Challenges and Opportunities in Deploying IPv6 Applications

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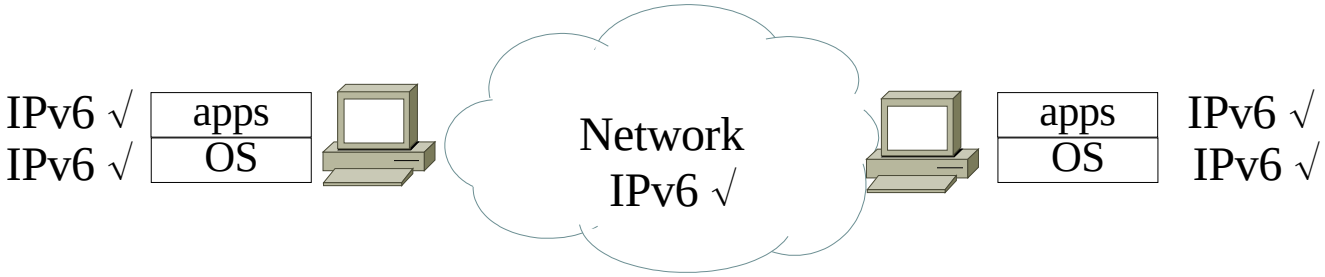
Plan

- IPv6 ROI
- End to end
- IPng Recommendation
- Incremental Deployment
- Network Toolkit
- TSP tunnel Broker
- Case Studies
- Conclusion

IPv6 Return on Investment

- Many features of IPv6, taken separately, do not provide, at this time, sufficient ROI to justify a full upgrade, end-to-end, of the network, the operating systems and the applications.
  - Each feature has an equivalent <ugly> fix in IPv4.
  - Large legacy installed base (IPv4-only)
- The combination of IPv6 features help provide a better ROI, but still usually not sufficient.
- Choices:
  - Upgrade the whole network, OS, apps.
    - Provides all the good features of IPv6
    - If you can afford the upgrade, great.
  - Incremental deployment
    - Get the good features of IPv6
    - Lower cost for deployment
    - Risk is manageable. Outcome is positive.
  - Wait until the very last minute
    - Do not benefit IPv6 features
    - Behind. Difficult to catch up market. Loose market share.

End to End



- Applications:
  - Need to be converted to IPv6. Change of network API.
- Operating system:
  - Need to be IPv6 enabled
- Network:
  - Lan, enterprise, edge, access, distribution, core, exchange, Internet, exchange, core, distribution, access, edge, enterprise, lan
  - Routers, firewalls, DNS, vpn servers, network management,. ..
  - Servers
  -
- It is only when all pieces are IPv6 enabled that an IPv6 application works

IPng Recommendation

- IETF IPng Recommendation [RFC1752: Jan 1995]:
  - The IPv6 transition plan is aimed at meeting four basic requirements:
    - Incremental upgrade.
    - Incremental deployment.
    - Easy Addressing.
    - Low start-up costs.

- [RFC1752] Bradner, S. and A. Mankin, "The Recommendation for the IP Next Generation Protocol", RFC 1752, January 1995.

How to deploy

A) Upgrade everything

B) Deploy incrementally:

- Per host/per application:
  - One host-application at a time, as needed.
- Have some IPv6 native backbone to aggregate traffic, deploy addressing, etc..
- IPv6 access over the IPv4 network
- Use transition technique to give IPv6 connectivity to the « far » hosts
- In an efficient network-wise way
- Low upfront costs while providing early service

