DOSAR

Grids on Campus Workshop
October 2, 2005

Joel Snow
Langston University

Outline

- What is DOSAR?
- History of DOSAR
- Goals of DOSAR
- Strategy of DOSAR
- DOSAR Achievements
- Perspectives
- Conclusions

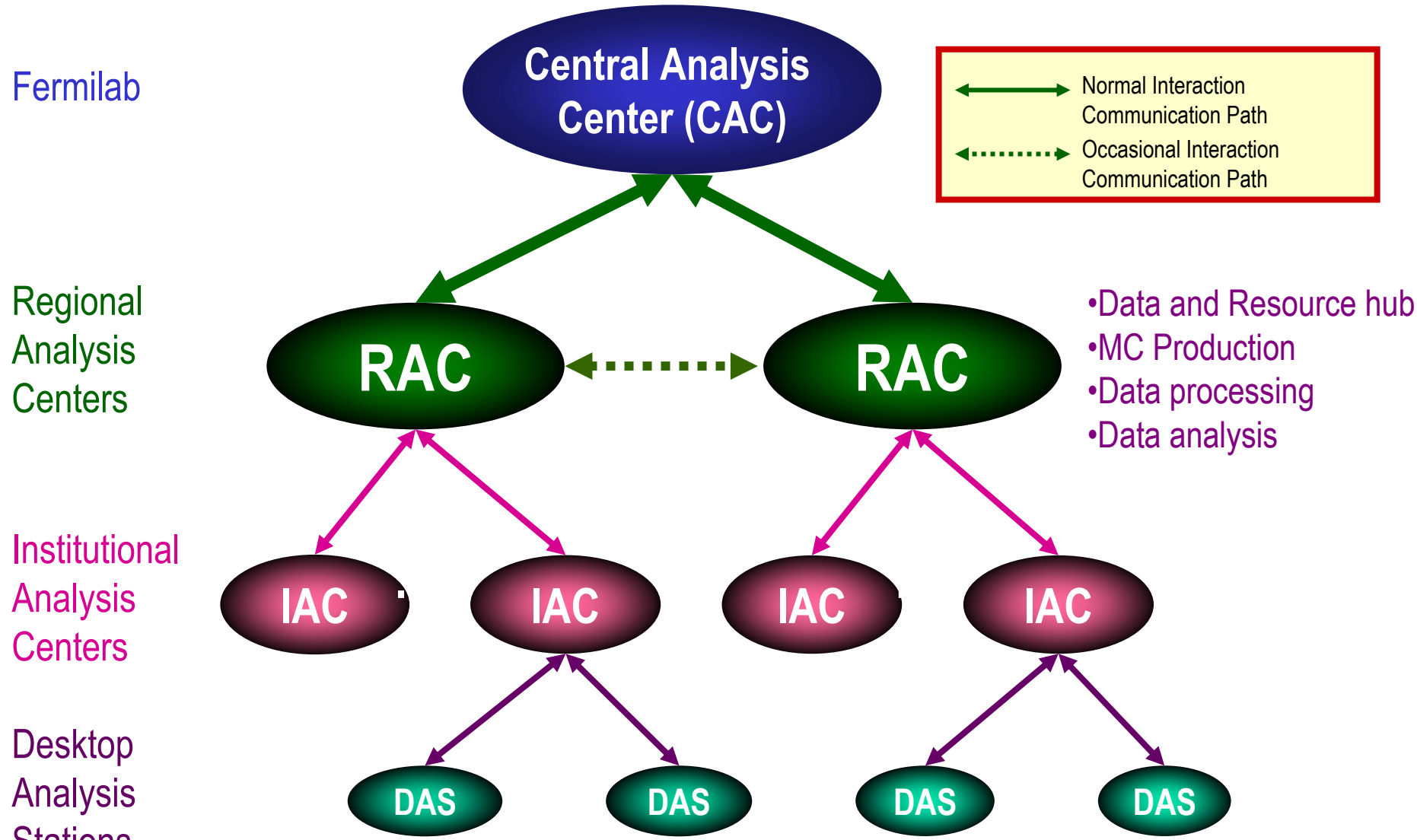
What is DOSAR?

