Project Management – Part I

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LQCD Project Progress Review

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Fermilab

Responses to Last Year's Review

- Track external dependencies
  - Added SciDAC, ILDG milestones to each site
  - FNAL computer room construction was already included
- Track storage costs
  - Users were asked to provide estimates of disk and tape usage in FY06/FY07 (allocation year is July-June)
  - FY06 physics production of MILC very fine lattices was slower than predicted, leading to a delay in the onset of the large propagator "bump" into FY07
  - Reassessment of storage costs is ongoing, and physics users are studying ways to plan workflow to lower duration and volume of temporary data products (regenerating if less costly)

Responses to Last Year's Review

- Memoranda of Understanding
  - MOU's were executed with each lab
- Assessing total costs to the labs
  - Measurements and estimates of power and cooling costs were prepared and updated for upcoming year. LQCD historical trends indicated a linear increase in power consumption.

Software

- Software development is out of scope
- Most applications run on the LQCD systems rely on libraries developed under SciDAC Lattice Gauge Computing Project
- Progress since last year's review:
  - Continued evolution of QDP asqtad inverter
  - QIO library development
  - Level-3 interface definition
  - "Force Term" optimizations

Software

- SciDAC-2 Near Term Goals
  - Multicore optimizations
  - Opteron, 64-bit bit optimizations
  - Native QMP implementation for Infiniband (started in SciDAC-1)
  - Automated workflow for analysis computing
  - Monitoring and control of large systems
  - Common runtime environment
  - ILDG/GRID

Scientific Progress – OMB300 PRM Goals

- Improved staggered configurations
  - Goal: 40^3x96 done, 48^3x144 half done at one quark mass, 25% done at a second (1.0 TF-yrs)
  - Achieved to date (through April, 58% of year):
    - 40^3x96 – 2882 of 3000 trajectories done – will easily finish
    - 48^3x144 @ 0.4 – 965 of 1500 done – 64% finished
    - 48^3x144 @ 0.2 – 80 of 470 done – will likely not finish unless heavier mass (0.4) running is suspended at 1500 trajectories; prefer to extend the 0.4 running so that measurements with sufficient statistics can be done earlier

Scientific Progress – OMB300 PRM Goals

- CKM weak decay matrix elements
  - Baseline: 28^3x96 completed
  - Goal: 40^3x96 completed
  - Accomplished to date (through April 2006):
    - D mesons: 28^3x96 complete, complete on 470 existing 40^3x96 configurations (out of 600 expected)
    - B mesons: 20^3x96 and 24^3x64 complete, complete on 470 existinig 40^3x96 configurations (out of 600 expected), about 80% complete on the 28^3x96.

Scientific Progress – OMB300 PRM Goals

- Hybrid calculation of quark structure of nucleon in chiral regime, including GPDs
- Baseline: 0.5 TF-yrs completed
- Goal: 0.8 TF-yrs completed
- Achieved to date (May 15):
  - Goal is 0.3 TF-yrs during FY06
  - To date: 0.189 TF-yrs complete, pace is 0.185 TF-yrs

Scientific Progress – OMB300 PRM Goals

- Calculation of properties of hot hadronic and quark matter in chiral regime
- Goal: 1.0 TF-yrs completed
- Achieved (through April 2006):
  - 0.27 TF-yrs on US QCDOC
  - 0.47 TF-yrs on RBC QCDOC
  - 0.74 TF-yrs total – ahead of pace (0.58 TF-yrs)

Scientific Progress – OMB300 PRM Goals

- DWF configuration generation
- Goal: 24^3x64 at one quark mass completed
- Achieved to date (April 30):
  - Generating at three masses instead of just one
  - Have completed 8000 trajectories; original goal was 5000 trajectories

FY2006 Details

- Performance to date (TF-yrs delivered, goal is 6.2 TF-yrs)

Running Sums	FNAL	Jlab	BNL	Total	Pace	% Pace	Deficit
Oct	0.067	0.069	0.427	0.564	0.612	92%	0.048
Nov	0.122	0.124	0.766	1.011	1.087	93%	0.076
Dec	0.162	0.181	1.108	1.451	1.563	93%	0.112
Jan	0.228	0.237	1.458	1.923	2.038	94%	0.116
Feb	0.303	0.304	1.876	2.483	2.633	94%	0.150
Mar	0.388	0.355	2.226	2.970	3.108	96%	0.138
Apr	0.477	0.426	2.572	3.474	3.584	97%	0.110

