



A X O N

Technical Brief

Microsoft Azure ExpressRoute



N E X T D C



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Introduction to AXON

In today's hyperconnected world our data, applications, clouds, locations and people live everywhere.

To operate and compete without limitation, we must integrate our siloed worlds. We need to be connected. Our people need access to whatever they need, whenever they need it, from wherever they are with complete confidence it is secure.

Connectivity with NEXTDC allows you to connect your physical and virtual worlds uniting the people, places and clouds most critical to your organisation.

We help you achieve this with NEXTDC's award-winning¹ Software Defined Networking platform, AXON.

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

¹ Australian Communications Industry Awards (ACOMMs) 2024 Winner: Best Digital Platform (AXON).



Microsoft Azure ExpressRoute

ExpressRoute is a service that enables you to create private connections between your Microsoft cloud services and your infrastructure located on your premises or in a colocation environment. ExpressRoute connections do not go over the public internet therefore offering greater reliability, faster speeds, lower latencies and greater levels of security than typical connections over the public internet. NEXTDC offers both ExpressRoute variants:

ExpressRoute Direct

ExpressRoute Direct is available in NEXTDC locations which have an ExpressRoute peering location on site and is available in 10Gbps, 100Gbps and 400Gbps. You connect directly to a dedicated ExpressRoute port.

ExpressRoute via an ExpressRoute connectivity partner

ExpressRoute is for customers who require 50Mbps to 10Gbps access into Azure via an ExpressRoute connectivity partner. You connect via AXON ports in AXON PoPs. AXON delivers ExpressRoutes to your AXON ports at any AXON PoP in Australia within a minute of ordering.

Microsoft Azure ExpressRoute user guide

For further information on configuring Microsoft ExpressRoute refer to:

<https://learn.microsoft.com/en-us/azure/expressroute/>

ExpressRoute Direct

ExpressRoute Direct is available in NEXTDC locations which have an on-site ExpressRoute peering location and are available in 10, 100 and 400Gbps speeds.

The diagram below shows four use cases and their solutions. Use case A shows how to connect to an ExpressRoute peering location within a NEXTDC facility. Use case B addresses how to connect to an ExpressRoute peering location in a NEXTDC facility from another NEXTDC facility in the same metro area.

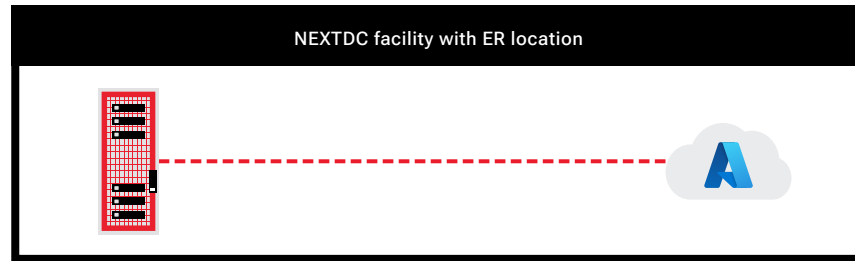
To order use the following procedure:

- 1** Sign up for the Microsoft Azure console and order an ExpressRoute. You will be directly billed by Microsoft for the dedicated port in addition to your usage charges.
- 2** Wait for the Microsoft Letter of Authority (LOA) for your dedicated port on the Microsoft network. This letter will contain the authorisation by Microsoft to connect into their network device and the information you need to order your cross connect from NEXTDC.
- 3** Login to [ONEDC](#) and order a cross connect, or between facilities within a metro area a DCle service or a DCIf² service, from your rack to the location mentioned in the LOA documentation, uploading the LOA when adding the Microsoft location details.
- 4** NEXTDC will notify you of completion, and your ExpressRoute will be ready for activation on your equipment.
- 5** Your ExpressRoute will be configurable in the Azure console.

2 You will be able to connect to a ExpressRoute peering location in a facility from your rack in another facility via dark fibre if the fibre path between the facilities is 10km or less.

