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Mobile IPv6 in a wireless Internet

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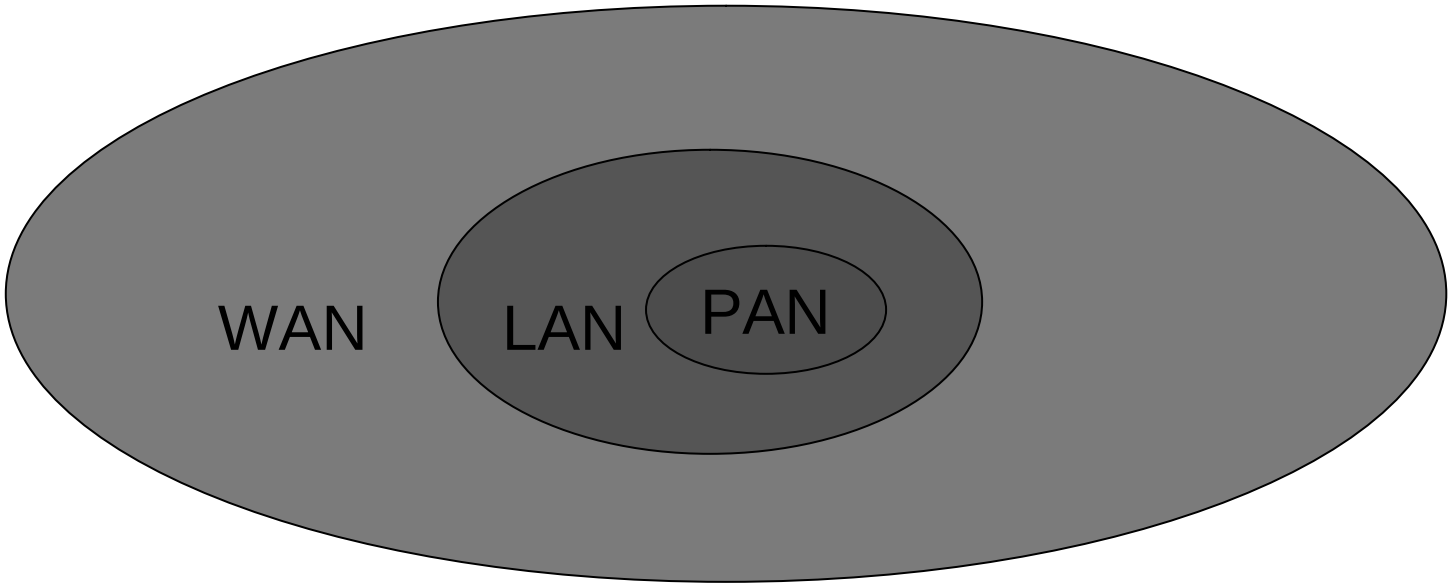
Outline

- *Trends and forecasts in the wireless world*
- *Mobile IPv6 overview*
- *Mobile IPv6 optimisations*
- *From Host to Network mobility*
- *Dual stack mobility*

Trends in the wireless world

- Mobile subscribers to exceed 1.2 Billion in 2004
- The merger between the mobile world and the Internet
- Heterogeneous access technologies
- Peer to peer applications on the rise
- Internet will be a mixture of IPv4, IPv6 and Dual Stack networks

