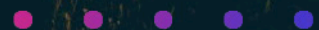Whitepaper

Autonomous Network Operations for Communication Service Providers

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Tech Mahindra and AWS collaborate on business value-focused AI solutions for Network Operations.

Co-authored by:
*Tech Mahindra,
Amazon Web Services, and
Third Eye Advisory*

Overview

The telecom industry globally is embracing technological advancement to cater to the ever-evolving data demands of customers, whilst Average Revenue per User (ARPU) is showing a downward trend. With the rollout of 5G, the operators are looking to optimize operational expenses (OpEx) by over 40% and maximize the yield of added capital investments (CapEx) to fulfill the 25% increased capacity demands that are expected to spawn new monetization models (*). Key contributors to OpEx efficiencies and network performance include open, software-based, energy-efficient modular network architecture, and leveraging Artificial Intelligence (AI) in networks to increase the level of autonomous operations, yielding a tangible return on investments. Level 3/Level 4 automation (a reference to TM Forum automation levels, as depicted in the below diagram) is not available on day 1 of network deployment. Hence, Communication Service Providers (CSPs) are evolving their operating models, processes, and operations tools capabilities to achieve automation outcomes during the operations phase.

Autonomous Levels	L0: Manual Operation & Maintenance	L1: Assisted Operation & Maintenance	L2: Partial Autonomous Networks	L3: Conditional Autonomous Networks	L4: High Autonomous Networks	L5: Full Autonomous Networks
Execution	P	P/S	S	S	S	S
Awareness	P	P/S	P/S	S	S	S
Analysis	P	P	P/S	P/S	S	S
Decision	P	P	P	P/S	S	S
Intent/Experience	P	P	P	P	P/S	S
Applicability	N/A	Select scenarios				All scenarios

P	People (manual)		S	Systems (autonomous)

TM Forum Reference Autonomous Networks Levels (ANL)

There is a growing need to enhance monitoring capabilities, automate operations, increase operational efficiency, and guarantee improved QoS (Quality of Service). Bringing AI/ML to network operations includes:

- Awareness of the existing operational environment including multi-network, multi-domain specific data pipelines, multi-vendor ecosystems, processes, and toolsets
- Evolving from the state-of-art to a centralized, cognitive automation platform that synthesizes complexity and generates descriptive, predictive, and prescriptive automation and recommendations

Tech Mahindra brings over 2 decades of experience as a strategic system integrator and network-managed services provider across global Communication Service Providers (CSPs). In collaboration with AWS (a leading cloud computing platform), Tech Mahindra has developed an AIOps solution framework (including Generative AI) leveraging Tech Mahindra's multi-vendor, multi-system, multi-domain network knowledgebase, and AWS' managed AI infrastructure including data management, AI frameworks to enable CSPs to embark on a customized journey toward Autonomous Operations (Level 3+).

Differentiated Partnership

- Tech Mahindra, a leading global provider of OSS system integration for over 25 years, leverages its extensive experience in network operations engagements, data management, OSS systems, and networks.

- Leveraging AWS managed services for data management, Large Language Models (LLM models), hosting options and data scalability.

- This partnership will be delivering AIML based Cognitive Operations use cases with the roadmap to achieve Intent driven Close Loop Automation

- Faster training of AI Model – Telco specific LLMs readiness

- AWS managed secure AIML Infrastructure

Industry Outlook

CSPs seek solutions for sustainable, self-learning, agile automation that can achieve tangible operational efficiencies and improve the overall quality of the network. In the short term (4 to 6 quarters) there is an emphasis on frictionless, business value-driven solutions covering data pipelines, governance, intelligent advisory, and process automation to assist operations. In the long term, the solution should evolve into self-learning close-loop automation.

To reach these goals, there is a need to build a flexible AI framework that continuously evolves with the changing AI landscape, expands in terms of AI models, and scales to meet network demands Given that most intelligent insights drive decisions on-premises, a hybrid cloud infrastructure is necessary where the scalable, state-of-the-art AI infrastructure, toolsets, and AI model marketplace can be leveraged for decisions and federated via on-premises edge agents.

Key Benefits to CSPs

- ANOP use cases enhances the performance of Network Operations Centre (NOC), Services Operations Centre (SOC) and field operations, as well as improves network and service performance metrics

- Improvement in E2E Network Availability to Four 9s

- Reduce Operational Expenses > 40%

- Automation of NOC / SOC processes > 75%

- Improvement in Customer Experience

Artificial Intelligence / Machine Learning (AI/ML) has been a key enabler for descriptive, predictive analytics and enhancing automation use cases (emulating functions or skills) at CSPs. With Generative AI, CSPs have the ability to build prescriptive guidance and auto-generate automation templates (emulating processes and workflows that include multiple skills). This capability is based on contextual enrichment powered by an adaptive, self-learning data foundation steeped in network and CSP-specific knowledge sets. Building an autonomous network also facilitates the need for reinforcement learning frameworks that can extend the base models and customize them, according to the needs of the CSP. As confidence and trust in automation governance systems grow, CSPs would be able to achieve >75% automation by leveraging partner ecosystems and AI infrastructure that can evolve and scale with their needs.

