Reimagining telecommunications with blockchains

From concept to reality

IBM Institute for Business Value

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Bringing blockchain to telecom

Most communications service providers (CSPs) are in the midst of large digital transformation programs in response to the disruptions plaguing them. Adding blockchain to this equation offers potential to both rationalize a CSP's current operations and develop new blockchain-based services. Moreover, as demands for transparency and trust continue, a robust blockchain foundation can be the springboard for increased ecosystem involvement, enabling new business models for revenue generation. Blockchain's importance is only expected to grow. CSPs should seek a long-term view as they evaluate how blockchain can help drive revenue growth and platform business opportunities, as well as internal efficiencies.

Executive summary

Blockchain is currently one of the most talked-about technologies. Across industries, organizations are exploring blockchain's potential impact in their space and how they can benefit from this emerging technology. The communications service provider (CSP) industry is no exception.

The biggest questions for CSPs, however, are "Where is the bang for the buck?" and "Where and how do we get started?" The good news is the opportunity to benefit appears real. The core attributes of blockchain's shared ledger approach help provide trust, security, transparency and control across the participating ecosystem for all points in a transaction process. This results in the potential for lower costs, faster throughput and improved experiences for all players. According to our recent global consumer survey, CSPs typically are among the most trusted organizations for handling personal data and securing privacy — even exceeding the trust level of financial institutions and governments in some countries.[1] This leaves them well positioned to monetize blockchain.

For the CSP, blockchain opens up the potential for improved efficiencies as well as new revenue growth. IBM's industry model shows the development of two key plays: the customer experience/efficiency play to become digital services providers (DSPs) and the growth play to become digital services enablers (DSEs). (See Figure 1.)[2]

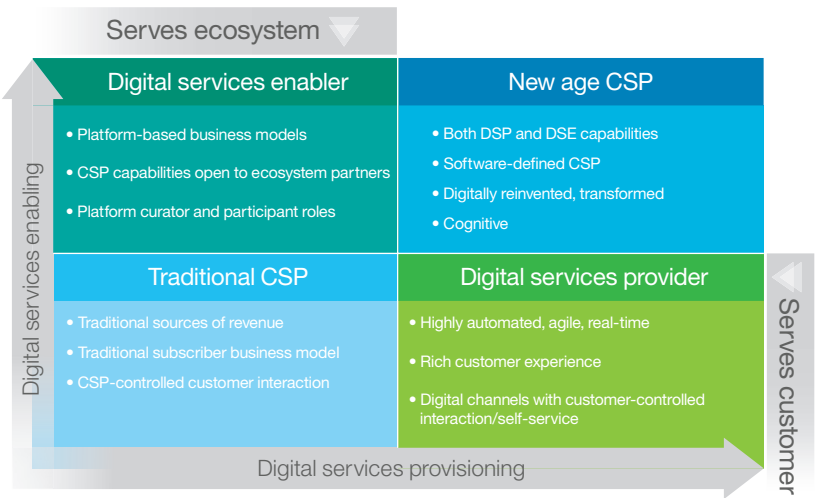
36%
of CSP organizations surveyed are already considering or actively engaged with blockchains

41%
of CSP organizations surveyed said blockchain could support their enterprise strategy by assuring data quality and accuracy

46%
of surveyed CSP organizations already exploring or engaged with blockchain said they invested in it to develop new business models

Figure 1

Blockchain technology provides opportunities to improve efficiencies and grow revenue for CSPs in both the DSP and DSE roles



In the DSP space, multiple opportunities exist for blockchain to help take out cost and improve customer experience, including contract delivery, dispute resolution and supply chain. CSPs can also provide customer services built on blockchain as new sources of revenue (in areas like micropayments and identity management, for example).

