“CRON BASED DASHBOARD DESIGN FOR OEM EQUIPMENT MANAGEMENT”

Project Report submitted in partial fulfillment of the requirements for the Degree of

BACHELOR OF TECHNOLOGY

By

AKHILESH KUMAR

Enrollment No: 161072

UNDER THE GUIDANCE

OF

MR. ARUN SAINI

(Senior Engineer, SRF, ERICSSON GLOBAL INDIA)

MR. ANKIT SRIVASTAVA

(Senior Engineer, SRF, ERICSSON GLOBAL INDIA)

Department of Electronics and Communication Engineering

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY,

WAKNAGHAT May-2020

PROJECT REPORT UNDERTAKING

I Mr. **Akhilesh Kumar**, Enrollment No. **161072**, Branch **Electronics and Communication Engineering** is doing my internship with **Ericsson India Global Services Pvt. Ltd.** at its **Noida** office from **February 3rd, 2020** to **July 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: Akhilesh Kumar

Date: 2nd June 2020

DECLARATION

I hereby declare that the work reported in this report entitled **"CRON BASED DASHBOARD DESIGN FOR OEM EQUIPMENT MANAGEMENT"** *in partial fulfillment of the requirements for the award of the degree of* ***Bachelor of Technology*** *in* ***Electronics and Communication Engineering*** *submitted in the department of Electronics and Communication Engineering,* *Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out over a period from Feb 2020 to May 2020 under the supervision of* ***(Arun Saini)*** *(Senior Engineer, Ericsson Global India) and* ***(Ankit Srivastava)*** *(Senior Engineer, Ericsson Global India).*

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

Akhilesh Kumar
(1610720)

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

Arun Saini
Senior Engineer
BMAS SA MSN SLOP SDU
BH 2LO TXN FM
arun.saini@ericsson.com

Ericsson Global India Pvt. Ltd.
Knowledge Boulevard, Sector-62, Noida
Gautam Buddha Nagar, U.P - 201301
0120 302 9200

Acknowledgement

I would like to express sincere thanks to my mentor ***Mr. Arun Saini*** *and* ***Mr. Ankit Srivastava*** *who provided the golden opportunity to work on this project,* **CRON BASED DASHBOARD DESIGN FOR OEM EQUIPMENT MANAGEMENT**. *He also helped in carrying out a lot of Research and helped me learn many new approaches and different methods.*

Secondly, I would also like to thank all , I would also like to thank, Mr. Pardeep Garg who is my guide at university, Professors and Lab assistants of Electronics and Communication Department of Jaypee University of Information Technology, Waknaghat who helped a lot in building the required skillset to work on this project within the limited time frame.

Akhilesh Kumar
(161072)

Table of Contents

LIST OF FIGURES

LIST OF ACRONYMS & ABBREVIATIONS

OEM	Original Equipment Manufacturer
ICT	Information and Communication Technologies
RDP	Remote Desktop Protocol
BMAS	Business Managed Services
MSDP	Managed Services Delivery Platform
IT	Information Technology
RAN	Random Access Network
LTE	Long Term Evolution
VoLTE	Voice over LTE
3GPP	3rd Generation Partnership Projects
DRAN	Distributed Random Access Network
CRAN	Centralized Random-Access Network
ERAN	Elastic Random-Access Network
SQL	Structured Query Language
VRAN	Virtual Random-Access Network
MSN	Managed Services Network
FTP	File Transfer Protocol
SDU	Service Delivery Unit
SLOP	Service line Operations

ABSTRACT

My five-month internship was with Ericsson Global India Services Pvt. Ltd. At it's Noida office beginning from the February 2020. Internship started with fundamental and mandatory training with qualified senior engineers and management officials of Ericsson which included some VPs and Country Heads too. This report is written to document the basic approaches and details of the technology learnt, challenges faced, and the solutions developed. Our training began with the fundamentals of the technology used at Ericsson Worldwide. The main goal of the project was to develop a solution to utilize large telecom data and manage it accordingly it can be utilized to avoid multiple manual tasks which are performed by other engineers.

The major challenge faced by the team was to report the equipment status of the OEM networking components employed for powering up the Bharti Airtel Infrastructures distributed all over India, considering all the difficulties the team is going through, and to keep the count of the their respective OEMs components and their functioning. The methodology of design and development is described properly in details in further chapters but in general the dashboard design and development depend on the various servers which they are employed on across India and the circles assigned to them. The designs and approaches were finalized by senior engineers of the RAN Transmission team.

Before the project could be deployed on Internal servers due to Covid-19 lockdowns and restrictions project had to be put on hold for indefinite time to not very urgent in nature. Due to the withdrawal of company laptop by the EGIS on the grounds of business requirements posed a problem of not having many system diagrams. However, working on project with team members and seniors has improved knowledge in general and refined the understanding of Ericsson as an organization. Project was based CRON scheduler and fetcher. Written in Python, Visual Basic, SQL with extensive works on Solaris, Linux and Microsoft servers. This project improved the understanding of the various Original Equipment Manufacturer that Bharti Airtel uses for its infrastructure for 2G/3G/4G/LTE operations in all the 22 telecom circles in India

Chapter – 1

Introduction

1.1 General Introduction

Bharti Airtel is a telecom company whose infrastructure is developed and managed by Ericsson, altogether Airtel uses three different OEMs for its telecom infrastructure in India. Namely, Ericsson [2], Ceragon [3] and Huawei [4]. Indian telecom circle is very vast due to very high number of telecom subscribers and vast geographical area of India, ranging from J&K to Andaman and Nicobar and from Arunachal Pradesh to Lakshadweep Islands. To manage such high number of telecom subscribers and telephony activities we need to maintain a very highly robust and scalable infrastructures which involves multiple number of servers distributed across India and accessible internally through secured protocols. The project involved fetching routine data from all 22 circles which involved different OEM and multiple Servers which counted to total 38 servers. Now the required task was to develop as Dashboard which contains all the information updated every day, flags any anomaly, discard pervious data and caches important data required for day to day operation.

1.2 Organization

Ericsson [6] is one of the leading global providers of Information and Communication Technology (ICT) to service providers. Ericsson works on developing and providing telecom connectivity solutions and services which are standard and very easy to use, adopt, and scale, for successful and fully connected infrastructures. Comprehensive portfolio of Ericsson ranges across Networks, Digital Services, Managed Services and Emerging Business; powered by 5G and IoT platforms. Ericsson develop, manage and deliver telecom network by facilitating hardware, software, and services to enable the full value of connectivity. Ranging from Networks, 5G, IoT to virtualization, Ericsson supports digital transformation for the next generation mobile telecommunication services and systems.

With managed services Ericsson create real value and business differentiation by taking an integrated approach covering all aspects of Telecom Businesses. By managing and optimizing telecom networks and IT operations with highly industrialized processes and

a truly global delivery model, they enhance operators' ability to meet – and exceed - consumer expectations.

