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Fujitsu EMEIA Blockchain Innovation Center

Brochure: Proof of Business: Use Case Architecture Deep Dive

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Dear Customer,

If there is one Business and IT subject that is hot (and not only in the financial world), it is without doubt Blockchain and Distributed Ledger Technology (DLT). Not unlike at some point in time 'Cloud', the term Blockchain is fast becoming a cure-all capable of solving all the problems of banks, industries and governments.

However, most businesses participants and their advisors have yet to fully understand their real Use Case and utility. Next to having the potential to drive simplicity and efficiency by the development of new services types and (business) processes DLT applications will always require deep collaboration between incumbents, innovators and regulators, potentially adding complexity and delaying implementation.

It should be clear that Blockchain is not a magic potion; instead, it is just one of many technologies that will form the foundation of next-generation services infrastructure. In the end, even though not unique, it is forcing us again to rethink, change, innovate and co-create.

The Basics

Blockchain is a logical and technical mechanism for reaching consensus regarding the state of a shared ledger between an unknown number of parties (permissionless) or known number (permissioned) who do not trust each other without the presence of an 'enforcer of trust' (central authority).

Permissionless Blockchains allow anyone to participate and are most commonly used in cryptocurrencies. They assume no trust between participants. Permissioned Blockchains restrict access in terms of who can perform various actions on the Blockchain. They assume some levels of trust, and are potentially more useful for many business applications than permissionless Blockchains.

An important topic amongst these applications is Smart Contracts. Smart Contracts are coded instructions (typically event driven) on the ledger that execute the specific terms and conditions that exist in contract between parties. Under typical (current) circumstances, these parties will usually be individuals, corporations, governmental agencies or other entities with a clear legal personality. It is however possible to create sophisticated code that is much more automated and self-executing by creating even smarter contracts.

As we have already observed in some emerging endeavors, we may see the creation of autonomous parties (Decentralized Autonomous Organization; DAO) including even IoT (Internet of Things) devices executing into Smart Contracts without human intervention.

Making it Real

Blockchain and Distributed Ledger technologies are heralding new business models, requiring an application assessment approach that considers the necessary capabilities and processes to enable effective digital business transformation. It is clear that the complexity and the rapidly evolving technology and digital business landscape are not always facilitating setting up an internal project. If you have already taken the next step however still unsure about the viability and production readiness of your Use Case, Fujitsu recommends doing a Proof of Business Use Case Architecture Deep Dive exercise as defined in this document. We are ready to support you and co-create the next step in this journey.

Frederik De Breuck
Presales Director BeLux and Head of the EMEIA Blockchain Innovation Center

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Primary question driving Blockchain Technology is ‘do I trust that the data I am using is good and I can rely on it to assess my risk?’

Why the need to do a Proof of Business Use Case Architecture Deep Dive?

The target audience of this ‘Proof of Business: Use Case Architecture Deep Dive’ are companies that have already started to discover the possibilities and have created either in code or on paper their use case. The ‘Proof of Business: Use Case Architecture Deep Dive’ goes deeper in the assessment of a Use Case than the ‘Proof of Business Assessment in a week’

A Proof of Concept is a technical exercise to demonstrate that your idea is operationally feasible is mostly used to garner support from internal stakeholders however will in most cases not be seen by potential customers. A Proof of Business goes deeper and further than a proof of concept (PoC), it focuses on the business value including possible external stakeholders and enterprise fabric of a company.

If you already have a Use Case and have done development activities (maybe even done a PoC), however you remain unsure about your overall architecture, created codes (smart contracts) and the business landscape you want your Use Case to operate in, another few steps are required.

This is why Fujitsu recommends doing a ‘Proof of Business: Use Case Architecture Deep Dive’. This service covers the overall architecture, the business and legal context, identified risks, the code and is conducted Fujitsu experts who have significant experience in the different projects in the market.

The ‘Proof of Business: Use Case Architecture Deep Dive’ is therefore best suited to validate whether your Use Case is an appropriate solution and is production-ready.