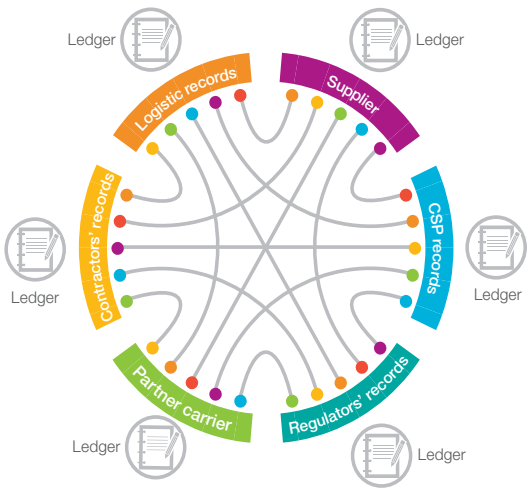
In the DSE space, as CSPs move to create and operate platforms serving ecosystems such as the Internet of Things (IoT), healthcare and managed services, blockchain could become a foundational building block to handle complex transactions across multiple participants. Early stage examples include blockchains for patient health records, advertising sales and media monetization.

To learn more about CSP executives' perspectives on blockchain, we looked at data from the 2017 IBM Institute for Business Value (IBV) C-suite survey of almost 3,000 global executives from 20 industries, including 174 from CSP organizations.[3] (For more information on the research, please see the *Study approach and methodology* section.) We found that 36 percent of CSP executives surveyed indicated they are already considering or actively engaged with blockchains. Though blockchain technology is still young and evolving, many CSP executives expressed confidence in its potential for their organization.

For those organizations already engaged with blockchain, there is a strong focus on its business use cases and outcome potential. Our advice for those in early stages of investigation and adoption is to target real use cases and work with partners to learn where the value lies, as well as how to capture and monetize a clear role in emerging blockchain ecosystems. Ideation sessions focused on DSP and DSE opportunities will help uncover many areas where blockchain could offer an advantage. We do not advocate a technology-led approach given this is still an emerging area and the business advantage of early movers will be lost if years of tech evaluation prevail.

Figure 2

Managing assets across the business network is challenging without blockchain



Thinking blockchain in telecom

In the past couple of years, companies in a variety of industries — including healthcare and banking – have been investigating or deploying blockchain technology. But what's in it for CSPs? What positive impact will blockchains have on existing processes and costs? Will it help create opportunities to generate more revenue and develop new services? And how can blockchains help CSPs better position themselves — as DSPs or DSEs — in a world that is increasingly all about data, customer experience, trust and digital ecosystems?

The relationships between participants — suppliers, regulators, partners, customers and even competitors — in a CSP's business network have become more and more complex. These business networks cross geographic and regulatory boundaries. Value is generated by the flow of products and services across business networks in transactions and contracts. The business network operates by transferring assets between parties. Anything that is capable of being owned or controlled to produce value is an asset.

There are two fundamental types of assets: tangible (a cell phone, for example) and intangible (a service agreement, for example). A shared ledger is key to successfully managing assets across the network (see page 5 sidebar: *The key components of blockchains*). Businesses have multiple ledgers, which are systems of records, for the multiple business networks in which they participate. Ledgers include transactions (an asset transfer onto or off the ledger) and contracts (conditions for a transaction to occur).

The simple example of provisioning a customer contract provides some insight as to how blockchain can benefit all parties. Consider the business network depicted in Figure 2, which illustrates what many CSPs must navigate when dealing with outside plant work in preparation for service to a customer building.

The key components of blockchains

Blockchain technology includes the following components to permit effective collaboration among players in a business network:

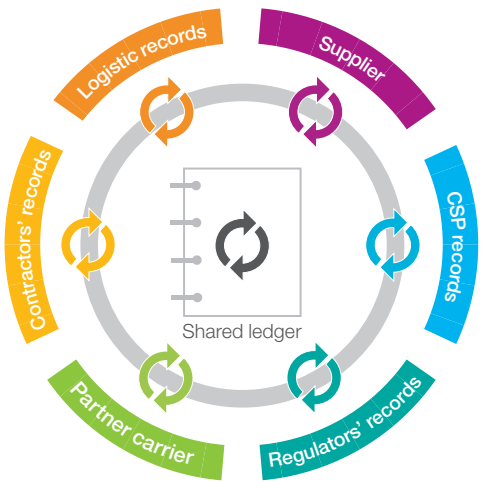
- *Shared ledger* – An append-only distributed system of records shared across the business network that provides transaction visibility to all involved participants.
- *Smart contract* – Business terms embedded in the transaction database and executed with transactions so that the appropriate contracts are executed when a transaction occurs.
- *Privacy* – Transactions are reliable, authenticated and verifiable.
- *Trust* – Transactions are endorsed by relevant participants.
- *Transparency* – All participants in the network are aware of all transactions that impact them.

