Putting **IPv6** to work

North American IPv6 Summit

Plaza Tower One Conference Facilities
Greenwood Village, CO
April 22-23, 2015

Rocky Mountain IPv6 Task Force

RMv6TF

30 Minutes to Perfect Abs (and an IPv6 Address Plan)

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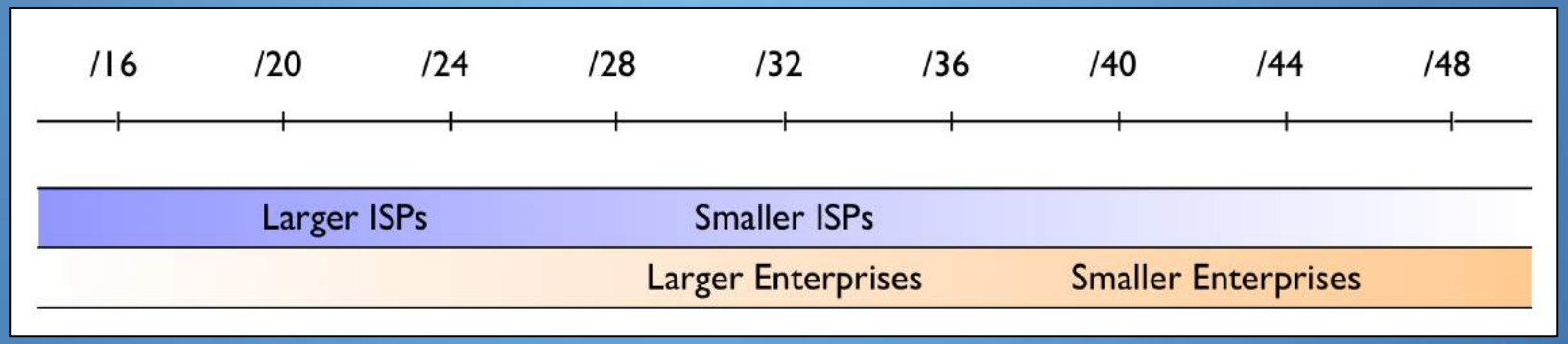
IPv6 Evangelist, Infoblox

April 22nd, 2015

Ready…

Determining Initial Allocation Size:

- Count your number of sites
- Sites often receive a /48
- Most enterprises receive between a /32 and a /44



Ready…

United Nations IPv6 Site Definition Council (UNv6SDC)*

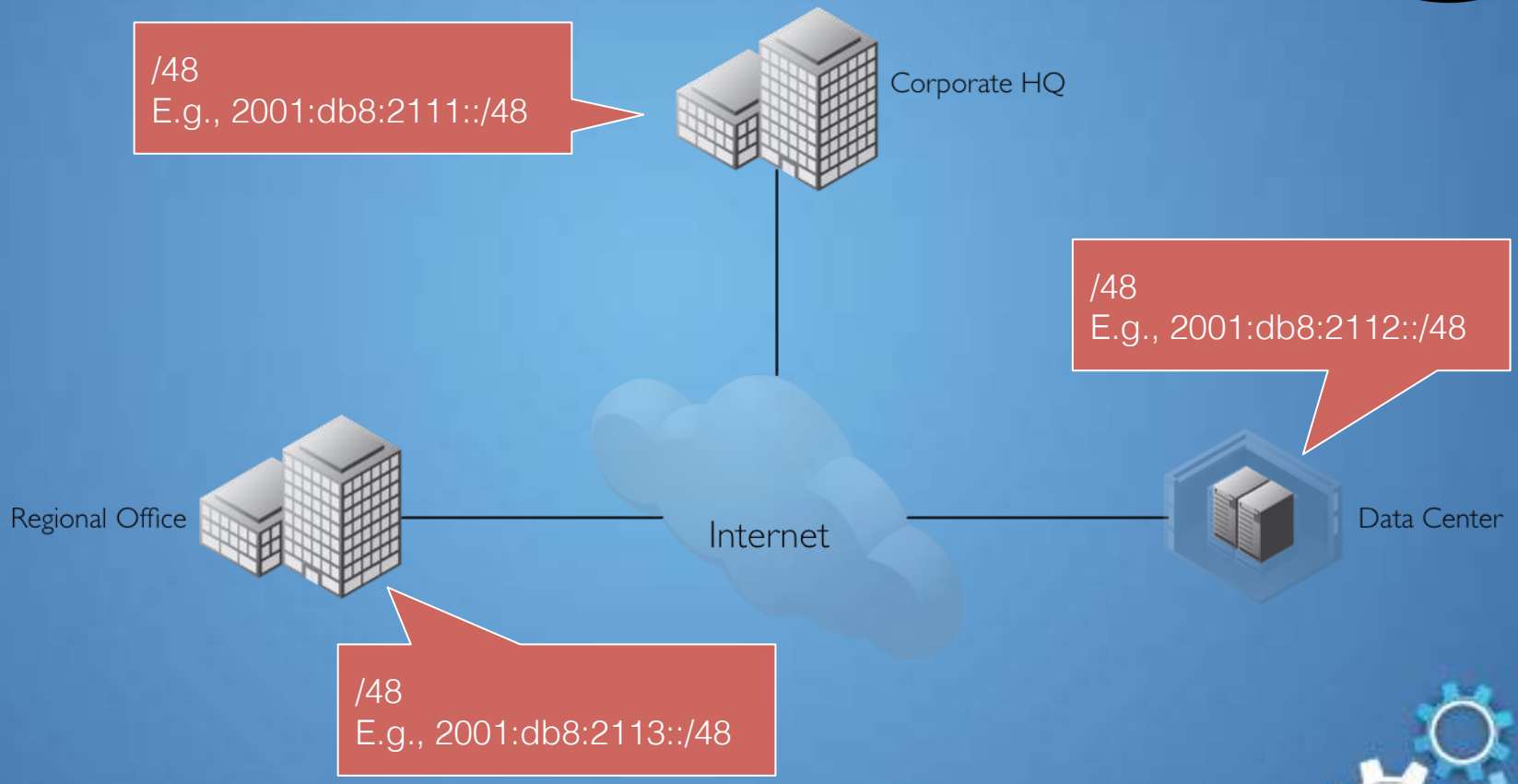
(*Not actually a real thing)

