IPv6 Addressing Plan

Webinar

March 2025

RIPE NCC Learning & Development

This webinar is being recorded

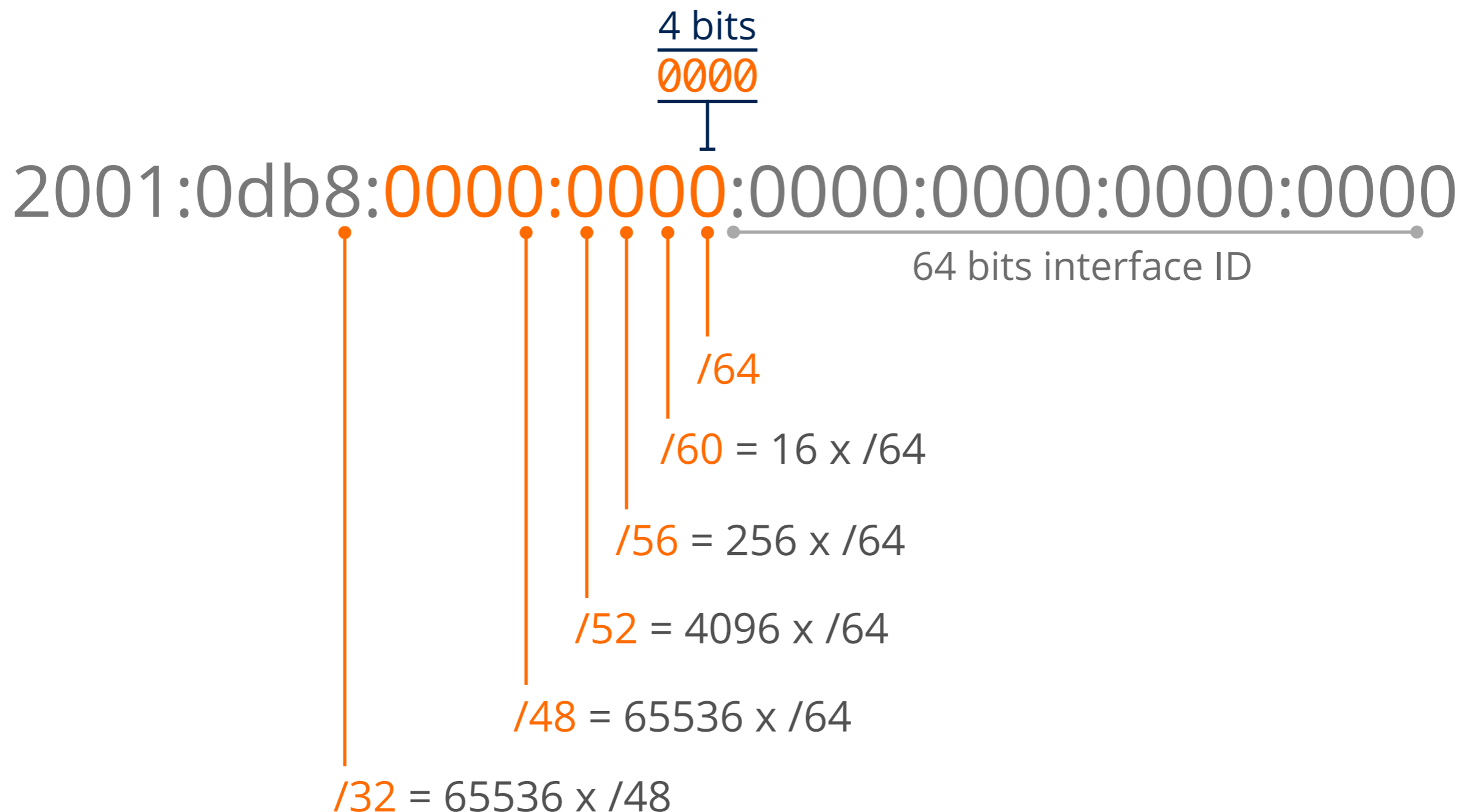# Why Create an Addressing Plan?

- **Benefits of an IPv6 addressing plan**

  - Mental health during implementation (!)

