

AVAILABILITY OF NETWORK WITH ITS MAINTENANCE IN TELECOM INDUSTRY

Anchal Sehgal¹, Dr. Rahul.O.Vaishya²

¹Total Quality Engineering Management, PEC university Of Technology, Chandigarh

²Production Engineering , PEC university Of Technology, Chandigarh

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ABSTRACT: Today the telecommunication is developing extremely fast because of the 4G network communication and 5G stands for the next generation. The communication network must be reliable and maintained by the telecom for their customers. This paper is about how the network is available and maintained by the telecom in Punjab areas and what kind of issues face by the telecom.

Keywords: 4G reliable, network, issues, maintain

1. INTRODUCTION

Telecommunication system have a long history of reliability-based design. These kind of designs are specified in terms of availability, rather than reliability.

Availability is another measure of statistical system performance and is indicative of a system's "uptime" or available time for service delivery.

Telecommunication contracts are written around Service level agreement (SLA) in which performance and operational targets are specified. Service providers (SPs) will sign a contract to provide a service that has specific target for the network being available or a target maximum downtime over a specific time interval². SPs must ensure that services they are providing should achieve the required performance target while customers will maintain expectations from the service requested.

2. RESEARCH METHODOLOGY

2.1. AVAILABILITY

When an item or a system is referred to as being "available", it is inherently implied that the system is working. When an item or system is referred to as "unavailable", it is implied that system has failed. Thus, when applied to a telecommunication item or system, the term availability implies how ready a system is for use.

$$\text{Percentage of Availability} = \frac{\text{total elapsed time} - \text{sum of downtime}}{\text{total elapsed time}} \times 100$$

The system is designed to provide an average life cycle availability of 99.9%. That is, probability that the system is available at any particular instant time is 0.999.

Availability can also be defined in terms of time- dependent function $A(t)$ given by:

$$A(t) = \Pr(X(t) = 1) \text{ For all } t \geq 0$$

$$X(t) = \begin{cases} 1 & \text{if item state is functional or successful} \\ 0 & \text{if item state is unfunctional or unsuccessful} \end{cases}$$

Where $A(t)$ = availability is for a moment to the calculation of availability implies that the availability of an item can change with time. This could be due to a number of factors including early or late item failure, maintenance /repair practice changes or sparing considerations.

The instantaneous availability $A(t)$ is related to the average availability A by the expression:

$$A(\text{avg}) = \frac{1}{t_2 - t_1} \int_{t_1}^{t_2} A(t) dt$$

2.2. UNAVAILABILITY

Unavailability is defined as probability that the system is not fixed at any particular instant in time or over a defined period of time.

Expression for instantaneous unavailability is

$$U(t) = Pr(X(t)) = 0 \text{ for all } t \gg 0$$

Where $U(t)$ = time dependant unavailability

2.3. RELIABILITY

It is used to calculate probability of failure for a single solution component. System's reliability is Mean Time between Failures (MTBF).

In other words, MTBF is the average time interval that elapses before a component fails and repair services.

$$MTBF = \frac{\text{Total elapsed time} - \text{Sum of downtime}}{\text{Number of Failures}}$$

Reliability is a time dependent function. Defining reliability as a statistical probability becomes a problem of distribution selection and metric calculation.

2.4. MAINTAINABILITY

As a metric measure of how quickly and efficiently a system can be repaired in order to ensure performance within the required specifications.

The common metric of efficiency of maintainability used in telecommunication system is MTTR (Mean time to restore/ repair). MTTR refers to average amount of time that a system is "down" or not operational². This restoral period can apply to either planned or unplanned outage events.

In Telecommunication environment, Downtime can significantly impact the availability of our system.

There are two types of downtime in telecommunication:

- a. Due to planned system maintenance such as a "preventive maintenance" (PM), system upgrades and system reconfiguration or growth.
This types of events are typically coordinated with between the system operator and customer and commonly fall outside of contractual availability calculations.

- b. Due to failure in the system that results in a service outage. This system downtime is most commonly of primary interest to system designers, operators and customers.
MTTR is commonly used interchangeably with the term Mean Downtime (MDT).

$$MDT = \text{Sum of MTD} + \text{time of it takes to identify failure \& to dispatch the repair}$$

2.5. MAINTENANCE

Preventive and reactive network maintenance tasks should be priority based on their urgency, which is often embedded in the severity of the associated maintenance alarms, as shown in Table-2.1¹

Table 2.1 Maintenance

Maintenance alarm type	Type of action
Prompt Maintenance Alarm(PMA)	Immediate maintenance activity is usually required
Deferred Maintenance Alarm(DMA)	Immediate action is not required
Maintenance event information(MEI)	Non-service affecting event notification with no immediate action required

Since, an equipment failure can generate addition unwanted maintenance alarms, which in turn can trigger unnecessary maintenance activity , there should be ways of properly interpreting, screening and preventing these unwanted alarms as an equipment failure can generate addition unwanted maintenance alarms

Network maintenance task carefully scheduled during appropriate maintenance windows when potential traffic distribution would have minimal effect on users.

