TMX QuantumFeed

Service Access Guide

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Chapter 1 Introduction

This document is a high-level guide that defines the TMX QuantumFeed™ service.

TMX QuantumFeed is a suite of low-latency data feeds from Toronto Stock Exchange, TSX Venture Exchange, TMX Select, and Alpha. These feeds are delivered in a fixed-length message format with ASCII and binary fields. The feed is disseminated using the TMX eXtreme Message Transfer (XMT) Protocol, which is a generic, high-efficiency protocol providing low latency in delivering market data information. The feeds are delivered to the clients on multicast channels, and optional gap recovery is provided on point-to-point TCP/IP channels.

The TMX QuantumFeed suite is comprised of the products and services defined in Chapter 7 of this document.

For acronyms and definitions used throughout this document, refer to Appendix B7.2Appendix B.

1.1 Intended audience

The intended audience of this specification consists of business analysts and programmer analysts.

1.2 Scope

This document contains details of the TMX QuantumFeed service including:

- Accessing QuantumFeeds
- Processing QuantumFeeds
- Optionally, recovering missed messages in the feed
- Available QuantumFeed products

1.3 Related documents

Feed customers implementing systems to receive and process TMX QuantumFeed products must read the following documents:

- *TMX QuantumFeed Service Access Guide* (this document) – Contains the high-level guide to the QuantumFeed service.
- *TMX eXtreme Message Transfer Protocol Specification* – Contains the details of the messaging protocol on which QuantumFeed is implemented.

Depending on the feed product for which the system is being developed, feed customers must familiarize themselves with one or more of the following documents:

- *TSX and TSX Venture QuantumFeed Level 2 Business Message Specification* – Contains Business message content and definitions for the Level 2 QuantumFeed for Toronto Stock Exchange and TSX Venture Exchange.
- *TSX and TSX Venture QuantumFeed Level 1 Business Message Specification* – Contain Business message content and definitions for the Level 1 QuantumFeed.
- *TMX Select QuantumFeed Level 2 Business Message Specification* – Contains Business message content and definitions for the Level 2 QuantumFeed for TMX Select.
- *TMX Select QuantumFeed Level 1 Business Message Specification.* – Contains Business message content and definitions for the Level 1 QuantumFeed for TMX Select.
- *Alpha QuantumFeed Level 2 Business Message Specification* – Contains Business message content and definitions for the Level 2 QuantumFeed for Alpha
- *Alpha QuantumFeed Level 1 Business Message Specification.* – Contains Business message content and definitions for the Level 1 QuantumFeed for Alpha

Chapter 2 Receiving QuantumFeeds

Real-time QuantumFeed products are delivered on multicast channels. Feed clients must listen to the multicast address to read the feed data. Optionally, if feed clients need to recover any missed messages or gaps, they should follow the recovery access process described in Chapter 5.

2.1 Feed delivery on multicast groups

QuantumFeeds are disseminated on multicast channels. A feed may or may not be partitioned. If a feed is not partitioned, then two instances (Feed Instance 1 and Feed Instance 2) of the feed are provided on separate multicast channels. If a feed is partitioned, then two instances of each feed partition are provided on separate multicast channels.

2.1.1 Feed naming convention

Names of QuantumFeed services follow the format *TQLx, VQLx, SQLx*, and *AQLx*

- **T** indicates that the feed is from TSX.
- **V** indicates that the feed is from TSX Venture.
- **S** indicates that the feed is from TMX Select.
- **A** indicates that the feed is from Alpha.
- **QLx** (where x = 1 or 2) stands for Level 1 QuantumFeed or Level 2 QuantumFeed.

TSX QuantumFeeds may be disseminated on one or more partitions. To obtain the complete feed, the client must read at least one instance of all the partitions for the given feed type.

A feed disseminated on a particular multicast channel can be uniquely identified by the Feed Service, Feed Partition and Feed Instance. The naming convention of the feeds is Feed Name = Feed Service-Feed PartitionFeed Instance.

- The Feed Partition is a two-digit number.
- The Feed Instance is a single letter.

For example:

- The TQL1 feed has two partitions with two instances each, called: TQL1-11A, TQL1-11B, TQL1-21A, and TQL1-21B. To receive the complete feed, the client must subscribe to at least one of TQL1-11A or TQL1-11B and one of TQL1-21A or TQL1-21B.
- The VQL2 feed has one partition and two instances, VQL2-11A and VQL2-11B.

When referring to QuantumFeeds generically, this document uses QLx instead of using TQLx, VQLx, SQLx or AQLx

2.1.2 Disseminating partitioned feeds

Figure 1 and Figure 2 show feed dissemination for feeds with one partition and two partitions.

Figure 1: Feed dissemination, one partition

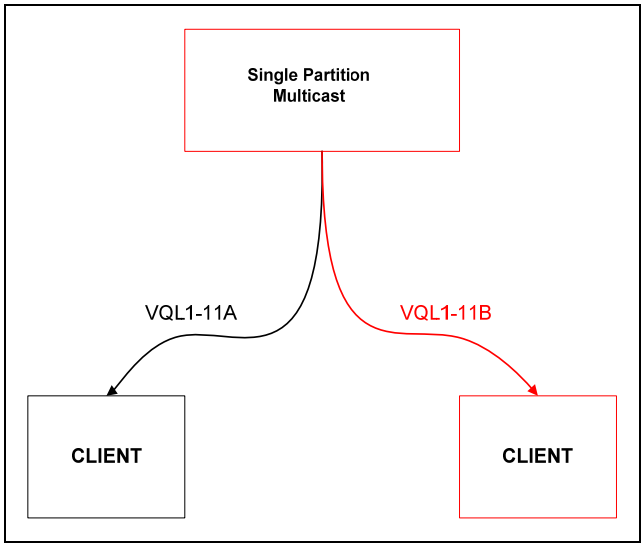
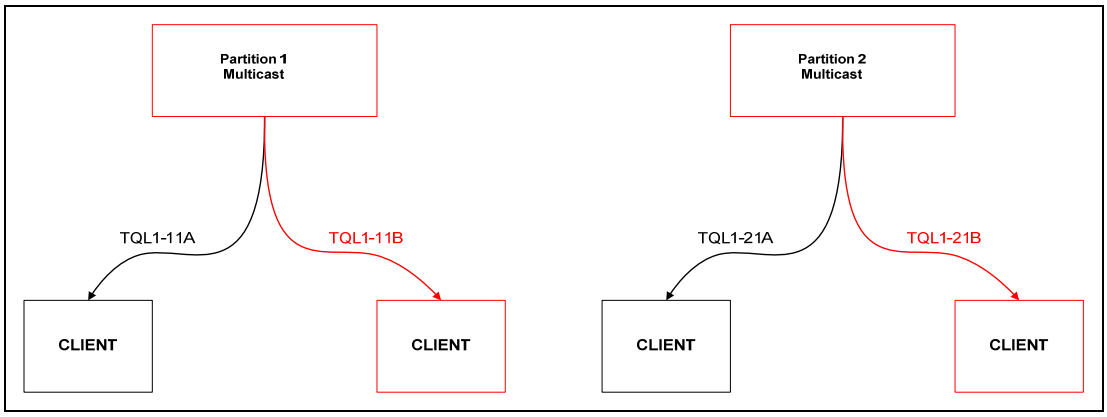


Figure 2: Feed dissemination, two partitions



Note: To obtain the complete feed, the client must read at least one instance of all the partitioned feeds for the given feed type.

2.1.3 Additional information during a disaster situation

If an unexpected system failure occurs at the TMX side, and if a switch to DR mode is required, only the first instance of each feed will be provided. The developers of the feed clients must design the system to factor in the unexpected outage of the second instances of each feed. Figure 3 and Figure 4 depict the scenario during a DR mode.

