IBM | Tech Mahindra

Recover First, Resolve Next

Towards Closed Loop Control for Managing Hybrid Networks

Connected World.
Connected Solutions.

CONTENTS

Target Audience

The intended interest group for this paper includes :

- Communication Service Provider (CSP) /Telco and Network/Service Operators
- Operations, IT, Planning & Optimization, Field Services
- OSS Suppliers / System Integrators
- Network Equipment and Application/Service Suppliers
- Other Standards Development Organizations and members interacting with Operations Support Systems (OSS).

Executive Summary

IBM and Tech Mahindra are partners in the TM Forum ZOOM catalyst project 'Recover first, Resolve next' – towards closed loop control for managing hybrid networks. The solution demonstrates Service Level Agreement (SLA) driven closed loop control, for automated fault recovery and remediation of service performance issues. The sponsors of this catalyst solution are AT&T, Orange and KDDI Labs.

This catalyst solution is for a mobile CSP expanding their network with virtualized Enhanced Packet Core (vEPC) functionality. It demonstrates automated end-to-end service assurance, utilizing service specific analytics, to provide closed loop recovery to maintain agreed service levels for end-customers. This joint ally uses industry standard APIs to provide seamless integration between the OSS and a multi-vendor, multi-function Network Function Virtualization (NFV) layer. It manages a hybrid network comprising traditional 2G/3G/4G LTE and virtualized network infrastructure.

The context for this solution is the changing telecom landscape where CSPs are planning to virtualize the network and collapse Telco and IT operations silos to a single set of standard Data Centre/Cloud processes and infrastructure. These progressions are expected to deliver the agility required for rapid rollout of new services with real-time expansion and contraction of network function capacity as and when needed.

IBM is uniquely positioned to help CSPs make this transformation based on over 20 years experience in serving CSPs manage their networks, its leadership in IT cloud, and market leading position in CSP service assurance.The go to market strategy adopted by IBM, along with vendors, providing complementary end-to-end solutions is their USP.

The synergies between IBM and Tech Mahindra have brought about the focus on Virtual Network function (VNFs) which will be integrated with OSS largely provided by market leaders like IBM. Tech Mahindra is also uniquely positioned to offer interoperability and VNF certification testing, performance tuning and SDN/NFV network transformation services.

Note on TM Forum ZOOM and ETSI MANO

Network Function Virtualization (NFV) as standardized by ETSI is set to transform the way that network operators architect and deploy networks. Network equipment available today as dedicated appliances from traditional network equipment vendors, will over time be replaced by network functions in software, that can run on a range of generic industry standard high volume, servers, switches and storage in the Cloud Data Center. These virtualized network functions (VNFs) can be instantiated or moved to various locations in the network as needed, without having to install new equipment. NFV Management and Orchestration (MANO) is the ETSI defined framework for the management and orchestration of all virtualized resources in the cloud data center including computing, networking, storage, and virtual machine (VM) resources.

TM Forum's Zero touch Orchestration, Operations and Management (ZOOM) project complements the on-going standardization work within ETSI. ZOOM defines the management functions, business processes, APIs, etc. required to enable automation, scalability, and agility. It aims to 'rewrite the rulebook for operations in the digital world'. It focuses on end-to-end management of an infrastructure where compute, storage and network aspects are all virtualized.

This catalyst project will provide input to the ongoing standards development work of the TM Forum ZOOM project.

Catalyst Solution Overview

The catalyst solution offers the ability to remediate quickly from an SLA breach situation by automating 'Recover First' from a fault or a 'performance degrade' scenario, possibly scaling up or migrating the Virtualized Network Functions (VNFs) to smoothly continue operations. 'Resolve Next' implies that any issue in the application or infrastructure can be resolved post recovery. To demonstrate 'Resolve Next' in action, the solution focuses on the virtualized Evolved Packet Core (vEPC) network function.

Using automation to overcome the management challenges of hybrid networks, it demonstrates manageability and interoperability between VNFs, VNF Managers (VNFMs) and OSSs in a multi-vendor environment. The project will generate key insights for operators regarding the framing of SLAs with VNF providers, and will deploy business rules and policies to address additional fault conditions introduced by virtualization.

