The Operations Dashboard

An Interactive, Collaborative Environment for Monitoring the Status of Virtual Organization-Specific Operations

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Song: I’m OK (I Promise)
Band: Chemical Romance
Gaming Environment: Death Jr.
Conference on Computing, Data, Visualization, Networking, MultiScale, Engineering, Life Sciences, Media, Scheduling, Monitoring, Virtual Reality, Programmers, GUI Design, Integration, HPC (CCR), CSE, Organization of CSNY, Abilene, Buffalo, Rochester, Albany, Syracuse, NLR, 32 AoA, HEAnet, CA*net, ESnet, R&E Network, NYSERNet Pop, MAN LAN, Courtesy of NYSERNet
Center for Computational Research

- Dell Linux Cluster (10TF peak)
  - 1600 Xeon EM64T Processors (3.2 GHz)
  - 2 TB RAM; 65 TB Disk
  - Myrinet / Force10
  - 30 TB EMC SAN

- Dell Linux Cluster (3TF peak)
  - 600 P4 Processors (2.4 GHz)
  - 600 GB RAM; 40 TB Disk; Myrinet

- SGI Altix3700 (0.4TF peak)
  - 64 Processors (1.3GHz ITF2)
  - 256 GB RAM
  - 2.5 TB Disk

- BioACE: Bioinformatics System
  - Sun V880 (3), Sun 6800
  - Sun 280R (2), Intel PIIIs
  - Sun 3960: 7 TB Disk Storage

- EMC SAN
  - 35 TB Disk, 190 TB Tape

- Tiled-Display Wall (11’×7’)
  - 20 projectors / 15.7M pixels
  - Dell PCs with Myrinet2000

- Access Grid Nodes (2)

- Staff
  - 11 Technical Staff
  - 3 Administrative Staff
CCR Visualization Resources

- **Tiled-Display Wall**
  - 20 NEC projectors: 15.7M pixels
  - Screen is 11’×7’
  - Dell PCs with Myrinet2000

- **Access Grid Nodes (2)**
  - Group-to-Group Communication
  - Commodity components

- **3D Passive Stereo Display**
  - VisDuo ceiling mounted system
Grid Computing Overview

- Coordinate Computing Resources, People, Instruments in Dynamic Geographically-Distributed Multi-Institutional Environment
- Treat Computing Resources like Commodities
  - Compute cycles, data storage, instruments
  - Human communication environments
- No Central Control; No Trust

Imaging Instruments

LHC

Computational Resources

Large-Scale Databases
Provide reliable **real-time** information for resources in a highly **distributed**, **heterogeneous** environment.
Computational Grid

Grid Resource → Grid Resource → Grid Resource

Grid Administrator

Site Administrator

Site Administrator

ACDC Grid Monitoring Infrastructure

Grid User

Grid User

Grid User

Provides real-time job, user, gatekeeper, storage and file transfer statistics.
The ACDC Grid Dashboard
Grid Monitoring at CCR

Computational Grid

1. Grid Resource
2. Monitoring Scripts
3. Database Support

MySQL Database

Grid Monitoring Interface
Grid Services

- Critical services are provided that facilitate computation
  - Connectivity
  - Authentication
  - GridFTP
- Monitoring must consider
  - Multiple platforms & architectures
  - Multiple administrative policies & VOs
- Challenges include
  - Isolating service issues
  - Collaborating and troubleshooting problems
  - Publishing results
  - Providing a single & coherent monitoring interface
Services provided:

- Site Functional Tests to discover information on services provided
- Interactive Web Interfaces to publish information to grid users
- Action Items to allow users to collaborate in updating information and resolving issues
Site Functional Tests

- Individual Perl programs (U Florida) that test specific features
- Executed locally (at CCR)
- Initiate socket or Globus commands to remote resources
- Determine the functionality of a service on such a remote resource
- Store status results in a MySQL database
- Execution:
  - Sequentially
  - Increase in complexity
  - Cascading dependencies
Site Functional Tests

Based on *site_verify.pl* by Dr. Craig Prescott of the University of Florida
Site Functional Tests

For compute resource $R$, VO $V$

For all SFTs

Is the SFT included on $R$ for $V$?

- **Y**
  - Did the dependent SFT on $R$ for $V$ pass?
    - **Y**
      - Run SFT on $R$ for $V$
    - **N**
  - **N**
    - Store results in database

- **N**
  - Post-process

Did the SFT pass?

- **Y**
  - Store results in database
- **N**
  - Post-process
Interactive Interface

Dynamically build the Site Resource – Service Matrix

Click a cell in the matrix to display detailed full-text results

View VO-Specific test results for a compute resource
Critical Tests

- Connectivity (socket can be established)
- Running a gatekeeper
- Authentication possible through Globus
- Fork job manager can run an “echo” command
VO-Specific Testing

- Verify that resources claiming to support a VO actually support the VO
- SFTs are executed under different VOs on various resources
- Execute VO-specific SFTs
VOs test each service to ensure **basic** functionality for ALL users

VOs test services relevant to them to ensure **extra** functionality for users

**VO-Specific Testing**
Site Resource – Service Matrix

- Dynamically constructed from MySQL database based on the grid and VO
- Presents color-coded and clickable site status results including resource and SFT
- Divided into 3 sections
  - Production sites (provide basic services)
  - Pending sites (fail basic services)
  - Offline sites (down for scheduled maintenance)
Action Items

- Organized in a 4-tier SSL authentication scheme based on browser certificates
- Restricted to ensure that only trusted administrators may update information
- Allows for publication to the Dashboard
- Facilitates collaboration with other Grid users and administrators by providing interactions through the Dashboard to resolve service issues
Action Items

