

WHITEPAPER

A future vision for the software market that the telecom industry needs to survive and thrive

Communication Service Providers need to build and deliver new digital enterprise-grade services, quicker, cheaper and on-demand to enable digital societies and flourishing business ecosystems. This paper sets out a clear, industry agreed future vision of software and services to achieve that through an open digital architecture and marketplace.

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ENDORSEMENTS

“ This is a timely paper addressing some of the key challenges telco operators face today. It presents a radically different approach to BSS transformation, which will form the foundation for service innovation and growth for the next couple of decades. ”



Anthony Rodrigo
Group CIO, *Axiata*

“ Connectivity is finally following Storage & Compute in that it is virtualizing. This presents NSPs the opportunity to liberate themselves from the long cycle-times of hardware and adopt the speed of software. Capturing this opportunity will be the difference maker between NSPs being the bystander vs. thriving in the digital economy. ”



BAIN & COMPANY

Herbert Blum
Global Practice Leader,
Bain & Company, Communications, Media & Entertainment

“ The Open Digital Framework is a great opportunity to rethink the software market place. Telcos need to be able to quickly share, find and deploy interoperable software components. ”



Peter Leukert
Global CIO, *Deutsche Telekom IT GmbH*

“ An ODA compliant software marketplace would greatly disrupt how telecom software has been traditionally developed and sourced, that would accelerate the digital transformation of service providers. ”



Gil Genio
CTIO, *Globe Telecom*

ENDORSEMENTS

“ As we shift to the infrastructure-agnostic cloud native IT architecture needed to underpin a multi-service operator like Orange, it's imperative that we are able to invest in the things which make a difference rather than spending millions of € in integrating again and again legacy solutions and customization. Open Digital Architecture offers a modern approach and the standards required for the industry to thrive, avoiding rigid, complex customized solutions. This paper sets out the vision and path not to commoditization of IT software, but rather freeing the whole industry to focus on delivering new and differentiated services that will allow us to thrive. ”

**Thierry Souche**

Group CIO & SVP, Orange Lab Services, Orange



“ Technology transformation is a major enabler of our overarching business strategy, which is to be a world-class digital leader that provides innovative services and platforms that enable the digital revolution of the MENA region. It's becoming very essential need for Telcos to extend their partnership arm, expand the product portfolio, adopt the online marketplace channel to increase revenues on the software verticals. The Open APIs architecture and the Open Digital Framework are indeed key accelerators to innovate faster and provide great foundation towards a successful completion of our software digital/business platform transformation. ”

Haitham M Alfaraj

Senior VP of Technology & Operation, stc

“ TM Forum's Open Digital Architecture lays the groundwork for transforming IT for the industry. The marketplace described in this paper is a promising concept for an industry that has proven collaboration drives innovation. A marketplace based on flexible industry standards will enable vendors, system integrators and cloud providers to focus on solving what matters most for our customers. ”

**Ruza Sabanovic**

EVP and Chief Technology Officer, Telenor Group

ENDORSEMENTS

“ Telco Operators are evolving from a traditional mindset to one whereby business and technology functions are able to truly embrace modern ways of working. Open Digital Architecture (ODA) is a true enabler to accelerate this digital transformation, allowing limitless scaling and multi-tenancy while remaining agnostic to the choice of underlying compute platform. This architecture paves the way to leverage cost-effectiveness, flexibility and scalability avoiding infrastructure lock-in while embracing true continuous integration/continuous deployment (CI/CD) cycles. Our objective as part of the sector is to be ready to provide the best connectivity with best customer experience and to be able to manage a wide range of present and future business scenarios.

The Open Digital Framework (ODF) initiative governed by TM Forum enables this radical architectural and cultural shift, offering Customer Service Providers an end-to-end migration path from legacy systems to modular, cloud native IT components, providing a blueprint to deliver intelligent operations fit for the 5G era. Telefónica is a world leader in APIfication within the Telco industry. We are promoting the use of Open APIs throughout the entire company, working both on core systems (BSS, OCS, OSS) and on the network (network softwardization). And, of course, we are actively collaborating with TM Forum in the definition of Open APIs, committing ourselves to keep providing knowledge to the community ensuring continued growth while helping to build new ecosystems and new digital partnership models with the vendor community. ”

Enrique Blanco Nadales

Chief Technology & Information Officer, Telefónica Group

Telefonica



“ Vodafone has put itself at the forefront of the TM Forum’s work to create an open ecosystem of software components. We believe that to be successful in the world of platforms and eco-systems we need to move away from traditional RFX processes and towards rapid proof-of-concepts and software marketplaces. ”

Carlos Valero Alcantara

Global Digital & IT Director -

Technology Strategy and Architecture, Vodafone

“ Telco operators are the backbone of digital society, but hyperscalers are in consumers’ and enterprises’ mind. Often stuck in legacy (IT and network), telcos struggle to speed-up, change course rapidly, innovate effectively and scale fast. TM Forum’s Open Digital Architecture offers a smart way out, leveraging all the new software capabilities out there across our telco and solution provider members. This vision for software - made by our members for our members and beyond – is at the heart of this whitepaper. ”

tmforum

Steffen Roehn

Chairman of the Board, TM Forum

EXECUTIVE SUMMARY

Facing a potentially toxic set of challenges, the telecoms industry is going through a profound transformation. Market saturation, technical and business legacy created during years of rapid growth, and fast-changing customer expectations have placed continuous pressure on operating costs and operational agility. At the same time, communication service providers (CSPs) find themselves caught in a paradox: demand for the core product of connectivity is growing exponentially, yet hyper-competition, saturated customer wallets and the continuous investment required to satisfy that demand means organic growth options are limited.

By 2035, 5G will enable \$13.2 trillion of global economic output¹. The next 15 years are predicted to be so impactful, that they will bring a fundamental change in the way we live, work and relate to one another; and the COVID-19 pandemic will only accelerate this change. For the consumer market, this will of course mean faster internet speeds and universal high-speed access through services such as fixed mobile broadband, but these opportunities hold limited growth potential for CSPs. The real potential of 5G is centered on the enterprise and B2B2x market. Everything-as-a-Service (XaaS) offers vital growth opportunities, which Bain predicts could be worth as much as a \$400 billion plus by 2025². CSPs could win a healthy slice of this opportunity, but in order to do so, they must emulate and collaborate with each other as well as with hyperscale players like Google, Amazon, Microsoft, Alibaba and Tencent; and also with new nimble insurgents who are better placed in the customer's eyes to deliver the digital services of the future.

