

Moving IPv6 to Production Running Cisco IOS

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Cisco IOS IPv6 Product Manager

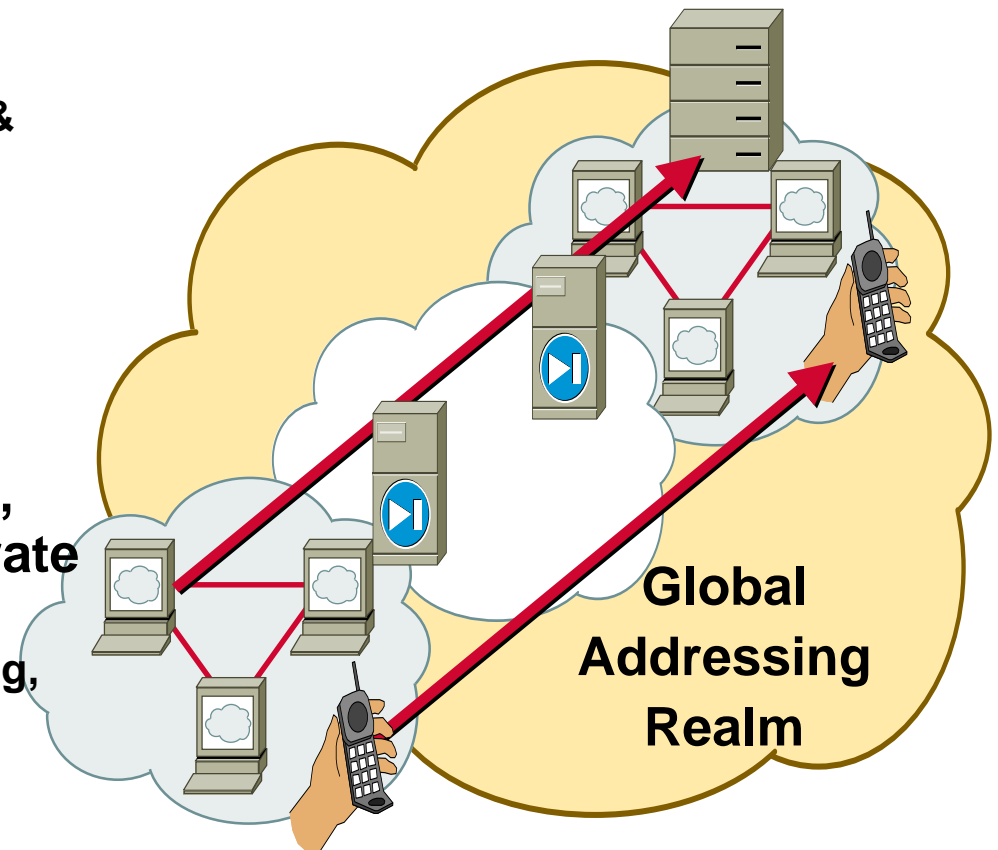
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IPv6 Business Case

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Only compelling reason: more IP addresses!

