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1 Introduction

1.1 Overview

This specification will be the standard specification used for the Cboe U.S. Options Opening Process Feed on the Cboe Options ("C1") Exchange platform.

Cboe customers may use the Cboe U.S. Options Opening Process Feed specification to receive real-time Opening Auction message information including auction updates and execution information.

The Cboe U.S. Options Opening Process Feed cannot be used to enter orders. For Cboe U.S. Options order entry, refer to the Cboe U.S. Options FIX or BOE specifications.

A WAN-Shaped version of the Cboe U.S. Options Opening Process Feed is available from both of Cboe’s datacenters. Customers may choose to take one or more of the following feed options depending on their location and connectivity to Cboe.

<table>
<thead>
<tr>
<th>Exchange</th>
<th>Shaping</th>
<th>Served From Data Center (Primary/Secondary)</th>
<th>Multicast Feed ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 Options</td>
<td>WAN</td>
<td>Primary</td>
<td>CCO</td>
</tr>
<tr>
<td>C1 Options</td>
<td>WAN</td>
<td>Primary</td>
<td>CDO</td>
</tr>
<tr>
<td>C1 Options</td>
<td>WAN</td>
<td>Secondary</td>
<td>CEO</td>
</tr>
</tbody>
</table>

Cboe customers may also use Cboe U.S. Options Multicast PITCH, Cboe U.S. Options Multicast TOP, and Cboe U.S. Options Auction data feeds to receive opening process messages. Refer to the specifications for the respective feeds for more information.

1.2 Feed Connectivity Requirements

WAN Shaped feeds are available to customers with a minimum of 100 Mbs/s of connectivity to Cboe via cross connect or dedicated circuit.

Customers with sufficient connectivity may choose the WAN-Shaped feeds from any of the Cboe datacenters. It should be noted that feeds from the secondary datacenter will have additional latency for those connected with Cboe in the primary data center due to proximity and business continuity processing.

Cboe U.S. Options Opening Process Feed real-time events are delivered using a single published multicast address for all symbol ranges.
1.3 Gap Request Proxy and Message Retransmission

Recovery of missed data is not available on the Cboe U.S. Options Opening Process Feed as this feed contains only unsequenced messages.

1.4 Spin Servers

A spin is not available on the Cboe U.S. Options Opening Process Feed as this feed contains only unsequenced messages.
2 Protocol

Cboe U.S. Options customers may receive the Cboe U.S. Options Opening Process Feed protocol over multicast to receive auction update and summary execution information.

2.1 Message Format

Cboe U.S. Options Opening Process Feed protocol messages are delivered unsequenced and may not be retrieved if missed.

All UDP delivered events will be self-contained. Developers can assume that UDP delivered data will not cross frame boundaries and a single Ethernet frame will contain only one Sequenced Unit Header with associated data.

The Cboe U.S. Options Opening Process Feed is comprised of a series of dynamic length un-sequenced messages. Each message begins with Length and Message Type fields. Cboe reserves the right to add message types and grow the length of any message without notice. Customers should develop their decoders to handle unknown message types and messages beyond the expected length. Messages will only be grown to add additional data to the end of a message.

2.2 Data Types

The following field types are used within the Sequenced Unit Header and PITCH 2.X.

- **Alphanumeric** fields are left justified ASCII fields and space padded on the right.
- **Binary** fields are unsigned and sized to “Length” bytes and ordered using Little Endian convention (least significant byte first).
- **Binary Long Price** fields are unsigned Little Endian encoded 8 byte binary fields with 4 implied decimal places (denominator = 10,000).
- **Multiplier** fields are unsigned Little Endian encoded 4 byte binary fields with 1 implied decimal place (denominator = 10).
- **Printable ASCII** fields are left justified ASCII fields that are space padded on the right that may include ASCII values in the range of 0x20 – 0x7e.

2.3 Message Framing

Messages will be combined into single UDP frame where possible to decrease message overhead and total bandwidth. The count of messages in a UDP frame will be communicated using the Sequenced Unit Header. Framing will be determined by the server for each site. The content of the multicast across feeds (e.g. C/D WAN-Shaped) will be identical, but framing will not be consistent across feeds.
2.4 Sequenced Unit Header

The **Sequenced Unit Header** is used for all Cboe U.S. Options Opening Process Feed messages.

