

Tailored Messaging

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the priority benefit of U.S. Patent Application No. 14/329,602, filed July 11, 2014, and entitled “Tailored Messaging,” and claims the priority benefit of U.S. Provisional Patent Application No. 61/845,613, filed July 12, 2013, and entitled “System and Method for Dynamically Distributing Market Data Across Multiple Devices in an Electronic Trading Environment,” and claims the priority benefit of U.S. Provisional Patent Application No. 62/022,736, filed July 10, 2014, and entitled “System and Method for Dynamically Distributing Market Data Across Multiple Devices in an Electronic Trading Environment.” The contents of each of the foregoing applications are herein fully incorporated by reference in their entirety for all purposes.

BACKGROUND

[0002] Electronic devices may exchange data messages to provide up-to-date information regarding, for example, the state of a device. In some systems, multiple recipients are interested in receiving updates from a data source. Techniques such as broadcast or multicast messaging may be used by the data source to provide these updates in certain types of networks. In other systems, some recipients may communicate with the data source using point-to-point connections because of, for example, network limitations, communication preferences (e.g., reliable delivery, ordering, etc.), and/or security requirements.

[0003] Some recipients may prefer to receive updates from the same data source at different rates. Providing updates at different rates while minimizing sending undesired messages to recipients limits the usefulness of broadcast or multicast messaging techniques and, as the number of recipients with different update rate preferences increases, point-to-point connections become more effective. However, with point-to-point connections, a message must be generated for each recipient. Additionally, some recipients may prefer to receive different levels or tiers of data in their updates. Customizing messages based on different levels or tiers of data requires generating different messages for each level or tier of data. As the number of recipients with different preferences grows, accommodating different update rates and different levels or tiers of data becomes cumbersome, especially for time-sensitive information where increased latency in receiving the data is not acceptable.

SUMMARY

[0003a] According to a first aspect of the present invention, there is provided a method of providing customized information updates to recipients based on recipient preferences, the method including: generating, by a computing device, a first snapshot message representing a state of a data source at a first time; sending, by the computing device, the first snapshot message to a first recipient and to a second recipient; generating, by the computing device, a first update message representing a difference between a state of the data source at a second time and the state of the data source at the first time; generating by the computing device a second update message representing a difference between a state of the data source at a third time and the state of the data source at the first time, wherein the first time, the second time and the third time correspond to intervals of a base update rate; and using update rate preferences set by the first recipient and second recipient, sending update messages to the first recipient and the second recipient, the update rate preferences being different for the first recipient and the second recipient, such that the sending of update messages to the first recipient and the second recipient comprises: sending, by the computing device, the first update message to the first recipient; sending, by the computing device, the second update message to the first recipient; and sending, by the computing device, only the second update message to the second recipient.

[0003b] According to a second aspect of the present invention, there is provided a tangible computer readable medium comprising instructions which, when executed, cause a machine to carry out the method as defined in the first aspect.

[0003c] According to a third aspect of the present invention, there is provided system for providing customized information updates based on recipient preferences, the system including: a data formatter arranged to: generate a first snapshot message representing a state of a data source at a first time, generate a first update message representing a difference between a state of the data source at a second time and the state of the data source at the first time, generate a second update message representing a difference between a state of the data source at a third time and the state of the data source at the first time, wherein the first time, the second time and the third time correspond to intervals of a base update rate; and a message sender arranged to: send the first snapshot message to a first recipient and to a second recipient using update rate preferences set by the first recipient and second recipient, the update rate preferences being different for the first recipient and the second recipient, such that the message sender is arranged to, send the first update message to the first recipient; send the second update message to the first recipient; and send only the second update message to the second recipient.

