Handoff Schemes Overview and Guidelines for Handoff Procedures in 802.16

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Purpose:

Disccussion

Handoff Schemes Overview and Guidelines for Handoff Procedures in 802.16

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Purpose

- Survey handoff schemes in cellular and WLAN networks
- Present guidelines for handoff support in 802.16
- Offer handoff support within the framework of the OFDMA PHY

Definition

- *Handoff* - a basic mobile network capability for dynamic support of terminal migration

- *Handoff Management* - the process of initiating and ensuring a seamless and lossless handoff of a mobile terminal from the region covered by one base station to another base station

Handoff Basics

- *Measurements* – UL and DL same and neighbor BS's
- *Decision* – when and where to hand the mobile terminal over
- *Execution* – transferring traffic and control to another BS

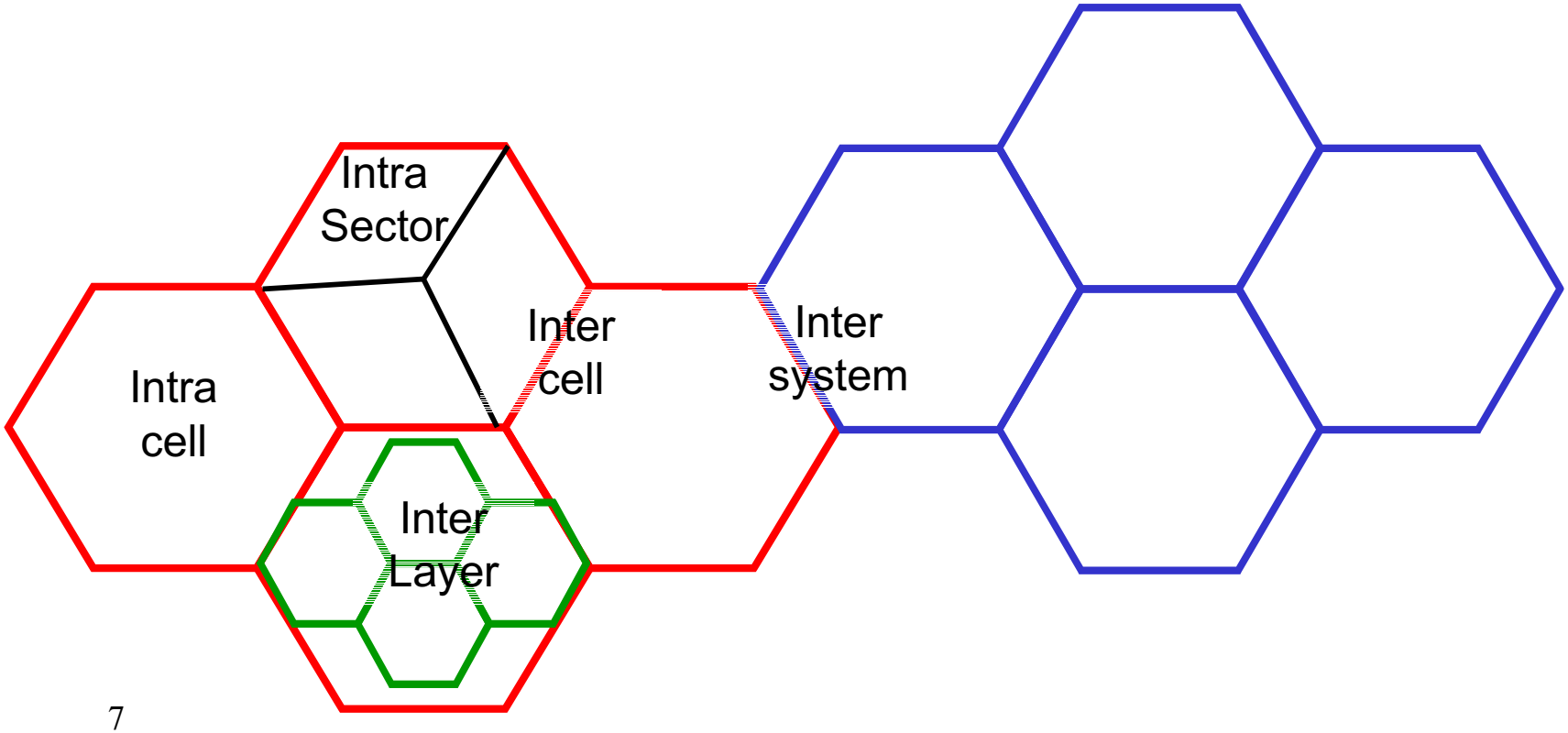
Types of Handoffs

- Location of the HO

	Network	Mobile
Measurements	Network Evaluated HO	Mobile Evaluated HO
Decision	Network Initiated HO	Mobile Initiated HO
Execution		

Types of HO

- Network Elements Involved



Types of HO

- Number of active connections
  - *Hard handoff*: 1 connection active at a time, "break before make"
  - *Soft Handoff*: >1 connection at a time
  - "make before break"

