NANC

netOps.ai & AWS powered Network Cloud

A Whitepaper on Accelerating 5G Telco Transformation

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1 Executive Summary

Across industries and around the world, 5G commercial launch is being accelerated and as a result, organizations are undergoing digital and Artificial Intelligence (AI) transformation that is changing the way businesses operate, compete and entertain customers.

Digital transformation requires dynamic, flexible, scalable and agile networks. In order to achieve this, networks must adopt key technologies such as cloud native, dynamic network slicing, Multi-access Edge Computing (MEC), smart IP network, ultra-high bandwidth and AI-enabled end-to-end 5G services

Dynamic and diverse services can only be delivered over 5G networks with investment in automation and associated working practices. In-addition cloud native coupled with DevOps and continuous integration (CI)/continuous delivery (CD) models are critical for faster service delivery and lower cost operations.

Tech Mahindra (TM) partnered with Amazon Web Services (AWS) to develop world's first end to end innovative, secure and automated cloud platform "NANC" (*netOps.ai and AWS powered Network Cloud*) to empower our customers to comprehend quicker, act smarter and faster to the changing world and to effectively build the NOF, 5G.

NANC offers a fully integrated and operationally ready public and private Cloud Platform for Telco Networks of Future. It is a zero CAPEX and low OPEX fully managed e2e solution primarily focused on rapid 5G rollout.

This white paper provides an overview of NANC solution, architecture and the key business value to enable Network Of Future (NOF)

2 Network of the Future (NOF): 5G accelerates digital transformation

Building the intelligent future

Building the Network of the Future (NOF) with 5G, network can be arranged into different slices to meet the diverse and varying requirements of Digital Services. One physical infrastructure yet multiple different arrangements. Never before have networks had such flexibility, agility and programmability.

5G is holistically redefining the network end-to-end by driving innovation in the following three pillars:

5G-AN (Access Networks): which will be disaggregated and virtualized, splitting the real-time and non-real-time functions of Base Stations. 5G NR (New Radio) will operate in diverse spectrum bands spanning across low, mid and high spectrum bands. 5G NR (New Radio) will enable operators to tap into mmWave spectrum bands to create fat OTA (over the air) pipes and deliver ultra-high throughput and ultra-low latency. To deliver average 1Gbps data rates and to solve for the cell edge problem, 5G AN will employ advanced phased antenna array technologies including MU-MIMO and Beamforming. With 5G, CSPs now have the opportunity to dis-aggregate and virtualize the RAN (vRAN) and pave the way for best-of-breed 5G AN solution.

5GC (Core Network): which will truly be cloud native, deployed on a Distributed Telco Cloud infrastructure, delivering unprecedented Service Agility. SDN and NFV are the foundational pillars of the 5G Core Network. 3GPP has specified 'Service Based Architecture' for 5G Core, built on the principles of Network Function disaggregation, containerization, microservices, APIs and more. Furthermore, control and user plane functions are being separated (CUPS) to enable independent scaling and unprecedented programmability. Finally, Edge Computing (MEC) will enable CSPs to dynamically place Network Functions (NF) closer to the end application to address ultra-low latency requirements. MEC will also enable industry verticals to place their own applications closer to the network endpoint. The Cloud native, Service Based 5G Core lends itself very well for Network Slicing by allowing reuse of network function services and even rapid network function customization, as needed, across slices. 5G Core will be Access agnostic. This will enable CSPs to deploy a converged core network which will integrate both 3GPP ANs (like 5G NR, 4G LTE) as well as non-3GPP Access Networks (like WiFi).

Hyper Automation: which will be mainstream to enable auto-pilot mode of operations for 5G networks. Orchestration, closed-loop control, AI/ML, RPA (Robotic Process Automation) will all play a key role in dynamically creating different network arrangements that best meet the needs of end applications and use-cases. 5G network will be completely cloud-native, software defined, disaggregated delivering unprecedented agility. SDN/NFV will be the bedrock foundation for 5G. Best-of-breed solutions will dominate 5G networks and will enable CSPs to aggressively bend their cost curve.

