
AWS
re:Invent

NET209

Scale your network with IPv6

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AWS

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Agenda

Where is the world with IPv6?

Using IPv6 for your private network on AWS

Depleting private (RFC 1918) IPv4 space

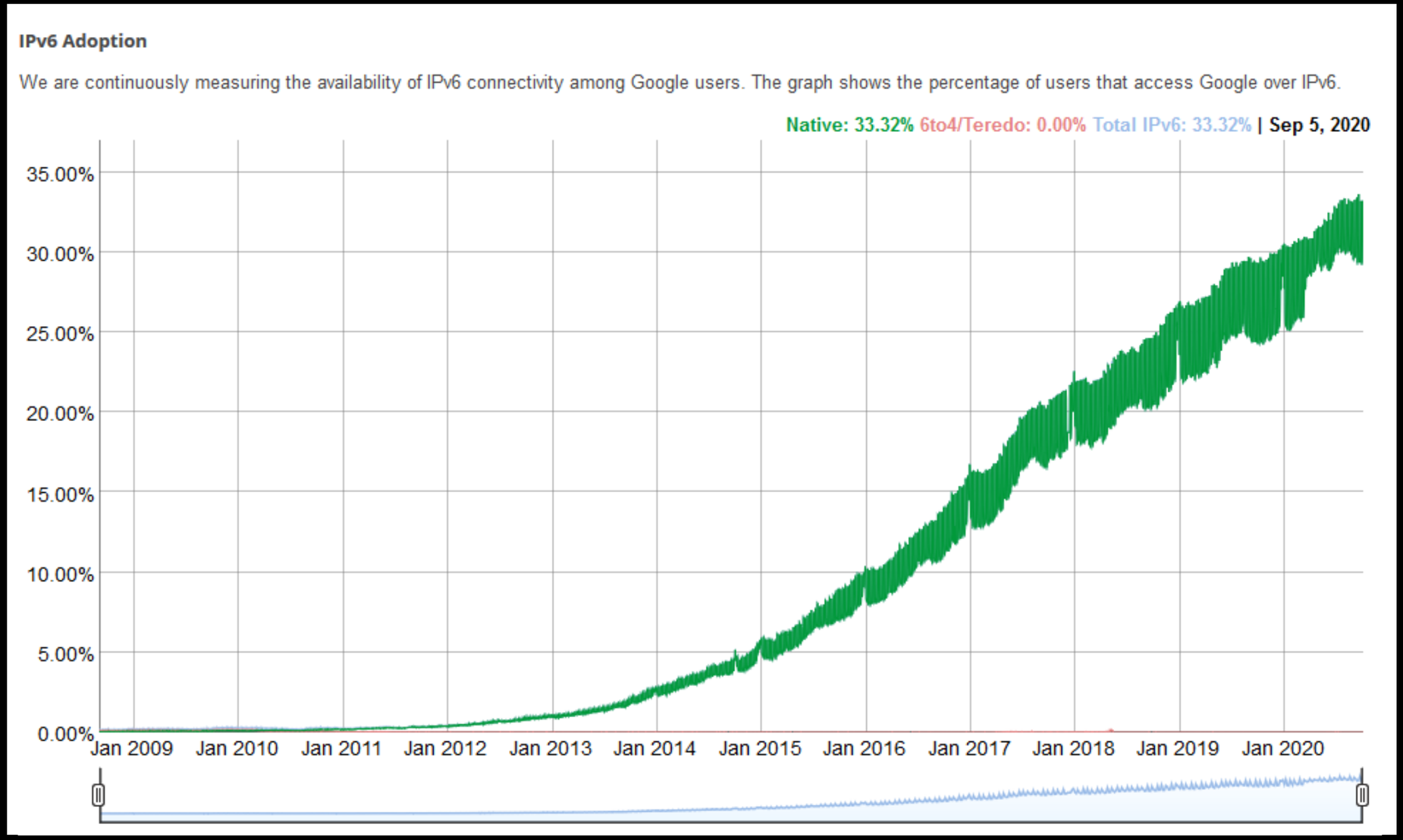
Adding scale to your private network with IPv6

Recent IPv6 launches at AWS



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Where is the world with IPv6?



Source: Google IPv6 Statistics, September 2020. https://www.google.com/intl/en/ipv6/statistics.html

Here are some more numbers

85.8%

Percentage of IPv6 deployment across US mobile carriers

Source: World IPv6 Launch, September 2020
https://www.worldipv6launch.org/measurements/

34.54%

YoY growth of percentage of IPv6 adoption not accounting for absolute growth in devices

Source: Google IPv6 Statistics, September 2020
https://www.google.com/intl/en/ipv6/statistics.html

25

Number of countries with >30% adoption of IPv6 with 6 countries at >50%

Source: Facebook IPv6 Adoption by Country Map, September 2020
https://www.facebook.com/ipv6/?tab=ipv6_country

5.8 billion

Number of IoT-connected endpoints in 2020 forecasted by Gartner

Source: Gartner, August 2019
https://www.gartner.com/en/newsroom/press-releases/2019-08-29-gartner-says-5-8-billion-enterprise-and-automotive-io

Using IPv6 for your private network on AWS



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IPv6 helps with IPv4 exhaustion on the internet and in your private network

Let us unpack that statement

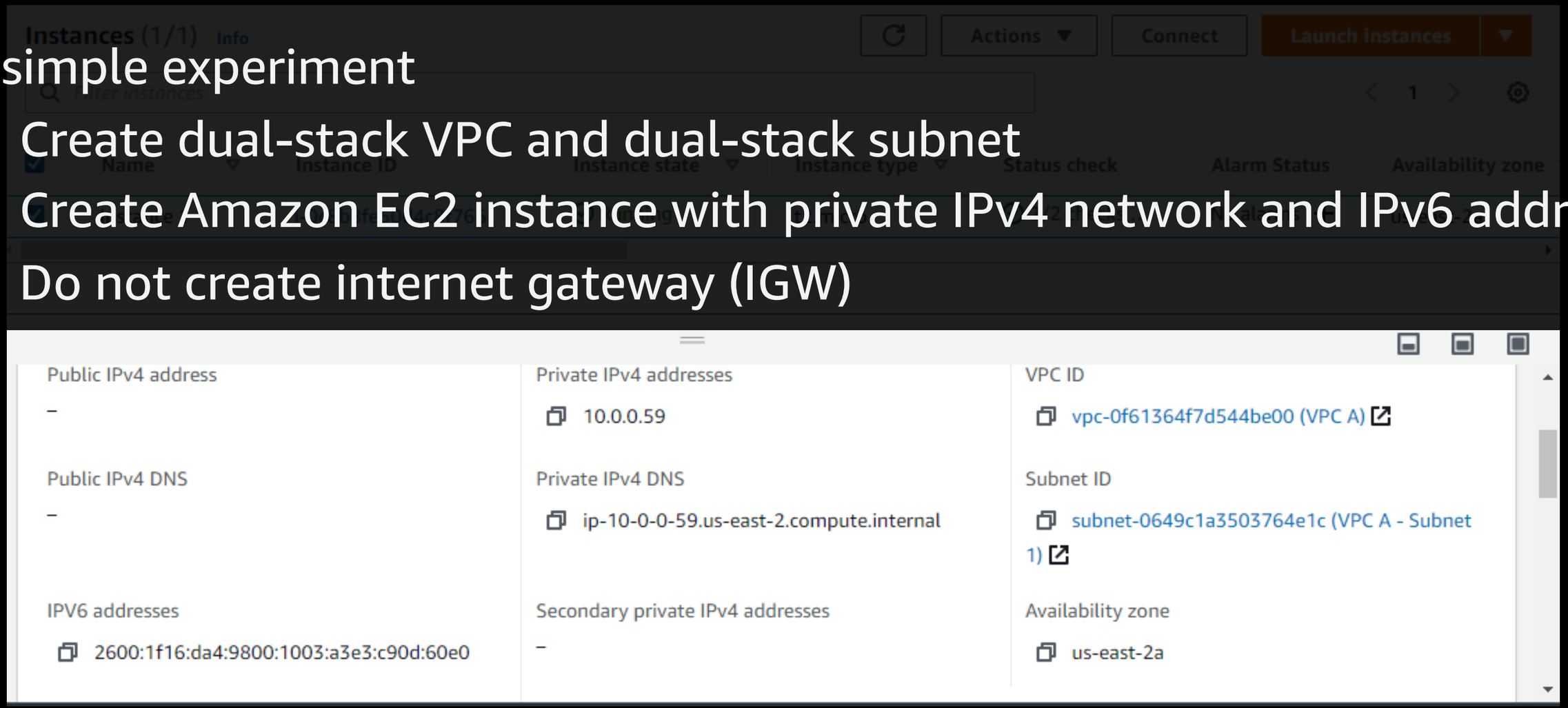
- IPv6 helps solve for IPv4 exhaustion
- IPv6 in private networks
- IPv6 brings scale to depleting space in private IPv4 networks

