US Options
Complex Auction
Multicast PITCH Specification

Version 2.1.2

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Contents

1   Introduction

1.1   Overview

Note that this specification will be the standard specification to be used for complex auctions on the Cboe Options ("C1"), EDGX Options and C2 Options Exchange platforms.

Cboe customer may use Complex Auction Multicast PITCH to receive real-time auction update and execution information during complex options auctions.

Complex Auction Multicast PITCH cannot be used to enter orders. For order entry, refer to the appropriate US Options FIX or BOE Specifications.

A Gig-Shaped version of the Complex Auction Multicast PITCH feed is available from both of Cboe's datacenters. Customers may choose to take one or more of the following Multicast PITCH feed options depending on their location and connectivity to Cboe.

Multicast PITCH Feed Descriptions:

Exchange	Shaping (Gig)	Served From Data Center (Primary/Secondary)	Multicast Feed ID
C1 Options	Gig	Primary	CAB
C1 Options	Gig	Primary	CBB
C1 Options	Gig	Secondary	CEB
C2 Options	Gig	Primary	WAB
C2 Options	Gig	Primary	WBB
C2 Options	Gig	Secondary	WEB
EDGX Options	Gig	Primary	EAB
EDGX Options	Gig	Primary	EBB
EDGX Options	Gig	Secondary	EEB

1.2   Feed Connectivity Requirements

Gig Shaped feeds are available to customers with a minimum of 1 Gb/s of connectivity to Cboe via cross connect or dedicated circuit.

Customers with sufficient connectivity may choose to take more than one Gig-Shaped feed from the Cboe datacenters. It should be noted that feeds from the secondary datacenter will have additional latency for those co-located with Cboe in the primary datacenter due to proximity.

Cboe Complex Auction Multicast PITCH real-time events are delivered using a published range of multicast addresses divided by symbol range units. It should be noted dropped messages cannot be recovered on this feed as this feed contains only unsequenced messages.

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

Feed Server _Real-Time MC_		Feed Server _Real-Time MC_
Unit 1, Feed A	Cboe Customer Receiving Host	Unit 1, Feed B
Feed Server _Real-Time MC_		Feed Server _Real-Time MC_
Unit 2, Feed A		Unit 2, Feed B
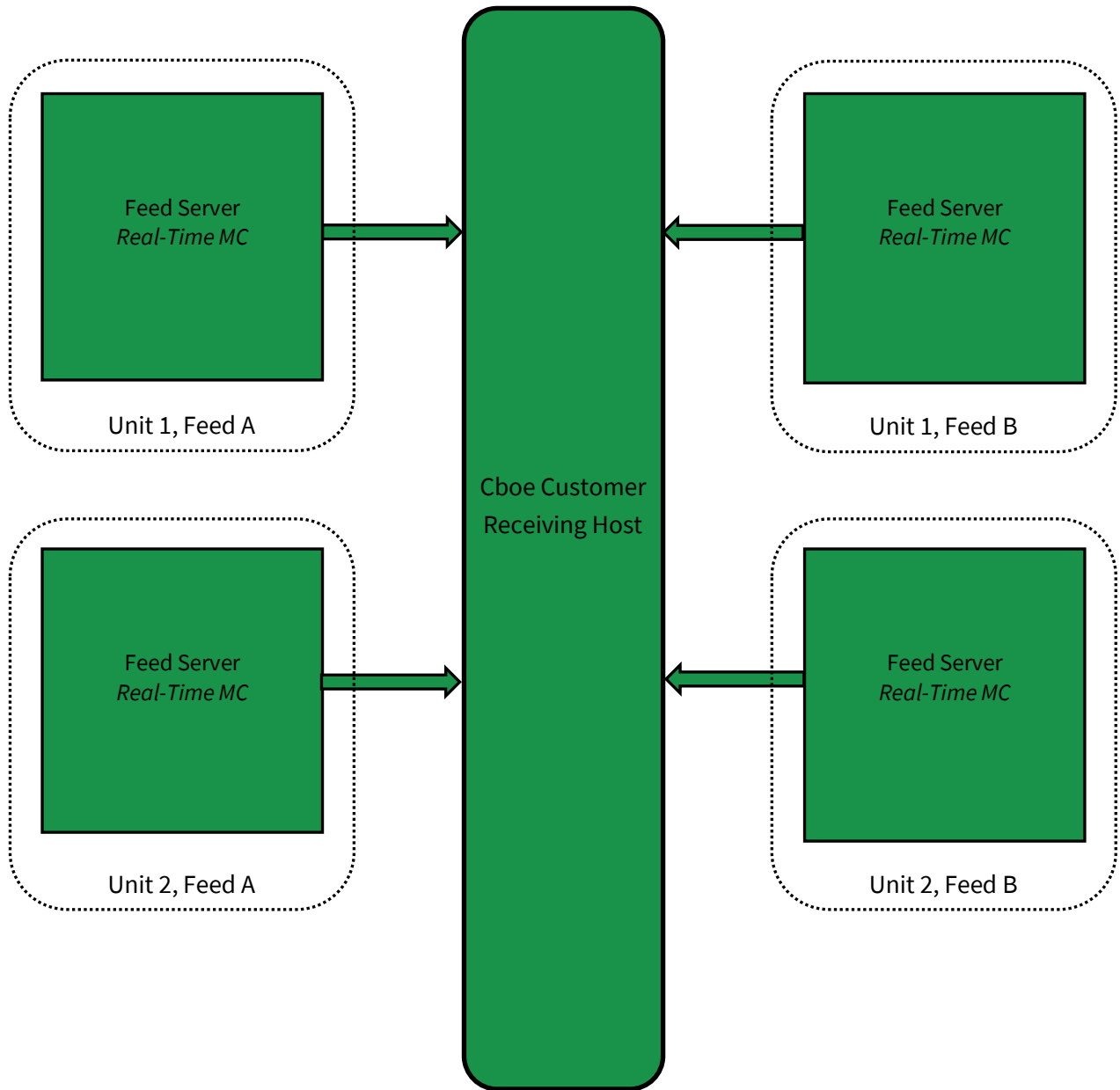
1.3   Symbol Ranges, Units, and Sequence Numbers

