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HPC Case Study

Customers of Large-scale HPC Systems

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Customer	Type	No. of CPU	Peak Perf.
RIKEN (Kobe AICS)	**The K computer**	**88,128 CPUs**	**11.28 PFlops**
Australian National University (NCI) System operation will start in early 2013	**x86 Cluster (CX400)**	**3,592 CPUs**	**1.2 PFlops**
University of Tokyo	**FX10**	**4,800 CPUs**	**1.1 PFlops**
Kyushu University System operation will start in July 2012	**x86 Cluster (CX400),** **FX10**	**3,720 CPUs**	**510 TFlops** **182 TFlops**
HPC Wales, UK	x86 Cluster	> 2,000 CPUs	> 300 TFlops
Japan Atomic Energy Agency	x86 Cluster, FX1, SMP	> 4,568 CPUs	214 TFlops
Institute for Molecular Science	x86 Cluster (RX300), FX10	> 420 CPUs	> 140 TFlops
Japan Aerospace Exploration Agency	FX1, SMP	> 3,392 CPUs	> 135 TFlops
RIKEN (Wako Lab. RICC)	x86 Cluster (RX200)	> 2,048 CPUs	108 TFlops
NAGOYA University	x86 Cluster (HX600), FX1, SMP	1,504 CPUs	60 TFlops
A*STAR, Singapore	x86 Cluster (BX900)	900 CPUs	> 45 TFlops
A Manufacturer	x86 Cluster	> 2,600 CPUs	> 77 TFlops
B Manufacturer	x86 Cluster	> 2,000 CPUs	> 38 TFlops

Type definitions: FX10=PRIMEHPC FX10, x86 Cluster=Clusters based on PRIMERGY x86 server, SMP= SPARC Enterprise SMP server

The University of Tokyo

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- Key requirements
  - Increasing number of users and diverseness
  - Software compatibility with the K computer
  - 1.4MW of power ceiling
- System overview
  - PRIMEHPC FX10 (4,800 nodes (50 racks))
  - Peak performance: 1.13 petaflops
  - Linpack performance: 1.04 petaflops (91.8% efficiency)
  - Focusing areas: earth science, astrophysics, seismology, weather modeling, materials science, energy, biology, hydrodynamics, solid-state physics…

#18 on TOP500

The University of Tokyo – System Overview

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Compute nodes, Interactive nodes

PRIMEHPC FX10 x 50 racks
(4,800 compute nodes)

Peak Performance: 1.13 petaflops
Memory capacity: 150 TB
Interconnect: 6D mesh/torus - ”Tofu”

Management servers

Job management
Operation management
Authentication

PRIMERGY RX200S6 x 16

External connection router

Local file system

PRIMERGY RX300 S6 x 2 (MDS)
ETERNUS DX80 S2 x 150 (OST)

Storage capacity: 1.1PB (RAID-5)

Shared file system

PRIMERGY RX300 S6 x 8 (MDS)
PRIMERGY RX300 S6 x 40 (OSS)
ETERNUS DX80 S2 x 4 (MDT)
ETERNUS DX410 S2 x 80 (OST)

Storage capacity: 2.1PB (RAID-6)

