The Operations Dashboard

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

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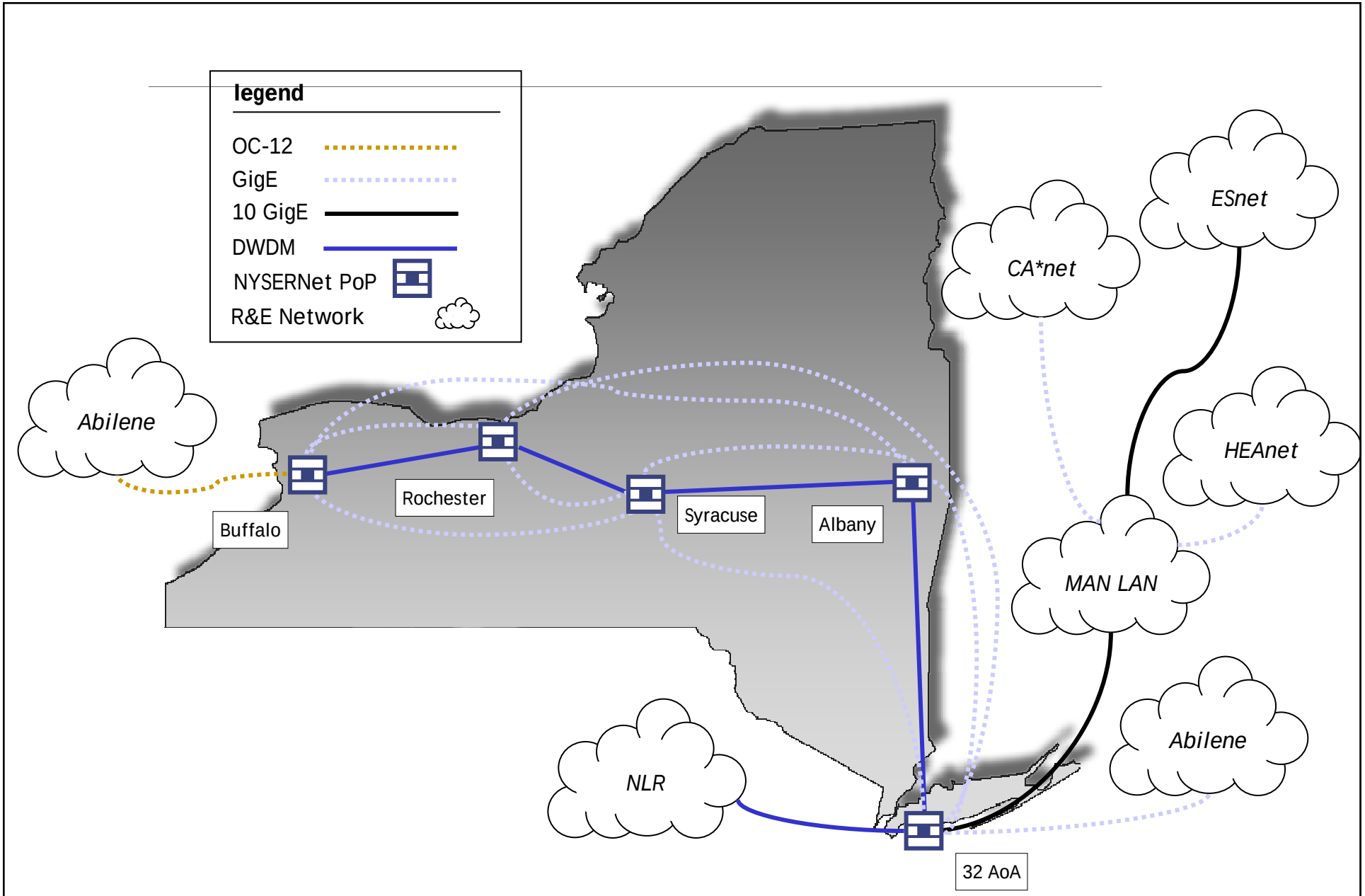
University at Buffalo

The State University of New York

MTV

IBC Digital & CCR

Song: I'm OK (I Promise)
Band: Chemical Romance
Gaming Environment: Death Jr.



