AUSTRALIAN LIQUIDITY CENTRE

In Detail: Connectivity Guide

ASX

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INTRODUCTION

The Australian Liquidity Centre (ALC) is a state-of-the-art data centre and financial markets community located just outside Sydney's CBD. It enables ASX customers to connect with each other and the Australian and global financial markets like never before.

Offering one central location for fast, simple connection to the financial markets community, the ALC provides low latency connectivity options to domestic and global liquidity sources, ASX market data and all ASX markets.

The ALC is designed to maximise the potential of its community. It houses all of ASX's primary trading, clearing and settlement systems as well as providing hosting facilities for its customers which include buy and sell-side firms, market infrastructure and liquidity venues, information and technology vendors, and infrastructure and network service providers.

The ALC is designed to a Tier-3 standard with fully redundant infrastructure, monitored and controlled 24/7 by both automated systems and onsite support staff.

This Connectivity Guide details technical connectivity at the ALC. If you require further information regarding any of these technical connectivity services, please contact ASX Information and Technical Services team[1].

[1] See Contact Information

ALC Features

The ALC design comprises the following elements:

Fire Protection	**Latest Fire Protection Technology** Gas Suppression and a Dry Pipe Sprinkler System. Very Early Smoke Detection Apparatus (VESDA) installed.
Power Systems	**Uninterrupted Power Supply** The ALC's electrical power is drawn from two separate 33 kV HV utility power supplies supporting a total power load of 3.5 MVA. The Diesel Rotary Uninterruptible Power Supply (DRUPS) system is installed in a distributed redundant configuration providing N+1 supply of up to 4.8MW. Power is fed to the ALC from the DRUPS in a no-break configuration to ensure continuity of supply to the data centre if failure of the power systems occurs. The diesel generators connected to the DRUPS system are tested monthly and have tank capacity for 72 hours of continuous running.
Air Conditioning	**Temperature Controlled Environment** The ALC uses three 1.2 MW air cooled chillers running in an N+1 configuration and is air-conditioned via 28 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. Chilled water buffer tanks are installed to maintain the supply of chilled water during maintenance cutover of chiller systems.
Under Floor Water Detection	**Early Warning** Under floor water leak monitoring systems are installed.
Environmental Controls	**Centrally Secure** All aspects of the ALC's environment are monitored by a central system. Any alarms from these devices are passed to the monitoring system for action by ASX staff located at the ALC.
Telecommunications	**High-Tech Connectivity** Two separate Meet Me Rooms (MMR) are provided in the ALC, each with cable routes via fully diverse access paths. Cabling from the MMRs to the trading floor is provided by optical fibre or copper via diverse communications risers. This cabling is managed by ASX.

ALC Site Security

The ALC is a Tier-3 designed data centre. Customer cabinets and devices within the centre are protected and secured from possible security breaches. Customers are only permitted to access their own cabinets and devices, and cabling infrastructure is protected from unauthorised third-party access.

Physical Access	**Biometric Security** Customers and their representatives wishing to access the ALC must have pre-approved access and must be induction-certified by ASX. During the initial induction process to the ALC, authorised visitors will be logged in the biometric IRIS identification system via a retinal scan. Induction certification involves ALC Health and Safety training on the data centre layout and evacuation points.
Security Monitoring	**360° Visibility** ALC security is controlled by a security token system. All doors are monitored for forced entry and "door open too long" alarms. ALC staff monitor each system. Video cameras are positioned in every row on the trading room floor, monitoring all cabinets.
Cabling Access	**Expertise Ensured** Customers may run their own cable in their own cages and between their own cabinets. Only ASX staff have access to overhead cabling, ensuring the most stringent standards are met.
Wireless Equipment	**Restricted Access** Customer wireless access points are not permitted to be housed within the ALC. Customer wireless equipment is permitted in the ALC to connect to ASX-supplied WiFi internet service.

ALC Access

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

Hours of Access	ALC is accessible 24 hours a day, 7 days a week.
Physical Access	An ASX Work Access Request Form must be completed by authorised customer representatives providing adequate details of: • The purpose and procedure of the work being performed (including any relevant documentation) • Contact details and contact information • Onsite 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	As part of the onboarding process into the ALC, new customers will be required to nominate support personnel who are authorised to be able to: • Request access to the ALC to perform works within the customer cabinet/s, and • Submit an ASX Work Access Request Form on the customer's behalf. Requests will not be accepted from customer employees or representatives not authorised by the customer.
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 customer representative must be onsite during the visit, unless express approval is provided by the customer that the third party technician may perform works in the absence of a customer representative.
Escorting Users	Visitors are escorted to their cabinets by an ASX representative. Persons working in the ALC 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 data hall.
Work Method Rules	The following rules apply to work conducted within the ALC: • 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 customers' cabinets 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. • No packaging boxes or plastics are to be stored in customer cabinets. • The ASX Facility Manager or their delegate will inspect all completed works if requested. If the Facility Manager or their delegate determines that the works were not carried out to appropriate standards, rectification work as deemed necessary by the Facility Manager or the delegate must be completed by the customer.
Video Surveillance	All access to individual cabinets in the ALC is recorded via video surveillance for security purposes.

ALC Access Procedure

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

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 ALC. 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.

Health and Safety

Customers are required to comply with all:

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

Upon request from ASX, the customer 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 customer 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 ALC. The customer will not bring any hazardous substances to the ALC or Bondi Junction data centre without the prior written consent of ASX. The customer 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 customer to undertake works or make use of services in accordance with Health and Safety Laws, but do not relieve the obligation of the customer to comply with all relevant Health and Safety Laws.

Customers must:

- Cooperate with any other suppliers or other persons engaged in or associated with services being provided at the ALC in order to maintain safety, and
- Cooperate 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 ALC 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 customer must ensure that all plant supplied by it is maintained in a condition that is safe and without risks to any person.

The customer will, prior to entering the ALC, undertake an assessment of the risks associated with the provision of services at the ALC 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 customer will immediately notify ASX of any accident, injury, property or environmental damage which occurs during the provision of the services at the ALC. Where requested, the customer 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.

ALC SERVICES – CONNECTIVITY

There are a large number of connectivity options available within the ALC for connecting to different ASX platforms and services. As well as ASX services, there are also cross connectivity options within the ALC to other market participants and/or third party service providers. These include cross connects between the customer and Network Service Providers (NSP), customer-to-customer, and customer to third party service providers. These different connectivity options are presented as single mode optical fibre, multi-mode optical fibre or copper ports within the customer cabinet.

The different connectivity options are discussed in detail in the following section. Some familiarity with ASX products is assumed in this section. If you are completely new to ASX product offering, please contact Information and Technical Services at ASX – contact details can be found at the back of this Connectivity Guide.

ASX TRADE SERVICES

ASX Trade Gateway in Cabinet (GiC)

The standard connection to ASX Trade is GiC and consists of switches, routers and gateways residing in the customer cabinet. This product is delivered as follows:

PHYSICAL LAYER

- ASX will install 2 routers, 2 switches and ASX Trade gateway(s)
- Connection will be delivered RJ45 Cat6 on the back of the gateway
- The media standard is 1000Base-T RJ45

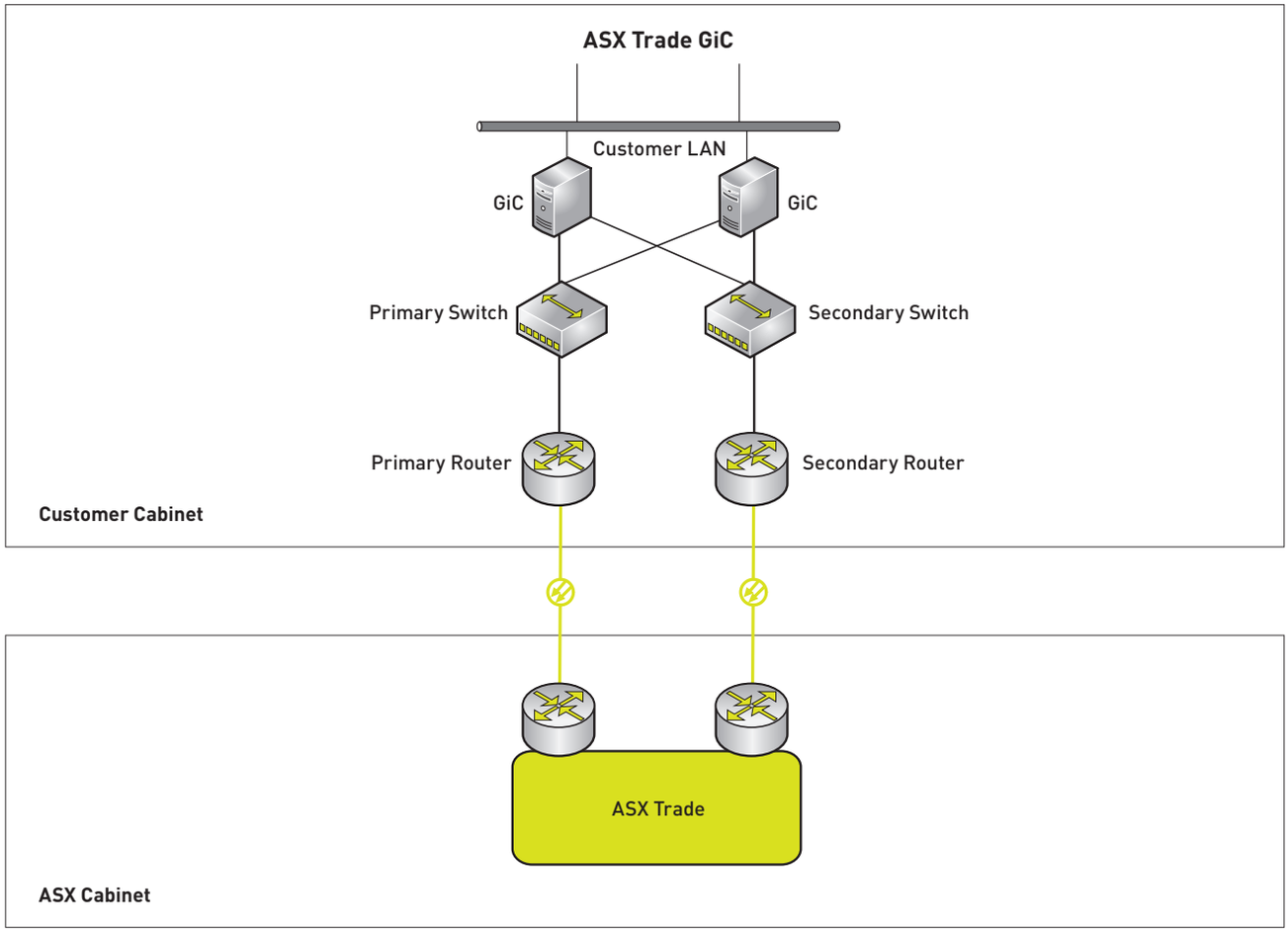
CUSTOMER ADDRESSING

- All addressing is IP Version 4
- The customer can use their own addressing for the customer side of the gateway

CUSTOMER INFRASTRUCTURE

- Customer network infrastructure will not require any additional feature sets
- Redundant Teamed Connections (RTC) are available for ASX Trade GiC gateway

PRODUCTION DIAGRAM



EQUIPMENT SPECIFICATION	
Gateway RU	1RU
Gateway Power Requirement	340W
Server Mounts	Horizontal Rails
Switch RU	1RU each
Switch Power Requirement	123W each
Router RU	1RU each
Router Power Requirement	160W each

GiC SERVICE DETAIL

ASX GiC	DETAILS
Order Books Available	ASX TradeMatch ASX PureMatch
TPS Capacity	Approximately 400 TPS per Gateway*
OI Session Capacity	Up to 40 concurrent OI Sessions*
Subscription Capacity	ASX Trade does not have subscription limitations
IP and Port Connectivity	Access Ports: 15024 or 15025

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

ASX Trade Liquidity Cross Connect (LCC)

ASX Trade LCC utilises TCP through a switched infrastructure.

