



Cboe Titanium U.S. Equities/Options Connectivity Manual

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Cboe Titanium U.S. Equities/Options Connectivity Manual

Overview

Cboe's primary trading platforms, BZX Equities Exchange, BYX Equities Exchange, EDGA Equities Exchange, EDGX Equities Exchange, BZX Options Exchange, EDGX Options Exchange, C2 Options Exchange (C2), and the Cboe Options Exchange (C1) are housed in the NY5 Equinix data center in Secaucus, New Jersey. The secondary data center is hosted by Cyxtera (ORD1) in 350 Cermak, Chicago, IL, for all platforms. The secondary data centers for BYX, EDGX, and EDGA Equities Exchange (EDGA) are hosted by Equinix (CH3) in Elk Grove Village, IL. Customers are strongly encouraged to establish connectivity to both data centers to minimize service disruption in the event of an issue at either data center. Secaucus is the "primary" or "hot" site, with Chicago/Elk Grove Village being "secondary" or "warm". Customers may receive market data from Chicago, and they may connect and heartbeat with order entry systems in Chicago. Orders submitted to Chicago will be rejected until Cboe declares the primary site in Secaucus "down".

Cboe also provides a primary network Point of Presence (PoP) in the Equinix NY4 and NY6 data centers in Secaucus, NJ. Customers can leverage their NY4/NY6 PoP connectivity to access multicast market data feeds and order entry sessions in the Cboe's primary data center. Customers may access the secondary network via PoPs located in Cyxtera ORD1 or Equinix CH1, both in 350 Cermak, Chicago, IL as well as CH3 in Elk Grove Village (available in **June 2026**).

It is the customer's responsibility for selecting their telecommunications provider and arranging for connections to Cboe's data centers and PoPs.

Cboe supports the following network connectivity choices for access to both Equities and Options:

- IPSec VPN via the Internet (only for certification or test sessions);
- Co-location Cross-connect (i.e., for customers co-located in the same data center as the Cboe trading platforms or a PoP);
- Extranet connectivity (See [Cboe Approved Extranet Providers](#) for a list of approved Extranet Providers); and
- Private line Ethernet (circuit extension from a carrier to Cboe, see the [Carriers](#) section for a list of Carriers)

Connectivity Matrix

Table 1. Connectivity Matrix

Description	NY4/NY5/NY6 Latency Equalized	ORD1	CH1	CH3 (Available in June 2026)
Data Center Role	Primary	Secondary		Secondary
Data Center Provider	Equinix	Cyxtera	Equinix	Equinix
Site Location	Secaucus, NJ	Chicago, IL	Chicago, IL	Elk Grove Village
Site Status	Hot/Primary	Warm/Secondary	PoP for Secondary	Warm /Secondary
Accepts Co-location Cross connects?	Yes	Yes	Yes	Yes
Accepts Circuit Extension from Telco?	Yes	Telco must be co-located within Telx	Yes	Yes
Access to Production Sessions/feeds?	Yes	No	No	No
Access to Disaster Recovery Sessions/feeds?	No	Yes	Yes	Yes
Access to Certification Sessions/Feeds?	Yes	No	No	No
Colocation of Network Equipment?	No	No	No	No
1G Monthly Recurring Connectivity Fees	See Cboe U.S. Equities Fee Schedules or Cboe U.S. Options Fee Schedules for details			
10G Monthly Recurring Connectivity Fees				
Supported Media Types	SMF	SMF, MMF	SMF, MMF	SMF
One-Way Time to Production FIX gateways	~11µs	N/A	N/A	N/A
Connectivity Contact	Greg Nelson (312) 994-3906	Bob Luparello (914) 309-2646	Greg Nelson (312) 994-3906	Greg Nelson(312) 994-3906

Physical Interfaces

The following standard physical interface specifications are supported in the ORD1, CH3, and CH1 data centers and PoPs. For other interface specifications contact noc@cboe.com.

Table 1. Specifications Supported in ORD1, CH3 and CH1 Data Centers and PoPs

Capacity	Specifications Supported
10G	SR (multi-mode), LR (single-mode) & ER (single-mode)
1G	SX (multi-mode), LX (single-mode) & 1000BaseT

The following standard physical interface specifications are supported in the NY4, NY5, and NY6 data centers:

Table 2. Specifications Supported in NY4, NY5, and NY6 Data Centers

Capacity	Specifications Supported
10G	ER* (single-mode)
10G	LR (single-mode)
1G	LX (single-mode)

*Contact Cboe NOC for details on ER Optical Transceivers

IPSec VPN

- Customers may connect via an IPSec Virtual Private Network (VPN) over the Internet for access to order entry and unicast market data feeds for certification and test purposes only. LAN-to-LAN IPSec VPN supported.
- IP address of the host presented to Cboe must be registered.
- Customers must contact Cboe NOC for encryption details and to receive their pre-shared key.

Note: Cboe does not offer multicast market data feeds over VPN.

Co-location Cross-connect

Equities and Options customers may co-locate within the NY5 data center or a data center where a Cboe PoP is located and cross-connect to Cboe.

- Each physical port connection (1Gbps and 10Gbps) within the Secaucus, and Chicago data centers/PoPs will be subject to a monthly recurring charge. See the [Cboe Fee Schedule](#) for more information.
- Co-location cross connect requests must come from a demarcation point on the data center floor or Mezzanine level. Roof-top access requests will not be accepted.
- Cboe reserves the right to charge for one-time setup and monthly recurring fees incurred connecting customers or extranets. See the [Cboe Fee Schedule](#) for more information.

With data center co-location, customers can place equipment, terminate communications circuits, and establish a cross-connect to Cboe (or other destinations) in their space. This gives the maximum amount of control to the Member. This option is neutral for the customer and provides the greatest flexibility for the customer in determining when and to whom to connect. Customers interested in co-location services should contact the data center/PoP Point of Contact (refer to the [Connectivity Matrix](#) for POC information).

Extranet

Customers may provision connectivity to Cboe via an extranet.

- Extranets have provisioned redundant connections to Cboe for use by multiple customers.
- Contact information for a variety of extranet providers can be found within [Extranet Providers](#).

This method is an attractive alternative when:

- The customer would otherwise have to provision a long-haul private line;
- Outsourcing of network services and network management is an option; or
- The ease and speed of turn-up are important (when both the customer and Cboe have an existing connection to the extranet).

Directly Connected via Private Line Ethernet

Customers may connect to Cboe via Private Line Ethernet.

- No co-location space is required. Cross-connect from Telco demarcation point to Cboe network via an Ethernet interface.
- Each physical port connections (1Gbps and 10Gbps) within the Secaucus and Chicago data centers/PoPs will be subject to a monthly recurring charge. See the [Cboe Options Fee Schedule](#) for more information.
- Cboe reserves the right to charge for one-time setup and monthly recurring fees incurred connecting customers or extranets. See the [Cboe Options Fee Schedule](#) for more information.
- Contact your carrier of choice to arrange connectivity to Cboe. See [Carriers](#) for more information.

