

Mobility on IPv6 Networks

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Outline

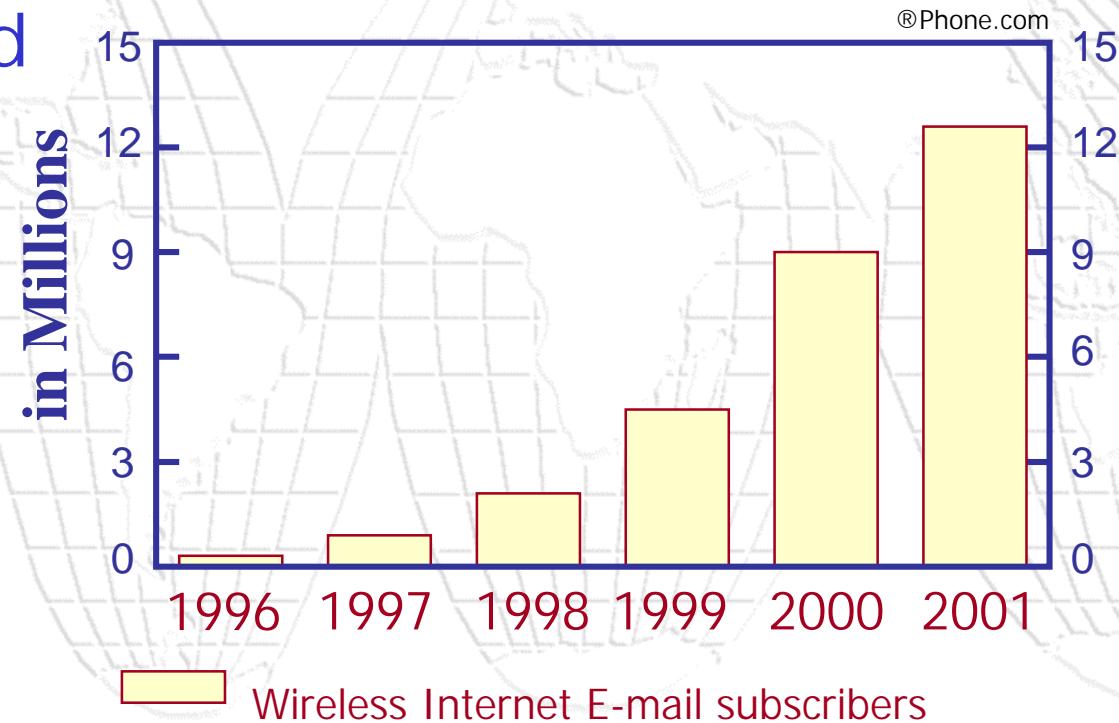


- Motivation
- MIPv6 architecture
- MIPv6 detailed operation
- Security
- Advantages
- Macromobility vs. micromobility
- Conclusions
- References

