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Mobility Management for IP-based Mobile Networks

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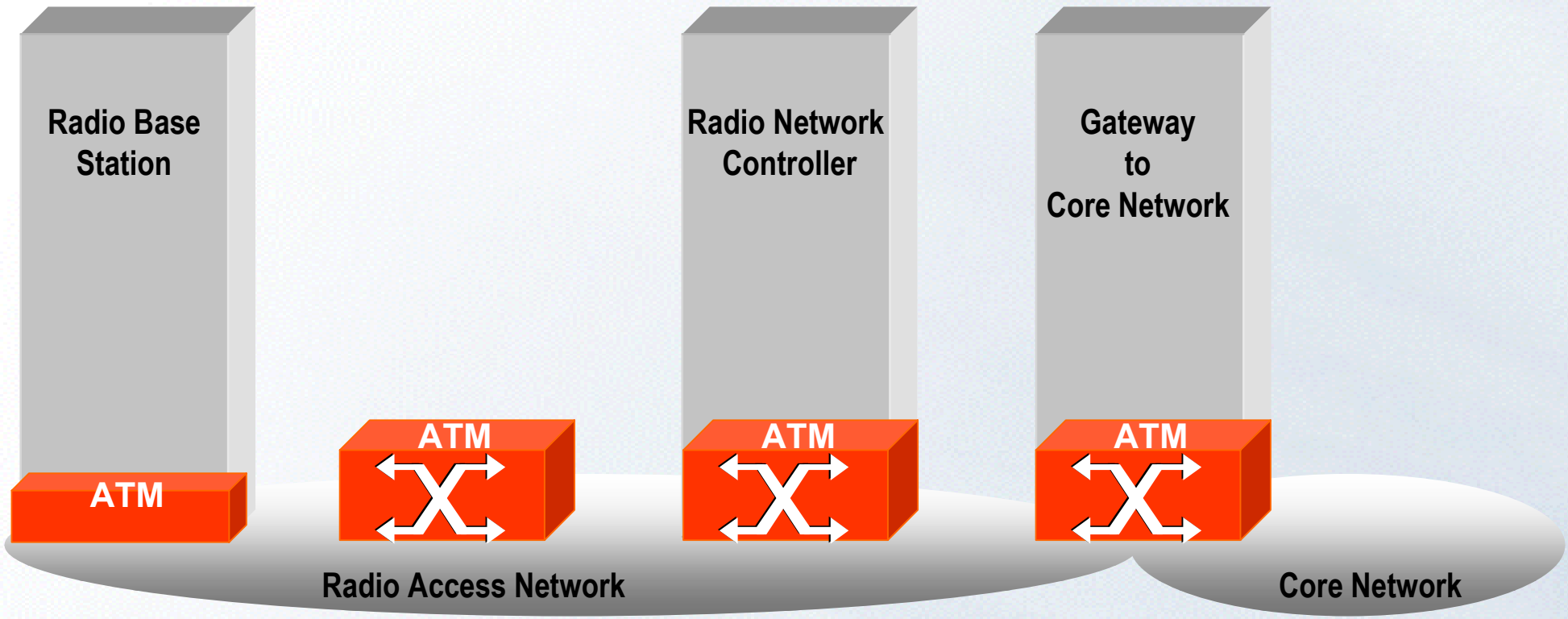
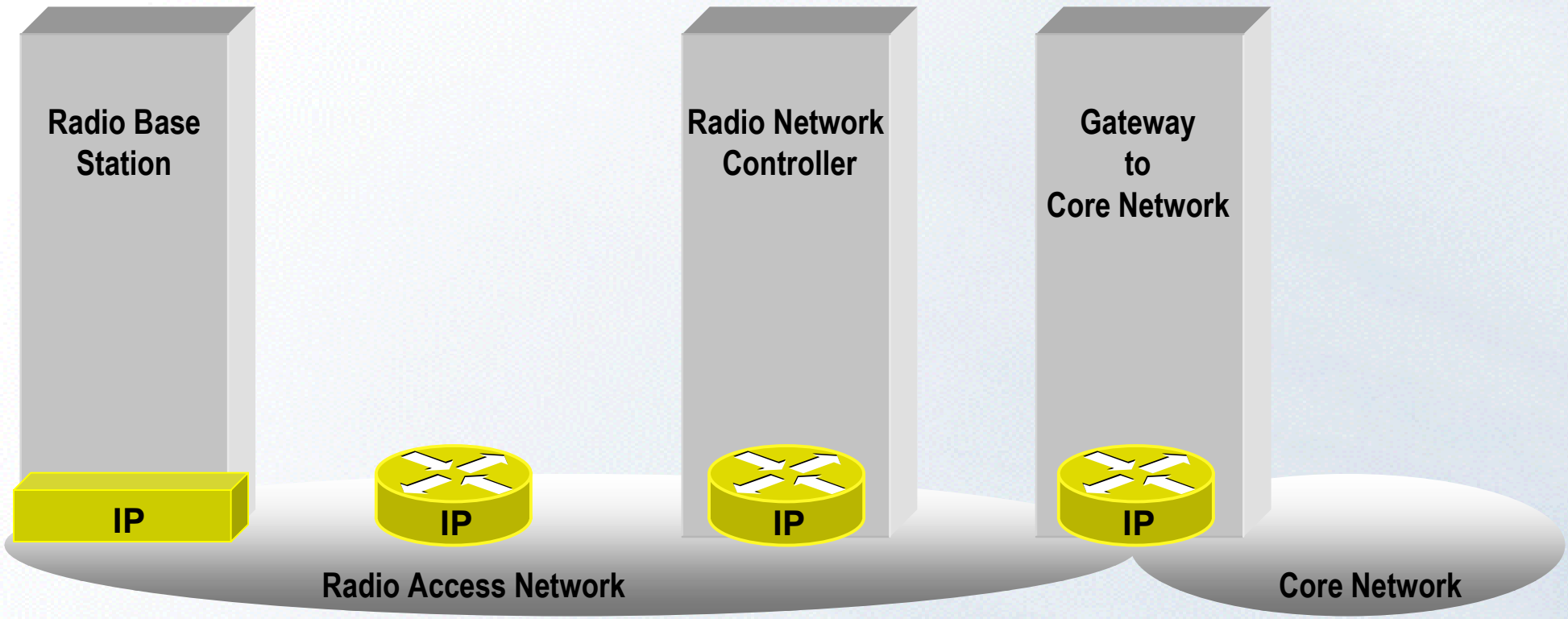
Overview