Fig 2.1 Ericsson at a Glance

1.3 Motivation

Ericsson is Telecom Giant specializing in the Managed Services, Digital services and IoT industry. The main focus at Ericsson is to empower the Infrastructures of the telecom operators. The problem statement posed here is fetching of Data across OEMs seamlessly and automating the processes.

1.4 Objective(s)

The objective is to develop an end to end Dashboard system to create reports of network equipment health using different CRON expressions. The design of the system aims at the utilization of data from different OEM servers, implementation of various OEM equipment details with optimal testing of state of the network equipment to generate the report of health for large sets of telecom data. The objectives of the project here is to design the Dashboard and report retrieval systems. Report retrieval systems implement status of the telecom network, latency and connectivity of the server, previous status, equipment health and various other

parameters are considered to generate the report of Bharti Airtel infrastructure.

1.5 Target Specification

Directly no 3rd Party client is involved in the project as the project is for internal automation for the team but overall it impacts the efficiency of the service delivery for Bharti Airtel by the RAN BO team at Ericsson BH-SDU SLOP. Network health report is used by the RAN Team to check transmission tickets more robustly which required finding the possible errors, disturbance and retrieval of the communication through wireless or optical mediums in telecom communications. Target was to cover 38 different servers which are established in 22 different circles of Bharti Airtel India operations. Additionally, it was aimed to support the OEMs in determining the possible decision making of specifying the units having bad health or malfunctioning.

1.6 Scope of Work

The Dashboard and Report retrieval system is designed to log the status of OEM equipment and generate reports on proprietary as well as OEM systems of Bharti Airtel on day to day basis for operations across all 22 telecom circles. This involves analyzing various data sources (mostly confidential to share), all 38 servers of Bharti Airtel, Ceragon, Huawei and Ericsson, data validation with pre-assigned operation range which is used by the RAN Team. The Dashboard system is designed to be scalable, robust and modular for operations with high performance. Dashboard and Report retrieval systems are designed to be easily replicable and simple to be redesigned in the use cases of requirement from other clients. Ericsson operates in India as a Global service providers, to name some, Bharti Airtel in India, Orange Mobile in Europe, Telstra in Australia. Hence the scope of the work required to be very robust, scalable and reproducible.

Chapter – 2

TRAINING BACKGROUND

2.1 Introduction

We joined Ericsson as an Intern on 2nd February 2020 which began after completing the condensed semester at the University. Internship began with lots of mentoring on transition from Campus to Corporate. During the period of 2nd February to 10th February, Induction program was conducted for all interns which made the internship onboarding smooth and easy

With corporate culture, we were made aware with the Organizational structures and hierarchy of the Ericsson. Generally, the Service Delivery Units have the typical service company structure which is meant to overlook and manage an existing service already developed. Any faults or corrections needed are solved by working on the raised tickets and the allotted team was RAN-Tx for Bharti Airtel SDU. So, we were allotted various teams in which the organization is distributed internally for Bharti Service Delivery Unit or the Managed Services Units. Initially we were given training in person by the Human resources managers at Ericsson and the senior engineers at the Technical trainers FLEX team**.**

Campus to Corporate – introduction to corporate work culture and finding out the difference between day to day operations in University campus compared to the corporate office.

Next introduced topics were the Basics of telecom which included the Generations of telecom networks, Network architectures of 2G, 3G, 4G/LTE and 5G. Focus was on 2G, 4G and 5G. Most of the revenue of Ericsson/Bharti Airtel are based on the 2G/4G networks while Ericsson is working on 5G for its commercial realization in India.

2.2 Training Planning

Initial phase of the internship was actually designated for the elaborated and extensive training on the Network Architectures, Ericsson Managed services Delivery Platforms and the various technologies designed and developed by the Ericsson R&D. Apart from this the nature of project required holistic knowledge of Data Science and Python

Programming Language which were focused in the training period.

2.2.1 The Ericsson Operation Engine

With Ericsson Operations Engine, we help CSPs and web scale players to transform their operations and address key business priorities such as lower TCO, enhanced user experience, new revenue streams and efficient transformation.

Our competitive advantage is based on people & domain expertise; data driven processes; modernized applications & platforms; automated and AI driven insights, provided by a global, trusted partner.

Through new delivery capabilities and innovative commercial models, the Ericsson Operations Engine supports end to end managed services offerings, such as Network Management Services, Enterprise Services, Cloud & IT Services, Network Design & Optimization.

Fig. 2.2. Key offering areas of Ericsson Operation Engine

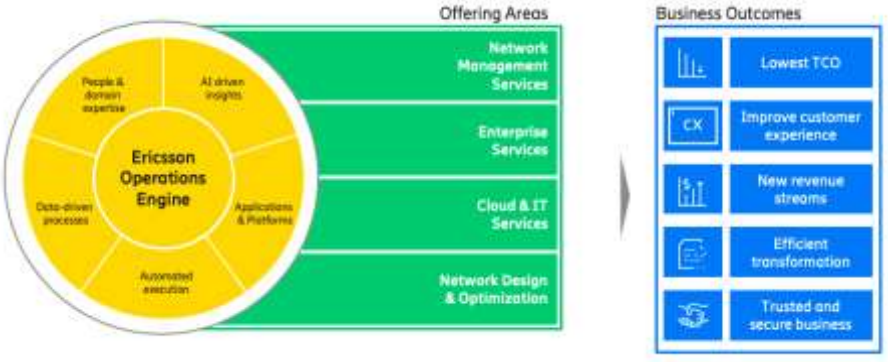


Fig. 2.3. Ericsson Operation Engine offering areas and Business outcomes.

2.2.2 Managed Services Delivery Platform

Powerful engine built from integrated tools, best in class tools in the market (currently 13 tools in the portfolio. It supports processes and people (automation, analytics, proactive, predictive). It is the centralized environment for handling multi-vendor and multi-technology networks (wireless, wireline).

MSDP is designed such that it can be used by Ericsson tech staffs for Managed services deliveries in 13 key areas. It utilized the MSDP core which can be used by the customer network tickets.

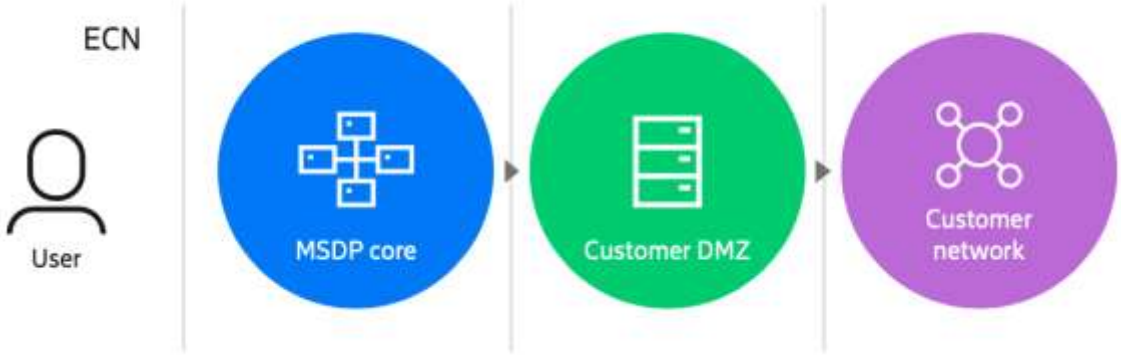


Fig 2.4. MSDP Architecture (Ericsson)

To obtain the license and approval for the access of the MSDP Platform (access bundled with OneFM, OneTM and NIM) we had to go through various assessments which could be taken after completing WBL modules (Web based learning modules) and assessment exams. It was necessary because we could access servers and internal data only if we had the access granted after completion of MSDP assessments.

