

*TOMORROW starts here.*



# Déploiement d'IPv6 chez Cisco

**Fayçal HADJ**

**Solution Architect IPv6**

**Cisco France**

**<http://gblogs.cisco.com/fr-ipv6/blog>**

# 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 to Cisco IT



- 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 centers and server rooms
- 1500+ labs world wide (500+ in San Jose)

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

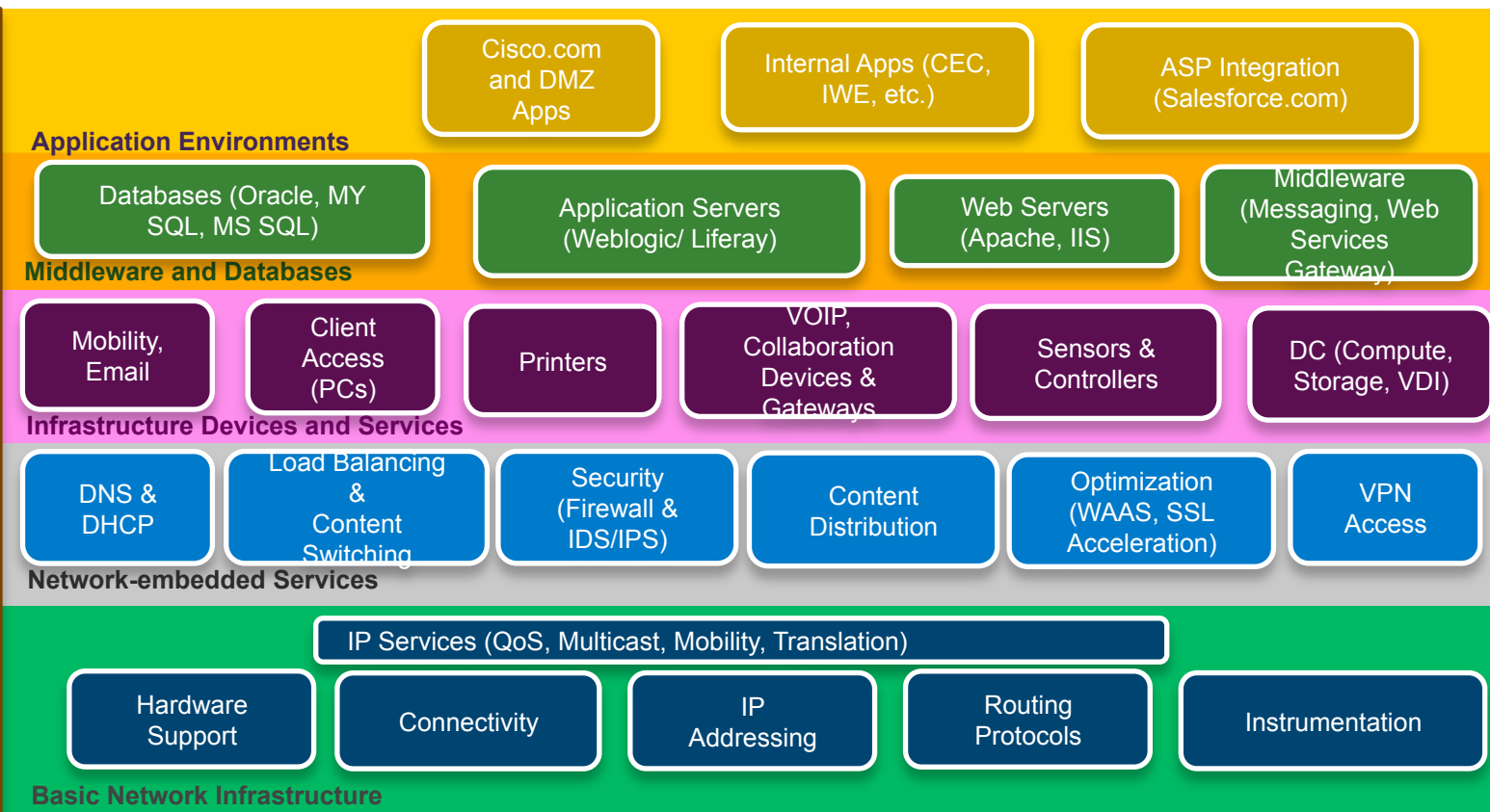
*Estimated Numbers*

# Cisco IT "Stack"

## IPv6 Scope

Security Inspection & Monitoring

Staff Training & Operations



# Corporate environment Security

CISCO IN 60 SECONDS

13 billion NetFlow  
records / day

We record 2.5 trillion  
DNS lookups every day

2 billion events / day  
collected in Splunk

6 million transactions /  
day handled by WSAs

Malware for 1% of all  
transactions  
automatically blocked  
by WSAs

1500 Labs globally

More than 200  
Business Support  
and Development  
Partners

More than 25,000  
Channel Partners

12 Critical Enterprise  
Production DCs

Over 100 Application  
Service Providers

124,000 employees  
worldwide

68,000  
FTEs

56,000  
vendors

120,000  
Windows hosts

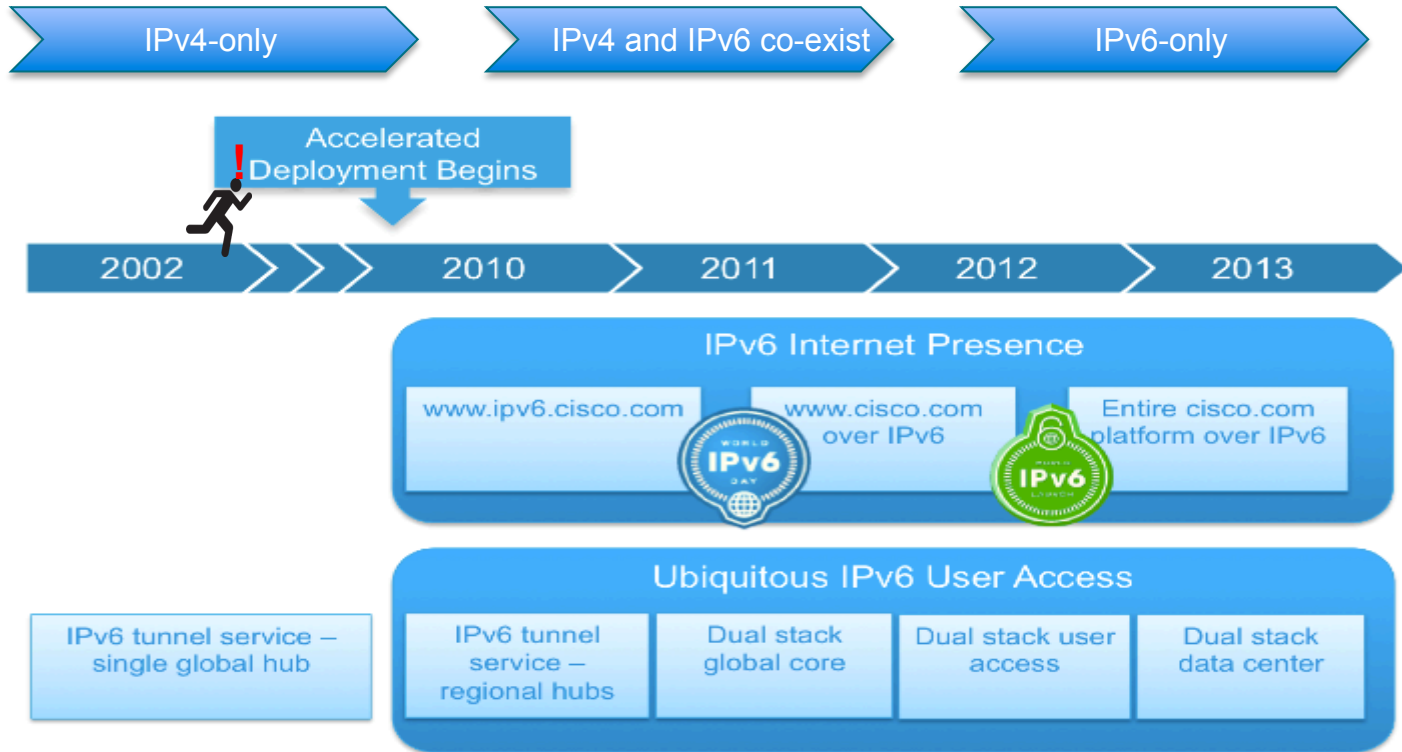
40,000 routers on  
Cisco's network

22TB of traffic  
inspected / day

750GB of system  
logs collected / day



# The IPv6 Journey – A High Level View



# Enterprise Deployment Options

*Outside – In*  
*Internet Evolution*  
*Business Continuity*  
*B2C, B2B*



*IPv4 Enterprise*



*IPv6 Internet*

*Inside – Out*  
*Globalization*  
*Technology Leadership*  
*Industry mandate*  
*BYOD-Security-Visibility*  
*Flatten management plane*



*Dual-Stack Enterprise*

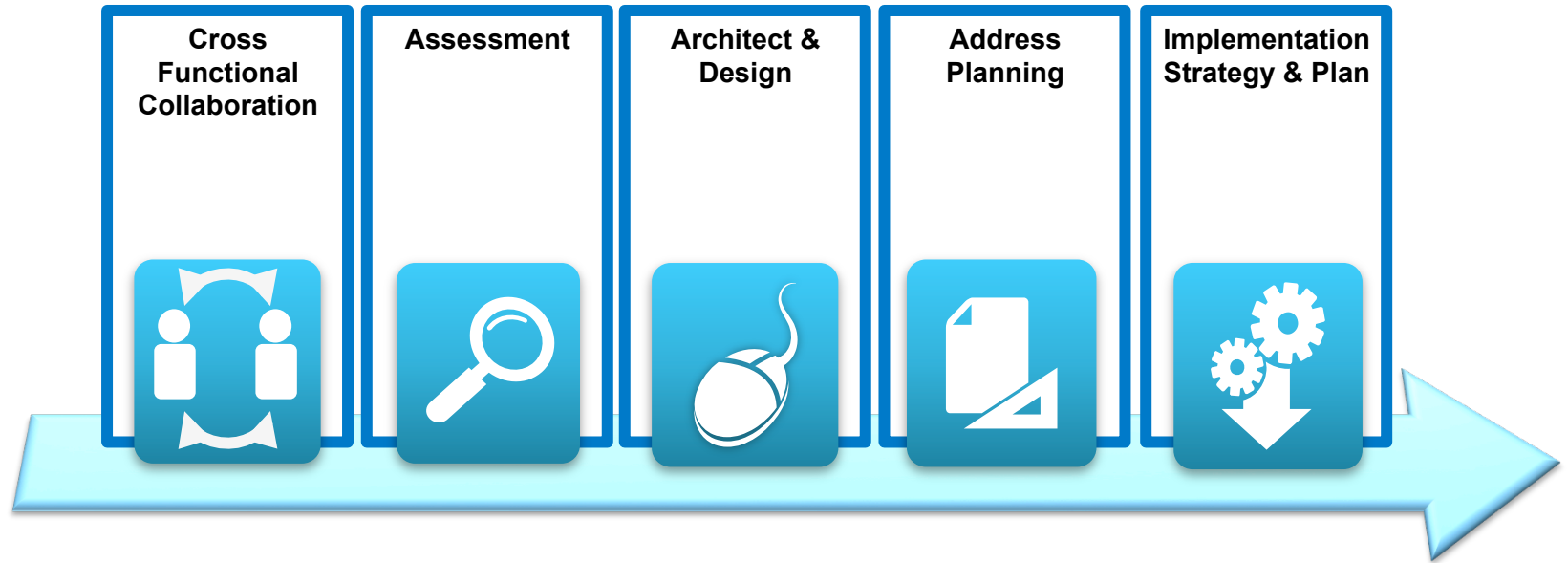


*IPv4 Internet*

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# Preparation

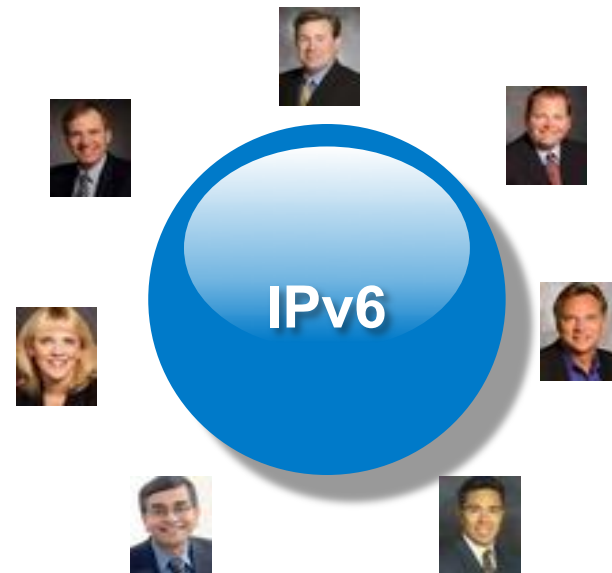
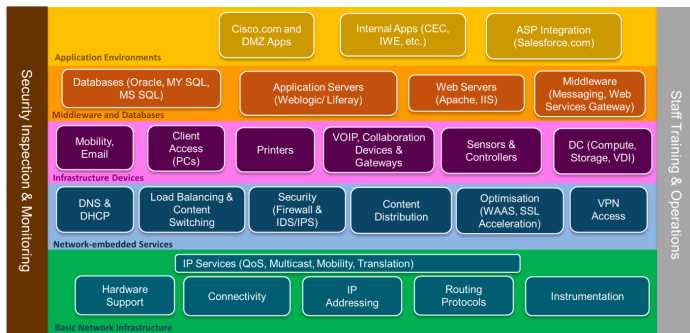


