Mission Critical Introduction

- Fujitsu Introduction
- Market Perspective
- PRIMEQUEST E Series Mission Critical Enterprise Servers
- Case Studies
- PRIMQUEST 3000 Hardware overview
**Corporate Roots in Japan**

**Headquarters: Tokyo, Japan**

- **Established:** 1935
- **President:** Tatsuya Tanaka
- **Employees:** 140,000
- **Supporting customers:** in more than 100 countries
- **R&D spend:** US$ 2.8 bill.
- **Research facilities:** Japan, US, UK, Germany, China, Singapore
- **Manufacturing locations:** Japan, Asia, Europe, North America

- Fujitsu is the world's fifth-largest IT services provider and No.1 in Japan.
- Fujitsu is among the World's top 10 providers of servers.
- FORTUNE named Fujitsu as one of 'the World’s Most Admired Companies' for the fifth consecutive year.
- Fujitsu Group holds about 78,000 patents worldwide.
- Fujitsu has been chosen for inclusion in the Dow Jones Sustainability World Index (DJSI World), the world's leading Socially Responsible Investment
1935
Fujitsu Limited established, Tokyo, Japan

1954
Japan's first automated electronic computer the FACOM 100

1972
Start of co-development with Amdahl Corporation

1978
Cooperation with Siemens to market Fujitsu mainframes in Europe

1979
Fujitsu surpassed IBM Japan, becoming the top computer developer in the Japanese market

1987
Augsburg, most modern IT factory in Europe, opened

1990
Joint Venture Siemens Nixdorf ICL acquisition (80%)

1991
Nokia Data acquisition

1994
Fujitsu Siemens Computers JV established

1997
Amdahl & DMR acquisitions

1999
Introduction of TRIOLE platform integration strategy for IT optimization.

2000
1999-2004 IT services businesses in Europe (ICL, DMR, Amdahl) integrated as Fujitsu Services

2002
Introduction of TRIOLE platform integration strategy for IT optimization.

2006
TDS becoming a Fujitsu company

2008
Introduction Dynamic Infrastructures.

2009
Acquisition of all shares in JV Fujitsu Siemens Computers. Renamed Fujitsu Technology Solutions

2009
Global Business Group operations united as Fujitsu under Richard Christou; new transnational model

2009
Acquisition of all shares in JV Fujitsu Siemens Computers. Renamed Fujitsu Technology Solutions

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Fujitsu’s blended delivery capabilities

- 6 Global Cloud Centers, geographic cloud dispersal, globally consistent services
- 5 Multi-lingual Service Desks supporting 29 languages
- 3 Global Delivery Centers (remote infrastructure and applications management)
- 5 Regional Delivery Centers
- Fujitsu Datacenters (85 in 26 countries)

Current capabilities or already under construction (subject to changes).
Challenges in the Data Center

- Data Centers are becoming more automated and efficient than ever before

**Problems in the Data Center**

Q: Has your organization experienced any of the following in the past 12 months?

- Downtime due to system failure
- Downtime due to human error
- Latency issues
- Downtime due to natural disasters
- Insufficient bandwidth
- Regulatory or compliance issues
- None of the above
- Security breaches
- Run out of IP addresses

**#1 Data Center Initiative**

Q: Thinking of the challenges in your organization’s Data Centers, please select the most important initiative

- Reduce downtime
- Provide better services delivery
- Reduce power consumption
- Improve asset management
- Improve workflow management
- Speed time to deploy applications
- Improve flexibility
- Improve cooling efficiencies

- Most important Data Center initiatives are reduce downtime and provide better services

N = 404; multiple responses allowed

Source: 2014 Data Center Survey, November 2014
## UNIX/RISC – IBM POWER, HP Itanium, Legacy SPARC

### Growth vs Market Share vs Vendor Revenue ($)

<table>
<thead>
<tr>
<th>Growth</th>
<th>Market Share</th>
<th>Vendor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013Q3-2012Q3</td>
<td>2013Q3</td>
<td>Vendor</td>
</tr>
<tr>
<td>-30%</td>
<td>56%</td>
<td>IBM</td>
</tr>
<tr>
<td>-25%</td>
<td>20%</td>
<td>Oracle</td>
</tr>
<tr>
<td>-37%</td>
<td>19%</td>
<td>HP</td>
</tr>
<tr>
<td>-34%</td>
<td>3%</td>
<td>Fujitsu</td>
</tr>
<tr>
<td>18%</td>
<td>2%</td>
<td>Bull</td>
</tr>
<tr>
<td>-69%</td>
<td>0%</td>
<td>NEC</td>
</tr>
<tr>
<td>-99%</td>
<td>0%</td>
<td>Hitachi</td>
</tr>
<tr>
<td>-67%</td>
<td>0%</td>
<td>Stratus Technologies</td>
</tr>
<tr>
<td>-31%</td>
<td>100%</td>
<td>Technologies</td>
</tr>
</tbody>
</table>

### Market Dynamics

**Fujitsu Market Analyser**

- Source: Gartner, quarterly update Q3 2013

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Value</td>
<td>10,000,000,000</td>
<td>20,000,000,000</td>
<td>30,000,000,000</td>
<td>40,000,000,000</td>
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</tbody>
</table>