Ready…

Characteristics of sites in IPv6:

- A site is a logical construct
  - Choose a site definition that makes sense for long-term planning and operational ease
  - Don't be afraid to keep things (one-size-fits-all) simple
- Often assigned a /48
  - You are free to assign a larger or smaller prefix based on what makes operational sense
  - Address conservation is generally *not* a design consideration in choosing a site definition
  - A /48 is the smallest Internet routable prefix in IPv6
- If there are not enough /48s in your initial allocation…
  - Obtain a larger allocation (RIRs hold contiguous bits in reserve)

Ready…


/48
E.g., 2001:db8:2111::/48
Corporate HQ
/48
E.g., 2001:db8:2112::/48
Regional Office
Internet
Data Center
/48
E.g., 2001:db8:2113::/48

Ready…


IPv6
I WANT YOU!
(TO CHOOSE A SITE DEFINITION THAT MAKES SENSE FOR YOUR ENTERPRISE BASED ON LONG-TERM OPERATIONAL VIABILITY AND NOT ANTIQUATED, IPv4-BASED, NOTIONS OF ADDRESS CONSERV-ATION…)

Ready…

Determining Initial Allocation Size:

Prefix	Subnet groups per /32	/48 subnets per group
/32	1	65,536
/36	16	4,096
/40	256	256
/44	4,096	16
/48	65,536	1

Set…

Obtain an allocation:

- RIR or ISP?
- RIR
  - Provider Independent (PI) allocation
    - “Portable”; i.e., may be announced through any provider
    - May be announced out-of-region*
    - Renumbering less likely
- ISP
  - Provider Assigned (PA) allocation
    - Not portable
    - Must renumber if switching providers
    - For smaller, more static, singly-homed enterprises

Set…

Use nibble boundaries:

- Think of all subnet groups in terms of buckets of 16, 256, 4096, and 65536

Prefix	Subnet groups per /48	/64 subnets per group
/48	1	65,536
/52	16	4,096
/56	256	256
/60	4,096	16
/64	65,536	1

Set…

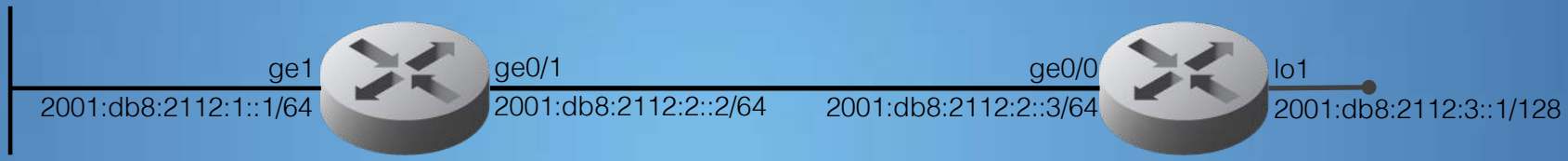
Use nibble boundaries:

- The “legibility dividend”

Subnet bits a multiple of 4		Subnet bits not a multiple of four	
Prefix:	2001:db8:1::/48	Prefix:	2001:db8:1::/49
Range:	2001:db8:1:0000:0000:0000:0000:0000 2001:db8:1:ffff:ffff:ffff:ffff:ffff	Range:	2001:db8:1:0000:0000:0000:0000:0000 2001:db8:1:7fff:ffff:ffff:ffff:ffff 2001:db8:1:8000:0000:0000:0000:0000 2001:db8:1:ffff:ffff:ffff:ffff:ffff

Set…

IPv6 interface assignments:



- LAN/VLAN Interfaces: /64
- Point-to-point links: /64
  - If you're running older router code, check with vendor to make sure ND cache exhaustion attacks, etc. are protected against; if not /127 could be configured (still set aside a /64 per point-to-point link)
- Loopback interfaces: /128
  - All loopbacks for a single routing domain can come from one /64