PHYSICAL LAYER

- Connection will be delivered on OM3 multimode duplex LC connector
- The media standard is 10GBASE-SR 10Gbps Ethernet connection
- It is the customer's responsibility to provide SFP's/XFP's to terminate the fibres

CUSTOMER ADDRESSING

- All addressing is IP Version 4
- The customer can use their own globally unique addressing, or
- The customer can be allocated a private /24 address range and two /30 address ranges to be used on the customer's infrastructure from the following ranges:

  172.30.0.0

  10.30.0.0

  192.168.0.0

ASX ADDRESSING

- Unicast services addressing to be advised by ASX

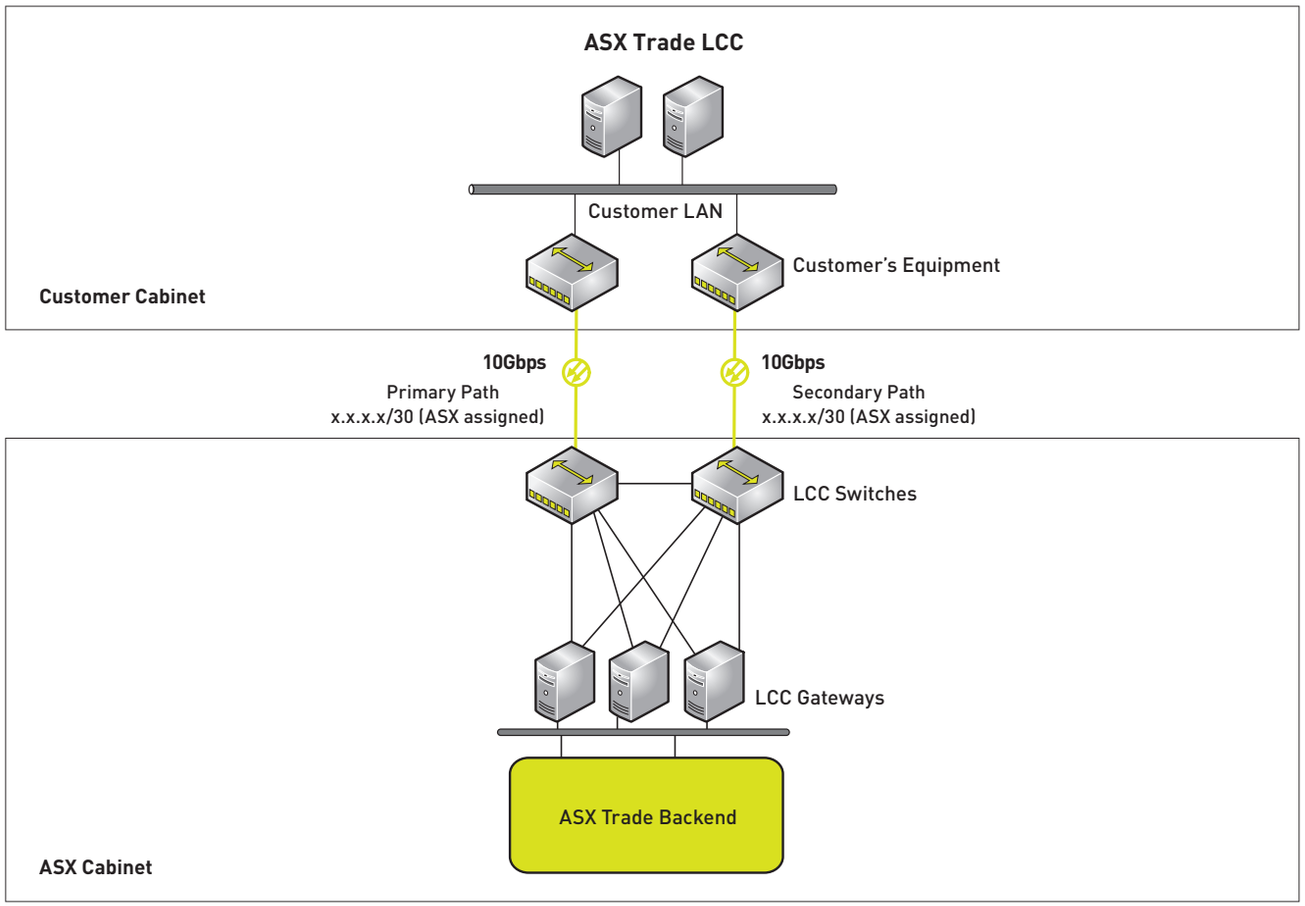
ROUTING

- ASX standard routing is static
- We offer BGP for customers on request
- AS numbers will vary for each service and connection
- MD5 BGP key will be required and can be set by either ASX or the customer
- Sending and receiving prefixes will also need to be agreed upon

CUSTOMER INFRASTRUCTURE

- Customer network infrastructure will not require any additional feature sets
- Customer infrastructure should be sized so it can buffer 10Gbps bursts

PRODUCTION DIAGRAM



LCC SERVICE DETAIL	
Order Books Available	ASX TradeMatch ASX PureMatch
TPS Capacity	Soft limit of 500 TPS per LCC
OI Session Capacity	45 concurrent OI Sessions of any TPS capacity per LCC
Subscription Capacity	No subscription limitations
IP and Port Connectivity	Each LCC has a dedicated IP address and port to which its user must connect Port: assigned by ASX from within the range 15024 to 15028

ASX OUCH

ASX OUCH is ASX's lowest latency order messaging platform for the equities market.

ASX OUCH utilises TCP through a switched infrastructure. Please note that ASX will utilise the same physical connections for ASX OUCH as the customer's ASX Trade LCC connections.

PHYSICAL LAYER

- Customers will use their existing ASX Trade LCC connection to connect to ASX OUCH
- If this is a new service it will be delivered on OM3 multimode duplex LC connector
- The media standard is 10GBASE-SR 10Gbps Ethernet connection
- It is the customer's responsibility to provide SFP's/XFP's to terminate the fibres

CUSTOMER ADDRESSING

- All addressing is IP Version 4
- We will presume that the customer will in most cases be using the same source subnet as their ASX Trade LCC connection, however additional ranges can be added if required. In this case additional address ranges will need to be specified on the order request
- The customer can use their own globally unique addressing, or
- The customer can be allocated a private /24 address range and two /30 address ranges to be used on the customer's infrastructure from the following ranges:

  172.30.0.0

  10.30.0.0

  192.168.0.0

ASX ADDRESSING

- Unicast services addressing to be advised by ASX

ROUTING

- ASX standard routing is static
- We do offer BGP for customers on request
- AS numbers will vary for each service and connection
- MD5 BGP key will be required and can be set by either ASX or the customer
- Sending and receiving prefixes will also need to be agreed upon

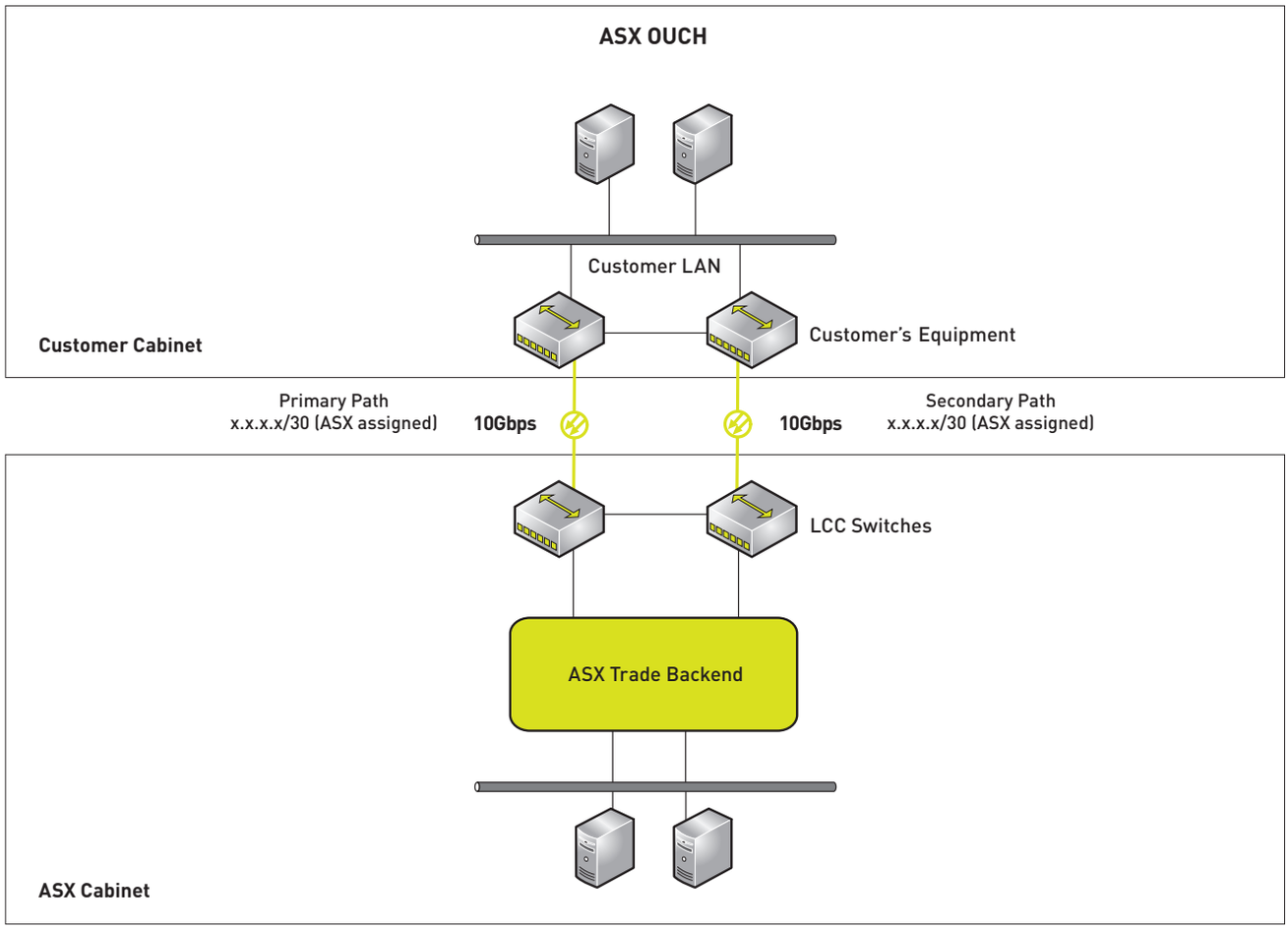
CUSTOMER INFRASTRUCTURE

- Customer network infrastructure will not require any additional feature sets
- Customer infrastructure should be sized so it can buffer 10Gbps bursts

CUSTOMER TEST ENVIRONMENT

- The customer test environment is provided on separate infrastructure thus a separate cross connect is required. If the customer has an existing trade PTE connection, ASX will enable ASX OUCH on that cross connect
- The physical layer specifications are the same as production

PRODUCTION DIAGRAM



IP ADDRESS AND TCP PORT INFORMATION

Please note that ASX will assign 5 ports to each customer that will relate to:

Port 1 Partition 1
Port 2 Partition 2
Port 3 Partition 3
Port 4 Partition 4
Port 5 Partition 5

In addition, the 15024 port has been made available as an OMNet APS port. This allows customers to connect to an in-house API to change their password for ASX OUCH sessions. This is not for general API (trading) usage.

AGGREGATE ADDRESS	**203.0.119.81/28**			
Service	Server 1	Server 2	API Port Range (5 per customer)	API Port
ASX OUCH Primary ALC	203.0.119.84	203.0.119.85	15995	15024
ASX OUCH Secondary ALC	203.0.119.86	203.0.119.87	16001-16495	15024

ASX OUCH SERVICE DETAIL	
Order Books Available	ASX TradeMatch ASX PureMatch – Partition 5
TPS Capacity	50 TPS standard, can be increased in 10 TPS blocks

ASX ITCH

ASX ITCH is ASX's low latency market data platform utilising multicast through a switched infrastructure. ASX ITCH customers will need to allow for the following infrastructure requirements:

Please note that ASX ITCH and ASX 24 ITCH utilise the same physical connections.

