Fujitsu’s DNA Roots:

~Engineering Mission Critical Machines for over 50 years~

Kazuhiko Endo, Senior Vice President
IA Servers Department
Fujitsu Limited
My Background

- Responsible for development of PRIMEQUEST server family
- Joined Fujitsu in 1984
- Started career as a Mainframe hardware engineer, before moving on to engineering UNIX systems ("PRIMEPOWER")
- Initial startup member of PRIMEQUEST development project (2003~present)
- Responsible for the development for all high-end x86 Fujitsu servers since 2009
- This is my second time in the Middle-East region
  - Oman Customers
  - Qatar Customers
  - UAE Customers
“What mankind can dream, technology can achieve”

Takuma Yamamoto, Former Fujitsu President

1954 Relay-based Mainframe (first in Japan)

1968 Establishment of Fujitsu Laboratories Ltd

1974 LSI based Computer (fastest in the world)

1989 Color Plasma Display

1994 World’s 1st PC with TV features

2001 “Raku-Raku” mobile phone

2006 World’s thinnest 12 inch notebook (19.9mm)

2007 World’s smallest & most power-efficient server

2009 Orbit control system for Ibuki satellite

2009 Server with Cool-Central™ Architecture

2010 Zero-Watt PC

2010 Zero-Watt Server

2010 Multi-Angle Vision™ for safer parking and driving

2011 0-Watt AC Adapter for Fujitsu LIFEBOOK notebooks

2011 "Green data center in a box"

2012 Peta-Scale Computing

2007 World’s thinnest 12 inch notebook (19.9mm)

2010 (Dec) "Green data center in a box"
Fujitsu’s 77 years of Transformation

- There are total of 4 logos that represented Fujitsu.
- Each logo reflects Fujitsu’s role in supporting society

<table>
<thead>
<tr>
<th>Period</th>
<th>Logos</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1935 to 1961</td>
<td>![Logo]</td>
<td>- Started as a telecom equipment manufacturer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Developed the first Japanese computer, FACOM</td>
</tr>
<tr>
<td>1962 to 1971</td>
<td>![Logo]</td>
<td>- Shifting to full-fledged computer business</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Slogan “Communications and Electronics”</td>
</tr>
<tr>
<td>1972 to 1988</td>
<td>![Logo]</td>
<td>- Expanding the Mainframe Server Business</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Heated rivalry with IBM</td>
</tr>
<tr>
<td>1989 to present</td>
<td>![Logo]</td>
<td>- ICT vendor with the full-fledged product lineup</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- “Everything on the Internet”, Globalization</td>
</tr>
</tbody>
</table>

One thing that does not change:

**Fujitsu is always committed to supporting public infrastructure**

With high-quality, high-reliable products
The Genius Who Transformed Fujitsu

Toshio Ikeda, The pioneer of computer domestic production in Japan

- Completed the first Japanese mainframe computer in 1951, using relay technology that were used in telecom equipment.
- In 1968, Fujitsu achieved No.1 share in Japan with “FACOM 230-60” mainframe.
- His ambition was to compete in the global market, not just in the Japanese domestic market.
- Convinced Fujitsu management to invest in Amdahl to compete with IBM for high-end mission-critical segments, and “M-series” mainframe was completed.
- His DNA and passion is succeeded to all Fujitsu’s products, including PRIMEQUEST.

Dr. Toshio Ikeda (1923-1974)
Over 55 Years Of Experience

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
Fujitsu also has a 40 year history in External Storage!

Disk Storage System for Mainframe

Capacity

'70

'80

'90

2000

2010

F479

446 MB/10.5”
7.56 GB/Unit

F6421

1.89 GB/8”
27 TB/System

F6427

146 GB/3.5”
503 TB/System

ETERNUS GR740

500 GB/3.5”
2,047 TB/System

ETERNUS6000

750 GB/3.5”
5,456 TB/System

ETERNUS DX8700

2TB/3.5”
5,456 TB/System

Disk Storage System for Open Systems
Fujitsu Systems: The Total Package

Mainframe Hardware
- Full lineup from Mainframes, Mission-Critical UNIX, Mission Critical x86 and standard x86 servers
- Wide range of storage systems to support and complement Fujitsu’s Mission-Critical hardware systems