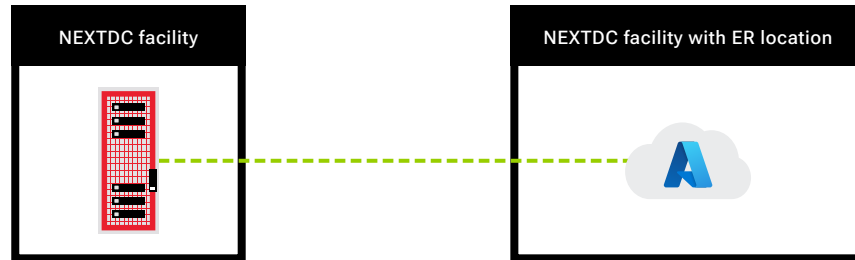
Use case A:

Connect to ExpressRoute peering location via Cross Connect (XC)



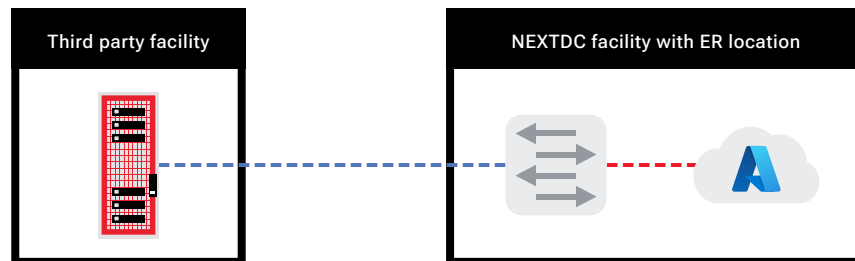
Use case B:

Connect to ExpressRoute peering location via Data Centre Interconnect (DCIe or DCIf)



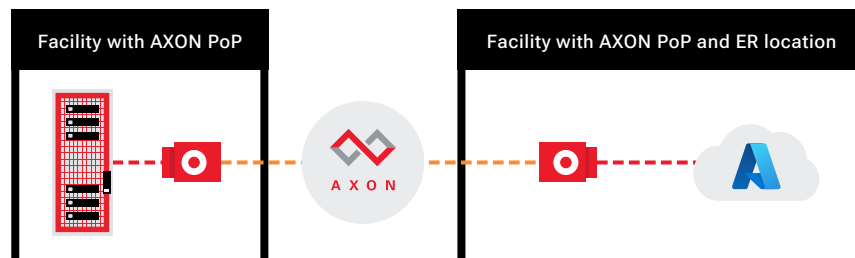
Use case C:

Connect to ExpressRoute peering location from on-premises infrastructure



Use case D:

Connect to ER location via AXON



In case you need to connect from a 3rd-party facility outside the NEXTDC network – use case C – you can get a carrier to connect you into the ExpressRoute peering location. Please work with a carrier of your choice to get the service delivered.

In those scenarios where your colocation is located in a facility with an AXON PoP, you can connect to an ExpressRoute peering location via a point-to-point connection built on AXON – see use case D.

LEGEND

	Customer rack		AXON port		Interconnect room		ER location
	Cross connect		DCIe or DCIf service		Carrier service		EXC

Microsoft ExpressRoute via AXON

ExpressRoute is available from any AXON Point of Presence to any AXON Point of Presence that is collocated with an Microsoft ExpressRoute Point of Presence.

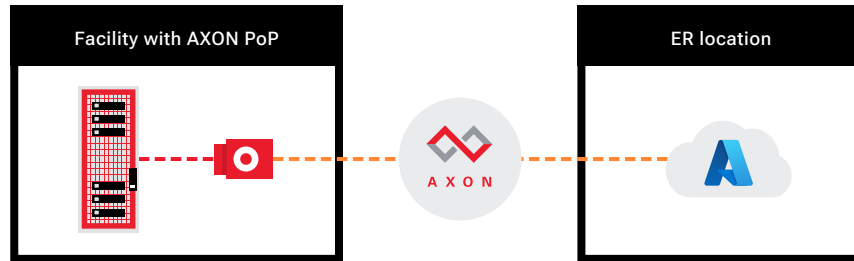
The diagram below shows two use cases and their solutions. Use case A shows how to connect to an ExpressRoute peering location from a facility with an AXON PoP.

