

FY2017

**R&D Strategy
Briefing**

September 20, 2017

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Fujitsu Laboratories' R&D Strategies

**CEO
FUJITSU LABORATORIES LTD.**

Shigeru Sasaki

The Fujitsu logo, consisting of the word "FUJITSU" in a bold, sans-serif font with a stylized infinity symbol above the "i".

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Outline of Fujitsu Laboratories

Fujitsu Laboratories: Mission

Driving the Fujitsu Group growth
with leading-edge technologies



Fujitsu's consolidated financial targets – Achievement goals

Operating profit margin ➡ **10% or more**

Overseas sales ratio ➡ **50% or more**

Global Activity

- **Employees:** Approx. 1200 in Japan, Approx. 230 overseas
- **Open Innovation:** 123 Projects in Japan, 44 Projects in 14 Countries



Quantum Computing/AI



Big Data Analysis



Healthcare AI



Traffic Surveillance AI



Fujitsu Laboratories' R&D strategic scheme

■ Solve social problems with advanced technologies by predicting the future and global trends

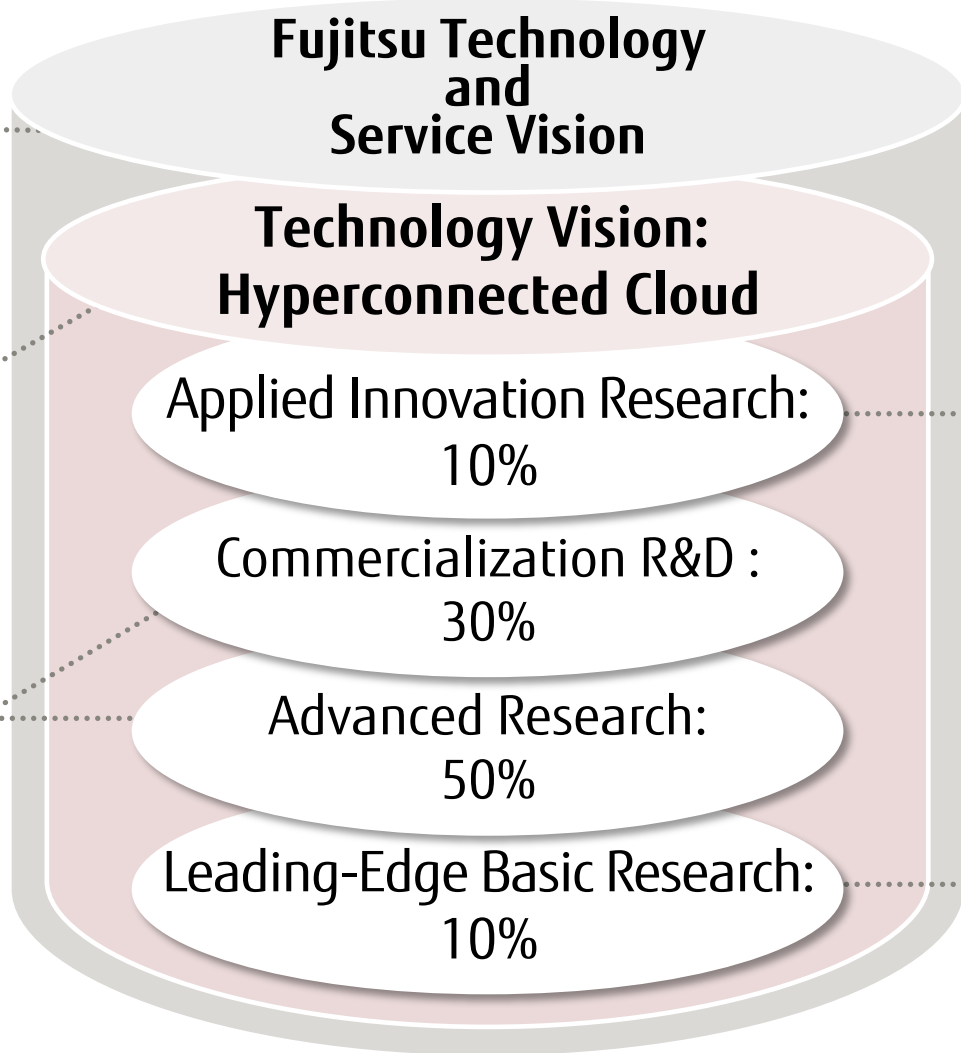
Human Centric Innovation

Digital Co-creation

Service-Oriented Connection

Connected Business Platform

Security AI
Intelligent Computing One Network
Foundational Research



Social innovation

Life innovation Mobility

Manufacturing Healthcare

- Computer Architecture
- Network Architecture
- Nine-Sensecomputing
- Social Science
- Physical and Chemical

Megatrends and Fujitsu Laboratories' R&D strategies

Changes and trends of the world which will be generated by technologies

"Information sharing" and "Quick decision making" with digital technologies will promote companies' new value creation and continuous development.

"Human creativity" × "Digital technologies" will enhance abilities and change work styles of people, and bring about the world where each person can play his/her role actively in various fields with delight.

Innovative digital technologies will transform social regulations, etc. and open ecosystem will generate evolvable values and systems.

Trends of Fujitsu Laboratories'

8 Emerging Technologies

Computing Revolution
Digital Annealer

Explainable artificial intelligence
Deep Tensor+Knowledge Graph

Data-driven platform connecting various industries:
Connected Digital Place

Dramatic increase in the number of connected things:
Zero Limitation Networking

System transformation toward the connected world:
Microservice Transformation

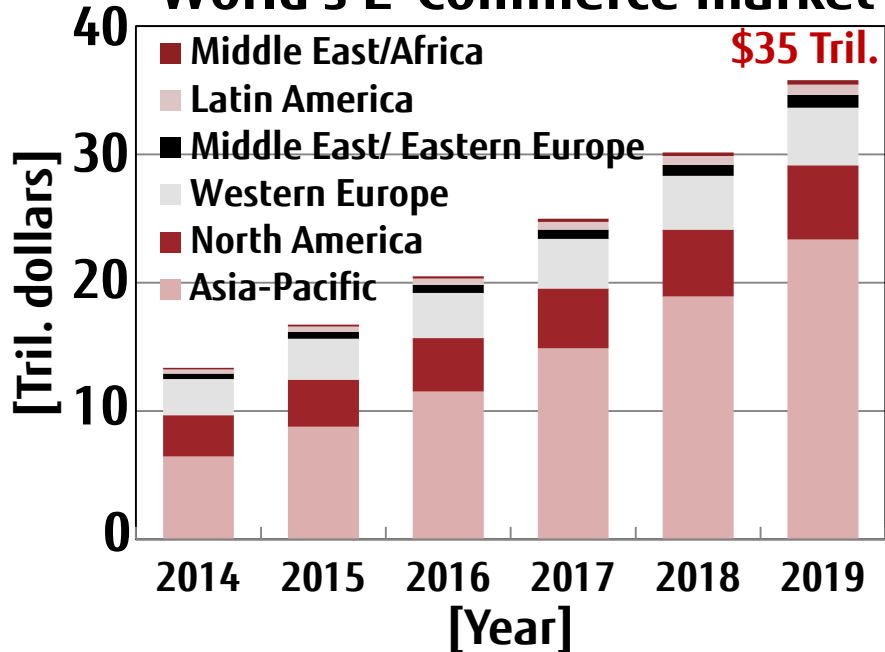
Data reliability assurance:
Borderless IoT Security

Understanding human five senses, feelings, illusion, etc. for human-machine collaboration:
Nine-Sensecomputing

Fusion of Physical and Chemical:
Materials Informatics

Future Trends of Logistics / Distribution Industry

World's E-Commerce market



Logistics/Distribution Industry Forecast

- Increase of logistics resources
- Shifting to global/borderless market
- Increase of logistics resources/ demands for workers
- In 2030
 - World population: Approx. 8.3 billion
 - Megacities with populations of over 10 mil.: 41 cities
 - Expansion of Cross-border EC (Volume of cross-border transactions: 3 times)
 - Fully automated transport /delivery of goods

