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BLOCKCHAIN: WHERE'S THE VALUE FOR TELECOMS?

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

As established industries race to digitize, expectations and hype for new technologies such as 5G are sky high. Digital Transformation World 2019 will explore these opportunities and challenges and more.
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Blockchain: Where's the value for telecoms?

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

Introduction

When a new technology or capability, is developed, any vertical sector needs to decide how, when and where to leverage its capabilities. It is more challenging for communications service providers (CSPs) to do this for a technology such as blockchain than it is, for example, with a next-generation network technology like 5G.

This is because network strategy is evolutionary and heavily standardized, and vendors supply equipment that is compatible with previous networks. Furthermore, when CSPs deliver something like 5G to their customers, it is the product, whereas blockchain and distributed ledger capabilities could be used to address a host of internal (operational) and external (service) use cases.

There will be no agreed roadmap for how CSPs exploit blockchain and distributed ledger technology, although best practices will emerge. Research undertaken by leading global professional services company, Accenture, indicates that CSPs are fully aware of the potential of blockchain. In a survey the company conducted late last year, one in five respondents predicted that distributed ledgers and blockchain will have a bigger impact on their organizations over the next three years than artificial intelligence, extended reality and quantum technology. Together these are known as DARQ technologies.

This report brings together research conducted by TM Forum analysts on the progress that seven leading CSPs – AT&T, Colt, Deutsche Telekom, Globe Telecom, Softbank, Telefónica and Vodafone – are making as they experiment with blockchain and distributed ledgers, and start proper deployments. It also draws on expert insights from Accenture on the most compelling use cases. Taken together, these two pieces of research provide the telecoms vertical with the guidance that they need to make sound judgments about the how, when and where to deploy this exciting new capability.

We hope you enjoy the read!

Mark Newman
Chief Analyst
TM Forum

> “ DARQ technologies will have the greatest impact on their organization over the next 3 years: 43% of communications industry executives ranked AI No. 1 – with 19% ranking distributed ledgers/blockchain as No. 1. ”

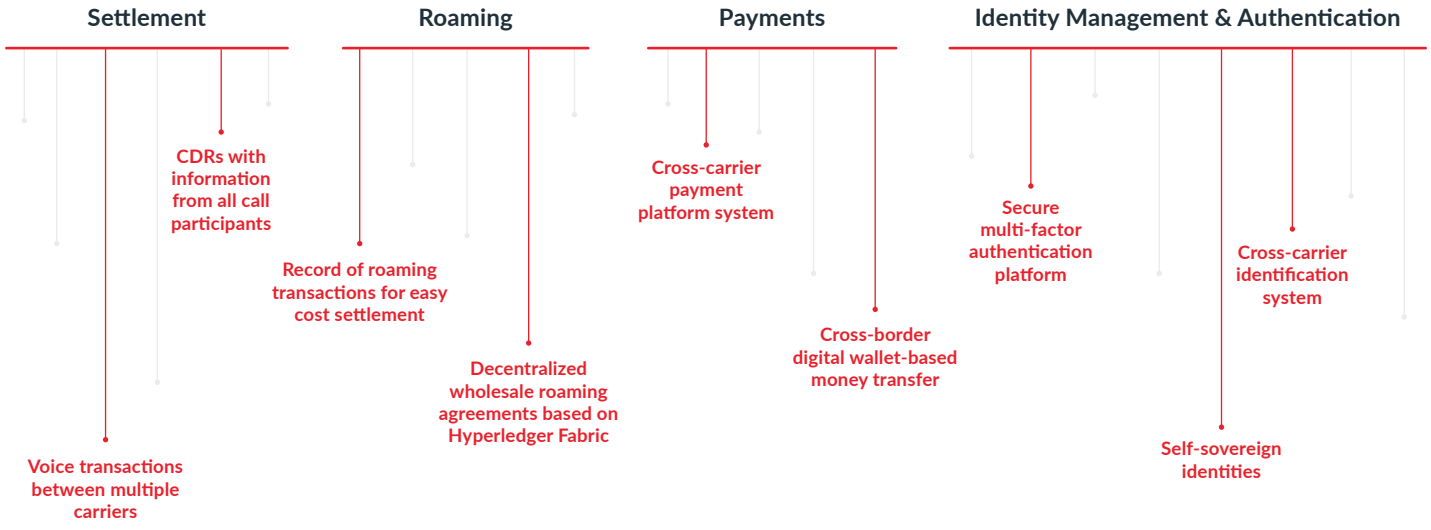
The big picture

With communications service providers' (CSPs') revenues and business models under growing pressure, blockchain's ability to improve critical processes such as roaming and identity management, while facilitating new business models, means interest in the technology is growing fast.

Blockchain establishes a shared, immutable record of transactions within a network. Each digital transaction is agreed by consensus and the transaction is then time-stamped, becoming a block in a chain of blocks. In this way, a blockchain represents a true, accurate and – perhaps most importantly – trusted record of each transaction made. So, what is the value for telecommunications companies?

For a start, the technology is especially well placed to facilitate settlement. Telefónica and Colt are already playing an important role in this area and have successfully completed a blockchain proof of concept (POC) aimed at settling voice transactions between multiple operators. Telefónica is focusing on call detail records to ensure settlement runs more smoothly. Deutsche Telekom is deploying blockchain to simplify roaming agreements,

Blockchain opportunities for CSPs



TM Forum, 2019

and its Telekom Innovation Laboratories subsidiary has developed its own approach based on Hyperledger Fabric, which is being developed in a Linux Foundation project.

Blockchain can also add value to identity management as it can cut out intermediaries through smart contracts. This means an ID number is all that is needed to authenticate an individual, resulting in far fewer processes and happier customers. Deutsche Telekom and SK Telecom are using blockchain to establish a real-name authentication program designed to streamline verification and subscription processing.

Meanwhile, SoftBank is working on a secure identification system that can cross borders, and AT&T has collaborated on a blockchain-based mobile authentication initiative. Vodafone, too, is honing its blockchain strategy and expects identity and supply chain management solutions to be launched within one to two years.

Inherent security

Given blockchain's origins in cryptocurrency, it is highly relevant when it comes to e-commerce and payment systems. Its inherent security means the technology can both protect transaction data and prevent the theft of financial information. Globe Telecom has used the technology to launch a cross-border money transfer service, while SoftBank has worked with partners to demonstrate a blockchain-based payment platform.

Carriers are evaluating more left-field use cases too, including Telefónica's trial of a blockchain-based platform enabling individuals to sell validated private information for a profit, and Deutsche Telekom's use of the technology to enable the anonymization and distribution of blocked IMEI numbers, a topic covered in TM Forum's recent *Blockchain Unleashed* Catalyst.

