



## Computing Technology

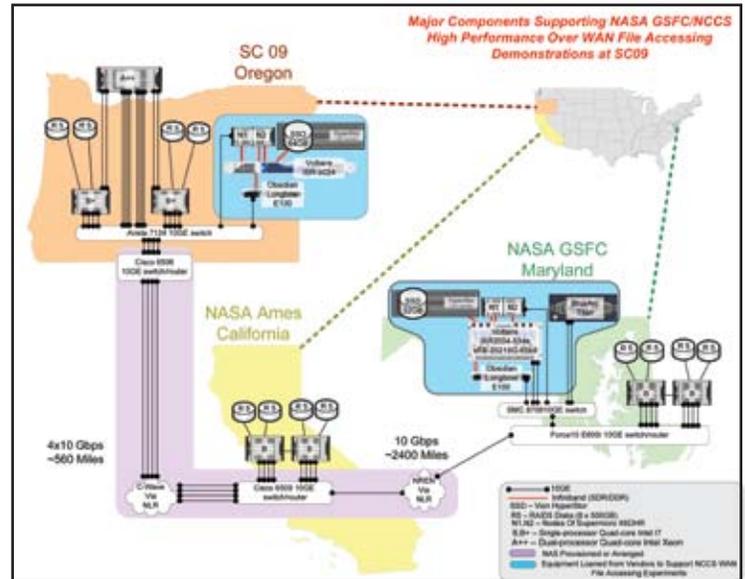
# Optimizing Wide-Area File Transfers for 10 Gbps and Beyond

NASA’s High-End Computing (HEC) Program delivers computing, storage, and networking services to the Agency’s aeronautics, exploration, science, and space operations missions. Scientists have access to systems at both the NASA Advanced Supercomputing (NAS) facility at Ames Research Center and the NASA Center for Computational Sciences (NCCS) at Goddard Space Flight Center. Models run on these systems ingest large amounts of data and generate even more data—some exceeding 120 terabytes per month in wide area network (WAN) transfers. As the systems are geographically distributed, it has become vital to provide very fast, high-end network services to store, share, and analyze all of this data.

A testbed of advanced hardware and software technologies has been installed at both NAS and NCCS to address efficient data movement and management across the WAN (bottom figure). This testbed involves 10- through 100-gigabit-per-second technologies and addresses distance issues through a suite of tests ranging from experimental wire-speed tests, traditional and emerging file transfer applications, and file systems (top figure).

The testbed uses the Research and Development (R&D) network between the two centers. The use of NASA R&D networks enables representative real-world testing of potential hardware and software solutions of data access and data movement throughout the WAN.

Using global satellite and remote sensory data, along with NASA’s HEC capabilities, scientists are developing models to make highly accurate global predictions about Earth’s climate. As both model fidelity and the number of remote sensory datasets increases, the amount of data scientists must handle has grown dramatically. The testbed work on high-performance, easy-to-use hardware and software technologies for optimizing data transfer, access, and sharing will allow scientists to focus on their missions—not the day-to-day tasks associated with data management.



Major components supporting NASA Center for Computational Sciences/NASA Advanced Supercomputing facility high-performance file transfers over wide area network testbed.

High Performance Wide Area Data Transfer Test Matrix							
Tests	Protocols			Connection Points			
	IP	IPoIB	RDMA	GSFC to SC09	ARC to SC09	SC09 Intra-booth	
Traditional	bbftp	●	●	●	●		
	scp	●	●	●	●		
	rsync	●	●	●	●		
Experimental	muttcp	●	●	●	●	●	●
	muttscp	●	●	●	●	●	●
	Trperl <sup>1</sup>			●	●		
	Rdma-ep <sup>1</sup>			●	●		
	Rdma-rsync <sup>1</sup>			●	●		
Xdd <sup>2</sup>	●	●		●			
Application	Grid FTP	●	●	●	●		
	iRODS	●	●	●	●		
File Systems	NFS	●	●	●	●		
	NFS Rdma			●	●		
	GPFS	●	●	●	●		
	Lustre	●	●	●	●		

<sup>1</sup> Courtesy of Obsidian Research.  
<sup>2</sup> End-to-end file transfers supported by the Oak Ridge National Laboratory Extreme Scale System Center and the Department of Defense.

Testing matrix of experimental wire-speed tests, traditional file transfer applications, emerging file transfer applications, and file systems.

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