- Distributed Organization for Scientific and Academic Research
  - It is a community and campus based grid organization
    - DOSAR in Korean is a Grand Master of Martial Arts or more broadly an entity with a much higher level of mind power
- Initially organized for distributed production and analyses in DØ experiment
- DOSAR is built upon a DØ Remote Analysis Model
  - Utilizes resource hubs, Regional Analysis Centers (RACs) equivalent to LHC Tier 2 Centers
- Playing leadership roles in realization of computing grids in corresponding campuses and states

DOSAR History

- DØ Remote Computing Era
  - SAM, DØ data management system, in place: pre-2001
  - DØRACE and DØGrid teams formed: Sept. 2001
  - DØ Remote Analysis Model Proposed: Nov. 2001
  - Proposal for RAC accepted and endorsed by DØ: Aug. 2002
  - UTA awarded MRI for RAC: June 2002
  - Prototype RAC established at Karlsruhe: Aug. – Nov. 2002
  - Formation of DØ Southern Analysis Region: Apr. 2003
    - DOSAR DØ MC Production begins (McFarm/SAM)
  - Activation of 1st US RAC at UTA: Nov. 2003
  - Formation and activation of DØSAR Grid for MC: Apr. 2004
    - SAMGrid/McFarm $\rightarrow$ pure SAMGrid

DØ Remote Analysis Model (DØRAM)



DOSAR History

- Beyond the DØ experiment boundary era
  - Transition to Distributed Organization for Scientific and Academic Research, DOSAR: Apr. 2005
    - Active engagements with LHC experiments begun
  - Three DOSAR sites start participate in DØ data reprocessing: May 2005
  - DOSAR VOMS installed at UTA: May 2005
  - DOSAR registered as a VO in OSG: July 2005
  - ATLAS distributed analysis system, DIAL, interfaced to PBS and implemented at UTA: Aug. 2005
  - US ATLAS production system, PanDA, under development at UTA and OU

DOSAR Consortium

- **First Generation IAC's**
  - ✓ University of Texas at Arlington
  - ✓ Louisiana Tech University
  - ✓ Langston University
  - ✓ University of Oklahoma
  - ✓ Tata Institute (India)
- **Second Generation IAC's**
  - – **Cinvestav, Mexico**
  - √ **Universidade Estadual Paulista (Brazil)**
  - √ **University of Kansas**
  - √ **Kansas State University**
- **Third Generation IAC's**
  - **Ole Miss, MS**
  - – **Rice University, TX**
  - – **University of Arizona, Tucson, AZ**

Primary Goals of DOSAR

- **Harness** for common grid use a diverse set of **human and computing resources previously unavailable**
- **Empower offsite remote users with desktop data analysis capability** as if they are at the experiment
- **Prepare all involved institutions to perform data analysis using grid technology** on DØ and future HEP experiments such as the LHC experiments, CMS and ATLAS
- Collaborate to use cutting edge **grid technology to promote a wide range of interdisciplinary and educational activities** within the member regions

Primary Goals of DOSAR

- **Communicate and disseminate accumulated experiences** with real large-data analyses to the grid community for the benefits of future HEP experiments and society as a whole.
- **Strongly participate in global grid efforts** such as OSG or EGEE to contribute to the development of grid resources and technology, utilizing a mixture of dedicated and desktop resources.
- Exploit grid projects and international research collaborations to **develop a highly trained technical workforce** within the member regions.