Set…

ipv6gen for IPv6 subnetting:

tcoffeen

```
spiderland:~ tcoffeen$ ipv6gen 2001:db8:1000::/44 48
2001:0DB8:1000::/48
2001:0DB8:1001::/48
2001:0DB8:1002::/48
2001:0DB8:1003::/48
2001:0DB8:1004::/48
2001:0DB8:1005::/48
2001:0DB8:1006::/48
2001:0DB8:1007::/48
2001:0DB8:1008::/48
2001:0DB8:1009::/48
2001:0DB8:100A::/48
2001:0DB8:100B::/48
2001:0DB8:100C::/48
2001:0DB8:100D::/48
2001:0DB8:100E::/48
2001:0DB8:100F::/48
spiderland:~ tcoffeen$
```

https://code.google.com/p/ipv6gen/

Go! Inter-site planning

Sample allocation: 2001:db8:1000::/44

Assign /48s to sites

- Leave one /48 for infrastructure between sites
- Make sure you have enough /48s for future use

Inter-site planning

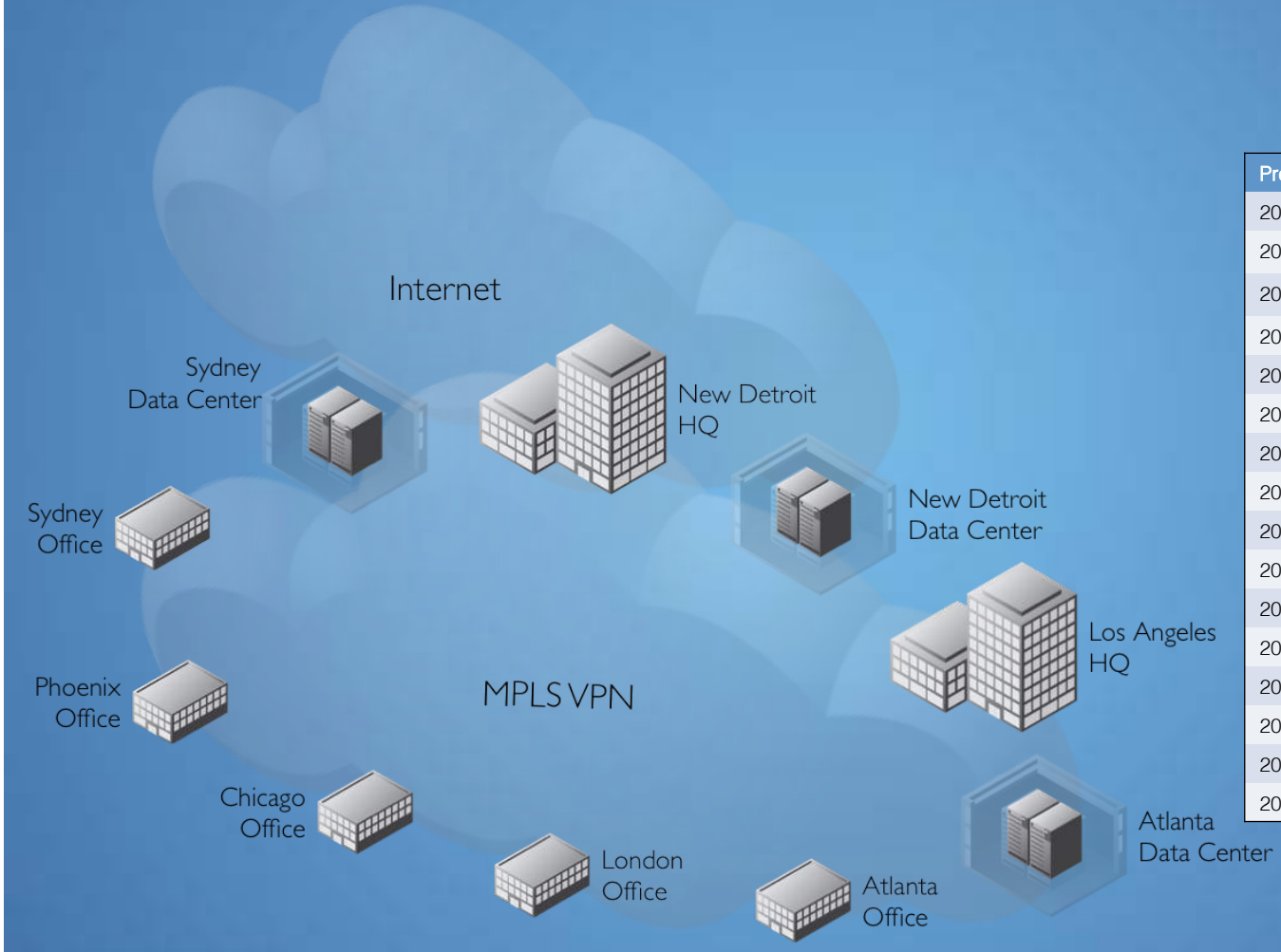
Prefix	Assignment
2001:0db8:1000::/48	Reserved
2001:0db8:1001::/48	Site 1
2001:0db8:1002::/48	Site 2
2001:0db8:1003::/48	Site 3
2001:0db8:1004::/48	Site 4
2001:0db8:1005::/48	Site 5
2001:0db8:1006::/48	Site 6
2001:0db8:1007::/48	Site 7
2001:0db8:1008::/48	Site 8
2001:0db8:1009::/48	Site 9
2001:0db8:100a::/48	Site 10
2001:0db8:100b::/48	Site 11
2001:0db8:100c::/48	Site 12
2001:0db8:100d::/48	Site 13
2001:0db8:100e::/48	Infrastructure
2001:0db8:100f::/48	Reserved