# Preparation

## 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](http://www.cisco.com)

# Preparation

## Architect and Design



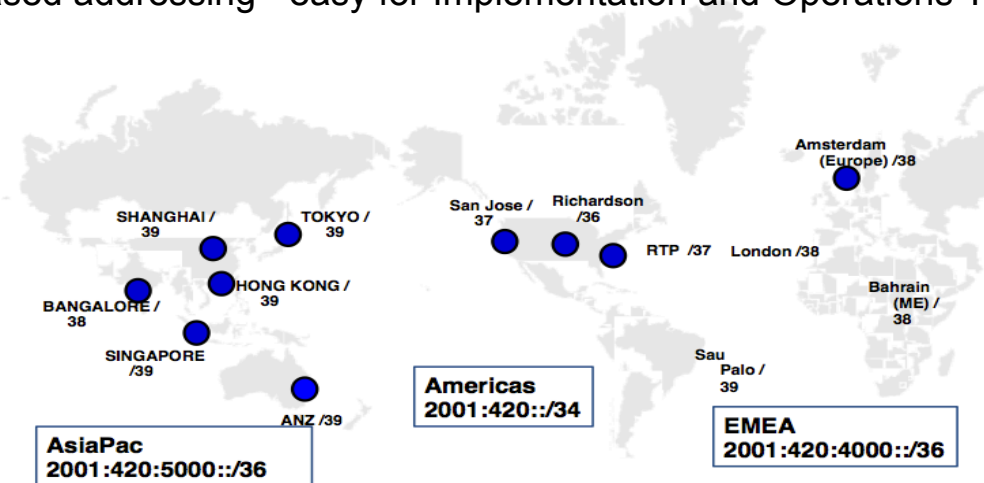
- Architectural decisions
  - Which routing protocol ?
  - SLAAC vs DHCPv6 ?
  - Which IPv6 transition technologies?
  - Code selection and qualification
- Documentation
  - Any new documentation required ?
  - Assess which existing designs are impacted and assign owners
  - Extra review board resources

# Preparation

## IPv6 Address Planning

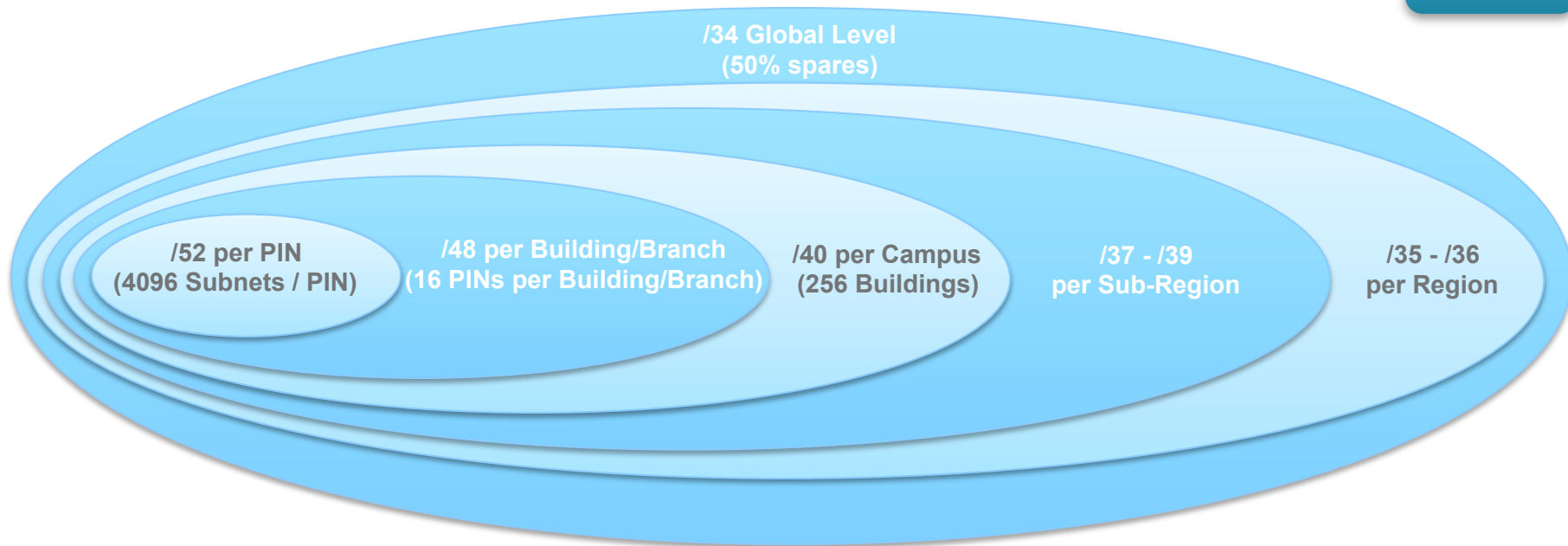


- Address management tool support for IPv6
- Established IPv6 Addressing policy
- Hierarchical Model – Global, Regional, Sub-Regional and Site levels
- Template-based addressing - easy for Implementation and Operations Teams



# Preparation

## IPv6 Address Planning



PIN = Place In the Network

A framework to classify functional areas of the network

eg, Lab, Desktop, DC, DMZ etc

```

[-] 2001:420::/32 C (Active) Primary IPv6 block[2001:420:0:0:0:0:0:0]
--+ 2001:420::/34 A (Active) Americas
--+ 2001:420:4000::/34 A (Active) EMEA and Asia Pacific
--+ 2001:420:8000::/34 A (Active) Worldwide Spare 1
--+ 2001:420:c000::/34 A (Active) Worldwide Spare 2, Global Infrastructure and Mobility

[-] 2001:420::/32 C (Active) Primary IPv6 block[2001:420:0:0:0:0:0:0]
--+ 2001:420::/34 A (Active) Americas
|   --+ 2001:420::/35 A (Active) US West
|   --+ 2001:420:2000::/35 A (Active) US East
|
|   --+ 2001:420:4000::/34 A (Active) EMEA and Asia Pacific
|   |   --+ 2001:420:4000::/36 A (Active) EMEA
|   |   --+ 2001:420:5000::/36 A (Active) Asia Pacific
|   |   --+ 2001:420:6000::/35 - (Unallocated Block) Add Subnet Add Address Block
|
--+ 2001:420:8000::/34 A (Active) Worldwide Spare 1
|   --+ 2001:420:8000::/35 A (Active) Tokyo and Northern Asiapac primary address block - Old block needs re-addressing
|   --+ 2001:420:a000::/35 A (Active) Sydney and Southern Asiapac primary address block - Old block needs re-addressing
|
--+ 2001:420:c000::/34 A (Active) Worldwide Spare 2, Global Infrastructure and Mobility
|   --+ 2001:420:c000::/42 A (Active) Global Infrastructure Block
|   --+ 2001:420:c040::/42 A (Active) Global Mobility Block
|   --+ 2001:420:c080::/42 A (Active) Webex Temporary Space expires Nov 1, 2011
|   --+ 2001:420:c0c0::/42 A (Active) Global Mobility - CVO/ECT ONLY
|   --+ 2001:420:c100::/40 - (Unallocated Block) Add Subnet Add Address Block
|   --+ 2001:420:c200::/39 - (Unallocated Block) Add Subnet Add Address Block
|   --+ 2001:420:c400::/38 - (Unallocated Block) Add Subnet Add Address Block
|   --+ 2001:420:c800::/37 - (Unallocated Block) Add Subnet Add Address Block
|   --+ 2001:420:d000::/36 - (Unallocated Block) Add Subnet Add Address Block
|   --+ 2001:420:e000::/35 - (Unallocated Block) Add Subnet Add Address Block

```

```

--[- 2001:420::/34 A (Active) Americas
  |--[- 2001:420::/35 A (Active) US West
    |--+ 2001:420::/37 A (Active) [NEW PLAN] - San Jose and MTV05
    |--+ 2001:420:800::/39 A (Active) SJ and MTV05 Spare - Old RWC Block [Remove all RWC addressing once RWC is migrated]
    |--+ 2001:420:a00::/39 A (Active) [New Plan] - Denver Summary
    |--+ 2001:420:c00::/39 A (Active) [New Plan] - LA/Hawthorne Summary
    |--+ 2001:420:e00::/39 A (Active) [New Plan] - Dallas Summary
    |--+ 2001:420:1000::/36 A (Active) [NEW PLAN] - Richardson Summary

[- 2001:420:2000::/35 A (Active) US East
  |--+ 2001:420:2000::/37 A (Active) [New Plan] - RTP Block (Includes RTP MAN)
  |--+ 2001:420:2800::/37 A (Active) [New Plan] - Kanata/Chicago/NY Block
  |--+ 2001:420:3000::/37 A (Active) [New Plan] - Lawrenceville/Sao Paulo/Orlando
  |--+ 2001:420:3800::/37 A (Active) [New Plan] - US East Spare

[- 2001:420:4000::/36 A (Active) EMEA
  |--+ 2001:420:4000::/40 A (Active) UK and Ireland
  |--+ 2001:420:4100::/40 A (Active) UK and Ireland Spare 1
  |--+ 2001:420:4200::/40 A (Active) UK and Ireland Spare 2
  |--+ 2001:420:4300::/40 A (Active) UK and Ireland Spare 3
  |--+ 2001:420:4400::/40 A (Active) Amsterdam Campus, European 1
  |--+ 2001:420:4500::/40 A (Active) European FSOs Block 3 and E
  |--+ 2001:420:4600::/39 A (Active) Amsterdam DCs
  |--+ 2001:420:4800::/40 A (Active) European Campuses
  |--+ 2001:420:4900::/40 A (Active) EMEA Spare 2
  |--+ 2001:420:4a00::/40 A (Active) EMEA Spare 3
  |--+ 2001:420:4b00::/40 A (Active) EMEA Spare 4
  |--+ 2001:420:4c00::/40 A (Active) ME
  |--+ 2001:420:4d00::/40 A (Active) ME Spare 1
  |--+ 2001:420:4e00::/40 A (Active) ME Spare 2
  |--+ 2001:420:4f00::/40 A (Active) ME Spare 3

  |--+ 2001:420:5000::/36 A (Active) Asia Pacific
    |--+ 2001:420:5000::/40 A (Active) Sydney (ANZ)
    |--+ 2001:420:5100::/40 A (Active) Sydney (ANZ) Spare 1
    |--+ 2001:420:5200::/40 A (Active) Chennai
    |--+ 2001:420:5300::/40 A (Active) Chennai Spare 1
    |--+ 2001:420:5400::/40 A (Active) Bangalore 1
    |--+ 2001:420:5500::/40 A (Active) Bangalore 2 (FSOs, Remote Access & Extranet)
    |--+ 2001:420:5600::/40 A (Active) Bangalore Spare 2
    |--+ 2001:420:5700::/40 A (Active) Bangalore Spare 3
    |--+ 2001:420:5800::/40 A (Active) Shanghai
    |--+ 2001:420:5900::/40 A (Active) Shanghai Spare 1
    |--+ 2001:420:5a00::/40 A (Active) Hong Kong
    |--+ 2001:420:5b00::/40 A (Active) Hong Kong Spare 1
    |--+ 2001:420:5c00::/40 A (Active) Singapore
    |--+ 2001:420:5d00::/40 A (Active) Singapore Spare 1
    |--+ 2001:420:5e00::/40 A (Active) Tokyo
    |--+ 2001:420:5f00::/40 A (Active) Tokyo Spare 1

```

```

--[-] 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 - Do not use for now until re-addressed)
--[-] 2001:420:80::/41    A (Active) [NEW PLAN] - SJ DMZ Space
--[-] 2001:420:100::/40   A (Active) SJ Site 1, 2, 3 and SJ Extranet
--[-] 2001:420:200::/41   A (Active) SJC DC Internal Prod & Non-prod
--[-] 2001:420:280::/41   A (Active) [New Plan] - SJ Site 4
--[-] 2001:420:300::/40   A (Active) SJ Site 5, 5.1, and others
--[-] 2001:420:400::/41   A (Active) SJ FSOs
--[-] 2001:420:480::/41   - (Unallocated Block) Add Subnet Add Address Block
--[-] 2001:420:500::/40   - (Unallocated Block) Add Subnet Add Address Block
--[-] 2001:420:600::/40   A (Active) MTV05
--[-] 2001:420:700::/42   A (Active) SJC Remote Access
--[-] 2001:420:740::/42   A (Active) [DO NOT USE] Reserved for Remote Access Expansion (zschaefe)
--[-] 2001:420:780::/41   A (Active) [NEW PLAN - kjawaid] SJ Tunnelled IPv6 Labs

