Mobile Communications

Micro-Mobility

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Mobility in IEEE 802.11

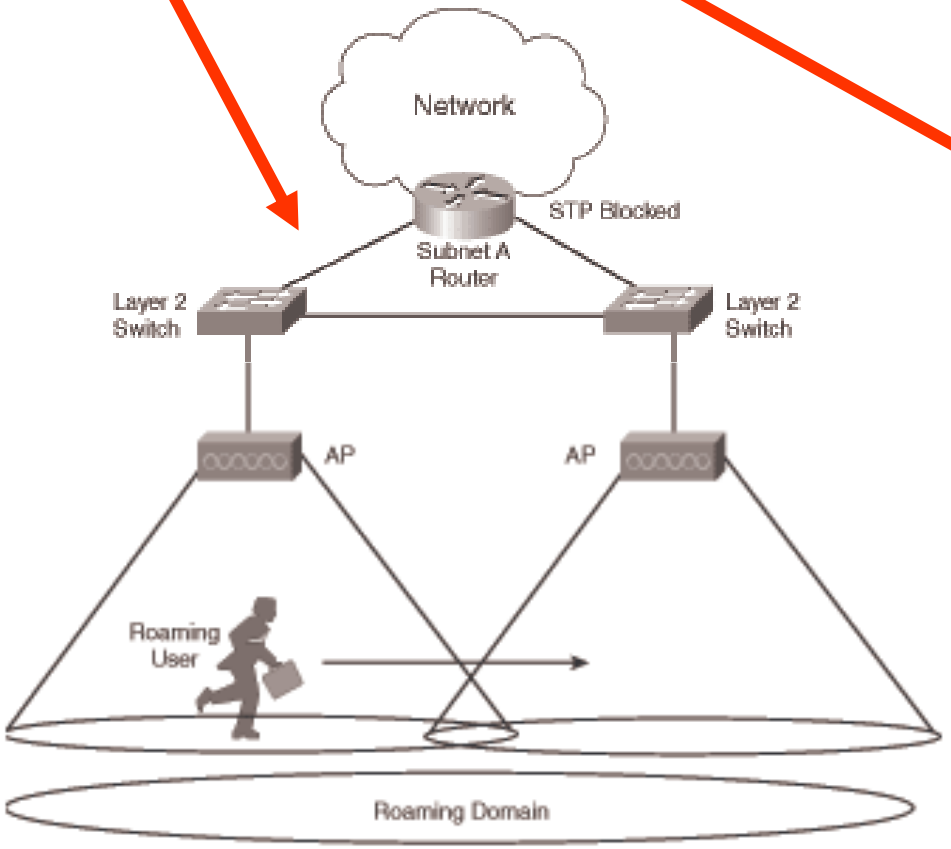
- *How is mobility currently managed in IEEE 802.11 networks?*

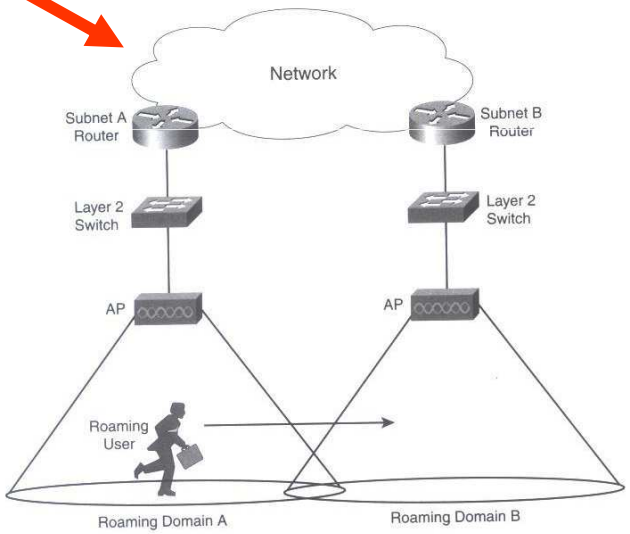
Break and Make

- Two concepts for *roaming*
  - » Break before make
    - – station ends association with current AP before creating an association to a new AP
  - » Make before break
    - – station associates with new AP before disassociating from the old AP

- *Normal* roaming in 802.11 *break before make*
  - » simpler MAC, simpler radio
  - » but ... data is lost during roaming

