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GHARDA INSTITUTE OF TECHNOLOGY

Experiment No. Date :

# Assignment No. - 2

Q.1 Draw a neat diagram of GSM system Architecture.

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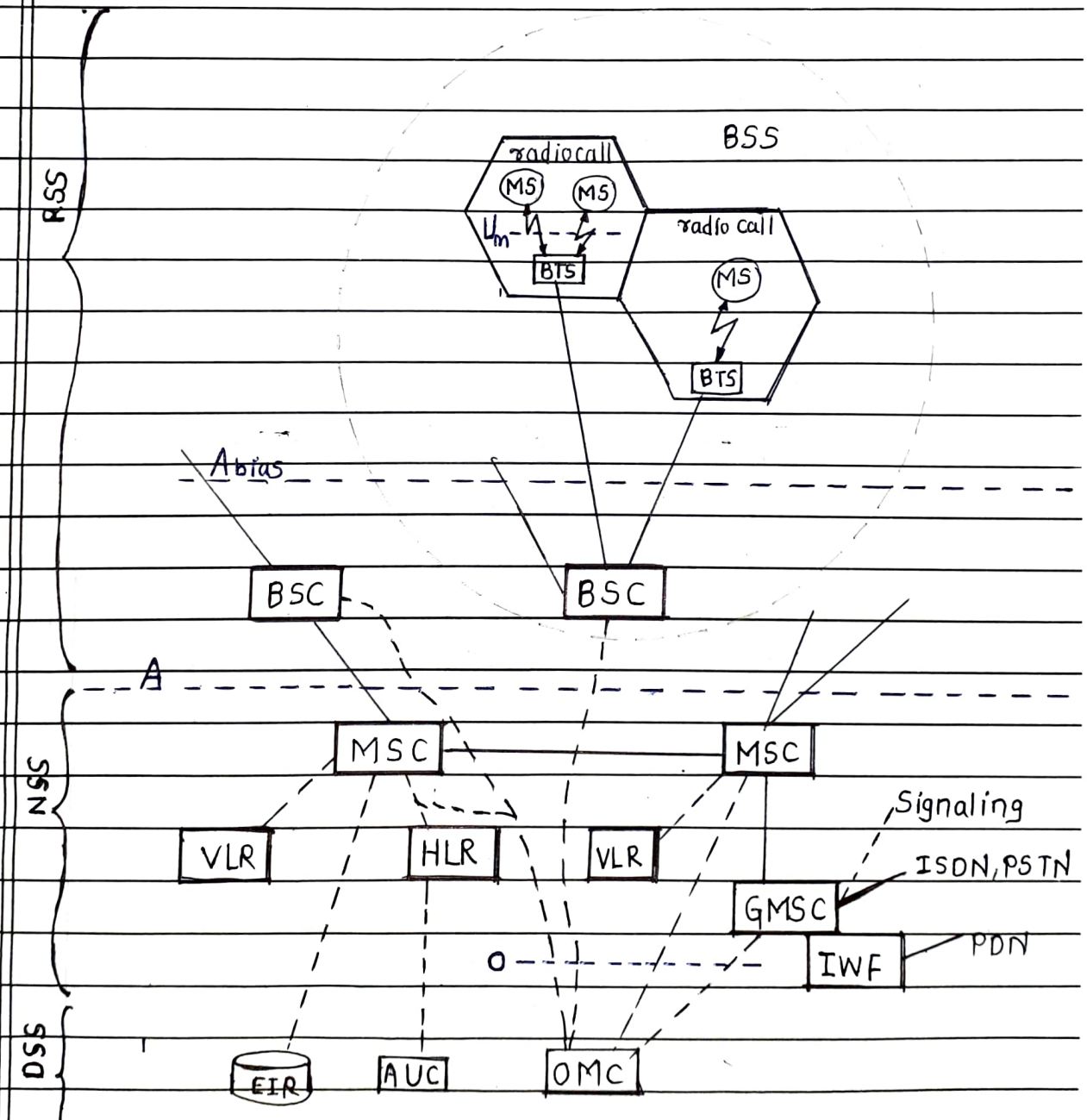



GSM. System Architecture.

