CD FY08 Tactical Plan Status

FY08 Tactical Plan Status Report for SCF/QCD

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FY08 Tactical Plan for SCF/QCD

- Relevant Strategic Plan(s):
  - FY08 Strategic Plan for Lattice QCD [2295-v2]
  - Also (briefly) covers the Cosmological Computing Initiative and RF Cavity Simulations support for TD
- Tactical Plan Leader: James N. Simone
- Organizational Unit home
  - SCF/QCD
- Tactical Plan Goals
  - Support DOE Office of Science LQCD Computing Project ("LQCD.OMB300")
  - Support DOE Office of Science Scientific Discovery Through Advanced Computing Lattice QCD Computing Project ("LQCD.SciDAC-2")
  - Provide architectural and operational guidance for high performance computing initiatives such as Cosmology Computing.

Activities Summary: FTEs

Level 0 Activity:	Lattice QCD	% of FY Complete:	67%

Personnel Usage (FTEs)

Tactical Plan Level 1 Activity	Allocation		Actual YTD			Current
	FTE-yrs	FTE-mos	FTE-yrs (Ave/mo.)	FTE-mos	% Consumed YTD	FY08 Forecast
Lattice QCD						
Lattice QCD	2.50	30.0	2.29	18.36	61	91%
SciDAC Lattice QCD	2.65	31.8	2.73	21.84	67	100%
LQCD FNAL Project	2.45	29.4	2.08	16.60	56	100%
Total	7.60	91.2	7.10	56.80	62	
Lattice QCD [and Experimental Astrophysics]						
COSMO-Computing	[0.5 hire]	[6.00]	1.25	9.99	167	0.5 actual rate 4mos 200%
Total	[0.5]	[6.00]	1.25	9.99	167	

Luciano Piccoli (DAQ/Controls) is contributing 0.40 FTE (avg) to SciDAC Lattice QCD

Activities Summary: M&S (Internal Funding)

Level 0 Activity: **Lattice QCD**   **percent of FY Complete:**   **67%**

Operating & Equipment M&S   *CD Internal Funding*

Tactical Plan Level 1 Activity	Operations M&S				Equipment M&S			
	FY Obligation Budget	YTD Obligations + RIPS	% Spent	Current FY08 Forecast	FY Obligation Budget	YTD Obligations + RIPS	% Spent	Current FY08 Forecast
Lattice QCD								
Facility ops and support	29078	4300	15	100%	0	0	---	
Scientific research (travel)	2475	0	0	90%	0	0	---	
Dept. infrastructure	1320	9860	750		0	0		
Total	32873	14160	43%		0	0		

Dept. Infrastructure obligations:

• Travel to SC08 and to LQCD-II CD0 review each for one member of QCD

• OpenClovis training ~5.5K

Activities Summary: M&S (External Funding)

Level 0 Activity: Lattice QCD   **% of FY Complete:** 67%

Operating & Equipment M&S   *CD External Funding*

Tactical Plan Level 1 Activity	Operations M&S				Equipment M&S			
	FY Obligation Budget	YTD Obligations + RIPS	% Spent	Current FY08 Forecast	FY Obligation Budget	YTD Obligations + RIPS	% Spent	Current FY08 Forecast
Lattice QCD								
LQCD FNAL Project	18000	2500	14		1489900	1452500	97	100%
SciDAC Lattice QCD	12000	2800	23		0	0	---	
Total	30000	5300	18%		1489900	1452500		

- M&S == travel

- EQ == "J/psi" cluster purchase + new servers and storage systems

Service Activity: LQCD/OMB300/Operations

- Operate the three LQCD.OMB300 clusters (QCD, Pion, Kaon) housed at LCC, Fermilab.

- Original Goals Related to this Activity
  - 1. Deliver 3.58 TFlops-yrs computing by Sept 30, 2008.
    - This is the aggregate TFlops-yrs for all three LQCD.OMB300 clusters.

- Adjusted Goals Related to this Activity
  - 1. Deliver 3.58 TFlops-yrs computing by Sept 30, 2008.
    - Project has delivered 2.58 TFlops-yrs till date and is on pace (2.387 TFlops-yrs, or 108% of pace).

