of transaction messages for the day, the number of transactions that are "in-flight" (transactions submitted to an exchange that have not yet been acknowledged by the exchange), the number of data bytes per second or the total number of bytes for the day. Limits may be selected so as to divide limited resources in a controlled fashion in order to increase productivity and profits. Each user is preferably categorized to belong to various entities. Thus, each user preferably has its own set of parameters that make up its limit use profile, and the profile parameters correspond to multiple entities or levels. The thresholds may be set manually by an administrator, or may be automatically set and/or adjusted. Automatic adjustment may be based on the number of fills (e.g., transactions to fills ratio—this may be used to increase the total number of transactions permitted per day), a given user's profit or other measure of success (this may be used to increase any of the limits), a measure of bandwidth utilization or other criteria.

[0026] In the event that transmission of a given transaction message to the exchange would exceed a threshold limit, the message is preferably placed in a transaction message queue until it may be transmitted without exceeding a threshold limit. The system automatically updates the queue when related transaction messages are received from the trading workstation(s), or when other limiting events occur. The transaction message queue may also automatically drop or reject messages if they remain in the queue for a predetermined length of time. The transaction message queue (or other component of the gateway) may further notify a user that a message is going to be, or has been, dropped or rejected.

[0027] The system preferably notifies an administrator (by email or other suitable messaging system, including instant messaging or paging and/or on-screen message) in the event of limits being enforced resulting in queuing of transaction messages. In addition, the system preferably highlights the effected user(s) on the monitor screen.

[0028] With reference to FIG. **2**, a preferred embodiment of the transaction message management system, or gateway **200**, will be described. Gateway **200** is preferably implemented on any one of the gateways illustrated in FIG. **1**. The gateway **200** allows an administrator, via administrator interface **202** to monitor, distribute, control and receive alerts on the use and status of limited network and exchange resources. The gateway **200** acts as a communication gateway between users' trading workstations **204** and a communications interface **206** to a trading exchange (e.g., CBOT®, CME®, EUREX®, etc.).

[0029] The gateway **200** may reside on the same physical computing platform as the trading workstations **204**, or it may be located on a separate physical device on a computer network. The gateway **200** may also be distributed across multiple devices.

[0030] The physical computing device of the gateway **200** may also implement such functions as a router, firewall, or other common network infrastructure component. In addition, a single physical device may provide more than one instantiation of a gateway **200**. The connections to trading workstations may be through a wired or wireless LAN, WAN, or other suitable connection medium.

[0031] There can also be an API (applications programming interface) between the trading workstation **204** and the gateway **200**. The gateway **200** can be any network device disposed in the communication path between trading workstations and an exchange. In addition, the functionality of the gateway **200** may be implemented at an exchange.

[0032] Similarly, the administrator interface may reside on the same physical computing device as the gateway **200**, or may be a remotely located workstation or interface device, including a wired or wireless device.

[0033] The gateway **200** includes a transaction message manager **208** to implement a transaction message transmission policy. The policy sets forth resource utilization limits according to a multiple-level hierarchy. The message manager **208** tracks message flow and system usage parameters according to multi-level identification information using limit counters **210** to ensure the amount of message traffic does not exceed predetermined message thresholds stored in limit table **212**.

[0034] Any messages that would cause a threshold to be exceeded are preferably queued in transaction message queue **214**. The transaction message queue is preferably stored in memory associated with the computing platform. The type of memory used may be any suitable memory, and is not limited to any particular type or structure. DRAM, RAM, FIFO buffers, FILO, etc. The storage mechanism may also take many forms, such as a database format, tables of software pointers, a linked list, a lookup table, etc. Further, the term "queue" refers to any suitable message storage and handling mechanism, and is not limited to a traditional first-in first-out queue. Rather, the stored messages in the queue are managed using the techniques set forth here. When the transaction message manager **208** receives a transaction message, it first checks to see whether it is related to any message that may have been placed in the queue. If the newly received transaction is related to a queued message, the queued message is updated to reflect the new information. A description of the queue management is set forth more fully below.