Motivation



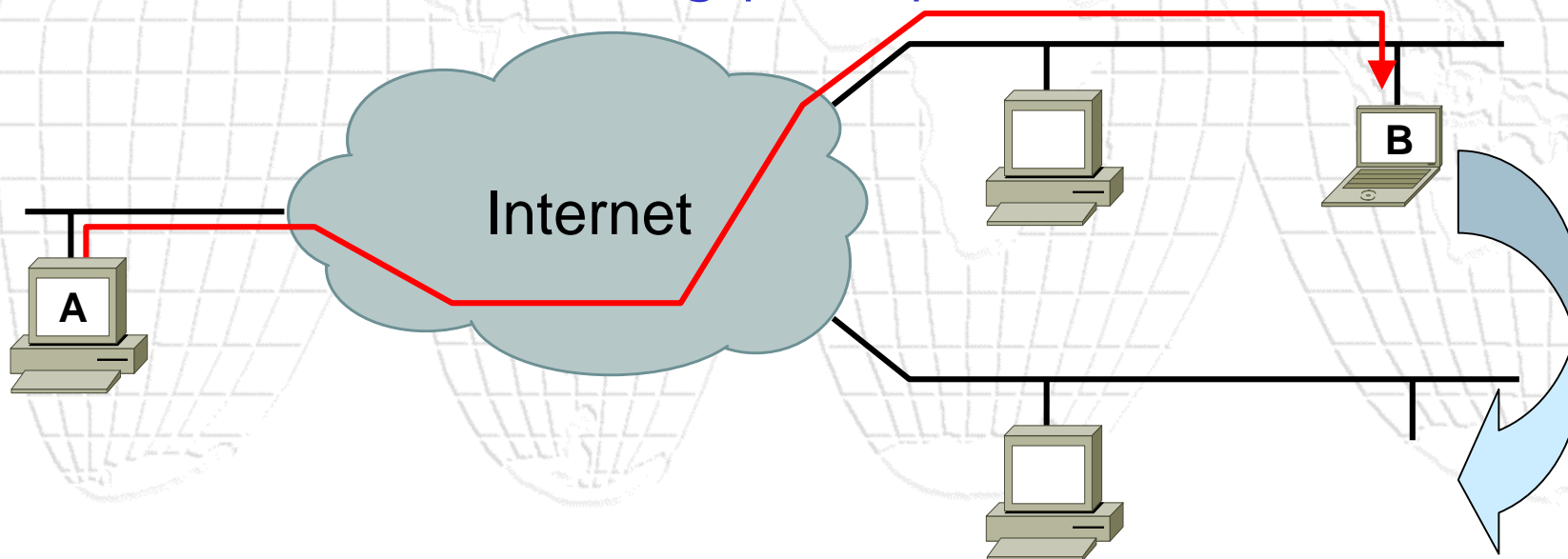
- Mobile computing is getting widespread
- GPRS and 3G mobile devices are packet switched



