

What You Make Possible



Inside Cisco IT: Making the Leap to IPv6

COCRST-2464

IPv6 Sessions

- BRKRST-1069 Understanding IPv6
- BRKRST-2301 Enterprise IPv6 Deployment
- BRKRST-2311 IPv6 Planning, Deployment and Troubleshooting
- BRKSEC-2003 IPv6 Security Threats and Mitigations
- BRKSPG-2604 Deploying Carrier Grade IPv6 using CGSE
- **COCRST-2464 Inside Cisco IT: Making The Leap To IPv6**
- TECRST-2661 Hands on Experience with IPv6

Agenda

- Overview
 - Introduction to Cisco IT
 - Making the case for IPv6
 - IPv6 Journey
 - Target State
- Preparation
- Implementation Tracks
 - Ubiquitous IPv6 Access
 - IPv6 Internet Presence
- Lessons Learned

Introducing Cisco

The Global Cisco Family



- 66,000+ Employees
- 20,000 Channel Partners
- 110+ Application Service Providers
- 210+ Business and Support Development Partners

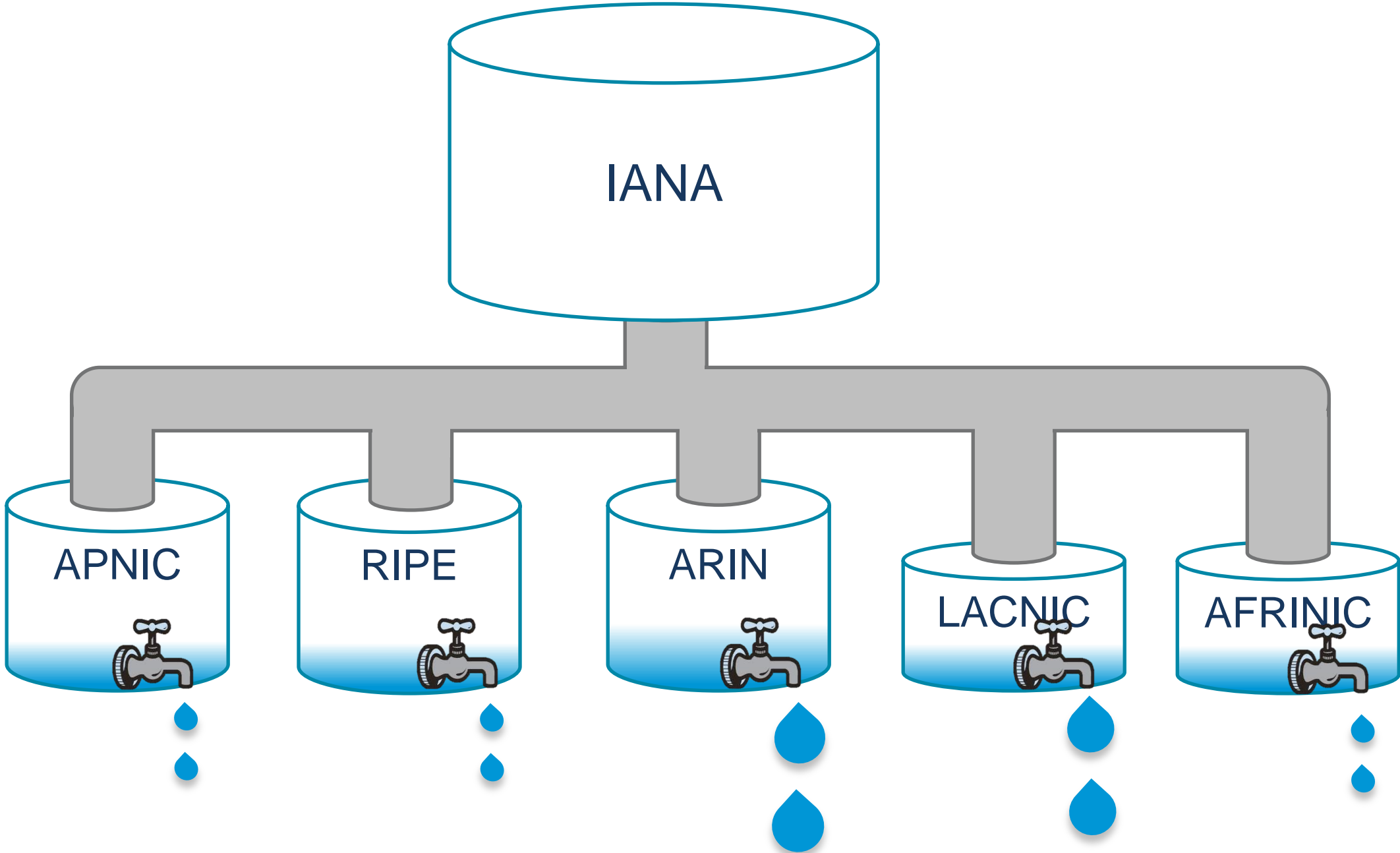
- 300 locations in 90 countries
- 450+ buildings
- 51 Data Centres and server rooms
- 1500+ labs world wide (500+ in San Jose)

Over 180,000 people around the world in the extended Cisco family

Estimated Numbers

Cisco *live!*

IPv4 Exhaustion



v4 Exhaustion

IPv4 & IPv6 Statistics

RIR v4 IPs Left	
AfriNIC	54,253,568
APNIC	18,510,848
ARIN	99,174,144
LACNIC	43,999,744
RIPE	17,272,832

v6 ASNs
15% (6,535/43,120)

v6 Ready TLDs
86% (272/316)

v6 Glues
11,466

v6 Domains
4,162,456 ↑

0
days remaining
IANA exhausted

HURRICANE ELECTRIC
INTERNET SERVICES

Making the Case for IPv6

Business Drivers

Leadership and Mindshare
Product Readiness

IT Drivers

Product Development and Testing
Continuity and Growth
Cisco on Cisco



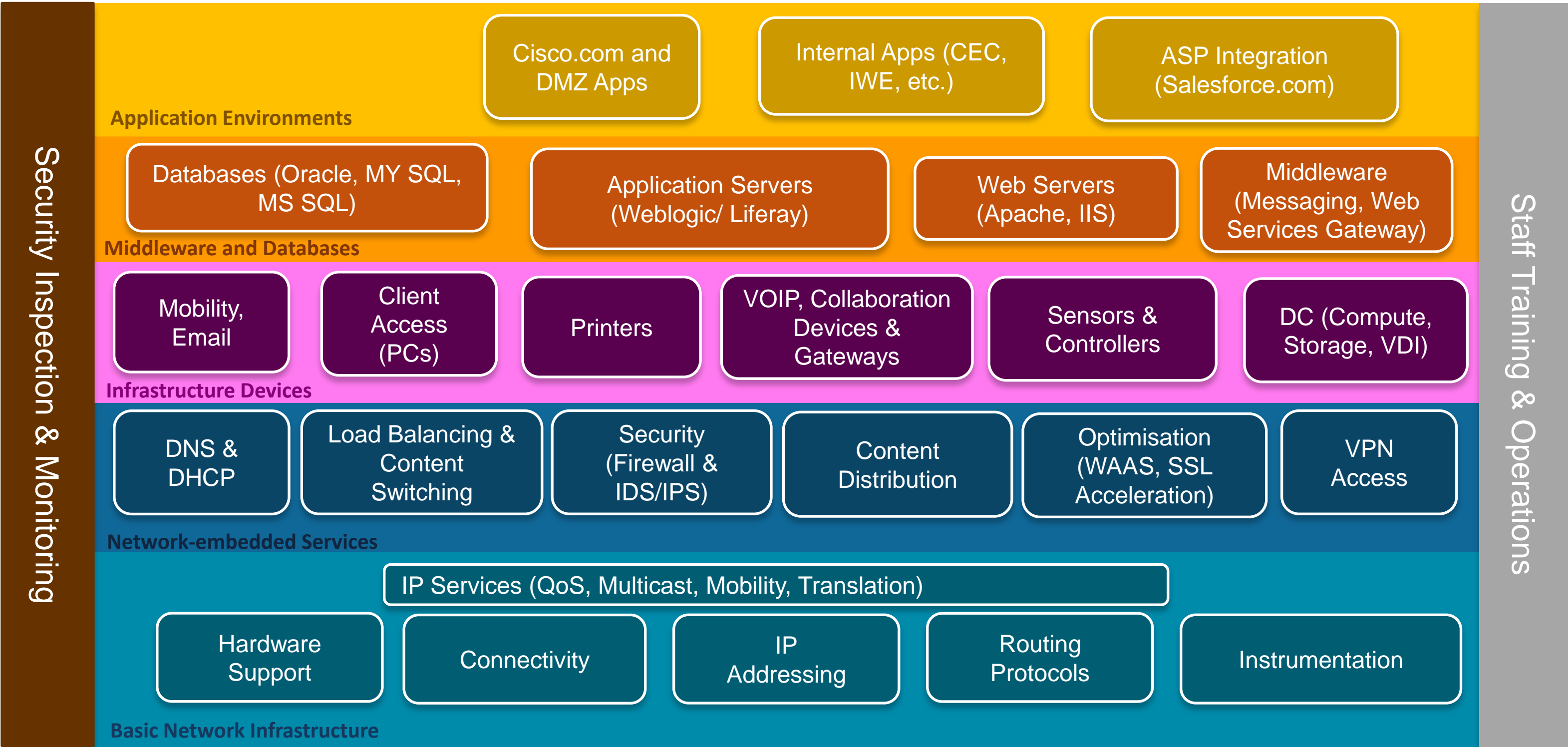
Goals

IPv6 Internet Presence
Ubiquitous IPv6 Access

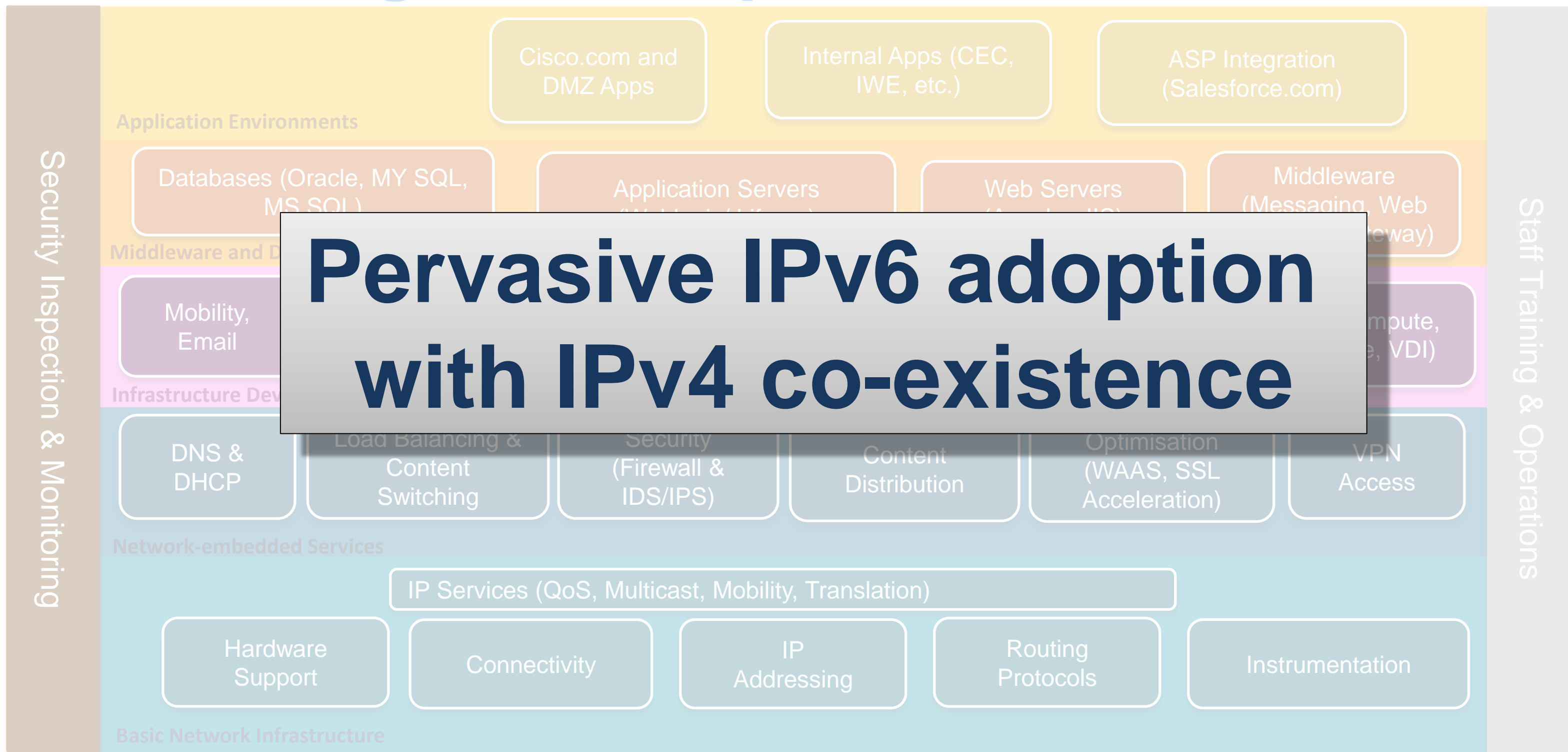
Constraints

Maintain IPv4 SLA & Security Posture
Funding & Resourcing
Product & Service Gaps

Cisco IT “Stack”



