

FUTURE OSS: TOWARDS AN OPEN DIGITAL ARCHITECTURE

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Towards an open
digital architecture

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The big picture

In the two decades since the explosion of independent software vendors onto the scene, the market for operational support systems (OSS) has expanded and contracted as communications service providers (CSPs) have sought to improve their processes. Hundreds of suppliers have come and gone or were consumed as they innovated their way into the heart of CSPs' operations and tried to repeat the magic by staying ahead of the next technology curve. In fact, improvements in operational efficiency and insights about network performance sometimes have led to the next curve.

OSS vendors were able to improve incrementally in part because the underlying fundamentals of networking remained intact – the FCAPS (fault, configuration, accounting, performance and security) framework still did the trick. Today, however, the underlying fundamentals are shifting quickly.

The cloud does not operate like a switched network, and cloud providers do not compete like, well, anyone CSPs have ever competed against. Virtualized architectures do not behave according to the same engineering principles as physical networks. And 5G will soon demand a level of scale and responsiveness that traditional OSS is not equipped to handle.

In short, the operations support model that has served CSPs well for so many years needs a new way forward.

In preparing this report we heard from more than one CSP that they do not like term “future OSS” because OSS is a legacy concept. We agree. However, it is difficult to describe whatever comes next without referring to what it is replacing.

Perhaps the best way to describe what comes next is by calling it an open digital architecture. TM Forum members are developing this concept, which we'll discuss in detail in [Section 3](#) of the report.

Driven by data

On the bright side, no matter what you call operations support, it has always relied on data. This is the cornerstone CSPs can build upon as they execute not only a more data-driven network operations model, but a data-driven business.

5G and networks of the future will take being data-driven to a new level, relying on artificial intelligence (AI) and machine learning, automation, microservices, and much tighter ties to business optimization. Future OSS must be agile, automated, proactive, predictive and programmable, when achieving any one of these goals is a challenge.

This report begins with the widely accepted premise that supporting networks, services and operations must change radically to keep pace with the upheavals in network technology and business models, to say nothing of customers' expectations. It also acknowledges that by the time CSPs reach the end of their latest phase of transformation, there may be no such thing as OSS.

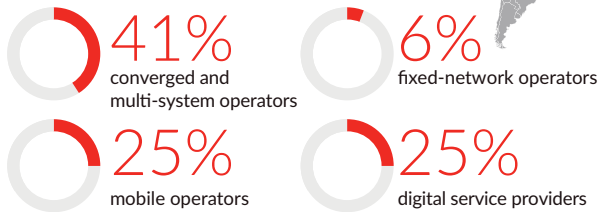
Through the lens of existing OSS, the CSPs and other industry experts we surveyed and interviewed paint a picture that can only be described as dubious. While operators believe the prize for a successful journey will be great, there are simply too many possibilities for them to say with certainty what future OSS will be.

But this does not mean CSPs are hesitant or apprehensive. Those that can afford to are testing all sensible options including automated operations, cloud models and open source software, which until now has been unthinkable. And while they may not be able to create a definitive roadmap for OSS, they are able to articulate the attributes that will be required.

Who are the Future OSS survey respondents?

CSPs

99 respondents from 29 unique companies operating in 28 countries



Suppliers

49 respondents from 43 unique companies



TM Forum, 2019

Who are the respondents?

We analyzed data from a targeted survey of TM Forum members conducted in October to learn about next-generation OSS, which we refer to as 'future OSS' throughout the report. Overall, we surveyed 99 CSP respondents and 49 supplier respondents, and we conducted several follow-up interviews.

The CSPs represented are primarily Tier 1 and Tier 2 operators delivering converged services, along with some pure-play wireless providers, fixed-network operators and digital services providers. CSP respondents include C-level executives and vice presidents with responsibility for product development, along with senior engineers and network architects. In addition, the report draws on data from an earlier survey about 5G and the enterprise market.

Learn more about the burgeoning relationship between CSPs and enterprises:



Read this report to understand:

- Why the thinning line between OSS and BSS (business support systems) must be fully erased
- Which attributes are necessary in future OSS and the options for implementing them
- Why a new, open architecture is needed to deliver the agility and security CSPs require, and how TM Forum members are collaborating to create it

- What the biggest challenges are to implementing future OSS
- Why CSPs have mixed feelings about cloud-based OSS
- The role analytics play in future OSS
- The timeline for future OSS

Section 1

Erasing the separation between OSS and BSS

Although communications service providers (CSPs) are seldom explicit when they talk about the challenges of transforming operational support systems (OSS) to become data driven and automated, the implication is that everything they want to do with OSS directly impacts processes generally associated with customer-facing business support systems (BSS).

For example, in a data-driven environment, OSS that can identify (and hopefully rectify) service degradation will need to connect to customer databases in order to identify who is impacted and then relay that data in real time to customer care and many other groups within the organization. This is done today to some degree, but not in real time and not automatically.

There are many other examples of the need for better data flow and processes between the two types of support systems. These examples explain why nearly 58% of respondents to our *Future OSS* survey identified the lack of synchronization and integration between customer-facing BSS and network-facing OSS as either a 'progress-inhibiting' or 'show-stopping' barrier to architecting

future OSS. The graphic below shows how CSPs ranked challenges to realizing their visions for future OSS.

It all impacts customers

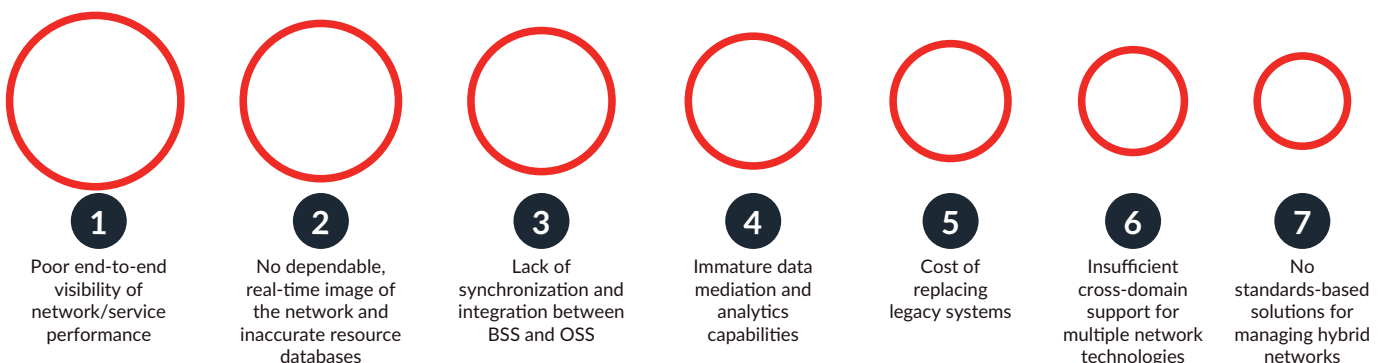
Poor end-to-end visibility into network and service performance, identified by 65% of respondents as the most significant barrier to future OSS, has always been a purely OSS concern, but it is also critical to BSS. 5G services like autonomous cars and remote healthcare illustrate why.

CSPs will have to deliver and assure these services in real time across partners' networks, and their enterprise customers will expect a real-time view of performance as well. Similarly, a real-time image of the network and an accurate resource management database, long

considered OSS-only functions, are necessary for CSP sales teams to price and design services for customers.

CSPs are sometimes criticized for being too technology centric. It's OK for them to focus on technology, so long as they leverage it to give customers what they want. OSS is the technology tool that helps business teams create innovative services. Indeed, CSPs cannot be customer centric without being masters of the systems that order, provision, assure, manage, analyze, automate, charge and bill for the services they deliver. These systems help operators understand how customers want to use the services they provide and why.

Ranking the barriers to future OSS



TM Forum, 2019

Some of the backlash about being too technology centric may be deserved in the networking part of operations. Engineers take pride in how resilient and well-designed their networks are. Obviously, this has garnered good results. However, networks must be engineered differently today and in the future. Mobile networks, for example, can no longer be engineered based on coverage maps; they must be dynamic and based on customer demand. OSS provides the data for addressing the agendas of both network engineering and customer experience teams.

Focusing on customer engagement is a wise and necessary strategy, but it can't be done without much tighter integration between OSS and BSS. Customer engagement in the digital marketplace is no more about moving existing ordering process and systems

online than being cloud native is about forklifting existing OSS and BSS into the cloud. They are both so much more complex. True customer engagement and OSS transformation require significant process re-engineering, a new open architecture that supports digital ecosystems, intelligent automation, data sharing and more. We'll discuss cloud and architecture more in the next sections.

OSS attributes

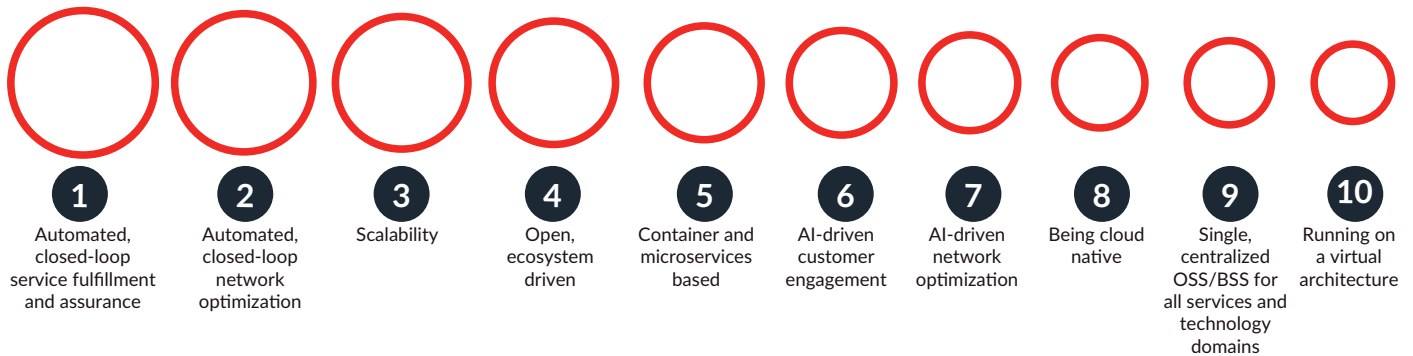
In addition to asking about the challenges to implementing future OSS, we asked respondents which attributes they value most highly. The graphic below shows how CSPs ranked a list of attributes.