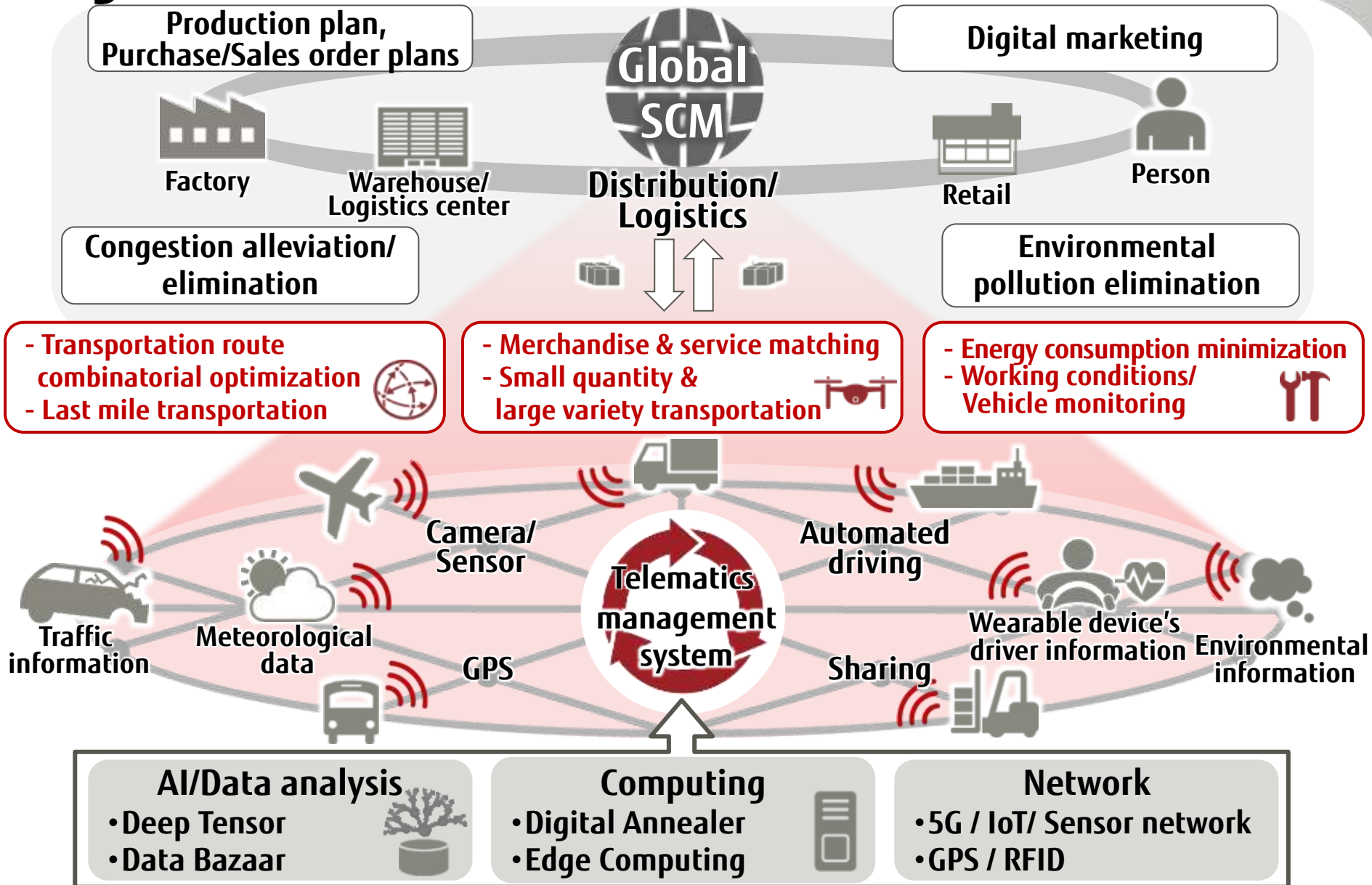
- Source: UNIDO, International Yearbook of Industrial Statistics 2016 by MIC
- 2016 the Future Direction of the Active Use of Big Data in the Distribution and Logistics Field by METI study group

Source: Analysis of ICT Industrial Trends in the IoT Era:
2016 White Paper on Information and Communications in Japan (by MIC)

Keys to the solution of social issues:

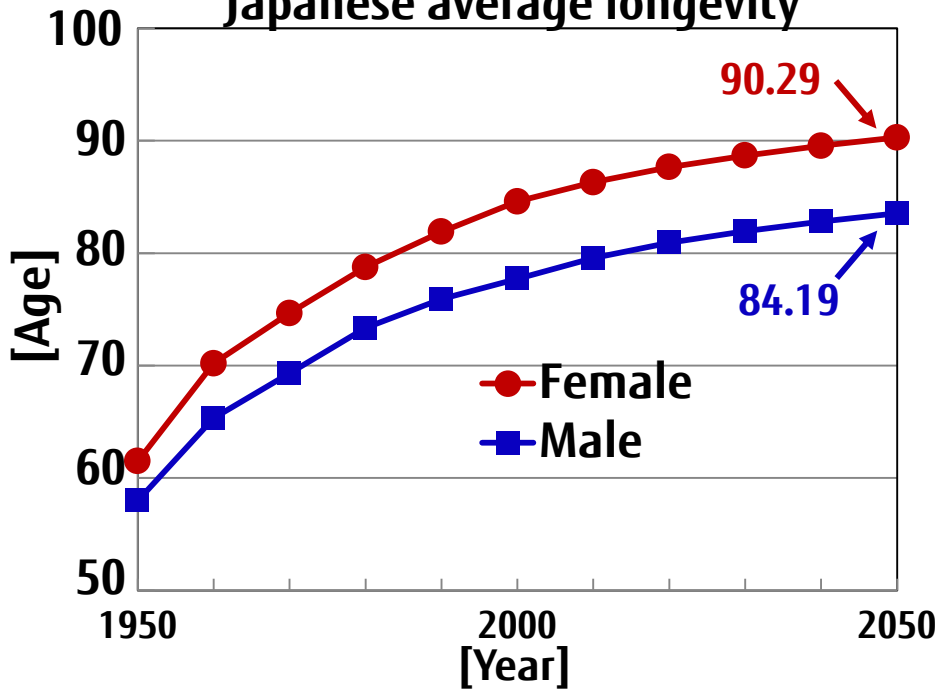
- Global logistics management across borders of land, sea and air
- Optimization of SCM, required time for delivery, work hours, and energy consumption
- Smart mobility realization by AI and connected car

ICT Supporting the Future E-Commerce, Logistics / Distribution



Future Trends of Work Style

Transition/prediction of Japanese average longevity



Source: Annual Report on the Aging Society: 2016 by Cabinet Office

Work style prediction

- In 2030 (Elderly people: at age 65 or over)
 - Number of elderly people in the world: Exceeded the one billion mark
 - Increase of the elderly percentage in the population
Japan: 32%, U.S.: 21%
China: 16%, Germany: 31%
- Diversified employment patterns
- Increased demand for engineers/professionals in new fields along with advent of advanced technologies

Source: United Nations, The World Population Prospects: The 2012 Revision

ICT Progress and Future Work Styles: 2016 White Paper on Information and Communications in Japan (by MIC)

