802.16e Handoff description

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802.16e Handoff description

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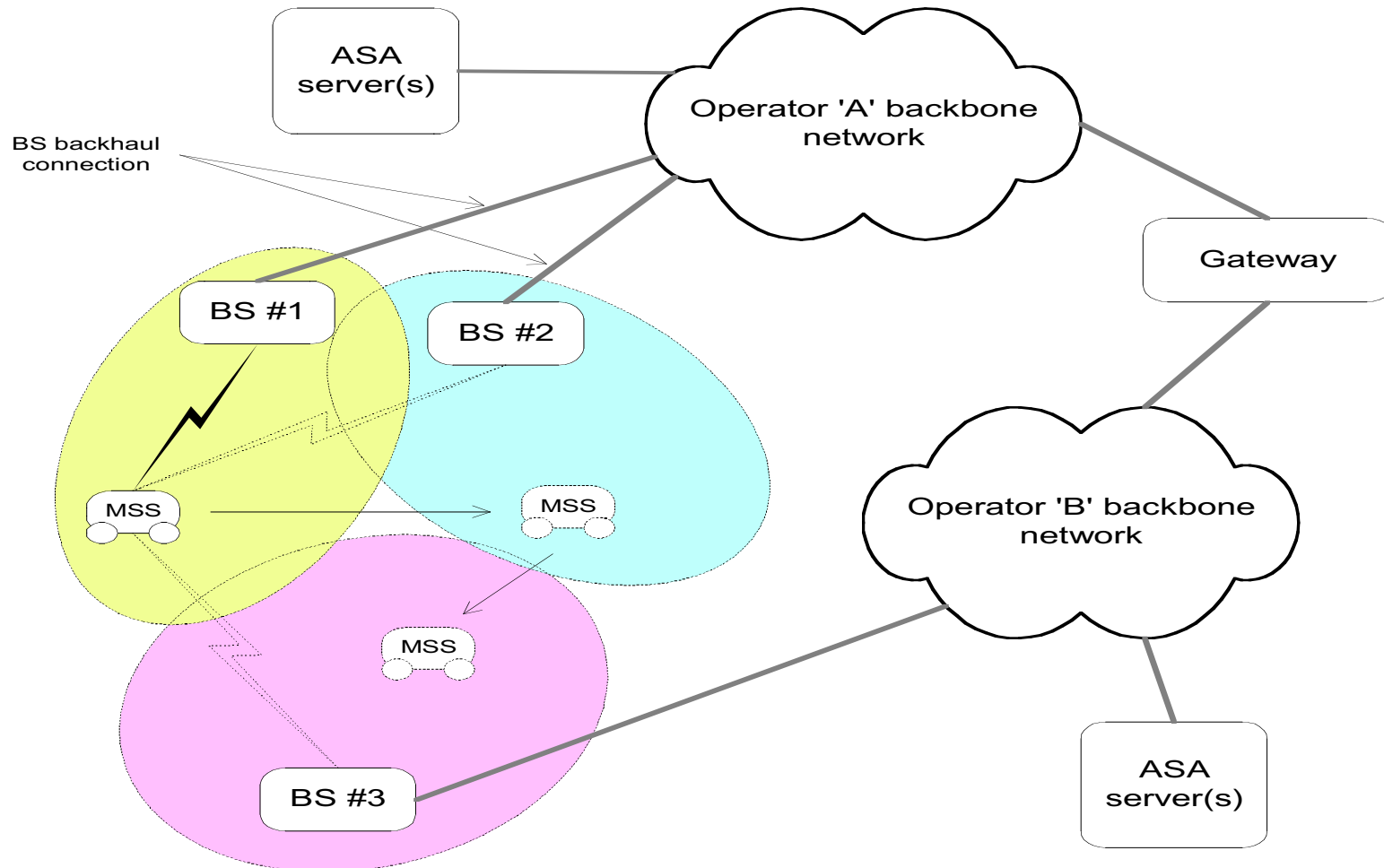
802.16e
Handoff Description

Itzik Kitroser

16e Handoff ad-hoc chair

Runcom

Entities

- **MSS** - Mobile Subscriber Station, contains MAC (CS), PHY layers
- **BS** - Base Station Sector, a single MAC entity covers a single air interface instance
- **ASA Server(s)** - Authentication and Service Authorization Server servicing the whole operator's network. These may be implemented as a centralized or distributed entity
- **Serving BS** - BS with which the MSS has recently performed registration at initial network-entry or during an HO
- **Target BS** - The BS that a MSS intends to be registered with at the end of a HO

