US Options
Multicast Top Specification

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1 Introduction

1.1 Overview

Note that this specification will be the standard Multicast Top specification to be used for the BZX Options, Cboe Options ("C1"), C2 Options and EDGX Options Exchange platforms. This specification is for the Simple book only, refer to the US Options Complex Multicast Top Specification for Complex book information.

Options participants may use the Multicast Top protocol to receive real-time top of book quotations direct from each exchange. Market data received through Multicast Top is less timely than receiving the same data from the Multicast PITCH Depth of Book feed. The Top protocol offers a significant reduction in the number of events and number of bytes of application data sent, compared to the US Options Multicast PITCH protocol.

The quotations received via Multicast Top provide an aggregated size and do not indicate the size or number of individual orders at the best bid or ask. The Multicast Top protocol also provides last trade price and size and cumulative volume data.

Complete depth of book market data can be received via the US Options Multicast PITCH protocol.

Top cannot be used to enter orders. For order entry, refer to the appropriate US Options FIX or BOE Specification.

All versions of the Multicast Top feed will be Gig-shaped (maximum 1 Gb/s) and will be available from one or both of Cboe's datacenters. Participants may choose to take one or more of the following Multicast Top feeds depending on their location and connectivity to Cboe.

Multicast Top Feed Descriptions:

Exchange	Shaping	Served From Data Center (Primary/Secondary)	Multicast Feed ID
BZX Options	Gig	Primary	OAT
BZX Options	Gig	Primary	OBT
BZX Options	Gig	Secondary	OET
C1 Options	Gig	Primary	CAT
C1 Options	Gig	Primary	CBT
C1 Options	Gig	Secondary	CET
C2 Options	Gig	Primary	WAT
C2 Options	Gig	Primary	WBT
C2 Options	Gig	Secondary	WET
EDGX Options	Gig	Primary	EAT
EDGX Options	Gig	Primary	EBT
EDGX Options	Gig	Secondary	EET

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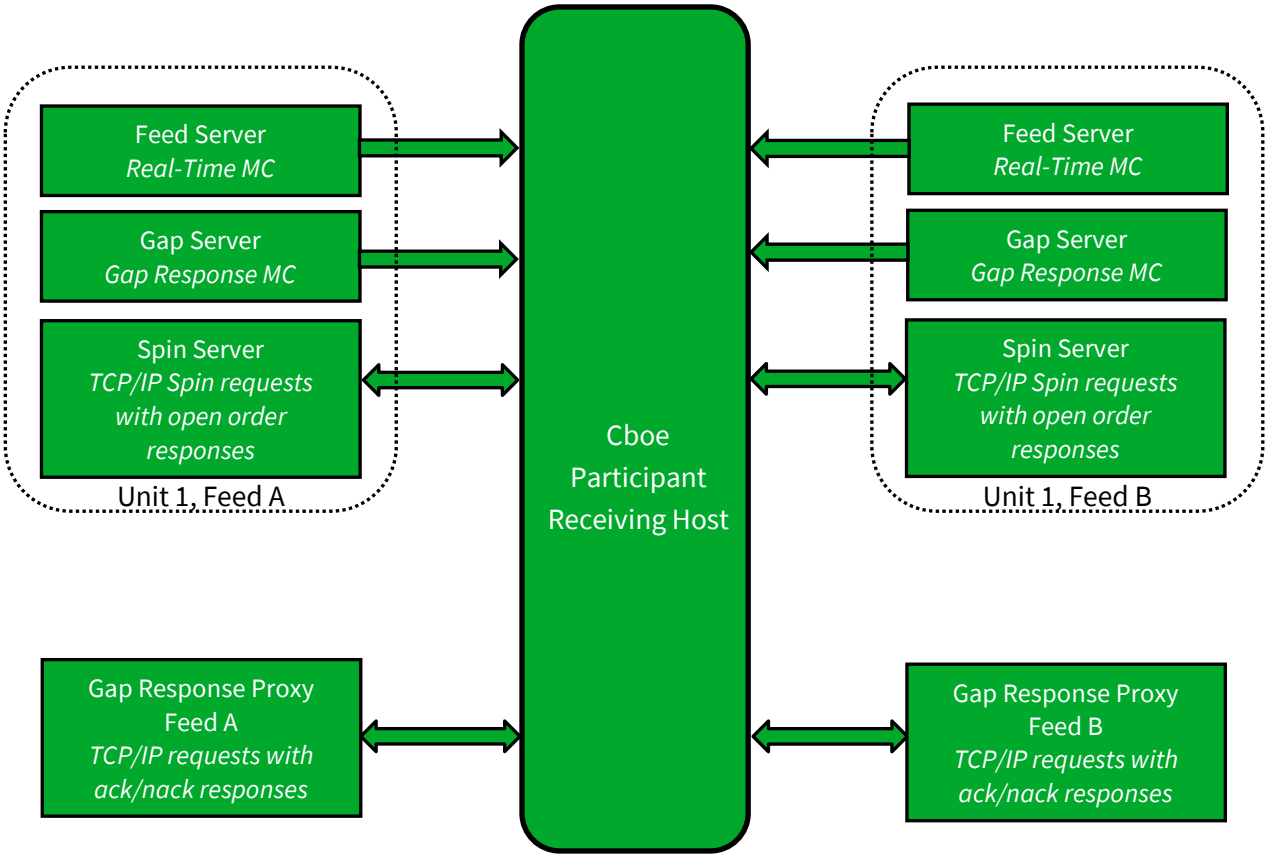
1.2 Feed Connectivity Requirements

Gig-Shaped feeds are available to participants who meet the minimum bandwidth requirements to Cboe via cross-connect, dedicated circuit, or a supported carrier.

Participants with sufficient connectivity may choose to take both the A and B feeds from Cboe's primary datacenter and arbitrate the feeds to recover lost data. Alternatively, participants may choose to arbitrate feeds from both datacenters. It should be noted that feeds from the secondary datacenter will have additional latency for those connected with Cboe in the primary datacenter due to proximity and business continuity processing.

Multicast Top real-time events are delivered using a published range of multicast addresses divided by symbol range units. Dropped messages can be requested using a TCP/IP connection to one of Cboe's Multicast Top Gap Request Proxy ("GRP") servers with replayed messages being delivered on a separate set of multicast ranges reserved for packet retransmission. Intraday, a spin of current top of book may be requested from a Spin Server.

The following diagram is a logical representation Multicast Top feed message flow between Cboe and a participant feed handler that is listening to the "A" and "B" instances of two units:



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1.3 Symbol Ranges, Units, and Sequence Numbers

Symbols will be separated into units and symbol distribution will not change intra-day. Cboe does, however, reserve the right to add multicast addresses or change the symbol distribution with 48 hours prior notice to participants. Care should be taken to ensure that address changes, address additions, and symbol distribution changes can be supported easily.

Message sequence numbers are incremented by one for every sequenced message within a particular symbol unit. It is important to understand that one *or more* units will be delivered on a single multicast address. As with symbol ranges, unit distribution across multicast addresses will not change intra-day, but may change after notice has been given.

Symbol distribution across units as well as unit distribution across multicast addresses are identical for real-time and gap response multicast addresses.

1.4 Options Specific Symbol Processing

Cboe has implemented a symbol mapping mechanism (`Symbol Mapping` message) for the Multicast Top feeds, which maps each specific simple options contract to a six character, ASCII *Symbol*. This symbol mapping significantly reduces the size of the Multicast Top feed and allows participants to use the same symbol handling mechanisms for the Cboe operated equity, options, and futures exchanges. This symbol mapping is the same as the US Options Multicast PITCH feed.

Mapping occurs on a continuous basis on each unit's multicast feed. `Symbol Mapping` messages will be un-sequenced and are sent from pre-market through the end of trading. The rate is variable and will be adjusted as bandwidth allows. Once the same contract has been seen twice, the user can be certain the full loop has been observed.

In addition to the symbol mapping events available on the Multicast Top feed, a downloadable file with current mappings is available via the Cboe website.

1.5 Gap Request Proxy and Message Retransmission

Requesting delivery of missed sequenced data is achieved by establishing a TCP connection to a Gap Request Proxy ("GRP") port. This GRP port is specific to Multicast Top and is NOT shared with the Multicast PITCH GRP port. Participants who do not wish to request missed messages do not need to connect to a GRP port for any reason or listen to the multicast addresses reserved for message retransmission. Participants choosing to request missed data will need to connect to their assigned GRP port, log in, and request gap ranges as necessary. All gap requests will be responded to with a `Gap Response` message. A `Gap Response` *Status* code of 'A'ccepted signals that the replayed messages will be delivered via the appropriate gap response multicast address. Any other `Gap Response` *Status* code will indicate the reason that the request cannot be serviced.

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Gap requests are limited in message count, frequency, and age by the GRP. Gap requests will only be serviced if they are within a defined sequence range of the current multicast sequence number for the requested unit. Participants will receive a total daily allowance of gap requested messages. In addition, each participant is given renewable one second and one minute gap request limits.

If more than one gap request is received for a particular unit/sequence/count combination within a short timeframe, all requests will receive a successful `Gap Response` message from the GRP, but only a single replayed message will be sent on the gap response multicast address.

If overlapping gap requests are received within a short period of time, the gap server will only send the union of the sequence ranges across grouped gap requests. Participants will receive gap responses for their requested unit/sequence/count, but receivers should be prepared for the gap responses to be delivered via multicast in non-contiguous blocks.

Gap acknowledgements or rejects will be delivered to users for every gap request received by the GRP. Users should be prepared to see replayed multicast data before or after the receipt of the gap response acknowledgement from the GRP.

1.6 Spin Servers

A Spin Server is available for each unit. The server allows participants to connect via TCP and receive a spin of the inside book and symbols with limited trading conditions on that unit. By using the spin, a participant can get the current book quickly in the middle of the trading session without worry of gap request limits. The Spin Server for each unit is assigned its own address and/or TCP port.