Cboe Global Cloud

- The Cboe Global Cloud service provides three (3) distinct, secure connectivity and access options for customers:
 1. PrivateLink - This option is a suitable access method if customer systems and/or processes are running within AWS Cloud (i.e., a current AWS customer).
 2. Internet Gateway (IGW) - This option is a suitable access method for customer systems and/or processes running on-premises in a local data center, or in another infrastructure provider's environment.
 3. Virtual Private Network (VPN) - This option is a suitable access method for customer systems and/or processes running on-premises in a local data center, or in another infrastructure provider's environment, where an encrypted virtual private connection is preferred over internet delivery.
- Cboe Global Cloud enables Cboe Data availability and dissemination in locations around the world. Cboe Data is currently leveraging the Amazon Web services (AWS) global network in the following three (3) regions:
 1. Virginia (US-East-1)
 2. London (EU-West-2)
 3. Hong Kong (AP-East-1)
- Additional regions will be included in the service through a phased rollout based on client demand. See [Cboe Titanium Cboe Global Cloud Feed Specification](#) for more information.

Ordering a Cross Connect to Cboe

Submit Request via Cboe Portal

A Cboe Customer Web Portal account is required to request a new cross connect or decommission existing connectivity to Cboe. Please see your firm's account administrator or contact the [Cboe Trade Desk](#) (+1 913-815-7001) for an account.

Required Information

- Location (NY5, NY4,... to include cage number if known)
- Number and speed of connections requested (1G or 10G)
- Registered BGP ASN (Cboe NOC can assign a private ASN)
- Networks advertised to Cboe (registered public IP's or Cboe assigned private addresses are accepted)
- Network and billing contact information
- Transit IP address (Public or private range assigned by Cboe NOC)

LOA-CFA

Upon approval of cross connect request, Cboe NOC will provide a Letter of Authorization - Customer Facility Assignment with the "Z-side" cage, cabinet, panel, and port pair assignment. The customer requesting the cross connect is known as the "A-Side".

Data Center Provider Request

The requesting customer submits a cross connect request with the appropriate data center provider:

- Equinix - NY5, NY4, NY6 and CH1
- Cyxtera - ORD1

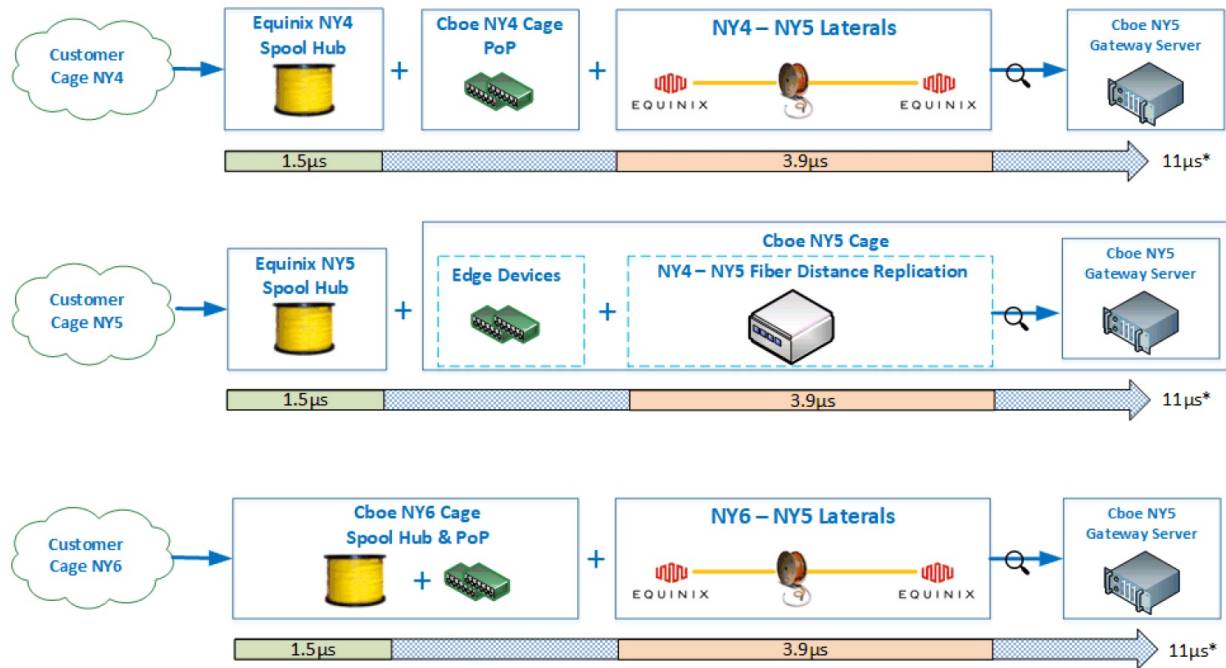
The data center provider will need the LOA-CFA and the A-side details to complete the connection. The "A-Side" customer is responsible for any data center setup fees and monthly recurring costs associated with the cross connect. As the "A-Side" customer, the customer is also responsible for initiating troubleshooting requests with the data center provider in the event of a down cross connect.

Latency Equalization

Cross connects originating within either NY4, NY5, or NY6 data centers will be engineered to provide equivalent latency between member demarcation points and the Cboe's order entry gateways in NY5. Equal fiber pathway latency will be determined by OBR testing. WAN circuits originating outside Secaucus, NJ will also be subject to latency equalization. For more details, see [Cboe Latency Equalization](#).

