CMS MC Production on OSG

Ajit Mohapatra

Dan Bradley

University of Wisconsin, Madison

- ✓ Overview
- ✓ CMS Production history on OSG
- ✓ New MC Production Model
- ✓ Routing CMS jobs to OSG
- ✓ Data Storage on OSG
- ✓ Data Transfer and Management
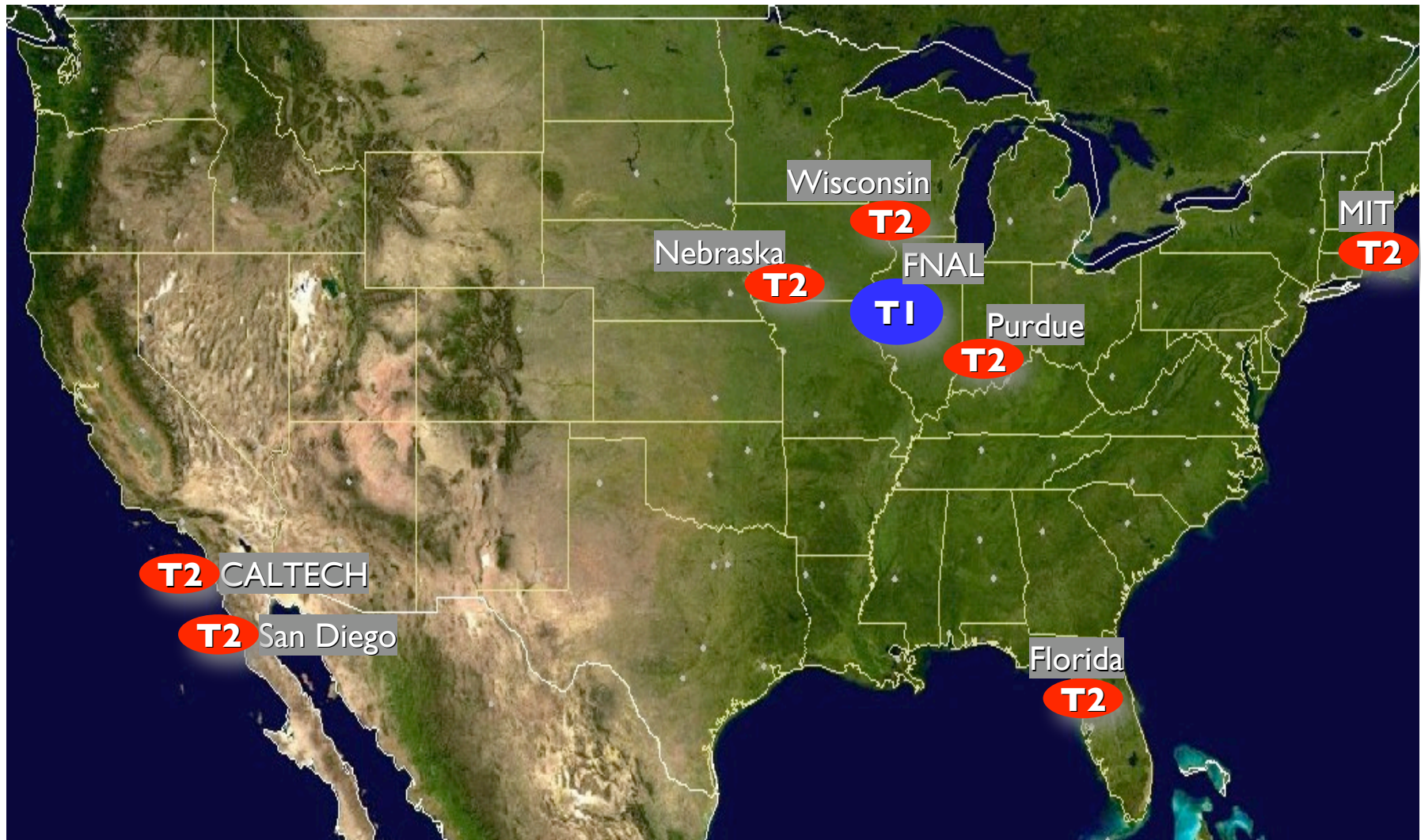- ✓ Production Summary
- ✓ Looking Forward

- Large scale MC production in CMS has been going on for past several years.

