

Advance Routing Workshop Lab

APNIC Workshop in bdNOG3

May 20 – 23, 2015. Dhaka, Bangladesh.

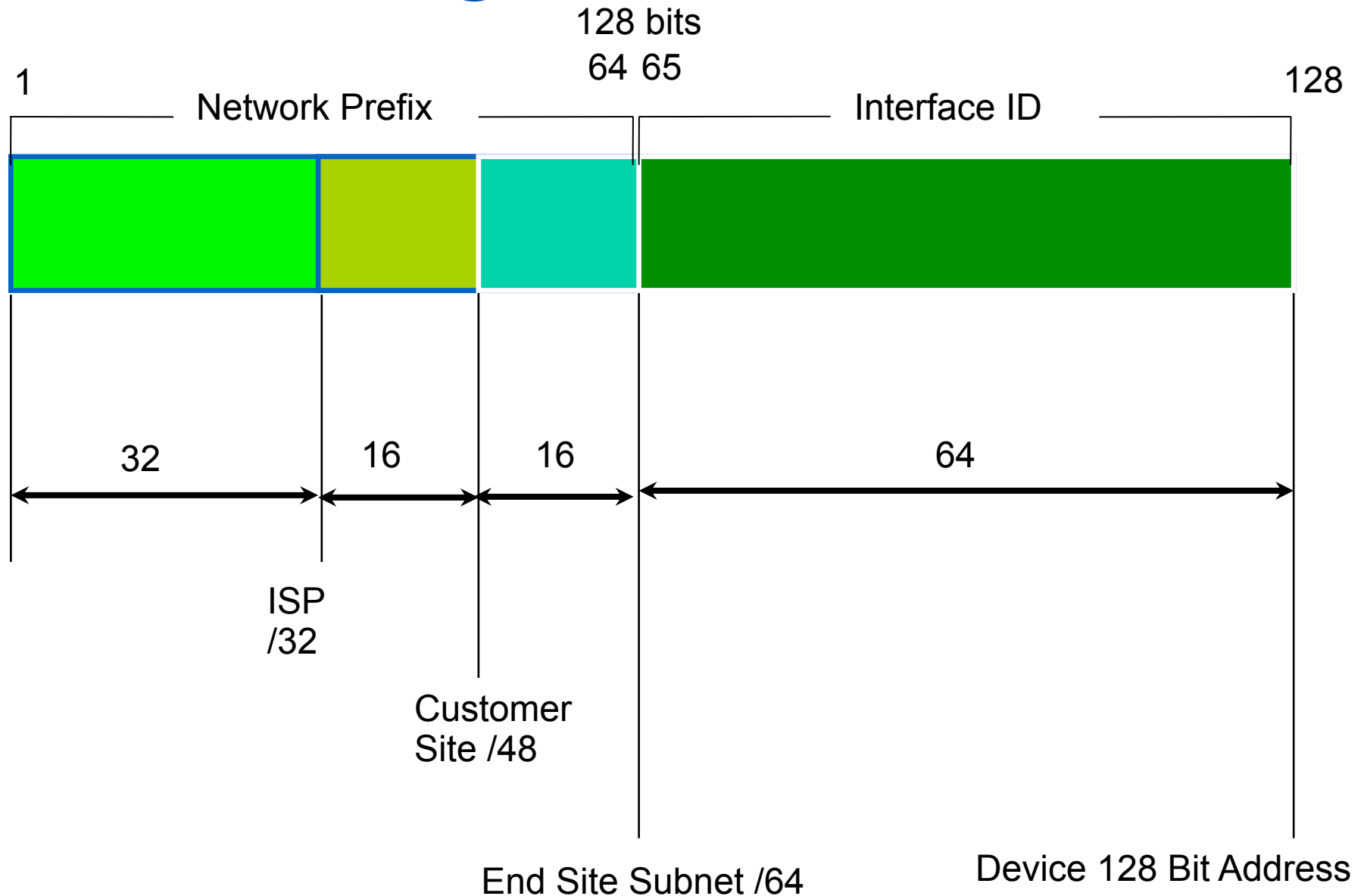
IPv6 Addressing

- An IPv6 address is 128 bits long
- So the number of addresses are 2^{128}
=340282366920938463463374607431768211455
(39 decimal digits)
=0xffffffffffffffffffffffffffffffff (32 hexadecimal digits)
- In hex 4 bit (nibble) is represented by a hex digit
- So 128 bit is reduced down to 32 hex digit

IPv6 Address Representation

- Hexadecimal values of eight 16 bit fields
 - X:X:X:X:X:X:X:X (X=16 bit number, ex: A2FE)
 - 16 bit number is converted to a 4 digit hexadecimal number
- Example:
 - FE38:DCE3:124C:C1A2:BA03:6735:EF1C:683D
 - Abbreviated form of address
 - 4EED:0023:0000:0000:0000:036E:1250:2B00
 - →4EED:23:0:0:0:36E:1250:2B00
 - →4EED:23::36E:1250:2B00
 - (Null value can be used only once)

IPv6 addressing structure

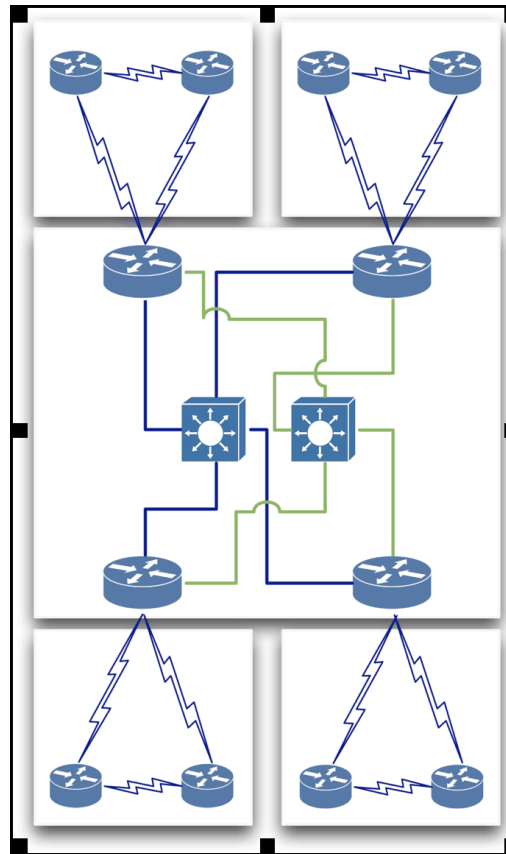


Training ISP Network Topology

Scenario:

- Training ISP has 4 main operating area or region
- Each region has 2 small POP
- Each region will have one datacenter to host content
- Regional network are inter-connected with multiple link

Training ISP Network Topology



Training ISP Topology Diagram

Training ISP Network Topology

Regional Network:

- Each regional network will have 3 routers
- 1 Core & 2 Edge Routers
- 2 Point of Presence (POP) for every region
- POP will use a router to terminate customer network i.e Edge Router
- Each POP is an aggregation point of ISP customer

Training ISP Network Topology

Access Network:

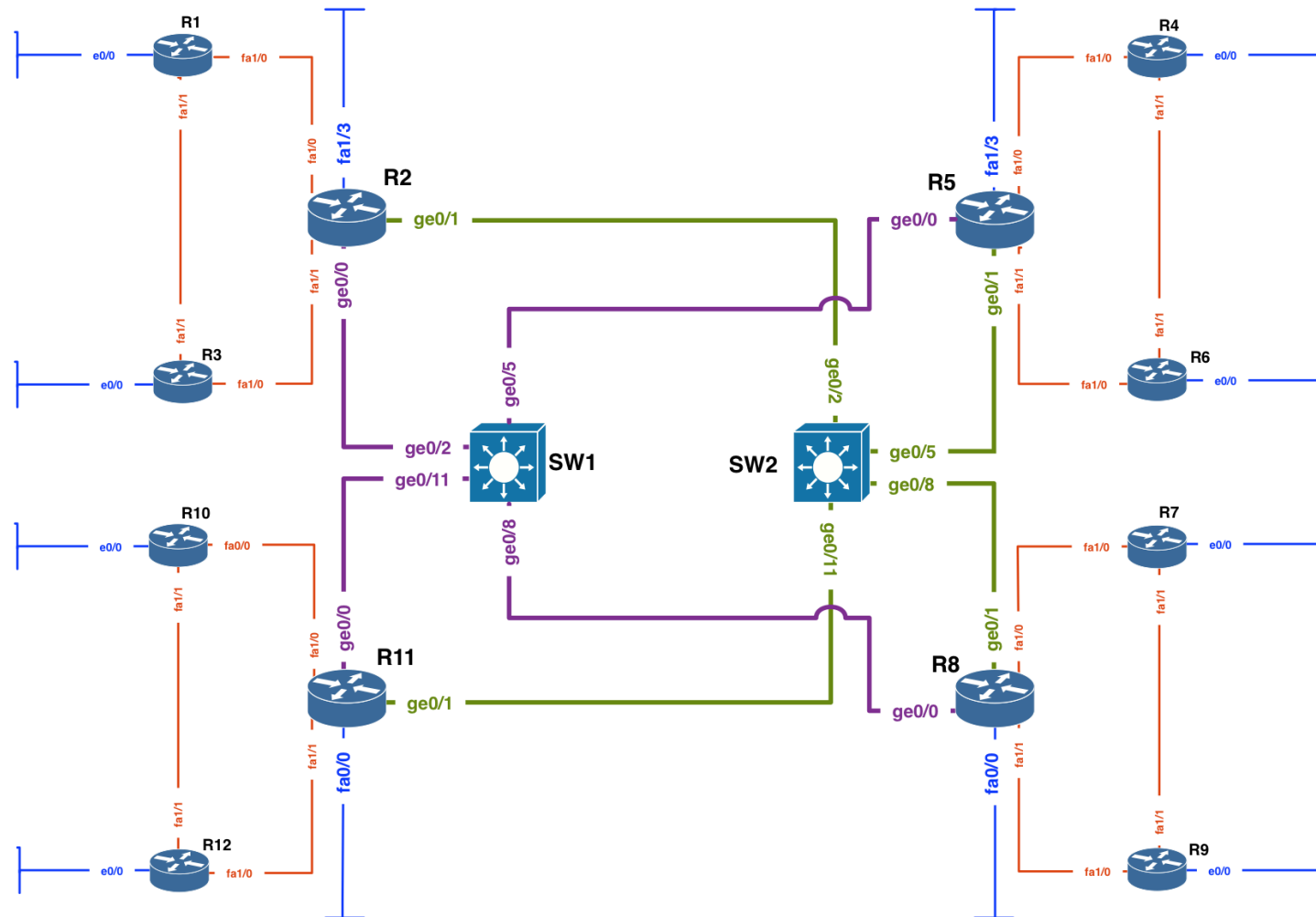
- Connection between customer network & Edge router
- Usually 10 to 100 MBPS link
- Separate routing policy from most of ISP
- Training ISP will connect them on edge router with separate customer IP prefix

Training ISP Network Topology

Transport Link:

- Inter-connection between regional core router
- Higher data transmission capacity than access link
- Training ISP has 2 transport link for link redundancy
- 2 Transport link i.e Purple link & Green link are connected to two career grade switch

Training ISP Network Topology



Training ISP Core IP Backbone

Training ISP Network Topology

Design Consideration:

- Each regional network should have address summarization capability for customer block and CS link WAN.
- Prefix planning should have scalability option for next couple of years for both customer block and infrastructure
- No Summarization require for infrastructure WAN and loopback address

Training ISP Network Topology

Design Consideration:

- All WAN link should be ICMP reachable for link monitoring purpose (At least from designated host)
- Conservation will get high preference for IPv4 address planning and aggregation will get high preference for IPv6 address planning.

Training ISP Network Topology

Design Consideration:

- OSPF is running in ISP network to carry infrastructure IP prefix
- Each region is a separate OSPF area
- Transport core is in OSPF area 0
- Customer will connect on either static or eBGP (Not OSPF)
- iBGP will carry external prefix within ISP core IP network

Training ISP IPV6 Addressing Plan

IPv6 address plan consideration:

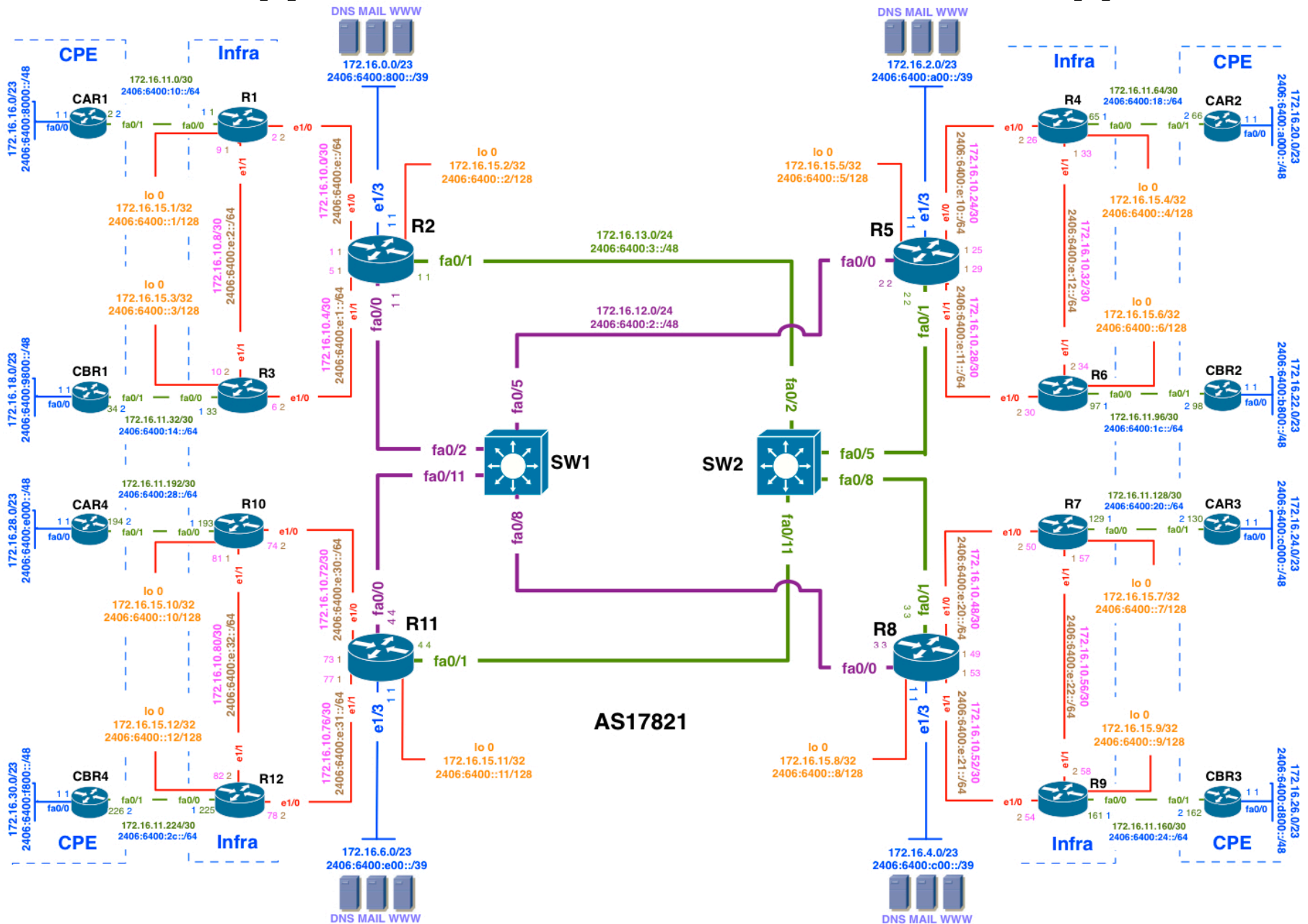
- Big IPv6 address space can cause very very large routing table size
- Most transit service provider apply IPv6 aggregation prefix filter (i.e. anything other than /48 & \leq /32 prefix size
- Prefix announcement need to send to Internet should be either /32 or /48 bit boundary

Training ISP IPV6 Addressing Plan

IPv6 address plan consideration (RFC3177):

- WAN link can be used on /64 bit boundary
- End site/Customer sub allocation can be made between /48~/64 bit boundary
- APNIC Utilization/HD ratio will be calculated based on /56 end site assignment/sub-allocation

Training ISP IPV6 Addressing Plan



Addressing Plans – ISP Infrastructure

- What about LANs?
 - /64 per LAN
- What about Point-to-Point links?
 - Protocol design expectation is that /64 is used
 - /127 now recommended/standardised
 - <http://www.rfc-editor.org/rfc/rfc6164.txt>
 - (reserve /64 for the link, but address it as a /127)
 - Other options:
 - /126s are being used (mirrors IPv4 /30)
 - /112s are being used
 - Leaves final 16 bits free for node IDs
 - Some discussion about /80s, /96s and /120s too

Addressing Plans – ISP Infrastructure

- ISPs should receive /32 from their RIR
- Address block for router loop-back interfaces
 - Generally number all loopbacks out of **one** /48
 - /128 per loopback
- Address block for infrastructure
 - /48 allows 65k subnets
 - /48 per region (for the largest international networks)
 - /48 for whole backbone (for the majority of networks)
 - Summarise between sites if it makes sense

Addressing Plans – Customer

- Customers get **one** /48
 - Unless they have more than 65k subnets in which case they get a second /48 (and so on)
- In typical deployments today:
 - Several ISPs give small customers a /56 or single LAN end-sites a /64, e.g.:
 - /64 if end-site will only ever be a LAN
 - /56 for medium end-sites (e.g. small business)
 - /48 for large end-sites
 - (This is another very active discussion area)

Addressing Plans Planning

- Registries will usually allocate the next block to be contiguous with the first allocation
 - Minimum allocation is /32
 - Very likely that subsequent allocation will make this up to a /31
 - So plan accordingly

Example Address Plan

- IPv6 Allocation From Registry is
 - 2406:6400::/32
- IPv4 Allocation From Registry is
 - 172.16.0.0/19

Training ISP IPV6 Addressing Plan

Table 1: Top level distribution infrastructure & customer

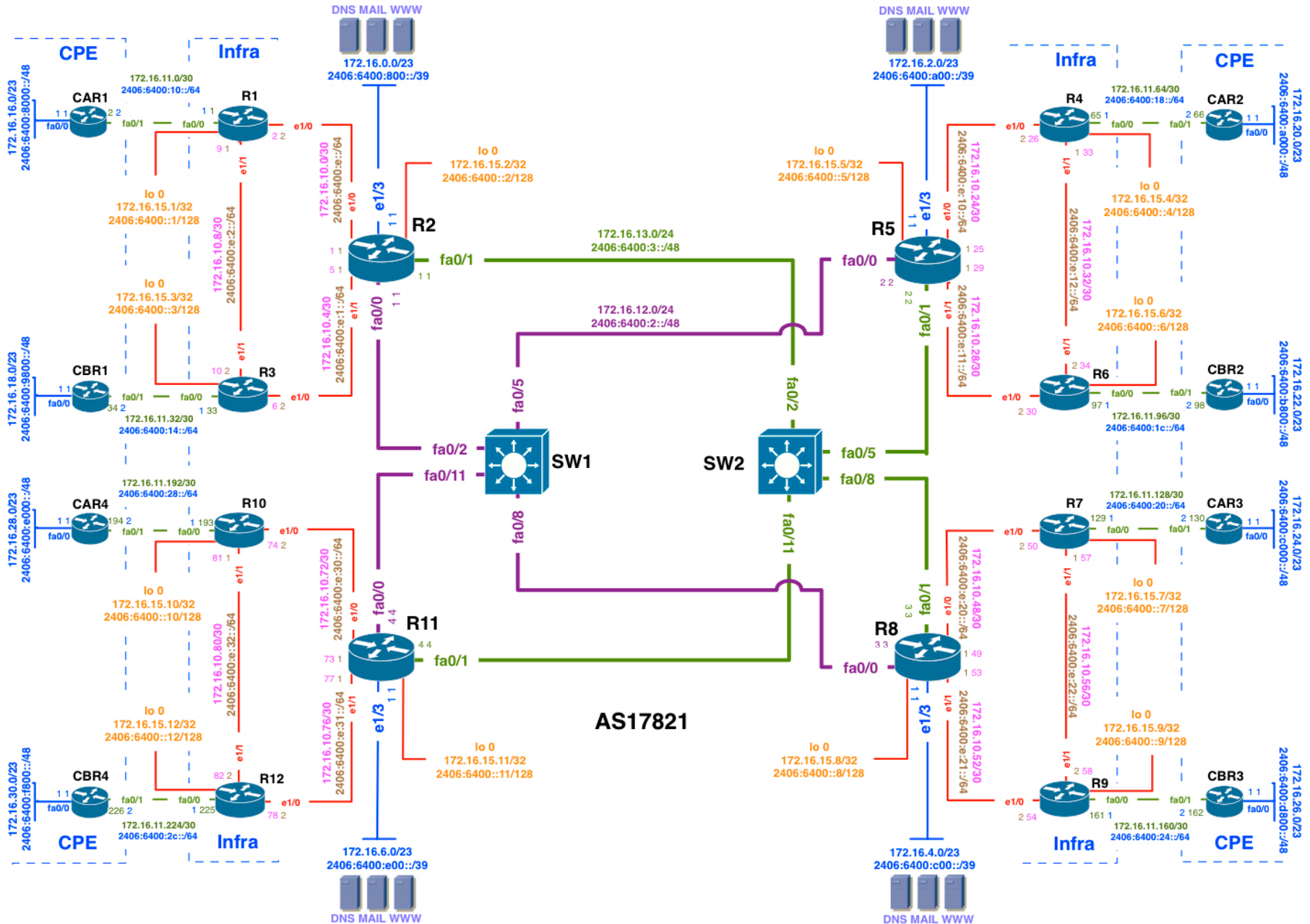
Block#	Prefix	Description	Reverse Domain	SOR	Registration
1	2406:6400::/32	<i>Parent Block</i>	0.0.4.6.6.0.4.2.ip6.arpa.	N/A	APNIC
2	2406:6400:0000:0000::/36	Infrastructure	0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Optional
	2406:6400:1000:0000::/36				
	2406:6400:2000:0000::/36				
	2406:6400:3000:0000::/36				
	2406:6400:4000:0000::/36				
	2406:6400:5000:0000::/36				
	2406:6400:6000:0000::/36				
	2406:6400:7000:0000::/36				
3	2406:6400:8000:0000::/36	Customer network Region 1	8.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
	2406:6400:9000:0000::/36				
4	2406:6400:a000:0000::/36	Customer network Region 2	a.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
	2406:6400:b000:0000::/36				
5	2406:6400:c000:0000::/36	Customer network Region 3	c.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
	2406:6400:d000:0000::/36				
6	2406:6400:e000:0000::/36	Customer network Region 4	e.0.0.4.6.6.0.4.2.ip6.arpa.	Not yet	Optional
	2406:6400:f000:0000::/36				

