SIAC

Securities Industry
Automation Corporation

Enhanced Autolink Facility
User Guide

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CTS/CQS/OPRA
Automated Retransmissions

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DOCUMENT HISTORY

Version	Date	Description
1.1	8/27/09	Initial Version Document
1.2	11/19/09	Section 3.8: Added system for CTS index messages "CTSI Network A&B"
1.3	01/15/10	Section 2.5 (Page 6): Revised size of packet between Block Length and ETX Section 2.6 (page 8 & 9): Added Block Length Field Section 3.1 (page 11): Added Block Length field description Section 3.4 (page 11): Added a table reflecting the Multicast Line Number range for each "System" and included the CTS/CQS & OPRA website links to the National Market System (NMS) Common IP Multicast Distribution Network Recipient Interface Specification
1.4	7/14/10	Appendix 'A' – New Primary IP Addresses

SECTION 1: Introduction

1.1 Automated Retransmissions

SIAC is deploying an Enhanced Autolink Facility to support automated retransmissions of Consolidated Tape System (CTS), Consolidated Quotation System (CQS), and Options Price Reporting Authority (OPRA) data. Direct multicast Data Recipients who receive any of the three data feeds can connect to Autolink via the Secure Financial Transaction Infrastructure (SFTI) Communications Network. For information on how to receive CTS, CQS, and OPRA retransmission data, contact the SFTI Service Center at 866-873-7422.

SECTION 2: Enhanced Autolink Facility

2.1 Overview

SIAC is migrating from the current retransmission request system, to an automated facility. The Enhanced Autolink Facility is designed to provide direct users of CTS, CQS and OPRA data with message retransmissions in the event the originally transmitted messages were not received. Data Recipients can connect directly through SFTI to the Enhanced Autolink Facility via TCP/IP addresses and ports.

Data Recipients will continue to enter user ID's and passwords, along with system, line, and sequence number information. Existing user ID's and passwords will be carried over into the Enhanced Autolink Facility. Retransmissions will continue to be disseminated over the current dedicated retransmission group multicast feeds.

2.2 Retransmission Messages

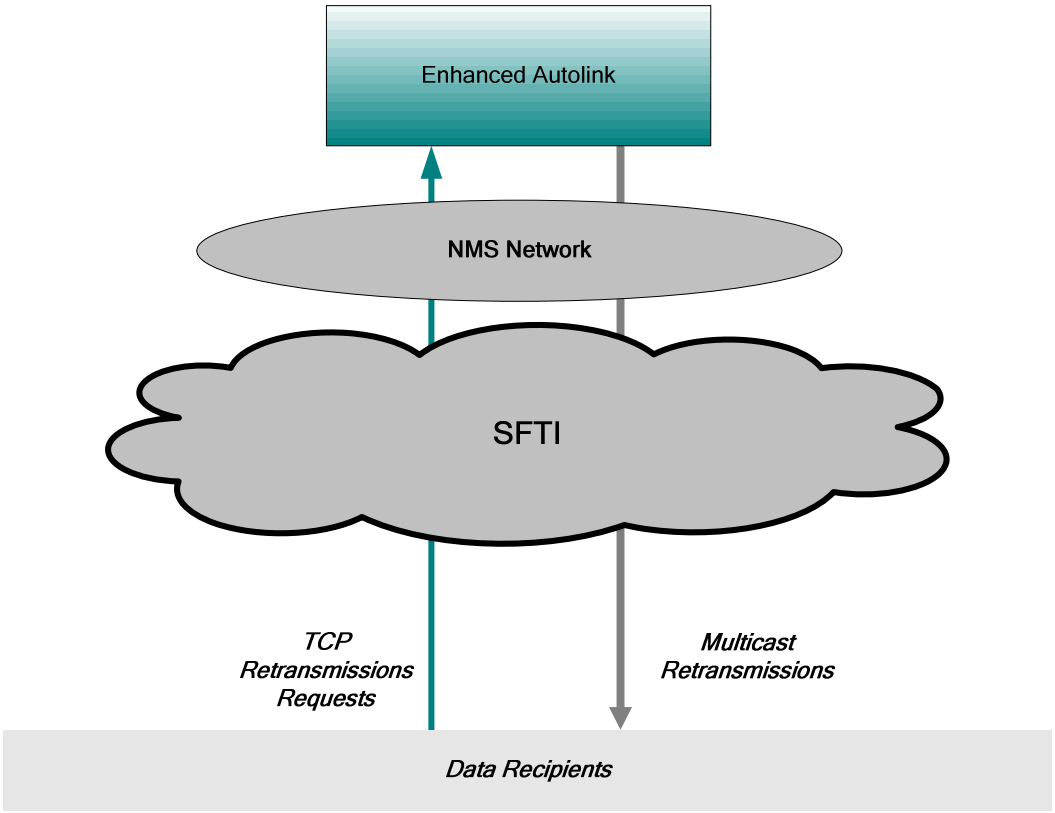
CTS, CQS, and OPRA disseminate redundant data feeds (A&B Streams). In the event a multicast recipient misses messages on one stream, the missing messages are available from the redundant stream. If messages are missed from both streams, retransmissions are available from the Enhanced Autolink Facility.