- The Old (now obsolete) operation model :
  - Based on agreement/willigness of individual CMS institutes to participate in the MC production.
  - Installation/maintainance of CMS software at the involved sites by their own people.
  - MC production, storage and transfer was managed by the sites.
  - Site responsibility to arrange/negotiate the needed resources by themselves. Ex : Wisconsin used GLOW resources for this.
  - Each production site performed the task based on the directions from the production mgmt group at CERN.
  - Wisconsin was one of several USCMS sites designated for MC production.

- New MC production/operation model since July 2006.
  - Centralised operation based on new data model and associated software
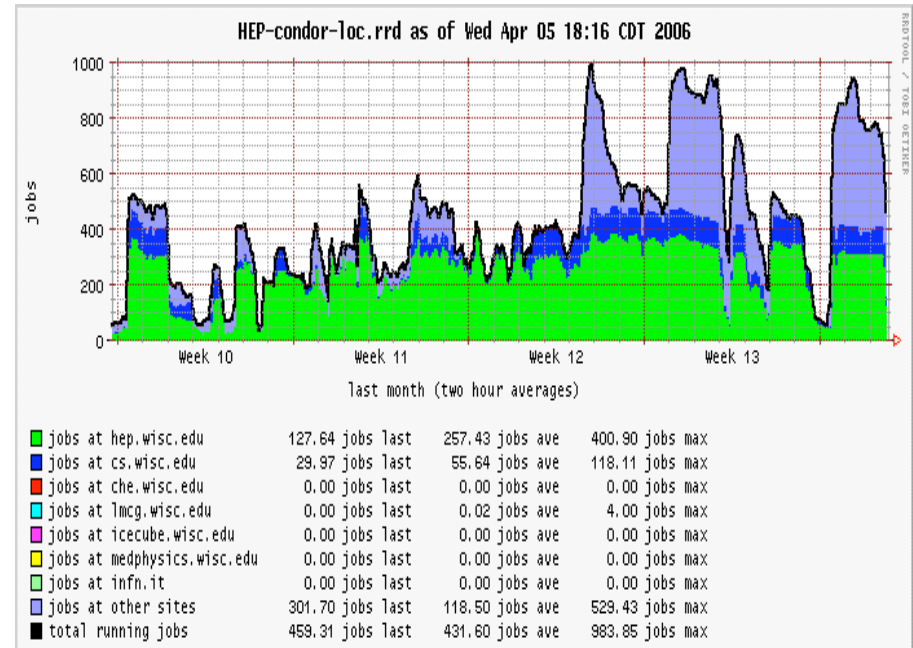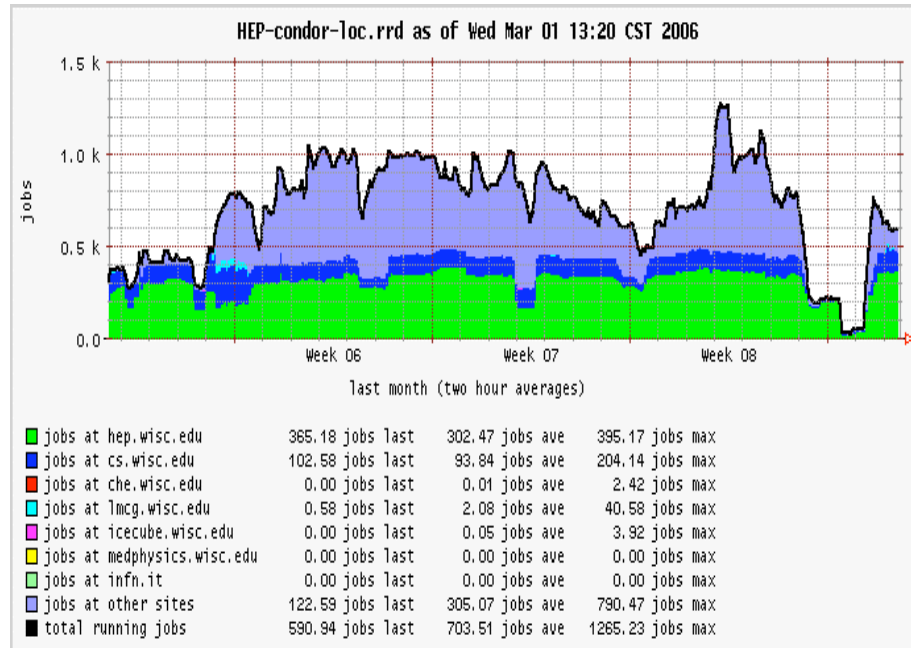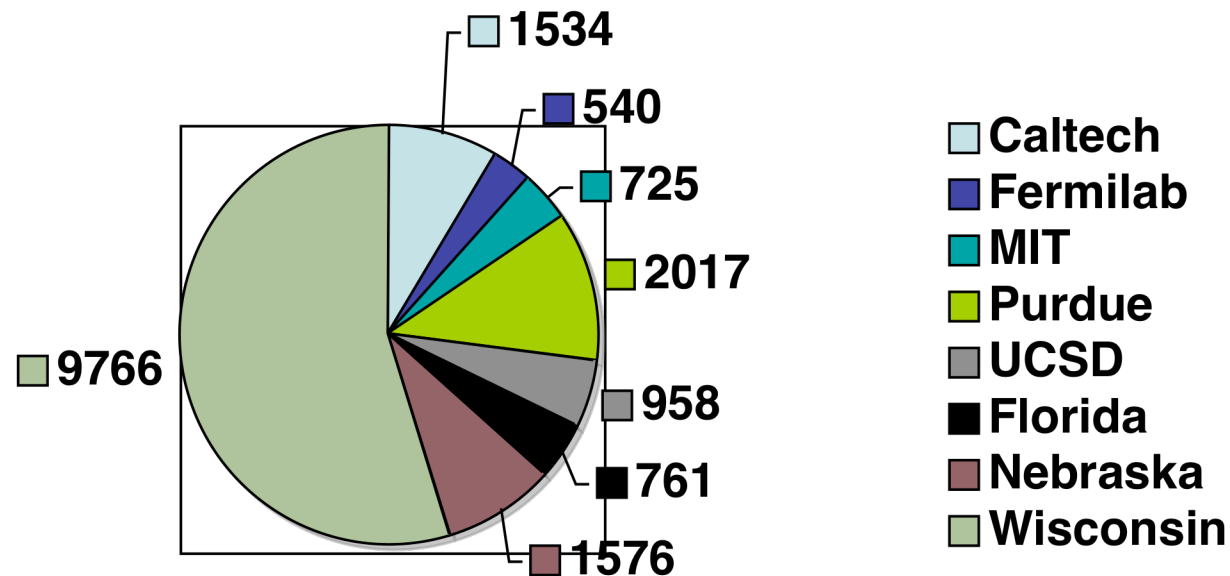 - Utilization of Computing Grid to the fullest extent.

