

# PRAGMA 34 Conference: Fujitsu

Technical Computing Solutions Unit  
May 9th, 2018

# Introduction of Fujitsu, Fujitsu HPC, HPC Center Examples

# Revenue by Sector – FY2016

Headquarters: **Tokyo, Japan** (Since 1935)

President: **Tatsuya Tanaka**

Revenue: **4.726 trillion yen (US\$41.7 billion)**

Stock Exchange: **Tokyo (code 6702), Nagoya**



FY 2016 Revenue by Business Segment

**Technology Solutions**  
Services

- Solutions • System Integration
- Infrastructure Services

**System Platforms**

- System Products • Network Products

**¥2,942.3 billion**  
**US\$31,301 million**

**65.6%**

**Ubiquitous Solutions**

- PCs/Mobile Phones
  - Mobilewear • Others
- ¥1,090.2 billion**  
**US\$11,598 million**



FUJITSU Tablet  
arrows



FUJITSU PC  
LIFEBOOK

**Device Solutions**

- LSI • Electronic Components
  - Others
- ¥540.3 billion**  
**US\$5,748 million**



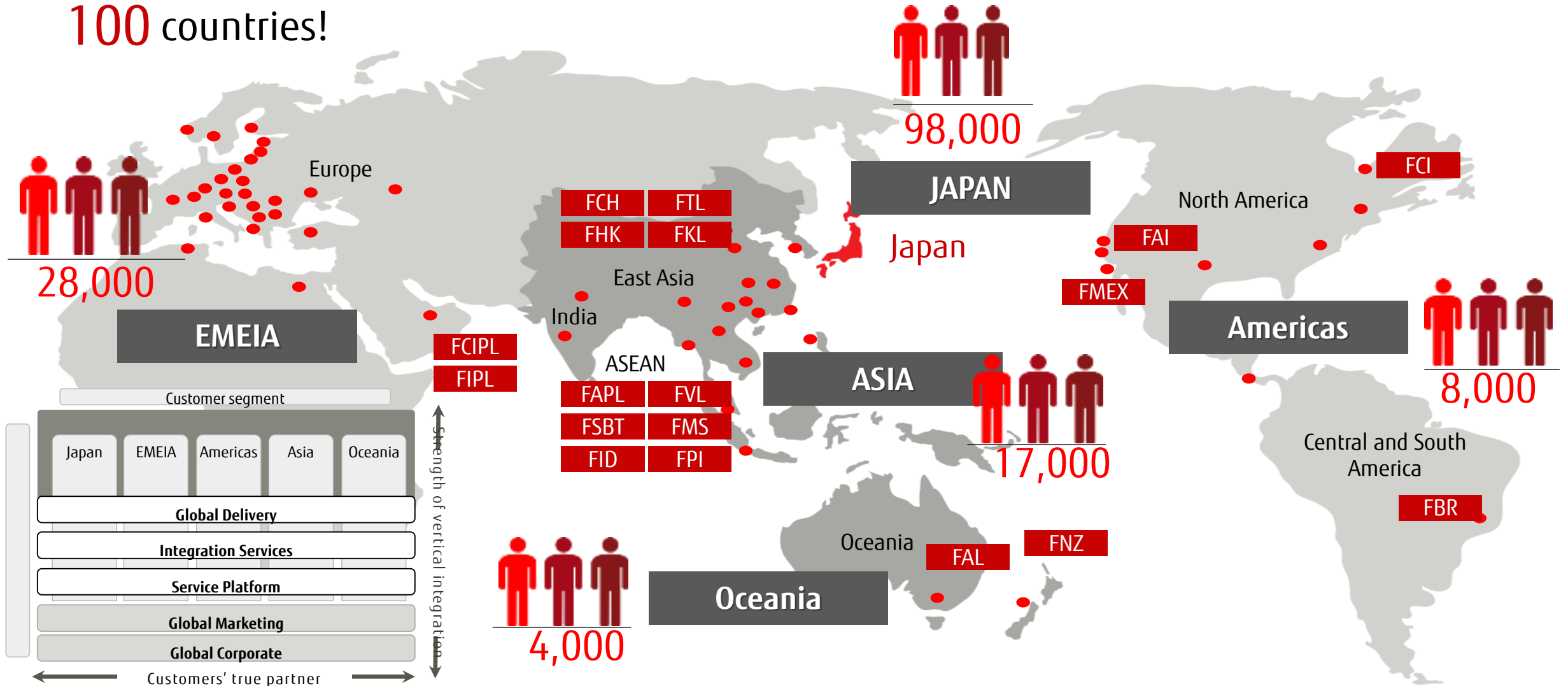
**Others**

**¥64.7 billion**  
**US\$688.4 million**



# Fujitsu Group

■ There are approximately **155,000** Fujitsu colleagues working with customers in over **100** countries!

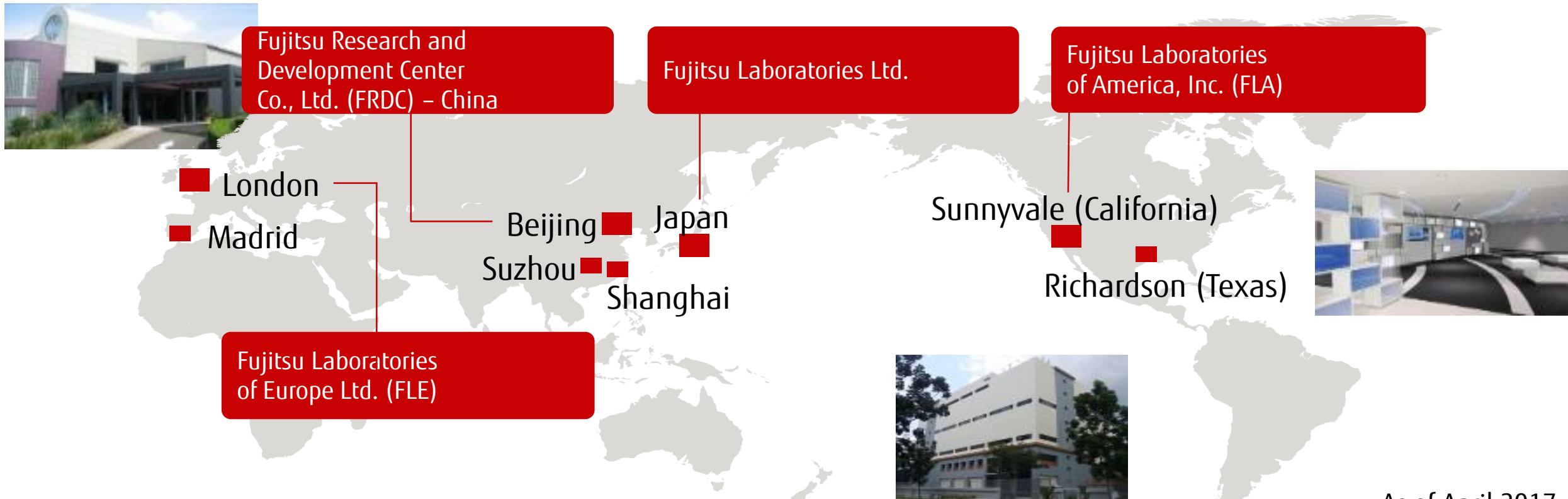


# Research and Development

Over 18,500 employees are engaged in R&D within the Fujitsu Group.

We have approximately 1,400 researchers in the Fujitsu Laboratories Group conducting leading-edge R&D at 4 key global R&D sites. Fujitsu spent approximately 3.9% of revenue on R&D, last year.

