

# **First Generation Systems**

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# Agenda

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- Introduction: AMPS
- AMPS architecture
- AMPS features
- Call operation
- Digital AMPS

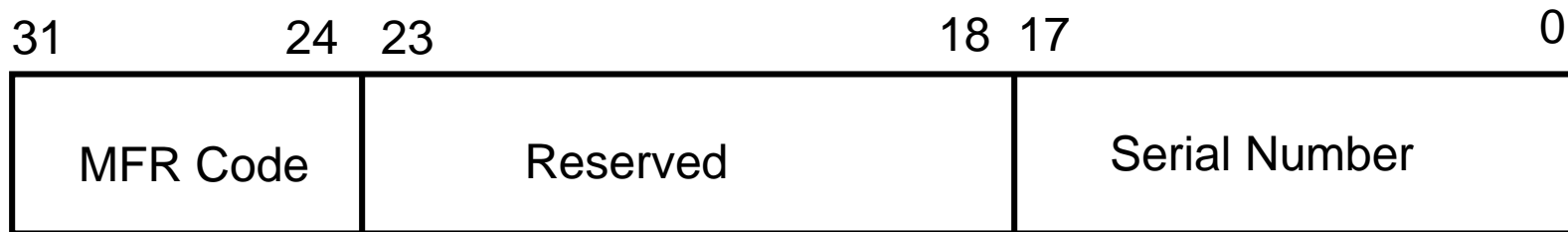
# Advanced Mobile Phone Systems (AMPS)

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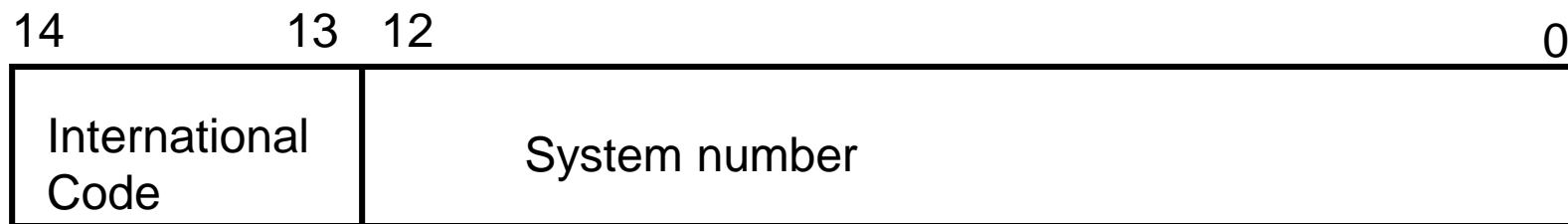
- Used in US and other countries
  - Conceived by Bell Laboratory in late 1970s
- Supports voice telephone traffic
- Uses 30 kHz. channels
- In late 1970s, the FCC allocated spectrum space of 800 MHz.

# AMPS Identifiers

- Three identification numbers are used in AMPS
  - The mobile station's electronic serial number (**ESN**)
  - The mobile operator's system identification number (**SID**)
  - The mobile station's mobile identification number (**MIN**)– 34bit