Each participant keeps one or more ledgers that are updated to represent business transactions as they occur. This is not cost effective nor efficient due to duplication of effort and intermediaries that add margin for services. It is clearly inefficient as the business conditions — the contracts — are duplicated by every network participant. This system is also vulnerable: A central system compromised due to an incident — such as fraud, cyberattack or simply mistakes that create inconsistencies — could affect the entire business network. Consider the same network using blockchain as depicted in Figure 3.

The blockchain architecture enables participants to share a ledger that is updated every time a transaction occurs through peer-to-peer replication. Cryptography is used to help ensure that network participants see only the parts of the ledger relevant to them and that transactions are reliable, authenticated and verifiable. Blockchain also allows the contract for asset transfer to be

Figure 3

Blockchain facilitates asset management across the business network



The key characteristics of blockchains

The blockchain provides the following:

- *Consensus* — All participants agree that a transaction is valid.
- *Provenance* — Participants know where the asset came from and how its ownership has changed over time.
- *Immutability* — No participant can tamper with a transaction once it is complete. If a transaction was in error, a new transaction must be used to reverse the error, with both visible.
- *Finality* — There is one place to determine the ownership of an asset or completion of a transaction. This is the role of the shared ledger.

embedded in the transaction database determining the conditions under which the transaction can occur. Network participants agree how transactions are verified through consensus or similar mechanisms. Oversight, compliance and audit can be part of the same network. The participants are the same as before — in this case, it is not a disintermediation play.

Blockchains can help CSPs operate much more effectively within their business network because they support consensus, provenance, immutability and finality (see sidebar: *The key characteristics of blockchain*). Potential benefits for CSPs include:

- *Time savings* — Transaction time is reduced from days to near instantaneous.
- *Cost removal* — Administrative overhead and cost of intermediaries are reduced or eliminated.
- *Enhanced data quality* — Data accuracy is maintained during all transactions.
- *Reduced risk* — Tampering, fraud and cybercrime are reduced.
- *Increased trust* — Shared processes and recordkeeping are visible to all concerned parties.
- *Reduction/elimination of disputes* — Absolute transparency is established as the process executes.

Some CSPs have already started the journey with blockchain. For example, in 2015, Orange launched its ChainForce initiative to support collaboration between corporate partners and startups exploring new blockchain technology and use cases.[4] Other CSPs exploring and piloting blockchain programs include Verizon and Du.[5] And in 2017, Sprint, SoftBank, Far EasTone and TBCASoft launched a consortium to explore blockchain-based services, inviting other operators to join.[6]

CSP views on blockchain

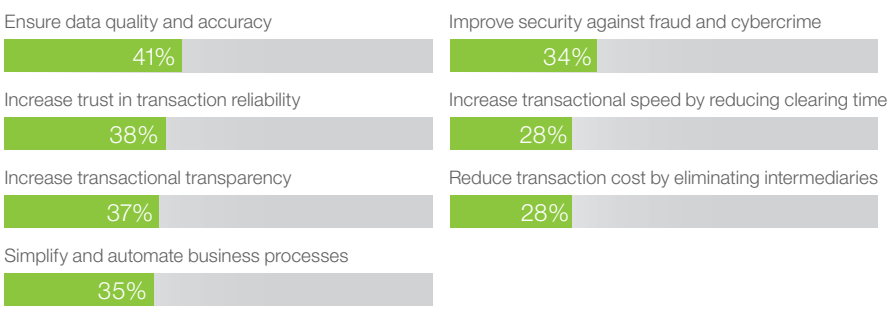
More than one-third of the CSP executives from our study are already considering or actively engaged with blockchains. But what plans do they have for this technology and how do they think it will add value to their organizations?

