

Leadership Computing at ORNL

**LEADERSHIP
COMPUTING FACILITY**
NATIONAL CENTER FOR COMPUTATIONAL SCIENCES



presented by

Fall Creek Falls Conference
October 24, 2006

presented by

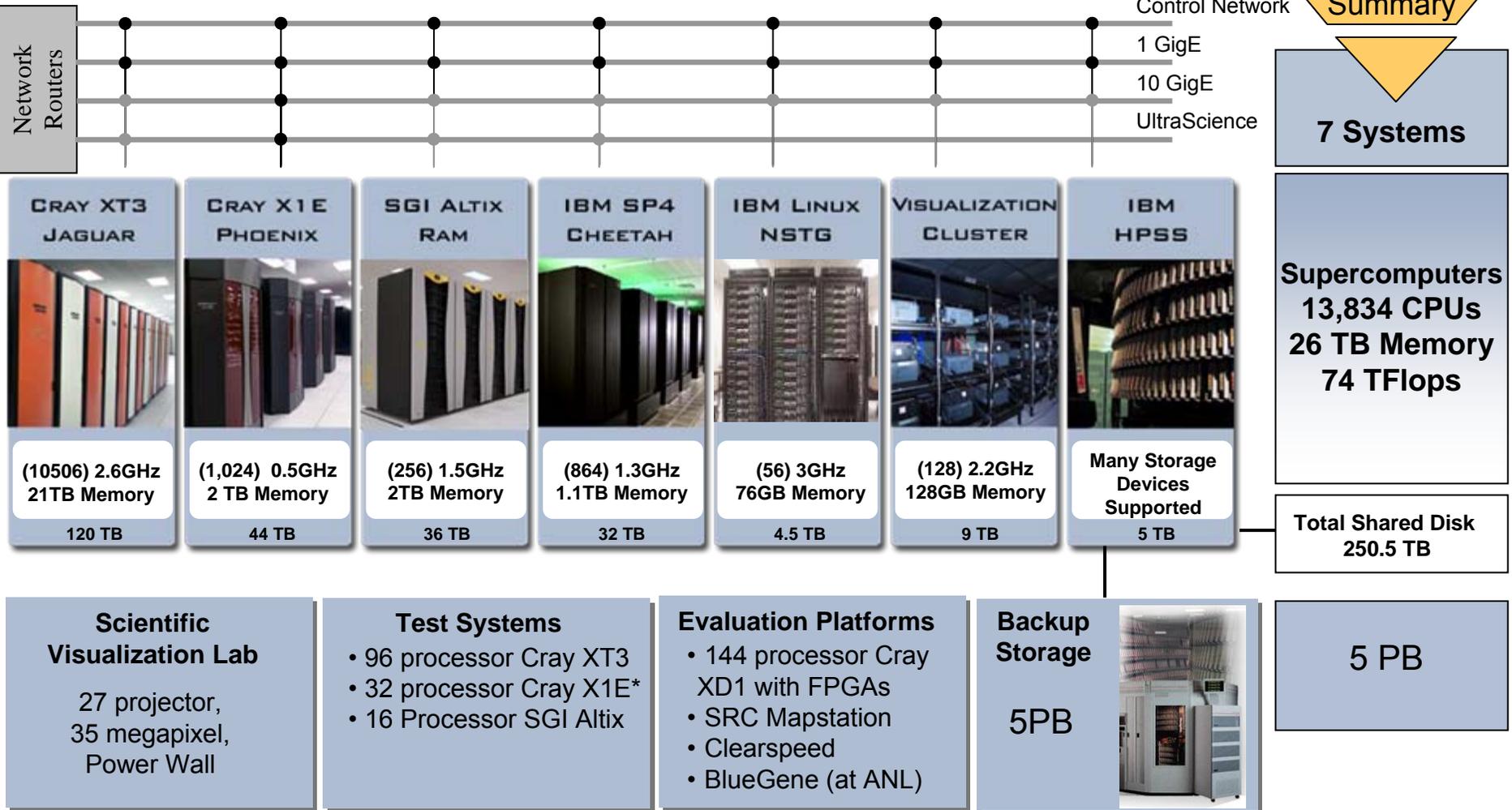
Buddy Bland
LCF Project Director

Outline

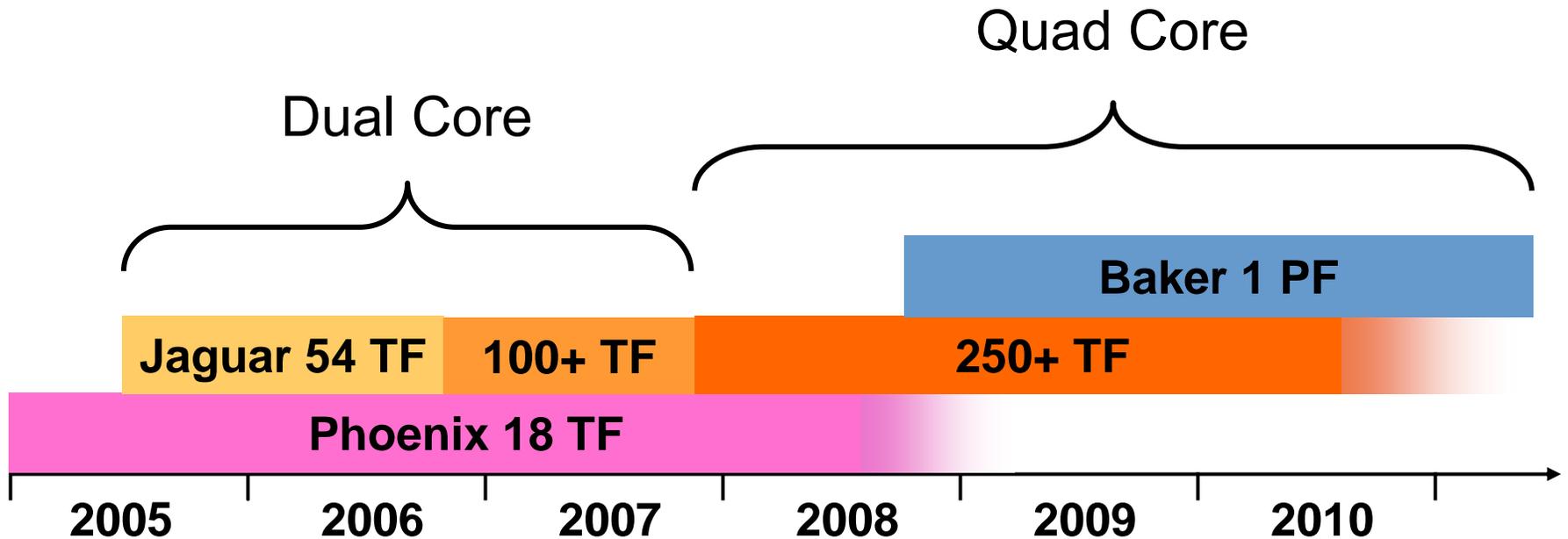
- System Roadmap
- Facility Plans
- Infrastructure Plans
- Software Plans