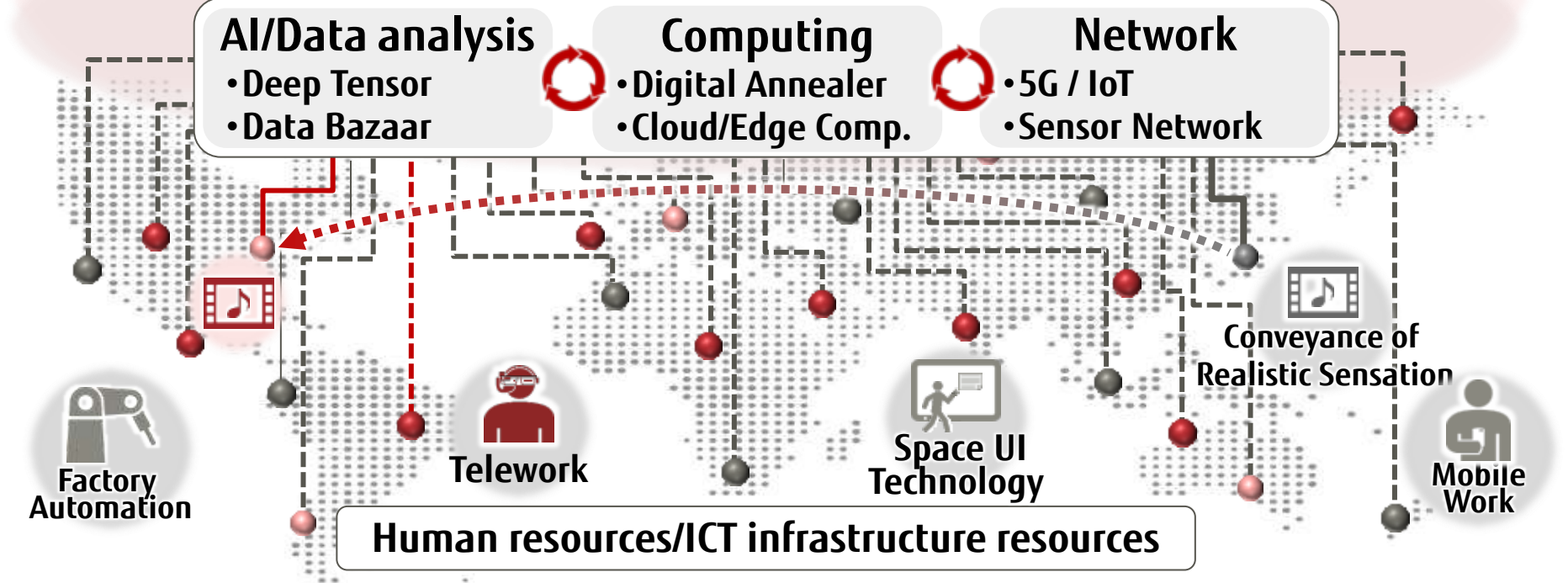
Keys to economic growth

- Recruit more diverse staffers globally (Value dynamism of individuals)
- Create new job categories and services by increasing business demand
- Expand/provide work opportunities and improve work quality/productivity

Future work styles

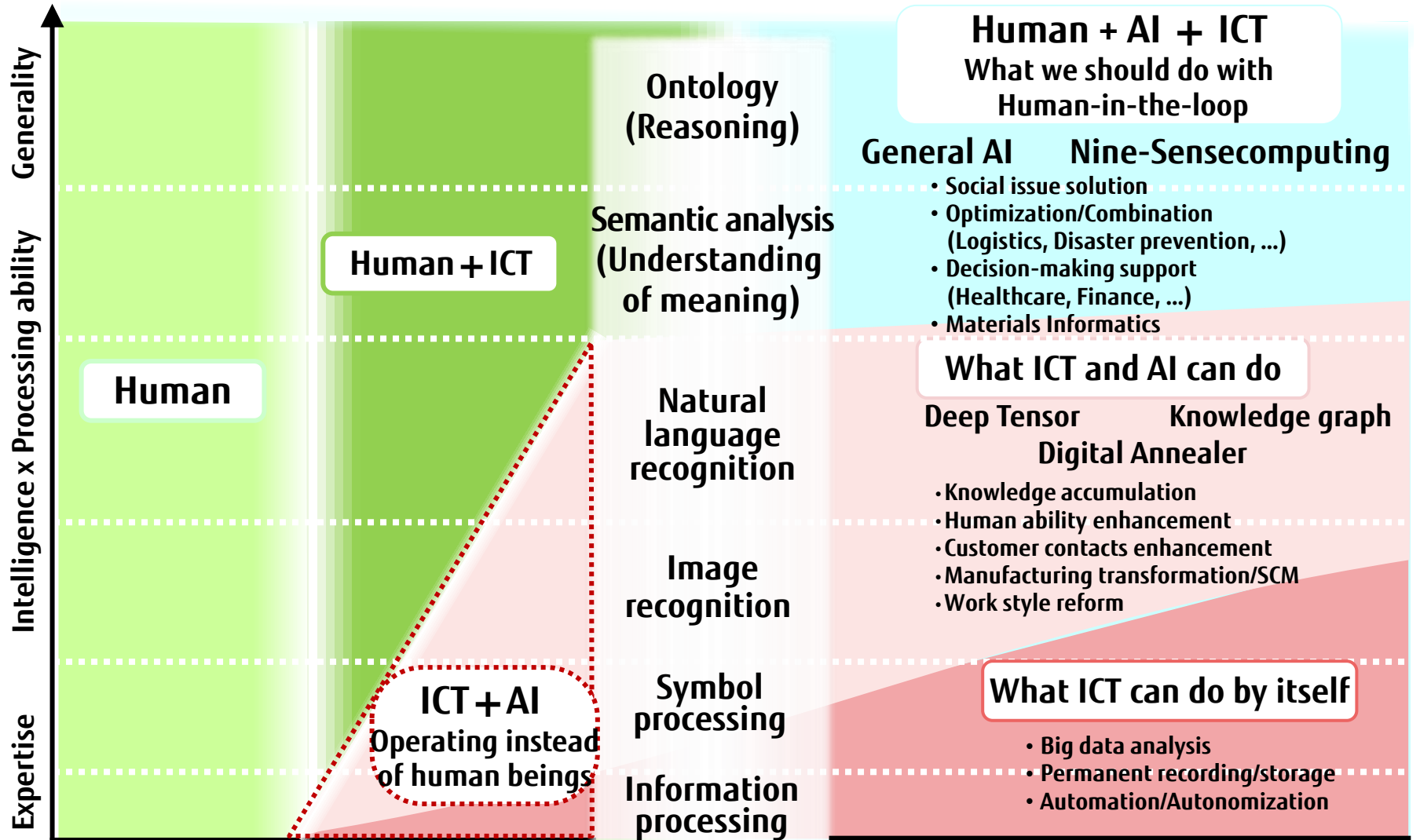
■ Maximize the performance of human resources all over the world and raise productivity

