FY2019 R&D Strategy Briefing

Oct. 25, 2019

FUJITSU

shaping tomorrow with you

Trust, Digital and Global

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Hirotaka Hara

CEO, FUJITSU LABORATORIES LTD.

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Achieving Digital Trust

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Make. Trust

Developing and providing
cutting-edge technologies for
ensuring “Trust” in the digital era

Achieving Digital Trust

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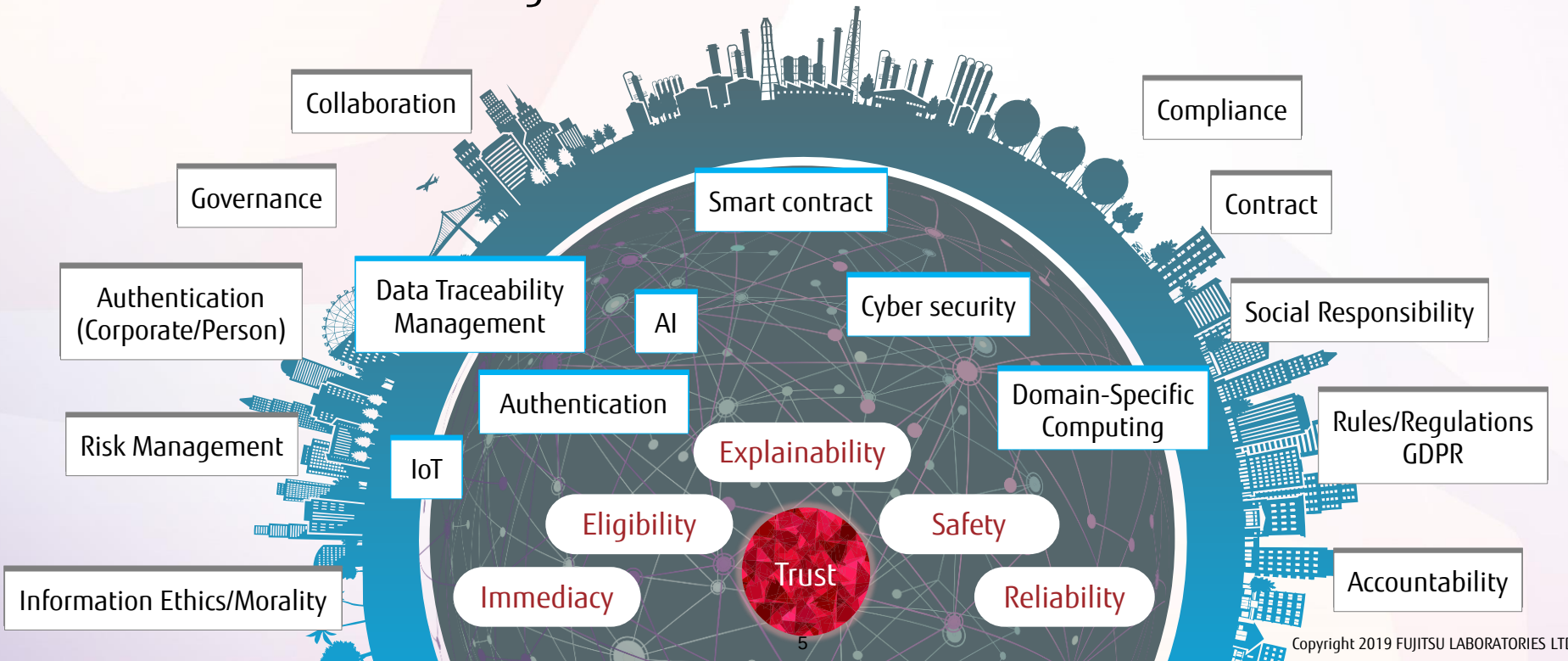
Fujitsu Laboratories ensures "Trust" by technologies for solving various customer issues in the digital era



