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REPORT

next generation CEM now!

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We hope you enjoy the report and, most importantly, 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


the big picture

The discipline of customer experience (CX) within communications service providers (CSPs) has changed a great deal in the past two to three years. That shift has been driven by the changing expectations of customers, the demands of CSPs to differentiate on CX, and by technological advancements, allowing greater analysis and control of data. CSPs' customer bases, both consumer and enterprise, are now in constant interaction with digital native companies, and this has not only radically altered their expectations, but also entirely changed the service quality playing field.

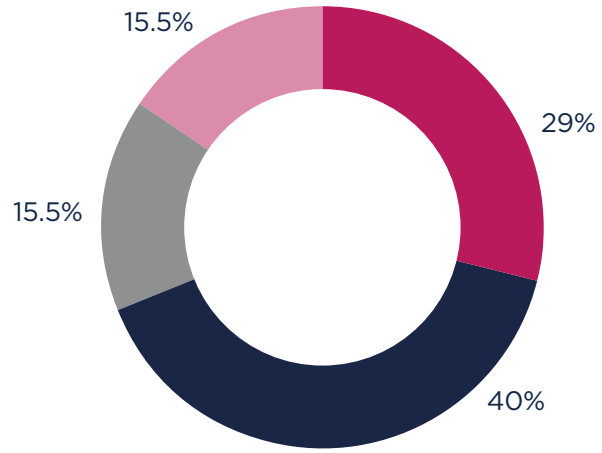
It is becoming clear that the collection and analysis of the right kinds of data will enable a leap forward in the way that CSPs can provide better experiences for their customers. This realization, however, is set against a sharp uptick in operational and service model complexity, making a data-centric customer experience management (CEM) policy increasingly difficult.

Rapidly shifting landscape

A radical improvement in CX is widely recognized by CSPs as a key piece of their digital transformation strategies, but achieving this is proving to be very difficult. The usual transformational strategy of buying technology and integrating it into current operational structures is not enough; significant changes need to be made in ways of working, company culture and to fundamental operational architectures.

As such, technical solutions are needed to help CSPs with these challenges, but so far such solutions from vendors have failed to meet the CEM ambitions of senior management at CSPs.

percentage of CSPs with executive-level ownership of end-to-end CX



TM Forum, 2021

As a result, CX is high on the radar of senior telco executives, with many initiatives coming from C-level strategy planning. In our survey for the report *Taking a cloud-native approach to customer experience*, more than two thirds of respondents said that CX within their organization had an executive-level owner (see chart on p.4).

For any CSP seriously addressing CEM functions, an incremental change is no longer the answer. In this report we look at industry evolutions and drivers of the next generation of CEM, as well as a fundamental aspect of the telco to techco transformational path.

Read this report to understand:

- How CSPs are radically changing their attitude to measuring and managing customer experience
- The importance of new technologies in analyzing a wide range of data to better inform CEM systems
- What is at stake for CSPs implementing a modernized CEM strategy
- How partner ecosystems are at the heart of new CEM platform models
- Why CEM is no longer just an operational support system (OSS) function, but a much wider consideration including network operations.

The collection and analysis of the right kinds of data will enable a leap forward in the way that CSPs can provide better experiences for their customers.

section 1

technology is driving CEM advancements

The drivers for overhauling the way communications service providers (CSPs) look at customer experience management (CEM) are more complex than previous cycles of modernization. In the next two sections we split those factors into two broad groups: technology and business drivers. Understanding each one of these aspects in detail is part of the process many CSPs are going through when interacting with TM Forum on digital transformation.

In general terms, CEM advancements are being driven by the following broad technological drivers.

5G and IoT growth

In terms of connectivity, the 5G era is being defined not only by its significant upgrade in data transfer speeds and methodologies, but also by the addition of billions of non-human endpoints in the internet of things (IoT). CSPs see growth potential in B2B markets, often under the momentum of vertical market solutions for mass IoT device deployments such as vehicle-to-everything (V2X) in connected cars, and autonomous vehicles and autonomous operations tools in industries such as agriculture. It is as important to ensure a flawless customer experience for these devices as it is for a consumer smartphone, but it is a significantly different process.

The shift to the cloud

The switch to cloud-native software, and the use of the cloud as the medium for telecoms operations, is a transformation as significant as the shift from fixed-line telecoms to mobile. Cloud-native software systems mean CSPs are switching to modular, microservice-based architectures connected with open API frameworks, which will allow a more harmonious ecosystem of multivendor IT to exist in telco operations. But the new types of service model that these architectures will allow is inherently more complex, making the task of deriving actionable CEM data from the ecosystem equally complex.

Data-centric operations

The changing face of operational and business support systems (OSS/BSS) and network-facing systems has let CSPs look for data from across the wider IT infrastructure for correlations with functions that impact customer experience (CX). For example, in service assurance the data coming up from the network is now being interrogated much more closely to enable a new breed of assurance systems to provide granular fault detection and prediction, closed loop service fulfillment and network optimization.

The switch to cloud-native software, and the use of the cloud as the medium for telecoms operations, is a transformation as significant as the shift from fixed-line telecoms to mobile.

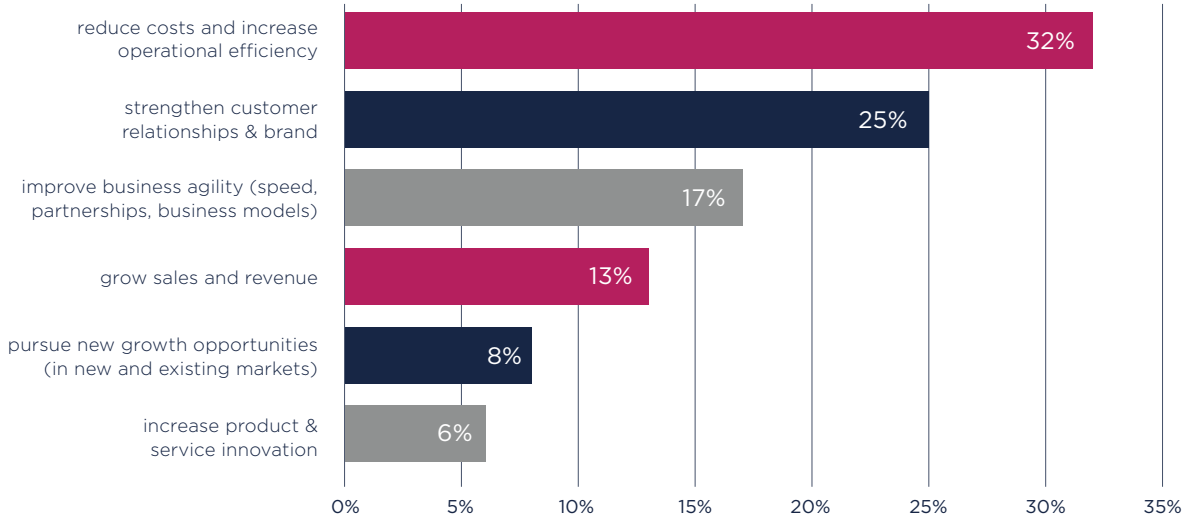
All these things affect CX, but in the past making the connection between an event in the network and a degradation of specific services was too complex. AI-enabled data analytics in CEM is changing that, and the ultimate aim is for this to happen in real time.

