

TRANSFORM SERVICE ACTIVATION FOR



5G SERVICES

WITH *REAL-TIME*
DATA ANALYTICS

Author: Sandra O'Boyle, Independent Analyst
Editor: Dawn Bushaus, Managing Editor



INTELLIGENT OPERATIONS FOR A 5G WORLD.

NICE/FRANCE
14-16 MAY/2019



DIAMOND SPONSOR



**The next decade will be one of
opportunity for the telecoms industry –
for those who can move fast enough.**

As established industries race to digitize, expectations and hype for new technologies such as 5G are sky high. Digital Transformation World 2019 will explore these opportunities and challenges and more. Join us in Nice to find out how.

dtw.tmforum.org

TM Forum's research reports are free and can be downloaded by registering on our website

Report author:

Sandra O'Boyle
Independent Analyst
o Boyle.sandra@gmail.com

Report editor:

Dawn Bushaus
Managing Editor
dbushaus@tmforum.org

Chief Analyst:

Mark Newman
mnewman@tmforum.org

Senior Analyst:

Tim McElligott
tmcelligott@tmforum.org

Editor, Digital Content:

Arti Mehta
amehta@tmforum.org

Sponsor & Production Manager:

Rachael Jacobi
rjacobi@tmforum.org

Commercial Manager, Research & Media:

Tim Edwards
tedwards@tmforum.org

Global Account Director:

Carine Vandevelde
cvandevelde@tmforum.org

Publications Marketing Manager:

Jan Lowdon
jlowdon@tmforum.org

Chief Marketing Officer:

Paul Wilson
pwilson@tmforum.org

Vice President of Marketing:

Charlotte Lewis
clewis@tmforum.org

Advisor:

Aaron Boasman-Patel
Vice President, AI & Customer Experience
aboasman@tmforum.org

Report Design:

thePageDesign

Published by:

TM Forum
4 Century Drive,
Parsippany,
NJ 07054
USA

www.tmforum.org
Phone: +1 973-944-5100
Fax: +1 973-944-5110

ISBN: 978-1-945220-44-9

Transform service activation for 5G services with real-time data analytics

- Page 4 **The big picture**
- Page 6 **Section 1**
Why order fulfillment and activation matters
- Page 12 **Section 2**
The value of analytics: From SIM order to activation
- Page 17 **Section 3**
Make it happen: Strategies for applying analytics to service activation
- Page 20 **Sponsored feature**
Optimize customer experience and make fast, confident decisions with data analytics
- Page 23 **TM Forum toolkit for digital transformation**



We hope you enjoy the report and, most importantly, will find ways to use the ideas, concepts and recommendations detailed within. You can send your feedback to the editorial team at TM Forum via editor@tmforum.org

© 2019. The entire contents of this publication are protected by copyright. All rights reserved. The Forum would like to thank the sponsors and advertisers who have enabled the publication of this fully independently researched report. The views and opinions expressed by individual authors and contributors in this publication are provided in the writers' personal capacities and are their sole responsibility. Their publication does not imply that they represent the views or opinions of TM Forum and must neither be regarded as constituting advice on any matter whatsoever, nor be interpreted as such. The reproduction of advertisements and sponsored features in this publication does not in any way imply endorsement by TM Forum of products or services referred to therein.

The big picture

Consumers expect instant gratification, which is something communications service providers (CSPs) often struggle to provide. By some estimates, operators lose upwards of \$50 billion annually due to service activation issues, and **TM Forum's 2018 research** on revenue assurance finds that revenue leakage remains stubbornly at 2%, with only about half of it recovered. CSPs are thwarted by the complexity of their diverse systems and manual investigations into issues that threaten service delivery.

Primitive and often retrospective monitoring of legacy business processes and rigid IT systems need to become real-time and dynamic, providing visibility into every step of the customer's journey, from placing orders, to on-time service provisioning and correct billing.

To improve the success of the order-to-activation process, CSPs need operational intelligence that makes far better use of the vast amounts of data they collect about the network, customers' usage, channel preferences, care interactions and social media. Correlating relevant data with product catalog and ordering systems provides a better understanding of when individual customers' expectations are not met and what can be done to improve delivery of services.

Redesigning visible ordering processes to be more responsive and customer-centric is a key priority in CSPs' digital transformations. This not only speeds up time to revenue but also prevents revenue loss by identifying issues quickly so they can be resolved before customers cancel orders.

This report assesses the benefits that can be achieved by using real-time operational analytics to improve ordering and delivery of new services or reactivation of services. We consider the pressing requirements for service providers as they go to market with new internet of things and 5G services, which involve on-demand activation, in many cases at scale, as well as a bewildering new array of devices and partners.

Although challenging, there is an opportunity to make a measurable impact to a CSP's bottom line by identifying and addressing problems during the order-to-activation process. Using analytics to improve operational visibility into the 'per-customer' order-to-activation process, will enhance customer experience and lay the groundwork to capitalize on 5G.

CSPs need to apply machine learning and predictive analytics to a comprehensive data platform to detect anomalous patterns so they can prevent issues affecting customers or send proactive notifications.

Read this report to learn:

- Why order fulfillment and activation, and operational intelligence from these activities, are so important
- Why visibility must be extended down to individual customers' journeys
- How big data analytics and platforms interpret the typically complex stories told by the data
- The opportunities and efficiencies promised by 5G
- How Vodafone UK and CenturyLink in the US have benefitted from real-time operational analytics