Heterogeneous access networks

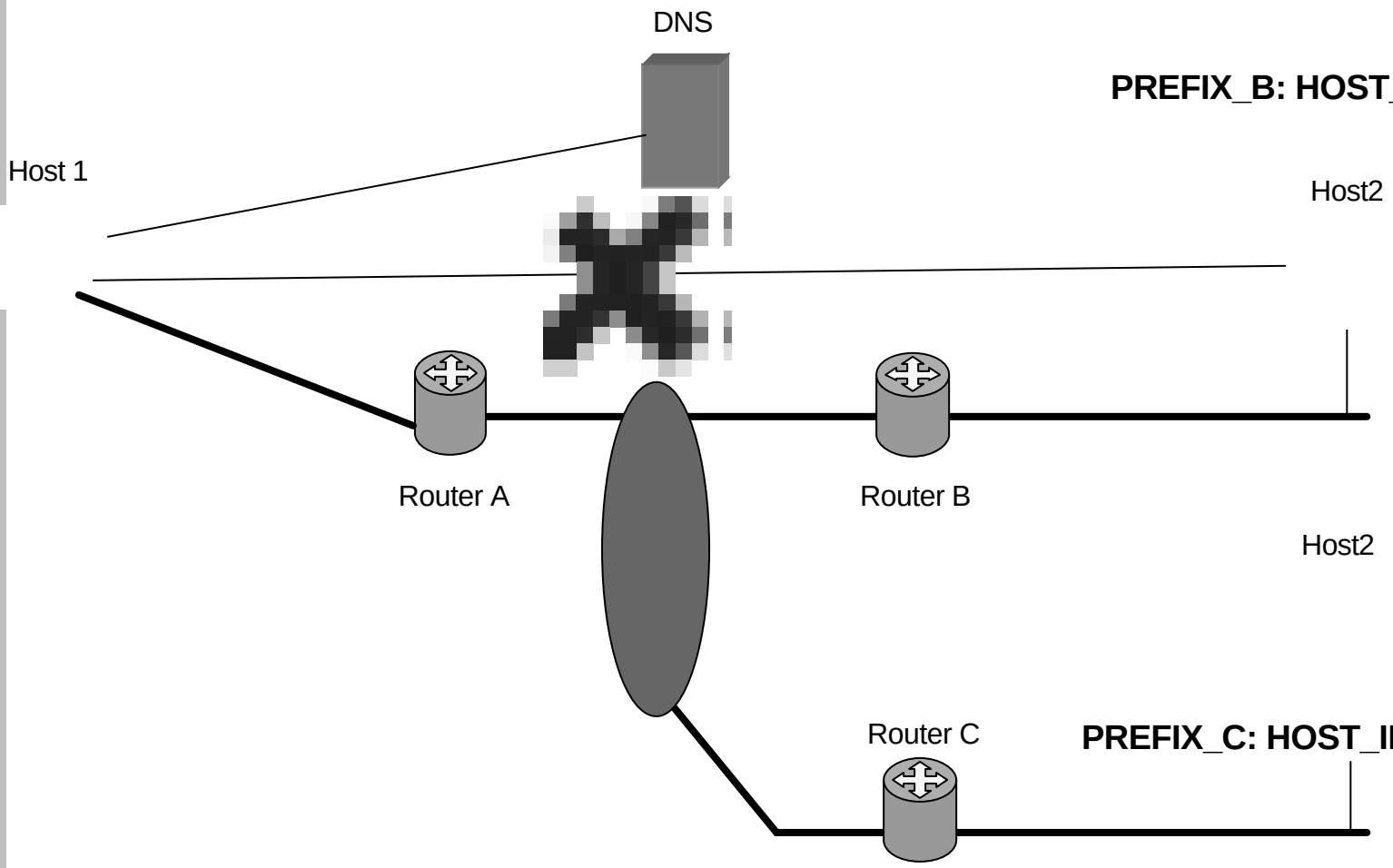


- **Different wireless technologies for different scenarios: PAN (e.g. Bluetooth), LAN (e.g. 802.11) and WAN (e.g. Flash OFDM, WCDMA)**
- **Different characteristics for each wireless technology: Coverage, QoS, Cost, reliability …etc**
- **Different IP versions: IPv4 and IPv6**

The future is peer!

- Peer to peer communication already exists in cellular networks
- IP-based cellular networks will inherit the same services and more:
  - Voice
  - Multimedia messages
  - Gaming
  - Chatting
  - Push to talk
  - And many more in future!

Why IP mobility?