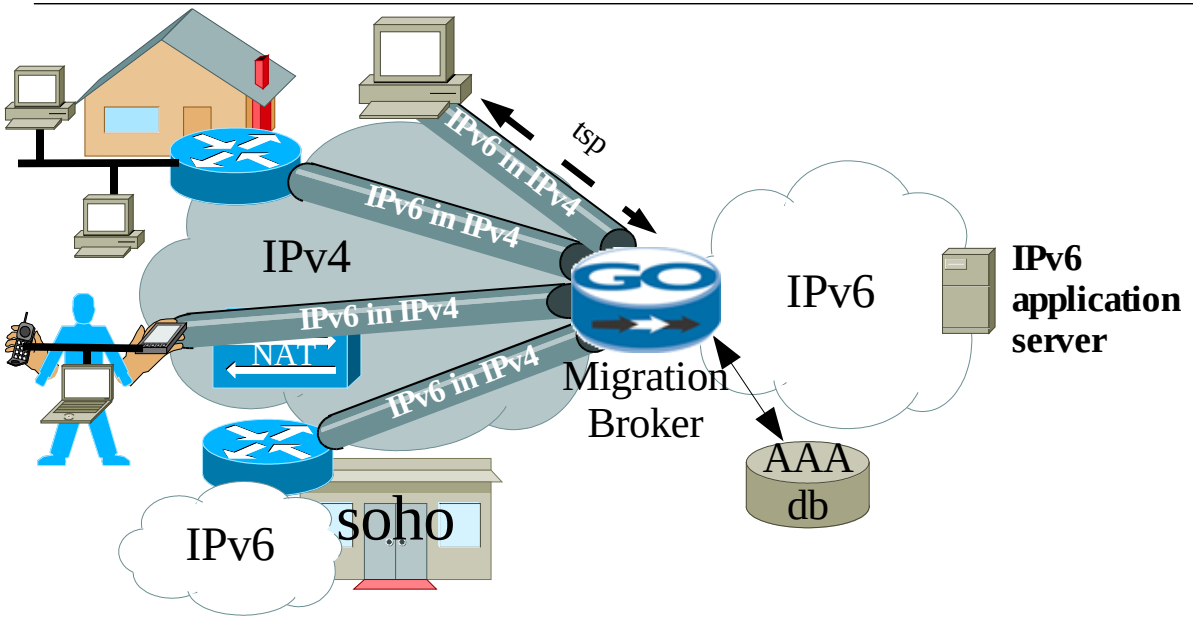
Write Your Requirements

- Possible Requirements:
  - NAT traversal: is there an IPv4 NAT in the network?
  - Networks: do you support only nodes or networks?
  - Mobility?
  - Is dependency on IPv4 address an issue?
  - AAA:
    - Authentication of the service
    - Accounting
  - DNS registration?

Network Toolkit

- 6PE:
  - IPv6 in MPLS.
  - Where MPLS is deployed
- ISATAP:
  - IPv6 in IPv4 tunnels.
  - End nodes only
  - Does not traverse NAT.
- Teredo:
  - End nodes only
  - Traverse NAT
- 6to4:
  - End nodes and networks
  - Does not traverse NAT
- TSP tunnel broker
  - End nodes and networks
  - Traverse NAT
  - Stable IPv6 Address (no dependency on IPv4 address)
  - AAA

TSP Tunnel Broker



- TSP Tunnel Broker has:
  - Tunnel Setup Protocol: signaling protocol for establishing the tunnel
  - TSP client on host or home gateway or router
  - TSP tunnel broker:
    - establish the tunnel end point
    - NAT traversal
    - Prefix delegation
    - AAA

TSP Tunnel Broker

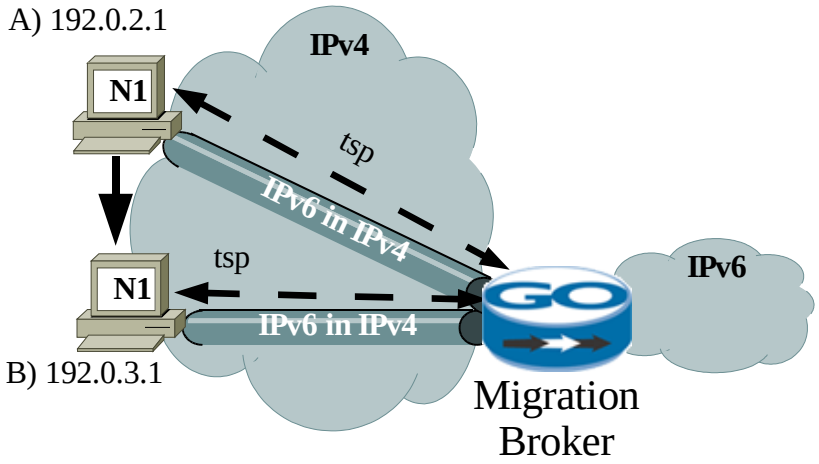
- TSP: Tunnel Setup Protocol
- Control channel
  - To negociate and establish the tunnel
- between
  - a TSP client
    - who needs IPv6 connectivity when only IPv4 is available
  - And a TSP tunnel broker,
    - behaving as an IPv6 network access server
    - offering IPv6 in IPv4 tunnels
    - detecting NATs and providing tunnels over NAT
    - offering network prefixes to networks (such as home, personal, org)
    - authenticating, authorizing and accounting users and traffic
- TSP client:
  - Lightweight (small footprint for embedded such as mobile phone, PDA, sensors, home gateways)
  - On a user PC, acts as a driver: i.e. Automatic, no user intervention.