Selling trust in the world of data

Data is the new natural resource of the digital economy. This resource continues to rapidly grow in volume as the use of smart devices increases and the IoT expands. And thanks to their networks, CSPs are in the middle of all the data transport and transactions. Recognizing the importance of data integrity, CSP executives from our survey expect blockchains to help ensure data quality and accuracy as well as increase trust in transactions from end to end (see Figure 4).

Figure 4

CSPs identified numerous ways that blockchain could support their enterprise strategies

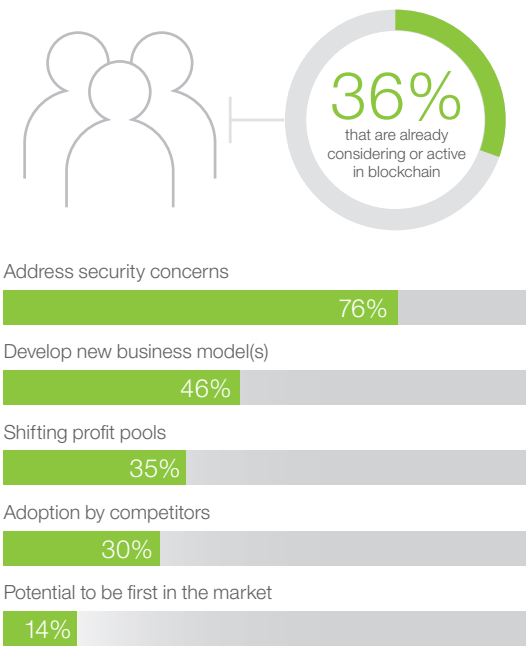


"Blockchain will provide a secure platform, the possibility to omit third-party intermediaries, and security measures against fraud and cybercrime."

CSP CIO from the United States

Figure 5

CSP organizations that are considering or are already engaged with blockchain cited numerous reasons for blockchain investments



Trust is the cornerstone of any type of business transaction. CSPs understand that the key contributing factors that define trust are transparency and security. Respondents said that blockchain technology will support them in their enterprise strategy by increasing transaction reliability (38 percent) and transparency (37 percent), while 34 percent expect blockchains to improve security against fraud and cybercrime.

Thirty-five percent said blockchains will also help them simplify and automate business processes, as a blockchain provides the opportunity to rationalize various aspects of a CSP's operations. According to 28 percent of respondents, blockchains will increase transaction speeds by reducing clearing and settlement time.

Aiming for new platform business models

Cyberattacks are increasingly common – and make headlines globally. As custodians of the networks, CSPs play a pivotal role in fighting the new threats that are emerging. CSPs are expected to support proactive protection against these threats with a range of technical and operational innovations. As such, it's not surprising that 76 percent of CSPs exploring or actively engaged with blockchain cited security as an important reason to invest in the technology (see Figure 5).

Almost half of those exploring or using blockchain (46 percent) see it as an opportunity to develop new business models, and 35 percent view it as a viable way to respond to shifting profit pools. Traditional business models are like pipes, pushing connectivity products and services out to customers; the value chain is linear. New business models are not linear. They require platforms that connect CSPs, partners, developers and consumers to create new value in far less structured ecosystems. According to a recent IBV study on ecosystems,

57 percent of surveyed CSP executives want their organization to become an ecosystem platform provider.[7] Providing blockchain services as part of the platform is an important emerging capability.

Eighty-seven percent of all CSP executives surveyed said that the customer is an important participant affecting their organization's ability to move forward with blockchain technology at commercial scale. This is not surprising since the customer experience should be a key consideration in designing an organization's processes. Four out of five respondents (82 percent) view partnering with technology providers as an important part of developing and delivering real and relevant solutions to the industry. Seventy-six percent said that regulators play a key role since blockchains need to comply with existing and future legislation (like those related to data protection, for example). And 72 percent recognize that industry consortia are important to their blockchain projects as they can facilitate agreements on standards.

