IPv6, The Next Big Internet Step !

IPv6 au service de l'experience utilisateur !!

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Agenda

- Introduction
- Comment garantir l experience utilisateur
- Modèles de déploiement d’IPv6
- Qui déploie IPv6 ?
- IPv6 chez Cisco
- Pourquoi Cisco ?
- Conclusions

Introduction

Acceleration de adoption d'IPv6 dans le monde

IPv4 Address Exhaustion

IANA, APNIC,RIPE, ARIN, LACNIC exhausted

http://ipv6.he.net/statistics/

IPv6-Capable Devices

By 2018, 48 percent (over 4.9 billion) of mobile devices will be capable of connecting to an IPv6 mobile network.

* Source: Cisco Visual Networking Index (VNI)

80%
of Internet core networks are IPv6

IPv6 Users

Steady growth globally*

3.5% globally
>7% in US
~50% in Vz Wireless

http://6lab.cisco.com/stats

IPv6 Content

~50% of Internet content*

Google

Akamai

facebook

YAHOO!

CLOUDFLARE.

Drivers Business

Public Secteur

Connected car

Retail

Globalisation

SmartCities

Smart Cities

AGT INTERNATIONAL CISCO

http://goo.gl/oH1hol

- **Cisco et AGT forment une alliance stratégique mondiale pour les villes intelligentes visant à transformer la manière dont les villes sont gérées et sécurisées . Des solutions qui modifient la donne pour les villes :**

- **Une solution de gestion de la circulation** qui identifiera, répondra et résoudra les incidents de circulation :
  - en fournissant une conscience de la situation de la circulation en temps réel
  - aidera à détecter les incidents en utilisant des flux vidéo en direct des zones d'incident,
  - Grace à des capteurs magnétiques sans fil incorporés à la chaussée
  - Grace à des lecteurs de plaques minéralogiques
  - aux médias sociaux
  - à une prédiction sophistiquée via la modélisation de la circulation
  - la formulation d'une stratégie alternative.

Les embouteillages coûtent 121 milliards de dollars par an en temps perdu et en carburant gaspillé rien qu'aux États-Unis, selon le Texas A&M Transportation Institute.

- **Une solution de sécurité urbaine** permet aux villes de prédire, se préparer, répondre et diminuer les incidents opérationnels et de sécurité en identifiant plus rapidement les activités suspectes. Les incidents seront gérés avec un logiciel qui utilise tout un éventail de capteurs, de données sur la ville, ainsi que de flux visuels et des médias sociaux. La solution utilisera des analyses pour automatiser et visualiser la situation et pour recommander la réponse appropriée.

Drivers technologiques

Cloud/MSDC
- Scale
- Virtualization
- Automation
- Simplification

Mobile Internet
- Scale: 10 Billions
- 4G-LTE / VoLTE
- Simplification
- Mobile networks

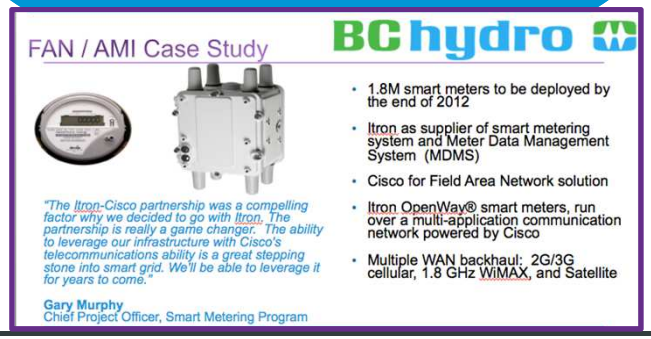
Internet of Things
- Scale: 50 Billions
- Automation-Self Networked
- IoT Protocols are IPv6 only

http://www.cisco.com/go/vni

Drivers technologiques
Exemples

IPv6

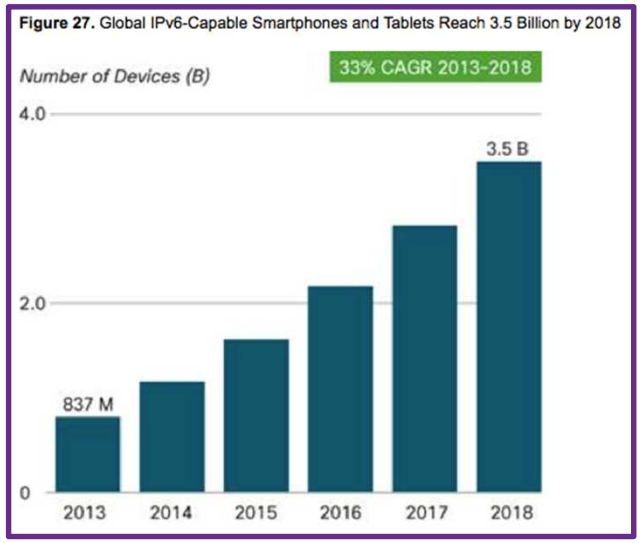
End2End Restored
Unlimited Connectivity
Global Reach

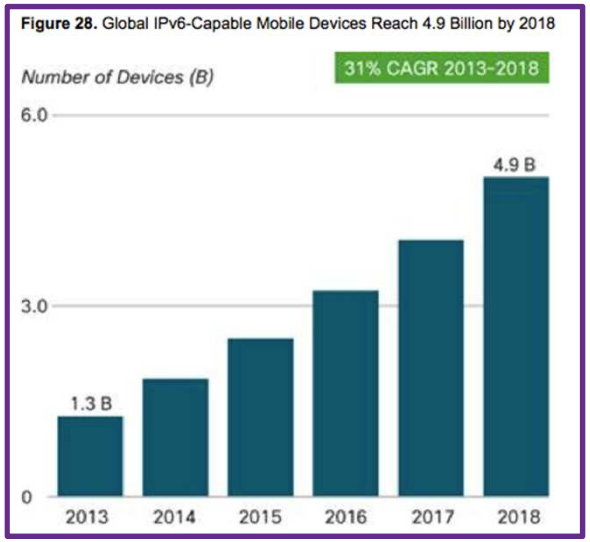


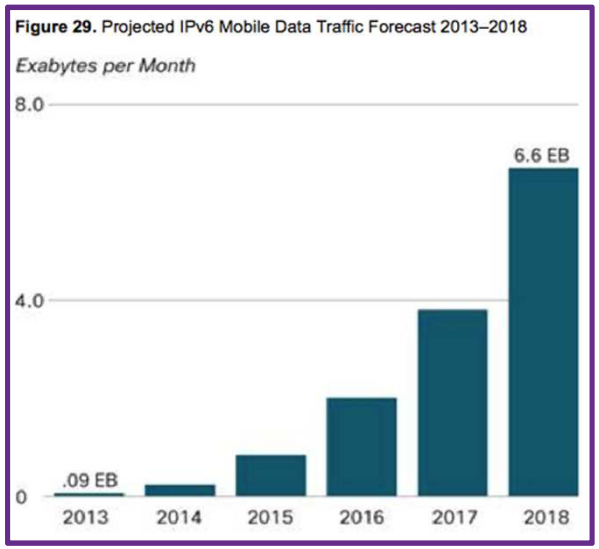
http://blog.azure.com/2014/06/11/windows-azures-use-of-non-us-ipv4-address-space-in-us-regions/
http://www.extremetech.com/mobile/127213-ipv6-now-deployed-across-entire-t-mobile-us-network

Visual Networking Index forecast 2013-2018

http://goo.gl/xxLT







Les OS utilisateurs ont tous IPv6 activé par défaut

On ne peut le désactivé facilement voire pas du tout !

Comment garantir l’experience utilisateur

Penurie IPv4 officielle !!!

IPv4 & IPv6

IANA **2 Fevrier 2011**

RIPE NCC Begins to Allocate IPv4 Address Space From the Last /8

14 Sep 2012

On Friday 14 September, 2012, the RIPE NCC, the Regional Internet Registry (RIR) for Europe, the Middle East and parts of Central Asia, distributed the last blocks of IPv4 address space from the available pool.

This means that we are now distributing IPv4 address space to Local Internet Registries (LIRs) from the last /8 according to section 5.6 of "IPv4 Address Allocation and Assignment Policies for the RIPE NCC Service Region".

This section states that an LIR may receive one /22 allocation (1,024 IPv4 addresses), even if they can justify a larger allocation. This /22 allocation will only be made to LIRs if they have already received an IPv6 allocation from an upstream LIR or the RIPE NCC

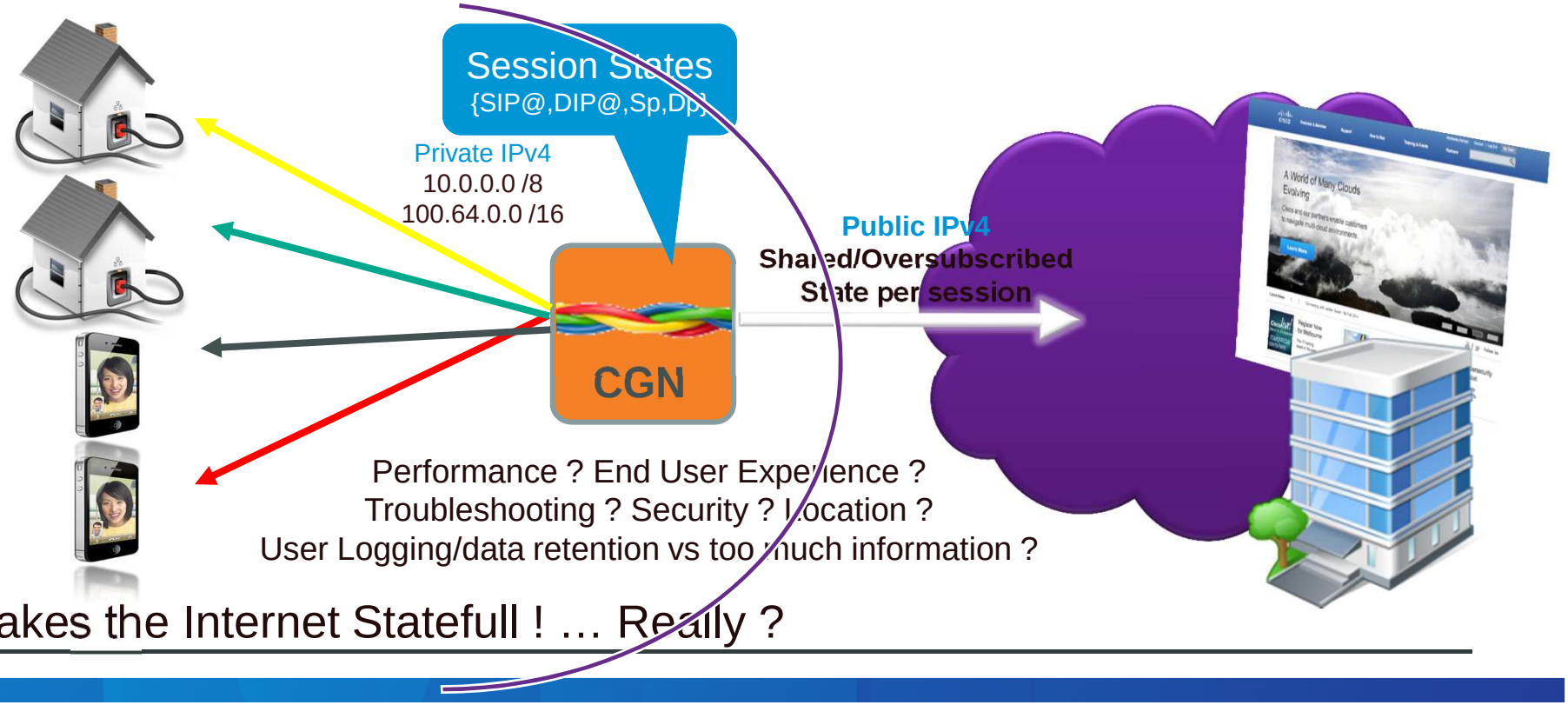
No new IPv4 Provider Independent (PI) address space can be assigned.

It is now imperative that all stakeholders deploy IPv6 on their networks to ensure the continuity of their online operations and the future growth of the Internet.

HURRICANE ELECTRIC INTERNET SERVICES

http://ipv6.he.net/statistics/

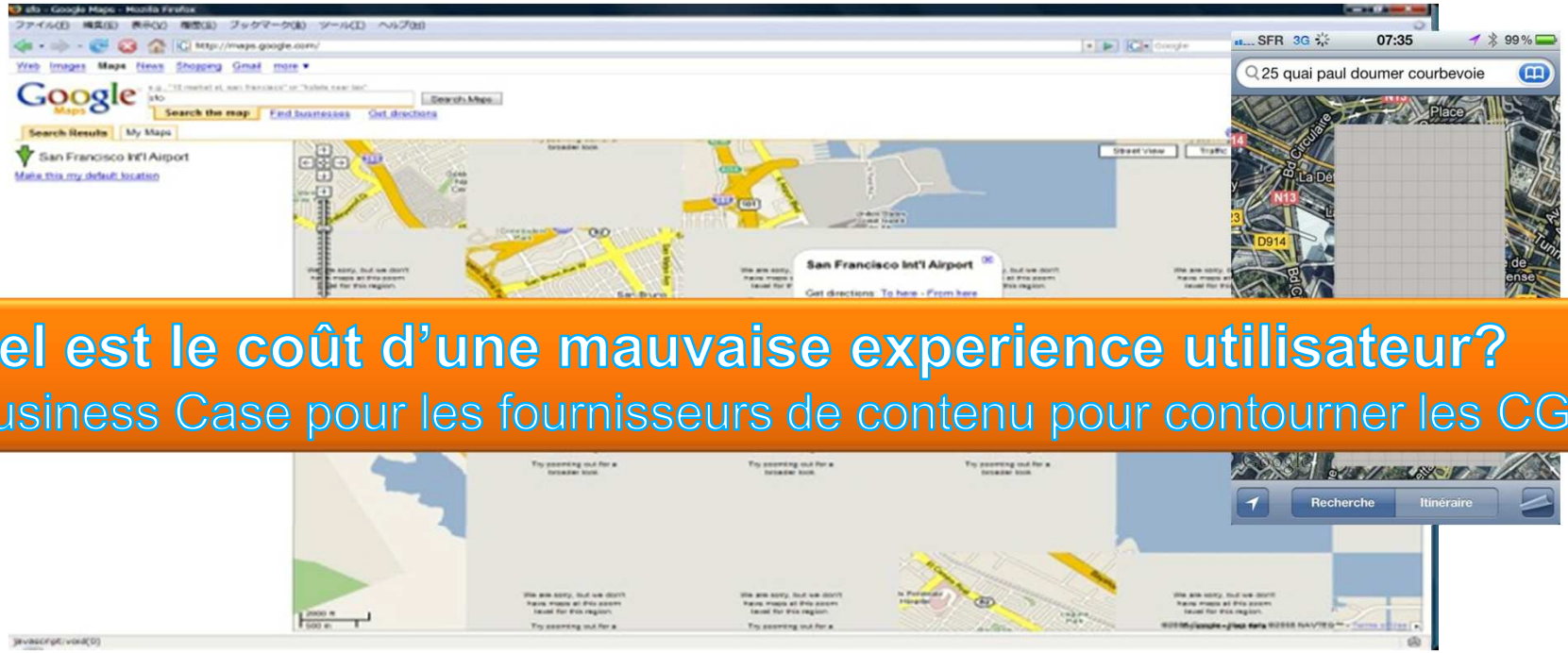
Carrier Grade NAT: Partage d'adresses IPv4 Publiques !



Makes the Internet Statefull ! … Really ?

Impact des CGN-NAT l'experience utilisateur

20 NAT Sessions times millions of users



Quel est le coût d'une mauvaise experience utilisateur?

=> Le Business Case pour les fournisseurs de contenu pour contourner les CGN

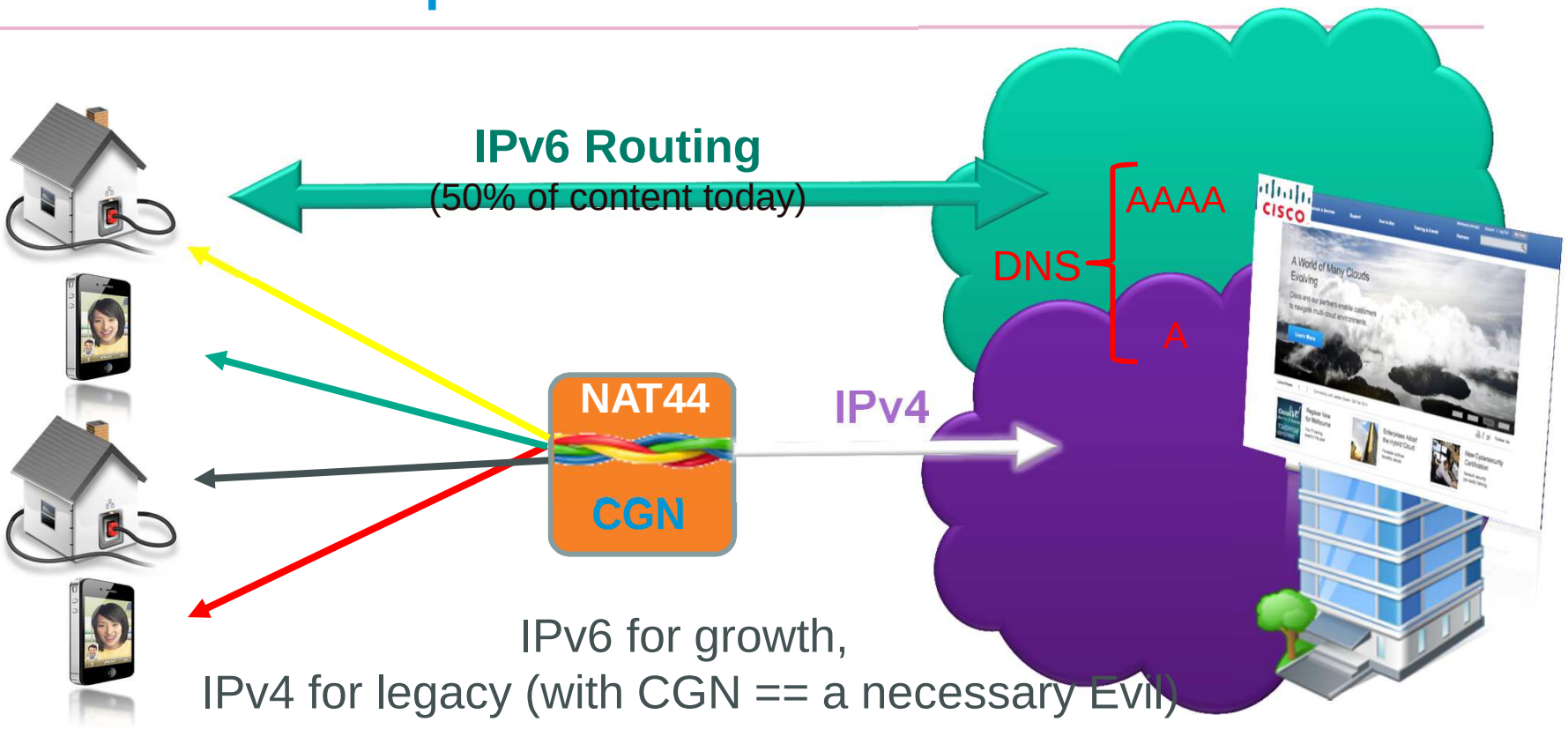
Web 2.0 (ex: AJAX) Application Behavior Under Constrained NAT Resources

Nombre de session TCP par application

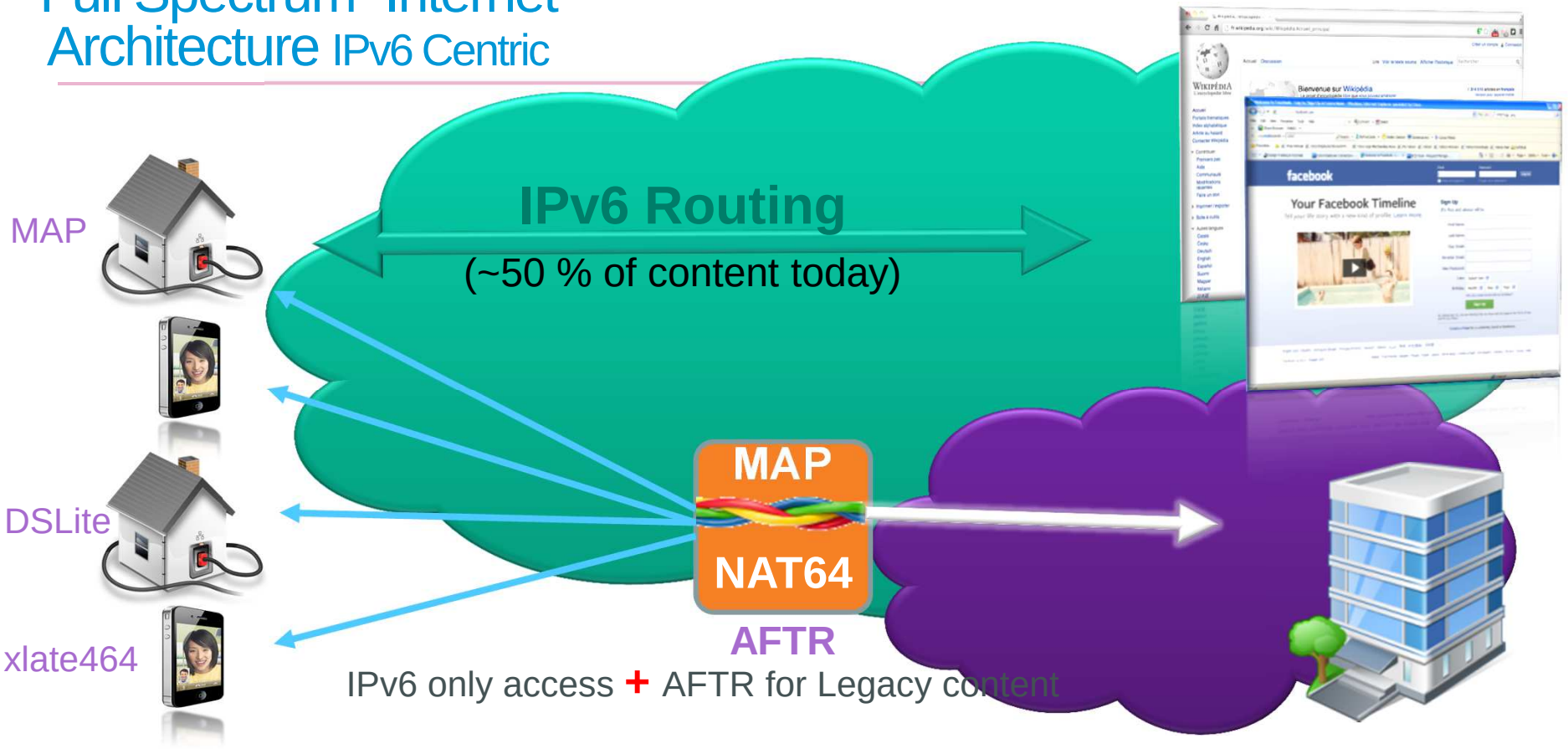
Application	# of TCP sessions
Generic Website	5～10
Yahoo top page	10～20
Google image search	30～60
ニコニコ動画 (Nico Nico Video)	
OCN photo friend	
iTunes	
iGoogle	～100
	50～60
	90
	100
	90

Combien de session simultanée exige votre business?

