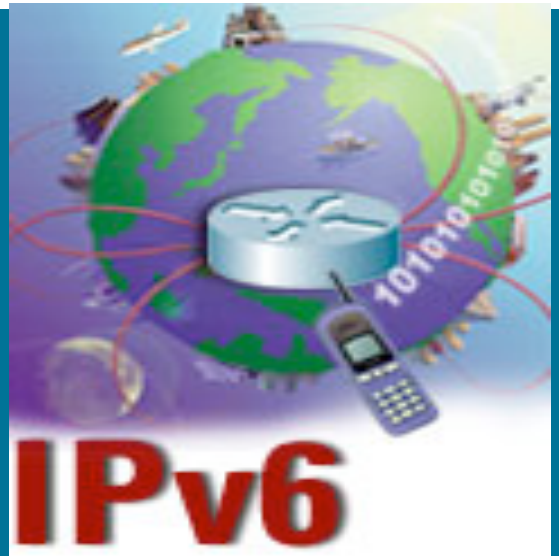
IPv6 @ Cisco

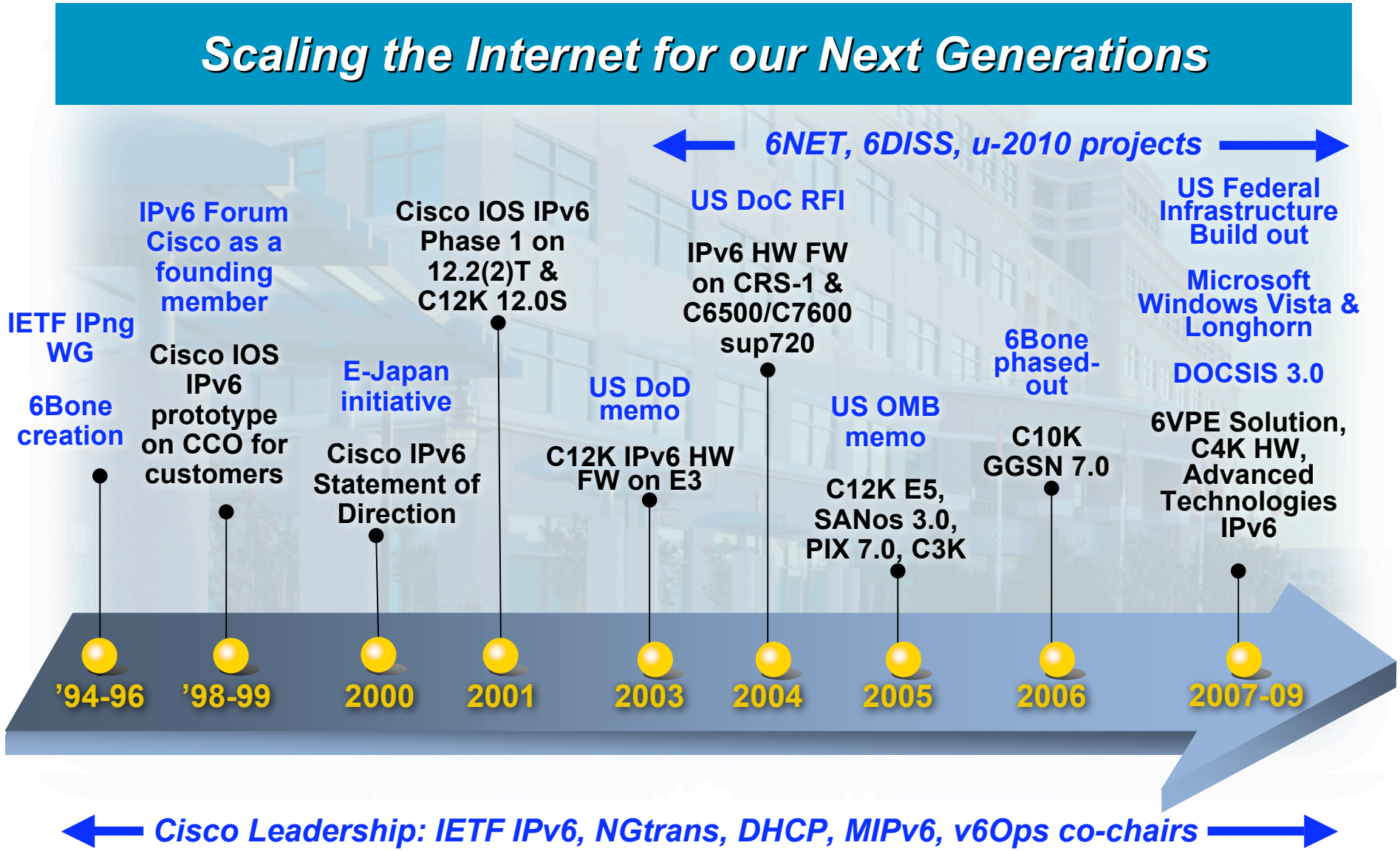


Philip Smith

AfriNIC 7, Durban

26th September 2007

Cisco IPv6 Timeline



Cisco IOS IPv6 Status

- General Production
  - Release 12.3 (May 2003)
  - Release 12.4
  - Release 12.5 (end of 2007)
- Technology Development
  - Early alpha & beta software (from 1996)
  - Release 12.2T (May 2001) – **first TAC supported IOS**
  - Release 12.3T & 12.4T
  - Release 12.5T (early 2008)

Cisco IOS IPv6 Status (cont)

- Core
  - Release 12.0S for GSR & 10720 (Feb 2002)
    - Hardware forwarding on GSR Engine3/4/5/…
  - IOS-XR for CRS-1 and GSR (May 2004)
- Edge & Enterprise
  - Release 12.2SB for 7200/7304/10000
  - Release 12.2SR for 7200 & 7600
- L3 switches
  - Release 12.2SX for 6500
  - Release 12.2SG for 4500
  - Release 12.2SE for 3750/3560

Industry's Broadest Platform Support

Cisco IOS 12.0S

Cisco 12000 Series Routers

Cisco 10720 Series

Cisco IOS 12.4/12.4T

Cisco 800 Series Routers

Cisco 1700 Series Routers

Cisco 1800 Series Routers

Cisco 2600 Series Routers

Cisco 2800 Series Routers

Cisco 3600 Series Routers

Cisco 3700 Series Routers

Cisco 3800 Series Routers

Cisco 7200 Series Routers

Cisco 7301 Series Routers

Cisco 7500 Series Routers (EoL)

Cisco IOS-XR

CRS-1, Cisco 12000

Cisco IOS 12.2S family

Cisco 72/7300 Series Routers

Cisco 75/7600 Series Routers

Cisco 10000 Series Routers

Catalyst 3750/3560/2960 Series

Catalyst 4500 Series

