



Document title

NYSE BONDS QUOTES CLIENT SPECIFICATON

Version

1.2a

Date

12 Mar 2015

© 2015 NYSE. All rights reserved. No part of this material may be copied, photocopied or duplicated in any form by any means or redistributed without the prior written consent of NYSE. All third party trademarks are owned by their respective owners and are used with permission. NYSE and its affiliates do not recommend or make any representation as to possible benefits from any securities or investments, or third-party products or services. Investors should undertake their own due diligence regarding securities and investment practices. This material may contain forward-looking statements regarding NYSE and its affiliates that are based on the current beliefs and expectations of management, are subject to significant risks and uncertainties, and which may differ from actual results. NYSE does not guarantee that its products or services will result in any savings or specific outcome. All data is as of March 12, 2014. NYSE disclaims any duty to update this information.

PREFACE

DOCUMENT HISTORY

The following table provides a description of all changes to this document.

VERSION NO.	DATE	CHANGE DESCRIPTION
1.0	05/28/2008	Original document.
1.1	12/08/2010	New format.
1.2	12/06/2011	Replaced IP address information with links to http://www.nyxdata.com/ipaddresses
	09/04/2011	Rebranded with new NYSE Technologies template
1.2a	03/12/2015	Eliminated sections Introduction and Bandwidth, corrected publication period in 2.1

CONTACT INFORMATION

For technical support please contact the Service Desk:

- Telephone: +1 212 383 3640 (International)
- Telephone: 866 873 7422 (Toll free, US only)
- Email: service.desk@nyx.com

FURTHER INFORMATION

- For additional product information, visit: <http://www.nyxdata.com/Data-Products/NYSE-ArcaBook>
- For updated capacity figures, visit our capacity pages at: <http://www.nyxdata.com/capacity>
- For details of IP addresses, visit our IP address pages at: <http://www.nyxdata.com/ipaddresses>
- For a full glossary, visit: <http://www.nyxdata.com/glossary/>

CONTENTS

1.	L1 COMMUNICATIONS AND IMPACT GUIDE	5
1.1	Overview	5
1.2	Access	5
1.3	Packet Retransmission	5
1.4	Quote Refresh.....	5
2.	L1 QUOTES OPERATIONAL INFORMATION	6
2.1	Publication Period.....	6
2.2	Gap Detection.....	6
2.3	Dual Site	6
3.	L1 QUOTES MESSAGE SPECIFICATIONS	7
3.1	Overview	7
3.2	Data Delivery format.....	7
3.3	General Processing Notes.....	7
3.4	Sequence Numbers	7
3.5	Symbols.....	7
3.6	Prices.....	8
3.7	NYSE Best Quotes Data Messages.....	8
3.8	Message Header Format	8
3.9	Message Body Format.....	10
4.	MESSAGE EXAMPLES	13
4.1	Overview	13
4.2	Scenario 1 - BestQuote for GMA15Z (cusip 36186CAE3).....	13
4.3	Scenario 2 -BestQuote for SPF12 (cusip 85375CAK7)	14
5.	COMMON PDP MESSAGE STRUCTURE	15
5.1	Overview	15
5.2	General Processing Notes.....	15
5.3	Common Message Header Format.....	15
5.4	Sequence Number Reset	17
5.5	Sequence Number Processing Notes.....	18
5.6	Heartbeat Messages	18
5.7	Heartbeat Message Processing Notes	18
5.8	Heartbeat Response Message	19
5.9	Retransmission Request Message.....	19
5.10	Quote Refresh Request	20
5.11	Symbol Index Mapping Request Message	21
5.12	Retransmission Response Message.....	22
5.13	Retransmission Message	24
5.14	Retransmission message processing notes	24
5.15	Symbol Index Mapping Message	25
5.16	Refresh Quote Message	26
5.17	Message Unavailable	28
APPENDIX A:	L1 QUOTE IP GROUP ASSIGNMENTS	30
A.1	Multicast Groups	30
A.2	Joining Multicast Groups	30

- A.3 Production IP Addresses..... 30**
- A.4 Retransmission Request Thresholds 30**
- A.5 L1 Quotes Testing 31**
- APPENDIX B: MESSAGE PROCESSING 32**
- B.1 Processing of Messages 32**
- B.2 Processing of Sequence Number Reset Messages..... 33**
- B.3 Processing of Heartbeat Messages..... 34**
- B.4 Processing of Heartbeat Response Messages 35**
- B.5 Processing of Data Messages 36**
- B.6 Processing of Gap Handling 37**
- B.7 Processing of Line Level Retransmissions 38**
- B.8 Processing of Refresh Messages 39**
- B.9 System Architecture..... 40**
- APPENDIX C: FREQUENTLY ASKED QUESTIONS 41**

1. L1 COMMUNICATIONS AND IMPACT GUIDE

1.1 OVERVIEW

This section provides an introduction to accessing ArcaBook Level One (L1) for Bonds, as well as suggested bandwidth message rates.

1.2 ACCESS

To access ArcaBook L1 Bonds, subscribers must join the multicast groups for primary feeds, as well as secondary feeds to assist in recovery. To request retransmissions of lost packets, subscribers must establish a TCP/IP connection (see [Packet Retransmission](#)). Please refer to [Message Processing](#) for diagrams that illustrate message processing and retrieval.

L1 Bonds uses UDP (User Datagram Protocol). Data feeds for specific stocks are sent to different multicast addresses (see [L1 Quote IP Group Assignments](#) for IP information). This addressing scheme allows customers to subscribe to the specific data feeds they need. Data feeds types are:

- Multicast Order Book
- Multicast Retransmission

1.3 PACKET RETRANSMISSION

In the event that a packet is lost on the primary feed for a multicast group, clients can retrieve the lost packet from the secondary feed. UDP can at times be unreliable and may drop packets from both the primary and secondary data feeds. If a packet is lost from both the primary and secondary feeds, clients then make a TCP/IP request to have the packets resent. Packets are resent via the Retransmission Multicast Feed.

Subscribers have the option to connect to the TCP/IP Recovery Server to request dropped packets from the ArcaBook multicast feed. This method is highly recommended in order to maintain a stable and accurate order book. The Recovery Server accepts connections on predefined addresses and ports and requires a heartbeat reply before responding to requests.

After a client establishes a TCP/IP connection, ArcaBook will immediately send a heartbeat request message to the client. Clients must respond to this request with a heartbeat response within a specific timeframe – otherwise ArcaBook will close the connection. This timeframe is currently set to thirty seconds but is subject to change—so clients should make this configurable. (Clients will be informed of changes to the timeframe via customer notice.) Regardless of the timeframe, the client should respond immediately with a heartbeat response message. After receiving the initial heartbeat response, the Recovery Server will send heartbeats to the client every 30 seconds to ensure that the TCP/IP connection is live.

Note that the Source ID that the client specifies in the heartbeat response message will be validated by ArcaBook. Each Source ID may be logged in only once per port at any given time. To define a Source ID for retransmission purposes, contact NYSE Arca Technical Support – FIX/Connectivity hotline and provide the desired Source ID. The FIX/Connectivity team will evaluate and approve or disapprove Source IDs. In case of disapproval, a new Source ID must be defined. In case of approval, FIX/Connectivity will make the necessary updates on the ArcaBook side to add the Source ID and applicable rules.

1.4 QUOTE REFRESH

Subscribers can request the current L1 quote for a bond symbol by sending in refresh request through the TCP channel. The response will be sent over refresh retrans channel over TCP.

2. L1 QUOTES OPERATIONAL INFORMATION

2.1 PUBLICATION PERIOD

The following section specifies the frequency and publication period for each message type disseminated by the L1 Bonds Quotes Product.

Table 1 Message Types and Publication Periods

MESSAGE TYPE	PUBLICATION PERIOD
L1 Bonds Quote	A quote is generated based on events. Every quote will be transmitted based on that event. The transmission time for the quote is between 4:00 am (EST) until market close (8 PM (EST) for most securities). Please check the NYSE website for any changes to trading hours.

2.2 GAP DETECTION

The PDP Distribution System will assign all data packets a unique, sequential message ID. This will allow recipients to identify 'gaps' in the message sequence and, if appropriate, reconcile them 'locally' with an alternate feed or request retransmission of the missing/corrupted data packet.

For the NYSE Arca Quotes product, each data stream will have its unique set of sequence numbers. The following is an example of sequencing for each channel:

BQ_AZ : SeqNum=1, SeqNum=2, SeqNum=3, ..., SeqNum=n.

If there is a gap in the sequence of any channel, it has to be recovered independently. Therefore, if there is a sequence number gap on channel BQ_AZ, the gap filling has to be done through the appropriate BQ_AZ retransmission channel. The same is valid for the other channels.

2.3 DUAL SITE

L1 Bonds Quotes data will be published using two (2) sets of unique IP Multicast Group IDs. Thus, when appropriate, each L1 Bonds quote channel will transmit a given message packet over two (2) Multicast Groups, each containing identical sequence numbers. This will allow customers to receive two redundant feeds. Additionally, any message can be retransmitted upon request.