### Chart Notes

- Blue line: RISC
- Red line: x86
- Green line: IA64

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History of Mission Critical Fujitsu Servers

- **FACOM 100**: 1st Fujitsu Mainframe
- **FACOM 230-60**: 1st System using IC Multi-Processor
- **M-190**: 1st Amdahl Based System
- **GS8600**: 1st Global Server
- **GS21**: Current Fujitsu Mainframe Family
- **PRIMEQUEST**: x86 based Mainframe

- **1954**: Became No1 in Computer sales in Japan, beating IBM
- **1963**: Shipped first mainframe outside Japan
- **1968**: Japanese Nationwide Online banking system went live
- **1975**: Amdahl 470V/6 was installed at NASA
- **2005**: Released Intel-Based PRIMEQUEST

**Nearly 65 Years Of Experience**
# Fujitsu’s Platform Product Portfolio

## Scale

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mainframe</th>
<th>UNIX Server</th>
<th>x86 Server</th>
<th>Super Computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Scale Enterprise System</td>
<td>BS2000</td>
<td>SPARC M10/M12</td>
<td>PRIMEQUEST</td>
<td>PRIMEHPC</td>
</tr>
<tr>
<td>&gt;99.999%</td>
<td>【MSP/XSP】</td>
<td>【Solaris】</td>
<td></td>
<td></td>
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<tr>
<td>Mid-Class Enterprise System</td>
<td>BS2000</td>
<td>SPARC M10/M12</td>
<td>PRIMEQUEST</td>
<td>PRIMEHPC</td>
</tr>
<tr>
<td>&gt;99.99%</td>
<td>【MSP/XSP】</td>
<td>【Solaris】</td>
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</tr>
<tr>
<td>Volume Server</td>
<td>BS2000</td>
<td>SPARC M10/M12</td>
<td>PRIMEQUEST</td>
<td>PRIMEHPC</td>
</tr>
<tr>
<td>&gt;99.9%</td>
<td>【MSP/XSP】</td>
<td>【Solaris】</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Entry

- ETERNUS

## Midrange

## High End

## Scale-Out
**PRIMEQUEST Concept**

- **Fujitsu Mission-Critical x86 Server**
  - Combine advantages of x86 server and UNIX/ Mainframe
  - With Fujitsu unique technologies and high quality

**UNIX/ Mainframe**
- High reliability
- High performance
- High flexibility

**x86 Server**
- Support for various software
- Lower HW cost
- Lower running cost

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- Fujitsu unique technology & features
  - High RAS
  - High Quality
  - Easy & Fast Recovery
  - TCO down with Partitioning feature
  - Flexible Configuration
  - Minimized System Failure
  - Easy implementation & management
  - Green ICT
PRIMEQUEST 12 years of Evolution

<table>
<thead>
<tr>
<th>Year</th>
<th>Model</th>
<th>CPU</th>
<th>Memory</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>1000 series</td>
<td>Xeon X7560</td>
<td>DDR4</td>
<td>8-core/2.26GHz, 24MB L3 cache, Max 1TB, 2~8CPU, Long Life support</td>
</tr>
<tr>
<td>2006</td>
<td>1000E2 series</td>
<td>Xeon E7-8870</td>
<td></td>
<td>10-core/2.4GHz, 30MB L3 cache, Max 2TB, 40x PCIe slots, 2~8CPU, Long Life support</td>
</tr>
<tr>
<td>2007</td>
<td>2000 series type2</td>
<td>Xeon E7-8890V3</td>
<td>DDR4</td>
<td>15-core/2.8GHz, 37.5MB L3 cache, Long Life support</td>
</tr>
<tr>
<td>2008</td>
<td>2000 series type3</td>
<td>Xeon E7-8890V4</td>
<td></td>
<td>Max 24TB</td>
</tr>
<tr>
<td>2009</td>
<td>3000 series</td>
<td>Xeon 81xx</td>
<td></td>
<td>Max 12TB</td>
</tr>
<tr>
<td>2010</td>
<td>400 series</td>
<td>Itanium 9050</td>
<td></td>
<td>2-core/1.60GHz, 9MB L3 cache, Max 2TB</td>
</tr>
<tr>
<td>2011</td>
<td>500 series</td>
<td>Itanium 9150M</td>
<td></td>
<td>2-core/1.66GHz, 24MB L3 cache, Max 2TB</td>
</tr>
<tr>
<td>2012</td>
<td>500A series</td>
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</tbody>
</table>
What is Mission Critical?