```

# Preparation

## IPv6 Address Planning



```
-- 2001:420::32 C (Active) Primary IPv6 block[2001:420:0:0:0:0:0]
-- 2001:420::34 A (Active) Americas
-- 2001:420:4000::34 A (Active) EMEA and Asia Pacific
-- 2001:420:4000::36 A (Active) EMEA
-- 2001:420:4000::40 A (Active) UK and Ireland
-- 2001:420:4100::40 A (Active) UK and Ireland Spare 1
-- 2001:420:4200::40 A (Active) UK and Ireland Spare 2
-- 2001:420:4300::40 A (Active) UK and Ireland Spare 3
-- 2001:420:4400::40 A (Active) Amsterdam Campus, European FSOs Block 1 & 2 and
-- 2001:420:4400::42 A (Active) [New Plan] AMS Infrastructure Block
-- 2001:420:4440::42 A (Active) Amsterdam Campus (AMS3 and AMS5)
-- 2001:420:4480::42 A (Active) Israel and European FSOs Block 1
-- 2001:420:44c0::42 A (Active) European FSOs Block 2
-- 2001:420:4500::40 A (Active) European FSOs Block 3 and European FSO Spares
-- 2001:420:4600::39 A (Active) Amsterdam DCs
-- 2001:420:4800::40 A (Active) European Campuses
-- 2001:420:4900::40 A (Active) EMEA Spare 2
-- 2001:420:4a00::40 A (Active) EMEA Spare 3
-- 2001:420:4b00::40 A (Active) EMEA Spare 4
-- 2001:420:4c00::40 A (Active) ME
-- 2001:420:4d00::40 A (Active) ME Spare 1
-- 2001:420:4e00::40 A (Active) ME Spare 2
-- 2001:420:4f00::40 A (Active) ME Spare 3
-- 2001:420:5000::36 A (Active) Asia Pacific
-- 2001:420:6000::35 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:8000::34 A (Active) Worldwide Spare 1
-- 2001:420:c000::34 A (Active) Worldwide Spare 2, Global Infrastructure and Mobility
-- 2001:470:d3cf::48 C (Active) R&D Tech Center IPv6 Sensor Lab - space from HE.net[2001:470:d3cf::48]
-- 2001:1890:e000:7400::56 C (Active) CBG (Linksys) Irvine Block[2001:1890:e000:7400:0:0:0:0]
-- 2001:1a:f8:fe4f::48 C (Active) R&D Tech Center IPv6 Sensor Lab - space from Sixxs.net[2001:1a:f8:fe4f::48]
-- 2610:40::32 C (Active) IPv6 block owned by LISP BU[2610:40:0:0:0:0:0:0]
-- 3ffe:c00::24 C (Active) Cisco 6bone Block[3ffe:c00:0:0:0:0:0:0]
-- f001:420::32 C (Active) Cisco Local Address Block[f001:420:0:0:0:0:0:0]
```

```
-- 2001:420:44c0::42 A (Active) European FSOs Block 2
-- 2001:420:44c0::48 A (Active) Bergen, Norway
-- 2001:420:44c1::48 A (Active) Lysaker, Norway
-- 2001:420:44c2::48 A (Active) Sandnes, Norway
-- 2001:420:44c3::48 A (Active) Tromsø, Norway
-- 2001:420:44c4::48 A (Active) Trondheim, Norway
-- 2001:420:44c5::48 A (Active) Vigra, Norway
-- 2001:420:44c6::48 A (Active) Norway Spare 1
-- 2001:420:44c7::48 A (Active) Norway Spare 2
-- 2001:420:44c8::48 A (Active) Bern, Switzerland
-- 2001:420:44c9::48 A (Active) Ecublens, Switzerland
-- 2001:420:44ca::48 A (Active) Lausanne, Switzerland
-- 2001:420:44cb::48 A (Active) Rolle, Switzerland
-- 2001:420:44cc::48 A (Active) Wallisellen, Switzerland
-- 2001:420:44cd::48 A (Active) Switzerland Spare 1
-- 2001:420:44ce::48 A (Active) Switzerland Spare 2
-- 2001:420:44cf::48 A (Active) Switzerland Spare 3
-- 2001:420:44d0::48 A (Active) Göteborg, Sweden
-- 2001:420:44d1::48 A (Active) Gothenburg, Sweden
-- 2001:420:44d2::48 A (Active) Stockholm, Sweden (in
-- 2001:420:44d3::48 A (Active) Sweden Spare 1
-- 2001:420:44d4::48 A (Active) Sweden Spare 2
-- 2001:420:44d5::48 A (Active) ESP02 - Espoo, Finland
-- 2001:420:44d6::48 A (Active) Vaasa, Finland
-- 2001:420:44d7::48 A (Active) Finland Spare 1
-- 2001:420:44d8::48 A (Active) Barcelona, Spain
-- 2001:420:44d9::48 A (Active) Bilbao, Spain
-- 2001:420:44da::48 A (Active) Madrid, Spain
-- 2001:420:44db::48 A (Active) Sevilla, Spain
-- 2001:420:44dc::48 A (Active) Valencia, Spain
-- 2001:420:44dd::48 A (Active) Spain Spare 1
-- 2001:420:44de::48 A (Active) Spain Spare 2
-- 2001:420:44df::48 A (Active) Spain Spare 3
-- 2001:420:44e0::48 A (Active) BLN2 - Berlin, Germany
-- 2001:420:44e1::48 A (Active) Bonn, Germany
-- 2001:420:44e2::48 A (Active) Cologne, Germany
-- 2001:420:44e3::48 A (Active) Düsseldorf, Germany
-- 2001:420:44e4::48 A (Active) FKF3 - Eschborn, Germany
-- 2001:420:44e5::48 A (Active) Gerlingen, Germany
-- 2001:420:44e6::48 A (Active) HLB2 - Hallbergmoos, Germany
-- 2001:420:44e7::48 A (Active) Hamburg, Germany
-- 2001:420:44e8::48 A (Active) Mannheim, Germany
-- 2001:420:44e9::48 A (Active) Munich, Germany
-- 2001:420:44ea::48 A (Active) Nuremberg, Germany
-- 2001:420:44eb::48 A (Active) Ratingen, Germany
-- 2001:420:44ec::48 A (Active) Stuttgart, Germany
-- 2001:420:44ed::48 A (Active) Walldorf, Germany
-- 2001:420:44ee::48 A (Active) Germany Spare 1
-- 2001:420:44ef::48 A (Active) Germany Spare 2
-- 2001:420:44f0::48 A (Active) Issy Les Moulineaux
-- 2001:420:44f1::48 A (Active) Biot-Sophia Antipolis
-- 2001:420:44f2::48 A (Active) Cesson Sevigne, France
-- 2001:420:44f3::48 A (Active) Gellainville, France
-- 2001:420:44f4::48 A (Active) Lille, France
```

```
-- 2001:420:44f0::48 A (Active) Issy Les Moulineaux, France
-- 2001:420:44f0::52 A (Active) ILM "Infrastructure"
-- 2001:420:44f0:1000::52 A (Active) ILM "Desktops VLAN"
-- 2001:420:44f0:1000::64 S (Active) ILM DATA VLAN 300
-- 2001:420:44f0:1000::1000 - (Next Unallocated) Add Interface
-- 2001:420:44f0:1000::1000 - R (Active) ILM v6 DATA VLAN 300
-- 2001:420:44f0:1001::64 S (Active) ILM DATA VLAN 301
-- 2001:420:44f0:1002::64 S (Active) ILM DATA VLAN 302
-- 2001:420:44f0:1003::64 S (Active) ILM WIRELESS DATA VLAN 250
-- 2001:420:44f0:1003::1000 - (Next Unallocated) Add Interface
-- 2001:420:44f0:1003::1000 - R (Active) ILM v6 WIRELESS DATA VLAN 250
-- 2001:420:44f0:1004::64 S (Active) ILM WIRELESS DATA VLAN 252
-- 2001:420:44f0:1005::64 S (Active) ILM WIRELESS DATA VLAN 253
-- 2001:420:44f0:1006::63 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:1008::61 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:1010::60 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:1020::59 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:1040::58 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:1080::57 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:1100::56 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:1200::55 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:1400::54 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:1800::53 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:2000::52 A (Active) ILM "LAB Subnet"
-- 2001:420:44f0:3000::52 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:4000::50 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f0:8000::49 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f1::48 A (Active) Biot-Sophia Antipolis, France
-- 2001:420:44f2::48 A (Active) Cesson Sevigne, France
-- 2001:420:44f3::48 A (Active) Gellainville, France
-- 2001:420:44f4::48 A (Active) Lille, France
-- 2001:420:44f5::48 A (Active) Lyon, France
-- 2001:420:44f6::48 A (Active) Paris, France
-- 2001:420:44f6::48 - (Unallocated Block) Add Subnet Add Address Block
-- 2001:420:44f7::48 A (Active) Strasbourg, France
-- 2001:420:44f8::48 A (Active) Toulouse, France
-- 2001:420:44f9::48 A (Active) France Spare 1
-- 2001:420:44fa::48 A (Active) France Spare 2
-- 2001:420:44fb::48 A (Active) Salzburg, Austria
-- 2001:420:44fc::48 A (Active) Vienna, Austria
-- 2001:420:44fd::48 A (Active) Austria Spare 1
-- 2001:420:44fe::48 A (Active) Luxembourg, Luxembourg
-- 2001:420:44ff::48 A (Active) [New Plan] - AMS IPv6 Labs
```

WW

EU

FR/ILM

# Preparation

## Implementation Strategy and Plan



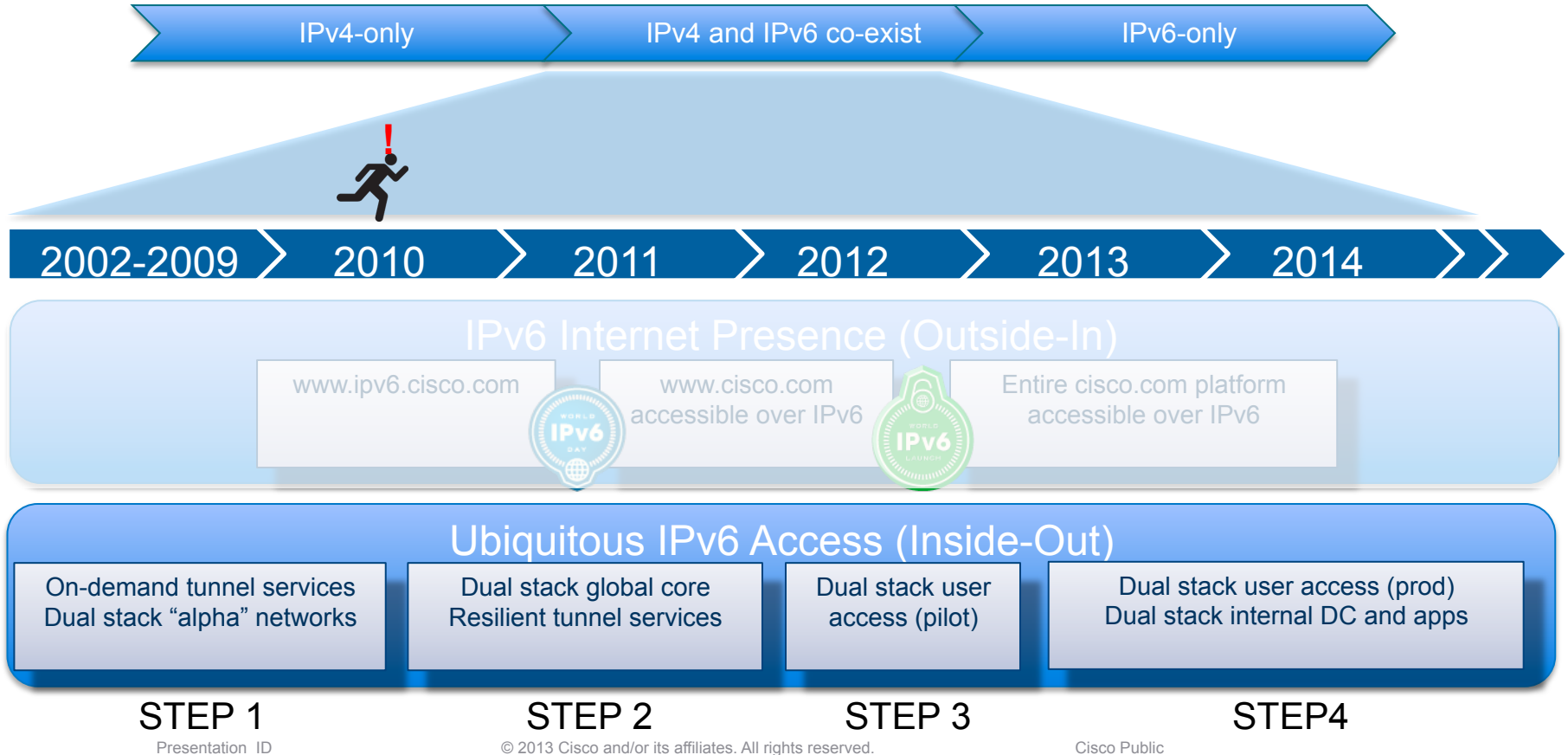
*“Dual stack where you can, tunnel where you can’t  
and NAT only when have to”*

- Long term plan that absorbs cost in established lifecycle process
- 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 implementation and operations teams

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- **Implementation Tracks**
  - Ubiquitous IPv6 Access
  - IPv6 Internet Presence
- Lessons Learned