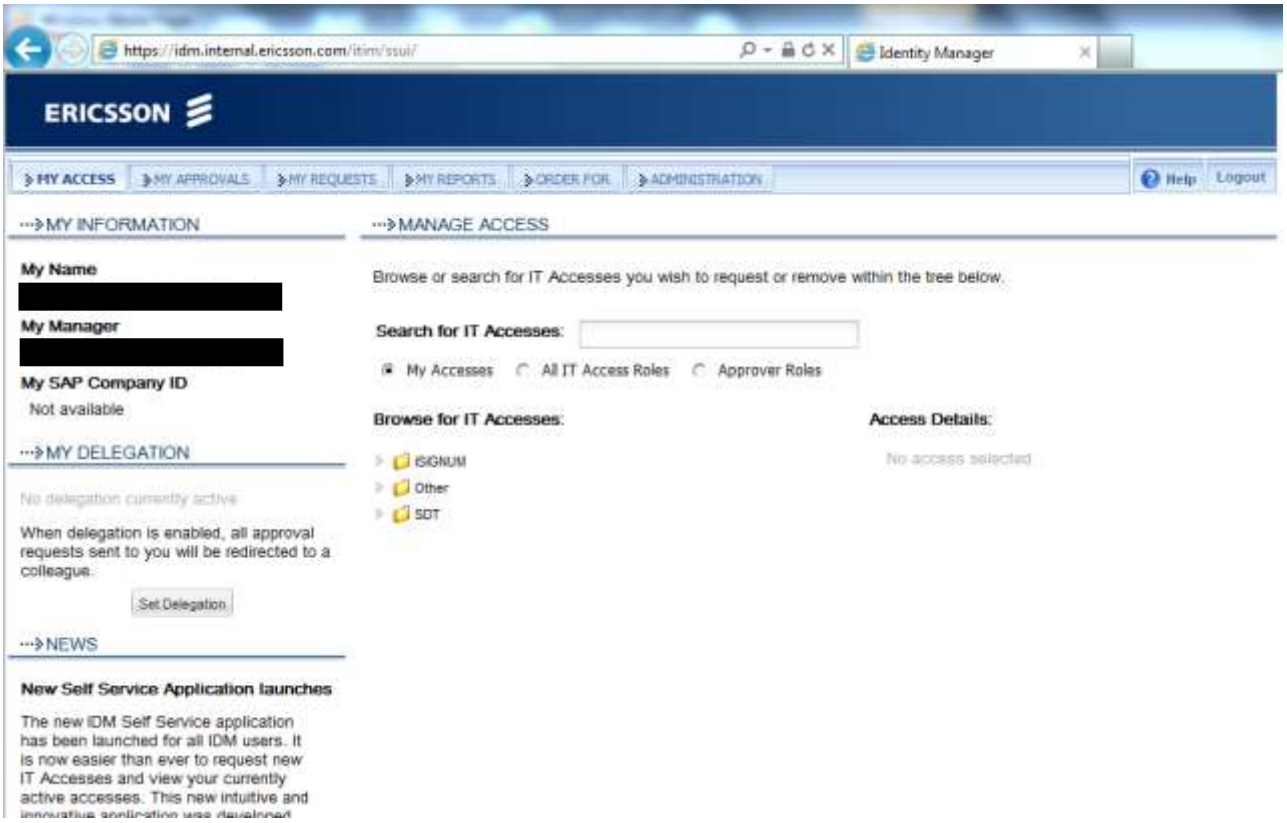


Fig 2.5. MSDP Login Screen and Access (Ericsson)

2.2.3 NIM

NIM Solution enables network inventory functions to the MS customers. The main task for this centralized repository is to ensure that automated and manual processes are driven by accurate data. Depending on a Role and Activities following access rights to MSDP NIM can be distinguished into

- NIM User
- NIM Engineer
- NIM LDA
- NIM Administrator

Before ordering an account MSDP NIM Assessments needs to be passed and which was done accordingly. Access to NIM was ordered using CUP (MSDP Tools/NIM).

Fig. 2.6. NIM Central User Provisioning (CUP).

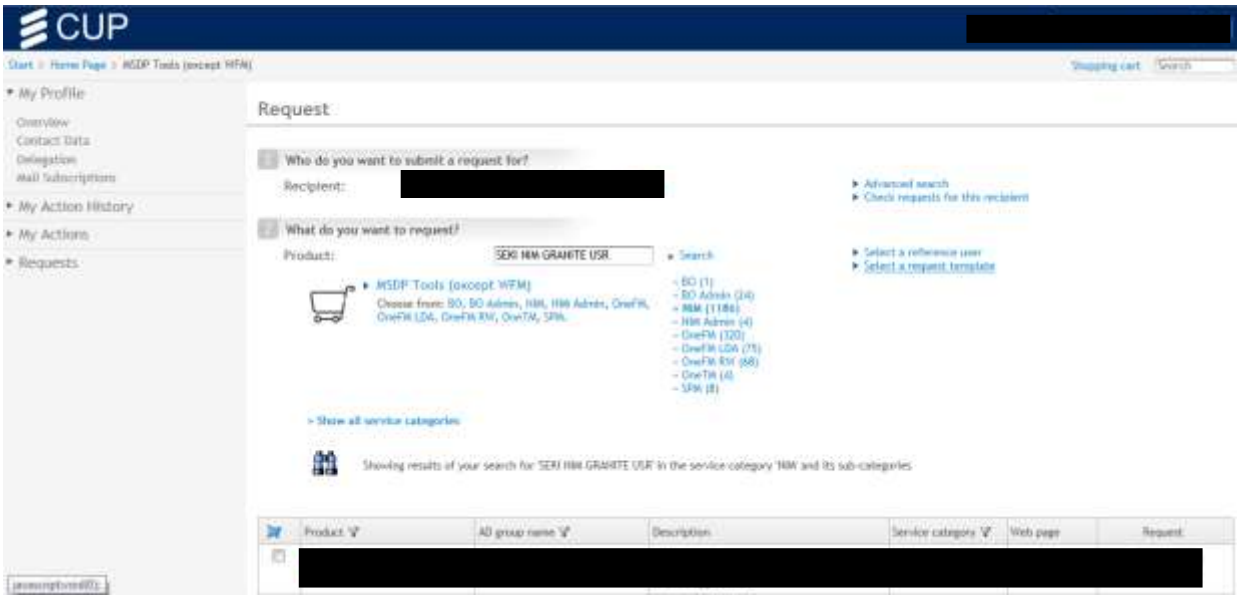


Fig. 2.7. NIM CUP Tool: Order Request

2.2.4 OneFM

MSDP OneFM is a centralized solution supporting Event Management Process used to monitor supported network. OneFM Account can only be accessed if MSDP Account is already authorized. Depending on a Role and Activities following access rights to MSDP OneFM can be distinguished

