

# Intelligent OSS (iOSS) a Solution for Modern Telco Network

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**Abstract**— Over the years, Customer's expectations from Telecommunication service providers have increased manifold. They expect greater functionality, higher customer experience with more value-added services. The demand for quicker resolution of customer issues have increased significantly and continuously. Even the investors have raised expectations and looking for greater return on their stakes. Churn of customers to other service provide is one of the greatest concern of the businesses. To meet such expectations, Telecommunication service providers should boost all aspect of their operational efficiency and achieve differential service quality. They must provide a scalable, resilient network and IT infrastructure to meet the customer demands and experience. They must greatly reduce the Opex costs. Moving towards OSS transformation, service providers are preparing to deliver complex services in the evolving landscape of next generation mobile communications and digital transformation. Thus, moving towards the intelligent OSS (iOSS) as next generation OSS transformation has brought lot of benefits, to the customers as well as the businesses. It has helped in delivering customer and service oriented. It has helped in increasing the revenue through various mechanism such as alignment of infrastructure, integration of data and information, consolidation of the tools and data. This paper describes the ways in which the iOSS transformation can be implemented in secure Telco cloud environment.

**Index Terms** - Assurance, iOSS, OSS, Telecommunication, Transformation

## I. INTRODUCTION

Operations Support Systems (OSS) have always been a critical system for any communication service providers (CSP). OSS is a group of various software or computer programs and IT systems used by CSPs for monitoring networks, controlling, analyzing and provisioning various network data, functions, network devices and IT subsystems.

OSS software is specifically dedicated to telecommunications service providers. In this paper we examine the need and history of OSS from the perspectives of maturing Network Operations support for various domains like Service Management, Service

Assurance and Customer Experience Management. Various Network Equipment Providers (NEPs) developed advanced OSS to support CSPs' networks.

OSS is mainly used by CSPs for supporting network provisioning, network planning, service [provisioning and fulfillment, service assurance for various services provided by CSPs to their customers as well as internal services used for customer services like Inventory management, configuration etc. Other OS functionality includes data reporting, analytics, correlation and aggregation, resource and asset planning. OSS data is of strategic importance to measure the impact of operational performance of network as well as services.

This paper talks about next Generation OSS and provides transformation strategy to achieve the same. Replacing the current OSS infrastructure to cope of with the stringent requirements of next generation network (NGN) and the range of services this network will support, is the need of the hour.

Next Generation OSS transformation helps in supporting better network planning, network provisioning, service fulfillment, and service assurance from a common core of service and resource management. It also helps in delivering functionality such as embedded analytics, correlation and aggregation, reporting, product life cycle management, multichannel support, resource and asset planning. OSS data is of strategic importance to measure the impact of operational technical processes on customer and business goals.

## II. NEED FOR INTELLIGENT OSS (iOSS)

**Evolving Technology** - Changes in the network ecosystems due to innovation of technology areas like SDN/NFV, 5G, IoT and other services

**Customer Demand** - Demand from customer increasing with the expectation to have better, quicker and faster services with the capability to detect the problem prior to its occurrence

**Transform to Digital Services** - Expectation to deliver Omni channel experience with the capability to drive the network and fulfil customer expectations

**Proactive Problem resolution** - Capability to identify the issue within the Network prior to it being noticed by Network Operations Centre (NoC) team and provide the necessary recommendation of resolution or ability to resolve the issue automatically.

By modularizing the OSS domain into its constituent

parts, Telecom Service Provider can focus on their individual business challenges, with real emphasis on operational agility. This becomes an accelerator for success in the new world of Next Generation Networks

III. KEY CHALLENGES

Below are a few key challenges to move towards iOSS journey of Next Generation OSS Transformation. Each of the below challenges can be addressed with due diligence and proper design, implementation and operations.