- ## Key Metrics
  1. Uptime, utilization and successful job completion rate.
  2. http://kaon2.fnal.gov/cluster/usage.html
  3. http://whcdf03.fnal.gov:10440/index.html

- ## Milestones
  As per external 2007 DOE USQCD progress review recommendations,
    - developed and deployed **usqcd.org/fnal** web-site on Feb 20, 2008.
    - implemented mechanics to track job failure rates

- ## Issues and Risks
  Facility issues at LCC could result in the failure to meet LQCD/OMB300 milestone to deliver 3.58 TFlops-yrs.

Project Activity: LQCD/OMB300/Deployment

- Design and initiate procurement of 4.2 Tflop/s FY08 J/Psi cluser.

- Original Goals Related to this Activity
  - 1. Benchmark data for candidate J/Psi cluster.
    - Interact with computer vendors.
  - 2. Passing formal external review of preliminary design.
    - Yearly DOE USQCD progress review at BNL, May 13-14, 2008.

- Adjusted Goals Related to this Activity
  - 1. Benchmark data for candidate J/Psi cluster.
    - Lattice QCD performs and scales best on Intel Nehalem architecture but this will not be in GA till Jan 2009.
  - 2. Passing formal external review of preliminary design
    - Reviewers have passed the preliminary J/Psi cluster design.

Key Milestones

- After extensive benchmarking and attending the Intel HPC roundtable (May 2008), it is clear that the FY08 half of the J/Psi cluster will be an AMD Barcelona based system.
- At the May external DOE review, the oral preliminary reviewers report endorsed the J/Psi design and procurement strategy.

Issues and Risks

1. If the GCC computer room C is not completed on time (current completion date of July 30, 2008), we might slip a top level OMB300 milestone.
2. Unforeseen performance issues with a new cluster could delay promised release-to-production date.

Service Activity: LQCD OMB300 Project Management

- Provide project management for the DOE SC LQCD Computing Project
- FY08 Objectives
  1. Respond to any issues raised by OMB pass-back of the BY09 Exhibit 300.
     Done – no issues raised by OMB.
  2. Respond to all data call requests from the DOE SC or OMB.
     Done – all requests completed and submitted on time.
  3. Complete and submit quarterly reports to the Federal Project Manager according to timeline defined by DOE SC.
     Done – FY08Q1, Q2, Q3 reports submitted on time; all perf. metrics met; have consistently received green scores.
  4. Organize the FY08 Annual DOE Progress Review.
     Done – review held at BNL on May 13-14, 2008.
  5. Report on project progress and status to external review committee and receive favorable assessment.
     In progress – Project status presented to committee; received favorable comments at review closeout; awaiting written report.

- Key Metrics
  1. Percent complete on FY08 deliverables
     All performance deliverables on track; delivered Tflops-yrs through April: 7.00 (actual) vs 6.98 (goal).
  2. Budget performance on FY08 deliverables
     Steady-state spend rate below linear baseline forecast through April (46% spent with 58% of year consumed). BNL QCDOC requiring significantly less support than anticipated; FNAL effort will ramp up to support FY08 cluster deployment.
  3. **Progress on specific scientific projects**
     On track; specific performance details summarized in FY08-Q3 report.

- Issues and Risks (specific to this activity, includes budget impact)
  1. Procurement and deployment of FY08 cluster at FNAL is major project deliverable. RFI is complete; preparation of RFP and requisition in progress. Critical to keep this moving through system.

Project Activity: SciDAC Lattice QCD

DOE funded project to foster lattice QCD software development and investigations.

Original Goals

3. Automated workflow for LQCD
   - Implement preliminary design
4. Cluster reliability
   - Implement preliminary design
5. 64-bit (Opteron) optimizations
   - Linear algebra libs and validity checks
6. Native Infiniband QMP
   - Preliminary implementation
7. Common runtime environment
   - deployment

Adjusted Goals

2. Automated workflow for LQCD
   - Implement preliminary design for configuration generation
- Cluster reliability
   - Implement sensor scripts and database, preliminary design
4. 64-bit (Opteron) optimizations
   - 64-bit SSE for some linear algebra operations
5. Native Infiniband QMP
   - Deferred: QMP/MPI is already pretty good
6. Common runtime environment
   - Dropped as goal by USQCD software coord. committee

- **Key Milestones**
  - Configuration generation workflow prototype implemented in ruby.
  - Reliability sensor scripts implemented; 10mos of monitoring in relational dB
  - http://whcdf03.fnal.gov/exp/WorkflowProject.html
  - http://whcdf03.fnal.gov/exp/ClusterReliabilityProject.html
  - Metrics: manpower delivered 2.7 FTE/mo (avg)

- **Issues and Risks**
  1. Delivered FTE's at risk from budget constraints and manpower reassignments in CD.