Real-time automation

Service orchestration is the key to pulling together service-based architectures and putting CSPs firmly on the path to fully autonomous operations. By managing and orchestrating their IT stacks as a highly interoperable real-time system, CSPs can start giving data back to CEM from the entire OSS/BSS ecosystem in a cohesive way to allow much greater intelligence from the CEM function. All of these technological trends relate to the core drivers for CX programs outlined to us by CSPs in our research (see chart right).

In the next section we look at CEM in the context of the wider IT ecosystem.

most significant drivers for customer experience programs



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section 2

addressing the disconnect between network developments and CEM

We are now right in the middle of 5G developments, with the move to the standalone version of 5G networks – 5G SA – starting to take hold and 5G core networks being brought online worldwide. This phase in the development of wireless communications technologies is a critical one, as the true power of 5G can be realized for the first time to introduce new service models for both consumers and enterprises.

One CTO of a European mobile network operator (MNO) we spoke to during the TM Forum Digital Transformation World Series event in late 2021, told us: "Customer experience is about to become a much bigger deal for MNOs because of 5G SA. If we look at the first wave of new services we have planned for network slices, like mobile private network applications in airports and manufacturing sites, and SLAs for emergency service units, we have to get those right. The idea of CEM is no longer just about not dropping calls on Mother's Day. In 5G it is understanding the specific purpose of connectivity, assuring that and then delivering excellence over the top in the application layer."

From these comments we can get a sense of the reasoning for the increased focus on CEM, and the shift to looking at CEM in a B2B context. Lots of the conversations we had while researching this report suggest there has been a disconnect between network topics and CX focus, but that this is now being addressed.

In our recent report on B2B customer experience (CX), our survey of CSP professionals found that when asked the question 'Are network events and CX integrated?', half the respondents said their company was actively increasing that integration now (see chart on p.11). Another 26% said integration is coming soon, while 8% had already fully integrated both.

AI partners unlock data analytics

In section 4 we look in more detail at AI and data analytics, but it is important to note here that the rate of technological change to the discipline of data analysis is now extreme, and this is leading to leaps forward in what it is possible to achieve from an operations and business point of view.

The idea of CEM is no longer just about not dropping calls on Mother's Day. In 5G it is understanding the specific purpose of connectivity, assuring that and then delivering excellence over the top in the application layer."

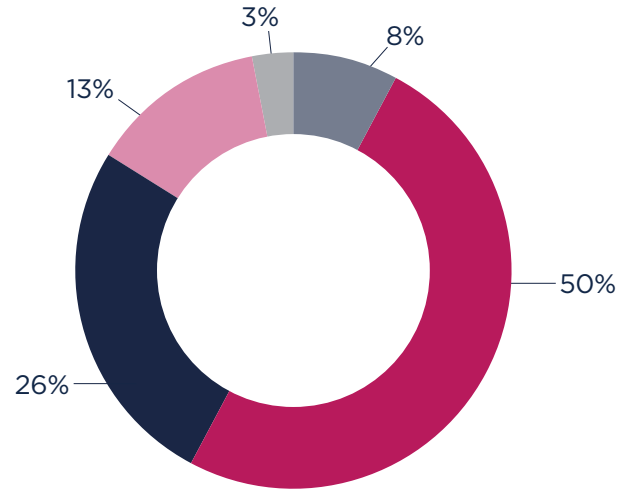
The challenge for many operators is teasing out the salient insights and actionable decisions from the noise of vast data lakes. This is inevitably leading many CSPs to seek help from their technology providers and partners, which have the necessary skills in using AI to get to the right data to create the right business outcomes.

The ever-increasing volume of this data cannot be underestimated, China Unicom's Wang Zhijun, Vice General Manager of Information Technology, told TM Forum recently: "On a daily basis we are now processing data volumes of around 17 terabytes, so the centralized big data analytics platform has to be capable of analyzing billions of records in just seconds. This enables more high-value and empowered decisions for business management, marketing management, network operations and customer perception."

CEM central to autonomous operations

The goal of fully autonomous operations is increasingly high on CSPs' 'to do' lists now that technological capabilities and vendor strategies are in place to enable it. The ultimate goal for autonomous operations is to support a set of innovative business models and network services that enable the digitalization of vertical industries such as smart cities, manufacturing and autonomous vehicles. In addition, the aim is to improve the digital life of consumers through fully automated and intelligent business, ICT and network operations.

are network events and CX integrated?



TM Forum, 2021

The concept of autonomous operations is, in a sense, a means to an end of transforming the service capabilities of the telecoms industry. The major concern in this process is that the industry could drive ahead with a sole focus on making the technology work and neglect the customer-facing elements above the network-centric architectures.