Human Empowerment



Collaboration between Human Beings and Human Centric ICT

■ Breakthrough in Human ability and performance by ICT



Human in the loop

Quick Decision Making

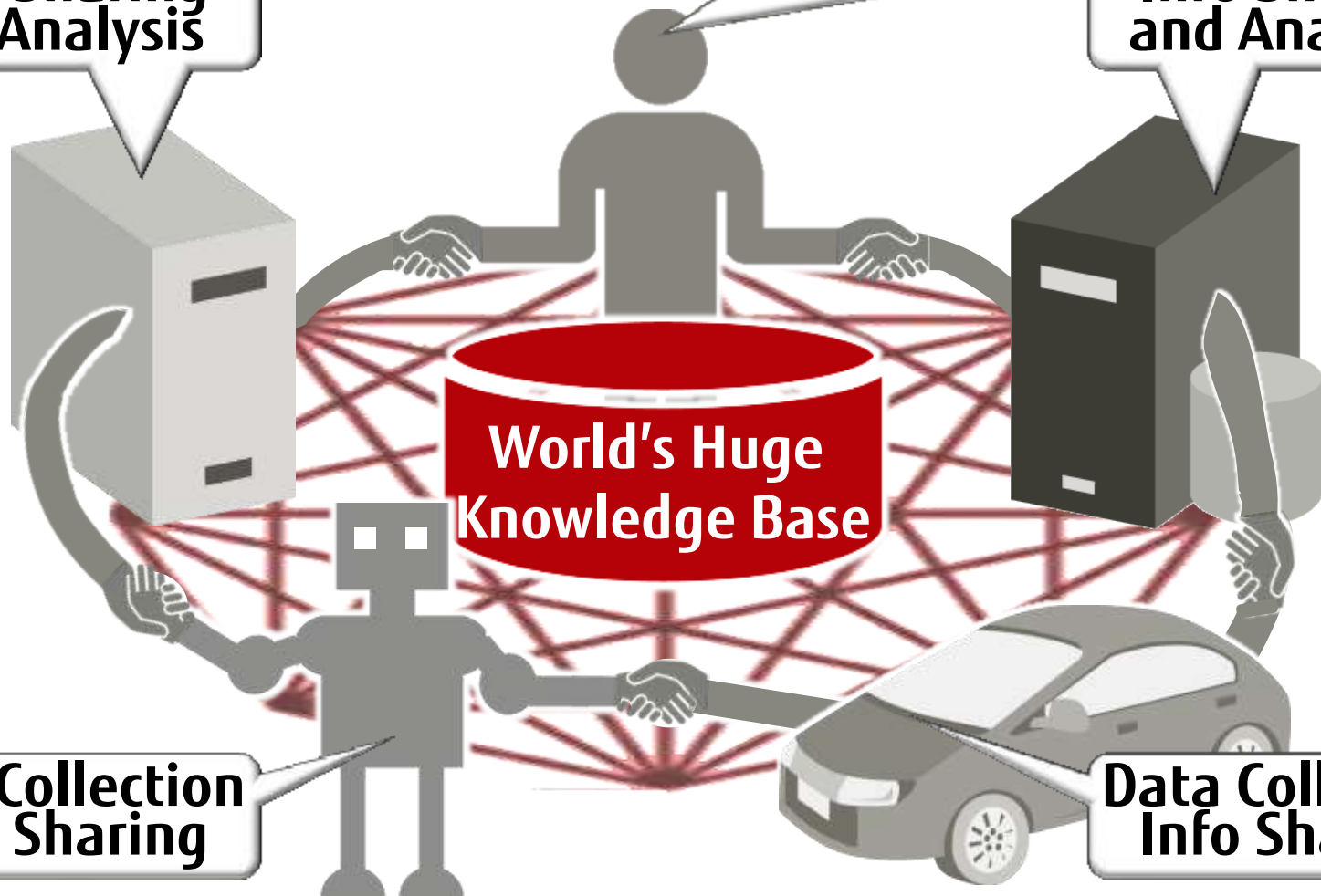
**Info Sharing
and Analysis**

**Info Sharing
and Analysis**

**World's Huge
Knowledge Base**

**Data Collection
Info Sharing**

**Data Collection
Info Sharing**



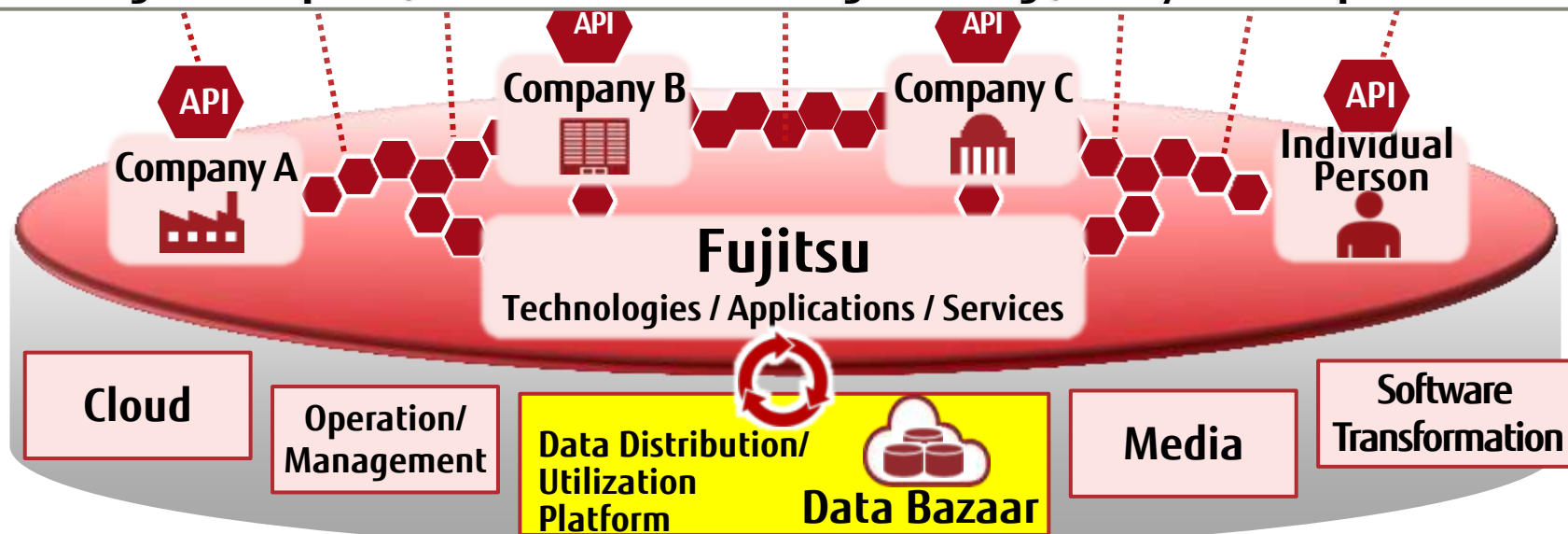
Connected Digital Place (CDP)

■ Co-creation platform for connecting data



Grasping the whole picture by seeing other industries' data, find the customer contacts.

Matching marketplace, Place for freewheeling thinking, Ecosystem implementation



The World of Hyperconnected Cloud

Driving Human Centric Innovation Digital Co-creation

Service-Oriented Connection:
Integrate various services dynamically
and promote Co-creation business

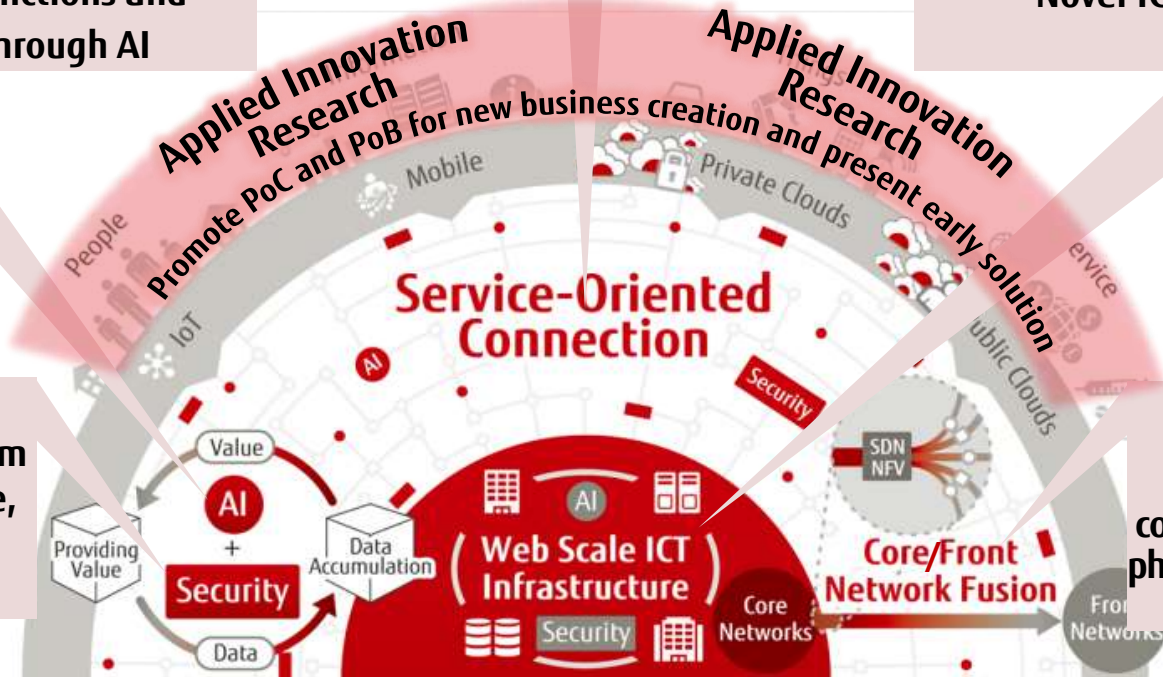
AI (Artificial Intelligence):
Make all products, functions and
services intelligent through AI

