2nd L.A. 4G Radio Access Network (RAN) Domain

Project report submitted in partial fulfillment of the requirement

for the degree of

BACHELOR OF TECHNOLOGY

IN

INFORMATION TECHNOLOGY

By

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UNDER THE GUIDANCE OF

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May 2020

DECLARATION

I hereby declare that the work presented in this report entitled **"2nd L.A. 4G Radio Access Network (RAN) Domain"** in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Information Technology** submitted in the department of Computer Science & Engineering and Information Technology**,** Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out over a period from 3rd February 2020 to 18th march 2020 under the supervision of **Rizwan Ur Rehman**(Assistant Professor, Computer Science& Engineering and Information Technology) and **Akash Jaiswal** Senior Engineer at Ericsson Global India Ltd.

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Sachin Gupta (161467)

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

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Dated: 25th May 2020

CERTIFICATE

It is certified that the work contained in the project report titled "2nd L.A. 4G Radio Access Network (RAN) Domain," by "Sachin Gupta," has been carried out under my/our supervision and that this work has not been submitted elsewhere for a degree.

DocuSigned by:

Akash Jaiswal

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and co-operation of numerous people involved in the work.

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TABLE CONTENT

LIST OF ACRONYMS & ABBREVIATIONS

1. RAN- Radio Access Network

2. FO- Front Office

3. FM- Fault Management

4. OSS- Operation Support System

5. CS- Circuit Switched

6. PS- Packet Switched

7. SLA- Service Level Agreement

8. WLA- Work Level Agreement

9. KPI- Key Performance Indicator

10. GSM- Global System for Mobile

11. LTE- Long Term Evolution

12. WBL- Web Based Learning

13. MSDP- Managed Service Delivery Platform

14. OneFM- Fault Management

15. OneTM- Trouble Management

16. WFM- Work Force Management

17. BTS- Base Transceiver System

18. RNC- Radio Network Controller

19. BSC- Base Station Controller

20. QOS- Quality of Service

21. eUTRAN- evolved UMTS Terrestrial Radio Access Network

22. eNodeB- evolved NodeB

23. RRU- Remote Radio Unit

24. BBU- Baseband Unit

25. MME- Mobility Management Entity

26. UE- User Equipment

27. SGW- Serving Gateway

28. TT- Trouble Ticket

29. IMS-IP Multimedia Subsystem

30. ZLD- Zero Level Document

31. PAM- Privileged Identity Management

32. GUI- Graphical User interface

33. CRAN- Cloud Radio Access Network

34. ORAN- Open Radio Access Network

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

A Radio Access Network (RAN) is the part of a telecommunications system that connects individual user devices to the core network through radio connections. A RAN provides the connection with its Core Network. RAN components include a base station and antennas that cover a specific region. The RAN controller is to control the user devices connected to it. During this internship, tasks in the RAN domain were performed after various Induction sessions, wide-ranging Web Based Trainings consisting of videos, content and documents and the On-Job Trainings.

Second level service problem restoration is passed on from the team working on the first level service problem restoration. Handling and analyzing of Trouble Tickets will be carried out to recommend timely actions and solutions to the Trouble Tickets with guidance, whenever necessary. Handling and execution of the Change Requests in the stipulated time frame has been done. New nodes which are to be put up are checked and tested properly before setting up (Acceptance Testing of Nodes). Apart from this, Emergency Handling, collaborating with other team's like, FM, OSS, CS Core & PS Core, Transmission team, etc., carried out with an ability to perform under time constraints depending upon the business requirements.

It must be made sure that the network uptime availability is maintained. Uptime is one of the most important parts of a service-level agreement (SLA) that a client signs with a vendor. Uptime specifies the amount of time that a given vendor product or service will be available. Distinct focus on Service KPI (Key Performance Indicator) must also be kept. KPIs can be used to ensure that SLA requirements are met and to keep customers informed about their service.

This report delineates the Second Level Assurance done in 4G Radio Access Networks. The report begins with an introduction of the Radio Access Network along with its evolution and the limitations of the traditional RAN Architecture. It also includes the Motivation and the Problem Statement of the project. The introductory chapter will be succeeded by a Literature Review of the existing work done in the field of Radio access network. Chapter 3 will be providing the work done in the Second level assurance in 4G RAN in Ericsson Global India Ltd. This chapter has been further sub-divided into sections and sub-sections which individually focus on the procedures and techniques adopted in handling the network issues of the clients.