[0003d] There is provided a method including: generating, by a computing device, a first snapshot message representing a state of a data source at a first time, wherein the first snapshot message is organized into a plurality of data levels, each data level representing a price level for a tradeable object and a corresponding quantity available at the price level; sending, by the computing device, the first snapshot message to a first recipient; generating, by the computing device, a first deltasnap message representing a difference in a state of the data source at a second time and the state of the data source at the first time, wherein the first deltasnap message is organized into the plurality of data levels; sending, by the computing device, the first deltasnap message to the first recipient; generating by the computing device a second deltasnap message representing a difference in a state of the data source at a third time and the state of the data source at the first time, wherein the second deltasnap message is organized into the plurality of data levels; and sending by the computing device the second deltasnap message to the first recipient.

[0003e] There is also provided a computer readable medium comprising instructions which, when executed, cause a machine to at least: generate a first snapshot message representing a state of a data source at a first time, wherein the first snapshot message is organized into a plurality of data levels, each data level representing a price level for a tradeable object and a corresponding quantity available at the price level; send the first snapshot message to a first recipient; generate a first deltasnap message representing a difference in a state of the data source at a second time and the state of the data source at the first time, wherein the first deltasnap message is organized into the plurality of data levels; send the first deltasnap message to the first recipient; generate a second deltasnap message representing a difference in a state of the data source at a third time and the state of the data source at the first time, wherein the second deltasnap message is organized into the plurality of data levels; and send the second deltasnap message to the first recipient.

[0003f] There is also provided a system including: a data formatter to: generate a first snapshot message representing a state of a data source at a first time, wherein the first snapshot message is organized into a plurality of data levels, each data level representing a price level for a tradeable object and a corresponding quantity available at the price level, and generate a first deltasnap message representing a difference in a state of the data source at a second time and the state of the data source at the first time, wherein the first deltasnap message is organized into the plurality of data levels; generate a second deltasnap message representing a difference in a state of the data source at a third time and the state of the data source at the first time, wherein the second deltasnap message is organized into the plurality of data levels; and a message sender to: send the first snapshot message to a first recipient, send the first deltasnap message to the first recipient, and send the second deltasnap message to the first recipient.

[0003g] There is also provided a method including: sending, by a computing device, a first snapshot message to a first recipient, the first snapshot message representing a state of a data source at a first time; sending, by the computing device, the first snapshot message to a second recipient; sending, by the computing device, a first deltasnap message to the first recipient, the first deltasnap message representing a difference in a state of the data source at a second time and the state of the data source at the first time; sending, by the computing device, a second deltasnap message to the first recipient, the second deltasnap message representing a difference in a state of the data source at a third time and the state of the data source at the first time; and sending, by the computing device, the second deltasnap message to the second recipient.

[0003h] There is also provided a computer readable medium comprising instructions which, when executed, cause a machine to at least: send a first snapshot message to a first recipient, the first snapshot message representing a state of a data source at a first time; send the first snapshot message to a second recipient; send a first deltasnap message to the first recipient, the first deltasnap message representing a difference in a state of the data source at a second time and the state of the data source at the first time; send a second deltasnap message to the first recipient, the second deltasnap message representing a difference in a state of the data source at a third time and the state of the data source at the first time; and send the second deltasnap message to the second recipient.

[0003i] There is also provided a computing device comprising: a processor; and memory storing computer readable instructions which, when executed by the processor, configure the processor to: send a first snapshot message to a first recipient, the first snapshot message representing a state of a data source at a first time; send the first snapshot message to a second recipient; send a first deltasnap message to the first recipient, the first deltasnap message representing a difference in a state of the data source at a second time and the state of the data source at the first time; send a second deltasnap message to the first recipient, the second deltasnap message representing a difference in a state of the data source at a third time and the state of the data source at the first time; and send the second deltasnap message to the second recipient.

[0003j] There is provided a method including storing, by a computing device, a snapshot message in a first buffer; sending, by the computing device, a first snapshot message from the first buffer to a first recipient; and sending, by the computing device, a second snapshot message from the first buffer to a second recipient; storing, by the computer device, a deltasnap message in a second buffer; sending, by the computing device, a first deltasnap

message from the second buffer to the first recipient; and sending, by the computing device, a second deltasnap message from the second buffer to the second recipient.