- MC production using GLOW resources @ UW Madison was going on for quite some time at UW. CMS MC production on OSG started early this year.

- A significant amount of simulated data (~ 40M) was produced (with the old MC production model) using the computing resources at the CMS T2 sites.

- Between 800 and 1000 jobs ran for significant periods.

Successful Production CPU Hours

□	**Caltech**
■	**Fermilab**
■	**MIT**
■	**Purdue**
■	**UCSD**
■	**Florida**
■	**Nebraska**
□	**Wisconsin**

Pie chart values: 1534, 540, 725, 2017, 958, 761, 1576, 9766

- Over 22 CPU years of successful production outside Wisconsin, limited, as usual, by availability of large assignments.

- Overall successful CPU hours ~ 80%

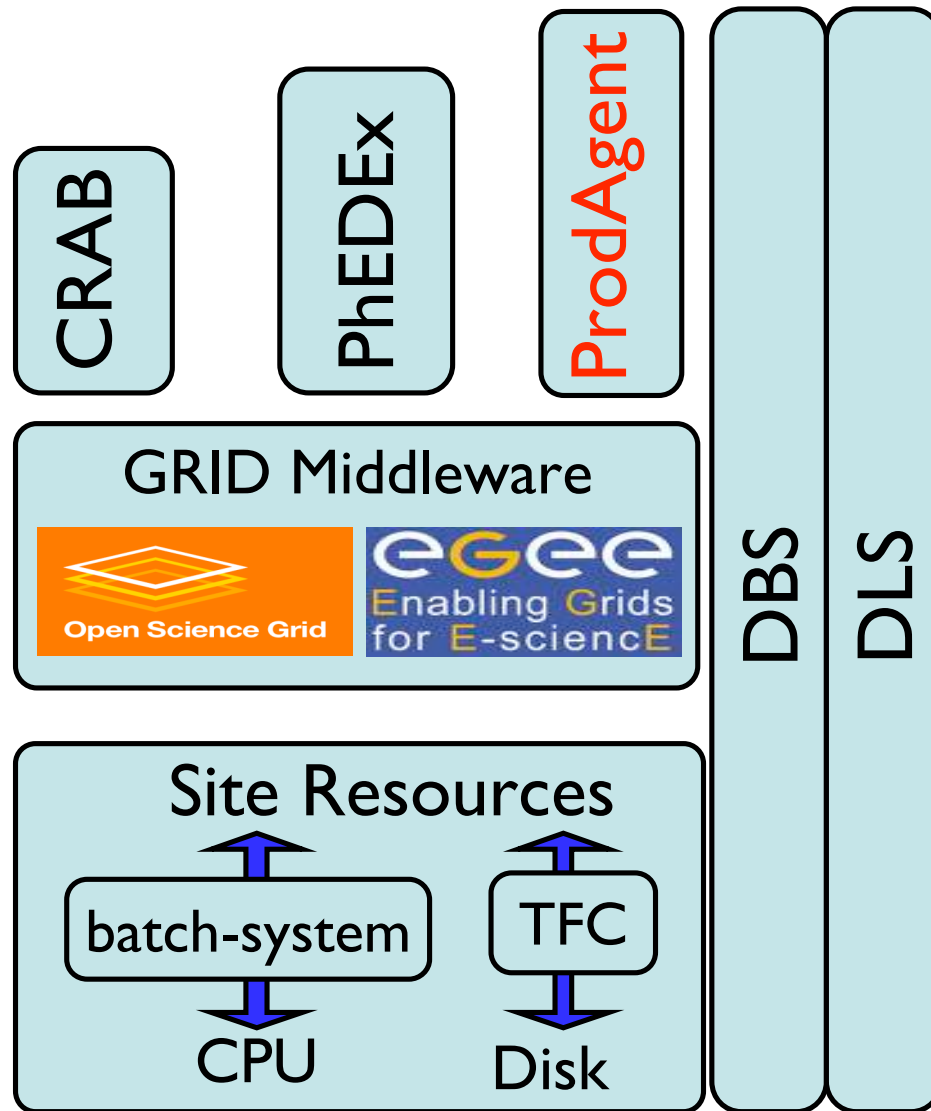| Site	Batch Slot	CPU (kSK2K)	Disk (TB)
Caltech	256	330	55
Purdue	228	329	32
Nebraska	256	360	58
Florida	240	320	25
UCSD	213	318	98
MIT	80	88	40
Wisc	428	547	91
TOTAL	1701	2258	399

New MC Production Model

- Based on new Data Model and Software

- Production on the Grid : LCG (LHC Computing Grid) and OSG.

- Centralized software installation and maintainance in LCG and OSG.

- Only a few operators : 3 in LCG and 1 in OSG.

- Model highlights :

  – Utilization of the Computing Resources via the Grid

  – Utilization of Storage Resources via the Grid.

  – Centalized data transfer and management mechanism

CRAB

PhEDEx

ProdAgent

GRID Middleware

Open Science Grid · eGee Enabling Grids for E-sciencE

DBS

DLS

Site Resources

batch-system → TFC

CPU · Disk

DBS : Data Bookkeping System
- Catalog of datasets and MC.

DLS : Data Location Service
- Where is this dataset located ?

TFC : Trivial File Catalog
- CMS specific namespace.

PhEDEx : Dataset transport
- Based on DBS/DLS info.