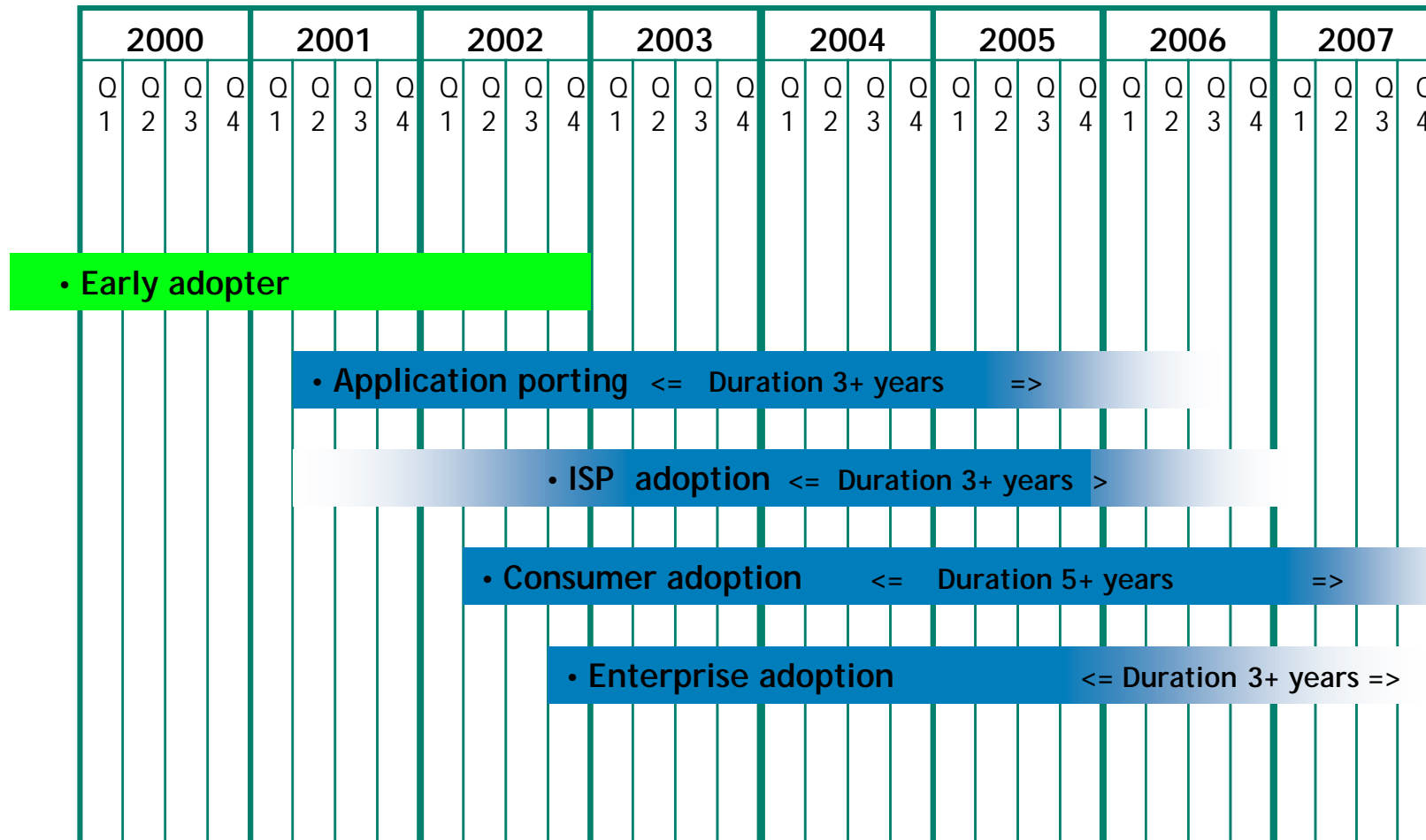
- **For billions of new users & new consumer's devices** (Asia, Europe & America) & (mobile phones, cars, PDAs, home & industrial appliances,...)
- **For always-on access** (cable, xDSL, wireless, ethernet-to-the-home,...)
- **For applications that are difficult, expensive, or impossible to operate through NATs** (IP telephony, IP Fax, peer-to-peer gaming, home servers,...)



IPv6 Timeline

(A pragmatic projection)