In addition to wanting agility, openness and low-cost solutions,

which are givens, CSPs also want future OSS to support automation. More than half of respondents put closed-loop fulfillment and assurance in their top three priorities, while a third put closed-loop optimization in the top 3 (see panel on page 7). This shows a shift in acceptance of automation.

When TM Forum began surveying CSPs about automation in 2015, many operators expressed deep reservations about closed-loop processes because they feared automation could compromise the five nines' reliability they guarantee and because it would eliminate jobs. Now, however, there is a realization and acceptance that manual processes for optimization and problem resolution simply won't work as the volume, velocity and variety of data explodes in a 5G world.

What are the most important attributes of future OSS?



TM Forum, 2019



We will look in depth at future BSS in a companion report to this one to be published in January 2020.

KDDI focuses on AI and digital twins

At Japanese CSP KDDI, AI and automation for network management are the top two OSS/BSS priorities followed by support for network functions virtualization and end-to-end orchestration, according to Tomohiro Otani, Executive Director, KDDI Research.

As we enter the new era and begin doing network slicing over 5G, the tight integration between OSS and BSS will be required," he says.

Otani adds that managing network performance has become difficult even in 4G networks given the high number of alarms, alerts and other indicators. With 5G, complicated by virtual networks, network monitoring will become untenable and manual corrections impossible.

In addition to applying AI to this problem, KDDI Research is championing an award-winning TM Forum Catalyst proof of concept that demonstrates how digital twin technology can be used to predict the degradation of networks.

A digital twin is a digital representation or visualization of an organization, building, city, product, person, network or process. Forbes' definition explains: "This pairing of the

virtual and physical worlds allows analysis of data and monitoring of systems to head off problems before they even occur, prevent downtime, develop new opportunities and even plan for the future by using simulations."

Digital twin technology isn't new. NASA has used it to mirror systems during missions, and in fact, leveraged it to help save the ill-fated Apollo 13 mission. GE also has used it to fine-tune wind turbines. In telecom, using the technology has been too expensive, but NFV makes it more practical.

Leveraging virtualization, the Catalyst team used the technology to demonstrate how digital twin technology can be used to scale 5G networks, automate the lifecycle management of network slices, and incorporate predictive demand and maintenance.

Watch this video to learn more:



Targeting the enterprise

CSPs' emphasis on automated, closed loop management and services such as network slicing demonstrates that their focus is on serving the enterprise market. At a recent Ericsson user-group event, Verizon's Amit Kapoor, Director of Virtual Network Services, noted that closed-loop assurance will be necessary for 5G services delivered to enterprise customers.

He described requirements for a self-healing network that allows applications to experience some degradation but uses predefined assurance metrics to make corrections autonomously through an orchestration engine. Enterprises are concerned about two things – productivity and business outcomes – he explained, adding that business outcome is a new requirement which operators are ill-equipped to assure.

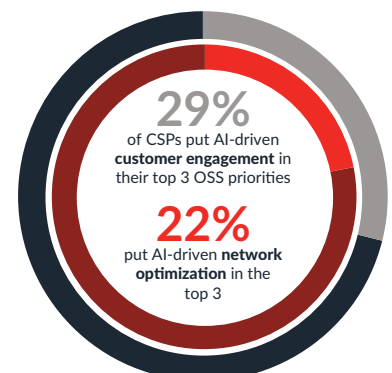
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The automation that virtualization brought to the data center we are now bringing to the network, and the expectation of the customer is that everything just works on demand,” Kapoor says. “In order for that to happen there needs to be an entire mind shift that occurs in the organization.”

Applying analytics

Although applying AI to customer experience and network optimization are lower on the list of OSS priorities than scalability and openness, previous research and interviews with CSPs indicate that AI will be a key requirement (see panel). And as CSPs leverage data using AI and analytics, the distinction between OSS and BSS will blur further.

AI-driven OSS



TM Forum, 2019

Verizon Consumer CIO says AI is mandatory

Vivek Gurumurthy, Senior Vice President and Chief Information Officer of Verizon's Consumer Group, said in September at TM Forum Digital Transformation North America that AI is not an options for telcos; it is mandatory. He added that traditional OSS/BSS and digital ecosystems will be entering an age of algorithmic transformation in which AI will directly impact the entire customer experience.

Verizon plans to build a unique service experience for customers that proactively predicts their needs, whether that means anticipating the next billing question or proactively responding to a service interruption.

"The BSS/OSS serving our customers will be AI powered, along with security, fraud detection, quality control, operations, availability and infrastructure," Gurumurthy. It's going to be a fabric that stretches across the board for our services."

The challenge to this algorithmic transformation is to reinvent the traditional architecture and create new blueprints for scaling AI architecture, he added.

Watch Gurumurthy's keynote:

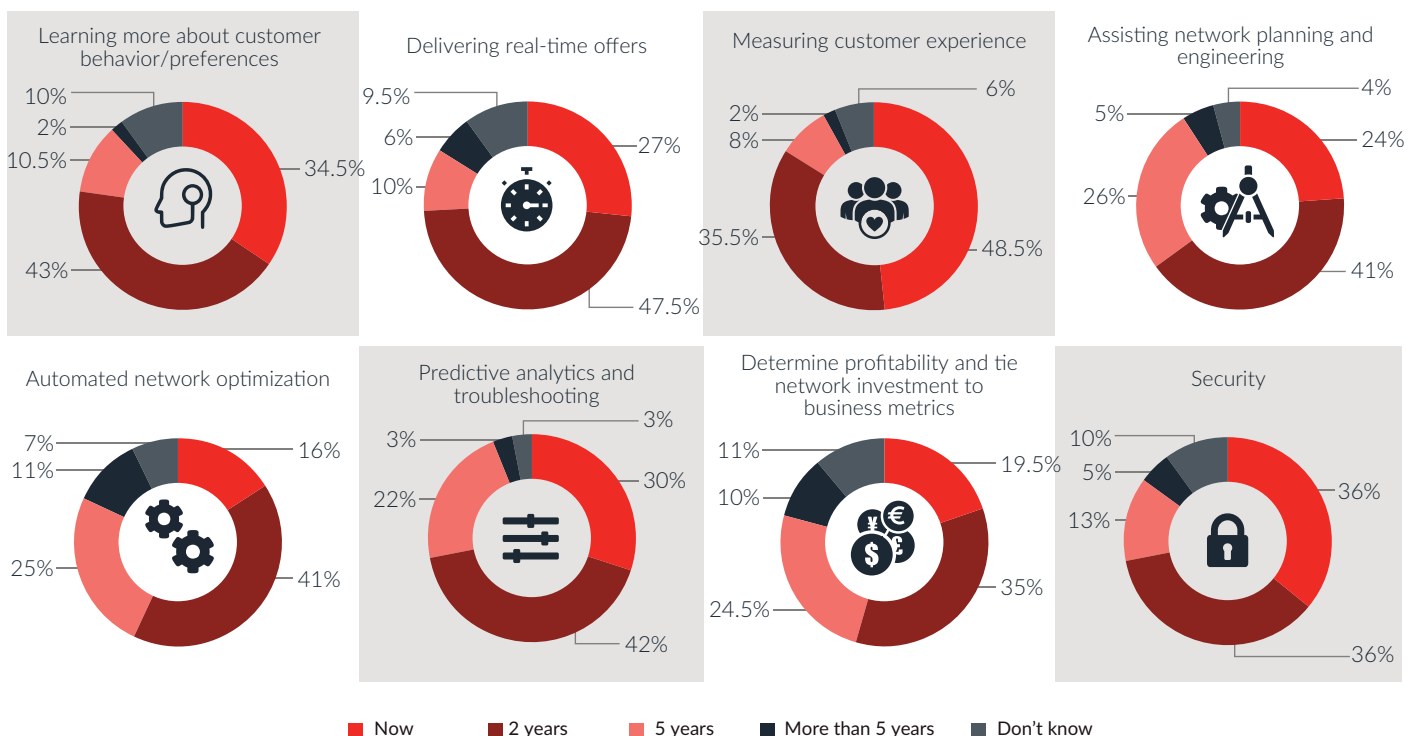


While CSPs are applying AI across the business, the most familiar use case is the customer service chatbot. Today chatbots are used only for customer engagement, and their intelligence is limited to what BSS can tell them along with some correlation algorithms that connect the dots of a customers' history much faster than a human customer service representative can.

Though some observers view using AI for customer service as risky, it does provide a good testbed for algorithms and a way to hone skills. Each contact provides the AI engine another nuanced customer interaction from which it can learn to distinguish similar but not replicated requests from millions of customers in order to respond properly. As one executive noted, customer data will make AI smarter.

The graphic below, which shows how CSPs expect to apply AI now and in the future, affirms CSPs' initial focus on using AI for customer experience, with nearly half of survey respondents saying their companies are already using AI to measure customer experience. Within two years, 85% say they will be working on it.

Where will CSPs apply AI-derived insights?



TM Forum, 2019

Embracing AIOps

Within two years, a majority of CSPs also expect to be using AI for operations (AIOps), which includes network planning, automated optimization and troubleshooting. Dr. Lester Thomas, Chief Systems Architect, Vodafone Group, explains that big data analytics are necessary for closed loop automation.

Vodafone is implementing machine-based analytics and human-created algorithms in its networks. According to Thomas, all forms of analytics, including AI and expert systems, need to be part of an “analytics toolkit” that optimizes customer experience based on data from network and business systems. He explains:

“

It is about getting good data from everywhere and into a single analytics engine.”

Vodafone Egypt, for example, is leveraging machine learning and big data analytics to create a self-organizing network (SON). In its emerging market, the operator has had to deal with a lack of resiliency in the country’s power supply which results in cell sites going offline. The SON’s machine-learning algorithms enable surrounding sites to reconfigure themselves and compensate for lost cells until they come back online.

This use of analytics changed the engineering practice from static radio planning to an autonomous application for self-correction. The application itself uses open source technology, and Vodafone has leveraged the [TM Forum Open Digital Architecture \(ODA\)](#) to apply multiple data sources across the business (see [Section 3](#) for more about ODA).

This example of automation based on intelligence is encouraging for operations. However, it is just one example and pertains to using network data for a specific purpose within a single operator. For end-to-end management, this approach will have to be applied in digital ecosystems of partners. This raises many ethical and regulatory issues about how data can be used.

Other OSS priorities

Being cloud native is a fairly low priority for survey respondents, with only 22% putting it in their top three priorities for OSS (see [Section 4](#) for more on cloud). Similarly, most CSPs don’t think it’s critical for OSS to run on a virtual architecture or be part of a single, centralized OSS/BSS for all service and technology domains.

