



NYSE EuronextSM

NYSE OpenBook Ultra

Customer Interface Specifications

Version 1.7

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Chapter 1 Introduction

1.0 Copyright/Trademark Statements

***Copyright
Statement***

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Notice

Every effort was made to ensure that the information in this document was complete and accurate at the time of publication. However, information is subject to change without notice.

1.1 Document Information

Document History

The following outlines the evolution of this Customer Interface Specification:

Version	Date	Pages Affected	Comments
Rev 0.1	03/10/08	All	Initial version for internal review.
Rev 0.2	03/17/08	27,44	Comments based on developer feedback
Rev 0.3	03/27/08	9-25	New Port numbers added
Rev 1.0	03/31/08	All	Final version for distribution
Rev 1.1	04/23/08	28-35	Added symbol mapping file layout
Rev 1.2	05/29/08	15,16,34,36	Retrans Request IP Change, clarifications on repeating price points on Full and Delta update messages
Rev 1.3	05/30/08	15,16,34,36	<ul style="list-style-type: none"> - Description of MsgSize field in the Packet header - Layout of Fields in PricePoints in Delta Message - Layout of fields in the Book Refresh Request message (message type: 22) - Description of ExtendedRefreshRequest message (msgtype 27) - Data Types of fields in RetransResponse message (messagetype 10)
Rev 1.4	06/23/08	32, 33, 39, 40, 46, 48,56,58	<ul style="list-style-type: none"> -“6 -End of Refresh Retransmission" (32,33) - LinkFlag Description change (33,40) - Symbol Index and Refresh Request clarification (46,48) -LinkFlag Processing Notes (56) -Multiple Packet refresh FAQ (58)
Rev 1.5	8/10/09	All	<ul style="list-style-type: none"> - UAT IP addresses added - Msg types changed from 228/229 to 230/231 - Refresh and Retrans IP's are now separated - Full Update message change to Trading Status - Delta Update message Change to Quote Conditions and Trading Status - HeartbeatSubscription message type '19' added - New reject reason code
Rev 1.6	10/16/09	35	Correction to a typo found on the page 35 section 2.30, the UAT IP address heading should say “Secondary UAT Refresh” not “Secondary UAT Retransmission”
Rev 1.7	11/25/09	All	Update after documentation review

**Contact
Information**

NYSE Product/Account Questions

1-212-656-3800

NYSE Service Desk:

1-866-873-7422

**Additional
Product
Information**

For additional product information please visit

<http://www.nyxdata.com>

For updated capacity figures please visit our capacity pages at :

<http://www.nyxdata.com/capacity>

For additional support information on NYSE OpenBook please visit our discussion Board at:

<http://www.nyxdata.com/nyxdata/Support/DiscussionBoard/tabid/108/view/topics/forumid/4/Default.aspx>

For additional information on SFTI please visit

<http://www.nyse.com/technologies/sfti/1223635951074.html>

**Referenced
Documents**

Many of the general technical concepts referenced herein are detailed in the following documents:

[*Data Distribution Model for IP Multicast Based Environment- Version 1.7; SIAC Communication Engineering Planning and Development; 9 November 2000.*](#)

[*SFTI Customer Guide – Version 1.5; SIAC; 03/12/04*](#)

[*NYSE Symbolology*](#)

1.2 Terms and Definitions

Overview

The following section contains terms and definitions that are used throughout this document.

Terms	Definition
PDP Format	PDP format is a binary format that is used for NYSE Proprietary Data products such as NYSE OpenBook Ultra.
Big Endian	Refers to which bytes are most significant in multi-byte data types. In big-endian architectures, the leftmost bytes are most significant. This byte order also corresponds to Network Byte Order.
Group ID	IP Multicast address for PDP data delivery.
Host Symbol Format	A format set internally by NYSE order processing systems. Its representation of suffix is different from NMS systems.
MART	Message Archive and Retransmission – The PDP component that archives and retransmits PDP message packets.
Monotonical	Incrementally increase in value by one.
PDP	NYSE Proprietary Data Product.
Port Number	Socket port assigned to a feed.
Publisher	Generic name for any system/application generating PDP message products.
PDP_OB	Proprietary Data Products Order Book– The data publication engine of the PDP that ‘productizes’ and publishes PDP Orders message packets.
Recipient	Synonymous with <i>Subscriber</i> .
Sequence Number	A unique, sequential message ID that both ‘tags’ each message and allows recipients to identify message ‘gaps’ and request retransmission (if appropriate).
Subscriber	Any customer/client system that will subscribe to, and receive data products from, the PDP data engine (i.e. the PDP_OB).
MTU	Maximum Transfer Unit – The largest size of IP datagram that may be transferred on a given network. Most network implementations have a default setting of 1500 bytes.
SFTI	Secure Financial Transaction Infrastructure
NYSE	New York Stock Exchange
SIAC	Securities Industry Automation Corporation
ASCII	American Standard Code for Information Interchange
DMM	Formerly known as specialist

Chapter 2 – NYSE OpenBook Ultra IP Group Assignments

Overview

The following chapter will provide you with all of the necessary connectivity information in order to subscribe to the NYSE OpenBook Ultra data feed.

2.1 Source Subnet

The table below defines the Source subnet and the NetMask for all messages in the NYSE OpenBook Ultra datafeed. Please add **all** source subnets to your firewall setting.

Production Subnet	NetMask
198.140.53.64	FF FF FF C0
198.140.54.64	FF FF FF C0
198.140.53.128	FF FF FF C0
198.140.54.128	FF FF FF C0

UAT Subnet	NetMask
198.140.57.208	FF FF FF F0
198.140.57.240	FF FF FF F0

2.2 Multicast groups

Due to capacity measures and data granularity requested by several customers, the NYSE data feed will be split into twenty (20) data streams. Each data stream will deliver a set of update messages for a certain range of symbols. The table below describes the categorization of the data feed.

Feed Name	Description
OB_AA	Multicast Groups assigned to deliver book messages of symbols starting with letter A
OB_BB	Multicast Groups assigned to deliver book messages of symbols starting with letter B
OB_CC	Multicast Groups assigned to deliver book messages of symbols starting with letter C
OB_DD	Multicast Groups assigned to deliver book messages of symbols starting with letter D
OB_EE	Multicast Groups assigned to deliver book messages of symbols starting with letter E
OB_FF	Multicast Groups assigned to deliver book messages of symbols starting with letter F
OB_GG	Multicast Groups assigned to deliver book messages of symbols starting with letter G
OB_HH	Multicast Groups assigned to deliver book messages of symbols starting with letter D
OB_IJ	Multicast Groups assigned to deliver book messages of symbols starting with letters I or J
OB_KK	Multicast Groups assigned to deliver book messages of symbols starting with letter K
OB_LL	Multicast Groups assigned to deliver book messages of symbols starting with letter L
OB_MM	Multicast Groups assigned to deliver book messages of symbols starting with letter M
OB_NN	Multicast Groups assigned to deliver book messages of symbols starting with letter N
OB_OO	Multicast Groups assigned to deliver book messages of symbols starting with letter O
OB_PQ	Multicast Groups assigned to deliver book messages of symbols starting with letters P or Q
OB_RR	Multicast Groups assigned to deliver book messages of symbols starting with letter R
OB_SS	Multicast Groups assigned to deliver book messages of symbols starting with letter S
OB_TT	Multicast Groups assigned to deliver book messages of symbols starting with letter T
OB_UV	Multicast Groups assigned to deliver book messages of symbols starting with letters U or V
OB_WZ	Multicast Groups assigned to deliver book messages of symbols starting with letter W - Z

2.3 Joining Multicast groups

To access NYSE OpenBook Ultra, 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 “Retransmission of dropped packets” below). Please refer to Appendix C for diagrams that illustrate message processing and retrieval.

Data feeds for specific stocks are sent to different multicast addresses. This addressing scheme allows customers to subscribe to the specific data feeds and channels they need. Data feeds types are:

Multicast NYSE OpenBook Ultra (Includes Symbol update messages)
Multicast Retransmission
Multicast Refresh (Request Based)

2.4 Packet Retransmissions

In the event 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 OpenBook 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. It accepts primary and secondary connections to assist recovery on the subscriber’s end.

After a client establishes a TCP/IP connection, NYSE OpenBook Ultra will send a heartbeat request message to the client. Clients should respond to this request with a heartbeat response within a specific timeframe. This timeframe is currently set to Sixty (60) 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 60 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 NYSE OpenBook Ultra. Each Source ID may only be logged in once per port at any given time.

To define a Source ID for retransmission purposes, contact the NYSE Service Desk Support and provide the desired Source ID. The Service Desk team will evaluate and approve or disapprove Source IDs. In case of disapproval, a new Source ID must be defined. In case of approval, NYSE Service Desk will make the necessary updates on the NYSE OpenBook Ultra side to add the Source ID and applicable rules.

**2.5 Primary
Production IP
addresses**

The table below defines the Primary Production IP/Multicast group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Primary data Feed – Symbol range A	233.75.215.96	60096
Primary data Feed– Symbol range B	233.75.215.97	60097
Primary data Feed – Symbol range C	233.75.215.98	60098
Primary data Feed– Symbol range D	233.75.215.99	60099
Primary data Feed – Symbol range E	233.75.215.100	60100
Primary data Feed– Symbol range F	233.75.215.101	60101
Primary data Feed – Symbol range G	233.75.215.102	60102
Primary data Feed– Symbol range H	233.75.215.103	60103
Primary data Feed – Symbol range I and J	233.75.215.104	60104
Primary data Feed– Symbol range K	233.75.215.105	60105
Primary data Feed – Symbol range L	233.75.215.106	60106
Primary data Feed– Symbol range M	233.75.215.107	60107
Primary data Feed – Symbol range N	233.75.215.108	60108
Primary data Feed– Symbol range O	233.75.215.109	60109
Primary data Feed – Symbol range P and Q	233.75.215.110	60110
Primary data Feed– Symbol range R	233.75.215.111	60111
Primary data Feed – Symbol range S	233.75.215.112	60112
Primary data Feed– Symbol range T	233.75.215.113	60113
Primary data Feed – Symbol range U and V	233.75.215.114	60114
Primary data Feed– Symbol range W-Z	233.75.215.115	60115

**2.6 Secondary
Production IP
addresses**

The table below defines the Secondary Production IP/Multicast group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Secondary data Feed – Symbol range A	233.75.215.224	60224
Secondary data Feed– Symbol range B	233.75.215.225	60225
Secondary data Feed – Symbol range C	233.75.215.226	60226
Secondary data Feed– Symbol range D	233.75.215.227	60227
Secondary data Feed – Symbol range E	233.75.215.228	60228
Secondary data Feed– Symbol range F	233.75.215.229	60229
Secondary data Feed – Symbol range G	233.75.215.230	60230
Secondary data Feed– Symbol range H	233.75.215.231	60231
Secondary data Feed – Symbol range I and J	233.75.215.232	60232
Secondary data Feed– Symbol range K	233.75.215.233	60233
Secondary data Feed – Symbol range L	233.75.215.234	60234
Secondary data Feed– Symbol range M	233.75.215.235	60235
Secondary data Feed – Symbol range N	233.75.215.236	60236
Secondary data Feed– Symbol range O	233.75.215.237	60237
Secondary data Feed – Symbol range P and Q	233.75.215.238	60238
Secondary data Feed– Symbol range R	233.75.215.239	60239
Secondary data Feed – Symbol range S	233.75.215.240	60240
Secondary data Feed– Symbol range T	233.75.215.241	60241
Secondary data Feed – Symbol range U and V	233.75.215.242	60242
Secondary data Feed– Symbol range W-Z	233.75.215.243	60243

**2.7 Primary
Retransmission
Request IP
addresses**

The table below defines the Primary TCP/IP retransmission request group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Primary Retrans Request – Symbol range A	198.140.59.77	24100
Primary Retrans Request – Symbol range B	198.140.59.77	24200
Primary Retrans Request – Symbol range C	198.140.59.77	24300
Primary Retrans Request – Symbol range D	198.140.59.77	24400
Primary Retrans Request – Symbol range E	198.140.59.77	24500
Primary Retrans Request – Symbol range F	198.140.59.77	24600
Primary Retrans Request – Symbol range G	198.140.59.77	24700
Primary Retrans Request– Symbol range H	198.140.59.77	24800
Primary Retrans Request – Symbol range I and J	198.140.59.77	24900
Primary Retrans Request– Symbol range K	198.140.59.77	25000
Primary Retrans Request – Symbol range L	198.140.59.77	25100
Primary Retrans Request– Symbol range M	198.140.59.77	25200
Primary Retrans Request – Symbol range N	198.140.59.77	25300
Primary Retrans Request– Symbol range O	198.140.59.77	25400
Primary Retrans Request – Symbol range P and Q	198.140.59.77	25500
Primary Retrans Request– Symbol range R	198.140.59.77	25600
Primary Retrans Request – Symbol range S	198.140.59.77	25700
Primary Retrans Request– Symbol range T	198.140.59.77	25800
Primary Retrans Request – Symbol range U and V	198.140.59.77	25900
Primary Retrans Request– Symbol range W-Z	198.140.59.77	26000