# The IPv6 Journey – A High Level View



# 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

## STEP 1– Tunnel Infrastructure



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

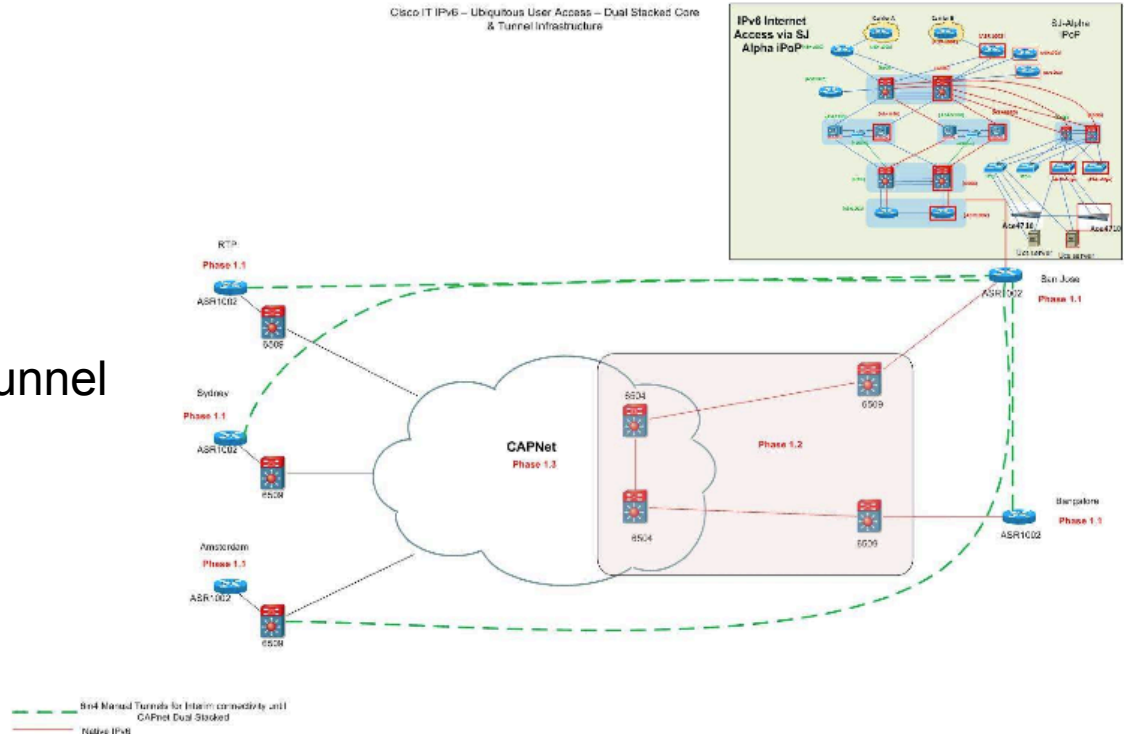


# Ubiquitous IPv6 Access

## STEP 2 – Go to Dual-STACK !!

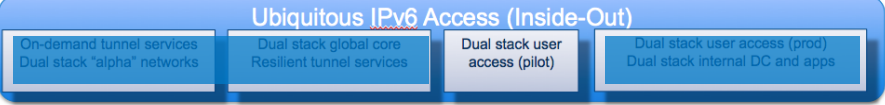


- Building / Lab = Manual 6in4 tunnels
- User = Anycast ISATAP
- SLA same as IPv4
- Dual stacked core + Global tunnel infrastructure

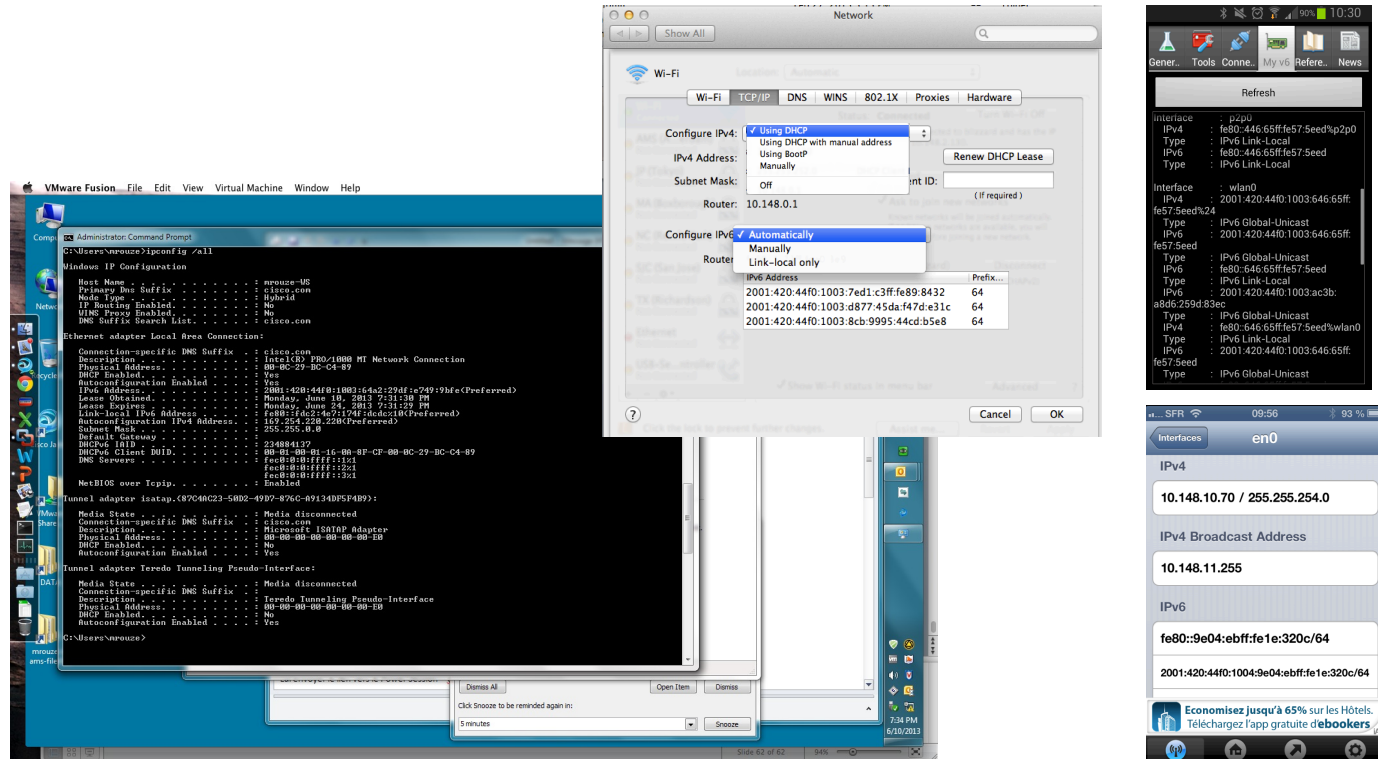


# Ubiquitous IPv6 Access

## STEP 3 – extending IPv6 to the Desktop !



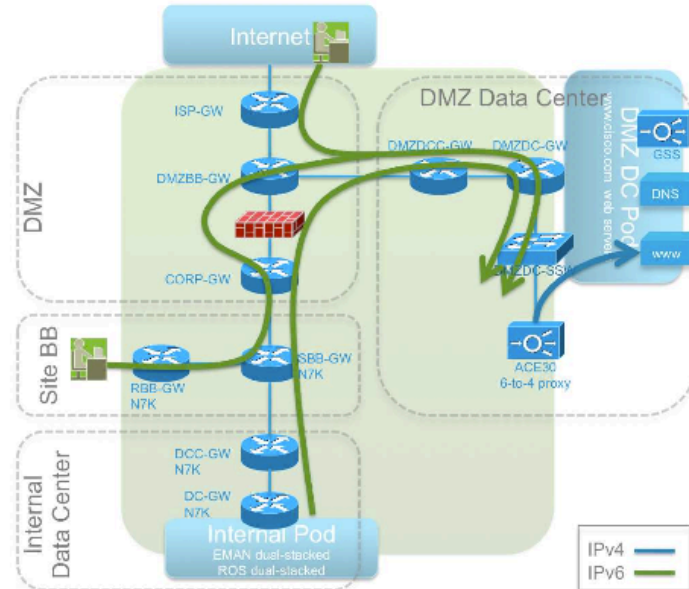
- Enabling IPv6 on the devices.
- Turning on IPv6 on the various operating systems used in the Cisco enterprise after extensively testing the operating systems: The Cisco IT client services team, which maintains all approved OS images, was engaged early in the process of extending IPv6 to the desktop.
- Employees were told that a building supported IPv6 only after the client services team provided an approved build.



# Ubiquitous IPv6 Access

## STEP 4 – extending IPv6 to DC!!

- Extending IPv6 into data centers required two actions :
  - One was turning on IPv6 in the Cisco Nexus® Switches and Cisco Catalyst® Switches, which were already certified for dual-stack operations
  - The other action was configuring management software, including Cisco Network Registrar, to monitor the IPv6 Internet presence and automatically assign addresses to IPv6-capable desktops.



# Ubiquitous IPv6 Access

## Deployment Status

### 2012 Achievements

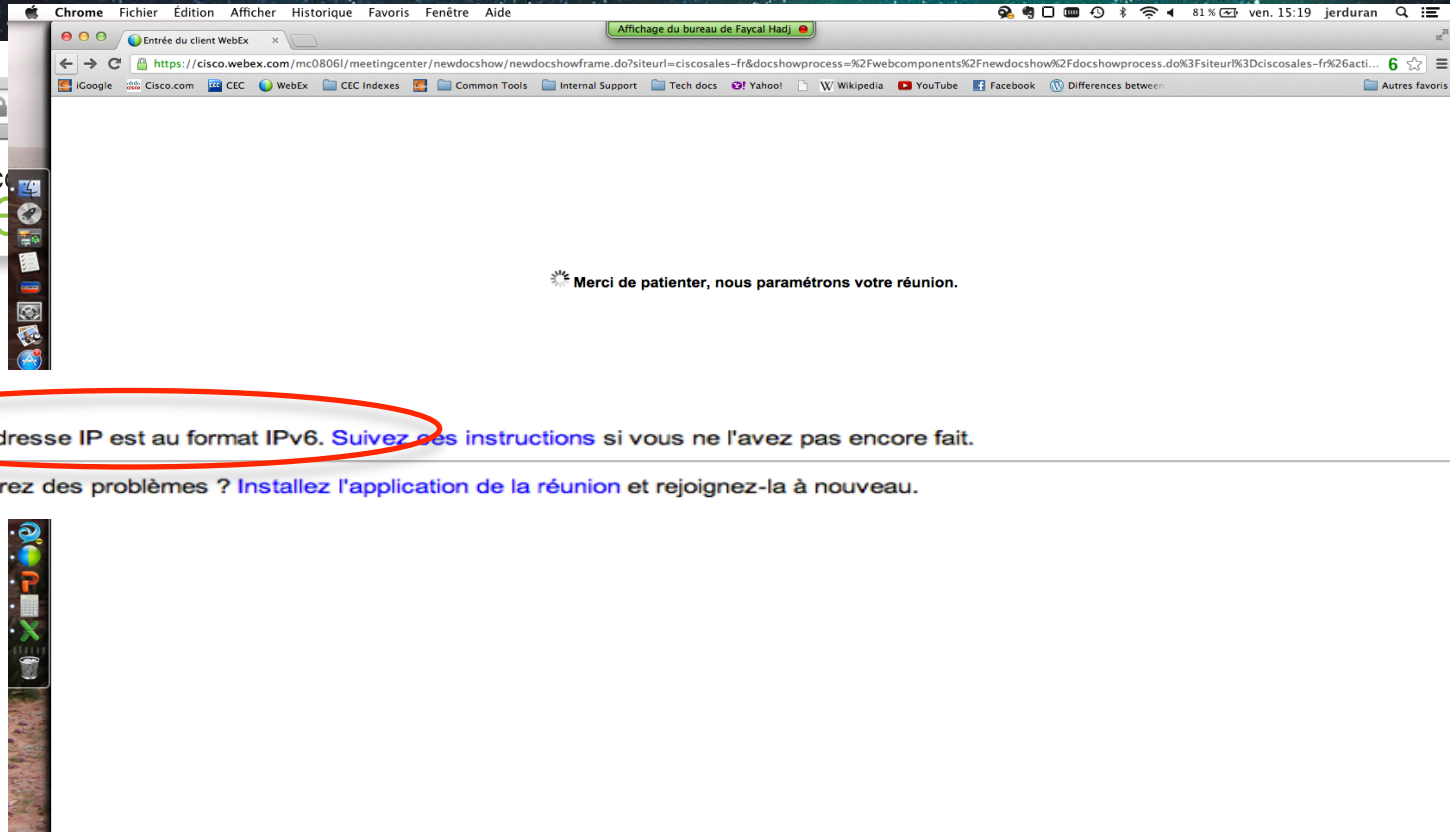
- ✓ Core 100% dual stack enabled
- ✓ DCs and iPoP required for World IPv6 Launch & end user DHCPv6
- ✓ 5 campus & 8 remote office buildings

### August 2013 Targets

- ⊙ All 21 production DCs
- ⊙ All 15 iPoPs
- ⊙ Additional 106 buildings
- ⊙ Covert 140 tunnelled labs to dual stack
- ⊙ Enable AnyConnect VPN headends
- ⊙ Enable 12 Extranet hubs

# Ubiquitous IPv6 Access

## IPv6 Access to WebEx collaboration services from within Cisco



# Ubiquitous IPv6 Access

IPv6 Access to WebEx collaboration services from within Cisco

Network operator measurements, 22nd May 2013 ([notes](#))

Show <input type="text" value="10"/> entries	Search: <input type="text" value="109"/>	
Participating Network	ASN(s)	IPv6 deployment
Cisco	109	17.62%
Showing 1 to 1 of 1 entries (filtered from 110 total entries)		
First Previous 1 Next Last		

