CBOE Financial Network

Network Specification

Version 5.1

April 1, 2011

OVERVIEW

The CBOE Financial Network (CFN) disseminates multicast market data products to trading firms and market data vendors. The products or Data Channels available on the CFN include the Current Quote / Last Sale (CQ/LS) or "top of book" and Book Depth (BD) channels for the OneChicago Exchange (ONE) and for the CBOE Futures Exchange (CFE). The Market Data Indices (MDI) channel is comprised of various CBOE index values that are available through the CBOE subsidiary, Market Data Express (MDX).

A new set of channels called CBOE Streaming Market (CSM) is now exclusively available on the CFN. These channels provide an optimized top of book feed for five exchanges: CBOE, CBSX, CFE, ONE, and C2. C2 is the new all electronic options exchange based in New Jersey. Please note that C2 is a separate exchange from the CBOE hybrid options exchange in Chicago.

NETWORK DESIGN

The CFN uses IP multicast to efficiently and equitably distribute market data to all connected firms simultaneously. Identical copies of the data are sent to different A and B multicast groups that follow diverse network paths so that a single network outage cannot affect both sets of groups. Since there is no provision for retransmitting missed data, firms should read both A and B groups to fill in any gaps.

There are two ways for firms to connect to the CFN:

- Direct Connections
- CBOE approved Extranet Service Providers

Direct Connections

With Direct Connections, firms are responsible for ordering and managing their own WAN circuits and routers to connect to CFN.   For the CBOE, CBSX, CFE and ONE exchanges and MDI the primary and secondary sources for both the A and B groups are located in the CBOE facility in downtown Chicago. Two connections to this facility are required to receive the A and B groups for these channels.

 If the Firm already has Direct Connections in place, these connections can also be leveraged for CFN multicast data with some exceptions. The existing Direct Connections can be used to receive CFN multicast data only for CBSX, CFE and ONE exchanges and MDI. To receive the **CBOE CSM** multicast feed, it is **required** to order an additional pair (A & B) of 1 Gbps Direct Connections to CFN. This is required because of the inherent high traffic volume of CBOE CSM which has the potential to burst to 1Gbps.

In the event of a disaster, A groups only for CBOE, CBSX, CFE, ONE and MDI will be transmitted from CBOE's Disaster Recovery (DR) site in the Savvis CH3 data center. To receive these data channels in a disaster scenario a single connection to this data center is required.

For the C2 exchange, the primary and secondary sources for both the A and B groups are located in the Equinix NY4 data center in Secaucus, NJ. Two connections to this data center are required to receive the A and B groups for these channels. The C2 exchange does not have a DR site. Existing C2 Direct Connections can be also be used to receive C2 CSM multicast data. **C2 data channels are not available from the CBOE Chicago facility and CBOE, CBSX, CFE, ONE and MDI channels are not available from the Equinix NY4 data center.**