Cyberspace

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“Trust” in all kinds of transactions

Implementing cyberspace

which can be used by all of stakeholders safely

People can handle their own personal data safely and securely

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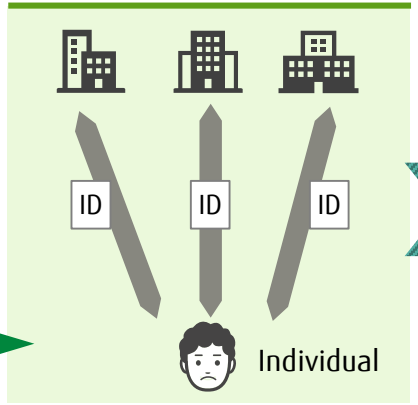
Aiming to create an integrated service for various businesses

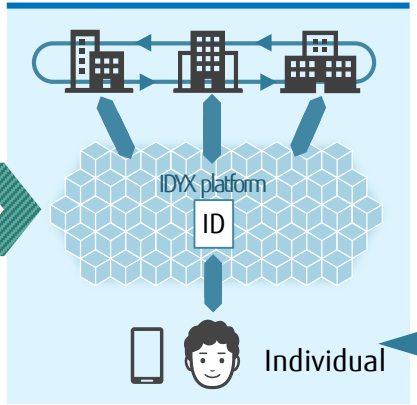
IDYX

Providing a platform through which people can control their identity exchange and use

- ID setting has to be made for each case
- Fear of ID leakage and abuse

How to ensure trust in IDs?





- Highly reliable identity exchange between businesses
- Improve trust in identity exchange and utilization

Each person can decide and control the range where their ID is used

Collaboration with JCB Co., Ltd.

Started joint research on digital identity handling

Connecting data for urban development

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Providing safe/secure data exchange/utilization platform using blockchain

Co-creation with
Mitsubishi Estate Co., Ltd.

Cutting-edge technologies for data management

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Virtuora DX

Secure data exchange

Dracena

Digital twin IoT platform

Chain Data Lineage

Data origin and history management

IDYX

Decentralized ID authentication

Physical space

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"Trust" that people are seeking

- Laws, Regulations, International rules
- Contracts, Code of Conducts
- Ethics, Moral, Religious values, etc.

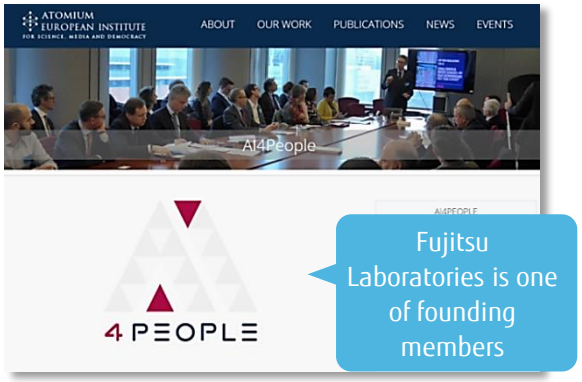
How to address AI ethical problems

Collaboration with AI4People in Europe

Nov. 2018

"Five ethical principles for AI"

Framework of European Commission's AI ethics guideline



Fujitsu Laboratories is one of founding members

Fujitsu Group AI Commitment

Mar. 2018

"Five principles to address AI ethical problems"

1. Provide value to customers and society with AI
2. Strive for Human Centric AI
3. Strive for a sustainable society with AI
4. Strive for AI that respects and supports people's decision making
5. As corporate social responsibility, emphasize transparency and accountability for AI

How to address AI ethical problems

Established the "Fujitsu Group External Advisory Committee on AI Ethics"

Aiming to reflect the objective opinions and ideas in the Fujitsu Group AI Commitment