When it comes to connectivity, we've been thinking mobile-first, where a service runs on a given data package or Wi-Fi connection. But this must change. By 2023, the worldwide number of IoT-connected devices is predicted to increase to 43 billion, three times more than 2018 and well beyond mobile's growth. Technologies developed out of 5G will play a key role in solving this. Like Cloud, 5G will enable industry verticals with new self-service, DIY, on-demand service models that will allow them to dynamically request network capabilities and resources that best meet the end application needs. With 5G, network can be sliced and differentially priced. Network Slicing automation and assurance will be the new paradigm. New charging models and business models will emerge to comprehensively enable IoT and Digital Transformation. This in turn will necessitate holistic transformation of BSS/OSS systems.

3   The need for automation and CI to build 5G cloud native networks

Keep everything running with speed and continuity

New 5G capabilities are being introduced to serve increasingly demanding use cases across diverse industries. On the network side, new technologies and architectures enable operators to meet high demand and the diversified performance requirements of different applications.

The challenge is that operators must meet these performance requirements using network technologies that are complex to integrate and operate while reducing cost. True cloud native and service lifecycle automation are the only solutions to lower their cost of production and maintain the pace of innovation. The goal is to build cloud-native networks that are responsive to changing demand, automated and run with low operating costs.

Decoupling virtual network functions (VNFs) from the infrastructure platform requires interoperability, onboarding, testing, optimization, scaling, and life cycle management. Even with well-defined standards, Integration efforts will grow multi-fold when building these networks and this is a true challenge for the operator. As a result, experienced integrators, with experience in multiple applications, technologies and platforms, are needed to design and deploy the solution. With deploying multi-vendor solution where each vendor's product has a different upgrade cycle, there is a strong requirement to automate these processes. Without automation, complexity and costs are higher and service quality is not guaranteed.

One of 5G objectives is to enable many use cases across many diverse industries. The challenge is that each use case is likely to have unique configuration, performance, and Service Level Agreement (SLA) requirements, all of which the operator must support on optimized networks.

5G networks are now live from 46 operators in 24 markets worldwide, and GSMA expects more than 79 commercial launches in 39 markets before the end of 2020. Initially, these networks will focus on enhanced mobile broadband (eMBB) services; however, this will rapidly change to deploy and scale diversified services and applications.

Dynamic and diverse services can only be delivered over 5G networks with investment

in automation and associated working practices. In-addition cloud native coupled with DevOps and continuous integration (CI)/continuous delivery (CD) models are critical for faster service delivery and lower cost operations.

Cloud infrastructure running telecom applications is dynamic by definition and design. To achieve flexibility and agility, operators must adopt a multi-domain and hybrid automation framework for Network Deployment, Continuous Integration (CI), Continuous Deployment (CD) for network assurance and AI based Operations. These CI/CD techniques take time to master and require expert DevOps engineers to implement. Well-staffed, experienced, vendor-neutral systems integrators can be valuable partners for operators on this journey.

4   Networks of the Future (NoF) design tenants

Reliable, Simple, Flexible and Reliable

5G network needs to be flexible, robust, programmable, automated and agile. The cloud-native 5G networks are expected to be developed with microservices and stateless containers. Additionally, DevOps is the efficiency booster and will aid in improving deployment and achieving operational efficiency. An e2e automation frame work is needed to provide significant acceleration of end-to-end validation cycles, and rapid deployment to production networks.
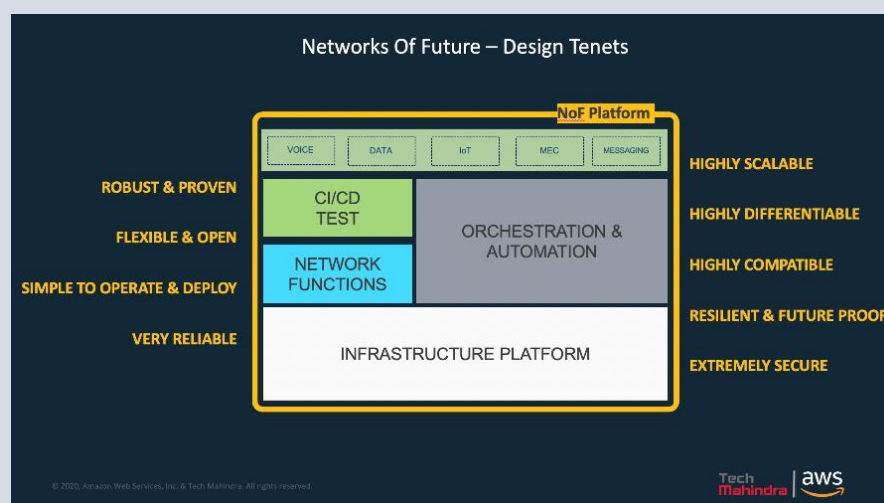