Figure 1 shows Direct Connections to CFN in Chicago, DR and C2.
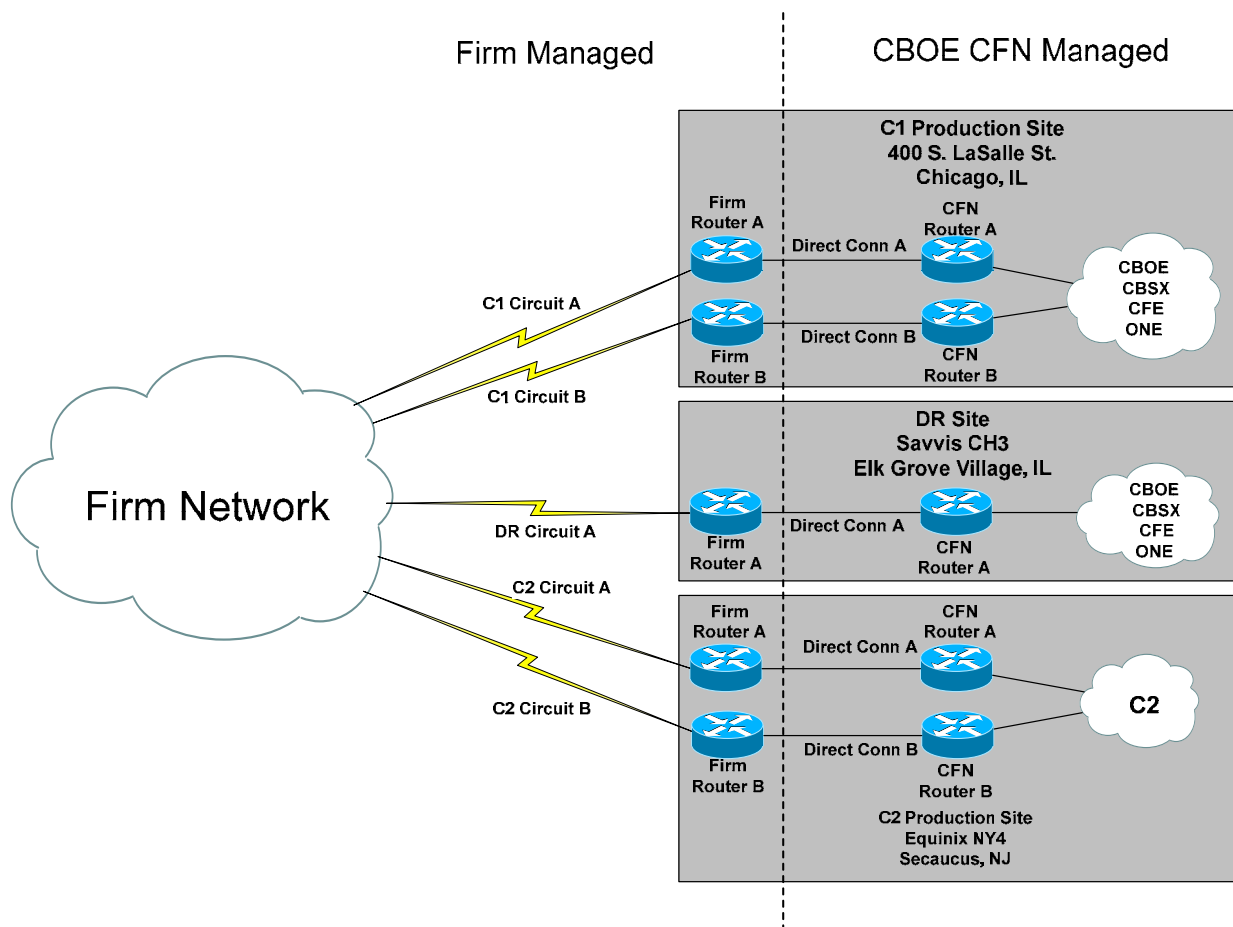

Figure 1: Direct Connections

CBOE approved Extranet Service Providers

The second type of CFN connection is via a CBOE approved Extranet Service Provider. These service providers have been approved by CBOE to transmit CFN data channels across their networks to firms. Firms only need to establish connections to the Extranet to receive the CFN data channels and not to the CBOE sites. Note, not all Extranets carry all CFN data channels or connect to all CBOE sites, e.g. DR or C2. Please check with each Extranet for specifics. A list of CBOE approved Extranets is available at https://systems.cboe.com/Publish/SystemsAPISite/ExtranetServiceProviders.pdf.

Firms must complete the CFN Connection Request form at the end of this document and return it to CBOE at api@cboe.com before ordering the connection through their Extranet Service Provider representative. Extranets will not be given the approval to send CFN data channels to a firm until this form has been received by CBOE. Firms will be billed by CBOE for the data and by the Extranet Service Provider for the connectivity. For redundancy, the Firm must have two connections to the Extranet network for the A and B groups.