- Specialists from diverse fields are appointed

Junichi Tsujii	Fellow in Information Technology and Human Factors, and Director of the Artificial Intelligence Research Center at the National Institute of Advanced Industrial Science and Technology, with concurrent positions as professor emeritus at the University of Tokyo and professor at the University of Manchester
Yuko Kimijima	Professor (of Intellectual Property Law), Keio University Law School
Hiroko Kuniya	Independent Journalist Trustee (Special Mission), Tokyo University of the Arts
Takanori Takebe	Professor, Institute of Research, Tokyo Medical and Dental University Director, Communication Design Center, Yokohama City University Deputy Director, Organoid Center, Cincinnati Children's Hospital
Kumiko Bandou	President, Japan Legal Support Center
Takakazu Yumoto	Director, Primate Research Institute, Kyoto University Also a professor in the area of ecosystem conservation in the field of Ecology and Social Behavior

Titles omitted

World's top digital technology

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Technologies supporting DX

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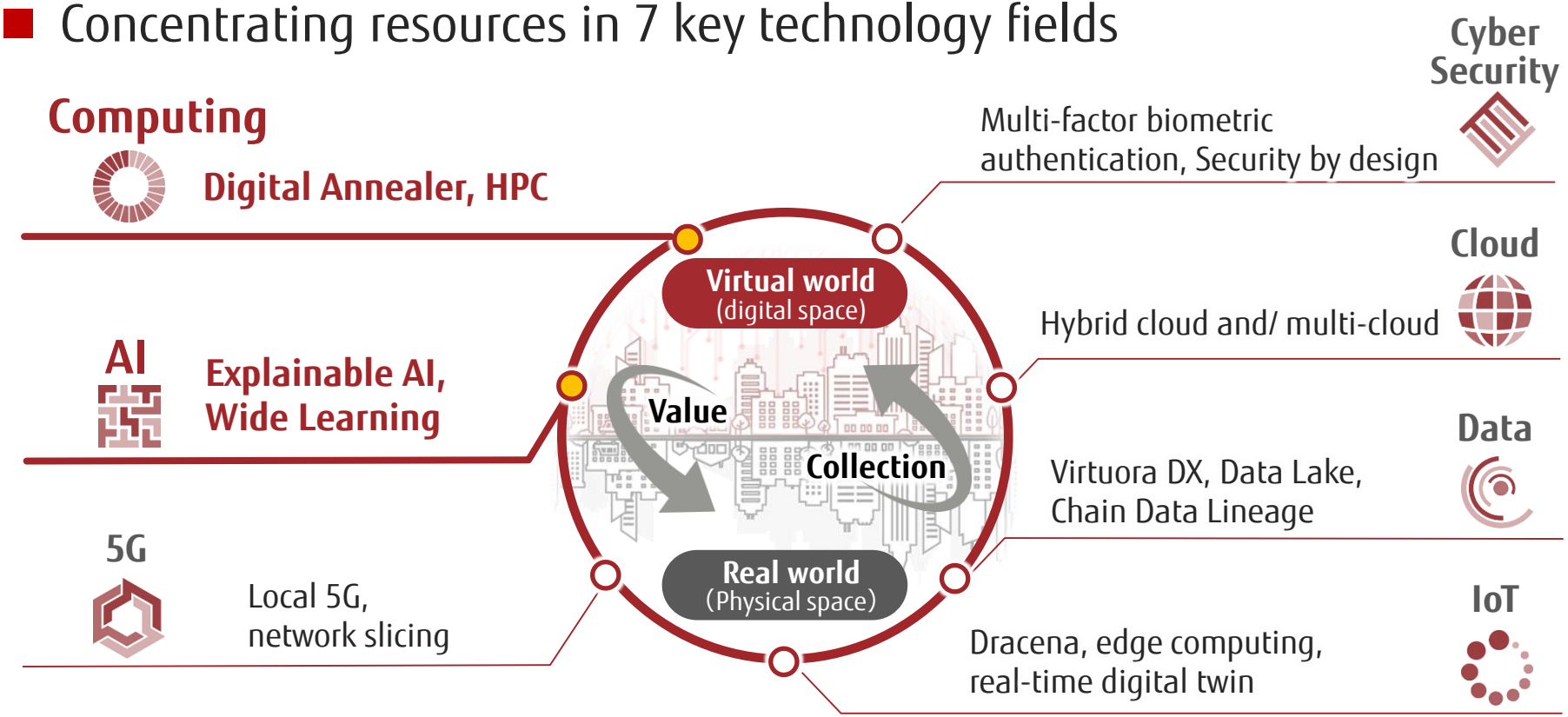
- Concentrating resources in 7 key technology fields



