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Media Backgrounder

Blockchain and Distributed Ledger Technologies

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It might come as a surprise that, despite all the hype around blockchain, CIOs do not yet consider it a business priority. According to industry [analyst David Furlonger at Gartner Symposium/ITxpo](#), only one in 20 rated it as a game changer for their organizations in the Gartner 2019 CIO survey. What is more, only 11 percent of CIOs said they have deployed or will deploy blockchain in the next twelve months.

However, these downbeat results probably represent "peak disenchantment" for blockchain and the wider group of technologies around it, usually called Distributed Ledger Technology (DLT). It is now clear that a wave of disruption is about to be unleashed by DLTs that will transform entire supply chains across agriculture, manufacturing, transport and logistics, wholesaling, retailing, and the way governments interact with citizens. The far-reaching consequences predicted when blockchain first emerged are now coming into view. In short, blockchain has progressed rapidly through the technology hype cycle, with tangible use cases now starting to proliferate.

One powerful example is how Fujitsu and [Rice Exchange](#) (Ricex) are bringing to market the world's first global blockchain-based rice trading platform. This brings unparalleled security, transparency, efficiency, traceability and new levels trust to the $450 billion global rice market. Ricex is the first digital platform designed for buying and selling rice, the world's largest agricultural commodity. It digitalizes rice trading using a DLT platform. Through this, buyers, sellers and service providers can easily find each other in a digital environment, efficiently conduct trades, and arrange insurance, shipping, inspection and settlement with the assurance of seamless integration and verifiable data.

The blockchain bottleneck
What has been holding Blockchain and DLT back is a combination of over-inflated expectations – standard procedure with most new technologies, of course, but especially pronounced in this case. Until recently, there was a lack of use cases offering a clear economic return, combined with the typical skills shortages you expect for any emerging technology. Vendors too must take their share of the blame, especially those who recommended DLT as the solution to any challenge that came into view – even where much simpler approaches were available.

As Fujitsu has long predicted, what is enabling the new forward momentum is a new, pragmatic emphasis on leveraging DLT technology to optimize efficiency and use it in those business processes where it makes sense. This comes across clearly during conversations with customers, who are starting to understand the benefits of the underlying technical principles. Discussions today are, as they should be, 80 percent about business benefits and only 20 percent about the actual technology stack. Looked at in this way, it often becomes clear that there are quicker, smarter solutions than blockchain – and as a results-focused solutions provider, Fujitsu always points customers to the best option.

What are the business benefits?
One of the paradoxes of DLT is that it is so different from what currently exists, so potentially revolutionary, that proponents have sometimes struggled to come up with a clear, easy-to-grasp list of use cases.

The core benefit of DLT is it creates trust between parties to conduct transactions – even when they don't know each other's identities. Indeed, it is said to provide trustworthiness like – or even better than – traditional ledgers (see **Blockchain: The Basics**, below).

In the case of Ricex, a DLT platform injects new levels of trust and efficiency into the highly fragmented international rice trade. It creates verified, immutable data for all stakeholders, such as traders, shippers, inspectors, insurers, regulators and payment system operators. The use of a distributed ledger removes friction and delays in the supply chain, ensuring security and transparency in international rice trades by allowing all stakeholders to see the same verifiable data, in real-time. It also allows buyers to search for rice that has been certified as sustainably grown. This gives buyers certainty about the provenance of the rice and in turn allows producers to charge a premium for their product.

For the CEO of a startup, like Ricex, DLT offers the ability to "rip up" the conventional way of doing things and completely re-engineer and automate processes and relationships. This is not only a matter of radical differentiation for a new player, it also enables friction to be driven out of the model to reduce or eliminate costs, with disintermediation often playing a primary role here. Security and accessibility – not usually the best bed-fellows – can both be guaranteed, as can traceability and auditability, with profound implications for regulation and governance.

For a CEO in an existing organization, the benefits might look similar, but the motivation can be different; probably a pre-emptive defensive move to avoid the pain of a disruptive new entrant.

Fertile ground for a DLT use case is likely to be found wherever there are complex supply chains or interrelationships – for example within the telco space where split revenues and cross-charging, often cross-border and overseen by powerful regulators, puts trust and transparency at a premium.