Catalyst 6500 Series

Cisco Product Portfolio

PIX Firewall (7.x), FWSM 3.1, LMS 2.5, MDS9500 series, CNR 6.2, NFC 5.x, NAM 3.x, GGSN 7.0

Coming Soon

Home Networking, IP Telephony

Cisco IOS – IPv6 Feature Overview

Security

- IPv6 std, extended, reflexive& enhanced extended ACL
- IPv6 IPsec – OSPFv3 authentication, site-to-site tunnel
- IPv6 Firewall

Integration

- Configured & Automatic Tunnels (RFC 2893)
- 6to4 (RFC 3056 & 3068)
- IPv6 over GRE/IPv4 (Pr. SW)
- IPv6 over MPLS (6PE)
- ISATAP
- NAT-PT (RFC 2765 & 2766)
- IP over IPv6 Tunnels

Routing

- RIPng
- OSPFv3
- IS-IS & MT IS-IS for IPv6
- EIGRP for IPv6
- MP-BGP IPv6 Unicast
- MP-BGP IPv6 Multicast
- Policy Based Routing

Core

- IPv6 (RFC 2460)
- ICMPv6 (RFC 2463)
- Neighbor Discovery (RFC 2461)
- Stateless Auto-Configuration
- Anycast
- CEFv6/dCEFv6
- uRPF Strict Mode
- CEFv6 Switched Tunnels
- HSRP & GLBP for IPv6
- Default Router Selection

Cisco IOS Software Release 12.4(11)T

Applications & Mgnt

- Telnet, TFTP, DNS resolver, HTTP, Ping, Traceroute, SSH
- Cisco IP & IP-Forwarding MIBs
- Netflow for IPv6
- SNMP over IPv6
- Syslog over IPv6

Broadband Access

- Cisco VSA AAA
- Radius AAA (RFC 3162)
- PPPoA, PPPoE, RBE and ATM 1483 encapsulations
- DHCPv6 Prefix Delegation (RFC3633), DHCPv6 Relay
- Stateless DHCP (RFC 3646)
- Generic Prefix

Multicast

- MLDv1, v2, Access Group
- PIMv2 SM, SSM, Bi-Dir
- PIM Embedded RP
- IPv6 MC over IPv4 tunnels
- Scope Boundaries
- Static mRoutes
- BSR