3. L1 QUOTES MESSAGE SPECIFICATIONS

3.1 OVERVIEW

The L1 Quote that reflects the highest bid and lowest offer in each L1 traded security.

3.2 DATA DELIVERY FORMAT

The L1 Bonds Quotes service uses the push-based publishing model. This means that data will be published based on its availability. Once a Best Quote is available, it will be published to L1 Quotes' Subscribers.

3.3 GENERAL PROCESSING NOTES

The following processing notes apply to the messages sent through the feed.

- All fields will be sent for every packet
- Only field values will appear in the published messages (e.g. no names, 'tags', sizes will appear in the message). The field names that appear in the descriptions below are for reference purposes only.
- All the fields are contiguous, with reserved fields for alignment issues
- All field sizes are fixed and constant
- The source time referenced will be using Eastern Standard Time (EST)
- Binary fields are provided in Big Endian format
- ASCII string fields are left-aligned and null-padded

3.4 SEQUENCE NUMBERS

All messages conform to the line level sequencing. Channel A to Z has its own sequence number. Subscribers can use sequence numbers to determine the following:

- Missing (gapped) messages
- Unordered messages
- Duplicate messages

Clients should note that the message sequence number per channel might restart from one following a failure recovery. A reset sequence number message will be sent to clients via the Multicast Groups to inform of such an event.

3.5 SYMBOLS

Bonds use the following identifiers:

- CUSIP/ISIN for clients who satisfy licensing requirements. By default CUSIP data is not disseminated in messages and will be left null. CUSIP data is only disseminated to clients that request this by contacting Client Services at ClientService@nyse.com.
- NYSE Bond Symbol is a unique identifier for the bond assigned by NYSE®. See the Securities Master file at <http://www.nyxdata.com/nysedata/default.aspx?tabid=726> for information correlating these symbols to bonds traded on NYSE Arca®.

To ensure high throughput and low latency, symbols are identified using a Symbol Index Mapping Table. This is an ordered list from 1 to N of all symbols. Symbol Indices are unique.

3.6 PRICES

Generally, the price of a bond order is expressed as a percentage of par. However, some bonds may express price in other manners such as yield-to-maturity.

The type of pricing used for bonds is not included in ArcaBook messages. Clients can determine this from the Securities Master File at <http://www.nyxdata.com/nysedata/default.aspx?tabid=726>.

Prices in this feed are represented by two fields, separating the denominator and the numerator. All prices in the feed share a common denominator, which is represented in the PriceScaleCode.

The PriceScaleCode field value represents the common denominator for the following formula:

$$Price = \frac{Numerator}{10^{PriceScaleCode}}$$

For example, a price of 27.56 is represented by a Numerator of 2756 and a PriceScaleCode equals to 2.

3.7 NYSE BEST QUOTES DATA MESSAGES

The following table contains a list of the message types in the NYSE Quotes feed.

Table 2 Message Types

MESSAGE TYPE	PUBLICATION PERIOD
L1 Quote	This message contains the L1 top of book Quote

3.8 MESSAGE HEADER FORMAT

All messages are preceded by a standard header format. The following table describes the header fields of an L1 Bonds Quote message.

Table 3 Header Format

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary Integer	<p>This field indicates the size of the message (header + body) in bytes. The value in this field does not account for the MsgSize field size.</p> <p>Sequence Number Reset – '18 Bytes'</p> <p>Heartbeat Message – '14 Bytes'</p> <p>Heartbeat Response Message – '34 Bytes'</p> <p>Message Unavailable – '22 Bytes'</p> <p>Retransmission Request Message – '42 Bytes'</p> <p>Retransmission Response Message – '46 Bytes'</p> <p>Refresh Request Message – '42 bytes'</p> <p>Bonds Quote Message - '50 Bytes'</p> <p>Bonds Refresh Quote Message - '86 Bytes'</p>

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgType				Symbol Index Mapping Request Message – '42 Bytes' Symbol Index Mapping Message – '54 Bytes'
	2	2	Binary Integer	This field identifies the type of message '1' – Sequence Number Reset '2' – Heartbeat Message '5' – Message Unavailable '10' – Retransmission Response message '20' – Retransmission Request Message '22' – Refresh Request Message '23' – Refresh Quote Message '24' – Heartbeat Response Message '25' - Symbol Index Mapping Request Message '26' - Symbol Index Mapping Message '141' – Quote Message.
MsgSeqNum	4	4	Binary Integer	This field contains the message sequence number assigned by PDP for each product. It is used for gap detection. Also known as Line Sequence Number (LSN).
SendTime	8	4	Binary Integer	This field specifies the time message was created by PDP. The number represents the number of milliseconds since midnight of the same day.
ProductID	12	1	Binary Integer	'117' is the product value used in the PDP header to identify the Quotes feed
RetransFlag	13	1	Binary Integer	A flag that indicates whether this is an original, retransmitted, or 'replayed' message. Valid values include: '1' – Original message '2' – Retransmitted message '5' – Refresh Retransmission
NumBodyEntries	14	1	Binary Integer	The number of times the message body repeats in the message. For example, if the body consists of a field (named Volume) and the "NumBodyEntries" field is 2, the number

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
				of bytes in the message body will be 8
FILLER	15	1	ASCII String	This is a filler, reserved for future use

3.9 MESSAGE BODY FORMAT

The table below describes the body fields of an L1 Quote message.

Table 4 Body Format

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
Symbol Index	16	4	Binary Integer	The numerical representation of the symbol.
SourceTime	20	4	Binary Integer	This field specifies the quote generation time. The number in this field represents the number of milliseconds since midnight of the same day.
QuoteLinkID	24	4	Binary Integer	The LinkID identifies a unique quote allows you to correlate quotes to the last sale. (Future)
AskPriceNumerator	28	4	Binary Integer	Ask Price for Quote
AskSize	32	4	Binary Integer	Size of the Quote on Ask side in shares
BidPriceNumerator	36	4	Binary Integer	Bid Price for Quote
BidSize	40	4	Binary Integer	Size of the Quote on Bid side in shares
PriceScaleCode	44	1	Binary Integer	See Price section in L1 Quotes Message Specifications chapter
ExchangeID	45	1	ASCII Character	The id of the originating exchange of the quote. Valid values: 'N' – NYSE 'P' – NYSE Arca
SecurityType	46	1	ASCII Character	This field specifies the security type for this message. Valid values:

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
				'F' – Fixed Income/Bonds
QuoteCondition	47	1	ASCII Character	<p>Valid values:</p> <p>'A': Slow on Ask side</p> <p>'B': Slow on Bid side</p> <p>'C': Closing</p> <p>'E': Slow on the Bid Due to an LRP or Gap Quote</p> <p>'F': Slow on the Ask Due to an LRP or Gap Quote</p> <p>'H': Slow on both Ask and Bid</p> <p>'N': Non-firm quote</p> <p>'O': Opening quote</p> <p>'R': Regular quote</p> <p>'U': Slow on the Bid and Ask Due to an LRP or Gap Quote</p> <p>'W': Slow on the Bid and Ask due to a "Set Slow List"</p> <p>Note: NYSE Arca will only send quote condition "R"</p>
FlatPricing	48	1	ASCII String	<p>"F" = flat pricing is in effect</p> <p>Blank = interest pricing is in effect</p>
Trading Action	49	1	Binary Integer	<p>The current state of trading:</p> <p>1 = Called</p> <p>2 = De-listed</p> <p>3 = Ex-interest</p> <p>4 = Missed an interest payment</p> <p>5 = Bankrupt</p> <p>6 = Late Filing</p> <p>7 = Below Listing Standards</p> <p>8 = Late Filing and Below Listing Standards</p> <p>9 = Bankrupt and Late Filing</p> <p>10 = Bankrupt and Below Listing Standard</p> <p>11 = Bankrupt, Below Listing Standards, and</p>

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
				Late Filing
FILLER	50	2	ASCII	This is a filler, reserved for future use

4. MESSAGE EXAMPLES

4.1 OVERVIEW

The following sections provide examples of the data content for the L1 Bonds Quotes product and discusses the following scenarios:

- BestQuote for GMA15Z (cusip 36186CAE3)
- BestQuote for SPF12 (cusip 85375CAK7)

4.2 SCENARIO 1 - BESTQUOTE FOR GMA15Z (CUSIP 36186CAE3)

The following scenario displays what a message would look like for a BestQuote for GMA15Z (cusip 36186CAE3).

Table 5 Best Quote for GMA15Z (CUSIP 36186CAE3)

FIELD NAME	VALUE
MsgSize	50
MsgType	140
MsgSeqNum	2
SendTime	41000250
ProductId	117
RetransFlag	1
NumBodyEntries	1
Filler	N/A
SourceTime	41000000
Symbol Index	10
QuoteLinkID	2
AskPriceNumerator	6538
AskSize	200
BidPriceNumerator	6497
BidSize	150
PriceScaleCode	2
ExchangeId	P
SecurityType	E
QuoteCondition	R
Flat Pricing	\0
Trading Action	1

4.3 SCENARIO 2 -BESTQUOTE FOR SPF12 (CUSIP 85375CAK7)

The following scenario displays what a message would look like for a quote for SPF12 (cusip 85375CAK7).

