Optimise™

Member Connectivity Guide

Version: 2.2.5

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Abstract
This document outlines the connectivity options for ISE's data centers.

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Tables

1. Introduction

This document provides market participants with the information needed to connect to ISE's two data centers. The data centers listed below house ISE Option and Gemini trading system.

1.1 Data Centers

Market participants connect to the ISE Option & Gemini trading system through ISE's data centers:

Table 1: ISE Data Centers

Equinix NY4 (Primary Data Center)	Telx (Backup Data Center)
755 Secaucus Road Secaucus, NJ 07094 NPA/NXX:201/422	100 Delawanna Avenue Clifton, NJ 07014 NPA/NXX:973/279

2. System Interfaces & Bandwidth Requirements

2.1 System Interfaces

The ISE offers three trading interfaces as well as a market data interface to participants:

1. Direct Trading Interface (DTI): A binary interface that allows direct access to the trading system.
    i. The *Premium Access* DTI allows a lower latency connection to the trading system. See Section 4.3: *Premium Access* Connectivity on page 10 for more details.
2. FIX Interface (IORS): Standard, FIX ver. 4.2 messaging interface.
3. PrecISE Trade®: ISE's proprietary trader workstation.
4. Market Data Interface (MDI): UDP multicast interface for the dissemination of ISE market data and reference data to participants.

NOTE: ISE does not redistribute OPRA data.

2.2 Bandwidth Requirements — Member Test

Bandwidth requirements for connectivity to the member test systems are lower than for the production system.

Table 2: Bandwidth Requirements — Member Test

Interface	Bandwidth Requirements – Simulation
DTI	20 Mbps in total (max.)
FIX	
PrecISE	
MDI	

2.3 Bandwidth Requirements — Production

Bandwidth requirements for connectivity to the production systems are dependent upon the interface the participants use to access the trading system.

2.3.1 Unicast

Table 3: Unicast Bandwidth Requirements — Production

Interface	Bandwidth Requirements ISE Production	Bandwidth Requirements Gemini Production
DTI	50 Mbps minimum requirements outbound (Market Participant to ISE).	50 Mbps minimum requirements outbound (Market Participant to ISE).
FIX	56 Kbps minimum requirements – ISE recommends a 1 Mbps connection.	56 Kbps minimum requirements – ISE recommends a 1 Mbps connection.

Interface	Bandwidth Requirements ISE Production	Bandwidth Requirements Gemini Production
PrecISE	56 Kbps minimum requirements – ISE recommends a 1 Mbps connection.	56 Kbps minimum requirements – ISE recommends a 1 Mbps connection.
MDI	775 Mbps subscription to all market data feeds inbound (ISE to Market Participant).An aggregate of 775Mbps per stream, A/B combined= 1.5 Gb.	775 Mbps subscription to all market data feeds inbound (ISE to Market Participant).An aggregate of 775Mbps per stream, A/B combined= 1.5 Gb.

Participants who receive multicast market data should subscribe to both A and B multicast groups ("live-live" concept). If a participant has only one line to the ISE data center(s), it must be sized to receive both streams for the ISE and Gemini exchanges in parallel if participating in both markets. Participants having two lines can distribute the A group via the primary line and the B via the secondary line. The above bandwidth recommendations for the MDI are based on current and historic market levels and are only estimates.

An example of a participant requesting depth and access to the DTI:

If the participant has two lines in parallel, each should be sized 1.5 Gbps to receive the market data from both exchanges. The DTI bandwidth of 100 Mbps will not be added, as one dataflow is inbound and the other outbound (full duplex).

If the participant has only one line and wants to receive both A and B group market data, the line must have a bandwidth of 3.0 GB.

2.3.2 Multicast

Table 4: Multicast Bandwidth Requirements — Production

Feed	ISE Options Requirements		ISE Gemini Requirements	
	A Stream	B Stream	A Stream	B Stream
Top Quote Feed	200 Mb		200 Mb	
Depth of Market Feed	500 Mb		500 Mb	
Order Feed	5Mb		5Mb	
Pre-Open Feed	10Mb		10Mb	
Reference Data	30Mb		30Mb	
Spread Feed	25Mb		25Mb	
Trade Feed	5Mb		5Mb	

Note: There is no primary stream as the same server sends both A and B feeds. Members must also calculate total bandwidth if participating in both exchanges.