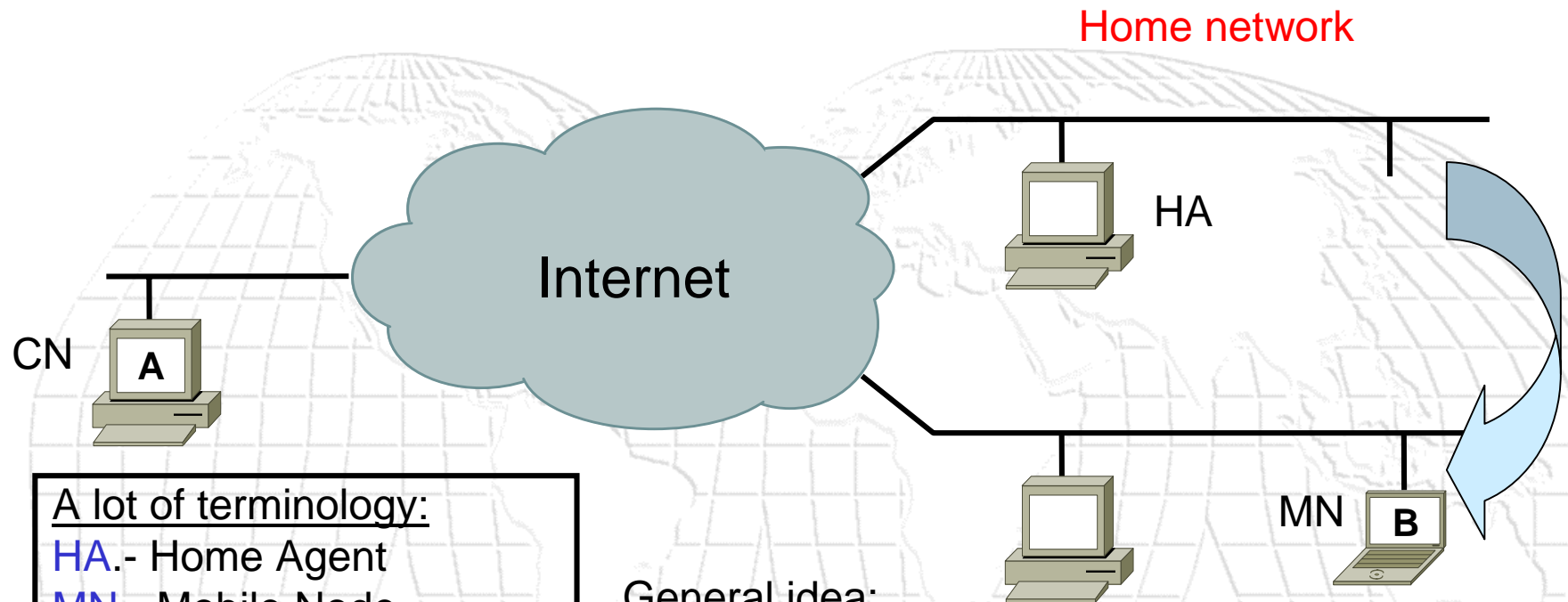
Motivation



- IP address has topological meaning
- IP assumes always the same point of attachment
- If B does not change its IP address, new routes need to be injected towards the Internet
- Hierarchical routing principle is broken



Mobile-IPv6 architecture



A lot of terminology:

HA.- Home Agent

MN.- Mobile Node

CN.- Correspondent Node

Home Network

Foreign Network

Home Address

CoA.- Care of Address

General idea:

- a.- MN gets a new CoA in a foreign network
- b.- MN registers the new CoA in its HA
- c.- CN sends to HA, HA tunnels towards MN
- d.- MN sends Binding Update (BU) and CN sends directly

IPv6 facilities



- Stateless Address Autoconfiguration
 - to configure the Care-of-Address
 - there is no need of Foreign Agent
- Neighbor Discovery
 - to detect movement
- Route optimization
 - IPv6 Routing Headers
- IP security
 - implements strong authentication and encryption features
- Additional facilities
 - Coexistence with Internet Ingress Filtering
 - Smooth Handoffs as part of route optimization
 - Renumbering of home networks
 - Automatic home agent discovery

Messages and structures



- Binding Update
 - Used for binding any of the owned CoA
- Binding ACK
 - Generated only if requested by the BU
- Binding Request
 - Eventually a host may request a BU
- Home Address
 - Option in a MNs generated packet to inform the destination about its home address
- Binding Cache
 - Consulted by CN before sending an IPv6 packet
- Binding Update List
 - Maintained by MN for non-expired BUs
- Home Agent List
 - Maintained by a HA
 - Lists every HA in the home network

Attaching to a foreign network

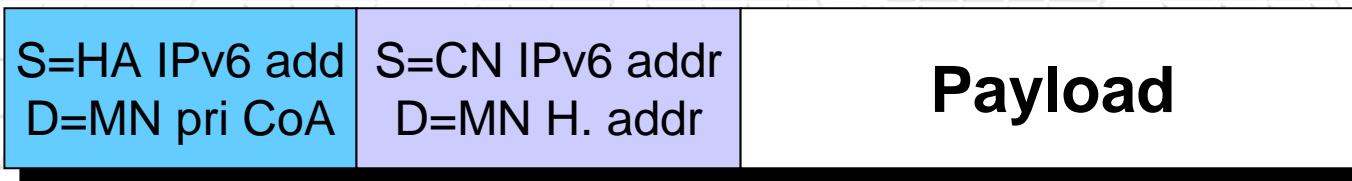


- Configure a new Care-of-Address
 - Use Stateless Address Autoconfiguration (Router Advertisement)
 - If after some time no advertisements are received, the MN sends a Router Solicitation message
 - Use Stateful Address Autoconfiguration (DHCP)
- Register this “primary” Care-of-Address with its HA.
 - Sends a BU to HA with ACK flag on
 - HA answers with a BU Acknowledgement

