

# Integration and Costing Plan for the University of Illinois/NCSA into the ATLAS Midwest Tier 2 Center

**V2: 12-1-2010**

## 1. Introduction

We present here an initial plan for integrating the University of Illinois and NCSA into the MWT2 consortium. To date we have focused mainly on determining the costs and commitments from the University and have indicated their impact separately and as integrated into the MWT2 facility in both effort and realized capacities.

## 2. Midwest Tier2 Infrastructure at Illinois

At the University of Illinois at Urbana-Champaign, the MWT2 will be hosted in the Advanced Computation Building (ACB) located at 1011 W. Springfield Avenue in Urbana, which is a stone's throw from the Loomis Laboratory of Physics. The ACB houses NCSA's specially designed machine room and most of the Center's high-performance computing and storage systems. The facility also includes conference space and NCSA's Help Desk. The ACB consists of three main rooms totaling 16,400 sq. ft. of raised floor, 4.5 MW of power capacity, 250 kW UPS, and 1,500 tons of cooling capacity. The MWT2 will be located in Room 200, which is 7,000 sq. ft. (no columns), has a 70" raised floor, 2.3 MW power capacity, and 750 tons of cooling capacity. The MWT2 resource will be part of the Illinois Campus Cluster (ICC). The floor space, racks, power, cooling, network infrastructure, regional provider connectivity fees, and staffing for core infrastructure support are provided through campus funds that subsidize the operation and maintenance of the ICC resource.

## 3. Storage at Illinois

The model for the ICC is that researchers buy the disk drives (currently 2 TB 7200 RPM 3.5 SATA) that get plugged into a DataDirect Networks (DDN) S2A9900 high-performance storage system. The S2A9900 is designed to handle up to 2.4 petabytes of storage in a rack occupying two floor tiles and deliver sustained, real-time throughput of up to 5 GB/s. Data delivery from the DDN storage units will be managed by GPFS in a Raid 6 configuration. The GPFS licenses are provided by the campus. At current pricing, we would be able to buy storage for exclusive use by the Tier-2 at \$225 / TB (raw). The Dell storage system we would by today currently costs \$233 / TB (raw), which implies a 3.4% savings to buy storage in the ICC assuming today's best prices.

## 4. Staffing at Illinois

The total staffing level for the MWT2 at Illinois comes from both the high energy physics group in the physics department, and the NCSA and will be at a level of 1.25 FTE on average. NCSA will provide 1/3 FTE for core infrastructure support and 1/3 FTE to support the ATLAS Tier-2 "application" on the ICC which includes ATLAS/OSG specific integration tasks. The remaining support comes from the HEP group for Dave Lesny. Dave has decades of experience in HEP computing and has deployed and currently operates a T3gs cluster in Loomis Laboratory that is functionally equivalent to an ATLAS Tier-2 site and regularly runs a mixture of production and user analysis jobs. Our current plan is to support Dave with MWT2 project funds at .25 FTE for years 1 and 2, increasing to 0.5 FTE in years 3-5, with the remainder of his salary picked up by the ATLAS task on the DOE HEP Grant. Dave will continue to provide consultation to the Illinois HEP group but his primary responsibility will be MWT2.

Table 1 Illinois staffing plan (FTE units)

	2011-12	2012-13	2013-14	2014-15	2015-16	AVG
NCSA-ICC-Core	0.33	0.33	0.33	0.33	0.33	0.33
NCSA-ATLAS	0.33	0.33	0.33	0.33	0.33	0.33
DL DOE HEP	0.25	0.25	0.15	0.15	0.15	0.19
DL MWT2-Project	0.25	0.25	0.5	0.5	0.5	0.4
<b>TOTAL</b>	<b>1.16</b>	<b>1.16</b>	<b>1.31</b>	<b>1.31</b>	<b>1.31</b>	<b>1.25</b>

## 5. Illinois Budget Summary

The table below summarizes the above contributions and staffing at Illinois over the 5-year project period. We have assumed the same 3% annual increase in personnel cost and have included as well estimates for “non-computing” equipment that may be needed to integrate the compute and storage resources at the ICC fully into MWT2. This would include any local head node servers, file servers for local squid caches, any additional network equipment, etc. As we get further into the details of the technical integration these costs will become better known. For now the estimates should be pretty good, as they are based on experience at the other MWT2 sites.