IPv6 has globally unique address space

BUT GLOBALLY UNIQUE IS NOT THE SAME AS PUBLIC

A simple experiment

1. Create dual-stack VPC and dual-stack subnet
2. Create Amazon EC2 instance with private IPv4 network and IPv6 address
3. Do not create internet gateway (IGW)



Test 1: Ping the instance from my IPv6 computer

```
C:\WINDOWS\system32>ping 2600:1f16:da4:9800:1003:a3e3:c90d:60e0

Pinging 2600:1f16:da4:9800:1003:a3e3:c90d:60e0 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 2600:1f16:da4:9800:1003:a3e3:c90d:60e0:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Test 2: Ping from second instance in same VPC

MAKE SURE SECURITY GROUPS ARE UPDATED

```
C:\Users\Administrator>ping  2600:1f16:da4:9800:1003:a3e3:c90d:60e0

Pinging 2600:1f16:da4:9800:1003:a3e3:c90d:60e0 with 32 bytes of data:
Reply from 2600:1f16:da4:9800:1003:a3e3:c90d:60e0: time=1ms
Reply from 2600:1f16:da4:9800:1003:a3e3:c90d:60e0: time<1ms
Reply from 2600:1f16:da4:9800:1003:a3e3:c90d:60e0: time=1ms
Reply from 2600:1f16:da4:9800:1003:a3e3:c90d:60e0: time=1ms

Ping statistics for 2600:1f16:da4:9800:1003:a3e3:c90d:60e0:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Recap: IPv6 in your virtual private cloud (VPC)

- We created a VPC with instances that talk to each other over IPv6 and cannot talk to the internet
- The IPv6 address can be public, but technically is not until you
  - Create an internet gateway (IGW)
  - Create a route in the route table to the IGW
  - Change settings on your instance security group to allow inbound IPv6 traffic

```
Reply from 2001:4860:4860::8888: time=10ms
Reply from 2001:4860:4860::8888: time=10ms

Ping statistics for 2001:4860:4860::8888:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 10ms, Maximum = 11ms, Average = 10ms
```

- Egress-only internet gateway (EIGW) for controlling IPv6 traffic

Depleting private IPv4 space



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Available IPv4 private IP space in RFC 1918



RFC 1918

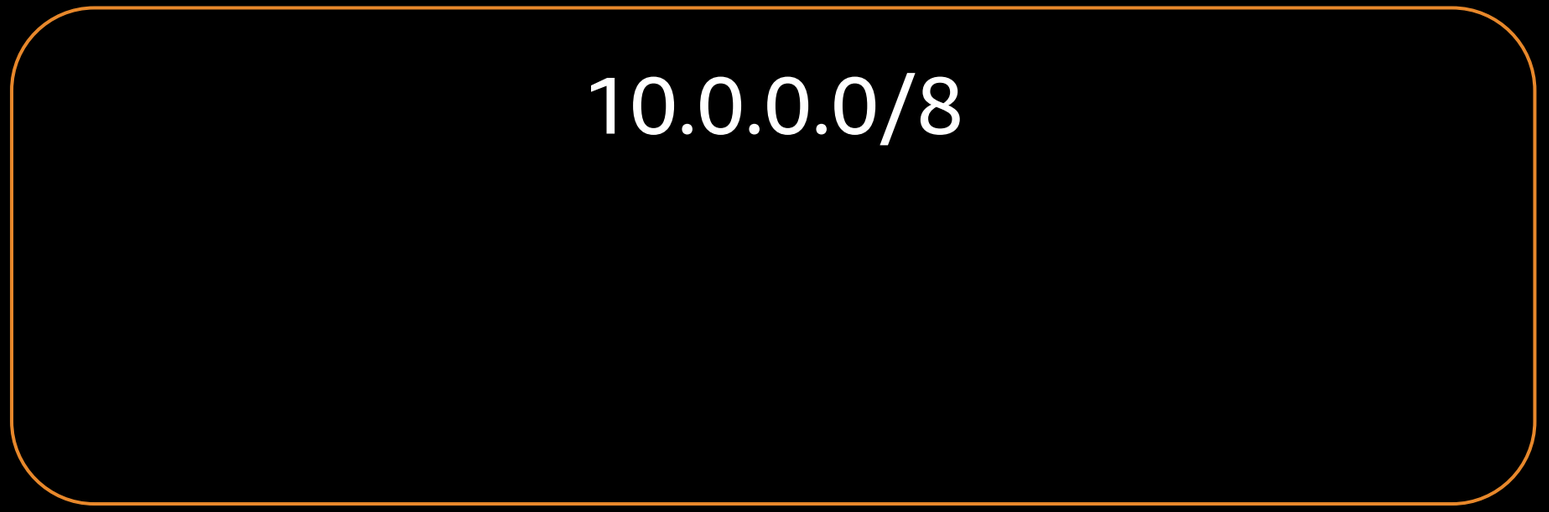
- 10.0.0.0/8
- 172.16.0.0/12
- 192.168.0.0/16

16 million IPs (65k x /24 s)

1 million IPs (4k x /24 s)