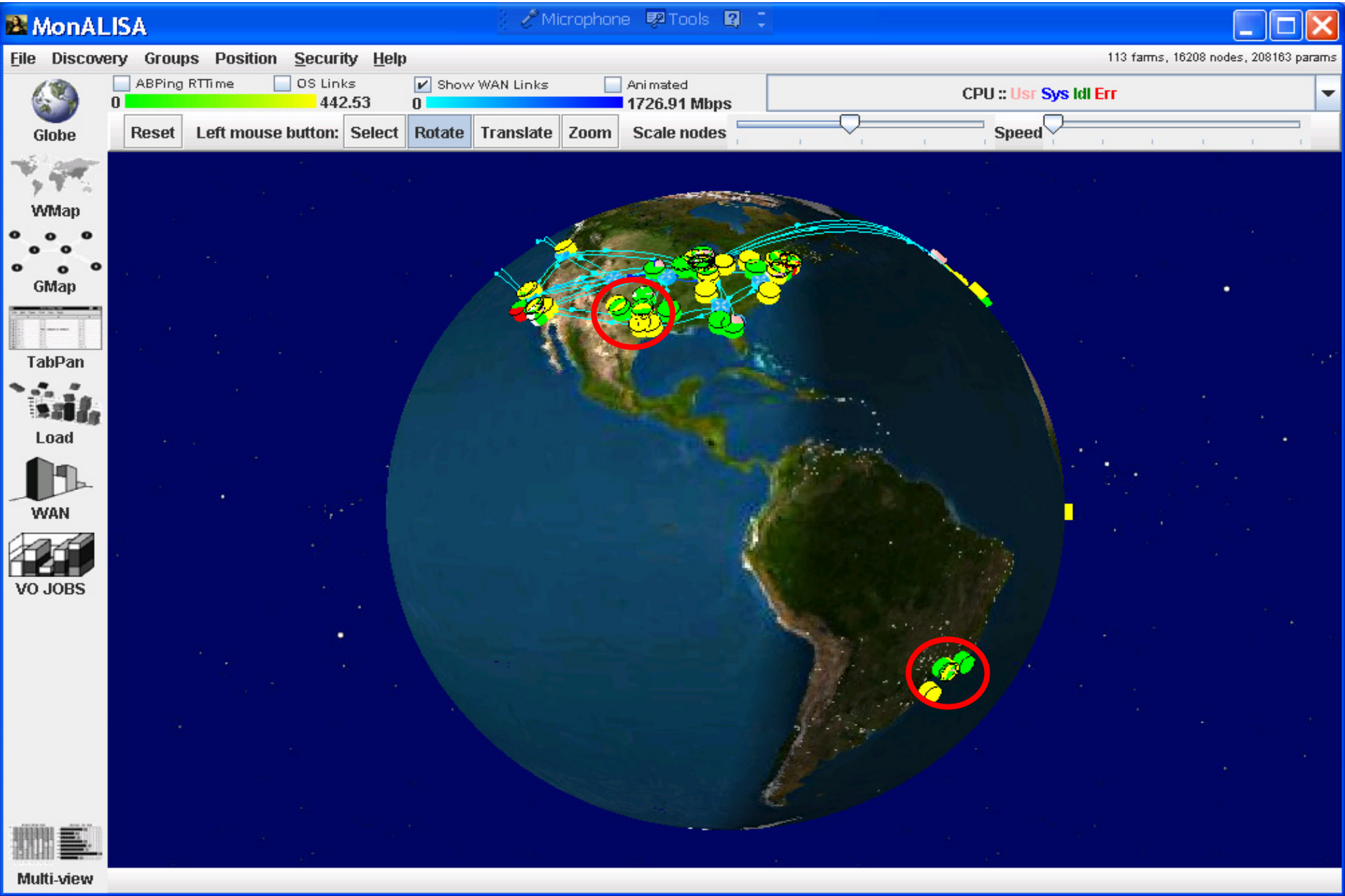
DOSAR Strategy

- Maximally exploit existing software and utilities to enable as many sites to contribute to the DØ and LHC experiments
  - Install SAMGrid and OSG infrastructures
  - Submit MC production and reprocessing jobs through SAMGrid
  - Implement OSG to move into the new, global grid framework
  - Participate in the Data Challenges of the LHC experiments
    - OSG production sites and integration test bed sites
  - Engage and contribute significantly in grid application development for LHC and DØ
  - Utilize existing distributed analysis framework for LHC and DØ data analyses at individual's desk
- Engage in realization of computing grid beyond HEP to Society
- Want to make everyday lives better

