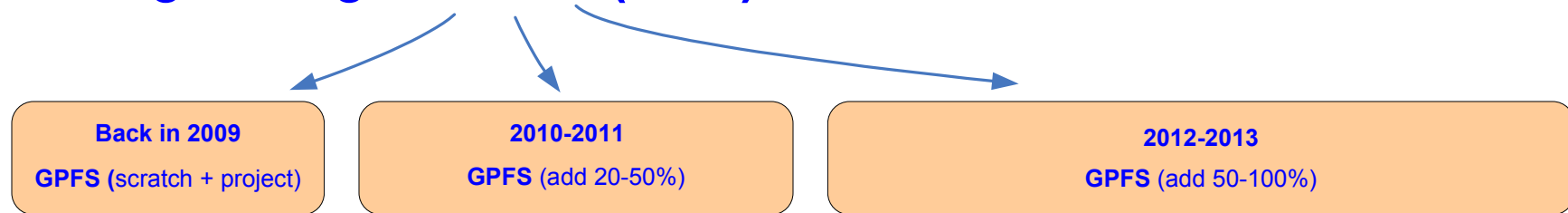




Storage Capacity Expansion Plan (initial)

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



Rationale:

* the longer we wait, the more we can buy with the same dollar amount (hopefully)

Usage management to date:

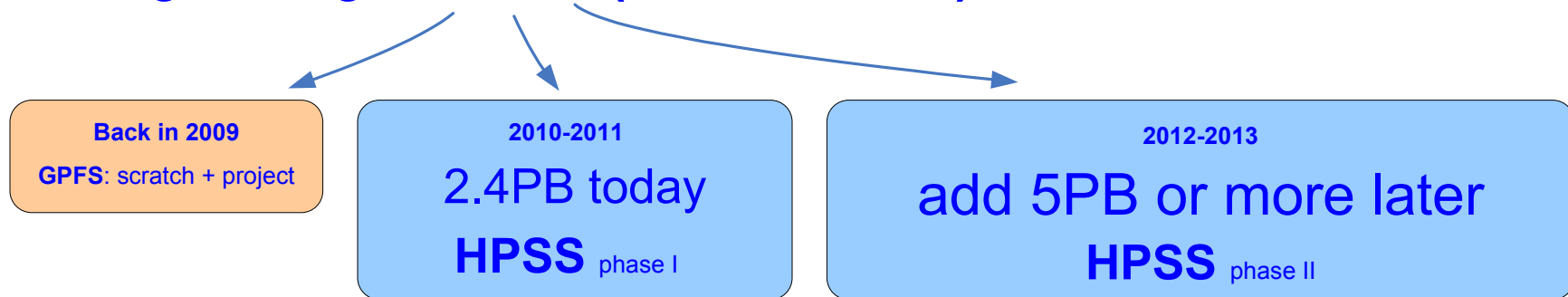
- * allocations
- * introduction of quotas & HSM (limited data offload capability)
- * regular purging (90 days old material)
- * 97-98% → cleanup effort email

What have we learned in 2 years of operation?

- * GPFS still has problems and limitations at our scale (4000 nodes cluster)
- * many user data distribution patterns not GPFS or HPC friendly
- * adding spinning disks to GPFS → more heat, higher electricity bill
- * more users, more data, more files → more problems on active file systems
- * 900+ users in Sep/2011 → we will need way more than 5PB and sooner
- * prices did not come down as we hoped for over this period

Storage Capacity Expansion Plan (revised)

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



Solution:

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

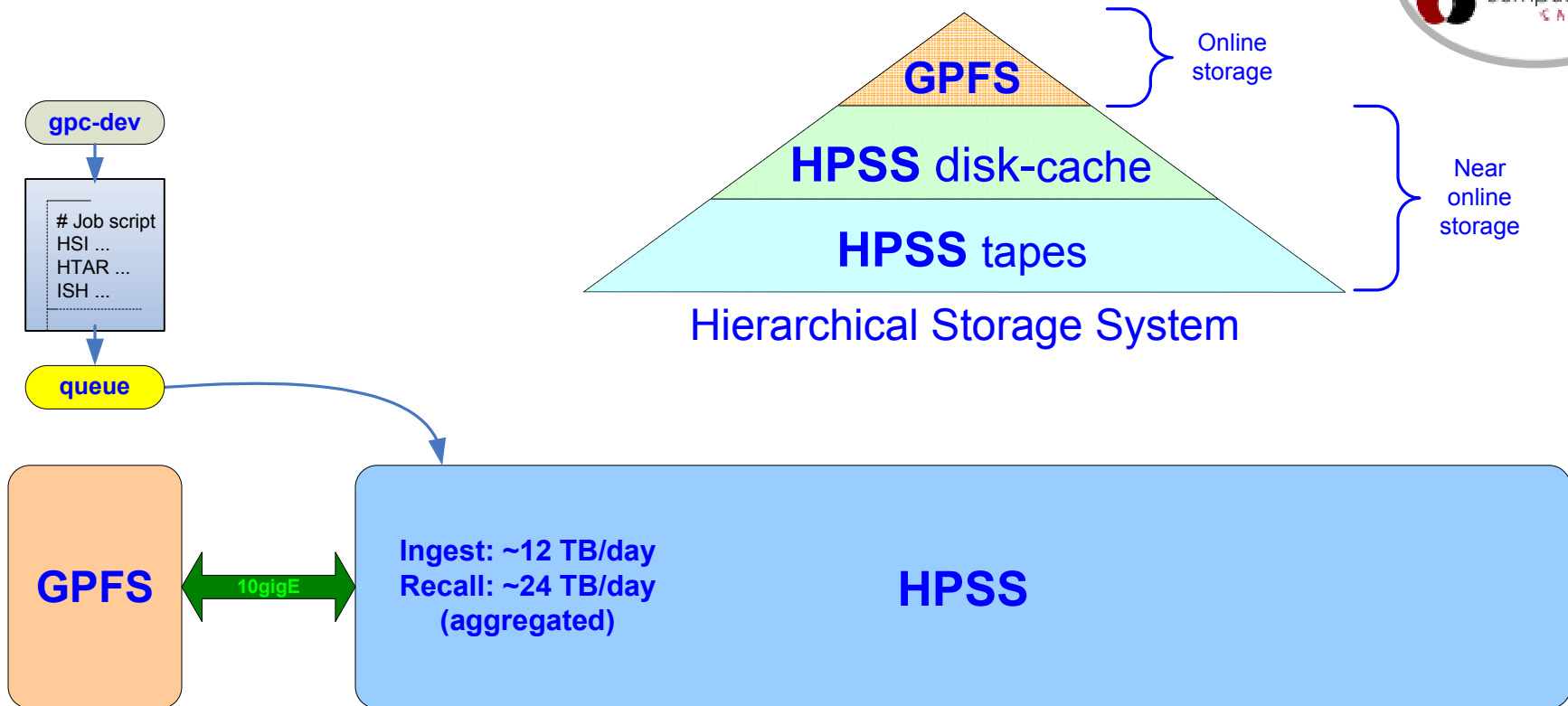
Usage management moving forward:

- * allocations: GPFS + HPSS (see end slides for details)
- * quotas & massive data offload to HPSS
- * regular purging (possibly 60 days old material)
- * 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

```
#!/bin/bash
#PBS -l walltime=72:00:00
#PBS -q archive
#PBS -N htar_create_tarball_in_hpss
#PBS -j oe
#PBS -m e
```

headers

```
echo "Creating a htar of finished-job1/ directory tree into HPSS"
```

```
trap "echo 'Job script not completed';exit 129" TERM INT
# Note that your initial directory in HPSS will be /archive/<group>/<user>/
```

```
cd /scratch/$(whoami)/workarea/
htar -cpf /archive/$(id -gn)/$(whoami)/finished-job1.tar finished-job1/
status=$?
```

htar
hs
ish

trap

```
trap - TERM INT
```

```
if [ ! $status == 0 ]; then
    echo 'HTAR returned non-zero code.'
    /scinet/gpc/bin/exit2msg $status
    exit $status
else
    echo 'TRANSFER SUCCESSFUL'
fi
```

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 on the archive queue

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



ISH used from the command line:

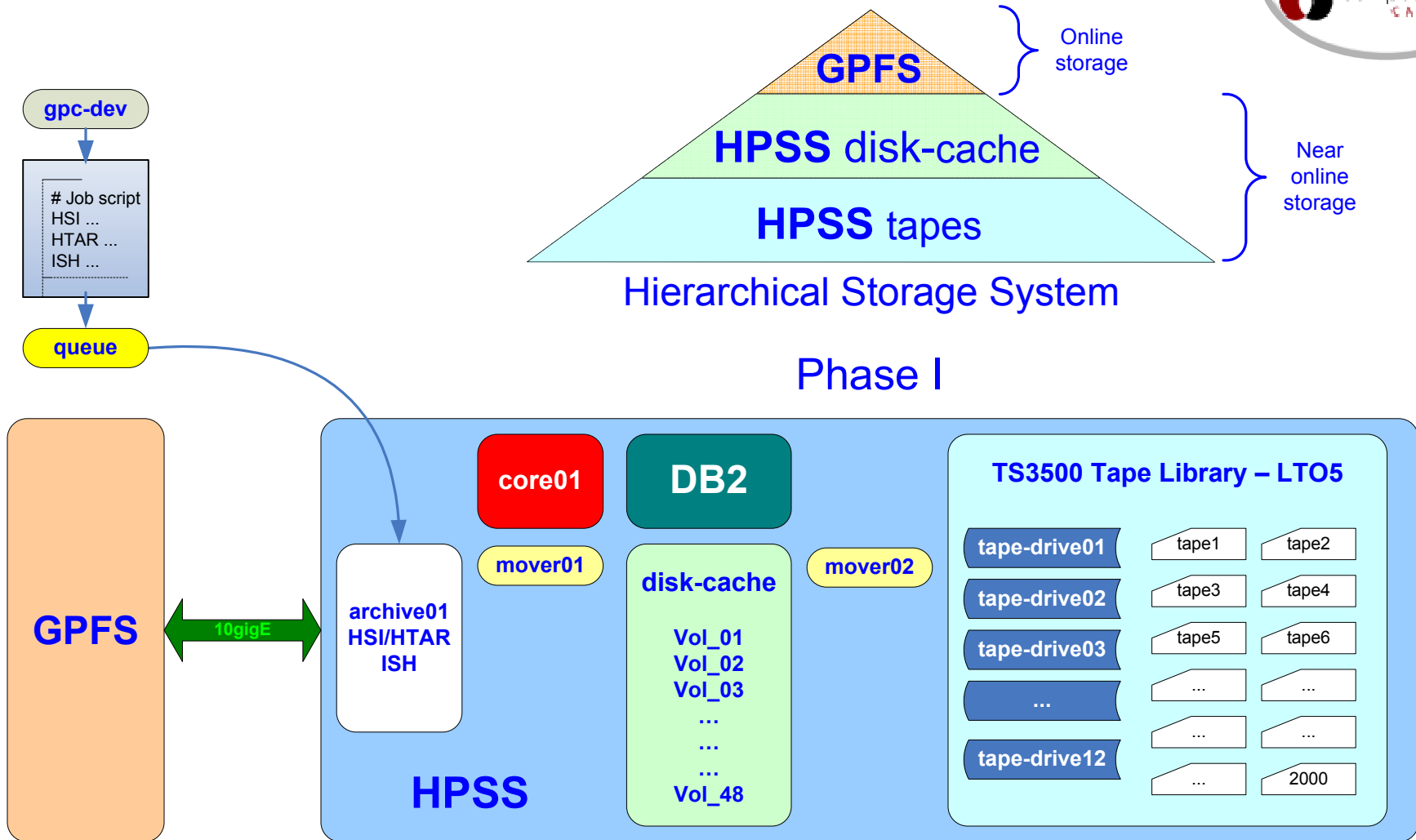
```
rzon@scinet02:~$ ls
data.tgz
rzon@scinet02:~$ /scinet/gpc/bin/ish
ish 0.98
Ramses van Zon - SciNet/Toronto/Canada/July 8, 2011
[ish]hpss.igz> index data.tgz
[ish]data.tgz.igz> ls -l
drwxr-xr-x rzon/scinet          0 2011-02-10 13:57:01 data/
-rw-r--r-- rzon/scinet      16714 2010-10-05 12:41:45 input.ini
-rwxr-xr-x rzon/scinet       293 2011-06-30 12:42:57 submit.pbs
[ish]data.tgz.igz> cd data
[ish]data.tgz.igz> ls
run1/  run2/
[ish]data.tgz.igz> find important*.dat
run1/important01.dat  run1/important02.dat  run1/important03.dat
run1/important04.dat  run1/important05.dat  run1/important06.dat
run2/important01.dat  run2/important02.dat  run2/important03.dat
[ish]exit
rzon@scinet02:~$
```