2.4 Recommended Connectivity

The ISE recommends the following circuit configuration for optimal redundancy based upon membership type:

Table 5: Recommended Connectivity

Market Participant Type	Connection to Primary Data Center (Equinix)	Connection to Backup Data Center (Telx)
Primary Market Makers (PMM) **(Required)**	2 Metro Ethernets or 2 cross connects	1 Metro Ethernet or 1 cross connect
Competitive Market Makers (CMM) in all 10 bins **(Required)**	2 Metro Ethernets or 2 cross connects	1 Metro Ethernet or 1 cross connect
Competitive Market Makers (CMM)	1 Metro Ethernet or 1 cross connect	1 Metro Ethernet or 1 cross connect
Electronic Access Members (EAM)	1 Metro Ethernet or 1 cross connect	1 Metro Ethernet or 1 cross connect
Service Bureau	1 Metro Ethernet or 1 cross connect	1 Metro Ethernet or 1 cross connect

2.5 Minimum Connectivity

The ISE's minimum requirements for connectivity based on market participant type are shown below:

Table 6: Minimum Connectivity

Market Participant Type	Connection to Primary Data Center (Equinix)	Connection to Backup Data Center (Telx)
Primary Market Makers (PMM)	2 Metro Ethernets or 2 cross connects	1 Metro Ethernet, 1 cross connect or 1 extranet connection
Competitive Market Makers (CMM) in all 10 bins	2 Metro Ethernets or 2 cross connects	1 Metro Ethernet, 1 cross connect or 1 extranet connection
Competitive Market Makers (CMM)	1 Metro Ethernet, 1 cross connect or 1 extranet connection	N/A
Electronic Access Members (EAM)	1 connection of any type	N/A
Service Bureau	1 connection of any type	N/A

3. Service Catalog

3.1 Connectivity Options

ISE offers the following connectivity choices in its data centers:

Table 7: ISE Connectivity Options

<table>
<tr><th>Connectivity Option</th><th>Description</th></tr>
<tr><td>Metro Ethernet</td><td>A wide variety of carriers are available at the Equinix and Telx data centers. Participants are required to arrange circuit procurement Member may procure single or redundant cross-connects in both the Equinix and Telx Datacenters.</td></tr>
<tr><td>Extranet</td><td>Extranet services providers can be used to establish connectivity. Please see below a table of supported providers and their ability to provide connectivity via ISE's data centers and also availability of market data multicast.
<table>
<tr><th>Extranet Providers:</th><th>Equinix</th><th>Telx</th><th>Market Data</th></tr>
<tr><td>BT Radianz</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>Guavatech</td><td>Yes</td><td>Yes</td><td>No</td></tr>
<tr><td>Savvis</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>SFTI</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>TNS</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td>IPC Systems</td><td>Yes</td><td>Yes</td><td>No</td></tr>
</table></td></tr>
<tr><td>IPSEC/GRE VPN</td><td>A secured connection (3DES or AES Encryption) is available through the internet to both data centers for unicast applications. ISE also offers a GRE tunnel for multicast in the test environment only. Production multicast data will not be offered over VPN due to scalability limitations.

NOTE: PrecISE trade is not available over VPN but available via the Internet.
Fix is not available via the Internet but available via VPN or Direct Connectivity</td></tr>
<tr><td>Colocation</td><td>The lowest latency connection to the trading system is through cross-connects in the primary and backup data centers. Please see Section 3.2 Colocation below for more information.</td></tr>
</table>

3.2 Colocation

ISE has reserved cabinets at Equinix which is referred to as the ISE Shared Member Cage for participants requiring six or less cabinets that are distributed on a first come, first served basis. Any participant requiring more than six cabinets must locate in a private space within the data center.

At the Telx data center, ISE has reserved shared cabinets, which are distributed on a first-come, first-served basis. Telx will offer a minimum of one rack for those participants who want to collocate at Telx.

All colocation services are contractual services between the participant and the data center provider.

NOTE: Equinix/Telx will charge the participant a monthly cross-connect fee per cross connect run to the ISE cage as well as a onetime installation fee This is in addition to the ISE port fee charges, which can be found in the OptimISE fee schedule.

Participants' network equipment does not reside in the ISE data center space. It can only be placed in the reserved colocation services areas, or the participant's private cage. Up to 10G cross-connects are available within the colocation as either Single Mode or Multimode handoffs based upon the distance between the participant's cage and the ISE data center space.

