FY2015 R&D Strategy Briefing

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Fujitsu Laboratories' R&D Strategies

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April 2, 2015

Hyperconnected World

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- **Technological advances are enabling diverse innovations**

IoT: Internet of Things

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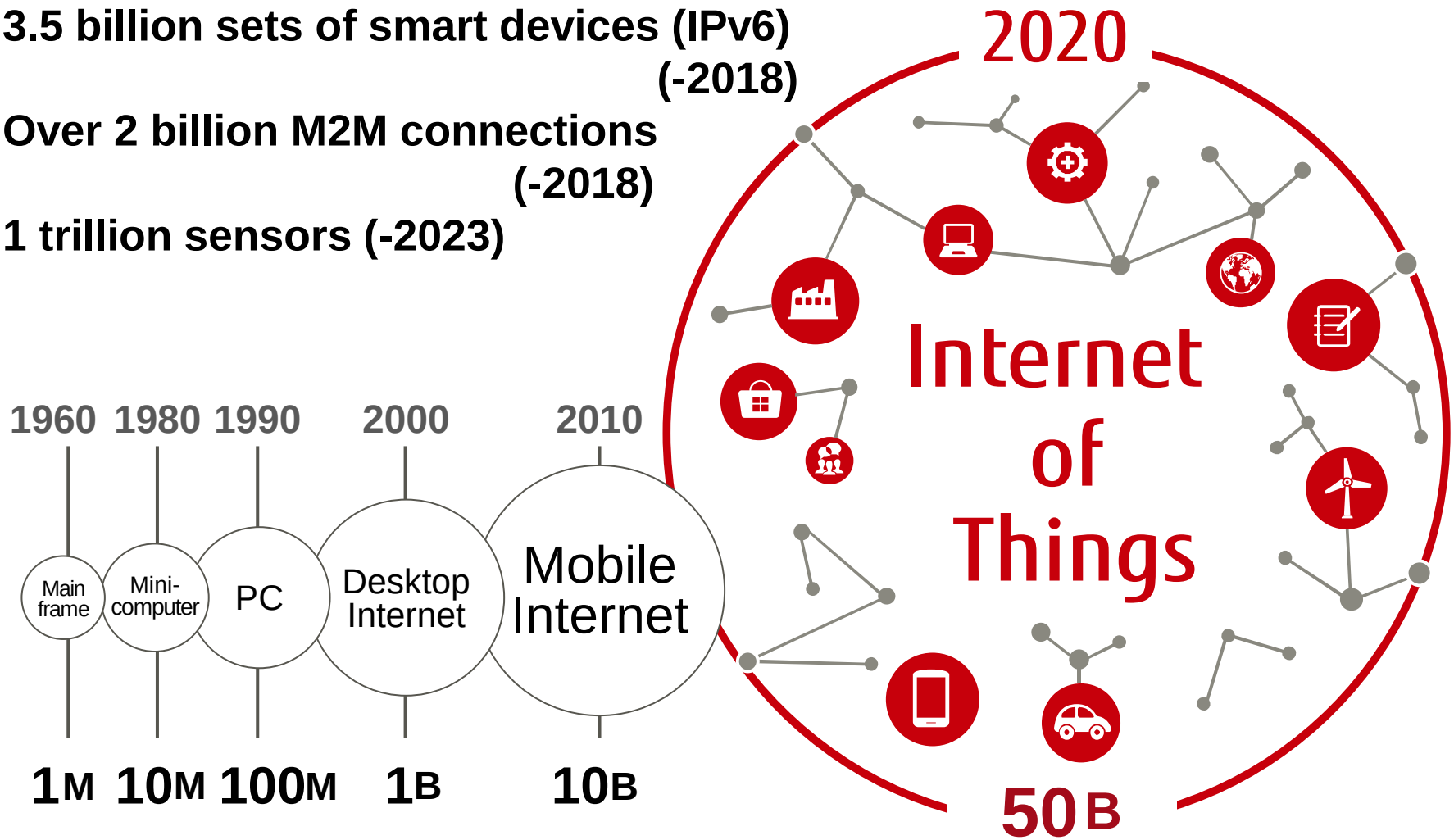
A multitude of “things” are connected with the Internet

- 3.5 billion sets of smart devices (IPv6) (-2018)
- Over 2 billion M2M connections (-2018)
- 1 trillion sensors (-2023)



(The number of users or devices)

Evolution of ICT and drivers

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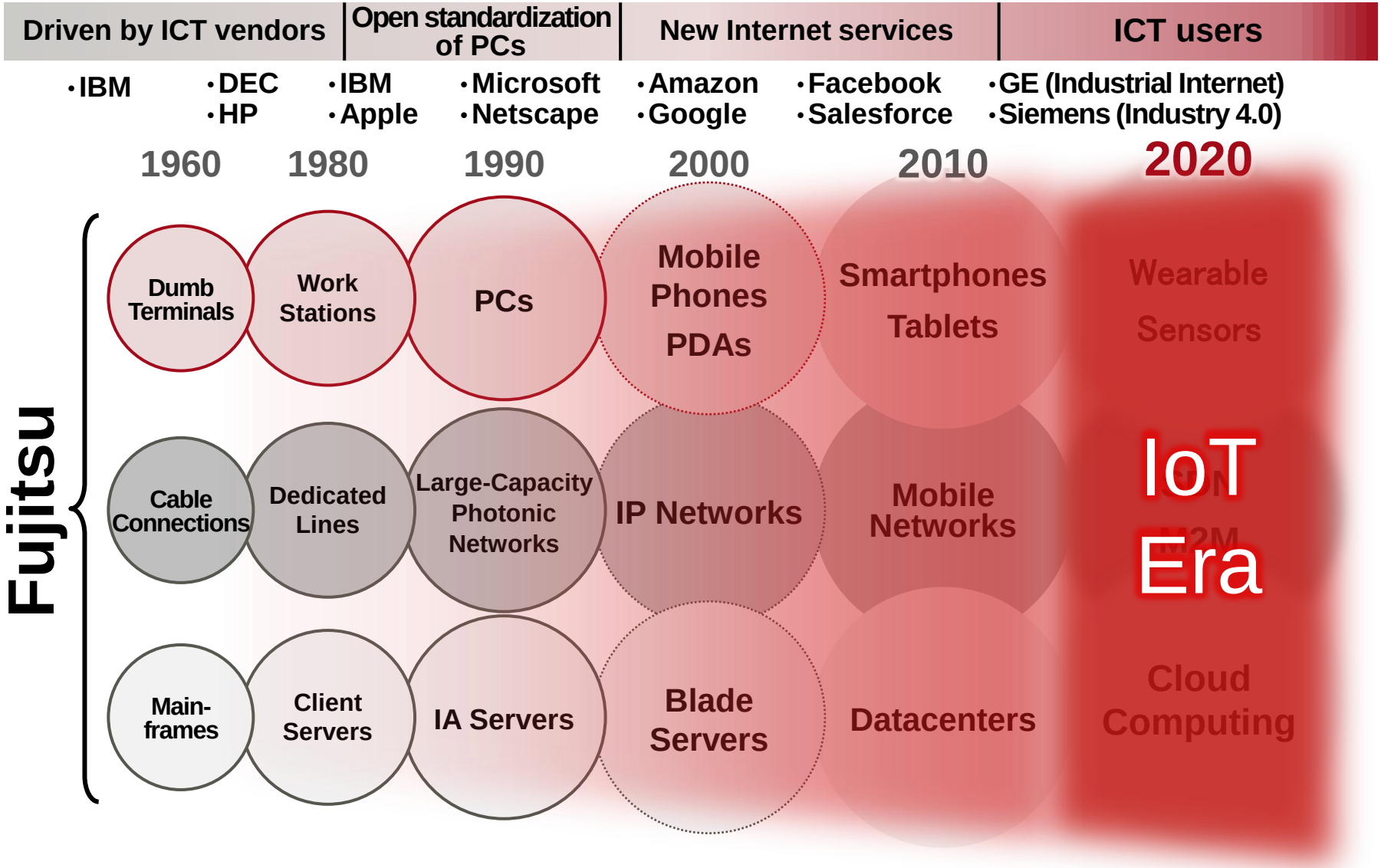
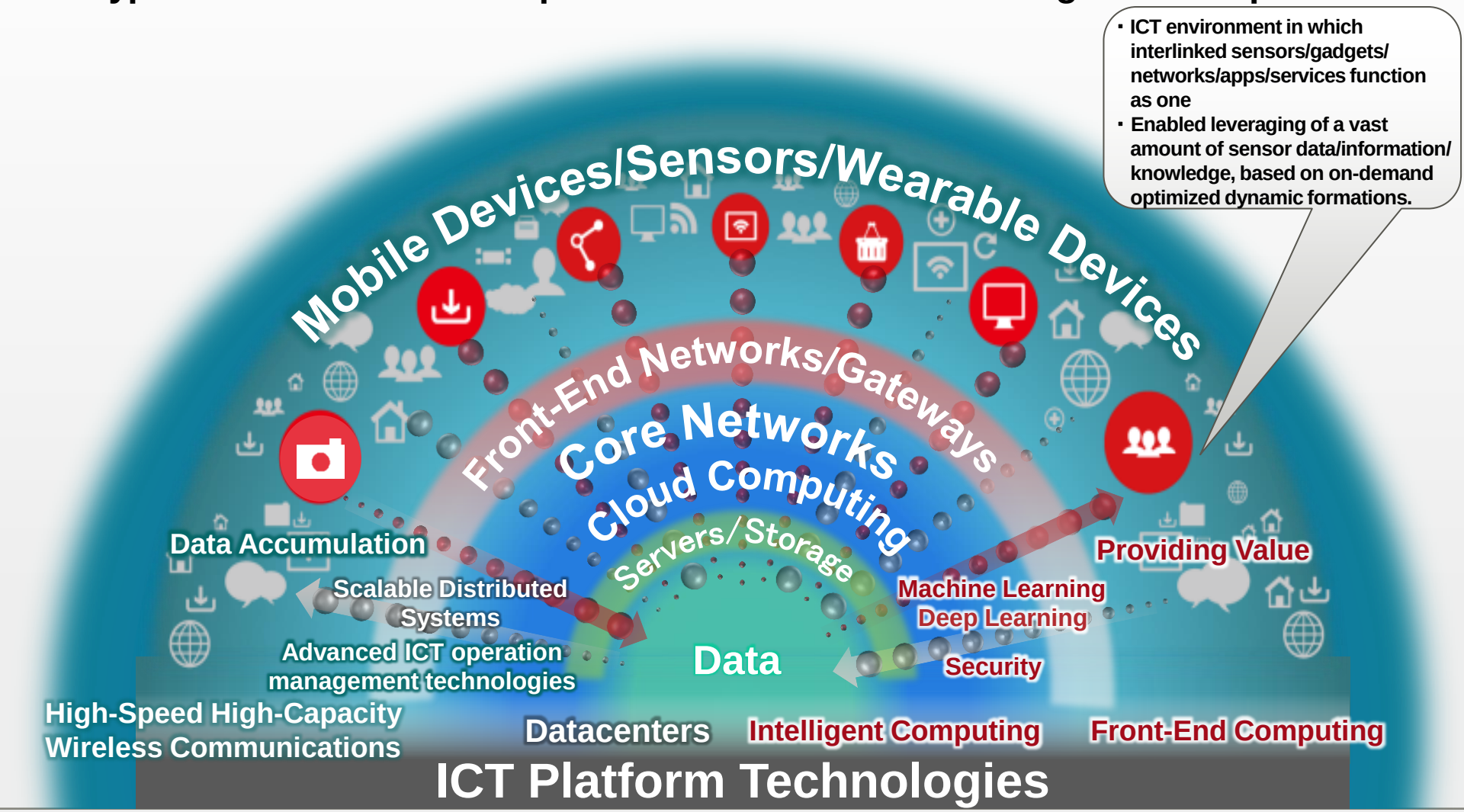
- Linkage and interaction of front-end devices, networks, and computing