Training ISP IPV6 Addressing Plan

Table 2: Top level summarization option infrastructure & customer

Block#	Prefix	Description	Reverse Domain
7	2406:6400:8000:0000::/35	CS net summary region1 [R2]	2x/36 arpa domain
8	2406:6400:a000:0000::/35	CS net summary region2 [R5]	2x/36 arpa domain
9	2406:6400:c000:0000::/35	CS net summary region3 [R8]	2x/36 arpa domain
10	2406:6400:e000:0000::/35	CS net summary region4 [R11]	2x/36 arpa domain

Training ISP IPV6 Addressing Plan



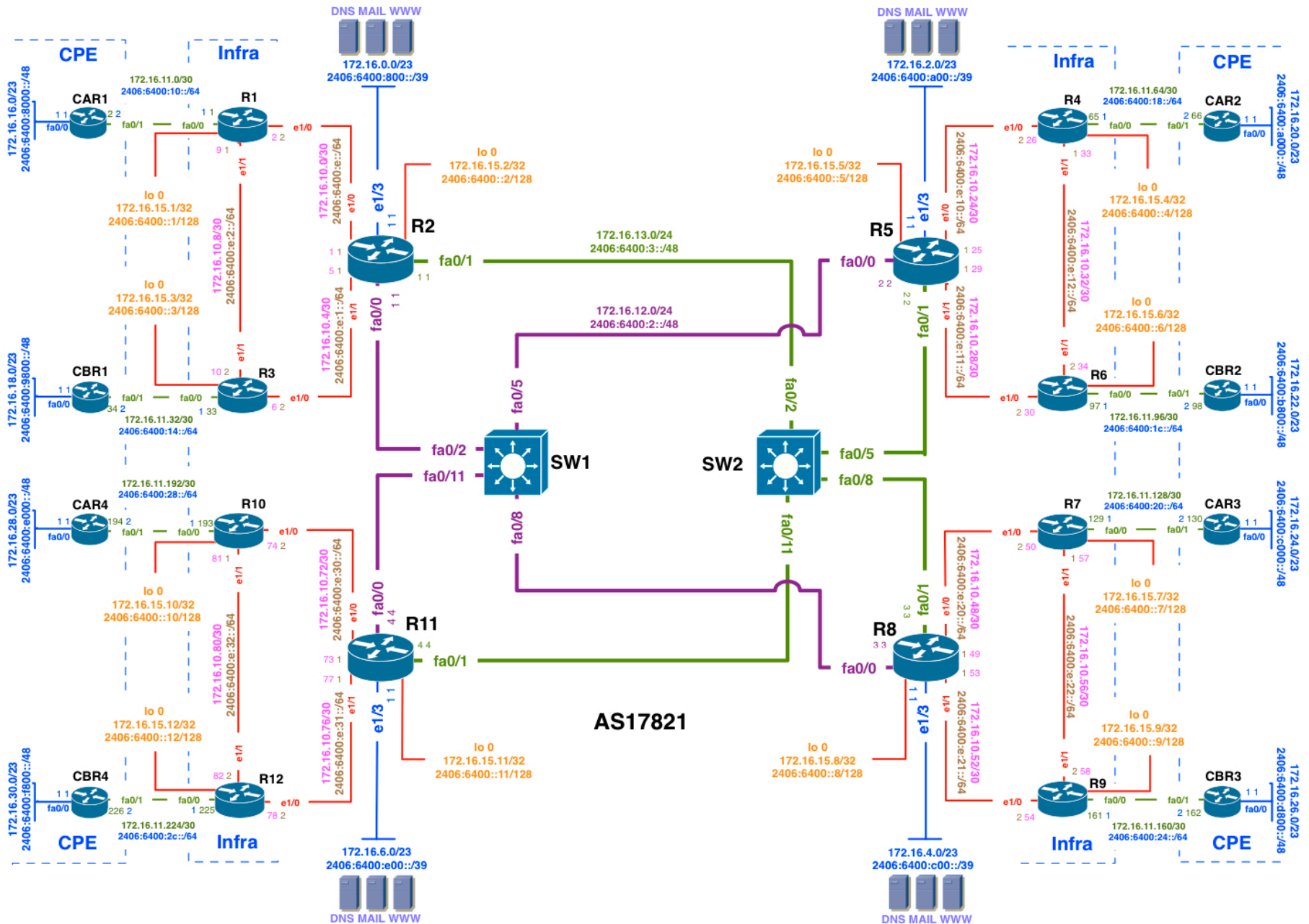
Training ISP IPV6 Addressing Plan

Table 3: Detail distribution infrastructure					
Block#	Prefix	Description	Reverse Domain	SOR	Registration
2	2406:6400:0000:0000::/36	Infrastructure	0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Optional
11	2406:6400:0000:0000::/40	Loopback, Transport & WAN [Infra+CS]	0.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Optional
	2406:6400:0100:0000::/40				
	2406:6400:0200:0000::/40				
	2406:6400:0300:0000::/40				
	2406:6400:0400:0000::/40				
	2406:6400:0500:0000::/40				
	2406:6400:0600:0000::/40				
	2406:6400:0700:0000::/40				
16	2406:6400:0800:0000::/40	R2 DC	8.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
	2406:6400:0900:0000::/40				
17	2406:6400:0a00:0000::/40	R5 DC	a.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
	2406:6400:0b00:0000::/40				
18	2406:6400:0c00:0000::/40	R8 DC	c.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
	2406:6400:0d00:0000::/40				
19	2406:6400:0e00:0000::/40	R11 DC	e.0.0.0.4.6.6.0.4.2.ip6.arpa.	No	Recommended
	2406:6400:0f00:0000::/40				

Training ISP IPV6 Addressing Plan

Table 4: Datacenter prefix summarization options

Block#	Prefix	Description	Reverse Domain
12	2406:6400:0800:0000::/39	Region 1 DC Summary [R2]	
13	2406:6400:0a00:0000::/39	Region 2 DC Summary [R5]	
14	2406:6400:0c00:0000::/39	Region 3 DC Summary [R8]	
15	2406:6400:0e00:0000::/39	Region 4 DC Summary [R11]	



Training ISP IPV6 Addressing Plan

Table 5: Further detail loopback, transport & infrastructure WAN

Block#	Prefix	Description	Reverse Domain	SOR	Registration
11	2406:6400:0000:0000::/40	Loopback, Transport & Infra WAN	0.0.0.0.4.6.6.0.4.2.ip6.arpa.		
20	2406:6400:0000:0000::/48	Loopback		No	Recommended
	2406:6400:0001:0000::/48				
21	2406:6400:0002:0000::/48	Purple Transport		No	Recommended
22	2406:6400:0003:0000::/48	Green Transport		No	Recommended
	2406:6400:0004:0000::/48				
	2406:6400:0005:0000::/48				
	2406:6400:0006:0000::/48				
	2406:6400:0007:0000::/48				
	2406:6400:0008:0000::/48				
	2406:6400:0009:0000::/48				
	2406:6400:000A:0000::/48				
	2406:6400:000B:0000::/48				
	2406:6400:000C:0000::/48				
	2406:6400:000D:0000::/48				
23	2406:6400:000E:0000::/48	WAN Prefix Infra Link		No	Recommended
	2406:6400:000F:0000::/48				

Training ISP IPV6 Addressing Plan

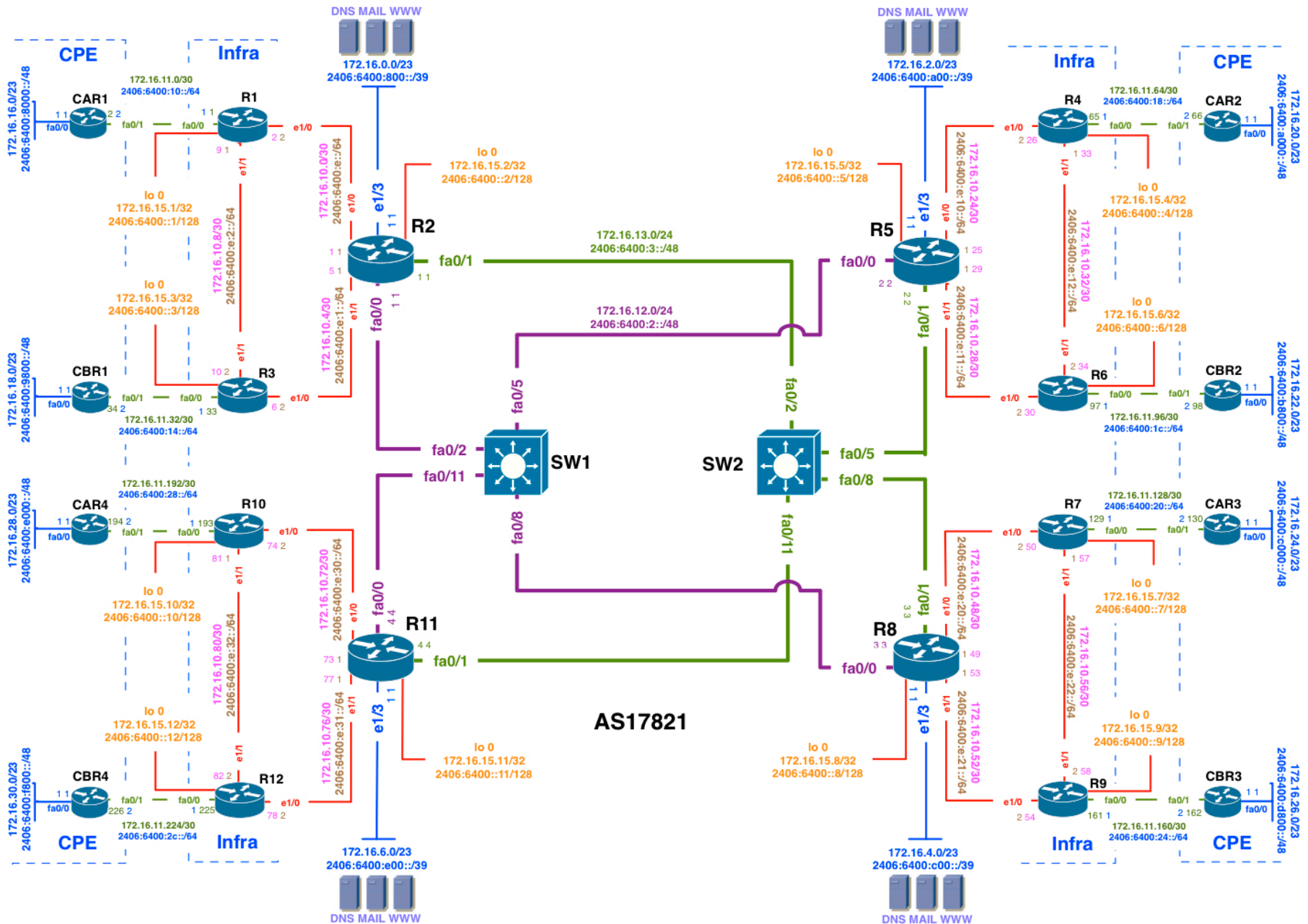
Table 6: Further detail CS link WAN

Block#	Prefix	Description	Reverse Domain	SOR	Registration
27	2406:6400:0010:0000::/48	WAN Prefix CS Link R1 Region1		No	Recommended
	2406:6400:0011:0000::/48				
	2406:6400:0012:0000::/48				
	2406:6400:0013:0000::/48				
28	2406:6400:0014:0000::/48	WAN Prefix CS Link R3 Region1		No	Recommended
	2406:6400:0015:0000::/48				
	2406:6400:0016:0000::/48				
	2406:6400:0017:0000::/48				
32	2406:6400:0018:0000::/48	WAN Prefix CS Link R4 Region2		No	Recommended
	2406:6400:0019:0000::/48				
	2406:6400:001A:0000::/48				
	2406:6400:001B:0000::/48				
33	2406:6400:001C:0000::/48	WAN Prefix CS Link R6 Region2		No	Recommended
	2406:6400:001D:0000::/48				
	2406:6400:001E:0000::/48				
	2406:6400:001F:0000::/48				
37	2406:6400:0020:0000::/48	WAN Prefix CS Link R7 Region3		No	Recommended
	2406:6400:0021:0000::/48				
	2406:6400:0022:0000::/48				
	2406:6400:0023:0000::/48				
38	2406:6400:0024:0000::/48	WAN Prefix CS Link R9 Region3		No	Recommended
	2406:6400:0025:0000::/48				
	2406:6400:0026:0000::/48				
	2406:6400:0027:0000::/48				
42	2406:6400:0028:0000::/48	WAN Prefix CS Link R10 Region4		No	Recommended
	2406:6400:0029:0000::/48				
	2406:6400:002A:0000::/48				
	2406:6400:002B:0000::/48				
43	2406:6400:002C:0000::/48	WAN Prefix CS Link R12 Region4		No	Recommended
	2406:6400:002D:0000::/48				
	2406:6400:002E:0000::/48				
	2406:6400:002F:0000::/48				

Training ISP IPV6 Addressing Plan

Table 7: CS link WAN summarization options			
Block#	Prefix	Description	Reverse Domain
24	2406:6400:0010:0000::/45	WAN CS Link Region1 Summary [R2]	
25	2406:6400:0010:0000::/46	WAN CS Link Region1 POP1 Summary [R1]	
26	2406:6400:0014:0000::/46	WAN CS Link Region1 POP2 Summary [R3]	
Block#	Prefix	Description	Reverse Domain
29	2406:6400:0018:0000::/45	WAN Prefix CS Link Region2 Summary [R5]	
30	2406:6400:0018:0000::/46	WAN CS Link Region2 POP1 Summary [R4]	
31	2406:6400:001C:0000::/46	WAN CS Link Region2 POP2 Summary [R6]	
Block#	Prefix	Description	Reverse Domain
34	2406:6400:0020:0000::/45	WAN Prefix CS Link Region3 Summary [R8]	
35	2406:6400:0020:0000::/46	WAN CS Link Region3 POP1 Summary [R7]	
36	2406:6400:0024:0000::/46	WAN CS Link Region3 POP2 Summary [R9]	
Block#	Prefix	Description	Reverse Domain
39	2406:6400:0028:0000::/45	WAN Prefix CS Link Region4 Summary [R11]	
40	2406:6400:0028:0000::/46	WAN CS Link Region4 POP1 Summary [R10]	
41	2406:6400:002C:0000::/46	WAN CS Link Region4 POP2 Summary [R12]	

Training ISP IPV6 Addressing Plan



Training ISP IPV6 Addressing Plan

Table 8: Further detail loopback					
Block#	Prefix	Description	PTR Record	SOR	Registration
20	2406:6400:0000:0000::/48	Loopback		No	Recommeded
			YES		
43	2406:6400:0000:0000::1/128	Router1 loopback 0	YES	No	No
44	2406:6400:0000:0000::2/128	Router2 loopback 0	YES	No	No
45	2406:6400:0000:0000::3/128	Router3 loopback 0	YES	No	No
46	2406:6400:0000:0000::4/128	Router4 loopback 0	YES	No	No
47	2406:6400:0000:0000::5/128	Router5 loopback 0	YES	No	No
48	2406:6400:0000:0000::6/128	Router6 loopback 0	YES	No	No
49	2406:6400:0000:0000::7/128	Router7 loopback 0	YES	No	No
50	2406:6400:0000:0000::8/128	Router8 loopback 0	YES	No	No
51	2406:6400:0000:0000::9/128	Router9 loopback 0	YES	No	No
52	2406:6400:0000:0000::10/128	Router10 loopback 0	YES	No	No
53	2406:6400:0000:0000::11/128	Router11 loopback 0	YES	No	No
54	2406:6400:0000:0000::12/128	Router12 loopback 0	YES	No	No

Training ISP IPV6 Addressing Plan

Table 9: Further detail transport					
Block#	Prefix	Description	PTR Record	SOR	Registration
21	2406:6400:0002:0000::/48	Purple Transport		No	Recommeded
	2406:6400:0002:0000::1/48	Router2 fa0/0	YES	No	No
	2406:6400:0002:0000::2/48	Router5 fa0/0	YES	No	No
	2406:6400:0002:0000::3/48	Router8 fa0/0	YES	No	No
	2406:6400:0002:0000::4/48	Router11 fa0/0	YES	No	No
Block#	Prefix	Description	PTR Record	SOR	Registration
22	2406:6400:0003:0000::/48	Green Transport		No	Recommended
	2406:6400:0003:0000::1/48	Router2 fa0/1	YES	No	No
	2406:6400:0003:0000::2/48	Router5 fa0/1	YES	No	No
	2406:6400:0003:0000::3/48	Router8 fa0/1	YES	No	No
	2406:6400:0003:0000::4/48	Router11 fa0/1	YES	No	No

Training ISP IPV6 Addressing Plan

Table 10: Further detail Infra WAN					
Block#	Prefix	Description	PTR Record	SOR	Registration
23	2406:6400:000E:0000::/48	WAN Prefix Infra Link		No	Recommeded
55	2406:6400:000E:0000::/64	R2[::1]-R1[::2]	YES	No	No
56	2406:6400:000E:0001::/64	R2[::1]-R3[::2]	YES	No	No
57	2406:6400:000E:0002::/64	R1[::1]-R3[::2]	YES	No	No
	2406:6400:000E:0003::/64				
	2406:6400:000E:0004::/64				
	2406:6400:000E:0005::/64				
	2406:6400:000E:0006::/64				
	2406:6400:000E:0007::/64				
	2406:6400:000E:0008::/64				
	2406:6400:000E:0009::/64				
	2406:6400:000E:000A::/64				
	2406:6400:000E:000B::/64				
	2406:6400:000E:000C::/64				
	2406:6400:000E:000D::/64				
	2406:6400:000E:000E::/64				
	2406:6400:000E:000F::/64				
58	2406:6400:000E:0010::/64	R5[::1]-R4[::2]	YES	No	No
59	2406:6400:000E:0011::/64	R5[::1]-R6[::2]	YES	No	No
60	2406:6400:000E:0012::/64	R4[::1]-R6[::2]	YES	No	No
	2406:6400:000E:0013::/64				
	2406:6400:000E:0014::/64				
	2406:6400:000E:0015::/64				
	2406:6400:000E:0016::/64				
	2406:6400:000E:0017::/64				
	2406:6400:000E:0018::/64				
	2406:6400:000E:0019::/64				
	2406:6400:000E:001A::/64				
	2406:6400:000E:001B::/64				
	2406:6400:000E:001C::/64				
	2406:6400:000E:001D::/64				
	2406:6400:000E:001E::/64				
	2406:6400:000E:001F::/64				
61	2406:6400:000E:0020::/64	R8[::1]-R7[::2]	YES	No	No
62	2406:6400:000E:0021::/64	R8[::1]-R9[::2]	YES	No	No
63	2406:6400:000E:0022::/64	R7[::1]-R9[::2]	YES	No	No
	2406:6400:000E:0023::/64				
	2406:6400:000E:0024::/64				
	2406:6400:000E:0025::/64				
	2406:6400:000E:0026::/64				
	2406:6400:000E:0027::/64				
	2406:6400:000E:0028::/64				
	2406:6400:000E:0029::/64				
	2406:6400:000E:002A::/64				
	2406:6400:000E:002B::/64				
	2406:6400:000E:002C::/64				
	2406:6400:000E:002D::/64				
	2406:6400:000E:002E::/64				
	2406:6400:000E:002F::/64				
64	2406:6400:000E:0030::/64	R11[::1]-R10[::2]	YES	No	No
65	2406:6400:000E:0031::/64	R11[::1]-R12[::2]	YES	No	No
66	2406:6400:000E:0032::/64	R10[::1]-R12[::2]	YES	No	No
	2406:6400:000E:0033::/64				
	2406:6400:000E:0034::/64				
	2406:6400:000E:0035::/64				
	2406:6400:000E:0036::/64				
	2406:6400:000E:0037::/64				
	2406:6400:000E:0038::/64				
	2406:6400:000E:0039::/64				
	2406:6400:000E:003A::/64				



Training ISP IPV6 Addressing Plan

Table 11: Detail CS link WAN Region 1					
Block#	Prefix	Description	PTR Record	SOR	Registration
27	2406:6400:0010:0000::/48	WAN Prefix CS Link R1 Region1		No	Recommended
	2406:6400:0010:0000::/64	R1[::1]-CAR1[::2]	Yes	No	No
	2406:6400:0010:0001::/64		Yes	No	No
	2406:6400:0010:0002::/64		Yes	No	No
	2406:6400:0010:0003::/64		Yes	No	No
	2406:6400:0010:0004::/64		Yes	No	No
	2406:6400:0010:0005::/64		Yes	No	No
	2406:6400:0010:0006::/64		Yes	No	No
	2406:6400:0010:0007::/64		Yes	No	No
	2406:6400:0010:0008::/64		Yes	No	No
	2406:6400:0010:0009::/64		Yes	No	No
	2406:6400:0010:000A::/64		Yes	No	No
	2406:6400:0010:000B::/64		Yes	No	No
	2406:6400:0010:000C::/64		Yes	No	No
	2406:6400:0010:000D::/64		Yes	No	No
	2406:6400:0010:000E::/64		Yes	No	No
	2406:6400:0010:000F::/64		Yes	No	No
Block#	Prefix	Description	PTR Record	SOR	Registration
28	2406:6400:0014:0000::/48	WAN Prefix CS Link R3 Region1		No	Recommended
	2406:6400:0014:0000::/64	R3[::1]-CBR1[::2]	Yes	No	No
	2406:6400:0014:0001::/64		Yes	No	No
	2406:6400:0014:0002::/64		Yes	No	No
	2406:6400:0014:0003::/64		Yes	No	No
	2406:6400:0014:0004::/64		Yes	No	No
	2406:6400:0014:0005::/64		Yes	No	No
	2406:6400:0014:0006::/64		Yes	No	No
	2406:6400:0014:0007::/64		Yes	No	No
	2406:6400:0014:0008::/64		Yes	No	No
	2406:6400:0014:0009::/64		Yes	No	No
	2406:6400:0014:000A::/64		Yes	No	No
	2406:6400:0014:000B::/64		Yes	No	No
	2406:6400:0014:000C::/64		Yes	No	No
	2406:6400:0014:000D::/64		Yes	No	No
	2406:6400:0014:000E::/64		Yes	No	No
	2406:6400:0014:000F::/64		Yes	No	No