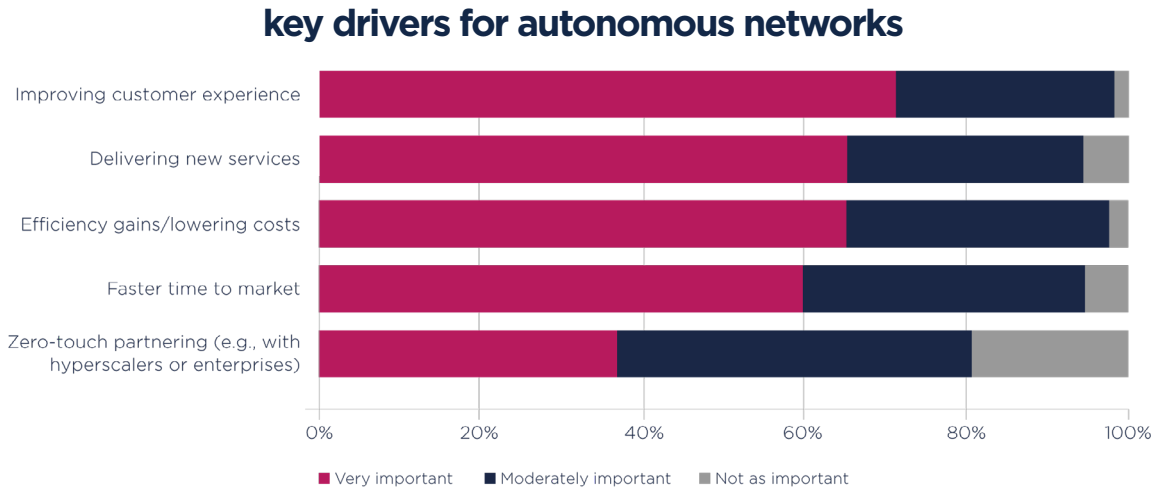
> The drive towards autonomous operations can be seen as the juncture at which CSPs should stop, assess and redesign their CEM strategy to suit modern operational ambitions.

Any strategy for autonomous operations should inherently include detailed plans for CEM, so that new service models can be delivered with service quality excellence. The drive towards autonomous operations can be seen as the juncture at which CSPs should stop, assess and redesign their CEM strategy to suit modern operational ambitions, and it should be driven by policies which maximize experience and business values.
Our recent survey of CSP operations decision-makers revealed that improving customer experience is the number one driver for implementing an autonomous networks strategy within the company (see chart).

5G technology can drive CEM change

The idea of 5G network slicing has been at the center of industry dialog for a decade now, with the emphasis on enabling CSPs to deliver new and innovative services. The specific service models are worthy of interest, such as augmented reality and virtual reality (AR/VR), cloud gaming and autonomous drones. But another crucial element that CSPs are becoming excited about is the granular CX capabilities that will become available in delivering any service over a network slice.

In addition, advancements at the network edge, such as multi-access edge computing (MEC) and edge cloud technologies, are building a new networking paradigm in the coming age of 5G SA. Rather than process vast amounts of data back in a centralized cloud, MEC is used to process data closer to the user so that it can be analyzed and acted on either in the device or at the nearby base station. This provides latency speeds that are essentially imperceptible for the end user when interacting with content or processing decisions.

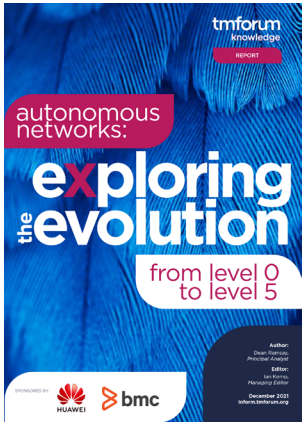


TM Forum, 2021

In terms of CX, this is big leap forward from anything that has been available in the 4G era, and it is set to significantly change the relationship between service provider and customer to the point where CSP Net Promoter Scores (NPS) could match those of digital natives such as Amazon.

In each of these areas, the 5G era should help CSPs see their network operations not just as a traditional web of disparate infrastructure through which data can flow if the right functions have been put in place, but as an opportunity for insight and proactive customer service improvement.

Read our report Autonomous Networks: exploring the evolution from level 0 to level 5 for a detailed examination of the path towards autonomous operations for CSPs.



Embedding excellence into 5G capabilities

The big challenge for many operators has been measuring these technology investments and process improvements against CX, which is where we are seeing the influence of the vendor CEM platforms in making those links.

The European CTO we spoke to said: "I think the attitude of many mobile operators who are making large investments in their networks to drive 5G is that it is a procurement exercise – get as much new equipment and software which will maximize coverage and move the maximum number of customers over to 5G. The way I see it, is that first and foremost we need to imbue all new 5G capabilities with excellence. The customer needs to be wowed by new 5G services, and everything that is related to network-as-a-service should be customer-centric. That is very possible using the tools we have at our disposal, but as an industry that's never our first priority, which is maybe why we don't have a reputation comparable to Apple or Google."

So we can see that the desire is there at least within some CSP management to make these connections between new network technology and the CEM function in operational and business support systems (OSS/BSS).

More detail on how this is being done is covered in section 4.

The customer needs to be wowed by new 5G services, and everything that is related to network-as-a-service should be customer-centric."

section 3

CEM improves the health of telco business models

Improving telco business models while simultaneously improving customer experience (CX) is one of the fundamental concepts of the TM Forum Open Digital Architecture (ODA). The interaction between functions in service and network operations is a focus for many CSPs undergoing digital transformation with the help of TM Forum standards, Open APIs and methodologies.

The phrase "experience-driven operations" has been used in several TM Forum Catalyst projects recently, and the Forum has defined a CX maturity model as operators strive to measure their progress towards a more CX-centric future.

The TM Forum Customer Experience Maturity Model aligns with the Forum's Digital Maturity Model. It provides six dimensions CSPs can use to measure their level of maturity against the model: Experience, Strategy, Technology, Operations, Culture and Data.

Using a questionnaire-style format with a well-defined scoring system, the model helps CSPs identify areas for customer experience improvement objectively and based on well-defined models and best practices. Since 2019 many CSPs have moved from the Emerging or Initiating stages described in the model to Performing or Advancing (see graphic).

5 levels of CX maturity

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Using AI to drive better CX business outcomes

The recent TM Forum Catalyst proof of concept project, Leveraging AI/ML to drive CX business outcomes proactively, revealed where some of the biggest customer experience (CX) gaps are and which aspects can be used to drive better business outcomes. It won the TM Forum "Best implementation of innovative technology solutions" award for generating business value and deliverables for customer experience standards and best practices.

The Catalyst project, a joint innovation program led by Huawei, China Unicom, PCCW, China Mobile and STC, was focused on proving that in a telco context AI can accurately discover customer needs and context, providing a significant advantage over non AI-enabled systems. With insights from the Catalyst, CSPs and partners can invest in CX more strategically, giving them the best return on customer experience and helping them to achieve experience-centric business operations.