- Introduction to IP-based Radio Access Networks
- Definition of Mobility Management
- Mobility Management concepts for the IP-based RAN
- Mobility Management schemes
- Conclusion

IP-based 3G RAN?



IP-based 3G RAN?



Was that all?

No!

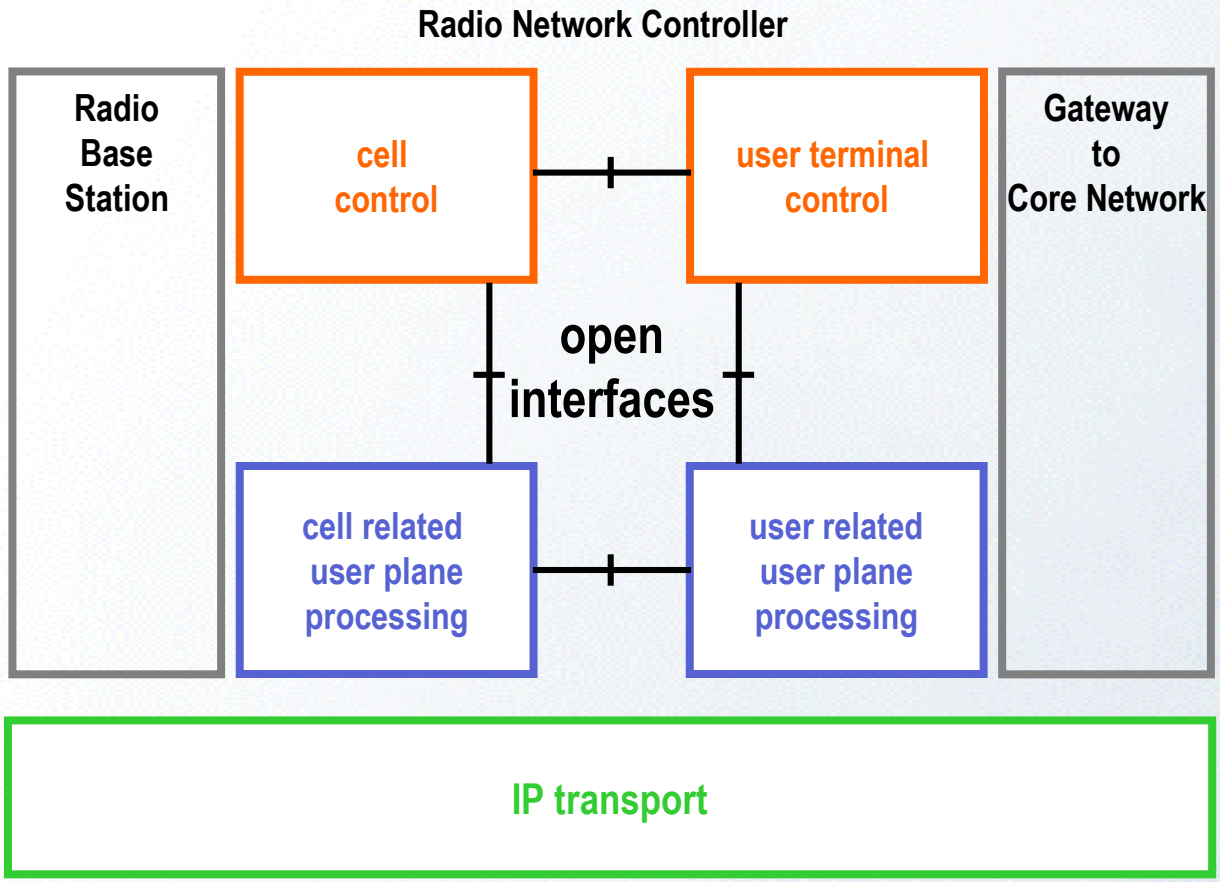
IP-based RAN =

- **IP transport**

+

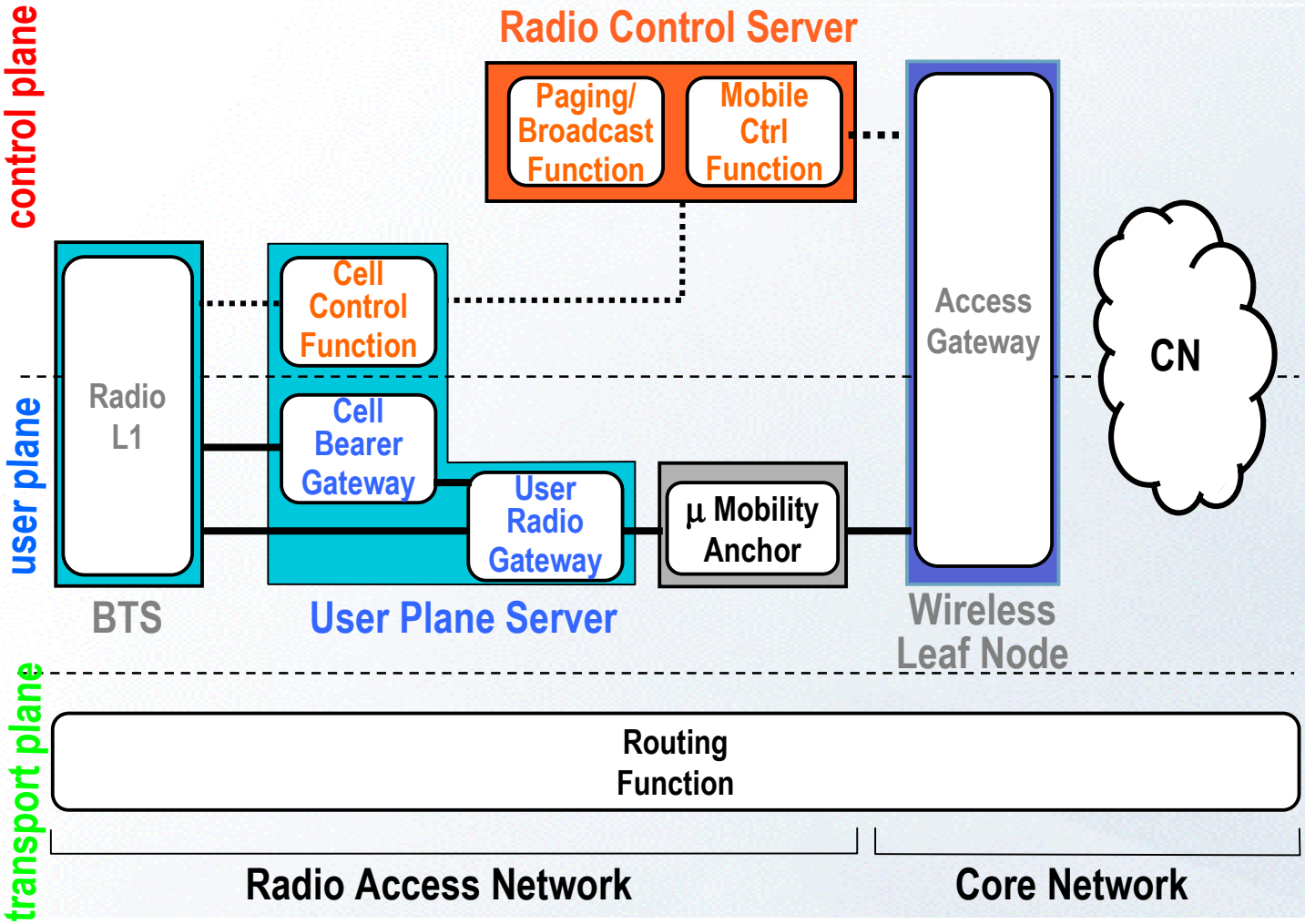
- **Open Architecture based on Internet paradigms**

Architectural principles



- **separation of transport and RAN functions**
- **distribution of RAN functions**
  - user / control plane