Hyperconnected Cloud

- From server consolidation-based usage (servers/storage/applications), to clouds
- Further permeation of cloud architecture to front-end networks and devices
- Hyperconnected cloud comprised of amoeba-like interlinkages of multiple clouds



From a Cloud Computing perspective

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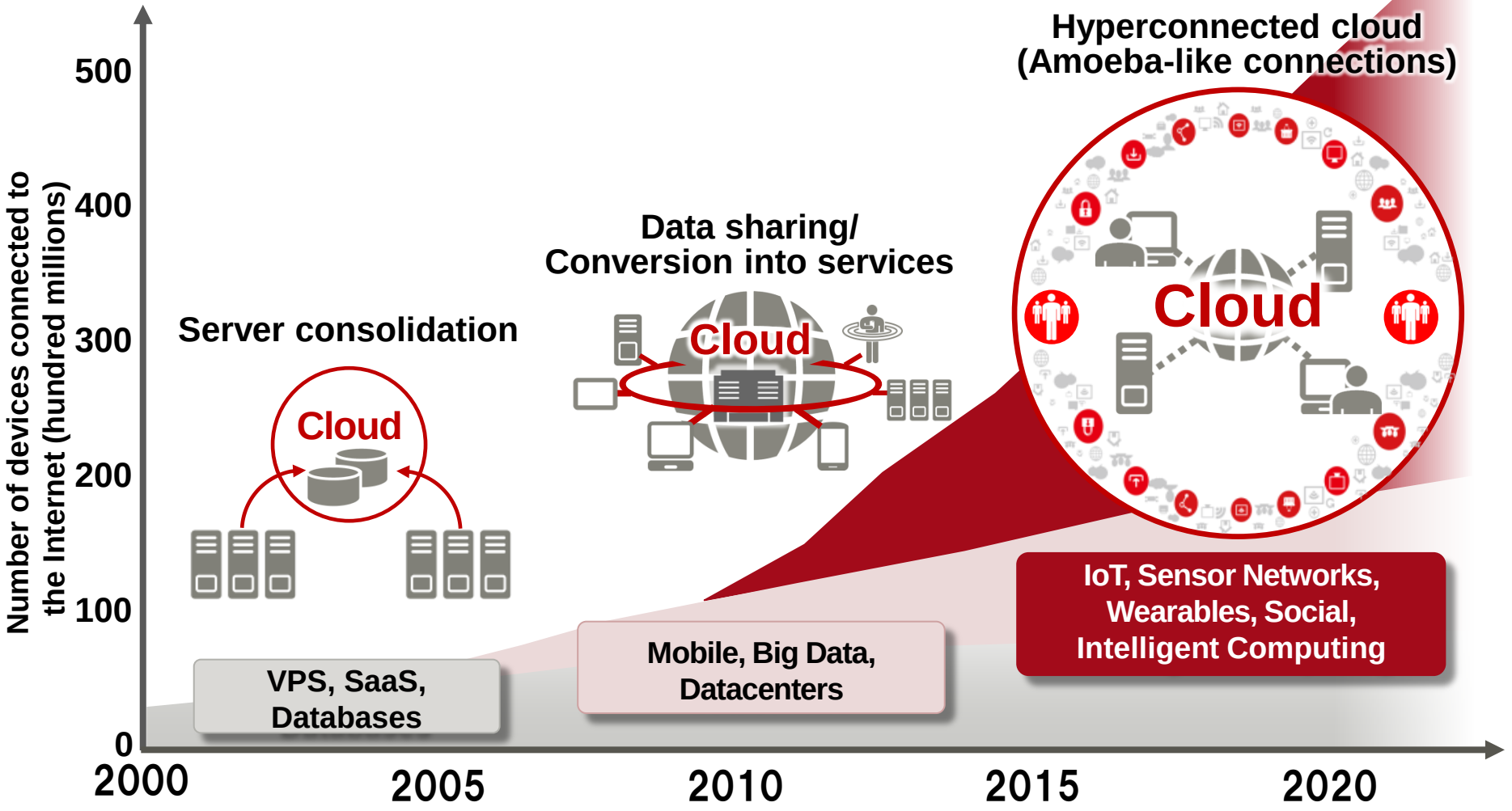
From server consolidation-based usage to a Hyperconnected Cloud



Sources: Ministry of Internal Affairs and Communications (Japan); IDC + content added by Fujitsu Laboratories Ltd.

From a Data perspective

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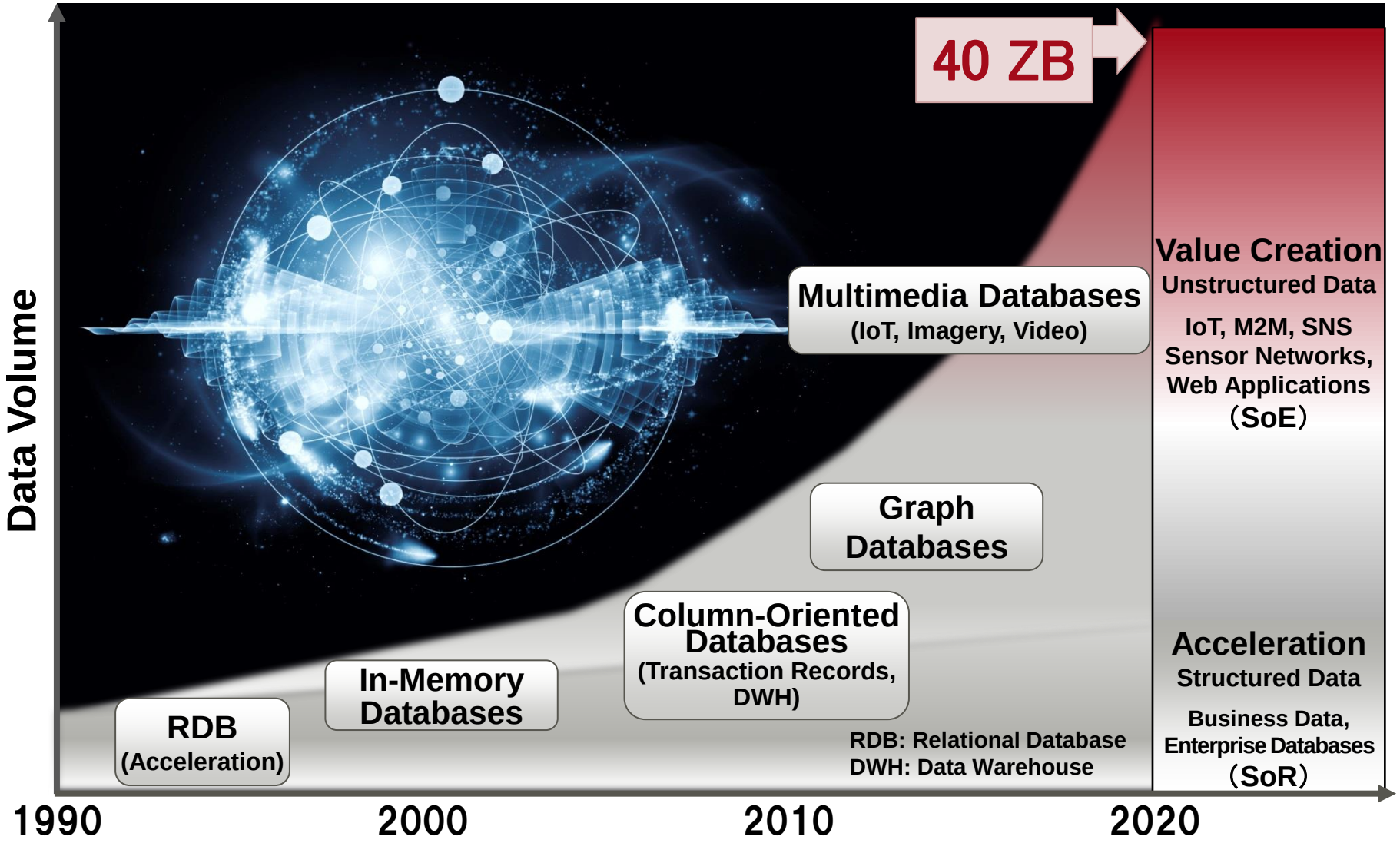
Explosive expansion of Unstructured Data



Source: Ministry of Internal Affairs and Communications (Japan) + content added by Fujitsu Laboratories Ltd.

From a Human-Centric perspective

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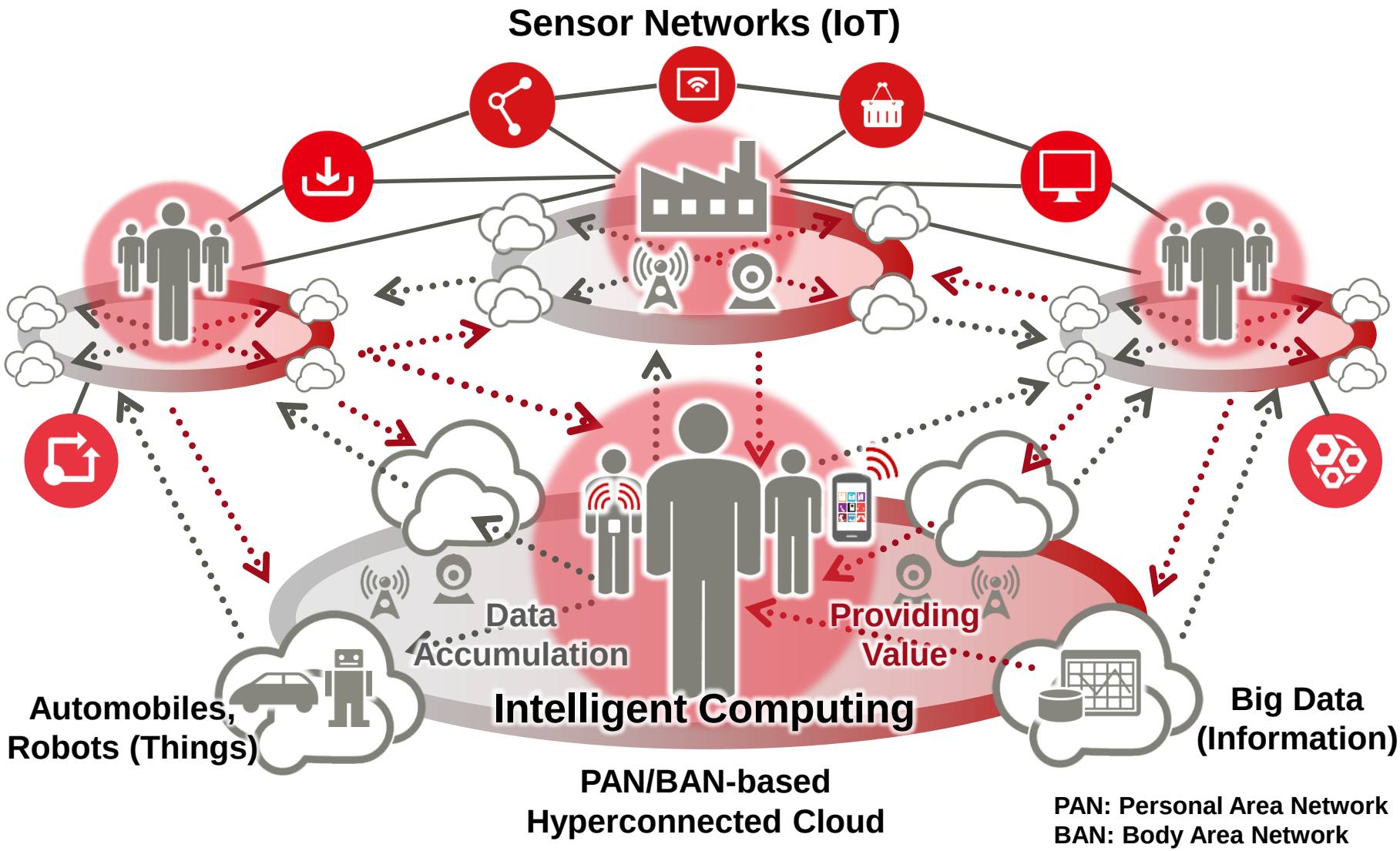
Intelligent Computing-driven Human Empowerment