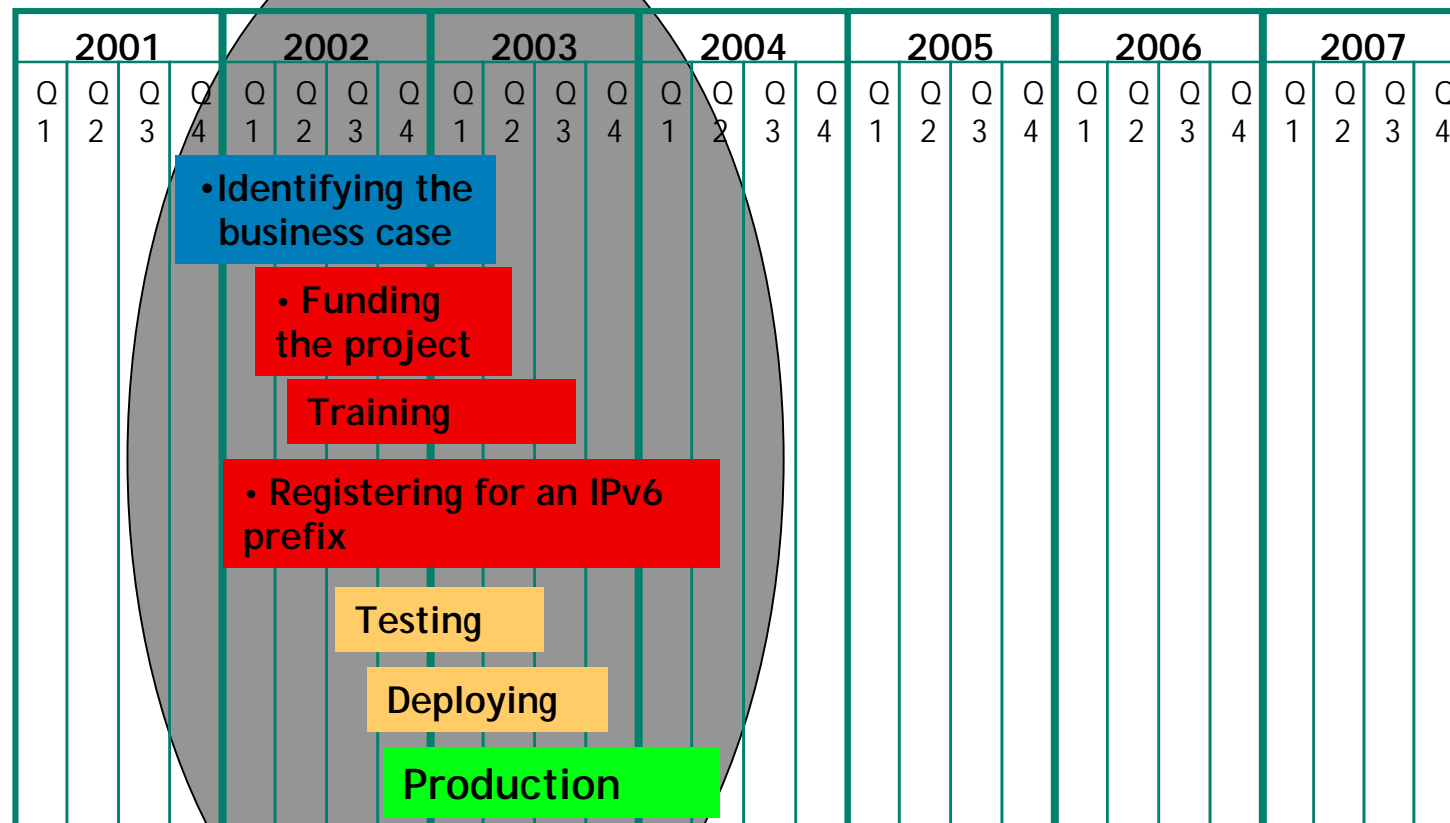
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An IPv6 project Timeline

(An other pragmatic projection)

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How long is needed for each phase of an IPv6 deployment project?

Cisco IOS IPv6 Phase I

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Cisco IOS
Upgrade
=
Free IPv6

Cisco IOS Release	IPv6 Features Supported
Phase I Early Adopters Cisco IOS 12.2(2)T, (4)T Any router able to run 12.2T, from Cisco 800 to Cisco 7500 IP Plus, Enterprise and SP images	IPv6 Basic specification (RFC 2460) ICMPv6, Neighbor Discovery Stateless auto-configuration RIPv6 (RFC 2080) Multi-Protocol Extensions for BGP4 (RFC 2843 & 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

Cisco IOS IPv6 Phase II

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Cisco IOS Release	IPv6 Features Under Development
Phase II Backbone Deployment On-Going 12.2(8)T 12.0(21)ST	i/IS-ISv6 CEFv6/dCEFv6 AAA/Dialer Pool, NAT-PT Extended Access Control List IPv6 over IPv4 GRE Tunnels IPv6 Provider Edge router (6PE) over MPLS DNS AAAA client Link-Local BGP Peering CDP, SSH, IPv6 MIB Phase I Sustaining

