Core

Project report submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

by

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UNDER THE GUIDANCE OF

Dr. Sunil Datt Sharma

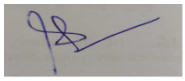
JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

May 2020

Date:_____

CERTIFICATE

This is to certify that the project titled **CORE** is a record of the bonafide work done by **HarshitaRana**(161077) submitted in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology (B.Tech) in **Electronics and Communication Engineering** of JAYPEE UNIVERSITY OF INFORMATION AND TECHNOLOGY during the academic year 2019-20.



Dr. Sunil Datt Sharma
Project Guide,
Electronics and Communication
JUIT

Date: _____

CERTIFICATE

This is to certify that the project entitled **CORE** was carried out by **HarshitaRana (**161077) at **Ericsson India Global Services Pvt Ltd, Noida** under my guidance during **February, 2020** to **August, 2020**.

Mrs. PrachiVarshney
Project manager
Srf team(sdubharti)
Ericsson India Global
Services Pvt Ltd, Noida

ACKNOWLEDGMENTS

This project report bears the imprint of many people who shared with me their scholarly and practical expertise. It is difficult to mention the names of all individually, but they do have my continuing gratitudeFirst and foremost, I thank the Almighty who is at the helm of everything and at whose command dances the successes and failures of life.

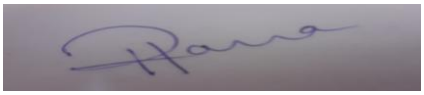
Next, I would like to offer my sincere thanks to Ericsson India Global Services Private Limited team for giving me the opportunity to pursue my final semester training with them.

I would also like to express my deep sense of gratitude and reverence for my respected HOD, Dr M. J Nigam and my internal mentor Dr. Sunil Dutt Sharma to whom I am indebted to for allowing me to carry out my final semester training at Ericsson Global and helping me in every way possible for the successful completion of the project. I express my deepest thanks to both of them for taking part in a useful decision making process related to my project and for providing valuable suggestions and giving necessary advice and guidance.
I would like to offer a special thanks to Mr. Peeyush Gupta (Project Coordinator) for his constant support and help in the completion of this project.

I am additionally utilizing this chance to offer my most profound thanks and uncommon gratitude to Mr. Salil and Sanjay Kumar Shahi, who notwithstanding being uncommonly occupied with his obligations, invested significant energy to hear, guideand keep me on the right way and permitted me to do my undertaking under his direction.

My heartfelt gratitude goes to Mr. Ramesh,Mrs.Swatigupta, for their cooperation and willingness to share their immeasurable knowledge in the field of my project as well as answering all my queries and providing valuable assistance. Also, I am extremely grateful to Mr. Subham Kumar Pandey and the entire HR and Talent Management Team at Ericsson Global for providing invaluable support throughout the training period and helping me adapt to the corporate culture with much ease.

Last yet not the least, I see this open door as a major achievement in my vocation advancement. I plan to use all the procured abilities and information learnt through this venture in the most ideal manner, and would like to keep on chipping away at their improvement so as to accomplish my ideal vocation targets.



HarshitaRana(161077)

ABSTRACT

Ericsson is one among the main suppliers of Information and Communication Technology (ICT) to specialist co-ops. It empowers the total estimation of availability by making game-changing innovation and administrations that are anything but difficult to utilize, receive, and scale, making our clients fruitful during a completely associated world.

During the 1st month, I got an overview of the telecom basics including GSM, 3G, 4G model architectures, various call flows (prepaid/postpaid/data call), types of protocols (like SIP, SS7, Diameter) and important nodes (like Visitor Location Register, Home Location Register, MSC, BSC, RNC, NodeB, etc). After this, I was assigned a few projects with the SDU bhart Team in the packet Core domain.

The tools used in this project were Citrix . These tools enabled me to login to different nodes and manage any type of fault in the system. Alarm Monitoring was a very important part of the task which was done by the help of these tools using suitable commands.

Through this project, I have gained knowledge in the field of core in telecommunications. I have also added future scope which is going to be introduced in the coming years, thus expanding the business of Ericsson.

CONTENTS

CHAPTER 1
INTRODUCTION

1.1 Ericsson: A Brief History

Framework in innovation and data for media communications administrators, conventional broadcast Internet Protocol (IP) and communications organizing gear, portable broadband, tasks and business bolster administrations, satellite TV, IPTV, video frameworks, and a broad administrations activity.

Ericsson had a 27% part of the overall industry inside the 2G,3G,4G and 5G portable system framework advertise in 2018.

Lars Magnus Ericsson established the organization in 1876 and begin at 2016 it's headquartered in Stockholm which is located in Sweden. There are a sum of 95,000 individuals utilized at Ericsson and it works in around 180 nations. Additionally, as of September 2019, the organization holds more than 49,000 allowed licenses incorporating various of those in remote interchanges and the organization likewise invests heavily in being the creator of Bluetooth innovation.

Everything started in Lars Magnus' youth when his relationship with telephones began as a maker of instruments.

He does his job for firm that make message gear to the Swedish association Telegrafverket. At age 30 (1876), he begins a message auto shop through buddy Carl Johan Andersson's guide in centre Stockholm wherein he fixed remote made telephones. Around two years after the fact in 1878, he started making and selling his own phone gear. In spite of the fact that his phones were not in fact imaginative, an understanding was made by him so as to give phones and switchboards to the organization 'StockholmsAllmännaTelefonaktiebolag'. Additionally in 1878, neighborhood phone merchant Numa Peterson employed Ericsson to direct a few phones from the Telephone Company which is Bell. He purchased an assortment of Siemens phones and dissected the innovation. He was well aware with Bell and Siemens Halske

phones through his company's fix work for Telegrafverket and Swedish State Railways. He improved these structures to gracefully a greater instrument to be utilized by new phone organizations like Rikstelefon to flexibly less expensive assistance than the Bell Group. As Bell had not protected their creations in Scandinavia, Ericsson didn't confront any patent or eminence issues. His readiness as an instrument maker was shown with the heavenly standard of finish and the lavish arrangement of Ericsson telephones of this period. Later in the year, he began to make telephones in a general sense equivalent to those of Siemens.

his first item was done in 1879. Ericsson turned into an essential provider of phone hardware to Scandinavia. Nonetheless, its processing plant couldn't proceed with request and thus, joinery and metal-plating were contracted out. A ton of its rough materials were imported, and in the following decades, Ericsson became tied up with an assortment of firms to ensure that the provisions of metal, wire, ebonite, and magnet steel were all together. A significant part of the pecan wood utilized for cupboards were ship in from the United States. Stockholm's phone arrange extended that year and in this way the organization improved into a phone producer. At the point when Bell purchased the most significant phone arrange in Stockholm, it just permitted its own phones to be utilized with it. Ericsson's hardware was sold basically to free phone relationship inside the Swedish open country and in other Nordic nations.