The research for this report was carried out in March and April 2019, and highlights early CSP blockchain projects. Most are still at the POC stage, but as the initiatives come to fruition, the technology can enable other emerging technologies, perhaps facilitating secure communication between internet of things devices. Indeed, given blockchain's ability to facilitate new business models while improving internal efficiencies, its importance is surely set to increase.

Read this report to understand:

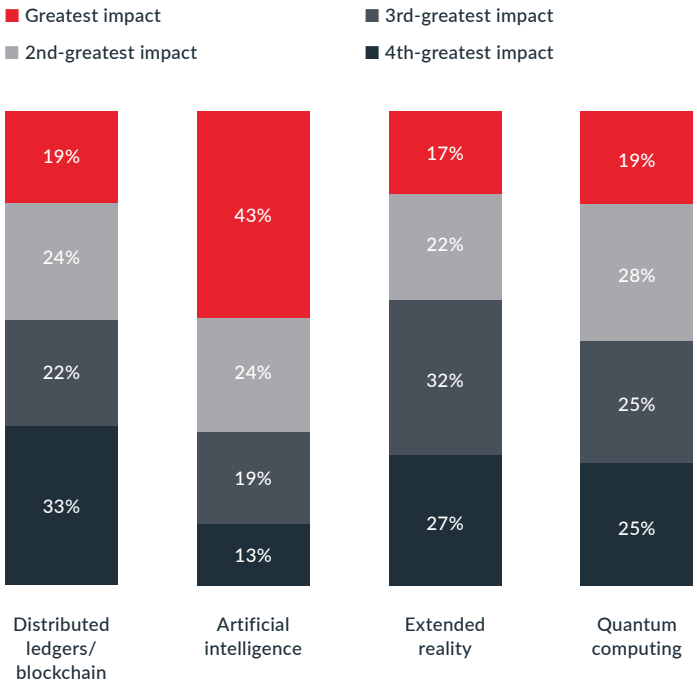
- CSPs' motivation for adopting blockchain
- The way in which blockchain pioneers are defining the best approaches and partners
- How leading CSPs are developing new blockchain solutions
- Recommendations for other CSPs looking to use blockchain
- How TM Forum Catalysts can help share best practices and innovation

Section 1

How CSPs are using blockchain

Interest in blockchain is increasing among communications service providers (CSPs). According to an **Accenture survey** of executives across 20 industries and 27 countries, 19% of communications industry respondents ranked distributed ledgers/blockchain as the technology they expect to have the greatest impact on their organizations over the next three years.

Blockchain opportunities for CSPs



TM Forum, 2019 (source for data: Accenture)

As blockchain moves out of the proof-of-concept (POC) stage, CSPs will urgently need an informed strategy to drive real business value from it. This section looks at how the following blockchain pioneers are using the technology in telecoms:

- Telefónica
- Globe Telecom
- Deutsche Telekom
- Vodafone
- AT&T
- Colt Technology Services
- SoftBank

Telefónica builds efficiency and trust

Telefónica is one of the largest telecommunications companies in the world, with an especially strong presence in Europe and Latin America. The company believes that by applying blockchain technology to end-to-end telco processes, it will be possible to introduce a new form of command and consent into the flow of information, bringing greater trustworthiness and efficiency to the process. Reflecting its high level of activity in this area, the company has already forged several substantial blockchain partnerships.

For example, Telefónica played an important role in the International Telecoms Week Global Leaders' Forum (ITW GLF – see below), including helping with the successful completion of a blockchain POC aimed at settling voice transactions between multiple carriers in October 2018. According to Enrique Wong Lam, Telefónica's Head of Voice Wholesale Product Marketing, the POC was all about creating trust.

"Of course, we have very good relationships and partners, but, at the end of the day, business is business," he says. "We use blockchain to bring trust to the process." Telefónica is now looking to widen the scope of the POC, and is evaluating the end-to-end settlement of any kind of voice agreement, from contracts through to payment.

Unifying CDR data

Telefónica recognizes the importance of call detail records (CDRs) when it comes to settlement. As part of a separate POC with IBM, the company created a unique CDR, '1CDR', containing information from all the participants on a call. The November 2018 collaboration focused broadly on blockchain's ability to address complex challenges intrinsic to carrier services, such as registering data and information from different sources.

However, it also looked at how blockchain can be used to

What is the ITW Global Leaders' Forum?

The ITW GLF is a network of leaders from the world's largest wholesale operators who convene to drive the next phase of growth for the industry. The GLF and its members are interested in the transformative potential of blockchain, and in October 2018 announced the successful completion of a multi-lateral blockchain POC led by PCCW Global and Colt Technology Services in collaboration with BT, Orange, Telefónica and Telstra.

The POC demonstrated the viability of a platform able to settle voice transactions between multiple CSPs in minutes rather than hours. Supported by technology partner and blockchain specialist Clear, the trial was the first to involve a multi-lateral series of relationships among the wholesale telecommunications industry.

improve the reliability and transparency of information collected by different networks when routing international calls. The first joint project has already been tested in a lab environment, and Telefónica plans to begin deploying a new trust layer embedded in the network by the middle of this year.

"The problem all carriers have with settlement is based on CDRs," says Wong Lam. "We think that if we can unify all of the CDR data for a single call then most of the billing problems can be solved."

Telefónica also is beginning to evaluate how it can apply blockchain to roaming and believes the technology can usefully be deployed in other areas as well, including digital identity, the supply chain and tokenization.

Evaluating private blockchains

In addition, Telefónica is a member of the European Telecommunications Standards Institute's (ETSI's) Permissioned Distributed Ledgers group, which focuses on the deployment of private blockchains. In December 2018, ETSI established the group, whose founding members include Telefónica, Ericsson, Huawei, Intel and Vodafone, to evaluate the use of private blockchains across various industries and governmental institutions.

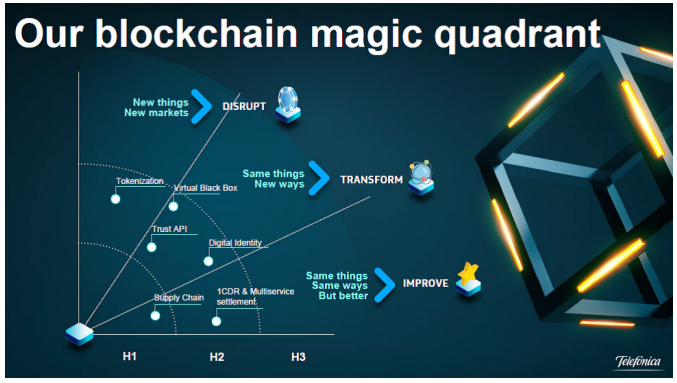
The companies agreed to work with ETSI to assess the challenges of using permissioned distributed ledgers, associated business use cases and the necessary functional architecture and solutions. The group held its first meeting in January at Telefónica's headquarters in Madrid, where it discussed project priorities and elected representatives from each of the participating companies.