[0003k] There is also provided a computer readable medium comprising instructions which, when executed, cause a machine to at least: store a snapshot message in a first buffer; send a first snapshot message from the first buffer to a first recipient; and send a second snapshot message from the first buffer to a second recipient; store a deltasnap message in a second buffer; send a first deltasnap message from the second buffer to the first recipient; and send a second deltasnap message from the second buffer to the second recipient.

[0003l] There is also provided a system including: a data formatter to: store a snapshot message in a first buffer; store a deltasnap message in a second buffer; and a message sender to: send a first snapshot message from the first buffer to a first recipient; send a second snapshot message from the first buffer to a second recipient; send a first deltasnap message from the second buffer to the first recipient; and send a second deltasnap message from the second buffer to the second recipient.

[0003m] There is also provided a method including: generating, by a computing device, a first snapshot representative of a first set of data captured at a first time; sending, by the computing device, a first version of the first snapshot to a first subscribing device, the first version of the first snapshot tailored according to a first preference of the first subscribing device; generating, by the computing device, a first deltasnap representative of a difference between the first set of data and a second set of data, the second set of data representing data generated at a second time after the first time; and sending, by the computing device, a first version of the first deltasnap to the first subscribing device, the first version of the first deltasnap tailored according to the first preference of the first subscribing device.

[0003n] There is also provided a computer readable medium comprising instructions which, when executed, cause a machine to at least: generate a first snapshot representative of a first set of data captured at a first time; send a first version of the first snapshot to a first subscribing device, the first version of the first snapshot tailored according to a first preference of the first subscribing device; generate a first deltasnap representative of a difference between the first set of data and a second set of data, the second set of data representing data generated at a second time after the first time; and send a first version of the first deltasnap to the first subscribing device, the first version of the first deltasnap tailored according to the first preference of the first subscribing device.

[000o]There is also provided a computing device comprising: a processor; and memory storing computer readable instructions which, when executed by the processor, configure the processor to: generate a first snapshot representative of a first set of data captured at a first time; send a first version of the first snapshot to a first subscribing device, the first version of the first snapshot tailored according to a first preference of the first subscribing device; generate a first deltasnap representative of a difference between the first set of data and a second set of data, the second set of data representing data generated at a second time after the first time; and send a first version of the first deltasnap to the first subscribing device, the first version of the first deltasnap tailored according to the first preference of the first subscribing device.

[0003p]There is also provided a method including: generating, by a computing device, a first snapshot representative of a first state of a dataset at a first time; sending, by the computing device, the first snapshot to a first subscribing device and a second subscribing device; generating, by the computing device, a plurality of deltasnaps, each of the plurality of deltasnaps representing a difference between the first state of the dataset at the first time and a subsequent state of the dataset at a time subsequent to the first time; based on a first update rate, sending, by the computing device, a first portion of the plurality of deltasnaps to the first subscribing device; and based on a second update rate, sending, by the computing device, a second portion of the plurality of deltasnaps to the second subscribing device.

[0003q]There is also provided a computer readable medium comprising instructions which, when executed, cause a machine to at least: generate a first snapshot representative of a first state of a dataset at a first time; send the first snapshot to a first subscribing device and a second subscribing device; generate a plurality of deltasnaps, each of the plurality of deltasnaps representing a difference between the first state of the dataset at the first time and a subsequent state of the dataset at a time subsequent to the first time; based on a first update rate, send a first portion of the plurality of deltasnaps to the first subscribing device; and based on a second update rate, send a second portion of the plurality of deltasnaps to the second subscribing device.

[0003r]There is also provided a computing device comprising: a processor; and memory storing computer readable instructions which, when executed by the processor, configure the processor to: generate a first snapshot representative of a first state of a dataset at a first time; send the first snapshot to a first subscribing device and a second subscribing device; generate

a plurality of deltasnap, each of the plurality of deltasnap representing a difference between the first state of the dataset at the first time and a subsequent state of the dataset at a time subsequent to the first time; based on a first update rate, send a first portion of the plurality of deltasnap to the first subscribing device; and based on a second update rate, send a second portion of the plurality of deltasnap to the second subscribing device.