Line of Business users can cover an extremely diverse range of possibilities:

- CISOs seeking greater security alongside better accessibility for users
- Quality managers and brand managers who need absolute assurance that the products they are making and selling contain the specific ingredient characteristics (organic, carbon-neutral, line-caught, FTC-certified, palm-oil-free, etc.)
- Supply chain managers wanting improved service from total transparency and automated transactions
- CFOs demanding an end to invoice fraud and the ability to create automated and 100% verifiable audit trails
- Procurement managers needing reassurance about the origin of raw and processed materials
- Logistics managers scratching their heads over how to drive out the inefficiencies inherent in a global or regional array of suppliers
- Human resources managers wondering how to link performance incentives more clearly to KPIs
- Partner managers wanting greater transparency across an ecosystem as well as clearer actions performance accountability

How Fujitsu helps customers extract value from DLT – rapid co-creation and Blockchain as-a-Service
Fujitsu has one of the most complete blockchain capabilities in the market. This wealth of skills, experience and technology translates into faster time to market for customers – often the crucial factor in use cases.

Fujitsu's approach to working with customers on DLT stands on the core principles of co-creation of business-aligned solutions, rapid productization and leveraging as-a-service platforms and offerings, when these are appropriate.

Fujitsu believes any workable solution has to be rooted in the real needs of an organization and focused on business outcomes. This cannot be achieved with black-box solutions imposed by vendors, but has to be the product of shared input, often across a wider ecosystem than just the customer and a vendor. Fujitsu has a genuine commitment to co-

creation, has invested in a global network of [Digital Transformation Centers](#) to foster co-creation, triggered by its [Fujitsu Human Centric Experience Design](#) (HXD) methodology.

Another reason for the increasing adoption of DLT is the support now available to enterprises from Fujitsu for blockchain-as-a-service platforms and proof of business rapid-prototyping frameworks. Except when working in a greenfield situation (which is highly unlikely for existing businesses), blockchain and DLT solutions are currently a supplementary platform, not an end-to-end solution: integration with existing business fabric is an obligation often ignored by the blockchain purists.

Fujitsu offers an extremely rapid blockchain productization framework, from its [Blockchain Innovation Center](#) in Brussels, Belgium – with its promise of a Minimum Viable Product (MVP) in just five days. The goal is to create the potential to jump-start new blockchain development, or to de-risk existing blockchain projects. As a preliminary step before committing to a full project, this approach avoids many of the common pitfalls of blockchain projects and focuses on creating business value prior to engaging larger resources.

Getting to benefits faster is one advantage of Blockchain-as-a-Service (BaaS). It reduces the number of hurdles to be jumped to get to the benefits and creates acceleration that really does facilitate adoption and rapid prototyping.

The new [Fujitsu Flow suite of BaaS offerings](#) is a practical example how this works. The first offering in the suite is Fujitsu InvoiceFlow. This enables enterprises and government agencies to avoid - and frequently eliminate – the very real issue of accidental data error and the increasing problem of invoice fraud. Procurement fraud is estimated to cost UK business alone £127 billion a year, with the use of so-called "crime-as-a-service" gangs on the rise – where an invoice scam can be set up in less than a day, with cyber-criminals accepting a percentage of the gains as their fee. Fujitsu InvoiceFlow eliminates the threat of scams by cryptographically joining a buyer's purchase order, any related payments and all related invoice data from the seller, together for the entire lifecycle of the account.

Recently the news was full of stories about [a scammer who netted a total of $122m from Facebook and Google](#), simply by sending false invoices. This is something that InvoiceFlow can help prevent from happening.

Alongside InvoiceFlow is the new fraud-busting DocumentFlow, an easy-to-use web-based application using blockchain technology to track the validity of any digital file or asset, including documents, audio and video files, images and files from almost any application. Fujitsu DocumentFlow drastically reduces instances of document fraud or piracy, as it can track where a digital file is manipulated, unlawfully copied or simply to check that an asset is the latest and agreed version. The technology works on any digital file type, providing a clear audit trail to validate anything from a university graduation certificate to an engineering drawing file. It can immediately flag and label any alterations, and help trace distribution and changes to copyrighted or protected corporate and governmental materials via an immutable audit log, which also facilitates verifications and audits.

Using cloud-native applications or platforms removes complexity from the underlying ledger platform, lowers risk and makes implementation easier. For example, Fujitsu is working with a large manufacturer on a rapid Proof of Business (PoB) productization framework using BaaS to accelerate the POB itself, with Fujitsu able to provision the platform in just minutes during a preparatory meeting.

Blockchain: The Basics
Blockchain is a database infrastructure, originally designed for the crypto-currency Bitcoin as an alternative to traditional government-guaranteed money and bank-controlled payments. What makes this technology special is that the data is not held in a single, central place (a ledger), but is multiplied and stored across a distributed network of nodes (ledgers).