- a) Resistance to Change
- b) Data Privacy & Security Compliance
- c) Integration Challenges
- d) Engagement with Multiple Vendors
- e) High Cost
- f) Performance Issues
- g) Migration of Live Traffic & Customer
- h) Integration & Management of Multi-Cloud Environment

IV. INTELLIGENT OSS MARKET SIZE

The market size of next generation OSS and BSS has been valued in 2016 at USD 29.79 billion and is presumed to gain traction over the forecast period. Intelligent OSS will be helping telco service Providers predicting the consumer churn as well as in measuring customer experience. Also, service providers are improving in business operation process and their growth using these OSS transformations. For enhancing the growth in market, iOSS will play a major role and driver of growth over the forecast period.

U.S. next generation OSS & BSS market, by architecture, 2014 - 2025 (USD Billion)

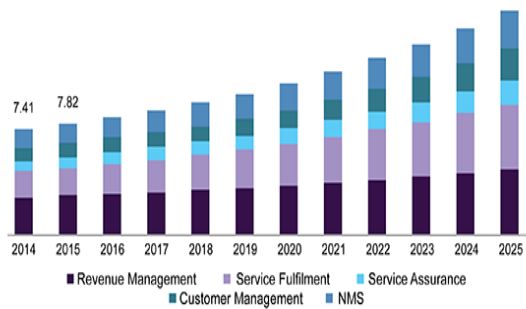


Figure 1: iOSS & BSS Market

Operations Support System (OSS) and Business Support System (BSS), are used by CSPs for service assurance, service fulfilment, customer service and billing. CSPs are being transformed continuously due to change in technologies and way data is being managed. Virtualization of network components and software-defined network have enabled the service provider network to come down to a solution. These functionalities will further boost the demand for intelligent OSS market

V. OVERVIEW OF IOSS

The iOSS can be achieved by having a well discussed and thought out strategy. A few of the aspects are listed below:

- a) Deployment/Migration of OSS Applications in various public, private or hybrid cloud
- b) Integration of OSS applications with Network and IT Stack
- c) Provide E2E visibility across IT, Networks, Services and Customer Experience
- d) Enable Process Automation & Service Orchestration
- e) Enable full control and management of business risk, service disruption and failure by supporting best-practice processes such as ITIL and eTOM.
- f) Centralised Fault and Performance Management capabilities across the New IT & Network
- g) Auto ticketing of events/alarms based on rules and policy for all domains in IT and Network
- h) Actionable analytics to improve the Customer Experience and QoS

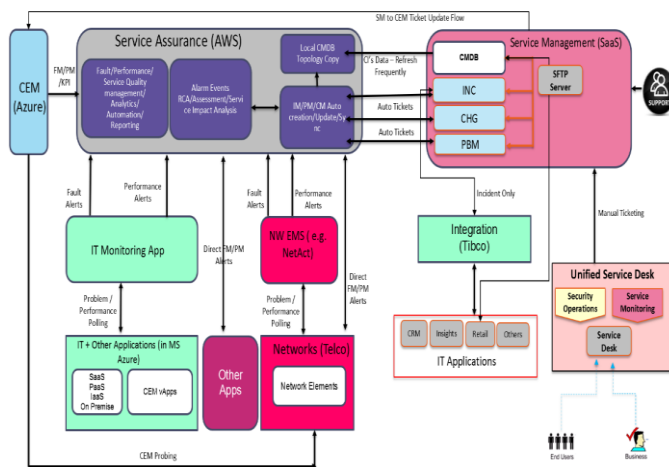


Figure 2: View of iOSS

In Figure 2, which is the overview of the iOSS, the stack of the core network as well as IT stack are shown. It showcases the end to end view of the flow of events/alarms from network and IT components towards Service Assurance. Service Assurance has integration with Service Management CMDB for latest copy of network and IT inventory for correlation/root cause analysis and service impact analysis. CEM system has integration with Service Assurance for sending alarms/events based on faults or KPIs based on CDR analysis. We will discuss the solutions of each of the domains of OSS in below sections.

