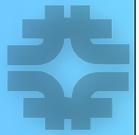


# CMS Budget

Ian Fisk  
November 7, 2007



## US-CMS WBS is divided into 6 Parts

- ➔ I.1 Tier-1
  - Maps onto CMST I in the Facility Quadrant
- ➔ I.2 Tier-2
  - NSF Research Program support through UCLA
- ➔ I.3 Grid Services and Interfaces
  - Includes LHC People, Facility People, and Grid Group
- ➔ I.4 Application Services and I.5 Distributed Computing Tools
  - Combined into the same tactical plan
- ➔ I.6 Software and Support
  - Includes all the framework development and helpdesk support



# Covers 4 Areas of the US-CMS WBS



## WBSI.3 Grid Services and Interfaces (Ruth Pordes of FNAL) (6.0FTE)

- ➔ People supported in CD (4.35FTE)
  - Grid Service Development –workload management, security, accounting, information services, OSG interfaces with WLCG, extensions for interoperation with the EGEE
  - Grid Integration – Testing, validation, interoperability with the EGEE, and QA for OSG releases
  - Grid Operations – US CMS grid support center for OSG, interoperation with the EGEE, support for WLCG.



# Grid Service Development and Deployment

US-CMS relies on work in the OSG

- ➔ Packaging, support, security for grid services and site services
- Service Testing

Primary development contributions are in specific areas that CMS has a vested interest in the scale or functionality

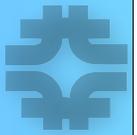
- ➔ US-CMS is contributing to the glide-in WMS (0.5FTE)
  - Proposed pilot implementation for a scalable workload management tool on the OSG
- ➔ Contributing to authentication and authorization effort (0.5FTE)
- ➔ Contributing to the Accounting Effort (0.5FTE)

Integration effort (~3.0FTE)

- ➔ Configuring scalable interfaces and services at FNAL
- ➔ Troubleshooting



# Operations



## Grid Services Development and Support

- ➔ US-CMS relies on work in the OSG:
  - Packaging, testing and support of the Virtual Data Toolkit grid middleware
  - Security, operations and support for grid services, site services and grid interfaces to the WLCG.

## US CMS relies on support from FermiGrid:

- ➔ Operations of central services for VO management, accounting, integration and testing.

## US-CMS participates in the OSG Integration Testbed (ITB)

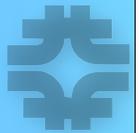
- ➔ Contributions from DISUN at Tier-2s and FNAL

## Installation and Validation

- ➔ CMS software is centrally maintained for Tier-2 and opportunistic sites with 0.50 FTE installation and site validation activity, supported through DISUN



# Development Areas

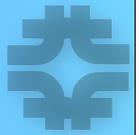


Primary development contributions are in specific areas that CMS has a vested interest in the scale and/or functionality

- ➔ US-CMS is contributing to the glide-in Workload Management System (WMS). 0.5FTE
  - Proposed pilot implementation for a scalable workload management tool to meet the throughput and management needs of CMS.
  - Collaboration with US ATLAS PANDA project.
  - Proposed as basis for OSG scalable WMS.
- ➔ Improvements in Condor batch and grid submission scaling for the facilities and the distributed computing scale (0.25FTE)



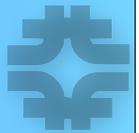
# Effort on Grid Services



DISUN Effort	1.60FTE
Development and Integration	4.5FTE
Ruth Pordes	0.1FTE
Total	4.6
Total with DISUN	6.2FTE