Cutting-edge computing technologies

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Achieving World's Highest Speed through
Deep Learning Acceleration Technology (April, 2019)

Digital Annealer

New architecture for solving combinatorial optimization problems at high speed

Announcing today

Content-Aware Computing

World's first technology to realize both
tenfold higher speed and user-friendliness

PeptiDream Inc.

PeptiDream

Sep., 2019
Press release

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Fujitsu and PeptiDream Inc. started joint research for drug discovery. Finding new drug candidate compounds tenfold faster than before

- ✓ Narrowing down the candidate compounds from several trillion kinds of peptides with Digital Annealer
- ✓ Reducing the search time from previous 3 months to about 10 days
- ✓ Aiming to accelerate the speed of drug discovery through joint research with leading pharmaceutical companies such as Novartis International AG in Switzerland

Receiving a high evaluation for the stable performance of Digital Annealer, we are promoting expansion of peptide drug discovery market which is drawing a lot of attention recently

Cutting-edge AI technologies

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AI patent application ranking in Japan: 2nd

(Jul., 2019: JPO survey on patent applications for AI-related inventions)

XAI Explainable AI

Deep Tensor | Knowledge Graph | Wide Learning

- Technologies that enabled rapid commercialization of Explainable AI
- Breakthrough technology for proposing an appropriate action beyond prediction of a certain event

Announcing today

AI quality

World's first technology for AI quality management

› High Durability Learning

Issues of AI qualities presented by Fujitsu

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Grasping data characteristics