Types of HO

- Types of data transferred
  - *Circuit Switched*
  - *Packet Switched*

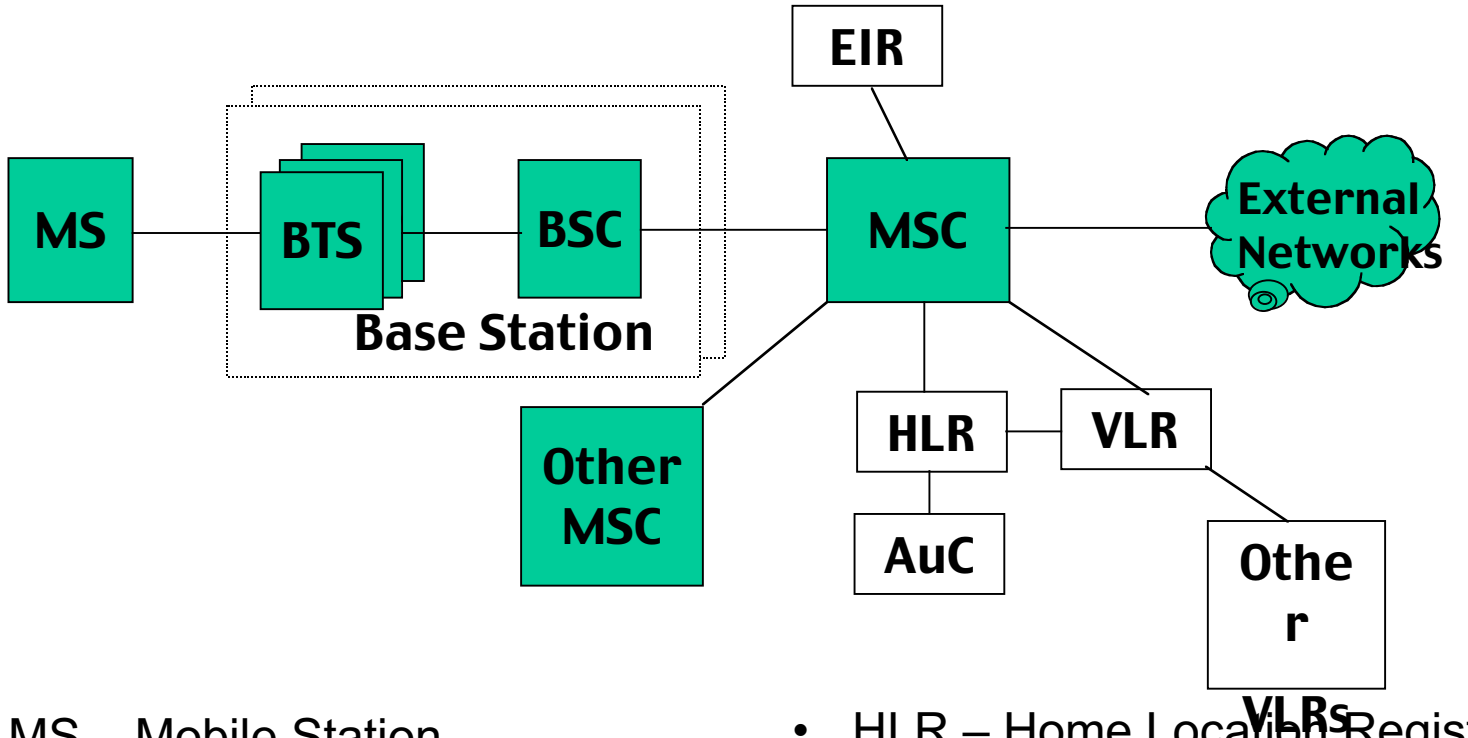
Requirements for HO

- *Latency*: The time required to effect the handoff should be appropriate for the rate of mobility of the mobile terminal, as well as the nature of data transferred.
- *Scalability*: The handoff procedure should support handoffs within the same cell, between different base stations in the same or in different networks
- *Minimal drop-off* and *fast recovery*
- *QoS* maintained or re-negotiatied
- *Minimal additional signaling*

Handoff Implementation

- Cellular SYSTEMS
  - 2G (GSM)
  - 3G (UMTS)
- Wireless LAN
  - 802.11
  - HIPERLAN 2
- Mobile IP

The Cellular Network



- MS – Mobile Station
- BTS – Basestation Transceiver Station
- BSC – Basestation Controller
- MSC – Mobile Switching Center
- HLR – Home Location Register
- VLR – Visitor Location Register
- EIR – Equipment Identity Register
- AuC – Authentication Center

GSM

- Types (network elements)
  - Intracell HO
  - Inter-Cell HO within the same BSC
  - Intra MSC HO
  - Inter MSC HO
- Types (function location)
  - Mobile initiated
  - Network initiated, mobile assisted

GSM (cont.)

- Measurements of the Broadcast Channel on a free time slot
- Decision according to:
  - Minimum acceptable performance

    power control is preferred over HO
  - Power budget algorithms

    HO is preferred over power control

UMTS

- Intra-system Handover:
  - Intra-frequency HO
  - Inter-frequency HO
- Inter-system HO
  - Different radio access technologies (e.g. UMTS and GSM/EDGE)
  - Different radio access modes (e.g. FDD/WCDMA and TDD/TD-CDMA)

