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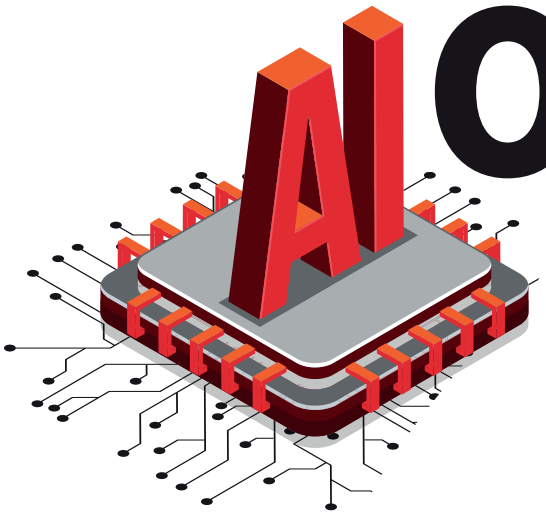

AIOps

From automation to autonomous networks

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December 2020

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The big picture

Transformation impacts every aspect of a communications service provider's (CSP's) business, including operations which have undergone constant change since the mid-1990s. In that time, their role has altered from offline records related to telephony services to processes that design, install, provision, activate, maintain and manage inventory for every network-based service. AI in operations, or AIOps, envisions a high level of AI-assisted or AI-driven automation in IT and network operations.

We are in the earliest days of the move to AIOps, which has gained currency as research firms like Gartner have pushed the concept into the marketplace. Gartner states, "AIOps combines big data and machine learning to automate IT operations processes, including event correlation, anomaly detection and causality determination." This definition applies to AIOps in enterprise IT environments: CSPs typically have bigger and more complex IT environments with multiple sets of IT challenges.

In addition to those faced by any large enterprise, challenges include CSP-specific business and operations systems and processes that keep the lights on, plus new, software-defined and controlled networks. Each of these environments is in flux, moving towards cloud-native architectures that can run on public, private and hybrid (a combination of public and private) clouds. Automating operations is the scope of AIOps for CSPs, although the teams working on AI and automation are largely separate today.

"We are talking about AIOps from the processes side. We are not talking about AI modules for change management, for example, but rather the operational processes that need to change when we deploy AI in our operations," explains Aaron Boasman-Patel, TM Forum's VP, Customer Experience & AI. He emphasizes that AI is not needed for basic, rules-based automation, but adds, "if you want intelligent operations and automation, then you need AI — AIOps and automation eventually will become one."

This is not an easy journey, as Tayeb Ben Meriem, Coordinator of OSS Standardization at Orange explains:

> "We have to move away from a traditional way of operating toward AI automation."

Ben Meriem was speaking during a panel on AIOps at TM Forum's Digital Transformation World Series 2020. "That means we have to break silos that exist today, for instance from fulfillment and assurance, and we need to integrate all of this into a framework," he explained, echoing the same views as the CEO and Chairman of Orange group (see page 6).

AI is different

As AI components move into CSPs' operational environments, the AIOps Service Management collaboration team within the Forum is working to develop that framework to define how this very different technology should be applied, governed and managed.

It is important to understand just how different working with AI is from traditional operations software. It is intent-based rather than procedural, and employs non-deterministic logic, not predictable outputs from specific inputs. It is also immature regarding operations. As Yao Yuan, Project Manager at China Mobile, noted about the first phase of a Catalyst proof of concept, *AI empowered 5G intelligent operations*, run in summer 2020:

> “AI is a great but not an easy technology, and sometimes training the AI is as difficult as raising a baby.”

For this report we surveyed a small, targeted panel of operations experts who are active in TM Forum’s collaborative work on AIOps. We wanted to gain a picture of their adoption, direction and real-world implementation of AIOps, and a measure of its maturity. A large majority of the group we surveyed work in operations for CSPs in hands-on managerial roles.

Read the report to understand:

- Why a lot of automation does not need AI
- Where AI can be most usefully introduced and how
- Why new technologies and autonomous networks are major drivers of AIOps
- The benefits of automated networks enabled by AIOps
- The challenges of implementing AIOps
- Learnings and success stories from CSPs around the world, including China Mobile, Orange, PCCW/Hong Kong Telekom and Telecom Argentina
- The role of TM Forum’s Open Digital Architecture and Open APIs

Section 1

What's driving AIOps?

AIOps envisions a high level of AI-assisted or AI-driven automation in IT and network operations. It is a radical leap but essential if communications service providers (CSPs) want to reach their automation goals. How they advance from here to there is the bigger question AIOps helps solve.

Operations IT environments are usually some combination of complex, hybrid, multi-vintage, multi-vendor, siloed and partially offline. Typically, they are not yet cloud-enabled nor do they use APIs to expose functions or services internally or to third parties. Understanding how CSPs' IT environments arrived at this state helps reveal both the pressure to increase automation, with or without AI, and the hurdles operators face in achieving their goals.

In the late nineties, operations support systems (OSS) were largely offline and designed to complement or replace paper-based records of tasks related to providing telephony services. By aggregating those tasks, initially with manual handoffs and later with various vintages of enterprise integration software, CSPs created processes to design, install, provision, activate, maintain and manage inventory, and provide service assurance for every network-based service. Automating flow-through was a commonly touted but less commonly achieved goal.

Through the 2000s, as the internet expanded, CSPs' services and networks multiplied and became more complex. IP, web and mobile came to dominate, causing a rapid expansion in devices. More recently the introduction of application-based services and the first generation of IoT have added more products, silos, components and integrations to the mix.

As parallel lines of business emerged, they often developed their own associated operations IT. As a result, there are many different generations of software architecture. Operators have made organization-wide efforts to integrate and streamline these systems to improve operational efficiency and reduce high running costs, but it has proved a tough nut to crack. Most CSPs still carry these layers of legacy operations, not least to avoid the risk of business disruption posed by replacing them.

Complex operations

As a result, anything from COBOL-based Bellcore-era systems, the J2EE-based systems that followed them and cloud-based applications may work side by side in CSPs today.

"Telco operations is one of the most complex environments with multiple technologies from multiple vendors working in tandem with each other for specific outcomes," says Mohammed Fahim Momen, General Manager, Operations Systems Software (OSS) & Customer Insight for Robi Axiata.

Data tends to be disparate, processes may be semi-documented and inconsistently automated, and organizations tend to work in silos. "What results is a very complex infrastructure serving different purposes," Momen continues.

CSPs must rethink IT

Clearly, making a leap to fully automated operations infused with AI is not going to be simple, but C-level leaders are demanding it, with good reason. Stéphane Richard, CEO and Chairman of Orange and GSMA Board Chairman, told TM Forum's Digital Transformation World Series 2020 keynote audience that, "IT transformation is an absolutely essential element of many operators' strategies, including Orange," and insisted that the telecom industry must "rethink the way we do IT."

He noted that IT is recognized as a strategic capability, but board-level scrutiny reveals that, "IT is too complex, too rigid, and too cost intensive". He observed IT transformation projects are too slow and expensive, and that billing, ordering, provisioning, and other core IT functions are monolithic.

CSPs' legacy debt is so heavy in fact, "by 2025 technical debts will consume more than 40% of operators' current IT budgets," Richard said.

The solution is for CSPs to make a "rapid shift to an open, modern, software-based technology architecture that enables new operating and business models," he added. This new architecture should be "loosely coupled, cloud native, and AI-driven," he explained, and must be made from standard components that can be interchanged without customization. In short, Richard said the industry "must evolve from a closed IT architecture to an open platform architecture" – see below.