Figure 3: Single partition feed dissemination (DR mode)

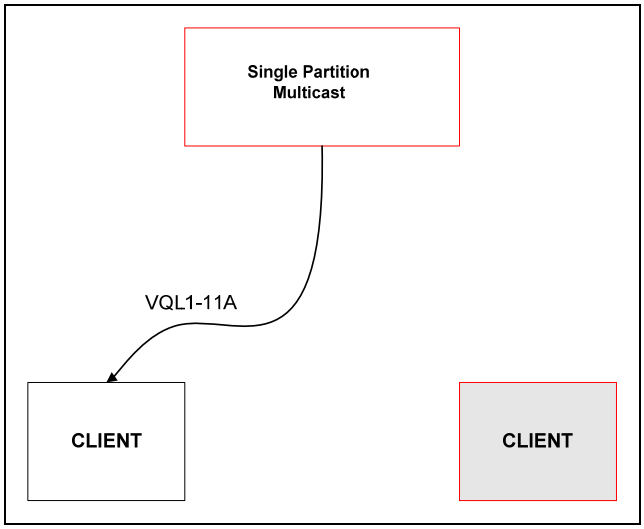
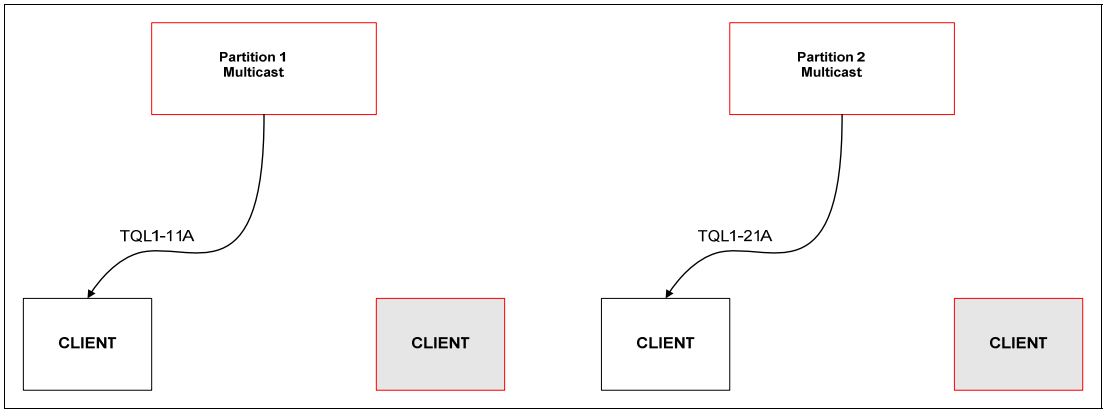


Figure 4: Two partition feed dissemination (DR mode)



2.2 Joining a multicast group

Multicast IP address and port numbers for each of the feed instances will be provided to the clients. The clients can join the multicast groups using this information.

The clients connect to a multicast group by a process called “joining” the multicast group. Once joined to a multicast group, the client can read the feed messages that are disseminated on that group.

2.3 Maintaining feed reception

Once joined to the multicast group, the feed clients can receive the feed messages. During periods of inactivity, the QuantumFeed server sends a Heartbeat message every 30 seconds. If there is an inactive period of more than one minute without the receipt of the Heartbeat message, the feed client should leave the multicast group and try to join the group again.

2.4 Leaving a multicast group

To terminate reception of data, a subscribing client must leave the multicast group. If a client terminates without issuing a message to leave, the network will issue a time-out for the multicast group subscription and terminate the delivery of multicast data to the client.

Chapter 3 QuantumFeed Messages

QuantumFeed messages are delivered using the TMX eXtreme Message Transfer (XMT) Protocol. For more details on the protocol, refer to the *TMX eXtreme Message Transfer Protocol Specification*.

This section contains details on QuantumFeed implementation using the TMX XMT Protocol.

3.1 Message types

At a high level, the QuantumFeed messages can be classified into two types:

- Administrative Messages
- Business messages

Administrative messages are primarily concerned with the mechanics of operating and/or informing about a session. They do not contain business-related information. Such messages include Heartbeat, Login Request, Login Response, Logout, Ack, Replay Request, Sequence Jump, Operation, and Reject messages.

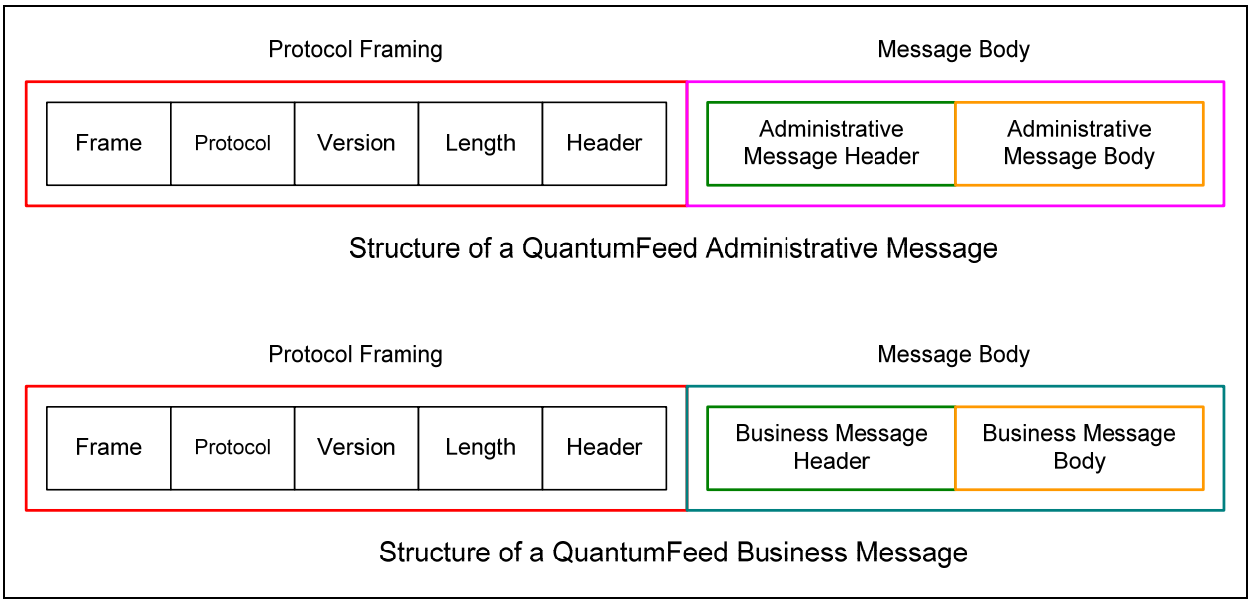
Business Messages contain business-related information.

3.2 Message format

Each QuantumFeed message consists of a message header and a message body.

- The **message header** consists of protocol-level details, including: the frame identifier, protocol version, the message length, message type, and so on.
- The **message body** consists of either an Administrative message header along with an Administrative message body or a Business message header along with Business message body, depending on whether the message is an Administrative message or a Business message. The message structure is illustrated in Figure 5.

Figure 5: Administrative and Business message structure



3.3 Identifying the message type

The message header identifies if the message is an Administrative message or a Business message. If the message is an Administrative message, the message header specifies the type of Administrative message. If the message is a Business message, the Business Message Header contains the type of Business message.

3.4 Administrative message types

Following are the Administrative messages that are valid for the QuantumFeed implementation.

Message Name	Message Type		Description
	HEX	ASCII	
Heartbeat	0x30	0	Heartbeat messages are sent by the QuantumFeed server and the feed client during the idle period to confirm that the session is still alive.
Login Request	0x31	1	This is a client-initiated Administrative message. The Login Request is used to initiate the connection-oriented session between the feed recovery client and the QuantumFeed recovery server.
Login Response	0x32	2	This is a server-initiated Administrative message. A Login Response is sent from the QuantumFeed Recovery server to the feed recovery client as a response to the Login Request. A Login Response message confirms the establishment of a session and also confirms all the negotiable parameters in the Login Request. Any messages that are sent by the feed recovery client before reception of the Login Response are ignored by the Recovery server.
Logout	0x33	3	This is a client-initiated Administrative message. The Logout message is sent by the feed recovery client to notify that it will leave the session. This message is accepted only by the Recovery server after the session is established successfully.
Ack	0x34	4	This is a server-initiated Administrative message. The Ack message is sent by the recovery server as an acknowledgement to the requests made by the feed recovery client
Replay Request	0x35	5	This is a client initiated Administrative message. The Replay Request message is used by the feed recovery client to request a retransmission of previously sent messages. A single replay can specify multiple streams of messages.
Sequence Jump	0x36	6	This is a server-initiated Administrative message. The Sequence Jump message is used to advance the sequence number from the current to the new sequence to represent certain messages that are not resendable or no longer available. The feed recovery client should skip to the new sequence and continue from there.
Reject	0x39	9	Reject messages are used in response to the request messages when they fail validation or if the request message is not permitted in certain states. Fatal conditions in Reject cause immediate dissolution of the connection/session.