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Proof of Business: Use Case Architecture Deep Dive: the Steps

The Deep Dive

The 'Proof of Business: Use Case Architecture Deep Dive' provides a comprehensive approach for understanding exposures, and focus on application components from the early design stages through possible production deployment. The Fujitsu Experts analyze the business challenges along with application development practices to pinpoint the organization's most critical areas in the area of Blockchain and Distributed Ledger Technology Use Case.

This service comprehensively reviews your Use Case estate and provides the necessary insight you need to support your decision making process. Fujitsu provides the advisory services and techniques to identify flaws, pitfalls and potential risks for the Use Case. The experts provide tactical and strategic guidance to reduce the overall risk and improve the production-readiness of your Use Case.

The ultimate goal of the assessment is to gather insights on the created and developed Use Case (in the various stages) and give customers the confidence to take the next steps, possibly in co-creation with a company like Fujitsu. The base service 'Proof of Business: Use Case Architecture Deep Dive' has typically an assumed lead time of (10) days organized in a 'sprint'. The service is available for the Ethereum and Hyperledger Fabric Platform. Other platforms are available on request.

Important note: The assessment can take longer if during the first day and during the first analysis the code or architecture is proven to be of a high complexity or the Use Case and/or the relevant Code is insufficiently or not documented. At the end of the first day a status meeting is conducted to jointly agree on the way forward. If no consensus can be reached, only the already preformed efforts are invoiced.

The following steps are included in the basic 'Proof of Business: Use Case Architecture Deep Dive'

Step	Description
Application Architecture Assessment	Identifies critical architectural vulnerabilities and attention points in your Blockchain and Distributed Ledger Technology Use Case in order to reduce the impact and cost of the design decisions taken or that are still to be taken.
Business Architecture Assessment	Identifies and focuses on providing the involved stakeholders with clear insights on the potential risks or gaps in the Business model related to the selected Use Case
Smart Contract and Frontend Code Assessment	Provides a point-in-time analysis of the Smart Contract code, using real-world application examples and best practices. Fujitsu Experts will investigate both structure (How is it put together?) and behavior (What does it do?). The outcome characterizes your code's maintainability and alignment with business goals. The analysis provides feedback and recommendations.
Accelerator Advisory Service	In the context of the 'Proof of Business: Use Case Architecture Deep Dive', the emphasis of the Accelerator Advisory Services is on rapid growth and accelerating the Use Case (post assessment), and support customers to sort out organizational,

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Step	Description
	architectural, operational and strategic difficulties that the business might be facing in the context of the Use Case. It can be understood as a more holistic business advisory service, bearing some resemblance to traditional management consulting practices, however adjusted and focused on the Use Case at hand and the consequences for the Organization and its ecosystem (nodes, parties, etc.; post assessment). This part of the Service is optional and on a Time and Material basis.

The Approach in Practice

In practice, the 'Proof of Business: Use Case Architecture Deep Dive' includes four key steps:

1. The Workshop
2. The Research and Assessment Phase
3. The Report Preparation
4. The Result Presentation

The Workshop

The goal of the workshop is to understand the Use Case in detail and confirm the next steps conducted during the Research and Assessment Phase.

It is imperative that all information related to the selected Use Case are collected in an orderly and transparent fashion, summarized and given to the person leading the Assessment. Full access to the Architects, Business Owner, Application Developer(s) or the Application Administrator is considered a critical success factor for this workshop. The document stack of the 'Proof of Business: Use Case Architecture Deep Dive' includes a Non-disclosure Agreement (NDA) protecting both the customer and Fujitsu. If required, after the assessment the base data can be destroyed on request with a formal confirmation by Fujitsu of the destruction of the data.

The Research and Assessment Phase

After collecting all possible information about the Use Case and conducting the Workshop that has enabled the Fujitsu experts to understand the Use Case.

The following assessments are included:

- Application Architecture Assessment;
- Business Architecture Assessment;
- Smart Contract and Frontend Code Assessment.

The following assessments are not included by default:

- Accelerator Advisory Services.

Unless the complexity has forced a different direction, these assessments are conducted in two five-day sprints.

The work is done based on the collected information and the analysis of the evidence.