Web Scale ICT Infrastructure:
Novel ICT architecture toward
intelligent cloud era

Security:
Integrated security system
protecting cyberspace,
IoT, personal identity
data, and products

**Core/Front
Network Fusion:**
One network virtually
connecting all things from
physical networks to front-
end devices and services

Leading-Edge Basic Research:
Challenging the limitations of ICT



Main Topics for Today's Press Release

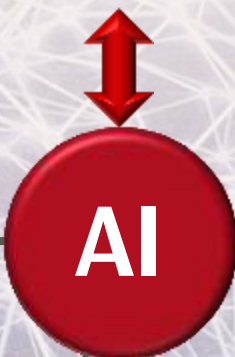
"Information Sharing" and "Quick Decision Making"

Reasoning/Thinking are important

- Big Data analysis
- Existing and Empirical knowledge learning
- Data cleansing

Swiftness is important

- High-speed data analysis
- Optimization problems
- Data sampling



Explainable machine learning

- System automation
- Emotion/feeling understanding
- Medical care (Gene analysis, Drug discovery)
- Matching pattern recognition
- Cyber security
- Network automation

Challenge Currently Unsolvable problems

- Operation/Route planning
- Medical care (Radiotherapy)
- Investment portfolio
- Chemical substance search
- Disaster prevention plan
- Electric network optimization