2.8 Secondary Retransmission Request IP addresses

The table below defines the Secondary TCP/IP retransmission request group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Secondary Retrans Request – Symbol range A	198.140.58.77	24100
Secondary Retrans Request – Symbol range B	198.140.58.77	24200
Secondary Retrans Request – Symbol range C	198.140.58.77	24300
Secondary Retrans Request – Symbol range D	198.140.58.77	24400
Secondary Retrans Request – Symbol range E	198.140.58.77	24500
Secondary Retrans Request – Symbol range F	198.140.58.77	24600
Secondary Retrans Request – Symbol range G	198.140.58.77	24700
Secondary Retrans Request– Symbol range H	198.140.58.77	24800
Secondary Retrans Request – Symbol range I and J	198.140.58.77	24900
Secondary Retrans Request– Symbol range K	198.140.58.77	25000
Secondary Retrans Request – Symbol range L	198.140.58.77	25100
Secondary Retrans Request– Symbol range M	198.140.58.77	25200
Secondary Retrans Request – Symbol range N	198.140.58.77	25300
Secondary Retrans Request– Symbol range O	198.140.58.77	25400
Secondary Retrans Request – Symbol range P and Q	198.140.58.77	25500
Secondary Retrans Request– Symbol range R	198.140.58.77	25600
Secondary Retrans Request – Symbol range S	198.140.58.77	25700
Secondary Retrans Request– Symbol range T	198.140.58.77	25800
Secondary Retrans Request – Symbol range U and V	198.140.58.77	25900
Secondary Retrans Request– Symbol range W-Z	198.140.58.77	26000

**2.9 Primary
Retransmission
IP addresses**

The table below defines the Primary IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Primary Retransmission – Symbol range A	233.75.215.116	61001
Primary Retransmission – Symbol range B	233.75.215.116	61002
Primary Retransmission – Symbol range C	233.75.215.116	61003
Primary Retransmission – Symbol range D	233.75.215.116	61004
Primary Retransmission – Symbol range E	233.75.215.116	61005
Primary Retransmission – Symbol range F	233.75.215.116	61006
Primary Retransmission – Symbol range G	233.75.215.116	61007
Primary Retransmission – Symbol range H	233.75.215.116	61008
Primary Retransmission – Symbol range I and J	233.75.215.116	61009
Primary Retransmission – Symbol range K	233.75.215.116	61010
Primary Retransmission – Symbol range L	233.75.215.116	61011
Primary Retransmission – Symbol range M	233.75.215.116	61012
Primary Retransmission – Symbol range N	233.75.215.116	61013
Primary Retransmission – Symbol range O	233.75.215.116	61014
Primary Retransmission – Symbol range P and Q	233.75.215.116	61015
Primary Retransmission – Symbol range R	233.75.215.116	61016
Primary Retransmission – Symbol range S	233.75.215.116	61017
Primary Retransmission – Symbol range T	233.75.215.116	61018
Primary Retransmission – Symbol range U and V	233.75.215.116	61019
Primary Retransmission – Symbol range W-Z	233.75.215.116	61020

2.10 Secondary Retransmission IP addresses

The table below defines the Secondary IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Secondary Retransmission – Symbol range A	233.75.215.244	61101
Secondary Retransmission – Symbol range B	233.75.215.244	61102
Secondary Retransmission – Symbol range C	233.75.215.244	61103
Secondary Retransmission – Symbol range D	233.75.215.244	61104
Secondary Retransmission – Symbol range E	233.75.215.244	61105
Secondary Retransmission – Symbol range F	233.75.215.244	61106
Secondary Retransmission – Symbol range G	233.75.215.244	61107
Secondary Retransmission – Symbol range H	233.75.215.244	61108
Secondary Retransmission – Symbol range I and J	233.75.215.244	61109
Secondary Retransmission – Symbol range K	233.75.215.244	61110
Secondary Retransmission – Symbol range L	233.75.215.244	61111
Secondary Retransmission – Symbol range M	233.75.215.244	61112
Secondary Retransmission – Symbol range N	233.75.215.244	61113
Secondary Retransmission – Symbol range O	233.75.215.244	61114
Secondary Retransmission – Symbol range P and Q	233.75.215.244	61115
Secondary Retransmission – Symbol range R	233.75.215.244	61116
Secondary Retransmission – Symbol range S	233.75.215.244	61117
Secondary Retransmission – Symbol range T	233.75.215.244	61118
Secondary Retransmission – Symbol range U and V	233.75.215.244	61119
Secondary Retransmission – Symbol range W-Z	233.75.215.244	61120

2.11 Primary Refresh IP addresses

The table below defines the Primary IP/Multicast Refresh group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Primary Refresh – Symbol range A	233.75.215.116	61051
Primary Refresh – Symbol range B	233.75.215.116	61052
Primary Refresh – Symbol range C	233.75.215.116	61053
Primary Refresh – Symbol range D	233.75.215.116	61054
Primary Refresh – Symbol range E	233.75.215.116	61055
Primary Refresh – Symbol range F	233.75.215.116	61056
Primary Refresh – Symbol range G	233.75.215.116	61057
Primary Refresh – Symbol range H	233.75.215.116	61058
Primary Refresh – Symbol range I and J	233.75.215.116	61059
Primary Refresh – Symbol range K	233.75.215.116	61060
Primary Refresh – Symbol range L	233.75.215.116	61061
Primary Refresh – Symbol range M	233.75.215.116	61062
Primary Refresh – Symbol range N	233.75.215.116	61063
Primary Refresh – Symbol range O	233.75.215.116	61064
Primary Refresh – Symbol range P and Q	233.75.215.116	61065
Primary Refresh – Symbol range R	233.75.215.116	61066
Primary Refresh – Symbol range S	233.75.215.116	61067
Primary Refresh – Symbol range T	233.75.215.116	61068
Primary Refresh – Symbol range U and V	233.75.215.116	61069
Primary Refresh – Symbol range W-Z	233.75.215.116	61070

2.12 Secondary Refresh IP addresses

The table below defines the Secondary IP/Multicast Refresh group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Secondary Refresh – Symbol range A	233.75.215.244	61151
Secondary Refresh – Symbol range B	233.75.215.244	61152
Secondary Refresh – Symbol range C	233.75.215.244	61153
Secondary Refresh – Symbol range D	233.75.215.244	61154
Secondary Refresh – Symbol range E	233.75.215.244	61155
Secondary Refresh – Symbol range F	233.75.215.244	61156
Secondary Refresh – Symbol range G	233.75.215.244	61157
Secondary Refresh – Symbol range H	233.75.215.244	611058
Secondary Refresh – Symbol range I and J	233.75.215.244	61159
Secondary Refresh – Symbol range K	233.75.215.244	61160
Secondary Refresh – Symbol range L	233.75.215.244	61161
Secondary Refresh – Symbol range M	233.75.215.244	61162
Secondary Refresh – Symbol range N	233.75.215.244	61163
Secondary Refresh – Symbol range O	233.75.215.244	61164
Secondary Refresh – Symbol range P and Q	233.75.215.244	61165
Secondary Refresh – Symbol range R	233.75.215.244	61166
Secondary Refresh – Symbol range S	233.75.215.244	61167
Secondary Refresh – Symbol range T	233.75.215.244	61168
Secondary Refresh – Symbol range U and V	233.75.215.244	61169
Secondary Refresh – Symbol range W-Z	233.75.215.244	61170

**2.13
Retransmission
Request
Thresholds**

The table below summarizes the Retransmission request thresholds for the NYSE OpenBook Ultra feed. The numbers below represent the thresholds per channel.

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 the NYSE Service Desk 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 packets or less will be honored.	1000	Request will not be processed.
Limitation of Generic Requests Time Interval	If the generic request on a message which is not within this threshold, the request will not be honored.	75000	Request will not be honored.
Limitation of Generic Requests	If the number of a subscriber's generic requests reaches the threshold number of requests per day, the subscriber will be blocked and its retransmission request will no longer be honored during that particular day.	500	Subsequent retransmissions 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.

**2.14 NYSE
OpenBook
Ultra Testing**

The following section contains the IP/Multicast group assignments and Retransmission request assignments for the test/replay service. These replay tests are generally run at night (**Tues and Thurs from 7PM to 9PM**) and over different multicast groups than the production environment so that subscribers do not need to worry about incorrect data over the production lines.

The data replayed over this network is from a previous trading session (canned)—all messages, or a range of messages, for a given service in their original sequence.

**2. 15 Primary
Test IP
Addresses**

The table below defines the Primary Test IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Primary Test data Feed – Symbol range A	233.75.215.64	60064
Primary Test data Feed– Symbol range B	233.75.215.65	60065
Primary Test data Feed – Symbol range C	233.75.215.66	60066
Primary Test data Feed– Symbol range D	233.75.215.67	60067
Primary Test data Feed – Symbol range E	233.75.215.68	60068
Primary Test data Feed– Symbol range F	233.75.215.69	60069
Primary Test data Feed – Symbol range G	233.75.215.70	60070
Primary Test data Feed– Symbol range H	233.75.215.71	60071
Primary Test data Feed – Symbol range I and J	233.75.215.72	60072
Primary Test data Feed– Symbol range K	233.75.215.73	60073
Primary Test data Feed – Symbol range L	233.75.215.74	60074
Primary Test data Feed– Symbol range M	233.75.215.75	60075
Primary Test data Feed – Symbol range N	233.75.215.76	60076
Primary Test data Feed– Symbol range O	233.75.215.77	60077
Primary Test data Feed – Symbol range P and Q	233.75.215.78	60078
Primary Test data Feed– Symbol range R	233.75.215.79	60079
Primary Test data Feed – Symbol range S	233.75.215.80	60080
Primary Test data Feed– Symbol range T	233.75.215.81	60081
Primary Test data Feed – Symbol range U and V	233.75.215.82	60082
Primary Test data Feed– Symbol range W - Z	233.75.215.83	60083

2.16 Secondary Test IP Addresses The table below defines the Secondary Test IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Secondary Test data Feed – Symbol range A	233.75.215.192	60192
Secondary Test data Feed– Symbol range B	233.75.215.193	60193
Secondary Test data Feed – Symbol range C	233.75.215.194	60194
Secondary Test data Feed– Symbol range D	233.75.215.195	60195
Secondary Test data Feed – Symbol range E	233.75.215.196	60196
Secondary Test data Feed– Symbol range F	233.75.215.197	60197
Secondary Test data Feed – Symbol range G	233.75.215.198	60198
Secondary Test data Feed– Symbol range H	233.75.215.199	60199
Secondary Test data Feed – Symbol range I and J	233.75.215.200	60200
Secondary Test data Feed– Symbol range K	233.75.215.201	60201
Secondary Test data Feed – Symbol range L	233.75.215.202	60202
Secondary Test data Feed– Symbol range M	233.75.215.203	60203
Secondary Test data Feed – Symbol range N	233.75.215.204	60204
Secondary Test data Feed– Symbol range O	233.75.215.205	60205
Secondary Test data Feed – Symbol range P and Q	233.75.215.206	60206
Secondary Test data Feed– Symbol range R	233.75.215.207	60207
Secondary Test data Feed – Symbol range S	233.75.215.208	60208
Secondary Test data Feed– Symbol range T	233.75.215.209	60209
Secondary Test data Feed – Symbol range U and V	233.75.215.210	60210
Secondary Test data Feed– Symbol range W - Z	233.75.215.211	60211

**2.17 Primary
Test
Retransmission
Request IP
addresses**

The table below defines the Primary test TCP/IP retransmission request group and port assignments for all messages in the NYSE OpenBook Ultra feed.
Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Primary Test Retrans Request – Symbol range A	198.140.59.77	27100
Primary Test Retrans Request – Symbol range B	198.140.59.77	27200
Primary Test Retrans Request – Symbol range C	198.140.59.77	27300
Primary Test Retrans Request – Symbol range D	198.140.59.77	27400
Primary Test Retrans Request – Symbol range E	198.140.59.77	27500
Primary Test Retrans Request – Symbol range F	198.140.59.77	27600
Primary Test Retrans Request – Symbol range G	198.140.59.77	27700
Primary Test Retrans Request– Symbol range H	198.140.59.77	27800
Primary Test Retrans Request – Symbol range I and J	198.140.59.77	27900
Primary Test Retrans Request– Symbol range K	198.140.59.77	28000
Primary Test Retrans Request – Symbol range L	198.140.59.77	28100
Primary Test Retrans Request– Symbol range M	198.140.59.77	28200
Primary Test Retrans Request – Symbol range N	198.140.59.77	28300
Primary Test Retrans Request– Symbol range O	198.140.59.77	28400
Primary Test Retrans Request – Symbol range P and Q	198.140.59.77	28500
Primary Test Retrans Request– Symbol range R	198.140.59.77	28600
Primary Test Retrans Request – Symbol range S	198.140.59.77	28700
Primary Test Retrans Request– Symbol range T	198.140.59.77	28800
Primary Test Retrans Request – Symbol range U and V	198.140.59.77	28900
Primary Test Retrans Request– Symbol range W - Z	198.140.59.77	29000

