

## Fujitsu Technology and Service Vision 2019

**Executive Summary** 

shaping tomorrow with you



# Human Centric Innovation Driving a Trusted Future

We are living in a world that is more connected, more globally integrated and faster paced than it has ever been. The benefits that have been brought by digital technology seem obvious and ubiquitous. But the world is increasingly becoming chaotic.

In the spaghetti-like complexity of the networked world, many of the traditional structures and institutions that we relied upon are proving inadequate or even breaking down. Governance struggles to keep pace with technology, data grows faster than it can ever possibly be controlled.

Today we can't tell what is true on the web. We are in the dark as to who uses our private data and where. We are seeing an increase in the damage from cyber-attacks, which now target critical social infrastructure as well. Al is advancing rapidly and being applied in many fields. But there is a growing concern about the trustworthiness of Al's judgement and the impact of the technology on jobs. Is there any way out of the chaos?

In today's complex world, trust has become a big challenge. Rebuilding trust is the central issue to a better future.

As a service oriented company founded on delivering strong digital technologies and as your business partner, Fujitsu wants to co-create trusted businesses and contribute to realizing a sustainable world. In this book, we lay out our thinking on how trust can be rebuilt for business and society, and what technology can make it possible.

The Fujitsu Technology and Service Vision sets out our vision and provides insights to leaders of business and the public sector into how they can use ICT to create innovation and build a different future. The central idea of our vision is **Human Centric Innovation**. This is a unique approach to creating business and social innovation by empowering people with advanced technology.

https://www.fujitsu.com/global/vision/

### **Revolution of Trust**

Before the industrial age craftspeople used their skills to make things to order. In the industrial era, standardized products have been supplied at low cost through a vertical value chain that enables mass production. In the digital era, the business paradigm is changing dramatically. Now, we are able to respond to the diverse needs of individual customers and citizens, through combining a variety of services offered in a cross-industry ecosystem. This is a new human centric business model.

This shift of business paradigm is closely related to trust. Businesses and communities use two forms of trust. The most fundamental form of trust is that which exists directly between people. This is personal trust, or 'Trust 1.0'. As economic activities grow beyond small communities, we need a different type of trust. Institutional trust, or 'Trust 2.0' enables trust to scale as people place their trust in governments, banks and other organizations. But in a world increasing in complexity, where everything is being connected in a distributed manner, Trust 2.0 doesn't provide enough scale. With four billion people already online, as well as tens of billions of things and devices connected to the Internet, how can we ensure the privacy and trustworthiness of data? How can we underwrite the end-to-end transactions and data exchanges throughout a vast ecosystem, which comprises many organizations?

We need to add a new layer to the trust model. Distributed Digital Trust, or 'Trust 3.0' uses technology to underwrite distributed transactions and assure the trustworthiness of data.

Let's take a look at how companies can respond to this paradigm shift and build a trusted business.



### **Co-create a Trusted Business**



How can organizations deal with complexity and chaos and build the trust they need to thrive? We believe that organizations need to take three actions to realize a human centric trusted business.

#### Architect a Purpose-Driven Business

In your journey to co-create a trusted business with customers and ecosystem partners, the first question to ask must be what your purpose is. What outcome does your business exist for to serve society? What value do you create for people? What problem do you solve for your customers? Where do you fit in relation to your partners and customers? These may be difficult for anyone to answer. But to draw a big picture of your purpose-driven business is the first action.

Build a Human Centric Organization

Secondly, it is important to set up a work environment where people can readily collaborate within their team and with external partners. How can they work more creatively and proactively? This requires empowerment of people and a culture that allows failure. The second action is to build a human centric organization.

### Drive the Business with Digital

The third action is to use digital technology to drive your business. A key part of this is the ability to turn data into value while maintaining the trustworthiness of data. It is vital to secure trust in this complex distributed world (Trust 3.0).

#### **Digital Muscles**

These actions require organizations to take a radical approach to transforming at every level. Organizations have become adept at running a traditional supplycentric, monolithic model of businesses. To use the human body as a metaphor, it is as if the organization has developed a strong set of muscles to work in this way. But responding to the business challenge requires a different approach. It requires a different set of muscles, enabling the enterprise to collaborate with ecosystem partners and co-create value.

We call these 'Digital Muscles'. These are: Leadership, Ecosystem, Empowered People, A Culture of Agility, Value from Data, Business Integration. All of them must be underpinned by trust. According to Fujitsu research, companies that have stronger digital muscles can deliver bigger business outcomes. Digital transformation is not realized by simply introducing digital technology. Instead, it is a long-term process of developing digital muscles to continuously transform the business.

### Drive the Business with Digital

To help our customers build trusted businesses, Fujitsu provides advanced digital technologies such as AI, IoT, security and blockchain as services on MetaArc, a multi-cloud based digital business platform. In addition, we provide digital technologies that transform businesses in various industries. The following are some of the initiatives.