Knowledge Graph

Deep Tensor

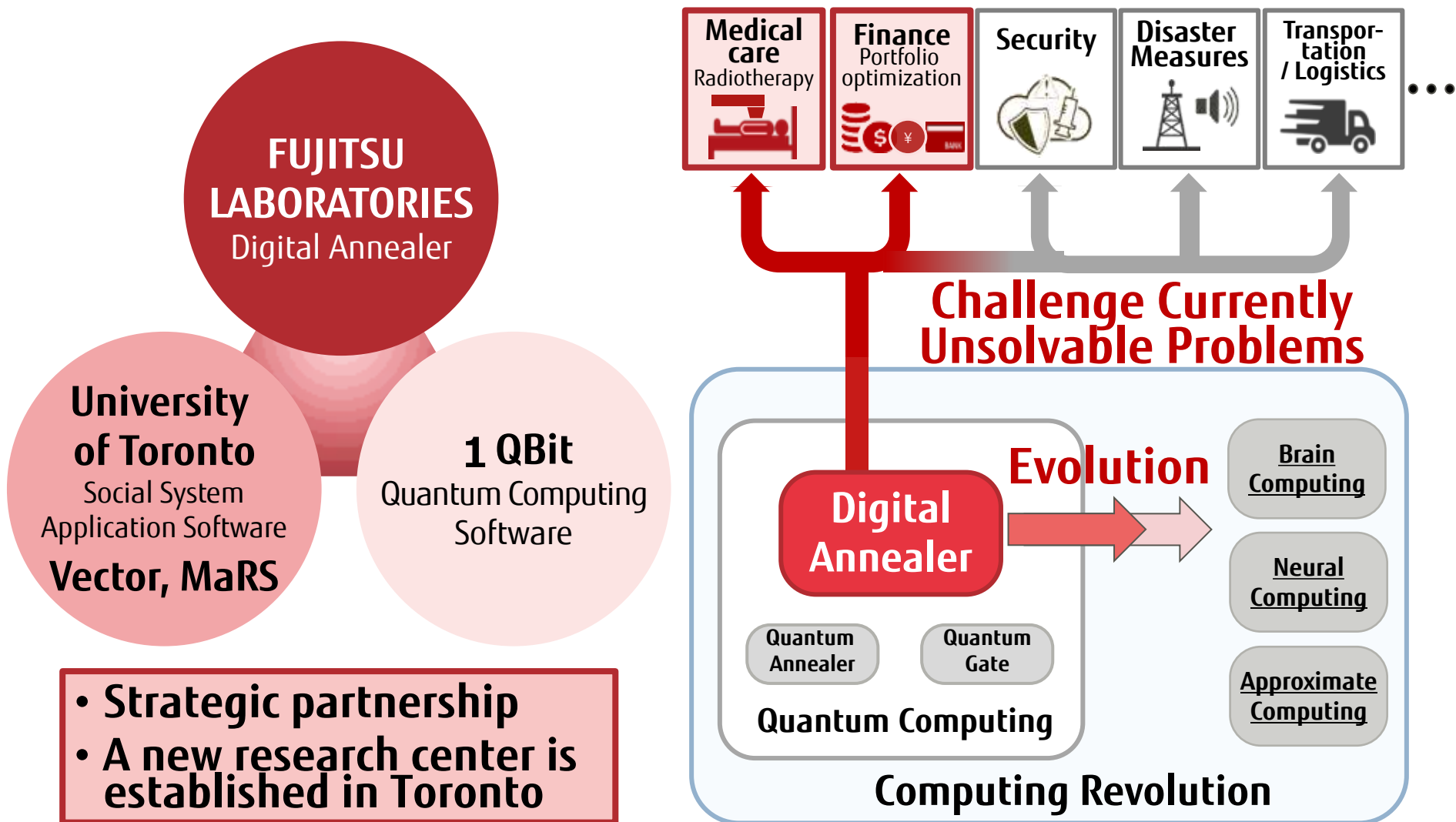
Deep Learning Unit

Digital Annealer

Domain Specific Computing

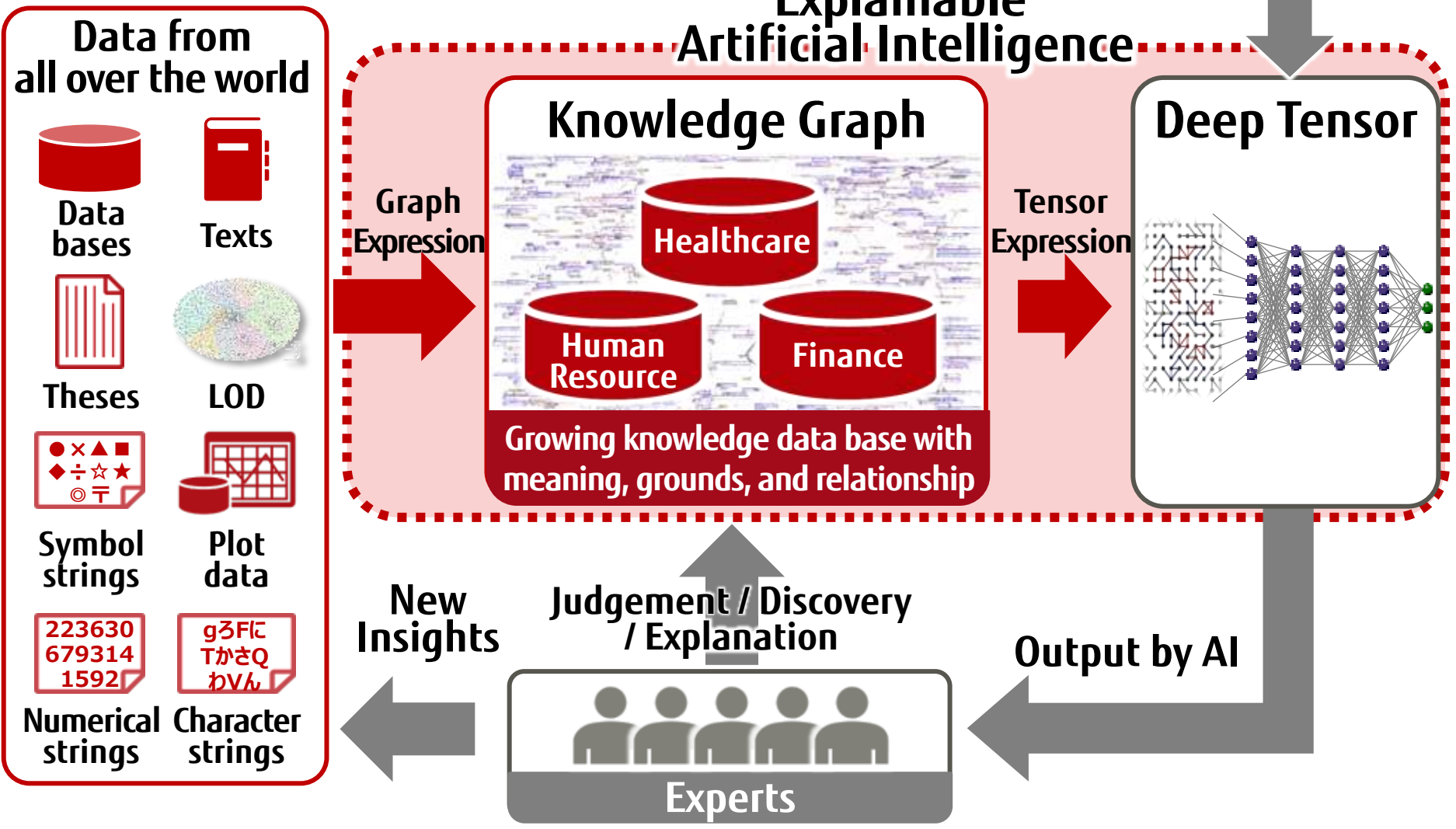
Strategy of Quantum Computing

Achievement of Computing Revolution by Global Co-creation



Explainable Artificial Intelligence

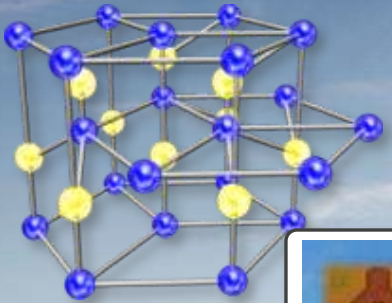
■ Fusion of Deep Tensor and Knowledge Graph



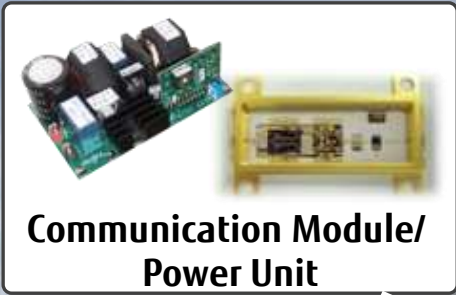
An Honorable International Award : Receiving the 33rd Kyoto Prize

■ Dr. Takashi Mimura, Honorary Fellow

- Invention of a HEMT (High Electron Mobility Transistor) by using compound semiconductors
- Significantly contributed to the innovation of communication technologies
- Parabolic Antenna, Vehicle Radar, Power Device



Satellite-Television Antenna



Communication Module/
Power Unit

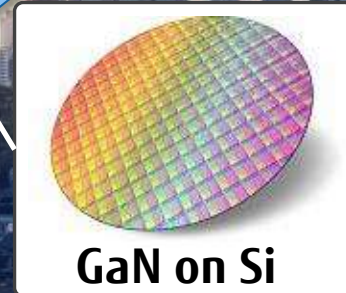


High-Efficiency AC Adaptor

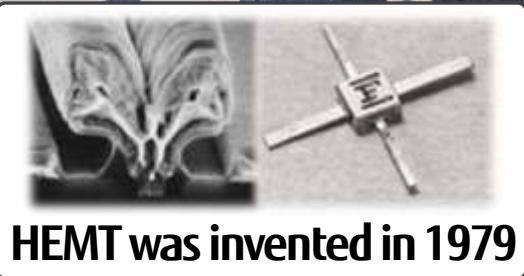
IP has been registered



GaN-HEMT



GaN on Si



HEMT was invented in 1979

The Fujitsu logo, consisting of the word "FUJITSU" in a bold, white, sans-serif font. The letter "i" is stylized with a small infinity symbol above it. The background of the slide features abstract, glowing white lines and a grid of small dots on a dark background.

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Technology Exhibits

Service-Oriented Connection

- 04. Reducing Data Preparation Time: Data Bazaar Technology for Generating Automatic Data Conversion Logic
- 05. Designing Technologies for Microservices Enabling the Rapid Change of Business Applications
- 06. Speed-Up Technology for Blockchain Transaction Processing

Web Scale ICT Infrastructure

- 01. Strategy for a "Digital Annealer": Challenge to Explore a New Computing Technology
- 10. Solving Customer Problems by Practical Implementation of High-Speed Image Retrieval Technology in Retail and Healthcare fields

Core/Front Network Fusion

- 07. Network Technology to Accelerate Secure Data Exchange Market Using Blockchain
- 08. Operation Management Platform for IoT Field-Area Systems
- 09. World first 5G Wireless Technology for On-demand High-Definition Video Distribution Service



AI

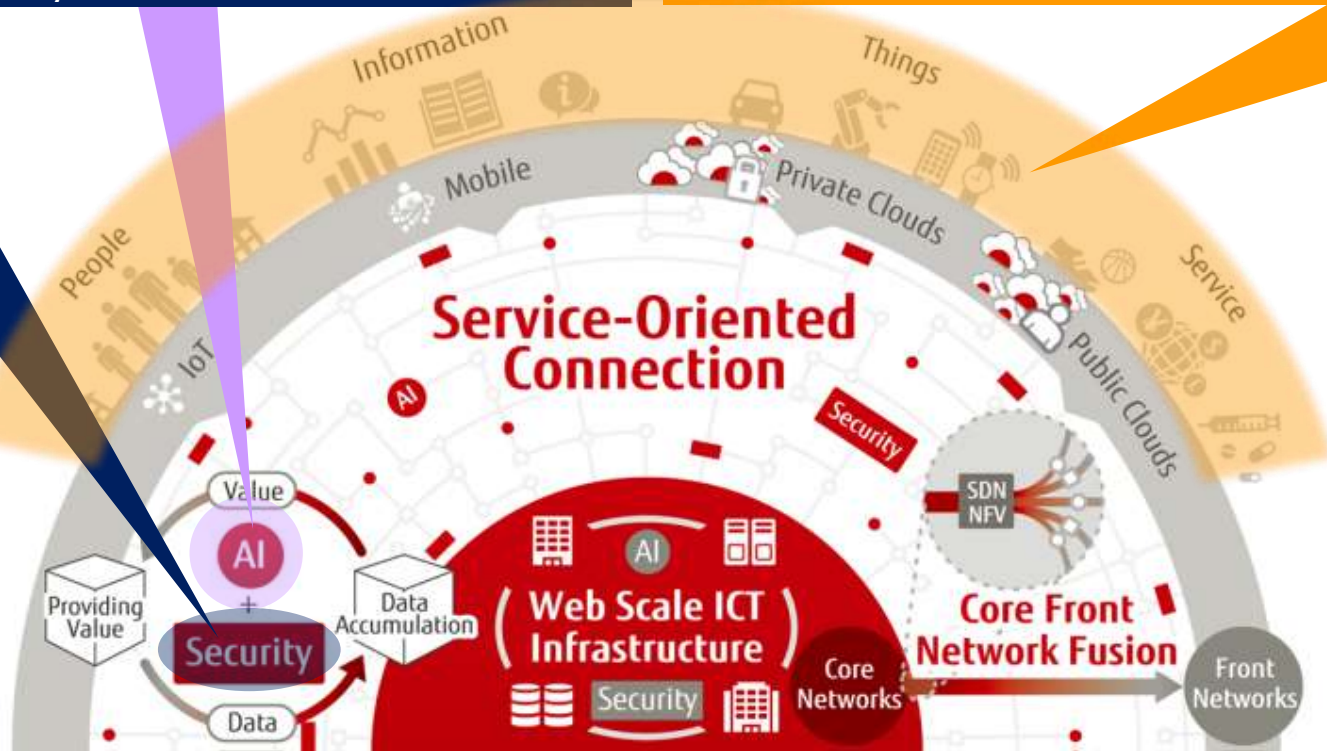
- 02. Explainable Artificial Intelligence with Deep Tensor and Knowledge Graph
- 11. Practical Application of Deep Tensor for Identifying Cyber Attacks

Security

- 11. Practical Application of Deep Tensor for Identifying Cyber Attacks
- 12. Human Centric Personal Data Store(PDS) and Risk-Aware Anonymization

