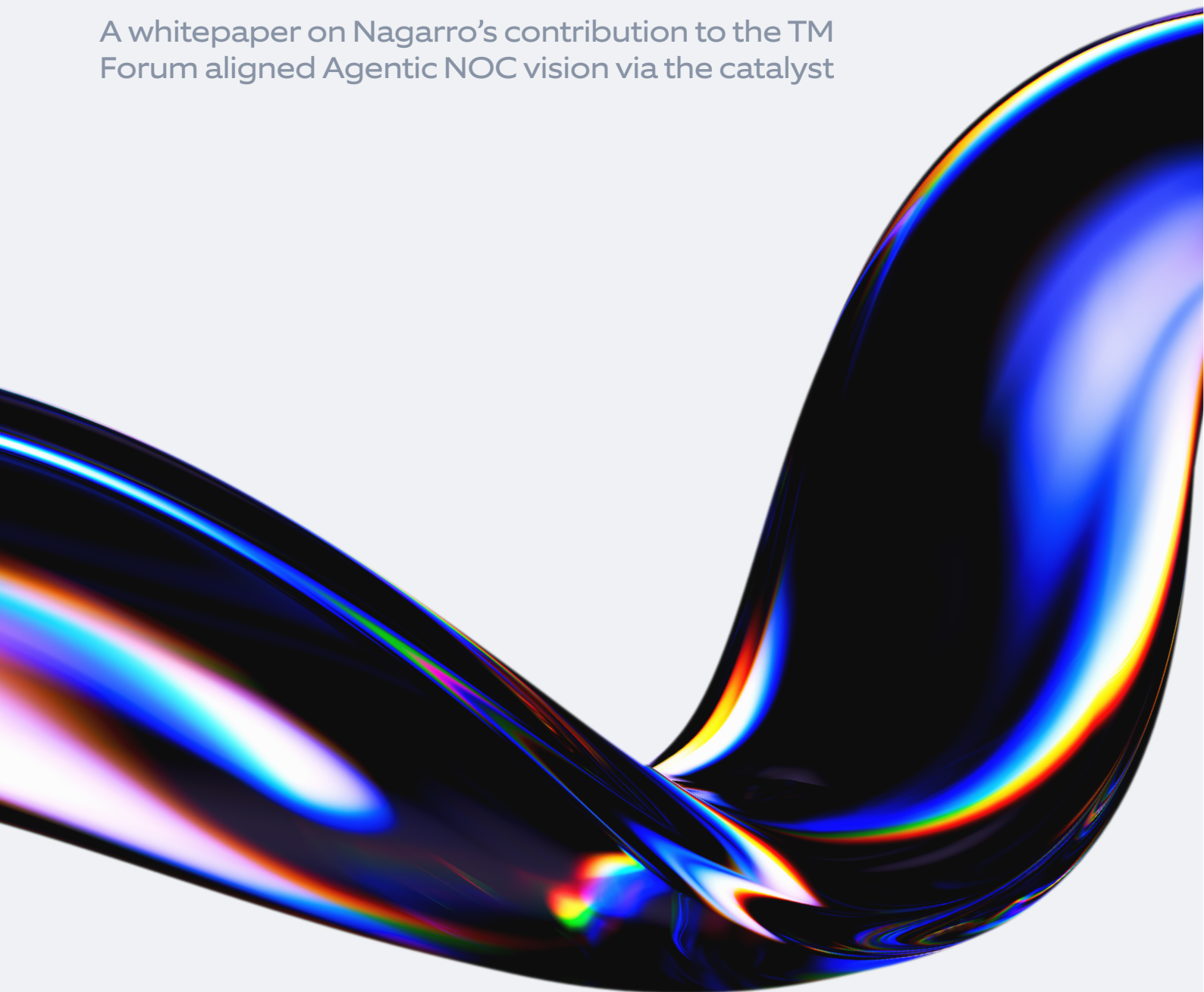




# Agentic NOC – AI native Operations for Autonomous Telco

A whitepaper on Nagarro's contribution to the TM Forum aligned Agentic NOC vision via the catalyst



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# Introduction

The telecommunications industry is undergoing a fundamental transformation. The growth of 5G, cloud-native cores, edge infrastructure, and multi-vendor complexity have made reactive, manual NOCs too slow and rigid to scale effectively. In this new era of Telecom operations, automation itself is no longer sufficient on its own to manage the operational complexities and there is a gradual transition towards autonomous operations.

As this new emerging autonomous paradigm is taking shape, Telcos are increasingly focusing on making their NOCs more intelligent. TM Forum sees NOC powered with agent-based intelligence as a path to higher network autonomy, especially at Autonomous Network level 4 and above, where operations become increasingly intent-driven, self-healing and self-optimizing, while still operating within governance guardrails.

However, most of the Telcos are approaching the agentic NOC primarily from an operational efficiency lens and less from the business and customer impact lens. From a business perspective, the value of transitioning to AN level 4 is significant for Telcos. In an Agentic NOC, this translates into specialized impact agents that can calculate technical service exposure, subscriber impact, revenue risk, and SLA credit implications in real time, turning operational telemetry into decisions that matter to customer experience and business value.