From a System Integration perspective

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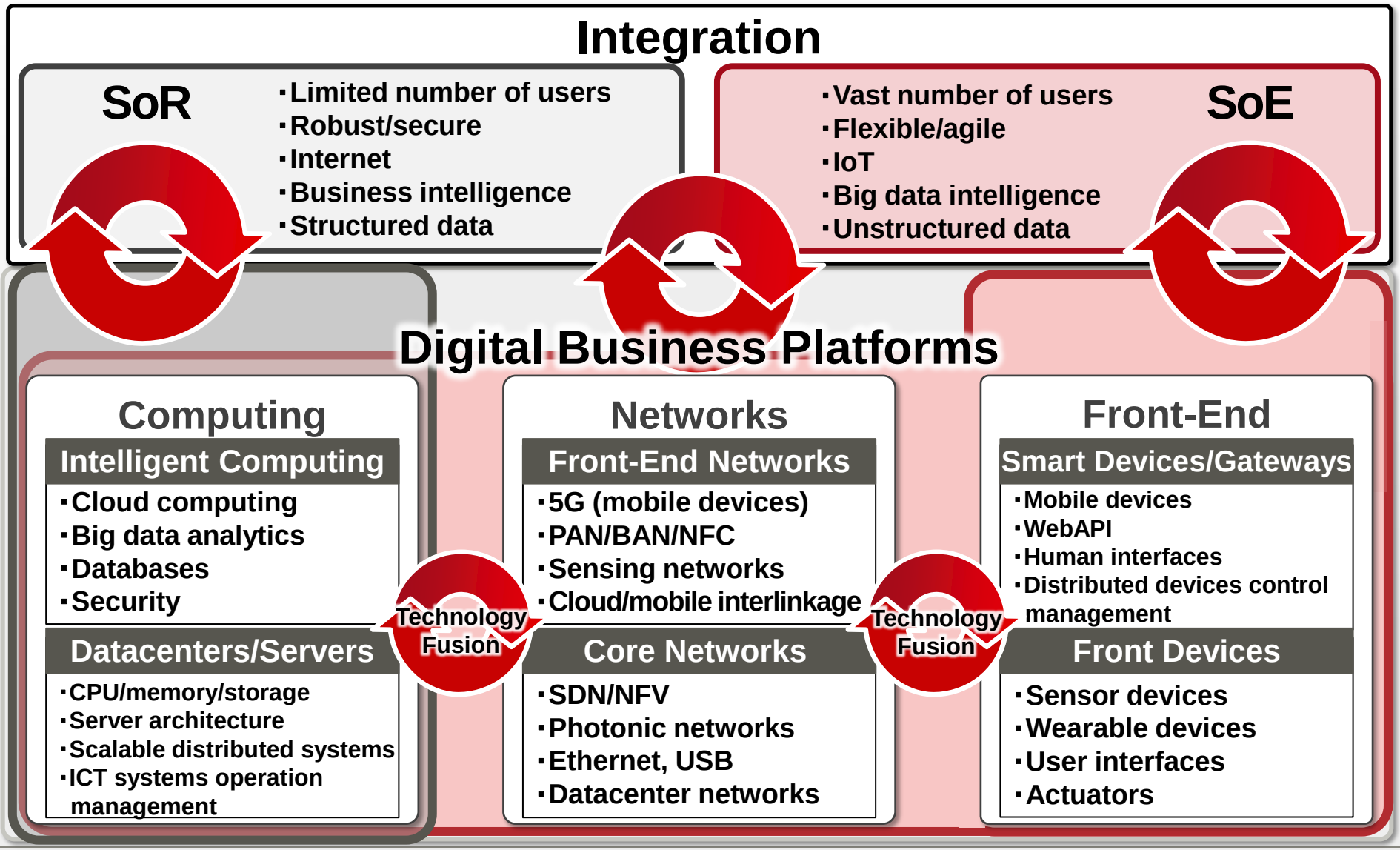
Comprehensive strength for generating Innovation



From a Human-Centric perspective

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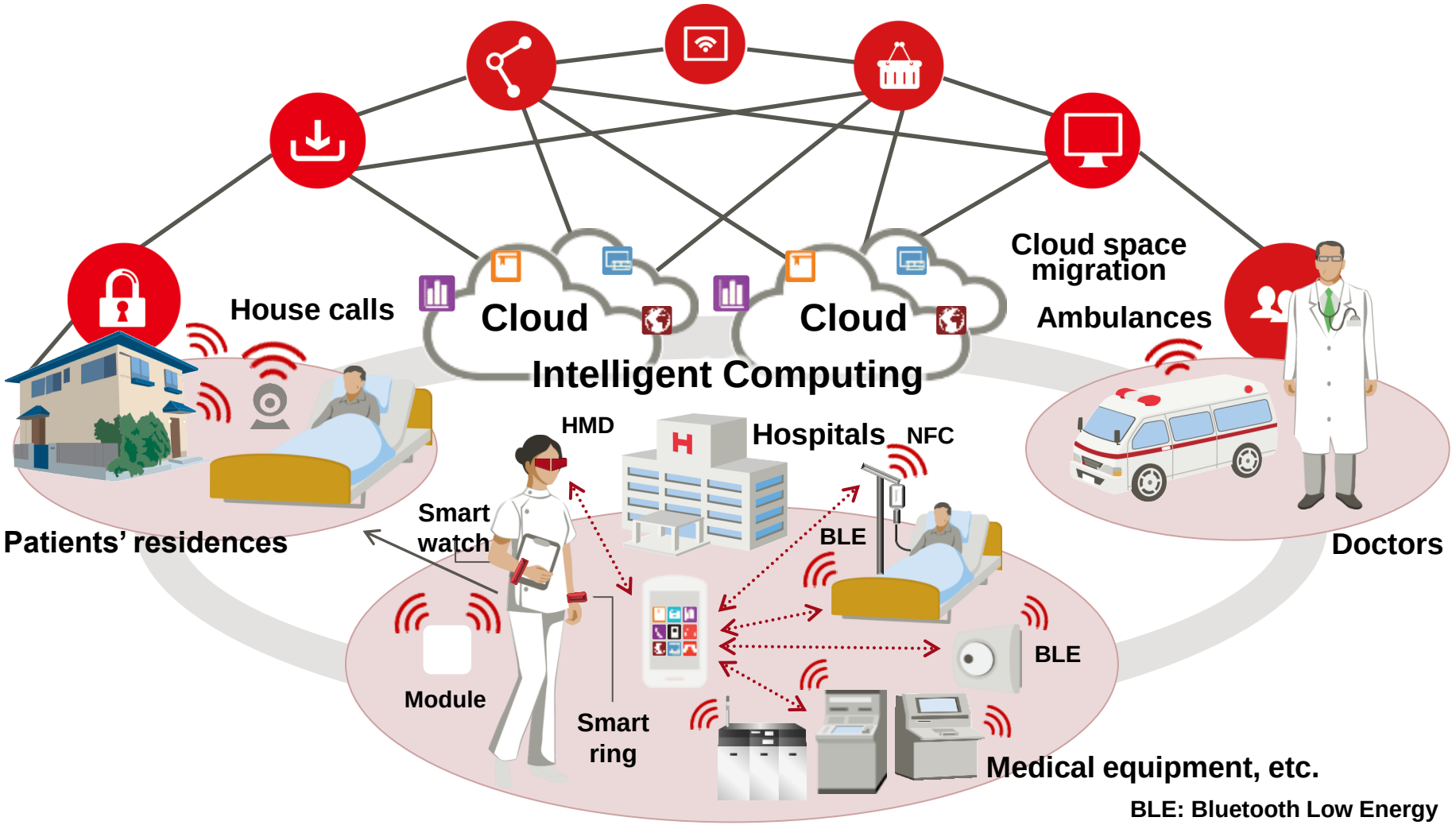
Example: Healthcare



BLE: Bluetooth Low Energy
PAN: Personal Area Network
BAN: Body Area Network
HMD: Head Mount Display