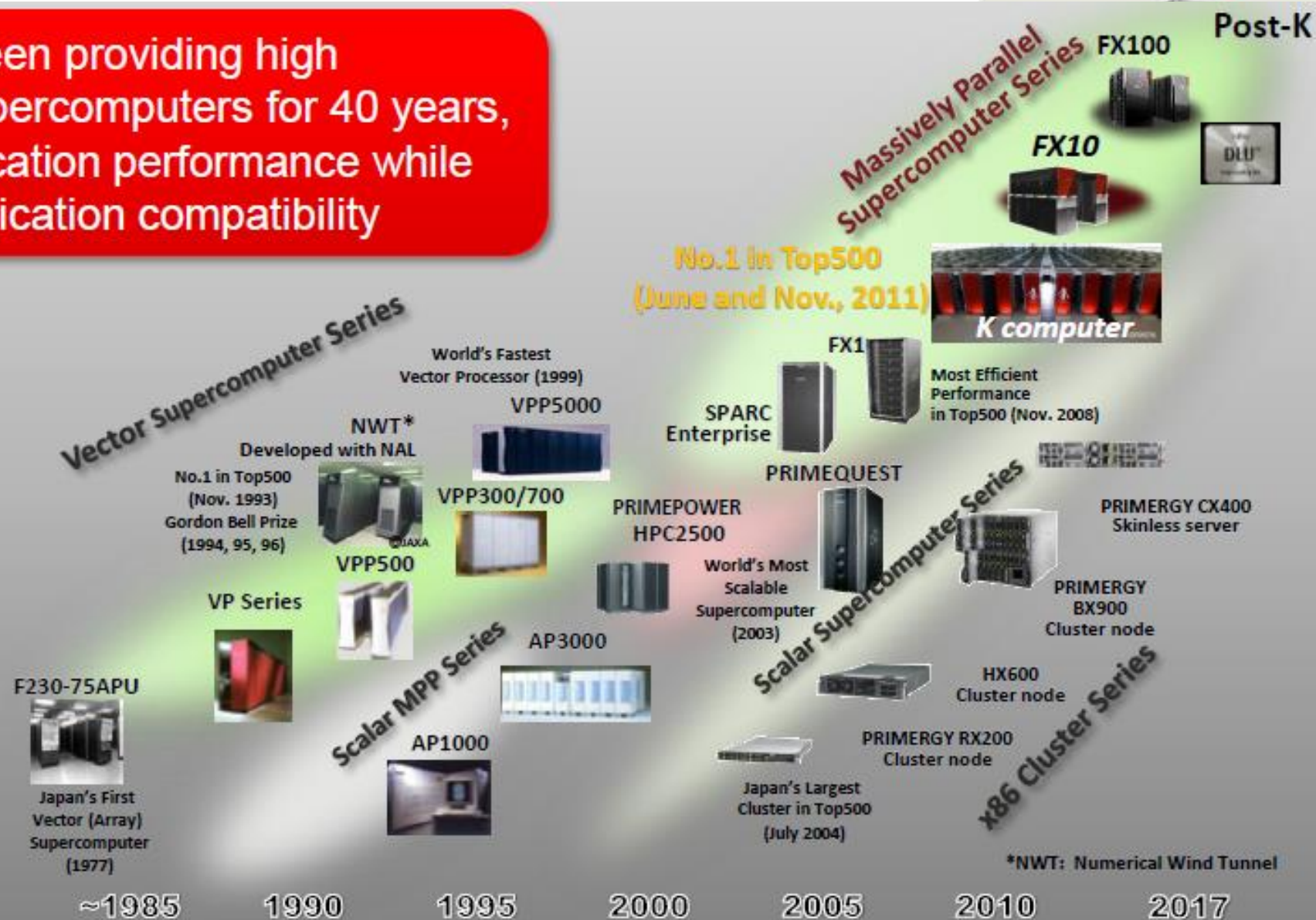
In addition to in-house efforts, Fujitsu engages in collaborative R&D with renowned universities, corporations and research institutions, worldwide.





# Fujitsu's Expertise in HPC for Over 40 Years

FUJITSU has been providing high performance supercomputers for 40 years, increasing application performance while maintaining application compatibility



# Oakforest-PACS

The first of its kind in the world; over 8,000 Xeon Phi nodes connected by Omni-Path Interconnect, surpassing the "K Computer" by 1.3 times.

Customer: JCAHPC

## ■ High Performance

This system promotes cutting-edge computational science, while also greatly contributing to Japanese science & technology

## ■ Construction

- 8,208 Intel® Xeon Phi™ Nodes, Storage: 26.2PB
- Intel® Omni-Path Interconnect
- Performance: 25PF (Peak)
- Official operation started in Dec., 2017.

