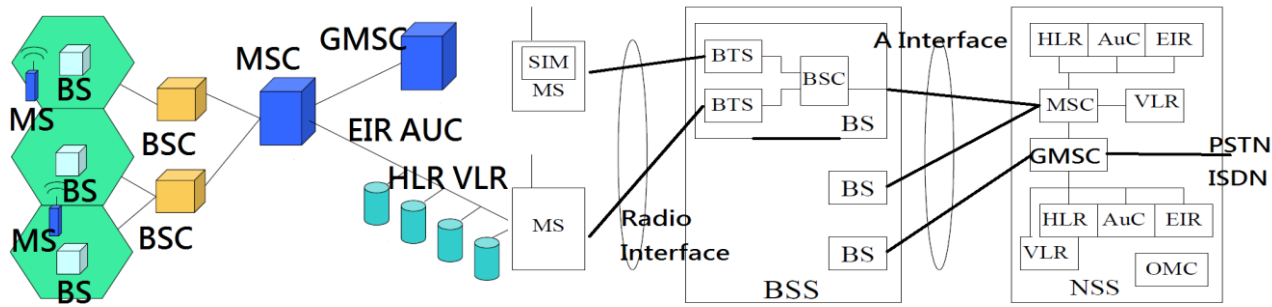


Q. Draw the hardware architecture of GSM system. Also give a short description for each hardware component that is included in the GSM architecture.



-GSMC(Gateway Mobile Switch Center)網路連接器移動交換中心:連接各 MSC

●BSS(Base Station Subsystem)基地台子系統

–MS(Mobile Station)移動台，如手機

–BS(Base Station)基地台，如天線整體

–BSC(Base Station Controller)基地台控制器

–BTS(Base Transceiver Station)基地收發信台(接收 MS 信號傳給 BSC 由 BSC 控制連結 MSC)

●NSS(Network Station Subsystem)網路子系統

–MSC(Mobile Switch Center)移動交換中心(連結各 BS (by BSC)並搜尋 EIR,AuC,HLR,VLR 等資訊)

–VLR(Visitor Location Register)拜訪位置暫存器(暫存 user 撥打的對方位置以供 MSC 使用)

–HLR(Home Location Register)所屬位置暫存器(暫存 user 所在位置以供 MSC 使用)

–AuC(Authentication Center)權限中心(屬網路管理，聚 white, gray, black-list 管理使用者是否具資格使用網路)

–EIR(Equipment Identity Register)設備識別暫存器(偵測 user 使用的設備是否合法可用)

–OMC(Operation and Maintenance Center)操作維護中心

Q. Please describe the logical channels defined in the GSM systems. Give a short description for the usage of each type of logical channels.(up/down link?)

●Traffic Channel– Are used to transmit user information (speech or data)

• TCH/Full (TCH/F)– Allows the transmission of 13 Kbps of speech

• TCH/Half (TCH/H)– Allows the speech coded at a half rate

●Control Channel (CCH)

◎Broadcast Channel (BCH)

• Are point-to-multipoint, downlink-only channels

• Classification

– Broadcast Control Channel (BCCH) – Frequency Correction Channel (FCCH) – Synchronization Channel (SCH)

◎Common Control Channel (CCH)

• Are point-to-multipoint, downlink-only channels that are used for paging & access except for RACH.

• Classifications

– Paging Channel (PCH) – Access Grant Channel (AGCH) – Random Access Channel (RACH)

◎Dedicated Control Channel (DCCH)

• Are bidirectional, point-to-point channels

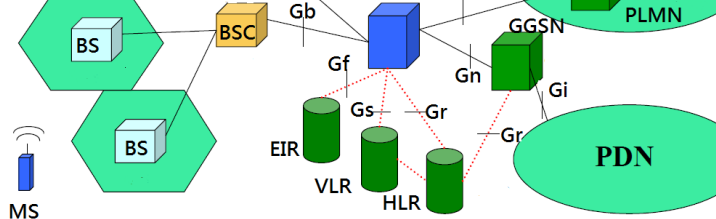
• Classifications

– Stand-Alone Dedicated Control Channel (SDCH) – Associated Control Channel (ACCH)

• Slow Associated Control Channel (SACCH)

• Fast Associated Control Channel (FACCH)

Q. Please draw the hardware architecture of the GPRS system. Compared that to GSM system, what hardware components are absent from the GSM? Also give a short description for each hardware component that is included in the GPRS architecture but not in the GSM architecture.