  - cell related / user related functions
- **open interfaces**

Architecture and functions



- **not all functions shown**
- **important distinction:**
  - function
  - network element

  e.g. the Radio L1 function is a function of the BTS
- **dynamic functions serving a UE are**
  - localized on network elements
  - some of them must be relocated as the UE moves - especially those in the user plane

Definition

The task of the Mobility Management is

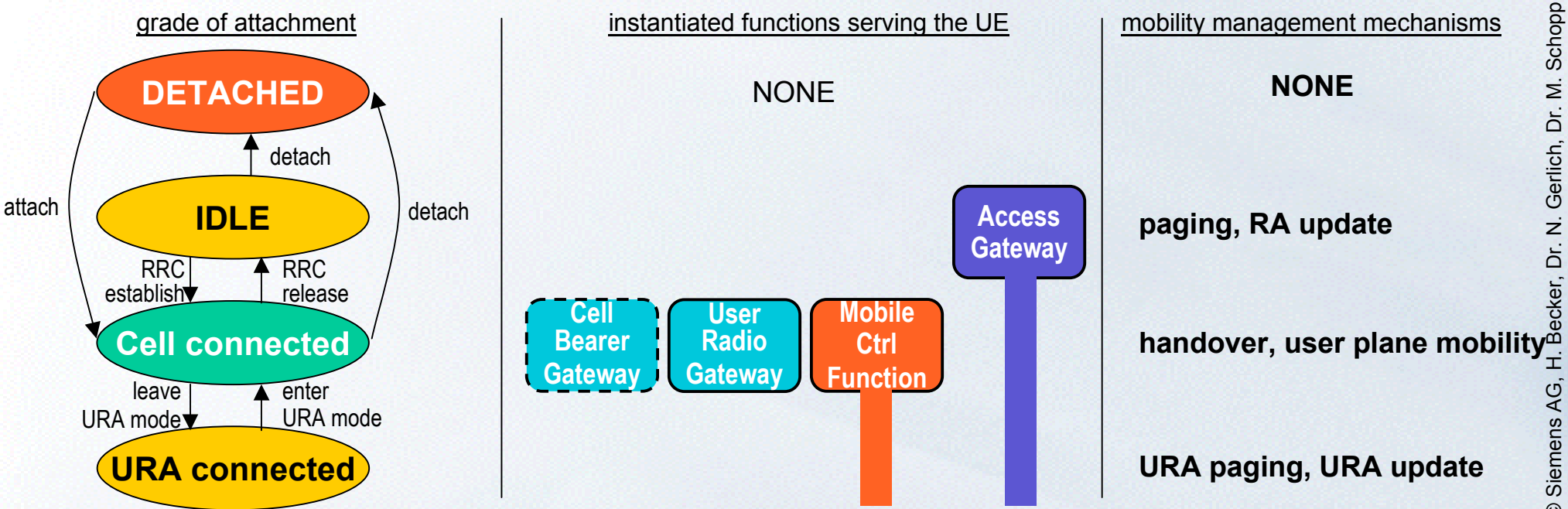
- to maintain location information of the user equipment