HA detailed operation

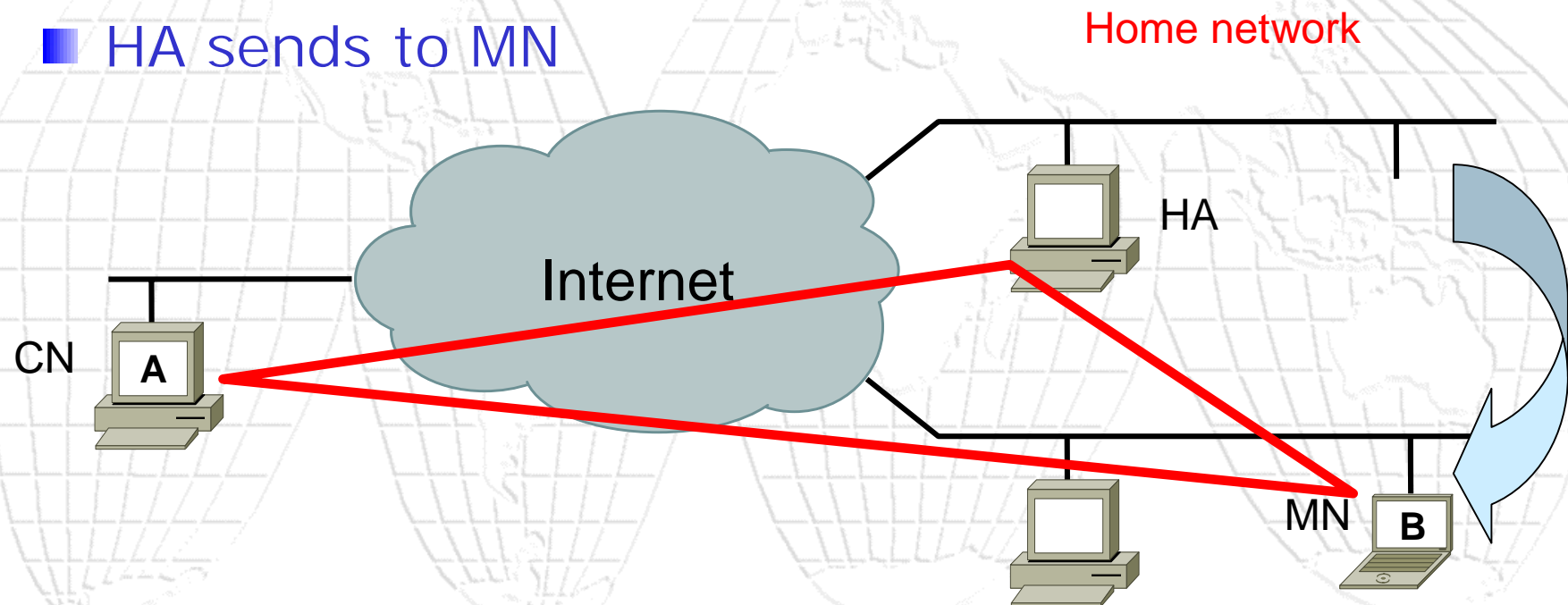


- After the MN registers its CoA, the HA performs “proxy Neighbour Discovery”
 - HA multicasts a Neighbor Advertisement on behalf of MN
- Sends packets for MN with IPv6 encapsulation