NOTE: ISE will offer a maximum of two cross-connects at Equinix, and one cross-connect at Telx for collocated participants. **Some connection options may incur an additional cost**.

In addition to the direct connections previously mentioned, participants can access the trading system through service bureaus or by using PrecISE Trade over the internet. When using these options, no further actions need to be taken.

3.3 Unsupported Connectivity

The ISE does not offer the following services to participants:

- ISE-owned circuits.
  - Members are required to order their own circuits if not providing cross-connects (colo)
- TDM-based circuits.
  - T1,T3, and traditional copper connections (56K, 64K, or Frame-Relay) are not accepted in either data center
- Field hardware (i.e. participant cabinet and router management).
  - ISE does not deploy any equipment for members. We interface directly with members' hardware via BGP/Static configuration.

4. Production Connectivity Access

4.1 Ordering New Connections

Based on the participant's requirements, one or more of the following forms will need to be completed:

- Member Change Request (for all new Metro Ethernet, Extranet, or Cross-connect connections).
- VPN Survey (for all new VPN through internet connections).

ISE will issue Letters of Authorization (LOAs) to members who are colocating in Equinix or Telx. For those members who will be dropping a carrier circuit (for example Sidera or Reliance Globalcom), ISE will issue the LOA to the carrier. Participants are required to inquire with their provider before placing the order that the provider will extend the circuit from their demarc to the ISE cage (a.k.a. the last mile extension). The carrier will not be able to do the physical extension — this will be completed by Equinix — but it must be specified on the order that the ordering party is requesting the full extension.

A network certification test with network staff from both the Market Participant and ISE will be arranged for every new connection. Certification testing must be passed prior to using the connection.

4.2 Dedicated Gateways

The ISE's Dedicated *Gateway* offering allows members to have a pair of gateways that are not part of the shared gateway pool. A pair of gateways can support up to 200 sessions.

Some of the benefits for members include:

- Gateway pairs are assigned for member's exclusive use — no other members use those gateways
- Member's broadcasts are segregated from other members' broadcasts, reducing overall broadcast latency.

The new service is available to all DTI customers.

Dedicated Gateways require changes to your firm's network connectivity and network certification.

NOTE: Dedicated Gateways are only available in Equinix, not Telx

4.3 Premium Access Connectivity

ISE's *Premium Access* utilizes high-speed network switches and cards and removes the load-balancer network hop to the DTI/MDI interfaces. This service provides a significant latency performance improvement. The latency savings is estimated to be up to 150µs for DTI and up to 10µs for MDI interfaces.

Table 8: Premium Access Technical Details

PREMIUM ACCESS OFFERING
Cutting Edge Juniper QFX3500 Switches & Solarflare NICs
Fiber channels between switch and gateways.
Only 10Gb cross-connections supported. (Equinix Data Center Only)
DTI sessions connect directly to the DTI Gateways (Dedicated or Shared) using a two-step application connection protocol.
No Load Balancer

- Network access via single mode or multi-mode fiber (50µm Micron).
- New configurations required to establish BGP sessions to new Juniper Switches.

NOTE: See the Production Unicast IP addresses in **Section 5.7.1: Unicast IP Addresses and Ports** on **page 13** for details about Premium Access IP addresses.

5. Technical Details

5.1 Multicast

The multicast data feed is disseminated in parallel over two streams (A and B), originating from a single source. This concept is relevant in IP multicasting using the unreliable UDP protocol, as it increases the probability of receiving data from at least one of the two sources.

The Market Data Interface (MDI) provides both FAST encoded, and raw binary multicast data streams. Participants can subscribe to these and receive logically grouped data by joining specific multicast channels (IP addresses). The multicast groups are provided to each participant based on their individual entitlements. Entitlements are implemented using IGMP static joins for the specific groups that a participant is entitled to on the ISE WAN routers. ISE supports Shared PIM or Static IP IGMP. Static IGMP joins for the required multicast groups must be configured on the participant routers in order to receive the required channels.

NOTE: FAST is an acronym for the **F**IX **A**dapted for **ST**reaming technical standard.

5.2 Address Space

ISE will only accept registered IP space given by participants and extranet providers. If this is not possible, ISE will assign RFC 1918 space to participants to source their traffic.