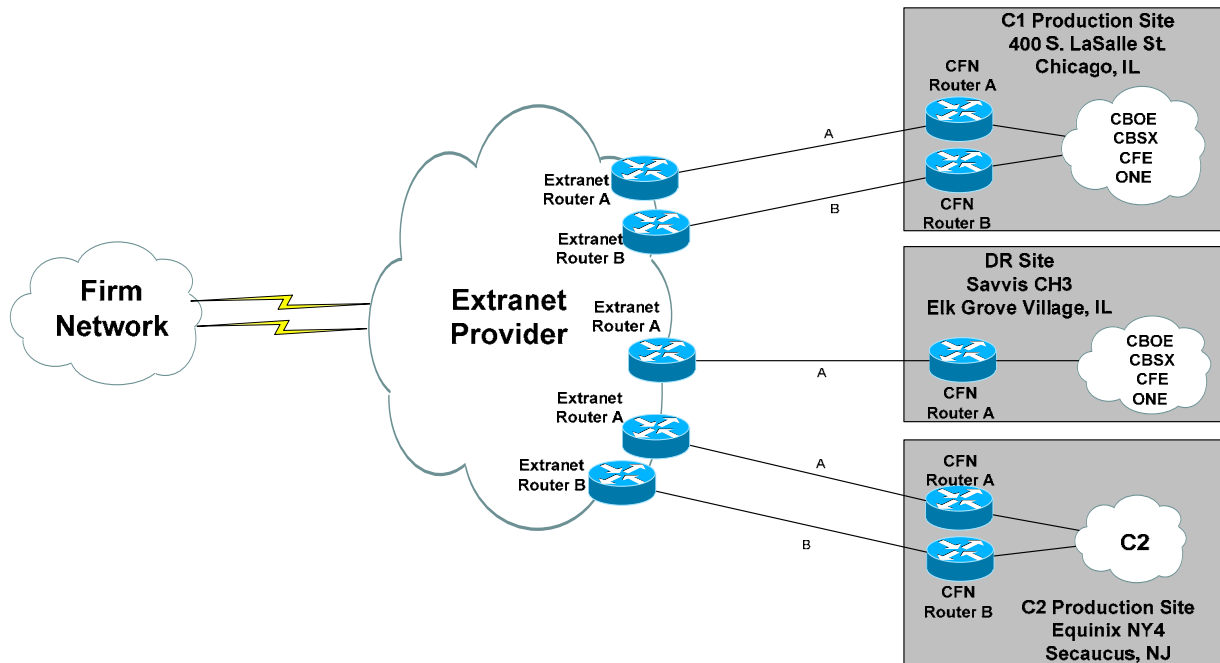Figure 2 shows a sample Extranet Service Provider.

Figure 2: Extranet Service Provider Connection

DATA CHANNEL INFORMATION - PRODUCTION

For each Data Channel, shown in Table 1 below, identical data is transmitted to two sets of multicast groups – A groups and B groups, with unique multicast group IP addresses and UDP port numbers. Bandwidth for each Data Channel is based on historical peak utilization and future growth.

CFE and ONE Current Quote / Last Sale (CQ/LS)

The CFE and ONE CQ/LS data channels use one multicast group each.

CFE and ONE Book Depth (BD)

The CFE and ONE BD data channels use three multicast groups each. Products are distributed across the three groups alphabetically:

A-E - Multicast Group One
F-N - Multicast Group Two
O-Z - Multicast Group Three

Market Data Indices (MDI)

The MDI data channel uses one multicast group.

CBOE Streaming Market (CSM)

To achieve the lowest possible latency, CSM channels will not be buffered. This means that each CSM group can burst up to 1 Gbps for brief periods. The duration of these microbursts will vary from one CSM channel to another. The bandwidth given in Table 1 is the average rate for peak 1 ms intervals.

Due to the bandwidth of the CBOE CSM channel in particular and the nature of multicast traffic, it is strongly recommended that CBOE CSM not share the same circuits with unicast traffic flows if the circuit bandwidth is 1 Gbps or less.