Triangle routing

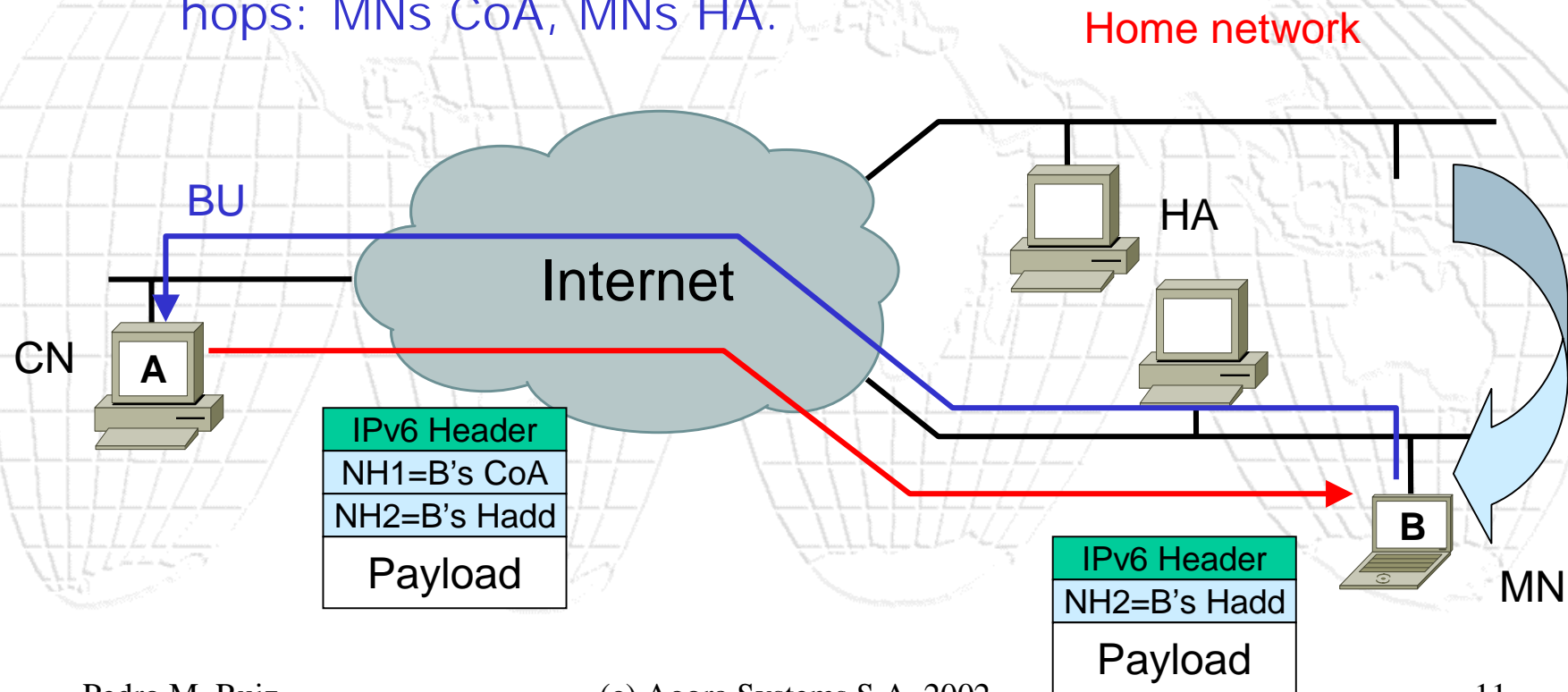
- MNs sends to CN (uses Home Address extension)
 - So, no problem with ingress filtering (anti-spoofing)
- CN sends to HA
- HA sends to MN



Route optimisation



- MN can send BUs to CNs
- CNs maintain a BU Cache
 - If destination there, it sends with a routing header of two hops: MNs CoA, MNs HA.



Binding details



- MN needs to set the ACK bit in the BU to trigger the sending of a BU ACK by CN
- If a packet is coming from the CN to the MN through the HA, it will send a BU.
- Setting the ACK bit is a **MUST** when the BU is addressed to the MNs HA
- A CN may send a Binding Request towards the MN before the entry expires in its Binding Cache. The MN **MAY** answer with a BU
- Binding messages **MUST** be authenticated
 - Not required for Binding Requests

Dynamic HA Address Discovery



- While the MN is away the home network may change
 - Eventually its home agent can change as well
- MN can send "ICMP HA Address discovery request" to "Mobile IPv6 Home-Agents" anycast address for its own subnet prefix
- Any HA in its home link will send an "ICMP HA Address discovery reply" including a list of candidate HAs in preference order.
- This list is maintained by every HA using the "H" bit in each home agent's periodic unsolicited multicast "Router Advertisement".

