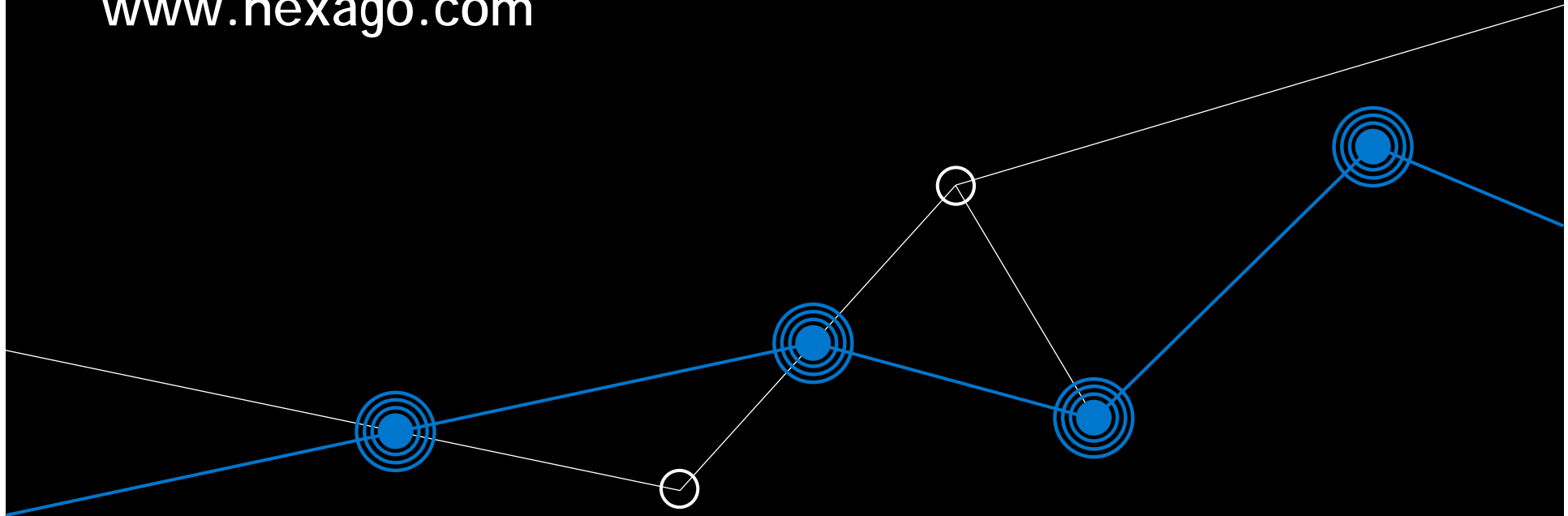


IPv4 to IPv6 transition and migration for fixed and mobile networks

www.hexago.com

06/2008



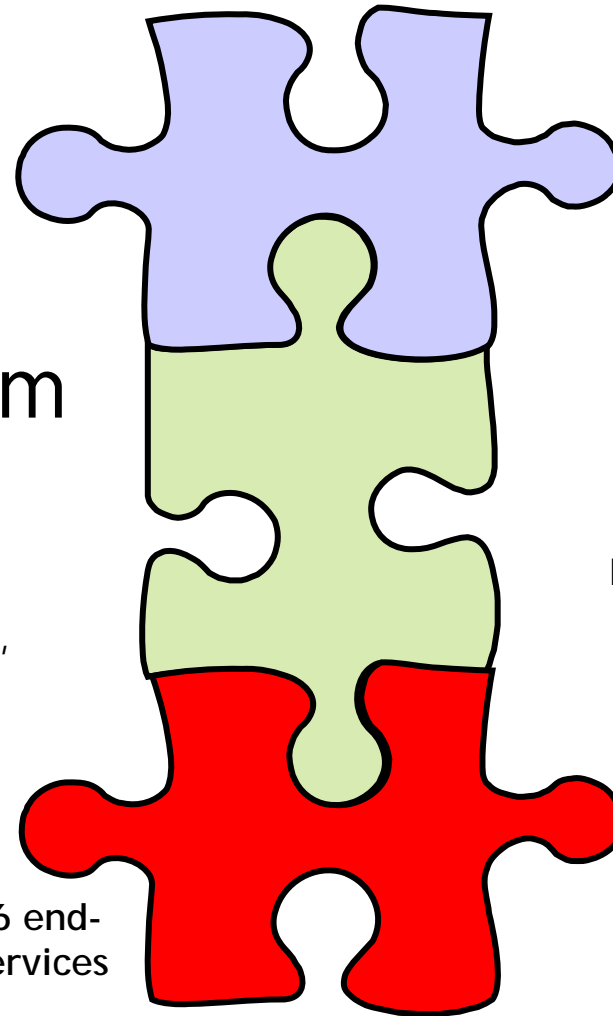
IPv6 Transition Components



Operating System

The OS must be dual-stack
IPv6 support in Solaris 7,
Windows 2000 , FreeBSD 4.0
(KAME), Linux (Usagi) in 2000,
Mac OS X 10.2...

Network must be IPv6 end-
to-end in order for services
to be deployed.



Network

Applications

Both server and client
must be IPv6.

Examples: Bind, Sendmail,
Apache, FTP server and
clients, Telnet, IE, Mozilla,
Lynx, Opera, Windows Media
Player, OpenSSH, Putty,
Quake, Icecast,
GnomeMeeting, OpenLDAP,
Ethereal, XEmacs and others.

Hexago provides tools to
deploy IPv6 networking
rapidly and at low cost.

Transition Mechanisms Classes

- Dual Stack