Agreement on requirements

Quality standard

AI ethics

Explainability

Performance monitoring

Promoting R&D for AI quality management

Data classification

Security/ Privacy

Safety

System performance indicator

Functional adaptability

Relearning

Prestigious global leading laboratory

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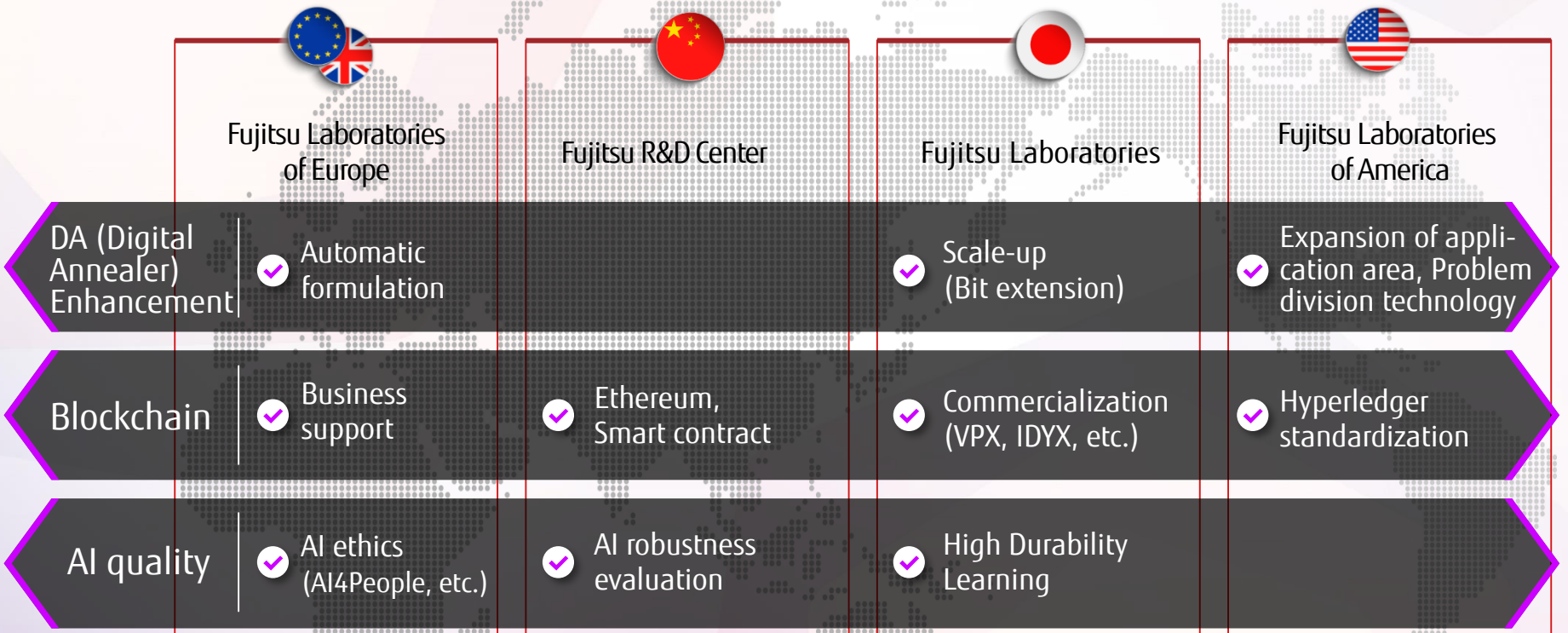
True globalization

Promoting R&D globally under the best organizational structure



Open innovation

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Collaborating with the best partner in each technology field

Representative examples of open innovation

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UNIVERSITY OF TORONTO

Exploring application fields of Digital Annealer through 11 joint projects

Optimization of doses in radiotherapy for cancer

Inria INVENTEURS DU MONDE NUMÉRIQUE

Joint research with the world's leading institute for mathematical science about topological data analysis

Achieved the world's highest accuracy* for detecting an irregular pulse through an electrocardiogram

*1: Verified by using PhysionNet's MIT-BIH and PTB Diagnostics datasets

MIT Massachusetts Institute of Technology

Aiming at realizing autonomously growing AI systems, conducting joint research on Life-long Learning

Set up a fund for Brain x AI research

TUM

Joint research on high-speed/high-capacity database system using nonvolatile memory

Joint paper was selected at the leading international forum concerning database*2

*2: SIGMOD 2018

Carnegie Mellon University

Developed an AI facial expression recognition technology for detecting subtle changes in facial expression

Achieved the highest accuracy ever recorded in the international institute's benchmark*3

