



# Cboe Crypto Feed Specification

Version 1.0.2

March 28, 2018

## Contents

<b>1</b>	<b>Introduction .....</b>	<b>4</b>
1.1	Feed Hours.....	4
1.2	Crypto Server (TCP).....	4
1.3	Crypto Feed Server (UDP) .....	5
1.4	Crypto Gap Request Proxy and Message Retransmission via Crypto Gap Server.....	5
<b>2</b>	<b>Protocol .....</b>	<b>7</b>
2.1	Message Format .....	7
2.2	Data Types.....	8
2.2.1	Pricing Units .....	8
2.2.2	Symbols .....	8
2.3	Message Framing.....	8
2.4	Sequenced Unit Header .....	9
2.5	Heartbeat Messages .....	9
<b>3</b>	<b>Crypto Server Session Messages (TCP) .....</b>	<b>11</b>
3.1	Crypto Login .....	11
3.2	Login Response .....	11
3.3	Replay Complete .....	12
<b>4</b>	<b>Crypto Gap Request Proxy Session Messages (TCP) .....</b>	<b>13</b>
4.1	GRP Login .....	13
4.2	Login Response .....	13
4.3	Gap Request .....	13
4.4	Gap Response .....	14
<b>5</b>	<b>Crypto Update Messages (UDP) .....</b>	<b>15</b>
5.1.1	Clear Quote.....	15
5.1.2	Symbol Summary.....	15
5.1.3	Best Quote Update.....	16
5.1.4	Market Status .....	17
5.1.5	ADAP .....	17
5.1.6	Trade.....	18
5.1.7	Auction Update.....	19
5.1.8	Auction Summary.....	20
<b>6</b>	<b>Multicast Configuration .....</b>	<b>21</b>
6.1	US Futures Production Environment Configuration.....	21
6.1.1	Limitations/Configurations.....	21
6.1.2	Crypto Multicast Routing Parameters .....	21
6.1.3	Crypto Multicast Addresses.....	22

Cboe Crypto Feed  
Specification (Version 1.0.2)

6.2	US Futures Certification Environment Configuration.....	23
6.2.1	Crypto Certification Multicast Routing Parameters.....	23
6.2.2	Crypto Certification Multicast Addresses .....	23
<b>7</b>	<b>Crypto Market Centers .....</b>	<b>24</b>
7.1	Market Center Directory.....	24
<b>8</b>	<b>Support.....</b>	<b>25</b>

## 1 Introduction

The Cboe Crypto Feed delivers consolidated quote, trade, and Aggregated Depth At Price (ADAP) information for [Crypto Market Centers](#) via UDP or TCP/IP using the binary Crypto Feed protocol. The feed consists of Clear Quote, Symbol Summary, Best Quote Update, Market Status, ADAP, Trade, Auction Update, and Auction Summary messages.

The TCP/IP delivered feed can be used as a standalone product or to augment the UDP feed for recovery and start up purposes. The TCP/IP feed is available from the Crypto Server and sends a replay of missed trades and refreshes the current state of the Crypto Feed books followed by real-time updates to the books after a connection is established.

The UDP delivered feed is sourced from the Crypto Feed Server (FS). Users may also connect to the Crypto Gap Request Proxy for retransmission of missed packets on the UDP feed by the Crypto Gap Server (GS).

While the TCP/IP and UDP delivered feeds offer equivalent real-time updates with matching sequence numbers, the consumer should assume message framing will be different between the transmission protocols.

It is important to note that the Crypto Feed is an aggregated feed. Updates for a symbol are sent as capacity for the feed allows. The image for a symbol will be current at the time of delivery, but multiple updates may be combined into a single update. The interval between updates is dependent on the market conditions and the capacity configuration of the particular feed.