# Application Services

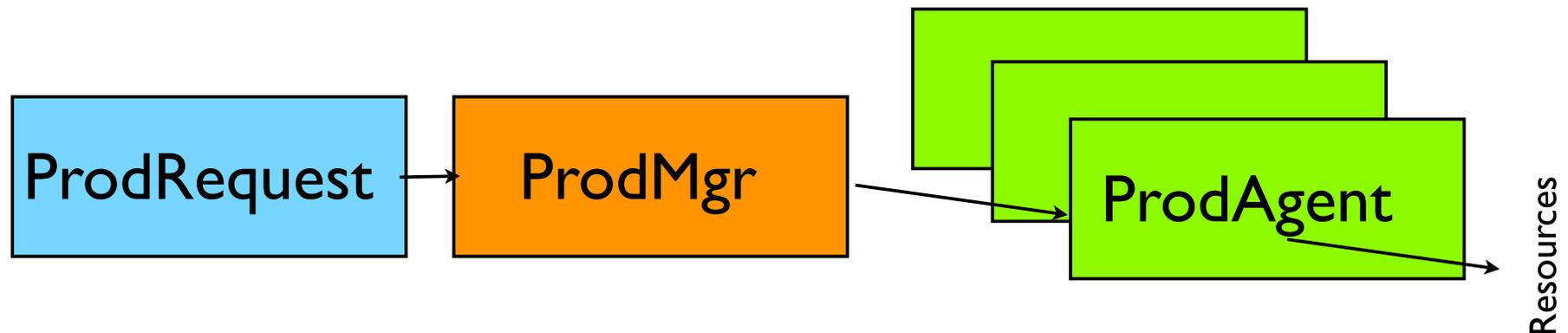


- ➔ WBS 1.4 Application Services (Peter Elmer of Princeton)(10.15 FTE)
  - Responsible for data management development
    - Data Placement and Data Bookkeeping
    - Data Transfer Components
    - Distributed database solutions
  - Support and operations of current prototypes
- ➔ WBS 1.5 Dist. Computing Tools (Frank Wuerthwein UCSD) (6.00 FTE)
  - Responsible for tools for distributed analysis and production
    - Simulation, Tier-I Reprocessing, Tier-0 Prompt Reconstruction
  - Integration with Grid services
  - Operations of the distributed computing environment



The ProdAgent Infrastructure runs all the organized processing in CMS

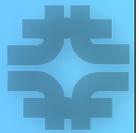
- ➔ Originally Developed for Simulated Event Production
- ➔ Used in CSA06 for Reprocessing and Organized Skimming
- ➔ Adopted in February to also operate the Tier-0 workflow



Represents the tools that manage workflows on approximately 80% of the computing resources in CMS



# Workflow Management (2)



Use of a common tool for all organized process tasks has an efficiency for the experiment

- ➔ US-CMS effort is very strong, but the additional development needs of the Tier-0 workflow is substantial
- ➔ Probably sufficient provided that CERN and other CMS groups provide development effort
  - Needs to be watched. We are in the regime of being at risk of significant problems with the loss of key individuals
    - We have ~3.0FTE of Development effort.

Big push needed in the next 2 years

- ➔ Transition to operations, improving automation and reducing effort
- ➔ Transition to data processing, improving efficiency
- ➔ Increase in scale



# Analysis Workflow



US-CMS made a strategic decision to contribute to the CMS Remote Analysis Builder (CRAB)

- ➔ Originally an INFN developed prototype for analysis configuration and submission
- ➔ Half FTE from base support enabled OSG direct submission. Improved utilization of Tier-2 resources

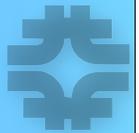
Currently 0.75FTE of development effort

There is roughly a factor of 5 increase in scale required of this component

- ➔ Transition to a service architecture
- ➔ Changes in submission infrastructure proposed for both EGEE and OSG sites



# Operations and Integration



US-CMS has worked on demonstrating the scalability of the infrastructure

- ➔ Attempting to improve the scalability and usability of processing tools
  - Working on opportunistic access to Tier-3 centers for CMS and other VOs
    - ~0.30FTE
- ➔ US-CMS currently has about 50% of the utilized simulated event resources in the experiment
  - Fluctuates over time, but for the CSA07 production was roughly half
- ➔ Currently resources are kept busy with ~1 FTE of operations supported by DISUN
  - Need to augment with US-CMS data ops team members
    - Currently 0.25 FTE and growing primarily on the core program of the US data operations teams