  - Easier implementation of security policies

  - Efficient addressing plans are scalable

  - More efficient route aggregation

4-bit Boundaries

- **IPv6 offers flexibility with addressing plans**
- **Network addressing can be done on 4-bit boundaries**

4 bits

0000

2001:0db8:0000:0000:0000:0000:0000:0000

64 bits interface ID

/64

/60 = 16 x /64

/56 = 256 x /64

/52 = 4096 x /64

/48 = 65536 x /64

/32 = 65536 x /48

The /64 story

- "Every interface ID must be a /64" (RFC 4291)

- Because of SLAAC

- Other RFCs followed this

- The **only** exception is a /127 for point-to-point links

ISP Addressing Plan

- What should an ISP addressing plan contain?

    - Address space for internal use

    - Loopback interfaces

    - Point-to-point connections

    - Servers, routers and other infrastructure at POPs

- Use a /48 per POP

- Address space for customers

Loopback Interfaces

- **One /128 per device**

  - One /64 contains enough addresses for all your manually configured loopback addresses

- **Take an easy to remember block for loopback addresses**

Point-to-point Links

- **With old router operating software:**

  - One /64 per point-to-point connection

  - Reserve /64 per point-to-point link, but configure a /127

- **With new router operating software:**

  - Configure a /127 per point-to-point connection

  - You can group them under a single /64

- **Recommendation is reserving a separate /64 and configuring /127 per point-to-point link!**