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

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.

It should be noted that this feed only contains unsequenced messages.

1.4   Complex Options Specific Symbol Processing

Cboe has implemented a Complex Instrument Creation ("CIC") process due to the seemingly infinite number of combinations that can make up a complex instrument. This allows the Complex Auction Multicast PITCH specification to be consistent with the equities, standard options, and complex options Multicast PITCH specifications. This CIC process significantly reduces the size of the Complex Auction Multicast PITCH feed and allows customers to use the same feed handler for Cboe equity, options, and futures exchanges.

Real-time CIC messages are available on each unit's multicast feed. `Complex Instrument Definition` messages are used to map the 6 character feed Complex Instrument ID ("CID") to complex instrument definition. A complex instrument definition consists of two or more option legs. The complex instrument is valid only for the current trading date on which it was created. `Complex Instrument Definition` messages are unsequenced messages and can be sent from pre-market through the end of trading. Once a complex instrument is created, it cannot be deleted or modified for the remainder of the trading day.

1.5   Gap Request Proxy and Message Retransmission

Recovery of missed data is not available on the Complex Auction Multicast PITCH feed. There are two main reasons. First this feed contains only unsequenced messages. Second the complex option auctions are short lived by nature making recovery of dropped messages impractical.

Prior to the start of any new auction, the corresponding `Complex Instrument Definition` message will be sent to ensure the customer has correct complex instrument information.

1.6   Spin Servers

A spin is not available on the Complex Auction Multicast PITCH feed as this feed is unsequenced.

2 Protocol

Cboe users may use the PITCH 2.X protocol over multicast to receive auction update and execution information direct from Cboe.

PITCH 2.X cannot be used to enter orders. For order entry, refer to the appropriate US Options FIX or BOE Specifications.

2.1 Message Format

The messages that make up the PITCH 2.X protocol are delivered using Cboe `Sequenced Unit Header` which handles sequencing and delivery integrity. All messages delivered via multicast as well 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.

This PITCH data feed is comprised of a series of dynamic length unsequenced 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 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` 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).

➢ **Signed Binary** fields are signed and sized to "Length" bytes and ordered using Little Endian convention (least significant byte first).

➢ **Binary Signed Short Price** fields are signed Little Endian encoded 2 byte binary fields with 2 implied decimal places (denominator = 100). The short price range is -327.68 to +327.67. Prices outside of this range will use the long price.

➢ **Binary Signed Long Price** fields are signed Little Endian encoded 8 byte binary fields with 4 implied decimal places (denominator = 10,000).

➢ **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).

➢ **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 unit and site. The content of the multicast across feeds (e.g. A/B Gig-Shaped) 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 Cboe Multicast PITCH 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 potentially for the unit field.

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.
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	Always zero.
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 all multicast addresses if no data has been delivered within 1 second. Heartbeat messages never increment the sequence number for a unit.

Outside of trading hours Cboe sends heartbeat messages on all real-time channels with a sequence of "0" 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   PITCH 2.X 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.

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   Complex Instrument Definition (C2 and EDGX Only) Deprecated with Feature Pack 4

A `Complex Instrument Definition` message represents a complex instrument that is available to place orders. This message is unsequenced (sequence = 0) and is sent just prior to every `Auction Notification` message. `Complex Instrument Definition` messages will also be sent in a continuous loop through the day at variable rates as bandwidth allows.

The `Complex Instrument Definition` message will contain two or more repeating groups of leg definitions. There is a limit of 12 leg definitions.