To emulate and collaborate with the hyperscale and more nimble players, CSPs need to fundamentally rethink their operating model and processes; speed of decision-making, culture, ways of working, and the systems that support them – a holistic business transformation. In simple terms, this means evolving traditional connectivity to products fit for the '-as-a-Service' future, and adding new products, services and capabilities to go beyond connectivity and become a digital service provider (DSP). While service providers recognize the need to urgently move away from over-complex, rigid and siloed processes and technologies, progress to date has been too slow to enable the flexibility, agility and innovation needed to capture the potential value of new 5G services and business models. In short,

CSPs are transforming too slowly to capture the new value they are helping to create.

Legacy processes and technologies are a systemic part of the problem. Progress to address these challenges is so slow that Gartner predicts that by 2025, technical debt will consume more than 40% of operators' current IT budgets³. CSPs often struggle to balance "quick fix" changes to meet short-term business needs (which only increase their technical debt) with investing in sustainable long-term transformation of the business and the software that runs it. IT is no longer the concern of the CIO alone; it is now a strategic capability that is highly visible in the Boardroom. This has come to prominence as CSPs risk being left behind by the enterprise customers they are targeting for growth. Gartner predicts, in the same timeframe (by 2025) that 75% of enterprise workloads will be moved out of traditional data centers to the edge and central cloud.

A rapid and radical shift to an open, modern, software-based technology architecture that enables new operating and business models is therefore needed; one which is loosely coupled, cloud native, data and AI-driven; made up of standard components which can be easily procured and deployed, without the need for customization. To achieve the required concept-to-cash cycles, service providers and their suppliers need to embrace combining development, security and operations (DevSecOps), continuous integration/continuous deployment (CI/CD) and agile ways of working across their organizations. Together with partners, they must also deliver 'zero-touch' agility to achieve operating cost objectives.

This new architectural and software approach has already delivered spectacular and disruptive results, especially with new greenfield operators such as Reliance Jio in India and high expectations for Rakuten in Japan. Notably, the ambitions of these companies go far beyond connectivity, seeking to become end-to-end digital platform providers. Since launching in September 2016, Jio has become one of the world's fastest growing technology companies and is now the number one mobile carrier in India with over 376 million subscribers⁴, and most recently attracting substantial investment from companies such as Facebook.

Achieving these goals will require a fundamental, holistic change in how software is architected, built, procured,

¹ Source: © 2019, IHS Markit, "The 5G economy"

² Source: Bain, <https://www.bain.com/insights/telcos-400-billion-as-a-service-enterprise-gold-mine/>

³ Source: Gartner, Application Modernization Should be Business-Centric, 15th August 2019, IDG00430084

⁴ Source: <https://www.timesnownews.com/technology-science/article/reliance-jio-beats-airtel-and-vodafone-idea-with-over-376-million-subscribers-in-january-2020-traj/590195> 6

licensed, and maintained. Pivoting towards a ‘software-first’ solution will not be easy – it creates significant changes for both buyers and sellers.

Traditional silos between business, operations and network expertise must be overcome. Equally, a rich history of customization, rigid integration and static processes must be left behind.

To address these challenges, TM Forum members are leading an industry initiative to build the Open Digital Framework (ODF). ODF includes the target Open Digital Architecture (ODA); incorporating a modern, flexible integration fabric (Open APIs), together with the infrastructure for binary testing of conformance for interoperability and end-to-end management. ODF also provides tools to support migration from legacy systems to ODA’s modular, cloud native architecture with software components enabling IT and network capabilities over time. In short, ODF is a future-proof blueprint for service providers to deliver intelligent operations fit for the 5G and IoT era, leveraging Artificial Intelligence (AI).

The adoption of ODF enables a new style of a software market for CSPs as they evolve to become digital service providers (DSPs) – one where the procurement and assembly of interoperable solutions is easier and where these solutions are substantially cheaper to deploy, integrate and upgrade. Made up of industry standard, self-describing components, they will enable systems designers to discover solutions that can be used to

accelerate innovation in a “try and buy, fail fast and cheap” approach.

Open Digital Framework marks a significant change for the DSP software market, simplifying the solutions and removing the need for large-scale customization and integration. Service providers will prioritize investment in software and technology that differentiates their business, not in the customization and integration of non-differentiating solutions. This creates opportunities for new market entrants and established vendors to unlock value-added partnerships.

Collaboration across the industry will be vital to this effort. Service providers will drive the demand for these new, flexible solutions, while software vendors and solution providers will bring their essential expertise. Only through collaboration can the industry attain the required knowledge and agree the required standards and common code assets such as APIs. Working closely with the relevant standards bodies, TM Forum is the platform to drive rapid innovation in these developments and will play a critical role in igniting the market.

The foundations are now in place – now is the time to scale.

Time for Change

This paper addresses the business and technical transformation required of the telecoms software market to be fit for the future. The actions prescribed are summarized in the table below:

Now	Next (12-24m)	Near Future (24-36m)
<ul style="list-style-type: none"> Industry alignment on ‘north star’ and commitment to the necessary standards ODA component interoperability demonstrated in proof of concept projects (e.g. TM Forum Catalysts) Open API conformance mandatory in CSP software procurement Market-leading vendors offer initial ODA compliant components Partial ODA Reference Implementation deployed in lab environment and used in Proof of Concept solutions Active co-creation of the software Canvas 	<ul style="list-style-type: none"> ODA compliant components routinely available from commercial software vendors Full ODA compliance certification mandatory in CSP software procurement Completion of the full scope of the ODA Reference Implementation and commercial conformance test environment Robust, standardized commercial models established for the component suppliers and for the operator of the marketplace(s) 	<ul style="list-style-type: none"> Commercial ODA-compliant marketplace(s) available for the procurement of software components Marketplace(s) populated with discoverable ODA-compliant IT and Network components Full ODA-compliant CSP IT deployments routinely implemented and operational providing service to end customers

WHY WE NEED A NEW APPROACH TO SOFTWARE

There is no doubt that the telecoms industry is going through profound change. The need to collaborate and compete with over-the-top digital natives and platform businesses such as Google, Facebook, Amazon, Alibaba and Tencent have never been more pressing. Advances in digital technologies and the evolving demands of customers are driving market transformation at speeds we have never seen before. The success of these digital natives lies in their ability to understand, quickly react and innovate based on changing customer needs. They operate with modern software engineering at their core, and experiment with and implement new technologies continuously. Autonomous and agile ways of working have driven rapid, scalable and data-driven decision making.

As stated earlier, it is predicted that 5G will enable \$13.2 trillion of global economic output by 2035⁵. The challenge for CSPs is how to capture a fair share of the potential future revenues they help to create. The telecoms industry faces a demanding economic and competitive landscape driven by internal and external challengers, and as data consumption continues to rise, operator profits are stagnating or declining due to increased competition. According to a report published by the World Economic

Forum in association with Accenture⁶, the role that telecom operators have played in accelerating digital business and service models has not translated into new value for operators themselves. Operators' share of the industry profit pool declined from 58% in 2010 to 45% in 2018⁷ and it is expected to fall further and more rapidly. One of the key reasons for this, is because they have reacted too slowly, failed to change their business strategy, and have not moved towards an open, software-based, modular architecture quickly enough.