Section 1

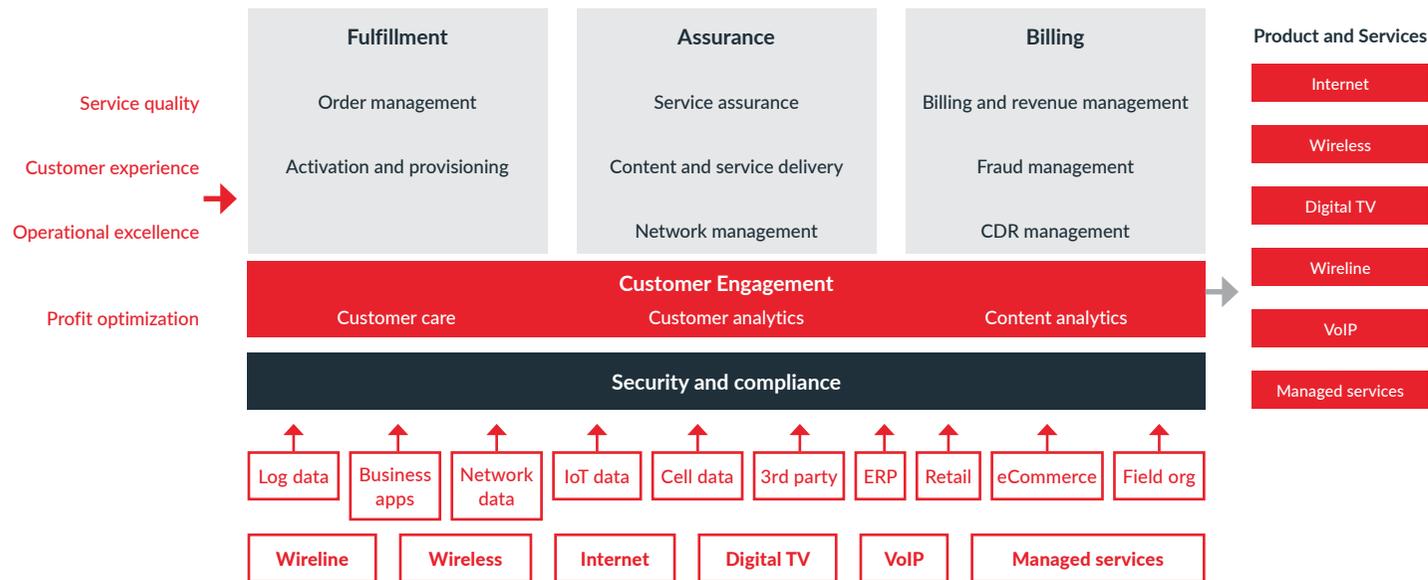
Why order fulfillment and activation matters

Winning a new customer in the highly competitive telecoms markets is 10 times more expensive than keeping one by making sure they are happy. Failing to satisfy a 'new' customer at the first hurdle – delivery of their service order – is also costly. If an order fails or is not provisioned correctly, they will likely cancel it, churn and complain on social media and review sites. For enterprise customers, the stakes are even higher as failure to provision their services correctly can have a high impact on business productivity.

As a result, CSPs are razor-focused on gaining an end-to-end view of customer experience because it impacts the bottom line. In the cases of order activation, management and fulfillment, this involves pulling together relevant data from

call detail records (CDRs), interactive voice response systems, operational support systems (OSS) and social channels as well as correlating multiple pieces of data from the customer journey to understand what's happening.

The digital customer: CSPs focus on operational intelligence



TM Forum, 2019 (based on graphic from Splunk)

Being able to collect and correlate unstructured data sources like social media, and structured data such as from customer relationship management (CRM) systems, has always been difficult. Being able to do it accurately and efficiently, at scale, while maintaining insight into an individual customer's experience is the goal.

Urgent need

The business models that support digital services require that:

- Telcos have insight into operations and processes across the business
- Agile IT systems be used
- Customer experience remains consistent, regardless of the channel or service

According to TM Forum's research, more than 80% of CSPs are upgrading or planning to upgrade IT systems and processes to support new business models and growth, which demonstrates their determination to enable new digital ecosystems and capitalize on them. Integrated cloud and network platforms, analytics and omnichannel customer care are fundamental in



Read this report to learn more about CSPs' plans for 5G

servicing customers more efficiently as well as more effectively to improve customers' satisfaction and loyalty.

5G challenges legacy IT

With the introduction of 5G, there will be many more connected devices and systems to test, activate, provision and remotely monitor at scale, for example, sensors deployed in a building, connected cars, etc. The nature of many of these devices is unlike those of the past and present. Specifically, with networked devices embedded into infrastructure, automobiles and other manufactured goods, the activation process must be adaptable to the needs of third-party production processes, requiring a degree of flexibility and scale beyond the scope of legacy OSS/BSS applications.

“ More than 80% of CSPs are upgrading or planning to upgrade IT systems and processes to support new business models and growth. ”

Hence the transformation of OSS and business support systems (BSS) is essential if CSPs are to maximize their revenue opportunities from 5G. As the 5G report notes:

Operational silos must be consigned to history and services managed end-to-end from network provisioning, through to product creation, billing and service delivery, and back again.

Even if CSPs are working with an IT integrator or cloud partner, and therefore not responsible for the end-to-end solution, they still will have to connect devices and users effectively, and be able to turn services on and off on demand.

Third-party partnerships are crucial to the development and delivery of many new 5G services for different industries and enterprises, like connected cars, augmented and virtual reality, automated factories and so on. The graphic opposite shows the improvements possible with 5G. To realize many of the promises, CSPs will need control and visibility of their own processes to ensure orders can be delivered 'right first time' to succeed with their preferred business model of revenue sharing.

The promises of 5G



Peak data rate of 1-20Gbps and user-experienced data rate of 10-100Mbps



Latency of 1-10 milliseconds



Mobility-based quality of service at speeds up to 500 kilometers per hour



Connection density of up to 1 million devices per square kilometer



Peak spectral efficiency of 15-30Bps per hertz



Network energy efficiency improvements of 90%



Area traffic capacity of 0.1-10Mbps per square meter

TM Forum, 2019 (source for data: ITU)

“ Operational silos must be consigned to history and services managed end-to-end from network provisioning, through to product creation, billing and service delivery, and back again. ”

Gaining operational efficiency

The business case for 5G is as much about efficiency and automation gains in IT and network operations as it is about generating new revenue from 5G services by entering new markets. That efficiency and automation will be enabled by network functions virtualization (NFV), software-defined networks (SDN) and network slicing. Yet the goals of automated service activation, service provisioning and order management will only be possible through closer integration with IT.

