2 G Architecture– GSM, GPRS and Others

Lesson 12

HSCSD, DECT and WLL

High-speed circuit switched data (HSCSD)

- An innovation to use multiple timeslots at the same time
- 2.5G GSM phase 2 standard
- An enhancement of circuit switched data (CSD)─ the original data transmission mechanism in GSM systems
- Large parts of GSM transmission capacity used up by error correction codes in the original CSD transmission

HSCSD

- HSCSD offers various levels of error correction that can be used in accordance with the quality of the radio link

- Where CSD could transmit at only 9.6 kbps, the HSCSD data rates go up to 14.4 kbps

- Several GSM traffic channels (TCHs) can join to transmit the data at high speed

- Several TDMA slots allotted to a source

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HSCSD

- A single user gets the time slots, except at call set up

- HSCSD— a high speed service for image or video transfers which are timing sensitive

- Using a maximum of 4 time slots, it can provide a maximum transfer rate of up to 57.6 kbps

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HSCSD

- If four TCH/F14.4 channels transmit together then AUR (air interface user rate) = 57.6 kbps per duplex

- In transmission of normal voice data traffic, HSCSD gives smaller latency to data as compared to GPRS

HSCSD

- HSCSD offers better quality of service than GPRS due to the dedicated circuit-switched communication channels
- However, HSCSD less bandwidth efficient than GPRS which is packet-switched

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DECT (DIGITAL ENHANCED CORDLESS TELECOMMUNICATIONS SYSTEM

- An accepted standard since 2002
- DECT ─ for short-range communication
- Same frequency in different time slots used for the uplink and downlink radio carriers

DECT 1900

- 1880-1990 MHz for the uplink and downlink frequencies for full duplex channels of 10 radio-carriers

- The frequencies ranges— 1890.0 MHz $\pm$ 864 kHz, 1891 MHz $\pm$ 864 kHz, 1892 MHz $\pm$ 864 kHz, …, 1898 MHz $\pm$ 864 kHz MHz, and 1899 MHz $\pm$ 864 kHz

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DECT Link

- Each link provides 120 channels for uplink and 120 channels for downlink

- Each radio carrier frequency has TDD (time division duplex) frame with 12 uplinks and 12 downlinks

DECT TDD

- Uplink and downlink instants in separate time slots

- Each TDD time-slot─ 417 μs

- TDD frame duration = (12 + 12) $\times$416.7 μs = 10 ms for each of the 10 radio carriers

- GMSK Like GSM

Channel Frequency band

- 1.728 MHz each

- Each successive 4 ms— 24 TDMA channels for each radio-carrier band

- 1.152 Mbps Channel bit rates for DECT

- Speech coding— ADPCM (adaptive differential pulse code modulation)

- Voice-data traffic rate— 32 kbps.

DECT and GSM Differences in multiple access techniques

- (a) DECT same radio carrier frequency for uplink and downlink and (b) DECT TDD-TDMA slots

- TDD of DECT differs from the half duplex transmission between Mobile station and BTS

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DECT and GSM Differences in multiple access techniques

- The carrier frequency bands different (45 MHz more for downlink) but time slot is just 3.577 μ s more for uplink (less than 1 bit interval of 3.692 μ s)

DECT and GSM Differences in multiple access techniques

- TDD of DECT also differs from GPRS

- During transmission by class-10 Mobile station, there can be 4 receiving time slots and 2 transmitting time slots in the data frame of the same frequency-channel

- A maximum of 5 slots can be used at an instant out of 8

DECT 1900

- Each radio carrier─ 12 downlink time slots (SL0 to SL11) and 12 uplink time slots (SL12 to SL23), total 24 time slots

