Introduction to Mobile Communications

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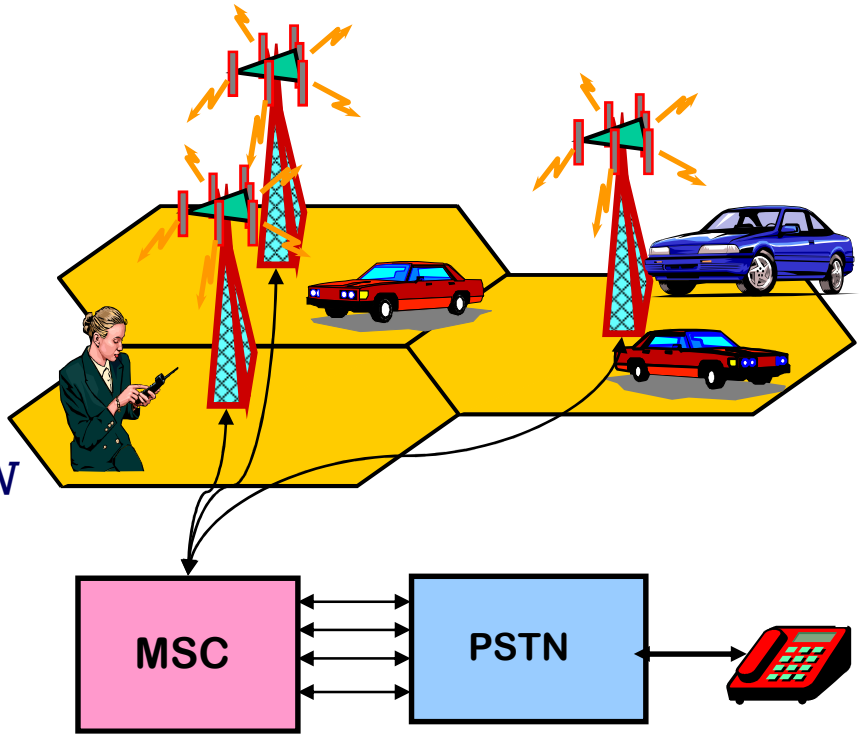
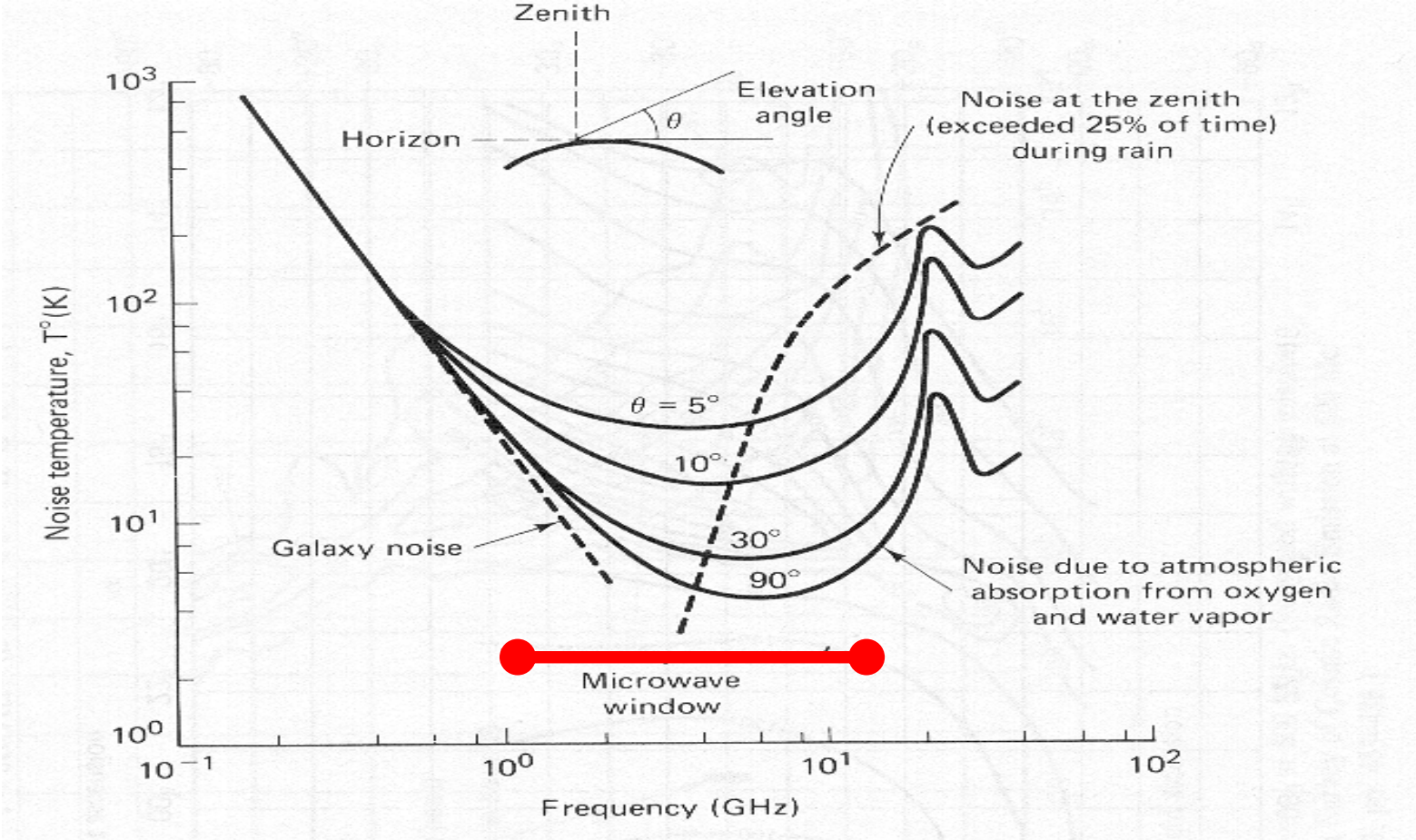
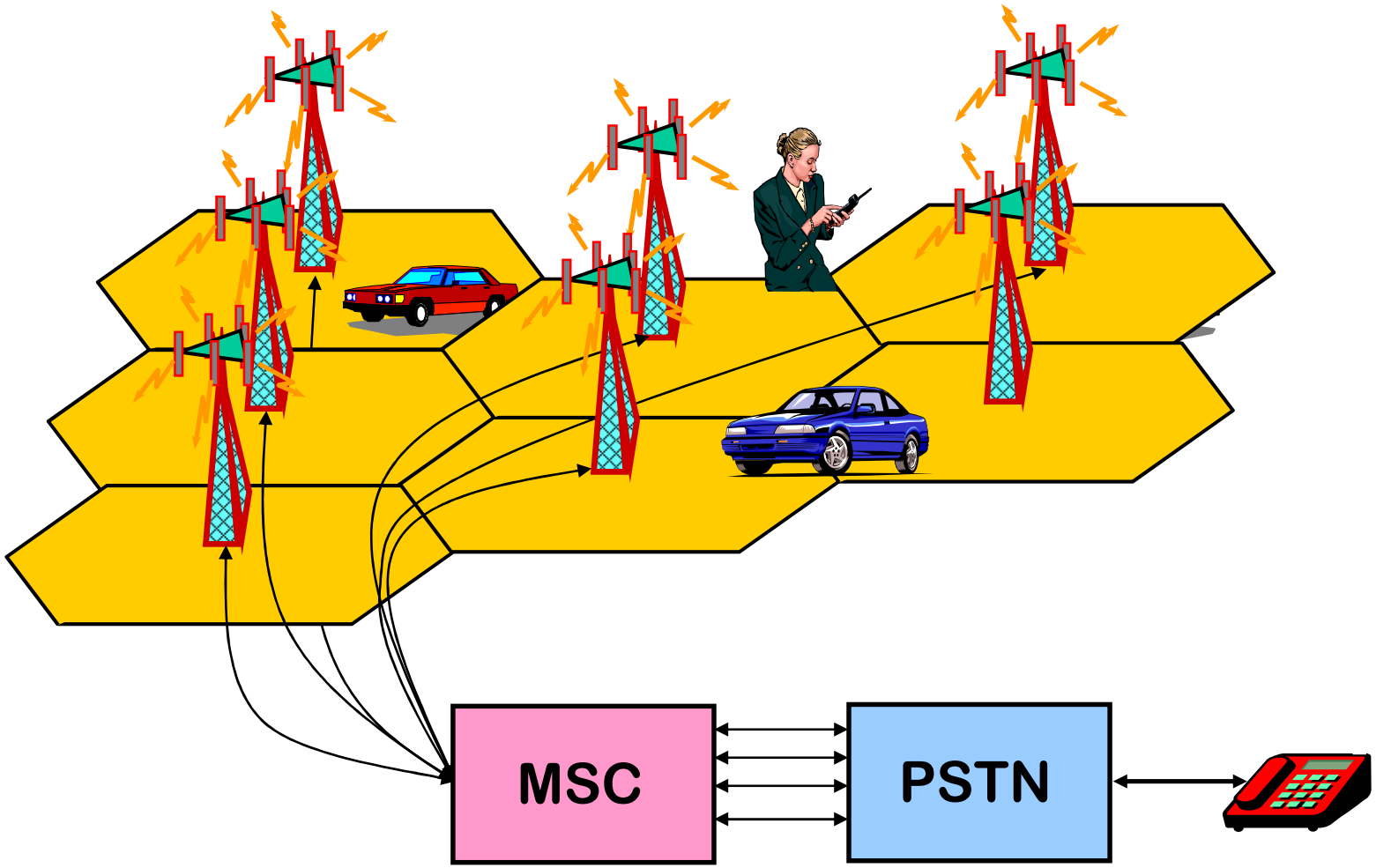