Follow-up discussions with CSPs suggest that the low score for centralized OSS/BSS has more to do with the impracticality of using a single OSS across certain domains, such as wireless and wireline divisions or consumers and IoT, than it does with having tighter integration between OSS and BSS or making them part of a single architecture.

In the next section, we’ll look at the cultural changes required for IT transformation.

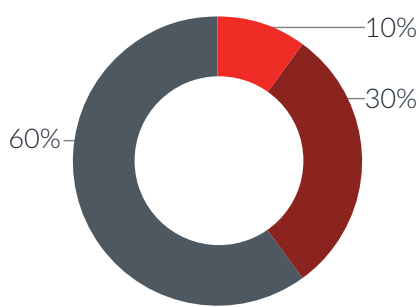
Section 2

CSPs must embrace cultural change

An important aspect of transforming operational and business support systems (OSS/BSS) is embracing cultural change. Communications service providers (CSPs) must be willing to adopt new attitudes and ways of working, and they must be willing to retrain workers.

TM Forum is planning a report later this year that will explore the issue of culture across the entire CSP organization, but regarding OSS specifically, our survey shows that 90% of respondents believe that cultural change will be required to realize and maintain their vision of future OSS. A majority of respondents believe this change must be significant.

Is significant cultural change necessary?



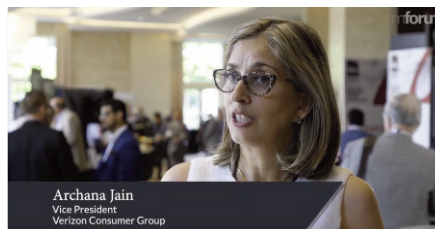
- Significant cultural change is not required for future operations support
- Some cultural change is required for future operations support
- Future operations support will require significant cultural change

TM Forum, 2019

Archana Jain, Vice President of Verizon's Consumer Group, believes that company culture can stand in the way of digital transformation. During an interview at Digital Transformation North America in September, she explained that Verizon's main focus is to ensure services without interruption and provide excellent customer experience. However, there is no one tool for the job, and culture can be a hindrance.

"The main challenge [for operational transformation] continues to be the culture," she said. "There are people who really understand what needs to be done...but there are some people who resist the new ways of working. We can't wait to get them on board."

Watch the interview with Verizon's Jain:



Lack of skills

In a 2018 TM Forum report, *Digital Transformation Tracker 2: How to fix the cultural divide*, 75% of CSP respondents said they believe cultural and organizational issues are a very serious or moderately serious challenge to digital transformation. Often, the issue of culture is conflated with a general lack of necessary software skills among a workforce trained to install and manage hardware, and discussions begin with the need for training or re-training.

But cultural change should start with upper management making strategic decisions about the future of the organization and the results a company expects from the changes it is implementing. Only then can the rank and file be nudged in a new direction through training.

A [2016 PWC report](#) about cultural change in telecom driven by digitalization makes the point: “Telecom operators’ leaders need to strengthen cultural alignment and acceleration. They can best do so by catalyzing existing emotions to mobilize latent cultural energy – an approach that is a powerful and practical way to trigger significant, sustainable and positive change, provided the energy is aligned with the business’s strategic and operating priorities. Achieving this represents a very different kind of leadership challenge.”

The discussion today about retraining the workforce seems more earnest than in the past when CSPs have faced layoffs or transitioned from one technology to another, like circuit-switched to Internet Protocol. For example, AT&T announced in May 2018 it would invest \$1 billion in retraining approximately half its workforce of 250,000. While the price tag may seem excessive, it is likely lower than the cost of hiring new employees. As Bill Blase, Senior Executive Vice President of Human Resources, AT&T, [explained in a CNBC article](#) about the investment:

“We could go out and try to hire all these software and engineering people and probably pay through the nose to get them, but even that wouldn’t have been adequate. Or we could try to reskill our existing workforce so they could be competent in the technology and the skills required to run the business going forward.”

Even relatively new companies like Amazon face similar staffing challenges due in part to automation. [The company said in July](#) that it would spend \$700 million to retrain employees.

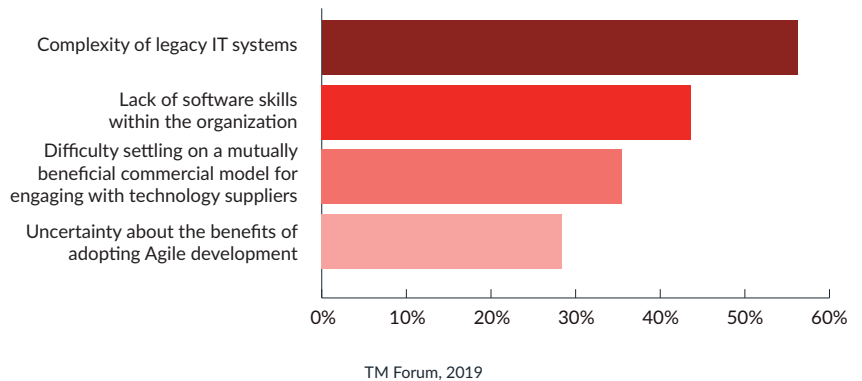
Agile & DevOps

In a recent TM Forum survey of C-level executives for our [CTIO Outlook 2020](#) report, respondents cited lack of skills as an obstacle to adopting Agile development, second only to complexity of legacy IT systems (see graphic below). But embracing Agile DevOps practices is key to future OSS because it will foster innovation and speed deployment of new services.

While there are many definitions of DevOps, [this one from the Agile Admin](#) (a blog written by Ernst Mueller, Head of Engineering at Precision Autonomy and former Director of Engineering Operations at AT&T Cybersecurity), is good because it describes how DevOps relates to the people in IT:

“DevOps is the practice of operations and development engineers participating together in the entire service lifecycle, from design through the development process to production support.”

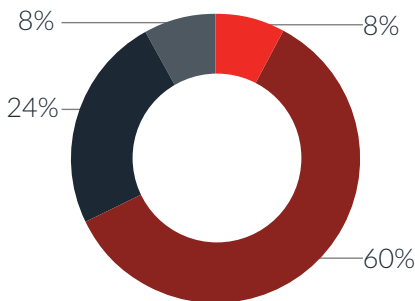
Biggest challenges to adopting Agile software development



Like cloud architectures and virtualization, DevOps got its start in IT rather than networking. CSPs are just getting underway applying the principles to network operations. Telecom-specific DevOps is part of [TM Forum's Agile Operations Toolkit](#), which advocates having a collaborative approach towards end-to-end service delivery by executing on a common goal between development, production and business teams to achieve business objectives.

This requires continuous integration, testing and deployment, which is a huge cultural shift and no small undertaking. Indeed, the difficulty of implementing DevOps is likely a big reason why telcos have been slow to embrace it. In the *Future OSS* survey, 60% of CSP respondents said they are still in the very early stages of incorporating DevOps practices and tools into their operations.

CSPs' adoption of DevOps slow but underway



- DevOps is part of our transformation plan, but we are not ready to incorporate it
- We are in the early stages of incorporating DevOps into our operations
- We currently follow DevOps practices across our operations
- We do not plan to incorporate DevOps but insist our suppliers do

TM Forum, 2019

Faster time to market

Adopting a DevOps approach is worth the effort, however, because it can help CSPs reduce the time it takes to move new products from concept to commercial rollout, which even after years of process improvement typically takes up to 18 months. It also delivers key benefits relevant to ongoing product enhancements and testing new ideas.

For example, DevOps eliminates the handoff from one working group or department to another during the lifecycle of a new product because it operates on a continuous cycle of development, deployment, assurance and improvement in which no group lets go of their responsibility for the success of a service. Keeping all parties engaged in the product lifecycle makes it easier to apply performance and other network data back into the process and make continuous improvements to the product. It eliminates the need to repeat a long, redundant upgrade and release process.

Listen to Vodafone's Dr. Lester Thomas discuss how DevOps is integral to the company's ability to automate the continuous build-test-release process for delivery of new products and experiences:

WEBINAR
October 23, 100pm BST

GLOBAL ARCHITECTURE FORUM

Open standards and Open APIs in Vodafone's digital transformation



It's OK to fail

In addition, DevOps allows for more experimentation and 'fast-fail' scenarios, which reduces the risk of developing services that do not meet expectations. A fast-fail approach to service introduction gives CSPs many more chances to hit upon the right service rather than putting months of money and effort in developing what they can only hope is a killer app.

MyRepublic CTO David Robinson, who will give a presentation at Digital Transformation Asia called *How failing can make you a winner: Adopting a fail fast, fail often, fail smarter approach to innovation*, said in a [recent interview with Enterprise IT News](#): "For us to achieve our vision of disrupting the industry, the key focus areas for me [are] hiring and retaining the best talents, removing barriers to productivity, automation and an 'everything as code' mindset, whilst continuing the 'fail, but fail fast' philosophy and culture. This will allow us to become a more innovative, experimental and versatile organization that can adapt quickly to the changing markets."

In the next section, we'll look at how TM Forum members are collaborating to address some of the technological and cultural challenges to reimagining OSS.

Section 3

Collaboration is required at every level

Legacy operational and business support systems (OSS/BSS) will not suffice as business enablers for 5G networks or any next-generation network. Most communications service providers (CSPs), especially large ones, realize this, and they are actively participating in defining and developing what comes next.

As noted in the introduction to this report, the term 'future OSS' is a misnomer. The future will not be OSS or BSS because both are legacy concepts that must be reimagined. Perhaps most importantly, future operational processes must become autonomous to address rapidly increasing complexity. Service delivery, assurance and monetization are not easy when they:

- Are created and delivered as part of a multi-party offering
- Utilize multiple network technologies
- Traverse multiple cloud, core and enterprise domains
- Promise on-demand, programmable levels of service
- Must guarantee security and privacy end to end

TM Forum members discuss future OSS/BSS in terms of the Operations Center of the Future, the primary characteristic of which will be “zero-friction integration”. They are developing this concept in the [Open Digital Architecture \(ODA\) project](#) (see panel opposite).

What is the Open Digital Architecture?

Part of the [Open Digital Framework](#) (see [page 31](#)), ODA attempts to address many of the challenges highlighted in this report, such as tighter integration between OSS and BSS, the need for analytics and automation, ability to scale, support for ecosystems of partners, and simplification through open application program interfaces (APIs). The idea is to develop a common blueprint for operations management that CSPs and suppliers can agree on. ODA also applies DevOps practices to network operations and insists that security and privacy be included from the outset in the architecture.