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The Report Preparation

The findings of all the assessments are consolidated into a Management Report, which contains high-level design and sizing recommendations for the Use Case. The report is presented back to you to ensure all aspects of the report are fully understood during the last step.

The Assessment report is typically available two weeks after the last day in the aforementioned sprint

The Result Presentation

The Result Presentation is conducted remotely unless otherwise agreed on a mutually agreed data after the publication of the report.

Overview of a Typical Timeline

WEEK 1	DAY 1	DAY 2 – DAY 5
	The goal of the workshop is to understand the Use Case in detail and confirm the next steps conducted during the Research and Assessment Phase.	▪ Application Architecture Assessment; ▪ Business Architecture Assessment; ▪ Smart Contract and Frontend Code Assessment; ▪ Daily Scrum Meeting 30 min conference call; ▪ On the 5th day a meeting is planned to deep dive in any blockers or next steps.
WEEK 2	DAY 1 – DAY 5	
	▪ Application Architecture Assessment; ▪ Business Architecture Assessment; ▪ Smart Contract and Frontend Code Assessment; ▪ Daily Scrum Meeting 30 min conference call; ▪ On the 5th day a meeting is planned to deep dive in any final blockers and present a number of draft conclusions.	
WEEK 2 CLOSING + 2 WEEKS		
	The findings of all the assessments are consolidated into a Management Report, which contains high-level design and sizing recommendations for the Use Case.	
AGREED DATE		
	The Result Presentation is conducted remotely unless otherwise agreed on a mutually agreed data after the publication of the report.	

Fujitsu uses insights gathered during various implementations and projects to highlight the common pitfalls and offer solutions and recommendations.

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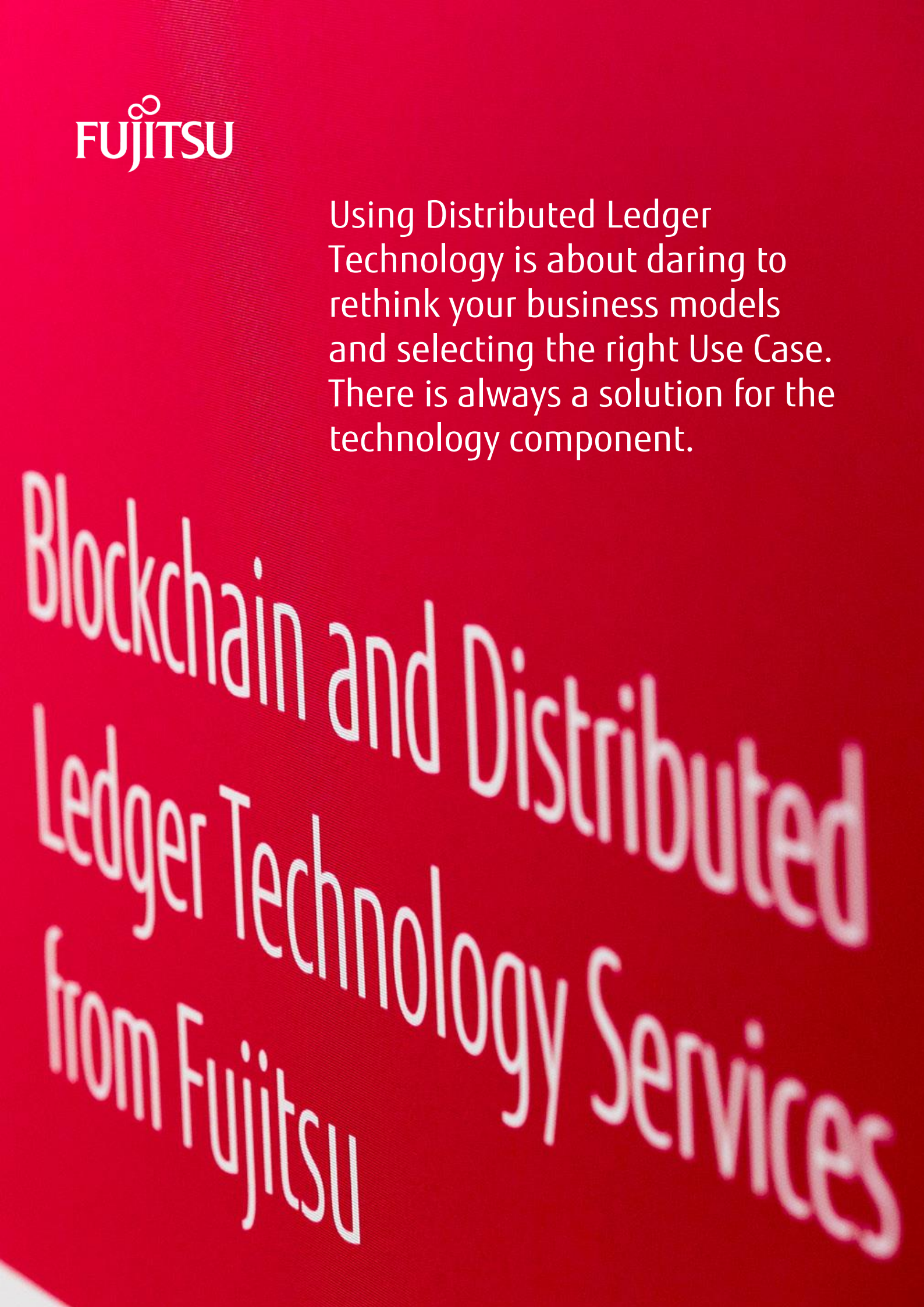
Using Distributed Ledger Technology is about daring to rethink your business models and selecting the right Use Case. There is always a solution for the technology component.