Upon successful login and periodically thereafter, a `Spin Image Available` message is sent which contains a sequence number indicating the most recent message applied to the book. Using a `Spin Request` message, a participant may request a spin for the orders up to a sequence number noted within one of the *last ten* `Spin Image Available` messages distributed. If the `Spin Request` submitted does not present a sequence number that matches one of the last ten `Spin Image Available` messages distributed, the spin will return orders up to the next closest sequence number reported through a `Spin Image Available` message that is greater than the sequence number requested.

In the case a participant sends a sequence number in a `Spin Request` that is higher than the sequence number reported by the most recent `Spin Image Available` message, the next spin image to be generated will be returned when it is available. If the requested sequence number is still higher at that time, an "O" (Out of Range) error will be generated.

A spin will consist of `Two Side Update`, `Single Side Update`, `TOP Trade`, `Trading Status` and `Time` messages. While receiving the spin, the participant must buffer multicast messages received. If the `Spin Image Available` message sequence number is the participant's reference point, multicast messages with larger sequence numbers should be buffered. If a non-`Spin Image`

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`Available` sequence number is the participant's reference point which they send in their `Spin Request`, they should buffer from that point on, but note that within the spin they may receive sequence numbers beyond that point which they may disregard. When a `Spin Finished` message is received, the buffered messages must be applied to spun copy of the book to bring it current.

Customers can also use the Spin Server to request a spin of all `Symbol Mapping` messages by sending an `Instrument Definition Request`. The Spin Server can only process one spin at a time. Customers will need to wait for a `Spin Finished` or `Instrument Definition Finished` message before submitting another request.

Section 5 shows an example flow of messages between a participant and Cboe's Multicast Top feed and Spin Server.

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2 Protocol

Cboe users may use the Top protocol over multicast to receive real-time top of book quotations and execution information direct from Cboe.

2.1 Message Format

The messages that make up the Top protocol are delivered using `Sequenced Unit Header` which handles sequencing and delivery integrity. All messages delivered via multicast as well as to/from the Gap Request Proxy ("GRP") or Spin Server will use the `Sequenced Unit Header` for handling message integrity.

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.

TCP/IP delivered events from the GRP may cross frames as the data will be delivered as a stream of data with the TCP/IP stack controlling Ethernet framing.

The Top data feed is comprised of a series of dynamic length 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. Participants should develop their decoders to deal with unknown message types and messages that grow 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`, GRP messages, and Top.

- **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).
- **Signed Binary** fields are signed and sized to "Length" bytes and ordered using Little Endian convention (least significant byte first).
- **Binary Price** fields are unsigned Little Endian encoded 8 byte binary fields with 4 implied decimal places (denominator = 10,000).
- **Binary Short Price** fields are unsigned Little Endian encoded 2 byte binary fields with 2 implied decimal places (denominator = 100).
- **Binary Long Price** fields are unsigned Little Endian encoded 8 byte binary fields with 4 implied decimal places (denominator = 10,000).

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- **Bit Field** fields are fixed width fields with each bit representing a Boolean flag (the 0 bit is the lowest significant bit; the 7 bit is the highest significant bit).
- **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.
- **Time Offset** are 4 byte unsigned Little Endian values that represent the number of nanoseconds since the last `Time` message.

2.3 Message Framing

Top of book update 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 unit and site. The content of the multicast across feeds (e.g. A/B) will be identical, but framing will not be consistent across feeds. Receiving processes that receive and arbitrate multiple feeds cannot use frame level arbitration to fill gaps.

2.4 Sequenced Unit Header

The `Sequenced Unit Header` is used for all Multicast Top messages as well as messages to and from the Gap Request Proxy ("GRP") and Spin Servers.

Sequenced and un-sequenced data may be delivered using the `Sequenced Unit Header`. Un-sequenced headers will have a 0 value for the *Hdr Sequence* field and potentially for the *Hdr Unit* field. All messages sent to and from the GRP and Spin Server are un-sequenced while multicast may contain both sequenced and un-sequenced messages.

Sequenced messages have implied sequences with the first message having the sequence number contained in the header. Each subsequent message will have an implied sequence one greater than the previous message up to a maximum of count messages. Multiple messages can follow a `Sequenced Unit Header`, but a combination of sequenced and un-sequenced messages cannot be sent within one header.

The sequence number for the first message in the next frame can be calculated by adding the *Hdr Count* field to the *Hdr Sequence*. This technique will work for sequenced messages and `Heartbeats`.

Sequenced Unit Header				
Field	**Offset**	**Length**	**Value/Type**	**Description**
Hdr Length	0	2	Binary	Length of entire block of messages. Includes this header and *Hdr Count* messages to follow.

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Hdr Count	2	1	Binary	Number of messages to follow this header.
Hdr Unit	3	1	Binary	Unit that applies to messages included in this header.
Hdr Sequence	4	4	Binary	Sequence of first message to follow this header.
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 from the GRP, Spin Server, and all multicast addresses if no data has been delivered within one second. `Heartbeat` messages never increment the sequence number for a unit, but can be used to detect gaps on the real-time multicast channels during low update rate periods.

`Heartbeats` on the real-time multicast addresses during trading hours will have an *Hdr Sequence* value equal to the sequence of the next sequenced message to be sent for the unit. `Heartbeats` on gap multicast addresses will always have the *Hdr Sequence* field set to 0. All `Heartbeat` messages sent to and from the GRP and Spin Server are considered un-sequenced and should have sequence and unit fields set to 0.

Outside of trading hours Cboe sends `Heartbeat` messages on all real-time and gap channels with a sequence of "0" to help users validate multicast connectivity. `Heartbeat` messages might not be sent outside of normal trading hours.

Cboe expects `Heartbeat` messages to be sent to the GRP on live connections no less than every 5 seconds. Failure to receive two consecutive `Heartbeat` messages will result in the GRP or Spin Server terminating the client connection.

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3 Top Messages

With the exception of `Time` messages, each Top message reflects the update of the top of book or execution of an order in the system.

3.1 Time

A `Time` message is immediately generated and sent when there is a Top event for a given clock second. If there is no Top event for a given clock second, then no Time message is sent for that second. 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. The *Time* field is the number of seconds relative to midnight Eastern Time, which is provided in the `Time Reference` message.

Time				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x20	`Time` Message
Time	2	4	Binary	Number of whole seconds from midnight Eastern Time.
Total Length = 6 bytes				

3.2 Unit Clear

The `Unit Clear` message instructs feed recipients to clear all market snapshots for the book in the unit specified in the `Sequenced Unit Header`. This message will be sent at startup each day. It would also be distributed in certain recovery events such as a data center fail-over.

Unit Clear				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x97	`Unit Clear` Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Total Length = 6 bytes				

3.3 Symbol Mapping

The `Symbol Mapping` message are sent as an unsequenced message. One unsequenced `Symbol Mapping` message for each *Symbol* are sent in a continuous loop as bandwidth allows.

Members who consume the 5G-Shaped Multicast PITCH feeds will be able to receive the full list of symbols in approximately 5 minutes, and will allow for optimal distribution in situations where market data is susceptible to throttling as a result of high message burst rates. All 1 Gigabit-Shaped ("1G-Shaped") feeds will continue to complete the full loop of *Symbol Mapping* messages in approximately 30 minutes.

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Symbol Mapping				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x2E	`Symbol Mapping` Message
Feed Symbol	2	6	Printable ASCII	*Symbol* right padded with spaces.
OSI Symbol	8	21	Printable ASCII	OSI Symbol
Symbol Condition	29	1	Alphanumeric	`N` = Normal `C` = Closing Only
Underlying	30	8	Alphanumeric	Symbol of underlying equity right padded with spaces.
Total Length = 38 bytes				

3.4 Market Update Messages

Market Update messages reflect real-time events to the current state of the market. These messages are always sequenced and may be recovered via the Gap Request Proxy ("GRP").

3.4.1 Single Side Update

`Single Side Update` messages provide an updated price and size for a single side of a *Symbol*. The side is denoted by the *Side* field. One `Single Side Update` message may reflect one or more updates to the inside book that were processed at the same time, but will only be done so in a way that can be arbitrated between A/B feeds.

`Single Side Update` messages come in two variants: `Single Side Update Expanded (Short)` and `Single Side Update Expanded (Long)`. The `Single Side Update Expanded(Short)` message is used whenever possible, but the `Single Side Update Expanded(Long)` message is used when the *Price* cannot be represented by a Binary Short Price or the *Quantity* cannot be represented by an unsigned 16-bit integer.

If any All or None size exists on both sides at a price level at or better than the firm quote, it will be represented by a separate message.