Courtesy of NYSER*Net*

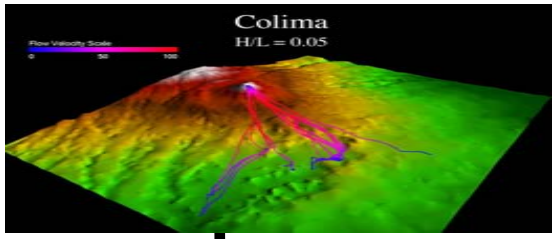
Center for Computational Research

- **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

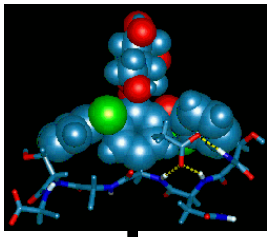
CCR Visualization Resources

- **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



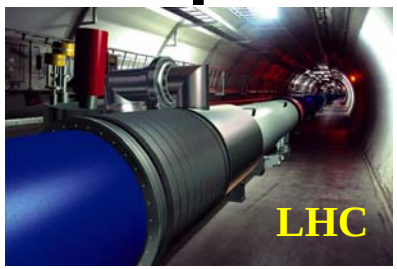
Data Acquisition

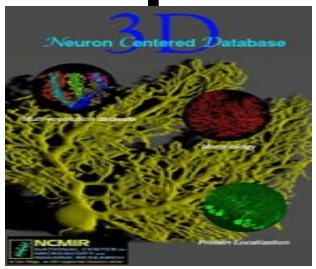


Advanced Visualization

Analysis

Imaging Instruments

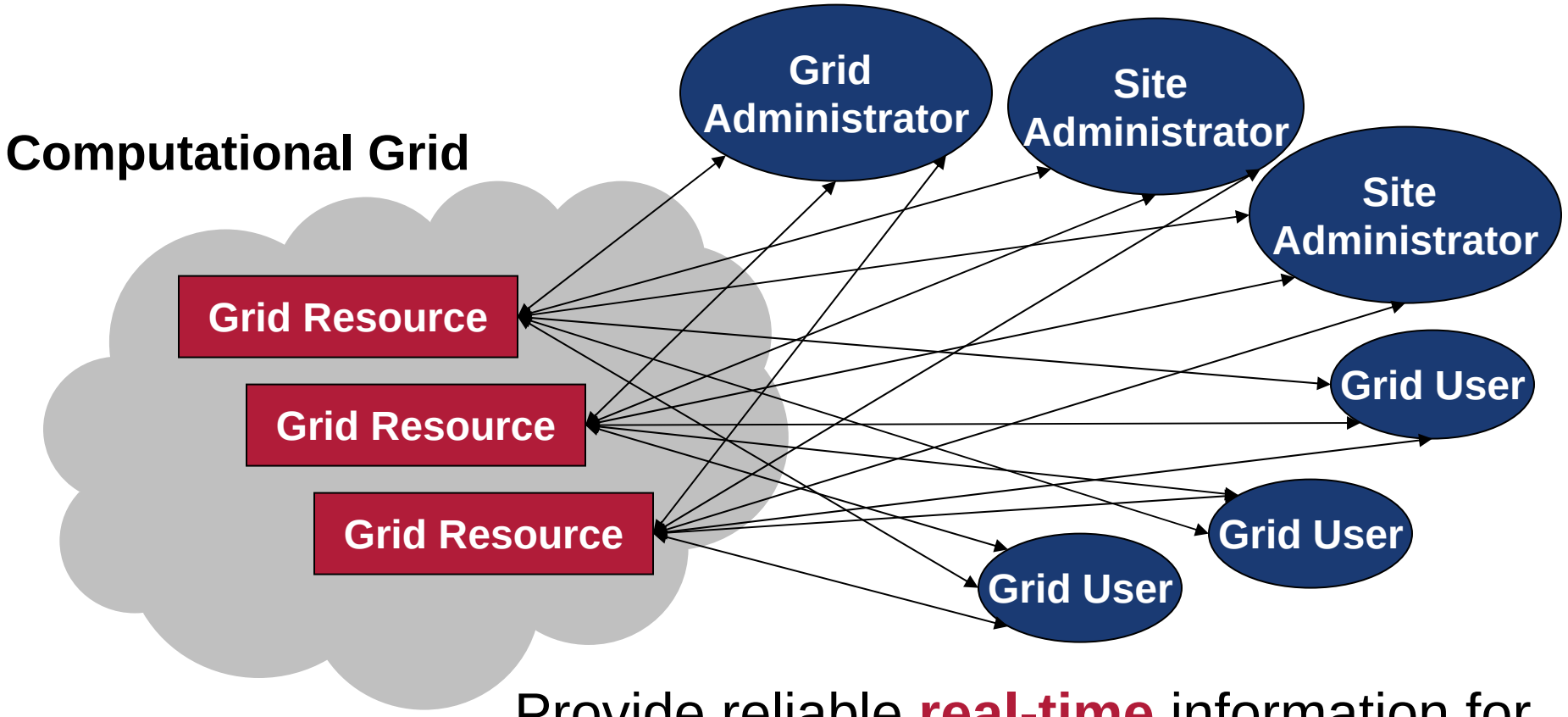




Large-Scale Databases

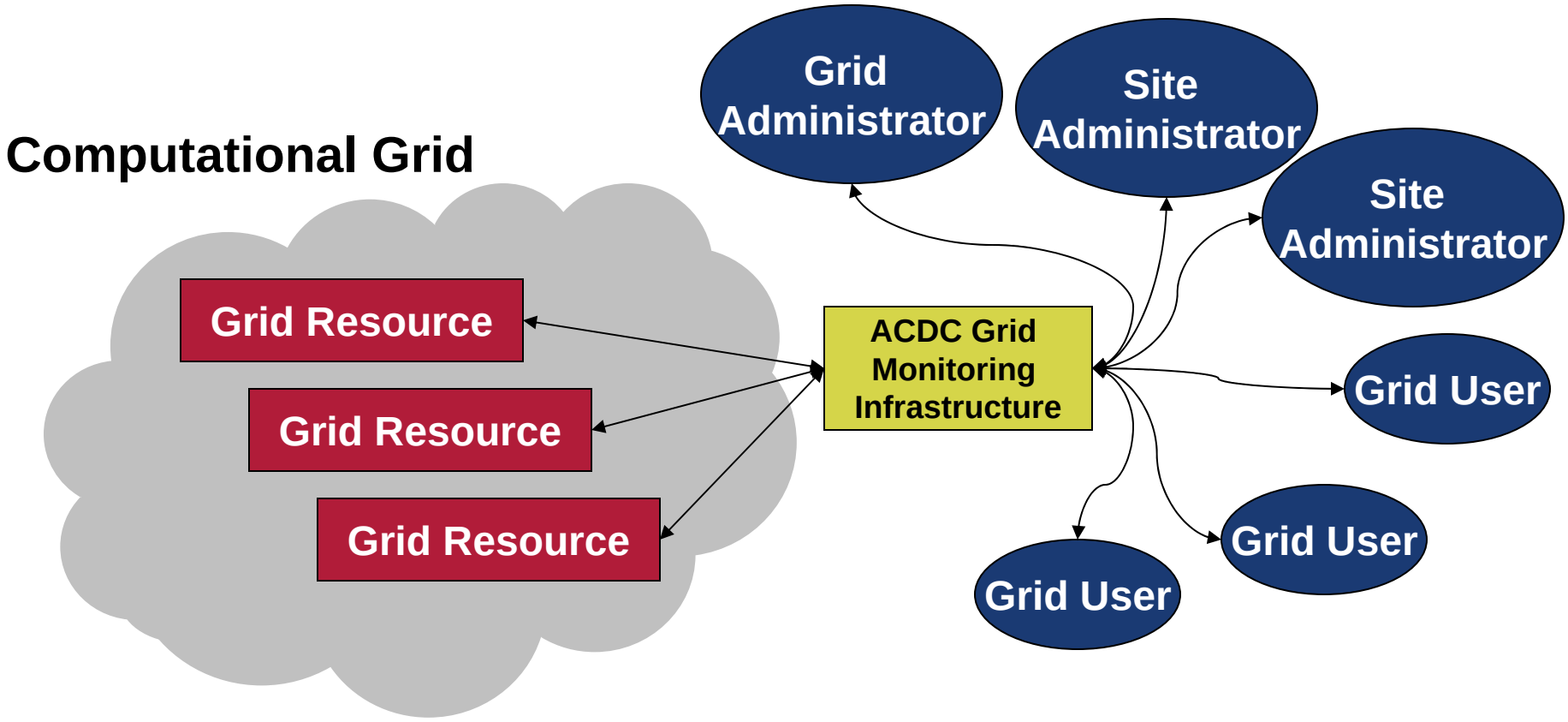
- Coordinate Computing Resources, People, Instruments in Dynamic Geographically-Distributed Multi-Institutional Environment