IPv6 QoS (MQC)

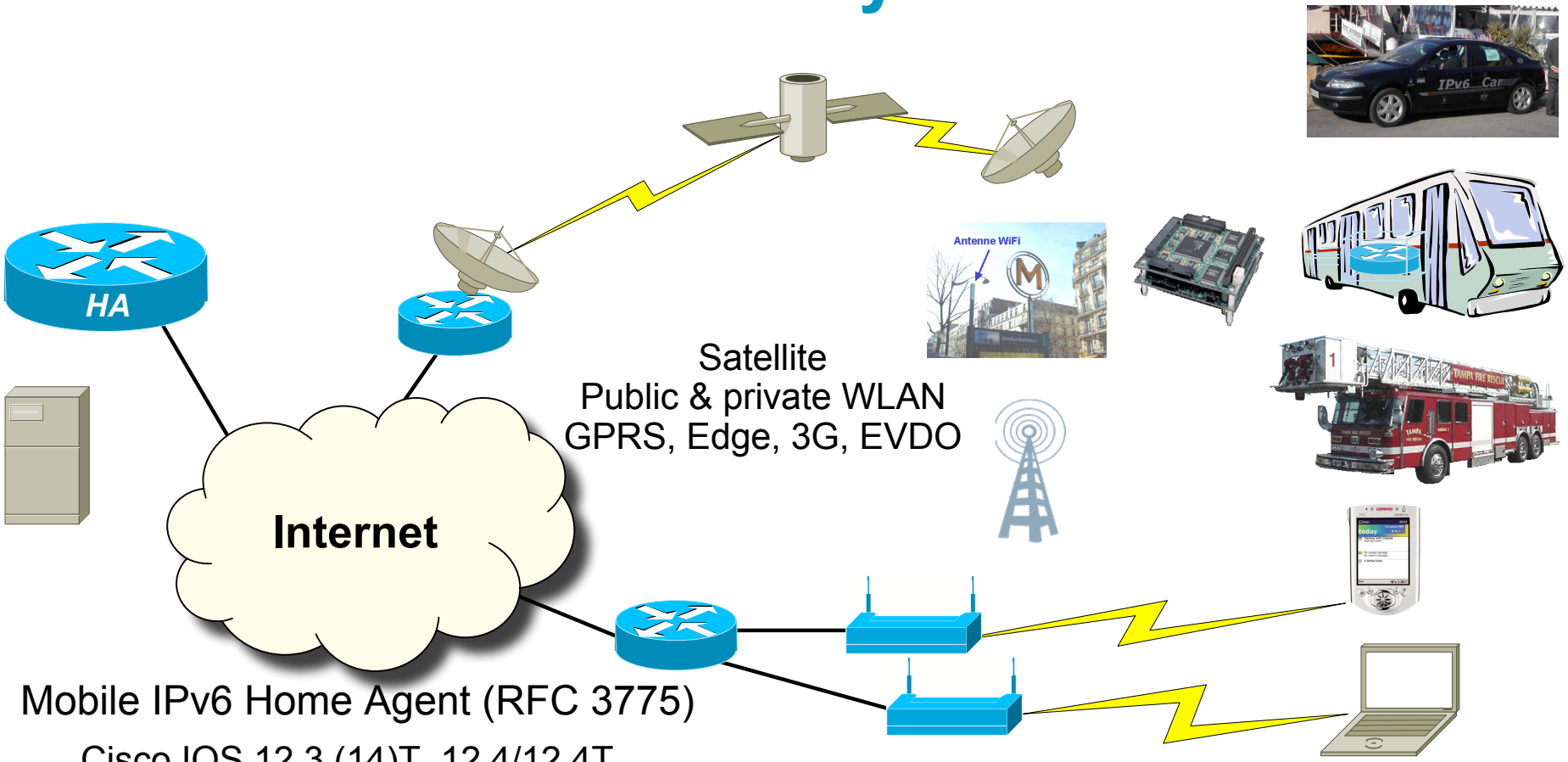
Mobile IPv6

- MIPv6 Home Agent
- Lite Authentication

Cisco IPv6 compliance

- Conformance tests + Interoperability tests
  - IPv6 Ready Logo – www.ipv6ready.org
  - US DoD JITC conformance – http://jitc.fhu.disa.mil/adv_ip/register/register.html
  - Cable Labs DOCSIS 3.0 conformance
  - Microsoft Vista/Longhorn interoperability – Vista logo
- Cisco IOS Release certification
  - Cisco IOS 12.4(11)T achieved JITC certification
  - Cisco IOS 12.3, 12.3T, 12.2SX and 12.0S are compliant with the IPv6 Ready Logo Phase I
  - Cisco IOS 12.4(9)T is compliant with IPv6 Ready Logo Phase II core specs

