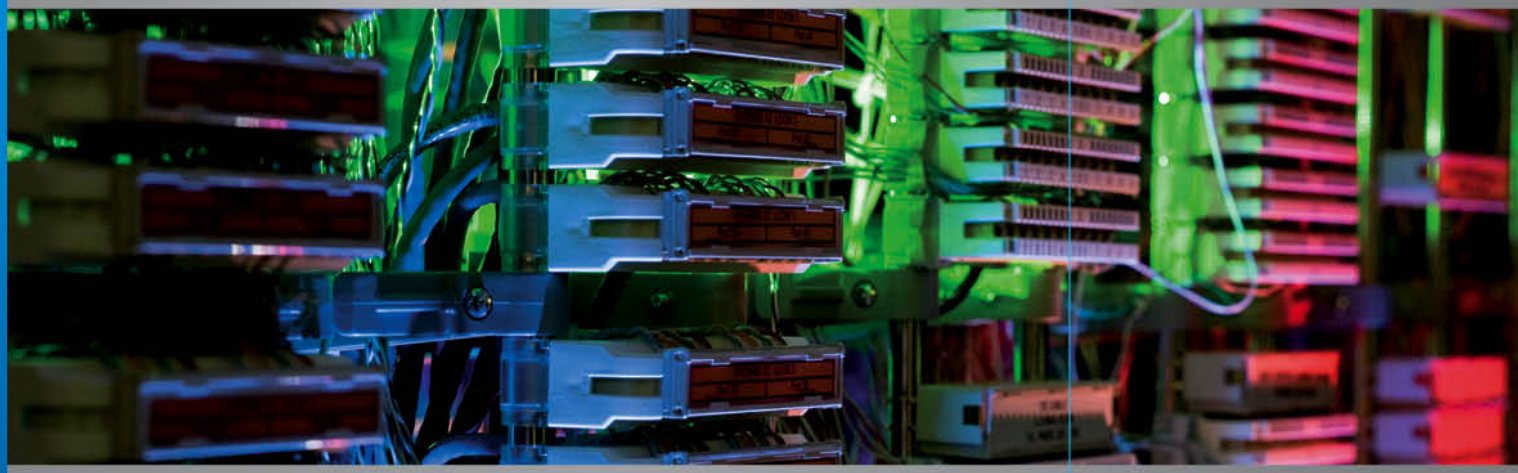
ASX CoLo

ASX Australian Liquidity Centre Technical Services Guide



ASX
AUSTRALIAN SECURITIES EXCHANGE

Contents

1 About this Guide

This Guide outlines the technical information necessary for technology teams in ASX customer organisations to plan for and make use of ASX Australian Liquidity Centre Facility ("the Facility") products and services.

1.1 Document Conventions

The parties that make use of the products and services offered within the Facility are described collectively as Users, which encompasses the separate categories of:

- Trading, Clearing, and Settlement Participants;
- Trading Clients of Participants;
- Market Information Vendors (MIV);
- Independent Software Vendors (ISV);
- Application Service Providers (ASP);
- Broker Service Providers (BSP);
- Network Service Providers (NSP)
- Alternate sources of liquidity; and
- Other Users as determined by ASX.

1.2 Product and Service Ordering

All products and services detailed in this document must be ordered via completion of the ASX Australian Liquidity Centre Order Form and subsequent submission to your ASX Account Manager. Please see the Order Form for contact details.

Purchase of Service Provider services must be agreed with the Service Provider. ASX facilitates connectivity to the service on instruction of the Service Provider.

1.3 Document Change Tracking

The following are the key changes in the ASX ALC Technical Services Guide Version 2:

The new service offerings detailed are:

- ASX Time Services (Page 21):
  - ASX GPS Service;
  - ASX PTP Service; and
  - Roof Space for Antenna.
- 10 Mbps NSP Cross Connect

The updated technical details are:

- Services Termination Summary
- ASX ITCH Connectivity Requirements
- ASX ITCH Configuration Requirements
- Technical Service Guidelines
  - Goods Receiving, Goods Storage, and Package Disposal Services
  - ASX Smart Hands and ASX Specialist Services
  - Equipment Installation or Decommission Services

2 ASX Australian Liquidity Centre Facility

The Facility is a Tier 3 designed data centre housed in a purpose-built building located at:

ASX ALC,
5 Broadcast Way,
Artarmon, NSW, 2064.

The primary ASX Trading Systems (ASX Trade and ASX Trade24) are physically located in the Facility. The ASX Business Continuity Site at Bondi Junction hosts the site, software and hardware redundancy of ASX Trade and ASX Trade24.

2.1 Facility Design

The Facility design comprises the following elements:

Service Element	Details
Fire Protection	Gas Suppression and a Dry Pipe Sprinkler System. Very Early Smoke Detection Apparatus (VESDA) installed.
Power Systems	Facility electrical power is drawn from two separate 33 kV HV utility power supplies supporting a total power load of 3.5 MVA. Three Diesel Rotary Un-interruptible Power Supply systems (DRUPS) are installed in a distributed redundant configuration providing N+1 supply of up to 1.6 MW. Power is fed to the Facility from the DRUPS in a no-break configuration to ensure continuity of supply to Facility if failure of the power systems occurs. The Diesel generators connected to the DRUPS systems are tested monthly and have tank capacity for 72 hours of continuous running.
Air Conditioning	The Facility uses three 1.2 MW air cooled chillers running in an N+1 configuration and is air-conditioned via twenty eight down-flow 105 kW Computer Room Air Conditioner (CRAC) units. The trading floor is on a raised floor and air is distributed using adjustable damper blade floor grills strategically positioned throughout the Data Centre raised area. All chiller and CRAC infrastructure is supported on the DRUPS power configuration and chilled water buffer tanks are installed to maintain the supply of chilled water during maintenance cutover of chiller systems.
Under Floor Water Detection	Under floor water leak monitoring systems installed.
Environmental Controls	All aspects of the Facility environment are monitored by a central system. Any alarms from these devices are passed to the monitoring system for action by ASX operations staff located at the Facility.
Telecommunications	Two separate Meet Me Rooms (MMR, carrier rooms) are provided in the facility, each with cable routes via fully diverse access paths. Cabling from MMRs to the trading floor is optical fibre or copper via diverse communications risers. This cabling is exclusively installed and managed by ASX.

2.2 User Cabinets

Product Element	Details
Cabinet Specifications	47 RU x 1100 mm deep and 800 mm wide with a 6 port fibre patch panel and a 5 port UTP patch panel in the first User Cabinet. 1 RU is required at the top of each Cabinet for the electronic locking system. The electronic system must not be manipulated or removed by Users. 3 RU is the total allowance required at the top of each Cabinet. ASX will install additional patch panels as services are provisioned. Front and rear doors are a standard 80% free air mesh door (excluding cabinet surround). Perforations limit the visibility into the cabinets.
Cabinet Locking	All Cabinets include: • Electronic locking mechanisms • Remote access control • Access monitoring and reporting
Cabinet Power	Allocation in increments of 2 kW per cabinet with increments of 2 kW available up to a maximum of 6 kW for an individual cabinet. Electrical power is delivered via two vertical power rails connecting to separate A & B feeds with the following specifications: • 32A/230V unmetered power rails • 20 C13 IEC Outlets and 4 C19 IEC Outlets Redundant power supply based on separate GPOs and Power Distribution Units (PDU). NB: ASX recommends use of a static switch for any single-corded devices within User Cabinets. Such devices must be tested and tagged by an electrician before installation. NB: ASX monitors each User's power use at the Cabinet level however charges for power use aggregated across all of a User's Cabinets.
Inter-Cabinet Configuration	Users with concurrent Cabinets are able to patch devices between these Cabinets by removing the common Cabinet panels ("gland plates"), which are accessible from within each Cabinet only. The removed gland plates must be left with Facility Operations Centre staff.