ISH used from a job script:

```
#!/bin/bash
# This script is named: data-list.sh
#PBS -q archive
#PBS -N hpss_index
#PBS -j oe
#PBS -m e
/scinet/gpc/bin/ish hindex
```

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

HPSS – main components

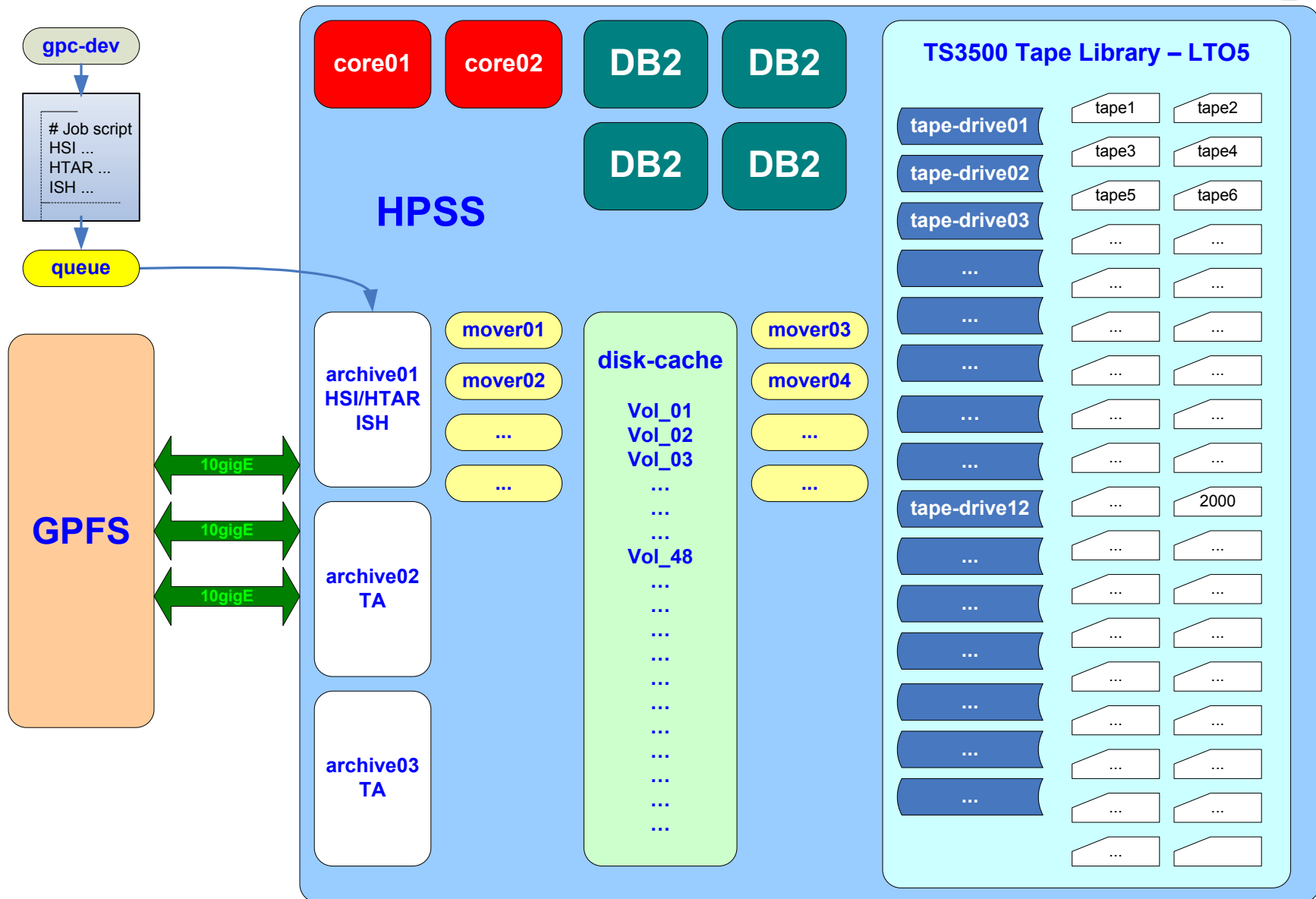


HPSS (broad use of the term) = nodes + disks + network + FC + HPSS + DB2 + HSI + HTAR + ISH + Library + tapes + services

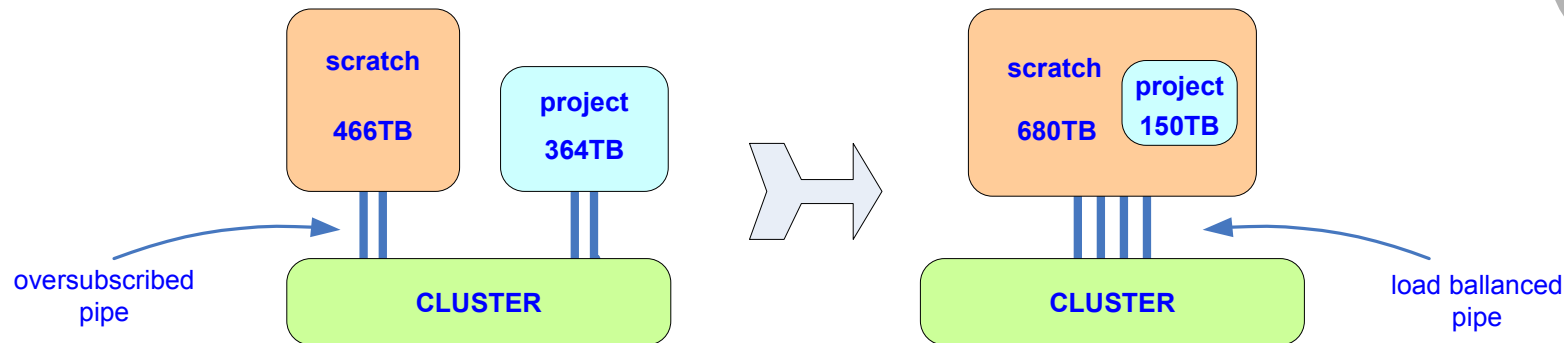
HPSS – scaling potential



Possible Phase II (TBD)



Merger of scratch and project (in 1-2 months)



Objectives:

- * Migrate user's data from project to HPSS
- * Increase size and performance of scratch

Breakdown:

830TB total available on the new filesystem (4 controllers, load balanced)
 scratch 680TB , reorganized on a per group hierarchy, as in project.
 project 150TB , same mounting point as before

Transition:

- * "freeze" /project (i.e. make it read-only) for a period of roughly 1-2 weeks
- * temporarily back-up the /project data to two completely separate tape systems
- * /project disks will then be reconfigured during scheduled system downtime
- * groups with allocations of 5 TB or less will see no difference
- * groups with > 5TB allocations will find that they have an empty /project with 5TB of available space and all their former /project data will live in HPSS



Policies:

scratch (same as before)

90 days purgeable (for now)

20TB/user but max 80TB/group (quota enforced)

1M/user and 10M/group file limit

project allocated by RACs

non-purgeable

5TB max/group, 1M file limit (quota enforced)

excess must be migrated to HPSS

hpss allocated by RACs

quota enforced

non-deleted by SciNet

beyond RAC: users can buy tape for one-time cost of ~ \$120/TB/copy

RAC Applications:

* PIs can request "dedicated" (never purged) storage for their groups for 2012

* up to 5 TB (per group) will be allocated on disk (/project), remainder on HPSS

* project space which is not reallocated in the next RAC call is migrated to HPSS and then deleted from disk

Next SNUG (October/12): We will devote part of the session to answer questions regarding the RAC request for time/storage allocation process.