Chapter 4 shall form the penultimate chapter of the report which is the Conclusion of the project done which is followed by future scope which will be stated in Chapter 5.

CHAPTER 1

INTRODUCTION

Ericsson Radio System

The equipment, programming, and related administrations to manufacture particular and versatile radio access systems. It remembers items for the territories of radio, RAN Compute, site arrangements, MINI-LINK for microwave transmission, a completely incorporated IP switch portfolio, and front-pull arrangements – all oversaw by a typical administration framework. Ericsson Radio System is intended to fit all site types and traffic situations, even as systems develop in scale and multifaceted nature, from 2G, 3G, 4G, and 5G.

RAN Architecture Evolution

In past ages, the Base Stations were constrained by a focal gadget. In 2G, it was the BSC (Base Station Controller) and in 3G, it was the RNC (Radio Network Controller). These controllers were answerable for setting up the radio connects to the remote gadgets by means of the Base Stations, for controlling the associations while being used, for guaranteeing the QoS (Quality of Service), also, for giving over an association with another Base Station when required.

In LTE Fig. 1.1, this idea was relinquished, as it required critical assets on the grounds that the assignment was gathered in barely any system hubs. Most applications on the gadget just transmit data in overflows with long break in the middle. During this season of idleness, the air interface association with the cell phones must be changed to utilize the accessible data transfer capacity productively and to decrease the force utilization of the cell phones. Along these lines, the parcel exchanged association creates a ton of flagging burden on account of the successive exchanging of the air interface. Consequently, these administration assignments were appropriated by giving the usefulness of the BSC into Base stations to accelerate the association arrangement time and to diminish the time required for

handover, which is urgent for constant administrations. In this way, making the LTE Access organize a basic level system of interconnected Base Stations without a brought together controller (BSC).

Radio Access Network of LTE (eUTRAN)

The Radio Access Network of LTE is otherwise called eUTRAN (UMTS Terrestrial Radio Access Network). Here, the Base station is otherwise called eNodeB (e represents advanced). The eNode-B comprises of two units-

•RRU (Remote Radio Unit) which comprises of the recieving wires which is answerable for tweak and demodulation of the considerable number of signs transmitted or got broadcasting in real time interface.

•BBU (Baseband Unit) which comprises of advanced modules which forms all signs transmitted or gotten on air interface, and goes about as an interface deeply arrange over a rapid backhaul association.

The eNode-B isn't only answerable for the air interface, yet in addition for Radio Resource

The board which incorporates

•Radio Bearer Control

.Radio Admission Control

•Connectivity Mobility Control

•Dynamic designation of assets to UEs in both uplink and downlink.

•Encryption of client information stream

•Selection of a MME at UE connection when no directing to a MME can be resolved from

the data gave by the UE.

•Routing of User Plane Data towards Serving Gateway (SGW)

•Scheduling and transmission of paging messages

•Scheduling and transmission of communicate data

In any case, one outcome of the absence of a concentrated controller is that, as the UE moves, the system must exchange all the data identified with the UE. Accordingly, to maintain a strategic distance from information misfortune during handover, X2 interface was presented. In LTE, Base Stations can legitimately speak with one another over the X2 interface for two purposes.

•Handovers are presently constrained by Base Stations themselves. Thusly, if the objective cells are known and reachable over X2 interface, the cells discuss straightforwardly with one another. Something else, the S1 interface and a center system are utilized to play out the handover.
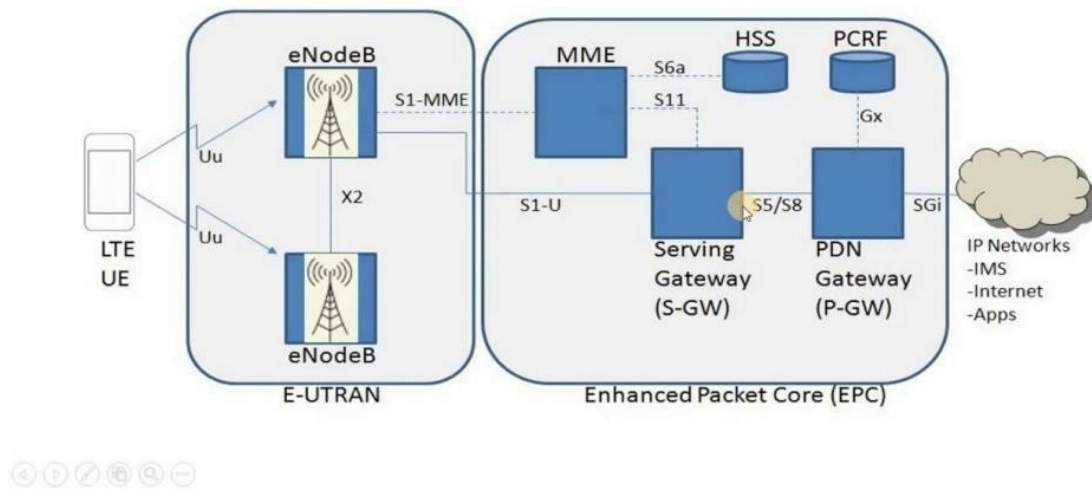
•Interference Coordination