新增加:
SGSN(Service GPRS Support Node)取代原 GSM 的 MSC,原 MSC 為 circuit switch,此 SGSN 扮演 packet switch 腳色
GGSN(Gateway GPRS Support Node)連接 internet 網路及他家網路

Q. Please give four major difference between GSM and GPRS in terms of traffic, switching, charging, and bandwidth.

GSM: FDMA+TDMA/circuit switch/based on time/9.6kbps

GPRS:CDMA/packet switch/based on data/117kbps

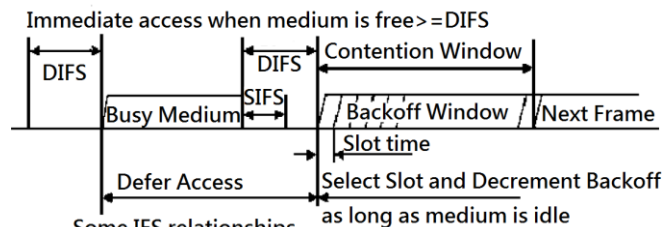
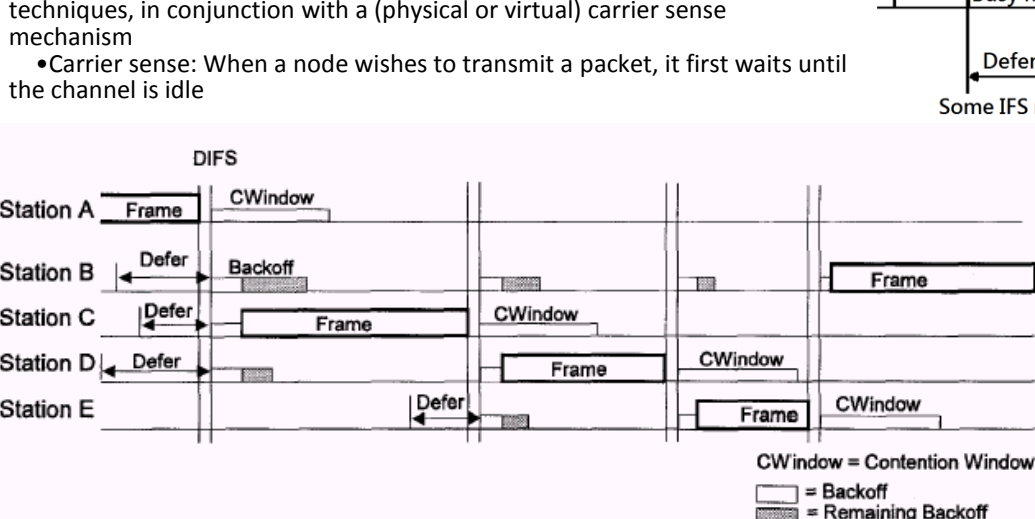
Q. Explain how do the CA and CW(IFS and backoff procedure) work in IEEE802.11.

Collision Avoidance

•With half-duplex radios, collision detection is not possible

•CSMA/CA: Wireless MAC protocols often use collision avoidance techniques, in conjunction with a (physical or virtual) carrier sense mechanism

•Carrier sense: When a node wishes to transmit a packet, it first waits until the channel is idle

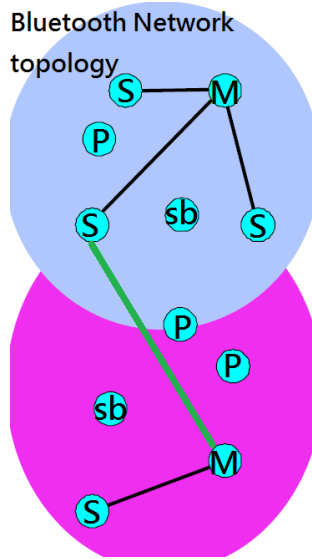


•Collision avoidance: Once channel becomes idle,the node waits for a randomly chosen duration before attempting to transmit

↑ (CW part 1)Some IFS relationships and basic access method

←(CW part 2)Backoff procedure

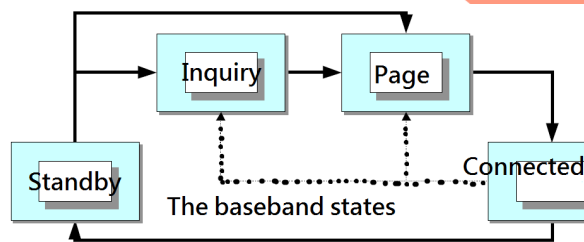
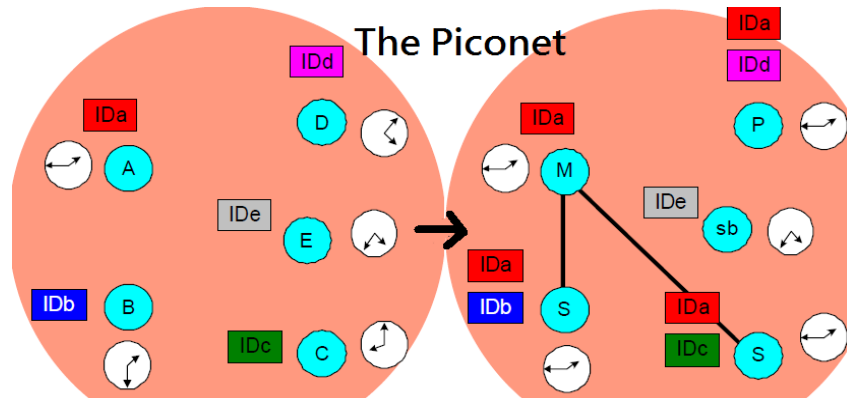
Q. What is piconet? What is a scatternet in Bluetooth? Draw pictures and give description to each of the question.(include the state-transition of the baseband status in a Bluetooth device. Explain the meaning and the process of each