NCCS Resources

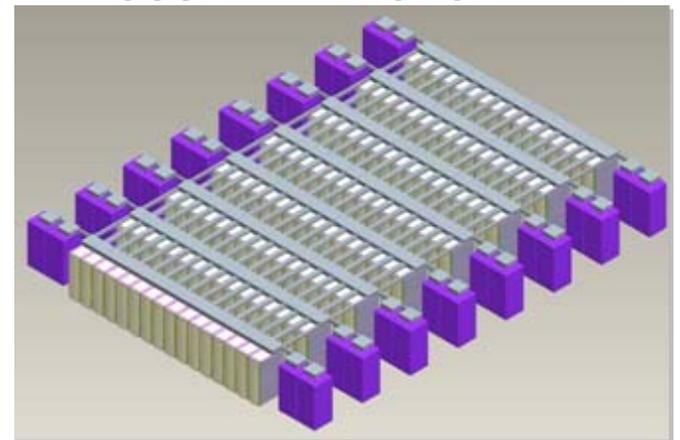
October 2006
Summary



LCF Systems Roadmap



Jaguar (Cray XT3) 54 TF



Cray "Baker" 1 PF

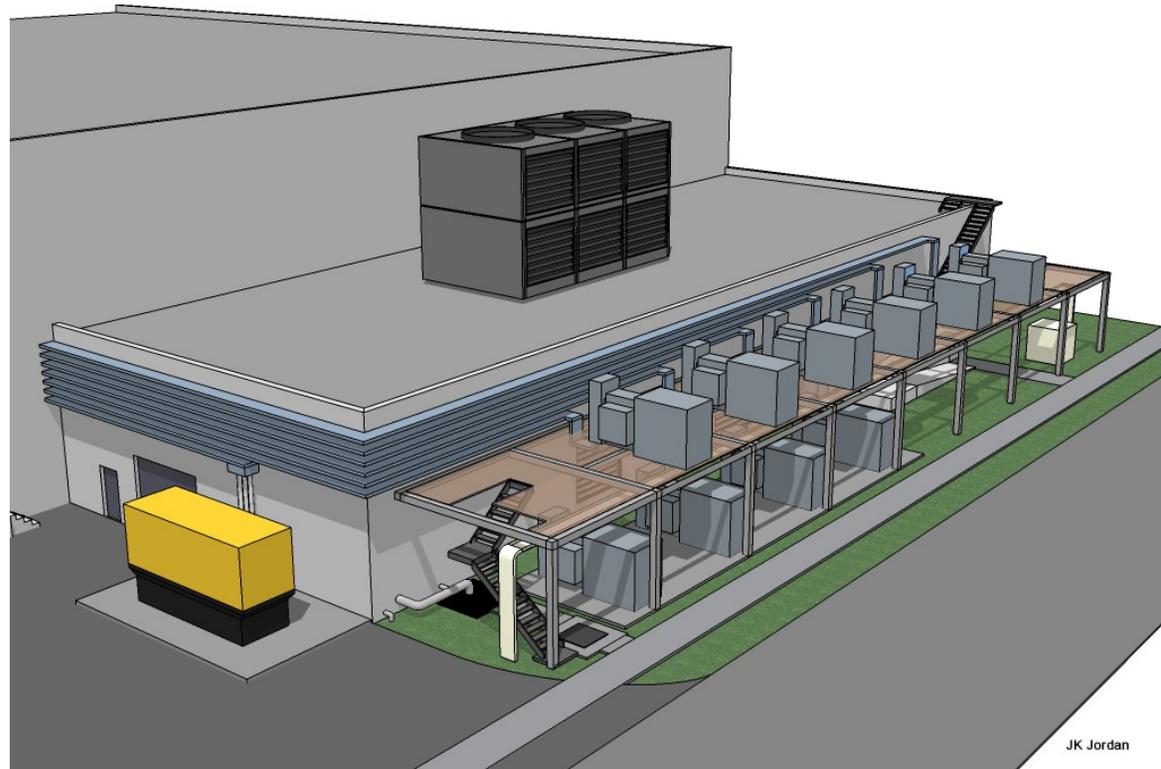
Facility Upgrades

- 3.3 MW Power upgrade completed in May 2006. Provides power through the 250 TF system upgrade.
- Site preparation for 100 TF upgrade is nearing completion in 2nd floor
 - Increase raised floor height to 36", install **25 air-handlers** and replace 4" pipe with 12" pipe
 - Install **11 power distribution units**



Utility Upgrades to Facility for 1 PF System

- Upgrade building power from 7.3 to 25+ MW
- Tie building cooling into ORNL cooling plant via 36 inch pipes
- Upgrade UPS and generator capability



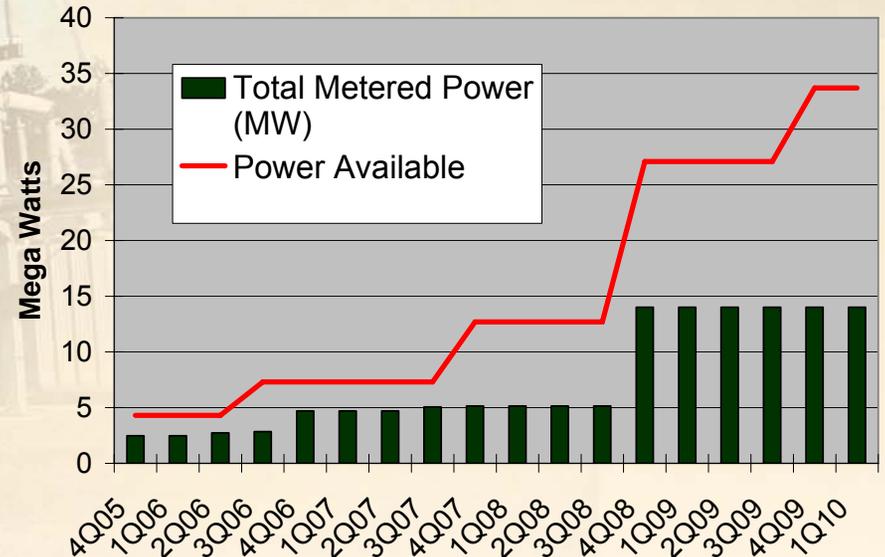
Partner with TVA to deliver reliable, cost effective, power

- ORNL substation under construction – 70+ MW
- Upgraded transmission capability – Three redundant feed circuits
- Two new chiller plants in East Campus
- Planned expansion of central chiller plant
- Interconnected for redundancy

