High Performance Computing in our everyday life

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Scientific & Technical computing has brought about not only problem-solving but also “creating new value”.

**Health & Safety**
Creating a Better Life
Contributing to a secure and prosperous society, through new drug development and improved weather forecasting.

**Industry**
Innovating Manufacturing
Powerful new innovating manufacturing methods through high-speed, accurate analysis / simulation.

**Science**
Unveiling Mysteries
Exploring the origins of humankind, space, and the universe through high-speed data processing and simulation.
All start with Supercomputers…
Neutrinos and Dark Matter Observation

Astronomy

Outline
Experiment–analysis system for neutrinos and detection of proton decay, exploring the origins of the universe.

Contribution
Fujitsu installed a cluster system, running on a 24/7 basis, for analyzing neutrinos arriving from space, an accelerator and supernova explosions that may only appear once in every few decades. We support this Nobel Prize-level research, unveiling the mysteries of the universe.
Neutrinos and Dark Matter Observation

To contribute to a greater understanding of the nature of neutrinos, dark matter, gravity waves, and the origins of the universe itself.

Subterranean Experiment Site
Super-Kamiokande Experimental Water Tank
- Pre-processing Unit
- Approx. 500GB/day
- Real-Time Processing
- Noise Reduction

Calculation & Research Building (Outdoor system)
- Data Analysis Unit
- 142 PRIMERGY BX922
- Approx. 3PB storage
- Data Server
- Approx. 50GB/day
- Experiment Measurement Data
- Backups etc.
- Throughput Performance 960MG/s (Average value for Read/Write)

Project
- Super-Kamiokande Experiment-Analysis System

Client
- University of Tokyo, Institute for Cosmic Ray Research

Technology & Solution
- A real-time processing system with high-reliability on a 24/7 basis and high-speed analytic performance, double of its predecessor.
- Noise reduction allows to assuredly select and store the important phenomenon being studied.
- Realizing more precise measurements than ever before and also reducing the time needed to analyze them.
- Promising efficiency in researching the differences in oscillations between neutrinos and anti-neutrinos.
Astronomy

Outline
The world’s largest radio telescope, ALMA, located 5,000 meters above sea level in Chile, has the world’s highest resolution. This is the first collaborative project with both the US & Europe in NAOJ history.

Contribution
The ACA Correlator for ALMA, a ultra-high-speed data processing system Fujitsu created, brings answers to great cosmic mysteries, such as the origins of the universe and the planets inhabiting it.
Astronomy Radio Telescope

By identifying proto-star components in space, we can explore the origin of the planets and the galaxy, revealing cosmic mysteries.

ALMA Array Operations Site (AOS), located at an altitude of 5,000 meters.

Correlator

Fourier transform of 1.5 Terabps

Control

Processing ×8

Processing ×8

Processing ×8

Processing ×8

Collecting Data

ALMA Operations Support Facility (OSF), the "Base Camp"

Remote control of OS at AOS

Data Analysis System

Data Archive System

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Project

ALMA: The Atacama Large Millimeter/Submillimeter Array

Client

National Astronomical Observatory of Japan

Technology & Solution

- Developed dedicated hardware which is capable of real-time correlation processing. Observational data is transferred from the 16 antennas every second, each with a size of 1.5 Terabps.

- Achieves stable operation under severe conditions: operating at an altitude of 5,000 m and pressure of 0.5 atmospheres.

- Using diskless servers in accordance with severe environmental conditions at AOS.
Utilizing Big Data

A*STAR

Outline
Establish a center of excellence (CoE) to create urban development solutions which aim to build sustainable cities.

Contribution
Fujitsu aims to contribute to the growth of Singaporean society and the development of a sustainable city, through managing transportation and energy resources, creating an eco-friendly city, minimizing disasters, and creating new business.
Utilizing Big Data

Aiming to create next-generation solutions for sustainable urban development

Social Science Solution Research
- Environmental pollution
- Disaster prevention
- Epidemic prevention
- Economic model
- Urban planning problem

Collaborative research
A*STAR × Fujitsu

Live data
- Power information
- Position information
- Traffic information

HPC/Big Data Management HPD bases
- Data handling base: [DBMS, MW]
- Data storage base: [Server, Disk]
- High-speed calculation base: [FX10, MW]

Project
- Utilizing big data for urban development solution research

Client
- Agency for Science, Technology, and Research (A*STAR)

Technology & Solution
- High-speed big data processing technology.
- Computer simulation technology.
- Collaborative research in sustainable fields, such as creating an environmentally-friendly city, managing traffic, efficient energy use, and the "social system" using a computer.
Creating New Industries with HPC

HPC

Outline
A national project to improve the economic development by implementing supercomputer technology in Wales, UK.

Contribution
As a research partner, Fujitsu and HPC Wales are collaborating to improve economic growth as well as technical capability in the area, by advancing the use of supercomputers in priority fields.
Creating New Industries with HPC

We aim to make significant contributions to create a prosperous society, using HPC for priority research, such as global warming solutions.