From a Human-Centric perspective

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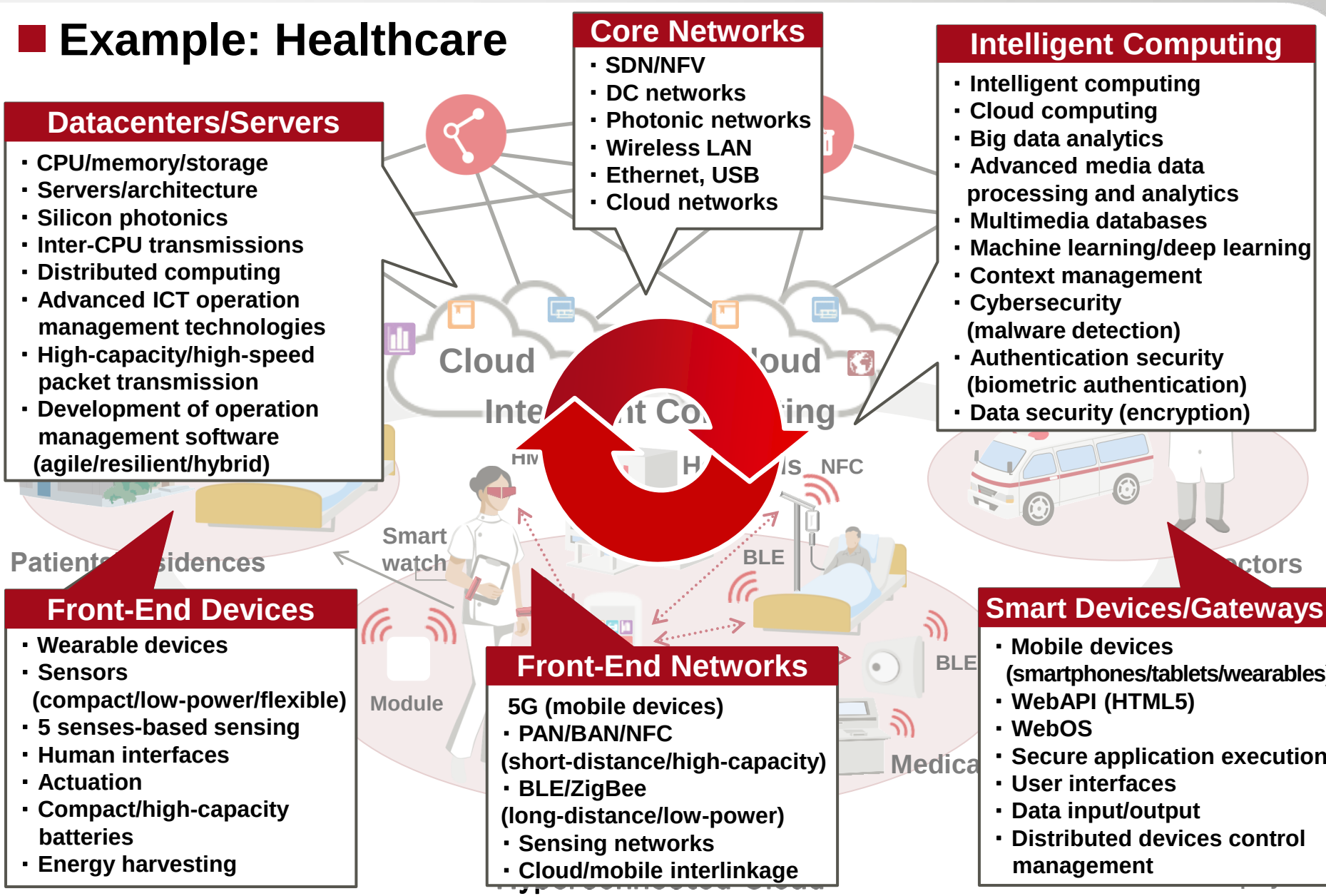
Example: Healthcare



Core Networks
- SDN/NFV
- DC networks
- Photonic networks
- Wireless LAN
- Ethernet, USB
- Cloud networks

Intelligent Computing
- Intelligent computing
- Cloud computing
- Big data analytics
- Advanced media data processing and analytics
- Multimedia databases
- Machine learning/deep learning
- Context management
- Cybersecurity (malware detection)
- Authentication security (biometric authentication)
- Data security (encryption)

Datacenters/Servers
- CPU/memory/storage
- Servers/architecture
- Silicon photonics
- Inter-CPU transmissions
- Distributed computing
- Advanced ICT operation management technologies
- High-capacity/high-speed packet transmission
- Development of operation management software (agile/resilient/hybrid)

Front-End Devices
- Wearable devices
- Sensors (compact/low-power/flexible)
- 5 senses-based sensing
- Human interfaces
- Actuation
- Compact/high-capacity batteries
- Energy harvesting

Front-End Networks
- 5G (mobile devices)
- PAN/BAN/NFC (short-distance/high-capacity)
- BLE/ZigBee (long-distance/low-power)
- Sensing networks
- Cloud/mobile interlinkage

Smart Devices/Gateways
- Mobile devices (smartphones/tablets/wearables)
- WebAPI (HTML5)
- WebOS
- Secure application execution
- User interfaces
- Data input/output
- Distributed devices control management

Fujitsu Laboratories Group: Overview

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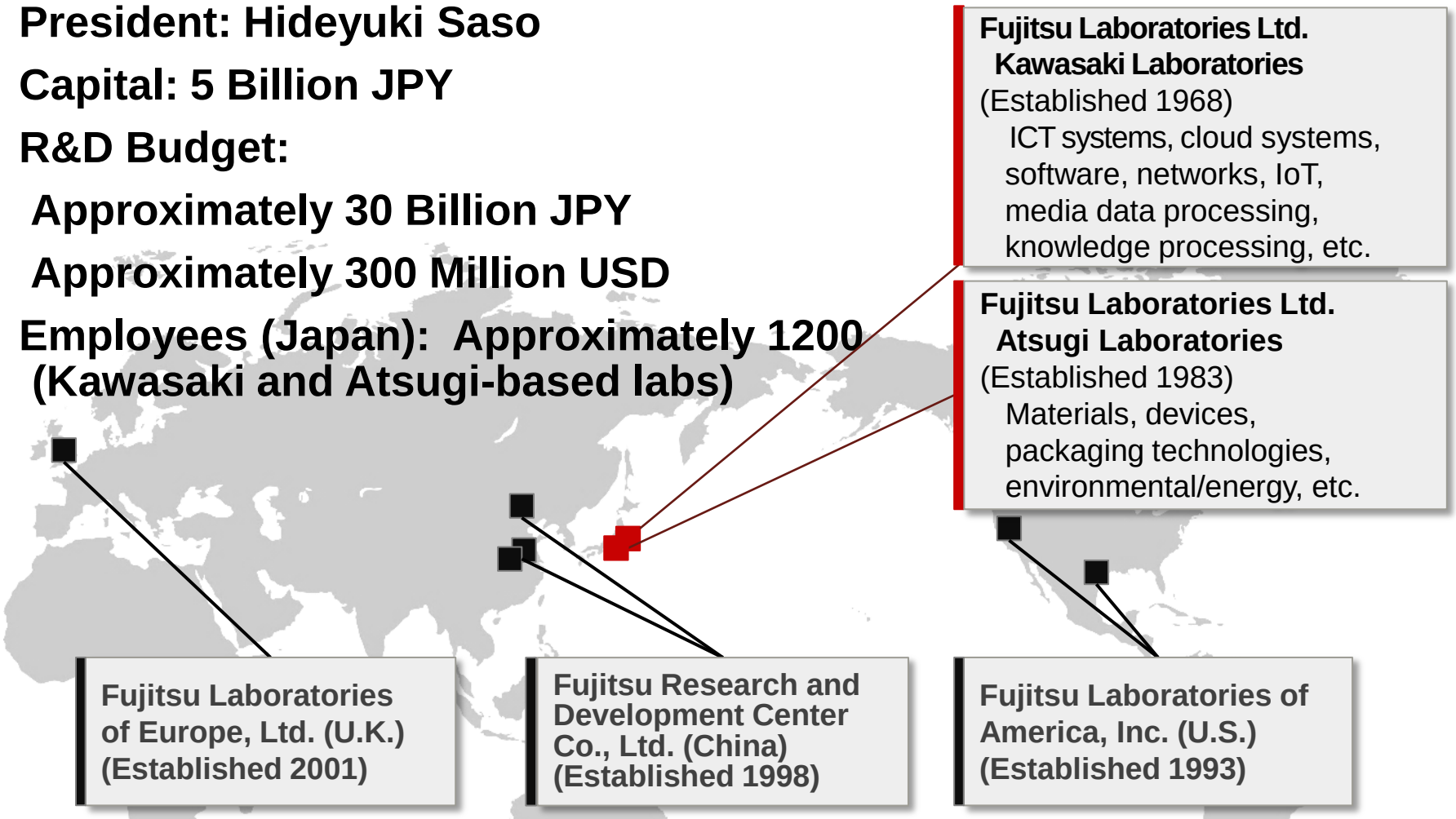
- **President: Hideyuki Saso**
- **Capital: 5 Billion JPY**
- **R&D Budget:**
  Approximately 30 Billion JPY
  Approximately 300 Million USD
- **Employees (Japan): Approximately 1200 (Kawasaki and Atsugi-based labs)**



- **Employees (Global R&D sites): Approximately 210: U.S./China/U.K.**

US$=¥100. http://www.fujitsu.com/global/about/ir/data/results/2013/

Fujitsu Laboratories: Mission

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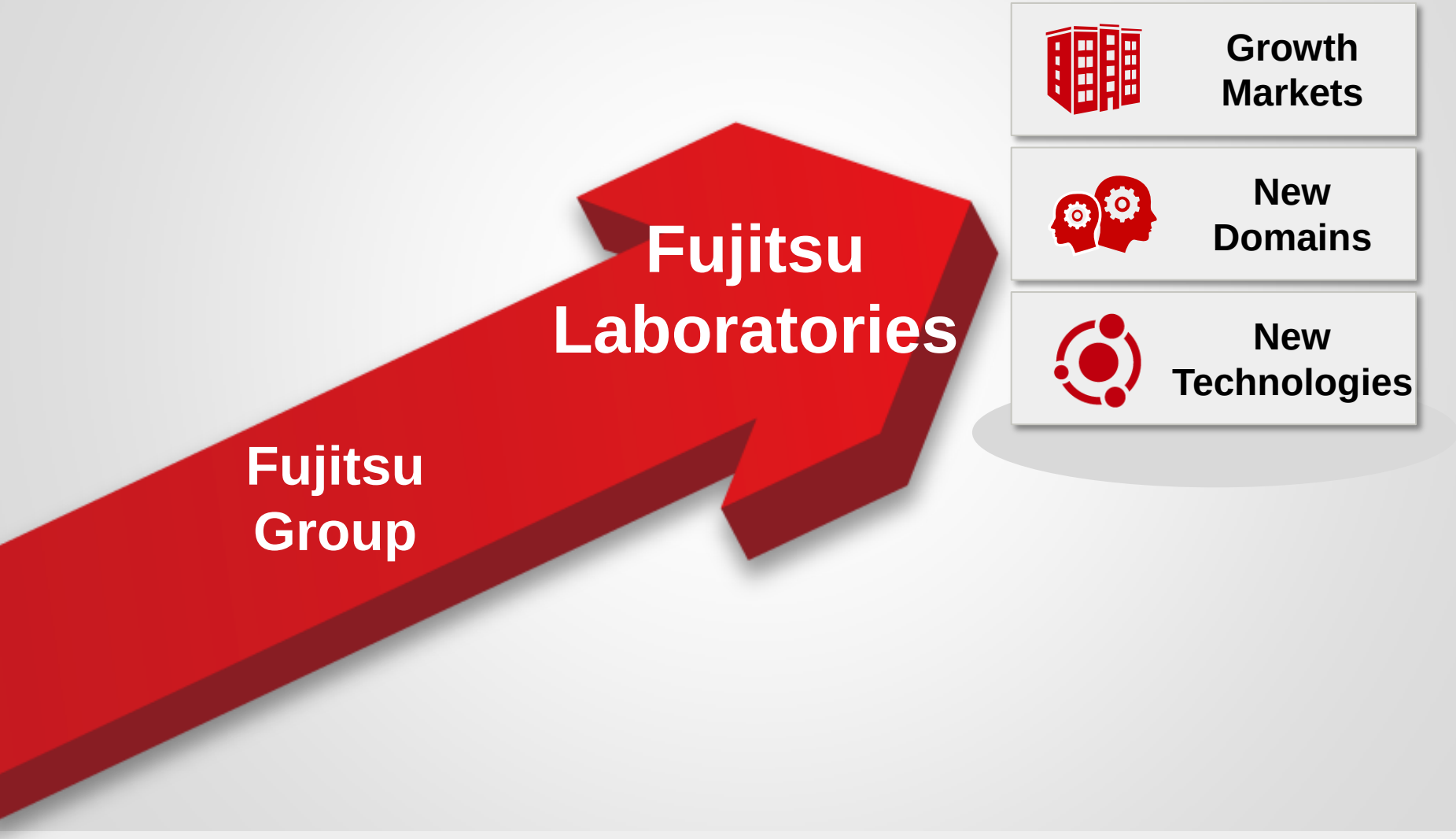
Technologies to drive growth of the Fujitsu Group