IPv6 – “Full Spectrum” Internet



"Full Spectrum" Internet Architecture IPv6 Centric



Tous les OS modernes supportent IPv6

- Prefer IPv6 connectivity (RFC 5221)
- Automatically enable IPv6 (RFC 4862)
- Run IPv6 over IPv4 under certain circumstances
  - Tunneled over an IPv4 core,
  - And/or on L2 segment

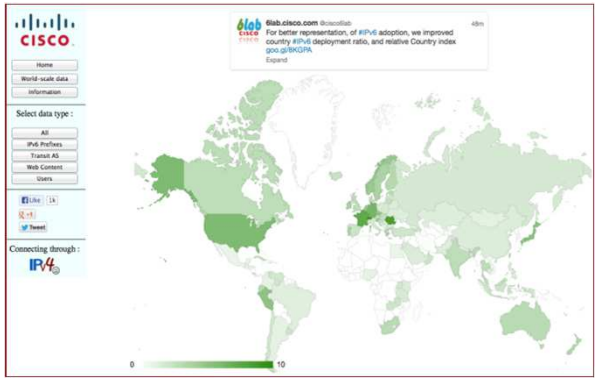
- Try to use IPv6 if they receive an IPv6 address from DNS (RFC 6555 (Happy Eyeballs)
- Use link-local addresses for “plug and play” protocols (Bonjour / Zeroconf)
- Don’t always display IPv6 information (mobile devices)
- Use privacy addresses (RFC 4961)

Métriques d’adoption d’IPv6

6lab.cisco.com/stats

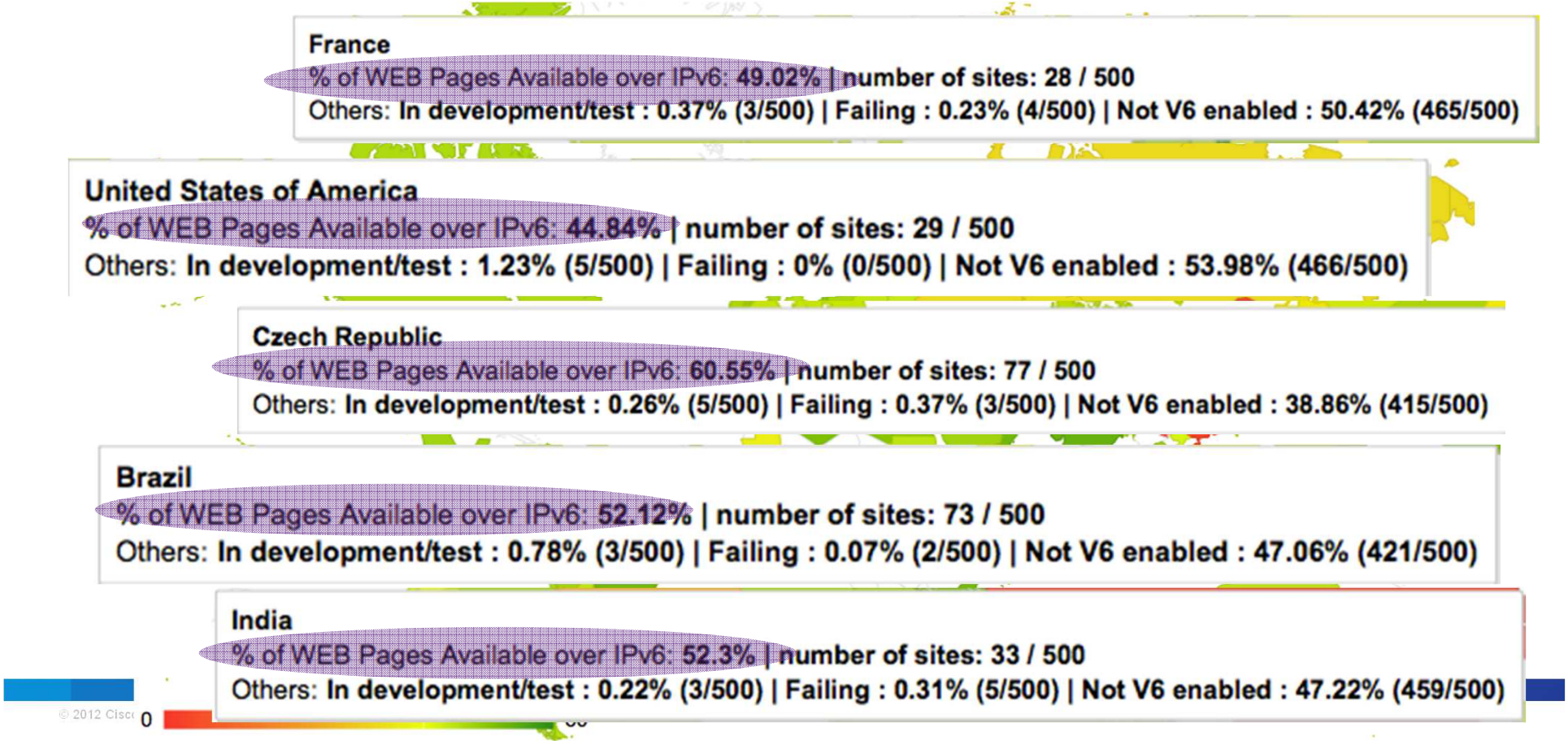
Plannification	Routage	Contenu	Utilisateurs	Trafic
Obtention d’un prefix IPv6	Propagation du prefix IPv6 dans le réseau	Rendre son contenu Accessible en IPv6	Fourniture de services IPv6 par les ISP + Les terminaux IPv6	

“When a tree falls, we can hear it.
When the forest grows, not a sound”
Gandhi



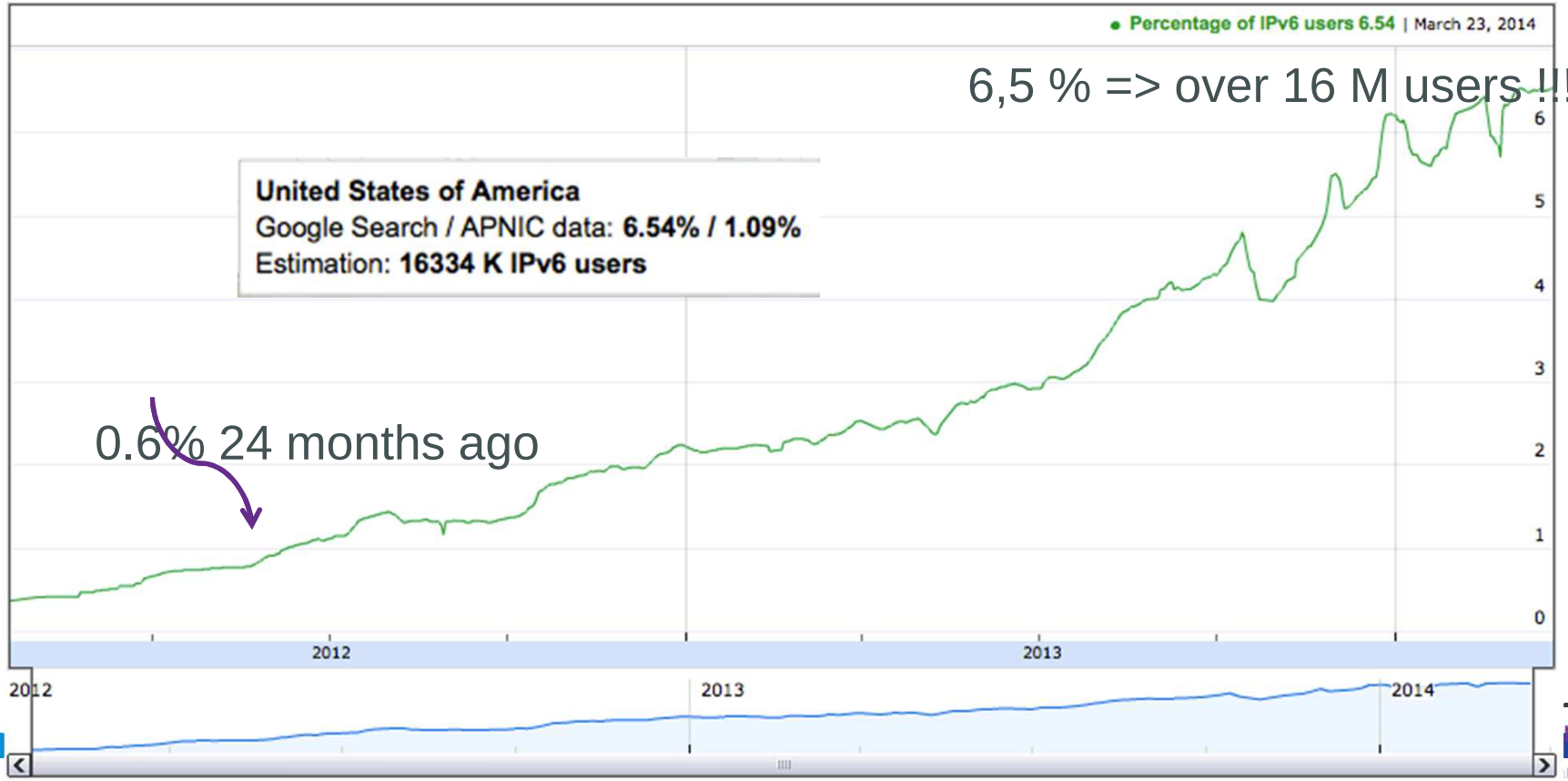
6lab.cisco.com/stats

~50% des contenus sont accessibles en IPv6



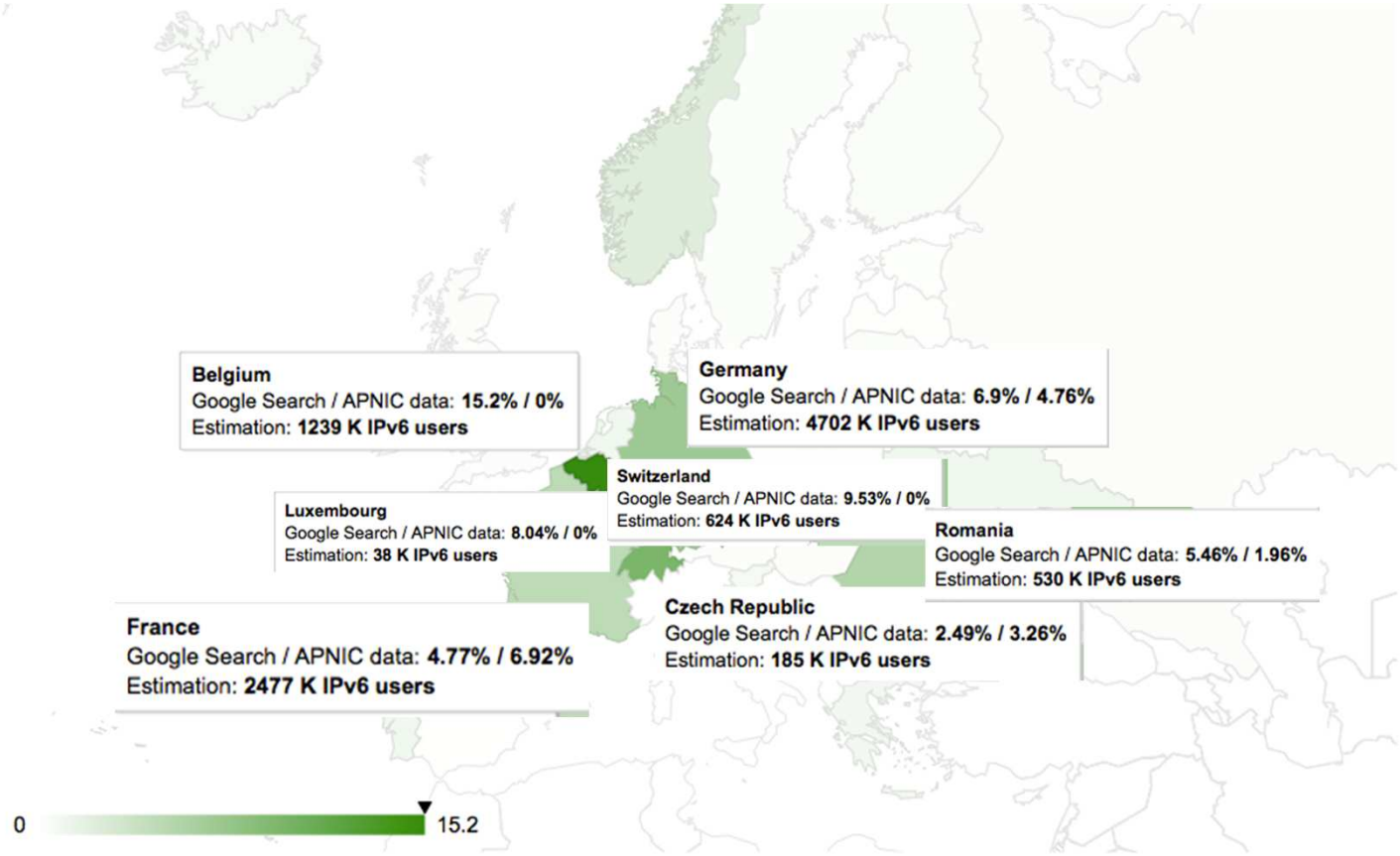
Utilisateurs IPv6 : USA

6lab.cisco.com/stats



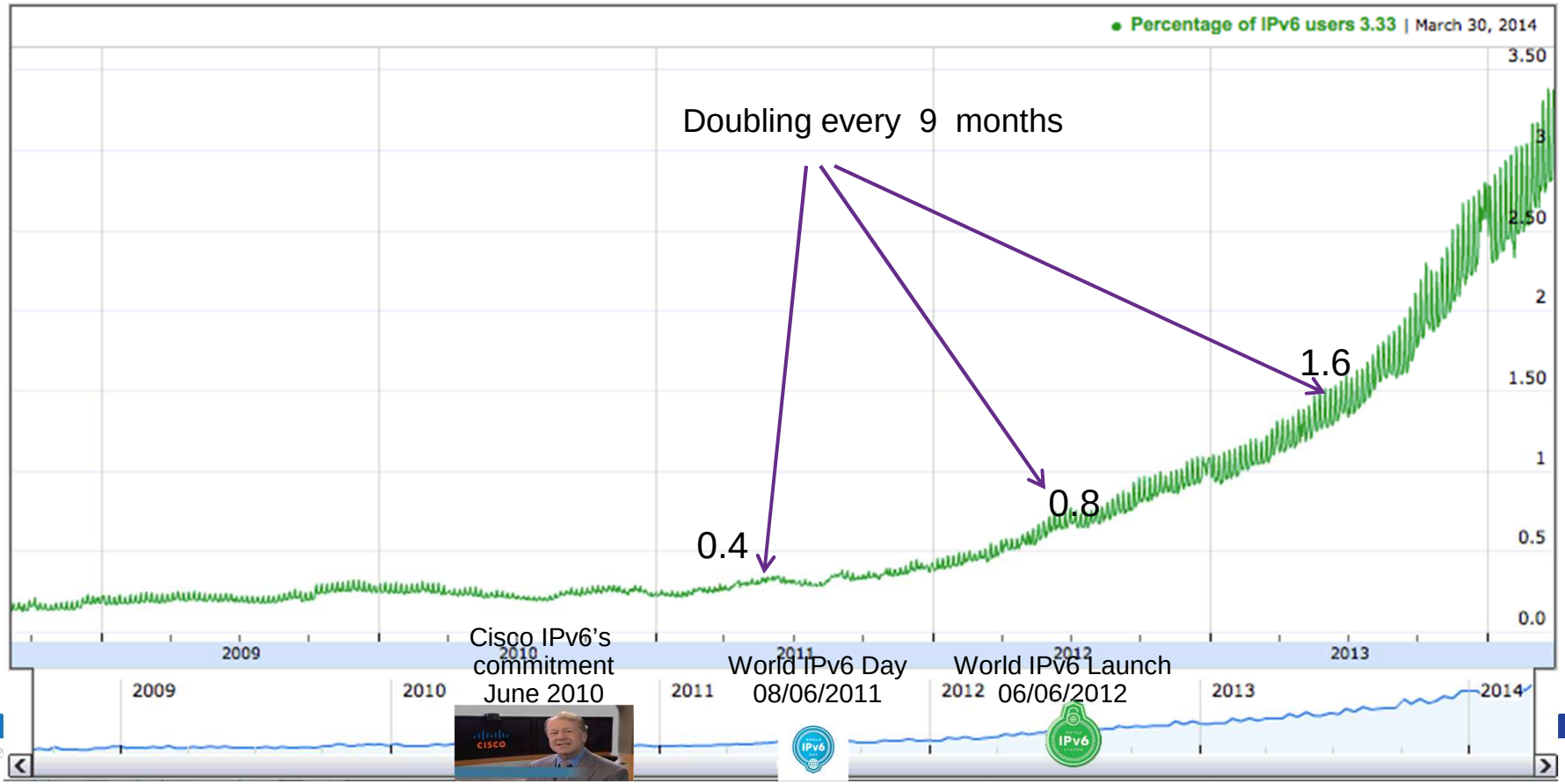
Utilisateurs IPv6 : Europe

6lab.cisco.com/stats



IPv6 vs IPv4 : Google

www.google.com/ipv6/measurement



IPv6 vs IPv4 : Google

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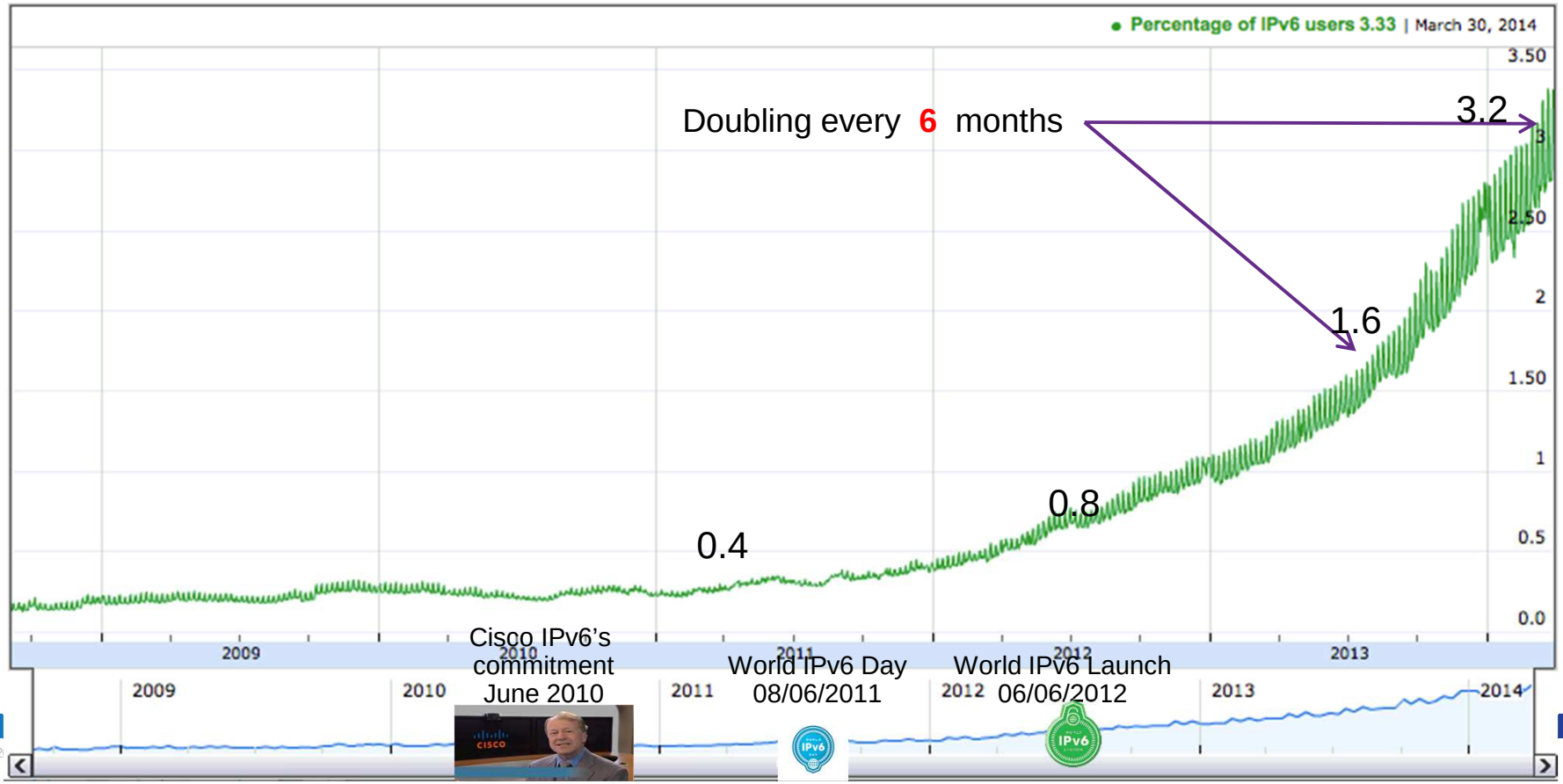
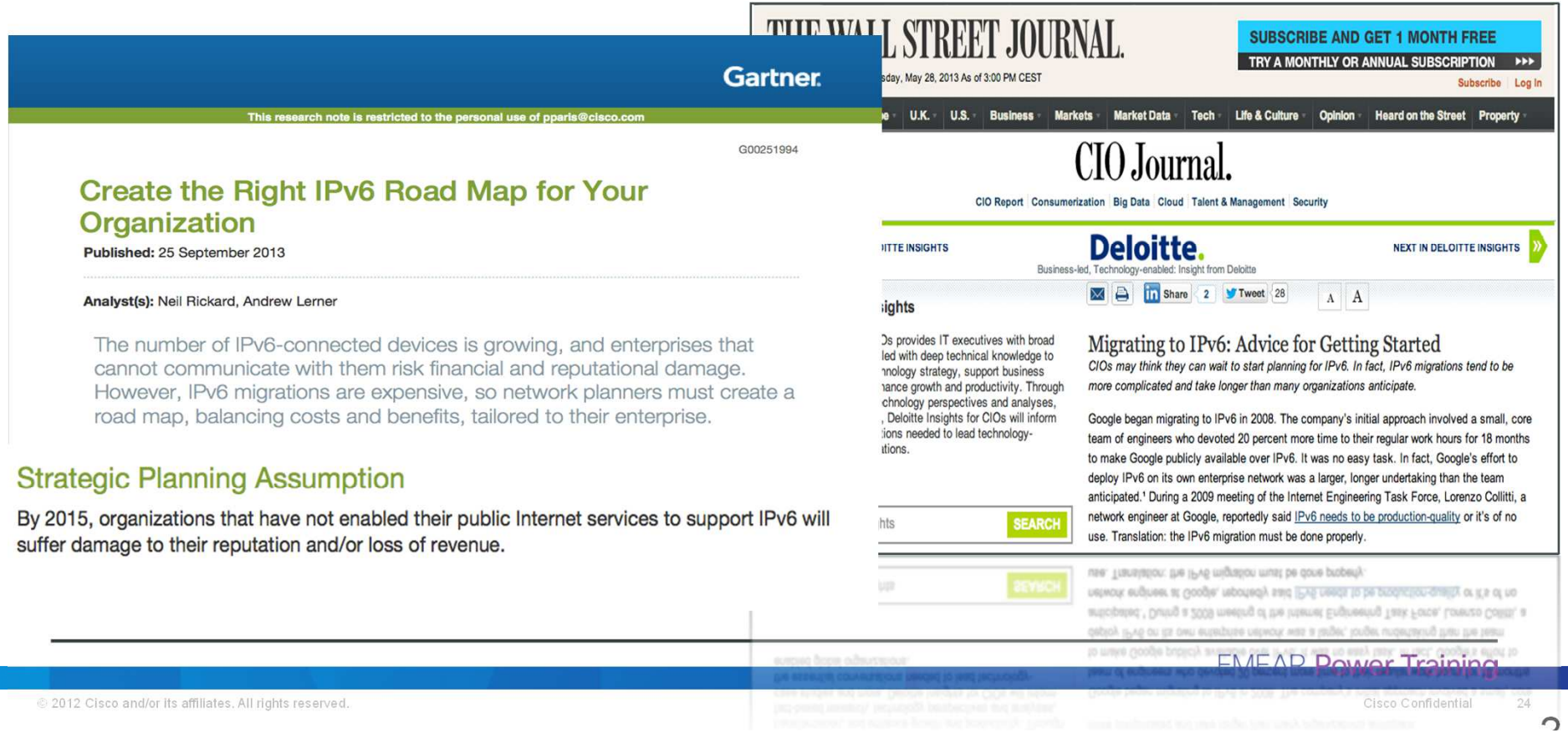


Roadmap IPv6
Qu'en pensent les autres ?



Gartner

This research note is restricted to the personal use of pparis@cisco.com

G00251994

Create the Right IPv6 Road Map for Your Organization

Published: 25 September 2013

Analyst(s): Neil Rickard, Andrew Lerner

The number of IPv6-connected devices is growing, and enterprises that cannot communicate with them risk financial and reputational damage. However, IPv6 migrations are expensive, so network planners must create a road map, balancing costs and benefits, tailored to their enterprise.

Strategic Planning Assumption

By 2015, organizations that have not enabled their public Internet services to support IPv6 will suffer damage to their reputation and/or loss of revenue.