2.18 Secondary Test Retransmission Request IP addresses

The table below defines the Secondary test TCP/IP retransmission request group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Secondary Test Retrans Request – Symbol range A	198.140.58.77	27100
Secondary Test Retrans Request – Symbol range B	198.140.58.77	27200
Secondary Test Retrans Request – Symbol range C	198.140.58.77	27300
Secondary Test Retrans Request – Symbol range D	198.140.58.77	27400
Secondary Test Retrans Request – Symbol range E	198.140.58.77	27500
Secondary Test Retrans Request – Symbol range F	198.140.58.77	27600
Secondary Test Retrans Request – Symbol range G	198.140.58.77	27700
Secondary Test Retrans Request– Symbol range H	198.140.58.77	27800
Secondary Test Retrans Request – Symbol range I and J	198.140.58.77	27900
Secondary Test Retrans Request– Symbol range K	198.140.58.77	28000
Secondary Test Retrans Request – Symbol range L	198.140.58.77	28100
Secondary Test Retrans Request– Symbol range M	198.140.58.77	28200
Secondary Test Retrans Request – Symbol range N	198.140.58.77	28300
Secondary Test Retrans Request– Symbol range O	198.140.58.77	28400
Secondary Test Retrans Request – Symbol range P and Q	198.140.58.77	28500
Secondary Test Retrans Request– Symbol range R	198.140.58.77	28600
Secondary Test Retrans Request – Symbol range S	198.140.58.77	28700
Secondary Test Retrans Request– Symbol range T	198.140.58.77	28800
Secondary Test Retrans Request – Symbol range U and V	198.140.58.77	28900
Secondary Test Retrans Request– Symbol range W - Z	198.140.58.77	29000

**2. 19 Primary
Test
Retransmission
IP addresses**

The table below defines the Primary Test IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Primary Test Retransmission – Symbol range A	233.75.215.84	61201
Primary Test Retransmission – Symbol range B	233.75.215.84	61202
Primary Test Retransmission – Symbol range C	233.75.215.84	61203
Primary Test Retransmission – Symbol range D	233.75.215.84	61204
Primary Test Retransmission – Symbol range E	233.75.215.84	61205
Primary Test Retransmission – Symbol range F	233.75.215.84	61206
Primary Test Retransmission – Symbol range G	233.75.215.84	61207
Primary Test Retransmission – Symbol range H	233.75.215.84	61208
Primary Test Retransmission – Symbol range I and J	233.75.215.84	61209
Primary Test Retransmission – Symbol range K	233.75.215.84	61210
Primary Test Retransmission – Symbol range L	233.75.215.84	61211
Primary Test Retransmission – Symbol range M	233.75.215.84	61212
Primary Test Retransmission – Symbol range N	233.75.215.84	61213
Primary Test Retransmission – Symbol range O	233.75.215.84	61214
Primary Test Retransmission – Symbol range P and Q	233.75.215.84	61215
Primary Test Retransmission – Symbol range R	233.75.215.84	61216
Primary Test Retransmission – Symbol range S	233.75.215.84	61217
Primary Test Retransmission – Symbol range T	233.75.215.84	61218
Primary Test Retransmission – Symbol range U and V	233.75.215.84	61219
Primary Test Retransmission – Symbol range W - Z	233.75.215.84	61220

**2. 20 Secondary
Test
Retransmission
IP addresses**

The table below defines the Secondary Test IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Secondary Test Retransmission – Symbol range A	233.75.215.212	61301
Secondary Test Retransmission – Symbol range B	233.75.215.212	61302
Secondary Test Retransmission – Symbol range C	233.75.215.212	61303
Secondary Test Retransmission – Symbol range D	233.75.215.212	61304
Secondary Test Retransmission – Symbol range E	233.75.215.212	61305
Secondary Test Retransmission – Symbol range F	233.75.215.212	61306
Secondary Test Retransmission – Symbol range G	233.75.215.212	61307
Secondary Test Retransmission – Symbol range H	233.75.215.212	61308
Secondary Test Retransmission – Symbol range I and J	233.75.215.212	61309
Secondary Test Retransmission – Symbol range K	233.75.215.212	61310
Secondary Test Retransmission – Symbol range L	233.75.215.212	61311
Secondary Test Retransmission – Symbol range M	233.75.215.212	61312
Secondary Test Retransmission – Symbol range N	233.75.215.212	61313
Secondary Test Retransmission – Symbol range O	233.75.215.212	61314
Secondary Test Retransmission – Symbol range P and Q	233.75.215.212	61315
Secondary Test Retransmission – Symbol range R	233.75.215.212	61316
Secondary Test Retransmission – Symbol range S	233.75.215.212	61317
Secondary Test Retransmission – Symbol range T	233.75.215.212	61318
Secondary Test Retransmission – Symbol range U and V	233.75.215.212	61319
Secondary Test Retransmission – Symbol range W- Z	233.75.215.212	61320

**2. 21 Primary
Test Refresh IP
addresses**

The table below defines the Primary Test IP/Multicast Refresh group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Primary Test Refresh – Symbol range A	233.75.215.84	61251
Primary Test Refresh – Symbol range B	233.75.215.84	61252
Primary Test Refresh – Symbol range C	233.75.215.84	61253
Primary Test Refresh – Symbol range D	233.75.215.84	61254
Primary Test Refresh – Symbol range E	233.75.215.84	61255
Primary Test Refresh – Symbol range F	233.75.215.84	61256
Primary Test Refresh – Symbol range G	233.75.215.84	61257
Primary Test Refresh – Symbol range H	233.75.215.84	61258
Primary Test Refresh – Symbol range I and J	233.75.215.84	61259
Primary Test Refresh – Symbol range K	233.75.215.84	61260
Primary Test Refresh – Symbol range L	233.75.215.84	61261
Primary Test Refresh – Symbol range M	233.75.215.84	61262
Primary Test Refresh – Symbol range N	233.75.215.84	61263
Primary Test Refresh – Symbol range O	233.75.215.84	61264
Primary Test Refresh – Symbol range P and Q	233.75.215.84	61265
Primary Test Refresh – Symbol range R	233.75.215.84	61266
Primary Test Refresh – Symbol range S	233.75.215.84	61267
Primary Test Refresh – Symbol range T	233.75.215.84	61268
Primary Test Refresh – Symbol range U and V	233.75.215.84	61269
Primary Test Refresh – Symbol range W - Z	233.75.215.84	61270

**2. 22 Secondary
Test Refresh IP
addresses**

The table below defines the Secondary Test IP/Multicast Refresh group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:

NYSE OpenBook Ultra	IP	Port
Secondary Test Refresh – Symbol range A	233.75.215.212	61351
Secondary Test Refresh – Symbol range B	233.75.215.212	61352
Secondary Test Refresh – Symbol range C	233.75.215.212	61353
Secondary Test Refresh – Symbol range D	233.75.215.212	61354
Secondary Test Refresh – Symbol range E	233.75.215.212	61355
Secondary Test Refresh – Symbol range F	233.75.215.212	61356
Secondary Test Refresh – Symbol range G	233.75.215.212	61357
Secondary Test Refresh – Symbol range H	233.75.215.212	61358
Secondary Test Refresh – Symbol range I and J	233.75.215.212	61359
Secondary Test Refresh – Symbol range K	233.75.215.212	61360
Secondary Test Refresh – Symbol range L	233.75.215.212	61361
Secondary Test Refresh – Symbol range M	233.75.215.212	61362
Secondary Test Refresh – Symbol range N	233.75.215.212	61363
Secondary Test Refresh – Symbol range O	233.75.215.212	61364
Secondary Test Refresh – Symbol range P and Q	233.75.215.212	61365
Secondary Test Refresh – Symbol range R	233.75.215.212	61366
Secondary Test Refresh – Symbol range S	233.75.215.212	61367
Secondary Test Refresh – Symbol range T	233.75.215.212	61368
Secondary Test Refresh – Symbol range U and V	233.75.215.212	61369
Secondary Test Refresh – Symbol range W- Z	233.75.215.212	61370

**2.23 NYSE
OpenBook
Ultra UAT
Testing**

The following section contains the IP/Multicast group assignments and Retransmission request assignments for the User Acceptance testing environment. These replay tests are generally run intra-day **Mon thru Friday from 9AM to 5PM** and over different multicast groups than the production environment and test environment so that subscribers do not need to worry about incorrect data over the production lines.

The data replayed over this network is from a previous trading session (canned)—all messages, or a range of messages, for a given service in their original sequence.

**2. 24 Primary
UAT IP
Addresses**

The table below defines the Primary UAT IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges: (current UAT environment offers AA and WZ channels)

NYSE OpenBook Ultra	IP	Port
Primary UAT data Feed – Symbol range A	233.75.215.50	65022
Primary UAT data Feed– Symbol range B	233.75.215.50	65023
Primary UAT data Feed – Symbol range C	233.75.215.50	65024
Primary UAT data Feed– Symbol range D	233.75.215.50	65025
Primary UAT data Feed – Symbol range E	233.75.215.50	65026
Primary UAT data Feed– Symbol range F	233.75.215.50	65027
Primary UAT data Feed – Symbol range G	233.75.215.50	65028
Primary UAT data Feed– Symbol range H	233.75.215.50	65029
Primary UAT data Feed – Symbol range I and J	233.75.215.50	65030
Primary UAT data Feed– Symbol range K	233.75.215.50	65031
Primary UAT data Feed – Symbol range L	233.75.215.50	65032
Primary UAT data Feed– Symbol range M	233.75.215.50	65033
Primary UAT data Feed – Symbol range N	233.75.215.50	65034
Primary UAT data Feed– Symbol range O	233.75.215.50	65035
Primary UAT data Feed – Symbol range P and Q	233.75.215.50	65036
Primary UAT data Feed– Symbol range R	233.75.215.50	65037
Primary UAT data Feed – Symbol range S	233.75.215.50	65038
Primary UAT data Feed– Symbol range T	233.75.215.50	65039
Primary UAT data Feed – Symbol range U and V	233.75.215.50	65040
Primary UAT data Feed– Symbol range W - Z	233.75.215.50	65041

**2.25 Secondary
UAT IP
Addresses**

The table below defines the Secondary UAT IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:
(current UAT environment offers AA and WZ channels)

NYSE OpenBook Ultra	IP	Port
Secondary UAT data Feed – Symbol range A	233.75.215.178	65122
Secondary UAT data Feed– Symbol range B	233.75.215.178	65123
Secondary UAT data Feed – Symbol range C	233.75.215.178	65124
Secondary UAT data Feed– Symbol range D	233.75.215.178	65125
Secondary UAT data Feed – Symbol range E	233.75.215.178	65126
Secondary UAT data Feed– Symbol range F	233.75.215.178	65127
Secondary UAT data Feed – Symbol range G	233.75.215.178	65128
Secondary UAT data Feed– Symbol range H	233.75.215.178	65129
Secondary UAT data Feed – Symbol range I and J	233.75.215.178	65130
Secondary UAT data Feed– Symbol range K	233.75.215.178	65131
Secondary UAT data Feed – Symbol range L	233.75.215.178	65132
Secondary UAT data Feed– Symbol range M	233.75.215.178	65133
Secondary UAT data Feed – Symbol range N	233.75.215.178	65134
Secondary UAT data Feed– Symbol range O	233.75.215.178	65135
Secondary UAT data Feed – Symbol range P and Q	233.75.215.178	65136
Secondary UAT data Feed– Symbol range R	233.75.215.178	65137
Secondary UAT data Feed – Symbol range S	233.75.215.178	65138
Secondary UAT data Feed– Symbol range T	233.75.215.178	65139
Secondary UAT data Feed – Symbol range U and V	233.75.215.178	65140
Secondary UAT data Feed– Symbol range W - Z	233.75.215.178	65141

**2.26 Primary
UAT
Retransmission
Request IP
addresses**

The table below defines the Primary UAT TCP/IP retransmission request group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:
(current UAT environment offers AA and WZ channels)

