

PERFORMANCE TUNING OF A HIGH CAPACITY/HIGH PERFORMANCE ARCHIVE FOR ECS

Sixth NASA Goddard Space Flight Center Conference on Mass Storage
Systems and Technologies

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Agenda



- **ECS SITES**
- **DISTRIBUTED ACTIVE ARCHIVE CENTER (DAAC) OVERVIEW**
- **ARCHIVE COMPONENT CONFIGURATION**
- **PROJECTED DESIGN THROUGHPUT PERFORMANCE**
- **INITIAL PERFORMANCE ACHIEVED VS. CURRENT PERFORMANCE**
- **INITIAL CONFIGURATION VS. CURRENT CONFIGURATION**
- **LESSONS LEARNED**

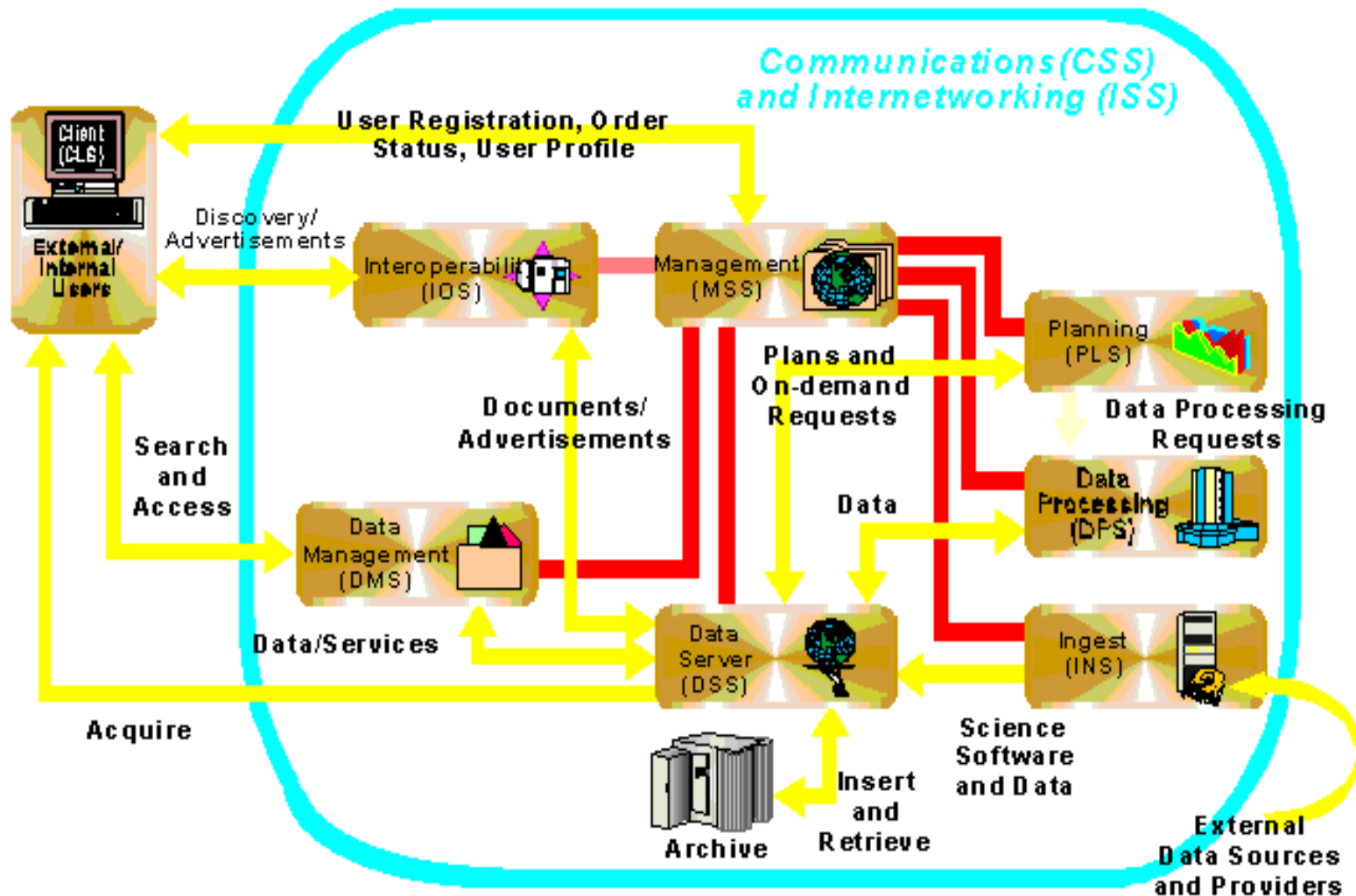
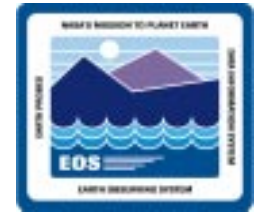
ECS DAACs



