

Cisco IPv6 Position RN.2 Project Proposal

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Empowering the
Internet Generation



Cisco IOS Roadmap: The Confluence of IPv4/IPv6

IOS Release	Market Target
Phase I IOS 12.2(1)T Q1 CY 2001	Early Adopter Deployment
Phase II H2 CY 2001	Production Backbone Deployment
Phase III CY 2002	Enhanced IPv6 Services

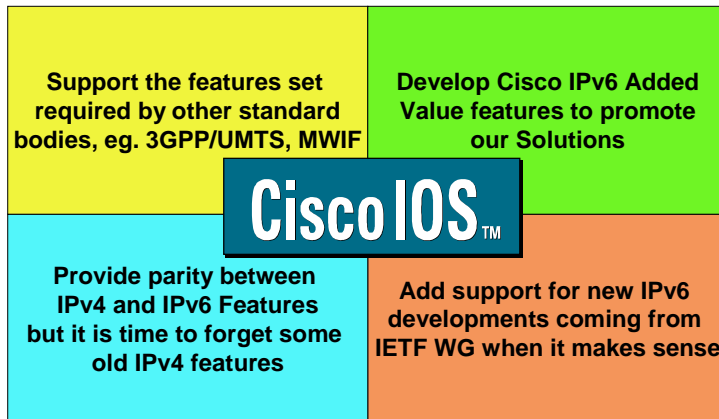
IOS
upgrade
=
Free IPv6
support

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Where is the IPv6 roadmap coming from?

Listening our Customers



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Cisco IOS IPv6 Phase I

IOS Release	IPv6 Features Supported
<p>Phase I Early Adopters IOS 12.2(1)T Q1 CY 2001</p> <p>Any router able to run this release Cisco 800 to Cisco 7500</p>	<p>IPv6 Basic specification (RFC 2460) ICMPv6, Neighbor Discovery Stateless auto-configuration RIPv6 (RFC 2080) Multi-Protocol extensions for BGP4 (RFC 2545 & 2858) Configured and Automatic Tunnels 6to4 Tunnel Standard Access List IPv6 over Ethernet (10/100/1000Mb/s), FDDI, Cisco HDLC, ATM and FR PVC, PPP (Serial, POS, ISDN) Ping, Traceroute, Telnet, TFTP,</p>

IOS upgrade = Free IPv6 support

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Cisco IOS IPv6 Phase II

IOS Release	IPv6 Features under development
<p>Phase II Backbone Deployment Cisco IOS 12.2(3)T or (4)T</p> <p>Estimated EFT dates in ()</p> <p>Specific Cisco 12000 release on 12.0ST</p>	<p>i/IS-ISv6 (Q1 CY01) CEFv6/dCEFv6 (Q3 CY01) Dial (Q2 CY01) Extended Access List (Q3 CY01) NAT-PT (Q2 CY01) IPv6 Edge router (6PE) over MPLS (Q3/4 CY01) DNS AAAA client (Q1 CY01) SSH, IPv6 MIB (Q3 CY01) Phase I Sustaining</p>

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Cisco IOS IPv6 Phase III

IOS Release	Evaluation of IPv6 Phase III Features
<p>Phase III Enhanced Protocols</p> <p>Estimated Dates: CY 2002</p> <p>IOS 12.2S , IOS 12.3 mainline</p>	<p>OSPFv3: under development E-IGRP: under development Mobile IPv6: Home Agent prototype currently under development IPsec: mandated by IPv6 specs, Authentication required by OSPFv3, Mobile IP Binding Association, Router renumbering, Network Management IPv6 Multicast: MLD, PIMv6 SM, PIM SSM and PIM Bi-Dir as candidates.</p>

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Cisco IOS IPv6 Phase III

IOS Release	Evaluation of IPv6 Phase III Features
<p>Phase III Enhanced Services</p> <p>Estimated Dates: CY 2002</p> <p>IOS 12.2S , IOS 12.3 mainline</p>	<p>IPv6 QoS: Not different from IPv4 (Diff. Serv. & RSVP). UMTS Rel. 5 requirements have high priority.</p> <p>Statistics (ala Netflow): Gathering IPv6 statistics such as IPv6 Src/Dst addresses, AS number & Bytes count</p> <p>Tunnels: GTP over IPv6, IPv4 over IPv6 tunnels</p>

