

A Guide to AWS Peering: Architecture and Troubleshooting

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AWS



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Agenda

AWS Architecture (Global Infrastructure)

AWS Peering Landscape & Link Types

Route Scoping & Peering Policy

Operations & Self-Service Tools

Provisioning Workflow

Q&A



AWS Regions & Availability Zones

AWS Regions

- Independent geographic area with cluster of data centers
- Designed for fault tolerance, data sovereignty, reduced latency
- Each contains multiple Availability Zones (AZs)

Availability Zones

- Distinct physical data center within a Region
- Redundant power, networking, connectivity
- High availability and fault tolerance within region

Global Infrastructure

39

Regions

123+

Availability Zones

750+

CloudFront PoPs

45+

Local Zones

33+

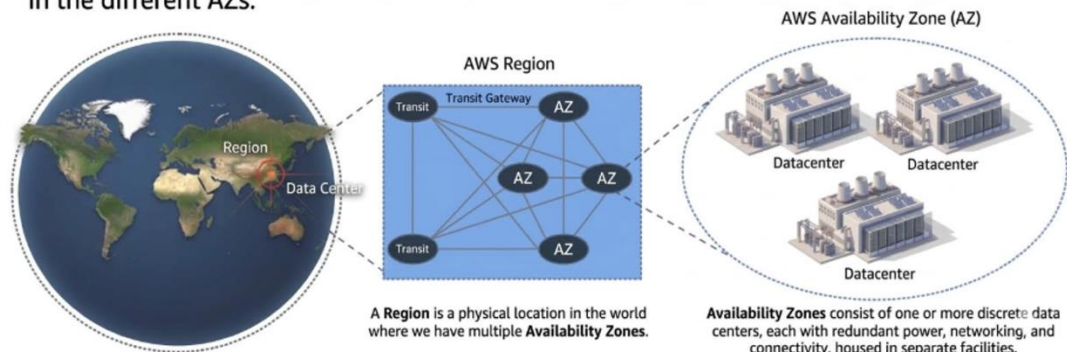
Wavelength Zones



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AWS Region Architecture Design

AWS Regions are comprised of multiple AZs for high availability, high scalability, and high fault tolerance. Applications and data are replicated in real time and consistent in the different AZs.



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AWS Peering Landscape & Link Types



AWS Peering Framework

- Both parties present in Data Centre (ideal case)
- One party in another DC – Backhaul used for peering
 - Backhaul can be owned by other party or AWS

AWS Selective Peering Principle

- Eye-Ball Network for Public Peering
- Ensures efficient traffic exchange and network resource utilization



AWS Peering by the Numbers

Autonomous System Numbers

16509	Used for public peering
14618	Legacy ASN, lives in US-EAST
7224	Used to peer for Direct Connect

Scale

175	Internet Exchanges
189	Colocation Facilities

Reference: <https://peeringdb.com/org/1520>



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South Asian Peering Landscape

Metro Locations

BOM | BLR | CCU | DEL | HYD | MAA | PNQ

Internet Exchanges

- Extreme IX
- DE-CIX
- NIXI
- Equinix Mumbai

Key Facts

- Hundreds of South Asian Peers
- Peering with all major Indian carriers
- IX-centric approach
- New POPs in pipeline for South Asian regions



Peering Link Types Overview

- **PNI (SFI)**
 - Private Network Interconnect
 - Settlement Free Interconnect
- **IX Bilateral Peering**
 - Public Peering



PNI/IX Routing Features

Features	Details
AS Path Prepending	Primary tool for Traffic Engineering (TE)
RPKI/ROA	Route Origin Authorization based filtering
MD5 Encryption	Supported but not mandatory
BFD Support	Not currently supported
BGP Communities	Not currently supported



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Route Scoping & Peering Policy



Route Scoping — Regional Routing

AWS Routing Regions

- On public or private peering, peers receive region-specific routes
 - SIN vs SYD as an example
- Routes are from the nearest AWS Region or localized groups of regions

Purpose

- Reduce the blast radius
- Localize content — avoid using Backbone connectivity
- Use Internet instead of Backbone



Peering Policy

Peering Policy

AWS Peering policy outlines :

- The requirements for parties that wish to peer with Amazon's AS16509
- Technical and Operational requirements

Details:

- <https://peering.aws>
- <https://aws.amazon.com/peering/policy>



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Operations & Self-Service Tools



Common Operational Issues

General Internet Edge Issues

 Link Error

 Interface Discard

 Low RX

 BGP Session Flapping (MPL)

 Routing Issue (Scope)

 Non-optimal Path / TE / CDN



Operational Actions & Auto-Mitigation

Traffic Shifting Actions – Core standard

- Device shifting
- Session shifting (link level)
- Link out of LAG
- Escalation to DC/Colo team
- Automated remediation with monitoring

Auto-Mitigation Actions

- Take device/link out of service
- Put device/link back into service
- Roll back a change
- Move traffic from the link
- Escalation

Important Caveat

Taking the wrong action can be worse than taking no action.