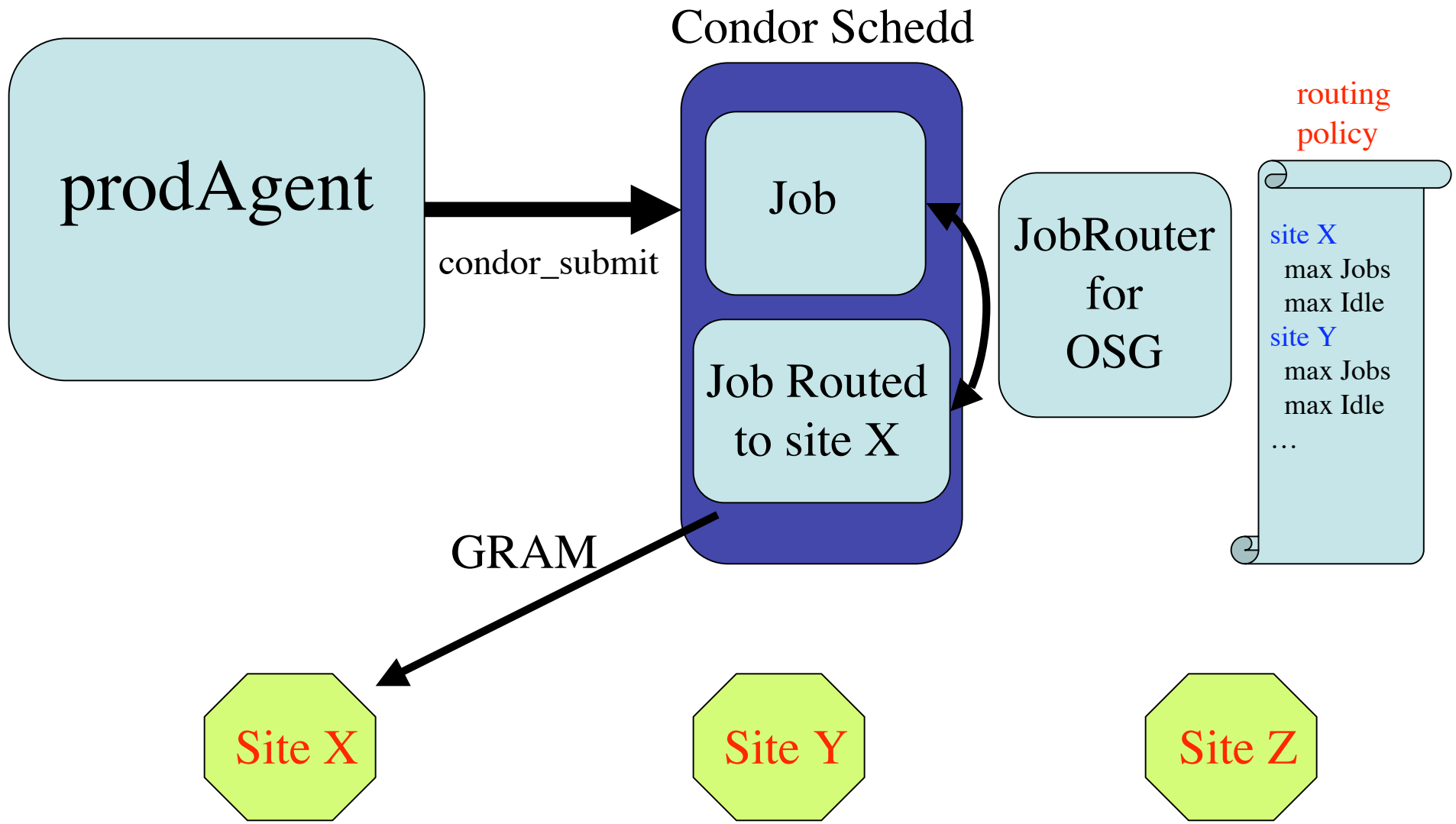ProdAgent : MC Prod. System
- Centralised (LCG/OSG)