- Translation
- Tunneling

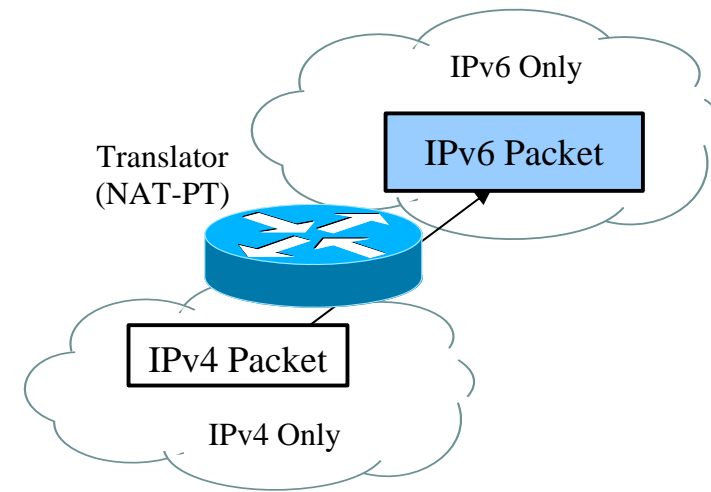
Transition Mechanisms Classes

- Dual Stack
 - Running native IPv6 (dual-stack or separate networks) is ideal, but not always deployable rapidly
 - Too costly
 - Hardware or software sometimes cannot be upgraded
 - Devices are not under the same administrative authority
 - Have to manage two separate networks

Transition Mechanisms Classes

- Continue

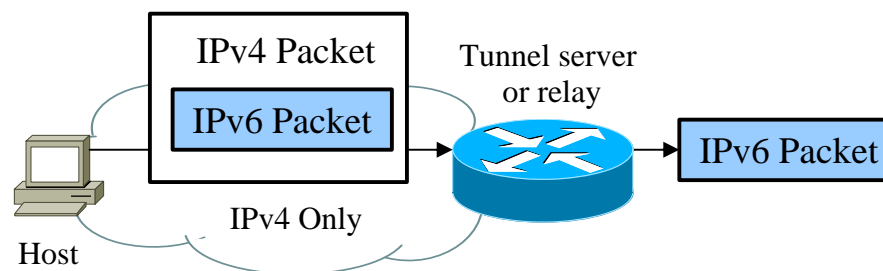
- Translation
 - Transforms an incoming packet to another protocol.
 - Issues:
 - Hard to translate protocols with embedded addresses (DNS, FTP), an application-level gateway is required.
 - No multihoming, multicast and IPsec
 - Requires keepalive mechanisms.
 - NAT-PT is being deprecated
(see draft-ietf-v6ops-natpt-to-exprmntl-03.txt)