Example: Taking a congested link/Device out of service can make congestion worse.



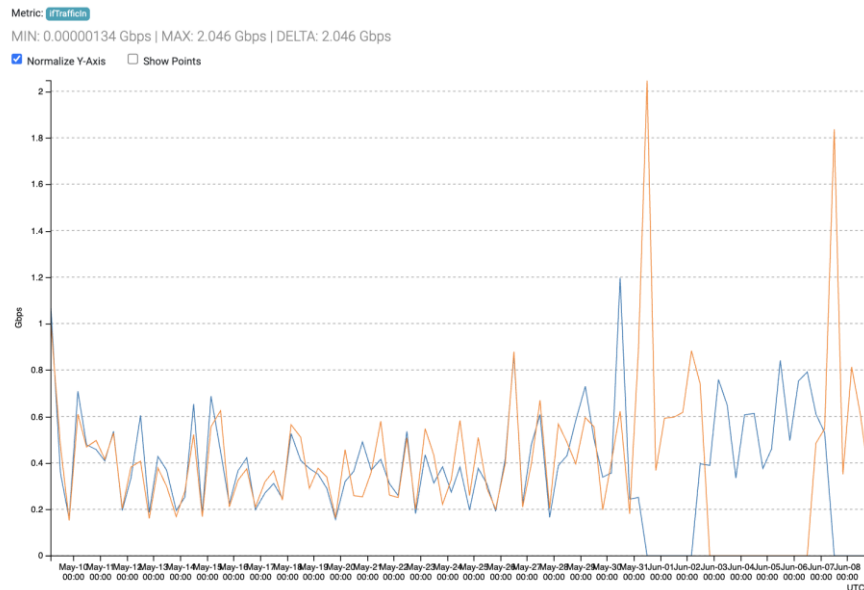
Maintenance Process

Maintenance Triggers

- Software patch
- OS upgrade
- Hardware related

Maintenance Workflow

- Shift traffic away from each device/interface
 - BGP filtering
 - IGP metric poisoning
- Once traffic drained (monitoring) maintenance deployment starts



- Sufficient redundancy must be in place to maintain connectivity
- Automated maintenance notifications sent to peers



Static Routing Issues

AWS is against static routing by peers (mainly found in IX)

Causes

- Misconfiguration
- Deliberate action

Impact on AWS

- AWS deployment requires zero traffic after shift
- Static routes cause deployment failures
- Working with peer and IX to take corrective action

Our Peering Policy highlights this:

"Peer must not establish a static route, route of last resort, or otherwise send traffic to Amazon through any route not announced via BGP."



Self-Service Tool — EC2 Reachability

<https://ec2-reachability.amazonaws.com>

- Check reachability to a particular host in a region
- Ensure network-to-network reachability
- First line of attack to tackle peering-related issues
- If no issue with test-host → issue likely is EC2 hosting security policy (WAF, SG)

US EAST
N. Virginia

Region	IP Prefix	IP	Test
us-east-1	3.80.0.0/12	3.80.0.0	✓
us-east-1	3.208.0.0/12	3.208.0.0	✓
us-east-1	3.224.0.0/12	3.224.0.0	✓
us-east-1	13.216.0.0/13	13.216.0.0	✓
us-east-1	18.204.0.0/14	18.204.0.0	✓
us-east-1	18.206.0.0/13	18.206.0.0	✓
us-east-1	18.232.0.0/14	18.232.0.0	✓
us-east-1	23.20.0.0/14	23.23.255.255	✓
us-east-1	34.192.0.0/12	34.192.0.54	✓
us-east-1	34.224.0.0/12	34.224.0.252	✓
us-east-1	35.153.0.0/16	35.153.128.254	✓
us-east-1	35.166.0.0/13	35.166.0.253	✓
us-east-1	44.192.0.0/11	44.192.0.0	✓
us-east-1	50.16.0.0/15	50.17.255.254	✓
us-east-1	50.19.0.0/16	50.19.255.254	✓
us-east-1	52.0.0.0/15	52.1.255.254	✓
us-east-1	52.2.0.0/15	52.2.0.2	✓
us-east-1	57.4.0.0/14	57.7.355.355	✓