*3: FERA2017

RIKEN

Developing innovative platform technologies for robust machine learning

Received "Satomi award" from Japanese Society of Fetal Cardiology

Human resource management strategy specific to our laboratories

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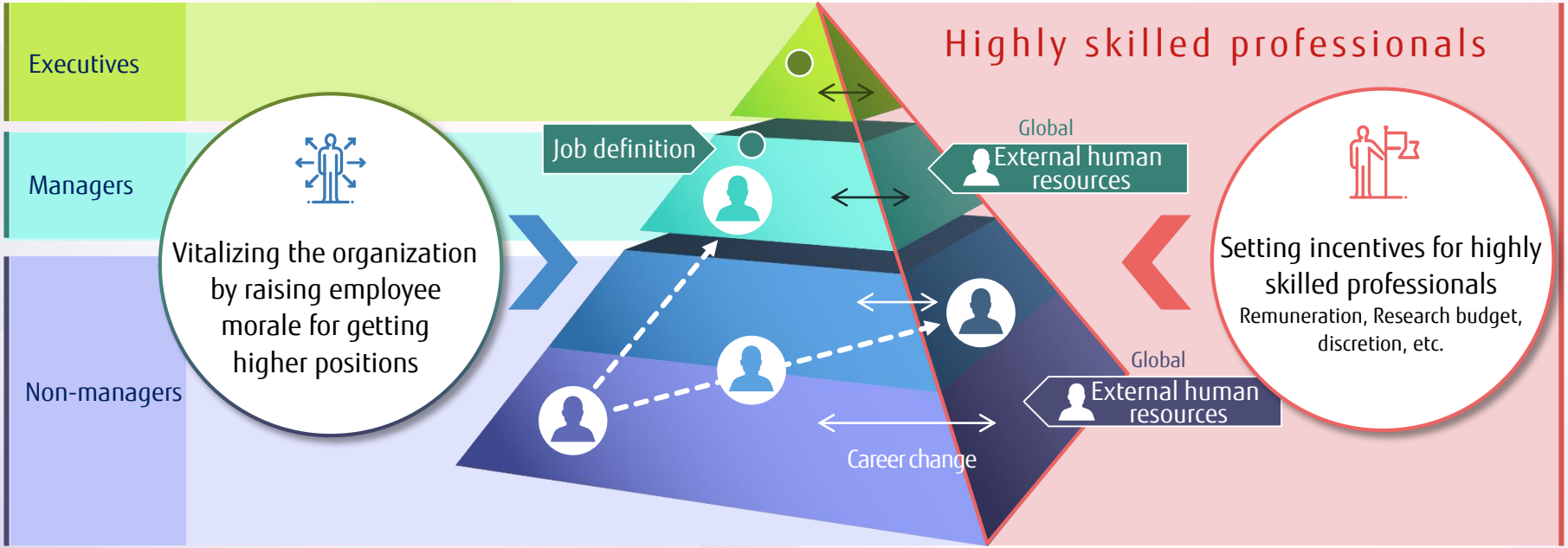
Key points

- Fostering highly skilled professionals (Setting unique incentives & Recruiting the world's top-level researchers)
- Introducing a multi-career path for strengthening R&D capacity of company
- Human management system clarifying job description for promoting young researchers and vitalization of organization



Fujitsu's top researchers around the world

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Akira Nakagawa

Associate Fellow, FLL

Video encoding technology

World's top researcher

Development of H.264/AVC
Received the Medal of Honor with Purple Ribbon award in 2016

Arnab Roy

Research Manager, FLA

Cryptographic technology

World's top researcher

Deputy chair of NIST Subgroup

Ahmed Al-Jarro

Principal Researcher, FLE

AI simulation technology

World's top researcher

Selected as a topic of Top Conferences

- NVIDIA GPU Technology Conference GTC 2019
- Super Computing 2019

Jun Sun

Director of Information Processing Laboratory, FRDC

Character recognition technology

World's top researcher

Invited to give a lecture at ICDAR, which is the most prestigious international conference of character recognition technology