TSP Capabilities

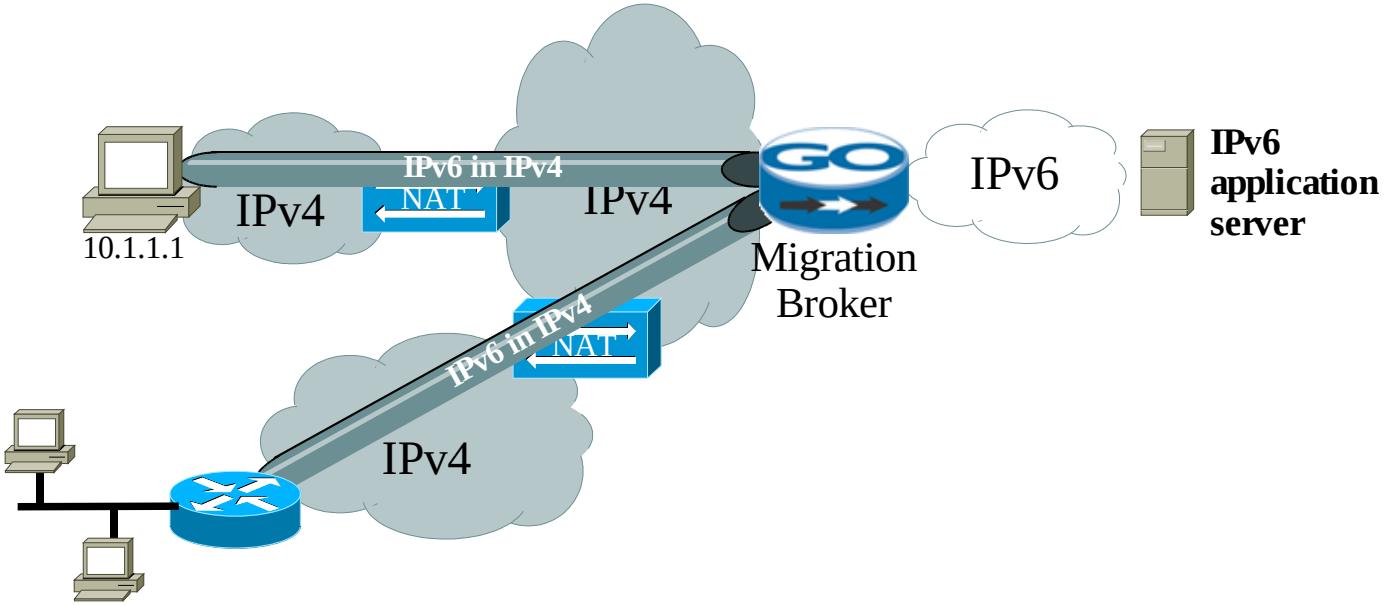
- Tunnel types:
  - IPv6 in IPv4
  - IPv6 in UDP-IPv4 (a NAT is in the path)
  - IPv4 in IPv6
- Permanent or temporary IPv6 address
- Prefix delegation
- IPv4 Mobility/change of address detection
- Mobile networks
- DNS automated registration
  - tunnel end-point name (AAAA record)
  - Inverse tree delegation for assigned prefix (NS record)
- Keepalive/Heartbeat