Mainframe Operating System, software development
- Developed the OS in-house for optimum performance and system reliability
- Know-how let do development of Firmware for raising the reliability of components

PRIMEQUEST is a culmination of >70 years of Fujitsu Mainframe innovation brought into the x86 world.
Fujitsu Mainframe Installations Globally

Fujitsu Mainframes have been installed at 3,000 companies around the world, with over 5,000 systems

Fujitsu’s “Mission Critical” servers after “M-Series” (“GS” Series Mainframes, PRIMEPOWER and PRIMEQUEST) all succeed the strict criteria for high-reliable computing, achieving high standards set by Dr. Ikeda
PRIMEQUEST

Mission Critical Servers Redefined

IT reshaping Business
Strategically focus area
- Targeting MF, UNIX and High-End x86

Succeed MF technology, know-how
Mainframe servers for Japan and EMEA Market

Joint development with Oracle
UNIX server “SPARC Enterprise”

Strategically focus area
- Targeting MF, UNIX and High-End x86

PRIMEQUEST as open MC server
PRIMERGY as Standard High Vol. Server

Source: IDC Worldwide Quarterly Server Forecast 2011 Q4

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Server Market – Fujitsu PRIMEQUEST Positioning

Replacing Mission Critical UNIX/RISC & Mainframe Servers
New Option for Maturing x86 Customers

WW Server Forecast per OS (CY2013)

- MC Market
  - UNIX $12B
  - MF $5B
- SHV Market
  - Windows $29B
  - Linux $11B

CAGR (2010-2013)
- 8%
- 3%
- +5%

Latest !!

Gartner 2011: Linux Market Revenue will exceed UNIX/RISC in 2015

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Vendors have moved away from Itanium

Will customers keep on using mission-critical applications on servers using processors that have lost support?

"Oracle Stops All Software Development For Intel Itanium Microprocessor"  Will not run new Oracle DB

"RHEL6 (supported) Architecture: x86, x86-64, IBM Power, IBM System Z"  No support for IA64 whatsoever

"Windows Server 2008 R2 will be the last iteration to support the Intel Itanium processor"  Only Extended support after 2013
"... these current versions will continue to be supported via Mainstream Support until mid-2013..."

"PRIMEQUEST 1000 series servers are equipped with Xeon processors"  Discontinued Itanium Models

**Change of Intel’s Marketing position for Xeon**

Xeon now rivals Itanium in mission-critical capability

### Past

- Clearly positioning Itanium processors superior to Xeon.

### After 2010

- Due to resurgence of AMD, Itanium technology was implemented within Xeon, creating a superior CPU.

### Spec/Function comparison between Xeon and Itanium

<table>
<thead>
<tr>
<th>Spec/Function</th>
<th>2002 to 2005</th>
<th>2006 to 2009</th>
<th>2010 and beyond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>Xeon &lt; Itanium</td>
<td>Xeon &gt; Itanium</td>
<td>Xeon &gt; Itanium</td>
</tr>
<tr>
<td>Expandability</td>
<td>Xeon &lt; Itanium</td>
<td>Xeon = Itanium</td>
<td>Xeon = Itanium</td>
</tr>
<tr>
<td>RAS Feature</td>
<td>Xeon &lt;&lt; Itanium</td>
<td>Xeon &lt; Itanium</td>
<td>Xeon = Itanium</td>
</tr>
<tr>
<td>64bit</td>
<td>Itanium only</td>
<td>Xeon = Itanium</td>
<td>Xeon = Itanium</td>
</tr>
<tr>
<td>ISV Support</td>
<td>Xeon &gt; Itanium</td>
<td>Xeon &gt; Itanium</td>
<td>Xeon &gt; Itanium</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>Xeon &gt; Itanium</td>
<td>Xeon &gt; Itanium</td>
<td>Xeon &gt; Itanium</td>
</tr>
<tr>
<td>OS Support</td>
<td>Xeon = Itanium</td>
<td>Xeon = Itanium</td>
<td>Xeon &gt; Itanium</td>
</tr>
</tbody>
</table>