Network reference model

ASA server(s)

Operator 'A' backbone network

BS backhaul connection

BS #1

BS #2

Gateway
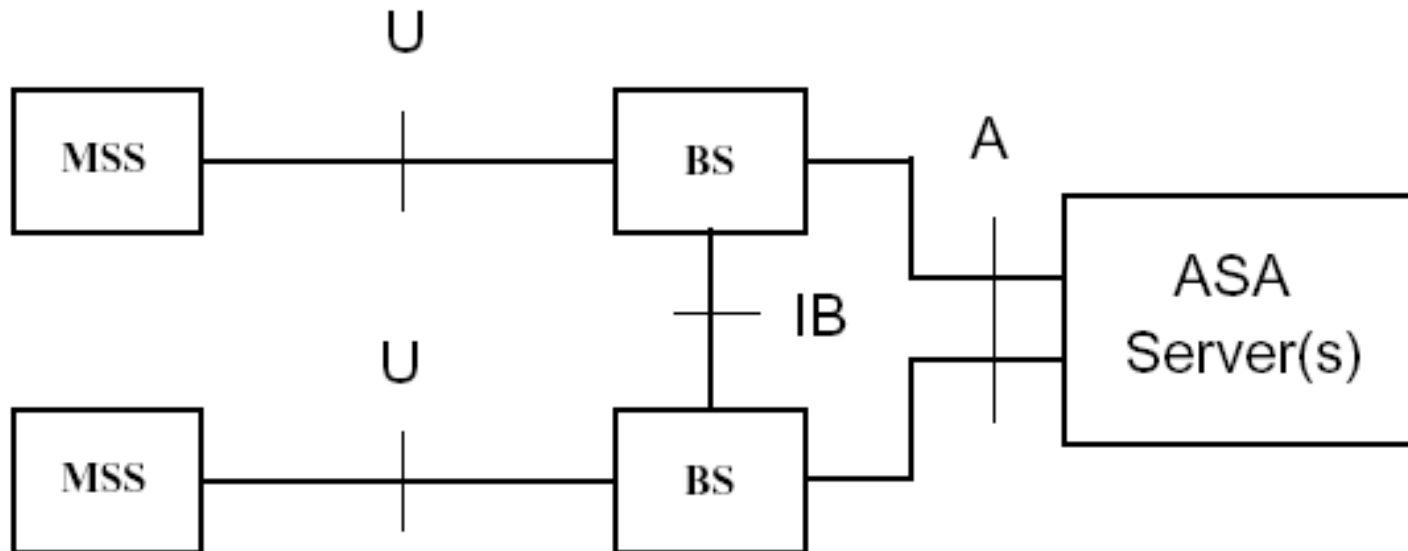
MSS

MSS

Operator 'B' backbone network

MSS

BS #3

ASA server(s)

BS and MSS protocol stack

- ## MSS protocol stack
  - No difference here compared to IEEE 802.16a standard
- ## BS protocol stack