Promising young AI researchers

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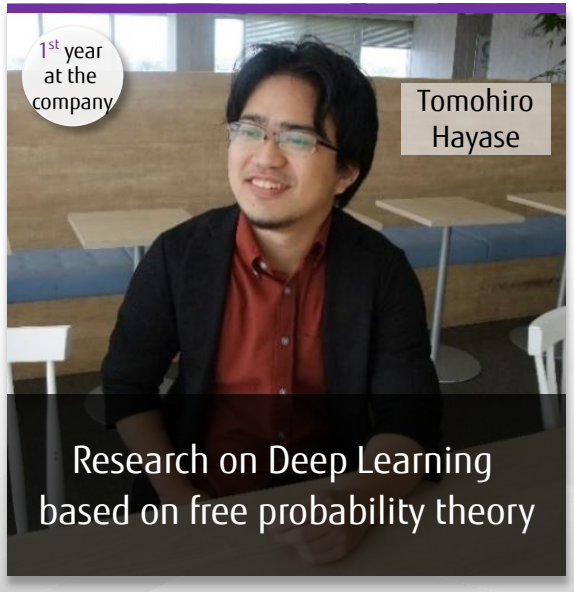
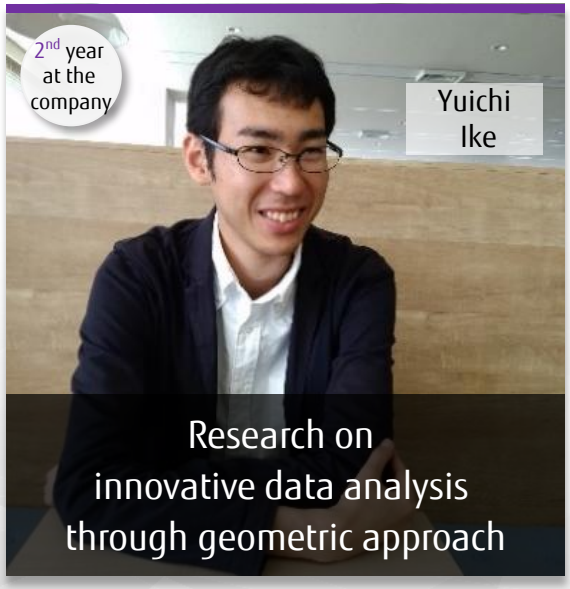
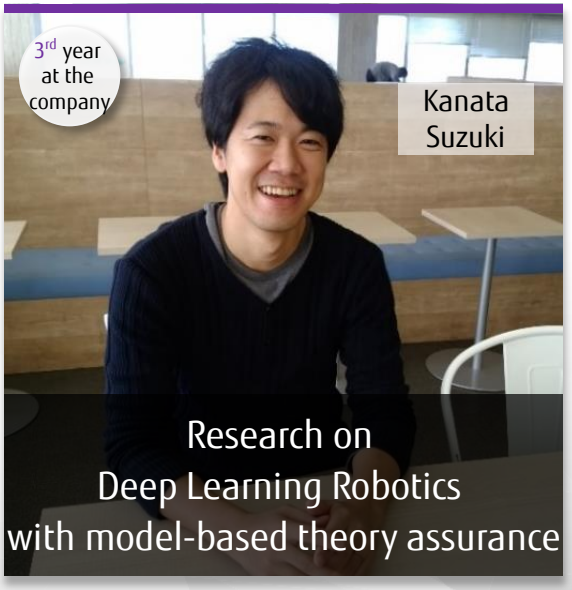
JST ACT-X — Japanese major program for fostering young creative researchers

Three researchers of Fujitsu Laboratories were selected, which is only nomination from private sector

30 researchers were selected from among 170 applicants (Acceptance rate is 17%)







