Assessment :- 03

Page No.
Date / /

1.@ Define the role of a foreign Agent (FA) and a Home Agent (HA) in the Mobile IP architecture How do they differ in their responsibilities?

→ * Home Agent (HA) :-
- located in home network of mobile node
- Maintion permonent IP address of mobile node
- keep current location of mobile node.
- Tunnel packet to the mobile node when it is away from home network

* Foreign Agent (FA) :-
- Located in visited (foreign) network
- Provides care of address (Cof) to mobile node
- Helps in registration with Home Agent.
- Receive tunnel packets from HA and deliver to mobile node.

	Home Agent (HA)	Foreign Agent (FA)
1)	In home Network	In foreign network
2)	Maintain mobility binding	Provides temporary address
3)	Tunnels packet to MN	Foward packet to MN
4)	Stores permonent IP	Support visiting mobile node

Shrikrupa

(b) Explain the concept of "care of Address" (CoA). What is the difference between Foreign Agent CoA and a Colocated CoA?

→ Care of address (CoA):- Care of address is a temporary IP address assigned to mobile Node (MN) when it moves to a foreign network.
- It represent the current location of the mobile node.
- The Home Agent (HA) sends (tunnels) packet to this address.
- It enables mobility without changing the permanent home IP.

* Types of care of Address

Foreign Agent CoA	Co-located CoA
1) Address of the foreign Agent (FA)	Address assigned directly to the mobile node.
2) Shared by multiple node.	Unique for each mobile node.
3) FA receives tunneled packet and forward to MN	MN recives tunneled packet directly
4) Does not require separate IP for MN.	Require separate temporay IP.

Shrikrupa

(c) Describe the Registration process in Mobile IP. What are the key piece of information the mobile Node sends to its Home agent?

→ Registration process in Mobile IP:-
Registration is the process by which a Mobile Node (MN) inform its Home Agent (HA) about its new care of address (CoA) when it move to a foreign network.

* Steps:-
1. MN obtains a Care of address (CoA) from foreign Agent or locally.
2. MN sends Registration Request to HA
3. HA verifies and updates mobility binding table.
4. HA send Registration Reply (accept/reject)
5. If accepted, HA starts tunneling packet to COA.

* Key Information sent by Mobile Node
The registration Request contains:-
- Home IP address of MN
- Care of address (CoA)
- Home Agents IP address
- life time (duration of registration)
- Identification field
- Authentication data.

Shrikrupa

Page No.
Date

2(a) What is "Tunneling" in Mobile IP? Explain the generic "IP-within-IP" encapsulation technique with a diagrammatic representation of the packet header

→ Tunneling in Mobile IP:-
Tunneling is the process of encapsulating the original IP packet inside another IP packet to deliver it to the mobile Node's Care-of address (CoA)
- Done by the Home agent (HA)
- Ensure packets reach the mobile node in a foreign network
- Uses:- IP-with IP encapsulation

*IP-within-IP Encapsulation:-
In this technique, the entire original IP packet is placed inside a new IP packet

* Working:-

1. Corresponding Node sends packet to MN's home address
2. HA intercept the packet
3. HA adds a new IP header (outer header)
4. Packet is tunneled to the CoA.
5. Foreign Agent (or MN) decapsulates and deliver data.

Shrikrupa

Page No.
Date

(b) Identify briefly explain the primary function of the mobility Header in Mobile IPv6.

→ The Mobility Header in mobile IPv6 is an extension header used to manage mobility-related messages.

* Main function:-

1) Binding Update (BU):-
- Sent by Mobile Node to inform Home Agent or correspondent node about new care of address

2) Binding Acknowledge (BA):-
- Sent in response to Binding Update (Accept / Reject)

3) Binding Request (BR):-
- Request the mobile Node to send a Binding Update.

4) Home Test Init (HoTI):-
- Used in Return Routability procedure (security check via home address)

5) Home Test (HoT):
- Reply for HoTI message

Shrikrupa

Page No.
Date

6. How does Bidirectional Tunneling between the mobile node and its Home agent work in Mobile IPv6? What is its main advantage and potential drawback?

→ Bidirectional Tunneling in Mobile IPV6:-
Bidirectional Tunneling is a communication method where all traffic between the mobile Node (MN) and Corresponding Node (CN) pass through the home Agent (HA).

*How it works:-
1. CN sends packet to MN's Home address
2. HA intercepts the packet
3. HA tunnels the packet to MN's care of address (CoA)
4. MN recieves and decapsulates the packet
5. When MN sends reply it tunnels packet back to HA
6. HA forwards it to CN.

*Advantages:-
- CN does not need to support Mobile IPv6
- Works with existing IPv6 infrastructure.

*Disadvantages:-
- Packets always go through HA.
- Cause higher delay (latency)

Shrikrupa

Page No.
Date

3. a) Explain the Dynamic Home Agent address Discovery (DHAAD) procedure in Mobile IPv6. Why is this feature not required in basic Mobile IPv4?