[0035] When an event occurs that causes any of the limit counters **210** to decrement, the transaction queue **214** is analyzed to determine whether any messages may be transmitted to the exchange. An example event that would cause a limit counter **210** to decrement is the passage of time with respect to a message threshold based on the number of messages allowed over a particular time frame. The transaction message manager will transmit a queued message to the exchange via the gateway processing unit **216** if doing so does not violate the messaging policy. It may also be desirable to queue messages received from the exchange into an out queue **218**. One reason would be to conserve bandwidth between a trading workstation and a gateway. Further details of out queue **218** and aggregation of exchange messages may be found in the commonly assigned U.S. patent application Ser. No. 10/183,845, filed Jun. 26, 2002 in the name of Jens-Uwe Schluetter et al., entitled "System and Method for Coalescing Market Data at a Network Device," Attorney Docket No. 02-453, the contents of which are hereby incorporated by reference.

[0036] With respect to FIG. **3**, a multiple-level user identification hierarchy of a preferred embodiment will be described. Depicted in FIG. **3** are two exchanges, two

gateways, two members, three groups, four users and four tradable objects. As used herein, the term "tradable object" refers simply to anything that can be traded with a quantity and/or price. It includes, but is not limited to, all types of tradable objects such as financial products, which can include, for example, stocks, options, bonds, futures, currency, and warrants, as well as funds, derivatives and collections of the foregoing, and all types of commodities, such as grains, energy, and metals. The tradable object may be "real", such as products that are listed by an exchange for trading, or "synthetic", such as a combination of real products that is created by the user.

[0037] More or fewer levels of user classification may be used, depending on the needs of the members and the dictates of the exchanges. The gateways and the exchanges may be interconnected using a many-to-one, one-to-many relationship. That is, multiple gateways may be connected to a single exchange, and a single gateway may be connected to multiple exchanges. The gateway device preferably monitors and manages all communications with the exchanges, and also serves to perform any message format translation, if necessary.

[0038] Similarly, multiple gateways may connect to a single member, and multiple members may connect to a single gateway. From the member level and below, each level is preferably related in a one-to-many relationship. That is, a single member entity may include one or more groups (and a group belongs to a single member), each group may include one or more users (and a user belongs to a single group), and each user may include one or more tradable objects (and a tradable object belongs to a single user). It should also be noted that limits may be based on classes or types of tradable objects. For example, futures and options are two types of tradable objects. An October 100 IBM call is a tradable object. Options related to IBM is class of tradable objects. Similarly, call options on IBM stock is another class of tradable objects that happens to be a subset of the general class of IBM options. October calls for IBM stock is another class of tradable objects that is a subset of the class of IBM call options.

[0039] Users sharing the same group level are preferably provided access to the transaction messages and trading activity of other users within the group. This may be desirable when a group of traders is working together to achieve a common goal (such as, e.g., hedging investments).

[0040] An individual user may also be subcategorized based on the software tools or applications that are being used. That is, a user (or administrator) may wish to separately monitor the transaction messaging relating to a particular trading application being used (e.g., an automated tool or a manual trading tool). In this particular case an entity may be defined as a single user's activities on a single trading tool. Alternatively, an entity may be defined to include all users or a subset of users that use the particular trading application.

[0041] As shown in FIG. **3**, users are preferably grouped in a hierarchical manner, or tree structure, meaning that each user is uniquely identified by multiple identification parameters (preferably at least two) or entity parameters, specifying which entities they belong to, with the possibility that certain users share one or more identification parameters at a given entity level in the hierarchy. For example, USER 1 **302**, is identified by the 4-tuple: USER 1, GROUP 1, MEMBER 1, and GATEWAY 1. In contrast, USER 1 **304** is identified by the 4-tuple USER 1, GROUP 2, MEMBER 1, and GATEWAY 1. Note also that each of USER **302**, **304** may alternately be identified as being part of GATEWAY 2. Preferably, a user is designated as belonging to a specific gateway.

[0042] The identification levels depicted in FIG. **3** are one embodiment of an example identification hierarchy. Alternative embodiments may utilize more or fewer levels. For example, one embodiment may use only the user level. Another embodiment using only a single gateway may utilize only the user and tradable object levels. Additional levels such as account or software application may also be used. Furthermore, a user may be identified by a single unique name or number that may be translated, or mapped, into a corresponding unique multiple-level name designation. In one respect, this allows for more simplified messaging, in that the transaction messages from the trading stations **204** to the gateway **200** need not include all of the identification names or parameters in the hierarchy.