The costs of Bell hardware and administrations drove Henrik Tore Cedergren to make an autonomous telephone utility called StockholmsAllmännaTelefonaktiebolag in 1883. As Bell wouldn't convey gear to contenders, he shaped an agreement with Ericsson to give the hardware to his new phone organize. In 1918, the organizations were converged into AllmännaTelefonaktiebolaget LM Ericsson.

In 1884, a plan by C. E. Scribner at Western Electric established the framework of a numerous switchboard manual phone trade. This was legitimate in light of the fact that the gadget wasn't licensed in Sweden, in spite of the fact that inside the US, it had held patent 529421 since 1879. The next year, LM Ericsson and Cedergren visited the US, visiting a few phone trade stations to gather "motivation". They found that the U.S. switchboard plans were further developed however Ericsson phones were identical to other people.

A specialist by the name of Anton Avén at StockholmsAllmännaTelefonaktiebolag in the year 1884 consolidated the earpiece and the mouthpiece of a commonplace phone into a handset. It was utilized by administrators in the trades where administrators expected to have one hand free when addressing the clients. It was this general concept that Ericsson fused into Ericsson's items and everything started with a phone named 'The Dachshund'.

1.2 Vision

“Our purpose is to empower an intelligent, sustainable and connected world. For more than a century, we have been putting smart tools in the hands of people in every sector of our society, creating intelligent technologies that drive positive change. We remain committed to this effort, leaving no one behind.”[1]

1.3 Brand Values

TRUST: We are the devoted accomplice and a power for good in the public eye.

INNOVATION: We transform bits of knowledge without hesitation to propel enterprises and society. Any Technology super-brand must be energized by constant advancement and development.

PERFORMANCE: We excel with the best people and technology. Superior Performance has always been at the core of our brand.

1.4 Core Values

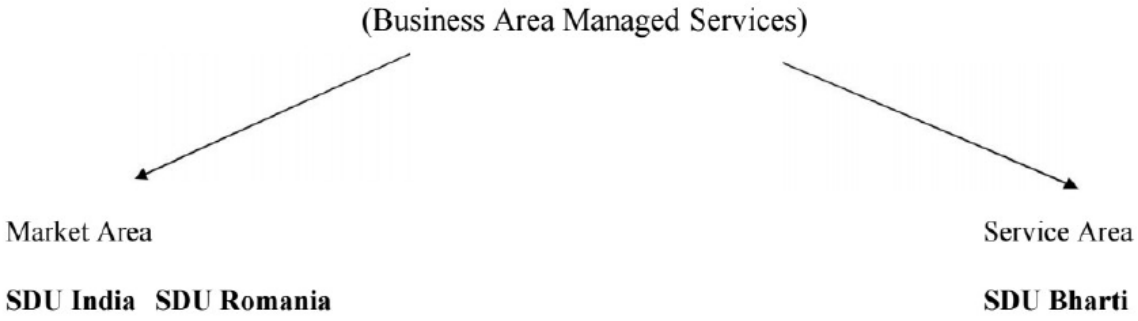
RESPECT: We must treat people with respect and value diversity. We must recognize the value of property and the environment.

PERSEVERANCE: We should always put in the extra effort even when things seem hard, troublesome or even impossible.

PROFESSIONALISM: We must act professionally and set high standards. We should take responsibility for the impact of our own actions and always give our best to the team.

1.5 Organization Structure

Ericsson India Global Services Private Limited



1.5.1 SDU India

I am a part of SDU Operate India (Core and VAS Domain) which is headed by KishanDutt. It mainly manages the overseas networks like Liberty Global (LG), Virgin Media (UK), Telestra (Australia), Vietnam Mobile (Vietnam), MTN (Afghanistan), Telenor (Myanmar), etc. SDU India consists of three domains:

- Core and VAS
- IP and Transmission
- OSS

Core and VAS domain supports the core functionality of the network. The core elements consists of MSC(Mobile Switching Center),VLR (Visitor Location Register),
HLR (Home Location Register),
AUC (Authentication Center), EIR (Equipment Identity Register), GMSC (Gateway MSC), SMSC (Short Message Service Center), SGSN (Serving GPRS Support Node), GGSN (Gateway GPRS Support Node), etc. It has further five sub-domains:

- Circuit-Switched Core (CS Core)
- Packet-Switched Core (PS Core)
- Value Added Services (VAS)
- TV & Multimedia
- SOC

1.5.2 Bharti

It mainly manages the network of Bharti Airtel all over India. Bharti Airtel SDUGSM services in all the 22 telecom circles of India. Ericsson manages 2G, 3G, 4G/LTE, Offers Network, LAN or WAN and Wi-Fi technologies around 15 circles. 150 million Airtel subscribers enhanced network and high speed broadband services. In India, Ericsson provides G, 3G and 4Gss services and mobile commerce. Like SDU India, it also has three domains: Intelligent are benefited

●RAN

●Transmission

●CORE

1.6 Circuit Core

An inside framework is a media transmission framework's middle part, which offers or provides different organizations to the buyer's or customers who are interlinked by the passageway sort out [2]. Its main capacity is to take calls over Public Switched Telephone Network (PSTN).This area likewise deals with the call streams, flagging, area update and every single other capacity identified with call. The bundle center area is liable for the information part.

CHAPTER 2
BACKGROUND THEORY

Versatile media communications is among the quickest developing and the most requesting of the considerable number of broadcast communications advances that exist directly. This specific innovation additionally speaks to an inexorably high extent of all new phone memberships around the world. In the majority of the cases, cell arrangements effectively contend with customary wireline systems and cordless phones. On the off chance that this pattern proceeds, at that point later on, cell frameworks utilizing advanced innovation will turn into the all inclusive technique for media transmission.

2.1 HISTORY OF WIRELESS COMMUNICATION

After the innovation of radio in the late 1800s, the beginnings of portable interchanges before long followed. The principal uses of portable radio were just restricted to route reasons for the boats adrift, however as radio ideas grew, so did its utilization as a specialized instrument. The significant achievements in the advancement of remote correspondences are summed up in the accompanying table:

Table 2.1 - Milestones in development of wireless communications [3]

Date	Activity
1906	Reginald Fesseden successfully transmits human voice over radio. Up until that time, radio communications consisted of transmissions of Morse Code.
1915	J. A. Fleming invents the vacuum tube making it possible to build mobile radios.
1921	The Detroit police department used a 2 MHz frequency in the department's first vehicular mobile radio. The system was only one way and police had to find a wireline phone to respond to radio messages
1930s	Amplitude Modulation (AM) two-way mobile systems were in place in the U.S. that took advantage of newly developed mobile transmitters and utilized a "push-to-talk" or half-duplex transmission. By the end of the decade channel allocation grew from 11 to 40.
1935	Invention of Frequency Modulation (FM) improved audio quality. FM eliminated the need for large AM transmitters and resulted in radio equipment which required less power to operate. This made the use of transmitters in vehicles more practical

