



netOps.ai Powering Telco Networks on AWS

Whitepaper on Accelerating 5G Telco Transformation



Connected World. Connected Experiences.

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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 an End to End innovative, secure and automated cloud platform "netOps.ai" powering Telco Networks on AWS to empower our customers to comprehend quicker, act smarter and faster to the changing world and to effectively build the Network of Future (NOF), 5G.

netOps.ai offers a fully integrated and operationally ready public and private Cloud Platform for Telco Networks of Future. It is a fully managed End-to-End solution with Low TCO (CAPEX and OPEX) primarily focused on rapid 5G rollout.

This white paper provides an overview of netOps.ai solution on AWS, 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, the 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 realtime 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 non3GPP 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 network functions (NFs) 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 158 operators in 67 markets worldwide as of March 2021 as reported by S&P Global Market Intelligence. 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

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(CD), Continous Testing (CT), 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 tenets

Reliable, Simple, Flexible and Reliable

5G network needs to be flexible, robust, programmable, automated and agile. The cloudnative 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 framework 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 resilient. 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 hardware and Infrastructure 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 netOps.ai – Powering Telco Networks on AWS

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

Tech Mahindra (TM) has partnered with Amazon Web Services (AWS) to deliver end to end innovative, secure and automated cloud platform "netOps.ai" 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).

"netOps.ai" powered by AWS, 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. netOps.ai along with it's continuous automation and orchestration framework combined with Tech Mahindra's deep Industry and System Integrator experience helps 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 cloud workloads.

"netOps.ai" powered by AWS, is elastic, scalable, flexible and secure fully managed e2e solution that address 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

netOps.ai is a continuous automation and orchestration platform supporting multi-cloud, multi-domain and multi-vendor environments.

netOps.ai comprehensive offering is designed and developed to accelerate digital transformation and enable faster deployment of 5G Networks.



Figure 2 netOps.ai Solution Overview

The key tenets of netOps.ai platform are summarized below -

- netOps.ai is built for cloud native 5G networks that supports multi-cloud (private / public) and multi edge deployments (edge / core)
- netOps.ai uses latest frameworks like micro services, observability, CI/CD automation that enables Unified Operations
- netOps.ai drives hyper automation for Continuous Integration, Continuous Orchestration, Continuous Test, Network Assurance and AI based Operations

netOps.ai 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 lower TCO along with speed and agility. 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 Solution Blueprint

Networks of the Future must be robust, simple, reliable, scalable and resilient. With the possibilities that 5G brings in, networks also need to be deployed across multiple locations and on various cloud providers including the private and public cloud infrastructure. Networks also need to be managed and healed with minimal human intervention and being driven by AI / ML recommendations.

netOps.ai platform addresses all these requirements of Networks of the Future utilizing open source and commercially available components to provide a single pane of glass to CSPs for simpler management of their networks. The high level solution blueprint is depicted below.



Figure 3: netOps.ai Solution Blueprint

netOps.ai solution blueprint comprises of the following pillars:

Continuous Integration Framework (CIF): This framework implements the CI / CD principles and automates the entire journey from availability of vendor artifacts for new software version of the network functions and all through up to validations and successful deployment of the newly defined release. This is achieved by the Continuous Change Framework (CCF) and Continuous Test Framework (CTF), which are part of this layer. CIF also enables automation of set-up of virtual infrastructure, cloud native platforms and common infrastructure services.

Continuous Design Framework (CDF): This framework provides design time ingestion of artifacts related to VNFs / CNFs, various policy templates, custom workflows etc. These artifacts are then used by other framework components during the actual execution. It also provides a catalogue of all the artifacts which could be selected to define the specific execution flows.

Continuous Orchestration Framework (COF): This framework enables orchestration of specific network functions or network services spanning multiple domains on desired cloud infrastructure along with application of the day 0 & day 1 configurations. This framework enables support for slicing use cases.

Continuous Assurance Framework (CAF): This framework aggregates the FM / PM events across all the layers from hardware till the application and across all the domains, using various CNCF based open source frameworks and thus providing CSPs a single and intelligent view of the status of their networks. This framework also supports policy based closed control loops to enable zero touch healing of the network functions.

Continuous Insights & Intelligence Framework (CI2F): This framework implements an opensource based architecture for data ingestion in to the data lake and enables development of micro services to analyze the data and provide predictive insights using AI / ML algorithms. These insights could then be acted upon by the CAF and COF frameworks for the cases when automated resolutions are recommended.

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In summary, netOps.ai blueprint addresses hyper automation capabilities desired by the CSPs to support 5G and next generation services.

In this solution blueprint, the 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.

5.3 Base Reference Architecture

Automate, configure, install & operate across hybrid environments

netOps.ai utilizes AWS cloud foundational services such as Amazon Virtual Private Cloud (VPC) and Amazon Elastic Kubernetes Service (EKS) on 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 EKS helps in creating a Kubernetes environment to host CNFs, cloudnative 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.



Figure 4: netOps.ai on AWS: Base Reference Architecture for 5G

A typical deployment of 5G core network on AWS enabled by Tech Mahindra netOps.ai platform is depicted in the above diagram.

E2E Orchestration and automation is achieved through a mix of 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).

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. netOps.ai enables customers to experience self-service/DevOps based environments with CI/CD capabilities

netOps.ai, powered by AWS aims to maximize benefits for our customers by providing:

- Global scale infrastructure with deployment of 5G Services across 81 Availability Zones and 25 Geographic Regions
- Reduced Total Cost of Ownership (TCO)
- Single Pane of Glass View: For all fulfilment and assurance needs of an operator
- Enable web scale operations by providing single click deployment feature of entire stack from infrastructure to Network Services across thousands of sites
- Reliable, Resilient and Secure solution
- Easier and faster Staff training in order to build competence in AWS Cloud based infrastructure and operations.

6 Conclusion

Joint collaboration and continuous innovation

netOps.ai powered by AWS 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 platform netOps.ai and Continuous Integrator services.

TechM has built netOps.ai framework drawn upon the deep expertise and experience of providing network professional services to leading Operators around the globe and understanding of the needs and challenges faced by Operators.

netOps.ai powered by AWS is the outcome where Best of public cloud providers have joined hands with Best of Continuous Integrators in the Telecom domain to enable CSPs to build Network of the Future supporting 4G/5G use cases through hyper automation of distributed networks.

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.

Authors

Ravi Calyanakoti, Global Portfolio Head – Core and Network Cloud, Tech Mahindra (ravi.calyanakoti@techmahindra.com)
Tulasi Ram Bora, Lead Architect (netOps.ai), Tech Mahindra (TB0095408@TechMahindra.com)
Shobhit Srivastava, Lead Solution Architect, Tech Mahindra (SS00662339@TechMahindra.com)
Milind Jalwadi, Principal Consultant, Tech Mahindra (SS00662339@TechMahindra.com)
Shonil Kulkarni, WW Partner Solutions Architecture Leader, Global SIs, Amazon Web Services (shonilk@amazon.com)

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www.youtube.com/user/techmahindra09 www.facebook.com/techmahindra www.twitter.com/tech_mahindra www.linkedin.com/company/tech-mahindra www.techmahindra.com

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