Extensive Platform Support

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Check latest release number & availability with your local Cisco team

Cisco IOS 12.2T

Cisco 800 series Routers

Cisco 1400 series Routers

Cisco 1600 series Routers

Cisco 1700 series Routers

Cisco 2500 series Routers
[12.2(4)T]

Cisco 2600 series Routers

Cisco 3600 series Routers

Cisco 4500/4700 series
Routers [12.2(2)T only]

Cisco 7100 series Routers

Cisco 7200 series Routers

Cisco 7500 series Routers



Cisco IOS 12.0ST

Cisco 12000 series Routers

Cisco IOS 12.2S

Cisco 7200 series Routers

Cisco 7500 series Routers

Cisco 7600 series Routers

Catalyst 6500 series

Cisco IOS 12.2(4)XF1

Cisco ubr7100, ubr7200,
ubr10012. Tunnels only

Cisco IOS 12.2B

Cisco 7400

Cisco IOS IPv6 EFT only

AS5300, 5400

IPv6 Deployment Scenarios

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- **Many ways to deliver IPv6 services to End Users**
 - End-to-end IPv6 traffic forwarding is the Key feature
 - Minimize operational upgrade costs
- **Service Providers and Enterprises may have different deployment needs**
 - Incremental Upgrade/Deployment
 - ISP's differentiate Core and Edge infrastructures upgrade
 - Enterprise Campus and WAN may have separate upgrade paths
- **IPv6 over IPv4 tunnels**
- **Dedicated Data Link layers for native IPv6**
- **Dual stack Networks**
 - IPv6 over MPLS or IPv4-IPv6 Dual Stack Routers

