Mobile IP Network Layer

Lesson 04

Mobile IP, Packet Delivery and handover Management

Mobile Internet protocol (mobile IP)

- Defined by the Internet Engineering Task Force (IETF)
- Described in the IETF RFC 3344
- A protocol developed to allow inter-network mobility for wireless nodes without them having to change their IP addresses

Requirements for the evolution of the new mobile IP protocol

- Need for Enhancing IP Network capacity—Use of the existing IP protocol by large number of Mobile nodes (MNs) will lead to a decrease in the network

Need for Upgrading capacity of Routers, and Data-link and Physical layers

- IP network protocols support 48-bit MAC addresses
- But when the number of MNs is large, then other interfaces and lower level protocols required
- For mobile nodes to move from one place to another while using the existing IP protocol , new protocols are required at the data-link and physical layers

Security Needs

- The mobility of the called MN must be hidden from the calling MN
- When a new IP address allocates at the new hosting subnet of the existing IP-based infrastructure, the identity of the mobile node is not hidden from another host
- The MN exposes and lacks security when using the existing IP protocol

Need for Non-Transparency from higher layers

- The transport layer establishes a connection between a given port at a given IP address (called socket) with another port at another IP address
- The connection, once established by the transport layers between the sockets, is broken as soon as the new address is assigned

Reestablishment problems due to Non-Transparency from higher layers

(a) Reestablishment of the connection takes time which means loss of data during that interval

(b) Reestablishment process has to share the same network and the given transmission rate

Need of Non-Transparency from higher layers

- Any movement of the MN will be transparent to the TCP and to *L*7 in case the TCP layer re-establishes the connection when the IP protocol used by the MN
- There is, therefore, a need for non-transparency of the MN to distant ports

Examples of Non-Transparency from higher layers

- Assume a distant router is sending data packets for an IP address, presently assigned to a mobile terminal using another router
- When the terminal moves from one service area to another, the routing tables on the route need to be updated
- Till this is done the packets will not reach their new destination

Routing table problems

- The reconfiguration messages for updating the routing tables have to share the same network and the given transmission rate

Reestablishment Problems

- Reestablishment of the connection takes time and this means loss of data during that interval
- Any movement on the part of the MN transparent and, thus, not secure from the distant hosts on the network of distant routers

Working of Mobile IP

- A router has a home agent (HA) for a set of home networked MNs, as well as a foreign agent (FA) for the visiting MNs
- An agent– software employed at a router or the host serviced by a router

Use of HAs and FAs

- The same software can function as both the HA and the FA at different instants of time
- An MN can also have software which functions as an FA instead of the FA at the router

