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DATA COMMUNICATION NETWORK.

1. GSM system Architecture:

* GSM is the most successful digital mobile telecommunication system in the world today. A GSM system that has been introduced in several European countries for railroad systems is GSM-Rail. This system does not only use seperate frequencies but offer many additional service which are unavilable using in the public GSM systems.

SYSTEM ARCHITECTURE:

* As with all systems in the telecommun area, GSM comes with a hierarical, complex syst architecture comprising many entities, interfaces and acronyms.

* Generally, a GSM customer only notices a very small fraction of the whole network - the mobile stations [MS] and some antenna masts of the base transceiver stations [BTS].

1. RADIO SUBSYSTEM:

As the name implies, the radio subsystem (RSS) comprises all radio specific entities ie., the mobile station (MS) and the base station subsystem (BSS). The connection between the RSS and the NSS via the A interface [solid lines) and the connection to the OS via the O interface [dashed lines].

1. Base station subsystems [BSS]
2. Base transceiver station [BTS]
3. Base station controller [BSC].

2. NETWORK AND SWITCHING SUBSYSTEM:

* The "heart" of the GSM system is

formed by the network and switching sub-system [NSS]. The NSS connects the wireless network with standard public networks, performs handovers between different BSSs, comprises functions for worldwide localization.

1. Mobile services switching center [MSC]
2. Home location register [HLR]
3. Visitor location register [VLR]

OPERATION SUBSYSTEM:

* The third part of a GSM system, the operation subsystem [OSS], contains the necessary functions for network operation and maintenance. The OSS possesses network entities of its own & access other entities, via SS7 signaling.

1. Operation and Maintenance Center. [OM

2. Authentication centre [AuC]

3. Equipment identity Register [EIR]

1. Operation And Maintenance center [OMC]:

* The OMC monitors and controls all other network entities via O interface. Typical OMC management functions are traffic monitoring. It use the concept of telecommunication management network [TMN].

2. Authentication Centre [AuC]:

* As the radio interface & mobile stations are particulary vulnerable, a seperate AuC, has been defined to protect user identity.

3. Equipment Identity Register [EIR]:

* It stores all device identifications registered for this network. It also contains a list of valid IMEIs and a list of malfunctioning devices.

2. Handover :

* Cellular system require handover procedure as a single cells do not cover the whole service area, but eg.., only upto 35km around each antenna on the countryside and some hundred meters in cities.

* The smaller the cell size and the faster the movement of a mobile station through the cells.

⇒ There are two basic reasons for a handover.

* The mobile station moves out of the range of a BTS (or) a certain antenna of a BTS respectively. The received single level decreases continuously.

* The wired infrastructure may decide th the traffic in one cell is too high & shift so ms to other cells with a lower load.

Four Possible Handover Scenarios In GSM:

* Intra-cell handover, * Inter-cell, intra-BSC handover, * Inter-BSC, Intra-MSC handover
* Inter MSC handover.

1. Intra-cell handover: Within a cell, narrow-band interference could make transmission at a certain frequency impossible.

2. Inter-cell, intra BSC handover: This is a typical handover scenario. The mobile station moves from one cell to another.

3. Inter-BSC, intra-MSC handover: As a BSC only controls a limited number of cells GSM also has to perform handovers between cells controlled by different BSCs.

4. Inter-MSC handover: A handover could be required b/w two cells belonging to different MSCs. Now both MSCs, perform the handover together.

8. REQUIREMENTS OF MOBILE IP:

* Many field trails and proprietary systems finally led to mobile IP as a standard to enable mobility in the internet.

* Several Requirements accompanied the development of the standard:

1. Compatibility:

* The installed base of internet computers i.e., computers running TCP/IP and connected to the internet is huge.

* A new standard cannot introduce changes for applications (or) network protocols already in use.

* Mobile IP has to be integration into existing operating systems.

2. Transparency:

* Mobility should remain "invisible" for many

higher layer protocols and applications. Besides it maybe noticing a lower bandwidth and some interruption in service, higher layer should continue to work even if the mobile computer has changed its point.

3. Scalability and Efficiency:

* Enhancing IP for mobility must not generate too many new messages flooding the whole network. Special care has to be taken considering the lower bandwidth of wireless links.

4. Security:

* Mobility poses may security problems. The minimum requirement is that of all the message related to the management mobile IP are authenticated.

* The IP layer must be sure that if it forwards a packet to a mobile host that this host receives the packet.

4. ENTITIES OF MOBILE IP :

* The following defines several entities and terms needed to understand mobile IP as defined in RFC 3344.

Mobile node [MN]:

* A mobile node is an end-system (or) router that can change its point of attachment to the internet using mobile IP.

Correspondent node [CN]:

* Atleast one partner is needed for communication. CN represents this partner of the MN.

Home network : The home network is the subnet, the MN belongs to with respect to its IP address. No mobile IP support is needed within the home network.

Foregin network: The foregin network is the current subnet the MN visits and which is not the home network.

Foregin Agent: The FA can provide several services to the MN during its visit to the foregin network. The FA can have the CoA acting as tunnel endpoint and forwarding packets to the MN.

Care of Address [CoA]: The CoA defines the current location of the MN from an IP point of view. All IP packets sent to the MN are delivered to the CoA, not directly to the IP address of the MN.