2.3 Cabinet Cages

The Facility allows for provisioning of caged groups of Cabinets. Physical segregation of caged Cabinets (if required) does not affect messaging latency to ASX Trading Platforms or from Service Providers.

Service Element	Details
Cage Specification	Cages run from the raised floor to a height of 2200 mm. Cages are a mesh construction to maintain the flow of cooling air.
Cage Order Time	Allow at least six weeks to complete.

3 External Connectivity to the Facility

Users are able to connect to external network sites via both ASX Net and any NSP maintaining a presence in a Facility MMR.

3.1 Facility Connection over ASX Net

Connection to a User Cabinet from a site external to the Facility is available via ASX Net. A Facility Connection over ASX Net does not require an NSP Cross Connect.

Service Element	Details
Service	1 Gbit/s dedicated service.
Presentation	The connection presents at the User's external site as an Ethernet port. The connection presents at the User's Facility Cabinet as a dedicated Ethernet port on the UTP patch panel.
Lead time	Two weeks if ordered for an existing ASX Net Site. Up to six weeks if ordering a new ASX Net connection.

3.2 Facility Connection via an NSP

The Facility is carrier neutral. ASX will connect the User to the NSP of its choice. Only NSPs will be hosted in the Facility MMRs.

External connectivity via an NSP must terminate in one or both of the two MMRs. NSP Cross Connects between the NSP in the MMR and User Cabinet(s) are installed and maintained by ASX and are either a:

- SMOF connection; or
- CAT 6E UTP connection.

Please Note: the cable runs for NSP Cross Connects are greater than 100 m. This means that a UTP NSP Cross Connect is able to support PSTN, however cannot support Ethernet.

The User must make appropriate arrangements with ASX to allow for NSP technician access to the User's Cabinet should the NSP require end-to-end connection testing to be performed.

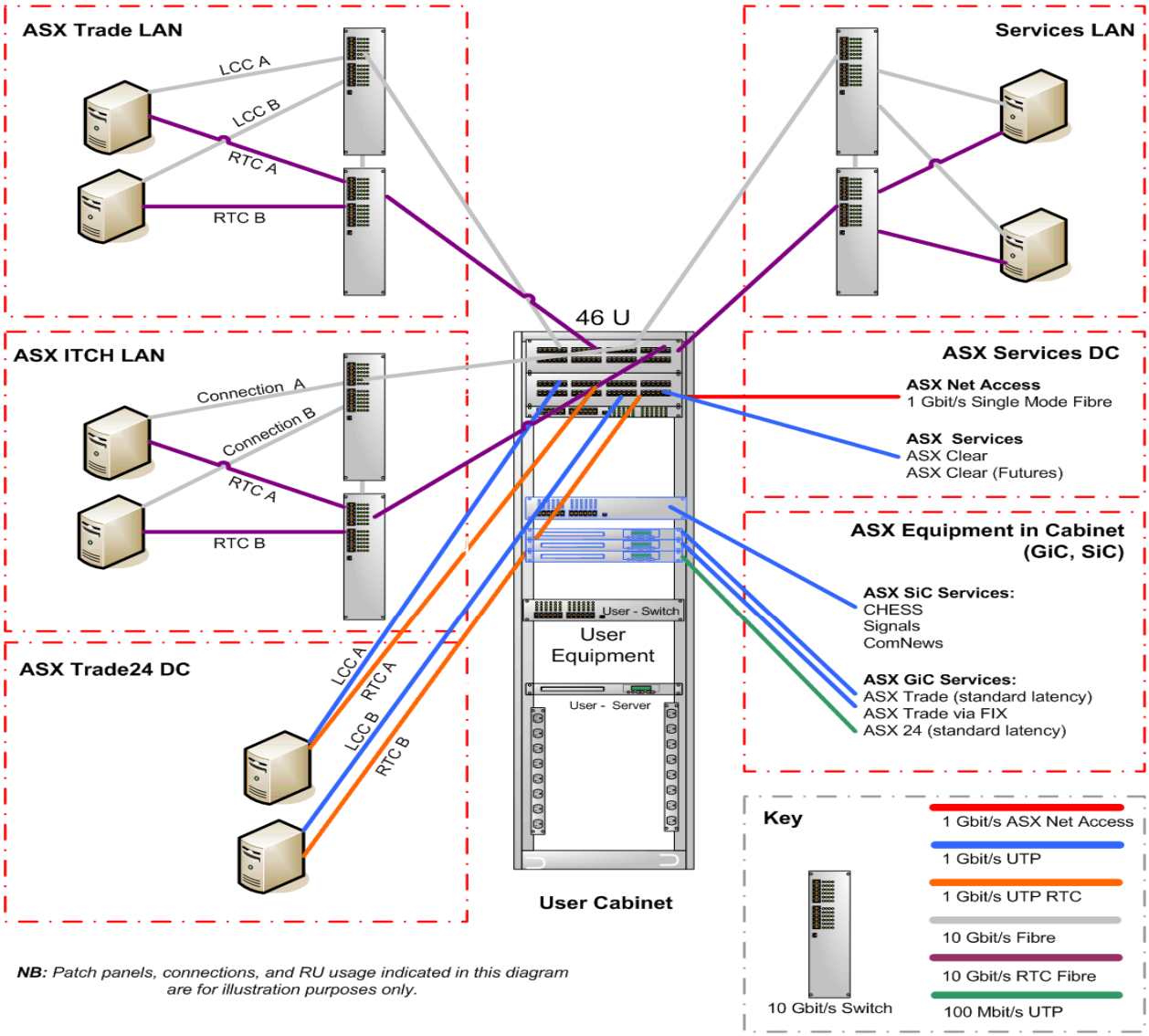
NSPs are not able to terminate connections at the Bondi Junction Business Continuity Site.

4 Connectivity within the Facility

ASX installs and manages all connections to ASX Liquidity and Services, and to Service Providers within the Facility, excluding connections between a User's devices in concurrent Cabinets and some ASP and Participant Connections (please refer to the ASP and Participant definitions in the Glossary).

Connections to ASX and Service Provider Services are implemented via either Direct Cable (DC) connection, a Local Area Network (LAN), or via ASX system gateways and/or switches installed in the User Cabinet.

Please note: User-owned wireless devices are not permitted within the Facility, except for use with the WiFi internet service offered by ASX.



NB: Patch panels, connections, and RU usage indicated in this diagram are for illustration purposes only.

Network Distribition

- ASX Trade LAN and ASX Services LAN logical connections are provided to a single physical connection (e.g. multiple LCC per patch port).
- ASX Trade, ASX PureMatch, and ASX ITCH are provided via a 10 Gbit/s fibre LAN.
- ASX Trade 24 is provided via a 1 Gbit/s UTP DC connection.
- External site connection is available via ASX Net or Network Cross Connect to an NSP cabinet in the MMR.
- Access over ASX Net is provided as a 1 Gbit/s single fibre connection.
- ASX Clear and ASX Clear (Futures) infrastructure is provisioned as DC connections.
- ASX Trade FIX infrastructure is provisioned as a GiC connection.

4.1 Redundant Teamed Connection (RTC)

A Redundant Teamed Connection (RTC) provides physical path redundancy for its associated primary connection. Should the primary connection fail, connectivity will automatically and seamlessly cut-over to the RTC.

All RTCs are optional, and available for all connection types listed below.

Users are responsible for regular testing of RTCs. RTC testing can be carried out by unplugging or disabling the primary connection.

4.2 Local Area Networks (LAN)

Connectivity from a User Cabinet to ASX and Service Provider services is implemented via separate 10 Gbit/s fibre LANs. Each LAN allows multiple services to be provisioned on a single physical connection.

