MOBILE COMPUTING

CSE-4225

Fall-2019

Global System for Mobile Communication (GSM)

- **Based on set of standards**
- **Developed (as a 2G cellular phone technology) by the European Telecommunications Standards Institute (ETSI)**
- **First deployed in Finland in December 1991**
- **In mid-2010s**
  - Became a global standard
  - Achieving over 90% market share
  - Operating in over 193 countries and territories

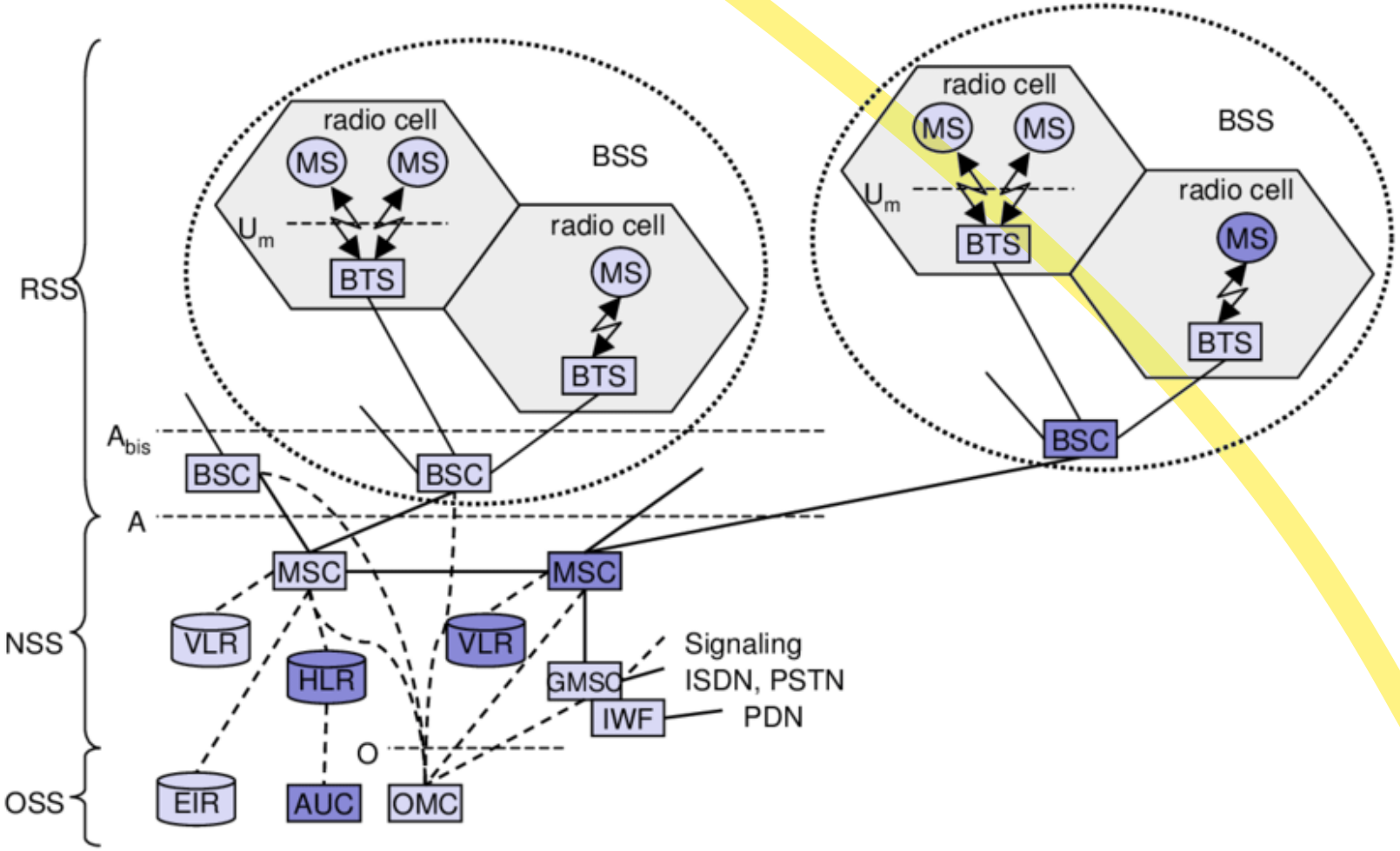
GSM Goals

- **It should offer good subjective speech quality**
- **It should have a low phone or terminal cost**
- **Terminals should be able to be handheld**
- **The system should support international roaming**
- **It should offer good spectral efficiency**
- **The system should offer Integrated Services Digital Network (ISDN) compatibility**
  - ISDN is a set of communication standards for simultaneous digital transmission of voice, video, data, and other network services

GSM Architecture (Cont.)

- **A GSM network comprises of many functional units**
  - Radio/Base Station Subsystem (RSS/BSS)
  - Network Switching Subsystem (NSS)
  - Operation Support Subsystem (OSS)