Table 6 Best Quote for SPF12 (CUSIP 85375CAK7)

FIELD NAME	VALUE
MsgSize	82
MsgType	140
MsgSeqNum	3
SendTime	41000250
ProductId	140
RetransFlag	1
NumBodyEntries	1
Filler	N/A
SourceTime	41000000
Symbol Index	347
QuoteLinkID	51674
AskPriceNumerator	6540
AskSize	300
BidPriceNumerator	6538
BidSize	200
PriceScaleCode	2
ExchangeId	P
SecurityType	E
QuoteCondition	R
Flat Pricing	F
Trading Action	7

5. COMMON PDP MESSAGE STRUCTURE

5.1 OVERVIEW

In broad terms, there are two types of messages transmitted as part of this protocol: control and data. Control messages do not contain data per se; rather, they allow conversing parties to exchange session-specific information (for example, 'reset sequence number'). Data messages are product specific and, although they will adhere to the general specification, they are defined specifically in a later section.

5.2 GENERAL PROCESSING NOTES

The following processing notes apply to the messages described above.

- All fields will be sent for every packet
- Any physical packet will contain at most one message
- Only field values will appear in the published messages (e.g. no names, 'tags', sizes will appear in the message). The field names that appear in the descriptions below are for reference purposes only.
- All the fields are contiguous, i.e. there is no explicit (or implicit) 'padding' between fields regardless of the juxtaposed data types, sizes, and alignment issues.
- All field sizes are fixed and constant
- The source time referenced will be using Eastern Standard Time (EST)
- Binary fields are provided in Big Endian format
- All binary fields will be unsigned (unless otherwise specified)
- ASCII string fields are left-aligned, null-padded

5.3 COMMON MESSAGE HEADER FORMAT

All PDP messages will contain a Common Message Header. This model is akin to that of an envelope/letter paradigm. The message header comprises envelope information; the message body comprises the letter. All correspondence will use the same envelope format regardless of content.

The intent of this design is to minimize development burden on behalf of Subscribers. That is, all Subscribers may implement line-level protocol processing once, and then need only develop parsing algorithms for messages of choice.

Table 7 Header Format

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
MsgSize	0	2	Binary Integer	This field indicates the size of the message (header + body) in bytes. The value in this field does not account for the MsgSize field size. Sequence Number Reset – '18 Bytes' Heartbeat Message – '14 Bytes' Heartbeat Response Message – '34 Bytes' Message Unavailable – '22 Bytes' Retransmission Request Message – '42 Bytes'

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
				Retransmission Response Message – '42 Bytes' Refresh Request Message – '42 bytes' Bonds Quotes Message - '50 Bytes' Bonds Refresh Quote Message - '86 Bytes' Symbol Index Mapping Request Message– '42 Bytes' Symbol Index Mapping Message – '58 Bytes'
MsgType	2	2	Binary Integer	This field identifies the type of message '1' – Sequence Number Reset '2' – Heartbeat Message '5' – Message Unavailable '10' – Retransmission Response message '20' – Retransmission Request Message '22' – Refresh Request Message '23' – Refresh Quote Message '24' – Heartbeat Response Message '25' - Symbol Index Mapping Request Message '26' - Symbol Index Mapping Message '141' – Quotes Message.
MsgSeqNum	4	4	Binary Integer	This field contains the message sequence number assigned by PDP for each product. It is used for gap detection. Also known as Line Sequence Number (LSN).
SendTime	8	4	Binary Integer	This field specifies the time message was created by PDP. The number represents the number of milliseconds since midnight of the same day.
ProductID	12	1	Binary Integer	'117' is the product value used in the PDP header to identify the NYSE Arca Quotes feed
RetransFlag	13	1	Binary Integer	A flag that indicates whether this is an original, retransmitted, or 'replayed' message. Valid values include: '1' – Original message '2' – Retransmitted message '5' – Refresh Retransmission

FIELD	OFFSET	SIZE (BYTES)	FORMAT	DESCRIPTION
NumBodyEntries	14	1	Binary Integer	The number of times the message body repeats in the message. For example, if the body consists of a field (named Volume) and the “NumBodyEntries” field is 2, the number of bytes in the message body will be 8
FILLER	15	1	ASCII String	This is a filler, reserved for future use

5.4 SEQUENCE NUMBER RESET

This message is sent to ‘reset’ the Sequence Number at start of day, in response to failures, etc. Note that this message will contain a valid sequence number. The message format is shown below.

Table 8 Sequence Number Reset

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the ‘header’ fields of the Sequence Number Reset Message					
MsgSize	0	2	Binary Integer	18	Refer to section 6.3
MsgType	2	2	Binary Integer	‘1’	Refer to section 6.3
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary Integer		Refer to section 6.3
ProductID	12	1	Binary Integer	‘117’	Refer to section 6.3
RetransFlag	13	1	Binary Integer	‘1’	Refer to section 6.3
NumBodyEntries	14	1	Binary Integer	‘1’	Refer to section 6.3
FILLER	15	1	ASCII String		This is a filler, reserved for future use
Set forth below are the ‘body’ fields of the Sequence Number Reset Message					
NextSeqNumber	16	4	Binary Integer		This field contains the sequence number value that the recipient should expect in the immediately succeeding data packet. Note that this message will contain its own valid sequence number in the header portion of the message.

5.5 SEQUENCE NUMBER PROCESSING NOTES

Sequence numbers normally begin at one (1) and increase monotonically with each subsequent message. There are two scenarios where the sequence number is reset (besides the start of day). First, if the value should exceed the maximum value that the SeqNum field may contain, it will be reset to one (1). Second, if PDP_BQ has a failure and it recovers, it sends a sequence number reset message. The SeqNum field of that message will be set to one (1) and the NextSeqNumber field will be set to two (2). Please refer to [Processing of Sequence Number Reset Messages](#) for a suggested way of processing.

5.6 HEARTBEAT MESSAGES

Subscribers that choose to establish and remain connected to the TCP/IP retrans server will receive heartbeat messages to let them know that the connection is still alive.

Table 9 Heartbeat Messages

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the Heartbeat Message					
MsgSize	0	2	Binary Integer	'14'	Refer to section 6.3
MsgType	2	2	Binary Integer	'2'	Refer to section 6.3
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary Integer		Refer to section 6.3
ProductID	12	1	Binary Integer	'117'	Refer to section 6.3
RetransFlag	13	1	Binary Integer	'1'	Refer to section 6.3
NumBodyEntries	14	1	Binary Integer	'0'	Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use

5.7 HEARTBEAT MESSAGE PROCESSING NOTES

- Heartbeat messages will be sent with the same sequence number as the most recent message that was sent.
- Heartbeat messages will only contain the PDP Message Header with an empty body.
- Subscribers must respond to these heartbeat requests with a heartbeat message.

Please refer to [Message Processing](#) for a suggested way of processing.

5.8 HEARTBEAT RESPONSE MESSAGE

This message will be sent by subscribers that choose to establish and remain connected to the TCP/IP retransmission server intraday. This message lets the NYSE know that the connection is still alive. Subscribers must respond to these heartbeat requests with a heartbeat response message.

Table 10 Heartbeat Response Messages

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the Heartbeat Response Message					
MsgSize	0	2	Binary Integer	'34'	Refer to section 6.3
MsgType	2	2	Binary Integer	'24'	Refer to section 6.3
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary Integer		Refer to section 6.3
ProductID	12	1	Binary Integer	'117'	Refer to section 6.3
RetransFlag	13	1	Binary Integer	'1'	Refer to section 6.3
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use
Defined below are the 'body' fields of the Heartbeat Response Message					
SourceID	16	20	ASCII String		This field represents the name of the source requesting retransmission. This field is null padded, left aligned

5.9 RETRANSMISSION REQUEST MESSAGE

This message is sent by Subscribers requesting missing messages. The MART will retransmit the appropriate message(s).

Table 11 Retransmission Request Messages

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the Generic Retransmission Request Message					
MsgSize	0	2	Binary Integer	'42'	Refer to section 6.3
MsgType	2	2	Binary Integer	'20'	Refer to section 6.3
MsgSeqNum	4	4	Binary		Refer to section 6.3

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
SendTime			Integer		
	8	4	Binary Integer		Refer to section 6.3
	12	1	Binary Integer	'117'	Refer to section 6.3
	13	1	Binary Integer	'1'	Refer to section 6.3
	14	1	Binary Integer	'1'	Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use
Defined below are the 'body' fields of the Generic Retransmission Request Message					
BeginSeqNum	16	4	Binary Integer		The beginning sequence number of the requested range of messages to be retransmitted.
EndSeqNum	20	4	Binary Integer		The end sequence number of the requested range of messages to be retransmitted.
SourceID	24	20	ASCII String		This field represents the name of the source requesting retransmission. This field is null padded, left aligned

5.10 QUOTE REFRESH REQUEST

This message will be sent by subscribers requesting a refresh message based on a symbol. Subscribers shall send one request per symbol. It is imperative that the NumBodyEntries field be set to 1.

