

AXON

Technical Brief

Microsoft ExpressRoute CUSTOMER GUIDE



Contents

Microsoft ExpressRoute	4
Microsoft Azure ExpressRoute Guide	4
ExpressRoute Onboarding	5
ExpressRoute Technical Requirements	6
Minimum requirements	6
ExpressRoute over AXON – minimum requirements	7
Fully Redundant Design Requirements	8
Minimum requirements	8
ExpressRoute over AXON – fully redundant design	9
Handoff Options	10
AXON Port Specifications	10
Interface options	10
Service attributes	10
AXON ExpressRoute Tasks	11
Microsoft Peering for Office 365	12
Routing	12
Quality of Service	15
NEXTDC support contacts	16
Terms and Conditions and SLA	16
Glossary	17

Introduction to AXON

To operate and compete without limitation today, you need to integrate your siloed worlds together. You need to be interconnected.

Interconnectivity with NEXTDC allows you to connect your physical and virtual worlds and unite the people, places and clouds most critical to your organisation. The way we help you achieve this is via NEXTDC's Ethernet connectivity platform, AXON.

AXON's high-speed ethernet connections give you fast and secure access on-demand to any number of services across all of our locations, allowing you to connect the clouds, carriers and data centres that underpin your hybrid cloud.

Microsoft ExpressRoute

ExpressRoute is a service that enables you to create private connections between Azure data centres and infrastructure that's on your premises or in a colocation environment. ExpressRoute connections do not go over the public Internet, and offer more reliability, faster speeds, lower latencies and higher security than typical connections over the Internet.

Microsoft Azure ExpressRoute Guide

Download the full setup guide for Microsoft Azure ExpressRoute written by Microsoft at this link:

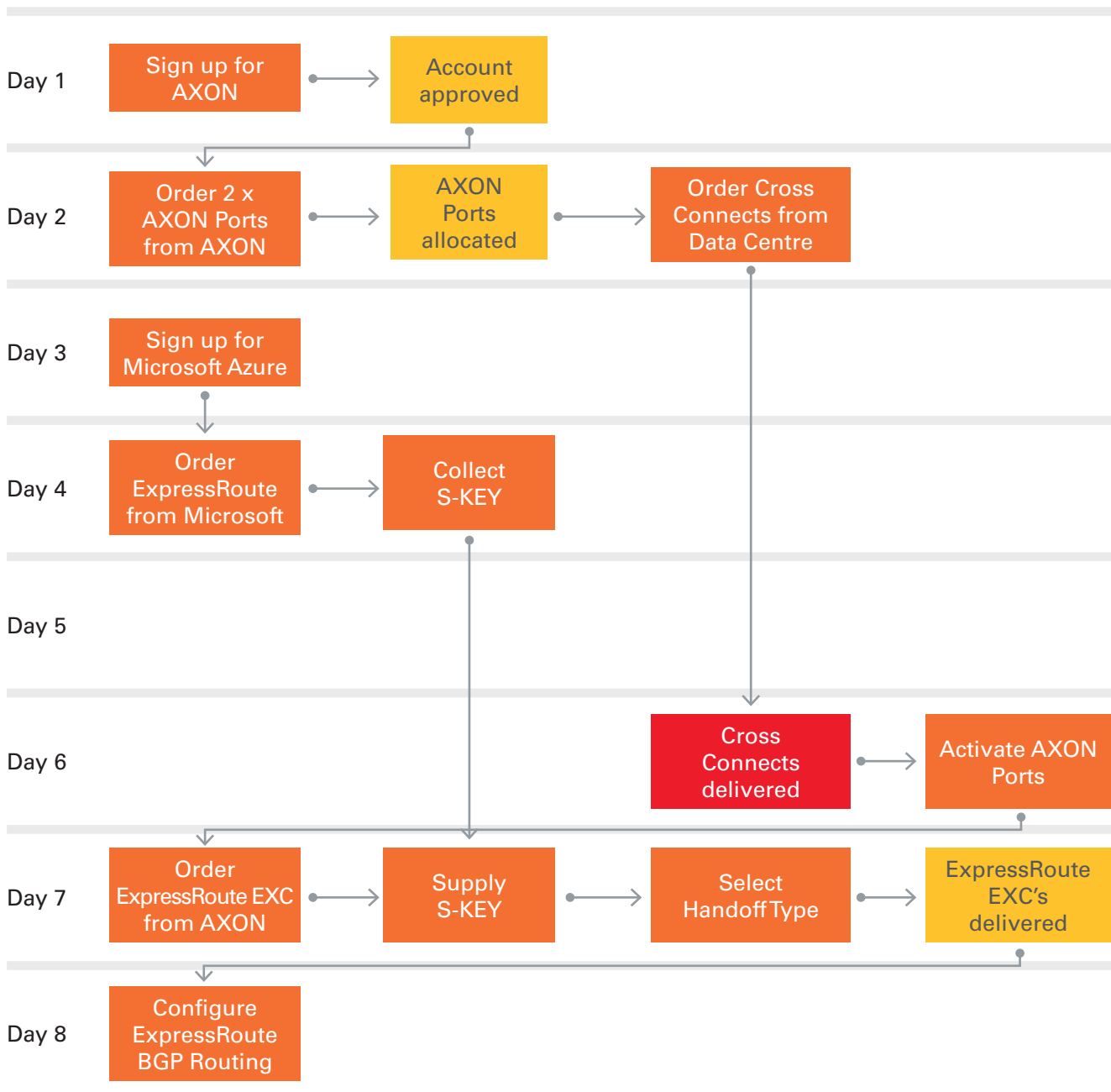
[Microsoft Azure ExpressRoute.pdf](#).