Fujitsu Group: R&D Scheme

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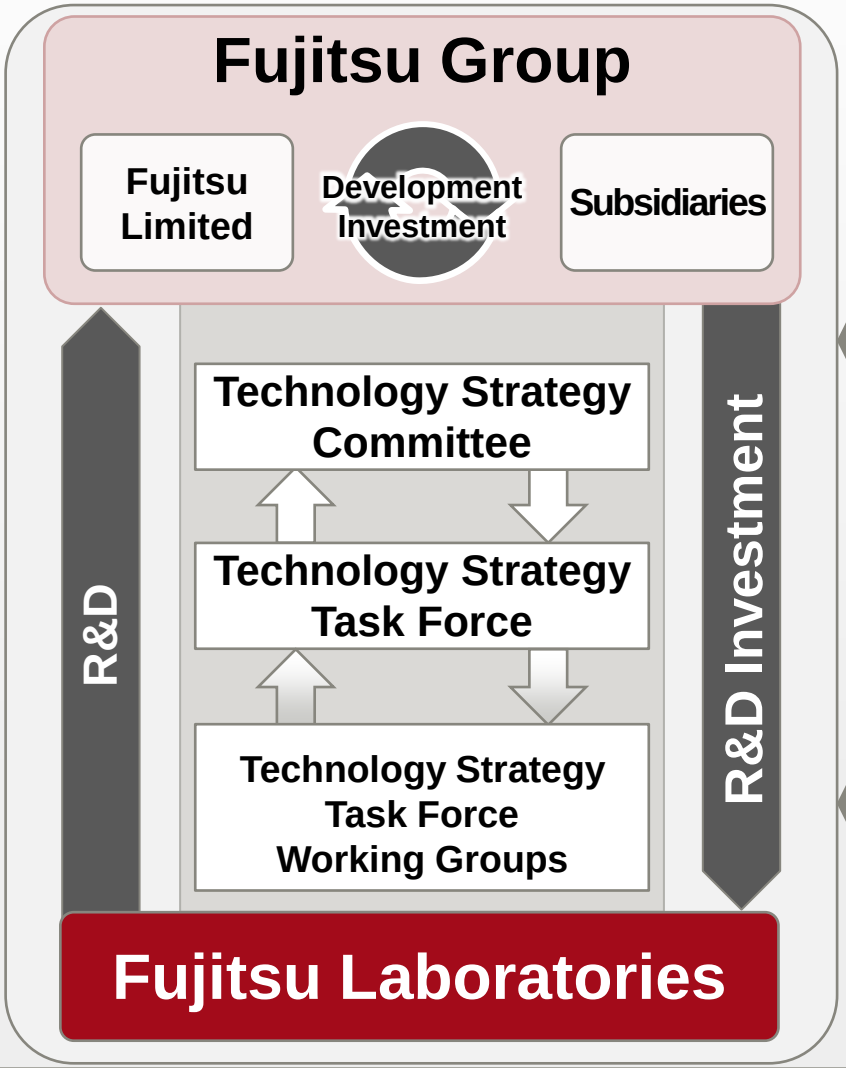
- **Clarification of technology and business directionalities; proposal and promotion of technology strategies**



Open Innovation

Governmental Projects

- R&D of large-scale programmable photonic networks to realize ethernet systems exceeding 100G
- R&D pertaining to cyber-attack analysis and detection
- Governmental program (Japan): Creation of Innovation Centers for Advanced Interdisciplinary Research Areas Program: "Photonic network ultra-low-energy technologies"
- Next-generation smart devices development project: "Development of probe data processing processor", etc.

Joint R&D with Universities/ R&D Institutions

- InSIGHT (Ireland): Large-scale data storage/search technologies for LOD
- Horizon 2020 (various EU nations): SmarterEMC2, 5G
- MIT (U.S.): Optimized management of transportation methods based on mobility demand forecasting
- Tohoku University – International Research Institute of Disaster Science (Japan): Natural disaster simulation research

etc.

Segmentation of R&D Themes by R&D Budget

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Top-down resource allocation

Commercialization R&D (Approx. 30%)

- R&D directly linked to business, with clear business plans
- Commercialization through technology transfer of R&D achievements

Advanced research (Approx. 50%)

- Advanced R&D (mid- to long-term) targeting business growth and strengthening of competitive edge, based on collaborations with a specific or multiple Business Units
- R&D achievements are transferred in stages to directly-contracted research

Long-term / Strategic Research (Approx. 20%)

- Leading-edge basic research: technology research of aimed toward significant future breakthroughs; transfer of R&D achievements to phases for practical use and commercialization
- Applied innovation research: discovery of new business domains and business models; linking R&D achievements to PoC and PoB

Apply Fujitsu's Vision to Research Themes

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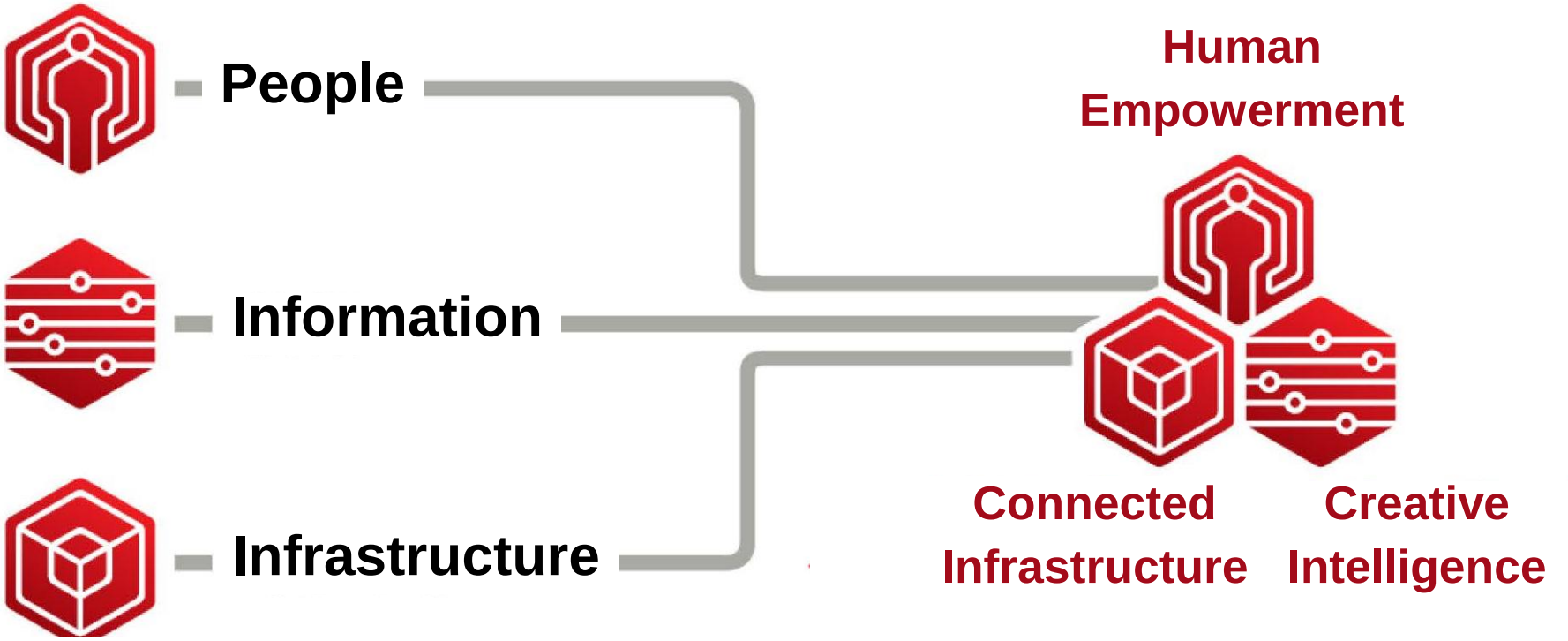
Fujitsu Technology and Service Vision

- Create new value for business and society by integrating management resources of people, information, and infrastructure
- Realization of concrete business results



ICT Mega Trends

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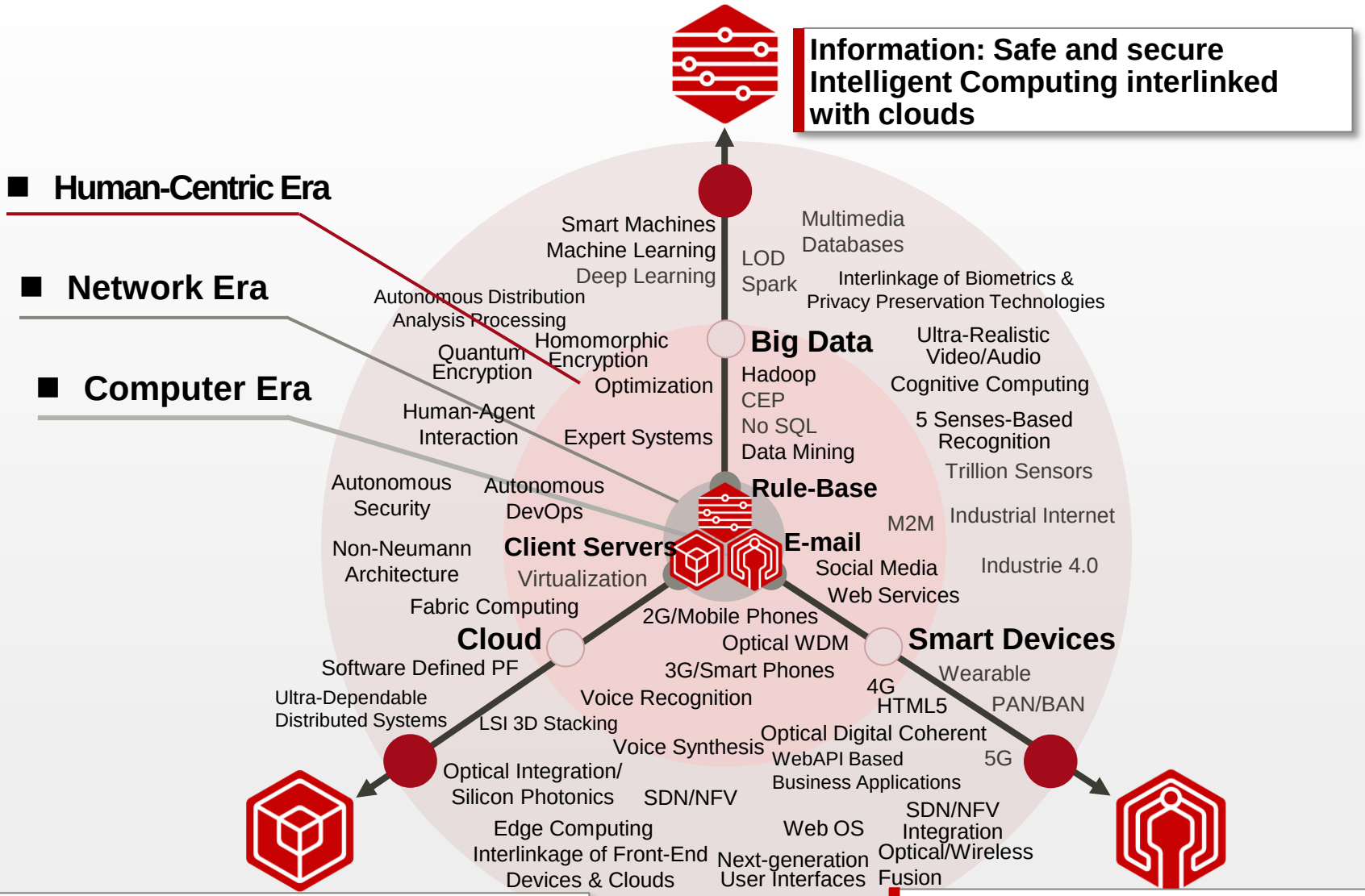