*Upgrade to Xeon now rivals Itanium in mission-critical capability.*
## Fujitsu Platform Products - Enterprise

<table>
<thead>
<tr>
<th>System Size</th>
<th>Mainframe</th>
<th>UNIX Servers</th>
<th>Linux/Windows Servers</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Super Computer</strong></td>
<td></td>
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<tr>
<td></td>
<td>Global Server PRIMEFORCE</td>
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<tr>
<td></td>
<td>SPARC Enterprise</td>
<td></td>
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<tr>
<td></td>
<td>PRIMEQUEST</td>
<td>PRIMERGY</td>
<td></td>
<td>ETERNUS</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>DX8000</td>
</tr>
<tr>
<td>High-end</td>
<td></td>
<td>[Solaris]</td>
<td></td>
<td>DX400</td>
</tr>
<tr>
<td></td>
<td>GS series</td>
<td></td>
<td></td>
<td>DX80/90</td>
</tr>
<tr>
<td></td>
<td>(for Japan market)</td>
<td></td>
<td></td>
<td>JX40</td>
</tr>
<tr>
<td>Mid-range</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>BS series</td>
<td></td>
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<tr>
<td></td>
<td>(for EMEA market)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume-range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Fujitsu’s DNA = Mission-Critical Systems

Advanced Technology
- Processor/ASIC
- Semiconductor

Mainframe Technology
Maintaining mainframe technology heritage for overall system robustness

Quality Management
Japan quality + German quality

Servers, Storage Systems, Middleware

“Mission-Critical Systems” with maximum reliability
PRIMEQUEST Concept vs Standard x86

PRIMEQUEST delivers Mission Critical Availability

PRIMEQUEST
- Mainframe Qualities
  - Design
  - QA
  - Manufacturing
- Mission Critical Operations
- High End Enterprise Features
- 10x Greater Reliability
- Highest Availability
- Affordable performance

PRIMERGY
- Highest performance
- Cost efficiency in its class
PRIMEQUEST continues the Advanced (PRIME) technology pursuit (QUEST)

- **April, 2005**: PRIMEQUEST 400 series (Itanium) announcement
- **November, 2005**: Technology partner contract with EDS (U.S.)
- **April, 2006**: PRIMEQUEST 500 series (dual core Itanium) announcement
- **August, 2006**: World best record of SAP 2-tier SD (Linux)
- **July, 2006**: Offering virtual machine function
- **October, 2007**: World best record of TPC-C (Linux)
- **April, 2008**: 500A series announcement
- **April, 2009**: World record of SAP 2-tier SD (Windows)
- **April, 2010**: 1000 series (Xeon) announcement
- **March, 2010**: 1000 series Enhancement
- **April, 2011**: 1000 series Enhancement
- **April, 2012**: World record of SAP 2-tier SD (Windows)
Failure Rate Comparison by Component

- 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

Figures : Relative AFR*¹ for PQ components *² (corresponding AFR setting for standard x86 servers = 1)

*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.
PRIMEQUEST: 85% lower Annual Failure Rate than standard x86 servers

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

*1 This graph compares AFR of PQ510A and PC server. (This situation is the same with subsequent PQ1000 systems.)

For such comparison, (AFR for PQ components)/(AFR for IA server components) is shown.
Mainframe Development & QA Process

Intensive design review in each development process

<table>
<thead>
<tr>
<th>Step 0</th>
<th>Development Planning Council</th>
<th>Product Planning</th>
<th>Product specification, Development policy Development schedule, Conception design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Basic Design Council</td>
<td>Basic Design</td>
<td>Quality assurance plan, RASIS function DVT plan</td>
</tr>
<tr>
<td>Step 2</td>
<td>Detailed Design Council</td>
<td>Design / Prototype</td>
<td>Safety confirmation Evaluation of characteristics/reliability Confirmation of new parts and units</td>
</tr>
<tr>
<td>Step 3</td>
<td>Design Completion Council</td>
<td>Prototype</td>
<td>System test Quality assurance test Initial lot quality verification</td>
</tr>
<tr>
<td></td>
<td>Mass Production Shift Council</td>
<td>Shipment Judgment</td>
<td>Initial lot quality verification</td>
</tr>
<tr>
<td>Step 4</td>
<td>Project Review</td>
<td>Mass Production</td>
<td>Authorization of shipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shipment</td>
<td>Initial quality monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coping Complaint Response</td>
<td>Design Review</td>
</tr>
</tbody>
</table>
Reliability of Redhat Linux

Today: Quality of Linux is higher than Solaris

Why is Linux ACR decreasing?

