



Storage Capacity Expansion Plan (initial)

Storage Budget: \$ \$ \$ (5PB)



Rational:

- * the longer we wait, the more we can buy with the same budget (hopefully)

Usage management:

- * allocations
- * introduction of quotas & HSM (limited data offload capability)
- * regular purging

What have we learned in 1 ½ years of operation?

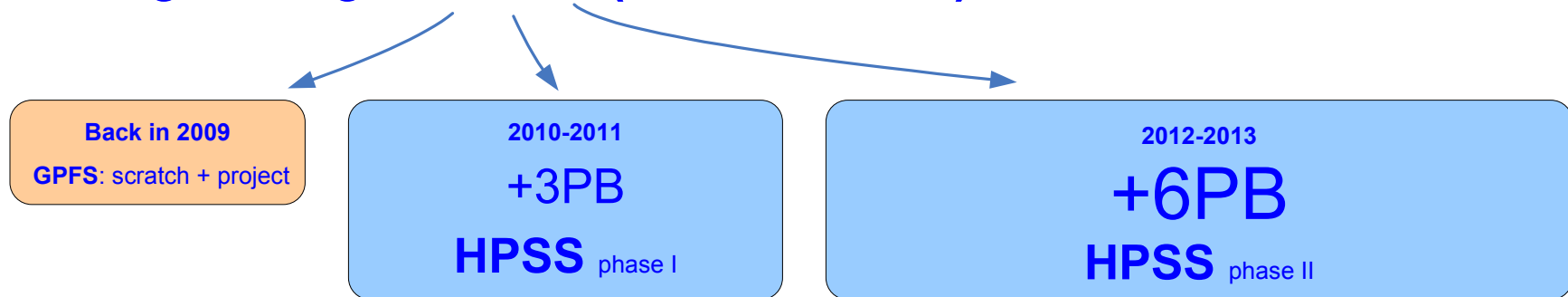
- * GPFS problems and limitations at our scale (4000 nodes cluster)
- * user data distribution patterns not GPFS or HPC friendly

Conclusion:

- * just adding spinning disks to active filesystems is not a good solution
- * more users, more data, more files => more problems

Storage Capacity Expansion Plan (revised)

Storage Budget: \$ \$ \$ (5PB or more)



Solution:

- * near online storage with HPSS (tape-backed hierarchical storage system)