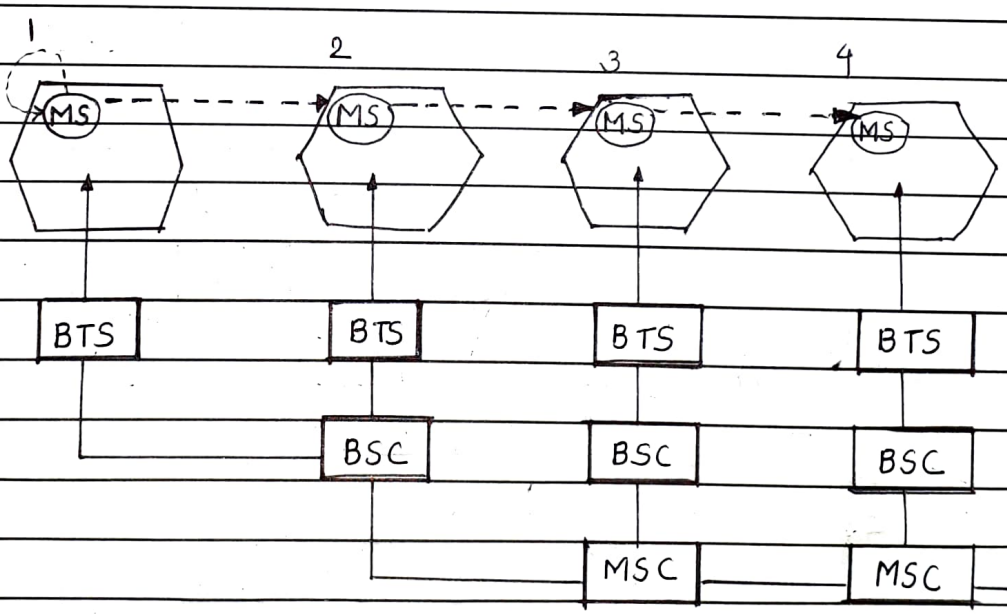
Page No:

Q.2 → Explain various types of handoffs in GSM networks.

When a mobile user is engaged in conversation the MS is connected to the BTS via radio link. If the mobile user moves to the coverage area of another BTS, the radio link to the old BTS is eventually disconnected & a radio link to the new BTS is established to continue the conversation. This process is called handover or handoff.

- The number of handovers to be performed depends on two factors.

1. Cell size :- The smaller is the size of cell more the handovers required.
2. Speed of MS :- Higher the speed of MS more handovers are required.




1) Intra-cell handover :- This handover or handoff takes place within cell. This is performed in order to optimize the traffic load in the cell or to improve the quality of the connection by changing the

carrier frequency.

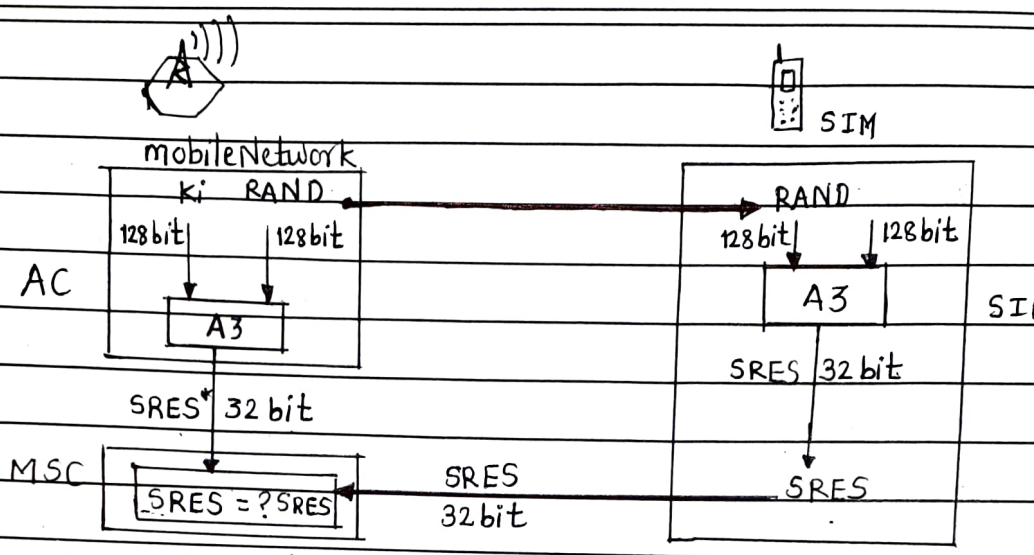
2) Inter-cell, intra-BSC handover / handoff :-
This handover occurs when a mobile station moves from one cell to another cell but stays within the control of same BSC. The BSC then performs the handover, it assigns a new radio channel in new cell & release old one.