- Rapidly growing Install-Base leads Maturity
- Explosive demand for Mission Critical systems
- Enhancing Development/Validation

* ACR is an annual call rate represents the Quality. ACR includes trouble call and QA call.
## Server RAS Comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>PRIMEQUEST 1800E2 8x Intel E7</th>
<th>HP Superdome 2 Intel Itanium</th>
<th>IBM Power System 770 POWER 7</th>
<th>Fujitsu/Oracle SPARC M Class</th>
<th>IBM x3850 DELL R910 HP DL980</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Board Recovery (Automated)</td>
<td>✅</td>
<td></td>
<td>✪</td>
<td>✅</td>
<td>✧</td>
</tr>
<tr>
<td>Flexible I/O Redirection</td>
<td>✅</td>
<td>✧</td>
<td>✧</td>
<td>✮</td>
<td>✧</td>
</tr>
<tr>
<td>Hardware Partitions Electrical Isolation</td>
<td>✮</td>
<td>✮</td>
<td>✧</td>
<td>✮</td>
<td>✧</td>
</tr>
<tr>
<td>Online maintenance</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✧</td>
</tr>
<tr>
<td>Management processor (Redundant)</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✧</td>
</tr>
<tr>
<td>System clock (Redundant)</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✧</td>
</tr>
<tr>
<td>Memory Mirroring</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✧</td>
</tr>
<tr>
<td>CPU Error detection/correction</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✧</td>
</tr>
<tr>
<td>Component level Redundant &amp; Hot-plug (PS,fans, disks, PCI)</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✮</td>
<td>✧</td>
</tr>
</tbody>
</table>

- **PRIMEQUEST 1800E2 8x Intel E7**
  - System Board Recovery (Automated)
  - Management processor (Redundant)
  - System clock (Redundant)
  - Memory Mirroring
  - CPU Error detection/correction
  - Component level Redundant & Hot-plug (PS,fans, disks, PCI)

- **HP Superdome 2 Intel Itanium**
  - Flexible I/O Redirection
  - Hardware Partitions Electrical Isolation
  - Online maintenance
  - CPU Error detection/correction
  - Component level Redundant & Hot-plug (PS,fans, disks, PCI)

- **IBM Power System 770 POWER 7**
  - System Board Recovery (Automated)
  - Management processor (Redundant)
  - System clock (Redundant)
  - Memory Mirroring
  - CPU Error detection/correction
  - Component level Redundant & Hot-plug (PS,fans, disks, PCI)

- **Fujitsu/Oracle SPARC M Class**
  - Flexible I/O Redirection
  - Hardware Partitions Electrical Isolation
  - Online maintenance
  - Management processor (Redundant)
  - System clock (Redundant)
  - Memory Mirroring
  - Component level Redundant & Hot-plug (PS,fans, disks, PCI)

- **IBM x3850 DELL R910 HP DL980**
  - Online maintenance
  - Management processor (Redundant)
  - System clock (Redundant)
  - Memory Mirroring
  - Component level Redundant & Hot-plug (PS,fans, disks, PCI)

- **IBM x3850 DELL R910 HP DL980**
  - Online maintenance
  - Management processor (Redundant)
  - System clock (Redundant)
  - Memory Mirroring
  - Component level Redundant & Hot-plug (PS,fans, disks, PCI)
Oracle License fee reduction

Oracle Enterprise Edition on PRIMEQUEST vs. Unix/RISC Systems

50% reduction

- Half the license and support fee
  - vs. IBM Power Systems and HP Integrity Systems *¹