The Catalyst led to some extremely positive business results as a consequence of implementing the concepts explored in the project. Among the successes for some of the Catalyst team champions were:

- Hong Kong Telecom was able to achieve improved operational efficiency and tangible business outcomes in the first half of 2021. The growth in the number of 5G users was very strong and was expected to reach 20% by the end of 2021, while the monthly churn rate in the first half of the year dropped by about 20%.
- Telecom Argentina was able to establish one unified language about user experience among its network, marketing and customer experience departments, which enabled the operator to improve operational efficiency and support the transformation to a customer-centric culture, organization and processes. Among other indicators, the company managed to increase the satisfaction of its mobile connectivity customers (+10 Net Promoter Score points), reduced the start time of videos by 50% on its content platform over the mobile network, and developed marketing campaigns to improve voice over LTE services.
- China Mobile (in Hui province) achieved more efficient customer experience assurance and said it hoped to further enhance its business agility in how customer responsiveness, prediction accuracy and investment costs are balanced in its intelligent experience operating system.
- China Unicom used digitization and intelligence to improve customer experience, focusing on the whole lifecycle of pre-sales, in-sales and after-sales. Through open and reusable data assets and data analysis capabilities the operator said it was able to truly realize the use of business data to drive business growth and create business value.

CEM improves operational efficiency

The relationship between operational efficiency and CEM has often been problematic – for example, when it comes to network capacity overhead. The more capacity an operator builds into a network, the more it can be sure that it will not risk quality of service (QoS) degradation in times of peak usage. However, capacity is costly, and if it is not calculated correctly it is a waste of resources, meaning lower operational efficiency.

Network virtualization strategies over the past decade have sought to eradicate this overhead by closely matching the available capacity in the network with what is required and spinning up new virtual resources when necessary. The weak point is that this has seldom taken into account the customer experience and whether the network could be dynamically fine-tuned to maximize customer experience in real time.

A good focus point for this activity is in a modern service assurance function. Here, instead of just passively monitoring alarms, assurance should be able to use AI-enabled data analytics to interrogate the vast amounts of data coming up from all network domains, correlate information on performance, faults, alarms, scheduled engineering activity and so on, and via an open API relate that information to a CEM function in the form of actionable insights which relate to specific customer services.

In doing this CSPs are, for the first time, now being empowered to make the connection between extremely complex events in the network and the service experience that a customer is receiving, and if that impact is negative, take remedial action in an automated way. Breaking down the historical silos with operational and business support systems (OSS/BSS) is key to achieving this goal.

Breaking down the data silos

Creating an operational ecosystem in which data can be used to achieve efficiency, cost savings and general speed of process requires a CSP to address the fundamental issue of data silos head on. While we are seeing advancements in the software, standards and processes to make this happen, a key factor here is the culture of the company.

Stuart Powell, Principal for Data & AI Governance at Telstra, recently told TM Forum at the Digital Transformation World Series event: “We realized a few years ago [that] if we wanted to be a digital company we needed to get our data under control.” One of the biggest changes Telstra had to make was to its business culture, starting with ensuring that senior leaders understand and buy into the whole process. “That has required a fair bit of education. Our senior management team wasn’t naturally speaking about data and AI with any level of authority or any level of understanding,” said Powell.

CSPs are, for the first time, now being empowered to make the connection between extremely complex events in the network and the service experience that a customer is receiving.

Now Telstra's CEO leadership team meets once a quarter to talk about data and AI issues. Telstra also identified "executive data owners" in each of its nine business functions who meet every month to "wrestle with what are the big issues in terms of getting data quality across different silos in the organization to make it really work".

Real-time operations and regulation

The 5G era is catalyzing demand for experience assurance to move from a near real-time state to as genuinely close to real time as possible. For example, in many B2B applications such as industrial monitoring and control, a millisecond-level experience management is needed to ensure efficient and safe running of the service. This level of experience assurance has not been practical within a CSP's IT environment so far, but the wave of new service models that 5G, and particularly 5G SA, will generate will make it necessary.

Regulation will also play a part in shaping future CEM developments. One function of CEM that is sometimes overlooked is its role in conforming to data/privacy regulations within specific geographies. Many characteristics for health and safety laws or for services provided to emergency services groups require a certain profile of experience that is not just aspirational, but essential.

In the coming decade we will see these types of services being moved onto 5G network slices where a mobile network operator can guarantee a certain profile of delivery characteristics for specified periods. However, to be able to do this with any degree of certainty, CSPs need to have their CEM platform preparations in place and efficiently linked to surrounding systems.

One function of CEM that is sometimes overlooked is its role in conforming to data/privacy regulations within specific geographies.

section 4

Data-driven CEM moves to the next level

The drivers and opportunities created by an evolved CEM function clearly show that the collection, analysis and use of data is central to maximizing the benefits from communications service providers' (CSPs') investments. It has also been a major focus for the leading CEM systems and service suppliers.

The traditional view of CEM in telecoms focuses on the quality of services provided to a customer; the behavior and characteristics of customers as users; and on customer touchpoints that may happen during customer relationship management (CRM) processes, during remedial customer care interactions or in scheduled interactions like billing.

Digital-native companies are increasingly cited as a reference point for CSPs looking to improve their customer experience, as well as the specific focuses they have that give them Net Promoter Scores in the 60s and 70s while telcos are generally around the zero mark. The graphic on page 21 shows the fundamental building blocks of a digital native, and many of these characteristics are strategic goals for CSPs now.

Influencing quality of service

Controlling the quality of service (QoS) that a customer experiences by directly linking specific events in the operational fabric of the operator with impact on service quality has often been a very complex proposition. As such, CSPs have traditionally focused on trying to alter the customer's perception of the QoS they receive at various touchpoints.

A significant technological change that has occurred in the past five years is the CSP's ability to collect and analyze data from all over the operational ecosystem. This vastly improves an operator's ability to correlate certain processes or events in the network or operational support system (OSS), with a change in QoS on specific services, in specific places, for specific customers. This in turn allows CSPs to be able to make accurate predictions about the impact of any changes they make in the operational architecture of the company.