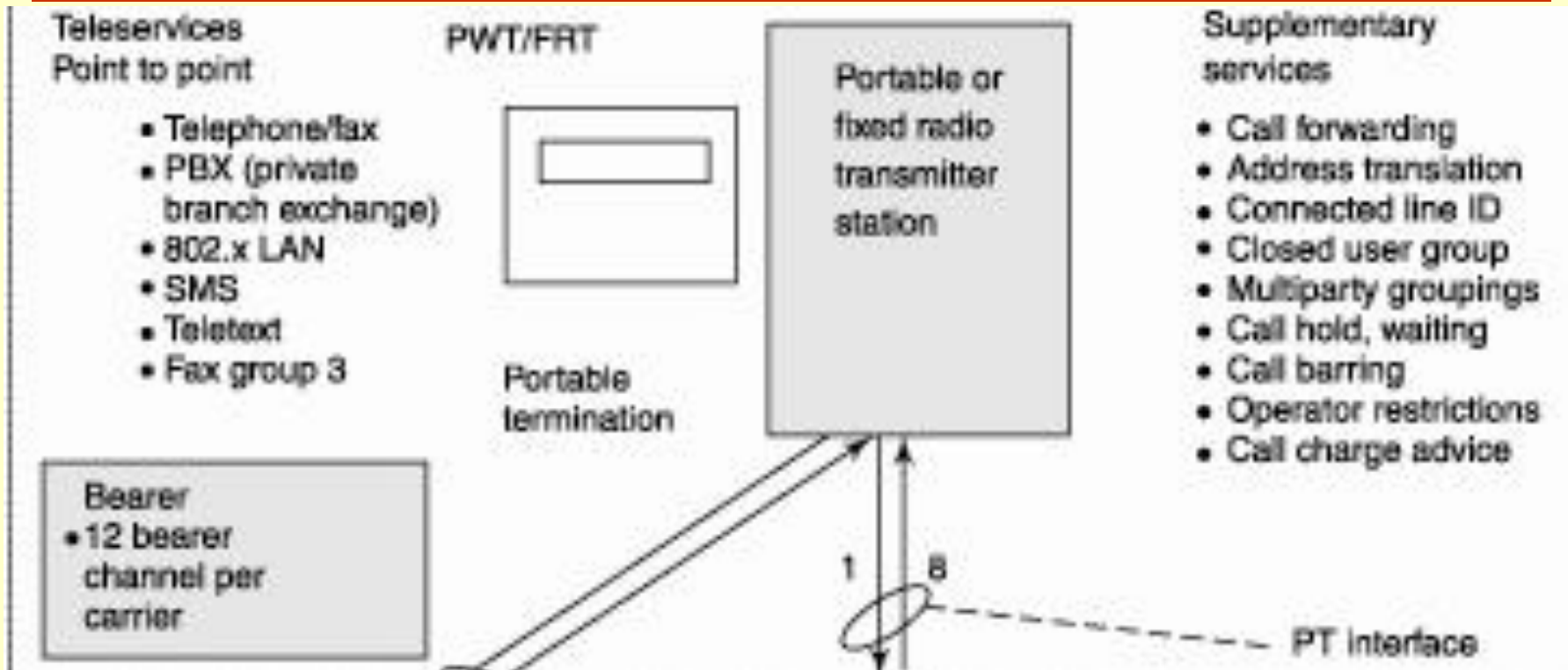- Hence number of channels = (12 + 12) $\times$ 10 = 240, 120 for uplink and 120 for downlink

Data burst

- Each of 416.7 μs

- A guard space at the beginning and the end, each of interval 26 μs (equal to 30 bit transmission time interval) is reserved to account for the delays in signals and computational time