Setting IPv6 Scope



IPv6 Target State

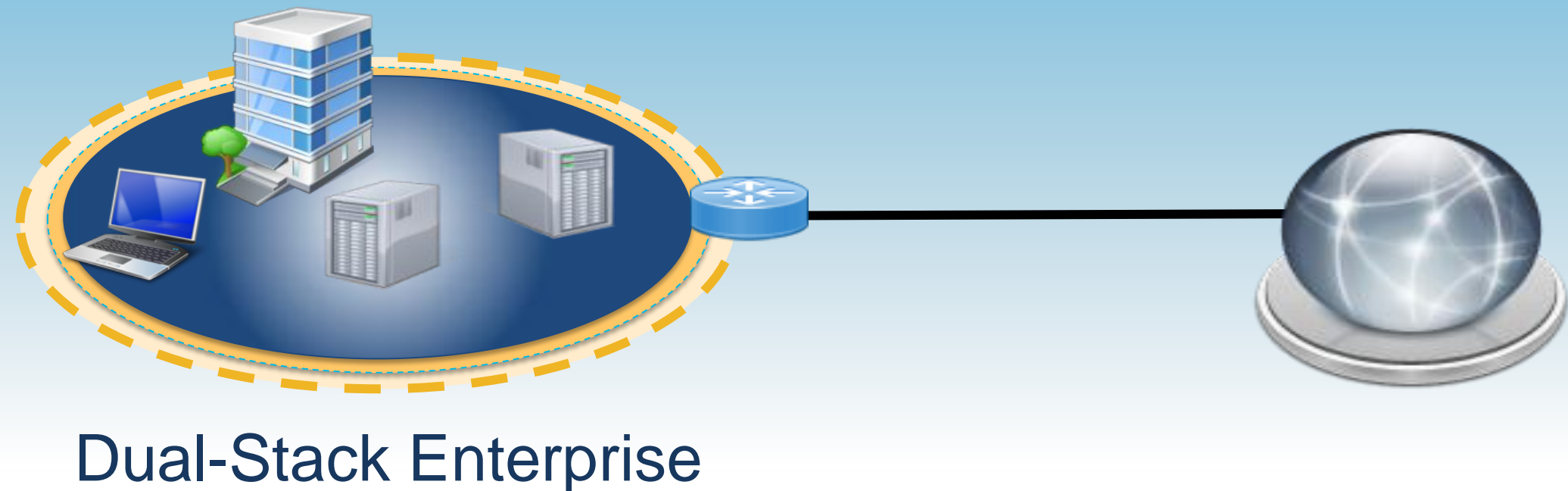
IPv6 Internet Presence

- Internet Evolution
- Business Continuity
- Customers, partners, employees

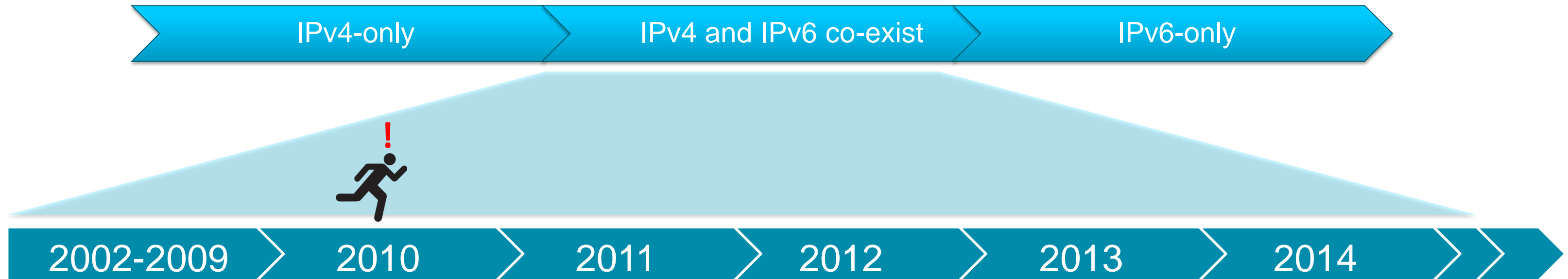


Ubiquitous IPv6 Access

- Globalisation
- Technology Leadership
- Product Development



The IPv6 Journey – A High Level View



IPv6 Internet Presence (Outside-In)

www.ipv6.cisco.com



www.cisco.com
accessible over IPv6



Entire cisco.com platform
accessible over IPv6

Ubiquitous IPv6 Access (Inside-Out)

On-demand tunnel services
Dual stack “alpha” networks

Dual stack global core
Resilient tunnel services

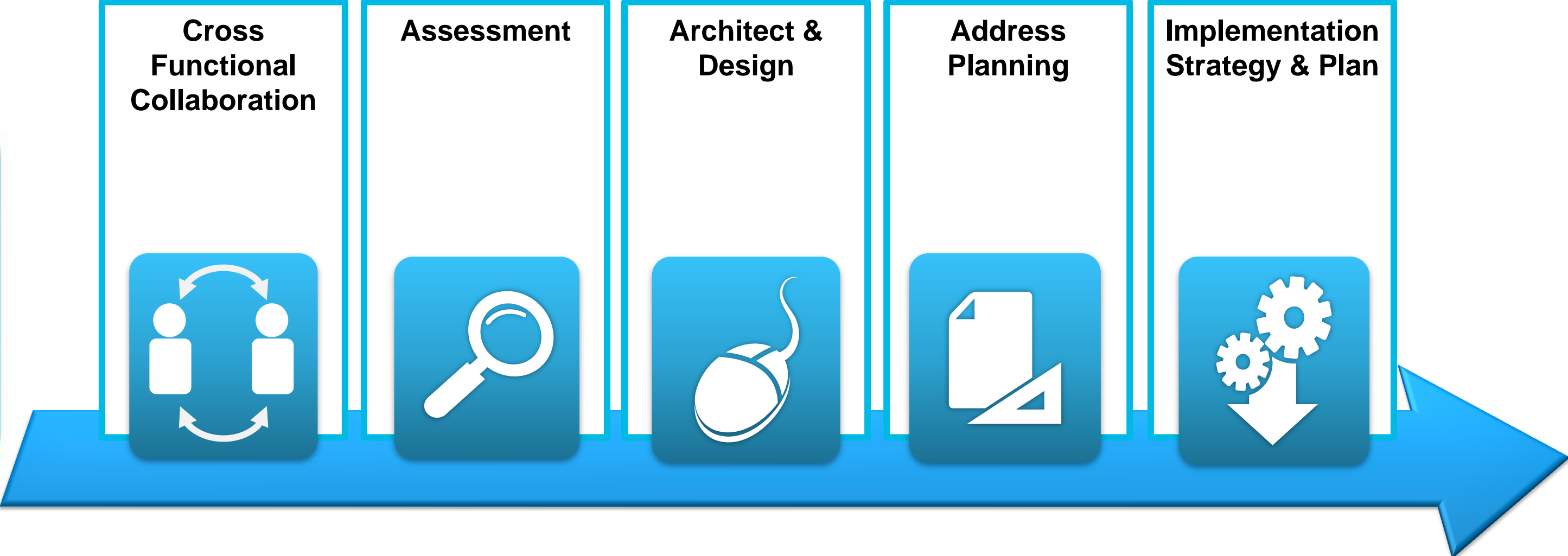
Dual stack user
access (pilot)

Dual stack user access (prod)
Dual stack internal DC and apps

Agenda

- Overview
 - Introduction to Cisco IT
 - Making the case for IPv6
 - IPv6 Journey
 - Target State
- Preparation
- Implementation Tracks
 - Ubiquitous IPv6 Access
 - IPv6 Internet Presence
- Lessons Learned

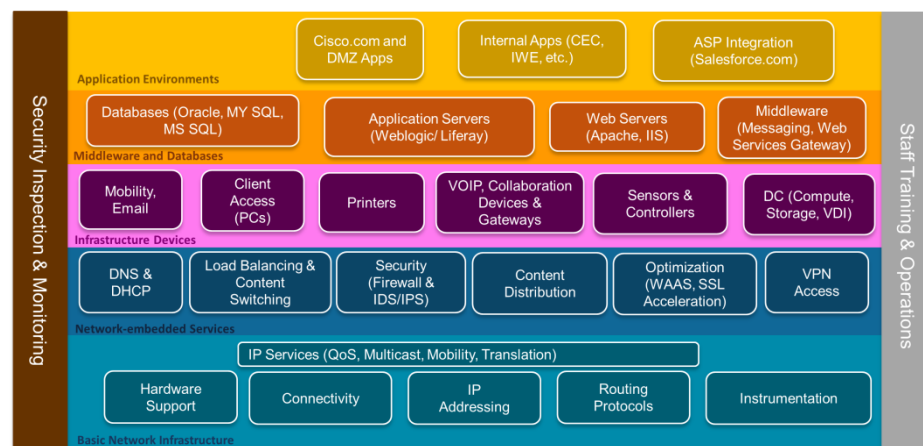
Preparation



Preparation

Cross Functional Collaboration

- Example of the need for wide cross functional collaboration across IT on IPv6
- Preparation and execution required participation of team members from 7 of 9 of CIO's direct reports



Preparation

Assessment



- Cisco products, features
 - Engaged Advanced Services for network IPv6 readiness report
- Other vendors
- Tools
 - Security
 - Network management
- Service providers
- Applications behind www.cisco.com

Preparation

Architect and Design



- Architectural decisions
 - Which routing protocol ?
 - SLAAC vs DHCPv6 ?
 - Code selection and qualification
- Documentation
 - Any new documentation required ?
 - Assess which existing designs are impacted and assign owners
 - Extra review board resources

Preparation

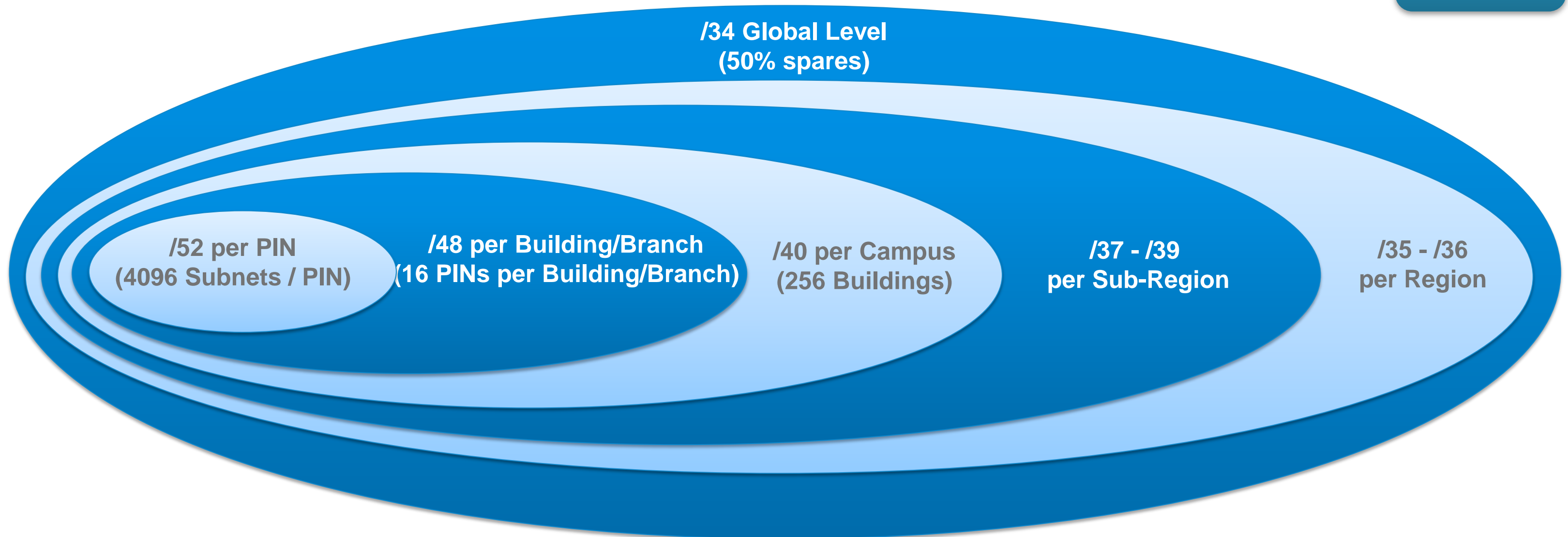
IPv6 Address Planning



- Established IPv6 Addressing policy
- Address management tool support for IPv6
- Hierarchical Model – Global, Regional, Sub-Regional and Site levels
- Template-based addressing - easy for Implementation and Operations Teams

Preparation

IPv6 Address Planning



PIN = Place In the Network

A framework to classify functional areas of the network
eg, Lab, Desktop, DC, DMZ etc

Preparation

IPv6 Address Planning



EMAN Address Management
About | Help | Feedback | Preference

EMAN > OPDATA > Management Applications > Address Management
Area: All Support: All TZ: PD

Dashboard

--	2001:420::/34	A (Active) Americas	
--	2001:420::/35	A (Active) US West	
--	2001:420::/37	A (Active) [NEW PLAN] - San Jose and MTV05	
--	+ 2001:420::/41	A (Active) [NEW PLAN] - SJ Infrastructure	(Contains some allocations from Old plan)
--	+ 2001:420:80::/41	A (Active) [NEW PLAN] - SJ DMZ Space	
--	+ 2001:420:100::/41	A (Active) [NEW PLAN] - SJ Site 1	
--	+ 2001:420:180::/41	A (Active) [NEW PLAN] - SJ Site 2	
--	+ 2001:420:200::/41	A (Active) [NEW PLAN] - SJ Site 3	
--	+ 2001:420:280::/41	A (Active) [New Plan] - SJ Site 4	
--	+ 2001:420:280::/48	A (Active) San Jose Site 4 Infrastructure Subnet	
--	+ 2001:420:281::/48	A (Active) SJC "1" Building	
--	+ 2001:420:282::/48	A (Active) SJC "2" Building	
--	+ 2001:420:283::/48	A (Active) SJC "3" Building	
--	+ 2001:420:284::/48	A (Active) SJC "4" Building	
--	+ 2001:420:285::/48	A (Active) SJC "5" Building	
--	+ 2001:420:286::/48	A (Active) SJC "6" Building	
--	+ 2001:420:287::/48	A (Active) SJC "7" Building	
--	+ 2001:420:288::/48	A (Active) SJC "8" Building	
--	+ 2001:420:289::/48	A (Active) SJC "9" Building	
--	+ 2001:420:28a::/48	A (Active) SJC "10" Building	
--	+ 2001:420:28b::/48	A (Active) SJC "11" Building	
--	+ 2001:420:28c::/48	A (Active) SJC "12" Building	
--	+ 2001:420:28c::/52	A (Active) San Jose Site 4 - Building 12 Infrastructure	
--	+ 2001:420:28c:1000::/52	A (Active) San Jose Site 4 - Building 12 "Desktops VLAN"	
--	+ 2001:420:28c:2000::/52	A (Active) San Jose Site 4 - Building 12 "LAB Subnet"	
--	2001:420:28c:3000::/52	- (Unallocated Block)	Add Subnet Add Address Block
--	2001:420:28c:4000::/50	- (Unallocated Block)	Add Subnet Add Address Block
--	2001:420:28c:8000::/49	- (Unallocated Block)	Add Subnet Add Address Block

- + Address Mgmt
 - [Browse Address Space](#)
 - [Search Address Space](#)
 - [Search DNS Change Log](#)
 - + CIDR Block
 - + Address Block
 - + Subnet
 - + Scope
 - + Host
 - + Interface (A/PTR)
 - + Alias (CNAME)
 - + Mail Exchanger (MX)
 - + Text (TXT)
 - + Service (SRV)
- + Name Server Mgmt
- + DHCP Server Mgmt
- + Jumpstart Mgmt
- + PXE Mgmt
- + WLAN Mgmt
- + Security Mgmt
- + Lookup Table Mgmt
- + Reports / Trending
- + Monitoring
- + Miscellaneous

Preparation

Implementation Strategy and Plan



“Dual stack where you can, tunnel where you can’t and NAT only when have to”