Transition Mechanisms Classes

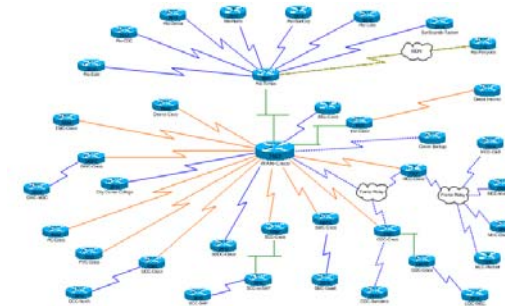
- Continue

- Tunneling
 - Involves the encapsulation of each IPv6 packet to transit the IPv4 network.



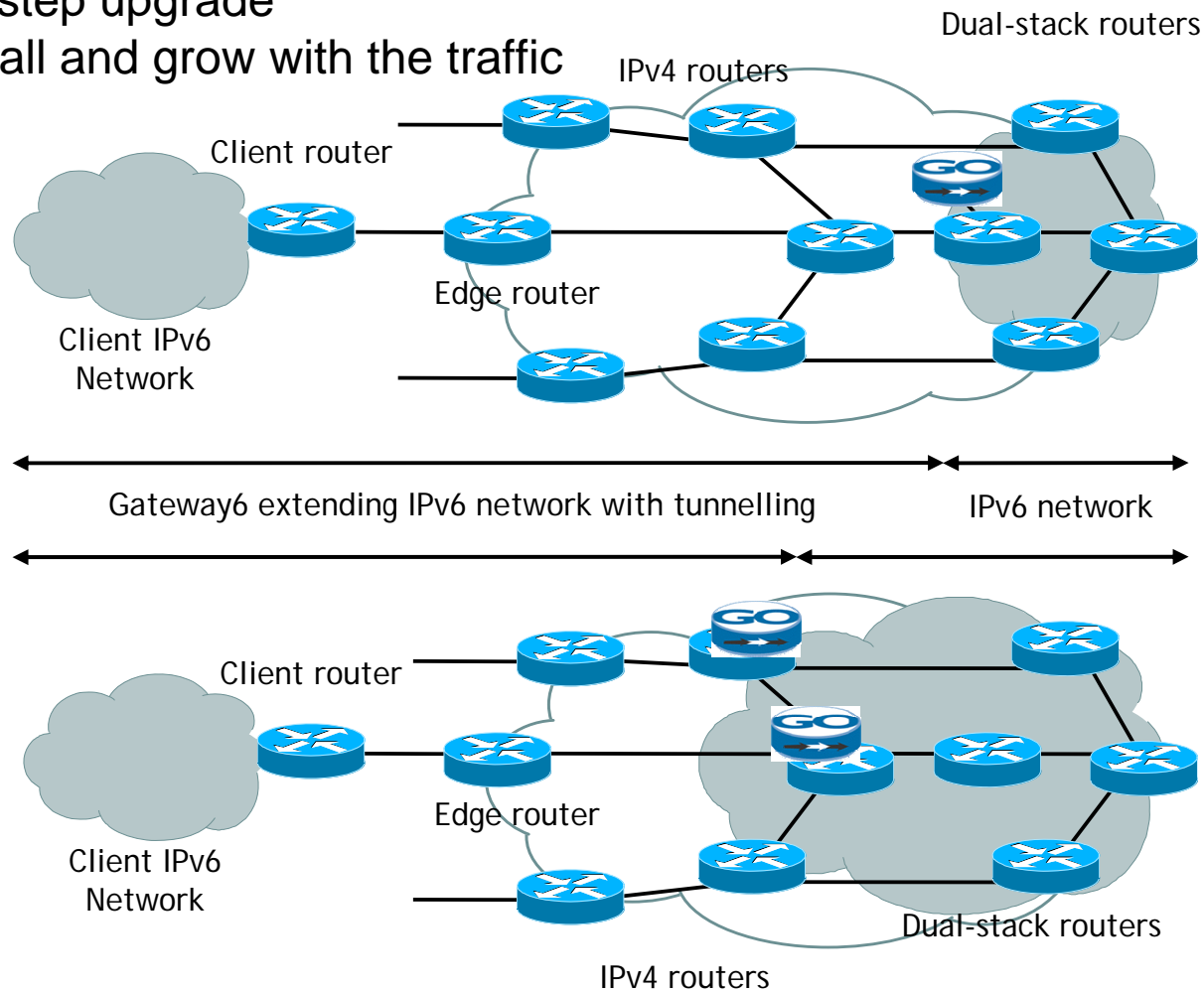
Types Of Tunneling Mechanisms

- **Manual tunnels:**
 - Done by hand
 - Not scalable (hard to manage over 100)
- **Automatic tunneling**
 - Includes 6to4, ISATAP, Teredo
 - Low maintenance and easy to deploy
 - Weaker security (see RFC3964 on 6to4 security)
 - IPv6 addresses and prefix are not permanent (renumbering is often required)
 - Harder to debug, return path is often asymmetric
- **Negotiated tunneling**
 - Uses a client server approach
 - Can be layer 2 (L2TP) or layer 3 (Gateway6/TSP)
 - Supports authentication and AAA systems
 - Permanent IPv6 addresses
 - Prefix delegation is permanent