Asking the right questions

In any assessment, Fujitsu focuses not only on the technology components, as it is clear that within Distributed Ledger Technology the complexity primarily sits in the selection of the Use Case and the implementation scenarios. Focusing on the technology is a mistake and heralds potential failure. The focal point must be the implementation answering a few key questions outlined below:

1. What is the value created by optimization via Distributed Ledger Technology?
2. Are there new and sustainable business opportunities emerging from the assessment or your thinking journey?
3. Is there a real business case either in cost optimization, efficiency or adjusted business models or all of the above?
4. Have you sufficiently focused on non-technical elements including: Decision and Process Modelling, Business (re-)engineering, Use Cases Interaction, Enterprise Ontology, Adoption?
5. How will regulatory and compliancy issues be addressed?
6. Are all stakeholders (internal, participants, authorities, etc.) on board (in- and outside the company) and is the right governance in place?

The above questions are a subset of the questions used during any assessment. We use them during the journey we take together.

Co-creating

At Fujitsu, Co-creating is part of our DNA. It helps you and us to harness the power of collaboration to deliver your unique digital transformation by driving ideation. The Co-creating Programs have been developed over decades of experience in Japan and around the world; working with customers, exchanging perspectives, ideas, and information in a highly focused and innovative way. The approach is driven by our Human Centric Experience Design (HXD). It's done at speed to focus people's minds. It enables four key things:

1. Understand your business challenge within the context of your strategy;
2. Look at the issues through different lenses;
3. Combine business and technology expertise to develop rapid outline concepts;
4. Develop joint working plan for immediate experimentation.

The point is to create a powerful vision from four critical ingredients:

1. People – Combine the right skills and expertise from diverse backgrounds;
2. Purpose – Formulate a formal, strong purpose that is understood by all and relentlessly pursued. It must be of strategic importance to your business;
3. Outcome – Define what you want to achieve. It must relate to the needs of your business, employees, customers and markets;
4. Design – Unlock the skills of your people in a fun and energizing way, so concepts can be developed and tried out quickly.

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The Teams

The following table highlights the structure of the team during the journey.

Your Team	Our Team
A maximum of six (6) business and IT leaders They should have a clear understanding of the processes and the strategy of your company. We expect them to have worked on the Use Case that is under investigation.	**Distributed Ledger Technology (DLT) and Business Expert(s)** Responsible for the 'Proof of Business: Use Case Architecture Deep Dive' **Customer Contact** This is typically the Service Delivery Manager, Account Manager or Sales Contact **Development Team (remote)** Responsible for the deep code analysis and documentation analysis

Work Products

The typical work products (deliverables) are:

1. Non-disclosure Agreement on the shared information;
2. Report and documentation on the initial Use Case workshop;
3. Assessment Report as described;
4. Presentation of the results.