Technology Vision and R&D Roadmap

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- **Further segmentation of ICT megatrends; mapping to research themes**

Hyperconnected Networking connecting people, information, and things

【Nurture connected value】

Internet Services	Networks	IoT Devices

Safe and secure Intelligent Computing interlinked with clouds

【Generate new insights】

Knowledge Processing	Security	Media Data

Integrated Infrastructure supporting hyperconnected clouds

【Supporting reliability and expansion】

Cloud	ICT Infrastructure	Computing Performance

Fujitsu Laboratories: New Organizational Structure

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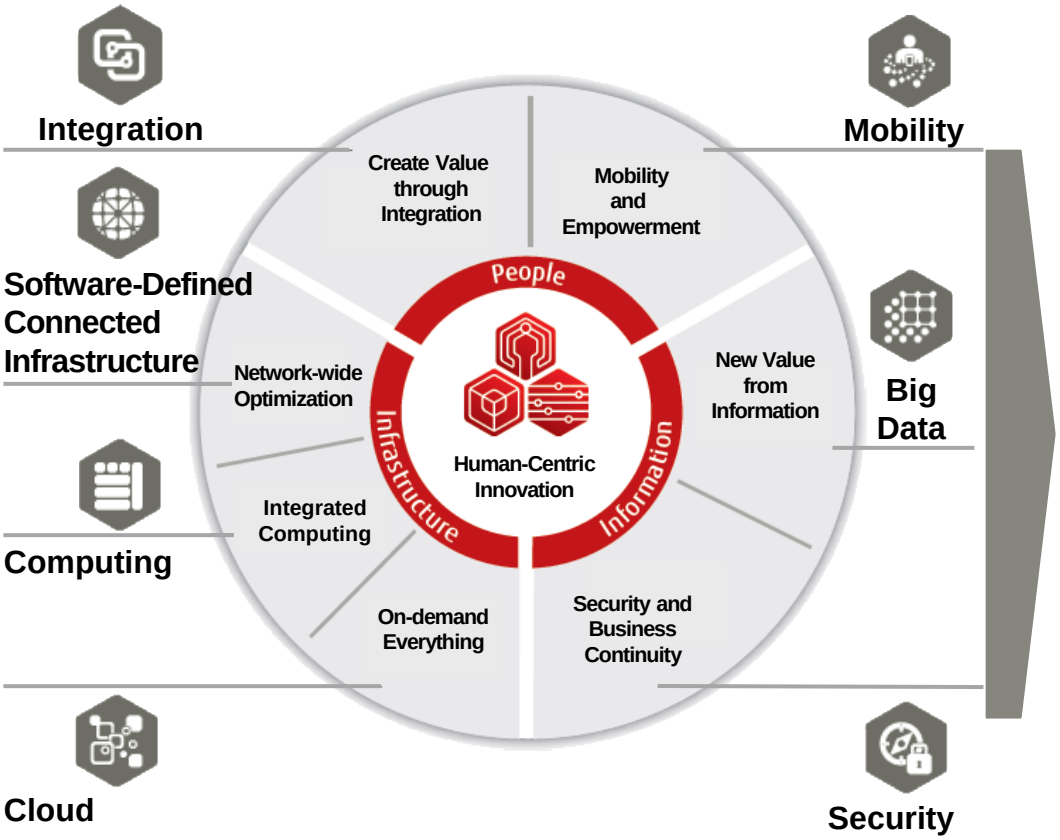
Aligned with Fujitsu's Technology and Services Portfolio



- Computer Systems Laboratory
- Software Laboratory
- ★ Information Systems Technologies Laboratory

- Ubiquitous Systems Laboratory
- ■ Network Systems Laboratory

- ■ Media Processing Laboratory
- ★ Knowledge Information Processing Laboratory

- Devices & Materials Laboratory
- Monozukuri Technologies Laboratory

★ Applied Innovation Research Center

★: Newly established
■: Reorganization

Fujitsu Laboratories: R&D Strategy Structure

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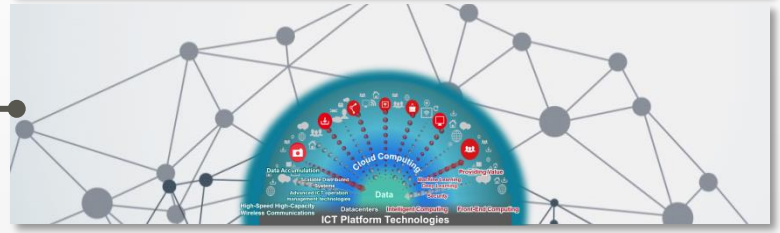
Fujitsu Technology and Service Vision

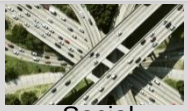
Hyperconnected Cloud



Applied Innovation Research


Natural Disaster Mitigation


Environment


Social Infrastructure


Energy

Commercialization R&D


Transportation/ Logistics


Healthcare


Agriculture


Education

Advanced Research

ICT Megatrends

Leading-Edge Basic Research

- **Computer Architecture**
- **Network Architecture**
- **Cognitive Computing**
- **Social Science**
- **Physical and Chemical**

Leading-Edge Basic Research

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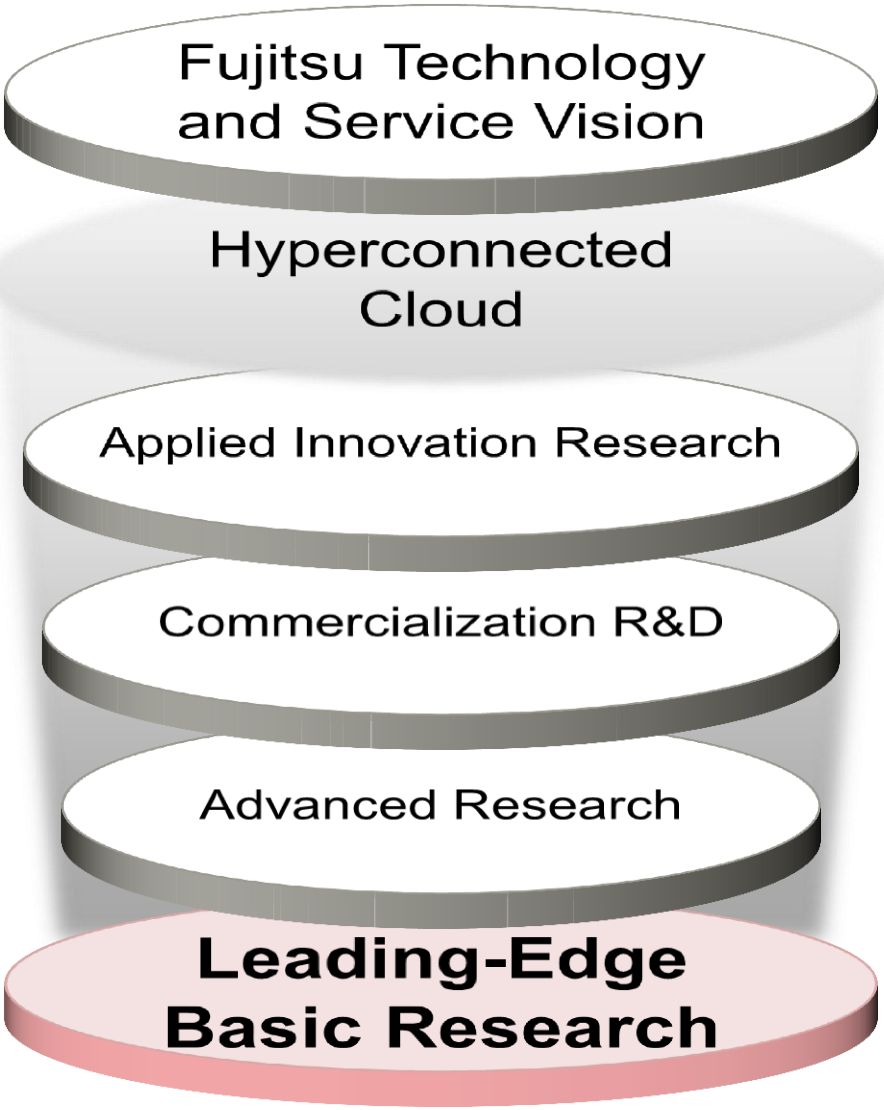
Breaking through limits of ICT



Computer Architecture:

Machine learning-based ICT to intellectually support people

Network Architecture:

Robust, dramatically ultra-high-capacity transmissions

Cognitive Computing:

Sensing: 5 senses-based, sensibility-based, emotional; actuation

Social Science:

Validation method-based analysis, evaluation, verification of social phenomena

Physical and Chemical:

New devices based on materials infomatics and bio-infomatics; packaging/energy-related technologies