Early familiarity with opportunities and challenges associated with blockchains will help CSPs gain advantages in cost savings, revenue growth and new business models. We believe CSPs will see the greatest impact from blockchain in the following three areas:

- *Streamlining internal processes*: Employing blockchain primarily for internal efficiencies within the CSP, including interactions with suppliers and other CSPs
- *Providing services built by CSPs on blockchain*: Services developed for customers and delivered and controlled by CSPs
- *Collaborating in business ecosystems – including the IoT*: Serving each ecosystem participant as a peer and trusted partner.

Streamlining internal processes

The modularity provided by smart contracts enables various aspects of CSPs' operations to be streamlined, which helps make them cheaper and faster, as well as more reliable, scalable and transparent. Blockchain cryptography protects information and creates a fully recorded transaction audit trail.

There are various opportunities for blockchains to streamline internal processes. Implementation of blockchain within the CSP environment will likely have the greatest impact on a CSP's core management systems, such as billing, eSIM provisioning and network function virtualization (NFV) management, where it can help provide cost savings through efficiency gains. Another obvious area for significant cost savings with blockchain is roaming (see sidebar: *Deploying blockchain for roaming*).

Improving supply chain management

Blockchain has triggered a new wave of innovation in supply chain management. Blockchain helps track a multitude of supply chain transactions more reliably and transparently. Each time value changes hands — whether it involves physical products, services or money — the transaction can be documented, creating a traceable permanent history of the product or transaction, from source to ultimate destination.

In telecommunications, supply chain management impacts areas such as wire and cable, handsets, accessories and telecommunications construction for CSPs working with network suppliers, regulators and contractors to effectively track the lifecycle of their assets. Improvement of the end-to-end supply chain across partners can help CSPs improve their speed to market and continuity of product supply, and well as achieve greater flexibility and lower cost structure, which helps increase profitability.

Deploying blockchain for roaming

Today, roaming forces CSPs to integrate high-cost systems and provide complicated access/authentication settings for enabling roaming calls across networks. A blockchain ledger and a smart contract could manage — in a centralized and shared way — roaming subscriber identification, roaming billing, fraud identification and overage management.

Blockchain provides valuable benefits for both CSPs and subscribers. Benefits for CSPs include faster identification of visiting subscribers, prevention of fraudulent traffic and claims reduction. The clearing house could be completely eliminated as an intermediary, which could lead to significant cost savings. And subscribers could gain more control of their bills (no bill shock), an improved experience and increased satisfaction.

We already see examples of blockchain projects in supply chain management emerging in other industries. In a pilot, Walmart, one of world's largest food chains, was able to track a product from a farm all the way to its store shelves. The company expects that the tracking process, which historically has taken days or weeks, could be cut to minutes or even seconds.[8] And Maersk, a global leader in transport and logistics, is piloting a blockchain platform that connects all participants in the transport supply chain.[9]

Another example where blockchain clearly results in improvements is supply chain finance. The complexity and scale of existing supply chain finance solutions have posed major challenges in ensuring adequate funding and efficient operations, as disputes in the supply chain can have serious impacts. In most cases, the dispute resolution process involves three main parties:

- *Suppliers*: Suppliers want to be paid when products are shipped, but there are often many product delivery disputes, which cost time and resources to resolve. These issues sometimes result in higher interest rates and failure to fulfill contracts.
- *Receivers*: When products are not delivered on time, delivered incorrectly or not delivered at all, a dispute is often filed to put payment on hold until the issue is resolved. This, in turn, can result in reduced trust between parties.
- *Financiers*: Financiers need to monitor dispute interactions between partners and suppliers. In the end, they need to recover money financed to partners and, at the same time, keep customer satisfaction high.

A number of case studies have shown that applying blockchain in supply chain finance has the potential to increase control, speed and reliability — and lower costs (see sidebar: *IGF applies blockchain in supply chain financing*).