Figure 1. Cboe Latency Equalization - Secaucus, NJ

Cboe Latency Equalization Secaucus, NJ

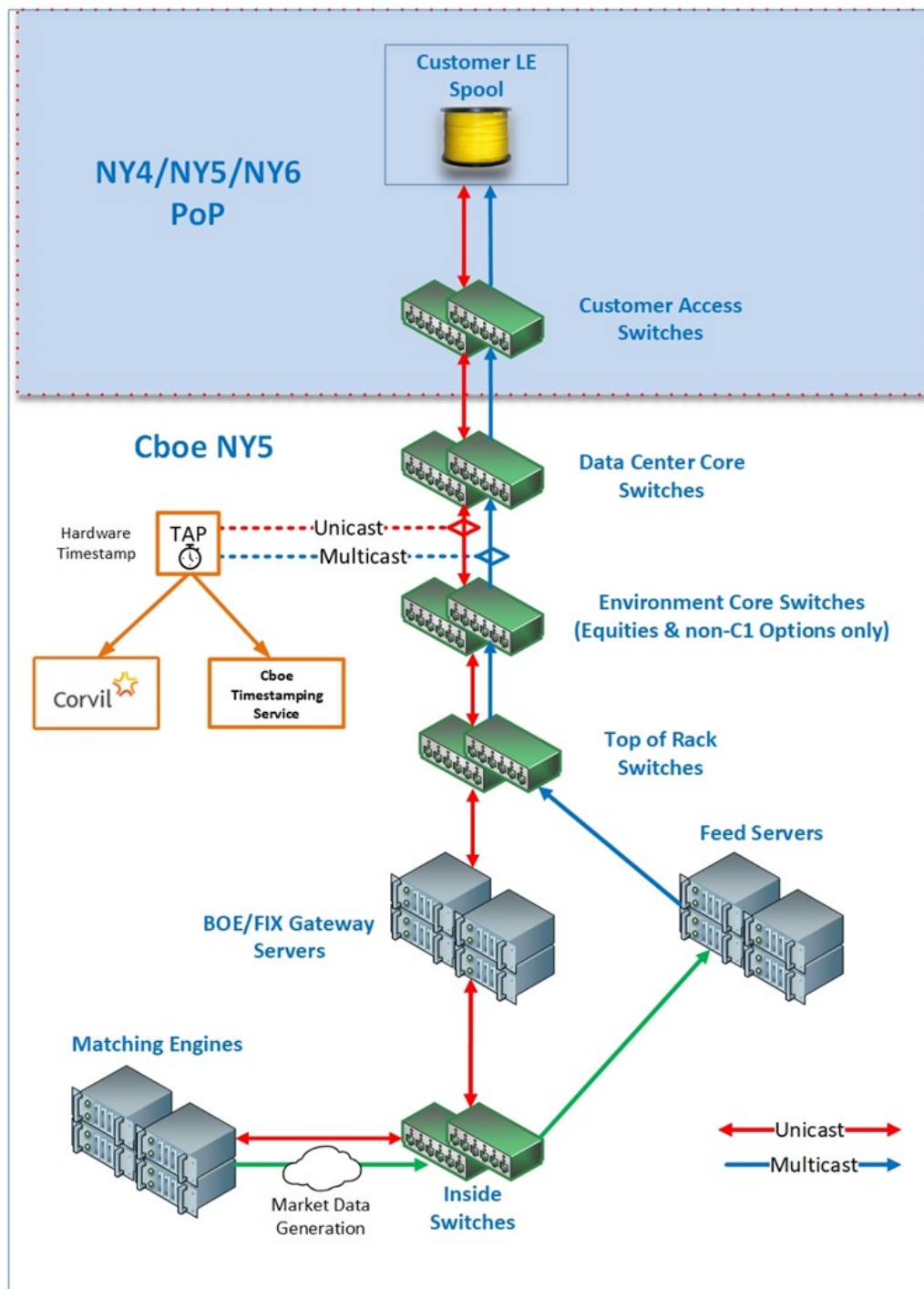


See NY5 Expanded View

* Average one-way latency based on 128byte packet size

Cboe Latency Equalization Secaucus, NJ

- Cboe/Equinix Latency Equalization Infrastructure, provides an equal optical length of fiber to customers connecting in the NY4, NY5, or NY6 Secaucus, NJ data centers.
- Fiber cross connects to customer cages are run from Equinix Latency Equalized Hubs using equal lengths of single-mode fiber to each customer cage. The additional slack fiber is stored on the Cboe side of the cross connect. Regardless of the customer's distance from the Equinix Latency Equalized Hub, the fiber spool length is identical.
- NY6 – NY5 cross connects use fiber trunks that are engineered to be the same optical distance as NY4 – NY5, even though NY6 is physically closer to NY5.
- Latency Equalized Hubs within NY4/NY5/NY6 are connected via fiber trunks to the gateway servers in the NY5 data center. Since the NY5 Latency Equalized Hub is much closer to the gateway servers, these fiber trunks connect through additional lengths of fiber to replicate the distance between NY4 to NY5. It is imperative that customers order cross connects only in their local data centers. For example, the Letter of Authorization (LOA) for a customer cage located in NY4 will specify a NY4 demarcation. In this scenario, attempting to order a NY4-to-NY5 cross connect would greatly increase your fiber distance and overall latency to the matching engine in NY5 – duplicating the latency equalized engineered distance.
- Customers with cages outside of NY4/NY5/NY6 Secaucus campus or WAN connections should order cross connects to the NY4 Latency Equalized Hub for the lowest latency.
- Every customer fiber path and trunk is tested end-to-end using a proprietary Optical Backscatter Reflectometer (OBR).
- Total one-way latency represented is measured from the customer fiber handoff to the Environment ToR switch egress point, prior to the Gateway server NIC, based on the average using 128byte packet size.
- Finally, the fiber patch between assigned demarcation point and the Cboe outside network device is adjusted to a custom length, ensuring the total fiber optical length is within acceptable tolerances.



Request for Physical Port Relocation

Customers can submit a request to the Cboe NOC to relocate cross connects to another switch port on the same switch or a different switch within the same Data Center. The following guidelines must be adhered to:

- Only Layer 3 NY4, NY5, or NY6 cross connects are eligible for physical port relocation within the same data center.
- Requests must be submitted in writing to noc@cboe.com.
- Requests must be submitted at least seven (7) calendar days prior to the requested move date.
- Moves can only be performed during normal maintenance windows.

- Requests must include either the Equinix-assigned cross connect ID or the transit IP address to properly identify the connection being moved.
- The physical port being moved must have been in service for at least 90 days prior to the request. Physical ports are not eligible for relocation for 90 days after the requested move.
- Relocation requests are limited to two (2) physical ports per request. Firms must wait until the relocation request has been fulfilled before submitting subsequent requests.
- Port relocation requests will be randomly assigned from currently available ports. The Cboe NOC will not disclose the current switch port location or the new port number following relocation.
- Port relocation requests to another switch must stay on the same switch path type (i.e., primary to primary and secondary to secondary switches).
- Port relocations may require a transit IP address change.

Inbound Bandwidth Limit

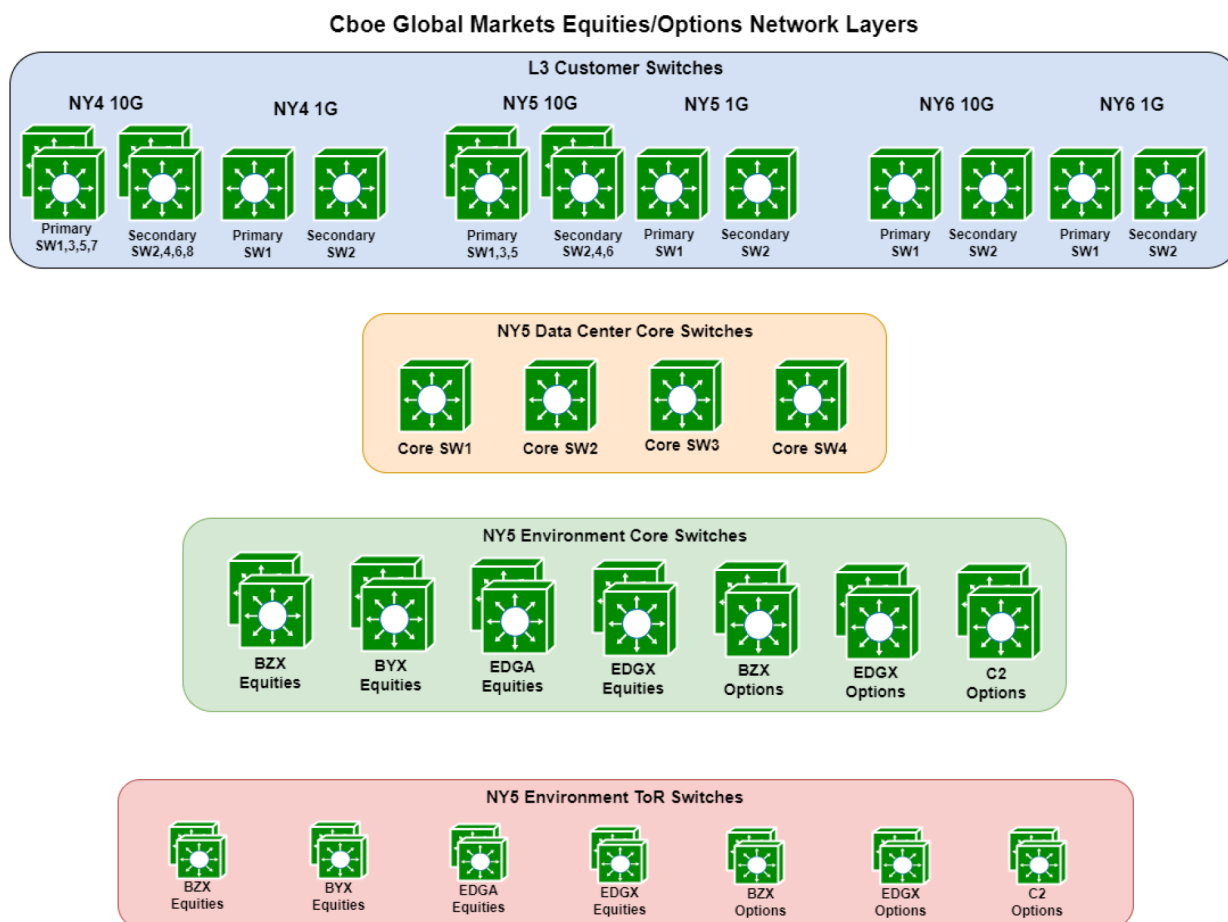
To maintain fair and orderly markets and prevent potential network congestion issues, Cboe monitors inbound bandwidth per 10 Gbps physical port at the customer access switch level. Any 10 Gbps physical network connection which receives inbound data exceeding a bandwidth limit of a 5 gigabit per second (5 Gbps) average measured over a two second time interval will automatically be disabled. This inbound bandwidth limit is based on observations of actual data traffic patterns and is equally applied across all Cboe customer 10 Gbps physical ports.