A director in charge of network planning we spoke to at a large UK mobile network operator said of the changing face of CEM: "CEM, as it relates to the network, for us used to involve a lot of guesswork. It was just too complicated to determine what knock-on effect or impact our planning activities would have on customer circuits being carried over that part of the network. Big data analytics changed all that from about 2014, and now we're in a position where we can model impact predictions for specific groups of customers and put in place the appropriate actions to ensure their experience isn't affected. And if it is affected, then we can put in place the right customer care provisions to minimize the damage."

AI is already becoming a key piece of the functionality of our CEM systems, but in five years' time I see AI being totally endemic to both BSS/OSS generally and specifically to CEM."

When asked about the use of AI in this strand of CEM evolution, he said: "AI is already becoming a key piece of the functionality of our CEM systems, but in five years' time I see AI being totally endemic to both BSS/OSS generally and specifically to CEM."

Using data to better understand customers

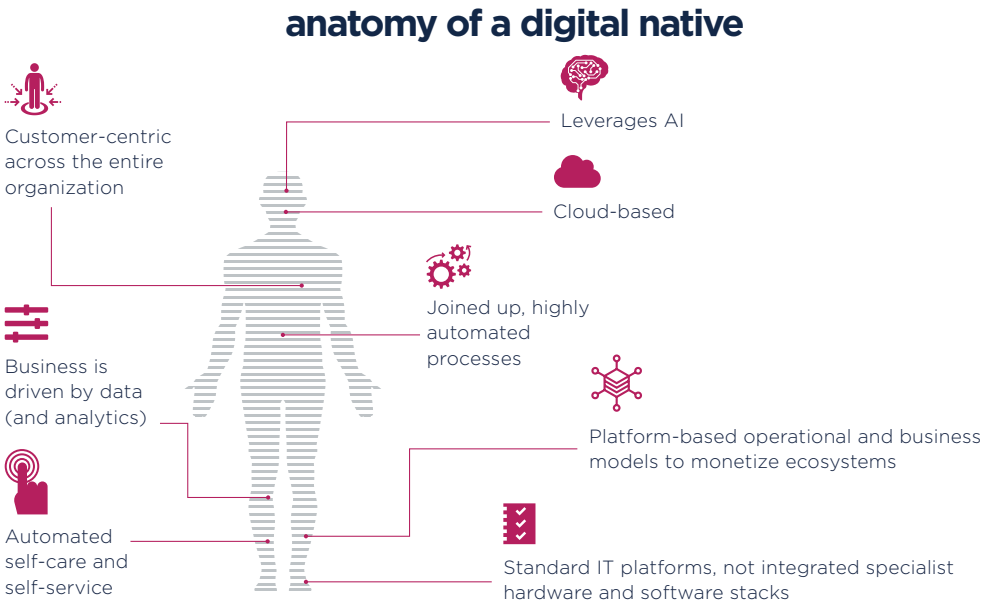
CSPs already have vast amounts of user data, which can be used to establish a rich profile to provide reliable information about that user's experience requirements. Establishing and constantly improving these profiles can influence some of the core metrics of the business, such as churn and ARPU.

Users are also often willing to pay for a high-quality experience. With this in mind, telcos can open their data to third parties and, by expanding co-operation with service providers in a given vertical industry, better monetize the user experience.

In turn, 5G is catalyzing the need to use big data, AI/machine learning and other new technologies to build a unified, open and intelligent digital platform to transform network operations and capabilities. This platform model is becoming increasingly attractive to CSPs as it aligns well with their larger operational software strategies to build platforms using common architectures and industry standards, which will allow much closer interactions with their customers.

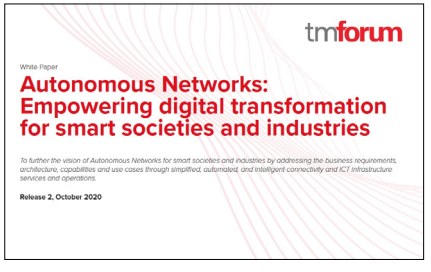
CSPs are looking specifically for more input into the development of their CEM systems to tightly fit their commercial offerings and configurations. As such, leading CEM vendors are building platforms on which they and their CSP customers can jointly develop domain-specific models using the exact data they need to optimize CX. Development and co-creation are becoming a big deal for CSPs as they focus on the problems presented by the large amount of raw and inflexible data that is continually increasing. Using the platform model, CSPs hope to speed up developments to increase the efficiency of CEM processes, and significantly reduce the time to market for new applications.

In the final section we outline some practical steps to help CSPs plan the evolution to next-generation customer experience management.



TM Forum, 2020

Read this white paper to find out more about autonomous networks driving digital transformation:



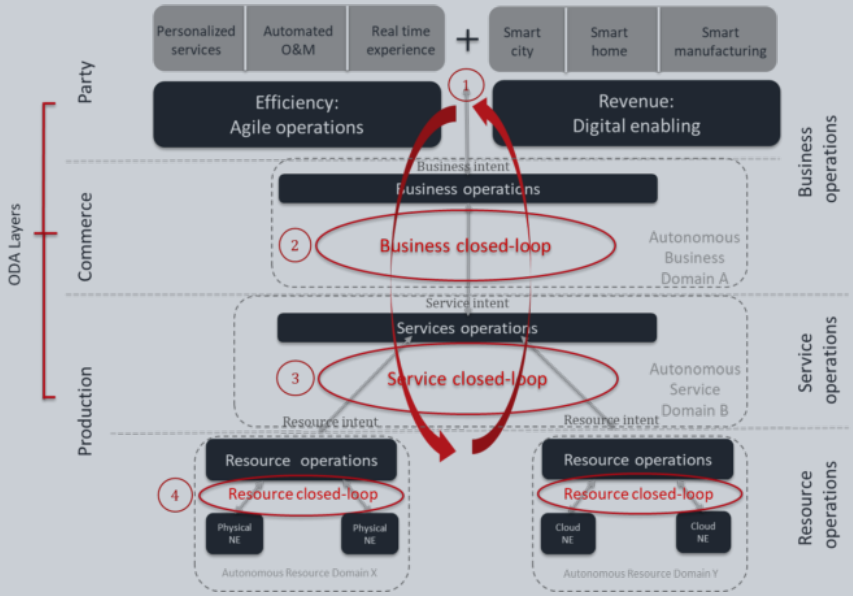
TM Forum Open Digital Architecture empowers data

A common key theme for CSPs implementing TM Forum's Open Digital Architecture (ODA) is how to use their new operations frameworks to positively impact their customers' experience of new service models. Many see the new wave of diversified business models as a turning point, from where new technology, processes and IT configurations will provide a different type of telco experience.