IGF applies blockchain in supply chain financing[10]

IBM Global Financing (IGF) provides global financing, client financing and global asset recovery services. To manage the network of suppliers and producers, the company adopted a system that utilizes blockchain to improve resolution time for common disputes.

Blockchain was integrated into the existing user interface to deliver enhanced information to both suppliers and business partners. This includes key data regarding shipment status, which significantly reduces proof of delivery disputes. This was accomplished with no code changes to IGF's core commercial financing system by using a shadow ledger approach.

The blockchain approach resulted in faster settlement, generating a reduction in resolution time (from 40 plus days to under 10 days), a reduction in the number of disputes (75 percent decrease), material administrative expense savings for all stakeholders and full end-to-end visibility for each partner.

"With blockchain, we could offer convenience to the users by offering an authenticated identity service for use across devices and organizations."

CSP COO from China

Providing services built on blockchain

The success of digital services cannot be ignored. CSPs transforming into DSPs recognize the opportunity to provide value-added digital services that meet rising customer expectations. But they haven't been able to capture significant value at the scale and speed of digital disruptors.

Today, there are new opportunities in different areas, such as services based on trust. CSPs have a trusted position in dealing with sensitive data, even more so than banks and governments in most economies.[11] In this context, CSPs can provide a variety of customer services built on blockchain. CSPs frequently interact with their customers, have access to vast quantities of data about their customers, and already provide valuable services through mobile, internet and other channels. Adding new services built on blockchain is a natural extension.

Areas in which CSPs should consider deployment of blockchains include micropayments in exchange for digital assets (for example, music, mobile games), mobile money (subscriber-to-subscriber money transfers, international remittance) and more secure handling of electronic health records. In addition, a key area where CSPs should leverage blockchain is identity-as-a-service.

Identity-as-a-service

While CSPs power some of consumers' most technologically advanced devices, the ways CSPs interact with customers — primarily in-store and through call centers — have largely remained unchanged. Online activations for many CSPs remain single-digit percentages — not for lack of interest, but rather lack of reliable, low-risk and convenient digital methods to validate a user's identity.

New digital identity ecosystems are coming, and CSPs should be among the leaders and early adopters (see sidebar: *Why hurry?*). The vast amount of data CSPs possess and the proliferation of smartphones put CSPs in a unique position to act as a source of identity and authentication, bringing new revenue streams. CSPs could provide and manage blockchain-based identity-as-a-service to consumers, not only for use with their provider, but also to identify themselves to other organizations like hospitals and government agencies.

In a blockchain, identity authentication could be applied across devices, apps and organizations, helping consumers reduce the hassle and privacy threat of identifying themselves to government agencies, banks and other businesses. There are no costly discussions with representatives, pictures of driver's licenses to store, lengthy forms to fill out or skill testing questions required. The blockchain's decentralized nature eliminates single points of failure, dramatically improving resilience. As important, it maintains complete privacy for individual users while maintaining convenience and ease of access.

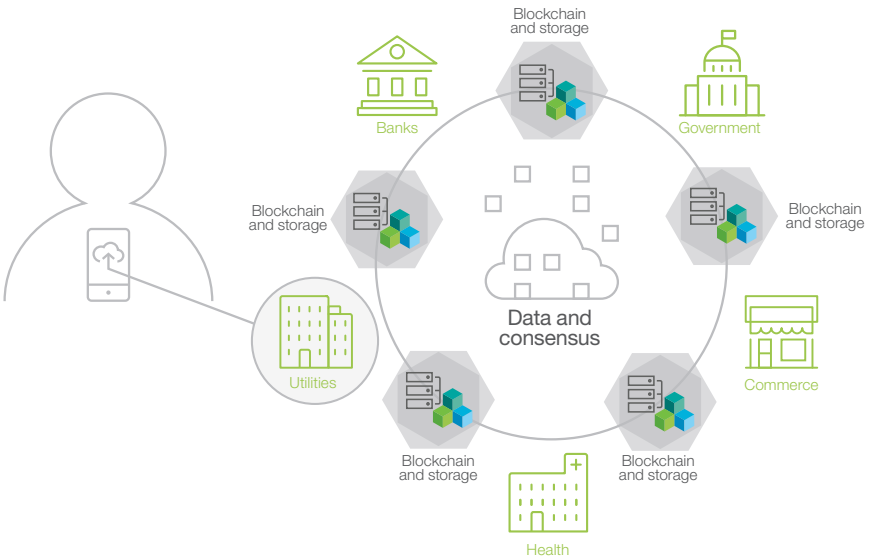
Because providers enjoy a high level of customer trust, they are well positioned to offer such a service. The result is a CSP-verified identity that can be used via a mobile app provided by the CSP (see Figure 6). A user could access all services that require identity verification, such as building access, airline service and smart vehicle use, as well as verify personal documents such as driver's licences and passports.