VI. SERVICE MANAGEMENT

The Transformed Service Management provides an environment to support the dynamics of constant business evolution. It enables control and management of business risk, service disruption and failure by supporting best-practice processes such as ITIL.

The Configuration Management Data Base (CMDB) hosts the relevant network and IT data to ensure Service Management and Assurance processes are executed efficiently and effectively.

A. Intelligent Solution

- a) Deployment of Service Management to Cloud

- b) Extensible, Resilient, Scalable cloud platform that is easy to upgrade and maintain
- c) Alignment of Support Processes to have a unified Single Process across the Organization each for incident, problem, change, work order, service request tickets.
- d) Automation of the single unified support process
- e) Create new services quickly and easily for any line of business
- f) Single Automated Inventory Configuration Management DB integrated with Network and IT.
- g) Complete automation for changes in network or IT Stack
- h) Configuration and Management of Enterprise SLAs and Operational KPIs
- i) Report Dashboard, SLA Monitoring,
- j) Extensive Knowledge Base of known issues
- k) Extensive Knowledge Base of known issues
- l) Automated Self Service Portal for Employees and Support staff.
- m) 360 view of Service inventory consumed by the individual customer. Services are defined according as per SID model and are customer-facing services

- b) Deliver deep solution and implementation expertise and resolution of technical constraints
- c) Single point of contact for all integration and interface delivery within time and budget parameters.
- d) Connecting business users to IT services anywhere, anytime, on any device
- e) Automated ticketing for Incident/Problem/Change based on Alerts
- f) Intelligent incident ticketing based on monitored events
- g) Automation of inventory management & network Quick turnaround of resolution of trouble tickets
- h) High Operational Efficiency up to 60%
- i) Automatic deployment of network and IT services due to automated network and resource topology

**B. Business Benefits**

With Transformation of Service Management, the Telco would get the following Business outcome:

- a) Reduced operational costs and resources

**VII. SERVICE ASSURANCE**

As part of the transformation towards cloud for network operations, Telecom Service Provider has built a Service Assurance Platform. The E2E Service Assurance solutions aims to provide centralized Fault and Performance Management and End-to-End Service monitoring/assurance and automation capabilities across the IT and Core Network components including transformed RAN.