Return to Home Network



- MN just uses its Home Address
- MN issues an IPv6 Neighbour Advertisement so that:
 - Cancels the proxy Neighbour Advertisement issued by HA
 - IPv6 packets are not intercepted anymore
 - HA detects MN is no longer away

Security



- BUs and Binding Ack. options HAS to contain Authentication Data to prevent forged BU or Binding Ack.
 - At least providing sender auth, integrity and replay protection
 - Extended Security Payload (ESP) is not enough
- Binding requests do not require authentication

MIPv6 advantages wrt MIPv4

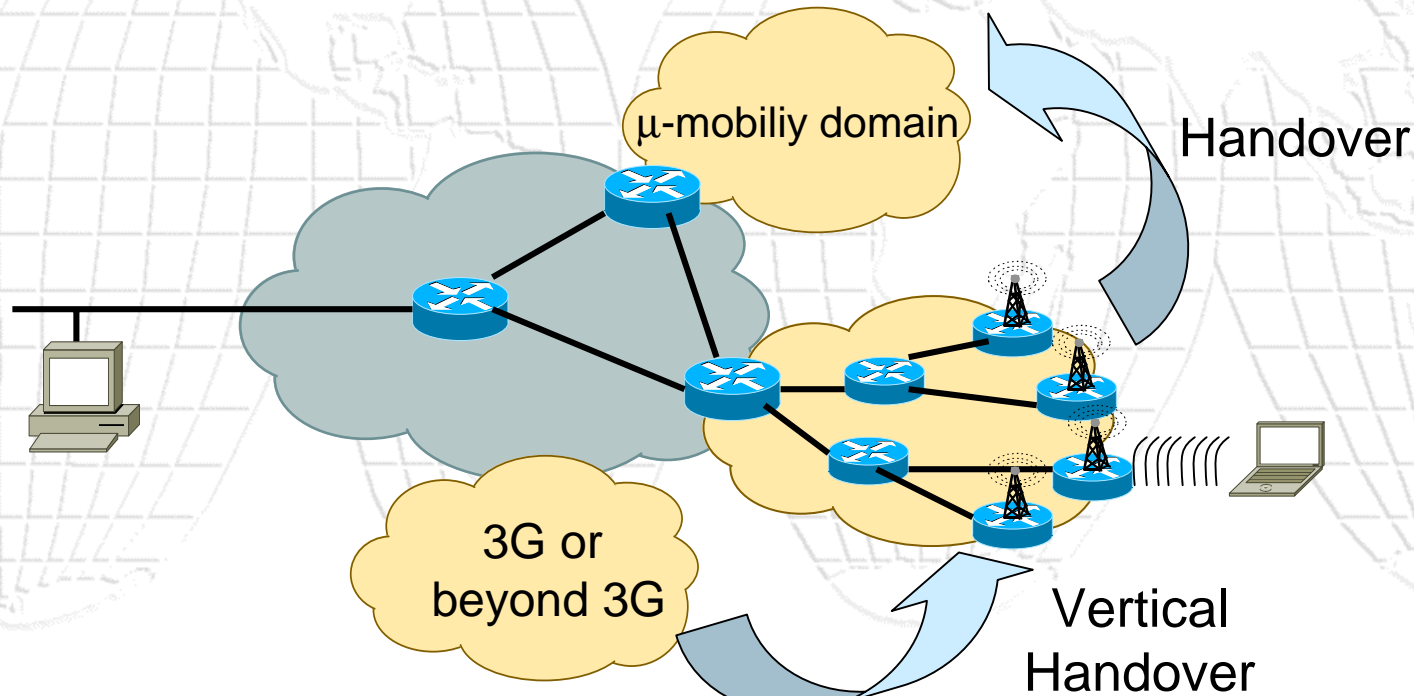


- Route optimisation
- Coexistence with ingress filtering
- IPv6 destination options allow piggybacking instead of needing additional signalling messages
- No foreign agents needed because IPv6 autoconfiguration features are used
- Neighbour advertisements issued by HAs to intercept the traffic for a MN are independent from the physical layer (ARP is not)
- Dynamic Home Agent discovery using Anycast
- ...