Training ISP IPV6 Addressing Plan

Table 12: Detail CS link WAN Region 2					
Block#	Prefix	Description	PTR Record	SOR	Registration
32	2406:6400:0018:0000::/48	WAN Prefix CS Link R4 Region2		No	Recommended
	2406:6400:0018:0000::/64	R4[::1]-CAR2[::2]	Yes	No	No
	2406:6400:0018:0001::/64		Yes	No	No
	2406:6400:0018:0002::/64		Yes	No	No
	2406:6400:0018:0003::/64		Yes	No	No
	2406:6400:0018:0004::/64		Yes	No	No
	2406:6400:0018:0005::/64		Yes	No	No
	2406:6400:0018:0006::/64		Yes	No	No
	2406:6400:0018:0007::/64		Yes	No	No
	2406:6400:0018:0008::/64		Yes	No	No
	2406:6400:0018:0009::/64		Yes	No	No
	2406:6400:0018:000A::/64		Yes	No	No
	2406:6400:0018:000B::/64		Yes	No	No
	2406:6400:0018:000C::/64		Yes	No	No
	2406:6400:0018:000D::/64		Yes	No	No
	2406:6400:0018:000E::/64		Yes	No	No
	2406:6400:0018:000F::/64		Yes	No	No
Block#	Prefix	Description	PTR Record	SOR	Registration
33	2406:6400:001C:0000::/48	WAN Prefix CS Link R6 Region2		No	Recommended
	2406:6400:001C:0000::/64	R6[::1]-CBR2[::2]	Yes	No	No
	2406:6400:001C:0001::/64		Yes	No	No
	2406:6400:001C:0002::/64		Yes	No	No
	2406:6400:001C:0003::/64		Yes	No	No
	2406:6400:001C:0004::/64		Yes	No	No
	2406:6400:001C:0005::/64		Yes	No	No
	2406:6400:001C:0006::/64		Yes	No	No
	2406:6400:001C:0007::/64		Yes	No	No
	2406:6400:001C:0008::/64		Yes	No	No
	2406:6400:001C:0009::/64		Yes	No	No
	2406:6400:001C:000A::/64		Yes	No	No
	2406:6400:001C:000B::/64		Yes	No	No
	2406:6400:001C:000C::/64		Yes	No	No
	2406:6400:001C:000D::/64		Yes	No	No
	2406:6400:001C:000E::/64		Yes	No	No
	2406:6400:001C:000F::/64		Yes	No	No



Training ISP IPV6 Addressing Plan

Table 13: Detail CS link WAN Region3					
Block#	Prefix	Description	PTR Record	SOR	Registration
37	2406:6400:0020:0000::/48	WAN Prefix CS Link R7 Region3		No	Recommended
	2406:6400:0020:0000::/64	R7[::1]-CAR3[::2]	Yes	No	No
	2406:6400:0020:0001::/64		Yes	No	No
	2406:6400:0020:0002::/64		Yes	No	No
	2406:6400:0020:0003::/64		Yes	No	No
	2406:6400:0020:0004::/64		Yes	No	No
	2406:6400:0020:0005::/64		Yes	No	No
	2406:6400:0020:0006::/64		Yes	No	No
	2406:6400:0020:0007::/64		Yes	No	No
	2406:6400:0020:0008::/64		Yes	No	No
	2406:6400:0020:0009::/64		Yes	No	No
	2406:6400:0020:000A::/64		Yes	No	No
	2406:6400:0020:000B::/64		Yes	No	No
	2406:6400:0020:000C::/64		Yes	No	No
	2406:6400:0020:000D::/64		Yes	No	No
	2406:6400:0020:000E::/64		Yes	No	No
	2406:6400:0020:000F::/64		Yes	No	No
Block#	Prefix	Description	PTR Record	SOR	Registration
38	2406:6400:0024:0000::/48	WAN Prefix CS Link R9 Region3		No	Recommended
	2406:6400:0024:0000::/64	R9[::1]-CBR3[::2]	Yes	No	No
	2406:6400:0024:0001::/64		Yes	No	No
	2406:6400:0024:0002::/64		Yes	No	No
	2406:6400:0024:0003::/64		Yes	No	No
	2406:6400:0024:0004::/64		Yes	No	No
	2406:6400:0024:0005::/64		Yes	No	No
	2406:6400:0024:0006::/64		Yes	No	No
	2406:6400:0024:0007::/64		Yes	No	No
	2406:6400:0024:0008::/64		Yes	No	No
	2406:6400:0024:0009::/64		Yes	No	No
	2406:6400:0024:000A::/64		Yes	No	No
	2406:6400:0024:000B::/64		Yes	No	No
	2406:6400:0024:000C::/64		Yes	No	No
	2406:6400:0024:000D::/64		Yes	No	No
	2406:6400:0024:000E::/64		Yes	No	No
	2406:6400:0024:000F::/64		Yes	No	No



Training ISP IPV6 Addressing Plan

Table 14: Detail CS link WAN Region 4					
Block#	Prefix	Description	PTR Record	SOR	Registration
42	2406:6400:0028:0000::/48	WAN Prefix CS Link R10 Region4		No	Recommended
	2406:6400:0028:0000::/64	R10[::1]-CAR4[::2]	Yes	No	No
	2406:6400:0028:0001::/64		Yes	No	No
	2406:6400:0028:0002::/64		Yes	No	No
	2406:6400:0028:0003::/64		Yes	No	No
	2406:6400:0028:0004::/64		Yes	No	No
	2406:6400:0028:0005::/64		Yes	No	No
	2406:6400:0028:0006::/64		Yes	No	No
	2406:6400:0028:0007::/64		Yes	No	No
	2406:6400:0028:0008::/64		Yes	No	No
	2406:6400:0028:0009::/64		Yes	No	No
	2406:6400:0028:000A::/64		Yes	No	No
	2406:6400:0028:000B::/64		Yes	No	No
	2406:6400:0028:000C::/64		Yes	No	No
	2406:6400:0028:000D::/64		Yes	No	No
	2406:6400:0028:000E::/64		Yes	No	No
	2406:6400:0028:000F::/64		Yes	No	No
Block#	Prefix	Description	PTR Record	SOR	Registration
43	2406:6400:002C:0000::/48	WAN Prefix CS Link R12 Region4		No	Recommended
	2406:6400:002C:0000::/64	R12[::1]-CBR4[::2]	Yes	No	No
	2406:6400:002C:0001::/64		Yes	No	No
	2406:6400:002C:0002::/64		Yes	No	No
	2406:6400:002C:0003::/64		Yes	No	No
	2406:6400:002C:0004::/64		Yes	No	No
	2406:6400:002C:0005::/64		Yes	No	No
	2406:6400:002C:0006::/64		Yes	No	No
	2406:6400:002C:0007::/64		Yes	No	No
	2406:6400:002C:0008::/64		Yes	No	No
	2406:6400:002C:0009::/64		Yes	No	No
	2406:6400:002C:000A::/64		Yes	No	No
	2406:6400:002C:000B::/64		Yes	No	No
	2406:6400:002C:000C::/64		Yes	No	No
	2406:6400:002C:000D::/64		Yes	No	No
	2406:6400:002C:000E::/64		Yes	No	No
	2406:6400:002C:000F::/64		Yes	No	No

Training ISP IPV6 Addressing Plan

Table 15: Customer block Region 1					
Block#	Prefix	Description	Reverse DNS	SOR	Registration
7	2406:6400:8000:0000::/35	Customer block Region 1			
	2406:6400:8000:0000::/40	Customer block POP1 [R1]		>= /48 Yes	Yes
	2406:6400:8100:0000::/40				
	2406:6400:8200:0000::/40				
	2406:6400:8300:0000::/40				
	2406:6400:8400:0000::/40				
	2406:6400:8500:0000::/40				
	2406:6400:8600:0000::/40				
	2406:6400:8700:0000::/40				
	2406:6400:8800:0000::/40	Customer block future use/POP		>= /48 Yes	Yes
	2406:6400:8900:0000::/40				
	2406:6400:8A00:0000::/40				
	2406:6400:8B00:0000::/40				
	2406:6400:8C00:0000::/40				
	2406:6400:8D00:0000::/40				
	2406:6400:8E00:0000::/40				
	2406:6400:8F00:0000::/40				
	2406:6400:9000:0000::/40	Customer block future use/POP		>= /48 Yes	Yes
	2406:6400:9100:0000::/40				
	2406:6400:9200:0000::/40				
	2406:6400:9300:0000::/40				
	2406:6400:9400:0000::/40				
	2406:6400:9500:0000::/40				
	2406:6400:9600:0000::/40				
	2406:6400:9700:0000::/40				
	2406:6400:9800:0000::/40	Customer block POP2 [R3]		>= /48 Yes	Yes
	2406:6400:9900:0000::/40				
	2406:6400:9A00:0000::/40				
	2406:6400:9B00:0000::/40				
	2406:6400:9C00:0000::/40				
	2406:6400:9D00:0000::/40				
	2406:6400:9E00:0000::/40				
	2406:6400:9F00:0000::/40				

Training ISP IPV6 Addressing Plan

Table 16: Summarization oprions customer block Region 1			
Block#	Prefix	Description	Reverse Domain
	2406:6400:8000:0000::/35	Customer block Region 1 [R2]	
	2406:6400:8000:0000::/37	Customer block POP1 [R1]	
	2406:6400:8800:0000::/37	Customer block future use/POP	
	2406:6400:9000:0000::/37	Customer block future use/POP	
	2406:6400:9800:0000::/37	Customer block POP2 [R3]	

Training ISP IPV6 Addressing Plan

Table 17: Detail customer block Region 1

Block#	Prefix	Description	Reverse DNS	SOR	Registration
	2406:6400:8000:0000::/40	1st Customer block POP1 [R1]			
	2406:6400:8000:0000::/48	1st Customer prefix POP1 [R1]		Yes	Yes
	2406:6400:8001:0000::/48				
	2406:6400:8002:0000::/48				
	2406:6400:8003:0000::/48				
	2406:6400:8004:0000::/48				
	2406:6400:8005:0000::/48				
	2406:6400:8006:0000::/48				
	2406:6400:8007:0000::/48				
	2406:6400:9800:0000::/40	1st Customer block POP2 [R3]			
	2406:6400:9800:0000::/48	1st Customer prefix POP2 [R3]		Yes	Yes
	2406:6400:9801:0000::/48				
	2406:6400:9802:0000::/48				
	2406:6400:9803:0000::/48				
	2406:6400:9804:0000::/48				
	2406:6400:9805:0000::/48				
	2406:6400:9806:0000::/48				
	2406:6400:9807:0000::/48				

Training ISP IPV6 Addressing Plan

Table 18: Customer block Region 2					
Block#	Prefix	Description	Reverse DNS	SOR	Registration
8	2406:6400:a000:0000::/35	Customer block Region 2			
	2406:6400:A000:0000::/40	Customer block POP1 [R4]		>= /48 Yes	Yes
	2406:6400:A100:0000::/40				
	2406:6400:A200:0000::/40				
	2406:6400:A300:0000::/40				
	2406:6400:A400:0000::/40				
	2406:6400:A500:0000::/40				
	2406:6400:A600:0000::/40				
	2406:6400:A700:0000::/40				
	2406:6400:A800:0000::/40	Customer block future use/POP		>= /48 Yes	Yes
	2406:6400:A900:0000::/40				
	2406:6400:AA00:0000::/40				
	2406:6400:AB00:0000::/40				
	2406:6400:AC00:0000::/40				
	2406:6400:AD00:0000::/40				
	2406:6400:AE00:0000::/40				
	2406:6400:AF00:0000::/40				
	2406:6400:B000:0000::/40	Customer block future use/POP		>= /48 Yes	Yes
	2406:6400:B100:0000::/40				
	2406:6400:B200:0000::/40				
	2406:6400:B300:0000::/40				
	2406:6400:B400:0000::/40				
	2406:6400:B500:0000::/40				
	2406:6400:B600:0000::/40				
	2406:6400:B700:0000::/40				
	2406:6400:B800:0000::/40	Customer block POP2 [R6]		>= /48 Yes	Yes
	2406:6400:B900:0000::/40				
	2406:6400:BA00:0000::/40				
	2406:6400:BB00:0000::/40				
	2406:6400:BC00:0000::/40				
	2406:6400:BD00:0000::/40				
	2406:6400:BE00:0000::/40				
	2406:6400:BF00:0000::/40				

Training ISP IPV6 Addressing Plan

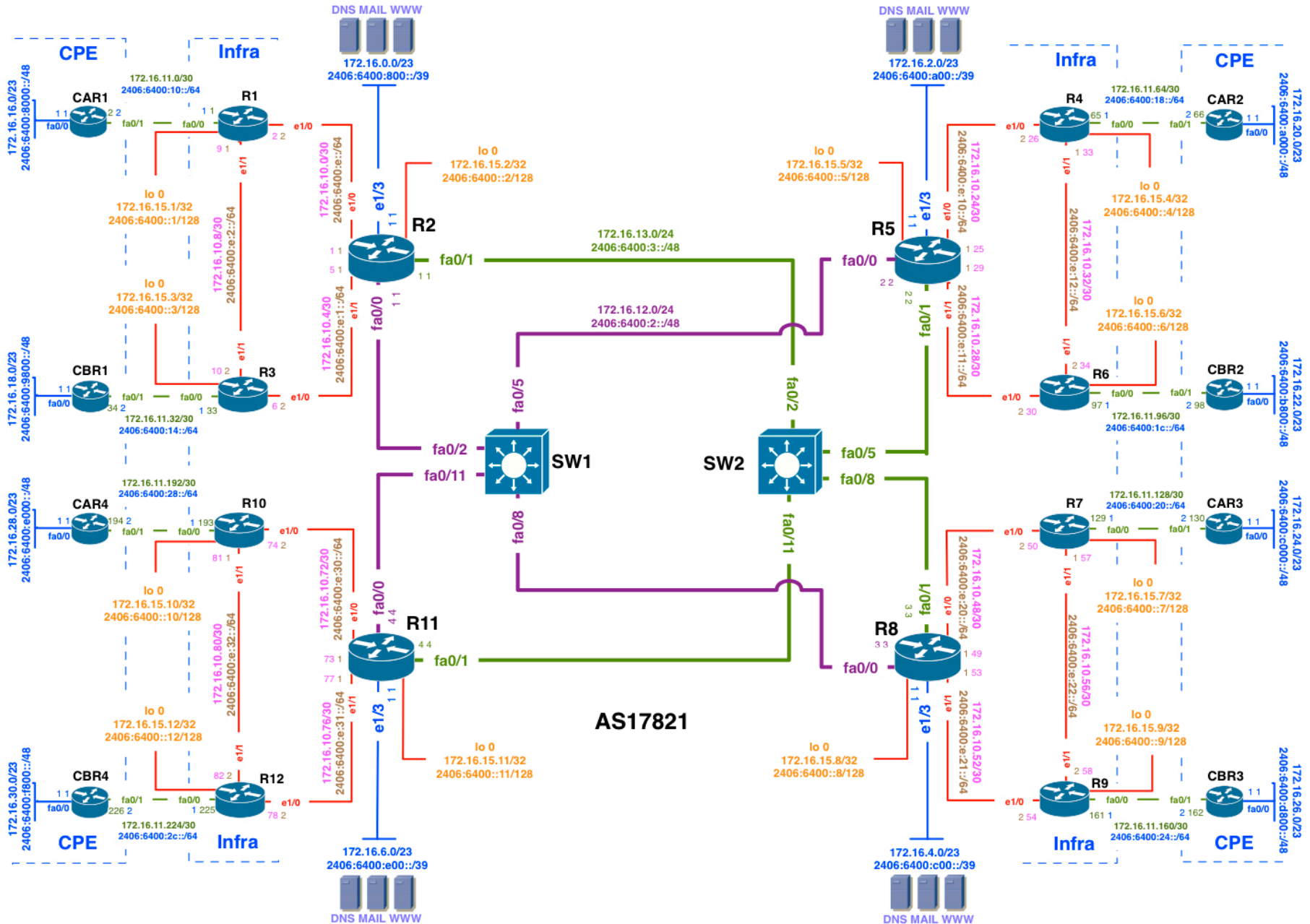
Table 19: Summarization oprions customer block Region 2			
Block#	Prefix	Description	Reverse Domain
	2406:6400:A000:0000::/35	Customer block Region 2 [R5]	
	2406:6400:A000:0000::/37	Customer block POP1 [R4]	
	2406:6400:A800:0000::/37	Customer block future use/POP	
	2406:6400:B000:0000::/37	Customer block future use/POP	
	2406:6400:B800:0000::/37	Customer block POP2 [R6]	

Training ISP IPV6 Addressing Plan

Table 20: Detail customer block Region 2

Block#	Prefix	Description	Reverse DNS	SOR	Registration
	2406:6400:A000:0000::/40	1st Customer block POP1 [R4]			
	2406:6400:A000:0000::/48	1st Customer prefix POP1 [R4]		Yes	Yes
	2406:6400:A001:0000::/48				
	2406:6400:A002:0000::/48				
	2406:6400:A003:0000::/48				
	2406:6400:A004:0000::/48				
	2406:6400:A005:0000::/48				
	2406:6400:A006:0000::/48				
	2406:6400:A007:0000::/48				
	2406:6400:B800:0000::/40	1st Customer block POP2 [R6]			
	2406:6400:B800:0000::/48	1st Customer prefix POP2 [R6]		Yes	Yes
	2406:6400:B801:0000::/48				
	2406:6400:B802:0000::/48				
	2406:6400:B803:0000::/48				
	2406:6400:B804:0000::/48				
	2406:6400:B805:0000::/48				
	2406:6400:B806:0000::/48				
	2406:6400:B807:0000::/48				

Training ISP IPV6 Addressing Plan



Training ISP IPV6 Addressing Plan

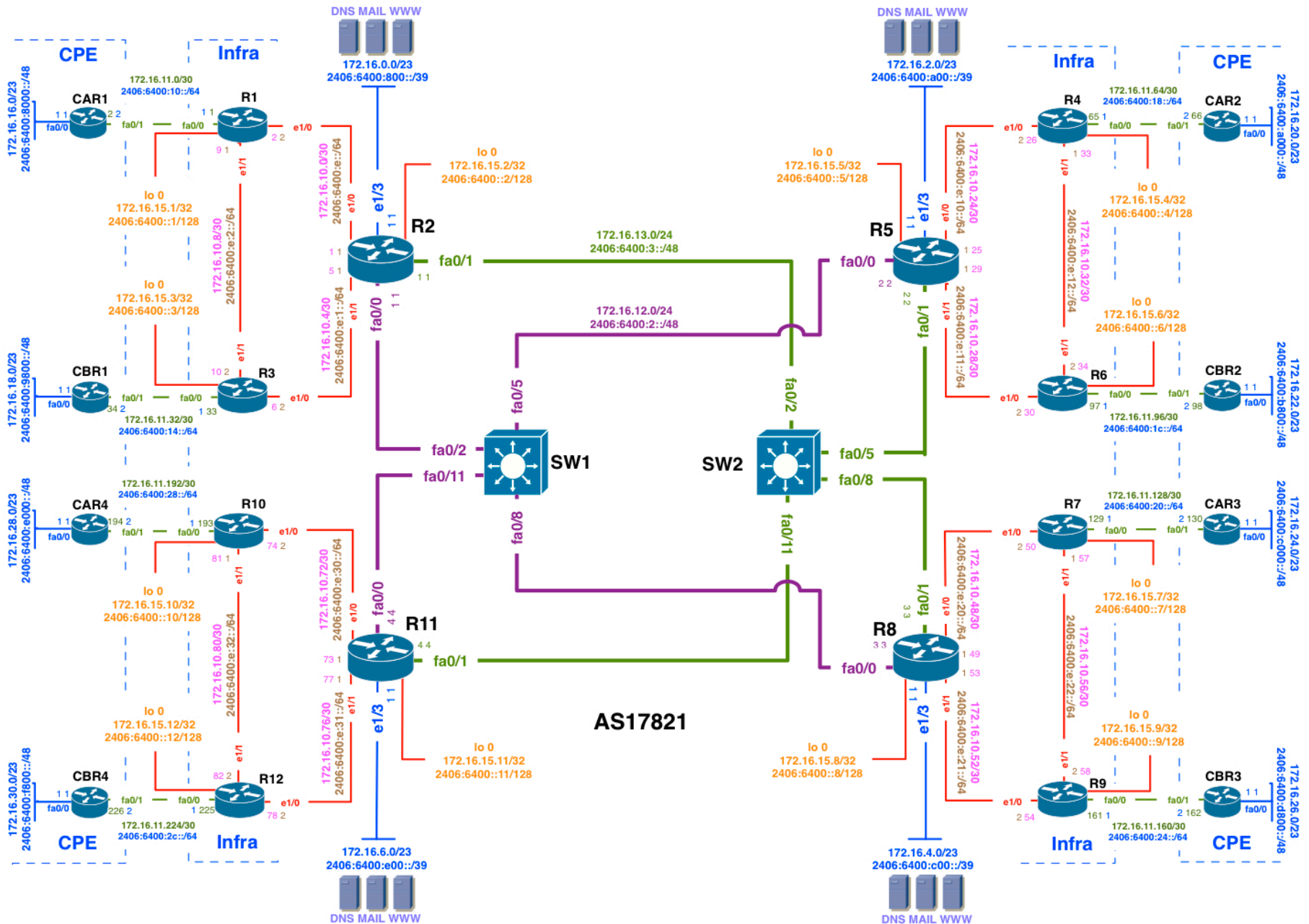
Table 21: Customer block Region 3					
Block#	Prefix	Description	Reverse DNS	SOR	Registration
9	2406:6400:c000:0000::/35	Customer block Region 3			
	2406:6400:C000:0000::/40	Customer block POP1 [R7]		>= /48 Yes	Yes
	2406:6400:C100:0000::/40				
	2406:6400:C200:0000::/40				
	2406:6400:C300:0000::/40				
	2406:6400:C400:0000::/40				
	2406:6400:C500:0000::/40				
	2406:6400:C600:0000::/40				
	2406:6400:C700:0000::/40				
	2406:6400:C800:0000::/40	Customer block future use/POP		>= /48 Yes	Yes
	2406:6400:C900:0000::/40				
	2406:6400:CA00:0000::/40				
	2406:6400:CB00:0000::/40				
	2406:6400:CC00:0000::/40				
	2406:6400:CD00:0000::/40				
	2406:6400:CE00:0000::/40				
	2406:6400:CF00:0000::/40				
	2406:6400:D000:0000::/40	Customer block future use/POP		>= /48 Yes	Yes
	2406:6400:D100:0000::/40				
	2406:6400:D200:0000::/40				
	2406:6400:D300:0000::/40				
	2406:6400:D400:0000::/40				
	2406:6400:D500:0000::/40				
	2406:6400:D600:0000::/40				
	2406:6400:D700:0000::/40				
	2406:6400:D800:0000::/40	Customer block POP2 [R9]		>= /48 Yes	Yes
	2406:6400:D900:0000::/40				
	2406:6400:DA00:0000::/40				
	2406:6400:DB00:0000::/40				
	2406:6400:DC00:0000::/40				
	2406:6400:DD00:0000::/40				
	2406:6400:DE00:0000::/40				
	2406:6400:DF00:0000::/40				

Training ISP IPV6 Addressing Plan

Table 22: Summarization oprions customer block Region 3			
Block#	Prefix	Description	Reverse Domain
	2406:6400:c000:0000::/35	Customer block Region 3 [R8]	
	2406:6400:C000:0000::/37	Customer block POP1 [R7]	
	2406:6400:C800:0000::/37	Customer block future use/POP	
	2406:6400:D000:0000::/37	Customer block future use/POP	
	2406:6400:D800:0000::/37	Customer block POP2 [R9]	

Training ISP IPV6 Addressing Plan

Table 23: Detail customer block Region 3					
Block#	Prefix	Description	Reverse DNS	SOR	Registration
	2406:6400:C000:0000::/40	1st Customer block POP1 [R7]			
	2406:6400:C000:0000::/48	1st Customer prefix POP1 [R7]		Yes	Yes
	2406:6400:C001:0000::/48				
	2406:6400:C002:0000::/48				
	2406:6400:C003:0000::/48				
	2406:6400:C004:0000::/48				
	2406:6400:C005:0000::/48				
	2406:6400:C006:0000::/48				
	2406:6400:C007:0000::/48				
	2406:6400:D800:0000::/40	1st Customer block POP2 [R9]			
	2406:6400:D800:0000::/48	1st Customer prefix POP2 [R9]		Yes	Yes
	2406:6400:D801:0000::/48				
	2406:6400:D802:0000::/48				
	2406:6400:D803:0000::/48				
	2406:6400:D804:0000::/48				
	2406:6400:D805:0000::/48				
	2406:6400:D806:0000::/48				
	2406:6400:D807:0000::/48				