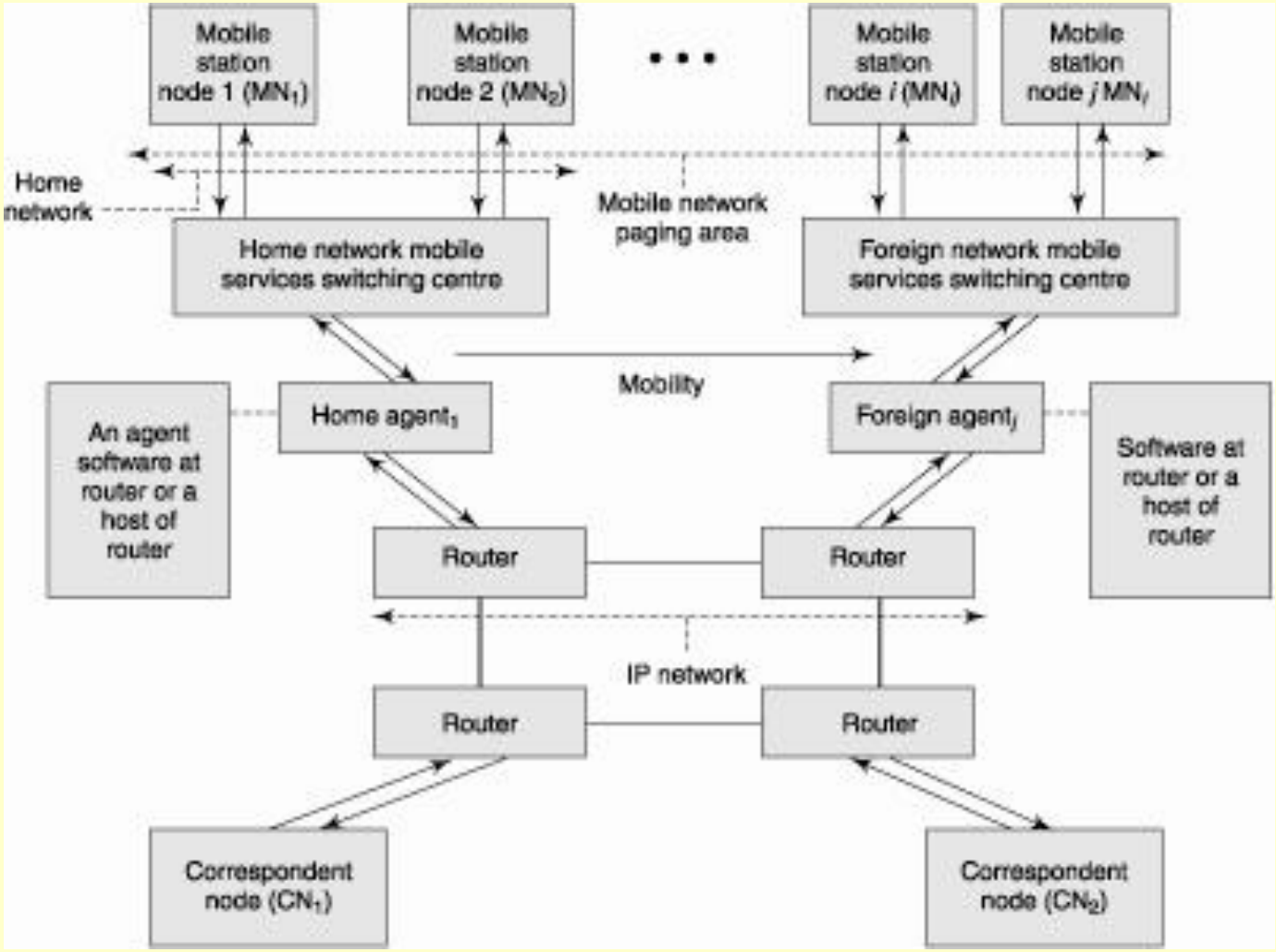
Working of Mobile IP

- The HA and the FA play a location management role similar to that of the HLR and the VLR in a GSM system

Working of Mobile IP

- An MN can access Internet services using the mobile IP protocol
- The MN can change its service router when visiting another location (which is serviced by a different router)

Mobile IP network employing home and foreign agents



Switching Center home agent (HA)

- Provides services to an MN at the registered home network including transmitting and receiving packets from the Internet
- A home agent assigns MNs to routers which support the MNs

Switching Center home agent (HA)

- A home network is a mobile radio subsystems network within an area, called paging area
- The home network is like a subnet
- Just like a subnet has a number of IP hosts, a home network has the MNs

Paging area

- Area in which the MNs of home as well as foreign networks can be approached through a single MSC or a set of MSCs
- Routing of packets through the routers performed when an MN moves within one paging area

Switching centre foreign agent for a foreign network of visiting MNs

- Foreign network– another mobile radio subsystem network which the MNs of home network visit within the paging area
- Foreign agent– a provider of the IP address and services, including transmitting and receiving packets from the Internet, for MNs on visit to a foreign network

Switching centre foreign agent for a foreign network of visiting MNs

- Foreign agent– assigns MNs to a router, which supports the MNs of other home networks

Different paging areas interconnected through gateway routers

- Form a backbone network
- Rerouting of the packets done through the gateway routers when an MN moves from one paging area to another

