

# IPv6 Transition

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Yanick Pouffary

Member North American IPv6 Task Force [www.nav6tf.org](http://www.nav6tf.org)

Member IPv6 Forum Technical Directorate [www.ipv6forum.com](http://www.ipv6forum.com)

Hewlett Packard Distinguished Technologist

[Yanick.Pouffary@hp.com](mailto:Yanick.Pouffary@hp.com)

# Discussion

- Facts and Keys to Deploying IPv6 Successfully
- Practical Aspects of IPv6 Deployment and Roadmap
- Transition Mechanisms Available
- Transition Analysis

# IPv6 Deployment - Facts

- Facts:
  - Millions of nodes are running IPv4 today
  - Some nodes will never upgrade to IPv6
    - Large investment in IPv4 applications
- Consequences:
  - IPv4 and IPv6 will coexist for an extended period
  - Transition should prevent isolation of IPv4 nodes

# Keys to Deploying IPv6 Successfully

- No disruption - no Flag Day
  - IPv6 and IPv4 routers and hosts can interoperate
- No Dependencies - Incremental upgrade and deployment
  - IPv6 routers and hosts can be deployed in a highly diffused and incremental fashion
- Low start-up costs
  - Make transition as easy as possible for end-users, system administrators, and network operators

# Practical Aspects of IPv6 Deployment

- Analyze, Plan, Analyze, Plan your infrastructure
- Obtain addresses
- Pick appropriate deployment scenario
  - Routing/subnet layout
  - Transition tools
  - DNS
  - Network Management
- And then plan for hosts .....
- Keep it simple

# Practical Aspects of IPv6 Deployment

- Expect most systems will be software upgradeable
  - Beware of IPv4 implementations in hardware
  - Ask your vendors about their IPv6 plans before buying new hardware
- New and modified software
  - IP stack, DNS, DHCP, routing protocols
- Transparent for end users
- Network Administrator
  - Quite a lot to learn, but much has a familiar feel

# Separate or Align IPv4 and IPv6 Topologies



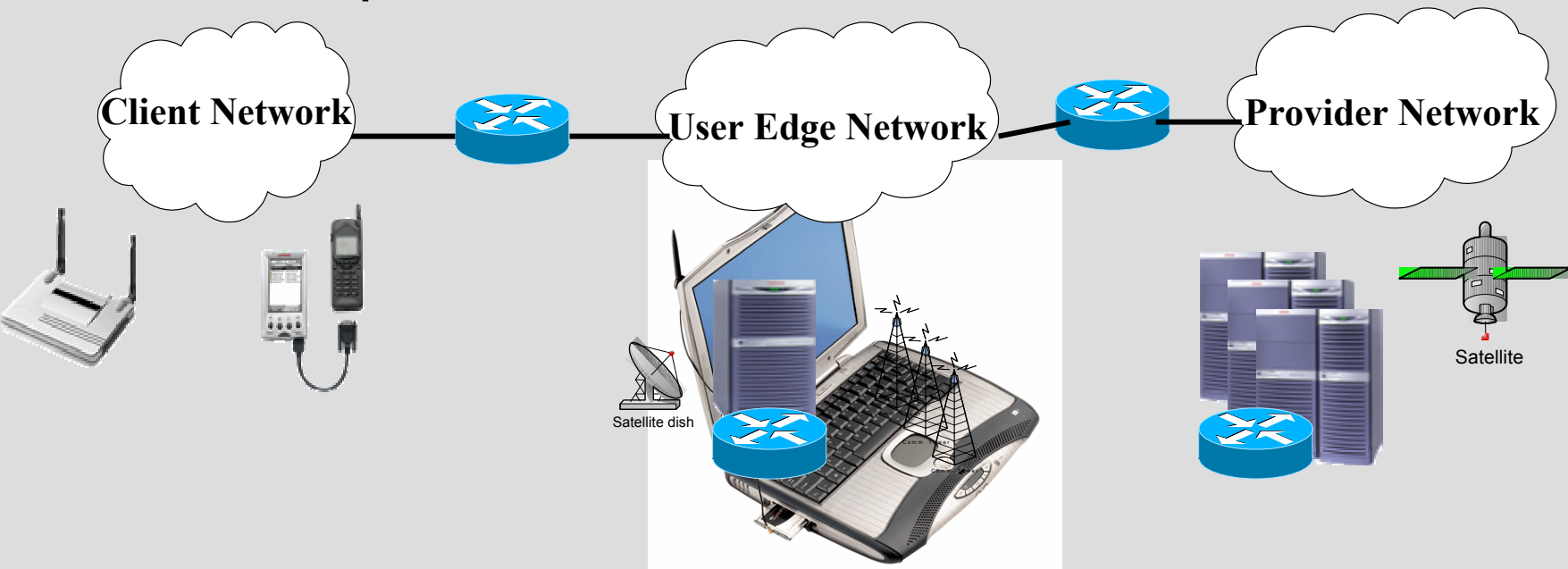
- SEPERATE
  - Keep the IPv6 topology logically separate from the IPv4 network
    - A separate IPv6 topology could replace an inefficient IPv4 topology
- ALIGN
  - Align the two topologies by using the same domain boundaries, areas, and subnet organization