Figure 1 Telco Network Of Future Design Tenets

Networks of the Future must be robust, simple, reliable, scalable, agile and resilience. The infrastructure platform along with orchestration/automation solution will play a major role in achieving this goal. It addresses four major domains – infrastructure/platform, tenant, build with CI/CD and orchestration & automation.

The need of the hour

A new breed of infrastructure platform and automation/orchestration solution that makes the relevance of HW and Infra much less than what it is presently, an XaaS solution that has already achieved most, if not all, design tenets and instills confidence in the overall network transformation.

5   NANC (NetOps.ai and AWS powered Network Cloud)

Together, unlocking the cloud experience by delivering hybrid, multi-cloud solution

Tech Mahindra (TM) partnered with Amazon Web Services (AWS) to deliver world's first end to end innovative, secure and automated cloud platform "NANC" to empower our customers to comprehend quicker, act smarter and faster to the changing world and to effectively build telco network of the future (NOF)
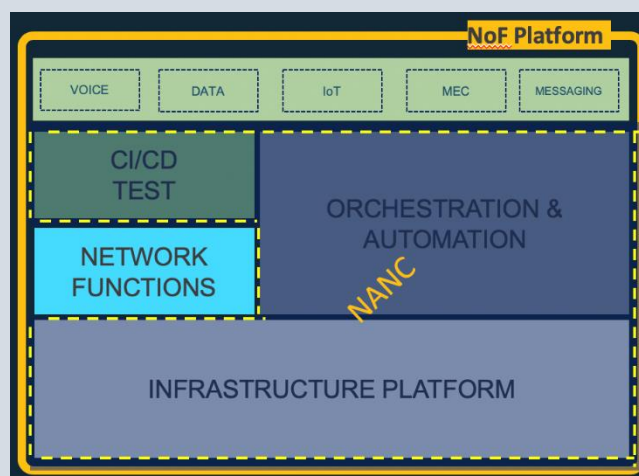

Figure 2: E2E cloud Telco Cloud Solution

NANC is a fully Integrated and operationally ready multi-purpose multi-function end-to-end automation cloud platform that utilizes market leading AWS public cloud platform and hybrid cloud services such as AWS Outposts along with Tech Mahindra's E2E orchestration and automation framework netOps.ai combined with Tech Mahindra's Deep Industry and System Integrator experience to provide a seamless and highly modular Telco Cloud Offering that make it faster, cheaper and easier for our customers to design, develop, deploy and manage clouds.

NANC is the most elastic, scalable, flexible and secured fully managed e2e managed solution that address our customers' unique challenges by enabling several deployment scenarios including greenfield, brownfield, virtual, physical or hybrid scenarios. Together we can deliver more innovation and value to our customers

5.1 Solution overview

Future ready infrastructure platform aligned to customers' business needs

NANC's comprehensive offering is designed and developed to accelerate digital transformation and enable faster deployment of 5G Networks. The solution is flexible to address multiple deployment scenarios including greenfield, brownfield, physical, virtual or hybrid deployment

NANC is a fully managed e2e solution for all Infrastructure platforms with Orchestration, Automation, Assurance, CI/CD and all operational needs that enables operators to achieve their business objectives due to zero CAPEX and lower OPEX along with speed and agility

NANC manage VNF/CNF Onboarding, Certification and benchmarking Service. The service also includes strong alliance ecosystem with various 5G technology vendors to ensure full compatibility and performance benchmarking of their respective VNFs/CNFs, reduces implementation risk and accelerates go-to-market.