5.3 Routing Protocols

A dynamic routing protocol is required to automate failover of a participant's circuits or connections. ISE standardizes on BGP. ISE will only peer with the Autonomous System (AS) domain or a private address space assigned by ISE.

The following protocols are used for ISE/Participant connections:

- EBGP is used to send/receive route information between the ISE WAN router and the participant routers.
- IBGP neighboring is recommended between the participant routers.
- (Optional) Bidirectional Forwarding Detection (BFD) to provide fast forwarding path failure detection and subsequent fast convergence times on the EBGP links to the participants. (Requires specific Cisco hardware and software revisions [at additional cost]).

5.4 Hardware Requirements (Routers)

Participants connecting to the Equinix and Telx data centers should utilize Customer Premises Routers (CPR) with the following minimum requirements:

1. 10/100/1000 Mbps or 10 GB Ethernet port speed for link connections.
2. EBGP and IBGP routing protocol compatible with Cisco 65xx and current Cisco IOS code
3. Multicast routing participant hardware must be capable of running Layer 3 multicast/PIM.

5.5 Hardware Responsibilities

Participants are responsible for the procurement of their own hardware and connectivity to the trading system. They are also responsible for managing their network equipment and terminating the Metro Ethernet circuits at their facilities or cross connects from the colocation areas in Equinix and Telx.

5.6 IP Addresses for Member Test

The following IP subnet and sources are needed to configure access the member test environment(s). For specific Unicast and Multicast channel details please see the *Simulation Guide,* available on the member's web site https://members.ise.com.

Interface	Envt	Subnet	Notes
DTI/FIX/PrecISE	MT1/MT2	207.231.198.0/27	MT1/MT2 DTI/Fix/PrecISE Segment
Premium Access DTI	MT1/MT2	207.231.198.32/28	Premium Access DTI Segment
MDI A Feed 224.0.75.0/26	MT1/MT2	207.231.198.64/26	RP -207.231.198.248/32-Equinix & Telx
MDI B Feed 224.0.75.64/26	MT1/MT2	207.231.198.64/26	RP -207.231.198.248/32 Equinix & Telx

5.7 IP Addresses for Production

The following IP addresses are used to access the ISE Options and Gemini production environment.

5.7.1 Unicast IP Addresses and Ports

Table 9: Unicast IP Addresses & Ports — Production

Envt	IP Address	Interface	Port(s)
Primary Equinix NY4	207.231.197.5	VIP for DTI Interface (All Members)	20011 / 20012 NOTE: DTI sessions should be split between ports.
	207.231.197.6	VIP for Prem. Access Connection Gateway	20021
	207.231.196.64/27	VIP subnet for Prem. Access DTI interface	20031 / 20032
	207.231.196.192/26	VIP subnet for Dedicated gateways	20031/20032
	207.231.197.37	VIP for PrecISE Trade Interface	SSL 443
	74.120.84.118 or precise.iseoptions.com	PrecISE Trade via the Internet	SSL 443
	207.231.197.38	VIP for FIX (IORS) Interface	Member-specific
	207.231.197.39	Member FTP VIP	N/A

Envt	IP Address	Interface	Port(s)
	74.120.84.126	VPN Peer1-IPSEC Primary	N/A
Backup / DR TelX	207.231.197.133	VIP for DTI Interface (All Members)	20011 / 20012
	Premium Access is not available at TelX		
	207.231.197.164	VIP for PrecISE Trade	SSL 443
	74.120.84.250 or precise.iseoptions.com	PrecISE Trade via the Internet	SSL 443
	207.231.197.165	VIP for FIX (IORS)	Member-specific
	207.231.197.39	Member FTP VIP	N/A
	74.120.84.254	VPN Peer2-IPSEC Secondary	N/A

NOTE: Please make sure your DTI sessions are split and balanced between ports. Connectivity to the DTI is through a load balancer with a single VIP (Versatile Interface Processor) with two TCP/IP ports. Load balancing DTI sessions across both ports will ensure the ISE infrastructure load is optimal.

5.7.2 IP Sources and Subnets for Multicast Services

The table below represents the network parameters needed to configure the participant's network for production Multicast Feeds (Fast or Binary format).