CSM data channels for CBOE and C2 are spread across multiple multicast group addresses. Some groups are used for market data updates. One group in each CSM channel is used for sending security definitions. A few channels have groups reserved for future use. Please reference **Table 1A & 1B** for more details.

Table 1A: Data Channel Info for CBOE, CBSX, CFE, ONE and MDI

Data Channel	Bandwidth	A Groups Multicast IP Address	UDP Port	B Groups Multicast IP Address	UDP Port	Description
ONE CQ/LS	15 Mbps	233.65.120.1	52101	233.65.120.2	52102	CQ/LS
ONE BD	50 Mbps	233.65.120.3	52103	233.65.120.4	52104	BD 1
		233.65.120.5	52105	233.65.120.6	52106	BD 2
		233.65.120.7	52107	233.65.120.8	52108	BD 3
CFE CQ/LS	10 Mbps	233.65.120.16	52116	233.65.120.17	52117	CQ/LS
CFE BD	10 Mbps	233.65.120.18	52118	233.65.120.19	52119	BD 1
		233.65.120.20	52120	233.65.120.21	52121	BD 2
		233.65.120.22	52122	233.65.120.23	52123	BD 3
MDI	1 Mbps	233.65.120.32	52132	233.65.120.33	52133	MDI
CBOE CSM Standard	800 Mbps	233.65.120.96	64900	233.65.120.112	64932	Prod 1
		233.65.120.97	64901	233.65.120.113	64933	Prod 2
		233.65.120.98	64902	233.65.120.114	64934	Prod 3
		233.65.120.99	64903	233.65.120.115	64935	Prod 4
		233.65.120.100	64904	233.65.120.116	64936	Prod 5
		233.65.120.101	64905	233.65.120.117	64937	Prod 6
		233.65.120.102	64906	233.65.120.118	64938	Prod 7
		233.65.120.103	64907	233.65.120.119	64939	Prod 8
		233.65.120.104	64908	233.65.120.120	64940	Prod 9
		233.65.120.105	64909	233.65.120.121	64941	Prod 10
		233.65.120.106	64910	233.65.120.122	64942	*Reserved*
		233.65.120.107	64911	233.65.120.123	64943	*Reserved*
		233.65.120.108	64912	233.65.120.124	64944	*Reserved*
		233.65.120.109	64913	233.65.120.125	64945	*Reserved*
		233.65.120.110	64914	233.65.120.126	64946	*Reserved*
		233.65.120.111	64916	233.65.120.127	64948	Security Definitions
CBOE CSM Strategy	190 Mbps	233.65.120.144	64950	233.65.120.146	64954	Prod 1
		233.65.120.145	64952	233.65.120.147	64956	Security Definitions
CFE CSM Standard	40 Mbps	233.65.120.136	64860	233.65.120.138	64862	Prod 1
		233.65.120.137	64864	233.65.120.139	64866	Security Definitions
CFE CSM Strategy	10 Mbps	233.65.120.152	64966	233.65.120.154	64970	Prod 1
		233.65.120.153	64968	233.65.120.155	64972	Security Definitions
ONE CSM Standard	200 Mbps	233.65.120.128	64848	233.65.120.132	64852	Prod 1
		233.65.120.129	64849	233.65.120.133	64853	Prod 2
		233.65.120.130	64850	233.65.120.134	64854	*Reserved*
		233.65.120.131	64856	233.65.120.135	64858	Security Definitions
ONE CSM Strategy	130 Mbps	233.65.120.148	64958	233.65.120.150	64962	Prod 1
		233.65.120.149	64960	233.65.120.151	64964	Security Definitions
CBSX CSM	150 Mbps	233.65.120.140	64868	233.65.120.142	64870	Prod 1
		233.65.120.141	64872	233.65.120.143	64874	Security Definitions