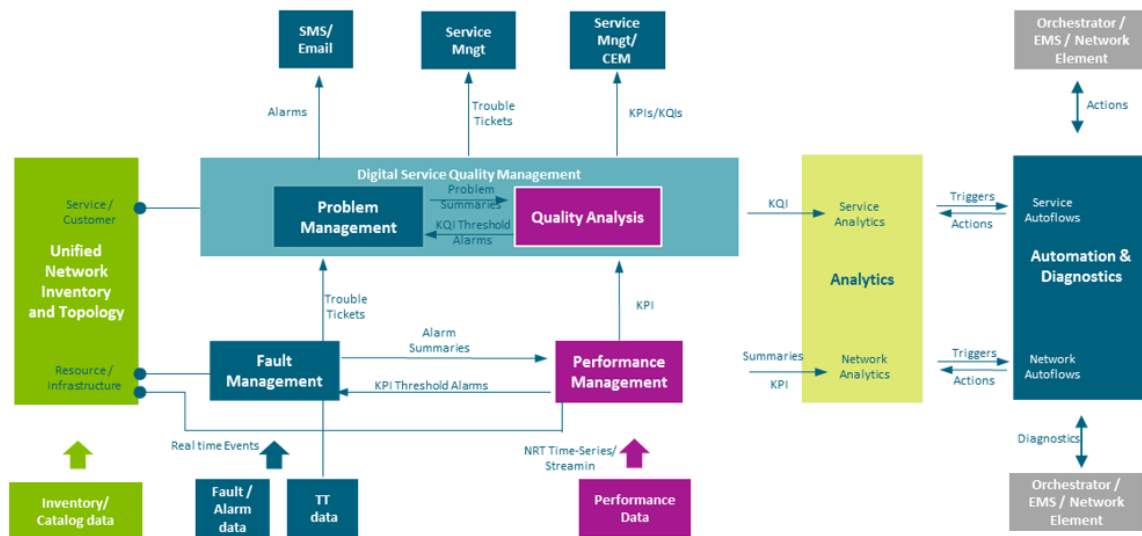


Figure 3: Service Assurance Solution

**A. Service Assurance Functionalities**

The below table captures the functionalities that have been built in the intelligent Service Assurance application.

**Table 1: Service Assurance Functionalities**

Functions	Description
Service Performance Monitoring	<p>Measure the performance of a service against the expected performance and identify areas for improvement.</p> <ul style="list-style-type: none"> <li>• Events monitoring and management.</li> <li>• Events filtering</li> <li>• Service performance monitoring and management</li> <li>• Service quality thresholds</li> </ul>
Manage Customer Assurance	<p>Ensure that all provided products to the customers are continuously available and performing to given product KPIs. This includes the execution of proactive (e.g. manage an incident event or communicate on measured performance) and reactive (e.g. respond a customer's request) activities including all recovery activities.</p>
Provide Reports	<ul style="list-style-type: none"> <li>• Report on performance of services &amp; underlying entities to provide Management Information to measure and increase the efficiency of operational activities.</li> <li>• Fixed Reporting, Ad-Hoc Reporting, Dashboard Reporting, Analytics &amp; Reporting</li> </ul>
Fault Correlation	<p>Analyse a large number of faults and within these identify the key events that are causing the issues within the large mass of information.</p> <ul style="list-style-type: none"> <li>• Incident &amp; Problem Enrichment</li> <li>• Incident &amp; Problem prioritization</li> </ul>
Root Cause Analysis	<p>Analyse dependencies between events identified and understand whether some events can be explained by others.</p> <ul style="list-style-type: none"> <li>• Customer &amp; Service Impact Assessment</li> </ul>
Planned Outage Management	<p>Understand when planned maintenance is going to result in downtime and schedule the maintenance for an appropriate time in order to reduce the impact the outage will have on services.</p> <ul style="list-style-type: none"> <li>• Events monitoring and management</li> <li>• Suppress alarms generated by CIs under scheduled maintenance</li> </ul>
Identify Impacted Customer & Network Services	<p>Capability to identify all customers impacted by a network fault or outage in order to manage communications and service continuity for those customers.</p> <p>Incident &amp; Problem Enrichment</p> <ul style="list-style-type: none"> <li>• Customer &amp; Service Impact Assessment</li> </ul>
Identify and Manage Alerts	<p>Capability to identify IT &amp; network alerts / alarms including correlation and prioritization in order to handle and resolve appropriately</p> <ul style="list-style-type: none"> <li>• Customer Notification Messaging</li> </ul>
Manage & Resolve Network Outages	<p>Capability to identify, manage and resolve planned and un-planned network outages in order to reduce the impact the outage may have on services.</p> <ul style="list-style-type: none"> <li>• Customer &amp; Service Impact Assessment</li> </ul>
Manage Service Notifications	<p>Capability to trigger outbound notifications to individual user or groups of users based on certain events such as service outages, order milestone updates, etc.</p> <ul style="list-style-type: none"> <li>• Users Notification Messaging</li> </ul>
Visualising Trouble Tickets	<p>Capability to record and track customer 'trouble tickets' in response to incidents, complaints or service queries,</p>
Inform Users	<p>Capability to keep customers informed of service status and progress towards fault resolution and distribute and publish reports to user community</p> <p>User Notification Messaging</p>
Manage Availability	<p>The capability to define, analyse, plan, measure and improve all aspects of the availability of service assets. Availability Management is responsible for ensuring that all Service Assets and related processes, tools, roles etc. are useful for the required Service Level Targets for Availability.</p> <ul style="list-style-type: none"> <li>• Events (Alarms/Alerts) Monitoring &amp; Management</li> <li>• Events Filtering</li> <li>• Events Aggregation &amp; Correlation</li> <li>• Events Enrichment</li> <li>• Service Capacity Monitoring &amp; Management</li> </ul>
Operate Network	<p>Capability to manage the entire network including monitoring and maintenance in order to keep the network available</p>