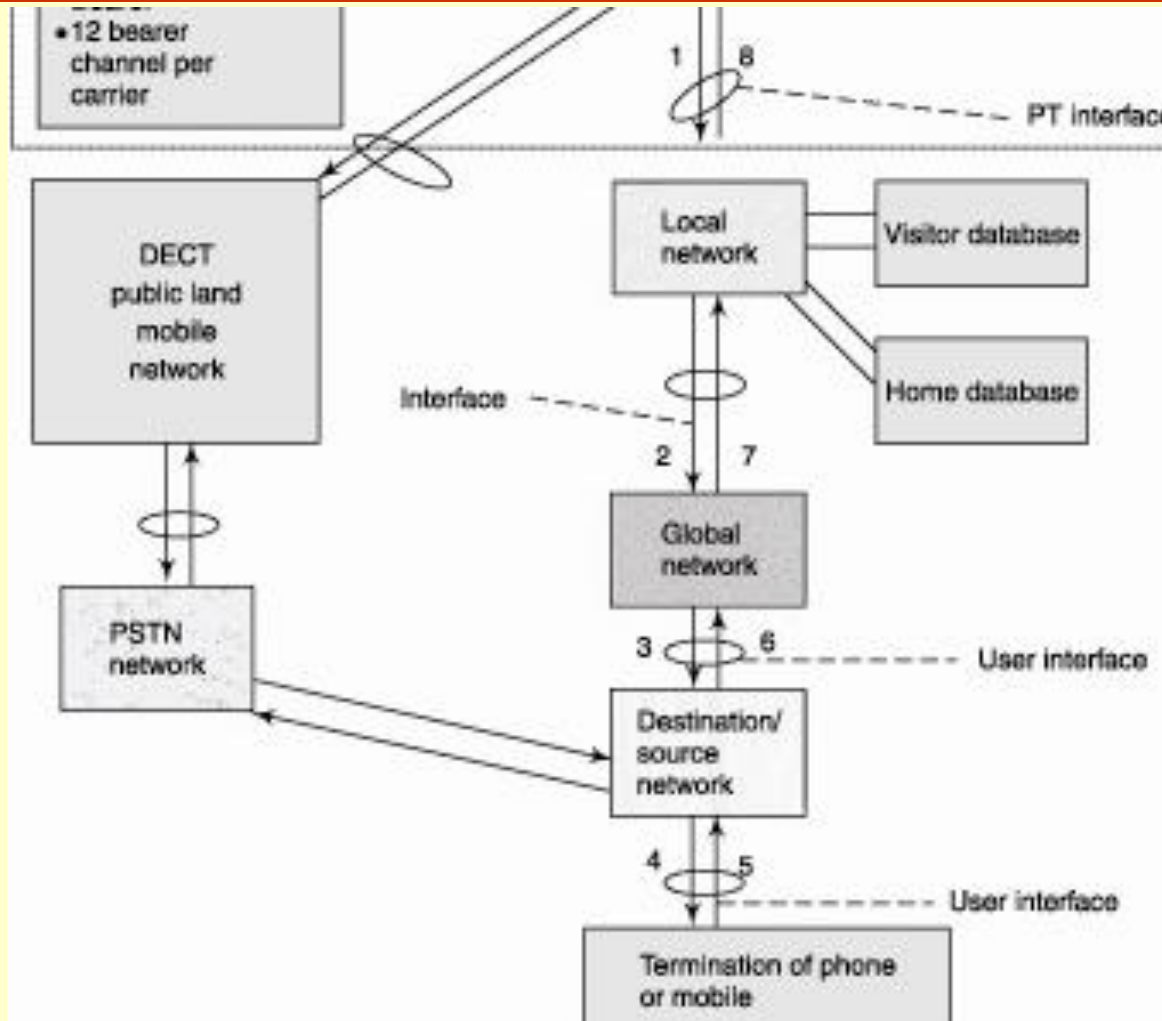- The effective time for the data bits is, therefore, $(416.7 - 26 - 26) \cong 364$ μs

Data burst

- 420 bits transmitted in the 364 μs interval

- The data transmission rate is 24 $\times$480/10 ms^{-1} = 1152 kbps

- A GMSK signal is modulated and transmitted at 1152 kbps (=0.868 μs/bit)