- Deployed systems
  - JLab “6n” – 0.3 Tflops (on project), goal 0.2 Tflops
  - FNAL “Kaon” – estimate 1.9 Tflops (on project), goal 1.8 TFlops

Change Control

Level	Cost	Schedule	Technical Scope
LQCD Program Manager (Level 0)	Any increase in the total project cost	3-month or more delay of a Level 1 milestone date	Change of any WBS element that could adversely affect performance specifications
LQCD Change Control Board (Level 1)	A cumulative increase of more than $125K in WBS Level 2	> 1-month delay of a Level 1 milestone date or > 3-month delay of a Level 2 milestone date	Any deviation from technical deliverables that does not affect expected performance specifications
LQCD Contractor Project Manager (Level 2)	Any increase of > $25K in the WBS Level 2	> 1-month delay of a Level 2 milestone date	Technical design changes that do not impact technical deliverables.

Change Control

- JLab FY2006 Cluster (“6N”)
  - Baseline agreement from August review response was to purchase a Fermilab “Pion” clone
    - “Pion” = single socket, single core Pentium 640
  - Joint benchmarking at JLab and FNAL in November showed that dual core Pentium 820D or 830D could be more cost effective
    - Could only test single nodes, not cluster performance
    - Unclear how much competition for Infiniband would hinder performance
    - Conservative estimates indicated a win
    - Level 1 change control triggered (technical scope)

Change Control, cont'd

- JLab proposal to CCB (Dec 2005):
  - JLab would use its 2005 SciDAC funds and base contributions to build a dual core Pentium 820D SciDAC cluster by February 2006
  - If the SciDAC cluster proved more cost effective than "Pion", JLab would exercise options on RFP to purchase an additional 128 nodes on project
  - If not, JLab would build a 128 node "Pion" clone, issuing an RFQ by late February
- February testing of the SciDAC cluster resulted in acceptance of the change by CCB