Layer 2 vs Layer 3 Roaming





IEEE 802.11 Roaming

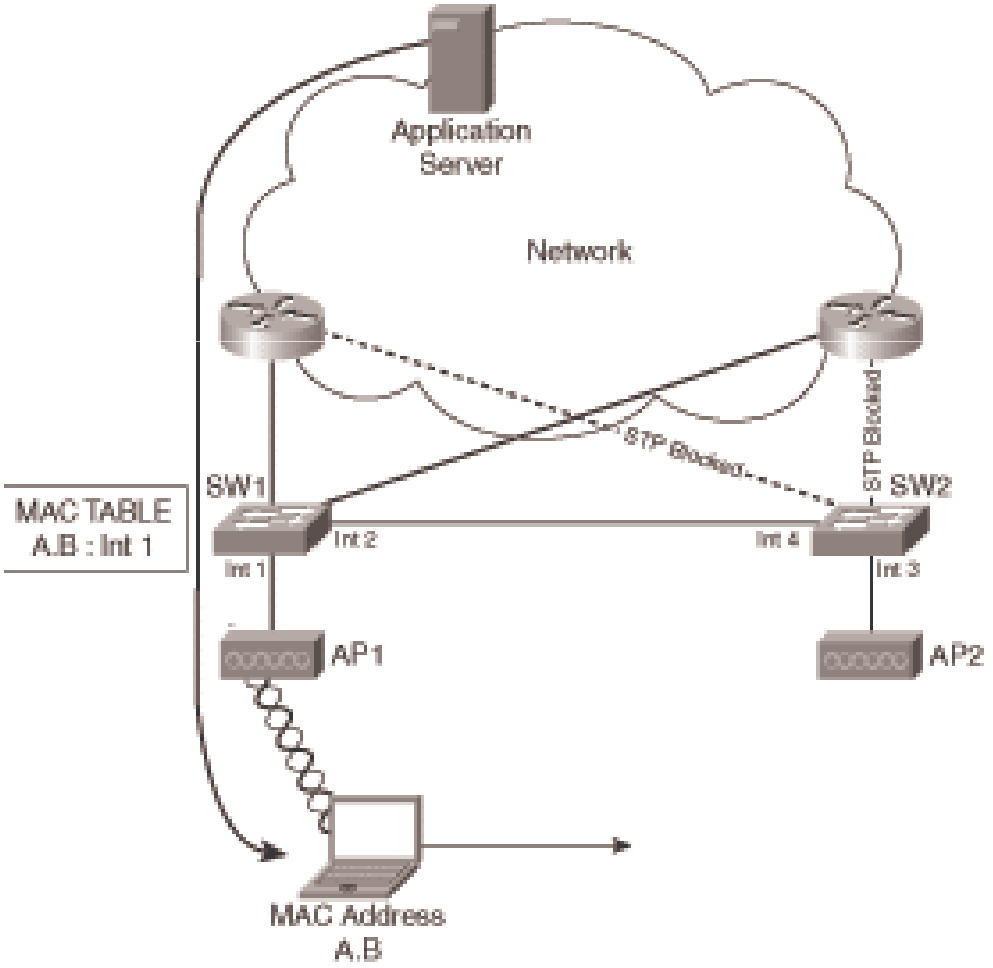
- Sequence of events
  1. Station decides *when* to roam
     based on signal strength, frame acknowledgment, missed beacons, …
  2. Station decides *where* to roam (new AP)
     scans the medium for new APs, either before or after the decision to roam
  3. Station initiates the roam
     sends ***reassociation*** frames to associate to a new AP
  4. Station resumes existing data transferences

- Roaming duration depends on some processes
  - » probing
  - » 802.11 authentication
  - » 802.11 association
  - » 802.1X (security, keys)

AP Discovery

- Active scanning
  - » station actively searches for an AP
  - » station
    - – sends probe requests and waits for probe responses from AP, on each channel
    - – probe response delay in a channel: 10 to 20 ms
- Passive scanning
  - » station silently listens for beacon frames on each channel
  - » station continues to change channels
  - » slower then active scanning; AP sends usually 10 beacon/s

Configuring Routes During L2 Roaming (./…)