LAN Services are segregated into specific groupings illustrated in the diagram on Page 9. Connectivity to each group requires a separate physical connection. These LANs are:

- ASX Trade LAN - providing connectivity to ASX TradeMatch, ASX VolumeMatch, and ASX PureMatch;
- ASX ITCH LAN - providing connectivity to the ASX ITCH Market Information feed;
- Service Provider LAN - providing connectivity to ASX and Third Party services.

Each LAN has security controls implemented by ASX. The User is responsible for implementing their own additional security measures within their solution should they consider it necessary.

Each LAN presents to the User Cabinet as a patched fibre port in the Cabinet patch panel, and may carry multiple logical connections (e.g. multiple Service Provider Services).

The network path length for all ASX Trade LAN connections is the same to facilitate location latency neutrality within the Facility.

Please note: ASX will not add network routes to a primary connection or RTC for Facility connections. Switching, routing and the use of NAT beyond the connections (provided fibre port) is the responsibility of the User.

4.2.1 Connection Specification

Space requirement:	zero RU
Presentation:	Single fibre patch panel port
Bandwidth:	10 Gbit/s

4.2.2 LAN RTC Specification

RTCs for LAN (and DC) connections are additional patched patch panel ports. By default they are provisioned on the next available port in the Cabinet to which the associated primary connection is delivered.

The primary / RTC configuration is active / passive. ASX testing has indicated that this teaming does not affect latency.

4.3 Direct Cable (DC) Connections

DC connectivity to the ASX systems listed below are implemented via Category 6A UTP copper cable patched to a patch panel port in the User Cabinet. DC connections to non-ASX managed systems may be made via UTP, SMOF or MMOF as required.

ASX Trade24 DC
- ASX 24

ASX Services DC
- ASX Clear
- ASX Clear (Futures)

DC connections to non-ASX Services
- Non-concurrent User Cabinet cross-connect
- NSP Cross Connect

DC connections carry one system connection each. For example, an ASX 24 DC connection carries one ASX 24 LCC, while a single fibre connection to the ASX Trade LAN can carry multiple ASX Trade LCCs.

The cable lengths for all ASX Trade24 DC connections are the same to facilitate location latency neutrality within the Facility.

Please note: ASX will not add network routes to a primary connection or RTC for Facility connections. Switching, routing and the use of NAT beyond the connections (provided fibre port) is the responsibility of the User.

4.3.1 Connection Specification

Space requirement:	zero RU
Presentation:	Single UTP, SMOF or MMOF patch panel port
Bandwidth:	1 Gbit/s (ASX managed connections only)

4.3.2 DC RTC Specification

RTCs for DC (and LAN) ASX managed connections are additional patched patch panel ports. The primary / RTC configuration is active / passive. ASX testing has indicated that this teaming does not affect latency.

4.4 ASX Switch in Cabinet (SiC)

Connectivity to CHESS, ASX Signals, and ComNews is implemented via an ASX switch (provided and maintained by ASX) installed in the User Cabinet.

The switch provides a 1 Gbit/s connection to the ASX Services to which the User subscribes. ASX will implement Quality of Service provisioning for ASX Services.

See Page 19 for TCP/IP and Port details for each associated service.

4.4.1 Switch Specification

Space requirement:	1 RU
Power requirement:	135 W (average consumption 60 W per power supply)
Bandwidth:	1 Gbit/s

4.4.2 SiC RTC Specification

RTCs for SiC connections present as a second identical 1 RU switch in the same User Cabinet.

4.5 ASX Gateway in Cabinet (GiC)

Standard latency connections to the ASX Trading Platforms (ASX Trade and ASX Trade24), and the FIX Protocol connection to ASX Trade are available via installation of ASX Gateway(s), an ASX switch, and an ASX router in the User Cabinet.

4.5.1 Equipment Specification

Gateway Space requirement:	1 RU
Gateway Power requirement:	340 W
Server Height:	4.27 cm (1.68")
Server Width:	44.70 cm (17.60")
Server Depth:	54.61 cm (21.50")
Sever Mounts:	Horizontal rails
Switch Space requirement:	1 RU each
Switch Power requirement:	123 W (average consumption 60 W per power supply)
Router Space requirement:	1 RU each
Router Power requirement:	160 W (average consumption 32 W per power supply)

4.5.2 GiC RTC Specification

RTCs for GiC connections are implemented as a second identical switch and router installed in the User Cabinet with teamed connections to the relevant ASX Gateway. No direct User connections to these switches are permitted.

4.6 Participant to Client Cabinet Connections

Connectivity between a Participant Cabinet and that of their Client will be provided as a User-managed SMOF connection presented as a patched SMOF port in the Cabinet patch panel. The connection will be via the ASX ALC frame.

The Participant to Client Cabinet connection is classed as a Service Provider Connection.

4.7 Connectivity Termination Summary

Service	Delivery	Service Speed	Connectivity Termination
ASX Trade LCC	LAN	10 GBit/s	MMOF
ASX Trade24 LCC	Direct Connection	1 Gbit/s	UTP
ASX ITCH	LAN	10 GBit/s	MMOF
Service Provider Connection	LAN	10 GBit/s	MMOF
Non-concurrent Cabinet Connection	Direct Connection	*User managed*	MMOF / SMOF / UTP
Client Cabinet Connection	Direct Connection	*User managed*	MMOF / SMOF / UTP
ASX Clear	Direct Connection	1Gbit/s	UTP
ASX Clear Futures	Direct Connection	1Gbit/s	UTP

5 Trading Access

Low latency connectivity to ASX Trading Platforms for order entry and order management is provided to trading Users via a Liquidity Cross Connect (LCC) implemented on either the ASX Trade LAN, or ASX Trade24 DC. Standard latency trading connections are implemented via a GiC connection.

FIX connection for trading access to ASX Trade is also available, and is delivered via a GiC connection.

ASX provisions, installs and monitors all connections to ASX Services.

5.1 ASX Trade Access

5.1.1 Liquidity Cross Connect – ASX Trade

ASX Trade LCCs are logical connections implemented on the ASX Trade LAN. A single ASX Trade LCC presents to the User's Cabinet as a fixed IP address accessible via a specified MMOF patch panel port connected to the ASX Trade LAN.

Multiple ASX Trade LCCs will be delivered to a single patch panel port in a User Cabinet.

Service Element	Details
Order Books Available	ASX TradeMatch ASX PureMatch ASX VolumeMatch
Connection and Redundancy	As per ASX Trade LAN solution. See page 10 (redundancy LAN) and page 16 (connection)
TPS Capacity	Soft limit of 500 TPS per LCC.
OI Session Capacity	45 concurrent OI Sessions of any TPS capacity per LCC.
Subscription Capacity	ASX Trade does not have subscription limitations.
IP and Port Connectivity	Each LCC has a dedicated IP address and port to which its User must connect. IP Address: assigned by ASX from within the designated Class C address range (see page 14). Port: assigned by ASX from within the range 51024 to 51028.

5.1.2 GiC – ASX Trade

ASX Trade connection via GiC presents to the User's Cabinet as described in Page 12.

Service Element	Details
Order Books Available	ASX TradeMatch ASX PureMatch ASX VolumeMatch
Connection and Redundancy	As per ASX GiC solution. See Section 4.1 (redundancy) and 4.5 (GiC).
TPS Capacity	Approximately 400 TPS per Gateway*.
OI Session Capacity	Up to 60 concurrent OI Sessions*.
Subscription Capacity	ASX Trade does not have subscription limitations.
IP and Port Connectivity	IP Address: assigned by ASX from within the designated Class C address range (see section 5.3). Access Ports: 15024 or 15025

* NB: Gateway utilisation close to these levels will result in significant performance degradation.

5.1.3 FIX Connection – ASX Trade

ASX Trade connection via the FIX Protocol is available via a GiC connection, with a FIX-enabled ASX Trade Gateway housed in the User's Cabinet.

