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1. (a) What is the purpose of the agent discovery process in MIPv4? (4%) (b) What are the two messages sent for agent discovery? (4%) (c) What two steps have to be done when the mobile enters and stays in a visited network? (4%)

2. (a) Explain MIPv4 route optimization and then draw a figure for it. (4%) (b) Explain MIPv4 regional registration and then draw a figure for it. (6%) (c) Which limitations of MIPv4 are solved by the above two approaches? (4%)

3. Draw figures and describe two MIPv6 modes to deliver packets to mobiles. (8%) Explain ingress filtering. (4%)

4. How SIP supports mid-session terminal mobility? (6%)

5. Draw a figure to describe the pinball routing problem of network mobility (AR-> MR1 -> MR2 -> MNN). (11%)

6. (a) List three components of the Global Satellite Positioning System (GPS). (6%) (b) How many orbital planes, satellites per plane does it have? (4%) (c) What purpose of the GPS data protocol is? (2%) (d) Write down the name of the GPS data protocol. (3%) (15% total)

7. With which three precise coordinate items do digital (Vector) maps use to represent the map locations? (6%)

8. What is the geographic information system (GIS)? (6%)

9. Which three methods can enhance the accuracy of GPS Positioning against GPS Errors and Biases? How they work? (name: 2%, functions: 4%, 18% total)

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1. (a) What is the purpose of the agent discovery process in MIPv4? (4%) (b) What are the two messages sent for agent discovery? (4%) (c) What two steps have to be done when the mobile enters and stays in a visited network? (4%)

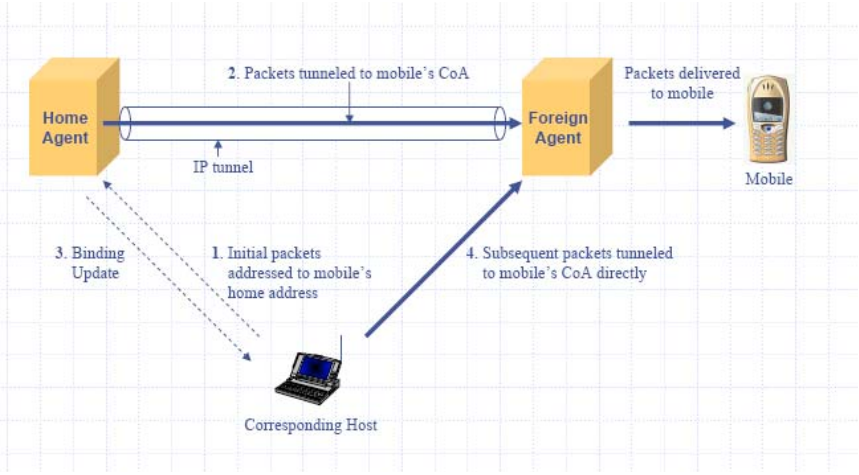
Ans: (a) the process for a mobile terminal to discover the mobility agents and receive information from these agents.

(b) Agent Advertisement messages; Agent Solicitation message.

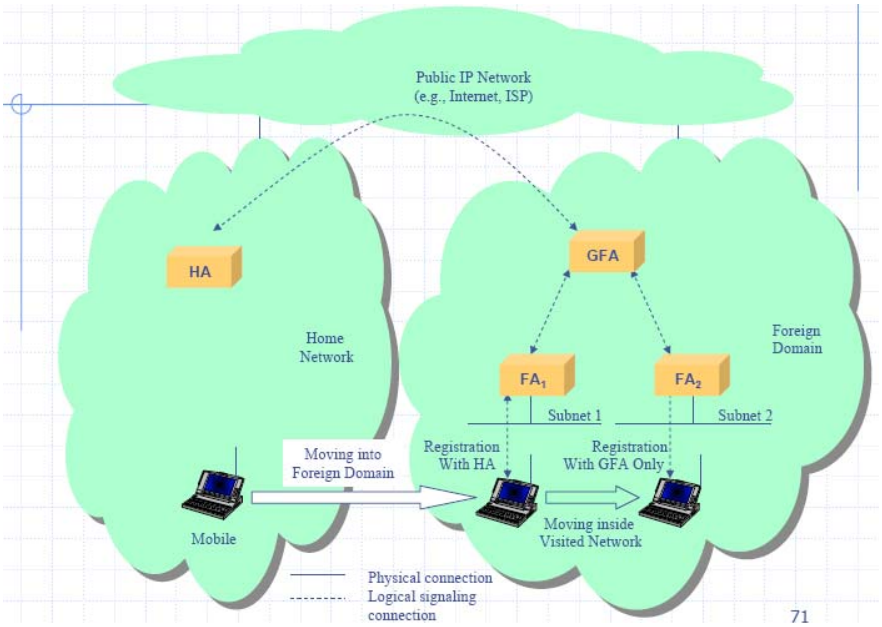
(c) a mobile has to acquire a CoA; it then register the CoA with its HA.