17,6%

## Cisco Enterprise Network (AS109)



8%



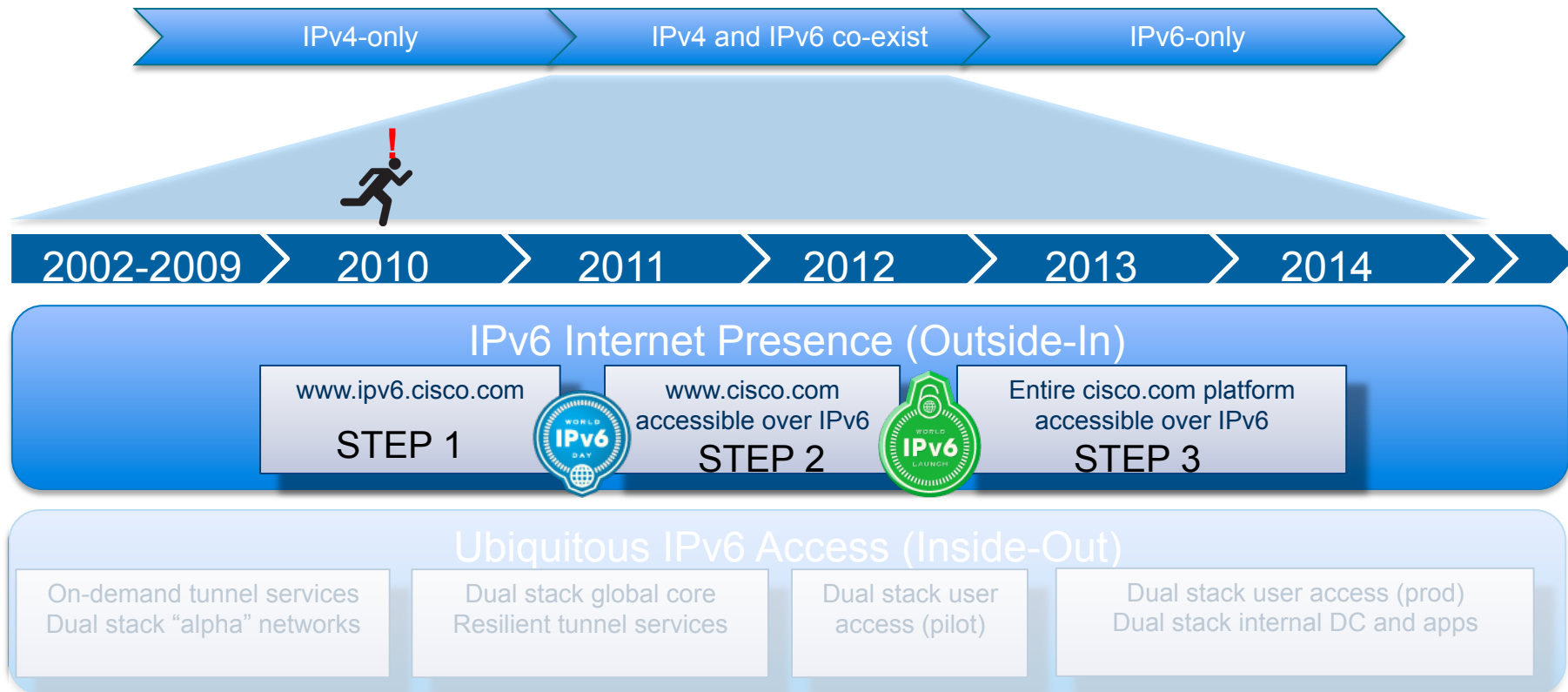
Source: Google

October 2011 • May 2012 • June 2012 • Jul 2012 • Aug 2012 • Sep 2012 • Oct 2012 • Nov 2012 • Dec 2012 • Jan 2013 • Feb 2013 • Mar 2013

# 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

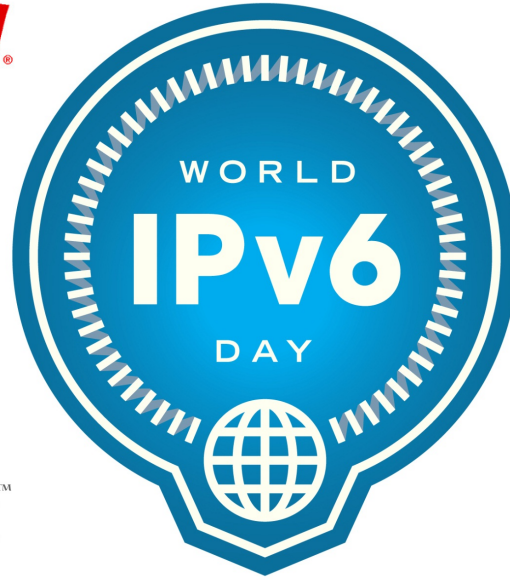


YAHOO!



Microsoft

Google™



facebook®



**24 hour IPv6 “test flight” 8<sup>th</sup> June 2011**

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

# World IPv6 Day

## STEP 1

### IPv6 Internet Presence (Outside-In)

www.ipv6.cisco.com

STEP 1



www.cisco.com  
accessible over IPv6

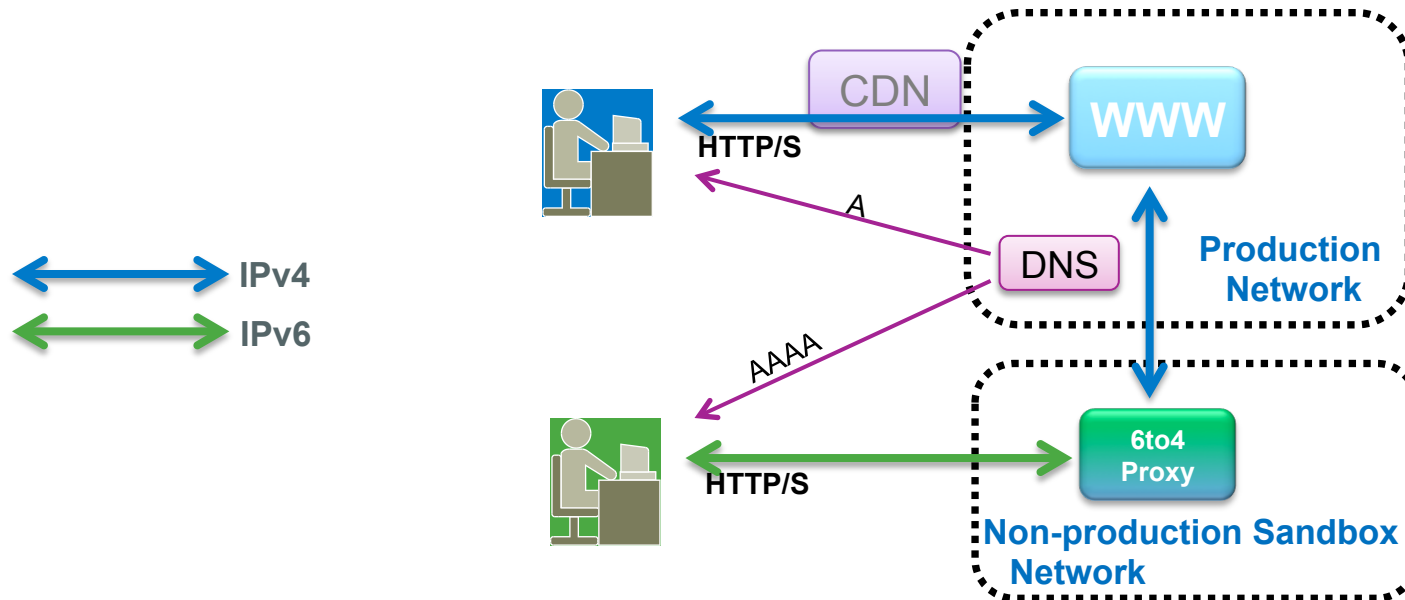
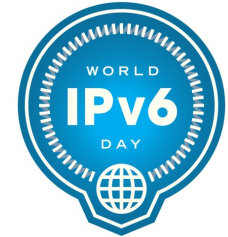
STEP 2



Entire cisco.com platform  
accessible over IPv6

STEP 3

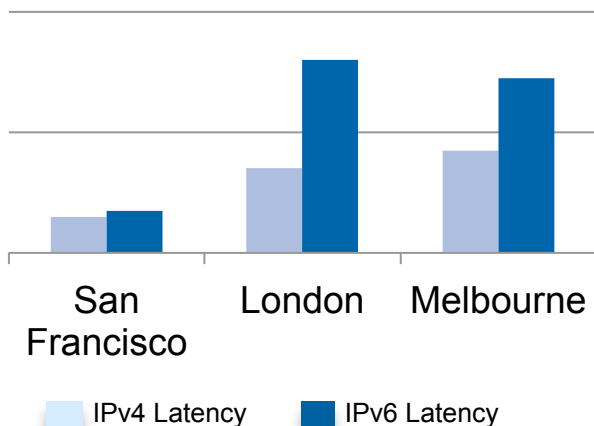
- Reverse proxy solution ( ACE4710)
- Returned A and AAAA records for [www.cisco.com](http://www.cisco.com)



# World IPv6 Day

## Our Experience

- Network traffic volume based on NetFlow data
  - 1.11% of all traffic to/from [www.cisco.com](http://www.cisco.com) was IPv6
- Support Cases
  - No support cases for [www.cisco.com](http://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.



# IPv6 Launch

## STEP 2

### IPv6 Internet Presence (Outside-In)

www.ipv6.cisco.com

STEP 1

www.cisco.com  
accessible over IPv6

STEP 2

Entire cisco.com platform  
accessible over IPv6

STEP 3



**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

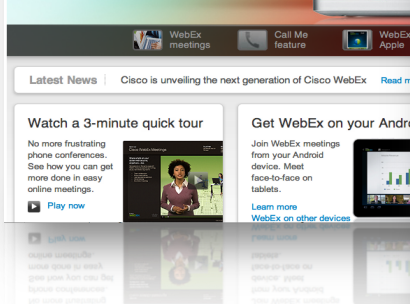
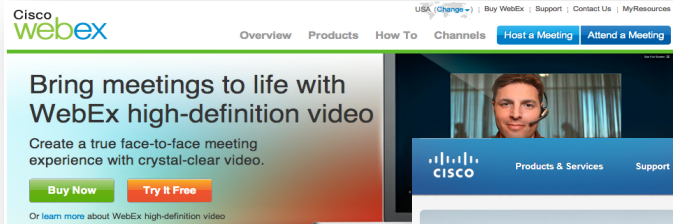
CISCO  
FACEBOOK  
INTERNODE  
MICROSOFT BING  
YAHOO!

**DO YOUR PART**  
**JOIN THE LAUNCH!**

**[www.worldipv6launch.org](http://www.worldipv6launch.org)**

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

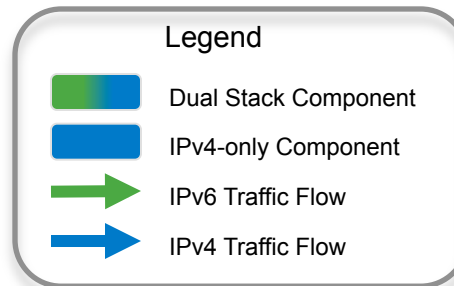
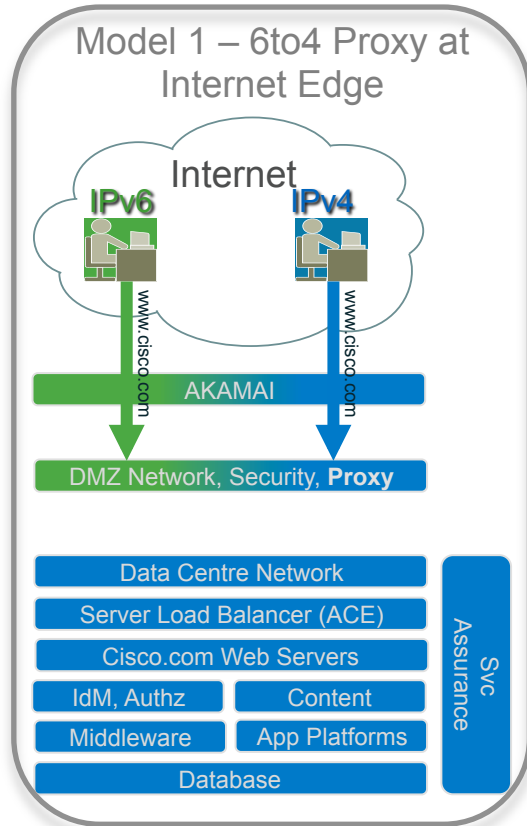
# World IPv6 Launch @ Cisco



[www.cisco.com](http://www.cisco.com)  
[www.webex.com](http://www.webex.com)  
[home.cisco.com](http://home.cisco.com)