This whitepaper focuses on the work Nagarro is doing in the Agentic NOC space, focusing on the service impact and business impact layers, through the TM Forum's catalyst project by collaborating with leading Telcos, data platform, and Technology partners. The solution is rooted in different TM Forum's Autonomous Network (AN) frameworks and assets and aligns with TM Forum's vision of zero-touch, zero-wait, and zero-trouble operations.

The whitepaper presents a business and technology view of the Agentic NOC for autonomous telcos. The audience comprise of Business heads and Network heads.



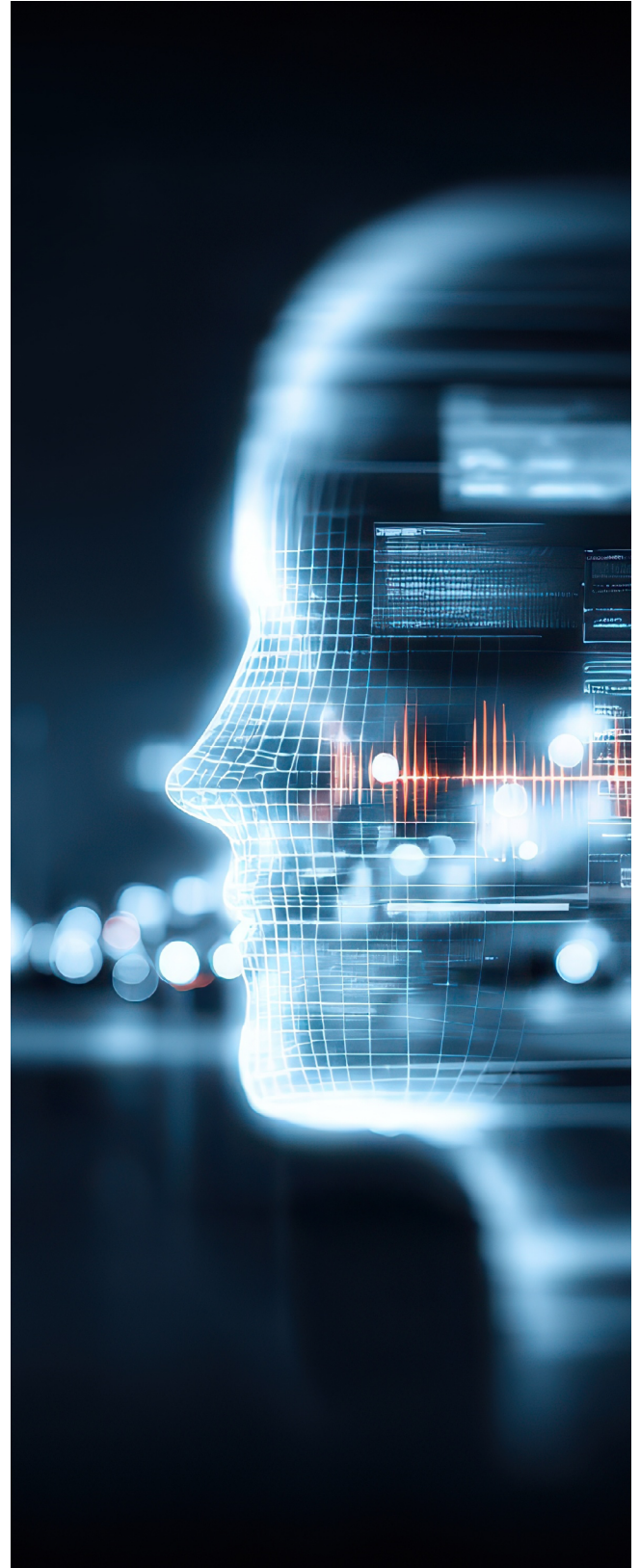
# Need for an Agentic NOC

The traditional NOCs were well suited to conventional telecom environments where operations team could rely on domain silos, static correlation rules, threshold alerts, and human escalation paths because the environment was more predictable and the pace of change was slower. That model struggles in multi-vendor, multi-domain environments (4G/5G), fixed line networks, where faults propagate across RAN, transport, core, IT (OSS and BSS), and customer facing platforms in ways that are difficult to detect and interpret quickly. Even the conventional automation approach based on rules is insufficient as it fails to work effectively across ambiguity, different contexts, and continuously varying signals.

**Primarily, three structural changes are driving the need for an intelligent NOC model.**

- Networks are becoming more programmable and distributed, creating more states, dependencies, and event volumes than human teams can continuously interpret.
- Services are increasingly experienced driven and SLA linked, meaning that operations must understand customer and business impact.
- Economics of current telecom industry demand higher efficiency, which puts pressure on operators to improve operational resilience without scaling headcount linearly.

Consequently, many Telcos are transitioning from a monitoring mindset to an autonomy driven mindset. TM Forum's work in this space reflects exactly this shift, emphasizing self-healing, adaptive intelligence, and AI-native operations as a path to AN level 4 and above. AN Level 4 is especially relevant as it addresses the extremely complex cross domain environment and enables decision-making based on active closed-loop behaviour with limited human intervention, yet still within explicit governance and policy boundaries.