- OneFM Read-Only User
- OneFM Read-Write User
- OneFM Local Data Administrator

Before ordering an account, MSDP OneFM Assessments needs to be passed which was done too. Access to OneFM application can be ordered using CUP (MSDP Tools/OneFM) and choosing appropriate Customer group with access rights

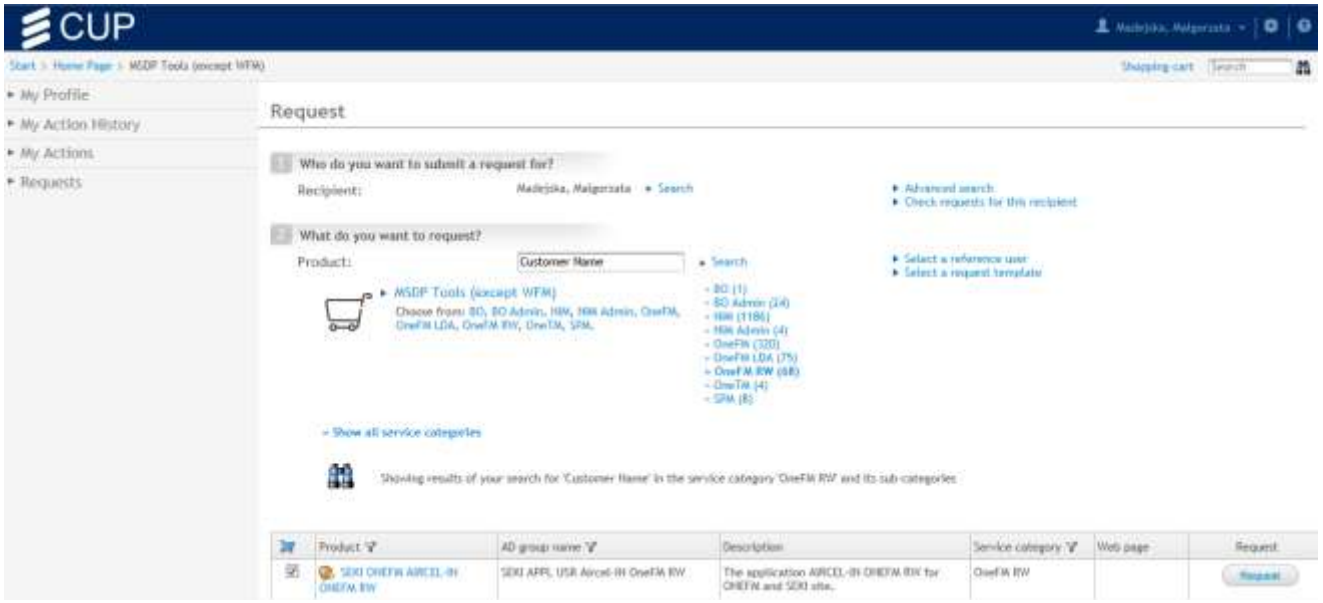


Fig 2.8. OneFM Access: Order Request

2.2.5 OneTM

MSDP OneTM is a Trouble and Change Management system used to support MS Customers To order OneTM Account MSDP Account is a pre-requisite.

Depending on a Role and Activities performed in the system two main access rights to MSDP OneTM can be distinguished in these categories:

- OneTM Operator
- OneTM NOC Admin

Before ordering an account MSDP OneTM Assessments needs to be passed

Access to OneTM application can be ordered using CUP (MSDP Tools/OneTM) SEKI APPL USR OneTM. OneTM account can be ordered by raising Service Request towards MSDP Operations using ITSM or by sending email internal service desk with information about Customer name and requested Group need to be provided.

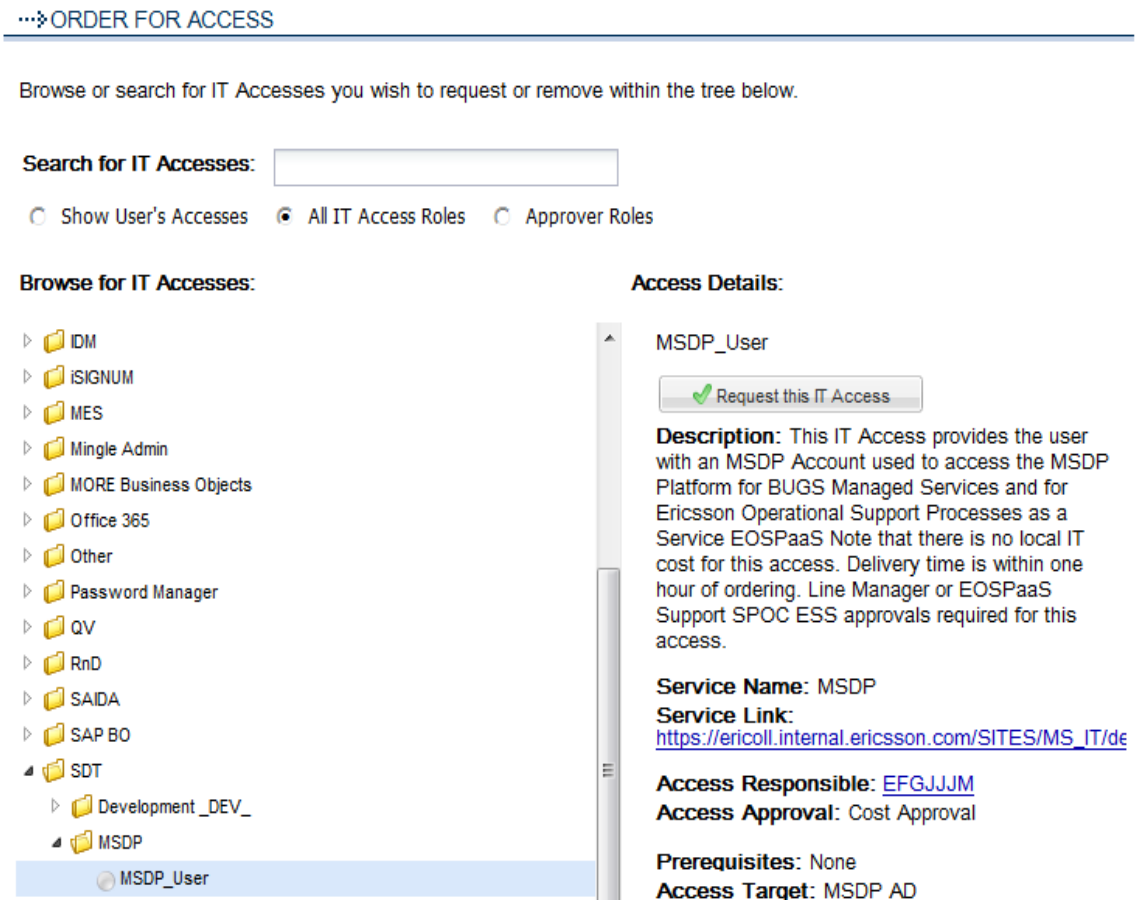


Fig 2.9. OneTM Access: Order Request

2.2.6 WFM

WFM system is dedicated for Field Organizations which provides scheduling functionality in order to improve the efficiency of the field force. WFM supports both Internal and External Users working with Field Operations Organizations

Access to WFM was ordered using CUP (MSDP WFM Tools).