Why hurry?

Reliable digital identity solutions are critical to enabling the next wave of digital transformation for society as a whole. Many governments are looking to public/private sector partnerships for help, and participants across industries are stepping up. CSPs are in a strong position, having been a reliable enabler for consumers and businesses alike in the digital age thus far. As CSPs face the risk of disintermediation by smartphone manufacturers or operating system (OS) providers, digital identity solutions represent a strong connection back to the customer — and a way to continue delivering value. CSPs need to move now and seize the opportunity to enable strong identity use cases using smartphones — before another party beats them to the punch.

Figure 6

Through an app on their smartphones, users would be able to control what identity information to share



Users would be able to control—right from an app on their smartphone—what identity information they share from the blockchain-stored trusted credentials with the organizations of their choice. Those organizations could then quickly validate user identity to arrange new services.

Collaborating in business ecosystems

CSPs can also use blockchain in digital business ecosystems to handle complex transactions across multiple participants. In this role, the CSP is the trusted partner and deploys blockchain technology to streamline processes and improve trust among the parties. Based on new business models, CSPs can create additional revenue streams.

For example, blockchain could play a role in machine-to-machine (M2M) and IoT environments, where devices connected to the internet automatically interact with each other by collecting and exchanging data. Blockchain and smart contracts could both monitor and orchestrate these interactions. Recognized as a trusted party, CSPs are best placed to accelerate this development to materialize their ambitions in the IoT space.

Blockchain for advertisement sales

The convergence of telecom and media companies has been happening for some time. Numerous mergers and acquisitions have closed or are in process, including Verizon's purchase of Yahoo's web business and AT&T's acquisition of DIRECTV and pending acquisition of Time Warner (under U.S. regulatory review as of November 2017).[12] CSPs are currently working with media content in various ways including creation, distribution and broadcasting.

Advertisement sales are critical to monetizing the media content for CSPs working in the area. The advertisement sales process for media companies is complex and involves multiple players, including ad agencies, broadcasters and advertisers. Successfully managing the entire ad sales process is critical, and blockchain can play an important role.

There are various pain points related to the interactions in the ad sales process (see sidebar: *The ad sales process and its key pain points*). Many of these pain points could be alleviated by moving to a shared collaborative environment using blockchain technology for centralized, consistent and shared information (see Figure 7). In this environment, each player owns a copy

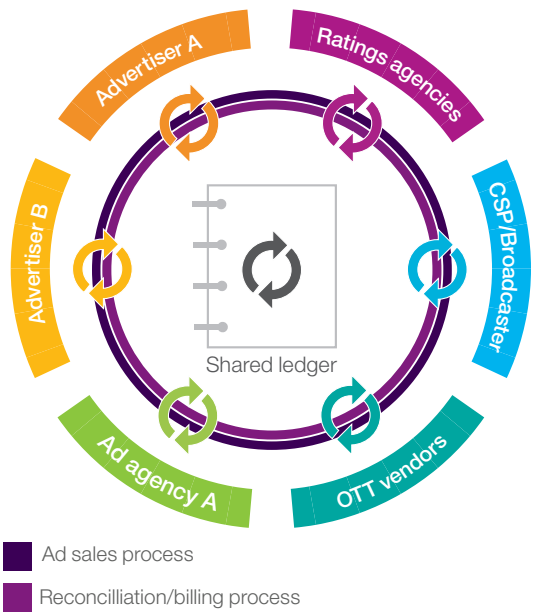
The ad sales process and its key pain points