The *Leg Offset* field is provided to support adding additional fields to this message between the offset field and the Leg definitions. A *Leg Offset* of 1 means the leg definitions begin immediately following the *Leg Offset* field.

Complex Instrument Definition				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field
Message Type	1	1	0x99	`Complex Instrument Definition` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Complex Instrument Id	6	6	Printable ASCII	Complex Instrument Id right padded with spaces
Leg Count	12	1	Binary	The number of legs in this complex instrument
Leg Offset	13	1	Binary	Leg definitions begin this many bytes past this field
The following fields repeat *Leg Count* times (maximum of 12) for multi-leg strategies.				

Leg Ratio	13 + Leg Offset + (10 * Leg Index)	4	Signed Binary	Leg ratio (positive for buy-side, negative for sell-side)
Leg Symbol	13 + Leg Offset + (10 * Leg Index)	6	Printable ASCII	Option Symbol of leg right padded with spaces
Total Length = 13 + *Leg Offset* **+ (***Leg Count*** * 10) bytes**				

3.3 Complex Instrument Definition Expanded (C1 Only) Effective in C2 and EDGX with Feature Pack 4

A `Complex Instrument Definition Expanded` message represents a complex instrument that is available to place orders. This message is unsequenced (sequence = 0) and is sent just prior to every `Auction Notification` message. `Complex Instrument Definition Expanded` messages will also be sent in a continuous loop through the day at variable rates as bandwidth allows.

The `Complex Instrument Definition Expanded` message will contain two or more repeating groups of leg definitions. There is a limit of 12 leg definitions plus one equity leg.

Complex Instrument Definition Expanded				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	*Length* of this message including this field.
Message Type	1	1	0x9A	`Complex Instrument Definition Expanded` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Complex Instrument Id	6	6	Printable ASCII	Complex Instrument Id right padded with spaces.
Complex Instrument Underlying	12	8	Printable ASCII	Complex Instrument Underlying right padded with spaces.

Complex Instrument Type	20	4	Alphanumeric	4 character field; each field describes a characteristic.
				
				Character 1: Complex Option Type
				    O = All legs are options
				    E = One leg is an equity leg
				Characters 2-4: Reserved

Leg Count	24	1	Binary	The number of legs in the complex instrument. The maximum number of legs is currently 12 options legs and 1 (optional) equity leg.
The following fields repeat *Leg Count* times for multi-leg strategies. *Leg Index i*s zero-based.				
Leg Symbol	25 + Leg Index * 13	8	Printable ASCII	Option or Equity Symbol of leg, right padded with spaces.

Leg Ratio	33 + Leg Index * 13	4	Signed Binary	Leg ratio (positive for buy-side, negative for sell-side). For options this is the number of contracts, for equities this is the number of shares.
Leg Security Type	37 + Leg Index * 13	1	Alphanumeric	O = Leg is an Option instrument E = Leg is an Equity instrument
Total Length = *25* + (*Leg Count * 13*) bytes				

3.4   Symbol Mapping (C1 Only) Effective in C2 and EDGX with Feature Pack 4

A `Symbol Mapping` message is used to map the 6 character simple instrument multicast feed symbol field to an OSI symbol and Underlying. These messages are not sequenced (sequence = 0) and are sent continuously through the day at variable rates as bandwidth allows.

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. All spaces if not available or not applicable.
Total Length = 38 bytes				

3.5   Auction Notification

`Auction Notification` messages are used to disseminate order details of a complex auction. Auctions will be available for a defined period of time known as the exposure period.

Auction Notification				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAD	`Auction Notification` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp.
Complex Instrument Id	6	6	Printable ASCII	Complex Instrument Id right padded with spaces.
Auction ID	12	8	Binary	Day specific identifier assigned to this auction.

Auction Type	20	1	Alphanumeric	**All values will be available on C2, and EDGX with the implementation of Feature Pack 4.** C = Complex Options (COA) S = Complex Solicitation Auction Mechanism (C1 Only) B = Complex AIM (C1 Only) O = COA All or None (C1 Only)
Side	21	1	Alphanumeric	B = Buy S = Sell
Price	22	8	Binary Signed Long Price	Auction price The price field will be populated for all Auctions on EDGX Options, and for SAM Auctions on C1. This field will be set to zero for AIM on C1 and COA on C1 and C2 Options.
Quantity	30	4	Binary	Instrument quantity.
Customer Indicator	34	1	Alphanumeric	N = Non-Customer C = Customer
ParticipantID	35	4	Alphanumeric	Executing Broker (optional) of firm attributed to this quote.
Auction End Offset	39	4	Binary	Nanosecond offset from last timestamp.
Client ID *C1 Only* **Effective in C2 and EDGX with Feature Pack 4**	43	4	Alphanumeric	Optional user specified value attributed to this quote.
Total Length = 43 bytes or 47 bytes for C1				

3.6 Auction Cancel

`Auction Cancel` messages are used to disseminate the cancelation of an earlier `Auction Notification` message as a result of a user cancelation of the original complex auction, a user modification request to change the complex auction price or increase the original complex auction quantity, a fading of the NBBO or to cancel any remaining complex auction quantity from the original `Auction Notification` following the complex auction termination.