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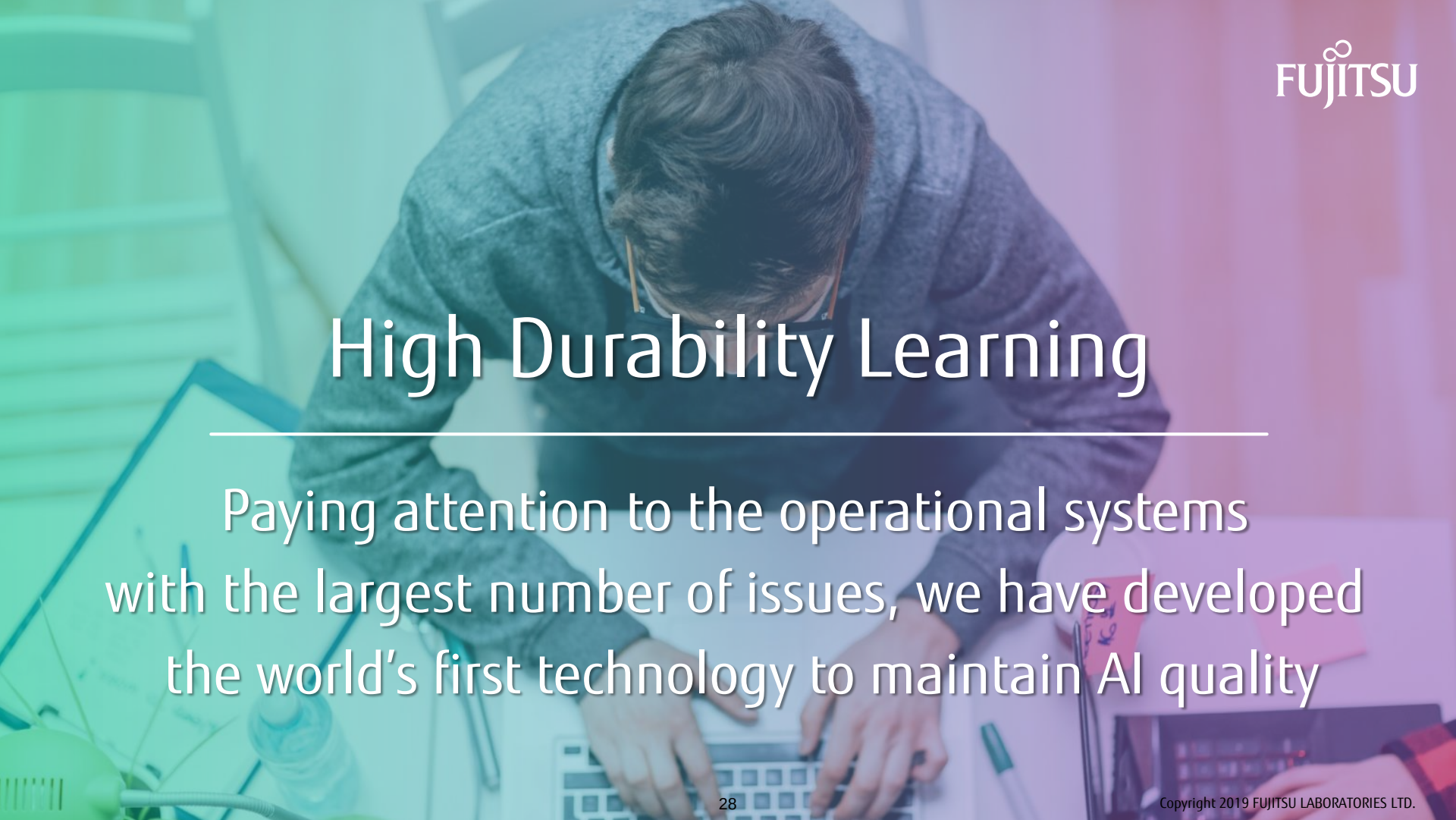

High Durability Learning

Paying attention to the operational systems with the largest number of issues, we have developed the world's first technology to maintain AI quality

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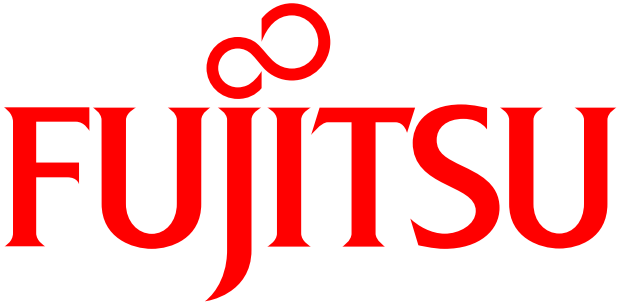
Content-Aware Computing

Computing technology based on a new concept focusing on the content of processing target data



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