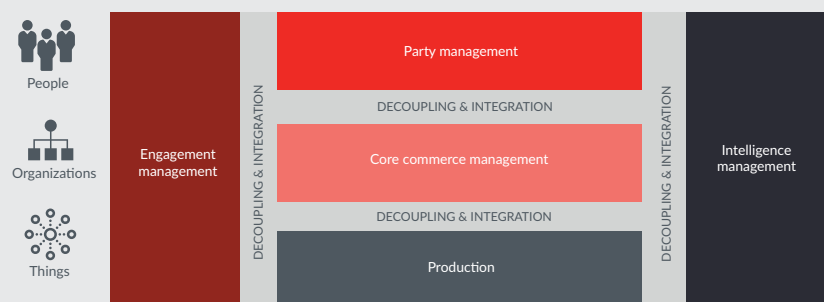
ODA's functional architecture shown below has been modelled to represent enterprise functions and corresponding interactions that go beyond the traditional pipeline business models of

CSPs. It is a component-based architecture, with the business services of a component exposed as a set of [Open APIs](#). These APIs can be further decomposed into a set of services and microservices. The advantage of using microservices is that they can be managed on scalable infrastructure using [Agile](#) development practices (for more on Agile, see [page 11](#)).

CSPs and other organizations can use ODA to set an architectural vision and plan relevant roadmaps to implement it. The transformation guides that are part of the ODA enable organizations to work backwards from their target architecture.

If you're interested in learning more or joining the ODA project, please contact [George Glass](#), TM Forum's VP of Architecture & APIs.

TM Forum Open Digital Architecture: a work in progress



TM Forum, 2018

Agility is key

Vodafone Group is active in developing the ODA with a primary goal of increasing agility. The company's Chief Systems Architect, Dr. Lester Thomas, explains that in the future CSPs will need systems that can adapt to any new scenario, whether it is a core network outage, degradation of service, sudden or unexpected demand, or a way to onboard and monetize a new service.

These scenarios could also include new business models or absorbing the operations of an acquired company. In short, support architectures must be able to deal with all kinds of changes without needing to change themselves, which requires open APIs, cloud-native applications and Agile work practices like DevOps.

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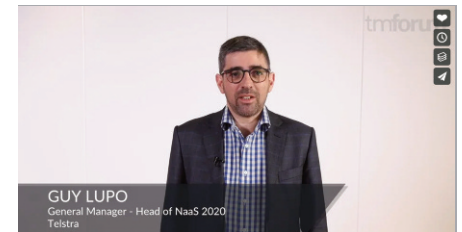
It is not a world where you can just say ‘I refreshed my OSS, now I can sit back,’” Thomas says. “It is a continuous evolution. The work is never done – it never ends.”

There has never been a good definition of where OSS ends and BSS begins, according to Thomas, but ODA is redefining the layers between systems and developing APIs that specify exactly how integration happens between the layers. A new way of thinking about OSS and BSS is to focus on service management rather than network management. This allows for an ‘intent-based’ approach that abstracts the complexity of the network at a high level and uses a customer’s intent along with analytics and policy to orchestrate and assure services.

Simplifying with NaaS

Vodafone and Telstra have worked together on intent-based network as a service (NaaS) as part of a multi-phased [TM Forum Catalyst proof of concept](#). The two companies were instrumental in creating the [TM Forum NaaS API Component Suite](#), which draws on what was learned in the Catalyst.

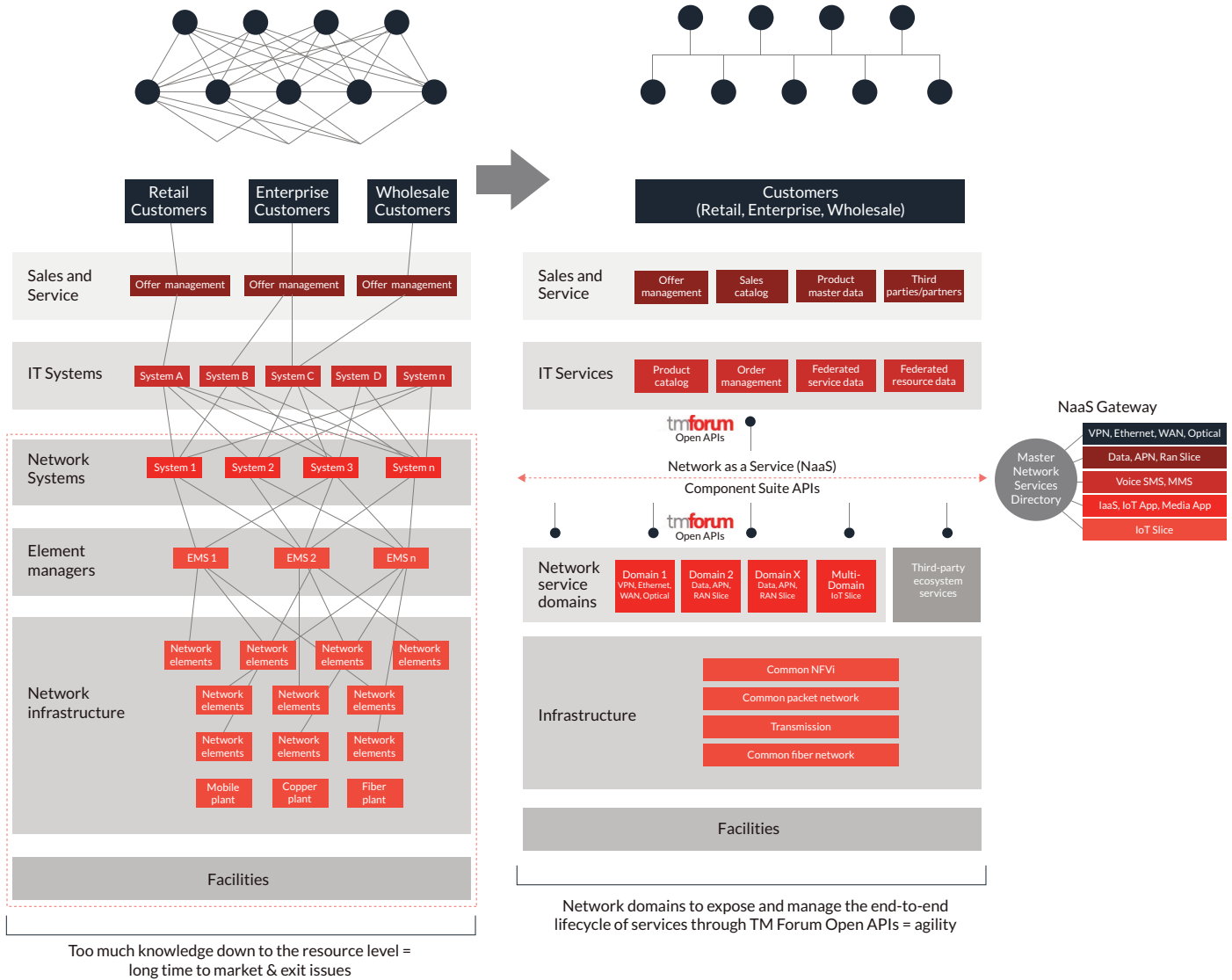
Watch this video to learn more about the Catalyst:



[In a case study](#) published late last year, Telstra executives noted that the full benefits of automation and transformation cannot be realized without virtualizing the network layer. Moving network functionality into software and creating a catalog of exposed services help Telstra compose combinations of products and offers with minimal impact or reconfiguration on the network side.

The company has now deployed NaaS as a network abstraction layer, creating a unified, standard way to publish and consume network-exposed services using TM Forum Open APIs (see graphic on [page 15](#)). This simplification will help speed delivery of products and offers, as well as make it easier, faster and more secure for partners and customers to connect and leverage the Telstra network.

CSPs need to simplify



Telstra & TM Forum, 2018

Vodafone is following a similar path with NaaS. The company uses the NaaS API Component Suite to enable an end-to-end flow of information that allows multiple domains in multiple markets to appear and function like a single network from the customer's perspective. That's

critical for a company that provides mobile services in 24 countries and fixed broadband in 19 markets.

Thomas explains that the NaaS Component Suite allows Vodafone to achieve closed loop automation for some network domains and supports

the company's use of a federated network model that empowers local teams in different markets to be innovative and develop their own levels of automation. It also helps them move away from the idea of a single, monolithic OSS.

Working together

ODA is not the only vision for the future of OSS/BSS. Other standards-development organizations (SDOs) and open source groups are developing their own platforms and architectures. The [Open Network Automation Platform \(ONAP\) community](#), for example, is working on an open source platform for real-time, policy-driven orchestration and automation of physical and virtual network functions.

Just as CSPs are expected to collaborate with partners to deliver the complex, new services customers are demanding, so too must SDOs and open source groups work together to address complexity, and they are. [MEF](#) was a champion of the NaaS Catalyst, for example, and many other Catalysts have demonstrated how ONAP and ODA can work together.

Vodafone and other CSPs use the ONAP production environment while being strong proponents of ODA for other functions and APIs. This type of collaboration is the future of OSS/BSS.

Most 5G opportunities will need to be addressed by ecosystems of partners, which means suppliers can no longer just talk about being open and providing multi-vendor support, Thomas says. They need to accomplish it, and the only way to do so is by agreeing to use an open architecture.

“Telcos are moving from [being] pipeline companies to platform companies offering digital-enabling services upon which other companies will innovate and build their B2B2X models,” Thomas explains. “That is why being open gets all the way

down into service management components. You have got to be giving not just a guaranteed level of service, but you need to interact with all the systems that are [supporting] that guarantee.”

Complementary efforts

Vincent Seet, Head of Enterprise Architecture, Globe Telecom, also sees the ONAP platform and ODA as complementary. For example, the company uses Open APIs from TM Forum while also looking to ONAP for an open source platform to validate new functionality.

“

Collaboration among the different SDOs is very important to us,” Seet says. “The sharing of information between different organizations helps everyone.”

Globe Telecom uses the term “digital service factory” instead of future OSS. The company is trying to introduce the concept of “lifecycle service orchestration” (LSO), which Seet has borrowed from MEF, but Seet believes the concept should not focus only on enterprise connectivity, but also be applicable for orchestrating across multiple service domains.