Telefónica has engaged in other collaborations too, including one with Microsoft intended to accelerate innovation. While the companies' agreement in February focuses on the Microsoft Azure AI platform, it encompasses a commitment to identify opportunities based on disruptive technologies such as blockchain.

Telefónica has forged a partnership with security technology start-up Rivetz aimed at developing smartphone security solutions for blockchain-based transactions and messaging. This agreement was announced in May 2018 and combines the CSP's network security services with Rivetz's blockchain and trusted-computing technologies.

Meanwhile, Telefónica is using blockchain as a means of experimenting with new business models, and has trialed a blockchain-based platform, Wibson, which allows individuals to sell validated private information for a profit. US Patent and Trademark Office documents from October 2017 show that Telefónica has evaluated using blockchain as a means of verifying data using cryptography.

Telefónica's blockchain strategy



Courtesy of Enrique Wong Lam, Telefónica

Globe Telecom focuses on roaming

Globe Telecom operates one of the largest mobile, fixed-line and broadband networks in the Philippines. The company has already demonstrated considerable interest in blockchain technology, with a particular focus on solutions intended to address the settlement of roaming costs. This, Globe believes, could lead to settlements being conducted in real time, without needing offline reconciliation.

Says Vincent Seet, Head of Enterprise Architecture, Globe Telecom, "We're still at the POC stage, but we envisage blockchain will remove the need for a data clearinghouse. All partners engaged in roaming transactions will maintain a blockchain record, so they will know how and when the roaming occurred."

In addition, Globe's subsidiary, Globe Fintech Innovations (also known as Mynt), and Alibaba Group's Ant Financial used blockchain as the basis for the world's first cross-border digital wallet-based money transfer service in June 2018. Globe Telecom is keen to promote blockchain technology across the sector and was one of several CSPs championing TM Forum's *Blockchain Unleashed* Catalyst (see below).

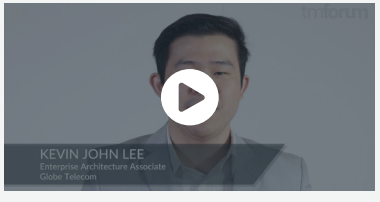
Catalyst shows blockchain's potential

TM Forum's *Blockchain Unleashed* Catalyst aimed to show just how disruptive blockchain might be for CSPs. BT, Globe Telecom, KDDI, Optus, Orange, Singtel, Telefónica, Ultrafast Fiber and Vodafone all collaborated on the project, with other participants including Deloitte, IBM, Infosys and Openet.

Globe Telecom managed the Catalyst, which focused on five use cases:

- Eliminating CDRs to enable real time fraud detection, dispute-free settlement and billing
- Digital identity-as-a service
- Service-level agreement monitoring
- Reducing mobile phone thefts
- Mobile number portability

The next phase of the project will be demonstrated at TM Forum's Digital Transformation World 2019 to be held in Nice, France, in May.



Watch Globe Telecom's Kevin John Lee discuss the project

Deutsche Telekom builds innovative solutions

Deutsche Telekom is the largest telecommunications provider in Europe and operates several subsidiaries worldwide. Much of the company's blockchain work is conducted by its Telekom Innovation Laboratories (T-Labs) subsidiary, and in particular T-Lab's dedicated Blockchain Group. The importance the company attaches to blockchain is reflected in the fact it has already negotiated tariffs with telecommunications providers, via smart contracts, to adjust roaming costs to customers' needs and evaluated how blockchain can be used to secure networks against hackers.

Recently, Deutsche Telekom has worked on several innovative blockchain-based solutions. For example, in February it announced City Pass, an initiative to provide access to a range of municipal services via a single account. The data generated through City Pass cannot be manipulated, and transactions are settled between partners directly. Also, in June 2018 the company began testing a blocking procedure for stolen phones with its implementation partner Camelot Innovative Technologies Lab, and created a decentralized blocking list to enable the anonymization and distribution of blocked IMEI numbers.

Like many of its peers, Deutsche Telekom is active in a number of blockchain-based membership organizations too, sharing best practice and helping the technology to gain a firm footing. These include the global Hyperledger community, which it joined in December 2018. As part of its extensive work with that community, T-Labs has prototyped a decentralized, transparent approach to settling and executing wholesale roaming agreements based on Hyperledger Fabric.

What is Hyperledger?

Hyperledger is an open source, collaborative effort designed to advance cross-industry blockchain technologies. Hosted by The Linux Foundation, the multi-project, multi-stakeholder initiative includes 10 business blockchain and distributed-ledger technologies.

Through collaboration on software development, Hyperledger aims to build communities of developers building blockchain frameworks and platforms. In particular, the Hyperledger Sawtooth project is developing a modular platform for building, deploying, and running distributed ledgers.

> " We envisage blockchain will remove the need for a data clearinghouse. "

Next Identity Platform

Meanwhile, T-Mobile US has developed strong links with the open source community in this area. Says Erik Meijer, Board Area, Technology & Innovation, for Deutsche Telekom (and member of TM Forum's Digital Ecosystems Advisory Board), "I'm really impressed with what our T-Mobile US colleagues are implementing with Hyperledger Sawtooth, creating the Next Identity Platform.

"Next Identity is an enterprise-grade blockchain application that facilitates decentralized decision making for our Team of Experts at the point of interaction with clients. Topping this off is our intensive collaboration with the global open source community. Being part of a large-scale ecosystem for open innovation is one of our main drivers for being actively involved at TM Forum – establishing intelligent operations for a '5G for all' world."

Since February, T-Labs has been a member of the Hedera Hashgraph Governing Council, whose Hedera Hashgraph platform provides a distributed public ledger which can be used to develop globally decentralized applications. In addition, T-Labs is building an ecosystem known as Hashstax, which aims to provide access to numerous blockchains through a single interface. The system provides software developers and IoT device manufacturers with access to decentralized features such as payment, identity and smart contracts.

"We have set up something with partners and they have done this on their own stack. They have built Hashstax, which is a blockchain-as-a-service application," Meijer says.

In addition, Deutsche Telekom is working with other CSPs to develop solutions based on blockchain, and in February signed a memorandum of understanding (MoU) to accelerate its strategic partnership with South Korea's SK Telecom. The partnership encompasses Blockchain Mobile ID intended to give users self-sovereign identities and protect their personal data.