The telecom infrastructure of the future will be software-based and autonomous, powered by artificial intelligence. Service providers and their suppliers need to start preparing for that now. Most of the changes that will happen over the coming decade are different than those of the past: they will be software based and require scale that telcos lack in some parts of their business. The need to change to a software, AI-driven model will happen so quickly that it will feel almost overnight to a traditional telco. AI and other software-based technologies are evolving so rapidly that they will force service providers to make strategic choices that will reshape their business models, products and services and workforces⁸.

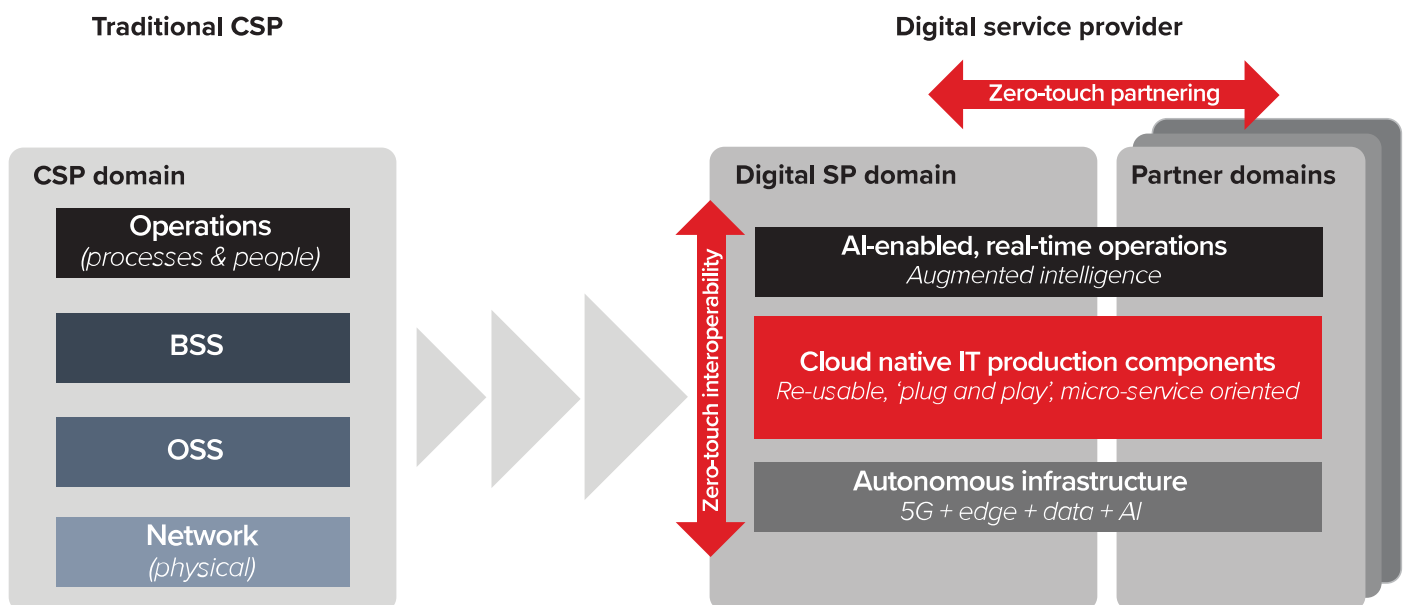


Figure 1: Schematic representation of architectural transformation from traditional CSP to DSP

⁵Source: © 2019, IHS Markit, "The 5G economy"

⁶Source: World Economic Forum, <http://reports.weforum.org/digital-transformation/wp-content/blogs.dir/94/mp/files/pages/files/dti-telecommunications-industry-white-paper.pdf>

⁷Ibid., based on WEF predictions

⁸Source: Bain & Co., <https://www.bain.com/insights/telco-2030-wait-and-see-is-no-longer-an-option/>

Driven by the need to reduce costs, quicken time-to-market and to find new consumer and enterprise revenue streams, CSPs are urgently looking for a new approach to business processes and software to enable these goals. Central to this success will be the transformation of operators' legacy operational and business support (OSS/BSS) systems, moving away from traditional, monolithic and customized software silos.

Previous attempts at transforming legacy technology have left service providers increasingly frustrated. With traditional approaches, the complexity of customization and integration has continually increased, as has the time and cost of solution deployment. The past 30 years has seen generation after generation of closed systems with limited flexibility and agility. As a result, IT transformation projects have morphed into huge, complex programs that rarely deliver on time. As the delivery risk has shifted to suppliers, BSS has become an unattractive market, with many large players either reconsidering their commitment or scaling back their offers⁹. The net effect is a software market for telecoms that is evolving too slowly to meet the needs of the CSPs.

The lack of relevant standards continues to be a limiting factor in service provider IT transformations, especially in the traditional OSS/BSS area as highlighted in TM Forum's [report on BSS transformation](#)¹⁰. A good comparison is the network supply chain, which is heavily and formally standardized, enabling the relatively straightforward swapping out of components. The IT ecosystem in telecoms lacks equivalent standard architecture, languages and approaches. Another is standardization of the internet, which requires a centralized body to not only develop extensible standards, but also provide the test suite that confirms compliance, such as HTML5. This style of standardization will be critical to delivering the required speeds and innovation while avoiding integration costs.

One successful standardization effort has been TM Forum's Open API program – a suite of over 50 industry-agreed extensible API specifications for interoperability, widely adopted and mandated by leading service providers. Open APIs alone, however, are not sufficient. This has spurred TM Forum members to develop the Open Digital Architecture, a truly cloud native, componentized architecture which brings the full potential of Open APIs to life. This potential was recently demonstrated in the TM Forum [Business Operating System Catalyst proof-of-concept project](#), which created reference implementations for standard ODA Components¹¹ and demonstrated the art of the possible to 'mix and match' software components from different vendor partners to meet business and end-customer needs.

The adoption of the Open Digital Architecture is already starting to radically reshape the software market for service providers. The concept of a supporting software marketplace, where operators can quickly and easily find and experiment with ODA compliant software components from their vendor partners has the ambition to cut concept-to-cash cycles from 18 months to 18 days, or less. This new generation of solutions, implemented by vendors, can become a cornerstone to generate value in the fast-moving digital ecosystems developing around 5G.