InfiniBand network

External file system

Ethernet network

Campus LAN

End users

Log-in nodes

PRIMERGY RX300 S6 x 8

InfiniBand
Ethernet
FibreChannel

Kyushu University

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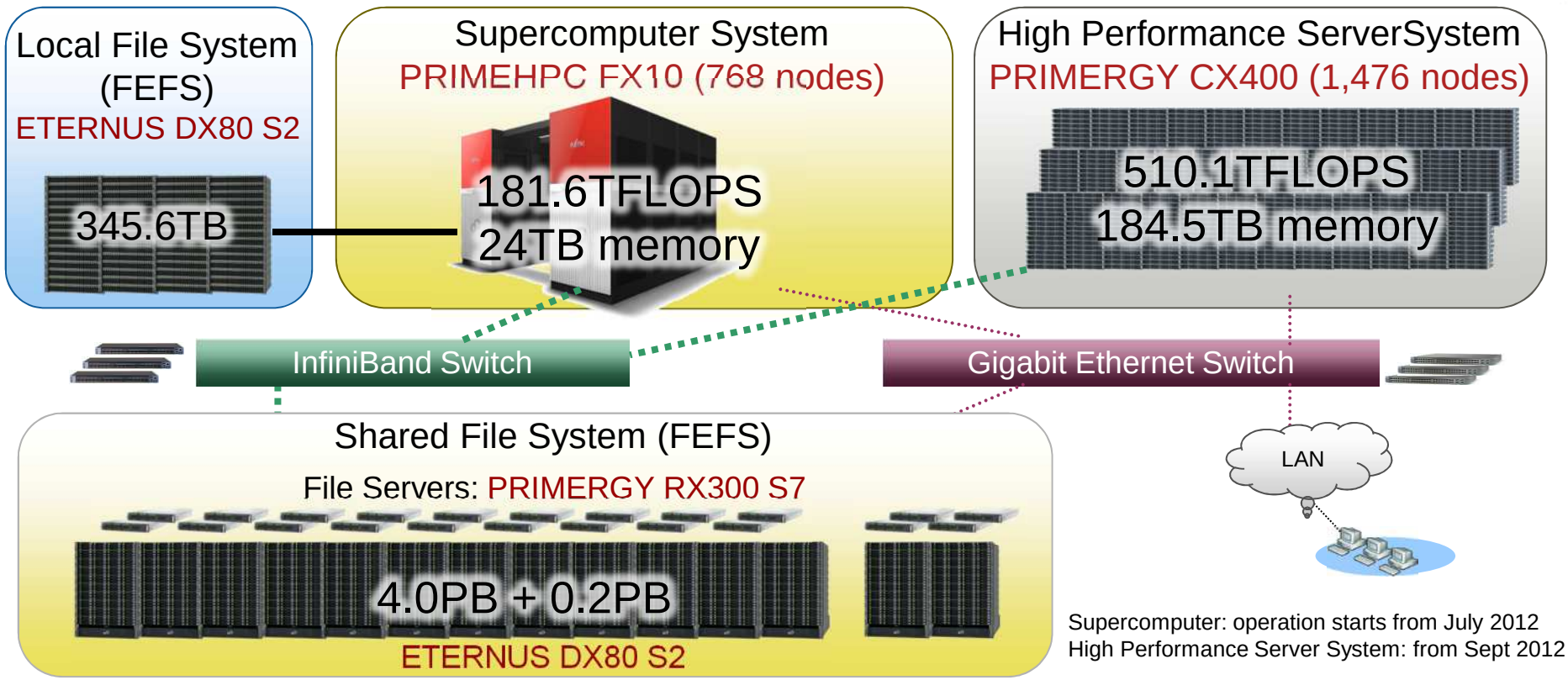
Total peak performance: 691.7 teraflops
Operations beginning: July 2012

- Features:
  - Hybrid system of Fujitsu SPARC64 and x86 cluster
  - Software compatibility with the K computer
- Supercomputer System
  - PRIMEHPC FX10 (768 nodes, SPARC64 IXfx)
  - Peak performance: 181.6 teraflops
- High-performance Server System
  - PRIMERGY CX400 (2,952 CPUs, New Intel Xeon E5)
  - Peak Performance: 510.1 teraflops

Kyushu University – System Overview



Supercomputer: operation starts from July 2012
High Performance Server System: from Sept 2012

NCI-NF
(Australia's national research computing service)

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- Key requirements
  - To improve the computational modeling capability in the research field below
    - Climate change
    - Ocean and marine
    - Earth system science
    - National water management research

  - Very high-energy efficiency, PUE is well under 1.20
- System overview
  - PRIMERGY CX400 (Including CX250S1) : 3,592 nodes (50 racks)

    Peak performance : 1.2 Petaflops
  - PRIMEHPC FX10 : 96 nodes (1 rack)