Proven solution accelerators leveraging fully integrated analytics & assurance stack for AWS, VNFs, CNFs, orchestration & automation that is hosted on the cloud as a service platform to help our customers extract maximum performance from their infrastructure assets. The solution also includes handy Cloud TCO measurement and monitoring tools to access, organize, understand, control, and optimize the network platform operations and usage cost

NANC is a Single Pane of Glass View for all fulfilment and assurance needs of an operator; managed through a model driven REACT based netOps.ai UI

We specialize in helping our customers unlock their cloud experience by delivering hybrid, multi-cloud services and non-linear growth for our customers to accelerate digital transformation. We provide a comprehensive suite of services spanning the entire lifecycle of the Cloud journey for our customers, providing them with a strategic direction and a tactical approach for cloud adoption across public, private and hybrid environments.

5.2   Base Reference Architecture

Automate, configure, install & operate across hybrid environments

NANC utilizes AWS cloud foundational services such as Amazon Virtual Private Cloud (VPC) and Amazon Elastic Compute Cloud (EC2) to host centralized functions such as 5G Core (5GC). Amazon Virtual Private Cloud (VPC) allows provisioning of a logically isolated section of the AWS Cloud where AWS resources are launched in a virtual network that is defined by the Operator while Amazon EC2 provides the virtual servers to host virtual network functions and cloud-native network functions that can scale up and down as the compute requirements change using EC2 Auto Scaling in a highly available manner using Elastic Load Balancing
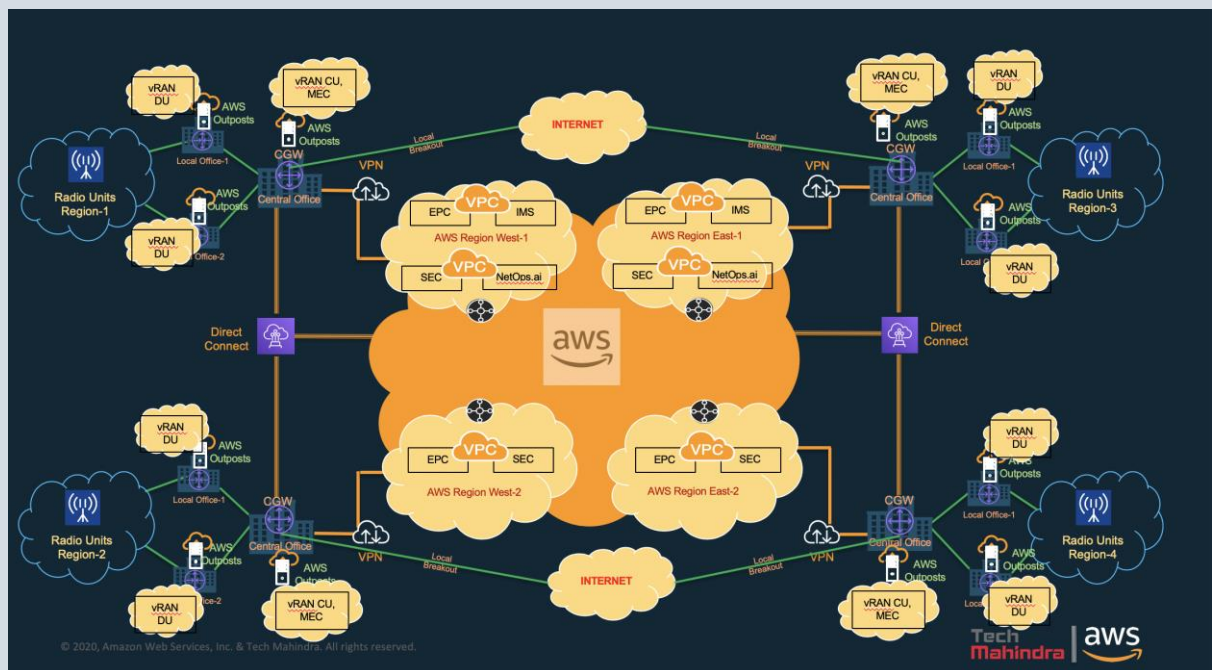