<table>
<thead>
<tr>
<th>System</th>
<th>Core factor</th>
<th>License fee for 64 cores</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Power Systems (Power6/7)</td>
<td>1.0</td>
<td>ca 3.0M USD</td>
</tr>
<tr>
<td>HP Integrity-2 (Itanium9300)</td>
<td>1.0</td>
<td>ca 3.0M USD</td>
</tr>
<tr>
<td>SPARC Enterprise M (SPARC64 VII+)</td>
<td>0.5</td>
<td>ca 1.5M USD</td>
</tr>
<tr>
<td>PQ1800E (Xeon 7500 &amp; E7)</td>
<td>0.5</td>
<td>ca 1.5M USD</td>
</tr>
</tbody>
</table>

License fee for 64 cores

*¹ As of January 19th, 2011
PRIMEQUEST Specification Overview

- **High-availability RAS features**
  - Memory mirroring
  - HW Partitioning
  - Standby system board
  - Flexible I/O
  - H/W RAID, S/W RAID
  - PCIe slot extension

- **Enhanced manageability**
  - Management Board (MMB)
  - Optional MMB for redundancy
  - Remote management, HDD & PCIe Card Hot plug, etc.
  - Cable-less design

- **Full Standard OS Support**
  - Windows Server
  - RedHat Enterprise Linux
  - SUSE Linux
  - VMware, OVM, Hyper-V
  - Solaris x86, Oracle Linux

- **Scalability**
  - 8x Xeon E7 Processors
  - Max 80 Cores, 160 threads

- **Memory**
  - Max. 2TB (4TB(32GB*128) design)

- **Partitions**
  - Up to 4 (Electrically Isolated)

- **Onboard I/O**
  - 16x GigaEthernet
  - 8x USB 2.0

- **Extendable I/O**
  - 16x PCIe 2.0 (8 Lane)
  - Up to 40 with PCI Boxes

- **Form Factor**
  - 12U Rackmount
Dual/Redundant Design

Completely Dual/Redundant Design for High Reliability & Availability

- Mirrored Memory, multiple CPU-CPU paths, CPU-I/O paths
- Fault component automatically Isolated

(Note: Double physical memory is required for partitions using the memory mirror)
Flexibly Configurable H/W Resources

Partitioning
Each block that one server is divided into multiple blocks can work as an independent system.

- Different OSs can run in partitions
- Rebooting and shutting down per partition
- Flexible partitioning using Flexible I/O and Reserved SB
- Multiple applications can be consolidated in one server
- A fault in one partition never affect other partitions
Cable-less Design

- Each component directly plugged “Mid-plane” and are interconnected
- Cable-less design removes cable fault, human cabling errors
- Enables Flexible IO feature

Maintainability, Operability, Reliability all improved

- System board (SB)
- SAS Unit (SASU)
- I/O board (IOB)
- Giga-LAN/SAS/PCI-Box Interface board (GSPB)
- Server management board (MMB)
- Mid-plane (MP)
All Faults Isolated within their Partition

- Errors in one partition do not affect any other partition
- Maximized uptime automatic replacement of faulty system boards by Reserved System Board

Hardware Partitioning

Partition #1
- Application
- OS
- CPU/Memory

Partition #2
- Application
- OS
- CPU/Memory

Reserved System Board
- CPU/Memory
Advanced Reliability Starts With Silicon

Intel® Xeon® E7-8800 Family Reliability Features

**Memory**
- Inter-socket Memory Mirroring
- Intel® Scalable Memory Interconnect (Intel® SMI) Lane Failover
- Intel® SMI Clock Fail Over
- Intel® SMI Packet Retry
- Memory Address Parity
- Failed DIMM Isolation
- Memory Board Hot Add/Remove
- Dynamic Memory Migration*
- OS Memory On-lining *
- Recovery from Single DRAM Device Failure (SDDC) plus random bit error
- Memory Thermal Throttling
- Demand and Patrol scrubbing
- Fail Over from Single DRAM Device Failure (SDDC)
- Enhanced DRAM Double Device Data Correction
- Fine Grained Memory Mirroring
- Memory DIMM and Rank Sparing
- Intra-socket Memory Mirroring
- Mirrored Memory Board Hot Add/Remove