Tunneling Adds IPv6 Gradually

Step by step upgrade
Start small and grow with the traffic



Gradual Growth

Scaling is a key advantage of the Gateway6 solution

- Clients can be preconfigured and left alone
- The client will automatically find the closest Gateway6
 - Redirect function in TSP makes this possible
 - Anycast or client discovery mechanisms finds closest Gateway6

The operator can deploy the clients and start only with a few Gateway6 servers and then add capacity as the traffic volume increases

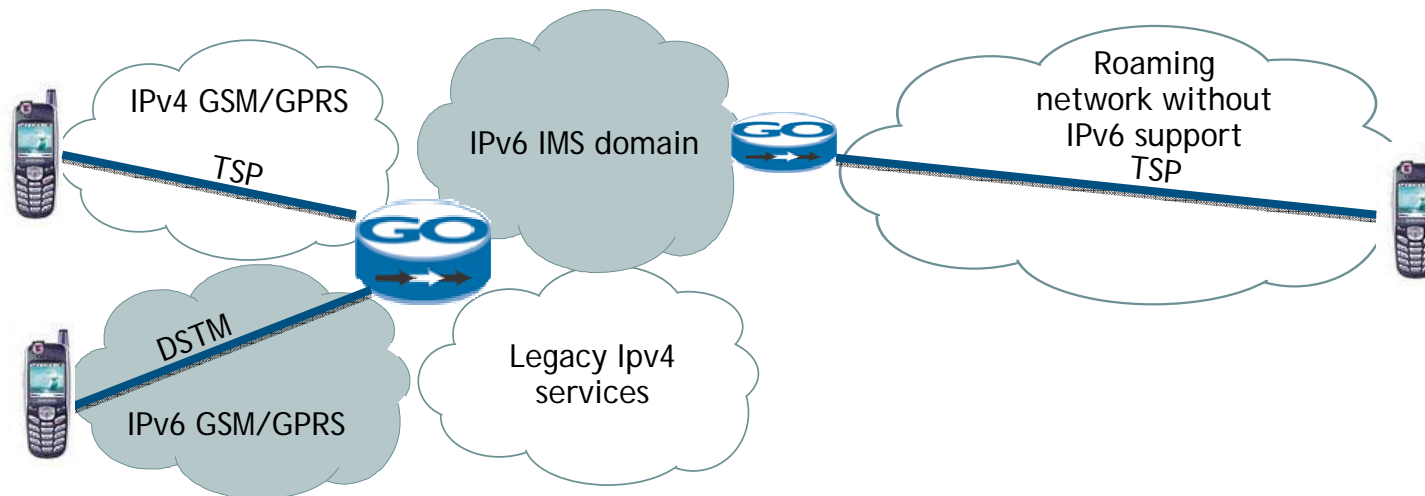
- All users get IPv6 support
- As traffic increases more Gateway6 are deployed
- In the end the tunneling will only be used to bridge the access network, the last mile
- Becomes a permanent deployment in part of the network where there is no need to replace the equipment