The bandwidth limit is an inbound data limit and thus does not apply to outbound data, such as market data, received through a physical port. However, if a physical network connection is disabled due to exceeding the inbound bandwidth limit, the physical network connection will not be able to submit inbound data or receive outbound data until it is re-enabled.

To re-enable an impacted physical network connection disabled due to exceeding the inbound bandwidth limit, a customer must contact Cboe NOC and provide a written post-mortem outlining the issue that caused the bandwidth limit to be exceeded and the actions taken to remediate the issue. Any connection disabled a second time within the same trading day for exceeding the inbound bandwidth limit will be re-enabled only after an additional written post-mortem is received and customer testing has been performed with Cboe NOC during standard Cboe maintenance hours.

L3 Network Overview - Equities/Options

Figure 1. Cboe Global Markets Equities/Options Network Layers



L3 Customer Access Layer

Equities/Options employs both 1G and 10G dedicated switches that serve as the network access point for customer connections. The number of switches at this layer is largely based on customer demand. Uplinks use the vendor default hashing algorithm.

Table 1. L3 Customer Access Layer

DC Location	Quantity	Customer Bandwidth	Uplink to DC Core	Make	Model	Switching Mode
NY4	2	1G	2x100G (Core 3&4) 2x100G (Core 1&2)	Arista	DCS-7280SR3-48YC8	Store-and-Forward
NY5	2	1G	2x100G (Core 3&4) 2x100G (Core 1&2)	Arista	DCS-7280SR3-48YC8	Store-and-Forward
NY6	2	1G	2x100G (Core 3&4) 2x100G (Core 1&2)	Arista	DCS-7280SR3-48YC8	Store-and-Forward
NY4	8	10G	2x100G (Core 1&2) 2x100G (Core 3&4)	Arista	DCS-7050SX3-96YC8	Cut-Through*
NY5	6	10G	2x100G (Core 1&2) 2x100G (Core 3&4)	Arista	DCS-7050SX3-96YC8	Cut-Through*
NY6	2	10G	2x100G (Core 1&2) 2x100G (Core 3&4)	Arista	DCS-7050SX3-96YC8	Cut-Through*

*Switching mode is effectively store-and-forward one way due to speed change from 10G to 100G.

L3 Data Center Core Layer

These are chassis-based switches designed to mesh the customer access layer with the Environment core layer. The Data Core layer services seven environments - BZX Equities, BYX Equities, EDGA Equities, EDGX Equities, BZX Options, EDGX Options, and C2 Options. Uplinks use the vendor default hashing algorithm.

Table 1. L3 Data Center Core Layer

DC Location	Quantity	Uplink to Env. Core Switches	Make	Model	Switching Mode
NY5	4*	4x100G Port-Channel	Arista	DCS-7304	Cut-Through

*Each environment is spread across two Data Center Core switches

Cores 1 & 2 - BYX Equities, EDGA Equities, EDGX Equities, and C2 Options

Cores 3 & 4 - BZX Equities, BZX Options, and EDGX Options

L3 Environment Core Layer

This layer uses dedicated switches for connecting the BZX Equities, BYX Equities, EDGA Equities, EDGX Equities, BZX Options, EDGX Options, and C2 Options environments Top of Rack (ToR) switches with the DC Core layer. Uplinks use the vendor default hashing algorithm.

Table 1. L3 Environment Core Layer

DC Location	Environment	Quantity	Make	Model	Switching Mode
NY5	BZX Equities	2	Arista	DCS-7260CX3-64E-R	Cut-Through
NY5	BYX Equities	2	Arista	DCS-7260CX3-64E-R	Cut-Through
NY5	EDGA Equities	2	Arista	DCS-7260CX3-64E-R	Cut-Through
NY5	EDGX Equities	2	Arista	DCS-7260CX3-64E-R	Cut-Through
NY5	BZX Options	2	Arista	DCS-7260CX3-64E-R	Cut-Through
NY5	EDGX Options	2	Arista	DCS-7260CX3-64E-R	Cut-Through
NY5	C2 Options	2	Arista	DCS-7260CX3-64E-R	Cut-Through

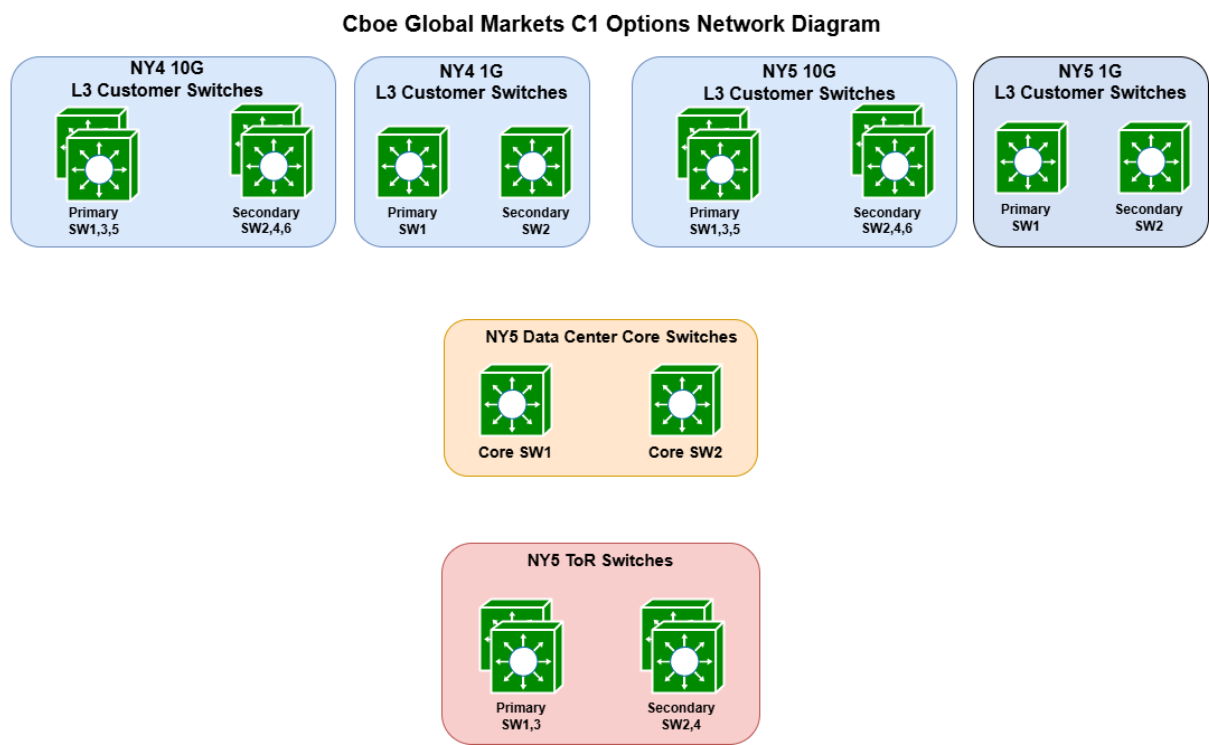
L3 Top of Rack (ToR) Layer

These switches function to connect order handler servers to the Environment Core switches. Each server NIC is connected to two ToR switches in an active/passive redundancy model.