Service Performance/SLA Management requires data collection from multiple layers (physical, virtual, and logical), calculation of KQIs, and linkage to SLAs. The solution provides automated SLA driven closed loop control to remediate Service Performance issues, based on service level performance monitoring of the virtualized network infrastructure.

Managing the Agile Infrastructure

CSPs are moving into a new era. Investment focus has moved from the siloed telecom operations processes of fulfillment and assurance towards integrating orchestration and management of a virtualised cloud based infrastructure that includes networking. This opens up new possibilities for service provider innovation to shorten the time to market for new services, and lowering OPEX and CAPEX.

Managing an agile infrastructure requires an analytics driven approach combining infrastructure, service and customer experience analytics with more automated core operations management capabilities of fault/event, network topology, performance, configuration and policy management.

To support CSPs, vendors need to collaborate on key use cases, to increase the range of virtualized network functions supported, and build out integrated service orchestration & management solutions that are ready for CSPs to deploy.

This new operations environment requires dynamic management, where networking resources are automatically moved to where they're required. This enables systems operators to effectively manage peaks and valleys in demand, use fewer networking resources operating at higher rates of efficiency and utilization, thereby resulting in fewer disruptions in service and more automated systems management. Applying cloud technologies to networking in a hybrid environment will enable a CSP to quickly re-route bandwidth to a city or region where access is disrupted by a natural disaster or unexpected surge in usage. It will also enable CSPs to offer Enterprise customers higher value cloud based network services.

Hybrid-network Management Challenges

The siloed organization and OSS process model that served CSPs as they upgraded from 2G, to 3G/4G LTE will not continue to support them as they extend their network coverage and capacity with software controlled cloud network infrastructure. CSPs will need to focus transformation on service management of the hybrid network and adopt new ways of working to enable cross-team collaboration.

Today, the mobile CSP's Network Operations Center (NOC) team manages the end-to-end mobile network. With the addition of virtualization, for example, in the mobile packet core, i.e. vEPC, it's the CSP's IT/ Data Center team that provides this Virtual Network Function as a service, according to an agreed service level based on pre-defined key performance metrics. The imperative for the IT/Data Center will be to recover first from any issue to maintain service availability and performance.

CSPs will consolidate event analytics for the IT/Data Center/Cloud infrastructure for insights into recognizing common or recurring patterns of behavior so that run-book driven remediation can be automatically applied. Both teams will have their own set of usage and performance analytics. The NOC will manage all elements of the service delivery path, i.e. across physical, logical and virtual elements, including connectivity to the mobile end user's access device. It will also need to manage the application quality of service experienced by mobile end-users.

An Agile Operations Scenario

A CSP's Network Operations Center (NOC) manages the end-to-end hybrid mobile network and uses virtualized network functions, e.g. vEPC, provided 'as a service' by the CSP's IT/Datacenter department. The IT/Datacenter is responsible for the virtualized infrastructure providing many virtual functions, e.g. vCPE, vCDN, vIMS etc. to both internal and external customers.

The NOC has end-to-end visibility managing across physical and virtual elements, and end user applications. The IT/Datacenter has visibility across VNFs and also into the underlying infrastructure supported, and may provide analytics data views to the NOC.

The NOC and IT/Datacenter will be bound by a set of Service Level Agreements (SLAs)/Operational Level Agreements (OLAs). These will be based on performance metrics provided by the IT/Datacenter and the NOC's own set of measurements across the hybrid network. Scale In/Scale Out to meet demand will happen automatically to avoid an SLA threshold breach.