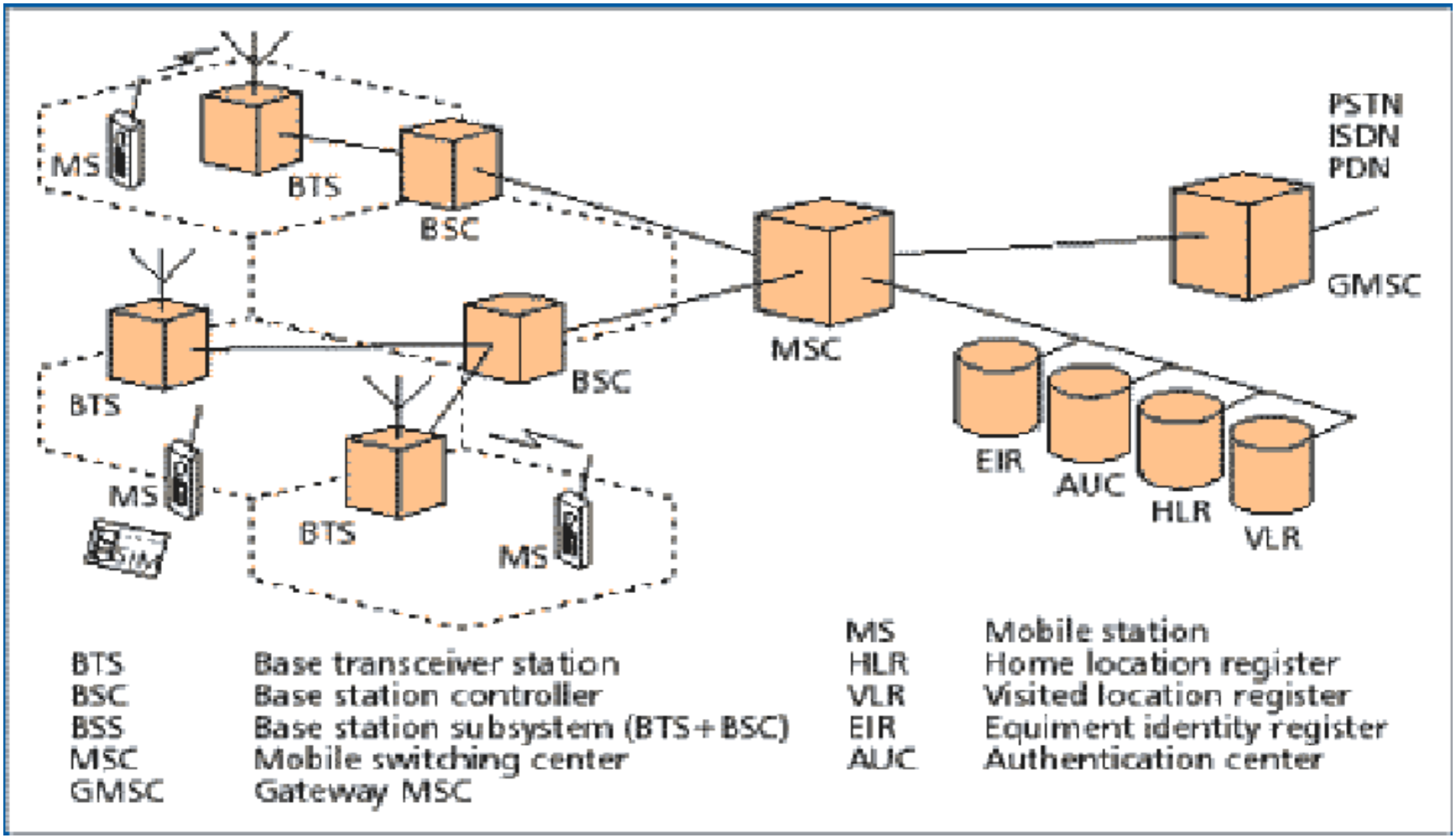
GSM Architecture



GSM Architecture

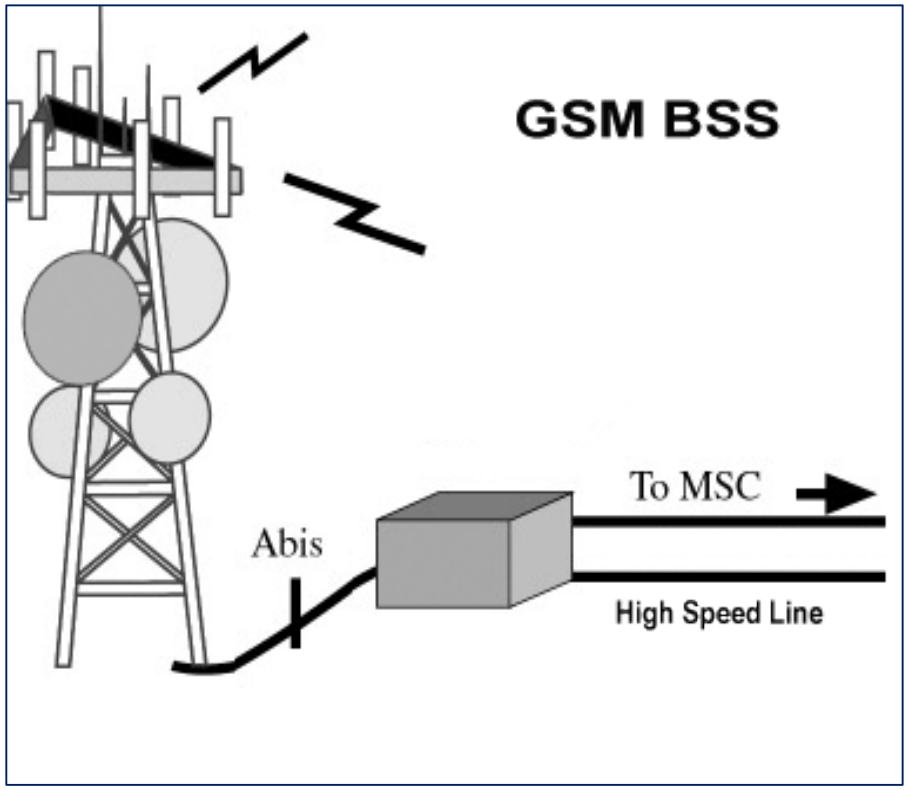
- **Additional components of the GSM architecture comprise of databases and messaging systems functions:**
  - Home Location Register (HLR)
  - Visitor Location Register (VLR)
  - Equipment Identity Register (EIR)
  - Authentication Center (AUC)
  - SMS Serving Center (SMS SC)
  - Gateway MSC (GMSC)
  - Chargeback Center (CBC)
  - Transcoder and Adaptation Unit (TRAU)
    - Data rate conversion unit