  - Check **RFC 6164** for rationales of using /127

ISP Example
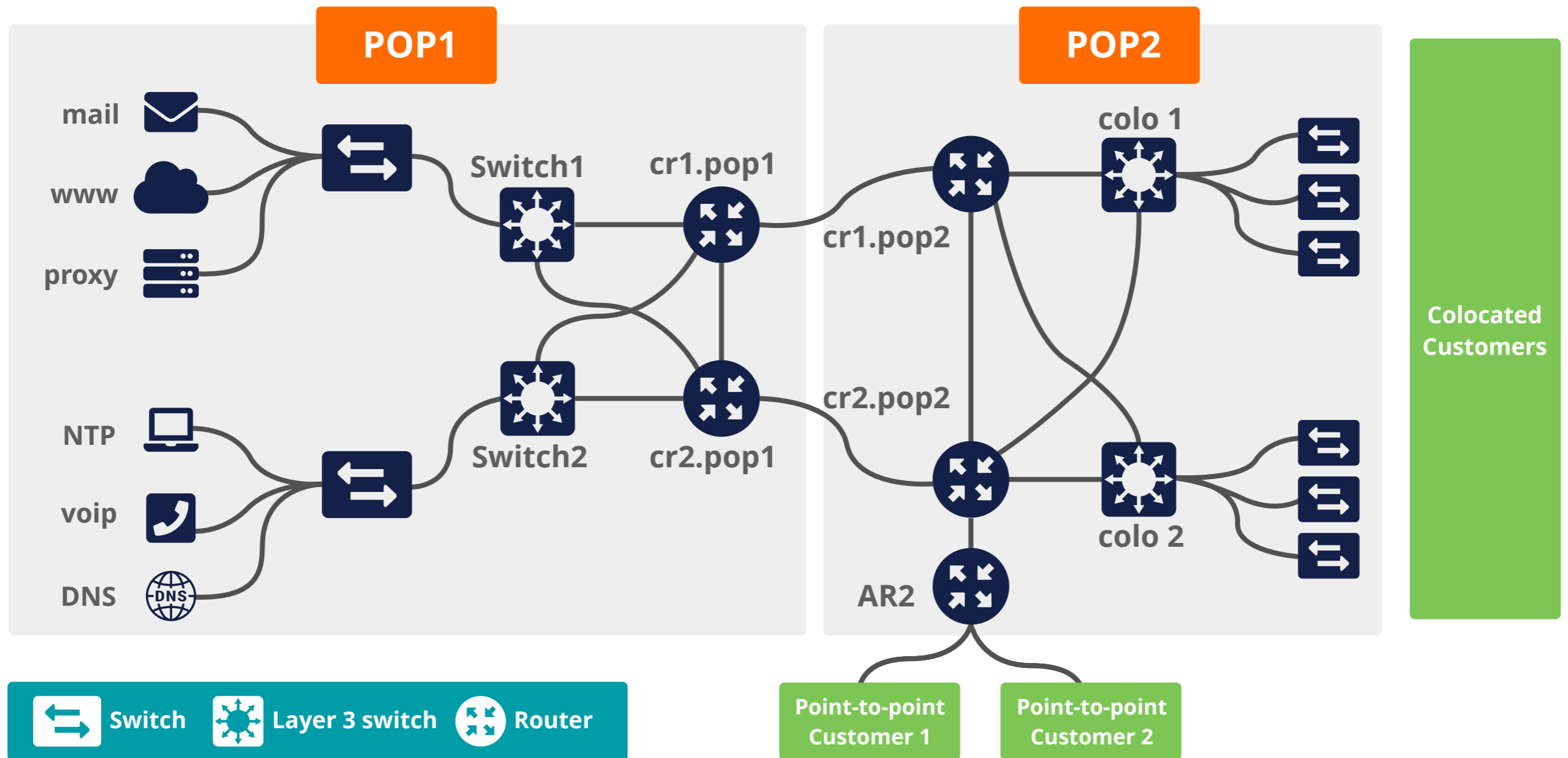
- **We will assign a /48 per POP**
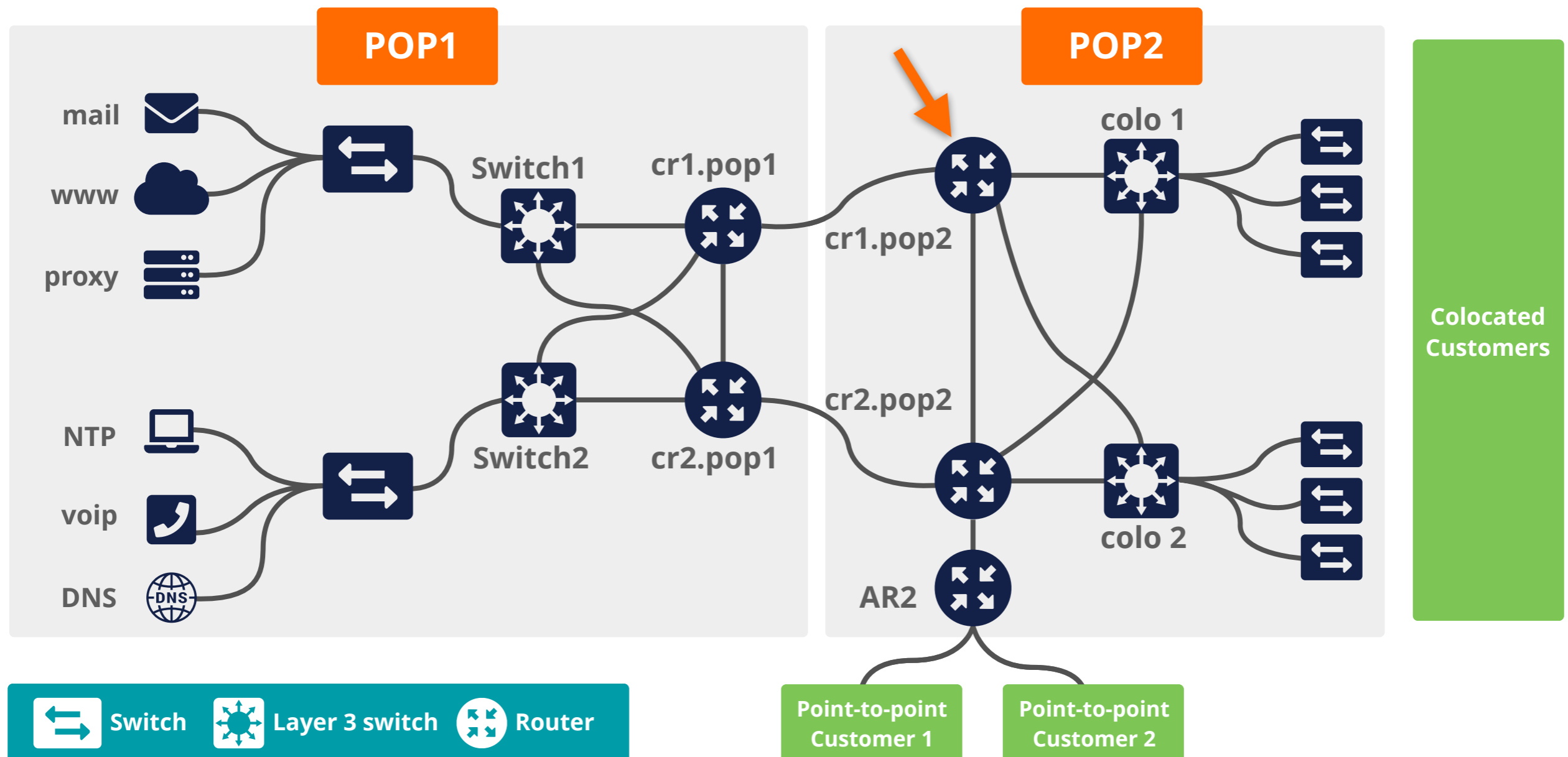
- **We will work on 4-bit boundary:**