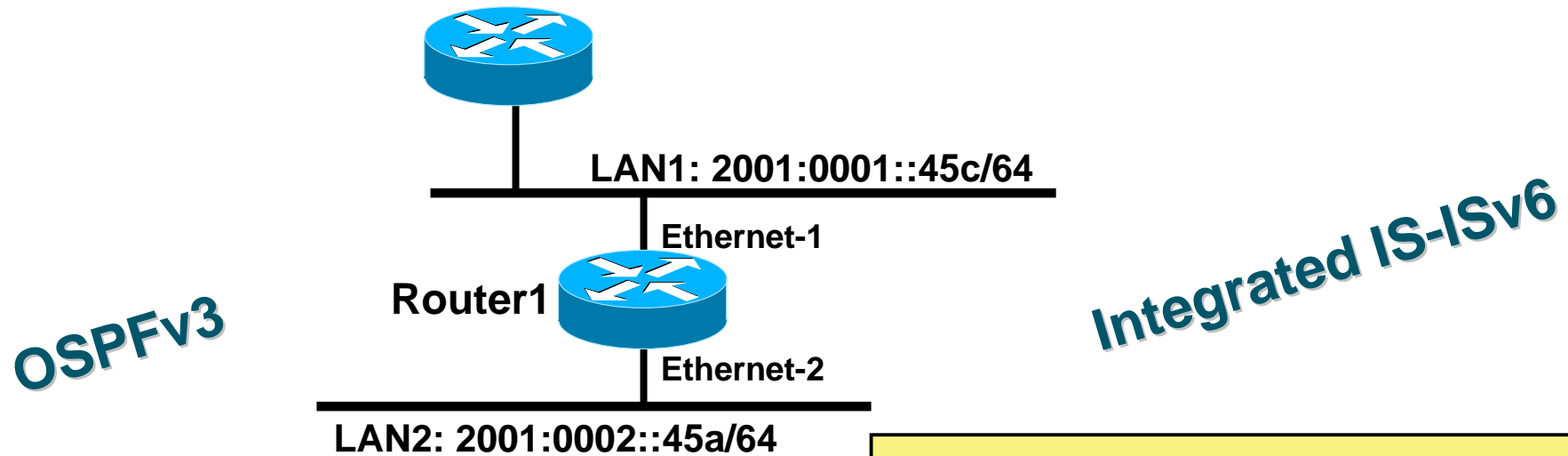


Routing in IPv6

- As in IPv4, IPv6 has 2 families of routing protocols: IGP and EGP
 - IGP are RIPng (RFC 2080), Cisco EIGRP for IPv6, OSPFv3 and Integrated IS-ISv6
 - EGP is MP-BGP4 (RFC 2858 and RFC 2545)
- IPv6 still uses the longest-prefix match routing algorithm.
- i/IS-ISv6 (draft-ietf-isis-ipv6-02)
 - Integrated IGP for IPv4 & IPv6
- OSPFv3 (RFC 2740)
 - « Ships in the Night » routing, has to run OSPFv2 for IPv4
- Cisco IOS supports all of them
 - Pick one meeting your objectives
- IPv6 tunnels & Routing considerations, eg. 6to4 tunnels

Configuring Cisco IOS IPv6 Routing

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```
Router1#
interface loopback 0
  ip address 192.222.222.1 255.255.255.0
interface ethernet-1
  ipv6 address 2001:0001::45c/64
  ipv6 ospf 1 area 1 enable

interface ethernet-2
  ipv6 address 2001:0002::45a/64
  ipv6 ospf 1 area 1 enable

ipv6 router ospf 1
  redistribute static
```

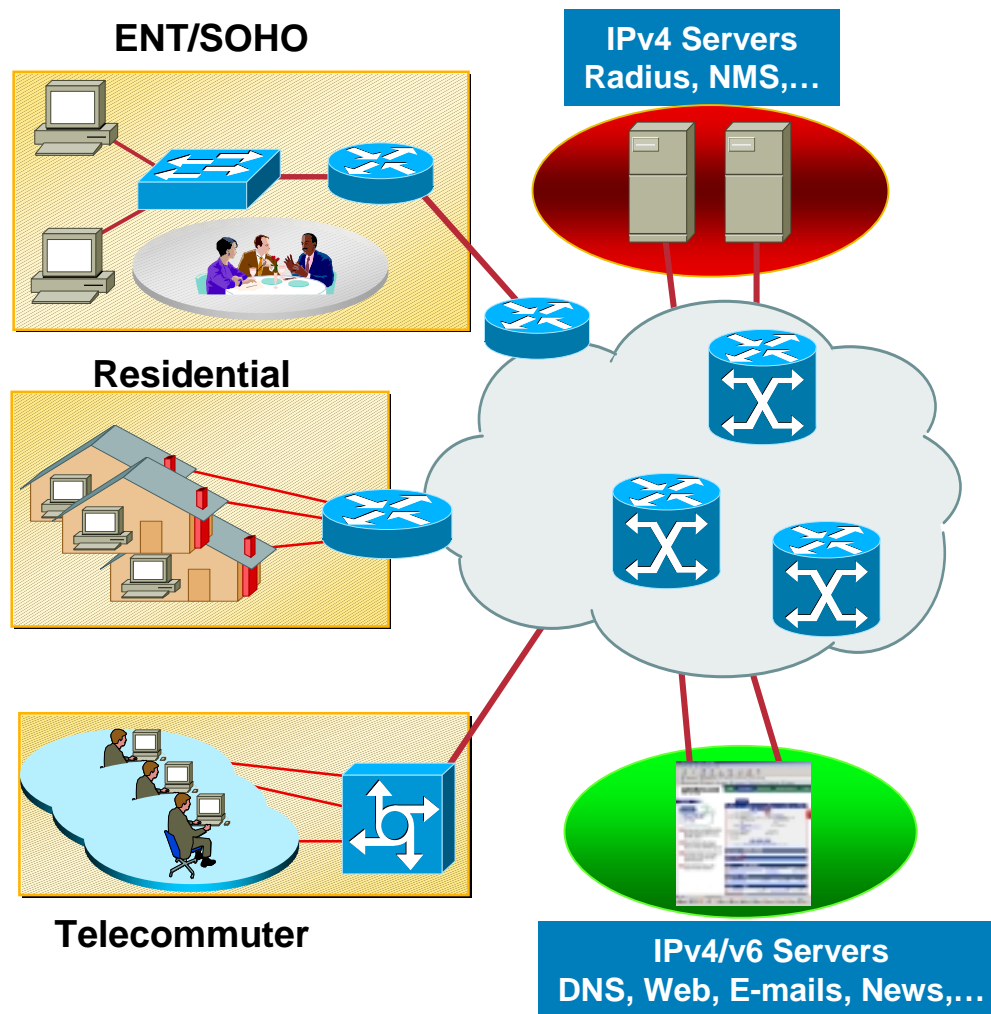
```
Router1#
interface ethernet-1
  ipv6 address 2001:0001::45c/64
  ipv6 router isis