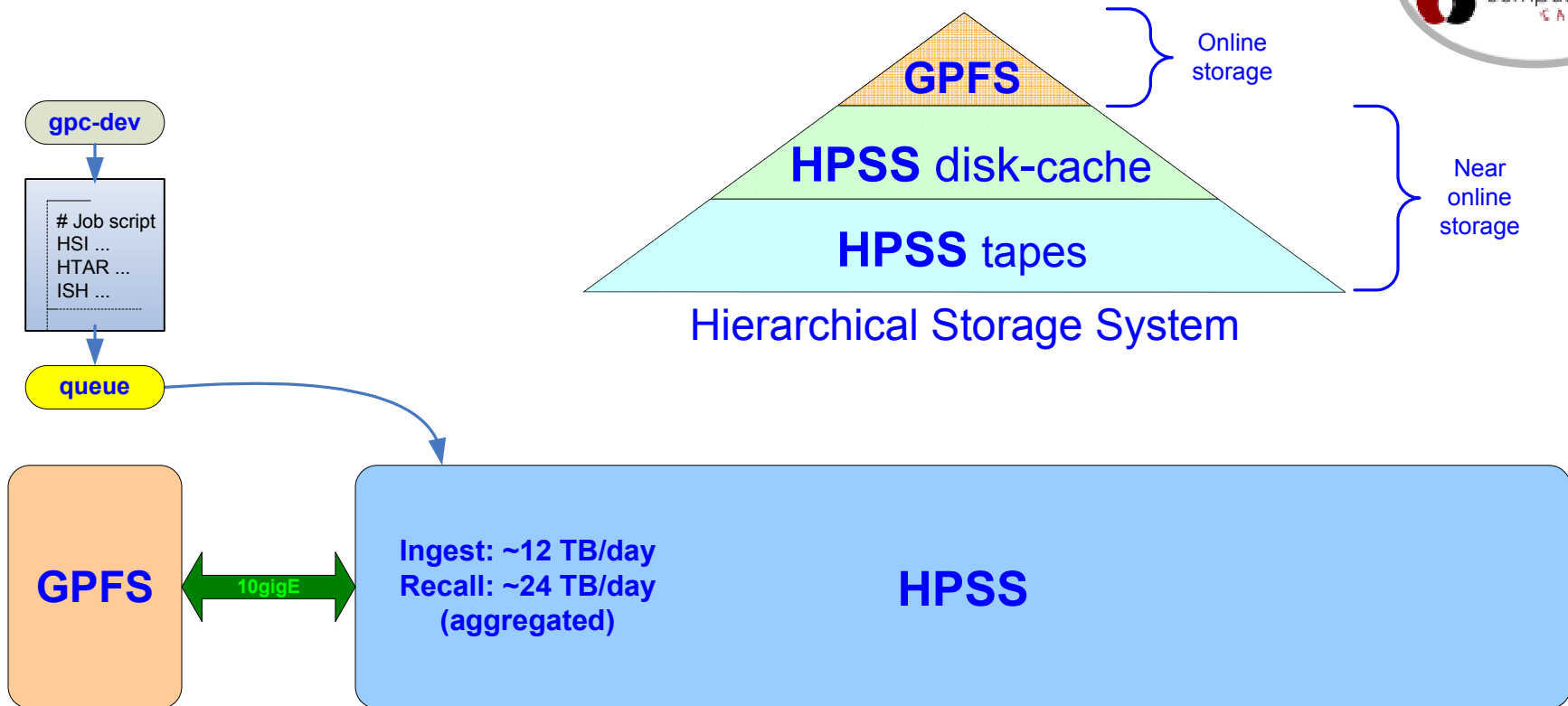
Usage management:

- * allocations: GPFS + HPSS (TBD)
- * quotas & massive data offload to HPSS
- * regular purging
- * less utilization of small files
- * more utilization of tarballs in the regular workflow by users (new campaign)

About HPSS (High Performance Storage System):

- * 10+ years history, used by 50+ facilities in the “Top 500” HPC list
- * very reliable, data redundancy and data insurance built-in.
- * highly scalable, reasonable performance at SciNet
- * HSI/HTAR (and ISH) clients also very reliable and used on several HPSS sites.

How it works ...



- * access and transfer management is done through the GPC queue system
- * end-user interaction via HSI/HTAR/ISH calls in the job scripts

- * HSI is a client with an ftp-like interface which can be used to archive and retrieve large files. It is also useful for browsing the contents of HPSS.
- * HTAR is a utility that creates tar formatted archives directly into HPSS. It also creates a separate index file (.idx) that can be accessed quickly.
- * ISH is a TUI utility to perform an inventory of contents in your tarballs.



Scripted File Transfers

File transfers in and out of the HPSS should be scripted into jobs and submitted to the archive queue. Scripts should use the HSI, HTAR and/or ISH clients as in the example below:

```
#!/bin/env bash
#PBS -q archive
#PBS -N hsi_put_file_in_hpss
#PBS -j oe
#PBS -me

/usr/local/bin/hsi -v <<EOF
cput -p /scratch/$USER/workarea/finished-job1.tar.gz : finished-job1.tar.gz
EOF
status=$?
if [ ! $status == 0 ];then
    echo '!!! TRANSFER FAILED !!!'
fi
exit $status
```