Packet Delivery and Handover Management

- Correspondent node (CN)– an MN or a fixed IP host linked to a router, which communicates IP packets to another MN in a home or foreign network (when on visit)

Case 1: CN a fixed node and MN_L at the home network

- CN message transmits for connection establishment or a packet using the IP protocol
- HA_l (the home agent for MN_l) receives the message or packet and, using the information that the destined MN_l is at the home network itself, it delivers the message or packet to MN_l

Case 1: CN a fixed node and MN_L at the home network

- Receives the response message or packet from MN_l
- Delivers it to the CN using the IP protocol

Case 1: CN a fixed node and MN_L at the home network

- Receives the response message or packet from MN_l
- Delivers it to the CN using the IP protocol

Case 2: CN an MN_k and MN_L both at home networks with agents HA_k and HA_L

- MN_k message for connection establishment or a packet using the IP protocol transmits through HA_k
- Same way as in case 1
- The packet delivers to HA_l and then to MN_l
- MN_l response like in case 1

Case 2: CN an MN_k and MN_L both at home networks with agents HA_k and HA_L

- HA_k and HA_l deliver the packets from one end to another and vice versa by just forwarding the packets to their respective MNs using the IP protocol

Case 3: CN a fixed node and MN_L is at a foreign network

- CN transmits a message for connection establishment or a packet using the IP protocol
- As in case 1
- HA_l receives the packets and uses the information that the destined mobile node MN_l is not at the home network and is presently visiting a foreign network and is reachable via a foreign agent FA_j

Case 3: CN a fixed node and MN_L is at a foreign network

- HA_l encapsulates the received IP packet using a new header
- Care-of address (COA) at the new header over the IP packet sent by HA_l
- Handover– Packet encapsulated with the new header with COA transmits to FA_j by tunnelling

Case 3: CN a fixed node and MN_L is at a foreign network

- The FA_j reads the COA and decapsulates the IP packet
- Reads the destination IP address and transfers the packet to MN_l

Case 3: CN a fixed node and MN_L is at a foreign network

- When MN_l sends the response message or IP packet with CN as the destination address, FA_j transfers the packet to CN as would have been done by HA_l in case the MN_l is at the home network
- The mobility of MN_l is secured from the CN as any movement on the part of MN_l is known only to HA_l and FA_j

Case 4: CN is MN_K and MN_L at the foreign and home networks with FA_k and HA_s

- The packet delivery process similar to the step in Case 3
- MN_l transmits to CN MN*k* delivers the packet to FA_k
- Here, FA_k is used instead of HA_k as now MN_k is on a visit
- FA_k transfers the message to HA_l like in case 1 where CN transfers the message to HA_l