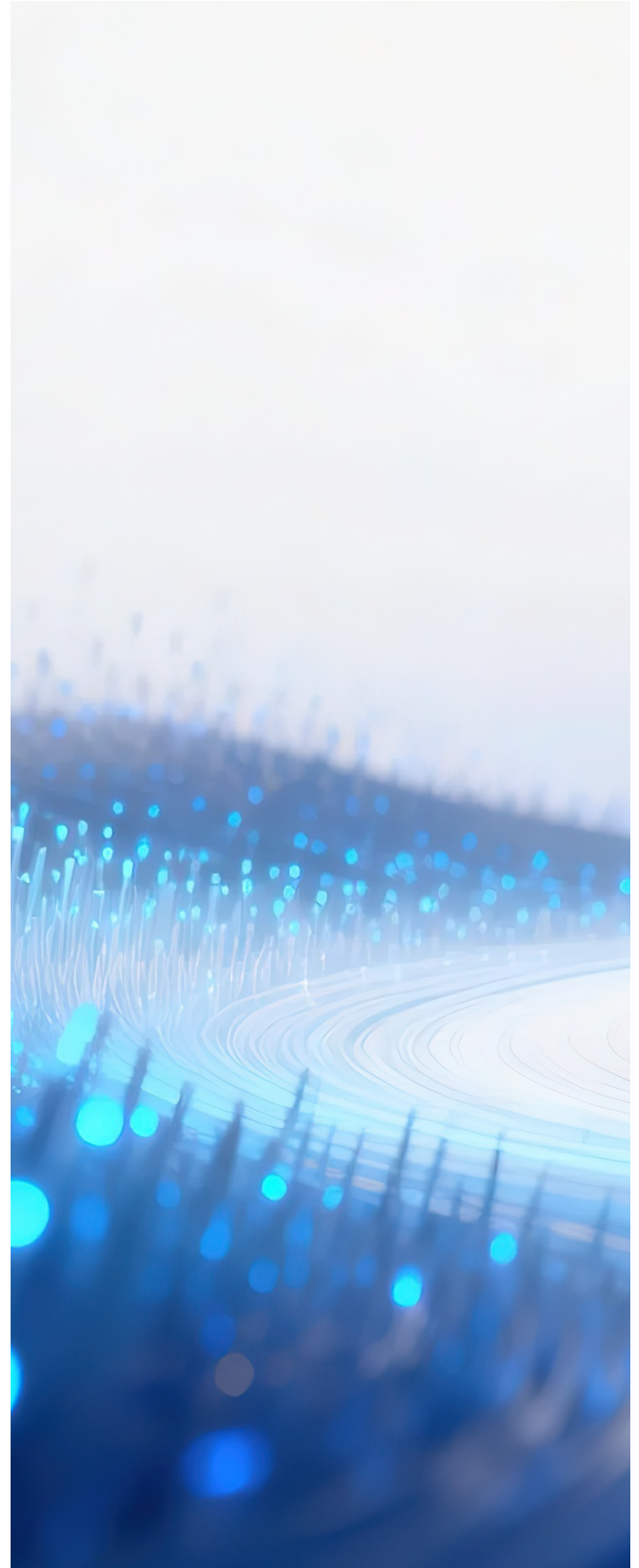


# Need for an Agentic NOC

## **TM Forum reference for Autonomous Networks**

TM Forum is clearly the leading industry reference point for autonomous networks. Its autonomous network work represents the telecommunications industry's most comprehensive, widely adopted, and authoritative initiative for defining and standardizing the path to autonomous operations. With active participation from the world's leading Telcos, leading technology partners, and major system integrators and consistent collaboration with 3GPP, TM Forum is putting in the place the architectural blueprints, evaluation frameworks, Open API standards, and industry benchmarks, fundamental to implementation of AN.

The reference architecture as defined in IG1251 describes the autonomous network as intent-driven, context-aware, and guided by knowledge and intelligence. It organizes autonomous capabilities into modular domains and layered operational views, so Telcos (CSPs) can progress incrementally rather than through a disruptive replacement of the existing operations. This is important as it enables CSPs to start with high-value fault and service-assurance scenarios, as defined in IG1339, rather than waiting for enterprise-wide transformation to complete.





# Need for an Agentic NOC

## **Agentic NOC – what does it look like?**

Agentic NOC is a very strong fit for AN level 4 and beyond and helps translate it into a tangible operating model. It enables human-supervised autonomy in the short term and selective autonomous execution in the medium term. TM Forum’s work on agentic AI also strengthens the case for an agent-based architecture. Rather than relying on one monolithic intelligence layer, it introduces specialized agents that collaborate across observability, assurance, detection, diagnosis, impact analysis, and remediation. These agents operate over a shared context layer that includes telemetry, topology, policy, intent, historical incidents, and operational knowledge. Each agent has a bounded responsibility, specific inputs, well-defined tools, and clear guardrails. Together they form a coordinated operational workflow that is more modular and explainable.

At the operating-model level, this approach changes the role of human teams. NOC engineers are no longer the first line of interpretation for every alarm. Instead, they increasingly supervise, approve, and optimize agent behaviour, intervening in high-risk cases and refining policies for better closed-loop operation over time.