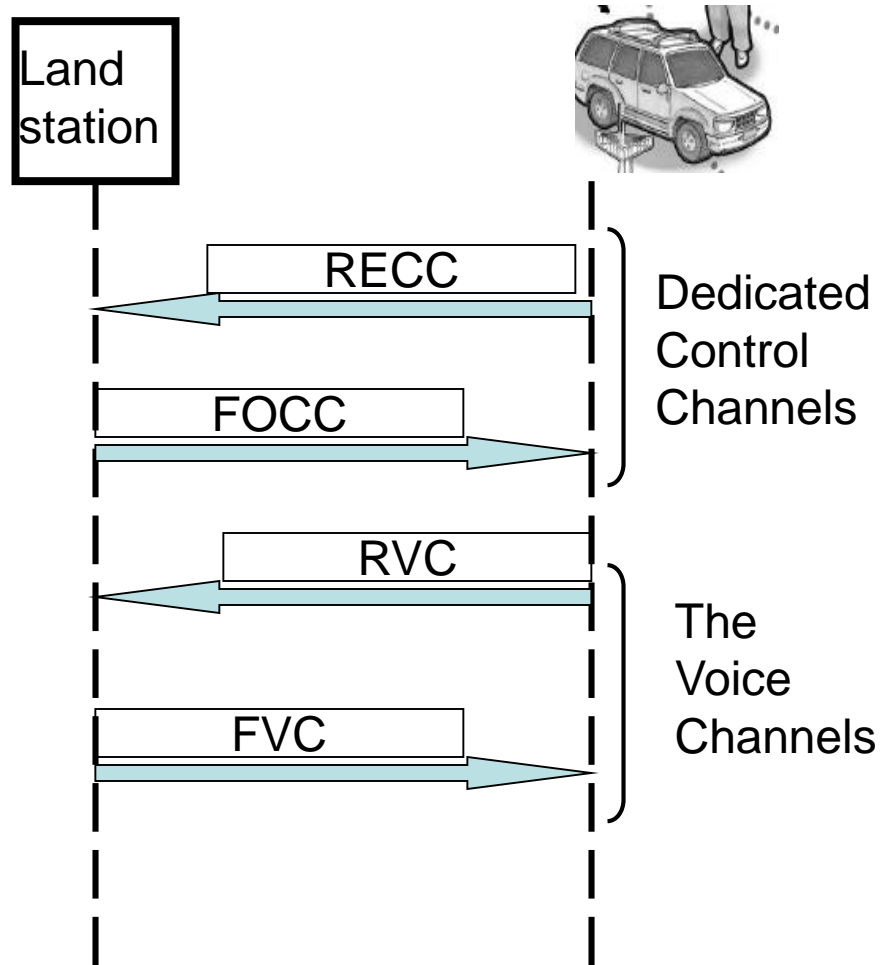


ESN format



SID format

# Traffic and Control Channels



**The AMPS channels**

# Traffic and Control Channels

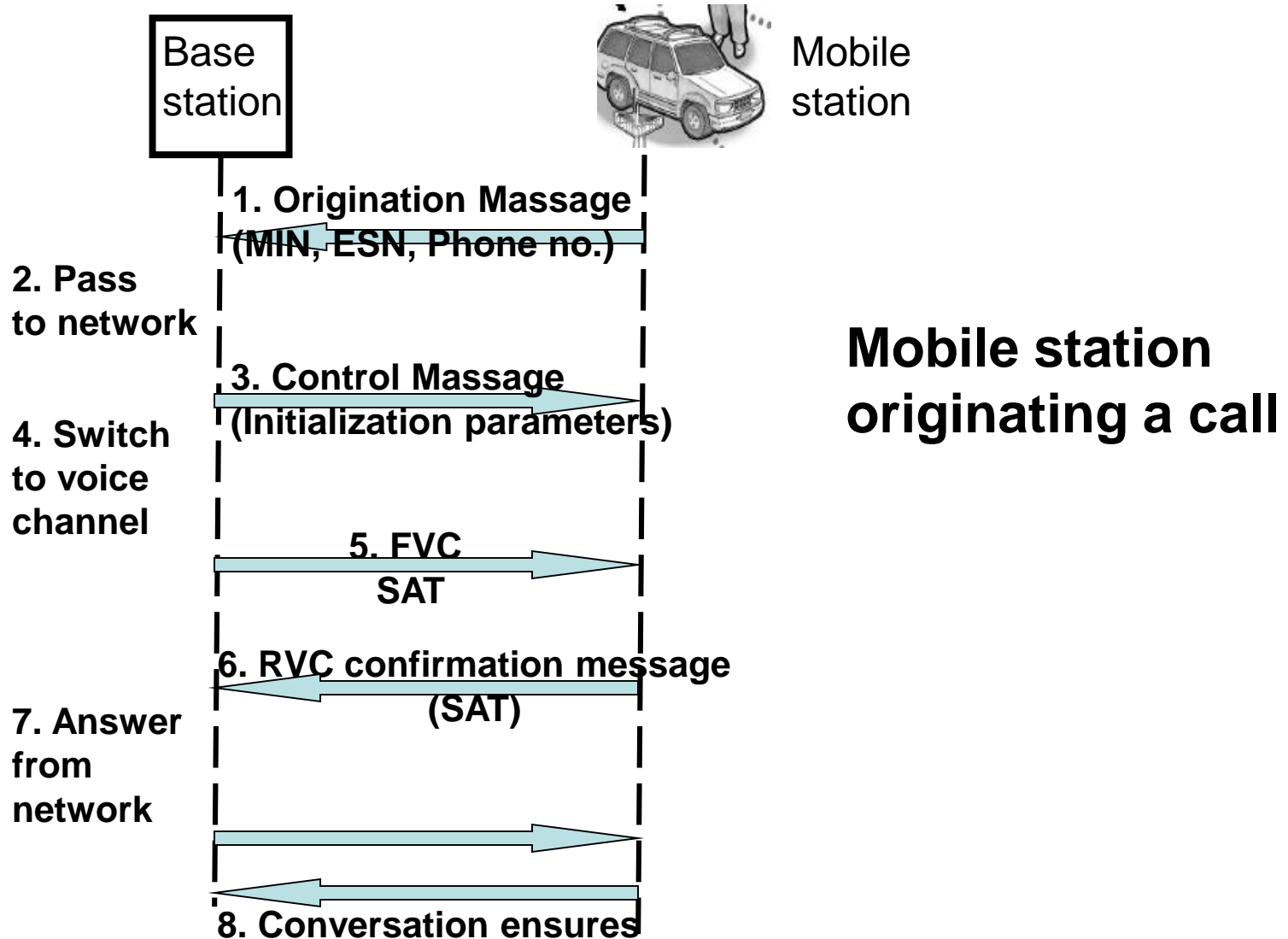
- 21 channels are available for control purpose
- **Forward control channel (FOCC)**
  - Continuous data stream sent from the base station (BS) to the mobile station (MS)
  - It is a TDM channel with three multiplexed data streams, viz. stream A, B and busy-idle stream
- **Reverse control channel (RECC)**
  - Data sent from MS to BS
- Both operates at 10 kbps
- **Forward voice channel (FVC)** and **Reverse voice channel (RVC)** are voice channels.
- They are selected by the network and assigned to the MS
- BS informs MS using FOCC, which RVC to use
- Then BS switches to appropriate FVC