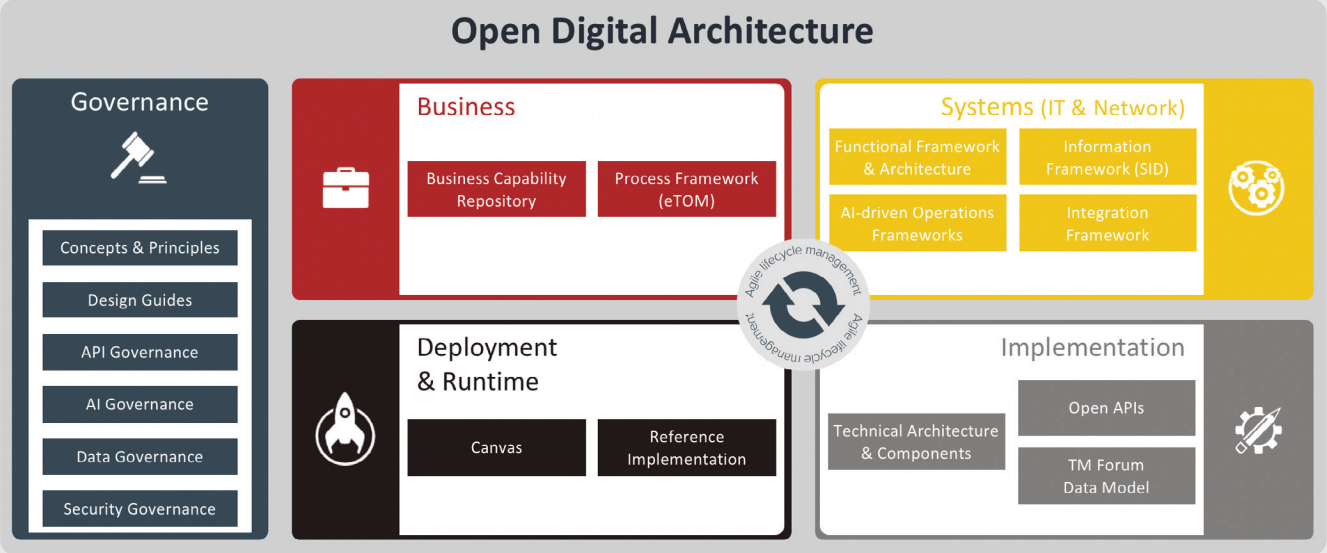
Moving to an open platform architecture

TM Forum's members are developing the Open Digital Architecture (ODA) which complements the Open APIs initiative. Its purpose is to help CSPs transition operations to an open platform architecture. Orange's Richard pointed out that aging standards processes may not be effective in rethinking IT; he suggested "complete code" and "real tests within the TM Forum" is what CSPs need to move to a fully automated, AI-driven IT infrastructure.

In June 2020 the ODA took a remarkable step forward when a group of traditional operational and business support systems (OSS/BSS) vendors joined the more than 30 CSPs that are working on the initiative. They include BT, Chunghwa Telecom, Deutsche Telekom, Globetom, Telefónica, Telenor, and Vidéotron. The ODA working group is "committed to transforming from legacy OSS/BSS to cloud-native software components and replacing traditional IT architectures with the Open Digital Architecture's standardized plug-and-play components, data model and Open APIs."

In other words, contributors to the ODA are defining how CSPs' operations can pivot to open, cloud-native architectures and standard APIs while helping CSPs to minimize both business disruption and stranded cost.

In December 2020, the Forum announced another big step forward: Accenture, Axiata Digital Labs, Global Wavenet, Globetom, Oracle Communications, Orange, SigScale, Sysbiz Technologies, Vodafone, and Whale Cloud are collaborating to build a test platform for the ODA. It will be used by the Forum's members to validate ODA-compliant software components to help CSPs deploy agile, cloud native software-based networks to speed up innovation and monetize 5G.



The future of legacy debt

"I believe 5G is an opportunity to start to go forward with and without something," says Tomohiro Otani, Executive Director with KDDI Research. While proven processes, business knowledge and data need to carry forward, CSPs' legacy debt should not.

Quantifying "legacy debt" means understanding what legacy is. "My working definition of a legacy system is anything that's in the field and doing something useful," says Mark Mortensen, Principal Analyst, Communications Software, with ACG Research, "but most people would like to call them pre-cloud systems and I think that's a reasonable distinction."

From an architectural perspective, operations systems evolved from pre-object oriented to object oriented, to J2EE and .NET, and now to the cloud. Many legacy systems, as a result, are ill-equipped for cloud native environments and yet continue to play key roles in CSPs' day-to-day operations.

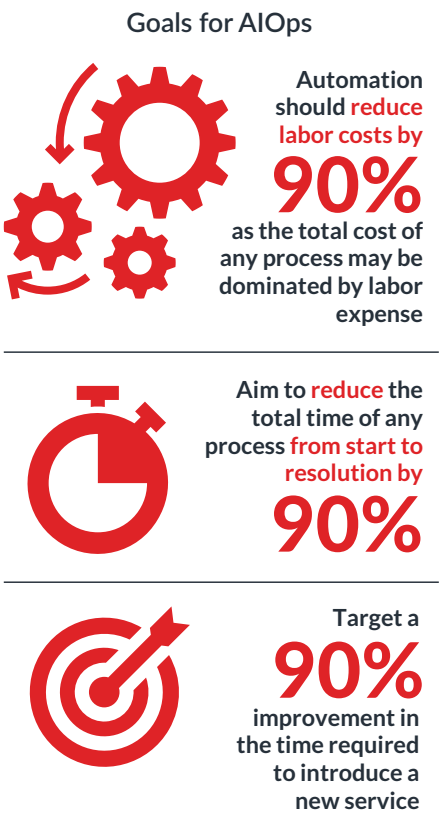
To span the gap, legacy systems "will eventually getrecoded," says Mortensen. "You take a monolith and break it up into microservices over time or you start over and recode the whole system. This is a known art and that work is already happening. Everyone is re-coding to go onto the cloud," he adds.

As AIOps for CSPs encompass AI, operations automation, and autonomous networks, it is easy to assume AI and automation are the same thing. "They are still not intertwined," says Momen of Robi Axiata. "Rules and input-output based software engines are powerful enough to execute many basic as well as advanced tasks which are not necessarily AI by definition," he says.

Momen thinks that the hype around AI tends to equate it with automation, but automation with and without AI "will continue to generate value based on different use cases."

ACG Research reports that, "CSPs are committed to automation in their business and network operations, with 20% growth in annual spending for automation projects." In a research note[1], Mark Mortensen, Principal Analyst, Communications Software, ACG Research, groups the three major benefits of network automation into operations cost, operations speed, and business agility. He calls on CSPs to aim for order of magnitude improvements in each area.

Mortensen recommends a 90% rule as shown below.



TM Forum, 2020 (source: ACG Research)

He states that current technology – that is, without AI – can automate nearly 75% of manual effort "to cut service provisioning times by an order of magnitude." The lowest hanging fruit, he says, may be in automating "the individual tasks that otherwise would be performed by people using command-line interfaces," which are text-based and not user friendly.

Automation without AI

CSPs' processes tend run within silos, although there are often dependencies and interconnectivity between them. Nevertheless, the silos and processes work independently and were deployed that way to carry out specific job functions within those silos as "traditional software does give us significant leverage" Momen says. The functions of such operations systems can encapsulate decades of domain expertise effectively, but typically use no AI to automate portions of operations process, like design, planning, provisioning, or service deactivation.

There are also proven use cases for traditional operations software that are AI-like but do not involve AI. "Self-organizing networks, anomaly detection, process control and governance, insight and reporting, and many more use cases based on traditional software are yielding excellent results without any AI," he explains.

[1] Dr. Mark H, Mortensen, *Economic Benefits of Network Automation*, ACG Research, April 2020. With permission.

Where AI wins

There are areas, however, where a consensus of confidence has emerged around AI's superiority over traditional software. Momen and others interviewed for this report say AI is the best option for processing extremely large data sets that combine heterogeneous data from multiple sources and where multi-domain or cross-functional correlation is required.

For example, "360-degree assurance of network performance and customer experience requires a unified platform and solution, and there the need for AI arises," Momen says. AI may also be a better fit than traditional software for automating responses to both repetitive analytical requirements as well as continuously changing network configuration and customer experience-related requirements.

Where to focus?

Autonomous networking use cases are driving interest in AIOps, including those instances where AI is not part of the automation architecture. CSPs know it will typically take a few steps along the automation path to increase the degree of zero-touch service they can offer, never mind achieve autonomous networks on large scale: Many more milestones remain on that path.

Given the complex and often disparate state of most operations environments, there are basic criteria for automation CSPs can use to determine where to start. Most of the hard work is practical and detail oriented. "It's not like you plant a seed and grow an autonomous network," says Armijo Marchant, Chief Architect, Telecom Argentina.

She warns peers not to take automation's complexity lightly and urges those who seek to automate operations processes to respect the "mandatory conditions" for effective automation. Marchant says:

> "The more deterministic a process is, the better automation will fit it."

Marchant advises peers approaching operations automation and AI to take several key incremental steps, including:

- Understanding and identifying processes and operations that are well suited for automation.
- Improving these first with "simple automation."
- Gathering data to understand the automated operations environment better.
- Testing AI-assisted automated interventions and measuring whether there are gains and improvements.

AI vs. engineers

Marchant says from vast experience that deterministic processes involving known events, conditions and outcomes are best suited to automation and to event-driven architectures. With this approach, she says, the CSP can define precisely how it responds to events in an automated, repeatable and scalable way. It is a very engineering-driven, proven, auditable and reproduceable approach to automating processes. Like an automobile engine, it can be measured and fine-tuned over time to increase performance.

In the context of AIOps, it is proposed that AI could be used in place of event-driven automation. In such a case, intent-based AI would determine how to best operate a process using non-deterministic and potentially non-reproduceable conditions and logic.