This data distribution is the foundation and strength of blockchain technology, as it enables trusted information storage without a central controlling body (or trusted third party often referred to as an 'authority'). What creates the trust in this structure is that new transactions are sent to the blockchain, where they are encrypted before being sent

to every node for validation and, once validated, stored in blockchain building blocks. Every new block is linked by cryptography (hash tree) to the previous block (which, in turn, is securely attached to its predecessor block).

These attributes make the chain immutable and highly transparent: any change in a block entails change in every subsequent block on every node and no single organization can control access to data. DDoS or similar attacks are unlikely as no single point of attack exists. The fact that every node stores part of any transaction guarantees accessibility and reliability of data, which inevitably leads to a high degree of trust in the information stored in a blockchain.

The high transparency and reliability of DLT also suits technologies such as the Internet of Things (IoT), where large volumes of data need to be shared outside the business – a trend, which will only grow as companies increasingly work closely within entire ecosystems. The exchange of information also brings security concerns. However, the nature of DLT makes it well suited to handling these types of transactions. By using a distributed network and software with appropriate algorithms, it is possible to build a data exchange network across multiple organizations and enable all participants to share data safely and rapidly.

As well as greater trust and security, DLT transactions also hold the potential to include a high degree of process automation and to produce an automated, trustworthy audit trail. If implemented, this will improve business process efficiency and drive simplicity for new client services. However, not all DLTs have been created with automation capabilities.

The difference between permissioned and permissionless DLTs
DLT operates in two different modes, depending on its planned application. This can be 'permissionless' (or public), which has no governance, assumes no trust between the participants and where anyone can participate at any time. On the other hand, 'permissioned' DLTs include governance, impose restrictions who can perform various actions on the blockchain, assume some level of trust and are potentially more useful for many business applications. The choice of permissionless or permissioned DLTs governs every aspect of their constitution – from liabilities, operational risk, cost, and speed to business processes.

There has been much debate about the validity of permissionless and permissioned applications. Some people refused to recognize permissioned models since they considered them to be just shared or common ledgers. However, permissioned models are now finding their way into the overall business landscape, encouraged by regulators and compliancy requirements in the financial sector, where there are obligations related to Anti-Money Laundering and Know Your Customer, and by business operators who have to know who they are working with in the event of liability claims.

Alternative DLT platforms
There is a trend away from the initial use of blockchain as cryptocurrencies into areas such as real estate and supply chains, where automation and wholly reliable audit trails are crucial.

The other key trend in the evolution of DLT is towards faster processing of transactions. Since Bitcoin is permissionless and the consensus of anonymous transactions is based on the Proof of Work (PoW), verification of each transaction takes at least 10 minutes, and often significantly longer. Even without this bottleneck, the maximum transaction rate achievable with Bitcoin would be around seven transactions per second.

This limitation of Bitcoin has spurred numerous developments of DLTs, such as Ethereum and Ripple. Here, faster transaction rates, as well as more diversified applications, have been key drivers. Fujitsu participates as a Premier member and a technical steering committee member of the [Hyperledger](#) blockchain technology, managed by the Linux Foundation. Because Hyperledger is a permissioned network, all participants are known. This simplifies the consensus mechanism significantly, allowing the maximum transaction rate to go beyond 1,000 per second, which makes it more suitable for enterprise use.

The aim of Hyperledger Fabric is to build a DLT platform for all industries with functions for enterprise use. It incorporates automation through flexible smart contracts and has been designed to work with multiple utilities and tools, the programming languages Go and Java for example, for high efficiency development and subsequent ease of maintenance. Automation, which is a key differentiator in Hyperledger Fabric, is implemented through Chaincode, a smart contract written in Go that typically handles business logic agreed to by members of the network.

The combination of advantages inherent with Hyperledger Fabric, including greater intrinsic trust, additional security, the possibility of smart contract automation, machine-to-machine communication and self-executing code, to name just some, makes it a more viable basis for building new, monetizable business models.

There are also other so-called 'next generation blockchain' approaches being taken in DLTs with adaptations of the core blockchain concept, such as IOTA, which is based on a network of nodes (as opposed to a chain) known as the 'Tangle'.

The Fujitsu Enterprise Blockchain
DLT can only reach its full potential if it is combined with smart contracts (i.e. chaincode in Hyperledger) and automation (artificial intelligence, Robotic Process Automation, etc.). This is where Fujitsu's expertise comes to the fore, working alongside customers to co-create solutions that deliver the most business value and contribute to their ongoing digital transformation.