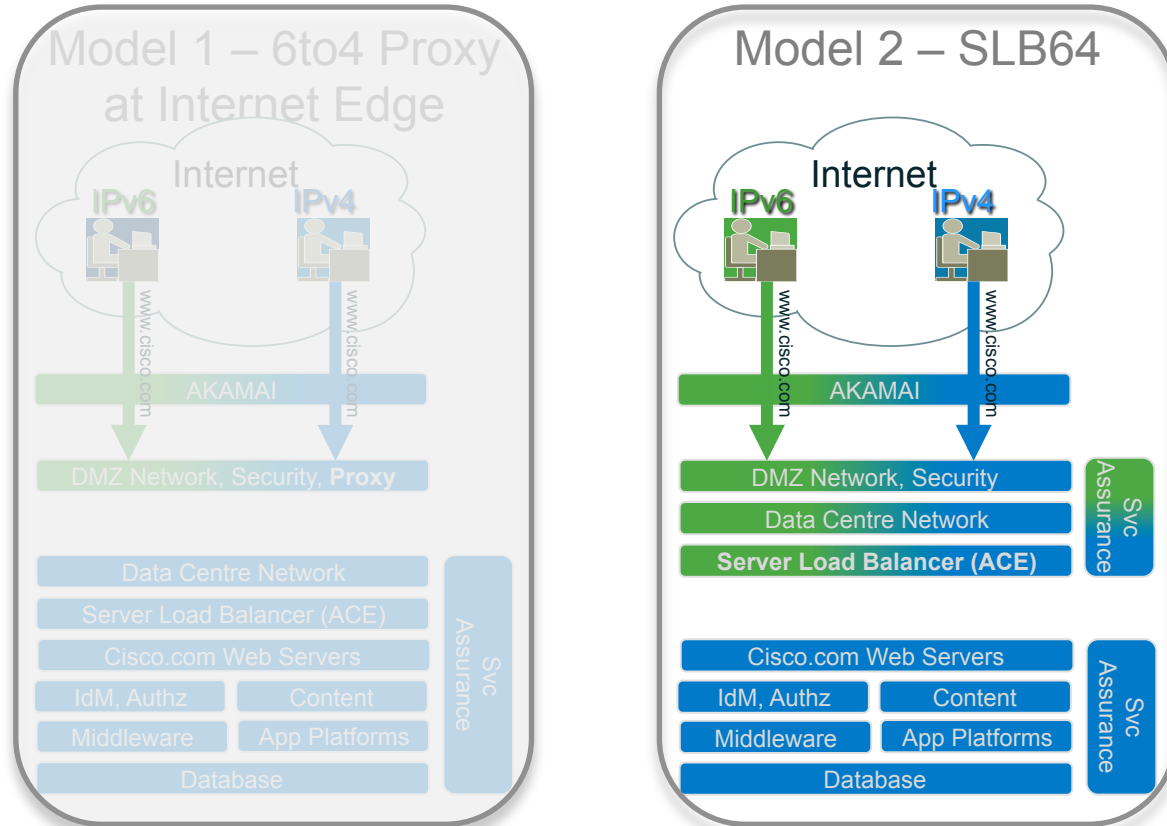
# Cisco's IPv6 Web Presence

## Architecture for www.cisco.com



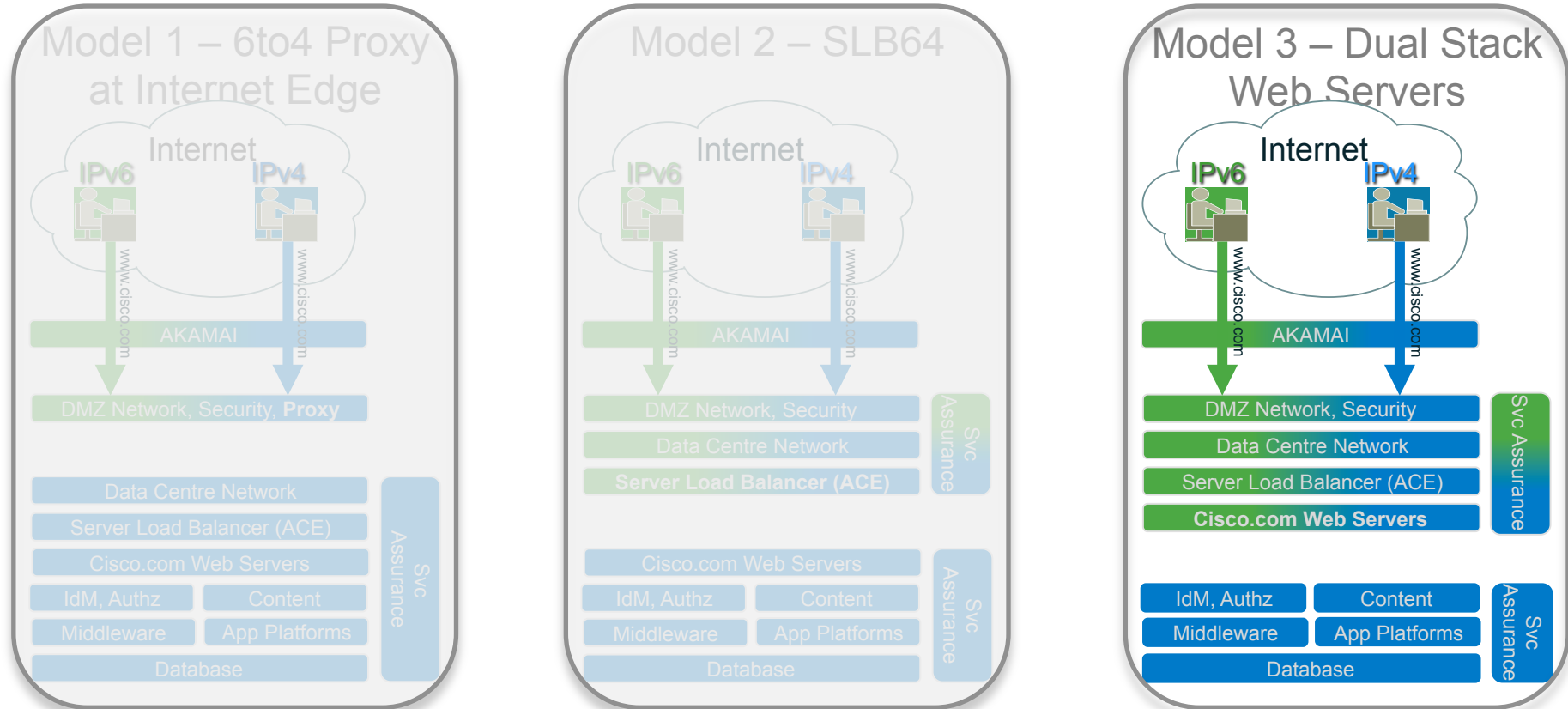
# Cisco's IPv6 Web Presence

## Architecture for www.cisco.com



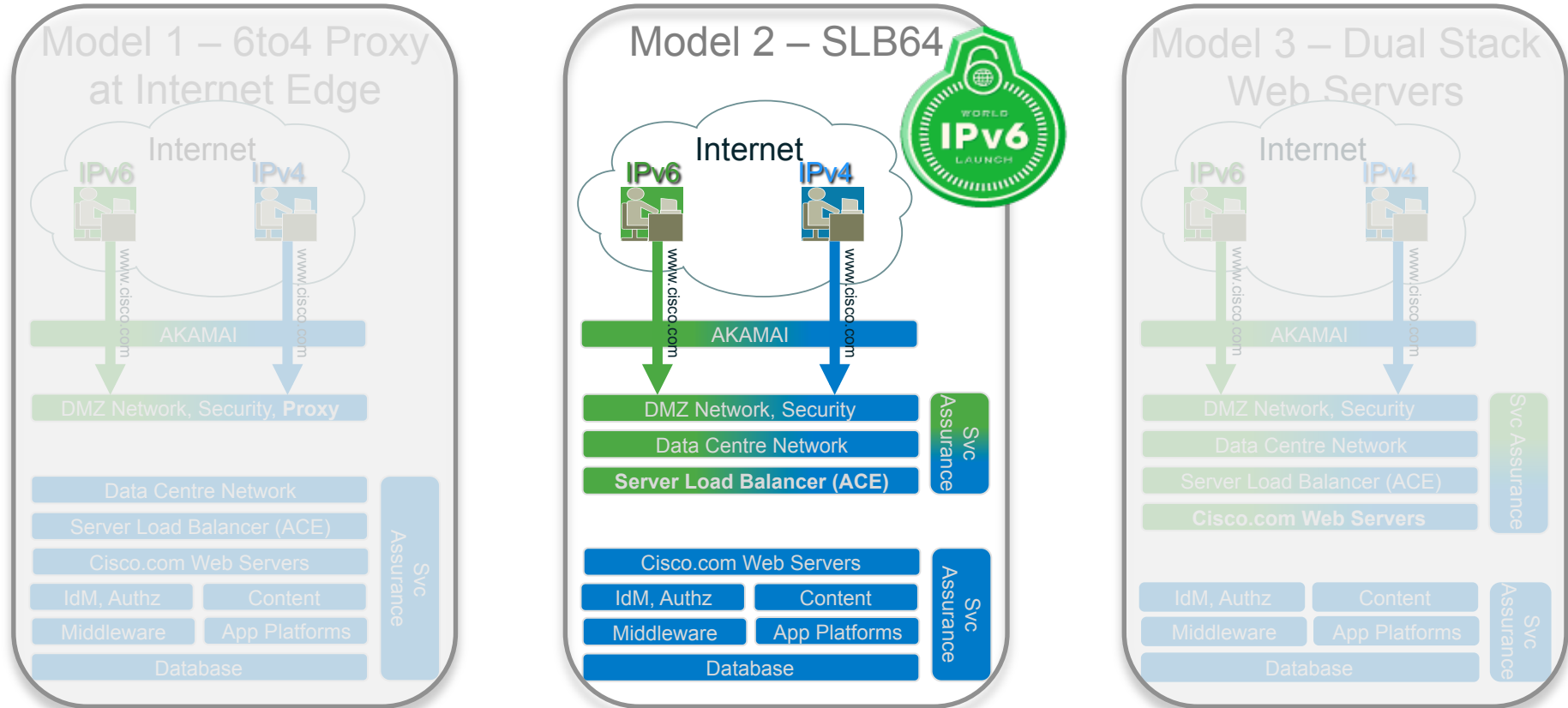
# Cisco's IPv6 Web Presence

## Architecture for www.cisco.com



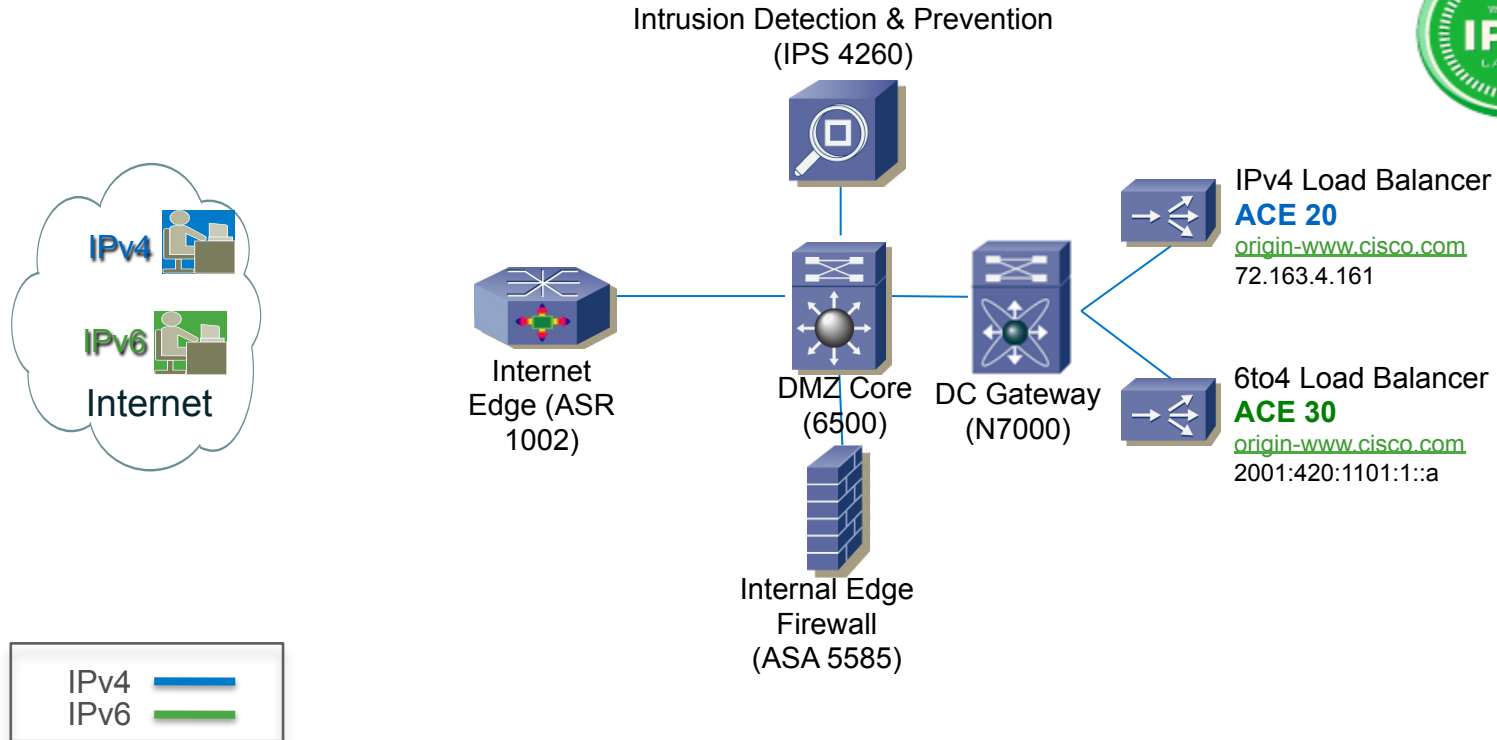
# Cisco's IPv6 Web Presence

## Architecture for www.cisco.com



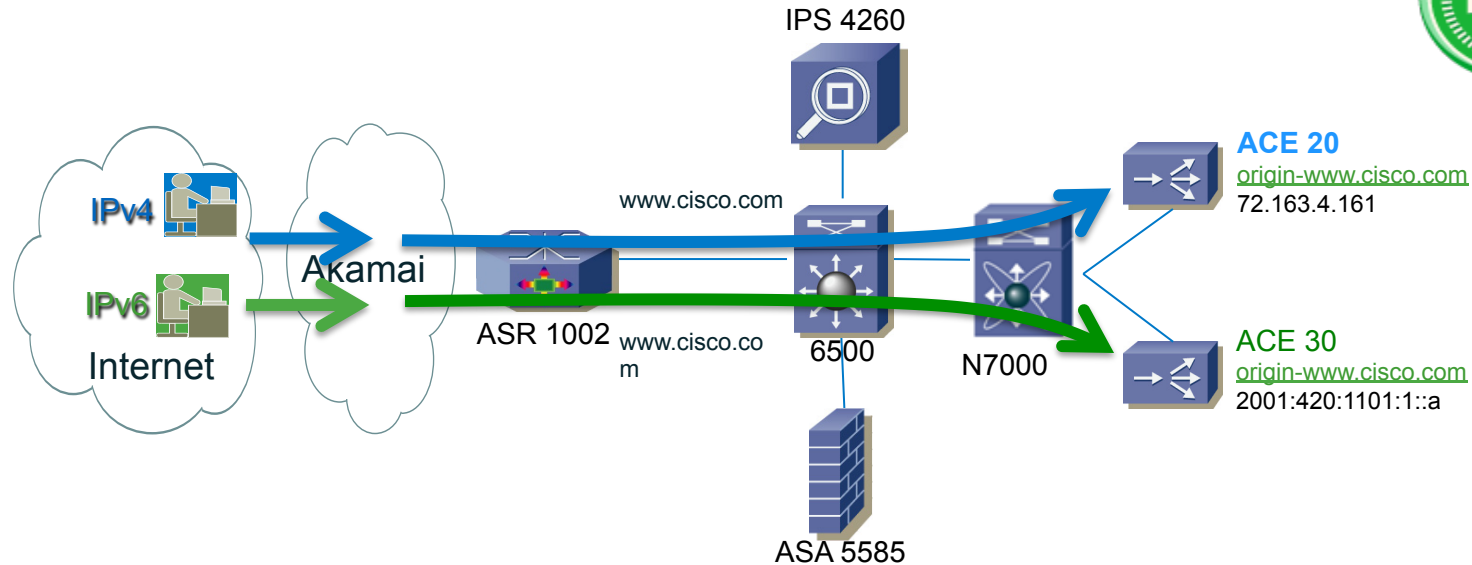
