IPv6 Addressing Plan Fundamentals
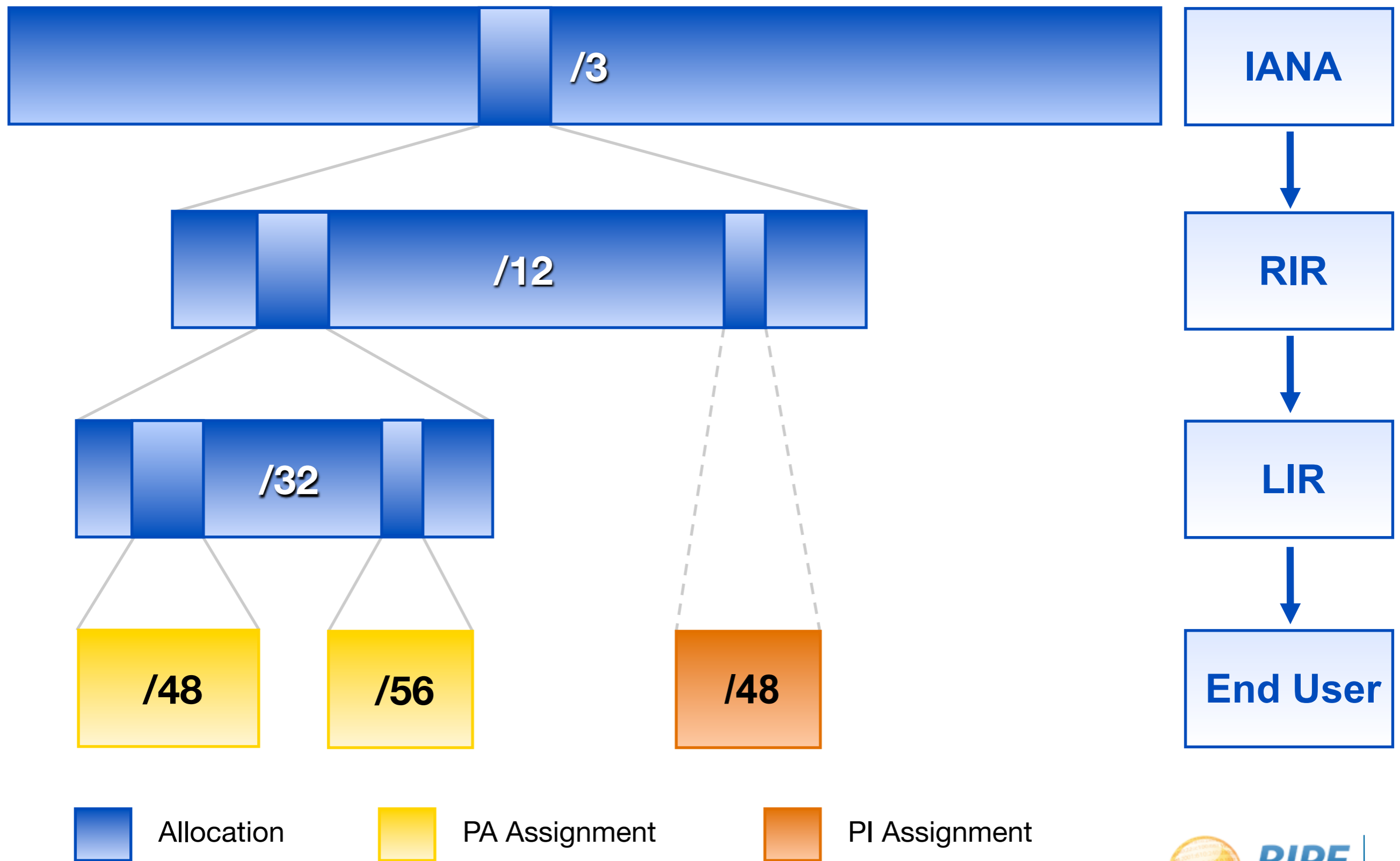
Nathalie Trenaman
Trainer, RIPE NCC
Tuesday, 24 April 2012

IP Address Distribution

/3

/12

/32

/48

/56

/48

IANA

RIR

LIR

End User

Allocation   PA Assignment   PI Assignment

RIPE NCC

IPv6 Address Basics

- IPv6 address: 128 bits
  - 32 bits in IPv4

- Every subnet should be a /64

- Customer assignments (sites) between:
  - /64 (1 subnet)
  - /48 (65,536 subnets)