- Re-run a Site Functional Test on a compute resource
- Establish a maintenance schedule for a remote site
- Contact a site administrator regarding site status results
- Upload a proxy for VO-Specific Testing
- Register a new compute resource for monitoring
Off-Line Demonstration
Choose a Grid/VO/Version

View **VO-Specific tests** results on compute resources, **organized** by grid and infrastructure version:

- The default grid designation for newly registered resources
- VO-Specific testing, with proxies on behalf of VO users
- The default version for non-OSG compute resources

**Dynamically** draws the corresponding Site Resource – Service Matrix
The Site Resource – Service Matrix is displayed for the Grid/VO/Version selected at the top of the page

- Production sites passed the four Critical Tests
- Pending sites failed at least one of the four Critical Tests
- Offline sites are currently under maintenance
The **Site Resource – Service Matrix** is organized by computer resource and SFT

- Compute resources make up the rows of the matrix
- Site Functional Tests make up the columns of the matrix
- Cells are color-coded based on result codes and are clickable to yield further information
Full Text SFT Results

Clicking a cell yields more information:

Site Status Details

Grid: OSG
VO: GRASE
Host: u2-grid.ccr.buffalo.edu

Test: Remote Host Uptime
Description: Executes the uptime command on the resource, echoing back status and load information on the compute element.

Timestamp: 2006-07-10 17:43:36 EST
Status: PASS

Text: COMMAND: uptime
CMD - globus-job-run u2-grid.ccr.buffalo.edu/jobmanager /bin/sh -c "uptime"
STDOUT - 17:40:32 up 86 days, 9:48, 0 users, load average: 0.06, 0.04, 0.03
STDOUT -  

Close Window

• SFT and runtime information
• Full text SFT results from the compute resource
**VO-Specific** testing (SFTs relevant to only one VO) are displayed in the **Auxiliary Operations Dashboard**

- Clicking the “VO-Specific Tests” cell for a compute resource brings up the VO-Specific tests for the selected VO and compute resource.
Further interact with the Operations Dashboard through the provided Action Items

- General Action Items are provided for all Operations Dashboard users and allow certain read-only access or message dispatches to site / dashboard administrators

- Clicking an Action Item invokes it and brings up a new window for the grid user

- Access is granted/restricted based on browser certificates, and is graded by the sensitivity of the action
Check Privileges

Determine your **privilege level** and the Action Items you have permissions to access

- Verifies the browser certificate to determine individual privilege levels

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Collaborate with site administrators by contacting them directly from the dashboard

- Use supplied recipients from our records or supply your own
- Add your own comments to isolate or report service errors on a compute resource for your VO
- Full text results of the SFT in question are attached to assist the administrator in troubleshooting the problem
Show Test History

View historical SFT information for a compute resource and VO

• Choose a time range for a compute resource and a VO to view historical SFT results over

• Click a region of the dynamic chart to view specific full text SFT results which caused the change.
Re-run a Site Functional Test

Troubleshoot and publish the latest test results by invoking SFTs directly

- Run tests in the background or in the foreground through the popup window
- Results are visible by all users once the test is complete
**Publish Maintenance Information**

**Publish** maintenance information by establishing a maintenance schedule and setting the resource to offline.

- Access is restricted to administrators of the site and dashboard administrators.
- Establish a maintenance schedule by setting maintenance dates.

The resource will appear in the **Offline** section of the Site Resource – Service Matrix during the dates selected (and visible through the ‘Check Maintenance Schedule’ Action Item), publishing that this resource will be unavailable.
Enable/Disable SFTs

Exclude SFTs for a compute resource and VO or enable them such that they will be run

- Mark SFTs to be tested or not tested during status updates
- Excluded SFTs are grey on the Site Resource – Service Matrix and are not run for the compute resource and VO
Add a New Resource

Register a new compute resource for monitoring within the ACDC Grid Monitoring Infrastructure

- Provide the hostname of the new compute resource

- Initial verifications and a prompt for administrative information fully register the compute resource in the Ad-Hoc grid where it can be monitored through the dashboard infrastructure.

Instructions:
- Enter the fully-qualified host name of the compute element you wish to submit for monitoring under the ACDC Grid Dashboard Monitoring Infrastructure. Submissions will be verified and added to the 'Ad-Hoc' grid in the monitoring pages. Enter parameters as follows:
  - Hostname: the fully-qualified host name of the compute element to submit
Upload a New Proxy

**Update** the proxies used to perform VO-Specific Site Functional Testing on behalf of VO members

- View the current information stored for VOs in the Operations Dashboard
- Upload a new proxy file or update administrative information for the VO for our records
Further Remarks

- Operations Dashboard
  - Lightweight, Interactive, Collaborative environment
  - VO-Specific test execution using VO proxies
  - VO-Specific tailored Site Functional Tests
  - Flexible STFs with interactive Web interface and Action Items that provide a tool to publish and collaborate on issues

- Future Developments
  - New SFTs to verify evolving user requirements
  - New Action Items to extend the interactive toolkit
Status of Monitor

- Monitors over 150 remote resources across 4 grids (OSG, OSG-ITB, ACDC, TeraGrid) for 10 VOs
- Run on 4 1.6GHz Intel Xeon processors
- Implemented using PHP, HTML/DHTML/JavaScript, SSL, Perl, MySQL, shell scripts
- Utilizes Globus Toolkit to interface with remote sites
- Supported by 148GB MySQL database of current & historical statistics
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