Figure 1.1 LTE Architecture

Limitations in the traditional RAN architecture

There are a few impediments in the customary cell design. In the first place, each BTS is expensive to construct and work. Second, when more BTS are added to a framework to improve its ability, obstruction among BTS is progressively serious as BTS are nearer to one another and a greater amount of them are utilizing a similar recurrence (Frequency Re-use) . Third, since clients are versatile, the traffic of each BTS changes, and accordingly, the normal use pace of individual BTS is truly low. Be that as it may, these preparing assets can't be imparted to different BTS. Hence, all BTS are intended to deal with the greatest traffic, not normal traffic, bringing about a misuse of preparing assets and force out of gear times.

Motivation

To guarantee legitimate administration and support of a Telecommunication arrange, different things must be remembered and worked upon. Legitimate examination of the shortcoming/cause must be done identified with the framework/arrange issues, while working inside very much characterized framework bolster rules. Issues must be organized to meet the Service Level Agreement and the Work Level Agreement (SLA/WLA). We should attempt to take part in inner specialized conversations in view to improve the general system execution and make suggestions at every possible opportunity. Likewise, a right working approach must be guaranteed.

Problem Statement

Uptime is one of the most significant pieces of a help level understanding (SLA) that a customer signs with a merchant. Uptime indicates the measure of time that a given seller item or administration will be accessible. It must be ensured that the system uptime accessibility is kept up. Unmistakable spotlight on Service KPI (Key Performance Indicator) must be kept. KPIs can be utilized to guarantee that SLA prerequisites are met and to keep clients educated about their administration. The Trouble Tickets conclusion ought to be done inside the SLA. We need to ensure that the accompanying errands are dealt with:

- To deal with and examine Trouble Tickets and prescribe convenient activities and answers for Trouble Tickets with direction, when essential.
- To deal with and execute the Change Request in specified time span.
- Capacity to perform under time limitations relying on the business necessities.

CHAPTER 2

Literature Review

Year	Author	Title	Publisher	Findings
2019	M. A. Habibi, M. Nasimi, B. Han and H. D. Schotten	A Comprehensive Survey of RAN Architectures Toward 5G Mobile Communication System	IEEE Access, vol. 7	This paper helped to understand how various RAN architectures are being reconstructed for transition towards 5G.
2014	H. Niu, C. Li, A. Papathanassiou and G. Wu	RAN architecture options and performance for 5G network evolution	IEEE Wireless Communications and Networking Conference Workshops (WCNCW), Istanbul	This paper explained the role of network virtualization, its challenges, and the expected technical and economic benefits for implementing the different RAN architecture options for 5G networks.

Rest of the data is confidential as it is taken from Ericsson internal website and hence, can't be shared.

CHAPTER 3

Work Done

Firstly, to augment the knowledge in the concept of the respective domains the following set of WBLs (Web Based Learning's) has been done which consists of wide-ranging videos, content and documents based on our domains and other HR training.

Web Based Learning's:

Some of the WBLs completed are:

COURSES

Table 3.1 WBLs completed

MSDP (Managed Service Delivery Platform) Ways of Working
MSDP WFM Introduction
MSDP One FM Introduction
MSDP One TM Introduction
GSM Radio Access Network Overview
GSM RAN SW Licensing
GSM Radio Access Network Overview [Old Version]
GSM System Survey
WCDMA RAN W14 Overview
IP Fundamentals
IP Routing Overview
IP Routing Fundamentals

LTE Radio Interface
LTE Radio Access Network Protocols and Procedures
Auto-integration in LTE
LTE L13B Features and Functionality
LTE/SAE a System Overview, WBL
LTE/EPC Introduction
LTE/EPC Architecture
LTE Radio Network Configuration
EVO Controller Overview
LTE Fundamentals
5G Overview
RAN Architecture Evolution
What is 5G RAN?
5G RAN Operations
5G Overview
Ericsson 5G RAN System Techniques
RAN Architecture Evolution to 5G

There were also few mandatory training sessions which were assigned to create awareness about the data privacy and security so that one is aware about how to handle subscriber personal information. Some training was also based on IMS (IP Multimedia Subsystem).