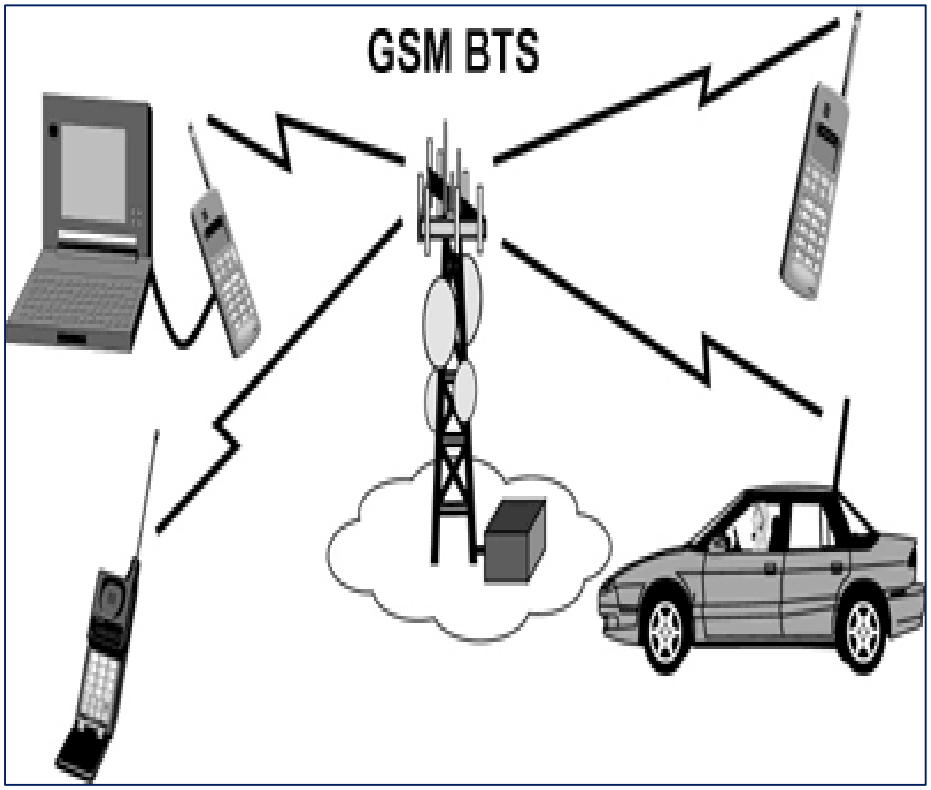
GSM Architecture

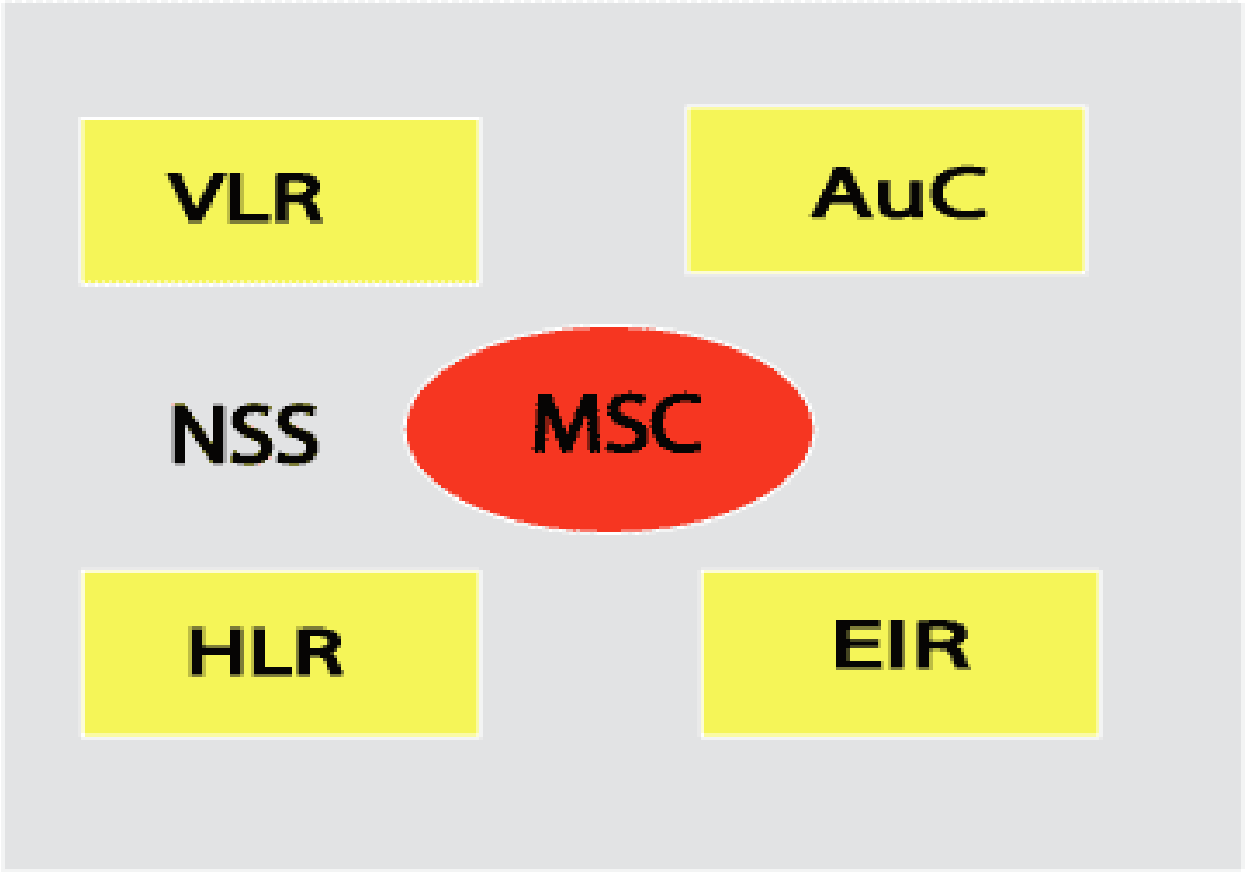


GSM Subsystem

- **Radio Subsystem (RSS)**
  - RSS = MS + BSS
  - BSS = BTS + BSC
- **Network Switching Subsystem (NSS)**
  - NSS = MSC + HLR + VLR + GMSC
- **Operation Support Subsystem (OSS)**
  - OSS = EIR + AUC







Radio Sub System Functions

- **Base Subsystem (BSS)**
  - Maintain radio connection to MS
  - Coding/Decoding voice
  - Rate adaption
- **Base Transceiver Station (BTS)**
  - Comprises of antennas, signal processing, amplifiers etc.
  - Can form a signal or several radio cells by using sectorized antennas
- **Base Station Controller (BSC)**
  - Manage the radio resources for one or more BTS
  - Handles radio setup, frequency hopping
  - Handles inter-cell handovers

Sector Antenna

- Directional microwave antenna with a sector-shaped radiation pattern
- The largest use of these antennas is as antennas for cell phone base-station sites
- Used for limited-range distances of around 4 to 5 km