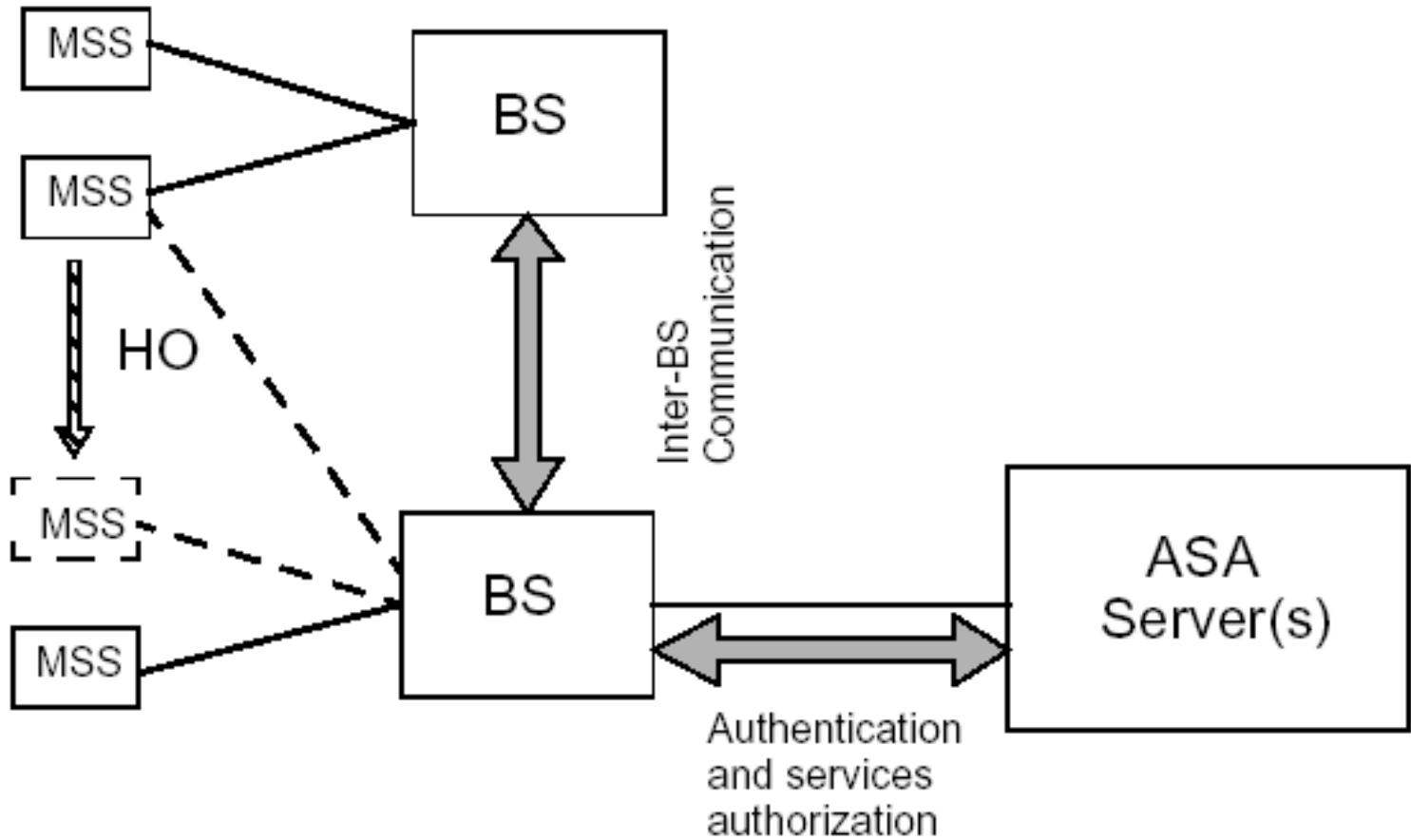| Mobility Agent	
CS SAP	
CS	**Backhaul Protocol Stack**
MAC (common Part)	
PHY	
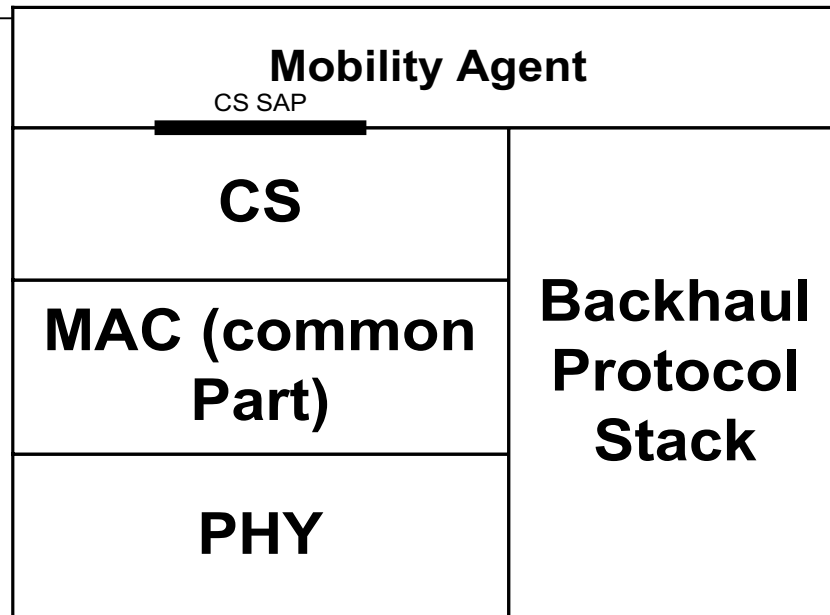
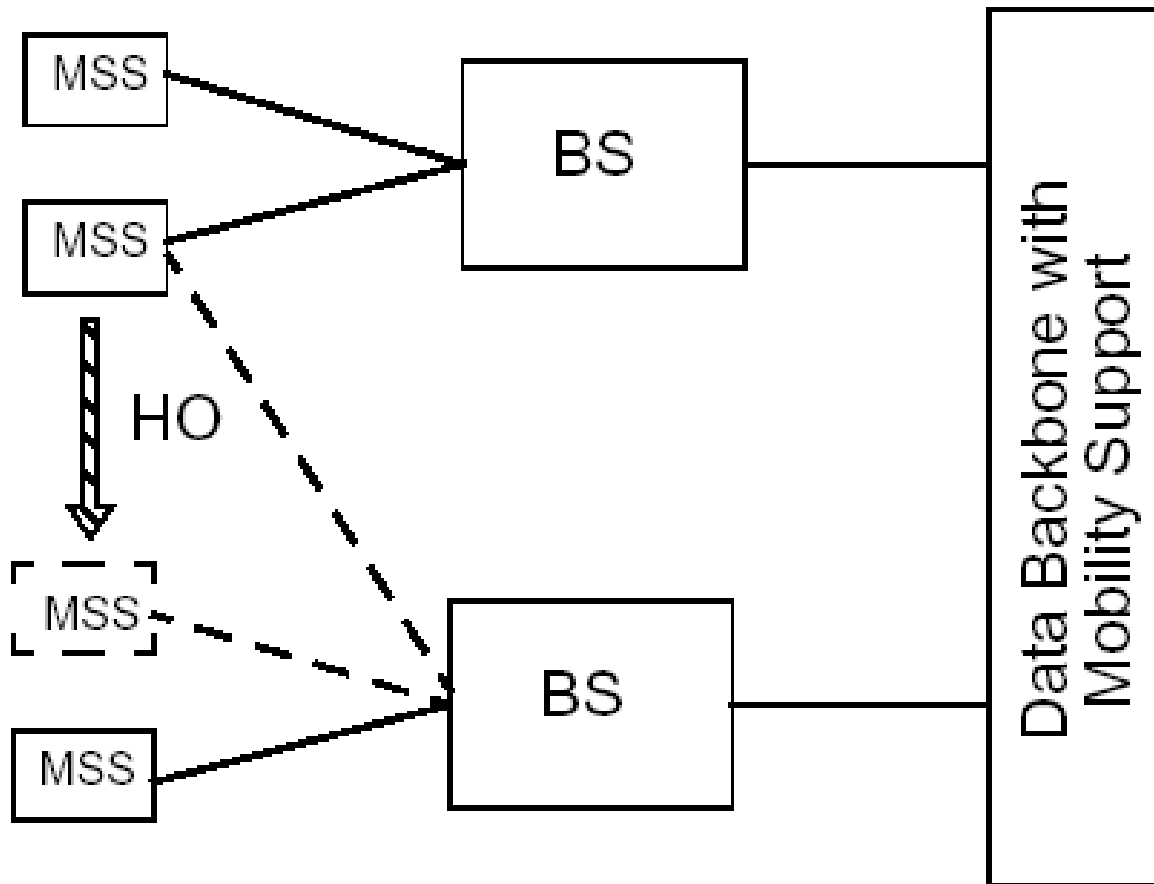# Network Reference Model