Condor Schedd

prodAgent

condor_submit

Job

Job Routed
to site X

JobRouter
for
OSG

GRAM

routing
policy

site X
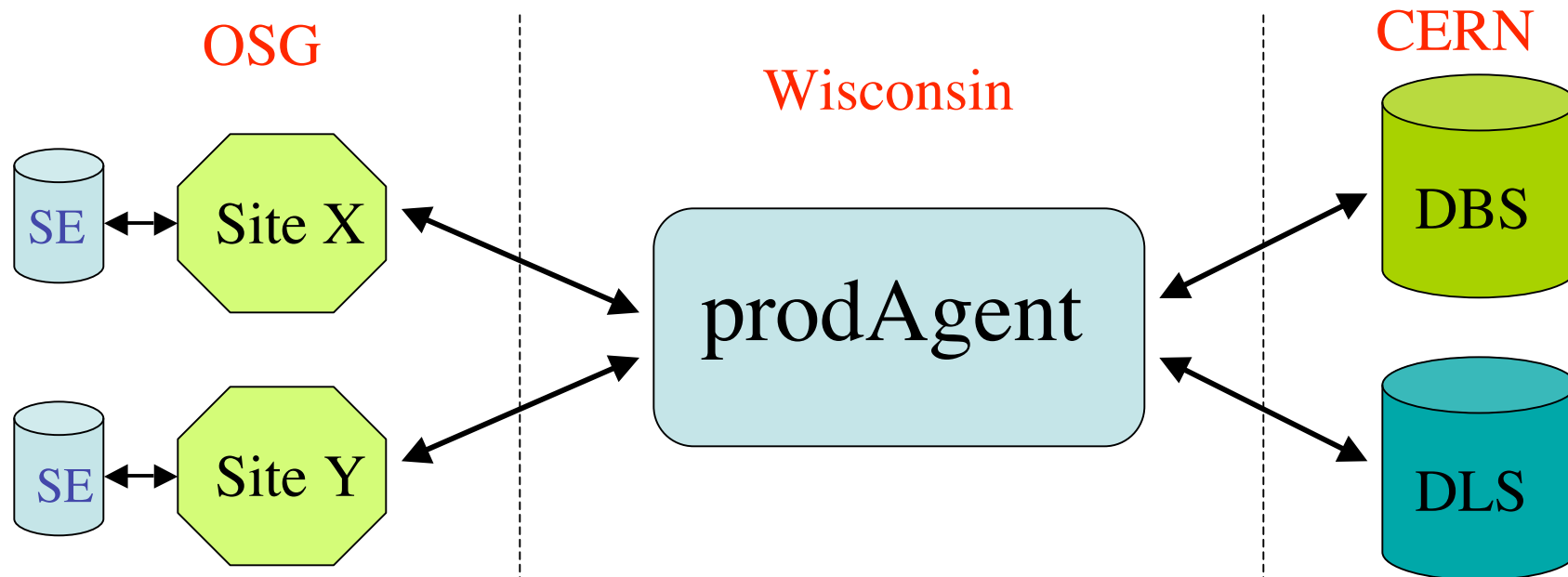   max Jobs
   max Idle
site Y
   max Jobs
   max Idle
…

Site X

Site Y

Site Z

- MC data gets stored at each site's Storage Element (SE).
  - ✓ all USCMS SE's are dCache based with SRM support
- Dataset registration in central servers (@CERN)
  - ✓ Dataset Book-keeping Service (DBS)
  - ✓ Dataset Location Service (DLS)