For CTS and CQS, originally transmitted messages contain the alphabetic uppercase character 'O', in the Retransmission Requestor field of the Message Header. Originally transmitted OPRA messages contain a 'blank' in the Retransmission Requestor field of the Message Header. All retransmitted CTS, CQS or OPRA messages (sent as a result of a request received by the Enhanced Autolink Facility) will only contain the alphabetic upper case character 'V' in the Retransmission Requestor field of the Message Header. As such, no other Retransmission Requestor ID will be supported in this new facility.

2.3 Why TCP vs. UDP?

1. More control is established over retransmissions (preventing a flood of UDP requests).
2. One connection for each requestor at a time is allowed on each server.
3. Return confirmation is provided to the requestor.
4. Verification of 'user ID' and "password" takes place before allowing a connection to be made.
5. Prevents a connection from being made if the maximum number of retransmission requests is exceeded.

2.4 System Diagram



2.5 Functionality

1. Dual Connections

   a) Two redundant servers are available to process retransmission requests. Either server can be used.
   b) Requests can be made to both servers simultaneously.
   c) Duplicate requests of the same retransmissions at the same time will not be processed (reference the Retransmission Threshold section).
   d) The option is available to keep a connection established for the entire day.
   e) Connections will be accepted only during defined hours (CTS/CQS: 3:30 AM - 8:30 PM, ET and OPRA 6:10 AM - 6:30 PM, ET)

2. Prevention of invalid Data Recipients and Multiple Connections on the same server

   a) When making a connection, each Data Recipient is identified by a unique user ID and password within a defined timeframe. If the user ID and password are not received within the specific timeframe (30 seconds), the connection will close.
   b) The retransmission request contains the Data Recipient's unique user ID and password.
   c) Requests from invalid Data Recipients will not be processed.
   d) Only one connection at a time can be established by a Data Recipient (user ID) on each server.

3. Provide Timely Retransmissions

   a) The retransmission request with the highest sequence number (most current) will be transmitted at a higher priority.
   b) A duplicate retransmission request will not be processed (reference the Retransmission Threshold section).
   c) A maximum of 1 million CTS, CQS or OPRA messages per request is allowed. Large requests will be broken down into smaller segments by the Enhanced Autolink Facility (Smaller requests will be processed in between segments of larger requests).
   d) If more than 1 million messages are required, multiple requests should be generated.
   e) Multiple retransmission requests can be placed in a packet (size of packet between Block Length and ETX is 1,002 bytes).

4. Retransmission Request Acknowledgements

Upon receiving a CTS, CQS or OPRA retransmission request from a Data Recipient, the system will send one of the following acknowledgements back to the Data Recipient:

   a) The TCP/IP connection was refused.
   b) The request was processed normally.
   c) The request contained an invalid message size.
   d) A duplicate request was received.
   e) The request was rejected due to invalid system name, line, user ID, or password.
   f) The format of the request was incorrect.
   g) The request exceeded the number of messages per request.
   h) The request exceeded the number of requests per day.
   i) Invalid sequence number request.