## ■ Shared System

Tokyo University and Tsukuba University share this system. This is the first attempt in Japan for this kind of partnership.



Peak  
Performance

25 PFLOPS



Supercomputer  
Performance

Japan: #2 / Global: #9

1.3 faster than K

※Peak performance 2.2x



# NSCC (National Supercomputer Center)

## Singapore National Initiative for Boosting Scientific Research

- ✓ HPC platform to further advance R&D in Singapore and nurture young talent by bringing together research institutes of higher learning and industry partners
- ✓ Potential usage includes research in the areas of modeling and simulation, and data analytics

### ■ Fujitsu Competencies

Fujitsu's deep-rooted background in R&D, broad industry networks, technical know-how and experience building HPC facilities made us the perfect choice for this project.

### ■ Construction

- 1,288 Intel Xeon™ Nodes (128 nodes w/GPUs), Storage: 13PB
- Mellanox EDR Infiniband® Interconnect
- Performance: 1PF
- Official operation started in Mar., 2016.

### ■ End-to-End

Fujitsu's integral professional and managed services in the design, construction, and maintenance of the HPC facility.







# K computer/Post K computer

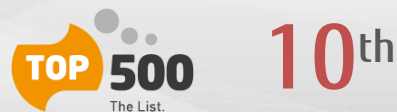


K computer is necessary for safety and security of public, and to maintain international competitiveness

Customer : Riken AICS

© RIKEN

- Indispensable platform for advanced science research
- Still leading benchmarks awards after 6 years from delivery



※ as of Nov. 2017

Now working with RIKEN to develop Post K computer, aiming to be the most advanced general purpose supercomputer in the world

## Post-K Development Goals

- Application performance
- Low power consumption
- User convenience
- Ability to produce ground-breaking results