IMS (IP Multimedia Subsystem)

Truly, cell phones have given voice bring administrations over a circuit-exchanged style organize, instead of carefully over an IP bundle exchanged system. Elective strategies for conveying voice (VoIP) or other sight and sound administrations have opened up on cell phones; however they have not gotten normalized over the business. IMS is a compositional structure to give such normalization. There were additionally WBLs dependent on Python Fundamentals, Data Science, Automation, 5G and VoLTE to enhance the information picked up previously.

Some of the other mandatory trainings that were done are:

COURSES

Knowledge Assessment - Ericsson Microwave Products Overview
IMS Signaling Part 3: Diameter in IMS
Sustainable Work-Life and Stress Prevention
Occupational Health & Safety (OHS) Incident Handling
Ericsson Network Manager (ENM) - Overview and Highlights
EGMS Awareness
Ethernet Transport Fundamentals
IP Fundamentals
BSP Overview
ENM Overview
VoLTE Introduction
5G core concepts Introduction
GSM System Survey
VoLTE e2e Call Path Course
5G Core Network Architecture

Table 3.2 List of other mandatory trainings

5G Transport Overview
Ericsson Cloud Systems
Python: Data Science Fundamentals
Automation 101
Data Science Statistics using python and visualization tools
Ericsson Mobile Backhaul Microwave Reference Solution Fundamentals
BMAS Data Science Fundamentals

MSDP (Managed Service Delivery Platform)

MSDP is Managed Service Delivery Platform. It offers brought together assistance access, the executives, and activity advancement bolster stage. It is multi-inhabitant, multi-seller and multi-innovation. It handles in excess of 100 MS contracts in more than 50 nations. Handles more than

Billion cautions for every year with more than 21.3 million tickets for each year and more than 14 million work arranges every year.

MSDP is utilized at whatever point an organization has been contracted to deal with client's system. MSDP devices serve start to finish the board of systems in multi-client, multi-nation situations empowering productive caution checking, investigating, issue rebuilding and so forth.

It contains a few arrangement territories including various apparatuses. A portion of the instruments are:

Workforce Management (WFM)

The workforce the executives (WFM) framework is a framework for the field tasks which gives booking usefulness so as to improve the effectiveness of the field power. In the WFM framework work orders are utilized to hold data viewing the mentioned benefits just as to monitor the advancement of work being accomplished for the equivalent in requests to meet the administration prerequisites. For field experts with appropriate access rights it is

conceivable to see and keep up the work arranges through a WAP interface. It plays out the accompanying assignments:

• Manages workforce

• Efficient arranging and control of assets

The WFM condition can be actualized as Stand Alone or by mix with oneTM.

One FM

One FM (MSDP Fault Manager) is a unified framework which supports Fault Management procedures or Event Management forms. One FM inside the MSDP devices is going about as an umbrella framework, to which all Element Managers of various kinds and sellers (or Network Elements legitimately) send their cautions and occasions. It gives a typical stage to MSDP NOC clients to improve assets and administrations and take important activities proactively. One FM tracks caution/occasion data in an elite, in-memory database, and presents data important to explicit clients through channels and perspectives that can be arranged exclusively. One FM has computerization works that ca

perform clever handling on oversaw data.

There are three access levels in One FM:

•   RO (Read Only): Can just screen alerts

•   Read Write-Can screen and access the cautions

•   Local Admin (LDA)

OneTM

The Trouble and Change Management apparatus utilized inside MSDP is called ONE-TM. It handles Trouble Tickets, Work Orders and Change Requests in an incorporated NMS arrangement. Reports on some KPIs are additionally included. The entrance is gotten through Citrix customers.

OneTM is regularly utilized along with a Fault Management framework. Tickets can be

made dependent on contribution from the Fault Management framework just as different

sources, for example, calls and messages from end-clients.