Prefix	Number of /64 subnets
/48	65 536
/52	4096
/56	256
/60	16
/64	1

- **Look at the number of point-to-point links**

- **Just to be sure, we reserve a /64 per link!**

Take the poll!

What prefix would you assign to cr1.pop2?

ISP Guidelines

- **In common cases:**

  - One /48 per POP

  - Calculate growth

  - Make it scalable

Customers

- Customers should get a large block of addresses

  - /48 for business customers

  - /48 or /56 for residential customers

- The current policy allows bigger than /48 but you might need to justify it if audited or if you request another allocation from the RIPE NCC

- Every assignment must be registered

Example Situation (Customers)

- **A customer has 6 functions**

  - Servers

  - Office PCs

  - Network Engineer PCs

  - Guests

  - VPN (remote workers)

  - Infrastructure (point-to-point and loopbacks)

Example Situation (Customers)

- **A customer has 3 locations**

  - Main building, floor 1

  - Main building, floor 2

  - Secondary office

Example Situation (Customers)

- A customer receives **2001:0db8:1a2b::/48**

- **Work on 4-bit boundary**

  - 6 functions (leaves room for 10 more functions)

  - 3 locations (leaves room for 13 more locations)

  - We still have 8 bits left!

    - Room for 256 networks per function per location

Example Plan (Customers)

- Putting this in the address:

  2001:0db8:1a2b:FLXX::/64

  - F = Function (0=infrastructure, 1=servers, 2=office, 3=engineers, 4=VPN, f=guests)

  - L = Location (0=main building 1, 1=main building 2, 2=secondary office)

  - XX = Number of network of type + location

Example Plan (Customers)

- **2001:0db8:1a2b:1000::/64**

  - Servers in Main Building, floor 1, network 0

- **2001:0db8:1a2b:1200::/64**

  - Servers in the secondary office, network 0

- **2001:0db8:1a2b:f209::/64**

  - Guest in secondary office, network 9

Example Plan (Customers)

- **2001:0db8:1a2b:0000::1/128**

  - Loopback address (infrastructure, location doesn't apply)

- **2001:0db8:1a2b:0102::/127**

  - Point-to-point link (infrastructure, location doesn't apply)

- **2001:0db8:1a2b:41ab::/64**

  - VPN in main office, floor 1, user 171

Alternatives (Customers)

- **The previous example is just an idea**

  ✓ Adapt as necessary

- **2001:0db8:1a2b:FFLX::/64**

  - 256 functions

  - 16 locations

  - 16 networks per function per location

Summary (Customers)

- **Tips:**

  - Work on 4-bit boundary

  - Group subnets by function

  - Group subnets by location

  - Make a scalable addressing plan

Exercise: Take the poll again!

What is the IPv6 address for an engineer's PC,

in the main building floor 2,

for computer number 2?

Example:

2001:0db8:1a2b:FLXX::/64

- **F = Function (0=infrastructure, 1=servers, 2=office, 3=engineers, 4=VPN, f=guests)**

- **L = Location (0=main building 1, 1=main building 2, 2=secondary office)**

- **XX = Number of network of type + location**

Customers And Their /48

- Customers have no idea how to handle **65,536 subnets**!