Advanced Research

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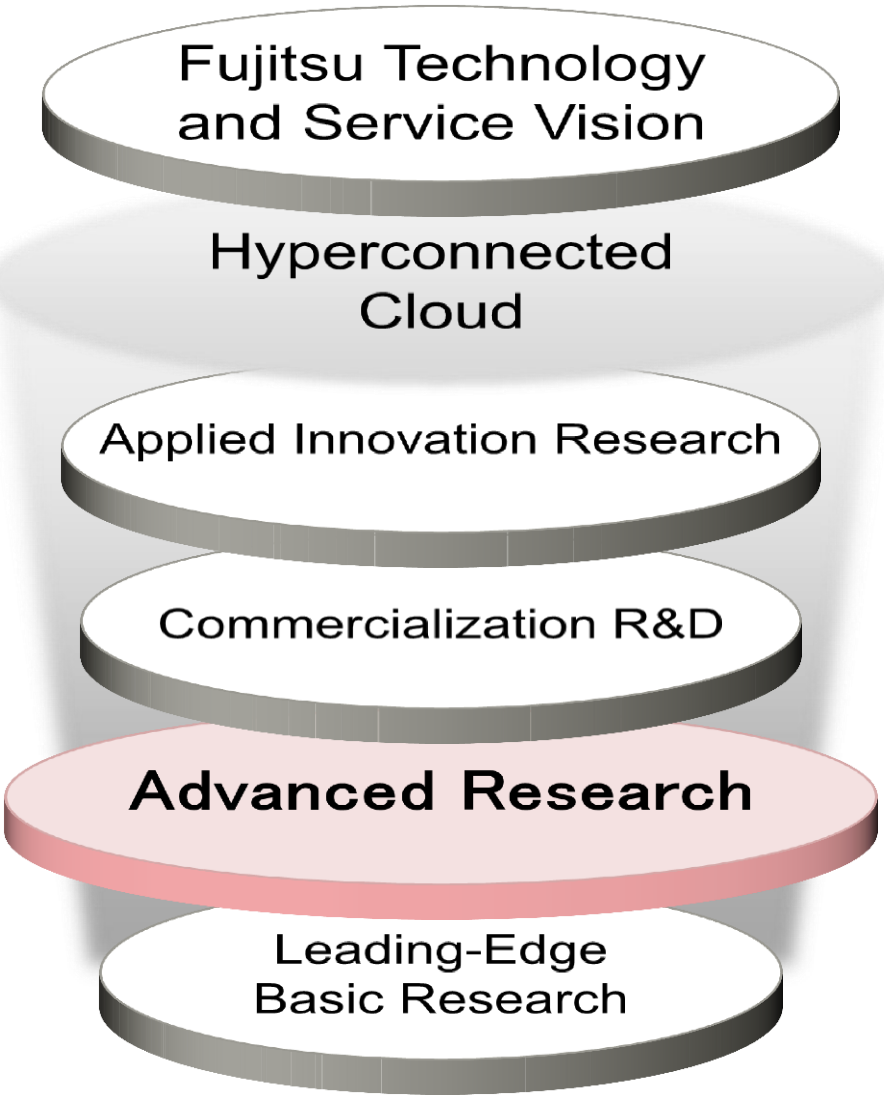
- **Advances in Cloud Systems that encompass Intelligent Front-End Interfaces**



- **Fusion of Front-End Devices, Networks, Cloud Systems**
  - **Enhancing domains for front-end devices and networks for the coming trillion-sensor era**
  - **Seamless linkage among clouds**

Reorganization: Network Systems Laboratory
Collaboration with: Ubiquitous Systems Laboratory

- **Intelligent Computing**
  - **Realization of artificial intelligence-based advanced information processing**
  - **Knowledge creation from a multitude of data, from business data to media/sensor data**
  - **Development of ultra-high-speed databases and media data processing engines**

Reorganization: Network Systems Laboratory
Collaboration with: Ubiquitous Systems Laboratory

Commercialization Research

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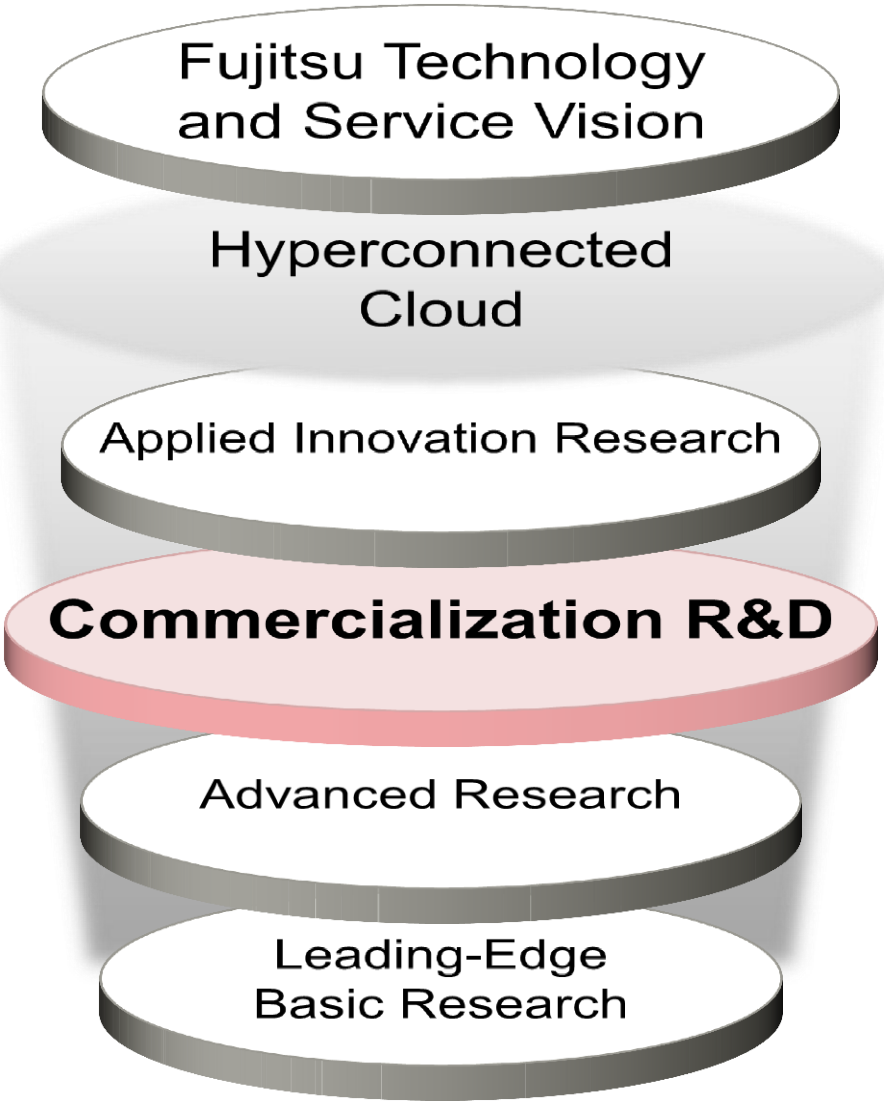
Deep focus on Cloud Technology for the Digital Business Era



- **Strengthen competitiveness of System Integration business**
  - Promote Web API-based service-oriented software
  - Accelerate development and operation of software for leveraging new devices in the IoT Era
  - Modernization and greater development efficiencies for mission-critical software

  Newly established:
  Information Systems Technologies Laboratory

- **Commercialization of next-generation cloud systems**
  - Agile/resilient/hybrid building and operation of scalable cloud architecture
  - Seamless systemization of front-end computing and back-end systems

Applied Innovation Research

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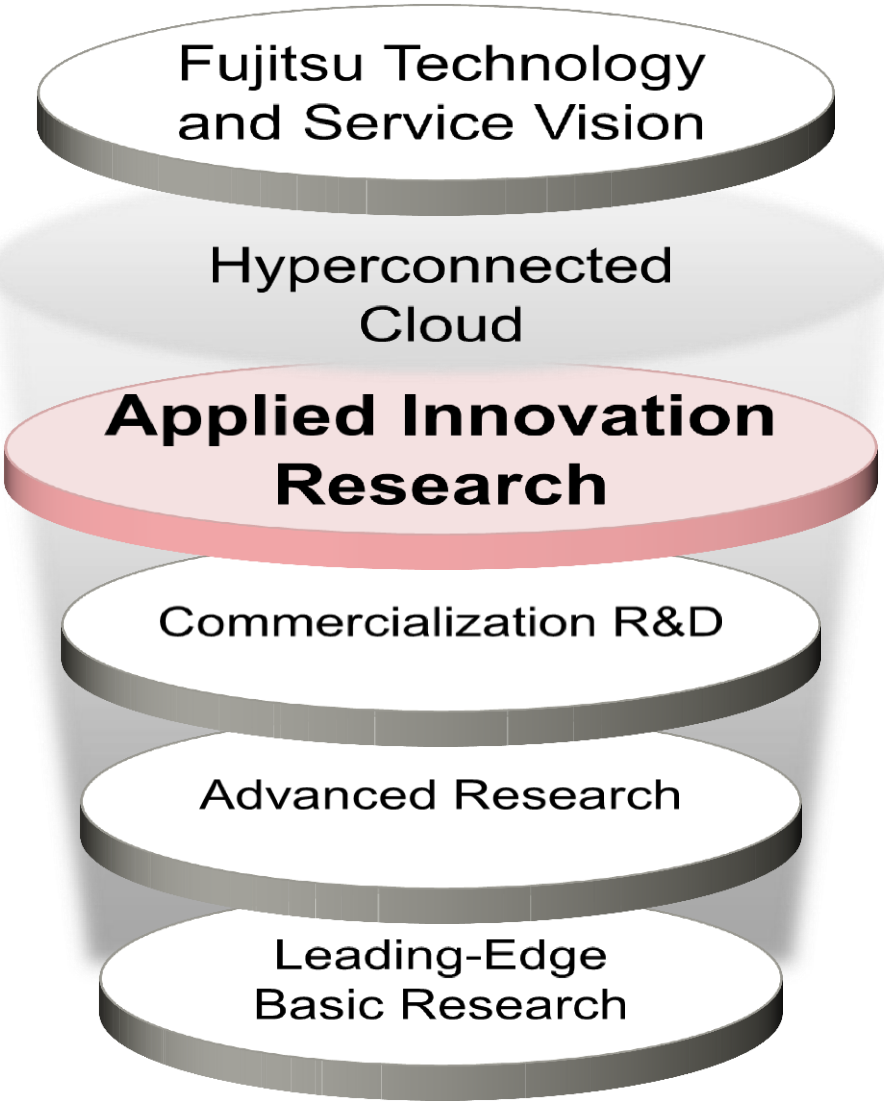
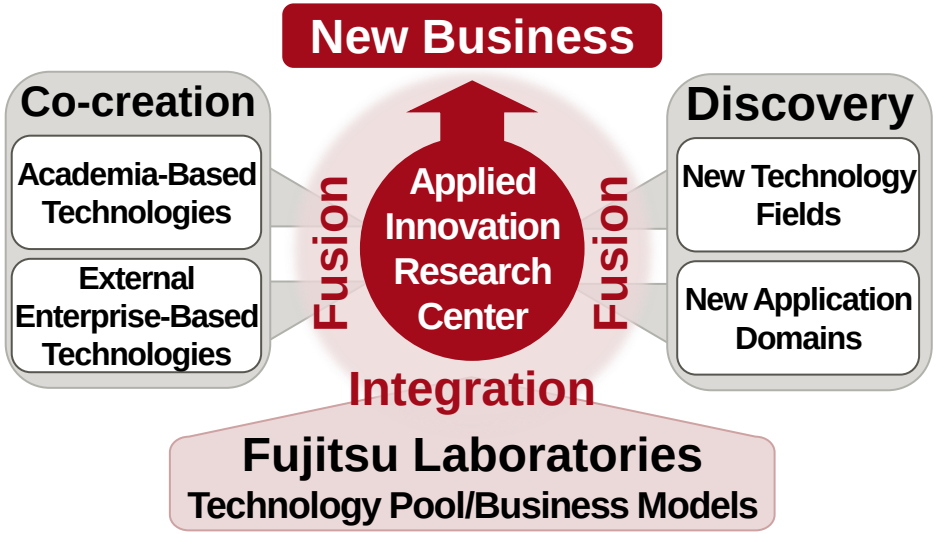
Discovery and creation of New Businesses



- **Domains for which further growth and can be anticipated**
  - Automotive Innovation Laboratories
  - Healthcare Innovation Laboratories
  - Social Innovation Laboratories
- **New domains relevant to people's lives and activities**
  - Life Innovation Laboratories
  - Robotics Advancement Office