- Long term plan that absorbs cost in established lifecycle process rather than rip and replace
- Have a quick and scalable solution in hand to relieve delivery pressure
- Rip and replace only where necessary (Fast track projects)
- Management via IPv4 with IPv6 service monitoring
- On going training and exposure for I & O teams

Agenda

- Overview
 - Introduction to Cisco IT
 - Making the case for IPv6
 - IPv6 Journey
 - Target State
- Preparation
- **Implementation Tracks**
 - Ubiquitous IPv6 Access
 - IPv6 Internet Presence
- Lessons Learned

Ubiquitous IPv6 Access

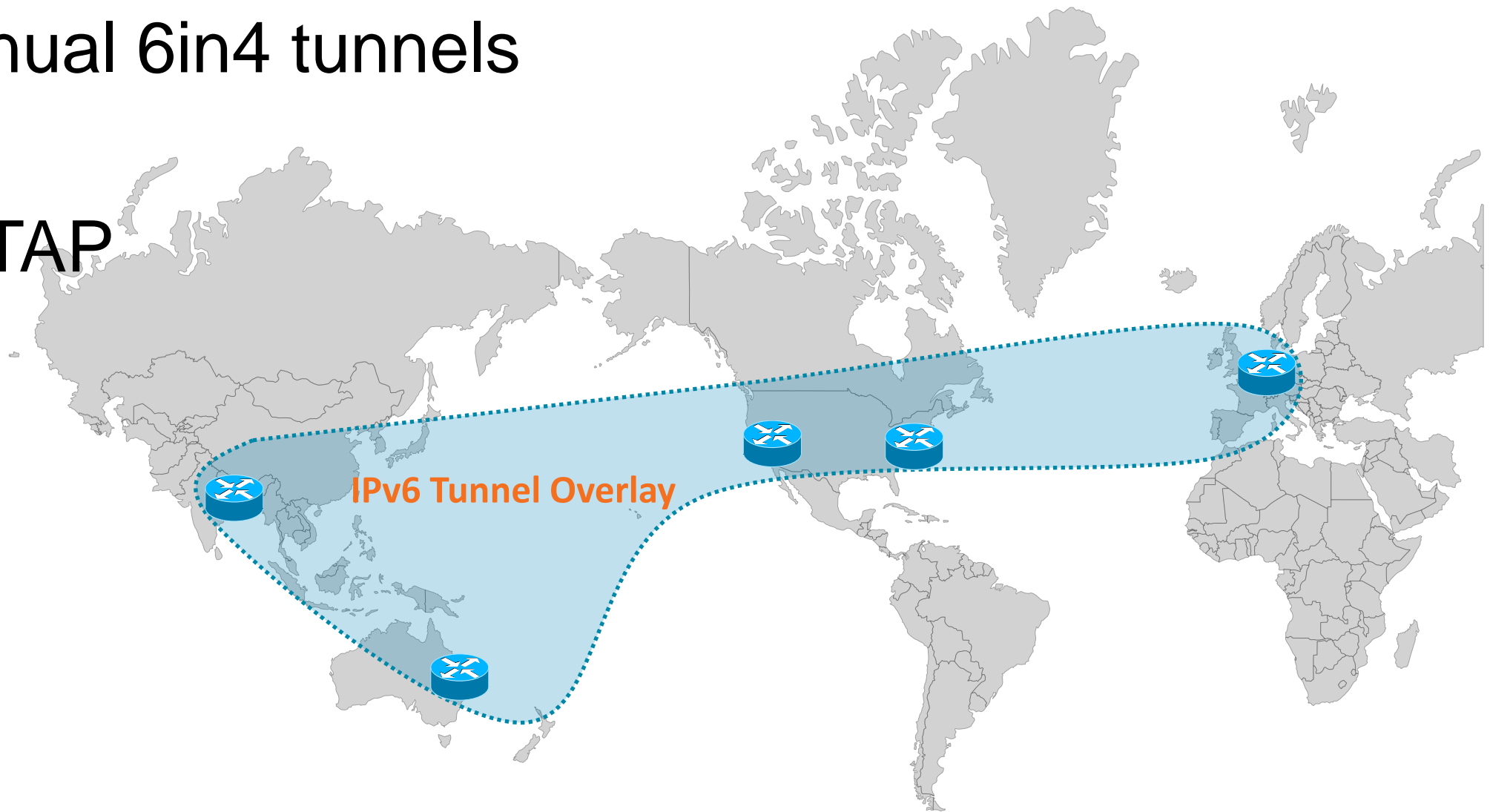
Long Term Plan - Dual Stack the Network

- Core to edge rollout
- Multi-year plan absorbed into existing lifecycle management
 - Simultaneous projects across Desktop, DC, Remote Access, iPoPs
 - Accelerated deployment for select remote sites / services
- Dual stacked services
 - DNS, IP address management, DHCPv6
- Routing protocol same as IPv4 - EIGRP
- SLA same as IPv4

Ubiquitous IPv6 Access

Short Term Plan – Tunnel Infrastructure

- Dual stacked core + Global tunnel infrastructure
- Building / Lab = Manual 6in4 tunnels
 - Evaluating LISP
- User = Anycast ISATAP
- SLA same as IPv4



Network: IPv6 Status

FY12 Achievements

- ✓ Core 100% enabled
- ✓ DCs and iPoP required for World IPv6 Launch & end user DHCPv6
- ✓ 5 campus & 8 remote office buildings

FY13 Targets

- 🎯 All 21 production DCs
- 🎯 All 15 iPoPs
- 🎯 A further 88 buildings
- 🎯 Covert 107 tunnelled labs to native IPv6
- 🎯 Enable anyconnect VPN headends

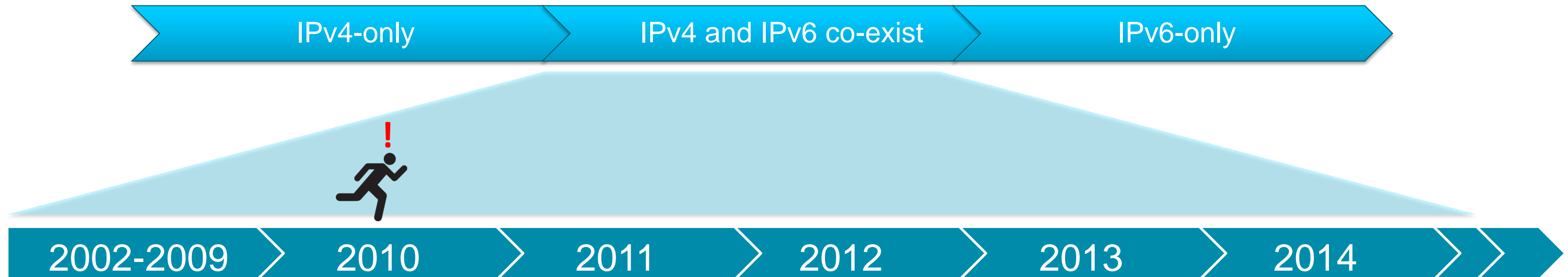
Still Planning

- ? Cisco Virtual Office
- ? Extranet

Agenda

- Overview
 - Introduction to Cisco IT
 - Making the case for IPv6
 - IPv6 Journey
 - Target State
- Preparation
- **Implementation Tracks**
 - Ubiquitous IPv6 Access
 - **IPv6 Internet Presence**
- Lessons Learned

The IPv6 Journey – A High Level View



IPv6 Internet Presence (Outside-In)

www.ipv6.cisco.com



www.cisco.com
accessible over IPv6



Entire cisco.com platform
accessible over IPv6

Ubiquitous IPv6 Access (Inside-Out)

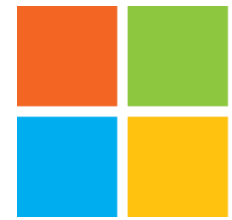
On-demand tunnel services
Dual stack “alpha” networks

Dual stack global core
Resilient tunnel services

Dual stack user
access (pilot)

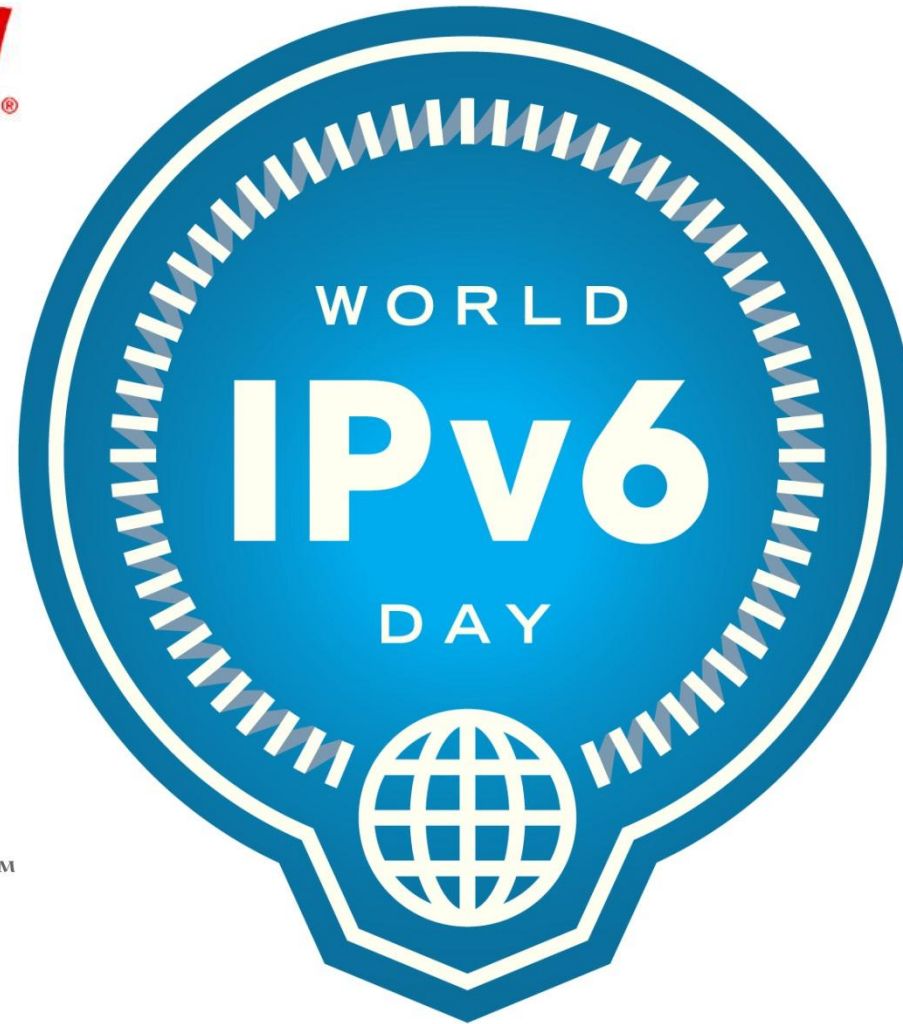
Dual stack user access (prod)
Dual stack internal DC and apps

YAHOO!



Microsoft

Google™



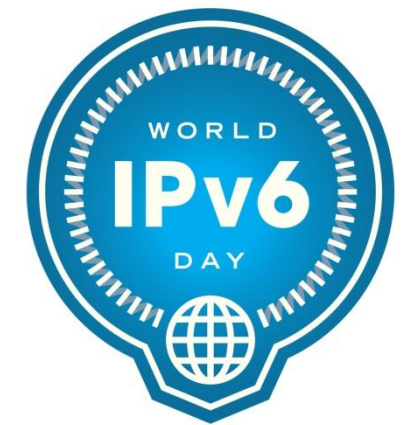
facebook®



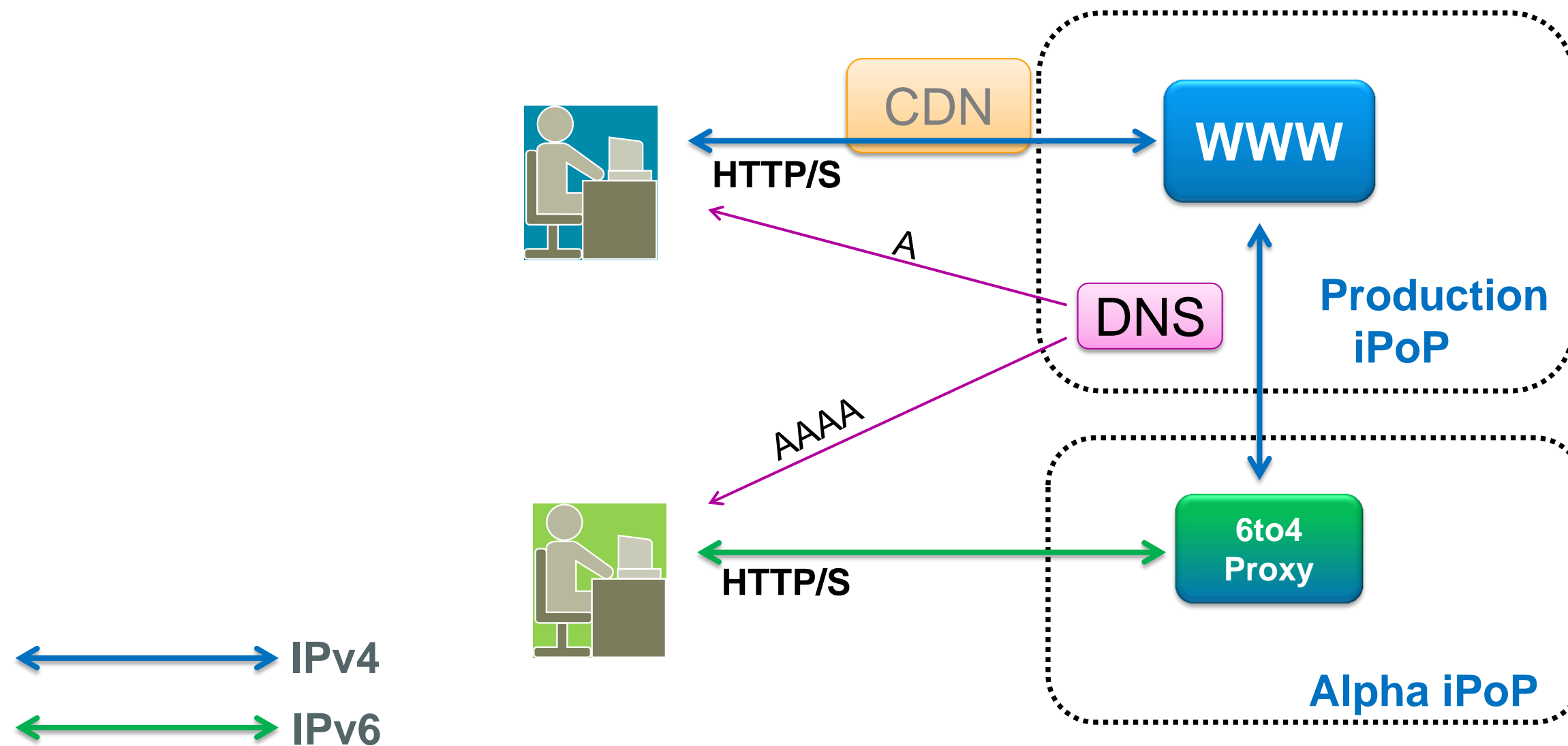
24 hour IPv6 “test flight” 8th June 2011