Training ISP IPV6 Addressing Plan

Table 24: Customer block Region 4					
Block#	Prefix	Description	Reverse DNS	SOR	Registration
10	2406:6400:e000:0000::/35	Customer block Region 4			
	2406:6400:E000:0000::/40	Customer block POP1 [R10]		>= /48 Yes	Yes
	2406:6400:E100:0000::/40				
	2406:6400:E200:0000::/40				
	2406:6400:E300:0000::/40				
	2406:6400:E400:0000::/40				
	2406:6400:E500:0000::/40				
	2406:6400:E600:0000::/40				
	2406:6400:E700:0000::/40				
	2406:6400:E800:0000::/40	Customer block future use/POP		>= /48 Yes	Yes
	2406:6400:E900:0000::/40				
	2406:6400:EA00:0000::/40				
	2406:6400:EB00:0000::/40				
	2406:6400:EC00:0000::/40				
	2406:6400:ED00:0000::/40				
	2406:6400:EE00:0000::/40				
	2406:6400:EF00:0000::/40				
	2406:6400:F000:0000::/40	Customer block future use/POP		>= /48 Yes	Yes
	2406:6400:F100:0000::/40				
	2406:6400:F200:0000::/40				
	2406:6400:F300:0000::/40				
	2406:6400:F400:0000::/40				
	2406:6400:F500:0000::/40				
	2406:6400:F600:0000::/40				
	2406:6400:F700:0000::/40				
	2406:6400:F800:0000::/40	Customer block POP2 [R12]		>= /48 Yes	Yes
	2406:6400:F900:0000::/40				
	2406:6400:FA00:0000::/40				
	2406:6400:FB00:0000::/40				
	2406:6400:FC00:0000::/40				
	2406:6400:FD00:0000::/40				
	2406:6400:FE00:0000::/40				
	2406:6400:FF00:0000::/40				

Training ISP IPV6 Addressing Plan

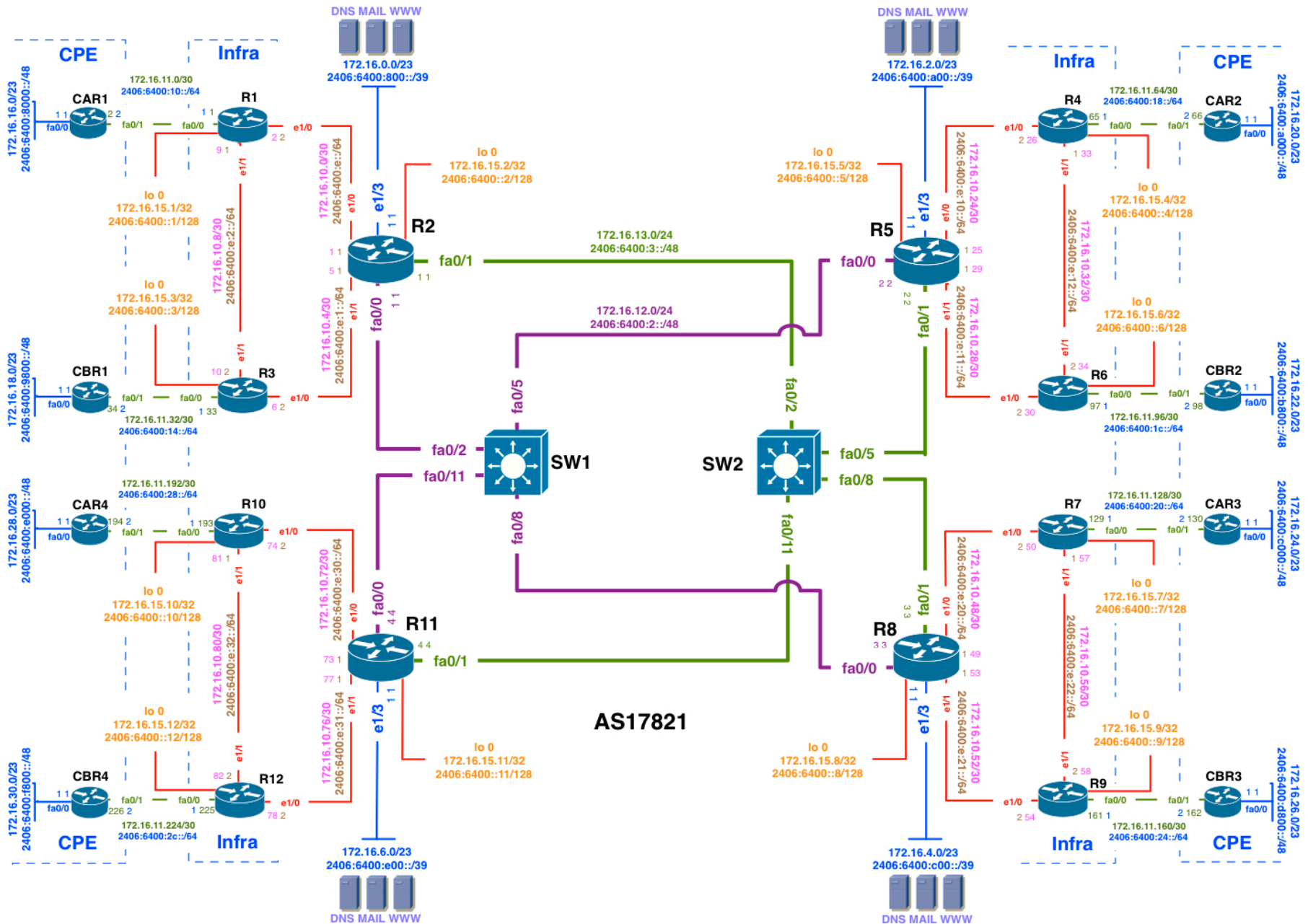
Table 25: Summarization oprions customer block Region 4			
Block#	Prefix	Description	Reverse Domain
	2406:6400:e000:0000::/35	Customer block Region 4 [R11]	
	2406:6400:E000:0000::/37	Customer block POP1 [R10]	
	2406:6400:E800:0000::/37	Customer block future use/POP	
	2406:6400:F000:0000::/37	Customer block future use/POP	
	2406:6400:F800:0000::/37	Customer block POP2 [R12]	

Training ISP IPV6 Addressing Plan

Table 26: Detail customer block Region 4

Block#	Prefix	Description	Reverse DNS	SOR	Registration
	2406:6400:E000:0000::/40	1st Customer block POP1 [R10]			
	2406:6400:E000:0000::/48	1st Customer prefix POP1 [R10]		Yes	Yes
	2406:6400:E001:0000::/48				
	2406:6400:E002:0000::/48				
	2406:6400:E003:0000::/48				
	2406:6400:E004:0000::/48				
	2406:6400:E005:0000::/48				
	2406:6400:E006:0000::/48				
	2406:6400:E007:0000::/48				
	2406:6400:F800:0000::/40	1st Customer block POP2 [R10]			
	2406:6400:F800:0000::/48	1st Customer prefix POP2 [R10]		Yes	Yes
	2406:6400:F801:0000::/48				
	2406:6400:F802:0000::/48				
	2406:6400:F803:0000::/48				
	2406:6400:F804:0000::/48				
	2406:6400:F805:0000::/48				
	2406:6400:F806:0000::/48				
	2406:6400:F807:0000::/48				

Training ISP IPV6 Addressing Plan



Training ISP IPV4 Addressing Plan

Summary parent block IPV4

Block#	Prefix	Size	Description
1	172.16.0.0	/19	Parent block
2	172.16.0.0	/20	Infrastructure
3	172.16.16.0	/20	Customer network

Training ISP IPV4 Addressing Plan

Detail DC infrastructure block IPV4

Block#	Prefix	Size	Description	SOR	Register
2	172.16.0.0	/20	Infrastructure		
4	172.16.0.0	/23	Router2 DC summary net		
5	172.16.0.0	/24	Router2 DC	No	Recommended
6	172.16.2.0	/23	Router5 DC summary net		
7	172.16.2.0	/24	Router5 DC	No	Recommended
8	172.16.4.0	/23	Router8 DC summary net		
9	172.16.4.0	/24	Router8 DC	No	Recommended
10	172.16.6.0	/23	Router11 DC summary net		
11	172.16.6.0	/24	Router11 DC	No	Recommended

Training ISP IPV4 Addressing Plan

Detail infrastructure WAN block IPV4

12	172.16.10.0	/24	WAN prefix		Optional
13	172.16.10.0	/30	Router2-1 WAN	No	
14	172.16.10.4	/30	Router2-3 WAN	No	
15	172.16.10.8	/30	Router1-3 WAN	No	
16	172.16.10.24	/30	Router5-4 WAN	No	
17	172.16.10.28	/30	Router5-6 WAN	No	
18	172.16.10.32	/30	Router4-6 WAN	No	
19	172.16.10.48	/30	Router8-7 WAN	No	
20	172.16.10.52	/30	Router8-9 WAN	No	
21	172.16.10.56	/30	Router7-9 WAN	No	
22	172.16.10.72	/30	Router11-10 WAN	No	
23	172.16.10.76	/30	Router11-12 WAN	No	
24	172.16.10.80	/30	Router10-12 WAN	No	

Training ISP IPV4 Addressing Plan

Detail customer link WAN block

Block#	Prefix	Size	Description	SOR	Register
	172.16.11.0	/26	WAN CS Link Region1		
	172.16.11.0	/27	WAN CS Link POP1 [R1]		
	172.16.11.0	/30	R1[::1]-CAR1[::2]	No	No
	172.16.11.4	/30			
	172.16.11.32	/27	WAN CS Link POP2 [R3]		
	172.16.11.32	/30	R3[::33]-CBR1[::34]	No	No
	172.16.11.36	/30			
	172.16.11.64	/26	WAN CS Link Region2		
	172.16.11.64	/27	WAN CS Link POP1 [R4]		
	172.16.11.64	/30	R4[::65]-CAR2[::66]	No	No
	172.16.11.68	/30			
	172.16.11.96	/27	WAN CS Link POP2 [R6]		
	172.16.11.96	/30	R6[::97]-CBR2[::98]	No	No
	172.16.11.100	/30			
	172.16.11.128	/26	WAN CS Link Region3		
	172.16.11.128	/27	WAN CS Link POP1 [R7]		
	172.16.11.128	/30	R7[::129]-CAR3[::130]	No	No
	172.16.11.132	/30			
	172.16.11.160	/27	WAN CS Link POP2 [R9]		
	172.16.11.160	/30	R9[::161]-CBR3[::162]	No	No
	172.16.11.164	/30			
	172.16.11.192	/26	WAN CS Link Region4		
	172.16.11.192	/27	WAN CS Link POP1 [R10]		
	172.16.11.192	/30	R10[::193]-CAR4[::194]	No	No
	172.16.11.196	/30			
	172.16.11.224	/27	WAN CS Link POP2 [R12]		
	172.16.11.224	/30	R12[::225]-CBR4[::226]	No	No
	172.16.11.228	/30			

Training ISP IPV4 Addressing Plan

Detail infrastructure block Transport & Loopback IPV4

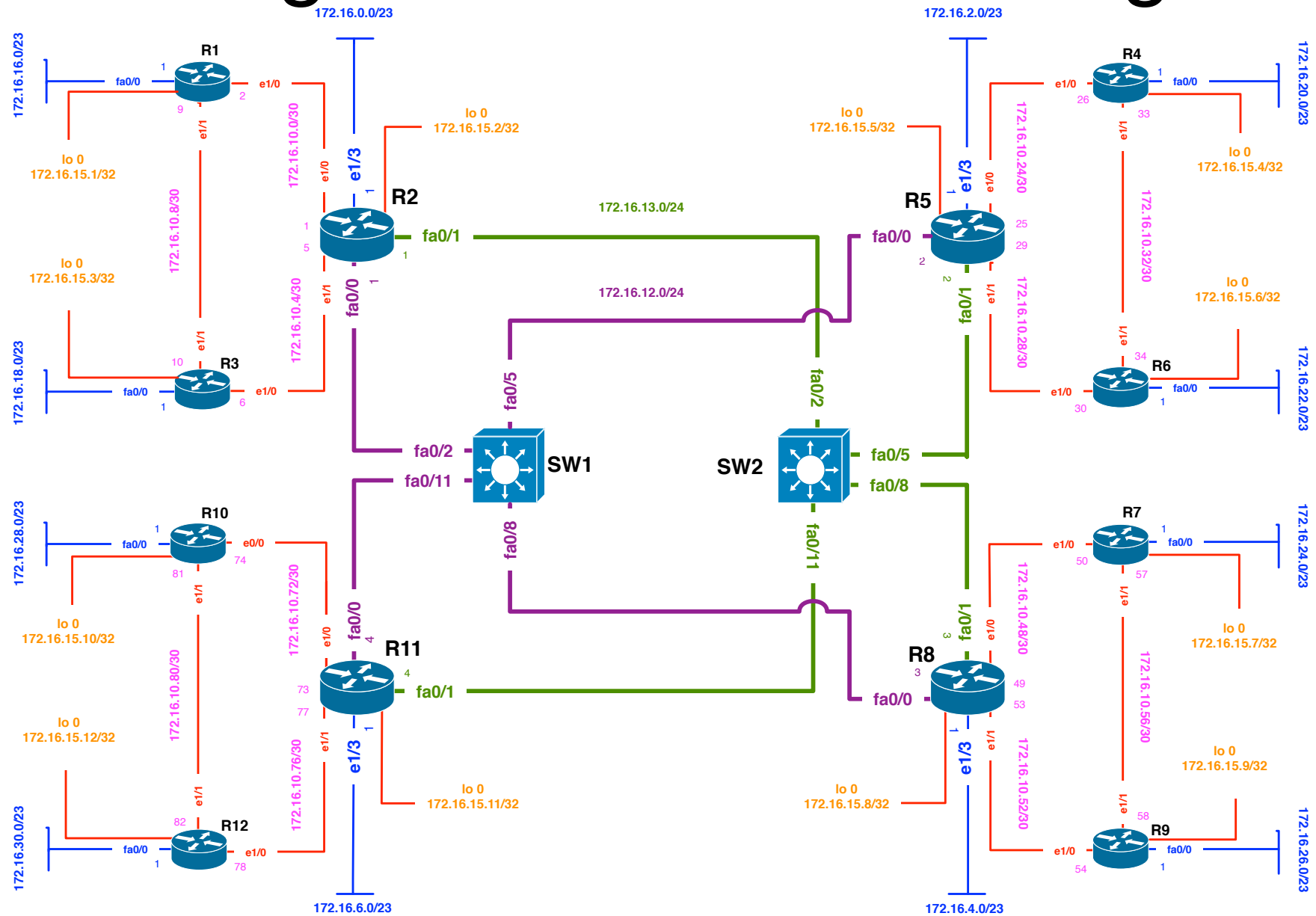
25	172.16.12.0	/24	Transport link PURPLE	No	
26	172.16.13.0	/24	Transport link GREEN	No	
27	172.16.15.0	/24	Loopback	No	

Training ISP IPV4 Addressing Plan

Detail customer block

Block#	Prefix	Size	Description	SOR	Register
28	172.16.6.0	/20	Customer network		
29	172.16.16.0	/22	Router2 summary net		
30	172.16.16.0	/23	Router1 CS network	Yes	Must
31	172.16.18.0	/23	Router3 CS network	Yes	Must
32	172.16.20.0	/22	Router5 summary net		
33	172.16.20.0	/23	Router4 CS network	Yes	Must
34	172.16.22.0	/23	Router6 CS network	Yes	Must
35	172.16.24.0	/22	Router8 summary net		
36	172.16.24.0	/23	Router7 CS network	Yes	Must
37	172.16.26.0	/23	Router9 CS network	Yes	Must
38	172.16.28.0	/22	Router11 summary net		
39	172.16.28.0	/23	Router10 CS network	Yes	Must
40	172.16.30.0	/23	Router12 CS network	Yes	Must

Training ISP IPV4 Addressing Plan



Training ISP IPv4 Address Plan



Questions?

Configuration of OSPF as IGP

Minimum Router OS require for OSPF3:

Cisco IOS

- 12.2(15)T or later (For OSPFv3)
- 12.2(2)T or later (For IPv6 support)

Jun OS

- JUNOS 8.4 or later

Configuration of OSPF as IGP

Before enabling OSPF3 on an Interface following steps must be done on a Router:

- Enable IPv6 unicast routing
- Enable IPv6 CEF

```
config t  
ipv6 unicast-routing  
ipv6 cef (distributed cef)
```

Configuration of OSPF as IGP

Configure interface for both IPv4 and IPv6:

```
interface e1/0
description WAN R1-R2
no ip redirects
no ip directed-broadcast
no ip unreachable
ip address 172.16.10.2 255.255.255.252
no shutdown
```

```
interface e1/0
ipv6 address 2406:6400:000F:0000::2/64
ipv6 enable
```

Configuration of OSPF as IGP

Verify Interface configuration:

```
sh ip interface e0/0
```

```
ping 172.16.10.1
```

```
sh ipv6 interface e0/0
```

```
ping 2406:6400:000F:0000::2
```

Configuration of OSPF as IGP

IPv4 Interface configuration for Router1:

```
interface loopback 0
description Router1 Loopback
no ip redirects
no ip directed-broadcast
no ip unreachable
ip address 172.16.15.1 255.255.255.255
no shutdown

interface e1/0
description WAN R1-R2
no ip redirects
no ip directed-broadcast
no ip unreachable
ip address 172.16.10.2 255.255.255.252
no shutdown
```



Configuration of OSPF as IGP

IPv4 Interface configuration for Router1:

```
interface e1/1
description WAN R1-R3
no ip redirects
no ip directed-broadcast
no ip unreachables
ip address 172.16.10.9 255.255.255.252
no shutdown

interface fa0/0
description Router1 customer network
no ip redirects
no ip directed-broadcast
no ip unreachables
no cdp enable
ip address 172.16.16.1 255.255.255.0
no shutdown
```



Configuration of OSPF as IGP

IPv6 Interface configuration for Router1:

```
interface loopback 0
```

```
ipv6 address 2406:6400:0000:0000::1/128
```

```
ipv6 enable
```

```
interface e1/0
```

```
ipv6 address 2406:6400:000F:0000::2/64
```

```
ipv6 enable
```

```
interface e1/1
```

```
ipv6 address 2406:6400:000F:0002::1/64
```

```
ipv6 enable
```

```
interface fa0/0
```

```
ipv6 address 2406:6400:0100:0000::1/48
```

```
ipv6 enable
```

Configuration of OSPF as IGP

OSPF Configuration for IPv4:

- OSPF for IPv4 can be configured from global configuration mode
- Interface mode configuration will also activate OSPF process on your running config

Configuration of OSPF as IGP

OSPF Configuration for IPv6:

- OSPF for IPv6 need to configure from Interface configuration mode
- Interface mode configuration will automatically activate OSPF process on your running config

Configuration of OSPF as IGP

OSPF for IPv6 Configuration Command:

```
router ospf 17821
log-adjacency-changes
passive-interface default
network 172.16.15.1 0.0.0.0 area 1
no passive-interface e1/0
network 172.16.10.0 0.0.0.3 area 1
no passive-interface e1/1
network 172.16.10.8 0.0.0.3 area 1
```

Configuration of OSPF as IGP

OSPF for IPv6 Configuration Command:

```
interface loopback 0
ipv6 ospf 17821 area 1
interface e1/0
ipv6 ospf 17821 area 1
interface e1/1
ipv6 ospf 17821 area 1
```

Configuration of OSPF as IGP

Verify OSPF configuration:

```
sh run
```

```
!
```

```
interface Ethernet1/0
```

```
description WAN R1-R2
```

```
ip address 172.16.10.2 255.255.255.252
```

```
no ip redirects
```

```
no ip unreachable
```

```
half-duplex
```

```
ipv6 address 2406:6400:F::2/64
```

```
ipv6 enable
```

```
ipv6 ospf 17821 area 1
```



Configuration of OSPF as IGP

Example OSPF configuration for Router1:

```
router ospf 17821
log-adjacency-changes
passive-interface default
network 172.16.15.1 0.0.0.0 area 1
no passive-interface e1/0
network 172.16.10.0 0.0.0.3 area 1
no passive-interface e1/1
network 172.16.10.8 0.0.0.3 area 1
```

Configuration of OSPF as IGP

Example OSPF configuration for Router1:

```
interface loopback 0
ipv6 ospf 17821 area 1
interface e1/0
ipv6 ospf 17821 area 1
interface e1/1
ipv6 ospf 17821 area 1
```


OSPF Packet Type

Five OSPF Packet Type:

t: Specifies the OSPF packet type:

- 1: hello [every 10 sec]
- 2: DBD [Database Descriptor Packet]
- 3: LSR [Link State Request Packet]
- 4: LSU [Link State Update Packet]
- 5: LSAck [Link State Ack Packet]

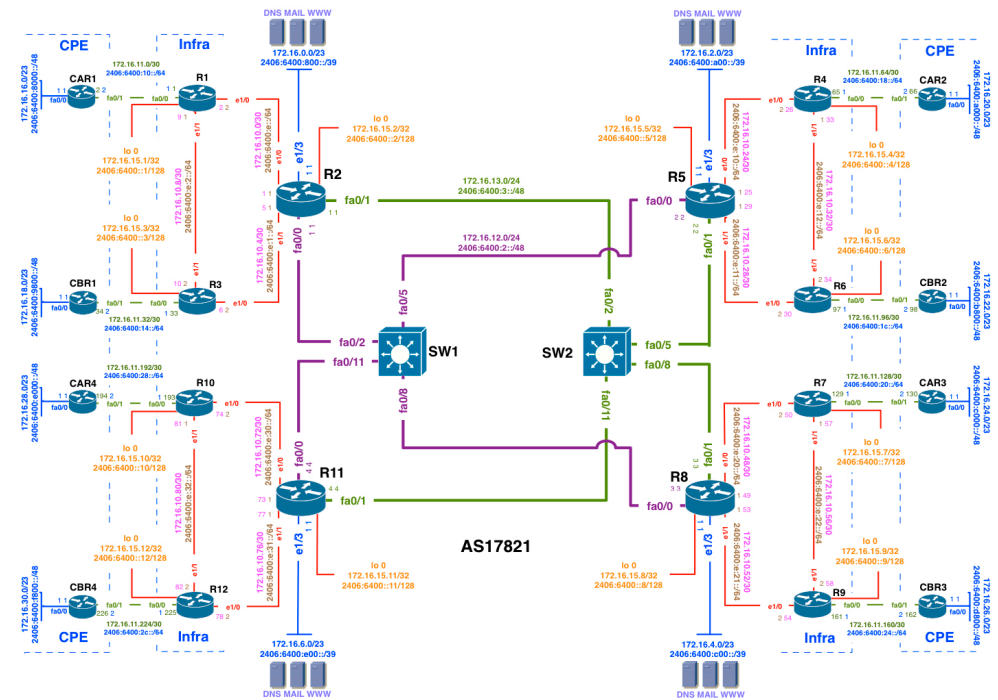
```
debug ip ospf packet
```

```
debug ipv6 ospf packet
```

Questions?