Newly established: Applied Innovation Research Center



Global Collaboration

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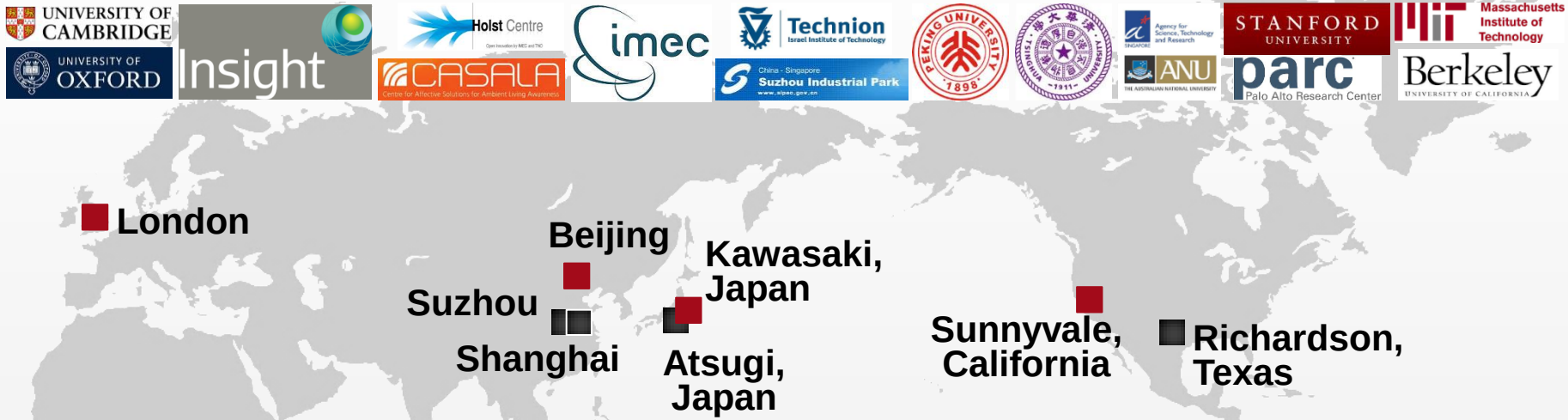
11 Countries, 104 Projects



Off-shore research leveraging exceptional researchers

Discovering regional technology trends

Technology dissemination to raise global presence

"Act local" activities targeting discovery of new businesses

Technology Exhibits – Categories

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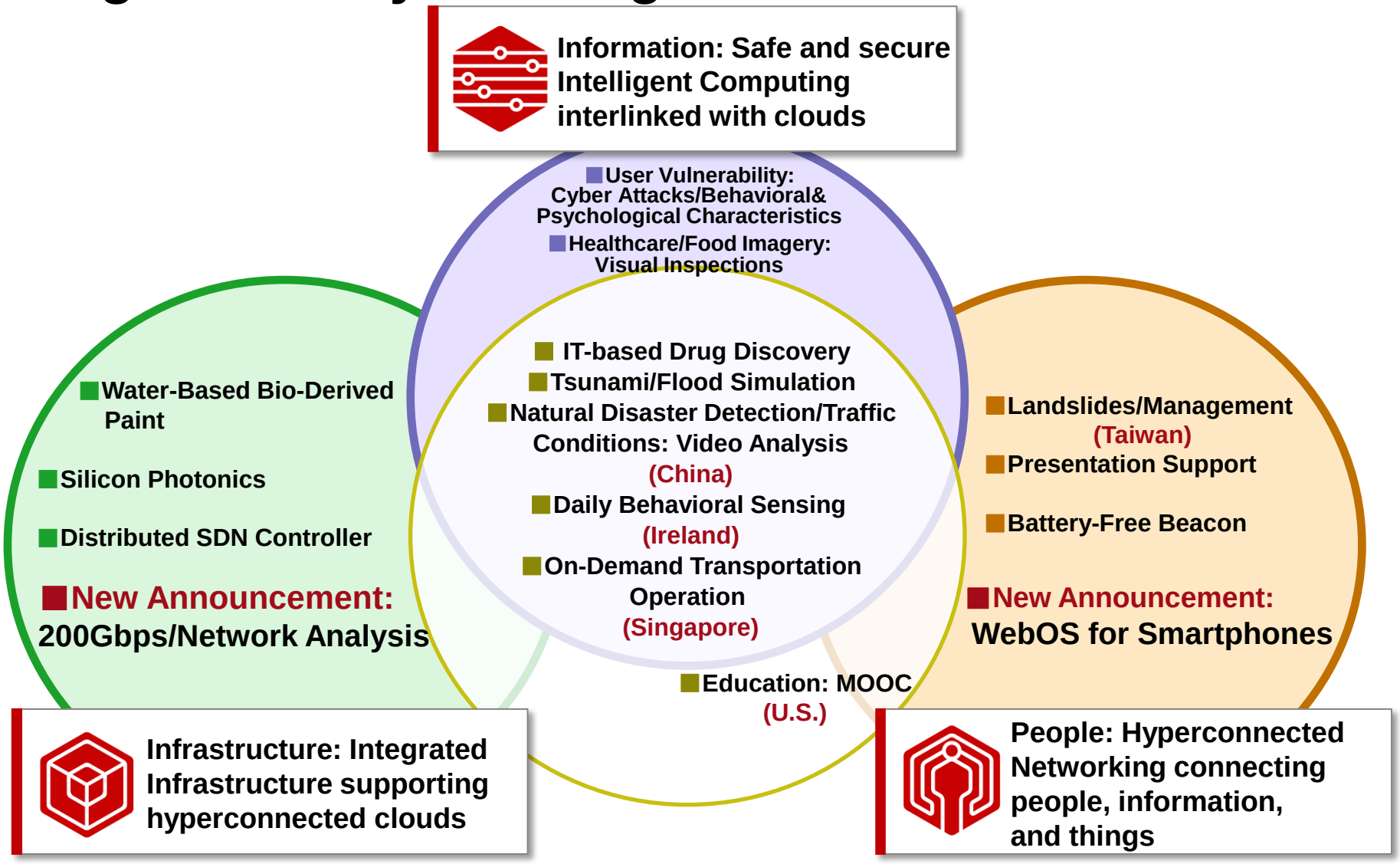
Segmented by ICT megatrends



Major Achievements in FY2014 (1/2)

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R&D Domain	#	Achievements	Press Releases
Integrated Infrastructure supporting hyperconnected clouds	1	World's Fastest 200Gbps Software-Based Packet Quality Analysis Technology	New Press Releases
Hyperconnected Networking connecting people, information, and things	2	WebOS Technology for Easy Connection with Various Smartphones and Ambient Devices	
	3	Presentation Support Technology to Help Listeners Follow Materials During a Presentation	Previous Press Releases
	4	Automatic Knowledge Extraction Technology from Open Online Contents	
	5	Control Technology for Large-Scale Sensor Network System	
	6	Flexible Beacon that Needs No Battery Replacement	
Safe and secure Intelligent Computing interlinked with clouds	7	Natural Disaster Simulation Technologies for Better Disaster-Response Decision-Making	Previous Press Releases
	8	Video Monitoring and Analysis Technology for Detecting Disasters or Traffic Violations	
	9	Assessment Tool that Visualizes a Community's Characteristics Applying LOD Technology	

Major Achievements in FY2014 (2/2)

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R&D Domain	#	Achievements	Press Releases
Safe and secure Intelligent Computing interlinked with clouds	10	Nudge Technology for Mobility on Demand to Increase Operator Profit and User Satisfaction	Previous Press Releases
	11	First Technology that Identifies Users Vulnerable to Cyber Attack Based on Behavioral and Psychological Characteristics	
	12	Image Analysis Technology for Assisting Professionals in Visual Inspections	
	13	New Era in Drug Development: IT-Based Drug Discovery Technology	
	14	Technology for Early Detection of Irregularities in Motor Functions Using a Sensory Smart House	
Integrated infrastructure supporting Hyperconnected Clouds	15	World's Smallest, Most Energy-Efficient Silicon Photonics Optical Transceiver for Inter-Processor Transmissions	Previous Press Releases
	16	Cluster-based Distributed SDN Controller for Resilient Wide Area Networks <SDN: Software Defined Networking>	
	17	Materials Technology to Reduce the Burden on the Environment	

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Fujitsu Limited foundation: 80th anniversary

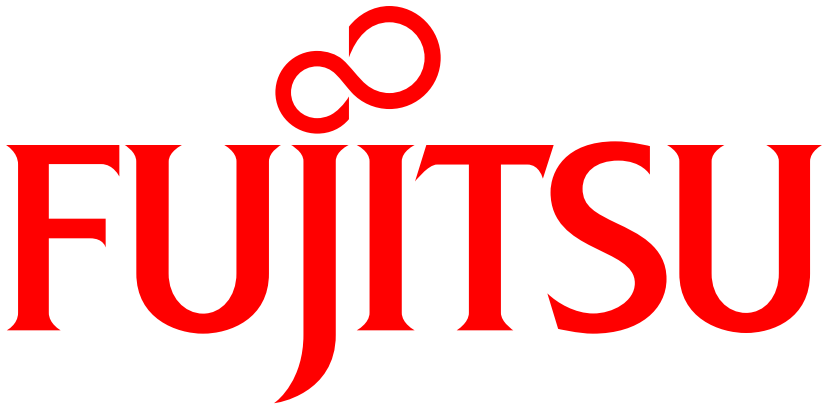
Innovation
||
Invention x Business Model

Cautionary Statement

These presentation materials may contain forward-looking statements that are based on management's current views and assumptions and involve unknown risks and uncertainties that could cause actual results, performance, or events to differ materially from those expressed or implied in such statements. Words such as "anticipates", "believes", "expects", "estimates", "intends", "plans", "projects", and similar expressions which indicate future events and trends identify forward-looking statements.

Actual results may differ materially from those projected or implied in the forward-looking statements due to, without limitation, the following factors:

• general economic and market conditions in the major geographic markets for Fujitsu's services and products, which are the United States, EU, Japan and elsewhere in Asia, particularly as such conditions may affect customer spending;
• rapid technological change, fluctuations in customer demand and intensifying price competition in the IT, telecommunications, and microelectronics markets in which Fujitsu competes;
• Fujitsu's ability to dispose of non-core businesses and related assets through strategic alliances and sales on commercially reasonable terms, and the effect of realization of losses which may result from such transactions;
• uncertainty as to Fujitsu's access to, or protection for, certain intellectual property rights;
• uncertainty as to the performance of Fujitsu's strategic business partners;
• declines in the market prices of Japanese and foreign equity securities held by Fujitsu which could cause Fujitsu to recognize significant losses in the value of its holdings and require Fujitsu to make significant additional contributions to its pension funds in order to make up shortfalls in minimum reserve requirements resulting from such declines;
• poor operating results, inability to access financing on commercially reasonable terms, insolvency or bankruptcy of Fujitsu's customers, any of which factors could adversely affect of preclude these customers' ability to timely pay accounts receivables owed to Fujitsu; and
• fluctuations in rates of exchange for the yen and other currencies in which Fujitsu makes significant sales or in which Fujitsu's assets and liabilities are denominated, particularly between the yen and the British pound and U.S. dollar, respectively.



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