**I/O Hub**
- Physical IOH Hot Add
- OS IOH On-lining *
- PCI-E Hot Plug

**CPU/Socket**
- Machine Check Architecture (MCA) recovery
- Corrected Machine Check Interrupt (CMCI)
- Corrupt Data Containment Mode
- Viral Mode
- OS Assisted Processor Socket Migration*
- OS CPU on-lining *
- CPU Board Hot Add at QPI
- Electronically Isolated (Static) Partitioning
- Single Core Disable for Fault Resilient Boot

**Intel® QuickPath Interconnect**
- Intel QPI Packet Retry
- Intel QPI Protocol Protection via CRC (8bit or 16bit rolling)
- QPI Clock Fail Over
- QPI Self-Healing

Advanced reliability features work to maintain data integrity
Machine Check Architecture Recovery

Previously seen only in RISC, mainframe, and Itanium-based systems

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

Un-correctable Errors

Error Contained

Error Detected*

Normal Status With Error Prevention

Error Corrected

HW Correctable Errors

Allows Recovery From Otherwise Fatal System Errors

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PRIMEQUEST Performance: SPEC int_2006

Top Class Performance* in UNIX/Windows/Linux Servers

*:Excluding expensive Power -7 (About 3-times Xeon)
PRIMEQUEST Performance: SAP SD 2 tier

PRIMEQUEST is equivalent to SPARC Enterprise M9000 for 95% of Customers

- Reduced power consumption and server space at similar performance
  - 80 PLUS GOLD *1 certified highly efficient power supplies
  - Power consumption can be reduced to around one-fifth
  - Server space can be reduce to nearly one-sixth

HP Superdome (Itanium9100/128cores) vs. PRIMEQUEST 1800E2 (Xeon E7/80cores)

- Power consumption can be reduced to around one-fifth
- Server space can be reduced to nearly one-sixth

18 KWatts & 84U vs. 4.0 KWatts

Space 1/6
PRIMEQUEST Installations

Installation in 25 countries/ over 2,000 units
As of December 2010 (PRIMEQUEST 1000/500A/500/400)

Database Servers
- Nikken Gakuin/Kenchiku Shiryo Kenkyusya Co., Ltd (Windows)
- Circle K Sunkus (Linux)
- Shibaura Institute of Technology (Windows)
- TIS (Linux)
- Tsu Municipal Office (Windows)
- To Solutions Co., Ltd. (Windows)
- Nagoya University Hospital (Linux)
- The Banshu Shinkin Bank (Windows)
- Vodafone K.K. (Currently Softbank Mobile) (Windows)
- Yamazaki Baking Co., Ltd. (Windows)
- Yamato Group (Linux)
- Inje University Paik Hospital (Windows)
- Sejoong Namo Tour (Korea) (Linux/Windows)
- Seoul National University (Korea) (Linux)
- Sung-Ae Hospital (Korea) (Windows)
- Severance Hospital (Korea) (Windows)
- Lotte World (Korea) (Windows)
- Jiangyin Software Park (China) (Linux)
- YTO (China) (Linux)
- Eastern Asia Commercial Bank (Vietnam) (Linux)
- Banco Popular (Spain) (Windows)
- Coput (Spain/ Bureau of transportation) (Linux)
- TMN (Portugal) (Linux)
- The Anthony Marano Company (USA) (Windows)
- Fulton County (USA) (Linux)
- Vivo (Brazil) (Linux)

ERP Platform
- Konica Minolta Holdings (Windows)
- Daiichi Sankyo (Windows)
- Toray Engineering Co., Ltd (Windows)
- Japan Vilene Co., Ltd (Windows)
- KDN (Germany) (Linux)

Virtualization Platform
- Toshima Ward Office (VMware)
- Ohita Prefectural Government (VMware)

Legacy Modernization
- NTT Data Corporation (Linux)
- Shiga Bank, Limited (Linux)
- Shizuoka Bank (Linux)
- TKC Corporation (Windows)
- Tokyo Stock Exchange (Linux)
- Nogata City (Fukuoka) City Hall (XSP)
- Ministry of Justice (Linux)