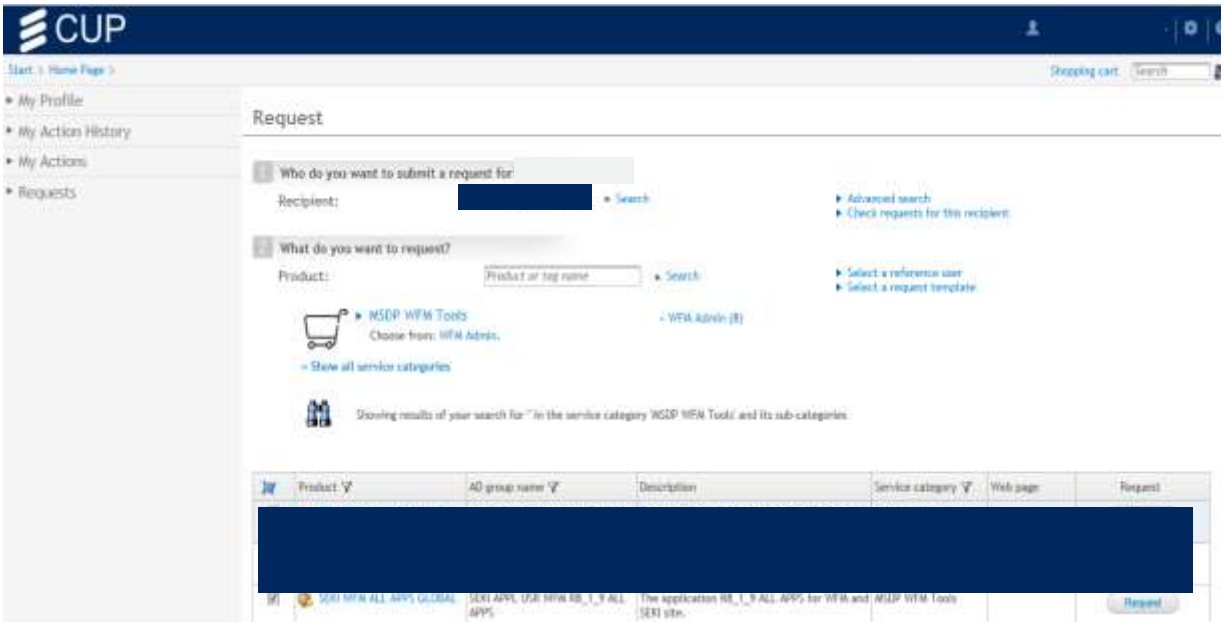


Fig. 2.10. WFM CUP tool.

2.3 Project Planning

After enough access into the Managed Services Networks was granted. The project architecture planning and designing was the next phase. With the specified end user goals and scope of the project was decided we started planning the architecture, requirements and design of the project. We already had predefined the requirements of Data and the report to be generated. Moving on to the implementation part of the project, we decided to test various technology stacks for processing and storing the status of Data coming from all the circles of India which crosses

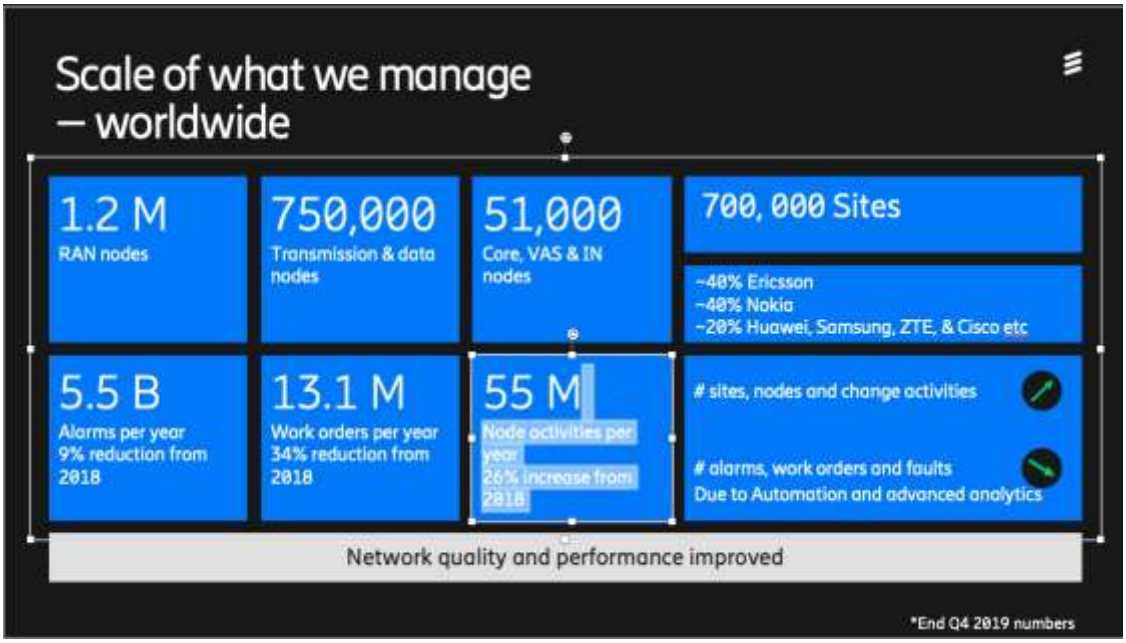


Fig. 2.11. Depiction of the amount of node updates data processing to be done.

Alone in Bharti Airtel use case, we process more than 100k+ node updates data every day from one circle, we are talking 22,00,000 node updates per day. Since we are talking of scale and scalability of the system, we began to think of efficient cloud computing which we wanted us to explore large-scale data warehousing tools and powerful cloud-based machines. We started exploring Amazon AWS EC2 and AWS RedShift for Cloud based machines and data warehousing tools respectively.

Fig. 2.12. Amazon Web Services RedShift

Fig. 2.13 Amazon Web Services EC2

2.3.1 Dashboard Design and Components Breakdown

Data fetching and Report Generating was broken down in two segments which included Software status and Hardware Status.

Further the required categories were discussed which were set to

- Card Hardware Summary
- Hardware Summary
- Software Summary
- Visibility Report
- Status and Health of Equipment

Challenges arrived when the data was classified into unknown patterns with unstructured OEM Classification of server with different IPs. This was solved using Data preprocessing, Data categorization and clustering analysis for the Card Type.