#### Human Centric Mobility

A wide variety of real-time data related to the movement of people, cars, and so on are used by various ecosystem partners such as automakers, parts suppliers, digital service providers, and insurance providers to realize mobility services such as autonomous driving and ride sharing.

Fujitsu provides leading-edge digital technologies in the three areas of 'Collecting' (collecting data), 'Connecting' (connecting to networks), and 'Utilizing' (leveraging data). These help realize human centric mobility services. For example, we have developed technologies to compress the enormous amount of image information of self-driving vehicles to a minimum for use, to safely download and update autonomous driving software wirelessly, and to enable autonomous communication between vehicles. We have also developed a streaming data processing architecture 'Dracena'. This technology enables real-time, non-stop processing of event data collected from a huge number of connected vehicles and other IoT devices in the real world. With this technology, we are working to realize a mobility digital twin that will mirror the dynamic mobility of an entire big city and enable the delivery of various innovative services.

#### **Innovative Shopping Experience**

In the world of retail, after the expansion of e-commerce and the convergence of real stores with online shopping, there is a new focus on how real, physical stores can be digitalized. Together with customers, Fujitsu is working to realize cashless, cardless shopping using biometric authentication, as well as store automation that connects the entire store with sensors and IoT technology.

The key is not to sell goods, but to realize customers' experiences. Real stores need to respond to the needs of consumers who want to use goods rather than own them. At the same time, the movement to build an ecosystem with companies in different industries through non-monetary tokens such as



loyalty points is accelerating. We are co-creating new sharing services using smart phones for real stores, and ecosystem business models based on blockchain.

#### **Customer-engaging Financial Services**

In addition to automating operations, financial service providers are accelerating the creation of ecosystems with companies in other industries. One of their goals is to embed financial services into

various situations of people's lives and provide human centric services that satisfy needs of people at any situation.

Fujitsu offers its Finplex financial solution, which provides a systematic approach consisting of authentication infrastructure, payment platforms, and financial services APIs.

### Solve Complex Problems through Trusted AI

#### **Trusted Al**

The problem of bias in AI, especially deep learning technology, is becoming an issue. There are also growing concerns about the 'black box' nature of the technology.

Fujitsu researches and develops AI under the philosophy of 'Human Centric AI'. We believe in the importance of developing AI that collaborates with people. Our AI offering, FUJITSU Human Centric AI Zinrai, has delivered many business outcomes for our customers. For instance, it has helped our customers engage with their customers through the use of chatbots, or automated quality inspection processes through image recognition. Now we are also developing trusted AI that can be used with confidence by people so that AI can be applied to complex business and social issues. With this in mind, Fujitsu has succeeded in developing the world's first 'Explainable AI'. This is achieved by combining two unique AI technologies from Fujitsu. The first is the Knowledge Graph, which builds a knowledge base in a format that the AI can handle. It visualizes relationships between pieces of the knowledge. The building of reliable, digitalized knowledge bases in specialized areas is an essential part of making AI usable by business and society in the future. The second technology is machine learning technology with a function to explain the reason for the judgment. Fujitsu offers two original technologies: 'Deep Tensor', a deep learning technology that enables high-precision analysis of graph-structure data, and 'Wide Learning', a technology that enables high-precision analysis even from a small amount of learning data.

#### New Computing Architecture to Solve Complex Problems

In spite of the rapid advances in Al, some problems are just too complex for current computing architecture. Combinatorial optimization is one example. There are, for instance, more than 100 quadrillion ways of holding a

Knowledge Graph



portfolio of only 20 stocks. To calculate an optimum portfolio is beyond the capabilities of conventional computing technology, at least within a practical time.

Fujitsu's 'Digital Annealer' is a new computing architecture, using a digital circuit design inspired by quantum phenomena. It is the only commercial solution that can solve complex combinatorial optimization problems in the real world. Digital Annealer has already proven its exceptional performance in combinatorial optimization problems, from minimizing risk across complex financial portfolios to the optimization of complicated work in a warehouse. We have begun to apply Digital Annealer with our customers to problems in manufacturing, transportation, healthcare, and biochemical research.

Furthermore, in 2019, the second generation of Digital Annealer service increased its 'coupling' – a measure of its capacity – from 1,024 bits to 8,192 bits, accelerating processing speed by 100 times and enabling applications for even larger problems in the real world. The second generation of

Evolution of Digital Annealer

Digital Annealer has the potential to tackle some genuinely large scale problems. For instance reducing traffic congestion in Toyko, by optimizing the routes of vehicles traveling through the center of the city. Or to accelerate the development of new drugs by computing potential configurations of 'medium-sized' molecules made up of building blocks of up to 50 amino acids. By expanding the total coupling to 1 million bits in the future, the technology would be able to optimize traffic flow across the greater Tokyo area, and be applicable for the development of new drugs made of much larger molecules.