The emergence of new 5G services in areas such as IoT, mobile payments, identity management, connected cars, smart cities, and other technologies will allow CSPs to branch into many new industries (see graphic below). Some CSPs have successfully offered a form of digital services for years. Vodafone, for example, launched its **M-Pesa mobile payments**

initiative in Kenya and Tanzania and was then able to follow up the success of the program by rolling it out in three new markets as well as launching additional financial services. Orange also has **big banking ambitions**. By expanding into adjacent industries, CSPs can create new sustainable revenue streams and profits.

Service lifecycles are shorter

To achieve those aims, CSPs need to offer upgrades and new on-demand services more often, which places tremendous stress on operations. In addition, customers expect higher levels of service with so many competitive options available to them now. CSPs are routinely compared to digital companies and competitors that are easy to do business with and have user-friendly interfaces, self-service portals and seamless ordering processes.

Promising vertical markets

Industry	 Industrial automation	 Remote monitoring and control	 Global smart grid	 Smart city technology investments	 Digital health	 Global connected car
Size by Year	\$239B by 2023	\$27B by 2023	\$70B by 2024	\$158B by 2024	\$379B by 2024	\$219B by 2025
% of CSPs using partner or joint venture strategy	69%	62%	58%	67%	60%	48%

Netcracker & TM Forum, 2018 (sources for data: Global Market Insights, IDC, Markets and Markets, Research & Markets)

The volume of IoT devices in homes and businesses is growing rapidly and will accelerate greatly with 5G. Order-to-activation processes must evolve to be closer to real-time and smarter, driven by data analytics and machine learning. A reduction in service lifecycle time is a critical focus for CSPs.

Customers won't tolerate ordering portals that do not connect to middleware systems (so cannot provide immediate answers) or error-prone order management systems. Other companies do it excellently, so why not service providers? Self-service and self-care need to be managed in real time.

Customers don't have the patience to wait while an error in the front end (typically at customer touch points) or at the back end (with service provisioning and configuration) is being corrected.

Reputational loss

CSPs are increasingly vulnerable to reputation loss, penalties and legal costs because of not meeting customer service level agreements. As they support more mission-critical mobile services – like the emergency services, health applications and so on – pressure to provide an improved level of service excellence will increase.

In the next section, we'll look at how analytics can help.

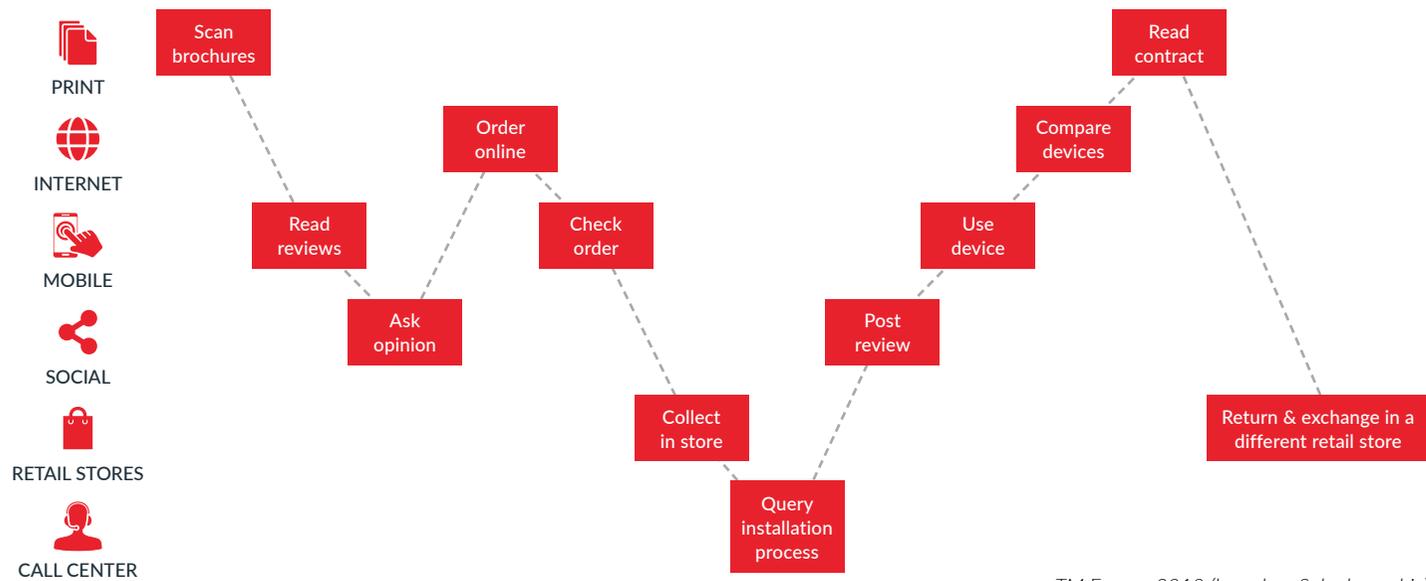
“ Order-to-activation processes must evolve to be closer to real-time and smarter, driven by data analytics and machine learning. ”

Section 2

The value of analytics: From SIM order to activation

With the advent of digital marketing channels, most customers have created their own non-linear buying experiences. They hop between different channels, depending on what they want to do, when and how. Understanding individuals' preferences, practices and experiences, and the touch points they involve is key to digital transformation. The value of real-time analytics is in correlating relevant data to understand the end-to-end experience so that problems can be discovered and remediated fast.

Viewing the entire customer journey



TM Forum, 2019 (based on Splunk graphic)

Interpreting the story

Big data analytics play a key role for communications service providers (CSPs) now in providing visibility into a customer's experience, from ordering a service to receiving it correctly, in a timely manner. The role of analytics is to interpret the story the data tells, accurately and quickly.

