



Journey to IPv6 Campus of the Future

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Agenda

- Why IPv6 matters
- Why IPv6 for Enterprise matters
- Why SJC23
- Why IT needs IPv6
- How to deal with an IPv6 island
- Next steps

Why IPv6 Matters

- IPv4 address exhaustion
- Remove dependency on IPv4 address, achieve high performance network
- Achieve single protocol stack when Datacenter and Campus are both on IPv6 only Network
- IoT devices IP address needs grows exponential

IPv6 in Enterprise - Why it Matters

It matters to our customers

- Web scale companies built IPv6 only datacenters, enterprise IPv6 campuses are a natural follow-up
- Customers are looking to Cisco to lead the transition

It matters to Cisco

- Simplify operational cost by supporting only a single protocol stack for Datacenter and Campus. IPv6 only Network (Cisco DC 2018, v4 exhaustion)
- IoT matters here too, this is where IoT will live in Enterprise
- Campus is the last frontier – IPv6 DCs, WAN, etc have more maturity
- Its about Leadership : demonstrate IPv6 Campus transition for customers to follow

IPv6 in Enterprise – Where We Were, Where We are now

Where We Were

- Most Enterprises including Cisco have dual stack enabled
- Most of the testing was done on v4 first and v6 was best effort
- Network device and policy management was done using v4
- Limited system and solution testing for v6