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Perimeter and Prerequisites

The following conditions are applicable:

- The customer provides all relevant information at minimum the elements in this document;
- There is no transfer of Intellectual Property (IP) between parties;
- The assessment can take longer if during the first day and during the first analysis the code or architecture is proven to be of a high complexity or the Use Case and/or the relevant Code is insufficiently or not documented. At the end of the first day a status meeting is conducted to jointly agree on the way forward. If no consensus can be reached, only the already preformed efforts are invoiced;
- The base service 'Proof of Business: Use Case Architecture Deep Dive' has an assumed lead time of (10) days organized in a 'sprint';
- The Assessment report is typically available two weeks after the last day in the aforementioned sprint;
- You agree to be mentioned as a reference customer.

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Asking the right questions and identifying how information needs to flow are essential to select the right Use Case

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Background Information

Disruption

Many industries have already been disrupted by digitalization, which has created new business models and ways of working. However there's another transformation that is just around the corner – as blockchain and Distributed Ledger Technology (DLT) based transactions shake up many industries and redefine how information is shared and handled.

Blockchain and DLT are significantly different from anything else in use on the market today. Fujitsu understands and knows there are challenges as Distributed Ledgers mature further and keep on disrupting how we think about and handle data.

Fujitsu continuously investigates, invests and collaborates with various public and private sector stakeholders in order to ensure it accumulates sufficient information in the market in order to help customers in this challenging transformational journey. This not only in the financial services but also in areas where Fujitsu has seen Blockchain and DLT venture for beyond its original intent and purpose (e.g. IoT, AI, RPA, Smart Cities, Public Ledgers, Chain of Custody, Voting, Digital ID / Self-Sovereign Identity, etc.).

Subsequently, for Fujitsu, Blockchain and DLT are as much a social / business experiment as they are a technical one. For Fujitsu, Blockchain and DLT is enabling however also forcing us all to question certain orthodoxies and conventions that are foundational to today's business models, in all sectors for that matter. They are Co-creation by Design and fit right in the Human Centric and Digital model of Fujitsu.

Gaining Understanding

In order to recapitulate, Blockchain is essentially a distributed database that allows for potentially complex trust relationships between database users. It works via a distributed network of nodes and users to move any 'digitalized' asset from peer to peer (native records or reference records) and validation is done by the majority of nodes ('mining'; consensus algorithms).

By design, it does not require an intermediate party ('authority') or facilitator to authenticate or to settle and confirm transactions. In essence, the primary question driving Blockchain technology is, 'do I trust that the data I am using is good and I can rely on it to assess my risk?'

Blockchain technology operates in two different modes depending on its planned application. This can be permissionless (or public), which assumes no trust between the participants and where anyone can participate. On the other hand, permissioned (or private) blockchains restrict who can perform various actions on the blockchain, assume some levels of trust and are potentially more useful for many business applications.