PHYSICAL LAYER

- The service will be delivered on OM3 multimode duplex LC connector
- The media standard is 10GBASE-SR 10Gbps Ethernet connection
- It is the customer's responsibility to provide SFP's/XFP's to terminate the fibres

CUSTOMER ADDRESSING

- All addressing is IP Version 4
- The customer can use their own globally unique addressing, or
- The customer can be allocated a private /24 address range and two /30 address ranges to be used on the customer's infrastructure from the following ranges:

  172.30.0.0

  10.30.0.0

  192.168.0.0

ASX ADDRESSING

- Multicast configuration (addressing, static RP, multicast groups) to be advised by ASX
- Unicast services addressing to be advised by ASX

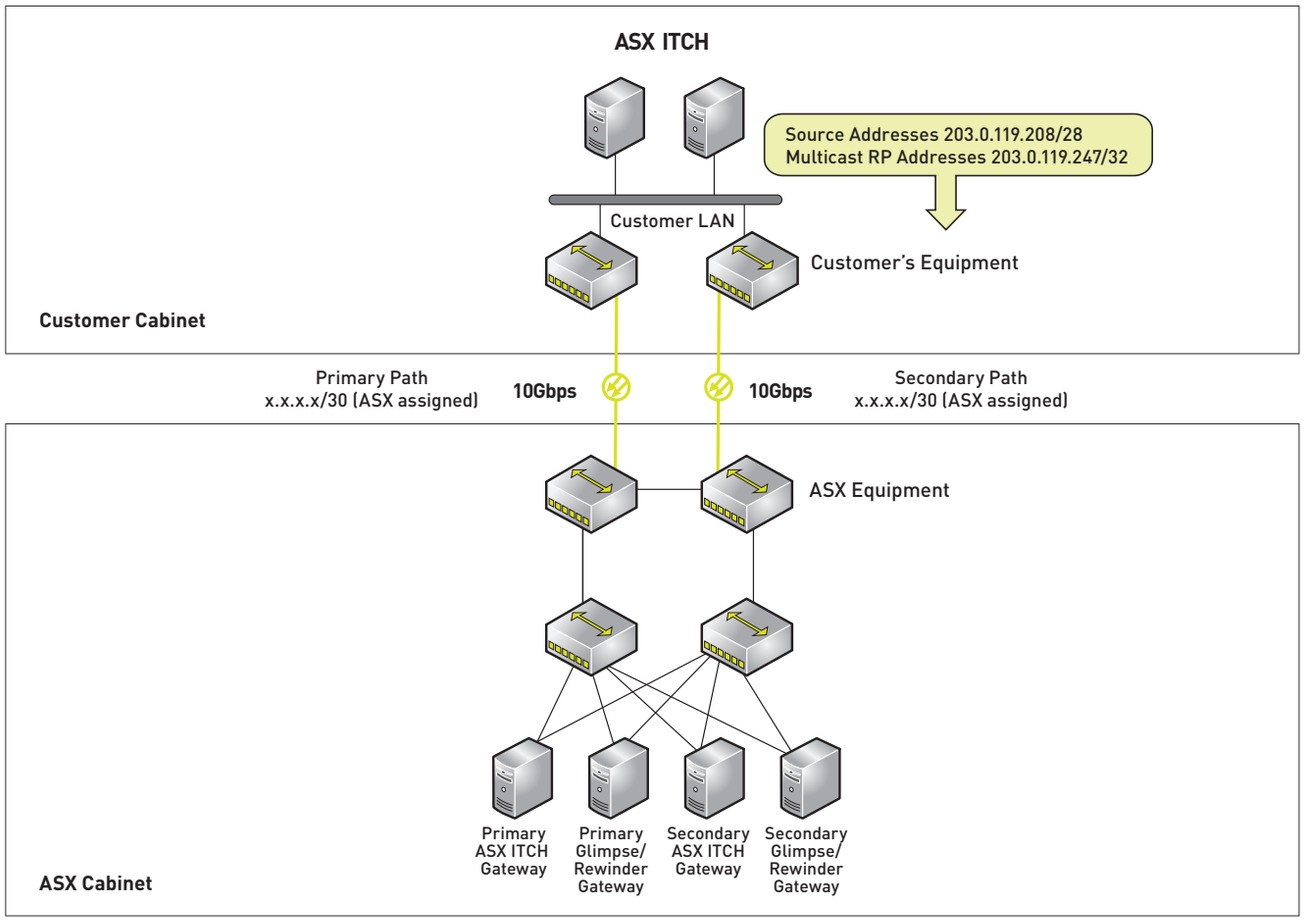
CUSTOMER'S INFRASTRUCTURE

- Customer's network infrastructure will require the multicast feature set
- Customer's infrastructure should be sized so it can buffer 10Gbps bursts
- Customers can elect to have separate connections for ASX ITCH and ASX 24 ITCH but must terminate it on separate infrastructure

ROUTING

- ASX standard routing is static
- We do offer BGP for customers on request
- AS numbers will vary for each service and connection
- MD5 BGP key will be required and can be set by either the exchange or customer
- Sending and receiving prefixes will also need to be agreed upon

PRODUCTION DIAGRAM



Customers of ALC will be required to configure for the below multicast solution.

CONFIGURATION

The configuration is engineered so that all traffic goes via the primary path in an active-standby arrangement.

PRODUCTION MULTICAST AND UNICAST ADDRESSING

AGGREGATE ADDRESS	203.0.119.208/28	233.71.185.8/29					
Production	**Multicast Source**	**Multicast Group**	**Multicast Port**	**Glimpse Address**	**Glimpse Port TCP**	**Rewinder IP Address**	**Rewinder UDP Port**
Channel A							
Partition 1	203.0.119.212	233.71.185.8	21001	203.0.119.213	21801	203.0.119.213	24001
Partition 2	203.0.119.212	233.71.185.9	21002	203.0.119.213	21802	203.0.119.213	24002
Partition 3	203.0.119.212	233.71.185.10	21003	203.0.119.213	21803	203.0.119.213	24003
Partition 4	203.0.119.212	233.71.185.11	21004	203.0.119.213	21804	203.0.119.213	24004
Partition 5	203.0.119.212	233.71.185.12	21005	203.0.119.213	21805	203.0.119.213	24005
Channel B							
Partition 1	203.0.119.214	233.71.185.16	21101	203.0.119.215	21801	203.0.119.215	24001
Partition 2	203.0.119.214	233.71.185.17	21102	203.0.119.215	21802	203.0.119.215	24002
Partition 3	203.0.119.214	233.71.185.18	21103	203.0.119.215	21803	203.0.119.215	24003
Partition 4	203.0.119.214	233.71.185.19	21104	203.0.119.215	21804	203.0.119.215	24004
Partition 5	203.0.119.214	233.71.185.20	21105	203.0.119.215	21805	203.0.119.215	24005

MULTICAST PIM RENDEZVOUS POINT PRODUCTION

MULTICAST RP ADDRESS	203.0.119.247/32

ASX Clear

Below is the technical information customers will need to connect to ASX Clear platform.

PHYSICAL LAYER

- Connection will be delivered on 1Gbps copper into the customers rack
- The media standard is copper 1000BASE-T
- It is the customer's responsibility to provide the termination equipment

CUSTOMER ADDRESSING

- All addressing is IP Version 4
- The customer can use their own addressing for the connection

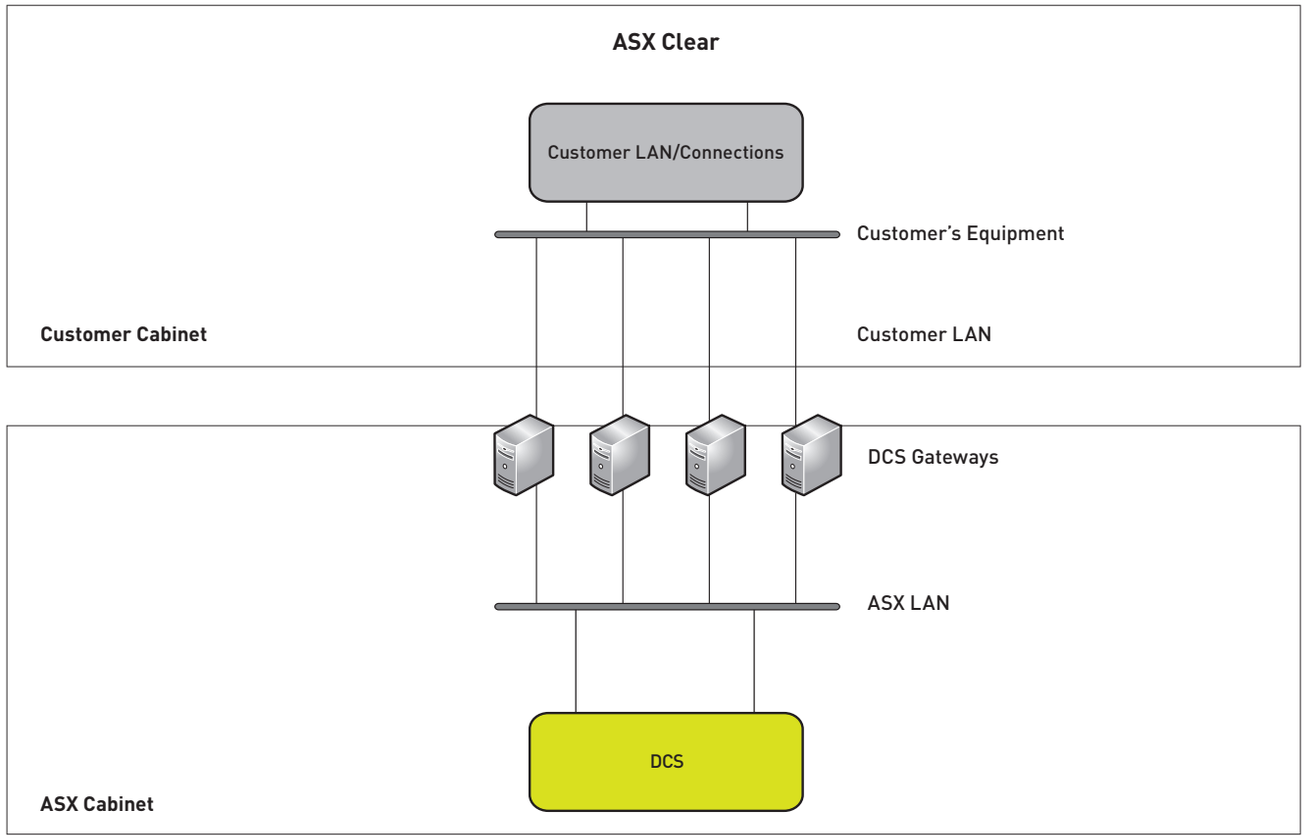
ASX ADDRESSING

- The connection for the application will be the IP address the customer assigned and port 20240, 20025
- Outbound connections from ASX will be to ports 20240, 20222 and 20024

CUSTOMER INFRASTRUCTURE

- Customer network infrastructure will not require any additional feature sets

PRODUCTION DIAGRAM



ASX Settlement

The settlement system and electronic securities depository for all cash equities traded in Australia is ASX Settlement. Settlement is conducted through the Clearing House Electronic Subregister System (CHESS). Through CHESS, customers receive true Delivery versus Payment (DvP), exchanging cash for securities irrevocably.

Connections for CHESS are as follows and are accessed via the E2 (SiC) solution described at the end of this section.

ASX Settlement:	203.4.179.22	4200	Production
ASX Settlement:	203.4.179.23	4207	External Test Service (XP1)
ASX Settlement:	203.4.179.23	4210	External Test Service (XP2)
ASX Settlement:	203.4.179.23	4208	Performance Test (Test 9)
ASX Settlement (CHESS) :	203.4.179.23	4209	Accreditation (Comm Test)

ASX Best

Below is the technical information customers will need to connect to ASX Best.