Requirements for IP Mobility

- Compatibility with existing Internet hosts and applications

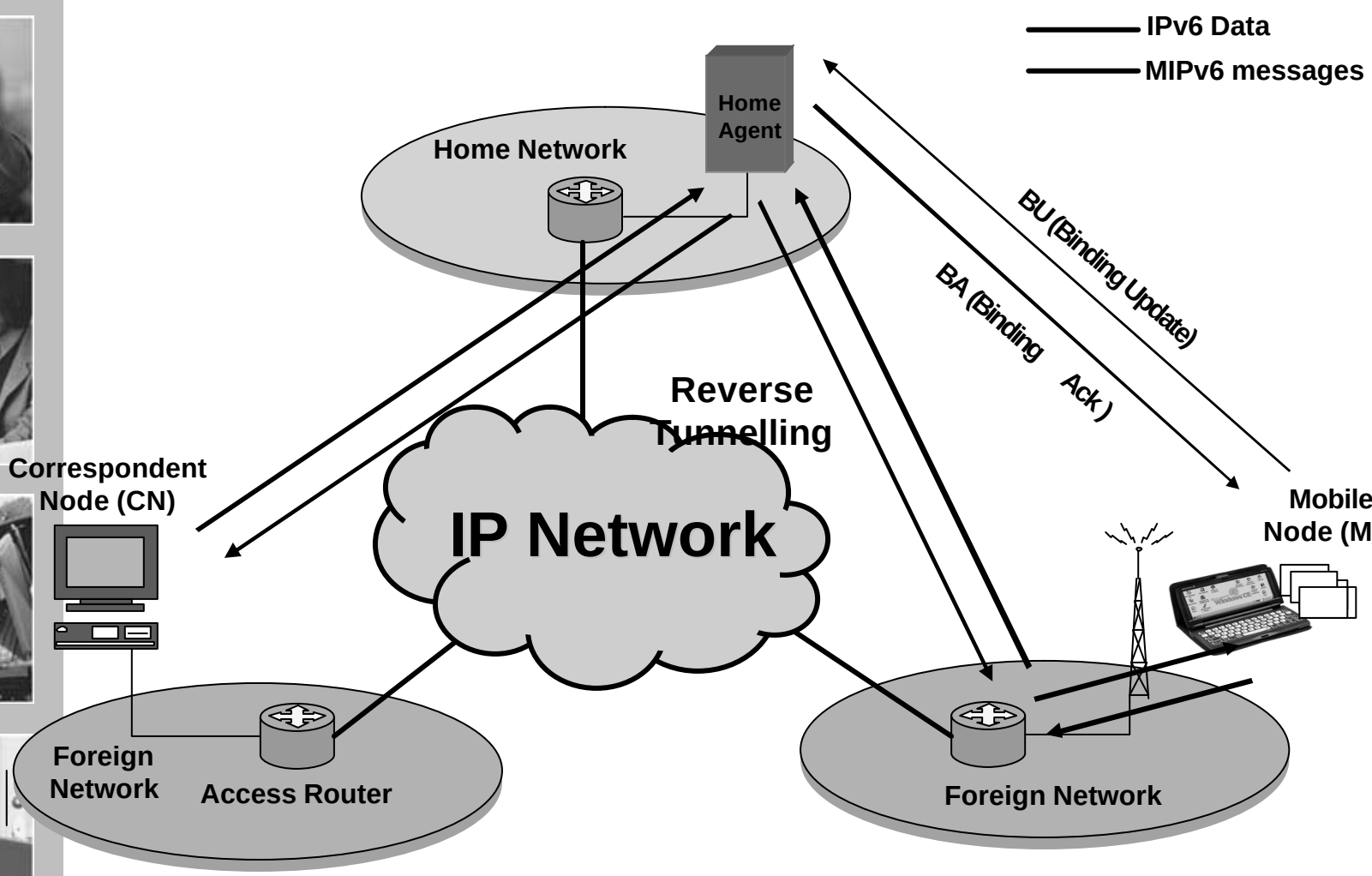
→ **Access technology independent**

→ **Ease of operation/integration**

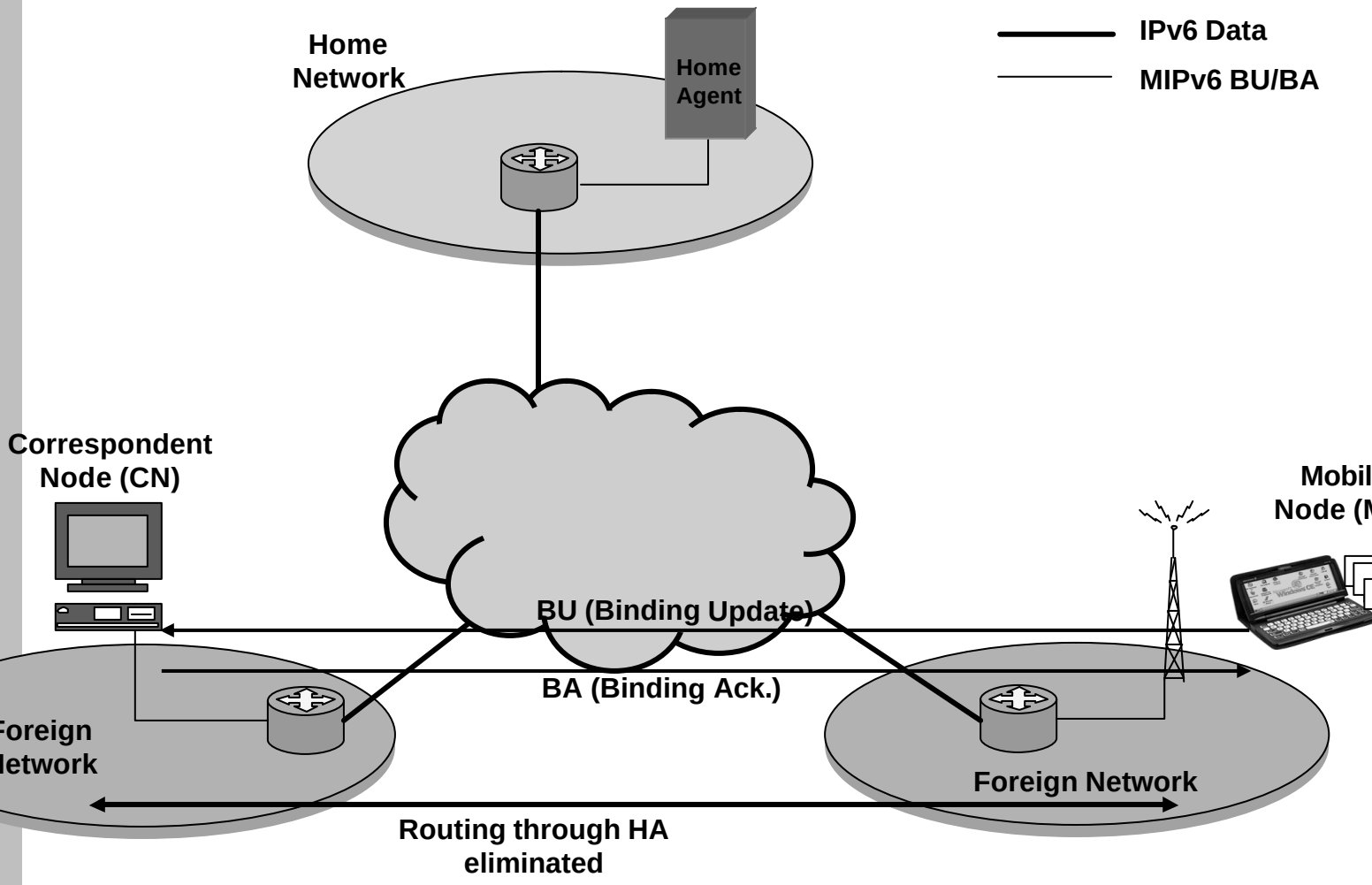
→ **Application transparency**

- No modification of existing routers or routing mechanisms
- Internet-wide mobility : “reachable everywhere”
- No modification of non-mobile hosts (i.e. TCP/IP stacks)
- No modification of applications
- Maintain connections while moving between subnets

Mobile IPv6 – Routing through HA

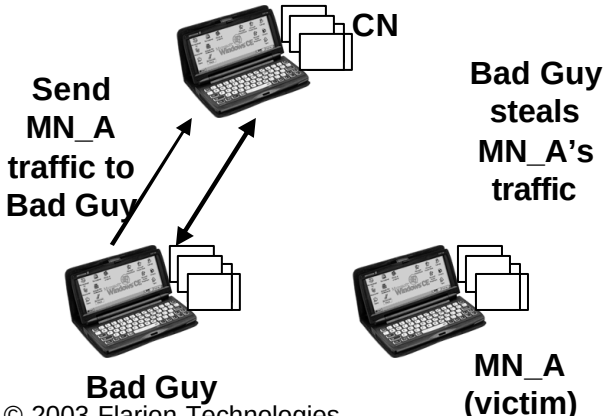


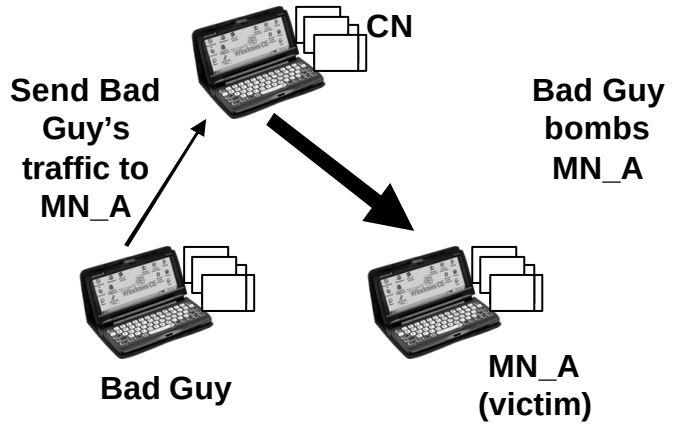
Mobile IPv6 – Route Optimisation



Securing Route optimisation

- Why do we need to secure it?
  - The BU orders the receiver to send traffic to a different address (e.g. Packets intended for address X should be sent to Y)
  - Attackers can:
    - Direct a MN's traffic to themselves (steal traffic)
    - Direct a MN's traffic somewhere else (Bombing attacks)
    - Deny a MN from communicating with other nodes (DoS attacks).
    - More attacks are possible.