[0043] In a preferred embodiment, an administrator may select users, groups, or any other entity, and create a new entity containing the desired sets or subsets of pre-existing entities. This newly created entity may then be monitored and/or limited accordingly. In this way, the manner of providing a hierarchical arrangement of entities is flexible.

[0044] The gateway transaction message transmission policy is preferably implemented by ensuring the number or frequency of transaction messages transmitted to an exchange does not exceed message thresholds. The transaction message thresholds may be specified for each entity to ensure that transmission of a given transaction does not exceed the number of messages permitted for the entity. Limits for any particular entity may include such things as the number of messages per second (e.g., using a "sliding window" to count messages transmitted with the last second), the total number of transaction messages for the day, the number of transactions that are "in-flight" (transactions submitted to an exchange that have not yet been acknowledged by the exchange), the number of data bytes per second or the total number of bytes for the day. Numerous other types of limits may also be used, and the above are merely representative examples of useful limits.

[0045] With respect to FIGS. **4**A-D, one embodiment of a graphical user interface (GUI) used for allocating the messaging resources is depicted. In table **400**, all the entities associated with an exchange are displayed. Data fields are provided for an administrator to enter limit values (or formulas) based on the various entities. In FIG. **4**A, the entities are identified by Member, Group, Trader, Tradable Object Type, and Tradable Object. The levels at which the entities may be limited are Gateway, Member, Group, and Trader. As can be seen in FIG. **4**A, the "Member" entity contains four members: TTMBR, TT-TST, TTSIM, and TTTRN. In this embodiment, when an administrator types a value into any cell in the "MBR LIMIT" column, this value automatically propagates to all cells in that column corresponding to the same member value. Thus, for example, typing a "10" into the cell for any user belonging to the TTSIM Member entity will result in all the users belonging to the TTSIM Member entity to have a limit of 10 in-flight transactions. Similarly, in-flight limits may be specified for the entire gateway in the GATEWAY LIMIT column, and group and trader limits may be specified for individual traders in the TRDR LIMIT and GROUP LIMIT columns,

respectively. Note that the trader identified as Trader 001 (trader entity), SIM (Group entity) and TTSIM (Membership entity) is listed three times, once for each of three separate tradable objects. These entries may correspond to three separate individuals, or may actually be the same person trading three separate tradable objects. In one preferred embodiment of FIG. **4**A, the specified TRDR LIMIT applies to the cumulative messages for all product types, or it may act as a limit only to that tradable object, such that the trader's effective limit is the cumulative amount of all listed types and/or tradable objects. However, a further preferred embodiment would allow the limits for a given trader to be set at the trader level, and apply separate, non-cumulative limits at the product type and tradable object levels.

[0046] A provision for timeouts is also provided at the Gateway (GW T/O) and Member (MBR T/O) levels. Preferably, the time increment is specified in seconds. If a message has remained in the queue for the timeout period, the transaction message is preferably deleted from the queue, and the user is notified that the message has been deleted from the queue.

[0047] The TRDR FLOOR (Trader Floor) parameter indicates the number of transactions that are permitted without payment of additional fees. The TRDR FACTOR (Trader Factor) indicates the number of additional transactions that are permitted per fill. In a preferred embodiment, the Trader Floor and Trading Factor are used to dynamically configure the total transaction message limit for an entity. In a preferred embodiment, the total number of transactions is determined by either the Trader Floor parameter, or the Trading Factor multiplied by the number of fills, whichever is greater. In an alternative embodiment, the total number of transactions may equal the Trader floor parameter plus the Trader Factor times the number of fills. In other embodiments, alternative factors may be selected by an administrator, and combined in an appropriate manner. In the embodiment shown in FIG. **4**A, the trader floor and factor levels are applied only to the tradable objects level of the transaction messages.

[0048] In one preferred embodiment, exceeding the total transaction limit will not result in the queuing of transaction messages. Rather, the trading entity or administrator is notified that the limit has been exceeded, and that further transaction messages may result in a fee.