PHYSICAL LAYER

- Connection will be delivered on 1Gbps copper into the customers rack
- The media standard is copper 1000BASE-T
- It is the customer's responsibility to provide the termination equipment
- ASX Best can be delivered over ASX Trade LCC

CUSTOMER ADDRESSING

- All addressing is IP Version 4
- The customer can use their own addressing for the connection

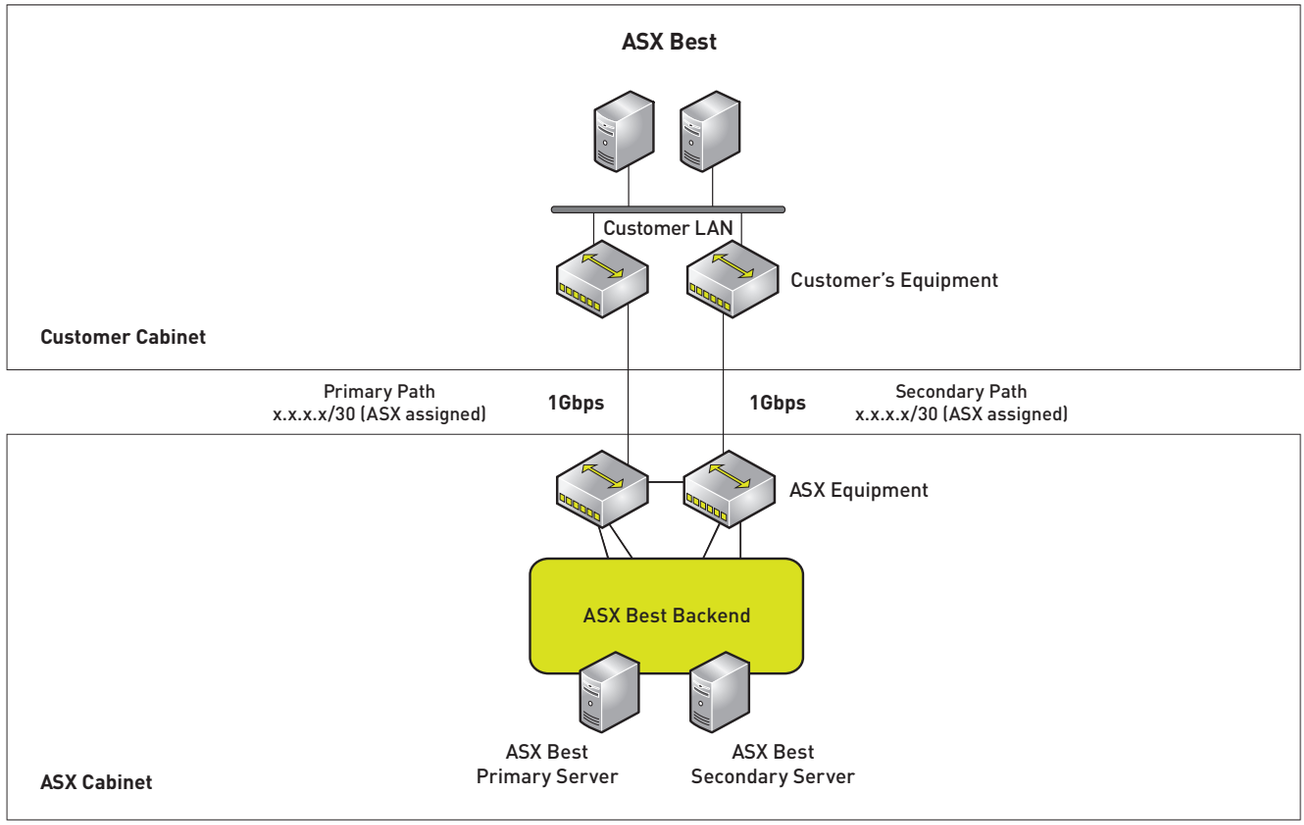
ASX ADDRESSING

- Primary connection is to 203.0.119.250 18997
- Secondary connection is to 203.0.119.251 18997

CUSTOMER INFRASTRUCTURE

- Customer network infrastructure will not require any additional feature sets

PRODUCTION DIAGRAM



ASX TRADE24 SERVICES

ASX Trade24 Gateway in Cabinet (GiC)

Standard connections to ASX Trade24 are delivered as follows:

PHYSICAL LAYER

- ASX will install 2 routers, 2 switches and ASX Trade24 gateway(s)
- Connection will be delivered RJ45 Cat6 on the back of the gateway
- The media standard is copper 1000Base-T RJ45

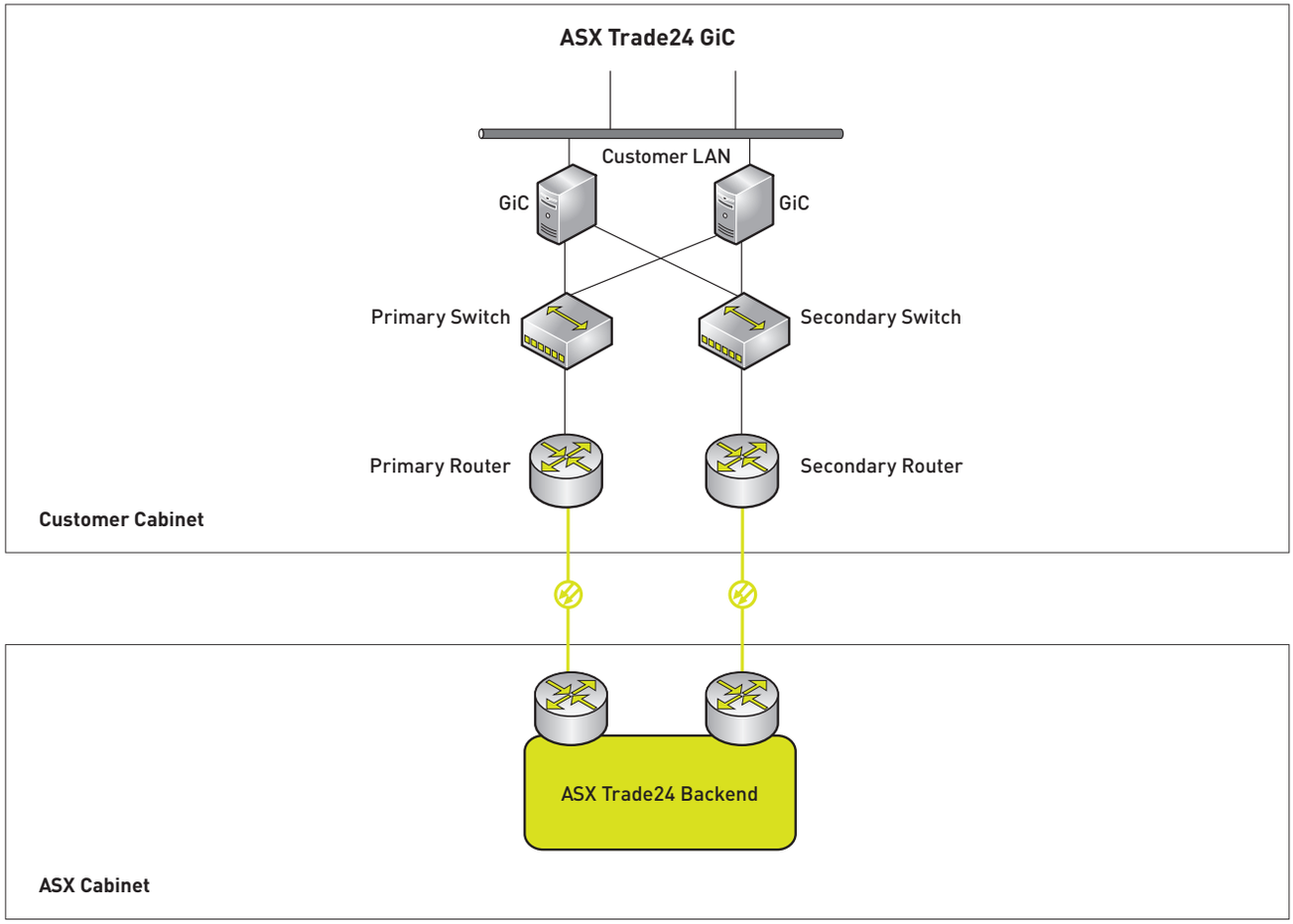
CUSTOMER ADDRESSING

- All addressing is IP Version 4
- The customer can use their own addressing for the customer side of the gateway

CUSTOMER INFRASTRUCTURE

- Customer network infrastructure will not require any additional feature sets
- RTCs are available for ASX Trade24 GiC gateways

PRODUCTION DIAGRAM



EQUIPMENT SPECIFICATION	
Gateway RU	1RU
Gateway Power Requirement	340W
Server Mounts	Horizontal Rails
Switch RU	1RU each
Switch Power Requirement	115W each
Router RU	1RU each
Router Power Requirement	130W each

ASX TRADE24 GiC SERVICE DETAIL	
Connection and Redundancy	As per ASX GiC solution
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 Port: 2634 RDP: 55035

ASX Trade24 LCC

ASX Trade24 LCC connection is delivered on a 1 to 1 basis into the back of a hosted server in ASX's cabinet.

PHYSICAL LAYER

- Connection will be delivered on 1Gbps copper into the customers rack
- The media standard is copper 1000BASE-T
- It is the customer's responsibility to provide the termination equipment

CUSTOMER ADDRESSING

- All addressing is IP Version 4
- The customer can use their own addressing for the connection

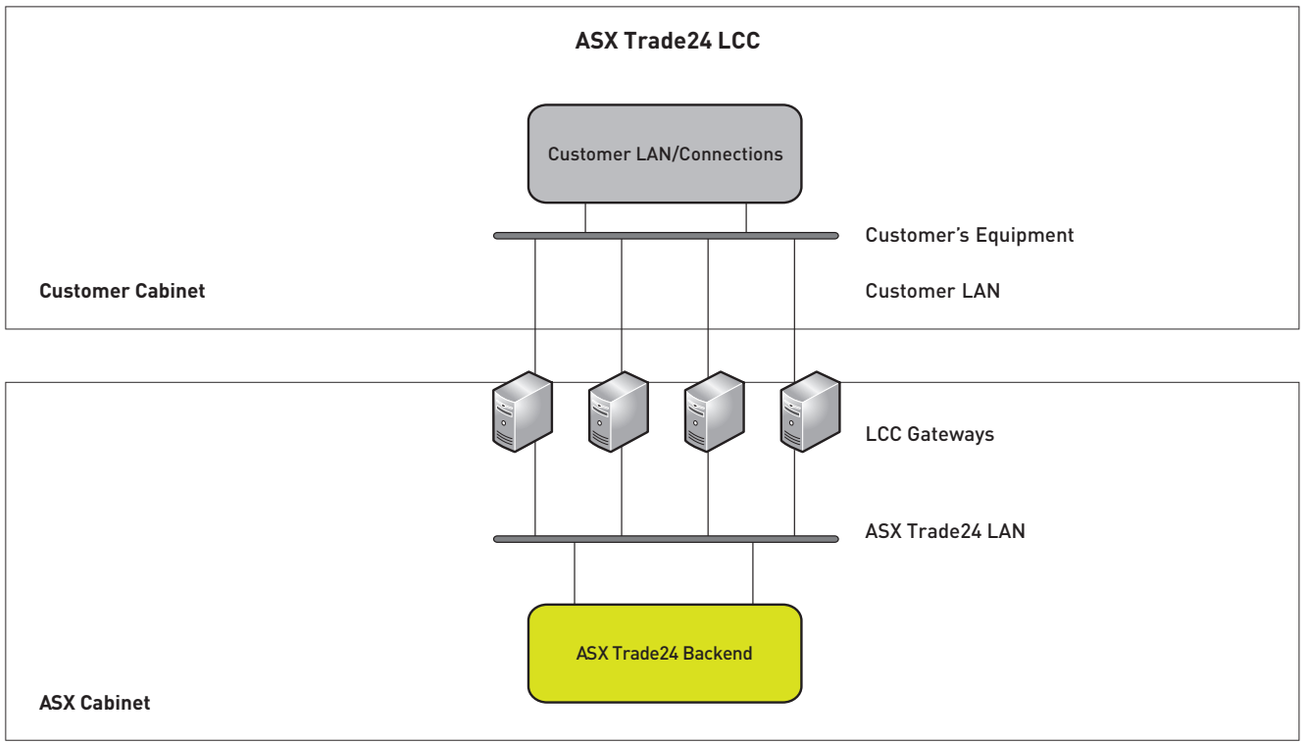
ASX ADDRESSING

- The connection for FIX will be the IP address the customer assigned and port 2634
- To manage the account and limits on the server the connection will utilise the same IP and port 55035

CUSTOMER INFRASTRUCTURE

- Customer network infrastructure will not require any additional feature sets

PRODUCTION DIAGRAM



ASX TRADE24 LCC SERVICE DETAIL	
TPS Capacity	12 TPS per connection
ASX 24 Risk Administration	Access via RDP 55035
IP and Port Connectivity	Each LCC has a dedicated IP address and port to which its user must connect IP Address: Customer can assign any IP address to the broker side of these gateways; in addition if return routes are required ASX can add them as needed Port: 2634

ASX 24 ITCH

Below is the technical information customers will need to connect to ASX 24 ITCH.