- Minimum allocation size /32
  - 65,536 /48s
  - 16,777,216 /56s

Address Notation

2001:0db8:003e:ef11:0000:0000:c100:004d

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Address Notation

2001:0db8:003e:ef11:0000:0000:c100:004d

2001:db8:3e:ef11:0:0:c100:4d

Address Notation

2001:0db8:003e:ef11:0000:0000:c100:004d

2001:db8:3e:ef11:0:0:c100:4d

2001:db8:3e:ef11::c100:4d
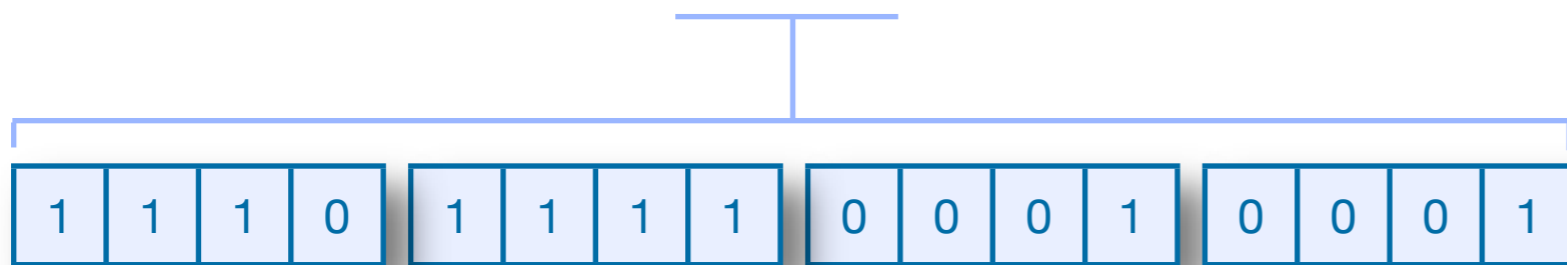
Address Notation

2001:0db8:003e:ef11:0000:0000:c100:004d

2001:db8:3e:ef11:0:0:c100:4d

2001:db8:3e:ef11::c100:4d

| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |

Why Create an IPv6 Addressing Plan?

- Mental health during implementation(!)

- Easier implementation of security policies

- Efficient addressing plans are scalable

- More efficient route aggregation

IPv6 Address Management

- Your Excel sheet might not scale

  - There are 65.536 /48s in a /32

  - There are 65.536 /64s in a /48

  - There are **16.777.216** /56s in a /32

- Find a suitable IPAM solution

Addressing Plans for ISPs

- A /48 per pop can be used
  - separate blocks for infrastructure and customers
  - document address needs for allocation criteria