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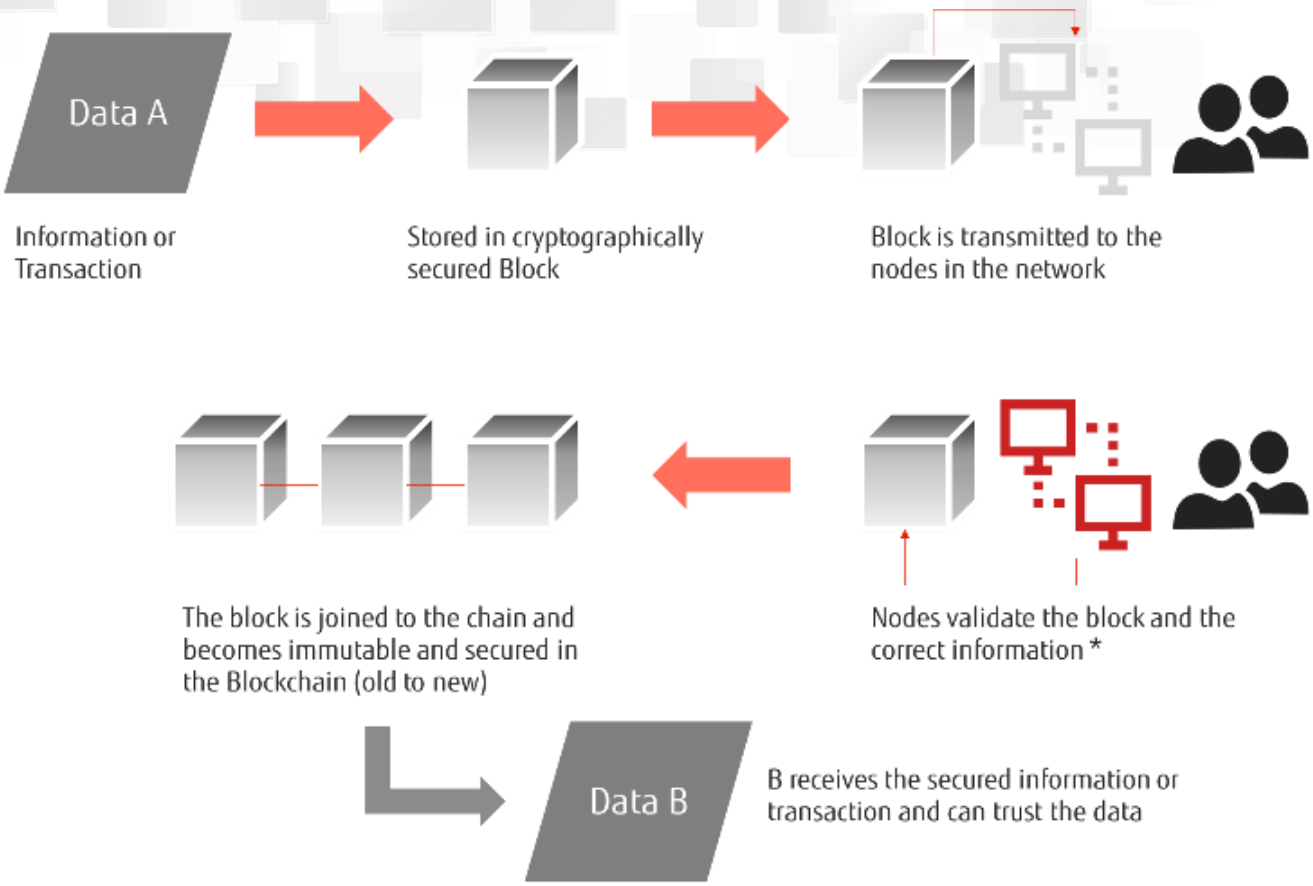

* Number of different consensus algorithms that are existing: Proof of Work, Proof of Stake, Proof of Activity, Proof of Burn, Proof of Capacity, Practical Byzantine Fault Tolerance, etc.

The choice of permissionless or permissioned blockchains governs every aspect of their constitution – from liabilities, operational risk, cost, and speed to business processes. In summary, the technology functions in two primary modes:

- **Permissionless (or Public):** Permissionless Blockchains allow anyone to participate. The transactions are validated and processed by votes / consensus. A vote does not depend on having a prior identity of any kind within the ledger and no pre-existing trust is assumed between participating nodes;
- **Permissioned (or Consortium / Private):** Permissioned Blockchains restrict access in terms of who can perform various actions on the Blockchain. The transactions are validated and processed by those who are already recognized by the ledger and some level of pre-existing trust is assumed and proven.

Blockchain purists will probably refuse to call the permissioned model 'Blockchains' as they tend to consider them just shared or common ledgers. It is more a question of definitions and common standards that are not set on a practical scale yet.

Even though some of the Use Cases with Permissionless Blockchains are mind-blowingly interesting and disruptive for the entire economic and social fabric, it is highly unlikely that they will immediately find their way into the overall business landscape. Consortium and private Blockchains (Permissioned) are currently the expected norm in businesses. Based on the innovations that are available in the field of identity management, it is more likely that a hybrid form with a manageable depth of identity exposure will take the foreground, certainly when considering aspects such as GDPR and the rapidly evolving digital landscape.