The goal is to provision services without human involvement, almost instantly. This automation is designed to ensure processes work correctly, at scale, while substantially eliminating the errors that are inherent in manual intervention, which slows service activation processes and requires time-

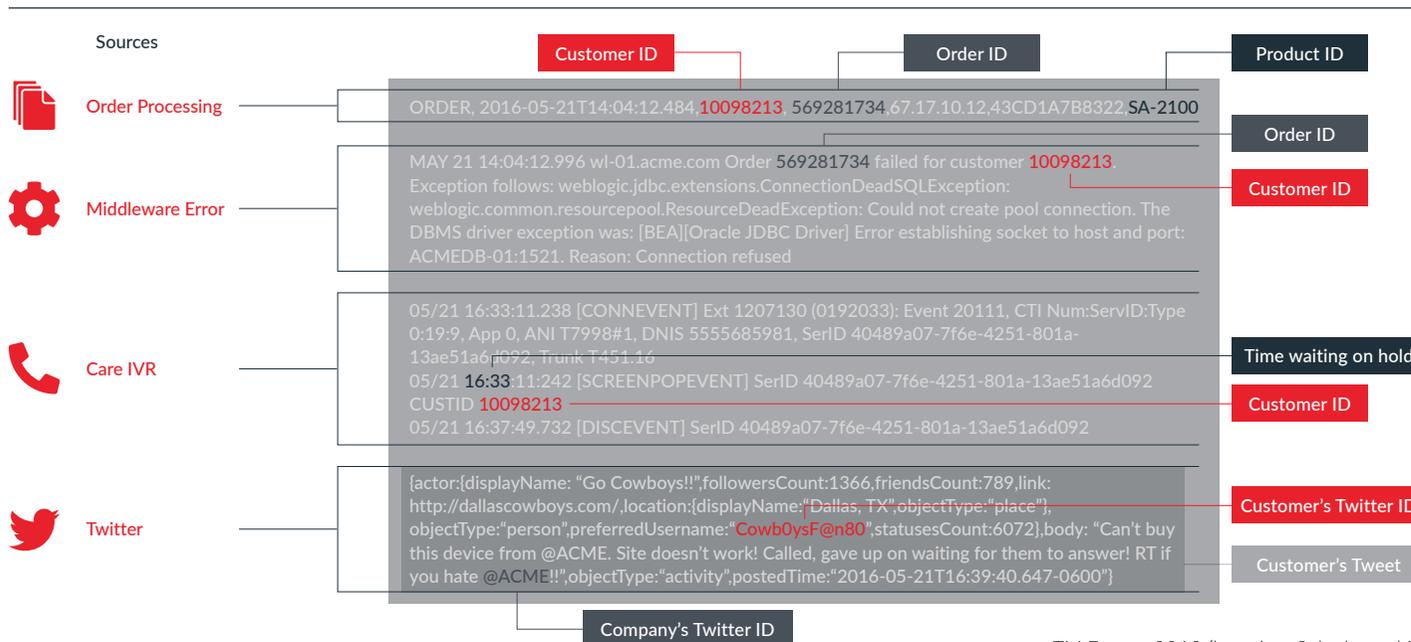
intensive troubleshooting, intervention and remediation.

Complex activation

A SIM card order and activation process can be complex, involving multiple applications and workflows that are hard to follow. For example, analytics can tell the story behind a customer's experience of ordering a service:

1. The customer tries to place an order to buy a product
2. The customer encounters a middleware error, is denied and the order cannot be processed
3. The customer then calls the call center to explain; after being

Machine data contains critical insights



TM Forum, 2019 (based on Splunk graphic)

kept on hold for several minutes, they decide to hang up and forget the order

4. Then the person tweets about their bad experience

These types of situations happen, but it's difficult track when, where, why or to whom. Using a big data analytics platform which can ingest, analyze and correlate data from order systems and interactive voice logs along with data about customers from the customer relationship management (CRM) system (which is stored securely in a separate database), it's possible to see what happened.

CSPs can then identify journeys that are not completed, take weeks to complete or put revenue at risk. Analytics can also detect recurring issues and patterns that would be otherwise very difficult to recognize from mountains of data generated every minute of every day. This improves customer experience and ensures faster activations and shortens time to revenue cycles.

Gaining visibility

Intelligent analytics provide visibility into complex and disparate order-to-activation processes by:

- Tracking between multiple applications and emitting complex logs at high velocities
- Capturing order type, docs sent, options selected and actions to take
- Visualizing steps including order entry via a web app, credit check, transmission across multiple back-end applications, then physically by a logistics partner and finally the customer
- Identifying individual customers' journeys and experiences at scale

Benefits of using analytics

Customer experience – there are two components to creating great customer experience. The first is to offer a predictable and consistent service that meets the customer's expectations. The second is to reduce provisioning time. Engaging with the customer and proactively keeping them informed throughout the process also reduces churn.

Cost optimization – reducing costs without negatively impacting customer experience is becoming core to successful order-to-activation processes. This can be achieved by reducing human intervention through automation and optimizing inventory.

Cash flow/revenue management – cash flow can be hugely improved by shortening the cycle time, reducing errors in order processing, and cutting the number of steps in the process along with the resources required to fulfill orders. Revenue management is better managed by preventing order fallouts and the costs associated with retrieving an order.

CenturyLink uses data to drive transformation

US operator CenturyLink is using big data analytics to drive digital transformation and DevOps capabilities to speed development of new and transformative services and to rationalize legacy offerings. To do this, the company is bringing together an array of structured and unstructured data sets (for example, OSS/BSS data and network data from layers of disparate systems) to gain a single, coherent view of end-to-end customer experience across the service delivery path.

Connecting the customer's service experience to the underlying infrastructure helps CenturyLink understand interdependencies and identifies relevant actions teams can take to resolve

issues. This applies across the entire customer and service lifecycle – from marketing and sales to operations, engineering, planning, and on the customer side across services, devices and locations. All teams work with the same data and a ‘single source of truth’ to better understand and improve end-to-end customer experience.

They can then act on what the data reveals. Sophisticated analytics and faster access to data coupled with machine learning help the company respond quickly. Even better, teams can go upstream to be proactive, predictive and prescriptive. And analytics is affecting top and bottom lines in terms of improved key performance indicators for the business (for example, reducing truck rolls, churn and trouble tickets) as well as digital transformation from technology and cultural perspectives.