Defining an x86 Mission Critical Server Feature set:

- **99.999% RAS Out of the Box**
  - Designed to minimise Planned and Unplanned downtime, Designed to “Not Fail”

- **Intel XEON Platinum RISC Class CPU (Intel “Run Sure”)**
  - Machine Check Architecture (MCA)
  - Advanced Memory Protection - Double Data Device Correction (DDDC/DDDC+1)
  - CPU designed for High Throughput + High RAS > 99.999%

- **Enterprise Class Server**
  - Redundant Hot Swap Self Healing Architecture (High Level of Fault Tolerance)
  - Physical Partitioning & Dynamic Partition Reconfiguration
  - Hot Add/Hot Replace for Proactive Online Repairs
  - Hot swap System Boards, IO Units, Disk Units, PCI Slots, MMB
  - Hot Swap PSU, FAN, HDD

- **Mainframe Design, Manufacturing, Testing & Quality Assurance**
  - Increased CPU, Voltage & Temperature Tolerances
  - Advanced System Boards with zero surface wire & zero wire crossing
  - Multilevel testing of all System Boards, CPUs & RAM
  - Customer Configurations Burned in for 24 hours before shipment
  - Annual Failure Rate 0.1 vs 1 (10x Greater Reliability)

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What Features Are Missing?
Intel® Xeon®–Based Solutions Provide Uptime Similar to IBM Power Systems - 2014

<table>
<thead>
<tr>
<th>Operating System</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM AIX* (IBM Power Systems*)</td>
<td>99.9968%</td>
<td>99.9977%</td>
<td>99.9983%</td>
</tr>
<tr>
<td>Suse Linux Enterprise Server*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(x86)</td>
<td>99.9978%</td>
<td>99.9977%</td>
<td></td>
</tr>
<tr>
<td>Windows Server* (x86)</td>
<td></td>
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<tr>
<td>Red Hat Enterprise Linux* (x86)</td>
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</tr>
<tr>
<td>Oracle Solaris* (SPARC*)</td>
<td></td>
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</tr>
</tbody>
</table>

Unplanned downtime (hours/year)—lower is better³

³ITIC (Information Technology Intelligence Consulting) server reliability study, 2014.
Enhanced Memory Reliability New feature for Xeon E7 Family CPUs

SDDC (Single Data Device Correction)

- 1 DRAM Chip Failure: OK
- 2 DRAM Chip Failures: Down

DDDC (Double Data Device Correction)

- 1 DRAM Chip Failure: OK
- 2 DRAM Chip Failures: OK
PRIMEQUEST – Intel XEON E7 Family
MCA – Machine Check Architecture – Unresolved Error Containment

MCA Recovery

System works in conjunction with OS or VMM to recover or restart processes and continue normal operation

Error information passed to OS / VMM

Bad memory location flagged so data will not be used by OS or applications

System Recovery with OS

Normal Status With Error Prevention

Error Detected*

Error Contained

Error Corrected

HW Correctable Errors

Un-correctable Errors

Allows Recovery From Otherwise Fatal System Errors
Most Reliable x86 Server

The Same Design and Production Process as Mainframe

- High Quality Design
- 3 levels of testing:
  - Component
  - Unit
  - BTO (Built-to-Order)
- Intense test conditions

Fujitsu Quality

- High tolerance design
- Electro-magnetic noise reduction
- Intense QA test for driver software
- Strict selection of components from suppliers
PRIMEQUEST – High Quality for High Reliability
Mainframe Paradigm for Design, Manufacturing, Testing & Quality Assurance

- Failure rates for all components much lower than standard x86 servers
- Dramatically lower failure rates for PSU (Less than 1/30th)
- System Board, DIMM: 1/10th the failure rate of x86 servers

AFR comparison of PQ and standard x86 server AFR (%)

*1 AFR : Annual Failure Rate
*2 This graph compares AFR of PQ510A and IA servers (This situation is the same with subsequent PQ1000 systems)

For such comparison, (AFR for PQ components)/(AFR for IA server components) is shown.
# Market Position of PRIMEQUEST: Advantages

<table>
<thead>
<tr>
<th>Added Value of PQ</th>
<th>Better performance</th>
<th>Better RAS</th>
<th>Lower Cost</th>
<th>Support and Service Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Spec</td>
<td>✔ High-end 8-way x86 server</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main-Frame Level quality</td>
<td>✔ Main-Frame level design and quality</td>
<td>✔ Main-Frame level Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimized Service Stoppage</td>
<td>✔ Components redundancy</td>
<td>✔ Hot Maintenance</td>
<td>✔ Dynamic Reconfiguration</td>
<td>✔ Memory error check and correction</td>
</tr>
<tr>
<td>Fast Recovery</td>
<td>✔ Flexible IO + SB combinations</td>
<td>✔ Reserved SystemBoard automatic recover</td>
<td>✔ Partitioning feature to reduce license fee</td>
<td>✔ Industry standard virtualization support</td>
</tr>
<tr>
<td>Reduce TCO</td>
<td>✔ Partitioning feature to reduce license fee</td>
<td>✔ Industry standard virtualization support</td>
<td>✔ 80 Plus Pentium PSU</td>
<td>✔ Optimized power and cooling control</td>
</tr>
<tr>
<td>Green ICT</td>
<td>✔ 80 Plus Pentium PSU</td>
<td>✔ Optimized power and cooling control</td>
<td>✔ 80 Plus Pentium PSU</td>
<td>✔ Optimized power and cooling control</td>
</tr>
</tbody>
</table>
PRIMEQUEST – 3800E Specifications

※OS support list of Fujitsu Server Products can be download here: https://sp.ts.fujitsu.com/dmsp/Publications/public/osrel-py.pdf