interface ethernet-2
  ipv6 address 2001:0002::45a/64
  ipv6 router isis

router isis
  address-family ipv6
  redistribute static
  exit-address-family
  net 42.0001.0000.0000.072c.00
```

Cisco IOS IPv6 Dialer Pool/AAA

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- Solutions to deploy IPv6 over Dial and DSL access
 - ATM RFC 1483 Routed
 - RBE for ATM RFC 1483 Bridged
 - PPPoA
 - PPPoE
- IPv6 prefix pools
- IPv6 AAA attributes
 - IPv6 prefix
 - IPv6 route
 - IPv6 ACL {In, Out}
- Proxy RA

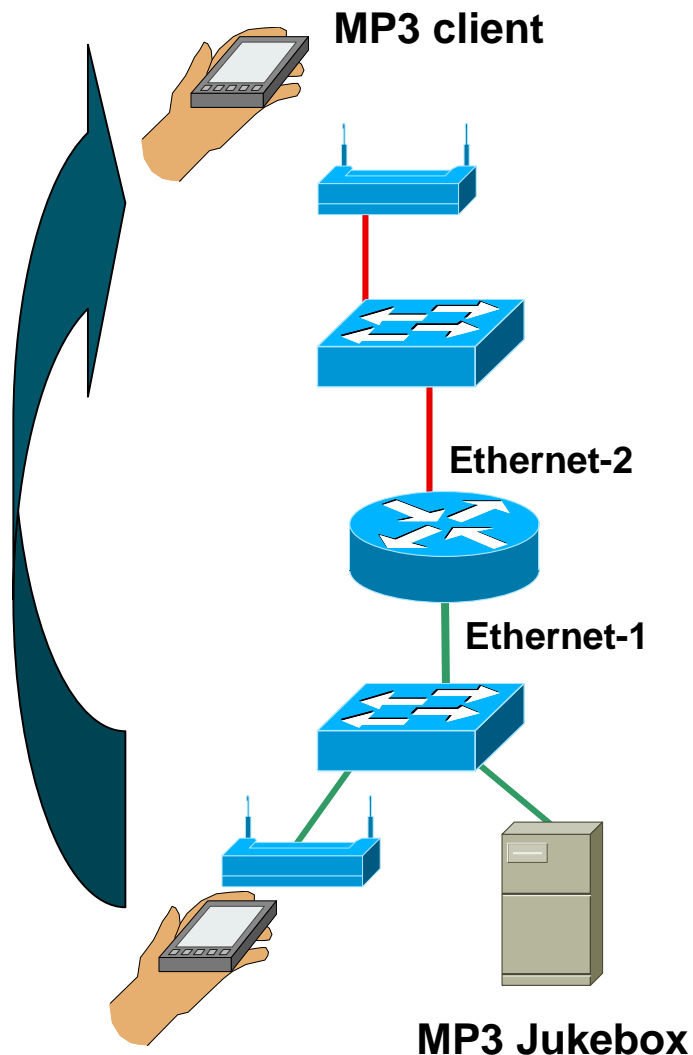
Cisco IOS IPv6 Phase III

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Cisco IOS Release	Evaluation of IPv6 Phase III Features
Phase III Enhanced Protocols Target date: CY 2002	OSPFv3: Visit our demo E-IGRP: H2CY02 Mobile IPv6: Home Agent Technology Preview, need stable IETF MIPv6 draft IPSec: Mandated by IPv6 specs, Authentication required by OSPFv3, Mobile IP Binding Association, Network Management IPv6 Multicast: MLD, PIMv2 SM, PIM SSM as first candidates.

Cisco IOS Mobile IPv6 HA A Technology Preview

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Cisco IOS Mobile IPv6 Home Agent

- Built on IETF MIPv6 draft 13