If any customer firm size exists, the best customer firm quote will be represented as a separate message. (C1 Only)

3.4.1.1 Single Side Update Expanded (Short)

Single Side Update Expanded (Short)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xD4	`Single Side Update Expanded (Short)` Message

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Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Symbol	6	6	Printable ASCII	*Symbol* right padded with spaces.
Side	12	1	Alphanumeric	`B` = Bid Side `S` = Ask Side
Bit Fields	13	1	Bit Field	**Bits 0-2 – Reserved** **Bit 3 – AON** `0` = Price level is a firm quote `1` = Price Level is AON (All or None) **Bit 4 – Customer** (C1 Only) `0` = Not customer specific. `1` = Price Level is specifically for firm customer quotes. **Bits 5-7 – Reserved**
Price	14	2	Binary Short Price	Price
Quantity	16	2	Binary	Total number of contracts on the inside book (customer and non-customer). If Customer bit is set, this will be zero.
Customer Quantity	18	2	Binary	Number of customer contracts on the inside book. A zero value denotes that there are no customer contracts at the inside price. If Customer bit is set, this will be the number of customer contracts on the inside book considering only customer firm quotes. Will always be zero for C2.
Total Length = 20 bytes				

3.4.1.2 Single Side Update Expanded (Long)

Single Side Update Expanded (Long)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xD5	`Single Side Update Expanded(Long)` Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Symbol	6	6	Printable ASCII	*Symbol* right padded with spaces.
Side	12	1	Alphanumeric	`B` = Bid Side `S` = Ask Side
Bit Fields	13	1	Bit Field	**Bits 0-2 – Reserved** **Bit 3 – AON** `0` = Price level is a firm quote `1` = Price Level is AON (All or None)

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				Bit 4 – Customer (C1 Only) `0` = Not customer specific. `1` = Price Level is specifically for firm customer quotes. **Bits 5-7 – Reserved**
Price	14	8	Binary Long Price	Price
Quantity	22	4	Binary	Total number of contracts on the inside book (customer and non-customer). If Customer bit is set, this will be zero.
Customer Quantity	26	4	Binary	Number of customer contracts on the inside book. A zero value denotes that there are no customer contracts at the inside price. If Customer bit is set, this will be the number of customer contracts on the inside book considering only customer firm quotes. Will always be zero for C2.
Total Length = 30 bytes				

3.4.2 Two Side Update Message

`Two Side Update` messages provide an updated price and size for both sides of a *Symbol*. One `Two Side Update` message may reflect one or more updates to the inside book that were processed at the same time, but will only be done so in a way that can be arbitrated between A/B feeds.

`Two Side Update` messages come in two variants: `Two Side Update Expanded (Short` and `Two Side Update Expanded (Long)`. The `Two Side Update Expanded(Short)` message is used whenever possible, but the `Two Side Update Expanded (Long)` message is used when the *Price* cannot be represented by a Binary Short Price or the *Quantity* cannot be represented by an unsigned 16-bit integer.

If any All or None size exists on both sides at a price level at or better than the firm quote, it will be represented by a separate message.

If any customer firm size exists, the best customer firm quote will be represented as a separate message. (C1 Only)

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3.4.2.1 Two Side Update Expanded (Short)

Two Side Update Expanded (Short)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xD6	`Two Side Update Expanded (Short)` Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Symbol	6	6	Printable ASCII	*Symbol* right padded with spaces.
Bit Fields	12	1	Bit Field	**Bits 0-2 – Reserved** **Bit 3 – AON** `0` = Price level is a firm quote `1` = Price Level is AON (All or None) **Bit 4 – Customer** (C1 Only) `0` = Not customer specific. `1` = Price Level is specifically for firm customer quotes. **Bits 5-7 – Reserved**
Bid Price	13	2	Binary Short Price	Bid Price
Bid Quantity	15	2	Binary	Total number of contracts on the inside bid (customer and non-customer). A zero value indicates there is no bid. If Customer bit is set, this will be zero.
Bid Customer Quantity	17	2	Binary	Number of customer contracts on the inside bid. A zero value denotes that there are no customer contracts at the inside price. If Customer bit is set, this will be the number of customer contracts on the inside bid considering only customer firm quotes. Will always be zero for C2.
Ask Price	19	2	Binary Short Price	Ask Price
Ask Quantity	21	2	Binary	Total number of contracts on the inside ask (customer and non-customer). A zero value indicates there is no ask. If Customer bit is set, this will be zero.
Ask Customer Quantity	23	2	Binary	Number of customer contracts on the inside ask. A zero value denotes that there are no customer contracts at the inside price. If Customer bit is set, this will be the number of customer contracts on the inside ask considering only customer firm quotes. Will always be zero for C2.
Total Length = 25 bytes				

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3.4.2.2 Two Side Update Expanded (Long)

Two Side Update Expanded (Long)				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xD7	`Two Side Update Expanded (Long)` Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Symbol	6	6	Printable ASCII	*Symbol* right padded with spaces.
Bit Fields	12	1	Bit Field	**Bits 0-2 – Reserved** **Bit 3 – AON** `0` = Price level is a firm quote `1` = Price Level is AON (All or None) **Bit 4 – Customer** (C1 Only) `0` = Not customer specific. `1` = Price Level is specifically for firm customer quotes. **Bits 5-7 – Reserved**
Bid Price	13	8	Binary Long Price	Bid Price
Bid Quantity	21	4	Binary	Total number of contracts on the inside bid (customer and non-customer). A zero value indicates there is no bid. If Customer bit is set, this will be zero.
Bid Customer Quantity	25	4	Binary	Number of customer contracts on the inside bid. A zero value denotes that there are no customer contracts at the inside price. If Customer bit is set, this will be the number of customer contracts on the inside bid considering only customer firm quotes. Will always be zero for C2.
Ask Price	29	8	Binary Long Price	Ask Price
Ask Quantity	37	4	Binary	Total number of contracts on the inside ask (customer and non-customer). A zero value indicates there is no ask. If Customer bit is set, this will be zero.
Ask Customer Quantity	41	4	Binary	Number of customer contracts on the inside ask. A zero value denotes that there are no customer contracts at the inside price. If Customer bit is set, this will be the number of customer contracts on the

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				inside ask considering only customer firm quotes. Will always be zero for C2.
Total Length = 45 bytes				

3.4.3 Top Trade Message

The `Top Trade` message provides information about executions of orders on the book. `Top Trade` messages are necessary to calculate execution-based data. `Top Trade` messages do not alter the book. One or more `Single Side Update Expanded` or `Two Side Update Expanded` messages will follow a `Top Trade` message to reflect the updated book (for example, an aggressive order may take out one or more price levels and establish a new level on the opposite side).

Any order may be executed in parts. A complete view of all executions can be built from all `Top Trade` messages.

The `Top Trade` message sends the trade price, trade quantity, execution id, and trade condition of a trade as well as the cumulative volume for the trading session. A `Top Trade` message will be sent for each execution, but not every `Top Trade` message indicates a trade. A `Top Trade` message can also be sent when an auction executes against a non-displayed order, such as a contra response. The *Trade Condition* value of 'X' (Trade Break) is sent whenever an execution is broken. Trade breaks will contain the *Symbol*, *Quantity*, *Price,* and *Execution Id* of the original trade. The *Total Volume* field will be reduced by the number of shares reported in the *Quantity* field.

Top Trade				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xB8	`Top Trade` Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Symbol	6	6	Printable ASCII	*Symbol* right padded with spaces.
Quantity	12	4	Binary	Incremental number of contracts executed or corrected (see *Trade Condition*).
Price	16	8	Binary Long Price	The execution price of the order.
Execution Id	24	8	Binary	Cboe generated day-unique execution identifier of this trade. *Execution Id* is also referenced in the `Trade Break` message.
Total Volume	32	4	Binary	Total number of contracts traded on the current trading session (may decrease if the *Trade Condition* field indicates a canceled trade).

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Trade Condition	36	1	Alphanumeric	**See Options Trade Condition Codes section for details.**
Total Length = 37 bytes				

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3.5 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. The `Auction Update` messages are sent every five seconds during an opening period. Refer to the Cboe Opening Process specification for more information.

The `Options Auction Update` message has the following format:

Options Auction Update				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xD1	`Options Auction Update` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Symbol	6	8	Printable ASCII	*Symbol* right padded with spaces.
Auction Type	14	1	Alphanumeric	G = GTH Opening (C1 Only) O = RTH Opening H = Halt Re-Opening V = Volatility Opening
Reference Price	15	8	Binary Long Price	Collared VMIM price computed on the queuing book only.
Buy Contracts	23	4	Binary	Cumulative Buy contracts at the *Reference Price* and above.
Sell Contracts	27	4	Binary	Cumulative Sell contracts at the *Reference Price* and below.
Indicative Price	31	8	Binary Long Price	Collared VMIM price computed on the combined queueing book and the continuous book. Equal to *Reference Price* for options that do not have a GTH trading session.
Auction Only Price	39	8	Binary Long Price	Uncollared VMIM price computed on the queuing book only.
Opening Condition	47	1	Alphanumeric	O = Would open Q = Need quote to open B = Need more buyers (C1 Only) S = Need more sellers (C1 Only) C = Crossed Composite Market
Composite Market Bid Price	48	8	Binary Long Price	Bid Price of the prevailing Composite Market
Composite Market Offer Price	56	8	Binary Long Price	Offer Price of the prevailing Composite Market.
Total Length = 64 bytes				

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3.6 Auction Summary

`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 Cboe opening price.

The `Auction Summary` message has the following format:

Auction Summary				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	0x96	`Auction Summary` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Symbol ID	6	8	Printable ASCII	*Symbol* right padded with spaces.
Auction Type	14	1	Alphanumeric	`G` = GTH Opening (C1 Only) `O` = RTH Opening `H` = Halt Re-Opening `V` = Volatility Opening
Price	15	8	Binary Long Price	Auction price.
Quantity	23	4	Binary	Cumulative number of contracts executed during the auction.
Total Length = 27 bytes				

3.7 Trading Status

The `Trading Status` message is used to indicate the current trading status of an options contract. A `Trading Status` message will be sent whenever a security's trading status changes. The following summarizes the Trading Status values in the Cboe system:

- H = Halt state.
- Q = Queuing. Sent starting at 7:30AM ET once orders can be accepted for queuing in preparation for the market open.
- T = Trading. Sent when symbol is open for trading, sometime after 9:30AM ET.

A `Trading Status` message will also be sent:

- For a Regulatory Halt "Q"ueuing Period in any symbol where the underlying has experienced a Regulatory Halt as well as the "T"rading resumption for the same instrument.

The *Trading Status* field will be used to represent the status of the RTH Session (9:30am ET – 4:15pm ET) and the *GTH Trading Status* field will be used to represent the status of the GTH Session.