VENDOR	NE Type	AP	BIH	CHN	DL	GJ	HR	HRHP	JK	KK	KL	KOL	MH	MP	MUM	NESA	ORI	PB	RAJ	ROB	TN	UPE	UPW	GrandTotal
HUAWEI	ISM8	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
HUAWEI	EG2D	0	0	0	0	0	0	0	0	2018	290	0	0	0	0	0	0	0	0	0	529	0	0	2837
HUAWEI	CSHO	0	0	0	0	0	0	0	0	6161	1507	0	0	0	0	0	0	0	0	0	2006	0	0	9674
HUAWEI	MODU	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HUAWEI	EG6	0	0	0	0	0	0	0	0	8902	3209	0	0	0	0	0	0	0	0	0	3177	0	0	15288
HUAWEI	CSHU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
HUAWEI	-	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
HUAWEI	EM6X	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	4
HUAWEI	VS2	0	0	0	0	0	0	0	0	1881	1013	0	0	0	0	0	0	0	0	0	288	0	0	3182
HUAWEI	CD1	0	0	0	0	0	0	0	0	1884	1013	0	0	0	0	0	0	0	0	0	288	0	0	3185
HUAWEI	SL4D	0	0	0	0	0	0	0	0	2018	296	0	0	0	0	0	0	0	0	0	640	0	0	2954
HUAWEI	CSHD	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	4

Fig. 2.15. Data for depiction.

Chapter – 3

DASHBOARD SYSTEM DESIGN & REPORT GENERATION

3.1 Overview:

Any SDU working for service provider, let us say SDU Romania or SDU Bharti has 4 stages of operations which decides the data, troubleshooting, processing, integration or field services. Initially automated operations and technical authorized engineers work upon incident management. Which involves Ericsson Operation Engine which seamlessly integrates through CSP and Enterprise solution. In all this process data is stored somewhere on OEM servers which needs to be retrieved for update, solution or troubleshooting. Now this data needs to access from that server if one has

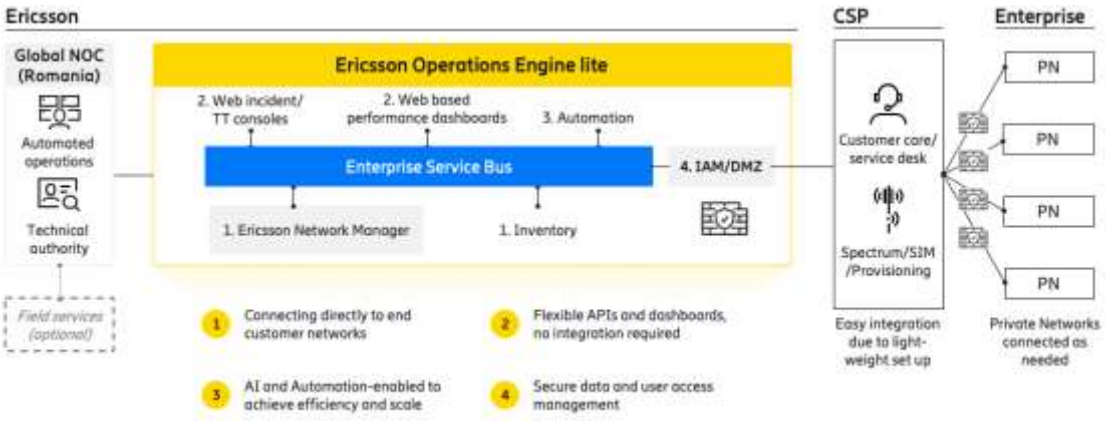


Fig. 3.1. Overview of SDU

3.2 Data Sources:

Data sources are the internal OEM servers distributed across India at 38 locations further distributed in three different OEMs namely

- Huawei
- Ceragon
- Ericsson

3.3 Processes:

3.3.1 CRON Scheduler

The software utility cron is a time-based job scheduler in Unix-like computer operating systems. The use of cron in our case is to fetch data periodically.We use cron to set up and maintain software environments by scheduling specific tasks to process periodically at fixed hours, dates, or specific time periods.

3.3.2 Server Logger

Server logging agent is used to login periodically with using cron scheduler to perform the server login, since the Telecom industry is one of the most security concerned, we are not using FTP for fetching files as its risks being attacked. We are going through OpenVPN TCP with RDP. The server logger will be a utility function to authorize the authentication for the various OEM servers. Different servers require different protocols, so our logger utility was designed to be case based.

3.3.3 File Fetcher:

File fetcher uses Pretty Good Privacy (PGP) for encryption with public keys assigned both sides. Pretty Good Privacy is an encryption program that provides cryptographic privacy and authentication for data communication. PGP is used for signing, encrypting, and decrypting texts, e-mails, files, directories, and whole disk partitions and to increase the security of e-mail communications.

3.3.4 Data Preprocessing:

Data science has been extensively in the project to decide categories, counting numbers from each use cases and displaying over the dashboard.

We have used Python programming languages, NumPy libraries for numerical calculations, Pandas for data exploration and data processing and Matplotlib for displaying, plotting and charting data.

3.4 Outro to the processes and design:

We fetch data from 38 different servers of 3 different OEMs distributed over 22 different circles which records above 1 lakh node updates everyday which required us to design a pipeline which includes mainly 6 components, namely:

- Cron Scheduler
- Data Logger
- Server Logger
- File Fetcher
- Data processing utility
- Charting and Plotting utility

Chapter – 4

IMPLEMENTATION

4.1 Disclaimer:

Not all the project work was completed before the Covid-19 lockdown which had put the project as well as internship on the hold. Some incomplete work would be acknowledged at the time of drafting the report.

The main aim was to develop a Dashboard and Report Generating system which can act as a one stop for generating all the output network reports for the OEM equipment.

Dashboard system setup has different steps involved from the design to implementation part. We begin by collecting all the necessary files from server and copying the source files to the Data Processing phase of system.

Fig. 4.1. Fetching the required files

Most of the files are required to be reformatted as per our need. Some data is discarded while keeping the data required in a fixed format. Data preparation and reformatting is done after it is obtained using the Citrix portal of the Ericsson Internal Data handling system. At the time of fetching the files from source, file validation checks are also done along with the data fetching. Various checks are discussed in the later sections of the document.

Once the data is fetched we perform the checks. After we are done with both, we copy the files to next phase, which is the Data preprocessing phase. Till this step, we have fetched all the data needed for the report preparations. We now create a master database which is needed so that we can fetch specific information for the report preparation. We used AWS RedShift to create the Datawarehouse as the queries can exceed a very large number per day.