Macro and micromobility



- IETF is supporting two different streams:
 - Macromobility support (Mobile IP)
 - Micromobility support (Cellular-IP, HMIP, etc)



What about applications?

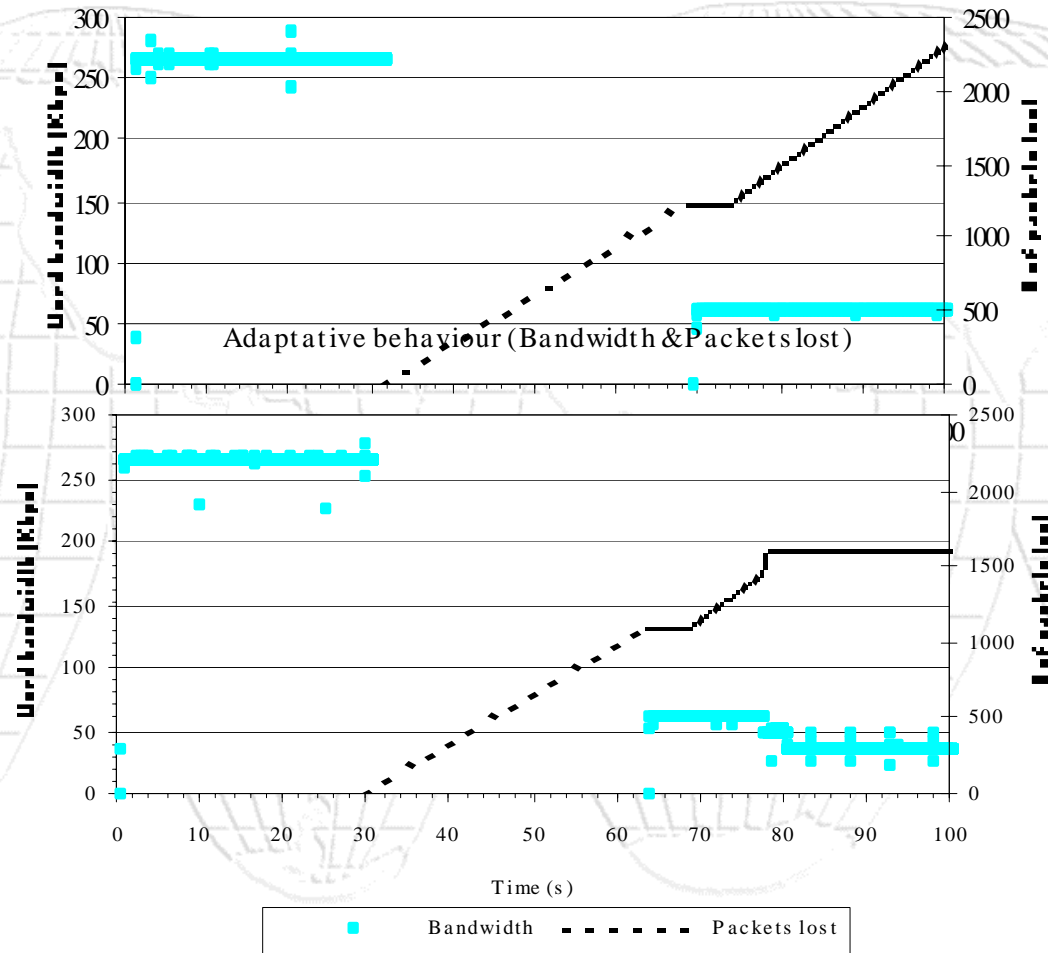


- The use of routing headers prevents the application for managing address changes.
 - The MN always is reachable by its home addr.
 - Home Address extension informs CNs
 - CNs sends packets with a two hop routing header
 - HOP1 = CoA
 - HOP2 = Home Address
- However, applications (specially real-time) have to deal with
 - Unplanned handovers
 - Continuous changes in the available bandwidth
 - ...