Table 1. L3 Top of Rack (ToR) Layer

DC Location	Environment	Quantity	Make	Model	Switching Mode
NY5	BZX Equities	2	Arista	DCS-7050SX3-48YC8	Cut-Through
NY5	BYX Equities	2	Arista	DCS-7050SX3-48YC8	Cut-Through
NY5	EDGA Equities	2	Arista	DCS-7050SX3-48YC8	Cut-Through
NY5	EDGX Equities	2	Arista	DCS-7050SX3-48YC8	Cut-Through
NY5	BZX Options	2	Arista	DCS-7050SX3-48YC8	Cut-Through
NY5	EDGX Options	2	Arista	DCS-7050SX3-48YC8	Cut-Through
NY5	C2 Options	2	Arista	DCS-7050SX3-48YC8	Cut-Through

L3 Network Overview - C1 Options



L3 Customer Access Layer

C1 Options employs both 1G and 10G dedicated switches that serve as the network access point for customer connections. The number of switches is largely based on customer demand. Uplinks use the vendor default hashing algorithm.

Table 1. L3 Customer Access Layer

DC Location	Quantity	Bandwidth	Uplink Bandwidth	Make	Model	Switching Mode
NY4	2	1G	2x100G	Arista	DCS-7280SR2-48YC6	Cut-Through*
NY5	2	1G	2x100G	Arista	DCS-7280SR2-48YC6	Cut-Through*
NY4	6	10G	4x100G	Arista	DCS-7050SX3-48YC12	Cut-Through*
NY5	6	10G	4x100G	Arista	DCS-7050SX3-48YC12	Cut-Through*

*Switching mode is effectively store-and-forward one way due to speed change 1G to 100G or 10G to 100G.

L3 Data Center Core Layer

These are chassis-based switches designed to mesh the customer access layer with the Top of Rack layer. Uplinks between layers are all 2x100G port-channel using the vendor default hashing algorithm.

Table 1. L3 Data Center Core Layer

DC Location	Quantity	Uplink Bandwidth	Make	Model	Switching Mode
NY5	2	2x100G port-channel	Arista	DCS-7304	Cut-Through

L3 Top of Rack (ToR) Layer

These switches function to connect order handler servers to the Data Center Core switches. Each server NIC is connected to two ToR switches in an active/passive redundancy model.

Table 1. L3 Top of Rack (ToR) Layer

DC Location	Quantity	Uplink Bandwidth	Make	Model	Switching Mode
NY5	6	2x100G port-channel	Arista	DCS-7050CX3-32	Cut-Through

Market Data Feeds

Cboe offers four different types of market data feeds:

- Multicast PITCH
- TCP PITCH
- TOP
- Last Sale

Cboe requires that customers allocate a minimum of 10 Gbps per Multicast PITCH 8G or 5G-shaped feed, 1 Gbps per Gig-Shaped feed, and 100 Mb/s per Multicast PITCH WAN-Shaped feed. With respect to TCP PITCH and TOP feeds, Cboe understands firms will have varying levels of sensitivity with respect to latency and as such encourages customers to use the statistics provided below to make a well-informed decision regarding the bandwidth they will require based on their organization's latency sensitivity.

The table below shows the bandwidth statistics for historical highs for Cboe market data feeds. The table shows the bandwidth and Messages Per Second (MPS) peaks for 1, 5, 10, 30, and 60-second intervals. Peaks for 1 and 10 millisecond interval peaks are also included. The TCP statistics include 11 bytes for TCP/IP overhead per packet and do not include the data link layer overhead.

Table 1. Cboe Market Data Feeds - Historical Highs Bandwidth Statistics

Cboe Market	Interval Seconds	Multicast PITCH		TOP		TCP PITCH	
		MPS	Mb/s	MPS	Mb/s	MPS	Mb/s
BZX Equities Exchange	.001	21,906,000	6,485	2,751,000	669	2,090,000	1,680
	.010	19,767,500	5,854	1,565,500	385	1,918,900	1,542
	1	661,312	228	279,919	74	408,069	328
	5	458,865	159	181,516	48	350,133	282
	10	379,868	131	153,553	40	345,079	278
	30	242,836	84	108,395	28	247,154	199
	60	192,468	67	87,545	23	208,273	167
BYX Equities Exchange	.001	18,225,000	5,395	3,995,000	961	2,165,000	1,481
	.010	11,200,000	3,315	1,518,500	385	1,620,000	1,114
	1	216,316	68	118,737	31	287,657	231
	5	122,092	41	59,985	16	151,437	69
	10	97,771	33	52,313	14	125,665	57
	30	75,117	26	44,086	11	97,798	45
	60	57,300	20	34,144	9	74,634	34
BZX Options Exchange	.001	53,780,000	15,961	13,848,000	4,764	N/A	N/A
	.010	50,083,300	14,825	12,457,800	4,286	N/A	N/A
	1	19,140,227	5,743	6,463,617	2,265	N/A	N/A
	5	10,766,932	3,549	5,227,154	1,871	N/A	N/A
	10	9,989,098	3,356	4,555,679	1,651	N/A	N/A
	30	7,393,339	2,518	3,538,378	1,221	N/A	N/A
	60	5,891,085	2,013	2,981,243	1,030	N/A	N/A
EDGA Equities Exchange	.001	20,626,000	6,106	4,243,000	1,022	1,878,000	1,197
	.010	12,108,700	3,584	1,481,500	437	1,495,000	1,202
	1	209,839	66	118,348	31	223,388	180
	5	113,384	38	65,923	17	213,290	172