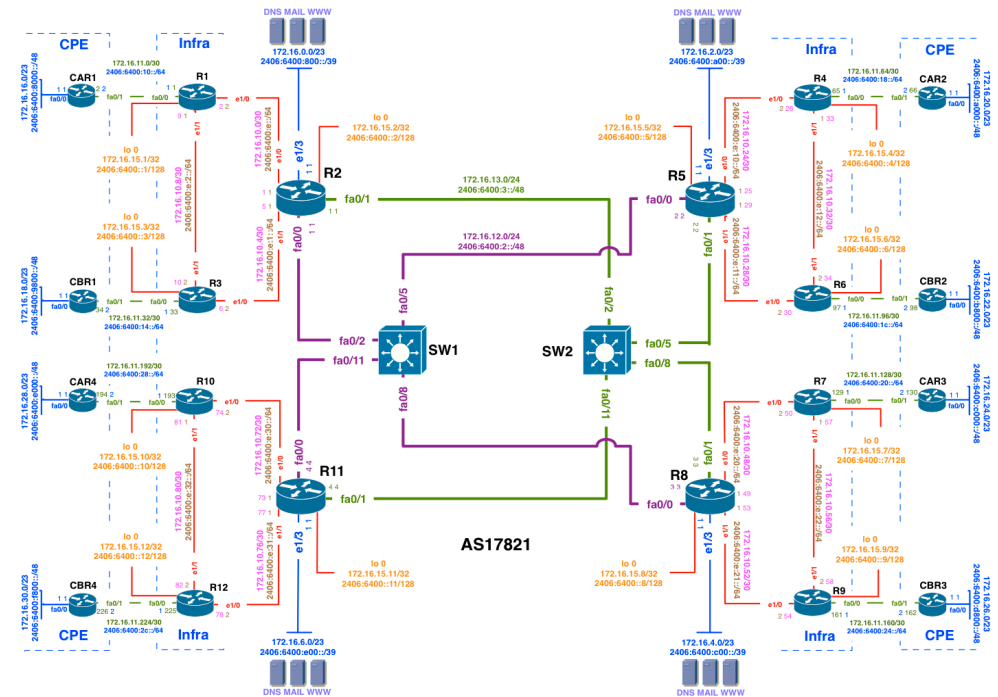
Route Filtering

- Types of prefixes in IP core network:
 - Internal Prefixes
 - External prefixes
 - Downstream customers
 - Internet prefixes



Route Filtering

- Internal prefixes originated in IP core network
 - Loopback
 - Connect inter-regional networks
 - Transport
 - Infrastructure point-to-point
 - Customer side point-to-point
 - Data centre
 - Some ISP originate from separate AS if it is a large public hosting operation and multihome DC



Route Filtering

- Loopback Prefix
 - Prefix size /128
 - Advertised in IGP i.e. OSPF
 - Scope within IP core network
 - Can be summarize in IGP i.e. OSPF if the number of loopback prefixes are large within the region

Route Filtering

Loopback prefixes in Training
ISP network:

```
Router1#sh ipv6 route
IPv6 Routing Table - default - 51 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       D - EIGRP, EX - EIGRP external, ND - Neighbor Discovery, I - LISP
       O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
```

```
LC 2406:6400::1/128 [0/0]
   via Loopback0, receive
OI 2406:6400::2/128 [110/10]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
O  2406:6400::3/128 [110/10]
   via FE80::C802:1FF:FEAE:1D, Ethernet1/1
OI 2406:6400::4/128 [110/21]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400::5/128 [110/11]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400::6/128 [110/21]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400::7/128 [110/21]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400::8/128 [110/11]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400::9/128 [110/21]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400::10/128 [110/21]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400::11/128 [110/11]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400::12/128 [110/21]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
```



Route Filtering

- Transport Prefix
 - Prefix size can be /64~/48
 - /48 is preferred if BGP traffic engineering required in future
 - Advertised in IGP i.e. OSPF
 - Scope within IP core network

Route Filtering

Transport prefixes in Training
ISP network:

```
Router1#sh ipv6 route
IPv6 Routing Table - default - 51 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
        B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
        I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
        D - EIGRP, EX - EIGRP external, ND - Neighbor Discovery, I - LISP
        O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
        ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
```

```
OI 2406:6400:2::/48 [110/11]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400:3::/48 [110/11]
   via FE80::C801:1FF:FEAE:1C, Ethernet1/0
```


Route Filtering

- Prefixes advertised/originated in IP core network
 - Point-to-point
 - Infrastructure point-to-point
 - Prefix size /64 [/127 on interface configuration according to rfc-6164]
 - Advertised in IGP i.e. OSPF
 - Scope within IP core network
 - Can be summarize in IGP i.e. OSPF if the number of p-to-p prefixes are large within the region
 - Customer side point-to-point
 - Prefix size /64 [/127 on interface configuration according to rfc-6164]
 - Advertise from EGP i.e. iBGP (Not OSPF)
 - Scope within IP core network
 - Summarization in iBGP using network statement and pull up route [Atomic summarization]

Route Filtering

Infrastructure p-to-p prefixes in
Training ISP network:

```
Router1#sh ipv6 route
IPv6 Routing Table - default - 51 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
        B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
        I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
        D - EIGRP, EX - EIGRP external, ND - Neighbor Discovery, I - LISP
        O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
        ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
```

```
C 2406:6400:E::/64 [0/0]
  via Ethernet1/0, directly connected
O 2406:6400:E:1::/64 [110/20]
  via FE80::C802:1FF:FEAE:1D, Ethernet1/1
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
C 2406:6400:E:2::/64 [0/0]
  via Ethernet1/1, directly connected
OI 2406:6400:E:10::/64 [110/21]
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400:E:11::/64 [110/21]
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400:E:12::/64 [110/31]
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400:E:20::/64 [110/21]
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400:E:21::/64 [110/21]
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400:E:22::/64 [110/31]
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400:E:30::/64 [110/21]
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400:E:31::/64 [110/21]
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
OI 2406:6400:E:32::/64 [110/31]
  via FE80::C801:1FF:FEAE:1C, Ethernet1/0
```

Route Filtering

Customer p-to-p prefixes in
Training ISP network:

```
Router1#sh ipv6 route
IPv6 Routing Table - default - 51 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
        B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
        I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
        D - EIGRP, EX - EIGRP external, ND - Neighbor Discovery, I - LISP
        O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
        ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
```

```
S 2406:6400:10::/48 [1/0]
   via Null0, directly connected
B 2406:6400:14::/48 [200/0]
   via 2406:6400::3
B 2406:6400:18::/48 [200/0]
   via 2406:6400::4
B 2406:6400:1C::/48 [200/0]
   via 2406:6400::6
B 2406:6400:20::/48 [200/0]
   via 2406:6400::7
B 2406:6400:24::/48 [200/0]
   via 2406:6400::9
B 2406:6400:28::/48 [200/0]
   via 2406:6400::10
B 2406:6400:2C::/48 [200/0]
   via 2406:6400::12
```

Route Filtering

- Data Centre Prefix
 - Prefix assignment can be /48 or a number of /48 if need more
 - /48 is preferred as it will support specific BGP network advertisement for traffic engineering purpose
 - Usually advertised in iBGP but ISP can prefer to advertise from separate AS using eBGP if DC is multihome, has separate routing policy then IP core and providing public hosting service
 - Scope within IP core network if single home
 - For multihoming case origin AS is different and ISP will allow transit only

Route Filtering

Data center prefixes in Training
ISP network:

IPv6 Routing Table - default - 51 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP

I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary

D - EIGRP, EX - EIGRP external, ND - Neighbor Discovery, I - LISP

O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2

B 2406:6400:800::/48 [200/0]

via 2406:6400::2

B 2406:6400:A00::/48 [200/0]

via 2406:6400::5

B 2406:6400:C00::/48 [200/0]

via 2406:6400::8

B 2406:6400:E00::/48 [200/0]

via 2406:6400::11

Receiving Prefixes

- There are three scenarios for receiving prefixes from other ASNs
 - Customer talking BGP
 - Peer talking BGP
 - Upstream/Transit talking BGP
- Each has different filtering requirements and need to be considered separately

Receiving Prefixes: From Customers

- ISPs should only accept prefixes which have been assigned or allocated to their downstream customer
- If ISP has assigned address space to its customer, then the customer IS entitled to announce it back to his ISP
- If the ISP has NOT assigned address space to its customer, then:
 - Check in the five RIR databases to see if this address space really has been assigned to the customer. **Legitimacy of Address (LoA)** check
 - The tool: `whois -h jwhois.apnic.net x.x.x.0/24`
 - (jwhois queries all RIR database)

Receiving Prefixes: From Customers

- Example use of whois to check if customer is entitled to announce address space:

```
$ whois -h whois.apnic.net 2406:6400::/32
```

```
Inet6num:      2406:6400::/32
netname:      APNIC-AP
descr:       Asia Pacific Network Information Centre
descr:       Regional Internet Registry for the Asia-Pacific
descr:       6 Cordelia Street
descr:       South Brisbane, QLD 4101
descr:       Australia
country:      AU
admin-c:      AIC1-AP
tech-c:       NO4-AP
mnt-by:       APNIC-HM
mnt-irt:      IRT-APNIC-AP
changed:      hm-changed@apnic.net
status:       ASSIGNED PORTABLE
changed:      hm-changed@apnic.net 20110309
source:       APNIC
```

Portable – means its an assignment to the customer, the customer can announce it to you

Receiving Prefixes: From Peers

- A peer is an ISP with whom you agree to exchange prefixes you originate into the Internet routing table
 - Prefixes you accept from a peer are only those they have indicated they will announce
 - Prefixes you announce to your peer are only those you have indicated you will announce

Receiving Prefixes: From Peers

- Agreeing what each will announce to the other:
 - Exchange of e-mail documentation as part of the peering agreement, and then ongoing updates

OR

- Use of the Internet Routing Registry and configuration tools such as the IRRToolSet

www.isc.org/sw/IRRToolSet/

- New initiative Resource Certification (RPKI)

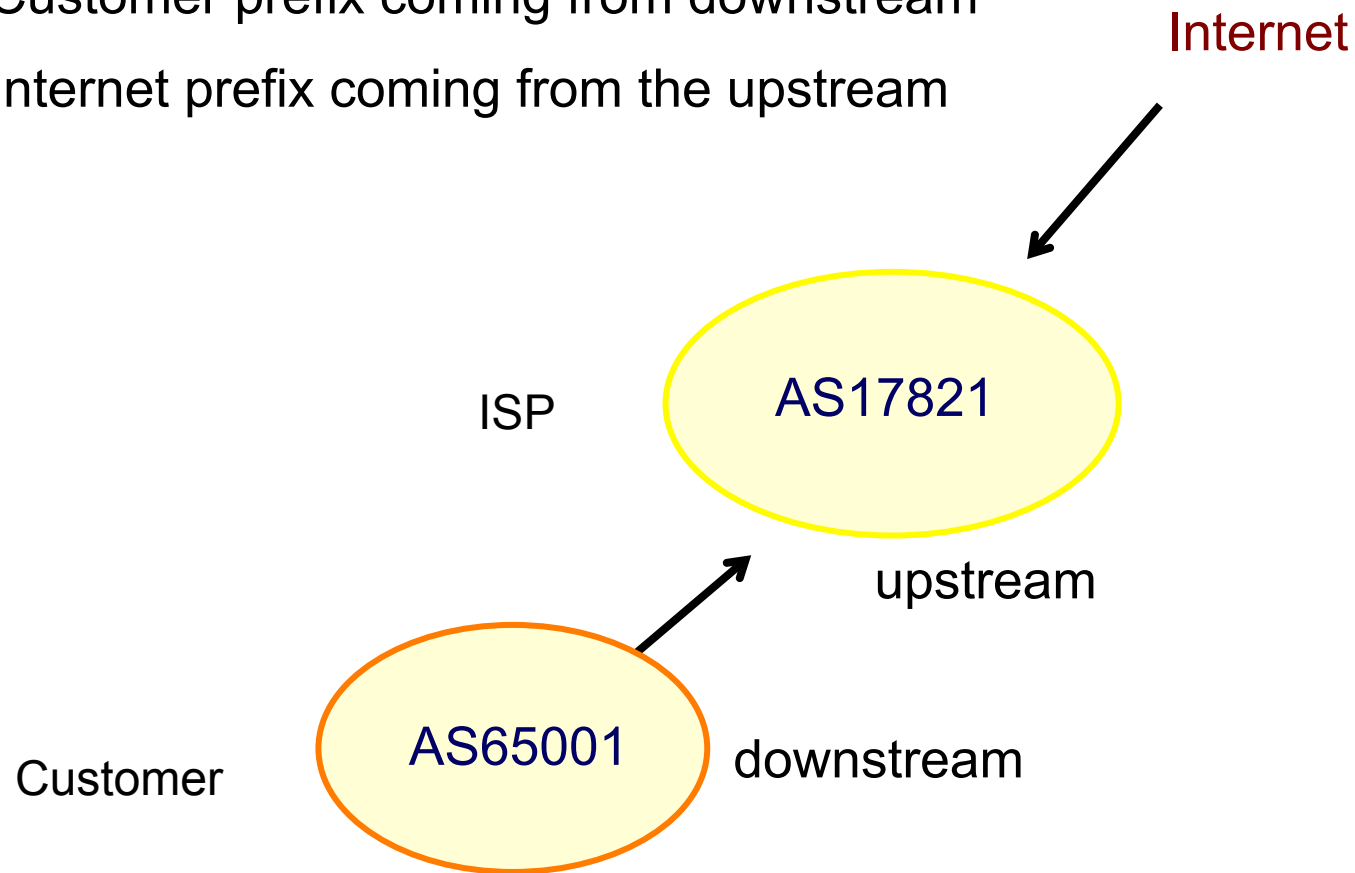
<http://www.apnic.net/services/services-apnic-provides/resource-certification>

Receiving Prefixes: From Upstream

- Upstream/Transit Provider is an ISP who you pay to give you transit to the WHOLE Internet
- Receiving prefixes from them is not desirable unless really necessary
 - Traffic Engineering – see BGP Multihoming presentations
- Ask upstream/transit provider to either:
 - originate a default-route
 - OR
 - announce one prefix you can use as default

Route Filtering Case study

- External Prefixes
 - Customer prefix coming from downstream
 - Internet prefix coming from the upstream



Route Filtering

Downstream customer prefixes
in Training ISP network:

```
Router1#sh ipv6 route
```

```
IPv6 Routing Table - default - 51 entries
```

```
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
```

```
B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
```

```
I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
```

```
D - EIGRP, EX - EIGRP external, ND - Neighbor Discovery, I - LISP
```

```
O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
```

```
ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
```

```
B 2406:6400:8000::/48 [20/0]
  via FE80::C80C:1FF:FEAF:6, FastEthernet0/0
B 2406:6400:9800::/48 [200/0]
  via 2406:6400::3
B 2406:6400:A000::/48 [200/0]
  via 2406:6400::4
B 2406:6400:B800::/48 [200/0]
  via 2406:6400::6
B 2406:6400:C000::/48 [200/0]
  via 2406:6400::7
B 2406:6400:D800::/48 [200/0]
  via 2406:6400::9
B 2406:6400:E000::/48 [200/0]
  via 2406:6400::10
B 2406:6400:F800::/48 [200/0]
  via 2406:6400::12
```

Route Filtering

Upstream Internet prefixes in
Training ISP network:

```
Router1#sh ipv6 route
IPv6 Routing Table - default - 51 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
        B - BGP, HA - Home Agent, MR - Mobile Router, R - RIP
        I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
        D - EIGRP, EX - EIGRP external, ND - Neighbor Discovery, I - LISP
        O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
        ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
```

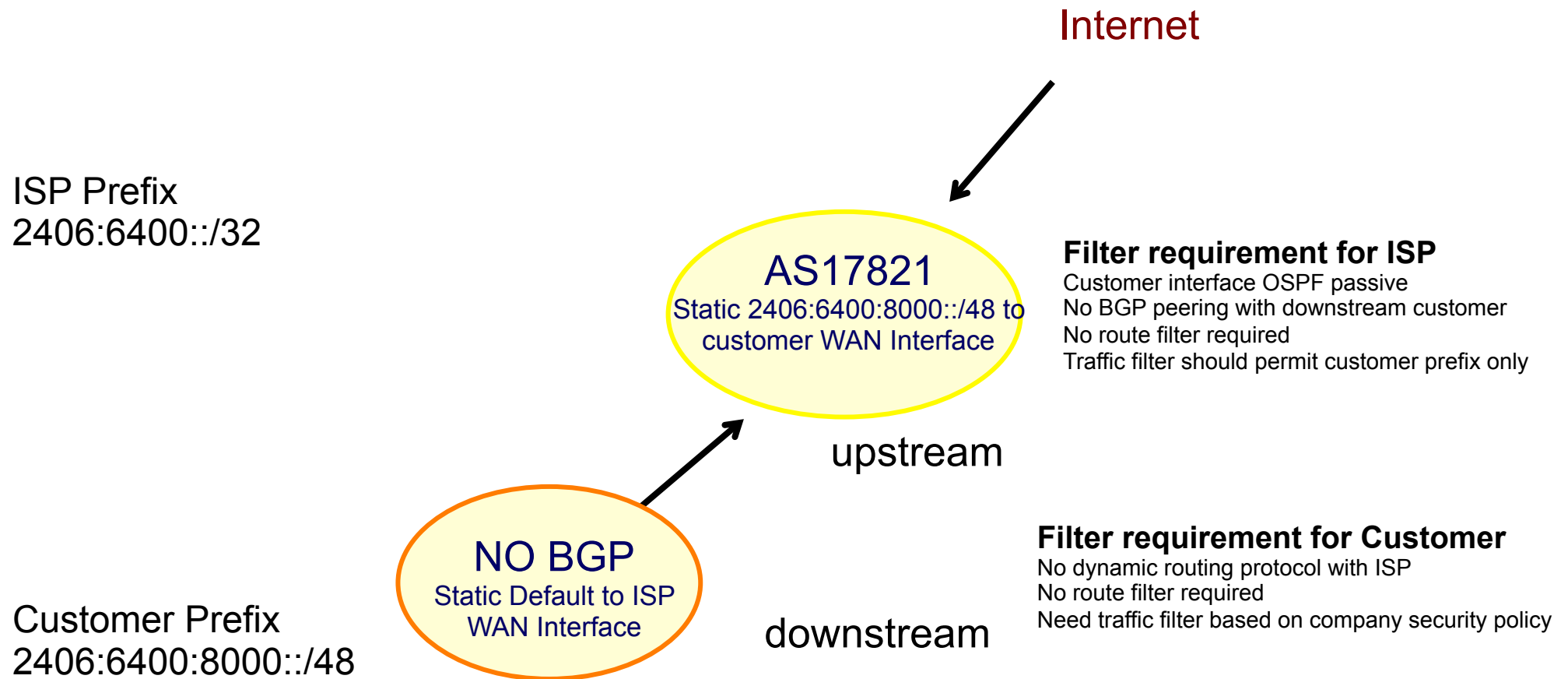
```
B 2406:6400:8000::/48 [20/0]
   via FE80::C80C:1FF:FEAF:6, FastEthernet0/0
B 2406:6400:9800::/48 [200/0]
   via 2406:6400::3
B 2406:6400:A000::/48 [200/0]
   via 2406:6400::4
B 2406:6400:B800::/48 [200/0]
   via 2406:6400::6
B 2406:6400:C000::/48 [200/0]
   via 2406:6400::7
B 2406:6400:D800::/48 [200/0]
   via 2406:6400::9
B 2406:6400:E000::/48 [200/0]
   via 2406:6400::10
B 2406:6400:F800::/48 [200/0]
   via 2406:6400::12
```

Route Filtering

- Customer prefix coming from downstream:
 - Option 1: Customer **single home** and **non portable prefix**
 - Customer is not APNIC member prefix received from upstream ISP
 - Option 2: Customer **single home** and **portable prefix**
 - Customer is APNIC member receive allocation as service provider but no AS number yet
 - Option 3: Customer **multihome** and **non portable prefix**
 - Customer is not APNIC member both prefix and ASN received from upstream ISP
 - Option 4: Customer **multihome** and **portable prefix**
 - Customer is APNIC member both prefix and ASN received from APNIC