OSG

CERN

Wisconsin

SE ↔ Site X

SE ↔ Site Y

prodAgent

DBS

DLS

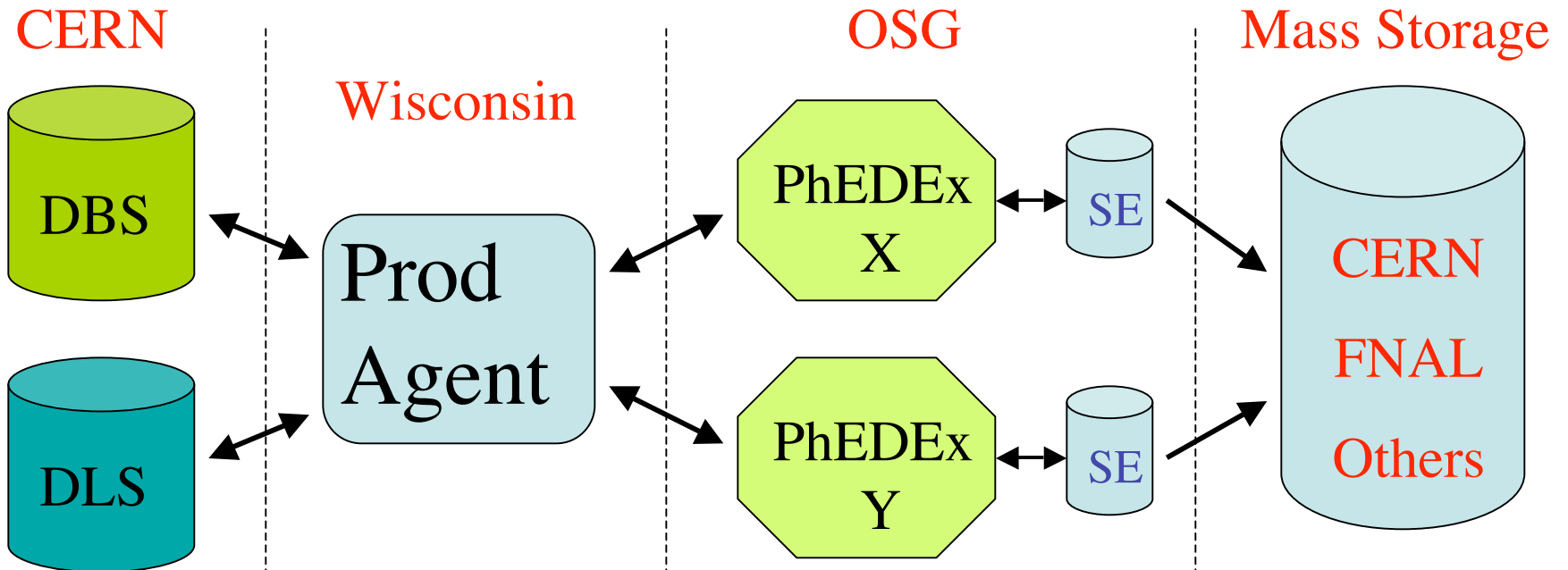# Data Transfer and Management
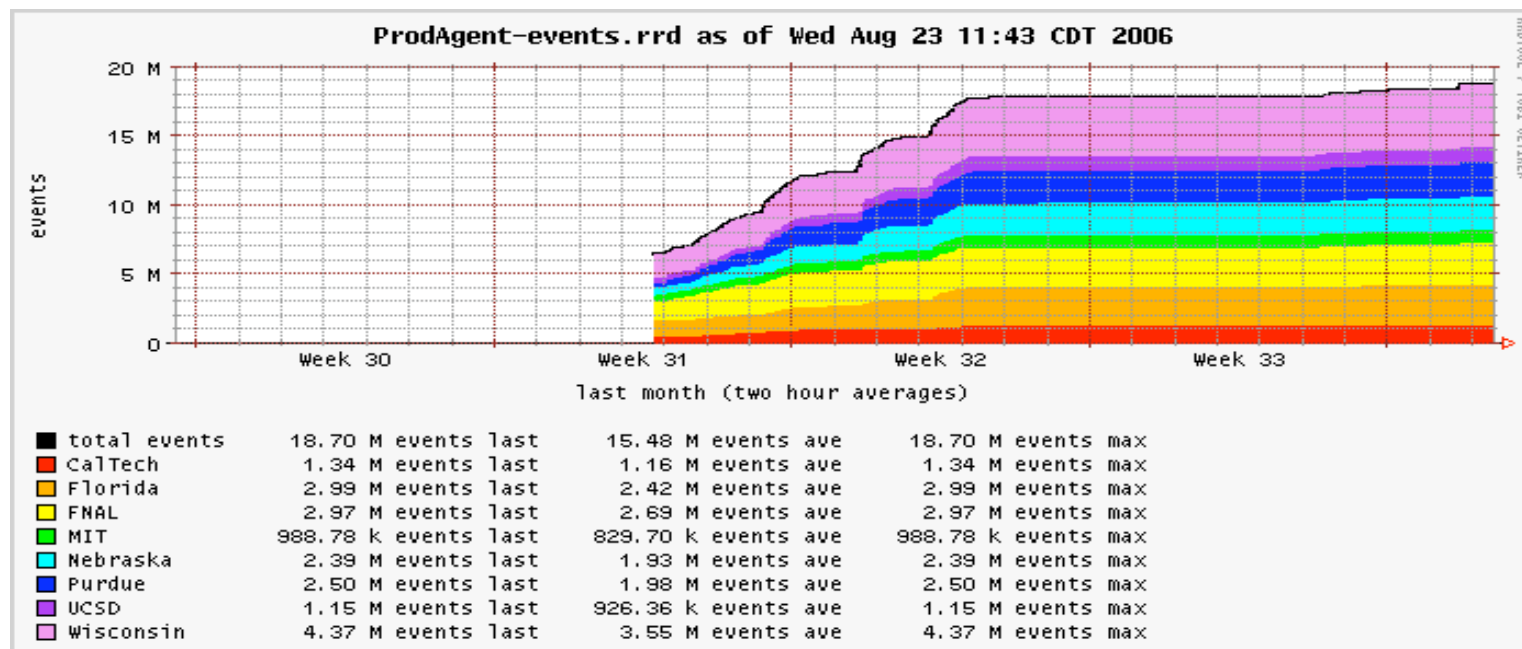
- Output file from one job is too small for efficient management (~ 250MB).
  - ✓ Files are merged to create larger data blocks (~ 2GB)
- Data blocks are then transported (by PhEDEx) or analyzed in place.