Please note that ASX will utilise the same physical connections for both ASX ITCH and ASX 24 ITCH.

PHYSICAL LAYER

- The service will be delivered on OM3 multimode duplex LC connector
- The media standard is 10GBASE-SR 10Gbps Ethernet connection
- It is the customer's responsibility to provide SFP's/XFP's to terminate the fibres

CUSTOMER ADDRESSING

- All addressing is IP Version 4
- The customer can use their own globally unique addressing, or
- The customer can be allocated a private /24 address range and two /30 address ranges to be used on the customer's infrastructure from the following ranges:

  172.30.0.0

  10.30.0.0

  192.168.0.0

ASX ADDRESSING

- Multicast configuration (addressing, static RP, multicast groups) to be advised by ASX
- Unicast services addressing to be advised by ASX

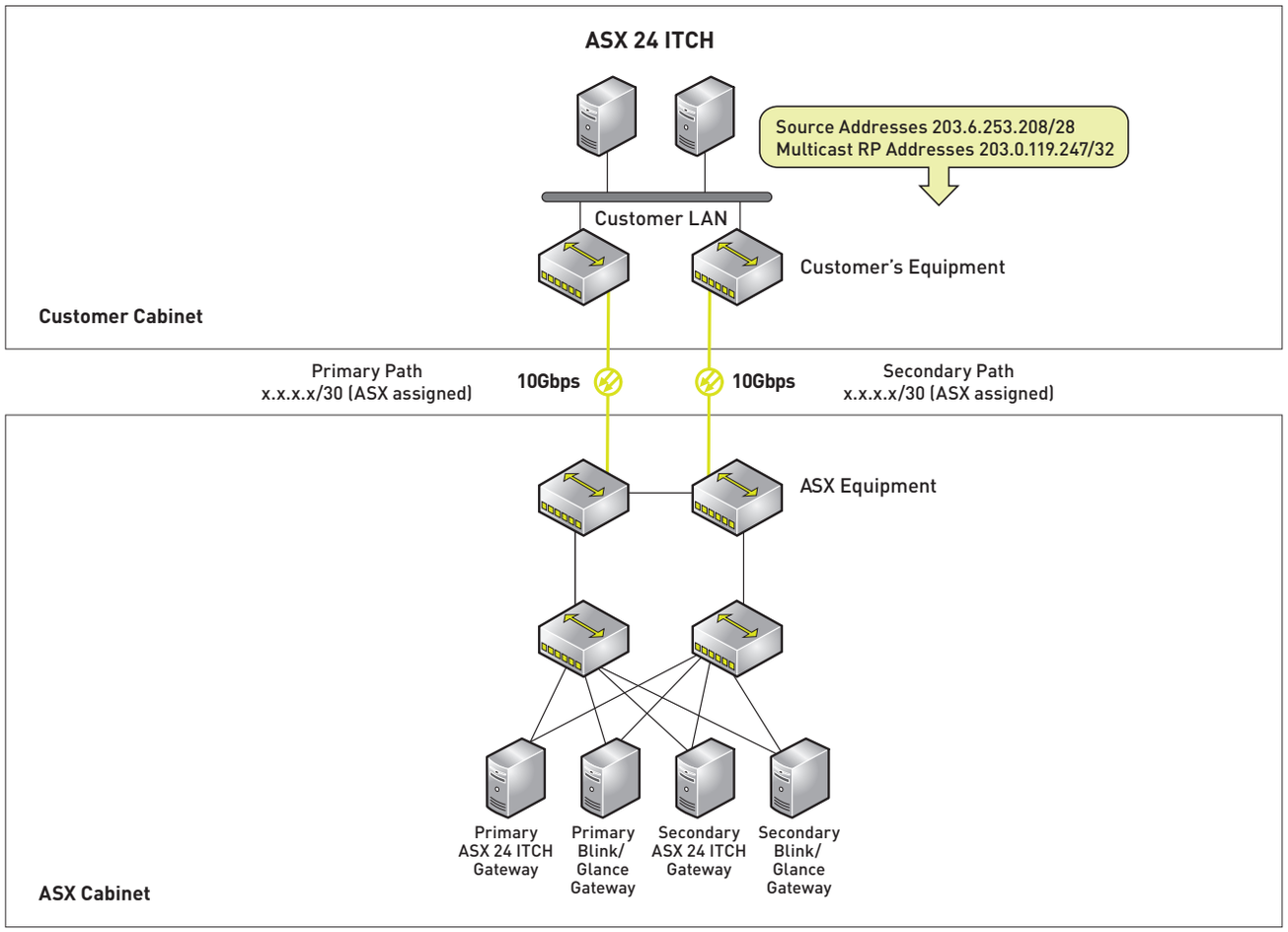
CUSTOMER'S INFRASTRUCTURE

- Customer's network infrastructure will require the multicast feature set
- Customer's infrastructure should be sized so it can buffer 10Gbps bursts
- Customers can elect to have separate connections for ASX ITCH and ASX 24 ITCH but must terminate these on separate infrastructure

ROUTING

- ASX standard routing is static
- We do offer BGP for customers on request
- AS numbers will vary for each service and connection
- MD5 BGP key will be required and can be set by either ASX or the customer
- Sending and receiving prefixes will also need to be agreed upon

PRODUCTION DIAGRAM



ASX 24 ITCH CONFIGURATION REQUIREMENTS

Customers of ASX 24 ITCH will be required to configure for the below multicast solution.
The following are the key elements for assessing the below requirements.

AGGREGATE ADDRESS	203.6.253.208/28	233.71.185.128/28					
Production	**Multicast Source**	**Multicast Group**	**Multicast Port**	**Glance Address**	**Glance Port TCP**	**Blink Address**	**Blink UDP Port**
Channel A							
NZFOE Channel A	203.6.253.212	233.71.185.129	31002	203.6.253.213	31802	203.6.253.213	31902
SFE Channel A	203.6.253.212	233.71.185.130	31003	203.6.253.213	31803	203.6.253.213	31903
Channel B							
NZFOE Channel B	203.6.253.214	233.71.185.145	32702	203.6.253.215	31802	203.6.253.215	31902
SFE Channel B	203.6.253.214	233.71.185.146	32703	203.6.253.215	31803	203.6.253.215	31903

ASX Clear (Futures)

Below is the technical information customers will need to connect to ASX Clear (Futures).

PHYSICAL LAYER

- Connection will be delivered on 1Gbps copper into the customer's rack
- The media standard is copper 1000BASE-T
- It is the customer's responsibility to provide the termination equipment

CUSTOMER ADDRESSING

- All addressing is IP Version 4
- The customer can use their own addressing for the connection

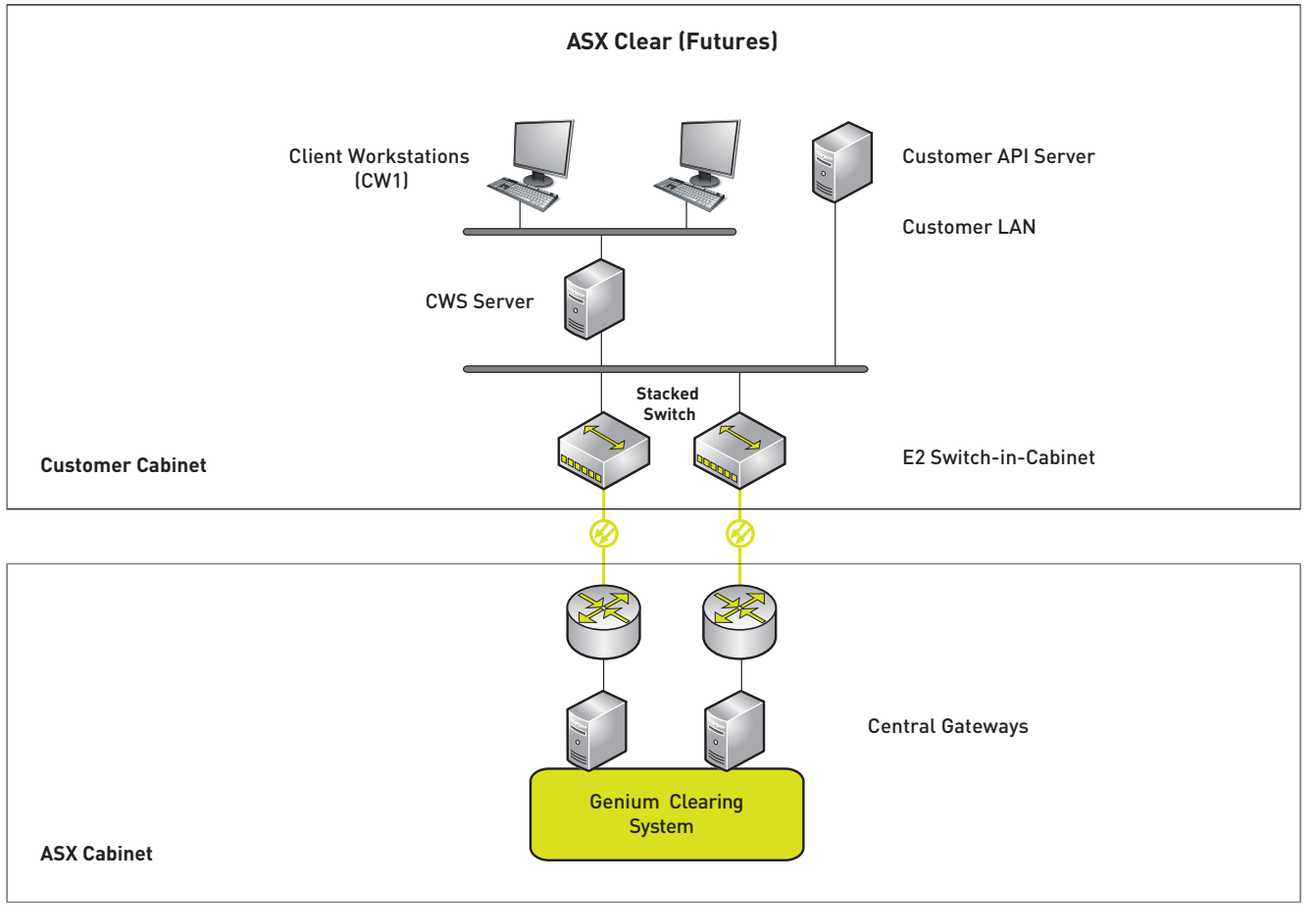
ASX ADDRESSING

- Workstation connections: Genium workstations connect to the CWS server on port 2121 and 2122
- API Connections: Genium API applications connect to the ASX-hosted Genium servers at 203.4.179.237 on port 32024 and 32025

