102-1 Wireless Final

1. (a) Describe functions of VLR (6%), AuC (2%), EIR (2%) and MSC (4%) in GSM Infrastructure. (b) What interface is between MS/BTS, BTS/BSC and BSC/MSC in GSM? (6%) (20% total)

2. Describe flows of Automatic Location Update (4%) and Automatic Call Forwarding using HLR-VLR (8%) (12% total)

3. Draw a figure to show 7 components (not in GSM) of UMTS-Network Reference Architecture. (2*7= 14%)

4. Explain packet forwarding process of ***Mobile IP*** (12% total)

5. List four characteristics of MANET. (8%)

6. Describe AODV routing in ad hoc network. (8%)

7. What are the frequency band and highest data rate supported by (a) 802.11a (2%) (b) 802.11b (2%) (c) 802.11g (2%) (d) Bluetooth (2%, 8% total)?

8. (a) Please draw the signal wave after applying FSK and PSK for binary data 101101. （note:要說明 bit 0 and 1 如何表示，並畫出相對的 carrier signal 與 101101 的圖）(14%) (b) Explain Quadrature Amplitude Modulation (QAM) (4%) (18% total)

102-1 Wireless Final

1. (a) Describe functions of VLR (6%), AuC (2%), EIR (2%) and MSC (4%) in GSM Infrastructure. (b) What interface is between MS/BTS, BTS/BSC and BSC/MSC in GSM? (6%) (20% total)

Ans:

(a) VLR contains information about all visiting MSs in that particular area of MSC (2%)

- VLR has pointers to the HLR's of visiting MS (2%)
- VLR helps in billing and access permission to the visiting MS (2%)
- AUC provides authentication and encryption parameters (2%)
- EIR contains identity of equipments that prevents service to unauthorized MSs (2%)
- Mobile Switching Center (MSC): Mainly performs the switching by controlling calls to and from other telephone/data systems. (2%) Also, performs functions such as network interfacing, common channel signaling, etc (2%)

(b) MS/BTS: U_m (2%)
BTS/BSC: A_{bis} (2%)
BSC/MSC: A (2%)

2. Describe flows of Automatic Location Update (4%) and Automatic Call Forwarding using HLR-VLR (8%) (12% total)

Ans:

Automatic Location Update: (4%)

MS->VLR

VLR->HLR

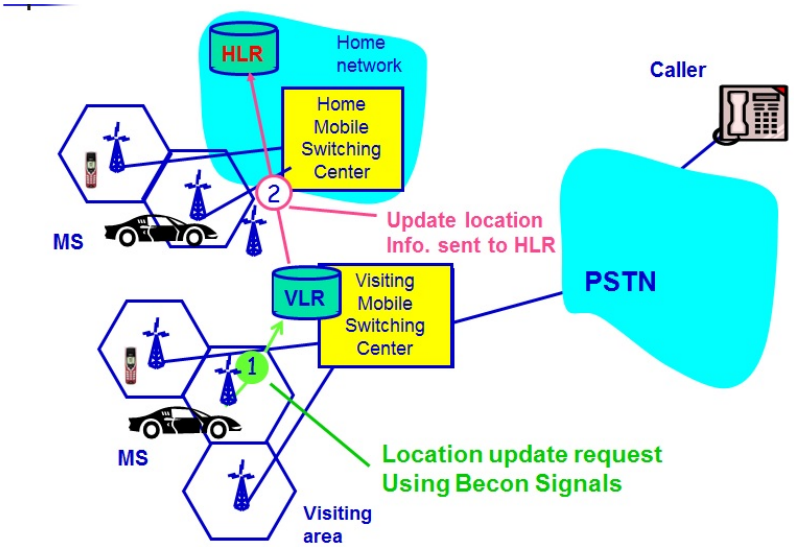
Automatic Call Forwarding using HLR-VLR (8%)