[0049] FIGS. **4**B-**4**D depict an example gateway status screen, a Trader status screen, and a Tradable Object status screen, respectively. The gateway screen of FIG. **4**B preferably lists all gateways utilized in the system. The system preferably displays the number of transactions that are currently queued, the total number of messages that have been queued since the system was reset, the maximum number of messages queued at any given time, the current number of transactions in-flight, the total number of transaction messages sent since the system was last reset, the maximum number of messages that were in flight at a given time, and the number of in-flight messages that will result in an alarm (visual or audible, preferably to the administrator).

[0050] The screens of FIGS. **4**C and **4**D preferably contain any entity selected by an administrator. The entities may be selected from the exchange screen of FIG. **4**A. Alternatively, entities may be automatically selected for display based on various criteria, which are preferably configurable by an administrator. For example, any entities that approach or exceed limits may be displayed, or any particularly active entities that do not presently have limits set may be displayed.

[0051] FIG. **4**C displays the statistics for a selected trader. Specifically, the information displayed is the number of currently queued messages, the total number of messages that have been queued, the maximum number of messages queued at any given time, the current number of in-flight messages, and the maximum number of in-flight messages. FIG. **4**D presents information including the type of object and the tradable object. The statistics include the total number of fills, the total fill ratio, the number of trader transactions and the number of trader fills.

[0052] FIGS. **4**A-**4**D are one embodiment of the display and limit screens. These are presented herein as examples, and the screens and the particular information being shown may change depending on what limits are being followed, and other criteria determined by the intended use of the gateway system.

[0053] With respect to FIG. **5**, a preferred embodiment of managing financial transaction messages will be described. At block **502**, the gateway **200** program determines whether a limiting event has occurred. If no limiting event occurs, the system waits for such an event. A limiting event may be any event that the system has been configured to track. For example, limiting events including transaction message transmissions, transaction message receipts, time lapses, etc. For in-flight transactions, a limiting event may include the transmission of a transaction to the exchange (causing an increment, or count up, to the number of in-flight transactions for the user), or the receipt of an order acknowledgement from the exchange (resulting in the appropriate counter being decremented, or counted down).

[0054] For limits relating to transactions per second (or other suitable time period), the relevant user counter is incremented when a transaction message is transmitted, and decremented as time lapses. Similarly, for data byte transmission rates, counters are increased based on transmissions, and decremented as time lapses. Preferably, the time-based counters are checked at a set time interval to determine whether a decrement should occur, thus the limiting event may be a timing signal. The time period may be configurable, and for example, may be in the 100's of milliseconds, but other values may be used. The selection of the time interval may be determined based on the overall system load, including the number of users be serviced, as well as other factors.

[0055] Further limit events may include the receipt of fills. That is, a system may be configured to adjust the total number of transactions permitted based on the number of fills.

[0056] At block **504**, the appropriate counters are updated, or if appropriate, the limit threshold values may be revised. The counters include, but are not limited to, those for tracking total transaction messages and total byte transmission, transaction message transmission rates, data transmission rates, and in-flight transactions for any entity. Of course, each limiting event will typically result in the adjustment of counters at the various levels corresponding to the user's hierarchical designation or assignment, such as the user's group, account, gateway, or whatever entity applies, and which also may include counters for levels below the user, such as tradable object. As stated above, certain thresholds may also be adjusted.

[0057] At block **506**, if any of the counters are decremented (or alternatively, if any thresholds are increased), then control is passed to block **508** to determine whether any queued messages may be transmitted. As discussed above, a worst-case logic is preferably utilized, which requires all applicable counts to be below the relevant thresholds before a queued transaction message is de-queued and sent to the exchange. If the counters are only incremented, then a further limiting event is awaited at block **502**.

[0058] In the event that transmission of a given message to the exchange would exceed a threshold limit, the message is preferably placed in a transaction message queue until it may be transmitted without exceeding a threshold limit. The system automatically updates the queue when related messages are received from the trading workstation(s). The transaction message queue may also automatically drop messages if they remain in the queue for a predetermined (but configurable) length of time.

[0059] The system preferably notifies an administrator in the event of limits being enforced, resulting in queuing of transaction messages. The notification method is preferably configurable, and may include notification by email, instant messaging, paging, an on-screen message, or other suitable messaging system. In addition, the system preferably highlights the effected user(s) on the monitor screen so the administrator may easily identify the user. Whenever a user reaches a limit a notification is also preferably sent to the user's terminal.