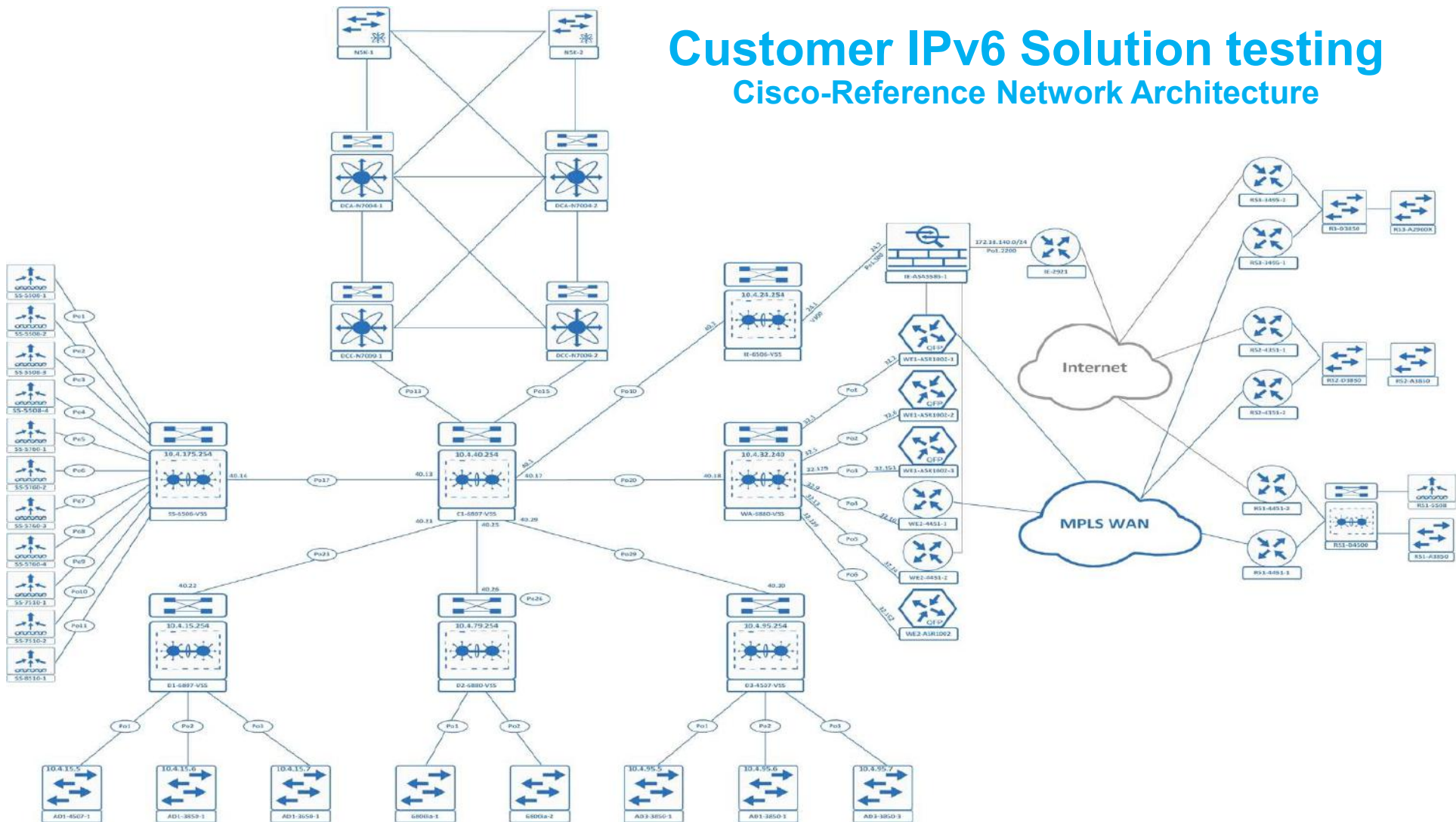


Where We are now

- A Few Large Enterprises are moving towards v6 only network
- Work closely with leading edge enterprises on v6 only transition
- Evaluate the features and fill any development and test gaps across the portfolio
- Customer specific solution testing
- Work side by side with Cisco IT for Customer Zero strategy
- Deploy v6 only network in one of the Cisco buildings

