

HEC FSIO Session 4: Next Generation I/O Architectures & Communication and Protocols Gaps Roadmap

**Steve Poole and Lee Ward
August 2008**

2007 Next Generation I/O Architectures Gap Area

Area	Researcher	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12	Rankings
Understanding file system abstractions - File system architectures	Choudhary	█	█	█				 Good work, but much of research is in infancy. A small portion ready for commercialization.
	Dickens	█	█	█				
	Maccabe/Schwan	█	█	█				
	Reddy	█	█	█				
	Shen	█	█	█				
	Thain	█	█	█				
	Wyckoff	█	█	█				
	SciDAC – PDSI	█	█	█				
PNNL	█	█	█	█				
Understanding file system abstractions - naming and organization	Bender/Farach-Colton	█	█	█				 Very hard problem. More researchers need to attack this problem.
	Thain	█	█	█				
	Tosun	█	█	█				
	Zhang/ Jiang	█	█	█				
	SciDAC – SDM	█	█	█				
	SciDAC - PDSI	█	█	█				
Self-assembling, Self-reconfiguration, Self-healing storage components	Ganger	█	█	█				 Good work being done, but it's a hard problem that will take more time to solve.
	Ligon	█	█	█				
	Ma/Sivasubramaniam/ Zhou	█	█	█				
	SciDAC - PDSI	█	█	█				
	SciDAC - SDM	█	█	█				
Architectures using 10 ⁶ storage components	Ligon	█	█	█				 Very little work being done here for a very near term problem. Simulators will/must play a role here
	PNNL	█	█	█	█			
Hybrid architectures leveraging emerging storage technologies	Gao	█	█	█				 Big potential reward, but very little work being done in the HPC area.
	PNNL	█	█	█	█			
HEC systems with multi-million way parallelism doing small I/O operations	Choudhary	█	█	█				 Good initial research; needs to be moved into testing. More fundamental solutions being pondered including non-volatile solid state store.
	Dickens	█	█	█				
	Gao	█	█	█				
	FASTOS – I/O Forwarding	█	█	█				

 Very Important	 Greatly Needs Research	 Greatly Needs Commercialization
 Medium Importance	 Needs Research	 Needs Commercialization
 Low Importance	 Does Not Need Research	 Does Not Need Commercialization
 Full Calendar Year Funding	 Partial Calendar Year Funding	 On-Going Work

2007 Communication and Protocols Gap Area

Area	Researchers	FY 07	FY 08	FY 09	FY 10	FY 11	FY 12	Rankings
Active Networks	Chandy							   Novel work being done, but not general enough.
Alternative I/O transport schemes	Sun							   Most aspects are being addressed.
	Wyckoff							
	Lustre							
	pNFS							
Coherent Schemes	ANL/CMU							   No consensus on how to do this correctly, but some solutions are in products.
	UCSC's Ceph							
	Lustre							
	Panasas							
	PVFS							

- | | | |
|---|---|--|
| <p> Very Important</p> <p> Medium Importance</p> <p> Low Importance</p> <p> Full Calendar Year Funding</p> | <p> Greatly Needs Research</p> <p> Needs Research</p> <p> Does Not Need Research</p> <p> Partial Calendar Year Funding</p> | <p> Greatly Needs Commercialization</p> <p> Needs Commercialization</p> <p> Does Not Need Commercialization</p> <p> On-Going Work</p> |
|---|---|--|

Next Generation I/O Architectures

Gaps

- Understanding file system abstractions – file system architectures
- Understanding file system abstractions – naming and organization
- Self-assembling, Self-reconfiguration, Self-healing storage components
- Architectures using 10^6 storage components
- Hybrid architectures leveraging emerging storage technologies
- HEC systems with multimillion way parallelism doing small I/O operations

Communication and Protocols Gaps

- Active Networks
- Alternate I/O transport schemes
- Coherent schemes

Speakers & Areas of Research

- Improving Scalability in Parallel File Systems for HEC
 - Walt Ligon, Clemson
 - Architectures using 10^6 storage components
- The Server-Push I/O Architecture for HEC
 - Xian-He Sun , Illinois Tech
 - Alternative I/O transport schemes (Communications & Protocols)
- Active Storage Networks for HEC
 - John Chandy , U. Conn.
 - Active Networks (Communications & Protocols)
- Active Data Systems
 - A.L. Narasimha Reddy , TAMU
 - Understanding file system abstractions - File system architectures