- **High-availability RAS features**
  - High Quality Manufacturing
  - RISC Class CPU, Machine Check Architecture
  - DDDC+1, Memory & Sparing mirroring
  - Physical & Logical Partitioning
  - Reserve System Board (HW Cluster)
  - Flexible I/O
  - Hot Replaceable PCIe (x48), IO Units (x4), System Boards (x4), Disk Units (x4), PSU (x4), Fans (x6)
  - Cableless Design
  - Redundant Management Boards (MMB)

- **Full Standard OS Support**
  - Windows Server/Hyper-V 2012 R2 DC/SE
  - Windows Server/Hyper-V 2016 DC/SE
  - RedHat 7.3
  - SUSE Linux 12 SP2
  - Oracle Linux 7.3 & OVM 3.4.4
  - VMware 6.5

- **Scalability**
  - 8x Xeon Platinum Processors
  - Max 224 Cores, 448 threads

- **Memory**
  - Max. 24TB DDR4

- **Partitions**
  - Up to 4 (Electrically Isolated)
  - Up to 8x Logical/Extended Partitions

- **Onboard I/O**
  - 16x 10Gbps Ethernet
  - 8x USB 2.0

- **Extendable I/O**
  - Up to 56x PCIe 3.0 (8 Lane)
  - 48 slots Hot pluggable

- **Form Factor**
  - 7U Rackmount
Intel® Xeon® Processor Scalable Family Overview

- Designed for widest range of key workloads & optimized data analytics
- Increased VM density for cloud application
- Faster application response time and lower software license costs
- Up to 28 cores
- Up to 50%+ more performance vs. predecessor
- New UPI with 45%+ more inter-CPU bandwidth (10.4 GT/s)
- New core micro-architecture
- Up to 20% better core performance vs equivalent predecessor
- 50%+ more memory bandwidth via 6 channels
- Up to 50% more PCIe IO bandwidth (48 lanes per CPU)

High bandwidth connections for networking and memory performance

**Intel® Xeon® Processor E7 Family**
(4S / 8S+)

- Intel® Xeon® Processor E7 Family (2S / 4S)

**SKL**
- 48 lanes PCIe
- 1x100G Intel® OPA Fabric*

**SKL**
- 48 lanes PCIe
- 1x100G Intel® OPA Fabric*

* Optional
Enhancements in PQ3800(type1)

- **Performance improvement**
  - Support new Intel Xeon processor
  - 2666Mhz DIMM
  - Speed up in CPU-CPU communication
  - RAS improvement

- **Supporting new I/O**
  - 32Gbps FC
  - 100Gbps Infiniband, Omni Path
  - 6.4TB PCIe SSD

- **Adapting to Datacenter requirement**
  - 5U in B model, 7U in E model
  - Redfish support (BIOS read/write w/o reboot)
  - 40 degree support
  - Energy efficiency

- **Improvement in Reserved SB**
  - Shorten 30→5mins
    (boot time is 8mins at 12TB – shortened planned downtime)
Partitioning

- **PRIMEQUEST 3000 E Model** can be divided to 4x Physical Partitions as if independent servers with high secure fault isolation.

  Multiple Physical OSes can run concurrently in different hardware partitions

  Ideal feature for server consolidation

- **Benefits:**
  - Flexible 2S, 4S, 6S, 8S Partition options
  - Flexible CPU configurations – 4C, 12C, 20C, 28C
  - Self Healing via Reserve System Board (OS Agnostic)
  - Increased resource utilization
  - Reduced Risk through Isolation of HW/SW failure/error
  - Cost Reductions Save the license fee of SW (Such as Oracle DB – see PPAR)
Reserved SystemBoard: Example

SB#2 (RSB) is attached to Partition#3 and powered on.

Reconfigure SB#3 to partition#2 and as new RSB.

Linux partition#3 with CPU Error.

Partition#2 with SB#2 as RSB starts shutdown.
Maintenance

- **Easy and Safe Maintenance**
  - Components of PRIMEQUEST are easily accessible from front and rear
  - No need to move chassis position from rack
  - No risk of System Down with cabling accidents
  - Support PCI-card Hot-plug in both E model(PCI Box) and B model(IOUB)
  - PRIMEQUEST has Firmware online update
Performance

- **World top-class Performance**
  - **Computing**
    - SPECint_rate_base2006
      - PQ3000: #1 11,400 WR
    - SPECfp_rate_base2006
      - PQ3000: #1 7,120 WR

- **For SAP application**
  - SAP SD 2-Tier
    - #7 @ 101,000 concurrent users

- **For VMware**
  - VMmark v2
    - Has not be tested yet

- **For VMware**
  - PQ2000 Type3
    - Best 8-socket server result worldwide 06.06.2016
    - Best 2-socket and 8-socket server result worldwide (06.06.2016)
    - Best 8-socket server result on Windows worldwide

*Reference*
SAP SD 2 Tier Benchmark 17/9/17

SAP SD 2 Tier is a real world test that involves running the Application Server and Database on a single server.
What Makes PRIMEQUEST Mission Critical?