Customer IPv6 Solution testing

Cisco-Reference Network Architecture



Platforms deployed in the IPv6 Island



Catalyst 3850



Catalyst 4500



Catalyst 6800



ASR 1000



 WLC 8510/8540



Cisco APs

5 Steps to a pure IPv6 Campus

Step 1



Ascertain the Goals of the Project

Step 2



Veer past the long history

Step 3



Cisco on Cisco

Step 4



Identify the ideal project size

Step 5



Manage early adopter anxiety

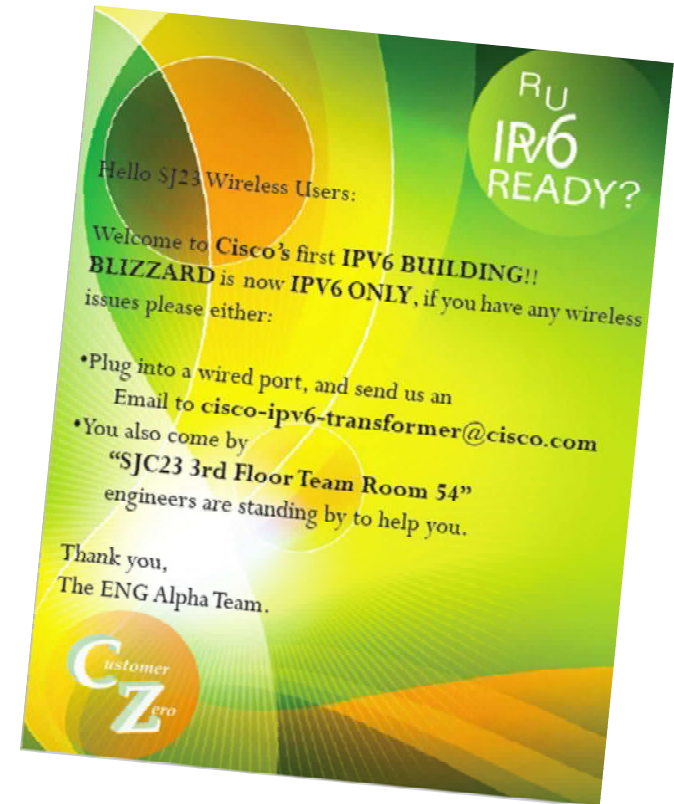
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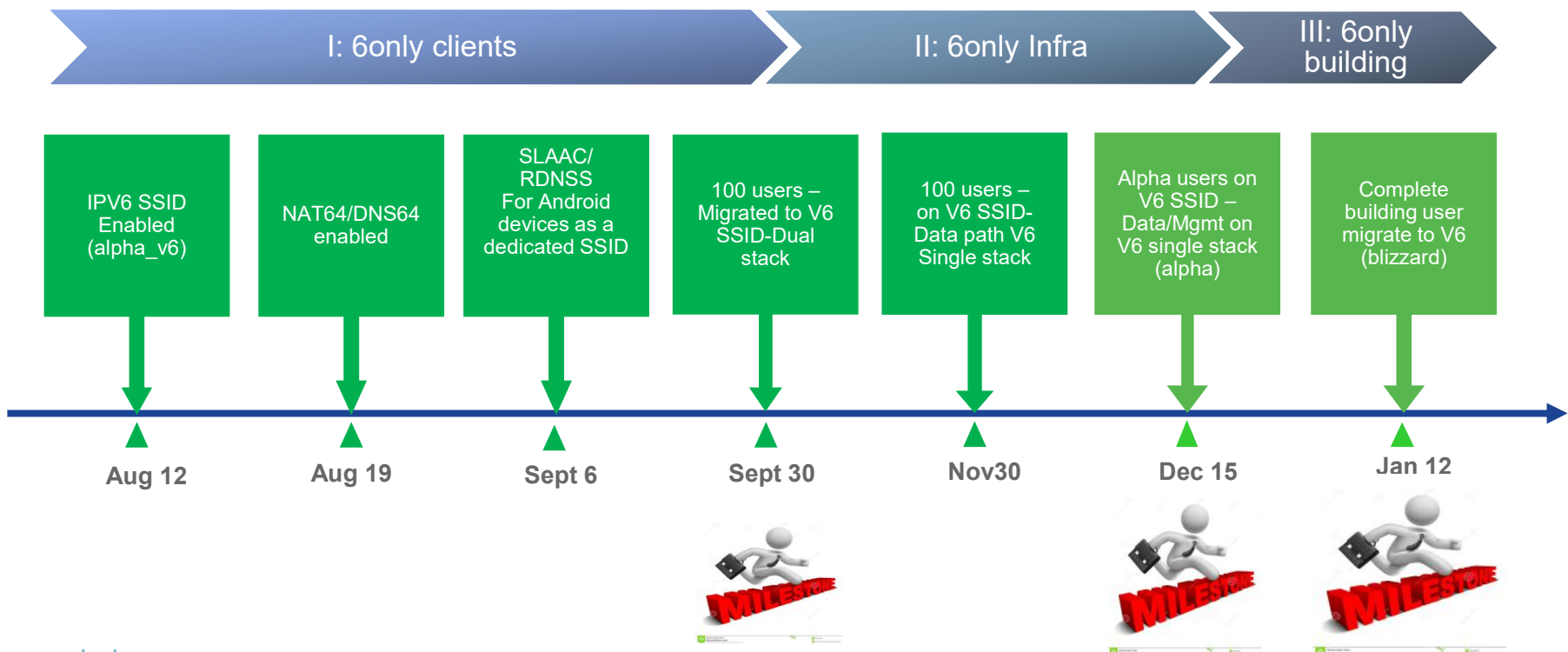
Microsoft Office User, 4/19/2017

IPv6 Solution Customer Zero – Bld23

- Cisco on Cisco Story, deploy a solution in Cisco network before Customer adoption
- ENG Alpha and IT ETE Team administrate SJ23 network
- Phased approach for migrating to a complete IPv6 only building
- Traffic pattern analysis to identify applications over IPv6
- Multiple workshops inviting each functional group to validate their workflow over IPv6
- War room support for helping users upgrade system and applications to IPv6 ready