DOSAR Accomplishments

- The only established US analysis region within DØ
- Constructed and activated a Regional Analysis Center
- Formed and activated six new MC production farms
- Data access capability implemented in 70% of the sites
  - These sites are doing data analysis
- Employed, developed and implemented many useful monitoring tools
  - Ganglia, MonaLISA, ACDC, GridCat
  - McFarmGraph, McPerM, McQue, and McFarmDB
- Demonstrated OSG and SAMGrid interoperability

Monitored through MonALisa as an OSG VO



MonALISA

MONitoring Agents using a Large Integrated Services Architecture

DOSAR DØ Reprocessing

- Three DOSAR sites participated in DØ Reprocessing
  - 1 billion events, 250 TB data, done using SAMGrid on 3 continents
- UTA DPCC started in May 2005
  - The first site to transfer 6TB of data
- OSCER started late May 2005, shortly after UTA
  - A great accomplishment since OSCER is a general purpose cluster; Opens vast resources for use in HEP
- SPRACE certified and started in late July 2005
  - High utilization of the upgraded network of 622Mbits/sec

P17 Reprocessing Status

DØ P17 Reprocessing - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

Address http://www-d0.fnal.gov/computing/reprocessing/p17/ Go Links

P17 Reprocessing

Mike Diesburg (diesburg@fnal.gov)
Daniel Wicke (wicke@fnal.gov)

Participating sites

FNAL Farm, CMS-Farm, GridKa, Lyon, Prague, D0SAR, UK, Westgrid.

Overall status

P17 Reprocessing Status as of 30-Sep-2005 (all sites)

Total Raw Events	**986190444**	
Processed Events	**898661806**	
Sites	**fnal FNAL OSCER FZU_GRID WestGrid ccin2p3 GridKa UTA-DPCC Wisconsin IMPERIAL_PRD CMS-FNAL-WC1 SPRACE**	

P17 Reprocessing Status as of 30-Sep-2005 (Remote sites only)

Processed Events	**767363385**	
Sites	**fnal FNAL OSCER FZU_GRID WestGrid ccin2p3 GridKa UTA-DPCC Wisconsin IMPERIAL_PRD CMS-FNAL-WC1 SPRACE**	

Internet

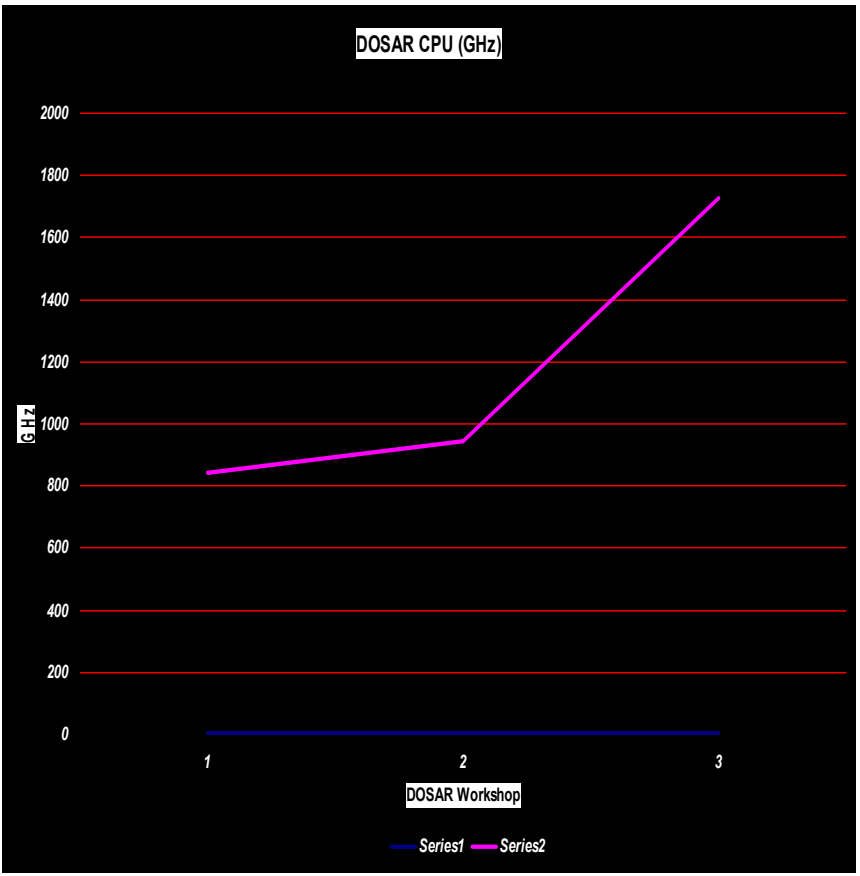
DOSAR DØMC and Reprocessing Stat.