2 different possibilites of location CoA:

1. Foregin agent CoA
2. Co-located CoA

Home Agent [HA]:

The HA provides several services for the MN and its located in the home network. The Tunnel for packets towards the MN starts at the HA.

* The HA maintains a location registry i.e., it is informed to the MN's location by the current CoA.

TUNNELING AND ENCAPSULATION:

* A tunnel establishes a virtual pipe for data packets between a tunnel entry and a tunnel endpoint.

* Packets entering a tunnel are forwarded inside the tunnel and leave the tunnel unchanged.

* Tunneling i.e., sending a packet through a tunnel, is achied by using encapsulation.

ENCAPSULATION:

* Encapsulation is the mechanism of taking a packet consisting of packet header and data and putting it into the data part of a new packet. The reverse operation, taking a packet out of the data part of another packet, is called as decapsulation.

* Encapsulation and decapsulation are the operations typically performed when a packet is transferred from a higher protocol layer to a lower layer (or) from a lower to a higher layer respectively.

5. Basic purpose of DHCP:

* The dynamic host configuration protocol (DHCP) is mainly used to simplify the installation and maintenance of network computers.

* DHCP is based on a client / server model. DHCP clients send a request to a server to which the server responds. [DCHP DISCOVER].

AGENT DISCOVERY:

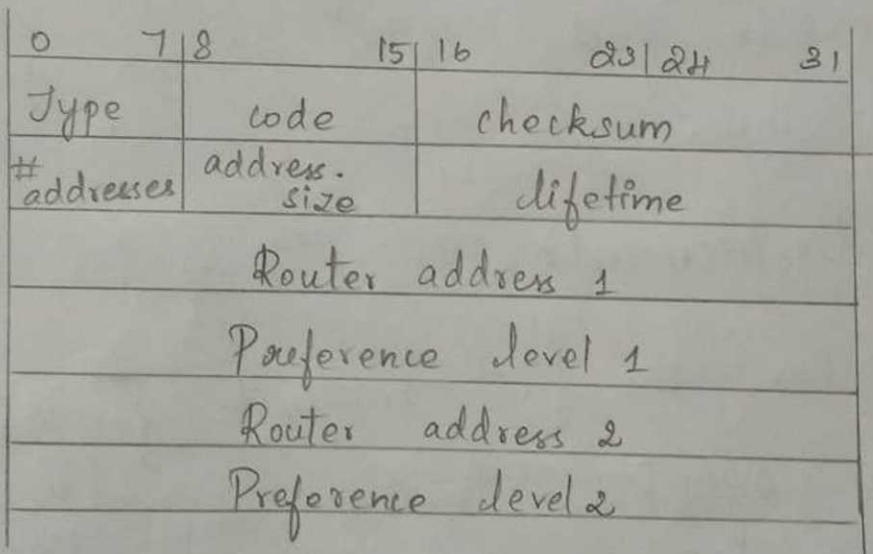
* One initial problem of an MN after moving is how to find a foregin agent. For this purpose mobile IP describes two methods agent advertisement and agent solicitation, which are in fact router discovery methods plus extensions.

Agent advertisement:

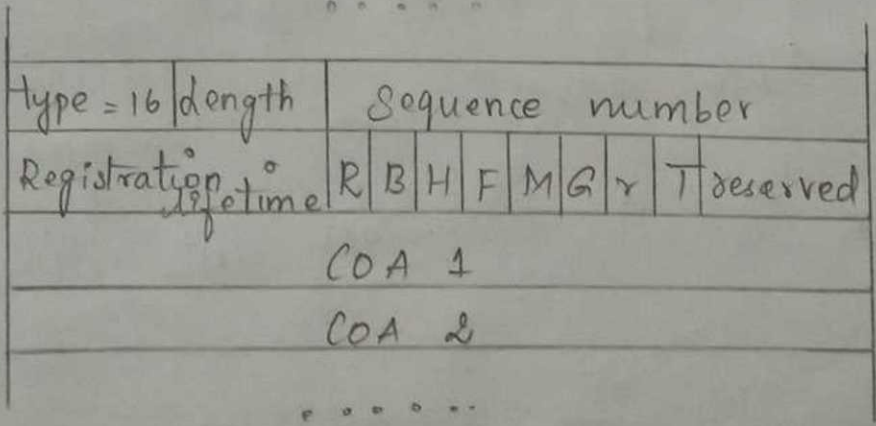
* For the first method, foreign agents and home agents advertise their presence periodically using speial agent advertisement messages. These advertisement messages can be seen as a beacon broadcast into the subnet.

* The agent advertisement packet according to RFC 1256 with the extension for mobility. The upper part represents the ICMP packet while the lower part is the extension needed for mobility.

* The feilds necessary on lower layers for the agent advertisement are not shown. Clea mobile nodes must be reached with the appropiate link layer address.



Agent advertisemen packet [RFC] mobility extensic



AGENT SOLICITATION:

* If no agent advertisement are present (or) the inter-arrival time is too high, and an MN has not received a COA by other means eg.., DHCP as discussed in section 8.2, the mobile node must send agent solicitations.

* These solicitations are again based on RFC 1256 for router solicitations.

* If node does not receive an answer to its solicitations it must decrease the rate of solicitations exponentially to avoid flooding the network until it reaches a maximum interval between solicitations.

* The case that the MN is looking for a better connection while still sending via the old path. This is the case while moving through several cells of different network.