Phased Approach for SJC23 IPv6 Deployment



First IPv6 Building – Cisco SJC23



500+ users

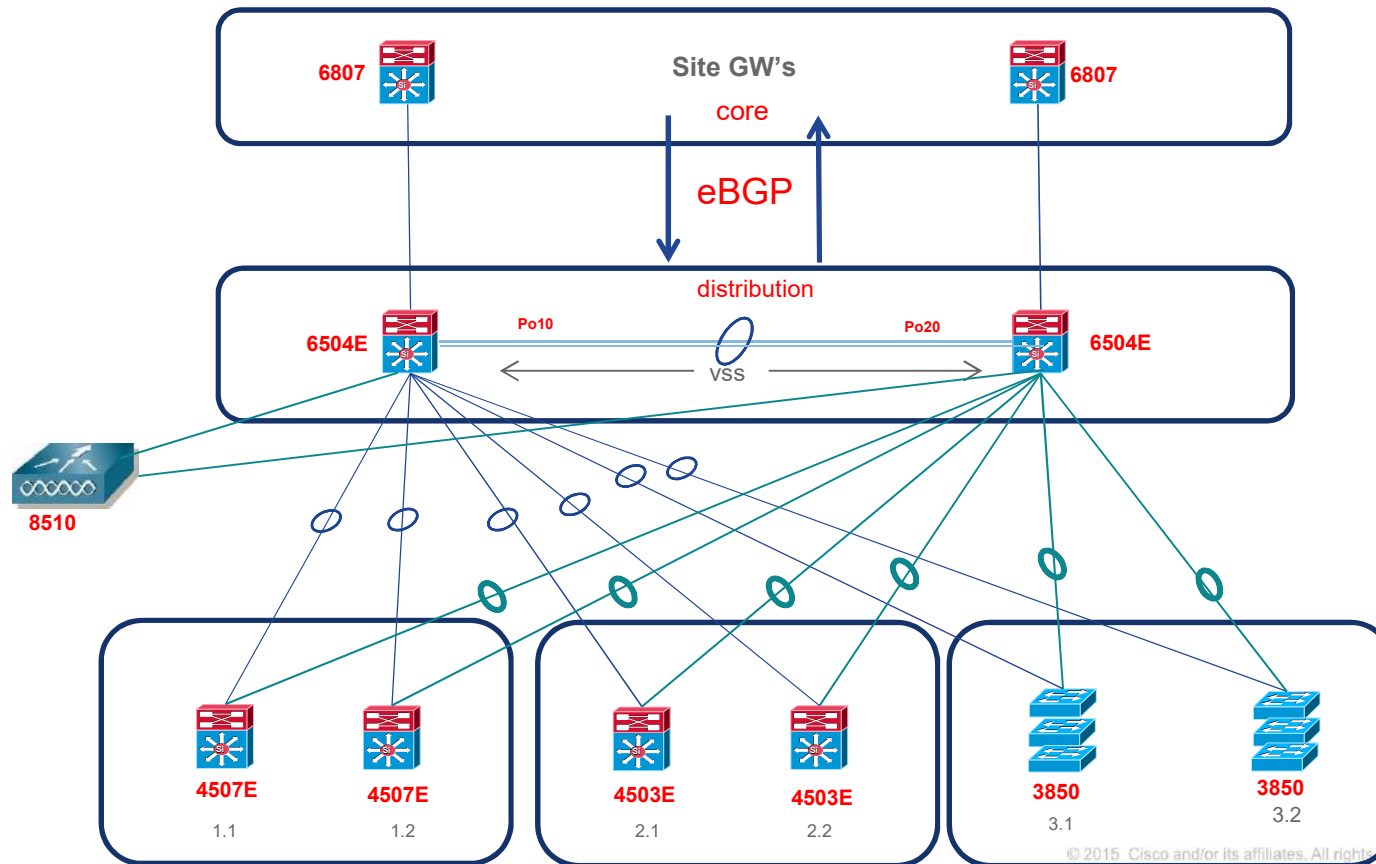
3 floors, 6 wiring closets

500+ switch ports, 120 APs

40~ applications

**3 months phased
approach, IT template**

SJC23-IPv6 Only Network



Building 23 IPv6 Transition: Users Experience

Understand what people use the network for

- Functional group visit
- Building Traffic analysis
- Identify Primary Applications:
 - Collaboration
 - Call/Telepresence
 - Spark(inc. Video Call)
 - Jabber
 - Business Apps
 - Exchange/email
 - http/intranet/wiki
 - Video/Cisco TV
 - VNC/Remote Desktop