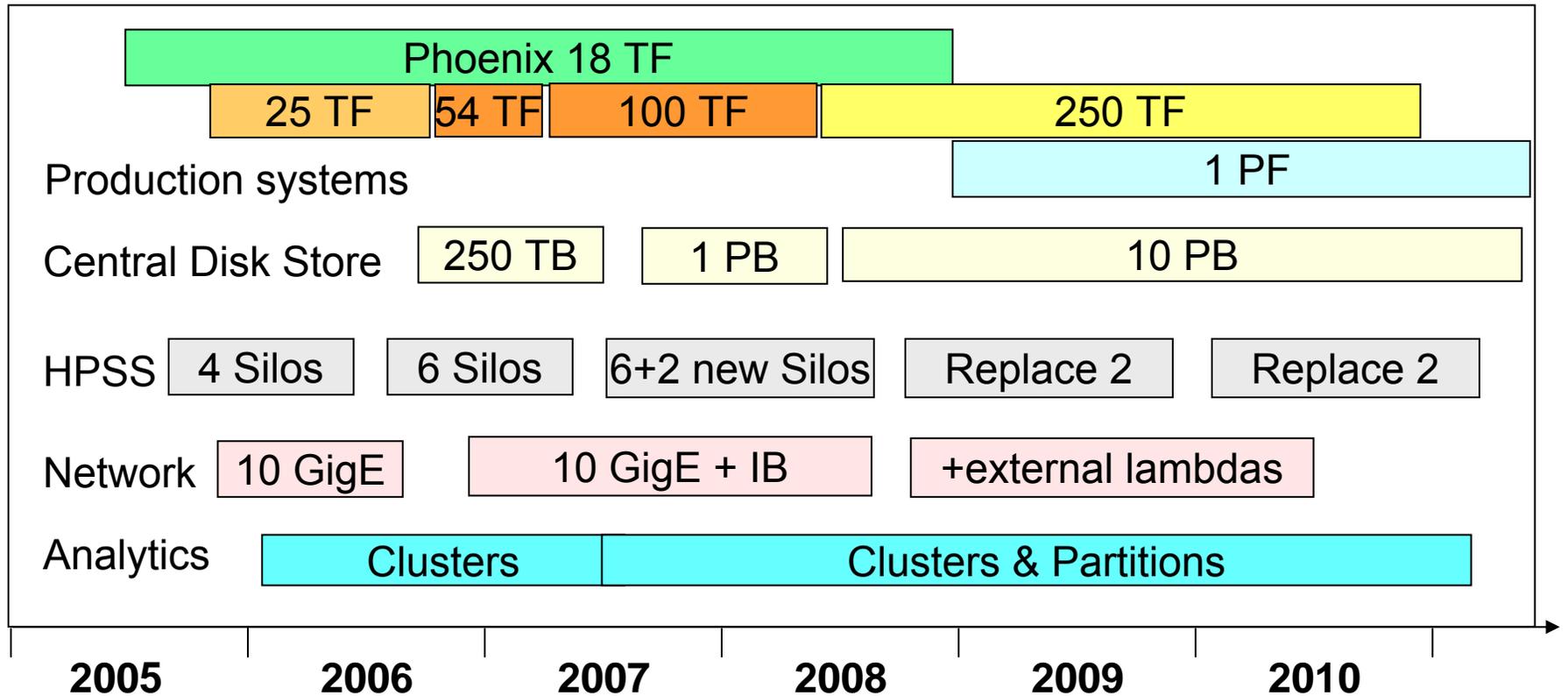


Retail price of electricity by state