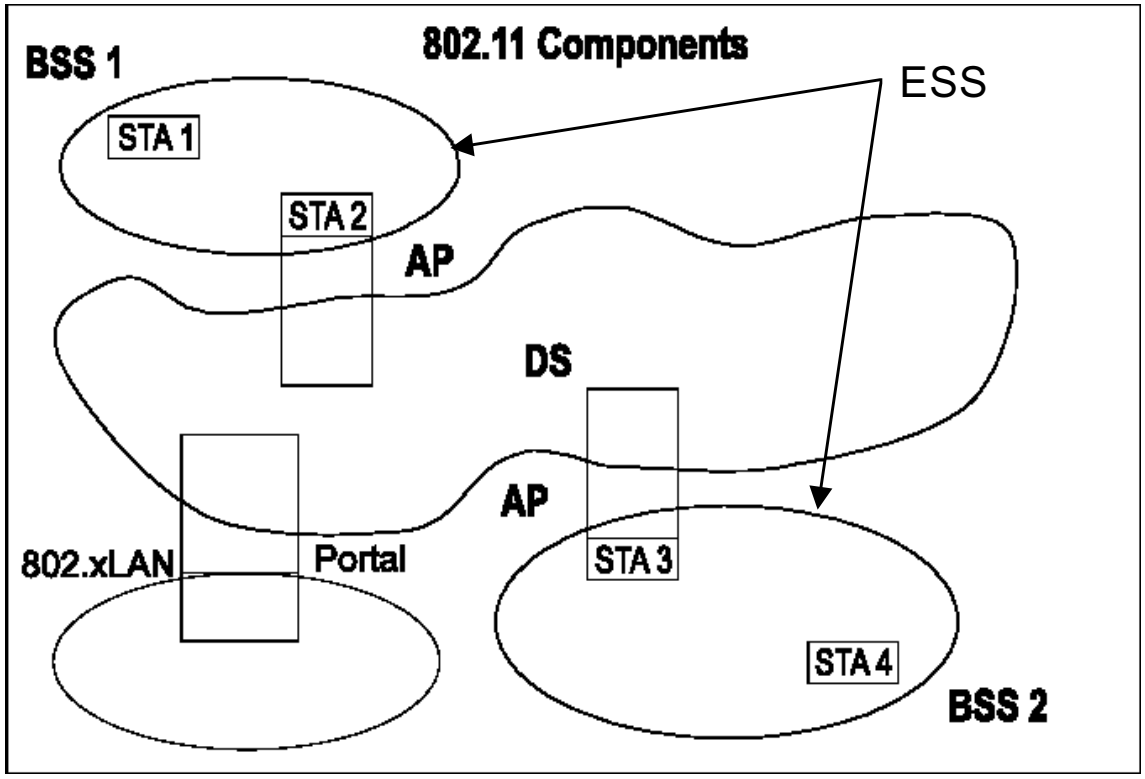
UMTS (cont.)

- Soft Handoff
  - For intra frequency HO
  - Active set controlled by the Radio Network Controller, based on mobile measurements
- Hard handoff
  - For inter-frequency HO, multi-layer
  - Network evaluated, based on mobile measurements

UMTS (cont.)

- Compressed Mode can be used to provide “peeping window” in other frequencies
- Mobile required to monitor up to 32 BS in one or two frequencies
- Broadcast channel and Primary Common Pilot channels are used by the HO process
- Measurements are filtered with 50-200μs symbols- for 60km/h mobiles

802.11



STA- Station

AP – Access Point

DS – Distribution System

BSS- Basic Service Set

ESS- Extended Service Set

802.11 – Mobility Types

- No Transition
  - Static
  - Local movement
- BSS Transition
- ESS Transition

802.11 Process

- Use of the re-association DS service
- Handoff is mobile initiated, hard handoff
- Beacon frames are used for synchronization and measurements

HIPERLAN 2

- Consists of a number of Access Points and Mobile Terminals
- Centrally controlled:
  - In centralized mode: controlled by an AP
  - In Direct mode: by one MT serving as CC
- Handover is restricted to business and public applications