✓ Enterprise Class Server with 99.999% Out of the Box
✓ Mainframe Design, Manufacture, Testing & QA Paradigm
  ✓ Manufactured in the same Factory as Fujitsu Mainframes, SPARC M10 & FX10 & ETERNUS
✓ Intel XEON Platinum is a RISC Class CPU designed for MC 99.999% workloads
  ✓ Intel “Run Sure” - DDDC, DDDC+1, Machine Check Architecture + 70+ RAS feature above Silver/Bronze
✓ Redundant & Hot Swap
  ✓ System Boards (CPU/RAM), IO Units, PCI Slots, Disk Units, HDDs, MMBs (PSU, Fans), System Clock
✓ System Partitioning
  ✓ Physical Partitions, Dynamic Reconfiguration of Physical Partitions (RedHat/SuSE) & Logical Partitioning (2H 2014)
✓ Self Healing Architecture
  ✓ Flexible IO, Reserve Systems Boards (Built in HW Clustering)
✓ High Scalability & Throughput
  ✓ 224 Cores, 12-24TB RAM, 56x PCI Slots
✓ On-line firmware update
Case studies and Reference Material
## 5.1 Case Study: Installations

### Installation in 38 countries more than 4,800 units

As of May 2017 (PRIMEQUEST 2000/1000/500A/500/400)

<table>
<thead>
<tr>
<th>Database Servers</th>
<th>Virtualization Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ODK Solutions (VMware/Windows)</td>
<td>• Shizuoka Daiichi Television Corporation (VMware)</td>
</tr>
<tr>
<td>• TIS (Linux)</td>
<td>• Oita Prefectural government (VMware)</td>
</tr>
<tr>
<td>• Kenchiku Shiryō Kenkyūsha Co., Ltd (Windows)</td>
<td>• Kansai University (VMware/Windows)</td>
</tr>
<tr>
<td>• Shibaura Institute of Technology (Windows)</td>
<td>• Doshisha University (VMware)</td>
</tr>
<tr>
<td>• Daiwa Securities Co., Ltd (Linux)</td>
<td>• Toshiba Ward Office (VMware)</td>
</tr>
<tr>
<td>• Daiwa Next Bank (Linux)</td>
<td>• Board of Education of Nara City (VMware)</td>
</tr>
<tr>
<td>• To Solutions Co., Ltd. (Windows)</td>
<td>• Ziarre Limited (Hong Kong)(Linux)</td>
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<tr>
<td>• Nagoya University Hospital (Linux)</td>
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<tr>
<td>• The Banshu Shinkin Bank (Windows)</td>
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<tr>
<td>• Tsu Municipal Office (Windows)</td>
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<tr>
<td>• Yamazaki Baking Co., Ltd. (Windows)</td>
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<tr>
<td>• Yamato System Development (Linux)</td>
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<tr>
<td>• Inje University Paik Hospital (Korea)(Windows)</td>
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<tr>
<td>• Sejoong Namo Tour (Korea) (Linux/Windows)</td>
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<td>• Seoul National University (Korea) (Linux)</td>
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<td>• Sung-Ae Hospital (Korea) (Windows)</td>
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<td>• Severance Hospital (Korea) (Windows)</td>
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<td>• Lotte World (Korea) (Windows)</td>
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<td>• Jiangyin Software Park (China) (Linux)</td>
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<td>• YTO (China) (Linux)</td>
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<td>• Baoji High-tech Development Zone People’s Hospital (China) (Linux)</td>
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<tr>
<td>• Eastern Asia Commercial Bank (Vietnam) (Linux)</td>
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<td>• Banco Popular (Spain) (Windows)</td>
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<tr>
<td>• Coput (Spain/ Bureau of transportation) (Linux)</td>
<td></td>
</tr>
<tr>
<td>• Portugal Telecom (Portugal) (Linux)</td>
<td></td>
</tr>
<tr>
<td>• Meditel (Morocco) (Linux)</td>
<td></td>
</tr>
<tr>
<td>• The Anthony Marano Company (USA) (Windows)</td>
<td></td>
</tr>
<tr>
<td>• Fulton County, Georgia (USA) (Linux)</td>
<td></td>
</tr>
<tr>
<td>• SICOOB (Brazil) (Windows)</td>
<td></td>
</tr>
<tr>
<td>• Vivo (Brazil) (Linux)</td>
<td></td>
</tr>
<tr>
<td>• NTT Data Corporation (Linux)</td>
<td></td>
</tr>
<tr>
<td>• TKC Corporation (Windows)</td>
<td></td>
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<tr>
<td>• Gunma Bank (Linux)</td>
<td></td>
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<tr>
<td>• Shiga Bank (Linux)</td>
<td></td>
</tr>
<tr>
<td>• Shizuoka Bank (Linux)</td>
<td></td>
</tr>
<tr>
<td>• Shizuoka City (XSP)</td>
<td></td>
</tr>
<tr>
<td>• Tokyo Stock Exchange (Linux)</td>
<td></td>
</tr>
<tr>
<td>• Nagata City (Fukuoka) City Hall (XSP)</td>
<td></td>
</tr>
<tr>
<td>• Ministry of Justice (Linux)</td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Legacy Modernization</strong></td>
<td></td>
</tr>
<tr>
<td><strong>ERP Platform</strong></td>
<td><strong>High Performance Computing</strong></td>
</tr>
<tr>
<td>• Ube Kosan (Windows)</td>
<td>• Institute for Cosmic Ray Research, University of Tokyo (Linux)</td>
</tr>
<tr>
<td>• KONICA MINOLTA HOLDINGS, INC. (Windows)</td>
<td>• National Institute of Occupational Safety and Health (Linux)</td>
</tr>
<tr>
<td>• Toray Engineering Co., Ltd., (Windows)</td>
<td></td>
</tr>
<tr>
<td>• Nagano Kenkyō Bensan Co.; Ltd. (Windows)</td>
<td></td>
</tr>
<tr>
<td>• JAPAN VILENE COMPANY, LTD. (Windows)</td>
<td></td>
</tr>
<tr>
<td>• KDN (Germany) (Linux)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Australia, Austria, Belgium, Brazil, China (Hong Kong), Denmark, Finland, France, Germany, India, Indonesia, Italy, Japan, Jordan, Kazakhstan, Kuwait, Cyprus, Malaysia, Morocco, Netherland, Poland, Portugal, Russia, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Switzerland, Taiwan, Tunisia, Turkey, UAE, USA, Vietnam and Czech.*
Case Study: Tokyo Stock Exchange