# Data Management

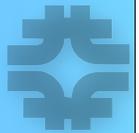


US-CMS is significant contributor to 3 areas of Data Management

- ➔ Data Bookkeeping System (DBS)
  - Primary data discovery system
- ➔ Conditions data serving
  - Frontier systems deployed at Tier-0, Tier-1, and Tier-2 systems (~40 instances)
  - Frontier in the process of deployment on the HLT systems (~1000 instances)
- ➔ Data Transfer
  - PhEDEx data transfer system
    - Responsible for all data replications in CMS



# Data Management



## Dataset Bookkeeping effort includes

- ➔ DBS servers, interfaces, and schemas
- ➔ DBS web browser
- ➔ Support and Operations

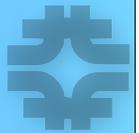
## Work is left to do in three broad areas

- ➔ Reconciliation of PhEDEx and DBS managed data areas
  - PhEDEx was intended to manage data only in transfer
  - Currently the information systems can get out of sync
- ➔ Inclusion of other sources of data into DBS queries
  - Queries on conditions, luminosity, good runs, etc.
- ➔ Inclusion of physics information into queries

~4.0FTE of effort



# Conditions



CMS is relying on work done for CDF for the distributed database infrastructure

- ➔ Leveraging a lot of developed work
- ➔ Operations and deployment effort
  - There are more production sites in CMS

Effort needed this year in the application to make efficient connection to Frontier

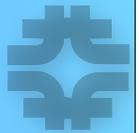
Deployment on the HLT farm is required for this year

- ➔ Intrinsically easier than the global deployment, but at a larger scale

~1.85FTE



# Data Transfer



PhEDEx has been in production since 2004

- ➔ Has seen a big increase in functionality and scale over the three years
- ➔ Push this year for improved packaging, configuration, and operability

Effort began this year on data consistency and data integrity checking

Data transfer is one of the big technical hurdles in CMS

- ➔ Tier-0 to Tier-1 transfers are large and need to be reliable
- ➔ Number of Tier-1 to Tier-2 permutations are challenging

PhEDEx has been struggling with routing and priority issues in the presence of many transfers, unavailable files, unreliable sites

- ➔ Significant development effort needed in this year
- ➔ Currently have ~2FTE of development



# Effort on Application Services and DCT



➔ Prod Agent

Core Support	0.5
DISUN Effort	2.8FTE
Project Support	5.50FTE
CMS Effort at FNAL	7.68FTE
Total	16.5FTE

➔ DISUN

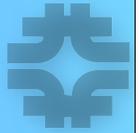
➔ CRAB

➔ Core

➔ Management



# I.6 Software and Support

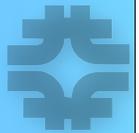


## WBS I.6 Software and Support (6.4 FTE)

- Includes CMS framework development effort and support for users
  - CMSSW
  - Visualization
  - Geometry and conditions
  - Support
    - Documentation, Direct Support, Tutorials Etc.
- Has primarily CMS supported dedicated experts
  - Benefits from consulting and support from CD Experts
- Big contribution from project supported people at Universities and CERN



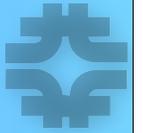
# Effort on Software and Support



Project Support	6.5FTE
Development and Integration	6.4FTE
Total	12.9FTE



# International CMS and US-CMS



We currently contribute 1 FTE of effort spread over 3 people to CMS Computing and Offline Management roles

- ➔ Deputy Computing Coordinator, Integration Co-Coordinator, and Simulation participation
  - Both CD and CMS benefit from having people in coordination roles

We currently have 1.25FTE in Project Management of US-CMS

- ➔ 1.0FTE is CMS supported

During this last year of preparation we will be traveling regularly to CERN

- ➔ The travel budget is large
- ➔ Was calculated to support management travel, supporting activities like networking work, etc.