In an operations world where practitioners tend to prefer complete control over and visibility into how their processes and systems are flowing, moving to AI-driven, intent-based automation is a leap that will take time to complete.

In the next section, we'll look at responses to an AIOps survey conducted for this report.

Section 2

CSPs are committed to implementing automation – and AI

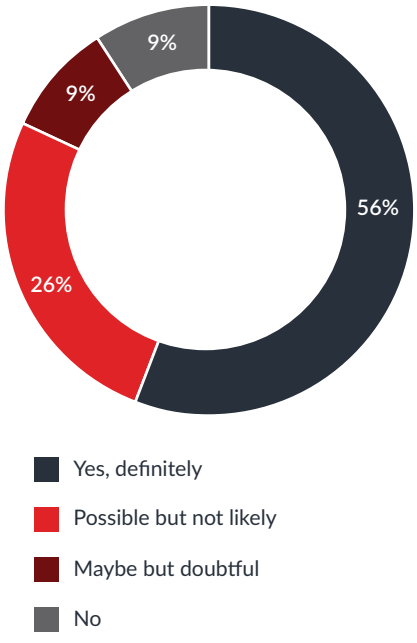
Communications service providers' (CSPs') digitalization and automation efforts started with customer experience, and substantial investment on improvements continues. The aim is to provide all-digital, on-demand, self-serve functionality supported by automated processes, like service activation. Many CSPs have already transformed their customer-facing channels to be more e-commerce and self-service led, and the first pure digital mobile brands are launched and growing.

When we carried out our first AIOps survey in 2018, the term had barely been coined. Even now, only 30% of CSP respondents to a survey conducted for this report say they hear the term used in their companies at least weekly, with 54% saying they never hear it used.

Still, more than half believe we will have autonomous networks run by AI within a decade, in parallel with developments in virtualized networks and cloud-native IT. Another 26% say such fully autonomous networks will be possible, if not likely, within 10 years.

Read the report to learn more:

Will CSPs deploy large-scale, fully autonomous networks run by AI within 10 years?

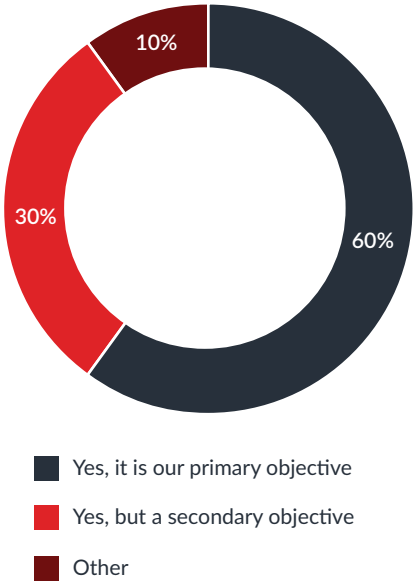


TM Forum, 2020

This finding is backed up by 60% of survey respondents saying that increased automation is a primary objective for their operations. A further 30% call it a secondary objective.

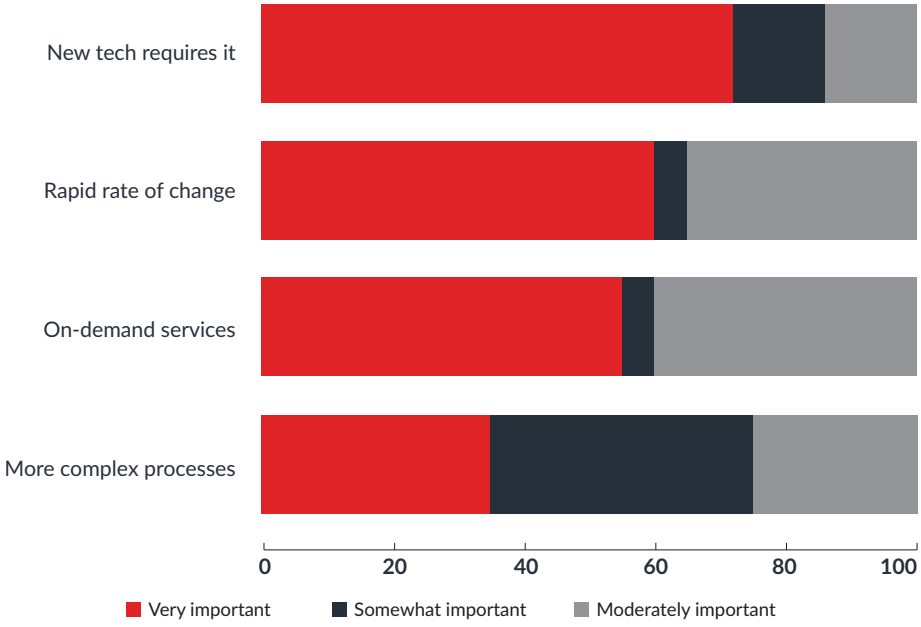
> Without question, CSPs intend to automate operations, which is a much clearer statement of direction than our first report found.

Is increasing automation a key objective for operations?



TM Forum, 2020

What is driving operations automation?



TM Forum, 2020

Key drivers

The majority of survey respondents say the biggest driver behind automating operations is that new technology requires it. Implementation of software-defined networking (SDN) and network functions virtualization (NFV), for example, demands automated and integrated operations where fulfillment and assurance are seamless.

Mark Mortensen, Principal Analyst, Communications Software, ACG Research explains:

> “In software-based networks, services can be “instantaneously deployable for automated provisioning, replacing the logistics-bound physical equipment in many cases and speeding the introduction and provisioning of new services. This can only be done through massive automation.”

A substantial majority, 60%, of our survey respondents also rate the rapid rate of change inherent in 5G and autonomous network services as being very important drivers for automation, while 55% point to growth in on-demand services.

Rakuten Mobile puts network automation in the spotlight

Automating operations established itself center stage during the *Digital Transformation World Series 2020* keynote when Tareq Amin, Group Executive Vice President, Chief Architecture Officer and CTO, Rakuten Mobile, stated "automation is the underpinning of everything that we're going to do in the network." Rakuten Mobile is the first cloud-native operator, built that way from scratch, as well as having innovative, disruptive business models.

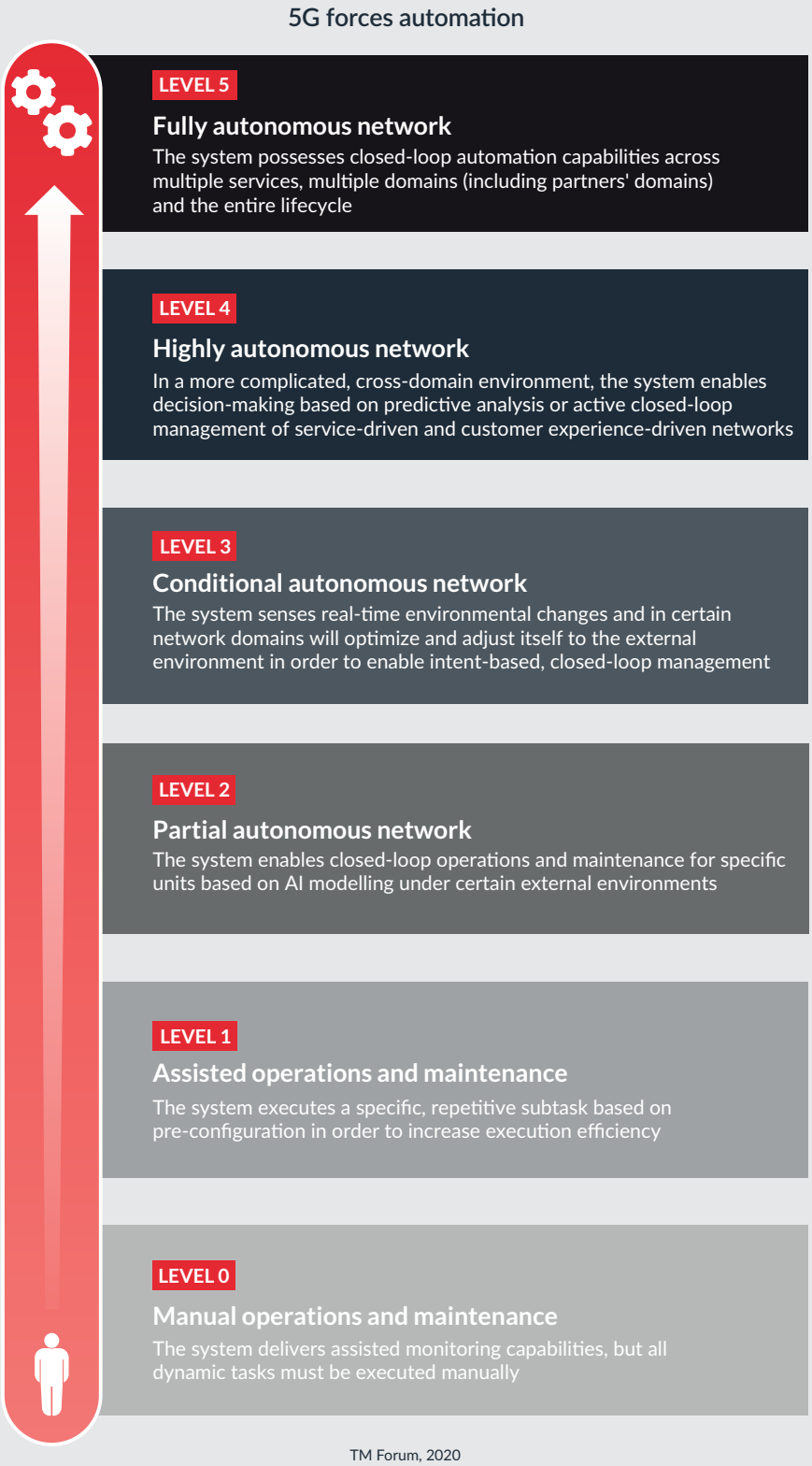
Like Orange's Stéphane Richard, who said CSPs must shift their IT to a cloud-native platform model, Amin called for a "massive transformation of how we offer OSS and BSS to this industry."