Tokyo Stock Exchange (TSE)

TES is the World’ s No.3, Japan’ s No.1 largest Stock Exchange, which is engaged in the provision of market facilities for trading of securities, publication of stock prices and quotations, ensuring fair trading of securities and other financial instruments, and other matters related to the operation of exchange financial instruments markets.

Business Challenges

- **Top-level High-Reliability**: “Never-stop” is necessary for a system which handles billions of financial trading every day.
- **Extremely High speed processing**: Fast changing market, large amount of trading need high performance for real time processing.

Solution of Fujitsu

- By bringing together Fujitsu’s technological strengths, including its high-reliability, high-performance FUJITSU Mission-Critical Server PRIMEQUEST and the FUJITSU Server PRIMERGY, along with middleware such as the FUJITSU Software Primesoft Server, which incorporates new high-reliability, high-speed technology.

<table>
<thead>
<tr>
<th>Fujitsu HW</th>
<th>Fujitsu MW</th>
<th>OS, Other MW/SW</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMERGY: x86 server</td>
<td>PRIMECLUSTER: High Reliability platform software</td>
<td>Oracle, etc</td>
</tr>
<tr>
<td>ETERNUS: Storage</td>
<td>ETERNUS SF: Storage platform software</td>
<td>etc</td>
</tr>
<tr>
<td>Etc.</td>
<td>Etc.</td>
<td></td>
</tr>
</tbody>
</table>

Case Study: Daiwa next bank

Daiwa Securities Group – Daiwa next bank

Daiwa Securities Group is one of the largest financial groups in Japan, providing comprehensive financial services, including retail brokerage, investment banking and asset management.

Business Challenges

- **High running cost of legacy main-frame system**: Need to reduce running cost by using Linux-based open-system.
- **High reliability of core banking system**: Get the higher reliability to reduce stoppage time, and improve service quality.

Solution of Fujitsu

- The new system, a Linux-based open-source core banking system that employs Fujitsu's PRIMEQUEST x86 mission-critical servers, was built based on Fujitsu's W-Bank open-source core banking solution, to achieve the high performance and high reliability.
- The new highly-reliable system was built in a short period of just 13 months.

<table>
<thead>
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</tr>
<tr>
<td>Etc.</td>
<td>Etc.</td>
<td>Etc.</td>
</tr>
</tbody>
</table>

Sample of proposal from FBR: Consolidation and Server Refresh

- Current solution near max load
- Hardware requires refreshment
- Newer PRIMEQUEST consolidates 4 Servers with Better performance
- Reduce SQL License costs
- Reduce Power and BTU Consumption
- Footprint reduction

(*) A DR site available with same configuration
Sample of proposal from FBR: IBM Power to PRIMEQUEST

The Customer Problem:
Current solution IBM power based
- Reported Performance Issue
- Need cost reduction from the current solution
- ISV was already working on a new Hardware Solution

Fujitsu Approach:
- Get the ISV Contact with Customer
- Introduce PRIMEQUEST to customer and ISV
- Plan a POC together with ISV
- ISV run their application on PRIMEQUEST
- ISV provide good report with the Results of PRIMEQUEST vs. IBM Power POC

Fujitsu Proposal:
- PRIMEQUEST 2000 Series with 3x PPAR and RHEL
- A Reserved SystemBoard for fast recovery in case of issue
Sample of proposal from FBR: HP Itanium to PRIMEQUEST

- **The Customer Problem:**
  - Current solution with HP PA-RISC
    - Need technology refreshment
    - HP has suggested Superdome Itanium
    - Application need to be re-compiled

- **Fujitsu Approach:**
  - Warning that Itanium is a dying technology
  - Introduce PRIMEQUEST to customer as a Mission Critical solution
  - Enforce PRIMEQUEST unique features to help customer decision against competitors.

- **Fujitsu Proposal:**
  - PRIMEQUEST 2000 Series and RHEL
  - RHEL Advanced Mission Critical (AMC) Support
  - RSB and Memory Mirror for better RAS
Cielo

Largest Credit card processing company in Brazil, they were also old Fujitsu customer with PQ1800E and online payments.