# AMPS Features

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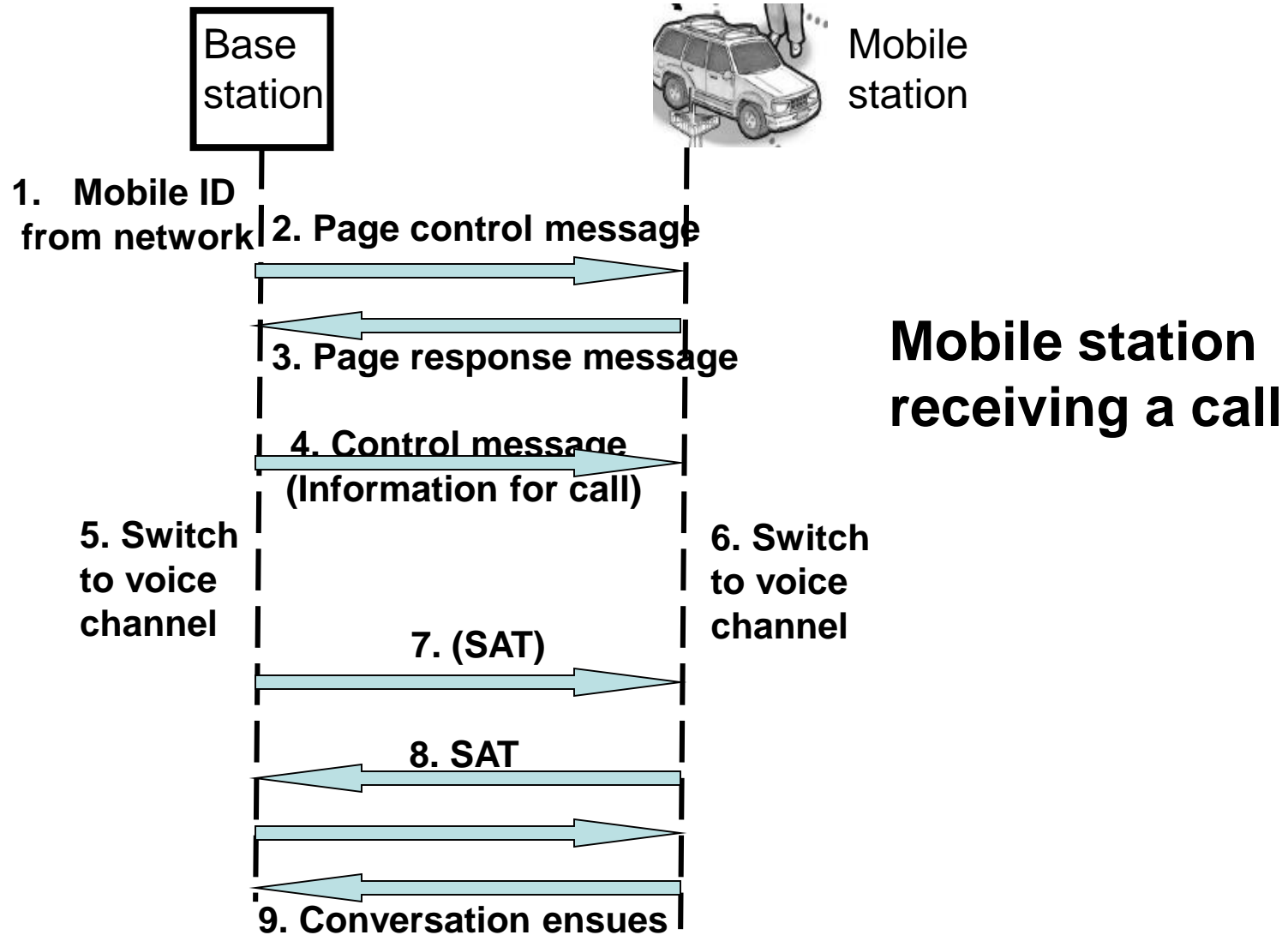
- Supervisory Audio Tone (SAT)
  - Used to continue link continuity between the base station and the mobile station
  - Three signals: 5970Hz., 6000Hz., 6030Hz.
- Signaling Tone (ST)
  - Request to send more data during conversation
  - Continuous alert signal
  - Disconnect signal used by the mobile station
  - Handoff confirmation signal sent by the mobile user