NYSE OpenBook Ultra	IP	Port
Primary UAT Retrans Request – Symbol range A	198.140.57.11	65212
Primary UAT Retrans Request – Symbol range B	198.140.57.11	65213
Primary UAT Retrans Request – Symbol range C	198.140.57.11	65214
Primary UAT Retrans Request – Symbol range D	198.140.57.11	65215
Primary UAT Retrans Request – Symbol range E	198.140.57.11	65216
Primary UAT Retrans Request – Symbol range F	198.140.57.11	65217
Primary UAT Retrans Request – Symbol range G	198.140.57.11	65218
Primary UAT Retrans Request– Symbol range H	198.140.57.11	65219
Primary UAT Retrans Request – Symbol range I and J	198.140.57.11	65220
Primary UAT Retrans Request– Symbol range K	198.140.57.11	65221
Primary UAT Retrans Request – Symbol range L	198.140.57.11	65222
Primary UAT Retrans Request– Symbol range M	198.140.57.11	65223
Primary UAT Retrans Request – Symbol range N	198.140.57.11	65224
Primary UAT Retrans Request– Symbol range O	198.140.57.11	65225
Primary UAT Retrans Request – Symbol range P and Q	198.140.57.11	65226
Primary UAT Retrans Request– Symbol range R	198.140.57.11	65227
Primary UAT Retrans Request – Symbol range S	198.140.57.11	65228
Primary UAT Retrans Request– Symbol range T	198.140.57.11	65229
Primary UAT Retrans Request – Symbol range U and V	198.140.57.11	65230
Primary UAT Retrans Request– Symbol range W - Z	198.140.57.11	65231

**3. 27 Primary
UAT
Retransmission
IP addresses**

The table below defines the Primary UAT IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed.
Data will be divided into 20 symbol ranges:
(current UAT environment offers AA and WZ channels)

NYSE OpenBook Ultra	IP	Port
Primary UAT Retransmission – Symbol range A	233.75.215.50	65072
Primary UAT Retransmission – Symbol range B	233.75.215.50	65073
Primary UAT Retransmission – Symbol range C	233.75.215.50	65074
Primary UAT Retransmission – Symbol range D	233.75.215.50	65075
Primary UAT Retransmission – Symbol range E	233.75.215.50	65076
Primary UAT Retransmission – Symbol range F	233.75.215.50	65077
Primary UAT Retransmission – Symbol range G	233.75.215.50	65078
Primary UAT Retransmission – Symbol range H	233.75.215.50	65079
Primary UAT Retransmission – Symbol range I and J	233.75.215.50	65080
Primary UAT Retransmission – Symbol range K	233.75.215.50	65081
Primary UAT Retransmission – Symbol range L	233.75.215.50	65082
Primary UAT Retransmission – Symbol range M	233.75.215.50	65083
Primary UAT Retransmission – Symbol range N	233.75.215.50	65084
Primary UAT Retransmission – Symbol range O	233.75.215.50	65085
Primary UAT Retransmission – Symbol range P and Q	233.75.215.50	65086
Primary UAT Retransmission – Symbol range R	233.75.215.50	65087
Primary UAT Retransmission – Symbol range S	233.75.215.50	65088
Primary UAT Retransmission – Symbol range T	233.75.215.50	65089
Primary UAT Retransmission – Symbol range U and V	233.75.215.50	65090
Primary UAT Retransmission – Symbol range W - Z	233.75.215.50	65091

2. 28 Secondary UAT Retransmission IP addresses

The table below defines the Secondary UAT IP/Multicast retransmission group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges: (current UAT environment offers AA and WZ channels)

NYSE OpenBook Ultra	IP	Port
Secondary UAT Retransmission – Symbol range A	233.75.215.178	65172
Secondary UAT Retransmission – Symbol range B	233.75.215.178	65173
Secondary UAT Retransmission – Symbol range C	233.75.215.178	65174
Secondary UAT Retransmission – Symbol range D	233.75.215.178	65175
Secondary UAT Retransmission – Symbol range E	233.75.215.178	65176
Secondary UAT Retransmission – Symbol range F	233.75.215.178	65177
Secondary UAT Retransmission – Symbol range G	233.75.215.178	65178
Secondary UAT Retransmission – Symbol range H	233.75.215.178	65179
Secondary UAT Retransmission – Symbol range I and J	233.75.215.178	65180
Secondary UAT Retransmission – Symbol range K	233.75.215.178	65181
Secondary UAT Retransmission – Symbol range L	233.75.215.178	65182
Secondary UAT Retransmission – Symbol range M	233.75.215.178	65183
Secondary UAT Retransmission – Symbol range N	233.75.215.178	65184
Secondary UAT Retransmission – Symbol range O	233.75.215.178	65185
Secondary UAT Retransmission – Symbol range P and Q	233.75.215.178	65186
Secondary UAT Retransmission – Symbol range R	233.75.215.178	65187
Secondary UAT Retransmission – Symbol range S	233.75.215.178	65188
Secondary UAT Retransmission – Symbol range T	233.75.215.178	65189
Secondary UAT Retransmission – Symbol range U and V	233.75.215.178	65190
Secondary UAT Retransmission – Symbol range W- Z	233.75.215.178	65191

**2. 29 Primary
UAT Refresh
IP addresses**

The table below defines the Primary UAT IP/Multicast Refresh group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:
(current UAT environment offers AA and WZ channels)

NYSE OpenBook Ultra	IP	Port
Primary UAT Refresh – Symbol range A	233.75.215.50	64501
Primary UAT Refresh – Symbol range B	233.75.215.50	64502
Primary UAT Refresh – Symbol range C	233.75.215.50	64503
Primary UAT Refresh – Symbol range D	233.75.215.50	64504
Primary UAT Refresh – Symbol range E	233.75.215.50	64505
Primary UAT Refresh – Symbol range F	233.75.215.50	64506
Primary UAT Refresh – Symbol range G	233.75.215.50	64507
Primary UAT Refresh – Symbol range H	233.75.215.50	64508
Primary UAT Refresh – Symbol range I and J	233.75.215.50	64509
Primary UAT Refresh – Symbol range K	233.75.215.50	64510
Primary UAT Refresh – Symbol range L	233.75.215.50	64511
Primary UAT Refresh – Symbol range M	233.75.215.50	64512
Primary UAT Refresh – Symbol range N	233.75.215.50	64513
Primary UAT Refresh – Symbol range O	233.75.215.50	64514
Primary UAT Refresh – Symbol range P and Q	233.75.215.50	64515
Primary UAT Refresh – Symbol range R	233.75.215.50	64516
Primary UAT Refresh – Symbol range S	233.75.215.50	64517
Primary UAT Refresh – Symbol range T	233.75.215.50	64518
Primary UAT Refresh – Symbol range U and V	233.75.215.50	64519
Primary UAT Refresh – Symbol range W - Z	233.75.215.50	64520

2. 30 Secondary UAT Refresh IP addresses

The table below defines the Secondary UAT IP/Multicast Refresh group and port assignments for all messages in the NYSE OpenBook Ultra feed. Data will be divided into 20 symbol ranges:
(current UAT environment offers AA and WZ channels)

NYSE OpenBook Ultra	IP	Port
Secondary UAT Refresh – Symbol range A	233.75.215.178	64526
Secondary UAT Refresh – Symbol range B	233.75.215.178	64527
Secondary UAT Refresh – Symbol range C	233.75.215.178	64528
Secondary UAT Refresh – Symbol range D	233.75.215.178	64529
Secondary UAT Refresh – Symbol range E	233.75.215.178	64530
Secondary UAT Refresh – Symbol range F	233.75.215.178	64531
Secondary UAT Refresh – Symbol range G	233.75.215.178	64532
Secondary UAT Refresh – Symbol range H	233.75.215.178	64533
Secondary UAT Refresh – Symbol range I and J	233.75.215.178	64534
Secondary UAT Refresh – Symbol range K	233.75.215.178	64535
Secondary UAT Refresh – Symbol range L	233.75.215.178	64536
Secondary UAT Refresh – Symbol range M	233.75.215.178	64537
Secondary UAT Refresh – Symbol range N	233.75.215.178	64538
Secondary UAT Refresh – Symbol range O	233.75.215.178	64539
Secondary UAT Refresh – Symbol range P and Q	233.75.215.178	64540
Secondary UAT Refresh – Symbol range R	233.75.215.178	64541
Secondary UAT Refresh – Symbol range S	233.75.215.178	64542
Secondary UAT Refresh – Symbol range T	233.75.215.178	64543
Secondary UAT Refresh – Symbol range U and V	233.75.215.178	64544
Secondary UAT Refresh – Symbol range W- Z	233.75.215.178	64545

Chapter 3 – NYSE OpenBook Ultra Operational Information

3.1 Publication Period The following section specifies the frequency and publication period for each message type disseminated by the NYSE OpenBook Ultra Product.

Message	Message Type	Publication Period
NYSE OpenBook Ultra Full Update Message	230	An OpenBook Full update message is generated at the start of day, upon request, or when there is a failure on the NYSE systems. The initial OpenBook Full update message will be transmitted at approximately 2:00 am (EST)
NYSE OpenBook Ultra Delta Message	231	An OpenBook delta message is generated based on events. Every OpenBook delta message will be transmitted based on that event. The transmission time for the message is between 7:30 am (EST) until market close (4 PM (EST) for most securities). Please check the NYSE website for any changes to trading hours.

3.2 Gap Detection The PDP Distribution System will assign all data packets a unique, sequential message number. This will allow recipients to identify ‘gaps’ in the message sequence and, if appropriate, reconcile them with the primary/secondary multicast groups or request retransmission of the missing/corrupted data packets.

For the NYSE OpenBook Ultra product, each data stream will have its unique set of sequence numbers. In other words, the message sequence for NYSE OpenBook Ultra A channel (OB_AA) is independent from the message sequence of D channel (OB_DD) and so on. The following is an example of sequencing for each channel.

OB_AA : SeqNum=1, SeqNum=2, SeqNum=3, ..., SeqNum=n.
OB_BB : SeqNum=1, SeqNum=2, SeqNum=3, ..., SeqNum=x.
OB_CC : SeqNum=1, SeqNum=2, SeqNum=3, ..., SeqNum=m.
OB_DD: SeqNum=1, SeqNum=2, SeqNum=3, ..., SeqNum=y.

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 OB_DD, then the gap filling has to be done through the appropriate OB_DD retransmission channel. The same is valid for the other channels.

3.3 Dual Site NYSE OpenBook Ultra data is redundant service with identical data transmitted through Primary and Secondary Multicast groups. This will allow customers to receive two redundant feeds. Additionally, any message can be retransmitted upon request.

Chapter 4 – NYSE OpenBook Ultra Message Specifications

Overview

The NYSE OpenBook Ultra is a Real-Time full limit order depth of book information for all NYSE listed securities. Updates are sent as an event(s) occurs on the book. Data is enriched with value added information such as the change reason, the LinkID in the event of an execution, the number of orders at the current price point, as well as the source timestamp in microsecond granularity.

4.1 Data

Delivery format

The NYSE OpenBook Ultra service uses the push-based publishing model. This means that data will be published based on its availability. Once a Order book change is available, it will be published to NYSE OpenBook Ultra Subscribers.

4.2 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

The following processing notes apply to both the Full Update and Delta Update Message

- Any Update Message can span multiple messages and/or multicast packets. This is because a maximum limit on the size of a packet to be 1500 bytes. This is done to avoid the "splitting" of messages due to network MTU restrictions.
- For Update Messages that span multiple messages/packets, all fields not part of the 'price point' section will be repeated for each packet. To determine the number of 'price point' in any given message, use the following formula
 - $\text{NumPricePoints} = (\text{SizeOfMessage} - \text{sum}(\text{size of fixed fields of message})) / \text{sum}(\text{size of fields for a price-point})$

FullUpdate processing notes

- Full Update Messages that span multiple packets/messages must be processed as one complete message.
- For Full Update Messages that span multiple packets, if a packet is lost, then the whole message should be considered lost.
- Full Update Messages contain all active price points regardless of prior period activity.

DeltaUpdate processing notes

- Delta Update Messages that span multiple packets must be processed as one complete message.
 - For Delta Update Messages that span multiple packets, if a packet is lost, then the whole message should be considered lost.
 - All price points containing a zero (0) quantity should be removed as an active price point.
 - If no changes have occurred for a given symbol (e.g., an inactive stock) since the last publication, no Delta Update Message is generated for that symbol
-

4.3 Sequence Numbers

All messages conform to the line level sequencing. Each channel A,B,C, D, etc 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 event.

4.4 Symbols

The stock symbols represented in this feed include the root and optional suffix utilizing NYSE Symbology.

For example, if a symbol's root is "ABC" and its suffix is "PRA", the symbol's root/suffix will be represented as: "ABC PRA\0\0\0". Between the root and the suffix there will be one space. After the suffix, null values follow to fill the 11 characters allocated for the stock symbol field.

Note: "\0" represents a null value

To ensure high throughput and low latency, symbols are identified using a Symbol Index Mapping Table in the delta messages (msg type 229). This is an ordered list from 1 to N of all symbols per multicast group. Symbol Indices are unique for every symbol and do not change each trading day. New symbols are appended to the end of the symbol mapping index and symbol that removed do not have their index number reused.