Cboe Market	Interval Seconds	Multicast PITCH		TOP		TCP PITCH	
		MPS	Mb/s	MPS	Mb/s	MPS	Mb/s
	10	109,687	37	55,514	14	209,524	168
	30	88,356	30	47,854	12	168,734	136
	60	53,392	18	40,587	10	89,026	72
EDGX Equities Exchange	.001	26,193,000	7,753	3,836,000	923	1,800,000	1,415
	.010	23,176,100	6,860	1,393,200	388	1,540,400	1,238
	1	2,143,661	635	203,048	54	382,443	288
	5	429,055	127	136,793	36	258,911	215
	10	259,927	90	118,936	31	243,882	197
	30	177,518	61	90,433	23	186,546	151
	60	142,422	49	76,163	20	154,775	125
EDGX Options Exchange	.001	56,952,000	16,957	19,422,000	6,681	N/A	N/A
	.010	47,315,900	14,053	18,712,400	6,439	N/A	N/A
	1	20,192,514	6,044	8,588,305	2,945	N/A	N/A
	5	10,371,347	3,353	5,361,302	1,925	N/A	N/A
	10	8,956,406	3,003	4,806,920	1,657	N/A	N/A
	30	6,882,654	2,342	3,835,827	1,322	N/A	N/A
	60	5,808,602	1,983	3,275,959	1,130	N/A	N/A
Cboe C2 Options Exchange	.001	53,622,000	15,962	17,714,000	6,121	N/A	N/A
	.010	45,456,100	13,455	16,904,700	5,815	N/A	N/A
	1	16,540,922	4,974	7,236,484	2,478	N/A	N/A
	5	8,669,332	2,802	4,751,626	1,712	N/A	N/A
	10	7,196,746	2,428	3,867,593	1,413	N/A	N/A
	30	5,503,212	1,884	2,855,190	985	N/A	N/A
	60	4,459,877	1,531	2,408,799	832	N/A	N/A
Cboe C1 Options Exchange	.001	52,548,000	15,679	25,716,000	8,930	N/A	N/A
	.010	41,914,200	12,407	24,687,700	8,509	N/A	N/A
	1	19,114,521	5,781	9,069,573	3,117	N/A	N/A
	5	11,882,182	3,826	6,106,066	2,192	N/A	N/A
	10	10,758,321	3,640	5,474,648	1,894	N/A	N/A
	30	9,359,064	3,194	4,772,229	1,651	N/A	N/A
	60	7,649,362	2,618	4,108,423	1,422	N/A	N/A

*Statistics as of 07/01/2026 . Equities TOP feed is TCP. Options TOP feed is multicast.

Note that Cboe data will have microbursts within the one-second interval above, and these microbursts will exceed the peak rates at the one-second interval. This is demonstrated within the 1 and 10 millisecond interval statistics. The extent to which the network connection to the customer will cope with the microbursts exceeding the available bandwidth without packet loss will depend heavily on the buffers in the end-to-end path.

During spikes in quote updates, customers using less than sufficient bandwidth will experience queuing of their market data. Customers using the same bandwidth to both receive quotes and transmit orders may expect their orders to be slightly delayed if they have less than sufficient bandwidth. Many customers will find these delays unacceptable and should provision their bandwidth to reduce these delays. The following table demonstrates statistics regarding latency incurred as a result of queuing on Gig-Shaped and WAN-Shaped Multicast PITCH feeds.

Table 2. Gig-Shaped and WAN-Shaped Multicast PITCH Feeds Latency Statistics

Cboe Market	Measurement	8G-Shaped Multicast PITCH Serialization Delay (µs)	5G-Shaped Multicast PITCH Serialization Delay (µs)	Gig-Shaped Multicast PITCH Serialization Delay (µs)	WAN-Shaped Multicast PITCH Serialization Delay (µs)
BZX Equities Exchange	Average	N/A	N/A	33	9,964
	Standard Deviation	N/A	N/A	1,271	443,896
	Historical High	N/A	N/A	33	9,964
BYX Equities Exchange	Average	N/A	N/A	4	172
	Standard Deviation	N/A	N/A	100	11,618
	Historical High	N/A	N/A	9	172
BZX Options Exchange	Average	13	119	N/A	N/A
	Standard Deviation	88	1,016	N/A	N/A
	Historical High	13	141	N/A	N/A
EDGA Equities Exchange	Average	N/A	N/A	10	259
	Standard Deviation	N/A	N/A	324	4,921
	Historical High	N/A	N/A	868	13,672
EDGX Equities Exchange	Average	N/A	N/A	879	16,515
	Standard Deviation	N/A	N/A	14,343	247,377
	Historical High	N/A	N/A	1,131	19,465
EDGX Options Exchange	Average	3	256	N/A	N/A
	Standard Deviation	67	1,621	N/A	N/A
	Historical High	3	1,174	N/A	N/A
Cboe C2 Options Exchange	Average	3	115	N/A	N/A
	Standard Deviation	69	934	N/A	N/A
	Historical High	4	202	N/A	N/A
Cboe C1 Options Exchange	Average	3	126	N/A	N/A
	Standard Deviation	105	900	N/A	N/A
	Historical High	12	152	N/A	N/A

*Statistics as of 07/01/2026.

As the volume on an exchange increases, the market data feed bandwidth required to accommodate peaks will also grow. Customers can obtain the latest published market data bandwidth and serialization statistics within this Connectivity Manual. Additionally, monthly statistical updates are presented through the FIF Market Data Capacity working group.

Multicast PITCH

Key features include:

- Low latency, up to 50% latency reduction vs. TCP PITCH.
- Bandwidth versions:
 - Gig-Shaped, requires minimum gigabit cross-connect.
 - WAN-Shaped (Equities Only) shaped to 100Mb.
 - 5G-Shaped (Options only) requires a dedicated 10G connection.
 - 8G-Shaped (BZX, C2, EDGX and C1 Options only) requires a dedicated 10G connection.
- Gap Response Proxy to recover small data gaps.

- Spin Server to efficiently recover from intra-day disconnects.
- Efficient binary messaging and new modify order message.

Refer to the [Cboe Titanium U.S. Equities/Options Multicast Depth of Book \(PITCH\) Specification](#) for complete details.

Multicast PITCH Feed Availability Matrix

Table 1. Equities

Cross Connect Data Center & Bandwidth	Equities Full-Depth of Book Multicast Feeds															
	1G -Shaped								WAN-Shaped							
	BZX		BYX		EDGA		EDGX		BZX		BYX		EDGA		EDGX	
	A	B	A	B	A	B	A	B	C	D	C	D	C	D	C	D
Secaucus NY4/NY5/NY6 Exchange 10G	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Secaucus NY4/NY5/NY6 Exchange 1G	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 2. Options

Cross Connect Data Center & Bandwidth	Options Full-Depth of Book Multicast Feeds															
	5G - Shaped						8G - Shaped						5G - Shaped		8G - Shaped	
	BZX		EDGX		C2		BZX		EDGX		C2		C1		C1	
	A	B	A	B	A	B	C	D	C	D	C	D	A	B	C	D
Secaucus NY4/NY5/NY6 Exchange 10G																
Secaucus NY4/NY5/NY6 Exchange 1G*																
Secaucus NY4/NY5/NY6 5G Options 10G	✓	✓	✓	✓	✓	✓										
Secaucus NY4/NY5/NY6 8G BZX Options	✓	✓					✓	✓								
Secaucus NY4/NY5/NY6 8G EDGX Options			✓	✓					✓	✓						
Secaucus NY4/NY5/NY68G C2 Options					✓	✓					✓	✓				
Secaucus NY4/NY5C1-Only 10G													✓	✓	✓	✓
Secaucus NY4/NY5C1-Only 1G*																

*1G connections can only subscribe to non-full-depth of book C1 market data products shaped 1G and smaller

10G Cross Connect Market Data Feed Boundaries

Exchange customers will be able to select from three different types of 10G connections:

Table 1. 10G Connections

Type of Connection	Allowed	Blocked
Exchange 10G	All Equities/Options Unicast All Equities Feeds non-full Depth Options feeds for X, Z, and C2	All 5G Options Feeds All 8G Options Feeds
Dedicated 5G Options	All Equities/Options Unicast Order Entry non-full Depth Options feeds for X, Z, and C2 All 5G Options Feeds	All Equities Unicast/Multicast Feeds All 8G Options Feeds
Dedicated 8G Options (Z, X, or C2)	All Equities/Options Unicast Order Entry non-full Depth Options feeds for X, Z, and C2 5G Options Feeds on a per-market basis 8G Options Feeds on a per-market basis	All Equities Unicast/Multicast Feeds 5G/8G Feeds from other Options Markets

Disaster Recovery

Table 1. Disaster Recovery

Cross Connect Data Center & Bandwidth	Equities				Options			
	WAN-Shaped				5G -Shaped			
	BZX	BYX	EDGA	EDGX	BZX	EDGX	C2	C1
Chicago 10G	✓	✓	✓	✓	✓	✓	✓	✓
Chicago 1G*	✓	✓	✓	✓				

*1G connections can only subscribe to non-full-depth of book C1 market data products shaped 1G and smaller.