# AMPS Operation





# AMPS Operation



# Blank and Burst Operation

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- The voice channels (FVC, RVC) also carry digital signaling messages in addition to the analog voice traffic
- Message is sent with FSK signaling at 10 kbps
- First 101 bit sequences, called *dotting sequence*, are sent to inform about digital signal
- Then comes synchronization bit stream and message.

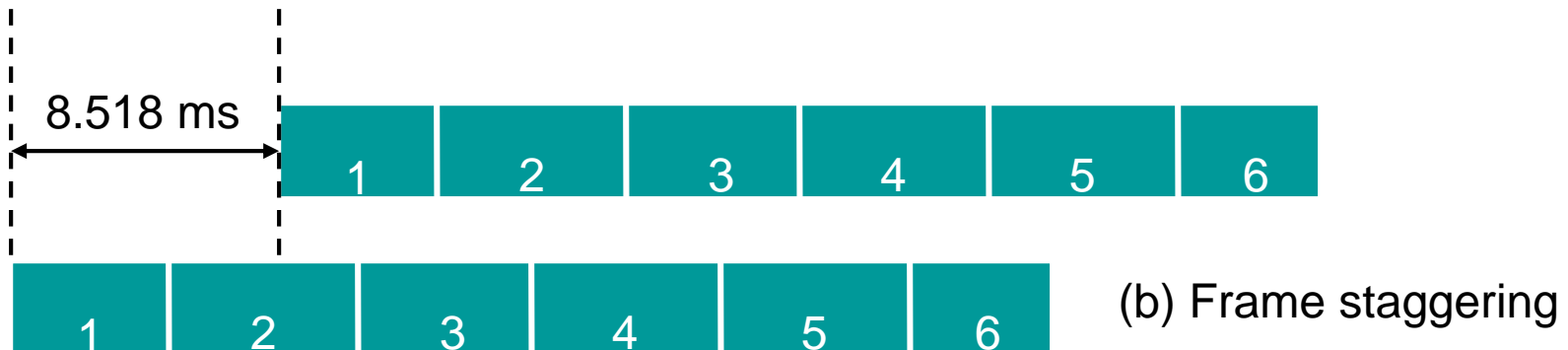
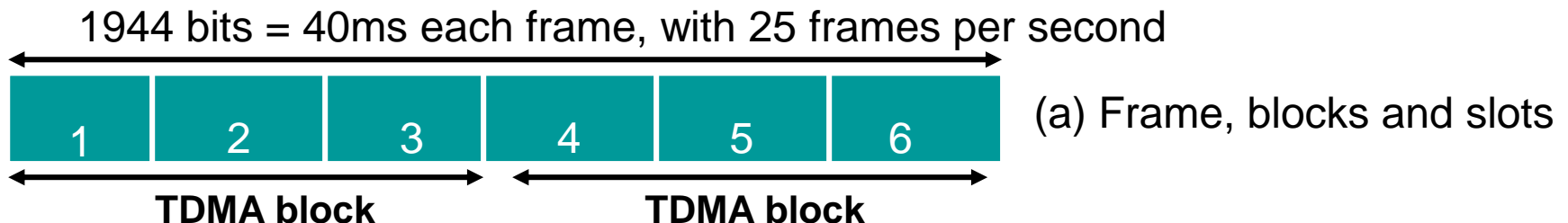
# D-AMPS