Satellite Systems Noise Level



Cellular System



Cellular Coverage

- The geographic area served by a cellular radio system is broken up into smaller geographic areas, or cells.
- Uniform hexagons most frequently are employed to represent these cells on maps and diagrams;
- in practice, though, radio-waves do not confine themselves to hexagonal areas, so that the actual cells have irregular shapes.
- All communication with a mobile or portable instrument within a given cell is made to the base station that serves the cell.

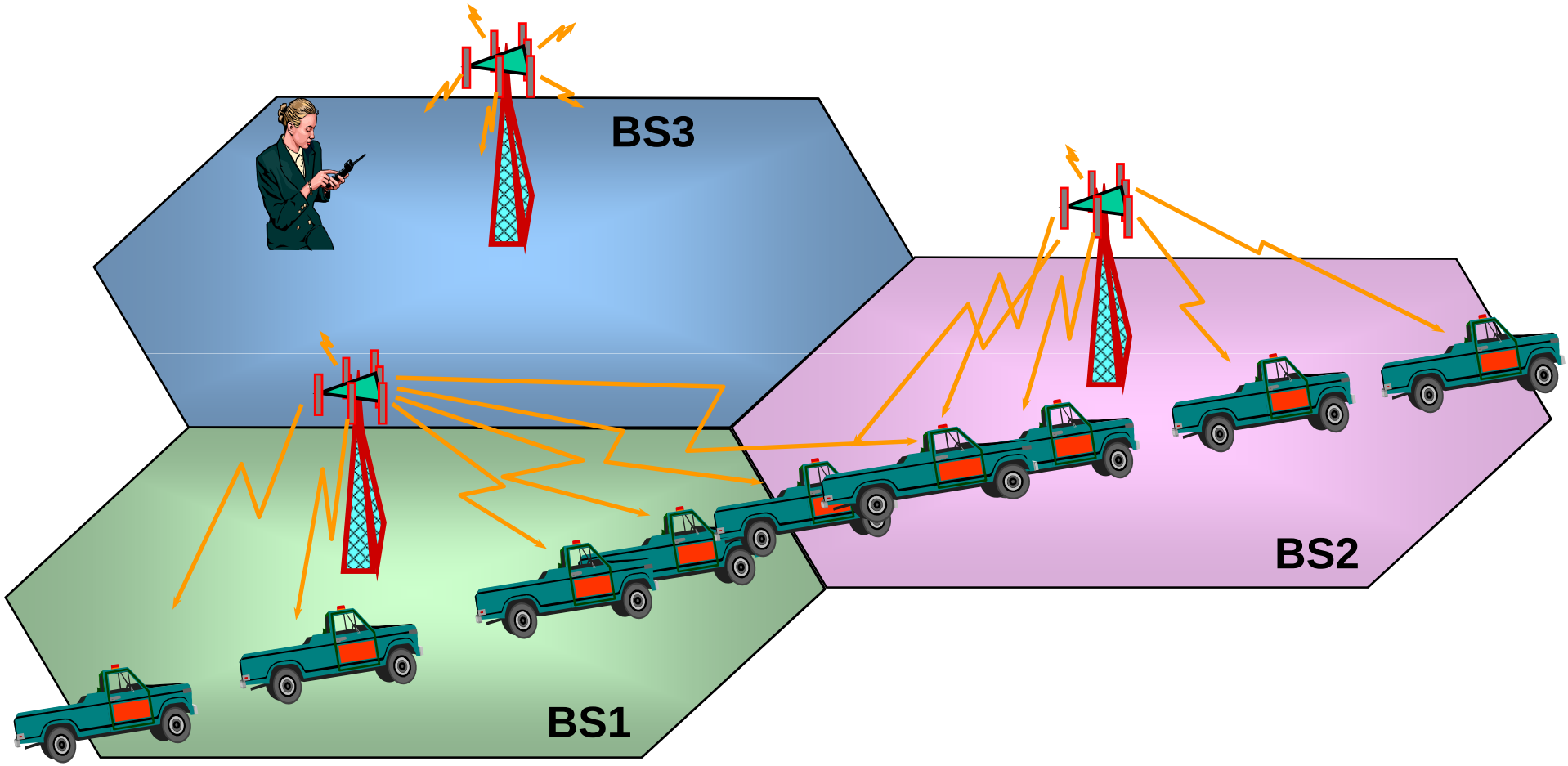
Frequency Reuse

- The transmitting power of battery-operated portable units is relatively low and the attenuation of the propagating radio waves is relatively high.
- That gives us the opportunity for the sending and the receiving frequencies assigned to a cell to be reused in other (more distant) cells within the larger geographic area.
- Thus, the spectral efficiency of a cellular system is increased by a factor equal to the number of times a frequency may be reused within its service area.

Handoff (Handover)