Prepare Users for IPv6

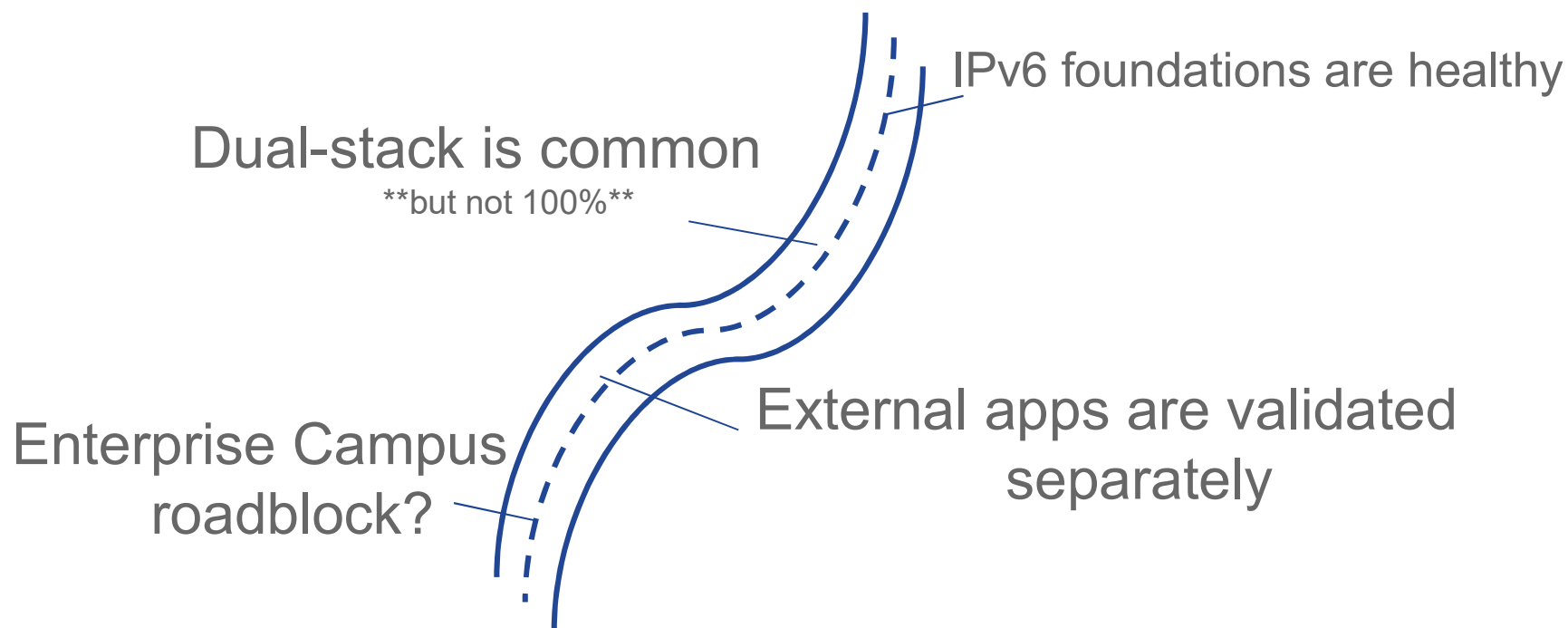
- Build User Profiles
 - Engineering Dev/Test(lab dependent)
 - Business/Finance/Mgmt
 - Product Mgmt and Marketing
 - Engineering Release Mgmt
- Workshop and dry runs
 - Periodic dry runs to enable building users for transition
 - War rooms to address any issues/questions