This feed will deliver only unsequenced data using the **Sequenced Unit Header**. Unsequenced headers will have a 0 value for the sequence field and unit field.

<table>
<thead>
<tr>
<th>Field</th>
<th>Offset</th>
<th>Length</th>
<th>Value/Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hdr Length</td>
<td>0</td>
<td>2</td>
<td>Binary</td>
<td>Length of entire block of messages. Includes this header and <strong>Hdr Count</strong> messages to follow.</td>
</tr>
<tr>
<td>Hdr Count</td>
<td>2</td>
<td>1</td>
<td>Binary</td>
<td>Number of messages to follow this header.</td>
</tr>
<tr>
<td>Hdr Unit</td>
<td>3</td>
<td>1</td>
<td>Binary</td>
<td>Unit that applies to messages included in this header.</td>
</tr>
<tr>
<td>Hdr Sequence</td>
<td>4</td>
<td>4</td>
<td>Binary</td>
<td>Will be zero.</td>
</tr>
</tbody>
</table>

**Total Length = 8 bytes**

2.5 Heartbeat Messages

The **Sequenced Unit Header** with a count field set to “0” will be used for heartbeat messages. During trading hours heartbeat messages will be sent if no data has been delivered within 1 second. Heartbeat messages never increment the sequence number.

Outside of trading hours Cboe sends heartbeat messages are sent to help users validate multicast connectivity. Heartbeat messages may not be sent from 12:00 am – 1:00 am ET or during maintenance windows.
3 Cboe U.S. Options Opening Process Feed Messages

3.1 Time

A *Time* message is sent whenever the source time for a unit passes over a second boundary. All subsequent time offset fields for the same unit will use the new *Time* value as the base until another *Time* message is received for the same unit.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Offset</th>
<th>Length</th>
<th>Type/(Value)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0</td>
<td>1</td>
<td>Binary</td>
<td><em>Length</em> of this message including this field</td>
</tr>
<tr>
<td>Message Type</td>
<td>1</td>
<td>1</td>
<td>0x20</td>
<td>Time Message</td>
</tr>
<tr>
<td>Time</td>
<td>2</td>
<td>4</td>
<td>Binary</td>
<td>Number of whole seconds from midnight Eastern Time</td>
</tr>
</tbody>
</table>

*Total Length = 6 bytes*

3.2 Options Auction Update

Options Auction Update messages are used to disseminate price and size information and Composite Market bid and offer prices during Opening and Re-Opening (halt) auctions on the Cboe Options Exchange. Options Auction Update messages are sent every five seconds during an opening period provided that one of the field values has changed. When no values have changed, a message is sent once every 60 seconds. Refer to the Cboe Options Opening Process specification for more information.

The Options Auction Update message has the following format:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Offset</th>
<th>Length</th>
<th>Type/(Value)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0</td>
<td>1</td>
<td>Binary</td>
<td><em>Length</em> of this message including this field</td>
</tr>
<tr>
<td>Message Type</td>
<td>1</td>
<td>1</td>
<td>0xD1</td>
<td>Options Auction Update Message</td>
</tr>
<tr>
<td>Time offset</td>
<td>2</td>
<td>4</td>
<td>Binary</td>
<td>Nanosecond offset from last unit timestamp.</td>
</tr>
<tr>
<td>Symbol</td>
<td>6</td>
<td>8</td>
<td>Printable ASCII</td>
<td>Symbol right padded with spaces.</td>
</tr>
<tr>
<td>Auction Type</td>
<td>14</td>
<td>1</td>
<td>Alphanumeric</td>
<td>G = GTH Opening</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>O = RTH Opening</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H = Halt Re-Opening</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V = Volatility Opening</td>
</tr>
<tr>
<td>Reference Price</td>
<td>15</td>
<td>8</td>
<td>Binary Long Price</td>
<td>Collared VMIM price computed on the queuing book only.</td>
</tr>
<tr>
<td>Buy Contracts</td>
<td>23</td>
<td>4</td>
<td>Binary</td>
<td>Cumulative Buy contracts at the Reference Price and above.</td>
</tr>
<tr>
<td>Sell Contracts</td>
<td>27</td>
<td>4</td>
<td>Binary</td>
<td>Cumulative Sell contracts at the Reference Price and below.</td>
</tr>
</tbody>
</table>

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Auction Summary messages are used to disseminate the results of an auction. An Opening or Re-Opening Auction Summary message for each symbol is sent at the conclusion of its Opening or Re-Opening auction and represents the Cboe Opening Price.