<http://www.internetsociety.org/ipv6/archive-2011-world-ipv6-day>

World IPv6 Day



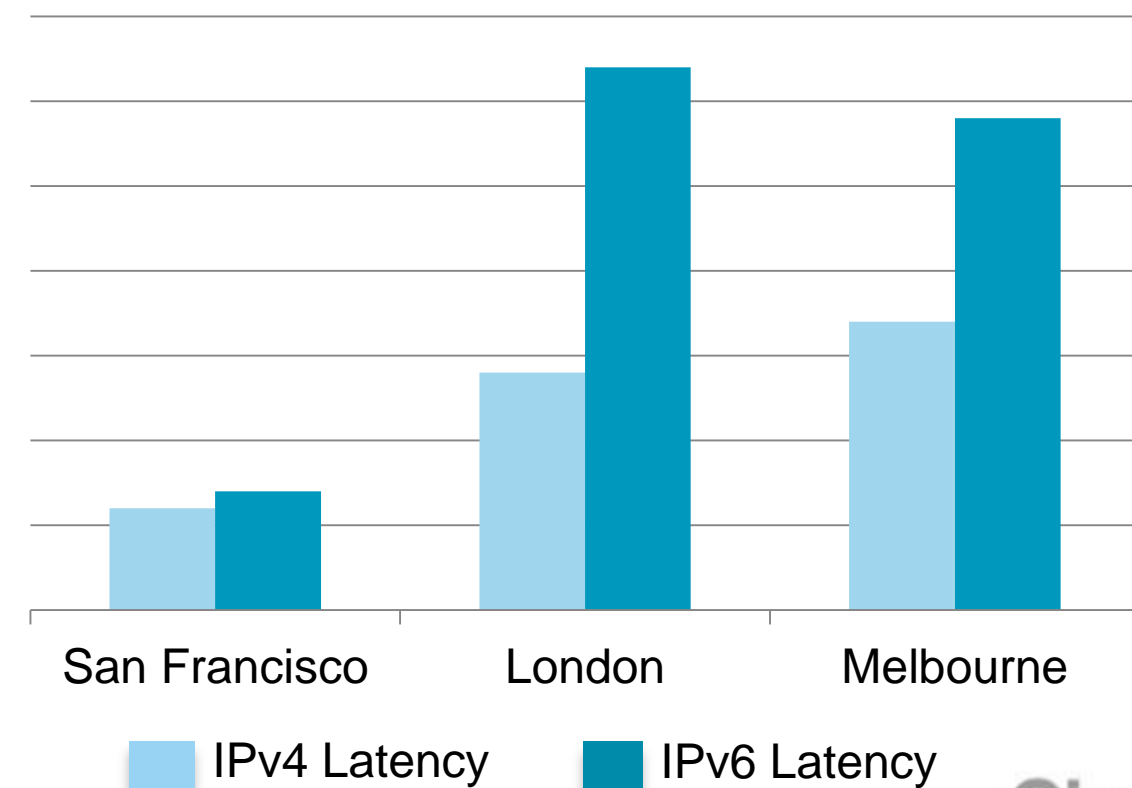
- 6to4 reverse proxy solution
- Returned A and AAAA records for www.cisco.com



World IPv6 Day

Our Experience

- Network traffic volume based on NetFlow data
 - 1.11% of all traffic to/from www.cisco.com was IPv6
- Support Cases
 - No support cases for www.cisco.com related to World IPv6 Day
- IPv6 performance - Content served over IPv6 was NOT cached/accelerated by CDN. All content was served from a single origin in San Jose.





THIS TIME IT IS FOR REAL
6 JUNE 2012

Major Internet service providers (ISPs), home networking equipment manufacturers, and web companies around the world are coming together to permanently enable IPv6 for their products and services by 6 June 2012.

THIS TIME IT IS FOR REAL

Major Internet service providers (ISPs), home networking equipment manufacturers, and web companies around the world are coming together to permanently enable IPv6 for their products and services by 6 June 2012.

AKAMAI
COMCAST
FREE TELECOM
KDDI
TIME WARNER CABLE



AT&T
D-LINK
GOOGLE
LIMELIGHT
XS4ALL

CISCO
FACEBOOK
INTERNODE
MICROSOFT BING
YAHOO!

DO YOUR PART
JOIN THE LAUNCH!

JOIN THE LAUNCH!
DO YOUR PART

www.worldipv6launch.org

3000+ WEB sites, 50+ Operators, 4 RHG vendors

World IPv6 Launch @ Cisco

Cisco webex

Overview Products How To Channels Host a Meeting Attend a Meeting

Bring meetings to life with WebEx high-definition video

Create a true face-to-face meeting experience with crystal-clear video.

[Buy Now](#) [Try It Free](#)

Or [learn more](#) about WebEx high-definition video

WebEx meetings Call Me feature WebEx Apple

Latest News Cisco is unveiling the next generation of Cisco WebEx [Read more](#)

Watch a 3-minute quick tour

No more frustrating phone conferences. See how you can get more done in easy online meetings.

[Play now](#)

Get WebEx on your Android

Join WebEx meetings from your Android device. Meet face-to-face on tablets.

[Learn more](#)

[WebEx on other devices](#)

Worldwide Account Log Out My Cisco

The Extraordinary is Within Reach

Help your employees transform from knowledge workers into collaborative innovators.

[Learn More](#)

Latest News [Smart Services: Spotting Problems Before They Happen - 15 Oct 2012](#) [Follow Us](#)

Cisco Unified Access

One policy. One management. One network.

[Learn More](#)

Empower, Engage, Innovate

Learn about Cisco's collaboration strategy and new innovations.

[Watch Live Keynote](#)

My Networked Life New Video Series

True stories from a connected world.

[Watch Videos](#)

Cisco Home Networking

home.cisco.com/en-us/home

Meet the New Linksys Smart Wi-Fi Routers

[LEARN MORE](#)

Connect Your Life.

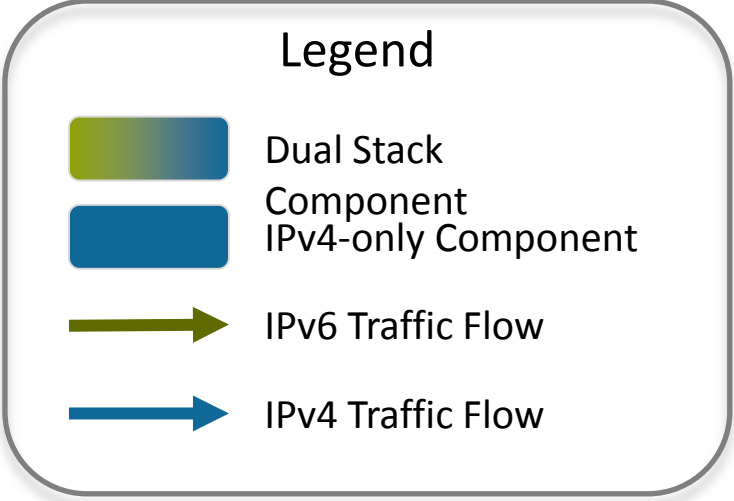
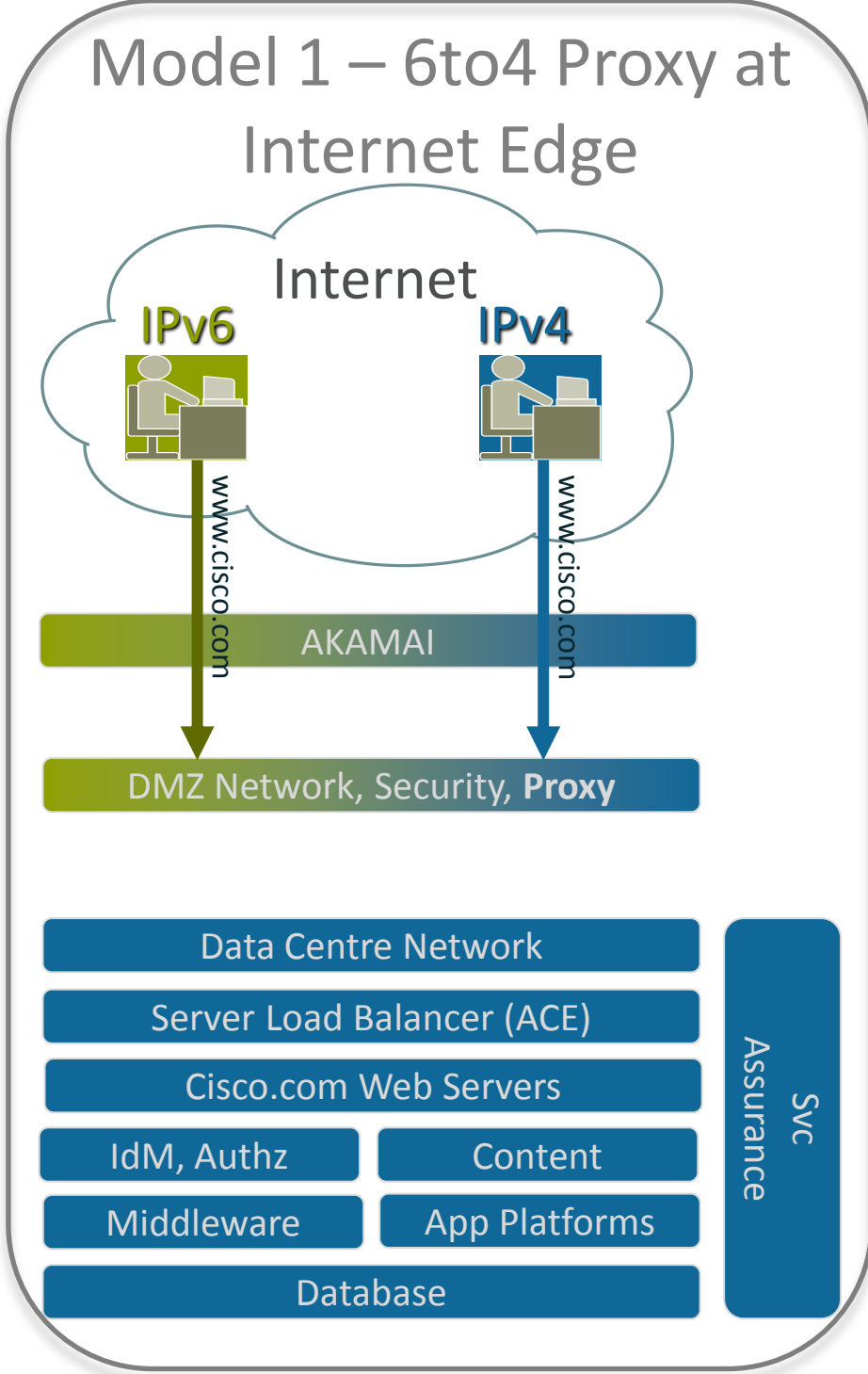
Coming Soon Cisco Connect Cloud