Trading Status				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x31	`Trading Status` message

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Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Symbol	6	6	Printable ASCII	*Symbol* right padded with spaces.
Reserved	12	2	Reserved	Reserved
Trading Status	14	1	Alpha	H = Halted Q = Quote-Only R = Opening Rotation T = Trading
Reserved	15	1	Reserved	Reserved
GTH Trading Status (C1 Only)	16	1	Alpha	H = Halted Q = Quote-Only T = Trading
Reserved2	17	1	Alpha	Reserved
Total Length = 18 bytes				

3.8 Width Update (C1, C2, and EDGX Only)

The `Width Update` message is used to communicate opening quote width multiplier. This message will be sent 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.

Width Update				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0xD2	`Width Update` Message
Time Offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Underlying	6	8	Printable ASCII	Underlying right padded with spaces.
Width Type	14	1	Alphanumeric	R = Regular V = Volatility
Multiplier	15	4	Multiplier	Width multiplier
Total Length = 19 bytes				

3.9 End of Session

The `End of Session` message is sent for each unit when the unit shuts down. No more sequenced messages will be delivered for this unit, but heartbeats from the unit may be received.

End of Session				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x2D	`End of Session` Message
Timestamp	2	4	Binary	Nanosecond offset from last unit timestamp.
Total Length = 6 bytes				

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3.10 SOQ Strike Range Update (C1 Only)

The `SOQ Strike Range Update` message is only available on the C1 Exchange. This message disseminates the minimum and maximum strike prices of the 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:

SOQ Strike Range Update				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x9D	`SOQ Strike Range Update` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
SOQ Identifier	6	20	Printable ASCII	Dissemination symbol of the final SOQ right padded with spaces.
Lower Strike Price	26	8	Binary Long Price	SOQ lower strike price
Upper Strike Price	34	8	Binary Long Price	SOQ upper strike price
Total Length = 42 bytes				

3.11 Constituent Symbol Mapping (C1 Only)

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:

Constituent Symbol Mapping				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0x9E	`Constituent Symbol Mapping` Message
Feed Symbol	2	6	Printable ASCII	*Symbol* right padded with spaces
OSI Symbol	8	21	Printable ASCII	OSI Symbol
Symbol Condition	29	1	Alphanumeric	`N` = Normal `C` = Closing Only
Underlying	30	8	Alphanumeric	Symbol of underlying right padded with spaces
SOQ Identifier	38	20	Printable ASCII	Dissemination symbol of the final SOQ right padded with spaces.
Total Length = 58 bytes				

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4 Gap Request Proxy Messages

The following messages are used for initializing a TCP/IP connection to the Gap Request Proxy ("GRP") and to request message retransmissions. Participants only need to implement the following messages if gap requests will be made. Each of the following message types must be wrapped by an unsequenced unit header as described in Section 2.4. The following messages will not be delivered using multicast.

4.1 Login

The `Login` message is the first message sent to the GRP by a user's process after the connection to the GRP is established. Failure to login before sending any other message type will result in the connection being dropped by the GRP.

Login				
Field	**Offset**	**Length**	**Value/Type**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x01	`Login` Message
SessionSubId	2	4	Alphanumeric	*SessionSubId* supplied by Cboe.
Username	6	4	Alphanumeric	*Username* supplied by Cboe.
Filler	10	2	Alphanumeric	(space filled)
Password	12	10	Alphanumeric	*Password* supplied by Cboe.
Total Length = 22 bytes				

4.2 Login Response

The `Login Response` message is sent by the GRP to a user's process in response to a `Login` message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the `Login Response` message is sent.

Login Response				
Field	**Offset**	**Length**	**Value/Type**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x02	`Login Response` Message
Status	2	1	Alphanumeric	Accepted or reason for reject.
Total Length = 3 bytes				

Login Response – Status Codes	
'A'	Login Accepted
'N'	Not authorized (Invalid Username/Password)
'B'	Session in use
'S'	Invalid Session

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4.3 Gap Request

The `Gap Request` message is used by a user's process to request retransmission of a sequenced message (or messages) by one of Cboe's gap servers.

Gap Request				
Field	**Offset**	**Length**	**Value/Type**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x03	`Gap Request` Message
Unit	2	1	Binary	*Unit* that the gap is requested for.
Sequence	3	4	Binary	*Sequence* of first message (lowest sequence in range).
Count	7	2	Binary	*Count* of messages requested.
Total Length = 9 bytes				

4.4 Gap Response

The `Gap Response` message is sent by the GRP in response to a `Gap Request` message. The *Unit* and *Sequence* fields will match the values supplied in the `Gap Request` message. A `Gap Response` message, with a Status of Accepted or reason for failure, will be sent for each `Gap Request` message received by the GRP.

Gap Response				
Field	**Offset**	**Length**	**Value/Type**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x04	`Gap Response` Message
Unit	2	1	Binary	*Unit* the gap was requested for.
Sequence	3	4	Binary	*Sequence* of first message in request.
Count	7	2	Binary	*Count* of messages requested.
Status	9	1	Alphanumeric	Accepted or reason for reject*.
Total Length = 10 bytes				

Gap Response – Status Codes	
'A'	Accepted
'O'	Out of range (ahead of sequence or too far behind)
'D'	Daily gap request allocation exhausted
'M'	Minute gap request allocation exhausted
'S'	Second gap request allocation exhausted
'C'	Count request limit for one gap request exceeded
'I'	Invalid Unit specified in request
'U'	Unit is currently unavailable

* - All non-'A' status codes should be interpreted as a reject.

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5 Spin Messages

Each of the following message types must be wrapped by an unsequenced unit header as described in Section 2.4.

5.1 Login

The `Login` message is the first message sent to the Spin Server by a user's process after the connection to the Spin Server is established. Failure to login before sending any other message type will result in the connection being dropped by the Spin Server.

The format of the `Login` message for the Spin Server is identical to that of the GRP described previously in Section 4.1.

5.2 Login Response

The `Login Response` message is sent by the Spin Server to a user's process in response to a `Login` message. The status field is used to reflect an accepted login or the reason the session was not accepted. If login fails, the connection will be dropped after the `Login Response` message is sent.

The format of the `Login Response` message for the Spin Server is identical to that of the GRP described previously in Section 4.2.

5.3 Spin Image Available

The `Spin Image Available` message is sent once per second and indicates through what sequence number a spin is available.

Spin Image Available				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x80	`Spin Image Available` Message
Sequence	2	4	Binary	Spin is available which is current through this sequence number.
Total Length = 6 bytes				

5.4 Spin Request

The `Spin Request` message is used by a user's process to request transmission of a spin of the unit's order book. Refer to Section 1.6 for more complete details regarding *Sequence* specification as well as buffering requirements.

Spin Request				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x81	`Spin Request` Message

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Sequence	2	4	Binary	Sequence number from a `Spin Image Available` message received by the participant.
Total Length = 6 bytes				

5.5 Spin Response

The `Spin Response` message is sent in response to a user's `Spin Request` message indicating whether a spin will be sent.

Spin Response				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x82	`Spin Response` Message
Sequence	2	4	Binary	Sequence number from a `Spin Image Available` message received by the participant.
Order Count	6	4	Binary	Always zero.
Status	10	1	Alphanumeric	Accepted or reason for reject*.
Total Length = 11 bytes				
Spin Response – Status Codes				
'A'	Accepted			
'O'	Out of Range (*Sequence* requested is greater than *Sequence* available by the next spin)			
'S'	Spin already in progress (only one spin can be running at a time).			

* - All non-'A' status codes should be interpreted as a reject.

5.6 Spin Finished

The `Spin Finished` message is sent to indicate that all messages for the spin requested have been sent. A `Spin Finished` message is only sent if a `Spin Request` was not rejected. Upon receipt of a `Spin Finished` message, any buffered multicast messages should be applied to the participant's copy of the book to make it current.

Spin Finished				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x83	`Spin Finished` Message
Sequence	2	4	Binary	Sequence number from the `Spin Request` message.
Total Length = 6 bytes				

5.7 Instrument Definition Request

The `Instrument Definition Request` message is used by a user's process to request transmission of this unit's Symbol Mappings. Refer to Section 1.6 for more complete details regarding *Sequence* specification as well as buffering requirements.

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Instrument Definition Request				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x84	`Instrument Definition Request` Message
Sequence	2	4	Binary	Must be 0. Only the current Symbol Mappings are available.
Total Length = 6 bytes				

5.8 Instrument Definition Response

The `Instrument Definition Response` message is sent in response to a user's `Instrument Definition Request` message indicating whether a spin will be sent.

Instrument Definition Response				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x85	`Instrument Definition Response` Message
Sequence	2	4	Binary	Will always be 0.
Instrument Count	6	4	Binary	Number of `Symbol Mapping` messages which will be contained in this spin.
Status	10	1	Alphanumeric	Accepted or reason for reject
Total Length = 11 bytes				

Instrument Definition Response – Status Codes	
'A'	Accepted
'O'	Out of Range (*Sequence* must be 0)
'S'	Spin already in progress (only one spin can be running at a time)

* - All non-'A' status codes should be interpreted as a reject.

5.9 Instrument Definition Finished

The `Instrument Definition Finished` message is sent to indicate that all `Symbol Mapping` messages for this unit have been sent. An `Instrument Definition Finished` message is only sent if an `Instrument Definition Request` was not rejected.

Instrument Definition Finished				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x86	`Instrument Definition Finished` Message
Total Length = 2 bytes				

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5.10 Spin Server Usage Example

The following diagram (see next page) shows the exchange of messages over time between a participant and Cboe's Multicast Top feed and Spin Server.

At time 1, the participant has no state of the book and desires to become current. The participant caches the received Multicast Top messages (sequences 310172 and 310173) for later use. Since the participant has no book, they cannot yet be applied.

At time 5, the participant has successfully logged into the Spin Server and has cached another message, sequence 310174.

At time 7, the participant receives a `Spin Image Available` message which indicates that the spin server is capable of giving them a spin of all symbols as of sequence 310169. The participant does not have all messages cached after 310169 (they are missing 310170 and 310171), so this spin is not useful to the participant.