The Auction Summary message has the following format:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Offset</th>
<th>Length</th>
<th>Type/(Value)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0</td>
<td>1</td>
<td>Binary</td>
<td>Length of this message including this field.</td>
</tr>
<tr>
<td>Message Type</td>
<td>1</td>
<td>1</td>
<td>0x96</td>
<td>Auction Summary Message</td>
</tr>
<tr>
<td>Time offset</td>
<td>2</td>
<td>4</td>
<td>Binary</td>
<td>Nanosecond offset from last unit timestamp.</td>
</tr>
<tr>
<td>Symbol</td>
<td>6</td>
<td>8</td>
<td>Printable ASCII</td>
<td>Symbol right padded with spaces.</td>
</tr>
<tr>
<td>Auction Type</td>
<td>14</td>
<td>1</td>
<td>Alphanumeric</td>
<td>G = GTH Opening</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>O = RTH Opening</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>H = Halt Re-Opening</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V = Volatility Opening</td>
</tr>
<tr>
<td>Price</td>
<td>15</td>
<td>8</td>
<td>Binary Long Price</td>
<td>Auction price.</td>
</tr>
<tr>
<td>Quantity</td>
<td>23</td>
<td>4</td>
<td>Binary</td>
<td>Cumulative number of contracts executed during the auction.</td>
</tr>
</tbody>
</table>

**Total Length = 27 bytes**
3.4 Width Update

The Width Update message is used to communicate the opening quote width multiplier. This message will be sent at the beginning of the day for all underlyings and in the event that the exchange decides to change the quote width multiplier on a per underlying basis. For complete details on the opening collars see the Cboe Opening Process Specification.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Offset</th>
<th>Length</th>
<th>Type/(Value)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0</td>
<td>1</td>
<td>Binary</td>
<td>Length of this message including this field.</td>
</tr>
<tr>
<td>Time Offset</td>
<td>1</td>
<td>1</td>
<td>0xD2</td>
<td>Width Update Message</td>
</tr>
<tr>
<td>Underlying</td>
<td>2</td>
<td>4</td>
<td>Binary</td>
<td>Nanosecond offset from last unit timestamp.</td>
</tr>
<tr>
<td>Width Type</td>
<td>6</td>
<td>8</td>
<td>Printable ASCII</td>
<td>Underlying right padded with spaces.</td>
</tr>
<tr>
<td>Multiplier</td>
<td>14</td>
<td>1</td>
<td>Alphanumeric</td>
<td>R = Regular</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V = Volatility</td>
</tr>
</tbody>
</table>

Total Length = 19 bytes

3.5 Symbol Mapping

A Symbol Mapping message is used to map the 6 character multicast feed symbol field to an OSI symbol. These messages are sent continuously through the day at variable rates as bandwidth allows.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Offset</th>
<th>Length</th>
<th>Type/(Value)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0</td>
<td>1</td>
<td>Binary</td>
<td>Length of this message including this field.</td>
</tr>
<tr>
<td>Message Type</td>
<td>1</td>
<td>1</td>
<td>0x2E</td>
<td>Symbol Mapping Message</td>
</tr>
<tr>
<td>Feed Symbol</td>
<td>2</td>
<td>6</td>
<td>Printable ASCII</td>
<td>Symbol right padded with spaces.</td>
</tr>
<tr>
<td>OSI Symbol</td>
<td>8</td>
<td>21</td>
<td>Printable ASCII</td>
<td>OSI Symbol</td>
</tr>
<tr>
<td>Symbol Condition</td>
<td>29</td>
<td>1</td>
<td>Alphanumeric</td>
<td>N = Normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>C = Closing Only</td>
</tr>
<tr>
<td>Underlying</td>
<td>30</td>
<td>8</td>
<td>Alphanumeric</td>
<td>Underlying right padded with spaces.</td>
</tr>
</tbody>
</table>