OneTM can make work requests to be utilized by Workforce Management (WFM).

OneTM assists with the accompanying tasks:Supports Incident administration

- Supports Problem the executives

- Helps activity focuses

The accompanying obligatory trainings were done so as to gain admittance to MSDP and different apparatuses of MSDP:

Table 3.3 List of MSDP Trainings

MSDP (Managed Service Delivery Platform) Ways of Working
MSDP WFM Introduction
MSDP One FM Introduction
MSDP One TM Introduction

In the wake of finishing the trainings, a bunch of evaluations identified with MSDP must be passed, on consummation of which one would be qualified to raise a solicitation to gain admittance to MSDP and its apparatuses.

In the wake of getting the MSDP Access, insights regarding the group stock were given, which gives the information about the various hubs that each group is managing.

Different Node Types that the group is working was given, alongside the elements of every one of them, joined by the difference among the various hubs so one is very much aware of the usefulness of every one of the hubs. Alongside the Node Types, the hub circles were additionally given which the group is managing in combination with the Node Hub.

OneTM- Working with Trouble Tickets

Trouble tickets (TT)

Inconvenience Ticket or TT for short is a record of an occasion that isn't a piece of the standard activity, causing an interference or quality decrease of the administration. A case of this is when portable calls can't be finished in a specific region. A Trouble Ticket depicts a system occurrence that should be tended to right away. In the event that it is made with the end goal of arrangement or goals in a current situation, it is called Service Request.

Inconvenience Tickets can be made in OneTM, on the difficulty ticket sheet, by filling compulsory fields in the TT structure. Here, the client can depict the issue, characterize it's need, type, and sub class and determine who the ticket is doled out to.

The existence pattern of a Trouble Ticket is characterized by limited state changes. The Trouble Ticket experiences various states from New, until at long last it is Cleared and Closed.

OneTM Access

An oneTM access demand must be made through Citrix customers, after which the entrance demand was endorsed.

The Trouble and Change Management instrument utilized inside MSDP is called ONE-TM. It handles Trouble Tickets, Work Orders in a coordinated NMS arrangement. Reports on some KPIs are additionally included. The entrance is gotten through Citrix customers.

OneTM is regularly utilized along with a Fault Management framework. Tickets can be made dependent on contribution from the Fault Management framework just as different sources, for example, calls and messages from end-clients. OneTM can make work requests to be utilized by Workforce Management (WFM).

A diagram of the device was given and the application page was made acclimated. Clarification on the most proficient method to dispatch OneTM and its route was given. The MSDP Trouble Problem or OneTM is a piece of MSDP Tools Solution. This application is utilized in all Ericsson Operation Centers in their every day support for the client systems, and give them unlimited oversight over their procedure of dealing with the difficulty .

An individual utilizing OneTM is known as a client. Every client has a login name, a secret key and indicated get to rights. The entrance rights choose what the client is permitted to do in the framework. There are two essential degrees of access for interior clients, Read and Read-Write. With Read get to, the clients can look and view tickets that are taken care of in the client's association. With Read-Write get to, the clients can likewise make and alter tickets of various types.

Integrations

The most significant devices from OneTM point of view are OneFM, NIM and WFM.

The TM Solution gives an interface that any issue chief, for example, OneFM can associate with. The interface bolsters the capacity to make Trouble Tickets from cautions. Data about the caution is moved to the TM arrangement. The incorporation with NIM furnishes the difficulty ticket framework with data about the locales. The information are recovered from the system stock framework and put away in a difficult situation the executives framework. WFM fills in as the framework for field activities. With the combination the booking usefulness opens up, which improves the productivity of the field power.

Case Flow

An issue happens in the client's system and a caution is brought up in the client's Fault Management System. The caution is sent to MSDP OneFM. MSDP alert relationship and channels are applied. The alert is enhanced with site data got from the NIM database. A Trouble Ticket is made in MSDP OneTM dependent on the caution with the correct seriousness. The Trouble Ticket is enhanced with progressively point by point site and system component data got from the NIM database. Cautions from OneFM and tickets from OneTM will be utilized in the reports made in the MSDP announcing device. At that point the ticket is relegated to NOC clients and the remedial activities are performed. If necessary, field power is reached. For this situation, a Work Order is made and sent to the WFM framework, in light of which field power is sent to the site.