www.cisco.com
www.webex.com
home.cisco.com



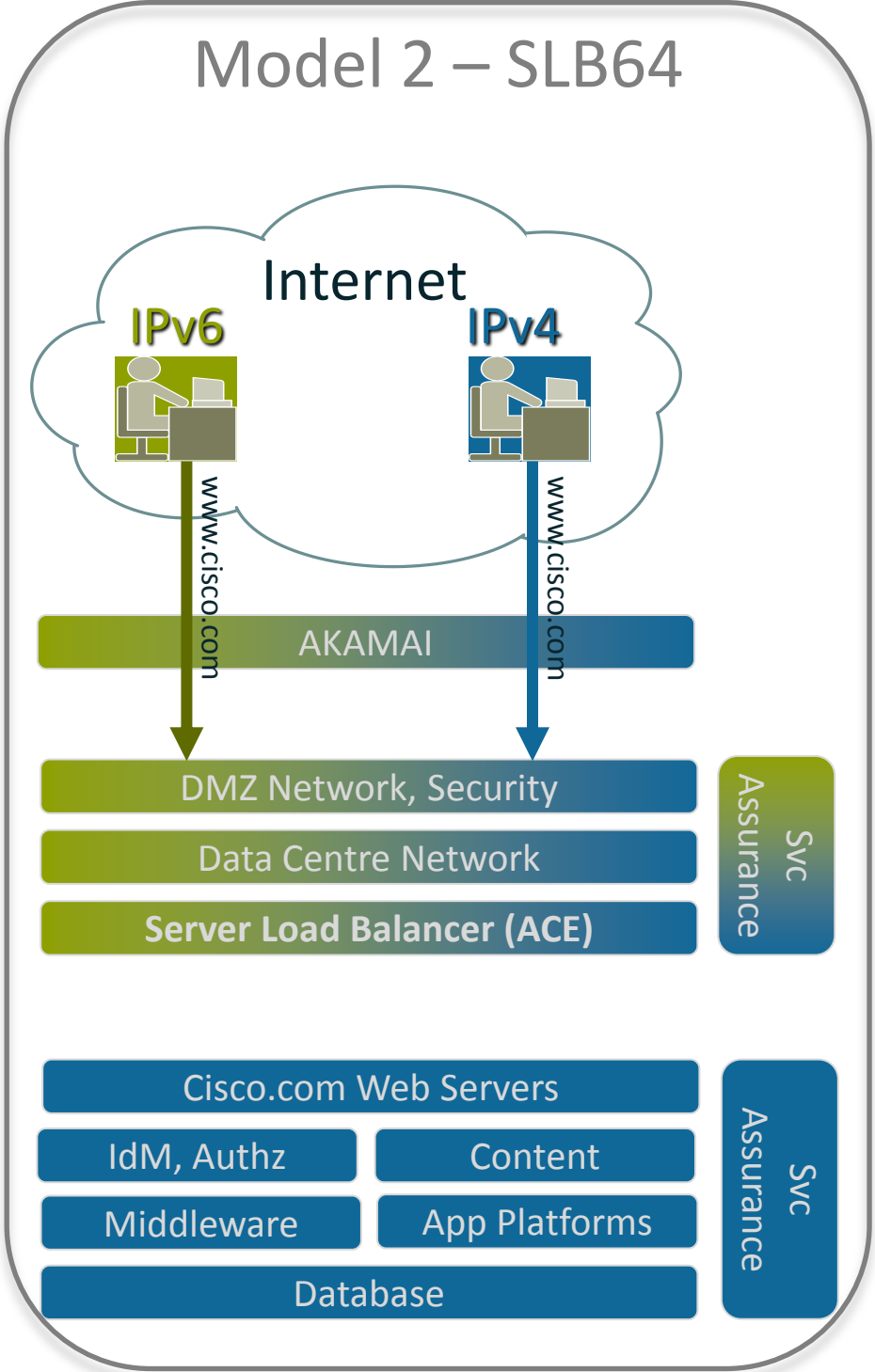
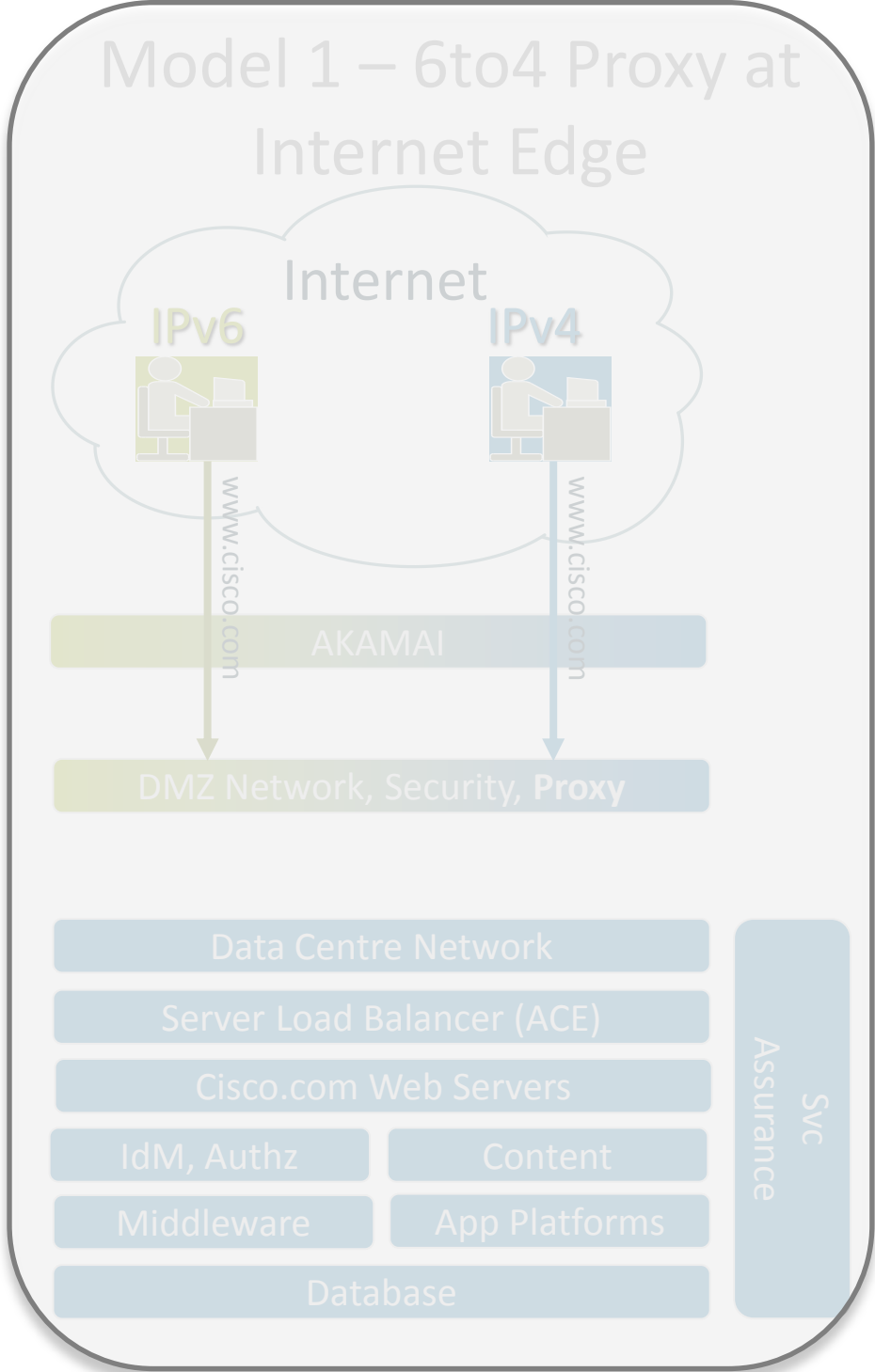
Cisco's IPv6 Web Presence

Architecture for www.cisco.com



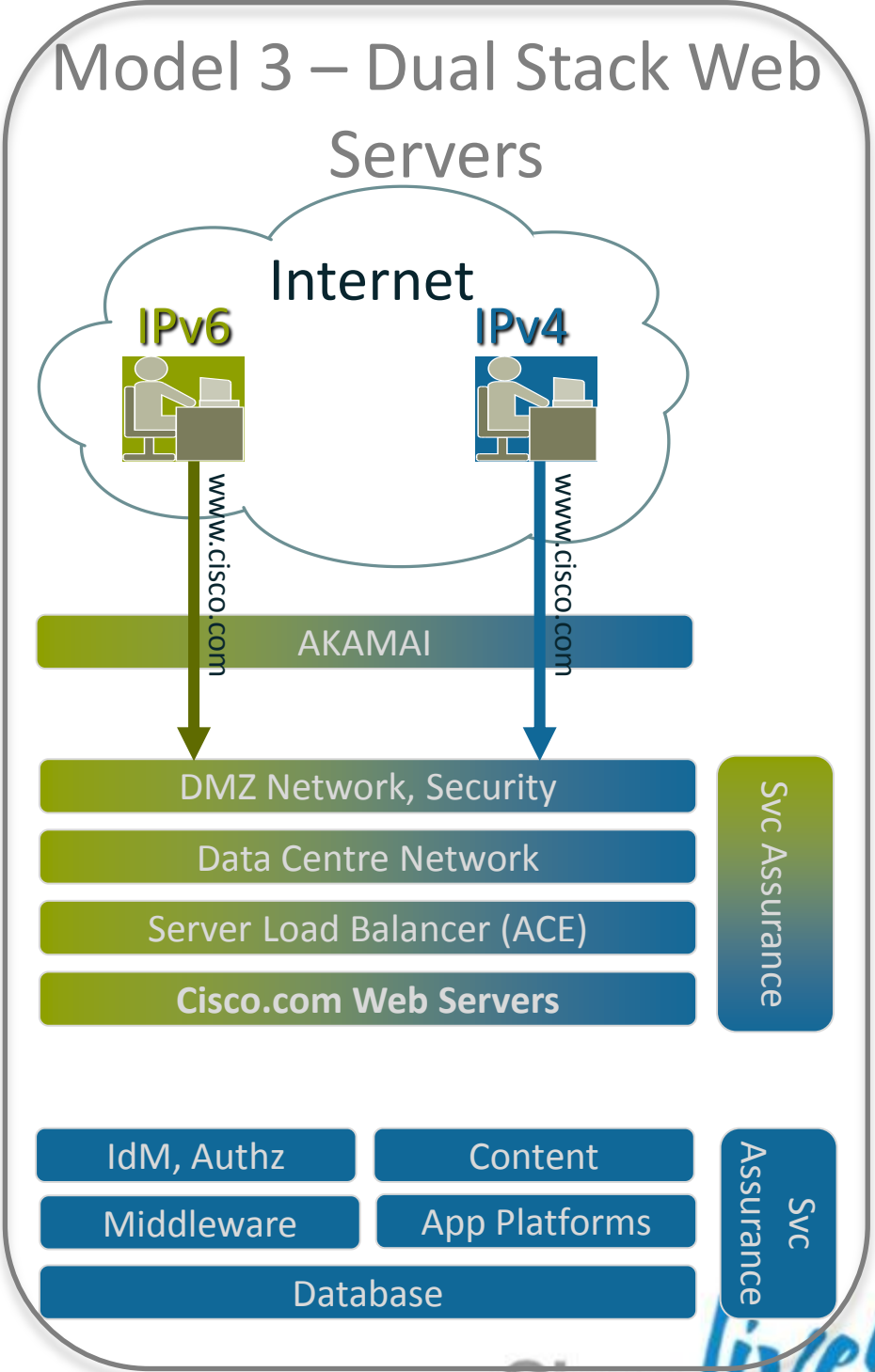
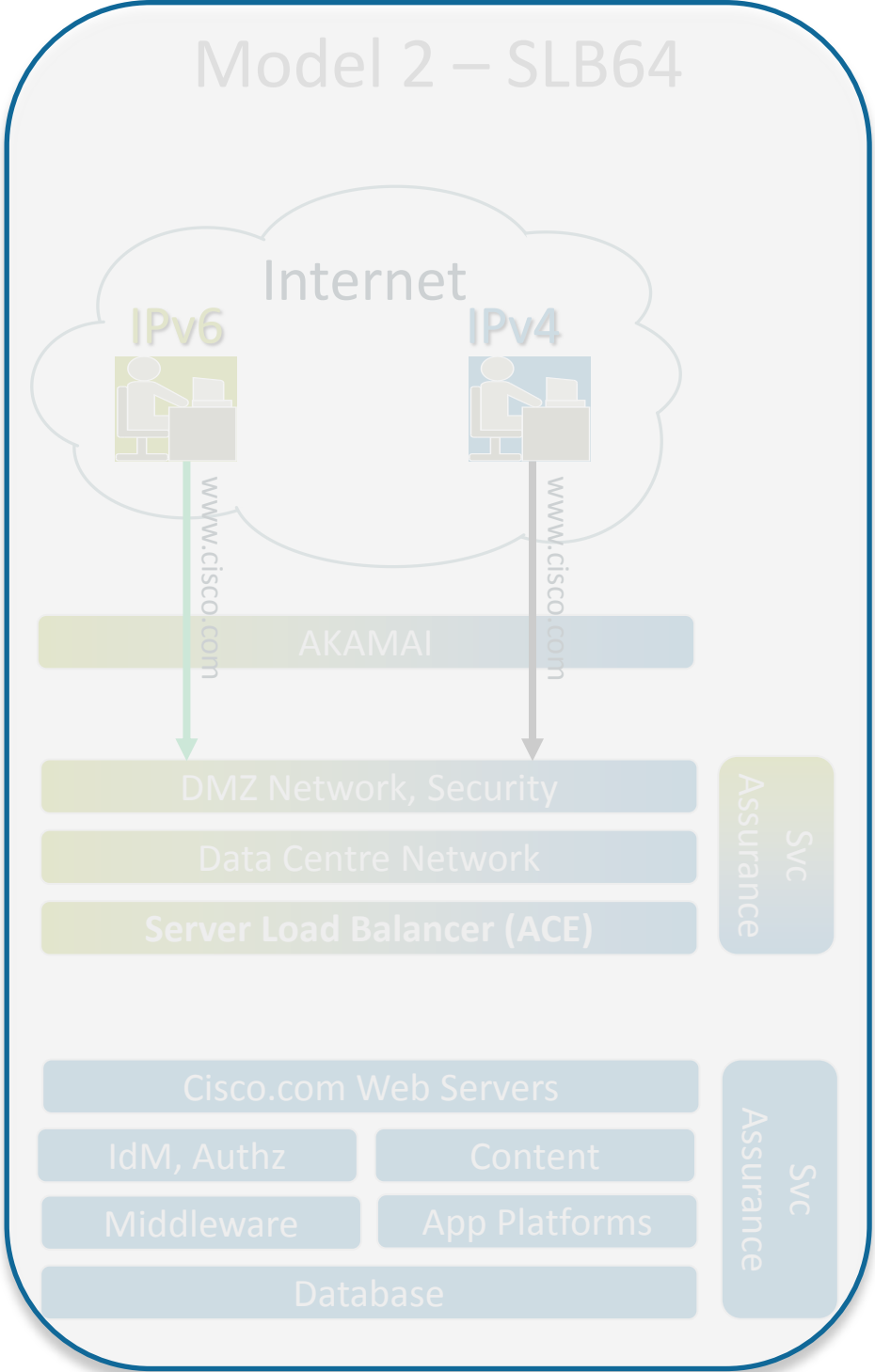
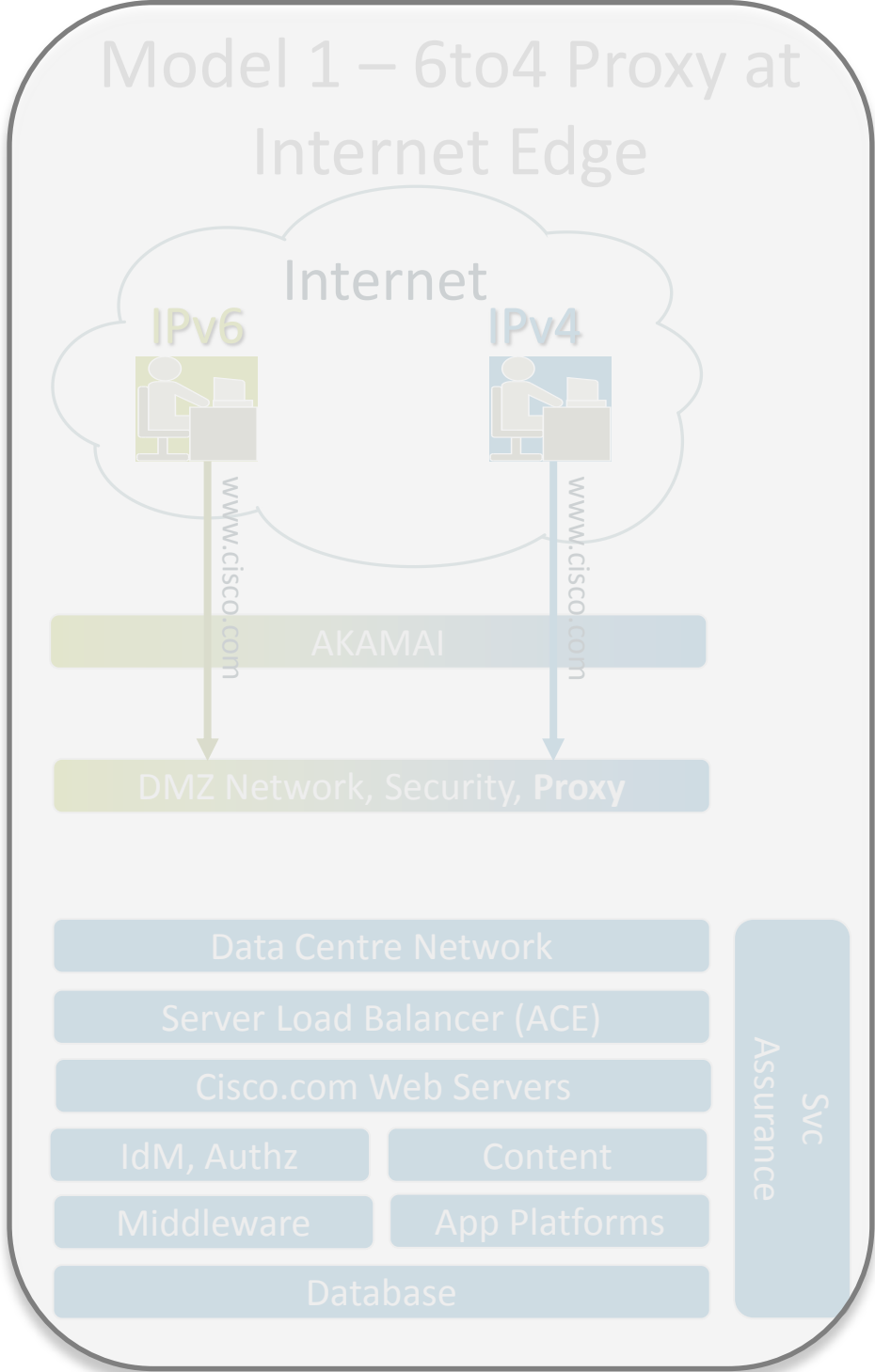
Cisco's IPv6 Web Presence