The symbol mapping is available via four methods:

- 1)NYSE OpenBook Ultra Full Update Message
- 2)NYSE OpenBook Ultra Full Update Refresh Message
- 3)Symbol Update Message
- 4)FTP file on <ftp.nyse.com/OpenBook/SymbolMapping/SymbolMap.xml>
LoginID: anonymous

Note: The symbol mapping file has both NYSE and Amex securities. Amex Securities are represented by Channel "AZ" and also have the exchange code "A"

4.5 Symbol Mapping file layout

The layout below is for the symbol mapping xml file found on the <ftp.nyse.com> servers. The XML file is updated twice daily – at 12am (EST) and 8:30am (EST)

```
<?xml version='1.0' encoding='utf-8'>
<xs:schema xmlns:xs='http://www.w3.org/2001/XMLSchema' >
  <xs:complexType name='SymbolMap' >
    <xs:sequence>
      <xs:element name='Symbol' type='xs:string' >
        </xs:element>
      <xs:element name='Index' type='xs:int' >
        </xs:element>
      <xs:element name='Channel' type='xs:int' >
        </xs:element>
      <xs:element name='ExchangeID' type='xs:int' >
        </xs:element>
    </xs:sequence>
  </xs:complexType>
  <xs:element name='SymbolMappingFile' >
    <xs:complexType>
      <xs:sequence>
        <xs:element name='SymbolMap' type='SymbolMap' >
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:schema>
```

4.6 Prices

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.

**4.7 NYSE
OpenBook
Ultra Data
Messages**

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

Message	Message Type	Publication Period
NYSE OpenBook Ultra Full Update Message	230	An OpenBook Full update message is generated at the start of day, upon request, or when there is a failure on the NYSE systems. This message contains the complete Order book with all price points, an aggregated quantity at each price point and a symbol mapping.
NYSE OpenBook Ultra Delta Message	231	An OpenBook delta message is generated based on events that occur on book such as interest being added, executions, cancellations and interest routed to a different market. This message contains the aggregated quantity at the price point, the quantity of the event, the reason for the message (new order, cancel, execution), a LinkID (if an execution occurs), and the number of orders.

4.8 Message Header Format

All messages are preceded by a standard header format. The table on the next page describes the header fields of an NYSE OpenBook Ultra message.

Field	Offset	Size (Bytes)	Format	Description
MsgSize	0	2	Binary Integer	This field indicates the size of the message body in bytes, excluding these two bytes: Sequence Number Reset – '18 Bytes' Heartbeat Message – '14 Bytes' Heartbeat Response Message – '34 Bytes' Message Unavailable – '22 Bytes' Retransmission Request Message – '42 Bytes' Retransmission Response Message – '42 Bytes' Refresh Request Message – '50 Bytes' Extended Refresh Request Message – '38 Bytes' Symbol Update Request Message – '36 Bytes' Symbol Update Message – '28 Bytes' OpenBook Full Update Message - 'at least 46 Bytes' OpenBook Delta Update Message - 'at least 34 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 '19' – Heartbeat Subscription message '20' – Retransmission Request Message '22' – Refresh Request Message '24' – Heartbeat Response Message '27' – Extend Refresh Request '34' – Symbol Update Request '35' – Symbol Update Message '230' – OpenBook Full Update Message '231' – OpenBook Delta Update 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	'115' is the product value used in the PDP header to identify the NYSE OpenBook Ultra 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 '3' – Message Replay '4' – Retransmission of a 'replayed' message

				<p>'5' – Refresh Retransmission</p> <p>'6' - End of Refresh Retransmission</p> <p>'129' – Test Original Message</p> <p>'130' – Retransmission of a test message</p> <p>'131' – Replay of a test message</p> <p>'132' – Retransmission Replay of a Test Message</p>
NumBodyEntries	14	1	Binary Integer	<p>The number of times the message body repeats in the message. For example, if the body consists of only a single field (named Volume) and the “NumBodyEntries” field is 2, this signifies there were two events for the price point and as a result the number of bytes in the message body will be 8</p>
LinkFlag	15	1	Binary Integer	<p>Contains the sequence of this packet in set of packets for a refresh retransmission.</p> <p>Used in conjunction with the RetransFlag, indicates whether there are other packets in the refresh retransmission and if so gives the sequence number of this packet in that series, allowing clients to handle out of order UDP packets.</p> <p>This field applies only to Refresh Retransmissions (messages with RetransFlag of either 5 or 6).</p> <p>For all other messages/RetransFlag's this field is always set to 0.</p>

4.9 Full Update Message Format

The table below describes the body fields of an OpenBook Full Update message (MsgType = '230')

Field Name	Offset	Size	Format	Description
MsgSize	16	2	Binary Integer	This field indicates the number of bytes in this message including this field. MsgSize=sum(fixed fields) + number of price Points*sum (price point fields for 1 price point)
SecurityIndex	18	2	Binary Integer	This field identifies the numerical representation of the symbol.
SourceTime	20	4	Binary Integer	This field specifies the time when the full update was generated in the order book. The number represents the number of milliseconds since midnight of the same day. Example: If the time is 13:12 56 seconds, 170 milliseconds and 30 microseconds This field will contain the value 47576170
SourceTimeMicro Secs	24	2	Binary Integer	This field indicates the number of microseconds that have elapsed within the millisecond the full update message was generated in the book. For example If the sourcetime is 13:12:56 secs, 170ms and 30microsecs This field will contain value 30
SymbolSeqNum	26	4	Binary Integer	This field contains the sequence number assigned by the source system to this message also known as the EventID. The sequence number is unique only to a given stock. Hence orders for two different stocks may share the same source sequence number.
SourceSessionID	30	1	Binary Integer	This field contains the source-session identifier. This number is incremented with every new source-session (restart, matching engine intra-day stock add/move, etc) during the day. Default value is "1". The SymbolSeqNums may restart at a lower number with every new session to ensure unique sequence numbers.
Symbol	31	11	ASCII String	This field contains the full symbol in NYSE Symbology. A sequence of characters representing the symbol, padded with NULLs
PriceScaleCode	42	1	Binary Integer	The pricescalecode code for the price fields in this message. Represents the number of digits after the decimal place in the price. Example: - For a price of 12.1, the pricescalecode is 1. - For price 13, the code is 0
QuoteCondition	43	1	ASCII Character	This field contains the current quote condition for the symbol The quote condition shall be blank if no quote condition exists (example when the Book is fast). Valid Values: 'E' = Slow on the Bid due to LRP or GAP Quote 'F' = Slow on the Ask due to LRP or GAP Quote 'U' = Slow on the Bid and Ask due to LRP or GAP Quote 'W' = Slow Quote due to a Set Slow list on both the bid and offer sides
TradingStatus	44	1	ASCII Character	The current trading status of the equity. Valid Values: P = Pre-Opening for messages sent before the stock is opened on a trade or quote O = The stock has opened or re-opened C = The stock was closed from the Closing template H = The stock is halted during a trading halt and has not resumed
Filler	45	1	Binary Integer	This is a filler, reserved for future use

MPV	46	2	Binary Integer	This field contains the minimum price variation, also known as Tick, minimum amount by which prices can differ.
<p>The following fields represent a price point and can repeat in a message: A price-point consists of 4 items</p> <ul style="list-style-type: none"> - The Buy/Sell Side Indicator - The actual price at the "side" - the total quantity available at the price point/side combination - the total number of orders at that price-point/side <p>Note: There maybe 0 price points in a message due to internal matching engine processing. If that is the situation, continue to process the message to maintain the correct sequence number.</p> <p>To identify the number of price points in the message, use the formula: (MsgSize - sum(size of fixed fields)) / size of 1 price point</p>				
PriceNumerator	48	4	Binary Integer	This field contains the price (numerator) of this price point. Note: The price is represented by the PriceScaleCode and the PriceNumerator. For example, a price of 12.1 has a "price numerator" of 121 and a scalecode of 1
Volume	52	4	Binary Integer	This field contains the total interest quantity at a price point
NumOrders	56	2	Binary Integer	This field contains the number of orders at the current price point
Side	58	1	ASCII Character	This field indicates the side of the order Buy/sell. Valid Values: 'B' – Buy 'S' – Sell
Filler	59	1	Binary Integer	This is a filler, reserved for future use

4.10 Delta Update Message Format

The table below describes the body fields of an OpenBook Delta Update message (MsgType = '231')

Field Name	Offset	Size	Format	Description
MsgSize	16	2	Binary Integer	This field indicates the number of bytes in this message including this field. MsgSize=sum(fixed fields) + number of price Points*sum (price point fields for 1 price point)
SecurityIndex	18	2	Binary Integer	This field identifies the numerical representation of the symbol.
SourceTime	20	4	Binary Integer	This field specifies the time when the full update was generated in the order book. The number represents the number of milliseconds since midnight of the same day. Example: If the time is 13:12 56 seconds, 170 milliseconds and 30 microseconds This field will contain the value 47576170
SourceTimeMicroSecs	24	2	Binary Integer	This field indicates the number of microseconds that have elapsed within the second the full update message was generated in the book. For example If the sourcetime is 13:12:56 secs, 170ms and 30microsecs This field will contain value 30 micros
SourceSeqNum	26	4	Binary Integer	This field contains the sequence number assigned by the source system to this message. The sequence number is unique only to a given stock. Hence orders for two different stocks may share the same source sequence number.
SourceSessionID	30	1	Binary Integer	This field contains the source-session identifier. This number is incremented with every new source-session (restart, matching engine intra-day stock add/move, etc) during the day. Default value is "1". The SymbolSeqNums may restart at a lower number with every new session to ensure unique sequence numbers.
QuoteCondition	31	1	ASCII Character	The current quote condition for the symbol The quote condition shall be blank if no quote condition exists (example when the Book is fast). Valid Values: 'E' = Slow on the Bid due to LRP or GAP Quote 'F' = Slow on the Ask due to LRP or GAP Quote 'U' = Slow on the Bid and Ask due to LRP or GAP Quote 'W' = Slow Quote due to a Set Slow list on both the bid and offer sides
TradingStatus	32	1	ASCII Character	The current trading status of the equity. Valid Values: P = Pre-Opening for messages sent before the stock is opened on a trade or quote O = The stock has opened or re-opened C = The stock was closed from the Closing template H = The stock is halted during a trading halt and has not resumed
PriceScaleCode	33	1	Binary Integer	The pricyscalecode code for the price fields in this message. Represents the number of digits after the decimal place in the price. Example: - For a price of 12.1, the pricyscalecode is 1. - For price 13, the code is 0

The following fields represent a price point and can repeat in a message:

A price-point consists of 6 items

- The Buy/Sell Side Indicator
- The price at the "side"
- the total quantity available at the price point/side combination
- The quantity of the event
- the total number of orders at that price-point/side
- the "change" reason i.e. the reason the price point was affected

Note: There maybe 0 price points in a message due to internal matching engine processing. If that is the situation, continue to process the message to maintain the correct sequence number.

To identify the number of price points in the message, use the formula:

$$(\text{MsgSize} - \text{sum}(\text{size of fixed fields})) / \text{size of 1 price point}$$

PriceNumerator	34	4	Binary Integer	This field contains the price (numerator) of this price point. Note: The price is represented by the PriceScaleCode and the PriceNumerator. For example, a price of 12.1 has a "price numerator" of 121 and a pricescalecode of 1
Volume	38	4	Binary Integer	This field contains the total interest quantity at a price point
ChgQty	42	4	Binary Integer	The volume of the event taking place (i.e size of the order, cancel or execution)
NumOrders	46	2	Binary Integer	This field contains the number of orders at the current price point
Side	48	1	ASCII Character	This field indicates the side of the order Buy/sell. Valid Values: 'B' – Buy 'S' – Sell
ReasonCode	49	1	ASCII Character	This field identifies why the volume at the price point was modified Valid Values: 'O' - New order/additional interest added 'C' - Cancel 'E' - Execution 'X' - Multiple events
LinkID1	50	4	Binary Integer	The LinkID identifies a unique transaction in the matching and allows you to correlate execution reports and quotes to the last sale. This field is populated only when an execution occurs. (Optional)
LinkID2	54	4	Binary Integer	The LinkID identifies a unique transaction in the matching and allows you to correlate execution reports and quotes to the last sale. This field is populated only when a repeat execution occurs at the same price point due to a single event(Optional)
LinkID3	58	4	Binary Integer	The LinkID identifies a unique transaction in the matching and allows you to correlate execution reports and quotes to the last sale. This field is populated only when a repeat execution occurs at the same price point due to a single event(Optional)

Appendix A– Common PDP Message Structure

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 (e.g., ‘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.

A.1 General Processing Notes

The following processing notes apply to the messages described above.

- 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, 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 align, null padded.
-

A.2 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.