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Smart Contracts

An important aspect in Blockchain and Distributed Ledger Technology are the Smart Contracts. At its core, a Smart Contract is an agreement in a different form factor between two or more parties that is stored on each node in a distributed ledger network. It is however important to note that the term 'Contract' can be misleading as to date it is not (yet) a Contract in the conventional and legal sense of the word, often leading to some confusion (e.g. 'code is law'- discussion).

In the context of Distribute Ledgers, Smart Contracts are coded instructions (typically event driven; machine-readable) on ledger (blockchain) computers (nodes) that execute the specific terms and conditions, which exist in contracts between parties. In other words, they embed an agreed upon business logic in code. Under typical (current) circumstances, these parties will usually be individuals, corporations, governmental agencies or other entities with a clear legal identity however, you can have multiple parties, who may not trust each other fully.

Capturing contractual business logic in a classic 'if-then-else'-mode to safeguard trustworthiness of terms and conditions is something radically different. There are automatically executing instructions that existing today (e.g. bank accounts) however not those that are being controlled by multiple nodes / participants in a network. In most architectures, these Smart Contracts do so without any specified trusted organization, central authority or central server.

Benefits

Blockchain and Distributed Ledger Technology (DLT) are heralding creative potential and seem to be driving exceptional levels of innovation. The technology has the capacity to deliver a new kind of trust implementation to a wide range of services in our financial markets, supply chains, consumer and business-to-business services, publicly held registers and Internet of Things.

It is the combination of all these technologies that make Blockchain and DLT unique. Its benefits include:

- Accessibility: As many nodes store the whole history of transactions, it is most likely that information access is ensured at any time;
- Transparency: No single organization can control access to data, which increases transparency significantly;
- Data privacy: Blockchain solutions use cryptography to secure information. This is usually a public key infrastructure;
- Security/trustworthiness: From the outset, blockchain has been designed to meet the highest security standards, based on the general assumption that untrustworthy participants will attempt to join the network. DDoS or similar attacks are unlikely as no single point of attack exists.

It is however important to remain vigilant. Blockchain has the intrinsic potential to become the most disruptive technology and approach in the next decades as it evolves further. It does not provide a solution to every problem. At this stage, the use of Blockchain needs to be carefully validated on a case-by-case basis whilst considering the total cost of a distributed ledger compared to one single ledger and the sometimes more immediate benefits of such classic models.

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Key Fujitsu Blockchain achievements

Please visit http://www.fujitsu.com/global/ for the latest information;

- In March, 2018, Fujitsu opened a The Blockchain Innovation Center in Brussels, Belgium with the aim of developing the potential of blockchain beyond financial services as a new architecture for information systems and sectors of all kinds. To do this the Center will undertake research with external partners and collaborate on specific projects to explore the technology's potential and limitations. The first blockchain R&D project being developed at the center focuses on 'Blockchain as enabler of services in the context of Smart Cities', and is being conducted in collaboration with Innoviris, the Brussels institute for the encouragement of scientific research and innovation. Although the initial focus is on Smart Cities, the goal is to deliver scalable, secure, business-ready blockchain and DLT solutions in a wide variety of industries.
- 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 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 is actively involved as a founding member and contributor to the open source blockchain framework Hyperledger Fabric, one of the Hyperledger blockchain frameworks hosted by The Linux Foundation. This collaborative effort aims to advance blockchain technology by identifying and addressing important features for a cross-industry open standard for distributed ledgers that can transform the way business transactions are conducted globally.
- 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.

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About the Fujitsu EMEIA Blockchain Innovation center

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Fujitsu is the leading Japanese information and communication technology (ICT) company, offering a full range of technology products, solutions, and services. Approximately 155,000 Fujitsu people support customers in more than 100 countries. We use our experience and the power of ICT to shape the future of society with our customers. Fujitsu Limited (TSE: 6702) reported consolidated revenues of 4.5 trillion yen (US $40 billion) for the fiscal year ended March 31, 2017. For more information, please see http://www.fujitsu.com.