The Crypto Feed is available with different combinations of ADAP levels and update rates to meet the needs of feed recipients. Current Crypto Feed Descriptions:

Name	Best Quote	ADAP Levels	Bandwidth
Crypto Summary	Yes	0	10Mb
Crypto Premium	Yes	10	25Mb

### 1.1 Feed Hours

The Cboe Crypto feed will startup on Sunday at approximately 10:00 a.m. CT and shutdown on Friday at approximately 4:05 p.m. CT. A daily restart occurs between 4:05 and 4:45 p.m. CT each day at which time sequences will be reset. Feed startup and shutdown times may be adjusted without notice.

### 1.2 Crypto Server (TCP)

The client connects to an assigned host and port using a TCP/IP socket. To request a port be assigned to your firm, please reach out to the CFE Trade Desk ([cfetradedesk@cboe.com](mailto:cfetradedesk@cboe.com)).

Upon connection, the customer must send a `Crypto Login` message. The `Crypto Login` message's `Next Sequence` field allows customers to specify the next sequence number they expect to receive. If a

## Cboe Crypto Feed Specification (Version 1.0.2)

customer logs in after trading begins or after connection loss, the *Next Sequence* field can be used to tell the server to replay any Trade messages that have occurred since the last received Trade message.

If the *Next Sequence* field is set to 1 (one), then all Trade messages from the beginning of the day will be replayed after the server sends a successful Login Response message. Once the server has replayed any Trade messages, it will deliver relevant Market Status information, a spin of Symbol Summary, and ADAP messages from its cache for each active symbol. Then the server will send the customer a Replay Complete message followed by the live stream of Symbol Summary, Best Quote Update, ADAP, Trade, Market Status, Auction Update, and Auction Summary messages.

If the *Next Sequence* field is set to 0 (zero), then no Trade messages will be replayed after the server sends a successful Login Response message. However, the customer may still receive a spin of Market Status, Symbol Summary, and ADAP messages followed by a Replay Complete message before receiving the live stream of Symbol Summary, Best Quote Update, ADAP, Trade, Market Status, Auction Update, and Auction Summary messages.

If a customer's process cannot keep up with the Crypto feed's rate of transmission, the connection will be closed by the server. The client should then reconnect and login with the appropriate *Next Sequence* number to receive any missed trades and a spin of the latest image for all symbols.

### **1.3 Crypto Feed Server (UDP)**

The UDP delivered Crypto Feed is sourced by the Crypto Feed Server (FS). The FS generates the multicast events for the Crypto Feed and performs throttling of events to ensure the bandwidth requirements of the feed are not exceeded.

The FS does not receive messages from customers and no login or port is necessary.

Multicast addresses and ports for the Crypto feed are listed in the [Multicast Configuration](#) section of this document.

### **1.4 Crypto Gap Request Proxy and Message Retransmission via Crypto Gap Server**

Requesting delivery of missed data is achieved by connecting to a Crypto Gap Request Proxy (GRP). Customers who do not wish to request missed messages do not need to connect to a GRP for any reason or listen to the multicast addresses reserved for message retransmission. Customers choosing to request missed data will need to connect to their assigned GRP, 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 "Accepted" 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.

Cboe Crypto Feed  
Specification (Version 1.0.2)

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. Larger sequence number gaps should be recovered via the Crypto Server over TCP. Customers will receive a total daily allowance of gap requested messages. In addition, each customer is given renewable one second and one minute gap request limits.

If more than one gap request is received for a particular 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. Customers will receive gap responses for their requested 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.

## 2 Protocol

Customers may utilize the Crypto Feed protocol over TCP/IP and/or multicast to receive the Crypto Feed directly from Cboe.

The Cboe Crypto Feed cannot be used to enter orders.

### 2.1 Message Format

The messages that make up the Crypto Feed protocol are delivered using Sequenced Unit Header which handles sequencing and delivery integrity. All messages delivered via TCP/IP or multicast 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 Crypto Server or Crypto Gap Request Proxy may cross frames as the data will be delivered as a stream of data with the TCP/IP stack controlling Ethernet framing.

The Cboe Crypto 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. 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 Cboe Crypto Feed.