Field	Offset	Size (Bytes)	Format	Description
MsgSize	0	2	Binary Integer	This field indicates the size of the message body in bytes, excluding these two bytes: Sequence Number Reset – '18 Bytes' Heartbeat Message – '14 Bytes' Heartbeat Response Message – '34 Bytes' Message Unavailable – '22 Bytes' Retransmission Request Message – '42 Bytes' Retransmission Response Message – '42 Bytes' Refresh Request Message – '50 Bytes' Extended Refresh Request Message – '38 Bytes' Symbol Update Request Message – '36 Bytes' Symbol Update Message – '28 Bytes' OpenBook Full Update Message - 'at least 46 Bytes' OpenBook Delta Update Message - 'at least 34 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 '19' – Heartbeat Subscription message '20' – Retransmission Request Message '22' – Refresh Request Message '24' – Heartbeat Response Message '27' – Extend Refresh Request '34' – Symbol Update Request '35' – Symbol Update Message '230' – OpenBook Full Update Message '231' – OpenBook Delta Update 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	'115' is the product value used in the PDP header to identify the OpenBook Ultra 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 '3' – Message Replay '4' – Retransmission of a 'replayed' message '5' – Refresh Retransmission '6' - End of Refresh Retransmission '129' – Test Original Message

				<p>'130' – Retransmission of a test message</p> <p>'131' – Replay of a test message</p> <p>'132' – Retransmission Replay of a Test Message</p>
NumBodyEntries	14	1	Binary Integer	<p>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</p>
LinkFlag	15	1	Binary Integer	<p>Contains the sequence of this packet in set of packets for a refresh retransmission.</p> <p>Used in conjunction with the RetransFlag, indicates whether there are other packets in the refresh retransmission and if so gives the sequence number of this packet in that series, allowing clients to handle out of order UDP packets.</p> <p>This field applies only to Refresh Retransmissions (messages with RetransFlag of either 5 or 6).</p> <p>For all other messages/RetransFlag's this field is always set to 0.</p>

A.3 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.

Field Name	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 A.2
MsgType	2	2	Binary Integer	'1'	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'1'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section A.2
LinkFlag	15	1	Binary Integer	'0'	Refer to section A.2
Defined 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.

A.4 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_OB 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). Third, a Full update message will be sent for all symbols on the channel(s) where the reset sequence number message was sent. Please refer to B.2 Processing Sequence Number Reset Messages for a suggest way of processing.

A.5 Heartbeat Subscription Message

Subscribers can optionally subscribe with the retrans/refresh server to receive heartbeats, by issuing this message with a valid sourceID. Once subscribed, the retrans/refresh server will forward PDP Heartbeats.

Note: Clients that do not explicitly subscribe for heartbeats would start receiving heartbeats only after they have issued at least 1 refresh/retrans request to the retrans/refresh server.

Field Name	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 A.2
MsgType	2	2	Binary Integer	'19'	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'1'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section A.2
LinkFlag	15	1	Binary Integer	'0'	Refer to section A.2
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

A.6 Heartbeat Messages

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

Field Name	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 A.2
MsgType	2	2	Binary Integer	'2'	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'1'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	'0'	Refer to section A.2
LinkFlag	15	1	Binary Integer	'0'	Refer to section A.2

A.6 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 should respond to these heartbeat requests with a heartbeat message.

Please refer to C.3 Processing Heartbeat Messages for a suggest way of processing.

A.7 Heartbeat Response Message

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

Field Name	Offset	Size	Format	Value	Description
Set forth below are the ‘header’ fields of the Hearbeat Response Message					
MsgSize	0	2	Binary Integer	‘34’	Refer to section A.2
MsgType	2	2	Binary Integer	‘24’	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	‘115’	Refer to section A.2
RetransFlag	13	1	Binary Integer	‘1’	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	‘1’	Refer to section A.2
LinkFlag	15	1	Binary Integer	‘0’	Refer to section A.2
Defined below are the ‘body’ fields of the Hearbeat Response Message					
SourceID	16	20	ASCII String		This field represents the name of the source requesting retransmission. This field is null padded, left aligned

A.8 Retransmission Request Message This message is sent by Subscribers requesting missing messages. The MART will retransmit the appropriate message(s).

Field Name	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 A.2
MsgType	2	2	Binary Integer	'20'	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'1'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section A.2
LinkFlag	15	1	Binary Integer	'0'	Refer to section A.2
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

A.9 Symbol Index Mapping Request Message This message is sent by Subscribers requesting the Symbol index mapping.

Field Name	Offset	Size	Format	Value	Description
Set forth below are the 'header' fields of the Symbol Index Mapping Request Message					
MsgSize	0	2	Binary Integer	'36'	Refer to section A.2
MsgType	2	2	Binary Integer	'34'	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'1'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section A.2
LinkFlag	15	1	Binary Integer	'0'	Refer to section A.2
Defined below are the 'body' fields of the Symbol Index Mapping Request Message					
SourceID	16	20	ASCII String		This field represents the name of the source requesting retransmission. This field is null padded, left aligned
SecurityIndex	36	2	Binary Integer		This field identifies the numerical representation of the symbol. SecurityIndex value can be zero, which is to request all symbol mapping for the multicast group.

A.10 Book Refresh Request

This message is sent by Subscribers requesting a full book refresh message.

Field Name	Offset	Size	Format	Value	Description
Set forth below are the 'header' fields of the NYSE Packet Unavailable Message					
MsgSize	0	2	Binary Integer	'50'	Refer to section A.2
MsgType	2	2	Binary Integer	'22'	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'1'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section A.2
LinkFlag	15	1	Binary Integer		Refer to section A.2
Defined below are the 'body' fields of the NYSE Packet Unavailable Message					
Symbol	16	16	ASCII String		A sequence of characters representing the symbol, padded with NULLs. The symbol contains the root, optionally followed by a space and an optional suffix in host format for e.g.: "IBM PRA\0\0\0\0"
SourceID	32	20	ASCII String		This field represents the name of the source requesting retransmission. This field is null padded, left aligned

A.11 Refresh Processing Notes

The refresh replies from MaRT may lag behind the current state disseminated by the OpenBook process. Thus, it is possible clients may not be able to correctly apply delta messages received from the main feed on the refresh from MaRT.

To prevent this, it is recommended that clients implement the following logic in the order listed below:

1. Join the main data multicast feed and queue up data for symbols for which refresh is required.
2. Next, join the MaRT retransmission channel and issue a refresh request for the desired symbol(s)
3. Read and process the resulting refresh retransmission entirely
4. Now, start processing the queued up data from main feed as follows
 - a. If the EventId of the main data feed is lower or equal to that received from MaRT, discard the message(s)
 - b. If the EventId is exactly one more than that from MaRT, process/apply the messages.
 - c. If there was a gap in event ids between MaRT refresh message and that in main queue, re-request for a refresh from MaRT (go to step 2).

A.12 Extended Book Refresh Request

This is an extended form of a refresh request (msgtype 22) from clients to PDP.

The main differences are:

- Clients need to specify the Security Index in place of the actual symbol name. (a SecurityIndex of 0 signifies all symbols. Note: Request for SecurityIndex 0 may be limited or blocked to prevent denial-of-service attacks)
- Clients may optionally request for a refresh of just a particular message group/type of the entire state. Currently, this field is not applicable and maybe set to 0 or 228.

Example:

If Type is set to 228, it indicates clients want a refresh of just the order state
 If Type is set to 0, it indicates clients want a complete refresh (i.e. all the states, if applicable)

Please note: When requesting a Symbol index Mapping or refresh request, you need to send to the request to symbols corresponding channel. I.E symbol ABC to Channel AA, BBB to Channel BB otherwise your request will not be honored.

Field Name	Offset	Size	Format	Value	Description
Set forth below are the 'header' fields of the NYSE Packet Unavailable Message					
MsgSize	0	2	Binary Integer	'38'	Refer to section A.2
MsgType	2	2	Binary Integer	'27'	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'1'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section A.2
LinkFlag	15	1	Binary Integer		Refer to section A.2
Defined below are the 'body' fields of the NYSE Packet Unavailable Message					
SourceID	16	20	ASCII String		This field represents the name of the source requesting retransmission. This field is null padded, left aligned
SecurityIndex	36	2	Binary Integer		This field identifies the numerical representation of the symbol. User can combine this value with the session id to obtain a unique key.
MsgTyoe	38	2	Binary Integer		The group or type of refresh requested A value of 0 indicates 'all'

**A.13
Retransmission
Response
Message**

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

Field Name	Offset	Size	Format	Value	Description
Set forth below are the 'header' fields of the NYSE Retransmission Response Message					
MsgSize	0	2	Binary Integer	'42'	Refer to section A.2
MsgType	2	2	Binary Integer	'10'	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'1'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section A.2
LinkFlag	15	1	Binary Integer	'0'	Refer to section A.2
Defined below are the 'body' fields of the NYSE 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	Character		This is a flag that indicates whether the retransmissions request was accepted or rejected. Valid values: 'A' – Accepted 'R' - Rejected
Reject Reason	41	1	Character		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 '6' - Rejected. Request message seqnum TTL (Time to live) is too old. Use refresh to recover current state if necessary.
Filler	42	2	ASCII String		This is filler, reserved for future use.

A.14 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_OB, 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.

Field Name	Offset	Size	Format	Value	Description
Set forth below are the 'header' fields of the Retransmitted Message					
MsgSize	0	2	Binary Integer		Refer to section A.2
MsgType	2	2	Binary Integer		It will be the MsgType of the original message sent by the PDP_OB.
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'2' or '5'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	Same as original message	Refer to section A.2
LinkFlag	15	1	Binary Integer		Refer to section A.2
All the 'body' fields of the Retransmitted Message are the same as the original message					

A.15 Symbol Index Mapping Message

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

Please note: When requesting a Symbol index Mapping, you need to send to the request to symbols corresponding channel. I.E symbol ABC to Channel AA, BBB to Channel BB otherwise your request will not be honored.

Field Name	Offset	Size	Format	Value	Description
Set forth below are the 'header' fields of the Symbol Index Mapping Message					
MsgSize	0	2	Binary Integer	'28'	Refer to section A.2
MsgType	2	2	Binary Integer	'35'	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	'115'	Refer to section A.2
RetransFlag	13	1	Binary Integer	'1'	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	'1'	Refer to section A.2
LinkFlag	15	1	Binary Integer		Refer to section A.2
Defined below are the 'body' fields of the Symbol Index Mapping Message					
Symbol	16	11	ASCII String		A sequence of characters representing the symbol, padded with NULLs. The symbol contains the root, optionally followed by a space and an optional suffix in host format for e.g.: "IBM PRA\0\0\0\0"
FILLER	27	1	ASCII String		This is filler, reserved for future use
SecurityIndex	28	2	Binary Integer		This field identifies the numerical representation of the symbol.

A.16 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:

- a. 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.
- b. The most current sequence number (SEQNUM) contains the latest information.
- c. If the SEQNUMS are the same: messages are the same, any of the two messages contains the same information.

Please refer to C.6 Processing of line level Retransmission Messages for a suggest way of processing.

A.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.