Amin said that Rakuten Mobile is "heading towards a Level 4 autonomous network in two years" which will be self-organizing, self-optimizing, and "designed to address real-time issues in the underlying infrastructure while sustaining service continuity." In other words, it will embrace AIOps.

The graphic shows that a Level 4 autonomous network stops just short of "no humans needed". Rakuten Mobile has no legacy IT debt as it builds out its infrastructure with the hyperscale cloud era in mind.

Yet Rakuten Mobile's focus on automation, and the benefits it seeks to derive from it, are common to the industry, as are decisions about what role AI will play in automating operations.

This is why there is such a high level of interest in how it fares from CSPs all around the world.



TM Forum, 2020

"If 5G is deployed with the existing operational processes and systems environment, operational costs will balloon and on a long-term basis may not be sustainable," Appledore analyst Francis Haysom argued in a recent research note.

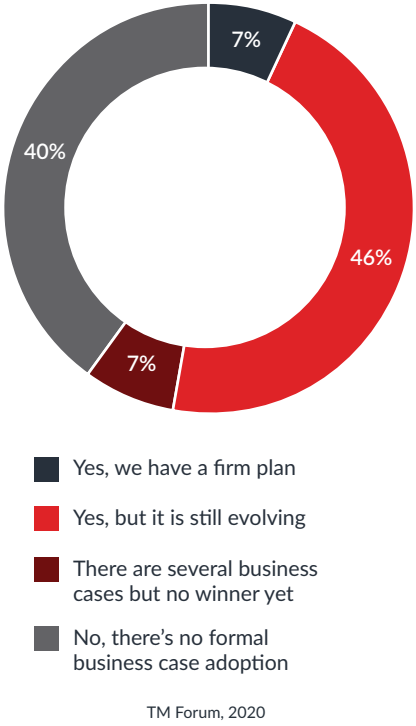
Haysom says CSPs will face 5G network cost increases of 50% to 300% and "must be prepared that customer demand for increased speed beyond what LTE can deliver may not generate increased revenue per subscriber." In other words, for 5G's business case to make sense, given build costs and spectrum fees, operations must become faster, better and cheaper.

CSPs are well aware of this, and that automation is key to them being able to handle the expected huge increases in data volumes sufficiently quickly, more efficiently, and at less cost.

Almost two-thirds, 64%, of our survey respondents believe the kind of scale and complexity IoT and 5G will bring to operations can only be automated with AI. They also agree with Appledore's point that unless the operations model becomes less costly, more effective and far more automated, 5G business models may not work.

Hence, despite AIOps being at an early phase, almost half (46%) of respondents report that they have at least one evolving AI business case and 7% have a firm plan.

Do CSPs have a business case for AIOps?

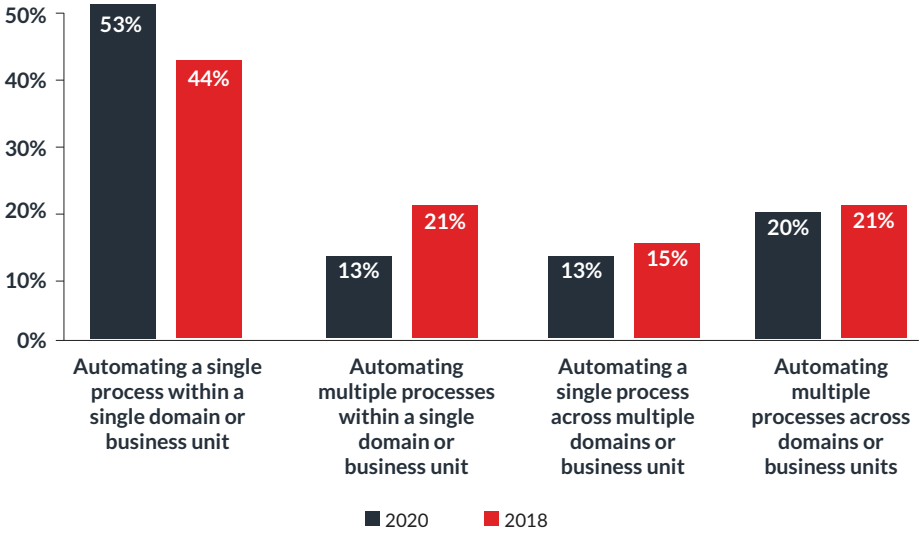


TM Forum, 2020

Further, 54% of respondents are using AI today to automate a single operations process within a single domain, and more than a third are using AI to automate one or more processes across multiple domains. As the graph below shows, compared with data collected in TM Forum's 2018 AIOps survey, CSPs are more focused now on using AI to automate a single process within a single domain, possibly reflecting the practical difficulties involved in automating large-scale operations. It indicates how big the gap is between islands of automation and end-to-end orchestration.

In the next section, we'll look at some of the challenges CSPs are facing in adoption of AIOps.

How are CSPs using AI to automate operations?



Source, TM Forum, 2018 and 2020

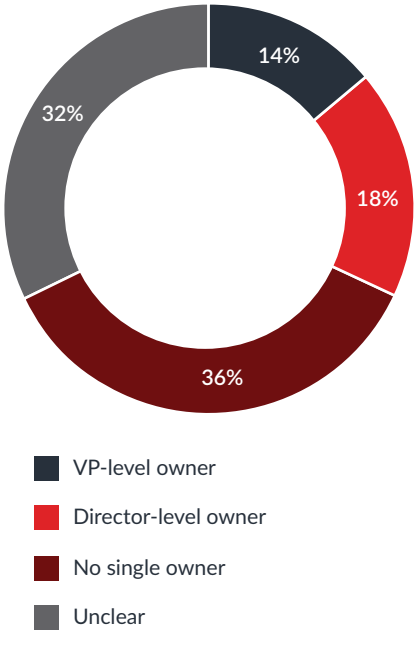
Section 3

AIOps market is starting to take shape but faces some tough challenges

AIOps adoption is in an early phase among communications service providers (CSPs). A market is starting to take shape with signs of growing interest and activity, but obstacles to progress remain.

Our survey conducted for this report shows that telcos' top management is yet to adopt a common approach to AI. Indeed, no respondents report a C-level owner and only 14% report having a VP-level owner for AI. Over a third, report multiple owners as AI is cross-functional, and another third say it is unclear who owns what.

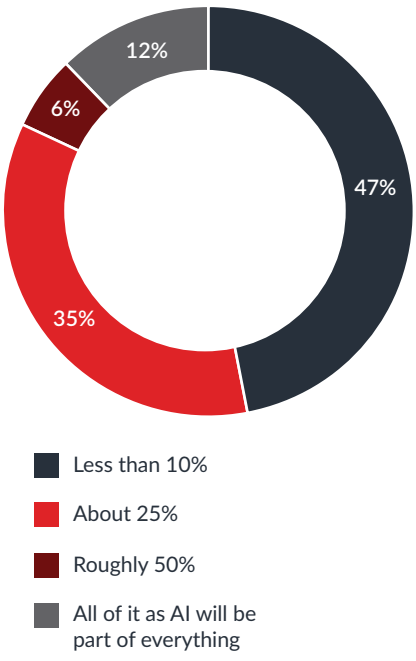
Who owns AI?