Also, as more Telcos transition towards higher levels of autonomy, particularly AN4 and above, Agentic NOC designs need to be aligned with emerging AI governance expectations such as the EU AI Act, especially around human oversight, logging, robustness, data quality, and transparency for AI-generated outputs.





# Agentic NOC catalyst C26.0.924

As Nagarro, we are contributing to the Agentic NOC journey by participating in the TM Forum’s agentic NOC open innovation catalyst project. This is a collaboration project comprising of leading Telcos (CSPs), technology partners, and data platform providers. A view of the participants is mentioned below:

The catalyst deploys a multi-agent AI fabric that spans the full RAN–transport–core operations stack, not point AI bolted on to a NOC tool. The pattern is simple: there are specialized agents for anomaly detection, fault detection, cross domain co-relation, root cause analysis, service and business impact analysis and close-loop remediation.



## Key agents for catalyst:

Agent	Primary role	Key output
Anomaly detection agent	Identify abnormal conditions across alarms, KPIs and events	Anomalies, severity, confidence
Triage agent	Alarm co-relation, cross-domain correlation, filtration, prioritization, severity (critical/major/minor)	Primary fault domain, Alarm name, Fault resource id, fault occurrence time
RCA agent	Identify root cause across topology, incident history	Root cause candidate, confidence level, evidence
Service impact agent	Estimate the MTTR	Key Effectiveness Indicator (KEI) -> MTTR (Mean time to resolve) services impacted, topology impacted, QoS degradation
Business impact agent	Quantify revenue impact, SLA credit risk, enterprise, and consumer exposure	Key Business Indicators (KBIs) -> Revenue loss / at risk, Penalty exposure Customer impact map SLA impact map
Remediation agent	Provide recommendations to resolve the detected problem	Recommended or executed next-best action

Our solution is anchored in TM Forum's Open Digital Architecture (ODA), Autonomous Networks reference architecture (IG1251), Autonomous AI Control Loop and IG1220 closed-loop models, and relevant TMF Open APIs,

notably, TMF 701 (Process Flow Management API REST Specification), TMF 921 (Intent Management), TMF 642 (Alarm management), TMF 656 (Service problem management).