Field Name	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 A.2
MsgType	2	2	Binary Integer	‘5’	Refer to section A.2
MsgSeqNum	4	4	Binary Integer		Refer to section A.2
SendTime	8	4	Binary Integer		Refer to section A.2
ProductID	12	1	Binary Integer	‘115’	Refer to section A.2
RetransFlag	13	1	Binary Integer	‘1’	Refer to section A.2
NumBodyEntries	14	1	Binary Integer	‘1’	Refer to section A.2
LinkFlag	15	1	Binary Integer		Refer to section A.2
Defined 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 B – Message Processing

Overview

The following chapter provides workflow diagrams to simplify how the NYSE Book messages should be processed

B.1 Processing of messages

The following is the recommended way of processing messages

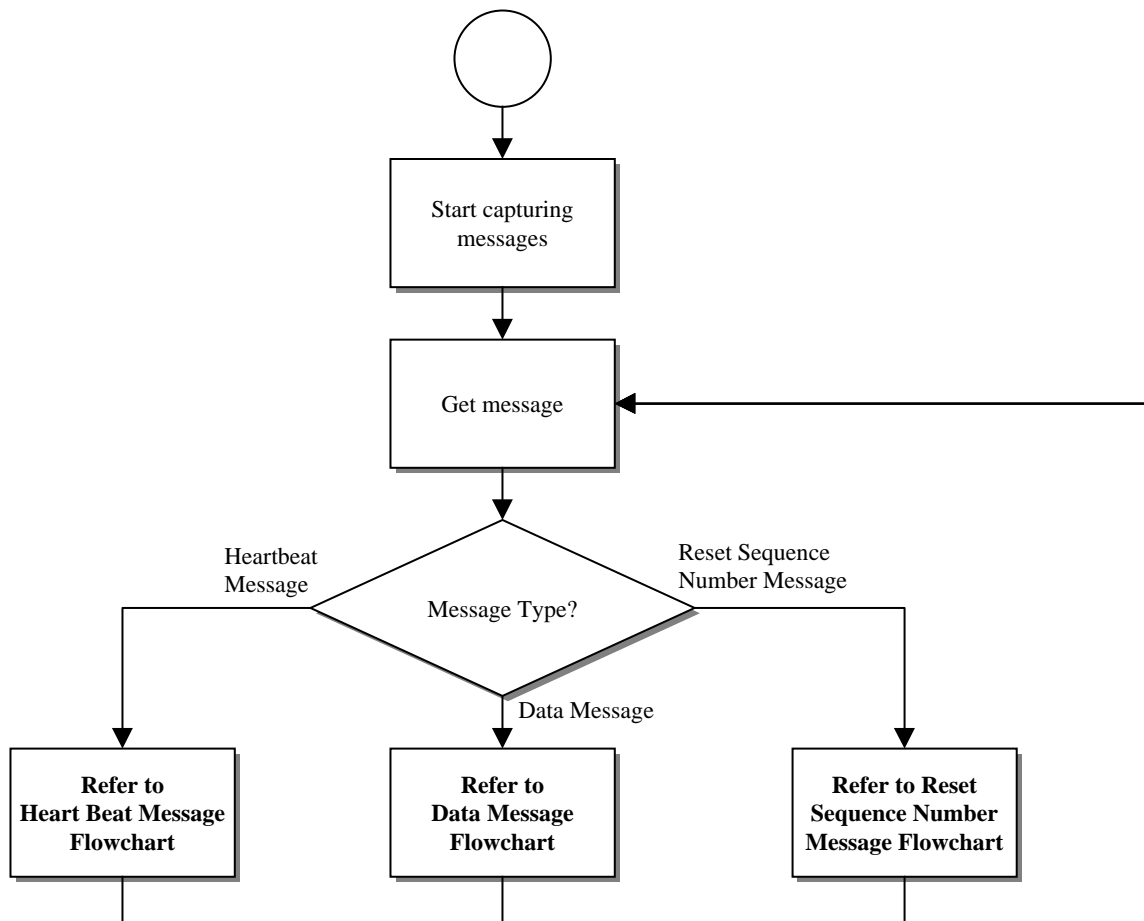


Figure 1. Processing of Messages

B.2 Processing of sequence number reset messages

The following is the recommended way of processing Sequence Number Reset Messages