Architecture for www.cisco.com



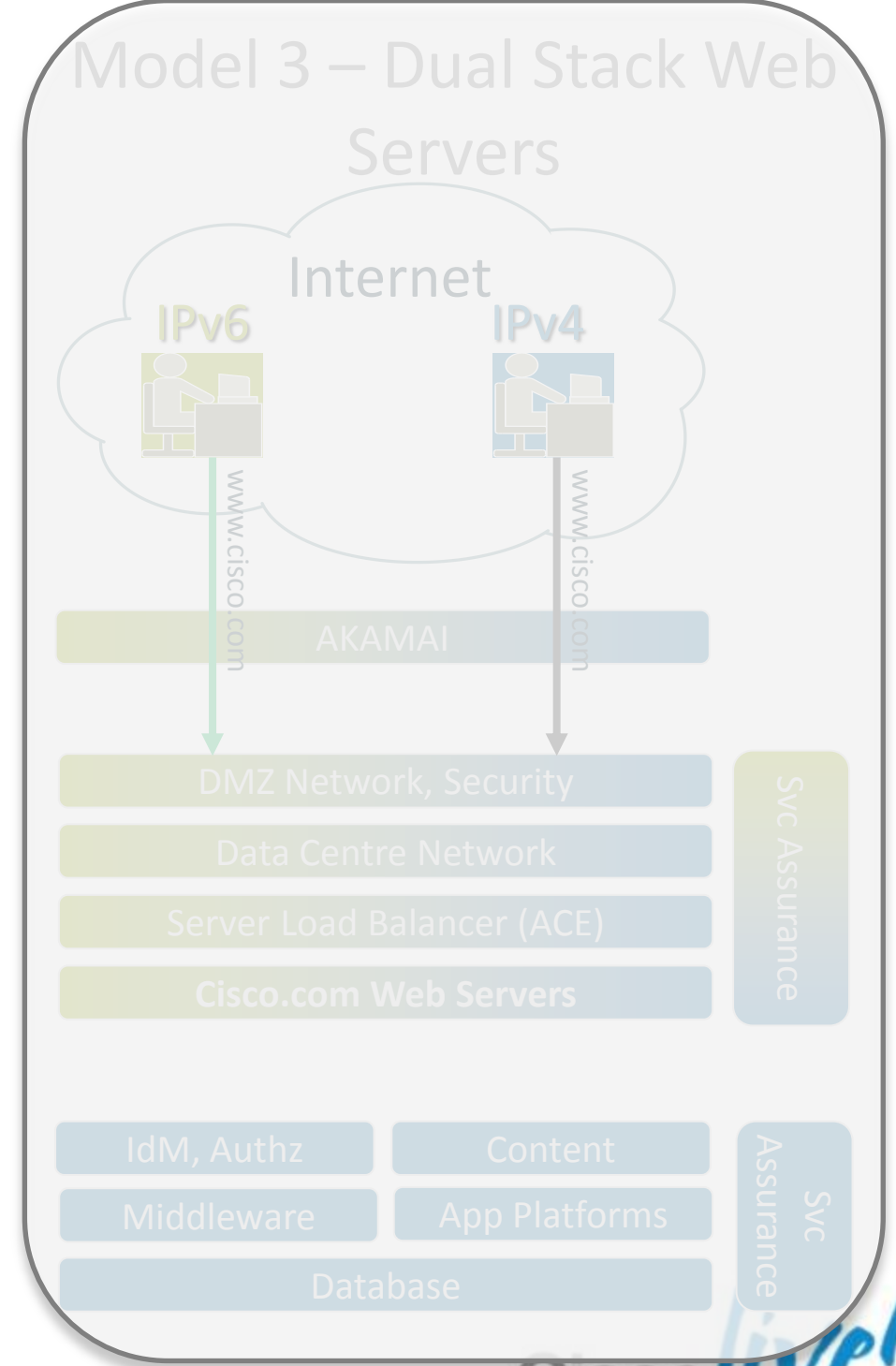
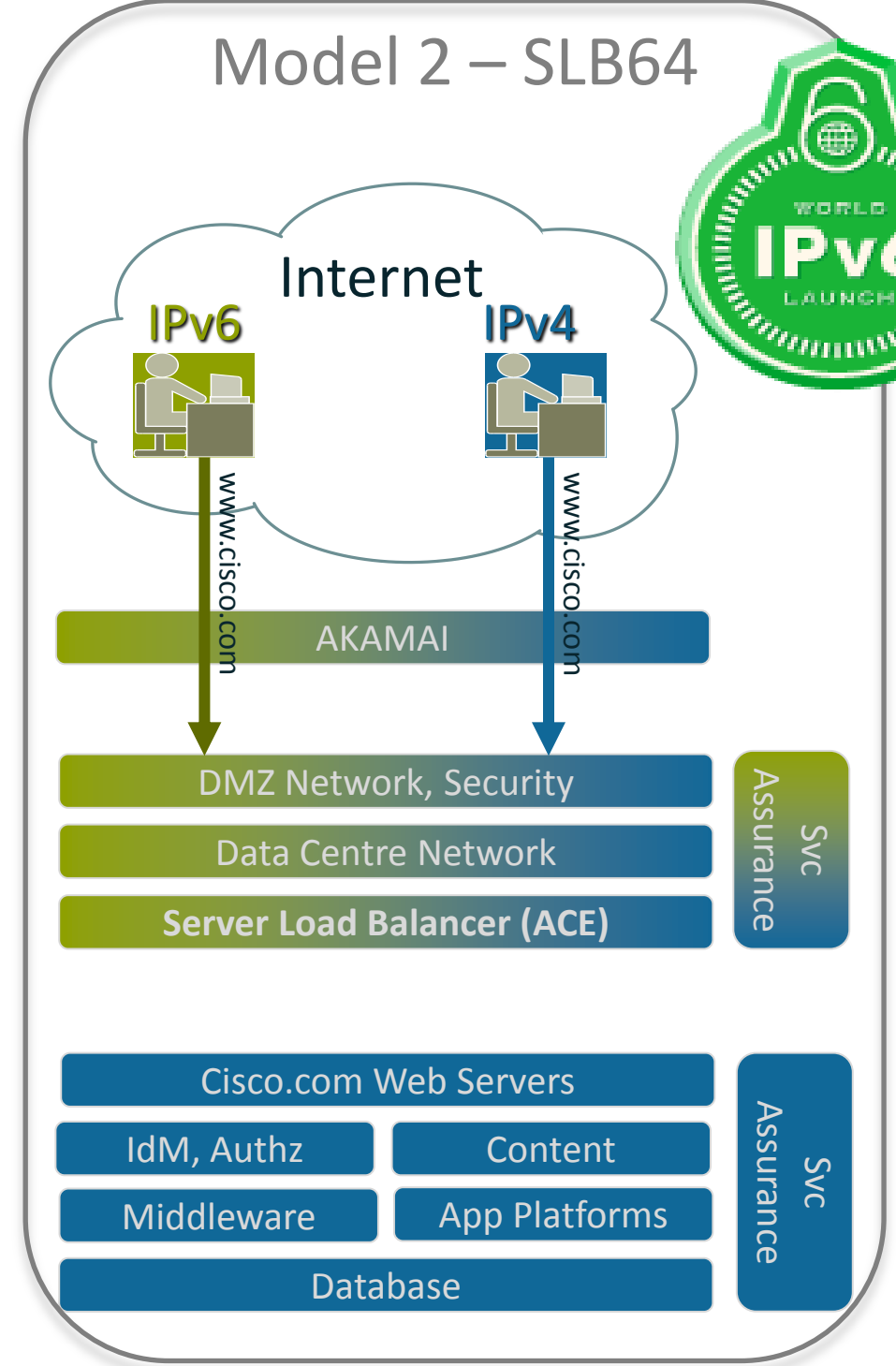
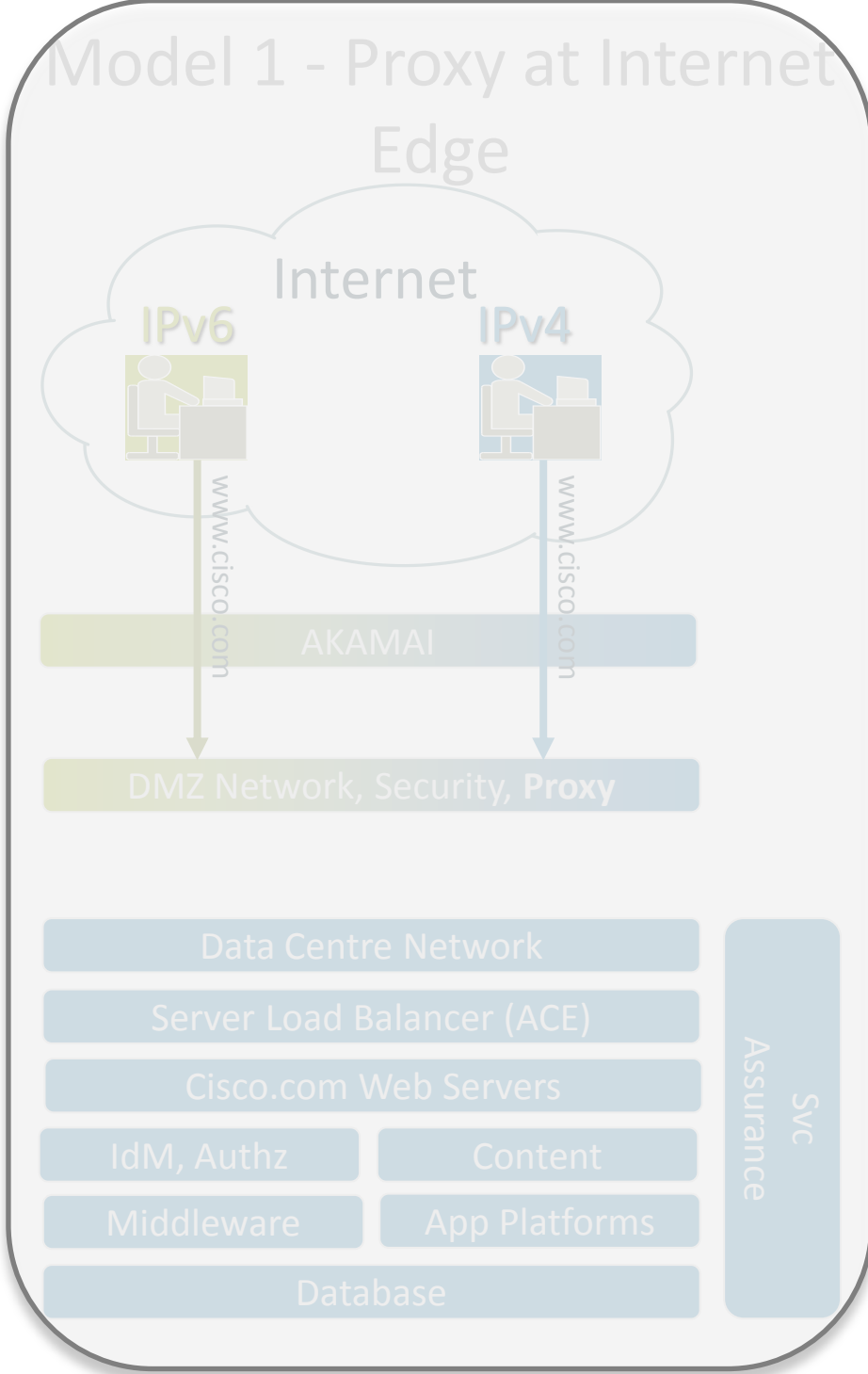
Cisco's IPv6 Web Presence

Architecture for www.cisco.com



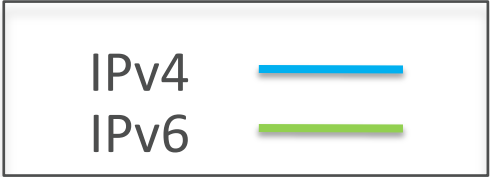
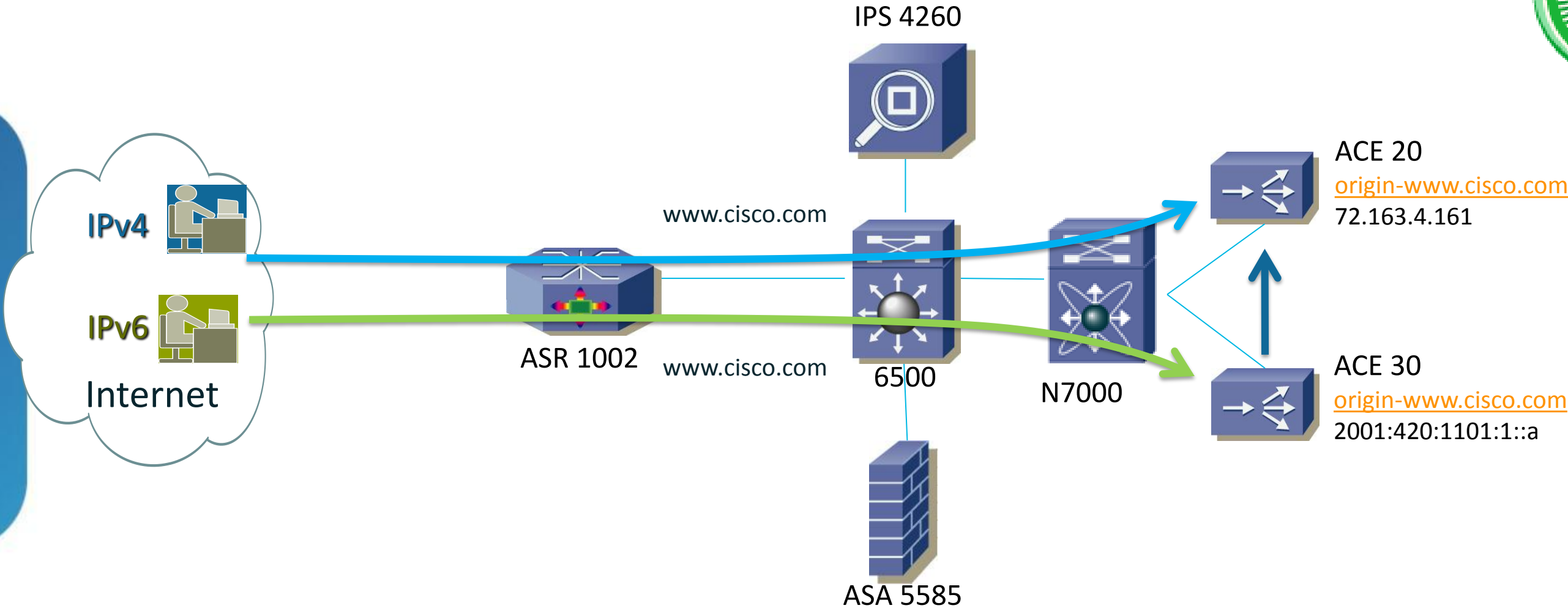
Cisco's IPv6 Web Presence