- Usually a mobile unit proceeds from one cell to another during the course of a call,
- A central controller (mobile telephone switching office (MTSO)) automatically reroutes the call from the old cell to the new cell without a noticeable interruption in the signal reception.
- This process is known as handoff.
- MTSO acts as an intelligent central office switch that keeps track of the movement of the mobile subscriber.

Handoff (Handover)

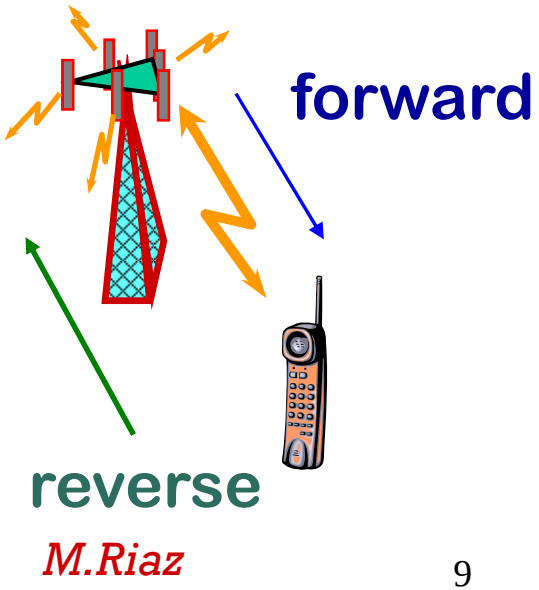


Cellular Telephone System Structure

- A cellular telephone system consists of:
  - Mobile stations (MS)
    - Handheld or vehicular
  - Base stations (BS)
    - Towers supporting several transceivers
  - Mobile switching center (MSC) or mobile telephone switching office (MTSO)
    - Activity control of all BS, connects to PSTN

Cellular System Radio Interface

- The ***common air interface*** **(CAI)** defines communication between BS and MS
- Types of channels used in a mobile system:
  - Forward voice channel (FVC)
  - Forward control channel (FCC)
  - Reverse voice channel (RVC)
  - Reverse control channel (RCC)