# Agentic NOC catalyst C26.0.924

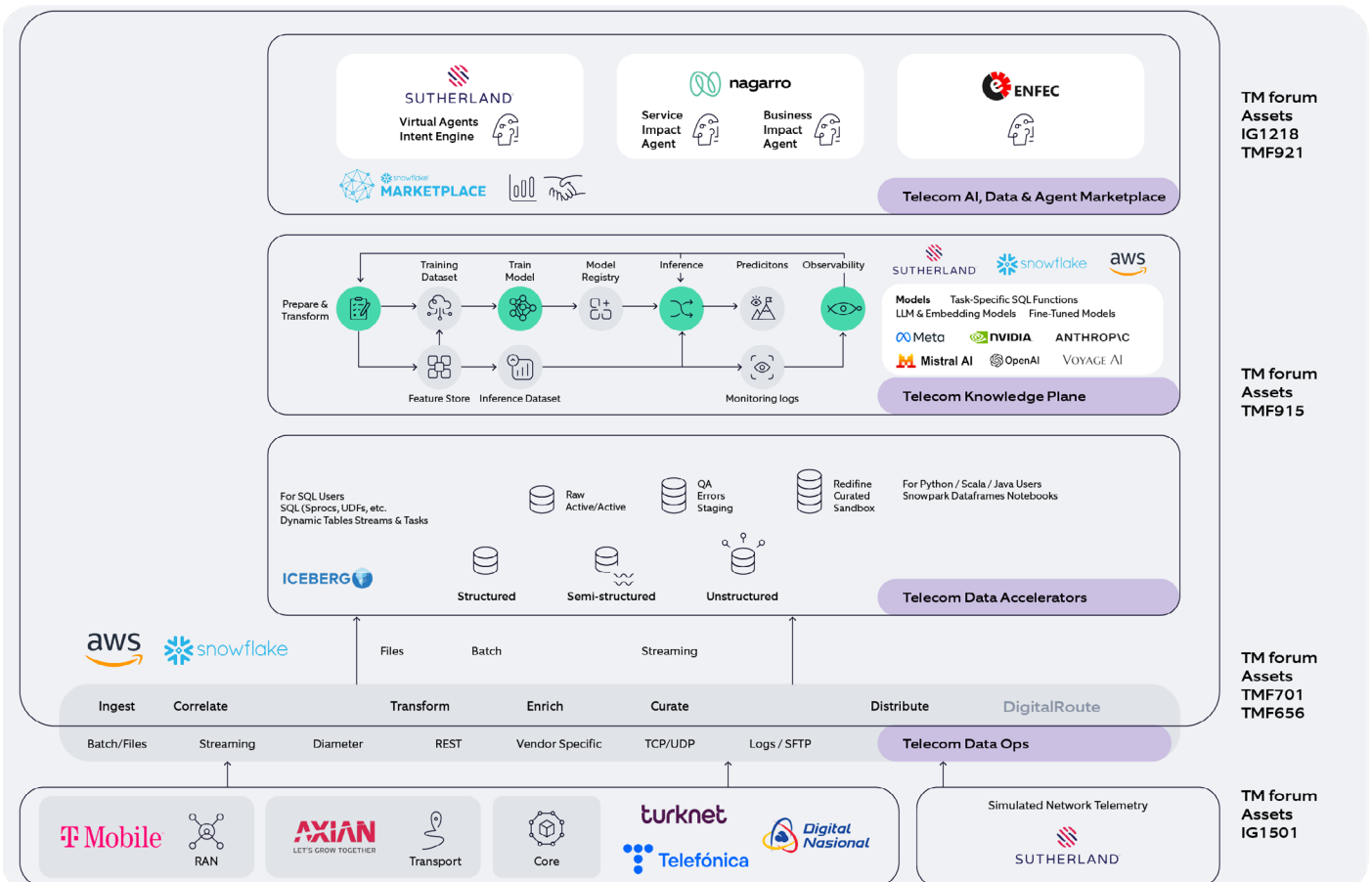
## A view of the solution architecture

Agentic NOC is a very strong fit for AN level 4 and beyond and helps translate it into a tangible operating model. It enables human-supervised autonomy in the short term and selective autonomous execution in the medium term. TM Forum’s work on agentic AI also strengthens the case for an agent-based architecture. Rather than relying on one monolithic intelligence layer, it introduces specialized agents that collaborate across observability, assurance, detection, diagnosis, impact analysis, and remediation. These agents operate over a shared context layer that includes telemetry, topology, policy, intent, historical incidents, and operational knowledge. Each agent has a bounded responsibility, specific inputs, well-defined tools, and clear guardrails. Together they form a

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# Agentic NOC catalyst C26.0.924

We have implemented a layered architecture as part of catalyst solution development.

At the bottom is the high-performance data fabric layer which ingests and normalizes data from alarms, KPIs, traces, logs, performance data, fault events, topology, ticketing, and external systems from across the domains in a multi-network setup. It stores, indexes and processes the normalized telemetry at scale, enabling fast model training, real time queries and multi-domain correlation across large datasets.

Above are the knowledge plane and the intelligence layers.

The knowledge plane layer adds context through service-resource mappings, topology graphs, dependency models, customer and SLA data, historical incident records, and policy definitions. This layer is critical because the same alarm can mean vastly different things depending on where it occurs, which services depend on it, and which customers are affected.

The intelligence layer is where ML models, reasoning engines, and LLM based agents collaborate. This is where anomaly detection, alarm correlation, root-cause inference, service impact and business analysis, and recommendation generation happen.

Then there is the agent orchestration layer responsible for coordinating multiple agents, workflows, tool calls etc., ensuring that actions are executed in the right sequence and within policy guardrails.

Finally, the presentation UI layer exposes insights, recommended actions, and execution status to Network and business teams, enabling human supervision, auditability, and faster operational decisions.



# Nagarro's catalyst focus – Service and Business impact

## Why are these important?

In an Agentic NOC, the service impact agent and business impact agent are the bridge between network operations and business outcomes. They move the Telcos from “what failed?” to “who all are affected, what all services are impacted, with what likely business consequences for instance revenue and penalty, and what should be prioritized now? This distinction changes everything about escalation, communication, and remediation urgency.

## Service Impact agent

As part of the catalyst, Nagarro's service impact agent ingests data from triage agent and enriches it using topology, service mapping, and historical incident data for its output. It achieves it by:

- Estimating the MTTR (Mean Time to Resolve) by intelligent analysis on the HISTORICAL\_INCIDENT\_MAPPING
- traversing RESOURCE\_TOPOLOGY\_MAPPING to identify impacted sites, nodes, cells, links, and domains
- querying RESOURCE\_SERVICES\_MAPPING to determine which customer-facing services are impacted
- querying BASELINE\_KPI\_MAPPING to determine the QoS degradation because of faults and anomalies.

## Business Impact agent

Our business impact agent receives the impact context from the Service Impact Agent and extends the output into financial and customer focused dimensions. It achieves this by:

- Estimating the revenue at risk/loss by querying the CUSTOMER\_CATEGORY\_REVENUE and RESOURCE\_SERVICES\_MAPPING

- Expected SLA credit exposure as certain percentage of MRC (Monthly Recurring charge) in case of breach by querying the SLA\_KPI\_BASELINE
- Querying the RESOURCE\_SERVICES\_MAPPING to determine the customer impact map

This approach aligns with Agentic NOC model as it requires contextual reasoning across multiple systems of record rather than simple threshold logic. It also maps directly to TM Forum's layered service/resource model, where service assurance must be anchored to both resource behaviour and customer-facing services.

Nagarro has implemented its framework leveraging the underlying AWS services such as AWS Bedrock, Lambda and Sagemaker. We have also implemented MCP server for our AI agents to communicate with different tools and the underlying Snowflake data fabric layer.

Both the service and business impact agents are designed as a coordinated pair within the wider multi-agent ecosystem and use a combination of classical ML models and statistical analysis, generate the output to be published on to the dashboard. This coordinated flow implemented by us ensures that post the inputs from triage agent, within 30 seconds, the orchestrator agent has both service and business impact context from the impact agent pair thereby enabling business based intelligent, autonomous remediation prioritization that is a major challenge currently faced by Telcos.