Table 12 Quote Refresh Request

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the Refresh Request Message					
MsgSize	0	2	Binary Integer	'38'	Refer to section 6.3
MsgType	2	2	Binary Integer	'22'	Refer to section 6.3
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary Integer		Refer to section 6.3
ProductID	12	1	Binary Integer	'117'	Refer to section 6.3

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
RetransFlag	13	1	Binary Integer	'1'	Refer to section 6.3
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use
Set forth below are the 'body' fields of the Refresh Request Message					
SymbolIndex	16	4	Binary Integer		This field identifies the numerical representation of the symbol. SymbolIndex value can be zero, which is to request all symbol mapping for the multicast group.*
RetransmitMethod* *	20	1	Binary Integer		'0' – retransmit via UDP (This will be supported in the future releases)** '1' – retransmit via TCP/IP connection(this is the default and only option right now.)**
Filler	21	3	ASCII String		This is filler, reserved for future use.
SourceID	24	20	ASCII String		This field represents the name of the source requesting retransmission. This field is null padded, left aligned

5.11 SYMBOL INDEX MAPPING REQUEST MESSAGE

This message is sent by Subscribers requesting the Symbol index mapping.

Table 13 Symbol Index Mapping Request Message

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the Symbol Index Mapping Request Message					
MsgSize	0	2	Binary Integer	'42'	Refer to section 6.3
MsgType	2	2	Binary Integer	'25'	Refer to section 6.3
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary Integer		Refer to section 6.3
ProductID	12	1	Binary Integer	'117'	Refer to section 6.3

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
RetransFlag	13	1	Binary Integer	'1'	Refer to section 6.3
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use
Set forth below are the 'body' fields of the Symbol Index Mapping Request Message					
SymbolIndex	16	4	Binary Integer		This field identifies the numerical representation of the symbol. SymbolIndex value can be zero, which is to request all symbol mapping for the multicast group.*
RetransmitMethod**	20	1	Binary Integer		'0' – retransmit via UDP (this is the default)** '1' – retransmit via TCP/IP connection**
Filler	21	3	ASCII String		This is filler, reserved for future use.
SourceID	24	20	ASCII String		This field represents the name of the source requesting retransmission. This field is null padded, left aligned

* To request all symbols for a specific multicast group, specify '0' (zero) in the SymbolIndex field.

** RetransmitMethod is a field that gives customers the ability to specify if they want Symbol Index Mapping sent to them via TCP/IP or UDP.

5.12 RETRANSMISSION RESPONSE MESSAGE

This message will be sent immediately via TCP/IP in response to the subscribers' request for retransmission messages, i.e. Retransmissions, Refreshes, and Symbol Index Mappings. This message does not contain any information but an ACK or NAK of the request message.

Table 14 Retransmission Response Message

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the Retransmission Response Message					
MsgSize	0	2	Binary Integer	'42'	Refer to section 6.3
MsgType	2	2	Binary Integer	'10'	Refer to section 6.3
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary		Refer to section 6.3

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
ProductID			Integer		
	12	1	Binary Integer	'117'	Refer to section 6.3
	13	1	Binary Integer	'1'	Refer to section 6.3
	14	1	Binary Integer	'1'	Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use
Set forth below are the 'body' fields of the Retransmission Response Message					
SourceSeqNum	16	4	Binary Integer		This field contains the request message sequence number assigned by the client. It is used by the client to couple the request with the response message.
SourceID	20	20	ASCII String		This field represents the name of the source requesting retransmission. This field is null padded, left aligned
Status	40	1	ASCII String		This is a flag that indicates whether the retransmissions request was accepted or rejected. Valid values: 'A' – Accepted 'R' - Rejected
Reject Reason	41	1	Binary Integer		This is a flag that indicates the reason why the request was rejected. Valid values: '0' – Message was accepted '1' – Rejected due to permissions '2' – Rejected due to invalid sequence range '3' – Rejected due to maximum sequence range (>1000) '4' – Rejected due to maximum request in a day '5' – Rejected due to maximum number of refresh requests in a day

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Filler	42	2	ASCII String		This is filler, reserved for future use.

5.13 RETRANSMISSION MESSAGE

Upon receipt of a valid retransmission request message, the requested message(s) will be sent. This message(s) has the same message format and content as the original messages sent by the PDP_BQ, with the exception that the 'RetransFlag' in the header is set to the value of '2' or '5' depending on whether the retransmission is for a non-replay or a replay retransmission message, respectively.

Table 15 Retransmission Message

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the Retransmitted Message					
MsgSize	0	2	Binary Integer	MsgSize of the original message sent	Refer to section 6.3
MsgType	2	2	Binary Integer		It will be the MsgType of the original message sent by the PDP_BQ.
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary Integer		Refer to section 6.3
ProductID	12	1	Binary Integer	'117'	Refer to section 6.3
RetransFlag	13	1	Binary Integer	'2' or '5'	Refer to section 6.3
NumBodyEntries	14	1	Binary Integer	Same as original message	Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use
All the 'body' fields of the Retransmitted Message are the same as the original message					

5.14 RETRANSMISSION MESSAGE PROCESSING NOTES

- All Subscribers will receive retransmission messages through the retransmission channel.

- Due to the multicast nature, subscribers will receive 'all' retransmission messages, including messages that were not requested by them.
- Note that when a message for a particular symbol is retransmitted, a new message for the same symbol may be sent through the regular channel. This scenario is very likely to occur with busy symbols and may cause confusion as to which message contains the latest information on that symbol.

In order to resolve the conflict, the following qualification method should be applied:

- Check the MsgSeqNum field. A retransmitted message retains the same sequence number as the original message. Even refreshes are retransmitted with the original sequence numbers for the message they belonged to.
- The most current sequence number (SEQNUM) contains the latest information.
- If the SEQNUMS are the same: messages are the same, any of the two messages contains the same information.

Please refer to [Processing of Line Level Retransmissions](#) for a suggest way of processing.

5.15 SYMBOL INDEX MAPPING MESSAGE

This message is sent by NYSE Arca in response to a Symbol Index Request or sent automatically when there are intraday symbol additions.

Please note: This message will come back via TCP/IP or UDP as specified by the customer in the RetransmitMethod.

Table 16 Symbol Index Mapping Message

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the Symbol Index Mapping Message					
MsgSize	0	2	Binary Integer	'58'	Refer to section 6.3
MsgType	2	2	Binary Integer	'26'	Refer to section 6.3
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary Integer		Refer to section 6.3
ProductID	12	1	Binary Integer	'117'	Refer to section 6.3
RetransFlag	13	1	Binary Integer	'1'	Refer to section 6.3
NumBodyEntries	14	1	Binary Integer		Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use
Set forth below are the 'body' fields of the Symbol Index Mapping Message					

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
SymbolIndex	16	4	Binary Integer		This field identifies the numerical representation of the symbol.
Symbol	20	22	ASCII String		The Bond Symbol.
Cusip	42	14	ASCII String		The Bond Cusip
FILLER	56	4	ASCII String		This is filler, reserved for future use

5.16 REFRESH QUOTE MESSAGE

This message is sent by NYSE Arca in response to a Refresh Quote Request or sent automatically when there are intraday symbol additions.

The message is similar to the Quote message with the addition of the symbol and cusip appended to the message.