ASIA PACIFIC
Hong Kong

Region	IP Prefix	IP	Test
ap-east-1	16.162.0.0/15	16.162.0.253	✓
ap-east-1	16.162.0.0/16	16.162.80.8	✓
ap-east-1	16.163.0.0/16	16.163.0.253	✓
ap-east-1	18.166.0.0/15	18.166.0.253	✓
ap-east-1	43.198.0.0/15	43.198.0.0	✓
ap-east-1	54.46.0.0/17	54.46.0.0	✓
ap-east-1	95.40.0.0/15	95.40.0.0	✓

EUROPE
Frankfurt

Region	IP Prefix	IP	Test
eu-central-1	3.64.0.0/12	3.64.0.0	✓
eu-central-1	3.120.0.0/14	3.120.0.0	✓
eu-central-1	3.124.0.0/14	3.124.0.0	✓
eu-central-1	18.153.0.0/16	18.153.7.254	✓
eu-central-1	18.156.0.0/14	18.156.0.0	✓
eu-central-1	18.184.0.0/15	18.184.0.0	✓
eu-central-1	18.192.0.0/15	18.192.0.0	✓
eu-central-1	18.194.0.0/15	18.194.0.252	✓
eu-central-1	18.196.0.0/15	18.196.0.253	✓
eu-central-1	18.198.0.0/15	18.198.0.0	✓
eu-central-1	35.156.0.0/14	35.156.63.252	✓
eu-central-1	52.28.0.0/16	52.28.63.252	✓
eu-central-1	52.29.0.0/16	52.29.63.252	✓
eu-central-1	52.57.0.0/16	52.57.255.254	✓
eu-central-1	52.58.0.0/15	52.58.63.252	✓
eu-central-1	54.93.0.0/17	54.93.32.2	✓
eu-central-1	54.93.128.0/17	54.93.162.162	✓
eu-central-1	63.176.0.0/14	63.176.0.0	✓

ASIA PACIFIC
Hyderabad

Region	IP Prefix	IP	Test
ap-south-2	16.112.0.0/16	16.112.0.0	✓
ap-south-2	18.60.0.0/15	18.60.8.120	✓
ap-south-2	40.182.0.0/17	40.182.0.0	✓
ap-south-2	98.130.0.0/16	98.130.0.0	✓

ASIA PACIFIC
Jakarta

Region	IP Prefix	IP	Test
ap-southeast-3	15.232.0.0/16	15.232.0.0	✓
ap-southeast-3	16.78.0.0/16	16.78.0.0	✓
ap-southeast-3	16.79.0.0/16	16.79.0.0	✓

Test-host reachable? → YES: Issue is EC2/WAF/SG (not peering) | NO: Peering issue → escalate



Self-Service Tools — RIPE ATLAS & NLNOG RING

RIPE ATLAS

- Probes deployed across AWS ec2
- <https://atlas.ripe.net/probes/public>
- GitHub available
- As Looking Glass currently unavailable, probe can be easily used for reverse trace

NLNOG RING

- VM hosted with SSH access
- 550 ASNs participating
- 60 countries covered
- 741 RING nodes available
- <https://ring.nlnog.net>



Non-Peering Reachability Issues

Issues NOT related to peering:

Cloud Security Groups

Customer-configured access controls

WAF Blocking

Web Application Firewall rules

IP Blacklisting

IP address reputation blocking

PV Geo Issue

Geographic restriction problems

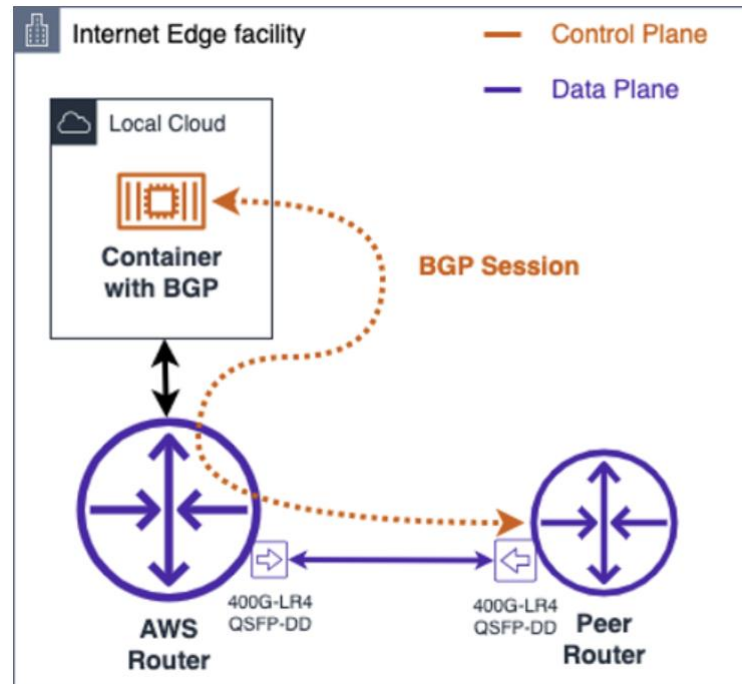
Important Distinction

AWS cloud support is different to Peering support. Paid cloud customers have a dedicated escalation channel.



Duplicate ICMP reply and AWS architecture

```
PING 99.83.90.4 (99.83.90.4): 56 data bytes
64 bytes from 99.83.90.4: icmp_seq=0 ttl=255 time=6.399 ms
64 bytes from 99.83.90.4: icmp_seq=0 ttl=254 time=6.491 ms (DUP!)
64 bytes from 99.83.90.4: icmp_seq=1 ttl=254 time=5.385 ms
64 bytes from 99.83.90.4: icmp_seq=1 ttl=255 time=5.475 ms (DUP!)
64 bytes from 99.83.90.4: icmp_seq=2 ttl=255 time=5.224 ms
64 bytes from 99.83.90.4: icmp_seq=2 ttl=254 time=5.316 ms (DUP!)
64 bytes from 99.83.90.4: icmp_seq=3 ttl=255 time=10.389 ms
64 bytes from 99.83.90.4: icmp_seq=3 ttl=254 time=10.420 ms (DUP!)
64 bytes from 99.83.90.4: icmp_seq=4 ttl=255 time=15.511 ms
64 bytes from 99.83.90.4: icmp_seq=4 ttl=254 time=15.538 ms (DUP!)
64 bytes from 99.83.90.4: icmp_seq=5 ttl=255 time=2.740 ms
64 bytes from 99.83.90.4: icmp_seq=5 ttl=254 time=2.820 ms (DUP!)
^C
--- 99.83.90.4 ping statistics ---
6 packets transmitted, 6 packets received, +6 duplicates, 0% packet loss
round-trip min/avg/max/stddev = 2.740/7.642/15.538/4.191 ms
```



05

Understanding Provisioning Workflow



Deployment Workflow

Ordering



Provisioning



Deployment

Intent-Based Networking (IBN) Deployment

- Shifts operations from manual, CLI-driven configuration to automated lifecycle
- End-state defined by operator
- Captures network policies and automatically translates them into hardware configurations
- Automated across the entire network

Provisioning System Overview

IX Ordering

- External portal: <https://interconnect.amazon/>
- PeeringDB authentication (new iteration)
- Multiple locations per ASN
- Portal-ordered sessions: Fully Automated

PNI Ordering

- Processed by AWS Business Team
- Create and hand off LOA
- Most steps automated after LOA

Required PeeringDB Fields

NOC	Maintenance	Peering Policy	MPL
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Provisioning in Action



New peering request

We have registered a new peering request between Amazon (AS16509) and NAB Investment Holdings T/A Managed Networks (AS38887).

This email contains the details of the request together with what the next steps are for the interconnection to become operational.

Request details

EdgeIX - Brisbane

1. (AS38887) 2001:df0:680:4::32 ↔ (AS16509) 2001:df0:680:4::23
2. (AS38887) 2001:df0:680:4::32 ↔ (AS16509) 2001:df0:680:4::22
3. (AS38887) 103.136.103.50 ↔ (AS16509) 103.136.103.34
4. (AS38887) 103.136.103.50 ↔ (AS16509) 103.136.103.35

IX Australia Brisbane (QLD-IX)

1. (AS38887) 2001:7fa:11:2:0:97e7:0:1 ↔ (AS16509) 2001:7fa:11:2:0:407d:0:1
2. (AS38887) 2001:7fa:11:2:0:97e7:0:1 ↔ (AS16509) 2001:7fa:11:2:0:407d:0:2
3. (AS38887) 218.100.76.129 ↔ (AS16509) 218.100.76.46
4. (AS38887) 218.100.76.129 ↔ (AS16509) 218.100.76.52

MegaIX Brisbane

1. (AS38887) 103.26.70.19 ↔ (AS16509) 103.26.70.96
2. (AS38887) 103.26.70.19 ↔ (AS16509) 103.26.70.100
3. (AS38887) 2001:dea:0:20::13 ↔ (AS16509) 2001:dea:0:20::60
4. (AS38887) 2001:dea:0:20::13 ↔ (AS16509) 2001:dea:0:20::64



Pending peering request

We have processed a peering request between Amazon (AS16509) and NAB Investment Holdings T/A Managed Networks (AS38887).