Application and Service status over IPv6

Priority	Impact Level	Service	Application
High	Medium	Client	CiscoTV/IPTV
Medium	High	Client	File transfer FTP, TFTP, SSH, SCP
Low	Low	Client	Anyconnect
High	High	Client	Jabber
High	High	Client	Webex
High	High	Client	Outlook
Medium	Medium	Client	VNC
Low	Low	Client	Remote Desktop
Medium	High	Client	Telepresence
Low	Low	Client	App Store
Medium	Medium	Client	IP Phone
High	High	Client	public web
Medium	Medium	Client	wwwin.cisco.com
Low	Low	Client	Proximity
Low	Low	Client	Google Docs
Low	Low	Client	skype
Medium	Low	Client	dropbox
High	Medium	Client	Cisco Print
		Client	AnyConnect (SSL) through NAT64
		Client	Cisco DayCare Video Monitor
High	High	Collab	Spark Client
High	High	Collab	Spark Web
High	High	Facilities	CCTV, Badge, Phy Security Infra
		Mgmt	SNMP
		Mgmt	Netflow
		Mgmt	NTP
		Mgmt	LDAP/AD
High	High	Network	IPv6 Multicast
High	Medium	Network	WaaS
High	Medium	Network	ACNS
Medium	Low	Network	dACLs/802.1x/ISE
		Network	OSPFv3 routing, mult platforms
		Network	NAT64 on ASR/CSR
		Network	NAT64 on ASA
		Network	DNS64 on bind9
		Network	CAPWAP over v6

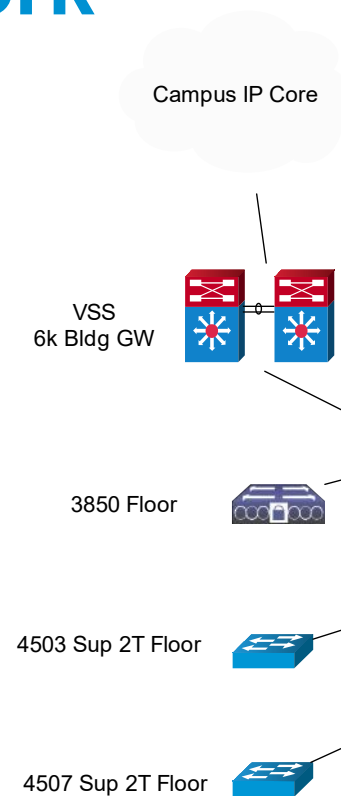
One step for IPv6, a leap for IT readiness

IPv6 only campus journey for IT



Examining the access network

- Cisco on Cisco - why real deployments
- How is the Cisco campus built today?
- How do our customers build?
- Platform forward leaning