# Use cases implemented in the catalyst

The catalyst demonstrates two (2) high value use cases, as defined by TM Forum in its IG1339 document, with measurable proof points.

- Intelligent fault correlation across RAN and transport domains – This use case comprised of the four outage scenarios namely, Link failure, RU not detected, HW fault and FH (Fronthaul) loop back alarm. As part of the use case implementation:
  - ◇ RAN fault and OSS data is ingested into the underlying data fabric layer
  - ◇ An agent of agents fabric orchestrates ML based correlation, graph reasoning across topology and alarm analytics to determine whether an apparent RAN fault is in fact driven by an underlying transport issue.
- Transport / IP anomaly detection for fixed line network – The traffic anomaly resulted in unexpected congestion in IP/MPLS core leading to increased latency, packet loss, and jitter. For use case implementation:
  - ◇ Anomaly detection agent uses time series deep learning models to learn normal performance counter behaviour and flag deviations before hard faults are raised
  - ◇ Anomaly signals feed both the fault correlation and impact assessment.

For both the use cases mentioned above, service and business impact is implemented and demonstrated into a converge unified Telco dashboard.





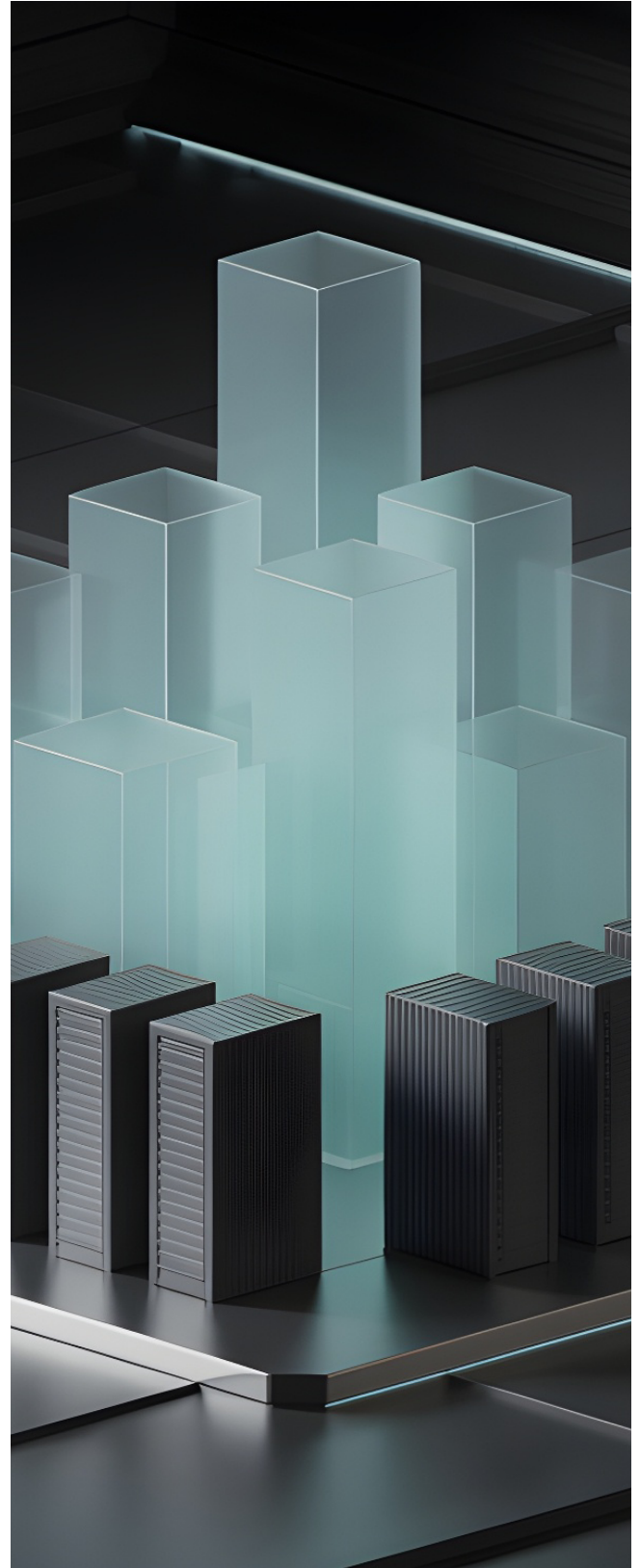
# Measurable outcomes of the catalyst

TM Forum AN4 benchmark KPIs are generally framed as Autonomous Network Key Effectiveness Indicators (KEIs) and Key Business Indicators (KBIs). Considering, Telcos are at different levels on their autonomous journey and observing varying benefits, it will take time to arrive at concrete benchmarking numbers. However as per TM Forum Telcos at higher levels of AN maturity have cited up to 70% improvement in NPS and up to 55% reduction in maintenance and operations costs.

The Catalyst's credibility and outcomes are validated against real operator data from the Telco champions across three continents, not synthetic benchmarks, and every gain is traceable on the unified Telco dashboard that links each autonomous action to its KPI impact.