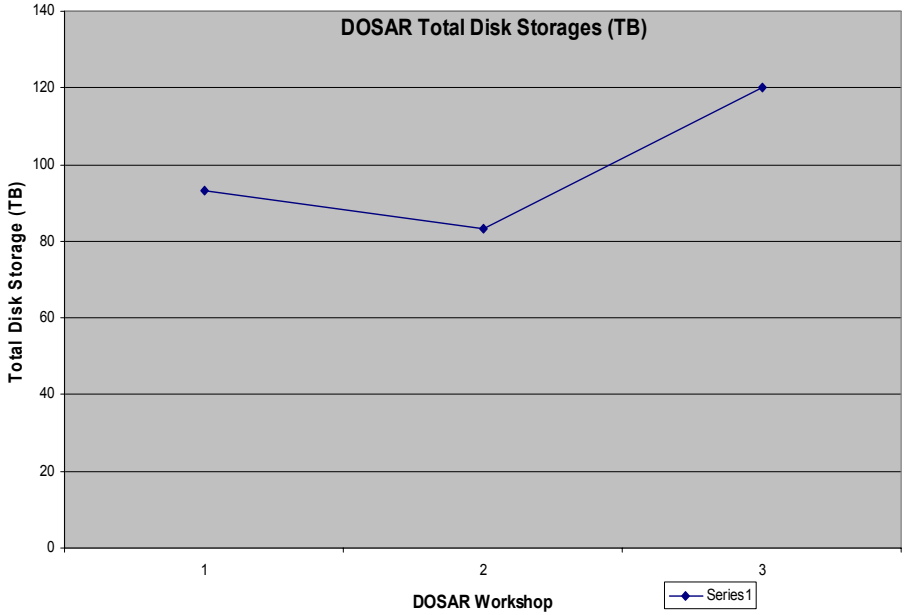
Institution	Inception	N_{MC} (TMB) x10^6	$N_{Repro.}$ x10^6
LTU	**6/2003**	**0.9**	0
LU	**7/2003**	**2.1**	0
OU	**4/2003**	**2.6**	12.6
Tata	**6/2003**	**3.5**	0
SPRACE	**4/2004**	**4.3**	9.1
UTA-HEP	**1/2003**	**4.2**	0
UTA–RAC	**12/2003**	**11.0**	30.8
Total	As of 9/30/05	28.6	52.5