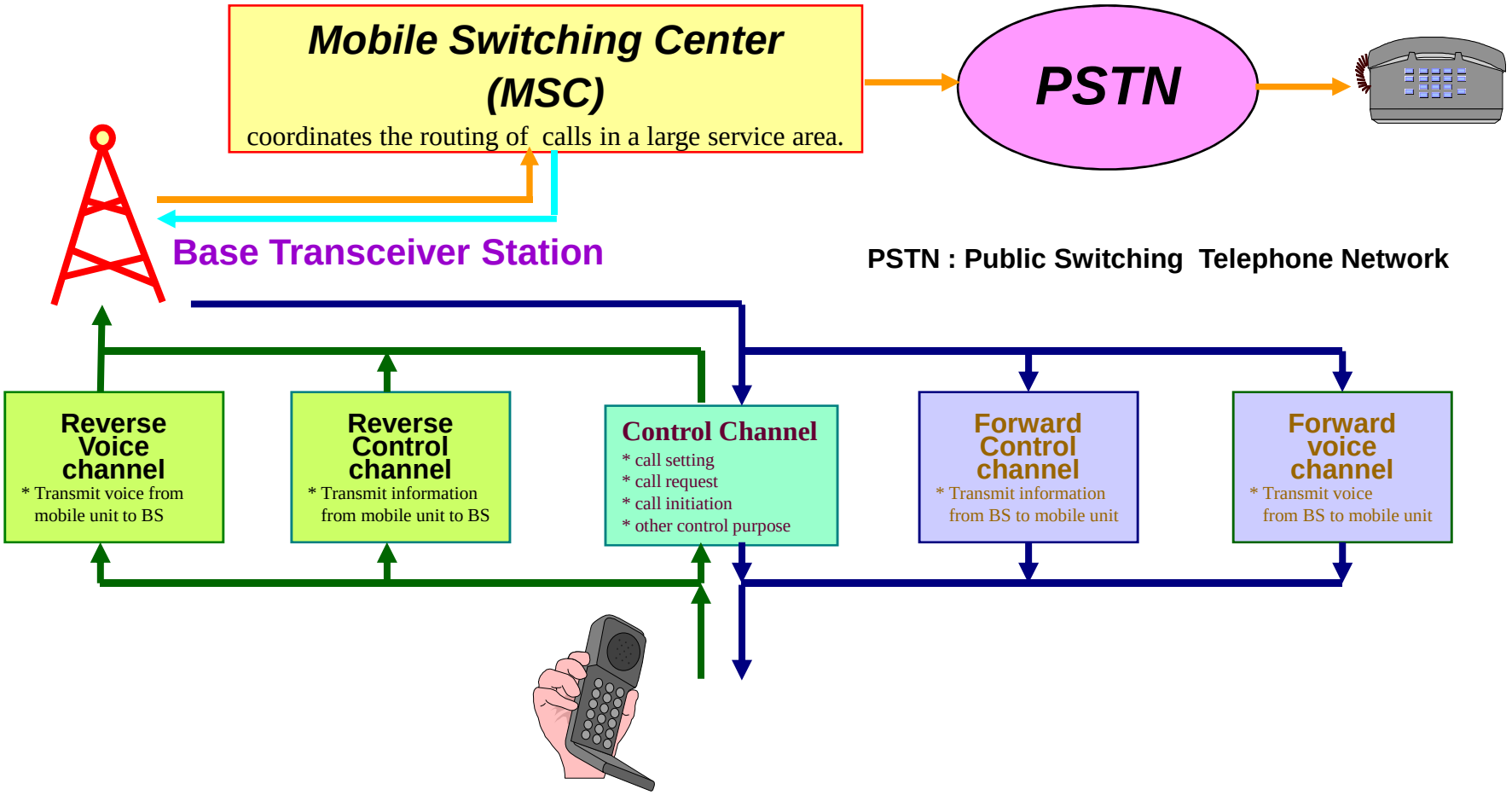


M.Riaz

Cellular Telephone System

- Forward voice channel (FVC)
  - BS to MS voice transmission
- Reverse voice channel (RVC)
  - MS to BS voice transmission
- Forward control channel (FCC) and Reverse control channel (RCC)
  - Setting up mobile call and moving it to voice channel