TSP moving node

- When changing IPv4 address, TSP re-establish automatically the IPv6 tunnel



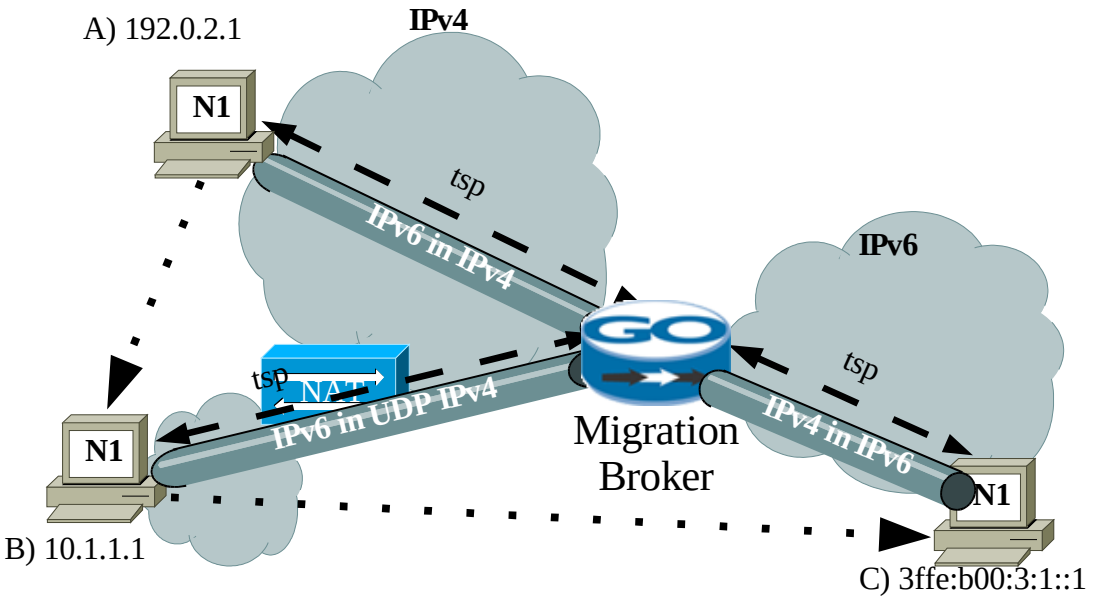
Connecting IPv6 over NAT



- Migration Broker connects:
  - IPv6 nodes and networks
  - located behind a NAT
  - enabling applications to be deployed, otherwise impossible with NAT

TSP: Ubiquitous IP

- Also enables IPv4 in IPv6 tunnels
- Mobile node/network with:
  - IPv4 with reachable address
  - IPv4 behind a NAT
  - IPv6 network
- TSP tunnel broker provides both IP protocols in all cases.