Project Activity: Cosmo Computing

Development and operations of computing for cosmology.

- **Original Goals Related to this Activity**
  1. Integrate hardware ordered in FY07 into the Computational Cosmology Cluster.
  2. Release Computational Cosmology Cluster to production use.

- **Adjusted Goals Related to this Activity**
  1. Integrate hardware ordered in FY07 into the Computational Cosmology Cluster.
  2. Release Computational Cosmology Cluster to production use.
  3. Implement LQCD-like metrics.
  4. Assist in the purchase of components to expand the CC cluster.

Key Metrics

1. Metrics are not currently tracked, and an important goal is to port the LQCD assessment framework to the CC cluster

Milestones

- CC Cluster released to users late January, 2008

Issues and Risks

1. On-going problems with AMD quad-core hardware
2. Job mix requires much more I/O than we were told – critical to deploy a parallel file system (Lustre?) in the coming months to handle the load

Activity: TD RF Cavity Simulations

This activity was not part of the 08 Tactical Plan

Provide MPI computing capability to TD engineers doing accelerator related RF cavity design.

- **Original Goals Related to this Activity**
  1. Understand TD's FY08 computing requirements.
  2. Provide TD engineers an MPI cluster so that they can meet their deadlines.

- **Adjusted Goals Related to this Activity**
  1. Understand TD's FY08-09 requirements.
  2. Expend minimum effort needed to keep MPI cluster running.

- # Key Metrics
  1. Usage since 10/23/07: 1020 jobs, 252K node-hours, 49% utilization
  2. RFSIMS cluster usage http://fnpc275.fnal.gov/

- # Milestones
  - RFSIMS cluster commissioned 2007-10-23

- # Issues and Risks
  1. Activity not budgeted in FY08 and subject to available manpower.

Tactical Plan Issues and Risks

- Action Items
  - Need to plan for the transition from the Cosmos Computing Initiative to a future Cosmos Computing Facility.
  - Strategy for handling requests for high performance computing capability: one-off requests, initiatives, o(yr) projects, facilities.

- Issues and Risks
  - We are running very lean on effort
  - We must meet our OMB300 and SciDAC commitments
    - Deploy J/psi cluster: GCC-C ready on time
   - No extended LCC facility downtime
    - Sufficient FTEs

Tactical Plan Status Summary

- Status Summary
  - FTEs delivered mostly on track
    - QCD clusters have had few major issues the past few months.
    - Some base effort shifted over to Cosmos computing.
    - Bulk of LQCD project deployment effort will come after cancellation of furloughs.
    - SciDAC effort on track (temporary reassignment of L. Piccoli to QCD).
  - M&S spending:
    - Expect bump in base spending on deployment of the new J/psi cluster.
    - LQCD Project EQ Requisition for J/psi cluster purchase is in process.
  - Service and project activities
    - On target to reach goals and milestones for QCD project and SciDAC-II.