"The traditional identity [interaction] now is a consumer of our services, but in the future, it will be a machine trying to consume functionality-as-a-service out of our cloud," Meijer says. "We want to transfer out of legacy and into the future."

> " Deutsche Telekom is evaluating how blockchain can be used to secure networks against hackers. "

Vodafone removes complexity

Vodafone is a multinational telecommunications conglomerate that owns and operates networks in 25 countries, with partner networks in a further 44 territories. Vodafone has a growing interest in blockchain technology, and, like Telefónica, is working with standards body ETSI to evaluate the use of private blockchain across various industries and governmental institutions with a view to developing future industry standards.

As part of recent efforts to define a group-wide blockchain strategy, Vodafone mapped its various activities and assessed more than 20 blockchain use cases. The graphic below shows some of the areas where CSPs might use specific features of blockchain.

Potential uses for blockchain in telecoms

Blockchain feature	Privacy	Identity	Security	Asset	SLA	Digital rights
Works in a 'trustless' environment	x	x	x	x	x	x
Distributed ledger requires no intermediaries	x	x	x	x	x	x
Decentralized consensus ensures integrity	x	x	x	x	x	x
Immutability prevents tampering	x	x	x	x	x	x
Near-real-time updates maintain consistency	x	x	x	x	x	x
Verifiability supports auditing	x	x	x	x	x	x
Timestamps & sequencing support chronology		x	x	x	x	x
Scripted transactions support smart contracts			x	x	x	x
Fractional currency for micro-transactions					x	x

TM Forum, 2019

An integrated strategy

Now Vodafone is focusing on identity, supply-chain management, roaming and IoT. Says Pierguido Caironi, Vodafone Group's Operational Excellence Manager, "We want to define an integrated blockchain strategy and drive real business value while providing a better customer experience."

In the case of identity management, the objective is to provide customers with increased control over their personal data and to simplify access to a wide range of digital services within Vodafone. In supply-chain management, the focus is on contract management, enabling all parties to record business terms and service level agreements on a shared distributed ledger.

For roaming, the aim is to leverage blockchain to enable more efficient, instantaneous and frictionless inter-operator processes. Regarding IoT, the intention is to supplement Vodafone's IoT service platform with a Digital Asset Broker that allows customers to transact digital peer-to-peer services. The operator has either run or is running POCs in each of these areas and, although the technology is still at an early stage, the intention is to release at least two minimum viable products in the first quarter of 2020.

Vodafone is working on blockchain-based initiatives in specific regions. For example, since 2017 it has been part of the Alastria Blockchain Ecosystem, a government-backed consortium of Spanish enterprises and start ups aimed at accelerating digital ecosystems on a collaborative blockchain platform.

" We want to define an integrated blockchain strategy and drive real business value while providing a better customer experience. "

AT&T authenticates identity

US-based AT&T is the world's largest telecommunications company. The company's blockchain activities mainly involve providing solutions to business customers via AT&T Consulting, which can design, deploy and manage blockchain solutions across verticals including manufacturing, retail and healthcare. However, the operator is open to deploying blockchain in other areas of its operations too, and collaborates when it makes sense to do so, such as with blockchain-based mobile authentication. With fellow US operators Sprint, T-Mobile and Verizon, AT&T is active in the Mobile Authentication Taskforce, which through Project Verify is developing a secure multi-factor authentication platform.

To learn more about the Mobile Authentication Taskforce and Project Verify, see this report

Like a number of its peers globally, AT&T has forged partnerships with leading blockchain vendors in order to enhance its capabilities in this area. For example, in September 2018 it announced the creation of a suite of blockchain solutions designed to work with technology from leading blockchain vendors IBM and Microsoft. These are aimed mainly at helping enterprise customers solve complex business problems by utilizing AT&T's global network and IoT capabilities. AT&T solutions are able to record data on the IBM Blockchain Platform, and the operator's IoT platforms can also be integrated with Microsoft Azure blockchain technology in order to bring transparency and accountability to supply chains.

In addition, AT&T has collaborated on a blockchain project with telecoms equipment giant Ericsson. As part of a wider IoT cybersecurity agreement, the two companies have completed a POC on a blockchain solution providing security to vehicles. AT&T is evaluating more leftfield use cases too, including using blockchain as a means of storing and providing access to data on online transactions. In December 2018, the company sought a patent for a blockchain-based social media history 'map' able to store subscribers' data as a way of tracking 'micro-culture transactions.

> " AT&T has forged partnerships with leading blockchain vendors in order to enhance authentication capabilities. "

Colt Technology Services settles voice transactions

Colt Technology Services is a provider of global network and voice services. The company has already demonstrated a strong interest in blockchain and believes that as the scale and complexity of business interactions increases, a secure, distributed system is essential to maintain the integrity of privacy and transactions. Colt regards blockchain as a means of improving the often error-prone manual approaches associated with traditional business processes. The company is applying blockchain to the back office too, including as part of automating the customer onboarding process.

Colt participated in the GLF POC (see page 11), which it co-led with PCCW. The project focused on using blockchain to automate the inter-carrier settlement of wholesale international services. In October 2018, Colt and Zeetta Networks, a provider of open networking solutions for heterogeneous networks, announced another POC – Blockchain-Based Carrier Marketplace for LSO Sonata – to demonstrate how carriers can buy and sell network services in a secure, distributed and trusted marketplace.

Watch this video to learn more about the blockchain marketplace POC

Colt has evaluated blockchain in other areas of its operations, including making software-defined networking (SDN) interoperability easier to manage. In September 2018, the operator announced it had been working with MEF on SDN interconnect. The collaboration set out to assess how the process of engaging with interconnect partners could be complemented by blockchain – for example, by establishing relationships with other carriers via a smart contract.

> “ Colt regards blockchain as a means of improving the often error-prone manual approaches associated with traditional business processes. ”

SoftBank builds cross-carrier systems

SoftBank is a provider of mobile, fixed-line and ISP services. The company is part of the multinational SoftBank Group, which owns stakes in Arm Holdings, Sprint and Alibaba, among others. SoftBank is extensively involved in blockchain, primarily through its involvement in the Carrier Blockchain Study Group (CBSG) Consortium (see panel).

In June 2017, the partners began technical trials to connect TBCASoft's blockchain platform to operators' systems, subsequently demonstrating a payment platform system using TBCASoft's blockchain technology. The project connects telecommunication backend systems, and aims to eliminate late transactions or transaction failures between CSPs.

In February, SoftBank and TBCASoft expanded the scope of their collaboration, launching a blockchain-based Identification & Authentication Working Group under the CBSG. As part of this initiative, TBCASoft created a foundation application framework called Cross-Carrier Identification System (CCIS) for identification and authentication services.