Total Length = 38 bytes

3.6 End of Session

The End of Session message is sent for the feed when all the units have shut down. No more auction messages will be delivered for this feed.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Offset</th>
<th>Length</th>
<th>Type/(Value)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0</td>
<td>1</td>
<td>Binary</td>
<td>Length of this message including this field.</td>
</tr>
<tr>
<td>Message Type</td>
<td>1</td>
<td>1</td>
<td>0x2D</td>
<td>End of Session Message</td>
</tr>
</tbody>
</table>
3.7 SOQ Strike Range Update

The SOQ Strike Range Update message is only available on the C1 Exchange. This message disseminates the minimum and maximum strike prices in the strike price range used to calculate the Special Opening Quote (“SOQ”) on a Volatility Settlement date. In the event that multiple distinct SOQ calculations occur on the same day, the applicable SOQ is differentiated by the SOQ Identifier field, which is set to the CSMi symbol on which the final settlement SOQ value is disseminated.

The SOQ Strike Range Update message has the following format:

```
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Offset</th>
<th>Length</th>
<th>Type/Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0</td>
<td>1</td>
<td>Binary</td>
<td>Length of this message including this field</td>
</tr>
<tr>
<td>Message Type</td>
<td>1</td>
<td>1</td>
<td>0x9D</td>
<td>SOQ Strike Range Update Message</td>
</tr>
<tr>
<td>Time offset</td>
<td>2</td>
<td>4</td>
<td>Binary</td>
<td>Nanosecond offset from last unit timestamp</td>
</tr>
<tr>
<td>SOQ Identifier</td>
<td>6</td>
<td>20</td>
<td>Printable ASCII</td>
<td>Dissemination symbol of the final SOQ right padded with spaces.</td>
</tr>
<tr>
<td>Lower Strike Price</td>
<td>26</td>
<td>8</td>
<td>Binary Long Price</td>
<td>SOQ lower strike price</td>
</tr>
<tr>
<td>Upper Strike Price</td>
<td>34</td>
<td>8</td>
<td>Binary Long Price</td>
<td>SOQ upper strike price</td>
</tr>
</tbody>
</table>
```

Total Length = 42 bytes

3.8 Constituent Symbol Mapping

The Constituent Symbol Mapping message is only available on the C1 Exchange. This message is used to communicate which options series (if any) are Constituent Series in a Volatility Settlement Special Opening Quote (“SOQ”). The message is identical to the Symbol Mapping message with the addition of the SOQ Identifier field, which is set to the CSMi symbol on which the final settlement SOQ value is disseminated. The Constituent Symbol Mapping message is sent as an unsequenced message with one message sent for each Constituent Series in a continuous loop as bandwidth allows.

The Constituent Symbol Mapping message has the following format:

```
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Offset</th>
<th>Length</th>
<th>Type/Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>0</td>
<td>1</td>
<td>Binary</td>
<td>Length of this message including this field</td>
</tr>
<tr>
<td>Message Type</td>
<td>1</td>
<td>1</td>
<td>0x9E</td>
<td>Constituent Symbol Mapping Message</td>
</tr>
<tr>
<td>Feed Symbol</td>
<td>2</td>
<td>6</td>
<td>Printable ASCII</td>
<td>Symbol right padded with spaces</td>
</tr>
</tbody>
</table>
```
<table>
<thead>
<tr>
<th>OSI Symbol</th>
<th>8</th>
<th>21</th>
<th>Printable ASCII</th>
<th>OSI Symbol</th>
</tr>
</thead>
</table>
| Symbol Condition | 29 | 1 | Alphanumeric | N = Normal  
C = Closing Only |
| Underlying | 30 | 8 | Alphanumeric | Symbol of underlying equity right padded with spaces. |
| SOQ Identifier | 38 | 20 | Printable ASCII | Dissemination symbol of the final SOQ right padded with spaces. |

**Total Length = 58 bytes**
4 Message Types

0x20  Time
0xD1  Options Auction Update
0x96  Auction Summary
0xD2  Width Update
0x2E  Symbol Mapping
0x2D  End of Session
0x9D  SOQ Strike Range Update
0x9E  Constituent Symbol Mapping
5 Example Messages

Each of the following message types must be wrapped by a sequenced unit header as described in Section 2.4. Note that in the following examples, each byte is represented by two hexadecimal digits.