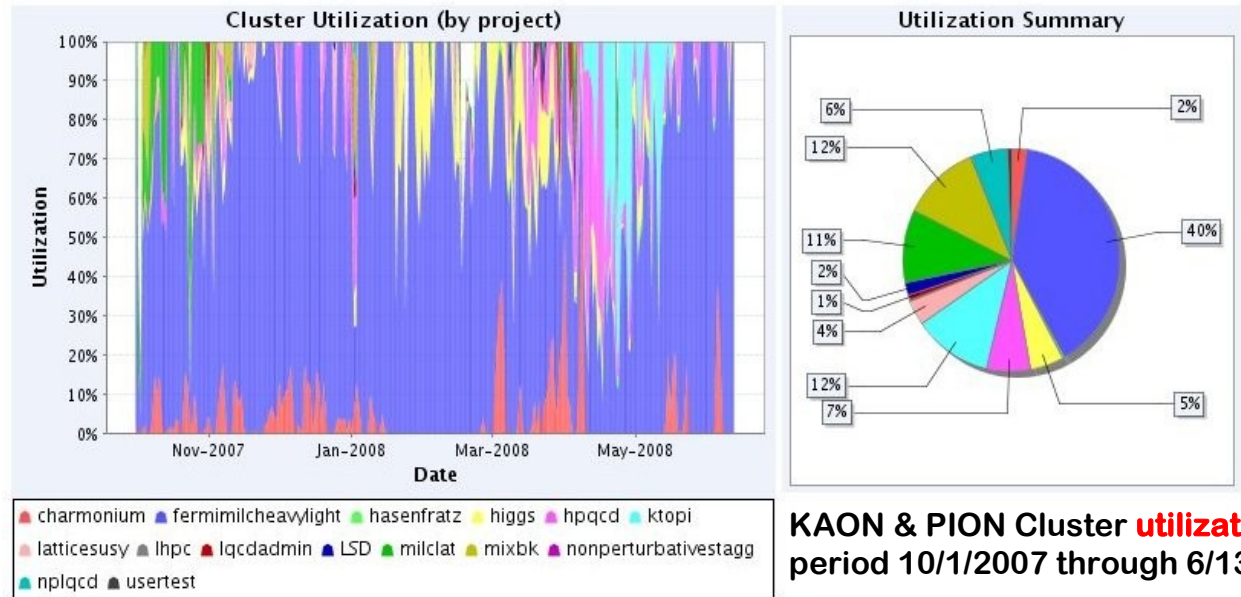# End of status report

Additional supporting slides follow…

Service Activity: LQCD/OMB300/Operations
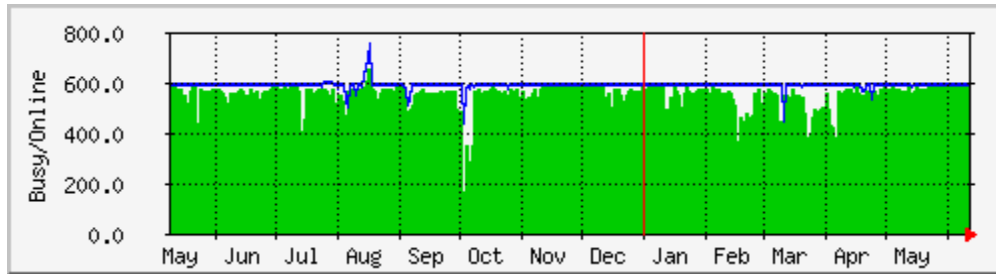
KAON yearly busy nodes plot (uptime)

KAON & PION Cluster utilization for period 10/1/2007 through 6/13/2008

Project Activity: SciDAC QCD Workflow: Goals

- Original
  - Complete evaluation of workflow systems ☺
  - Document simple workflow patterns used by LQCD ☹
  - Work with Askalon and Swift teams to create prototypes ☺
  - Select system to use 😐
  - Develop back and front end systems for workflow systems 😐
  - SuperComputing'07 poster ☺
  - Participate in SciDAC conference ☹
  - Have ConfGen workflow running by July ☺

- Adjusted
  - Detailed analysis of workflow use in ConfGen
  - Selected OpenWFU for prototyping
  - Delayed description of workflow patterns
  - Delayed work with Swift developers
  - Unable to participate in SciDAC conference aiming for posters at e-Science Conference and Lattice'08

Project Activity: SciDAC QCD Workflows: Status

- Workflow evaluation document
  http://whcdf03.fnal.gov/exp/attachments/WorkflowProject/WorkflowEvaluation.doc

- Study of applicability of Askalon and Swift as workflow tools
  - Conclusion: current tools do not fulfill requirements:
    http://whcdf03.fnal.gov/exp/attachments/WorkflowProject/FunctionalRequirements.doc

- Configuration Generation analysis document

- Development of ConfGen management system
  - Recording of data provenance and physics parameter
  - Uses OpenWFE (simple BPM engine), may be used with Swift or Askalon or any other workflow system