- Provide them with information!
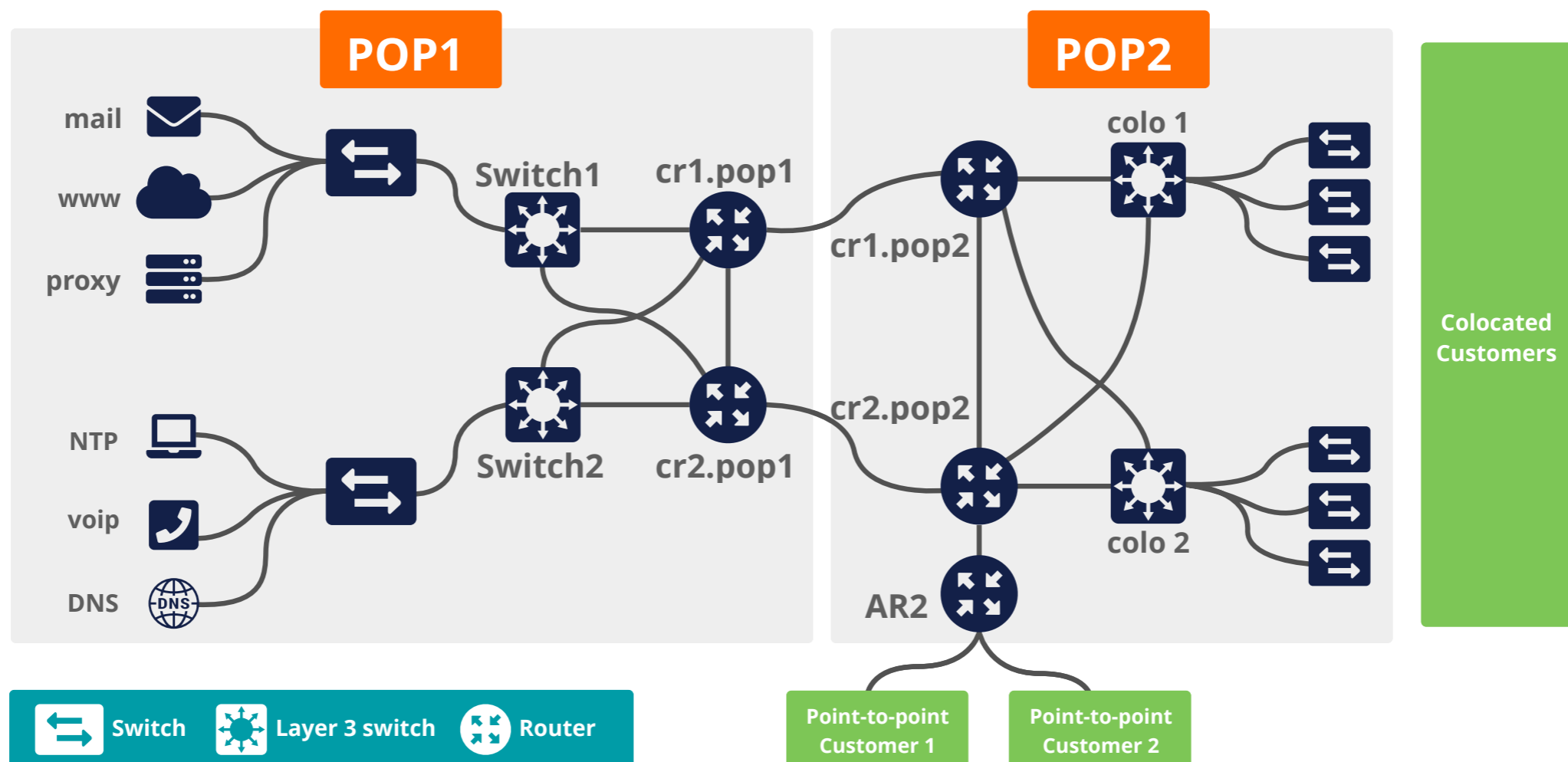

Link to the document:

https://www.ripe.net/support/training/material/
basicipv6-addressing-plan-howto.pdf