Remember!

IPv4 and IPv6 can share same physical infrastructure, can coexist in the box and on the wire.

# Where can Network Topology Transition take place?

- At the client network within the user network.
- At the edge of the user network to the provider.
- At the provider network for the user network.





# Points of Transition (Geography)

- Packets over a local link
- Packets over a site
- Packets within an Intranet (multiple sites')
- Packets over a private Internet (multiple Intranets')
- Packets over the public Internet
- Packets over a Mobile IP Network (Wireless)
- Packets over a Mobile IP Network (Wireless) and to a Broadband Network (Wireline) or the Reverse
- Packets from IPv6 Network thru IPv4 Cloud to IPv6 Network
- Packets from IPv4 Network thru IPv6 Cloud to IPv4 Network

# Points of Transition (Network Nodes)

- Clients
- Servers
- Routers
- Gateways
- Mobility Management
- Network Management
- Transition Nodes
- Firewalls
- Public Key Infrastructure Servers for Security

# Points of Transition (Network Software)

- Network Management and Utilities
- Network Internet Infrastructure Applications
- Network Systems Applications
- Network End User Applications
- Network High Availability Software
- Network Security Software

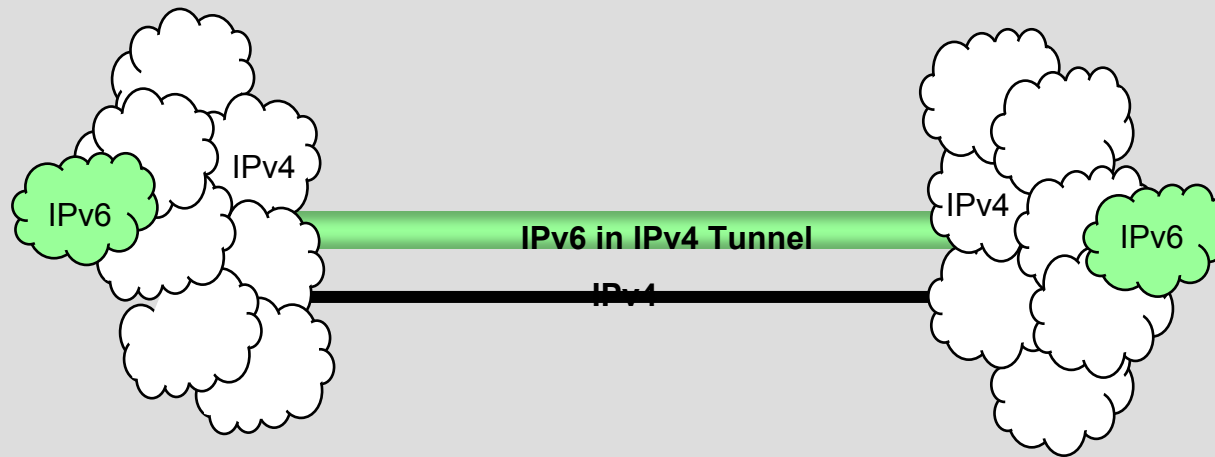
# Transition Hot Spots

- Wireless Communications and integration with Wireline (Broadband) Communications
- Mobile IPv6 for Cellular Handoffs and Mobile Ad-Hoc Routing
- Application Porting Methodology
- IPv6 Security infrastructure requirements
- IPv6 Intrusion Detection
- Training, Porting applications, and Hardware Upgrades
- Network Management of new IPv6 infrastructure and points of transition
- Key Management for IPsec and Public Key Infrastructure