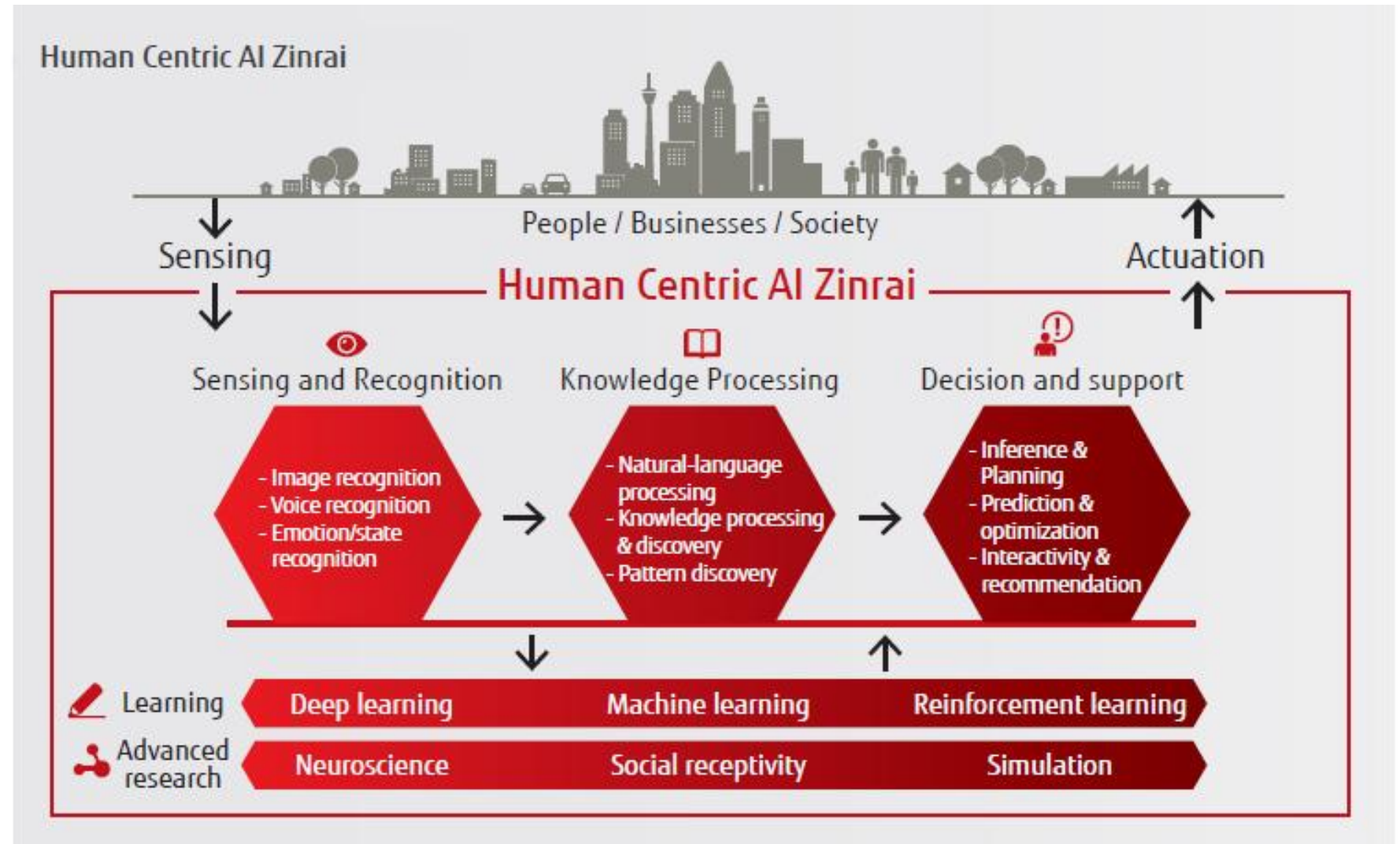
shaping tomorrow with you

# HPC + AI Systems

# Human-Centric AI "Zinrai"

- Fujitsu is combining component tech, such as:
  - machine learning
  - deep learning
  - visual recognitioninto our digital solutions and services.

- The goal is to use AI to complement human activity, not replace it, by developing solutions that take care of tedious and/or repetitive work, so humans can focus on important matters.



# Processor for Deep Learning ("DLU")



Applying K computer Technologies

## DLU Features:

- Unique architecture, newly developed for "Deep Learning"
