Intelligent Networks Panel

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August 5, 2014

Technology Trends

- Memory/Storage (David's talk)
  - Integration of storage class memory on the memory bus
- Network
  - Integration of NIC with the memory bus
    - Blue Gene/Q
  - Complex Topologies
    - Dragonfly, Torus and hierarchical
    - Diverse application flows and support for Quality of Service

Expect more faults at various layers of the system

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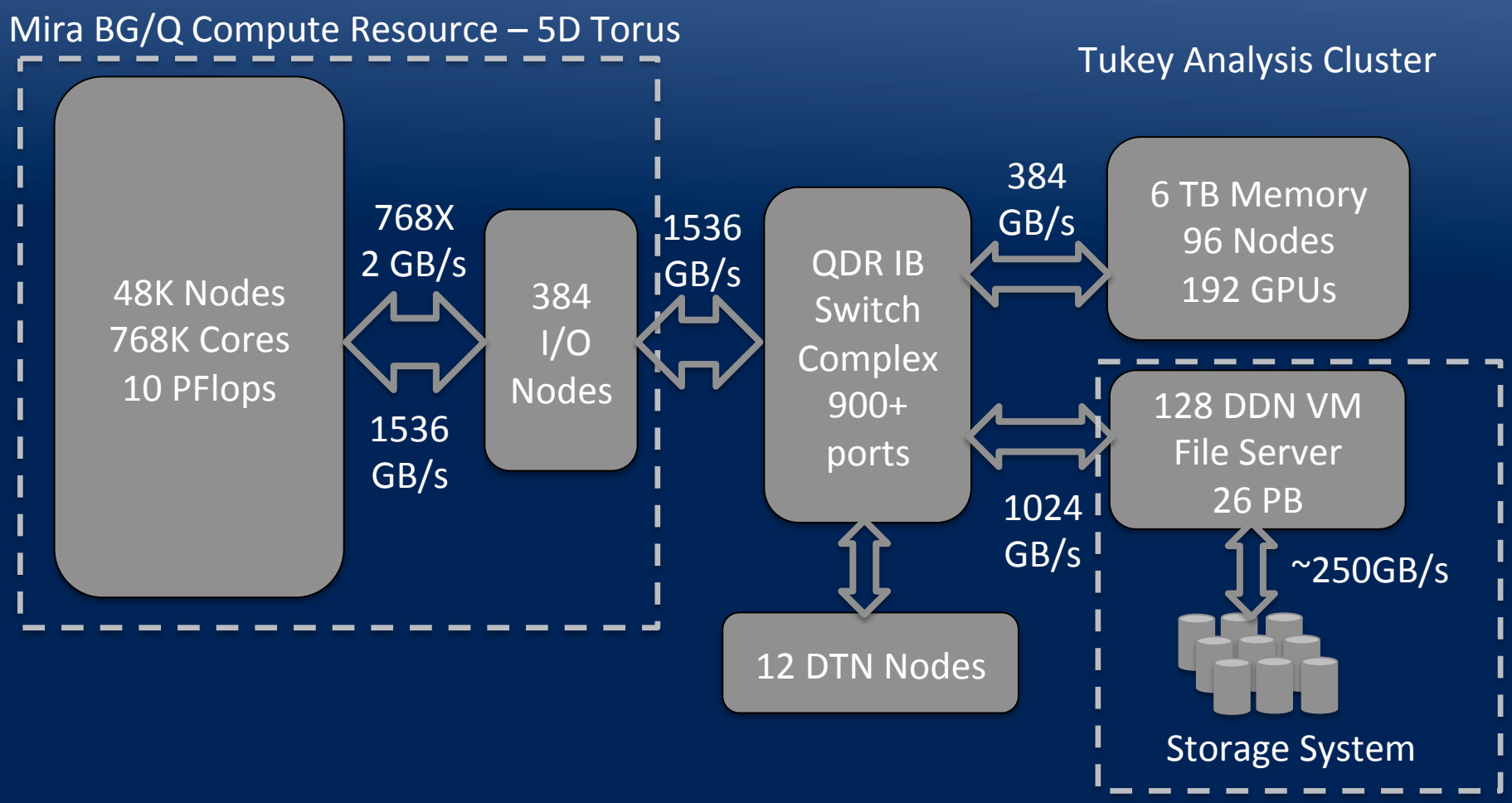
Argonne Leadership Computing Facility I/O Infrastructure