The field engineer acknowledges the work request and fixes the issue. The front office or the back office asks the maker, who is the proprietor or the end client, for check and shuts the difficulty ticket. The issue is consequently settled.

Searching Filters

The most well-known approach to look through tickets is to utilize the inquiry channels. There are a few distinct channels accessible, which will facilitate the quest for tickets that are relegated.

From the Show Trouble Ticket dropdown list, we need to choose a channel as required. In a difficult situation tickets field, the rundown of coordinating tickets shows up. This page shows the most significant ticket information.

In the wake of picking the pursuit channel, the tickets are recorded. The quantity of tickets that have been doled out can be seen that should be taken care of by the group. The ticket number, title, depiction, and the sort and sub classification of the case are shown.

The following zone gives the need level and the real condition of the revealed case alongside the client name and the related site subtleties.

Severity Levels

Following are the distinctive seriousness levels with regards to the Trouble Tickets

- Critical

- Major

- Minor

- Supplementary 1

- Supplementary 2

- Supplementary 3

Advantageous 1 is non administration influencing; however in the event that excess gets down, at that point it will get Critical.

Advantageous 2 is non administration influencing, however in the event that excess gets down, at that point it will turn into Major.

Advantageous 3 is non administration influencing, however in the event that excess gets down, at that point it will get Minor. The difficulty ticket with Critical seriousness must be organized first, etc.

The Service Level Agreement (SLA) time for the diverse seriousness levels are:

•Critical-2 hours

•Major-3 hours

•Minor-8 hours

•Supplementary 1-24 hours

•Supplementary 2-48 hours

•Supplementary 3-72 hours

Viewing Tickets

Right off the bat, the primary tab must be engaged, that is, the Trouble Tickets. In the wake of picking the inquiry channel, the tickets are recorded. The quantity of tickets that are doled out can be seen . The ticket can be opened by double tapping on it. The difficulty ticket structure opens, which gathers all the subtleties of the case to which our ticket applies. In the upper left corner, the ticket number, its title, its depiction and the sort and subcategories of the case are shown. The following zone gives the need level and the real condition of the announced case and on the correct hand side, the client name and the related site subtleties are appeared.

The lower part contains data on the clients who are allocated to the ticket, that is, who are answerable for it. Likewise, some extra data can be found here, for example, work log or the ticket history and a few tabs.

Roles

Contingent upon the client's job in the association, various jobs are accessible. The most widely recognized jobs are the Operator, the CR Approver, the NOC Administrator, the Application Administrator, and the administration work area head.

TT Life Cycle

During the dealing with process, you can adjust the province of Trouble Tickets by picking one from a constrained arrangement of potential changes.

New is the essential province of TT when the administrator fills the necessary information. At the point when all the compulsory fields are filled, and the TT is spared, it moves consequently to the Queued state. Presently the ticket is doled out to a particular gathering and it is in the line of that gathering to chip away at it. The condition of the ticket changes to Open, when the alloted engineer acknowledges it and begins to take a shot at it. In the event that the designer dismisses the ticket, it moves to the Closed state. The designer has the privilege to place an Open ticket in Deferred state if further information is required from the end client. A conceded ticket can be revived if the operational work is conceivable once more, or it very well may be shut if new data originates from the client about the issue being fathomed.

The condition of the ticket changes from Open to Cleared, when the work is done and goals is given. A cleared ticket can at present be revived if the client guarantees the issue despite everything happens. The state changes to Closed when the work is totally wrapped up. In this express, no further updates are permitted.

Accepting TTs

Before dealing with the Trouble ticket, first it must be acknowledged. Open it by double tapping on the picked section on the Trouble Tickets sheet of Resolution Start page.
To acknowledge the ticket, select Yes from the Accepted choice rundown. The ticket will open in Edit Mode.

Rejecting TTs

To dismiss a TT, select No from the Accepted choice rundown. We likewise need to clarify the explanation behind our dismissal. A notice will be sent to the Customer, who can peruse the reason for dismissal in the Work Log.

Adding Work log

The work log is one of the most significant enlightening fields in a difficult situation Ticket. The Work Log shows which steps have been now done to tackle the issue, when they were done, and by whom. When the Work Log section is made and is shown in the Work log table of the Trouble Ticket, the passages can be arranged in Ascending or Descending request.

ZLD (Zero Level Document)

ZLD

ZLD represents Zero Level Document. All these caution sections are sent to the Front office in a combined structure alongside the change history which shows changes done in alert for trustee or deferral previously. Some of them are worked upon by NOC clients (TT) and some by field (Work Order) , which are done as expressed by the ZLD.