- Energy-saving design
- **Goal : 10x better "performance per watt" compared to competitors**
- Large scalability : Utilizes HPC interconnect technology
- Capable of handling very large-scale neural networks

FY2018~

DLU<sup>TM</sup>  
(Deep Learning Unit)





# Digital Annealer

Quantum-inspired computer hardware that can rapidly solve combinatorial optimization problems using existing semiconductor technology!

Large Scale

■ 1024-bit scale, inter-bit full connection

Accurate

■ 16-bit inter-bit connection precision

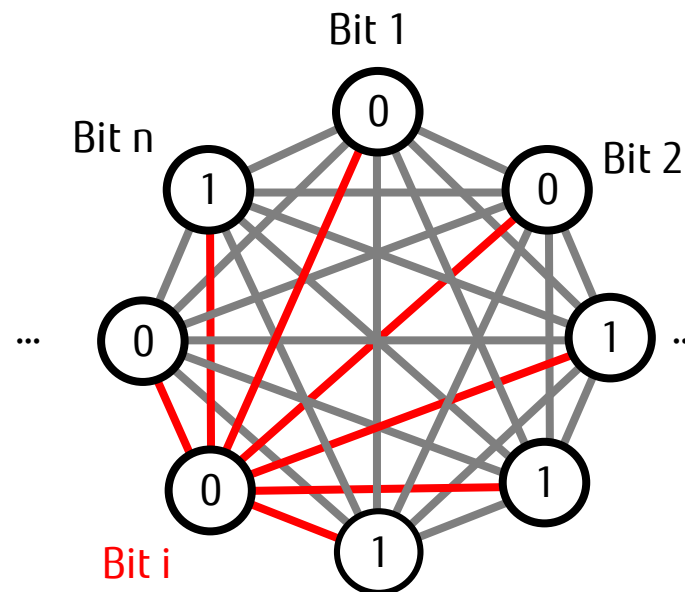
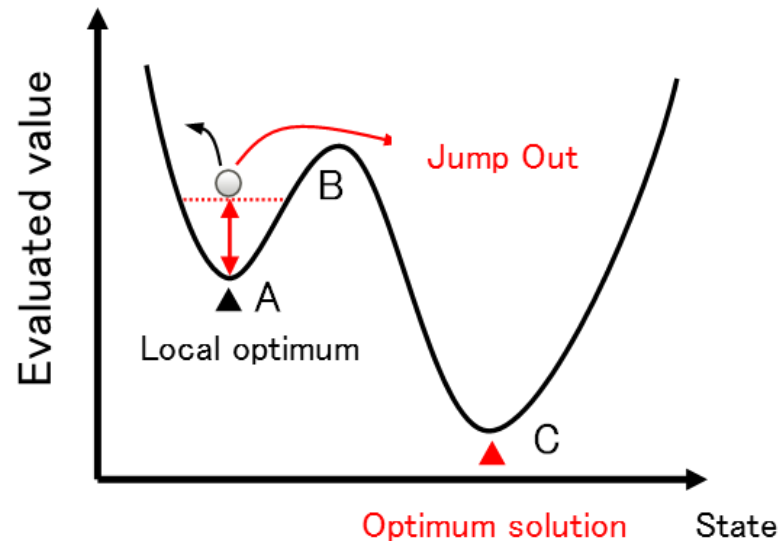
Stable