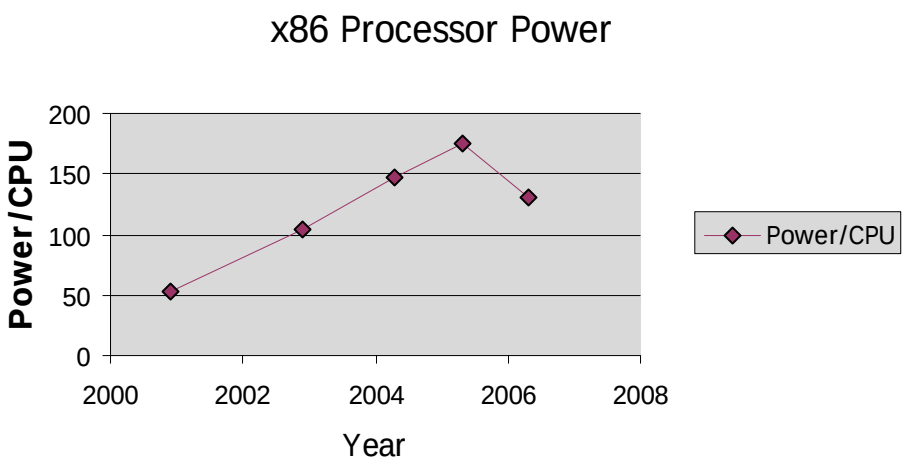
Backup Slides

Storage Needs for FY07 Allocation

P.I.	Disk (GB)	Tape (TB)	Type	Node-Hrs	Where
Catterall	10	0.0	Clusters	0.15	FNAL
Christ	2000	0.0	QCDOC	26.23	BNL
Dudek	50	0.0	Clusters	0.50	JLab
Edwards	20	0.0	Clusters	0.24	FNAL
Juge	400	0.0	Clusters	0.29	FNAL
Kronfeld	10000	50.0	Clusters	4.20	FNAL
Lepage	10	0.0	Clusters	0.70	FNAL
Liu	1000	0.0	Clusters	0.30	JLab
Negele	2000	45.0	Clusters	3.50	JLab
Osborn	100	1.0	Clusters	0.25	FNAL
Petreczky	2250	0.0	QCDOC	14.14	BNL
Richards	3000	0.0	QCDOC	11.60	BNL
Richards	3000	27.0	Clusters	0.88	FNAL
Sharpe	200	0.8	QCDOC	1.20	BNL
Sugar	10	0.0	QCDOC	34.70	BNL
Sugar	10	12.4	Clusters	2.00	FNAL
Wilcox	24	0.1	Clusters	0.26	JLab
Total	24084	136.3			
Disk Cost	$30,105				
Tape Cost	$51,796	(9940B)	$24,535	(LTO-3)	

LQCD Power Trends

What	Year	Power/Node	Performance	Performance/Watt
700 Mhz P-III	2000.9	53	60	1.13
2.4 Ghz Xeon	2002.9	104	600	5.77
2.8 Ghz P4E	2004.3	147	1208	8.22
3.2 Ghz P4 640	2005.3	176	1662	9.44
Opteron 280	2006.3	130	1930	14.85



LQCD Cluster Power Costs

FNAL – Linear										
	Node Cnt	Power/Node	Total Node Power	Cooling Power	Cooling Power	Total Power	Cost Basis	Operating Months	Cost	Total Cost
		Watts	Kwatt	Kwatt	Tons	Kwatt	$/Kwatt-Hr		K$	K$
FY2006	128	160	20.5	14.3	4.1	34.8	$0.052	12	$15.9	
	520	176	91.5	64.1	18.2	155.6	$0.052	12	$70.9	
	500	260	130.0	91.0	25.9	221.0	$0.052	3	$25.2	
		Totals	242.0	169.4	48.2	411.4				$111.9
FY2007	128	160	20.5	14.3	4.1	34.8	$0.075	12	$22.9	
	520	176	91.5	64.1	18.2	155.6	$0.075	12	$102.2	
	500	260	130.0	91.0	25.9	221.0	$0.075	12	$145.2	
		Totals	242.0	169.4	48.2	411.4				$270.3
FY2008	520	176	91.5	64.1	18.2	155.6	$0.078	12	$106.3	
	500	260	130.0	91.0	25.9	221.0	$0.078	12	$151.0	
	360	350	126.0	88.2	25.1	214.2	$0.078	3	$36.6	
		Totals	347.5	243.3	69.2	590.8				$293.9
FY2009	500	260	130.0	91.0	25.9	221.0	$0.081	12	$157.0	
	360	350	126.0	88.2	25.1	214.2	$0.081	12	$152.2	
	150	350	52.5	36.8	10.4	89.3	$0.081	3	$15.9	
		Totals	308.5	216.0	61.4	524.5				$325.1
Jlab – Linear										
FY2006	256	130	33.3	23.3	6.6	56.7	$0.045	12	$22.3	
	384	208	80.0	56.0	15.9	136.0	$0.045	12	$53.6	
	280	200	56.0	39.2	11.1	95.2	$0.045	6	$18.8	
		Totals	169.3	118.5	33.7	287.8				$94.7
FY2007	384	208	79.9	55.9	15.9	135.8	$0.047	12	$55.7	
	280	200	56.0	39.2	11.1	95.2	$0.047	12	$39.0	
	400	350	140.0	98.0	27.9	238.0	$0.047	6	$48.8	
		Totals	275.9	193.1	54.9	469.0				$143.5
FY2008	384	208	79.9	55.9	15.9	135.8	$0.049	12	$57.9	
	280	200	56.0	39.2	11.1	95.2	$0.049	12	$40.6	
	400	350	140.0	98.0	27.9	238.0	$0.049	12	$101.5	
		Totals	275.9	193.1	54.9	469.0				$200.0
FY2009	384	208	79.9	55.9	15.9	135.8	$0.051	12	$60.2	
	280	200	56.0	39.2	11.1	95.2	$0.051	12	$42.2	
	400	350	140.0	98.0	27.9	238.0	$0.051	12	$105.5	
		Totals	275.9	193.1	54.9	469.0				$208.0