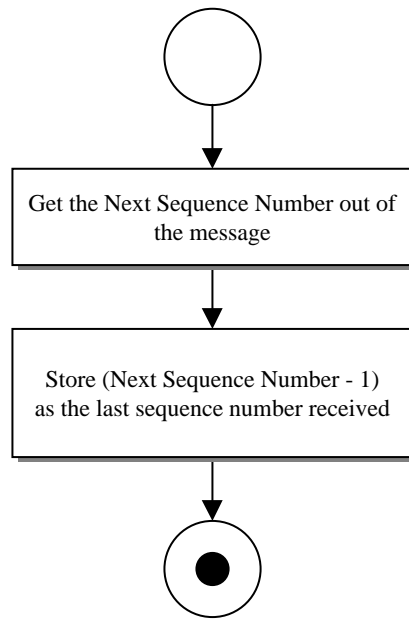


Figure 2. Processing of Sequence Number Reset Message

B.3 Processing of Heartbeat messages

The following is the recommended way of processing Heartbeat messages

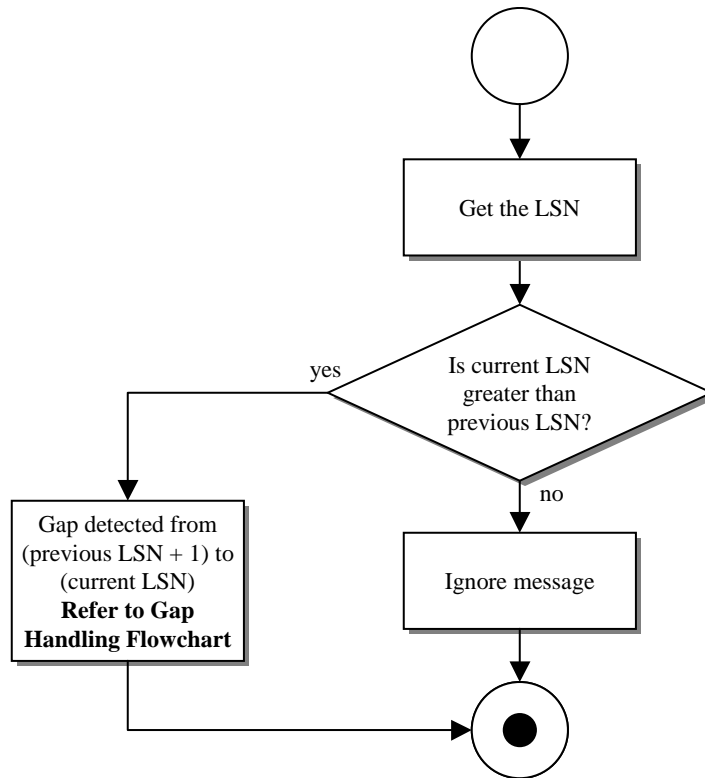


Figure 3. Processing of Heartbeat Messages

B.4 Processing of Heartbeat response messages

The following is the recommended way of processing Heartbeat messages

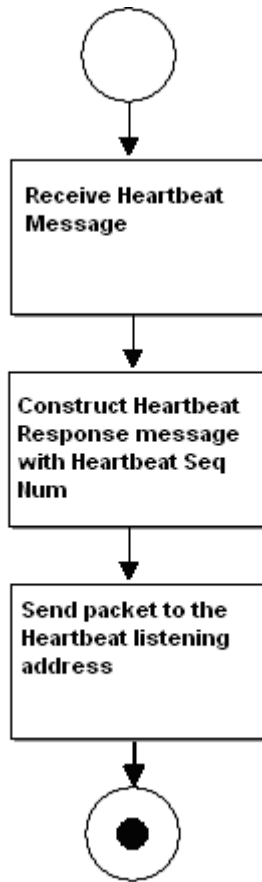


Figure 4. Processing of Heartbeat Response Messages

B.5 Processing of Data messages

The following is the recommended way of processing Data messages

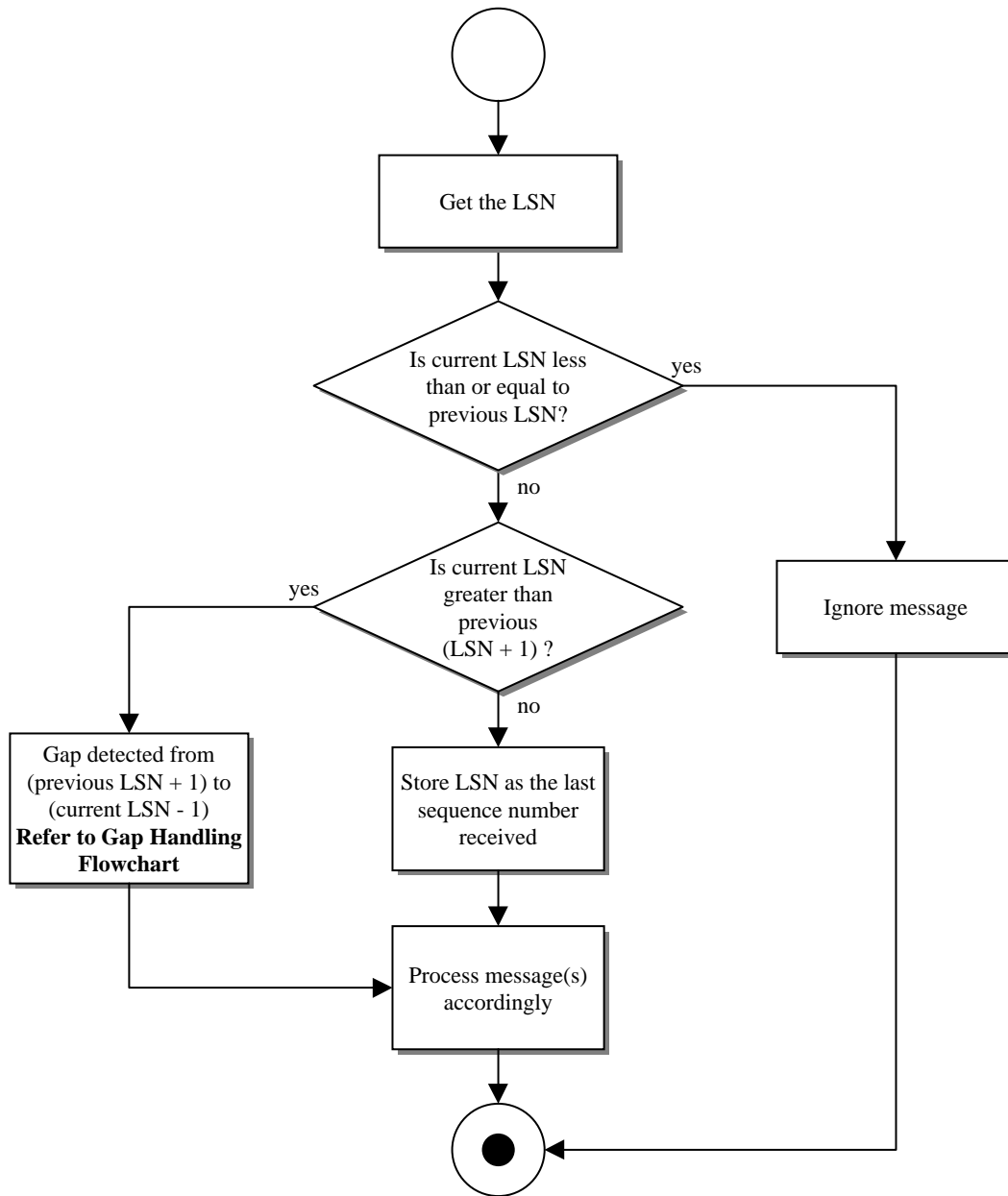


Figure 5. Processing of Data Messages

B.6 Processing of Gap handling

The following is the recommended way of handling message gaps

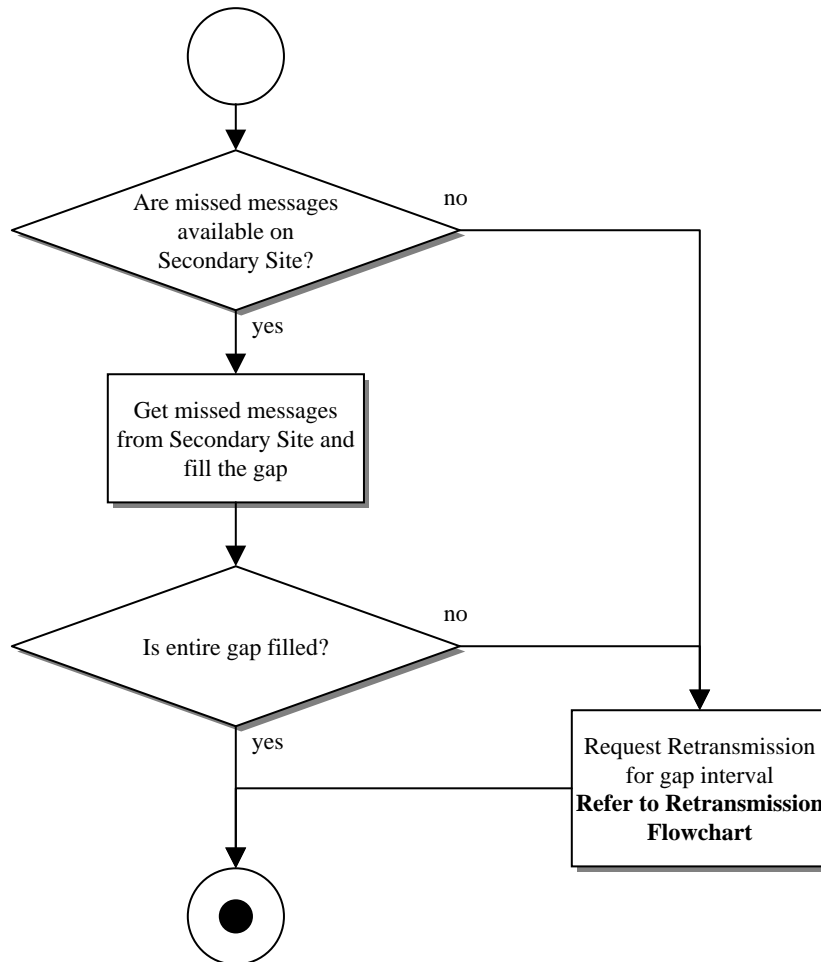


Figure 6. Processing of Gap Handling

B.7 Processing of line level retransmissions

The following is the recommended way of line level retransmissions

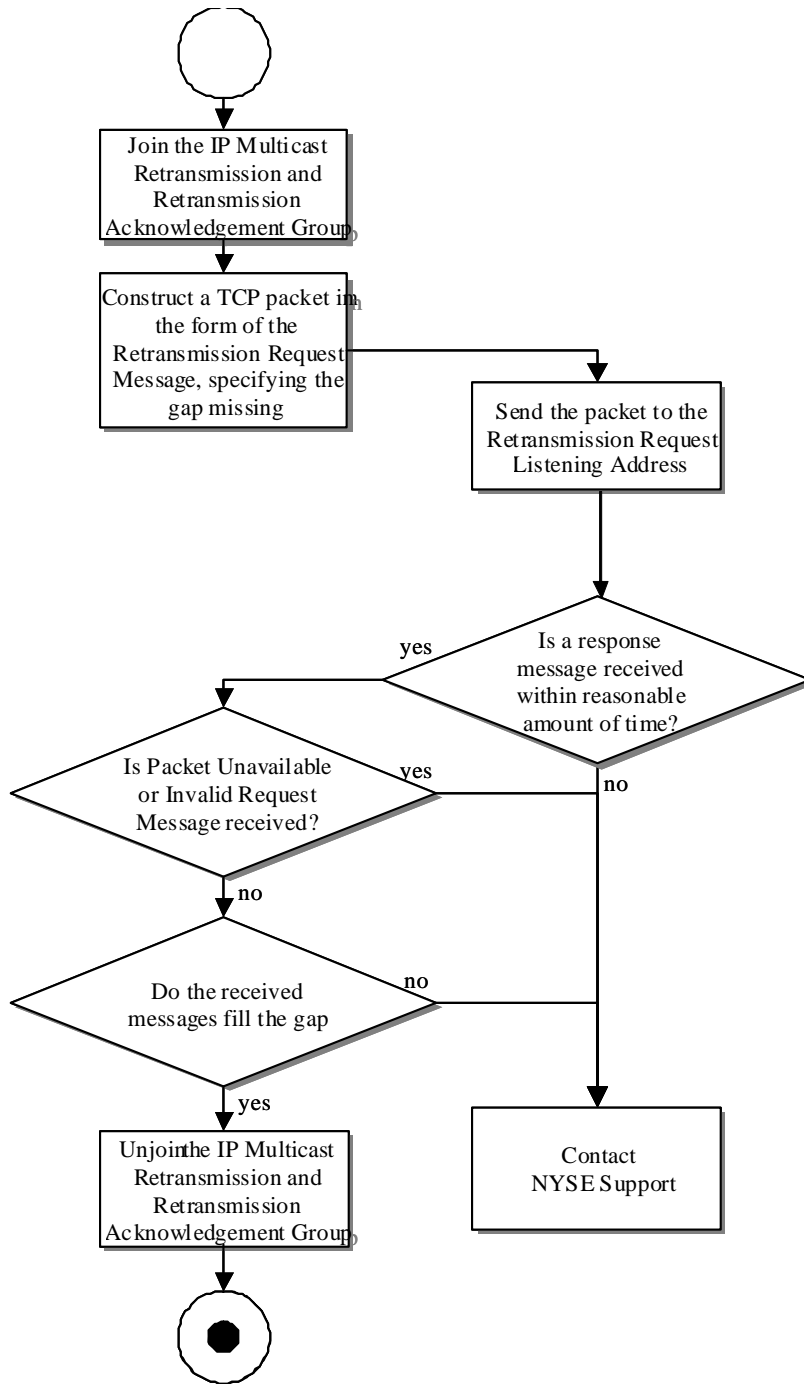
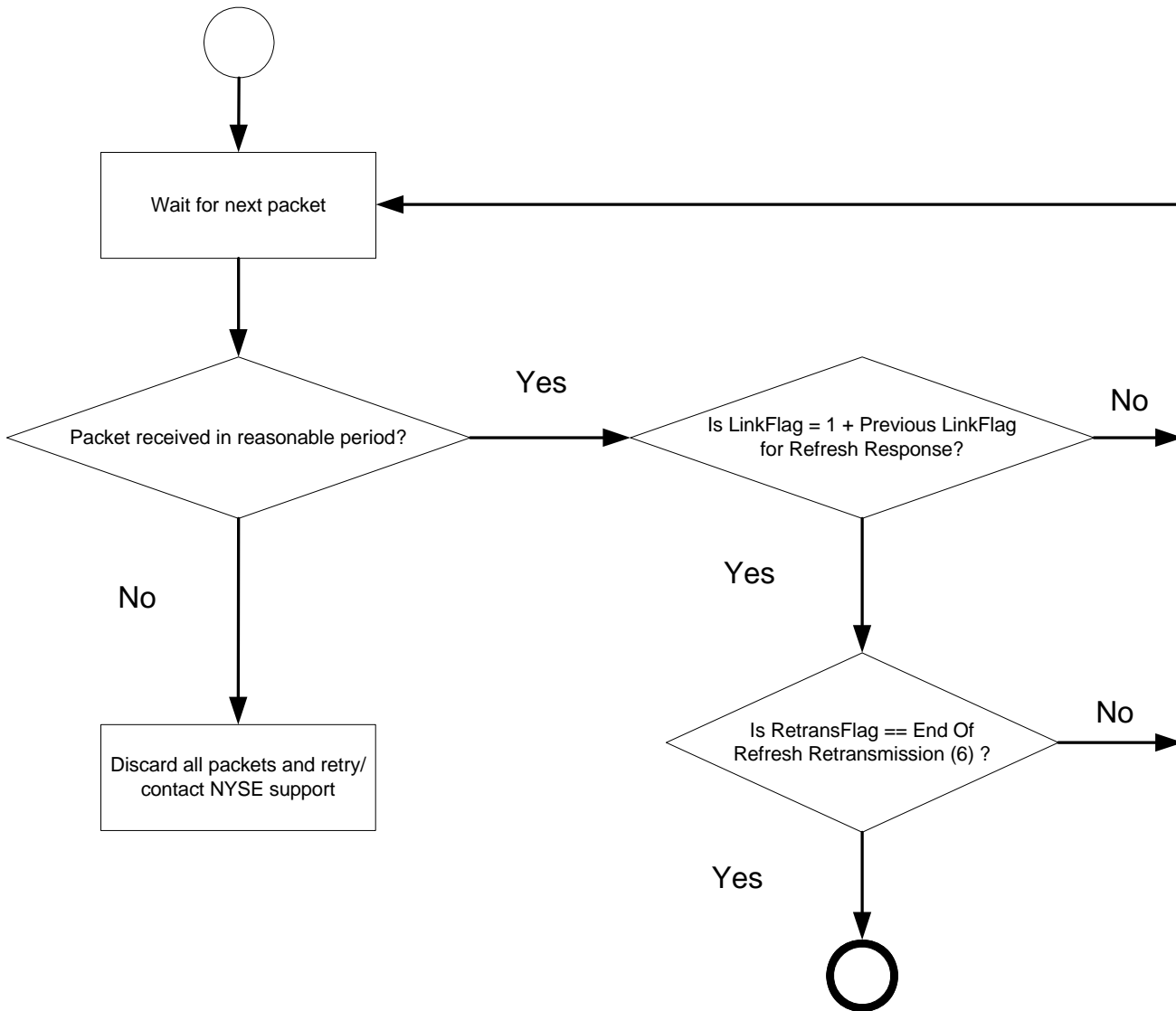


Figure 7. Processing of Line Level Retransmissions

B.8 Processing of Refresh messages

The following is the recommended way of processing Refresh messages



Appendix C– Frequently Asked Questions

Overview

The following section provides information to assist subscribers with frequently asked questions concerning the NYSE OpenBook Product. For more up to date information please visit the NYSE OpenBook Ultra discussion board on <http://www.nysedata.com/nysedata/Support/DiscussionBoard/tabid/108/view/topics/forumid/4/Default.aspx>

Q: What is the average packet size?

A: The order book packet can vary between 18 and 1400 bytes long.

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

A: Contact NYSE Support and provide the desired Source ID. NYSE 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, NYSE 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 OpenBook Ultra Impact Guide in chapter 2.

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

A: Refer to the NYSE OpenBook Ultra Impact Guide in chapter 2.

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 2 (two) 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. NYSE recommends that Subscribers increase the standard UDP buffer setting to capture this burst.

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

A: Please contact NYSE Support to reactivate your Retransmission ID, as your application may have reached the retransmission thresholds as specified in Appendix A - Section A.

Q: Do I need to establish a TCP/IP connection? Do I need to do this on a daily basis?

A: Yes, a TCP/IP connection is needed for requesting retransmissions of any kind, e.g., dropped packets, book refresh, symbol mappings, etc.

Q: How do I request the Symbol Index Mapping?

A: Symbol mappings can be requested by establishing a TCP/IP connection to the Recovery/Retransmission Server. Subscribers must connect to the appropriate IP and port for the desired symbol range. Subscribers can populate the symbol index field 0 in order to receive the full symbol list that multicast group. The Symbol Index Mapping will be sent down the Refresh Multicast Group (Request Based).

Q: How are intraday symbol adds handled in reference to Symbol Index Mapping?

A: The index mapping for a intraday symbol add is sent down the appropriated multicast channel before any adds, modifies, deletes, or imbalances. This ensures subscribers can process inline without having to issue a request. If the mapping update is missed or dropped inline, subscribers may request the mapping through the Recovery Server.

Q: What is the correct method of dealing with out of sequence UDP packets for refreshes that span multiple PDP packets ?

A: The last packet in a series of refresh packets will contain a RetransFlag of 6 (end of refresh retransmission). All other refresh packets will contain a RetransFlag of 5 (Refresh Retransmission). In addition, the LinkFlag of each packet contains the sequence of that packet in a series of multi-packet refresh retransmissions. Thus, if the refresh retransmission is split over n packets, packets 1 to n-1 will contain RetransFlag 5 and LinkFlags of 1, 2, ... n-1 respectively. The last packet will have a RetransFlag of 6 and LinkFlag of "n". On reading any packet (in any order), the application can detect whether it has gapped any packets in the series (if it is missing LinkFlag packets of less than the current packet) and whether there are more packets (if the RetransFlag is 5). The application must then wait for the remaining packets to be read off the wire and process the entire refresh retransmission. Note: If any of the packets are lost in transit (after waiting for a reasonable time for them to be read), the client may resubmit the refresh request.

Q: Can I send my symbol index or refresh requests to any channel or does it need to be to specific the channel Symbol letter range?

A: When requesting a Symbol index Mapping or refresh request, you need to send to the request to symbols corresponding channel. I.E symbol ABC to Channel AA, BBB to Channel BB otherwise your request will not be honored.

Q: Which Source Subnet is for the Primary feed and for the Secondary Feed?

We are using the subnet model in order to mitigate any kind of server failure on our end. This is why there is no guarantee that the source IP I provide you today will be the same tomorrow. Some firms need to add the Source IPs to their network filters or firewall rules. That is why these Source Subnets are provided.

Q: Is it possible, in OpenBook Ultra, for the book/feed to be "crossed"/"locked" ? If so, why/when ?

Yes, it is possible for the book to be crossed/locked under certain conditions:

- a. Before-Open: The book may very well be locked and crossed until the stock is opened by the DMM
 - Opening time is typically 9:30 AM but some stocks may open late due to news pending or equipment failure , etc type of opening delays (if you subscribe to the Alerts feed, you should see opening delay alerts for the stock)
- b. Around-open: When the book opens, it should unlock/uncross within seconds
 - However, in some rare condition, it may take a few minutes (depends on certain type of quotes and required DMM activity)
- c. Slow market: During the day the book may lock/cross for a few seconds (up to a minute) when the book switches from auto-exec to manual
 - (When an LRP is hit. If you subscribe to the LRP feed, you will have knowledge of what the LRP was, around that time)

Q: Are odd lot orders published in OpenBook Ultra?

No. The matching engine does not publish odd lot orders to this feed at this time.

Q: What types of orders are included from the OpenBook Ultra feed?

Includes displayed limit order, broker and DMM interest.

Q: Should the OBO and PUMP feeds (around the 1 second snapshots) match?

OpenBook Ultra is a real-time event based feed while as OpenBook Real-Time is based on 1 second snapshots of the order book. Assuming that clients are matching based on a 1 second interval; the two feeds should represent equivalent data, except for issues related to timing. Thus, assuming there is not much activity on a given price-point, the two feeds should show similar volumes.

Q: Why doesn't the top of the book from OpenBook Ultra match the CQS Quote and the NYSE Best Quote?

They're all separate feeds with their own timings. The OpenBook Ultra doesn't necessarily have to be top of the book. But at some point in the sequence of events when an order arrival hits the top of the book, that event would exist in the Best Quotes feed and CQS feed at different points in time. Top of book should be the same as CQS.