Finally, when all the fields are stored, we begin by fetching each parameter with fixed checks of cases to affirm the report generation. We extract all the information required from the master database we had created.

```
#region "LanWan"
if (ReportType == "LanWan")
{
    SQLQuery(ref con, ref dt, "SELECT * FROM `trans`.`router_info` where flag=1 ");

    for (int i = 0; i < dt.Rows.Count; i++)
    {
        TRANZFileDownloader(dt.Rows[i][0].ToString(), dt.Rows[i][1].ToString(), dt.Rows[i][3].ToString());
    }
}
#endregion
```

Fig. 4.2 Report Generation Query

Since we have already achieved the Data retrieval from the server, we will now initiate the report generation which requires us to consider various parameters for the correct data count and updates.

```
#region "SoftHwCardCount"
if (ReportType == "SoftHwCardCount")
{
    ExcelCreator_SoftHwCardCount(ConfigurationManager.AppSettings["RawFilePath"].ToString() + "Backup\\");
}
#endregion

#region "CurrentAlarm"
else if (ReportType == "CurrentAlarm")
{
    ExcelCreator_CurrentAlarm(ConfigurationManager.AppSettings["RawFilePath"].ToString() + "Backup\\");
}
#endregion

#region "LicenseAlarm"
else if (ReportType == "LicenseAlarm")
{
    ExcelCreator_LicenceAlarm(ConfigurationManager.AppSettings["RawFilePath"].ToString() + "Backup\\");
}
#endregion
```

Fig. 4.3 Equipment Count Generation Query

Towards the final step, the reports are exported to the required XLS format required to be published for generating the Network reports. The Dashboard server is provided with the access to the OEM servers using our server logger utility. Once the validation is completed using the checks, we publish the entire circle-wise reports such that the OEM network equipment status can be viewed in the reports in their respective Dashboard feature parameters with the required attributes.

```
#region "QIA_Dashboard"
else if (ReportType == "QIA_Dashboard")
{
    //
    ExecuteSQLQuery(ref con, "delete  from `trans`.`All_Current_Alarm_Hua`");
    ExecuteSQLQuery(ref con, "delete  from `trans`.`temp_alarm_hua`");
    ExecuteSQLQuery(ref con, "delete  from `trans`.`inv_hua_Curralarm_License`");

    Huawei_QIA_Alarm_System();
    Huawei_QIA_Alarm();
    ExcelCreator_QIA(ConfigurationManager.AppSettings["RawFilePath"].ToString() + "Backup\\");
}
#endregion
```

Fig. 4.4 QIA Dashboard Report Queries

4.2 Data Preprocessing Implementation

The Dashboard report generation process required setup to be done from scratch while some pre- developed, customizable codebase could be used.

4.2.1 Requirements: Hardware/ Softwares

Data warehousing framework run on an AWS EC2 setup with the following specifications configured for testing:

- 2GB RAM
- 500Mb of Disk space for storing and caching data from servers.
- Working internet connection is required to communicate the Amazon web services like Simple Storage services, EC2 and Redshift with our dashboard server.

We used AWS services for the testing purposes, however post development the deployment was set to be done on our internal servers which are mainly Linux Solaris based

- Amazon EC2 (Linux OS: RedHat distribution) Orchestration Engine for the entire process.
- Amazon Web Services Redshift: For establishing the RDB and Data Warehousing.
- Amazon S3: Free tire for disk space (free tier 20,000 Get and Put request was used for the testing and prototyping purposes.)

The following access/tools will be needed to communicate with AWS elements:

- Ericsson Managed Services Remote Desktop Access.
- Linux Terminal for communicating to EC2 SSH access.
- SQL: Database queries

4.2.2 Cron Auto Fetch

This utility is designed to perform the cron job to automatically fetch the telecom data to our Relational databases tables which is first stored with AWS S3. This is intended to augment the existing Dashboard Integration which allows transfer of files manually.

Features:

- It can automatically copy the input files from the source to EC2 machine and S3 storage without any request from server or client.
- Auto-fetch is the intial step in the initiation of data query.
- It can maintain logging of all the automated process execution.
- Email updates as notification to the authorized users who are given access to the files on servers with the Internal MSDP, Citrix and SIGNUM accounts.

4.2.3 Cycle Creation and Data Archival

The Dashboard server engine is designed for *"cycle time id and scenario id"*. For each process, the client is configured for cron based job. It uses the cycle, time id and the scenario id to cache the preexisting contents.

There is a provision for archival of data, built into the Dashboard for auto archiving the Redshift data onto S3 files. This is also done based on cron job and the files are stored in flat files on S3 bucket. (We currently tested the storing of files on the S3 storage.)

4.3 Process Trigger

The process needs to be run every day at 1 a.m. and 1 p.m. at the end of the telephony cycle to fetch the processes status. To do that, we devised the triggers in two different ways.

- One trigger method can be done directly by performing the Dashboard init script. This requires all permissions granted and all the data present on the

server locations. It also requires an instruction process control table for the execution.

- Other trigger method is to configure the control tables for auto trigger mode. All the files are fetched as soon as they are generated by the OEM equipment.

Dashboard system has a logging script for logging all the processes which in turn is managed by different logger scripts written in Python. Process logger works in two different levels, one for the basic system level logging which logs details of scripts running, triggers and updates. Another level maintains logs of all the file transfers, copying of files and changes in parameters specified.

It logs all the terminal activities into specified log files.

4.3.1 AWS Infrastructure elements logging

It begins after all the process level logging such that all the RedShift and S3 processes will be logged in with timestamps.

4.3.2 Process Logging

It logs all the completed processes and given any error, it will be logged separately with the error messages for its troubleshooting.

4.3.3 Fetch utility logging

Fetch data utility is used to fetch files/databases to our environment from the OEM servers. It will keep logging all the fetch (get and put) so that we have a log with timestamps.

4.3.4 Source file transfer logging

We fetch the files using our cron fetcher on EC2 machine and they are uploaded onto the Amazon web services Simple storage services storages in respective buckets such that we can process them and map them to the Redshift database. It will keep logging all the fetch (get and put) so that we have a log with timestamps.

Chapter – 5

PROCESS QUALITY ASSURANCE

5.1 Process Quality Check

After reporting data, we need to do quality checks, we use Data Quality Modules or DQM which is designated to perform different types of QC checks on the data used by Ericsson. We need to configure different tables which are in DQM for doing the QC checks.

5.1.1 FQCM

File Quality Check Module or FQCM is used to perform QC checks on the existing files in the servers of OEM. Supported checks in the FQCM are following:

- File Checks: We checks the format of the file, its extension, naming conventions and the file header.
- Data checks: Inside the file we perform the checks involving the uniqueness of data, range check of the data, domain and length of the data available in the file. We also check the NULL status of files, we discard such files.

We performed following QC checks on the fetched data:

- Data Range Check: Only specific range data were to be selected and finals checks using QCM were done for benchmarking the data range.
- Null Checks: Files having null attributes were discarded while fetching and also checks were done after data fetch.
- Data Domain Check: Data needs to be strictly from the specified OEMs servers and in accordance to the specific circle domain, so Domain QCM was used.

5.1.2 Quality Check Module

We use QCM modules for the Quality Checks in the process of moving data from cron based fetcher to the data preprocessing pipeline. Any discrepancies are checked and flagged for corrections.