A user request to modify the complex auction price or to increase the original complex auction quantity will result in a cancelation of the complex auction followed by a new `Auction Notification` message. `Auction Cancel` messages will not be issued for complex auction quantity decrements.

Auction Cancel				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field

Message Type	1	1	0xAE	`Auction Cancel` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Auction ID	6	8	Binary	Day specific identifier assigned to this auction
Total Length = 14 bytes				

3.7 Auction Trade

`Auction Trade` messages are used to disseminate executions resulting from a complex auction.

Auction Trade				
Field Name	**Offset**	**Length**	**Type/(Value)**	**Description**
Length	0	1	Binary	Length of this message including this field
Message Type	1	1	0xAF	`Auction Trade` Message
Time offset	2	4	Binary	Nanosecond offset from last unit timestamp
Auction ID	6	8	Binary	Day specific identifier assigned to this auction
Execution ID	14	8	Binary	Day specific identifier assigned to this execution
Price	22	8	Binary Signed Long Price	Trade price
Quantity	30	4	Binary	Instrument quantity traded
Total Length = 34 bytes				

3.8 Options Auction Update (C1 Only) Effective in C2 and EDGX with Feature Pack 4

`Options Auction Update` messages are used to disseminate price and size information during the Opening and Re-Opening (halt) process for complex instruments. The `Options Auction Update` messages are sent every five seconds during an opening period. Refer to the Cboe Options Complex Book Process specification for more information.

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.
Complex Instrument ID	6	8	Printable ASCII	*Complex Instrument* right padded with spaces.
Auction Type	14	1	Alphanumeric	G = GTH Opening O = RTH Opening H = Halt Re-Opening

Reference Price	15	8	Binary Signed Long Price	SNBBO Collared Auction-Only Price.
Buy Contracts	23	4	Binary	Cumulative Buy interest at the Reference Price.
Sell Contracts	27	4	Binary	Cumulative Sell interest at the Reference Price.
Indicative Price	31	8	Binary Signed Long Price	SNBBO Collared Volume Maximizing Imbalance Minimizing Price computed on combined Auction-Only and Continuous Book.
Auction Only Price	39	8	Binary Signed Long Price	Volume Maximizing Price computed on the Auction-Only Book.
Opening Condition	47	1	Alphanumeric	O = Would open
Total Length = 48 bytes				

3.9   Auction Summary (C1 Only) Effective in C2 and EDGX with Feature Pack 4

`Auction Summary` messages are used to disseminate the results of the Opening and Re-Opening process of a complex instrument. An Opening or Re-Opening `Auction Summary` message for each complex instrument is sent at the conclusion of the Opening or Re-Opening process and represents the Cboe opening price.   Refer to the Cboe Options Complex Book Process specification for more information.

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.
Complex Instrument Id	6	8	Printable ASCII	*Complex Instrument Id* right padded with spaces.
Auction Type	14	1	Alphanumeric	G = GTH Opening O = RTH Opening H = Halt Re-Opening
Price	15	8	Binary Signed Long Price	Auction price
Quantity	23	4	Binary	Cumulative instrument quantity executed during the auction
Total Length = 27 bytes				

3.10 End of Session

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

Field Name	Offset	Length	Type/(Value)	Description
End of Session				
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				

4   Message Types

4.1   PITCH 2.X Messages

0x20	Time
0x99	Complex Instrument Definition
0x9A	Complex Instrument Definition Expanded
0x2E	Symbol Mapping
0xAD	Auction Notification
0xAE	Auction Cancel
0xAF	Auction Trade
0xD1	Auction Update
0x96	Auction Summary
0x2D	End of Session

5   Example Messages

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

5.1   Time Message

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

5.2   Complex Instrument Definition Message Deprecated with Feature Pack 4

```
Length              22                              34 bytes
Type                99                              Complex Instrument
                                                    Definition
Time offset         18 D2 06 00                     447,000 ns since last
                                                    Time Message
CID                 43 30 30 30 31 32               C00012
Leg Count           02                              2 legs
Leg Offset          01                              One byte
Leg Ratio           01 00 00 00                     1 = Buy 1
Leg Symbol          30 30 30 30 30 31               000001
Leg Ratio           FF FF FF FF                     -1 = Sell 1
Leg Symbol          30 30 30 30 30 32               000002
```

