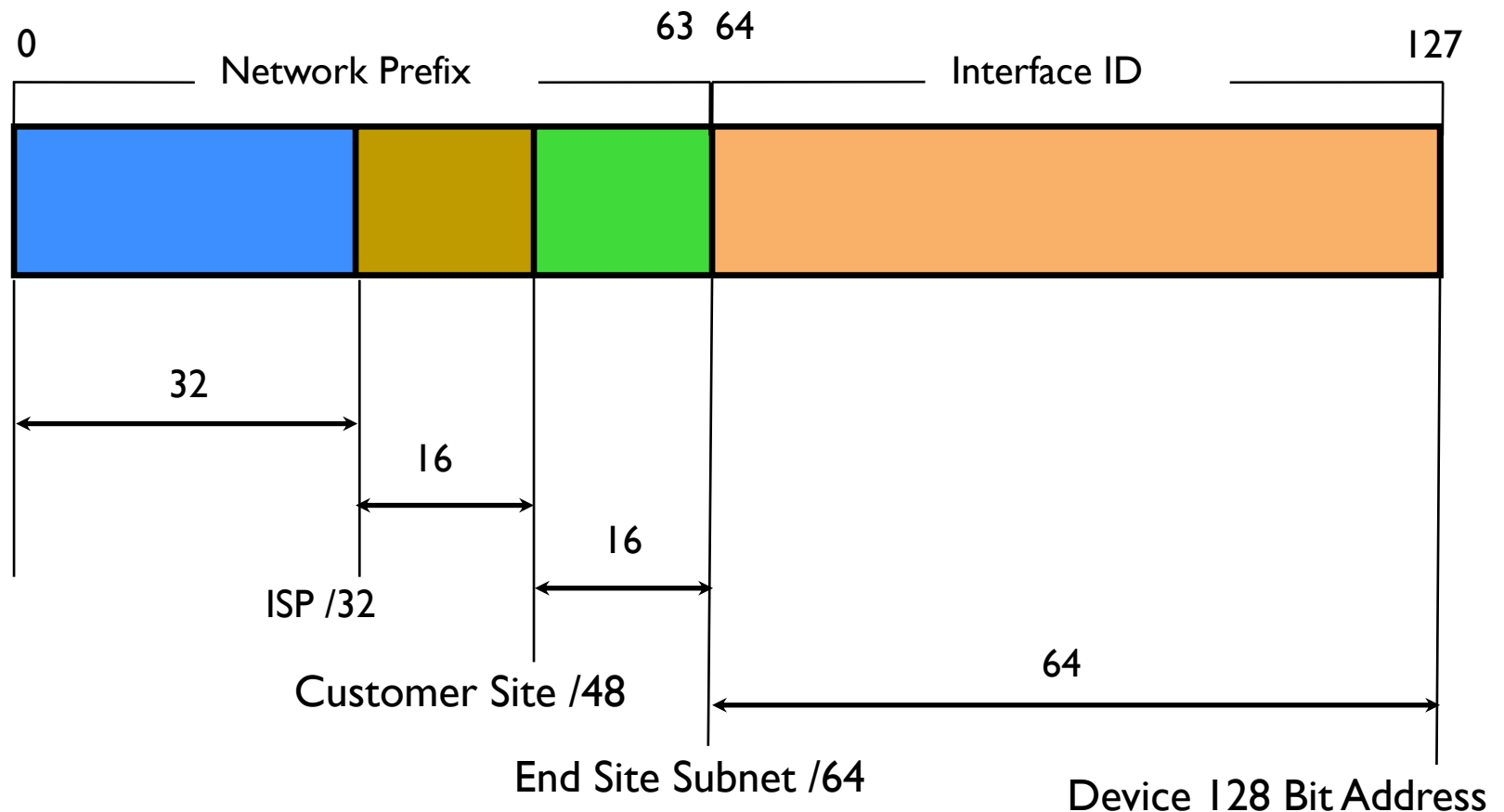


# IPv6 Address Planning

# IPv6 Address Recap



# IPv6 Address Planning

- Network Operators allocated /32 by RIRs
- Global Routing prefix /48
  - /56 (ISPs to end site)
  - upstream could filter anything smaller
  - Consider the **routing table size!**