Table 1B: Data Channel Information for C2

Data Channel	Bandwidth Allocation	A Groups		B Groups	
		Multicast IP Address	UDP Port	Multicast IP Address	UDP Port
C2 CSM	640 Mbps	233.103.126.16	64900	233.103.126.144	64932
		233.103.126.17	64901	233.103.126.145	64933
		233.103.126.18	64902	233.103.126.146	64934
		233.103.126.19	64903	233.103.126.147	64935
		233.103.126.20	64904	233.103.126.148	64936
		233.103.126.21	64905	233.103.126.149	64937
		233.103.126.22	64906	233.103.126.150	64938
		233.103.126.23	64907	233.103.126.151	64939
		233.103.126.24	64908	233.103.126.152	64940
		233.103.126.25	64909	233.103.126.153	64941
		233.103.126.26	64910	233.103.126.154	64942
		233.103.126.27	64911	233.103.126.155	64943
		233.103.126.28	64912	233.103.126.156	64944
		233.103.126.29	64913	233.103.126.157	64945
		233.103.126.30	64914	233.103.126.158	64946
		233.103.126.31	64916	233.103.126.159	64948

NETWORK CONFIGURATION - PRODUCTION

Direct Connections require the use of PIM Sparse Mode with static Rendezvous points (RPs). Firms will need routes to the appropriate multicast source networks and RPs listed in **Table 2**. These routes can either be configured statically or CBOE can send them via BGP. Configurations with Extranet Service Provider may be different.

CERTIFICATION AND TESTING

There is a CFN environment to test and certify CSM channels only. At this time there is no certification environment for the other data channels. Firms may listen to production CSM traffic via production connectivity or via after hours replay. Multicast traffic from the certification environment is also available through a GRE tunnel in a VPN connection. Note, the VPN for CFN testing is different from the VPN used for testing CBOE unicast APIs. **Appendix 1** contains information on the VPN setup and a sample configuration for a Cisco router. Certification data channel and multicast information is listed in **Table 3.**

Table 2: Multicast Configuration Information

Data Channel	Group A		Group B	
	Source Network	Rendezvous Point	Source Network	Rendezvous Point
CSM for CBOE, CFE, ONE, CBSX Standard/Strategy	170.137.1.128/26	170.137.255.124	170.137.9.128/26	170.137.255.125
CFE/ONE CQ/LS	170.137.92.0/24 170.137.100.0/28	170.137.255.97	170.137.91.0/24	170.137.255.98/32
CFE/ONE BD	170.137.13.96/28	170.137.255.97	170.137.13.112/28	170.137.255.98/32
MDI	170.137.13.96/28 170.137.100.0/28	170.137.255.97	170.137.13.112/28	170.137.255.98/32
CSM for C2	170.137.128.0/26	170.137.128.253	170.137.128.64/26	170.137.128.254

Table 3: Certification Environment Information

Test/Cert Data	Mcast Address	UDP Port Range	Source Network	RP
CSM API Test	233.65.120.241 233.65.120.243 233.65.120.245	64800 - 64999	170.137.253.0/24	170.137.255.14

DATA FORMATS

The CFN does not process the market data or modify the data formats in any way. For information on the specific data formats please reference the CFN documentation site, https://systems.cboe.com/Auth/CFN.aspx

CONTACT INFORMATION

To report a problem on an existing CFN connection, please call the CBOE Operations Department at 312-786-7642.

For all other inquiries, please send an email to api@cboe.com.

CFN Production Connection Request

General Information & Data Channel Selections

Requester billing info:

Firm Name: _____

Address: _____

City: _____

State: _____

Zip Code: _____

Country: _____

Firm Contact: _____

Telephone: _____

E-Mail Address: _____

Requestor Contact (if different from above):

Name: _____

Title: _____

Telephone: _____

Cell Phone/Pager: _____

E-Mail Address: _____

_____ Initial here if you approve the applicable fees for this service. Note, service will not be activated if this is not initialed.