3) Inter-BSC, Intra-MSC handover :- This handover takes place between two cells managed by different BSCs. This handover is controlled by MSC.

4) Inter MSC handover :-
Inter MSC handover takes place between two cells belonging to different MSCs. Both MSCs perform the handover together.

Q.3 Write a short note on privacy and authentication in GSM.

→
- Before accessing any GSM service the user must be authenticated.
- Authentication is done & based on SIM that stores the individual authentication key Ki, the user identification IMSI and the algorithm A3.
- Authentication process uses challenge-response method.




Ki : Individual subscriber authentication key.

SRES : signed response

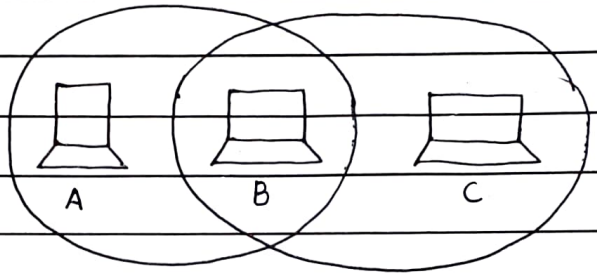
fig : Authentication in GSM

* Steps involved in authentication process.

1. The process control (AC) generates a 128 bit random number RAND as challenge.
2. VLR sends this 128 bit random number (RAND) to the MS.
3. The MS computes the 32 bit signed response (SRES) based on the random number (RAND) with the authentication algorithm (A3) using the individual subscriber authentication key (Ki).
4. MS sends this SRES to the MSC.
5. Similarly, access control also calculates the signed response called SRES.
6. Now, MSC compares the value of signed response received by AC & MS. If the values are same then the subscriber is accepted, otherwise subscriber is rejected.

Q.4 Explain in short how hidden station problem is avoided in WLAN.

→ Hidden nodes in a wireless network are nodes that are out of range of other nodes or a collection of nodes.




The hidden terminology is described as follows :-

- Terminal A sends the data to B, terminal C cannot hear A.
- Terminal C wants to send data to B, terminal C senses a "free" medium (CS fails) & start transmitting.
- Collision at B occurs, A cannot detect this collision (CD fails) & continues with its transmission to B.
- Terminal A is "hidden" from C & vice versa.

The methods that can be employed to solve/avoid hidden node problem are :-

1. Increasing Transmitting power from the nodes :- It can solve the hidden node problem by allowing the cell around each node to increase in size, encompassing all of the other nodes.
2. Omnidirectional antennas :- Since nodes using directional antennas are nearly invisible to nodes that are not positioned in the direction the antenna is aimed at, directional antennas should be used only for very small

networks. (eg. dedicated point-to-point connections).

Q.5 Explain IP Packet delivery with respect to mobile IP.

→ a) Data transfer from Fixed CN to MN :-

1. When CN to MN packet transfering, the CN doesn't know about the MN's current location & sends the packet to the IP address of MN.
2. The packet is routed via the standard routing mechanism of the Internet to the router responsible for MN's home network.
3. The HA detects that the MN is currently not in its home network. Instead of forwarding the packet into the subnet as usual, the packet is encapsulated & its tunneled to the COA of the MN.
4. FA now decapsulates the packet & forwards the original packet with CN as source & MN as destination.

b) Data tranfer from MN to fixed CN :-

1. The packet is sent by the MN with its original IP address as the sender & the CN's IP address as the receiver.
2. The FA responsible for the foreign network acts as a default router & forwards the packet to the router responsible for the CN
3. The router responsible for CN then forwards the packet to CN.