5.3   Complex Instrument Definition Expanded (C1 Only) Effective in C2 and EDGX with Feature Pack 4

```
Length              33                              51 bytes
Type                9A                              Complex Instrument
                                                    Definition Expanded
Time offset         18 D2 06 00                     447,000 ns since last
                                                    Time Message
CID                 43 30 30 30 31 32               C00012
Complex             5A 56 5A 5A 54 20 20 20         ZVZZT
Instrument
Underlying
Complex             4F 00 00 00                     O = All Legs are
Instrument                                          Options
Type
Leg Symbol          30 30 30 30 30 31 20 20         000001
Leg Ratio           FF FF FF FF                     -1 = Sell 1
Leg Security        4F                              Option Leg
Type
Leg Symbol          30 30 30 30 30 32 20 20         000002
Leg Ratio           01 00 00 00                     1 = Buy 1
```

```
Leg Security          4F                              Option Leg
Type
```

5.4   Symbol Mapping Message (C1 Only) Effective in C2 and EDGX with Feature Pack 4

```
Length                1E                              30 bytes
Type                  2E                              Symbol Mapping
                                                      Message
Feed Symbol           30 30 6D 45 56 4F               00mEVO
OSI Symbol            4D 53 46 54 20 20 31 30         MSFT  100116C00047500
                      30 31 31 36 43 30 30 30
                      34 37 35 30 30
Symbol                43                              'C' – Closing Only
Condition
Underlying            4D 53 46 54 20 20 20 20         MSFT
```

5.5   Auction Notification Message Deprecated with Feature Pack 4

```
Length                2B                              43 bytes
Type                  AD                              Auction Notification
Time offset           18 D2 06 00                     447,000 ns since last
                                                      Time Message
CID                   43 30 30 30 31 32               C00012
Auction ID            05 40 5B 77 8F 56 1D 0B         631WC4000005
Auction Type          43                              C = COA
Side                  42                              B = Buy Side
Price                 E8 A3 0F 00 00 00 00 00         $102.50
Quantity              64 00 00 00                     100
Customer
Indicator             43                              C = Customer
ParticipantID         45 46 49 44                     EFID
Auct. End Offset      38 73 0E 00                     947,000 ns since last
                                                      Time Message
```

5.6   Auction Notification Message (C1 Only) Effective in C2 and EDGX with Feature Pack 4

```
Length                2F                              47 bytes
Type                  AD                              Auction Notification
Time offset           18 D2 06 00                     447,000 ns since last
                                                      Time Message
CID                   43 30 30 30 31 32               C00012
Auction ID            05 40 5B 77 8F 56 1D 0B         631WC4000005
Auction Type          4F                              O = COA AON
Side                  42                              B = Buy Side
Price                 00 00 00 00 00 00 00 00         Price not displayed
Quantity              64 00 00 00                     100
Customer
Indicator             43                              C = Customer
ParticipantID         45 46 49 44                     EFID
Auct. End Offset      38 73 0E 00                     947,000 ns since last
```

```
                                            Time Message
Client ID          43 4C 49 44              CLID
```

5.7   Auction Cancel Message

```
Length             E                        14 bytes
Type               AE                       Auction Cancel
Time offset        18 D2 06 00              447,000 ns since last
                                            Time Message
Auction ID         05 40 5B 77 8F 56 1D 0B  631WC4000005
```

5.8   Auction Trade Message

```
Length             22                       34 bytes
Type               AF                       Auction Trade
Time offset        18 D2 06 00              447,000 ns since last
                                            Time Message
Auction ID         05 40 5B 77 8F 56 1D 0B  631WC4000005
Execution Id       34 2B 46 E0 BB 00 00 00  0AAP09VEC
Price              E8 A3 0F 00 00 00 00 00  $102.50
Quantity           64 00 00 00              100
```

5.9   Options Auction Update (C1 Only) Effective in C2 and EDGX with Feature Pack 4

```
Length             30                       48 bytes
Type               D1                       Options Auction Update
Time offset        18 D2 06 00              447,000 ns since last
                                            Time Message
CID                43 30 30 30 31 32 20 20  C00012
Auction Type       4F                       Opening 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       E8 A3 0F 00 00 00 00 00  $102.50
Price
Opening Condition  4F                       O = Would Open
```

5.10   Auction Summary (C1 Only) Effective in C2 and EDGX with Feature Pack 4

```
Length             1B                       27 bytes
Type               96                       Auction Summary
Time offset        18 D2 06 00              447,000 ns since last
                                            Time Message
CID                43 30 30 30 31 32 20 20  C00012
Auction Type       4F                       O = Opening
Price              E8 A3 0F 00 00 00 00 00  $102.50
Quantity           4B 00 00 00              75
```