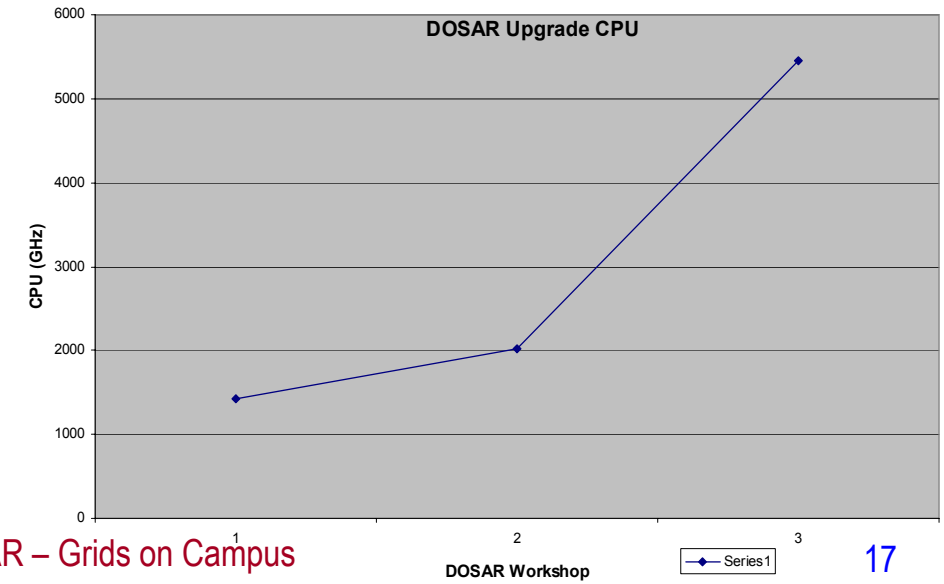
DOSAR Computing Resources and Users

Institutions	CPU(GHz) [future]	Storage (TB)	Analysis Users
Cinvestav	13	1.1	1
Langston	22+[60]	2.5	1
LTU	33+[192]	0.8	3
KU	12	2.5	2
KSU	40	3.5	0
OU	570+[3277]	5.4 + 120(tape)	6
São Paulo	315+[230]	14.8	4
Tata Institute	64+[28]	3.8	3
Ole Miss	163	10	2
UTA	510	74	5
Total	**1742 + [3787]**	**120 + 120 (tape)**	**25**

DOSAR Resource Trends (9/2004 – 9/2005)







What did we accomplish in DØ?

- ✓ Construct end-to-end service environment in a smaller, manageable scale
- ✓ Train and accumulate local expertise and share them
- ✓ Form a smaller group to work coherently and closely
- ✓ Draw additional resources from variety of funding sources
  - ✓ Promote interdisciplinary collaboration – HEP & CS
- ✓ Increase intellectual resources for the experiment
  - ✓ Enable remote participants to more actively contribute to the collaboration
- ✓ Form a grid and use it for DØ and LHC experiments
  - ✓ MC production
  - ✓ Re-processing
  - – **Analysis**
- ✓ Promote and improve IAC's group stature

