

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.

[0002a] 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

[0003] According to an aspect of the present invention, 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.

[0003a] According to another aspect of the present invention, there is 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.

[0003b] According to another aspect of the present invention, there is 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.

[0003c] 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.

[0003d] 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.

[0003e] 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.

[0003f] 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.

[0003g] 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.

[0003h] 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.

[0003i] 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.

[0003j] 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.

[0003k] 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.

[0003l] 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.

[0003m] 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.

[0003n] 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 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.

[0003o] 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.

[0003p] 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.

[0003q] 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.

[0003r] According to another aspect of the present invention, there is 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.

[0003s] 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.

[0003t] 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.

[0003u] 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.

[0003v] 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.

[0003w] 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.

[0003x] 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.

[0003y] 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.

[0003z] 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.

What is claimed is:

1. 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.
2. The method of claim 1, wherein the first deltasnap 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 claim 1 or 2, wherein the plurality of data levels are organized in descending order of interest.
4. The method of any one of the preceding claims, wherein the first deltasnap 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.

5. The method of any one of the preceding claims, further including:
before sending the first deltasnap message to the first recipient, determining, by the computer device, whether a difference between the second time and the first time is greater than an update interval specified by the first recipient; and
if the difference between the second time and the first time is greater than the update interval, sending, by the computing device, the first deltasnap message to the first recipient.
6. The method of any one of the preceding claims, wherein the data source is a market for the tradeable object and the first recipient is a first electronic trading device.
7. 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.
8. The computer readable medium of claim 7, wherein the first deltasnap message is to include 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.

9. The computer readable medium of claim 7 or 8, wherein the plurality of data levels are organized in descending order of interest.

10. The computer readable medium of any one of claims 7 to 9, wherein the first deltasnap message including one or more actions for each of the respective data levels, the actions to instruct the first recipient to modify the respective data level to reflect the state of the data source at the second time.

11. The computer readable medium of any one of claims 7 to 10, wherein the instructions further cause the machine to at least:

before the first deltasnap message is sent to the first recipient, determine whether a difference between the second time and the first time is greater than an update interval specified by the first recipient; and

if the difference between the second time and the first time is greater than the update interval, send the first deltasnap message to the first recipient.

12. The computer readable medium of any one of claims 7 to 11, wherein the data source is a market for the tradeable object and the first recipient is a first trading device.

13. 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.

14. The system of claim 13, wherein the first deltasnap message is to include 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.

15. The system of claim 13 or 14, wherein the plurality of data levels are organized in descending order of interest.

16. The system of any one of claims 13 to 15, wherein the first deltasnap message is organized into the plurality of data levels, the first deltasnap message including one or more actions for each of the respective data levels, the actions to instruct the first recipient to modify the respective data level to reflect the state of the data source at the second time.

17. The system of any one of claims 13 to 16, wherein the message sender is to, before the first deltasnap message is sent to the first recipient, determine whether a difference between the second time and the first time is greater than an update interval specified by the first recipient, and if the difference between the second time and the first time is greater than the update interval, send the first deltasnap message to the first recipient.

18. The system of any one of claims 13 to 17, wherein the data source is a market for the tradeable object and the first recipient is a first trading device.