5.11 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
```

6 Multicast Configuration

6.1 Production Environment Configuration

6.1.1 Limitations/Configurations

The following table defines Cboe current 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. Customers 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.

6.1.2   Unit/Symbol Distribution

Unit	C1 Symbol Range	C2 Symbol Range	EDGX Symbol Range
1	TBD	A – ADOZZ	A – ADOZZ
2	TBD	ADP – ANETZ* *except AMZN	ADP – ANETZ* *except AMZN
3	TBD	ANEU – BAAAZ	ANEU – BAAAZ
4	TBD	BAAB – BKNFZ	BAAB – BKNFZ
5	TBD	BKNG – BZZZZ	BKNG – BZZZZ
6	TBD	C – CLGXZ	C – CLGXZ
7	TBD	CLGY – CSXAZ	CLGY – CSXAZ
8	TBD	CSXB – DISAZ	CSXB – DISAZ
9	TBD	DISB – ETFBZ	DISB – ETFBZ
10	TBD	ETFC – FIVDZ	ETFC – FIVDZ
11	TBD	FIVE – GLDAZ	FIVE – GLDAZ
12	TBD	GLDB – GOOGZ	GLDB – GOOGZ
13	TBD	GOOH – HSXZZ	GOOH – HSXZZ
14	TBD	HSY – IWLZZ	HSY – IWLZZ
15	TBD	IWM – JNJAZ	IWM – JNJAZ
16	TBD	JNJB – LMTAZ	JNJB – LMTAZ
17	TBD	LMTB – MLNXZ	LMTB – MLNXZ
18	TBD	MLNY – MUAAZ	MLNY – MUAAZ
19	TBD	MUAB – NTESZ	MUAB – NTESZ
20	TBD	NTET – OXYAZ	NTET – OXYAZ
21	TBD	OXYB – QGENZ	OXYB – QGENZ
22	TBD	QGEO – RHAAZ	QGEO – RHAAZ
23	TBD	RHAB – SMGZZ* *except RUT, RUTW	RHAB – SMGZZ
24	TBD	SMH – SYEZZ* *except SPY	SMH – SYEZZ* *except SPY
25	TBD	SYF – TSKZZ	SYF – TSKZZ
26	TBD	TSL – UALAZ	TSL – UALAZ
27	TBD	UALB – VLOAZ	UALB – VLOAZ
28	TBD	VLOB – WDCAZ	VLOB – WDCAZ
29	TBD	WDCB – XLDZZ	WDCB – XLDZZ
30	TBD	XLE – ZZZZZ	XLE – ZZZZZ
31	TBD	AMZN	AMZN
32	TBD	SPY	SPY
33	TBD	RUT, RUTW	N/A
34	TBD	N/A	N/A
35	TBD	N/A	N/A

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.

6.1.3   C1 Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	TBD
Primary Data Center B feed	TBD
Secondary Data Center E feed	TBD

6.1.4   C2 Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.176
Primary Data Center B feed	74.115.128.177
Secondary Data Center E feed	170.137.16.134

6.1.5   EDGX Options Multicast Routing Parameters

Data Center	Rendezvous Point
Primary Data Center A feed	74.115.128.162
Primary Data Center B feed	74.115.128.163
Secondary Data Center E feed	174.136.181.240

6.1.6   C1 Options Address/Unit Distribution

The following tables describe the unit distribution across the C1 Complex Options Auction Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [CAB] TBD	Gig-Shaped [CBB] TBD
Unit	IP Port	Real-time MC	Real-time MC
1	TBD	TBD	TBD
2	TBD		
3	TBD		
4	TBD		
5	TBD		
6	TBD		
7	TBD		
8	TBD		
9	TBD		
10	TBD		
11	TBD		
12	TBD		
13	TBD		
14	TBD		
15	TBD		
16	TBD		
17	TBD	TBD	TBD
18	TBD		
19	TBD		
20	TBD		
21	TBD		
22	TBD		
23	TBD		
24	TBD		
25	TBD		
26	TBD		
27	TBD		
28	TBD		
29	TBD		
30	TBD		
31	TBD		
32	TBD		
33	TBD		
34	TBD		
35	TBD		

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. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

Secondary Datacenter		Gig-Shaped [CEB] TBD
Unit	IP Port	Real-time MC
1	TBD	TBD
2	TBD	
3	TBD	
4	TBD	
5	TBD	
6	TBD	
7	TBD	
8	TBD	
9	TBD	
10	TBD	
11	TBD	
12	TBD	
13	TBD	
14	TBD	
15	TBD	
16	TBD	
17	TBD	TBD
18	TBD	
19	TBD	
20	TBD	
21	TBD	
22	TBD	
23	TBD	
24	TBD	
25	TBD	
26	TBD	
27	TBD	
28	TBD	
29	TBD	
30	TBD	
31	TBD	
32	TBD	
33	TBD	
34	TBD	
35	TBD	

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.

6.1.7 C2 Options Address/Unit Distribution

The following tables describe the unit distribution across the C2 Complex Options Auction Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [WAB] 174.136.164.64/28	Gig-Shaped [WBB] 174.136.164.80/28
Unit	IP Port	Real-time MC	Real-time MC
1	30401	224.0.131.162	233.130.124.162
2	30402		
3	30403		
4	30404		
5	30405		
6	30406		
7	30407		
8	30408		
9	30409		
10	30410		
11	30411		
12	30412		
13	30413		