There are various interconnected players in the ad sales process, including advertisers, ad agencies, over-the-top (OTT) vendors, broadcasters and rating agencies. Process pain points include the following:

- Each player creates and manages bits of information with its own system of record, so obtaining a full end-to-end view is very difficult.
- Manual confirmation is needed between players (for example, operations department confirms spots available to traffic and ad agency confirms invoice to accounts receivable).
- The business rules are decided ex ante but not verified during the process.
- Shared information (for example, placements in orders) might change during the process (for example, ad run placements).
- Manual reconciliation and new consensus-building processes are required at the end of the process.

Figure 7

Pain points related to the ad sales process can be alleviated through blockchain technology



of the shared ledger and has a customized filter of the data available for visualization. Data is consistent across the network and based on shared and approved business rules included in the smart contract. When a change happens along the process, a new block is created to record and reflect the change in the dependent steps of the process, eliminating ex post reconciliation.

There are several benefits that blockchain brings to the ad sales process and its players:

- *Advertisers:* There is increased transparency in advertisement investment for advertisers. Advertisers can get detailed views of demographics, gross rating points (GRPs) of spots that ran and more accurate understanding of the ROI for an advertisement.
- *CSPs/broadcasters:* The inventory management process is more efficient, and inventory is utilized more effectively for CSPs and broadcasters. They can also streamline and accelerate the financial account reconciliation processes among the different parties.
- *Agencies:* Agencies can provide clients reliable ad-spend information, and the billing and invoicing processes can be further streamlined.

Additional benefits for all the parties in the process include increased trust among players, increased customer satisfaction and a simplified account management process.

The way forward

While blockchain technology is still evolving, the opportunity to benefit is real. To move toward reaping benefits, we recommend the following first steps:

- Spend time with a lead partner in blockchain to understand the business models and technologies, as well as understand the early use cases, proof points and emerging solutions.
- Evaluate where the technology stands today, the various blockchain providers and differences between their technology and policy approaches, and the position on standards and regulations appropriate to the country and sphere of business operations.
- Invest in ideation on potential opportunities in both the revenue growth/platform business area and internal efficiencies.

We believe blockchain has a bright future and the potential to change the way CSPs transact with their partners and execute core business processes. The time is now. CSPs need to take the first steps toward building real use cases and applications and, most important, understanding the opportunities blockchain offers.

Are you ready for blockchains?

The following questions can help determine if you are ready to move forward with blockchain:

- How efficient — in terms of transaction time, costs, reliability and auditability — is your company in transferring tangible and intangible assets within the organization or to external parties?
- How much cost could you save if you realized a broad reduction of intermediaries?
- What is the complexity of dispute resolution and how large is the impact of adverse resolution on the business?
- What service or revenue opportunities do you believe blockchain could open for you? Could it offer a new path to growth?
- What role do you like to play in business ecosystems? To what extent do you believe blockchain will be foundational in these ecosystems?

Study approach and methodology

We interviewed 2,965 C-suite executives from over 80 countries, including 174 CSP executives. Information was collected through a combination of live phone interviews and face-to-face meetings conducted from January through March 2017. The study draws input from CEOs, CFOs, CIOs, CMOs, COOs and CHROs.

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Related publications

Fox, Bob, Nick Gurney, Mario Cavestany, and Rob van den Dam. "The trust factor in the cognitive era: How CSPs can capitalize on personal data while preserving privacy." IBM Institute for Business Value. February 2017.

Fox, Bob, Nick Gurney, and Rob van den Dam. "Outthinking disruption in communications: The 2020 CSP in the cognitive era." IBM Institute for Business Value. February 2016.

Berman, Saul, Steve Canepa, Daniel Toole, and Rob van den Dam. "Becoming a 'living' media partner for your consumers: A cognitive future for media and entertainment." IBM Institute for Business Value. September 2017.

For more information

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Notes and sources

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