Architecture Decision for www.cisco.com



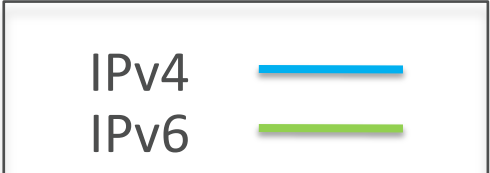
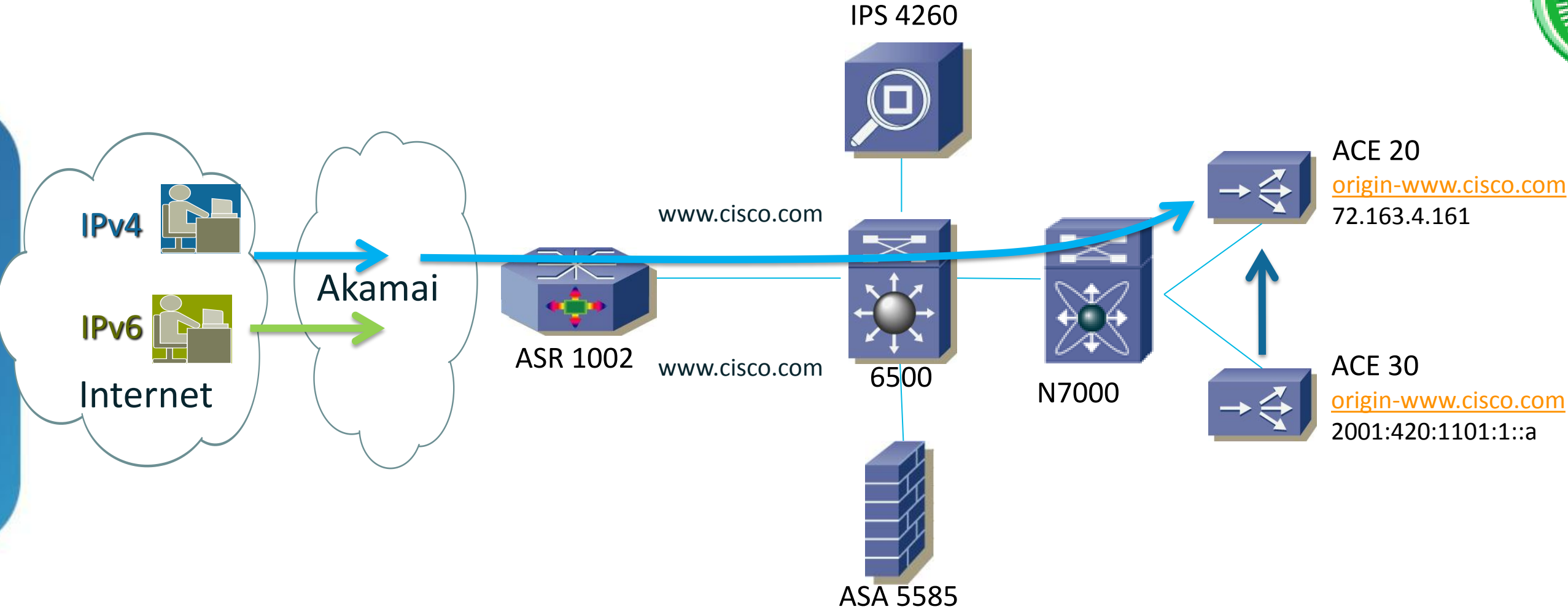
Cisco's IPv6 Web Presence

Design for www.cisco.com



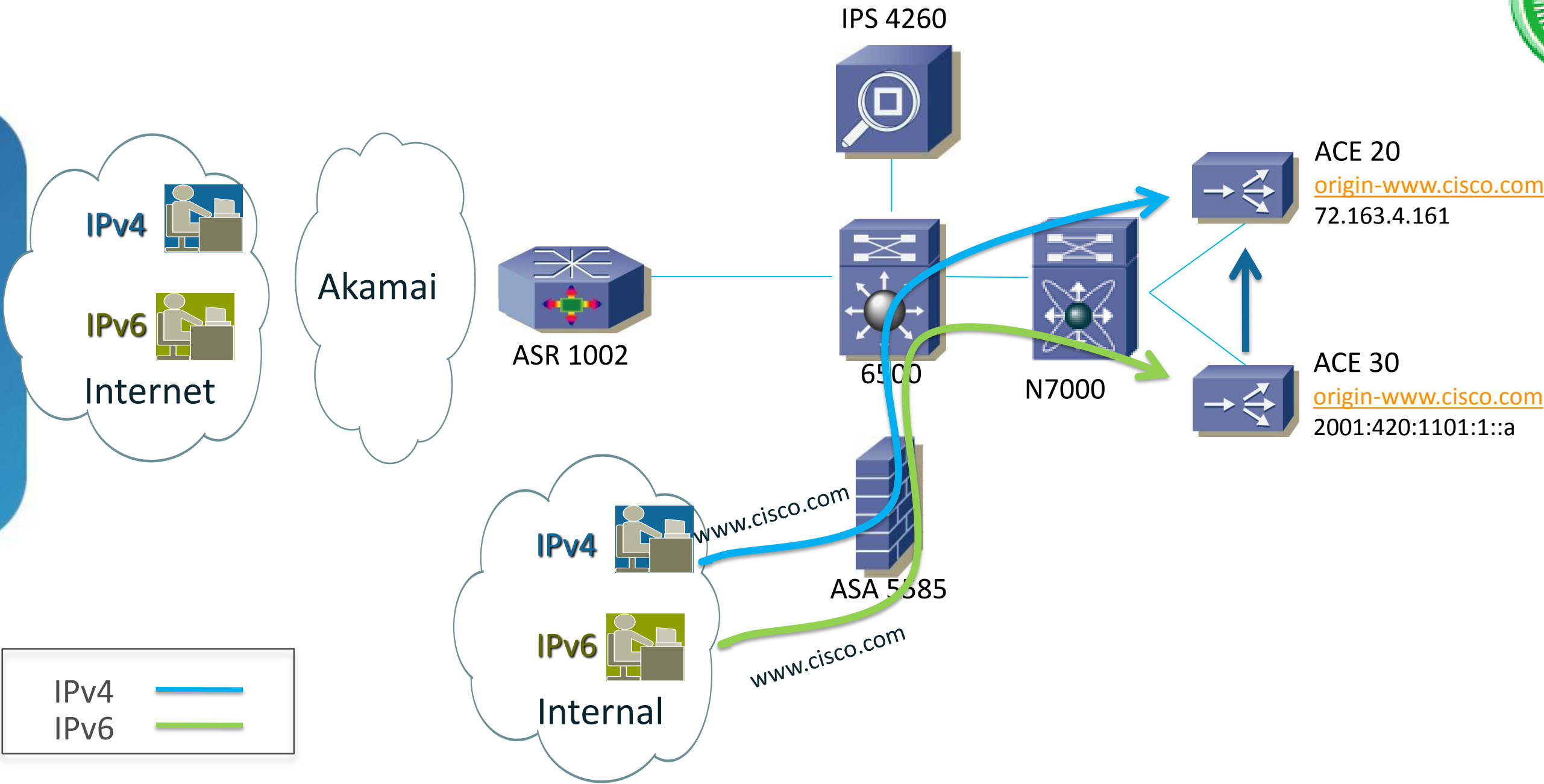
Cisco's IPv6 Web Presence

Design for www.cisco.com



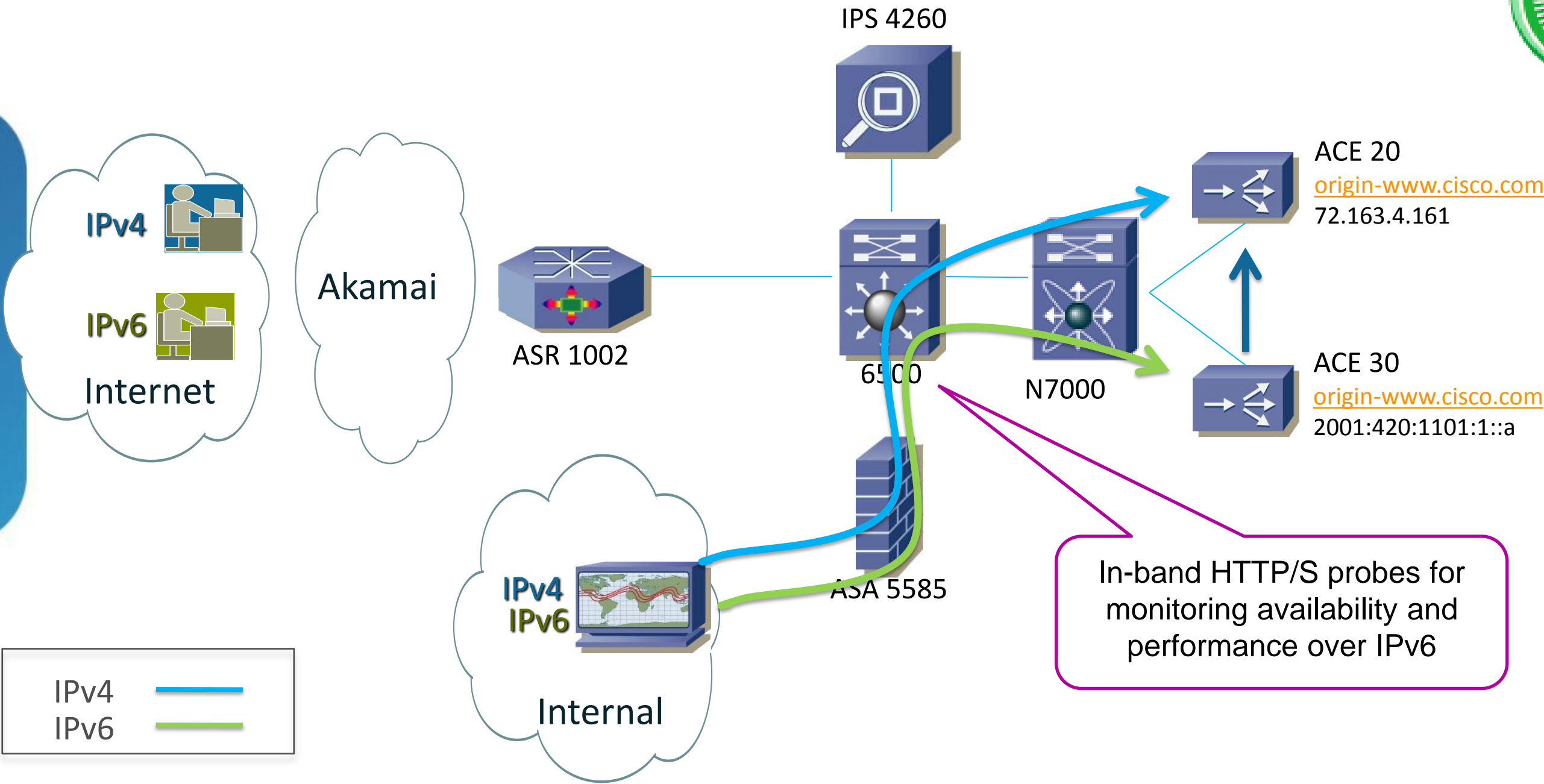
Cisco's IPv6 Web Presence

Design for www.cisco.com



Cisco's IPv6 Web Presence

Design for www.cisco.com



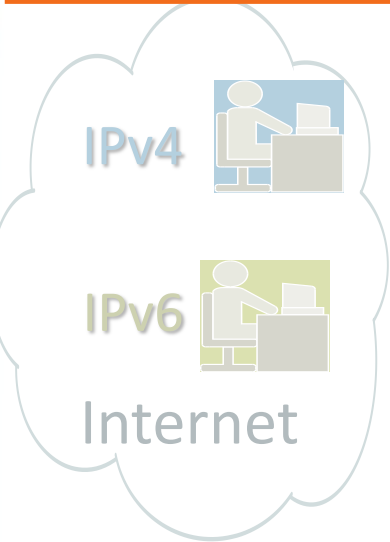
Cisco's IPv6 Web Presence

Design for www.cisco.com

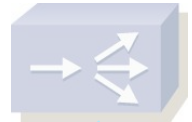
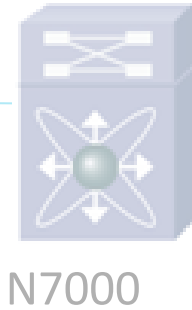
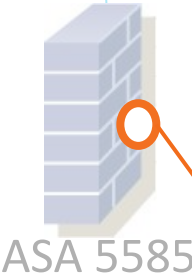
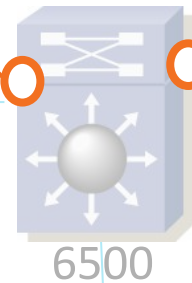
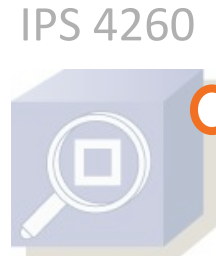


NetFlow v9

- forensic records
- Arbor (anomaly detection)