Inter-site planning

- 2 Corporate campuses
- 3 Data centers
- 5 Regional offices

OMNI CONSUMER PRODUCTS

Inter-site planning



Prefix	Assignment
2001:0db8:1000::/48	Reserved
2001:0db8:1001::/48	New Detroit corporate HQ
2001:0db8:1002::/48	Los Angeles corporate HQ
2001:0db8:1003::/48	New Detroit DC
2001:0db8:1004::/48	Atlanta DC
2001:0db8:1005::/48	Sydney DC
2001:0db8:1006::/48	Atlanta RO
2001:0db8:1007::/48	Chicago RO
2001:0db8:1008::/48	Phoenix RO
2001:0db8:1009::/48	London RO
2001:0db8:100a::/48	Sydney RO
2001:0db8:100b::/48	Site 11
2001:0db8:100c::/48	Site 12
2001:0db8:100d::/48	Site 13
2001:0db8:100e::/48	Infrastructure
2001:0db8:100f::/48	Reserved

Intra-site planning

Sites often share similar functions (even if their existing internal topology isn't uniform). For example:

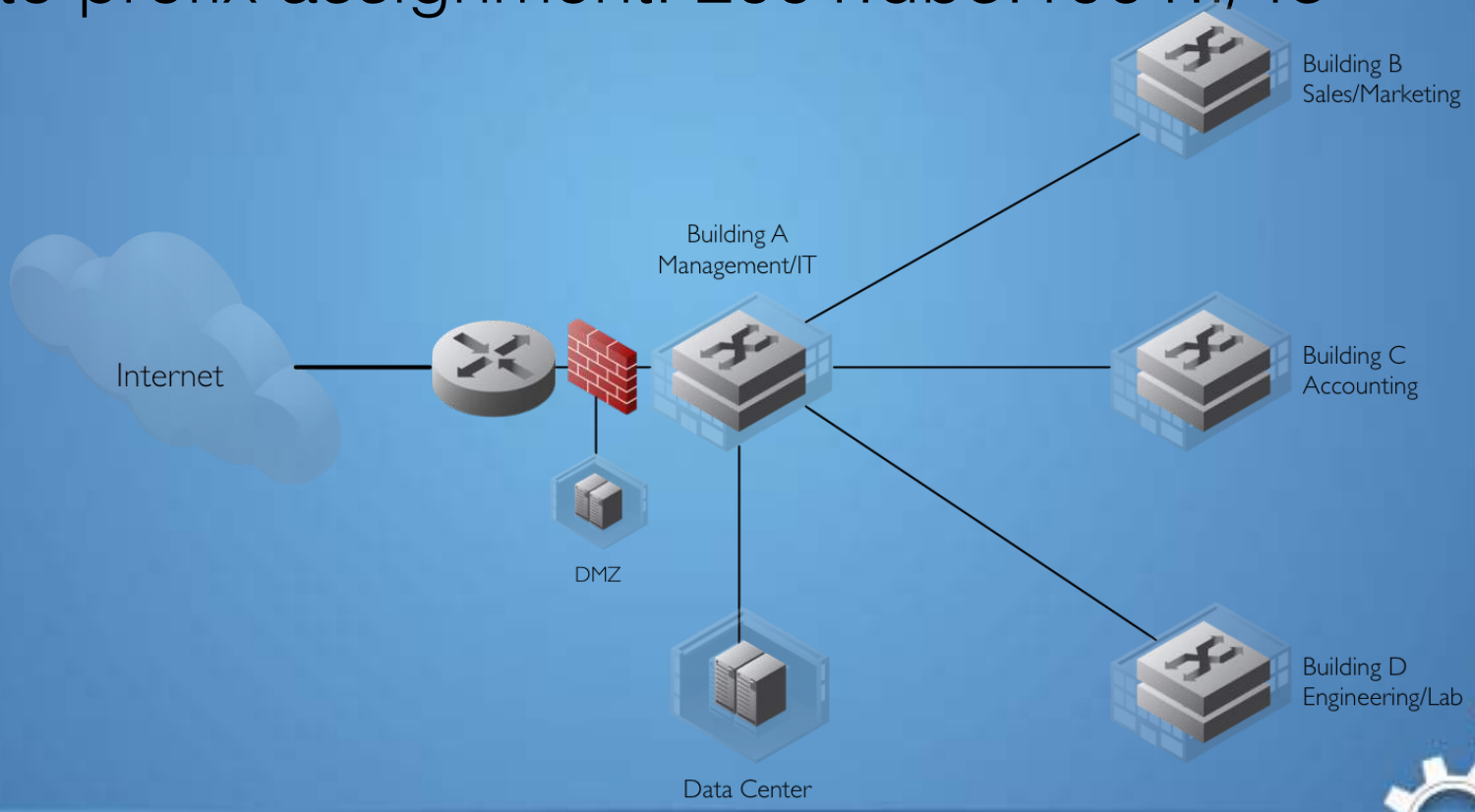
- Corporate campuses
- Data centers
- Regional offices

To keep things simple, try to give each site type a similar internal address plan.