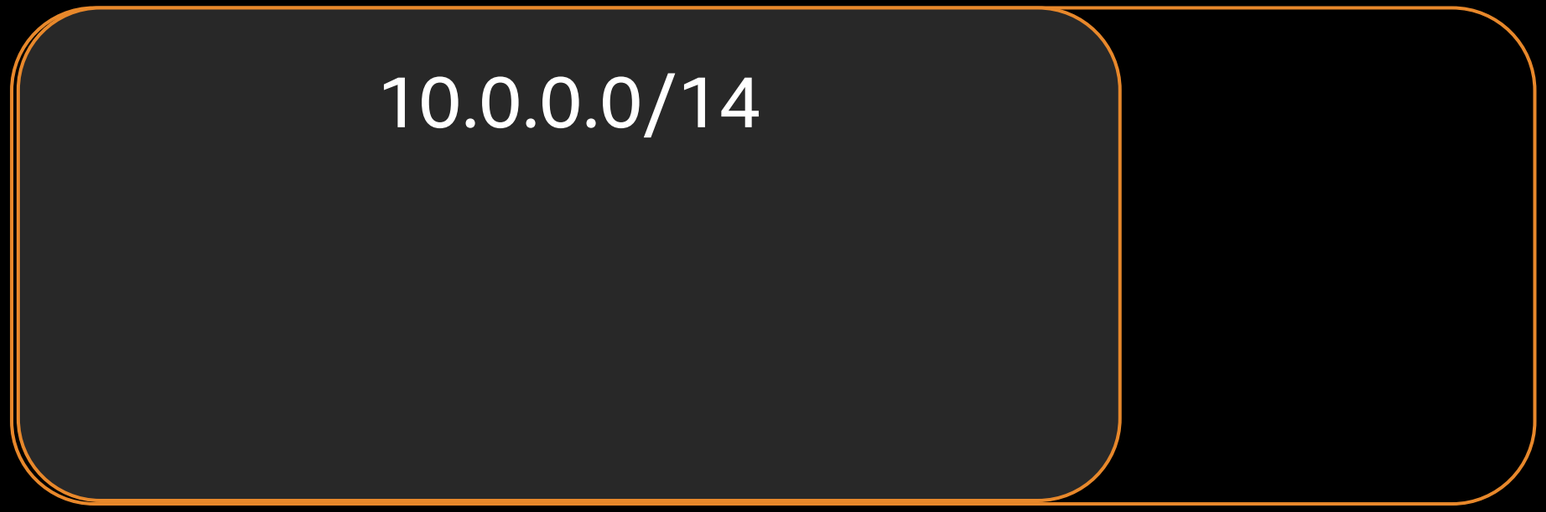
65 thousand IPs (256 x /24 s)

Allocation for all enterprise networks



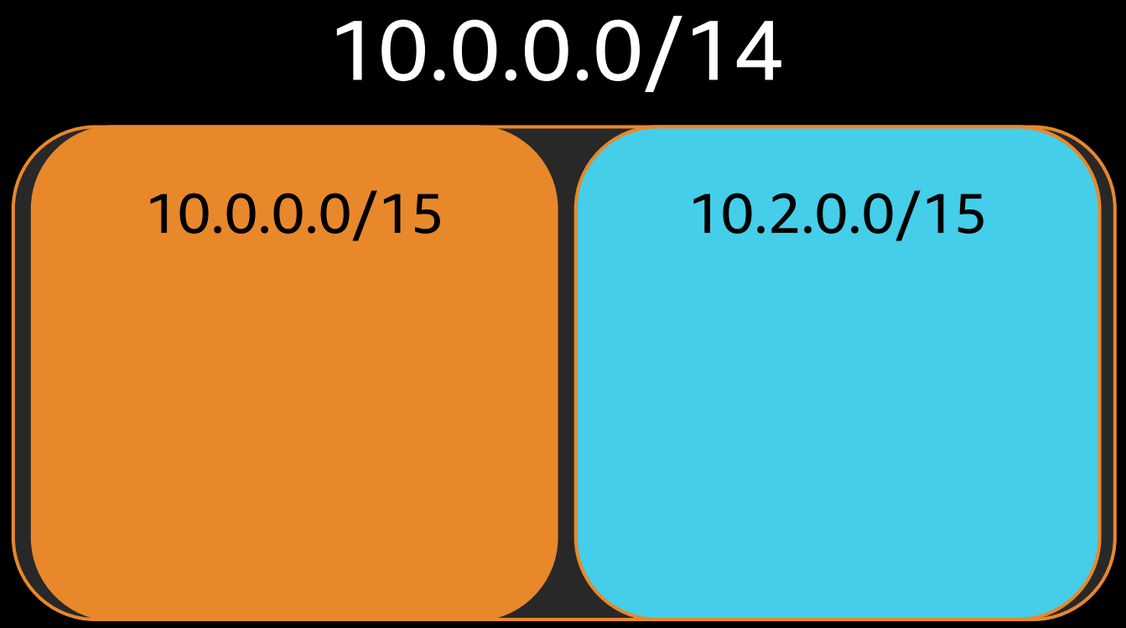
65k x /24

Allocation for AWS



1k x /24

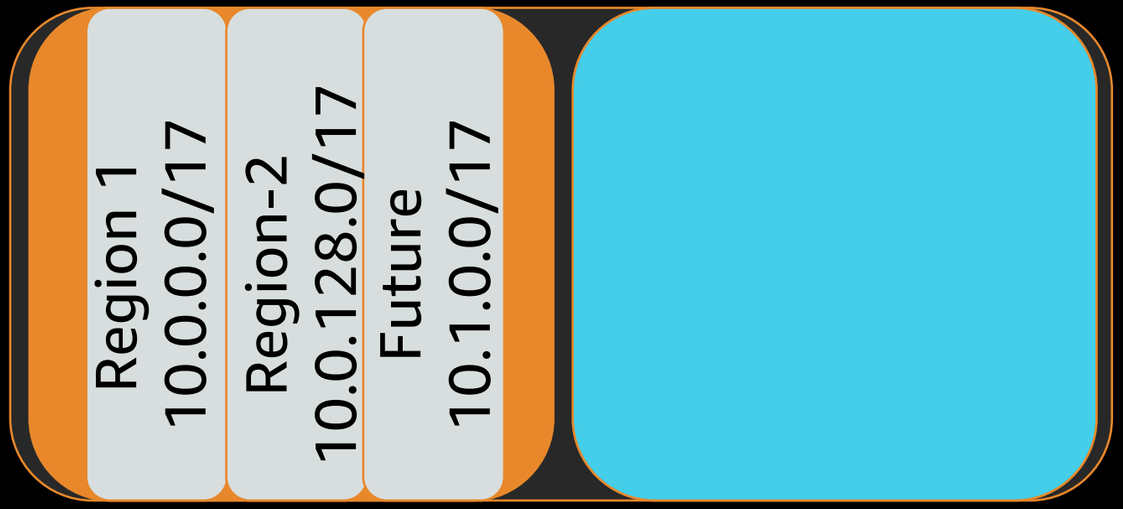
Allocation for production and nonproduction