1940s	The Federal Communications Commission (FCC) recognized a communication service it classified as Domestic Public Land Mobile (DPLM) radio service. The first DPLM system was established in St. Louis in 1946 and it utilized the 150 MHz band. The following year, a "highway" system was developed along the New York - Boston corridor using the 35-40 MHz band.
1947	D.H. Ring, working at Bell Laboratories, envisions the cellular concept.
1948	Shockley, Bardeen and Britain, at Bell Laboratories, invent the transistor which enables electronic equipment, including the radio to be miniaturized.
1949	Radio Common Carriers (RCCs) were recognized.
1949, 1958	Bell Systems made broadband proposals.
1964	AT&T introduces Improved Mobile Telephone System (IMTS).
1968	The FCC began to address issue of new US spectrum requirements.
1969	Nordic countries of Denmark, Finland, Iceland, Norway and Sweden agree to form a group to study and recommend areas of cooperation in telecommunication. This led to the standardization of telecommunications for all members of the Nordic Mobile Telephone (NMT) group, the first comprehensive international standardization group.
1973	The NMT group specifies a feature allowing mobile telephones to be located within and across networks. This feature would become the basis for roaming.
1979	The FCC authorized the installation and testing of the first developmental cellular system in the US (Illinois Bell Telephone Company).
1981	Ericsson launches the world's first cellular system in Saudi Arabia based on the analog NMT 450 standard.
1991	The first digital cellular standard (GSM) is launched.
1998	The number of mobile subscribers world-wide has grown to over 200 million.

2.2 ERICSSON IN MOBILE

Having a client base in excess of 130 nations, Ericsson is one of the main media transmission organizations on the planet. The organization's significant item is the Ax advanced trade which is utilized in the open systems in Europe, the America, Australia, Africa and Asia. Hatchet's secluded plan is the essential explanation which causes it to adjust effectively to a broad assortment of uses. The idea of open frameworks and normalized interfaces is principal to the advancement of all fresh media transmission items inside Ericsson [3].

Since the 1970's, Ericsson has been engaged with planning cell radio frameworks. It offers arrange items for every single significant norm, both simple and computerized [3]. The biggest Ericsson markets, with an expanded number of endorsers utilizing a company known as Ericsson framework are middle part Europe and
North America.
Ericsson invests wholeheartedly in providing 40% of the world's portable communication showcase and consequently, is the world's best provider of versatile system framework hardware. It additionally supplies half of the world's advanced communication advertise which basically suggests that half of all the world's computerized cell phone calls are exchanged by Ericsson trades.

2.3 GLOBAL SYSTEM FOR MOBILE COMMUNICATION (GSM)

GSM was first invented by ETSI (European Telecommunications Standards Institute) to support the protocols for 2G networks utilized by wireless devices. It comprises only of circuit switched network which supports SMS (Short Message Services) and voice calls. The approach techniques used are Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA).The modulation technique used id 8-PSK (Phase Shift Keying) which supports 3 bit/symbol.

2.3.1 GSM PHASES

In the end of 1980s, the packs that were responsible for developing the GSM Model realised that it was not possible for them to construct the whole model at one go with all the features so they decided to release it in various phases with some addition in features in all the respective stages

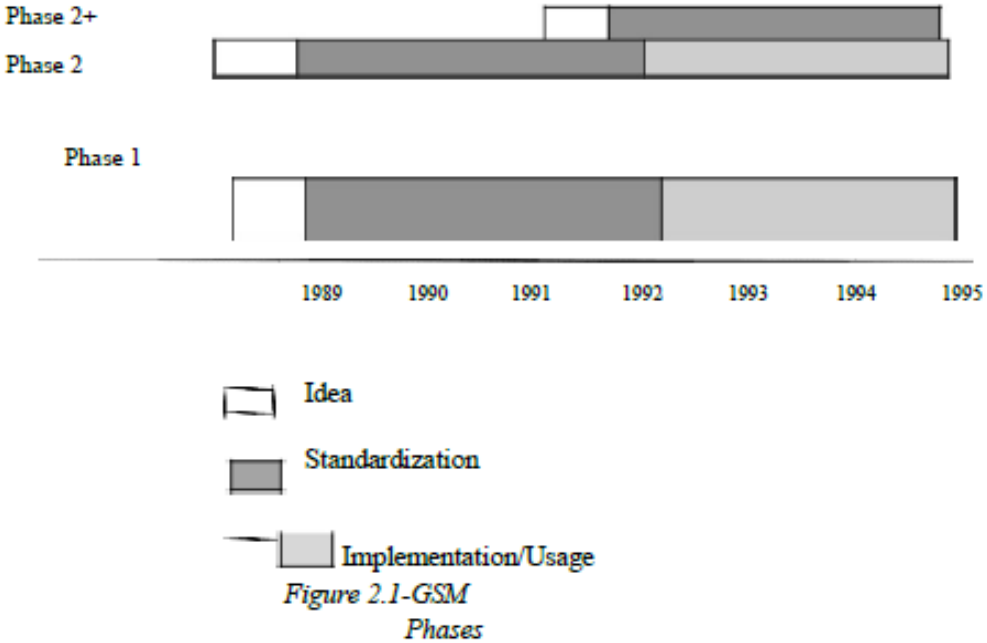


Figure 2.1-GSM Phases

Phase 1

Phase 1 consisted of features like:

- Call forwarding
- Voice Telephony
- International Roaming
- Call Barring
- SMS

Phase 1 included highlights like figuring and Subscriber Identity Module (SIM) cards. Later it was shut and can't be adjusted..

Phase 2

Phase 2 consisted of additional features like:

- Call hold
- Call Waiting
- Conference Calling
- Advice of Charge
- Calling Line Identification

Phase 2plus

- Multiple administration profiles
- Private numbering plans
- Access to Centrex administrations

Internally working with GSM 1800, GSM 1900 and the Digital Enhanced Cordless Telecommunications (DECT) standard.