in order to

- manage the localization of network resources involved in serving a particular user equipment.

Grades of attachment and mobility management

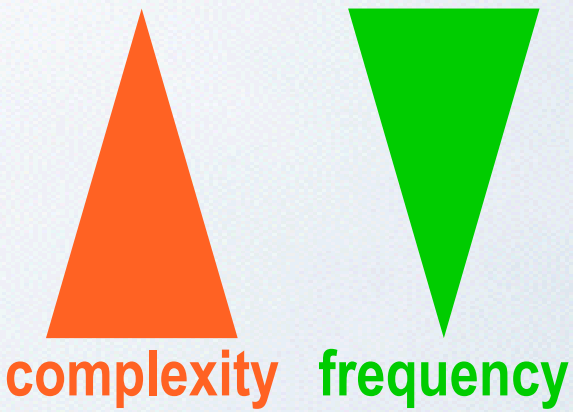
- **grades of attachment to the network**
  - aim: use network and terminal resources efficiently
  - depending on the communication needs
  - characterized by instantiated functions and mobility management mechanisms



Basic idea

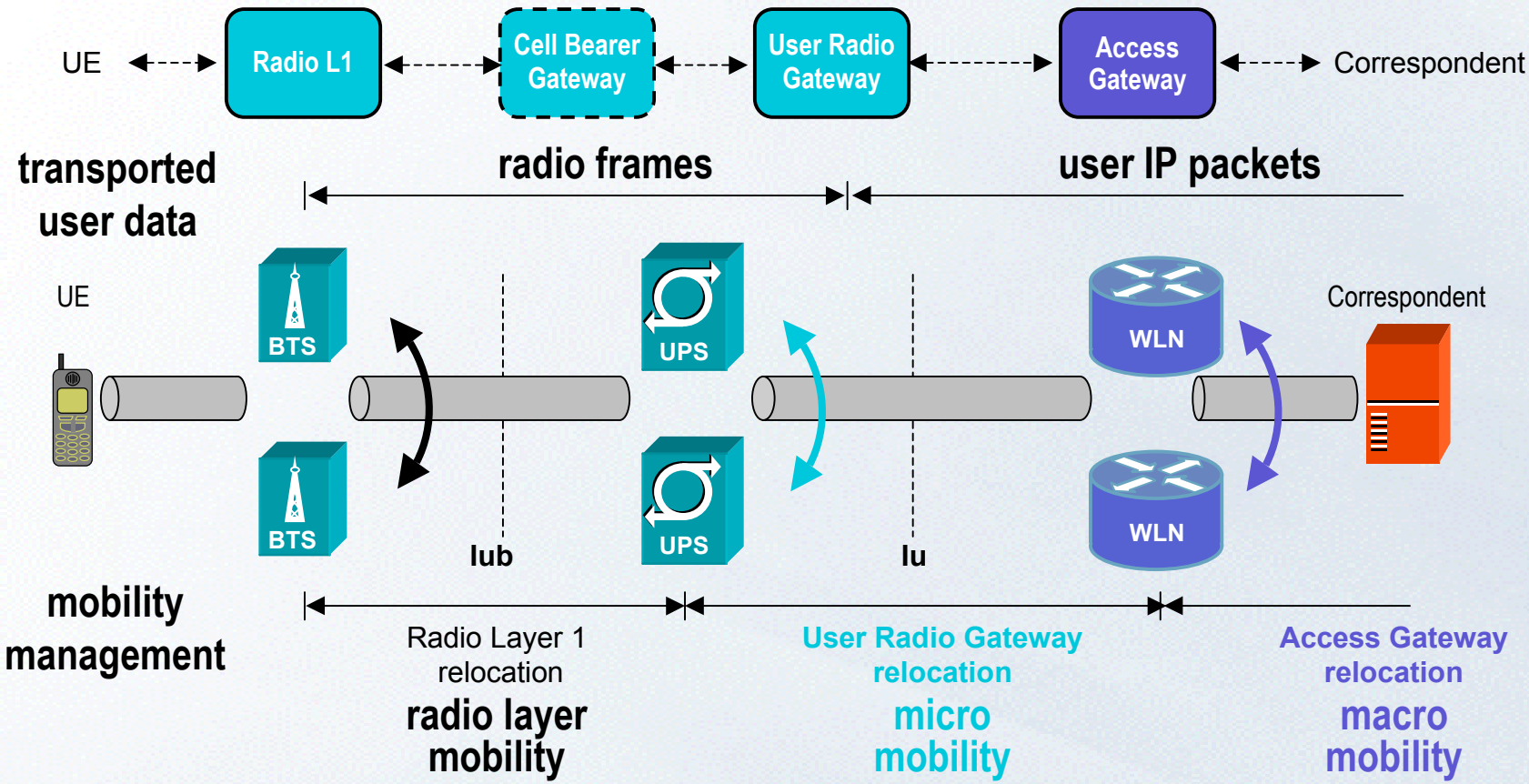
Exploit different grades of user and control plane mobility

