



Migrationsmöglichkeiten von IPv4 zu IPv6

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Agenda

- **Tunnellösungen**
- **Dual-Stack**
- **IPv6 in MPLS Netzen**
- **Der letzte Ausweg - Translation**
- **IPv6 @ Cisco**

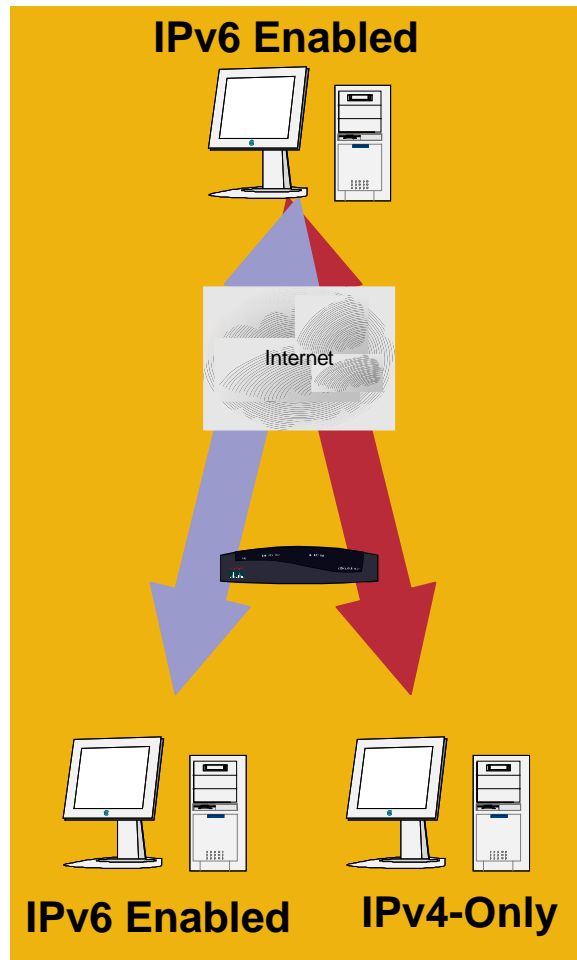
Transition Variables

- **Business Requirements**
 - Time frame required to meet a set of business requirements
 - Need for applications to communicate between administrative domains
 - New functions that can exist without extensive access to legacy IPv4 nodes
 - Mission critical applications that must interoperate with legacy nodes
- **Network Security Requirements**
 - Firewall support for both IPv4 & IPv6
 - Telecommuters and Mobile Node access methods
- **Availability of software & hardware upgrades for existing nodes**
 - Source code availability for custom applications
- **Order and rate for IPv6 deployment within a network**
 - Current use of IPv4 private addresses and NAT
 - Provider support for IPv6

IPv4-IPv6 Transition / Co-Existence

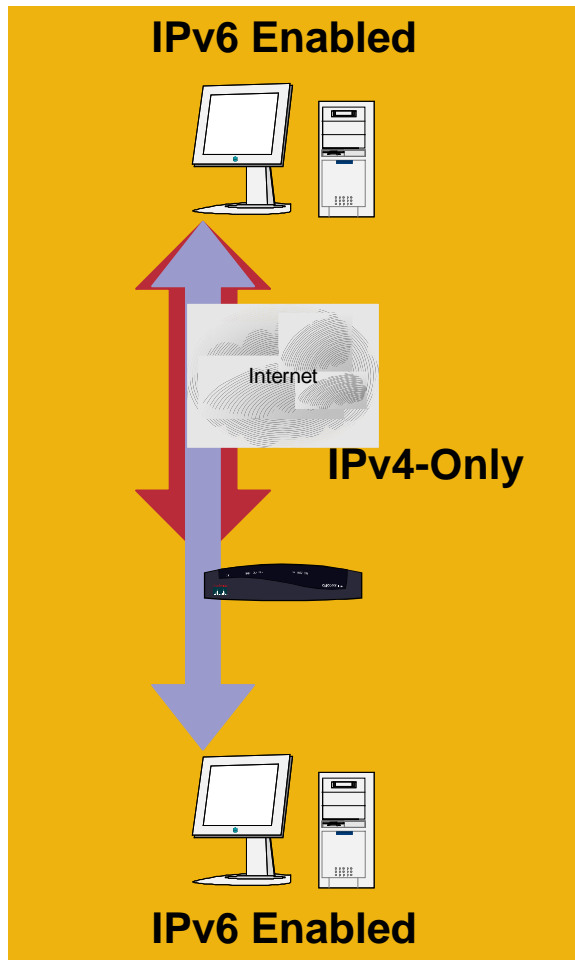
- A wide range of techniques have been identified and implemented, basically falling into three categories:
 - **Dual-stack techniques**, to allow IPv4 and IPv6 to co-exist in the same devices and networks
 - **Tunneling techniques**, to avoid order dependencies when upgrading hosts, routers, or regions
 - **Translation techniques**, to allow IPv6-only devices to communicate with IPv4-only devices
- Expect all of these to be used, in combination