- Use one /64 block (per site) for loopbacks
  - One /128 per device
  - One /64 contains enough /128s for 18.446.744.073.709.551.616 devices
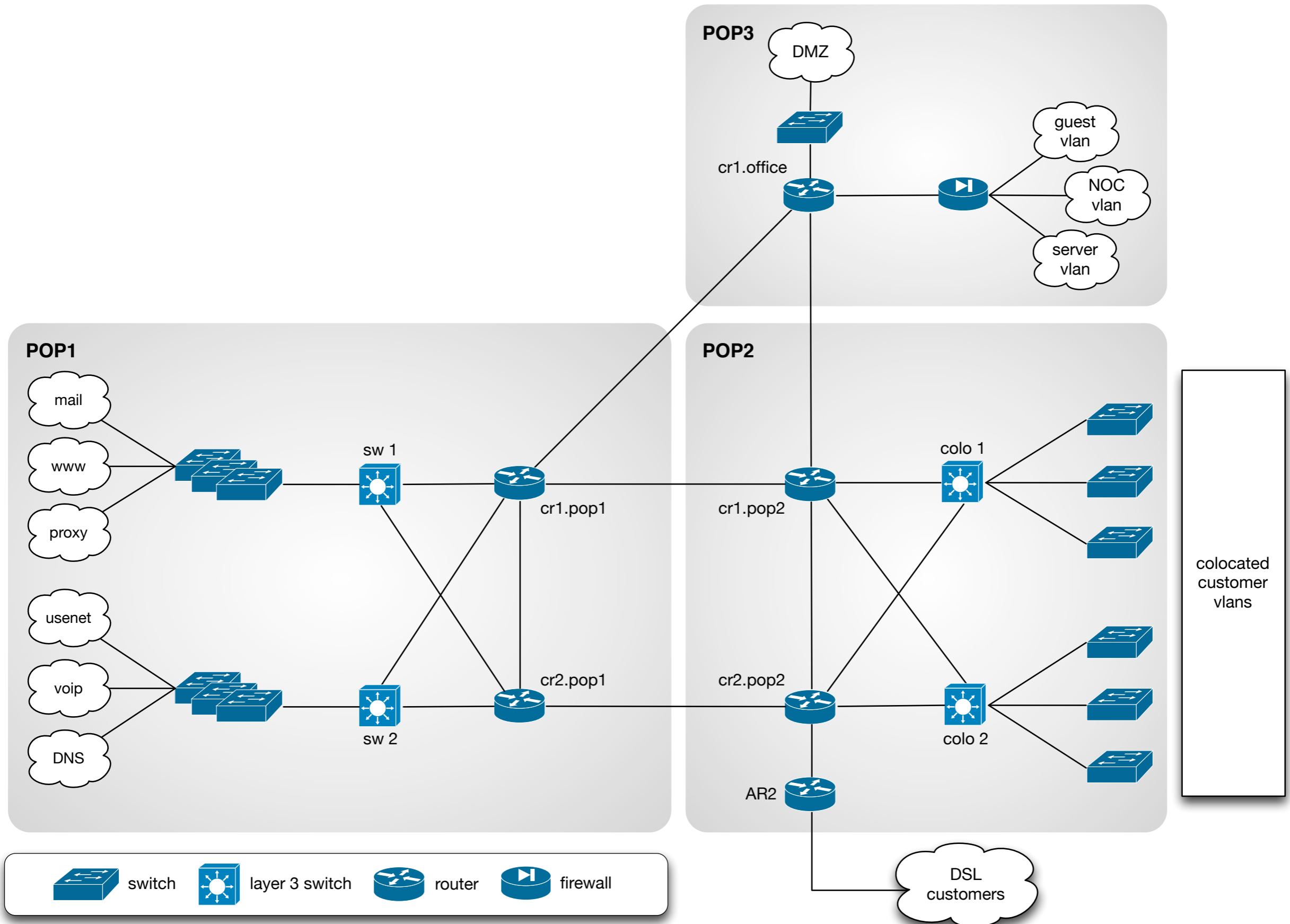
More On Addressing Plans for ISPs

- For private networks, look at ULA

- For servers you want manual configuration

- Use port numbers for addresses
  - pop server 2001:db8:1::110
  - dns server 2001:db8:1::53
  - etc...