Table 2 Illinois budget and contributions

Illinois	2011-12	2012-13	2013-14	2014-15	2015-16
Budget	\$300,000	\$304,500	\$309,068	\$313,704	\$318,409
NCSA-ATLAS Salary (1/3 FTE @ \$70,000)	\$23,333	\$24,033	\$24,754	\$25,497	\$26,262
Fringe (35.59%)	\$8,304	\$8,553	\$8,810	\$9,074	\$9,347
DL Salary (.25,.25,.15,.15,.15 FTE @ \$85,174)	\$21,294	\$21,932	\$13,554	\$13,961	\$14,380
DL Salary (.25,.25,.5,.5,.5 FTE @ \$85,174)	\$21,294	\$21,932	\$45,181	\$46,536	\$47,932
Travel	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
M&S	\$500	\$500	\$500	\$500	\$500
Overhead (58.5%)	\$13,919	\$14,293	\$27,893	\$28,686	\$29,503
"Personnel" loaded total	\$37,713	\$38,725	\$75,574	\$77,722	\$79,935
Network, headnodes, etc	\$25,000	\$5,000	\$5,000	\$10,000	\$5,000
Total "non-equipment"	\$62,713	\$43,725	\$80,574	\$87,722	\$84,935
Equipment (CPU,TB)	\$237,287	\$260,775	\$228,494	\$225,982	\$233,474
"Non-equipment" fraction	21%	14%	26%	28%	27%
3% IDCR	\$418	\$429	\$837	\$861	\$885

We have assumed also 1.5% increase in the nominal \$300K/y even if the average “non-equipment” fraction is lower than other Tier2 sites. The shaded blue figures indicate Illinois/NCSA personnel contributions (NCSA-core, NCSA-ATLAS which come from a cost sharing contribution from the College, and the HEP DOE group contributions). We also have included a row indicating a small contribution from the College for 3% of indirect costs returned for miscellaneous expenses.

## 6. Integrated MWT2 Costing and Capacities

The table below shows the fully integrated costing plan for MWT2 including the new Illinois/NCSA contributions. As before the blue shaded rows represent University contributions (from all three) and NCSA. Note the Illinois effort contributions are of three types: dedicated ATLAS-Tier2 staff, NCSA-ATLAS integration staff, and ICC core infrastructure. Also shown are the NCSA disk supplements and additional return on indirect costs.

Table 3 Integrated Costing Plan for MWT2

	2011-12	2012-13	2013-14	2014-15	2015-16
Budget (1.5% annual increase)	\$900,000	\$913,500	\$927,203	\$941,111	\$955,227
Projections	AVG burdened effort: \$439,391				
Personnel: UC,IU (project funded)	\$355,479	\$366,143	\$377,128	\$388,441	\$400,095
Personnel:UI (project funded)	\$37,713	\$38,725	\$75,574	\$77,722	\$79,935
Personnel total: (project funded)	\$393,192	\$404,869	\$452,701	\$466,163	\$480,029
Personnel (UC paid)	\$56,546	\$58,242	\$59,990	\$61,789	\$63,643
Personnel (IU paid)	\$35,000	\$35,000	\$35,000	\$35,000	\$35,000
Personnel (NCSA-ICC-core staff)	\$26,560	\$26,560	\$26,560	\$26,560	\$26,560
Personnel (NCSA-ATLAS staff)	\$31,638	\$32,587	\$33,564	\$34,571	\$35,608

	2011-12	2012-13	2013-14	2014-15	2015-16
Network, headnodes, etc	\$50,651	\$30,651	\$30,651	\$35,651	\$30,651
Total "non-equip" (project)	\$443,842	\$435,519	\$483,352	\$501,814	\$510,680
Subcontracts overhead (year 1)	\$14,000				
Equipment	\$442,158	\$477,981	\$443,851	\$439,297	\$444,547
Disk supplement (NCSA)	\$3,417	\$3,755	\$3,290	\$3,254	\$3,362
Equipment supplement (Illinois Dean, 3% IDCR)	\$418	\$429	\$837	\$861	\$885
compute %	40%	40%	40%	40%	40%
storage %	60%	60%	60%	60%	60%
CPU \$	\$177,030	\$191,364	\$177,875	\$176,063	\$178,173
Disk \$	\$268,962	\$290,801	\$270,103	\$267,348	\$270,621
CPU \$/HS06	\$14.29	\$11.34	\$9.00	\$7.14	\$5.67
Disk \$/TB	\$216.68	\$171.98	\$136.50	\$108.34	\$85.99
CPU HS06 purchased	12,391	16,876	19,764	24,647	31,426
CPU HS06 removed	8,519	4,921	18,333	6,233	12,391
Disk TB purchased	1,241.3	1,690.9	1,978.8	2,467.7	3,147.1
Disk TB removed	298.0	946.0	-	572.2	1,241.3
Job slots purchased	1,377	1,875	2,196	2,739	3,492
Job slots removed	(1,293)	(520)	(2,037)	(693)	(1,377)
HS06	<b>40,618</b>	<b>52,574</b>	<b>54,004</b>	<b>72,419</b>	<b>91,453</b>
TB (useable)	<b>2,760</b>	<b>3,504</b>	<b>5,483</b>	<b>7,379</b>	<b>9,285</b>
Job slots	4,314	5,670	5,828	7,875	9,989
HS06 required (high)	45,900	53,100	62,400	78,600	98,700
HS06 required (low)	26,700	36,300	48,900	63,000	77,100
TB required (high)	3,990	5,430	7,230	9,600	11,400
TB required (low)	3,000	4,110	5,790	7,650	8,700
University contributions	\$153,161	\$152,818	\$155,951	\$158,781	\$161,697
Non-equipment fraction	49%	48%	52%	53%	53%