5.1 Sequenced Unit Header

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hdr Length</td>
<td>31 00</td>
<td>49 bytes, including header</td>
</tr>
<tr>
<td>Hdr Count</td>
<td>02</td>
<td>2 messages to follow</td>
</tr>
<tr>
<td>Hdr Unit</td>
<td>01</td>
<td>Unit 1</td>
</tr>
<tr>
<td>Hdr Sequence</td>
<td>00 00 00 00</td>
<td>Always set to zero</td>
</tr>
</tbody>
</table>

5.2 Time Message

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>06</td>
<td>6 bytes</td>
</tr>
<tr>
<td>Type</td>
<td>20</td>
<td>Time</td>
</tr>
<tr>
<td>Time</td>
<td>98 85 00 00</td>
<td>34,200 seconds = 09:30 AM Eastern</td>
</tr>
</tbody>
</table>

5.3 Options Auction Update

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>40</td>
<td>64 bytes</td>
</tr>
<tr>
<td>Type</td>
<td>D1</td>
<td>Options Auction Update</td>
</tr>
<tr>
<td>Time offset</td>
<td>18 D2 06 00</td>
<td>447,000 ns since last Time Message</td>
</tr>
<tr>
<td>Symbol</td>
<td>30 30 6D 45 56 4F</td>
<td>00mEVO</td>
</tr>
<tr>
<td>Auction Type</td>
<td>56</td>
<td>Volatility Auction</td>
</tr>
<tr>
<td>Reference Price</td>
<td>E8 A3 0F 00 00 00 00 00</td>
<td>$102.50</td>
</tr>
<tr>
<td>Buy Contracts</td>
<td>64 00 00 00</td>
<td>100 Contracts</td>
</tr>
<tr>
<td>Sell Contracts</td>
<td>C8 00 00 00</td>
<td>200 Contracts</td>
</tr>
<tr>
<td>Indicative Price</td>
<td>E8 A3 0F 00 00 00 00 00</td>
<td>$102.50</td>
</tr>
<tr>
<td>Auction Only</td>
<td>E8 A3 0F 00 00 00 00 00</td>
<td>$102.50</td>
</tr>
<tr>
<td>Price</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening Condition</td>
<td>4F</td>
<td>O = Would Open</td>
</tr>
<tr>
<td>Composite Market</td>
<td>50 69 0F 00 00 00 00 00</td>
<td>$101.00</td>
</tr>
<tr>
<td>Bid Price</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offer Price</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.4 Auction Summary

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>1B</td>
<td>27 bytes</td>
</tr>
<tr>
<td>Type</td>
<td>96</td>
<td>Auction Summary</td>
</tr>
<tr>
<td>Time offset</td>
<td>18 D2 06 00</td>
<td>447,000 ns since last Time Message</td>
</tr>
<tr>
<td>Symbol</td>
<td>30 30 6D 45 56 5F 20 20</td>
<td>00mEVO</td>
</tr>
<tr>
<td>Auction Type</td>
<td>4F</td>
<td>O = Opening</td>
</tr>
</tbody>
</table>
Price   E8 A3 0F 00 00 00 00 00   $102.50
Quantity  4B 00 00 00   75

5.5 Width Update

Length   13   19 bytes
Type D2   Width Update
Time Offset 18 D2 06 00   447,000 ns since last Time Message
Underlying 5A 56 5A 5A 54 20 20 20   ZVZZT
Width Type 52   R = Regular
Multiplier 0F 00 00 00   Multiplier of 1.5