**ECS - Earth Observing System (EOS)
Data and Information System's Core System**

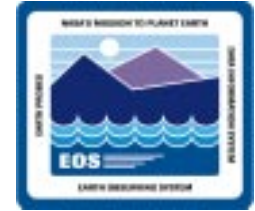
DAAC - Distributed Active Archive Center

ECS DAAC Subsystems and Data Flows



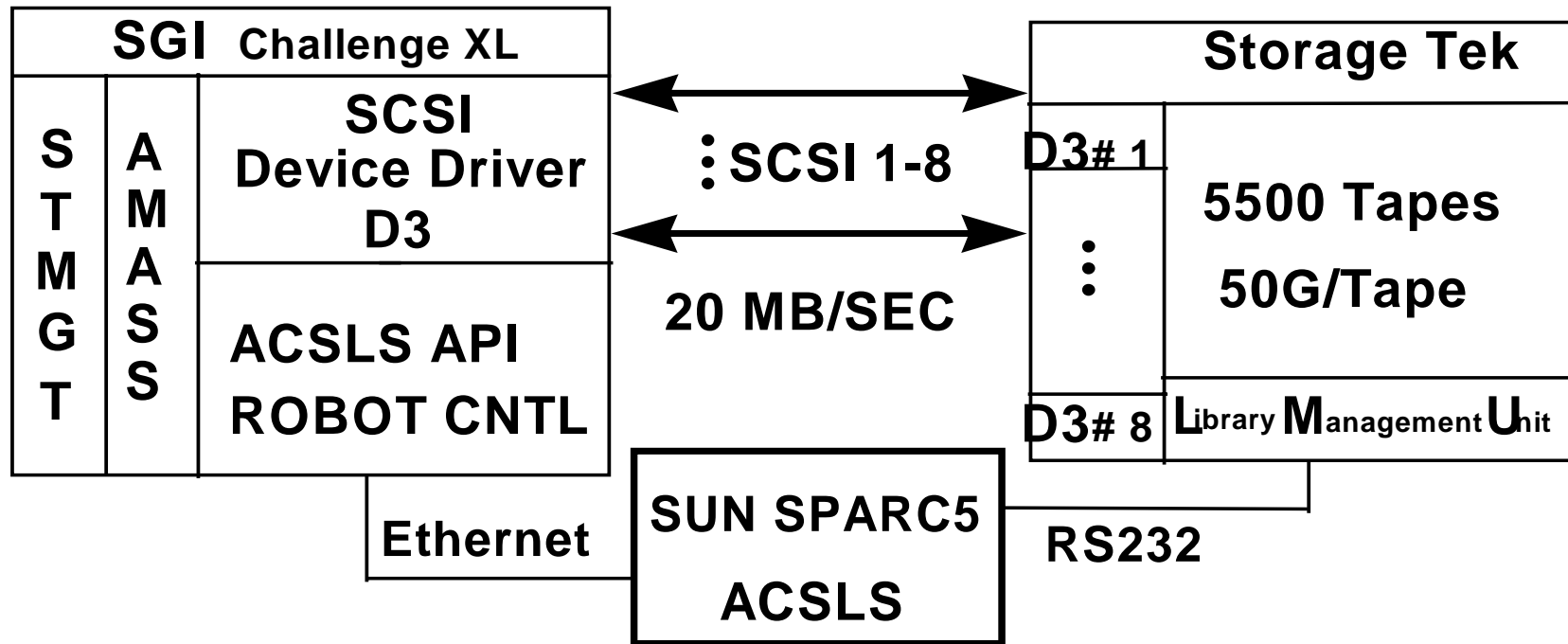
<http://edhs1.gsfc.nasa.gov:85/> - The ECS Data Handling System