TCP PITCH

Refer to the [Cboe Titanium U.S. Equities TCP Depth of Book \(PITCH\) Specification](#) for complete details.

TOP

The Cboe TOP feed offers up to 66% reduction in events and 84% reduction in bandwidth compared to the Cboe PITCH market data feed. Refer to the [Cboe Titanium U.S. Equities TOP Specification](#) for complete details.

Last Sale

The Last Sale feed is ideal for market data distributors. It is a real-time, intraday TCP feed that disseminates matched trade price, volume, and execution time from the Cboe Exchange order book. Users only need 2Mb of bandwidth to take this extremely efficient feed in real-time. Refer to the [Cboe Titanium U.S. Equities Last Sale Specification](#) for complete details.

FIX Order Entry

Bandwidth recommended for submitting orders via FIX depends on expected customer order volume. If a customer intends to submit orders to Cboe and will not receive market data, then it is possible that the customer can connect with less than a T1 equivalent connection. The following table shows the maximum number of inbound orders (and/or cancels) per second that can be handled, with no buffering or delay, with different capacity connections.

Table 1. Example Connection Rates

Order Protocol	256Kb	512Kb	1.5Mb
FIX	75/sec.	150/sec.	450/sec.

Telecommunications Providers

Some telecommunications providers available within the Secaucus and Chicago data centers/PoPs are listed below. This list is a summary and is not indicative of Cboe's preference or recommendation. For telecommunications providers not included on the list, please contact the Cboe NOC to discuss.

Extranet Providers

Cboe partners with several extranet providers to aggregate customer connectivity and provide low cost, value-added B2B services such as multicast market data feeds. Extranet providers are required to sign Telecommunications Service Provider Agreement after meeting the requirements outlined in the [Cboe Titanium U.S. Extranet Manual](#).

Cboe Approved Extranet Providers

Table 1. Extranet Providers

Company	Contact	Phone	Multicast Feeds *	Data Center(s)
BT Radianz www.btradianz.com	Gregory Knopp Gregory.Knopp@bt.com	US: (212) 205-1849		Secaucus Chicago
CenturyLink www.centurylink.com/technology	Danielle Durkin gems@centurylink.com	US: (973) 650-1107	Z, Y, O, A, X, C	Chicago
IPC Systems, Inc. www.ipc.com	John Tarantino john.tarantino@ipc.com	US: (212) 709-1099	Z, Y, A, X	Secaucus Chicago
ICE Data Services - Connectivity www.iceglobalnetwork.com	Connectivity Sales iceglobalnetwork-info@theice.com	US: (770) 661-0010 EU: +44 207 429 4610 APAC: +613 9249 2093	Z, Y, O, A, X, C	Secaucus Chicago
Options Technology www.options-it.com	sales@options-it.com	+1 (646) 205-2555	Z, Y, A, X, C, O	Secaucus Chicago
Pico www.pico.net	Sales sales@pico.net	US: (646) 701-6120	Z, Y, A, X, C, O	Secaucus Chicago
TNSi www.tnsi.com	Rick Gilbody, Global Head of Sales, Financial Markets rgilbody@tnsi.com	US: (347) 276-2935	Z, Y, O, C	Secaucus Chicago

* Z = BZX Equities, Y = BYX Equities, A = EDGA Equities, X = EDGX Equities, C = C1 Options, O = BZX Options, EDGX Options, or C2 Options

Carriers

Telecom carriers provide a dedicated circuit between customers in different data centers to a demarcation point in the Secaucus or Chicago data centers/PoPs. The circuit is extended from the demarc to a Cboe's network device.

It is recommended that customers use redundant connectivity via multiple telecommunications providers to each of the Cboe data centers.

Contact the Cboe NOC for information about circuit ordering details (e.g. NPA-NXX, LOA/CFA requirements, demarcation information, etc.).

Table 1. Carriers

Company	Contact	Phone	Data Center
Anova Technologies www.anova-tech.com	Heather Cannon hcannon@anova-tech.com	(312) 540-9594 x1113	Chicago
AT&T www.business.att.com	Dale Rife wr7024@att.com	(816) 275-2335	Secaucus
Hibernia Atlantic www.hiberniaatlantic.com	Hibernia Sales sales@hibernianetworks.com	(908) 516-4200 (888) 774-8080	Chicago
Hudson Fiber www.hudsonfiber.com	Thomas Kennedy tkennedy@hudsonfiber.com	(201) 820-8206	Secaucus
Level(3) Communications www.level3.com	William Simmons william.simmons@level3.com	(913) 909-9009	Secaucus Chicago
Lighttower Fiber Networks www.lighttower.com	Christopher J. Schook cschook@lighttower.com Jeffrey Mollica jmollica@lighttower.com	(631) 974-4307 (516) 375-6808	Secaucus
NexGen Networks	Jeffrey Barth jeffrey.barth@nexgen-net.com	(800) 310-2501	Chicago
Optimum LightPath www.optimumlightpath.com	Colleen M. Capen ccapen@optimumlightpath.com	(201) 644-9610	Secaucus
Perseus www.perseus.co	Tony Gerace agerace@perseus.co	(347) 325-9416	Secaucus Chicago
Sidera Networks www.sidera.net	Stephen Papa stephen.papa@sidera.net	(212) 324-5033	Chicago
Spread Networks, LLC	Spread Network Sales sales@spreadnetworks.com	(646) 837-0330	Chicago
Verizon Financial Network www.verizonbusiness.com/solutions/financial-services/insights/financial-services-network.xml	Verizon Financial Network Sales insales@vfnetworks.com	(800) 825-9196	Secaucus Chicago
XO Communications www.xo.com	Robert Bye robert.g.bye@xo.com	(630) 544-8512	Secaucus Chicago
Zayo Fiber Solutions/AboveNet www.abovenet.com	Travis Brown tbrown@above.net	(212) 803-5597	Secaucus Chicago

Support

Please direct questions or comments regarding this manual to noc@cboe.com (+1 913.815.7005). Cboe NOC is a one-call shop supporting U.S. customer and telecommunications providers during initial setup and continuing support of all connectivity issues.

- Core phone support hours: 7:00 a.m. - 11:00 p.m. ET Monday - Friday
- Outside of core support hours, to report a network issue that must be addressed prior to market open, leave a voicemail with the firm name, contact number, and the nature of the issue.
- For non-critical issues or for information, please email NOC and your request will be responded to the next business day.