- BTS relocation
- UPS relocation
- RCS relocation

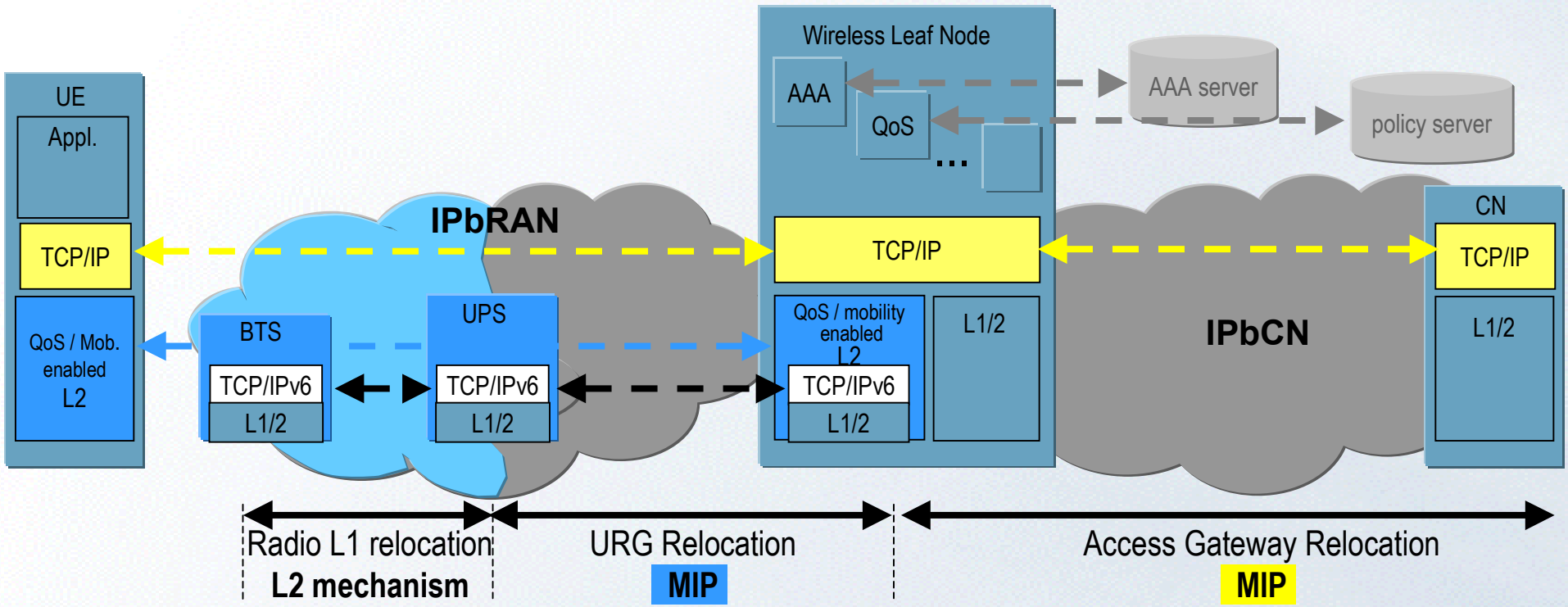


RAN related mobility management tasks in the user plane

Manage the localization of functions such that a transmission path between UE and correspondent is maintained