- Swift interactions are on hold (until we have a better understanding of our workflow needs)

- OpenWFE + Management System proof of principle is running on a small scale

Project Activity: SciDAC Cluster Reliability: Goals

- Original
  - Chose a messaging/control system ☹
  - Test Clovis on a cluster ☺
  - Reliably record monitoring data ☺
  - Recognize and correct a few problems automatically ☹
  - Instrument MPI to record job completion ☺

- Adjusted
  - Complete architecture and analysis/design document
    - Include essential failure and correction scenarios
    - Define possible worker node states
  - Investigate Clovis, SNMP and ActiveMQ
  - Clovis on hold
  - Implement data handling strategy for monitoring information
  - Enhance monitoring framework to carry out actions
  - Implement web based configuration for monitoring system
  - Review prototype infrastructure (Monitoring DB)

Project Activity: SciDAC Cluster Reliability: Status

- **OpenClovis class**
  - To be used as messaging/control layer
- **Monitoring Database (10 months of data)**
  - Syslog-ng used for monitoring, heartbeat and job status
  - Web access to job and health information
- **Collected failure and corrective action scenarios**
- **Added instrumentation to MPI to track job completion**

Project Activity: Other SciDAC activities

- 64-bit (Opteron) and other optimizations, SSE maintainance
  - Assisted Balint Joo at JLab with conversion of SSE inline assembly macros to more portable complier intrinsics for use in the Chroma application
  - Isolated and found a work-around for a GCC compiler bug/feature that led to incorrect SSE SU(3) algebra results in production MILC code
  - Still need to package and/or refine Cray-supplied 64-bit SSE SU(3) optimizations for Chroma and the SciDAC libraries
- Native Infiniband QMP implementation
  - On indefinite hold since MVAPICH/OpenMPI continue to improve
- Common runtime environment
  - SciDAC software committee considerably relaxed requirements; this work is done except for maintenance
  - BNL/JLab/FNAL implemented web documentation following the common standard agreed-to by the committee

Project Activity: Computational Cosmology: Goals

- Original
    - Integrate hardware ordered in FY07 into the Computational Cosmology Cluster ☺
    - Release Computational Cosmology Cluster to production use ☺

- Adjusted
    - Integrate hardware ordered in FY07 into the Computational Cosmology Cluster ☺
    - Release Computational Cosmology Cluster to production use ☺
    - Solve hardware reliability issues ☹
    - Implement LQCD-like metrics
    - Implement a parallel file system
    - Assist in the purchase of components to expand the CC cluster
    - Integrate new hardware into the CC cluster

Project Activity: Computational Cosmology

- Release CC Cluster to production use
  - Troubles with the AMD quad core processor (virtual memory bug) caused the delivery of cluster nodes to be delayed from October 2007 until January 2008
    - Engineering sample processors were used
  - The full cluster was released to production in late January
  - About 25% of the cluster nodes power off under heavy computational load, believed to be caused by overtemperature
    - AMD acknowledges the issue and will replace all processors with the new stepping
    - The engineering sample processors were 120 Watt parts; the replacement CPUs will be 90 Watt parts
- Implement LQCD-like metrics
  - We want to report uptime, utilization, job failure rates, and so forth
  - Procedures and scripts from LQCD can be used, but available manpower to date has been devoted to reliability issues, and recently, I/O issues

Project Activity: Computational Cosmology

- Implement parallel file system
  - We designed the cluster to accommodate the FNAL MPI codes ("ART"), which are computationally-intensive and not I/O intensive
  - Many of the external users run other code bases which are very I/O intensive
  - The burden on the existing NFS storage infrastructure often leads to unacceptable job performance
  - We believe the solution is to move storage to a set of dedicated nodes, and to use a parallel filesystem like Lustre or PVFS2 to simplify access
  - Will likely release a Lustre protoype to production in the next month

- Cluster Expansion
  - PPD has funds to expand the cluster by 60 dual-socket quad-core Opteron nodes + another 42 Tbyte SATAbeast
  - U.Chicago/KICP would add an additional SATAbeast
  - Expect new hardware by end of FY08