For more information on setting up ExpressRoute please visit azure.microsoft.com.

ExpressRoute Onboarding

Overview

The process for connecting to ExpressRoute via AXON is outlined below.



KEY	CUSTOMER	AXON	DATA CENTRE PROVIDER
			

ExpressRoute Technical Requirements

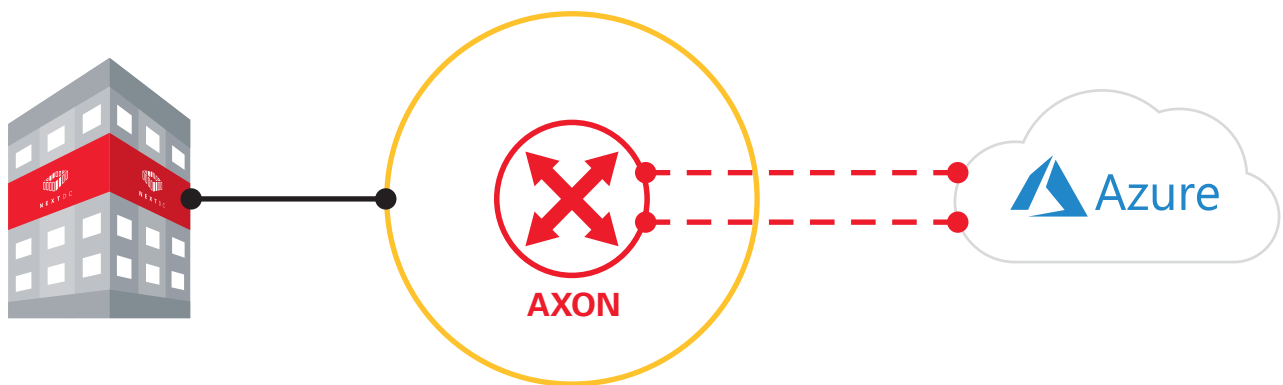
Minimum requirements

Following are the minimum requirements to connect to Microsoft ExpressRoute via AXON:

Item	Qty	Comment
Single Mode Fibre (SMOF) Cross Connect	1	<p>1 x dual core SMOF cross connect is required to interconnect with AXON for connection to ExpressRoute.</p> <p>Microsoft does not require customers to have a pair of physical interconnects however, "A redundant Layer 3 connectivity configuration is a requirement for our SLA to be valid." *</p>
10 Gbps Network Switch or Router	1	<p>You can connect to AXON using either a router or a switch.</p> <p>If you choose to use a switch, you will need to pass ExpressRoute traffic to a BGP capable router via appropriately dimensioned connectivity.</p>
10 Gbps Network Optics	1	<p>10 Gbps optic options are:</p> <ul style="list-style-type: none"> ▪ 10G-LRL (1KM) ▪ 10G-LR (10KM) <p>If your vendor only supplies LR optics and you are in the same data centre as the AXON POI, please order 1km (LRL) optics from AXON as they are compatible with 10km (LR) vendor optics.</p>
BGP Router	1	<p>A BGP capable router is required to connect to ExpressRoute.</p> <p>Two BGP virtual connections over two AXON EXCs are needed to satisfy Microsoft's requirements for "a redundant Layer 3 connectivity configuration."</p>
Autonomous System Number (ASN)	1	<p>You will require a BGP ASN to connect to ExpressRoute.</p>
Microsoft Azure Account	1	<p>To sign up for ExpressRoute you will require a working Azure account with active virtual networking resources in it.</p>
ExpressRoute Service Key (S-KEY)	1	<p>To sign up for ExpressRoute you will require a working Azure account with active virtual networking resources in it.</p>

* For more see the redundancy section of this web page: [ExpressRoute technical overview](#).

ExpressRoute over AXON – minimum requirements



Key



Patch Cable



Elastic Cross Connect



ExpressRoute

Fully Redundant Design Requirements

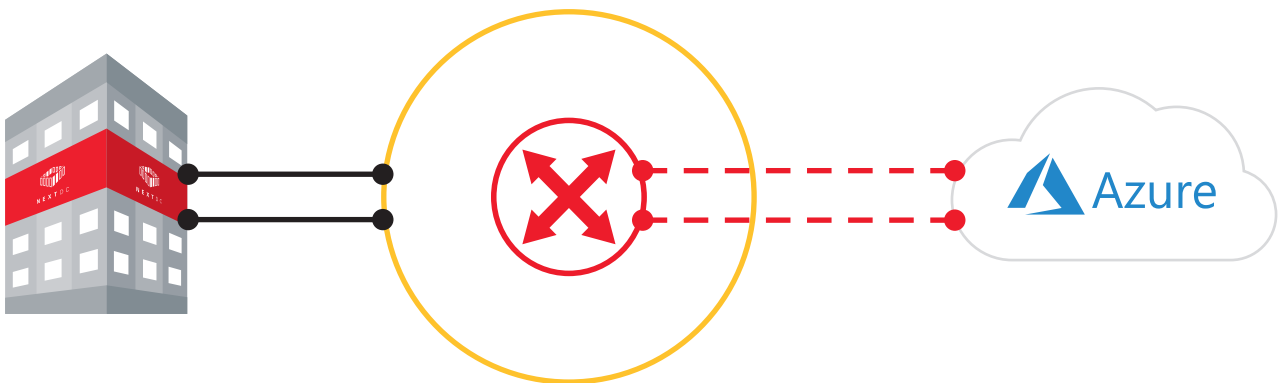
Minimum requirements

Following are the minimum requirements to connect to Microsoft ExpressRoute via AXON:

Item	Qty	Comment
Single Mode Fibre (SMOF) Cross Connect (Pair)	2	2 x dual core SMOF cross connects are required for port and switch redundancy connection to AXON. You may also consider requesting cable path diversity from your carrier and/or data centre provider.
10 Gbps Network Switches or Routers	2	You can connect to AXON using either routers or switches. If you choose to use switches, you will need to pass ExpressRoute traffic to BGP capable routers via appropriately dimensioned connectivity.
10 Gbps Network Optics	2	10 Gbps optics options are: <ul style="list-style-type: none"> ▪ 10G-LRL (1KM) ▪ 10G-LR (10KM) If your vendor only supplies LR optics and you are in the same data centre as the AXON POI, please order 1km (LRL) optics from AXON as they are compatible with 10km (LR) vendor optics.
BGP Routers	2	Two BGP capable routers to connect to ExpressRoute.
Autonomous System Number (ASN)	1	You will require a BGP ASN to connect to ExpressRoute.
Microsoft Azure Account	1	To sign up for ExpressRoute you will require a working Azure account with active virtual networking resources in it.
ExpressRoute Service Key (S-KEY)	1	To sign up for ExpressRoute you will require a working Azure account with active virtual networking resources in it.