c) Data Transfer from Mobile CN to the MN :-

1. The CN sends the packet with its original IP address as the source address & MN's original IP address as the destination address.
2. since the CN is also in the visiting network, the FA responsible for the CN sends the packet to the server router responsible for the home network of MN.
3. The HA of MN realizes that the MN is not in the home network.
4. The foreign agent (FA) of the MN receives this packet decapsulates it & forwards it to the MN.

d) Data Transfer from MN to a mobile CN

1. The MN sends the packet as usual with its own fixed IP address as a source address & CN's address as destination
2. The foreign agent (FA) router responsible for MN sends this packet to the home network of the CN.
3. The HA responsible for CN receives the packet & realizes that the CN is not in the home network
4. The FA responsible for CN receives the packet, decapsulates it & forwards it to the CN.

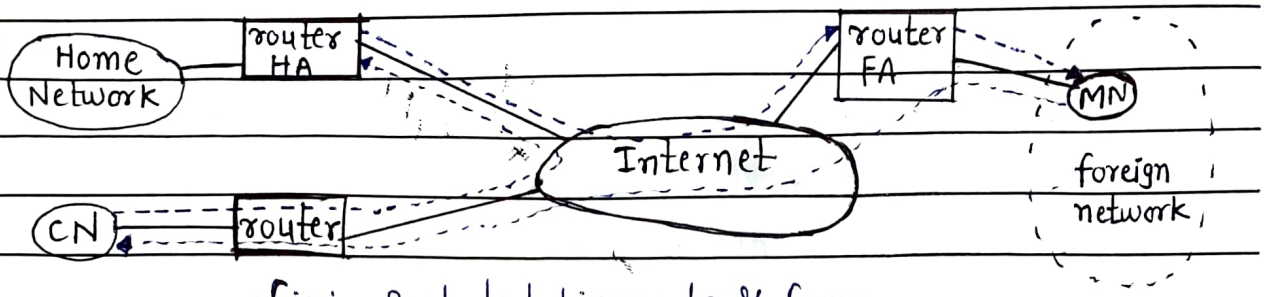



fig: Packet delivery to & from the Mobile Node.

Q.6 With respect to Bluetooth protocol explain piconet & scatternet.

→ Bluetoth Protocol Stack :-

It defines protocol stack defines the software layer that are used for communication on the top of the radio link
The top layer is the application layer.
The middle layer comprises of the industry standard protocols
The lower layer consists the bluetoth specific components
The Bluetooth network can support speech & data channels.

Piconet :-

It is a short range, low cost & power efficient radio technology that support point to point & point-to multipoint connections.
It connects handheld devices like printers, laptops, mobile phones & other accessories in the 10m radious.

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- The bluetooth enabled devices like printers can locate each other, but user action is essential in order to make connections with other devices & from networks.
- Upto eight devices can be connected in a Bluetooth network called PICONET.

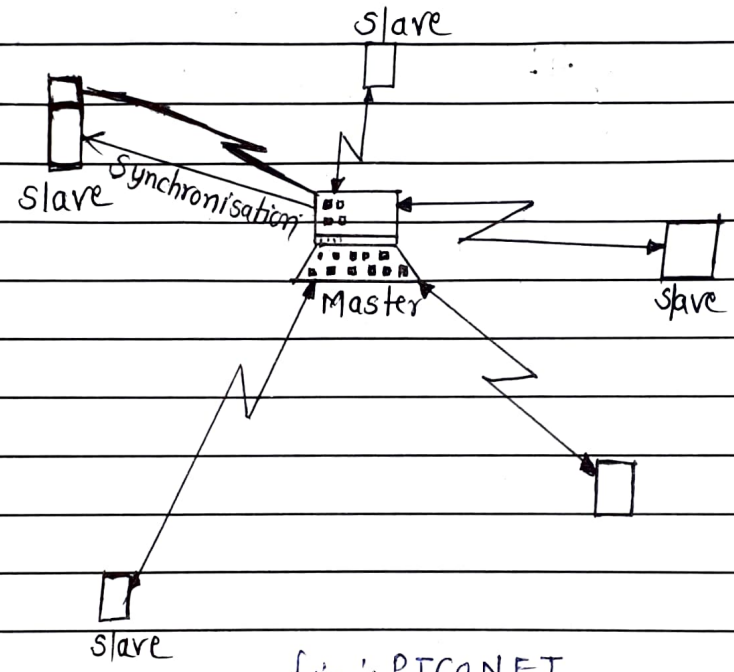


fig : PICONET.

