

MOBILE COMPUTING

Unit-1

Cellular System

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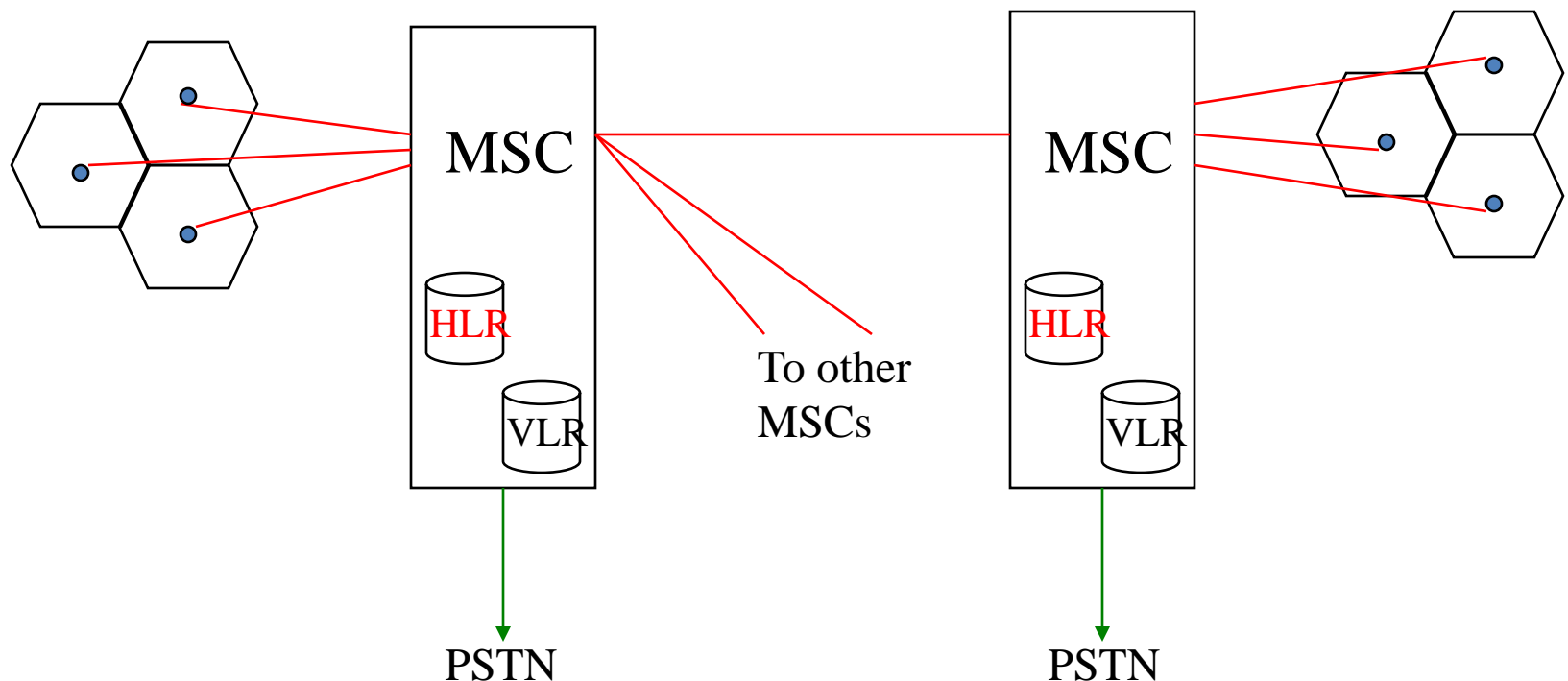
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Source & References:

The materials presented in this lecture has been taken from internet sites and books. This can be used only for academic purpose only.

- 1. J. Schiller, Mobile Communications, Pearson, 2nd Ed**
- 2. Asok K. Talukder, Mobile Computing-Technology, Applications & Service Creation, TMH**

- Each cell is served by a **base station (BS)**
- Each BS is connected to a **mobile switching center (MSC)** through fixed links
- Each MSC is connected to other MSCs and PSTN