- **Alphanumeric** fields are left justified ASCII fields and space padded on the right.
- **Binary** fields are unsigned and sized to “Length” bytes and ordered using Little Endian convention (least significant byte first).
- **Binary Crypto** fields are unsigned and sized to “Length” bytes and ordered using Little Endian convention (least significant byte first). Each Crypto has a different base unit. BTC is in millisatoshi (i.e. Bitcoin with 11 implied decimal places).
- **Binary Price** fields are unsigned and sized to “Length” bytes and ordered using Little Endian convention (least significant byte first). Each Currency has a different base unit.
- **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.

### 2.2.1 Pricing Units

Each symbol is sent as a Quantity/Price symbol. For example “BTCUSD” this would indicate the *Price* is in US Dollars while the *Quantity* is in Bitcoin. Every currency has an underlying base unit that could have a different number of implied decimals. Refer to section 2.2.2 for a listing of possible symbols and their associated units.

### 2.2.2 Symbols

Currency	Feed Symbol	Units	Implied Decimal Places
Bitcoin	<b>BTC</b>	Millisatoshi	11
Ethereum	<b>ETH</b>	Gwei	9
US Dollars	<b>USD</b>	Mil	4

## 2.3 Message Framing

ADAP update messages will be combined into a 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 feed. The content of the multicast across feeds will be identical, **but framing will not be consistent across feeds**. Receiving processes that receive and arbitrate multiple feeds cannot use frame level arbitration.



## 2.4 Sequenced Unit Header

The *Sequenced Unit Header* is used for all Crypto Feed messages delivered via multicast or TCP/IP.

Sequenced and un-sequenced data may be delivered using the *Sequenced Unit Header*. Un-sequenced headers will have a 0 value for the sequence field and potentially for the unit field.

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 with 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
<i>Hdr Length</i>	0	2	Binary	Length of entire block of messages. Includes this header and <i>Hdr Count</i> messages to follow.
<i>Hdr Count</i>	2	1	Binary	Number of messages to follow this header.
<i>Hdr Unit</i>	3	1	Binary	Unit that applies to messages included in this header (0 for all Crypto messages).
<i>Hdr Sequence</i>	4	4	Binary	Sequence of first message to follow this header.
<b>Total Length = 8 bytes</b>				

## 2.5 Heartbeat Messages

The *Sequenced Unit Header* with a *Hdr Count* field set to “0” will be used for heartbeat messages. During trading hours heartbeat messages will be sent from the Crypto Server, GRP and all multicast addresses if no data has been delivered within 1 second. Heartbeat messages never increment the sequence number, 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 a *Hdr Sequence* value equal to the sequence of the next sequenced message to be sent. Heartbeats on gap multicast addresses will always have the *Hdr Sequence* field set to 0. All heartbeat messages sent to and from the Crypto Server and GRP are considered un-sequenced and should have *Hdr Sequence* and *Hdr 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 may not be sent from 4:05 pm – 4:45 pm CT or during maintenance windows.

Cboe Crypto Feed  
Specification (Version 1.0.2)

Cboe expects heartbeat messages to be sent to the Crypto Server and GRP on live connections no less than every 5 seconds. Failure to receive 2 consecutive heartbeat messages will result in the termination of the client connection.

### 3 Crypto Server Session Messages (TCP)

The following messages are used for initializing a TCP/IP connection to the Crypto Server. Customers only need to implement the following messages if a TCP/IP connection to the Crypto Server is desired. The following messages will not be delivered using multicast.

See the '[Crypto Update Messages](#)' section of this document for a description of book and market related messages that are available from the Crypto Server.