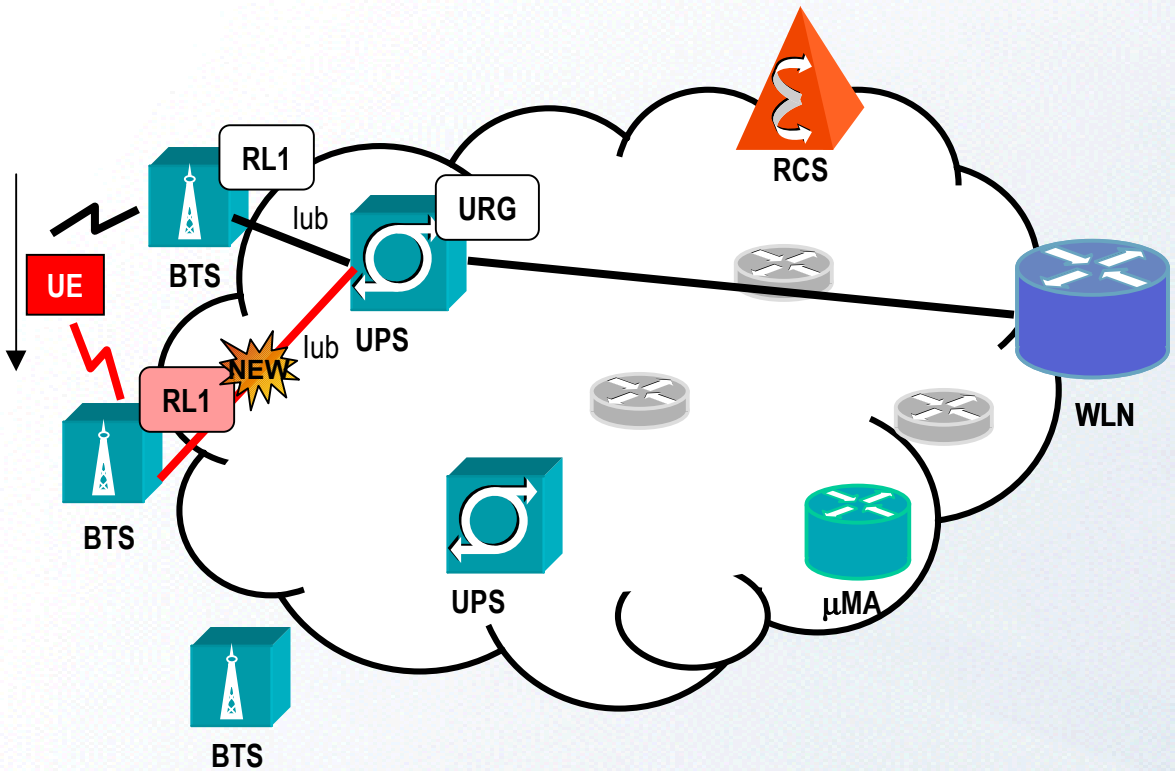


Layered IP mobility concept for IP-based Mobile Networks



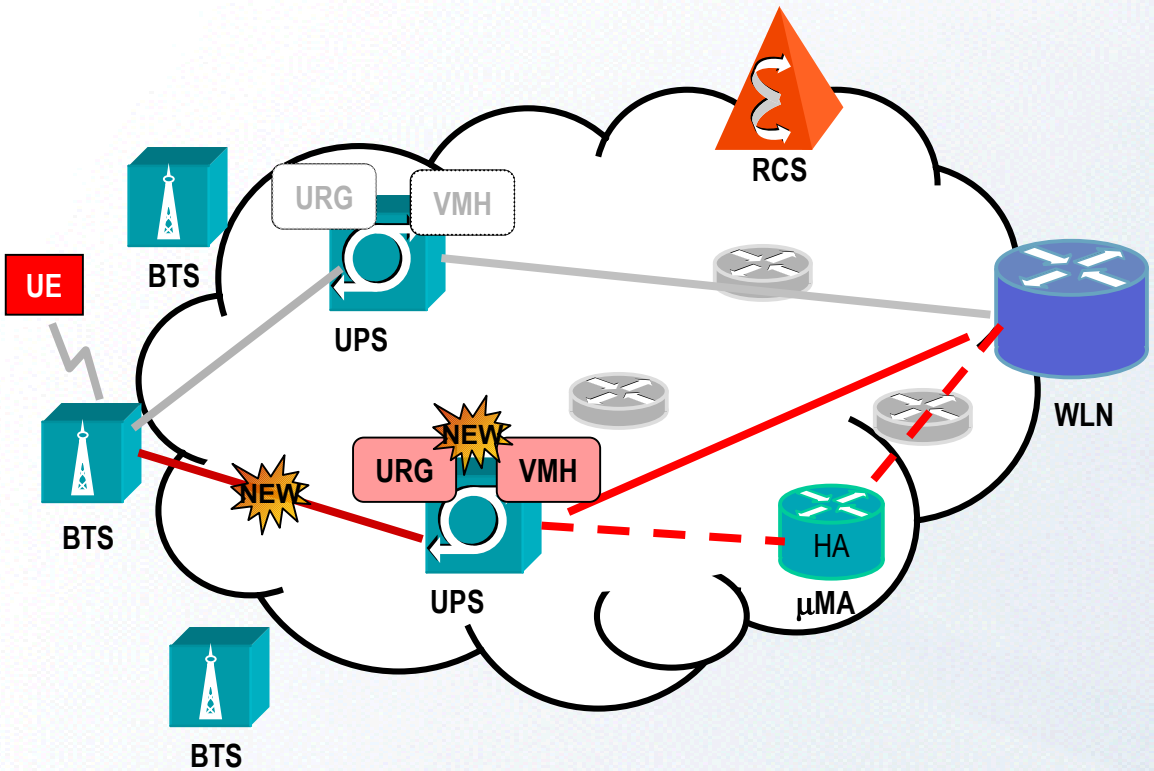
- **from user IP point of view the WLN is the access router**
  - → IPbRAN as QoS/mobility enabled Layer 2
- **between UPS and BTS radio frames containing data of multiple UEs are transported**
  - → IP based per UE mobility ends at the UPS