CFN Production Connection Request (continued)

Data Channels (Add_____ Delete _____)

_____ CFE CQ/LS (inc. COF)   _____ CFE CSM Standard
_____ CFE BD   _____ CFE CSM Strategy
_____ ONE CQ/LS   _____ ONE CSM Standard
_____ ONE BD   _____ ONE CSM Strategy
_____ MDI   _____ CBSX CSM
_____ CBOE CSM Standard   _____ C2 CSM
_____ CBOE CSM Strategy

Connection type

_____ Use existing Direct Connection (for all CSM data channels except for CBOE)

_____ New Direct Connection – Please contact api@cboe.com
    * For CBOE CSM, additional 1 Gbps Direct Connection is required*

_____ Use Extranet Provider – (Please specify) _____

CFN Certification Environment Access Request

Firm Name: _____

Address: _____

City/State/Zip: _____

Country: _____

Contact Name: _____

Title: _____

Telephone: _____

E-Mail Address: _____

VPN Info:

Peer IP Address: _____

Device Type: _____

Contact Name: _____

Title: _____

Telephone: _____

E-Mail Address: _____

Please complete this form and send to api@cboe.com.

Appendix 1
CFN VPN Connectivity Guide

This guide details how to setup an IPSec VPN tunnel with CFN in order to receive multicast data for testing and certification purposes. Please complete the CFN Certification Environment Access Request form and submit to api@cboe.com.

For ISAKMP, please use:
• 3DES for key encryption
• a hash algorithm of MD5 for data integrity
• Diffie-Hellman group 2
• An SA lifetime of 86,400 seconds with no volume limit (Cisco default)
• a preshared key of (a preshared key assigned by CBOE technical staff)
• aggressive mode turned off (Cisco default)

For IPSEC, please use:
• ESP-3DES for encryption and data integrity
• a hash algorithm of ESP-MD5 for data integrity
• no compression method (Cisco default)
• a lifetime of 3600 seconds with a volume limit of 4,608,000 kilobytes (Cisco default)
The VPN Peer address for the CBOE is **198.160.148.45**

The CBOE will configure this connection during the next available maintenance window: After network connectivity has been established, please contact the API Group at CBOE for certification assistance.

API Group can be contacted as follows:
Phone: 312-786-7300
Email: api@cboe.com

Customer Cisco Router Configuration – Sample

ip multicast-routing
crypto isakmp policy 2
encr 3des
hash md5
group 2
authentication pre-share
crypto isakmp key **(assigned by CBOE separately)** address **198.160.148.45**
!
crypto ipsec transform-set cboevpn esp-3des esp-md5-hmac
!
crypto map cboevpn 1 ipsec-isakmp
set peer **198.160.148.45**
set transform-set cboevpn
match address 100
!
interface Loopback0
ip address **x.x.x.x** 255.255.255.255 **(assigned by CBOE)**
!
interface Tunnel0
ip address **x.x.x.x** 255.255.255.252 **(assigned by CBOE)**
ip pim sparse-mode (required for CSM access)
tunnel source **x.x.x.x (assigned by CBOE)**
tunnel destination **10.239.4.1 (CBOE source)**
!
interface fa0/0
ip address **(IP/Subnet mask of internal network)**
ip pim sparse-mode (required for CSM access)
duplex auto
speed auto
no cdp enable
!
interface fa0/1
ip address **(firm outside public IP)**
crypto map cboevpn
!
ip route 170.137.255.14 255.255.255.255 (CBOE RP) Tunnel0
ip route 170.137.253.114 255.255.255.255 (CBOE CSM source) Tunnel0
ip route 170.137.253.116 255.255.255.255 (CBOE CSM source) Tunnel0
!
ip classless
no ip http server
no ip http secure-server
ip pim rp-address 170.137.255.14 CSM-GROUPS override #(required for CSM access)

access-list 100 permit gre host x.x.x.x (Loop0 IP) host 10.239.4.1 #(required for CSM access)

ip access-list standard CSM-GROUPS
 permit 233.65.120.240 0.0.0.15

**Please make sure to allow CBOE vpn address 198.160.148.45 in from the internet for isakmp and esp ports.