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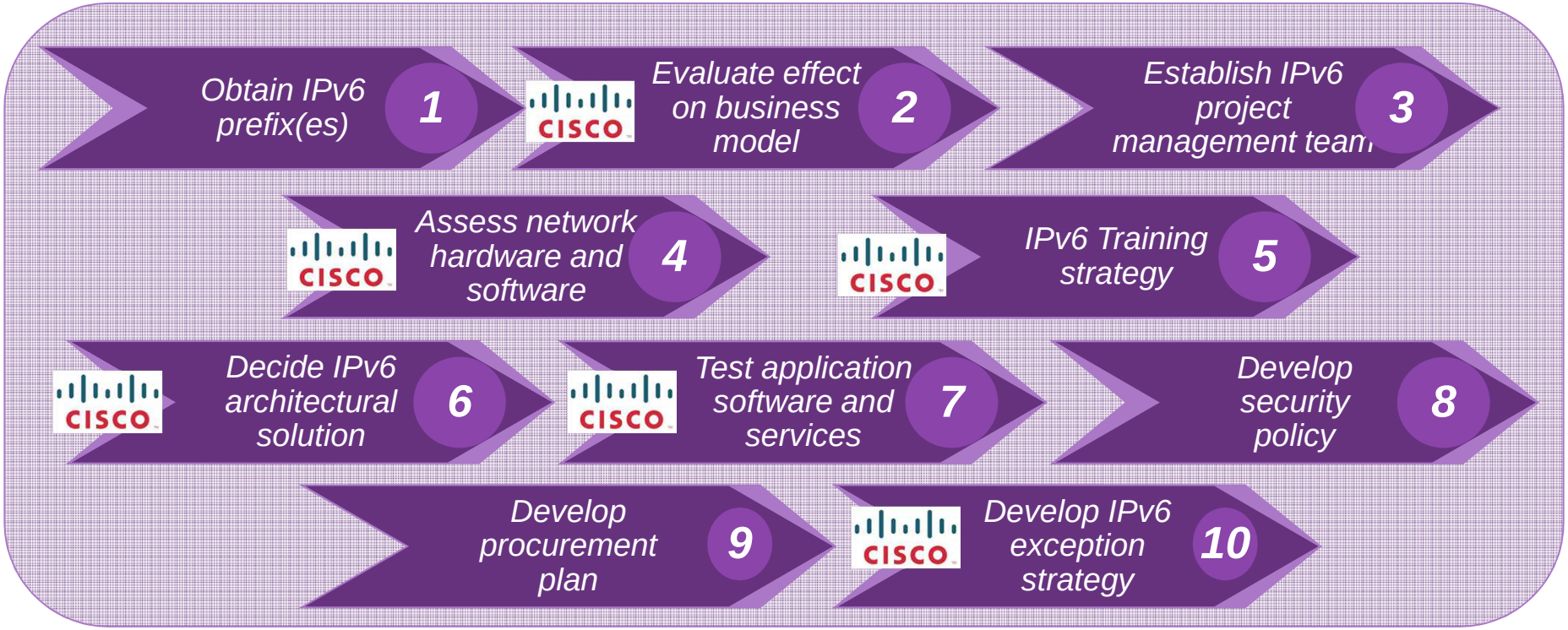
Migrating to IPv6: Advice for Getting Started

CIOs may think they can wait to start planning for IPv6. In fact, IPv6 migrations tend to be more complicated and take longer than many organizations anticipate.

Google began migrating to IPv6 in 2008. The company's initial approach involved a small, core team of engineers who devoted 20 percent more time to their regular work hours for 18 months to make Google publicly available over IPv6. It was no easy task. In fact, Google's effort to deploy IPv6 on its own enterprise network was a larger, longer undertaking than the team anticipated.[1] During a 2009 meeting of the Internet Engineering Task Force, Lorenzo Colitti, a network engineer at Google, reportedly said IPv6 needs to be production-quality or it's of no use. Translation: the IPv6 migration must be done properly.

IPv6 – Modèles de déploiement

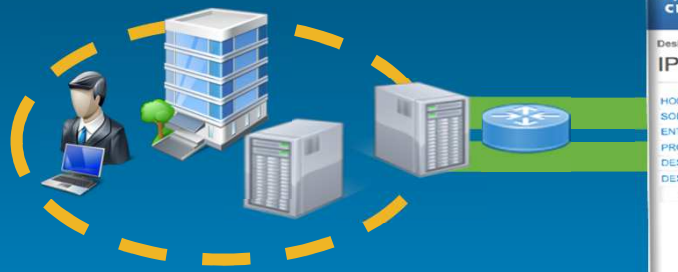
IPv6 Plannification



Modèles de déploiement pour les Entreprises
2 options

Outside – In

Internet Evolution
Business Continuity
B2C, B2B



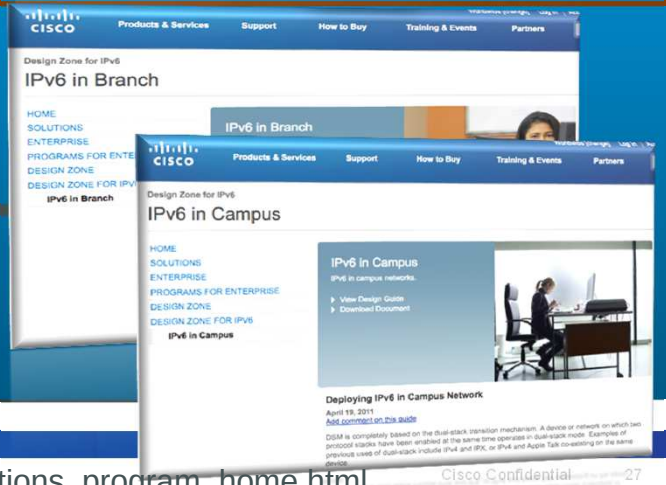
IPv4 Enterprise

IPv6 Internet

Inside – Out

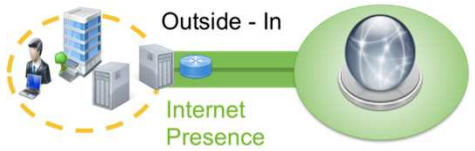
Globalization
Technology Leadership
Industry mandate
BYOD-Security-Visibility
Flatten management plane

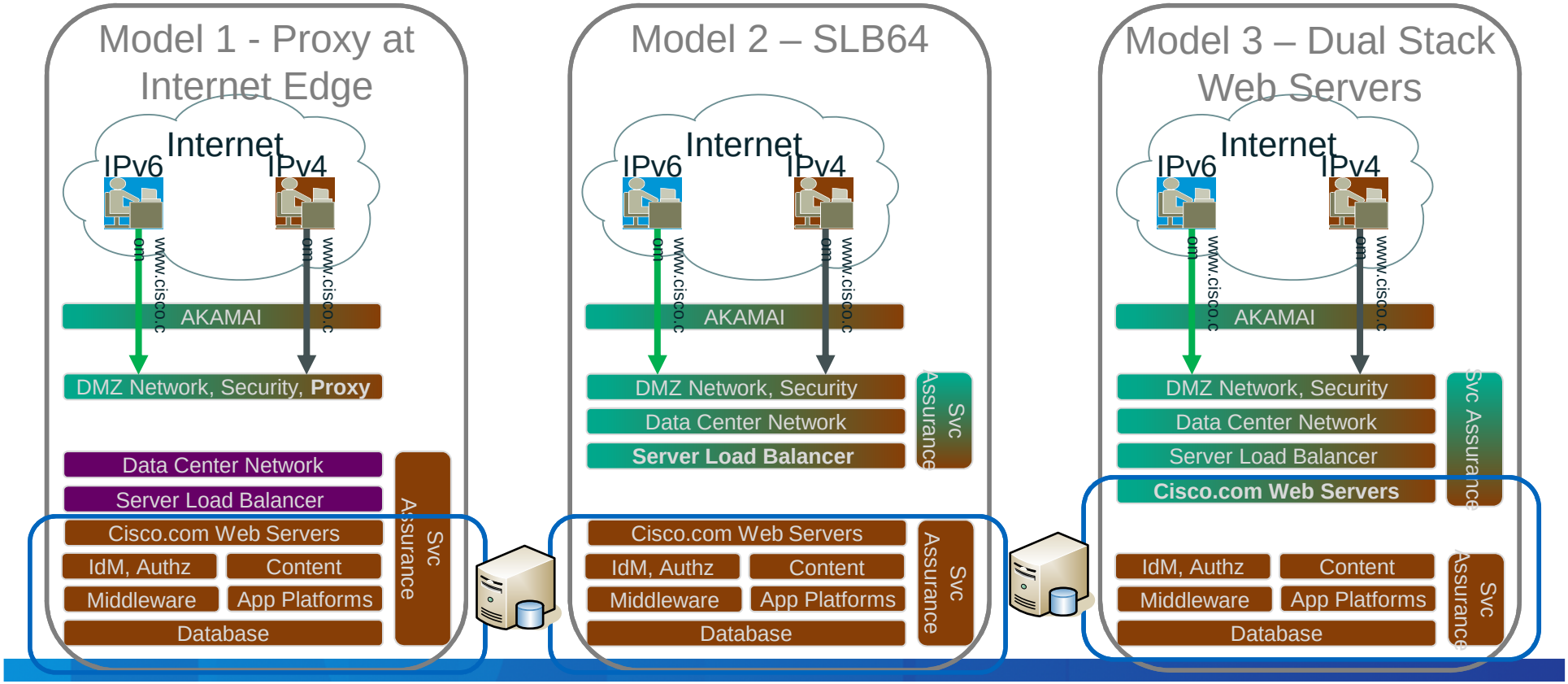
Dual-Stack Enterprise



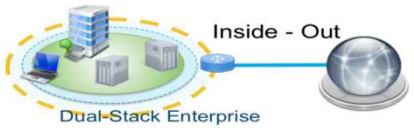
http://www.cisco.com/en/US/netsol/ns817/networking_solutions_program_home.html

Architecture pour une pésence Internet IPv6 outside-in

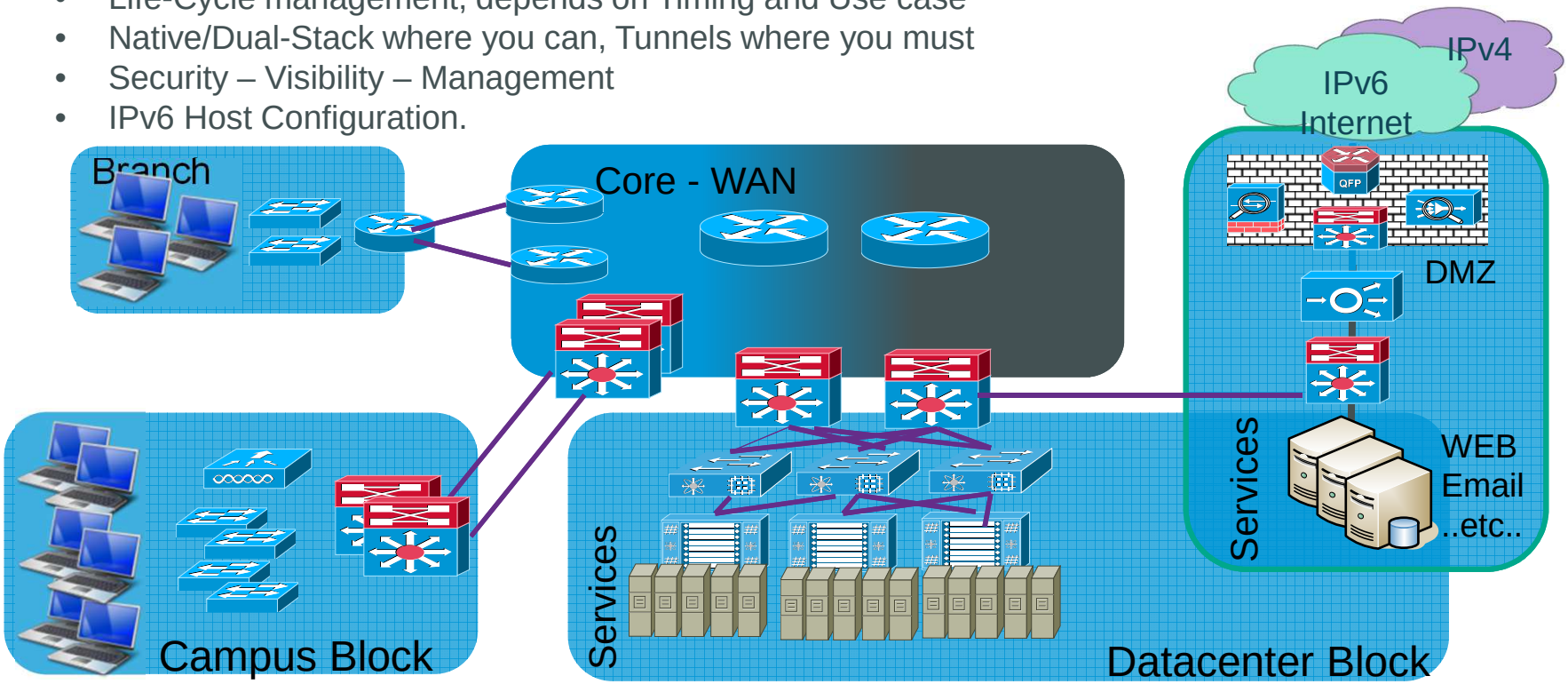




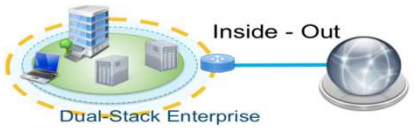
Intranet : Par ou commencer ?
Inside-out



- Life-Cycle management, depends on Timing and Use case
- Native/Dual-Stack where you can, Tunnels where you must
- Security – Visibility – Management
- IPv6 Host Configuration.

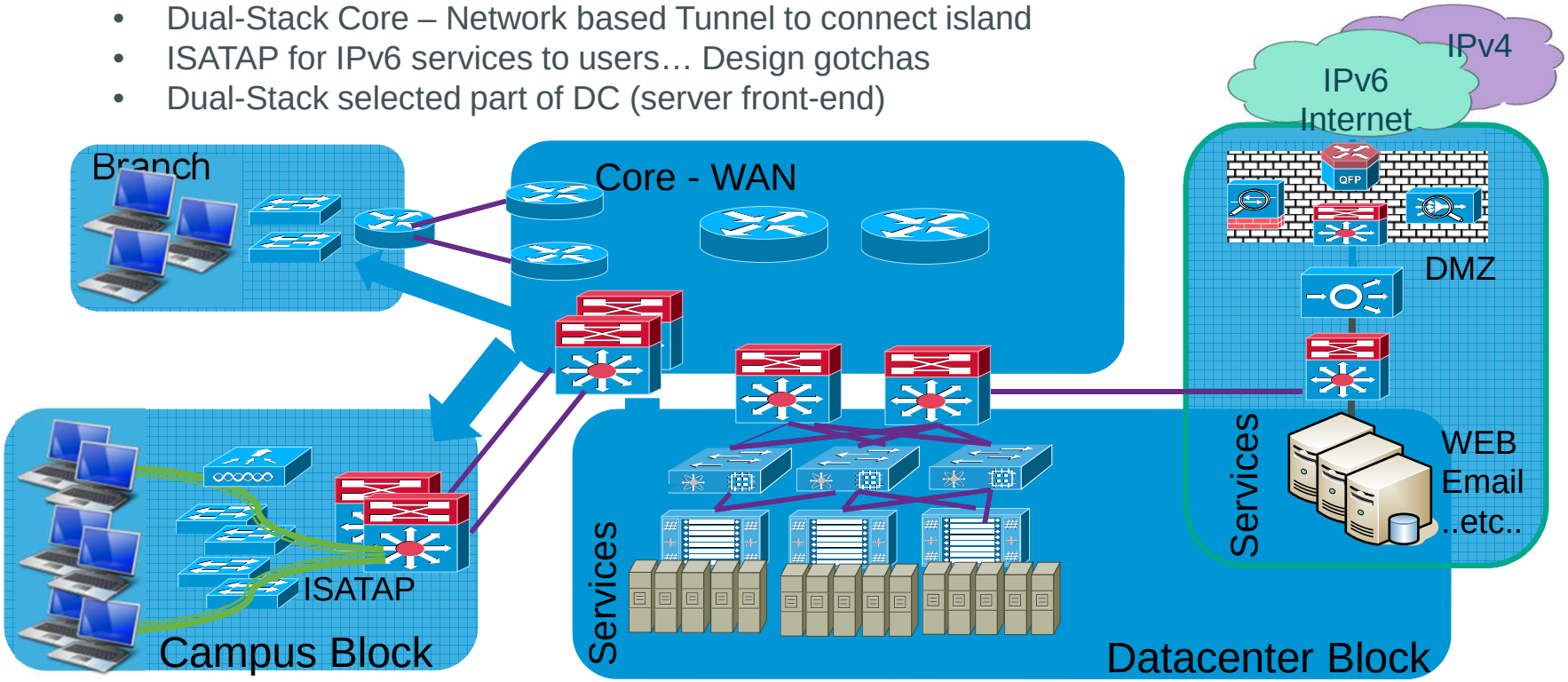


Du coeur vers la périphérie !
Inside-out

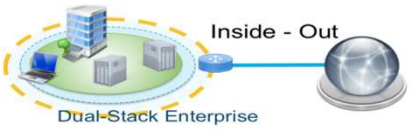


Orderly Transition – Slow to dual-Stack all the way to user

- Dual-Stack Core – Network based Tunnel to connect island
- ISATAP for IPv6 services to users… Design gotchas
- Dual-Stack selected part of DC (server front-end)

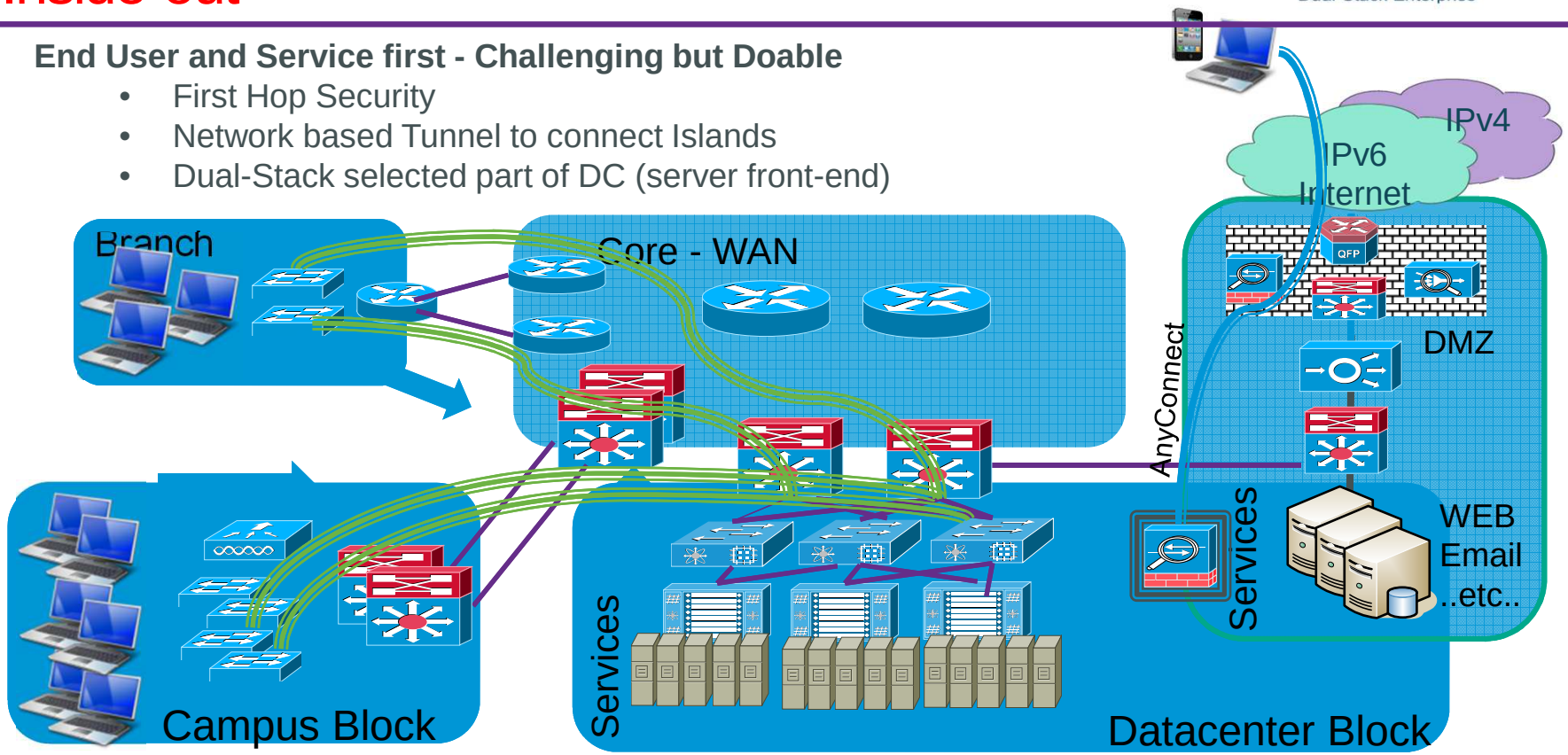


De la périphérie vers le coeur !
Inside-out



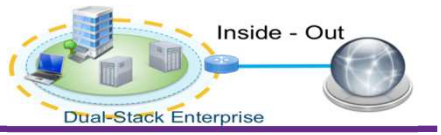
End User and Service first - Challenging but Doable

- First Hop Security
- Network based Tunnel to connect Islands
- Dual-Stack selected part of DC (server front-end)



Opérateurs – ISP

Quelles questions poser a vos opérateurs a propos d'IPv6 ?



Circuits

1. Are all components of the circuit IPv6 enabled? Yes / No (Mandatory response required)
2. If yes, does the circuit support dual stacks operation of IPv6 and IPv4? (Yes / No)
3. If no, please list components of circuit with the following conditions:
4. List of circuit components that are not IPv6 enabled, but are IPv6 ready. Please include road map with dates when components will be IPv6 enabled.
5. List of circuit components that are not IPv6 enabled, and are not IPv6 ready. Please include plan with dates when these components will be IPv6 ready and when they will be IPv6 enabled.
6. Can the circuit that services the existing IPv4 connection be converted to dual-stack without the physical changes ?
7. If the your IPv6 ready or IPv6 enabled circuits will have different Service Levels as compared to a IPv4 only circuit, please provide more details:
8. Please provide details if your IPv6 ready or IPv6 enabled circuits will not be able to route Provider Independent address space that is equal to existing routing across the contracted circuit.
9. Can IPv4 and IPv6 connectivity be delivered to a customer via a 802.1q tagged interface, with a separate VLAN for IPv4 and IPv6 communications?
10. If you use VRFs to provide a service, is the IPv4 and IPv6 using the same VRF or different ones ?

Prefixes

1. Do you support and publish the full IPv6 BGP Routing Table? If not what portion of the BGP Routing Table do you support? Are full IPv6 global routes available to end customers?
2. Do you host and provide the access to a "looking glass" IPv6 BGP router, for the troubleshooting purposes ?
3. Do you accept and announce /48 blocks?
4. What is the smallest prefix you accept
5. What is the smallest prefix your upstream providers accept from you? Are there any restrictions on prefix advertisements?
6. What percentage of your IPv4 peers to you currently peer with for IPv6? Are you partitioned from any other major networks? (i.e. lacking global reachability to other major networks) Reference http://en.wikipedia.org/wiki/Comparison_of_IPv6_support_by_major_transit_providers) ? Will the provider disclose its list of IPv6 peerings, indicating which IPv6 peerings are native and which are tunneled?
7. Does the provider have a policy in place regarding deployment of tunnels on its backbone network or with peerings? In other words, is there any IPv6 tunneling on the provider's backbone network, and if peerings with other providers currently exist which are tunneled, does/will the provider have a policy in place which will mandate peerings with providers be native? What MTU restrictions or standards are in place for any tunnels?

Services

1. Is global public IPv6 multicast connectivity available, and if so, via native BGP peering?
2. Are the Qos Policies (queuing/discard) applicable to both ipv4 and ipv6 traffic identical ? If not, please elaborate on differences.
3. Does the provider offer DNS services which support IPv6 forward and reverse registrations?
4. Are the DNS servers available via IPv6 transport?
5. do you provide IPv6 web hosting
6. do you have an IPv6 looking glass
7. do you post IPv6 performance metrics on your web site?