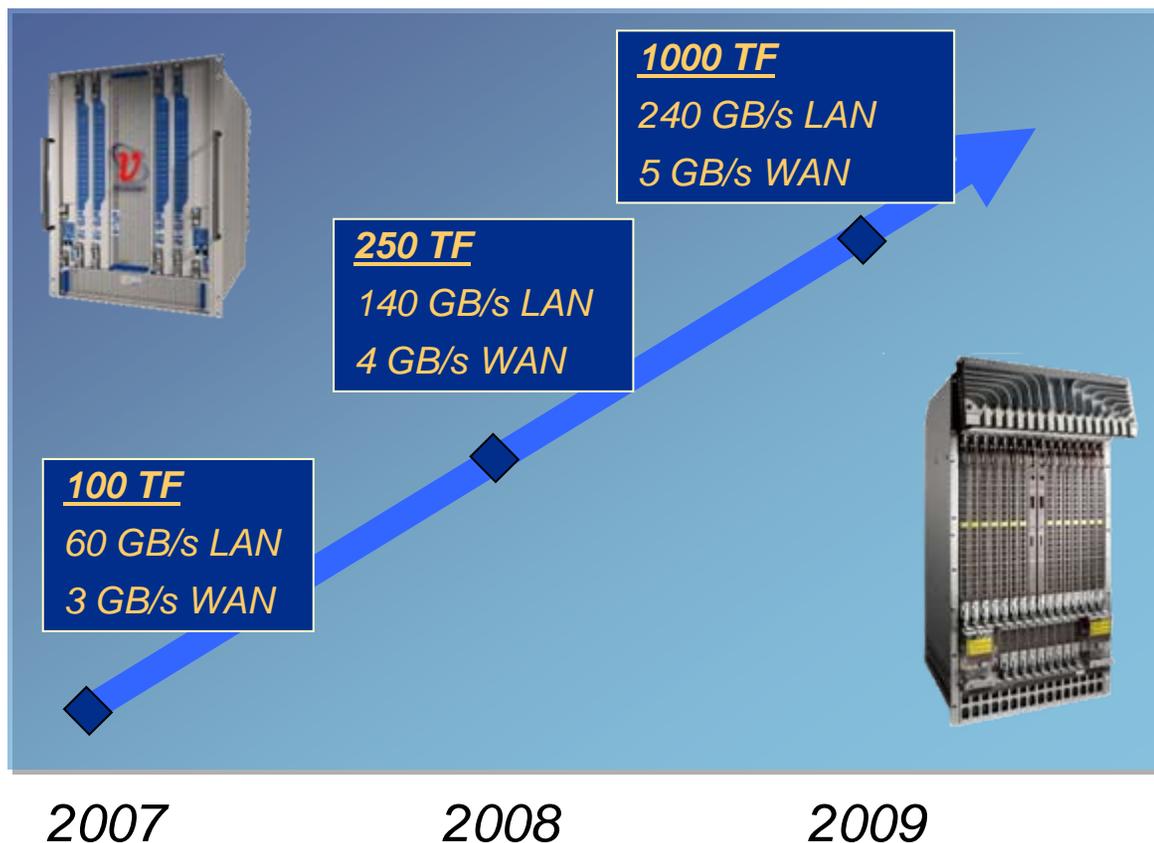
Source: Energy Information Administration Form EIA-861