ScatterNet :-

A scatter-net is formed when two or more piconets connect through a bridge node.
In addition to seven active slaves, there can be up to 255 parked nodes in that can only respond to a becon signal from the master.
The slaves are dumb devices that do the task that the master tells them to do.

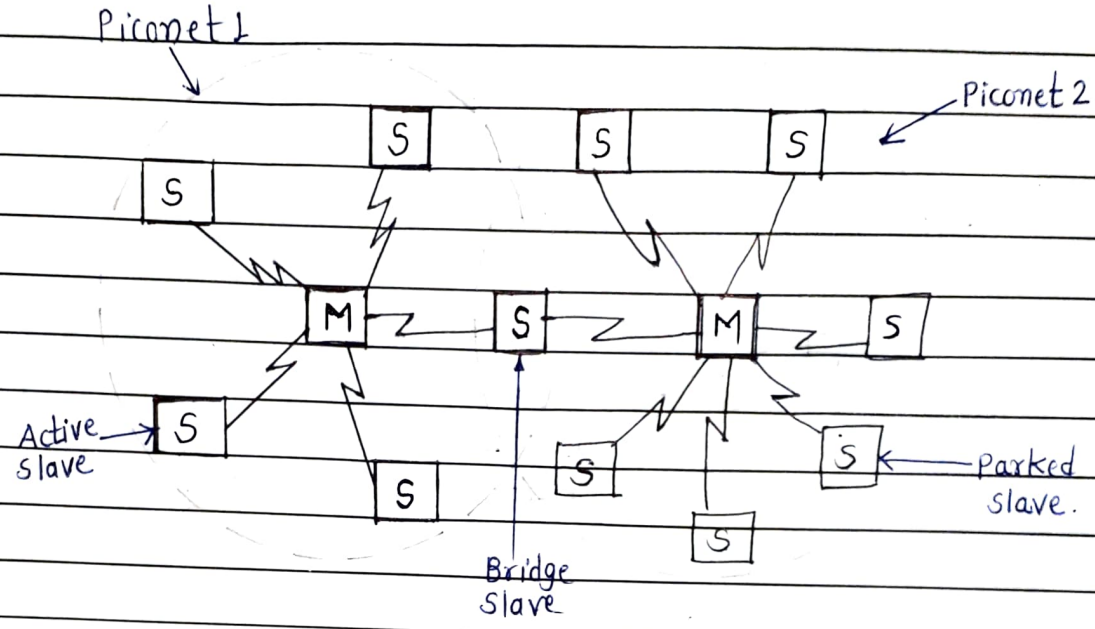


fig: Scatternet

Q.7 What is need of Micro Mobility ? Explain HAWAII in detail.

→ Micromobility is a powerful optim to tackle greenhouse gas emissions, & increase access to transportation. E-bikes or e-scooters are cost-effective to produce, run & operate compared to other means of transport. They are also more fuel-efficient & use clean energy without depending on fossil fuels.

HAWAII :-

HAWAII (Handoff Aware Wireless Access Internet Infrastructure) tries to keep micro-mobility support as transparent as possible, for both home agent & MN.