Project: Supercomputer Industrial Development Project
Client: HPC Wales

Technology & Solution

- The distributed systems, consisting of 2 primary hubs with large-scale supercomputers and 6 middle-to-small scale ones, can be remotely accessed from various higher education institutions & private enterprises.
- Fujitsu supports these systems with more than 30-years expertise in supercomputer solutions.

Improving Technological Capabilities
- Developing new technologies and highly-skilled human resources

Developing Local Industries
- Creating 400 new job opportunities and more than 10 new businesses

1,400 nodes
190 TFLOPS
Issues the World Faces

- Natural Disasters
- Environmental Pollution
- Climate Change
- Overpopulation/Urbanization
- Energy/Resource Exhaustion
- New Disease Outbreaks
Atmospheric Monitoring

Environment & Disaster Mitigation

Outline

By installing environmental management systems, Japan and Thailand cooperated to improve on the aerial environment in the area around the Map Ta Phut Industrial Estate.

Contribution

Fujitsu provided ICT-based environmental solutions that combines “air monitoring, environmental research and potential ability development”, which led to the contribution of solving environmental issues through multilayered action.
Atmospheric Monitoring

Under the international cooperation of Japan and Thailand, industry, government, and academia united in an effort to solve environmental challenges.

Chulalongkorn University (Bangkok)

Kingdom of Thailand

Map Ta Phut Industrial Estate

Environmental Researchers (Chulalongkorn University)
- Japanese/Thai workshops
- Introduction of diffusion forecast PC cluster
- Simulation system

Environmental Data Analysts (Industrial Estate Authority of Thailand)
- Measurement training
- Air monitoring system

Citizens and Nearby Inhabitants
- Environmental education contents
- Website on Monitoring information

Technology & Solution

- Developed system to observe atmospheric concentration of VOC (volatile organic compounds) and release information to government organizations and nearby inhabitants.
- Introduction of PC cluster systems for running simulations on predictions of atmospheric diffusion of VOC.
- Implementation of various training to develop the abilities of system users, researchers, and nearby inhabitants.
Environment & Disaster Mitigation

Outline
Construction and operation of environmental monitoring systems in the primary industrial sites of Saudi Arabia.

Contribution
In the primary industrial sites, Fujitsu has built an environmental monitoring system which constantly monitors air/water pollution. Moreover, we will contribute to environmental improvement by consulting the various data collected from this system.
Eco-Friendly City

By improving the environment for industrial sites, and establishing a system for environmental conservation, we aim to bring an “Eco-Friendly City” into reality.

Installation of environmental monitoring systems

1. Air and Water Data collection
   - Ambient Air
   - Emission Air
   - Water (Ambient & Emission)

2. Data Observations & Analyses
   - Integrated Database
   - Monitoring

3. Environmental Consulting
   - Environmental Regulation
   - Eco-friendly City Examination

Project | MEMS (MODON Environment Management System)
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Client | Saudi Industrial Property Authority

Technology & Solution

- Centralized management of air/water observational data and the visualization of it using 3D maps provide effective, integrated monitoring services.
- Enables sequence of integrated operating processes which collect data, analyze it, and implement consultation based on the analyzed results.
Utilization of Satellite Data for Disaster Management

Space

“Sentinel Asia (Watchman of Asia)”
An international cooperation project supporting disaster monitoring in the Asia-Pacific region.

Contribution
By using high-speed file transferring technologies of its own, Fujitsu has developed a structure which can rapidly transmit satellite images in various countries throughout Asia to disaster preventing organizations, contributing to disaster prevention and crisis management in those regions.
Utilization of Satellite Data for Disaster Management

Contribute to disaster prevention and crisis management through partnerships with victim countries of frequent natural disasters in Asia.

"Kizuna": High Speed Internet Satellite

- High Speed Communication

Disaster prevention organizations in Asian countries
- Use of satellite imagery
  - Now used by 58 organizations in 23 different countries, as well as 9 international organizations.

Sharing Platform of Natural Disaster Information
- Sharing / Use of Information
  - Imagery information receivable even in areas without high-speed internet landlines access

JAXA Japan Aerospace Exploration Agency
- Control of “Kizuna”
  - Transmits web content through WINDS

Project | Sentinel Asia
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Client | Japan Aerospace Exploration Agency (JAXA)

Technology & Solution
- Effectively utilizes space technology, such as earth observation satellites and communications satellites.
- Utilizes ultra-speed internet satellite “Kizuna” (WINDS) to transmit data from Sentinel Asia to disaster prevention organizations around Asia.
- Provides fast, reliable file transfer services, which is independent from the network quality, using high-speed file transfer solution “BI.DAN-GUN”.

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Cutting-Edge Technology for “Shaping Tomorrow”

Real World

Human Society
The world we live in

Virtual World

Application Solution

Platform Solution
Creating New Knowledge
Predicting the Future

Data collection

Data utilization

New knowledge
Future predictions

1. Data collection

2. Data processing
   - Analysis
   - Simulation

Past and Present Data

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