Real-time operational analytics at Vodafone

Vodafone UK’s IT operations team is using operational analytics to extract value from the high volumes of data flowing through its system logs and applications. The overall goals are to:

- Improve customer experience by delivering better service (for instance, reducing mean time to repair)
- Increase efficiency of the team
- Understand data, end-to-end across all systems in order to become more proactive in resolving issues

The team’s first use case for operational analytics was improving the consumer ordering process, in particular by managing and securely throttling the volumes of orders during peak times. Vodafone UK is deploying real-time analytics and machine learning of logs to monitor events proactively, remediate service issues, and support availability management and capacity planning. By automating routine fixes and repetitive monitoring tasks, IT operations staff are freed up to develop skills in new areas.

Analytics platform for 5G and IoT

The Vodafone IT operations team sees analytics platforms as essential to managing and correlating the volumes of data expected from new 5G services and IoT devices, which will increase the volume of data flowing over a still complex IT architecture. It will no longer be humanly possible to manage all the data, alerts, events and tickets generated.

A real-time analytics platform will be most effective with an end-to-end program in place, enabling DevOps across delivery and operational teams. This end-to-end sharing of data and insights across applications, processes and teams is essential to understanding the end-to-end customer experience.

It will also be valuable in detecting recurring issues in processes using machine learning, and as a way to introduce more automation, and predictive capabilities that will prevent these issues from happening in the first place.

“ End-to-end sharing of data and insights across applications, processes and teams is essential to understanding the full customer experience. ”

Section 3

Make it happen: Strategies for applying analytics to service activation

To improve the success of the order-to-activation process, CSPs need operational intelligence that makes better use of the vast amounts of data they collect about the network, customers' usage, channel preferences, care interactions and social media. Following are some steps they can take to get started:



Centralize the product catalog

The only sustainable way to support current and future sales channels is to create a unified product catalog and then align it with service catalogs and resource inventories to avoid fulfillment bottlenecks. A centralized catalog stack that supports every channel and is the 'single source of truth' for every product means a radical change in architecture, processes and, more importantly, thinking.



Adopt a standard, unified information model

Future operations and the ability to profit from digital services will benefit greatly from using a standard information model such as **TM Forum's Information Framework** (SID), part of the **Frameworkx** suite of standards-based tools and best practices (see page 26). Many previous efforts to transform OSS/BSS have been stalled by upgrades that failed to adequately integrate with existing systems and data. If system upgrades and replacements are based on a single information model that can be applied consistently across all OSS/BSS, costs go down, reliability goes up and customers (and the bottom line) win.



Correlate and visualize data

Big challenges for CSPs are knowing which data is relevant and ingesting, cleaning and organizing unstructured and structured data in such a way that it can be presented, accessed and queried by relevant stakeholders. Having a single data platform capable of ingesting and providing correlation capabilities across a multitude of datasets, with secure role-based access and visualizations of the data, are useful in providing a 'single source of truth' and a full view of instantiation of a service order through to activation, billing and customer care.



Use a common approach to data and standard APIs

Especially for 5G, CSPs must adopt a common approach to data across all IT and network domains. Data from the network will be used to inform customers, and information from the customer will impact on the network and everything in between. Data must be made easily available and usable across IT processes using standard application program interfaces (APIs) such as **TM Forum's Open APIs** to enable efficient sharing and access to data. This will also be critical for driving automation of order-to-activation processes, reducing reliance on manual scripting and instead using robotic process automation.



Consider cloud for AI

A cloud platform can layer machine learning and AI and easily ingest any relevant data sources. Many CSPs have years of experience with analytics under their belts now, particularly for value management of their customer base. The consensus is that analytics and AI belong together. Even though AI cannot solve all issues, there is more synergy than differences.

A majority of the opportunities to use AI are in improving the performance of existing analytics use cases. Yet one of the biggest problems CSPs have is that data is often siloed, so insights from one division are not shared with other areas of the company. TM Forum's AI collaboration project is trying to help CSPs address these issues. The team is developing AI standards, a reference model and an AI maturity model to help companies assess how far along they are in implementing AI across the business. To learn more or get involved, please contact Aaron Boasman-Patel via aboasman@tmforum.org.



Shift from channel-centric to customer-focused

CSPs can be so focused on their individual channels that they fail to understand how customers move around in them. Shifting from a channel-first to customer-first mentality when it comes to analytics and AI is critical. The complexity of CSPs' order-to-activation processes is ripe for machine learning and AI algorithms that can:

- Detect anomalies and patterns
- Predict and prevent issues impacting customers



Bring teams together

Ensure data scientists and analytics teams work closely with business leaders and domain experts. To maximize business value, analytics teams need to collaborate with subject matter experts across the business, for example, operations, engineering, marketing and sales. Service providers interviewed for this report note the success of tightly integrated analytics teams that span business, IT and domain experts. This brings data science and analytics closer to the business in terms of exploring and working with the data and involving the business in a collaborative mode.

This is especially important for CSPs, where data sets and processes are complex and understanding the data in the context of the underlying networks, services and processes is critical. Customized visualization, dashboards, reports and machine learning toolkits that meet the needs of the business at their level are also important. Proofs of concept and tangible use cases that prove the real value of analytics can help build momentum and enthusiasm, driving new ideas and opportunities from across the business.

Optimize customer experience and make fast, confident decisions with data analytics

With the emergence of 5G enabling the explosive growth of billions of connected devices in industries like automotive, industrial and healthcare, Communications Service Providers (CSPs) have an incredible opportunity to capitalize on this evolutionary era that may be the most transformative we've seen. Technologies are converging, and along with them the business strategies network and service providers are employing to compete with not only well-known adversaries in their own space historically, but new players not previously deemed threats. It's an eat or be eaten world and the winners are the ones who will leverage data to drive business insights and achieve service excellence to ensure they satiate their customers' ever-growing appetite for data--now.

Imagine if you had visibility across all OSS and BSS to truly have a picture of customer experience and network performance. And when something was wrong, the ability to quickly identify, why, where, who is impacted, how much it's costing you--and most importantly the appropriate steps to recover or remedy the situation, and perhaps automate responses to prevent similar challenges in the future. How would that change the way you manage and grow your business?