Seet says collaboration on this concept among CSPs, suppliers and groups like TM Forum, ONAP and MEF is mandatory to drive automation, which at a minimum requires:

- Multi-service orchestration
- End-to-end visibility augmented by AI and machine learning
- An accurate representation of the network that can be corrected based on available data
- AI-enabled operations

Security by design

Whatever architecture CSPs adopt for future OSS, security and privacy must be designed in from the beginning. Alexander Rockel, Security Lead, Oracle Communications, who is active in the effort to develop ODA security principles (see panel on [page 17](#)), explains that bolting on security solutions as an afterthought is costly and ineffective.

For example, security solutions brought in may not be compatible with a CSP’s support systems or with partners’ systems. In particular, this practice often leads to incompatibility with monetization, customer management and fraud-detection systems, as well as other security applications such as vulnerability management and identity access management.

“This is why the internet is inherently insecure,” Rockel says.

ODA security will hopefully serve as a solid baseline for CSPs to perform detailed planning for risk assessment and mitigation, Rockel says. And it can serve as a guide for suppliers to bring needed secure IT solutions to market.

In the next section, we’ll look at whether CSPs intend to move OSS to the cloud.

ODA addresses security and governance

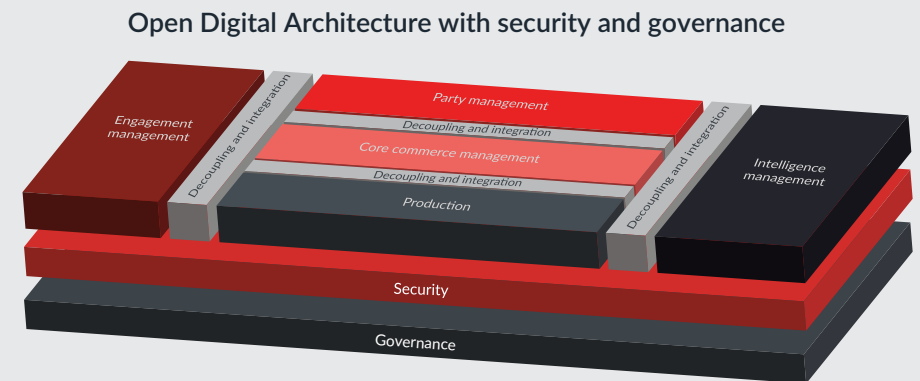
In July, TM Forum introduced two new ODA Information Guides focusing on security:

- [ODA Governance and Security Vision](#) is a business-level view of the concepts and requirements for security.
- [ODA Enterprise Risk Assessment](#) is a detailed set of concepts and tools to carry out enterprise risk assessment from functional and implementation perspectives.

Together the documents cover a full enterprise lifecycle vision for security and governance and provide detailed methods for assessing risk that support a DevOps approach. Here are some highlights:



Security and privacy by design requires a methodology and tools for analysis, as well as governance to address relevant security requirements and threats in all lifecycle stages.



TM Forum, 2019



Cloud-native agility is achieved by assembling configurations of run-time components, each containing collections of ODA functions exposed by Open APIs. The security solutions must now work for rapidly changing software-defined trust boundaries, which require automated security models and tools.



Enterprise risk assessment provides a set of methodologies and analysis techniques including risk mitigation to automate security and privacy through DevSecOps for ODA cloud-native implementations.



The DevSecOps opportunity is to enhance DevOps development tools with automated configuration of security based on the risk assessment methods and use of deployment monitoring tools for threat detection.

If you'd like to learn more or get involved in TM Forum's work on security, please contact the Forum's Chief Architect [Dave Milham](#).

Section 4

Is OSS moving to the cloud?

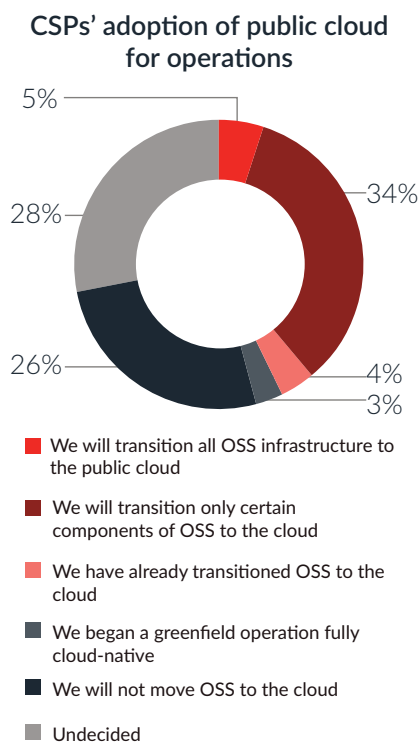
While AT&T announced recently that it intends to move all non-network applications to the public cloud, our research indicates that most communications service providers (CSPs) are unsure about whether to embrace cloud for operational support systems (OSS). They also are not planning to move quickly in reimagining OSS overall.

In December TM Forum will publish a detailed report on public cloud, so we will not cover the topic in depth here, but early survey and research results indicate that at least for OSS, the future won't be entirely in the cloud. In fact, the appetite for full migration of OSS to the public cloud is practically non-existent among survey respondents (see graphic opposite).

CSPs are wary

Cloud-native technologies are used to develop applications built with services packaged in containers, deployed as microservices and managed on elastic infrastructure through Agile DevOps processes and continuous delivery workflows. Containers isolate an application and its dependencies into a self-contained unit that can run anywhere. In this environment, hardware and operating systems are virtualized, which means the same operating system is shared with other hosted applications.

But many CSPs are wary of this approach. They want to keep their networks and network operations on-premise or in a private cloud because they see the network as a strategic differentiator, and they worry about latency affecting performance and reliability. Similarly, they are concerned about the security of public cloud applications.



TM Forum, 2019

However, CSPs also are intent on increasing automation in operations, and moving to the cloud could be a way to accelerate the effort. Cloud providers are beginning to convince some operators that the investments they have made in automated management of their cloud environments have resulted in a level of resiliency acceptable to CSPs. And cloud providers typically are even better than CSPs at scaling and adapting to traffic changes and other real-time demands.

Vincent Seet, Head of Enterprise Architecture, Globe Telecom, says his company is considering moving some OSS into the cloud but does not have a timeline for the transition. Today all Globe's OSS solutions are run on premises.

This is the case at Japanese CSP KDDI. Tomohiro Otani, Executive Director at KDDI Research, says OSS is so critical that the company believes it must maintain control of OSS hardware and software resources.

Vote of confidence

In July [AT&T and Microsoft announced](#) a \$2 billion, multiyear deal to collaborate on cloud, artificial intelligence (AI) and 5G. As part of the agreement, Microsoft will be AT&T's preferred cloud provider, and AT&T said it will move all its non-network applications and workloads to Microsoft's Azure platform by 2024.

George Glass, Vice President of Architecture & APIs, TM Forum, and former Chief Systems Architect, BT, sees AT&T's announcement as a crucial vote of confidence in public cloud, and he predicts that other CSPs will follow AT&T's lead.

"While telcos may have spent tens or hundreds of millions of dollars investing in data center infrastructure and its management, public cloud providers such as Microsoft (Azure), Amazon (AWS), Google (GCP) and IBM (IBM Cloud), closely followed by Oracle and Alibaba, are spending billions to deliver public cloud offerings," [he writes in a two-part series on public cloud](#). "This is something that CSPs can leverage."

Changing minds

At Digital Transformation World in May, Optiva and Google [joined forces to dispel five myths about public cloud](#), which include:

1. Public cloud is not secure
2. Private cloud is the same as public cloud
3. All public clouds are the same
4. Migrating to the cloud is the same as being cloud-native
5. Public cloud is more expensive

Interestingly, live polling after the presentation revealed that given what they had learned, 64% of the audience believed public cloud could be more secure than on-premises solutions, a double-digit improvement from the beginning of the session. A more widespread effort to educate operators could be key to getting them to buy into cloud.

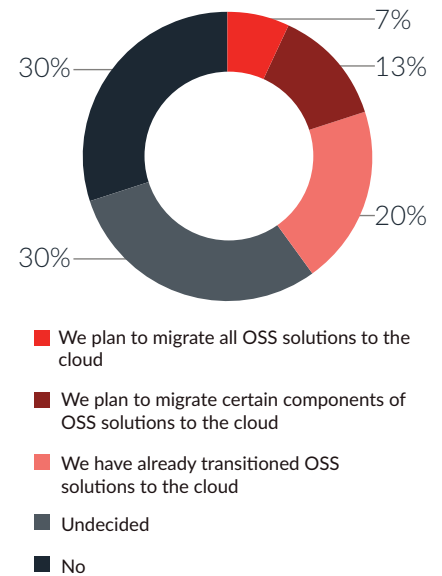
Our analysis finds that the applications and workloads best suited to cloud migration are those for which demand (traffic) is uncertain or where there are big fluctuations and variations. In terms of OSS, this variability is most likely to occur with services such as internet of things (IoT) and perhaps TV or video, where some operators are scaling up quickly.

What about suppliers?

Far more OSS suppliers have made the move to public cloud than their CSP customers (see graphic in next column). This makes sense because cloud-based solutions must be available for CSPs to adopt them.

The fact that 30% of suppliers are still undecided about cloud is interesting. Perhaps they are waiting for their customers to request the delivery model. Suppliers that are undecided likely will make some components available in the cloud as they and their customers seek to reduce operational costs, but they may wait it out as long as they can in order to avoid rocking the boat with customers and to squeeze the most out of their installed base of systems, which are still supporting legacy networks.

Suppliers' plans to move OSS solutions to the cloud



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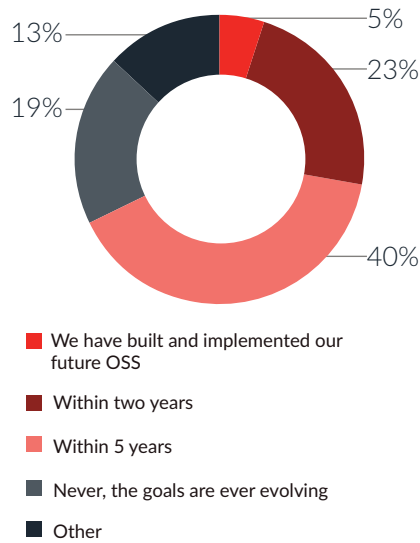
When we asked the questions about cloud of CSPs and suppliers, we asked them if they plan to migrate *existing OSS infrastructure/solutions* to the cloud. In our upcoming report on cloud, we will attempt to make this clearer by distinguishing between existing and new OSS infrastructure and solutions. Answering "no" to the question we posed in this survey may not necessarily mean that CSPs and suppliers don't plan to utilize the cloud. It may simply mean they won't use it for existing OSS. Perhaps operators do intend to adopt cloud-native solutions for new services or markets and gradually phase out legacy OSS and BSS.