At time 10, the participant receives a `Spin Image Available` message which is useful since it would be a spin of all orders up to and including sequence 310175 and the participant has all messages after 310175 cached.

At time 11, the participant sends a `Spin Request` for all messages up to and including 310175 and continues to cache Multicast Top messages received.

At time 14, the Spin Server acknowledges the `Spin Request` and indicates that three symbols will be sent.

At time 24, the spin server indicates that it has finished sending all open orders. The participant must then apply the cached messages from sequence number 310176 through current.

Notes:

- Spin Servers are available for each unit. Participants may need to employ multiple Spin Servers depending upon their architecture.

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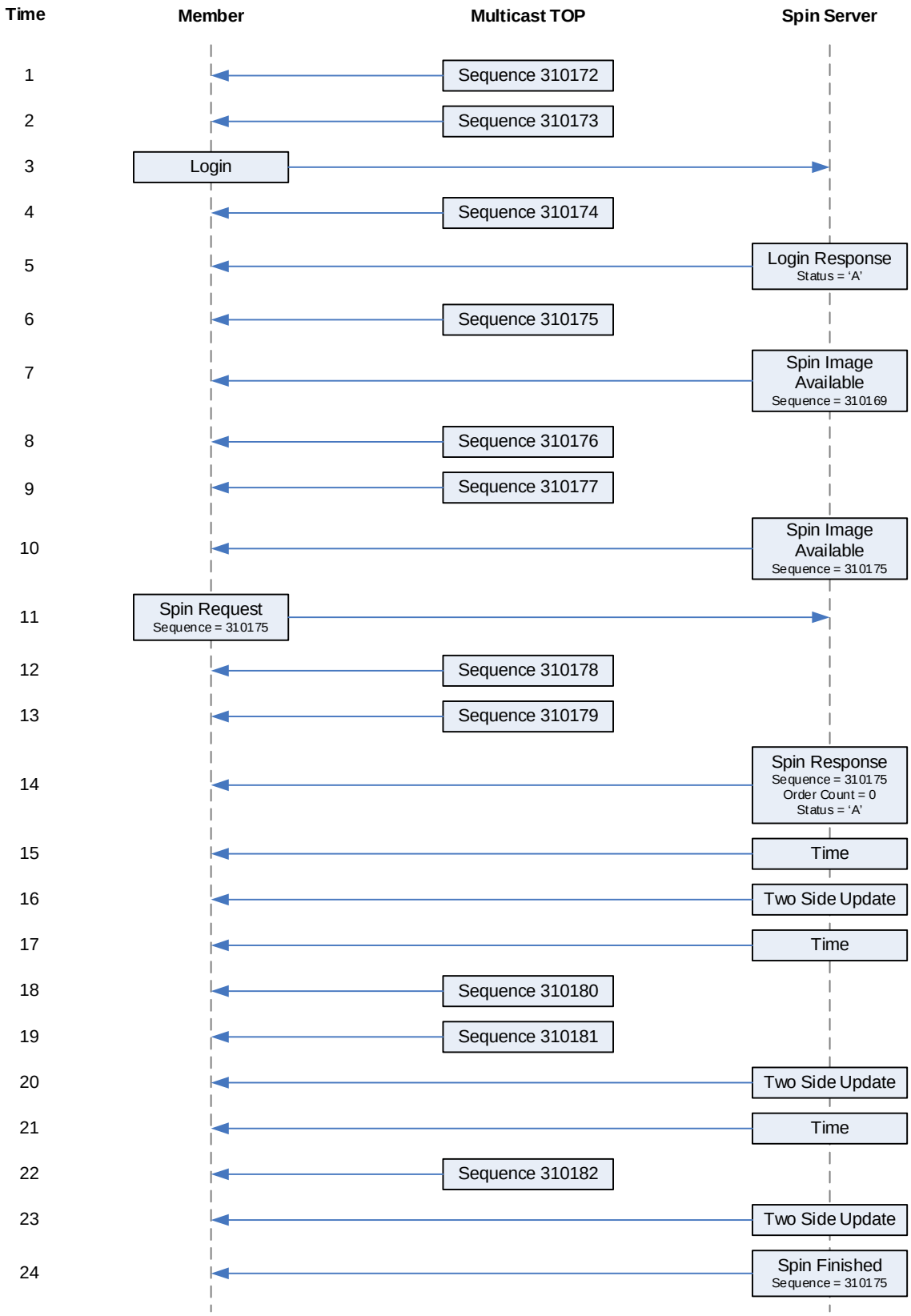

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6 Message Types

6.1 Gap Request Proxy Messages

0x01	Login
0x02	Login Response
0x03	Gap Request
0x04	Gap Response

6.2 Spin Server Messages

0x01	Login
0x02	Login Response
0x80	Spin Image Available
0x81	Spin Request
0x82	Spin Response
0x83	Spin Finished
0x84	Instrument Definition Request
0x85	Instrument Definition Response
0x86	Instrument Definition Finished

6.3 Top Messages

0x20	Time
0x97	Unit Clear
0x2E	Symbol Mapping
0xD4	Single Side Update Expanded (Short)
0xD5	Single Side Update Expanded (Long)
0xD6	Two Side Update Expanded (Short)
0xD7	Two Side Update Expanded (Long)
0xB8	Top Trade
0xD1	Options Auction Update
0x96	Auction Summary
0x31	Trading Status
0xD2	Width Update
0x2D	End of Session
0x9D	SOQ Strike Range Update
0x9E	Constituent Symbol Mapping

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7 Example Messages

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

7.1 Login Message

Length	16	22 bytes
Type	01	Login
SessionSubId	30 30 30 31	“0001”
Username	46 49 52 4D	“FIRM”
Filler	20 20	“ ”
Password	41 42 43 44 30 30 20 20 20 20	“ABCD00”

7.2 Login Response Message

Length	03	3 bytes
Type	02	Login Response
Status	41	Login accepted

7.3 Gap Request Message

Length	09	9 bytes
Type	03	Gap Request
Unit	01	Unit 1
Sequence	3B 10 00 00	First message: 4155
Count	32 00	50 messages

7.4 Gap Response Message

Length	08	8 bytes
Type	04	Gap Response
Unit	01	Unit 1
Sequence	3B 10 00 00	First message: 4155
Status	41	Accepted

7.5 Spin Image Available Message

Length	06	6 bytes
Type	80	Spin Image Available
Sequence	3B 10 00 00	Sequence: 4155

7.6 Spin Request Message

Length	06	6 bytes
Type	81	Spin Request
Sequence	3B 10 00 00	Sequence: 4155

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7.7 Spin Response Message

Length	0B	11 bytes
Type	82	Spin Request
Sequence	3B 10 00 00	Sequence: 4155
Order Count	00 00 00 00	Always zero
Status	41	Accepted

7.8 Spin Finished Message

Length	06	6 bytes
Type	83	Spin Finished
Sequence	3B 10 00 00	Sequence: 4155

7.9 Instrument Definition Request

Length	06	6 bytes
Type	84	Instrument Definition Request
Sequence	00 00 00 00	Sequence: 0

7.10 Instrument Definition Response

Length	0B	11 bytes
Type	85	Instrument Definition Response
Sequence	00 00 00 00	Sequence: 0
Instrument Count	B8 0B 00 00	3,000 Instruments
Status	41	Accepted

7.11 Instrument Definition Finished

Length	02	2 bytes
Type	86	Instrument Definition Finished

7.12 Time Message

Length	06	6 bytes
Type	20	Time
Time	98 85 00 00	34,200 seconds = 09:30 AM Eastern

7.13 Unit Clear

Length	06	6 bytes
Type	97	Unit Clear
Time Offset	18 D2 06 00	447,000 ns since last Time Message

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7.14 Single Side Update Expanded (Short)

Length	14	20 bytes
Type	D4	Single Side Update Expanded (Short)
Time Offset	30 FA D3 29	701,758,000 ns since last Time Message
Symbol	30 31 32 33 34 35	012345
Side	42	B (Buy)
Bitfields	00	Firm Quote
Price	7B 00	$1.23
Quantity	64 00	100 Contracts
Customer Quantity	64 00	100 Contracts

7.15 Single Side Update Expanded (Long)

Length	1E	30 bytes
Type	D5	Single Side Update Expanded (Long)
Time Offset	30 FA D3 29	701,758,000 ns since last Time Message
Symbol	30 31 32 33 34 35	012345
Side	42	B (Buy)
Bitfields	00	Firm Quote
Price	E0 F4 8F 04 00 00 00 00	$7654.3200
Quantity	64 00	100 Contracts
Customer Quantity	64 00	100 Contracts

7.16 Two Side Update Expanded (Short)

Length	19	25 bytes
Type	D6	Two Side Update Expanded (Short)
Time Offset	30 FA D3 29	701,758,000 ns since last Time Message
Symbol	30 31 32 33 34 35	012345
Bitfields	08	AON (All or None)
Bid Price	41 01	$3.21
Bid Quantity	64 00	100
Bid Customer Quantity	32 00	50
Ask Price	43 01	$3.23
Ask Quantity	C8 00	200
Ask Customer Quantity	64 00	100

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7.17 Two Side Update Expanded (Long)

Length	2D		45 bytes
Type	D7		Two Side Update Expanded (Long)
Time Offset	30 FA D3 29		701,758,000 ns since last Time Message
Symbol	30 31 32 33 34 35		012345
Bitfields	10		Customer
Bid Price	64 7D 00 00 00 00 00 00		$3.2100
Bid Quantity	00 00 00 00	0	
Bid Customer Quantity	FA 00	250	
Ask Price	2C 7E 00 00 00 00 00 00		$3.2300
Ask Quantity	00 00 00 00	0	
Ask Customer Quantity	C8 00	200	