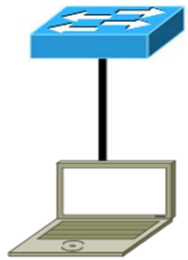
http://goo.gl/goWSH3

In More Detail—Vista/W7 on Link-Up

No Network Services

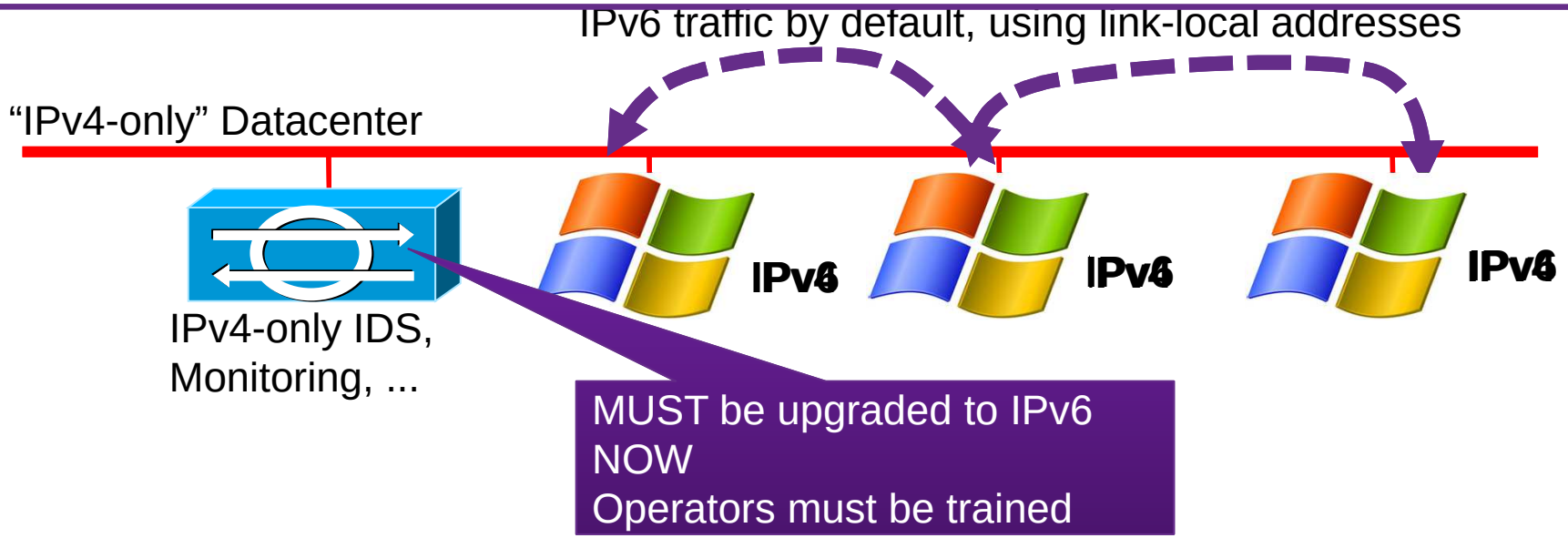
No.	Time	Source	Destination	Protocol	Info
1	0.000000	::	ff02::1:ffae:4361	ICMPv6	Neighbor solicitation
2	0.000030	fe80::80aa:fd5:f7ae:4361	ff02::2	ICMPv6	Router solicitation
3	0.000080	fe80::80aa:fd5:f7ae:4361	ff02::16	ICMPv6	Multicast Listener Report Message v2
4	1.155917	fe80::80aa:fd5:f7ae:4361	ff02::1:3	UDP	Source port: 49722 Destination port: 5355
5	1.156683	169.254.67.97	224.0.0.252	UDP	Source port: 49723 Destination port: 5355
6	3.484709	169.254.67.97	169.254.255.255	NBNS	Name query NB **ISATAP**<00>
7	126.409530	fe80::80aa:fd5:f7ae:4361	ff02::1:2	DHCPv6	Information-request
8	128.886397	0.0.0.0	255.255.255.255	DHCP	DHCP Discover—Transaction ID 0x6c8d6efa

1. Unspecified address :: Solicited node address NS/DAD
2. Looking for a local router ff02::2 RS
3. Looking for MLD enabled routers ff02::16 MLDv2 report
4. LLMNR for IPv6—ff02::1:3—advertise hostname
5. LLMNR for IPv4—224.0.0.252 from RFC 3927 address
6. No global or ULA received via step 1/2—Try ISATAP
7. Try DHCP for IPv6—ff02::1:2
8. Try DHCP for IPv4



fe80::80aa:fd5:f7ae:4361

IPv6 dans les data center IPv4 :
Ne soyons pas aveugle !!



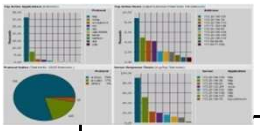
Tous les récents OS ont IPv6 activés par défaut et le privilégie

=> Attention à la sécurité (FW, IPS) !!

Visibilité du trafic IPv6

IPv6 MIBs and host support

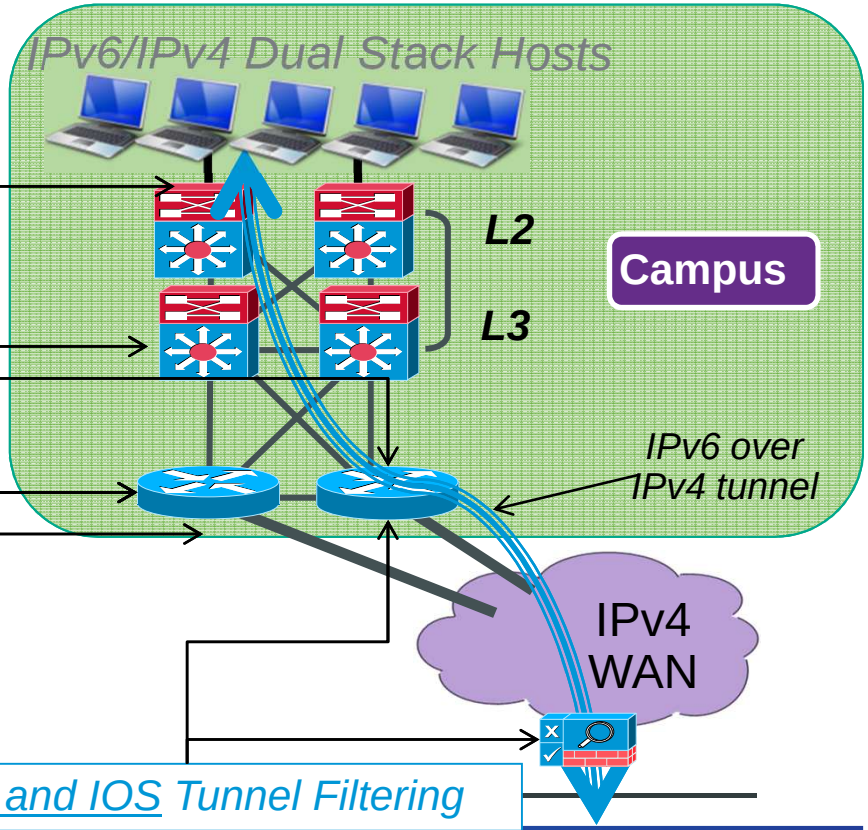
NAM Traffic Analyzer
Integrated Management & Reporting Console



IPv6 Traffic Metering with NAM and Flexible Netflow, including tunnel
(export over IPv4)

IPv6 SLA: E2E test, measurement
(UDP-Jitter, UDP-Echo, ICMP Echo, TCP Connect)

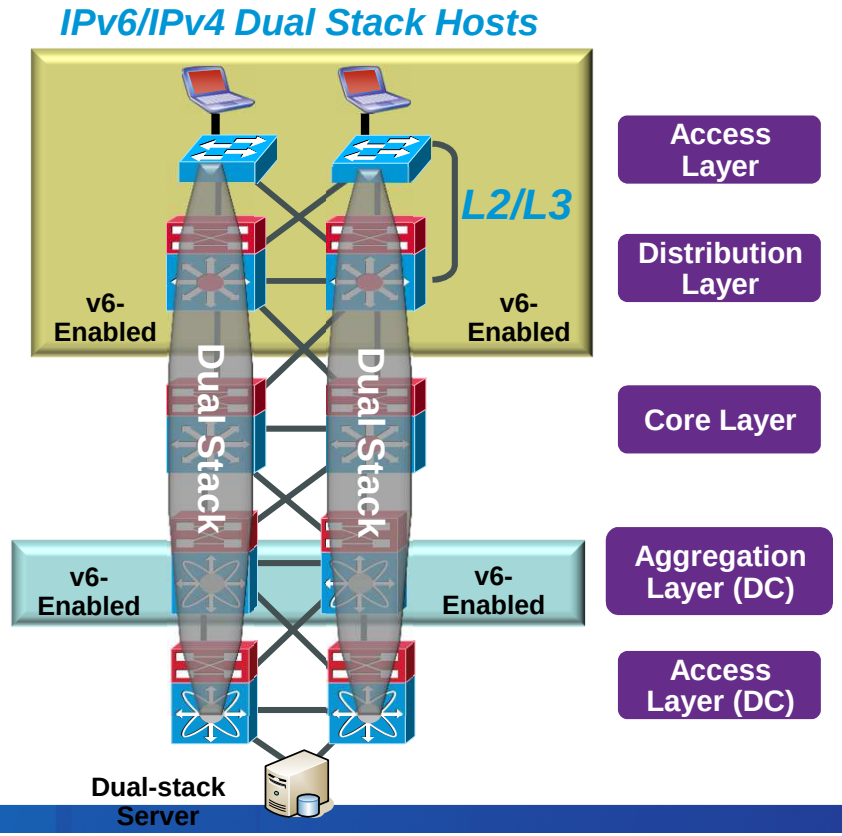
IPv6 Apps and Tunnel detection with NBAR2



ASA and IOS Tunnel Filtering

Option de déploiement d'IPv6 dans les réseaux de campus

- Dual Stack = Two protocols running at the same time (IPv4/IPv6)
- #1 requirement—switching/ routing platforms must support hardware based forwarding for IPv6
  - -3560/3750, 3560-X/3750-X +
  - -4500 Sup6E, Sup7E +
  - -6500 Sup32/720, Sup2T +
- IPv6 is transparent on L2 switches but consider:
  - -L2 multicast—MLD snooping
  - -IPv6 management—Telnet/SSH/HTTP/SNMP
  - -First Hop Security
- Expect to run the same IGPs as with IPv4
- Dual stack where you can, tunnel where you must



Qui déploie IPv6 ?

Etat des déploiements IPv6 dans le monde

- Top Service Providers :
- Verizon Wireless (40,4%)
- Free (31,03%)
- RCS & RDS (22,01%)
- Comcast (20,15%)
- Swisscom (18,66%)
- AT&T (14,82%)
- DT (12,28%)
- KDDI (8,87%)

http://goo.gl/0bo6Pg

Show 10 entries Search:

Participating Network	ASN(s)	IPv6 deployment
Comcast	7015, 7016, 7725, 7922, 11025, 13367, 13385, 20214, 21508, 22258, 33287, 33489, 33490, 33491, 33650, 33651, 33652, 33653, 33654, 33655, 33656, 33657, 33659, 33660, 33661, 33662, 33664, 33665, 33666, 33667, 33668, 36733	20.15%
ATT	6389, 7018, 7132	14.82%
KDDI	2516	8.87%
Free	12322	31.03%
Verizon Wireless	6167, 22394	40.40%
Deutsche Telekom AG	3320	12.28%
RCS & RDS	8708	22.01%
Time Warner Cable	7843, 10796, 11351, 11426, 11427, 12271, 20001	4.07%
Liberty Global	5089, 6830, 20825, 29562	2.52%
Telefonica del Peru	6147	5.14%

The driver seems to be innovation (US and EU)

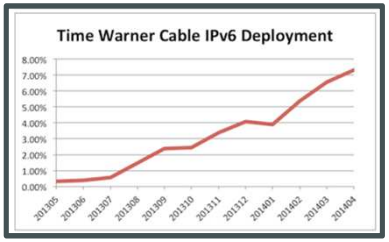
NOT demographics (APAC)

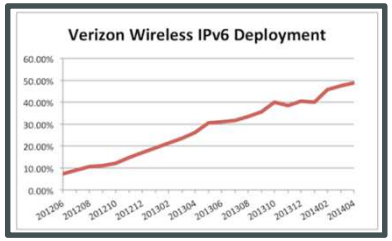
Etat des déploiements IPv6 dans le monde

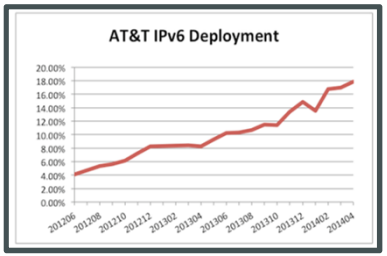
http://www.worldipv6launch.org/measurements/

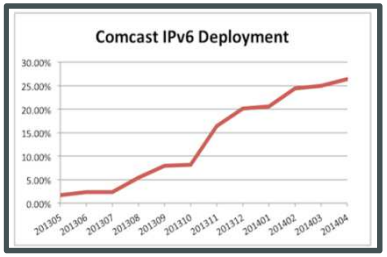
Show 25 entries Search:

Participating Network	ASN(s)	IPv6 deployment
Comcast	7015, 7016, 7725, 7922, 11025, 13367, 13385, 20214, 21508, 22258, 33287, 33489, 33490, 33491, 33650, 33651, 33652, 33653, 33654, 33655, 33656, 33657, 33659, 33660, 33661, 33662, 33664, 33665, 33666, 33667, 33668, 36733	26.36%
ATT	6389, 7018, 7132	17.88%
KDDI	2516	11.41%
Verizon Wireless	6167, 22394	48.71%
Free	12322	37.52%
Time Warner Cable	7843, 10796, 11351, 11426, 11427, 12271, 20001	7.31%
Deutsche Telekom AG	3320	19.76%
Telenet	6848	30.67%
RCS & RDS	8708	24.86%
Liberty Global	5089, 6830, 20825, 29562	3.07%
Telefonica del Peru	6147	7.58%
Swisscom	3303	24.54%
SoftBank BB	17676	3.24%
Chubu Telecommunications	18126	26.70%
Hughes Network Systems	6621	27.00%
T-Mobile USA	21928	22.18%
Belgacom	5432	8.43%
Opera Software ASA	39832	18.01%
VOO	12392	24.91%
XS4ALL	3265	21.55%
StarHub	4657, 55430	18.43%
Google Fiber	16591	76.52%

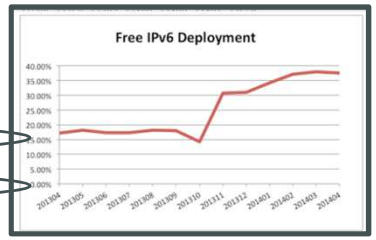


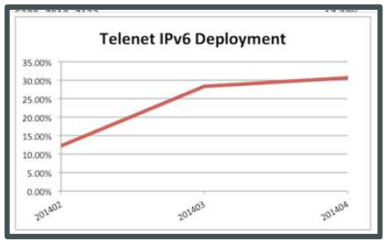


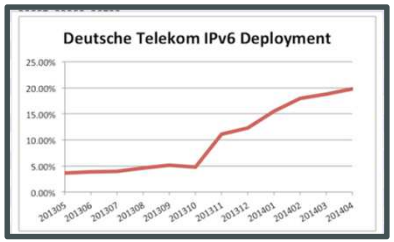




United States of America
Google Search / APNIC data: **7.31% / 1.09%**
Estimation: **18257 K IPv6 users**







France
Google Search / APNIC data: **5.04% / 6.92%**
Estimation: **2617 K IPv6 users**

Belgium
Google Search / APNIC data: **16.3% / 0%**
Estimation: **1329 K IPv6 users**

Germany
Google Search / APNIC data: **7.99% / 4.76%**
Estimation: **5445 K IPv6 users**

The driver seems to be innovation (US and EU)

NOT demographics (APAC)

PRESS RELEASE

Free (Iliad Group) Implements Cisco Carrier-Grade IPv6 Solution

One of the World's Largest Residential Broadband Solution Deployments

SAN JOSE, Calif., Sept. 2, 2010 – Cisco today announced that Free (Iliad Group), a leading broadband solutions operator in France, has deployed the Cisco® Carrier-Grade IPv6 Solution using Internet Protocol version 6 rapid deployment technology, also known as 6rd, allowing more than four million Free residential broadband customers to be a part of one of the world's largest live IPv6-enabled residential Internet service deployments.

The investment lets Free prepare for and mitigate the impending IPv4 address exhaustion, while scaling its network to address the rapid growth of Internet-connected devices. Free customers will benefit from Internet connectivity that can scale to meet the growing number of devices and applications.

Cisco ASR 1006

- **Maxime Lombardini, chief executive officer, Free (Iliad Group, France)**

"Free is committed to providing the latest innovations for its customers, including full support today for the IP Next-Generation Network, IPv6. We have chosen the Cisco Series Aggregation Services Routers ASR 1000 router for their support of an integrated high-performance IPv6 Rapid Deployment or 6rd technology, which allows us to supply IPv6 to our users in a remarkably simple and cost-efficient manner."

http://newsroom.cisco.com/dlls/2010/prod_090210.html
http://newsroom.cisco.com/dlls/2009/prod_052709e.html
http://newsroom.cisco.com/dlls/2006/prod_121206.html

PRESS RELEASE

SFR France Deploys Cisco Carrier Grade IPv6 Solution

Delivers IPv6 over L2TP while protecting existing IPv4 network investments

SAN JOSE, Calif., 8h June, 2011 – Cisco today announced that SFR France has selected its Carrier-Grade Internet Protocol Version 6 (CGv6) Solutionas a first step in the transition of their network infrastructure to IPv6. SFR, the second largest telecommunications operator in France, has deployed the Cisco ASR 1000 Seriesrouter, enabling IPv6 access to the Internet for residential customers.

SFR required a simple, cost effective solution to transition its IPv4 network to IPv6. The Cisco ASR 1000, utilizing Layer 2 Tunneling Protocol (LT2P), enabled SFR to leverage its existing investment in IPv4 network access infrastructure to quickly provide IPv6 services to their customers.

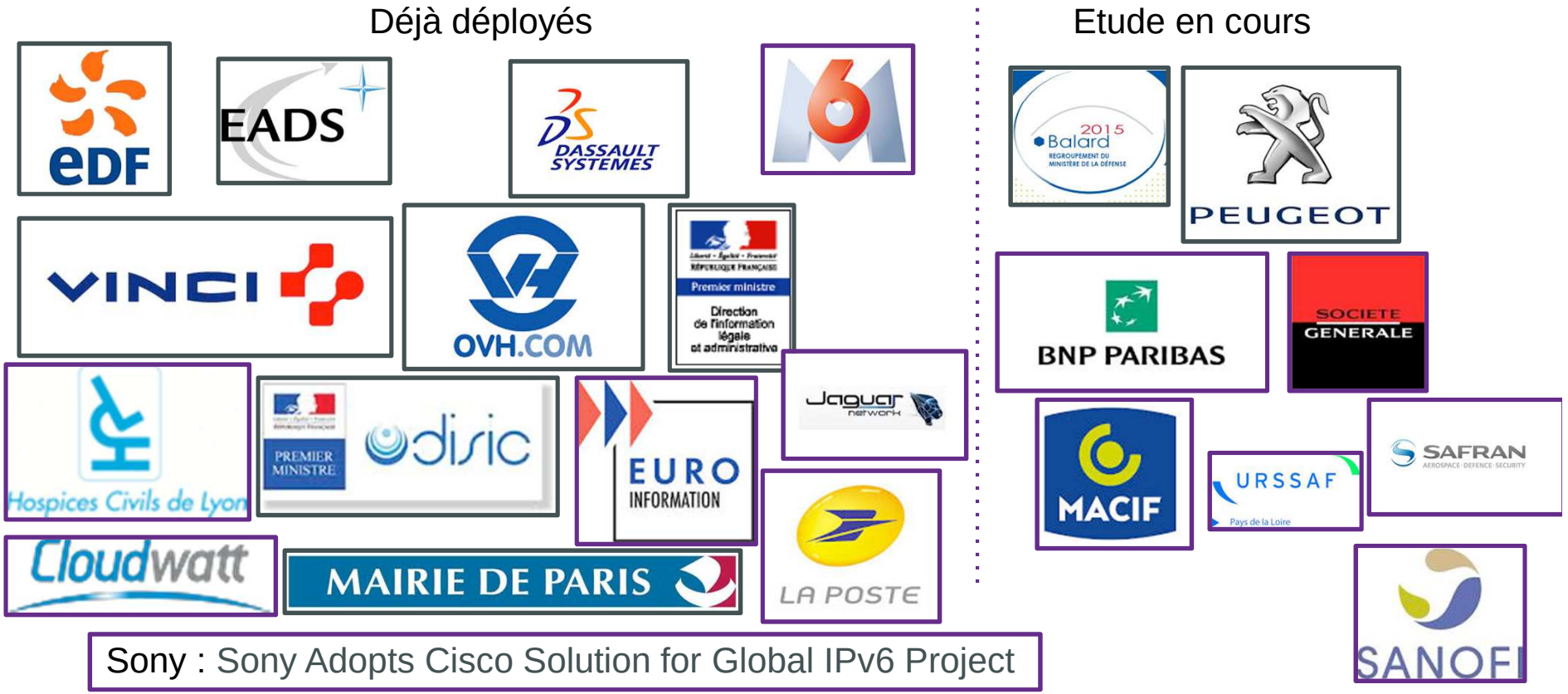
Highlights/Key Facts

- Because of the exponential growth of Internet services and increasing number of end users, Service Providers are looking for new ways for their current network architecture to meet the needs of Internet-ready appliances, new applications, and services. IPv6 is designed to enable service providers to meet these challenges and provide new services to their customers. As the number of devices per broadband user exponentially increases worldwide, cable, DSL, Ethernet to the home, wireless, and other always-on access technologies can benefit from the huge address range of IPv6.
- The IPv6 over L2TP approach requires limited investment and impact on existing infrastructure. Dual-stack IPv4/IPv6 services on the Residential Gateway (customer) side are enabled. The solution enables IPv6 sites to communicate with each other over an IPv4 core.The technology significantly reduces the lead-time to IPv6 deployment for service providers while protecting their existing network investment.
- Cisco has taken a leadership position to author and drive an open standard for L2TP, as defined in (RFC 5571), which describers IPv6 global connectivity over an IPv4 core. This document was approved in August 2009 by the Internet Engineering Steering Groupto be published as a Standards Track RFC.

L2TP Softwire Tunnel technology is a component of Cisco's Carrier-Grade IPv6 (CGv6)solution that outlines the three approaches of Preserve, Prepare and Prosper for customers looking to transition to IPv6. The framework was launched in October 2009 with the Cisco CRS family, ASR series and other products supporting this solution.

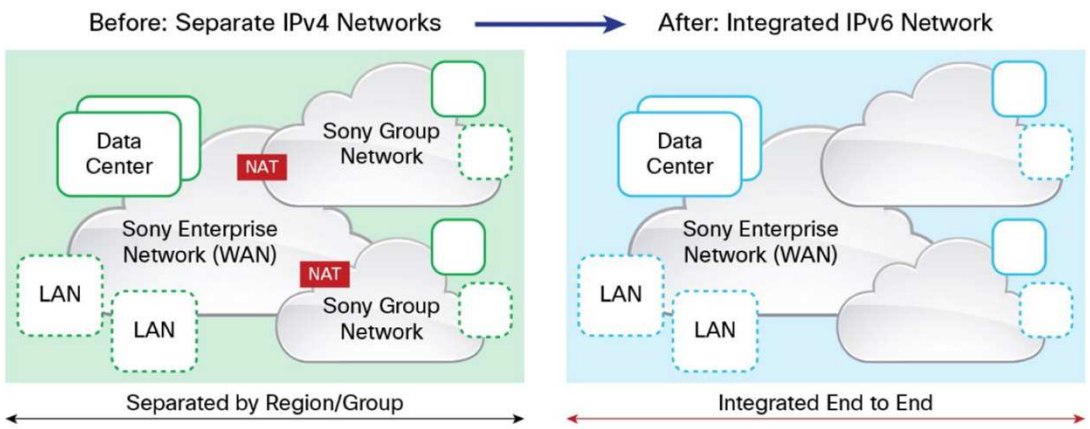
http://newsroom.cisco.com/uk/press-release-content?articleId=358080&type=webcontent

Autres déploiements et projets en cours …



Sony : Sony Adopts Cisco Solution for Global IPv6 Project

Sony adopts Cisco for Global IPv6



"Cisco, which has an excellent track record in network solutions, committed to our timeline, and we were able to resolve difficult challenges in the project thanks to the enormous support provided by Cisco engineers. We were able to start implementing IPv6 ahead of other companies, and feel that this is a significant result contributing to Sony's business."