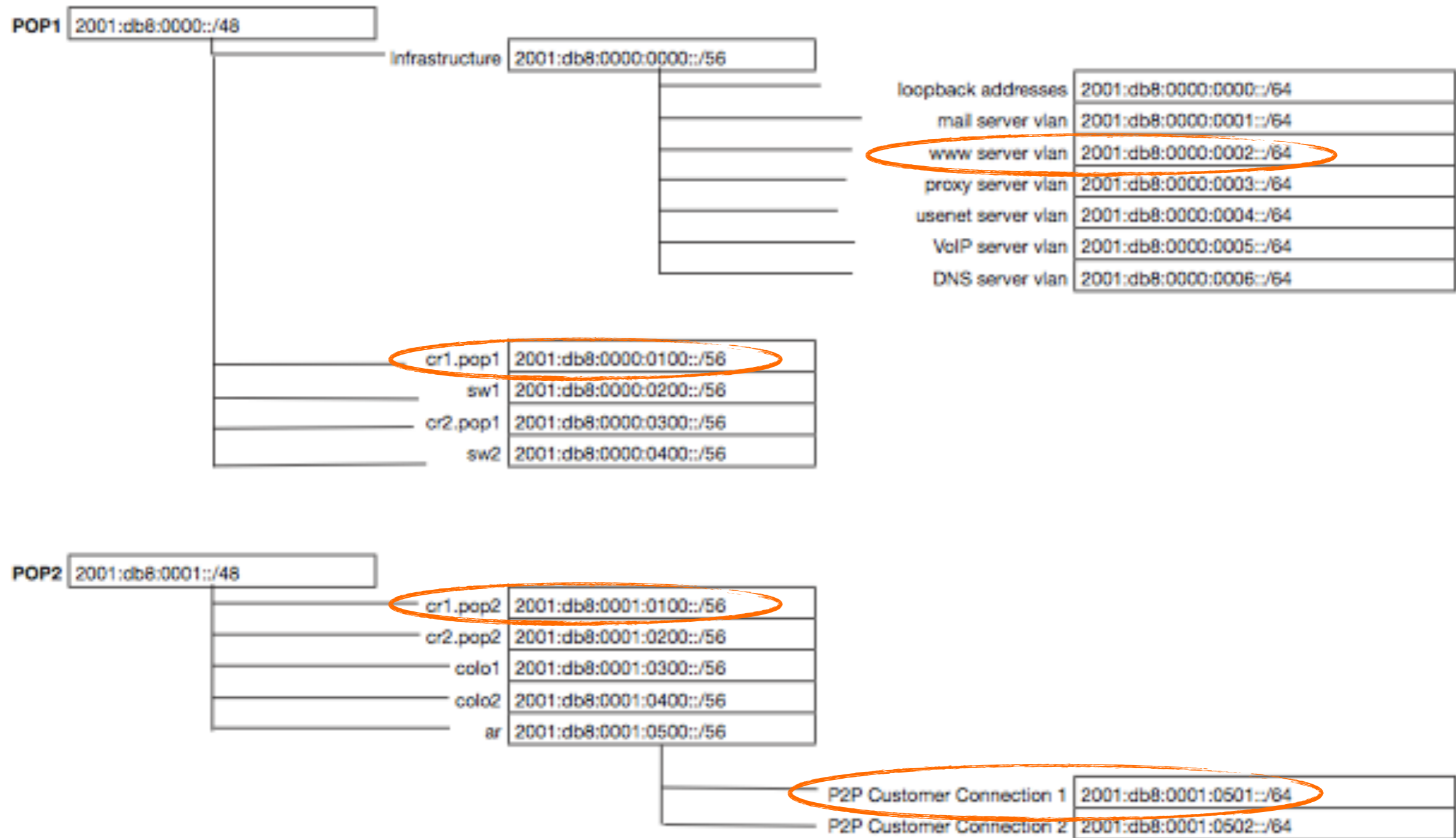# Exercise: Addressing Plan

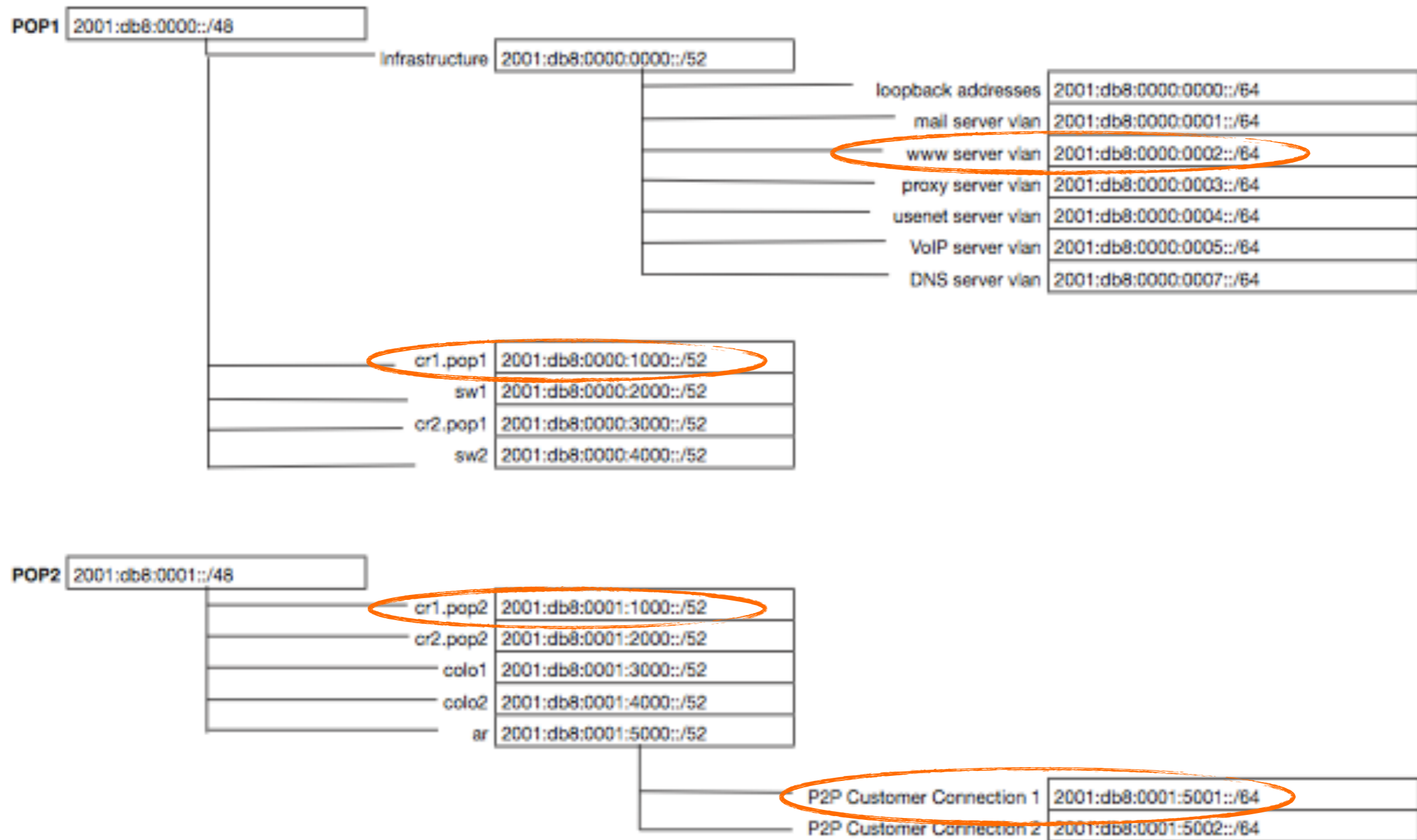Use the chat window to choose the assignments size to:

- www VLAN

- colo 1

- cr1.pop2 and cr1.pop1

- Point-to-Point customer 1

Addressing Plan: Solution 1

POP1 | 2001:db8:0000::/48

Infrastructure | 2001:db8:0000:0000::/56

loopback addresses | 2001:db8:0000:0000::/64
mail server vlan | 2001:db8:0000:0001::/64
www server vlan | 2001:db8:0000:0002::/64
proxy server vlan | 2001:db8:0000:0003::/64
usenet server vlan | 2001:db8:0000:0004::/64
VoIP server vlan | 2001:db8:0000:0005::/64
DNS server vlan | 2001:db8:0000:0006::/64

cr1.pop1 | 2001:db8:0000:0100::/56
sw1 | 2001:db8:0000:0200::/56
cr2.pop1 | 2001:db8:0000:0300::/56
sw2 | 2001:db8:0000:0400::/56

POP2 | 2001:db8:0001::/48

cr1.pop2 | 2001:db8:0001:0100::/56
cr2.pop2 | 2001:db8:0001:0200::/56
colo1 | 2001:db8:0001:0300::/56
colo2 | 2001:db8:0001:0400::/56
ar | 2001:db8:0001:0500::/56

P2P Customer Connection 1 | 2001:db8:0001:0501::/64
P2P Customer Connection 2 | 2001:db8:0001:0502::/64