#### 3.1 Crypto Login

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

Crypto Login				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	Length of this message including this field.
<i>Message Type</i>	1	1	0xCD	<code>Crypto Login</code>
<i>SessionSubId</i>	2	4	Alphanumeric	<i>SessionSubId</i> supplied by Cboe.
<i>Username</i>	6	4	Alphanumeric	<i>Username</i> supplied by Cboe
<i>Filler</i>	10	2	Alphanumeric	(space filled)
<i>Password</i>	12	10	Alphanumeric	<i>Password</i> supplied by Cboe
<i>Next Sequence</i>	22	4	Binary	Sequence number of the next sequenced message expected by the user.
<b>Total Length = 26 bytes</b>				

#### 3.2 Login Response

The `Login Response` message is sent by the server to a customer's process in response to a `Crypto 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
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x02	<code>Login Response</code>
<i>Status</i>	2	1	Alphanumeric	Accepted or reason for reject
<b>Total Length = 3 bytes</b>				
Login Response - Status Codes				
'A'	Login Accepted			
'N'	Not authorized (Invalid Username/Password)			
'B'	Session in use			
'S'	Invalid Session			
'Q'	Next Sequence is ahead of sequence			

### 3.3 Replay Complete

The `Replay Complete` message is sent to indicate that messages related to refreshing the state of the Cboe books have been delivered. After receipt of the `Replay Complete`, message updates will be sent on the session as needed until the client disconnects.

Market Status, Symbol Summary, and ADAP messages will be sent as needed to replay the current state of the books.

During the replay phase of the connection all messages with the exception of Trade messages will be un-sequenced.

Replay Complete				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xCE	<code>Replay Complete</code>
<i>Sequence</i>	2	4	Binary	Sequence number that reflects that last update on the feed.
<b>Total Length = 6 bytes</b>				

## 4 Crypto Gap Request Proxy Session Messages (TCP)

The following messages are used for initializing a TCP/IP connection to the Crypto Gap Request Proxy (GRP) and to request message retransmissions. Customers only need to implement the following messages if gap requests will be made. The following messages will not be delivered using multicast.

### 4.1 GRP Login

The GRP Login 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.

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

### 4.2 Login Response

The Login Response message is sent by the GRP to a user's process in response to a GRP 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
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0x02	Login Response
<i>Status</i>	2	1	Alphanumeric	Accepted or reason for reject
<b>Total Length = 3 bytes</b>				
Login Response - Status Codes				
'A'	Login Accepted			
'N'	Not authorized (Invalid Username/Password)			
'B'	Session in use			
'S'	Invalid Session			

### 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 the Cboe Gap Servers.

Cboe Crypto Feed  
Specification (Version 1.0.2)

The `Gap Request` message for the Cboe Crypto Feed is identical to the Multicast Pitch Gap Request message. The `Unit` field should be set to 0 since the Crypto Feed is not unitized.

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

#### 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 the `Status` field populated, will be sent for each `Gap Request` message received by the GRP.

The `Gap Response` message for the Cboe Crypto Feed is identical to the Multicast Pitch Gap Response message. The `Unit` field should be set 0 to since the Crypto Feed is not unitized.

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

## 5 Crypto Update Messages (UDP)

The messages described in this section are delivered from the Crypto Feed Server (UDP) and the Crypto Gap Server (UDP gap responses).

### 5.1.1 Clear Quote

The `Clear Quote` message instructs feed recipients to clear all quotes and Summary and/or ADAP information for the specified symbol on the specified market(s). This message does not affect the executed volume of the symbol.

Clear Quote				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xC7	Clear Quote
<i>Last Update Timestamp</i>	2	8	Binary	Timestamp of the last matching engine message that updated the quote information for this symbol in the Crypto server's cache.  Encoded as the number of nanoseconds since epoch.
<i>Symbol</i>	10	8	Alphanumeric	Symbol right padded with spaces.
<i>Market Center</i>	18	1	Alphanumeric	G = Gemini  See <a href="#">section 7.1</a> for a list of Market Centers.
<b>Total Length = 19 bytes</b>				

### 5.1.2 Symbol Summary

The `Symbol Summary` message delivers the Crypto Consolidated best bid/offer and total executed volume across all Crypto Market Centers.