The shift to a standardized, software component-based and cloud native model is also an opportunity for tier 2, start-up and open source based vendors with SaaS and cloud native software. This shift will increase the competitiveness of the telecoms software vendor market, reducing barriers and making it easier for software solutions created for other markets to be adopted by CSPs. The net effect will be a 'win-win' – increasing the scale of the opportunity to the benefit of both the service providers and software vendors. The below diagram from Bain & Co., shows how SaaS is expected to increase, allowing BSS vendors to tap into additional parts of the CSP's IT spend.¹²

⁹Source: TM Forum, <https://inform.tmforum.org/research-reports/future-bss-say-goodbye-to-software-customization/>

¹⁰Source: TM Forum, <https://inform.tmforum.org/research-reports/future-bss-say-goodbye-to-software-customization/>

¹¹Source: TM Forum, <https://inform.tmforum.org/catalyst/2019/05/bos-catalyst-aims-create-reference-implementations-standard-oda-components/>

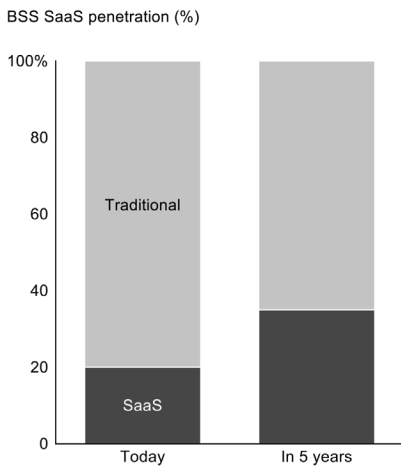
¹²Source: Bain & Co., © 2019, 'Telecom BSS Market and Digitization Trends.'

SaaS expected to increase, allowing BSS vendors to tap into additional parts of CSPs IT spend

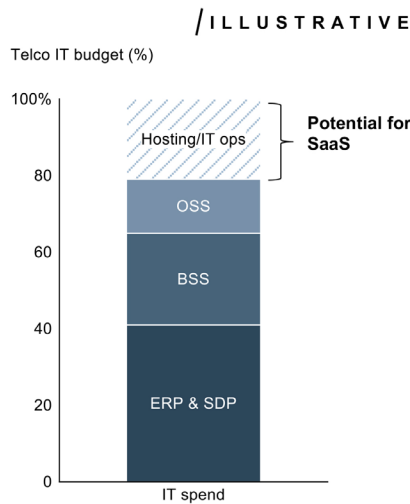
MARKET FUNDAMENTALS

TIER 2 BSS MARKET

Tier 2 CSPs expect increased usage of SaaS solutions



SaaS expands the addressable market for BSS vendors



Comments

- In a SaaS setup, the **BSS provider takes over parts of the hosting/operations** from the CSP
- This allows BSS providers to **tap into the hosting/IT operations budget**
- **SaaS expected to increase** significantly '18-'23, acting as a **fundamental growth driver**

“The adoption of SaaS is growing rapidly, allowing tier 2 CSPs to focus on their core. I view tier 2 vendors as well positioned to capture this growth, they are agile and light-weight”
Former Senior Dir. EPMO, T2 BSS vendor

Source: Market participant interviews; Bain analysis; Bain experience; Lit. search; IDC; Gartner; Ovum

Figure 2: Chart showing BSS SaaS penetration

- The traditional tier 2 BSS market exhibits slow but steady growth (€0.9-1.1B market growing at 3-5%) – primarily driven by the underlying shift to Software-as-a-Service solutions
- The CSP market has only experienced limited growth in the last decade and now CSPs are looking to revamp the traditional core underpinned by simplification and digitization and build new revenue streams through adjacent offerings
- This presents new opportunities for vendors to offer new solutions to revamp the core and create a digital ecosystem for adjacent industry offerings
- Customer purchasing behaviors for ecosystem solutions differs from historic OSS/BSS buying behaviors as CSPs are trying to create “future proof” solutions
- The vendor landscape for ecosystem solutions still emerging with many players today, but future winners will vary between end markets

A shift to a standardized, component-based software model will radically change the future software market for service providers; both for transforming legacy BSS/OSS

functions, and for offering the agility needed to adapt to different vertical enterprise and partner needs in digital ecosystems.

The implications of adopting this approach will be significant, ushering in a new wave of innovation and unlocking growth opportunities for service providers and vendor partners alike. Crucially, it will also enable CSPs to shift away from traditional mindsets of “the business is a customer of IT” and “network vs. IT” to one whereby the business and technology functions are able to truly embrace modern ways of working.

Delivering this level of change in the global telecoms market will not be easy. It requires strong and unwavering support from forward-thinking, innovative service providers, software vendors, system integrators and consultants – large and small. At time of writing, 28 companies have signaled their commitment to these goals by signing the TM Forum [Open API & Open Digital Architecture Manifesto](#), with more companies showing their commitment each month. The full list of signatories is available [here](#).

THE CHANGING INFRASTRUCTURE REQUIREMENTS OF SERVICE PROVIDERS

The transition from 3G to 4G was a huge success for customers, who experienced an order-of-magnitude improvement in data speeds with even greater reliability, coverage and lower latency. Combined with mass adoption of smartphones and rapid improvements in fixed line connectivity, a new wave of growth was unlocked, further disrupting established markets such as music and media, and creating a cloud services market worth hundreds of billions of dollars. Service providers, however, only achieved marginal commercial gains, and were generally unable to generate significant new revenue streams.

5G will undoubtedly deliver another order-of-magnitude improvement in speed and experience, but for CSPs, capturing value into long-term revenue growth will not be simple. Enterprise customers want end-to-end solutions, and 5G alone is only one technology - just a piece of the puzzle. It is the combination of several components of 'digital infrastructure' that unlocks the potential for enterprises. 5G (with the benefits of device density, low-latency and enhanced security, as well as network-as-a-service features such as network slicing), when combined with edge computing and machine learning/artificial intelligence (ML/AI) (for rapid decision making and new levels of automation), and central cloud, offers a powerful combination of technologies, to help digitize any industry vertical.

For CSPs, capturing value in the digital infrastructure market will mean offering attractive new services and embracing new business models, such as outcome-based pricing. These new revenues will come from a broad range of services, typically delivered in partnership with others. In some cases, the enterprise customer will be the end-user, but in many cases, there will be an extended ecosystem of partners, commonly referred to as B2B2x (or B2G2x for government and public services).

5G, as part of the digital infrastructure market, holds the potential to unlock new revenue streams from many industries, from manufacturing to smart health, and from automotive to smart cities. The available margins and digitization business case for these industries will often require scale to be effective, meaning service providers will need the capacity to deliver and operate 10x or 100x the diversity of services they do today and 10x or 100x more efficiently.