state as well. Also Show how the ID/CLOCK/and status of a device is maintained and changed in the forming of a piconet.)

←(part1/pic1)

- Piconet
 - Master can connect to 7 simultaneous or 200+ inactive (parked) slaves per piconet
 - Each piconet has maximum capacity (1MSPs)
 - Unique hopping pattern/ID
 - Scatternet
 - Piconets can coexist in time and space
- (part2/pic2)→
- All devices in a piconet hop together
 - To form a piconet: master gives slaves its clock and device ID
 - Hopping pattern determined by device ID (48-bit)
 - Phase in hopping pattern determined by Clock



in standby

Address (AMA, 3-bits)
Address (PMA, 8-bits)

devices in the vicinity
specific device
in a piconet (master or slave)

- Non-piconet devices are
- Piconet Addressing
 - Active Member
 - Parked Member

(part3/pic3)→

- Standby– do nothing
- Inquire– search for other
- Page– connect to a
- Connected– participate

Q. For both the FCA and DCA schemes, please give two algorithms from each channel allocation scheme. Please compare their advantages and dis-advantages as well.

FCA: -borrow from the richest(SBR):channels 不夠時向鄰近 channel 數最多者借 -borrow first available scheme(BFA):向鄰近第一個搜尋到可借的借

DCA: -centralized DCA :first available(FA)哪個 channel 空了就給需要者(可減少系統計算量) -distributed DCA:locally packing distributed

DCA(LP-DDCA)用 ACO 判斷配給哪個 channel

比較 FCA 和 DCA:-FCA 適用 heavy traffic -low flexibility in channel assignment DCA:-適用 light/moderate traffic -flexible channel allocation

Q. Please describe the GSM limitations and GPRS features in details.

GSM data limitations:

- 1.Uplink and downlink channels allocated for a user entire call period
- 2.Low bandwidth for user(9.6Kbps)
- 3.User pays based on duration, not based on volume
- 4.GSM is designed for speech, not data

GPRS Objectives:

- 1.GPRS uses packet switched resource allocation
- 2.Dynamic channel allocation -1 to 8 time slots -Available resources shared by active users -Up and down link channels reserved separately -GPRS and circuit switched(GSM) services can use same time slots alternatively
- 3.Efficient delivery of SMS over the GPRS air interface
- 4.Connections with data networks -IP network, X.25, GPRS own protocols

Q. please describe how each of the following protocol works in terms of the pseudo code: ALOHA, CSMA/CD, p-persistent CSMA/CD, CSMA/CA.

ALOHA

Whenever a station has a data, it transmits. Sender finds out whether transmission was successful or experienced a collision by listening to the broadcast from the destination station. Sender retransmits after some random time if there is a collision.

CSMA/CD

- Step 1: If the medium is idle, transmit
- Step 2: If the medium is busy, continue to listen until the channel is idle then transmit
- Step 3: If a collision is detected during transmission, cease transmitting
- Step 4: Wait a random amount of time and repeats the same algorithm

p-persistent CSMA Protocol:

- Step 1: If the medium is idle, transmit with probability p, and delay for one propagation delay with probability (1-p)
- Step 2: If the medium is busy, continue to listen until medium becomes idle, then go to Step 1
- Step 3: If transmission is delayed by one time slot, continue with Step 1

CSMA/CA

- All terminals listen to the medium same as CSMA/CD.
- Terminal ready to transmit senses the medium.
- If medium is busy it waits until the end of current transmission.
- It again waits for an additional predetermined time period DIFS (Distributed inter frame Space).
- Then picks up a random number of slots (the initial value of backoff counter) within a contention window to wait before transmitting its frame.
- If there are transmissions by other terminals during this time period (backoff time), the terminal freezes its counter.
- It resumes count down after other terminals finish transmission + DIFS The terminal can start its transmission when the counter reaches to zero.

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