The ODA and autonomous networks initiatives include the concept of an autonomous domain, which may operate at different levels of autonomy and expose a set of domain-based services. The domain itself is designed to be self-healing, self-configuring, self-optimizing and self-monitoring. It leverages whatever technology is appropriate using business rules or AI to monitor, configure and reconfigure the resources – physical or virtual – to meet the SLAs of the domain service.

While the idea is that the domain is autonomous and should try to sustain itself and meet its SLAs, that will not always be possible. For example, if there is a physical failure in the network element that is delivering the autonomous resource domain function, or a failure in the autonomous resource domain management, some decision-making will need to be handed back to a superior autonomous domain controller (i.e. the autonomous service domain).

As a result, a cross-domain controller is also required to monitor the individual domains. If it detects that a domain is failing to meet its SLA, or if it appears that it will fail based on previous experience (via AI/machine learning), the cross-domain controller can spin up a new supplementary domain, reconfigure an existing domain, or switch to an alternative domain that delivers an equivalent business capability or service using a completely different technology. The key is that in this example the input to the resource domain controller comes from the service domain's intent – which originates with the customer's SLA requirements – and traverses the layers of business, service and resource operations, with each layer encapsulating its services as an autonomous domain (see graphic).



section 5

make it happen – bringing together technology and business outcomes

CSPs need to focus on business outcomes and how they will benefit customers, no matter how far removed from customers they feel. The network's performance is arguably the single most important element of customer satisfaction, but from an operational point of view technology and business have always been disaggregated. Bringing together these two worlds under the motivations of CEM will have wide-reaching benefits for CSPs. Following are some steps CSPs can take to achieve this.

Link network to customer experience

Most CSPs have been working to understand the impact of network events on customer experience (CX), and particularly to prevent events affecting customers and CX metrics like Net Promoter Score (NPS). Our research has found that work on the integration needed is increasing rapidly within telcos and has senior management backing.

Use the right metrics

Progressive vendor partners will have a detailed strategy for examining the right metrics, from both within the CSP's operations and from customer data, to form a basis for CEM decision-making at both macro and granular levels.

Deliver a legacy replacement strategy

CSPs should put in place a strategy to replace legacy systems with a new, microservices-based digital experience layer, ultimately supporting all customer-facing channels. This replacement activity will eventually need to stretch across adjacent systems including customer relationship management (CRM), customer care and partner management.

Focus on cultural transformation

Investments in CEM need to include restructuring organizations, adopting customer-centric team structures and reskilling teams to adopt Agile, DevOps practices and continuous integration, delivery and testing (CI/CD/CT).

CSPs should put in place a strategy to replace legacy systems with a new, microservices-based digital experience layer.

Reduce organizational silos

Vendors working with TM Forum on ecosystem developments for CSPs are universally working to eradicate closed systems architectures and dependence on a single vendor of monolithic applications.

Consolidate systems

The consolidation of systems should be driven by the implementation of a well-defined program to shed legacy systems and costs, enabled because cloud-native technology stacks have proved easier to configure, more efficient, less expensive and more agile.

Find the right expert partners

CSPs are looking for expert partners that bring domain-specific CX expertise, knowledge of their IT environments and business processes, and that can provide cloud-native skills and technology. And they want partners that have a good understanding of data and a willingness to engage in an ecosystem of partners.

The consolidation of systems should be driven by the implementation of a well-defined program to shed legacy systems and costs.

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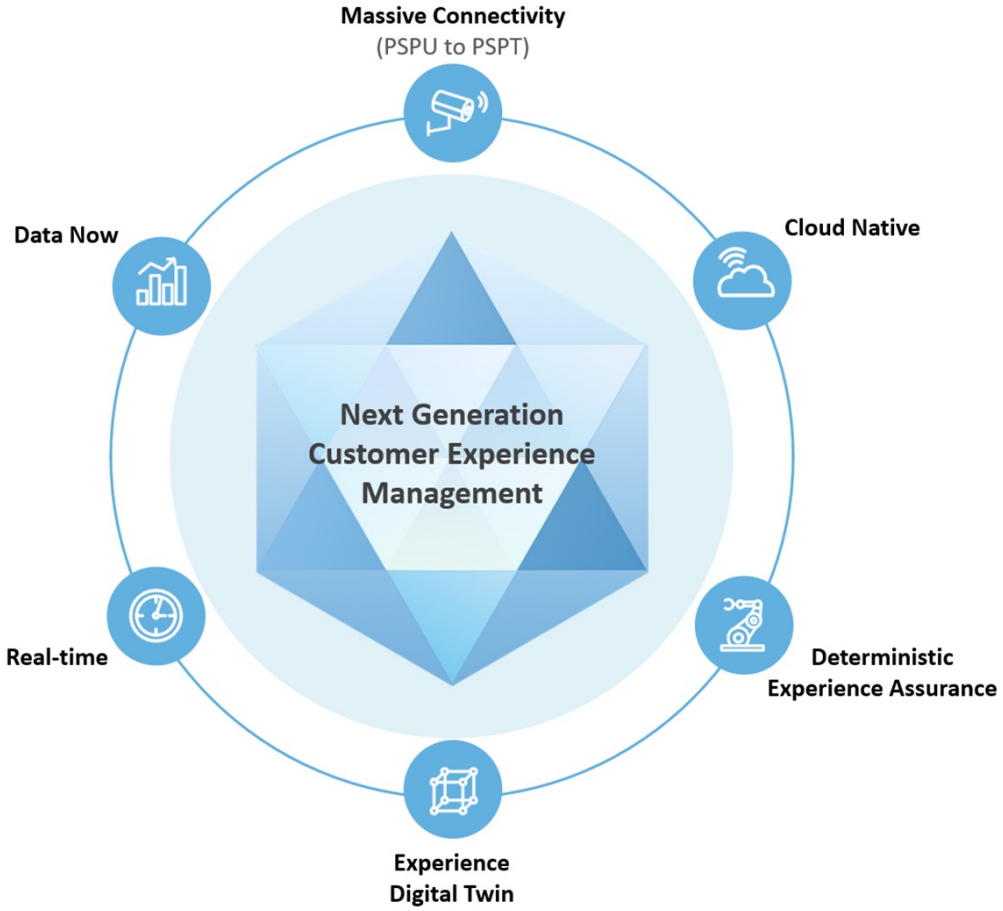
The 6 main drivers of CEM2.0 Platforms in the 5G era

The enriched consumer and industrial services which 5G offers have widely differentiated experience requirements; some require extremely high bandwidth, some require ultra-low latency, while others require a combination of both, often with the need for massive connectivity.