We've included the non-equipment fractions for the integrated center, higher obviously due to existing MWT2 staff at UC and IU. Note that as before we will follow a shared administrative model, meaning that all MWT2 project staff support services and operations at each of the three sites, making a unified MWT2 federation.

The comparison with required high/low HS06 and TB-(useable) requirements with this plan is shown in the plots below. The installed capacities are the blue curves. Clearly the CPU provisioning is in good shape throughout, while the useable storage projections are on the low-range of the ATLAS requirements. Here the requirements are for a 1.5 x nominal Tier-2 scale in the U.S. cloud context. This is a significant improvement in effectiveness over MWT2 in its original form, due to the lower personnel costs to the project at Illinois/NCSA.

Table 4 Direct university contributions to MWT2 for staff and equipment (does not include infrastructure costs for space, power, cooling, wide area network connectivity, etc.)

University staff and equipment contributions (5y)	
\$300,210	UChicago
\$175,000	Indiana
\$132,800	Illinois-NCSA-ICC-core
\$167,969	Illinois-NCSA-ATLAS
\$17,079	Illinois-Disk
\$3,429	Illinois-IDC

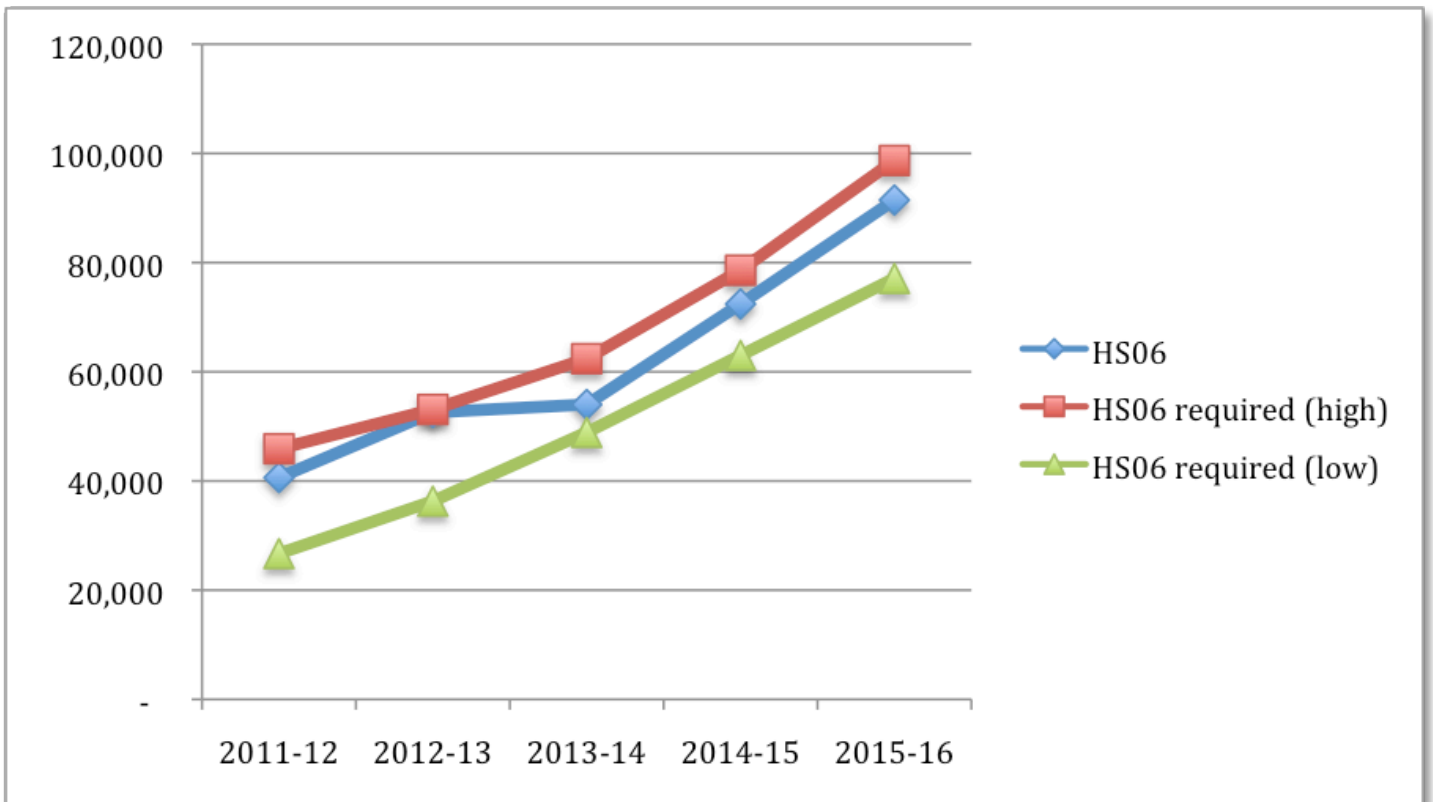


Figure 1 MWT2 installed CPU capacity in HS06 units versus high/low requirements for a 1.5x nominal Tier-2.

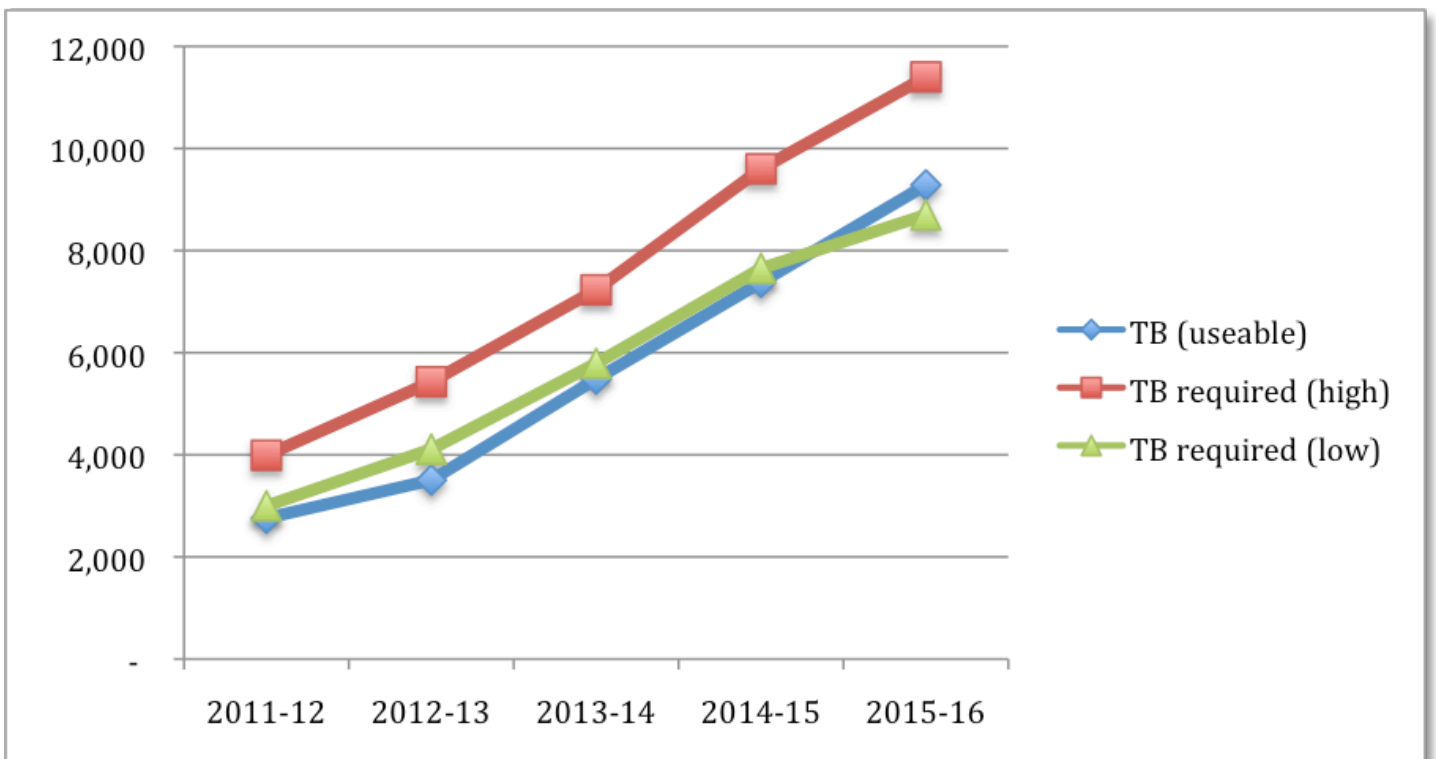


Figure 2 MWT2 installed useable disk capacity (TB) compared to high/low requirements for a 1.5x nominal Tier-2.