* For more see the redundancy section of this web page: [ExpressRoute technical overview](#).

ExpressRoute over AXON – fully redundant design



Key



Patch Cable



Elastic Cross Connect



ExpressRoute

Handoff Options

When ordering ExpressRoute via AXON you will need to choose one of the following handoff options:

- Multi VLAN Trunk Mode (802.1q)
- Single VLAN Mode (802.1q Double Tagged)

Item	Qty	Comment
HANDOFF - Multi VLAN Trunk Mode (802.1q)		
ExpressRoute C-TAG VLAN IDs	2	<p>You will need to provide two C-TAG VLAN IDs for each of the Microsoft peerings you wish to subscribe to: Private and Microsoft.</p> <p>Ethertype will be 0x8100.</p> <p>If you have also chosen to activate all of the Microsoft peering sessions, you will need to provide a total of six C-TAG VLAN ID's.</p>
HANDOFF - Single VLAN Mode (802.1q Double Tagged)		
QinQ (802.1q) capable switch or router	2	<p>To use Single VLAN QinQ mode handoff you will need a router that can unbundle double tagged 802.1q Ethernet frames.</p> <p>Ethertype will be 0x8100.</p> <p>Azure VLANs will be passed to you over a single VLAN (S-TAG). Azure services will be accessed by stripping off the outer S-TAG, allowing access to the C-TAG VLANs.</p>

AXON Port Specifications

Interface options

Following are the standard interface options to connect to AXON.

If you have a specific requirement that is not covered by these options, please contact your account manager.

Speed (Gbps)	Distance	Optic Type
10 Gbps	1 KM	10G-LRL
10 Gbps	10 KM	10G-LR
40 Gbps	1 KM	40G-LRL
40 Gbps	10 KM	40G-LR

* LRL optics are compatible with LR optics, if your vendor only supplies LR optics and you are interconnecting with us over fibre that is shorter than 1km you should select LRL and use appropriate attenuators.

Service attributes

Service Attributes	Parameter
MAC Layer	802.3-2002
MTU	9100
Port Mode	802.1q Trunk
VLAN Ethertype	0x8100

* MTU of 9100 is valid for AXON network components. Please check capabilities of the party you are connecting to.

AXON ExpressRoute Tasks

- 1 Sign up for AXON - your sales person will send you a link.

- 2 Order 2 x AXON ports via the AXON portal. You will receive an email with point of interconnect (POI) information.

- 3 Order 2 x single mode fibre (SMOF) cross connects to the AXON POI from your data centre provider.

- 4 Sign up for Microsoft AZURE with [Microsoft](#).

- 5 Activate AXON ports by plugging the cross connects in and activating the port on your network equipment.

- 6 Order ExpressRoute from your [Microsoft Azure account](#).
 - Define C-TAG VLAN ID(s)
 - Collect S-KEY from Microsoft

- 7 Order Elastic cross connects from AXON.
 - Choose handoff type:
 - **Single VLAN** (802.1q Double Tagged) or;
 - **Multi VLAN Trunk** (802.1q, one VLAN per C-TAG)
 - Supply ExpressRoute S-KEY
 - If you selected Multi VLAN Trunk handoff:
 - Supply ExpressRoute C-TAGs
 - Select VLAN ID(s) for AXON to deliver ExpressRoute on your AXON port

- 8 AXON will provision and activate your ExpressRoute EXC.