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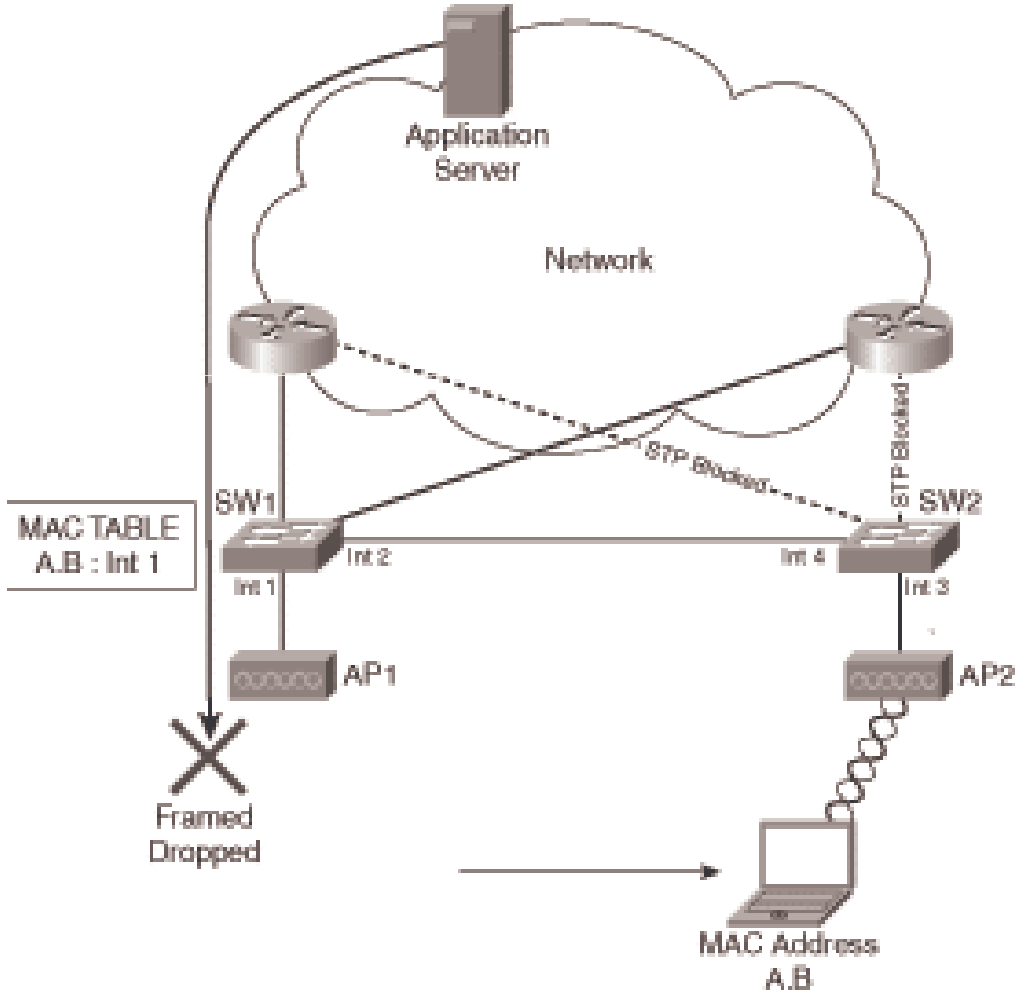
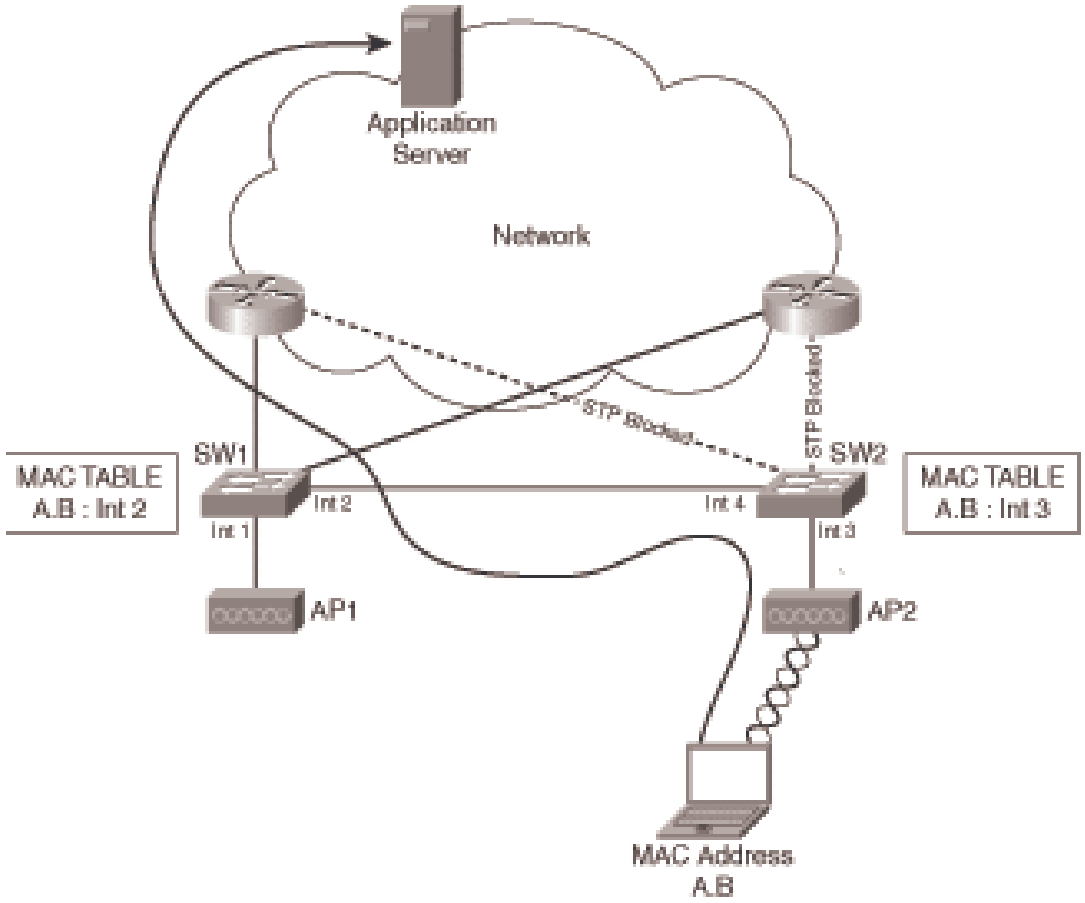