Fig.3: NANC Base Reference Architecture for 5G

E2E Orchestration and automation is achieved through a mix of Tech Mahindra netOps.ai and AWS managed services such as AWS CloudFormation, AWS Systems Manager, Amazon CloudWatch, Amazon EKS and Amazon ECS managed container orchestration services, AWS CodePipeline CI/CD orchestration for DevOps and broader suite of AWS cloud platform services and capabilities across compute, storage, databases, networking, analytics, security, machine learning (ML) and

artificial intelligence (AI), and Internet of Things (IoT)

netOps.ai framework is Tech Mahindra's next generation Automation and Managed Services Framework that enables e2e automation for Network Deployment, Continuous Integration, Continuous Deployment, Continuous Test, Network Assurance and AI based Operations.
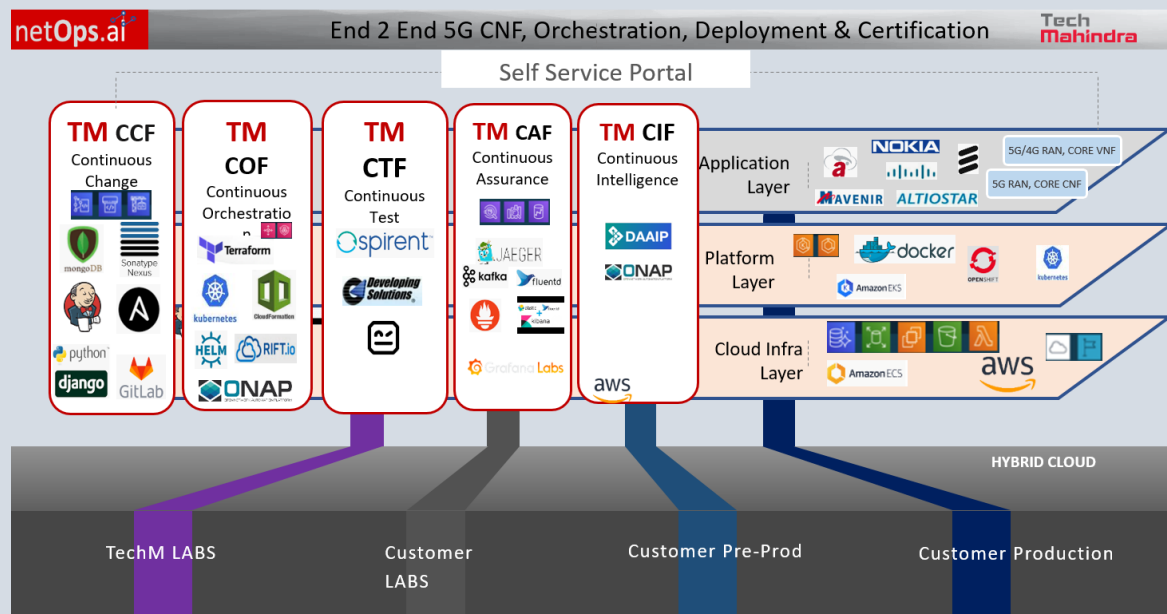

Figure 4: Five Functions of NetOps.ai

The framework acts as a common glue across multiple open source technologies and other vendor/standard bodies-provided OSS/BSS systems. Following are the components key functions highlights:

- **Continuous Change Framework (TM CCF)**
  - o Upload artefacts (images, vnfd, Helm Charts)
  - o Auto release creation
  - o Auto validation of parallel releases on multiple test beds and lab-line-ups
  - o Integrated with e2e slice lifecycle management
- **Continuous Orchestration Framework (TM COF)**
  - o automated deployment of images on cloud and container platforms
  - o Auto provisioning and execution of VNF/CNF life cycle management
  - o Integrated with e2e slice orchestration
- **Continuous Testing Framework (TM CTF)**
  - o Integrated with continuous change

- o Automated test execution and reporting
- o Parallel multi test bed execution management
- **Continuous Assurance Framework (TM CAF)**
  - o E2e 5G network slice assurance
  - o Cloud & container platform, VIM infra, network fabric & VNF/CNF monitoring, performance & alarm management
  - o Common messaging BUS to integrate any 3rd party monitoring tools
  - o Single dashboard to view FM and PM
- **Continuous Intelligence Framework (TM CIF)**
  - o Predictive insight & early capacity planning
  - o Predictive analytics attempts to provide proactive analysis of data, perform RCA, & closed Loop
  - o Identify patterns in event, resource and performance trends using AI/ML