2.3.2 GSM NETWORK COMPONENTS

The GSM engineering can be separated into two sections:

Every one of these frameworks are involved various useful units which are singular parts of the portable system [4]. The two frameworks are:

- Switching System (SS)
- Base Station System(BSS)

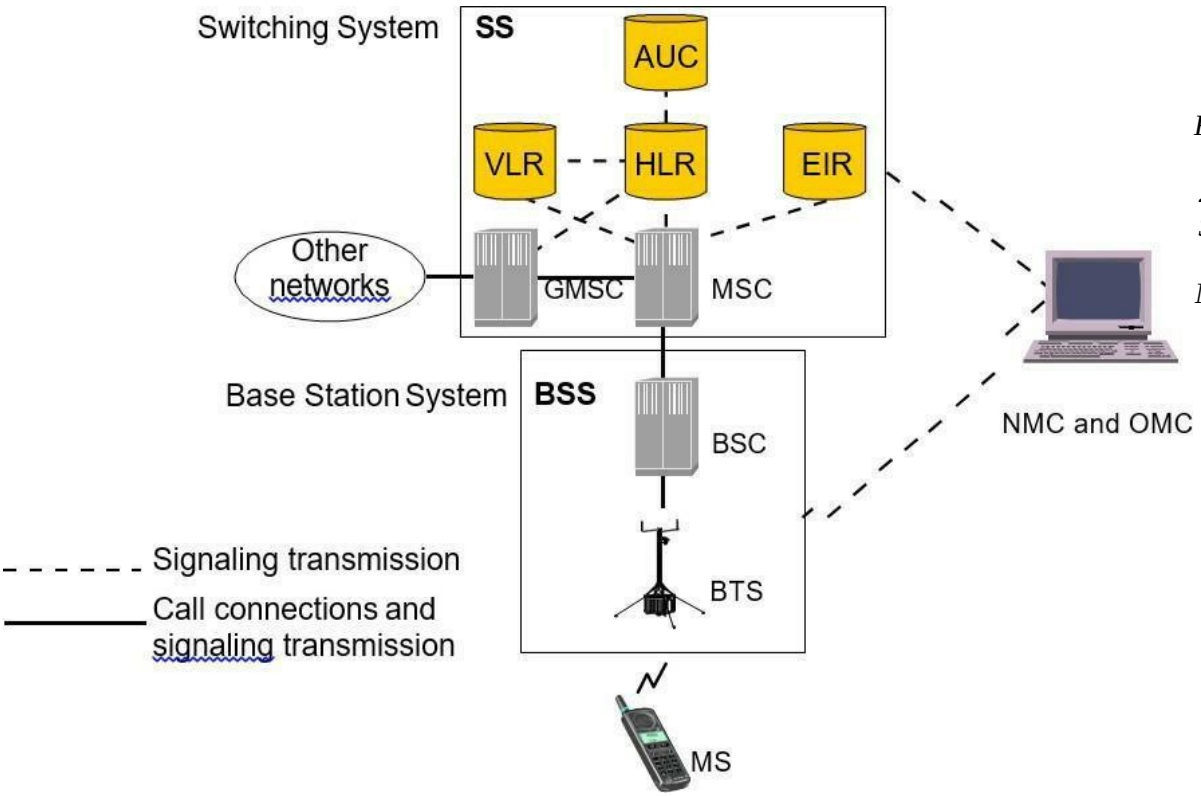


Figure 2.2- System Model

Switching System: It's the core part of the network which is responsible for routing and switching ofcalls. It also handles subscriber's information. The nodes which are a part of Switching System are:

- **Mobile Switching Center (MSC):** The MSC does out the call exchanging and steering processesfor the versatile system. It courses calls to and from other communication and information frameworks, for example, the Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), open information systems, private systems and other versatile systems with the assistance of certain conventions. Its capacities are:
    - It is a part of control layer. o It serves mobile subscribers, taking care of mobility management. o Establishes and control speech and data connections. o Store and manage subscriber data using in-built VLR. o Manage radio resources by control of the RAN nodes like BSC and RNC. o Connect to SGSN by Gs Interface in Packet Switched Network (in case of GPRS). o Route calls inside a PLMN using BICC and ISUP signaling. o Control Media Gateways
    - **Home Location Register (HLR):** The HLR is an incorporated database that stores andmanages every single portable membership and subtleties that has a place with a particular administrator. It goes about as a lasting location

For an individual's membership data until that membership is erased. Its main functions are as follows:

- Permanent Storage of details
- Billing and Charging
- Location Update
- Subscriber's authentication information(IMSI,IMEI)
- **Visitor Location Register (VLR):** The VLR database consists data about all the mobilesubscribers that are currently connected to a particular MSC. Thus, there is only one VLR for an MSC in a particular network. The VLR generally holds a temporary database of

subscriptions with the goal that the MSC can support all the endorsers presently visiting that specific MSC. The VLR can be viewed as a conveyed HLR as it likewise stores information like HLR as it also stores data like HLR but its data is temporary unlike
HLR's. Its functions are:

- Temporary storage of data
- We can identify the current location of both visitors and home subscribersfromVLR.

- **Equipment Identity Register (EIR**): The EIR is a database that contains mobile equipmentidentity database of a subscriber. This particular register helps to block calls from stolen, unauthorized, or defective Mobile Stations. Its main function is to store the IMEI number of a person. It also maintains the grey, black and white list which greatly helps in the mobile tracing activities.

- **Authentication Center (AUC):** The fundamental capacity of the AUC is to validate the subscribersattempting to utilize a system. It is utilized to shield the system from extortion endorsers. The AUC is a database which is associated with the HLR which gives it the verification parameters and figuring keys (autn, xres, ik, ck, rand) used to ensure that the system is secure.
- **Base Station Subsystem:**
  It consists of two parts which are mainly responsible for radio resource allocation.

- **Base Station Controller (BSC)**

The BSC controls every radio-related value of a GSM mastermind. This is a kind of switch which gives capacities like handover, radio channel assignment and cell arrangement. Various BSCs are commonly constrained through a MSC. It additionally controls BTS.

- **Base Transceiver Station (BTS)**

The BTS controls the radio interface (Um) to the Mobile Station. The BTS contains the radio gearfor model handsets and reception apparatuses which are presume to serve each phone present in the system. A collecting of BTSs are regularly constrained by a BSC.

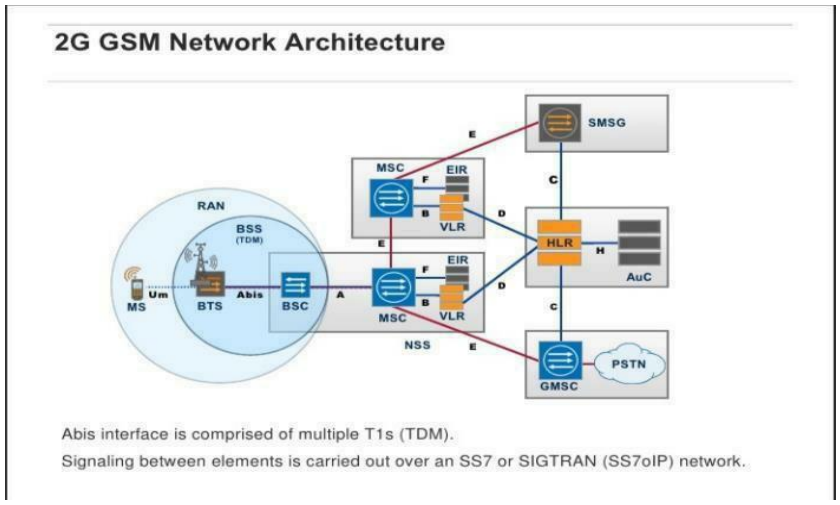


Figure 2.3-GSM Architecture

2.4 3G Network

The 3G system involves 2 essential portion: the User Equipment (UE) and UMTS Terrestrial Radio Access Network (UTRAN). The UE is mobile phone and UTRAN is the base station and the framework information. Both UE and UTRAN are made out of different layers. The 4 most diminished layers are: physical layer (PHY), Medium Access Layer (MAC), Radio Link Layer (RLC) and Radio Resource Layer (RRC) [5]. This substance would give a general depiction of UE and the limit of the different layers with the accentuation on RRC layer since this is the primary layer related with the undertaking.