Slow progress overall

Whether they move OSS to the cloud or stick with a more traditional approach, our survey shows that CSPs do not plan to move quickly on reimagining operations support. More than 40% of CSP respondents say it may take up to five years to realize their OSS vision.

Many of the respondents who selected “other” specified they are early in the strategic planning stage and could not specify a timeframe. We did not add these respondents to the 40% that said it will take five years, but we could have given the amount of time it takes to plan and implement a major OSS transformation.

CSPs' timeline for reimagining operations support



TM Forum, 2019

The 5% that claim to have built and implemented their long-term vision are the lucky greenfield providers with few to no legacy systems. Almost 20% of CSPs acknowledge the increasingly clear truth that support system transformation will be an ongoing process for the foreseeable future.

In the next section, we offer some steps CSPs can take now to reimagine operations support.

Section 5

Make it happen – Strategies for transforming operations

Deciding what to call future operational and business support systems (OSS/BSS) isn't as important as discussing what the systems need to do. Our research points to several requirements for future OSS. Above all, it needs to be agile, but communications service providers (CSPs) cannot just check a box that says, "We follow Agile methodologies."

Future OSS must enable any new service, business model, business agreement and network technology that comes along. It needs to be open to partners, third-party developers, other networks and data analytics environments. It must be data-driven with the capacity to interface with systems that use artificial intelligence. Finally, it must be automated, and it may be beneficial to move some or all of it to the cloud. Following are steps for CSPs to take as they transform operations.



Reimagine OSS

It is often hard to see things we're familiar with in a new light. Although it is most important to understand what the requirements are for future OSS, it may, indeed, help to start thinking of OSS by a new name. TM Forum members talk about the Operations Center of the Future. Or maybe it could be an "Agile Performance Engine" or "Quality Experience Enablement Platform". It is necessary to reimagine OSS to develop a new vision rather than simply improve on the old one.



Create a roadmap

Preparing for next-generation services often is met with a plan for upgrading existing OSS/BSS. This is not a roadmap to a new destination; it's a functional diagram with a new color palette and a couple of new connecting arrows. CSPs need a real roadmap. To create it, they should focus on what customers want to achieve, evaluate capabilities that can help and then design a plan to incorporate or migrate to systems that can support customers' requirements.



Evolve legacy systems

Most CSPs cannot afford to "rip and replace" their existing OSS. Evolution of these systems should be built into the roadmap. CSPs need a middle ground that allows for gradual migration in a controlled manner to a cloud-native architecture. This is where the Open Digital Architecture can help. It is fundamentally designed as a component-based architecture, with the business services of a component exposed as a set of Open APIs. These APIs can be further decomposed into a set of services and microservices that can be managed on scalable infrastructure using Agile development practices.



Consider public cloud

Based on our research, the jury is still out on whether CSPs intend to move operations to the public cloud. What is clear, however, is that IT systems will have to interact with other systems that are in the cloud, so it's important to keep up with changing requirements and new innovations. Operators should consider public cloud where it makes the most sense, such as when traffic or demand is unpredictable, and they should monitor the success of companies like AT&T that are moving to the cloud to benefit from lessons learned.



Drive consensus

Operators and suppliers should join industry organizations and open source communities that are addressing operations to ensure their voice is heard and to lend expertise. Consider joining TM Forum's [Collaboration Community](#) to develop the [Open Digital Architecture](#). Or, the [Open Network Automation Platform \(ONAP\)](#) is working on open source solutions for management and orchestration, while [MEF](#) focuses on service lifecycle orchestration. Vendors may want to consider the [Cloud Software Association](#) which focuses on software as a service.

Additional features and resources

24 | [Modernizing the Back Office: The Foundation for Digital Transformation](#)

27 | [Future OSS: Network Planning Automation](#)

31 | [TM Forum Open Digital Framework](#)

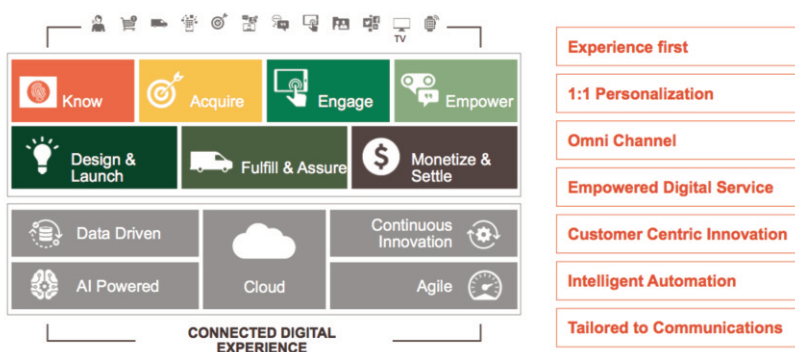
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Modernizing the Back Office: The Foundation for Digital Transformation

Today, many communications service providers (CSPs) are looking to be increasingly “digital” by developing a better understanding of the digital behavior of both their existing and prospective customers. CSPs want to more intelligently determine what core and digital services they should sell and to whom, and how they should best engage to sell and serve services to their customers via increasingly digital channels. Underpinning all of this is the assumption that CSPs can effectively fulfill, assure and bill customer services in an accurate, responsive and automated manner with increased agility and at lower cost. They seek to develop a warmer relationship that assures the customer that “we know you.”

Figure 1: Key Capabilities to Deliver a Digital Experience for Communications



In many cases, such CSPs believe their focus should primarily be on the customer engagement processes and systems that are needed to support new and compelling end customer journeys. However, becoming a digital CSP requires far more than simplifying and digitizing customer journeys. To see the bigger picture, CSP might reframe the question and ask themselves whether it should also include simplification, standardization and automation, if not outright

redesign, of their end to end processes to support the needs of increasingly online channels. It may also drive systems re-architecture and renewal in accordance with open standards and APIs to enable the agile, data-driven introduction of products and services enabling CSPs to decouple what they sell from how it gets delivered. Coincident with this may be changes in IT organization and skill sets such as agile, DevOps, etc. that may also be required.

Sometimes, its worse than you thought

Many of these points are often overlooked, and frequently understandably so, by digital transformation initiatives that are funded to focus predominantly on the front office. Consider these pitfalls from real-world CSP experiences:

- Failing to consider end-to-end processes** – A South American CSP engaged its vendor to implement a front office Customer experience/Customer Relationship Management transformation independently of, but in parallel with, a system integrator that was implementing the CSP’s back-office OSS transformation. The CSP’s naive expectation that when completed, these two projects should automatically work together – but without designing and governing the end to end processes up front, initial results indicated the CSP would not achieve the anticipated benefits of the entire transformation, before the CSP changed strategy and adopted a more holistic approach to rectify the program.

■ **Lengthy regression testing** – A North American CSP was hand-crafting fulfillment flows for each service they introduced which resulted in an escalating number of unmanageable flows that were extremely difficult to understand and change over time. This approach required continual regression testing of the solution, taking many weeks at considerable cost due to the “spaghetti” nature of the updates across the solution. This severely limited their operational agility.

■ **Poor systems availability** – A convergent European CSP transformed their front office systems to shift customer engagements to online channels (away from the call centre) and drove their customer interactions increasingly to non-business hours exactly when their back-office systems, being controlled by other CSP teams, were being taken off line for maintenance reasons. This resulted in poor customer experience and modest, at best, online customer adoption.

■ **Slow response times** – A South American CSP encouraged prospective customers to sign up for new mobile services via contemporary online digital channels with an industry leading customer experience solution. However, the CSP found high cart abandonment and very poor order conversion rates. These were caused by slow tasks in the automated back office processes such as credit checks, that had not been re-engineered for online use. Furthermore, because of the different executive ownership across front and back office systems, these back-office issues presented an existential threat to the entire front office program and the executives involved.

■ **Loss of control and erosion of skill sets** – An Asian CSP, in sharing some lessons learned from their B/OSS transformation, highlighted the perils of delegating responsibility for key back office processes and systems to external parties resulting in a gradual loss of control and skill sets in areas becoming increasingly important to CSPs’ digital futures.

How best to navigate the storm

So, what then are some key elements in a modernized back office that CSPs might consider to best ensure their customer engagement-driven, digital transformation is ultimately successful?

Start with a declarative model-driven approach that allows business analysts to design solutions for specific domains (5G, carrier ethernet, etc.) at a high level. This allows the

products themselves to be exposed in abstract form to the front office for bundling into offers, promotions, etc. This is important as it decouples what is sold from how it is delivered – more of a “lasagna” vs. “spaghetti” approach. The service or fulfillment view is abstracted from the underlying technologies, and the resource view further abstracted from the vendor specifics. Driving the end-to-end solution implementation from this information model engenders reuse through assembly vs. replication and localizes changes to maximize scalability and reduce testing efforts.

To illustrate how such an approach may be applied in practice, here are how two contrasting services, simplified 5G and complex B2B, are illustratively modeled using such an approach. As you can see, the model will drive the behaviour of the run time platform, thereby avoiding the need for domain specific customization.

Figure 2: Architectural Blueprint for Service and Network Orchestration – Design and Run time.

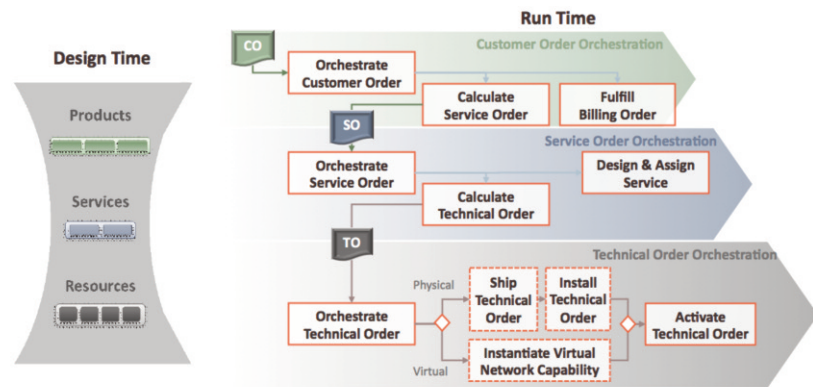


Figure 3: Applying the Model to 5G Services.