— Toshio Hiraga, Senior Manager, Distinguished Engineer Network Service Department, Sony Global Solutions Inc.

EXECUTIVE SUMMARY

Customer Name: Sony Corporation

Industry: Consumer electronics products and services; music, pictures, computer entertainment; and financial business.

Location: Headquartered in Tokyo, Japan; 700+ total network sites worldwide (60+ in country)

Global network users: 146,000

BUSINESS CHALLENGES

- Network expansion required much time due to complexity of enterprise network
- TCO had continually increased
- Numerous constraints on communications impeding communication between companies in Sony Group

NETWORK SOLUTION

- Cisco Enterprise IPv6 Solutions

BUSINESS RESULTS

- More versatile network, increasing business agility in response to changes in the business environment
- Reduced network TCO
- Network without communications constraints, supporting "One Sony" through information systems

http://www.cisco.com/c/dam/en/us/products/collateral/ios-nx-os-software/enterprise-ipv6-solution/sony_adopts_cisco_solution_cs.pdf

Deploiement IPv6 chez Cisco

Introduction à l'IT Cisco

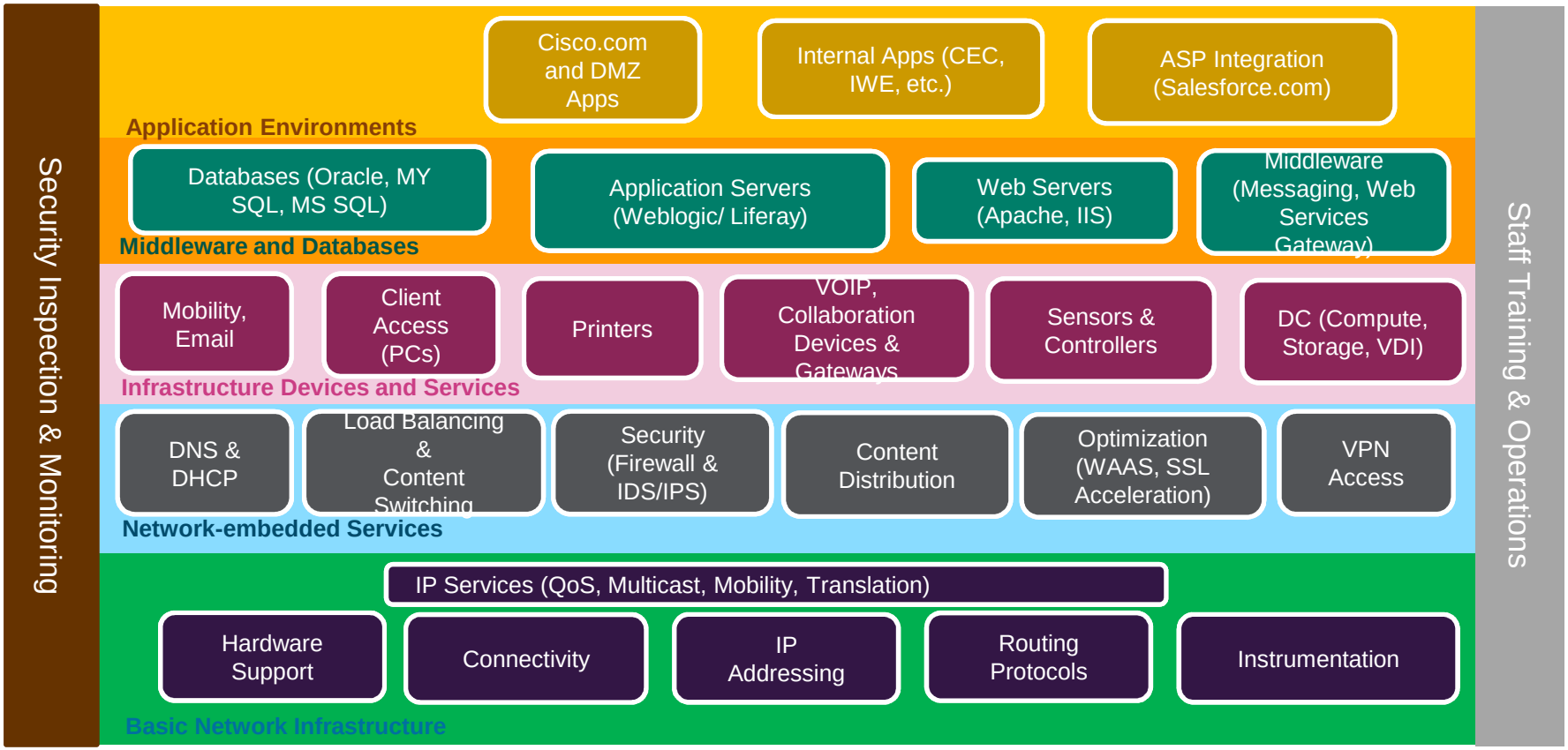
- 66,000+ Employés
- 20,000 Partenaires
- 110+ Applications Service Providers
- 210+ partenaires business et support

- 300 Bureaux répartis dans in 90 pays
- 450+ Batiments
- 51 Data centers
- 1500+ Laboratoires dont 500+ à San Jose

Plus de 180,000 personnes dans le monde incluant la famille Cisco étendue

Perimetre IT Cisco

IPv6 Scope



Contraintes en terme de sécurité

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

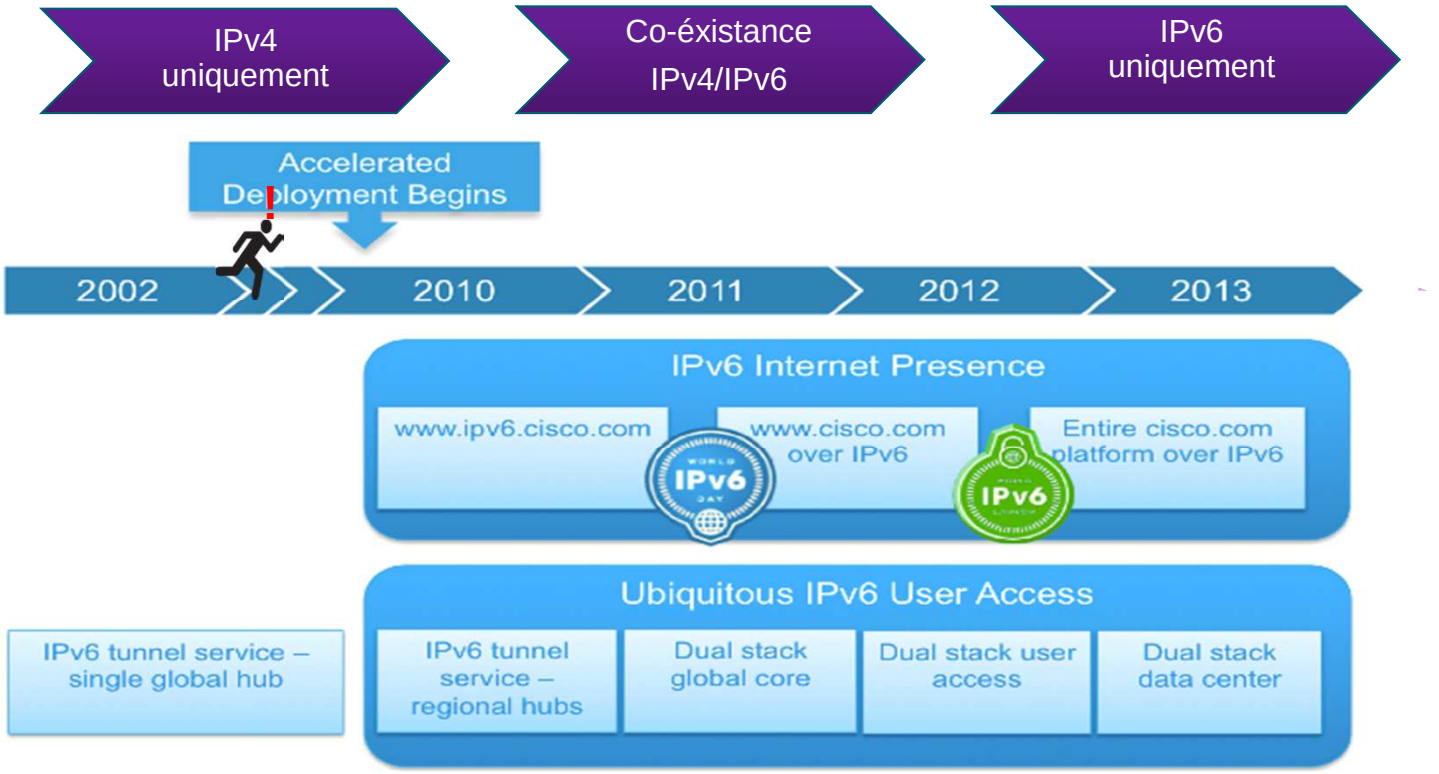
120,000 Windows hosts

40,000 routers on Cisco's network

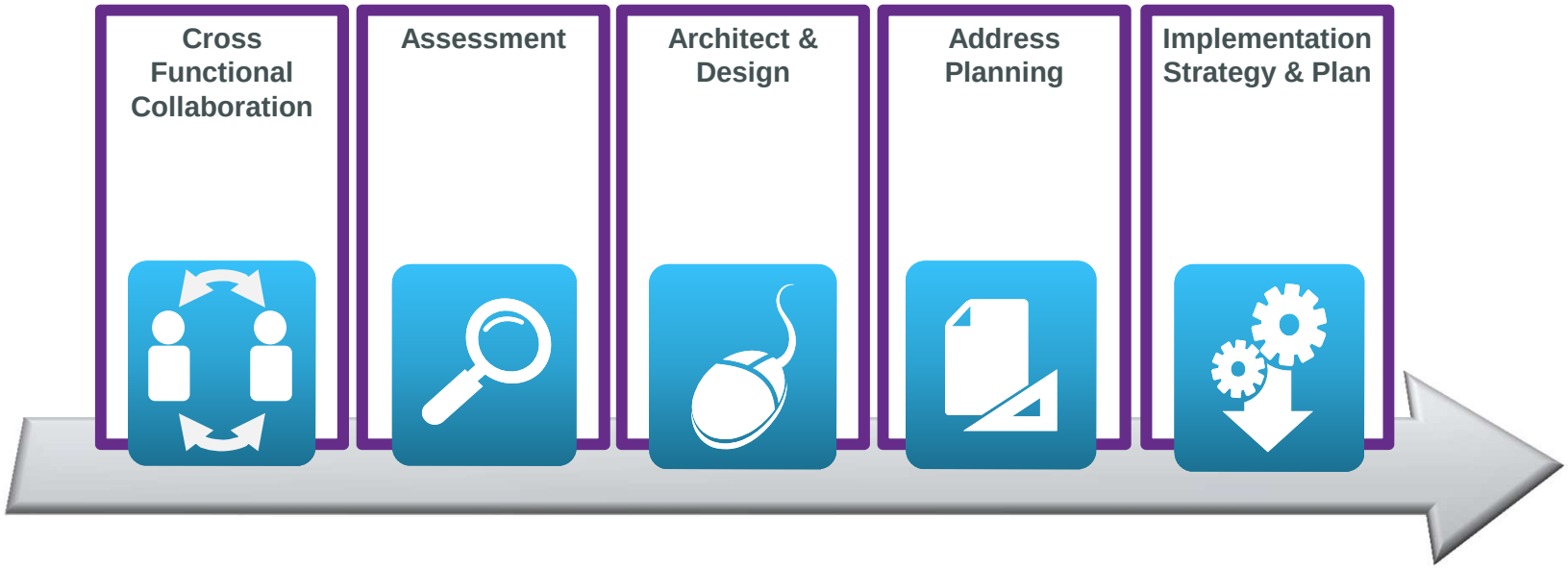
22TB of traffic inspected / day

750GB of system logs collected / day

The IPv6 Journey – Vue high level

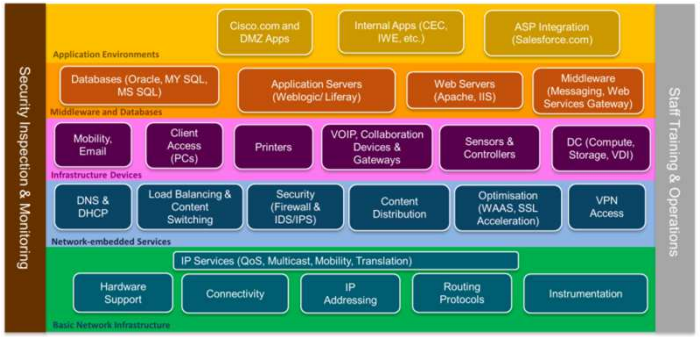


Préparation



Preparation

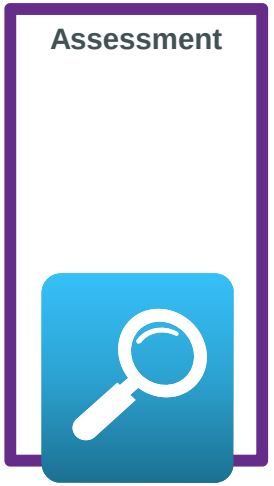
- Cross Functional Collaboration
- Example of the need for wide cross functional collaboration across IT on IPv6
- Preparation and execution required participation of team members from **7 of 9 of CIO's direct reports**



Preparation

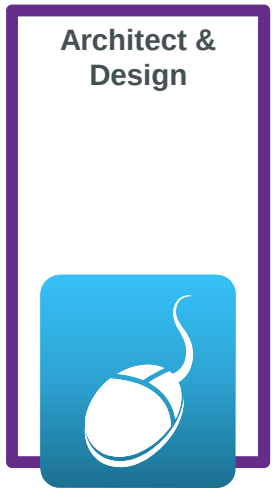
Assessment

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



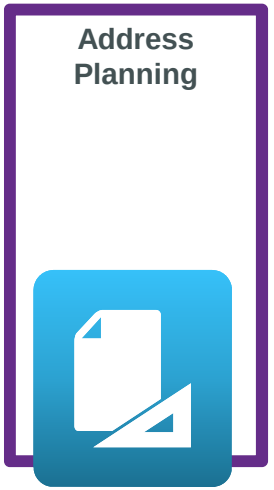
Preparation

Architecture et Design du réseau

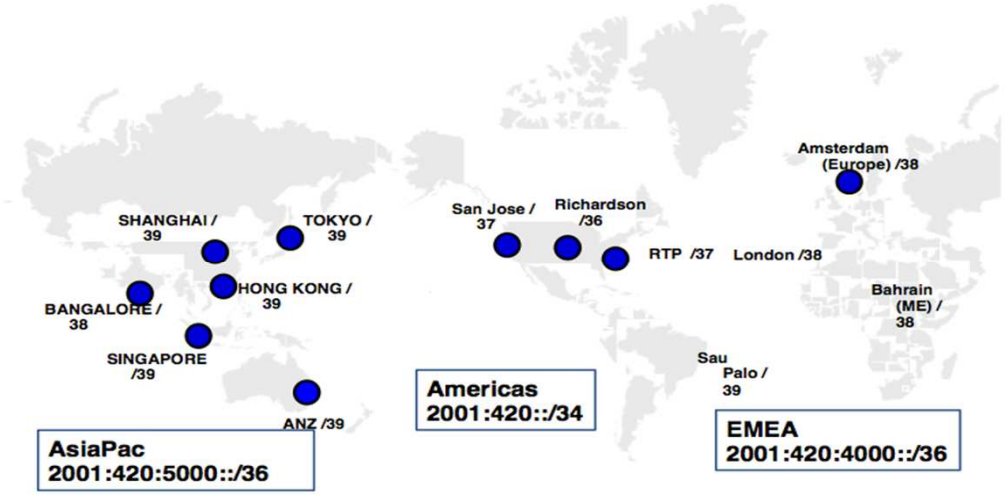


- **Architectural decisions**
  - Which routing protocol ?
  - SLAAC vs DHCPv6 ?
  - Which IPv6 transition technologies?
  - Code selection and qualification
- **Documentation**
  - Any new documentation required ?
  - Assess which existing designs are impacted and assign owners
  - Extra review board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

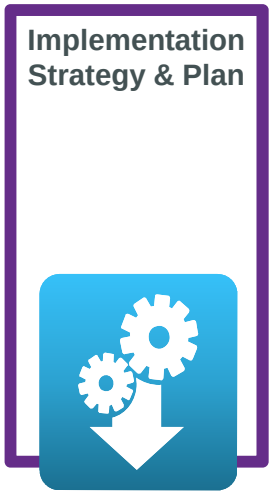
Preparation
Plan d adressage IPv6



- 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



- Implementation Strategy and Plan

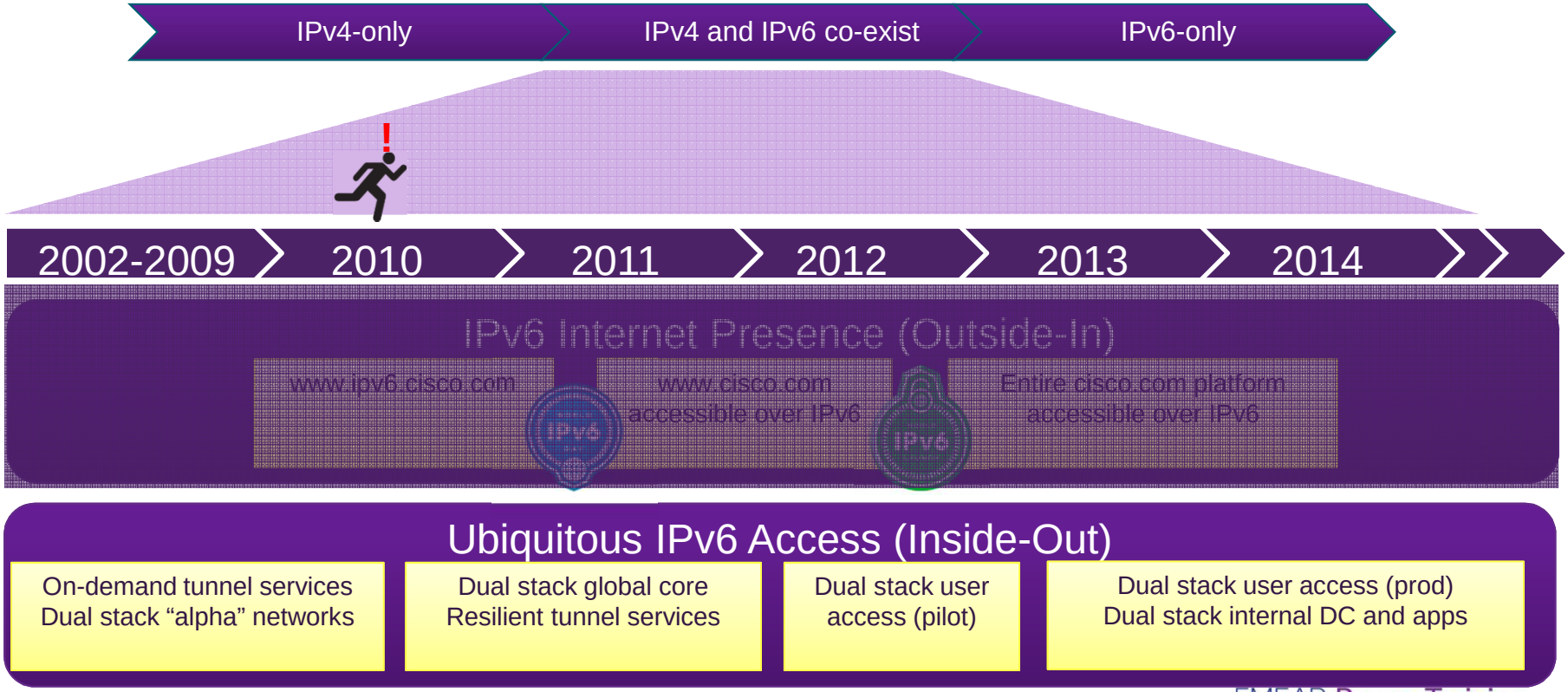
“Dual stack where you can, tunnel where you can’t and NAT only when have to”

- 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

Deploiement IPv6 chez Cisco

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

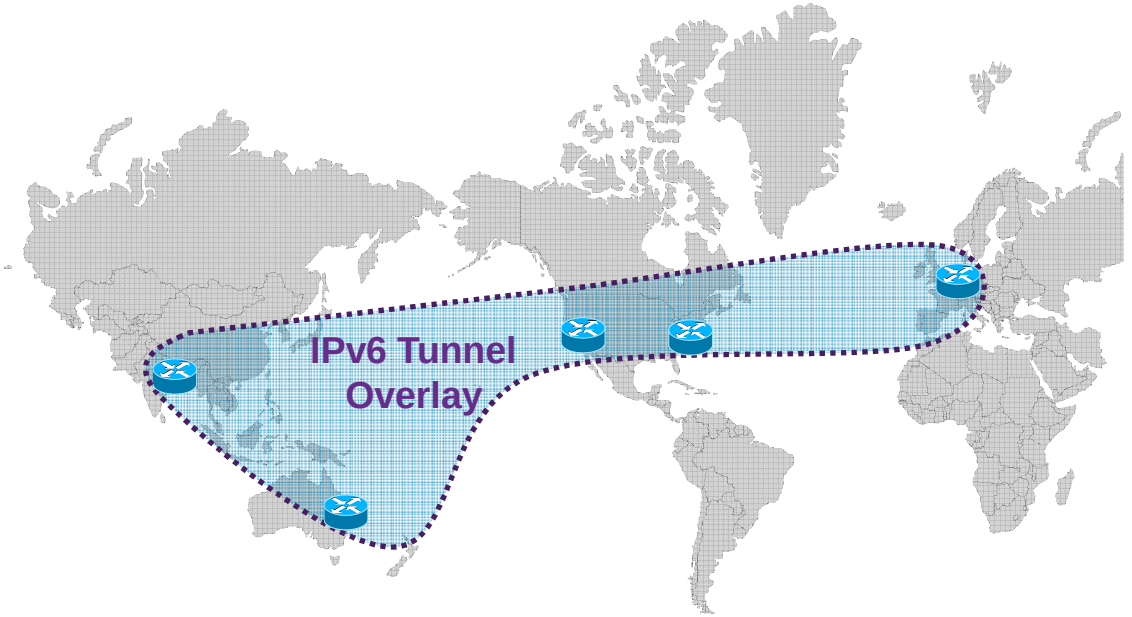
The IPv6 Journey – A High Level View



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



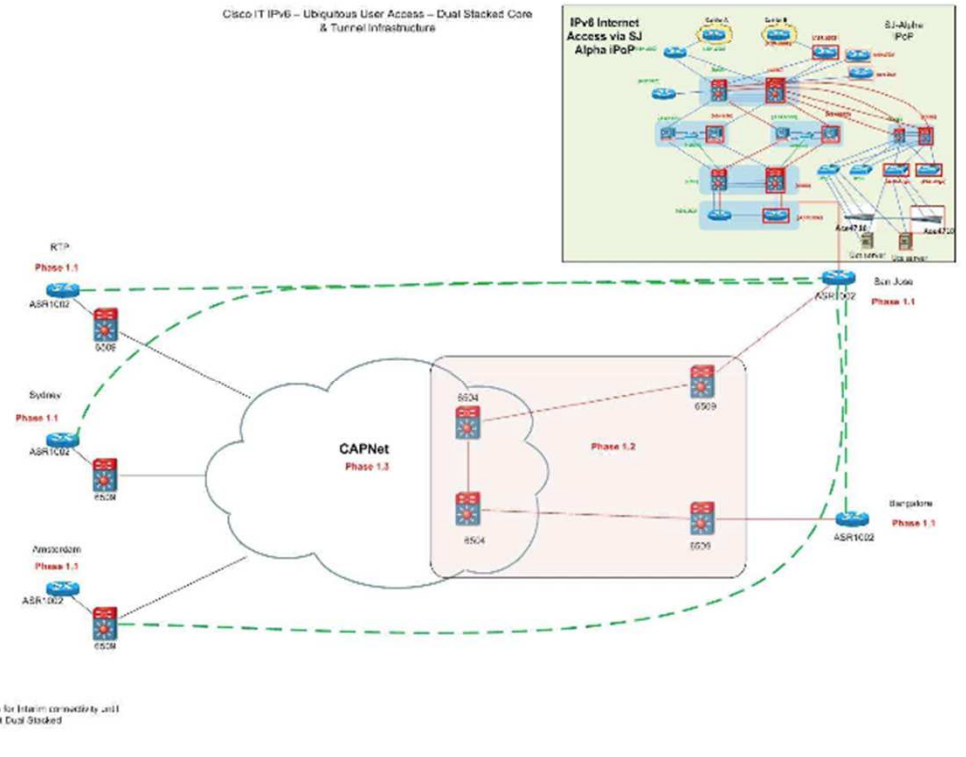
Ubiquitous IPv6 Access

- 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

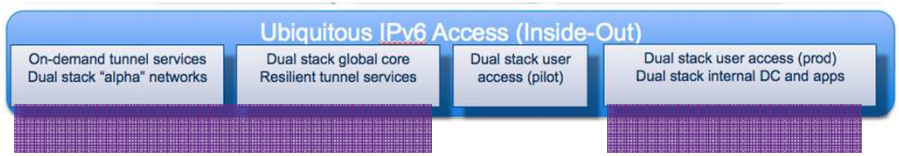
Ubiquitous IPv6 Access

- **STEP 2** – Go to Dual-STACK !!