# IPv6 Address Planning

- Future traffic engineering needs?
  - Contiguous assignment vs Split assignment
- Shift in thought:
  - IPv4: number of hosts ☹️
  - IPv6: number of **subnets!**

# IPv6 Address Plan: ISP Infra

- Loopbacks
- Point-to-Point links
- Internal Server LAN
  - also called NOC LAN
  - not seen from outside
- External Server LAN
  - Mail, DNS, etc

# IPv6 Address Plan: ISP Infra

- Dedicate a /40 (or /48) for the backbone infra
  - Every infrastructure assignment from this block!
  - Carried by IGP (NOT iBGP)
- Loopbacks
  - Generally one /48 (/60 and /64 also common) for all loopbacks
  - /128 as loopback
- Point-to-Point links
  - Dedicate a /48 for all P2P links
  - Assign /64 per link (RFC3177); RFC6164 recommends /127
    - Reserve /64 per link but use /127

# IPv6 Address Plan: ISP Infra

- Internal Server/NOC LAN
  - /60 (if different subnets within the NOC), or
  - /64
- External Server LAN
  - /64 (allows up to  $2^{64}$  services to be hosted)

# IPv6 Address Plan: Enterprise Customer

- Consider regional delegation
  - Aggregation in mind!
  - /40 per region?
- One /48 per customer
  - Could be transit customers or leased line customers
  - Could be given additional /48s as they grow
- Common to see ISPs give:
  - /56 to mid-sized customers
  - /64 or /60 for very small customers
  - Please share your experience



# IPv6 Address Plan: Customer WAN links

- Dedicate a /48 block for customer WAN links
  - Helps to monitor customer links
  - Not to be mistaken with the trusted infra PtP block!
  - Actual addressing still the same:
    - Reserve /64 and use /127
- Carried in iBGP (not IGP)
  - Aggregated at the GW router or POP routers

# IPv6 Address Plan: Broadband Customer

- Depends on your deployment
  - ND-RA for CPE WAN side
    - A /64 prefix on BRAS can still support  $2^{64}$  CPEs through SLAAC
  - DHCP-PD for CPE LAN side
    - A /48 pool on each BRAS (65k /64s can be delegated)
- Dedicate a /40 (or bigger) for Broadband network
  - /48s out of the /40 to each BRAS
  - Announced in iBGP by BRAS