DECT TELESERVICES AND SUPPLEMENTARY SERVICES

Teleservices
Point to point

- Telephone/fax
- PBX (private branch exchange)
- 802.x LAN
- SMS
- Teletext
- Fax group 3

Bearer
- 12 bearer channel per carrier

PWT/FRT

Portable termination

Portable or fixed radio transmitter station

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PT interface

Supplementary services

- Call forwarding
- Address translation
- Connected line ID
- Closed user group
- Multiparty groupings
- Call hold, waiting
- Call barring
- Operator restrictions
- Call charge advice
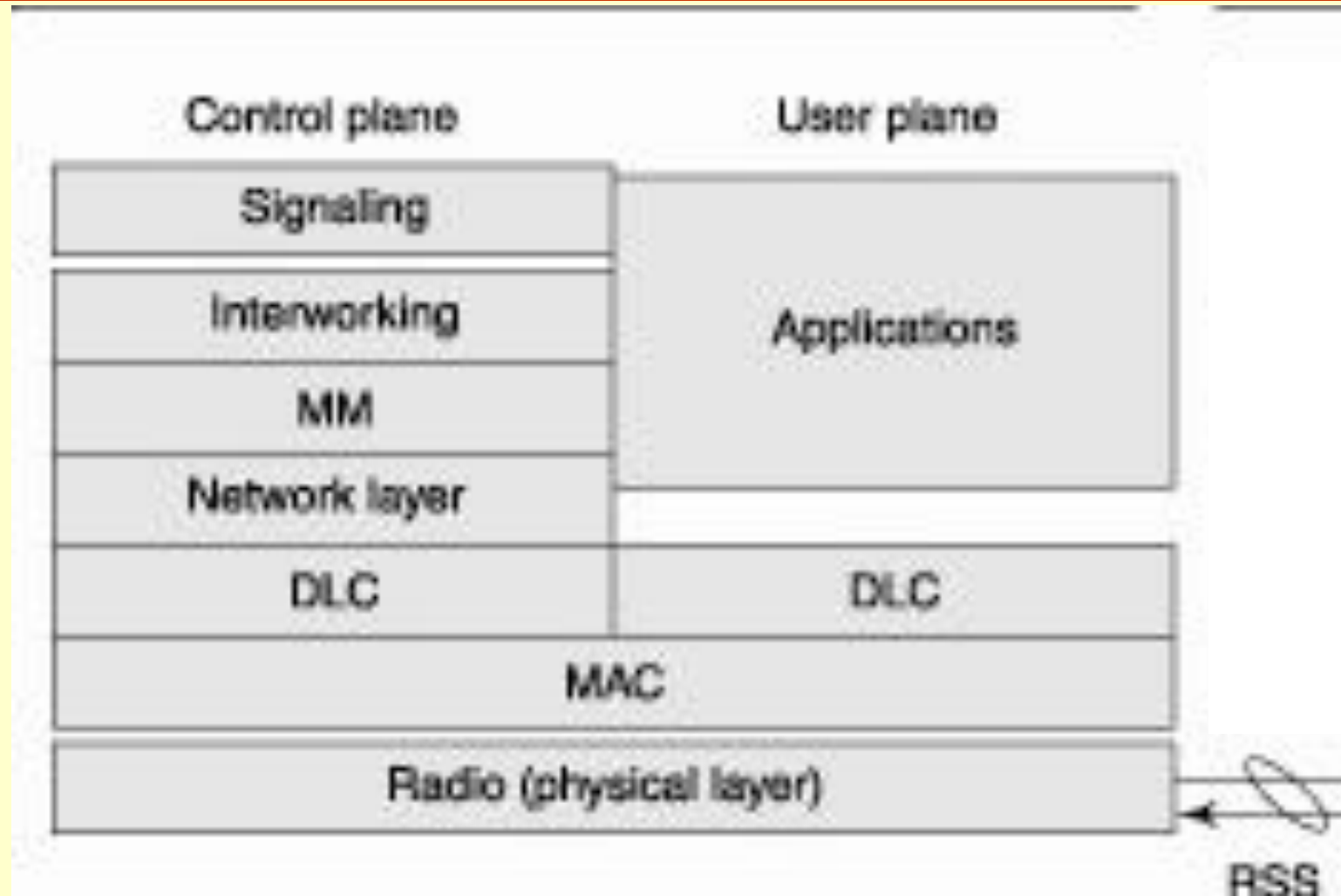
DECT ARCHITECTURE