Revision History

Document Version	Date	Description
7.0.0	04/04/14	Initial version of Manual supporting Cboe/Direct Edge integration changes.
8.0.0	02/21/15	Post-Direct Edge migration changes.
8.1.0	03/16/15	Added bandwidth statistics for EDGA/EDGX.
8.2.0	04/16/15	BZX Options move from NJ2 to NY5. Updated extranet contacts.
8.2.1	04/21/15	Update name change for Cboe Options Exchange to BZX Options Exchange.
8.3.0	05/04/15	Migration of BZX/BYX Exchanges to Secaucus, NJ.
8.3.1	05/07/15	Added to Approved Extranets table.
8.3.2	06/10/15	Updated Statistics Tables.
8.3.3	09/01/15	Updated Statistics Tables.
8.3.4	10/22/15	Updated Carrier Table.
8.3.5	12/03/15	Updated Statistics Tables.
8.4.0	12/07/15	Added section Feed Availability Matrix section 4.1.2.
8.5.0	02/19/16	Cboe branding/logo changes.
8.5.1	03/02/16	Updated Statistics Tables.
8.5.2	06/22/16	Updated Statistics Tables.
8.5.3	08/23/16	Updated Carrier Table.
8.5.4	09/01/16	Updated Statistics Tables.
8.5.5	09/23/16	Updated Carrier Table.
8.5.6	12/01/16	Updated Statistics Tables.
8.5.7	03/01/17	Updated Statistics Tables.
8.5.8	04/24/17	Updated Extranet Table.
8.5.9	06/01/17	Updated Statistics Tables.
8.5.10	08/01/17	Update Statistics Tables.
9.0.0	09/01/17	Added Cboe C2 connectivity information.
9.0.1	10/17/17	Cboe branding/logo changes.
9.0.2	01/02/18	Update Statistics Tables.
9.0.3	03/02/18	Update Statistics Tables.
9.0.4	07/02/18	Updated Statistics Tables.
9.0.5	07/30/18	Updated contact information for extranet providers.
9.0.6	08/06/18	Updated Statistics Tables.
9.0.7	08/15/18	Updated Statistics Tables.
9.0.8	10/05/18	Updated contact information for data center providers.
9.1.0	11/08/18	Updated Cyxtera data center identifiers. Added Latency Equalization diagram and link.
9.1.1	12/03/18	Updated Statistics Tables.
9.1.2	01/16/19	Updated Statistics Tables.
9.1.3	04/18/19	Updated Statistics Tables.
9.1.4	07/15/19	Updated contact information for extranet providers.
9.1.5	08/09/19	Updated link to Cboe Fee Schedule.

Document Version	Date	Description
9.1.6	08/13/19	Updated Statistics Tables.
10.0.0	10/07/19	Updated for launch of C1 Options on Bats Tech platform.
10.0.1	01/02/20	Updated Statistics Tables, added C1 statistics.
10.1.0	02/03/20	Added provision for ER Optical Transceivers in NY4/NY5.
10.1.1	03/02/20	Amended Feed Availability Matrix for 1G Shaped Feeds.
10.1.2	04/02/20	Updated Statistics Tables.
10.1.3	07/07/20	Updated Statistics Tables. Added Pico to Extranet Provider Table.
10.1.4	09/01/20	Updated C2 DR location to 350 Cermak.
10.1.5	12/09/20	Updated Statistics Tables.
10.1.6	04/05/21	Updated Statistics Tables.
10.1.7	09/27/21	Updated Statistics Tables. Removed Weehawken ERW2 as a PoP offering.
10.2.0	12/16/21	Updated hyperlink to Fee Schedule. Updated Statistics Tables. Added Cboe Global Cloud section.
10.2.1	09/14/22	Updated Statistics Tables.
10.2.2	01/31/23	Updated Statistics Tables. Fixed links to fee schedules and updated TNSi contact.
10.3.0	06/30/23	Added network diagrams and L3 details. Updated Statistics Tables.
10.3.1	08/14/23	Notice for Customer Access switch replacement.
10.3.2	11/20/23	Added DCS-7050SX3-96YC8 customer access switches.
10.3.3	12/08/23	Updates statistics tables.
10.4.0	12/19/23	Announcement of NY6 PoP (effective 04/01/24).
10.4.1	03/15/24	Provided additional transparency and diagrams for latency equalization.
10.4.2	04/03/24	NY6 available for Equities/Options production.
10.4.3	04/15/24	1G "E" feeds in Secondary Datacenter to be updated to 5G shaping and 1G feeds to be sunset (BZX, C2, and EDGX Only) (effective 06/22/24 06/15/24). 8G feeds added (BZX, C2, and EDGX Only) (effective 07/29/24 07/15/24).
10.4.4	05/01/24	Updated Options 1G sunset date and 1G "E" feed upgrade effective date to 06/22/24. Updated 8G effective date to 07/29/24. Added details about packaging of 5G/8G feeds.
10.4.5	05/31/24	Added two 10G L3 switches to the NY5 customer access layer.
10.4.6	07/12/24	Updated 1G "E" feeds in Secondary Datacenter to 5G shaping, sunset 1G feeds.
10.4.7	07/29/24	Updated Disaster Recovery table and Multicast PITCH Feed Availability Matrix (Equities and Options) for new 8G-shaped PITCH feed availability.
10.4.8	08/09/25	Added Section 3.6 Inbound Bandwidth Limit (effective 08/12/24).
10.4.9	09/09/24	Added new Section 4 for BZX Options 10 Gb L1 launch(effective TBD) 12/09/24 11/04/24.Updated Secaucus, NJ Latency equalization NY5 Expanded View image.
10.4.10	09/12/24	Updated image for BZX Options 10 Gb L1. Removed 90-day minimum for L3 to L1 conversion.
10.4.11	10/07/24	Updated BZX Options 10 Gb L1 launch effective date toTBD 12/09/24 .
10.4.12	11/11/24	Updated BZX Options 10 Gb L1 launch effective date toTBD.
10.4.13	12/04/24	Removed Layer Market Data Distribution section.

Document Version	Date	Description
10.4.14	01/15/25	Updated L3 Data Center Core Layer to 4x100G Port-Channel. Updated with Cboe Titanium branding.
10.4.15	02/20/25	Updated bandwidth and latency statistics in Market Data Feeds .
10.4.16	04/04/25	Updated diagram in L3 Network Overview - C1 Options
10.4.17	04/14/25	Updated the Cboe Market Data Feeds - Historical Highs Bandwidth Statistics table in Market Data Feeds .
10.4.18	05/14/25	Added Request for Physical Port Relocation .
10.4.19	07/25/25	Updated Overview to indicate that the secondary data center will be hosted by Equinix (CH3) in Elk Grove, IL (EDGA only)
10.4.20	08/04/25	Updated Cboe Options Fee Schedule link
10.4.21	08/18/25	Updated Equities/Options L3 Customer Access Layer to indicate that the model numbers will be updated to Arista DCS-7280SR3-48YC8 (effective 10/31/25 through 11/07/25).
10.4.22	08/29/25	Updated Overview to indicate that the secondary data centers for BYX and EDGA will be hosted by Equinix (CH3) in Elk Grove, IL (effective 09/13/25)
10.4.23	09/17/25	Updated TNSi contact information in Cboe Approved Extranet Providers .
10.4.24	10/22/25	Added Options Technology to Cboe Approved Extranet Providers . Updated the Cboe Market Data Feeds - Historical Highs Bandwidth Statistics table in Market Data Feeds .
10.4.25	12/01/25	Updated the L3 Customer Access Layer table with Arista DCS-7280SR3-48YC8 models.
10.4.26	03/17/26	Updated bandwidth statistics in Market Data Feeds .
10.4.27	05/14/26	Updated 10G Cross Connect Market Data Feed Boundaries to clarify order entry on Dedicated 5G Options and Dedicated 8G Options. Updated Overview to include Elk Grove Village (effective June 2026). Updated Connectivity Matrix with CH3 (effective June 2026). Updated Physical Interfaces to include CH3.
10.4.28	07/21/26	Updated bandwidth statistics in Market Data Feeds .