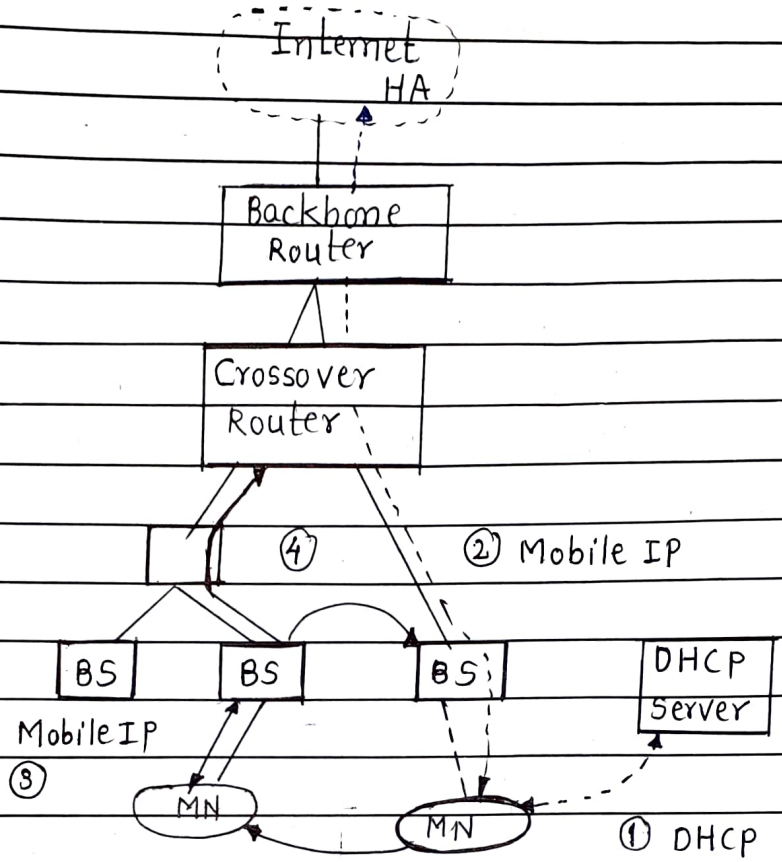


fig : Basic architecture of HAWAII

Working :-

step 1 :- On entering an HAWAII domain, a mobile node obtains a co-located CoA.

step 2 :- MN registers with the HA.

step 3 :- When MN moving another cell inside the foreign domain, the MN sends a registration request to the new base station as to a foreign agent.

step 4 :- The base station interprets the registration request and sends out a handoff update message, which reconfigures all routers on the paths from the

old & new base station to the crossover router.

Q.8 What do you mean by Self Organizing Network? Explain it in detail.

→ - SON stands for Self Organizing Network.
- It means that add an eNB wherever you want to put & just connect power & switch on, it would configure all of its configuration by itself. & makes itself ready for service.
- 'SON' is like a 'Plug-&-Play' functionality.