Service Element	Details
Order Books Available	ASX TradeMatch ASX VolumeMatch ASX PureMatch
Connection and Redundancy	As per ASX GiC solution. See Section 4.1 (redundancy) and 4.5 (GiC).
TPS Capacity	Approximately 400 TPS per Gateway*.
OI Session Capacity	Up to 60 concurrent OI Sessions*.
Subscription Capacity	ASX Trade does not have subscription limitations.
IP and Port Connectivity	IP Address: assigned by ASX from within the designated Class C address range (see section 5.3). FIX Order Port: 6003. FIX Market Data Port: 6004.

* NB: Gateway utilisation close to these levels will result in significant performance degradation.

5.2 ASX 24 Access

5.2.1 Liquidity Cross Connect – ASX Trade24

Each ASX Trade24 LCC supports a single ASX Trade24 login, and is implemented via the ASX Trade24 DC network.

The DC connection is made to an ASX Trade24 Gateway centrally hosted by ASX, thus no User Cabinet space or power is required.

Service Element	Details
TPS Capacity	12 TPS per connection.
Connection and Redundancy	As per DC solution. See page 10 (redundancy) and page 11 (DC).
ASX 24 Limit Administration	Access via pcAnywhere. Contact Market Access for solution details.
IP and Port Connectivity	Each LCC has a dedicated IP address and Port to which its User must connect. IP Address: assigned by ASX from within the designated Class C address range (see page 15). Port: 2634. pcAnywhere: assigned ports 5631 and 5632.

5.2.2 GiC – ASX Trade24

ASX Trade24 connection via GiC presents to the User's Cabinet as described in Page 12.

Service Element	Details
Connection and Redundancy	As per ASX GiC solution. See Section 4.1 (redundancy) and 4.5 (GiC).
TPS Capacity	12 TPS per connection
IP and Port Connectivity	Each ASX Trade24 Gateway has a dedicated IP address and Port to which its User must connect. IP Address: assigned by ASX from within the designated Class C address range (see page 15). Port: 2634. pcAnywhere: assigned ports 5631 and 5632.

5.3 LCC IP Address Allocation

ASX will allocate each User a Class C (24 bit mask) address range from the network ranges listed below. Users are required to utilise only IP addresses from the allocated range for all their devices directly accessing an ASX-supplied Facility connection.

Users can request a Class C address range from the pool, or in exceptional circumstances, from within a User's private address space. ASX will not allocate ranges already in use by another User.

Users that require access to both ASX Trade and ASX Trade24 will be allocated access to those systems from the same Class C address range unless separate allocations are specifically requested.

ASX Trade and ASX Trade24 Production Class C address ranges are:

- 172.30.1.x to 172.30.254.x (254 ranges available)
- 10.30.1.x to 10.30.254.x (254 ranges available)
- 192.168.1.x to 192.168.254.x (254 ranges available)

ASX Trade PTE Class C address ranges are:

- 172.31.1.x to 172.31.254.x (254 ranges available)
- 10.31.1.x to 10.31.254.x (254 ranges available)

Within each allocated range IP addresses .1 to .63 are reserved for ASX use. IP addresses from .64 to .254 are allocated for User devices.

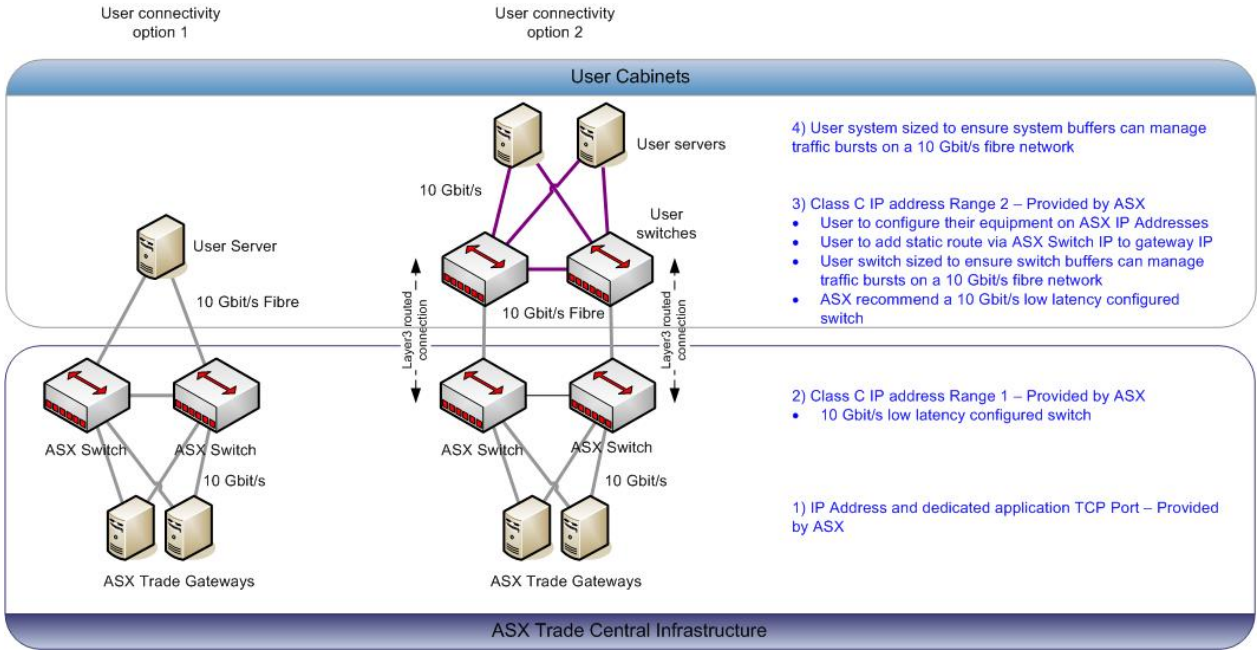
Services are presented to Users via specific IP addresses on specific fibre or UTP ports within User Cabinets. Details of the ports and IP addresses are communicated to Users after installation of the service by ASX.

5.3.1 ASX Trade LCC Connectivity Requirements

Users of ASX Trade LCC's are required to support the following access design:

1. Each ASX Trade LCC has an associated IP address and a single dedicated application TCP port, both provided by ASX.
2. ASX will provide a specific Class C IP address range to be used by the ASX infrastructure on the ASX Trade LAN.
3. ASX will provide another specific Class C IP address range to be used by all User equipment connecting to the ASX Trade LAN.
4. Users must add a static route on their equipment to provide a path to the IP address provided for each LCC.
5. User switch and server infrastructure buffers must be sized to manage traffic bursts on the 10 Gbit/s ASX Trade LAN.

User CoLo ASX Trade Connectivity Requirements



6 ASX Service Connections

Access to ASX Market Information products and Clearing and Settlement systems is available to Facility Users via ASX Services Connections.