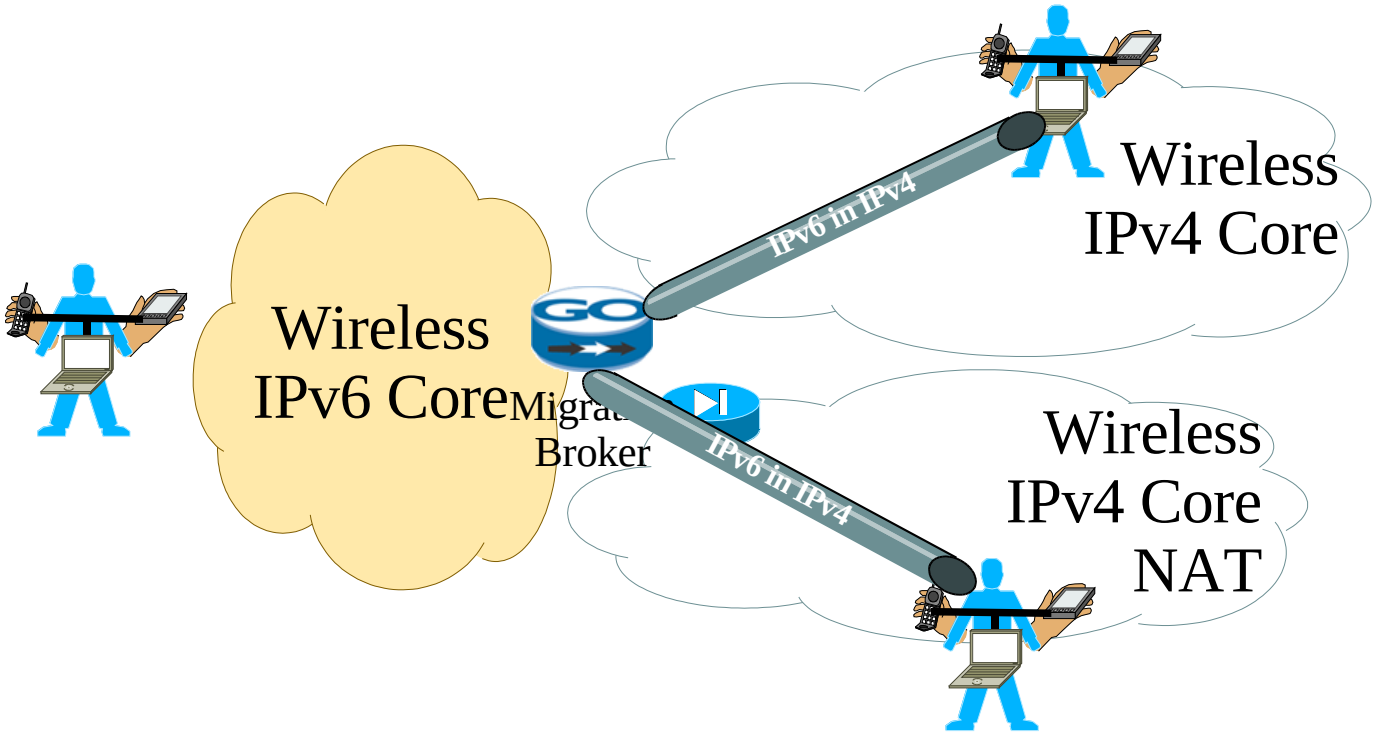
Case Studies

- Examples of customers:
  - Wireless provider
    - Mix of IPv4, IPv4 with private address space (NAT) and IPv6 networks
    - Need a transition tool handling all cases: Ubiquitous IP.
    - Example of application: mobile videoconferencing
  - Broadband provider
    - IPv6 E2E applications deployment to the home
    - Network management and support of home premises
  - Enterprise remote access

Wireless Provider

- Need:
  - Mobility application.
  - Using MobileIPv6
  - Connecting networks for the mobile node are:
    - IPv4-only with global address
    - IPv4-only with private address
    - IPv6
  - Goal: Ubiquitous IP
- Solution:
  - IPv6 in IPv4 tunnels with NAT traversal, with AAA.
  - Hexago Migration Broker
  - TSP client in mobile node.