7.18 Top Trade

Length	25	37 bytes
Type	B8	Trade
Time Offset	10 84 D4 23	601,130,000 ns since last Time Message
Symbol	36 35 34 33 32 31	654321
Quantity	BC 02 00 00	700 contracts
Price	08 E2 01 00 00 00 00 00	$12.34
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Total Volume	40 42 0F 00 00 00 00 00	1,000,000 contracts
Trade Condition	20	Normal Trade (space)

7.19 Top Trade (Condition = Trade Break)

Length	25	37 bytes
Type	B8	Trade
Time Offset	10 84 D4 23	601,130,000 ns since last Time Message
Symbol	36 35 34 33 32 31	654321
Quantity	BC 02 00 00	700 contracts
Price	08 E2 01 00 00 00 00 00	$12.34
Execution Id	34 2B 46 E0 BB 00 00 00	0AAP09VEC
Total Volume	84 3F 0F 00 00 00 00 00	999,300 contracts
Trade Condition	58	X – Trade Break

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7.20 Options Auction Update Message

Length	40	64 bytes
Type	D1	Options Auction Update
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	30 30 6D 45 56 4F	00mEVO
Auction Type	56	Volatilty Auction
Reference Price	E8 A3 0F 00 00 00 00 00	$102.50
Buy Contracts	64 00 00 00	100 Contracts
Sell Contracts	C8 00 00 00	200 Contracts
Indicative Price	E8 A3 0F 00 00 00 00 00	$102.50
Auction Only Price	E8 A3 0F 00 00 00 00 00	$102.50
Opening Condition	4F	O = Would Open
Composite Market Bid Price	50 69 0F 00 00 00 00 00	$101.00
Composite Market Offer Price	70 B7 0F 00 00 00 00 00	$103.00

7.21 Auction Summary Message

Length	1B	27 bytes
Type	96	Auction Summary
Time offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	30 30 6D 45 56 5F 20 20	00mEVO
Auction Type	4F	O = Opening
Price	E8 A3 0F 00 00 00 00 00	$102.50
Quantity	4B 00 00 00	75

7.22 Symbol Mapping Message

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 31 39 30 39 32 30 43 30 30 31 35 30 30 30 30	MSFT 190920C00150000
Symbol Condition	4E	‘N’ – Closing Only
Underlying	4D 53 46 54 20 20 20 20	MSFT

7.23 Trading Status Message

Length	12	18 bytes
Type	31	Trading Status
Time Offset	18 D2 06 00	447,000 ns since last Time Message
Symbol	39 39 38 38 37 37	998877

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Reserved	20 20	Reserved
Trading Status	54	T = Trading
Reserved	20	Reserved
Global Trading Hours Status	48	H = Halted
Reserved	20	Reserved

7.24 Width Update Message (C1, C2, and EDGX Only)

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

7.25 SOQ Strike Range Update (C1 Only)

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 20 20	VXS
Lower Strike Price	40 66 03 01 00 00 00 00	$1,700
Upper Strike Price	00 48 E8 01 00 00 00 00	$3,200

7.26 Constituent Symbol Mapping (C1 Only)

Length	3A	58 bytes
Type	9E	Constituent Symbol Mapping Message
Feed Symbol	30 30 6D 45 56 4F	00mEVO
OSI Symbol	53 50 58 57 20 20 31 39 30 39 32 37 43 30 32 33 39 30 30 30 30	SPXW 190927C02390000
Symbol Condition	4E	‘N’ – Normal
Underlying SOQ Identifier	53 50 58 20 20 20 20 20	SPX
	56 58 53 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20	VXS

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8 Multicast Configuration

8.1 Production Environment Configuration

8.1.1 Limitations/Configurations

The following table defines the configuration for network and gap request limitations. These limitations are session based. Cboe reserves the right to adjust the gap request limitations to improve the effectiveness of the gap request infrastructure.

Period/Type	Limit/Setting	Notes
MTU	1500	Cboe will send UDP messages up to 1500 bytes. Participants should ensure that their infrastructure is configured accordingly.
Gig-Shaped Throttle	1 Gb/s	The real-time and gap multicast head ends are configured to shape their output to this level to minimize packet loss.
Gap Response Delay	2 ms	The Gap Server will delay resending sequenced messages via multicast for the specified limit in order to satisfy multiple GRP gap requests with one multicast response.
Count	100	Any single gap request may not be for more than this number of dropped messages.
1 Second	320 Requests	This is the maximum number of retransmission requests allowed per second for each session. This is renewed every clock second.
1 Minute	1,500 Requests	This is the maximum number of retransmission requests allowed per minute for each session. This is renewed every clock minute.
Day	100,000 Requests	This is the maximum number of retransmission requests allowed per day for each session.
Within Range	1,000,000 Messages	Users' retransmission requests must be within this many messages of the most recent sequence sent by the real-time feed per session.

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8.1.2 Unit/Product Distribution

Unit	BZX/C2/EDGX Symbol Range	BZX/C2/EDGX Exceptions	C1 Symbol Range	C1 Exceptions
1	A – ADOZZ		A – ACNAZ	
2	ADP – ANETZ	Excludes AMZN	ACNB – AMGNZ	
3	ANEU – BAAAZ		AMGO – BAAZ	Excludes AMZN
4	BAAB – BKNFZ		BAB – BKNFZ	
5	BKNG – BZZZZ		BKNG – CASZZ	
6	C – CLGXZ		CAT – COOZZ	
7	CLGY – CSXAZ		COP – DEAAZ	
8	CSXB – DISAZ		DEAB – EEMAZ	Excludes DJX
9	DISB – ETFBZ	Excludes DJX	EEMB – FBAAZ	
10	ETFC – FIVDZ		FBAB – GOOFZ	
11	FIVE – GLDAZ		GOOG – GOOGZ	
12	GLDB – GOOGZ		GOOH – IFFAZ	
13	GOOH – HSXZZ		IFFB – IWLZZ	
14	HSY – IWLZZ		IWM – IWMAZ	
15	IWM – JNJAZ		IWMB – LOVZZ	
16	JNJB – LMTAZ		LOW – MPCAZ	
17	LMTB – MLNXZ		MPCB – NFLWZ	Excludes MXEA, MXEF
18	MLNY – MUAAZ		NFLX – NUEAZ	
19	MUAB – NTESZ		NUEB – PEPAZ	Excludes OEX
20	NTET – OXYAZ		PEPB – ROKUZ	Excludes QQQ, RLG, RLV
21	OXYB – QGENZ		ROKV – SPZZZ	Excludes RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPX, SPXW, SPY
22	QGEO – RHAAZ		SQ – TLRYZ	
23	RHAB – SMGZZ	Excludes RUT, RUTW	TLRZ – TSLAZ	
24	SMH – SYEZZ	Excludes SPY	TSLB – UVXXZ	Excludes UKXM
25	SYF – TSKZZ		UVXY – VZZZZ	Excludes VIX, VIXW
26	TSL – UALAZ		W – XLEAZ	Excludes XEO
27	UALB – VLOAZ		XLEB – ZZZZZ	Excludes XSP
28	VLOB – WDCAZ		QQQ	
29	WDCB – XLDZZ		AMZN	
30	XLE – ZZZZZ	Excludes XSP	SPY	
31	AMZN		DJX, MXEA, MXEF, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPESG*, XEO, UKXM, XSP	
32	SPY		VIX, VIXW	
33	RUT (BZX only) DJX, RUT, RUTW (C2 only) XSP (EDGX only)		SPX	
34	N/A		SPXW	
35	N/A		SPX/SPXW, Cross Product Spreads	

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.
*Effective 9/21/20

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8.1.3 BZX Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.178
Primary Data Center B feed	74.115.128.179
Secondary Data Center E feed	174.136.181.223

8.1.4 C1 Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.183
Primary Data Center B feed	74.115.128.184
Secondary Data Center E feed	174.136.181.249

8.1.5 C2 Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.174
Primary Data Center B feed	74.115.128.175
Secondary Data Center E feed	170.137.16.133

8.1.6 EDGX Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.180
Primary Data Center B feed	74.115.128.181
Secondary Data Center E feed	174.136.181.251

For additional information about physical connectivity, refer to the US Equities/Options Connectivity Manual.

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8.1.7 BZX Options Address/Unit Distribution

The following tables describe the unit distribution across the BZX Options Multicast Top feeds.

Primary Datacenter		Gig-Shaped [OAT] 174.136.164.128/28		Gig-Shaped [OBT] 174.136.164.144/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30151	224.0.62.0	224.0.62.4	224.0.73.0	224.0.73.4
2	30152				
3	30153				
4	30154				
5	30155				
6	30156				
7	30157				
8	30158				
9	30159	224.0.62.1	224.0.62.5	224.0.73.1	224.0.73.5
10	30160				
11	30161				
12	30162				
13	30163				
14	30164				
15	30165				
16	30166				
17	30167	224.0.62.2	224.0.62.6	224.0.73.2	224.0.73.6
18	30168				
19	30169				
20	30170				
21	30171				
22	30172				
23	30173				
24	30174				
25	30175	224.0.62.3	224.0.62.7	224.0.73.3	224.0.73.7
26	30176				
27	30177				
28	30178				
29	30179				
30	30180				
31	30181				
32	30182				
33	30183				

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.

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Secondary Datacenter		Gig-Shaped [OET] 174.136.181.192/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	31851	233.19.3.160	233.19.3.164
2	31852		
3	31853		
4	31854		
5	31855		
6	31856		
7	31857		
8	31858		
9	31859	233.19.3.161	233.19.3.165
10	31860		
11	31861		
12	31862		
13	31863		
14	31864		
15	31865		
16	31866		
17	31867	233.19.3.162	233.19.3.166
18	31868		
19	31869		
20	31870		
21	31871		
22	31872		
23	31873		
24	31874		
25	31875	233.19.3.163	233.19.3.167
26	31876		
27	31877		
28	31878		
29	31879		
30	31880		
31	31881		
32	31882		
33	31883		

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.