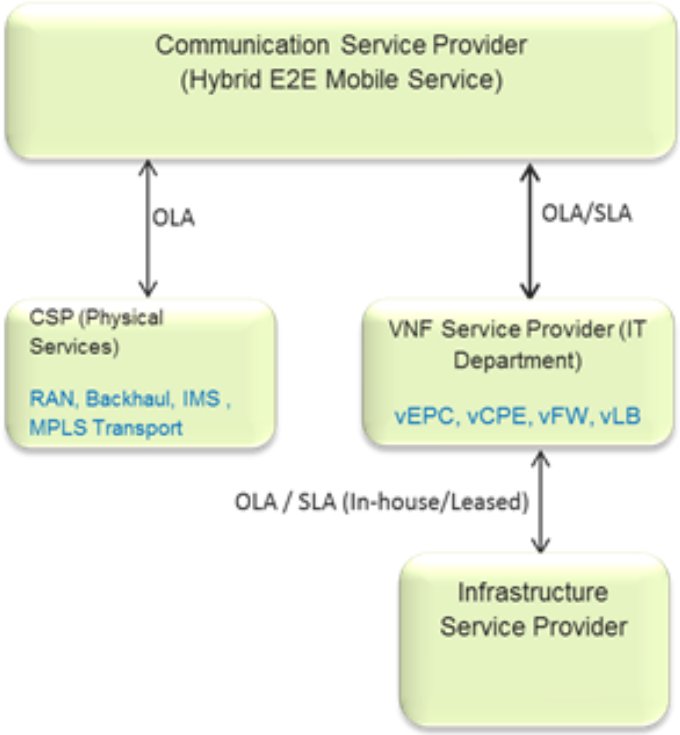

Figure 1 Managing Performance to meet Service Level Agreements

Solution Architecture Overview

The solution architecture comprises IBM's analytics driven orchestration and assurance capabilities integrated with Tech Mahindra's carrier grade Virtual Evolved Packet Core (vEPC) solution that scales independently for control and data plane surges. IBM's service assurance capabilities detect performance degradations and root-cause fault/events impacting contracted service levels, driving the closed loop management process where automatic scaling up or down of the infrastructure takes place as needed.

Tech Mahindra's vEPC includes a custom developed VNF Manager that enhances Open Source Cloud platforms for carrier grade requirements of virtual network functions. The VNF Manager is integrated with IBM's OSS / Orchestration Stack comprising IBM Cloud Orchestration, IBM Netcool policy, event and performance management capabilities, and IBM Now Factory for performance and customer experience analytics.