Gateway6 Applications - Mobile

IPv6 over IPv4 to start IPv6 3G/IMS services today

IPv6 roaming in IPv4 networks

Various solutions to access IPv4 services in IPv6 network

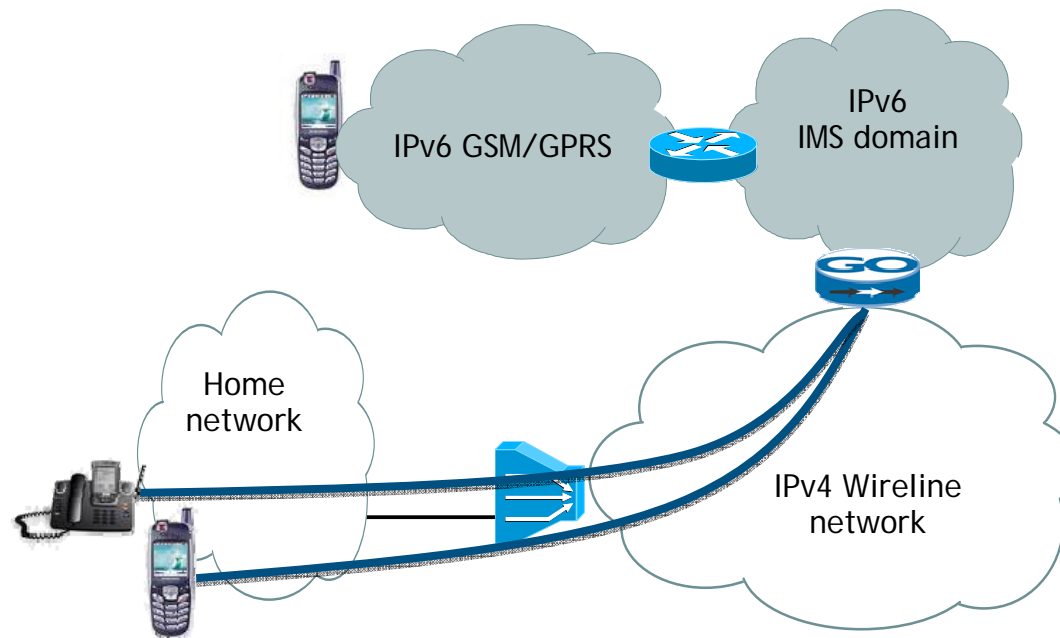


Gateway6 Applications - FMC