Splunk is the innovative technology that will give you the competitive edge you need to combat threats

from other businesses vying for your customers. With the Splunk platform, you can identify risks and opportunities to drive better decisions for the business, network operations, DevOps, IT and security. Splunk software analyzes, visualizes and monitors machine data from any source--such as networks (RAN and CN), customer premise equipment (cable modems, ONT), order to activation data (CRM, billing, IVR), application data (mobile, web, proprietary), security data (firewall, endpoint, threat intelligence)--to gain insights across your business -- whether your data is on-premises or in the cloud. It gathers and correlates massive volumes of data in real time--helping you improve service provisioning and delivery, operations, customer experience and network availability. Proactively resolve network performance problems, ensure consistent delivery of services to subscribers and accelerate the introduction of new products.

In the following pages we'll share examples of how CSPs are using Splunk to address a variety of business challenges.

Monitor Activations in Real Time

CSPs can effectively monitor their network infrastructures to proactively resolve problems, ensure consistent delivery of services and accelerate the introduction of new products. A real-time view of the

health of business transactions flowing between O2A applications puts data-driven insights in the hands of the CSR, able to track and resubmit failed orders, preventing days or weeks of delays and customer frustration. Historical O2A data can be used to model performance over time, by store, geo, device, plan or any other metric interesting to your business.

"Splunk is helping us fine-tune our operations as we continue our focus on putting the customer at the heart of all we do," said Dan Lloyd, chief strategy officer and corporate affairs director, Vodafone Australia. "Its diagnostics and analytics capabilities also help our internal teams uncover issues that may hinder performance or impact customers to maintain a level of performance we're proud of."

Proactively Resolve Customer Issues and Mitigate Churn

Gain an end-to-end view of the customer experience to gain new insights and proactively monitor and resolve customer issues across Internet, voice and data services. With Splunk, CSPs can improve uptime of services and gain insights into customer behavior by correlating data from multiple sources--structured, unstructured or semi-structured data, located on-premises, in the cloud or across environments. Applying machine learning capabilities can predict when

Optimize customer experience and make fast, confident decisions with data analytics

customers may churn based on one or more indicators from disparate systems.

"At Telstra, customer experience is our priority," said Dave Wilson, chief automation officer, Telstra. "Splunk helps provide us with real-time data in a single dashboard via Splunk IT Service Intelligence so that we can proactively respond to any issues."

Insights into Customer and Sales Performance

Splunk is used to combine clickstream data with CRM data for deeper understanding of sales performance in real-time. Many providers still use a classic data warehouse process to report and analyze the data. This means delays in insights as well as higher costs. Splunk can complement data warehouses to provide more meaningful insights into targeted content delivery, customer segmentation and sales performance by rep, location, device, all in near real time. Splunk software has enabled CSPs to analyze data in real time at the user and session level and create customer segments on-the-fly.

Physical Network Analytics

A successfully managed network leads to high rates of customer calls connecting, cell availability and low failure rates, which drive overall customer satisfaction and revenue. An organization can use Splunk to

monitor the infrastructure across cellular sites, watching availability, uplink/downlink performance and connection volumes over time. This information can help to deliver targeted field maintenance and accurate capacity planning.

Cell Tower Capacity Planning and Optimization

Splunk is able to play a critical role in the management of the mobile cellular network for communications providers. Splunk can be used in the planning process, ingesting many datasets including existing network information and demographic data, to identify where future capacity will be required. This use case will become especially prescient in the context of 5G, with the expected higher number of cell site requirements.

Detect Network Abusers and Prevent Fraud

Splunk helps communication providers recover what may previously have been considered revenue leakage, by offering a solution powered by machine learning, to identify suspicious patterns and automate the mitigation of fraudulent schemes like IP-PBX fraud, SIM swapping, and SIM cloning. Leverage other advanced features like adaptive thresholding to create intelligent alerts. Security orchestration automation response (SOAR) playbooks can trigger defensive actions based on predictive patterns and historical behavior.

Strengthen Security Posture

Splunk's analytics-driven security solutions provide a comprehensive approach to cybersecurity, including advanced techniques like machine learning and behavioral analytics. These techniques help security teams quickly identify, investigate, and respond to threats based on a broader security context than is possible with legacy security products. Splunk solutions can be deployed on-premises, in the cloud or in a hybrid deployment.

"The operational intelligence we have with Splunk makes it much quicker and easier to investigate and resolve any incidents that occur in our infrastructure. Traditional monitoring tools just tell you when something isn't working. With Splunk, we can now proactively manage operations and respond before an outage occurs or service erodes."
--Security Architect, Telenor.

Managed Security as a Service

Offer B2B managed security services fueled by Splunk to help find more threats faster, enabling security staff to spend less time triaging events and more time investigating potential threats. Splunk's unmatched analytics-driven security approach allows for deeper, more accurate detection capabilities than rules-based engines offered by legacy SIEMs. Enrich customer data flowing into Splunk with threat intelligence feeds to make better-informed decisions.

Optimize customer experience and make fast, confident decisions with data analytics

Real Time Compliance Reporting

Splunk makes demonstrating compliance in regard to technical controls a frictionless process. Access controls, comprehensive auditing and security baked into Splunk make compliance reporting easy.

- Quickly search through massive amounts of security events and machine data going back days, weeks or months to accelerate incident investigations or satisfy ad hoc requests from auditors
- Prove you handled digital records according to law and enforced your obligations.
- Create reports and dashboards to show the state of compliance with any required technical control for any point in time.

Service Provisioning and Delivery

Gain real-time visibility into network performance to resolve issues that interfere with service delivery. Monitor service provisioning to ensure that products work as intended.

"We found ways to save time and money, and cable providers can now more reliably predict how many boxes they can set up and install in a day. More importantly, we made deploying TiVo quicker and easier than ever for consumers." --VP of IT, TiVo, Inc.

Revenue Optimization

Splunk provides a single view where by you can understand customer usage of content and services to help drive higher monetization. Equally, it's important to accurately bill for appropriate services and reconcile transactions. Leading CSPs are also beginning to exploit new revenue sources such as mobile payments, connected cars and identity management.