DECT ARCHITECTURE

- 12 bearer channels (each in one SL) per carrier

- The terminal─ a portable wireless telephone (PWT) or a fixed phone with radio interface (FRT)

- The PWT or FRT connects to a public land mobile network for calling to a mobile or to a local network

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The local network

- Has a visitor database (similar to VLR in the MSC) and home database (similar to HLR in the MSC)

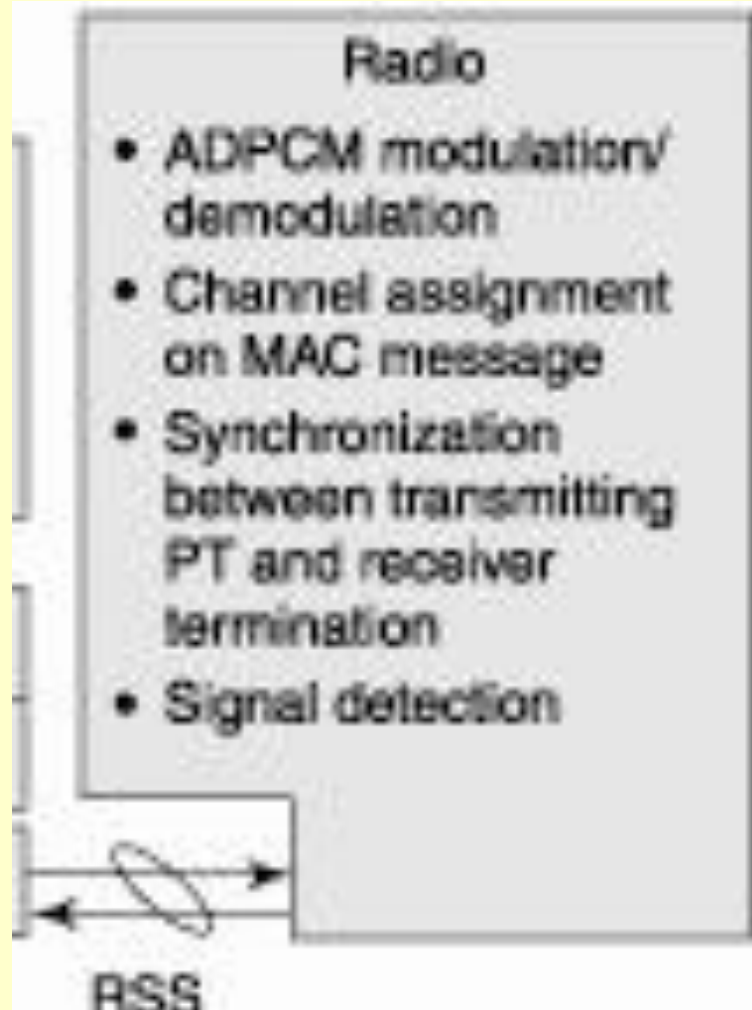- Can interface to a global network or an ISDN network

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Protocol layers in DECT

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Protocol layers in DECT

- Two planes—control plane (C-plane) and user plane (U-plane)

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Radio in DECT

Radio
- ADPCM modulation/ demodulation
- Channel assignment on MAC message
- Synchronization between transmitting PT and receiver termination
- Signal detection

RSS

MAC Functions

MAC (medium access control)