Cisco IOS IPv6 Mobility

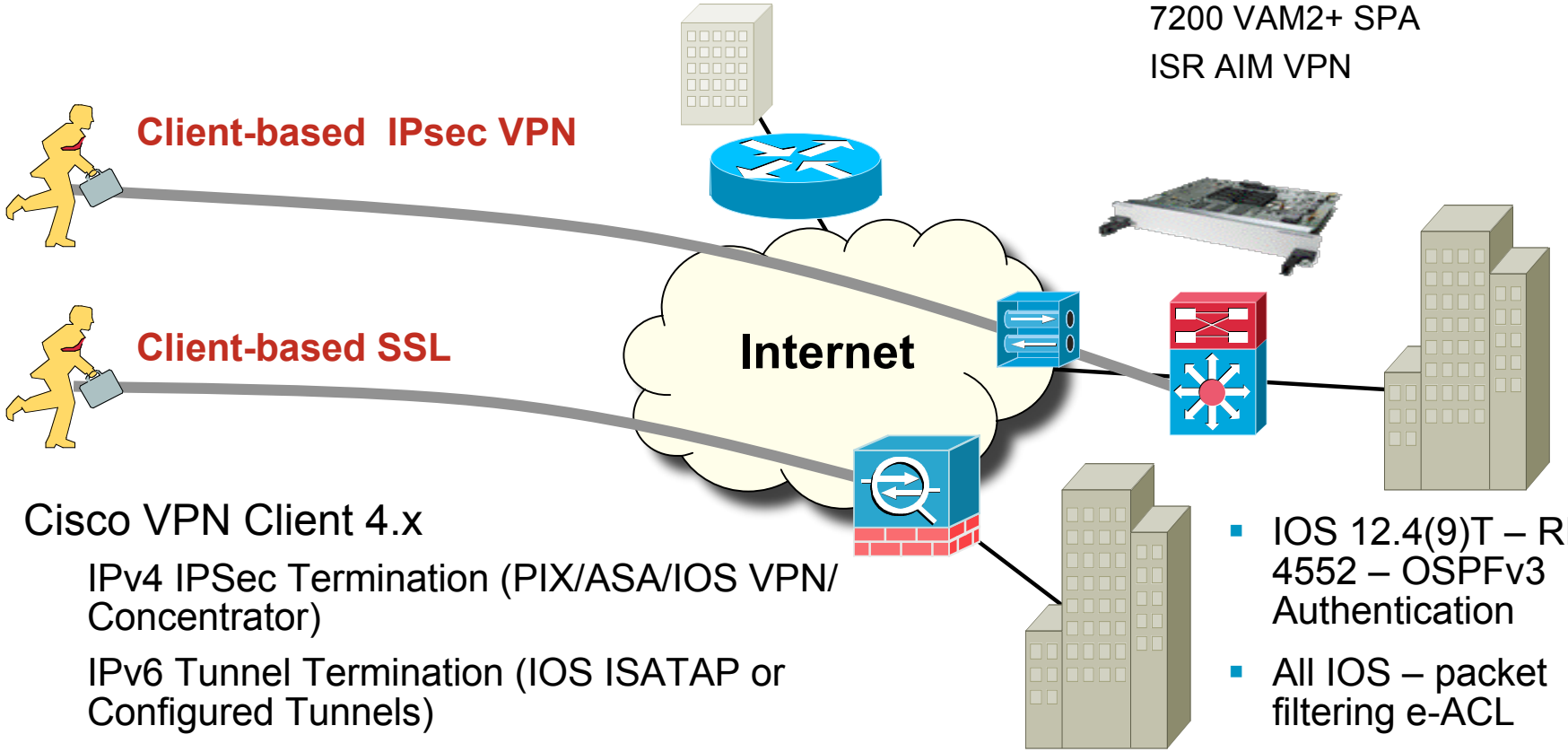


- Mobile IPv6 Home Agent (RFC 3775)
  - Cisco IOS 12.3 (14)T, 12.4/12.4T
- Lite Authentication (RFC 4285)
  - Cisco IOS 12.4(11)T
- IPsec for MIPv6 (RFC 3776) – Future
- Networks in Motion (NEMO) (RFC 3693) – Future

Tested with BSD, Linux and Windows XP Tech Preview MIPv6 client

Cisco IPv6 Security

- IPv6 IPSec Tunnels
  - IOS 12.4(4)T
- IPv6 HW Encryption
  - 7200 VAM2+ SPA
  - ISR AIM VPN



- Cisco VPN Client 4.x
  - IPv4 IPSec Termination (PIX/ASA/IOS VPN/ Concentrator)
  - IPv6 Tunnel Termination (IOS ISATAP or Configured Tunnels)
- AnyConnect Client 2.x
  - SSL/TLS or DTLS (datagram TLS = TLS over UDP
  - Tunnel transports both IPv4 and IPv6 and the packets exit the tunnel at the hub ASA as native IPv4 and IPv6.