Tools – Dual Stack



- **Primary tool**
- **Allows continued 'normal' operation with IPv4-only nodes**
- **Address selection rules generally prefer IPv6**
- **DSTM variant allows temporary use of IPv4 pool**

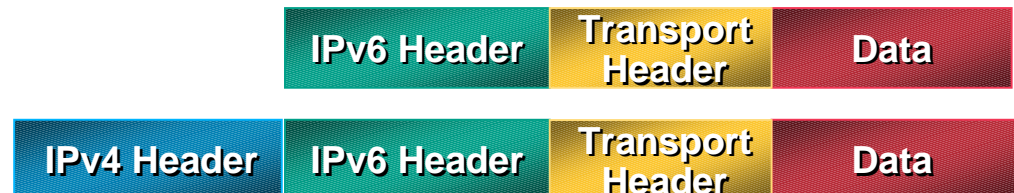
Tools – Tunneling



- Nodes view IPv4 network as a logical NBMA link-layer
- May be used in conjunction with dual-stack

IPv6 over IPv4 Tunnels

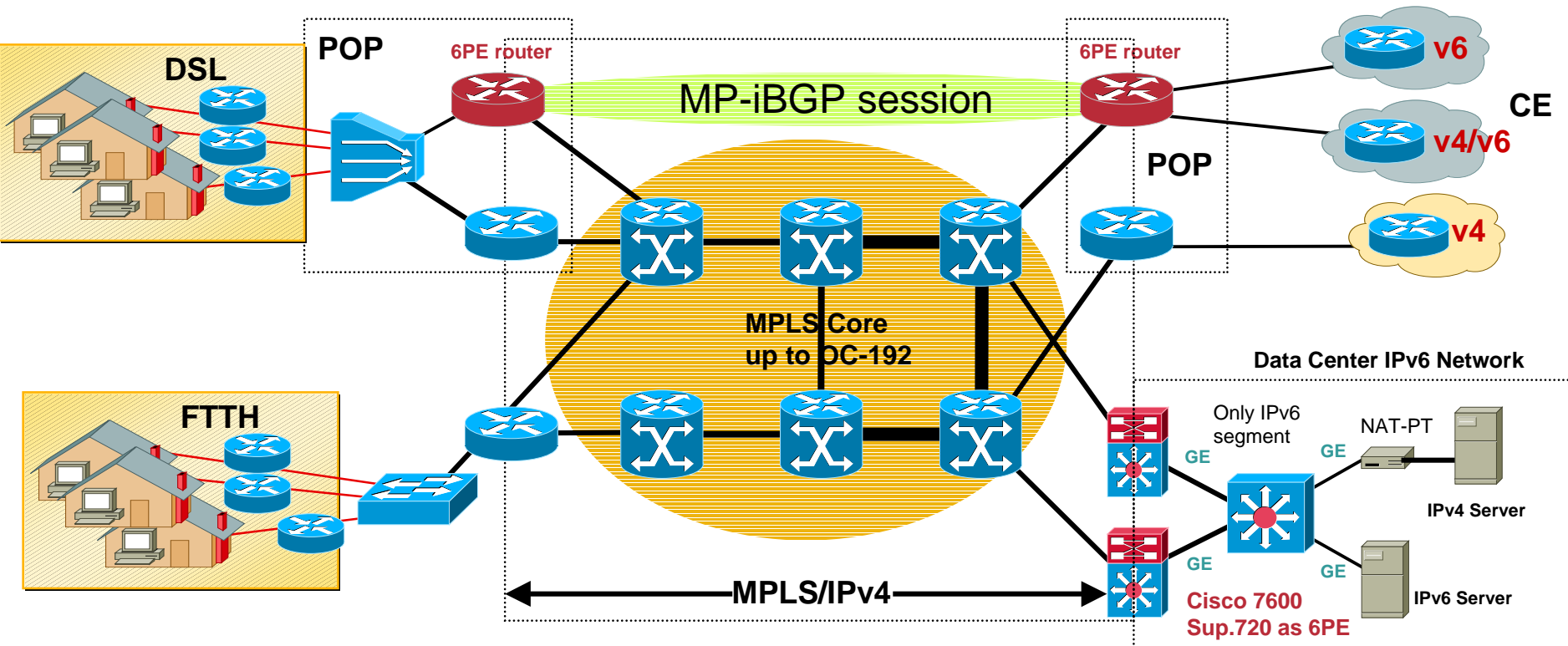
- **Several Tunnelling mechanisms defined by IETF**
 - Apply to ISP and Enterprise WAN networks**
 - GRE, Configured Tunnels, Automatic Tunnels using IPv4 compatible IPv6 Address, 6to4**
 - Apply to Campus**
 - ISATAP, 6over4**
- **No impact on Core infrastructure**
 - Either IPv4 or MPLS**