# Cisco's IPv6 Web Presence

Design for [www.cisco.com](http://www.cisco.com)



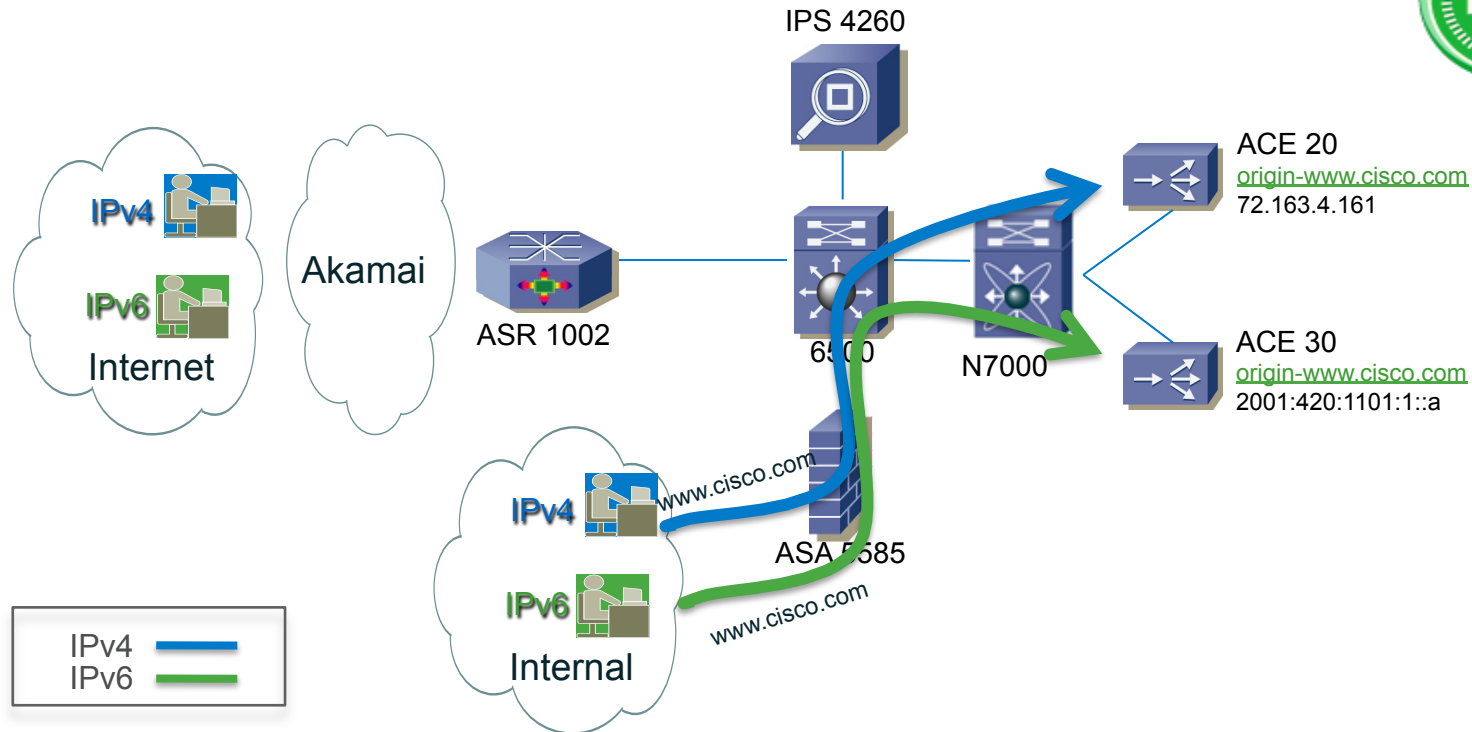
# Cisco's IPv6 Web Presence

Design for [www.cisco.com](http://www.cisco.com)



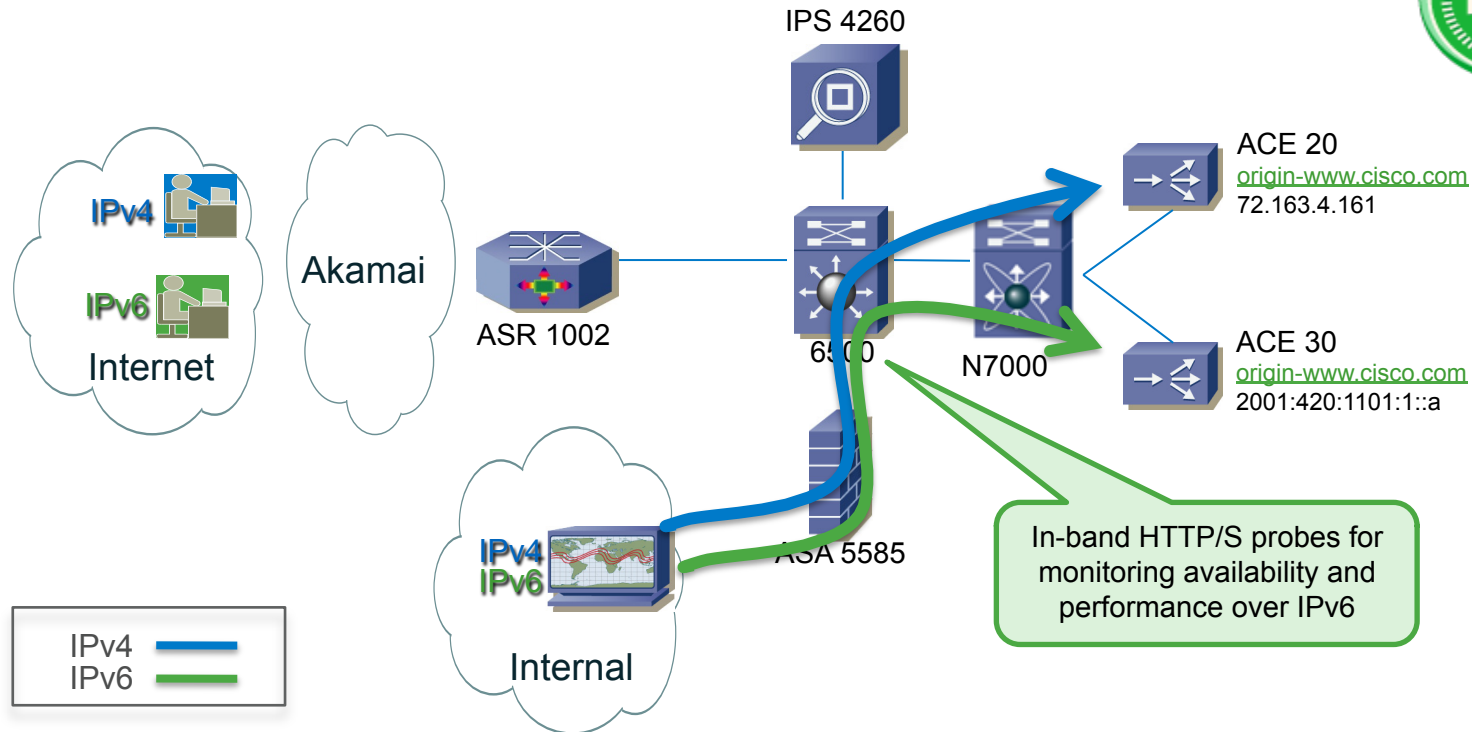
# Cisco's IPv6 Web Presence

Design for [www.cisco.com](http://www.cisco.com)



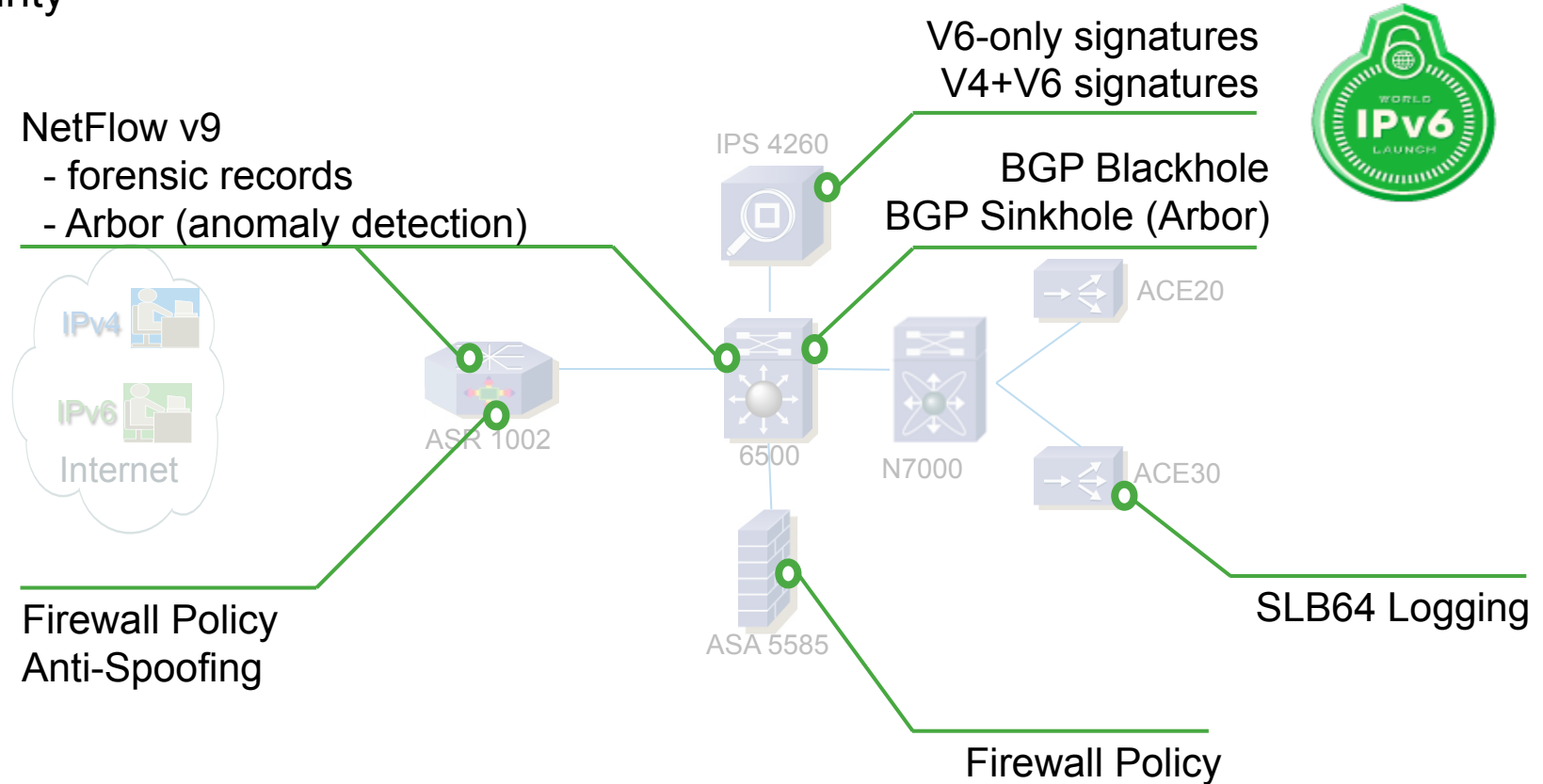
# Cisco's IPv6 Web Presence

Design for [www.cisco.com](http://www.cisco.com)