	<ul style="list-style-type: none"> <li>• Events (Alarms/Alerts) Monitoring &amp; Management</li> <li>• Events Filtering</li> <li>• Events Aggregation &amp; Correlation</li> <li>• Events Enrichment Service Capacity Monitoring &amp; Management</li> </ul>
Manage Network Performance	<p>Capability to track the network performance against pre-defined Key Performance Indicators, identifying and reporting on areas where the network is under performing.</p> <ul style="list-style-type: none"> <li>• Service Capacity Monitoring &amp; Management</li> <li>• Service Capacity Thresholds &amp; Alarming</li> </ul>
Network Monitoring	<p>Capability to continually monitor the network for issues such as slow, over utilised or failing components or a network outage notifying the network administrator of this information.</p>
Auto Flows	<p>Capability to initiate the workflow towards automation engines and ingest update against respective resources and service details from Service management.</p>

### VIII. CUSTOMER EXPERIENCE MANAGEMENT

The Network Customer Experience Management solution aims to provide a comprehensive capability for monitoring the Subscriber, Service and Network Experience at various levels.

It provides a solution which can monitor the proposed Telco cloud network and 3G CS legacy network providing network and customer analytics capability. This will increase Telco business revenue due to higher customer retention and better network. At the same time the solution will provide more accurate KPIs enhancing the capabilities to detect and resolve network issues.

The CEM solution will improve the customer experience and provide right level of information at the right time to support the end customer

#### A. Transformed Solution

Core CS, IMS and Messaging frames are captured and processed by the probes to generate TDRs. They are collected and processed by the processing engines, which generates the corresponding CDRs, and routes them to the Mediation in charge of storing them for further retrieval. Mediation notifies CEM application on Network topology updates. It updates Storage for referential data.

In parallel xDR processed by the engines are sent to the Big Data which convert them in required format and send them to Kafka cluster. Kafka cluster allows to consume and route the xDR toward spark cluster where xDR ingestors process, classify the xDR, to be stored in Azure Data lake Storage.

CEM solution includes the following components:

- CEM applications, probes, storage in the loud.
- Analytics application in the cloud

#### B. CEM Functionalities

- The enrichment of the CDR delivered by the probes
- The storage of the enriched CDR in the Storage
- Fully customizable UI displays KPIs computed on demand from xDRs.
- Deriving various KPI/KQIs as per requirement

- Integration with Service Assurance and Service Management applications
- Deriving key business intelligence for multiple applications used by various teams: Optimization, Customer Care, Supervision, Marketing and Management.
- Helps mobile operators to understand subscriber usage & behaviours in relation to data services, enhance user experience (QoE) for multiple services with advanced QoE KPIs, troubleshoot problems impacting subscribers and optimize mobile network performance and QoS

CEM Analytics applications provides a set of

predefined dashboards related to a defined objective. List of applications:

- Service Quality Management
- Customer Experience Management
- Device Management
- Roaming
- Network Performance Management

#### C. Business Benefits

With CEM Transformation, the Telco would get the following Business outcome:

- Strengthen the customer perception of our network as the most reliable network.
  - By proactively understanding issues impacting customer experience and providing customer support
  - By prioritizing operational resources, network performance improvement and network investment based on the scale of customer impact
  - By providing right level of information to other projects/teams for quick actions and resolutions
  - By providing Subscriber, Service and Network monitoring, troubleshooting and diagnosis
- Maximize the value (revenue/margin) generated from our customers.