Operational Infrastructure Roadmap

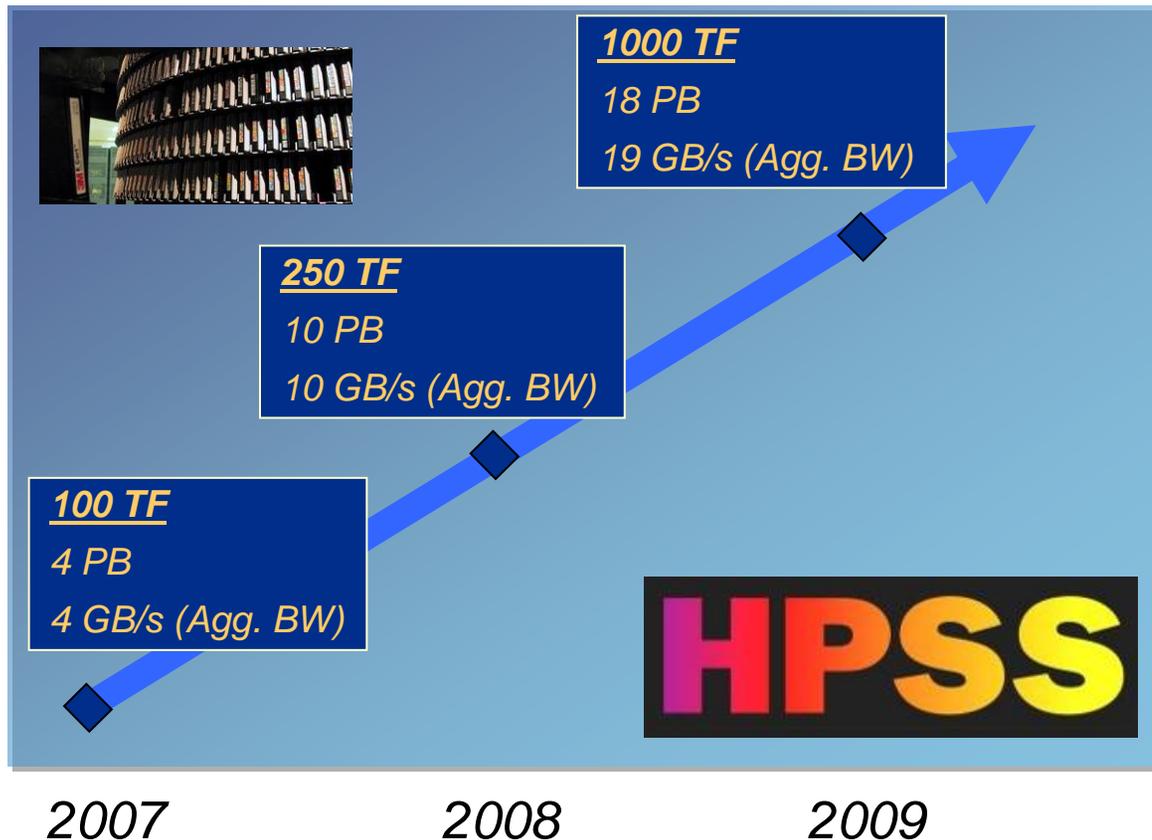


Networks



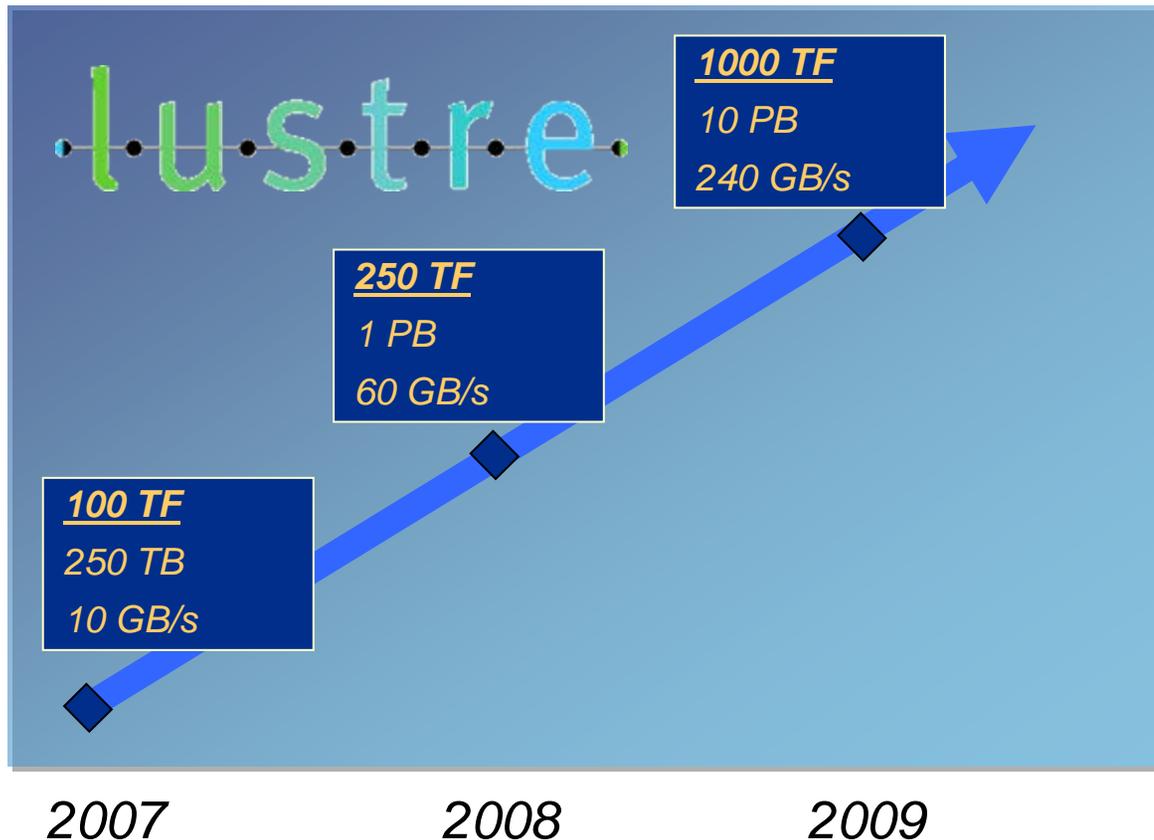
- Shifting to a hybrid InfiniBand/Ethernet network
- InfiniBand based network helps meet the bandwidth and scaling needs for the center
- Wide-Area network will scale to meet user demand using currently deployed routers and switches