# Deployment Roadmap Model

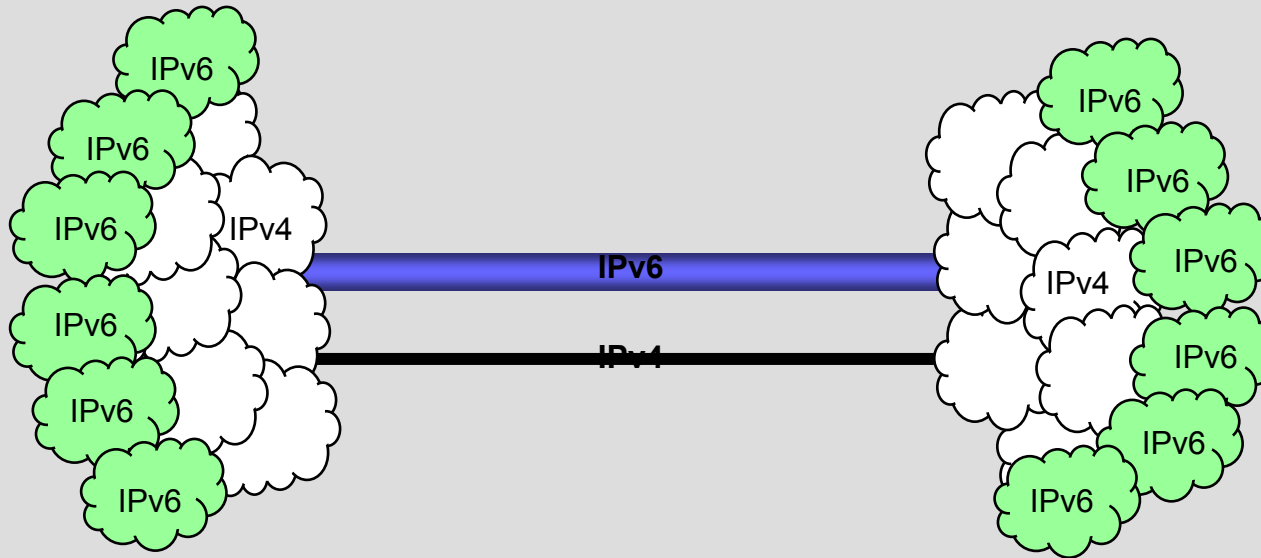
- Step 1 - Determine the set of network applications that must be ported or invented (where packets go over the network)
- Step 2 – Determine the Geography your applications must span
- Step 3 – Identify the Network components that must support IPv6
- Step 4 – Identify the Network components that require IPv6 Transition Mechanisms
- Step 5 – Identify the Network components that are new or being developed and can be initiated with IPv6 using IPv4 as scarce resource only