Intra-site planning

Corporate campus example:

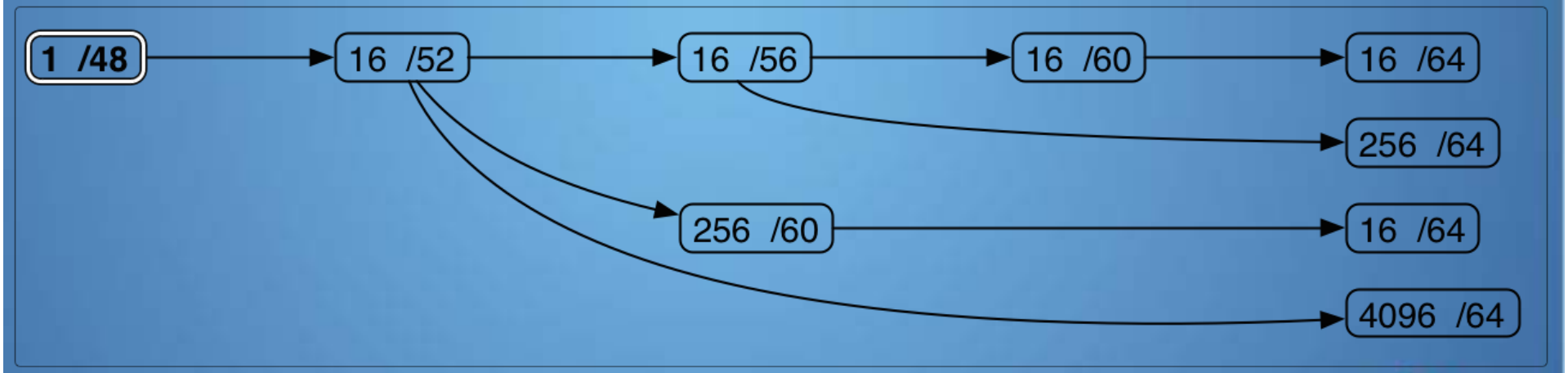
Site prefix assignment: 2001:db8:1001::/48



Intra-site planning

One Method for Site Prefix Assignment

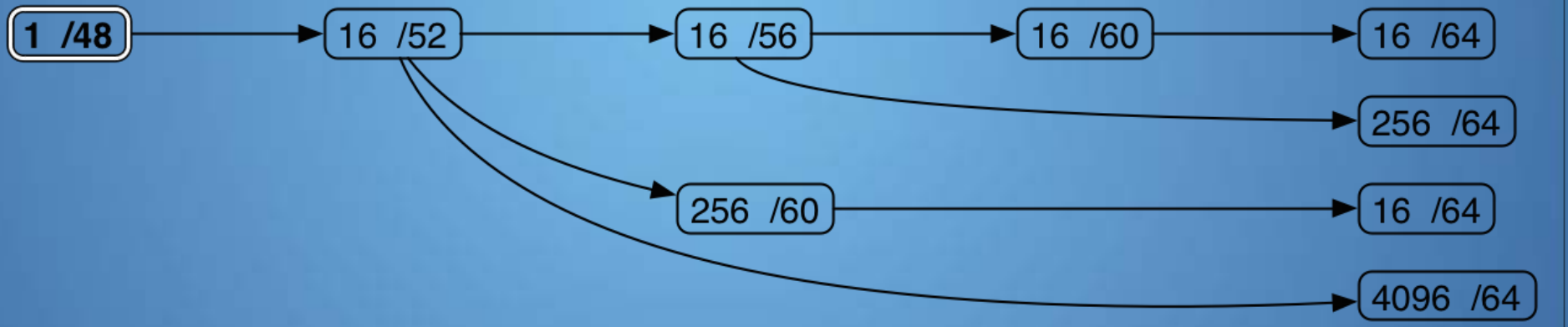
1. Work from left to right (highest level of hierarchy to lowest)



Intra-site planning

One Method for Site Prefix Assignment

2. Choose groups of prefixes for a given level based on either **ACL/security policy** (*function*) or **routing summarization** (*location*) requirements