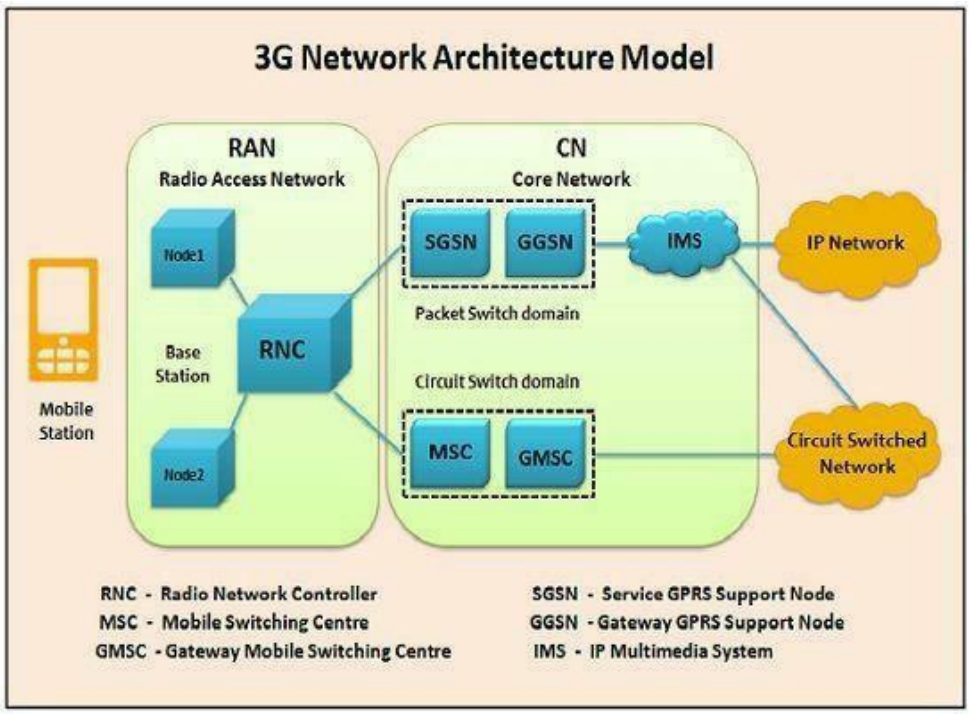


Figure 2.4-3G Architecture

WCDMA (Wideband Code Division Multiple Access) is a type of communication standard which is used in 3G cellular communication. Here, the access technique used is Code Division Multiple Access (CDMA).The frequency of 5 MHz is supported. Type of Modulation technique used is Quadrature Amplitude Shift Keying (QPSK).

2.4.1 Radio Access Network Part (RAN)

NodeB: It works just like a BTS in GSM network. One of its main task is radio resourcemanagement. Some of its functions are :

- Connecting with RNC by IuB interface.
- Connection of MAC protocol for transport channels such as RACH,FACHo Inner and Open loop power controloRadio Channel coding/decoding o Connecting User Equipment (UE) with Uu interface. o RF processing

RNC (Radio Network Controller): It works just like BSC in GSM network. Some of itsfunctions are :

- RNC controls radio resources in its area. One RNC controls multiple nodeB. o It works just like BSC but the difference is that it is more intelligent. o RNC looks after resource allocation.
- Connecting to Circuit and Packet Switched Networks respectively. o Connecting two RNC via X2 interface.

2.4.2 Core Network:

The core network consists of packet switched and circuit switched network. CScore part is same as that of GSM network and it is already explained earlier. Now, we will focus on the packet switched network. It generally handles the data part. There are two parts:

Serving GPRS Support Node (SGSN): The main function is that it provides authentication to thesubscriber through Authentication Center (AUC). The IDS (Internal Domain Server) helps SGSN to detect the appropriate GGSN and helps the connection between them.

Gateway GPRS Support Node (GGSN): It provides end to end service. GGSN generally provides anIP to the subscriber and connects it to different IPs like Facebook, Google, etc. IP given to us is private and dynamic in nature.

2.4.3 User Equipment (UE):

It is similar as Mobile Station (MS) in GSM network. Its advantage is thatit is more intelligent and it can do multitasking. These type of handsets are usually capable of connecting to the internet. It is supports connectivity between two devices or between device and internet. The name is provided by the 3GPP standard. These phones usually consists of USIM (Universal Subscriber Identity Module).

2.5 Long Term Evolution (LTE)

Research on LTE began during the mid 2004 by 3GPP (Third Generation Partnership Project), a media transmission body. LTE developed from UMTS (Universal Mobile Telecommunication System), which advanced from GSM. The most importantly type of LTE was reported in Release 8 of 3GPP particulars.

The rapid increase in the usage of data, online games, IP-TV, etc. necessitated the development of a newer technology with higher speeds and data rates. Therefore, LTE was developed with 300 Mbps peak downlink & 75 Mbps peak uplink.

LTE is a perfect technology to support services like Voice over IP (VOIP) and video conferencing. It uses both the FDD (Frequency Division Duplexing) and TDD (Time Division Duplexing) technology.

Table 2.2 – Evolution of LTE [6]

Year	Event
Mar 2000	Release 99 - UMTS/WCDMA
Mar 2002	Rel 5 - HSDPA
Mar 2005	Rel 6 - HSUPA
Year 2007	Rel 7 - DL MIMO, IMS (IP Multimedia Subsystem)
November 2004	Work started on LTE specification
January 2008	Spec finalized and approved with Release 8
2010	Targeted first deployment

2.5.1 Network Architecture

The system design of LTE consist of the accompanying 3 primary parts:

- User Equipment (UE).
- Evolved UMTS Terrestrial Radio Access Network (E-UTRAN). [RAN Part]
- Evolved Packet Core (EPC).[Core Part]