Automated <10%
Skill driven Manual >30%
Process driven Manual >60%

Current State

Skill driven Manual <25%
Process driven Automated >55%
Skill driven Automated >20%

Future State

Key Characteristics of AIOps Framework and Guiding Principles

Traditional operations practices shall evolve from process-driven to data-driven operations, by transforming tooling capability and operations environment. The following capabilities should be set to evolve into data-driven operations practices:

1.Data Foundation – Pipelines that ingest diverse data sets with governance and quality assurance across the lifecycle

2.360° Observability – Organizing telemetry across multiple domains, and multiple layers of resources/applications and services

3.Business Value-Focused Insights – Generating data-driven insights (via APIs) from a multiplicity of intelligence provider ecosystem

4.Unified Automation Toolsets – Employing insights for automation, combined with automation workflows

5.Presentation Layer – Creating dashboards and action hubs that can leverage insights for analytics, decision-making, and advisory purposes

Implementing the above poses challenges related to:

- Complexities in governance and quality assurance of the data collection and consolidation from multiple sources
- Rapid prototyping with evolving AI models requiring constant upgrade cycles and expensive AI-focused infrastructure
- Automation silos, resulting in fragmented efficiencies
- Accuracy of data from reference systems

To resolve these challenges, a holistic approach is required, that includes a combination of technology, partner ecosystem, and infrastructure, led by a consultative system integrator with expertise in managing operations across multi-vendor, multi-domain networks for Tier 1 operators. From the technology transformation perspective, this involves building a framework covering the above-listed five distinct capability areas that leverage technologies such as classical AI, GenAI, telco data lakes, automation agents, service models, and DevOps. The solution shall be agile, cost-optimized, and leverage the elastic infrastructure that grows with the business needs and evolves with the changes in technology toolsets.

# Key Characteristics of AIOps Framework and Guiding Principles

To realize quantifiable efficiencies and quality enhancement, Tech Mahindra has developed the Autonomous Network Operations Platform (ANOP).

ANOP is developed in collaboration with managed, scalable AWS AI and Data infrastructure leveraging TechM's 25 years of ecosystem integration experience, operational knowledge, and network expertise.

ANOP helps CSP customers elevate their mostly manual operations to a smarter, semi-autonomous paradigm, and eventually evolve into fully autonomous operations. Built on AWS-managed infrastructure and toolsets, Tech Mahindra synthesizes global, experiential knowledge sets into classical and Generative AI-based ANOP.ai base models. Using the Tech Mahindra managed data pipeline, these base models are enriched and fine-tuned exclusively for the CSP, compliant with data residency and sovereignty requirements provided by AWS AI/ML toolsets. As illustrated below, there are three layers, abstract infrastructure, platform, and smart operations layer that help provide a canvas that can grow in tandem with the data, technology, and infrastructure advancements.

While other automation solutions offer some automation outcomes, they pose the following challenges, which ANOP addresses:

- Standalone automation in pockets, lacking 360-degree focus
- Inflexibility to change due to the traditional waterfall development model
- Lack of cloud-native service delivery and operations
- Reactive automation, lack of intelligent decisions, and constant adoption of rules
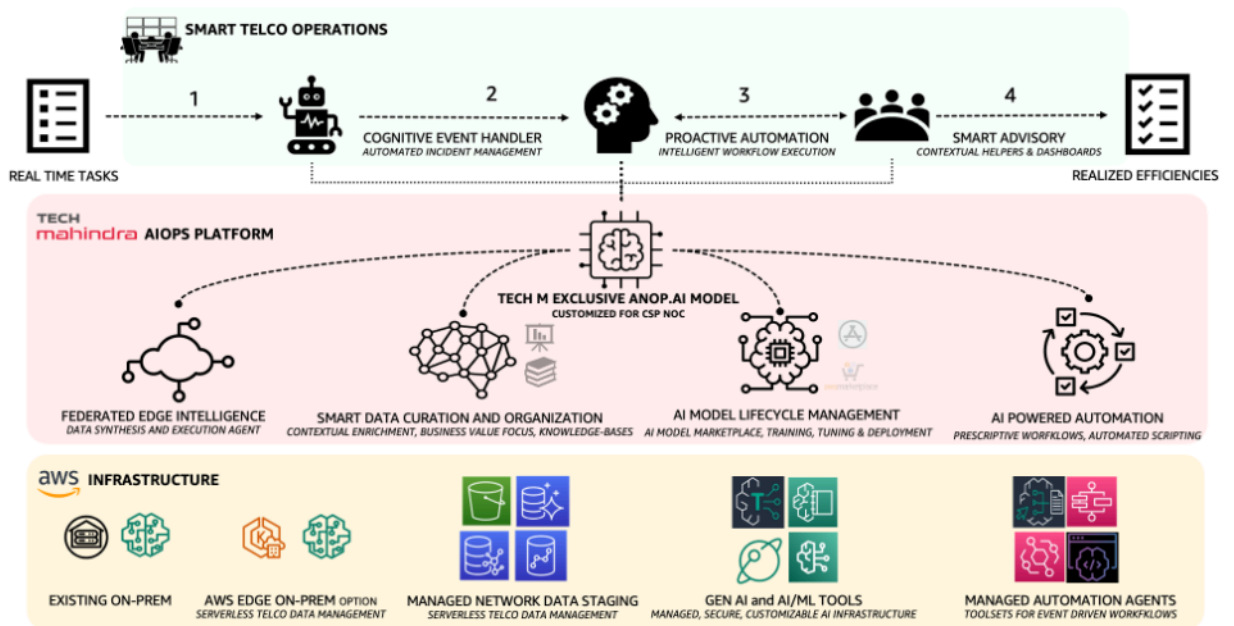
- The AWS Infrastructure layer, which includes the cloud continuum, helps bridge the on-premises infrastructure (incumbent, existing infrastructure, or AWS Outposts) to AWS regions or local zones. With this connectivity in place, the managed network data staging blueprints from AWS are leveraged to build scalable and flexible foundations that extend automation to various use cases.