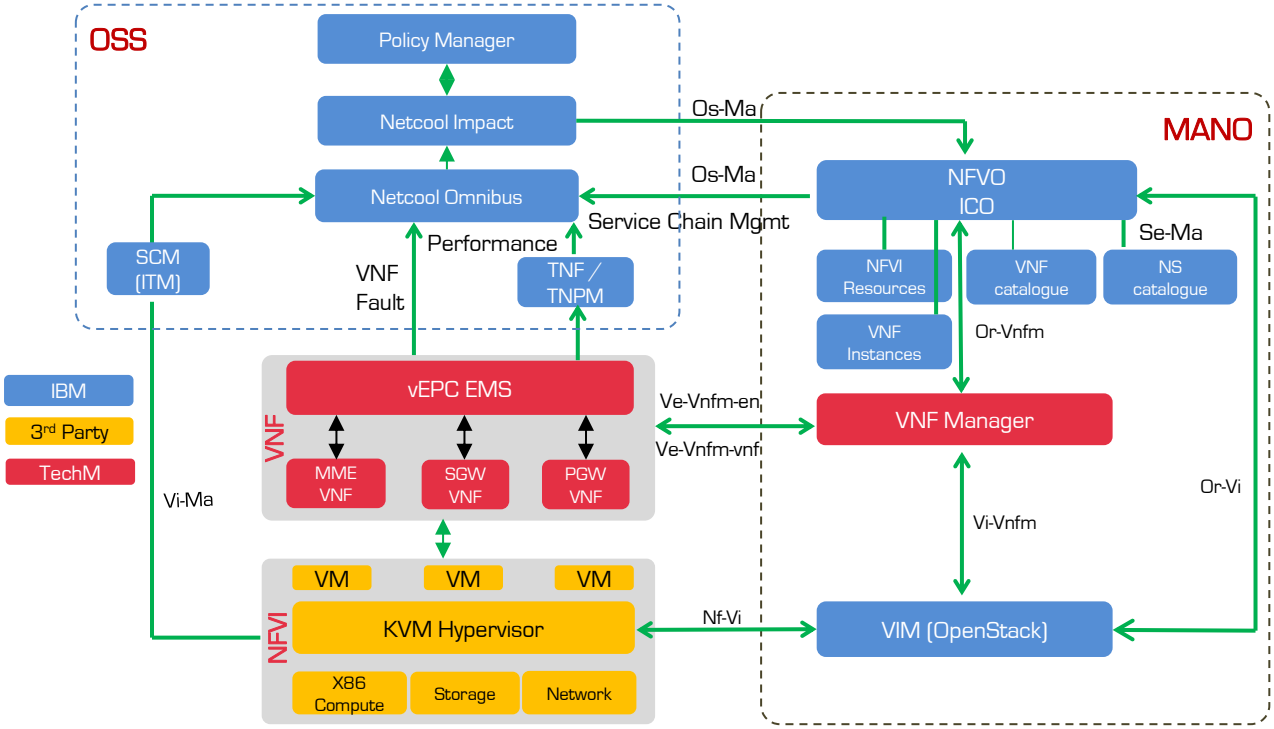

Figure 2 Closed Loop Management Solution Architecture

The solution architecture for end-to-end service assurance for hybrid networks comprises IBM software for Service Assurance which includes IBM Netcool Operations Insight, The Now Factory, and IBM Cloud Orchestration.

IBM Netcool Operations Insight includes Netcool/Omnibus and Netcool/Impact at the core with new analytics components implemented around it delivering real-time analytics for operational agility. In addition, it provides embedded search and historical event analytics to speed problem identification and resolution thereby improving operational efficiency.

IBM Now Factory Customer and Network Analytics provides near real time visibility and measurement of how individual customers use and experience their mobile services. With insight on experience, you can quickly diagnose and resolve customer issues across applications, devices and networks, as well as improve customer management. With insight on usage you can understand what interests your customer and create and target new offerings to increase average revenue per user.

IBM Cloud Orchestration manages the VNF provisioning, operations automation, and lifecycle management along with event reporting between NFVI and the E/NMS. The solution also includes an implementation and support for open interfaces and the data model between OSS and NFV layers. The management layer is a combination of standard off-the-shelf product(s) and custom application(s), which will interface with the multi-vendor NFV environment. IBM's Virtual Infrastructure Manager (OpenStack) manages the underlying virtual servers, storage and network infrastructure.

Tech Mahindra's vEPC solution is made up of four functional entities as shown in the figure below. Serving Gateway (SGW) and Packet Data Network Gateway (PGW) can be deployed as totally separated or co-located configurations. These virtual functions are decomposed into elementary virtual machines.

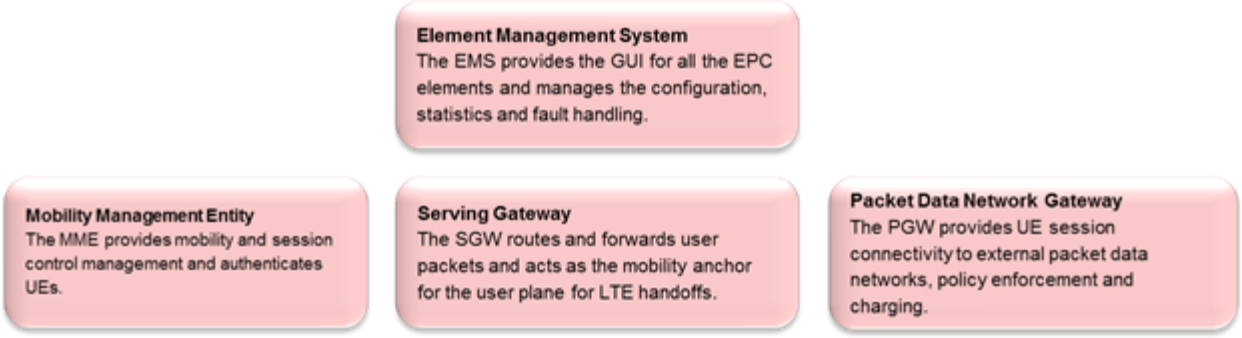

Figure 3 Functional entities of Tech Mahindra's vEPC

For More Information

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