Scientific Computing
Towards a 5 year Strategic Plan

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SLAC
NATIONAL ACCELERATOR LABORATORY

By 2017: Data Management

- Management of digital scientific data that supports the scientific mission areas of the laboratory.
  - » A repository and facility for the dissemination and analysis of light source experimental data and associated domain science specific simulations.
  - » LSST data center and center for cosmological simulation data
- Produce critical elements of the stack of data management tools required to to produce the complete stack.
- Develop underlying tools with commonality in mind.
  - » Work with other labs/partners
- Domain science specific tailoring at the user interface-
- Builds on existing expertise in large scale databases and data management; is aligned with current activities and opportunities.

By 2017: Simulation

- Center for Simulations supporting the scientific mission areas of the laboratory
  - » Production end to end simulation for light source experiments
  - » Expanded expertise in accelerator modeling to support for next generation accelerator design for basic energy sciences and high energy physics
  - » Continued role in Geant4 and follow-ons
  - » Continued expertise in large scale detector design for High Energy Physics and expanding that expertise to other domain sciences.
  - » Expanded program in large scale simulations for domain specific science in materials, catalysis, computational cosmology…
  - » Develop a core expertise in applied math to support the center; develop partnerships with campus

By 2017: Hardware Facilities

- Cost effect computing facilities that are operated to modern methodologies that meet the program needs with the appropriate mix of dedicated resources, local "cloud" and outsourcing to commercial or other academic “clouds”
  - » Evolution of Funding Model
    - Balance capital investments and operational expenses
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Additional Areas

- Algorithms/Visualization
  - » Closely tied to the specific science objectives of SLAC staff
  - » Look at possibilities for building underlying expertise that could support multiple efforts

- DAQ/Controls
  - » Closely tied to the facilities
  - » How to tie to Computing esp. Cybersecurity

Milestones: 2012

- DM: Data dissemination for JCSG using existing tools;
- DM: incremental improvements in the use of standard tools; evaluate support models, small experiment support
- DM: Explore policies for the management of light source
  - » data preliminary design for facility level scientific data management for light source data (working with partners)
- SIM: Initial prototyping for end to end xray simulation; re-compete SciDAC
- Fac: Stabilize ability to host new installations in Bld 50: EOL equipment and targeted EOL methodology
- Fac: Requirements gathering from the science directorates
- Fac: Technology road maps for storage, networking and compute clusters (hardware, software and methodologies)

Milestones: 2013

Funding/Budgets

Scientific Computing Funding Model

- The existing Scientific Computing Funding Model divides labor charges into three categories
  - » Infrastructure Services (fully operations funded)
  - » Shared Costs (50% operations, 50% “recharge”)
  - » Program specific costs
- Develop similar model could be applicable for equipment and M&S costs.
- SCFM explicitly states that BLD 50 infrastructure provisioning for space/power/cooling and basic networking is provided as an infrastructure cost.

Expanded hosting capability for BLD 50

- Associated IGPE Funding: $971K
- Enable ongoing hosting of computing equipment in BLD 50 in a consistent and planned way
  - » Adopt standard practice for hosting new installations in BLD 50 by building out integrated "pods" of rack space
  - » Over time use water or air cooled racks appropriate for power density
  - » Improves quality of service (getting equipment into production) with decreased labor costs through better use of staff time
  - » Proposal for 2012 enables continuation of modest expansion in line with requests for rack space in recent years
  - » Would not accommodate a PCDS purchase for 2012 hosted in BLD 50
  - » Does not accommodate improving equipment organization

STK Robotic Tape Systems

- Associated IGPE Funding: $386K
- 2 interconnected robotic tape systems
- 47 x 1TB tape drives (43 or 92% for SciComp, 4 for Windows backup) with 19 tape drive servers
- Approx. 13,000 slots for 1TB cartridges
- 10,000 1TB cartridges (97% for SciComp, 3% Windows backup)
- 78% full, 6-8 months left, no headroom if full
- 3000 empty slots = 3PB with 1TB cartridges or 15PB with 5TB cartridges
- ~35% LCLS growing, 30% BABAR static, 30% FGST slow growth
- Best strategy in the near future is to add 5TB drives while we still have some empty slots available

Unified Shared Disk Storage

- Associated IGPE Funding: $140K (seed funding)
- Transitioning from a Lab driven by the needs of one large research project to one with many research projects.
- Current State: Large numbers of independent data storage servers (storage islands)
  - » Increased overhead to manage the many storage islands
  - » No ability for clients to acquire storage capacity quickly
- Vision: Storage as a service rather than something owned by each science group
  - » Centrally managed, (possibly) shared storage rather than storage islands
  - » Decreased time to provide storage capacity to science groups
  - » Decreased management cost for new storage