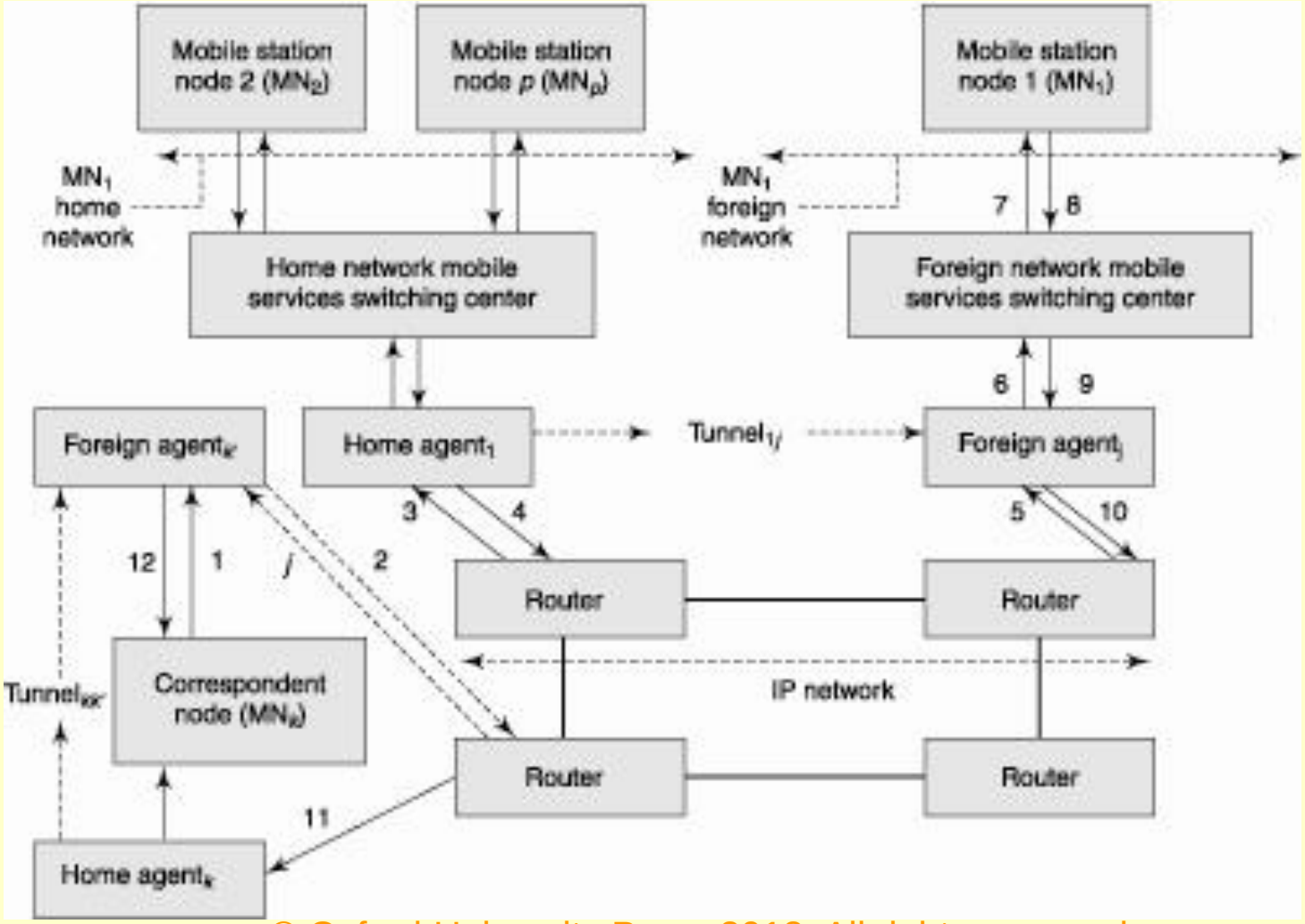
Case 5: CN MN_k and MN_L at foreign networks with agents $FA_{k'}$ and FA_j

- MN_k transmits → $FA_{k'}$
- $FA_{k'} \rightarrow HA_l$
- $HA_l \rightarrow FA_j$
- $FA_j \rightarrow MN_l$
- $HA_l \rightarrow FA_j$ through tunnel T_{lj}

Case 5: CN MN_K and MN_L at foreign networks with agents $FA_{K'}$ and FA_J

- MN_l responds → $FA_{k'}$
- FA_j → HA_k
- HA_k → $FA_{k'}$
- $FA_{k'}$ → MN_k
- HA_k → $FA_{k'}$ through another tunnel $T_{kk'}$

CN MN_K and MN_L at foreign networks with agents FA_K and FA_J



Case 6: CN an MN_K at the home and MN_L at a foreign network with FA_J

- Case just opposite to the case 4
- MN_k transmits to the CN
- FA_j delivers the packet to MN_l
- FA_j is used instead of HA_l as now MN_l is on a visit
- FA_j transfers the message to HA_l

Summary

- Need for mobile IP because of need to address large number of MNs
- Capacity up gradation need at data and physical layers
- Security
- Non transparency
- Mobile IP protocol uses home and foreign agents

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Summary

- CN transmits to corresponding home agent of destination mobile node
- Handover– Home agent encapsulates header with care of address
- Tunnelling of the message to foreign agent if source or destination is at foreign network

End of Lesson 04

Mobile IP, Packet Delivery and handover Management