512 x /24

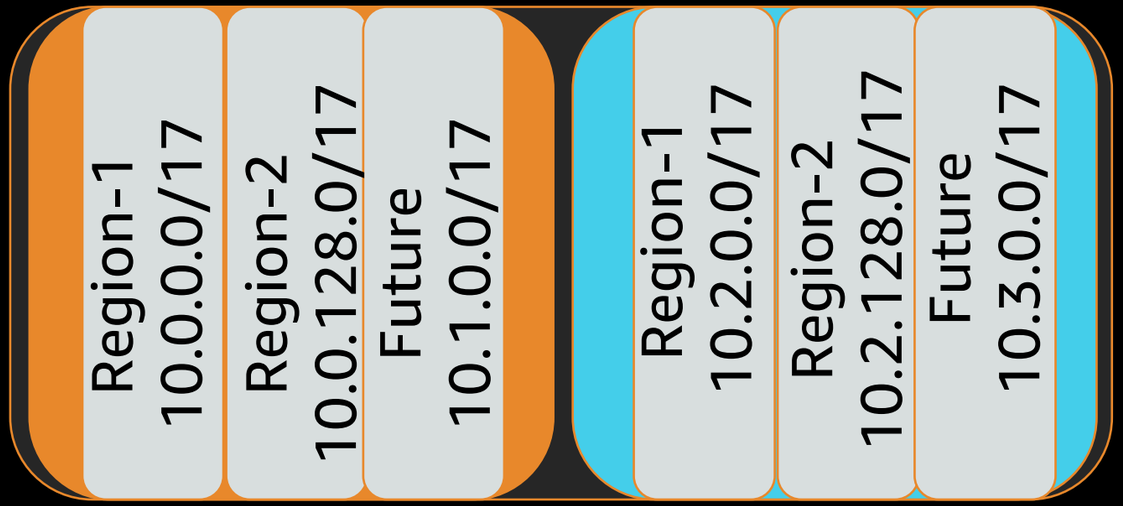
Allocation for AWS regions

10.0.0.0/14



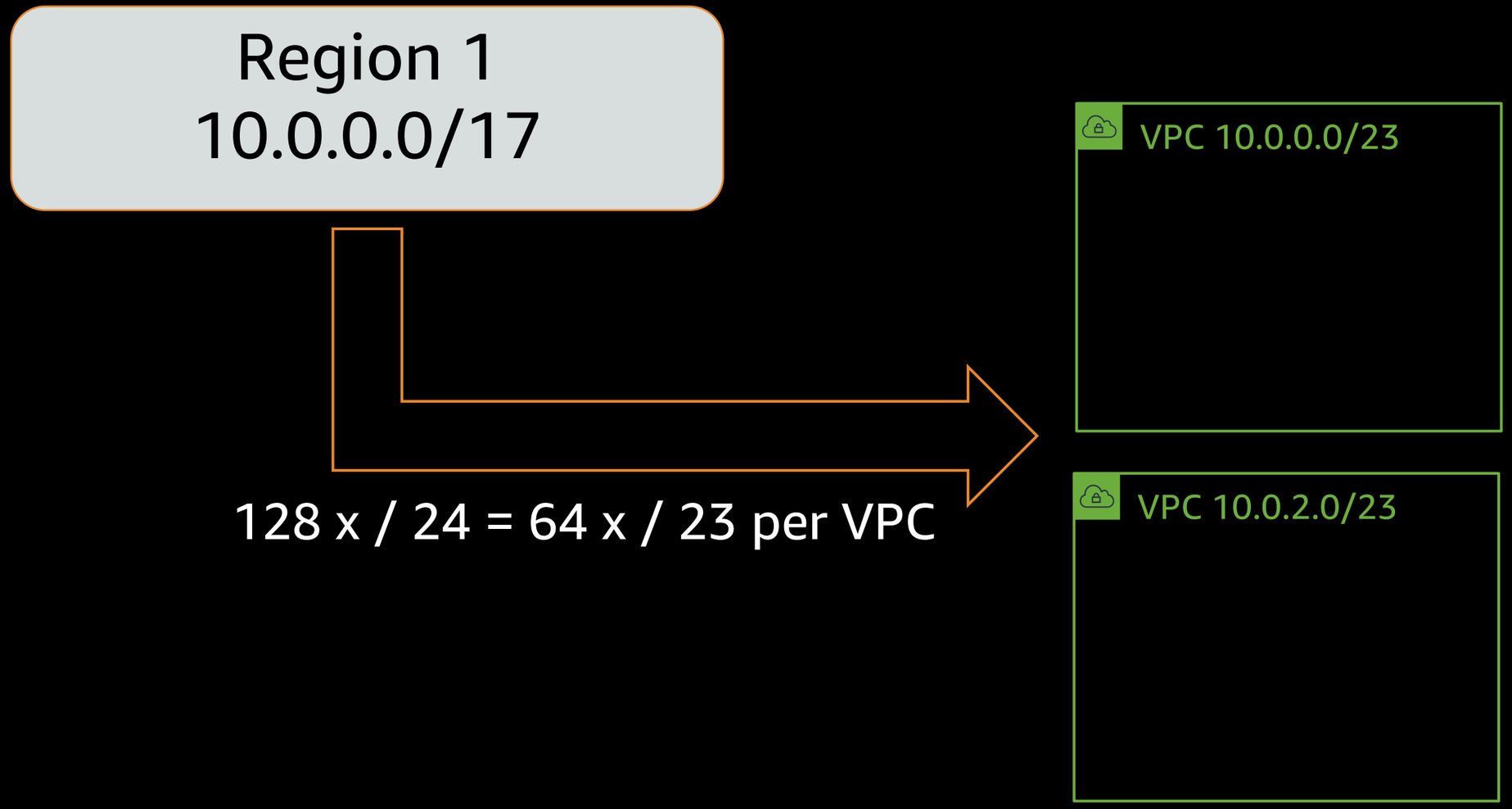
128 x /24

Allocation for AWS regions

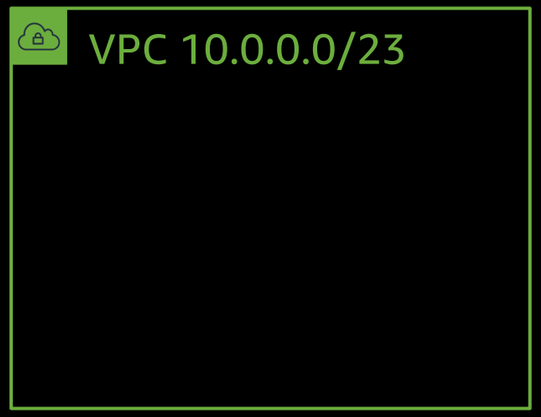


128 x /24

Allocation for AWS VPCs