CERN   OSG   Mass Storage

Wisconsin

DBS				
DLS	Prod Agent	PhEDEx X — SE	CERN FNAL Others	
		PhEDEx Y — SE		

ProdAgent-events.rrd as of Wed Aug 23 11:43 CDT 2006

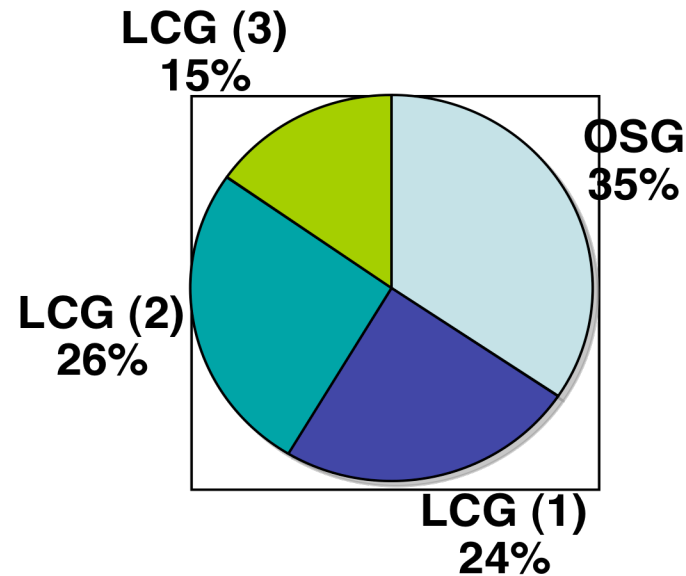|	last	ave	max
total events	18.70 M events last	15.48 M events ave	18.70 M events max
CalTech	1.34 M events last	1.16 M events ave	1.34 M events max
Florida	2.99 M events last	2.42 M events ave	2.99 M events max
FNAL	2.97 M events last	2.69 M events ave	2.97 M events max
MIT	988.78 k events last	829.70 k events ave	988.78 k events max
Nebraska	2.39 M events last	1.93 M events ave	2.39 M events max
Purdue	2.50 M events last	1.98 M events ave	2.50 M events max
UCSD	1.15 M events last	926.36 k events ave	1.15 M events max
Wisconsin	4.37 M events last	3.55 M events ave	4.37 M events max

- First production run continued for first 2 weeks of August.
- Four teams : 1 OSG (Wisconsin) and 3 LCG.
- Produced ~ 17M minbias events in OSG. The ttbar production is currently running.
- All 7 CMS T2 sites are participating successfully.

Pie chart: OSG 35%, LCG (1) 24%, LCG (2) 26%, LCG (3) 15%

- In 2 weeks all 4 production teams together simulated more than 45M minbias events.

- OSG is already making a significant contribution to the global CMS MC production.

Looking Forward

- Utilization of OSG for CMS MC production is going on for a while and will continue for the years ahead.

- For now, the operation is limited only to the CMS T2 sites in the US. Possible extension to non-CMS OSG sites may happen in the future.

- Thanks to everyone (DISUN, OSG, CMS, USCMS T2s, and others) for working together to make this possible.