- 9 Configure Layer 3 routing via your [Microsoft Azure account](#).

Microsoft Peering for Office 365

Connecting to Microsoft Office 365 via AXON

This section describes the technical requirements for connecting via AXON to Microsoft Office 365. Microsoft offers two types of peering via ExpressRoute – Private and Microsoft peering. The testing performed in the preparation of this document was based on the requirements set out in the Microsoft meet me specification for Microsoft peering, and summarises the key points required to establish such a connection via the AXON network.

Microsoft technical requirements

The technical requirements specified by Microsoft for connecting to Office 365 via Microsoft peering are set out below. The routing, address translation and quality of service requirements are each discussed.

Routing

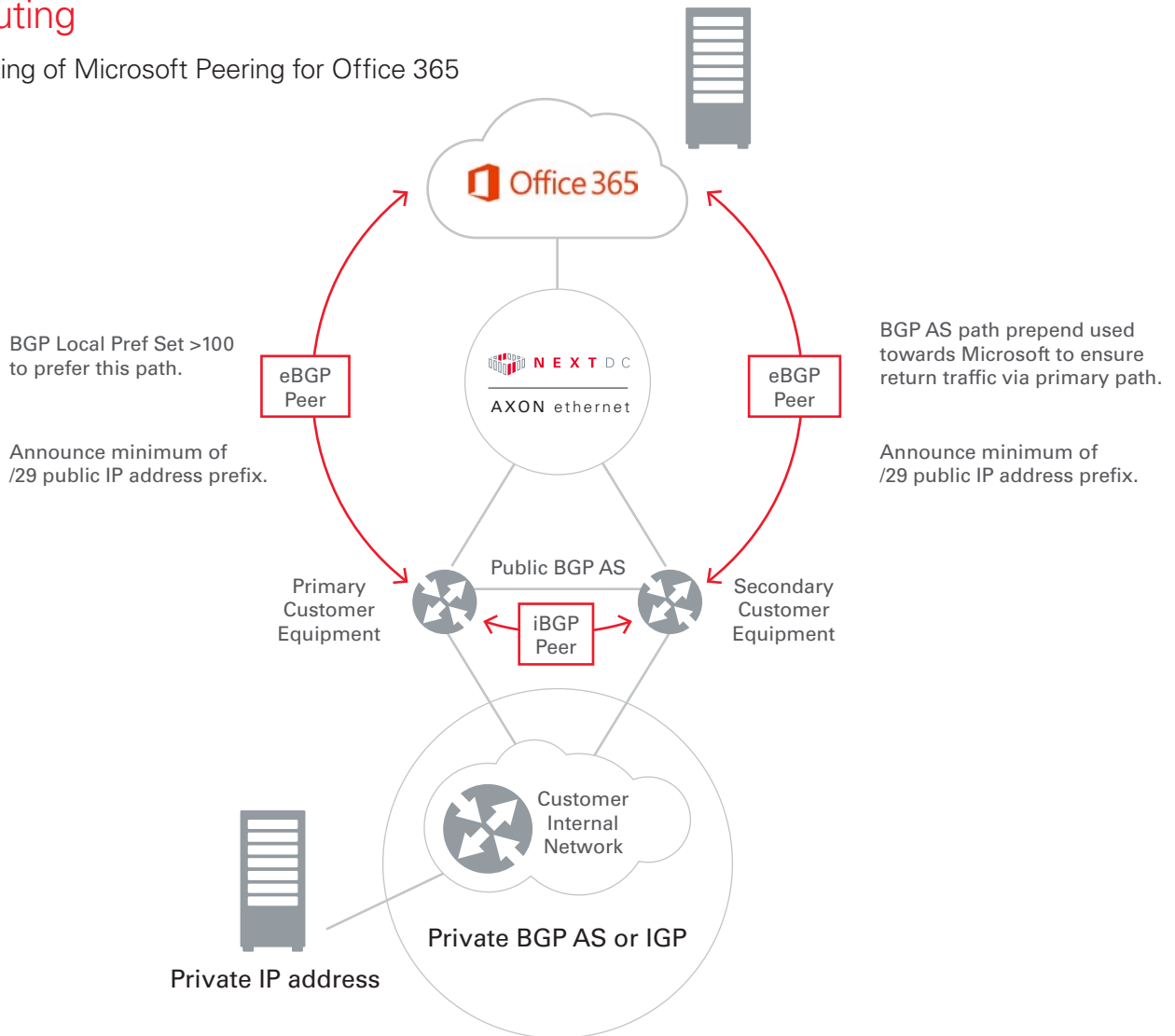
Routing via eBGP is required to establish connectivity to any of the Microsoft services. AXON does not take part in any routing decisions and only acts to facilitate layer-2 connectivity between Microsoft and the customer.