Radio Sub System Functions

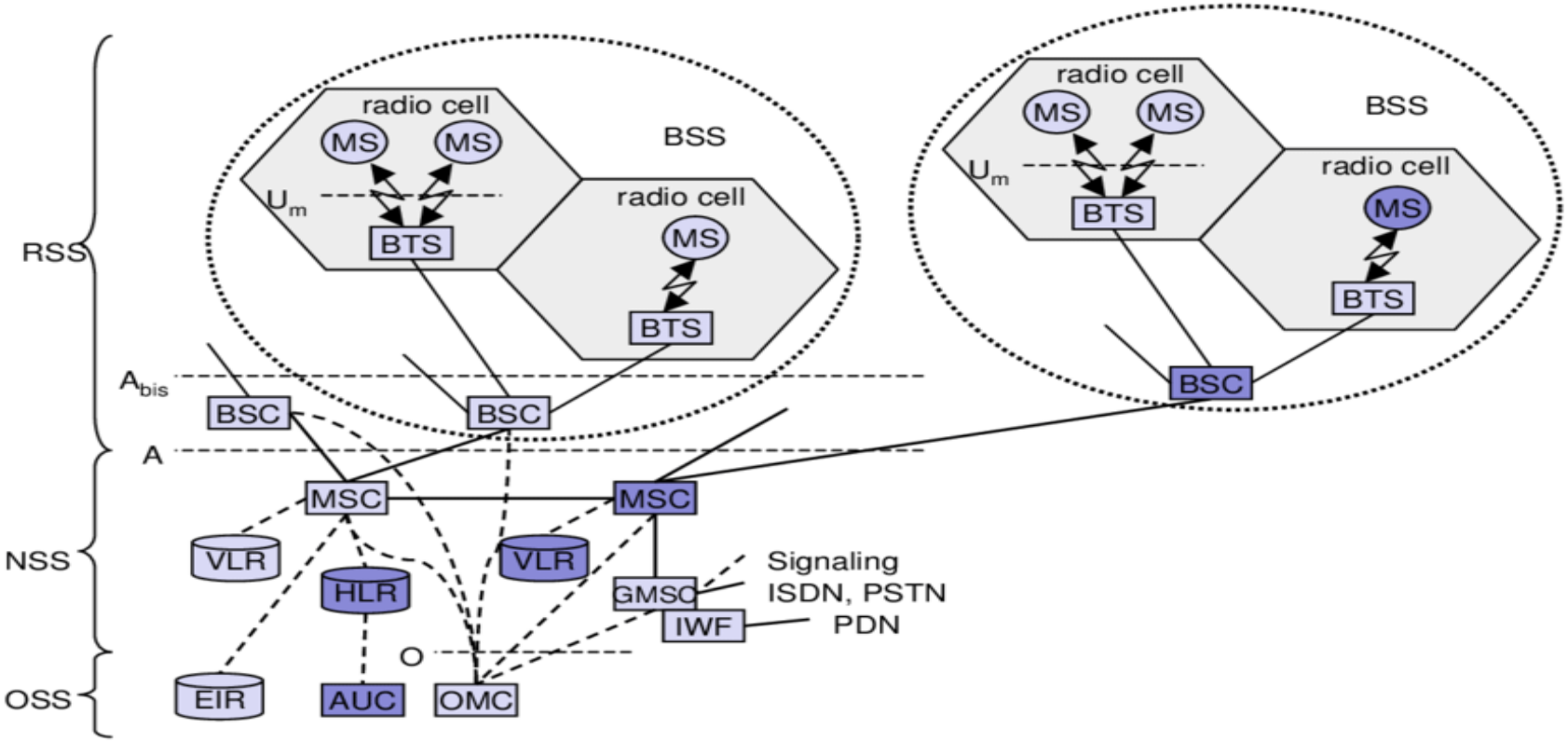
- **Mobile System (MS)**
  - International Mobile Equipment Identity (IMEI) is used to identify a MS
  - Consists of Mobile Equipment (ME) and Subscriber Identity Module (SIM)
  - Basically the mobile set
- U_m is the air interface for radio waves