Firewall Policy
Anti-Spoofing



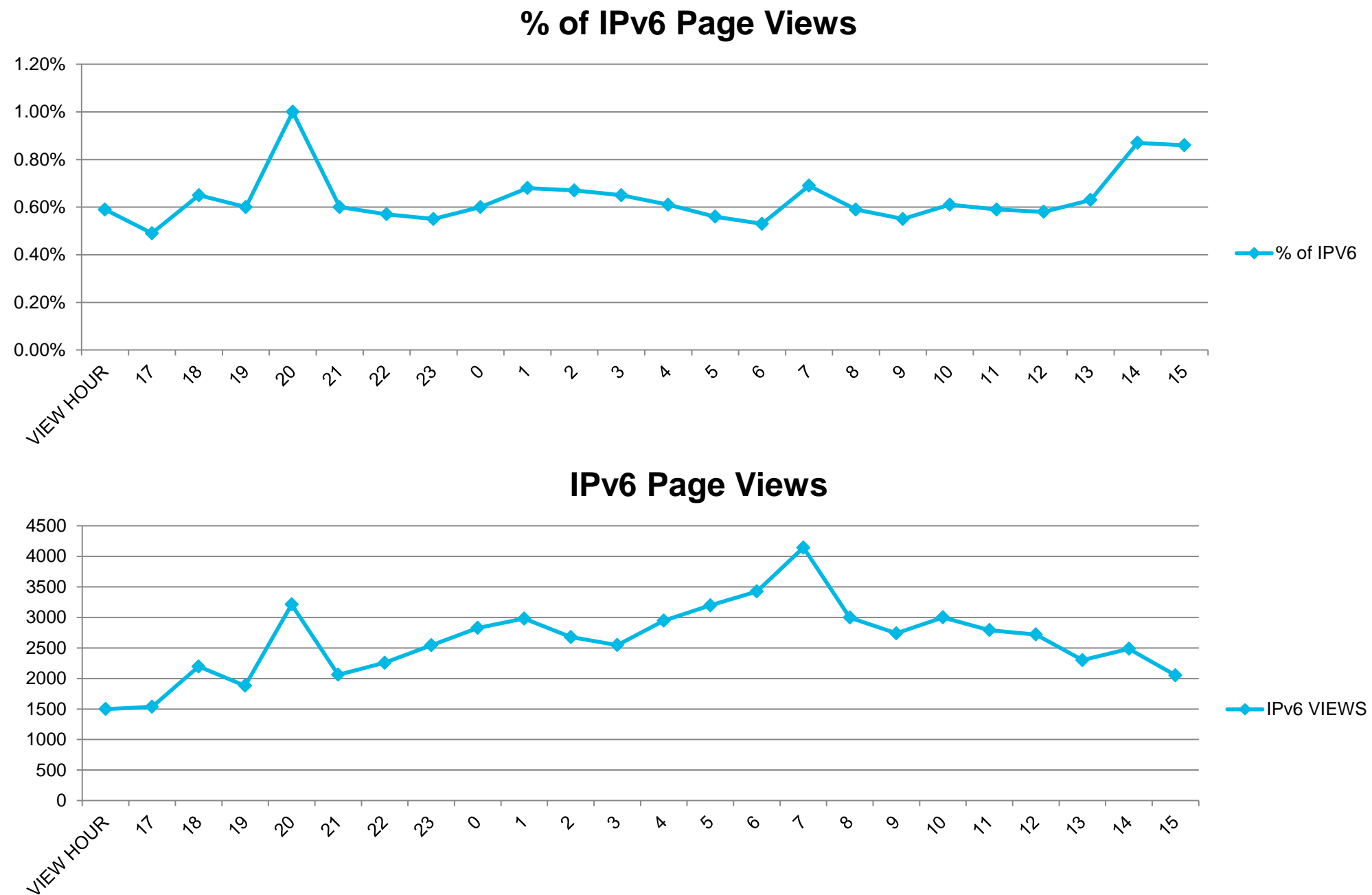
V6-only signatures
V4+V6 signatures

BGP Blackhole
BGP Sinkhole (Arbor)

SLB64 Logging

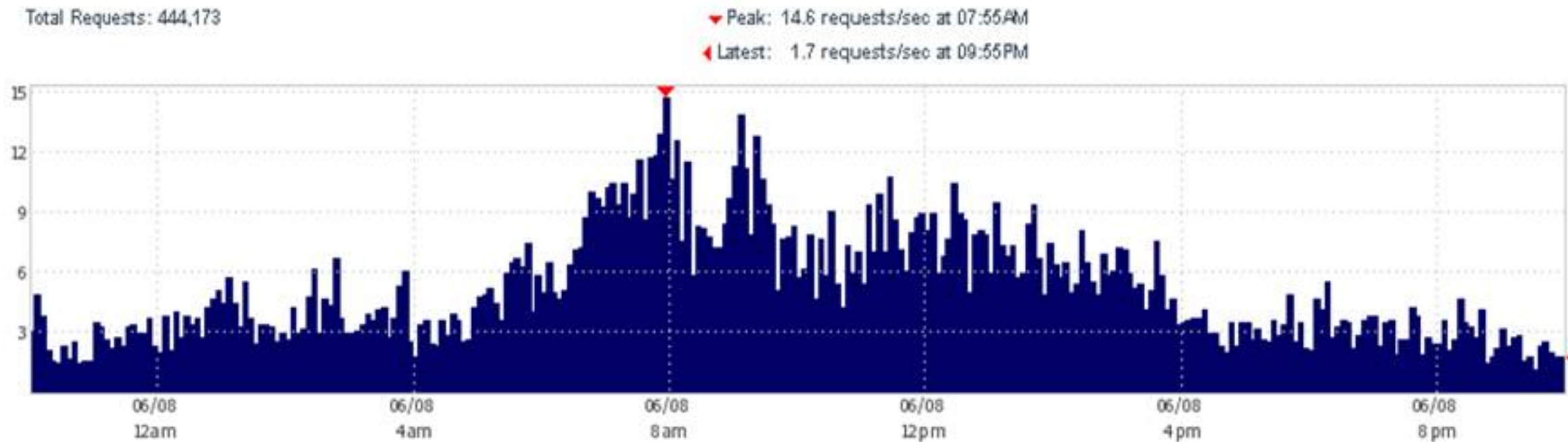
Firewall Policy

World IPv6 Launch Metrics for www.cisco.com



Source: Cisco IT web analytics

World IPv6 Launch Metrics for www.cisco.com



Data collected for time (24hrs)	IPv4		IPv6		IPv6 % of Total
	Total Requests	Peak Rate /sec	Total Requests	Peak Rate /sec	
06/05/2012 8:00 - 06/06/2012 8:00	160500000	2957.8	275951	15.1	0.17%
06/05/2012 17:00 - 06/06/2012 17:00	153900000	2784.7	494382	16.6	0.32%
06/06/2012 8:00 - 06/07/2012 8:00	157100000	2784.7	561912	16.6	0.36%
06/06/2012 22:00 - 06/07/2012 22:00	147000000	2455	477917	13.8	0.33%
06/07/2012 8:00 - 06/08/2012 8:00	141600000	2455	462781	14.6	0.33%
06/07/2012 22:00 - 06/08/2012 22:00	130900000	2155.9	444173	14.6	0.34%

Source: Akamai

Lessons Learned



Agenda

- Overview
 - Introduction to Cisco IT
 - Making the case for IPv6
 - IPv6 Journey
 - Target State
- Preparation
- Implementation Tracks
 - Ubiquitous IPv6 Access
 - IPv6 Internet Presence
- **Lessons Learned**

Lessons Learned

Creating The IPv6 Program



- Cross functional effort across the IT Stack
 - Starts with networking team taking the lead
 - Early engagement of security team, infrastructure and application teams follow
 - Highlighted the importance and urgency around IPv6 from engineers to execs, especially to the application / hosting teams
- Making the case
 - Business case for IPv6 internet presence is simpler to articulate
 - Business case for IPv6 on internal corporate network takes more work
- Early planning is key
- Absorb the IPv6 effort into existing network lifecycle management process

Lessons Learned

Product Support

- Network hardware, software, functionality
 - Routers, server load balancers
 - Wireless, switches
- Security
 - Firewalls, IDS/IPS, security event management and forensics logging
- Network management and service assurance
 - External and internal availability and performance monitoring



Lessons Learned

Product Support - Netflow



- IPv6 requires NetFlow v9
 - Some routing platforms don't support for both NetFlow v5 and NetFlow v9
 - Some routing platforms are constrained to two export destinations
 - Some collectors cannot receive/process Flexible NetFlow
- We had to shift NetFlow collection in our DMZ devices to deal with the constraints above
- Use of NetFlow reflectors can bring some relief

Lessons Learned

Service Provider Support - ISP



- Will the same SLA apply for IPv6?
- Can the circuit that services the existing IPv4 connection be converted to dual-stack without the physical changes?
- Are full IPv6 global routes available to end customers?
- Is there an IPv6 “looking glass”?
- Are there any restrictions on prefix advertisements?
- What percentage of your IPv4 peers do you currently peer with for IPv6
- Are you partitioned from any other major networks? (i.e. lacking global reach-ability to other major networks)

See http://docwiki.cisco.com/wiki/What_To_Ask_From_Your_Service_Provider_About_IPv6

Lessons Learned

Service Provider Support

- ISPs
- IP WAN providers
- External monitoring providers
- Content distribution providers



Lessons Learned

IPv6 Implications for Applications



- Geo-location and web analytics

Client_IpAddress := X-forwarded-for address first address;

If null then

Client_IpAddress := remoteAddress

end if;

use Client_IpAddress for IPCheck

- Development, testing, and QA teams require IPv6 access
- How will they get IPv6 access from within the corporate network?
- Supports the business case for an internal corporate network IPv6 deployment

Lessons Learned

End Devices



- Many of your end devices are already IPv6 enabled
 - From Microsoft Vista and Server 2008
 - From OS X Lion
- “Happy Eyeballs” can mask IPv6 connectivity issues
- Cisco traffic to Facebook, Yahoo! and Google:

Network operator measurements, 16th November 2012 ([notes](#))

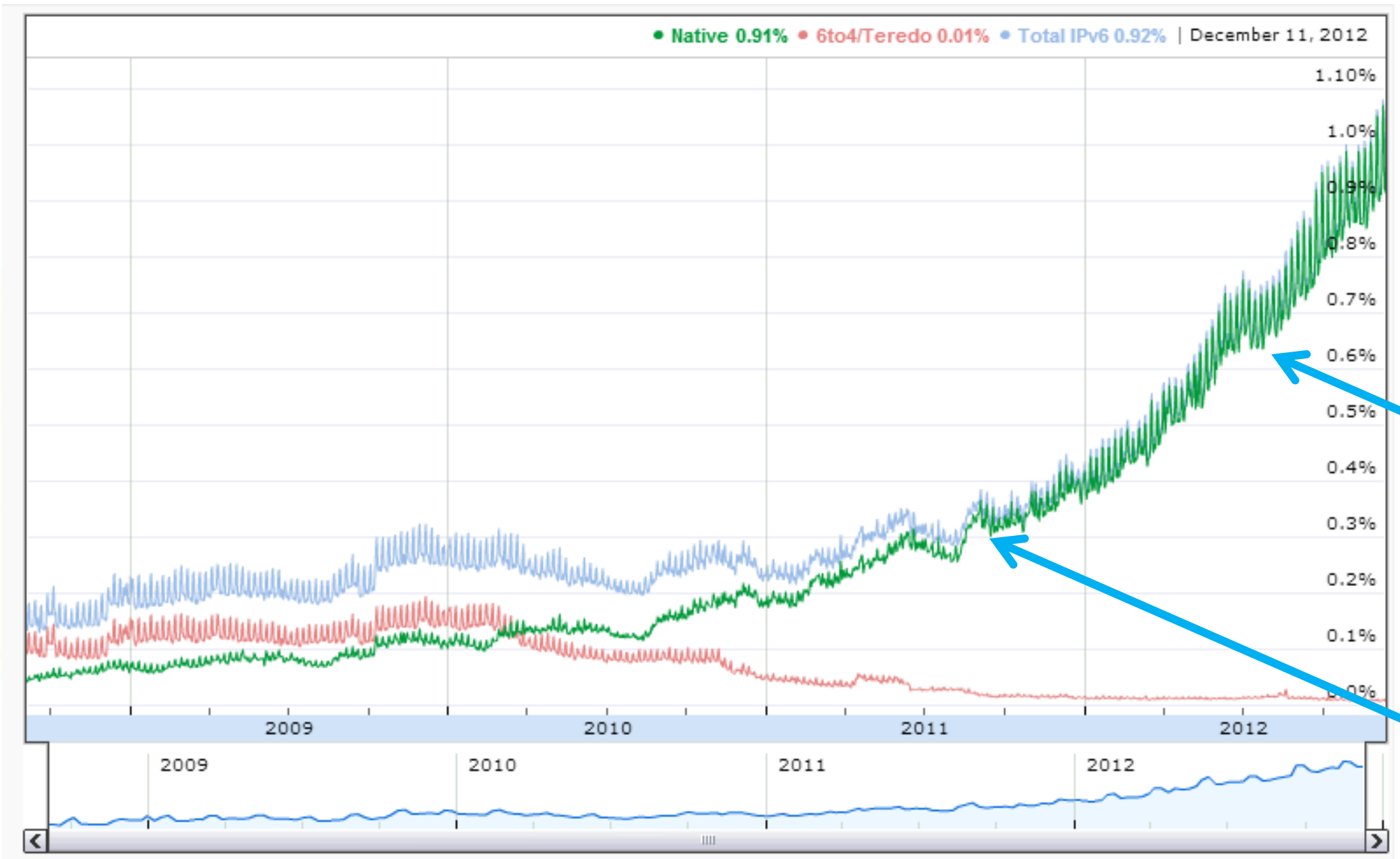
Show entries Search:

Participating Network	ASN(s)	IPv6 traffic
Cisco	109	4.81%

Source: <http://www.worldipv6launch.org/measurements/>

Lessons Learned

IPv6 Growth



World IPv6 Launch

World IPv6 Day

Source: Google

Q & A



Conclusion

- IPv6 business case is focused around 2 key deployment scenarios
- Dual stack wherever possible, tunnel where not possible
- Take iterative steps on your way to the target state
- Early planning and assessment of product and service gaps
- IPv6 is not a rip and replace effort but an absorbed gradual integration
- IPv6 affects every team across IT, it is NOT a network only problem

Complete Your Online Session Evaluation

Give us your feedback and receive a Cisco Live 2013 Polo Shirt!

Complete your Overall Event Survey and 5 Session Evaluations.

- Directly from your mobile device on the Cisco Live Mobile App
- By visiting the Cisco Live Mobile Site www.ciscoliveaustralia.com/mobile
- Visit any Cisco Live Internet Station located throughout the venue

Polo Shirts can be collected in the World of Solutions on Friday 8 March 12:00pm-2:00pm



Cisco *live!* 365

Don't forget to activate your Cisco Live 365 account for access to all session material,

communities, and on-demand and live activities throughout the year. Log into your Cisco Live portal and click the "Enter Cisco Live 365" button.

www.ciscoliveaustralia.com/portal/login.wv

Cisco *live!*