Securing Route optimisation…con

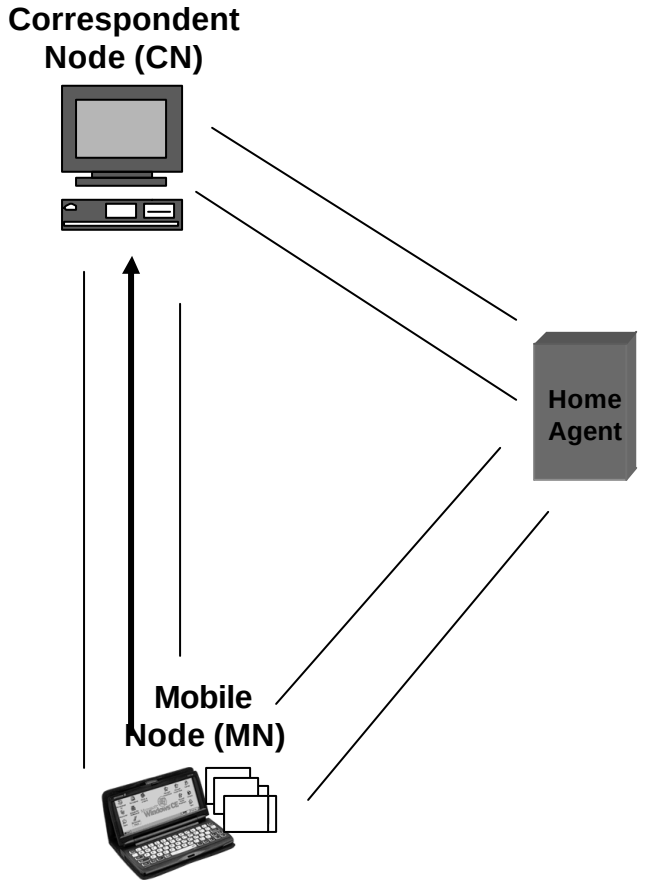
- What type of security is needed?
  - We need to AUTHENTICATE the MN that is AUTHORISED to send a BU. Encryption is not required, no confidential information.
- Which identities need to be used?
  - A MN needs to prove that it **owns** both, the home addres and CoA included in the BU.
  - Identity like: Hesham@flarion.com does not mean that Hesham owns home address X or CoA Y.

MIPv6 security –Return Routability

Inititate Test for HoA and CoA

Test for HoA and CoA

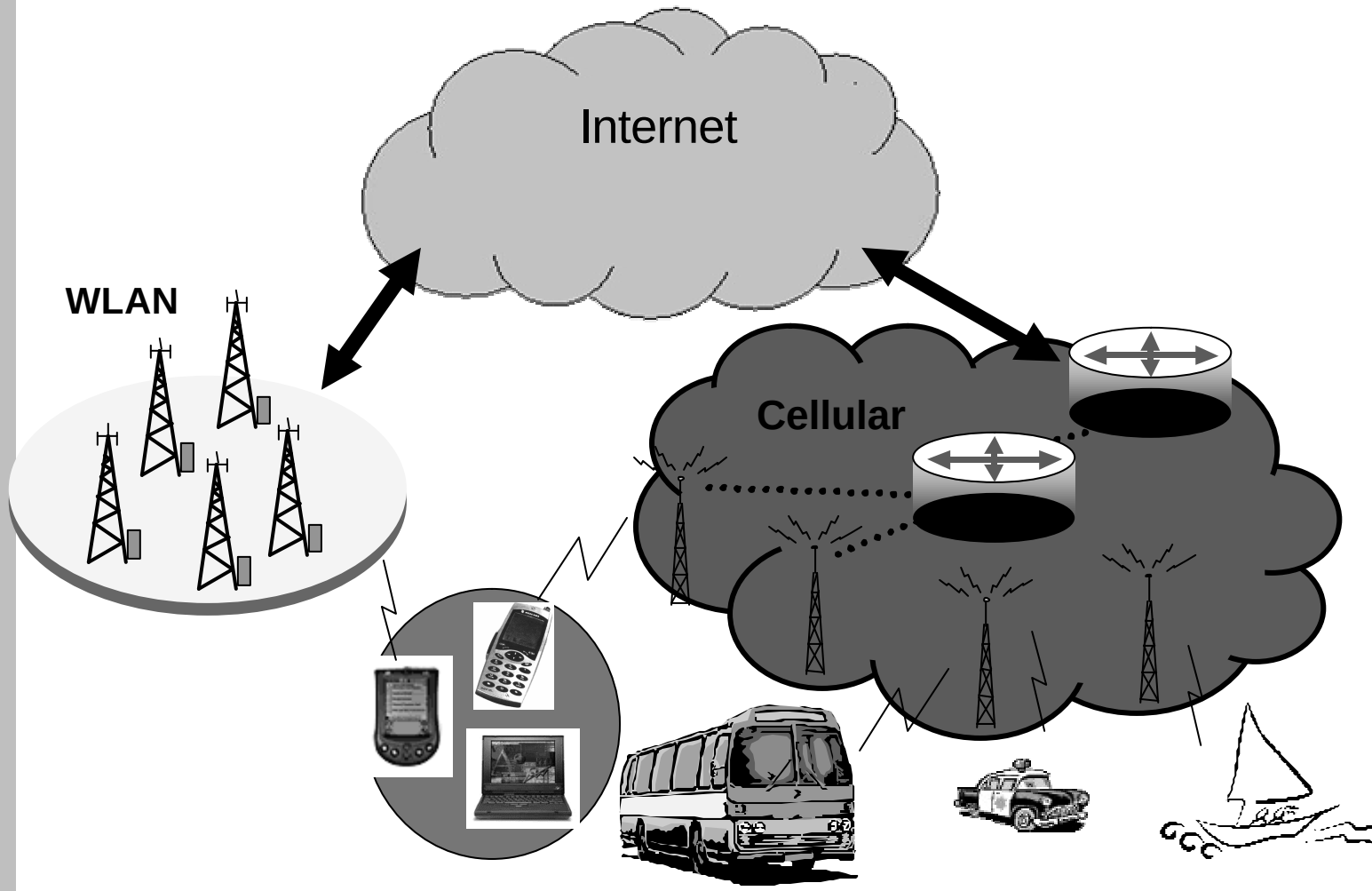
BU, authenticated with keys exchanged during test