[0060] Preferably, at any time the administrator may manually adjust any of the parameters to any of the entities at any level either before or after a limit is reached. This adjustment can preferably be done on the fly. A user is preferably notified whenever the user's limits are adjusted.

[0061] The transaction message manager **208** preferably maintains three sets of limit parameters in limit table **212**: Default, Permanent, and Temporary. Any changes that are made are considered Temporary and will apply until the end of the current run (unless modified). At any time the administrator can save the current setting as the Permanent setting or restore either the Permanent setting or the Default setting. On invocation, the utility will use the Permanent setting. If a Permanent setting has not been saved then Default setting will be used.

[0062] When limit parameters are changed, they may be applied to queued messages, or they may be applied forward in time (such that they will not be used for transactions that are already in the message queue **214**). Alternatively, the new limits may be applied to the queued messages. Whether the changes apply to queued messages may also be configurable by the administrator. The administrator is also able to set the parameter limits based on formulas to facilitate automatic limit adjustments. The formulas, which if present make up part of the transaction message transmission policy, may take into account logged users (by name and/or by number), exchange response times, network utilization, gateway utilization, other limits, status of other users, any measurement that is being monitored, combinations of limits, etc.

[0063] The system can be used with any formulas desired by the administrator. The gateway system **200** may provide predetermined formulas, but may also provide an interface to create new formulas. Still other embodiments have intelligence to automatically calculate and change the parameters. For example, parameters may be automatically increased or decreased to allow greater throughput if the system detects that the gateway's data lines to an exchange or that the exchange itself can support a greater number of messages. This detection can be done by various techniques known to those of ordinary skill in the art including by using pinging techniques or by querying routers regarding data line capacity.

[0064] As a result of reaching a limit, a user's requested transaction might have to be held in transaction message queue **214**. When this occurs the user is preferably notified that the transaction status is Queued. The user will preferably be able to remove queued transaction by submitting a "Remove queued" transaction.

[0065] To ensure that very stale orders are not sent to the market place, each user preferably has a transaction timeout parameter that identifies the maximum amount of time that an order can wait in queue before it is rejected due to timeout. The timeout parameter preferably does not apply to delete order transactions. It may be preferable to delete an order late as compared to never, but the same may not be true for new or changed orders. In case the entity submits a second transaction related to a transaction in the queue then the following logic is applied in one embodiment to determine which transaction stays in the transaction message queue **214**:

[0066] The first delete for the transaction preferably stays in the queue and will preferably never be replaced. This avoids duplicate delete transactions. All subsequent related transactions will be rejected indicating that a delete is already in queue.

[0067] A new change transaction will preferably replace an older change or cancel/replace transaction and be placed at the location of the older transaction in the queue. The older transaction will be rejected and the trader will preferably be notified.

[0068] A new cancel/replace transaction will preferably replace an older change or cancel/replace transaction and will be placed at the end of the queue.

[0069] A "truth table" for a preferred embodiment of the invention for queuing a transaction in the message transaction queue **214** is shown in Table 1. This logic is preferably used whenever a limit is reached or if there is a transaction from the same entity in queue.

TABLE 1

	Old Trans.		
New Trans.	None	Delete	All other transactions
Add	Append new transaction to queue.	N/A	
Delete		New transaction	Old transaction replaced in queue by new transaction.
Change			

TABLE 1-continued

	Old Trans.		
New Trans.	None	Delete	All other transactions
Cancel/Replace		rejected.	Old transaction removed, new appended to queue.
Remove queued	User option	Old transaction removed from queue.	
Timeout	N/A	No action.	Old transaction rejected due to timeout.

[0070] In Table 1, a New transaction (as specified in the first column of Table 1) refers to the transaction that is being processed, and an Old transaction (as specified in the first row of Table 1) refers to a related queued transaction. Thus, the treatment of a newly received transaction depends on whether any related transaction is already present in the queue. For example, with respect to the second row of Table 1, if the New transaction is an "Add" message (where Add refers to the first transaction related to a particular order), to it will be appended to the queue if there is no prior (Old) related transaction. Additionally, because there should not be any "Delete" messages or any "other type" of messages that relate to a New "Add", Table 1 indicates that such a scenario is not applicable (N/A in Table 1).