Through testing and discussions with Microsoft the following network design considerations and Microsoft pre-requisites should be considered:

- Only public IPv4 address space belonging to the customer is accepted. Microsoft checks this against the IP registries responsible for public IP address allocation – for example APNIC allocates and administers IP addresses in the Asia Pacific region.
- A minimum of a /29 public IPv4 prefix is accepted by Microsoft into their routing tables. You need to ensure that only agreed to prefixes are announced to Microsoft via route maps. You must not announce your entire internal network routing table.
- The /30 subnets used for the BGP peer links must be public address space. Private address space is not permitted.
- Only public BGP 2 or 4 byte AS numbers are allowed to peer with Microsoft (4 byte AS is only supported via PowerShell). Microsoft checks this against the IP registries responsible for public IP address allocation – for example APNIC allocates and administers AS numbers in the Asia Pacific region.
- Microsoft will be sending roughly 1000 prefixes per path
- BGP local preference should be used to determine the correct exit point (primary path) towards Microsoft
- BGP AS prepend must be used to increase the path length of the secondary path return traffic from Microsoft (this is important to ensure symmetric routing due to NAT being used).

Routing

Routing of Microsoft Peering for Office 365



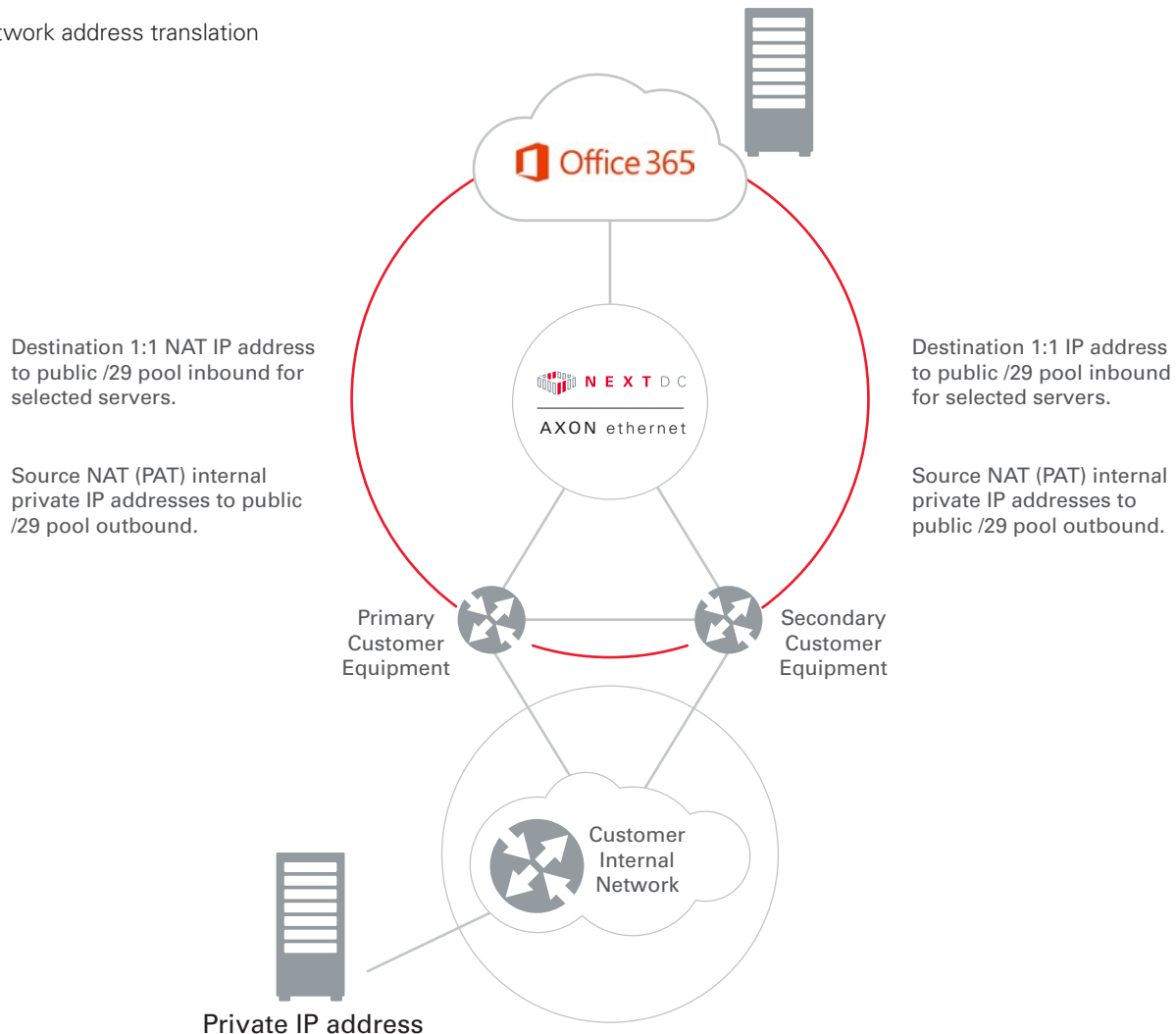
Network address translation

Network Address Translation (NAT) must be used because only public IPv4 address space is accepted by Microsoft. Microsoft requires outbound and inbound NAT for Office 365. The following conventions are used in the discussion and diagram below:

- Outbound: your network traffic towards Microsoft