Configuring Routes During L2 Roaming (…/…)



IEEE 802.11 Roaming - Problems

- (Re)Authentication process may take hundreds of ms
  - » Particularly when 802.1x is used (individual encryption keys)
- Unacceptable for VoIP

- New standard under development
  - » 802.11r
  - » Keys and QoS reservation transferred between APs

Micro-Mobility IP

FEUP

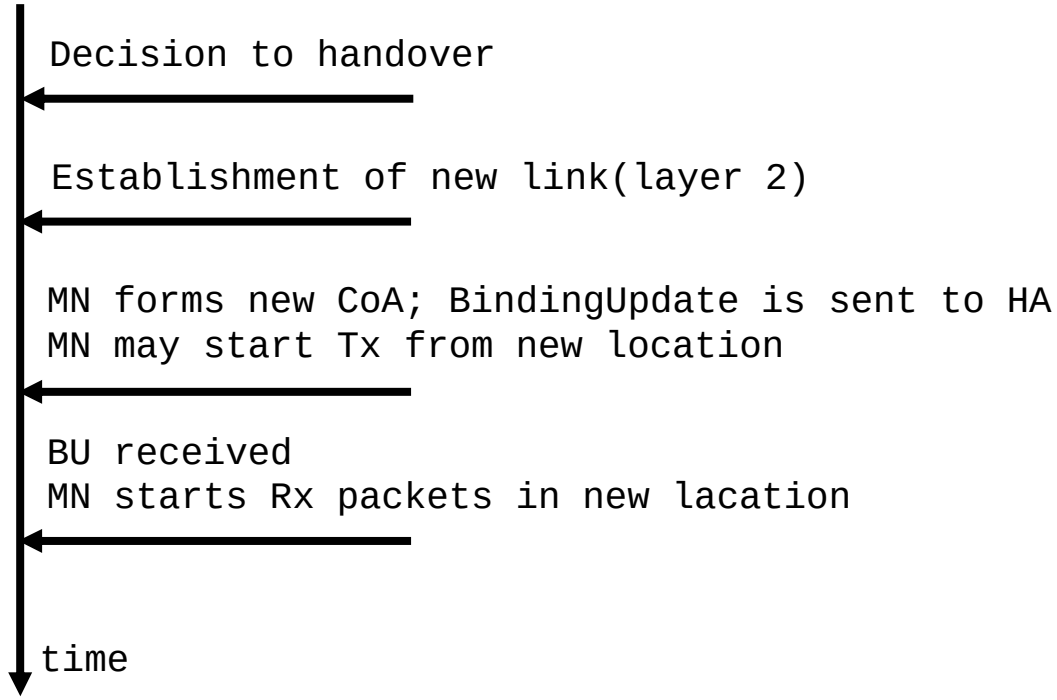
MPR

- *How can micro-mobility be handled at the IP layer?*

Micro-mobility solved at the IP Layer

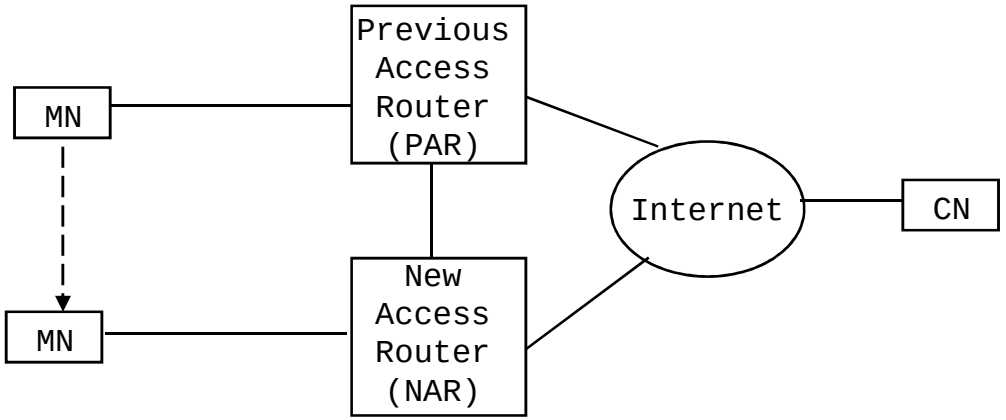
- Micro-mobility ← Frequent movements in an IP domain
- Problems of using Mobile IPv6 in micro-mobility scenarios
  - » Time required to detect the new network
  - » Time required for the terminal to configure an address in the new network
  - » Time required to update the new location (BindingUpdate) near the HomeAgent
  - » Packets sent to old CoA are lost
  - » Frequent movement → lots of signalling
- Solutions
  - » First - IP Celular, HAWAII
  - » More recently - FastHandover, HMIP - Hierarchical Mobile IP, Context transfer
- But, and whenever possible,
  - » Micro-mobility better performed at layer 2 ….