TM Forum, 2020

Another issue is that IT spending related to AIOps is as yet modest. The graph below shows that nearly half of survey respondents say AIOps will occupy less than 10% of their IT spending in operations during the next three years. For 35%, however, AIOps will command a quarter of their budget. A small portion of respondents, 12%, say as AI will be part of everything, in effect, all spending will go to AIOps.

Percentage of CSPs' IT spending on AIOps in next three years



TM Forum, 2020

At the launch of Orange group's five-year plan in December 2019, CEO and Chairman Stéphane Richard explained the challenge the company is facing:

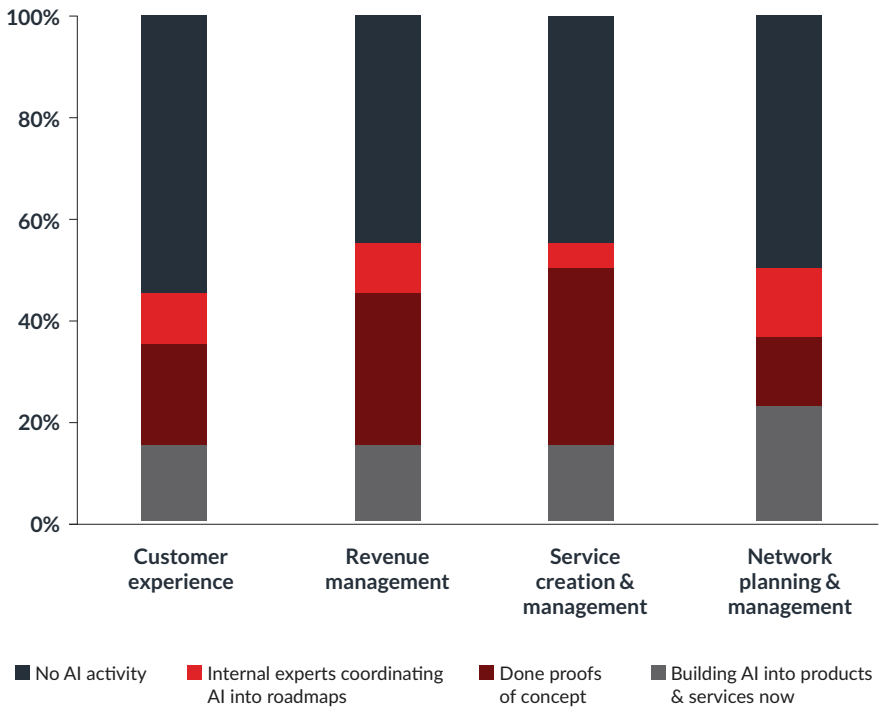
> "By 2025, Orange will have to reinvent itself and adapt to a constantly changing world. Artificial intelligence and data will be at the heart of this reinvention, both to improve customer experience and to make our networks smarter and the whole company more agile."

Use of AI

The graphic opposite shows CSPs' overall AI activity is low across the board. Specifically regarding the network, more than half of survey respondents say they do not use AI in network planning and management today, but nearly 25% are building AI into products and services in this category, a higher percentage than in the other three areas. Almost half have no AI activity in service creation and management, though roughly 35% have completed proofs of concept in this category.

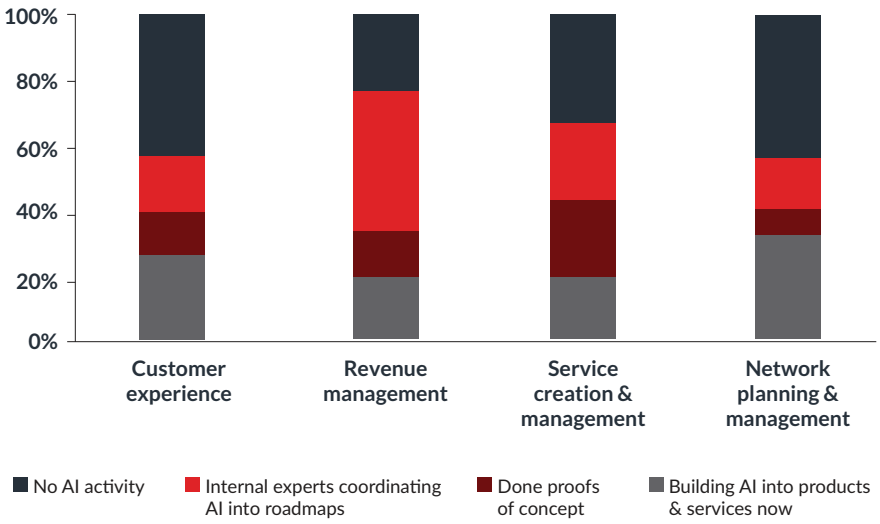
By 2022, respondents expect to see more forward momentum in AI deployments, with nearly nearly 35% of respondents seeing AI used in network planning and management by then. Service creation and management may see only small gains in adoption, however, with less than 20% of respondents saying it will be implemented by 2022.

CSPs' AI activity in 2020



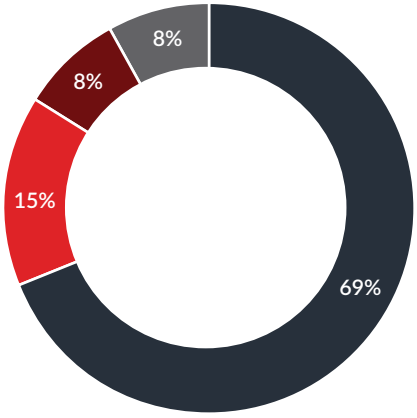
Source, TM Forum 2020

CSPs' expected AI activity in 2022



Source, TM Forum 2020

What is the most significant barrier to exposing operations data for network automation?



TM Forum, 2020

CSPs still face maturity hurdles with AI. Not only are AI tools immature, but the environment around them may not have transformed enough yet to feed them – no usable data and common model means no AI. So while network automation is a killer app for AI, 69% of survey respondents say the biggest barrier to network automation is a lack of standards for exposing network operations data streams.

In the next section, we'll look at lessons learned by early adopters of AIOps.

Section 4

Early successes and lessons in AIOps

Despite communications service providers (CSPs) being in the early part of the adoption curve for AI and other new technologies, success stories and early lessons are emerging.

Learning from an AIOps proof of concept

The *AI for IT & Network Operations (AIOps)* Catalyst project recently completed its third phase. This project includes seven CSPs that collectively represent more than 1.5 billion customers, such as China Telecom, China Mobile, China Unicom, KDDI Research, PCCW/Hong Kong Telecommunications (HKT), Smart Communications and Telefónica Deutschland.

The AIOps catalyst team has developed eight use cases based on the CSP project members' real-world business needs in customer experience, quality of service, business performance and efficiency.

These include:


Poor customer experience prediction and prevention


Churn prediction and proactive customer retention


Accurate service level monitoring


Proactive root cause identification, communication and resolution in 5G networks


Customer complaint prevention


Preventive maintenance


Intelligent operations and maintenance (O&M) for home broadband services


Closed-loop service assurance

Highly automated AIOps use cases like these are becoming increasingly possible, Mark Mortensen, Principal Analyst, Communications Software, ACG Research, explains, because "richer network status and usage information is available from the new generation of modern physical and virtual equipment. Automation using big-data analytics and artificial intelligence automation is the only way to gather, process and evaluate this onslaught of data."

Key learnings have resulted from this pioneering work in AIOps as well. For example, Tomohiro Otani, Executive Director, KDDI Research, says that early attempts to use AI in operations "found the precision was not so good." Over time, however, it was determined that "even the data we collect in the operations environment is not enough for AI learning, especially for QA types of operations," Otani says. Alternative techniques to generate enough data to train AIs for operations have had to be developed as a result.

HKT builds an AIOps strategy

"AIOps is part of the whole AI strategy in Hong Kong Telecom," says Derek Chen, Assistant Vice President of Customer Service for Hong Kong Telecom (HKT). The company's business in over-the-top (OTT) apps grew 26% in the past year while its premium customer base grew 8%, making a reactive customer support process for OTT applications unsustainable.

HKT applied AI to predict, prevent and analyze events to fix problems before customers could complain about them. "AIOps happens before the customer complains," says Chen.

To get started with AIOps, Chen advises CSPs to look at three key areas:

> Standardize data to be able to analyze it – "We had cloud service, web, mobile, social media, network equipment data…all in different formats," said Chen.

> Create a dynamic customer profile – "Customers change patterns from time to time and we need to understand when they have changed so we can match on it," he explained.

> Work toward real-time customer engagement – for every customer that calls in with a problem, said Chen, there are multiple other customers with the same problem who do not call at all. AIOps provides insights into how customers are using services so CSPs can engage them positively, "not just because they're calling us," he added.

As AI becomes embedded in products, Chen says, CSPs will need "AI for AI" because "if you don't have AI operations that support AI products, you are crippled."