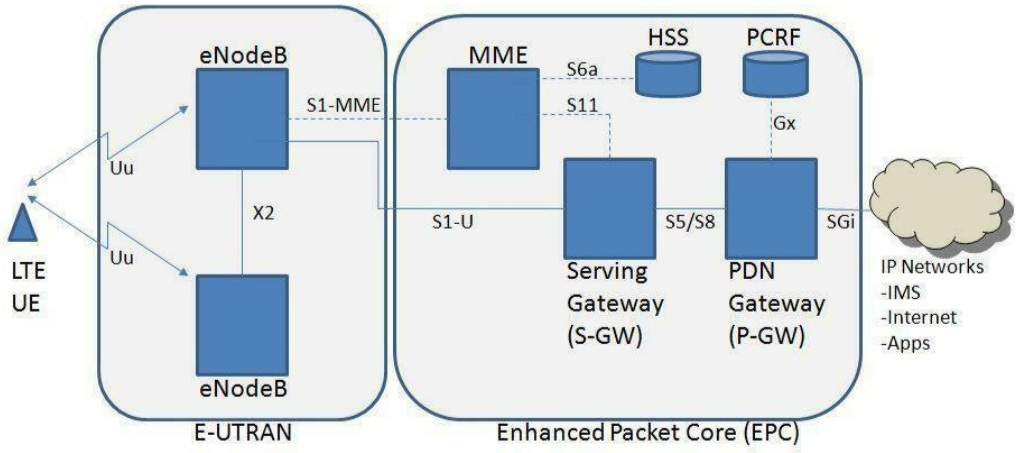


Figure 2.5-LTE Architecture

e-NodeB: E-UTRAN handles radio communications between UE and evolvedpacket core and just had single component, called **eNodeB** . Evey single eNodeB is a base station that controls UEs in at least one than one cell. The base station which is discussing legitimately with a portable is known as its serving eNodeB.

MME: MME represents Mobility Management Entity. MME commands the activities of the UEby methods for flagging mms and Home Subscriber Server (HSS).Some of its capacities are:

- NAS Security
- Idle state mobility handling

- EPS bearer control

PGW: The Packet Data Network Gateway (PGW) speaks with the world outside i.e.packet information systems, through SGi interface. Every bundle information organize is given a passage name (APN). The PDN portal capacities same like the GPRS bolster hub (GGSN) & the serving GPRS bolster hub (SGSN) in UMTS and GSM.

SGW: The serving door (SGW) fills in like a switch, and advances information among the basestation (BS) and the PDN portal. Its functionality is similar as SGSN of GSM technology.

HSS: Home Subscriber Server (HSS) is a focal database that consists all the necessaryinformation about the system administrator's Carrie's. It acts same as the Home LocationRegister (HLR) in GSM.

PCRF: PCRF represents Policy Control and Charging Rules Function. It's a part whichis liable for arrangement control and dynamic, just as for controlling the charging functionalities in the Policy Control Enforcement Function (PCEF), that is available in PGW. It generally keeps track of the plans subscribed by a particular user.

CHAPTER 3
METHODOLOGY

3.1 Work Plan

Activities Performed during the period

- During the period-‘5/02/2020 – 10/02/2020’ Induction programme was conducted for all interns where following topics were covered:
    - Campus to Corporate – introduction to corporate work culture o Basics of telecom –
        - Generations of telecom networks
        - Network architecture – 2G, 3G, 4G and 5G

- After completion of induction programme some web-based learnings were assigned.
    - Mandatory web-based learnings (WBLs):
        - MSDP One FM Introduction
        - MSDP WFM Introduction
        - MSDP One TM Introduction
        - MSDP (Managed Service Delivery Platform) Ways of Working
        - Health and safety of radio frequency exposure
        - Safe Driving Awareness
        - Data Privacy 2.0
        - Travel Security
        - Anti-Corruption 3.0
        - Be Security Aware
        - Sustainable Work-Life and Stress Prevention
        - Occupational Health and Safety Induction

- The Core and VAS domain of telecom networks.Circuit Core Domain Signaling Call Flow

Different types of Protocols o SS7 Stack o Sigtran

CHAPTER 4
CONCLUSIONS & FUTURE SCOPE

4.1 Work Conclusion

- During the 1st month, I got an overview of the telecom basics including GSM, 3G, 4G model architectures, various call flows (prepaid/ postpaid/ data call), types of protocols (like SIP, SS7, Diameter) and important nodes (like Visitor Location Register, Home Location Register, MSC, BSC, RNC, NodeB, etc).

- After this, I was assigned a few projects with the SDU bharti Team in the surf packet Core domain. Currently, I am doing IR21 validation, custom request checking and third levelof auditing.

- Also working as an intern in a corporate environment has made me familiar with some of the key business issues relevant to the ICT industry such as regulation, legal considerations, and the economics of telecommunications infrastructure, etc. Above all, I have acquired relevant organization skills, customer service skills, network planning skills, etc. and I firmly believe that the particular set of analytical and core skills in the field of telecommunications and networking could be applied to effectively manage projects and businesses within the capitalintensive ICT industry in which I wish to work in the near future.

4.2 Future Scope

Administrators are searching for approaches to build limit, inclusion and at same time guarantee that their business KPIs are met. They have been requesting a superior situation for advancements to have the option to give it a shot and execute new plans of action. They need effective systems and activities where administrations can be conveyed rapidly and easily while having the apparatuses to send and offer new administrations.

They also want virtual solutions to enable an unprecedented scalability and flexibility, from smaller decentralized deployments to larger centralized deployments.

The below mentioned sub-categories describes the future scope of my project and also briefly discusses the technologies that can be implemented to drive Ericsson's business operations.