CUSTOMER INFRASTRUCTURE

- Customer network infrastructure will not require any additional feature sets

PRODUCTION DIAGRAM



ASX TEST AND DEVELOPMENT ENVIRONMENTS

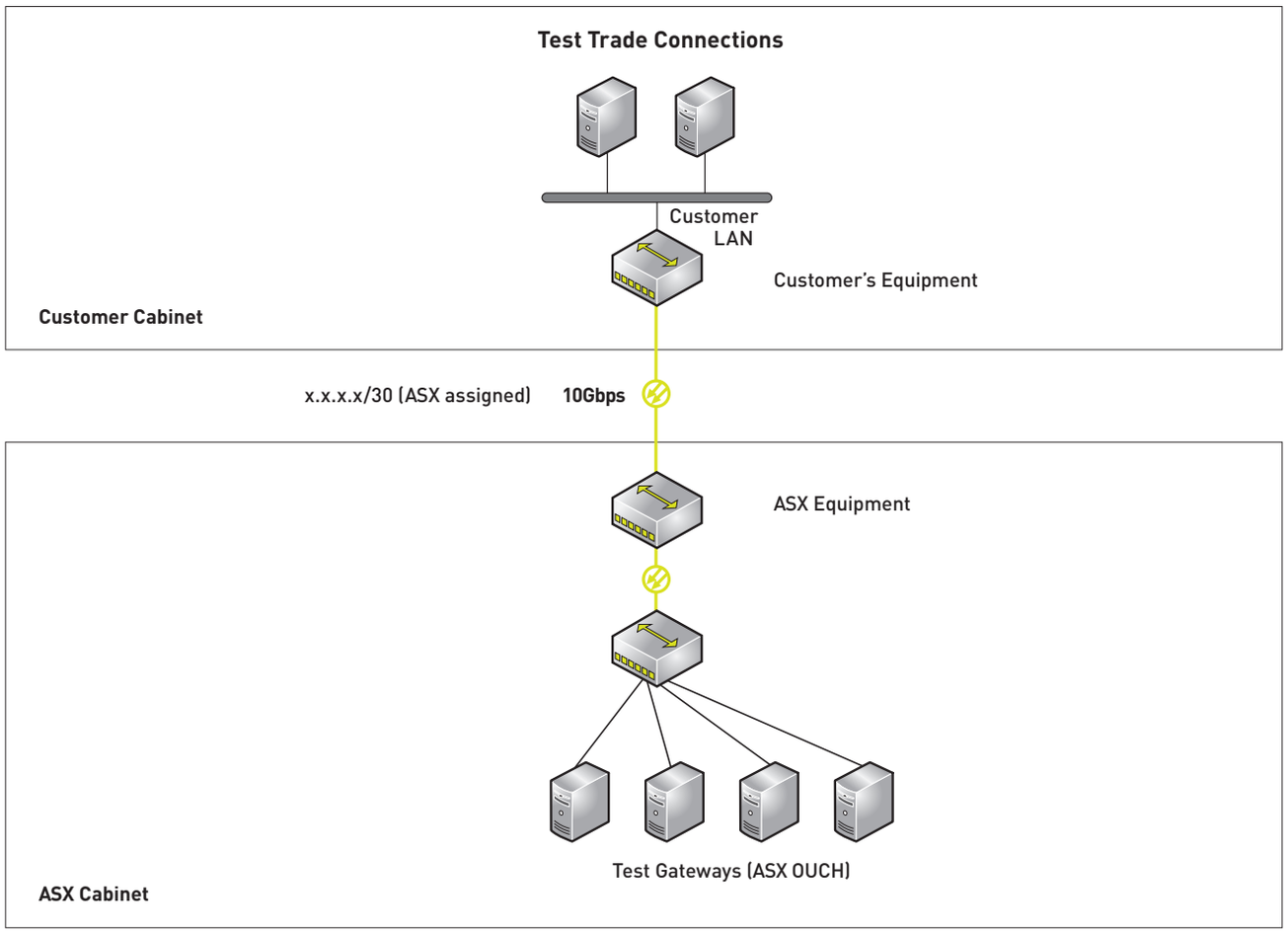
ASX Trade and ASX OUCH Development

CUSTOMER TEST ENVIRONMENT

- The customer test environment is provided on separate infrastructure thus a separate cross connect is required
- Please note that in the test environment ASX does not offer an RTC connection
- The physical layer specifications are the same as production

AGGREGATE ADDRESS	**203.0.119.81/28**			
Service	Server 1	Server 2 (5 per customer)	API Port Range	RTR Port
FTE ASX OUCH	203.0.119.168	203.0.119.169	15501-15579	15024
ETE ASX OUCH	203.0.119.170	203.0.119.171	15501-15579	15024

DEVELOPMENT DIAGRAM

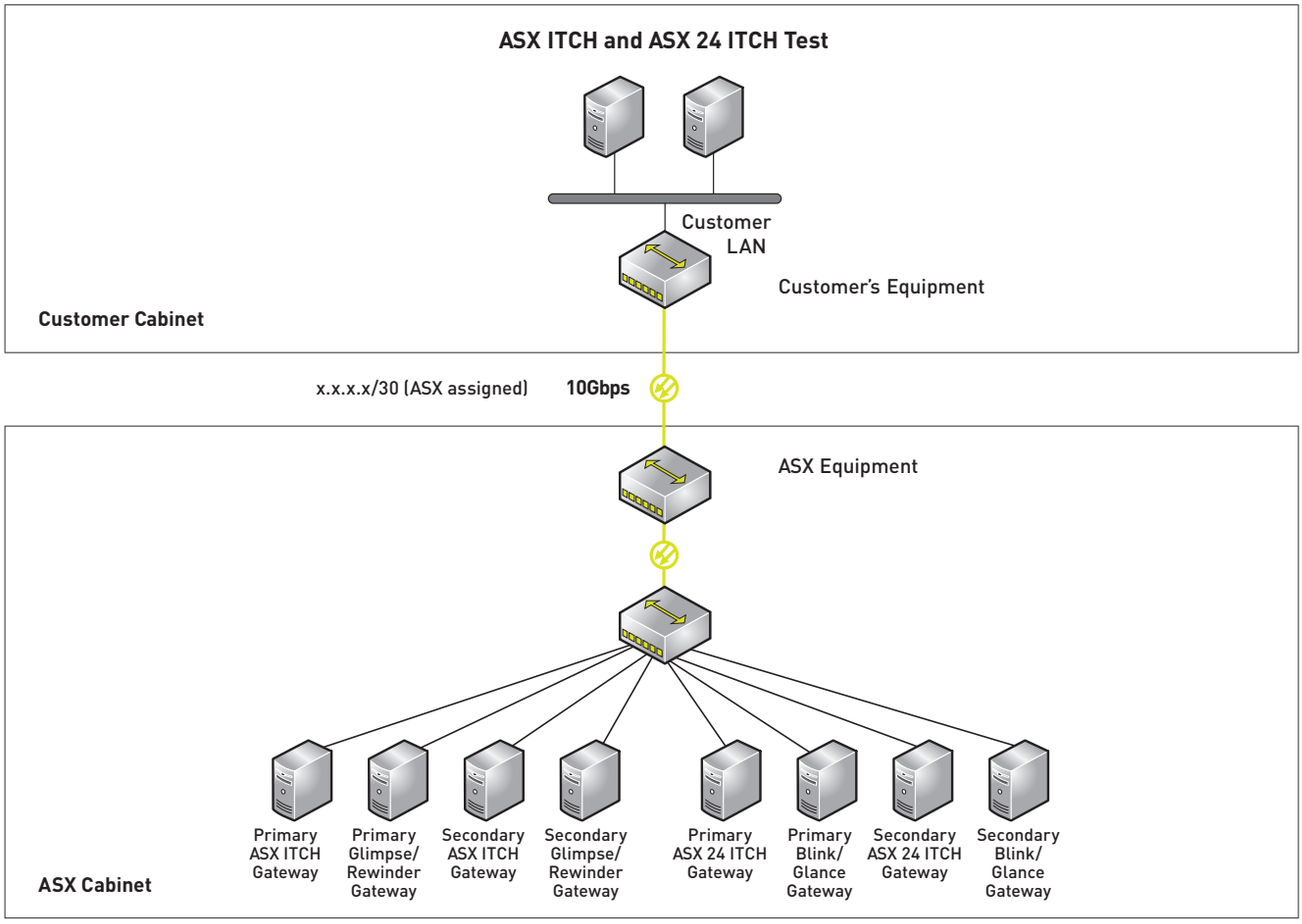


ASX ITCH and ASX 24 ITCH Development

CUSTOMER TEST ENVIRONMENT

- The customer test environment is provided on separate infrastructure thus a separate cross connect is required
- The physical layer specifications are the same as production
- The customer test environment only has one channel

DEVELOPMENT DIAGRAM



ASX ITCH DEVELOPMENT PLATFORM

AGGREGATE ADDRESS	203.0.119.224/28	233.54.12.232/29					
PTE ETE Channel A	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**	**Glimpse Address**	**Glimpse Port TCP**	**Rewinder IP Address**	**Rewinder UDP Port**
Partition 1	203.0.119.229	233.54.12.232	21001	203.0.119.229	21801	203.0.119.229	24001
Partition 2	203.0.119.229	233.54.12.233	21002	203.0.119.229	21802	203.0.119.229	24002
Partition 3	203.0.119.229	233.54.12.234	21003	203.0.119.229	21803	203.0.119.229	24003
Partition 4	203.0.119.229	233.54.12.235	21004	203.0.119.229	21804	203.0.119.229	24004
Partition 5	203.0.119.229	233.54.12.236	21005	203.0.119.229	21805	203.0.119.229	24005
AGGREGATE ADDRESS	**203.0.119.224/28**	**233.54.12.216/29**					
PTE ETE Channel B	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**	**Glimpse Address**	**Glimpse Port TCP**	**Rewinder IP Address**	**Rewinder UDP Port**
Partition 1	203.0.119.231	233.54.12.216	21101	203.0.119.231	21801	203.0.119.231	24001
Partition 2	203.0.119.231	233.54.12.217	21102	203.0.119.231	21802	203.0.119.231	24002
Partition 3	203.0.119.231	233.54.12.218	21103	203.0.119.231	21803	203.0.119.231	24003
Partition 4	203.0.119.231	233.54.12.219	21104	203.0.119.231	21804	203.0.119.231	24004
Partition 5	203.0.119.231	233.54.12.220	21105	203.0.119.231	21805	203.0.119.231	24005
AGGREGATE ADDRESS	**203.0.119.224/28**	**233.54.12.240/29**					
PTE FTE Channel A	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**	**Glimpse Address**	**Glimpse Port TCP**	**Rewinder IP Address**	**Rewinder UDP Port**
Partition 1	203.0.119.228	233.54.12.240	21001	203.0.119.228	21801	203.0.119.228	24001
Partition 2	203.0.119.228	233.54.12.241	21002	203.0.119.228	21802	203.0.119.228	24002
Partition 3	203.0.119.228	233.54.12.242	21003	203.0.119.228	21803	203.0.119.228	24003
Partition 4	203.0.119.228	233.54.12.243	21004	203.0.119.228	21804	203.0.119.228	24004
Partition 5	203.0.119.228	233.54.12.244	21005	203.0.119.228	21805	203.0.119.228	24005
AGGREGATE ADDRESS	**203.0.119.224/28**	**233.54.12.224/29**					
PTE FTE Channel B	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**	**Glimpse Address**	**Glimpse Port TCP**	**Rewinder IP Address**	**Rewinder UDP Port**
Partition 1	203.0.119.230	233.54.12.224	21101	203.0.119.230	21801	203.0.119.230	24001
Partition 2	203.0.119.230	233.54.12.225	21102	203.0.119.230	21802	203.0.119.230	24002
Partition 3	203.0.119.230	233.54.12.226	21103	203.0.119.230	21803	203.0.119.230	24003
Partition 4	203.0.119.230	233.54.12.227	21104	203.0.119.230	21804	203.0.119.230	24004
Partition 5	203.0.119.230	233.54.12.228	21105	203.0.119.230	21805	203.0.119.230	24005