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- AMPS: cochannel interference, limited capacity, excess user capacity (30kHz.)
- D-AMPS: uses both first generation and second generation technology
- D-AMPS permits mobile stations to co-exist with either analog or digital technology in the AMPS frequency band.

# Frame Structure

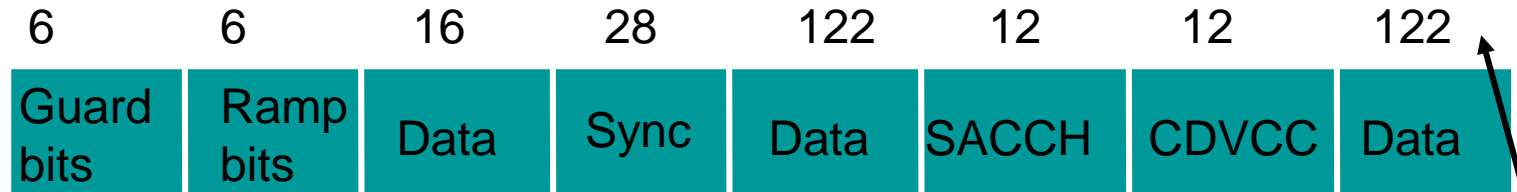
- ***TDMA*** frame consisting of six slots
- Uplink and downlink is staggered by **8.518ms** → half duplex mode, less expensive hardware and less power consumption
- $\pi/4$  shifted ***DQPSK*** modulation scheme is used.



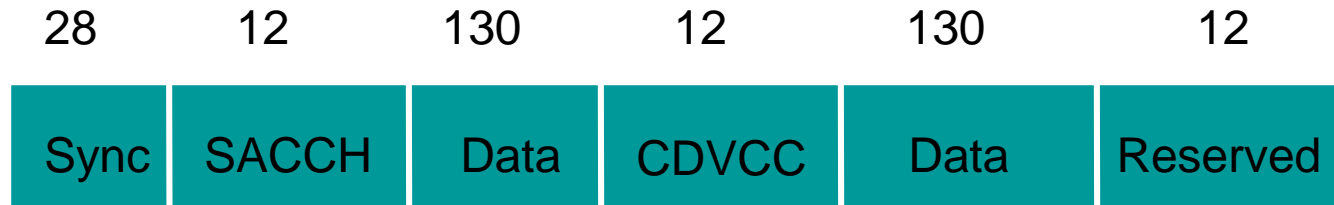
# D-AMPS Traffic Channel

- FOCC
- FVC
- Forward digital traffic channel (**FDTC**): consists of **FACCH** and **SACCH**, BS to MS digital user and control channel
- RECC
- RVC
- Reverse digital traffic channel (**RDTC**): consists of **FACCH** and **SACCH**, MS to BS digital user and control channel
- **FACCH** – Fast associated control channel
  - Used for signaling purpose
  - Can not be used simultaneously with user information
  - Uses *blank-and-burst* operation
- **SACCH** – Slow associated control channel
  - Continuous channel used for signaling
  - Fixed number of bits reserved in each TDMA slot

# D-AMPS slots



(a) Uplink: MS to BS



(b) Downlink: BS to MS

Total bits = 324



# References:

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- “Mobile and Wireless Networks”, Ulysses D. Black, Prentice Hall PTR
- “Wireless Communications & Networks”, William Stallings, 2e, Pearson Ed.