These factors can have wide-ranging, positive impacts on the infrastructure and software choices service providers make for their own businesses. Where legacy OSS/BSS systems were designed and customized to operate for a known product set, to a known scale, often on customized hardware configurations, Open Digital Architecture allows for limitless scaling and multi-tenancy while remaining agnostic to the choice of underlying compute platform. All these factors pave the way for service providers to avoid infrastructure lock-in, and many will opt to leverage the cost-effectiveness, flexibility and scalability of public cloud providers such as Microsoft Azure, Google Cloud Platform, Amazon Web Services and Alibaba Cloud.

Beyond infrastructure choice and removing the limitations of legacy OSS/BSS systems, ODA opens the possibility to embrace true continuous integration/continuous deployment (CI/CD) cycles. These approaches (found routinely in digital-native internet companies) to deliver such scale and efficiency can be combined with approaches found in site reliability engineering (SRE). SRE allows companies to treat operations as flexibly as modern software, meaning they can automate operational processes from initial deployment to continuous upgrades and full life-cycle management.

These factors will rapidly become differentiators when it comes to remaining competitive and unlocking growth. Service providers will need the capacity to constantly experiment, adapt and pivot – they will be 'constantly agile'. This requires a new software model, and the infrastructure to support it, that can manage a wide range of business scenarios to be fit to compete against digital natives beyond connectivity. The ODA standards offer a new software model of interoperable components that can be assembled to implement any of the ODA domains. Each component is self-describing, fitting a standard operating Canvas that is part of the ODA Reference Implementation. The ODA Canvas defines a standard, secure development and operational (DevSecOps) environment, built on top of the Kubernetes open standard. It is possible to run an ODA Canvas on a public cloud platform, or providers can choose to run it internally on top of any standard Kubernetes deployment.

MOVING TOWARDS SOFTWARE MARKETPLACES

The process of selecting and procuring software in the telecoms industry is an expensive business. TM Forum research shows the cost to the industry is as much as \$1Bn per year¹⁴, and those are only the direct costs. The true cost of the inflexibility, risk and impact on business agility of running lengthy RFP processes is certainly far higher (for more on procurement read the TM Forum Report “[Time to Kill the RFP?](#)”).

ODA paves the way to transform how CSPs discover, procure and implement ODA-compliant software solutions. We envision marketplaces of ODA compliant software components, Open APIs and micro-services, as an enabler to accelerate digital transformation. Such marketplaces would allow service providers to quickly experiment with software components to create a solution, onboard new partners and partner offerings faster, creating “minimal viable products” (MVPs) in a way that promotes experimentation, enabling operators to fail fast and learn faster, in step with market dynamics. This would have a transformative effect on the telecom software market, breaking down the barriers to entry in the market, while also fostering a new wave of innovative software solutions.

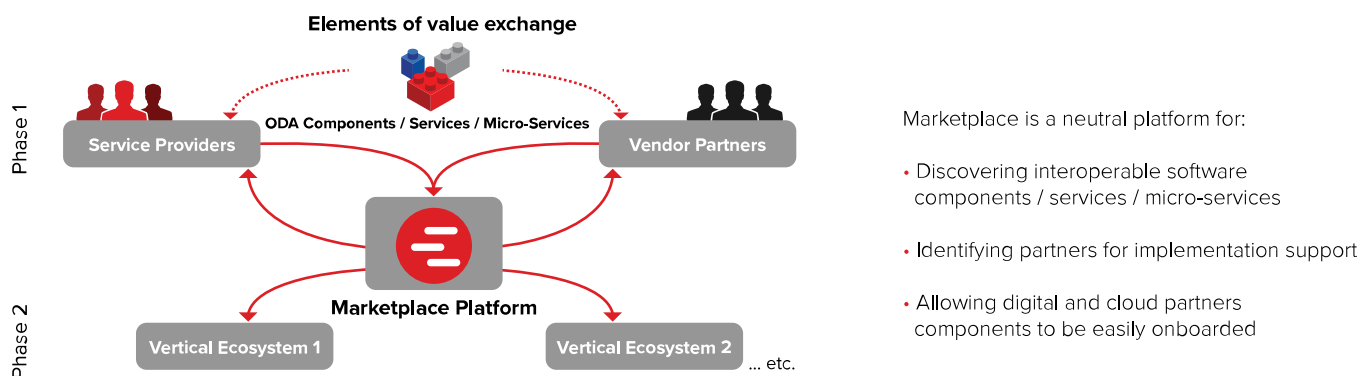
Marketplaces also have the potential to transform how service providers partner and sell their capabilities to others, including developers. Small and large enterprises are increasingly buying services from software marketplaces, making them a cornerstone of a successful go-to-market strategy for providers looking to sell their capabilities as a service, or in partnership with others.

By making their cloud-based software capabilities readily available to others, operators could reach millions of business users through application marketplaces, significantly expanding their reach and creating completely new revenue streams through indirect channels. This is a unique opportunity for service providers to create new revenue streams in partnership with others, leveraging their local market expertise, reach and access that will be increasingly valued.

Software marketplaces enable the speed, agility and innovation required to dominate new markets whilst presenting possibilities to match sellers and B2B expectations without investing too much at early stages of the product lifecycle. Marketplaces give wider exposure to the applications they include, and the ‘one-stop-shop’ approach makes it easy for buyers to purchase and leverage capabilities of applications. Critically for service providers, they put innovative solution creativity in the hands of partners and developers, who are often better placed to understand industry vertical and niche requirements.

Red Hat’s OpenShift, AWS Marketplace, and the Salesforce.com AppExchange are just a few examples of successful cloud service marketplaces. These marketplaces eliminate many of the most expensive and time-consuming elements of procuring, integrating and operating software, while putting the power in the hands of innovators, rather than assuming the solution provider has all the answers.

A neutral ‘software marketplace’ can transform how services are created, discovered, bought and sold



Marketplace is a neutral platform for:

- Discovering interoperable software components / services / micro-services
- Identifying partners for implementation support
- Allowing digital and cloud partners components to be easily onboarded

Figure 3: Sample marketplace concept

¹⁴Further reading, <https://inform.tmforum.org/research-reports/reinventing-procurement-2020s/>

The key objectives of such a marketplace include:

- Enable CSPs to accelerate their IT and business transformation. CSPs would be able to quickly discover and experiment with software components to create a solution, potentially an MVP using marketplace components and “try and buy” in step with market dynamics.
- Be an enabler for transformation to an open architecture, reducing risk and cost of failure by leveraging pre-built, software as service components with a standardized integration fabric.
- Improve trust, confidence and compliance by adherence to and pre-validation of ODA and Open APIs standards.
- Become the de-facto go-to place for “search before build” (in OSS/BSS context) for CSPs, system integrators and TM Forum member companies, accelerating innovation and time-to-market, while reducing the cost of building through reuse.
- Provide an opportunity for systems integrators to repurpose existing software assets and integration adapters that are reusable and offer them via the marketplace where they can monetize assets faster and cheaper.
- Allow digital and cloud partners to put their components into the marketplace so their services can be easily onboarded and offered at a lower cost with easier integration.