3.5 Business message types

Business messages that are valid for each feed type are specified in the Business message specification for the respective feed types.

- For Business messages that are disseminated on the Level 2 QuantumFeed for Toronto Stock Exchange and TSX Venture Exchange, refer to *TSX and TSXV Level 2 QuantumFeed Business Message Specification*.
- For Business messages that are disseminated on the QuantumFeed Level 1 for Toronto Stock Exchange and TSX Venture Exchange, refer to *TSX and TSXV QuantumFeed Level 1 Business Message Specification*.
- For Business messages that are disseminated on the QuantumFeed Level 2 for TMX Select, refer to *TMX Select QuantumFeed Level 2 Business Message Specification*.
- For Business messages that are disseminated on the QuantumFeed Level 1 for TMX Select, refer to *TMX Select QuantumFeed Level 1 Business Message Specification*.
- For Business messages that are disseminated on the QuantumFeed Level 2 for Alpha, refer to *Alpha QuantumFeed Level 2 Business Message Specification*.
- For Business messages that are disseminated on the QuantumFeed Level 1 for Alpha, refer to *Alpha QuantumFeed Level 1 Business Message Specification*.

3.6 General message rules and characteristics

This section describes general message rules and characteristics that apply to all messages.

Every message disseminated on Quantum Feeds always has a message type associated with it. Messages that belong to a given message type always possess the same structure and are always the same size. A message always contains all of the fields as per the specification provided for that message type, and the fields are always contiguous.

For different message types, sizes, and fields disseminated on a given QuantumFeed product, refer to the individual feed product specifications.

3.6.1 Message versioning

To provide flexibility during upgrades to new versions and in parallel runs, the QuantumFeed solution permits multiple versions of the same message type to co-exist. For example, version 1.0 and version 2.0 of the message type A (0x41) could co-exist on the same feed. If a feed client has not yet upgraded their system to process version 2.0, they can continue processing version 1.0.

3.6.2 Message sequencing

Every Business message disseminated on a given multicast group contains a sequence number, which is unique per combination of Source ID and Stream ID.

- Source ID represents the market and is one of: **Q** for TSX, **V** for TSX Venture, **S** for TMX Select, or **A** for Alpha.
- Stream ID represents a logical grouping within the Source ID.

Sequence numbers help the feed clients to identify gaps and recover the lost messages.

- For more information on detecting the gaps/missed messages, refer to Chapter 4, “Detecting Missed Data” on page 15.
- For more information on recovering lost messages, refer to Chapter 5, “Recovery” on page 18.

Chapter 4 Detecting Missed Data

A message can be uniquely identified across a given feed type by combining *Source ID*, *Stream ID* and *Sequence Number* (Source ID + Stream ID + Sequence Number).

Because Sequence Number by itself is not unique, any gap detection logic must be developed for each Source ID + Stream ID combination.

Each time a message is received, the client may choose to perform the gap detection test. A gap detection test would include the following steps:

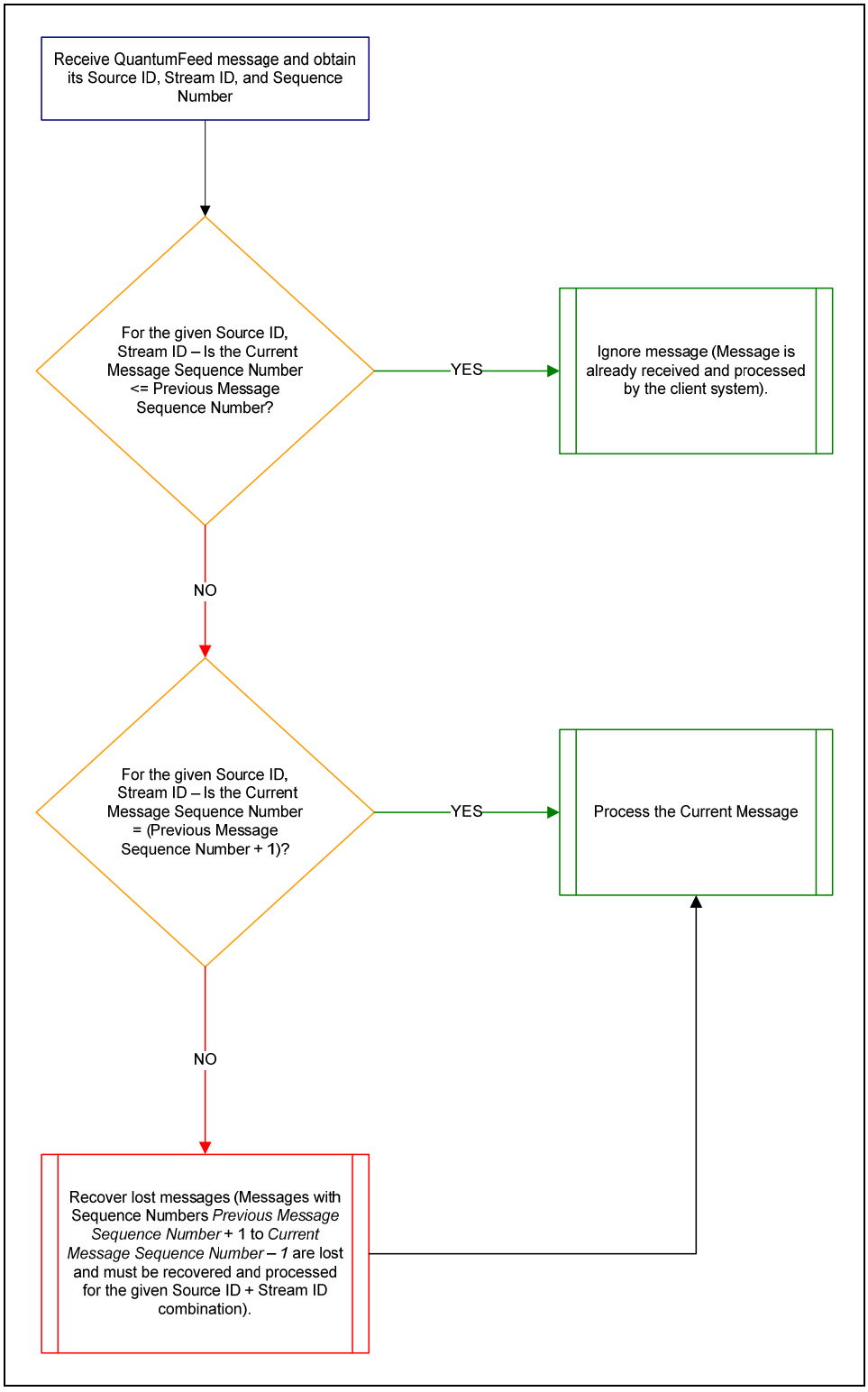
1. Receive the message.
2. Check (for a Source ID, Stream ID combination), if the current message's Sequence Number is equal to or less than the previous message's Sequence Number. If this is true, then ignore the message, because it is already processed by the client system.
3. Check (for a Source ID, Stream ID combination), if the current message's Sequence Number is greater than the previous message's Sequence Number and is equal to the previous message's Sequence Number + 1. If this is true, then process the current message as usual.
4. Check (for a Source ID, Stream ID combination), if the current message's Sequence Number is greater than the previous message's Sequence Number and is not equal to previous message sequence number + 1. If this is true, it means that the client has missed messages from p*revious message sequence number + 1 to Current sequence number -1* for that Source ID, Stream ID combination. In this case, the client may choose to recover lost data before processing the current message. As explained in Chapter 5, the lost data can be recovered using message arbitration or by submitting a recovery request on the QuantumFeed Recovery channel.