High Performance Computing
- FDK Corporation (Linux)
- Research Institute for Information Technology, Kyushu University (Linux)
- Research Center for Computational Science, Okazaki Research Facilities, National Institutes of Natural Sciences (Linux)
- Institute for Cosmic Ray Research, University of Tokyo (Linux)
- Toyota Central R&D Labs, Inc. (Linux)
- Japan National Institute of Occupational Health & Safety (Linux)
Tokyo Stock Exchange “Arrowhead”

One of the world’s most advanced Stock Trading System
Supporting the Tokyo Stock Exchange

- Live on January 4, 2010
- PRIMEQUEST and Linux

Highlights

- Migration from Fujitsu Mainframe
- Higher Performance
  - 2 ms for order response time, 3 ms for information distribution
  - More than 1,000 times as fast as the previous system
- High Reliability
  - Same level as mainframe systems
- Linear scalability, timely upgrade capability
  - Available double the capacity of the peak workload, upgrade in a week
PRIMEQUEST: Brazil VIVO

Customer and Call management system for the largest Mobile Operator in Southern Hemisphere
Supporting VIVO’s prepaid services

- In Production since October, 2006
- >56M Subscribers
- PRIMEQUEST and Linux

Approximately 56.8 million users

Highlights
- Migration from HP Integrity
- PRIMEQUEST HA & RAS Features
- 50x PRIMEQUEST 580 Servers since 2006
- 21x PRIMEQUEST 1800E server Upgrade in 2011
- High green performance is a driving factor of this upgrade
- 50% Reduction in Power Consumption
- 66% Reduction in server weights & space
- Fujitsu’s superior support capability
PRIMEQUEST: Morocco - Méditel

Customer and Call management system for the 2nd largest Mobile Operator in Morocco
Supporting Méditel’s Next Generation Intelligent Network (NGIN)

- In Production since Mid 2011
- >10M Subscribers
- PRIMEQUEST and Linux

Highlights

- High Reliability: PRIMEQUEST is a proven platform for NGIN systems
  - Stable operation at VIVO (Brazil) and TMN (Portugal) for years
- High Performance and High Expandability
  - Méditel selected PRIMEQUEST as Infrastructure to support mobile services for the growing telecom market in Morocco. i.e. 12% a year.
- 17 PRIMEQUEST servers
- 40 PRIMERGY servers
- 5 ETERNUS High End storage systems
## Other Recent Wins – Part 1

<table>
<thead>
<tr>
<th>Country</th>
<th>Segment</th>
<th>Qty</th>
<th>Overview of the system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Telecom</td>
<td>PQ1400S x42</td>
<td>DB server</td>
</tr>
<tr>
<td></td>
<td>Media</td>
<td>PQ1800E x4</td>
<td>Integrated web infrastructure</td>
</tr>
<tr>
<td></td>
<td>Service</td>
<td>PQ1400E x15</td>
<td>Bank’s IWF infrastructure system</td>
</tr>
<tr>
<td></td>
<td>Retail</td>
<td>PQ1800L x4</td>
<td>Core system</td>
</tr>
<tr>
<td></td>
<td>Finance</td>
<td>PQ1800E x3</td>
<td>on-line trading system</td>
</tr>
<tr>
<td></td>
<td>Public</td>
<td>PQ1400S x1</td>
<td>Integrated server infrastructure</td>
</tr>
<tr>
<td>Brazil</td>
<td>Finance</td>
<td>PQ1800E x5</td>
<td>Banking systems on SQL/ Windows</td>
</tr>
<tr>
<td>China</td>
<td>Public</td>
<td>PQ1800E x1</td>
<td>HIS application on RHEL Replacement of Stratus</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>IT</td>
<td>PQ1800E x1</td>
<td>Platform for cloud service: Virtual Private Server (VPS)</td>
</tr>
<tr>
<td>US</td>
<td>Retail</td>
<td>PQ1800E x1</td>
<td>Real-time inventory management system on Windows</td>
</tr>
<tr>
<td></td>
<td>IT</td>
<td>PQ1800E 1</td>
<td>Replacement of PQ500 series</td>
</tr>
<tr>
<td>Morocco</td>
<td>Telecom</td>
<td>PQ1800E x17</td>
<td>pre-paid call &amp; customer management system on RHEL</td>
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## Other Recent Wins – Part 2