ASX 24 ITCH DEVELOPMENT PLATFORM

AGGREGATE ADDRESS	203.6.253.208/28	233.71.185.128/28					
Primary Site Channel A	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**	**Glance Address**	**Glance Port TCP**	**Blink Address**	**Blink Port UDP**
NZFOE Channel A	203.6.253.212	233.71.185.129	31002	203.6.253.213	31802	203.6.253.213	31902
SFE Channel A	203.6.253.212	233.71.185.130	31003	203.6.253.213	31803	203.6.253.213	31903
AGGREGATE ADDRESS	**203.6.253.208/28**	**233.71.185.144/28**					
Primary Site Channel B	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**	**Glance Address**	**Glance Port TCP**	**Blink Address**	**Blink Port UDP**
NZFOE Channel B	203.6.253.214	233.71.185.145	32702	203.6.253.215	31802	203.6.253.215	31902
SFE Channel B	203.6.253.214	233.71.185.146	32703	203.6.253.215	31803	203.6.253.215	31903
AGGREGATE ADDRESS	**203.6.253.224/28**	**233.71.185.160/28**					
Primary Site Channel A	**Multicast Source IP**	**Multicast Group**	**Multicast Destination Port**	**Glance Address**	**Glance Port TCP**	**Blink Address**	**Blink Port UDP**
NZFOE Channel A	203.6.253.229	233.71.185.161	31002	203.6.253.230	31802	203.6.253.230	31902
SFE Channel A	203.6.253.229	233.71.185.162	31003	203.6.253.230	31803	203.6.253.230	31903

ALC CROSS CONNECTS

ASX offers a wide range of different connectivity options within the ALC and also to destinations outside the data centre. Refer to the latest ASX Schedule of Fees[2] to see prices for these cross connects.

ALC hosts a diverse range of financial market customers across:

- Buy and Sell-side firms
- Market Infrastructure and Liquidity Venues
- Information and Technology Vendors
- Infrastructure and Network Service Providers

ASX will facilitate connectivity between members of the community via ALC community cross connects.

NSP UNMANAGED FIBRE CROSS CONNECT 1 GB

This cross connect is delivered from Telco Room A or B for a carrier WAN connection, generally for trading and/or market data connections or other high bandwidth applications.

BSP FIBRE CROSS CONNECT 1GB

This cross connect is used to connect between two ALC customers' cabinets, e.g. broker-to-broker, buy-side-to-broker or broker-to-service provider connections.

NSP COPPER CROSS CONNECTION 10MB AND BELOW

This cross connect is delivered from Telco Room A or B. It is for low speed services (voice, ADSL etc) and is delivered as copper in the customers rack.

NSP CROSS CONNECT 100MB

These connections are delivered as SMOF from either Telco Room A or B. When ordering a telco service requiring a cross connect to a cabinet, ASX will require a certificate of completion so that the circuit termination can be identified in order to tie it up to the customer cabinet.

RTC CONNECTION

This is any redundant connection for any ASX system. The RTC provides a physically separate redundant path for a LCC. RTCs are available for all ALC LCCs.

COMNEWS CONNECTION

This service is delivered via E2 SiC[3]. ComNews is a comprehensive news feed that covers all 2000+ listed companies on ASX. The service is reachable over IP 203.4.179.80 using passive FTP (20+21).

SIGNAL B CONNECTION

Signal B is a progressive intra-day electronic signal which disseminates details of a member organisation's trades as soon as technically possible after they are executed on ASX Trade. Signal B provides subscribers with trade data for Equities, Exchange Traded Options, Fixed Interest securities and ASX Futures Contract securities. Signal B is available over the E2 SiC solution. Details can be found in the Service Connection section of this guide. The service is reachable via the IP 203.4.179.25 port 15002.

2 Available from asxonline.com

3 See section on E2 SiC Solution

PTE STANDARD CONNECTION TO ASX TEST ENVIRONMENTS

Delivered over E2 SiC. This can be used for both Enhanced Test Environments (ETE) and Functional Test Environments (FTE). Please see below for network setup.

IP ADDRESSES AND PORTS

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

E2 SiC SOLUTION

Below is the technical information customers will need to connect to SiC for CHESS, Signal B, ASX Trade24 test environment, ITC, ComNews, OTC, Austraclear and RITS.

PHYSICAL LAYER

- Connection will be delivered on 1Gbps copper off the back of the E2 switch which will be installed in your cabinet as a pair of stacked switches
- The media standard is copper 1000BASE-T
- It is the customer's responsibility to provide the termination equipment to connect to the services

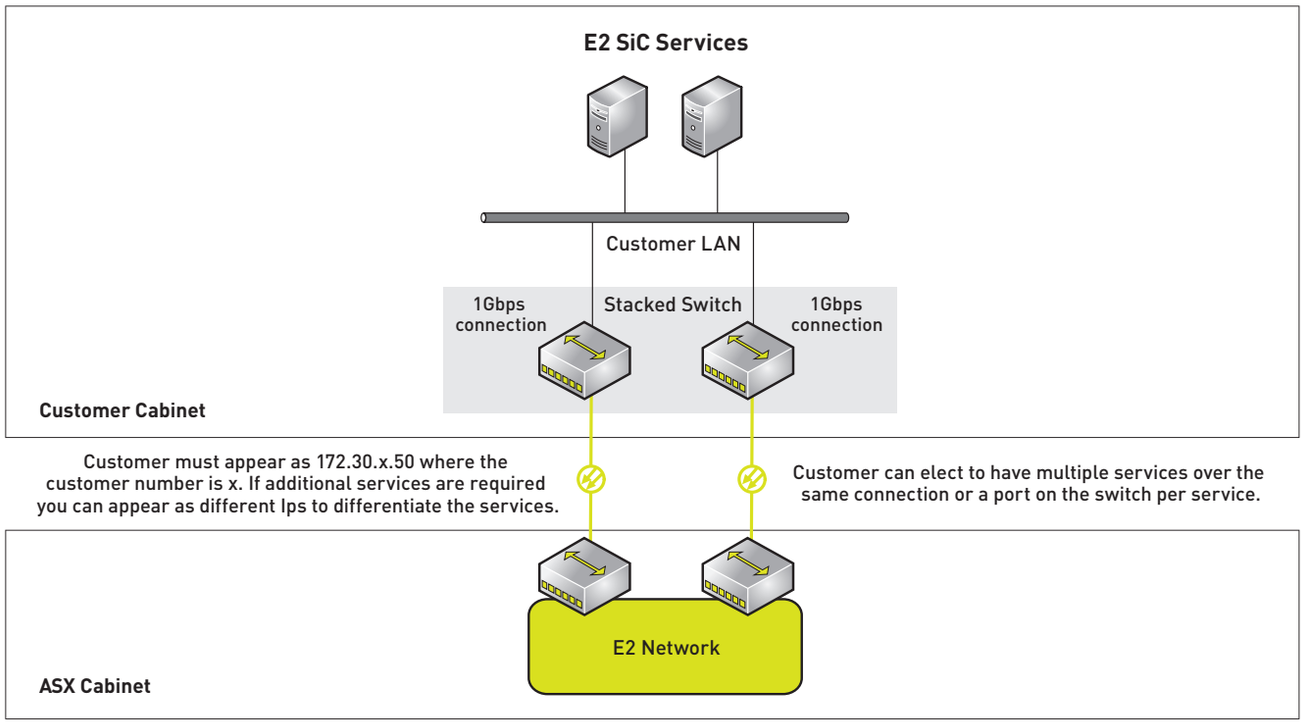
CUSTOMER ADDRESSING

- All addressing is IP Version 4
- ASX will assign an IP address range 172.31.x.0/25 where x is the customer number
- The customer will need to appear at 172.31.x.50 for the services. Additional services can be added using the next IP in the range in order to identify each service
- The next hop address on the switch is 172.31.x.32/25

CUSTOMER INFRASTRUCTURE

- Customer network infrastructure will require the capability to be able to NAT

PRODUCTION DIAGRAM



SWITCH SPECIFICATIONS

Switch RU	1RU each 2 switches
Switch power requirement	135W each

WAN CONNECTIVITY AVAILABLE FROM WITHIN THE ALC

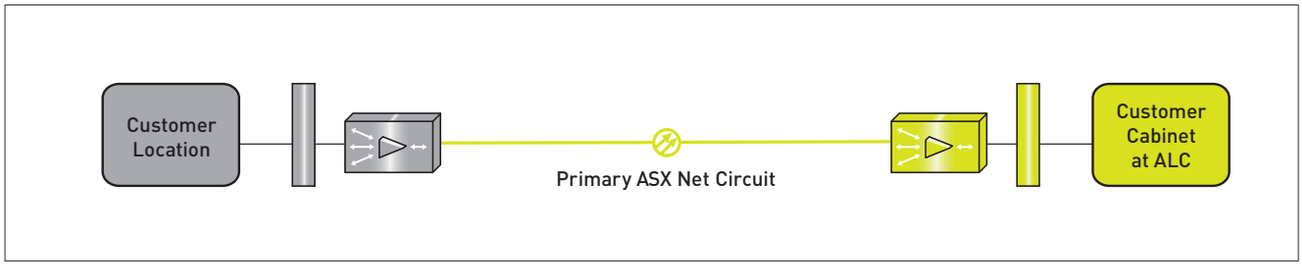
ALC Direct Connection

PHYSICAL LAYER

- Connection will be delivered on 1Gbps copper into the customer's rack
- The media standard is copper 1000BASE-T
- It is the customer's responsibility to provide the termination equipment

Please note that this is presented as a layer 1 service and the traffic across this link is transparent to the exchange.

PRODUCTION DIAGRAM



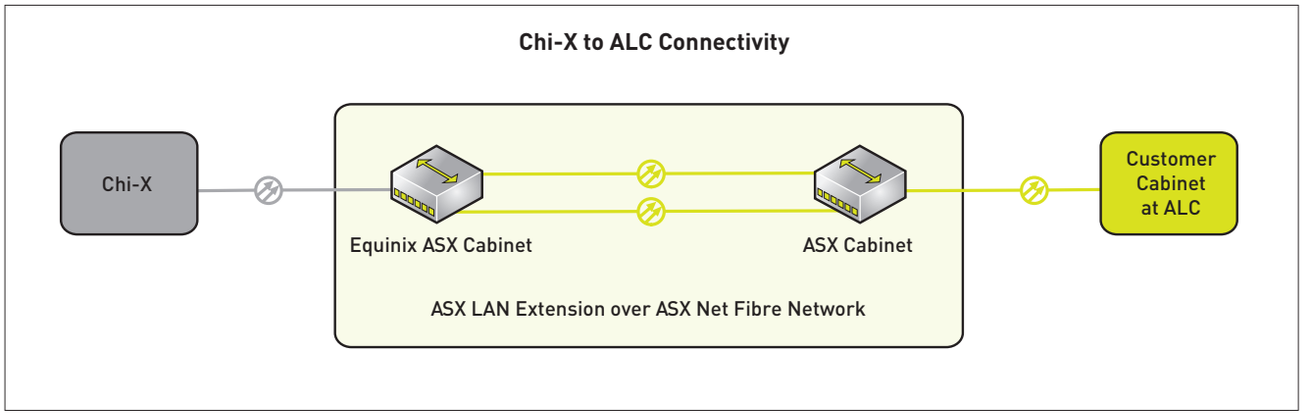
ALC to Chi-X or Equinix/Global Switch Feed

PHYSICAL LAYER

- Connection will be delivered on 1Gbps copper or MMF into the customers rack
- The media standard is copper 1000BASE-T or 1000BASE-SX (LC connector)
- It is the customer's responsibility to provide the termination equipment

Please note that this is presented as a layer 2 service with one VLAN (additional VLAN support can be requested), it is the customers responsibility to resolve the Layer 3 information with Chi-X.

This service is also available to a customer's cabinet in Equinix instead of Chi-X cabinet.