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

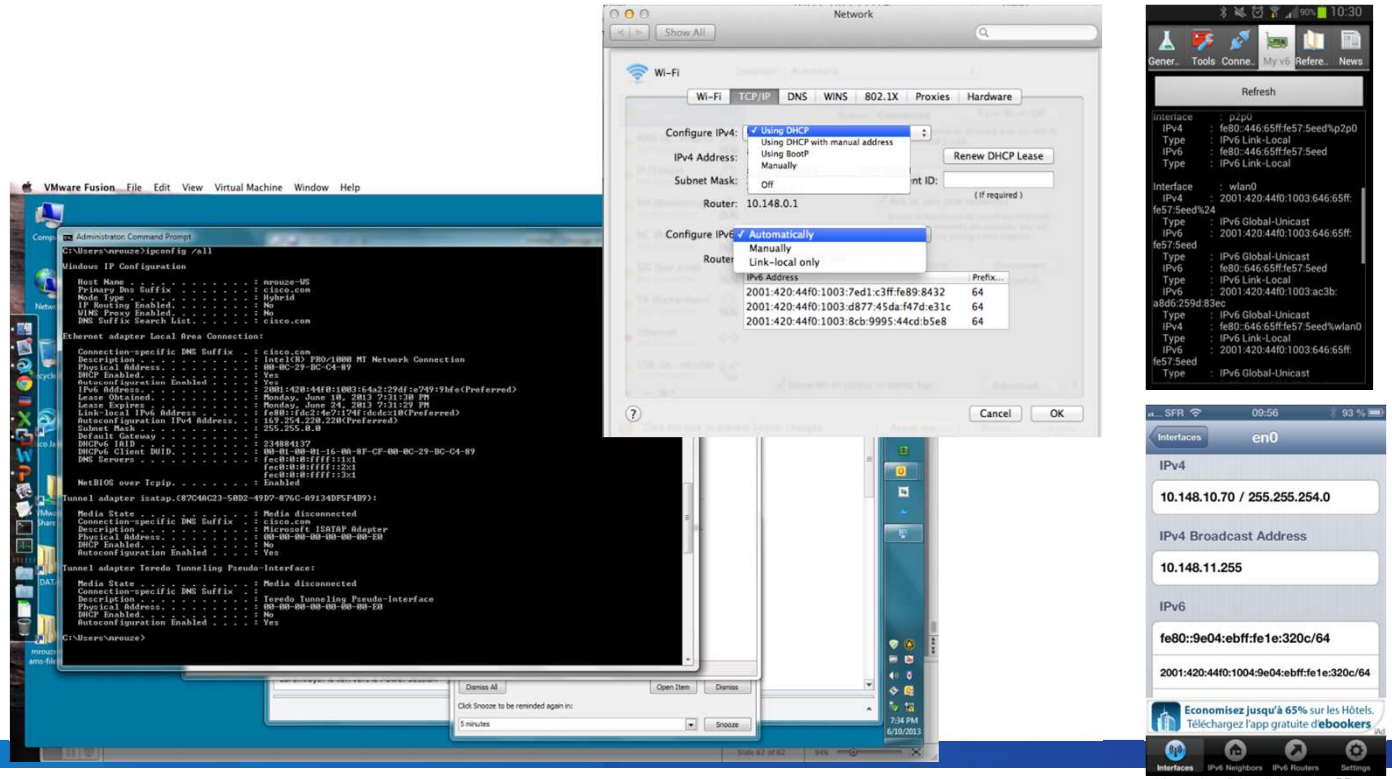


Ubiquitous IPv6 Access



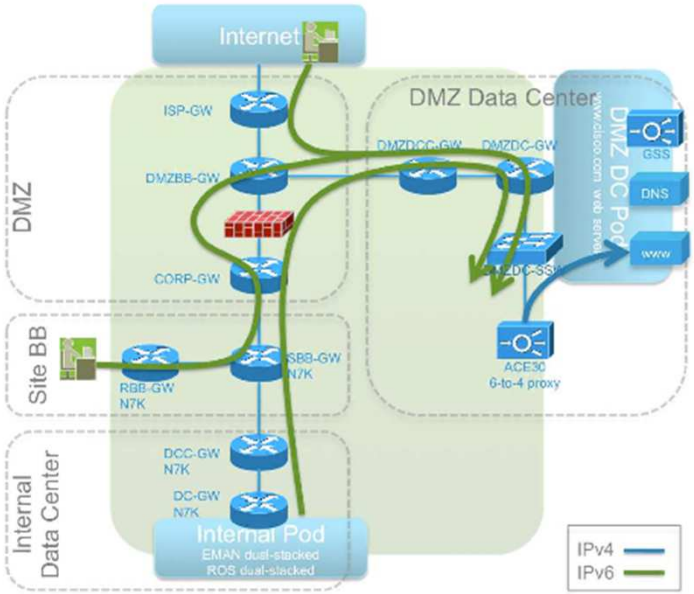
- **STEP 3** – extending IPv6 to the Desktop !!

- 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.

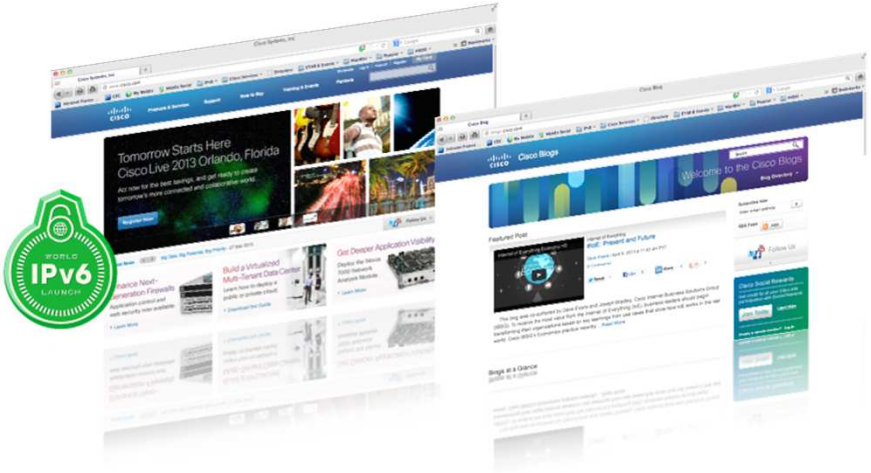


Ubiquitous IPv6 Access

- **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.



Cisco on Cisco …IPv6



- Most Cisco WEB properties
  - 90% of cisco.com apps support v6
  - ~4% of cisco.com users
  - $1.5B of business booked over IPv6
  - cisco.webex.com is ON !
- 100% of Core WAN/MAN
- All iPOP / DMZ
- 21 production DC
- Over 140 Buildings & Sale Branch offices
  - ~25000 users/devices
  - > 25% of user sessions

Déploiement IPv6 : Cisco

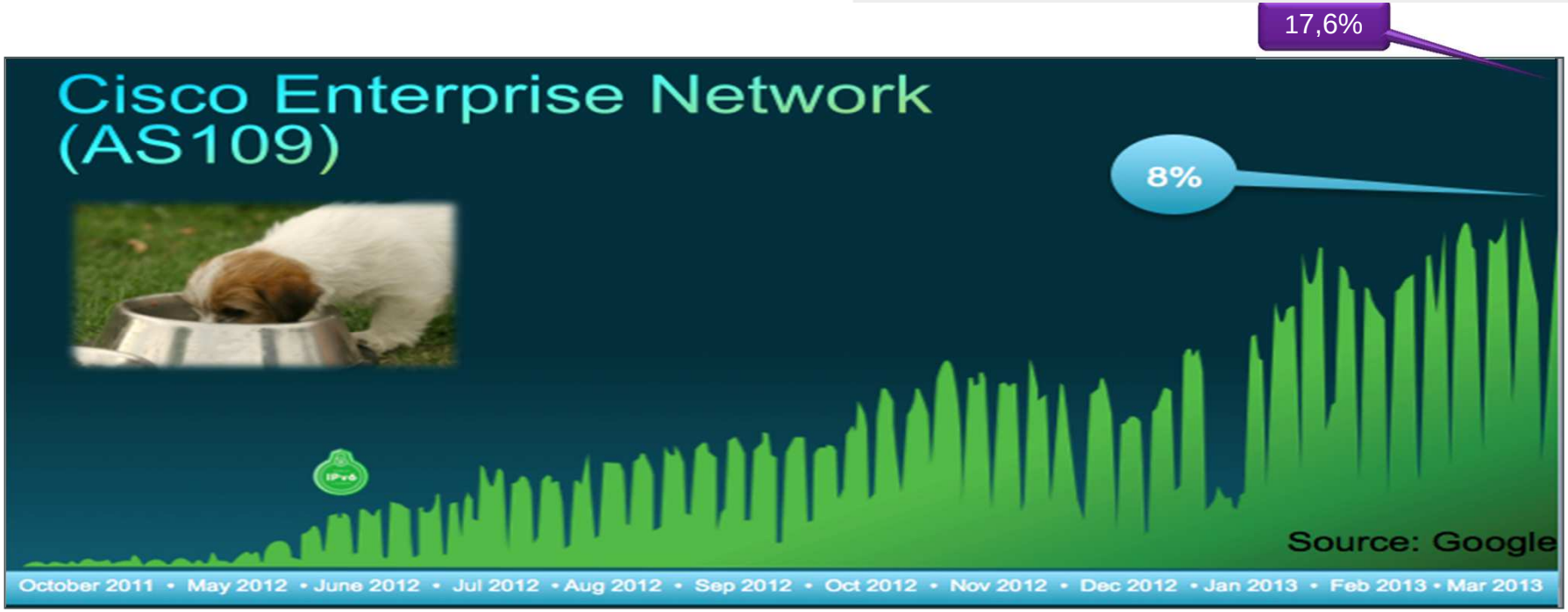
Network operator measurements, 22nd May 2013 (notes)

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



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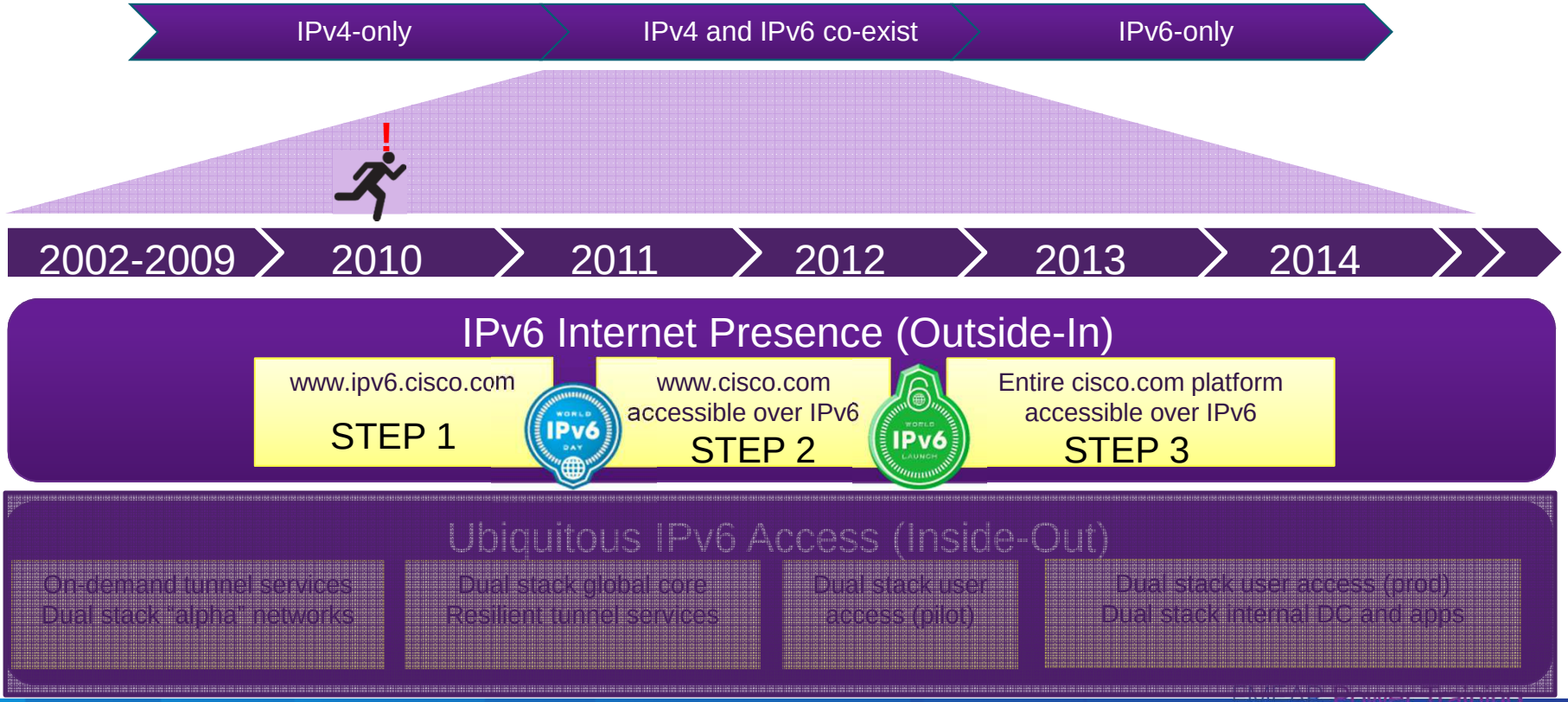
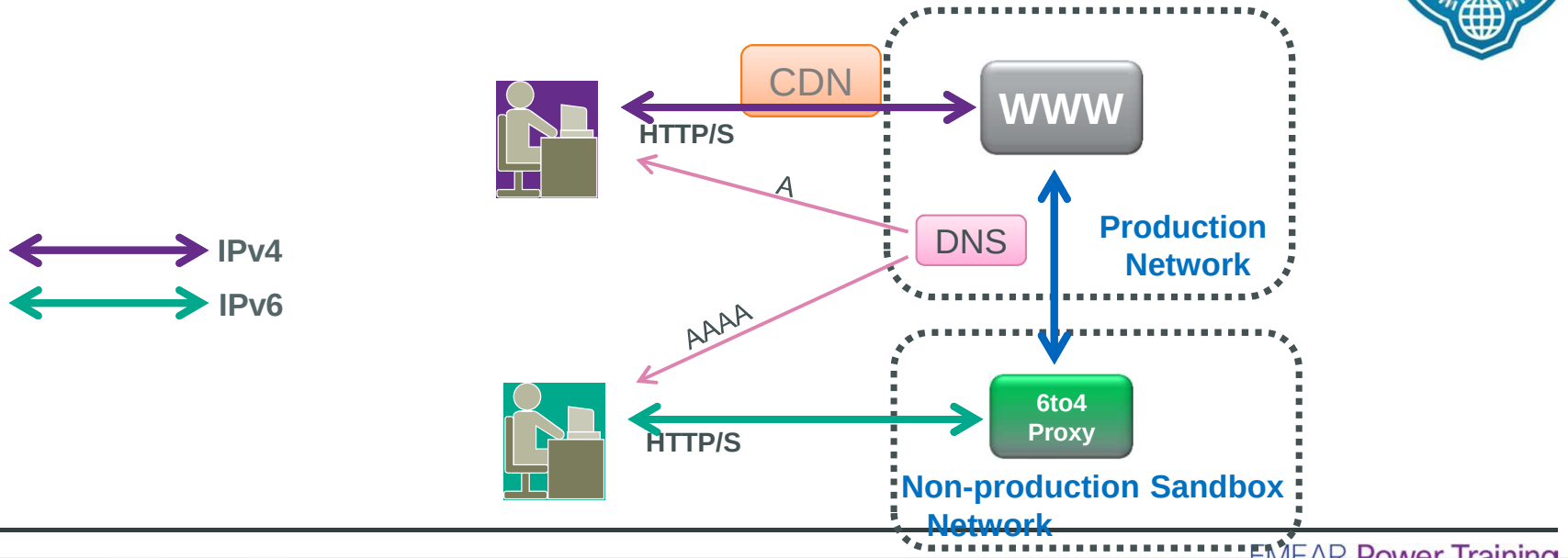


World IPv6 Day
STEP 1

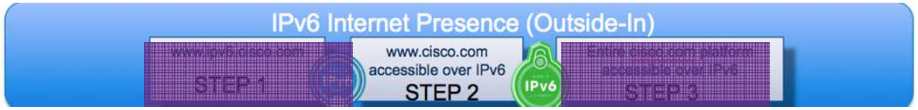
24 hour IPv6 “test flight” 8th June 2011 http://www.internetsociety.org/ipv6/archive-2011-world-ipv6-day

World IPv6 Day
STEP 1

- Reverse proxy solution (ACE4710)
- Returned A and AAAA records for www.cisco.com