# Start Simply



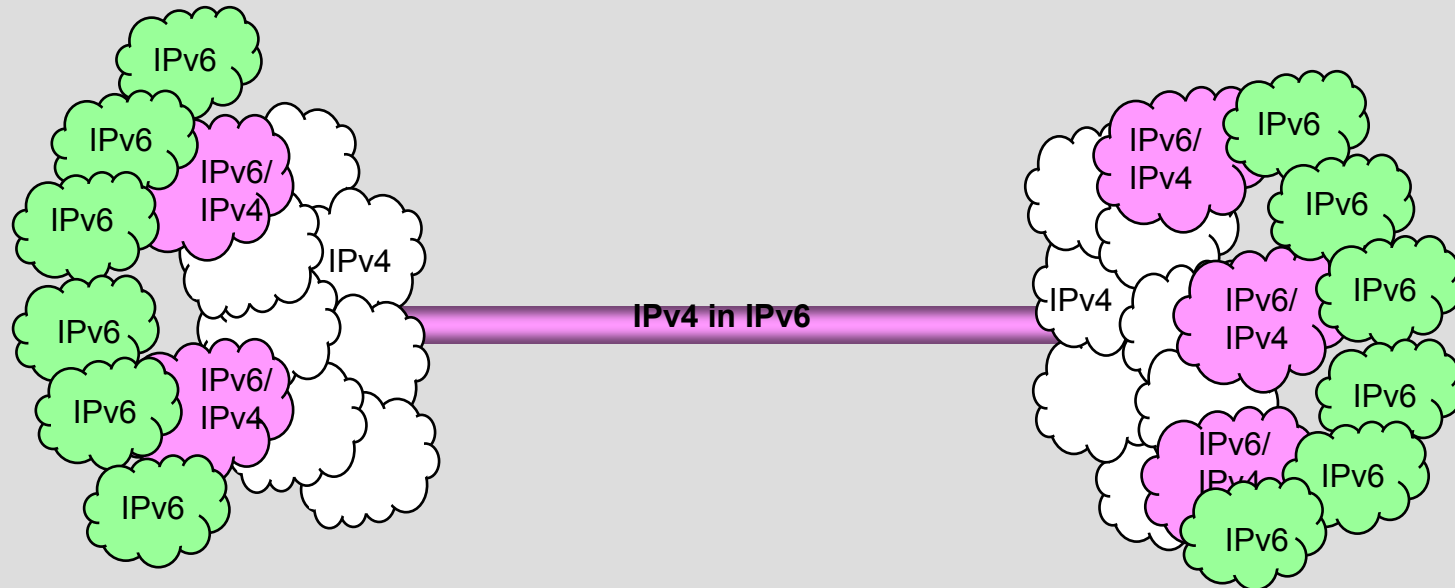
- Early IPv6 hosts join the network
- Link them using IPv6 in IPv4 tunnels
  - Running transparently over the IPv4 infrastructure; sharing the infrastructure and coexisting with IPv4
- Low risk

# Gain Confidence



- Add more IPv6 nodes
- Add native IPv6 links taking IPv6-only traffic
  - IPv6 and IPv4 links do not need to be physically separated

# Finally, An IPv6 Network



- Remove IPv4-only links as the IPv6 host population and infrastructure grow in number
- Tunnel IPv4 traffic in IPv6



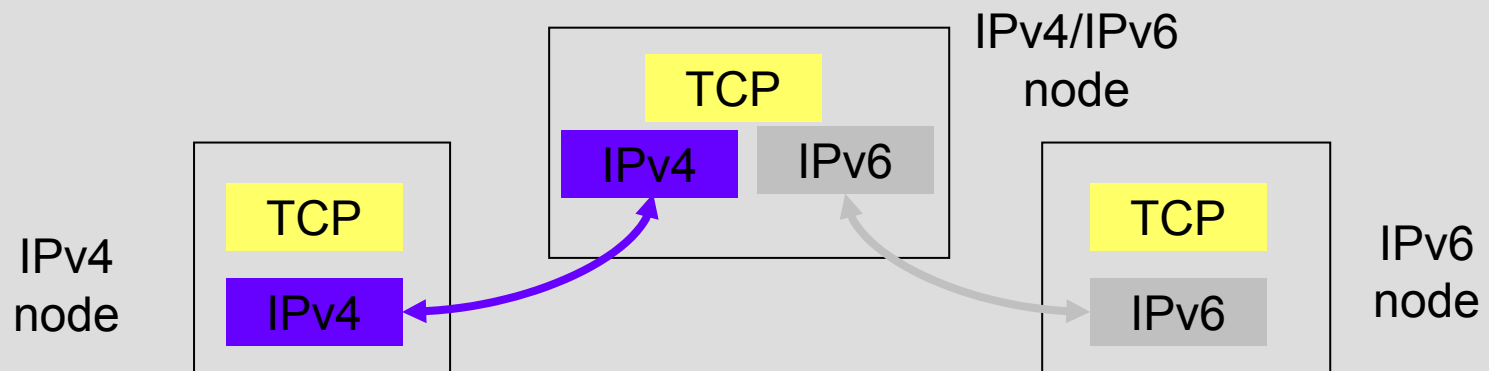
# Transition Mechanisms

- Many solutions to deliver IPv6 services
  - One size does not fit all
- Basic transition tools
- Translations
- IPv4 and IPv6 can share same physical infrastructure
  - Coexist in the box and on the wire