Chen says the AIOps service management framework is needed to provide "a full checklist not only for redesigning traditional operations processes but also in a way that the AI-enabled software systems are monitored, controlled and governed."

Orange builds groupwide AI competency

Orange created a group-level AI and data analytics organization about two years ago, led by Steve Jarrett, Global Head of Data & AI for Orange group. In May, with his colleague Emmanuel Lugagne-Delpon, SVP at Orange Labs Networks, he outlined some of Orange's successes so far, taking a "test and learn" approach, and looking always at where they can bring the maximum business benefit.

Lugagne-Delpon said at the online briefing, "We believe that AI can bring value to almost every phase of the network lifecycle – so network planning and design to optimize the efficiency of investment, operations for advanced monitoring, smarter maintenance and better security, and also optimization to populate a number of operation processes and also optimize the performance and the use of resources."

In May 2020, Orange Spain announced a new AI-based tool used for network planning called Smart CapEx. This live AI use case is saving the operator a reported 10% to 20% in CapEx efficiency. The tool evaluates cell sites for profitability based on a holistic view of quality, location, customer experience and business impact. As it is a use case that applies to every mobile operator within Orange group, this kind of AIOps capability could provide a strategic advantage particularly in the race to build out 5G coverage with an eye on near term profitability.

The two went on to describe a number of use cases, such as:

- The root causes of faults are famously hard to identify with alarms raising many false positives. Orange passes some 40 million homes with fiber in Europe and has about 8 million household subscribers. It has developed diagnostics that combine the established rules-based algorithms with AI to remotely pinpoint the root cause of FTTH outages and other issues. The older, rules-based system solves about 70% of problems, so AI is only brought to bear on the outstanding 30%. Some problems can be fixed remotely, but even when engineers have to intervene in the field, at least they are armed with information about the cause, which usually means a faster fix.

  Orange estimates the use of AI has avoided 280,000 trips into the field by engineers, saving the company more than €20 million a year, at the same time as improving customer satisfaction through less downtime and disruption.

- Orange is using AI with centralized self-organized network (C-SON) technology for two purposes. First to predict how traffic patterns at a radio site will evolve, using AI to reroute traffic to other base stations and avoid congestion. This gives customers better service and optimizes the use of expensive network assets.

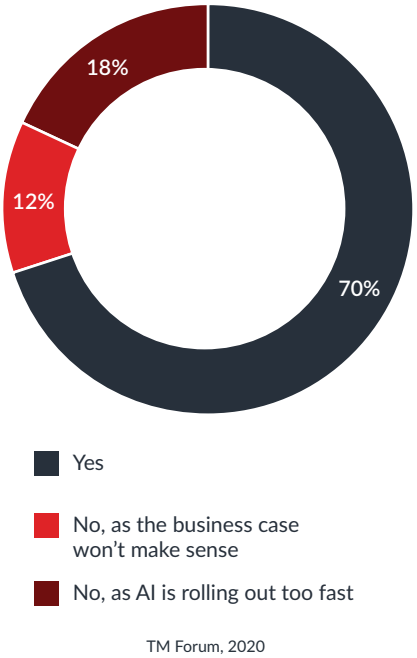
  Second, AI uses near real-time predictions about traffic to turn off elements, such as the antenna, that are not in use at the radio sites to reduce power consumption by a few percent. About half of the 18 countries, mostly in Europe, where Orange has deployed C-SON now have closed-loop automation.

During TM Forum's Digital Transformation World Series 2020, Jarrett described Orange's approach to building groupwide AI competencies. "Orange has a willingness to take risks and to let us take on large problems that have a big impact for the business," he said.

He explained that Orange had to identify at the outset, as most organizations do, the "foundational elements that were missing with data ingestion and data quality" and to establish workflows for managing data-centric projects.

He likens his experience as a large enterprise buyer of AI to the internet in the 1990s: There's a massive opportunity, "but it's not clear what will happen, and the tools are immature."

Do CSPs need a management layer for AI?



TM Forum, 2020

Jarrett says the biggest missing pieces for any organization trying to establish a strong AI competency tend to be a lack of tools and workflows to stage and structure the data work that AI teams must do.

Need to manage AI

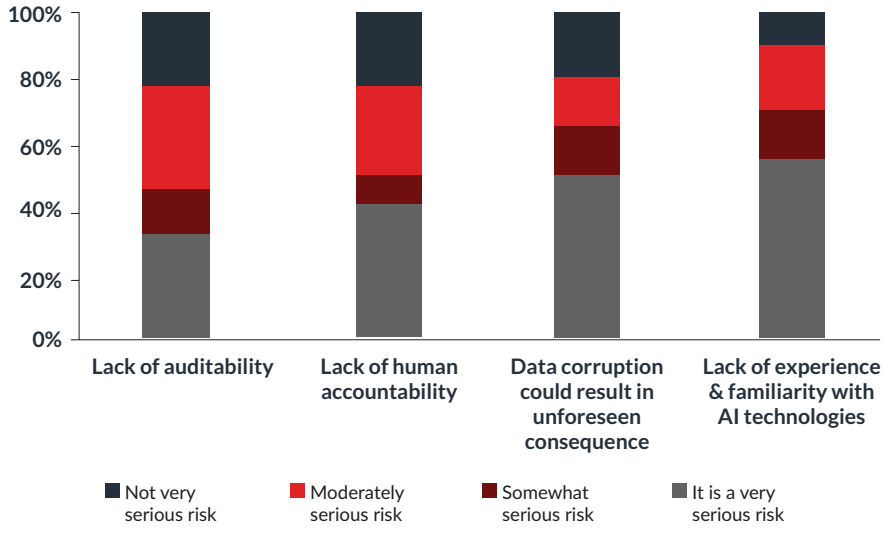
This was also the opinion of 70% of our survey respondents who believe a new layer will need to emerge just to manage AI. The other 30% are doubtful, either because the economics don't make sense or because AI will roll out too fast for CSPs to have time to build out an AI management layer.

Jarrett said there are opportunities now for suppliers to provide tools that "structure the work teams have to do so it is very well staged." He thinks most organizations have engineers and data scientists collaborating about data but have not yet structured the process. Orange, he explains, has had to establish its own processes, workflows and the governance needed to address this practical aspect of running an AI operation.

He offers three points of advice for peer CSPs establishing large scale AI programs:

- **Prep and stage your data** – the first major challenge CSPs can expect to face with AI comes in "getting the data ready," says Jarrett. "Improving our ability to structure and ingest that data and work with it in a workflow would pay dividends across the company," he says.
- **Focus on data that supports multiple use cases** – prepping data for AI is effort intensive. Jarrett explains Orange group's AI team aims to spot opportunities where data sets enable multiple use cases and where even small improvements would have a large impact on CapEx and OpEx, such as with network data.
- **Educate organizations to work with AI** – shifting the thinking of operations teams not only to try new AI tools but also to adopt new approaches and ways of solving problems is an equally important challenge to acknowledge and address. Jarrett reckons it will take a decade or more to use data and AI to really change and improve the way business is done and services are delivered to customers. He advises large organizations to invest in skills training, not just for developers and data scientists, but also cultural and technology awareness training so that organizations can adapt to using AI.

CSPs weigh AI risks



Source, TM Forum 2020

If knowledge is power, ignorance is risk

Survey responses align with Jarrett's advice. More than half say their own lack of familiarity with AI technology is the greatest risk it presents today. Half consider the possibility that data corruption will drive unintended but consequential AI behaviors as a "very serious risk". Each of these concerns outweigh other noted risks, such as a potential lack of auditability and human accountability in intent-driven, non-deterministic, AI-driven operations systems.

AI must be accountable

Armijo Marchant, Chief Architect, Telecom Argentina, says one issue she has found in her exploration of AI tools and models is that some take the approach of a "black-box of automation." But AI must be accountable and auditable, she says, and humans must be able to impose their authority on decisions. As a result, new governance processes are needed to both account for AI behavior and to address any potential biases in data sets and machine learning that may result in consequential and unpredictable behaviors.

There's real benefit as well, she says, in going through the effort to automate processes and become skilled with AI because of what is learned along the way.

> "Imagine automating your home. If you hire someone to do it, they might do it quickly and you'll be happy until you need to change something. And then you'll have to call someone again because you didn't learn anything from the process of automation," she explains. "You don't have the controls to make slight changes. So, it's not about automating and following instructions because we won't learn anything about these new technologies that way."

How to govern AI?

Indeed, one of the main challenges CSPs are facing is how to govern the many instances of AI that will be deployed in their networks and IT environments. Introducing AI models into operations transforms the production environment to be intrinsically dynamic. Unlike traditional software, AI may reason, learn and evolve autonomously when exposed to new input data. AI models tend to be "black-boxes," can be fragile, exposed to bias and are nondeterministic by nature.