Replacement of end of life services equipment

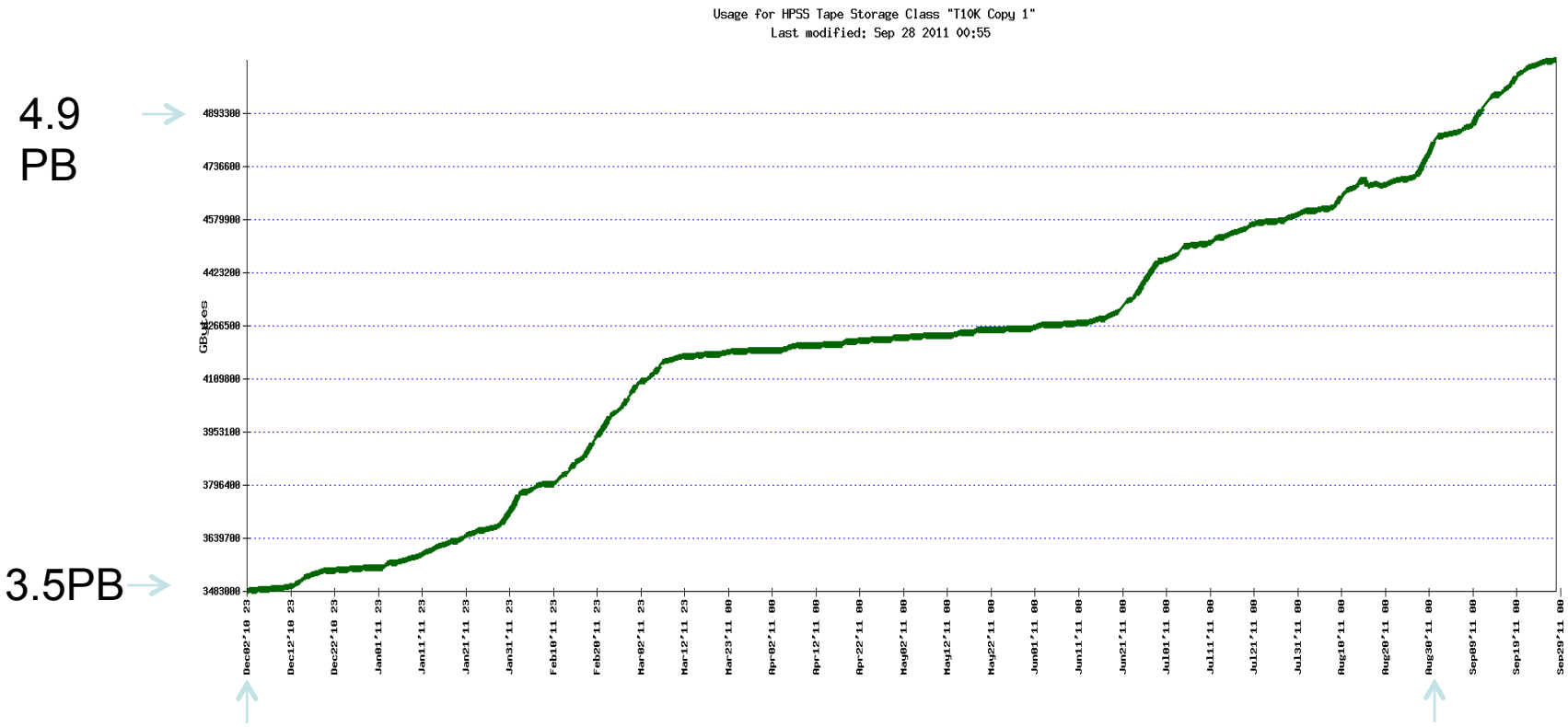
- Associated IGPE Funding: $165K
- Deferred purchases have led to services being hosted on obsolete equipment.
  - » Leads to the risk of service outages in the case of hardware failures as well as skewing planning and leading to unpredictable uses of key staff
- Need to develop EOL equipment policies and undertake targeted EOL methodology/equipment projects
  - » Work towards a model where the critical machines are replaced on a schedule leading to budget stability.
  - » Running obsolete equipment leads to outmoded methodologies
  - » 4 year replacement cycles are common; 5 years likely acceptable, with possible extension to 6 years case by case.
  - » 70% of oldest equipment targeted in year 1 of 2-year program

SciComp Infrastructure Servers & Arrays over 5 Years Old

Category	11 years	10 years	9 years	8 years	7 years	6 years	5 years	Total
AFS	1	5		9	3		1	19
Infrastructure	2	3	2		16	3	2	28
Monitoring		3	1	1	3	1	1	10
Shared SciComp			5	2	21	1	13	42
Testbed					5	11		16
Grand Total	**3**	**11**	**8**	**12**	**48**	**16**	**17**	**115**