Handover in MIP

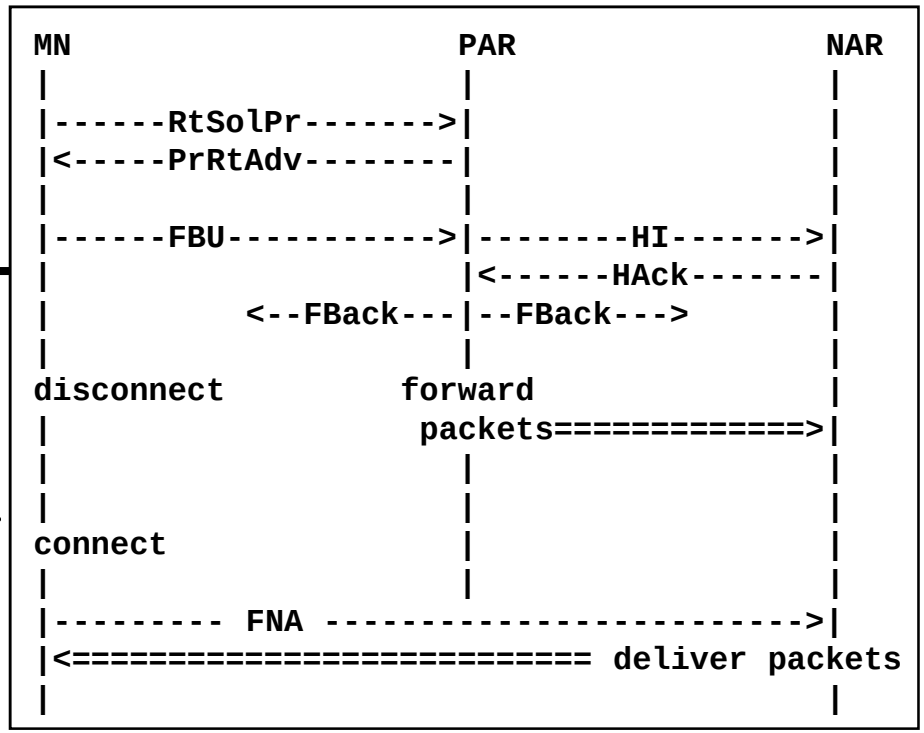


FastHandover Solution

- "Fast Handovers for Mobile IPv6"
  - draft-ietf-mipshop-fast-mipv6-03.txt
- MN learns about new router while connected to current router
  - Make before break
  - Fast detection of the NewAccess Router (NAR)
  - Auto-configuration of new CoA is antecipated
- MN also receives packets send to the PreviousAccessRouter
  - While BindingUpdate is not finished

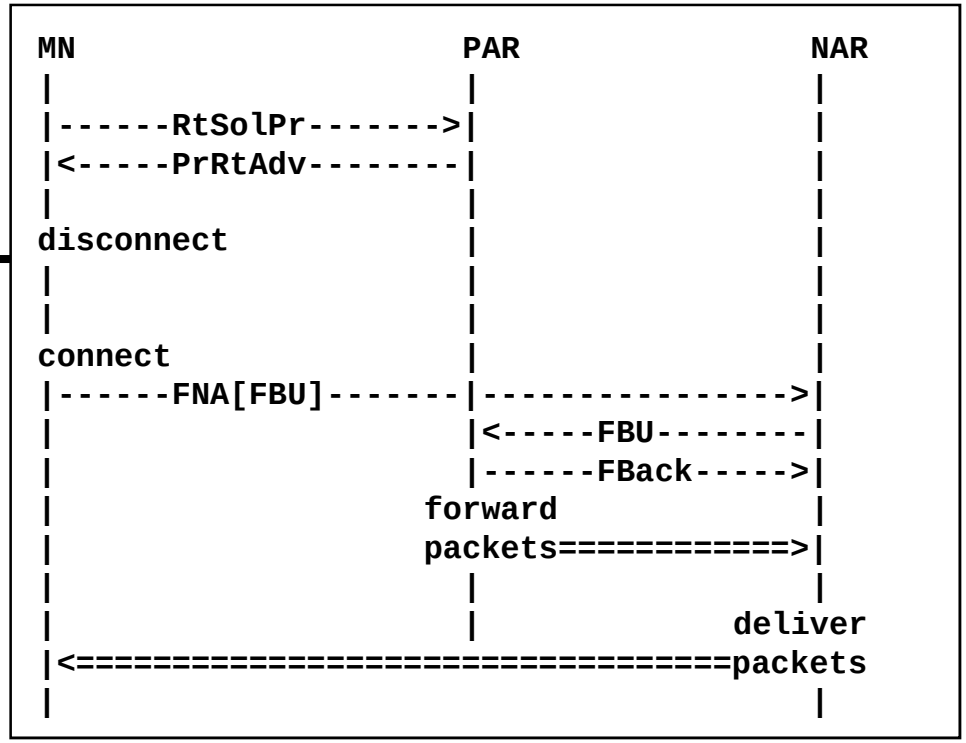


FastHandover – Previsible Handover



- MN discovers New Access Router
  - Using layer 2 mechanisms
  - E.g. by scanning WLANs
- MN forms NCoA
  - RouterSolicitationforProxyAdvertisment (RtSolPr)
  - ProxyRouterAdvertisment (PrRtAdv)
- MN requests tunnel establishment between PCoA e NCoA
  - FastBindingUpdate (FBU)
- MN sends FastNeighborAdvertism (FNA) to inform NAR about its arrival
  - NAR starts delivering packets to MN

FastHandover – Reactive Handover



- FBU sent from new location/link
  - » In a single message, MN announces itself to NAR and requests tunnel
  - » NAR contacts PAR sends FastBindUpdate

Hierarchical Mobile IPv6 (HMIPv6)

- Operation
  - » Domain has Mobility Anchor Point MAP
    - – Regional COA (RCOA) is mapped to Link COA (LCOA)
  - » In handover, MN just informs MAP
    - – Gets new LCOA, but maintains RCOA
  - » HA is contacted only when MAP changes