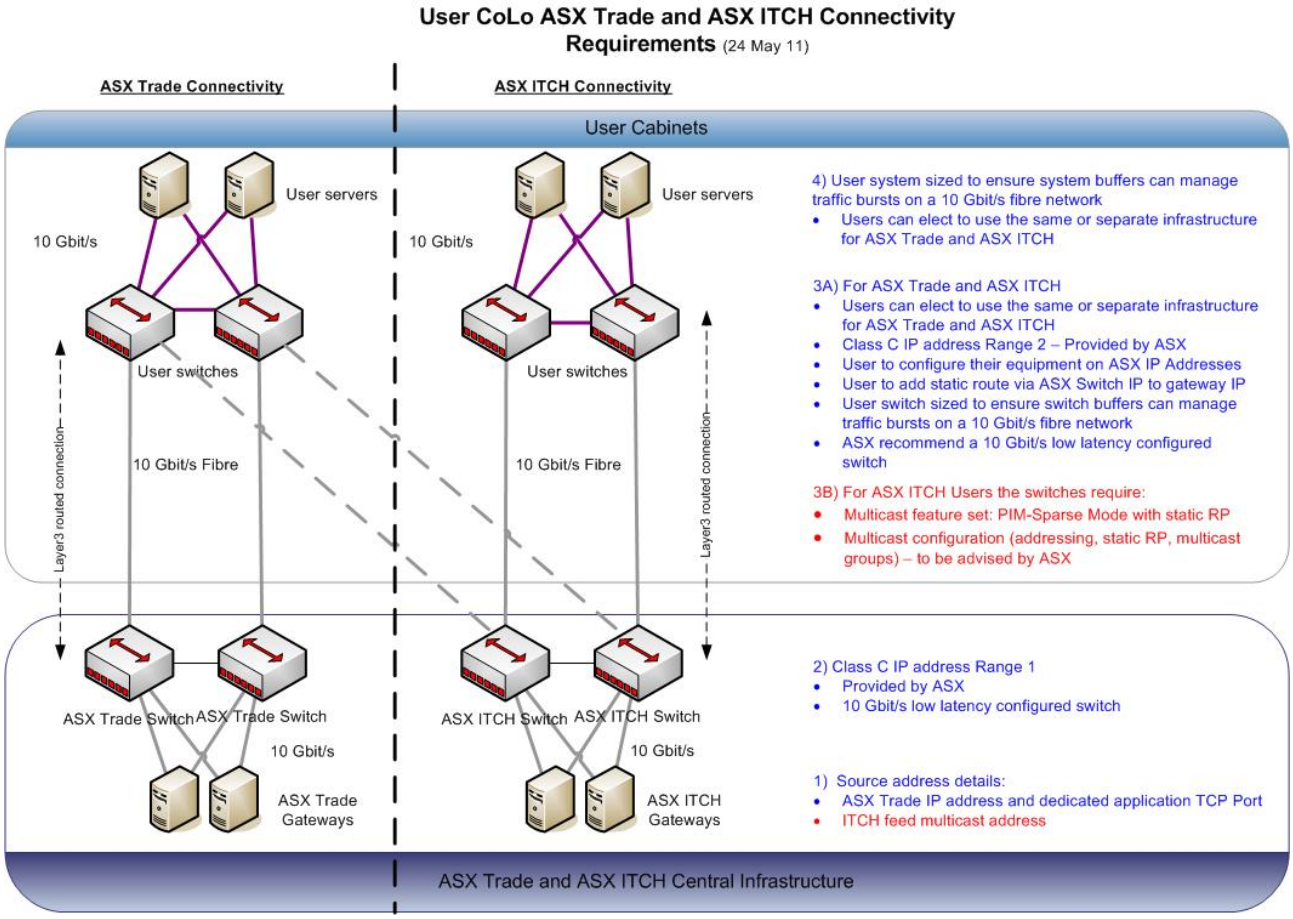
6.1 ASX Market Information Connections

Service	Service Connection	Test Environment Connection
ASX Market Information – ITCH	ASX ITCH LAN	Service Provider LAN
ASX Market Information – OMnet	ASX Trade LAN	Functional testing via SiC. Performance testing via Service Provider LAN.
ASX Market Information – FIX	GiC	SiC
ASX 24 Market Information – FIX	ASX 24 DC	SiC (functional testing only)
ASX 24 Market Information – ITC	SiC	Not available
ComNews®	SiC	Not available
Signal B	SiC	Not available
Chi-X Market Information	1Gbit/s MMOF	Not available

6.1.1 ASX ITCH Connectivity Requirements

ASX ITCH utilises multicast through a 10 Gbit/s low latency configured switched infrastructure. Users of ASX ITCH are required to support the following access design:

1. Each ASX ITCH connection has an associated multicast range
2. Each ASX Glimpse connection has an associated IP address and single dedicated TCP port, both provided by ASX.
3. ASX will provide a specific Class C IP address range to be used by ASX equipment on the ASX ITCH LAN .
4. ASX will provide another specific Class C IP address range to be used by all User equipment connecting directly to the ASX ITCH LAN.
5. User switches connected to the ASX Trade LAN can optionally be used to connect to the ASX ITCH LAN as well, as indicated by the dashed line in the diagram on the following page.
6. Switches connecting to the ASX ITCH LAN must support a multicast feature set: PIM-Spare Mode with static RP.
7. Users must add a static route on their equipment to provide a path to the IP address provided for each connection.
8. User switch infrastructure and server infrastructure buffers must be sized to manage traffic bursts on the 10 Gbit/s ASX ITCH LAN.



6.1.2 ASX ITCH Configuration Requirements

Users of ASX ITCH must configure their equipment to support the multicast solution below. The following are key elements of the ASX ITCH offering:

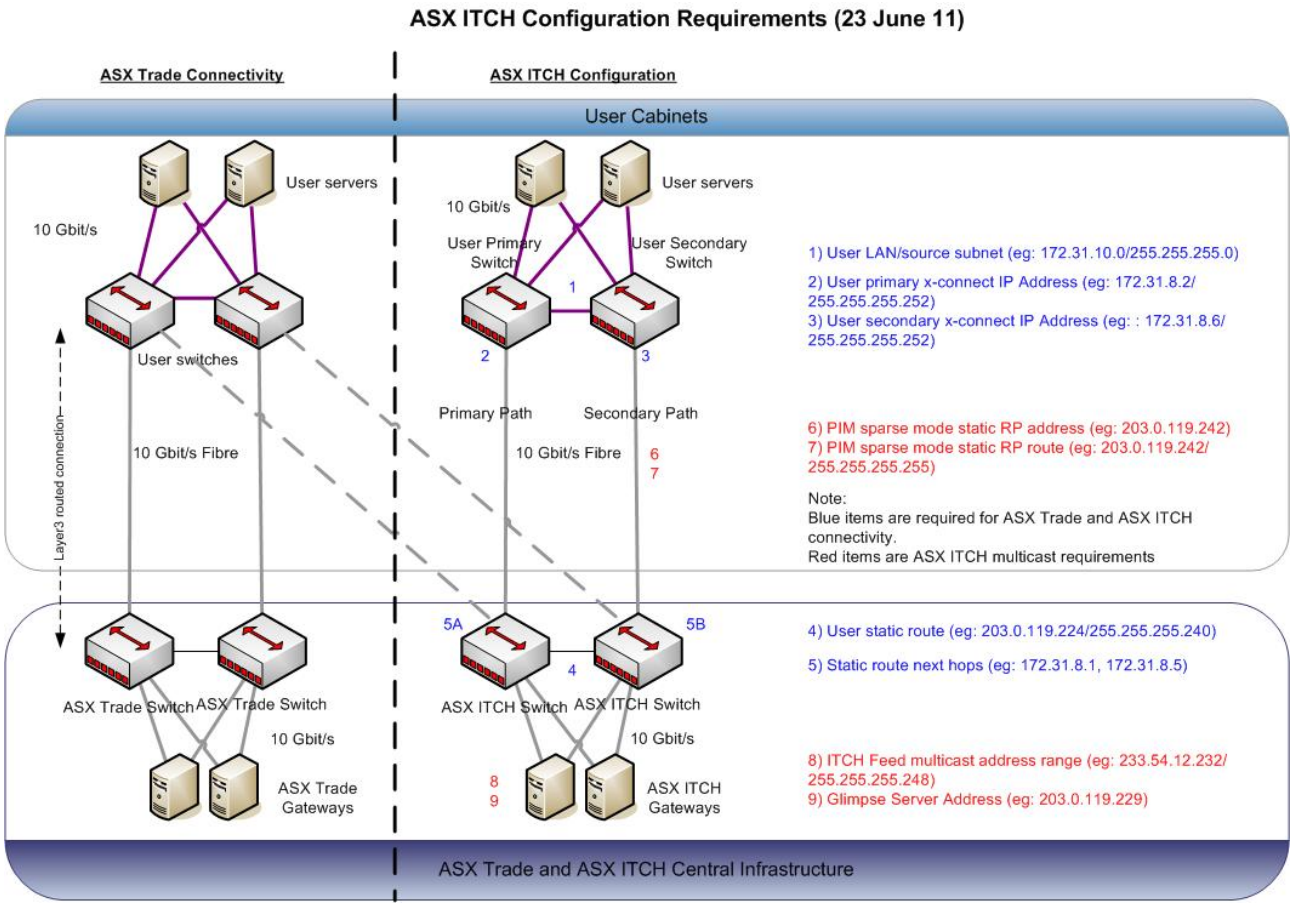
- The ASX configuration has been developed on Arista switches. Users will need to adjust the configuration for the devices they utilise.
- The ASX example configuration has no access control applied. It is the responsibility of the User to manage their security requirements.
- The ASX configuration is engineered so that all traffic routes via the primary path in an active-standby arrangement. The second switch will only be used in the event of a network failure.
- PIM timers, PIM DR and IGMP timers have been tuned to obtain the fastest failover times in the event of a network failure within an ASX environment.