14	30414		
15	30415		
16	30416		
17	30417	224.0.131.163	233.130.124.163
18	30418		
19	30419		
20	30420		
21	30421		
22	30422		
23	30423		
24	30424		
25	30425		
26	30426		
27	30427		
28	30428		
29	30429		
30	30430		
31	30431		
32	30432		
33	30433		

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. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

Secondary Datacenter		Gig-Shaped [WEB] 170.137.17.96/29
Unit	IP Port	Real-time MC
1	31401	233.182.199.112
2	31402	
3	31403	
4	31404	
5	31405	
6	31406	
7	31407	
8	31408	
9	31409	
10	31410	
11	31411	
12	31412	
13	31413	
14	31414	
15	31415	
16	31416	
17	31417	233.182.199.113
18	31418	
19	31419	
20	31420	
21	31421	
22	31422	
23	31423	
24	31424	
25	31425	
26	31426	
27	31427	
28	31428	
29	31429	
30	31430	
31	31431	
32	31432	
33	31433	

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.

6.1.8 EDGX Options Address/Unit Distribution

The following tables describe the unit distribution across the EDGX Complex Options Auction Multicast PITCH feeds.

Primary Datacenter		Gig-Shaped [EAB] 174.136.164.32/28	Gig-Shaped [EBB] 174.136.164.48/28
Unit	IP Port	Real-time MC	Real-time MC
1	30651	224.0.131.160	233.130.124.160
2	30652		
3	30653		
4	30654		
5	30655		
6	30656		
7	30657		
8	30658		
9	30659		
10	30660		
11	30661		
12	30662		
13	30663		
14	30664		
15	30665		
16	30666		
17	30667	224.0.131.161	233.130.124.161
18	30668		
19	30669		
20	30670		
21	30671		
22	30672		
23	30673		
24	30674		
25	30675		
26	30676		
27	30677		
28	30678		
29	30679		
30	30680		
31	30681		
32	30682		

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. Addresses in the gray area are pre-assigned but not available. Customers should not configure their networks or systems for these addresses.

Secondary Datacenter		Gig-Shaped [EEB] 174.136.176.144/28
Unit	IP Port	Real-time MC
1	31651	233.19.3.144
2	31652	
3	31653	
4	31654	
5	31655	
6	31656	
7	31657	
8	31658	
9	31659	
10	31660	
11	31661	
12	31662	
13	31663	
14	31664	
15	31665	
16	31666	
17	31667	233.19.3.145
18	31668	
19	31669	
20	31670	
21	31671	
22	31672	
23	31673	
24	31674	
25	31675	
26	31676	
27	31677	
28	31678	
29	31679	
30	31680	
31	31681	
32	31682	

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   Certification Environment Configuration

6.2.1   Unit/Symbol Distribution

Unit	C1 Symbol Range	C2 Symbol Range	EDGX Symbol Range
1	TBD	A – ADOZZ	A – ADOZZ
2	TBD	ADP – ANETZ* *except AMZN	ADP – ANETZ* *except AMZN
3	TBD	ANEU – BAAAZ	ANEU – BAAAZ
4	TBD	BAAB – BKNFZ	BAAB – BKNFZ
5	TBD	BKNG – BZZZZ	BKNG – BZZZZ
6	TBD	C – CLGXZ	C – CLGXZ
7	TBD	CLGY – CSXAZ	CLGY – CSXAZ
8	TBD	CSXB – DISAZ	CSXB – DISAZ
9	TBD	DISB – ETFBZ	DISB – ETFBZ
10	TBD	ETFC – FIVDZ	ETFC – FIVDZ
11	TBD	FIVE – GLDAZ	FIVE – GLDAZ
12	TBD	GLDB – GOOGZ	GLDB – GOOGZ
13	TBD	GOOH – HSXZZ	GOOH – HSXZZ
14	TBD	HSY – IWLZZ	HSY – IWLZZ
15	TBD	IWM – JNJAZ	IWM – JNJAZ
16	TBD	JNJB – LMTAZ	JNJB – LMTAZ
17	TBD	LMTB – MLNXZ	LMTB – MLNXZ
18	TBD	MLNY – MUAAZ	MLNY – MUAAZ
19	TBD	MUAB – NTESZ	MUAB – NTESZ
20	TBD	NTET – OXYAZ	NTET – OXYAZ
21	TBD	OXYB – QGENZ	OXYB – QGENZ
22	TBD	QGEO – RHAAZ	QGEO – RHAAZ
23	TBD	RHAB – SMGZZ* *except RUT, RUTW	RHAB – SMGZZ
24	TBD	SMH – SYEZZ* *except SPY	SMH – SYEZZ* *except SPY
25	TBD	SYF – TSKZZ	SYF – TSKZZ
26	TBD	TSL – UALAZ	TSL – UALAZ
27	TBD	UALB – VLOAZ	UALB – VLOAZ
28	TBD	VLOB – WDCAZ	VLOB – WDCAZ
29	TBD	WDCB – XLDZZ	WDCB – XLDZZ
30	TBD	XLE – ZZZZZ	XLE – ZZZZZ
31	TBD	AMZN	AMZN
32	TBD	SPY	SPY
33	TBD	RUT, RUTW	N/A
34	TBD	N/A	N/A
35	TBD	N/A	N/A

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 Multicast Routing Parameters

Data Center	Rendezvous Point
Certification Data Center	74.115.128.129