The Fujitsu vision for blockchain goes much further than this, however, and Fujitsu is focused on building on the advantages of Hyperledger Fabric to create an enterprise-class blockchain framework. Rather than expecting enterprises to build their own end-to-end blockchain capability, Fujitsu provides the Enterprise Blockchain capabilities via the common cloud platforms such as Microsoft Azure and AWS, including development, monitoring and operational services. Unlike solutions being put in place by other vendors, which require the user to develop their own smart contract capability and to ensure data security before they can develop any apps, the Fujitsu architecture builds-in these aspects, allowing users to focus immediately on the differentiation of their offering via app development.

To help users adapt easily to Hyperledger, Fujitsu offers functions, such as a data management, to control user and business access to the service, plus a member management function to register participants on to the service and form a permissioned network.
Fujitsu has also enhanced the native security in Hyperledger Fabric with a data-concealing function and a restriction technology. The data-concealing function ensures data privacy and security by enabling some or all data from other participants to be hidden, while the restriction technology allows restriction policies over which transactions are allowed.

Further key Fujitsu DLT achievements

- A delegation of the Blockchain Innovation Center in Brussels, focusing on financial service customers, operates in Spain, providing access to skilled developers and solution architects for co-creation projects
- Fujitsu and Sony Global Education have initiated blockchain field trials for course records and transcript management to evaluate the usefulness of blockchain technology in the management of course records and grade data. The trial is being conducted in collaboration with Human Academy Co., Ltd., an educational institution that accepts and teaches foreign students
- Fujitsu Limited and Fujitsu Laboratories Ltd. are applying blockchain technology to develop a system for trading related to energy shortages and surpluses among electricity consumers, including factories and retail stores
- Fujitsu Laboratories Ltd. has developed a digital identity exchange technology that makes it possible for individual users and service businesses involved in online transactions to confirm the identity of other parties in transactions. The technology is based on a Decentralized Identification (DID) utilizing blockchain that analyzes the risk of falsification and the trustworthiness of the other party's personal credentials when a user conducts a transaction online

- The [Fujitsu Intelligent Society Solution Blockchain Asset Service](#) is a cloud service that provides retail mechanisms, such as digital points, stamps and coupons, which can be used for a limited time in specified areas including tourist sites, markets, and shopping centers, using blockchain technology. With this service, users can collect digital points or stamps by reading QR codes located in specific areas with smart devices, and then exchange them for coupons and other benefits that can be used in stores and shopping centers within the specified area
- Fujitsu Laboratories have developed [software designed to create secure data exchange networks](#). With the proprietary data access control technology it has developed, Fujitsu aims to promote data exchange between organizations and across industries
- Fujitsu has developed technology that automates risk detection in order to [improve the safety of smart contracts](#)
- Fujitsu Laboratories have also developed two technologies that [enable secure transactions on blockchain](#)
- Fujitsu has also been engaged to deliver a pilot project with three major Japanese banks (Mizuho Financial Group, Sumitomo Mitsui Financial Group and Mitsubishi UFJ Financial Group) to field trial a cloud-based blockchain platform for sending funds between individuals, as well as a smartphone app to increase the usability of the system. The pilot builds on a successful joint trial held in March 2016 by Fujitsu and Mizuho bank to test a blockchain based cross-border securities transactions solution – the result of this trial was a significant reduction in post-trade processing times
- The Japanese bank pilot also extends a [partnership with the Japanese Bankers Association](#) (JBA) that will see Fujitsu build a blockchain platform, built on the open-source Hyperledger Fabric code base that individual banks within the JBA's ranks can then use to test various business use cases
- Fujitsu Spain is a member of the <u>Alastria consortium</u>, the world's first regulated national network based on blockchain, made up of about 70 of Spain's largest companies and institutions. This non-profit consortium is developing a DLT to become the new data exchange ecosystem in Spain by providing a common collaborative platform. Among its founders are notaries and lawyers who will ensure the security and veracity of information
- Fujitsu is also a member of the Blockchain Research Institute, led by management thinker Don Tapscott, and has joined the Alastria network (Alastria.io) in Spain alongside the country's 70 largest companies
- In July 2017, Fujitsu [announced the development of technology that accelerates the framework's transaction processing](#)
- Fujitsu is a board member of the Bitkom (German Federal Association for Information Technology) working group on blockchain, which is investigating blockchain technology and its impact on digital business processes. The working group is cross-sectoral, looking at technological, legal, social and business perspective, including the potential impact of technology on contracts, how organizations operate in markets, and how transaction mechanisms evolve

Online resources
- [Fujitsu Whitepaper: Blockchain – The Opportunity Beyond the Hype](#)
- Read the Fujitsu [blog: http://blog.ts.fujitsu.com/](http://blog.ts.fujitsu.com/)
- Follow Fujitsu on Twitter: http://www.twitter.com/Fujitsu_Global
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