For this software market and marketplace to succeed, new platforms and services will need to seamlessly integrate with existing BSS, OSS and network infrastructure based on standards – without code-level customization. Given the installed asset base and capital tied up in such technology,

there will be a rich market in abstraction layers, adapters, caching and other performance tools. These capabilities will allow providers to pursue pace-layered or multi-speed transformation programs, repositioning the digital boundary as illustrated in Figure 4 below, marrying a legacy technology base (slowly being migrated to cloud native) with new ODA-compliant software components. We already see the first examples of this from leading service providers who are improving digital and customer experience with a new, componentized architecture based on ODA to manage customer interactions and digital experience, linked to older legacy systems through abstraction.

Ultimately, a marketplace supporting this new software model will allow service providers to download or use a set of components that they can integrate and configure to deliver a new solution quickly and cheaply. For example, to build an automated mobility service, a 5G network slicing component (from network service providers such as Ericsson, Huawei, Nokia, etc.) can be downloaded or instantiated as a service, and integrated with an autonomous car platform (from a platform provider) and incorporated with the service provider’s own micro-service components.

Service providers are transforming digitally by developing dynamic customer experiences that allows them to be more agile. Current BSS solutions can constrain the ability to transform these experiences, and to reuse investments in software. A software marketplace for systems of engagement will help service providers deliver these transformations at a minimal cost-to-serve. As the fastest moving and most differentiating aspect of a service provider’s IT environment, systems of engagement are the logical place for many CSPs to focus first.

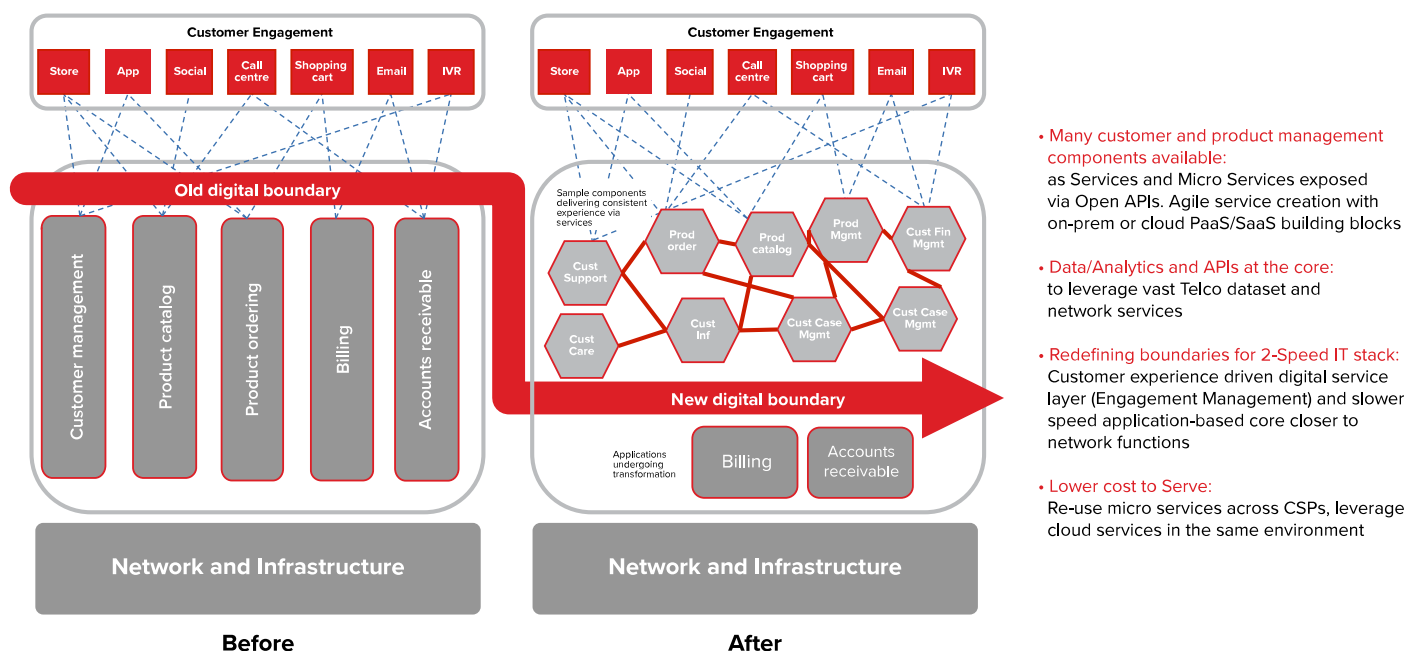


Figure 4: Showing the move towards component-based IT services

UNDERSTANDING HOW THE SOFTWARE MARKETPLACE COULD WORK

Put simply, a marketplace is an advertising portal for a certified software component. Service providers or any organization that is building digital services based on the Open Digital Architecture can use the marketplace to discover and select components.

The ODA component model comprises five elements: core function of the component, notification and reporting, management and operations, environment dependencies and requirements and security (see Figure 5). The component model includes meta-data describing the commercial cost for using components, and the Canvas implementation includes the capability to track usage events and manage the licensing and compliance. The marketplace does not preclude organizations building separate framework contracts if they want to offer alternative terms for their partnerships. The marketplace also does not restrict where a software component is executed.

The software marketplace can be run in two modes - firstly, as an open, commercial marketplace providing the ability to distribute commercial and open source components to the global service provider community – run as a commercial or open source initiative; secondly, as an internal, closed marketplace enabling the distribution of common software components across a group of operating businesses.

In the new software marketplace, many market players can contribute, cooperate and compete providing their capabilities and assets. A typical software marketplace has three different categories of components:

- Knowledge applications (telecom, IT, industry and application specific algorithms)
- Core applications (e.g. core commerce, partner management)
- Core ecosystem Toolchain (e.g. Canvas, test kit, tools, orchestration)

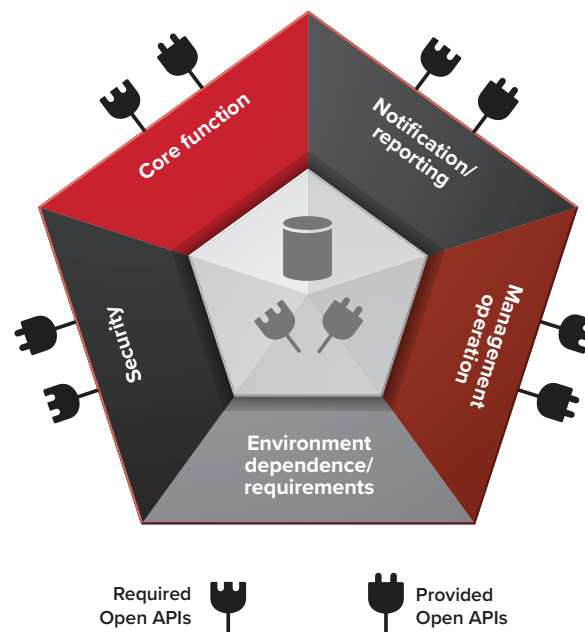


Figure 5: ODA-RI Component Structure

Knowledge Applications:

Ownership of these applications and specific domain knowledge will be critical to the differentiation of new services by the service provider. This layer will be defined by technologies (RPA, AI) and micro-services that provide easy customization for differentiation (e.g. a churn model). There is an opportunity for suppliers and service providers to create partnerships in the development and monetization of new components.