Important:

Note that the QuantumFeed solution does not mandate the recovery of missed messages. The client may choose not to recover the missed messages and continue to process the new incoming messages.

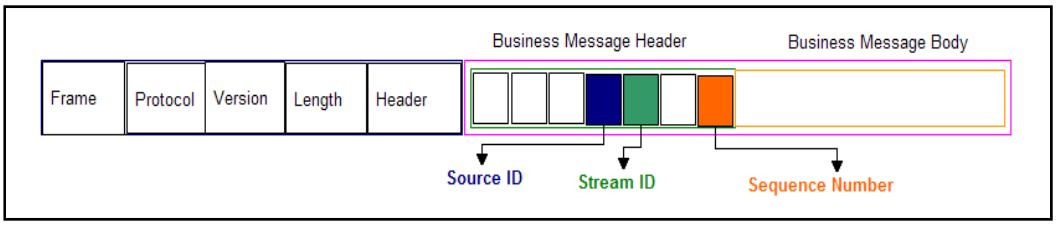
Figure 6 on page 16 explains the different steps involved in detecting missed data.

Figure 6: Detecting missed messages - flowchart



Source ID, Stream ID, and Sequence Number can be obtained from the Business message header, as illustrated in Figure 7.

Figure 7: Message structure and positions of Source ID, Stream ID and Sequence Number



Chapter 5 Recovery

The QuantumFeed implementation provides the following mechanisms for recovering missed messages, by using:

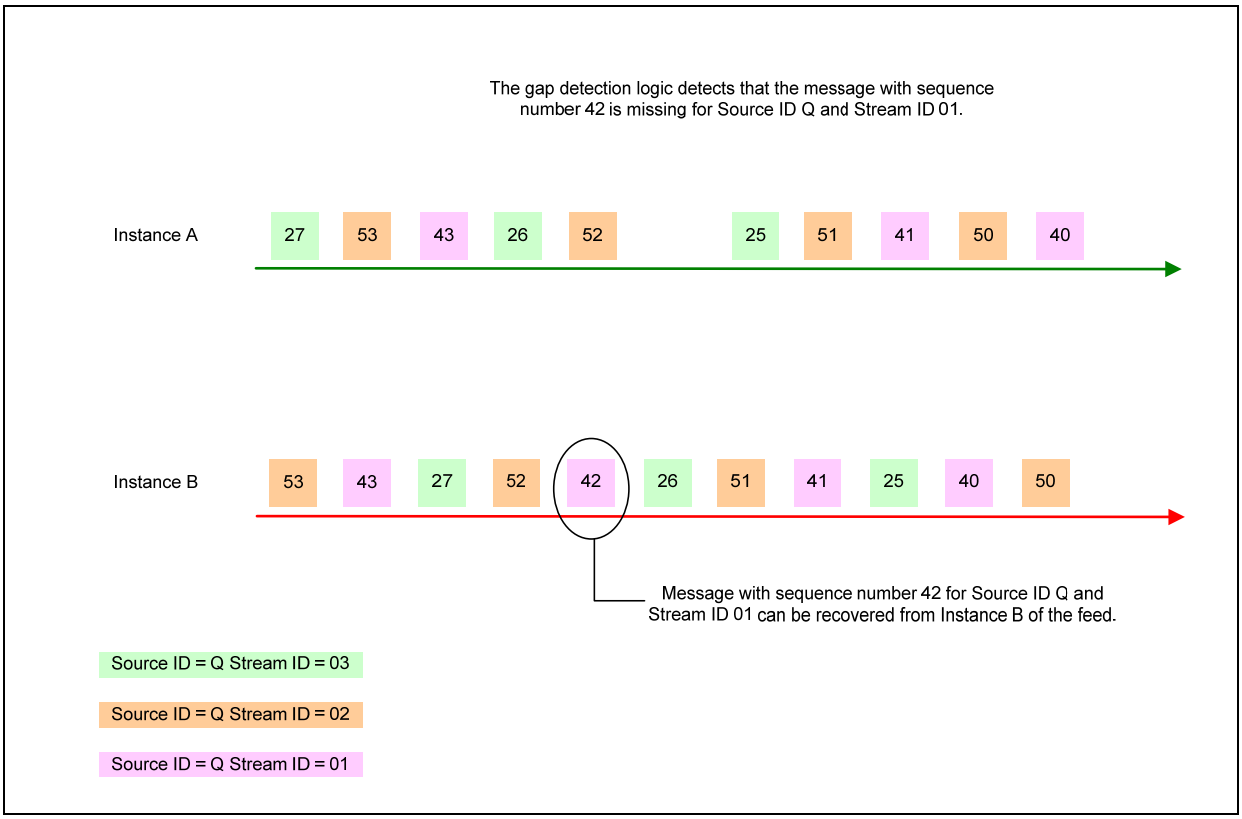
- Message arbitration
- TCP/IP recovery from the QuantumFeed Recovery channel
- Order Book Snapshot (**Note:** *This feature is yet to be implemented*)

5.1 Message arbitration

To recover data using message arbitration, the clients must be connected to both instances (instance A and instance B) of the same feed. If data loss is detected on one instance, then the clients must recover lost data from the other instance, as illustrated in Figure 8.

For example: If the client wants to perform recovery on the TQL1 feed (Toronto QuantumFeed Level 1 from a partition), the client must be connected to both instances of this feed from the same partition (TQL1-11A and TQL1-11B).

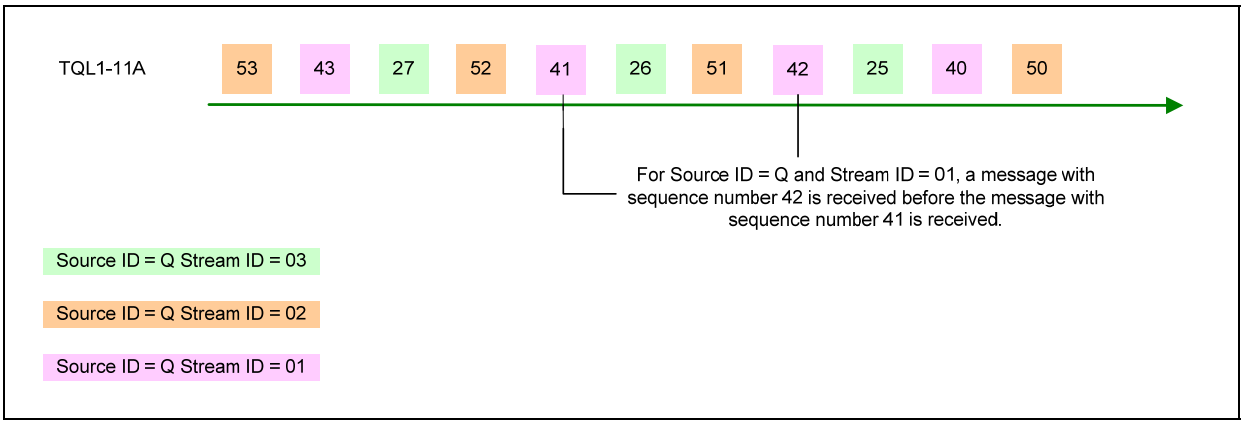
Figure 8: Recovering lost messages using message arbitration



Note: Messages with different Source ID, Stream ID combinations may be interleaved, as depicted in Figure 8.

Also, because of the nature of multicast, for a given Source ID and Stream ID combination, the clients *could* receive messages with a higher sequence number before they receive messages with a lower sequence number. This must be considered when designing systems that read multicast messages and recover lost messages.

Figure 9: A valid scenario given the nature of multicast



5.2 TCP/IP recovery over the Recovery channel

QuantumFeed clients can recover lost messages through the QuantumFeed Recovery channel (RC). Clients can connect to the Recovery channel using TCP/IP and request a retransmission of missed messages.