Allocation for VPC subnets

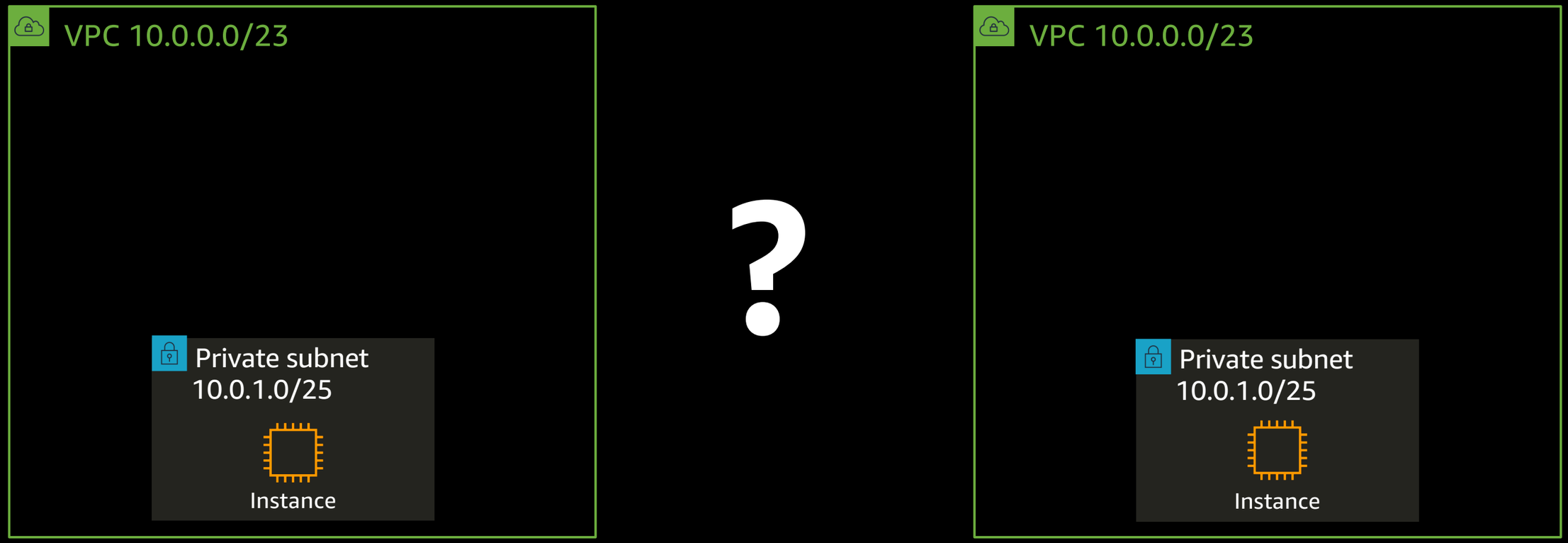


Allocation for VPC subnets



< 128 hosts per subnet

Overlapping VPC IP space



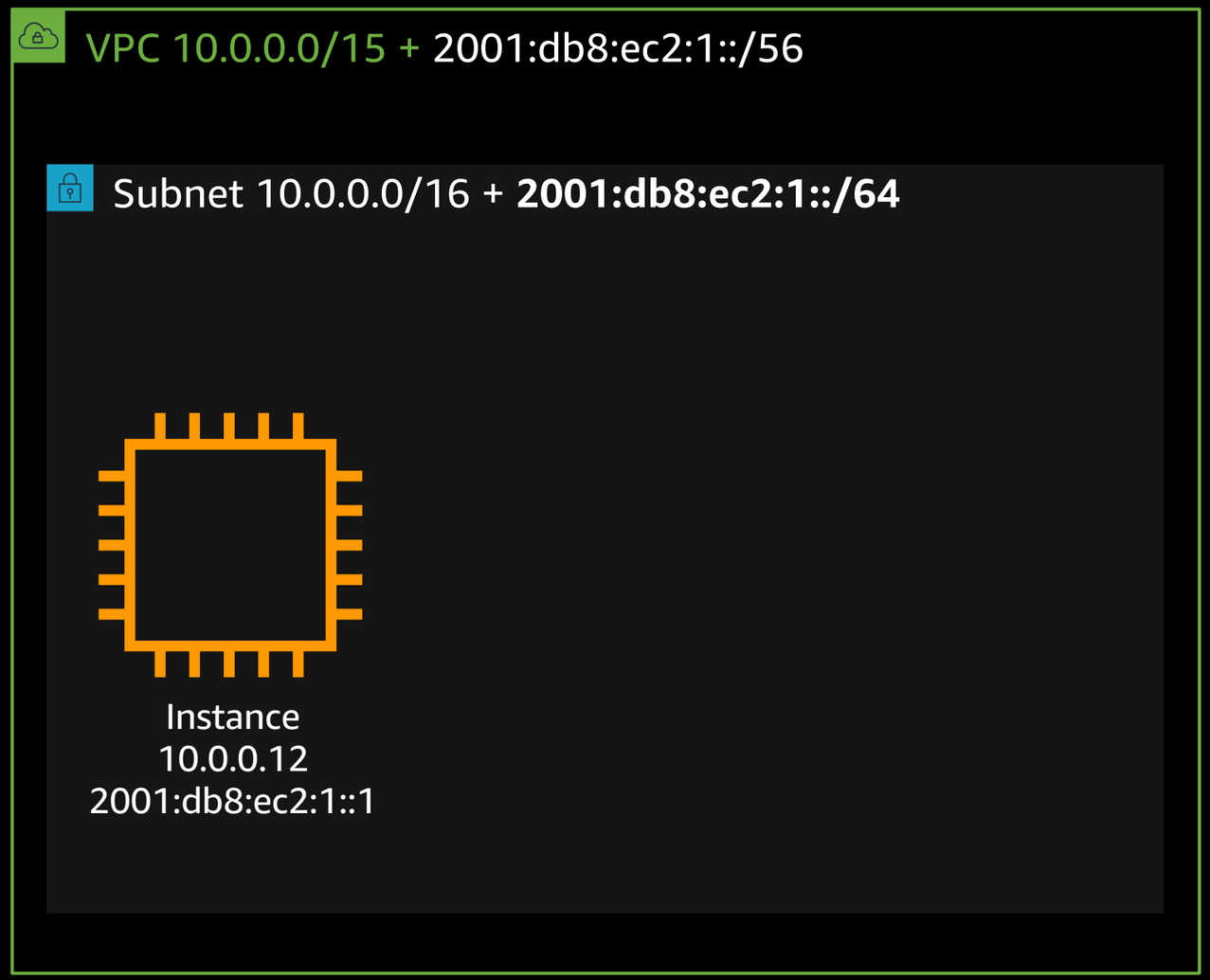
Adding scale to your private network with IPv6