Facilitating global settlement

The CBSG Consortium emerged from a February 2017 agreement between SoftBank, Sprint and TBCASoft to build a cross-carrier blockchain platform. Launched in September 2017, its aim is to facilitate the joint development of a blockchain platform for carriers.

It is led by blockchain technology company TBCASoft and SoftBank, with Sprint and Far EasTone Telecommunications as initial founding members. CBSG seeks to provide members and their customers with services such as secured global digital payments, clearing and settlement, personal authentication and IoT applications using blockchain technology. In July 2018, the consortium announced the creation of a blockchain working group for global remittance services.

Section 2

Make it happen – Strategies for adopting blockchain

It is essential that communications service providers (CSPs) work collaboratively while looking beyond obvious solutions if they are going to reap the full, potentially huge benefits of distributed-ledger technology. The following advice is drawn from the hard-won experience of blockchain pioneers.

Collaborate and share information

Collaboration with other companies, across sectors, helps drive the adoption of new technology for the benefit of all. Multi-carrier collaborations such as the Mobile Authentication Taskforce, the Carrier Blockchain Study Group (CBSG) Consortium, ETSI's Permissioned Distributed Ledgers group and the ITW Global Leaders' Forum (GLF) are all helping to share knowledge and best practice, while establishing new standards.

"It's important that carriers join together and apply the different use cases that others are working on internally," states Telefónica's Enrique Wong Lam.

For Globe Telecom's Vincent Seet, the high costs associated with developing blockchain services are another reason for carriers to work together: "It's important to encourage a co-creation mentality among CSPs so that we share the investment," he states.

TM Forum is playing its part too, bringing carriers and other organizations together to demonstrate blockchain's potential for disruption and value. According to Deutsche Telekom's Erik Meijer, "If you try to tackle blockchain alone, you are setting yourself up for failure. The innovation is moving so fast, and it's hard to know what you don't know. So being part of a community like TM Forum is important."

Choose unobvious partners

CSPs should work with a range of companies, not just the obvious ones. It's a good idea to forge links with companies with specialist blockchain knowledge. AT&T and Telefónica, for example, have sought to benefit from IBM and Microsoft's extensive experience, although Vodafone believes that, given blockchain's infancy, it may be too soon to commit to a single partner.

It's also important to seek out smaller, and potentially more innovative, companies for collaboration. Telefónica, for example, is working with Rivetz, a start-up dedicated to endpoint security within anonymous blockchain transactions. Similarly, Colt and other members of the ITW GLF are collaborating with blockchain start-up, Clear, in an effort to settle voice transactions between multiple carriers in minutes rather than hours.

" If you try to tackle blockchain alone, you are setting yourself up for failure. "

Explore a range of use cases

In addition to critical processes such as settlement and identity management, blockchain can play a role in many emerging CSP use cases. New revenue opportunities often come out of leftfield, so carriers should be open to the many new avenues blockchain enables. For instance, AT&T is looking to use the technology for storing data about online transactions, while Deutsche Telekom has used blockchain to provide access to a range of municipal services via a single account, and Globe Telecom has used it as the basis for a cross-border money transfer service.

Above all, it's important to focus on innovation. According to Meijer, "It's important to play around with [blockchain]; TM Forum's sandbox approach is very important."

Be selective

While blockchain can be highly useful in many areas of a CSP's business, it won't improve all of them. Telefónica's Wong Lam warns against trying to deploy blockchain where it does not bring sufficient value.

"The main thing we have learned is that blockchain cannot be applied to every area of the business. You need to be selective, as otherwise you will have a lot of innovation, but only a few of the use cases will be worthwhile," he says.

Vodafone's approach is to explore many ideas, assess the value of each, then proceed only when there is a clear business case with measurable key performance indicators.

" You need to be selective [with blockchain], as otherwise you will have a lot of innovation, but only a few of the use cases will be worthwhile. "

accenture

Accelerating future value for telcos through blockchain

This report shows clearly that blockchain is no longer in the aspiration or learning phase. Many proofs of concept and pilots are taking place, consortia have collaborated to develop industry use cases and platform solutions and implementation has begun.

Yet blockchain is still an emerging technology – and CSPs urgently need an updated and informed strategy around it to drive real business value and avoid the use of the technology for its novelty value.

All the indicators show that this focus will be worthwhile.

DARQ Power: Beyond Digital Transformation

Accenture's latest research for our Technology Vision 2019 (in field Oct-Dec 2018), our annual checkpoint on the technology priorities which businesses should start planning for now, offers the first trend as "**DARQ power**".

This research and our work with the leading CSPs across the globe mean that we firmly believe that distributed ledger technology, artificial intelligence (AI), extended reality (XR) and quantum computing will be the next set of new technologies to spark a step change in allowing the reimagination of entire industries.

D – **Distributed ledgers** will expand networks by eliminating the need for trusted third parties.

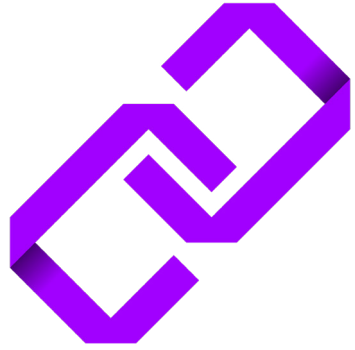
A – **AI** already plays a role in optimizing processes and influencing strategic decision making.

R – **Extended reality** creates entirely new ways for people to experience and engage with the world around them.

Q – **Quantum technology** will usher in novel ways to approach and solve the hardest computational problems.

The key here is the set. All four DARQ technologies are, or will be, powerful on their own. But as they advance, they will push each other forward further. And as DARQ technologies reach maturity, they will amplify the reach and capabilities of the business, creating new value from existing SMAC (social, mobile, analytics, cloud) investments.

> "Focus the discussion on operating model possibilities and ecosystem governance rather than the technology."