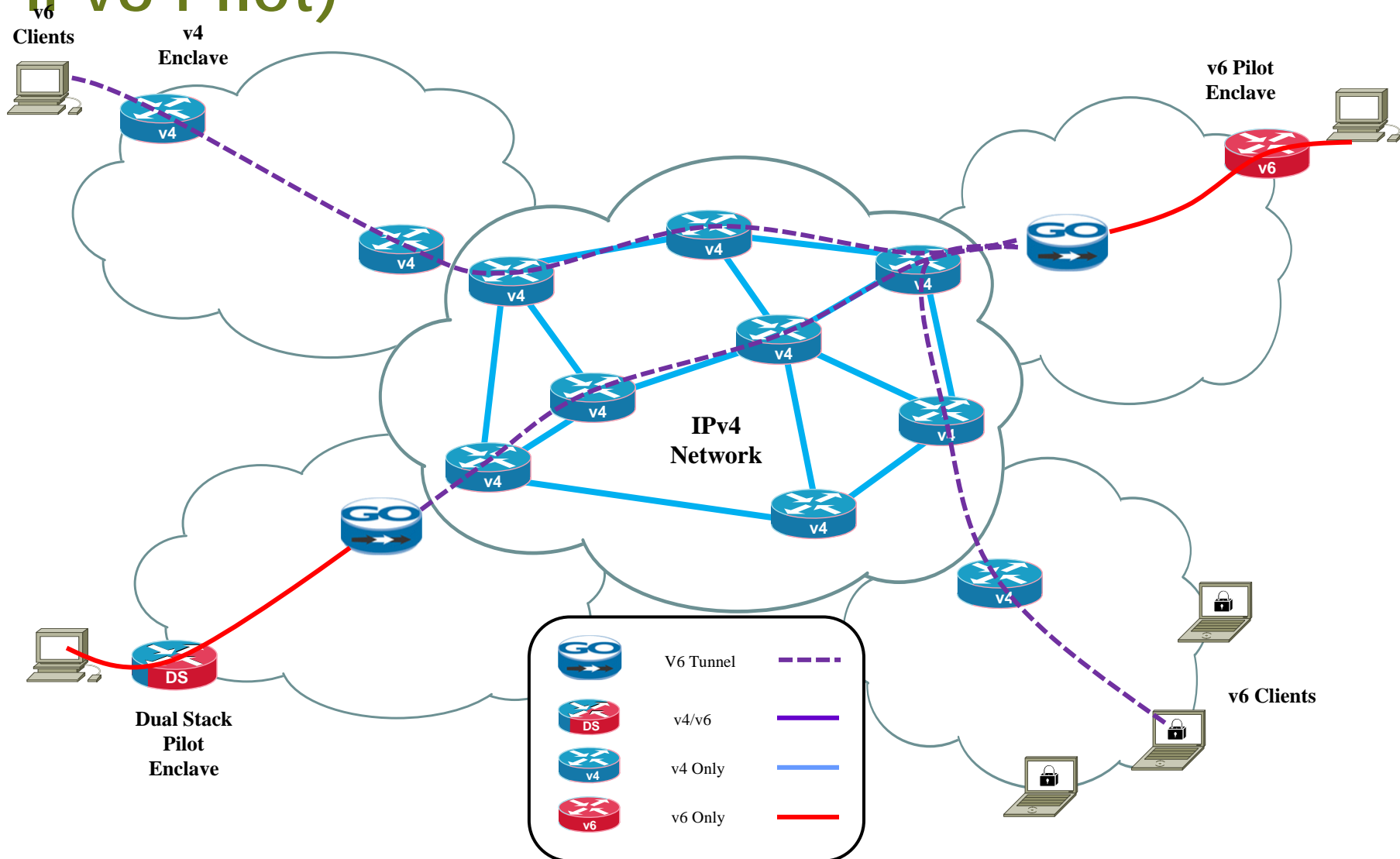
Provide a scalable platform for home access services

Accessing IPv6 IMS domain from wireline/wireless networks

IPv4 - IPv6 IMS interoperability - in progress



Transitioning Example (Phase 1 - IPv6 Pilot)



Transitioning Example (Phase 1)