IPv6 over MPLS Infrastructure

- **Some 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 (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

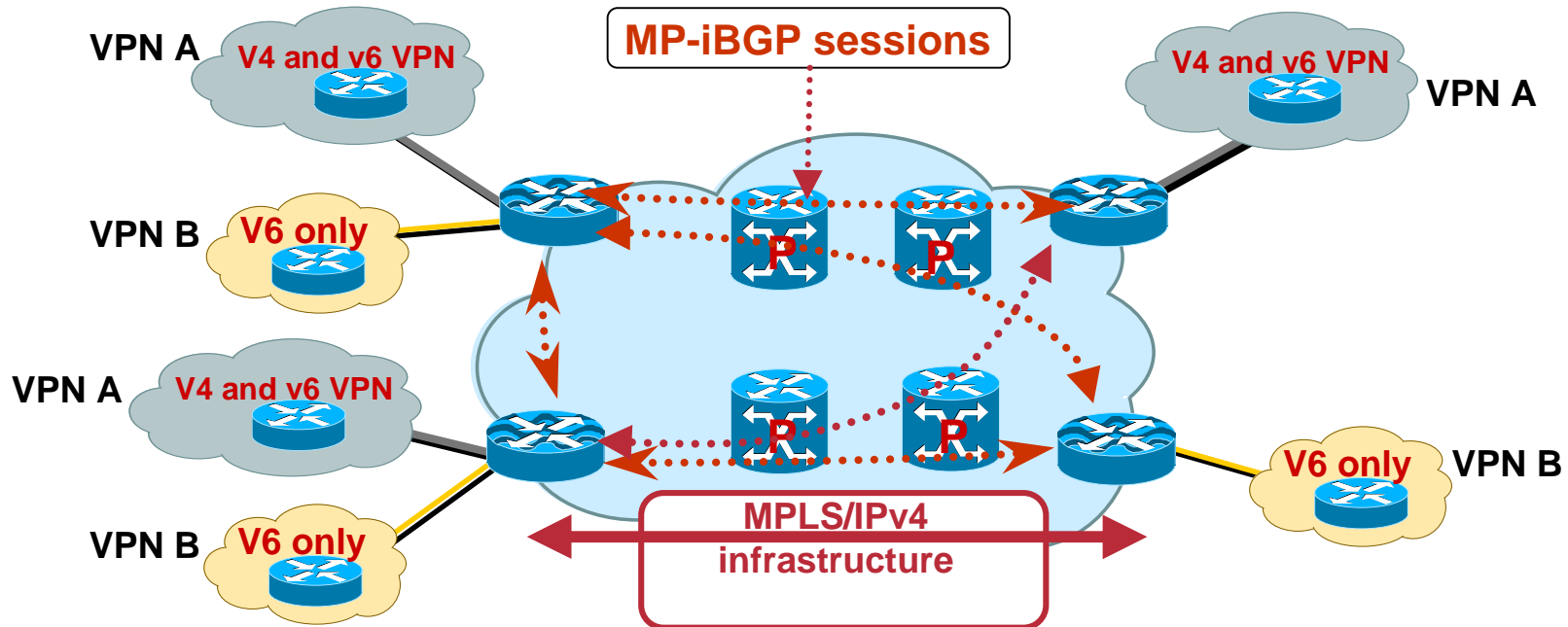
Minimum Infrastructure Upgrade for 6PE



- **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**

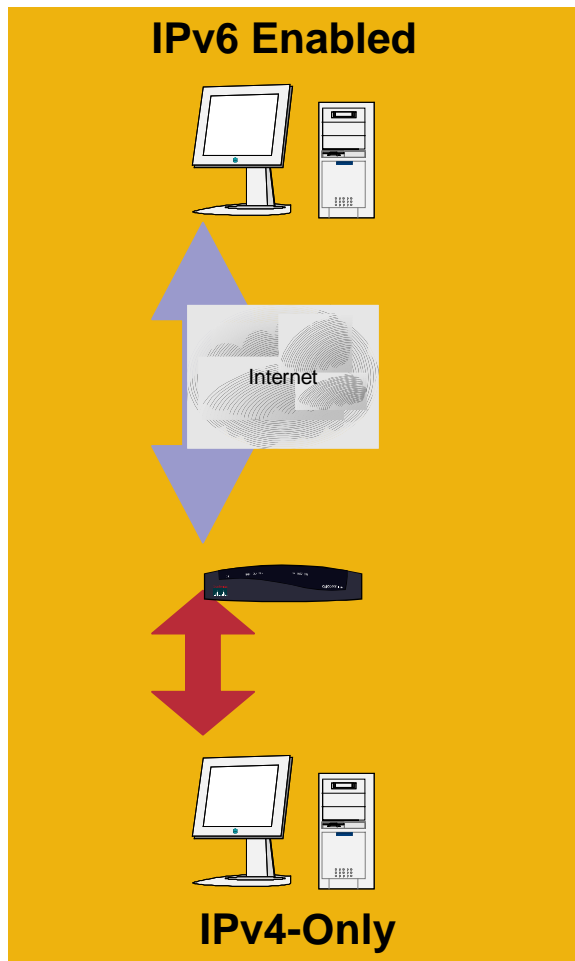
IPv6 VPN Provider Edge Router (6VPE)

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- For VPN customers, IPv6 VPN service is the same as IPv4 VPN service
- draft-ietf-ppvpn-bgp-ipv6-vpn-03 – Cisco co-authored
- 6VPE is added only when and where the service is required

Tools – Translation



- **Tool of last resort**
- **Allows for the case where some components are IPv6-only while others are IPv4-only**
- **Pay attention to scaling properties**
- **Same application issues as IPv4/IPv4 translation**

Cisco IPv6 Technology Strategy

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Intelligent Services

Cisco IOS IPv6 Feature set

Innovation

Performance

IPv6 Hardware Assisted
Forwarding

**Evolutionary
Infrastructure**

IPv6 Solutions
Focusing on Integration
and Co-Existence

Phases of Cisco IPv6 Program