6.2.3 C1 Options Address/Unit Distribution

The following table describes the unit distribution across certification C1 Complex Auction Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 170.137.126.16/28
Unit	IP Port	Real-time MC
1	32451	
2	32452	
3	32453	
4	32454	
5	32455	
6	32456	
7	32457	
8	32458	233.103.126.16
9	32459	
10	32460	
11	32461	
12	32462	
13	32463	
14	32464	
15	32465	
16	32466	
17	32467	
18	32468	
19	32469	
20	32470	
21	32471	
22	32472	
23	32473	
24	32474	
25	32475	
26	32476	233.103.126.17
27	32477	
28	32478	
29	32479	
30	32480	
31	32481	
32	32482	
33	32483	
34	32484	
35	32485	

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.

6.2.4　C2 Options Address/Unit Distribution

The following table describes the unit distribution across certification C2 Complex Auction Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 174.136.160.80/28
Unit	IP Port	Real-time MC
1	32401	
2	32402	
3	32403	
4	32404	
5	32405	
6	32406	
7	32407	
8	32408	224.0.74.158
9	32409	
10	32410	
11	32411	
12	32412	
13	32413	
14	32414	
15	32415	
16	32416	
17	32417	
18	32418	
19	32419	
20	32420	
21	32421	
22	32422	
23	32423	
24	32424	224.0.74.159
25	32425	
26	32426	
27	32427	
28	32428	
29	32429	
30	32430	
31	32431	
32	32432	
33	32433	

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.

6.2.5   EDGX Options Address/Unit Distribution

The following table describes the unit distribution across certification EDGX Complex Auction Multicast PITCH feeds out of the Primary datacenter.

Primary Datacenter		Certification 174.136.174.176/28
Unit	IP Port	Real-time MC
1	32651	224.0.74.188
2	32652	
3	32653	
4	32654	
5	32655	
6	32656	
7	32657	
8	32658	
9	32659	
10	32660	
11	32661	
12	32662	
13	32663	
14	32664	
15	32665	
16	32666	
17	32667	224.0.74.189
18	32668	
19	32669	
20	32670	
21	32671	
22	32672	
23	32673	
24	32674	
25	32675	
26	32676	
27	32677	
28	32678	
29	32679	
30	32680	
31	32681	
32	32682	

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

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

7.2   Bandwidth Recommendation

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

7.3   Multicast Test Program

The ZIP file located at http://www.batstrading.com/resources/membership/mcast_pitch.zip contains a sample program that may be used to test Multicast PITCH feed connections and to troubleshoot Multicast issues. Refer to the included README file for build and usage information.

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

Document Version	Date	Description
2.0.0	05/11/17	Initial draft in support of Complex orders for EDGX Options Exchange. Based on Bats Multicast PITCH 2.X.
2.0.1	05/15/17	Removed `Trading Status` message.
2.0.2	05/18/17	Various minor updates and clarification added.
2.0.3	07/28/17	Added Multicast Ips/Ports for Certification environment.
2.0.4	08/08/17	Added Multicast Ips/Ports for Production environment.
2.0.5	09/01/17	Added C2 Options references.
2.0.6	10/17/17	Cboe branding/logo changes.
2.0.7	10/25/17	Incorrect Multicast Feed IDs were fixed in sections 1.1, 6.1.5, and 6.1.6
2.0.8	11/24/17	Auction Price is only valid for EDGX Options and will be set to zero for C2 Options. Added C2 Options Certification IP and Port information. Added RUT, RUTW options (C2 Options Only) to distinct unit (unit 33).
2.0.9	02/05/18	Update C2 Options IP and Port information.
2.0.10	03/08/18	Updated Unit Distribution ranges.
2.0.11	03/23/18	Unit Distribution ranges Effective Date updated to 4/14/18.
2.1.0	11/16/18	Added support for C1 Options.
2.1.1	12/04/18	**Feature Pack 4 Updates.**
2.1.2	02/14/19	Added certification IP port and unit distribution information.