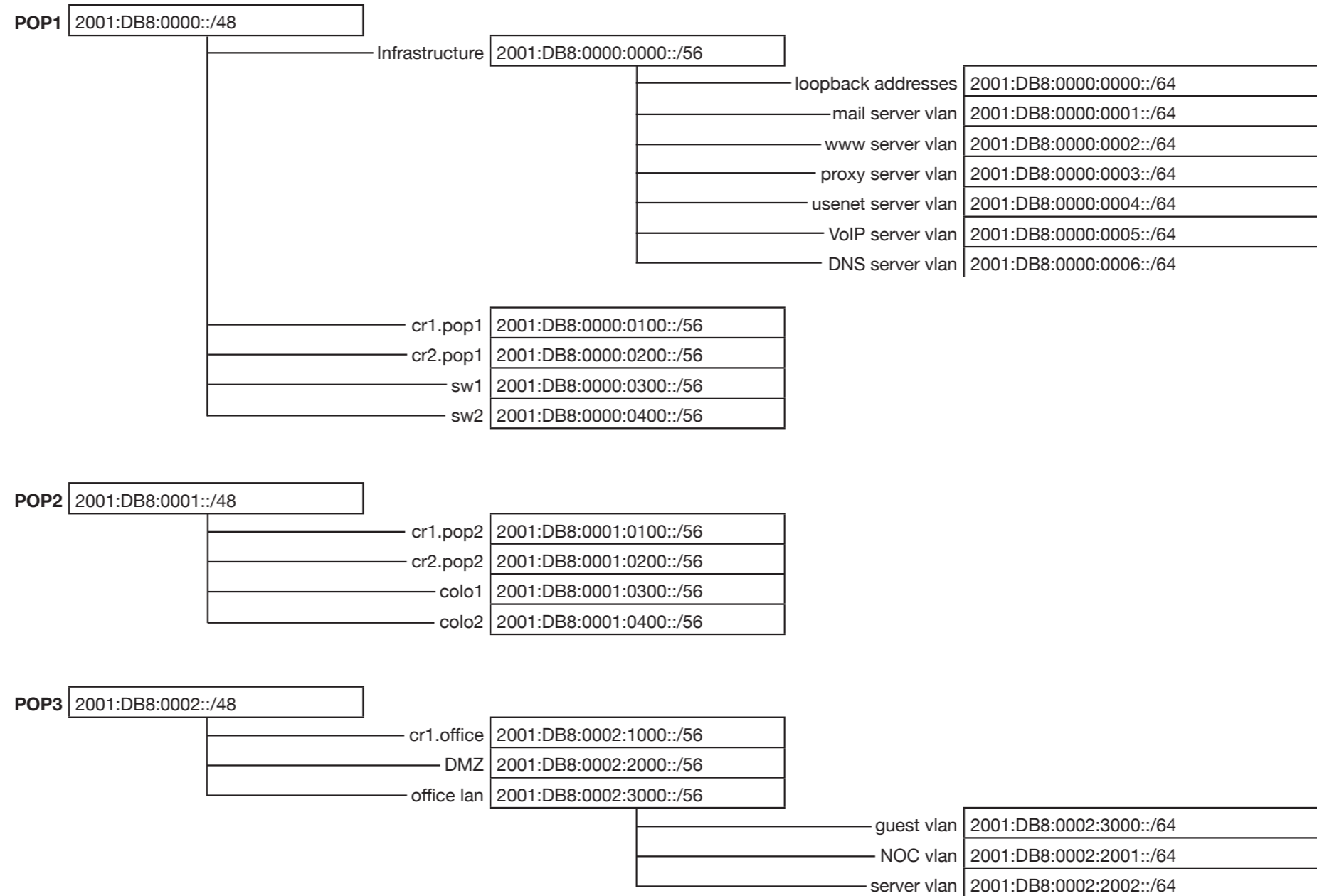# Point-to-Point Connections

- How much space for point-to-point connections?
  - RFC4291: Interface IDs are required to be /64
  - RFC3627: Use of /127 between routers considered harmful
  - RFC6547: RFC3627 to Historic Status
  - RFC6164: Using /127 on Inter-Router links

- Be safe: reserve a /64, assign a /127 per point-to-point connection
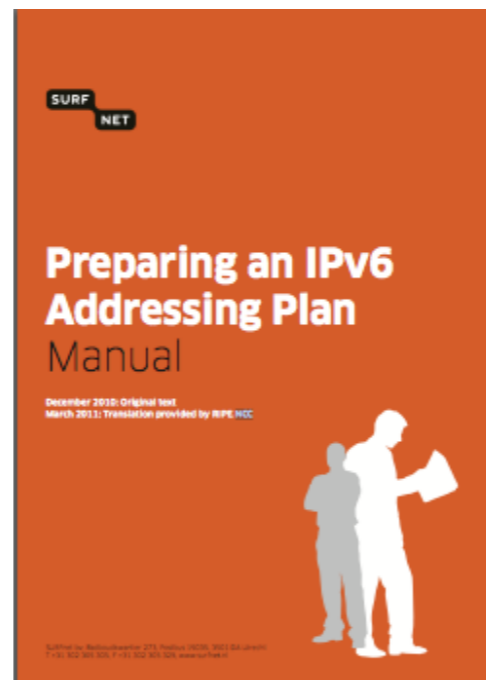
Addressing Plan Exercise (1)

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Addressing Plan Exercise (2)

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
cr2.pop1 | 2001:DB8:0000:0200::/56
sw1 | 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

POP3 | 2001:DB8:0002::/48

cr1.office | 2001:DB8:0002:1000::/56
DMZ | 2001:DB8:0002:2000::/56
office lan | 2001:DB8:0002:3000::/56

guest vlan | 2001:DB8:0002:3000::/64
NOC vlan | 2001:DB8:0002:2001::/64
server vlan | 2001:DB8:0002:2002::/64

Customer Assignments | 2001:DB8:1000::/44 (/56 each) | DSL Customers (3000)
2001:DB8:2000::/36 (/48 each) | Colocation Customers (1000)

Customers And Their /48

- Customers have no idea how to handle 65536 subnets!

- Provide them with information

  - https://www.ripe.net/lir-services/training/material/IPv6-for-LIRs-Training-Course/IPv6_addr_plan4.pdf

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Questions?