To order use the following procedure:

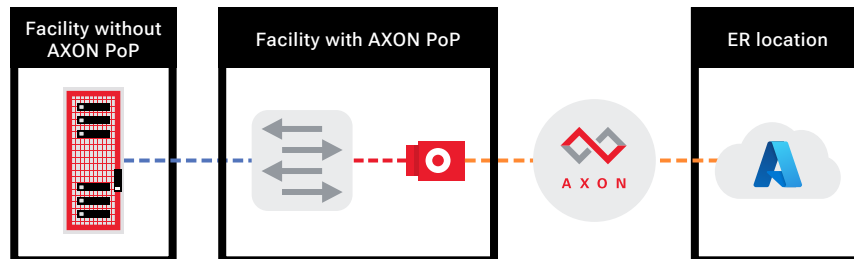
- 1 Sign up for AXON [online](#).
- 2 Accept the email invite to log in to the [AXON portal](#).
- 3 Sign up for the Microsoft Azure console.
- 4 Log in to the AXON portal and order 1 x AXON port to fulfil the minimum requirements from Microsoft (not backed by their SLA) or 2 x AXON ports for full redundancy. You will see the MeetMe information in the AXON port details and in an email sent to you.
- 5 Order 1 x dual-core single-mode cross connect per AXON port from your rack to the AXON port MeetMe location from your data centre provider. NEXTDC facilities cross connects are ordered in [ONEDC](#).
- 6 Activate your AXON port by plugging the cross connect in within your rack and activating the port on your network equipment.
- 7 Order Microsoft ExpressRoute from your Azure account.
 - Define C-TAG VLAN ID(s)
 - Collect S-KEY from Microsoft
- 8 Order 1 or 2 x Elastic Cross Connects (EXCs) in the AXON portal, depending on whether you adhere to the minimum requirements or to full redundancy requirements.
 - Choose handoff type:
 - Single VLAN (802.1q Double Tagged) or;
 - Multi VLAN Trunk (802.1q, one VLAN per C-TAG)
Please note that in case of selecting Multi VLAN Trunk Mode the system will reject a secondary service on the same port as the primary service.
 - Primary or secondary node
 - 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
 - Choose an AXON port and bandwidth option – available as 50Mbps, 100Mbps, 200Mbps, 300Mbps, 400Mbps, 500Mbps, 1Gbps, 2Gbps, 5Gbps and 10Gbps
- 9 AXON will provision and activate your Microsoft ExpressRoute EXCs.
- 10 Configure Layer 3 routing in the Azure console.

Use case A:

Connect to ExpressRoute peering location via AXON


Use case B:

Connect to ER location via third-party carrier service and AXON

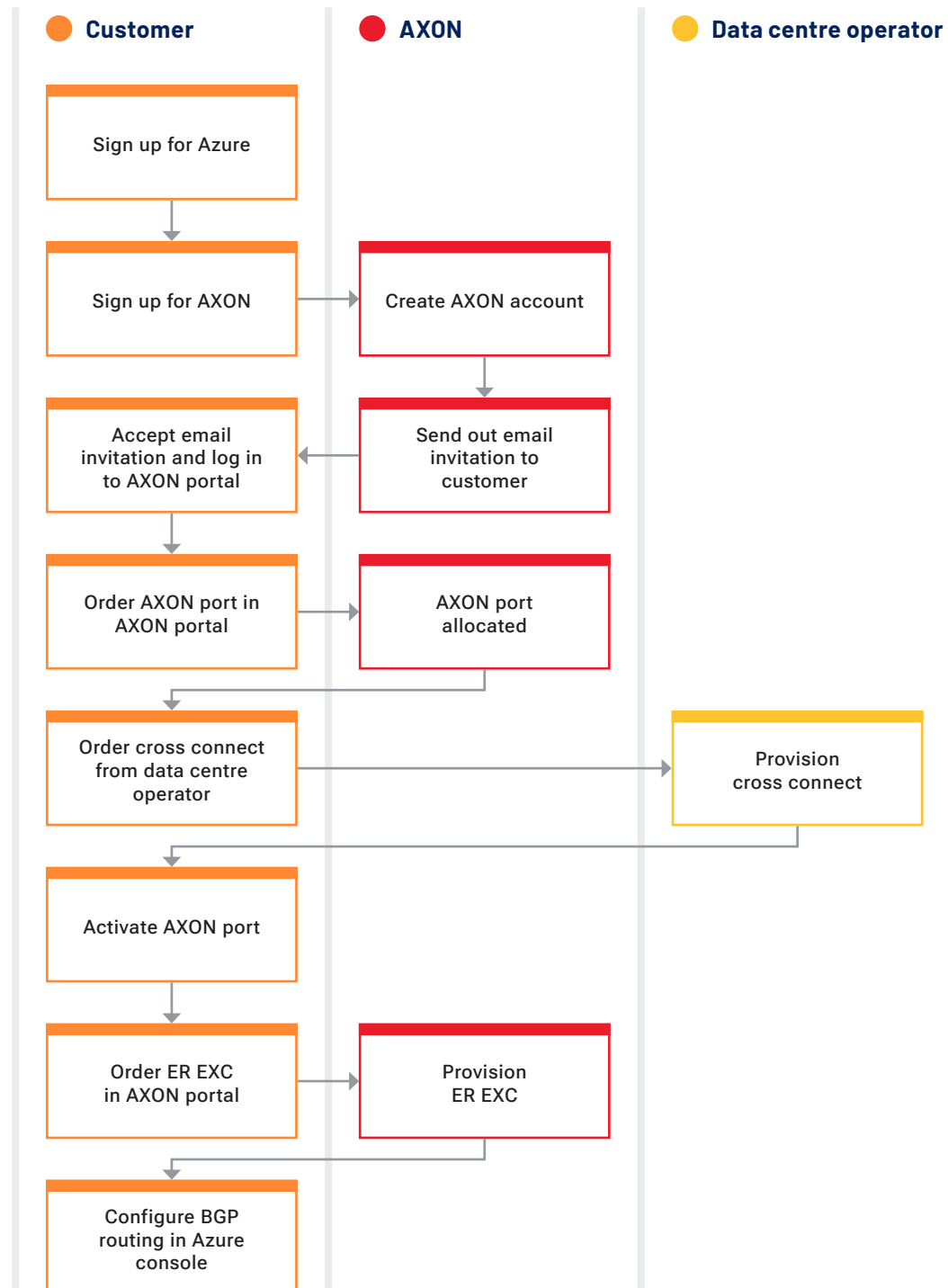


In case you need to connect to an ExpressRoute peering location from your colocation in a facility that does not have an AXON PoP – use case B – you can get a carrier of your choice to connect you to your AXON port at an AXON PoP.

LEGEND

	Customer rack		AXON port		Interconnect room		ER location
	Cross connect		DCIe or DCIf service		Carrier service		EXC

Setting up your Microsoft Expressroute



Technical requirements

Following are the requirements to establish Microsoft ExpressRoute via AXON.

Prerequisites

Item	Qty	Comment
Cross Connect	1 for minimum requirements OR 2 for full redundancy	Dual Core - Single Mode Fibre (SMOF) Cross Connects are required to interconnect with AXON for connection to Microsoft ExpressRoute.
10Gbps or 100Gbps Network Switch or Router	1 for minimum requirements OR 2 for full redundancy	You can connect to AXON using either a router or a switch. If you choose to use a switch, you will need to pass ExpressRoute traffic to a BGP capable router via appropriately dimensioned connectivity.
Network Optics	1 for minimum requirements OR 2 for full redundancy	Optics options for AXON ports are: ■ 1G-LX (10KM) ■ 10G-LRL (1KM) ■ 10G-LR (10KM) ■ 100G-LR4 (10KM) 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. Longer distances are supported on demand. Please discuss unique requirements and solution options with NEXTDC sales representatives. You will need to set the 1Gbps port that connects to a 1G AXON port to 1G/full-duplex.
BGP Router	1 for minimum requirements OR 2 for full redundancy	BGP capable routers are required 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 order an ExpressRoute EXC in AXON you will require the S-KEY of your ExpressRoute shown in the Azure console.