One Method for Site Prefix Assignment

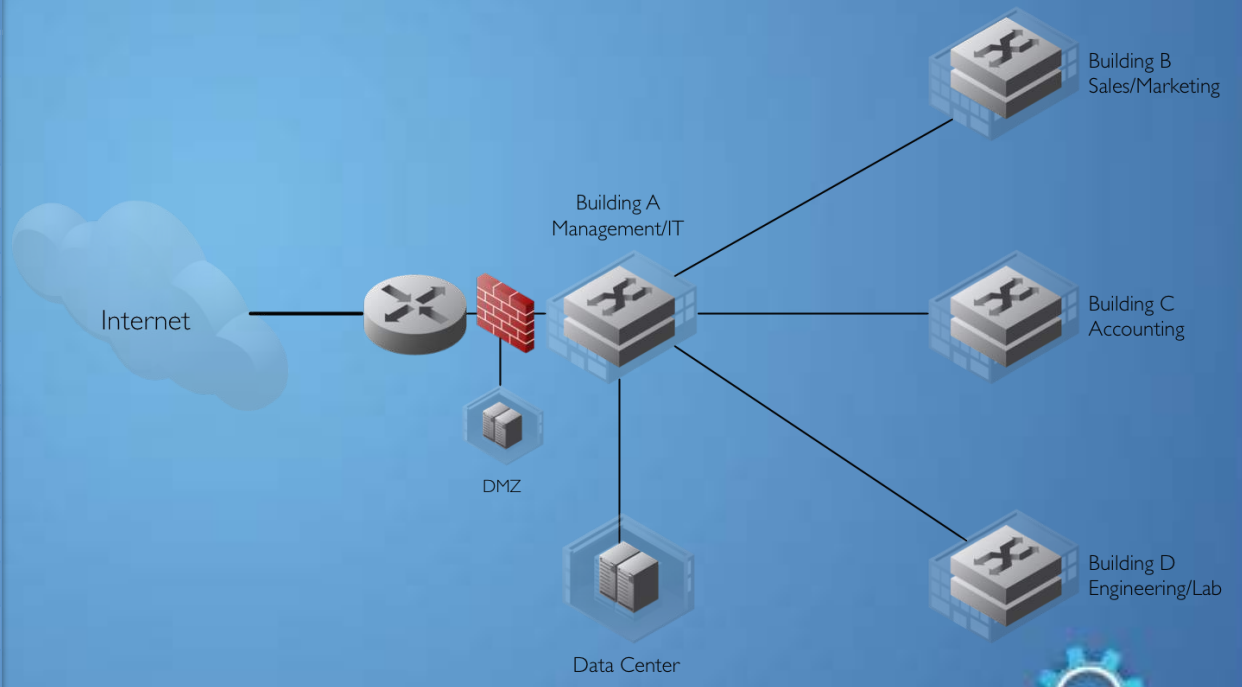
Level1

- Level 1
  - Up to 16 /52s for functions or locations

Intra-site planning

2001:db8:1001:[0-f]000::/52

Prefix	Assignment
2001:0db8:1001:0000::/52	Reserved
2001:0db8:1001:1000::/52	Management/IT
2001:0db8:1001:2000::/52	Sales/Marketing
2001:0db8:1001:3000::/52	Engineering
2001:0db8:1001:4000::/52	Lab
2001:0db8:1001:5000::/52	DMZ
2001:0db8:1001:6000::/52	Available
2001:0db8:1001:7000::/52	Available
2001:0db8:1001:8000::/52	Available
2001:0db8:1001:9000::/52	Available
2001:0db8:1001:a000::/52	Available
2001:0db8:1001:b000::/52	Available
2001:0db8:1001:c000::/52	Available
2001:0db8:1001:d000::/52	Available
2001:0db8:1001:e000::/52	Available
2001:0db8:1001:f000::/52	Reserved



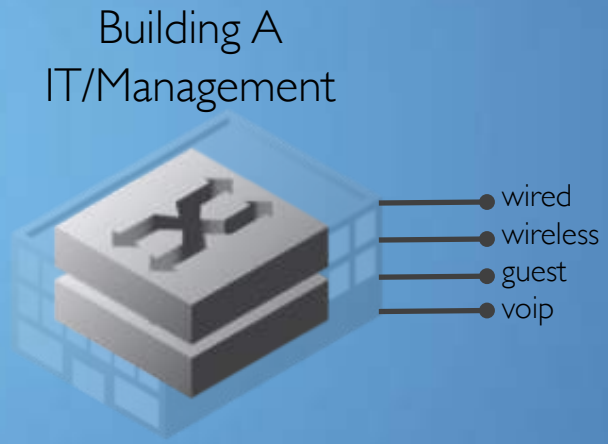
One Method for Site Prefix Assignment

- Level 2
  - For each /52 at Level 1:
    - Up to 16 /56s for additional functions or locations
    - Or, 256 /60s for additional functions or locations
    - Or, 4096 /64s for interfaces