The QuantumFeed Recovery server sends the requested messages to the client on the Recovery channel using TCP/IP. The Recovery channel allows the clients only to recover a limited number of messages already published on the multicast channel. The allowable limits are confirmed in the Login Response.

Each feed instance has its own Recovery channel, as shown in Figure 10 and Figure 11.

Recovery functionality for the TQL2 feed is split into two channels:

- **Regular recovery**: Less than one million messages
- **Long recovery**: All messages.

Each channel has a unique IP address and clients will need a port or ports on each channel.

Figure 10: Recovery for a single-partitioned feed

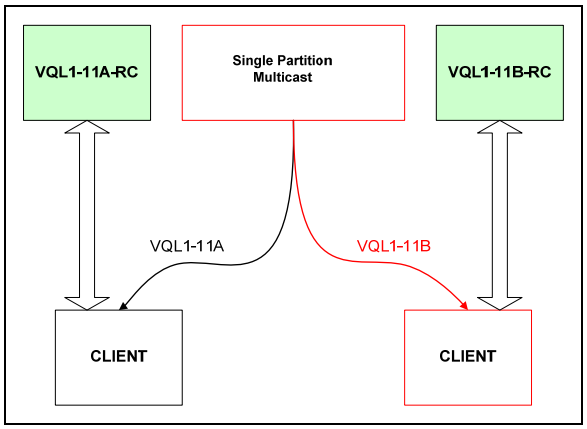
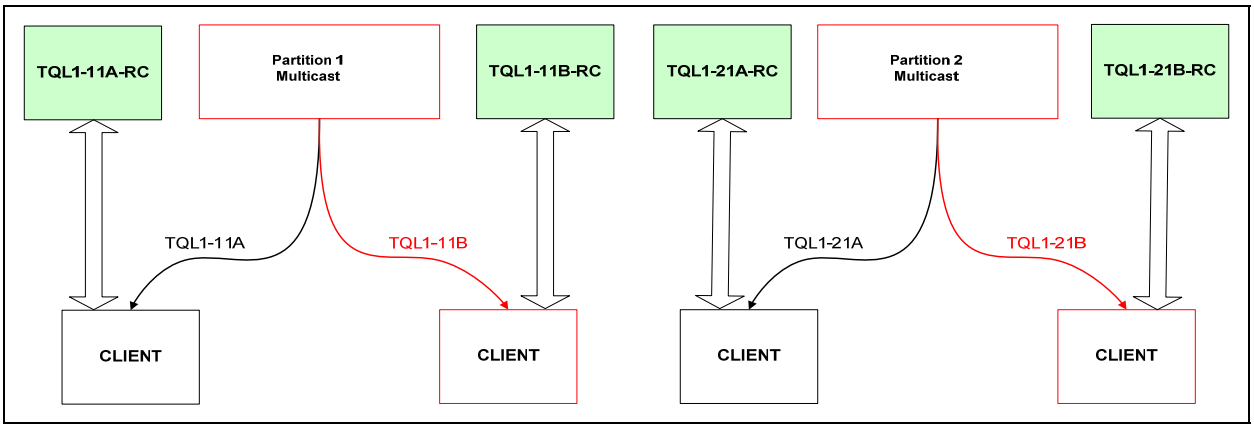


Figure 11: Recovery for a multiple-partitioned feed



Each client will be provided with a unique IP address and port for each Recovery server. In turn, the clients must provide their IP address. TMX will set up the clients as trusted IPs.

5.2.1 More about recovery during a disaster situation

If an unexpected system failure occurs at TMX, and if a switch to DR mode is required, recovery will be provided only for the first instance of the given feed (that is, for QLx-NA only). The developers of feed clients must design the system to factor in the unexpected outage of the recovery channel for the second instances of each feed. Figure 12 and Figure 13 depict the scenario during a DR mode.

Figure 12: Single-partitioned feed dissemination (DR mode)

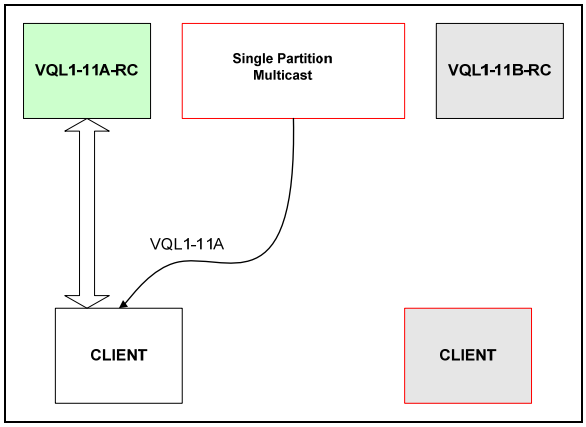
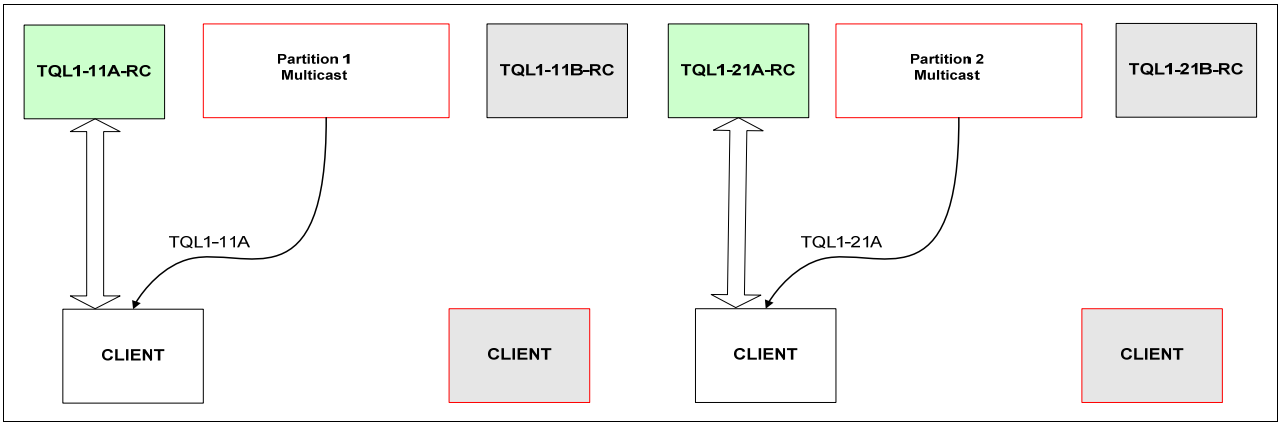


Figure 13: Multiple-partitioned feed dissemination (DR Mode)



5.2.2 Recovering missed data through the Recovery channel

This section describes how to recover missed data through the Recovery channel, and illustrates several different scenarios.

Establishing connection to the Recovery channel

A feed client attempting to connect to the QuantumFeed Recovery channel must be a trusted client. Such a client does not require authentication. QuantumFeed clients will be provided with the IP address and port information for each Recovery channel to which they should reconnect. To be added as a trusted client for the QuantumFeed Recovery channel, the clients must provide TMX with the IP address used to connect to the Recovery channel.

Recovery constraints

The following constraints exist on recovery requests:

- Recovery requests are limited to a maximum threshold value per session. If more than the threshold value messages are requested, the request is rejected, and the recovery request must be submitted to another recovery service. For more information about the threshold value, or to have it reconfigured, contact Vendor Services.
- Recovery requests submitted when a client-initiated recovery is in progress are queued and if allowable limits are exceeded, they will be rejected.

To confirm the presence of an active connection when messages are not being sent, Heartbeat messages are sent to the client's retransmission session every 30 seconds. Original Heartbeat messages sent with the real-time service delivery are not retransmitted.

Regular and long recovery

Recovery functionality for the TQL2 feed is split into two channels - regular recovery (<1,000,000 messages) and long recovery (all messages):

- **Regular recovery**: Allows clients to recover less than one million messages in a single request. The messages available are the latest rolling one million messages.
- **Long recovery**: Allows clients to request recovery back to message 1 at any point during the day.