NCI-NF – System Overview

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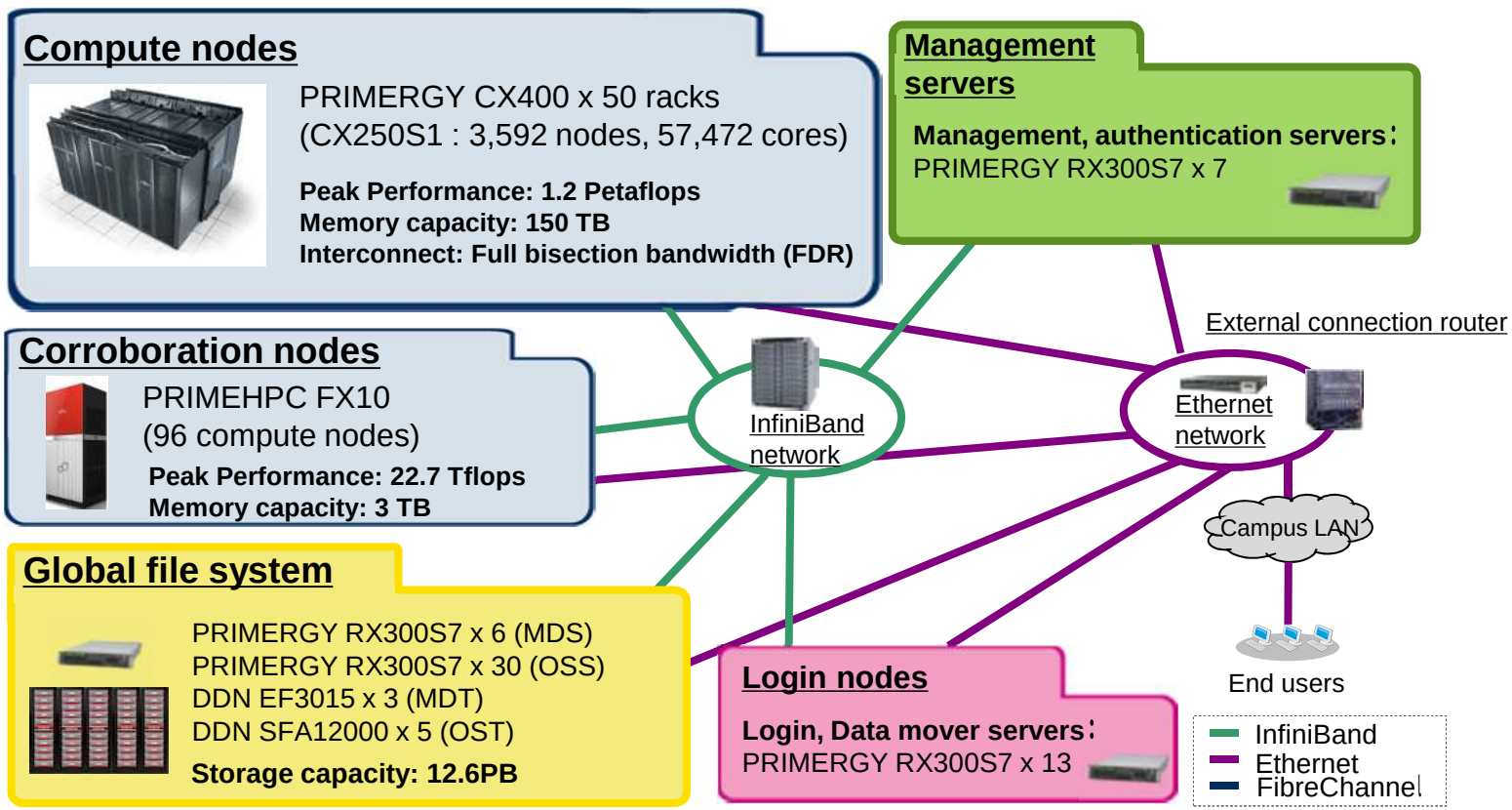

HPC Wales – A Grid of HPC Excellence

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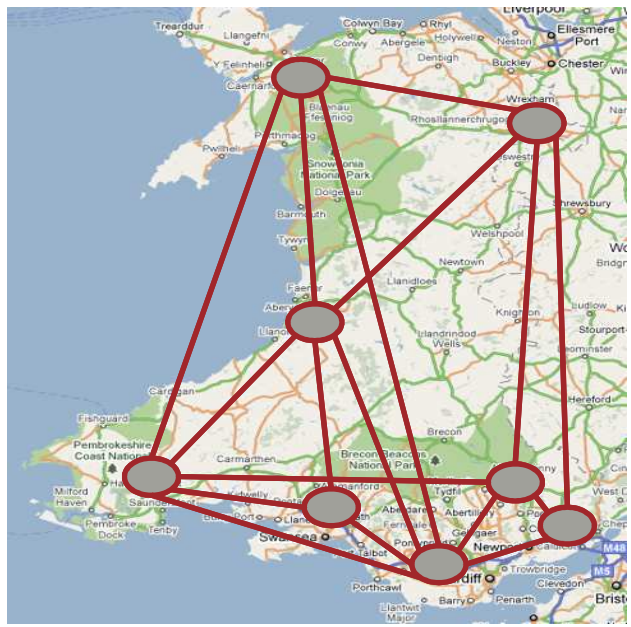
Motivation and background

- Position Wales at the forefront of supercomputing
  - Promotion of research, technology and skills
- Improvement of economic development
  - **Creation of 400+ quality jobs, 10+ new business**