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8.1.8 C1 Options Address/Unit Distribution

The following tables describe the unit distribution across the C1 Options Multicast Top feeds.

Primary Datacenter		Gig-Shaped [CAT] 170.137.114.64 /28		Gig-Shaped [CBT] 170.137.115.64 /28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30201	224.0.74.64	224.0.74.72	233.182.199.192	233.182.199.200
2	30202				
3	30203				
4	30204				
5	30205				
6	30206				
7	30207				
8	30208				
9	30209	224.0.74.65	224.0.74.73	233.182.199.193	233.182.199.201
10	30210				
11	30211				
12	30212				
13	30213				
14	30214				
15	30215				
16	30216				
17	30217	224.0.74.66	224.0.74.74	233.182.199.194	233.182.199.202
18	30218				
19	30219				
20	30220				
21	30221				
22	30222				
23	30223				
24	30224				
25	30225	224.0.74.67	224.0.74.75	233.182.199.195	233.182.199.203
26	30226				
27	30227				
28	30228				
29	30229				
30	30230				
31	30231				
32	30232				
33	30233	224.0.74.68	224.0.74.76	233.182.199.196	233.182.199.204
34	30234				
35	30235				

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.

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Secondary Datacenter		Gig-Shaped [CET] 170.137.124.208/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	31201	233.19.3.224	233.19.3.232
2	31202		
3	31203		
4	31204		
5	31205		
6	31206		
7	31207		
8	31208		
9	31209	233.19.3.225	233.19.3.233
10	31210		
11	31211		
12	31212		
13	31213		
14	31214		
15	31215		
16	31216		
17	31217	233.19.3.226	233.19.3.234
18	31218		
19	31219		
20	31220		
21	31221		
22	31222		
23	31223		
24	31224		
25	31225	233.19.3.227	233.19.3.235
26	31226		
27	31227		
28	31228		
29	31229		
30	31230		
31	31231		
32	31232		
33	31233	233.19.3.228	233.19.3.236
34	31234		
35	31235		

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.

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8.1.9 C2 Options Address/Unit Distribution

The following tables describe the unit distribution across the C2 Options Multicast Top feeds.

Primary Datacenter		Gig-Shaped [WAT] 174.136.168.224/28		Gig-Shaped [WBT] 174.136.168.240/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30251	224.0.131.240	224.0.131.244	233.130.124.240	233.130.124.244
2	30252				
3	30253				
4	30254				
5	30255				
6	30256				
7	30257				
8	30258				
9	30259	224.0.131.241	224.0.131.245	233.130.124.241	233.130.124.245
10	30260				
11	30261				
12	30262				
13	30263				
14	30264				
15	30265				
16	30266				
17	30267	224.0.131.242	224.0.131.246	233.130.124.242	233.130.124.246
18	30268				
19	30269				
20	30270				
21	30271				
22	30272				
23	30273				
24	30274				
25	30275	224.0.131.243	224.0.131.247	233.130.124.243	233.130.124.247
26	30276				
27	30277				
28	30278				
29	30279				
30	30280				
31	30281				
32	30282				
33	30283				

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.

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Secondary Datacenter		Gig-Shaped [WET] 170.137.17.88/29	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	31251	233.182.199.96	233.182.199.100
2	31252		
3	31253		
4	31254		
5	31255		
6	31256		
7	31257		
8	31258		
9	31259	233.182.199.97	233.182.199.101
10	31260		
11	31261		
12	31262		
13	31263		
14	31264		
15	31265		
16	31266		
17	31267	233.182.199.98	233.182.199.102
18	31268		
19	31269		
20	31270		
21	31271		
22	31272		
23	31273		
24	31274		
25	31275	233.182.199.99	233.182.199.103
26	31276		
27	31277		
28	31278		
29	31279		
30	31280		
31	31281		
32	31282		
33	31283		

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.

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8.1.10 EDGX Options Address/Unit Distribution

The following tables describe the unit distribution across the EDGX Options Multicast Top feeds.

Primary Datacenter		Gig-Shaped [EAT] 174.136.164.160/28		Gig-Shaped [EBT] 174.136.164.176/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**	**Real-time MC**	**Gap Resp. MC**
1	30751	224.0.62.8	224.0.62.12	224.0.73.8	224.0.73.12
2	30752				
3	30753				
4	30754				
5	30755				
6	30756				
7	30757				
8	30758				
9	30759	224.0.62.9	224.0.62.13	224.0.73.9	224.0.73.13
10	30760				
11	30761				
12	30762				
13	30763				
14	30764				
15	30765				
16	30766				
17	30767	224.0.62.10	224.0.62.14	224.0.73.10	224.0.73.14
18	30768				
19	30769				
20	30770				
21	30771				
22	30772				
23	30773				
24	30774				
25	30775	224.0.62.11	224.0.62.15	224.0.73.11	224.0.73.15
26	30776				
27	30777				
28	30778				
29	30779				
30	30780				
31	30781				
32	30782				
33	30783				

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.

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Secondary Datacenter		Gig-Shaped [EET] 174.136.176.112/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	31701	233.19.3.168	233.19.3.172
2	31702		
3	31703		
4	31704		
5	31705		
6	31706		
7	31707		
8	31708		
9	31709	233.19.3.169	233.19.3.173
10	31710		
11	31711		
12	31712		
13	31713		
14	31714		
15	31715		
16	31716		
17	31717	233.19.3.170	233.19.3.174
18	31718		
19	31719		
20	31720		
21	31721		
22	31722		
23	31723		
24	31724		
25	31725	233.19.3.171	233.19.3.175
26	31726		
27	31727		
28	31728		
29	31729		
30	31730		
31	31731		
32	31732		
33	31733		

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.

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8.2 Certification Environment Configuration

8.2.1 Unit/Symbol Distribution

Unit	BZX/C2/EDGX Symbol Range	BZX/C2/EDGX Exceptions	C1 Symbol Range	C1 Exceptions
1	A – ADOZZ		A – ACNAZ	
2	ADP – ANETZ	Excludes AMZN	ACNB – AMGNZ	
3	ANEU – BAAAZ		AMGO – BAAZ	Excludes AMZN
4	BAAB – BKNFZ		BAB – BKNFZ	
5	BKNG – BZZZZ		BKNG – CASZZ	
6	C – CLGXZ		CAT – COOZZ	
7	CLGY – CSXAZ		COP – DEAAZ	
8	CSXB – DISAZ		DEAB – EEMAZ	Excludes DJX
9	DISB – ETFBZ	Excludes DJX	EEMB – FBAAZ	
10	ETFC – FIVDZ		FBAB – GOOFZ	
11	FIVE – GLDAZ		GOOG – GOOGZ	
12	GLDB – GOOGZ		GOOH – IFFAZ	
13	GOOH – HSXZZ		IFFB – IWLZZ	
14	HSY – IWLZZ		IWM – IWMAZ	
15	IWM – JNJAZ		IWMB – LOVZZ	
16	JNJB – LMTAZ		LOW – MPCAZ	
17	LMTB – MLNXZ		MPCB – NFLWZ	Excludes MXEA, MXEF
18	MLNY – MUAAZ		NFLX – NUEAZ	
19	MUAB – NTESZ		NUEB – PEPAZ	Excludes OEX
20	NTET – OXYAZ		PEPB – ROKUZ	Excludes QQQ, RLG, RLV
21	OXYB – QGENZ		ROKV – SPZZZ	Excludes RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPX, SPXW, SPY
22	QGEO – RHAAZ		SQ – TLRYZ	
23	RHAB – SMGZZ	Excludes RUT, RUTW	TLRZ – TSLAZ	
24	SMH – SYEZZ	Excludes SPY	TSLB – UVXXZ	Excludes UKXM
25	SYF – TSKZZ		UVXY – VZZZZ	Excludes VIX, VIXW
26	TSL – UALAZ		W – XLEAZ	Excludes XEO
27	UALB – VLOAZ		XLEB – ZZZZZ	Excludes XSP
28	VLOB – WDCAZ		QQQ	
29	WDCB – XLDZZ		AMZN	
30	XLE – ZZZZZ	Excludes XSP	SPY	
31	AMZN		DJX, MXEA, MXEF, OEX, RLG, RLV, RUI, RUT, RUTW, SIXB, SIXC, SIXE, SIXI, SIXR, SIXRE, SIXT, SIXU, SIXV, SIXY, SPESG*, XEO, UKXM, XSP	
32	SPY		VIX, VIXW	
33	RUT (BZX only) DJX, RUT, RUTW (C2 only) XSP (EDGX only)		SPX	
34	N/A		SPXW	
35	N/A		SPX/SPXW, Cross Product Spreads	

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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.
*Effective 9/21/20

8.2.2 Certification Multicast Routing Parameters

Primary Certification Data Center	Rendezvous Point
BZX, C2, EDGX	74.115.128.129
C1	74.115.128.131

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8.2.3 BZX Options Address/Unit Distribution

The following tables describe the unit distribution across the certification BZX Options Multicast Top feeds.

Primary Datacenter		Gig-Shaped [Cert] 174.136.174.112/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32151	224.0.74.148	224.0.74.150
2	32152		
3	32153		
4	32154		
5	32155		
6	32156		
7	32157		
8	32158		
9	32159		
10	32160		
11	32161		
12	32162		
13	32163		
14	32164		
15	32165		
16	32166		
17	32167	224.0.74.149	224.0.74.151
18	32168		
19	32169		
20	32170		
21	32171		
22	32172		
23	32173		
24	32174		
25	32175		
26	32176		
27	32177		
28	32178		
29	32179		
30	32180		
31	32181		
32	32182		
33	32183		

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.

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8.2.4 C1 Options Address/Unit Distribution

The following tables describe the unit distribution across the certification C1 Options Multicast Top feeds.