While typical governance includes strategy management, quality management, risk management, security management, compliance management and other processes, AIOps adds new ones like bias management, which may be necessary to govern sensitive AI models and address "black box" concerns among CSPs.

TM Forum members are leading an initiative to create an industry-agreed AIOps Service Management Framework, which aims to re-engineer the processes in the software lifecycle and service operations management to govern AI software at scale. This will enable operations teams, process owners and business users to exploit AI safely and maximize its benefits. The idea is to mitigate risks and ensure the appropriate level of network and service quality.

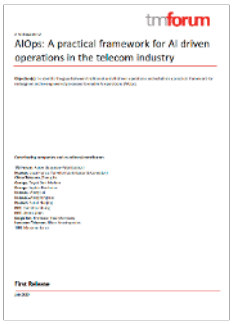
The AIOps Service Management Framework is part of the Open Digital Framework (see page 29) and is applicable to any type of architecture due to its agnostic design. It can operate as an independent process framework to help CSPs manage the deployment of AI into their current and target architectures. Using the framework, CSPs can:

- Redesign software deployment processes to release and commit AI software and components to production
- Redesign production processes to operate and maintain AI-based systems
- Redesign operations governance processes to govern AI-based systems

- Deal with fast changes coming from Development (Dev) to Operations (Ops) and from Ops to Dev for both offline and online models
- Integrate effective AI data operations and training practices for machine learning

To find out how you can get involved in TM Forum's work on AI governance, please contact Aaron Boasman-Patel.

To learn more about the AIOps Service Management Framework, read this white paper:



AI Checklist Cards

TM Forum members also have developed AI Checklist Cards to provide lightweight and practical guidance and best practices to support CSPs in the safe and effective deployment of AI systems at scale. Drawing inspiration from aviation and medicine, these simple checklists help organizations manage the growing complexity of AI deployments by addressing the software lifecycle from AI procurement, development and deployment to end-of-life management.

"The checklist is a way of managing the complexity of the domain you're operating in," says Rob Claxton, Chief Researcher at BT and Leader of TM Forum's AI Management Standards project. "Deploying AI at scale has become equally complex, so we can't just rely on individuals' knowledge to make it safe and deliver benefits."

The idea is "to help people do the right thing in the right moment and make sure they're not forgetting critical steps," he says. "But it's important that they don't become tools for simply checking compliance, because as soon as that happens, they become a stick to threaten people as opposed to a tool to help."

The downloadable cards are available to TM Forum members and non-members and are intentionally simple and easy to use. The cards are also designed to complement TM Forum's AI Readiness Check, an online tool that allows AI practitioners to identify gaps between current and target capabilities across six dimensions of a communications service provider's (CSP's) business.

Section 5

Make it happen – Strategies for adopting AIOps

Ultimately AIOps is a concept intended to help communications service providers (CSPs) think about how automation can change the way they operate their businesses and what role AI can play in improving automation. The task of moving to AIOps is immense, and as with all major new technology initiatives, a common question is simply, where do we start?

Think differently

The way to shift toward automated operations, AI adoption and autonomous networks is by beginning to think and operate differently. "We have to move away from a traditional way of operating toward AI automation," says Tayeb Ben Meriem, Coordinator of OSS Standardization for Orange and recognized Outstanding Contributor, TM Forum. "That means we have to break silos that exist today, for instance from fulfillment and assurance, and we need to integrate all of this into a framework," he explained at Digital Transformation World Series 2020.

Learn incrementally

AIOps is in the early part of the adoption curve among CSPs' operations teams – as we saw in Section 2, 54% of survey respondents are using AI today to automate a single operations process within a single domain, although more than 33% of respondents are using AI to automate one or more processes across multiple domains. María Eugenia Armijo Marchant, Chief Architect, Telecom Argentina, says there's real benefit in going through the effort to automate processes and becoming skilled at using AI because of what is learned along the way.

Organize & educate

Steve Jarrett, SVP Data and AI, for Orange group, offers three points of advice for peer CSPs establishing large scale AI programs. CSPs' first major challenge is to get their data ready and improve their ability to "structure and ingest that data and work with it in a workflow." Next, he says, focus on data that supports multiple use cases and has clear business benefits because data staging is so effort intensive. Finally, CSPs need to educate not only technology teams but their whole organizations about how to work with AI.

Prepare to automate

Some 70% of survey respondents say the biggest driver behind automating operations is new technology, like software-based networks. Don't forget there are also proven use cases for traditional operations software that are AI-like but do not involve AI. "Self-organizing networks, anomaly detection, process control and governance, insight and reporting and many more use cases based on traditional software are yielding excellent results without any AI," explains Mohammed Fahim Momen, General Manager, OSS & Customer Insight, for Robi Axiata.

Set ambitious goals

Operations automation should aim to achieve aggressive goals, delivering order of magnitude benefits. Mark Mortensen, Principal Analyst with ACG Research recommends targets including 90% labor cost reductions; 90% reduction in the time for any process from start to resolution; and 90% improvement in the time required to introduce a new service.

Go step by step

Marchant advises peers approaching operations automation and AI to take several key incremental steps, including:

- Understanding and identifying processes and operations that are well suited for automation
- Improving these first with "simple automation"
- Gathering data to understand the automated operations environment better
- Testing AI-assisted automated interventions and measuring whether there are gains and improvements

Manage change proactively

Change and adapting to change are continuous processes in the AIOps world. Derek Chen, Assistant Vice President of Customer Service for Hong Kong Telecom (HKT), advises CSPs not only to standardize data for analysis, but also to create dynamic customer profiles that adapt with changing customer patterns and to be proactive in solving customer problems "not just because they're calling us."

Focus on AI's strengths

Many CSPs report that AI is the best option for processing extremely large data sets that combine heterogeneous data from multiple sources and where multi-domain or cross-functional correlation is required. For example, "360-degree assurance of network performance and customer experience requires a unified platform and solution and there the need for AI arises," Robi Axiata's Momen says. AI may also be a better fit than traditional software for automating network configuration changes in response to live demands from customers.

Adopt a framework

CSPs should adopt the AIOps Service Management Framework. It provides the models, tools and guidance they need to implement AIOps. The framework helps operators re-engineer processes in the software lifecycle and management of service operations to govern AI software at scale. This will enable operations teams, process owners and business users exploit AI safely and properly to maximize its benefits. To learn more, please contact Aaron Boasman-Patel.

AI-Ops Success: 3 Steps to Overcome the Trust Gap

By Dima Alkin, VP Service Assurance, TEOCO

5G Makes Service Assurance More Critical than Ever

The Helix Service Assurance solution is well known for its industry leading abilities to monitor and manage telecom network performance, faults, and services. TEOCO has seen the rise of service assurance. What was once perhaps considered a second-tier issue is now taking center-stage. As evident from TMF research highlighted in the report, this area is rapidly evolving, and with the growing complexities of today's networks (5G, virtualization, cloud) more and more automation in Network Operations will be required.

In addition, 5G is ushering in an era of new services for both consumers and, probably more importantly, enterprises, where the requirement to deliver slice-based service level agreements (SLAs) means operators will need to have the ability to automatically monitor and manage network performance not just at the core and access, but all the way out to the edge.

Service Assurance in the Age of AIOps

TEOCO believes that AIOps will be a critical part of the digital transformation for network operations. Operators will need to consolidate information through data aggregation and real-time analytics, along with machine learning, artificial intelligence, and data visualization, as a way to drive automation and closed-loop enablement.

The ability to automate routine manual service assurance practices allows operators to scale while maintaining network performance. This includes managing faults faster and with greater accuracy. TEOCO's analytics-powered service assurance is already delivering the real world automation of tasks that were once manual and time consuming - such as in a Tier 1 operator where we have reduced the volume of trouble tickets by 52%, saving over 145K man-hours annually.

Contrary to 2G, 3G and 4G, a 5G strategy cannot be successfully delivered without an automated Network Operations Center. One that is heading towards a Zero-Touch philosophy that leverages advancements in ML and AI, and with telecom domain expertise embedded throughout. Scaling this capability in an agile way will only be possible by adopting an AIOps approach.

The right path for modernization requires both time and trust

Automation, however, is too often viewed in binary terms; a system is either automated or it's not. When it comes to complex telecom networks, automation, when done correctly, is an evolution. Something that requires the careful precision of a scalpel, not the brute force of a sledgehammer. But this targeted approach has as much to do with human nature as it does with technology.

In our quest towards digital transformation, sometimes we forget that there are people involved who have been doing this work in the past - and many of their tasks are now becoming automated. Human decision making is becoming less of a factor in managing today's telecom networks, and for network engineers, this can be especially unnerving. No one wants things to go sideways on their watch - and for millions of customers to lose service because a machine made the wrong decision. But today's networks need to scale, and operators must put their trust into AI software solutions that automate decisions that used to be made by experienced people.