Network Switching Subsystem Functions

- **Call control, charging, Mobility management, Signaling (connect radio network with standard public n/w), Subscriber data handling**
- **HLR and VLR ✓**
- **MSC**
  - High performance digital ISDN switch
  - Each MSC controls one or more BSS
  - Can perform registration, authentication, location updating, n/w interfacing
- **Gateway MSC (GMSC)**
  - Responsible for communication with external fixed network as PSTN, ISDN

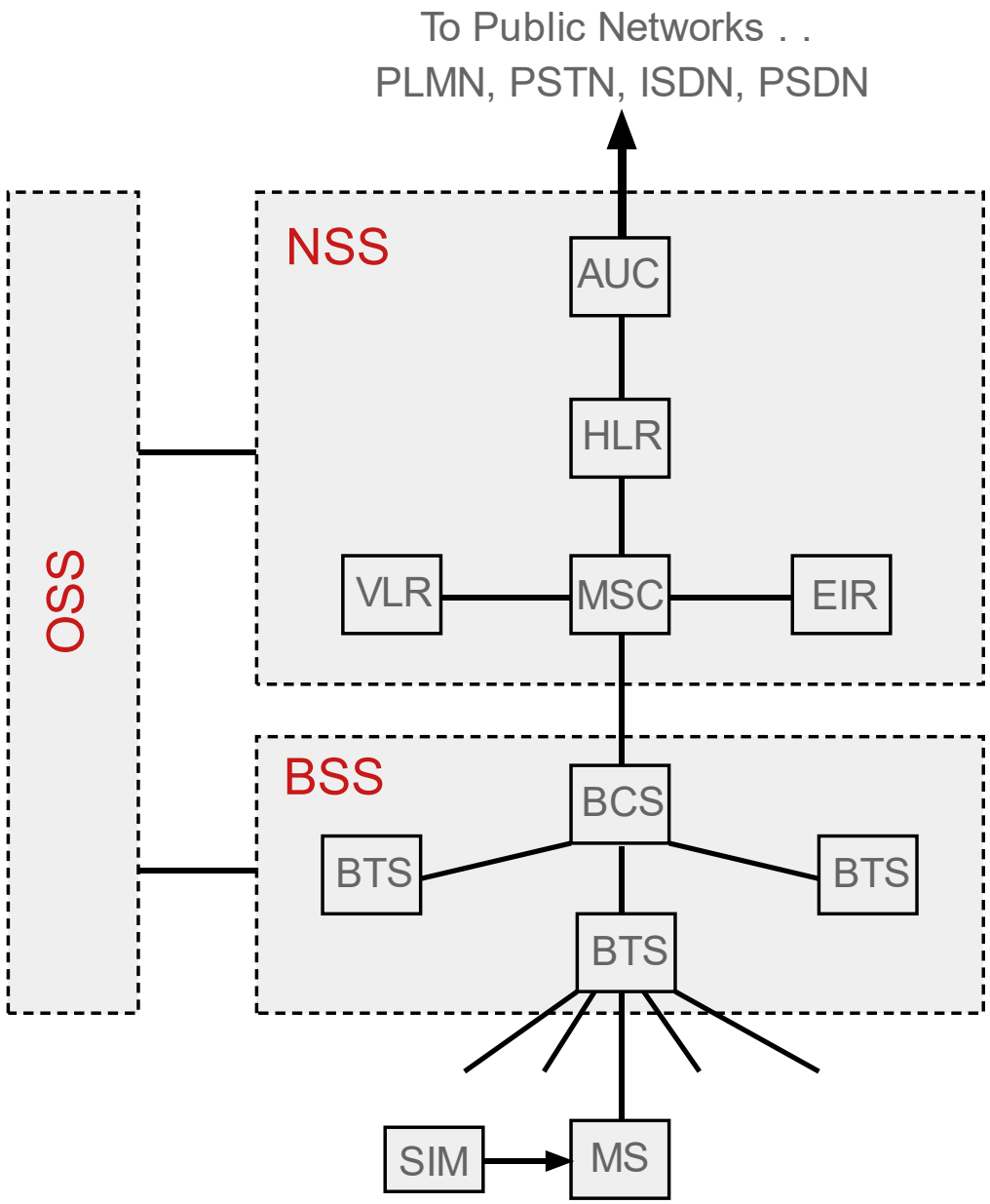
Network Switching Subsystem Functions

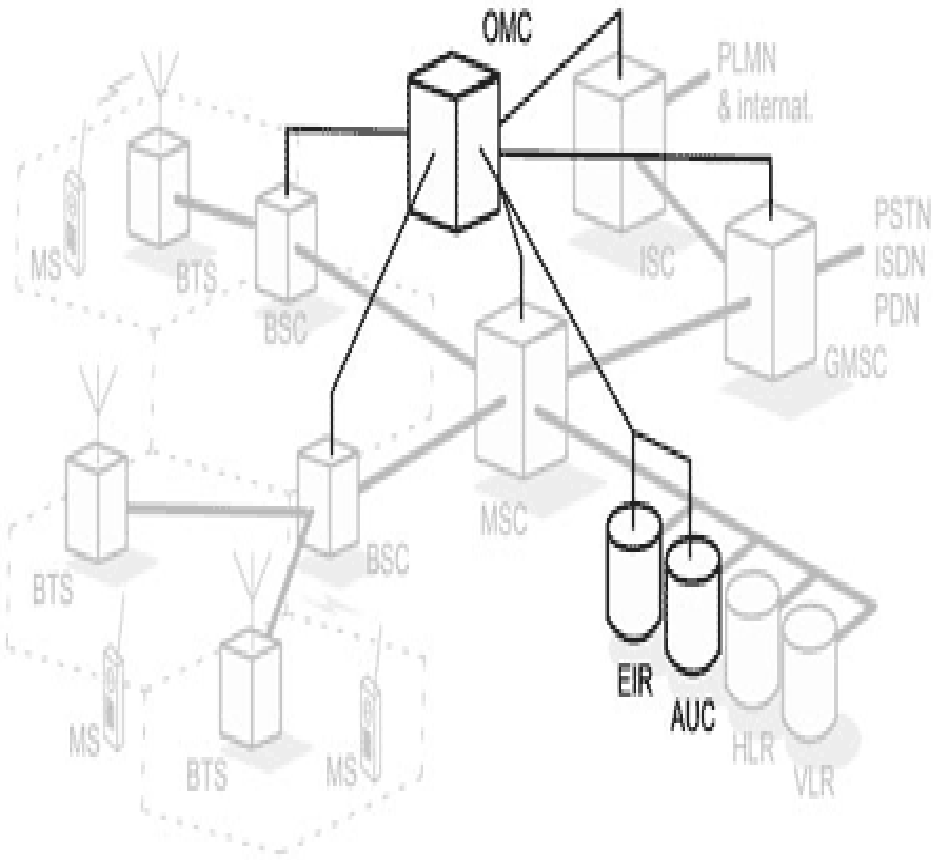
- **Inter-working function (IWF)**
  - It provides MSC to connect to public data n/w (PDN)



Operation Support Subsystem Functions

- **A functional entity used to maintain and control the overall GSM network**
- **Used to control the traffic load**
- **It contains**
  - Operation and Maintenance Centre (OMC)
  - Authentication Centre (AuC)
    - verify the SIM card
  - Equipment Identity Register (EIR)
    - used for security reasons
    - Contain three lists (white, gray, black)
    - International Mobile Equipment Identity (IMEI) identifies each MS





- **OMC system covers all the GSM elements**
- **OMC Functions**
  - Administration and commercial operation (subscription, end terminals, charging and statistics)
  - Security Management
  - Network configuration, Operation and Performance Management
  - Maintenance Tasks

- The operations and maintenance center (OMC) is connected to all equipment in the switching system and to the BSC
- The implementation of OMC is called the operation and support system (OSS)