- Inbound: traffic from Microsoft towards your network

Microsoft Peering for Office 365

Network address translation



Since NAT is stateful it is important to ensure that outbound and inbound routing is symmetric via the primary & secondary Microsoft paths (this may not be the case when using clustered firewalls).

The example below uses an internal network of 192.168.1.0/24, an internal server address of 192.168.1.20 and a customer public IPv4 prefix of 20.1.1.0/29. Refer to the above diagram for traffic flow directions and location of devices.

■ OUTBOUND

Source NAT should be used from your internal network to the advertised /29 public IPv4 address pool. For example source 192.168.1.0/24 source NAT to 20.1.1.1 (customer public IPv4 prefix 20.1.1.0/29 announced to Microsoft and configured as a secondary subnet on both AXON EXC's towards Microsoft)

■ INBOUND

Some Microsoft services require inbound connectivity to your internal network. Destination 1:1 NAT is used. For example source 20.1.1.2 destination NAT's to 192.168.1.20 (your public IPv4 prefix 20.1.1.0/29 announced to Microsoft and configured as a sub-interface on both AXON EXC's towards Microsoft, inbound traffic from Microsoft destined to 20.1.1.2 connects to internal server 192.168.1.20).

Quality of Service

Quality of service (diffserv or DSCP) tags from and to Microsoft must be supported and sent and received unaltered. This is particularly important for Skype for business that relies of “expedited forwarding” or diffserv EF. AXON passes tags through unaltered. AXON also does not do any 802.1q priority bit (P-bit) rewrite or mapping of diffserv. Customers need to ensure that their network “trusts” diffserv to and from Microsoft for all Microsoft services, and takes the appropriate scheduling action.