[0071] If the New transaction is a "Delete" message, the queue management actions are indicated by the third row of Table 1. Specifically, a Delete message will be appended to the queue if there is no related message; it will be rejected if a prior related Delete message is already in the queue; and for any other type of related prior message, the new Delete message will replace the prior message in the queue. A new "Change" message will be handled in a manner similar to a new Delete. Likewise, a Cancel/Replace will be handled similarly, with the exception that if the related prior message is "any other type", then the Old transaction is removed and the new Cancel/Replace message will be appended to the queue (rather than taking the Old transaction's place within the queue).

[0072] Furthermore, as illustrated in Table 1, when the New transaction is a "Remove queued" and no related transaction message is in fact in the queue, then the user has the option (as specified by "User option" in Table 1) to either send a delete to the exchange or to have the "Remove queued" transaction rejected. Finally, the last row of Table 1 indicates that when a timeout occurs, the Old transaction is removed from the queue.

[0073] The administrator may modify the above rules, but it is preferred to maintain no more then one related transaction in the transaction message queue **214**. Related transactions are transactions related to the same particular order, for example a buy order for a tradable object is related to a delete request for all or a part of that buy order. Preferably, each order has an identification parameter in its messages. In such an embodiment, two transactions are related if they have the same identifier. Preferably, the invention is configurable so that any type of transaction can or cannot be exempted from the queuing. Some example types of transactions include market orders, limit orders, stop orders, tradeouts (where a trader is trading out of all of his open positions), deletes, etc.

[0074] Furthermore, the gateway system is not limited to any particular message format. The system may be adapted for use with any messaging format having unique packet structures, various data fields, etc, including order identifier parameters, etc. Once the format of the packets is determined, then one of skill in the art may retrieve the necessary information to implement the message management system.

[0075] Since each entity has limits at each level and these limits can be different a "worst case" logic is preferably used for limit checking. That is, as soon as a limit is reached at any level, transactions will start queuing for all of the entities within that branch of the tree hierarchy.

[0076] An Example of an "In" queue in action is shown in Table 2, wherein a limit is set to 5 transactions per 1000 ms. For timing purposes, all transactions are considered to have occured at 0 time into the millisecond. All transactions are from same "entity". The letter in the Transaction and Action columns represents a transaction identifier. To "de-queue" a message means to take a transaction out of the queue and process it (send it to the exchange).

TABLE 2

Time	Transaction	Counter	Action	Reason
0	Submit A	0 → 1	To Exchange	Below limit, queue empty
107	Submit B	1 → 2	To Exchange	Below limit, queue empty
214	Submit C	2 → 3	To Exchange	Below limit, queue empty
290	Submit D	3 → 4	To Exchange	Below limit, queue empty
400	Submit E	4 → 5	To Exchange	Below limit, queue empty
401	Submit F	5	Queue F	Limit reached
550	Submit G	5	Queue G	Limit reached
633	Change A (called A1)	5	Queue A1	Limit reached
650	Submit H	5	Queue H	Limit reached
750	Delete A (called A2)	5	Queue A2 in place of A1	Limit reached, truth table
775	Delete A (called A3)	5	Reject A3	Limit reached, truth table
1000	Counter reduced	4 → 5	De-queue F	Below limit
1033	Submit I	5	Queue I	Limit reached
1107	Submit J & Counter reduced	4 → 5	Queue J, de-queue G	Transaction from same entity in queue, Below limit

TABLE 2-continued

Time	Transaction	Counter	Action	Reason
1214	Counter reduced	4 → 5	De-queue A2	Below limit
1290	Counter reduced	4 → 5	De-queue H	Below limit
1400	Counter reduced	4 → 5	De-queue I	Below limit
2000	Counter reduced	4 → 5	De-queue J	Below limit
2107	Counter reduced	4	None	Queue is empty
2108	Submit K	4 → 5	To Exchange	Below limit, queue empty
2214	Counter reduced	4	None	Queue is empty
2290	Counter reduced	3	None	Queue is empty
2400	Counter reduced	2	None	Queue is empty
3000	Counter reduced	1	None	Queue is empty
3107	Counter reduced	0	None	Queue is empty

[0077] In alternative embodiments, other variations are provided. In one embodiment, added granularity is provided to enable different settings based on: transaction type, software application, tradable object, current P/L (profit/loss), Fills per sec, etc. In a further embodiment, the transactions may be prioritized in the queue based on factors such as: user, type, user associated parameters, or any of the items used for "added granularity" above. A further embodiment includes the ability to set or change limits based on historical results (previous half of day, yesterday, last week, etc.).