Wireless Provider Network

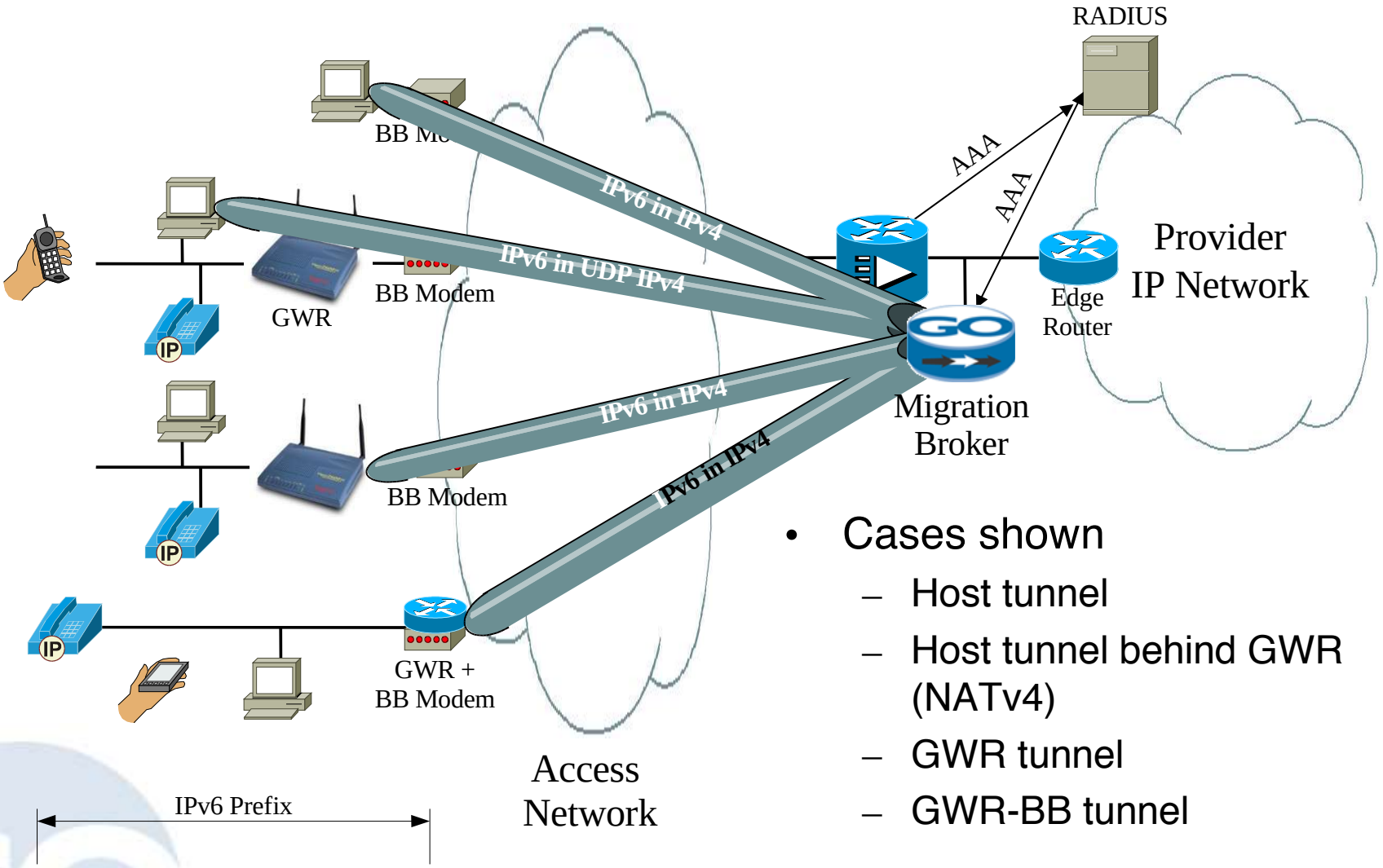


- Provides ubiquitous IP for the application.
- Mobile videoconferencing kept running even after multiple handovers with different kinds of IP access.

Broadband Provider

- Need:
  - IPv6 application to deploy to home networks.
  - Support issues and reachability to end nodes are very important.
  - IPv4 networks
  - Traceability/Anti-spoofing (legal considerations)
- Solution:
  - IPv6 in IPv4 tunnels with NAT traversal
  - AAA with permanent addressing for users.
  - Prefix delegation
  - Hexago Migration Broker
  - TSP client in either home gateway or in end node.