Archival Storage



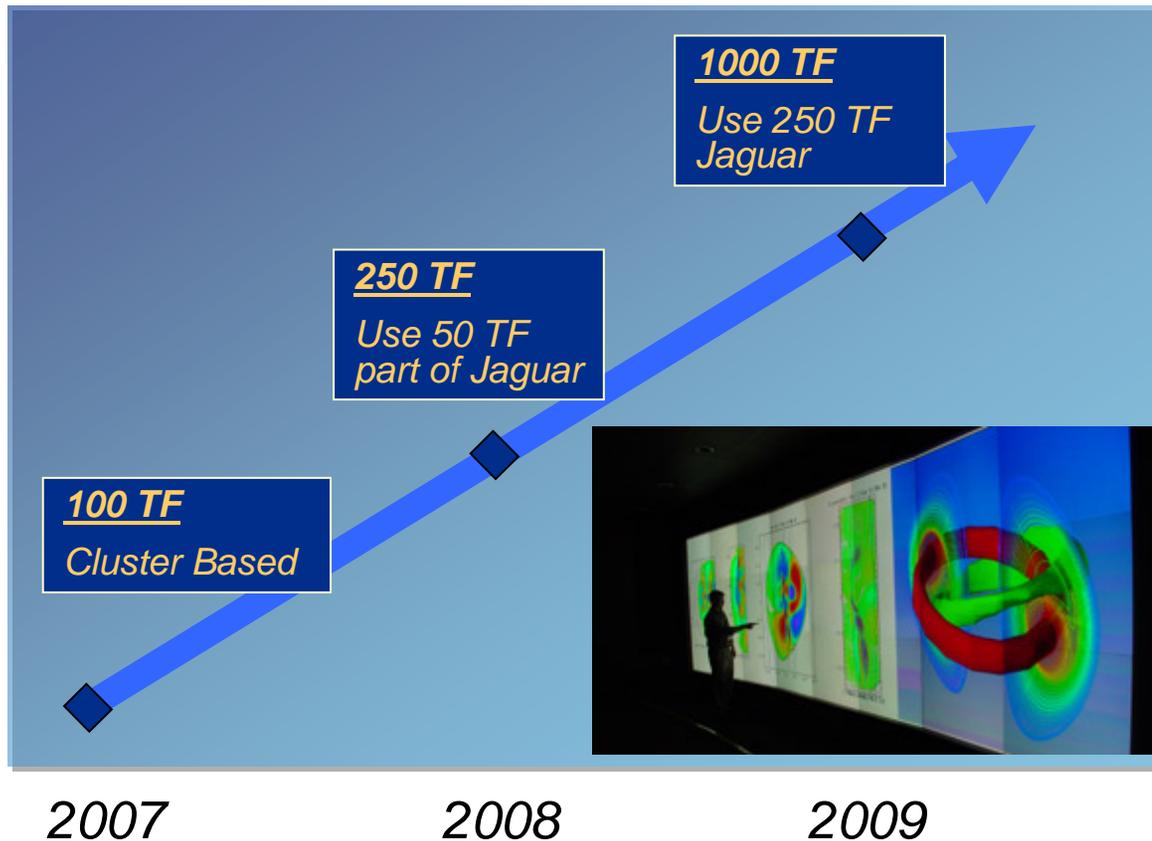
- HPSS Software has already demonstrated ability to scale to many PB
- Add 2 Silos/Year
- Tape Capacity & Bandwidth, Disk Capacity & Bandwidth are all scaled to maintain a balanced system
- Utilize new methods to improve data transfer speeds between parallel file systems and archival system

Center-Wide File System (Spider)



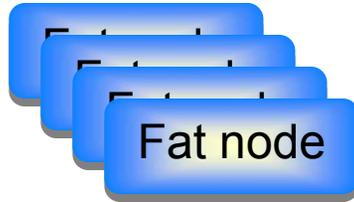
- Increase scientific productivity by providing single repository for simulation data
- Connect to all major LCF Resources
- Connected to both InfiniBand and Ethernet networks
- Potentially becomes *the* file system for the 1000 TF System

Data Analysis and Visualization



- Today we use a dedicated cluster for data analysis and visualization
- Our goal is to port the analysis and visualization tools to run directly on the large systems to avoid having to move data

Visualization Hardware Roadmap



“Fat nodes” support legacy visualization and analysis (IDL, AVS, etc.)



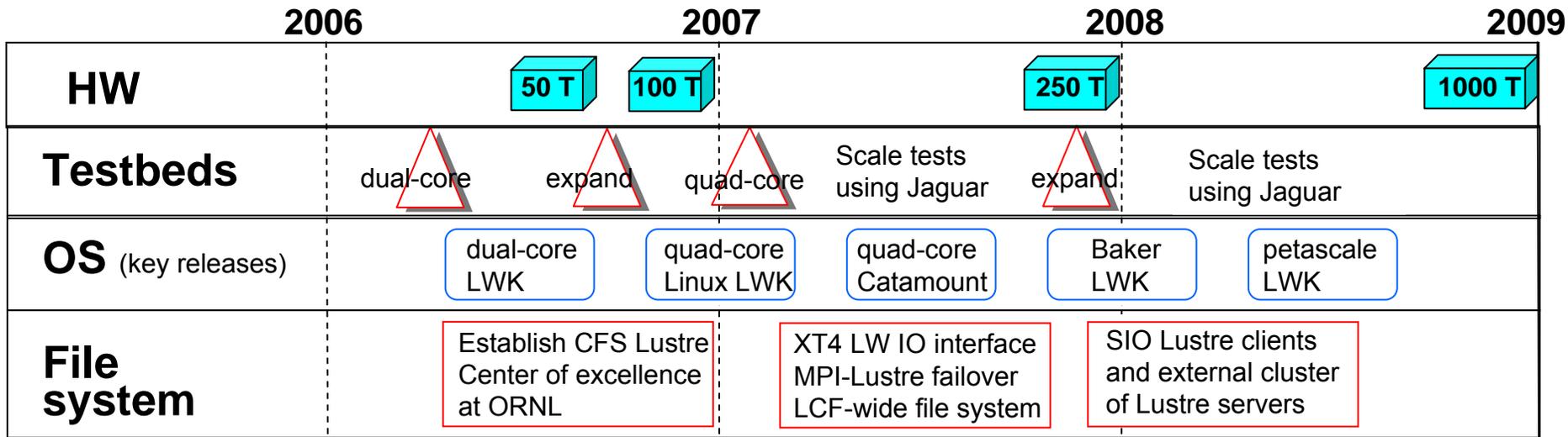
Distributed clusters support the largest analysis requirements (VisIt, EnSight, Paraview, etc.)