Implementation and rollout

- Distributed HPC clusters among 15 academic sites
  - With central hubs, tier 1 and 2 sites
  - Portal for transparent, easy use of resources
  - Rollout completed by Q1 2012



HPC Wales – Solution

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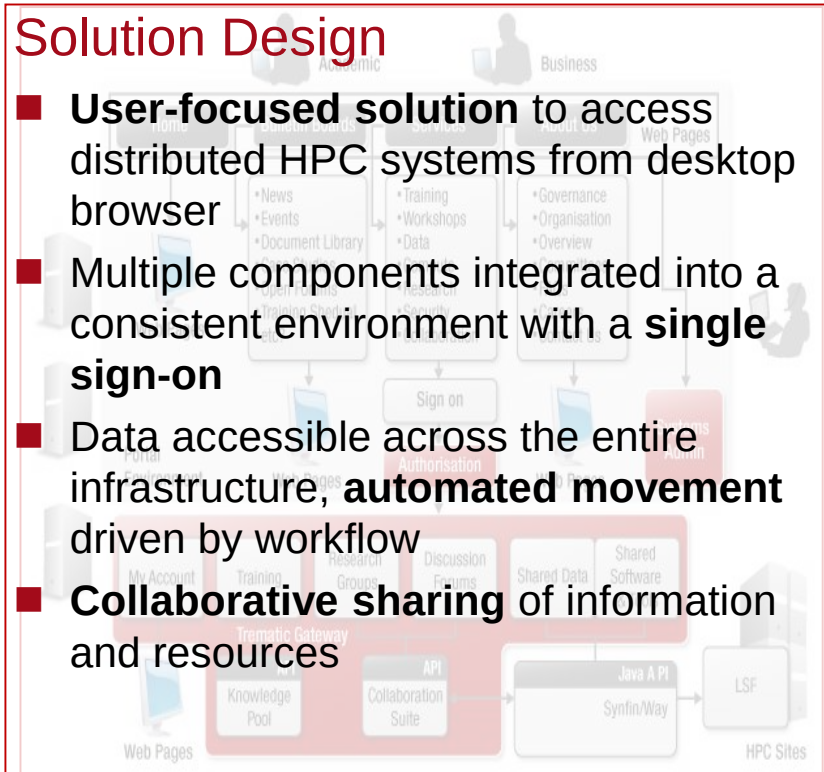
Performance & Technology

- >1400 nodes **PRIMERGY** BX922S2
- **Intel Xeon**, X5650 and X5680
  - Roadmap for upgrade
- **190 TFlops** aggregated peak performance
- **Infiniband**, 10 / 1 Gb Ethernet, FCS
- **Eternus** DX online SAN (home FS)
- **Parallel File System** (up to 10 GB/s)
  - DDN Lustre
- Backup & Archiving
  - Symantec, Quantum

Solution Design

- **User-focused solution** to access distributed HPC systems from desktop browser
- Multiple components integrated into a consistent environment with a **single sign-on**
- Data accessible across the entire infrastructure, **automated movement** driven by workflow
- **Collaborative sharing** of information and resources



A*STAR

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A*STAR

- Singapore's lead government agency
- Fostering world-class scientific research
  - Biomedical Sciences
  - Physical Sciences & Engineering
- Spurs growth in key economic clusters

Fujitsu and A*STAR (IHPC)

- R&D partnership to jointly develop
  - Applications
  - Technologies

for the use of next-gen. supercomputer in

- Computational Fluid Dynamics
- Material Sciences

PRIMERGY BX920 S2 at A*STAR

- 450 server blades (3888 cores)
- 45 Teraflops peak performance
- 91% of Linpack efficiency

Fujitsu HPC from workplace to #1 in TOP500

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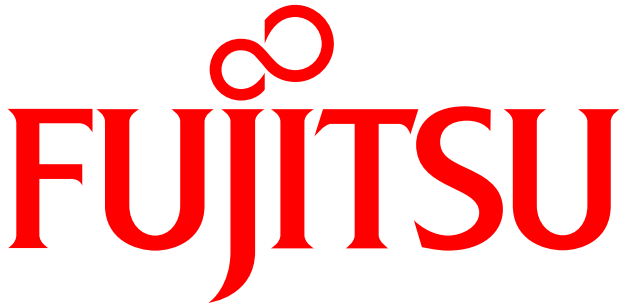
Celsius workstations

PRIMERGY x86 Clusters

PRIMEHPC FX10 Supercomputers



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