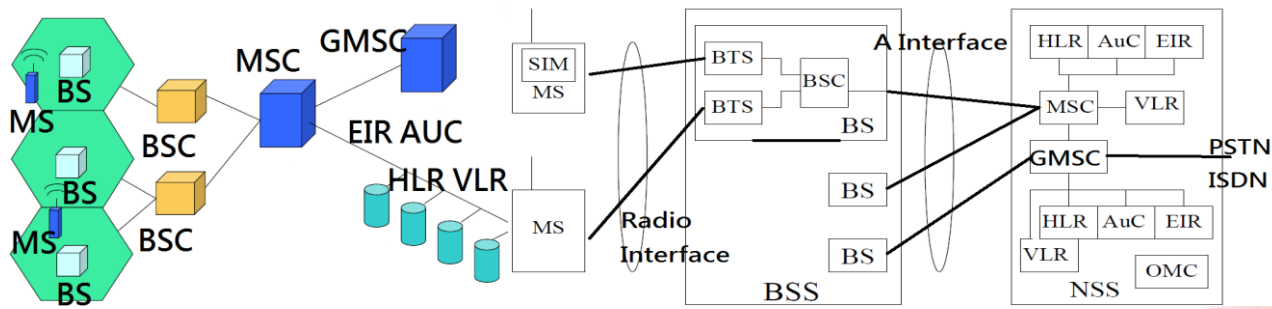


Q. Draw the hardware architecture of GSM system. Also give a short description for each hardware component that is included in the GSM architecture.



-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

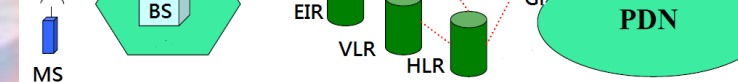
• Classifications

– 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.



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

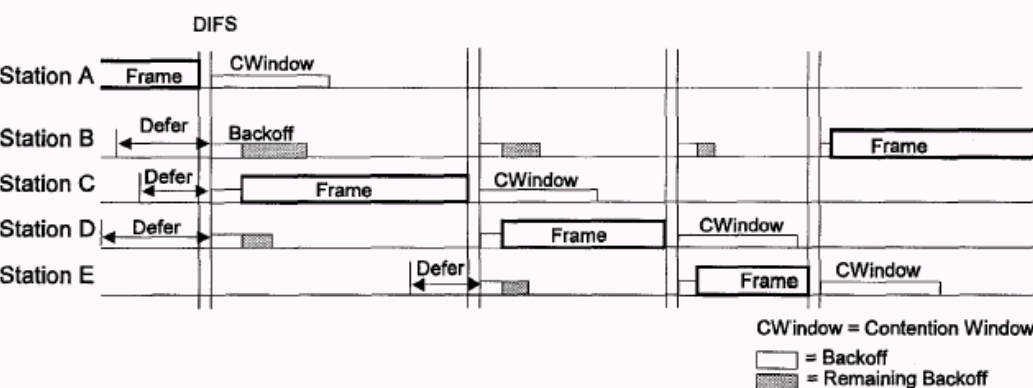
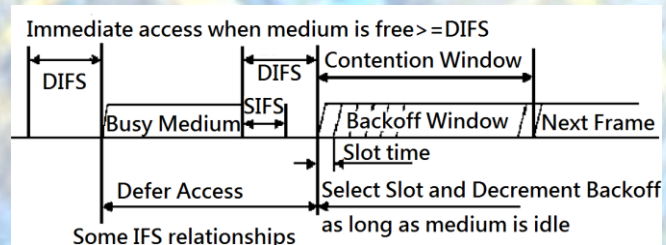
Q. Explain how do the CA and CW(IFS and backoff procedure) work in IEEE802.11.

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



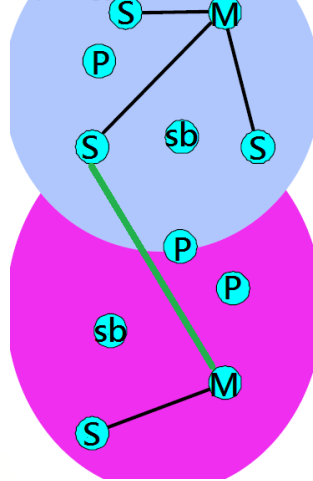
•Collision avoidance: Once channel becomes idle,the node waits for a randomly chosen duration before attempting to transmit

↑ (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

Bluetooth Network topology



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

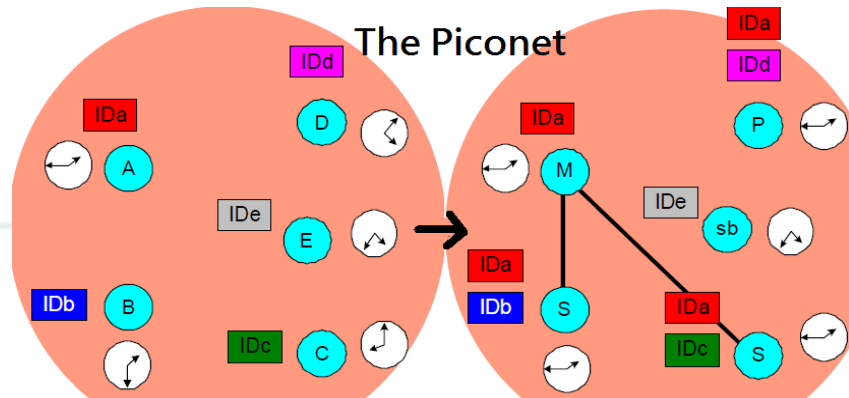
←(part1/pic1)

•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

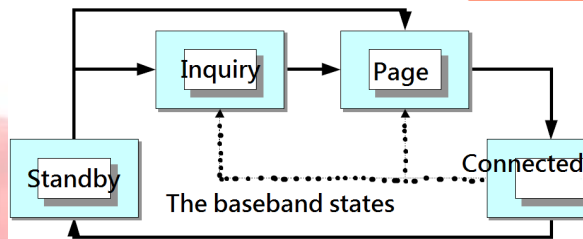
- Piconets can coexist in time and space
- (part2/pic2)→
- All devices in a piconet hop together
- To form a piconet: master gives slaves its clock and device ID
- Hopping pattern determined by device ID (48-bit)
- Phase in hopping pattern determined by Clock



- 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



in standby

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

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

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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