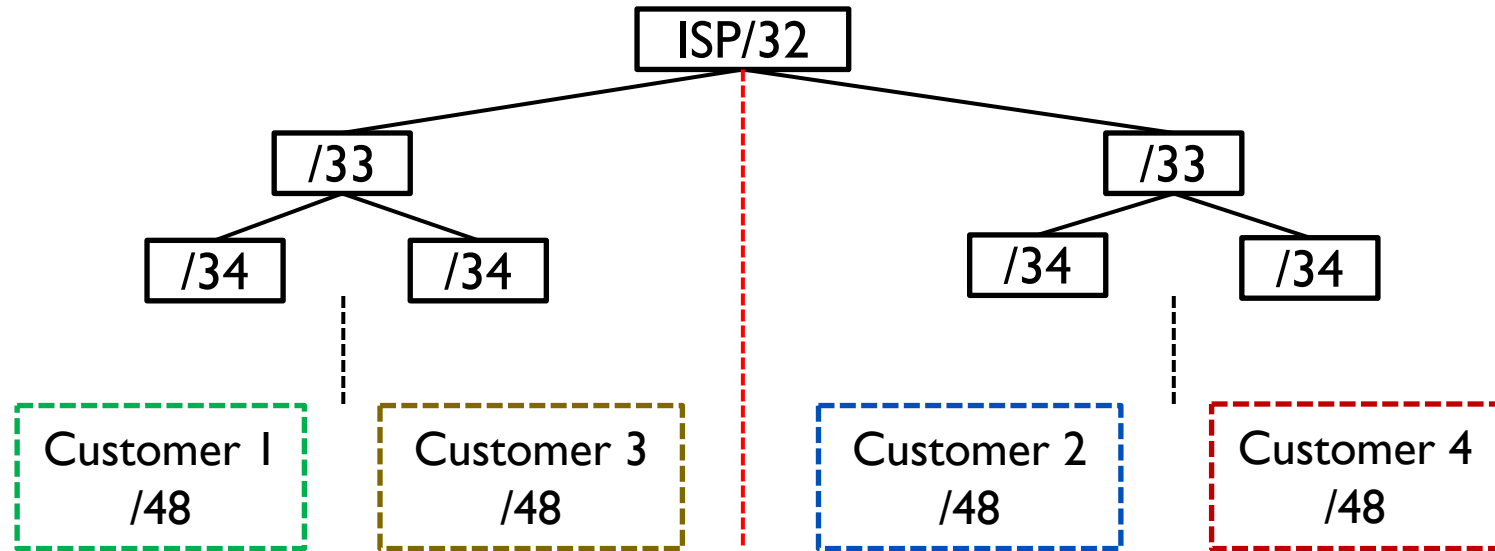
# IPv6 Address Plan: DC services

- DC infra blocks from your infra block
  - Loopbacks
  - PtP links
- dedicate /40 for Data Center (hosted) services
  - Depends on DC architecture
  - Dedicated VLAN/subnet per service?
    - /64 per VLAN/subnet ( $2^{64}$  servers)
  - Dedicated subnet per customer (customer buys VMs/hosts services)?
    - /64 per customer or subnet ( $2^{64}$  VMs)
  - Announced in iBGP (DC border router)

# IPv6 Address Plan: Traffic Shaping

- Borrow from IPv4
  - sub-aggregates to shape traffic
  - Difficult with contiguous assignment
- Assign customer prefixes (**that attract traffic**) from both ends of address space
  - Infrastructure prefix do not attract traffic

# IPv6 Address Plan: Traffic Shaping



- Customer prefixes assigned from each /33 sub-prefix
  - Similar to IPv4 sub-aggregates!
  - Allows us to balance incoming traffic

# IPv6 Address Plan: Routing

- IGP to carry next-hop reachability information
  - Infrastructure blocks (PtPs, loopbacks)
  - Aggregation desirable in IGP
- Customer prefixes (Enterprise, broadband, DC customers/services)
  - Sub-aggregates for traffic shaping (multihoming)
  - Consider regional delegation
  - iBGP carries all customer prefixes
    - Aggregation may interfere with traffic shaping
  - Aggregation necessary in eBGP (pull up routes)

# IPv6 Address Planning: Example

- ISP has **2406:6400::/32** prefix
  - 16x /36s
  - easier to play at nibble boundaries

#	Prefix	Comments
1	2406:6400:0000::/36	First /33
2	2406:6400:1000::/36	
3	2406:6400:2000::/36	
4	2406:6400:3000::/36	
5	2406:6400:4000::/36	
6	2406:6400:5000::/36	
7	2406:6400:6000::/36	
8	2406:6400:7000::/36	
9	2406:6400:8000::/36	Second /33
10	2406:6400:9000::/36	
11	2406:6400:a000::/36	
12	2406:6400:b000::/36	
13	2406:6400:c000::/36	
14	2406:6400:d000::/36	
15	2406:6400:e000::/36	
16	2406:6400:f000::/36	

# Example: High level plan

#	Prefix	Assignment	Comment
1	2406:6400:0000::/36	Infra + Cust	First /33
2	2406:6400:1000::/36	Customer	
3	2406:6400:2000::/36		
4	2406:6400:3000::/36		
5	2406:6400:4000::/36		
6	2406:6400:5000::/36		
7	2406:6400:6000::/36		
8	2406:6400:7000::/36		
9	2406:6400:8000::/36		Customer
10	2406:6400:9000::/36		
11	2406:6400:a000::/36		
12	2406:6400:b000::/36		
13	2406:6400:c000::/36		
14	2406:6400:d000::/36		
15	2406:6400:e000::/36		
16	2406:6400:f000::/36		