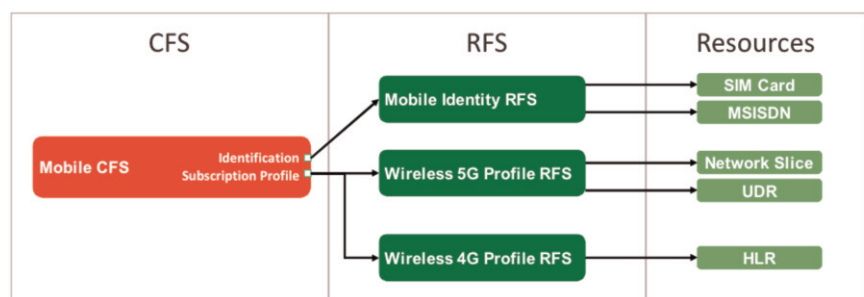
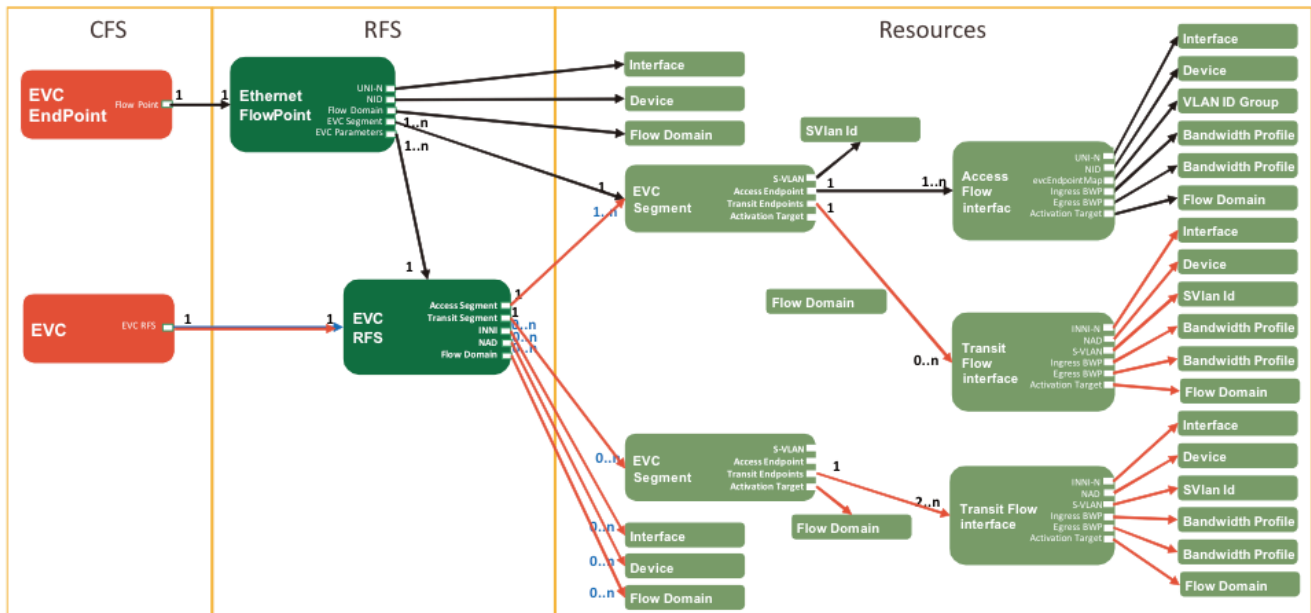


Figure 4: Applying the Model to Complex B2B Services.



At run time, the incoming order items are then mapped to a small number of standardized, manageable workflows and rules that recognize recurring patterns to dynamically create and execute an order orchestration plan unique to each order. Mapping incoming orders into standardized components is critical to avoid “special” orders which are customized to address customer specific requirements especially in B2B and which often lead to error prone manual processing. Such an intelligent orchestration approach decides and manages interactions with required fulfillment systems and the sequences of actions and dependencies between these actions. This helps address the issue of catalog bloat and increasing numbers of unmanageable workflows in the back office. In field experiences,

some CSPs have been able to reduce the number of such workflows from several thousand using traditional methods down to a few tens in number under this approach. This allows new offers and promotions in the front office to be rolled out with minimal or no changes to the fulfillment configuration rules and be very legible and highly adaptable to changes.

To support the automation expectations of the front office, it is important that the back-office supports continuous availability with near real-time responsiveness for the increasing use of online channels. This has been seen traditionally in mobile domains, but as CSPs increasingly engage additional domains through online channels, this elevates the

importance to simplify, automate and ensure very fast responses for all channels. In addition, the back office should also support cloudy / rainy day scenarios such as order cancellations, revisions, and compensation, as it supports sunny day scenarios. Nowhere is this more applicable than in the growth area of strategically important B2B services where orders may be in progress for a long time (up to two years in some CSPs) during which many changes may be received which need to be accurately and automatically accommodated. This helps ensure what gets sold matches what gets delivered and what gets billed – essential for an optimal customer experience and to avoid billing disputes with important enterprise customers.

Commensurate with the above in the back-office solution is the adoption of standards-based open architectures and alignment with TM Forum's Open Digital Architecture as part of the broader Open Digital Framework with concrete support for TMF's Open APIs for ease of solution interoperability. A recent example of this was a TM Forum catalyst called Zero Touch Partnering that showcases how CSPs can leverage TM Forum Open APIs to:

- Rapidly on-board offerings from new partners
- Assemble and curate blended offers
- Consistently orchestrate customer orders across multiple internal and external fulfillment systems using the TMF Product Order API.

A final element is embracing new technologies and ways of working to properly enable the points above. The opportunity to adopt cloud-native technologies and methodologies helps CSPs deploy more contemporary back-office solutions with operational characteristics ideally suited to supporting the front office transformation. This includes increased agility, availability, scaling and reduced costs.

Of equal if not greater importance is enabling CSPs to raise their brand visibility to recruit and retain the talent and skills (cybersecurity, digital, cloud-native, AI/ML, etc.) needed for tomorrow's digital CSP. As part of their organizational and skill-set transformation, this will allow them to identify and own areas they need to control to differentiate themselves in the market.

Conclusion

As CSPs look to transform their overall customer experience, implicit dependencies on the back-office are often overlooked resulting in impacts that may range from significant to existential in nature. To avoid this, CSPs need to modernize their back office by considering end-to-end processes and leveraging open, standards-based solutions that are model-driven with intelligent orchestration that, in turn, support full automation, continuous availability and near real time response times.

Oracle's Service and Network Orchestration solution has been widely deployed in large CSPs on a global basis, supporting order volumes into millions of orders per day with sub second response times providing CSPs the confidence of a proven, strong foundation to support their customer experience transformation, whether it be green field, brown field or a digital overlay.

Future OSS: Network Planning Automation

As the BT Group moves from the Legacy OSS towards the 5G ready OSS, one of the key challenges is Network Planning to ensure support for ever-growing demand for Core Network Capacity. Service providers are struggling with pace of network capacity growth required to meet the demanding needs of new products & services, including 5G, Data, TV & Media, Voice etc. Agility and Automation in Network Planning are the key goals to ensure Future OSS applications support this Growth Profile to enable OPEX Savings with a fast T2M (Time to Market) in a complex Hybrid Network (including PNFs & VNFs).

BT's Problem Area

BT Enterprise is Europe's largest wholesale telecoms service provider by revenue, including communication, collaboration and connectivity services. BT Enterprise provides a host of services including Data, Voice, Hosted Communications, Managed Services and Mobile.

As BT prepares for its Digital Transformation Journey and for the onset of 5G; one of the major challenges was coping with the ever-growing demand for core network capacity and overcoming its slow Growth Profile for Core Network. Major Core Network Planning issues were:

- Very high demand for additional capacity in the core network.
- Convoluted transactional planning processes to create services via multiple OSS platforms – minimal decision making in planning teams
- High people intensity for repetitive transaction impeding automation of processes

- Complex journeys to upgrade and integrate new hardware into the network
- Heavy reliance on manual interactions between Plant & Build functions, Engineering Services, BT Openreach Services & supplier teams

BT's Solution – Agile OSS Automation Solution

BT's vision of Agile OSS Solution is a complete transformation of the OSS stack to provide a model-driven OSS system that allows Resource Plan & Build, Dynamic end-to-end Service Design, Activation and management for legacy and future Network and services.

The solution was developed based on key principles of Human Centred Design (HCD) and Design Thinking. End stakeholder involvement at each stage of brainstorming, conceptualizing, developing, and implementing the solution leading to top quality User Experience.

The major areas for transformation are:

Next Gen Plan & Build Workflow Automation Transformation (NG WFMT)

- Transforming Plan & Build Processes with specifically built universal workflow management tools to enable the automation of these processes.

“

With exponential increase in NW Demand, putting more people to plan and build our network is simply not sustainable. Also, Infrastructure is increasingly Software driven. This presents a unique opportunity to re-engineer our existing processes AND automate Network Planning” Says Ravi Ramachandran - Platform Director, Fulfilment, Tools – BT OSS.

- The tool makes use of the TM Forum's ETOM model providing a foundation for the fulfilment processes for the orchestration workflows required for automation of the network planning journeys.

Next Gen Service & Resource Inventory Management (SRIMS)

- Simplifying service design and resource planning, providing a consistent Resource to Service mapping for Assurance and allowing for OSS readiness for future disruptive changes such as NFV/SDN supported services, mobility and future voice.