2.5.1 PREDICTIVE MAINTENANCE

The use of predictive tools to help in monitoring the 'health' of the communications equipment. When planning to contract network maintenance to a equipment supplier, it is important to bear in the mind that good management of the maintenance contractors starts by asking the right questions in the request for proposal (RFP) that has been submitted. Network operators can opt to outsource all maintenance tasks to equipment suppliers, or request 24/7 back-end support service for the in- house maintenance staff. As part of the RFP, equipment suppliers should also be asked to indicate their willingness to comply with certain other important maintenance- related requirements, such as:

- Guaranteeing a predefined maximum mean time to repair(MTTR);
- Dispatching personnel to perform corrective maintenance upon request;
- Providing a detailed description of the proposed online technical support;
- Providing all necessary tools and spare parts required to carry any fault;
- Specifying and describing the networking infrastructure covered by the maintenance contract (equipment, UPS system, wirings.
- Timing sources, power distribution panels, racks, A/C systems, etc.);
- Describing the mechanisms used by the repair and replacement service for all hardware
- faults.

Table 2.2 Telco Process

Core	Non-Core
<ul style="list-style-type: none"> • Interconnection services • Network operation center • Network management • Provisioning • Bill rating • Bill collection 	<ul style="list-style-type: none"> • Inbound customer service & technical support • HR, Payroll &accounts • Outbound telesales collection
<ul style="list-style-type: none"> • New services • Long term strategic planning • Market research 	<ul style="list-style-type: none"> • Sales support • Field force management

2.5.2 NETWORK UPTIME

Table 2.3 On calculating the uptime of network using the above mention formula is shown

Row Labels	Average of eNB-UPTIME(%)
Amritsar	99.42844609
Bhatinda	99.56268306
Chandigarh	99.758172
Jalandhar	99.48069968
Ludhiana-1	99.83395397
Ludhiana-2	99.52325535
Pathankot	99.8439111
Patiala	99.54259516
Sangrur	99.89745281
Grand Total	99.61713005