5.6 Symbol Mapping

Length   26   38 bytes
Type 2E   Symbol Mapping Message
Feed Symbol 30 30 6D 45 56 4F   00mEVO
OSI Symbol 4D 53 46 54 20 20 20 20 31 39   MSFT 190920C00150000
30 39 32 30 43 30 30 30
Symbol 4E   ‘N’ – Closing Only
Condition
Underlying 4D 53 46 54 20 20 20 20   MSFT

5.7 End of Session

Length   06   6 bytes
Type 2D   End of Session
Time Offset 18 D2 06 00   447,000 ns since last Time Message

5.8 SOQ Strike Range Update

Length   2A   42 bytes
Type 9D   SOQ Strike Range Update
Time Offset 18 D2 06 00   447,000 ns since last Time Message
SOQ Identifier 56 58 53 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
Price
Lower Strike 40 66 03 01 00 00 00 00   $1,700
Upper Strike 00 48 EB 01 00 00 00 00   $3,200
### 5.9 Constituent Symbol Mapping

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
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</tr>
<tr>
<td>Type</td>
<td>9E</td>
</tr>
<tr>
<td>Feed Symbol</td>
<td>30 30 6D 45 56 4F</td>
</tr>
<tr>
<td>OSI Symbol</td>
<td>53 50 58 57 20 20 31 39 30 39 32 37 43 30 32 33 39 30 30 30</td>
</tr>
<tr>
<td>Symbol</td>
<td>4E</td>
</tr>
<tr>
<td>Condition</td>
<td>‘N’ – Normal</td>
</tr>
<tr>
<td>Underlying</td>
<td>53 50 58 20 20 20 20 20</td>
</tr>
<tr>
<td>SOQ Identifier</td>
<td>56 58 53 20 20 20 20 20</td>
</tr>
</tbody>
</table>

*Feed Symbol: 00mEVO, OSI Symbol: SPXW 190927C02390000*
6 Multicast Configuration

6.1 US Options Production Environment Configuration

6.1.1 C1 Options Unit Distribution

The following table describes an updated C1 symbol distribution across units.

<table>
<thead>
<tr>
<th>Unit</th>
<th>C1 Symbol Range</th>
<th>C1 Exceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A – ACNAZ</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>ACNB – AMGNZ</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>AMGO – BAAZ</td>
<td>Excludes AMZN</td>
</tr>
<tr>
<td>4</td>
<td>BAB – BKNFZ</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BKNG – CASZZ</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CAT – COOZZ</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>COP – DEAAZ</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>DEAB – EEMAZ</td>
<td>Excludes DJX</td>
</tr>
<tr>
<td>9</td>
<td>DJXA – FBAAZ</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>FBAB – GOOFZ</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>GOOG – GOOGZ</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>GOOH – IFFAZ</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>IFFB – IWLZZ</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>IWM – IWMAZ</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>IWMB – LOVZZ</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>LOW – MPCAZ</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>MPCB – NFLWZ</td>
<td>Excludes MXEA, MXEF</td>
</tr>
<tr>
<td>18</td>
<td>NFLX – NUEAZ</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>NUEB – PEPAZ</td>
<td>Excludes OEX</td>
</tr>
<tr>
<td>20</td>
<td>PEPB – QQPZZZ</td>
<td>Excludes RLG, RLV</td>
</tr>
<tr>
<td>21</td>
<td>ROKV – SPZZZ</td>
<td>Excludes RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPX, SPXW, SPY</td>
</tr>
<tr>
<td>22</td>
<td>SQ – TLRYZ</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>TLRZ – TSLAZ</td>
<td></td>
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<tr>
<td>24</td>
<td>TSLB – UVXXZ</td>
<td></td>
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<tr>
<td>25</td>
<td>UVXY – VZZZZ</td>
<td>Excludes VIX, VIXW</td>
</tr>
<tr>
<td>26</td>
<td>W – XLEAZ</td>
<td>Excludes XEO</td>
</tr>
<tr>
<td>27</td>
<td>XLEB – ZZZZZ</td>
<td>Excludes UKXM, XSP</td>
</tr>
<tr>
<td>28</td>
<td>QQQ</td>
<td></td>
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<tr>
<td>29</td>
<td>AMZN</td>
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<tr>
<td>30</td>
<td>SPY</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>DJX, MXEA, MXEF, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, XEO, UKXM, XSP</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>VIX, VIXW</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>SPX</td>
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<td>34</td>
<td>SPXW</td>
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<tr>
<td>35</td>
<td>SPX/SPXW, Cross Product Spreads</td>
<td></td>
</tr>
</tbody>
</table>