Consequently, customer experience can no longer be assured through monitoring a few predefined service quality and network KPIs in a one-size-fits-all approach. Instead, a real-time model of perceived customer experience is required based on individual user needs in combination with the quality of the service actually being delivered. This makes it imperative that CSP's CEM platforms now evolve, not only to handle enhanced CEM modelling, but also to deal with the increased network complexity and diverse services which are characteristic of the 5G era.

In practical terms, Huawei believes that the next generation of CEM platforms (CEM2.0) will be driven by 6 main drivers, which are discussed in detail below:



1. Massive Connectivity from connecting people to connecting things

A key trend that 5G is greatly accelerating is that users are no longer limited to people. With the ongoing development of IoT and V2X services, things that access the network must also be considered users with "experience" requirements. As such, the CEM platform must expand from traditional per-service, per-user (PSPU) experience management to include per-service,

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The 6 main drivers of CEM2.0 Platforms in the 5G era

per thing (PSPT). Furthermore, the network service path can become longer, requiring the collection of experience data from terminals such as CPEs, cameras and PLCs. This requires significant re-structuring of the corresponding data collection and CX indexing system, while the experience evaluation model must consider many new aspects, from diverse device requirements to uniquely human experience needs such as level of immersion.

It is estimated that network capacity will need to grow by 1000-fold in the coming years, driven by the volume of connected devices and users, and their increasing bandwidth demands. Devices such as smart wearables, smart home appliances, and smart cars will inevitably lead to a hyper-connected smart world, with users typically downloading several terabytes of data each year, often at bandwidths exceeding 1Gb/s. This will lead to petabyte levels of traffic volume, while the proliferation of connected devices will lead to a massive increase in concurrent individual connections and associated connection requests.

Handling this volume and complexity requires a new approach to CEM. The CEM platform must be able to continuously, automatically and intelligently learn user and device characteristics and behaviors in order to accurately quantify the absolute and perceived experience delivered. Traditionally, this would involve the bulk collection of user plane data for subsequent analysis. However, the ongoing exponential growth in such data makes this approach both costly and impractical. Instead the CEM platform must perform efficient business and usage pattern correlation and modelling to intelligently select the data to be collected and analyzed. For example, the CEM platform could monitor CX in real-time at a high level and self-train to recognize any anomalies. Should CX performance suddenly decline, only then would the platform quickly zoom in to perform detailed data collection and analysis to locate the root cause, determine the scope of impact, and drive closed-loop corrective actions.

2. Data Now

Data Now refers to the end-to-end capabilities for realizing the value of data, turning collected data into timely, meaningful, actionable information, appropriate to each application scenario. These capabilities include: Data quality management and governance, metadata management, data security and accessibility, data product development, data asset management, data analysis and data visualization.

Data Now is key functionality of a CEM platform, and the core of this is the data architecture. This should include a set of scalable, replicable, self-optimizable data models which are decoupled from specific hardware and compliant to the TMF ODA.

Due to the explosive growth of traffic and connections, Data Now must have extreme data access and computing capabilities to enable real-time implementation of the various CEM analytics processes. These include poor quality perception (Awareness),

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impact and root cause identification (Analysis), next best action recommendation (Decision) and automated implementation (Execution). In parallel, Data Now needs to support data exploration to discover new valuable insights. For example, the relationship between drivers such as experience perception, attitudes, behaviours, service quality, network performance and business outcomes such as revenue, churn and cost-to-serve.

The ultimate aim of Data Now is to maximize business value by making the CSP's data readily available and usable by all areas of the business. Firstly, through clear data product development and asset management, data assets should be appropriately shared to meet the needs of daily operations and business objectives. Secondly, by providing non-technical staff and departments with a No-code/Low-code development environment and a pre-built set of plug-and-play data models with which to easily create their own front-end applications Together, these capabilities can provide the organisation with the necessary agility to integrate, analyse and exploit data for the benefit of itself and industry partners.

3. Real-Time

Real-time is another emerging characteristic of next generation CEM. Traditional CEM already uses statistical analysis-based perception systems to provide near real-time experience monitoring. However, in the 5G era, near real-time is no longer adequate. In many scenarios, such as industrial manufacturing control, millisecond-level experience assurance is required.

Network slicing also places stringent requirements on real-time CEM. Each network slice has to utilise shared compute and connectivity resources to meet specific SLAs, making it vulnerable to sudden and unpredictable resource conflicts or other network events. The CEM platform must detect and respond to these events almost instantaneously through real-time multi-dimensional service quality monitoring and root-cause analysis. More generally, the CEM platform should be continually monitoring delivered experience against resource use to ensure network slices don't use more resources than required, and to ensure that there are enough resources for elastic scaling.

In fact, real-time CEM is essential to the implementation of autonomous networks. Detection and analysis of CX issues in real-time is key to increasing the level of zero-touch network operation, with rapid root-cause determination an integral part of closed-loop issue resolution. Resources can be dynamically scaled as needed, based on demand and service experience.

Detection and analysis of CX issues in real-time is key to increasing the level of zero-touch network operation...

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The 6 main drivers of CEM2.0 Platforms in the 5G era

Finally, a real-time capability is necessary to deliver the proactive levels of service which end-users increasingly expect. Real-time understanding of end-users' experience, behaviours and trends is key to seizing each Moment of Truth, whether that be proactive resolution of a customer need, or a well-targeted marketing promotion.

4. Experience Digital Twin

Digital twin refers to the virtual modelling of a physical entity, process or system in an IT platform to support decision making. A digital twin can be updated in real-time to cover the entire lifecycle of the item being modelled, and with analytics can be used to predict future behaviour, including likely failures as well as the impact of proposed changes.

Digital twin is not only an enabling technology, but also a methodology for human beings in the digital society to understand and transform the world. Digital twin is now an important development paradigm for the digital transformation of industries, with some developed markets already adopting digital twin as a core part of implementing the Industrial Internet.