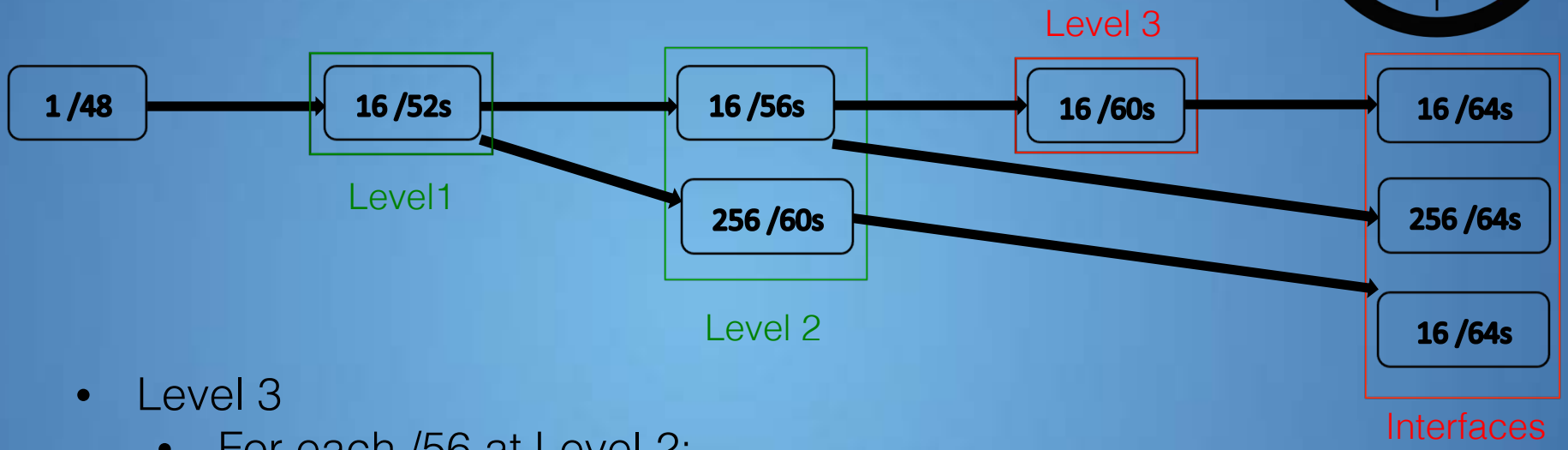
Intra-site planning

2001:db8:1001:1[0-f]00::/56

Prefix	Assignment
2001:0db8:1001:1000::/56	Reserved
2001:0db8:1001:1100::/56	Wired
2001:0db8:1001:1200::/56	Wireless
2001:0db8:1001:1300::/56	Guest
2001:0db8:1001:1400::/56	VoIP
2001:0db8:1001:1500::/56	Available
2001:0db8:1001:1600::/56	Available
2001:0db8:1001:1700::/56	Available
2001:0db8:1001:1800::/56	Available
2001:0db8:1001:1900::/56	Available
2001:0db8:1001:1a00::/56	Available
2001:0db8:1001:1b00::/56	Available
2001:0db8:1001:1c00::/56	Available
2001:0db8:1001:1d00::/56	Available
2001:0db8:1001:1e00::/56	Available
2001:0db8:1001:1f00::/56	Reserved



One Method for Site Prefix Assignment

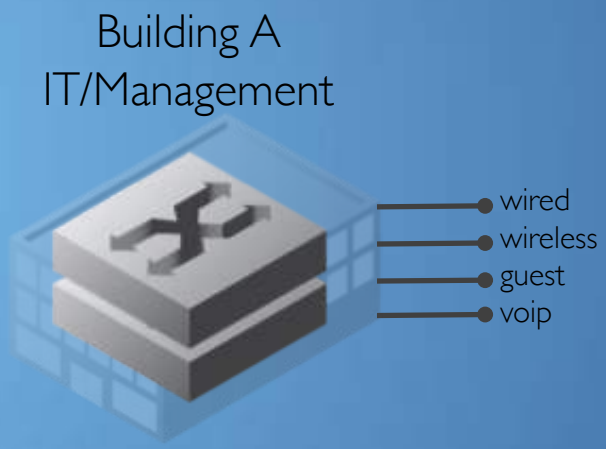


- Level 3
  - For each /56 at Level 2:
    - Up to 16 /60s for additional functions or locations
      - Each /60 provides 16 /64s for interfaces
    - Or, 256 /64s for interfaces
  - For each /60 at Level 2:
    - 16 /64s for interfaces

Intra-site planning

2001:db8:1001:1[1-4][00-ff]::/64

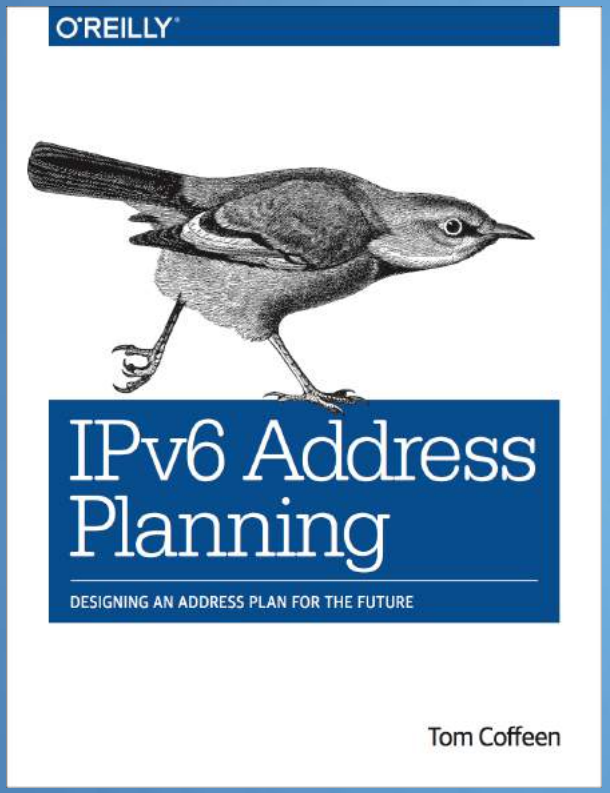
Assignment	Prefixes	Quantity
Wired	2001:0db8:1001:11[00-ff]::/64	256
Wireless	2001:0db8:1001:12[00-ff]::/64	256
Guest	2001:0db8:1001:13[00-ff]::/64	256
VoIP	2001:0db8:1001:14[00-ff]::/64	256