Each channel has a unique IP address and clients will need a port or ports on each channel.

5.2.3 Establishing a recovery session

Once a network-level connection is established, a trusted feed (recovery) client can establish a session with the Recovery server by sending a Login Request.

In response to a Login Request sent by the client, the Recovery server sends a Login Response message. The Login Response message confirms the establishment of a session and confirms all the negotiable parameters in the Login Request.

In the current implementation, the following parameters are not negotiable:

- Heartbeat interval
- Replay window size
- Replay window number

A client should send requests to the Recovery server only after it receives the Login Response message from the Recovery server. Any message sent by the client before receiving the Login Response message is ignored by the Recovery server.

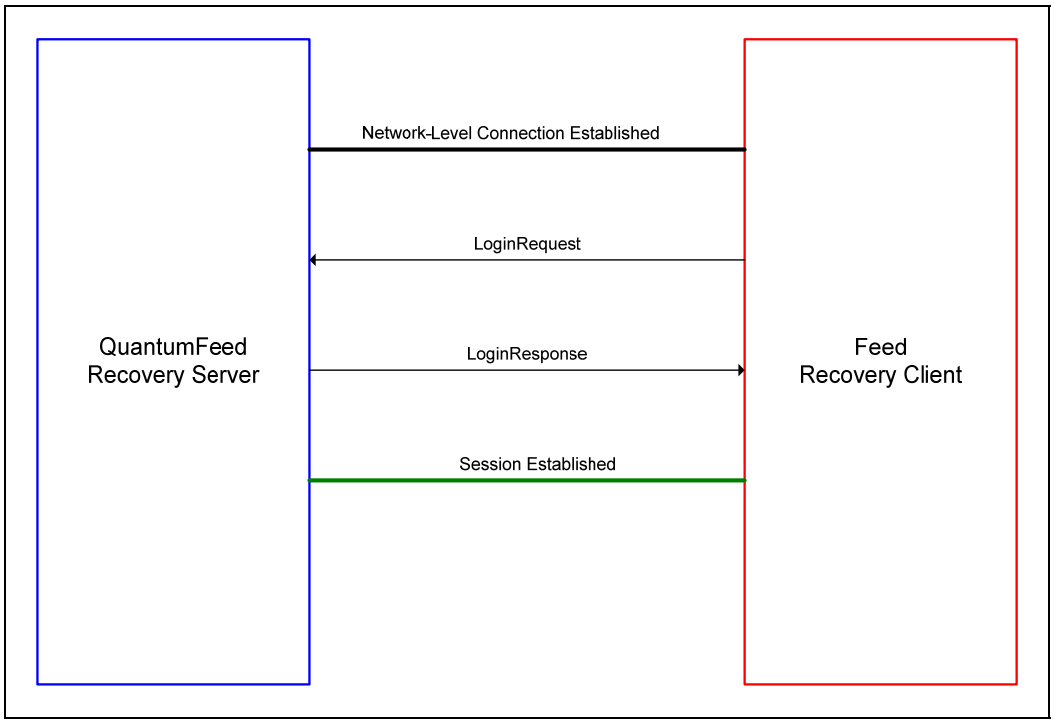
Recoveries are reliable and requested messages are sent using the same session.

Following are the different scenarios that could arise during connection and establishing a session.

Scenario 1: Client sends a Login Request and receives a Login Response (all negotiable parameters are accepted by server)

Figure 14 illustrates a scenario in which a session is successfully established. The feed client can start sending requests to the QuantumFeed Recovery server.

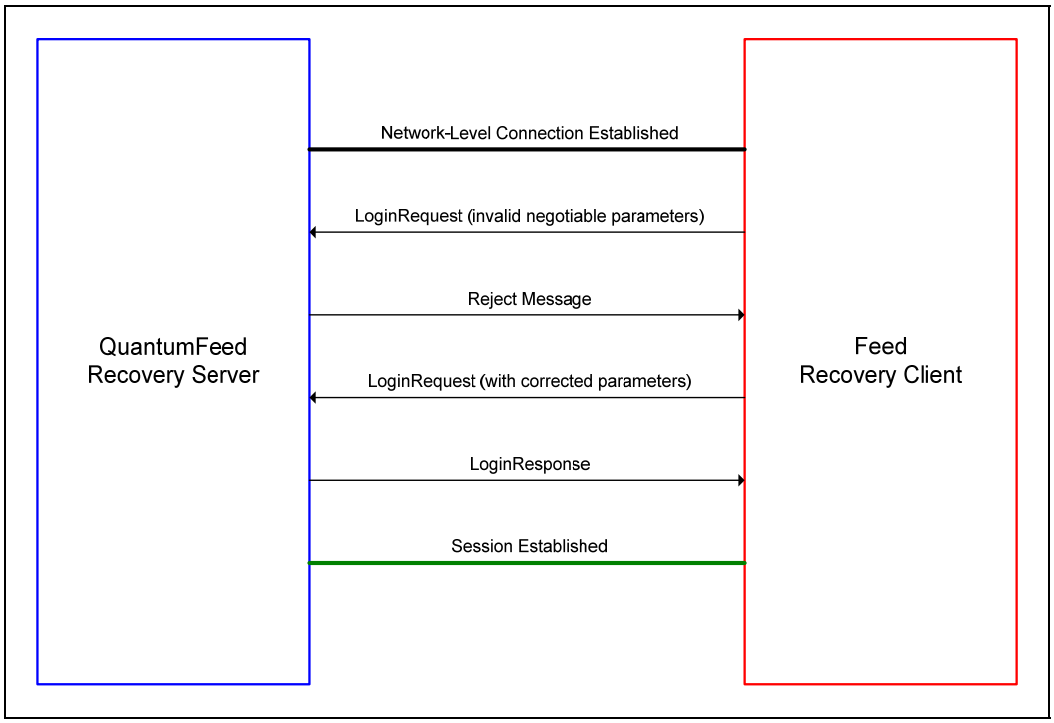
Figure 14: Session establishment successful



Scenario 2: Client sends a Login Request with negotiable parameters outside the allowable range

Figure 15 illustrates a scenario in which a Reject message is sent to the feed client informing the client that the requested parameter is not valid. The network connection is still valid but no session is established and the server does not process any requests from the client. On receiving the Reject message, the client may choose to resend a Login Request with updated parameters to attempt to establish a session.

Figure 15: Login Request with invalid negotiable parameters

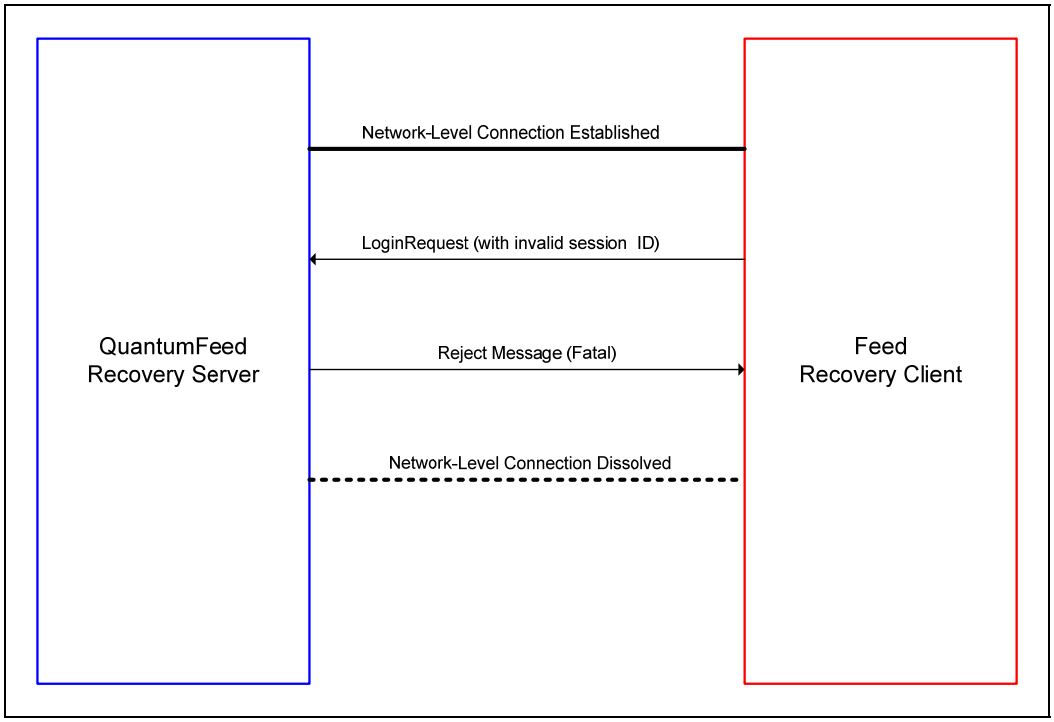


Scenario 3: Client sends a Login Request with invalid Session ID

If a client sends a Login Request with an invalid Session ID, the event is considered fatal. The server sends a Reject message to the client and disconnects the network connection.