- i. By tailoring upsell/cross sell offers to individual customers based on their customer experience index as a metric
- ii. By providing the customer data insight
- iii. Actionable analytics to improve Customer Experience and Quality of Service

### IX. AUTO TICKETING

Having an integration between Service Assurance (SA) and Service Management (SM) applications provides the ability for auto creation of the trouble tickets.

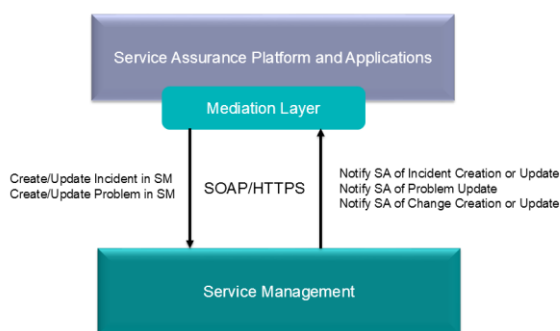


Figure 4: Auto Ticketing on Events

The rules and policies defined within SA will identify events/alarms eligible for Incident, Problem or Change creation. These policies will typically vary per Domain and is driven by solution-based use cases designed and configured as per the operational requirements.

SA interfaces with Service Management offers the capability to create and update Tickets and associate them with alerts and affected services.

SA offers reporting capabilities on Trouble Ticket information based on a variety of indicators. The SA reporting function uses source data from SA’s internal TT repository, which holds up-to-date ticket data and status. Resolved Tickets will be retained for a period of 3 months, this is configurable.

SA includes functionality to initiate a synchronization activity with Service Management, retrieve and update Incident, Problem and Change Tickets from Service Management. SA will define the synchronization time-window scope and query SM by timestamp. SM will return Tickets against SA-managed Entities updated since the timestamp. The synchronization will be initiated during the start-up of the SA platform and can be scheduled to be called periodically.

#### A. Rules for Auto Ticketing

SA does not automatically create an Incident ticket if it has already raised it against the same Entity for the same Primary Event or Root Cause Alarm (RCA) and the Ticket is Open in SM. In this case, if additional alarms arrive that correlate with an existing RCA the new alarms will enrich the existing Incident Ticket (provided the ticket is still

Open in SM) rather than create a new one.

The Event lifecycle is not affected by an update to the associated Incident Ticket (e.g. status update of the Incident Ticket). However, when an Event clears, any Incident Tickets for whom this Event was a Primary Event or RCA will be set to Resolved status.

A Ticket remains associated with its Primary and Associated Events, even when the Ticket is set to status Closed or Resolved or when the Event Clears. SA Archiving of a Clear Alarm does not affect the lifecycle of an associated Incident Ticket. SA will update an Incident Ticket to:

- Change its status, i.e. Resolve the Incident, triggered by automated event clearance
- Add/remove child events and affected services (e.g. when new events are also associated with the RCA of the Ticket)
- To update the Impact and Urgency values following recalculation due to changes in the Primary or RCA severity

SA will also update Configuration Item (CI) Relationships, which will add or remove additional affected Services to the Incident Ticket as a result of SA's Service Impact Analysis. SA will calculate the Incident Ticket's Impact and Urgency based on a combination of:

- The “Service Level” category of the managed entity of the Primary Event in SA (i.e. of the Event that triggered the creation of the Incident Ticket). This is derived from CMDB.
- The Primary Event's Severity
- The Primary Event's Name (Optional, for additional flexibility, so that rules can be configured for specific Alarm Names)

SA will Clear the Route Cause Alarm/Primary Event based on the Clear from Network Element (NEs)/Application or an Operator can update the Incident Ticket status to "Resolved" in SM

#### B. Auto Ticket for Change

Service Management will create Change Tickets for SA Managed Entities for maintenance activities. For Changes with associated Outage Windows, SA will not auto-create Incident Tickets for events against affected Managed Entities for the duration of the Outage Window. The events themselves will not be suppressed, the display of the alarms themselves will carry an indication that the entity is currently under a change and has planned outage. No special processing of Events (and their associated Incident/Problem tickets) that pre-exist when the Outage Window opens will be carried out by SA, either before or after the closure of the Outage Window.