Change History

All the progressions made to the alerts are included the Change History in the XLS standard arrangement. For instance some caution must be changed to be finished by field or in the event that it must be finished by the NOC , or in the event that we need to build the postponement of the alerts. These change passages will be made in the Change History.

Approval Process

When the progressions are done in ZLD, it requires two level endorsement post that the FO acknowledges it for changes.

ZLD Master Sheet

The ZLD Master sheet comprises of the cautions and the alert appointees (the one in control to fix the caution).

The trustees are generally the accompanying tea

   • The Back Office

   • L1 FM RAN

   • Circle NPO (RF Team)

   • Circle FM

   • Transmission team

Alarm Delay

It also consists of a column related to the alarm delays, which is decided by us. For example, if we have a Synchronization alarm, we need to put a delay of about 60 mins for it to auto retune. This is done so that only we only receive the genuine cases after getting filtered.

Alarm Consolidation

In this, we get a single TT in case of repetitive TTs (it gets consolidated). We also need to assign a time frame for this. For example, if we get 10 alarms in 30 mins, we consolidate it into.

Auto Clear

 If we want the TTs to remain even after the alarms are cancelled from the nodes because we need to update the reason, we apply Auto Clear. We apply a time frame for the same. For example, we apply a time frame of 30 mins, so even after the alarm has been cancelled from the nodes, the TT will be closed after 30 mins, so that we can update the reason within that time frame.

Correlation

If we have two alarms, A and B and Alarm B is dependent on Alarm A. Alarm B occurs only after the occurrence of Alarm A. So in this case, we combine both the alarms A and B into one. This can be of two types- Parent-Child Correlation and Parent-Parent Correlation. We only generate the Parent in the case of Parent-Child correlation. And in the case of Parent-Parent correlation, we will only generate any one of the Parents.

Mate Team

This is the automation team which handles the Smart Alarms. It performs Smart Alarm filtering for alarm monitoring purposes. Supposedly, we get an alarm in our node, we ask the mate team to perform correlation for 5 alarms (say) because it can't be performed in the Alarm Monitoring window. Even the Severity of the alarms is found in the Zero Level Document (ZLD). It also consists of a Critical Chat option, for instant reaction to the issue, in case a person misses out a TT by mistake.

Grouping TT's

If several TTs are related to similar problems, they can be grouped together. There are three different ways to group Trouble Tickets.

Parent-Child Correlation

Parent-Child relation is established when the same fault is reported several times by different users or customers. Suppose, there are four different users complaining about the same fault in a site.

In this scenario, an operator creates a single parent ticket and correlates all four problem tickets to it as child tickets. This way, the work is done on a single ticket, instead of multiple TTs addressing the same problem. We can relate up to fifty Child tickets to the Parent TT. When Parent-Child relation is established, the operator cannot change the state of the child ticket. The state of the Child ticket is automatically updated when the operator modifies the state of the Parent ticket. The establishment of the Parent Child relation is restricted according to the state of tickets. A ticket can be seen as a Parent only if it is in the Queued, Open or Deferred state. A cleared or closed ticket cannot be set as a Parent. The Mark as Parent button is disabled in these states. If an existing Parent ticket moves into Cleared or Closed state , it cannot be attached to other TTs any longer.

These Parent tickets don't show up in the ticket relation dialog window when the Relate to Parent button is clicked. A ticket in Cleared or Closed state cannot be marked as Child either. The relate to parent button is also disabled.

Primary Secondary Relation

Primary Secondary relation is established for interdependent tickets, when the resolution of one ticket is dependent on the other. Suppose, there is an alarm in a mobile tower for device 1 and after investigation, it is found that there is also an issue in device 2. To resolve the issue with device 1, the issue related to device 2 has to be resolved first. So, the TT for device 2 can be set as Primary Ticket, which needs to be resolved first, and the TT for Device 1 is related to it as Secondary Ticket. An operator, who has the 'Primary-Secondary relation access' rights can establish Primary-Secondary relation of Trouble Tickets.

In this kind of relationship, users are able to work individually on the primary and secondary trouble tickets.
However, a primary TT cannot be closed before all related secondary tickets are in closed state.

Duplication Records Correlation

Duplicate Records correlation is established to enable the correlation of similar tickets. It is based on a field configuration set for the customer.