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Phase 1

Phase 2

Phase 3

Phase 4

Done

Done

On going

Planned



IPv6 Early Adopters
Deployment

IPv6 Production
Backbone Deployment

IPv6 Enhanced
Services

IPv6 Solutions
Program

1996

2001

2002

2003

2004

2005 & Beyond

Summary

- **Transition will not be a quick process**
- **Tool set goal : minimize interdependence**
- **Dual-stack & Tunneling before Translation**
most difficult cases caused by IPv6-only
- **Recognize environment characteristics**
- **Applications will drive deployments**

More Information

- **CCO IPv6** - <http://www.cisco.com/ipv6>
- **The ABC of IPv6**
http://www.cisco.com/en/US/products/sw/iosswrel/products_abc_ios_overview.html
- **IPv6 e-Learning [requires CCO username/password]**
<http://www.cisco.com/warp/customer/732/Tech/ipv6/elearning/>
- **IPv6 Access Services :**
http://www.cisco.com/warp/public/732/Tech/ipv6/docs/ipv6_access_wp_v2.pdf
- **ICMPv6 Packet Types and Codes TechNote:**
<http://www.cisco.com/warp/customer/105/icmpv6codes.html>
- **Cisco IOS IPv6 Product Manager** – pgrosset@cisco.com

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