Design Projected Throughput Performance



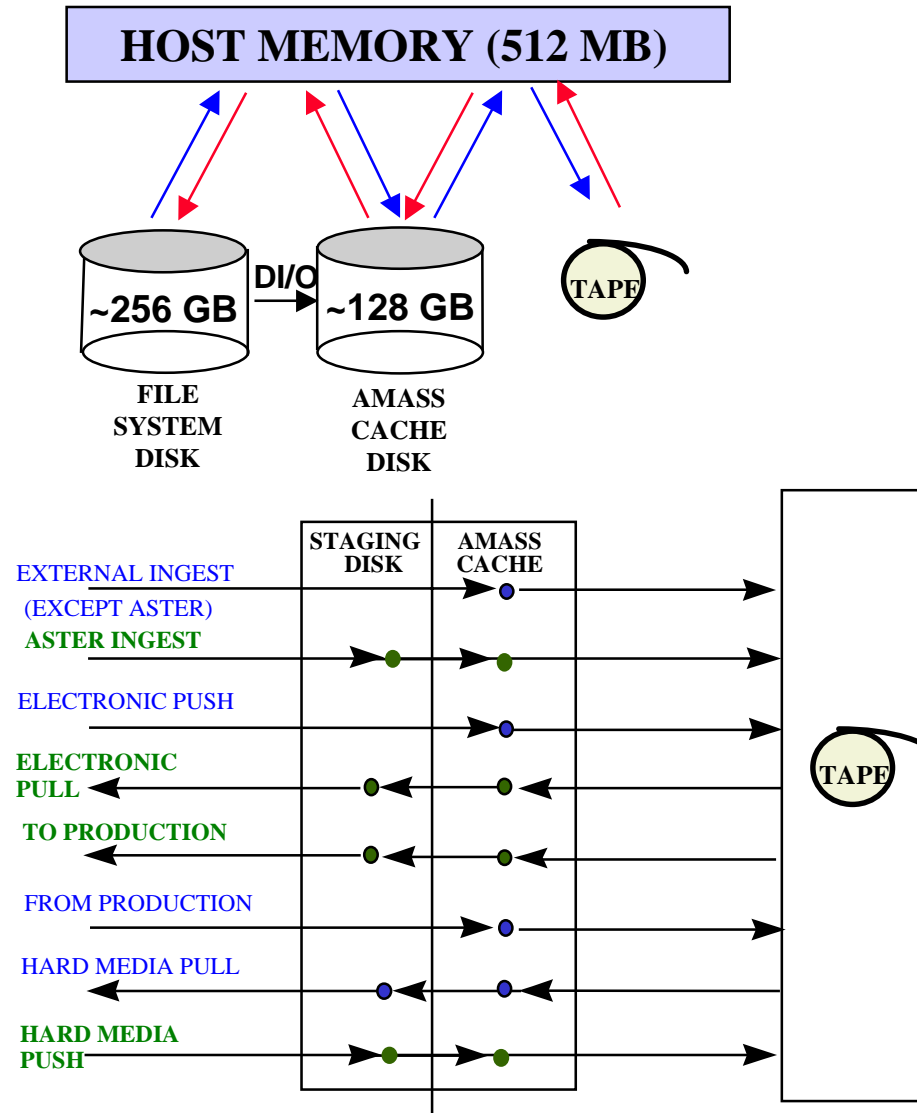
Single Channel	5 MB/sec
Cumulative for Eight Channels	40 MB/sec

GSFC DAAC Archive Configuration



Note: STMGT - ECS Storage Management Code Performing the Archive Control
 ACSLS - STK Automated Cartridge System Library Software

Data Flow to and from Tape



GSFC DAAC Archive Data Flow Performance Comparison



<u>Peak Rate</u> *	Single Channel		Cumulative (Eight Channels)		
	1/1997	8/1997	1/1997	8/1997	3/1998
Write (MB/sec)	~ 2	16	7	47	54 / 77.8
Read (MB/sec)	~ 2	16	9.5	29	36.9