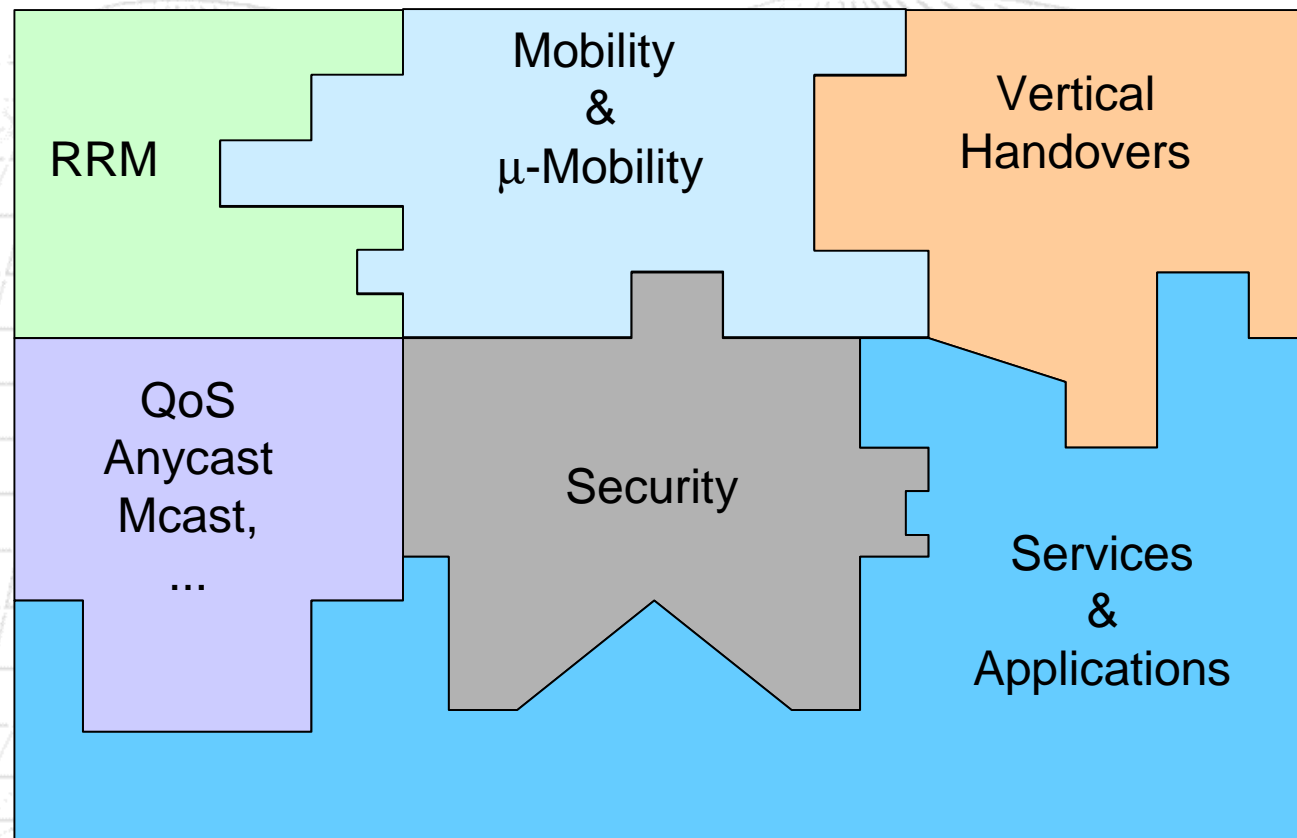
Applications (2)



Normal behaviour (Bandwidth & Packet Lost)



Conclusions



References



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