- **Control Plane Interfaces**

Network Structure and HO (control plane)

Network Structure and HO (data plane)

MAC Layer Handoff Procedures

- **Network topology advertisement**
  - A BS shall broadcast information about the network topology using the NBR-ADV MAC message.
  - An MSS may decode this message to find out information about the parameters of neighbor BS.

MSS scanning of neighbor BS

- A BS may allocate time intervals to MSS for the purpose of seeking and monitoring neighbor BS - **scanning interval**
- A MSS may request an allocation of a scanning interval using the SCN-REQ MAC message
  - The MSS indicates the duration of time it requires for the scan
- BS responds with placement of a Scanning_IE in the DL-MAP
  - The Scanning_IE either grants the requesting MSS a scanning interval that is at least as long as requested by that MSS, or deny the request
  - The BS may also place unsolicited Scanning_IE
- Passive scanning
  - A MSS shall use the allocated interval to seek neighbor BS
  - When neighbor BS are identified, estimate the connection quality

MSS scanning of neighbor BS – Cont'

- **Active scanning**
  - A MSS shall use the allocated interval to seek neighbor BS
  - When neighbor BS are identified, estimate the connection quality
  - A MSS may use the interval for UL ranging as well to in a procedure is called **association**.
- **When associating with a neighbor BS, two additional stages are performed**
  - **association-initial-ranging**
  - **association-pre-registration**
- **Association-initial-ranging is performed by transmitting a RNG-REQ MAC message**
- **Information on Association is reported to the Serving BS**