The 5G services opportunity opens the door to thousands of niche knowledge applications which can be created by a range of different developers and start-ups. The application developers can conform to TM Forum ODA and Open API standards to interconnect with CSPs' ODA enabled architecture. This opens the traditionally closed CSP ecosystem to niche players via the marketplace which can be discovered and monetized.

Core Applications:

These applications provide high value. Tier 1 and 2 vendors will provide the components that replace the current BSS/OSS. Orchestration of the new components will be a critical capability. There is an opportunity for vendors and service providers to create partnerships to build core applications.

Core ecosystem toolchain:

This will contain the production and transaction environments (Canvas, tools and test/interoperability) built to pre-defined standards with related toolchains. There will be many open source options in this category.

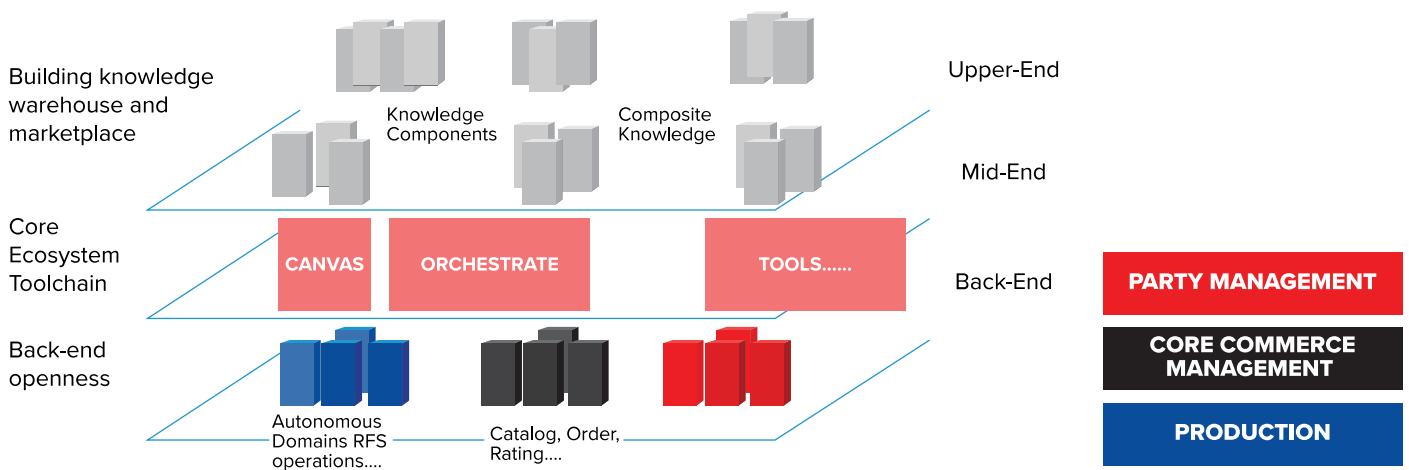


Figure 6: Typical software marketplace architecture

WHAT ARE THE IMPLICATIONS FOR THE VENDOR COMMUNITY?

Today's telecoms software market is increasingly challenging for many vendors. Customization, deployment risk and shrinking budgets have driven vendor consolidation and, in some cases, exits from the market. At the same time, the barriers for new entrants remain stubbornly high, stifling innovation and meaning the latest innovations go to other markets first. The net impact is an increasingly unhealthy market for all. Service providers are unable to move quickly enough to seize opportunities, and they cannot invest in new technologies and solutions while so much cost is attached to customization and duplication.

ODA reduces the cost and risk of integration for vendors, who are increasingly asked to accept or share the risk of integrating their software to highly customized legacy CSP systems. By following an industry standard, mandated as a qualification criterion by CSPs, vendors can dramatically reduce the risks and costs attached to the sales and delivery cycle. Software solutions are already increasingly sold on an -as-a-Service basis with upgradable features and add-on services and capabilities. This opens a new range of growth possibilities and the opportunity to embrace new business models (such as outcome-based models) that further differentiate vendors. Moreover, leading service providers are now clear they will prioritize investment in software and technology that differentiates their business, not in the customization and integration of non-differentiating (or worse, duplicate) solutions.

The creation of the new ODA software model, enabled by a software marketplace, will open the market to a new set of vendors, extending from tier 1 to tier 2, new entrants and open source based software providers. By reducing barriers to entry and improved innovation, the market for software will in fact grow as service providers are equipped to evolve their connectivity services, and lower the cost and timescales to develop, test and launch new revenue streams. With less money and time spent on non-beneficial integration and customization, more will be available to invest in software and technology that differentiates CSPs' businesses.

New channels will open providing indirect as well as direct ways to reach the service provider market. This will provide cheaper access to the global market and, as a result, we anticipate a growth in the opportunity for open source-based solutions, which are already accelerating their engagement with the service provider community.

The ODA software model can also open significant opportunities for vendors to grow their business, working

with new customers in a wide range of industry verticals. This represents an opportunity to transform their relationship with service providers from supplier/buyer to a trusted go-to-market partner. We can see early examples of this evolution in joint go-to-market strategies for private 5G networks, such as campus networks.

For all ecosystem players (CSPs, vendors/technology providers, B2B vertical customers) this will mean a fundamental change in terms of culture, know-how, relationships and roles. Vendors who can rapidly transition will have a significant competitive advantage to seize new business opportunities. Vendors that become active players by creating the new software model and the new marketplaces and that contribute to the development of the specifications, standards, APIs and knowledge-based components, will leverage that to create and consolidate their role as partners with the service providers. Vendors will also be able to create new revenue streams by providing key services such as quality and service assurance across the different software-based components.