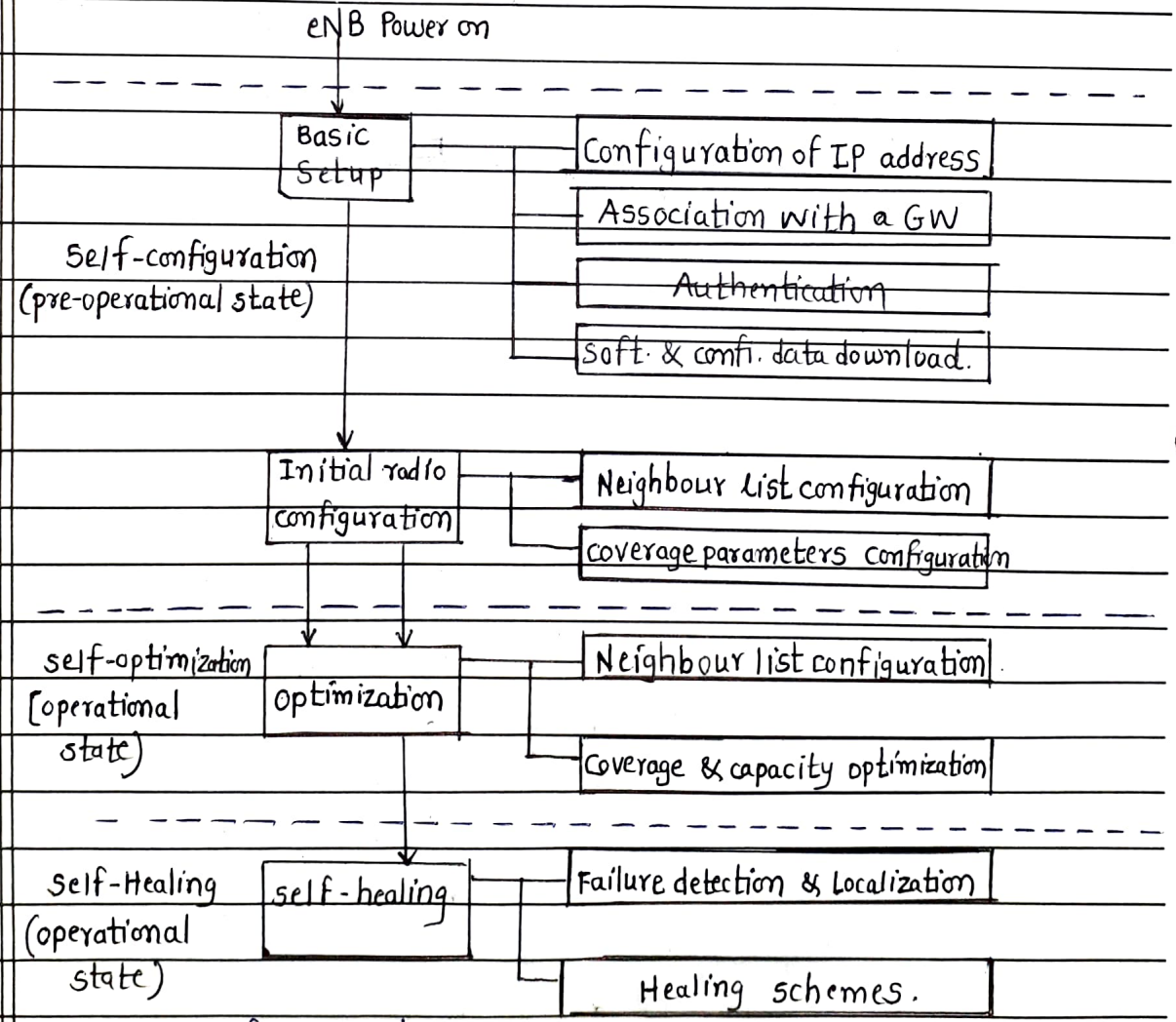


fig: SON Framework.

## SON Architecture :-

- Self-organizing functionality can be located at one place even split in different nodes.
- Self-optimizing algorithms can be located in OAM or eNB or both of them.
- SON can be divided into the three main architectures :-
1) Centralized SON
2) Distributed SON
3) Hybrid SON

### 1) Centralized SON :-

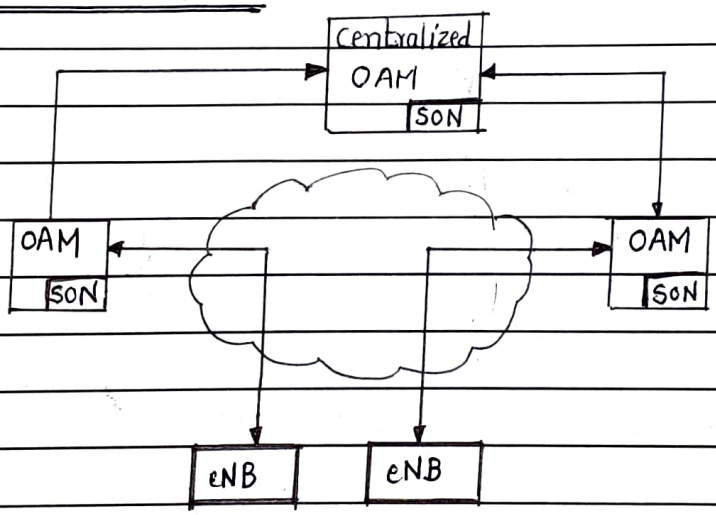


Fig : Centralized SON.

- In centralized SON, optimization algorithms are stored & executed from OAM system. Here, the SON functionality resides in a small number of locations, at a high level in the architecture.
- To impliment Centralized SON, existing Northbound interface (Itf-N), which is the interface between the Element

Manager & the network manager, needs to be extended.