Table 17 Refresh Quote Message

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the Refresh Quote Message					
MsgSize	0	2	Binary Integer	'86'	Refer to section 6.3
MsgType	2	2	Binary Integer	'23'	Refer to section 6.3
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary Integer		Refer to section 6.3
ProductID	12	1	Binary Integer	'117'	Refer to section 6.3
RetransFlag	13	1	Binary Integer	'1'	Refer to section 6.3
NumBodyEntries	14	1	Binary Integer	'0' or '1'	Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use
Set forth below are the 'body' fields of the Refresh Quote Message					
SymbolIndex	16	4	Binary Integer		The numerical representation of the symbol.
SourceTime	20	4	Binary		This field specifies the quote generation time. The number in this

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
			Integer		field represents the number of milliseconds since midnight of the same day.
QuoteLinkID	24	4	Binary Integer		The LinkID identifies a unique quote allows you to correlate quotes to the last sale. (Future)
AskPriceNumerator	28	4	Binary Integer		Ask Price for Quote
AskSize	32	4	Binary Integer		Size of the Quote on Ask side in shares
BidPriceNumerator	36	4	Binary Integer		Bid Price for Quote
BidSize	40	4	Binary Integer		Size of the Quote on Bid side in shares
PriceScaleCode	44	1	Binary Integer		See Price section in NYSE Arca Quotes Message Specifications chapter
ExchangeID	45	1	ASCII Character		The id of the originating exchange of the quote. Valid values: 'N' – NYSE 'P' – NYSE Arca
SecurityType	46	1	ASCII Character		This field specifies the security type for this message. Valid values: 'F' – Fixed Income/Bonds
QuoteCondition	47	1	ASCII Character		Valid values: 'A': Slow on Ask side 'B': Slow on Bid side 'C': Closing 'E': Slow on the Bid Due to an LRP or Gap Quote 'F': Slow on the Ask Due to an LRP or Gap Quote 'H': Slow on both Ask and Bid 'N': Non-firm quote 'O': Opening quote

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
					'R': Regular quote 'U': Slow on the Bid and Ask Due to an LRP or Gap Quote 'W': Slow on the Bid and Ask due to a "Set Slow List" Note: NYSE Arca will only send quote condition "R"
FlatPricing	48	1	ASCII String		"F" = flat pricing is in effect Blank = interest pricing is in effect
Trading Action	49	1	Binary Integer		The current state of trading: 1 = Called 2 = De-listed 3 = Ex-interest 4 = Missed an interest payment 5 = Bankrupt 6 = Late Filing 7 = Below Listing Standards 8 = Late Filing and Below Listing Standards 9 = Bankrupt and Late Filing 10 = Bankrupt and Below Listing Standard 11 = Bankrupt, Below Listing Standards, and Late Filing
FILLER	50	2	ASCII		This is a filler, reserved for future use
Symbol	52	22	ASCII String		The Bond Symbol.
Cusip	74	14	ASCII String		The Bond Cusip

5.17 MESSAGE UNAVAILABLE

This message will be sent to inform the subscribers of unavailability of a range of messages for which they may have requested retransmission via the Retransmission Multicast channels. Below is the message format.

Table 18 Message Unavailable

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
-------	--------	------	--------	-------	-------------

FIELD	OFFSET	SIZE	FORMAT	VALUE	DESCRIPTION
Set forth below are the 'header' fields of the NYSE Packet Unavailable Message					
MsgSize	0	2	Binary Integer	'22'	Refer to section 6.3
MsgType	2	2	Binary Integer	'5'	Refer to section 6.3
MsgSeqNum	4	4	Binary Integer		Refer to section 6.3
SendTime	8	4	Binary Integer		Refer to section 6.3
ProductID	12	1	Binary Integer	'117'	Refer to section 6.3
RetransFlag	13	1	Binary Integer	'1'	Refer to section 6.3
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section 6.3
FILLER	15	1	ASCII String		This is filler, reserved for future use
Set forth below are the 'body' fields of the NYSE Packet Unavailable Message					
BeginSeqNum	16	4	Binary Integer		The beginning sequence number of the requested range of messages to be retransmitted.
EndSeqNum	20	4	Binary Integer		The end sequence number of the requested range of messages to be retransmitted.

APPENDIX A: L1 QUOTE IP GROUP ASSIGNMENTS

A.1 MULTICAST GROUPS

The NYSE Arca data feed contains one data stream. The stream delivers quotes for all symbol ranges.

Table 19 Data Feed Categorization

FEED NAME	DESCRIPTION
BZ_AZ	Bonds Multicast Groups assigned to deliver quotes of symbols starting with letters A through Z.

A.2 JOINING MULTICAST GROUPS

Recipients' applications/hosts will be responsible for issuing Multicast subscriptions to one or more of the Multicast Groups assigned to the PDP_BQ product. In response to each authorized subscription request, SFTI network will complete the tasks associated with delivering the Multicast packets from the NYSE data source to the recipients' network.

The process of subscribing to a Multicast Group ID is also known as 'joining' a Multicast Group. Upon session termination, the subscriber's host system should issue an 'unjoin' message. This will terminate delivery of data to that host's local network. If an application/host terminates without issuing an 'unjoin' message, the network will eventually issue a 'timeout' for the Multicast Group subscription that will automatically terminate delivery of the Multicast packets to the host's local network.

A.3 PRODUCTION IP ADDRESSES

For details of IP addresses, visit our IP address pages at: <http://www.nyxdata.com/ipaddresses>

A.4 RETRANSMISSION REQUEST THRESHOLDS

The table below summarizes the Retransmission request thresholds for the L1 Quotes feed. The numbers below represent the thresholds per channel.

Table 20 Retransmission Request Thresholds

CAPABILITY	DESCRIPTION	THRESHOLD	ACTION
Prevention of invalid subscribers	Incoming requests from subscribers that are not in the enabled subscriber's source ID list will not be honored. PDP subscribers will need a source ID, which is a string that uniquely identifies the subscriber of the retransmission requests. Please contact NYSE Arca FIX Support Hotline to get a unique source ID.	N/A	Request will not be processed.
Limitation of Requests for a large number of packets	Only retransmission requests for 1000 messages or less will be honored.	1000	Request will not be processed.
Limitation of Generic Requests	If the number of a subscriber's generic requests reaches the threshold number of	5000	Subsequent retransmissi

CAPABILITY	DESCRIPTION	THRESHOLD	ACTION
	requests per day, the subscriber will be blocked and it's retransmission request will no longer be honored during that particular day.		ons requests from that subscriber will be blocked.
Limitation of requests for refresh messages	Only refresh requests for 5000 messages or less will be honored.	5000	Request will not be honored.

A.5 L1 QUOTES TESTING

For details of IP addresses, visit our IP address pages at: <http://www.nyxdata.com/ipaddresses>

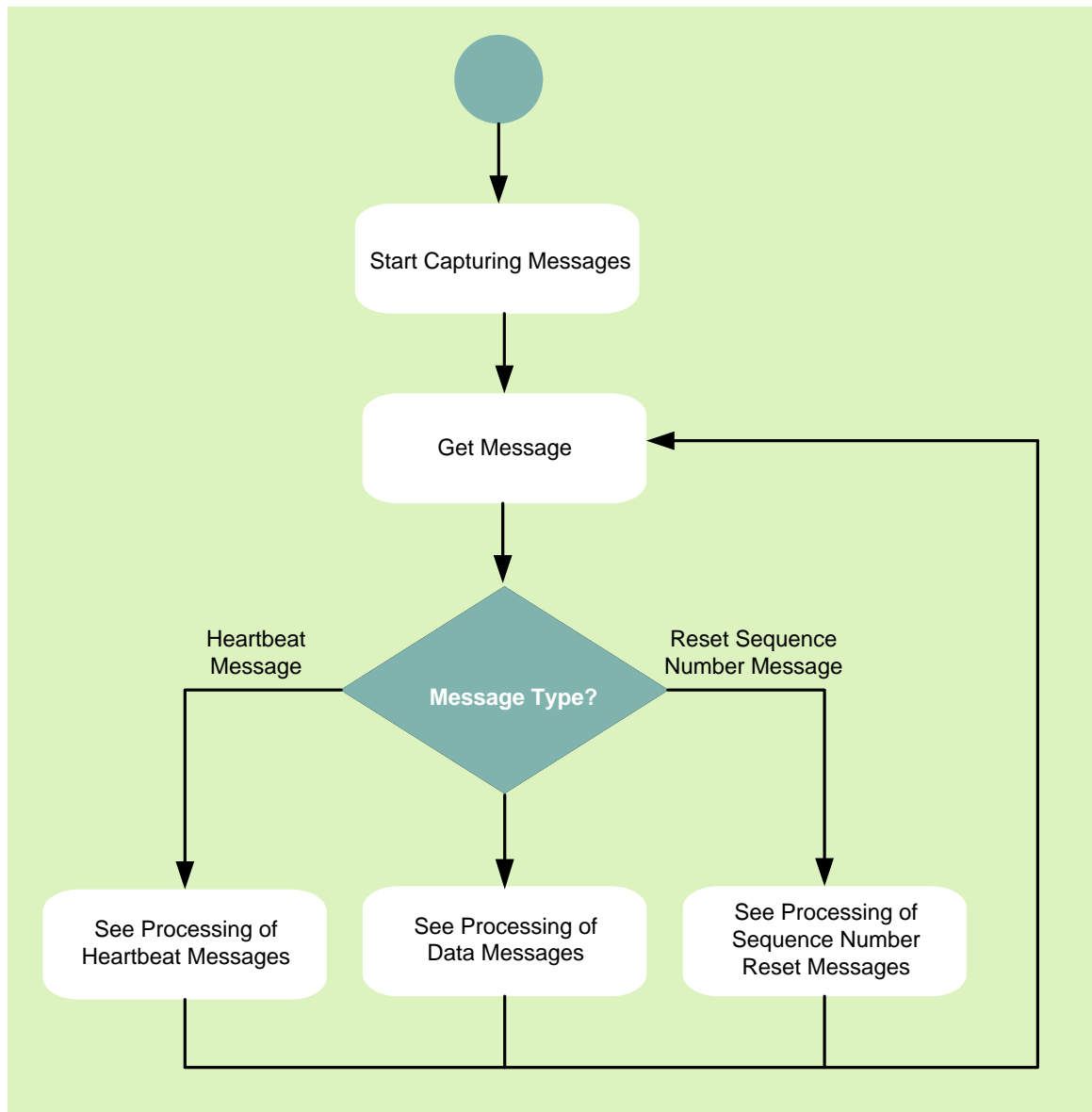
APPENDIX B: MESSAGE PROCESSING

The following sections provide workflow diagrams to simplify how the NYSE Quote messages should be processed.