- Treat Computing Resources like Commodities
  - Compute cycles, data storage, instruments
  - Human communication environments
- No Central Control; No Trust

Grid Monitoring



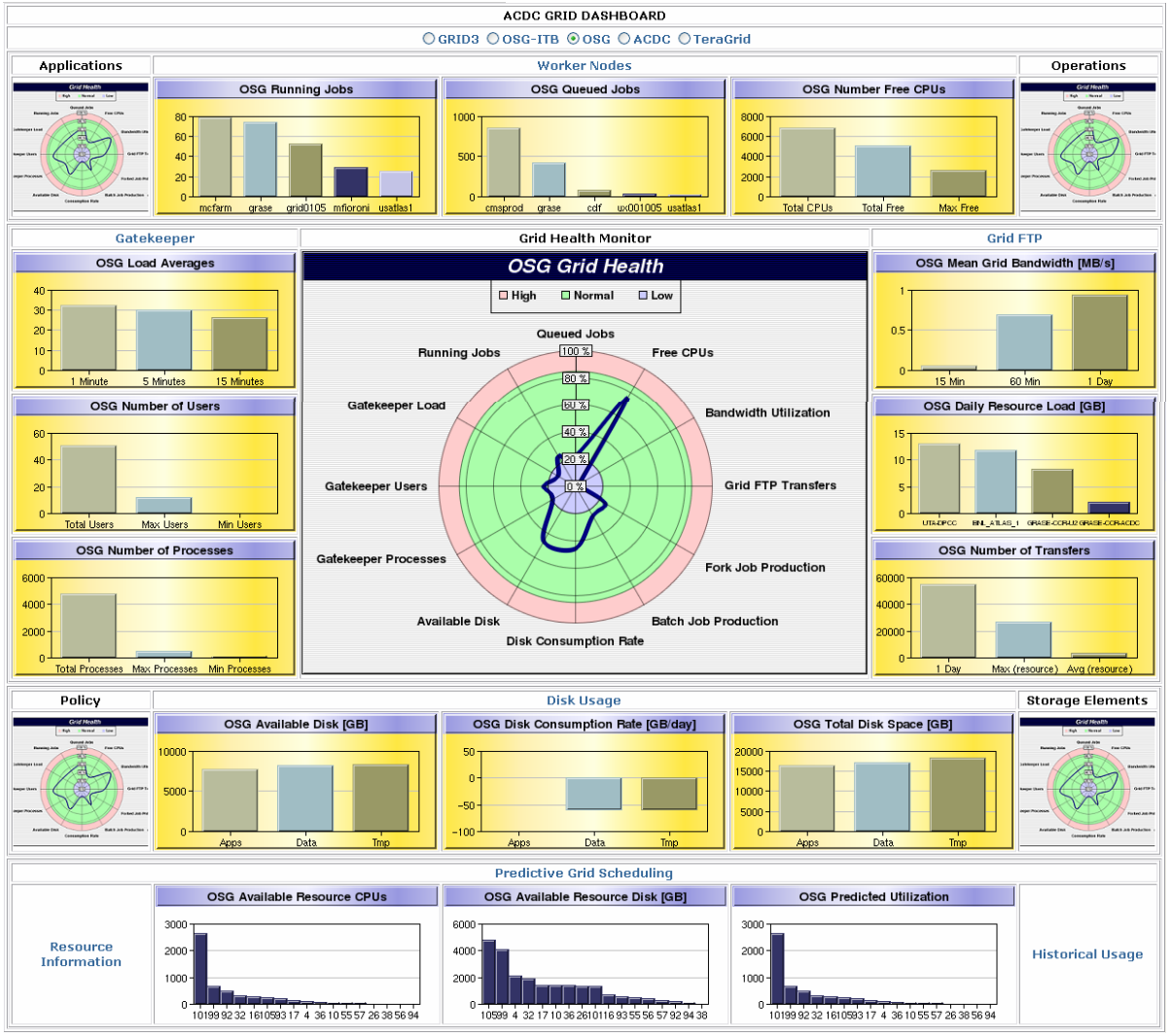
Provide reliable **real-time** information for resources in a highly **distributed**, **heterogeneous** environment.