## 2. Distributed SON :-

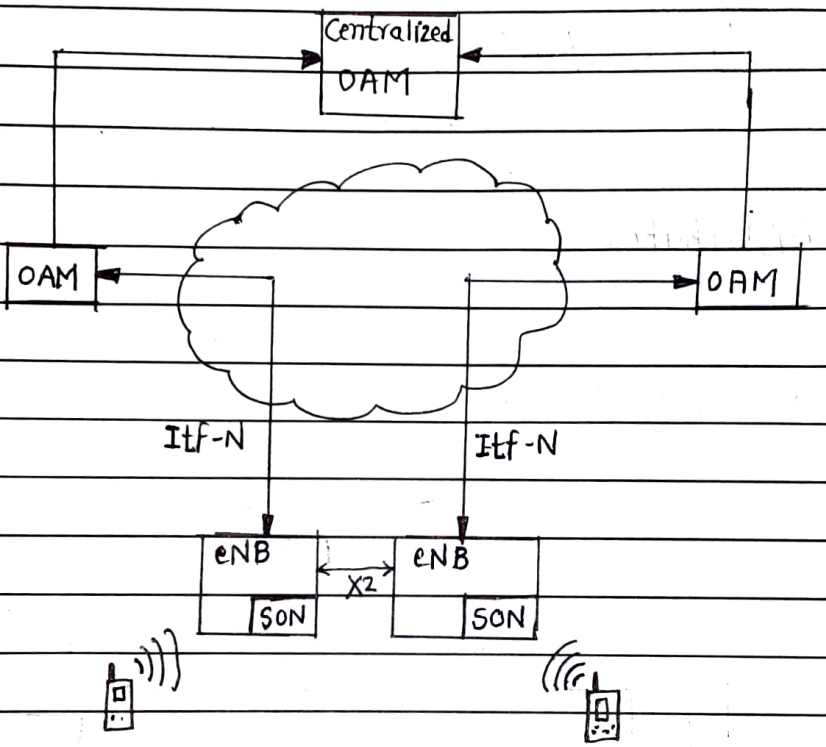


fig : Distributed SON

- In distributed SON, optimization algorithms are executed in eNBi. SON functionality resides in many locations at a relatively low level in the architecture.
- This increases the deployment efforts.
- fig. above shows an example of distributed SON. When this architecture is implimented in large number of nodes it has to be ensured that there is a coordination between them so that the network as a whole is optimised.

## 3) Hybrid SON :-

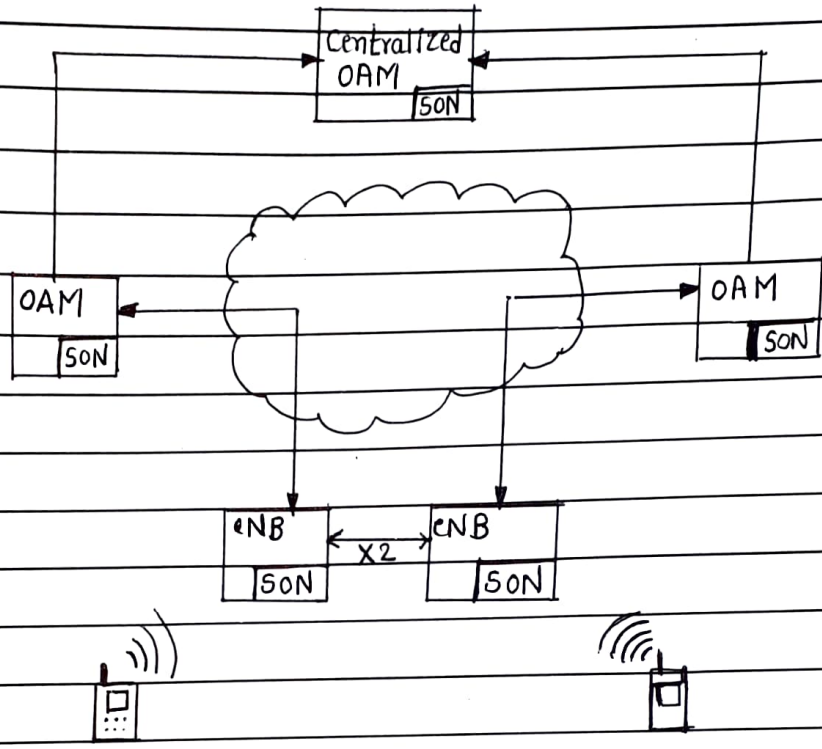


fig : Hybrid SON

- In hybrid SON, part of the optimization algorithms are executed in the OAM system, while others are executed in eNB
- The above fig. shows an example of Hybrid SON.
- In Hybrid SON, simple & quick optimization scheme are implimented in eNB & complex optimization schemes, are implimented in OAM so as to provide flexibility to support different kinds of optimization cases.