HL2- Function and Capabilities

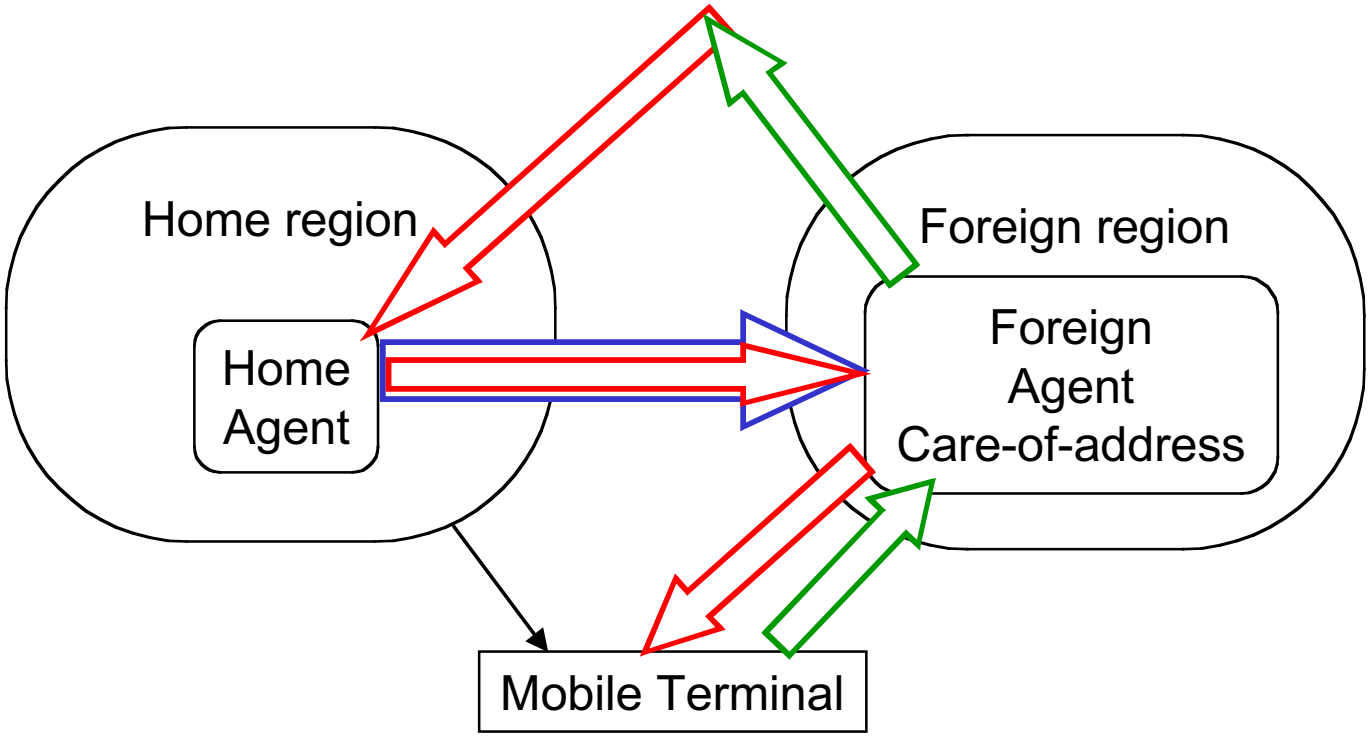
- Functions:
  - MT Absence
  - Handover, determined by the CC (Radio Resource Controller
- Capabilities
  - Association of MT to logically distinct subnetworks
  - Informing the core network of the changes of the population associated to a subnetwork
  - Monitoring of radio conditions for handover and for informing user and hosting core network of the prevailing radio/traffic conditions

HIPERLAN 2 (cont.)

- HL2 shall support:
  - Roaming between access networks
  - Continuous while in motion
- Rate of movement supported:
  - 10 m/s linear
  - 180 deg/sec rotation
- Packet loss or delay- to be handled by higher layers