Radio L1 relocation



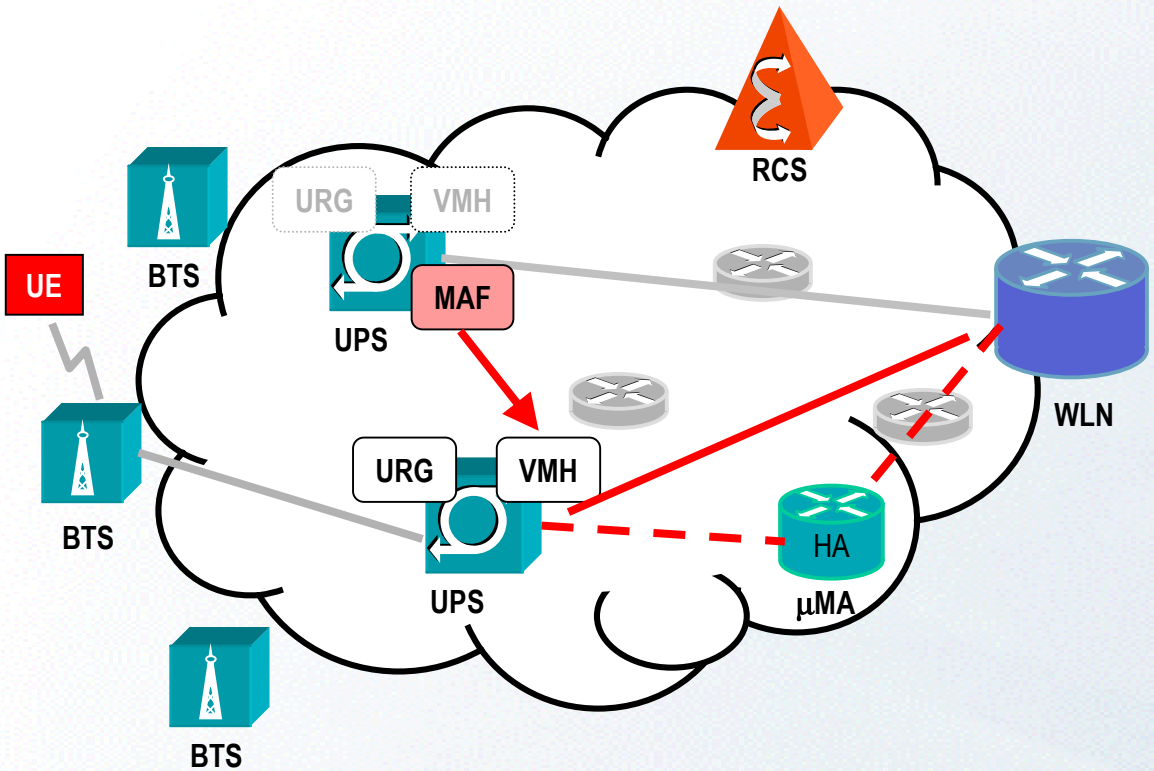
- **triggered by UE entering the radio coverage of a new BTS**
- **uses "legacy" mechanisms controlled by signaling from RCS**
- **soft handover**
  - instantiate RL1 function on new BTS
  - instantiate new Iub interface
  - if on dedicated channels: configure macro diversity combining (User Radio Gateway)
- **hard handover**
  - instantiate RL1 function on new BTS and Iub interface
  - release RL1 function on old BTS and Iub interface

User Radio Gateway relocation



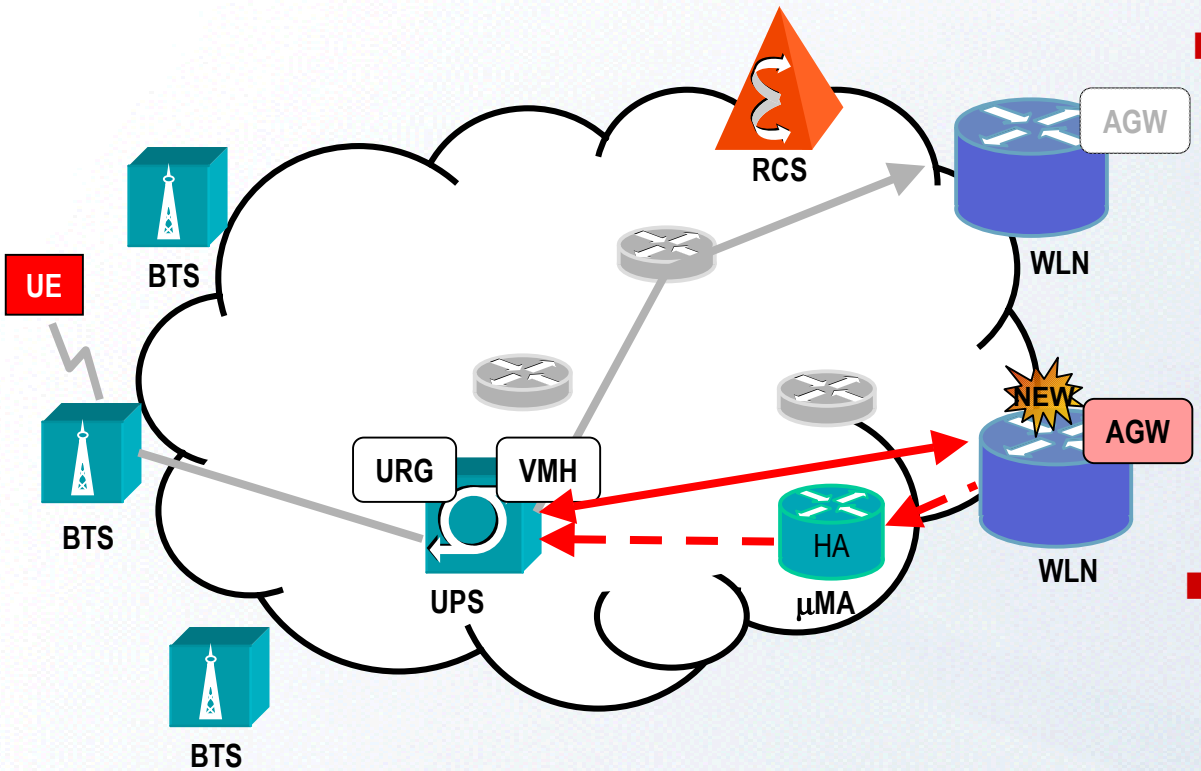
- **Triggered by the RCS (may run in parallel to RL1 reloc)**
- **uses Mobile IPv6**
  - **Virtual Mobile Host** (VMH) acts as tunnel endpoint and for MIPv6 signalling
  - VMH uses IPbRAN internal address from HA's subnetwork as home address
  - Care-of-address from UPS subnetwork
- **Relocation**
  - URG relocation by RCS signaling → VMH relocation
  - packet path configuration through MIPv6 signaling by VMH