[0003s]There is also provided a method comprising: generating, by a computing device, a first snapshot message representing a state of data and sending the first snapshot message to one or more recipients; and after generating the first snapshot message, periodically generating, by the computing device, deltasnap messages representing a change in the data represented in the first snapshot message and sending at least a portion of the deltasnap messages to one or more of the recipients.

[0003t]There is also provided a computer readable medium comprising instructions which, when executed, cause a machine to at least: generate a first snapshot message representing a state of data and send the first snapshot message to one or more recipients; and after generating the first snapshot message, periodically generate deltasnap messages representing a change in the data represented in the first snapshot message and send at least a portion of the deltasnap messages to one or more of the recipients.

[0003u]There is also provided a computing device comprising: a processor; and memory storing computer readable instructions which, when executed by the processor, configure the processor to: generate a first snapshot message representing a state of data and send the first snapshot message to one or more recipients; and after generating the first snapshot message, periodically generate deltasnap messages representing a change in the data represented in the first snapshot message and send at least a portion of the deltasnap messages to one or more of the recipients.

[0003v]There is also provided a method comprising: receiving, at a trading device, a first snapshot message, the first snapshot message representing a state of a data source at a first time; receiving, at the trading device, a first deltasnap message, the first deltasnap message representing a difference in a state of the data source at a second time and the state of the data source at the first time; based on the first deltasnap message and the first snapshot message, reconstructing at least a portion of the state of the data source at the second time; receiving, at the trading device, a second deltasnap message, the second deltasnap message representing a difference in a state of the data source at a third time and the state of the data source at the first time; and based on the second

deltasnap message and the first snapshot message, reconstructing at least a portion of the state of the data source at the third time.

[0003w] There is also provided a computer readable medium comprising instructions which, when executed, cause a machine to at least: receive, at a trading device, a first snapshot message, the first snapshot message representing a state of a data source at a first time; receive, at the trading device, a first deltasnap message, the first deltasnap message representing a difference in a state of the data source at a second time and the state of the data source at the first time; based on the first deltasnap message and the first snapshot message, reconstruct at least a portion of the state of the data source at the second time; receive, at the trading device, a second deltasnap message, the second deltasnap message representing a difference in a state of the data source at a third time and the state of the data source at the first time; and based on the second deltasnap message and the first snapshot message, reconstruct at least a portion of the state of the data source at the third time.

[0003x] There is also provided a computing device comprising: a processor; and memory storing computer readable instructions which, when executed by the processor, configure the processor to: receive, at a trading device, a first snapshot message, the first snapshot message representing a state of a data source at a first time; receive, at the trading device, a first deltasnap message, the first deltasnap message representing a difference in a state of the data source at a second time and the state of the data source at the first time; based on the first deltasnap message and the first snapshot message, reconstruct at least a portion of the state of the data source at the second time; receive, at the trading device, a second deltasnap message, the second deltasnap message representing a difference in a state of the data source at a third time and the state of the data source at the first time; and based on the second deltasnap message and the first snapshot message, reconstruct at least a portion of the state of the data source at the third time.

[0003y] There is also provided a data distribution method comprising: configuring, by a data formatter, a buffer in a memory to store data in a plurality of partitionable data levels, the plurality of partitionable data levels being organized in descending levels of interest; and sending, by a data sender, to at least one of a plurality of subscriber devices, from the buffer, a first message comprising a first requested data level and all data levels having a level of interest that is greater than or equal to the level of interest of the first requested data level.

[0003z] There is also provided a computer readable medium comprising instructions which, when executed, cause a machine to at least: configure a buffer in a memory to store data in a plurality of partitionable data levels, the plurality of partitionable data levels being organized in descending levels of interest; and send to at least one of a plurality of subscriber devices, from the buffer, a first message comprising a first requested data level and all data levels having a level of interest that is greater than or equal to the level of interest of the first requested data level.