- no IPsec support, waiting for IETF MIPv6 WG status
- Binding update can be filtered by source address using ACL

Cisco IOS IPv6 Phase III

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Cisco IOS Release	Evaluation of IPv6 Phase III Features
Phase III Enhanced Protocols Target date: CY 2002 And Later	Routing: OSPFv3 & E-IGRP Enhanced Services: Mobile IPv6, IPSec, IPv6 Multicast, IPv6 QoS Management: Netflow IPv6 record, SNMP over IPv6, MIB's enhancements Tunnels: IPv6 over IPv6, IPv4 over IPv6 tunnels, ISATAP IETF IPv6 Enhancements: eg. R.A. extensions, ICMPv6 prefix delegation, Hardware Acceleration: in-progress Encapsulation: Add enhanced support for DPT, Cable and DSL

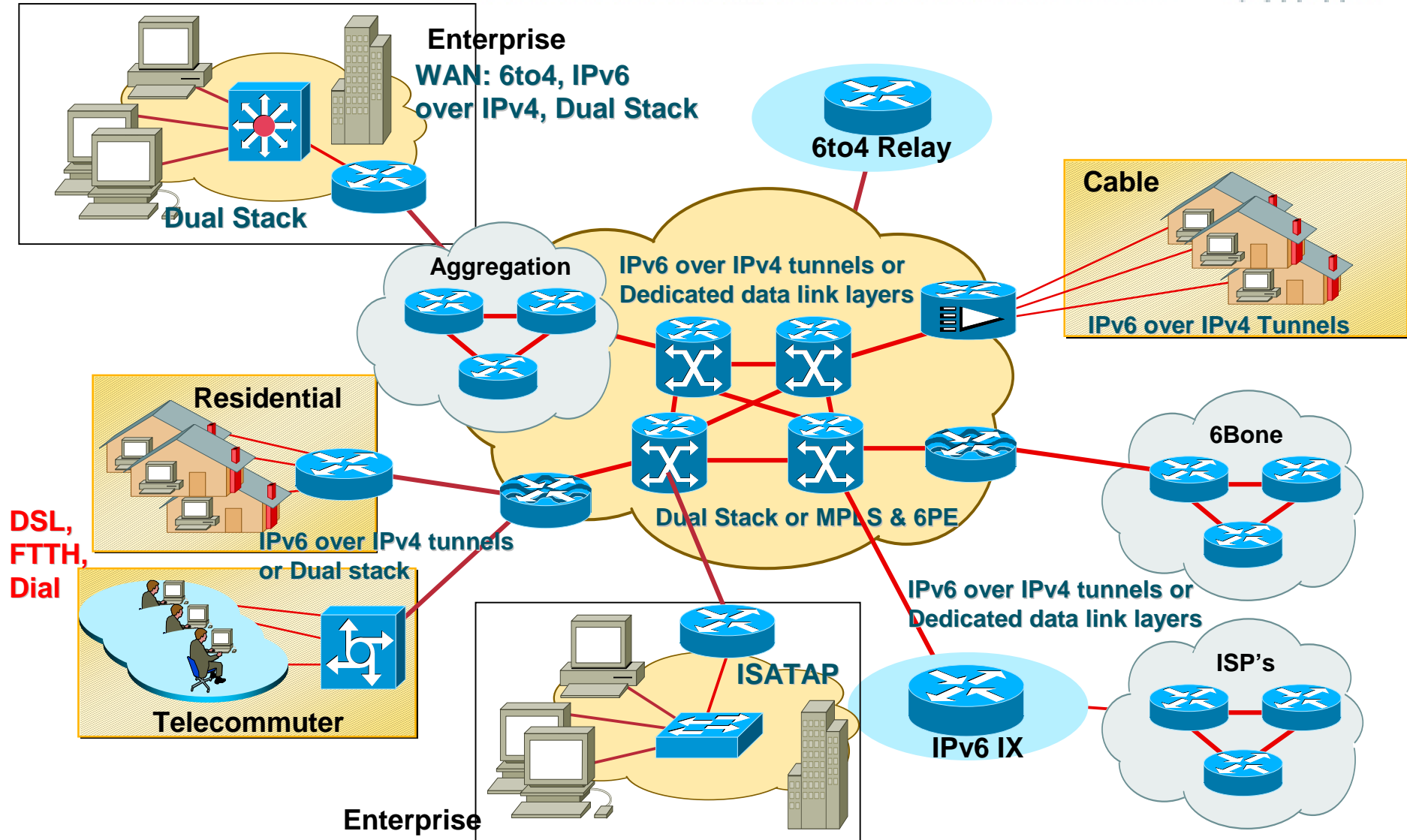
IPv6 Deployment Phases

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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	Requires a major upgrade. Valid on Campus or Access networks as IPv6 hosts may be located anywhere
IPv6-Only	Requires upgrading all devices. Valid when IPv6 traffic will become preponderant

Moving IPv6 to Production, running Cisco IOS

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..a lot to do still..