→ DHAAN is a mechanism that allows a Mobile Node (MN) to dynamically discover the address of a Home agent in its home network.

*Why it is Needed:-
In Mobile IPv6, the MN may not known the exact HA address in advance.
So DHAAD helps the MN find an available HA automatically.

*Procedure:-
1. MN sends a Home Agent Address Discovery Request to its home network
2. The message is sent to a special anycast address from Home Agents.
3. One or more HA's respond with their unicast IPv6 addresses
4. MN selects one HA and perform Binding Update (registration)

*Why Not Required in Basic Mobile IPv4
In Mobile IPv4, the HA address is manually configured in the Mobile node.

Shrikrupa

(b) What is the purpose of Agent Advertisment and Discovery in mobile IPV4? What specific ICMP message type is used for this?

→ * Purpose of Agent Advertisement and Discovery in Mobile IPv4:-
In Mobile IPv4, Agent Advertisement and Discovery help a Mobile Node (MN) detect whether it is in:-
- Home Network or
- Foreign Network

It also helps the MN to:-
- Discover available Foreign Agents (FA)
- Obtain a Care of address (CoA).
- Decide when to register with the Home Agent (HA)

* How it Works:-
- Agent Advertisement:-
  Home Agents and foreign Agents periodically broadcast advertisement.
- Agent solicitation.
  If MN does not recieve advertisement, it sends a solicitation request.

- ICMP router Advertisement (Type 9) (Extended with mobility Agent Advertisement fields)

Shrikrupa

(c) Describe the issue of "Triangle Routing" in basic Mobile IP. How do Route optimization and corresponding Each.

→ * Triangle Routing in Basic Mobile IP:-
Triangle Routing occurs when packets take an indirect path:-
- CN sends packet to MN's Home address
- Hf intercept and tunnels it to MN's care of address (CoA)
- Reply from MN may go directly to CN.

This creates triangular path, causing:-
- Extra delay (Higher latency)
- Increased network load
- Inefficient routing

* How Route Optimization Solves it:-
Route Optimization allows the correspondent Node (CN) to learn the MN's current Care of Address (CoA).

- MN sends Binding Update directly to CN.
- CN stores mapping in a Binding Cache.
- CN sends packet directly to CoF, bypassing HA

Shrikrupa

4(a) Explain the fundamental problem of standard TCP in wireless/mobile environment. Why do packet losses due to handover or bit error cause server performance degradation?

→ * Fundamental Problem of Standard TCP in Wireless/Mobile Environment:-

Standard TCP is designed for wired networks where:-

- Packet loss mainly occur due to network congestion.
- So, TCP assumes: Loss = congestion.

* Problem in Wireless/Mobile Networks:-

In wireless/mobile environements, packet loss occurs due to:-

- Bit errors (signals interference, noise)
- Handover between base stations.
- Temporary disconnections.

But TCP cannot distinguish between:-

- Congestion loss
- Wireless transmission loss

* When packet loss happens:-

1. TCP assumes congestion.
2. It reduce congestion window (cwnd)
3. Transmission rate drops drastically

Shrikrupa

(b) How does Indirect TCP (I-TCP) split the TCP connection? What are the key advantage of this splitting and what is its major critism?

→ * Indirect TCP (I-TCP):-

Indirect TCP improves TCP performance in wireless network by splitting the end to end TCP connection into two seperate connection.

* How I-TCP splits the Connection.

It divide communication into:-

1. Fixed host ↔ Base station (BS)
   - Normal TCP (wired, reliable link)
2. Base station ↔ Mobile Host (MH)
   - Seperate optimized connection (wireless link)

* Advantages:-

- Wireless error handled locally at base station.
- fixed host does not reduce congestion window unnecessarily.

* Faster Recovery.

- Packet ~~loss~~ losses on wireless link retransmitted locally.

Shrikrupa

Page No.
Date / /

⑥ Describe how the SnoopTCP protocol works.

→ Snoop TCP Protocol:-
Snoop TCP improve TCP performance over wireless links without breaking end-to-end TCP semantics.

*How Snoop TCP works:-
It introduce a Snop Agent at the Base station (BS).

Working steps:-
1. Fixed Host sends TCP packet to Mobile Host.
2. Base Station monitor (Snoops) all TCP packets.
3. BS caches (stores) unacknowledged packet.
4. If packet loss occurs on wireless link.
   - BS detects duplicate ACKs
   - BS locally retransmits lost packet.
5. Duplicate ACKs are suppressed from reaching the sender.

This prevents the sender from reducing its congestion window unnecessarily

*Key features:-
- No connection splitting
- Maintains end-to-end TCP reliability
- Local retransmission on wireless errors.

Shrikrupa