How do we overcome this trust gap?

Any automation initiative needs to do more than just focus on the technology. In fact, the technology piece is often the easiest part – it's getting the technology, people, and processes to all align that can be the biggest challenge.

At TEOCO, we have been working with operators for many years as they go through their digital transformation process. Of course, each situation is different, but we believe there are three steps that are critical for a successful AIOps-approach that builds trust and confidence along the way:

1) Assess Your Environment: *one size does not fit all*

The first step in an AIOps strategy is to understand where you are starting from. TEOCO are seeing a new generation of service providers coming into the market today; those who are developing 5G standalone without a hybrid, legacy network to manage. These operators are focused on automating from day one and are typically comfortable experimenting with the latest AI/ML tools. These 5G-native operators have the luxury of designing their networks and OSS layers this way from day one. Most of our incumbent customers, however, have legacy systems and processes and they need to take a vastly different approach. One that allows them to leverage their existing investments and infrastructure as much as possible whilst making thoughtful, smart decisions about where, when, and how to automate.

In some instances, TEOCO's analytics layer can overlay their existing solutions. This can extend the life of current investments, while providing the AIOps advantage that operators need. TEOCO has done this with our Helix Analytics solution by decoupling it from our own Service Assurance application layer. Operators can keep their existing fault and performance management solutions in place, whilst running the Helix Analytics layer on top to deliver insight and automation.

> "TEOCO's analytics layer can overlay existing solutions to extend the life of CSPs current OSS investments"

2) Predictions – To understand your objectives, *begin at the end*

One of the biggest contributors towards zero-touch, closed loop automation will be predictive analytics paired with service assurance. The ability to predict network faults and failures before they even happen will change the face of how networks are managed. The science is real and in production – but in some ways the technology has gotten ahead of itself, because most CSPs need to evolve their processes to support the outcomes.

First there needs to be an agreement amongst internal teams as to what should be predicted. After all – predicting network faults only helps when it is a fault that will have a business benefit from being fixed or mitigated before the failure occurs. High priority issues will need to be addressed immediately but identifying and prioritizing them will be part of this learning curve.

The second issue is for service providers to change the necessary processes and competencies to address AI-driven predictions once they are made. Managing network fault predictions will require a much more automated response. Fortunately, the industry is moving in that direction through AIOps.

These are new concepts in service assurance, and TEOCO is already applying them today through unsupervised machine learning on historical data, where we can predict network and equipment failures within a specific period at an extremely high level of precision and recall. TEOCO is helping operators realize the full potential of these AI tools, and can help support the evolution in organizational maturity as we realize it is not just about the technology, but people and processes that need to change as well.

3) Secure the right expertise and tools: *automation doesn't happen automatically*

TEOCO's experience has shown that when it comes to telecom network management and monitoring, generic analytics platforms do not deliver the integration and business value that comes from specialized products. The two key factors in finding the right tools are:

1. Telecom expertise needs to be embedded into the algorithms and features of the tools that deliver actual business value for the operator.

2. Being independent - with Open APIs that ensure integration and collaboration at every level, both towards internal systems and across vendors. TEOCO is committed to TMForum's Open API manifesto, which supports OSS/BSS interoperability.

TM Forum's AIOps service management frameworks and processes support this collaboration through a toolkit of assets, best practices, and repeatable processes necessary to create the agile deployment and efficient operations of the components that operations teams need.

TEOCO has been a proud participant and contributor to TMForum standards and APIs for many years,

> “Secure the right expertise and tools: automation doesn’t happen automatically”

and through our award winning catalyst collaborations have helped advance this universal standards, assets, and processes to create the fully automated, closed loop systems to power tomorrow’s networks.

TEOCO and Helix Analytics / How we help

Helix Analytics is an integrated set of service assurance software tools that apply patented AI and Machine-Learning algorithms on large volumes of data from diverse sources. These tools reveal deep, actionable insights about service behavior and the performance of the underlying network resources, detecting hidden correlations and anomalies. By acting upon these insights, CSPs can automate their processes, achieve a higher level of operational efficiency, and provide better services to enterprises and consumers.

Helix Analytics enables operators to:

- Focus valuable NOC, SOC and Engineering resources on the most critical issues
- Predict and prevent service degradations and SLA violations
- Expedite the resolution of fault, performance, and service events
- Automate the most complex network processes to support self-healing and closed-loop Orchestration

About TEOCO

TEOCO improves how communication service providers manage their networks – and their business.

With offices across the U.S. and the world, we are a leading provider of analytics, assurance, and optimization solutions to over 300 communication service providers – including mobile, fixed, and next generation networks and equipment manufacturers. TEOCO’s suite of software solutions reduces operational costs and improves network quality by delivering real-time, actionable insights into device, network, service, and business performance.

We help carriers prepare for new 5G business opportunities through our innovative work in advanced analytics, machine learning and network automation; and by investing in the technologies of tomorrow, such as mobile edge computing, smart cities, and even drone services.

For more information about TEOCO’s market-leading solutions, visit www.teoco.com

TM Forum Open Digital Framework

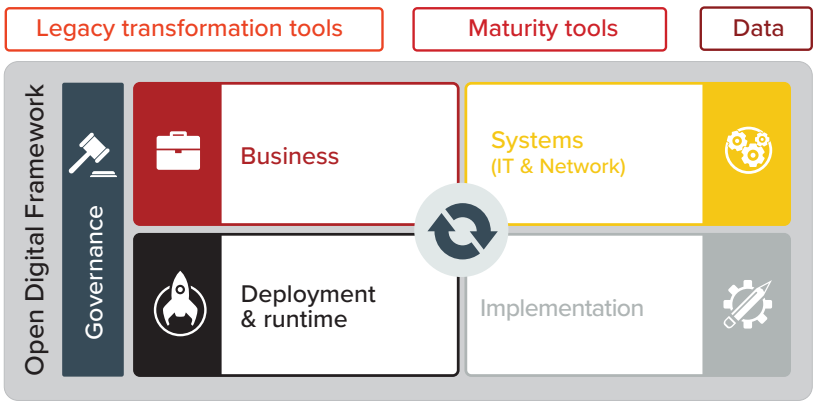
A blueprint for intelligent operations fit for the 5G era

The TM Forum Open Digital Framework (ODF) provides a migration path from legacy IT systems and processes to modular, cloud native software orchestrated using AI.

The framework comprises tools, code, knowledge and standards (machine-readable assets, not just documents). It is delivering business value for TM Forum members today, accelerating concept-to-cash, eliminating IT & network costs, and enhancing digital customer experience.

Developed by TM Forum member organizations through our Collaboration Community and Catalyst proofs of concept, building on TM Forum's established standards, the Open Digital Framework is being used by leading service providers and software companies worldwide.

Core elements of the Open Digital Framework



The framework comprises TM Forum's Open Digital Architecture (ODA), together with tools, models and data that guide the transformation to ODA from legacy IT systems and operations.

Open Digital Architecture

- Architecture framework, common language and design principles
- Open APIs exposing business services
- Standardized software components
- Reference implementation and test environment

Transformation Tools

- Guides to navigate digital transformation
- Tools to support the migration from legacy architecture to ODA

Maturity Tools & Data

- Maturity models and readiness checks to baseline digital capabilities
- Data for benchmarking progress and training AI

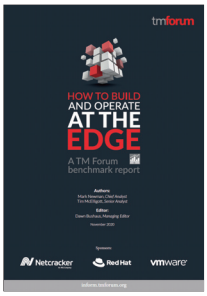
Goals of the Open Digital Framework

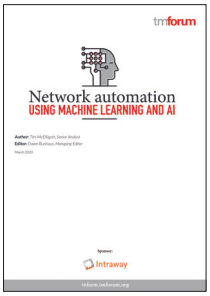
The aim is to transform business agility (accelerating concept-to-cash from 18 months to 18 days), enable simpler IT solutions that are easier and cheaper to deploy, integrate and upgrade, and to establish a standardized software model and market which benefits all parties (service providers, their suppliers and systems integrators).

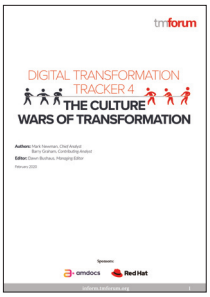
Learn more about member collaboration

If you would like to learn more about the Open Digital Framework, or how to get involved in the TM Forum Collaboration Community, please contact George Glass.

TM Forum research reports







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Published by:
TM Forum
4 Century Drive,
Parsippany,
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Phone: +1 973-944-5100
Fax: +1 973-944-5110
ISBN: 978-1-945220-88-3

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