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Cisco IOS IPv6 Phase III

IOS Release	Evaluation of IPv6 Phase III Features
<p>Phase III Enhanced Services</p> <p>Estimated Dates: CY 2002</p> <p>IOS 12.2S , IOS 12.3 mainline</p>	<p>Hardware Acceleration: Project in-progress on GSR, Cat.6K</p> <p>Encapsulation: Add full support for DPT, Cable and DSL</p> <p>Network Management: SNMP over IPv6, MIB update (RFC 2851)</p> <p>Phase II: Sustaining & Enhancement</p> <p>IETF IPv6 Enhancements: eg. router renumbering, R.A. extensions, router automatic prefix delegation, Robust Header compression,...</p>

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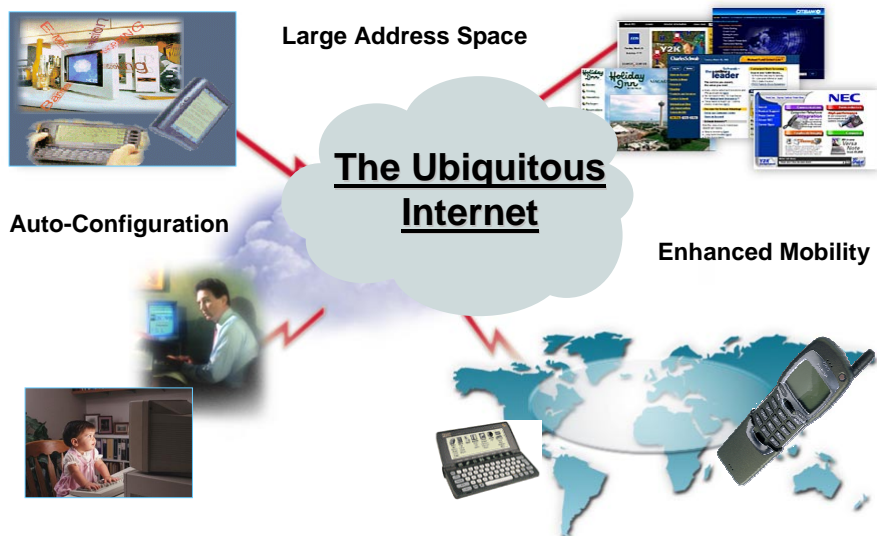
IOS Release	IPv6 Features Supported
Phase I IOS 12.2(1)T Q1 CY 2001	Basic IPv6 specifications support Multi-protocol Extensions for BGP4, RIPv6 Manual, Automatic & 6to4 Tunnel Support Tools such as Ping, Traceroute, etc
Phase II H2 CY2001	Enhanced Performances (CEFv6/dCEFv6), Link State IGP (ISIS-ISv6), IPv6 Edge router (6PE) over MPLS, Dial, NAT-PT, Enhanced tools (SSH, DNS client, MIB, etc)
Phase III CY 2002	Hardware Acceleration, OSPFv3, Mobility, Multicast, Security, QoS...

IOS upgrade = Free IPv6 support

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The IPv6 Hype



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Cisco in some IST projects

- Wineglass
- Lion
- NGN Labs
One of the partners
- IPv6 testbed
Prime Contractor

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IST2001 - VII.1.2 RN2: Technology and Application Experiments

Objectives:

Support large scale experimentation with middleware and end to end applications to provide the seamless integration of competitive access technologies with existing fixed infrastructure. These experiments, will build on the infrastructure provided by the RN1 activities and call for the involvement of real users in the context of problem oriented test beds, including the support of virtual communities.