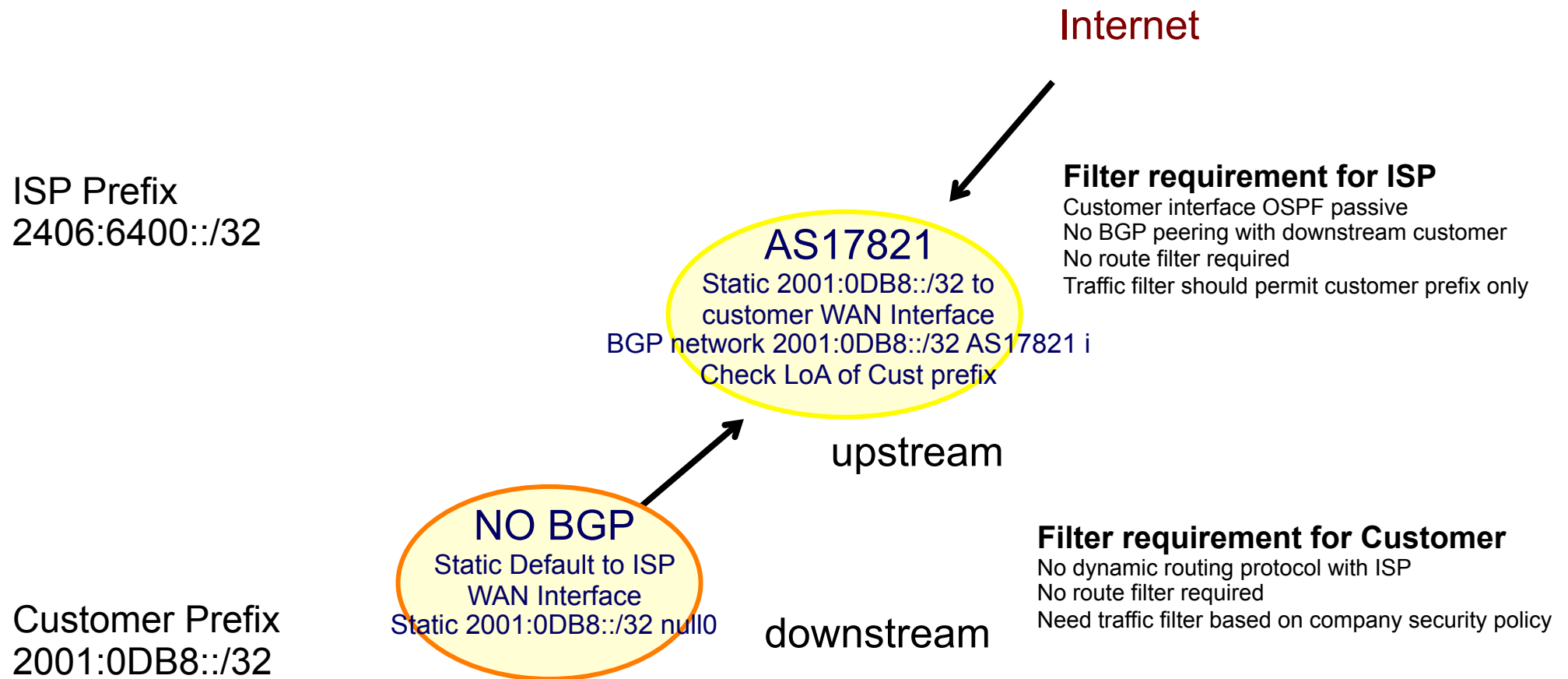
Route Filtering

- Option 1: Customer **single home** and **non portable prefix**



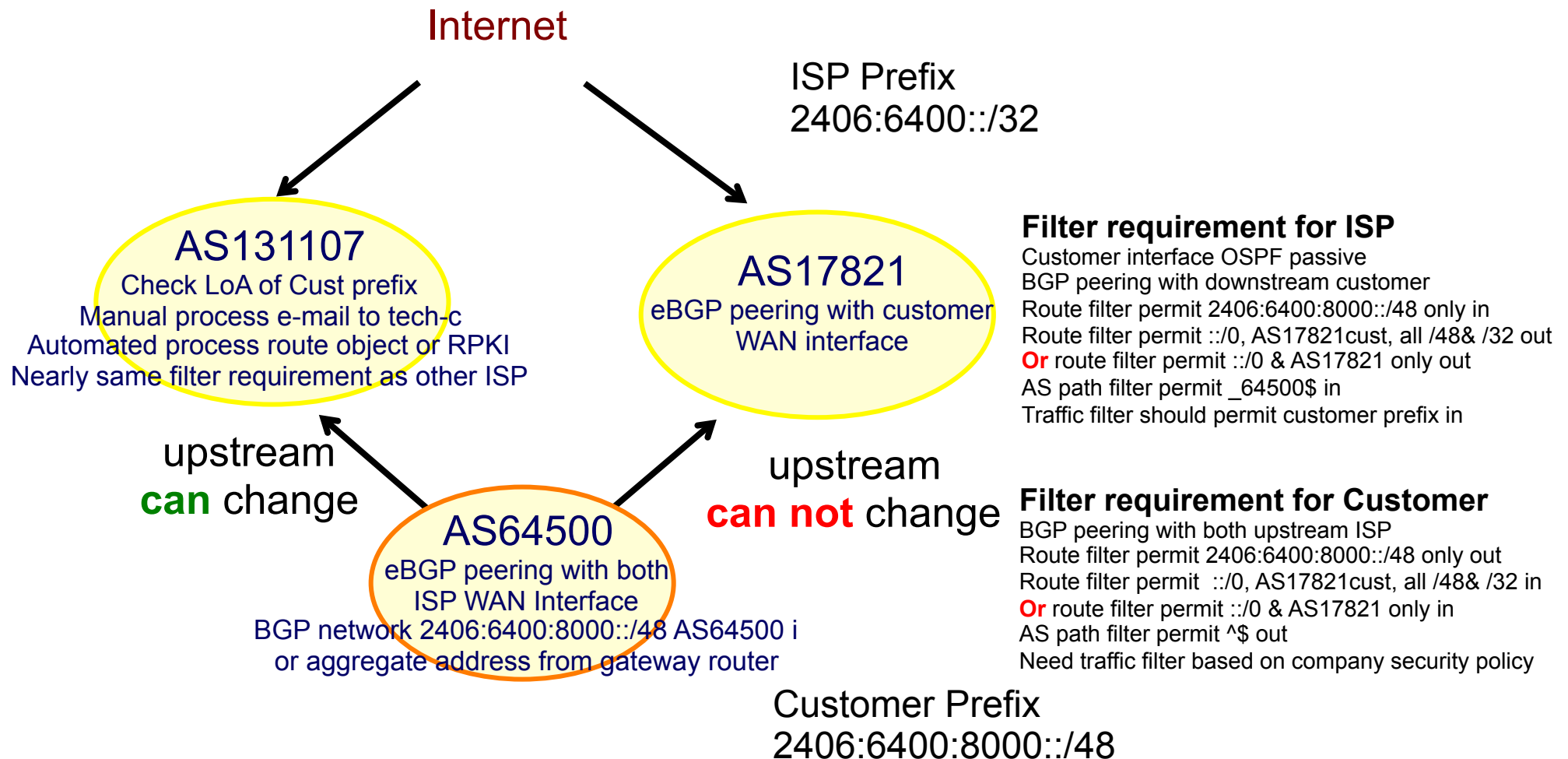
Route Filtering

- Option 2: : Customer **single home** and **portable prefix**



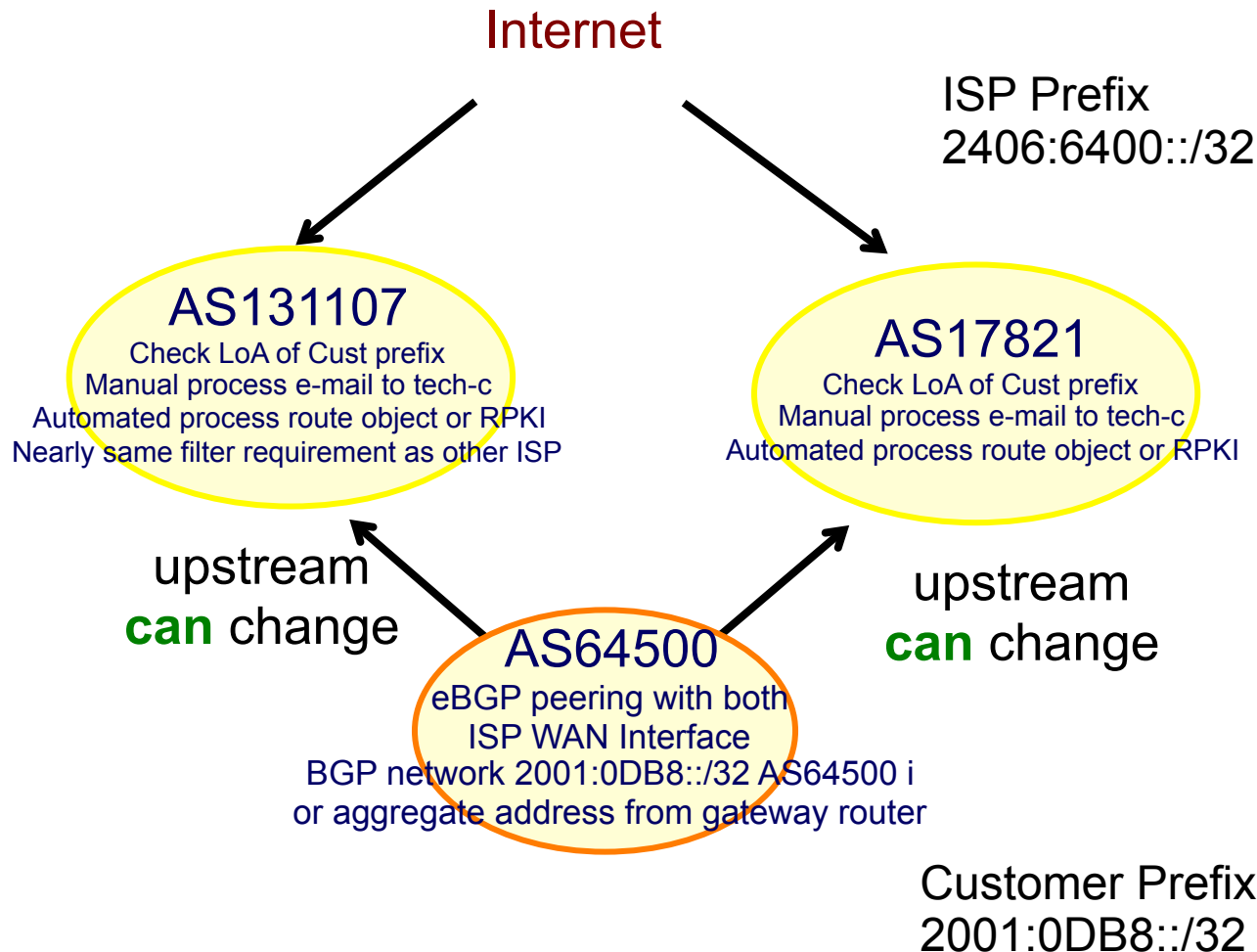
Route Filtering

- Option 3: Customer **multihome** and **non portable prefix**



Route Filtering

- Option 4: Customer **multihome** and **portable prefix**



Filter requirement for ISP

Customer interface OSPF passive
BGP peering with downstream customer
Route filter permit 2001:0DB8::/32 only in
Route filter permit ::/0, AS17821cust, all /48& /32 out
Or route filter permit ::/0 & AS17821 only out
AS path filter permit _64500\$ in
Traffic filter should permit customer prefix in

Filter requirement for Customer

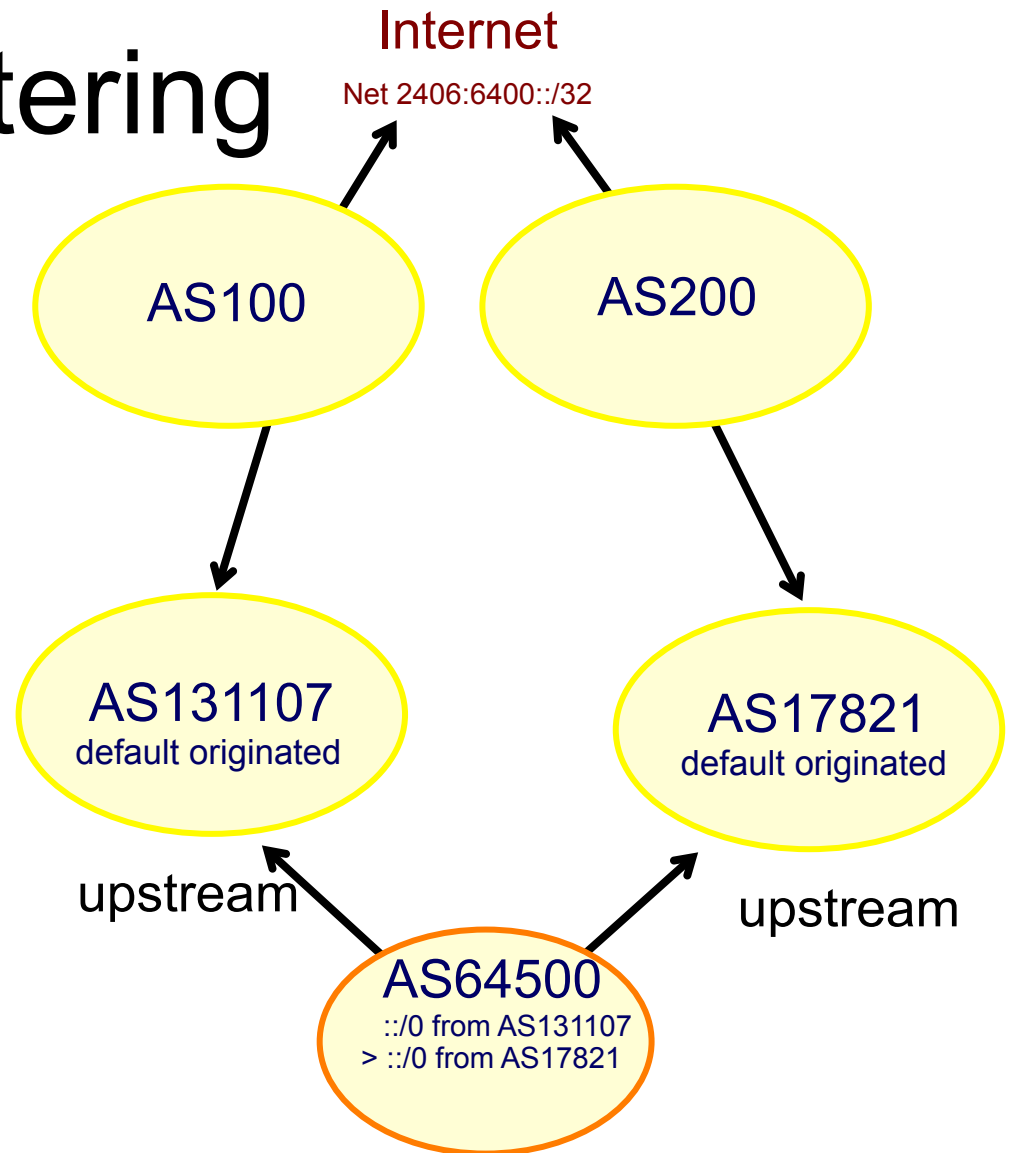
BGP peering with both upstream ISP
Route filter permit 2001:0DB8::/32 only out
Route filter permit ::/0, AS17821cust, all /48& /32 in
Or route filter permit ::/0 & AS17821 only in
AS path filter permit ^\$ out
Need traffic filter based on company security policy

Route Filtering

- Downstream Customer BGP In process design issue:
 - Option 1: ISP **default only** In
 - Customer is accepting ::/0 only from upstream ISP prefix
 - Option 2: ISP **default + local** In
 - Customer is accepting ::/0 and upstream ISP prefix and their other customer portable prefixes (**Non portable prefixes should not**)
 - Option 3: ISP **default + local + all** In
 - Customer is accepting ::/0, upstream ISP aggregated prefix and their other customer portable prefixes (**Non portable prefixes should not**) and all other from Internet

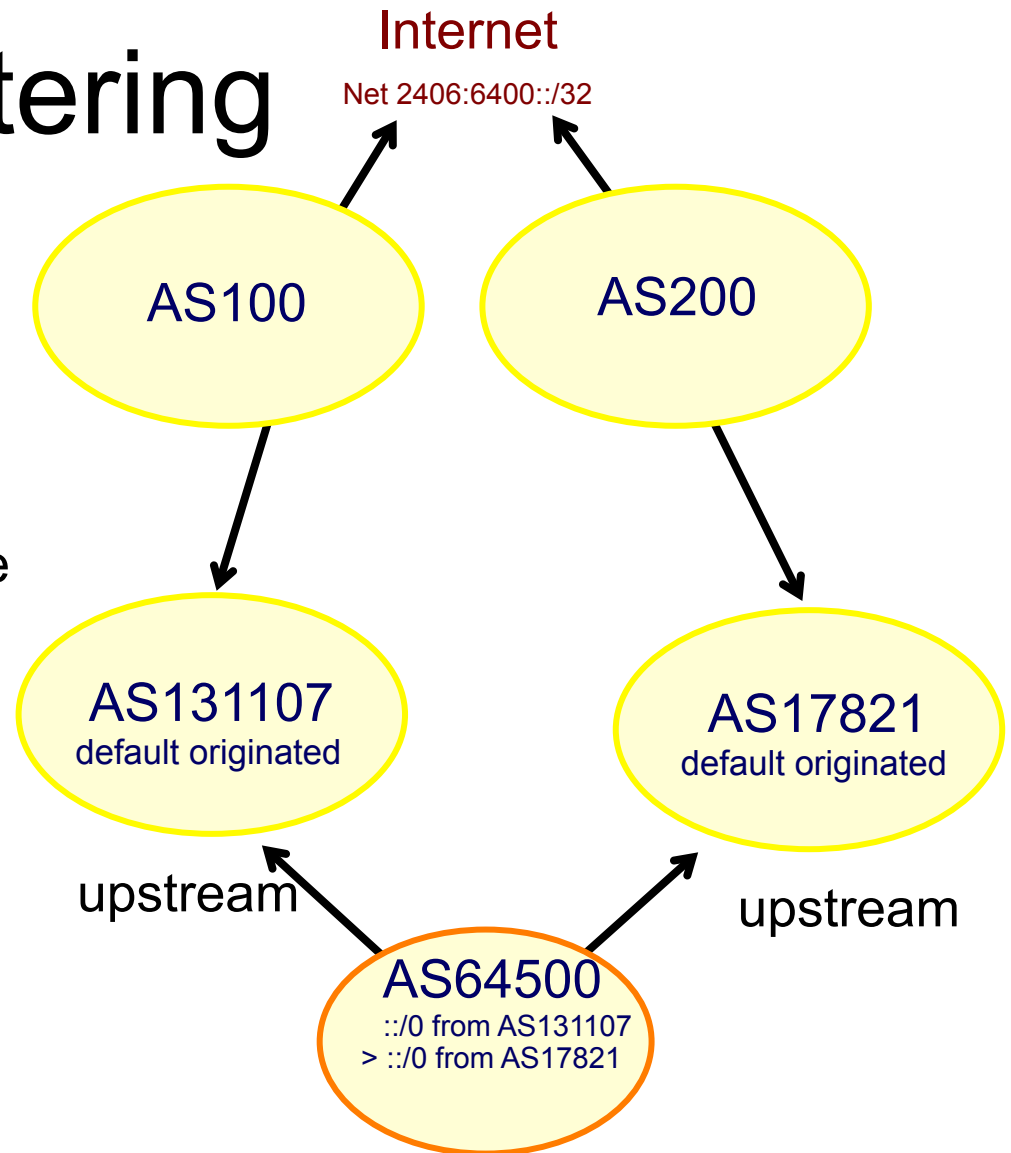
Route Filtering

- Option 1: ISP **default only** In
 - Can use a low configuration router (CPU/DRAM)



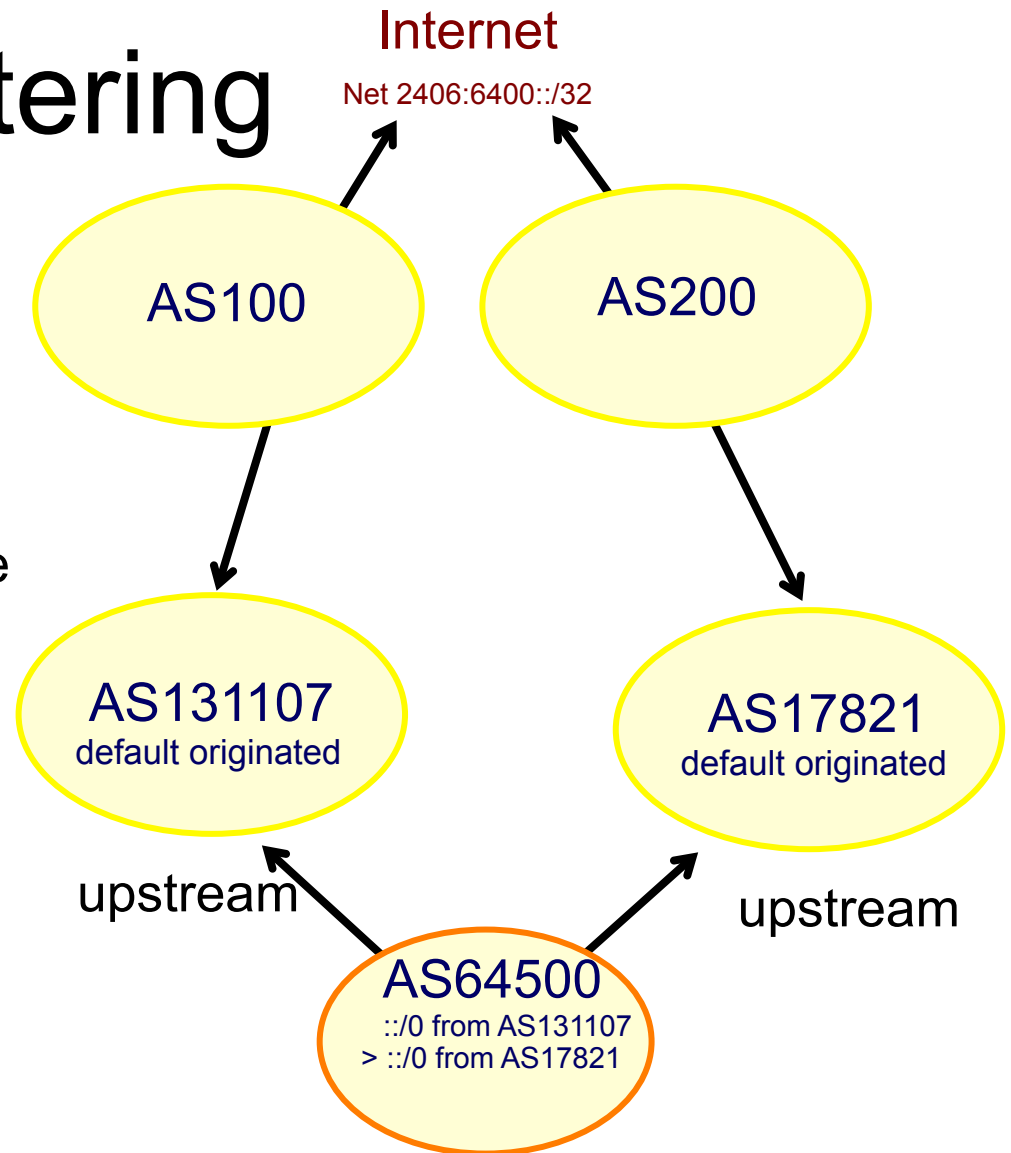
Route Filtering

- Option 1: ISP **default only** In
 - Can use a low configuration router (CPU/DRAM)
 - Easy to manage small routing table