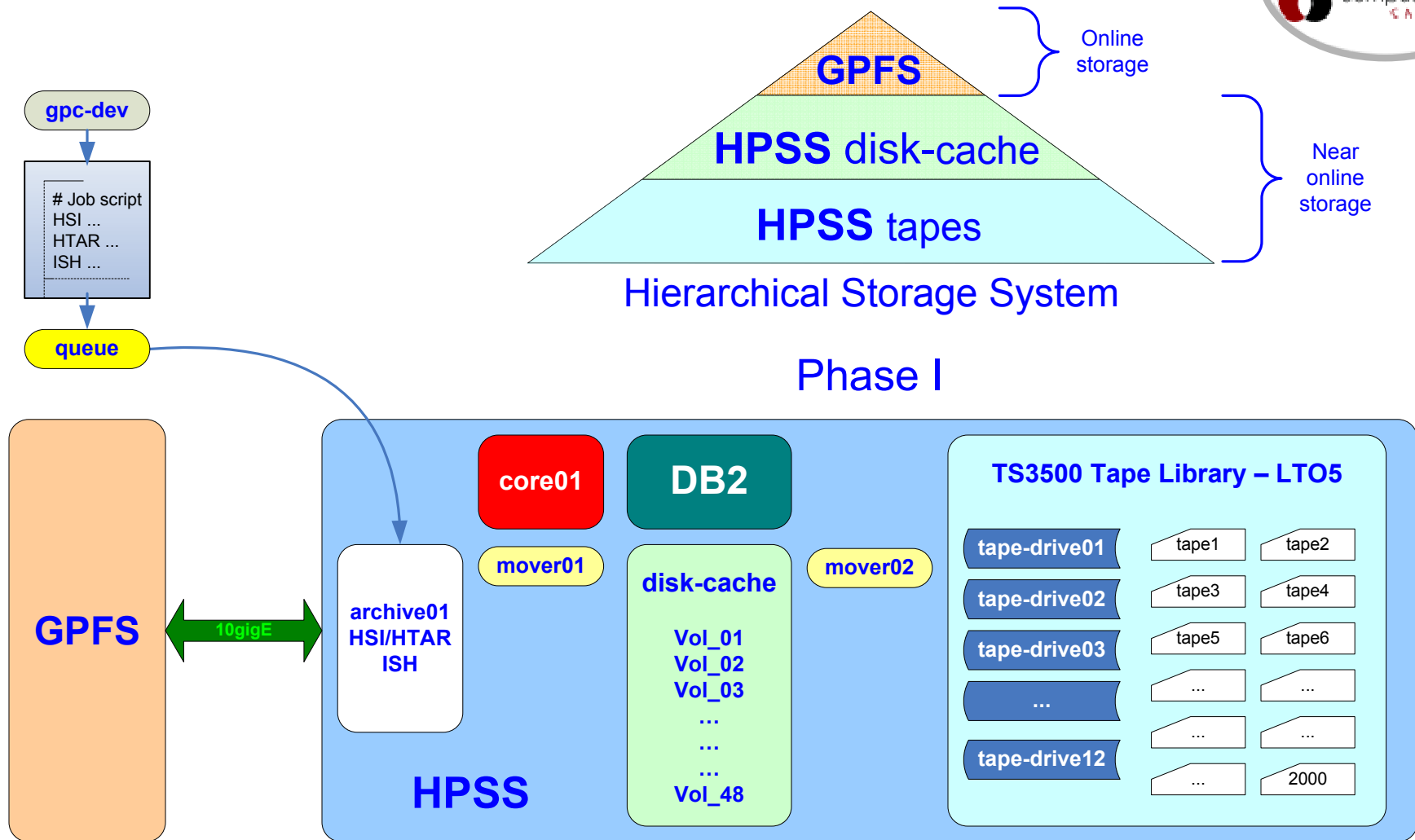
Note: Make sure to check the application's **exit code** and the returned log files for errors after all data transfers and any tarball creation process

The status of pending jobs can be monitored with `showq` specifying the archive queue:

```
showq -w class=archive
```

For more details and examples please consult the following wiki page:
<https://support.scinet.utoronto.ca/wiki/index.php/HPSS>

HPSS – main components



HPSS (broad use of the term) = nodes + disks + network + FC + HPSS + DB2 + HSI + HTAR + ISH + Library + tapes + services

HPSS – scaling potential



Possible Phase II (TBD)