[0003aa] There is also provided a data distribution system for distributing data to a plurality of subscriber devices, the data distribution system comprising: a memory; a data formatter to configure a buffer in the memory to store data in a plurality of partitionable data levels, the plurality of partitionable data levels being organized in descending levels of interest; and a data sender to send to at least one of the subscriber devices, from the buffer, a first message comprising a first requested data level and all data levels having a level of interest that is greater than or equal to the level of interest of the first requested data level.

[0003ab] There is also provided a method including: generating, by a computing device, a first snapshot message representing a state of a data source at a first time; sending, by the computing device, the first snapshot message to a first recipient; generating, by the computing device, a first update message representing a difference in a state of the data source at a second time and the state of the data source at the first time; sending, by the computing device, the first update message to the first recipient; generating by the computing device a second update message representing a difference in a state of the data source at a third time and the state of the data source at the first time; and sending, by the computing device, the second update message to the first recipient.

[0003ac] There is also provided a computer readable medium comprising instructions which, when executed, cause a machine to at least: generate a first snapshot message representing a state of a data source at a first time; send the first snapshot message to a first recipient; generate a first update message representing a difference in a state of the data source at a second time and the state of the data source at the first time; send the first update message to the first recipient; generate a second update message representing a difference in a state of the data source at a third time and the state of the data source at the first time; and send the second update message to the first recipient.

[0003ad] There is also provided a system including: a data formatter arranged to: generate a first snapshot message representing a state of a data source at a first time, generate a first update message representing a difference in a state of the data source at a second time and the state of the data source at the first time, generate a second update message representing a

difference in a state of the data source at a third time and the state of the data source at the first time; and a message sender arranged to: send the first snapshot message to a first recipient, send the first update message to the first recipient; and send the second update message to the first recipient.

CLAIMS

1. A method of providing customized information updates to recipients based on recipient preferences, the method including:

generating, by a computing device, a first snapshot message representing a state of a data source at a first time;

sending, by the computing device, the first snapshot message to a first recipient and to a second recipient;

generating, by the computing device, a first update message representing a difference between a state of the data source at a second time and the state of the data source at the first time;

generating by the computing device a second update message representing a difference between a state of the data source at a third time and the state of the data source at the first time,

wherein the first time, the second time and the third time correspond to intervals of a base update rate; and

using update rate preferences set by the first recipient and second recipient, sending update messages to the first recipient and the second recipient, the update rate preferences being different for the first recipient and the second recipient, such that the sending of update messages to the first recipient and the second recipient comprises:

sending, by the computing device, the first update message to the first recipient;

sending, by the computing device, the second update message to the first recipient; and

sending, by the computing device, only the second update message to the second recipient.

2. The method of claim 1, wherein the first update message includes one or more actions instructing the first recipient to modify the first snapshot message to reflect the state of the data source at the second time.

3. The method of claims 1 or 2, wherein the first snapshot message is organized into a plurality of data levels, each data level specifying a level of detail of the data provided from the data source.

4. The method of claim 3, wherein the plurality of data levels are organized in descending order according to the frequency with which they are requested.
5. The method of claims 3 or 4, wherein the first update message is organized into the plurality of data levels, the first update message including one or more actions for each of the respective data levels, the actions instructing the first recipient to modify the respective data level to reflect the state of the data source at the second time.
6. The method of any of claims 1 to 5, further including:
before sending the first update message to the first recipient, determining, by the computer device, that a difference between the second time and the first time is greater than an update interval specified by the update rate preference set by the first recipient.
7. The method of any of claims 1 to 6, wherein:
generating the first snapshot message further includes organizing the state of the data source at the first time into a plurality of first data levels, each data level specifying a level of detail of the data from the data source; and
generating the first update message further includes:
organizing the state of the data source at the second time into a plurality of second data levels;
determining a difference between the first data levels and the second data levels; and
generating one or more actions to be included in the first update message, the action being based on the difference between the first data levels and the second data levels.
8. The method of claim 7, wherein the actions instruct the first recipient to modify one or more first data levels to reflect the state of the data source at the second time.
9. The method of claims 7 or 8, wherein the first data level represents data from a data source that is more frequently requested than data represented by the second data level.