About Fujitsu EMEIA

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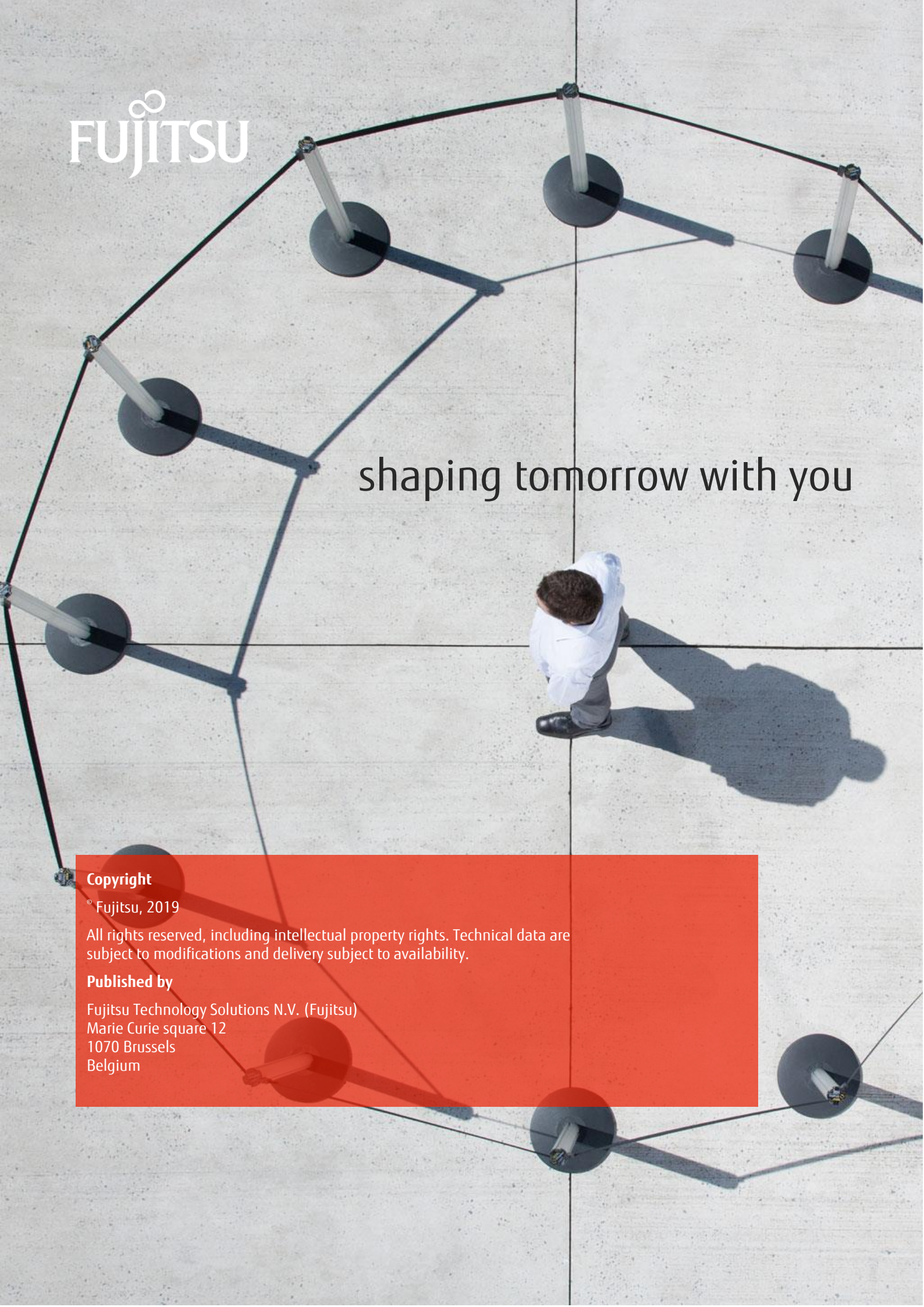

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