4.2.1 SDN, Cloud and NFV

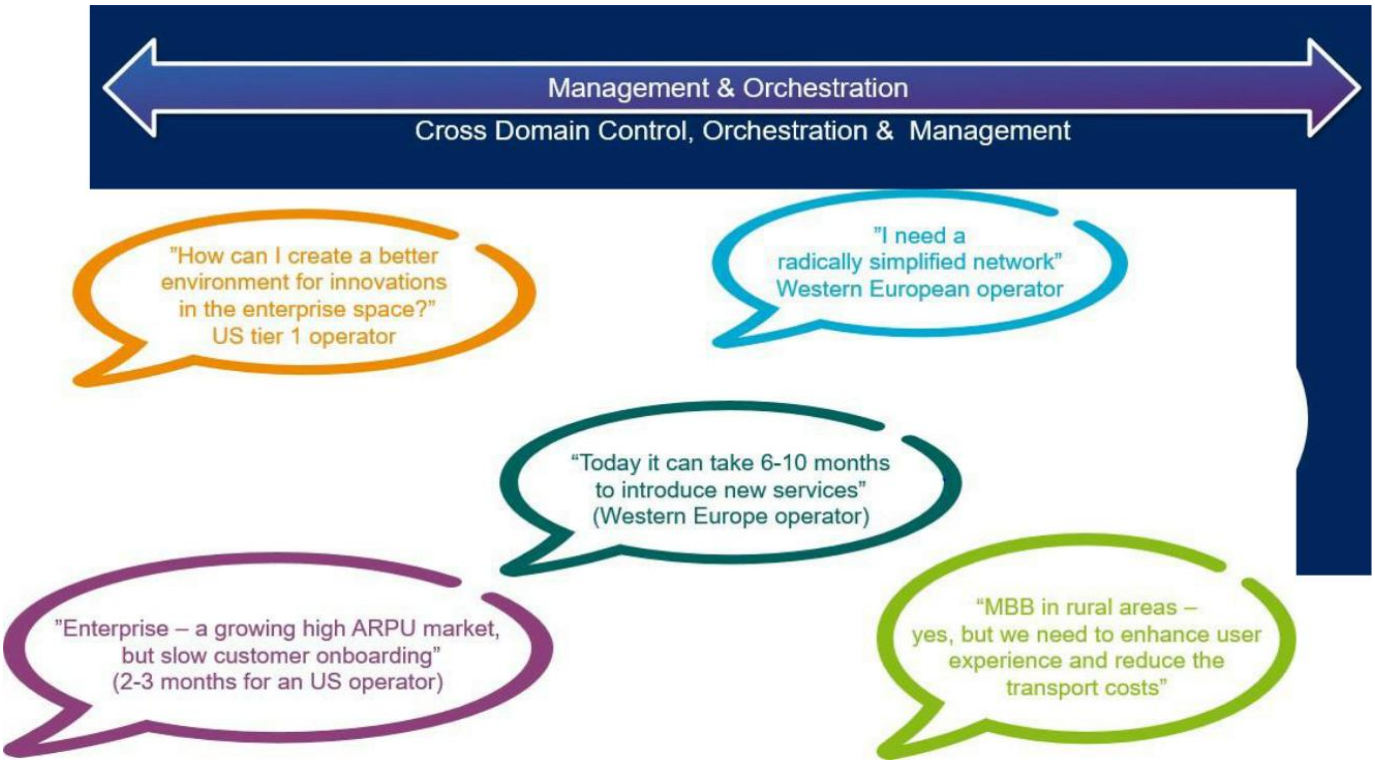
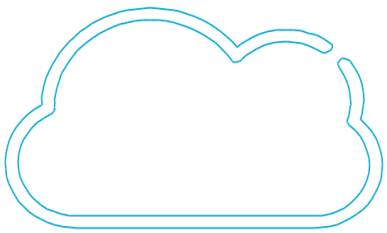


Figure 4.1 Emerging Technology

4.2.2 Cloud Computing

As indicated by NIST, distributed computing is expressed as a model for empowering universal, advantageous, on-request arrange access to a common pool of configurable processing assets (e.g., systems, servers, stockpiling, applications, and administrations) which will be quickly provisioned and discharged with negligible administration exertion or specialist co-op cooperation [8]. This cloud model advances accessibility and comprises of 5 basic qualities, three help models, and 4 organization models.



4.2.3 Cloud Models

The most basic building block of cloud model are, listed as follows:

Programming as a Service (SaaS): The capacity gave to the buyer is to utilize the supplier's applications running on a cloud infrastructure2. The applications are available from different customer gadgets through either a slender customer interface, for example, an internet browser (e.g., online email), or a program interface. The buyer doesn't oversee or control the basic cloud framework including system, servers, working frameworks, stockpiling, or even individual application abilities, with the conceivable exemption of restricted client explicit application arrangement settings [8].

Stage as a Service (PaaS): The capacity gave to the customer is to send onto the cloud foundation shopper made or procured applications made utilizing programming dialects, libraries, administrations, and devices upheld by the provider.3 The purchaser doesn't oversee or control the basic cloud framework including system, servers, working frameworks, or capacity, however has power over the conveyed applications and potentially arrangement settings for the application-facilitating condition [8].

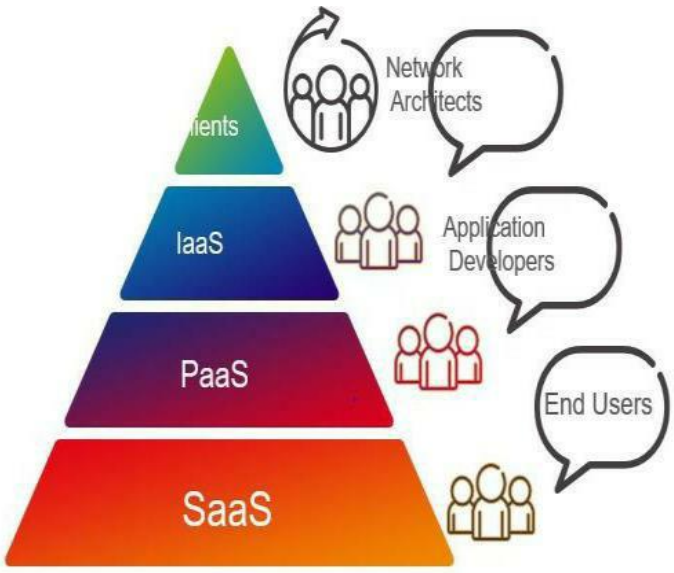


Figure 4.2 Cloud Models

The ability given to the purchaser is to batch produce , capacity, systems, and additionalq major registering assets at the buyer can send & run subjective programming,that can incorporate doing the job frameworks along with applications. Purchaser doesn't oversee or control the hidden cloud foundation yet had authority over working frameworks, stockpiling, along with conveyed applications; as well as potentially restricted control of select systems administration parts for that are, host firewalls.

Finally, located on top of the hierarchy are the clients.

4.2.4 Virtualization

What is virtualization?

Virtualization, in computing, is described as the act of making comprising a virtual (rather than actual) version of computing resources, including but not limited to a virtual hardware platform, operating system (OS),storage device / network resources.

4.2.5 NFV

Network Function Virtualization (NFV) is the volume to launch order works continuously at any ideal space inside the administrator's cloud stage. This is basic to advance asset use and understand the operational productivity that NFV guarantees. It is additionally vital to entitle to the speed proficiency and readiness to aid fresh business openings for example vertical sections, which is an essential for 5G. NFV is a notable innovation for the 5G prepared center.

Figure 4.3 NFV

4.2.6 SDN

SDN stands for Software Defined Networking.