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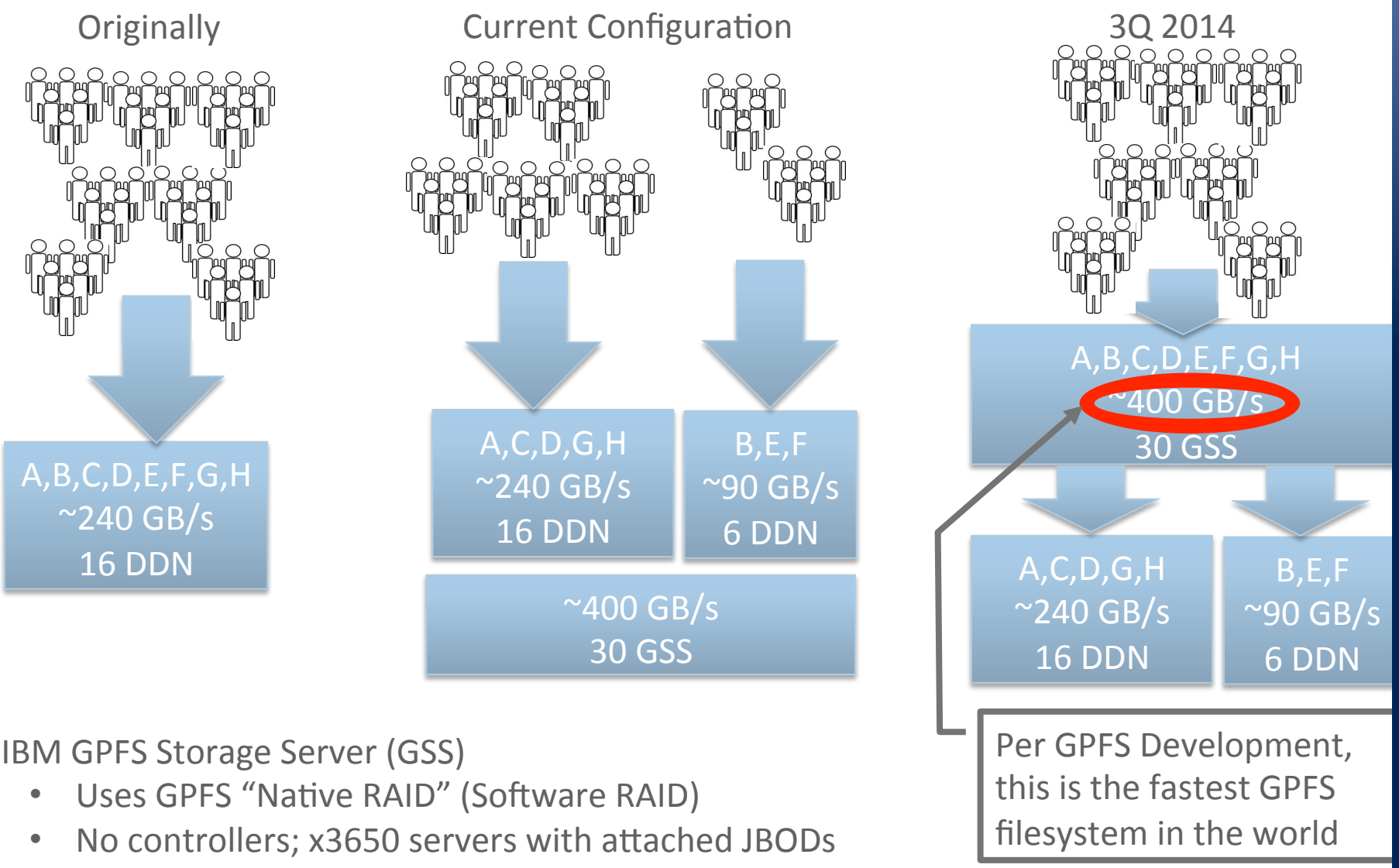
Our storage upgrade path



- IBM GPFS Storage Server (GSS)
  - Uses GPFS "Native RAID" (Software RAID)
  - No controllers; x3650 servers with attached JBODs