In the case of networks, current and historical network data can be converged with external (temporal/ experience) data to build digital twins of the physical network and its users. Through system-level simulation technology and AI capabilities, this can be extended to create Experience Digital Twins (EDT) which allow performance and experience to be dynamically predicted to enable autonomous network operation, with the impact of proposed changes being safely assessed before automated deployment.

An EDT can also accurately reflect the relationship between users, services, and the network, to support decision making across the entire business.

5. Deterministic Experience Assurance

The "best-effort" service capabilities provided by traditional networks do not meet the multi-dimensional and differentiated requirements of increasingly diverse vertical industry applications, particularly those that have potential health and safety impacts.

For example, a power protection switch might have to take effect within 20ms. This is not nice-to-have, it is essential. The service latency must be deterministic - it must be absolutely guaranteed. A network that can offer this guarantee is a deterministic network. In fact, a 5G deterministic network must offer "differentiated plus deterministic" service capabilities; it must be able to deterministically meet the various different requirements of the applications which it will support.

Serving vertical industries has become a key driver in the development of 5G networks. Industrial customers have put forward clear, deterministic requirements for service experience and quality assurance in terms such as bandwidth, delay, jitter, and reliability. These are captured in the 3GPP SA1 requirements standard (TS 22.104). In order to achieve these deterministic

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requirements, it is necessary to decompose them into lower level network management and operations SLAs. This requires the CEM platform to model and simulate deterministic experiences, creating a map from deterministic SLAs to mandated KPIs and the pre-defined capabilities of each network subdomain.

Furthermore, real-time deterministic experience simulation can help assure the ongoing experience, allowing optimization and remedial measures to be taken in advance should any deterioration be predicted.

6. Cloud Native

CSPs started to use cloud in the 4G era to realize automatic orchestration of network resources and services through network function virtualization (NFV) and software-defined networking (SDN). This allowed agile development and efficient management of digital services to provide high-quality customer experience.

With the arrival of 5G, the core network is now adopting a cloud-native SBA (Service Based Architecture), with traditional network functional units deployed in the form of micro-services, called using API interfaces.

This places additional requirements on CEM2.0. Firstly, experience management needs to handle more complex networks and services. A cloud native, micro-service architecture results in many more data interfaces over which the CEM platform has to collect, correlate and analyze data, while the flexible deployment possibilities inherent in a cloud-based approach further increase data collection and analysis complexity.

Secondly, the CEM platform itself has to be able to leverage the advantages of cloud technology, including flexible and scalable deployment with edge computing and a multi-cloud environment.

Summary and Next Steps

CEM2.0 needs to incorporate many advanced capabilities to meet the experience demands of the 5G era. To learn more about next generation CEM, and how Huawei's CEM solutions can be tailored to your individual needs, please visit https://carrier.huawei.com/cn/products/service-and-software.

The CEM platform itself has to be able to leverage the advantages of cloud technology, including flexible and scalable deployment with edge computing and a multi-cloud environment.

tm forum
open digital framework

A blueprint for intelligent operations fit for the 5G era

The TM Forum Open Digital Framework provides a migration path from legacy IT systems and processes to modular, cloud native software orchestrated using AI. The framework comprises tools, code, knowledge and standards (machine-readable assets, not just documents). It is delivering business value for TM Forum members today, accelerating concept-to-cash, eliminating IT and network costs, and enhancing digital customer experience. Developed by TM Forum members through our Collaboration Community and Catalyst proofs of concept and building on TM Forum's established standards, the Open Digital Framework is being used by leading service providers and software companies worldwide.

Core elements of the Open Digital Framework

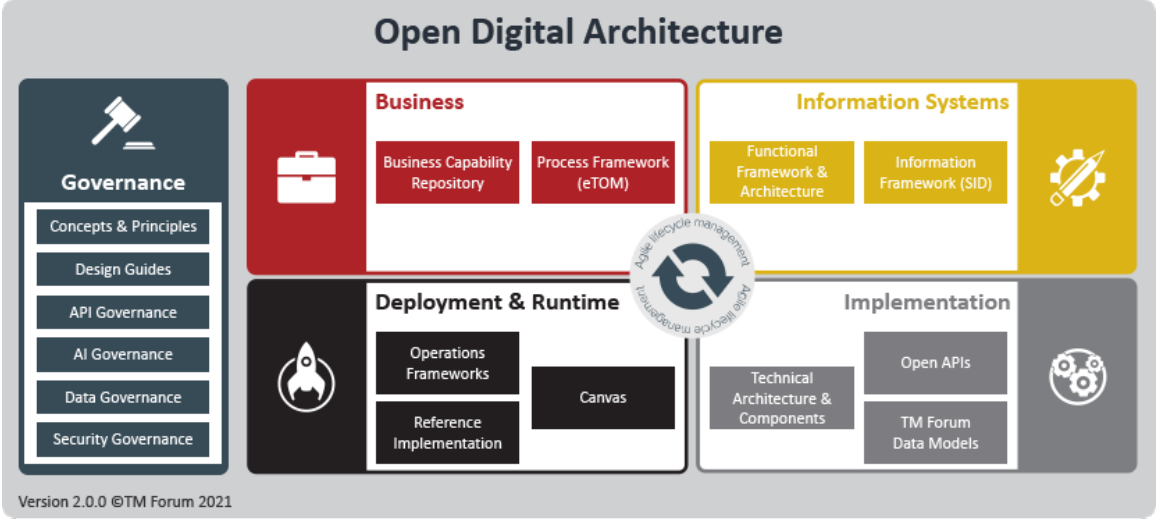
The framework comprises TM Forum's Open Digital Architecture (ODA), together with tools, models and data that guide the transformation to ODA from legacy IT systems and operations.

Open Digital Architecture

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

Transformation tools

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



Maturity tools & data

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

Goals of the Open Digital Framework

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

Learn more about collaboration

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

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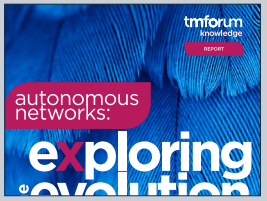
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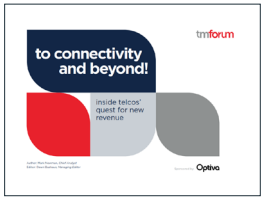
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