*Note: Compression enabled

GSFC DAAC Archive RAID Configuration



Initial RAID Configuration	Current RAID Configuration
RAID 5, with 4 Controllers	RAID 3, with 8 Controllers
Maximum of 22 GB of AMASS Cache, due to a 2 GB per partition restriction. Realistic size - 12 GB.	136 GB AMASS Cache in a single partition and an upward limit of 1 TB

GSFC DAAC Archive Initial RAID Configuration (1/97)



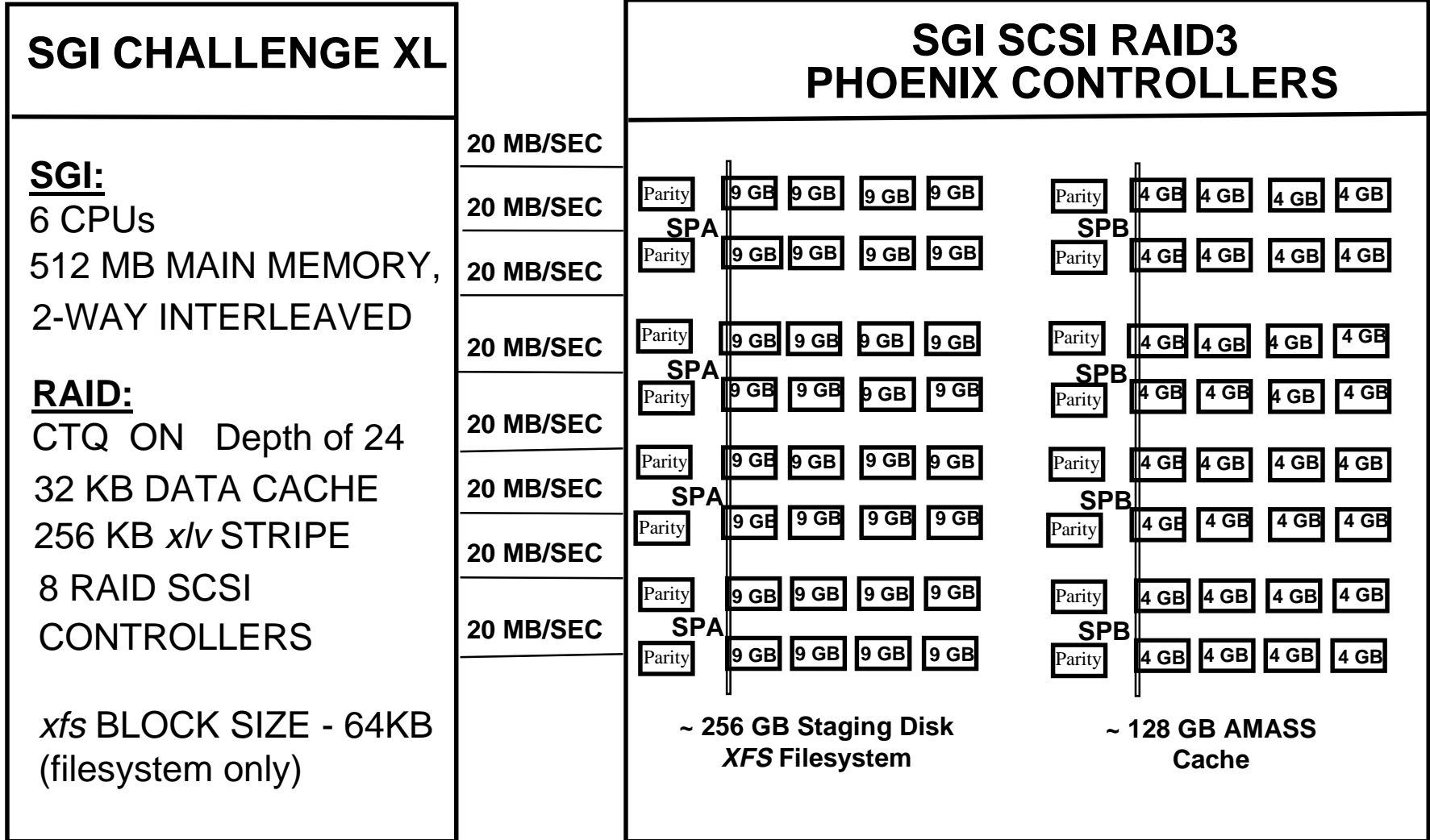
SGI CHALLENGE XL			SGI SCSI RAID5 PHOENIX CONTROLLERS											
<p><u>SGI:</u> 6 CPUs 512 MB MAIN MEMORY, 2-WAY INTERLEAVED</p> <p><u>RAID:</u> 32 KB DATA CACHE 4 RAID SCSI CONTROLLERS 128 KB <i>x/v</i> STRIPE</p> <p><i>xf</i>s BLOCK SIZE - 4KB (filesystem only)</p>	20 MB/SEC													
	20 MB/SEC	6 GB AMASS Cache in 3 partitions ~ 128 GB Staging Disk <i>XFS</i> Filesystem												
	20 MB/SEC	<table border="0" style="width: 100%; text-align: center;"> <tr> <td>Parity</td> <td>9 GB</td> <td>9 GB</td> <td>9 GB</td> <td>9 GB</td> <td>SPA</td> </tr> <tr> <td>9 GB</td> <td>Parity</td> <td>9 GB</td> <td>9 GB</td> <td>9 GB</td> <td>SPB</td> </tr> </table>	Parity	9 GB	9 GB	9 GB	9 GB	SPA	9 GB	Parity	9 GB	9 GB	9 GB	SPB
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9 GB	9 GB	Parity	9 GB	9 GB	SPA									
9 GB	9 GB	9 GB	Parity	9 GB	SPB									