[0078] In the above description those skilled in the art will recognize that circuit elements in block diagrams and boundaries between logic blocks are merely illustrative and that alternative embodiments may merge logic blocks or functional elements or impose an alternate decomposition of functionality upon various logic blocks or elements. For example, the gateway processing may be performed prior to the transaction message queuing. Numerous other examples will be apparent to those of skill in the art.

[0079] While the invention has been described in connection with a number of exemplary embodiments, the foregoing is not intended to limit the scope of the invention to a particular form, circuit arrangement, or semiconductor topology. To the contrary, the invention is intended to be defined only by the appended claims and to include such alternatives, modifications and variations as may be apparent to those skilled in the art upon reading the foregoing detailed description.

1. (canceled)

2. A computer readable medium having stored therein instructions executable by a processor, including instructions executable to:

determine, by a processor of a gateway, that a first limit for transmitting transaction messages from a first entity to an exchange over a communication link between the gateway and the exchange has been reached, wherein the first entity is one of a plurality of entities divided into one or more groups, wherein each entity in the plurality of entities is associated with a user, a tradeable object, and at least one limit, wherein the first entity is associated with the first limit, wherein the first limit is a number of transactions per second;

receive, by the processor of the gateway, a first transaction message after determining that the first limit has been reached, wherein the first transaction message is of a first type, is from the first entity, and includes a first transaction identification parameter;

determine, by the processor of the gateway, that the first limit associated with the first entity would be exceeded by transmitting the first transaction message to the exchange over the communication link;

determine, by the processor of the gateway, that a second transaction message in a transaction message queue is related to the first transaction message, wherein the second transaction message is of a second type, is from the first entity, and includes a second transaction identification parameter, wherein the second transaction message is determined to be related to the first transaction message based on the first transaction identification parameter and the second transaction identification parameter being the same; and

update, by the processor of the gateway, the transaction message queue based on the first type of the first transaction message and the second type of the related second transaction message.

3. The computer readable medium of claim **2**, wherein the first type of the first transaction message is one of the group of a delete message, a change message, and a cancel/replace message, wherein the second type of the second transaction message is a delete message, wherein the transaction message queue is updated by rejecting the first transaction message.

4. The computer readable medium of claim **2**, wherein the first type of the first transaction message is a delete message, wherein the second type of the second transaction message is one of the group of an add message, a change message, and a cancel/replace message, wherein the transaction message queue is updated by replacing the second transaction message with the first transaction message.

5. The computer readable medium of claim **2**, wherein the first type of the first transaction message is a change message, wherein the second type of the second transaction message is one of the group of an add message, a change message, and a cancel/replace message, wherein the transaction message queue is updated by replacing the second transaction message with the first transaction message.

6. The computer readable medium of claim **2**, wherein the first type of the first transaction message is a cancel/replace message, wherein the second type of the second transaction message is one of the group of an add message, a change message, and a cancel/replace message, wherein the transaction message queue is updated by removing the second transaction message and appending the first transaction message.

7. The computer readable medium of claim **2**, wherein the first type of the first transaction message is a remove queued message, wherein the second type of the second transaction message is one of the group of an add message, a delete message, a change message, and a cancel/replace message,

wherein the transaction message queue is updated by removing the second transaction message.

8. The computer readable medium of claim **2**, wherein the first type of the first transaction message is a timeout message, wherein the transaction message queue is updated by rejecting the second transaction message in response to determining the second type of the second transaction message is not a delete message.

9. The computer readable medium of claim **2**, wherein the first entity is associated with a second limit.

10. The computer readable medium of claim **2**, wherein the first entity is associated with a second limit, wherein the second limit is a total number of transaction messages for a day.

11. The computer readable medium of claim **2**, wherein the first entity is associated with a second limit, wherein the second limit is a bandwidth usage limitation.

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