Addressing Plan: Solution 2

POP1 | 2001:db8:0000::/48

Infrastructure | 2001:db8:0000:0000::/52

loopback addresses | 2001:db8:0000:0000::/64
mail server vlan | 2001:db8:0000:0001::/64
www server vlan | 2001:db8:0000:0002::/64
proxy server vlan | 2001:db8:0000:0003::/64
usenet server vlan | 2001:db8:0000:0004::/64
VoIP server vlan | 2001:db8:0000:0005::/64
DNS server vlan | 2001:db8:0000:0007::/64

cr1.pop1 | 2001:db8:0000:1000::/52
sw1 | 2001:db8:0000:2000::/52
cr2.pop1 | 2001:db8:0000:3000::/52
sw2 | 2001:db8:0000:4000::/52

POP2 | 2001:db8:0001::/48

cr1.pop2 | 2001:db8:0001:1000::/52
cr2.pop2 | 2001:db8:0001:2000::/52
colo1 | 2001:db8:0001:3000::/52
colo2 | 2001:db8:0001:4000::/52
ar | 2001:db8:0001:5000::/52

P2P Customer Connection 1 | 2001:db8:0001:5001::/64
P2P Customer Connection 2 | 2001:db8:0001:5002::/64

Questions

What's Next in IPv6

Webinars

Attend another webinar live wherever you are.

- ❖ Introduction to IPv6 (2 hrs)
- ❖ IPv6 Addressing Plan (1 hr)
- ❖ Basic IPv6 Protocol Security (2 hrs)
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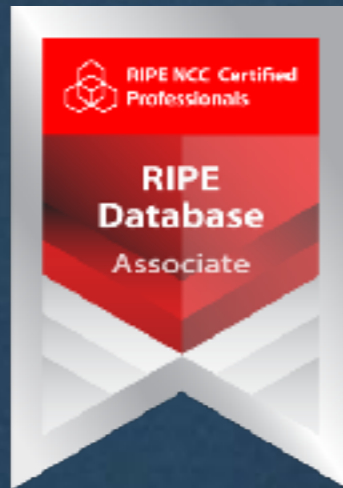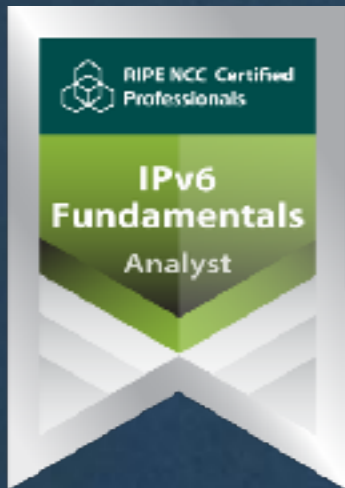
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https://www.ripe.net/feedback/ipv6-addressing-plan/

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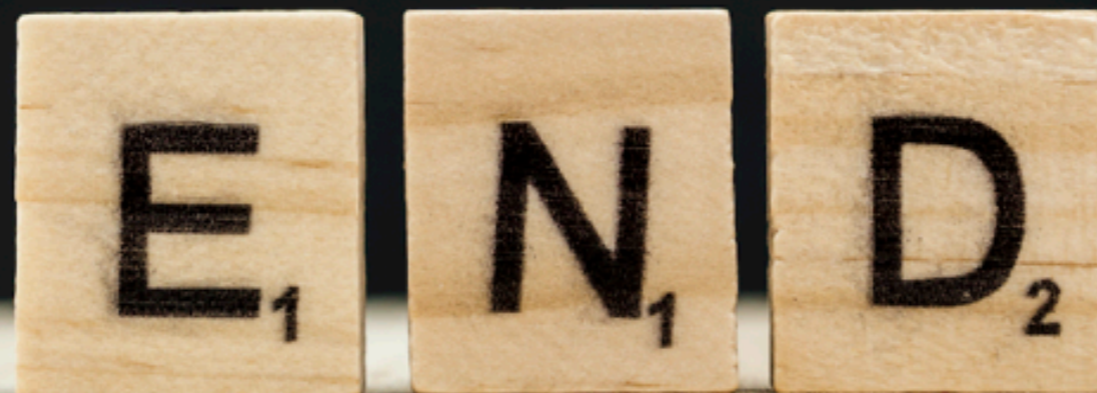
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