- Paging
- Network control, error control and correction
- Setup, maintain, and releasing channels for higher layers
- Activating/deactivating physical channels
- Broadcasting
- Segmentation
- Re-assembly
- Packet formatting
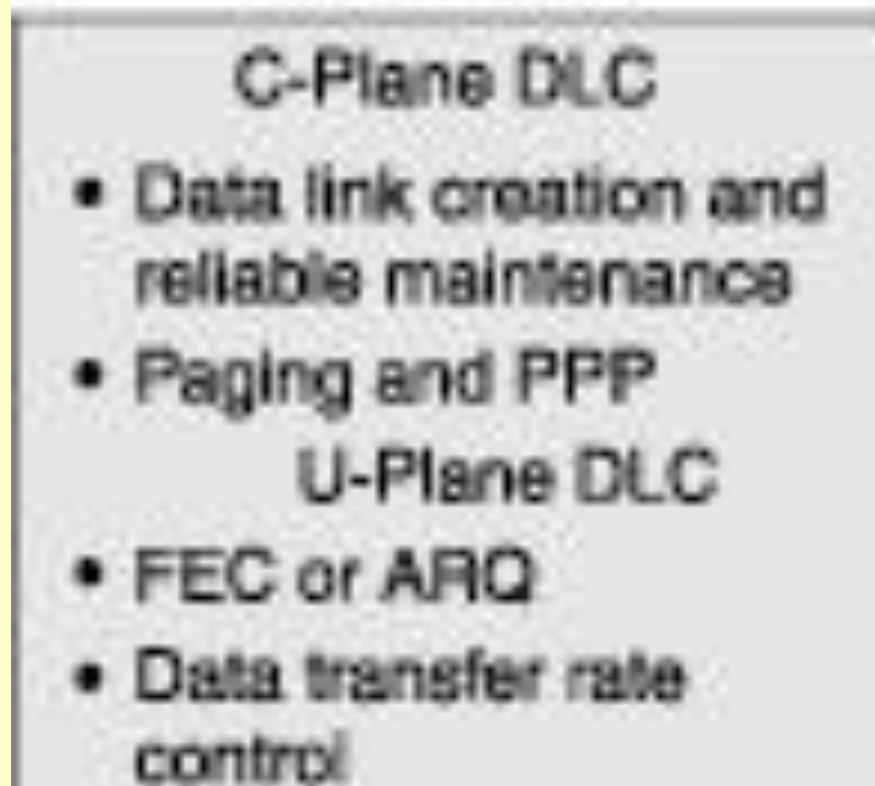
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Additional network layer

- In the control plane as compared to the user applications plane
- Transmits the DLC layer data directly to U-plane from the C-plane

Network layer Functions

Network layer

- C-plane similar to the GSM or ISDN network layer
- Connection-less or connection-oriented message service and cell control MM (authentication, location database management)
- Release and control of resources of fixed or wireless network
- Send and receive requests
- Check resources

C Plane in DECT

C-Plane DLC

- Data link creation and reliable maintenance
- Paging and PPP

U-Plane DLC

- FEC or ARQ
- Data transfer rate control

WLL (WIRELESS LOCAL LOOP)