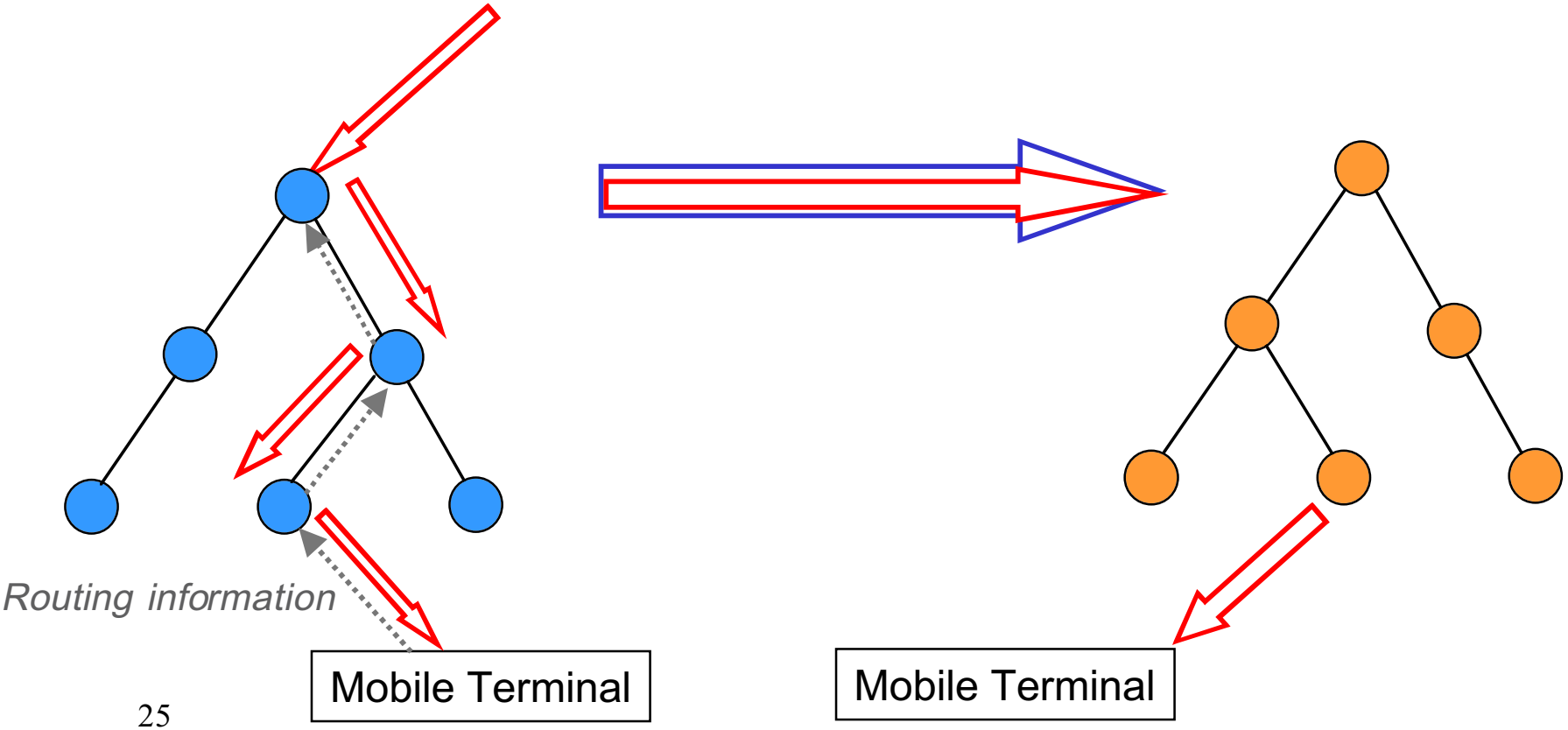
Mobile IP

- A solution to direct IP packets to a user connected via different access points



Handoff Aware Wireless Access Internet Infrastructure HAWAII

- Reduces network load by handling local HO within local area



Terminal Independent Mobile IP
TIMIP

- The network is aware if a terminal has mobile IP capability
- Basic parameters of the the mobile
  - Obtained by the network at an offline registration process
  - MIP is run by the network gateway if mobile lacks MIP capability

Cellular IP

- Uses layer 2 information
- Predicts possible handover
- Triggers Level 3 procedures before connection

Guidelines for 802.16 HO Procedures

Provide HO support of higher layers

- Mobile initiated
- Mobile evaluated
- Network initiated
- Network evaluated

- Intra sector
- Intra cell
- Inter cell
- Inter layer
- Inter system

Requirements for 802.16 HO Procedures

- Measurements of signals of neighboring base stations, in the same or in other frequencies
- Broadcasting of base station information
- Enabling intra-frequency handoff
- Enabling soft and softer handoff

Requirements for 802.16 HO Procedures

- Means for authentication and service verification
- Mechanisms for inter-mode handover among the various 802.16 PHYs and their options
- Support Mobile IP in both IPv4 and IPv6
- Provide signal strength and other indications for Cellular IP support