Figure 16 illustrates this scenario:

Figure 16: Login Request with invalid session ID leading to network disconnection

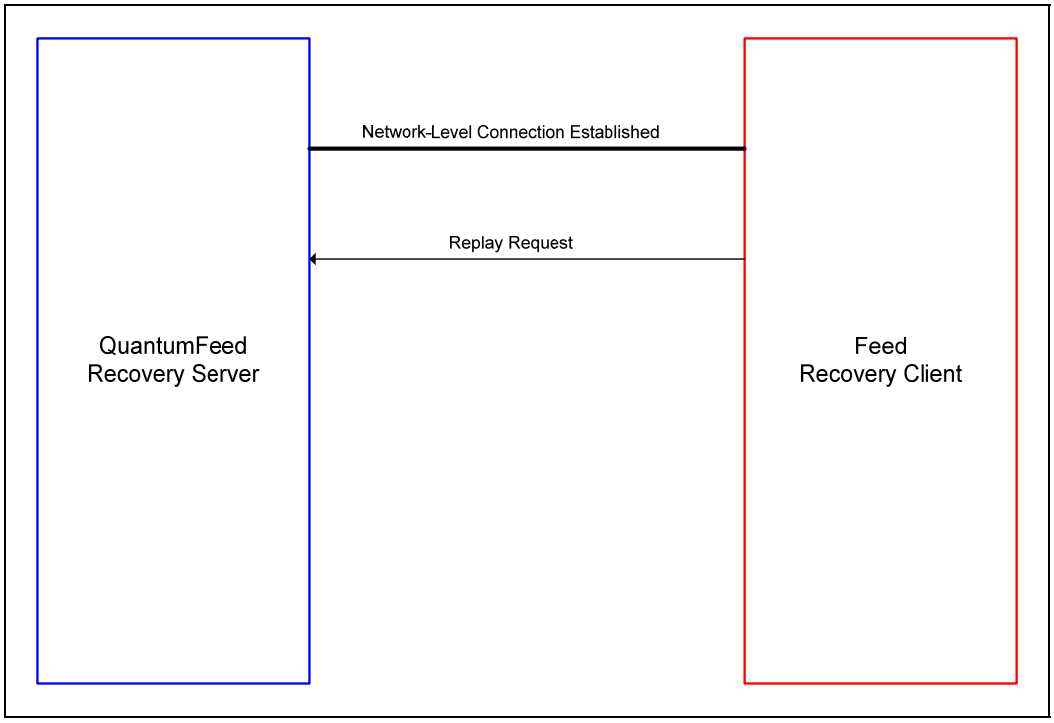


Scenario 4: Client sending requests without establishing a session

A session must be established before any requests from the client can be processed by the Recovery server. If any requests are sent by the client before a session is established, those requests are ignored by the Recovery server. In this case, the Recovery server does not send a Reject message.

Figure 17 illustrates such a scenario:

Figure 17: Recovery server ignores any requests received before session establishment



5.2.4 Maintaining the session

Once a session is established, it is maintained until the client sends a Logout Request. There is no requirement to send Heartbeat messages to keep the session alive.

5.2.5 Requesting recovery of missed messages

Once a session is established with the Recovery server, the clients can request the recovery of missed messages. The clients should use the Replay Request message to request recovery.

Each time the Recovery server receives a Replay Request, it sends an Ack message with all Business messages requested to be retransmitted. The retransmitted Business messages are flagged as Poss Dup.

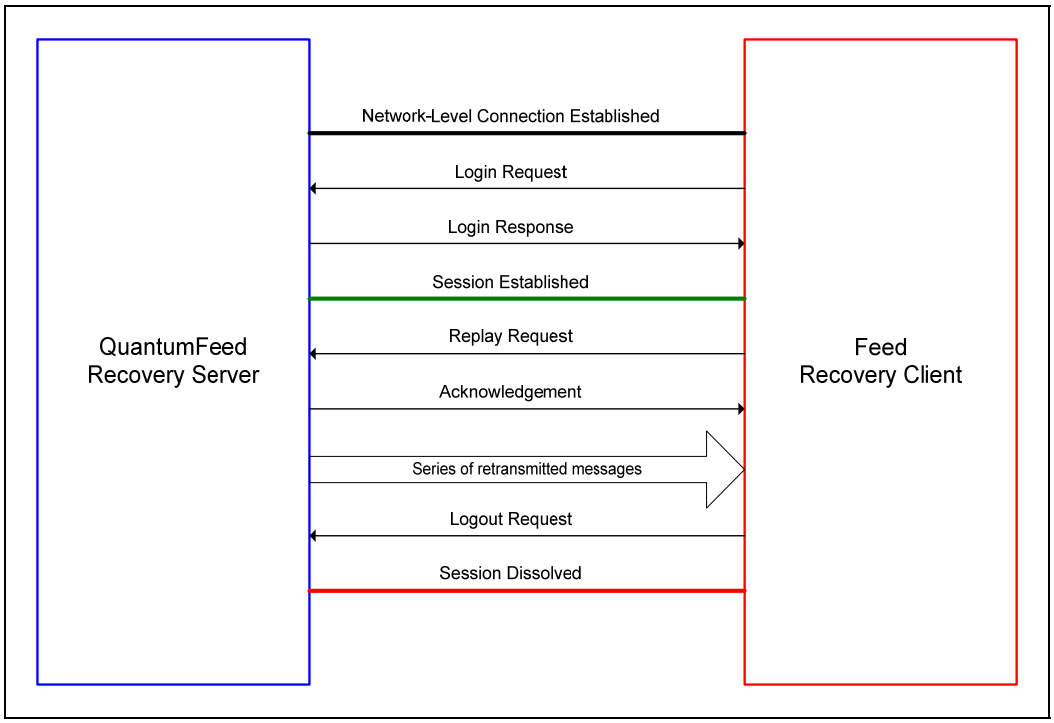
5.2.6 Disconnecting from the Recovery channel

Feed clients can disconnect from the Recovery channel at any time by sending a Logout message. The QuantumFeed Recovery server receives the Logout message and then disconnects the session between itself and the feed client.

5.2.7 Recovery illustration

Figure 18 illustrates the steps involved in Recovery.

Figure 18: Recovering missed messages through the Recovery channel



Chapter 6 Feed Availability

TMX QuantumFeeds are available as follows:

Exchange	Available From (EST)	Available Until (EST)
TSX and TSX Venture	03:00	17:00
TMX Select	03:00	17:30
Alpha	03:00	17:00

To avoid the need for large recovery, feed clients should join the multicast groups and establish recovery sessions, if necessary, five minutes before 03:00 (EST).