The building network

- Keep it simple – L2, routing, DHCPv6, VSS, primarily wireless

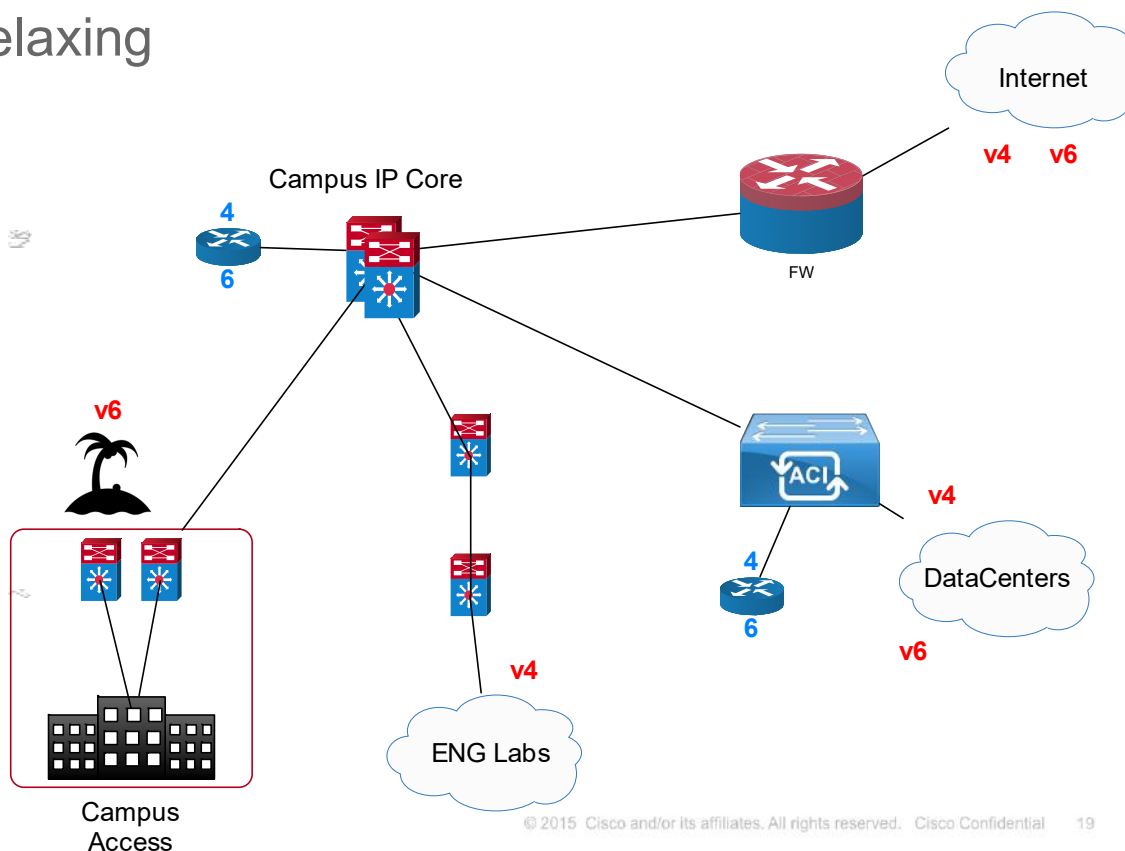
```
interface Vlan22
  description v6WIRELESS-DATA
  no ip address
  ipv6 address FE80::DEF link-local
  ipv6 address X::1/64
  ipv6 nd prefix X::/64 0 0 no-autoconfig
  ipv6 nd managed-config-flag
  ipv6 nd other-config-flag
  ipv6 dhcp relay destination X::12
  ipv6 eigrp 233
```

- Working towards Android exception (SLAAC)

How to deal with IPv6 islands

Islands aren't always relaxing

- Despite dual-stack, v6 native internal apps/services are still not the norm
- DNS64/NAT64 is a critical enterprise service