Mobile IPv6 optimisations

- Localised mobility management:
  - Uses Hierarchical MIPv6 (HMIPv6) to allocate a local HA (Mobility Anchor Point, MAP) in the visited network.
  - MNs only need to update the local MAP whenever they move within the local domain
  - Saves sending BUs to all CNs every time the MN moves
- Fast Handovers:
  - Allows MNs to anticipate movement in order to avoid movement detection delays.
  - When MN moves, the router on-link forwards traffic to its new location

Network Mobility



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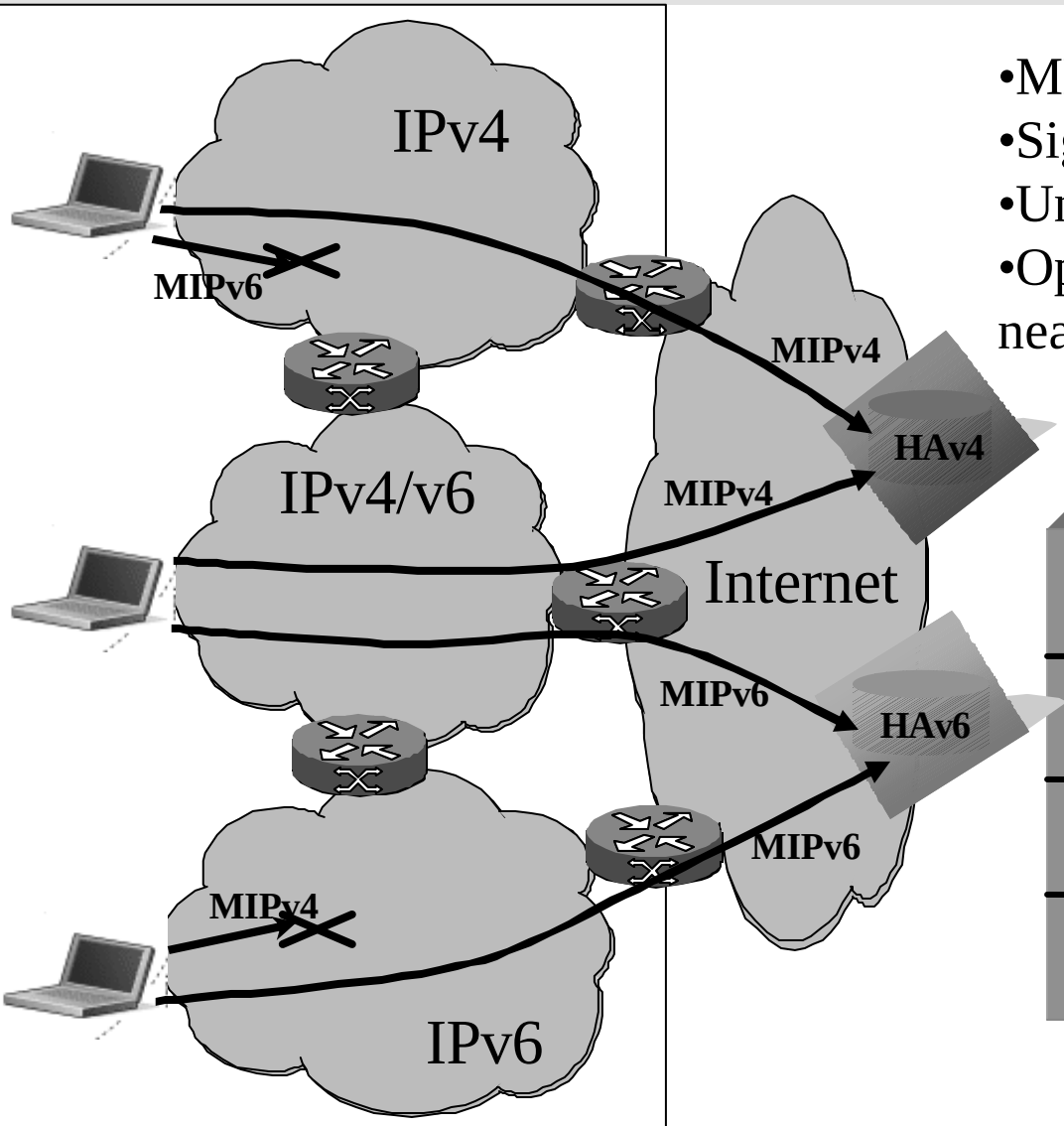
Mobility in a dual stack Internet

The problem

- MIPv4 allows IPv4 nodes to move in IPv4 networks
- MIPv6 allows IPv6 nodes to move in IPv6 networks
- Internet will be a mixture of IPv4, IPv6 and Dual Stack networks