The following are the diffserv tags as specified by Microsoft that must be supported for Office 365:

Traffic Class	Treatment (DSCP Marking)	Skype for Business Workloads
Voice	EF (46)	Skype / Lync voice
	AF41 (34)	Video
Interactive	AF21 (18)	App sharing
	CS3 (24)	SIP signaling
Default	AF11 (10)	File transfer
	CS0 (0)	Anything else

NEXTDC support contacts

The AXON Helpdesk can be contacted using the information below.

AXON help desk

Phone (Australia)	1300 698 677
Phone (International)	+61 7 3177 4799
Technical support	nxtops@nextdc.com
Service provisioning	nxtops@nextdc.com

Day	Hours of operation	Service faults
Monday	09:00 - 18:00	24 hours
Tuesday	09:00 - 18:00	24 hours
Wednesday	09:00 - 18:00	24 hours
Thursday	09:00 - 18:00	24 hours
Friday	09:00 - 18:00	24 hours
Saturday	CLOSED	24 hours
Sunday	CLOSED	24 hours

Terms and Conditions and SLA

A copy of our Terms and Conditions and Service Level Agreement can be found here:

https://www.nextdc.com/storage/app/media/NEXTDC_AXONVX_Terms_and_Conditions_Final-20170520.pdf

Glossary

AXON network

Term	Explanation
AXON Enabled data centre (DC)	A data centre containing an AXON point of interconnect (POI)
Campus	A cluster of AXON DC's which are close to each other and are treated as if they are one datacentre.
Cross Connect	A pair of single mode optical fibre (SMOF) cables connecting the customer to an AXON point of interconnect (POI). One Cross Connect is required for every AXON port.
Cross Connect - Local	A physical cross connect for which both the A-END and B-END reside in the same AXON DC.
Cross Connect - Carrier	A physical cross connect in which the B-END is external to the AXON DC it is connecting to. eg. A cross town dark fibre, Ethernet or wavelength service.
Edge Switch	AXON System's customer facing network equipment.
Fabric	A network region usually defined by city, state/territory or international borders. AXON is built as a series of fabrics (Sydney, Melbourne, Brisbane etc.) or network islands which are interconnected by partner carriers.
Interconnect	A Cross Connect and an AXON port used to physically connect customers to the AXON fabric.
Point of Interconnect (POI)	The fibre patch panel that customers order cross connects to. Generally located in the carrier interconnect room of an AXON DC.
Single Mode Optical Fibre (SMOF)	Optical fibre cable which complies with or exceeds ITUT Recommendations G.652 or G.652D

Glossary

AXON products

Term	Explanation
AXON port	The physical switch port on an AXON edge switch that is allocated to an AXON customer. This is the point of demarcation between AXON and its customers.
Elastic Cross Connect (EXC)	A layer 2 interconnect between two or more AXON ports.
ExpressRoute POP	A Microsoft ExpressRoute service is delivered directly to the customer over a fibre cross connect. An ExpressRoute local POP is available in NEXTDC locations which have an onsite ExpressRoute Point of Presence and is available in 1 or 10 Gigabit per second speeds.

AXON connected entities

Term	Explanation
Customer	A business or organisation that has signed up for an AXON account with a view to consuming AXON delivered services.
Integration Partner	An IT/network service organisation that has signed up for an AXON account with a view to using AXON to deliver value added products and services to their customers.
Carrier	A licensed carrier who owns significant physical network assets, has signed a carrier agreement and has interconnected with AXON with a view to consuming AXON delivered services.
Partner Carrier	A licensed carrier who owns significant physical network assets, has signed a partner carrier agreement and has interconnected with AXON with a view to consuming and also selling AXON delivered services which can be rapidly provisioned, modified and torn down ideally via API offering on demand elastic purchasing options in line with the overall ethos of the AXON product set.
Cloud Provider	A business or organisation which delivers high value cloud based services targeted at the SMB/enterprise & government markets. Cloud providers must own unique infrastructure or intellectual property which operates at scale, can be rapidly provisioned via API and offers on demand elastic purchasing options in line with the overall ethos of the AXON product set.