Business Challenges

- High performance: to meet the application performance requirements

Solution of Fujitsu

- PRIMEQUEST has unique RAS features that provide Da Cielo with the mission critical reliability and stability needed to support Lynx system which operates 24/7, non-stop.
- Able to achieve 50% better response time than IBM AIX server with POC
- IBM AIX: 8-10 ms and goes up to 15-16 ms.
- PRIMEQUEST 2800E: 3-4 ms and goes up to 6-8 ms.

<table>
<thead>
<tr>
<th>Fujitsu HW</th>
<th>OS, other MW/SW</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMEQUEST: Mission-Critical IA server</td>
<td>RHEL and Lynx</td>
</tr>
</tbody>
</table>
Case Study of FBR: Billing System

- **Claro**

  Biggest telecommunication company in Brazil. TV, mobile phone and internet provider with 31% market share.

- **Business Challenges**
  - **High performance**: to meet the application performance requirements
  - **Business continuity**: Improved availability based on PRIMEQUEST RAS.
  - **Platform modernization**: Migrating from HP Itanium Servers, reducing space, saving energy and improving performance and scalability.

- **Solution of Fujitsu**
  - 4x PRIMEQUEST 2800E
  - 5 partitions running syncsort app (Billing)
  - 4 partitions running Oracle DB
  - 1 full machine running (4TB Memory mirrored with 8 CPU sockets) running syncsort application
  - No DR site or cluster solutions.
  - Almost 3 years without unscheduled downtime

<table>
<thead>
<tr>
<th>Fujitsu HW</th>
<th>OS, other MW/SW</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMEQUEST: Mission-Critical IA server</td>
<td>RHEL, Oracle, SyncSort</td>
</tr>
</tbody>
</table>
Case Study of FBR: Server Consolidation

- **SICOOB**
  
  SICOOB is the largest credit union in Brazil.

- **Business Challenges**
  
  - Reduce licensing costs and energy consumption.
  - Implement a flexible and scalable solution to support SICOOB’s business growth.
  - Define IT strategy to reduce the number of physical servers and increase processing capabilities in the data center.

- **Solution of Fujitsu**
  
  - PRIMEQUEST for server consolidation.
  - Increase performance improves daily batch processing by 3 hours
  - Saving energy costs - reducing consumption by 3.13M kW/yr
  - Reduce carbon footprint (CO2 emission reduction of 140 tons/yr)

<table>
<thead>
<tr>
<th>Fujitsu HW</th>
<th>OS, other MW/SW</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRIMEQUEST: Mission-Critical IA server</td>
<td>VMware ESXi</td>
</tr>
<tr>
<td>Fujitsu Storage Eternus DX Series</td>
<td></td>
</tr>
</tbody>
</table>
PRIMEQUEST 3000 series – Hardware Overview
PQ 3000 HW - Front and Rear Side View

**PRIMEQUEST 3800B**

**PRIMEQUEST 3400E**

**PRIMEQUEST 3800E**

Front side

- SB
- SB
- SB
- SB
- SB + BMM_BOARD
- DU (1~4) NOD
- DU (5~8) NOD
- Operation Panel

Rear side

- Blank or MSB(1~3)
- IOUB
- I/OUE
- MGMT_LANU
- Management Disk Unit
- Base Unit

Business-Critical

Mission-Critical
PQ 3000 HW – PQ3800E

**Management Disk Unit**

- **4 Disk unit (DU_M)**
  - Raid card + 4 x HDD/SSD

**Mid-Plane**

- **PCI-BOX**: Optional component to expand PCI-E slot
- **IO Unit (IOUE)**
  - PCI Device Slot: 4 x low-profile Slot
  - 2 x Onboard LAN port

**Base Unit**

- **Disk Unit**
  - DU_SAS
    - 4 x HDD/SSD
  - DU_PCIE2
    - 4 x PCIe SSD SFF
  - Raid card

**System Board**

- **DIMM module**
  - 2 x 6 x DIMM slot per CPU

**Management Board (MMB)**

- **4 x Power supply Unit and 6 x Fan Unit**

No Active components, minimize failure possibility
PQ 3000 HW - Architecture: PRIMEQUEST 3800E

Management Board (MMB)

SystemBoard (SB)
- CPU
- MEM
- BMM_BOARD

SystemBoard (SB)
- CPU
- MEM
- BMM_BOARD

SystemBoard (SB)
- CPU
- MEM
- BMM_BOARD

SystemBoard (SB)
- CPU
- MEM
- BMM_BOARD

MMB provides a Web-GUI for hardware controlling, configuration and monitoring.

SB is computing unit of PQ, loads CPU, memory and BMM_BOARD which loads optional storage devices such as M.2 SSD.

BMM is board management module, loads BMC, PCH, Battery and optional components like TPM module.

Flex IO makes SBs and IOUEs can be combined freely (3400En/3800En).

IOUE loads I/O devices (PCIE cards), and connected with Disk Unit.

Disk Unit is a device to load storage. E type can load three kinds of Disk Unit, DU_SAS, DU_PCIE2, and DU_M. DU_SAS and DU_M can load Raid-card and 4 HDD/SSDs. DU_PCIE2 can load Retimer card and 4 PCIe SSD SFFs.

PCI BOX can load 12 PCIE cards to extend I/O devices.
### CPU spec: 2 type of CPU are available

- **Low frequency + multi core:**
  - e.g. Xeon Platinum 8176M 2.2GHz / 28 core
  - suitable for Multi-process application and server consolidation.