- IOS 12.4(9)T – RFC 4552 – OSPFv3 Authentication
- All IOS – packet filtering e-ACL

- IPv6 Firewall
  - IOS Firewall 12.3T, 12.4, 12.4T
  - FWSM 3.x
  - PIX 7.x, including ASA 5500 series

Other Devices

- Wireless Access Points

  In a dual stack environment, IPv6 and Multicast traffic is forwarded transparently

  Controllers: 4402-12, 4402-25, 4402-50, 4404, WiSM, 3750G, NM-WLC

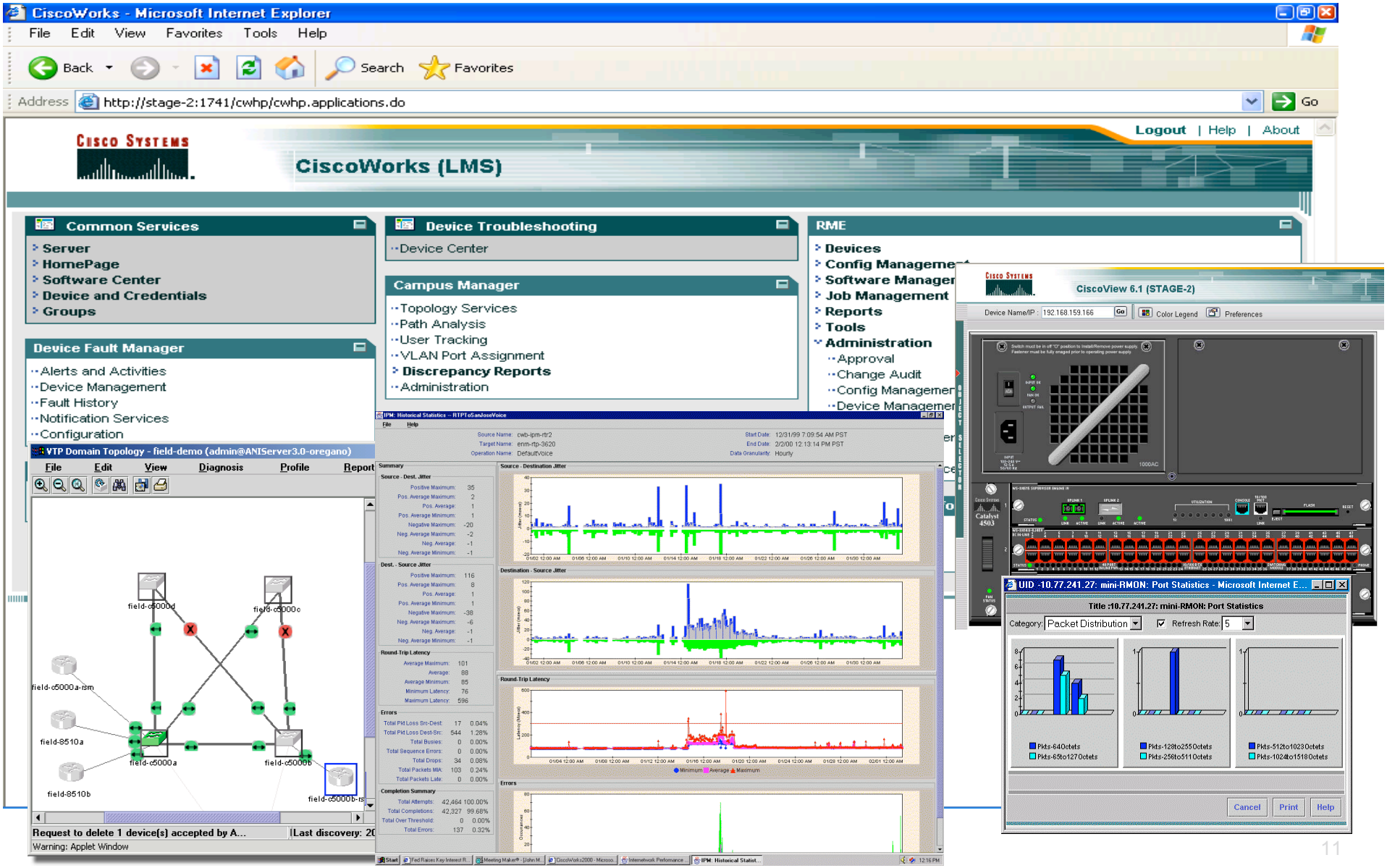
  Access Points: AP1130, AP1240, AP1000, AP1500, AP1300