Combined with AWS-managed AI infrastructure that includes the flexibility to build a comprehensive model leverages:

1. Amazon Bedrock to help create custom LLMs that are exclusive to the CSPs with the ability to use Agents that help transform insights to tangible actions and build a set of constantly evolving, live knowledge bases

2. Amazon Sage maker suite of AI/ML toolsets to build, adapt, and deploy AI per Life Cycle Management (LCM) requirements,

3. Amazon Managed Data Infrastructure that includes DynamoDB, Lake Formation, and EMR that grow with the demands and CSPs pay for what they use, and

4. Near real-time automation, helper functions such as Amazon Event Bridge, Step Functions, and Amazon Q Developer can assist in building actionable logic that follows CSP's operational processes

The ANOP platform layer introduces AI models augmented with CSP datasets and consists of functional elements that include,

- Federated Edge Intelligence- Managed on-premises or cloud-based AI for data ingestion, automation, and on-premises or cloud-based arbitration
- Smart Data Curation and Organization- Platform for data mediation, governance, multi-domain observability, and datasets for AI
- AI Model Lifecycle Management- Manage training, learning, tuning, and testing AI models with deployment orchestration
- Proactive Automation- AI-powered descriptive, predictive, and prescriptive workflow automation at the edge/cloud for various use cases

Finally, the "Telco operations layer" helps to deliver operational use cases, driving direct benefits of operations KPI improvement, through the following functional segments

- Cognitive Alarm Handler provides a normalized event arbitration framework that can drive outcomes using descriptive and predictive insights for alarm correlation, automated incident creation, and routing modules to reduce alarm backlogs and reduce MTTR.
- Proactive Automation can help execute tasks to automate incident troubleshooting, diagnosis, and resolution tasks to assist remote troubleshooting actions and provide analytics-based field dispatch recommendations.
- Smart Advisory functions provide prescriptive recommendations, including contextual guidance for scripts, incident resolution steps, and adaptive operational dashboards that are specific to Operations roles for NOC and field teams, helping resolve the incidents faster and on the first attempt.
- AIML-based correlation of service level metrics with resource level metrics offers faster diagnosis and resolution of service level issues.
- TechM has built more than 150 use cases across the above functional areas and is developing another 100 additional use cases as a roadmap.

Tech Mahindra Perspective

Automation has been a buzzword in the Telecom industry for many years. Operational teams have attempted to automate day-to-day manual tasks through scripts and Robotic Process Automation (RPAs). The monitoring tools and application OEMs have also attempted to incorporate Automation capabilities into their product features. However, these initiatives have only been able to deliver marginal outcomes in terms of efficiencies and outcomes. The efforts required to constantly manage and keep these ad hoc automation capabilities updated and synchronized have become increasingly complex and cumbersome compounding the challenge of maintaining and managing these islands of automation capabilities.

Tech Mahindra's approach towards AI/ML driven automation solutions considers all possible avenues to deliver efficiencies and outcomes across the end-to-end value chain of network and services operations. This perspective is at the heart of the ANOP solution, which was conceptualized, designed, and architected to deliver comprehensive operational improvements.

AWS Perspective

AWS wants to help CSP customers achieve their business goals of operational efficiencies by accelerating AI-driven automation, adapting to the rapidly evolving AI and Generative AI landscape, including managed infrastructure, ML models, and development toolkits, while maintaining control over the AI assets generated. With the flexibility to work across the cloud continuum between on-premises and AWS, the time to value generation is reduced with minimal impact on BAU (Business as Usual) functions and also builds synergies with existing on-premises toolsets. Additionally, AWS lowers the Total Cost of Ownership (TCO) with elastic infrastructure that scales with growth, accelerating the return on investment (ROI) for ANOP.

Third Eye Advisory Perspective

As workloads and users become more and more distributed leveraging technologies like Multi-Access Edge Compute (MEC), 5G, and Secure Access Service Edge (SASE), the complexity of network provisioning and operations grows exponentially. The only way for CSPs to deliver high-quality services at a competitive price is by leveraging automation, increasingly powered by AI/ML throughout the lifecycle of the network service.

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