B.1 PROCESSING OF MESSAGES

The following is the recommended way of processing messages.

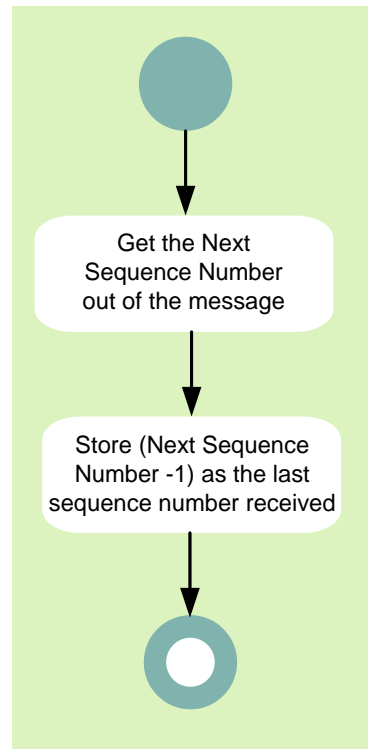
Figure 1 Processing of Messages



B.2 PROCESSING OF SEQUENCE NUMBER RESET MESSAGES

The following is the recommended way of processing Sequence Number Reset messages.

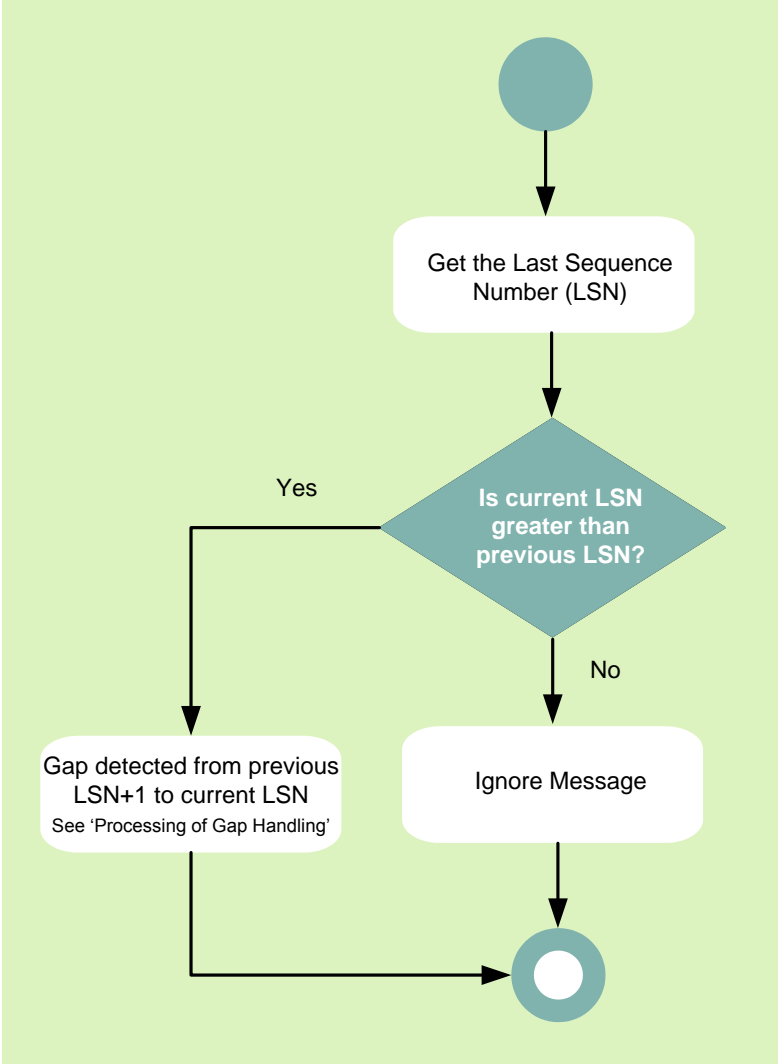
Figure 2 Processing of Sequence Number Reset Messages



B.3 PROCESSING OF HEARTBEAT MESSAGES

The following is the recommended way of processing Heartbeat messages.

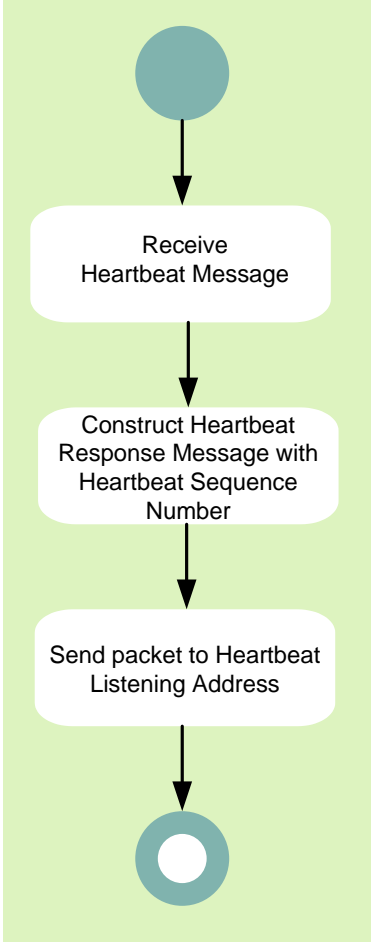
Figure 3 Processing of Heartbeat Messages



B.4 PROCESSING OF HEARTBEAT RESPONSE MESSAGES

The following is the recommended way of processing Heartbeat Response messages.

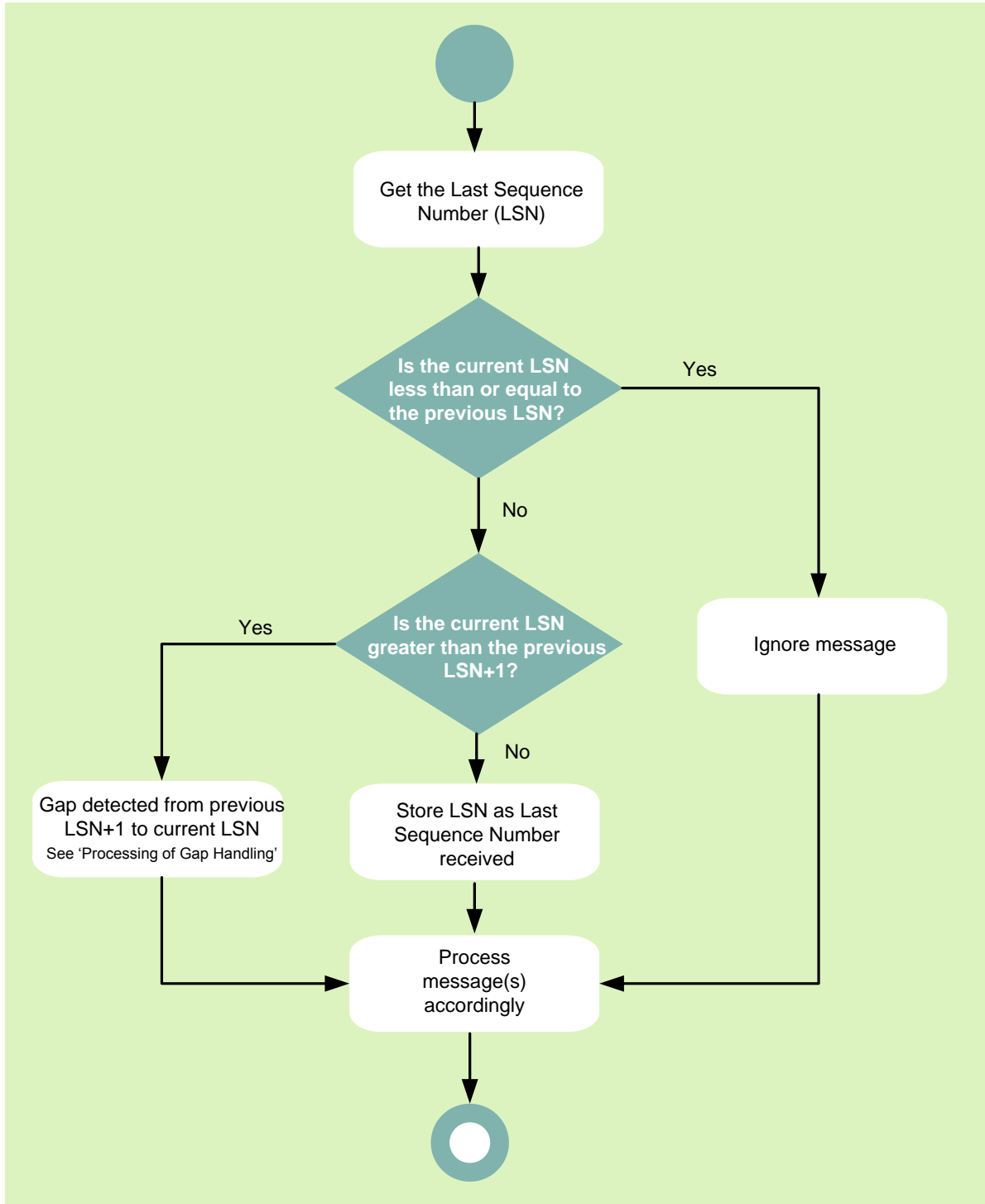
Figure 4 Processing of Heartbeat Response Messages



B.5 PROCESSING OF DATA MESSAGES

The following is the recommended way of processing data messages.