  (No IPv6 control plane yet)

- Multilayer Storage – MDS9000

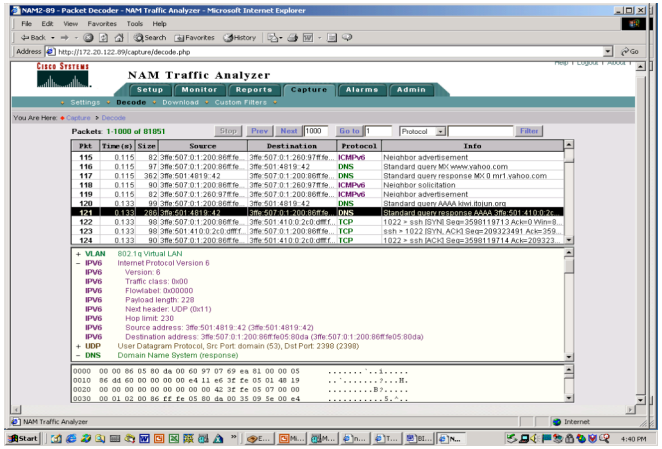
  SAN-OS 3.0 adds IPv6 support

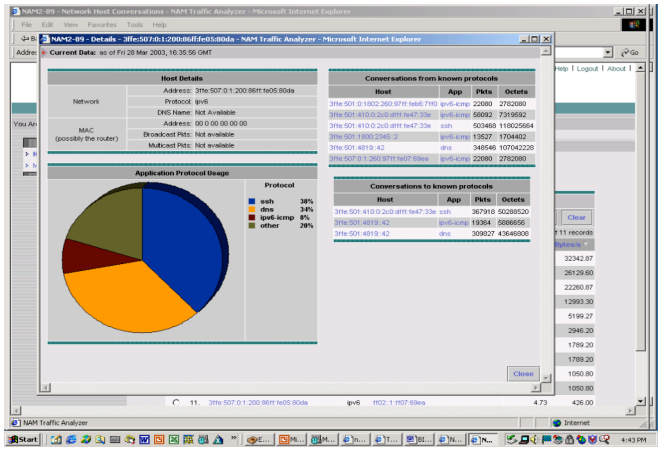
CiscoWorks LMS 2.5 – IPv6 Support



Cisco Network Analysis Modules (NAM)

- Service Modules for C6K, C7600 and ISR
- Release 3.x include IPv6 Network Management capabilities
- IPv6 monitoring and decodes with NAM
- Can set up alarms with IPv6 addresses
- Can configure an “easy” IPv6 capture filter and IPv6-historical reports