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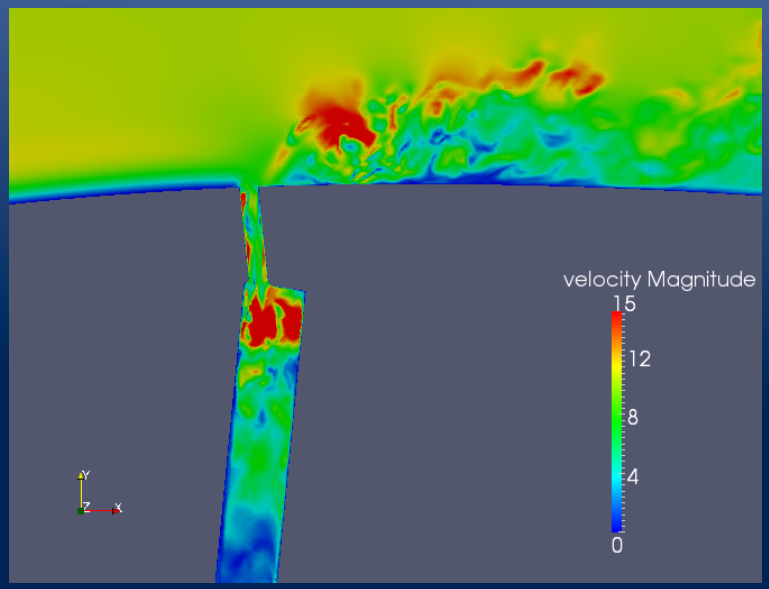
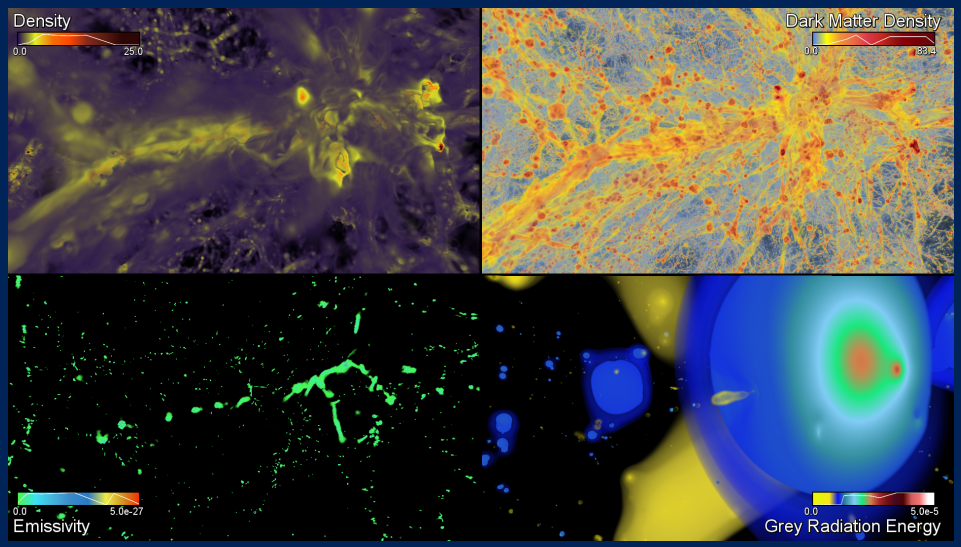
Slide courtesy Bill Allcock



Simulation-time Visualization of PHASTA CFD simulation for Aircraft design/

Isosurface of vertical velocity colored by velocity and cut plane through the synthetic jet (both on 3.3 Billion element mesh). *Image Courtesy: Ken Jansen*

Interactive Remote Visualization of Materials Science Simulation Data (Image Coutsey: Priya Vashista)



Remote Comparative Data Analysis of Enzo Simulations (Image Courtesy: Mike Norman)

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Application Trends

Application	Type of Flow	# of Flows	QoS				Transfer Type	Dataset Characteristics
			Deadline	Latency Sensitive	Burstiness	On-Demand		
Light Sources	Analysis	1 per beam.	Yes	No	Yes	No	M-D	Large/small files
	User transfer	1 per exp.	No	No	Yes	No	D-D	Large/small files
ENZO	Simulation	1 per site	Yes	No	Yes	No	D-D	Large files
	Remote Viz	1 per display	No	Yes	No	No	D-M/M-M	Large data
BioEnergy Centers	Analysis	Many per exp.	No	Yes	Yes	No	D-M/M-M	Large data
	Mirroring	Many per exp.	Yes	No	Yes	No	D-D	Large files
	Backup	1 per exp.	No	No	No	No	D-D	Large files
Climate	Replication	1 per simul.	Yes	No	Yes	No	D-D	Large/small files
	Prediction	1 per source	No	Yes	No	No	D-M	Large data
	Disaster	1 per source	Yes	Yes	Yes	Yes	D-M/M-M	Large data
Cosmology	Archival	1 per obser.	No	No	No	No	D-D	Large/small files
	Co-relation	1 per sim.	Yes	Yes	No	No	D-D/M-D	Large files
	Cataloging	1 per sim.	No	Yes	No	No	D-D	Small files

Application are increasingly being characterized by parallel data movement, sparse vs dense patterns, dynamic workflows and real-time interaction

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Top Focus Areas

- Simple interfaces for applications to describe their requirements to the underlying infrastructure
  - The requirements of applications change over time
- Reconfiguration of Infrastructure to meet the needs of the application
  - Commoditization of optics including WDM will be extremely useful to consider (even at a NIC)
- Data movement mechanisms that can deal with the complexity and capabilities of the various layers
  - Layout issues of memory, topology and routing, compute
- Infrastructure and related algorithms for reproducible performance for applications

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