Note - Cboe reserves the right to add units and/or change symbol distribution with 48 hours of notice and no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.
6.1.2 C1 Options Production Multicast Routing Parameters

<table>
<thead>
<tr>
<th>Data Center</th>
<th>Rendezvous Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>NY5 Primary Data Center A feed</td>
<td>74.115.128.183</td>
</tr>
<tr>
<td>NY5 Primary Data Center B feed</td>
<td>74.115.128.184</td>
</tr>
<tr>
<td>CH4 Secondary Data Center E feed</td>
<td>174.136.181.249</td>
</tr>
</tbody>
</table>

6.1.3 C1 Options Production Address/Unit Distribution

The following tables describe the unit distribution across the C1 Options Opening Process Feed.

<table>
<thead>
<tr>
<th>NYS Primary Datacenter</th>
<th>WAN Shaped [CCO] 170.137.114.80 /28</th>
<th>WAN Shaped [CDO] 170.137.115.80 /28</th>
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</thead>
<tbody>
<tr>
<td>Unit</td>
<td>IP Port</td>
<td>Real-time MC</td>
</tr>
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<td>30551</td>
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</tr>
<tr>
<td>2</td>
<td>30552</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>30553</td>
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<td>4</td>
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<tr>
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</tr>
</tbody>
</table>

Note – Cboe reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.
<table>
<thead>
<tr>
<th>Unit</th>
<th>IP Port</th>
<th>Real-time MC</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>31551</td>
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<td>31584</td>
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</tr>
</tbody>
</table>

Note – Cboe reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.
6.2 US Options Certification Environment Configuration

6.2.1 C1 Options Certification Unit Distribution

The following table describes an updated C1 symbol distribution across units.

<table>
<thead>
<tr>
<th>Unit</th>
<th>C1 Symbol Range</th>
<th>C1 Exceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A – ACNAZ</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>ACNB – AMGNZ</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>AMGO – BAAZ</td>
<td>Excludes AMZN</td>
</tr>
<tr>
<td>4</td>
<td>BAB – BKNFZ</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BKNG – CASZZ</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CAT – COOZZ</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>COP – DEAAZ</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>DEAB – EEMAZ</td>
<td>Excludes DJX</td>
</tr>
<tr>
<td>9</td>
<td>DJX – FBAAZ</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>FBAB – GOOFZ</td>
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</tr>
<tr>
<td>11</td>
<td>GOOG – GOOGZ</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>GOOH – IFFAZ</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>IFFB – IWLZZ</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>IWM – IMAZ</td>
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</tr>
<tr>
<td>15</td>
<td>IWM – LOW</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>MPCI – MPCA</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>MPCB – NFLWZ</td>
<td>Excludes MXEA, MXEF</td>
</tr>
<tr>
<td>18</td>
<td>NFLX – NUEAZ</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>NUEB – PEPAZ</td>
<td>Excludes OEX</td>
</tr>
<tr>
<td>20</td>
<td>PEPB – QQPZZ</td>
<td>Excludes RLG, RLV</td>
</tr>
<tr>
<td>21</td>
<td>ROKV – SPZZZ</td>
<td>Excludes RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPX, SPXW, SPY</td>
</tr>
<tr>
<td>22</td>
<td>SQ – TLRYZ</td>
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</tr>
<tr>
<td>23</td>
<td>TLRZ – TSLAZ</td>
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</tr>
<tr>
<td>24</td>
<td>TSLB – UVXXZ</td>
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</tr>
<tr>
<td>25</td>
<td>UVXY – VZZZZ</td>
<td>Excludes VIX, VIXW</td>
</tr>
<tr>
<td>26</td>
<td>W – XLEAZ</td>
<td>Excludes XEO</td>
</tr>
<tr>
<td>27</td>
<td>XLEB – ZZZZZ</td>
<td>Excludes UKXM, XSP</td>
</tr>
<tr>
<td>28</td>
<td>QQQ</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>AMZN</td>
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</tr>
<tr>
<td>30</td>
<td>SPY</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>DJX, MXEA, MXEF, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, XEO, UKXM, XSP</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>VIX, VIXW</td>
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<tr>
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<td>SPX</td>
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</tr>
<tr>
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<td>SPX</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>SPX/SPXW, Cross Product Spreads</td>
<td></td>
</tr>
</tbody>
</table>