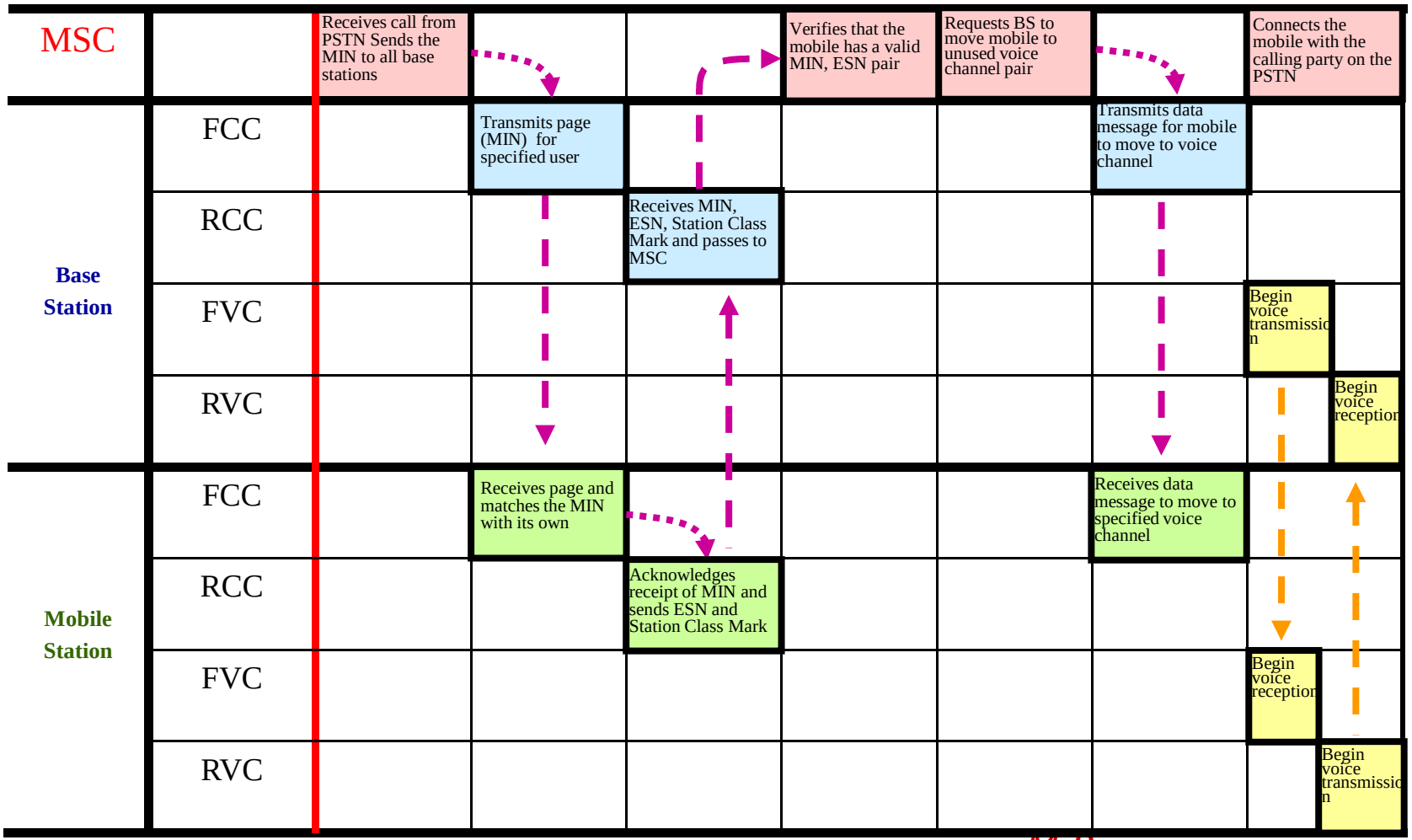
Cellular Telephone System



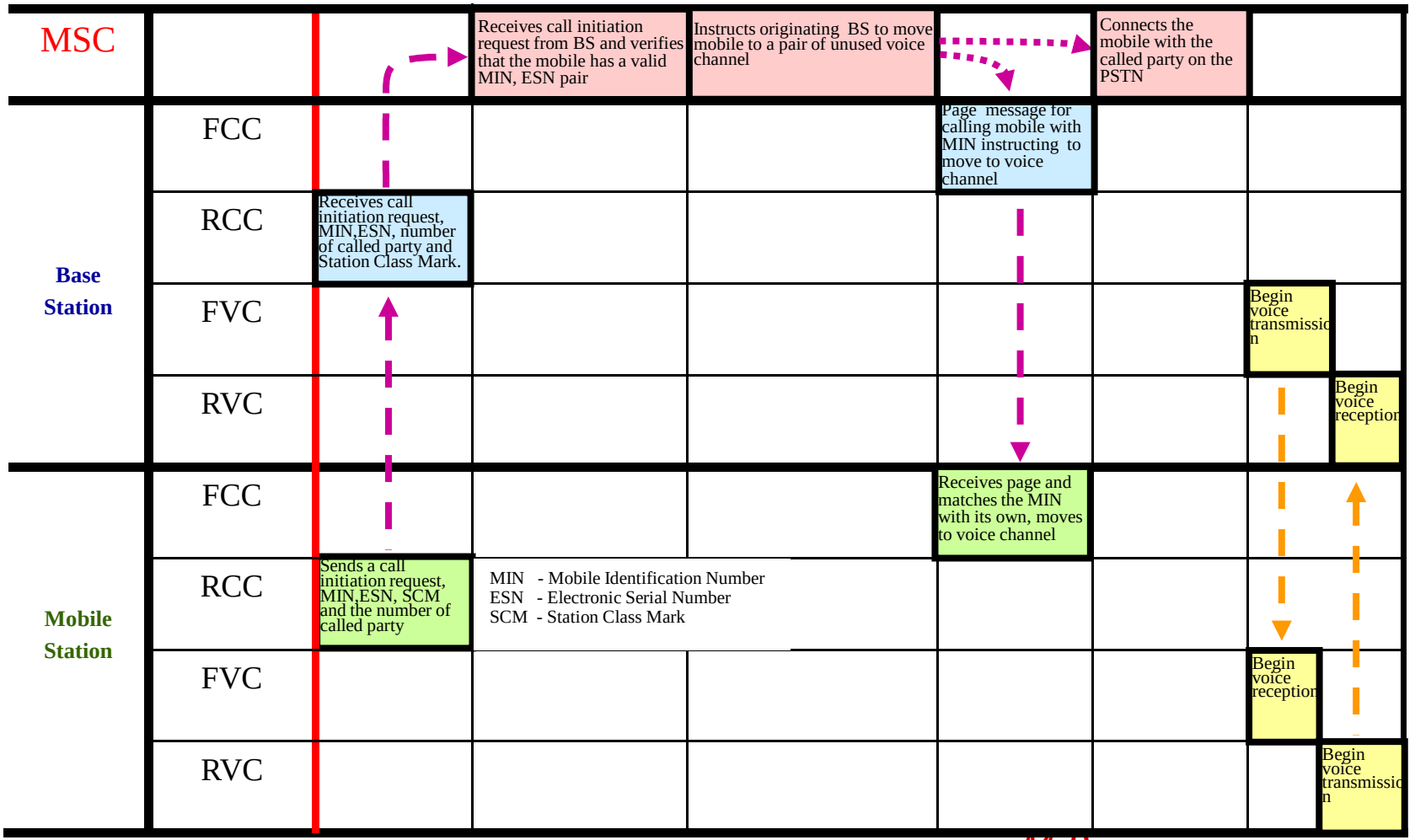
Cellular Telephone Call

- Mobile station (phone) turned on
  - it scans for the group of forward control channels(FCC) to find the one with the strongest signal
  - Monitors that control channel until the signal drops below usable level
  - Again scans for the strongest control channel
- The control channels are defined and standardized over the entire area

Call **to** a Mobile Phone



Call from a Mobile Phone



Roaming(1)

- **Roaming** allows subscribers to operate in mobile phone service areas other than the service area where the service is subscribed
- When a mobile enters area outside the home service area it is registered as roamer in the new service area
- Since FCC are everywhere the same, roamer is receiving information from FCC

Roaming(2)

- Every several minutes MSC issues command over each FCC to all mobiles previously unregistered to report their MIN and ESN over the RCC
- Unregistered mobiles periodically report back subscriber information upon receiving the registration request
- The MSC uses MIN/ESN data to request billing status from the home location register (HLR)
- If the mobile has roaming authorization at home, MSC registers the subscriber in a visiting location register (VLR) as a valid roamer
- Once registered roaming mobiles are allowed to receive and place calls from the new service area
- Billing is routed automatically to the subscribers home service provider (HLR)