- **High frequency + less core:**
  - e.g. Xeon Platinum 8156 3.6GHz / 4 core
  - suitable for Batch application and core-quantity-licensing SW (e.g. Oracle DB)

<table>
<thead>
<tr>
<th>CPU Name</th>
<th>Number of Cores</th>
<th>Freq. (GHz)</th>
<th>LLC (MB)</th>
<th>Max. Memory per CPU (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel® Xeon® Platinum 8180M Processor</td>
<td>28</td>
<td>2.5</td>
<td>38.5</td>
<td>1,500</td>
</tr>
<tr>
<td>Intel® Xeon® Platinum 8180 Processor</td>
<td>28</td>
<td>2.5</td>
<td>38.5</td>
<td>768</td>
</tr>
<tr>
<td>Intel® Xeon® Platinum 8176M Processor</td>
<td>28</td>
<td>2.1</td>
<td>38.5</td>
<td>1,500</td>
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<td>Intel® Xeon® Platinum 8176 Processor</td>
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<td>38.5</td>
<td>768</td>
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<tr>
<td>Intel® Xeon® Platinum 8170M Processor</td>
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<td>35.8</td>
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<td>Intel® Xeon® Platinum 8170 Processor</td>
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<td>35.8</td>
<td>768</td>
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<tr>
<td>Intel® Xeon® Platinum 8164 Processor</td>
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<td>35.8</td>
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<tr>
<td>Intel® Xeon® Platinum 8168 Processor</td>
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<td>2.7</td>
<td>33.0</td>
<td>768</td>
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<tr>
<td>Intel® Xeon® Platinum 8160M Processor</td>
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<td>Intel® Xeon® Platinum 8160 Processor</td>
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<td>2.1</td>
<td>33.0</td>
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<tr>
<td>Intel® Xeon® Platinum 8153 Processor</td>
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<td>Intel® Xeon® Platinum 8158 Processor</td>
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<tr>
<td>Intel® Xeon® Platinum 8156 Processor</td>
<td>4</td>
<td>3.6</td>
<td>16.5</td>
<td>768</td>
</tr>
</tbody>
</table>

CPU spec: 2 type of CPU are available

- Low frequency + multi core:
  - e.g. Xeon Platinum 8176M 2.2GHz / 28 core
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- High frequency + less core:
  - e.g. Xeon Platinum 8156 3.6GHz / 4 core
  - suitable for Batch application and core-quantity-licensing SW (e.g. Oracle DB)
## Advanced RAS features with New CPU of PRIMEQUEST 3000

<table>
<thead>
<tr>
<th>Advanced RAS features</th>
<th>OLD (Xeon-E7)</th>
<th>PRIMEUQEST 2000 series</th>
<th>NEW (Skylake[G/P])</th>
<th>PRIMEUQEST 3000 series</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRIMERGY</td>
<td>PRIMERGY</td>
<td>PRIMERGY</td>
<td>PRIMERGY</td>
</tr>
<tr>
<td>Clock Signal failover</td>
<td>not support</td>
<td>support</td>
<td>not support</td>
<td>support</td>
</tr>
<tr>
<td>QPI lane degradation</td>
<td>not support</td>
<td>support</td>
<td>not support</td>
<td>support</td>
</tr>
<tr>
<td>Core degradation</td>
<td>not support</td>
<td>support</td>
<td>not support</td>
<td>support</td>
</tr>
<tr>
<td>Socket(SB) degradation</td>
<td>not support</td>
<td>support</td>
<td>not support</td>
<td>support</td>
</tr>
<tr>
<td>DDDC+1</td>
<td>support</td>
<td>support</td>
<td>support</td>
<td>support</td>
</tr>
<tr>
<td>SDDC+1</td>
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<tr>
<td>ADDDC-MR</td>
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<tr>
<td>MCA Recovery Gen.2</td>
<td>support</td>
<td>support</td>
<td>support</td>
<td>support</td>
</tr>
<tr>
<td>Address Ranged Partial Mirror</td>
<td>support</td>
<td>support</td>
<td>not support</td>
<td>support</td>
</tr>
<tr>
<td>Mirror Keep Mode</td>
<td>not support</td>
<td>support</td>
<td>not support</td>
<td>support</td>
</tr>
</tbody>
</table>
PQ 3000 HW - PCI BOX

- PCI BOX to Expand PCI-E devices
  - Features and configurations of PCI-BOX
    - Providing additional 12 slots for PCI-E devices
    - Redundant PSU/FAN Unit as standard configuration
  - PCI Box Connection card
    - PCI Box Connection card is necessary to connect PCI BOX and IOU
      - every 6 PCI slots need 1 connection card
    - PCI Box Connection card must be installed in slot#2 or #3 of IOUE
    - The Performance bottle neck of connection card

- Benefits of PCI BOX
  - Expand Max. 48 PCI-E slots for I/O devices
  - PCI-BOX Support Hot-Plug

**Notice:** Load many high-speed I/O device under one connection card may dramatically slow down the I/O speed because the congestion frequently happens in I/O path. → per test is necessary
FUJITSU

shaping tomorrow with you