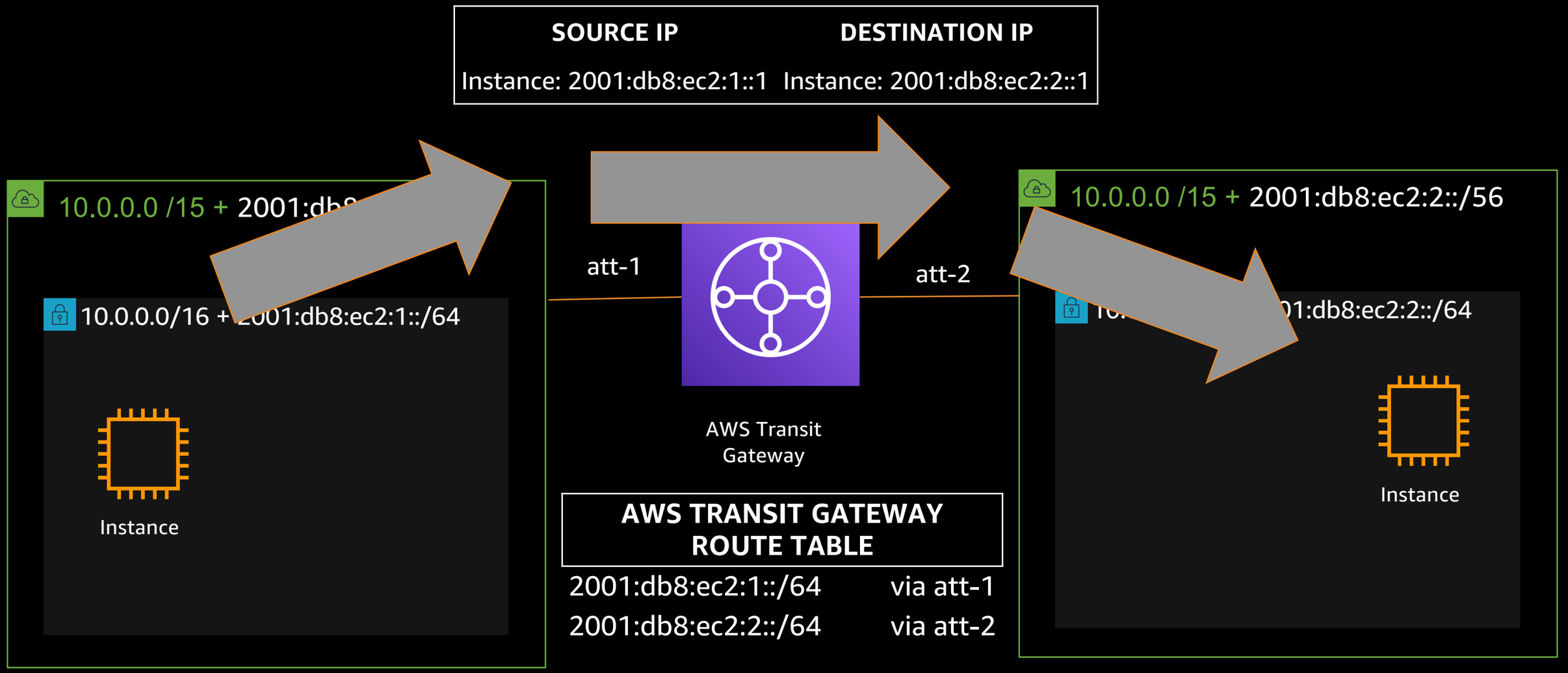
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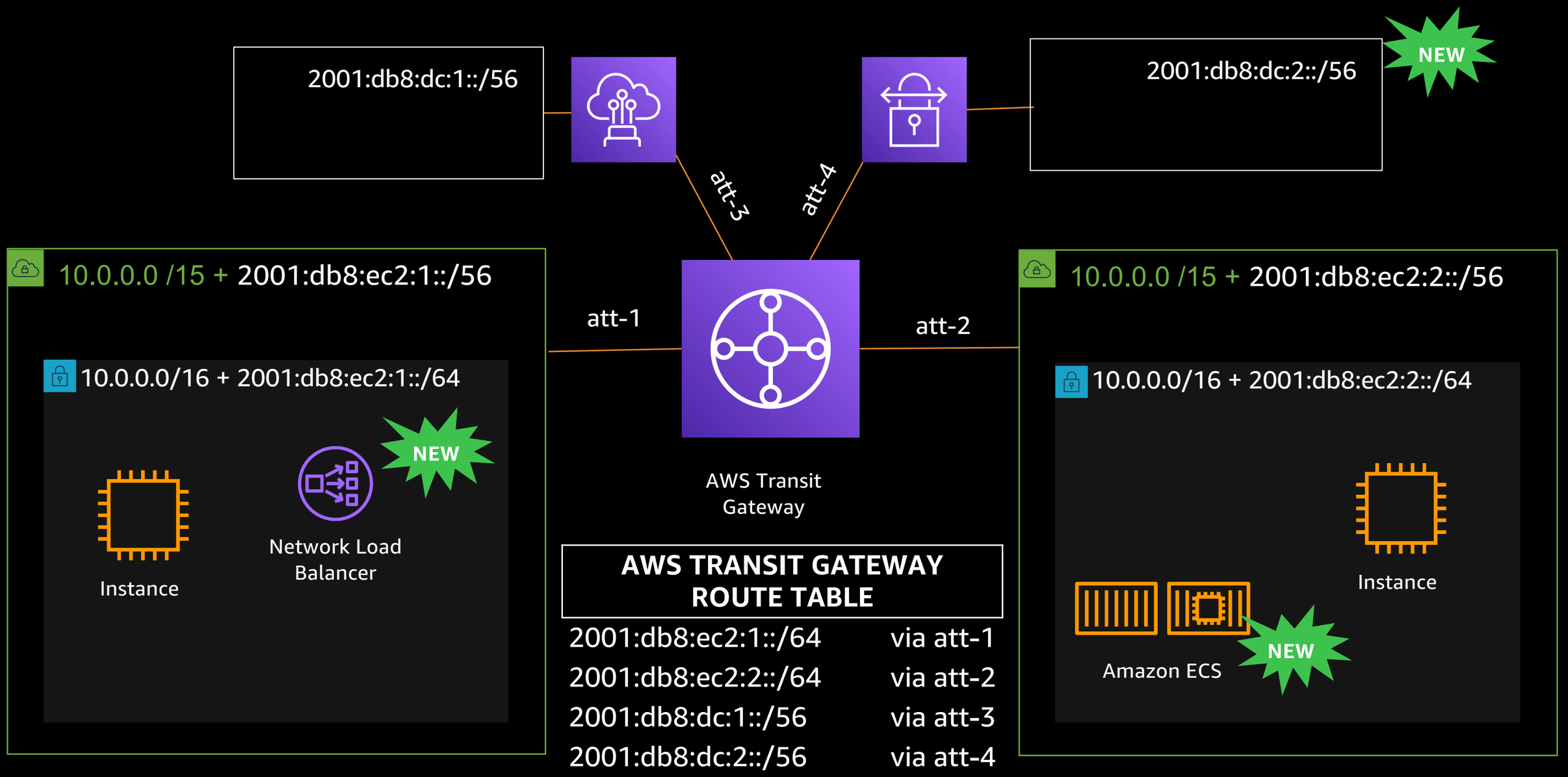
Add IPv6 to the VPC and subnet



AWS Transit Gateway and IPv6



Extending to an Enterprise Hybrid setup



Recent IPv6 launches



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Bring Your Own IPv6 (BYOIPv6)

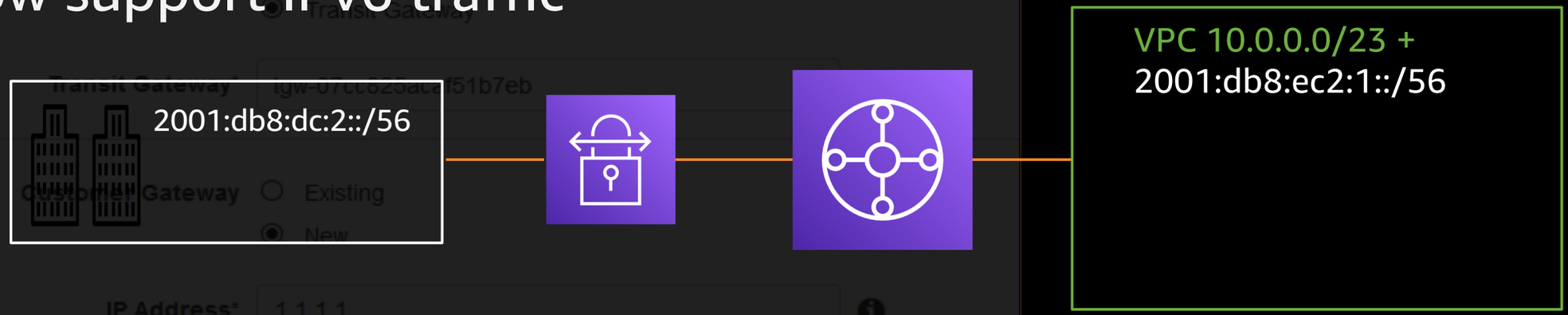
Bring your address range that is registered with your Regional Internet Registry