Various checks done:

- NULL check: Check for the null value. It doesn't require any other attributes for the check.
- File Length check: We check the length of the specified filed to fulfill certain length.
- Type check: We check the data type of the required files.
- Domain check: Data needs to be strictly from the specified OEMs servers and in accordance to the specific circle domain

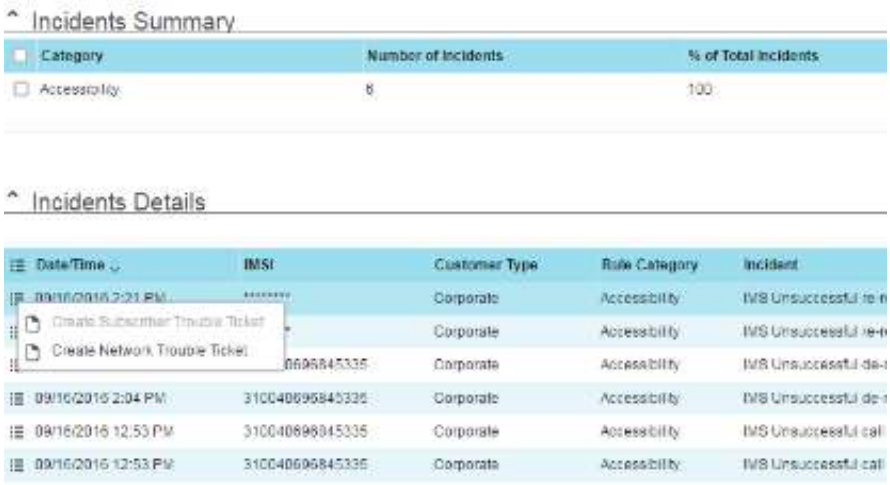


Fig.5.1 Incident check

5.1.3 Process Quality Checks

This module is designed to perform pre-defined QC checks as the process moves through each phase in the project from fetching to displaying.

Following are the Quality check parameters we used for testing the fetched data and processed data.

- Domain Check – Necessarily checks for the correct server and data tagging from the OEMS.
- Range Check – Checks for the ranges of up and down data from the OEM equipment. Minimum and maximum values are expected for the column.
- Type Check – Checks the data type inside the sheets retrieved from the servers. Values which are valid are Decimal, Integer, Alphabetic, Alphanumeric.

Chapter – 6

Learning Outcomes

4.1 Introduction

As the internship begin with the deeper outlook in Networking, Telecommunication and the Managed Services Delivery Platforms, I majorly worked on obtaining the access to the Ericsson services for the handling of raw telecom data. I also completed the very extensive WBL (Web Based Learning) systems which covered the fundamental operations of Ericsson in great details. Additionally, I spent my time configuring the AWS, Citrix workspace, setting up MSDP and the working of the Ericsson managed services networks. I was also responsible for the setting up the servers before handing data from nodes.

4.2 Learning Analysis

Mentors found the work to be satisfactory, designing and brainstorming parts of the project was very fruitful but due to unavoidable circumstances in this Covid-19 pandemic, we could not reach the deployment of dashboard or our program to Ericsson servers. However, I really enjoyed working on data, fetching from servers and designing the final structure of the project.

Chapter 7

CONCLUSION AND LATER WORK

7.1 Brief summary

- Benchmarking of the Dashboard prototype and efficiency against key internal operating standards.
- Assessing the design and purpose served against the scope of the project.
- Analysis of the data to report for possible faults.
- Create actionable reports and deliver to the assigned team.

7.2 Project and Internship wind-up

The aim of the project was to develop an efficient, errorless and quality report generation system such that possible faults are delivered to the team before hand and to reduce their manual work. This is an ongoing project on month to month basis, and still incomplete due to the Covid-19 business contingency plans.

7.3 Future scope

After the completion of the design of dashboard system, and once the project resumes after the Covid-19 crisis, we will begin with deploying the system to our servers with advance data analytics for finding upcoming errors and issues.

REFERENCES

[1] Wikipedia – http://www.wikipedia.org/
[2] Ericsson – https://www.ericsson.com/en
[3] Ceragon - https://www.ceragon.com/
[4] Huawei https://e.huawei.com/in/products/enterprise-networking/switches
[5] Bharti Airtel- https://www.airtel.in/about-bharti/about-bharti-airtel/Our-Brand-airtel
[6] About Ericsson https://www.ericsson.com/en/about-us

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

PLAGIARISM VERIFICATION REPORT

Date: 14-07-2020

Type of Document (Tick): **PhDThesis M.Tech Dissertation/ Report B.Tech Project Report Paper** ✓

Name: Akhilesh Kumar **Department:** ECE **Enrolment No** 161072

Contact No.9829754634 **E-mail. akhilesh_k@outlook.com**

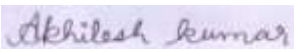
Name of the Supervisor: **Mr. Pardeep Garg (JUIT Supervisor)**
Mr. Arun Saini & Mr. Ankit Srivastava (Sr. Engineer, Ericsson Global India)

Title of the Thesis/Dissertation/Project Report/Paper (In Capital letters):CRON BASED DASHBOARD DESIGN FOR OEM EQUIPMENT MANAGEMENT

UNDERTAKING

I undertake that I am aware of the plagiarism related norms/ regulations, if I found guilty of any plagiarism and copyright violations in the above thesis/report even after award of degree, the University reserves the rights to withdraw/revoke my degree/report. Kindly allow me to avail Plagiarism verification report for the document mentioned above.

- Total No. of Pages = 43
- Total No. of Preliminary pages = 10
- Total No. of pages accommodate bibliography/references = 1



(Signature of Student)

FOR DEPARTMENT USE

We have checked the thesis/report as per norms and found **Similarity Index** at 9%. Therefore, we are forwarding the complete thesis/report for final plagiarism check. The plagiarism verification report may be handed over to the candidate.

(Signature of Guide/Supervisor) **Signature of HOD**

FOR LRC USE

The above document was scanned for plagiarism check. The outcome of the same is reported below:

<table>
<tr><th>Copy Received on</th><th>Excluded</th><th>Similarity Index (%)</th><th colspan="2">Abstract & Chapters Details</th></tr>
<tr><td rowspan="2"></td><td rowspan="4">• AllPreliminary Pages
• Bibliography/ Images/Quotes
• 14 Words String</td><td rowspan="2"></td><td>Word Counts</td><td></td></tr>
<tr><td rowspan="2">Character Counts</td><td rowspan="2"></td></tr>
<tr><td>Report Generated on</td><td rowspan="2">Submission ID</td></tr>
<tr><td rowspan="2"></td><td>Page counts</td><td></td></tr>
<tr><td></td><td>File Size</td><td></td></tr>
</table>

Checked by
Name & Signature **Librarian**

PLAGIARISM REPORT

Report

ORIGINALITY REPORT

9%	5%	1%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Jaypee University of Information Technology Student Paper	5%
2	www.eiseverywhere.com Internet Source	2%
3	Submitted to Heriot-Watt University Student Paper	1%
4	Submitted to Indian Institute of Technology Roorkee Student Paper	1%
5	ulir.ul.ie Internet Source	1%
6	Submitted to Anglia Ruskin University Student Paper	<1%
7	Submitted to University of Newcastle Student Paper	<1%