Broadband with TSP Tunnel Broker

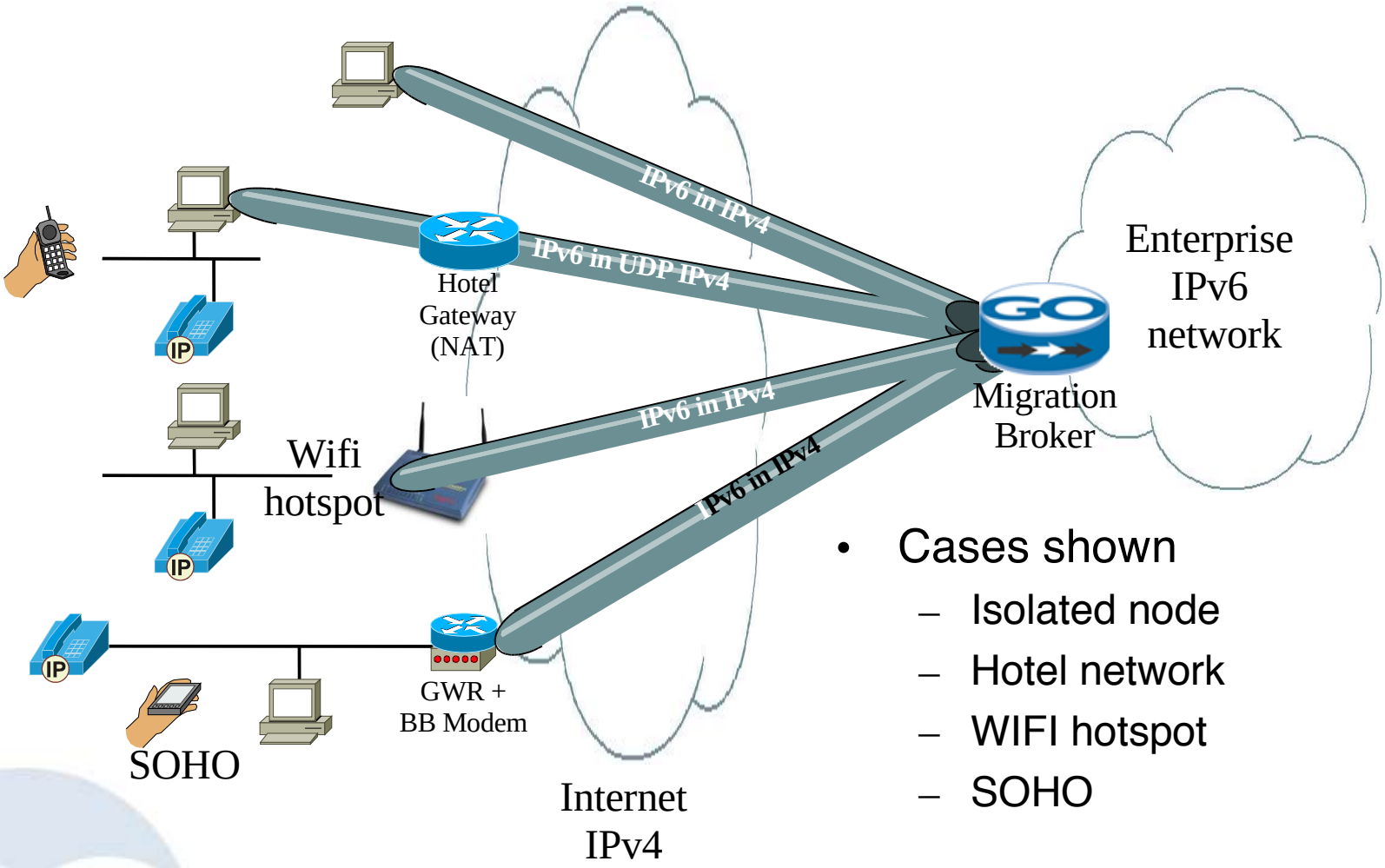


- Cases shown
  - Host tunnel
  - Host tunnel behind GWR (NATv4)
  - GWR tunnel
  - GWR-BB tunnel

Enterprise Remote Access

- Enterprise has:
  - An IPv6 network
  - Employees: travelling, remote offices, soho, mobile.
- Needs a way for employees to access the enterprise IPv6 network (VPN-like scenario)
  - NAT are used in all access networks (wifi hotspots, hotel networks, etc...)
- TSP tunnel broker:
  - NAT traversal
  - AAA for user authentication
  - Prefix delegation if mobile/home network
  - Mobility

Enterprise Remote Access Scenario



- Cases shown
  - Isolated node
  - Hotel network
  - WIFI hotspot
  - SOHO

Conclusion

- IPv6 ROI needs incremental deployment for most cases
- Incremental deployment enables low upfront cost and early service availability.
- TSP Tunnel Broker is a technology for incremental deployment and ubiquitous IP.
- Customer case studies

Hexago

- Founded after 6 years of R&D in IPv6, spinoff of Viagénie.
- IPv6 deployment solutions company
- Flagship product: Migration Broker
  - Responding to customer needs
  - Implements the TSP tunnel broker
  - Manage thousands of IPv6 in IPv4 tunnels
  - NAT-Traversal with automatic discovery
  - AAA
  - Secure and managed IPv6 deployment
  - Industry standard CLI. Easy to configure.
  - Low-cost and fast deployment of IPv6
  - IPv4 in IPv6 tunnelling for IPv6-only backbones
- Involved in IETF, IPv6Forum, North American V6 Task force
- Customers: Providers, Enterprise, Military, R&E. Worldwide.
- http://www.freenet6.net. Free IPv6 service using the Migration Broker. Available since Jan 1999!