Primary Datacenter		Gig-Shaped [Cert] 170.137.126.16/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32201	233.103.126.4	233.103.126.6
2	32202		
3	32203		
4	32204		
5	32205		
6	32206		
7	32207		
8	32208		
9	32209		
10	32210		
11	32211		
12	32212		
13	32213		
14	32214		
15	32215		
16	32216		
17	32217	233.103.126.5	233.103.126.7
18	32218		
19	32219		
20	32220		
21	32221		
22	32222		
23	32223		
24	32224		
25	32225		
26	32226		
27	32227		
28	32228		
29	32229		
30	32230		
31	32231		
32	32232		
33	32233		
34	32234		
35	32235		

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.

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8.2.5 C2 Options Address/Unit Distribution

The following tables describe the unit distribution across the certification C2 Options Multicast Top feeds.

Primary Datacenter		Gig-Shaped [Cert] 174.136.160.80/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32301	224.0.74.172	224.0.74.174
2	32302		
3	32303		
4	32304		
5	32305		
6	32306		
7	32307		
8	32308		
9	32309		
10	32310		
11	32311		
12	32312		
13	32313		
14	32314		
15	32315		
16	32316		
17	32317	224.0.74.173	224.0.74.175
18	32318		
19	32319		
20	32320		
21	32321		
22	32322		
23	32323		
24	32324		
25	32325		
26	32326		
27	32327		
28	32328		
29	32329		
30	32330		
31	32331		
32	32332		
33	32333		

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.

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8.2.6 EDGX Options Address/Unit Distribution

The following tables describe the unit distribution across the certification EDGX Options Multicast Top feeds.

Primary Datacenter		Gig-Shaped [Cert] 174.136.174.176/28	
Unit	**IP Port**	**Real-time MC**	**Gap Resp. MC**
1	32451	224.0.74.152	224.0.74.154
2	32452		
3	32453		
4	32454		
5	32455		
6	32456		
7	32457		
8	32458		
9	32459		
10	32460		
11	32461		
12	32462		
13	32463		
14	32464		
15	32465		
16	32466		
17	32467	224.0.74.153	224.0.74.155
18	32468		
19	32469		
20	32470		
21	32471		
22	32472		
23	32473		
24	32474		
25	32475		
26	32476		
27	32477		
28	32478		
29	32479		
30	32480		
31	32481		
32	32482		
33	32483		

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.

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9 Options Trade Condition Codes

The following table defines valid values for the *Trade Condition* field.

Type	Field Value
a	Single Leg Auction Non ISO Cboe auction types include AIM, SAM
b	Single Leg Auction ISO Cboe auction types include AIM ISO, SAM ISO
c	Single Leg Cross Non ISO Cboe auction types include Cust to Cust AIM, QCC
d	Single Leg Cross ISO Cboe order type is Cust to Cust AIM ISO
e	Single Leg Floor Trade
f	Complex to Complex Electronic Trade Cboe auction type is COA.
g	Complex Auction Trade Cboe order types include C-AIM, C-SAM
h	Complex Cross Cboe auction types include Cust to Cust C-AIM, C-QCC
i	Complex Floor Trade This value will be deprecated and all complex floor executions will be reported as condition 'm'.
j	Complex Electronic Trade Against Single Leg(s)
k	Complex with Stock Options Auction Trade Cboe auction types include C-AIM w/ Stock, C-SAM w/ Stock
m	Complex Floor Trade Against Single Leg(s) All complex floor executions will be reported as condition 'm'.
n	Complex with Stock Electronic Trade Includes COA auctions done electronically
o	Complex with Stock Cross Cboe auction types include C-QCC w/ Stock
p	Complex with Stock Floor Trade
t	Complex Floor Trade of Proprietary Products Marked as "Combo Order"
I	Electronic Trade
K*	Cabinet Order
O*	Opening Trade
S	ISO
X*	Trade Break

*The *Trade Condition* values of "X = Trade Break" , "O=Opening Trade", and "K=Cabinet Trade" will continue to be disseminated on the options PITCH and TOP feeds but will not be sent to OPRA.

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10 Connectivity

10.1 Supported Extranet Carriers

Cboe has certified a number of carriers defined in the Cboe US Equity/Options Connectivity Manual with respect to redistribution of Multicast data feeds. For more information on receiving Options Multicast Top through any of these providers, reach out to the vendor contact noted in the Extranet Providers section of the Connectivity Manual.

10.2 Bandwidth Recommendation

The Gig-shaped feeds require 1 Gb/s of bandwidth. Cboe will use 90% of these respective bandwidths for Multicast Top to allow participants to use the same physical connection for order entry if desired.

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11 References

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

12 Support

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

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Revision History

Document Version	Date	Description
1.0.0	11/29/2017	Initial version.
1.0.1	12/11/2017	Corrections to Two Side Update (Long) example message. Corrected message type for `Top Trade` example message.
1.1.0	01/29/2018	Added BZX and EDGX Options Top feeds. Effective in certification on 02/02/18 and production 03/09/18.
1.1.1	02/05/2018	Added C2 Options Production IP and Port information. Improved distribution of Symbol Mapping Messages Effective 3/2/2018.
1.1.2	02/27/2018	Added IP Addresses for the BZX and EDGX Options exchanges for NY5 and CH4.
1.1.3	02/28/2018	Corrected BZX Options Ips and Ports.
1.1.4	03/08/2018	Updated Unit Distribution ranges.
1.1.5	03/14/2018	Corrected the name of the EDGX Options Feed to EAT, EBT and EET.
1.1.6	03/23/2018	Unit Distribution ranges Effective Date updated to 4/14/18.
1.1.7	06/21/2018	Corrected `Trading Status` example message. *Order Count* on `Spin Response` is always zero.
1.1.8	08/15/18	Updated BZX Options Unit Distribution ranges to support RUT on new unit 33.
1.1.9	08/21/18	Removal of Customer Indicator for C2 Options effective 08/31/18.
1.2.0	11/16/18	Added support for C1 Options.
1.2.1	12/06/18	Added notes identifying Feature Pack 4 updates.
1.2.2	12/21/18	Removed Late Trade and Floor Trade values from `Top Trade` message, *Trade Condition* field, as these were added in error. Added note of clarification indicating a `Top Trade` message can also be sent when an auction executes against a non-displayed order, such as a contra response.
1.2.3	02/05/19	Removed Bit 4 – Cabinet Order information from relevant `Single Side Update` and `Two Side Update` messages, as C1 will not have an electronic book for Cabinet orders.
1.2.4	02/14/19	Added certification IP addresses and unit distribution information.
1.2.5	03/05/19	Added matching engine unit 33 information in support of XSP trading on EDGX Options effective 04/08/19. Added C1 certification primary data center rendezvous point IP address and C1 Certification symbol ranges.
1.2.6	04/15/19	Added Production IP addresses for C1 Options.

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		Added DJX to C2 ME 33 in Unit/Product Distribution tables (effective 05/08/19).
1.2.7	05/01/19	Added notes indicating `Auction Summary`, `Options Auction Update`, and `Width Update` messages will be disseminated for C2 and EDGX options, effective with C1 Feature Pack 7.
1.2.8	05/08/19	Removed *Trading Status* field value 'S' = Exchange Specific Suspension from `Trading Status` message, as this was added in error. Corrected C1 Production Gig-Shaped [CAT] and [CBT] source network IP addresses. Corrected description of `Width Update` message to indicate that message is only sent in the event that baseline MCW and OCW values are modified from their original state. Added Customer book type to single and two side updates to allow for supplying the top of Customer book.
1.2.9	05/14/19	Updated `Options Auction Update` message with *Opening Condition* = C (Crossed Composite Market), and added *Composite Market Bid Price* and *Composite Market Offer Price* fields. Added new `SOQ Strike Range Update` message. Updated example for `Options Auction Update` and added example for `SOQ Strike Range` messages. Added additional proprietary products to matching unit 31 in C1.
1.2.10	05/20/19	Added `Constituent Symbol Mapping` message with example.
1.2.11	06/12/19	Corrected certification and production C1 symbol range for units 9 and 20.
1.2.12	08/02/19	Added notes indicating `Options Auction Update` message *Opening Condition* field values 'B' and 'S' are C1 Only.
1.2.13	09/24/19	Updated OSI Symbol example values in `Symbol Mapping` and `Constituent Symbol Mapping` message type examples.
1.2.14	10/31/19	Corrected UKXM symbol exclusion entry in Unit Distribution table. Clarified description of `Time` message. Added Options Trade Condition Codes section (effective 1/13/20).
1.2.15	11/12/19	Added note indicating GTH will be applicable for C1 only as GTH is being sunset for C2 and EDGX (effective 11/22/19).
1.2.16	12/19/19	Updated Options Trade Condition Codes by adding 'O' =Opening Trade and correcting field value description for 'p'by removing "Includes Complex Auctions on the Floor" (effective 01/13/20).
1.2.17	01/06/20	Updated Options Trade Condition Code t = Complex Floor Trade of Proprietary Products Marked as "Combo Order"
1.2.18	01/08/20	Removed "l = Complex Auction Against Single Legs(s)" from Options Trade Condition Codes table .

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1.2.19	01/15/20	Added note indicating *Options Auction Update* and *Auction Summary* will be supported on BZX in support of new opening process (effective 01/30/20).
1.2.20	01/21/20	Added note to Options Trade Condition Code table indicating the value "i = Complex Floor Trade" will be deprecated effective 1/27/20. Upon the effective date all complex floor executions will be reported as condition 'm'.
1.2.21	08/27/20	Corrected Unit Symbol Distribution tables to indicate QQQ is an exception for C1 Unit 20 as it has a dedicated location on Unit 28. Added SPESG to the Unit Symbol Distrbiution tables for C1 unti 31 (**effective 9/21/20**).

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