IPv6 Launch

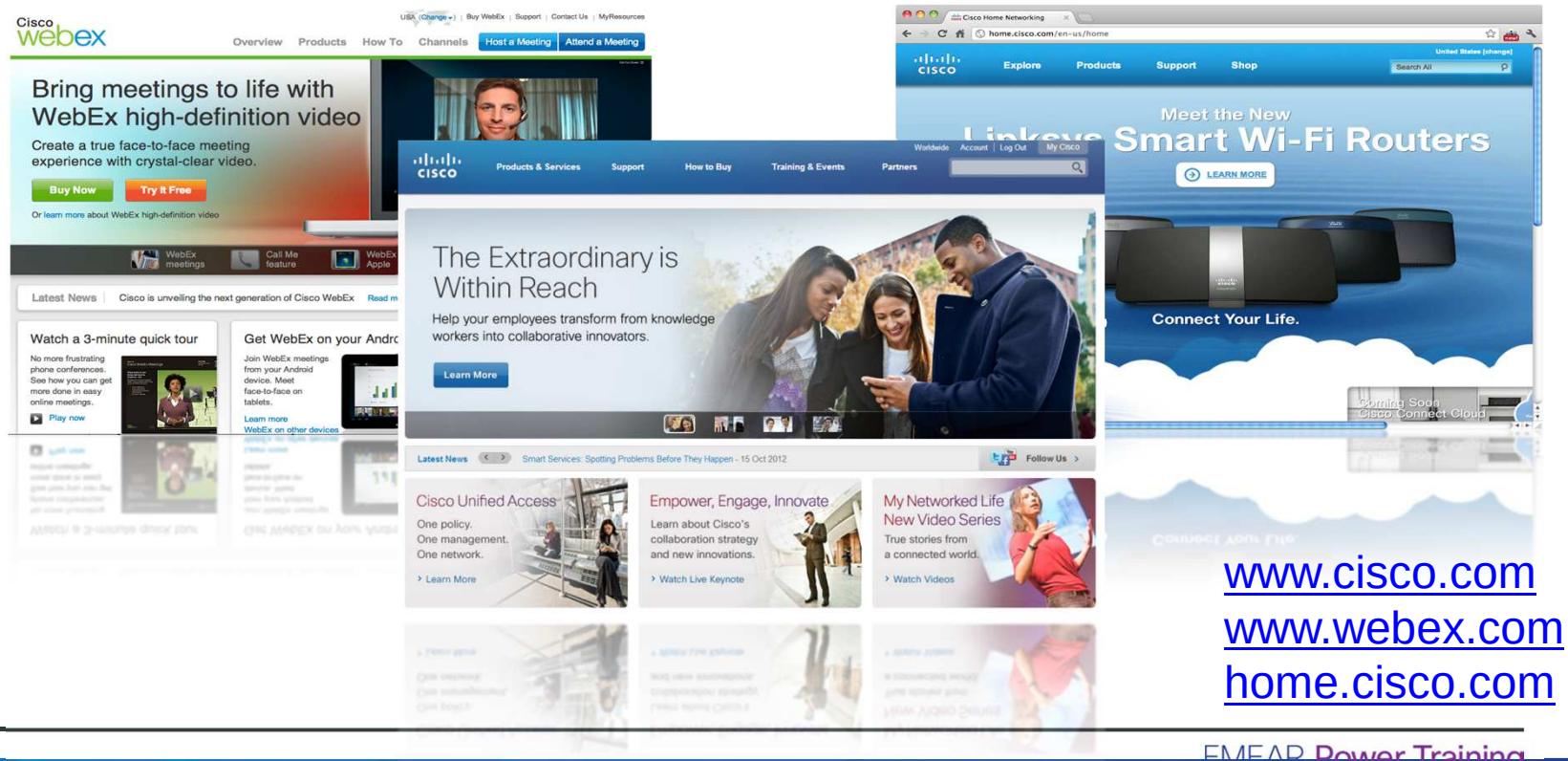


- **STEP 2**

www.worldipv6launch.org

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

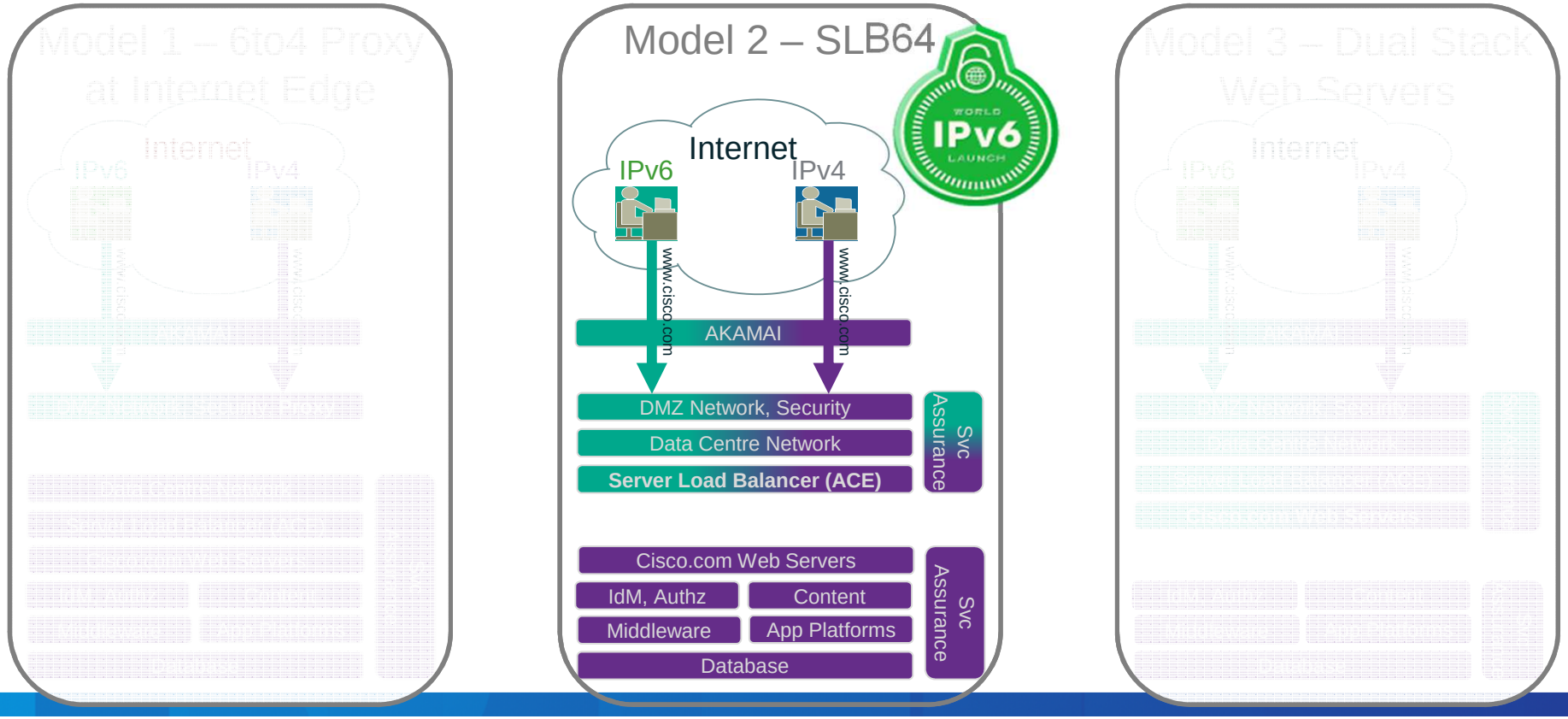
World IPv6 Launch @ Cisco



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

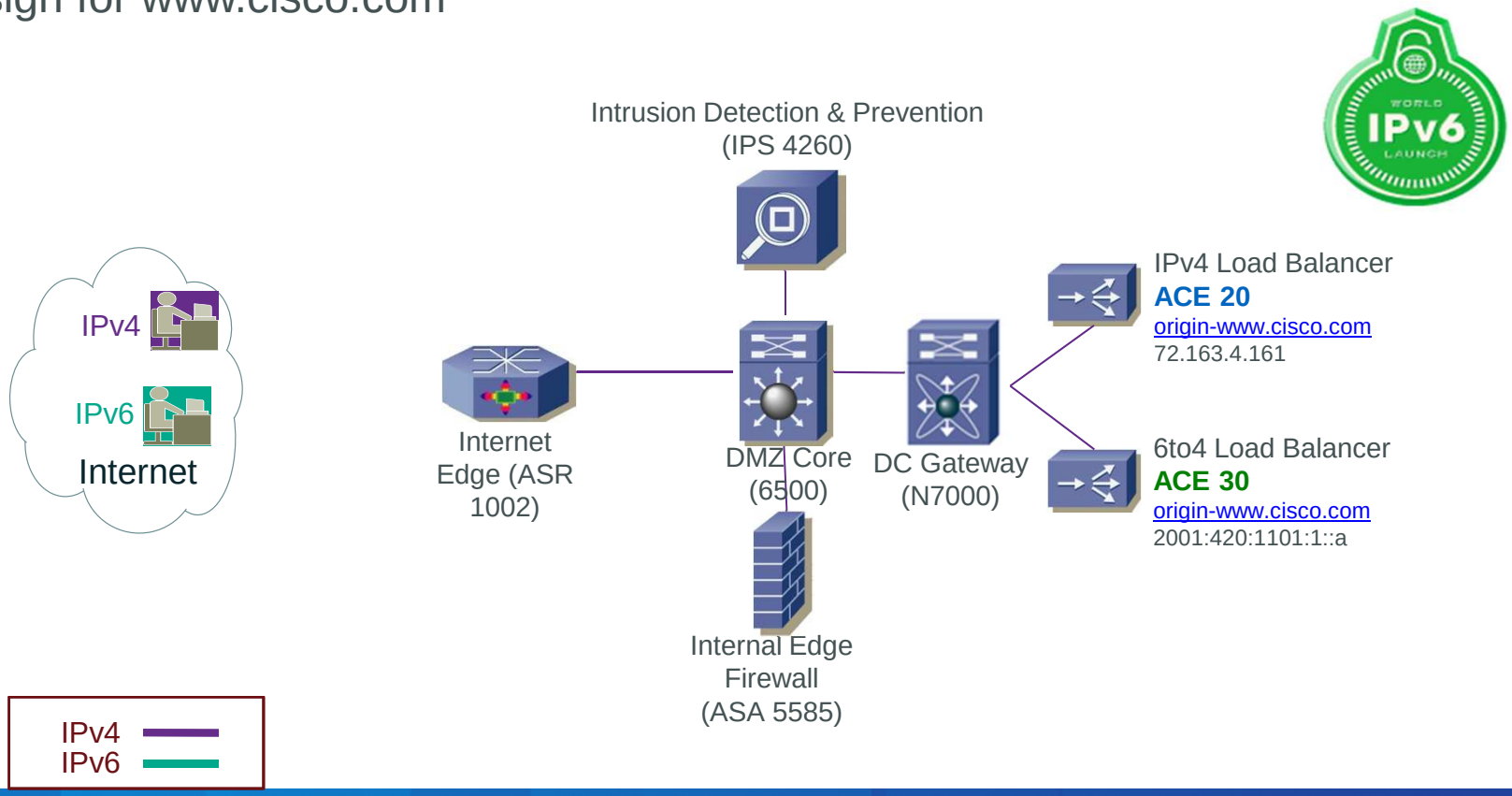
Cisco's IPv6 Web Presence

Architecture for www.cisco.com



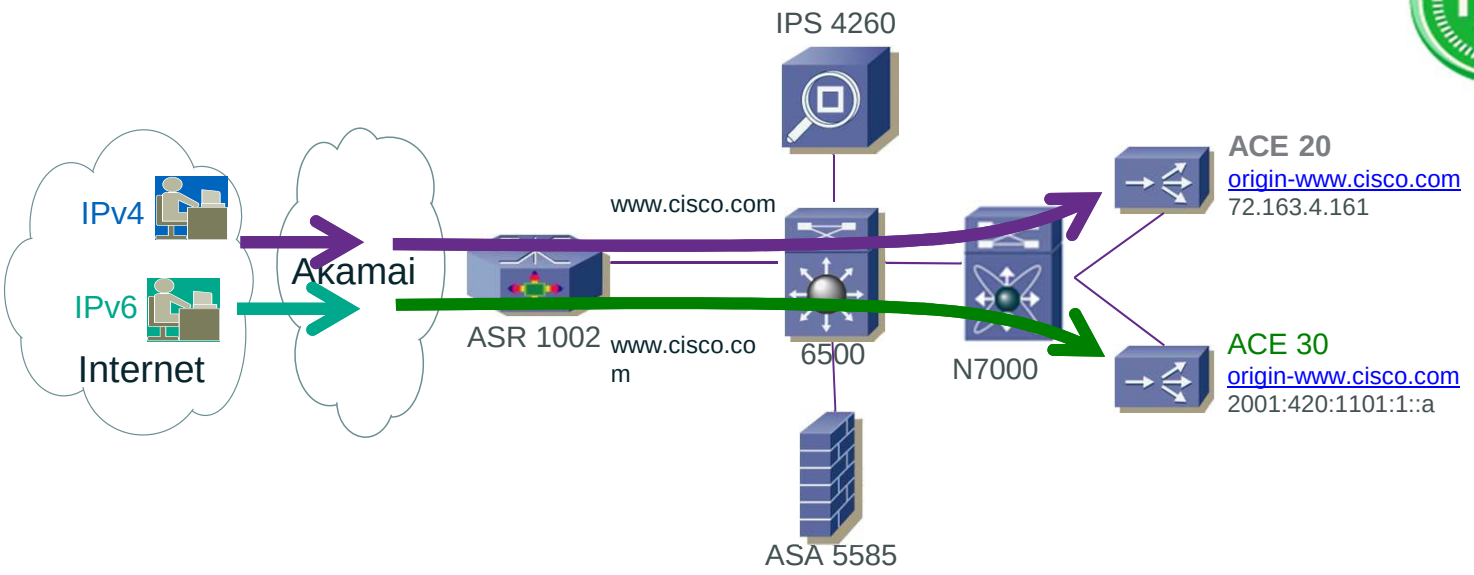
Cisco's IPv6 Web Presence

Design for www.cisco.com



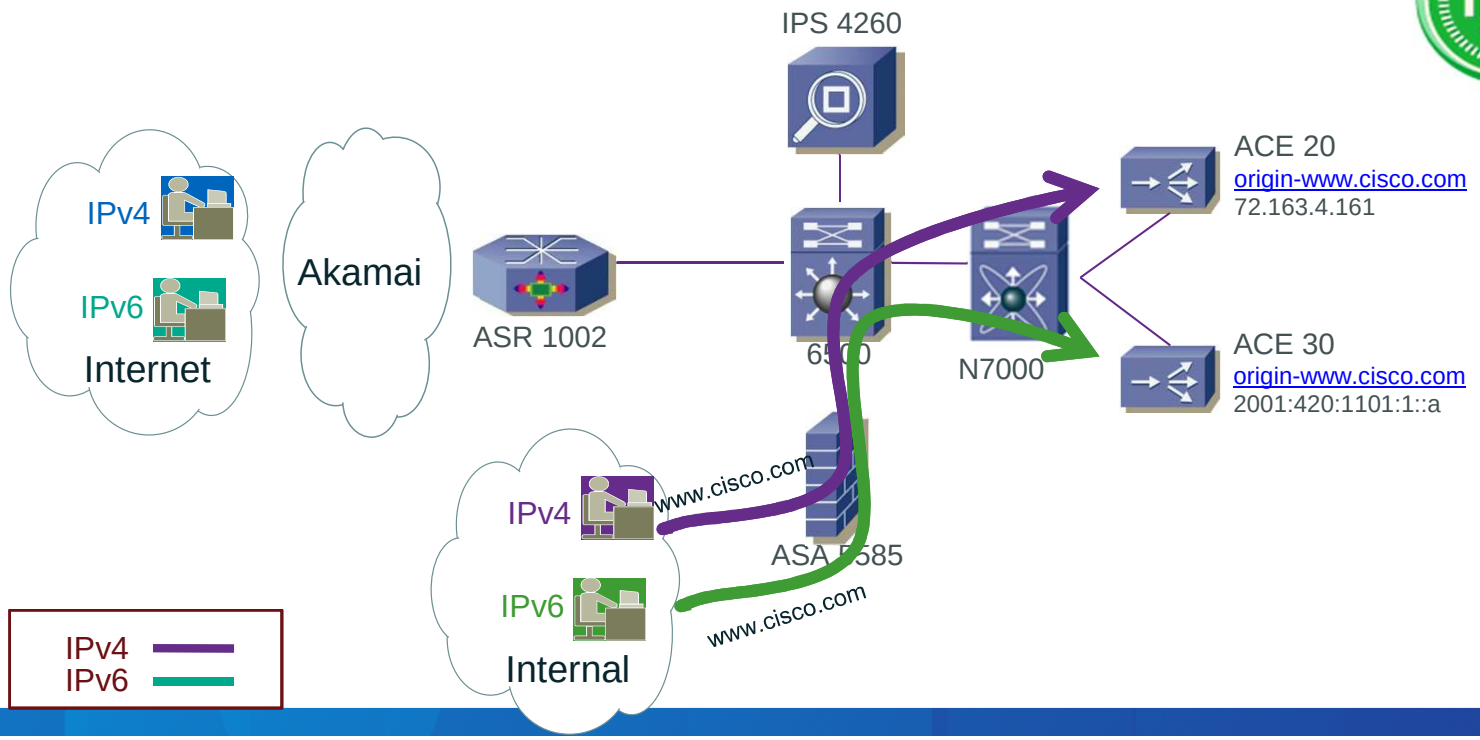
Cisco's IPv6 Web Presence

Design for www.cisco.com



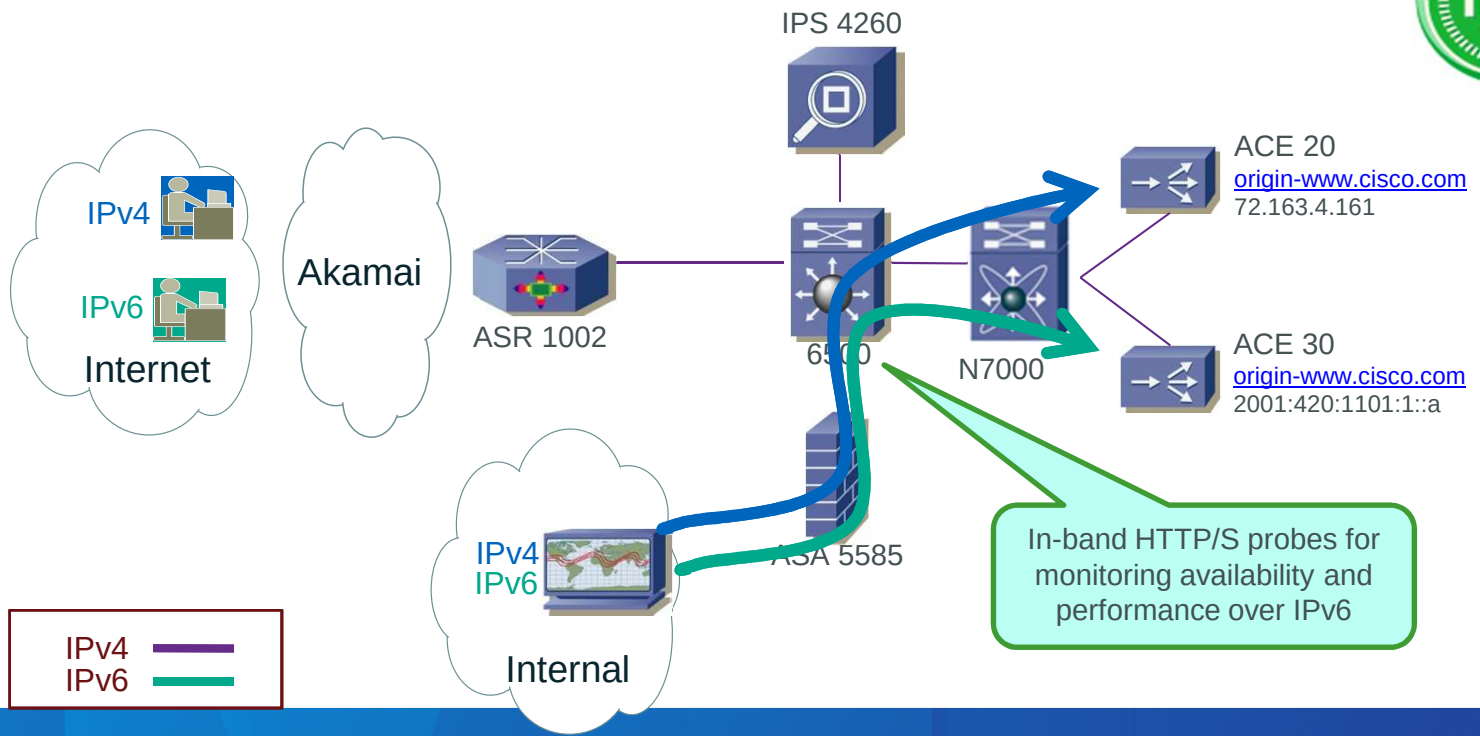
Cisco's IPv6 Web Presence

Design for www.cisco.com



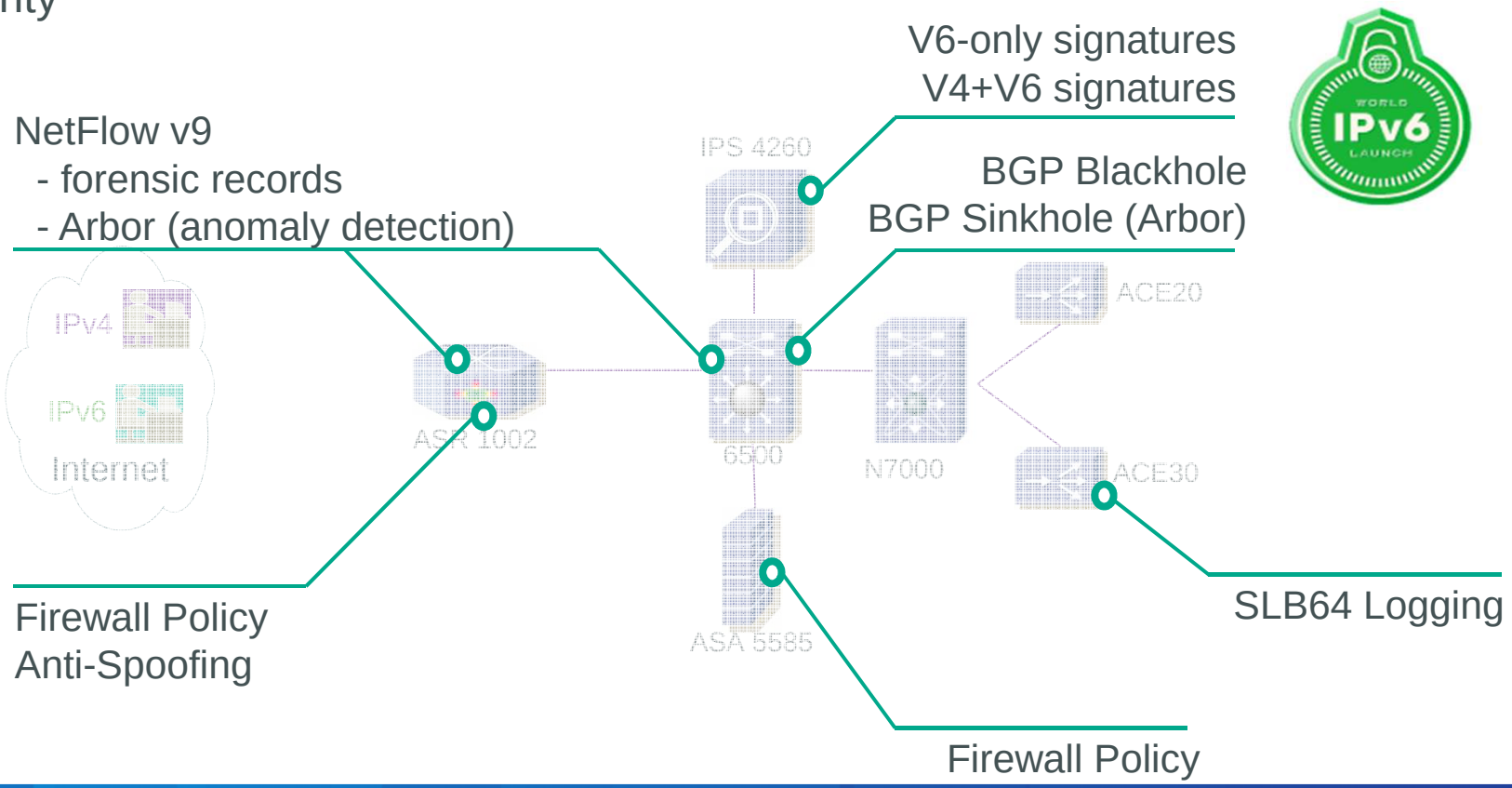
Cisco's IPv6 Web Presence

Design for www.cisco.com



Cisco's IPv6 Web Presence

Security



Deploiement IPv6 chez Cisco

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

Lessons apprises

- 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 apprises

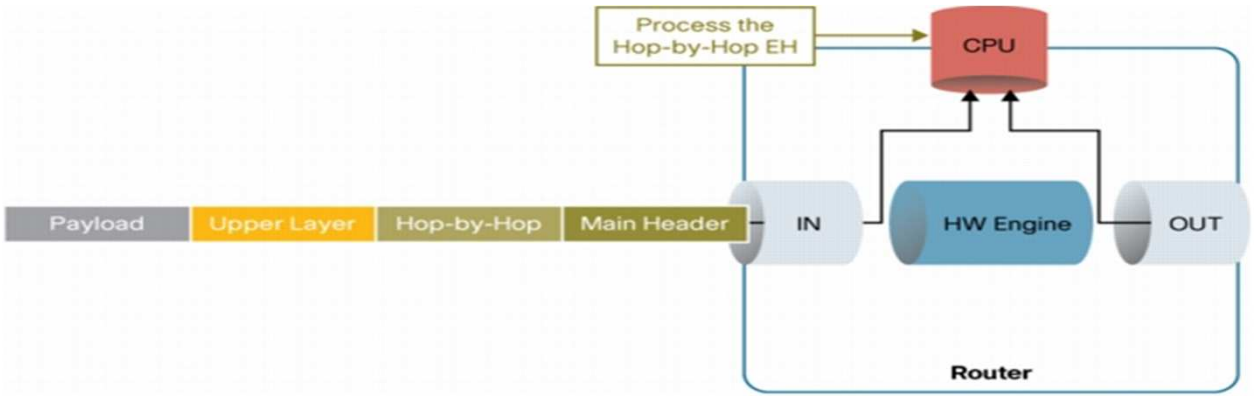
Produits

- 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 apprises

Sécurité

- 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 apprises

Metrologie

- 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 apprises
Postes de travail

Network operator measurements, 22nd May 2013 (notes)

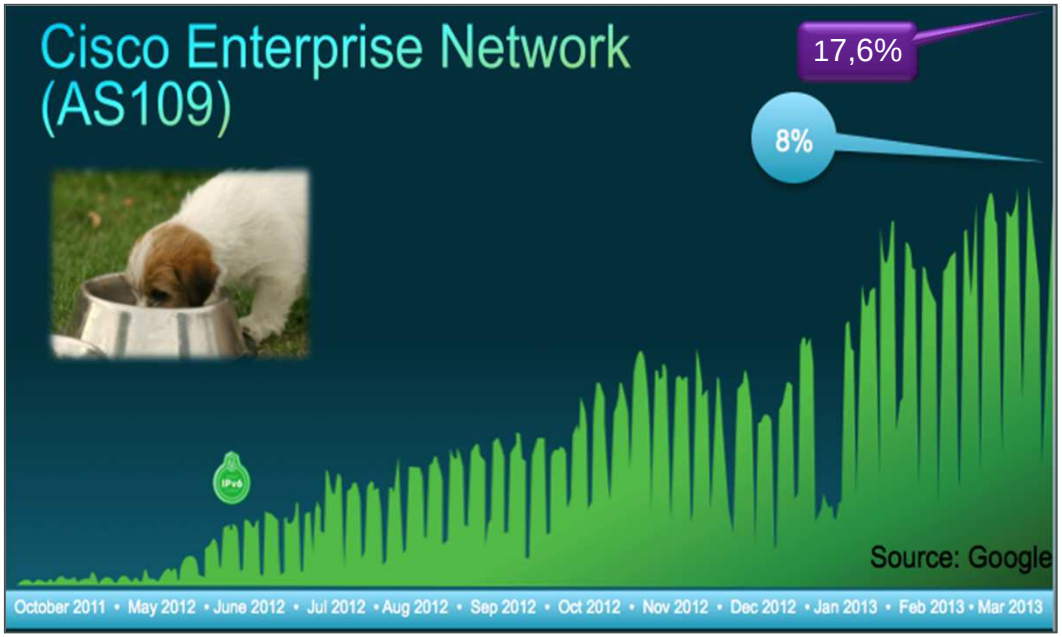
Show 10 entries Search: 109

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

- 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



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

Prévisions …

- During 2013 & 2014, 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 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.