Next Gen Service & Resource Activation Management Engine

- Transforming our domain-based management systems into a cross-domain, model-driven, network aware environment supporting the new standards (such as NETCONF/OpenConfig) and providing an abstraction to operational complexity of underlying Virtual and Physical Infrastructure

Service & Resource Catalogue

- This catalogue is a new component that allows the future OSS to be dynamic and data driven and key to integrating a DevOps environment. It is the authoritative master of

Specifications of Services (at various levels across CFSs (Customer Facing Services) and RFSs (Resource Facing Services) and Resources using standards where available (such as TMF SID, YANG, TOSCA...). These specifications are consumed ultimately by all OSSs that manage in any way the Network Services and Resources that they are running on

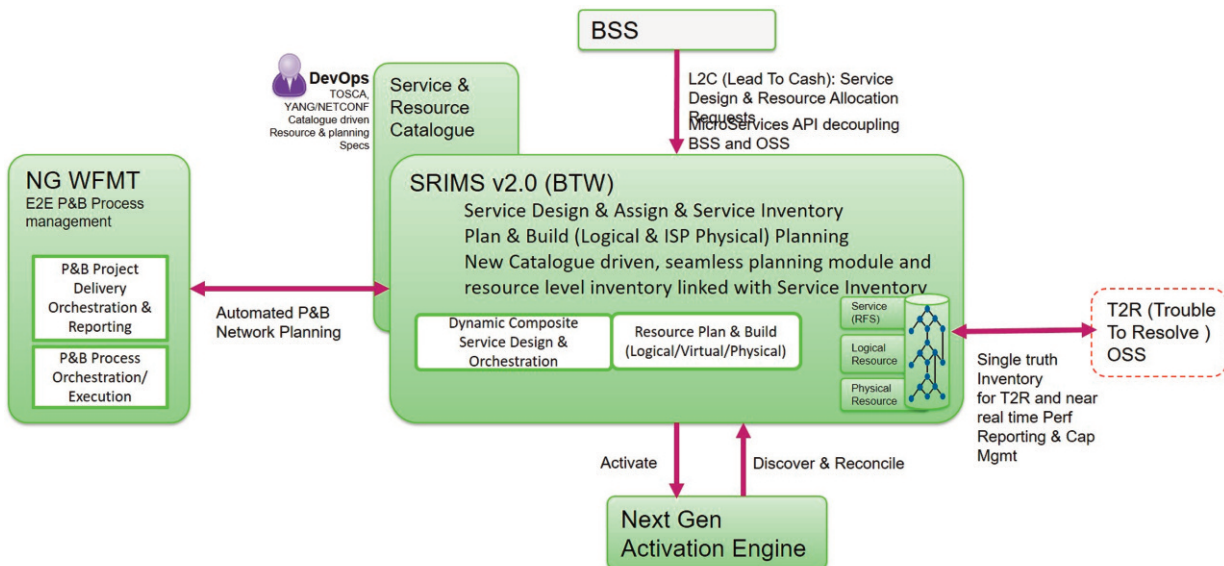
Next Gen OSS Automation

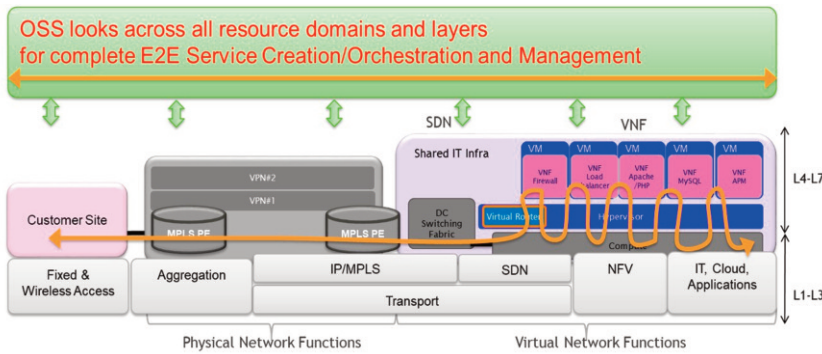
The major emphasis of the solution was to provide a holistic E2E service management, combining existing Physical Networks, Virtual Networks (SDN), Virtual (VNF) or Physical (PNF) network functions and Shared IT (SW/HW) infrastructure and provide automation solutions on top of this holistic inventory.

An enhanced Data Model providing a Single Truth Inventory View, across Service, Logical & Physical Inventory layers, has been developed in a Graph Database. TM Forum Information Framework (SID) and Open APIs have proved to be key assets here. The Information Framework (SID) provided a standard reference model and the Open APIs enabled quickly scalable Data Access Strategy for the enhanced Data Model.

“

The Automation has enabled 21C Network Planning team achieve target deliverables of building 3000 headends for Ultrafast Programme. We have connected enough ports in the broadband core network to the Openreach access network using automation to be able to reach 90% of the addressable market offered by Openreach. Reusable framework of NG WFMT has potential to serve other line of business/requirements like NFVi & EE/GS. It's an excellent example of an agile delivery and how automation is helping us build the number one network.” Says Sridhar Pai - Workflow Automation Engineering Manager - BT OSS.





Few key automation solutions implemented are:

Zero Touch Automation for Deploying PNF Base Build Configurations:

Zero Touch Automation for Deploying PNF Base Build configurations on Nokia devices to enable the chassis for Broadband customers. Key features of the solutions are:

Generic vendor specific checks

- Chassis capacity checks for Base Build Support
- Allow Base-build only based on checks

Automate base-build deploy:

- Apply base-build configurations (template based)
- E2E automation upto network

Pre-check Compatibility Matrix:

A Pre-check Compatibility Matrix has been integrated onto the Network Planning OSS application to:

- Carry out requisite validation before initiating a new network plan.
- Provide "To Do" plans in case of validation failures

The solution provides a generic framework enabling BT to add new validations & checks, as well configure individual use case specific checks. Key features of this tool are:

Vendor Specific Checks:

- Service Type support on Vendor Hardware

- Card Type upgrade configuration support

Site Power Level Checks:

- Power calculations for network hardware
- Power availability check at site

Network Discrepancy Checks:

- Validate OSS & Network Inventory
- Identify Network Inventory Discrepancies
- To Do plans for correcting Network Inventory Discrepancies

Business Benefits:

The Agile OSS Automation Solution has helped BT to get more value in its network planning journeys and enabled following key benefits:

Enabled yearly monetary savings:

Financial benefits resulting out of reduced costs from

- Automated manual tasks by the network planners
- Avoid network planning failures late in the process
- Speed up network capacity upgrade
- Reduce engineer visits and upgrade time/costs

Reduced planning tasks timelines:

With automated journeys and pre-checks to avoid, re-planning the planning tasks timelines are significantly improved with most network planning journeys reduced from days to few hours.

Reduced the application handoffs

The Agile OSS solution has helped integrate the E2E network inventory scattered across various legacy OSS applications. This clubbed with the automation solutions has enabled reduction of multiple cross OSS application hand-offs in network planning journeys

Free key resources for other crucial jobs

Network automation has enabled to free key expert resources to move away from mundane planning tasks and focus on crucial jobs of optimizing network and network design

Top Benefits
of Agile OSS Automation

<p>Cost Savings</p> <p>✓ Significant yearly cost reduction from automation & early failure detection</p>	<p>Rapid Planning</p> <p>✓ Automated Journeys</p> <p>✓ Pre-validated Planning</p> <p>✓ 70% Time Saving</p>
<p>Reduced Hand-offs</p> <p>✓ Optimized workflows</p> <p>✓ Integrated Applications</p>	<p>Free Key Resources</p> <p>✓ Eliminate Manual Tasks</p> <p>✓ Focus on Crucial Tasks</p>

TM Forum Open Digital Framework

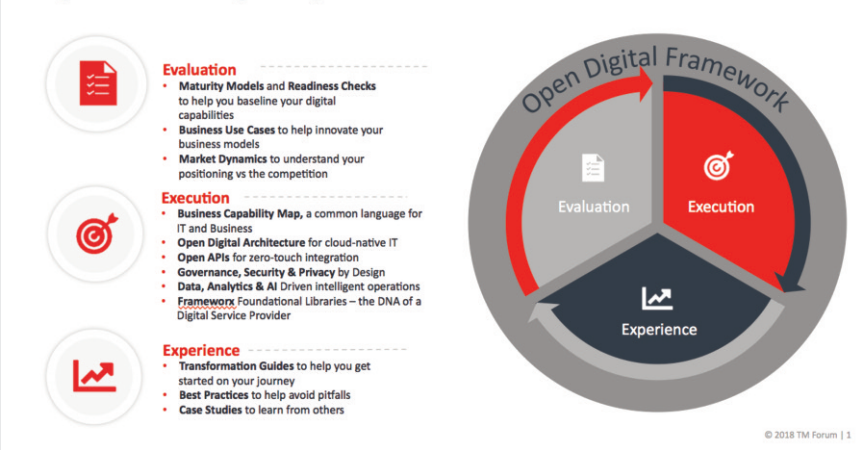
Delivering the tools to go from concept to cash in just 18 days

The [TM Forum Open Digital Framework](#) is an interactive, continuously evolving collection of tools, knowledge and standards that give communications service providers (CSPs) an end-to-end migration path from legacy systems to modular, cloud-native IT components. Simply put, it is a blueprint for service providers to deliver intelligent operations fit for the 5G era.

A prototype version of the framework is [available now](#) for TM Forum members to explore. It is being developed through the [TM Forum Collaboration Program](#) and [Catalyst Program](#), and builds on the success of the Forum's established [Open APIs](#) and the [Framework](#) suite of standards. Specifically, it includes:

- **Open Digital Architecture (ODA)** – an enterprise architecture blueprint, common language and key design principles for modular, cloud-based, open digital platforms that can be orchestrated using AI
- **Open APIs** – 50+ standardized REST-based APIs to facilitate zero-touch integration and zero-touch partnering
- **Data & AI standards** – an industry-agreed data model,

Components of the Open Digital Framework



together with standards maximizing the potential of AI to enhance customer experience and increase operational efficiency

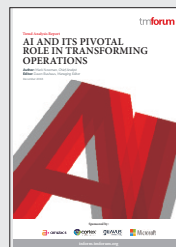
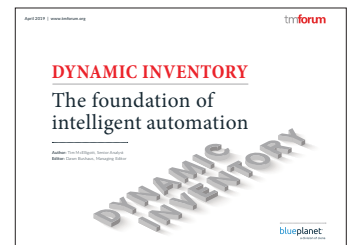
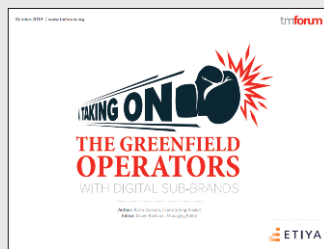
- **Reference implementations** – a framework for assembling and validating ODA components in the Forum's [Open Digital Lab](#), fostering the creation of a services marketplace
- **Practical guidance** – guides and videos showing how the Open Digital Framework can be used to transform the core business and enable new business growth
- **Foundational libraries** – normalized models providing a common language for business processes and information that

simplifies and de-risks transformation projects

The goal of the Open Digital Framework is to help service providers increase agility and drastically reduce the development cycle for products and services from 18 months to 18 days. Much of the collaborative work that is part of the framework is already available, but it helps to organize it and make it more accessible. The framework is a work in progress and will improve through crowdsourcing.

If you would like to learn more about the project or how to get involved in the TM Forum Collaboration Community, please contact [Andy Tiller](#).

TM Forum research reports



Meet the Research & Media team



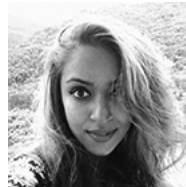
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