HO Process

- ## The HO process belongs to the break-before-make type
  - ### Make-before-break can still be implemented
- ## HO process consists of the following stages,
  - ### HO initiation
    - The decision to start the process is taken
    - Either MSS or BS can initiate HO
  - ### Termination of service with the serving BS
    - All connections belonging to the MSS are terminated
    - The context associated with connections is discarded (i.e. information in queues, ARQ state-machine, counters, timers, etc.)
    - Can be done retroactively following a message from Target BS

HO Process – cont'

- **Network re-entry in target BS**
  - The MSS re-enters the network using a fast network entry procedure
    - The BS may choose, instead of waiting for initial ranging request in MAINT region, to allocate non-contention transmission opportunity for the MSS (using its 48-bit MAC address).
  - MSS re-authorization
    - During this stage the MSS performs the re-authorization part of the PKM protocol used at initial network entry
    - The BS authenticates the user and as the security context has not changed (it is transferred from the old BS via backbone the security sub-layer can continue in normal operation.
  - After network re-entry, connection belonging to the MSS are re-established based on the availability of resources in the target BS

START

Initiate Cell Selection

Select alternate target base station

Synchronize with downlink and obtain parameters

Cell Rejected

Obtain uplink parameters

Cell Rejected

Ranging and uplink parameter adjustment

Cell Rejected

Negotiate basic capabilities

Cell Rejected

SS authorization and key exchange

Cell Rejected

Register with BS

Establish IP connectivity

Transfer operational parameters

Establish connections

Scanning intervals for detecting and evaluating neighbor BS

Normal operation

HO decision

Close all MSS Connections (break before make)

Synchronize with new downlink and obtain parameters

Cell Rejected

Obtain uplink parameters

Cell Rejected

Ranging and uplink parameter adjustment

Cell Rejected

SS re-authorization

Re-Register and re-establish connection

Normal operation

Re-establish IP connectivity

Close all MSS connections with the former serving BS (make before break)

HO

Serving BS (initial network entry)

— · — · — Neighbor BS

— — — — Target BS

MA-MAC Primitives

- **CS to MA: CS_MSS_ARRIVAL.indication**

  – Signals MSS arrival at the cell

- **CS to MA: CS_MSS_DEPARTURE.indication**

  – Signals MSS departure from the cell

- **Both Primitives are used at the BS and MSS and can be used as L2 triggers to L3**

Backbone Network Handoff procedures

- **Backbone network services**
  - Backhaul for traffic
  - Provide a BS with the identity of its neighbors
  - Provide a BS with the identity of the ASA server
  - Advertise the fact that a certain MSS has registered with a certain BS
  - Provide a BS information about a certain MSS
  - Information exchange during HO

Backbone Network Handoff procedures - cont'

- **Inter–base station messages:**
  - **I–am–host–of message**
    - Sent by a BS to notify other BS (or the ASA server) that a certain MSS is registered with it.
  - **MSS–info–request message**
    - Sent from one BS to another (or to the ASA server) to request information about an MSS.
  - **MSS–info–response message**
    - **Response to MSS–info–request**
  - **HO–notification message**
    - Sent by a BS to advertise an MSS intention to perform HO.
    - The message serves to alert the target base stations that a HO event is going to happen.

Backbone Network Handoff procedures - cont'

- **Inter-base station messages:**
  - **HO-notification-response message**
    - This message is sent from one BS to another BS, in response to a *HO-notification* message and provides the BS that sent the *HO-notification* message with information about the level of service the MSS could expect if it transitions to this BS.
  - **HO-notification-confirm message**

SAP for higher layer protocols

- Services between the MAC and higher layers for supporting the HO process. May be used to optimize higher layers HO process
- The information is defined as set of messages sent by the MAC layer to the higher layers, providing indication of particular events before and after MAC layer HO.
- **MSS Movement**
  - Occurs at the MSS, indication that the MSS has registered to a new Target BS.
- **Serving BS Pre-HO**
  - Occurs at the Serving BS, indication that a MAC layer HO of a certain MSS is about to take place.
- **Target BS Pre-Ho**
  - Occurs at the Target BS, indication that a MAC layer HO of a certain MSS is about to take place.

SAP for higher layer protocols

- ## BS Post-HO
  - Occurs at the Target BS or MSS, indication that a MAC layer HO between the MSS and the Target BS has been completed.

- ## Serving BS-Link Loss
  - Occurs at the Serving BS, indication that MAC layer link between the Serving BS and a certain MSS has been lost.