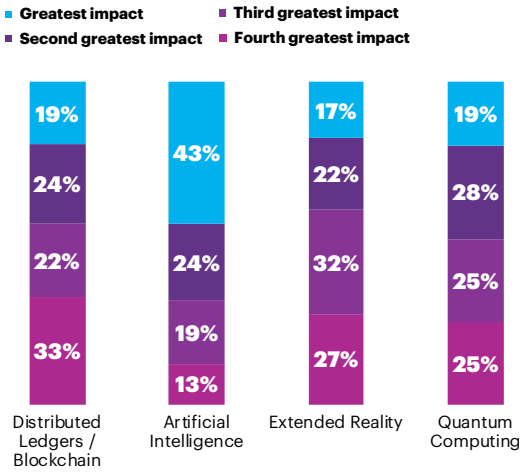


Accelerating future value for telcos through blockchain

Accenture Research - Technology Vision 2019: A snapshot of CSP respondents' thinking on DARQ

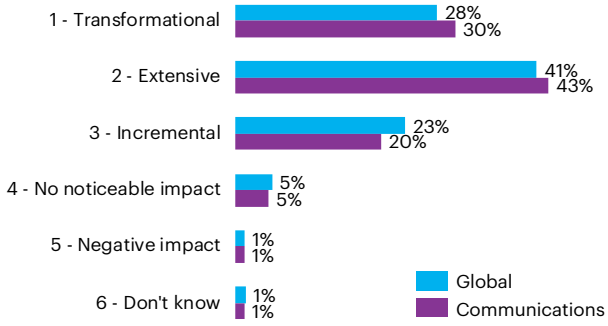
1. When asked to rank which of the DARQ technologies will have the greatest impact on their organization over the next 3 years, 43% of Communications industry executives ranked AI number one – with 19% ranking Distributed Ledgers/Blockchain as number one.

Communications



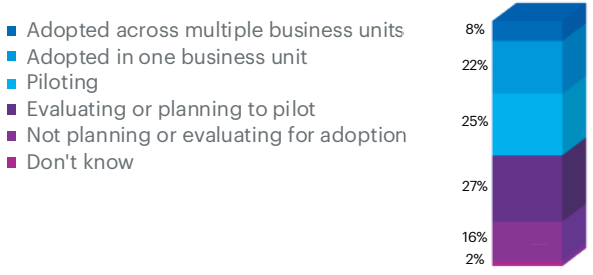
2. Some DARQ technologies will be more impactful today but exploring all four will be crucial to take advantage of combinatorial effects.

How do you anticipate the combination of DARQ technologies will transform your organization over the next three years?



3. 91% of Communications industry executives are currently experimenting with one or more DARQ technologies – here's their response on their organization's stage of adoption for Distributed Ledgers/Blockchain today.

Please indicate your organization's stage of adoption for each of the following emerging technologies today



One thing is clear – the future value of blockchain needs to be considered in a much greater context than simply the technology on its own.

Read more about decision points for DARQ and other emerging technology trends in Tech Vision 2019.

Note: DLT and blockchain are synonymous but not the same. DLT is the umbrella category. Blockchain is the more common term. All blockchain's are DLT. Not all DLTs are blockchain. The difference is the consensus mechanisms and management of the data. Check out this article from renowned Spanish Blockchain blogger @AlexPreukschat to learn more about the difference.

Analyst observations

According to Gartner:

"Gartner's business value forecast methodology quantifies the value of technology innovation rather than the dollars spent on it. The business value-add of blockchain will grow to slightly more than $176 billion by 2025, and then it will exceed $3.1 trillion by 2030."

(Forecast: Blockchain Business Value, Worldwide, 2017-2030 Published: 02 March 2017 ID: G00325744; Analyst(s): John-David Lovelock | Martin Reynolds | Bianca Granetto | Rajesh Kandaswamy).

And institutional digital assets observer, Diar, notes that, as of October 2018, venture capital investment in blockchain was reported as up by more than 280% than the year prior, meaning that there are ever more technology assets emerging.

(Read more: Venture capital companies go deep and wide with Blockchain Investments).

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Blockchain: So where are we and what is next?

From Accenture's perspective, recent projects have demonstrated that blockchain/DLT can scale and is ready for the next phase of the journey to production. The key is to educate the wider group of business leaders, being selective across the potential use cases focusing on the actual value cases and to focus the discussion on operating model possibilities and ecosystem governance rather than the technology.

Identification of future value from blockchain opportunities requires meeting the right criteria

As examples - the Internet of Things and Artificial Intelligence cannot reach their full capabilities without taking blockchain into consideration.

And the rise of 5G networks offers a further example of future possibility.

1. **Powered by blockchain: realizing AI's full potential**
   Blockchain's ability to securely expand an AI implementation's access to data across organizations will drive a whole new set of insights and value.

   Each AI system, and each algorithm within, is dependent upon training and acting upon trustworthy data to which it has access; typically limited to the organization implementing it. Simultaneously, blockchain is redefining business processes and systems of record, enabling secure and confident access to shared data between organizations and increased trust and confidence in the data. Together, AI and blockchain will enable organizations to exceed their current boundaries and gain access to significant amounts of trapped value.

   Blockchain doesn't cure bad data, but it does improve our ability to share and more importantly, trust the data used. In addition, as AI works through its complex decision trees, this "learning process" can be captured on a blockchain, in a tamper-evident fashion, and shared so its decisions may be evaluated and trusted.

   Security is perhaps the most critical element of this combination. AI-based applications must process huge amounts of data. Having the highest level of certainty that the data has not been altered or tampered with is critical for AI to achieve its potential. Currently, it's extremely difficult to identify data that has been modified or "poisoned" by an attacker. Using blockchain with AI against data vaults allows analysts to determine when a breach has occurred.

   Blockchain also makes hacking systems and stealing sensitive data and information difficult and the combination of the two forms a "double shield" against cyberattacks. Organizations can train machine-learning algorithms to automate real-time threat detection and continuously learn about the behavior of attackers.

   Read more: AI & Blockchain synergies

2. **Blockchain and IoT Disintermediation**
   Building on their opportunity in digital identity management (referred to in the earlier research chapter), CSPs have a closely related opportunity to facilitate IoT disintermediation and address the challenges associated with data authenticity and ownership, security and privacy, and the upfront and ongoing costs of deployment.

   This growth is also giving rise to increased devices autonomy, shifting focus from a single central authority and monolithic infrastructure to a new, decentralized architectural approach. Recent attacks on IoT devices have demonstrated that unsecure devices/routers can be the vehicle of massive digital denial-of-service (DDoS) outages, with huge societal and economical damage. Security is hence a priority and will be even more critical as telcos increasingly seek to become more highly valued platform players, with a need to authenticate a connected ecosystem of value-added services offered by players from multiple industries.

   CSPs are already engaged in the IoT ecosystem and, through blockchain, could deliver a value-added trust capability through digital identity validations and assuring the integrity of device transactions. They could also displace traditional centralized IoT cloud infrastructures by establishing a peer-to-peer communication model that allows for the lower-

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cost processing of billions of transactions between IoT devices, positioning themselves as the trusted authority for digital identity.

Read more: Blockchain plays to telcos' strengths

3. **5G and Blockchain**
We have identified a number of potential options for value propositions using Blockchain in 5G networks.

- Sharing of faster and regulated local connectivity for reliable service to devices.
- Instant monetization of diverse connection types through smart contracts.
- Local connection prices purely based on supply and demand in the area.
- New business models to use idle capacity for non-prioritized traffic.