# Example: High Level

#	Prefix	Assignment	Comment
1	2406:6400:0000::/36	Infra + Cust	First /33
1	2406:6400:0000:0000::/40	Backbone Infra (PtP, Loopbacks)	
2	2406:6400:0100:0000::/40	Enterprise Customer Reg1	
3	2406:6400:0200:0000::/40	Broadband Region1	
4	2406:6400:0300:0000::/40	Future Customers	
5	2406:6400:0400:0000::/40		
6	2406:6400:0500:0000::/40		
7	2406:6400:0600:0000::/40		
:			
:			
:			
:			
16	2406:6400:0f00:0000::/40		

# Example: High Level

#	Prefix	Assignment	Comments
9	2406:6400:8000::/36	Customer	Second /33
1	2406:6400:8000::/40	Broadband Region2	
2	2406:6400:8100::/40	Enterprise Customer Reg2	
3	2406:6400:8200::/40	Future Customers	
4	2406:6400:8300::/40		
5	2406:6400:8400::/40		
6	2406:6400:8500::/40		
7	2406:6400:8600::/40		
:			
:			
:			
:			
16	2406:6400:8f00::/40		

# Example: Infrastructure

#	Prefix	Assignment	Comments
1	2406:6400:0000::/36	Infra + Cust	First /33
1	2406:6400:0000::/40	Backbone Infra	
1	2406:6400:0000::/48	Loopbacks	
2	2406:6400:0001::/48	Point-to-Point	
3	2406:6400:0002::/48	Future Infra use	
4	2406:6400:0003::/48		
5	2406:6400:0004::/48		
6	2406:6400:0005::/48		
:			
:			
:			
:			
256	2406:6400:00ff::/48		

# Example: Customer

#	Prefix	Assignment	Comments
1	2406:6400:0000::/36	Infra + Cust	First /33
2	2406:6400:0100::/40	Enterprise Customer Reg1	
1	2406:6400:0100::/48	Customer WAN links	
2	2406:6400:0101::/48	Customer 1.1	
3	2406:6400:0102::/48	Customer 1.2	
4	2406:6400:0103::/48	Future Customers	
5	2406:6400:0104::/48		
6	2406:6400:0105::/48		
7	2406:6400:0106::/48		
8	2406:6400:0107::/48		
:			
:			
256	2406:6400:01ff::/48		

# Example: Customer

#	Prefix	Assignment	Comments
<b>1</b>	<b>2406:6400:0000::/36</b>	<b>Infra + Cust</b>	<b>First /33</b>
<b>3</b>	<b>2406:6400:0200::/40</b>	<b>Broadband Reg1</b>	
1	2406:6400:0100::/48	BRAS 1	
2	2406:6400:0101::/48	BRAS 2	
3	2406:6400:0102::/48	BRAS 3	
4	2406:6400:0103::/48	Future Customers	
5	2406:6400:0104::/48		
6	2406:6400:0105::/48		
7	2406:6400:0106::/48		
8	2406:6400:0107::/48		
:			
:			
256	2406:6400:01ff::/48		

# Example: Customer

#	Prefix	Assignment	Comments
9	2406:6400:8000::/36	Customer	Second /33
1	2406:6400:8000::/40	Broadband Reg2	
1	2406:6400:8000::/48	BRAS1	
2	2406:6400:8001::/48	BRAS2	
3	2406:6400:8002::/48	BRAS3	
4	2406:6400:8003::/48	Future BRAS	
5	2406:6400:8004::/48		
:			
:			
:			
256	2406:6400:80ff::/48		

# Example: Customer

#	Prefix	Assignment	Comments
9	2406:6400:8000::/36	Customer	Second /33
2	2406:6400:8100::/40	Enterprise Customer Reg2	
1	2406:6400:8100::/48	Customer 2.1	
2	2406:6400:8101::/48	Customer 2.2	
3	2406:6400:8102::/48	Future Customers	
4	2406:6400:8103::/48		
5	2406:6400:8104::/48		
:			
:			
:			
256	2406:6400:81ff::/48		



# Questions