5.3   Solution components

Networks of the Future must be robust, simple, reliable, scalable and resilience. In order to achieve this goal, NANC component solution addresses four major domains – infrastructure/platform, tenant, build with CI/CD and orchestration & automation.
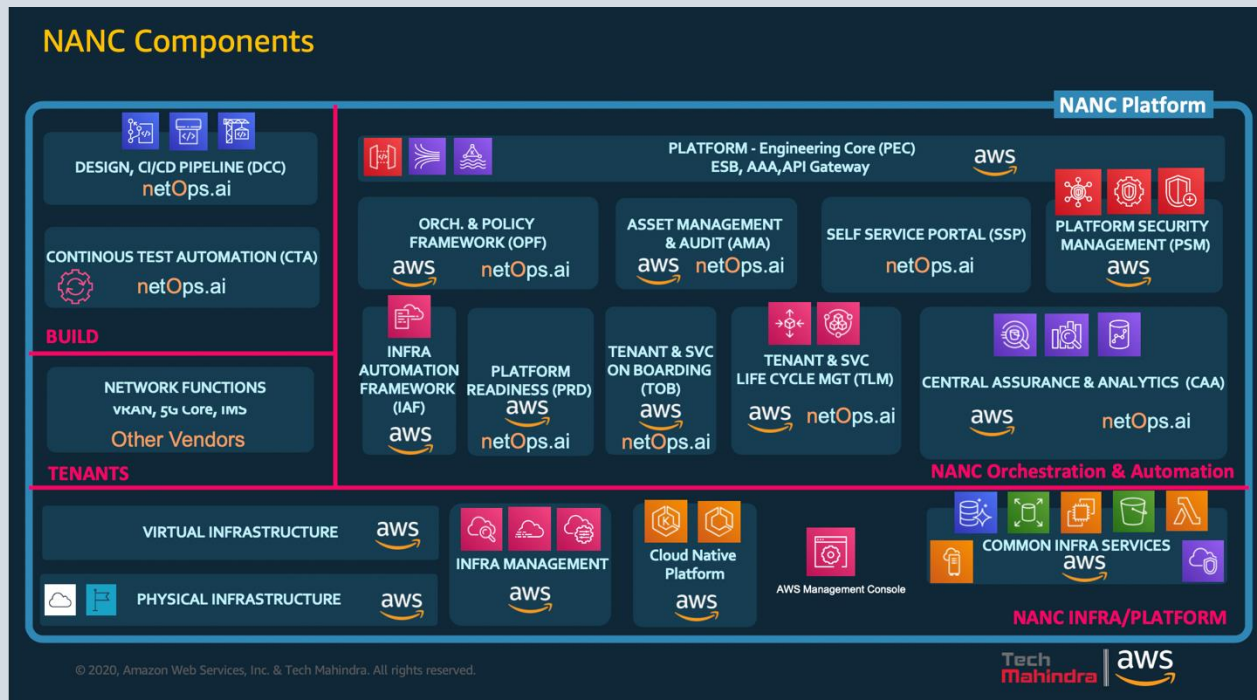

Figure 5: NANC Solution Components

Infrastructure/Platform: it includes physical and virtual infrastructure, cloud native platform and common infra services

Tenant: Network Functions under Tenants domain is defined by various virtualized or cloud native 4G or 5G or RAN network elements

Build: it is responsible for two main functions – Design CI/CD (HCC) and Continuous Test Assurance (HTA). HCC builds CI/CD pipeline in DevOps agile based environment to ensure no release, patch or change goes into production without validation & certification. HTA, on the other hand, provides a framework for automated & continuous testing for all solution components at various levels

Orchestration & automation: It performs numerous functions listed below.

- o   Central Assurance and Analytics
- o   Tenant & SVC Life Cycle Management
- o   Infrastructure Automation Framework
- o   Platform Readiness

- o Platform Orchestration and Operation - Engineering Core
- o Orchestration and Policy Framework
- o Self Service Portal
- o Platform Security Management
- o Asset Management and Audit
- o Tenant On-boarding

Infrastructure domain is fully addressed by AWS global cloud infrastructure, AWS cloud platform services such as Amazon VPC, Amazon EC2, Amazon EBS, Amazon S3, AWS Direct Connect, and AWS Transit Gateway and AWS Outposts hybrid-cloud service. The Orchestration, Automation and Continuous Integration, Deployment and test are addressed by a combination of AWS cloud native services and Tech Mahindra's netOps.ai solution components.