Caller -> home MSC

Home MSC checks HLR

Home MSC -> visiting MSC

visiting MSC -> MS



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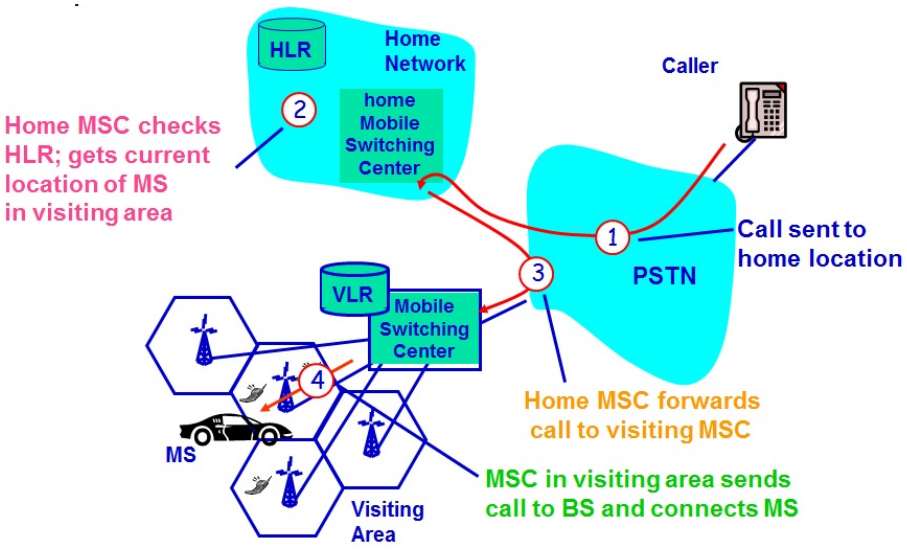
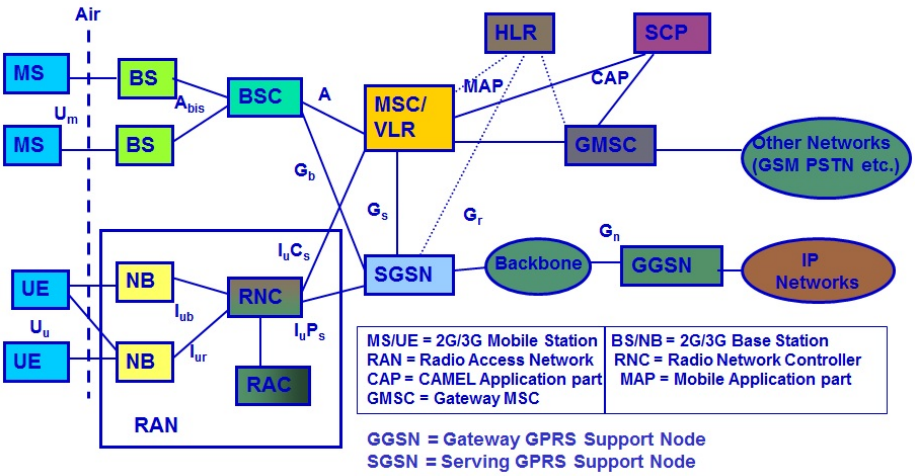


3. Draw a figure to show 7 components (not in GSM) of UMTS-Network Reference Architecture. (2*7= 14%)

Ans:



UE, NB, RNC, SGSN, GGSN, Backbone, IP Networks (2% each)

4. Explain packet forwarding process of ***Mobile IP*** (12% total)

Ans:

- A message sent from an arbitrary source to the MS at the home address is received by the HA (4%)
- Binding is checked, the CoA of the MS is encapsulated in the packet and forwarded to the network (4%)
- If CoA of the FA is used, then packet reaches FA, it decapsulates packet and passes to MS at the link layer (4%)

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5. List four characteristics of MANET. (8%)

Ans:

- Dynamic topologies: Network topology may change dynamically as the nodes are free to move
- Bandwidth-constrained, variable capacity links: Realized throughput of wireless communication is less than the radio's maximum transmission rate. Collision occurs frequently
- Energy-constrained operation: Some nodes in the ad hoc network may rely on batteries or other exhaustible means for their energy
- Limited physical security: More prone to physical security threats than fixed cable networks

6. Describe AODV routing in ad hoc network. (8%)

Ans:

- For AODV, source node broadcasts a route request packet (RREQ) to its neighbors (2%), which then forwards the request to their neighbors, and so on, until either destination or a node with "fresh enough" route to destination is located. (2%)
- During the process of forwarding the RREQ, nodes record in their route tables the address of the neighbor from which the first copy of the broadcast packet is received, thereby establishing a reverse path. (2%)
- AODV uses forwarding tables at each node. (2%)

7. What are the frequency band and highest data rate supported by (a) 802.11a (2%) (b) 802.11b (2%) (c) 802.11g (2%) (d) Bluetooth (2%, 8% total)?

Ans:

(a) 802.11a (2%)
in the 5-GHz band (1%)
at data rate up to 54 Mbps (1%)
(b) 802.11b (2%)
in the 2.4-GHz band
at data rate 5.5 and 11 Mbps
(c) 802.11g (2%)
in the 2.4-GHz band
at data rate up to 54 Mbps
(d) Bluetooth (2%)
in the 2.4-GHz band
at data rate up to 720Kbps

8. (a) Please draw the signal wave after applying FSK and PSK for binary data 101101. （note:要說明 bit 0 and 1 如何表示，並畫出相對的 carrier signal 與 101101 的圖）(14%) (b) Explain Quadrature Amplitude Modulation (QAM) (4%) (18% total)

Ans:

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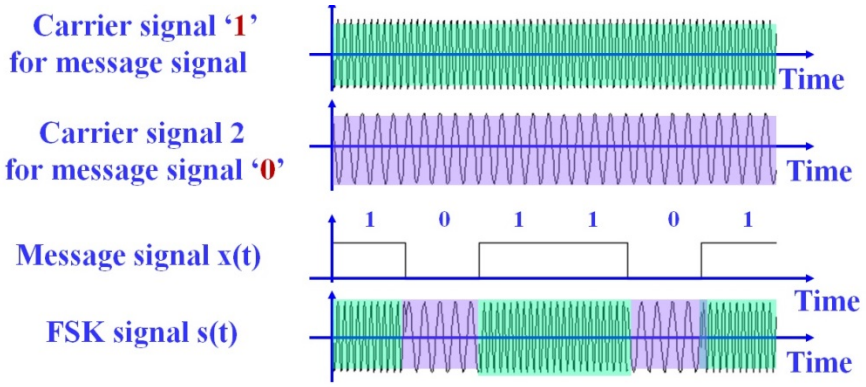
(a) FSK:

- 1/0 represented by two different frequencies (2%)



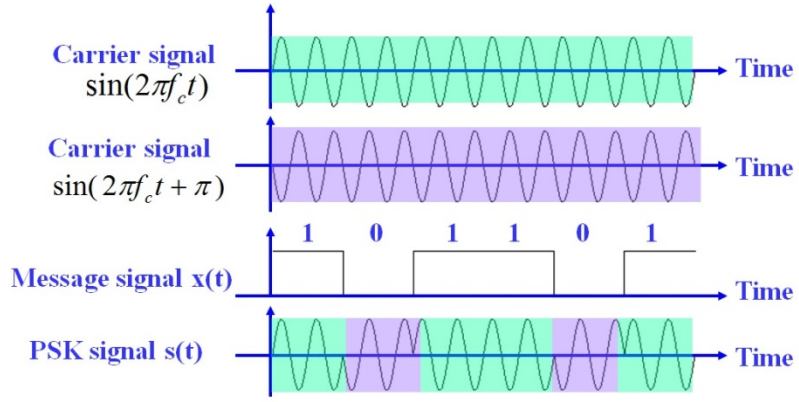
(1, 1, 3%)

PSK:

- Use alternative sine wave phases to encode bits (差 180 度) (2%)，如

  Binary 0: $\sin(2\pi f_c t)$

  Binary 1: $\sin(2\pi f_c t + \pi)$



(1, 1, 3%)

圖各 1%，一個 bit 0.5%

(b) Combination of ASK and PSK: modulate signals using two measures of amplitude and four possible phase shifts (4%)