SM will also update CI Relationships to pass information on the Managed Entities Outage Window. It is expected that SM will pass:

- A single Child Ticket of type “Unavailability” which provide information on the outage window “CI\_Unavailability\_Start\_Date” and “CI\_Unavailability\_End\_Date”. These field in this

record will be used to drive SA behavior during the outage.

- One or more Child Tickets of type “Configuration Item” which will provide CI Names (in the Child\_Record field) of the CIs that are affected by this Change Ticket

## X. RECOMMENDATION

The recommended approach for Telecom Service Provider which has large legacy footprint and large network and IT operations needs to be a phased approach. Identification of applications that can be migrated to the cloud requires an examination of architectural readiness, maturity and capability, in conjunction with an evaluation of the OSS landscape of the Telecom Service Provider. The deployment approach needs to be decided based on the scale of operations of the Telecom Service Provider. We propose a step-by-step approach for migrating to OSS on the cloud for the following three stakeholders:

### A. Review

- High-Level Statement of Work & Detailed Project plan
- Stakeholder Map, RACI and Comms Plan
- Customer Requirements
- Use cases
- Identify As-is Systems/Applications for capability, readiness & maturity
- Identify As-is Processes and its scope for optimization
- Current Metrics
- Priorities, KPIs, SLAs, KQIs,
- Knowledge Repositories

### B. Analysis

- High-Level Statement of Work & Detailed Project plan
- Evaluation of all elements
- Product roadmap of vendors, architecture and also if they have cloud support
- Gap identification & analyses (applications, process, systems, metrics)
- Identify applications for replacement or upgrade
- Draft to-be architecture
- Draft to-be solution and processes
- Identify the vendors/partners and review with them
- People and Support Org. analysis & observations
- Metrics analysis
- Identify dependencies

### C. Strategy and Planning

- Full analysis report
- Critical business input(s), Benefits statement & Business justification
- Roadmap to implement changes
- Define System Architecture and processes
- Phase Scope and Project Plan

- Review with stakeholders

## XI. FUTURE OF OSS

Next major shift for telecommunication service providers in OSS transformation is to move towards automation of most customer and network issues which require operations support currently. Also, integration of transformed OSS with other tools to automate the processes & tasks. This would bring down operational costs to significant level.

As the telecom market has become increasingly competitive, service providers have been under pressure to cut operational costs and maximize operational efficiency. Automating as many OSS processes and tasks as possible, will allow service provider to cope with larger volumes and faster process execution and significantly reducing cost. This will be the future.

OSS Security is also utmost important these days, hence consideration shall be done to avoid any security threats / vulnerabilities in OSS. In next research paper authors will focus more on OSS Security.

## XII. CONCLUSION

In this paper, we concentrate more on the iOSS in the telecommunication environment from the perspective of Service management, Service Assurance and Customer Experience Management. The telecommunication plays a major role in our day to day life, everything is digitalized and transformed in the current trend. Though OSS transformation seems to be a costly affair for business, it brings in huge benefit of reducing long term operational cost and delivering high value to the customer and businesses. The way OSS can be transformed has been explained in depth. If the key aspects defined are implemented and executed in appropriate manner, this would help the business to deliver more services, high customer experience & significant benefits to the customer.

## FUTURE WORK

Future work needs to be done to automate various recurring customer issues to provide self-resolution and to automate other IT processes and tasks in order to bring further operational efficiency and further reduce Opex costs. Authors are working towards these topics and expected to publish as a separate research paper soon.

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