Backup

HPSS Copy 1 (all but second LCLS copy)



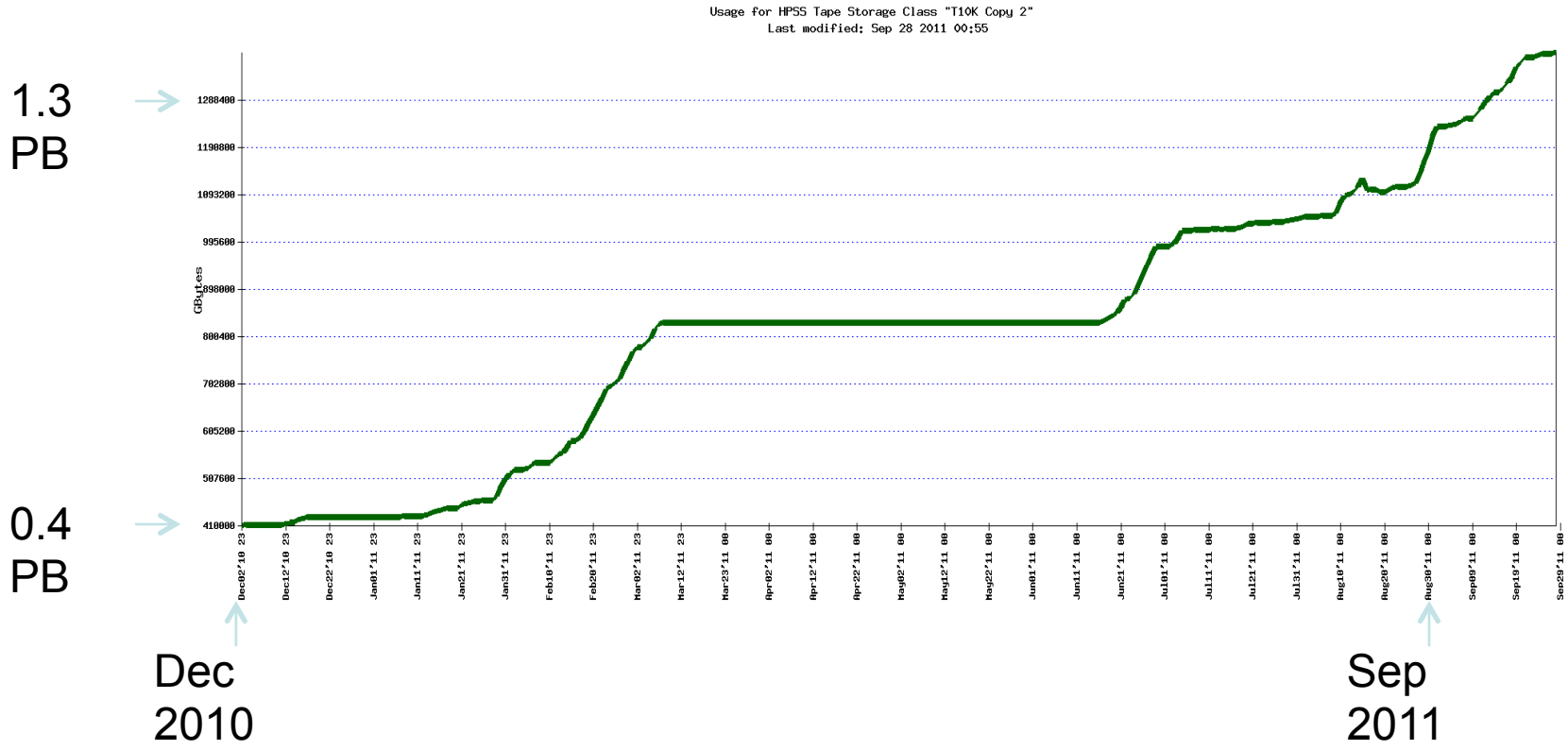
4.9 PB

3.5PB

Dec 2010

Sep 2011

HPSS Copy 2 (just LCLS copy#2)



The LTDA Power

- A deferred cost directly due to the ad hoc nature of the current model, $80K is requested for the express purpose of undoing the temporary power distribution required to accommodate 2011 purchases

Funding Scenario 3

Budget Element	Cost	Funding Model
BLD 50/2012	$971K ($715/$256K)	Program/ops split
BLD 50/power (deferred from 2011)	$80K	Basic Infrastructure (ops)
Next generation tape drives	$386K	Direct charged back to the programs based on usage
Modest shared storage pool	$140K	Direct charged back to the program based on usage
End of Life Sci Comp	$165K	Basic Infrastructure

In this scenario-there is a renegotiation of responsibility for the BLD 50 infrastructure (or programs will choose to host their own equipment)

$1242K Program charged Costs
$500K Operations