- Up to 60% reduction in MTTR as RCA and service/customer impact is estimated before it can spread, followed by closed-loop remediation.
- ~70% faster fault identification by correctly attributing apparent RAN faults to underlying transport causes, eliminating the iterative escalation that traditionally consumes hours.
- ~40% fewer incidents escalated to NOC engineers because of high-confidence multi-domain correlation which collapses redundant alarms.
- Up to 60% reduction in MTTD (Mean time to detect).

Together, these potentially translate into operational expense savings, improved CSAT and NPS and reduced customer churn for Telcos.



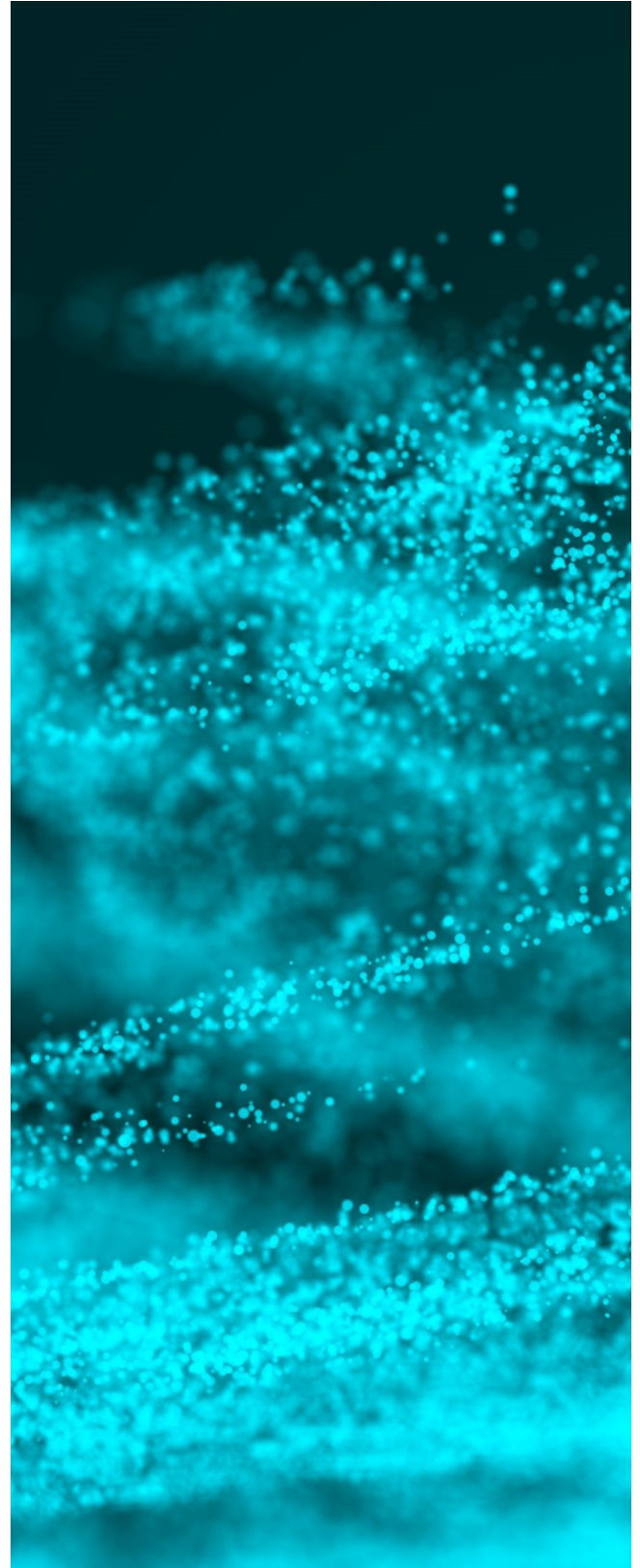


# Catalyst – moving forward

For us at Nagarro, the agentic NOC catalyst is the first step in the Autonomous networks L4 space. We see Agentic NOC extending to all the different high-value scenarios as defined by TM Forum comprising of

- Network focused scenarios namely
  - ◊ Network planning, deployment, maintenance and optimization.
  - ◊ Energy efficiency optimization
- Service oriented scenarios namely
  - ◊ Complaint handling
  - ◊ Service assurance
  - ◊ Fault management and,
  - ◊ Service delivery.
- Additionally, there are array of supporting use case such as
  - ◊ Virtual NOC agents to assist NOC engineers and field force
  - ◊ Digital twin to simulate different recommendations before execution
  - ◊ Security operations such as DDoS detection & automated mitigation, configuration drift and zero-trust compliance etc.

As Nagarro, we see ourselves participating in future AN catalyst projects in a more comprehensive manner by extending our solutioning to other upstream (anomaly, triage, RCA etc.) & downstream (remediation, verification etc.) agents for different high value use cases.