Up to 8,192 bits

2nd Generation available

April 2019

May 2018 Digital Annealer Cloud Service launched 1,024 bits

#### Traffic that can be optimized



Tokyo Metropolitan Area

#### Digital Annealing Unit



Next Generation 1 million bit scale



Greater Tokyo Area

#### **On-Premises System**



### **Distributed Digital Trust**

In a complex world where everything is connected to networks, new technology-based trust is needed. Fujitsu contributes to realizing Trust 3.0 by applying cutting-edge security and blockchain technologies to the identity of people as well as things, cyber security, and data security.

#### Identity of People and Things

Biometric authentication technology will help prevent impersonation and enable secure transactions. A combination of face, fingerprint, and vein biometrics is



<image>

the best way to assure the digital identity of people. Fujitsu has developed a biometric authentication technology that can identify a person using palm vein and face information and authenticate the person without physical contact. We are working to apply this technology to various fields like payment.

#### Cybersecurity using Intelligence

Fujitsu conducts research and development and provides security products and services in five areas: detection, blocking, analysis and recovery of malware and other cyber-attacks, threat information sharing, and protection within virtual systems. In particular, we are strengthening our intelligent security technologies, leveraging AI technologies including our unique Deep Tensor. We are also working to improve the trust of connected cars through secure distribution technology and in-vehicle network security technology.

#### End-to-end Data Security

In addition to developing anonymization and advanced encryption technologies to protect personal data, Fujitsu is working to provide end-to-end data security through the use of blockchain. Blockchain is sometimes called a 'trust protocol' and is used as a way of underwriting transactions without the need for a third party validation. However, existing blockchain technologies have not been able to address the challenge of ensuring the reliability of data across different blockchains and enterprises. Fujitsu is developing technology that connects different blockchains. In addition, we are working to develop a new technology that administers data trails across multiple organizations through blockchain.

Furthermore, we are envisioning a future in which data can be used safely and securely across regions and industries. This will be realized by building secure networks based on blockchains, and connecting various ecosystems of private companies, governments, public institutions, academic research institutes, NPOs, and others. Based on the security technology that Fujitsu has cultivated over many years, we are working to strengthen our blockchain technology and develop a certification infrastructure for corporations.



### **Trusted Society**

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We, as a leading technology company, believe that it is our social responsibility to bring happiness to as many people as possible around the world by creating new value around people. It is important to co-create human-centric values and social impact for urban mobility, health, and welfare in cross-industry ecosystems. By connecting these ecosystems through an autonomous distributed network protected by Trust 3.0, we will be able to create a society which is inclusive (no one is left behind), sustainable, and trusted. We call such a society a **Human Centric Intelligent Society**. This is our vision for the future. It underlies all of Fujitsu's business activities. achievement of the SDGs through working toward our vision. Some of these initiatives are introduced below.

#### Health and Well-being for all (SDG 3)

Through partnerships with medical institutions and other organizations, Fujitsu is contributing to realize 100-year lifespans of people by supporting a shift to a smart and healthy way of working, personalized healthcare for individuals, and both healthcare and elderly care. In the field of advanced medical care, we



are pursuing joint projects with Kyoto University for gene diagnosis using AI and the University of Toronto for cancer radiotherapy research using Digital Annealer. In addition, Fujitsu has developed a new technology to solve combinatorial optimization problems applicable to medium-size molecular drug discovery using Digital Annealer. Through these initiatives, we will continue to work together toward eradicating difficult diseases like cancer.

#### Sustainable Cities (SDG 11)

Fujitsu has launched initiatives to leverage cutting-edge technologies and collaborate with partners to solve complex urban challenges. For example, Fujitsu and FOMM (First One Mile Mobility), which supplies small electric vehicles (EVs) with removable batteries, have jointly developed a battery cloud service for managing EV's driving conditions, battery conditions, and battery usage in a smart way. FOMM started production of the small EVs in Thailand in February 2019. The combination of an EV capable of driving on water and a battery cloud is expected to contribute to addressing social issues such as urban congestion, exhaust gas and floods.

In Indonesia, Fujitsu built the Disaster Information

Management System for North Sumatran Regional Disaster Management Agency. It started operation in January 2019. This system uses a smartphone application to collect information on multiple disaster sites in a timely manner, and improves the initial response for prompt decision-making. It accelerates disaster response of local rescue and support activities.

In addition to these initiatives, Fujitsu is working with ecosystem partners to address SDGs in other areas such as sustainable agriculture (SDG 2), human-centric way of work (SDG 8), intelligent industrialization (SDG 9), and contribution to de-carbonized society (SDG 13).

In accordance with FUJITSU Way, our Group philosophy, we will continue to work with our customers and other stakeholders to build a trusted future.

### **FUJITSU LIMITED**

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