Grid Monitoring at CCR

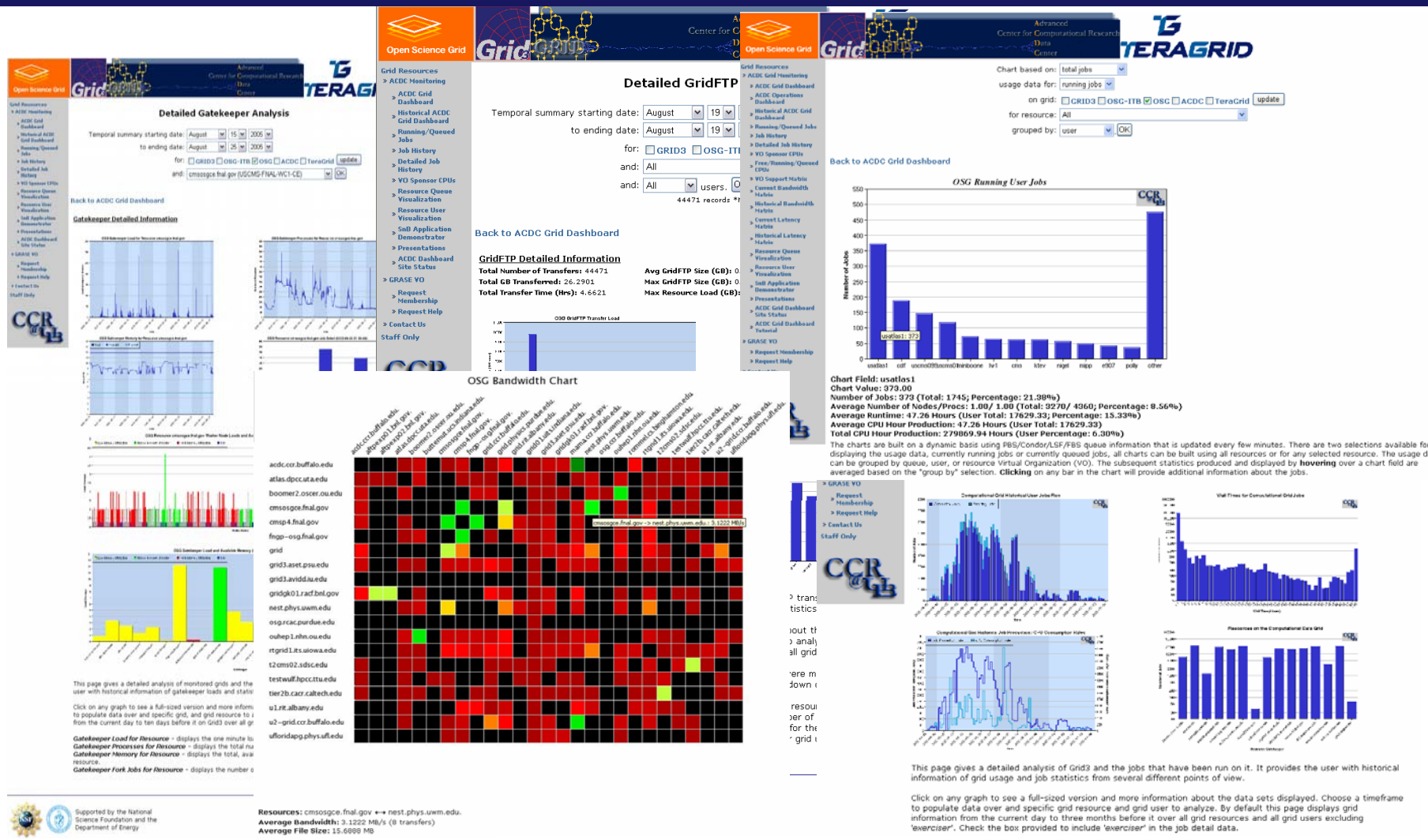


Provides **real-time** job, user, gatekeeper, storage and file transfer **statistics**.