The ASX configuration is comprised of the following details:

Note: the addresses provided below are examples only. Actual User addresses will be specific to the User and the target ASX environment (Production vs. PTE). User addresses will be provided by ASX Market Access during the new order process for each ASX environment.

1. User LAN/source subnet: 172.31.10.0/255.255.255.0
2. User primary cross connect IP address: 172.31.8.2/255.255.255.252
3. User standby cross connect IP address: 172.31.8.6/255.255.255.252
4. User static route: 203.0.119.224/255.255.255.240
5. Static route next hops: 172.31.8.1,172.31.8.5
6. PIM sparse mode static RP address: 203.0.119.242
7. PIM sparse mode static RP route: 203.0.119.242/255.255.255.255

8. ITCH feed multicast address range: 233.54.12.232/255.255.255.248
    a. NB: This address range allocation will be the same for all Users, however this specific address is an example only.
9. Glimpse server address: 203.0.119.229
10. Multicast static route example (note no next hop for multicast routes): route add -net 233.54.12.232 netmask 255.255.255.248 ethX



Further ITCH Service configuration details are available within the ITCH specification available from ASX Market Access.

6.2 ASX Trading Platform Test Environment Connections

The ASX Trade Participant Test Environment (PTE) is comprised of the Enhanced Test Environment (ETE) and Functional Test Environment (FTE).

Service	Service Connection	Test Environment Connection
ASX Trade Test Environment	Performance Testing	Service Provider LAN
	Functional Testing	SiC
ASX Trade24 Test Environment	ASX Services DC connection to an ASX SECUR Gateway.	SiC

6.3 ASX Clearing System Connections

Service	Service Connection	Test Environment Connection
ASX Settlement (CHESS)	SiC	SiC
ASX Clear	ASX Services DC connection to an ASX DCS Gateway	SiC
ASX Clear (Futures)	ASX Services DC connection to an ASX SECUR Gateway	SiC

6.4 ASX Service Configuration Details

Environment	ASX Service Address	Port	Comment
ASX Settlement (CHESS)	203.4.179.22	4200	Production
ASX Settlement (CHESS):	203.4.179.23	4207	Unscripted Test (XP1)
ASX Settlement (CHESS):	203.4.179.23	4210	XP2 test service
ASX Settlement (CHESS):	203.4.179.23	4208	Performance test (Test 9)
ASX Settlement (CHESS) :	203.4.179.23	4209	Accreditation (Comm test)
ASX24 ITC Market Data Service (Futures markets)	203.4.179.33	2212	Primary: Gore Hill
ASX24 ITC Market Data Service (Futures markets)	203.4.179.34	2212	Secondary: Bondi Junction
Reference Service: Signal B	203.4.179.25	15002	
ASX ComNews Server	203.4.179.80	20-21	
ASX Trade FTE	203.4.179.122	15024 to 15027 6003 6004	API ports FIX order entry FIX Market Data
ASX Trade ETE	203.4.179.121	15024 to 15027 6003 6004	API ports FIX order entry FIX Market Data
DCS Participant Test Environment	203.4.179.201	20025-20240. 20024, 20222, 20240	TCP dst port TCP src port
ASX Trade24: Gateway Functional Test	203.4.179.160		Ports allocated by ASX on a per User basis

6.5 ASX Time Services

Users have access to three ASX time service offerings:

- ASX GPS Time Service;
- ASX Trading Platform Time Service; and
- Roof Space for Antenna

6.5.1 ASX GPS Time Service

ASX provides a GPS satellite signal from one or both of two static rooftop antennae. Each antenna is connected into the ALC via fibre-optic transfer link to prevent transmission of a lightning strike to User equipment. The GPS signal presents as a BNC coaxial cable termination to the User's nominated Cabinet.

The delivered signal is suitable for any L1-band GPS receiver (1,575.42 MHz), does not require bias voltage and is suitable for 0v, 5v or 12v receivers. A dummy load is present to suit receivers that rely upon antenna circuit load detection. The ASX GPS solution tracks 6 to 12 satellites (depending on satellite geometry and time-of-day) to provide a stable 3D position reference.

6.5.2 ASX Trading Platform Service

ASX provides connection to the PTP synchronisation signal used to set the system clocks on ASX trading platforms. The PTP gateway is assessable via the Service Provider LAN, presenting as an Ethernet connection within the User's Cabinet.

ASX operates a PTP Grandmaster clock (Symmetricom S350 time server) stabilised with a Rubidium frequency standard. The PTP is compliant with IEEE1588 2008. The Grandmaster clock time reference is maintained by NMI (Australia's National Measurement Institute) to be ±100 microseconds of UTC (Aus) (the Australian realisation of UTC).

Sync packets are delivered by UDP and contain a hardware timestamp from the Grandmaster time base with 5 nanosecond resolution. The recommended PTP clients are:

- Windows: "DomainTime II";
- Linux: "sourceforge PTPd for IEEE1588 2008"

6.5.3 Roof Space for Antenna

ASX has limited space available for User Antenna installations. Planning for User Antenna installations must include ALC Management and ASX Infrastructure teams, and needs to consider the following:

- ASX must assess and approve the device and installation design;
- Device installation must be performed by ASX;
- The device must be passive (i.e no transmitting devices); and
- Roof to User Cabinet connectivity will be via fibre cable installed and maintained by ASX.

7 Service Provider Connections

ASX facilitates connections between Service Providers and their Clients within the Facility via ASX network connections.

Generally, connections to Service Providers are made via the Service Provider LAN. The exceptions are:

1. Connections to NSPs are made via NSP Cross Connects (NCC). NCCs connect a User to an NSP in one or both of the Facility MMRs.
2. Connections between a trading client and their Participant are delivered via a DC connection.
3. ASP or Participant services delivered to their Clients hosted within the ASP's or Participant's Cabinet space are delivered internally within the cabinet.

Service	Service Connection
Third Party Service	Service Provider LAN SMOF / MMOF / UTP DC connection (trading client to Participant only)
NSP Cross Connect	DC connection. Either a: • SMOF fibre connection; or • Cat 6E copper connection.

8 Technical and Operational Support Services

This section details the technical elements of the Technical Support Services provided within the Facility. Please refer to the *ASX Australian Liquidity Centre Business Services Guide* for the complete list of services offered.