For example, Blockchain is a potential technology for enabling reliable 5G services. To realize these services, CSPs will need to handle heterogeneous access notes and diverse access mechanisms. blockchain has the capability to assist in 5G wireless access technology deployments by providing seamless access across a diverse number of networks to devices and endpoints. For example, with 5G, CSPs will be required to manage access to rules, agreements and transactions across an increasing number of access points and mechanisms. Blockchain will play a reinforcing role, for example, in auditing agreements.

Possible use case of blockchain powering the 5G networks:

i. **Infrastructure sharing in 5G small cell networks -** Blockchain can enable network carriers to dynamically transfer infrastructure elements among themselves or other parties on demand via secure, auditable transactions.

ii. **5G network slicing broker -** Blockchain can create a secure and automatic broker of network slicing, adding the following benefits:

1) Superior level of security for 5G network slice transactions;
2) Higher efficiency in 5G network slice operations;
3) Opex cost saving.

Further possibilities include - for MVNOs - and MNOs - that might struggle to afford billion-dollar 5G buildouts, blockchain-enabled microtransactions and smart contracts could be an option. In this scenario, they could lease high-frequency spectrum from larger players, or even the government, in real time or on a pay-as-you-go basis.

As another example, with new complexity inherent in 5G, CSPs will be open to new vulnerabilities and blockchain as a digital ledger will help control and protect against unauthorized changes. Meanwhile, complexities and speed may also allow for hyper-personalization of offerings, which could be best tracked by using blockchain.

Read more: 5G Acceleration

4. **Edge Computing**
For 5G to meet the performance goals of very low latency and massive broadband, it requires edge computing. There is a time lag when data travels over the fiber networks connecting the radios on the towers to the network core, where edge computing can help by moving the application or content closer to the radio at the edge of the network, thereby reducing overall latency. The integration between blockchain and edge computing can bring the following benefits:

- **Edge computing solves computational problems of the blockchain process:** IoT devices are low-powered, geographically distributed and mobile. Limited computing resource and energy supply of IoT devices become major barriers when blockchain is applied to IoT systems specifically. Mobile edge computing can supply computing and communication resources for mobile blockchain.
- **Blockchain ensures data security:** When blockchain is applied to edge computing, it ensures that data are tamper-resistant and traceable.

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Blockchain & Distributed Ledger Technologies are driving business transformation

Blockchain causes new business networks to form that join up players within industry sectors and can be a major enabler as well as disruptor for many businesses. This is not just a technology play: Accenture approaches blockchain from the point of view of an operating model transformation.

Our approach has 3 underlying principles:

1. **Platform independent**
   With a new and fast evolving technology, we are yet to see the emergence of a dominant, all-purpose platform. As such, it is important to support the blockchain ecosystem in their effort both to innovate as well as to standardize. With such objectives in mind we are very active in the ecosystem and are founding members of Hyperledger, a Linux Foundation Project[1] and the Enterprise Ethereum Alliance[2]. We help our clients to optimize solutions by selecting the right blockchain platform for the right use case.

   Coming together to collaborate, establish standards and frameworks, and share innovation and knowledge, is critical to blockchain's adoption and growth. Accenture is well positioned across the ecosystem because of its relationships and technology independence. We have been at the forefront of founding and structuring the largest consortia of the ecosystem and continue to drive their missions forward. In addition, we are convening ecosystem consortia around particular use cases to shape and build networks.

   Moreover, industry analysts acknowledge there will likely be more than one successful DLT platform, that different platforms will succeed in different business ecosystems and that over time those ecosystems will see value in connecting with each other. Concern about picking the "wrong system" has been a hinderance in moving the technology forward. Having the ability to "interoperate" DLT systems mitigates some of these concerns – we have developed an integration solution which establishes a trusted "interoperability node" that sits between the target DLT systems and further enhancements will support multiple platforms and direct transfers between requestors.

   Read more: Connecting Ecosystems: Blockchain Integration

2. **Enabling the ecosystem**
   Blockchain becomes more powerful as the network grows and we have positioned ourselves to convene key stakeholders across the blockchain ecosystem.

   Our ecosystem relationships include enterprises across industries, major tech players (such as Microsoft, IBM, AWS, HPE, Intel), platform vendors, start-ups (including Ripple, R3, Digital Asset, MultiChain), consortia (including Hyperledger, Enterprise Ethereum Alliance, ID2020, Chamber of Digital Commerce, Hashed Health), regulators, governments and academic institutions (including MIT, Blockchain Research Institute and Cambridge University).

   As a leading independent technology organization, Accenture is able to bring the right combination of capabilities to each of our clients' unique challenges – and to provide an innovation framework to scale emerging tech solutions to enterprise strength.

   Read more: Blockchain services, alliances and partners

3. **World class integration and operability**
   Accenture has undertaken practical production deployments of DLT solutions on a global scale and holds a vendor agnostic approach, with the expertise to deliver from a technical and strategic position across all platforms.

   We advise on architectures and solutions that are designed to work seamlessly with existing systems and maximize blockchain's benefits. We also offer a portfolio of plug-in components to enhance flexibility, security and privacy (redaction, HSM, Evaluation Framework).

[1]https://www.linuxfoundation.org/press-release/2016/02/linux-foundations-hyperledger-project-announces-30-founding-members-and-code-proposals-to-advance-blockchain-technology/
[2]https://entethalliance.org/members/

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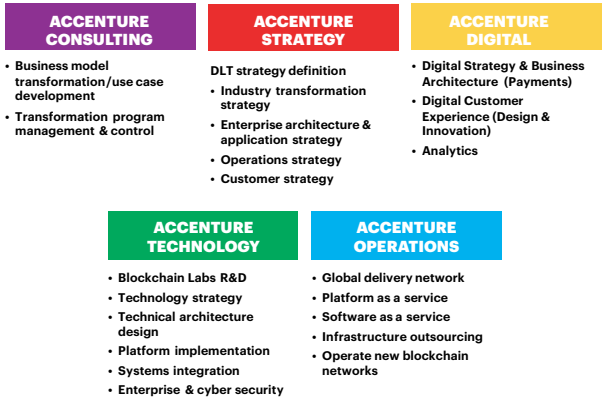
- Accenture DLT Readiness Assessment and Value Exploration (B-RAVE) - Accenture has developed an assessment toolkit to explore the fit of DLT technology to solve business problems and gauge the business value at stake. It is also used to evaluate the readiness of our clients' current enterprise IT environments.
- Accenture DLT Platform Selection Methodology - There are various flavours/options of DLT platforms (private or public, permissioned or permissionless, etc.). A consistent methodology to match functional and non-functional requirements of a network ecosystem to the most well-suited DLT platform is required.
- Accenture Distributed Ledger Reference Architecture - a platform agnostic Distributed Ledger Technology (DLT) Reference Architecture provides guidance and best practices. The DLT reference architecture is part of the wider Accenture Delivery Architecture (ADA v4) framework which is used to guide e.g. the integration into the CSP's legacy estate, exploiting standardization and its natural consequence - TM Forum Open APIs - as a key enabler of digital transformation.
- Accenture have set the gold standard in conjunction with Thales in developing an industrial grade HSM which creates scalable, efficient and highly secure DLT solutions.
- Accenture are utilizing Software Guard Extension and Sawtooth Lake to protect blockchain code and data from disclosure or modification.
- Accenture, in conjunction with a leading Investment Bank, have combined a LightWeight Wallet and HSM device for portable blockchain security.