# Cisco's IPv6 Web Presence

## Security



# World IPv6 Launch Metrics for [www.cisco.com](http://www.cisco.com)

- On June 6, 2012, IPv6 page views for [www.cisco.com](http://www.cisco.com) accounted for about 0.6% of all page views
- As of April 1, 2013, this number had increased to 1%



Source: Cisco IT web analytics

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# Lessons Learned

## Creating The IPv6 Program



- Making the case
  - Business case for IPv6 internet presence is simpler to articulate
  - Business case for IPv6 on internal corporate network may be more difficult to justify
- Cross functional effort across the IT Stack
  - Starts with networking team taking the lead
  - Early engagement of security team, infrastructure and application teams follow
- Early planning is key
- Absorb the IPv6 effort into existing network lifecycle management process

# Lessons Learned

## Product Support



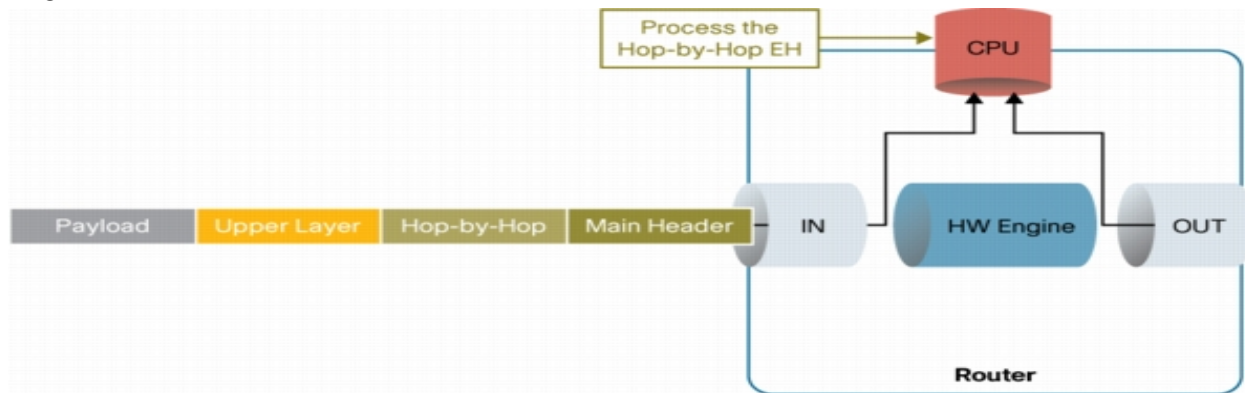
- Network hardware, software, functionality
  - Routers, server load balancers
  - Wireless, switches
- Network management and service assurance
  - External and internal availability and performance monitoring
- Security
  - Firewalls, IDS/IPS, security event management and forensics logging

# Lessons Learned

## Security



- The goal is security parity with IPv4
  - User attribution (IPv6-to-MAC binding), custom Internal tools, third party vendors, incident response playbook, firewalls, anomaly detection, netflow, IDS, log data, pen testing, transparent proxy with anti-malware
- Opportunities to improve security as IPv6 is introduced
  - First hop security in our access networks
- Security considerations with IPv6
  - ICMPv6
  - Privacy extensions for SLAAC
  - Hop by hop extension header



# Lessons Learned

## Product Support - Netflow



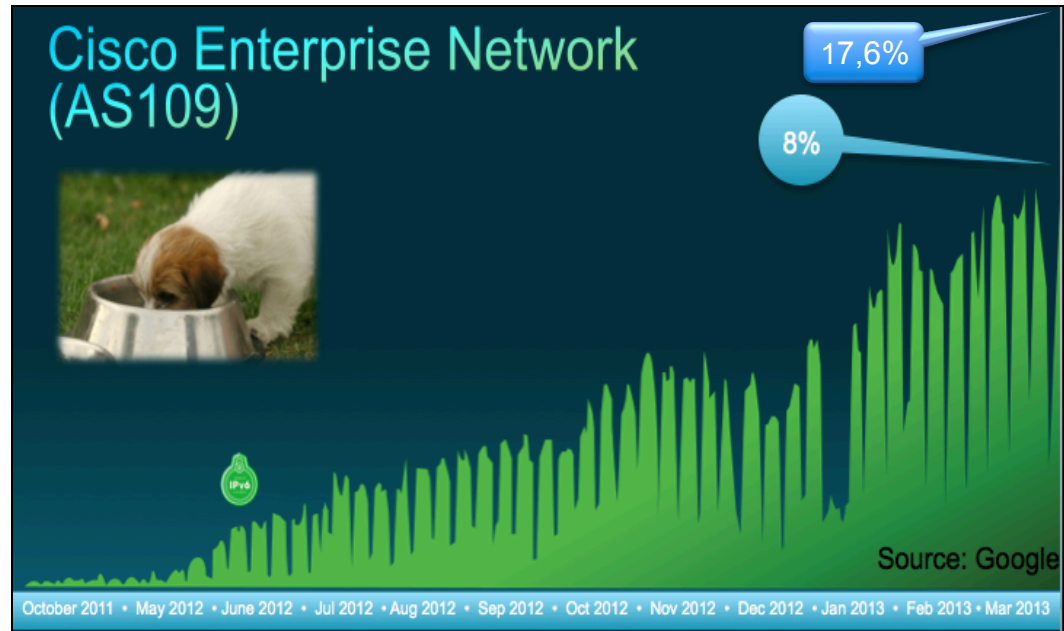
- IPv6 requires NetFlow v9
  - Some collectors cannot receive/process NetFlow v9
  - Some routing platforms don't support for both NetFlow v5 and NetFlow v9
  - Some routing platforms are constrained to two export destinations
- We had to shift NetFlow collection in our DMZ devices to deal with the constraints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

# Lessons Learned End Devices

- Many of our end devices are already IPv6 enabled
  - From Microsoft Vista and Server 2008
  - From OS X Lion (10.7)
- “Happy Eyeballs” can mask IPv6 connectivity issues

Network operator measurements, 22nd May 2013 ([notes](#))

Show	10	entries	Search:	109
Participating Network		ASN(s)		IPv6 deployment
Cisco		109		17.62%
Showing 1 to 1 of 1 entries (filtered from 110 total entries)				
First		Previous	1	Next Last



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

# Next STEP ...

- During 2013, Cisco IT expects to expand the cisco.com IPv6 web presence by providing IPv6 access to **ordering, support, marketing, and software download services**.
- To save time and minimize resource requirements, the initial design will use the reverse-proxy architecture. Other plans include:
  - Delivering end-to-end IPv6 in more locations
  - Adding IPv6 support to internal monitoring applications
  - Providing an IPv6 Internet presence for all Cisco websites
  - Extending IPv6 support to branch offices
  - Enabling IPv6 for the 27,000 Cisco teleworkers whouse Cisco Virtual Office
  - Providing dual-stack support in the desktop environment for the remaining Cisco offices
  - Continuing to integrate IPv6 with other borderless network services through the Extended Enterprise Network (E2N) program
  - Providing dual-stack support for the infrastructure as a service (IaaS) platform, called Cisco IT Elastic
  - Completing the transition at all IT-owned data center and DMZ sites.

# Conclusion

- Build the case and create the program
- IPv6 affects everyone across IT but is lead by the network team
- Multi-year effort with early planning key
- Assessment of product and service gaps
- Dual stack where you can, tunnel where you can't and NAT only when you have to
- Take iterative steps on our way to the target state

**"We chose to introduce IPv6 gradually, to not incur incremental costs. By following the normal hardware and software refresh cycle in the Fleet Upgrade Program, we didn't have to make a big one-time investment to IPv6-enable the infrastructure. The key to success is aligning the deployment timeline with change control windows and release cycles."**

**—Khalid Jawaid, Network Engineer, Cisco IT**

# Cisco IT IPv6 Case Study



Cisco IT Case Study – March 2013  
IPv6 Implementation

## How Cisco IT Is Implementing IPv6: Progress Update

Cisco IT now provides permanent IPv6 Internet presence and is well on the way toward ubiquitous IPv6 network access.

EXECUTIVE SUMMARY
<b>CHALLENGE</b> <ul style="list-style-type: none"><li>• Develop IPv6 Internet presence</li><li>• Progress toward ubiquitous IPv6 access on internal network</li><li>• Keep costs down</li></ul>
<b>SOLUTION</b> <ul style="list-style-type: none"><li>• For Internet presence, initially used reverse-proxy approach to save time; long-term plan is dual-stack approach</li><li>• For Internet access, enabled dual-stack support from the inside out, starting with core network</li><li>• Coordinated equipment upgrades and software updates with Cisco IT's Fleet Upgrade Program</li></ul>
<b>RESULTS</b> <ul style="list-style-type: none"><li>• Enabled IPv6 on cisco.com, webex.com, and home.cisco.com</li><li>• Provided IPv6 access in approximately one-third of global offices and in 90 labs</li><li>• IPv6-enabled 75 percent of core network</li></ul>
<b>LESSONS LEARNED</b> <ul style="list-style-type: none"><li>• Carefully plan address space</li><li>• Complete design early so IT team can certify hardware and software</li><li>• Consider using reverse proxy as temporary</li></ul>

### Background

At Cisco, the network connects people to people, people to devices such as sensors, and devices to devices. The confluence of people, process, data, and things, known as the Internet of Everything (IoE), is helping to increase asset utilization, improve productivity, create efficiencies in the supply chain, enhance the customer experience, and foster innovation.

IoE requires a vast number of IP addresses. This posed a challenge at Cisco because the Internet Assigned Numbers Authority (IANN) handed out its last IPv4 address block to the five regional Internet registries on January 31, 2011. As of March 2013, two of the registries had exhausted their address space, and the others are not far behind.

The solution is IPv6, which supports an unlimited number of global addresses. While IPv4 addresses contain 32 bits, or up to approximately 4.3 billion addresses, IPv6 addresses contain 128 bits, or up to  $2^{128}$  IP addresses. That number equates to billions and billions of addresses for every square meter on the planet, supporting the Internet of Everything.

## How Cisco IT Is Implementing IPv6: Progress Update ( March2013)

[http://www.cisco.com/en/US/solutions/collateral/ns340/ns1176/borderless-networks/IPv6-Implementation\\_Case\\_Study.pdf](http://www.cisco.com/en/US/solutions/collateral/ns340/ns1176/borderless-networks/IPv6-Implementation_Case_Study.pdf)

# ...even more information

## The business case for IPv6

<http://blogs.cisco.com/borderless/business-case-for-ipv6/>

## What enterprises should do about IPv6

[http://www.cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6553/whitepaper\\_c11-586154.html](http://www.cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6553/whitepaper_c11-586154.html)

## TechWiseTV: IPv6 implementation plan

<http://www.youtube.com/watch?v=bvyDWq6D8xk>

## CVD: Deploying IPv6 in Campus Networks

<http://www.cisco.com/en/US/docs/solutions/Enterprise/Campus/CampIPv6.html>

## CVD: Deploying IPv6 in Branch Network

<http://www.cisco.com/en/US/docs/solutions/Enterprise/Branch/BrchIPv6.html>

## CVD: Deploying IPv6 at the Internet Edge

[http://www.cisco.com/en/US/solutions/ns340/ns414/ns742/ns817/landing\\_ie\\_ipv6.htm](http://www.cisco.com/en/US/solutions/ns340/ns414/ns742/ns817/landing_ie_ipv6.htm)

## Cisco IPv6 Services

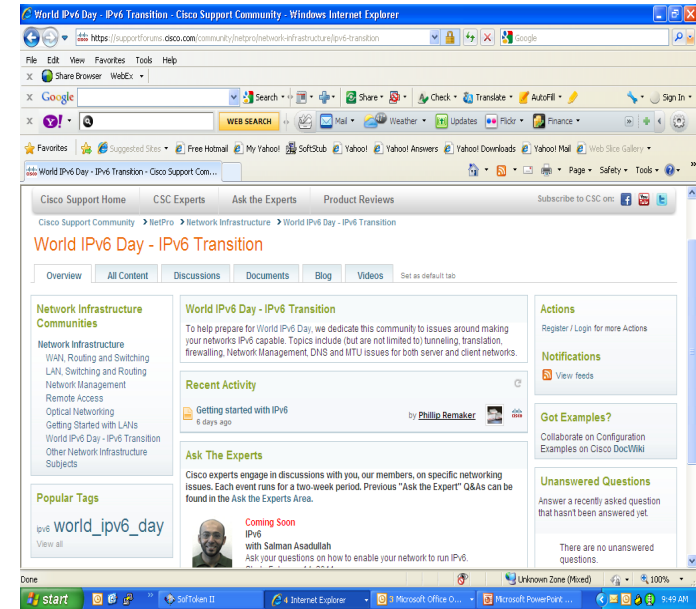
[http://www.cisco.com/en/US/services/ps6887/ps10716/docs/Cisco\\_IPv6\\_Services\\_AAG.pdf](http://www.cisco.com/en/US/services/ps6887/ps10716/docs/Cisco_IPv6_Services_AAG.pdf)



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- **Free** for anyone with Cisco.com registration
- Get **timely** answers to your technical questions
- Find **relevant** technical documentation
- Engage with over 200,000 **top technical experts**
- **Seamless** transition from discussion to TAC Service Request (*Cisco customers and partners only*)
- Visit the Cisco Support Community booth in the World of Solutions for more information

[supportforums.cisco.com](https://supportforums.cisco.com)  
[supportforums.cisco.mobi](https://supportforums.cisco.mobi)



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