The Duplicate Records correlation enables the search for similar records under the Duplicate Records tab.

Click on the Show/Refresh button to display the non child records as per the field search criteria configured for that Customer. To relate the ticket to a parent record, select one of the non child records and click on the relate to parent button. Once this relation is made, the current ticket will be marked as "Child" and the original ticket will be marked as "Parent".

Access Management

Access control issues troubles many organizations, as it not only increases risk with cases of phishing, but also with regards to insider threats, or simple mistakes by users with high level access. Many organizations have loose access controls. The majority of all security breaches originate from insiders and trusted partners. Threats disrupt service, cause customer churn, loss and fraud. Some common threats that a company can face is by:

- Employee mistake

- Spear phishing

- Weak password

- Vendor access

- Shared privileged accounts

The Struggle to Keep Pace with Cyber Security Threats is due to Technology Disruptions, Fraud

Compliance, Organizational complexity, Users, Networks, Access Methods, & Rights. Service Providers face new & unprecedented challenges.

Key access management issues with critical telecom network infrastructure are due to Industry and Government Regulations, insider threat, vendor access, unrestricted access to nodes, Shared Privileged accounts, and Operational efficiency. Security and operational issues with existing localized access controls are due to different access methods, Different log in credentials, Different security policies (e.g. password complexity), No regular password rotation in place, Poor control of users' privileges, Lack of full monitoring of user's actions, Lack of compliance with regulatory requirements etc.

Beyond Trust

Beyond Trust is an American company that develops, markets, and supports a family of privileged identity management (PAM), privileged remote access, and vulnerability management products for UNIX, Linux, Windows and Mac OS operating systems.

It is a Network-wide attribute and role-based identity and access policy management. It is a best in class Single Sign On and Privileged Identity Management solution that enables Telecommunications Service Providers and to Protect, Secure and Audit critical telecommunications network and IT infrastructure.

It has the following applications:

• Role and attribute based access controls

• Single Sign On for GUI and other applications

• Separation of users from device credentials

• Logging and reporting

.Take control of privileged credentials

• Take control of user access

• Centralized and uniform security policy enforcement

• Support Complex Telco and IT environments

It implements role based access control for the whole network, it also systematizes and decentralizes the access request and approvals to resource owners, along with assuring alignment of people processes & policies.

BeyondTrust is non-intrusive to users. The software helps power some of the most efficient organizations on the planet.

CHAPTER 4

Conclusion

Knowledge in the following tasks in the RAN domain was acquired after the Induction session, Web Based Trainings and On Job Trainings:

- Second level service problem restoration.

  - To handle and analyze Trouble Tickets and recommend timely actions and solutions to Trouble Tickets with guidance, when necessary.

  - Acceptance testing of nodes- This is done to the new nodes which are to be checked and tested properly before setting up.

  - Emergency Handling (It is considered to be an emergency whenever a problem impacts more than 30% of the service).

- Interface with other organizational entities such as FO,FM, OSS, CS Core & PS Core,

  transmission team. (Collaborating with the other teams working on other domains)

- Ability to perform under time constraints depending upon the business requirements.

CHAPTER 5

Future Prospects

Cloud radio access arrange (C-RAN) has been considered as one of the empowering system structures towards the usage of fifth era (5G) remote frameworks. Joining propelled radio, remote and processing strategies, C-RAN gives incredible potential to improve the system limit, range effectiveness, vitality proficiency and operational adaptability.

System dis-conglomeration is advanced by coalitions, for example, Open-RAN (O-RAN). This empowers adaptability and makes new open doors for rivalry, gives open interfaces and open source improvement, at last to facilitate the arrangement of new highlights and innovation with scale. The O-RAN partnership objective is to permit multi-seller arrangement with off-the rack equipment for the motivations behind simpler and quicker interoperability. System dis-collection additionally permits parts of the system to be virtualized, giving away proportional and improve client experience as limit develops. The advantages of virtualizing parts of the RAN give a way to be savvier from an equipment and programming perspective particularly for IoT applications where the quantity of gadgets is in the millions.

This procedure of virtualizing the baseband in the radio access arrange (RAN) is a piece of a more extensive pattern in the remote and more extensive telecom industry in which administrators are progressively hoping to move away from costly, committed equipment from customary providers and toward broadly useful registering hardware running programming. This outcomes in less expensive hardware that can be changed or redesigned all the more rapidly through programming.

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