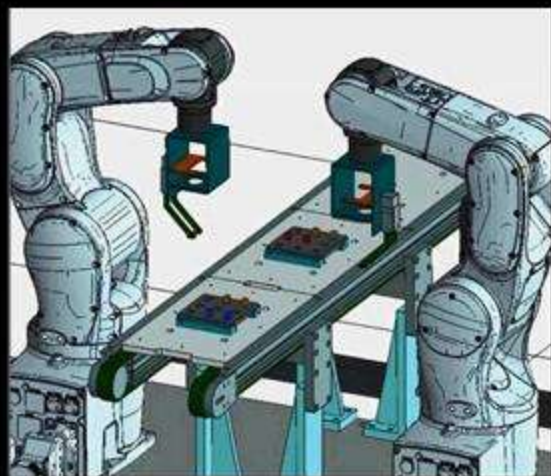
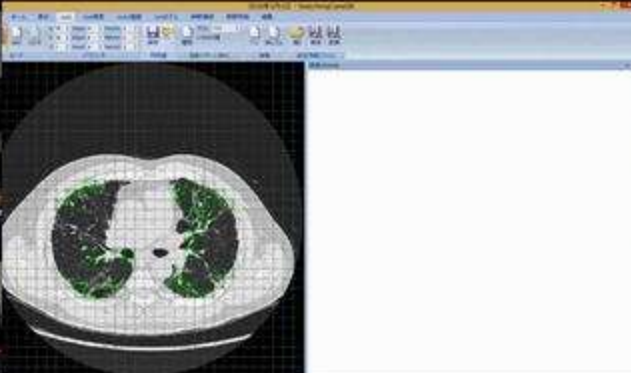
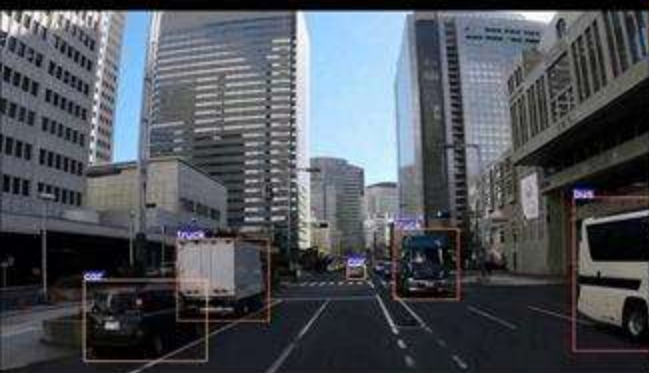
Applied Innovation Research


- 13. New AI Analysis Technology Using Sensor Data for Estimating Internal Damage to Bridges
- 14. World's First Wearable Hands-Free Speech Translation Terminal for Multilingual Communication



Leading-Edge Basic Research

- 01. Strategy for a "Digital Annealer": Challenge to Explore a New Computing Technology
- 03. Invention of High Electron Mobility Transistor (HEMT) Contributing to Great Advances in ICT