10. The method of claim 9, wherein the first snapshot message sent to the first recipient includes the first data level, and the first snapshot message sent to the second recipient includes the first and second data levels.

11. The method of any of claims 1 to 10, further comprising:

- generating, by a computing device, the first snapshot message to be stored in a first buffer;

- sending, by the computing device, the first snapshot message from the first buffer to the first recipient;

- sending, by the computing device, the first snapshot message from the first buffer to the second recipient;

- generating, by the computer device, the first update message to be stored in a second buffer;

- sending, by the computing device, the first update message from the second buffer to the first recipient;

- generating, by the computer device, the second update message to be stored in the second buffer;

- sending, by the computing device, the second update message from the second buffer to the first recipient;

- sending, by the computing device, the second update message from the second buffer to the second recipient.

12. The method of claim 11, wherein the second update message sent to the first recipient is a first portion of the second update message in the second buffer, and the second update message sent to the second recipient is a second portion of the second update message in the second buffer.

13. The method of claims 11 or 12, further including generating a first partition table in the first buffer at a location after that corresponding to the first snapshot message in the first buffer, the first partition table being configured to indicate a first partitionable location of the snapshot message and a second partitionable location of the snapshot message.

14. The method of claim 13, wherein the first snapshot message sent to the first recipient includes the snapshot message up to the first partitionable location, and the second snapshot

message sent to the second recipient includes the snapshot message up to the second partitionable location.

15. A tangible computer readable medium comprising instructions which, when executed, cause a machine to carry out the method of any of claims 1 to 14.

16. A system for providing customized information updates based on recipient preferences, the system including:

- a data formatter arranged to:

- generate a first snapshot message representing a state of a data source at a first time,

- generate a first update message representing a difference between a state of the data source at a second time and the state of the data source at the first time,

- generate a second update message representing a difference between a state of the data source at a third time and the state of the data source at the first time,

- wherein the first time, the second time and the third time correspond to intervals of a base update rate; and

- a message sender arranged to:

- send the first snapshot message to a first recipient and to a second recipient using update rate preferences set by the first recipient and second recipient, the update rate preferences being different for the first recipient and the second recipient, such that the message sender is arranged to,

- send the first update message to the first recipient;

- send the second update message to the first recipient; and

- send only the second update message to the second recipient.

17. The system of claim 16, wherein the first update message includes one or more actions instructing the first recipient to modify the first snapshot message to reflect the state of the data source at the second time.

18. The system of claims 16 or 17, wherein the first snapshot message is organized into a plurality of data levels, each data level specifying a level of detail of the data provided from the data source.

19. The system of claim 18, wherein the plurality of data levels are organized in descending order according to the frequency with which they are requested.

20. The system of claims 18 or 19, wherein the first update message is organized into the plurality of data levels, the first update message including one or more actions for each of the respective data levels, the actions instructing the first recipient to modify the respective data level to reflect the state of the data source at the second time.

21. The system of any of claims 16 to 20, wherein the message sender is arranged to, before the first update message is sent to the first recipient, determine that a difference between the second time and the first time is greater than an update interval specified by the first recipient.

22. The system of any of claims 16 to 21, wherein, in generating the first snapshot message, the data formatter is further arranged to:

- organize the state of the data source at the first time into a plurality of first data levels, each data level specifying a level of detail of the data from the data source;

- organize the state of the data source at the second time into a plurality of second data levels;

- determine a difference between the first data levels and the second data levels; and

- generate one or more actions to be included in the first update message, the action being based on the difference between the first data levels and the second data levels.

23. The system according to any of claims 16 to 22, wherein:

- the data formatter is arranged to store the first snapshot message in a first buffer;

- the message sender is arranged to send the first snapshot message from the first buffer to the first recipient and to the second recipient;

- the data formatter is arranged to store the first update message in a second buffer;

- the message sender is arranged to send the first update message from the second buffer to the first recipient;

- the data formatter is arranged to store the second update message in the second buffer;

- the message sender is arranged to send the second update message from the second buffer to the first recipient and to the second recipient.