IPv6 Pilots

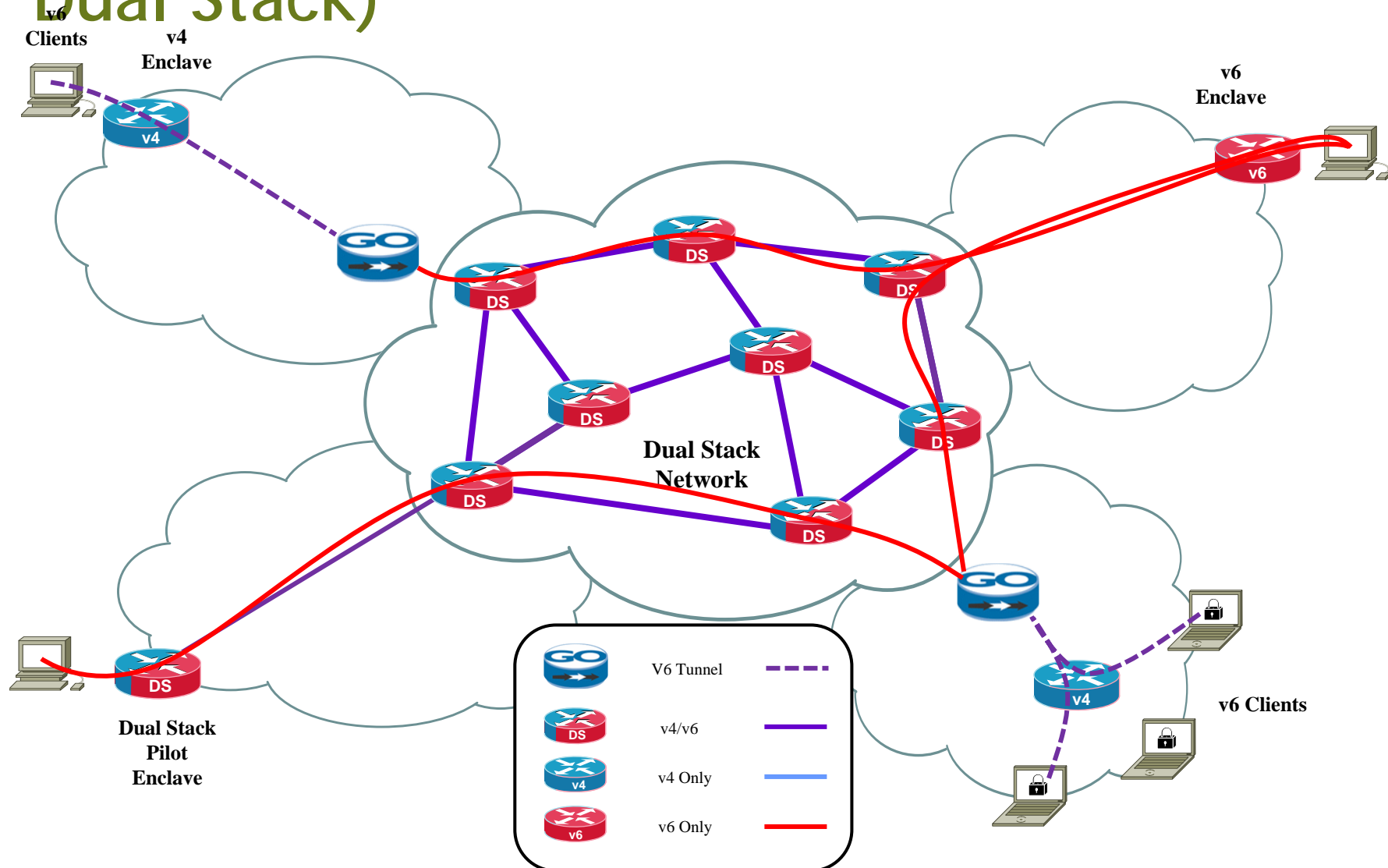
During Pilot Phase of Transition:

- Permit Managed, Dynamic IPv6 Tunnels to Pilot Enclaves
- Permit Managed IPv6 Tunnels between v6 Clients

Opportunities

- Utilization of Pilot Capabilities by v6 Community of Interest
- v6 Platform for Experimentation
- v6 Platform for v6 Application Development
- Transition Activities and Learning Without Large Upgrade Commitments

Transitioning Example (Phase 2 - Dual Stack)



Transitioning Example (Phase 2)