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
Multi VLAN Trunk Mode (802.1q)		
ExpressRoute C-TAG VLAN IDs	2	You will need to provide two C-TAG VLAN IDs for each of the Microsoft peerings you wish to subscribe to: Private and Microsoft. Ethertype will be 0x8100. If you have also chosen to activate all of the Microsoft peering sessions, you will need to provide a total of four C-TAG VLAN ID's.
Single VLAN Mode (802.1q Double Tagged)		
QinQ (802.1q) capable switch or router	2	To use Single VLAN QinQ mode handoff you will need a router that can unbundle double tagged 802.1q Ethernet frames. Ethertype will be 0x8100. 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.

Service attributes

Service Attributes	Parameter	Comment
MAC Layer	802.3-2002	
MTU	9100	MTU of 9100 is valid for AXON network components. Please check the capabilities of the party you are connecting to.
Port Mode	802.1q Trunk	
VLAN Ethertype	0x8100	

Microsoft peering for Office 365

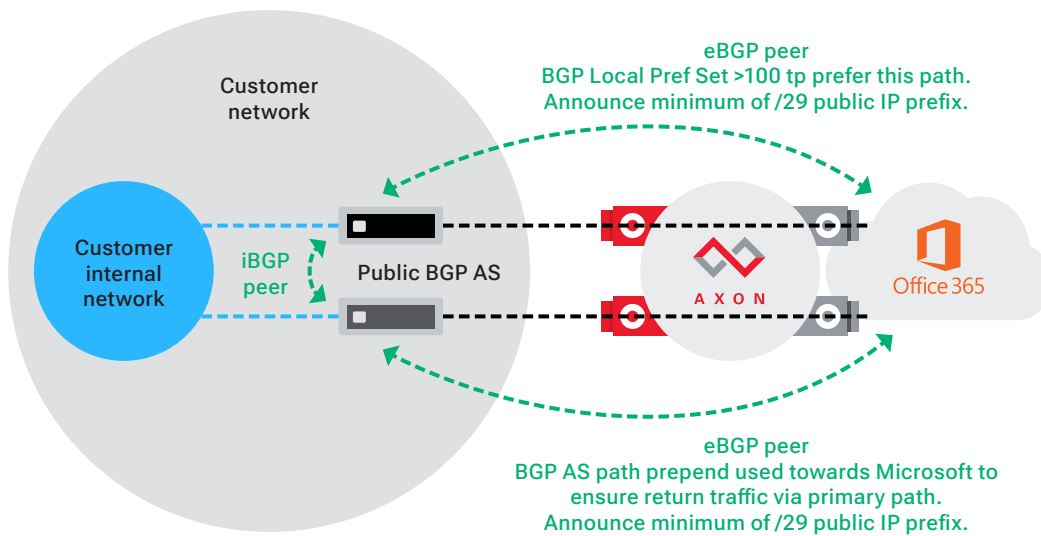
Microsoft offers two types of peering via ExpressRoute – Private and Microsoft peering. This section describes the technical requirements for connecting via AXON to Microsoft Office 365. The routing, network address translation and quality of service requirements are each discussed.

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 your network.

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 you is accepted. Microsoft checks this against the IP registries responsible for public IP address allocation. (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 specific 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.
- 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.