Functionality, continued

5. Message Sequence Number Rollover

Although unlikely, in the event of a CTS, CQS or OPRA message sequence number rollover, the Enhanced Autolink Facility will internally maintain the actual message sequence number (12 bytes). As such, the Data Recipient would be required to request the actual message sequence number.

For example:

If a Data Recipient experienced an OPRA gap before and after a message sequence number rollover from 1,999,999,996 to 0,000,000,003. The Data Recipient would request a retransmission message using the actual message sequence numbers of 001,999,999,996 to 002,000,000,003.

Enhanced Autolink Facility Actual Message Sequence Number 12 Bytes	**OPRA Output Sequence Number 10 Bytes**
001,999,999,996	1,999,999,996
001,999,999,997	1,999,999,997
001,999,999,998	1,999,999,998
001,999,999,999	1,999,999,999
002,000,000,001 Reset Msg Seq Number	0,000,000,001 Reset Msg Seq Number
002,000,000,002	0,000,000,002
002,000,000,003	0,000,000,003

2.6 Retransmission Request Procedure

NOTE: REFERENCE SECTION 3 FOR THE BELOW FIELD DESCRIPTIONS

1) Establish a TCP/IP connection:

A. A Data Recipient can establish a TCP/IP connection to enter a retransmission request message and upon receipt of the message the Enhanced Autolink Facility will generate a response back to the Data Recipient, after which the Data Recipient can close the TCP/IP connection or leave the TCP/IP connection up for the remainder of the day.

B. A Data Recipient also has the option to establish and maintain their TCP/IP connection for the remainder of the day. If a Data Recipient chooses this option, they will be required to send the following login request information upon establishing a TCP/IP connection. If the Data Recipient does **not** send this information within the specific timeframe (30 seconds) the TCP/IP connection will close.

Block Length	SOH	System	User ID	User Password	US	~~~	ETX
3	1	4	5	5	1		1

Example: 016<0x01>CTSA1234554321<0x03>

Connection Response: Upon receipt of a Data Recipient's login (user ID/password), the Enhanced Autolink Facility will send the following response which includes the original login request message information back to the Data Recipient.

Block Length	SOH	Responding SIAC System	Response Code	System	User ID	User Password	US	~~~	ETX
3	1	4	2	4	5	5	1		1

Example: Successful connection (Response Code '01'):

022<0x01>CTSA01CTSA1234554321<0x03>

Retransmission Request Procedure, continued

2) Enter a Retransmission Request Message: A Data Recipient is required to send the following retransmission request information regardless of whether or not they have already established a TCP/IP connection.

Block Length	SOH	System	Multicast Line Number	Low Message Sequence Number	High Message Sequence Number	User ID	User Password	US	~ ~ ~	ETX
3	1	4	3	12	12	5	5	1		1

Example: If a Data Recipient requests an OPRA retransmission for the range of messages with starting sequence number 1 and ending sequence number 5 whose user ID is '12345' and password is '54321', the request would look as follows:

043<0x01>OPRA001000000000001000000000051234554321<0x03>

Retransmission Request Message Response: Upon receipt of a retransmission request message, the Enhanced Autolink Facility will send the following response which includes the original retransmission request message information back to the Data Recipient.

Block Length	SOH	Responding SIAC System	Response Code	System	Multicast Line Number	Low Message Sequence Number	High Message Sequence Number	User ID	User Password	US	~ ~ ~	ETX
3	1	4	2	4	3	12	12	5	5	1		1

Example: Successful Request (Response Code '01'):

049<0x01>OPRA01OPRA001000000000001000000000051234554321<0x03>

Note: All retransmitted CTS, CQS or OPRA messages (sent as a result of a request received by the Enhanced Autolink Facility) will only contain the alphabetic upper case character 'V' in the Retransmission Requestor field of the Message Header. As such, no other Retransmission Requestor ID will be supported in this new facility.