Field Organization Analytics

Data from customer-premise equipment (CPE) like cable modems and optical network terminals can be used in the diagnostics process to determine things like services impacted (e.g., whether it's the internet, TV, phone, or perhaps all of the above). Those insights can be captured in Splunk, then queried by agents during the triage process to better diagnose issues

in real-time and prevent truck rolls. Correlating individual CPE data with that of other customers, along with network information, and further layering in machine learning can analyze symptoms, suggest likely cause and recommend actions to agents--ideally mitigating truck rolls and resulting in immediate cost savings. Splunk can even be used to map and stitch together KPIs across a complicated infrastructure and down to CPE to help determine the exact level of impact, whether to a single home, street, neighborhood or community. By leveraging Splunk for business critical insights based on machine data, CSPs can save and reinvest a significant amount of money annually.

Customers like CenturyLink, Telenor, Telstra, Verizon and Vodafone rely on Splunk products to promote superior customer experience, improve service delivery, ensure optimal network performance, accelerate innovation and launch of new services, improve security posture and reduce fraud, increase efficiencies, make data-driven decisions and gain tactical and strategic advantages. Learn more: www.splunk.com/telcomedia

“ Splunk is helping us fine-tune our operations as we continue our focus on putting the customer at the heart of all we do. ”

Dan Lloyd, Chief Strategy Officer and Corporate Affairs Director, Vodafone Australia.

TM Forum toolkit for digital transformation

Agile & Virtualized

TM Forum Digital Maturity Model

The DMM is a 'living' maturity model and set of metrics to help companies measure their true digital maturity. Members can access a guidebook as well as an Excel spreadsheet containing the actual model. It is also available as iOS app.

Agile OSS/BSS Toolkit

This toolkit includes a complete blueprint for a platform for managing a multi-vendor hybrid/NFV infrastructure, which includes open APIs, information models, best practices and deployment guides.

Open Digital Architecture

Developed collaboratively by the world's largest telecom operators and their partners, the ODA provides a common operations and IT management 'blueprint'. It combines proven cloud-computing best practices with TM Forum's work on zero-touch orchestration operations and management; digital ecosystem management; data analytics; AI and Open APIs.

Open & Partner Effectively

Open APIs

TM Forum offers more than 50 APIs to manage services end to end and throughout their lifecycle in a multipartner environment.

Digital Trust Challenges and Opportunities Standard

This technical report outlines the key concepts of digital trust and identifies the top seven digital trust challenges.

Monetizing the Internet of Everything Guide

This information guide describes a standardized approach and a monetization template for new, innovative services.

Customer Centricity

Customer Experience Implementation Suite

This set of tools consists of a guidebook, hundreds of metrics, a maturity model, lifecycle model, ROI model and more than 54 implementation use cases.

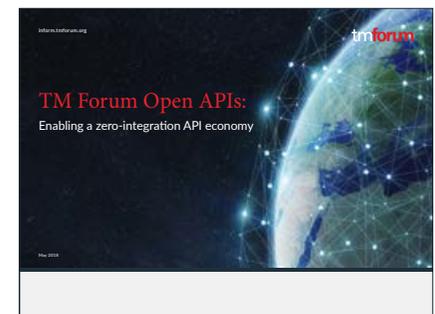
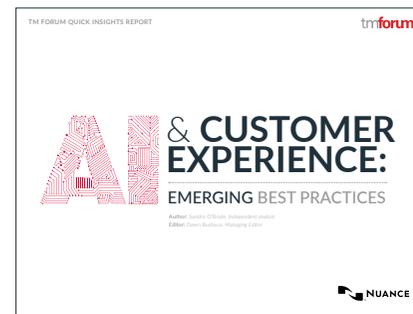
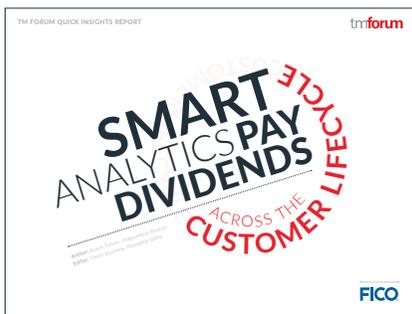
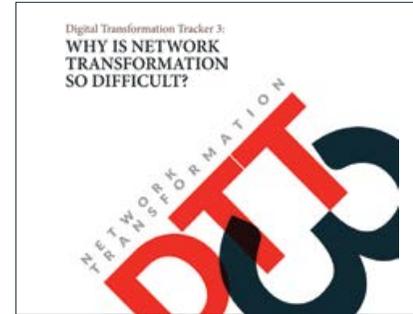
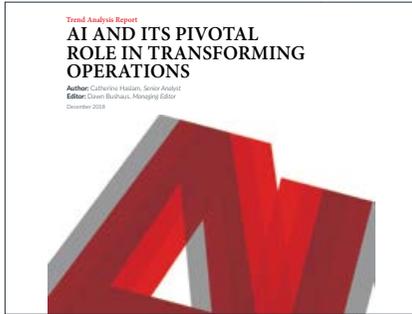
Big Data Analytics Solution Suite

This set of tools includes a big data reference model, a guidebook containing more than 65 use cases and 1700+ pre-defined metrics.

360 Degree View of a Customer

This guidebook offers a 360-degree view of a customer and explains how to put customers at the center of considerations and actions.

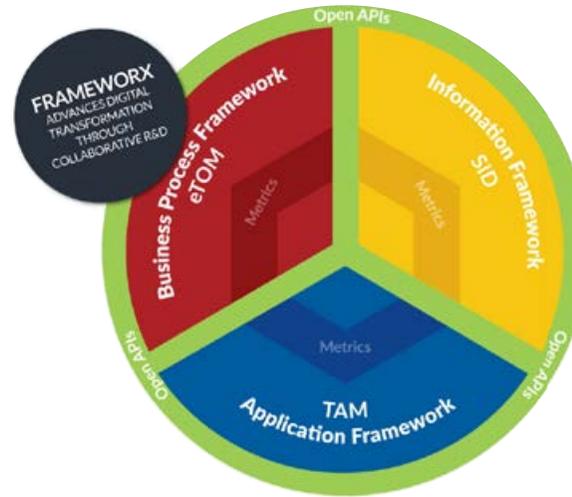
TM Forum research reports



TM Forum Frameworx

TM Forum Framework is a suite of best practices and standards that, when adopted, enable a service-oriented, highly automated and efficient approach to business operations. Framework provides hundreds of standardized business metrics that allow for benchmarking, as well as a suite of interfaces and APIs that enable integration across systems and platforms. Framework also includes adoption of best practices to help companies implement and use the standards and ensure ongoing conformance.