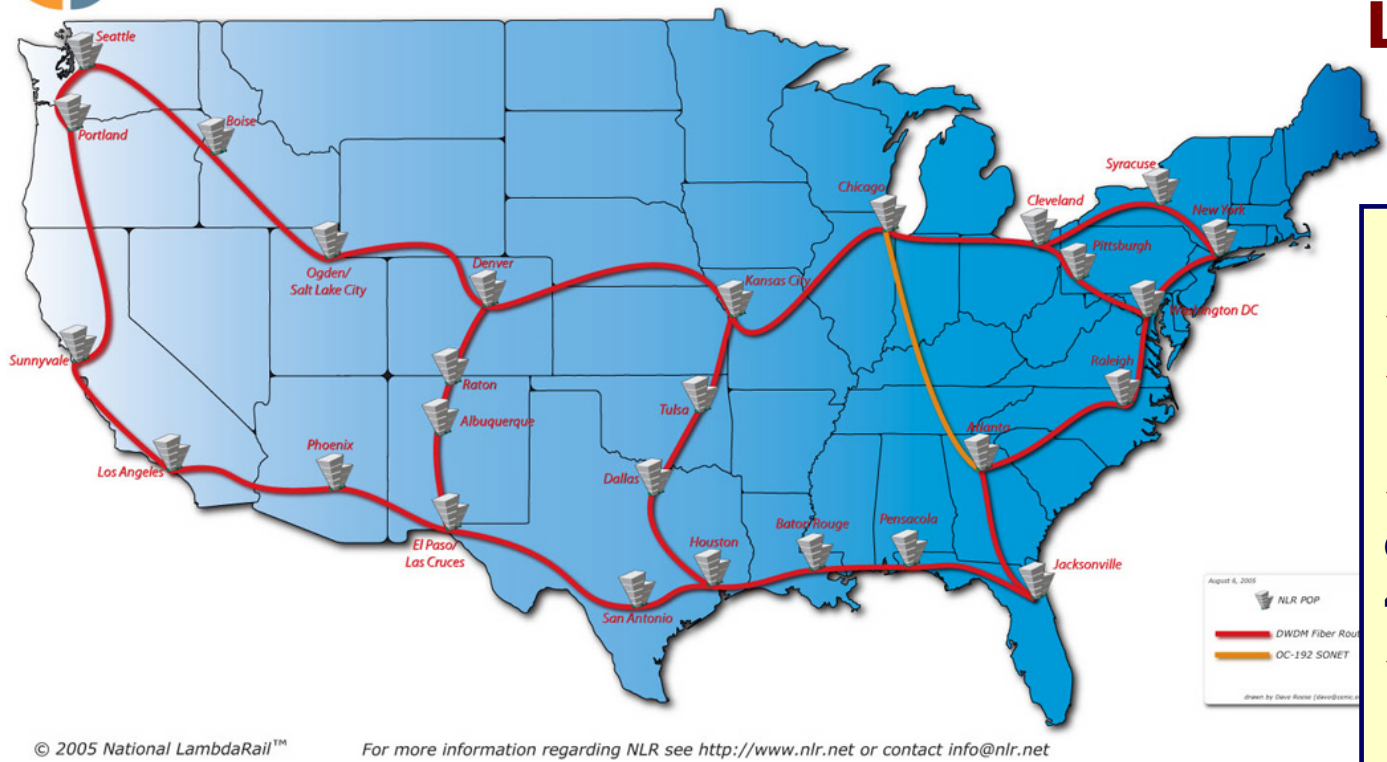
Some Successes in Funding at DOSAR

- Funds from NSF MRI for UTA – RAC: 2002
  - Construction of the first U.S. university based RAC
- EPSCoR + University funds for LTU – IAC: 2003
  - Increase IAC computing resources
- São Paulo state funds for SPRACE: 2003 & 2005
  - Construction of an extensive RAC for Brazil
  - Greater international networking bandwidth
- EPSCoR funds for OU & LU: 2004
  - Compute resources for IAC
  - Human resource for further development
- LTU as part of LONI wins support from State of LA: 2005
- OU, LU and UTA, together with UNM, won a joint ATLAS Tier 2 site: 2005

Network Bandwidth Upgrade

- Large current and anticipated bandwidth needs identified
  - UTA, OU and SPRACE participated in DØ reprocessing
  - LHC data transfer demands significant upgrades
    - The ATLAS SW Tier 2 will draw a constant background bandwidth usage of 2GBits/sec
  - The minimum bandwidth gets determined by the number of CPU's at a local site
  - Good for the states since large bandwidths are needed to improve communication for helping everyday lives (video calls via ethernet)
- University and states to keep up with the needs
  - UTA, Rice: 45MB/sec ➔ 1GB/Sec ➔ 10GB/sec (via Texas LEARN project)
    - A talk was given to LEARN organization for anticipated network usage of an LHC Tier 2
  - OU, LU: 1GB/sec ➔ 10GB/sec (NLR)
  - SPRACE: 45MB/sec ➔ 622MB/sec ➔2.5GB/sec (international)
  - LONI: A connection to NLR at 10GB/sec
  - Ole Miss: 155MB/sec ➔ 10GB/sec university network

National Lambda Rail (NLR)



NLR

- Coming Up Now
- Initially 4 10G Wavelengths
- Phase 2 completed by 4Q05
- Internet2 HOPI Initiative (w/HEP)
- To 40 10G Waves in Future

Transitioning **now to optical, multi-wavelength Community owned or leased "dark fiber" networks for R&E**

- nl, ca, pl, cz, uk, ko, jp
- 20 US States

Contributions to OSG/LCG

- Expertise in monitoring solutions such as Ganglia and MonALISA.
- Testing of framework, middleware, and user interfaces.
- Experience with interoperability issues, as faced between OSG and SAMGrid.
- Active participation in OSG integration and deployment activities.
- Partnering with high-speed optical network initiatives.
- Help implement and utilize grid computing technology for educational use.
- Participate in development and test grid-based HEP data analysis and disseminate the experience to OSG.