This email contains the details of the sessions that have been established as well as those pending to be configured on your side for the interconnection to become fully operational.

Request details

EdgeIX - Brisbane

1. (AS38887) 2001:df0:680:4::32 ↔ (AS16509) 2001:df0:680:4::23 is PENDING AS38887
2. (AS38887) 2001:df0:680:4::32 ↔ (AS16509) 2001:df0:680:4::22 is PENDING AS38887
3. (AS38887) 103.136.103.50 ↔ (AS16509) 103.136.103.34 is PENDING AS38887
4. (AS38887) 103.136.103.50 ↔ (AS16509) 103.136.103.35 is PENDING AS38887

MegaIX Brisbane

1. (AS38887) 103.26.70.19 ↔ (AS16509) 103.26.70.96 is PENDING AS38887
2. (AS38887) 103.26.70.19 ↔ (AS16509) 103.26.70.100 is PENDING AS38887
3. (AS38887) 2001:dea:0:20::13 ↔ (AS16509) 2001:dea:0:20::60 is PENDING AS38887
4. (AS38887) 2001:dea:0:20::13 ↔ (AS16509) 2001:dea:0:20::64 is PENDING AS38887

These sessions should be configured with the prefix limits currently announced in PeeringDB for [Amazon](#).



Completed peering request

We have completed a peering request between Amazon (AS16509) and NAB Investment Holdings T/A Managed Networks (AS38887).

This email contains the details of the sessions that have been established.

Request details

EdgeIX - Brisbane

1. (AS38887) 2001:df0:680:4::32 ↔ (AS16509) 2001:df0:680:4::23
2. (AS38887) 2001:df0:680:4::32 ↔ (AS16509) 2001:df0:680:4::22
3. (AS38887) 103.136.103.50 ↔ (AS16509) 103.136.103.34
4. (AS38887) 103.136.103.50 ↔ (AS16509) 103.136.103.35

IX Australia Brisbane (QLD-IX)

1. (AS38887) 2001:7fa:11:2:0:97e7:0:1 ↔ (AS16509) 2001:7fa:11:2:0:407d:0:1
2. (AS38887) 2001:7fa:11:2:0:97e7:0:1 ↔ (AS16509) 2001:7fa:11:2:0:407d:0:2
3. (AS38887) 218.100.76.129 ↔ (AS16509) 218.100.76.46
4. (AS38887) 218.100.76.129 ↔ (AS16509) 218.100.76.52

MegaIX Brisbane

1. (AS38887) 103.26.70.19 ↔ (AS16509) 103.26.70.96
2. (AS38887) 103.26.70.19 ↔ (AS16509) 103.26.70.100
3. (AS38887) 2001:dea:0:20::13 ↔ (AS16509) 2001:dea:0:20::60
4. (AS38887) 2001:dea:0:20::13 ↔ (AS16509) 2001:dea:0:20::64

Pre-Deployment Checks & Disconnection

Pre-Deployment Checks

1. Session Establishment
2. MPL in PeeringDB
3. No Private ASN
4. RPKI/ROA Validation
5. Minimum 1 Prefix Expected
6. Stable Sessions (~48 hours)

Disconnection

- Manually invoked
- Auto-removal after 30 days (no establishment)
- Last session in metro → manual intervention

Automated email reminders at every step | ~1 week buffer for sessions to become functional



Useful Links , Contacts & Q&A

Purpose	URL
Session Ordering Portal	https://interconnect.amazon/
EC2 Reachability Tool	https://ec2-reachability.amazonaws.com/
AWS Peering Information	https://aws.amazon.com/peering/
AWS PeeringDB Profile	https://peeringdb.com/asn/16509/

AWS Contacts	URL
Peering-to@amazon.com	Operation Related – Technical Issue
Peering-apac@amazon.com	APAC Peering Policy
Peering-emea@amazon.com	EMEA Peering Policy
Peering-amer@amazon.com	NASA Peering Policy
Peering-india@amazon.com	India Peering Policy

Questions & Answers

Thank you