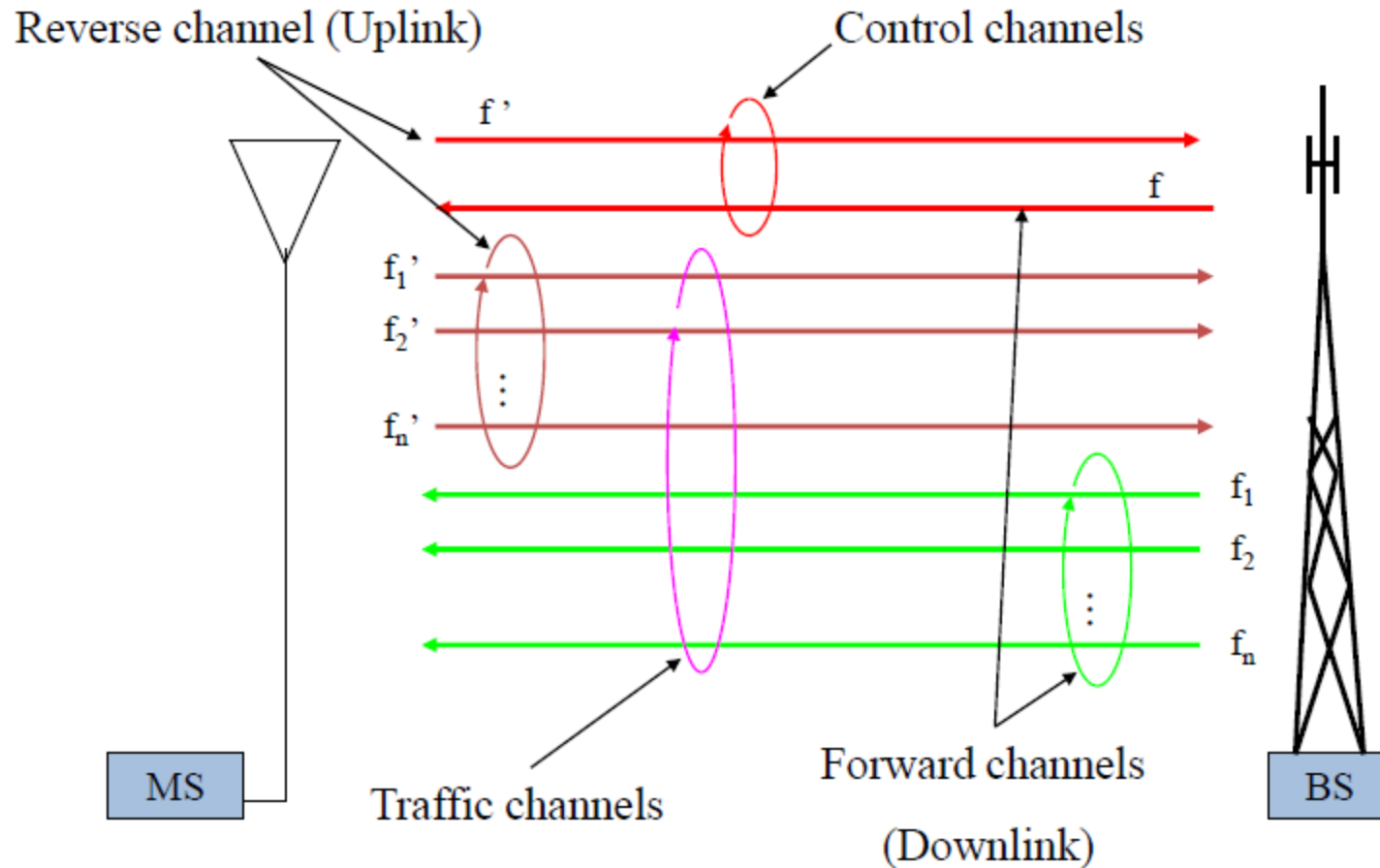
Cellular System Architecture

- Each MSC is a local switching exchange that handles
 - Switching of mobile user from one base station to another
 - Locating the current cell of a mobile user
 - **Home Location Register (HLR)**: database recording the current location of each mobile that belongs to the MSC
 - **Visitor Location Register (VLR)**: database recording the cell of “visiting” mobiles
 - Interfacing with other MSCs
 - Interfacing with PSTN (traditional telephone network)

Cellular System Architecture Cont.

- **Standard “Common Air Interface specifies 4 Channels (2 for Traffic and 2 for Control channels)”** One channel in each cell is set aside for **signaling** information between BS and mobiles
- **Voice Transmission Channels:** Channels used for sending and receiving data transmission.
- **Control Transmission channels:** Beacons for controlling signals b/w BS and user and vice versa.
 - Mobile-to-BS (Reverse voice Channel): location, call setup for outgoing, response to incoming
 - BS-to-Mobile (Forward Voice channel): cell identity, call setup for incoming, location updating

Types of Channels



Call Setup

- **Outgoing call setup:**
 - User keys in the number and presses call (no dial tone)
 - Mobile transmits access request on uplink signaling channel
 - If network can process the call, BS sends a channel allocation message
 - Network proceeds to setup the connection
- **Network activity:**
 - MSC determines current location of target mobile using HLR, VLR and by communicating with other MSCs
 - Source MSC initiates a call setup message to MSC covering target area

Call Setup Cont.

- **Incoming call setup:**
 - Target MSC (covering current location of mobile) initiates a paging msg
 - BSs forward the paging message on downlink channel in coverage area
 - If mobile is on (monitoring the signaling channel), it responds to BS
 - BS sends a channel allocation message and informs MSC
- **Network activity:**
 - Network completes the two halves of the connection

HLR

What is a Home Location Register (HLR)?

- A HLR is a database of user (subscriber) information, i.e., customer profiles, used in mobile (cellular) networks. It is a key component of mobile networks such as GSM, TDMA, and CDMA networks. A HLR contains user information such as account information, account status, user preferences, features subscribed to by the user, user's current location, etc. The data stored in HLRs for the different types of networks is similar but does differ in some details.
- HLRs are used by the Mobile Switching Centers (MSCs) to originate and deliver arriving mobile calls.

VLR

What is a Visiting Location Register (VLR)?

- A VLR is a database, similar to a HLR, which is used by the mobile network to temporarily hold profiles of roaming users (users outside their home area). This VLR data is based on the user information retrieved from a HLR. MSCs use a VLR to handle roaming users.

How are the HLR and VLR used?

- Each mobile network has its own HLRs and VLRs. When a MSC detects a mobile user's presence in the area covered by its network, it first checks a database to determine if the user is in his/her home area or is roaming, i.e., the user is a visitor.
- **User in Home Area:** HLR has the necessary information for initiating, terminating, or receiving a call.
- **User is Roaming:** VLR contacts the user's HLR to get the necessary information to set up a temporary user profile.
The user's location is recorded in the HLR, and in case the user roaming, it is also recorded in the VLR.
- Suppose that the user wants to make a call:

How are the HLR and VLR used?

- **User in Home Area:** MSC contacts the HLR prior to setting up the call.
- **User is Roaming:** MSC contacts the VLR prior to setting up the call.

Suppose that there is a call for the user (call goes to the home MSC):

- **User in Home Area:** Home MSC delivers the call immediately.
- **User is Roaming:** Home MSC contacts the VLR to determine the appropriate switch in the roaming area to handle the arriving call and then transfers the call to the roaming area MSC.