2. (a) Explain MIPv4 route optimization and then draw a figure for it. (4%) (b) Explain MIPv4 regional registration and then draw a figure for it. (6%) (c) Which limitations of MIPv4 are solved by the above two approaches? (4%)

Ans: (a) Allow a CN to be aware of a mobile's current CoA and then tunnel packets to the destination mobile's CoA directly.



(b) allow a mobile to register its new CoA locally with its visited gateway foreign agent (GFA) with regional registration request/reply when it moves between FAs connected to a same GFA. (6%)



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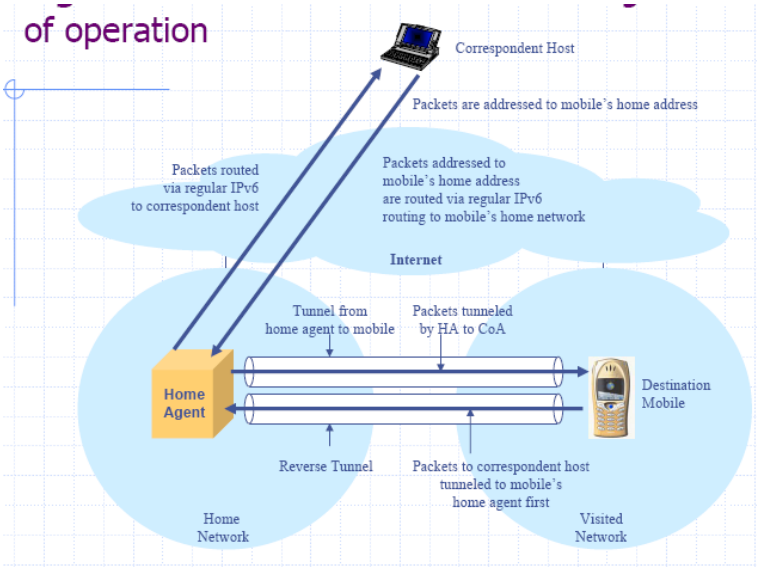
(c) RO: triangular routing (CN->HA->FA->mobile) (2%)

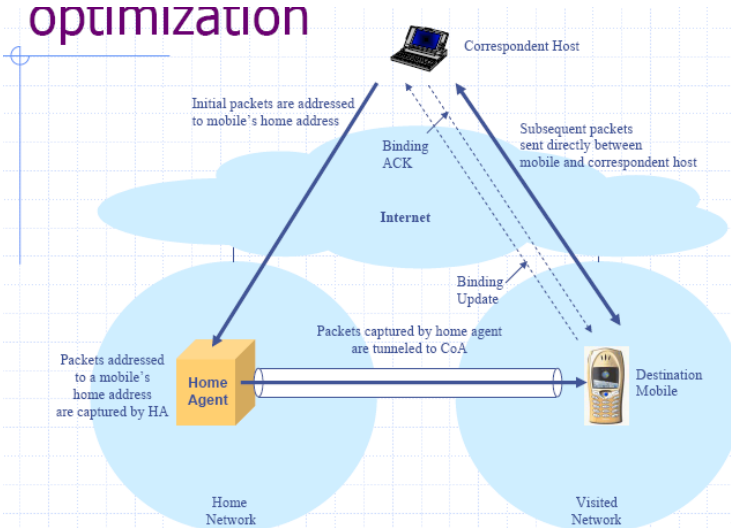
Regional registration: long handoff delay (a mobile has to register with its HA every time it changes its CoA) (2%)

3. Draw figures and describe two MIPv6 modes to deliver packets to mobiles. (8%) Explain ingress filtering. (4%)

Ans : (a) bi-directional tunneling mode:



(b) Route optimization mode



Ingress filtering: outgoing packets from a visiting mobile may not be able to go through the IP access router in the visited network (4%)

4. How SIP supports mid-session terminal mobility? (6%)

Ans: 1. mobile sends a new SIP INVITE message to invite the CN to re-establish the SIP session to the mobile's new location.