User Radio Gateway relocation



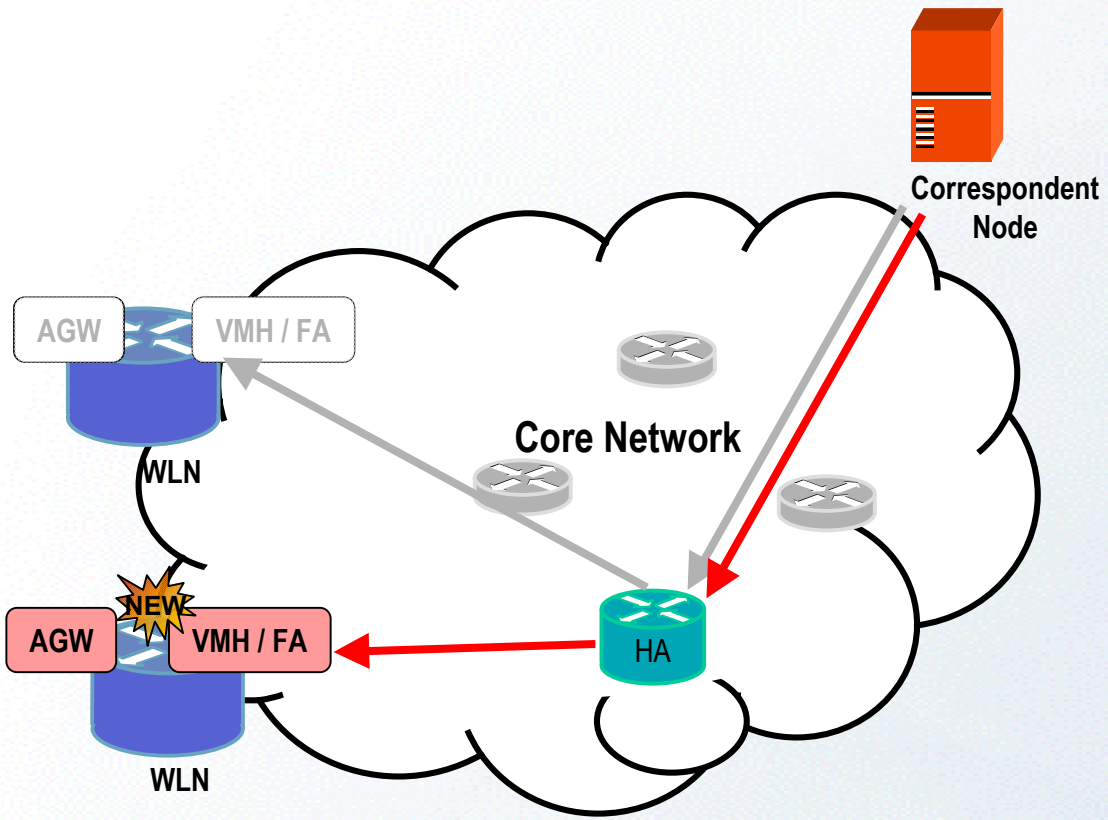
- **Reducing packet loss during relocation:**
  - **Mobile Anchor Function** (MAF) redirects in-flight packets to new UPS
  - **Hierarchical Mobile IP** mechanisms to include MAF in packet path

Access Gateway relocation: RAN



- **triggered by the RCS for path optimization**
- **new Iu interface set-up by "legacy" RANAP signalling**
  - RCS provides new WLN with IP address of VMH from HA's subnetwork
  - New WLN informs RCS about its IP address
  - RCS provides VMH with IP address of new WLN
- **Relocation**
  - packet path configuration through MIPv6 signaling by VMH

Access Gateway relocation: Core Network



- **down link redirection in Core: Mobile IP**
  - if UE cannot support Mobile IP: **Virtual Mobile Host** (VMH)
  - else: **Foreign Agent** (FA) function
- **Relocation**
  - AGW relocation by RCS signaling →
    - VMH relocation

    or
    - FA advertisements sent to UE
  - packet path configuration through MIP signaling

Summary

- **Mobility management concept combines**
  - existing IP mobility protocols with
  - traditional mobility management concepts
- **IP mobility shifts mobility management into transport layer**
- **IP based mobility is attractive for seamless inter technology roaming (eg. WLAN to 3G-RAN)**
- **Hierarchical non-monolithic model provides for flexibility**
  - macro mobility
  - micro mobility
  - radio layer mobility