Best Case scenario today



- MN supports both MIPv4 and MIPv6
- Significant overheads
- Unpredictable connectivity
- Optimized Mobility Management near-impossible

	IPv4 network	IPv6 network	DS network
MIPv4	✓ IPv4 ✗ IPv6	✗	✓
MIPv6	✗	✗ IPv4 ✓ IPv6	✓
MIPv4 MIPv6	✓ IPv4 ✗ IPv6	✗ IPv4 ✓ IPv6	✓

Overheads

- Every handoff involves
  - MIPv4 signaling
  - MIPv6 signaling
  - Route Optimization signaling
    - Multiple BUs/BAs for v6
  - Fast Handoff signaling
    - Various signals/processes for v4 and v6

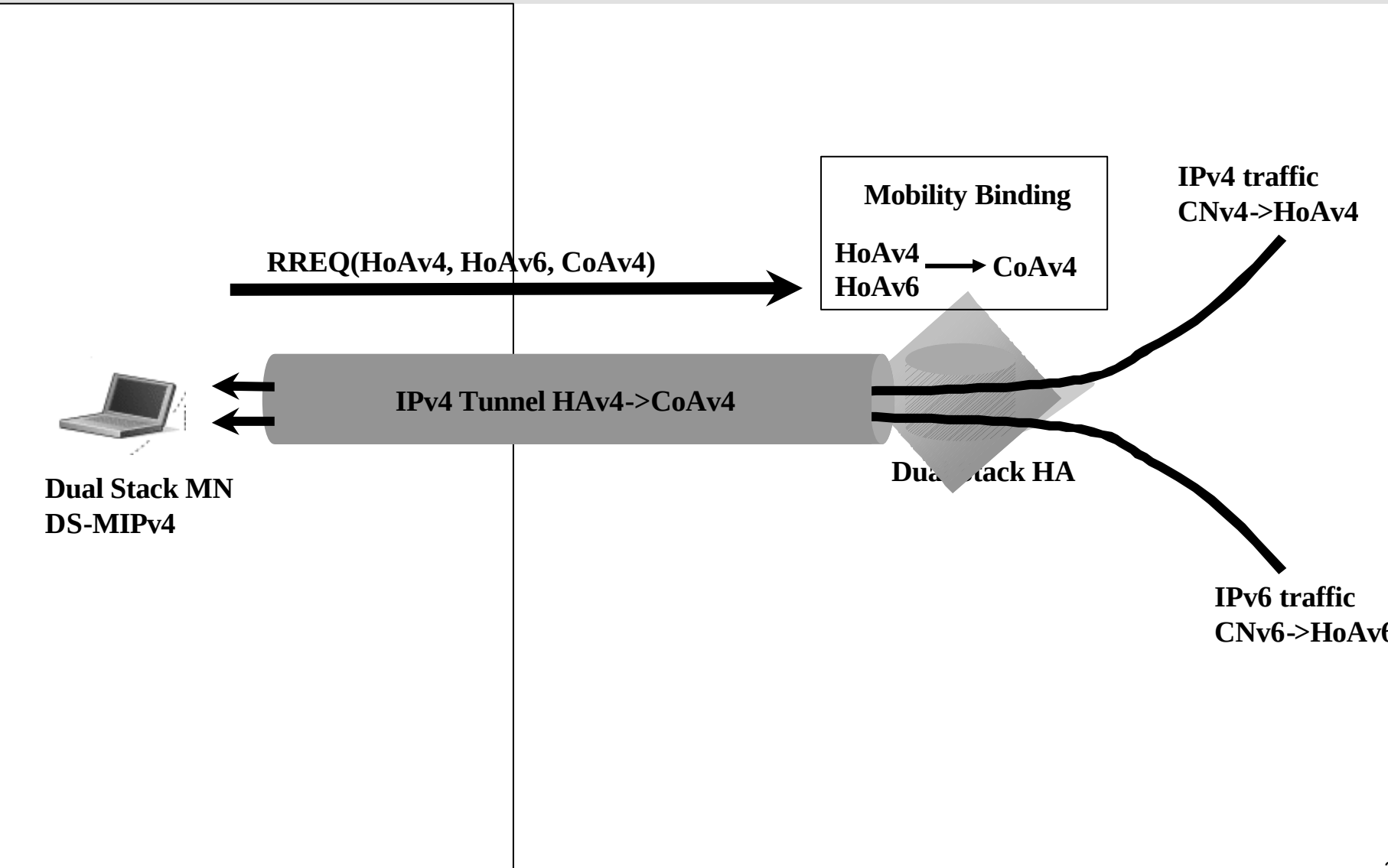
Deployment nightmare – optimization spaghetti

- MIPv4 and MIPv6 are NOT compatible technologies
  - Basic mechanisms are different
  - Optimizations are even more different
- Mobility Management based on MIP becomes untenable