Tera/Petascale
compute system



Moving toward a model of using a portion of the large computational resource for analysis

Software Roadmap



Lustre Centre of Excellence at ORNL

Three tasks in the CFS statement of work:

1. Develop a risk mitigation Lustre package for ORNL

- Lowest risk, scalable implementation
- Uses a Lustre file server cluster outside the Cray (Spider)
- Call forwarding thru I/O nodes

2. Train ORNL staff in Lustre Source

- Develop the local expertise
- Make ORNL less dependent on CFS and Cray staff
- Mitigates risk of CFS goes away

3. Assist Science teams in tuning their application I/O

- Focus on 2-3 key apps initially. Document results.
- On site Lustre workshops

Build a larger consortium around the Lustre Center of Excellence

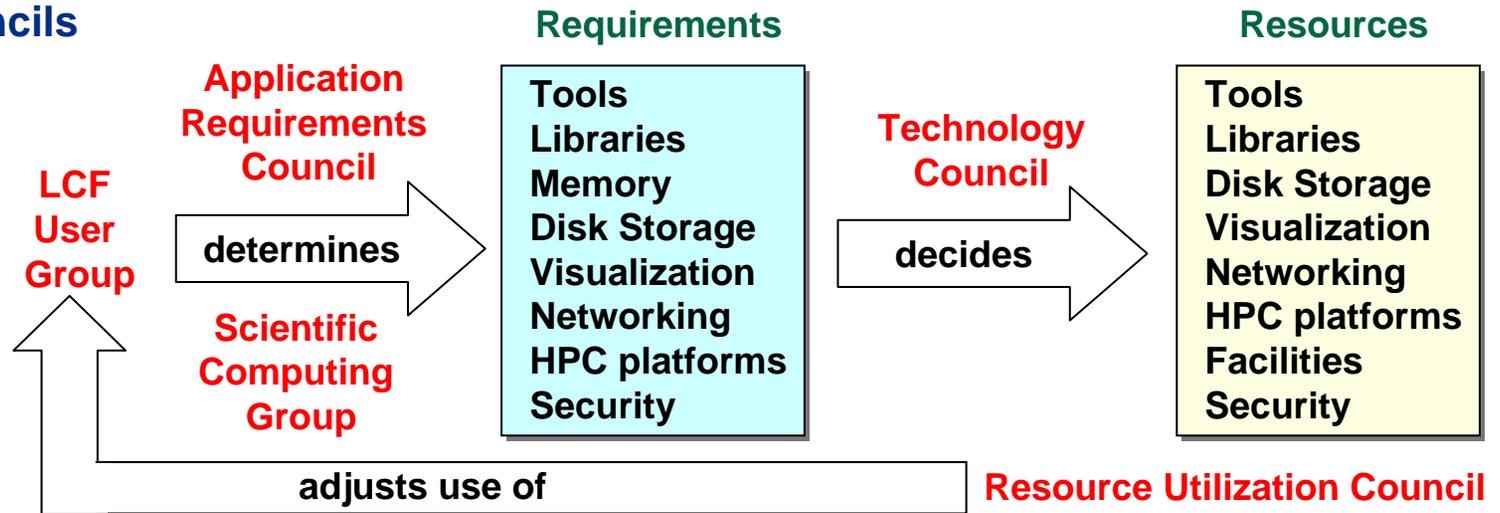
- LLNL, SNL, LANL, MIT-LL, and others
- Vendors: Sun, HP, Intel, Cray

Steps for Ensuring Application Readiness

- Early identification of codes for acceptance test and early access
- Liaisons to apps teams
 - **Scientific Computing Group**
- Cray Center of Excellence
 - **Working to scale libraries and codes**
- Lustre center of excellence
 - **Help tune App parallel I/O**
- Identification of App requirements
 - **Councils**

Candidate Codes

Acceptance	Science Day-1
CCSM	LSMS
LSMS	QMC/DCA
VH1	VH1/RADHYD
GTC	POP/CICE
NWChem	S3D
	GTC



Questions?



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