Branch Router NAM

Cisco Cat 65k NAM

IPv6 Deployment Scenario for ISP

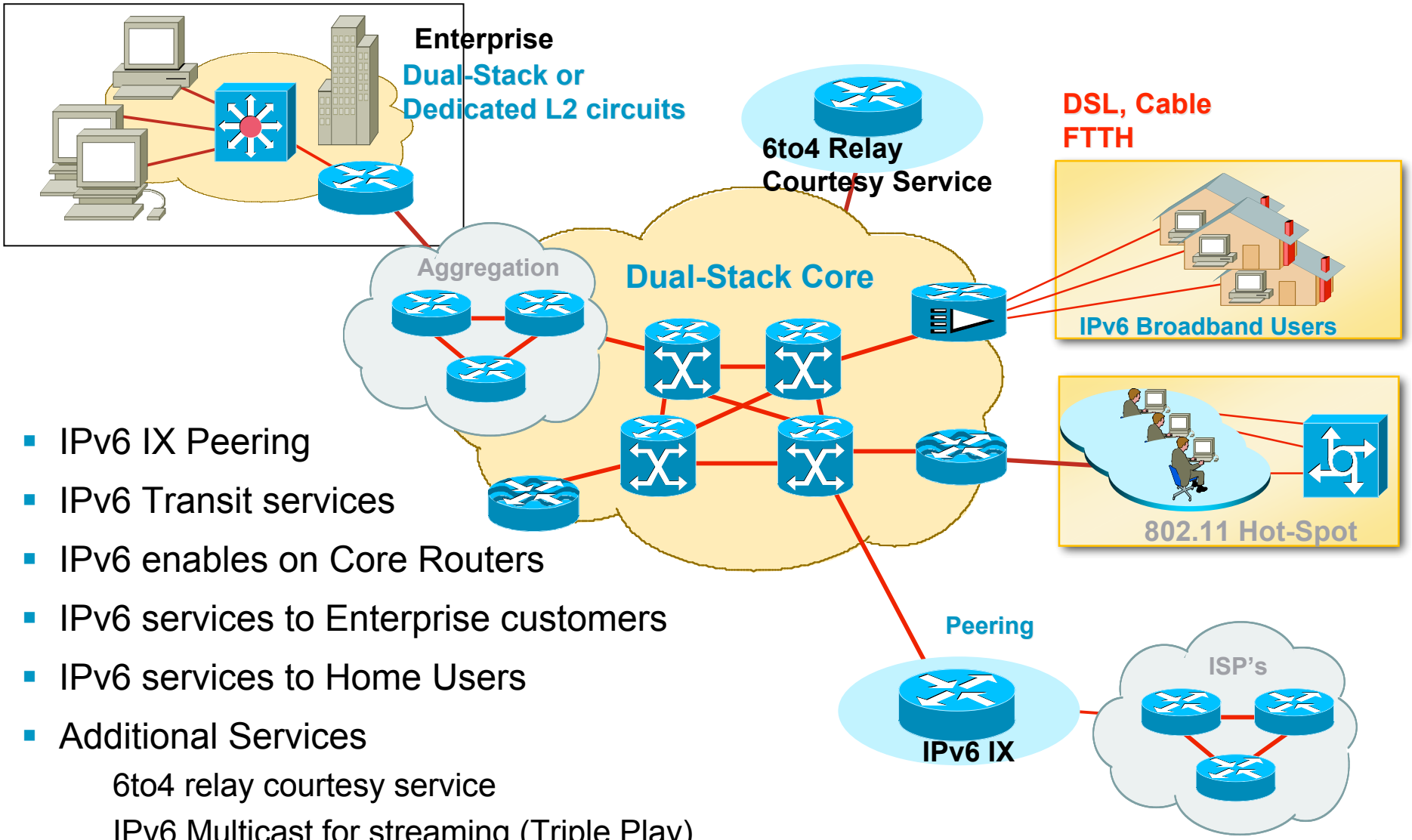
	Environment	Scenario	Cisco IOS support
Access	Few customers, no native IPv6 service form the PoP or Data link is not (yet) native IPv6 capable, ie: Cable Docsis (*)	Tunnels	Yes
	Native IPv4-IPv6 services between aggregation and end-users	Dual Stack	Yes
	Dedicated circuits – IPv4 – IPv6	Dual Stack	Yes
Core	Native IP – Core is IPv6 aware	Dual Stack	Yes
	MPLS – Core is IPv6 unaware	6PE/6VPE	Yes

(*) Before DOCSIS 3.0

Dual Stack IPv4-IPv6 Infrastructure

- Early trials were initially deployed using IPv6 over IPv4 tunnels
- Today, “Dual Stack network” is the normal evolution to deliver IPv6 services for native IP infrastructures
- Dual Stack may not necessarily apply to the entire infrastructure. One may begin on network’s portion such as Access or Core
  - An alternative is to associate dedicated L2 circuits to each IP protocol, eg. Over ATM or FR PVC, DWDM Lambdas,…
- Network design requirements
  - Selection of a routing protocol, ie: OSPFv3 or IS-IS
  - Decision on topology alignment or not, eg. Configuring MT IS-IS
  - Instrumentation and Management
  - Services, ie: Multicast, QoS,…