Though IPv6 today has all the functional capability of IPv4:

- **Implementations are not as advanced
(e.g., with respect to performance, multicast support, compactness, instrumentation, etc.)**
- **Deployment has only just begun**
- **Much work to be done moving application, middleware, and management software to IPv6**
- **Much training work to be done
(application developers, network administrators, sales staff,...)**
- **Some of the advanced features of IPv6 still need specification, implementation, and deployment work**

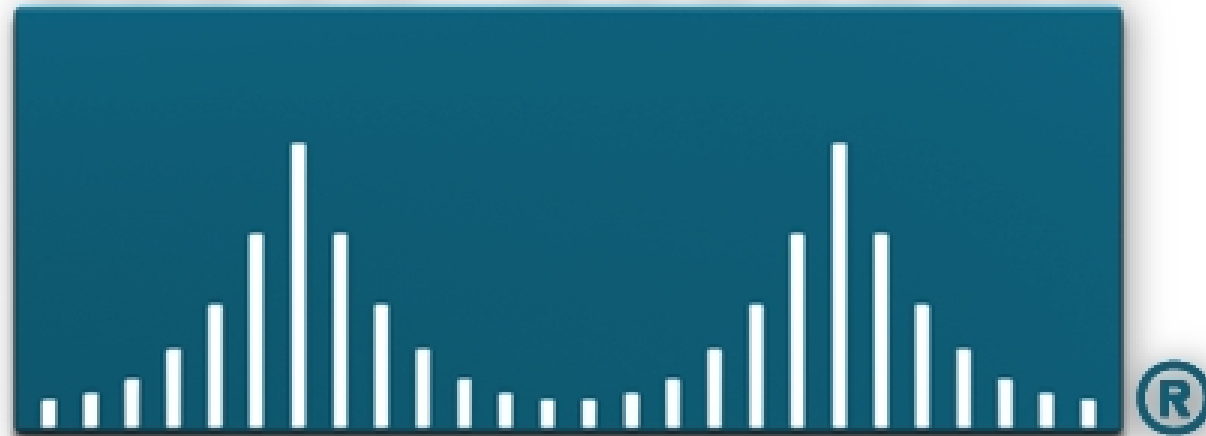
IPv6—Conclusion

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IPv6 Ready for Production Deployment?

- **Evaluate IPv6 products and services, as available**
 - Major O.S., applications and infrastructure for the IT industry
 - New IP appliances, e.g...3G, gaming, consumers...
 - IPv6 services from ISP
- **Plan for IPv6 integration and IPv4-IPv6 co-existence**
 - Training, applications inventory, and IPv6 deployment planning
 - Deploying IPv6 Networks (now), ABCs of IP Version 6 (coming)
- **Run IPv6 on Cisco IOS: the confluence of IPv4/v6**
www.cisco.com/ipv6

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