■ Works at normal temperature

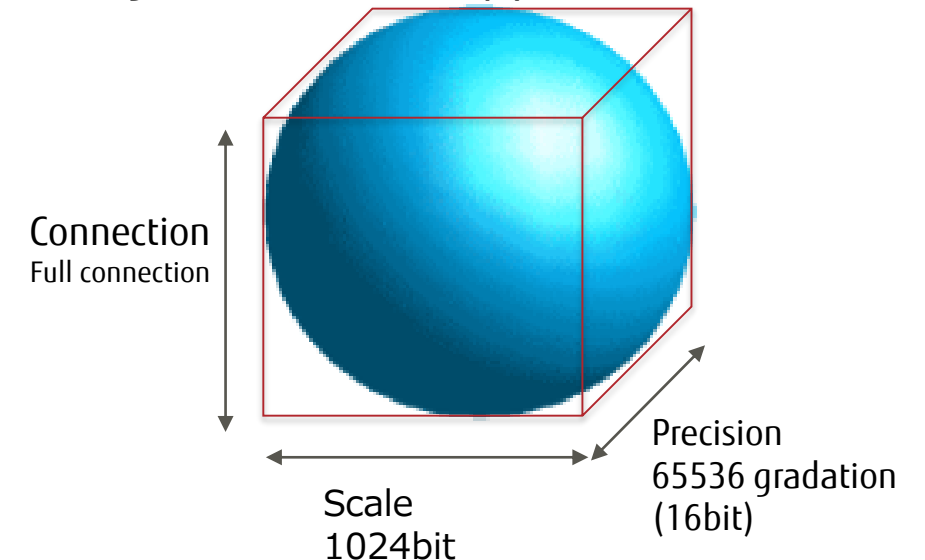
Rapid Evolution

■ Further enhancement in 2018

The only hardware in the world as of today, which can solve real world problems!



Scale x Connection x Precision is large.  
The Digital Annealer is very practical!.



# "AI Bridging Cloud Infrastructure" (ABCI)

Fujitsu won the deal for the most advanced AI supercomputer in the world, in order to promote AI research and development through industry-government-academia collaboration.

## National Institute of Advanced Industrial Science and Technology (AIST)

- AIST is one of the 3 core AI sites in Japan.  
The system is an open innovation platform for the purpose of implementing AI in society.
- Construction
  - 1,088 Nodes (4,352 GPUs), Storage: 22PB
  - Performance: 550 Peta-AI-Flops
  - Contract won in Sep,2017
  - Official operation to start in 2018.
- This system will act as a "roll-out" model for the next national AI projects in Taiwan and Singapore.