Dual Stack

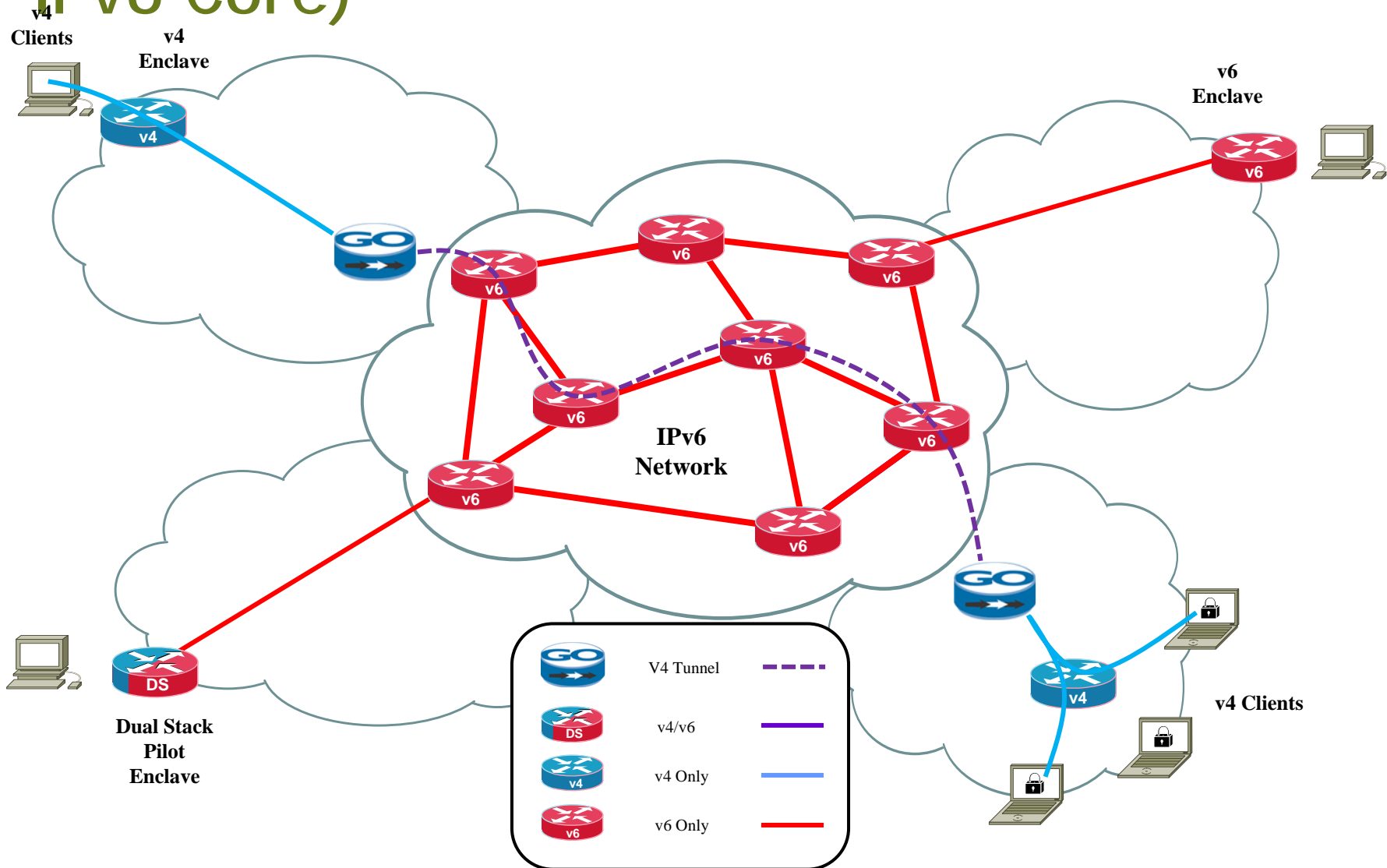
During Dual Stack Phase of Transition:

- Permit Managed, Dynamic IPv6 Tunnels to v6 Clients Through v4 Enclaves
- Permit Managed IPv6 Tunnels between v6 Clients That Lack Clear v6 Routing Path

Opportunities

- Utilization of v6 Capabilities by all v6 Communities of Interest and Clients
- v6 Platform Extension for Interoperability
- v6 Platform for v6 Application Transition
- Transition Activities and Learning Without Total v6 Upgrade Requirements

Transitioning Example (Phase 3 - IPv6 Core)



Transitioning Example (Phase 3)

v6 Core

IPv6 Native Phase of Transition:

- Permit Managed, Dynamic IPv4 Tunnels to v4 Clients Through v6 Enclaves
- Permit Managed IPv4 Tunnels between v4 Clients That Lack Clear v4 Routing Path

Opportunities

- Continue Utilization of v4 Capabilities by all Legacy v4 Communities of Interest and Clients
- v4 Platform Extension for Continued Interoperability
- v4 Platform for Legacy v4 Application Use

Summary

- IPv6 transition mechanisms are a complement to native IPv6 or dual-stack networks. It is important to combine all three techniques to achieve your goal.
- This technology can be used for government networks, universities, ISPs, etc to deploy IPv6 rapidly and cheaply.

Thank you.

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<http://www.hexago.com>

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