Dual Stack IPv4-IPv6 Case Study

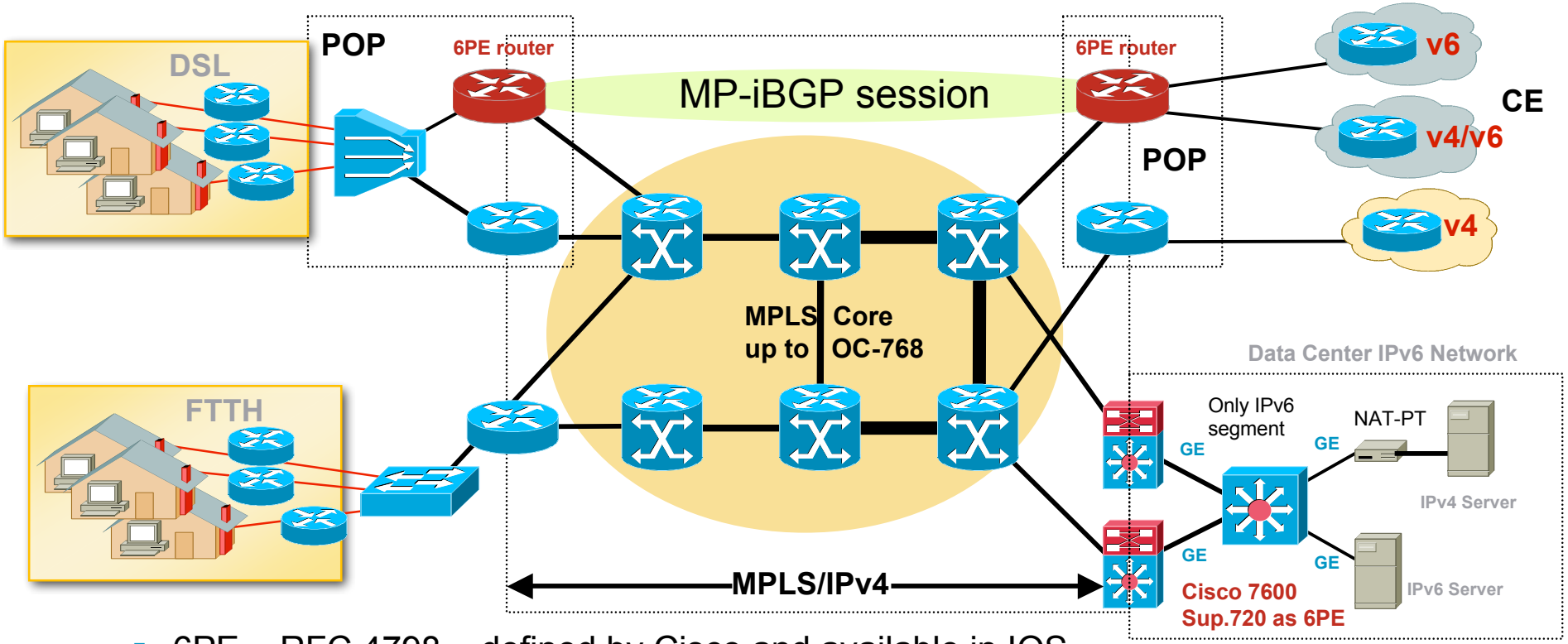


- IPv6 IX Peering
- IPv6 Transit services
- IPv6 enables on Core Routers
- IPv6 services to Enterprise customers
- IPv6 services to Home Users
- Additional Services
  - 6to4 relay courtesy service
  - IPv6 Multicast for streaming (Triple Play)

IPv6 over MPLS Infrastructure

- Service Providers have already deployed MPLS in their IPv4 backbone for various reasons
  - MPLS/VPN, MPLS/QoS, MPLS/TE, ATM + IP switching
- Several IPv6 over MPLS scenarios
  - IPv6 Tunnels configured on CE (no impact on MPLS)
  - IPv6 over Circuit_over_MPLS (no impact on IPv6)
  - IPv6 Provider Edge Router (6PE) over MPLS & IPv6 VPN over MPLS (6VPE) with no impact on MPLS core
  - Native IPv6 MPLS (require full network upgrade)
- Upgrading software to IPv6 Provider Edge Router (6PE)
  - Low cost and risk as only the required Edge routers are upgraded or installed
  - Allows IPv6 Prefix delegation by ISP

Minimum Infrastructure Upgrade for 6PE



- 6PE – RFC 4798 – defined by Cisco and available in IOS
- MPLS/IPv4 Core Infrastructure is IPv6-unaware
- PEs are updated to support Dual Stack/6PE
- IPv6 reachability exchanged among 6PEs via iBGP (MP-BGP)
- IPv6 packets transported from 6PE to 6PE inside MPLS

More Information

- Cisco's IPv6 Portal:

  www.cisco.com/go/ipv6

- Detailed **IPv6 product support**:

  www.cisco.com/en/US/products/ps6553/products_white_paper09186a00802219bc.shtml

- **IPv6 Start Here** documents the IPv6 feature set for Cisco IOS releases

  www.cisco.com/en/US/products/sw/iosswrel/ps5187/products_configuration_guide_chapter09186a00801d65ed.html

- Use **IOS Feature Navigator** to select correct image for purpose

  www.cisco.com/go/fn

Q and A