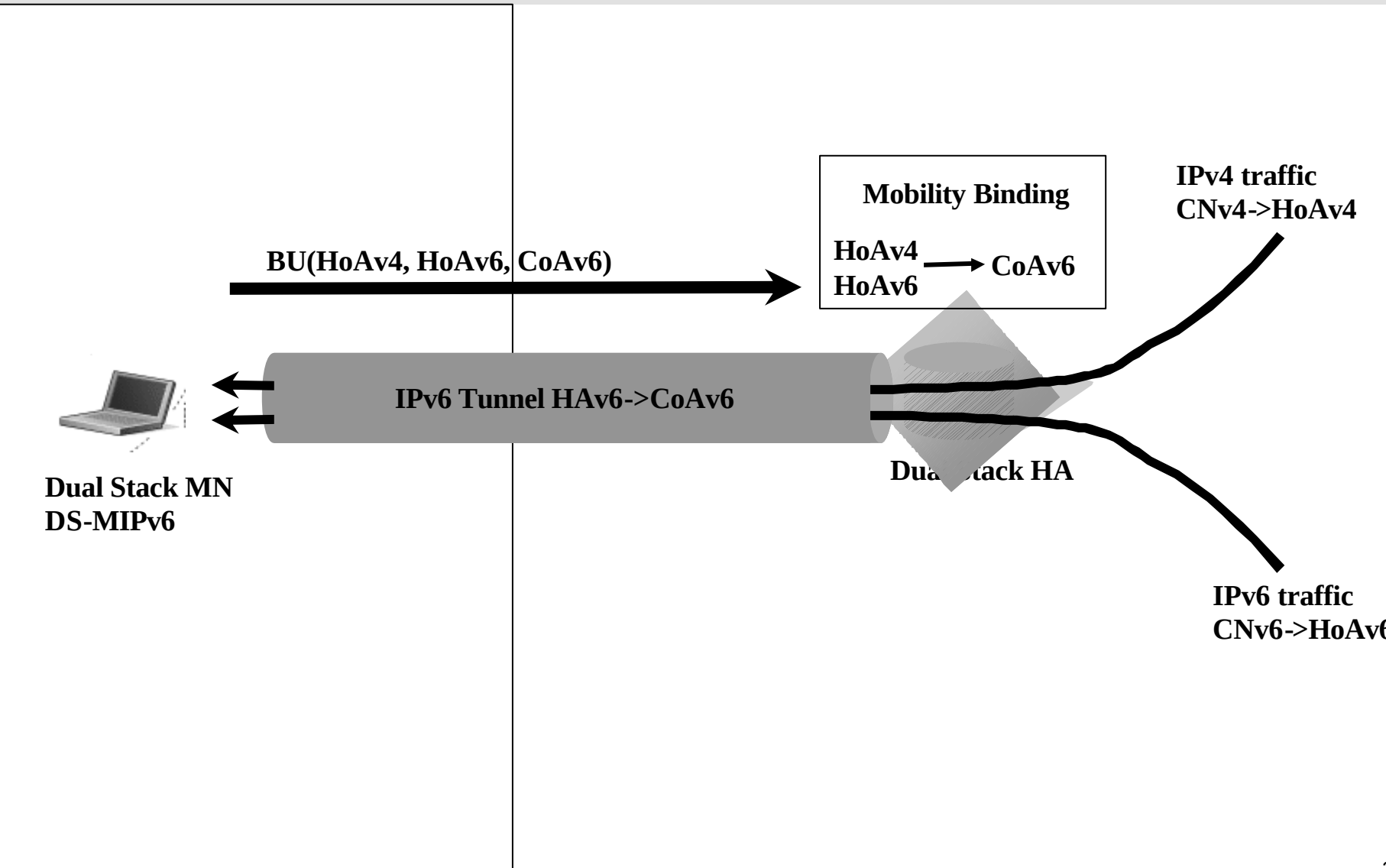
Solution

- Use MIP as migration tool
  - Use the tunneling capability of Mobile IP to forward both IPv4 and IPv6 traffic over the same Mobile IP created tunnel.
- MIPv4 extensions
  - Allow IPv4 and IPv6 HoAs to bind to an IPv4 CoA
- MIPv6 extensions
  - Allow IPv4 and IPv6 HoAs to bind to an IPv6 CoA