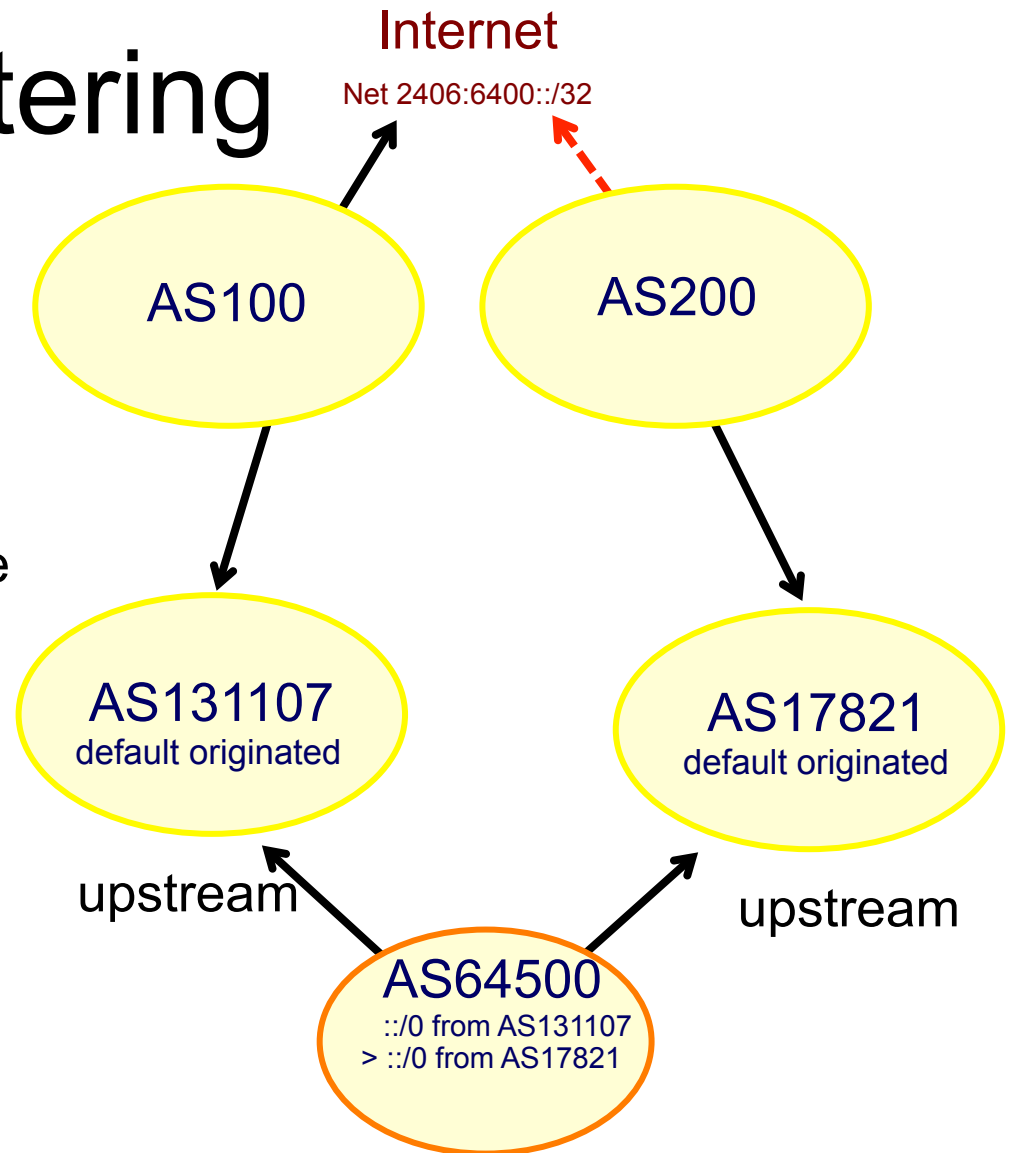
Route Filtering

- Option 1: ISP **default only** In
 - Can use a low configuration router (CPU/DRAM)
 - Easy to manage small routing table
 - Do not support destination specific traffic engineering



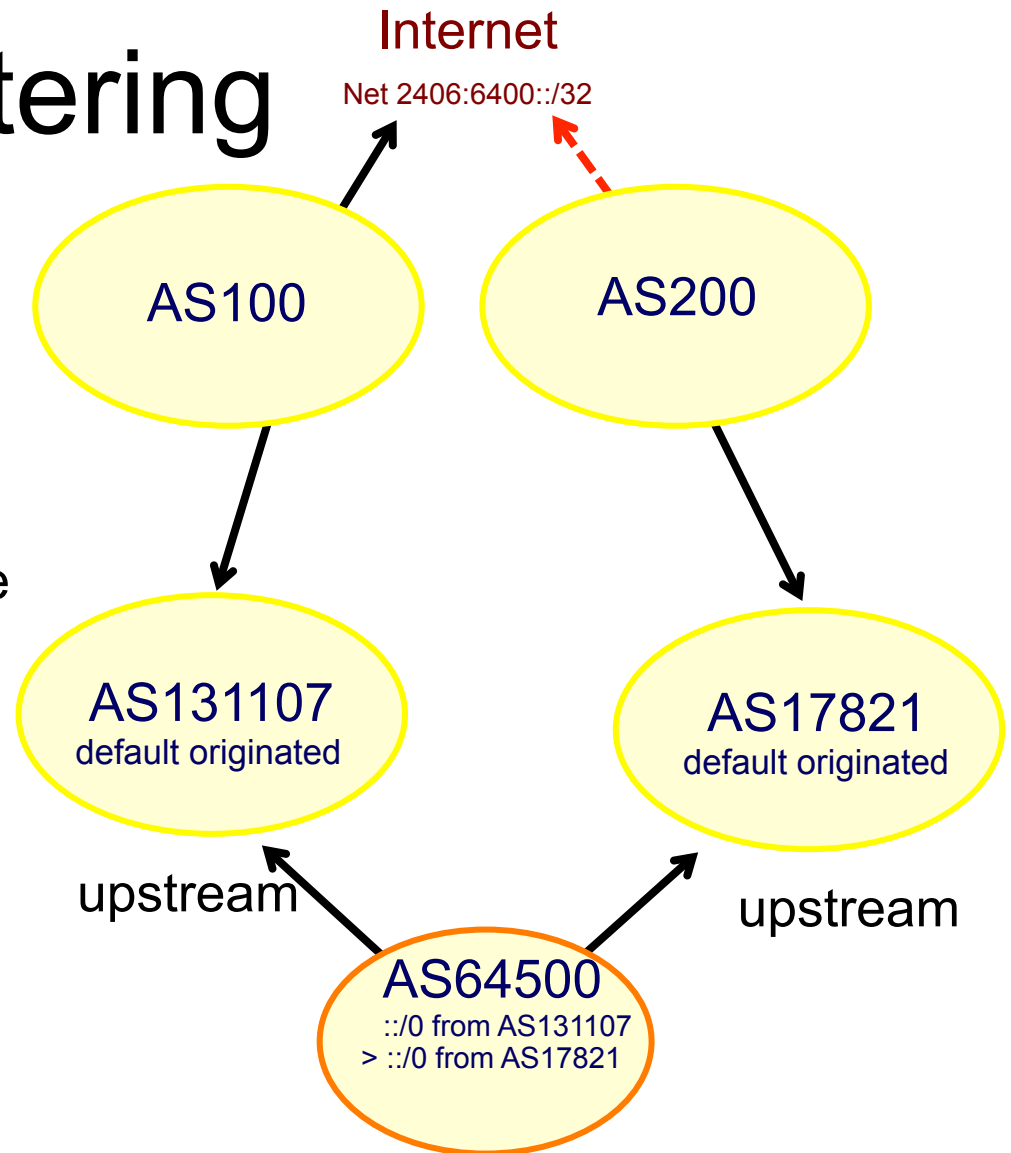
Route Filtering

- Option 1: ISP **default only** In
 - Can use a low configuration router (CPU/DRAM)
 - Easy to manage small routing table
 - Do not support destination specific traffic engineering
 - Can not re-route traffic if remote transit is down



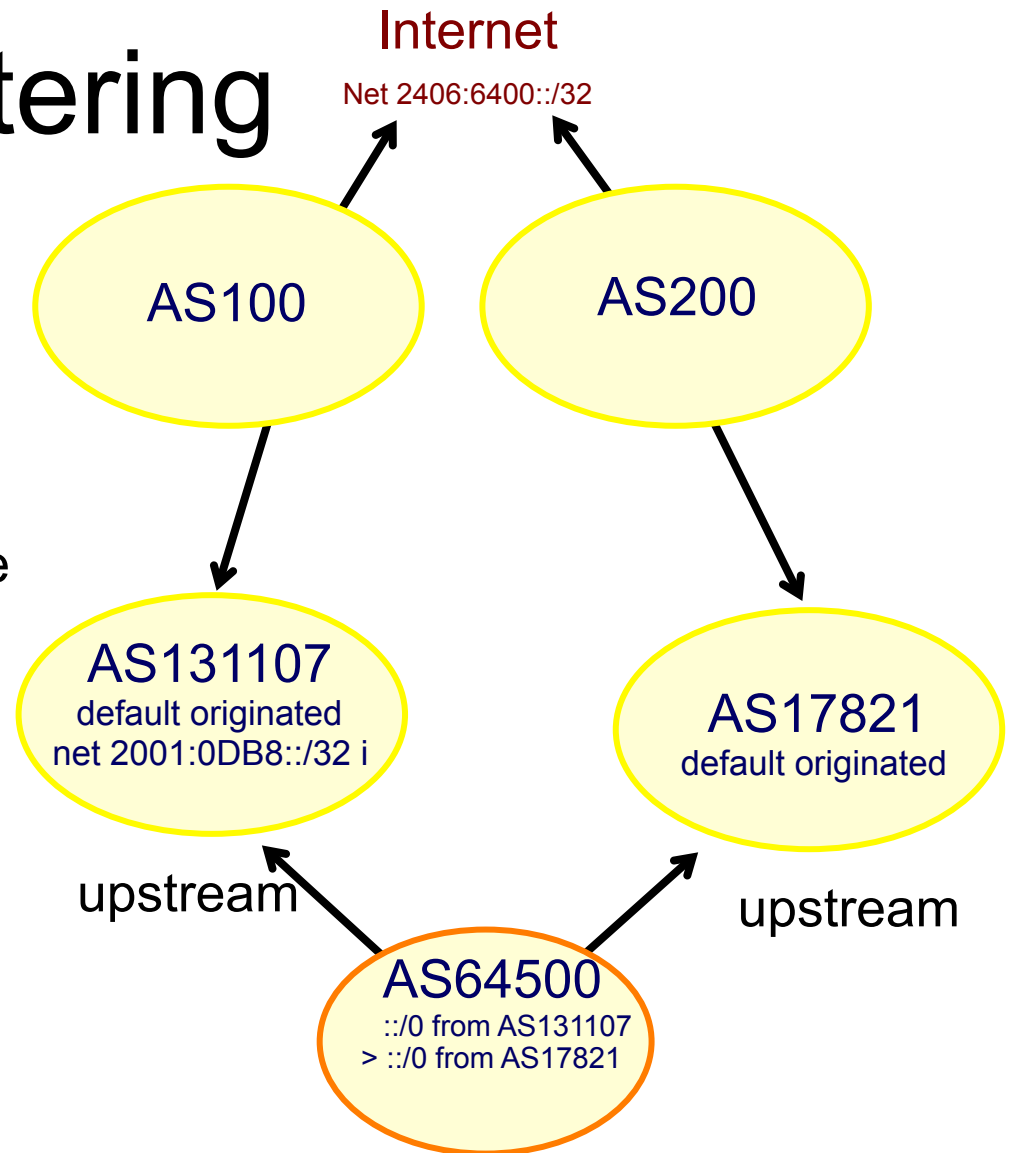
Route Filtering

- Option 1: ISP **default only** In
 - Can use a low configuration router (CPU/DRAM)
 - Easy to manage small routing table
 - Do not support destination specific traffic engineering
 - Can not re-route traffic if remote transit is down
 - I.e. Network 2406:6400::/32 is withdrawn in AS200 but default path in AS64500 is still sending traffic via AS 17821)



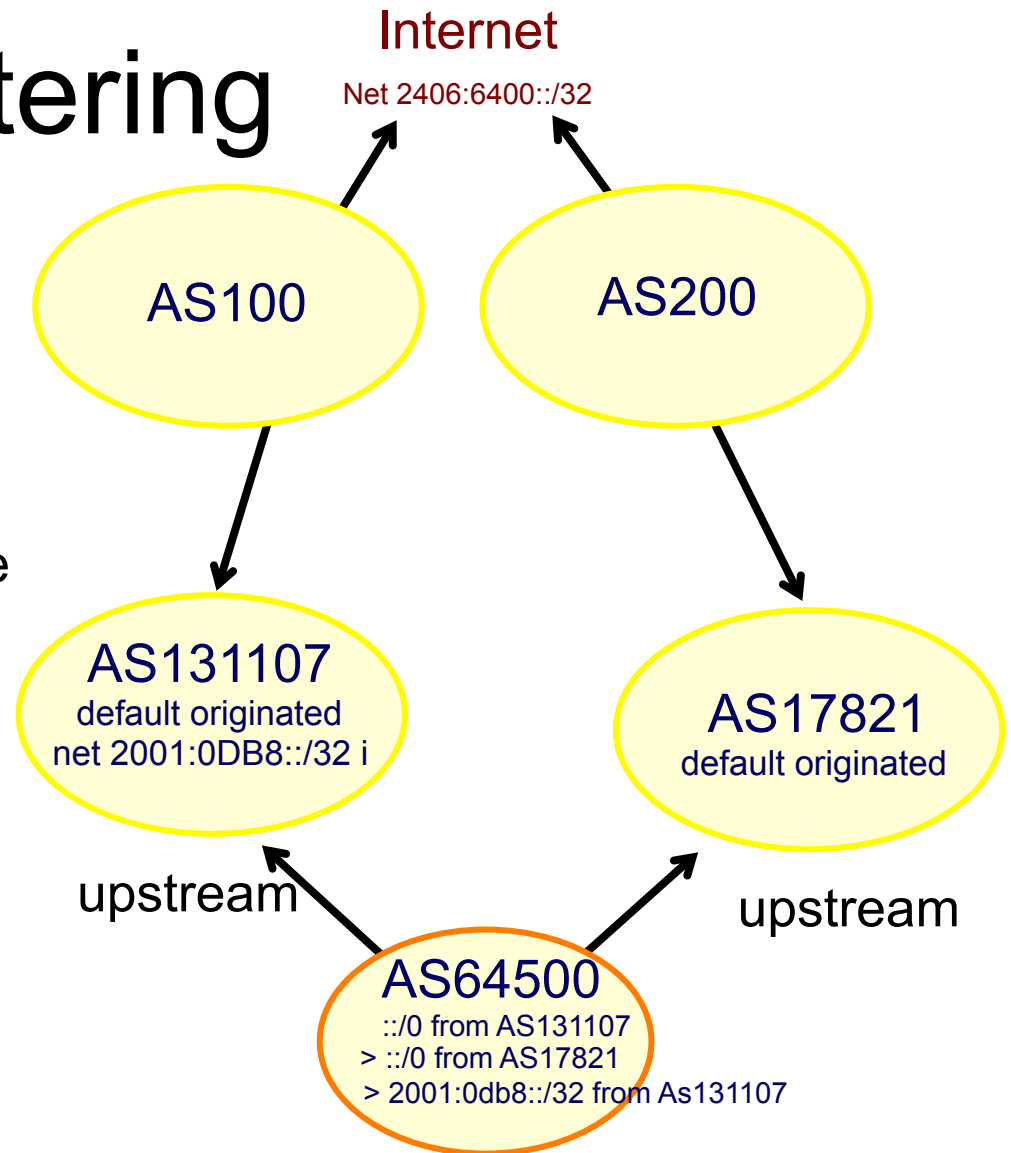
Route Filtering

- Option 1: ISP **default only** In
 - Can use a low configuration router (CPU/DRAM)
 - Easy to manage small routing table
 - Do not support destination specific traffic engineering
 - Can not re-route traffic if remote transit is down
 - Prefixes originated in AS131107 can be routed via AS17821 (**Sub-optimal path**)



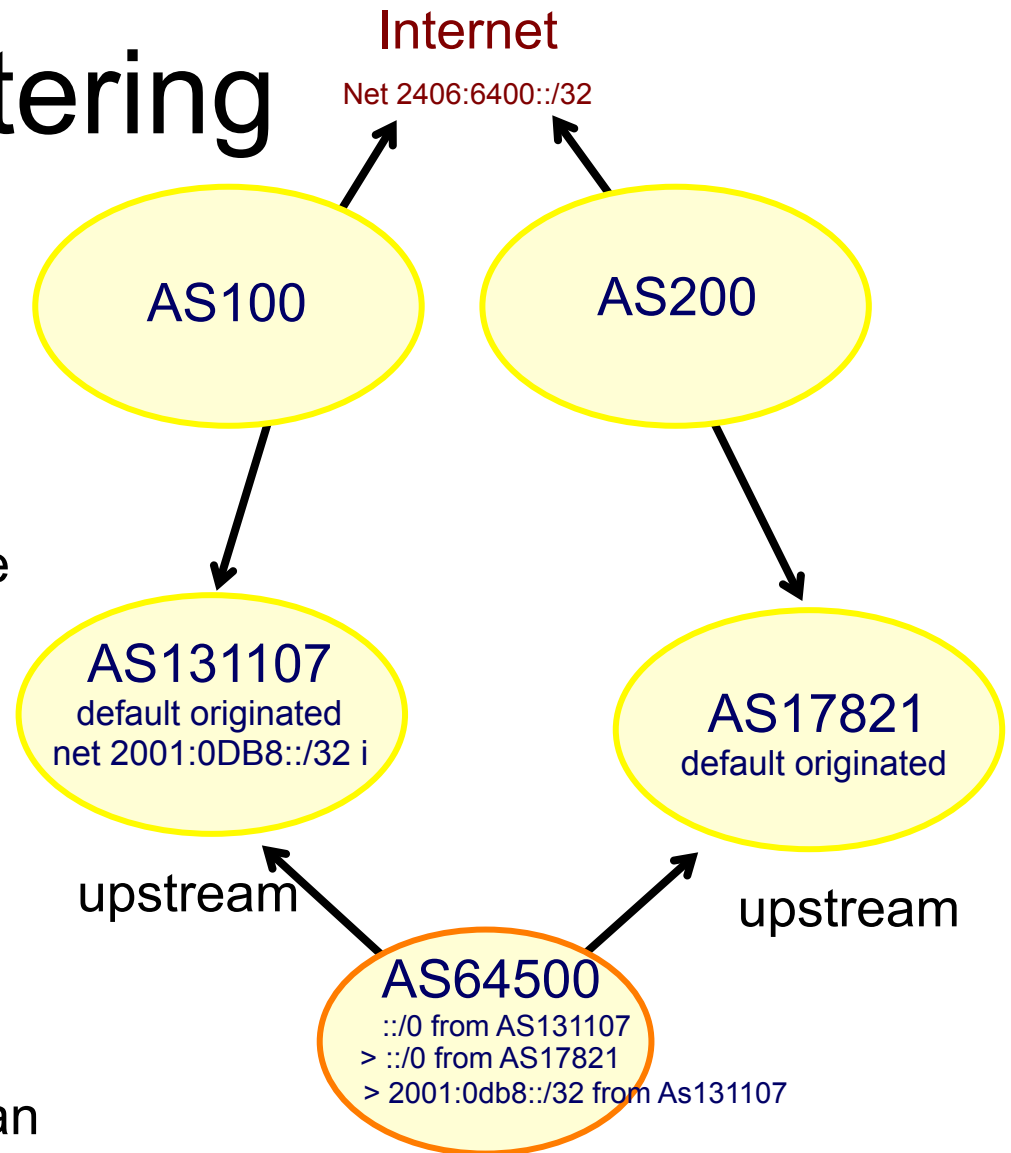
Route Filtering

- Option 2: ISP **default + local** In
 - Can use a low configuration router (CPU/DRAM)
 - Easy to manage small routing table
 - Do not support destination specific traffic engineering to the remote
 - Can not re-route traffic if remote transit is down
 - AS131107 is sending its portable local route to AS64500



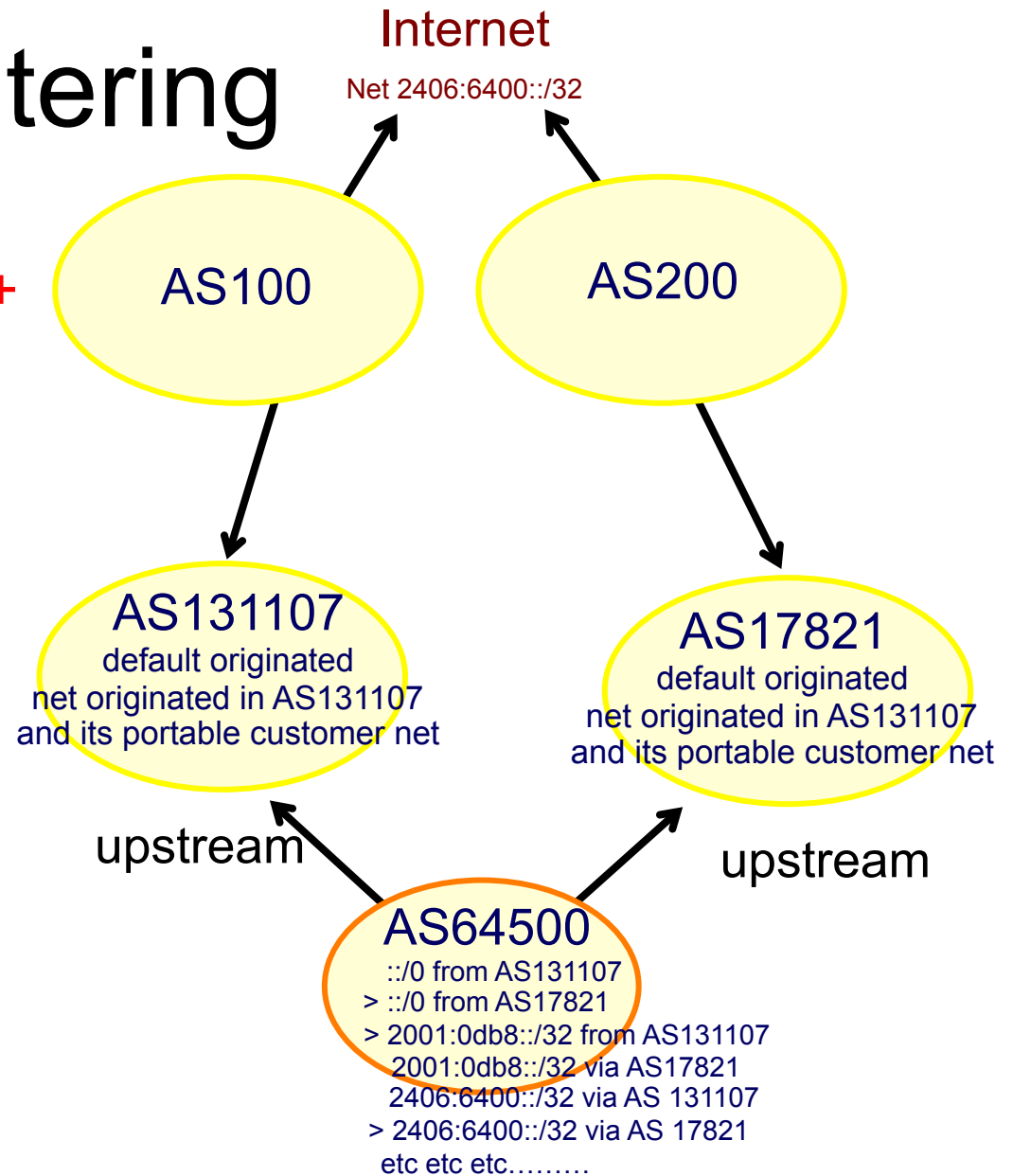
Route Filtering

- Option 2: ISP **default + local** In
 - Can use a low configuration router (CPU/DRAM)
 - Easy to manage small routing table
 - Do not support destination specific traffic engineering to the remote
 - Can not re-route traffic if remote transit is down
 - AS131107 is sending its portable local route to AS64500
 - Prefixes originated in AS131107 can now be routed via AS131107
(Optimal Path)