OTHER ALC SERVICES

ASX Time Services

ASX provides connection to two separate time synchronisation services within the ALC: GPS time feed and PTP. The GPS time feed allows ALC customers to sync their computer system clocks to the globally available GPS reference time, while ASX PTP time feed provides access to the same time signal used to set the clocks on ASX Trade and ASX Trade24 matching engines.

GPS TIME FEED

- Two antennae for optional redundancy
- Certified antenna-to-cabinet propagation delay
- Raw signal feed with minimal equipment between antenna and cabinet
- Separate feed available in Bondi Junction ASX Proximity data centre
- Presented in customer cabinet as LMR400 coaxial cab

Distance between redundant antennae is approximately 4 metres.

GPS signal is L1 1575.42 MHz, so Meinberg receivers will require an adaptor.

Total propagation delay is the sum of:

- Delay as measured at the ALC GPS distribution switch: 447ns
- Delay due to cabling (installed to required length) from the customer distribution point to customer cabinet: 4ns per metre of cable
- Delay through a signal booster (only used if cable length exceeds 60m): 9ns

Example 1

Customer installation with 42m of cable, no signal booster:

Delay: 447ns+ (42 x 4ns) = 615ns

Example 2

Customer installation with 80m of cable, with signal booster:

Delay: 447ns + (80 x 4ns) + 9ns = 776ns

PTP TIME FEED

- Time Source for ASX Matching Engines
- Symmetricom S350 time server stabilised with a Rubidium frequency standard
- Maintained by Australia's National Measurement Institute (NMI) to be to be ±100 microseconds of UTC (Aus)
- Presented in customer cabinet as RJ45 1000Base-T copper port

The PTP time servers are driven by a Rubidium-stabilised Symmetricom S350 time server.

PTP timing is provided by a Master Clock PTP option card housed in a Spectracom SecureSync time server.

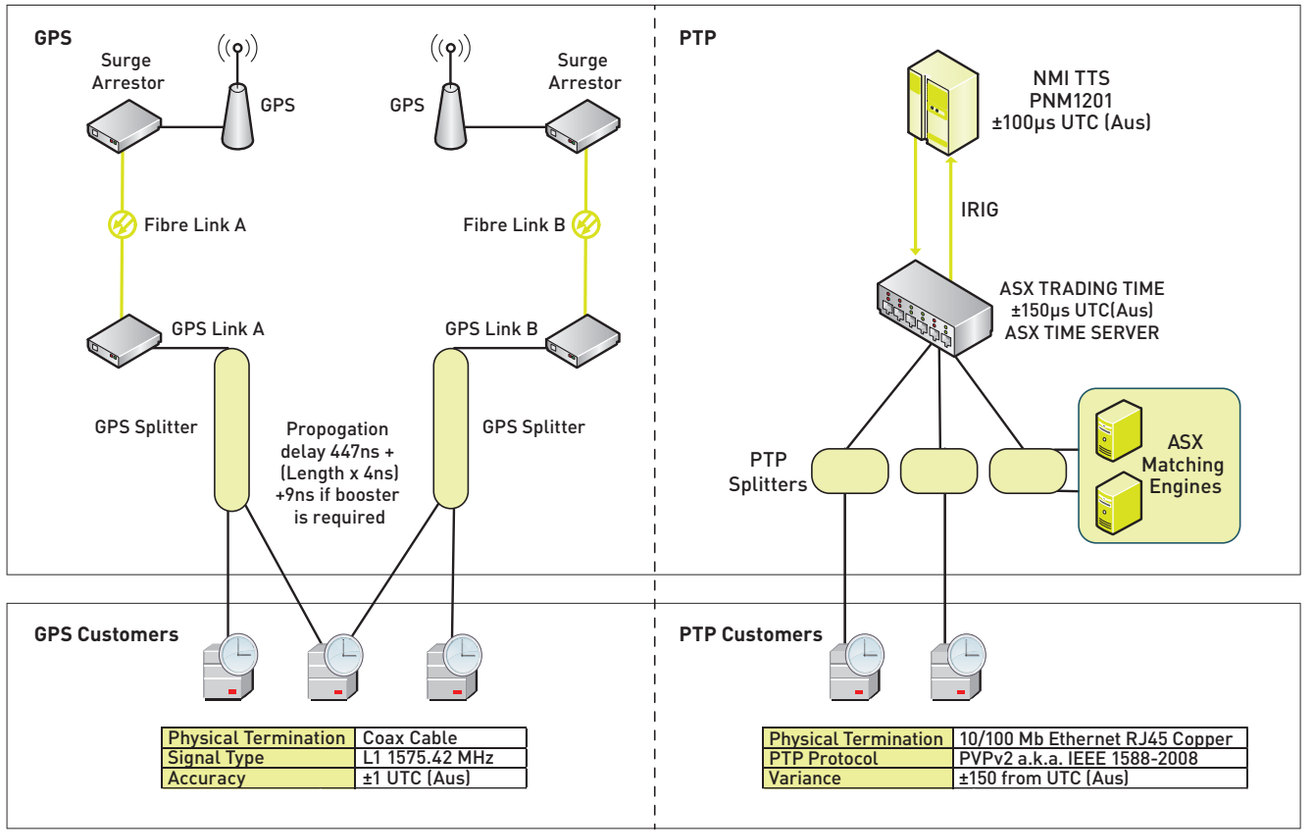
Matching engine time is within 150 µs of GPS time.

FIXED CONFIGURATION	
PTP Protocol	PVPv2 a.k.a. IEEE 1588-2008
Physical Interface	10/100 Mb Ethernet, RJ45 copper
Port Capacity	Sync rate above 512 syncs/sec

CUSTOMER VARIABLE CONFIGURATION (PER PORT)	
Delay Mechanism	End to end (default), peer to peer, or disabled
Mode	Ordinary clock (master), 2step (default), or 1step operation
Announce Interval*	2 seconds (default)
Sync Interval*	1 second (default)
Minimum Delay Request Internal*	16 seconds (default)
Minimum Peer Delay Request Interval*	1 second (default)
Time to Live (TTL)	1 (default)
Domain	0 (default)
Transport Protocol	Layer 3 (IPv4) (default) or Layer 2 (802.3/Ethernet)
IP Address (including Netmask and Default Gateway)	Static or DHCP (from customer DHCP server)

* Configurable in whole powers of 2.

PRODUCTION DIAGRAM FOR BOTH GPS AND PTP



ALC Racking Services

CUSTOMER CABINETS

Cabinet Locking	Electric 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 and 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) • ASX recommends use of a static switch for any single-corded devices within customer cabinets. Such devices must be tested and tagged by an electrician before installation • ASX monitors each customer's power use at the cabinet level however charges for power are aggregated across all of a customer's cabinets
Inter-Cabinet Configuration	Customers 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 ALC staff.

CABINET CAGES

The ALC allows for provisioning of a cage for customer use.

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	Cages can take up to 6 weeks depending on requirements.

GOODS RECEIVING AND STORAGE

Customer Responsibility	Each customer is responsible for: • Scheduling all deliveries to the ALC • All costs associated with delivery to or from the ALC • All paperwork associated with a delivery • Ensuring all packages are appropriately insured • Packages are clearly labelled with: Company name Contact details
Service Notification	24 hours' notice to Customer Technical Support[4] via appropriate form completion. Customers are required to update Customer Technical Support 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, Monday to Friday.
Emergency Services	Where these services are arranged at the ALC directly with the ALC staff or where less than 24 hours' notice is provided to Customer Technical Support, ASX will charge: • The service charge, plus • ASX Smart Hands charge
Goods Receiving	Receipt of one shipment of up to three boxes, including storage for up to 24 hours at the ALC. Courier will place the goods in store room under ASX staff supervision. Requires 24 hours' notice and is subject to ALC Health and Safety policy. If a package is not collected within 24 hours of delivery, the Goods Storage charge will be applied until it is collected.
Goods Sending	ASX will not send packages to ALC customers. Customers can store packages and arrange for the package collection.
Goods Receiving and Goods Storage Charging Units	Service charges include 3 boxes within the package size requirements.

4 Customer Technical Support (6:00am Monday to 8:00am Saturday, AEST) - T: 1800 663 053, T: +61 2 9227 0372, E: cts@asx.com.au

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.
Package Disposal	ALC customers are required to take all packaging with them when they leave the ALC. Packages and packaging are not to be stored within customer cabinets. Where packaging has not been removed by the customer, ASX will immediately dispose of it and deem it to be an emergency service (see above). Customers will be notified of the event and the service charge number.
Health and Safety	Customer of services are subject to ALC Health and Safety requirements.

ASX SMART HANDS AND ASX SPECIALIST SERVICES

Service Change	ASX Smart Hands and ASX Specialist Services are subject to change by ASX without notice and such changes are effective immediately.
Equipment Installation or Decommission	Installation or decommission of customer equipment into or from an established customer cabinet, including power connection, will require detailed description of works to be submitted with an order form[5].
Initial Cabinet Set-up	This is a mandatory service performed once for each customer cabinet and includes: • Installation of ASX hardware • Initial cabling provision • Installation of NSP cross connects
Health and Safety	Customers of services are subject to the ALC Health and Safety requirements.
Service Restrictions	Customers can only order services for delivery within their own cabinets.
Service Charges	Standard ordered services: • Services will be charged per hour • Reoccurring services (e.g. 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 • Customers can schedule multiple events in a week (e.g. 3 x 20 minute tape changes); and minimum charge increment is one hour
Service Description	ASX can reject a customer's instruction if the instruction is not reasonable or not within 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.

5 See Contact Information in this Connectivity Guide

EQUIPMENT INSTALLATION OR DECOMMISSION SERVICES

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	Customers of services are subject to the ALC Health and Safety requirements.
Service Restrictions	Customers can only order services for delivery within their own cabinets.
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 customer is responsible for arranging collection of the decommissioned equipment.
Surplus Parts	Unless the customer requests storage until the equipment is collected, ASX will dispose of surplus parts from installations.
Faulty Equipment	ASX will notify the customer if installed equipment is faulty. ASX will not attempt to resolve issues with faulty equipment. The customer can: • Organise appropriate specialist support to come on site to resolve the issue • Arrange for ASX to remove and store the equipment for the customer to collect or • Use ASX Specialist Support to assist in diagnosing the issue

APPENDIX: ACRONYMS

ALC	Australian Liquidity Centre
ASX	Australian Securities Exchange
CHESS	Clearing House Electronic Subregister System
CRAC	Computer Room Air Conditioner
DCS	Derivatives Clearing System
DRUPS	Diesel Rotary Uninterruptible Power Supply
DvP	Delivery versus Payment
ETE	Enhanced Test Environment
FTE	Functional Test Environment
GiC	Gateway In Cabinet
GPS	Global Positioning System
LAN	Local Area Network
LCC	Liquidity Cross Connect
MMR	Meet Me Room
MVA	Mega Volt Amps
NAT	Network Address Translation
NMI	National Measurement Institute
NSP	Network Service Provider
PDU	Power Distribution Unit
PTE	Participant Test Environment
PTP	Precision Time Protocol
RP	Rendezvous Point
RTC	Redundant Teamed Connection
SiC	Switch In Cabinet
TCP	Transmission Control Protocol
TPS	Transactions Per Second
TTL	Time To Live

CONTACT INFORMATION

To hear more about how you can become part of the leading financial community at the ALC, please contact us:

Adam Bradley

Head of Sales
Australia
T: +61 2 9227 0234
E: adam.bradley@asx.com.au

Andrew Biggart

Pre-Sales Technical Consultant
Australia
T: +61 2 9227 0025
E: andrew.biggart@asx.com.au

REGIONAL CONTACTS

Andrew Musgrave

Business Development Manager
Asia
T: +61 2 9227 0211
E: andrew.musgrave@asx.com.au

Cynthia Tazioli

VP, Business Development
North America
T: +1 312 803 5840
E: cynthia.tazioli@asx.com.au

James Keeley

Business Development Manager
Europe
T: +44 207 256 4155
E: james.keeley@asx.com.au

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