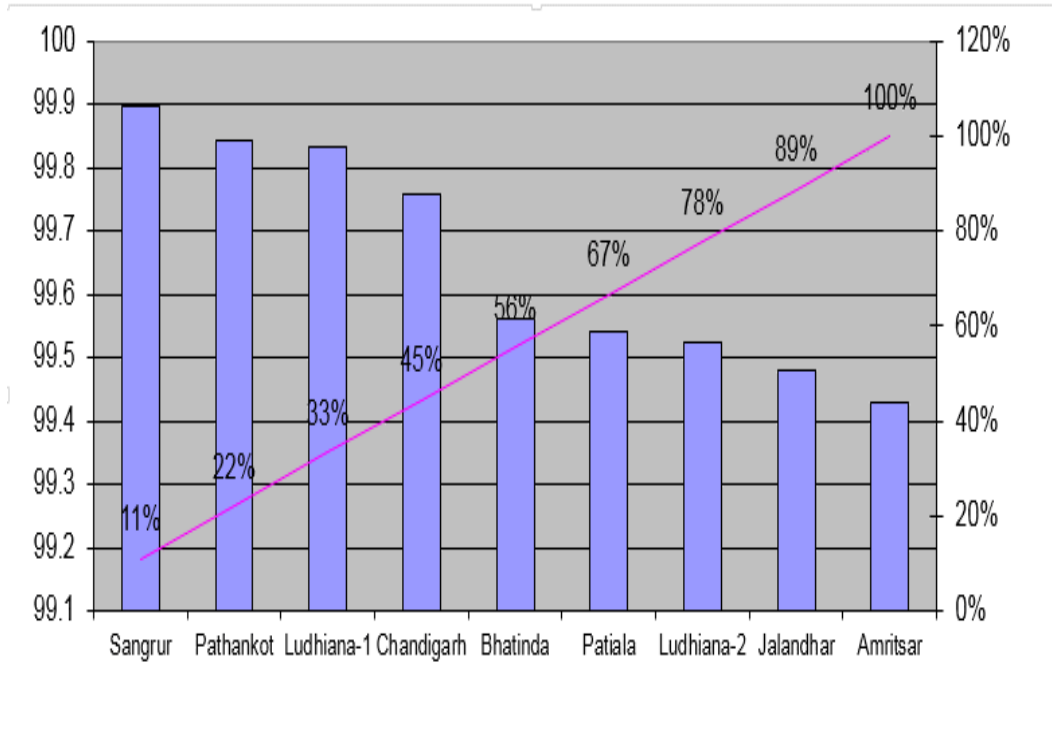


Fig 1. On calculating the uptime of network

2.5.3 Maintenance of equipment's

An equipment can fails the network and can generate the unwanted issues in the network that can trigger unwanted unnecessary maintenance activity. So there should be proper schedule or criteria to prevent that issues.

Network maintenance task carefully scheduled during appropriate maintenance windows when potential traffic distribution would have minimal effect on users.

Table 2.4 Electronics Maintenance Activities at Tower Sites (EnodeB)

EnodeB		Antenna	MW	CSS	
PM	CM	CM	PM	CM	CM
	Line Card Replacement	Cable Replacement	Weather proofing	Patch cord Replacement	Node Reset
	RRH Replacement	Motor Replacement		ODU/MDU Replacement	Node Replacement
	UMUA Replacement	Antenna Replacement	Patch cord Cleaning		

Table 2.5 Electronics Maintenance Activities for all Facilities

Electronics Corrective Maintenance Activities for all Facilities	
SI	Activities
1	Patch Cord/ CPRI Cable/ Power Cable Cleaning and replacement on faults (Routing/ Labelling/ Tieing should be proper after replacement of HW. Faulty Cable/ Cord should be removed)
2	Replacement of Air-Filter/ Fan Module/ Cards/HW/ SFP modules etc. on Faults
3	Support for NE Visibility to NOC and any configuration implementation under the guidance of NOC using console
4	Co-ordination with NOC on Fault Clearance
5	RF Antenna Electric/ Mechanical Tilt, Antenna Height Up and Down, Antenna Replacement etc.
6	Corrective repair of IBS / Wi-Fi Hotspot(AP) switches

PM = Preventive Compliance

CM= Corrective Compliance

2.6 NETWORK DOWNTIME ISSUES

The downtime issues means the system is unavailable at that time. This means the outage of the system i.e., or outage duration of the system is failed to provide the performance of the network or fails to perform it’s primarily function. The issues are basically occur due to equipment failures or the occurrence of unplanned event. Some issues are shown in the below chart. 2.1

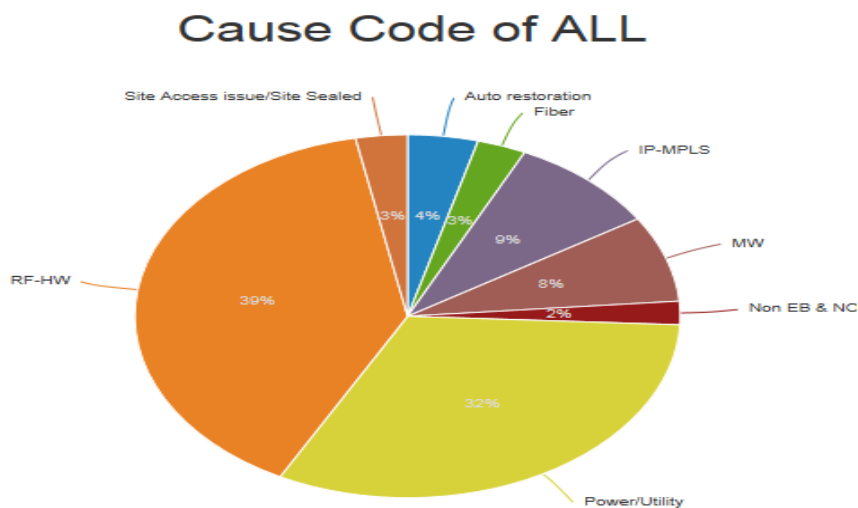


Fig.2 For Network Downtime Issue

3. CONCLUSION

In this paper, we have attempted to define the asset life cycle of network availability and its maintenance in the context of benchmarking standards and also indicated methods and the issues of the area. By highlighting the important academic and empirical issues related to communication network availability and its maintenance, hoping that will triggered more investigations case studies related to this important topic.

4. REFERENCES

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