Symbol Summary				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xC8	Symbol Summary
<i>Last Update Timestamp</i>	2	8	Binary	Timestamp of the last matching engine message that updated the quote information for this symbol in the Crypto server's cache.  Encoded as the number of nanoseconds since epoch.
<i>Symbol</i>	10	8	Alphanumeric	<i>Symbol</i> right padded with spaces.
<i>Cboe Cumulative Executed Volume</i>	18	8	Binary	Cumulative number of shares traded today across all Crypto Market Centers.

Cboe Crypto Feed  
Specification (Version 1.0.2)

<i>Bid Market Center</i>	26	1	Alphanumeric	G = Gemini See <a href="#">section 7.1</a> for a list of Market Centers.
<i>Consolidated Best Bid Price</i>	27	8	Binary 8.4 Price	Crypto Consolidated best bid price.
<i>Consolidated Best Bid Quantity</i>	35	8	Binary Crypto	Crypto Consolidated number of buy-side shares available for this symbol.
<i>Ask Market Center</i>	43	1	Alphanumeric	G = Gemini See <a href="#">section 7.1</a> for a list of Market Centers.
<i>Consolidated Best Ask Price</i>	44	8	Binary Price	Crypto Consolidated best ask price.
<i>Consolidated Best Ask Quantity</i>	52	8	Binary Crypto	Crypto Consolidated number of sell-side shares available for this symbol.
<b>Total Length = 60 bytes</b>				

### 5.1.3 Best Quote Update

The Best Quote Update message is used to update one side of the quote information for a symbol. Since the message only updates one side of the quote the previous value for the other side of the quote remains in effect.

This message does not affect the executed volume of the symbol.

Best Quote Update				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xC9	Best Quote Update
<i>Last Update Timestamp</i>	2	8	Binary	Timestamp of the last matching engine message that updated the quote information for this symbol in the Crypto server's cache.  Encoded as the number of nanoseconds since epoch.
<i>Symbol</i>	10	8	Alphanumeric	<i>Symbol</i> right padded with spaces.
<i>Market Center</i>	11	1	Alphanumeric	G = Gemini See <a href="#">section 7.1</a> for a list of Market Centers.
<i>Side Indicator</i>	19	1	Alphanumeric	B = Buy Side S = Sell Side
<i>Consolidated Best Quote Price</i>	20	8	Binary Price	Crypto Consolidated best price.
<i>Consolidated Quote Quantity</i>	28	8	Binary Crypto	Crypto Consolidated number of shares available for this symbol.
<b>Total Length = 36 bytes</b>				



Cboe Crypto Feed  
Specification (Version 1.0.2)

**5.1.4 Market Status**

The Market Status message is disseminated to reflect a change in the status of a Market Center. All markets should be assumed to be “Normal” unless otherwise indicated by a Market Status message.

The “Incomplete” Market Status is used to indicate that the Cboe Crypto Feed has not delivered updates for all of a market center’s symbols and that the feed is transitioning to “Normal”. If a market center transitions from “Normal” to “Excluded” the feed will deliver updates of symbol quote/ADAP information to properly reflect the state of the combined book. At the start of a market center’s transition from “Excluded” to “Normal” a Market Status message will be sent with “Incomplete” for the market center’s status. Symbol quote/ADAP information will then be sent for all applicable symbols. Once the market center’s symbol information has been disseminated a Market Status message will be delivered with a “Normal” market status.

Cboe Market Status				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xCA	Market Status
<i>Timestamp</i>	2	8	Binary	Timestamp of when the <i>Market Status</i> changed for the specified <i>Market Center</i> .  Encoded as the number of nanoseconds since epoch.
<i>Market Center</i>	10	1	Alphanumeric	G = Gemini  See <a href="#">section 7.1</a> for a list of Market Centers.
<i>Market Status</i>	11	1	Alphanumeric	N = Normal E = Excluded from Symbol Summary and ADAP updates I = Incomplete
<b>Total Length = 12 bytes</b>				

**5.1.5 ADAP**

Each ADAP message delivers one or more updates for a Symbol’s ADAP book. Each ADAP message contains one or more ADAP Blocks. A receiving process should interpret each ADAP Block as a replacement for any previously delivered ADAP Blocks at that price level.