Intra-site planning

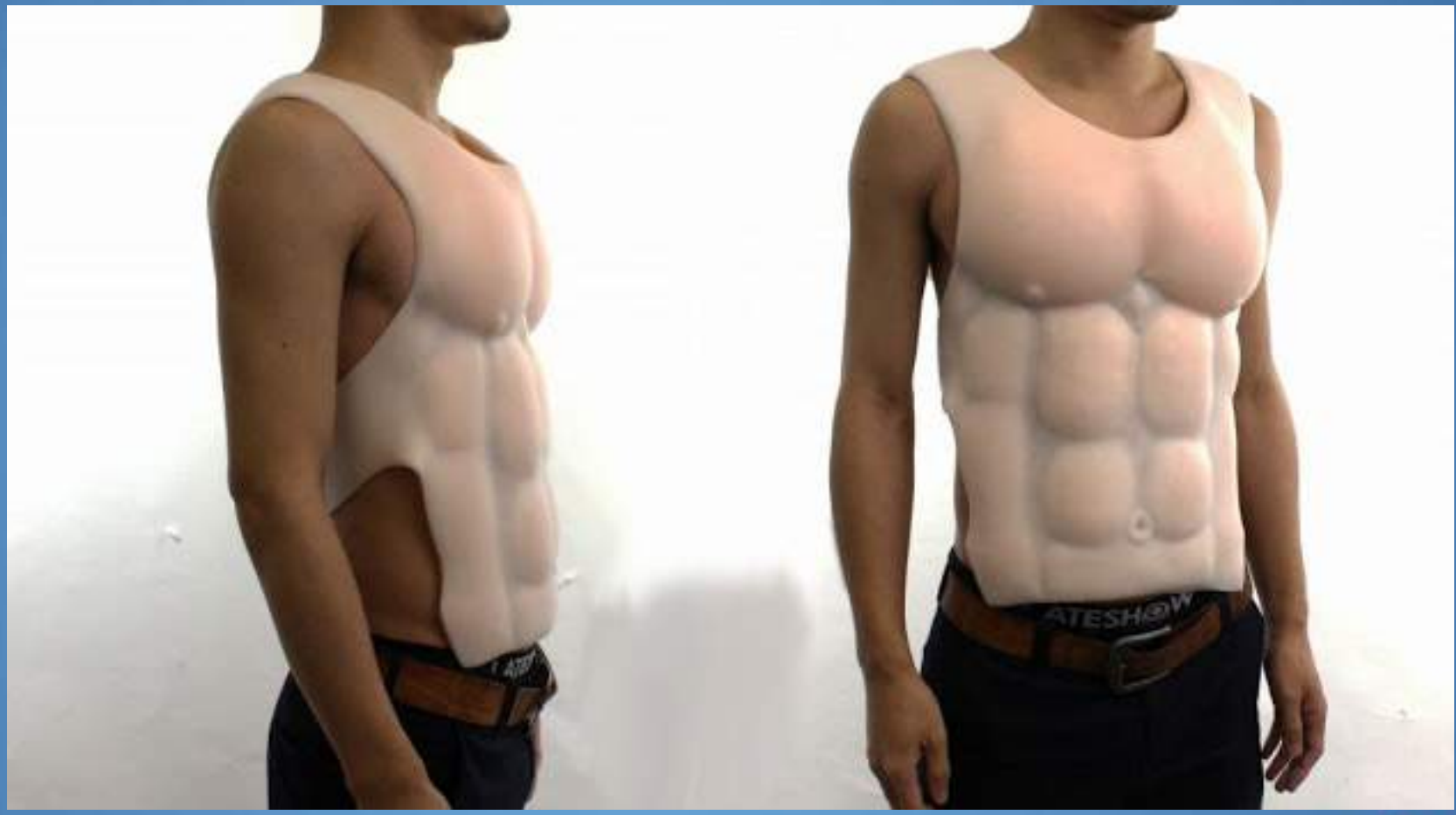
- Repeat the intra-site planning steps for each of the remaining sites.
- Remember to try to keep the plan as simple as possible by giving each site type a uniform internal address plan.

IPv6 Address Planning, O'Reilly Media, 2015



- For IT network architects, engineers, and administrators
- Comprehensive overview and current best-practices for designing, deploying, and maintaining an effective IPv6 addressing plan

Finally, perfect abs in 30 ~~minutes~~ seconds:



- White papers, solution notes, videos, webinars, guides, podcasts, and a new blog post at least every week
- Industry thought leadership around IPv6 adoption through participation in Internet engineering, address resource, and standards development forums

http://www.infoblox.com/ipv6

Thank you!

Questions?

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