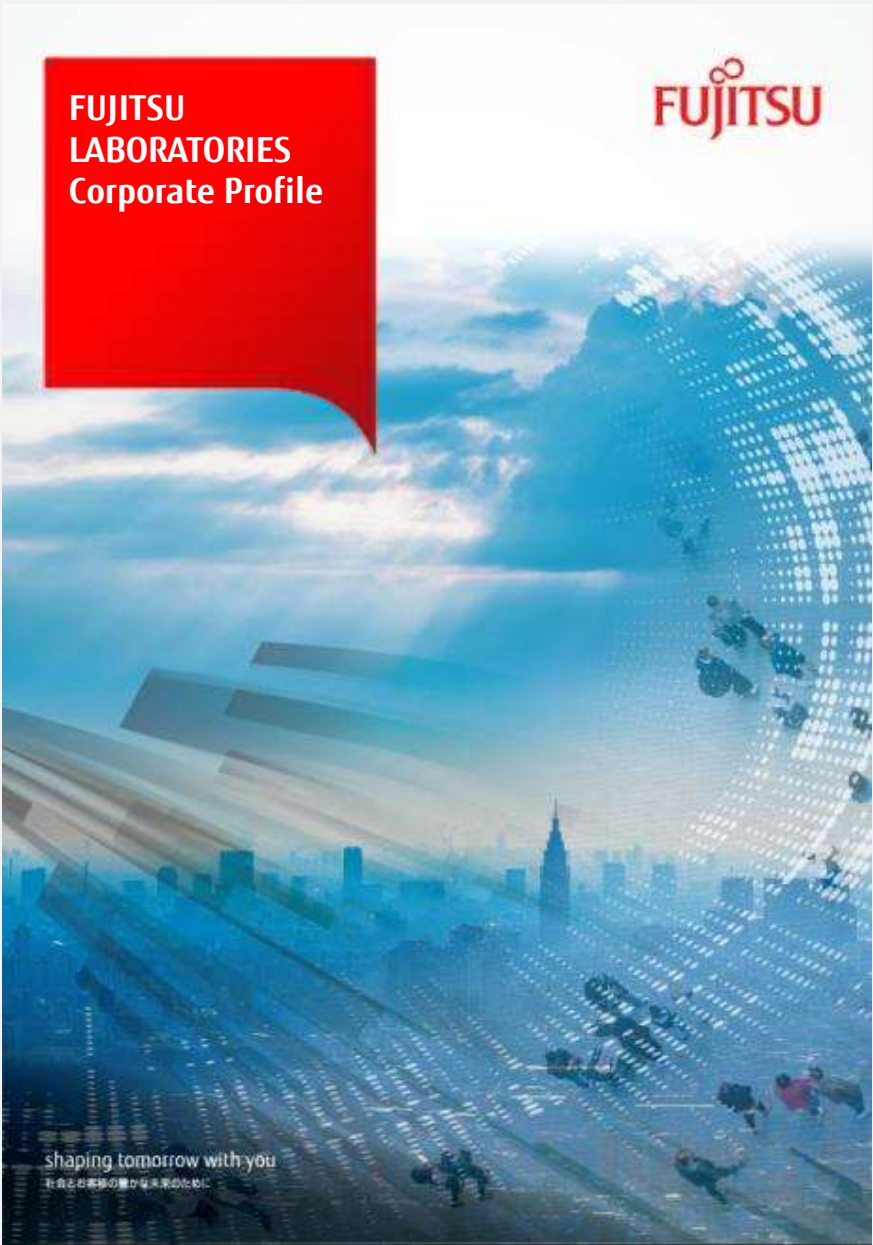




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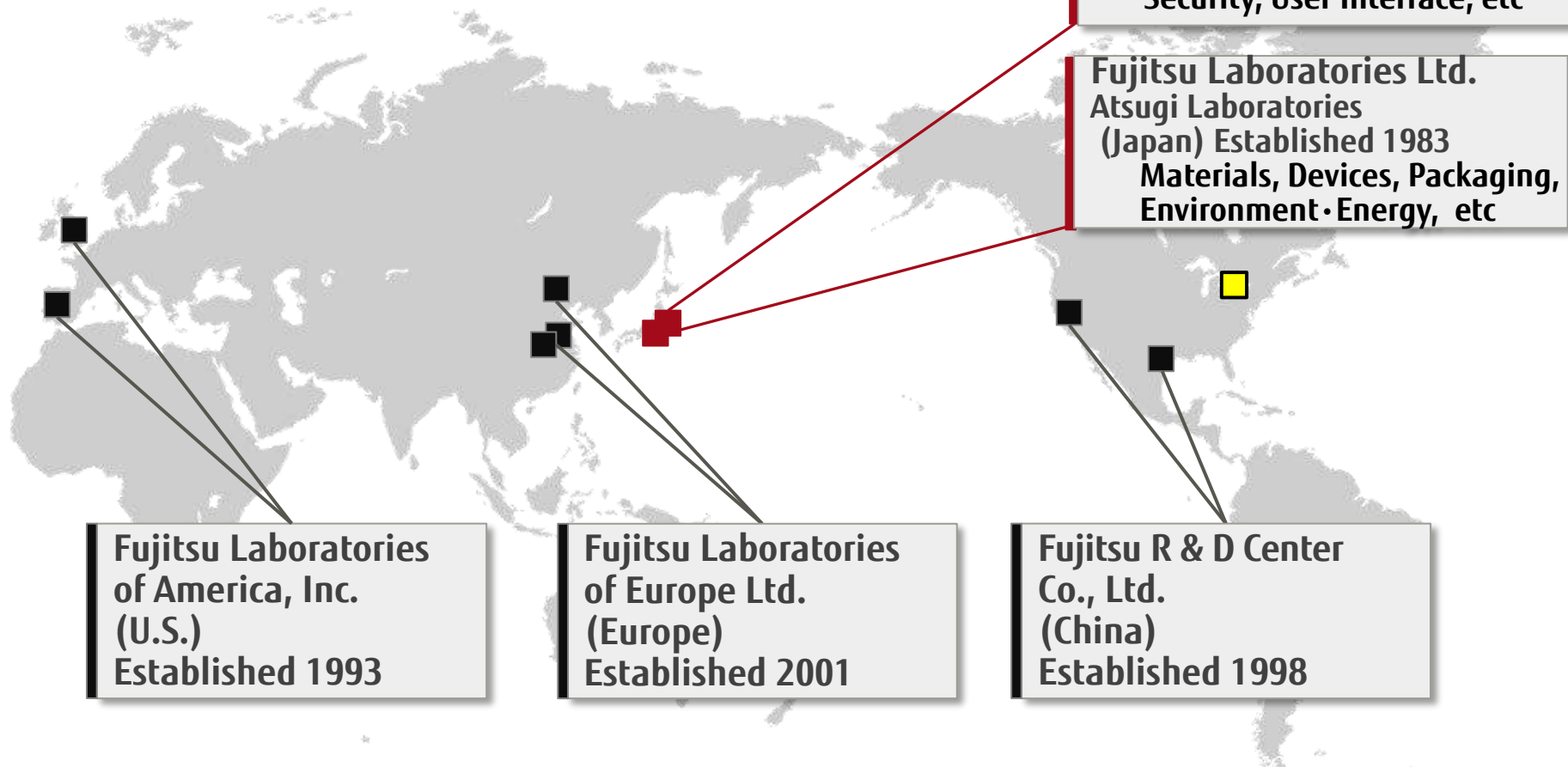
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FUJITSU LABORATORIES Corporate Profile 2017



Fujitsu Laboratories' Group: Overview

- CEO: Shigeru Sasaki
- R&D Budget: Approx. US\$ 167 million
- Total Employees: Approx. 1,400 worldwide



Fujitsu Laboratories Ltd.
Kawasaki Laboratories
(Japan) Established 1968
Computer, cloud system,
Network, IoT, Software,
AI, Knowledge processing,
Security, User Interface, etc

Fujitsu Laboratories Ltd.
Atsugi Laboratories
(Japan) Established 1983
Materials, Devices, Packaging,
Environment·Energy, etc

**Fujitsu Laboratories
of America, Inc.**
(U.S.)
Established 1993

**Fujitsu Laboratories
of Europe Ltd.**
(Europe)
Established 2001

**Fujitsu R & D Center
Co., Ltd.**
(China)
Established 1998

Organization, form April 1st, 2017

FUJITSU LABORATORIES LTD.

★: New

Computer Systems Laboratories

Software Laboratories

Information Systems Technologies Laboratories

IoT Systems Laboratories

Network Systems Laboratories

Front Technologies Laboratories ★

Artificial Intelligence Laboratories ★

Security Research Laboratories ★

Devices & Materials Laboratories

Applied Innovation Research Center

Fujitsu Laboratories of America, Inc.

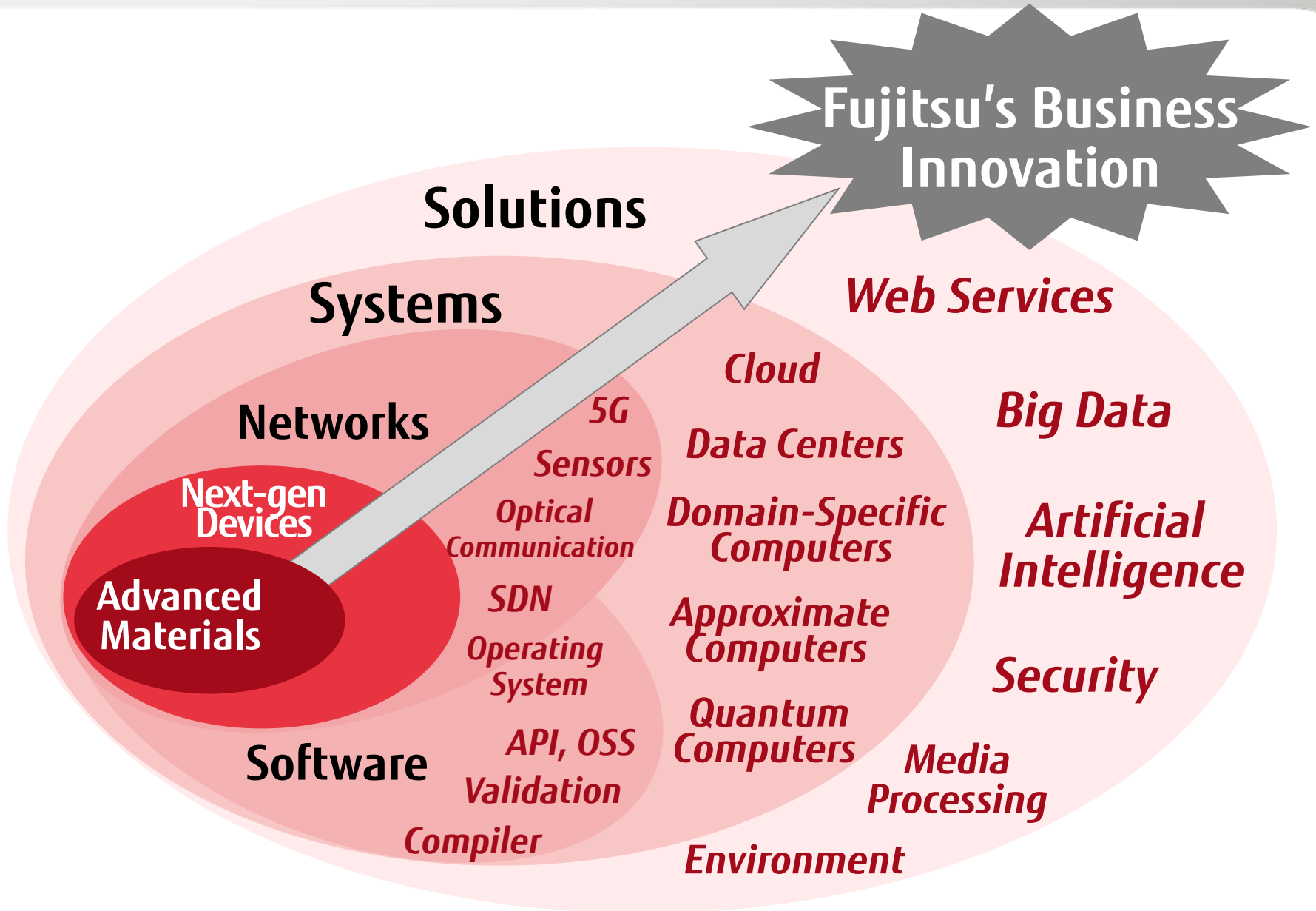
Fujitsu Research and Development Center

Fujitsu Laboratories of Europe, Ltd.

R&D Strategy and Planning Unit

R&D Management Unit

Technology Value Chain of R&D Themes



Positioning of Fujitsu Laboratories

**Through Digital Co-creation,
create values, develop new markets,
and contribute to the core business**

Business

**Fujitsu Limited and
Subsidiaries**

R&D

**Strategy
Taskforce**

**R&D
Investment**

Open Innovation

**Government
Projects**

**Universities
& Research
Institutes**

FUJITSU LABORATORIES

**Technologies and market trends
Customer and partner needs**

Flow of R&D and Business Deployment