A quantity of 0 indicates that the price level is either no longer available or the price level is not within the number ADAP levels maintained by the feed. In either case a receiving process should delete a price level with a 0 quantity from its cache.

ADAP				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field
<i>Message Type</i>	1	1	0xCB	ADAP

Cboe Crypto Feed  
Specification (Version 1.0.2)

<i>Last Update Timestamp</i>	2	8	Binary	Timestamp of the last matching engine message that updated the quote information for this symbol in the Crypto server's cache.  Encoded as the number of nanoseconds since epoch.
<i>Symbol</i>	10	8	Alphanumeric	<i>Symbol</i> right padded with spaces.
<i>ADAP Blocks</i>	18	1	Binary	Number of ADAP Blocks to follow
<i>ADAP Block Size</i>	19	1	Binary	Size of each ADAP Block
<b>Header Length = 20 bytes</b>				
<b>Long Update ADAP Block</b>				
<b>Field</b>	<b>Offset</b>	<b>Length</b>	<b>Value/Type</b>	<b>Description</b>
<i>Market Center</i>	0	1	Alphanumeric	G = Gemini  See <a href="#">section 7.1</a> for a list of Market Centers.
<i>Side</i>	1	1	Alphanumeric	B = Buy Side S = Sell Side
<i>Price</i>	2	8	Binary Price	<i>Price</i> level to add/update for Market Center's ADAP book.
<i>Quantity</i>	10	8	Binary Crypto	<i>Quantity</i> of shares at this price level in the Market Center's ADAP book. A value of zero implies deletion of this ADAP level.
<b>Long ADAP Block Length Indicated by ADAP Block Size in Header</b>				
<b>Total Length = Variable → (Header Length [20 bytes] + ADAP Blocks x ADAP Block Size)</b>				

### 5.1.6 Trade

Trade messages are sent when an order is executed in whole or in part on a Crypto Market Center.

Trade				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xCC	Trade
<i>Transaction Time</i>	2	8	Binary	The time the trade occurred on the specified <i>Market Center</i> .  Encoded as the number of nanoseconds since epoch.
<i>Symbol</i>	10	8	Alphanumeric	<i>Symbol</i> right padded with spaces.
<i>Market Center</i>	18	1	Alphanumeric	Reference <a href="#">table 7.1</a>
<i>Market Center Execution ID</i>	19	8	Binary	Market center specific execution identifier of this execution. <i>Execution ID</i> is also referenced in the Trade Break message.
<i>Last Price</i>	27	8	Binary Price	Last trade price.
<i>Last Quantity</i>	35	8	Binary Crypto	Last trade quantity.

Cboe Crypto Feed  
Specification (Version 1.0.2)

<i>Crypto Cumulative Executed Volume</i>	43	8	Binary Crypto	Cumulative number of shares traded today across all Crypto books.
<b>Total Length = 51 bytes</b>				

### 5.1.7 Auction Update

The Auction Update message is used to indicate the current auction details of a security on the applicable Market Center. An Auction Update message will be sent whenever a security's auction information changes.

Auction Update				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xCF	Auction Update
<i>Timestamp</i>	2	8	Binary	Timestamp of the matching engine Auction Update message emitted by the specified Market Center.  Encoded as the number of nanoseconds since midnight.
<i>Auction End Time</i>	10	8	Binary	Timestamp from Market Center on when the Auction Ends.  Encoded as the number of nanoseconds since midnight.
<i>Symbol</i>	18	8	Alphanumeric	<i>Symbol</i> right padded with spaces.
<i>Market Center</i>	26	1	Alphanumeric	G = Gemini  See <a href="#">section 7.1</a> for a list Market Centers.
<i>Price</i>	27	8	Binary Price	Price if auction was held now.
<i>Quantity</i>	35	8	Binary Crypto	Crypto quantity in the auction
<i>Collar Price</i>	43	8	Binary Price	Collar price of the auction.
<b>Total Length = 51 bytes</b>				

Cboe Crypto Feed  
Specification (Version 1.0.2)

**5.1.8 Auction Summary**

The Auction Summary message is used to indicate the end of an Auction on the applicable Crypto Market Center. An Auction Summary message will be sent whenever a security's Auction ends.