Table 10: Multicast Configuration Details — Production (Fast Feeds)

Envt	Group	ISE Source	Gemini Source	Subnet-Same for both exchanges	RP Same for both exchanges
Primary Data Center (Equinix NY4)	A	224.0.68.0/24	224.4.8.0/24	207.231.199.0/26	207.231.198.251/32
	B	224.0.69.0/24	224.4.9.0/24	207.231.199.128/26	207.231.198.252/32
Disaster Recovery Data Center (TelX)	A	224.0.68.0/24	224.4.8.0/24	74.120.87.0/26	207.231.198.251/32
	B	224.0.69.0/24	224.4.9.0/24	74.120.87.128/26	207.231.198.252/32

Table 11: Multicast Configuration Details — Production (Binary Feeds)

Envt	Group	ISE Source	Gemini Source	Subnet-Same for both exchanges	RP Same for both exchanges
Primary Data Center (Equinix NY4)	A	224.0.118.0/24	224.4.79.0/24	207.231.199.0/26	207.231.198.251/32
	B	224.0.119.0/24	224.4.80.0/24	207.231.199.128/26	207.231.198.252/32
Disaster Recovery Data Center (TelX)	A	224.0.118.0/24	224.4.79.0/24	74.120.87.0/26	207.231.198.251/32
	B	224.0.119.0/24	224.4.80.0/24	74.120.87.128/26	207.231.198.252/32

For specific multicast channel details please see the *MDI Programming Manual,* available on the member's web site https://members.ise.com.

6. Additional Information

6.1 Documentation

All documentation can be found on the member website at https://members.ise.com.

6.2 ISE Contacts

Please contact Technology Member Services at connect@ise.com or (212)897-0244, to talk about your connectivity options.

6.3 ISE Website

ISE will provide additional information on the market participant only website of ISE at https://members.ise.com.

Please sign up today to access documentation, FAQs, technical and ISE news blogs, training schedules and other support features.

Revision Table

Version	Date	Change	Section
1.0		Original Version	-
1.0.2	August 16, 2010	Source IP addresses of MDI A+B streams have been modified	6.6.1, 6.6.2
1.0.4	February 22, 2010	Updates for Final Version.	All
1.2	February 25, 2011	Updates for Optimise Production Simulation and production phases	All
1.2.1 – 1.2.4	March 2011 – April 2011	Miscellaneous updates to IP addresses as part of Optimise launch	All
1.2.5	May 19, 2011	Removed Optimise launch references	All
1.4.0	June 17, 2011	Removed old data center IP addresses in Tables 9 and 10. Increased revision number to match Optimise 1.4 release.	
1.4.1	June 30, 2011	Added IP addresses for Partitions 11 and 12 to Appendix A tables. Add Top Quote Multicast bandwidth of 150MB in Section 2.3.2	Appendix A, 2.3.2
1.4.2	July 13, 2011	Added IP addresses for Partitions 13, 14, and 15 to Appendix A tables (highlighted in pale blue/grey).	Appendix A
1.4.3	August 2, 2011	Updated IP addresses in tables to reflect move of member test environments to Telx data center	Tables 10 and 11
1.4.4	August 22, 2011	Updated Trade Feed IP address from 53250 to 53251	Tables 10 and 11
1.4.5	September 2011	Removed references to OM Click, the legacy trading application	
1.4.6	October 2011	Updated connectivity tables with minor changes	
1.4.7	October 2011	Added note and updated Table 14, Production Unicast IP Addresses, to specify DTI sessions must be split between the two DTI VIP ports. As described in Technical Bulletin 2011-55.	Table 14, 5.7.1
2.0.1	January 2012	Added section with details about ISE's Premium Access offering.	2.1, 4.2, 5.6, 5.7.1
2.0.2	January 2012	Updated ports for MT1/MT2	Table 10, 11, 12
2.0.3	February 2012	Updated Premium Access ports	Table 13
2.0.4	March 2012	Updated Premium Access ports	Table 13
2.1.0	May 2012	Removed references to legacy systems	
2.1.1	May 2012	Updated Bandwidth & Latency numbers	
2.1.2	August 2012	Added Fix Table IP. Document Review Clean-up	All
2.2.2	December 2012	Binary Feed Table Add	Tables 12 &13
2.2.3	January, 2013	Document repair to fix broken Table of Contents Misc. edits & correction	

Version	Date	Change	Section
2.2.4	April 11, 2013	Binary MT1 Updates Dedicated Gateways Document review with misc. edits & corrections	All
2.2.5	June 5, 2013	Gemini Updates -Bandwidth tables & Multicast sources added	All