Service	Details
Goods Receiving	Receipt of one shipment of up to three boxes, including storage for up to 24 hours at the Facility. Total size of three boxes must not exceed 100 cm x 100 cm x 100 cm. Courier will place the goods in store room under ASX Operator supervision. Requires 24 hours notice and is subject to Facility Health and Safety policy (see page 27).
Equipment Installation or Decommission	Installation or decommission of User equipment into or from an established User Cabinet, including power connection. Requires detailed description of works to be submitted with the Order Form.
Initial Cabinet Set-up	This is a mandatory service performed once for each User Cabinet. Service includes: • installation of ASX hardware • initial cabling provision • installation of NSP Cross Connects
ASX Smart Hands	First level support and maintenance. Response within: 30 minutes after notice via email or telephone. Services include: • Equipment power cycling (router, server, switch) • Check servers LEDs for activity • Visual inspections of equipment • Inventory of equipment or serial numbers • Load and unload tapes and have them ready for pick-up by offsite storage company • Emergency provision of other ASX Support Services including Goods Receiving, Goods Storage, and Package Disposal Services
ASX Specialist (Network Technician)	Network technician equipped to provide User network troubleshooting, including all necessary testing instruments. Scheduled notice: 24 hours via email for work during standard business hours. Emergency notice: 30 minutes - available during standard business hours. Supported network environments: AVAYA, CISCO, and ARISTA.
ASX Specialist (Server Technician)	Server technician equipped to provide User server troubleshooting, including all necessary testing instruments. Scheduled notice: 24 hours via email for work during standard business hours. Emergency notice: 30 minutes - available during standard business hours. Supported OS: All current versions of Microsoft Windows, and UNIX
Internet Access	Access to WiFi internet services within the Facility. Offered for 24 hours at a time to on-site visitors. Reasonable use policy applies.

9 Facility Security and Physical Access Guidelines

This section details the physical security and access requirements relating to the ALC and Bondi Junction data centres.

9.1 Facility Site Security

User Cabinets and devices within the area are protected and secured from possible security breaches. Users are only permitted to access their own Cabinets and devices, and cabling infrastructure is protected from unauthorised third party access.

Service Element	Details
Physical Access	Users or individuals representing the User wishing to access the Facility or Bondi Junction data centre must have pre-approved access and must be induction certified by ASX. (Induction certification is OH&S training on Facility and/or Bondi Junction data centre layout and evacuation points.)
Security Monitoring	Facility security is controlled by a security token system. All doors are monitored for forced entry and "door open too long" alarms. Facility staff monitor each system. Video cameras are positioned in every row of the Facility, monitoring all Cabinets.
Cabling Access	Facility Users are prohibited from accessing under-floor or over-head cabling.
Lockable Cabinets	Each Cabinet is individually lockable. See Page 7 for more information.
Wireless Equipment	User wireless equipment is not permitted to be housed within the Facility. User wireless equipment is permitted in the Facility only in connection with the ASX supplied WiFi internet service.

9.2 Facility and Bondi Junction Data Centre Access

Users are allowed all hours access to the Facility in order to support the equipment housed in their allocated Cabinet(s). Physical access must be pre-approved by ASX and will be monitored.

Service Element	Details
Hours of access	The Facility and Bondi Junction data centre are both accessible 24 hours a day, 7 days a week.
Physical Access	An ASX Work Access Request Form must be completed by nominated personnel with approval authority, providing adequate details of: • The purpose and procedure of the work being performed (including any relevant documentation); • Contact details and contact information; • On-site representative details and contact information; • Details of and contact information regarding the person(s) conducting the work (including third party technicians); • Proposed date and time and duration of the work; and • Cabinet ID(s) on which the work will be performed.
Authorised Personnel and Nominated Representatives	New Users are requested to nominate support personnel they wish to authorise to be able to: • Request access to the Facility to perform Works within the User's cabinet; and • Submit an ASX Work Access Request Form on the User's behalf. Requests will not be accepted from support personnel not authorised by the User.

Service Element	Details
Third Party Technicians	Third party technicians must be listed within the ASX Work Access Request Form as one of the person(s) conducting work. A User representative must be on-site during the visit, unless express approval is provided by the User that the third party technician may perform Works in the absence of a User representative.
Escorting Users	Visitors are escorted to their Cabinets by an ASX representative. Persons working in the Facility must at all times comply with the directions of security staff or the Facility Manager or their delegate.
Electronic Cabinet Keys	Cabinet keys remain in the possession of ASX at all times. An ASX Operator will both open and close a User's cabinet.
General Access Rules	Eating, drinking, smoking, or use of image capture devices are not allowed in the Facility.
Work Method Rules	The following rules apply to work conducted within the Facility or Bondi Junction data centre: • No soldering or welding is to be carried out without prior permission from the Facility Manager. • No floor tiles are to be lifted. • No unauthorised inspection of another Users' cabinet is allowed. • All cables installed in the cabinets must be run through supplied cable management devices. • Any packaging materials, mess or rubbish created by general access or the Works must be removed on the day of installation. • Visitors are required to keep to a minimum (within reason) the amount of space they take up while performing their work in the Facility. • No packaging boxes or plastics are to be stored in User Cabinets. • The ASX Facility Manager or their delegate will inspect all completed Works. If the Facility Manager or their delegate determines that the Works were not effected to appropriate standards, rectification work as deemed necessary by the Facility Manager or the delegate must be completed by the User.
Video Surveillance	All access to individual Cabinets in the Facility or the Bondi Junction data centre is recorded via video surveillance for security purposes.

9.3 Facility and Bondi Junction Data Centre Access Procedure

Facility visitors are required to adhere to the access procedures below.

Service Element	Details
Emergency Access	Notification is required. Physical access will be scheduled as soon as possible.
Planned Access	48 hours notification required.
ASX Work Access Request Form	All visits require submission of a completed ASX Work Access Request Form.
Prior to Arrival	Users must ensure that prior to arrival: • An ASX Work Access Request Form has been submitted by the User and approved by ASX. • ASX has been notified of any delay. Late arrivals may be refused access at ASX discretion.
On Arrival	On arrival, the following tasks need to be completed: 1) The ASX Facility Operations Centre must be contacted. The Facility Manager or their delegate will meet the Visitor at the ground floor lobby of the Facility. 2) The visitor must provide photo identification to be verified by the Facility Manager or their delegate against the list of authorised personnel. 3) An ASX Operator will record the following in the Computer Room Access Log: • Visitor's name and company; • Time of arrival; and • Brief description of reason for visit. 4) The visitor will be escorted to the appropriate Cabinet by an ASX Operator, who will unlock the Cabinet.
On Departure	The visitor must report to the Facility Operations Centre so the Facility Manager or their delegate can inspect the work performed and record departure information.

9.4 Health and Safety

Users are required to comply with all:

- Health and Safety Laws;
- Site Safety Requirements; and
- Reasonable directions of ASX relating to the safety of the Facility and persons.

Upon request from ASX, the User will cease using any Third Party Technicians, Authorised Personnel and Nominated Representatives in the provision of services that ASX considers unsuitable or fails to comply with any laws relating to occupational health and safety.

The User will give ASX prior written notice of any unsafe or hazardous conditions or material or of any 'hazardous substances' or 'dangerous goods' (as defined in the relevant Health and Safety Laws) which it intends to bring about, upon or bring to the Facility or Bondi Junction data centre. The User will not bring any hazardous substances to the Facility or Bondi Junction data centre without the prior written consent of ASX. The User will remain responsible for the use of such substances.

Any policies or procedures of ASX which relate to health and safety are intended only to assist the User to undertake Works or make use of Services in accordance with Health and Safety Laws, but do not relieve the obligation of the User to comply with all relevant Health and Safety Laws.