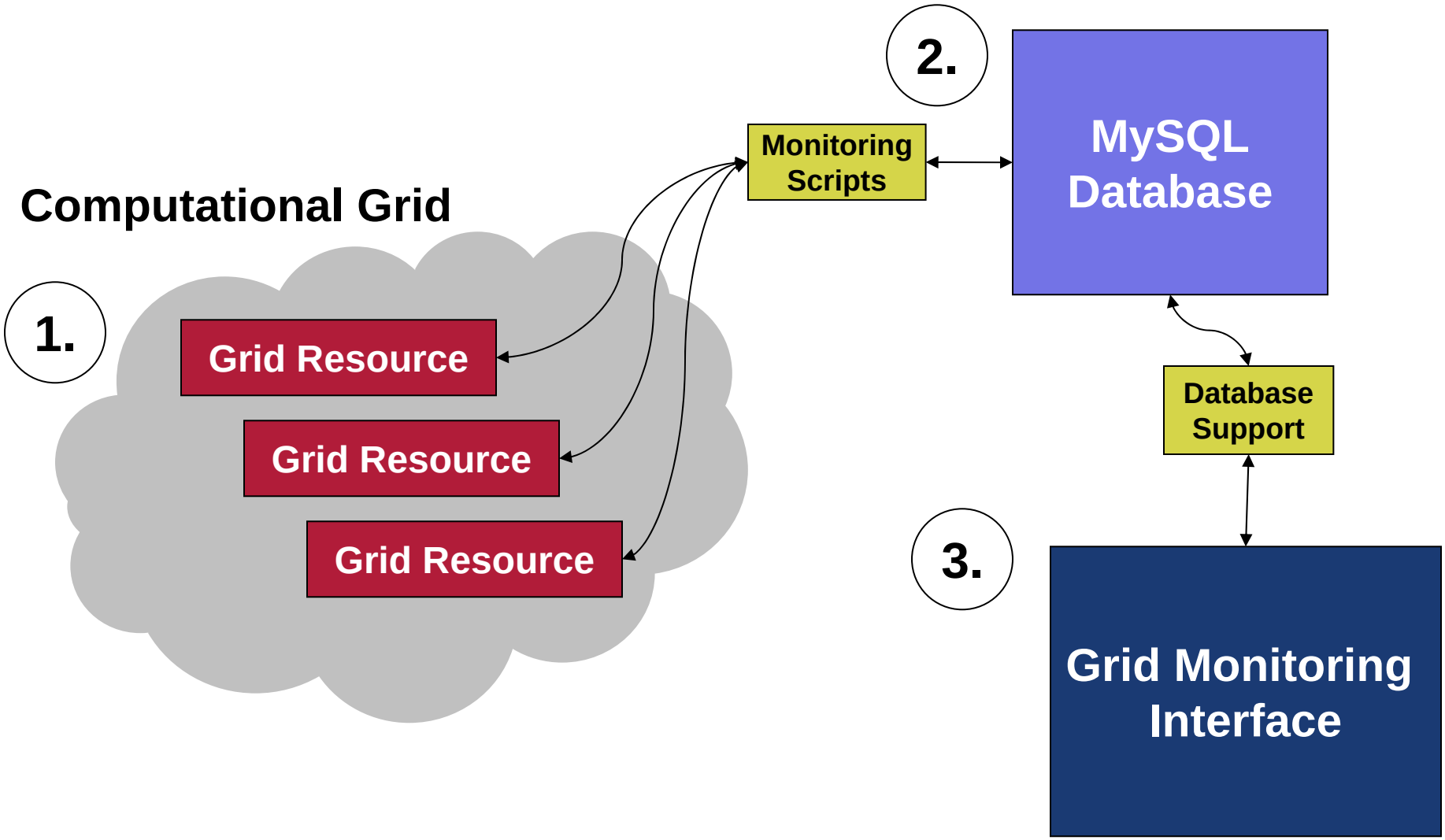
The ACDC Grid Dashboard



The ACDC Grid Dashboard



Grid Monitoring at CCR



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**

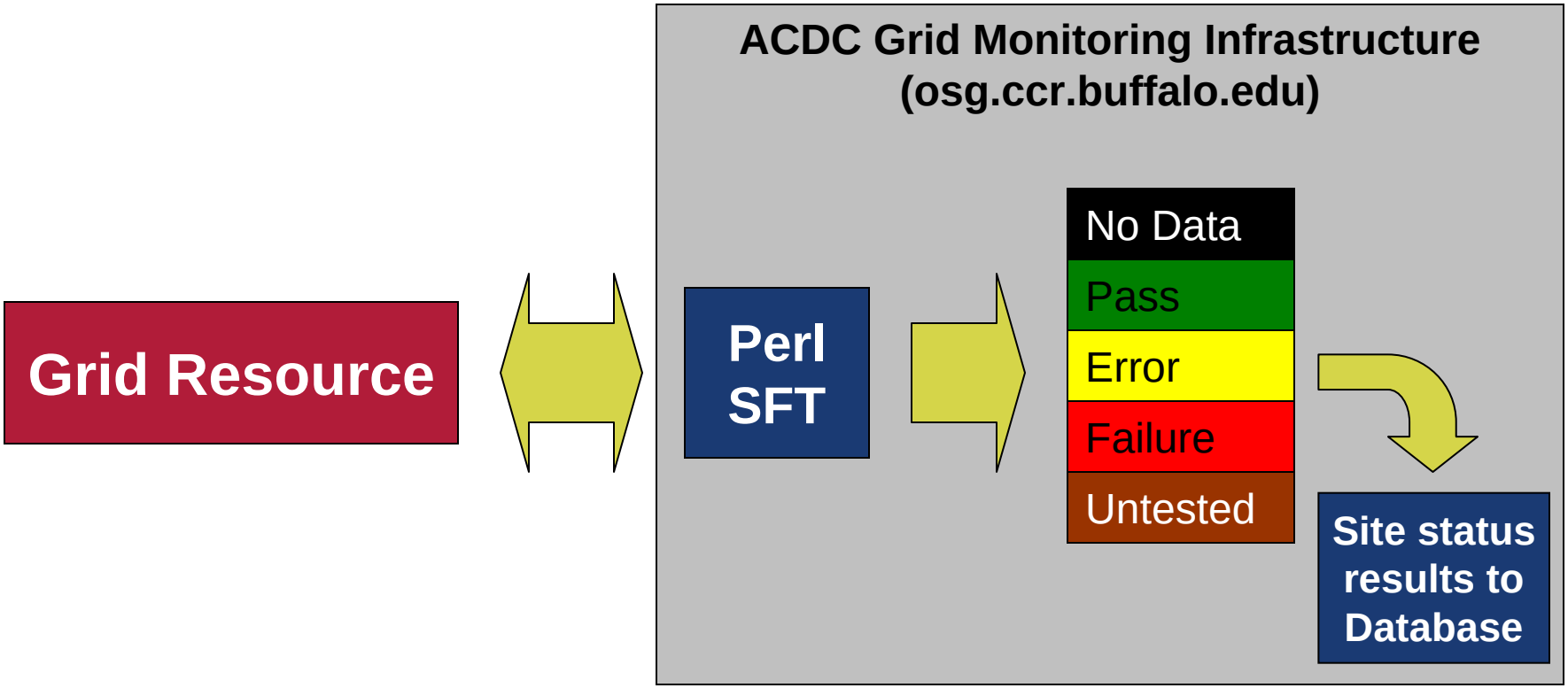
Operations Dashboard