Tech Mahindra's netOps.ai is the next generation Automation and Managed Services Framework that addresses two of the four domains above – build and orchestration & automation. netOps.ai framework is geared to accelerate 5G adoption by intelligently automating all the key network life cycle stages in a continuous fashion including integration, deployment, testing, service assurance and AI-based operations.

Tenant domain is addressed by OEMs

Over the last 5 years, Tech Mahindra has built a strong AWS Practice with over 1500+ Accredited AWS associates, including more than 500 AWS certified engineers and architects, across various streams of transformation and a dedicated AWS CoE.

5.4   Business Value

Simple, Fast and Cost Effective

Tech Mahindra and AWS strategic Partnership help our customers become agile, lean and build reliable platforms and applications on AWS Cloud. NANC enable customers to experience self-service/DevOps based environments with CI/CD capabilities

NANC aims to maximize benefits for our customers by providing:

- Reduced Total Cost of Ownership (TCO)
- Single Pane of Glass View: For all fulfilment and assurance needs of an operator
- Measurable business outcomes through transformation success
- Strong adherence to financial governance
- Zero or no deviation for regulatory and compliance requirements
- Improving end user experience
- Eliminate the need for Expensive Hardware Re-fresh
- Improved utilization Rates compared to Private Cloud
- Data Center Business
- Reliable, Resilience and secured solution
- Easier and faster Staff training in order to build competence in AWS Cloud based infrastructure and operations.

6   Collaboration/innovation in action

Network Slicing management automation using NANC

Network slicing uses the principles of modern cloud architecture to run multiple logical networks as virtually independent business operations on a common physical infrastructure. Each logical "slice" meets service-specific requirements for network priority, latency, data rate, quality of service (QoS), and other key performance indicators. Each slice type can have different versions of the following:

- Radio access technologies (RAT)
- Activated core network features in the control and user plane
- Resource dimensioning and locations

Operators expect this slicing capability to lead to new revenue opportunities from customized services. Almost all CSPs are considering network slicing however only few have figured out how to operationalize and monetize it. Network slicing presents various operational challenges:

Configuration capability: Allowing customers to adjust and modify the network functions as well as underlying resources within the network slice instance provided for them

Monitoring capability: Monitoring traffic characteristics and performance (e.g., data rate, packet drop, and latency), end user's geographical distribution, etc., and per session/user/slice instance-based monitoring, etc.

Control capability: Enabling customers to use application programming interfaces (APIs) provided by the CSPs to control network service.

Automation and orchestration are needed to solve operational challenges around configuration, monitoring, and control and make network slicing cost-effective. Network slice and resource life cycle management automation in a cloud native environment is a key to the success of this technology.

NANC enables dynamic orchestration of network slices that automates the slice design-to-deployment-to assurance cycle, including closed loop control. NANC allows CSPs to manage network slices over their life cycle and present them to customers in

an easily consumable manner.

Together, Tech Mahindra and AWS will demo Network slicing management automation using NANC at AWS Symposium that will be held on July, 8th 2020.

7   Conclusion:

Innovation continues

NANC is a revolutionary and World's first offering of its kind! It will enable CSPs to realize their business objectives of Cost, Speed and quality by combining World Class Public Cloud offerings from AWS along with Tech Mahindra's E2E Automation & Orchestration netOps.ai and Continuous Integrator services.

TechM has drawn upon its deep expertise and experience of providing network professional services to leading Operators around the globe, and its understanding of the needs and challenges faced by today Operators, to build the NANC framework.

To capitalize on network slicing, Automation and orchestration are needed to solve Network Slicing operational challenges. NANC has demonstrated its capabilities to effectively handle network slice and resource life cycle management for different configuration and use cases of network slicing.

We are ready to expand NANC to CSPs and handles many configurations and use cases requirements to enable Network of the Future (NOF)

Together, we are committed to providing best in class solutions that improve the customer experience, accelerate 5G roll-out and improve the maintenance of 5G networks

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