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Deployment scenario

- IPv6 over IPv4 tunnels
- Dedicated Data Link layers for native IPv6
no impact on IPv4 traffic & revenues
- Dual stack Networks
IPv6 over MPLS or IPv4-IPv6 Dual Stack Routers

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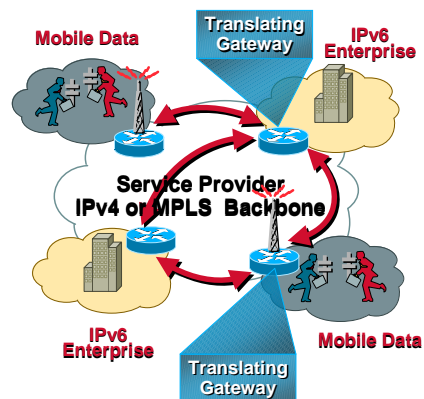
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IPv6 Tunnels over IPv4 or MPLS Infrastructure

- IPv6 over IPv4 Internet
ala 6Bone
- Any Cisco IOS 12.2(1)T routers can be used as IPv6 router
 - 6to4 Tunnel
 - Manual Tunnel
 - Automatic Tunnel
 - IPv4compatibleIPv6
- Leveraging defined Tunneling Technology
- No impact on existing IPv4 or MPLS infrastructure
using high-speed POS interfaces

Edge IPv6 Infrastructure:

IPv6 over IPv4 Internet:

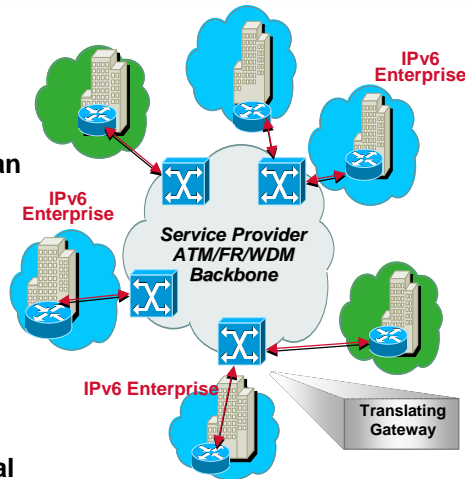


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Native IPv6 over Dedicated Data Links

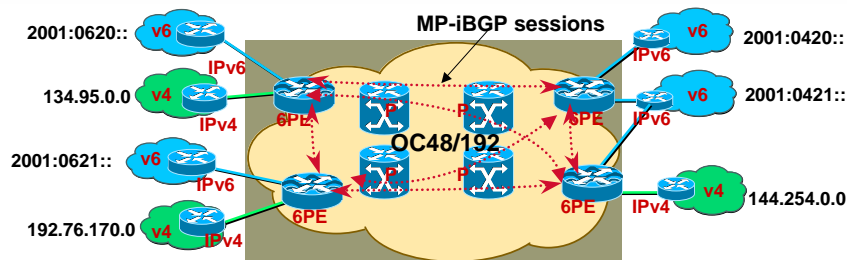
- Native IPv6 links over dedicated infrastructures
 - No impact on IPv4 traffic and revenues
- Any Cisco IOS 12.2(1)T routers can be configured
 - ATM & Frame Relay PVC's
 - Serial Lines, Sonet/SDH, FE/GE
- Cisco 12000 with Sonet/SDH interfaces can get IPv6 support
 - Today, EFT on private 12.0ST branch
- IPv6 over FE/GE, ATM or Sonet/SDH can run over an optical infrastructure (dedicated lamda)



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IPv6 Edge Router (6PE) over MPLS



- Many Carriers, large ISP and Mobile SP have invested on MPLS infrastructure
 - Core devices may be ATM switches, GSR or other vendor's routers
 - Leverages of MPLS features, eg. MPLS/VPN, TE, CoS,...
- UMTS Release 5 requires IPv6
 - GSM, GPRS and UMTS Release 99 needs circuit switching as well as IP
- Multiple implementation's options to integrate IPv6
 - IPv6 on CE, IPv6 over AToM, IPv6 Edge router (6PE), native IPv6 MPLS
 - 6PE allows the SP to offer IPv6 at lower cost and risk

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Dual Stack IPv4-IPv6 backbone

- Can be achieved beginning with Cisco IOS 12.2(1)T but have to consider the following:

IPv4 Hardware Forwarding
versus IPv6 Software Forwarding

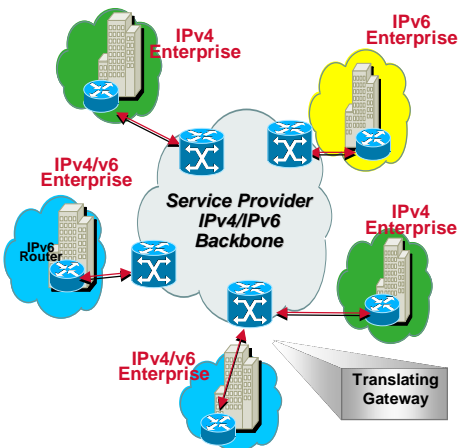
Memory size for IPv4 and IPv6
routing tables

Should IPv4 and IPv6 route to a
single dual-stack edge router the
same?