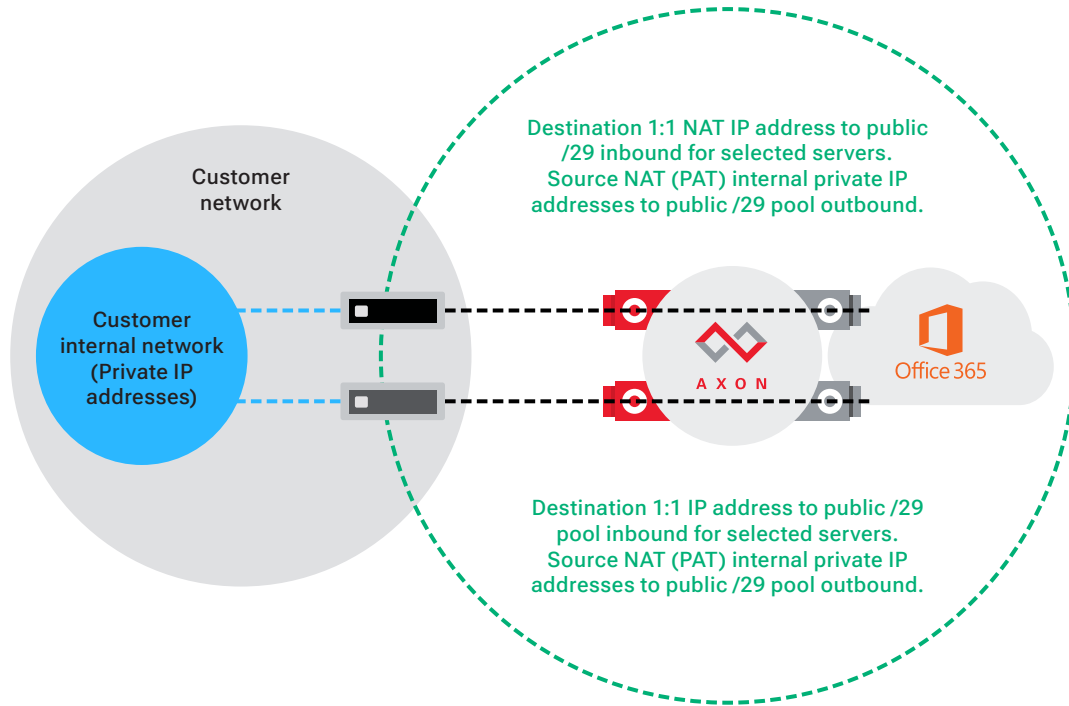
LEGEND

 AXON port	 VIF	 Microsoft Office 365
 Customer's primary networking device	 Customer's secondary networking device	 BGP peering

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.



LEGEND

 AXON port	 VIF	 Microsoft Office 365
 Customer's primary networking device	 Customer's secondary networking device	 BGP peering

Since NAT is stateful it is important to ensure that outbound and inbound routing is symmetric via the primary and 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 (QoS) requirements apply to Microsoft peering only. The DSCP values in your network traffic received on Azure private peering will be kept as is but they will not be used to prioritise the traffic on Microsoft's network.

For Microsoft peering, QoS tags (diffserv or DSCP) from and to Microsoft must be supported and sent and received unaltered. AXON passes tags through unaltered. AXON also does not do any 802.1q priority bit (P-bit) rewrite or mapping of diffserv. You need to ensure that your network trusts diffserv to and from Microsoft for all Microsoft services and takes the appropriate scheduling action.

The following are DSCP markings as specified by Microsoft that must be supported for Microsoft Teams:

Traffic Class	Treatment (DSCP Marking)	Microsoft Teams and Skype for Business Workloads
Voice	EF (46)	Skype / Microsoft Teams / Lync voice
Interactive	AF41 (34)	Video, VBSS
	AF21 (18)	App sharing
Default	AF11 (10)	File transfer
	CS0 (0)	Anything else

NEXTDC support contacts

AXON help desk

The AXON help desk can be contacted using the information below:



Phone (Australia)

1300 698 677



Phone (International)

+61 7 3177 4799



Technical support

nxtops@nextdc.com



Service provisioning

nxtops@nextdc.com

Hours of operation:



Monday – Friday

09:00 - 18:00

Sunday & Saturday

Closed



Service faults

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/axon-terms-of-service>

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 data centre.
Cross Connect	A pair of single mode optical fibre (SMOF) connecting the customer to an AXON point of interconnect (POI) within a facility. One Cross Connect is required for every AXON port.
DCle	NEXTDC's layer 1 interconnect between its facilities within the same metro area.
DCIf	NEXTDC's dark fibre interconnect between its facilities within the same metro area.
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.

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 Direct	A Microsoft ExpressRoute service delivered directly to the customer over a cross connect. Direct connections are available in NEXTDC locations which have an on-site Microsoft ExpressRoute peering location.
ExpressRoute	ExpressRoute via connectivity partner is for customers who require flexible bandwidth access into Microsoft. These connections are delivered over AXON and can be delivered to any AXON point of presence.

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.
Cloud Provider	A business or organisation which delivers high value cloud-based services targeted at the SMB/enterprise & government markets. Cloud providers own unique infrastructure or intellectual property which operates at scale, can be rapidly provisioned via API and offers on demand elastic purchasing options.