State Grid Activities

- Current Activities
  - HiPCAT: State of Texas: UTA and Rice
  - LONI: State of LA, LTU
  - OneNet: State of Oklahoma: OU, LU, OCHEP
  - State of São Paulo (Brazil) Grid: SPRACE
- Future Activities
  - Indian Grid: Tata
  - Mississippi Grid: Ole Miss
  - Kansas Grid: KU and KSU
  - Arizona Grid: UAZ

Condor Pool Project at OU

- Harness the power of student lab PC's
  - 750 PC's; about 100 are currently deployed
  - 2 head nodes; 1 currently deployed
  - PC's run RHEL3 and Condor 6.6.10
    - VMware5 and WinXP on top of that
  - PC's behind firewall on private campus network
    - Head nodes outside firewall; ssh accessible
  - VDT will be installed on head node to accept grid jobs
- Long term will flock with other university pools in region

Diverse Activities at UTA's DPCC

- DPCC has supported or currently supports
  - CSE: DB research using Oracle, Datamining, Biological simulations, Grid Scheduling, network simulations, Parallel Algorithim development
  - UT Southwestern Medical: Skin imaging for medical research
  - Biology: Retropseudogene discovery using BLAST/FASTA, Morphological Bayesian analyses using MrBayes
  - Geology: In the process of developing applications
- HEP – Grid production for ATLAS (OSG), D∅; OSG-ITB
  - Grid application development – DIAL, PanDA

LTU Collaborations

- HEP & CSE
  - On going research for fault tolerant grid enabled clusters
- LTU & LSU
  - Adapt LSU's general purpose Super Mike cluster for SAMGrid operation

iGrid 2005 Advanced Networking Activities at SPRACE

iGrid 2005 is a coordinated effort to:

- accelerate the use of multi-10Gb international and national networks;
- advance scientific research;
- educate decision makers, academicians and industry researchers on the benefits of these hybrid networks.

- iGrid showcases more than four-dozen real-time application demonstrations from 20 countries
- Caltech, CERN, SLAC, FNAL and Brazil demonstration used national and international networks to demonstrate the next generation of globally distributed physics analysis tools for Particle Physics and eScience research
- The technologies being developed most notably in the UltraLight, FAST, PPDG, GriphyN, iVDGL and ESLEA projects were used to show components of the so-called "Grid Analysis Environment", a grid infrastructure for physics analysis.
- Sophisticated monitoring framework (MonALISA) was used to illustrate the progress of the analysis tasks, data flows in the network, and the effects on the global system.

DOSAR Future

- Actively engaged in LHC experiments
  - UTA, OU and LU participating actively in ATLAS distributed production and analysis
  - LTU and Ole Miss in the process of working with CMS
  - SPRACE is working with CMS
- Actively participate in OSG as a community based, grass-root VO
  - Participate in OSG activities
    - Install the respective grid software framework
    - Add our VO to all possible monitoring programs
    - Actively participate in OSG software development in the context of LHC
  - Fully utilize the LHC and LC connections
- Continue promoting interdisciplinary collaboration and grid interoperability
- Actively participate and lead grid computing efforts in the respective states
- Start getting engaged in employing grid computing technology not just for research but also for education and clinical applications

Conclusions

- DOSAR contributed to DØ significantly
  - Produced significant fraction (>50%) of MC events and still is producing for the foreseeable future
  - Reprocessed over 52.5M events
- Network infrastructures for members significantly improved
- Became a VO in OSG
- Actively participating in LHC experiments
- Use DOSAR for DØ and LHC data analyses
  - Producing presentable results from DØ data analyses in the regional grid is a goal for the next year
- Fully utilize DOSAR beyond HEP
- Play larger leadership role in state-wide grid initiatives
- Promote grid technologies on campus and in our regions
- Participate in global grid efforts as a VO