Requires full upgrade

- IPv4 and IPv6 traffic should not
impact each other.

Require more feedback &
experiments



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Native IPv6-Only Backbone?

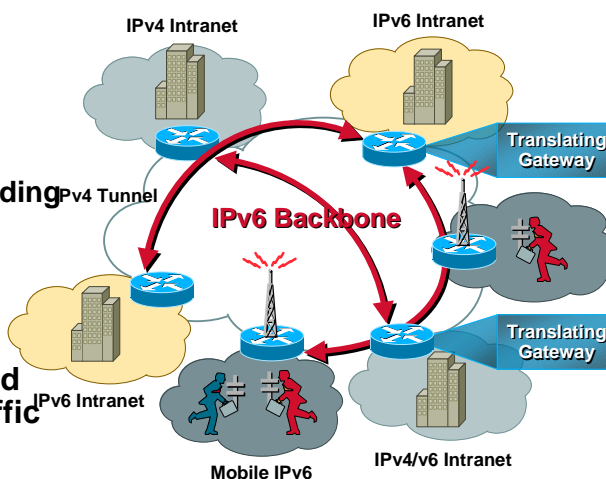
- Requires:

IPv4 over IPv6
Tunnels for
IPv4 traffic

Hardware forwarding
for IPv6

Network
Management
over IPv6

- Not recommended
today as IPv4 traffic
is still the main
source



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IPv6 Deployment Phases

Phases	Benefits
IPv6 Tunnels over IPv4	Low cost, low risk to offer IPv6 services. No infrastructure change. Has to evolve when many IPv6 clients get connected
Dedicated Data Link layers for Native IPv6	Natural evolution when connecting many IPv6 customers. Require a physical infrastructure to share between IPv4 and IPv6 but allow separate operations
MPLS 6PE	Low cost, low risk, it requires MPLS and MP-BGP4. No need to upgrade the Core devices, keep all MPLS features (TE, IPv4-VPN)
Dual stack or IPv6-only	Require to upgrade all devices. Valid scenario when IPv6 traffic volume is sufficient or applications are IPv6 only.

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Open Challenges

- **Determining future IPv6 routing table size**
- **IPv6 performance level needed, based on REAL IPv6 traffic expectations**
 - Next 12 months?, 24 months?
- **Mobile IPv6**
 - Clients, Application and Network design
- **IPsec versus Firewall on IPv6 networks**
- **IPv6 QoS features set needed for 3G networks**
- **Network Management tools**
- **Transition Tools, which ones?**
 - NAT-PT ALG support?
- **Field Training**
- **Interoperability**
- **Others ?**

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Possible WP

- 1 - Build an IPv6 pan-European network
- 2 - Study migration scenarios from IPv4 to IPv6
- 3 - Monitor the deployment and impact of IPv6 applications
- 4 - Introduction of new enhanced IPv6 services (Mobility, Security, . . .)
- 5 - Evaluate the manageability of a large IPv6 network

And?

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Phased Approach

Phase 1 -> installation and building the network (3 - 6 months)

- countries
- locations
- links (SP)
- participants (NRN's)
- operational responsibility
- IPv6 interoperability (other Ipv6 test beds)

Phase 2 -> network is operational (3 - 6 months)

all participants get access to basic set of IPv6 applications

Phase 3 -> detailed testing, evaluation, monitoring, . . . (24 months)

Phase 4 -> define the after project responsibility (final use after project)

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IPv6 - Conclusion

IPv6 in large production deployment - 2002 ?!

- IPv4 to IPv6 Migration Cookbook (unicast and multicast)
 - IPv6 Addressing Guidelines
 - IPv6 IXs and Multihoming
 - 3 user communities (Wireless, GRIDs, others)
 - IPv6 network operations Cookbook
- Other ideas?

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