In summary

Emerging technologies are catalysts for change, offering new business capabilities. Accenture has made Blockchain one of our strategic technology priorities; to make blockchain a reality for our clients, driving end-to-end business transformation across business ecosystems to deliver real value and open up new business growth opportunities.

Our Blockchain team is distributed around the globe, supported by our 5 businesses: underpinning our leadership position in the marketplace.



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We'd be delighted to discuss further!
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About Accenture

Accenture is a leading global professional services company, providing a broad range of services and solutions in strategy, consulting, digital, technology and operations. Combining unmatched experience and specialized skills across more than 40 industries and all business functions—underpinned by the world's largest delivery network Accenture works at the intersection of business and technology to help clients improve their performance and create sustainable value for their stakeholders. With 477,000 people serving clients in more than 120 countries, Accenture drives innovation to improve the way the world works and lives.

Visit us at www.accenture.com/telecoms.

TM Forum toolkit for digital transformation

Agile & Virtualized

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

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

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

Open & Partner Effectively

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

Digital Trust Challenges and Opportunities Standard
This technical report outlines the key concepts of digital trust and identifies the top seven digital trust challenges.

Monetizing the Internet of Everything Guide
This information guide describes a standardized approach and a monetization template for new, innovative services.

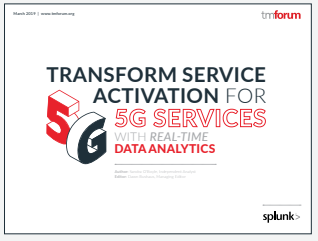
Customer Centricity

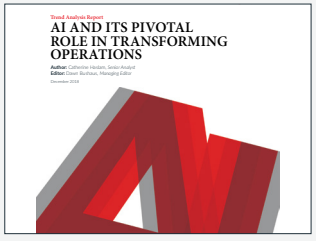
Customer Experience Implementation Suite
This set of tools consists of a guidebook, hundreds of metrics, a maturity model, lifecycle model, ROI model and more than 54 implementation use cases.

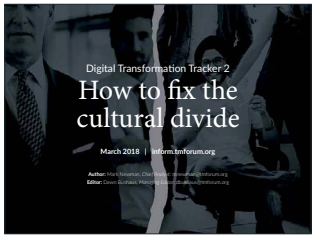
Big Data Analytics Solution Suite
This set of tools includes a big data reference model, a guidebook containing more than 65 use cases and 1700+ pre-defined metrics.

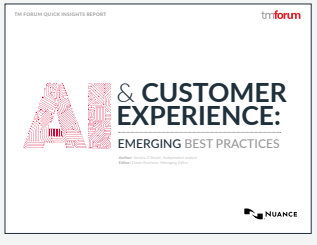
360 Degree View of a Customer
This guidebook offers a 360-degree view of a customer and explains how to put customers at the center of considerations and actions.

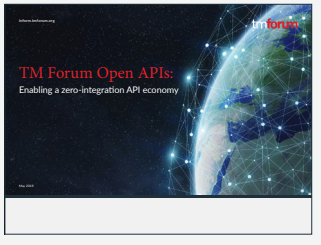
TM Forum research reports







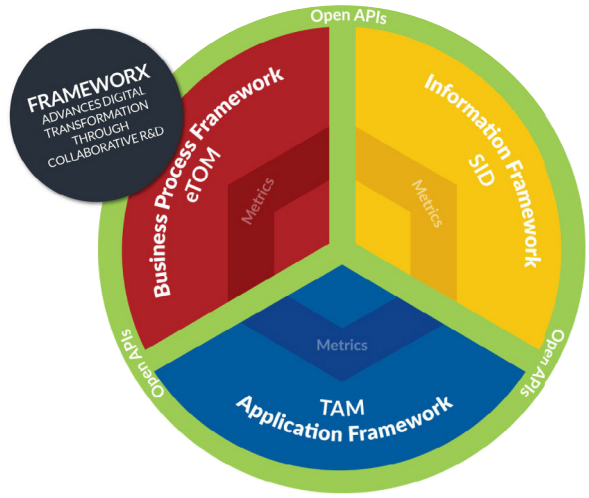




TM Forum Frameworx

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

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



8 things Frameworx can do for you:

1. Reduce transformation risk by delivering a proven blueprint for agile, efficient business operations
2. Innovate and reduce time-to-market with streamlined end-to-end service management
3. Create, deliver and manage enterprise-grade services across a multi-partner ecosystem
4. Improve customer experience and retention using proven processes, metrics and maturity models
5. Optimize business processes to deliver highly efficient, automated operations
6. Reduce integration costs and risk through standardized interfaces and a common information model
7. Gain independence and confidence in your procurement choices through conformance certification and procurement guides
8. Gain clarity by providing a common, industry-standard language

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

6 things you can do with the Business Process Framework:

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

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

5 things you can do with Information Framework:

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

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

5 things you can do with the Application Framework:

1. Streamline procurement by using common definitions and language to specify and evaluate solutions
2. Document and then rationalize your application inventory during transformation projects or mergers and acquisitions
3. Integrate faster and with lower costs by defining and clearly communicating the functions provided within each application
4. Reduce custom development costs with modular, standard application requirements
5. Increase automation and efficiency with standard, deployable components

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

To date, 45 of the world's leading CSPs and technology suppliers have signed the Open API Manifesto publicly demonstrating their endorsement of TM Forum's Open APIs. CSPs that adopt the Open APIs can position them as a preferred requirement in their IT requests for proposal, and technology partners can commit to using the Open APIs in relevant product applications. Together they can unlock many growth opportunities, including dramatically improving business and IT agility, reducing the cost and complexity of operations, and reducing integration cost, risk and time for the entire supply chain.

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

Access the Open APIs | Learn more

Best practices

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

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

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

Access the toolkits

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