Framework has been widely adopted and proven to significantly improve agility in IT and operations, resulting in increased margins, lower costs and optimal customer experience. Framework is created and evolved by TM Forum members who participate in the Forum's Collaboration Community.



8 things Framework can do for you:

1. Reduce transformation risk by delivering a proven blueprint for agile, efficient business operations
2. Innovate and reduce time-to-market with streamlined end-to-end service management
3. Create, deliver and manage enterprise-grade services across a multi-partner ecosystem
4. Improve customer experience and retention using proven processes, metrics and maturity models

5. Optimize business processes to deliver highly efficient, automated operations
6. Reduce integration costs and risk through standardized interfaces and a common information model
7. Gain independence and confidence in your procurement choices through conformance certification and procurement guides
8. Gain clarity by providing a common, industry-standard language

[Download latest files](#)

[Get training](#)

Business Process Framework (eTOM)

The Business Process Framework (eTOM) is a comprehensive, industry-agreed, multi-layered view of the key business processes required to run an efficient, effective and agile digital enterprise.

6 things you can do with the Business Process Framework:

1. Create a common language for use across departments, systems, external partners and suppliers, reducing cost and risk of system implementation, integration and procurement
2. Adopt a standard structure, terminology and classification scheme for business processes to simplify internal operations and maximize opportunities to partner within and across industries
3. Apply disciplined and consistent business process development enterprise wide, allowing for cross-organizational re-use
4. Understand, design, develop and manage IT applications in terms of business process requirements so applications will better meet business needs
5. Create consistent and high-quality end-to-end process flows, eliminating gaps and duplications
6. Identify opportunities for cost and performance improvement through re-use of existing processes and systems

[Download latest files](#)
[Get training](#)
Information Framework (SID)

The Information Framework (SID) provides standard definitions for all the information that flows through the enterprise and between service providers and their business partners.

5 things you can do with Information Framework:

1. Reduce integration costs by adopting standards-based models and using them in applications and interfaces
2. Save hundreds of design hours by starting with a mature framework and 1,500 entities developed and vetted by subject matter experts
3. Speed time to market by using well-understood integration interfaces, eliminating the need for data translation between systems
4. Avoid wasting precious development time on debates with your team, partners or vendors by adopting a widely proven, industry accepted, rich and extensible information model
5. Mandate conformance to the Information Framework and save time and money during vendor evaluation and procurement

[Download latest files](#)
[Get training](#)

Application Framework (TAM)

The Application Framework (TAM) provides a common language and means of identification for buyers and suppliers across all software application areas.

5 things you can do with the Application Framework:

1. Streamline procurement by using common definitions and language to specify and evaluate solutions
2. Document and then rationalize your application inventory during transformation projects or mergers and acquisitions

3. Integrate faster and with lower costs by defining and clearly communicating the functions provided within each application
4. Reduce custom development costs with modular, standard application requirements
5. Increase automation and efficiency with standard, deployable components

[Download latest files](#)
[Get training](#)
Open APIs

TM Forum's 50+ REST-based Open APIs have been developed collaboratively by communications service providers (CSPs), government organizations and their partners. When used internally, the Open APIs help companies transform their IT, increase operational agility and improve customer centricity. Externally they enable end-to-end seamless connectivity, interoperability and portability across complex digital ecosystems.

To date, 45 of the world's leading CSPs and technology suppliers have signed the Open API Manifesto publicly demonstrating their endorsement of TM Forum's Open APIs. CSPs that adopt the Open APIs can position them as a preferred requirement in their IT requests for proposal, and technology partners can commit to using the Open APIs in relevant product applications. Together they can unlock many growth opportunities, including

dramatically improving business and IT agility, reducing the cost and complexity of operations, and reducing integration cost, risk and time for the entire supply chain.

The Open APIs are often tested, improved and extended through TM Forum's Catalyst Program. Catalysts are proof-of-concept projects that bring together companies large and small to create innovative solutions to common challenges, demonstrating how solutions can be achieved by leveraging key TM Forum best practices and standards. Catalyst teams work on the projects for four to six months before demonstrating them at TM Forum's flagship events.

[Access the Open APIs](#)
[Learn more](#)

Best practices

TM Forum members have collaborated to produce an extensive library of standards, best practices, guidebooks, technical reports and much more covering the most important topics for companies operating in the digital economy.

We have arranged these resources into toolkits by topic. Click on the link below to access the full toolkits and download* all the available resources.

**Downloads are available to employees of TM Forum member companies. Interested in joining as a member? [Click here](#)*

[Access the toolkits](#)

Meet the R&M team



Chief Analyst:
Mark Newman
mnewman@tmforum.org



Managing Editor:
Dawn Bushaus
dbushaus@tmforum.org



Senior Analyst:
Tim McElligott
tmcelligott@tmforum.org



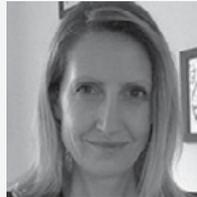
Editor, Digital Content:
Arti Mehta
amehta@tmforum.org



Sponsor & Production Manager:
Rachael Jacobi
rjacobi@tmforum.org



Publications Marketing Manager:
Jan Lowdon
jlowdon@tmforum.org



Global Account Director:
Carine Vandeveld
cvandeveld@tmforum.org



Commercial Manager, Research & Media:
Tim Edwards
tedwards@tmforum.org

For more about TM Forum's AI and analytics collaboration projects, please contact Aaron Boasman-Patel, VP, AI & Customer Experience, via aboasman@tmforum.org