- **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

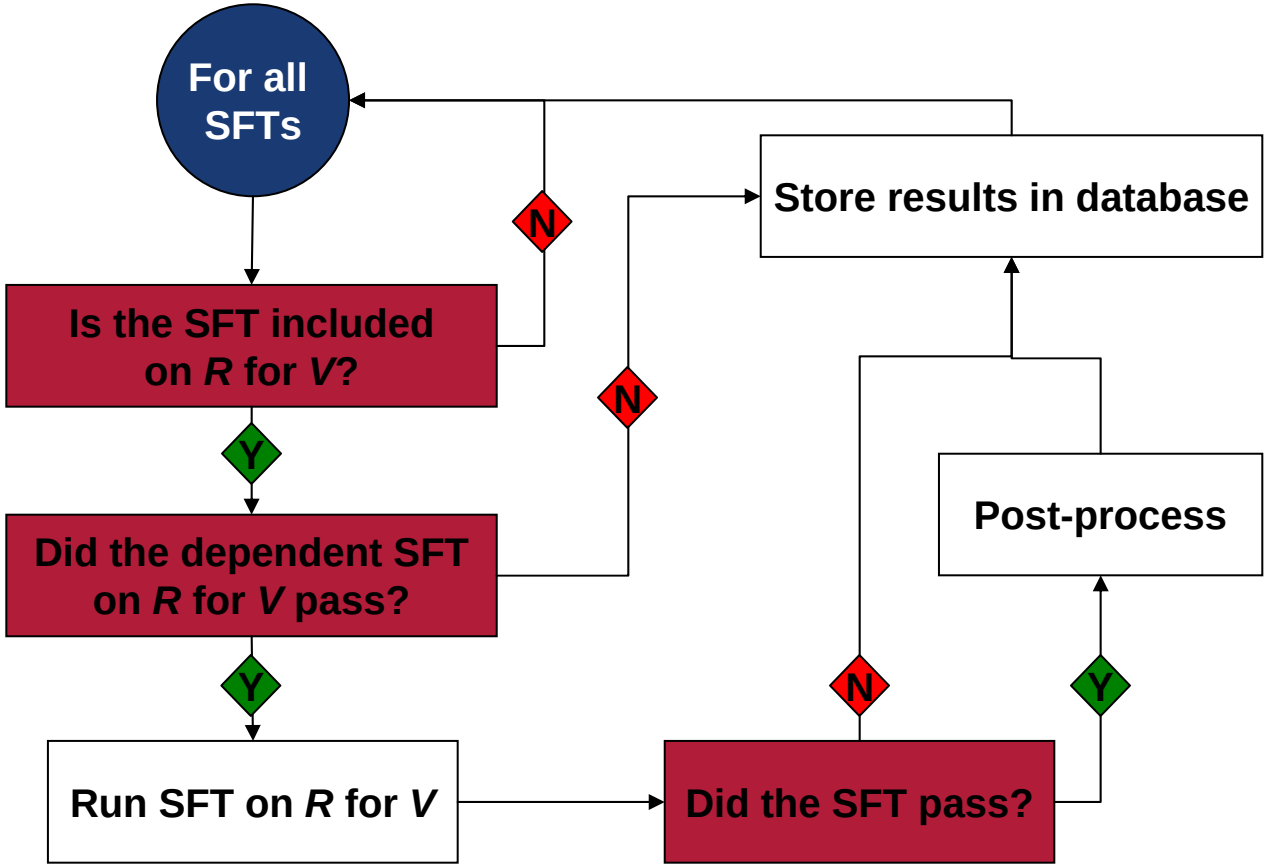
Site Functional Tests



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

Site Functional Tests

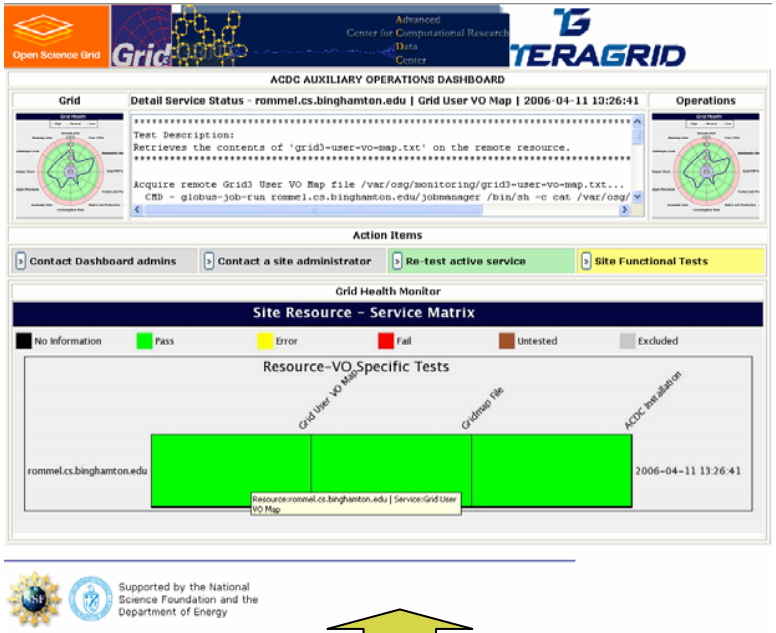
For compute resource ***R***, VO ***V***