2.7 Retransmission Thresholds

Capability	Description	Threshold
User Authorization	Requests with valid user ID's/passwords will be processed. Incoming requests from Data Recipients that are not in the enabled user ID list will not be processed.	N/A
Priority	The higher sequence number retransmission request will take precedence.	N/A
Maximum number of messages per request	A limit on the number of messages per request will be imposed. Note: If >1,000,000 the Data Recipient must generate multiple TCP requests.	1,000,000
Smaller requests not penalized at the expense of larger requests	Large requests will be broken down into smaller segments (smaller requests will be processed in between segments of larger requests).	100,000
Maximum number of requests per day	A limit on the number of requests per day will be imposed per Data Recipient.	500
Duplicate requests	Requests of the same range or within the same range received within a defined time frame, will be considered a duplicate, and will not be processed.	2 Minutes

SECTION 3: FIELD DESCRIPTIONS

3.1 Block Length

3 bytes, Numeric, Right Justified, Zero Filled. Indicates the total length of the message from the Start of Header (SOH) to the End of Text (ETX).

3.2 High Message Sequence Number

12 bytes, Numeric, Right Justified, Zero Filled. Identifies the end of the retransmission request message range.

3.3 Low Message Sequence Number

12 bytes, Numeric, Right Justified, Zero Filled. Identifies the start of the retransmission request message range.

3.4 Multicast Line Number

3 bytes, Numeric, Right Justified, Zero Filled. Indicates the multicast line number over which the retransmission should be generated.

System	Description	Multicast Line Number
CTSA	Network A	001-012
CTSB	Network B	001-012
CTSI	Index Network A&B	001-002
CQSE	Network E	001-012
CQSF	Network F	001-012
OPRA	OPRA	001-024

Note: Reference the latest National Market System (NMS) Common IP Multicast Distribution Network Recipient Interface Specification for the CTS/CQS/OPRA Network and Multicast Line breakdown using the following links.

CTS/CQS Link: https://www.nyxdata.com/nysedata/Default.aspx?tabid=519
OPRA Link: http://www.opradata.com/specs/common_ip_multicast_distribution.pdf

3.5 SOH AND ETX

1 byte, The Start of Header (SOH) control character (0x01) indicates the beginning of the block, whereas an End of Text (ETX) control character (0x03) signifies the end of the block.

3.6 US

1 byte, The Unit Separator (US) control character (0x1F) is needed in multiple message blocks to signify the end of the preceding message but not the end of the block. An ETX control character delimits the last message.

SECTION 3: FIELD DESCRIPTIONS, continued

3.7 Response Code

2 bytes, Numeric. Indicates one of the following response codes:

00 – Connection refused
01 – Successful connection/request
02 – Invalid size
03 – Invalid system, line, user ID, or password
04 – Duplicate request
05 – Incorrect format
06 – Exceeded maximum retransmission request size
07 – Exceeded maximum number of retransmission requests
08 – Invalid message sequence number

3.8 System / Responding SIAC System

4 bytes, Alphabetic, Right Justified. Indicates one of the following system names for both the System the request is being sent to by the Data Recipient and the Responding SIAC System.

System	Description
1) CTSA	Network A
2) CTSB	Network B
3) CTSI	Index - Network A & B
4) CQSE	Network E
5) CQSF	Network F
6) OPRA	OPRA

3.9 User ID

5 bytes, Alpha Numeric, Right Justified. A unique identifier for each Data Recipient (provided by SIAC).

3.10 User Password

5 bytes, Alpha Numeric, Right Justified. A unique password for each Data Recipient (provided by SIAC).

Appendix A – IP Addresses/Ports

IP Addresses:

Primary	
IP	**Mask**
159.125.61.177	255.255.255.248
159.125.62.177	255.255.255.248
Backup	
IP	**Mask**
198.140.41.177	255.255.255.248
198.140.42.177	255.255.255.248

Port Numbers:

System	Port Number
OPRA	30901
CTS	30903
CQS	30905