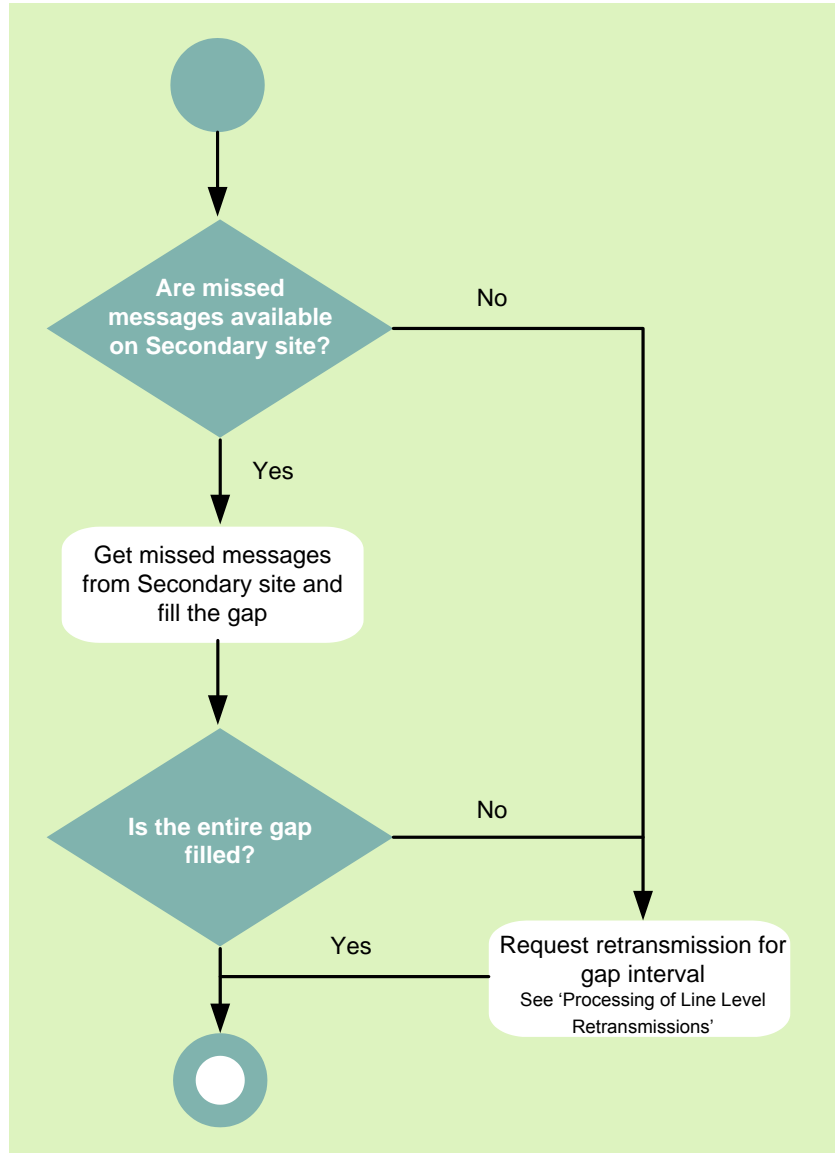
Figure 5 Processing of Data Messages



B.6 PROCESSING OF GAP HANDLING

The following is the recommended way of handling message gaps.

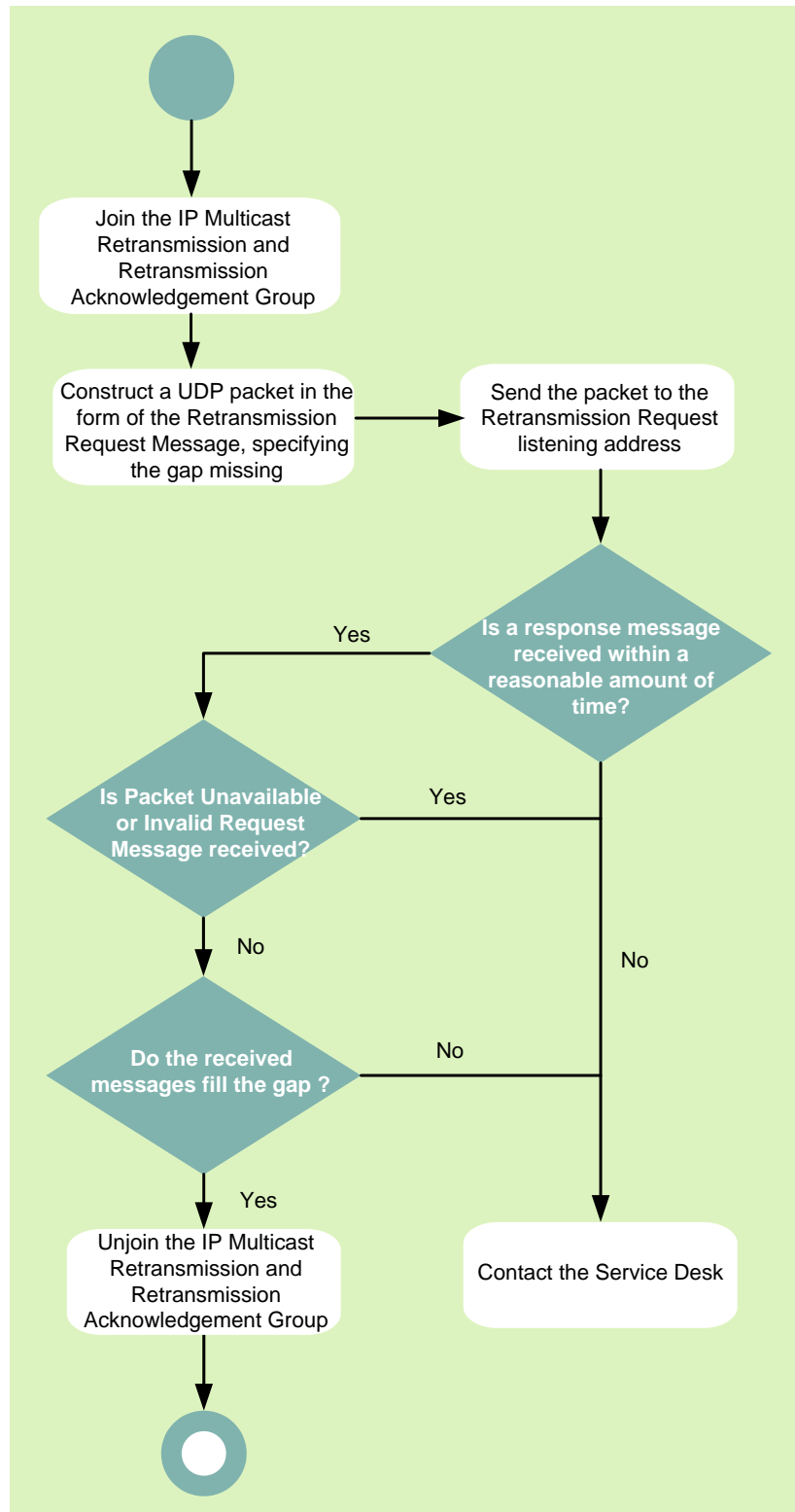
Figure 6 Processing of Gap Handling



B.7 PROCESSING OF LINE LEVEL RETRANSMISSIONS

The following is the recommended way of processing line level retransmissions.