Vendors will be able to create new revenue streams by providing key services such as quality and service assurance across different software components, often building on existing partnerships. The largest tier 1 and tier 2 vendors will be especially well-placed, along with system integrators who have the relevant expertise to ensure that the software components from marketplaces perform seamlessly together and deliver the end-to-end quality of service and resilience that service providers require. A successful example of a vendor who makes revenues from being a guarantor of quality assurance is Red Hat with their Enterprise Linux platform. Red Hat provides a platform to develop open source software with an assurance of reliability and quality support through a subscription model. Whether open source or not, there will be a sizable market for companies who can ensure performance, resilience, security and quality.

An increase in competition will be balanced by an increase in opportunity. But, just like service providers, not all will make the leap. Vendors who fail to embrace the new marketplace model or fail to shape and conform to the standards quickly enough, will lose credibility and miss out on business with the many CSPs who fully embrace this new approach. While this new software market will bring change, it also unlocks huge potential for vendors to thrive and help the overall market grow.

BUILDING THE NEW TELECOMS SOFTWARE MARKET WITH THE OPEN DIGITAL FRAMEWORK

Monolithic, rigid, highly customized systems that take too long to procure, are too expensive to implement and which cannot be reused will be replaced with agile, data and AI-driven solutions that are responsive to changes in market and product needs. These solutions are characterized by a modern software-based architecture that is lightweight, decoupled, cloud-based and data and AI-driven. They will comprise software components that can be easily discovered and procured from multiple vendors, and easily integrated and deployed.

Combined with a transformed culture and ways of working, such as CI/CD and DevSecOps, this new approach for telecoms software – which mirrors lessons learned from hyperscale cloud providers, will enable service providers to unlock a new era of innovation and growth.

To enable this radical architectural and cultural shift, TM Forum members, representing some of the world’s leading service providers, software vendors, system integrators and consultants, have been collaboratively building the Open Digital Framework (ODF) - a repository of tools, architecture, code, knowledge and standards to enable this software model and a marketplace to support it. ODF offers CSPs an end-to-end migration path from legacy systems to modular, cloud native IT components, and provides a blueprint for service providers to deliver intelligent operations fit for the 5G era. The adoption of the ODF enables the procurement and assembly of solutions that are easier and cheaper to deploy, integrate and upgrade.

The Open Digital Architecture, incorporating TM Forum’s Open APIs and Reference Implementations will facilitate the evolution of the new software model. The successful deployment and operation of this new software model, and the marketplace approach, relies on standard robust software components being created. In the future, instead of purchasing software applications and installing them in their own data centers, CSPs will instead source on-demand capabilities implemented in software components, services and microservices via Open APIs from the marketplace hosted on cloud platforms.

We envision a collaborative, industry-wide community governed by TM Forum defining the component standards, which have two dimensions:

- A set of industry-standard component definitions that decompose the full capabilities defined in the ODA Functional Architecture into standard software components.
- A standardized software-defined envelope that all components must utilize, capturing the meta-data that enables each component to be automatically deployed and managed in an operational ‘Canvas’. (The implementation for the component can be proprietary and is typically defined by linking to container images in a container repository.)

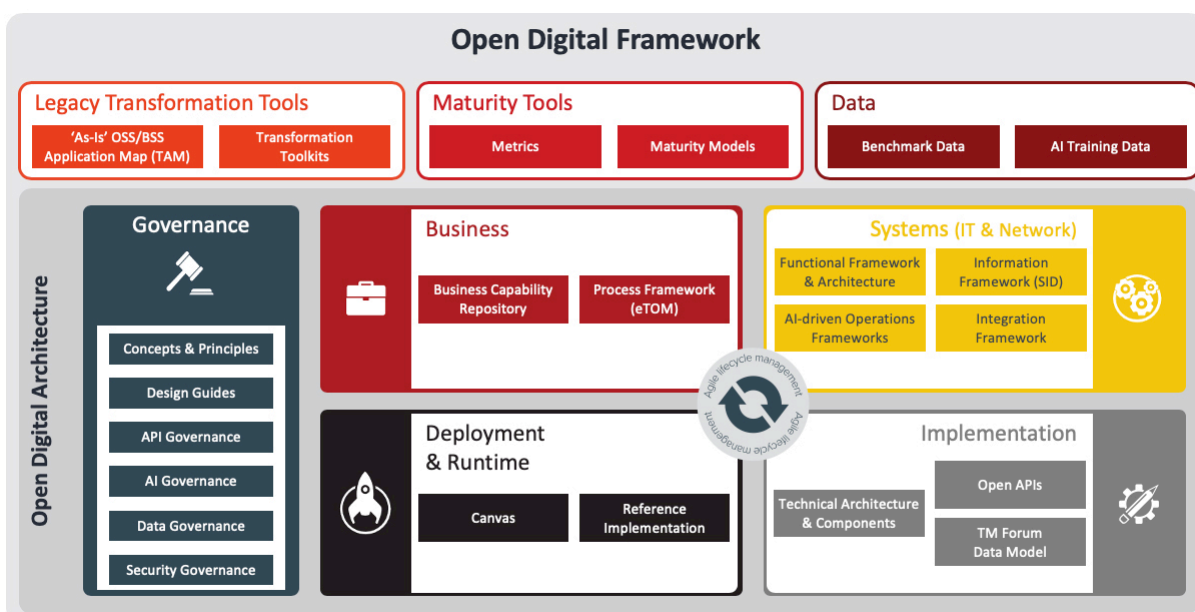


Figure 7: Open Digital Framework

The components are 'living' - continuously evolving through 'internet style' standardization rather than traditional standards development approaches, based on crowd-sourced CSP, vendor and open source community contributions. This requires tight version control and attention to backwards compatibility (already key principles of the TM Forum Open API development initiative). Complementary to the standards, a set of Component Conformance Test Kits (Component CTKs) are being rapidly developed that will allow compliance testing of a component against the standards, and a certification process for independent verification of this compliance.

The Open Digital Framework marks a significant change for the CSP software ecosystem, simplifying the solutions and removing large-scale customization and integration. CSPs will move towards investing in software and technology that differentiates their businesses, not in the customization and integration of non-differentiating solutions. New opportunities for CSP in-house teams, open source

providers and smaller-scale vendors to enter the market will be generated and there will also be opportunities for existing vendors to develop value-added partnerships by being active in the creation of the open digital marketplace and contributing to the knowledge-based platforms, specifications, standards and APIs.

CSPs will drive the demand for this new flexible, modular, API-driven solution as they build new ecosystems and trial new digital partnership models with the vendor community. TM Forum collaboration projects and **Catalysts** will play a critical role in igniting the market. To achieve scalability, these collaborative programs are establishing industrial strength standards for inter-operable software components based on TM Forum's Open APIs and data model underpinning the development of the software marketplace. More information about the Open Digital Framework can be found here: www.tmforum.org/opendigitalframework

TM Forum members are actively developing the ODA standards through our collaboration projects. [Click here to join them.](#)