The most specific prefix you can bring is /48 if publicly advertised and /56 if not publicly advertised

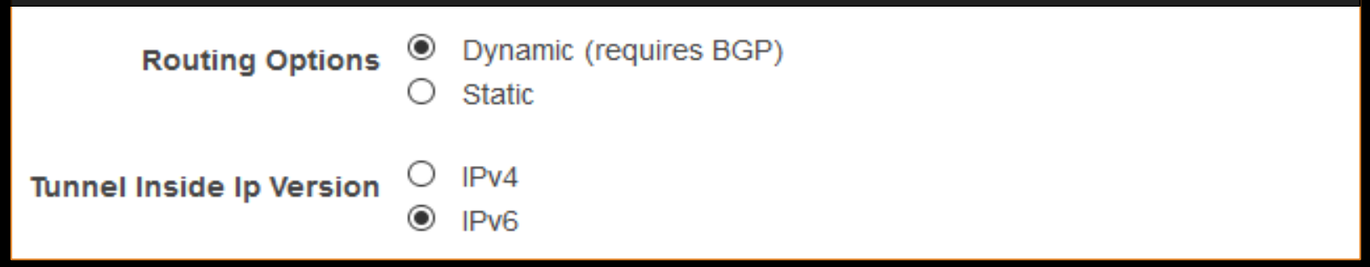
```
provision-byoip-cidr
--cidr <value>
[--cidr-authorization-context <value>]
[--publicly-advertisable | --no-publicly-advertisable]
[--description <value>]
[--dry-run | --no-dry-run]
[--pool-tag-specifications <value>]
[--cli-input-json <value>]
[--generate-cli-skeleton <value>]
```

AWS Site-to-Site VPN with IPv6

AWS Site-to-Site VPN connections to AWS Transit Gateway now support IPv6 traffic

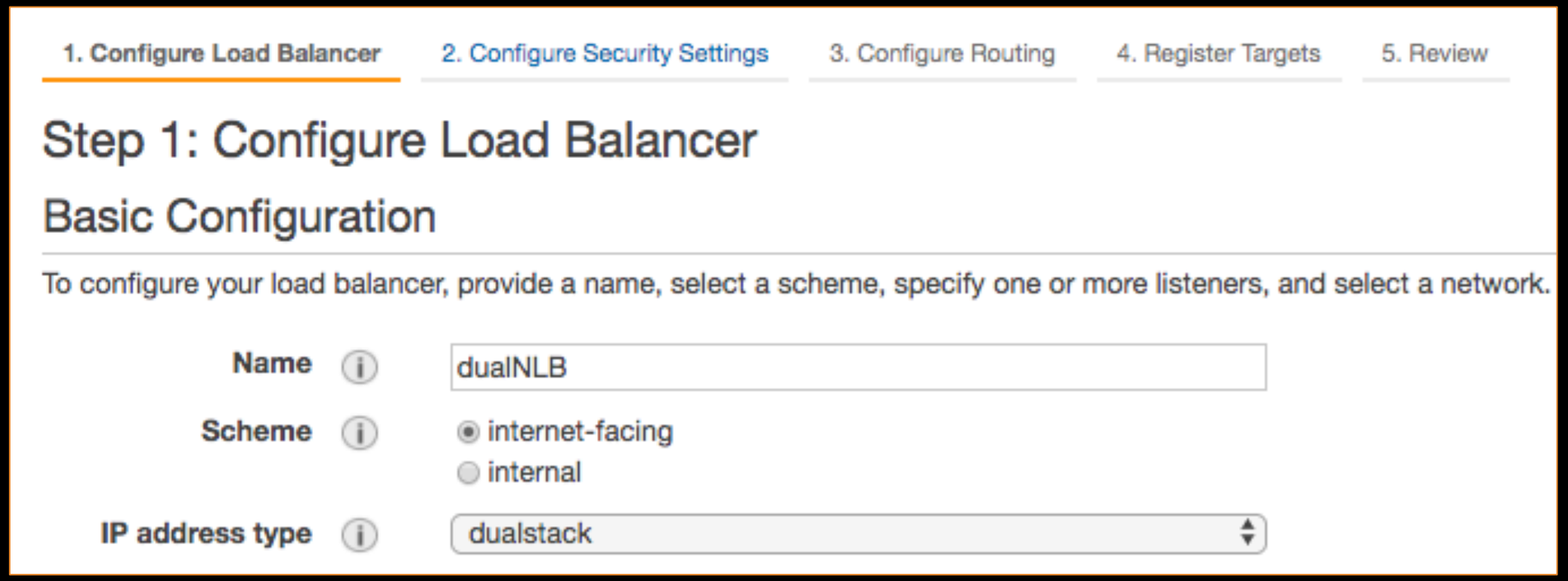


To add IPv6 connectivity, set tunnel option for **Inside IP** to **IPv6** when creating new VPN connection