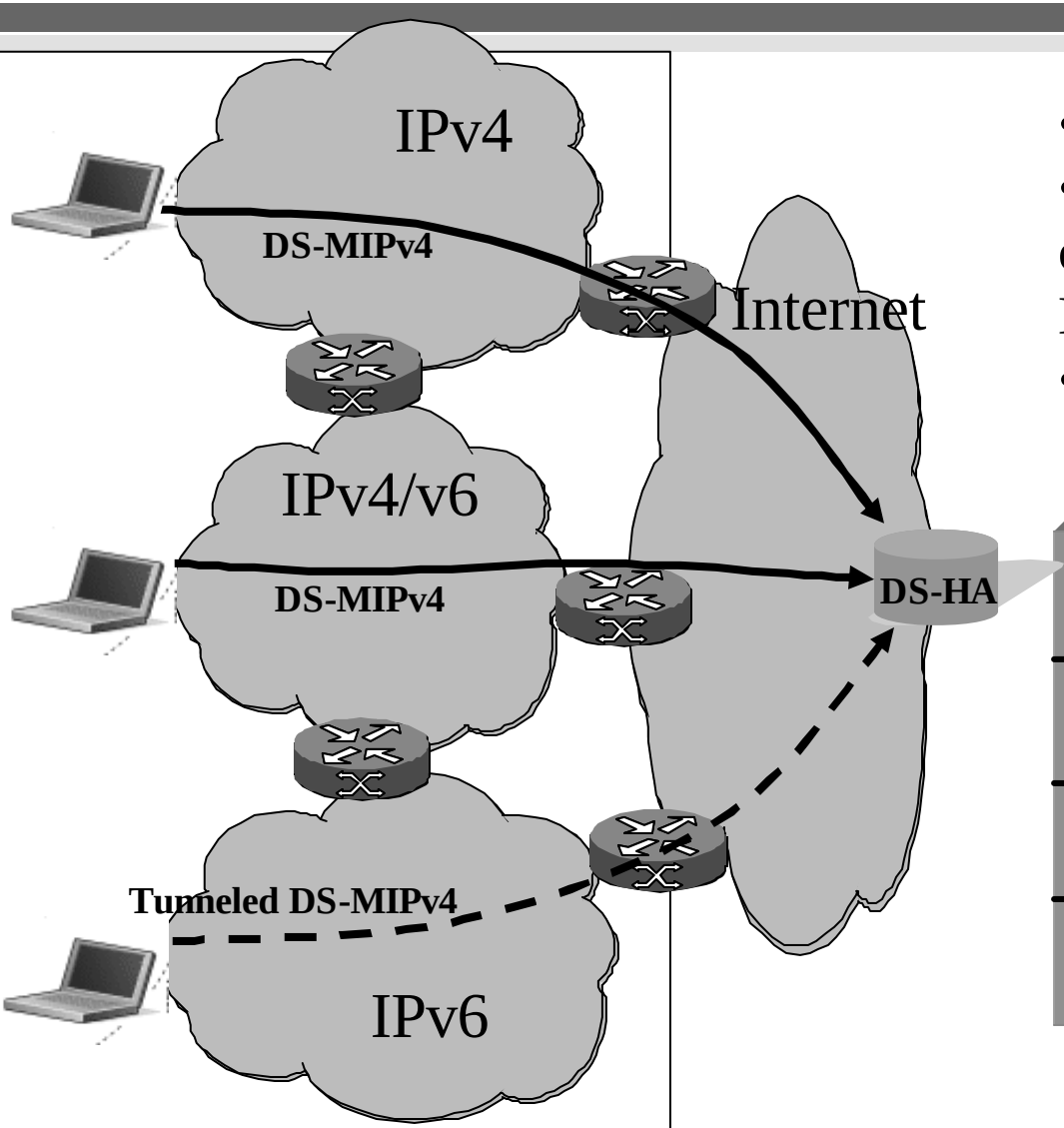
Creating DS Bindings in MIPv4



Creating DS Bindings in MIPv6



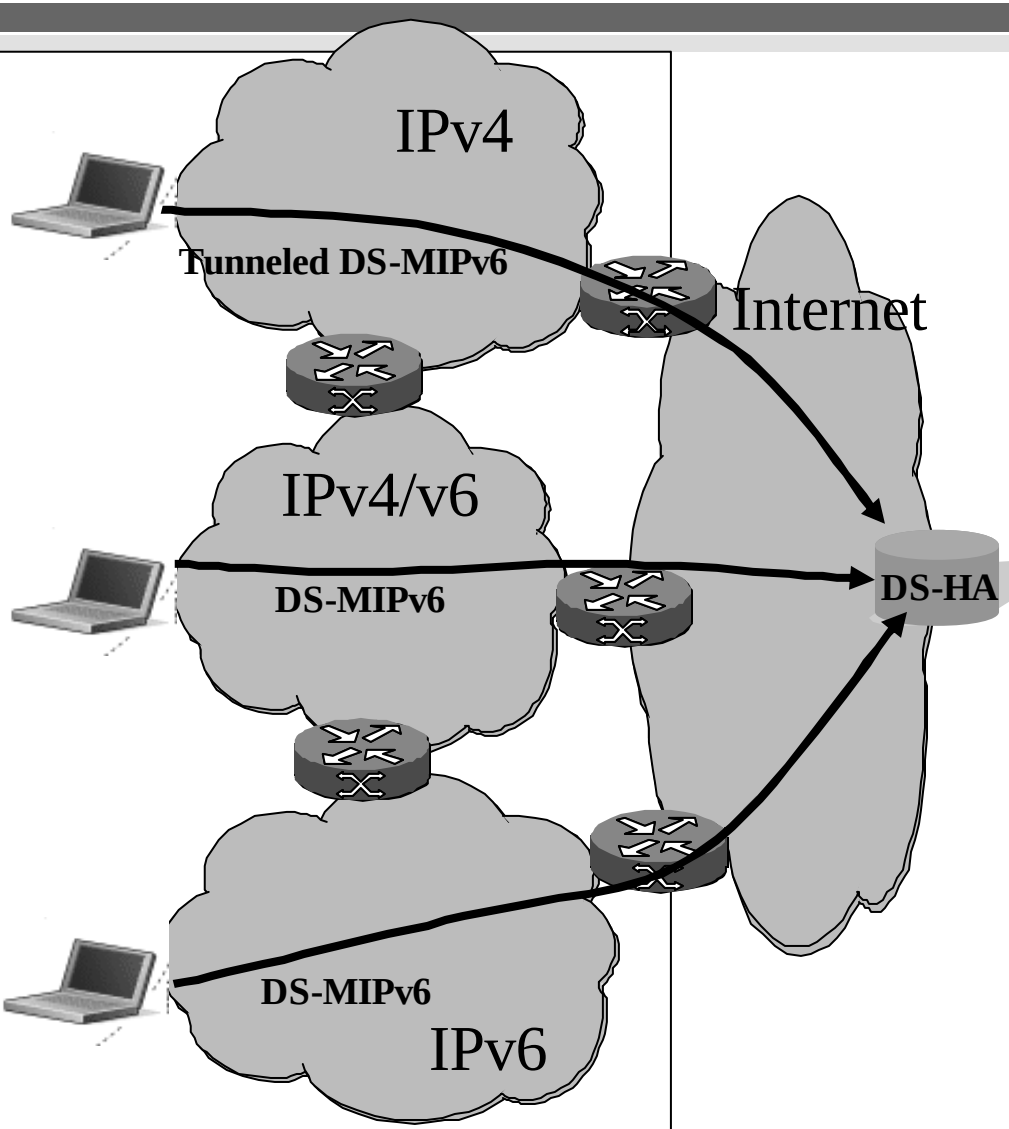
DS-MIPv4 scenario – IPv4 dominant



- MN supports DS-MIPv4
- MN fully connected and mobility optimized in IPv4 and Dual Stack Networks.
- Can also be tunneled over IPv6

	IPv4 network	IPv6 network	DS network
DS-MIPv4	√	?√	√
DS-MIPv6	?√	√	√
DS-MIPv4 DS-MIPv6	√	√	√

DS-MIPv6 scenario – IPv6 dominant



- MN supports DS-MIPv6
- MN fully connected and mobility optimized in IPv6 and Dual Stack Networks.
- Can also be tunneled over IPv4

	IPv4 network	IPv6 network	DS network
DS-MIPv4	√	?√	√
DS-MIPv6	?√	√	√
DS-MIPv4 DS-MIPv6	√	√	√

Thank you!