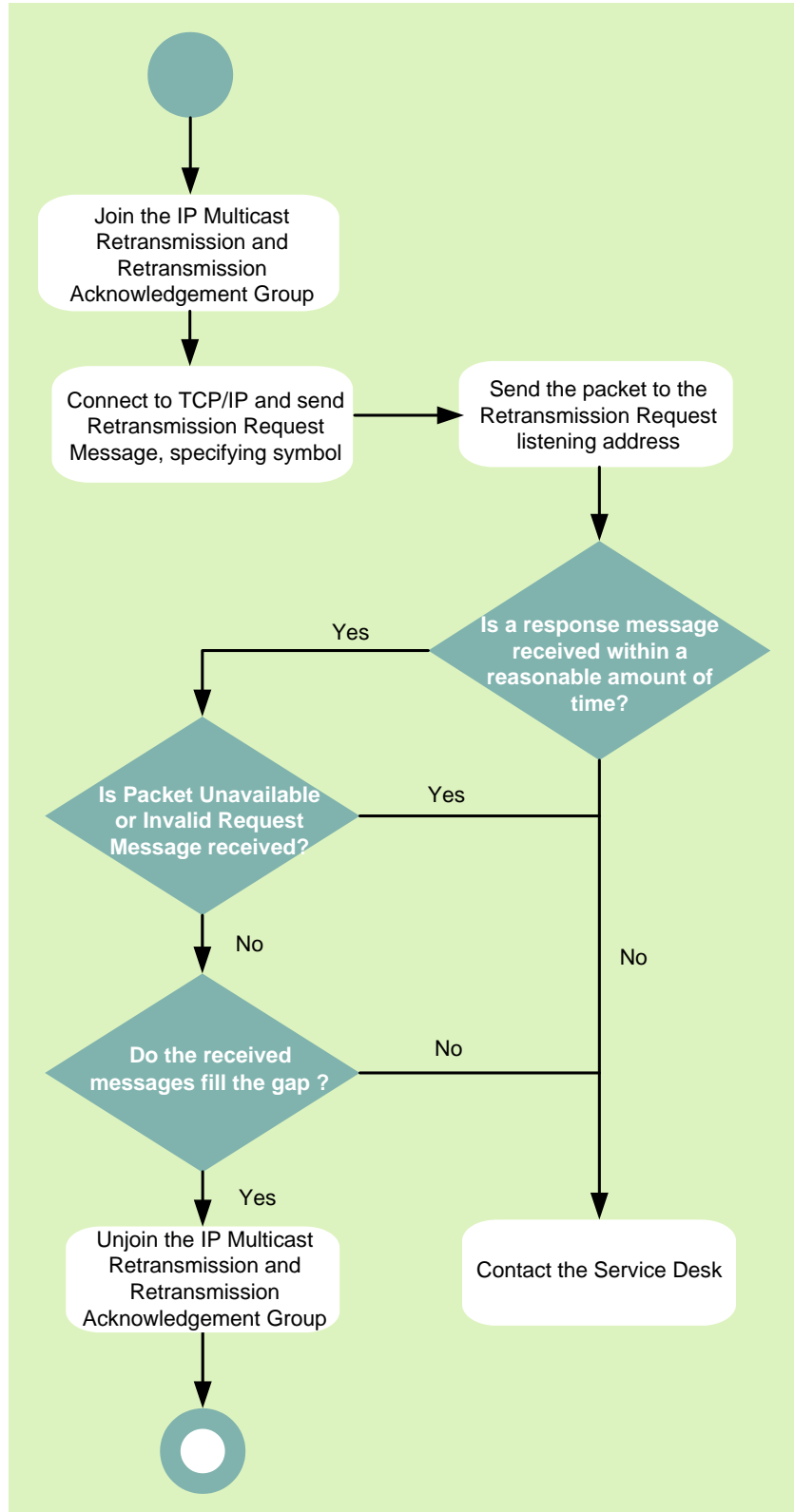
Figure 7 Processing of Line Level Retransmissions



B.8 PROCESSING OF REFRESH MESSAGES

The following is the recommended way of processing Refresh messages.

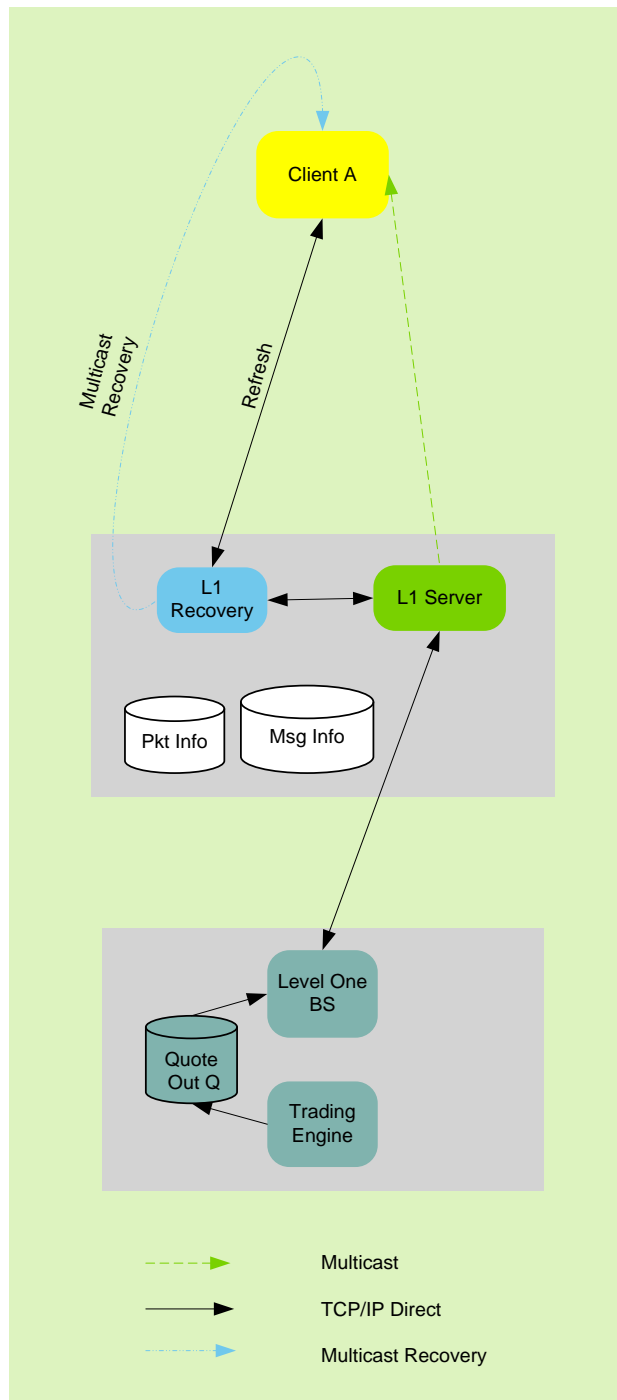
Figure 8 Processing of Refresh Messages



B.9 SYSTEM ARCHITECTURE

The following diagram illustrates basic data flow. Note that only one connection is shown per multicast group and TCP/IP recovery for simplicity. Subscribers must join multiple groups and make multiple TCP/IP connections to receive data in its entirety.

Figure 9 System Architecture – L1 Bonds Multicast Design



APPENDIX C: FREQUENTLY ASKED QUESTIONS

The following section provides information to assist subscribers with frequently asked questions concerning the NYSE Arca Quote Product. For more up-to-date information visit the product discussion board at:

<http://www.nyxdata.com/nysedata/Support/DiscussionBoard/tabid/108/view/topics/forumid/15/Default.aspx>

Q: What sizes are packets?

A: Packets can vary from 16 to 1400 bytes in length.

Q: What is the process to define a Source ID for retransmission purposes?

A: Contact SIAC Support and provide the desired Source ID. SIAC Support will evaluate and approve or disapprove the Source ID. In case of disapproval, a new Source ID has to be defined. In case of approval, SIAC Support will make the necessary updates on the product provider side to add the Source ID and applicable rules.

Q: What is the average message rate (messages per second) seen in a normal day for NYSE Quotes?

A: Refer to the NYSE Arca Quotes Impact Guide.

Q: What is the average number of messages seen in a normal day?

A: Refer to the NYSE Arca Quotes Impact Guide.

Q: Will retransmitted data ever come down the normal data feed?

A: No, retransmitted data will always be sent out on the designated retransmission IP/Multicast address/port.

Q: Are the Primary and Secondary feeds identical?

A: The feeds are not identical because they are distributed from two (2) different source addresses. However, the data content (like the sequence numbers and message content) are the same and can be used to fill gaps.

Q: We continue to see gaps in the feed even though our network is isolated and our server is underutilized. What could it be?

A: Although collisions are very rare, it is possible to have message gaps due to them. However, it is more likely that your multicast receiver is gapping during a message burst. This may be due to a UDP buffer overflow. SIAC recommends that Subscribers increase the standard UDP buffer setting to capture this burst.

Q: We sent several retransmission requests during the day and they were fulfilled, but now our retransmission requests are no longer being filled. What could it be?

A: Please contact SIAC Support to reactivate your Retransmission ID, as your application may have reached the retransmission thresholds.

Q: Is Symbol Index Mapping constant for the symbol or does it change every day? Can we download once and lookup for future references until we need new symbols?

A: It can change every day, but constant for a given day. So it is safe to cache it at the beginning of the day.

Q: What time are Symbol Index Mappings sent on multicast channel?

A: On most days they are sent around 3 AM Eastern, but it varies from day to day. It is safe to bring up your application around 1 AM to capture the symbol mappings over the multicast.