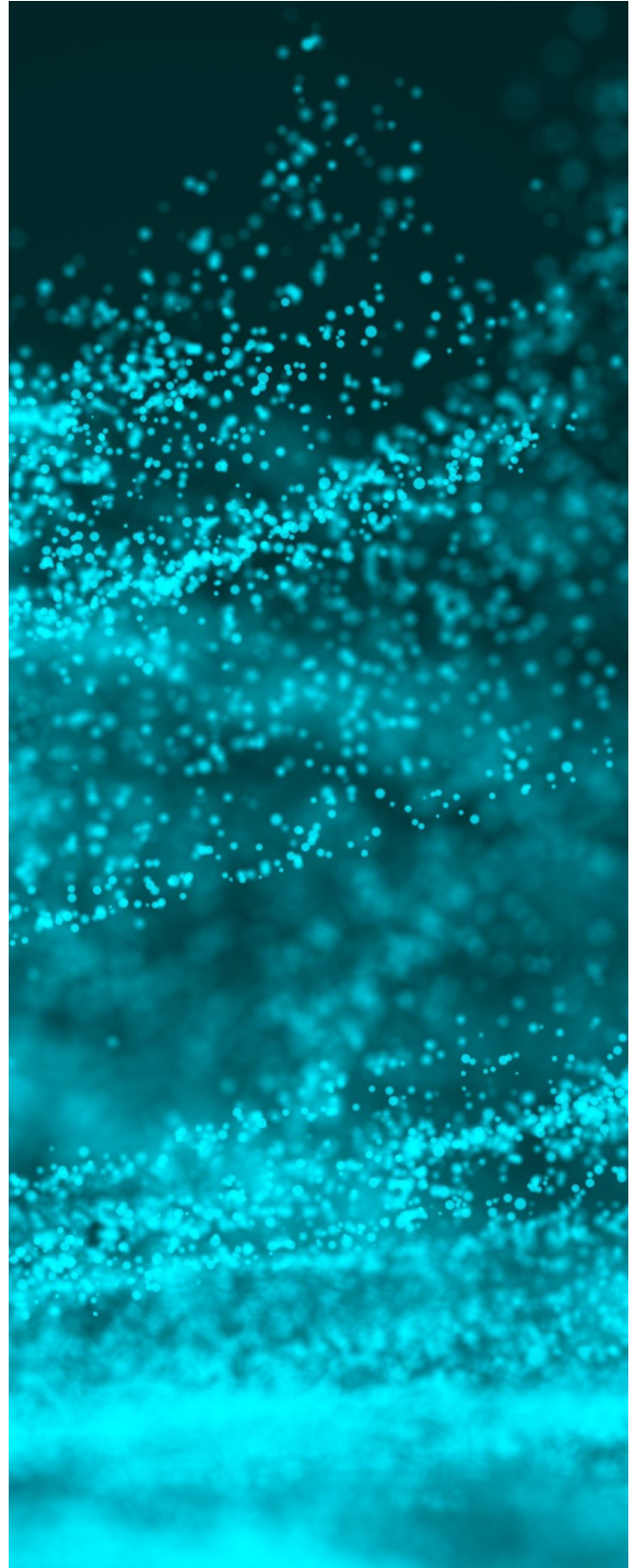




# Catalyst – a step change towards autonomy

The catalyst delivers a meaningful step change toward autonomous, zero touch network operations. It is a step from automation as a tool to autonomy as an operating model.

- Single domain to multi-domain correlation – solution reasons jointly across RAN, transport, and core, so a symptom in one domain gets attributed to its true cause in another, eliminating cross team escalation.
- Reactive to predictive - agents identify root cause and impact footprint before the impact spreads, so remediation begins preemptively.
- Bespoke to standards compliant – rather than a one-off demo, the solution is built on TM Forum’s AN architecture, Open APIs, agentic AI close loop (AACL) models etc.
- From recommendation to autonomous action - closed loop remediation runs end to end inside policy guardrails, detecting, identifying root cause and customer/service impact footprint, isolating, and restoring with minimal human intervention.





# In conclusion

The catalyst further substantiates that Agentic NOC is a credible and increasingly necessary path from traditional network operations to AI-native autonomous telco operations. It aligns with TM Forum's Autonomous Networks vision, reflects the emerging role of agentic AI in telecom, and offers a practical operating model for reducing operational friction while improving service and business outcomes. The human role moves up the stack from "find and fix" to "set intent and govern". For Telcos, pursuing AN Level 4 and beyond, the Agentic NOC is emerging as the operational blueprint.

Nagarro's contribution is pivotal in solutioning the service-impact and business-impact layers, the point where operational data becomes customer, contract, and revenue intelligence. By designing these agents with strong topology awareness and contract-aware reasoning, Nagarro can help CSPs move from reactive operations to impact-aware, Level 4-ready autonomous operations. Service and business impact truly contribute to making an Agentic NOC financially meaningful for Telcos.

## References

IG1251 Autonomous Networks Reference Architecture v1.0.1

IG1339 Autonomous Networks L4 High Value Scenarios v2.4.0

TM Forum's Assessing CSPs' progress towards Level 4 autonomous networks report

IG1256B Autonomous Networks High-Value Scenarios Effectiveness Indicators v1.2.0

IG1251C AN Level 4 Target Architecture v1.2.0

IG1358 Intent Based Operation User Guide v1.1.0



# About the author

**Soumya Seth** is a Telecom SME and Product Manager in Nagarro's Telecom Business Unit, bringing over 20 years of diverse experience across the communications industry. His primary focus is on leveraging AI and Agentic AI-powered solutions to enable autonomous networks, helping telecom operators drive operational efficiency, enhance customer experiences, and unlock new business value.



**Soumya Seth**