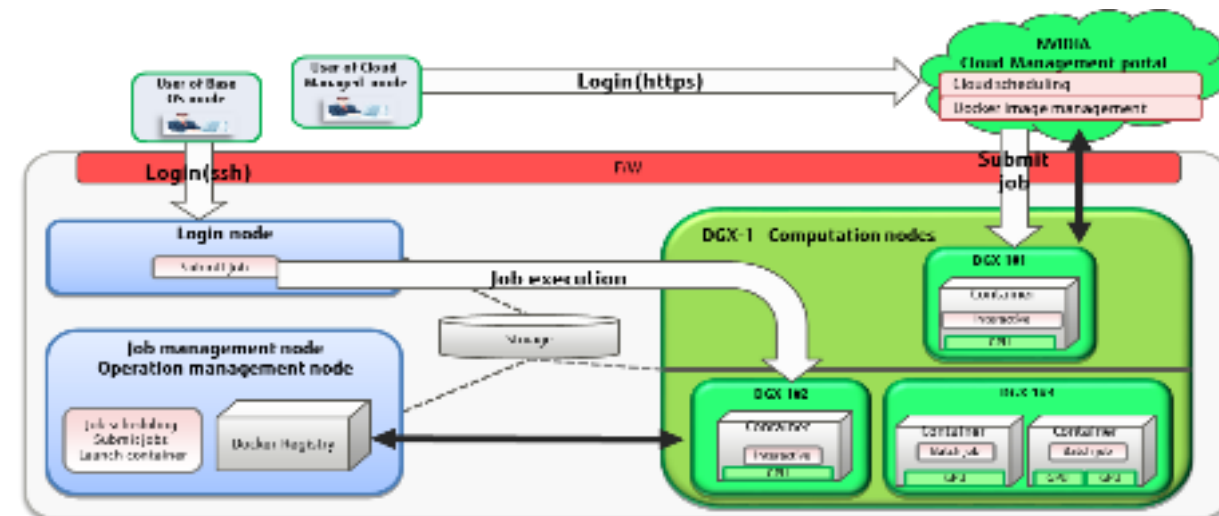


# RIKEN AIP (AI Platform)

- The largest NVIDIA DGX-1-equipped system at a customer site
- Constructed to accelerate Japan's AI research activities

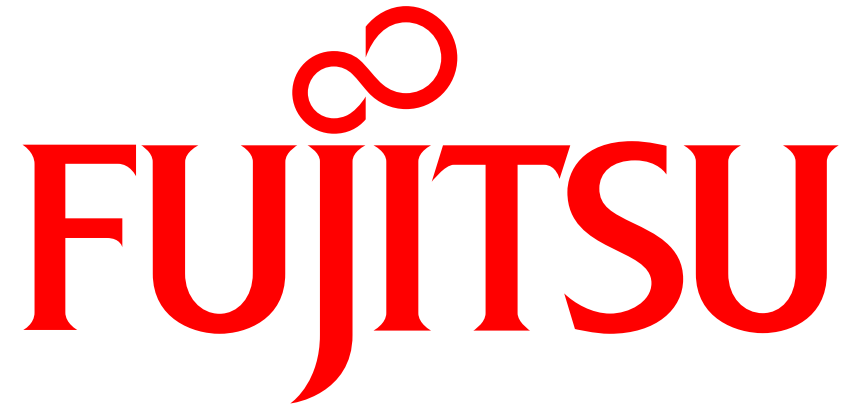
## Combined use of "Cloud Managed" mode and "Base OS" mode

- Mainly, "Base-OS Mode" is the mode used.
  - Cloud Managed Mode: 1 node
  - Base-OS Mode : 23 nodes
- Why "Base-OS Mode" was necessary:
  - To Realize Multi-container Execution
    - "Cloud Managed Mode" only supports 1 container / node, so far. Fujitsu installed a job scheduler for multi-container execution
  - To Mitigate Security Risks
    - "Cloud Portal" requires some of system information and Docker containers are stored in the public internet area



- "Deep Tensor" – a new solution for detecting multiple malware behaviors through AI!
- Post K – the successor to the famous K computer!
- X86 Cluster Solutions – a full range of Intel CPU-based HPC solutions, to fit any need!
- \*Also, make sure to check out "Nature" magazine at our booth!\*





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