Route Filtering

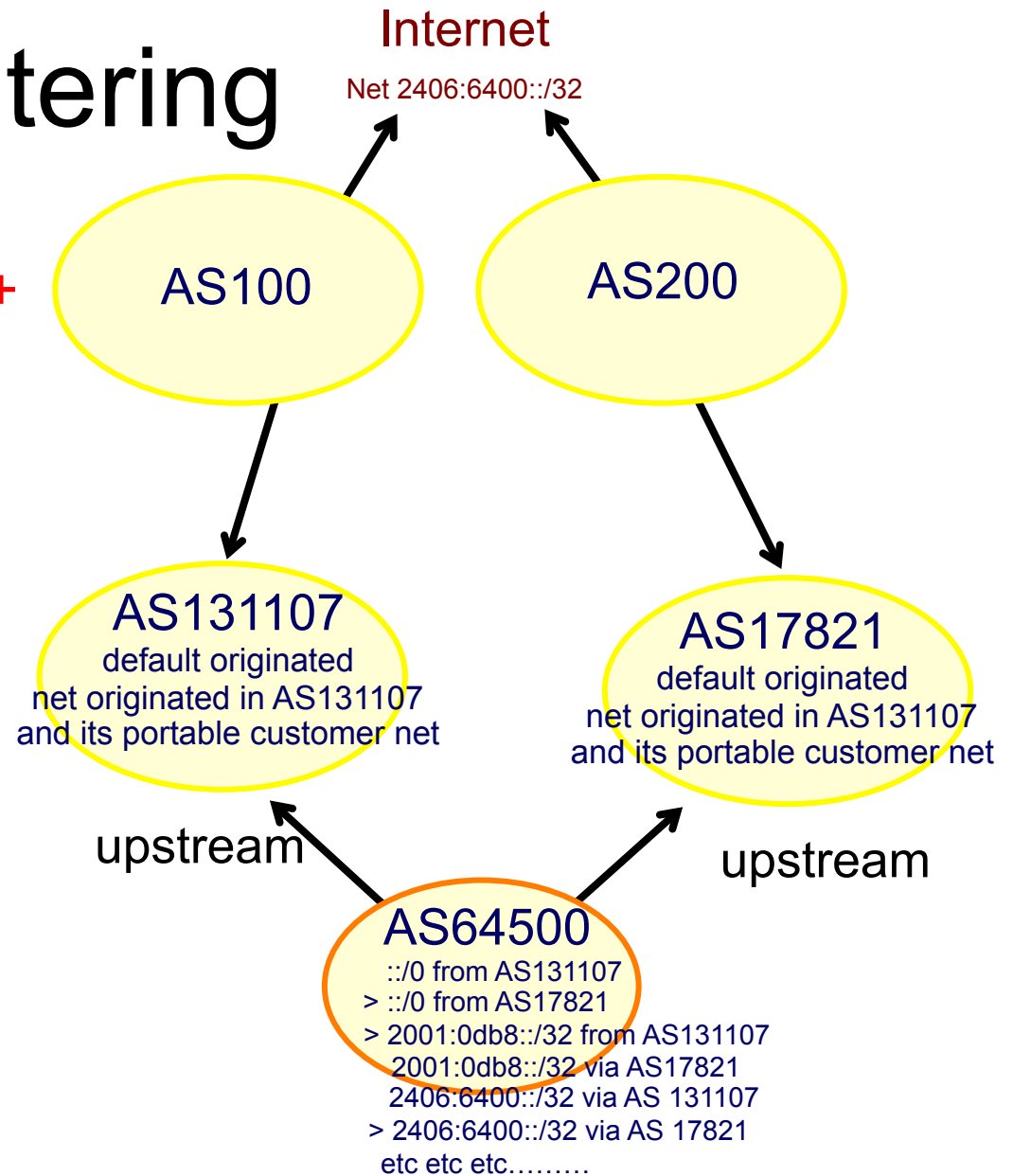
- Option 3: ISP **default + local** + **all** In
 - Need high configuration router (CPU/DRAM)



Route Filtering

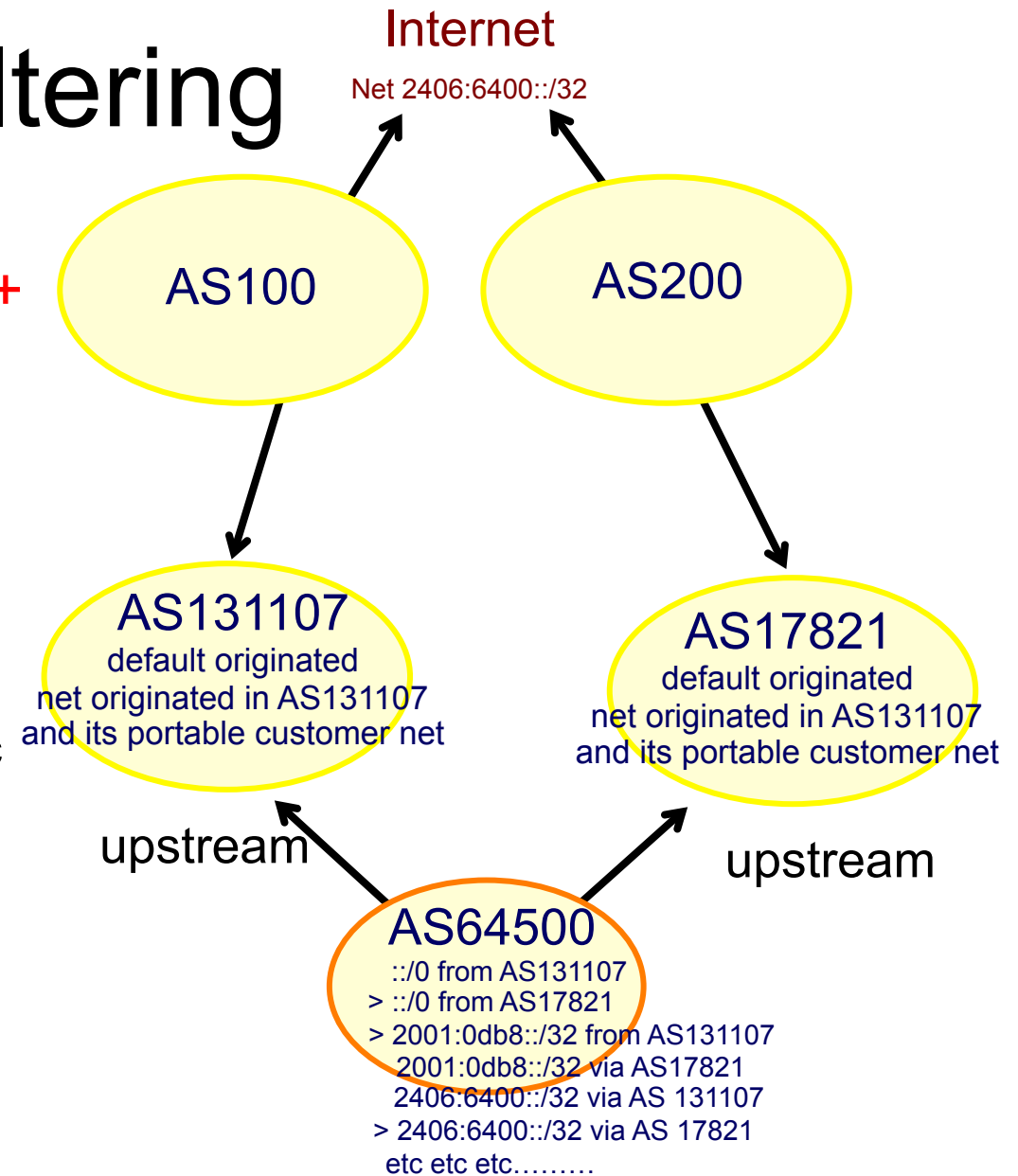
- Option 3: ISP **default + local** + **all In**

- Need high configuration router (CPU/DRAM)
- Need skilled people to manage large routing table



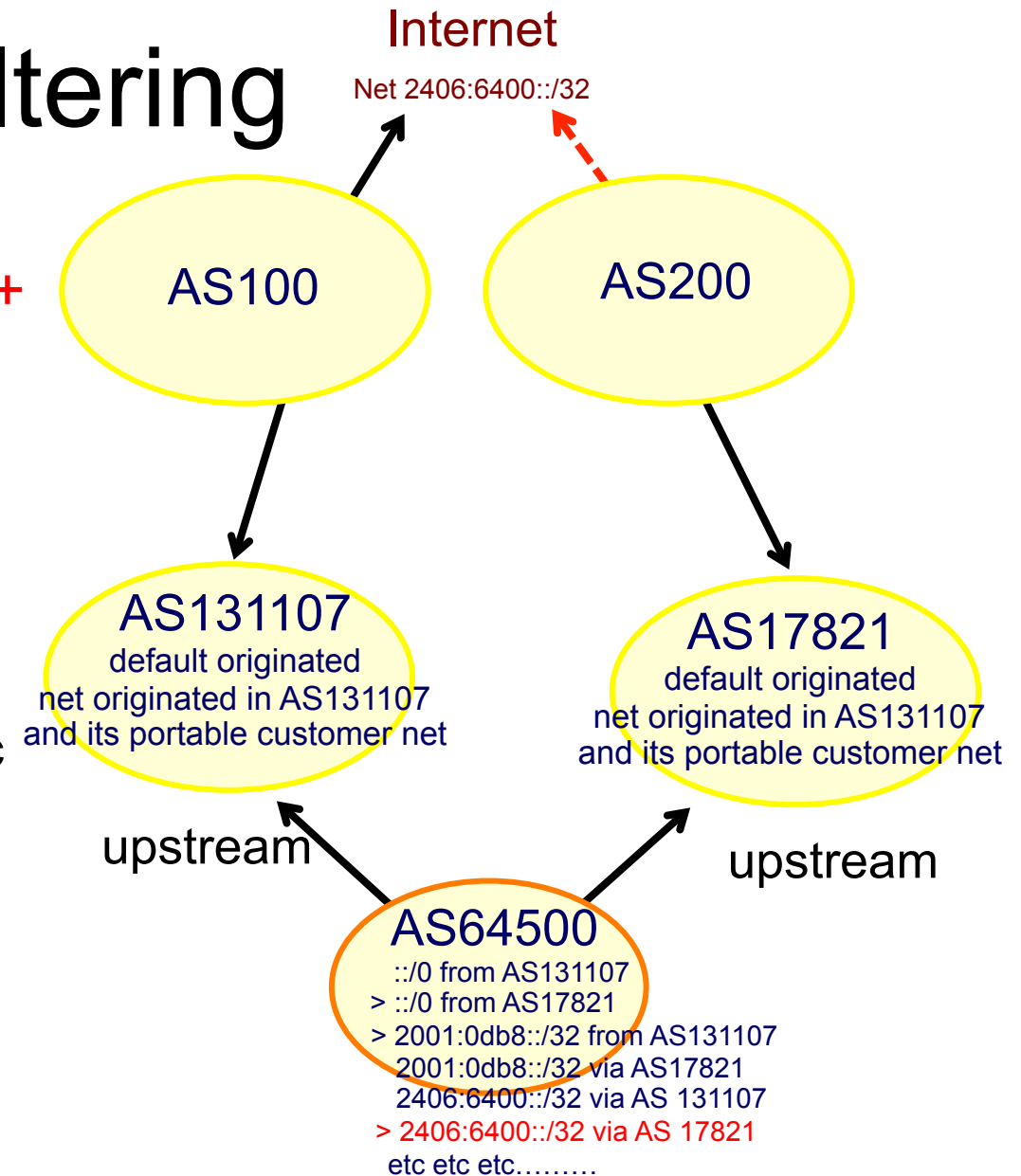
Route Filtering

- Option 3: ISP **default + local** + **all In**
 - Need high configuration router (CPU/DRAM)
 - Need skilled people to manage large routing table
 - Support destination specific traffic engineering to the remote



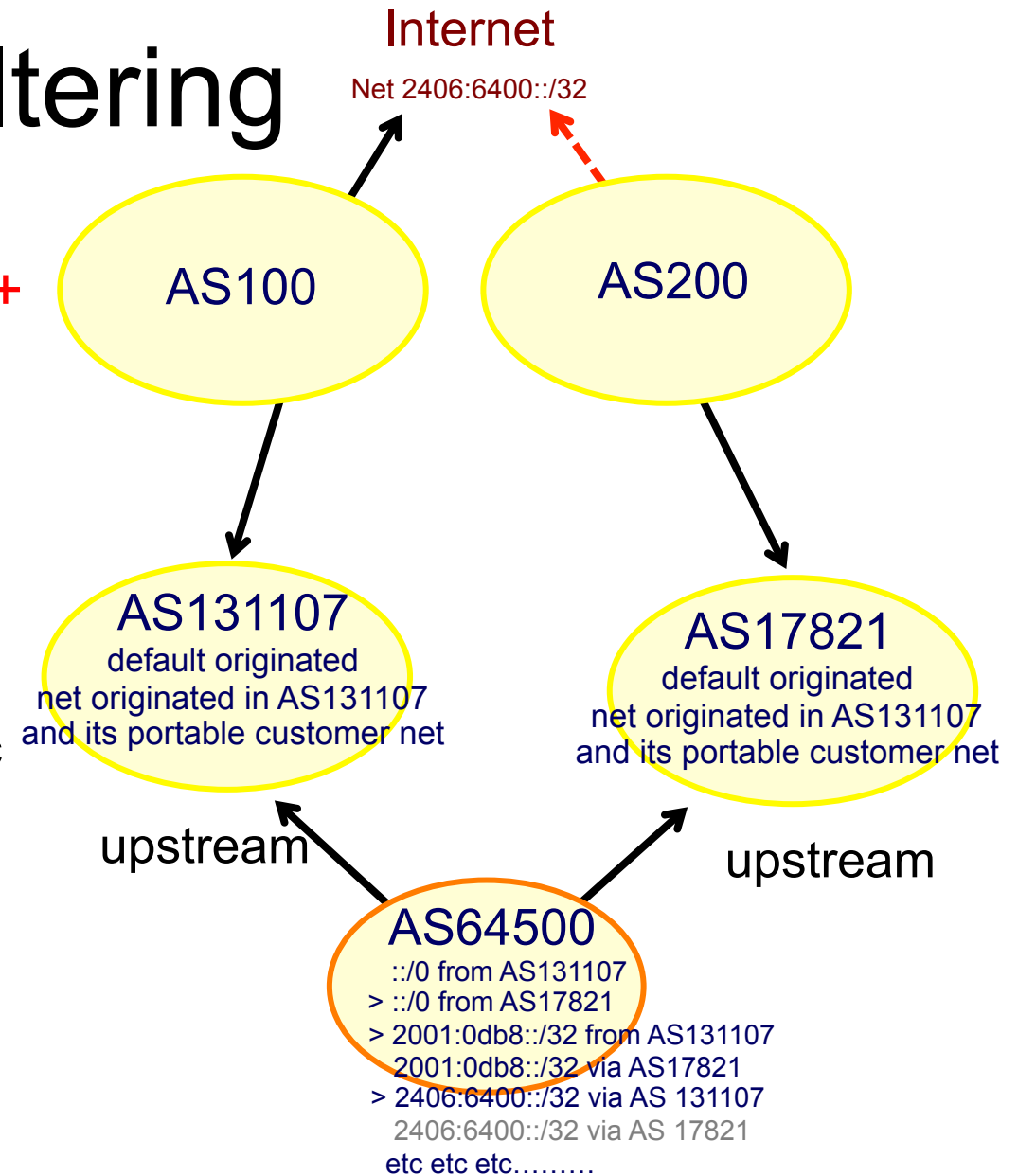
Route Filtering

- Option 3: ISP default + local all In
 - Need high configuration router (CPU/DRAM)
 - Need skilled people to manage large routing table
 - Support destination specific traffic engineering to the remote
 - Can now re-route traffic if remote transit is down



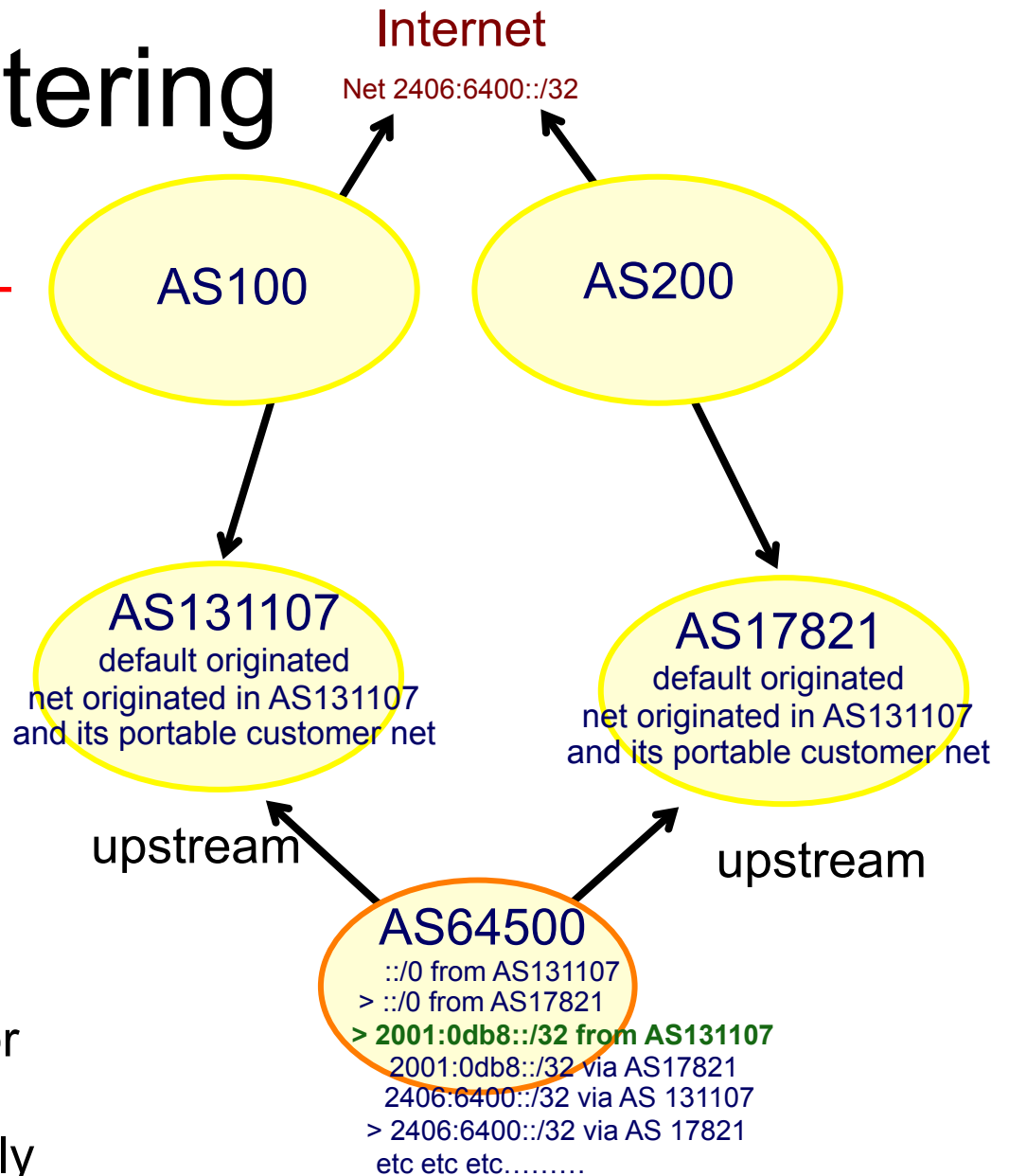
Route Filtering

- Option 3: ISP **default + local** + **all In**
 - Need high configuration router (CPU/DRAM)
 - Need skilled people to manage large routing table
 - Support destination specific traffic engineering to the remote
 - Can now re-route traffic if remote transit is down



Route Filtering

- Option 3: ISP **default + local** + **all In**
 - Need high configuration router (CPU/DRAM)
 - Need skilled people to manage large routing table
 - Support destination specific traffic engineering to the remote
 - Can now re-route traffic if remote transit is down
 - Prefixes originated in AS131107 or AS17821 can now be routed via AS131107 or AS17821 respectively



Route Filtering BCP

- **Prefixes: From Upstream/Transit Provider**
- If necessary to receive prefixes from any provider, care is required.
 - Don't accept default (unless you need it)
 - Don't accept your own prefixes
- For IPv4:
 - Don't accept private (RFC1918) and certain special use prefixes:
<http://www.rfc-editor.org/rfc/rfc5735.txt>
 - Don't accept prefixes longer than /24 (?)
- For IPv6:
 - Don't accept certain special use prefixes:
<http://www.rfc-editor.org/rfc/rfc5156.txt>
 - Don't accept prefixes longer than /48 (?)

Route Filtering BCP

- **Prefixes: From Upstream/Transit Provider**
- Check Team Cymru's list of "bogons"
www.team-cymru.org/Services/Bogons/http.html
- For IPv4 also consult:
datatracker.ietf.org/doc/draft-vegoda-no-more-unallocated-slash8s
- For IPv6 also consult:
www.space.net/~gert/RIPE/ipv6-filters.html
- Bogon Route Server:
www.team-cymru.org/Services/Bogons/routeserver.html
 - Supplies a BGP feed (IPv4 and/or IPv6) of address blocks which should not appear in the BGP table

Route Filtering Plan in Training Lab

- We will use **option 3**: Config on ISP Edge router **(In)**
 - Receive individual customer prefix
 - i.e.

On R1	From R13	2406:6400:8000::/48
On R3	From R14	2406:6400:9800::/48
On R4	From R15	2406:6400:a000::/48
On R6	From R16	2406:6400:b800::/48
On R7	From R17	2406:6400:c000::/48
On R9	From R18	2406:6400:d800::/48
On R10	From R19	2406:6400:e000::/48
On R11	From R20	2406:6400:f800::/48
 - And prefix originated by customer AS

Route Filtering Plan in Training Lab

- We will use **option 3**: Config on ISP Edge router (**Out**)
 - Send default prefix to customer i.e. `::/0`
 - Send aggregated ISP prefix i.e. `2406:6400::/32`
 - Send all individual customer prefix i.e. `2406:6400:8000::/48`
`2406:6400:9800::/48`
`2406:6400:a000::/48`
`2406:6400:b800::/48`
`2406:6400:c000::/48`
`2406:6400:d800::/48`
`2406:6400:e000::/48`
`2406:6400:f800::/48`
 - Send all Internet prefix with prefix length `>/32`, `/32` and `/48` only

Route Filtering Plan in Training Lab

- We will use **option 3**: Config on CPE router **(IN)**
 - Receive default prefix to customer i.e. `::/0`
 - Receive aggregated ISP prefix i.e. `2406:6400::/32`
 - Receive all individual cust prefix i.e. `2406:6400:8000::/48`
`2406:6400:9800::/48`
`2406:6400:a000::/48`
`2406:6400:b800::/48`
`2406:6400:c000::/48`
`2406:6400:d800::/48`
`2406:6400:e000::/48`
`2406:6400:f800::/48`
 - Receive all Internet prefix with prefix length $>/32$, $/32$ and $/48$ only

Route Filtering Plan in Training Lab

- We will use **option 3**: Config on CPE router (**Out**)
 - Send individual customer prefix only
 - i.e.

From R13	To	R1	2406:6400:8000::/48
From R14	To	R3	2406:6400:9800::/48
From R15	To	R4	2406:6400:a000::/48
From R16	To	R6	2406:6400:b800::/48
From R17	To	R7	2406:6400:c000::/48
From R18	To	R9	2406:6400:d800::/48
From R19	To	R10	2406:6400:e000::/48
From R20	To	R12	2406:6400:f800::/48
 - Send that prefix originated customer AS number

Questions?

Thank You! 😊