# Basic Transition Tools

## Dual Stacks and Tunnels

- Dual IP layer
  - Complete support for both IPv4 and IPv6
- Tunnels
  - Carry IPv6 traffic over IPv4 routing infrastructures
    - Or vice and versa
  - Host to Router, Host to Host, Router to Router
- Provides sending rules

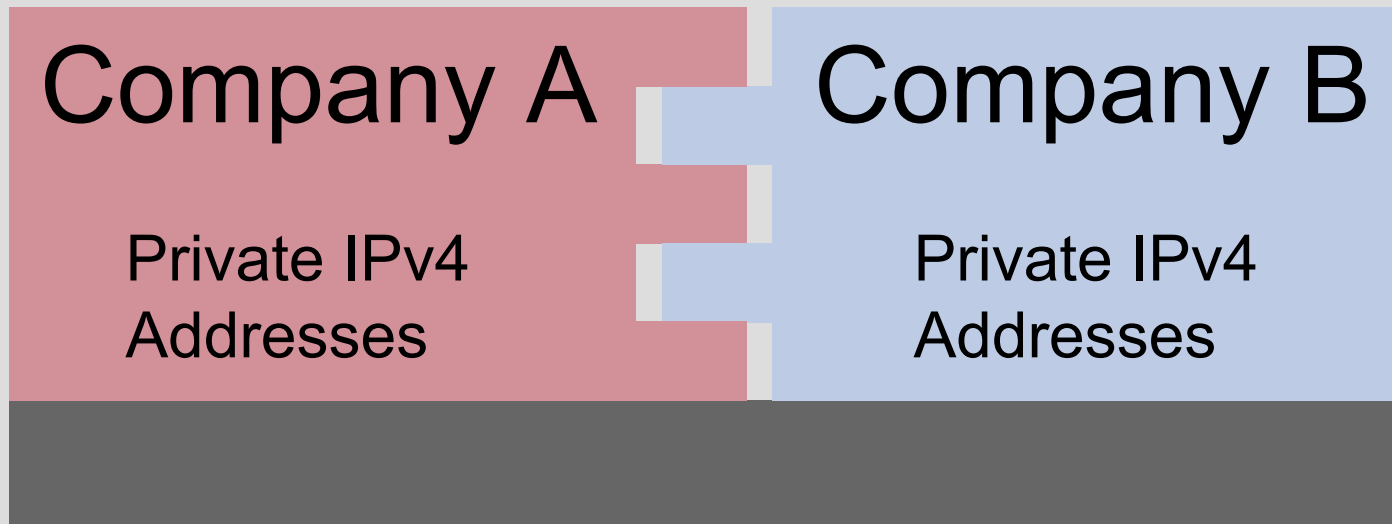


# Tunnel Choices

- Configured Tunnels
- Automatic Tunnels
  - 6to4
  - ISATAP
  - Teredo
- Dual Stack Transition Mechanism DSTM

# Merger of Two Companies

- Numerous overlapping addresses



- How to create a single network with minimum disruption and cost?

# Possible Solutions

- Deploy a Network Address Translator NAT box
  - Disadvantages: Performance hit; Single point of failure
- Renumber company B's network
  - Disadvantages: Costly; Time consuming; and Not popular with users
- Upgrade key nodes in both companies to IPv6/IPv4
  - Advantages: Transparent to users, Quick to implement; and Future-oriented solution

# Impact on Network Topology

## After upgrading to IPv6

- Connections to IPv4 nodes are maintained
  - You can reach all IPv4 nodes you could reach before
- Ability to reach IPv6 nodes inside and outside
- As the merged company evolves, new departments are added they may run dual-stack IP hosts or IPv6 only hosts

Remember!

IPv6 unites  
private address  
spaces

# Think IPv4/IPv6 Interoperability not Migration



- It will take years:
  - To displace the existing IPv4 infrastructure
  - To port all applications to IPv6
  - For ISPs to connect the whole Internet only with IPv6
- Most products will include a dual IP layer stacks supporting IPv4 and IPv6
  - Emerging markets and technologies like cell phones and Internet appliances will support IPv6 only

# Questions?