<table>
<thead>
<tr>
<th>Country</th>
<th>Segment</th>
<th>Qty</th>
<th>Overview of the system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Government</td>
<td>PQ1400S x11</td>
<td>New registration information system</td>
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<tr>
<td></td>
<td>IT</td>
<td>PQ1400E x5</td>
<td>Japan post bank’s core system</td>
</tr>
<tr>
<td></td>
<td>Logistics</td>
<td>PQ1400S x4</td>
<td>Global accounting system</td>
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<tr>
<td></td>
<td>Local Government</td>
<td>PQ1400S x3</td>
<td>Accounting system</td>
</tr>
<tr>
<td></td>
<td>IT</td>
<td>PQ1400S2 x2</td>
<td>Credit control system</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td>PQ1400S x2</td>
<td>Core system (NGX)</td>
</tr>
<tr>
<td></td>
<td>Local Government</td>
<td>PQ1800E x1</td>
<td>Resident registry network system</td>
</tr>
<tr>
<td></td>
<td>Local Government</td>
<td>PQ1800E x1</td>
<td>Resident registry network system</td>
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<tr>
<td></td>
<td>Public</td>
<td>PQ1400S x2</td>
<td>Hospital Information System</td>
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<td>Brazil</td>
<td>Finance</td>
<td>PQ1800E x4</td>
<td>Internet banking on SQL/ Windows</td>
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<tr>
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<td>Telecom</td>
<td>PQ1800E x2</td>
<td>NGIN Care</td>
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<td>Singapore</td>
<td>Manufacturing</td>
<td>PQ1800E2 x1</td>
<td>Oracle database (migration from PW)</td>
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<tr>
<td>Indonesia</td>
<td>Government</td>
<td>PQ1800E x4</td>
<td>NDSI project</td>
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<tr>
<td></td>
<td>Government</td>
<td>PQ1800E x1</td>
<td>Statistics analysis</td>
</tr>
<tr>
<td>China</td>
<td>Telecom</td>
<td>PQ1800E x1</td>
<td>Stock data distribution system</td>
</tr>
</tbody>
</table>
PRIMEQUEST: Unified Server Strategy
The Mission Critical Alternative To Proprietary RISC/UNIX

- MAINFRAME
- UNIX/RISC
- IBM pSeries
- HP Superdome
  - Integrity
  - NonStop
- SPARC
  - Enterprise
- Standard Intel
- Mission Critical
  - Application
  - Porting to Windows/Linux & ERP Migration To Virtual Infrastructure Templates or Pre-Certified Configurations

- PRIMEQUEST 1800E2
- MC HighEnd
  - Windows/Linux
  - Virtual Infrastructure
- Volume Server
  - Windows/Linux
- Standard Intel
Value Proposition: Never Stop Your Business

Best Blended Reliability of Fujitsu Mission Critical Technology and Red Hat Linux

Maximum Uptime Hardware
- Most of the Components Redundant
- Multiple Levels Protection
- Quality Assurance Through Manufacturing

Dependable and Secure Linux
- Rock-solid Security
- 24 Hours and Emergency Care
- Swift Trouble Shooting Using Linux Source Codes

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Summary

Fujitsu Mission Critical Technology
Total Cost Of Ownership vs Legacy UNIX/RISC

- **HW <50%**
  - vs. RISC
  - Integrity/Superdome
  - M Class
  - Pseries

- **SW <50%**
  - 0.5 Oracle Core Multiplier
  - vs Itanium/POWER

- **Reliability 10x**
  - Mainframe Paradigm
  - 99.999% vs 99.99%
  - Vs Standard Intel

- **6x DC Efficiency**
  - Power, Cooling, Floorspace
  - vs Integrity/M9000

- **AMC <50%**
  - Based on Acquisition cost
  - vs RISC

- **Open 100%**
  - Industry Standard Oses
  - VMware, Hyper-V, OVM
  - RedHat, Windows Solaris, SuSE

- **>ROI**
  - Faster ROI - acquisition
  - Increased ROI - AMC
  - Longer ROI - Open
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