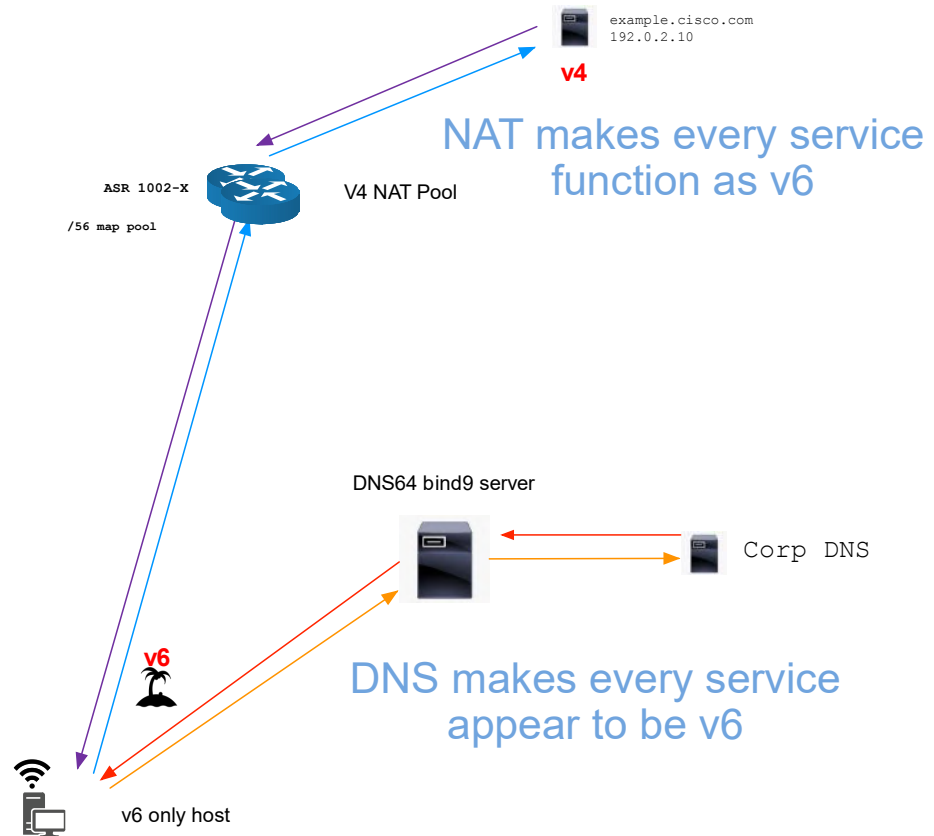


DNS64/NAT64

NAT64/DNS64
holds it all together

- BIND9 as DNS64
 - can be added to existing
- ASR1002-X NAT64 with HA
 - Simple config and stable

```
nat64 prefix stateful 2001:X::/96
nat64 v4 pool NAT64-IPv4 10.x.y.z 10.x.y.zz
nat64 v6v4 list NAT64 pool NAT64-IPv4 overload
redundancy 1 mapping-id 1
```



DNS64 isn't magic

- Enables business critical services
 - 95% of internal traffic
- Interacts with app/service design
 - Load balancers and DNS error codes
- Highlights outliers
 - Partial v6 implementations

Named based access

As much behavioral as technical

- Identify v4 literal hotspots (labs?)
- Facilitate easy naming
 - 172-16-32-1.cisco.com
- Self-service (chatops)

Enterprise complexity

- DNS64 doesn't solve all
 - Hard coded v4 in mutlicast, discovery, scripts
 - Client side virtualization (Virtualbox, Fusion, etc)

Enterprise complexity

IT operations is a client too

- Tapestry of supporting apps/tools to validate
- Integration into lynchpin policy pipelines (SLAAC)
- Instrumentation doesn't always translate

Enterprise complexity

This is why the journey matters

- Real experience shows what matters to users
- Real data provides comparisons
- Real impact incentives app/services owners

Next steps

What Next?

- Migration document/template based on the experience to enable future migrations
- Cisco's DC migration to IPv6-only to expand more buildings in Cisco to IPv6
- Cisco validated design and deployment guide for enabling seamless migration to IPv6 for our customers
- Development process change for new features. Parity between v4 and v6 for new development
- Working with industry leaders to drive V6 readiness

cisco-ipv6-transformer@cisco.com



DNS64 on bind

- Recursive DNS64

```
Dns64 2001:420:2ca:1::/96 {  
    recursive-only yes;  
    clients { any; };  
};  
recursion yes;  
forwarders {  
2001:420:68d:4001::a;2001:420:200:1::a;  
};
```

Devices and Software Versions

- Software version for SJ23 network
 - Nyquist(cat9k): cat9k_iosxe.16.05.99.SPA.bin
 - C3850: cat3k_caa-universalk9.SPA.03.06.03.E.152-2.E3.bin
 - C4503E: cat4500es8-universalk9.SPA.03.06.02.E.152-2.E2.bin
 - Cat6504E: s2t54-advipservicesk9-mz.SPA.151-2.SY9.bin
 - WLC5508: [8.4.2.41](#)
- Minimum Version of OS and App for IPv6 compatiability

OS/Software/App	Mac	Windows
Jabber	11.6+	11.6+ (Note: calling is currently unsupported on IPv6)
MS Office/Outlook	15.29+ (Outlook 2016)	2013 SP1
OS	OS X Mavericks 10.9 (or later)	• Microsoft Windows 10, 32 bit and 64 bit (Desktop OS x86) • Microsoft Windows 8.x, 32 and 64 bit • Microsoft Windows 7 SP1 or later, 32 and 64 bit
RDC		2.1.0
Real VNC	5.3.2+	5.3.2+
Tight VNC	Does Not Support IPv6	Does Not Support IPv6