- FRA (fixed-radio access)
- RITL (radio in the loop)
- Connects a user to PSTN networks or broadband Internet using radio signals
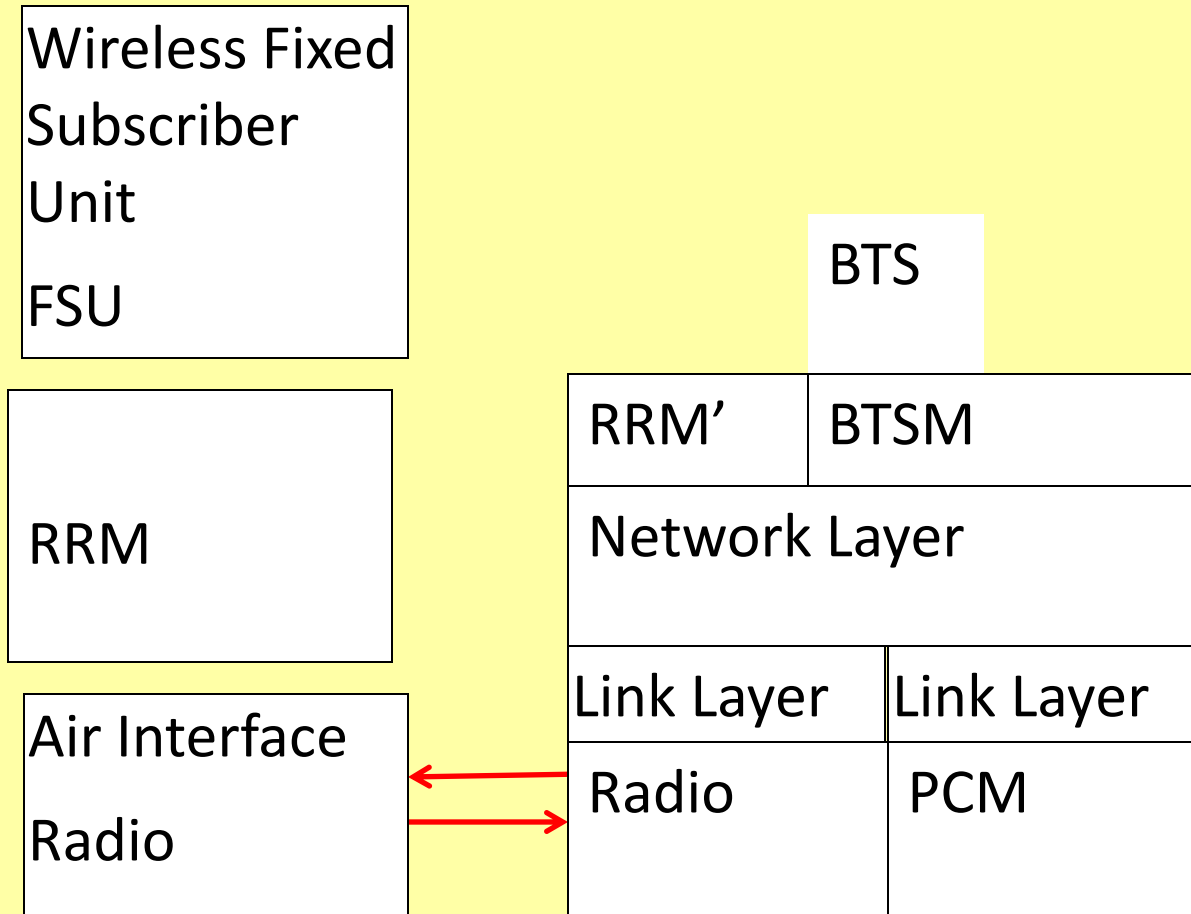
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WLL

- Includes fixed and cellular systems, cordless access systems, and proprietary fixed radio access systems

- WLL implemented over DECT or other technologies to provide the link between two terminals (PWT or FRT), including CDMA, TDMA, GSM, and UMTS 3G

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WLL

- WLL, in addition to being an alternate system, helps in providing telecommunication and broadband services where wired or fibre lines do not exist

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WLL – BTS Protocol Layers

Wireless Fixed Subscriber Unit FSU

RRM

Air Interface Radio

BTS

RRM'	BTSM
Network Layer	
Link Layer	Link Layer
Radio	PCM

Summary

- HDCSD
- Grouping of time slots for faster transmission
- DECT— DECT same radio carrier frequency for uplink and downlink
- DECT TDD-TDMA slots
- Protocol layers

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WLL

- Includes fixed and cellular systems, cordless access systems, and proprietary fixed radio access systems

End of Lesson 12
HSCSD, DECT and WLL