Chapter 7 Products and Services

The TMX QuantumFeed suite consists of these feed products:

- TMX QuantumFeed Level 2
- TMX QuantumFeed Level 1

7.1 TMX QuantumFeed Level 2

TMX QuantumFeed Level 2 contains the following information:

- Symbol and market status
- Order confirmations
- Trade confirmations
- Order cancel or modification confirmations
- Trade cancel or Modification confirmations
- Calculated Opening Price (COP) and limit assignment confirmations (TSX, TSXV, and XATS)

The feed messages are delivered in the TMX XMT Protocol and adhere to the QuantumFeed specifications captured in this document. For Business message structure and other implementation details that are specific to TMX QuantumFeed Level 2, refer to the latest *TSX and TSXV QuantumFeed Level 2 Business Message Specification, TMX Select QuantumFeed Level 2 Business Message Specification* and *Alpha QuantumFeed Level 2 Business Message Specification.*

The feeds are called:

- TQL2 – Toronto QuantumFeed Level 2
- VQL2 – TSX Venture Exchange QuantumFeed Level 2
- SQL2 – TMX Select QuantumFeed Level 2
- AQL2 – Alpha QuantumFeed Level 2

7.2 TMX QuantumFeed Level 1

TMX QuantumFeed Level 1 contains the following information:

- Trades
- Quotes
- Symbol and stock status

The feed messages are delivered in the TMX XMT Protocol and adhere to the QuantumFeed specifications captured in this document. For Business message structure and other implementation details that are specific to TMX QuantumFeed Level 1, refer to the latest *TSX and TSX Venture QuantumFeed Level 1 Business Message Specification*, *TMX Select QuantumFeed Level 1 Business Message Specification* and *Alpha QuantumFeed Level 1 Business Message Specification*.

The feeds are called:

- TQL1 – Toronto QuantumFeed Level 1
- VQL1 – TSX Venture Exchange QuantumFeed Level 1
- SQL1 – TMX Select QuantumFeed Level 1
- AQL1 – Alpha QuantumFeed Level 1

Appendix A Public IP Addresses and Port Numbers

Table 1: QuantumFeed Multicast Production

Feed Name	Feed			Recovery
	Group IP	Port	Source IP	Recovery IP
TQL1-11A	224.0.72.49	51001	142.201.227.59 142.201.227.60	142.201.227.50
TQL1-11B	224.0.72.113	51005	142.201.227.123 142.201.227.124	142.201.227.115
TQL1-21A	224.0.72.53	51101	142.201.227.32 142.201.227.33	142.201.227.38
TQL1-21B	224.0.72.117	51105	142.201.227.98 142.201.227.99	142.201.227.104
TQL2-11A	224.0.72.50	51002	142.201.227.59 142.201.227.60	142.201.227.49 142.201.227.28 (Long)
TQL2-11B	224.0.72.114	51006	142.201.227.123 142.201.227.124	142.201.227.114 142.201.227.92 (Long)
TQL2-21A	224.0.72.54	51102	142.201.227.32 142.201.227.33	142.201.227.37 142.201.227.25 (Long)
TQL2-21B	224.0.72.118	51106	142.201.227.98 142.201.227.99	142.201.227.103 142.201.227.89 (Long)
VQL1-11A	224.0.72.51	51003	142.201.227.59 142.201.227.60	142.201.227.48
VQL1-11B	224.0.72.115	51007	142.201.227.123 142.201.227.124	142.201.227.113
VQL2-11A	224.0.72.52	51004	142.201.227.59 142.201.227.60	142.201.227.47
VQL2-11B	224.0.72.116	51008	142.201.227.123 142.201.227.124	142.201.227.112
SQL1-21A	224.0.72.22	30904	142.201.227.32 142.201.227.33	142.201.227.13
SQL1-21B	224.0.72.86	31004	142.201.227.98 142.201.227.99	142.201.227.77
SQL2-21A	224.0.72.23	30905	142.201.227.32 142.201.227.33	142.201.227.14
SQL2-21B	224.0.72.87	31005	142.201.227.98 142.201.227.99	142.201.227.78

Feed Name	Feed			Recovery
	Group IP	Port	Source IP	Recovery IP
AQL1-11A	224.0.72.10	30830	142.201.227.59 142.201.227.60	142.201.227.20
AQL1-11B	224.0.72.106	30835	142.201.227.123 142.201.227.124	142.201.227.109
AQL2-11A	224.0.72.11	30840	142.201.227.59 142.201.227.60	142.201.227.21
AQL2-11B	224.0.72.107	30845	142.201.227.123 142.201.227.124	142.201.227.110

Note: **PIM**: sparse mode, **RP**: 142.201.227.254
Multicast subnet: 224.0.72.0/24

Table 2: QuantumFeed Multicast GTE

Feed Name	Feed			Recovery
	Group IP	Port	Source IP	Recovery IP
TQL1-11A	233.102.209.75	50401	142.201.223.28	142.201.223.34
TQL1-11B	233.102.209.49	50411	142.201.223.57	142.201.223.53
TQL1-21A	233.102.209.15	50421	142.201.223.70	142.201.223.66
TQL1-21B	233.102.209.91	50431	142.201.223.83	142.201.223.79
TQL2-11A	233.102.209.76	50402	142.201.223.28	142.201.223.35 142.201.223.45 (Long)
TQL2-11B	233.102.209.50	50412	142.201.223.57	142.201.223.54 142.201.223.95 (Long)
TQL2-21A	233.102.209.16	50422	142.201.223.70	142.201.223.67 142.201.223.98 (Long)
TQL2-21B	233.102.209.92	50432	142.201.223.83	142.201.223.80 142.201.223.101 (Long)
VQL1-11A	233.102.209.77	50403	142.201.223.28	142.201.223.36
VQL1-11B	233.102.209.51	50413	142.201.223.57	142.201.223.55
VQL2-11A	233.102.209.78	50404	142.201.223.28	142.201.223.37
VQL2-11B	233.102.209.52	50414	142.201.223.57	142.201.223.56
SQL1-21A	233.102.209.65	37762	142.201.223.70	142.201.223.106
SQL1-21B	223.102.209.122	37763	142.201.223.83	142.201.223.116
SQL2-21A	233.102.209.121	37772	142.201.223.70	142.201.223.107
SQL2-21B	233.102.209.123	37773	142.201.223.83	142.201.223.117
AQL1-11A*	224.0.106.25	37840	142.201.223.28	142.201.223.152
AQL1-11B*	224.0.106.153	37841	142.201.223.57	142.201.223.157
AQL2-11A*	224.0.106.26	37850	142.201.223.28	142.201.223.153
AQL2-11B*	224.0.106.154	37851	142.201.223.57	142.201.223.158

Note: **PIM**: sparse mode
RP: 142.201.52.1 except for feeds marked with * for which it is 142.201.223.254,
Multicast subnet: 233.102.209.0/25 except for feeds marked with * for which it is 224.0.106.0/24

Appendix B Acronyms and Definitions

- **AQL1**: Alpha QuantumFeed Level 1
- **AQL2**: Alpha QuantumFeed Level 2
- **Disaster situation:** A disaster situation at TMX is defined as the time duration from the moment a disaster is declared by TMX until normal state/operation is restored.
- **QL1**: QuantumFeed Level 1
- **QL2**: QuantumFeed Level 2
- **QuantumFeed**: TSX & TSX Venture QuantumFeed
- **SQL1**: TMX Select QuantumFeed Level 1
- **SQL2**: TMX Select QuantumFeed Level 2
- **TQL1**: Toronto QuantumFeed Level 1
- **TQL2**: Toronto QuantumFeed Level 2
- **TSX**: Toronto Stock Exchange (Senior Market)
- **TSXV**: Toronto Venture Exchange
- **VQL1**: Toronto Venture Exchange QuantumFeed Level 1
- **VQL2**: Toronto Venture Exchange QuantumFeed Level 2
- **XATS**: Alpha Trading Systems Limited Partnership, Alpha

Appendix C Revision History

Version	Date	Changes
3.01	2013/02/04	Updated RP and multicast subnet IP addresses for Alpha feeds in GTE.
3.0	2012/12/04	Added Alpha-related information. Made IP addresses Appendix A.
2.01	2012/09/18	Corrected Recovery IP address for TQL1-21 in GTE.
2.0	2011/04/12	• Added IPs/Ports for Partition 2 • Added IPs for Long recovery sessions • Added TMX Select feeds • Renamed feeds • Added description of regular and long recovery for TQL2
1.1	2010/12/03	Added Appendix B: Public IP Address and Port Numbers
1.0	2010/11/05	Document published

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