Users must:

- Co-operate with any other suppliers or other persons engaged in or associated with services being provided at the Facility in order to maintain safety; and
- Co-operate with ASX to enable ASX to comply with its obligations under all relevant Health and Safety Laws; and
- Immediately advise ASX of any act, fact or circumstance associated with their actions at the Facility relevant to the ability of the User to conduct itself in a manner that is safe and without risks to health and safety; and
- Supply all plant necessary to ensure the provision of the services in a manner that is safe and without risks to health. The User must ensure that all plant supplied by it is maintained in a condition that is safe and without risks to any person.

The User will, prior to entering the Facility, undertake an assessment of the risks associated with the provision of services at the Facility and identify and implement appropriate measures to control all such risks. Details of the risk assessment and evidence of implementation of adequate risk control measures will be provided to ASX upon and in accordance with any reasonable request.

The User will immediately notify ASX of any accident, injury, property or environmental damage which occurs during the provision of the services at the Facility. Where requested, the User will provide a written report to ASX giving complete details of the incident, its cause and any steps to be taken to prevent a recurrence.

10 Technical Services Guidelines

10.1 Goods Receiving, Goods Storage, and Package Disposal Services

Goods Receiving, Goods Storage, and Package Disposal service users must comply with the service elements set below.

Service Element	Details
Service change	The Goods Receiving, Goods Storage, and Packaging Disposal services are subject to change by ASX without notice and such changes are effective immediately.
Health and Safety	Users of services are subject to the Facility Health and Safety requirements.
User Responsibility	Each User is responsible for: • Scheduling all deliveries to the ASX ALC; • All costs associated with delivery to or from the ASX ALC; • All paper work associated with a delivery; • Ensuring all packages are appropriately insured; and • Packages are clearly labelled with: o Company name o Contact details
Service Notification	24 hours notice to Market Access via appropriate form completion. Users are required to update Market Access if the delivery time or date changes or if the delivery is cancelled.
Service Delivery	The services are available on a 24 hour basis. ASX requests services are arranged to occur between 08:00 and 17:00 on Monday to Friday.
Emergency Service	Where these services are arranged at the Facility directly with the ASX ALC Operations staff or where less than 24 hours notice is provided to ASX Market Access, ASX will charge: • the service charge, plus • the ASX Smart Hands charge
Goods Sending	ASX will not send packages to ASX ALC Users. Users can store packages and arrange for the package collection.
Package restrictions	Total package of 3 boxes must not: • exceed 100 cm x 100 cm x 100 cm in total; • exceed 25 kg weight (special arrangements to be organised with Market Access where packages exceed 25 kg to ensure appropriate lifting equipment and resources are available at the time of delivery); • be delivered as a pallet; or • contain liquids, combustibles, or hazardous materials.
Goods Receiving and Goods Storage charging units	Service charges include 3 boxes within the package size requirements
Package Inspections	ASX reserves the right to visually and physically inspect packages including opening packages.
Delivery Refusal	ASX can refuse to accept a delivered package if it does not comply with the defined package restrictions, if the package is damaged, or if the delivery was not advised to ASX.
Missing or Damaged Packages	ASX will not be responsible or liable for missing items or damage to components, which may occur during the packaging and delivery of equipment.
Goods Receiving	If a package is not collected within 24 hours of delivery, the Goods Storage charge will be applied until it is collected.
Package Disposal	ASX ALC Users are required to take all packaging with them when they leave the Facility. Packages and packaging are not to be stored within User Cabinets. Where packaging has not been removed by the User, ASX will immediately dispose of it and deem it to be an emergency service (see above). Users will be notified of the event and the service charge number.

10.2 ASX Smart Hands and ASX Specialist Services

ASX Smart Hands and ASX Specialist service users must comply with the service elements set out below.

Service Element	Details
Service change	The ASX Smart Hands and ASX Specialist services are subject to change by ASX without notice and such changes are effective immediately.
Health and Safety	Users of services are subject to the Facility Health and Safety requirements.
Service Restrictions	Users can only order services for delivery within their own Cabinets.
Service Charges	Standard ordered services: • Services will be charged per hour Reoccurring services (eg. Server restarts, tape removal): • Are only applicable to ASX Smart Hands service; • ASX will estimate and advise of the standard event time for each scheduled service; • The minimum standard event time for a Smart Hands service is 20 minutes; • Users can schedule multiple events in a week (eg 3 x 20 minute tape changes); and • Minimum charge increment is one hour.
Service Description	ASX can reject a Users instruction if the instruction is not reasonable or not within the ASX Smart Hands or ASX Specialist service offering.
Service Requirements	ASX can request additional information before performing a task. This may include further task details, serial numbers or cabinet layout diagrams.

10.3 Equipment Installation or Decommission Services

ASX Equipment Installation or Decommission service users must comply with the service elements set below.

Service Element	Details
Service change	The Equipment Installation or Decommission services are subject to change by ASX without notice and such changes are effective immediately.
Health and Safety	Users of services are subject to the Facility Health and Safety requirements.
Service Restrictions	Users can only order services for delivery within their own cabinets.
Service Description	ASX can reject a Users instruction if the instruction is not reasonable or not within the ASX Equipment Installation or Decommissioning service offering. Notes: • ASX will reject the installation if: o ASX is not appropriately certified to install the requested component; o The installation of a specified component may void the equipment warranty; or o OH&S requirements cannot be met. • The User must provide all requirements for the installation including: o Power Cords; o Network cables; o Equipment rails or shelves; and o Static Transfer Switches.
Service Requirements	ASX may to request additional information before performing a task. This may include further task details, serial numbers or cabinet layout diagrams.
Packaging Disposal	Is included within the Equipment Installation service.
Equipment Disposal	Is not included within the Equipment Decommission service. ASX will store decommissioned equipment under the Goods Storage service. The User is responsible for arranging the collection of the decommissioned equipment.

Service Element	Details
Surplus Parts	Unless the User requests storage until the equipment is collected, ASX will dispose of surplus parts from installations
Faulty Equipment	ASX will notify the User if installed equipment is faulty. ASX will not attempt to resolve issues with faulty equipment. The User can: • Organise appropriate specialist support to come on site to resolve the issue; • Arrange for ASX to remove and store the equipment for the User to collect; or • Use ASX Specialist Support to assist in diagnosing the issue.

11 Glossary

Term	Description
ASP	Auxiliary Service Provider
ASX	ASX Operations Pty Ltd (ABN 42 004 523 782)
Client	A Client of a Participant, Service Provider, or ASX
DC Connection	Direct Cable Connection
DR	Disaster Recovery
ETE	Enhanced Technical Environment – one environment in the ASX Trade PTE
FTE	Functional Technical Environment – one environment in the ASX Trade PTE
GiC	Gateway in Cabinet
IEC	International Electrotechnical Commission
LCC	Liquidity Cross Connect – a connection from a User Cabinet to an ASX Trading Platform
MMOF	Multi-Mode Optical Fibre
MMR	Meet Me Room – where telecommunications providers terminate their services for User access
NSP	Network Service Provider. Any provider of network connectivity outside the Facility (i.e. telecommunications carriers)
Participant	A Trading, Clearing, or Settlement Participant of ASX or ASX 24. A Participant may deliver Participant Services directly to its hosted Clients
Participant Services	Routing of Clients orders to ASX order books
PDU	Power Distribution Unit
PTE	Participant Technical Environment, comprised of the ETE and FTE for ASX Trade
RTC	Redundant Teamed Connection – a second network path to a primary connection
SiC	Switch in Cabinet
SMOF	Single-Mode Optical Fibre
Standard Business Hours	08:30 to 17:30 Monday to Friday, Sydney local time.
TPS	Transactions Per Second
Trading Floor	Area containing User Cabinets and ASX Trading Platforms within the Facility
User	Participants, Participant Clients, Market Information Vendors, Software Vendors, Network Service Providers. In case of a Participant, the reference of a User defines a Participant group, not an enterprise or holding of that group.
UTP	Unshielded Twisted Pair

12 Contact Information

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Disclaimer

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