GSFC DAAC Archive Intermediate RAID Configuration (8/97)

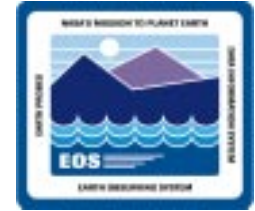


SGI CHALLENGE XL	SGI SCSI RAID3 PHOENIX CONTROLLERS					
<p>SGI: 6 CPUs 512 MB MAIN MEMORY, 2-WAY INTERLEAVED</p>	20 MB/SEC	Parity	9 GB	9 GB	9 GB	SPA
	20 MB/SEC	Parity	9 GB	9 GB	9 GB	SPB
	20 MB/SEC	Parity	9 GB	9 GB	9 GB	SPA
	20 MB/SEC	Parity	9 GB	9 GB	9 GB	SPB
	20 MB/SEC	Parity	9 GB	9 GB	9 GB	SPA
	20 MB/SEC	Parity	9 GB	9 GB	9 GB	SPB
	20 MB/SEC	Parity	9 GB	9 GB	9 GB	SPA
<p>CONTROLLERS</p> <p><i>xf</i>s BLOCK SIZE - 64KB (filesystem only)</p>	20 MB/SEC	Parity	9 GB	9 GB	9 GB	SPB
		<p>12 GB AMASS Cache in 6 partitions ~ 128 GB Staging Disk <i>XFS</i> Filesystem</p>				

GSFC DAAC Archive Current RAID Configuration (3/98)



Archive Library and Tape Functioning



Initial Operation	Current Operation
Sequential Media Mounts/ Dismounts	Asynchronous Media Mounts/ Dismounts
Sequential Rewind Operation	Asynchronous Rewind
Fixed Blocking Factor of 16 K Bytes for Transfers to Tape	User Configurable Blocking Factor, now set to 256 KB

AMASS Data Transfer Performance



Initial	Current
Used <i>cp</i> for data transfers	Use <i>dd</i> for data transfers with block size of 1024 KB
Synchronous I/O	Asynchronous I/O
Tape Drive Buffer Flush	Asynchronous Buffer Flush



Lessons Learned

Vendor cooperation is essential to performance fine-tuning

Need significant time allocation to integrate and tune

Consider a learning curve into the integration time budget

Fast magnetic disk is paramount for high performance tape archiving

Do not try this at home (If you do, at least buy a big UPS)