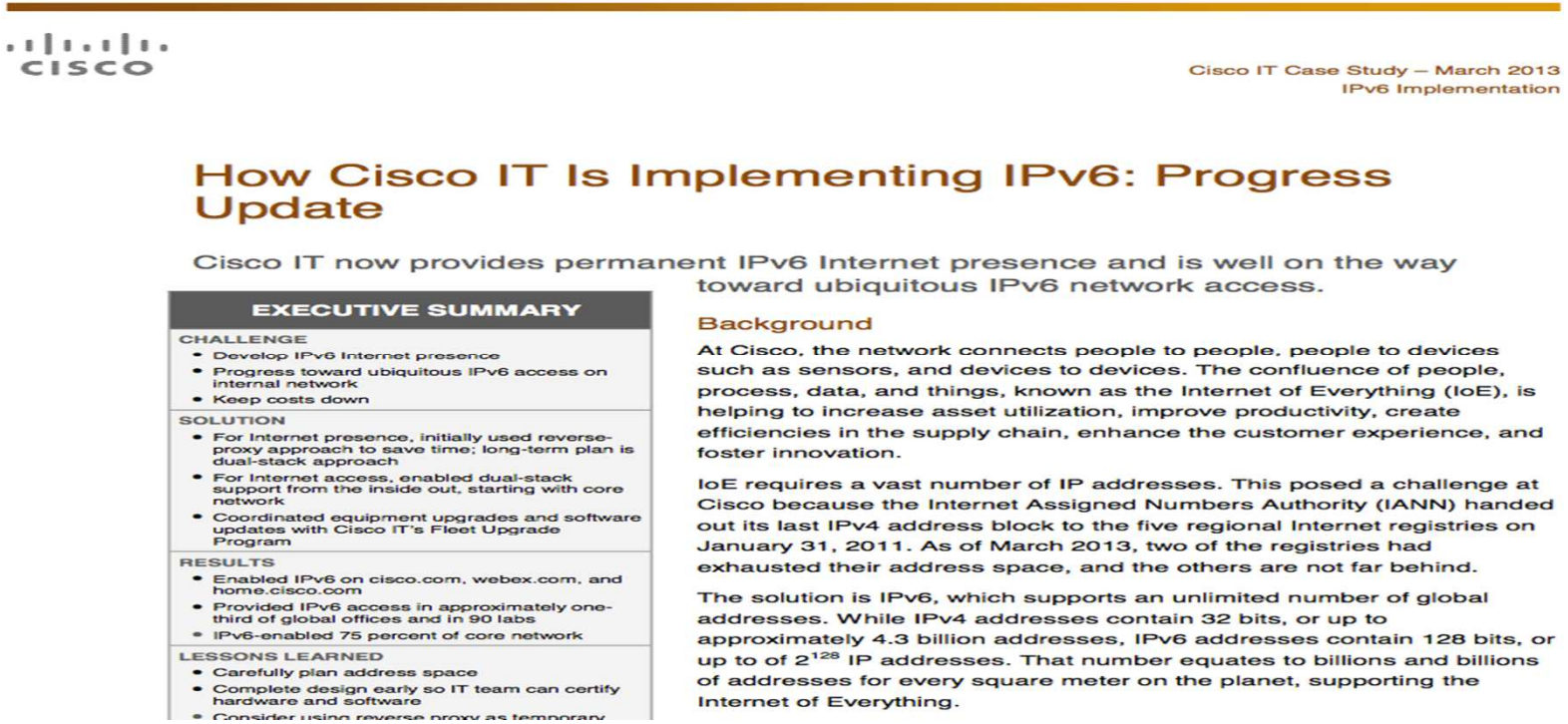
Lessons apprises
Conclusions

- 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

Cas d'étude du déploiement d'IPv6 chez Cisco



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

CHALLENGE
- Develop IPv6 Internet presence
- Progress toward ubiquitous IPv6 access on internal network
- Keep costs down

SOLUTION
- For Internet presence, initially used reverse-proxy approach to save time; long-term plan is dual-stack approach
- For Internet access, enabled dual-stack support from the inside out, starting with core network
- Coordinated equipment upgrades and software updates with Cisco IT's Fleet Upgrade Program

RESULTS
- Enabled IPv6 on cisco.com, webex.com, and home.cisco.com
- Provided IPv6 access in approximately one-third of global offices and in 90 labs
- IPv6-enabled 75 percent of core network

LESSONS LEARNED
- Carefully plan address space
- Complete design early so IT team can certify hardware and software
- Consider using reverse proxy as temporary

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 of 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

Pourquoi Cisco ?

Cisco reconnait la criticité de l'intégration d'IPv6

"… if we don't overcome the challenges of IPv4 … we will slow down the growth of the Internet and lose momentum as an industry."

"IPv6 is important to all of us … to everyone around the world. It is crucial to our ability to tie together everyone and every device."

"At Cisco we are committed architecturally to IPv6 across the board: All of our devices, all of our applications and all of our services."

– John Chambers
Chairman and Chief Executive Officer
Cisco

Diapositive 86

M3 ITGCR 'helps" . . . add 's'

purple boxes [with arrows] have very funky and unnecessary capitalization
Melissa; 12/01/2010

Contribution Cisco à la standardisation

RFC 5969 (6RD)

MAP (*draft-ietf-softwire-map & draft-ietf-softwire-map-t)*

Segment routing

M. Townsley , Chair du groupe Homenet @ IETF

http://datatracker.ietf.org/wg/homenet/charter/

RFC 6145 (NAT64)

RFC 6555 (Happy Eyeballs)

RFC 3849 (2001:DB8::/32)

RFC 4944 (compressed IPv6 @ in 6loPAN network)

RFC 7074 (Basic Requirements for IPv6 Customer Edge Routers)

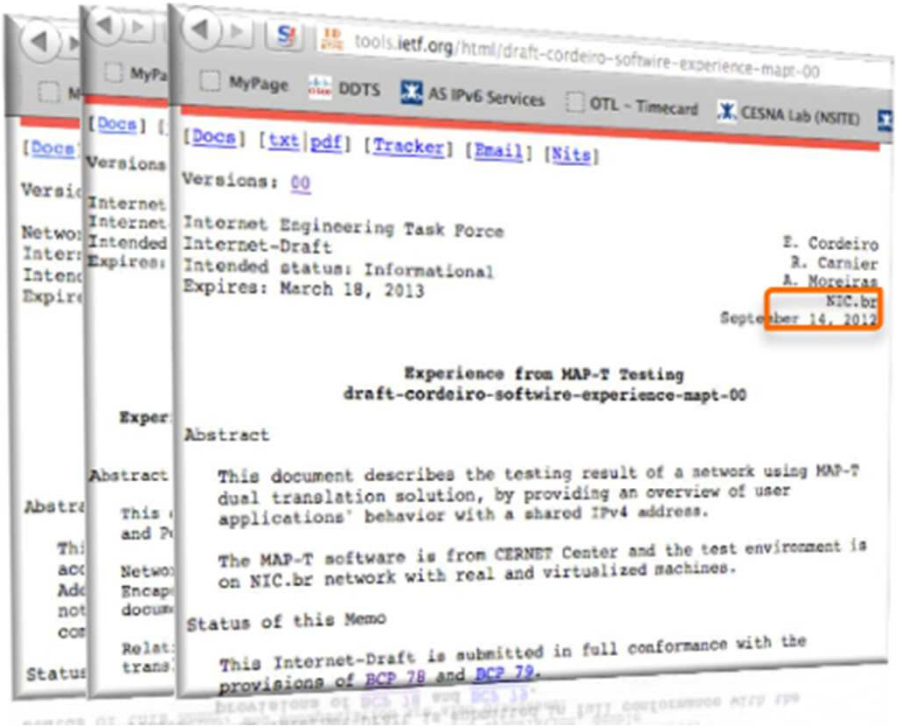
Fred baker has 706 total citations for 53 RFCs

Steve Deering has 1589 total citations for 40 RFCs;

Dan wing has 139 total citations for 26 RFCs

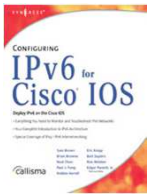
Mark Townsley has 147 total citations for 17 RFCs

Jean-Philippe Vasseur has 124 total citations for 11 RFC.

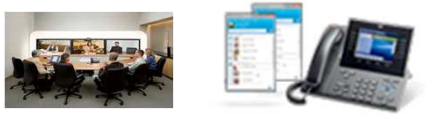


Toutes nos solutions supportent IPv6
Même performance et même parité fonctionnelle

First IOS version
Available with IPv6
June 2001



Published:Aug 16, 2002



CUCM 10.0
CUBE/IOS 15.3

AnyConnect 3.x
(Android, iOS)
Windows, MacOS

ASA 9.1 (incl IPS)
ASA-Cx
ESA, WSA

Webex Mobile
Client

Webex
Meeting

Prime Infra

IOS 15.3
IOS-XE 3.10

WLC 7.3

NXOS 6.2

Prime Infra

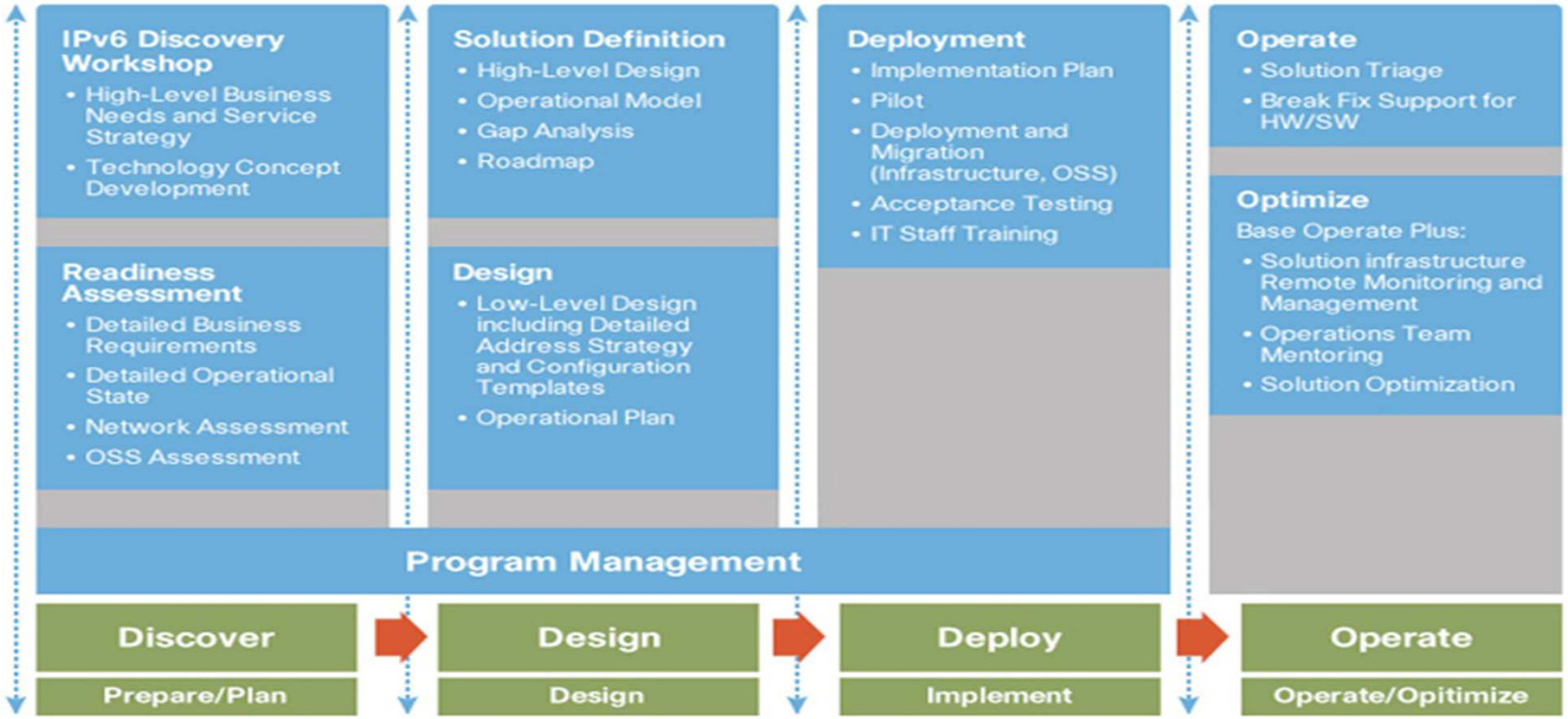
PNR

IOS-XR 4.3
IOS-XE 3.10
StarOS 14.0

100s of IPv6 features

Engineering Process changes – Test and Hardening - USGv6 certified Portfolio

Portfolio des services IPv6



Diapositive 89

M2 Ideas: change & to 'and'

text and graphic clean up [vendor]
Melissa; 12/01/2010

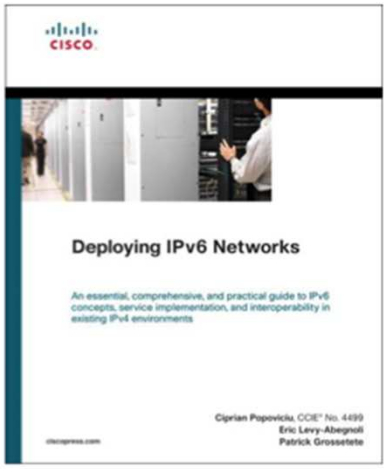
Conclusions

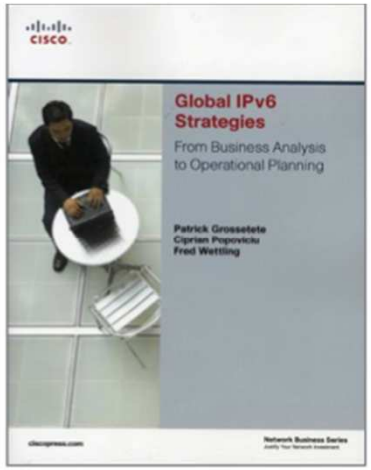
- Central RIR v4 address pools are **dry (or nearly dry)**
- IPv6 – **now "available" in the Internet**
- Internet Edge / Commerce **enhanced by IPv6 / degraded by CGNAT**
- Applications and hosts leverage IPv6 / have **IPv6 enabled automatically**
- Intranet security **requires IPv6 be enabled**
- IoE without IPv6 is the "Internet of Nothing" **(there is no IPv4 Smartgrid !)**
- IPv6 **restores the end to end model** for users and applications

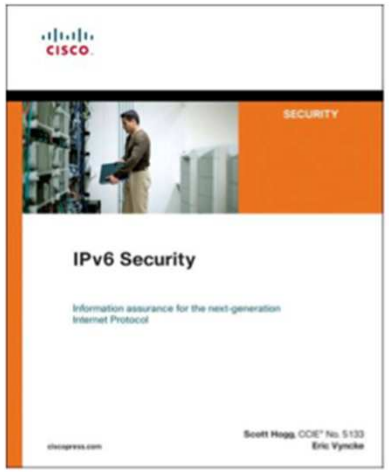
Références / Informations

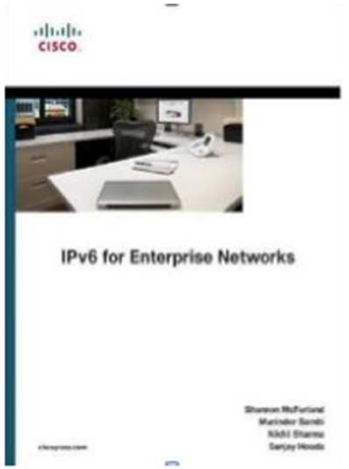
Cisco IPv6 home page : www.cisco.com/go/ipv6
Cisco IPv6 Knowledge portal : http://www.cisco.com/web/solutions/netsys/ipv6/knowledgebase/index.html
Cisco IPv6 Support community :https://supportforums.cisco.com/community/netpro/network-infrastructure/ipv6-transition
Cisco Blog IPv6 Tag : blogs.cisco.com/tag/ipv6
Cisco IPv6 design Zone : http://www.cisco.com/c/en/us/solutions/enterprise/design-zone-ipv6/index.html
Certification, USGv6/IPV6RL Ph2 :https://www.iol.unh.edu/services/testing/ipv6/usgv6tested.php
RIPE554 : http://www.ripe.net/ripe/docs/ripe-554
Afninic 6Spot : http://6spots.afrinic.net/
Cisco 6lab : http://6lab.cisco.com/stats/index.php
V6 launch Measurement : http://www.worldipv6launch.org/measurements/
IPv6 Gardner study : https://www.gartner.com/doc/2596422/create-right-ipv-road-map
Cisco IT Case Study :http://www.cisco.com/en/US/solutions/collateral/ns340/ns1176/borderless-networks/IPv6-Implementation_Case_Study.pdf

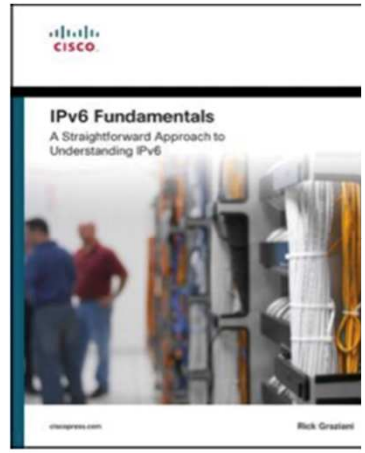
Livres IPv6











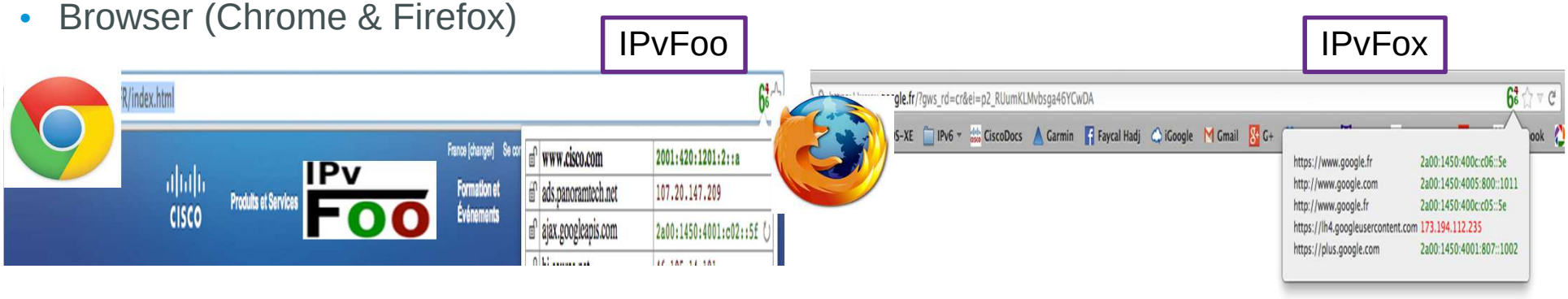
Call to actions ?????

Call to actions

- **Ask your IPv6 prefix ……if you don't have it yet and built your addressing plan !!**
- **Upgrade DNS servers to be able to serve IPv6 prefixes (can serve AAAA over an IPv4 transport)**
- **CL365 -Visit us online for PDFs and on-demand session videos. www.CiscoLiveEU.com**
- **Discuss your project's challenges with your Cisco technical and sales contacts**
- **Build your lab and get hands-on experience**
- **Ask for an IPv6 readiness assessment from Cisco or other**
- **Training , Training , Training , Training**

Test et visualisation de la connectivité IPv6

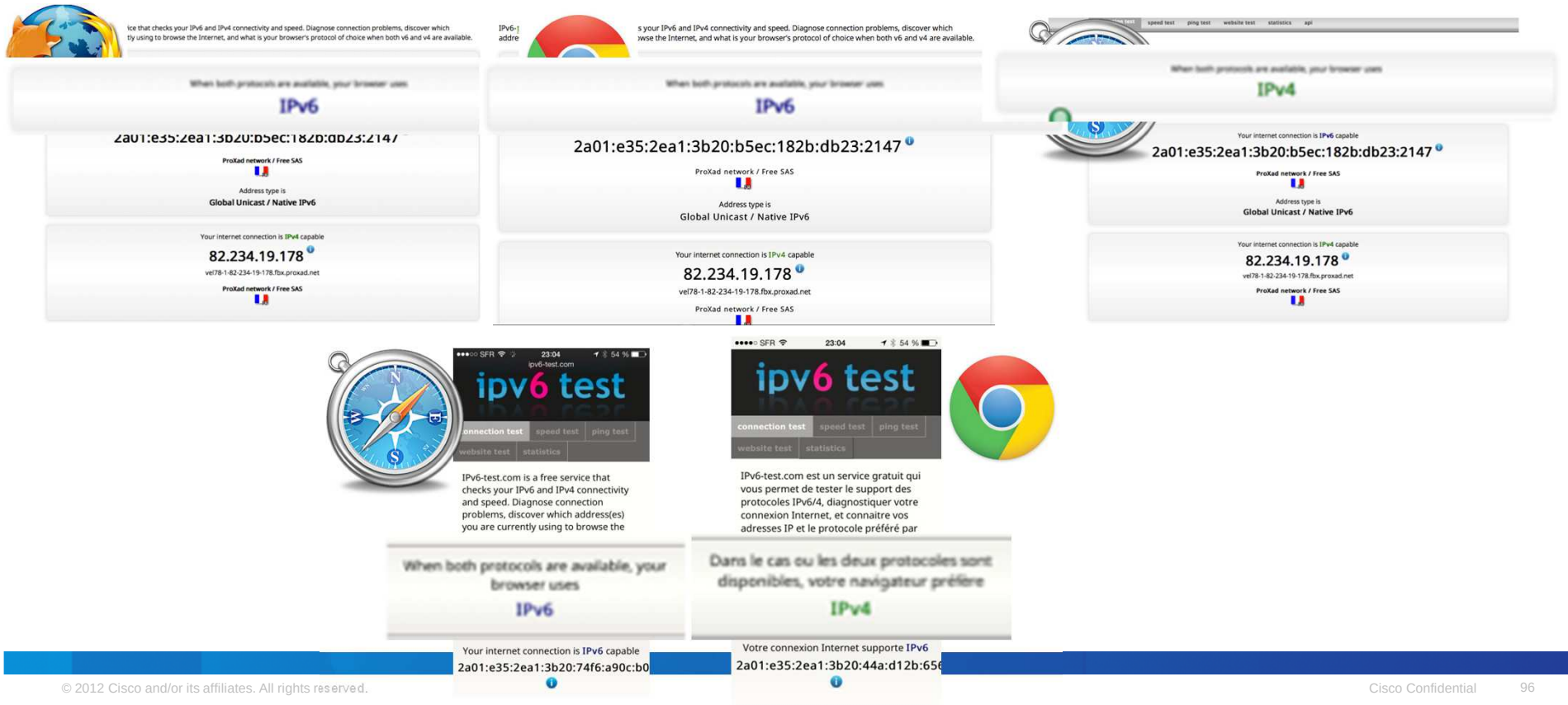
- http://test-ipv6.com , http://ipv6-test.com/speedtest/ et http://isp.testipv6.com/
- Browser (Chrome & Firefox)



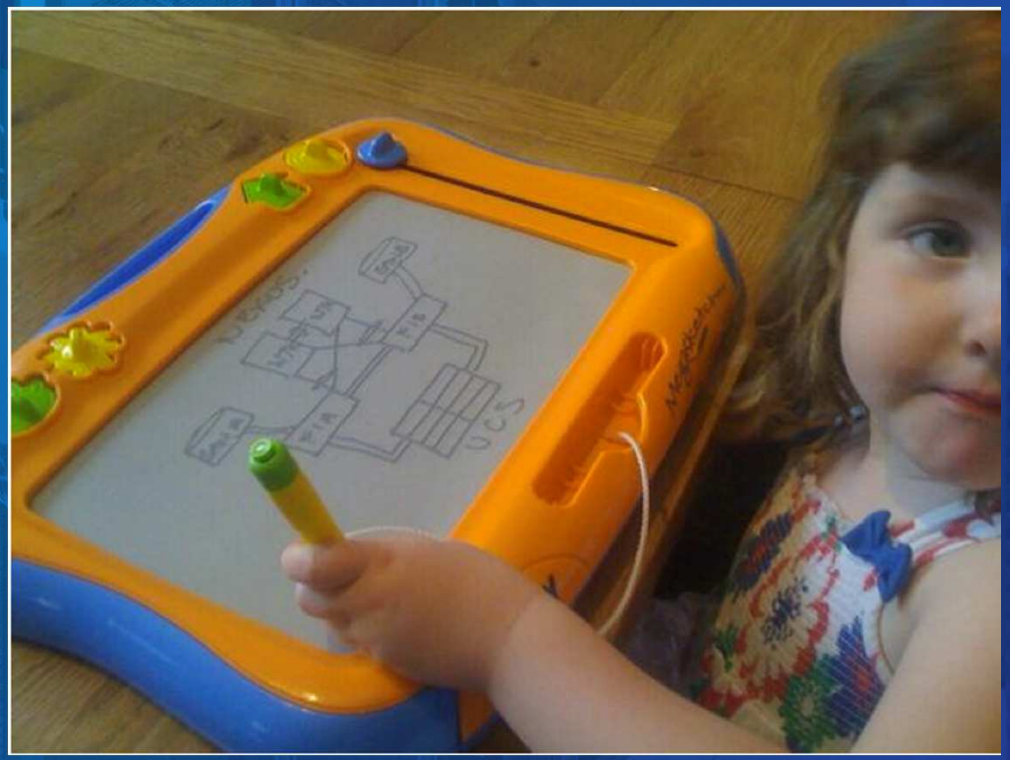
- **iPhone/iPad**
  - IP6config
    IP6toolkit
- **Android Store**
  - IPv6 & more

or IPv6 config

http://ipv6-test.com



Questions ?



Faycal HADJ
Technical Solution Architect
fhadj@cisco.com
CCIE #1135

Thank you.