- SDN today is like IP in the late 1990's
- Better way of forwarding traffic than IP or MPLS (More than just destination based routing of IP)

- Programmable = more flexible
- Do I need to replace my whole network to get the benefits of SDN?
- No, you can also deploy it as an overlay
- Is OpenFlow the same as SDN?
- OpenFlow is one way of doing SDN but not the only one (BGP, NetConf, Segment Routingare other ways)

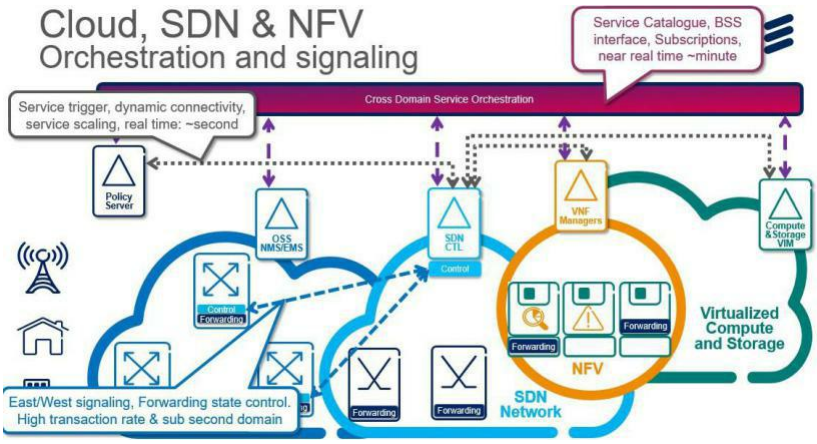


Figure 4.4Cloud,NFVandSDN

CHAPTER 5
IR21 validation(International roaming)

In this basically we are dealing with other telecom company of foreign region and making a pack to provide services (internet, incoming and outgoing call) to international imsi's.

24 For information: some operators may restrict the use of CAMEL on specific PMNs
25 To be completed only if CAP version 4 is supported.

PACKET DATA SERVICES INFORMATION

TADIG Code: XXXYY
Section ID: 16 (Conditional)

Section Not Applicable

Or

List of APN Operator Identifiers	
APN Operator Identifier[26]	

List of APNs available for testing and troubleshooting

APN WEB List

APN Credential				
APN	Username	Password	*ISP DNS IP address (primary)*	*ISP DNS IP address (secondary)*

APN WAP List

APN Credential					
APN	Username	Password	*WAP Gateway IP Address*	*WAP Server URL*	*WAP Port*

APN MMS List

APN Credential				
APN	Username	Password	*WAP Gateway IP address for MMS*	*Messaging Server URL*

APN M2M List

APN Credential				
APN	Username	Password	*ISP DNS IP address (primary)*	*ISP DNS IP address (secondary)*

GTP Version[27]

[redacted]

28 Maximum Multislot class capability available

29 If Yes please indicate how many simultaneous Primary PDP context are supported by the network

IP - ROAMING AND IP - INTERWORKING INFORMATION

TADIG Code: XXXYY
Section ID: 17 (Conditional)

Section Not Applicable

Or

21/109

List of All IP address ranges used by PMN for connection to Inter-PMN IP backbone[30]	IP Address Range

Any *additional* MNC/MCC (that is different to the MNC/MCC in the E.212 field) that may be sent in the Routing Area Identity (RAI) in GTP messaging from SGSNs[31]	MCC (3 digit)	MNC (2 or 3 digi

List of Autonomous System Numbers	ASN[32]

Any *additional* MNC/MCC (that is different to the MNC/MCC in the E.212 field) that may be sent in the User Location Information (ULI) in GTP messaging	MCC (3 digit)	MNC (2 or 3 digi

30 IP addresses or IP address range(s) of all operator's nodes that connect to the inter-PMN IP backbone network known as the "GRX" e.g. GGSNs, SGSNs, MMSCs, AAA Servers/Proxies, DNS Servers etc. This information is used for firewall and Border Gateway configuration (see PRD IR.34).

31 Provide the details of any MNC/MCC that is different to the E.212 field (located at the top of the IR.21 form) that can be sent from any SGSN in the VPMN to the GGSN in the HPMN, in the Create PDP Context Request and Update PDP Context Request GTP messages. If only the MNC/MCC as stated in the E.212 field is ser to the HPMN, this table should be left blank.

32 The Autonomous System Number (ASN) is a 16 or 32 bit integer that every PMN must assign to their IP network that is seen as one Autonomous System (AS). The ASN enables the exchange of exterior routing information between neighbouring Autonomous Systems. According to RFC4893, 4-Byte AS Numbers refers to ASN in the range 0.0 – 65535.65535..

5 Annex A

Updating of the GSM Association roaming database

GSMA Roaming Database

IR.21 Data

[Space blank for logo positioning, centred]

Effective Date of Change:	DD-MM-YYYY

ORGANISATION INFORMATION

Section ID: 1 (Mandatory)

Organisation Name:[1]	<Organisation Name>
Country Initials:	<XXX>

1 Maximum 128 chars. This field is only used for administrative purposes, however, it must always be filled in order to identify the operator.

GSM Association
Official Document IR.21

Non Confide

Effective Date of Change:	DD-MM-YYYY

ORGANISATION INFORMATION

Section ID: 1 (Mandatory)

Organisation Name:[1]	<Organisation Name>
Country Initials:	<XXX>

History of Changes

Date of Change	Section ID	*TADIG Code*	Description
YYYY-MM-DD			
YYYY-MM-DD			
YYYY-MM-DD			
YYYY-MM-DD			

1 Maximum 128 chars. This field is only used for administrative purposes, however, it must always be filled in order to identify th

GSM Association
Official Document IR.21

PACKET DATA SERVICES INFORMATION

TADIG Code: XXXYY

Section ID: 16 (Optional)

Section Not Applicable

Or

Section is also applicable for the following TADIG codes[42]

List of APN Operator Identifiers	
APN Operator Identifier[43]	

List of APNs available for testing and troubleshooting

APN WEB List				
APN Credential			*ISP DNS IP address (primary)*	*IS ad (s*
APN	Username	Password		

APN WAP List				
APN Credential			*WAP Gateway IP Address*	*WAP Server URL*
APN	Username	Password		

42 Fill-in that section if the information is also applicable with other networks of your organization or for MV

43 APN Operator Identifier used for GGSN resolution. The last three labels of the APN Operator Identifier must be in the form: MN

Example orange is a telecom service provider company of france which deal with other international telecom service provider to give their customers international roaming.

Direct Wholesale Roaming Access Agreement

Between

Orange France,
Having its registered address:
1 avenue Nelson Mandela
94110 Arcueil
FRANCE
(Hereinafter referred to as "Orange **France**")

.....
(Hereinafter referred to as "A")

And

<<Access Seeker>>,
having its registered address:

.....
(Hereinafter referred to as "B")

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Roll No:161077
Branch :ECE is doing my
internship with :Ericsson
From: 3 february 2020
to : 16 march 2020

As per procedure I have to
submit my project report to the university
related to my work that I have done during
this internship.

I have compiled my project report. But due
to COVID-19 situation my project mentor
in the company is not able to sign my
project report.

So I hereby declare that the project report is fully designed/developed by me and no part of the work is borrowed or purchased from any agency. And I'll produce a certificate/document of my internship completion with the company to TnP Cell whenever COVID-19 situation gets normal.

Signature_____

Name - Harshita Rana

Date - 1june 2020

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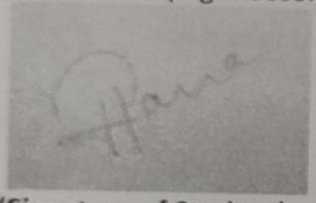

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