Note - Cboe reserves the right to add units and/or change symbol distribution with 48 hours of notice and no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.
6.2.2 C1 Options Certification Multicast Routing Parameters

<table>
<thead>
<tr>
<th>Data Center</th>
<th>Rendezvous Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>NY5 Certification Data Center</td>
<td>74.115.128.131</td>
</tr>
</tbody>
</table>

6.2.3 C1 Options Certification Address/Unit Distribution

The following tables describe the unit distribution across the C1 Options Certification Opening Process Feed.

<table>
<thead>
<tr>
<th>NY5 Primary Datacenter</th>
<th>Certification 170.137.126.16/28</th>
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<tr>
<td>Unit</td>
<td>IP Port</td>
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<td>32551</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
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Note – Cboe reserves the right to add multicast addresses with prior notice, but no migration period. Notice will be given that the distribution will change on a certain date. Care should be taken to support mappings in these tables via software configuration.
7 Connectivity

7.1 Supported Extranet Carriers

The Cboe U.S. Options Opening Process Feed will be made available to customers through extranet carriers that have completed their multicast implementation and certified with Cboe on a per-market basis. Cboe has certified a number of carriers for redistribution of Cboe Multicast data feeds as outlined in the Cboe US Equity/Options Connectivity Manual. For more information on receiving the Cboe U.S. Options Opening Process Feed through any of these providers, please refer to the vendor contact information noted in the Extranet Providers section of the Connectivity Manual.

7.2 Bandwidth Recommendation

The WAN-shaped feeds require 1Gbps of bandwidth. Cboe will use 90% of these respective bandwidths for Multicast to allow customers to use the same physical connection for FIX order entry if desired.
8 References

For more information on Cboe Symbology, please refer to the Cboe Symbology Reference document.

9 Support

Please e-mail questions or comments regarding this specification to tradedesk@cboe.com.
## Revision History

<table>
<thead>
<tr>
<th>Document Version</th>
<th>Date</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.0.0</td>
<td>11/16/18</td>
<td>Initial version 1.0.0.</td>
</tr>
<tr>
<td>1.0.1</td>
<td>02/14/19</td>
<td>Removed Trading Status from Message Types as it was included in error. Added certification IP addresses and unit distribution information.</td>
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<tr>
<td>1.0.2</td>
<td>03/05/19</td>
<td>Updated narrative description and field descriptions for Options Auction Update message.</td>
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<tr>
<td>1.0.3</td>
<td>04/15/19</td>
<td>Added Production IP addresses for C1 Options.</td>
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<tr>
<td>1.0.4</td>
<td>05/08/19</td>
<td>Corrected C1 Production IP addresses for Primary WAN Shaped [CCO] and [CDO] source network IP addresses.</td>
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<td>1.0.5</td>
<td>05/14/19</td>
<td>Updated Options Auction Update message with Opening Condition = C (Crossed Composite Market), and added Composite Market Bid Price and Composite Market Offer Price fields. Updated example for Options Auction Update and added example for SOQ Strike Range messages. Added additional proprietary products to matching unit 31 in C1.</td>
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<tr>
<td>1.0.6</td>
<td>05/20/19</td>
<td>Added Constituent Symbol Mapping message with example.</td>
</tr>
<tr>
<td>1.0.7</td>
<td>09/25/19</td>
<td>Updated OSI Symbol example values in Symbol Mapping and Constituent Symbol Mapping message type examples.</td>
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