IPv6 support on Network Load Balancer

For IPv6 clients, you can now create a Network Load Balancer that is dual-stack

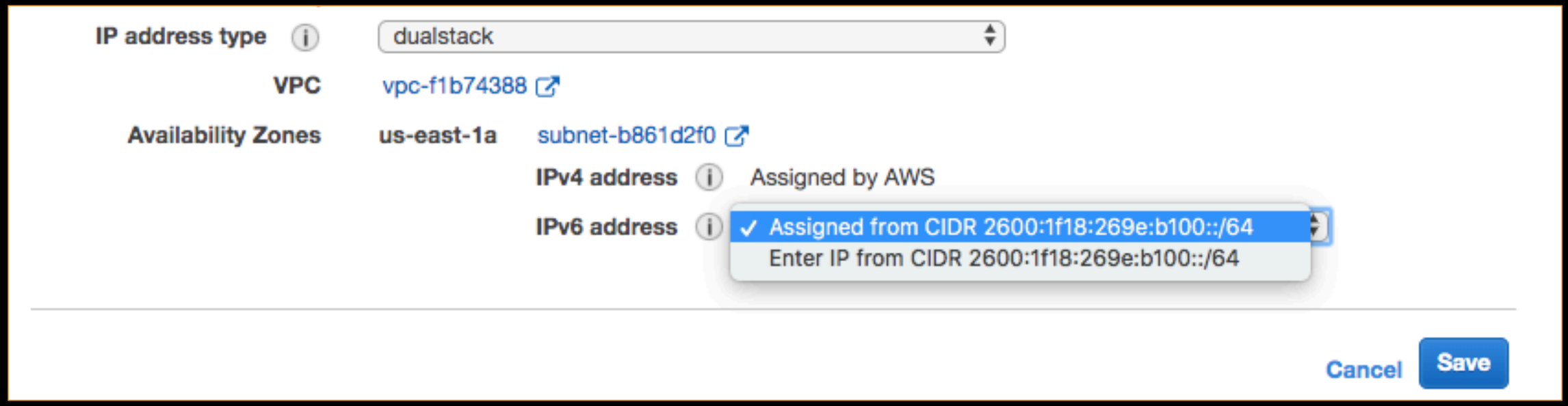


Or add IPv6 to an existing load balancer using **Edit IP address type**



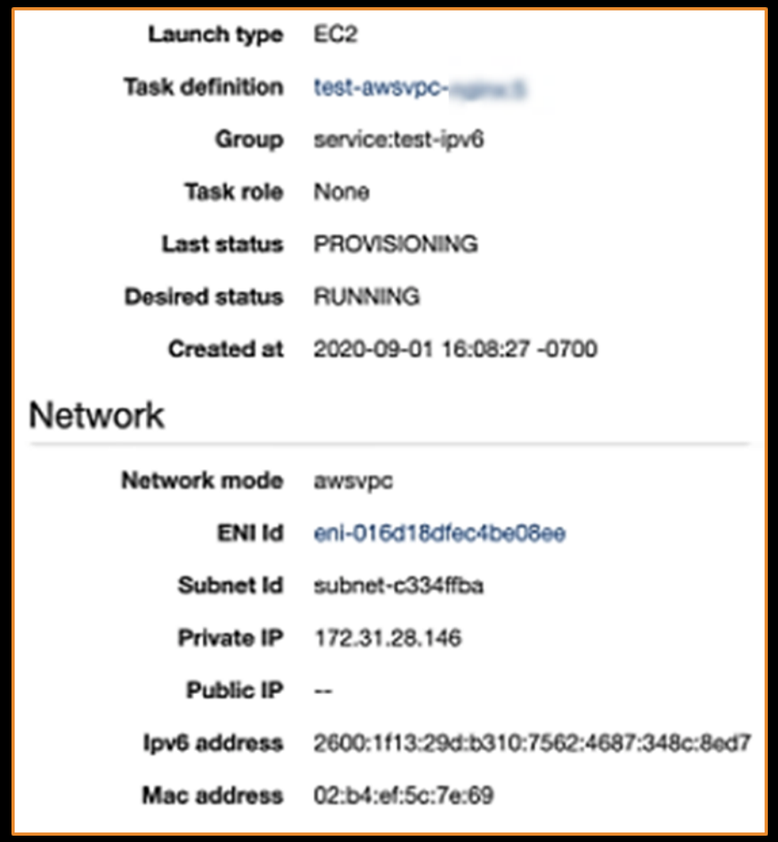
IPv6 support on Network Load Balancer

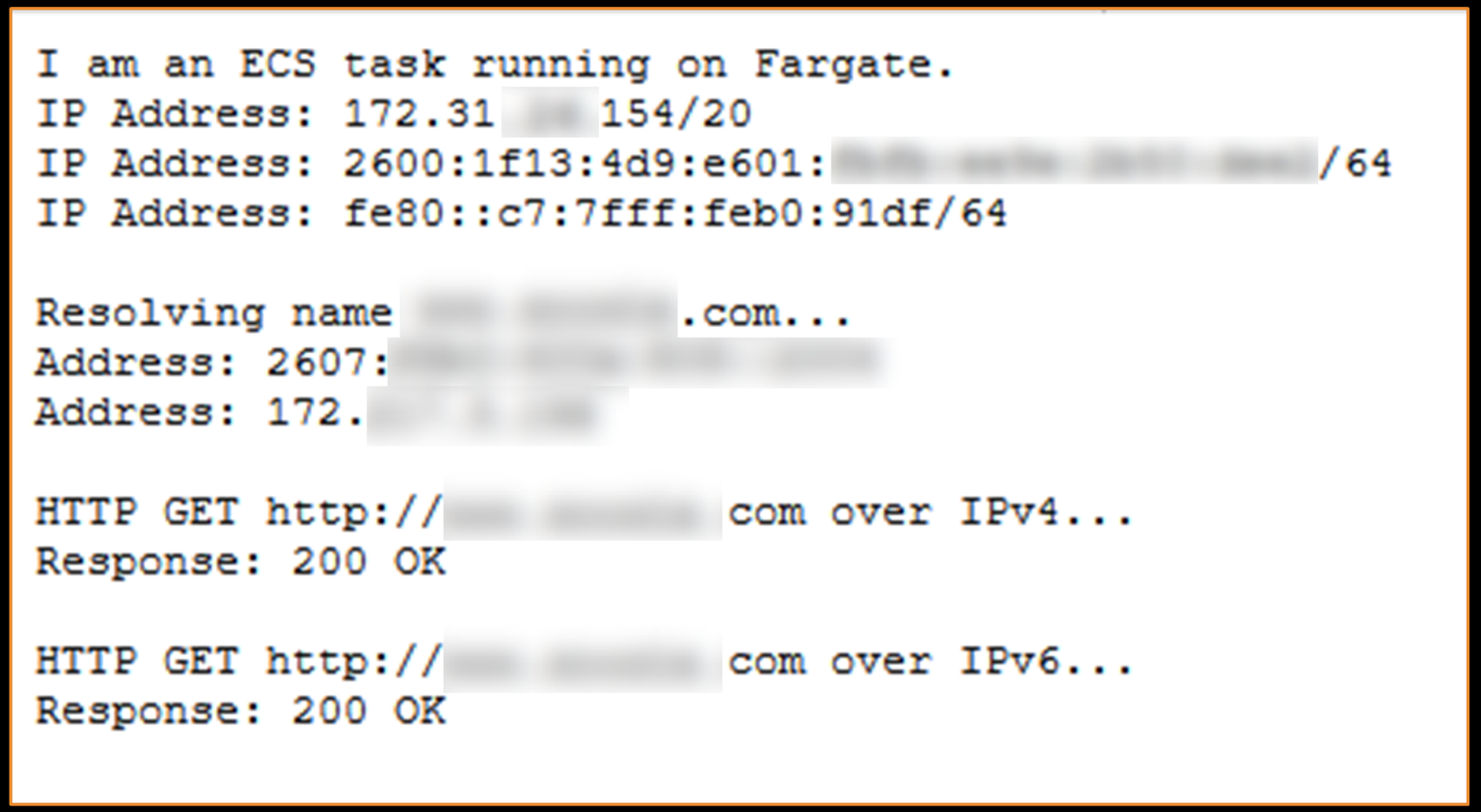
You can either opt to use a random IPv6 address from CIDR associated with the subnet or specify an IP address from that subnet



IPv6 on Amazon Elastic Container Service (ECS)

IPv6 supported for Amazon ECS on Amazon EC2 and AWS Fargate in awsvpc mode





AWS services that support IPv6


Amazon EC2


Amazon Simple Storage Service (S3)


Amazon VPC


Amazon CloudFront



Elastic Load Balancing



Amazon Elastic Container Service


AWS Shield



Amazon Route 53



AWS Site-to-Site VPN


AWS WAF


AWS Identity and Access Management


AWS Transit Gateway


Amazon WorkSpaces


AWS Direct Connect


AWS IoT

Thank you!



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