Auction Summary				
Field	Offset	Length	Value/Type	Description
<i>Length</i>	0	1	Binary	<i>Length</i> of this message including this field.
<i>Message Type</i>	1	1	0xD0	Auction Summary
<i>Timestamp</i>	2	8	Binary	Timestamp of the matching engine Auction Update message emitted by the specified Market Center.  Encoded as the number of nanoseconds since midnight.
<i>Symbol</i>	10	8	Alphanumeric	<i>Symbol</i> right padded with spaces.
<i>Market Center</i>	18	1	Alphanumeric	G = Gemini  See <a href="#">section 7.1</a> for a list Market Centers.
<i>Price</i>	19	8	Binary Price	Price of auction.
<i>Quantity</i>	27	8	Binary Crypto	Crypto quantity in the auction
<b>Total Length = 35 bytes</b>				

## 6 Multicast Configuration

### 6.1 US Futures 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.
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	1500 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.

#### 6.1.2 Crypto Multicast Routing Parameters

Data center	Rendezvous Point
Primary Data Center (NY5)	74.115.128.182

Cboe Crypto Feed  
Specification (Version 1.0.2)

**6.1.3 Crypto Multicast Addresses**

The following tables describe the distribution across production multicast Crypto feeds.

<b>NY5 Primary Datacenter</b>	<b>Real-time MC (Src) IP Addr</b>	<b>Gap Resp. MC (Src) IP Addr</b>
Crypto Summary	224.0.131.164:30301 (74.115.133.128/29)	224.0.131.165:30301 (74.115.133.128/29)
Crypto Premium	224.0.131.166:30302 (74.115.133.128/29)	224.0.131.167:30302 (74.115.133.128/29)

## 6.2 US Futures Certification Environment Configuration

### 6.2.1 Crypto Certification Multicast Routing Parameters

Data center	Rendezvous Point
Certification Data Center (NY5)	74.115.128.130

### 6.2.2 Crypto Certification Multicast Addresses

The following tables describe the current unit distribution across certification multicast Crypto feeds.

NY5 Primary Datacenter	Real-time MC (Src) IP Addr	Gap Resp. MC (Src) IP Addr
Crypto Summary	224.0.74.144:32201 (174.136.160.16/28)	224.0.74.145:32201 (174.136.160.16/28)
Crypto Premium	224.0.74.146:32202 (174.136.160.16/28)	224.0.74.147:32202 (174.136.160.16/28)

## 7 Crypto Market Centers

### 7.1 Market Center Directory

Market Center	Character Id	Website
Gemini	G	<a href="https://gemini.com/">https://gemini.com/</a>



## **8 Support**

To sign up for the Crypto Feed please contact Cboe Market Data Services at 212.378.8821 or email [marketdata@cboe.com](mailto:marketdata@cboe.com).

Please e-mail questions or comments regarding this specification to the CFE Trade Desk at [cfetradedesk@cboe.com](mailto:cfetradedesk@cboe.com).

Cboe Crypto Feed  
Specification (Version 1.0.2)

**Revision History**

<b>Document Version</b>	<b>Date</b>	<b>Description</b>
1.0.0	03/01/18	Initial version.
1.0.1	03/27/18	Added missing Multicast port information for certification and production.
1.0.2	03/28/18	Additional corrections to Multicast IP and Port information, including updated Source IPs and Rendezvous Points.