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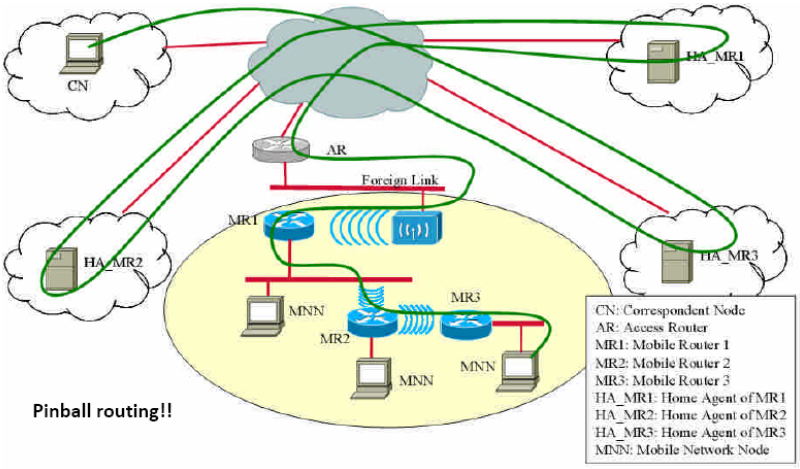
2. mobile also updates its location with its home SIP Redirect Server.

5. Draw a figure and describe the pinball routing problem of network mobility (AR-> MR1 -> MR2 -> MNN). (11%)

Ans:



兩個 MR1, MR2, MR1-HA, MR2-HA
CN 先送 pkt 到下層 MR2 的 HA (1%)
封裝 tunnel 到 MR2 (2%)
經過 MR1-HA(1%)，再封裝 tunnel 到 MR1 (2%)
MR1 解封裝 (2%)
MR2 解封裝 (2%)
送到 MNN (1%)

6. (a) List three components of the Global Satellite Positioning System (GPS). (6%) (b) How many orbital planes, satellites per plane does it have? (4%) (c) What purpose of the GPS data protocol is? (2%) (d) Write down the name of the GPS data protocol. (3%)

Ans:

(a) GPS Satellite broadcast its own-specific signal for each satellite (6%)
- GPS receiver **passively** receives these signal from the sky
- GPS ground stations control and adjust the satellite orbits

(b) 6 Orbital Planes with 4 Satellites per plane (4%)

(c) To combine data from different GPS receiver manufactured by different GPS manufacturers (2%)

(d) NMEA 0183 (3%)

7. With which three precise coordinate items do digital (Vector) maps use to represent the map locations? (6%)

Ans:

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Digital (Vector) Maps have precise coordinate system to represent the map locations (6%)

- Longitude
- Latitude
- Altitude

8. What is the geographic information system (GIS)? (6%)

Ans:

A **geographic information system (GIS)** is a system for capturing, storing, analyzing and managing data and associated attributes 或 GIS is a computer system (2%) which is capable of integrating, storing, editing, analyzing, sharing, and displaying (2%) geographically-referenced information (2%) (6%)

9. Which three methods can enhance the accuracy of GPS Positioning against GPS Errors and Biases? How they work? (name: 2%, functions: 4%)

Ans:

1. DGPS – Differential GPS

- It uses a network of fixed ground based reference stations to broadcast the difference information (2%)
  - Between the positions indicated by the satellite systems and the known fixed positions (or between the measured satellite pseudoranges and actual (internally computed) pseudoranges)
- Receiver stations may correct their pseudoranges by the same amount (2%)

2. WAAS – Wide Area Augmentation System

- It is achieved via a network of ground stations which measure the GPS signal and route the measurements to two master stations (2%)
- They generate and send the correction messages to geostationary satellites which broadcast the correction messages back to Earth (2%)
- WAAS-enabled GPS receivers will apply the corrections to their computed GPS position (1%)

3. AGPS – Assisted-GPS

- Mobile telephones with embedded GPS engines, 利用 base station 的信號，配合傳統 GPS 衛星信號，讓定位的速度更快。(3%)