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

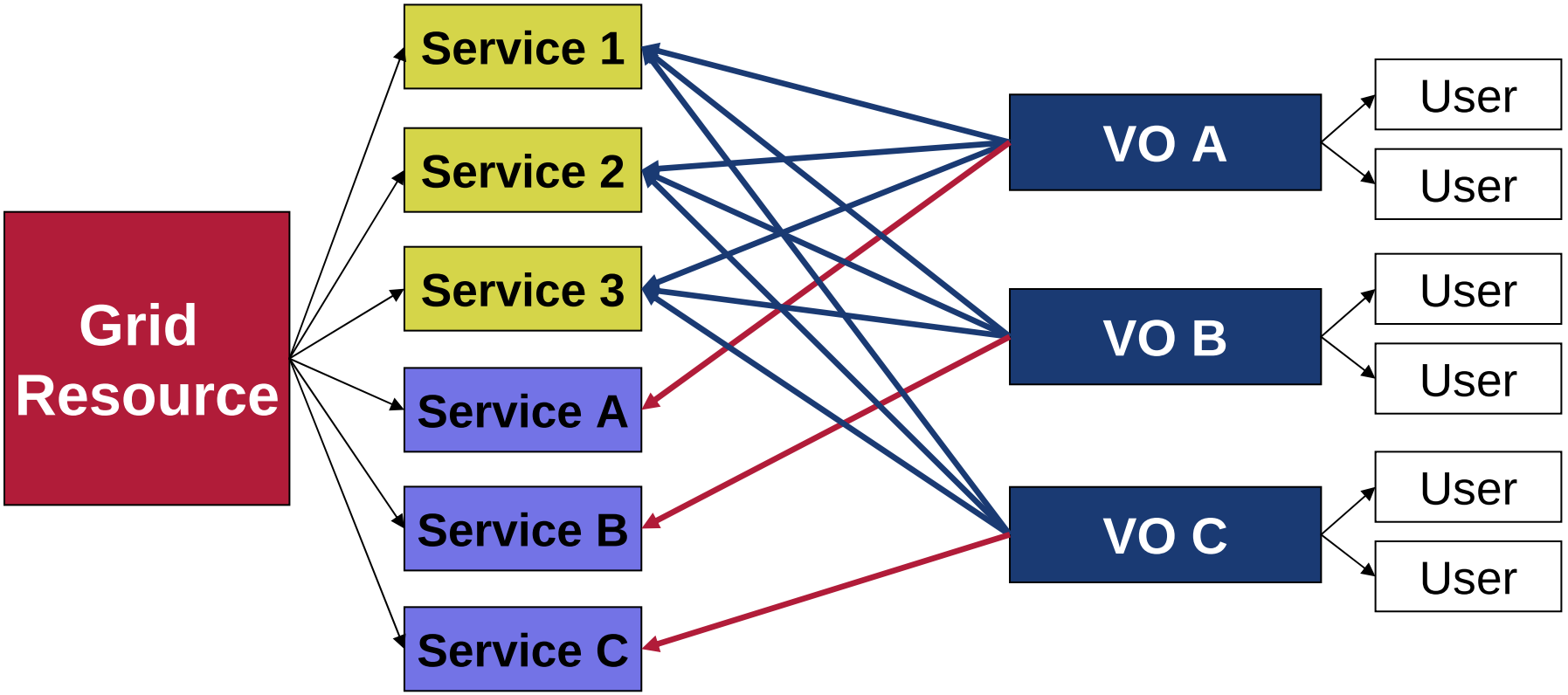
- **Connectivity (socket can be established)**
- **Running a gatekeeper**
- **Authentication possible through Globus**
- **Fork job manager can run an “echo” command**

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**

VO-Specific Testing

- VOs test each service to ensure **basic** functionality for ALL users
- VOs test services relevant to them to ensure **extra** functionality for users



The ACDC Operations Dashboard

Contact Dashboard Administrators	GENERAL
Contact a Site Administrator	
Check Privileges	
Check Maintenance Schedule	
Show Site Functional Test History	
Site / Policy Information	

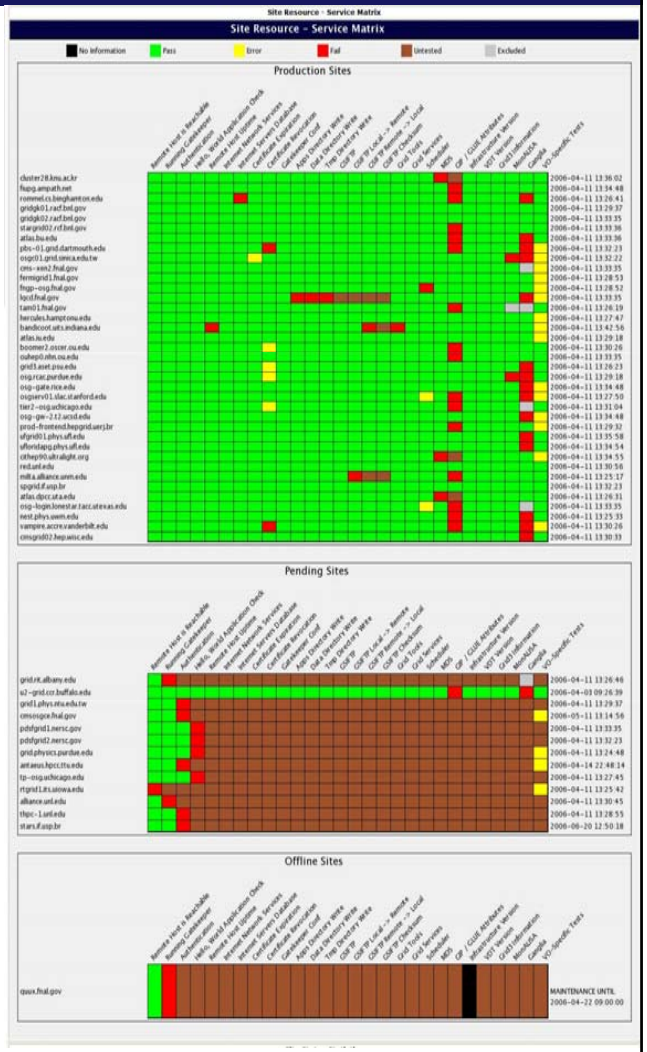
Re-test Active Service	LOW
Re-test Active Resource	

Pull Resource Data	MEDIUM
Set Offline / Online Status	
Update Registration Information	
Show / Hide Resources	
Site Functional Tests	

Register New Resource	HIGH
Pull Resource Data for ALL VOs	
Pull Data for ALL Resources	
Re-test All Resources	
Change Grid Designation	
Retire a Resource	
Upload a VO Proxy	
Database Sync	
Database Interface	

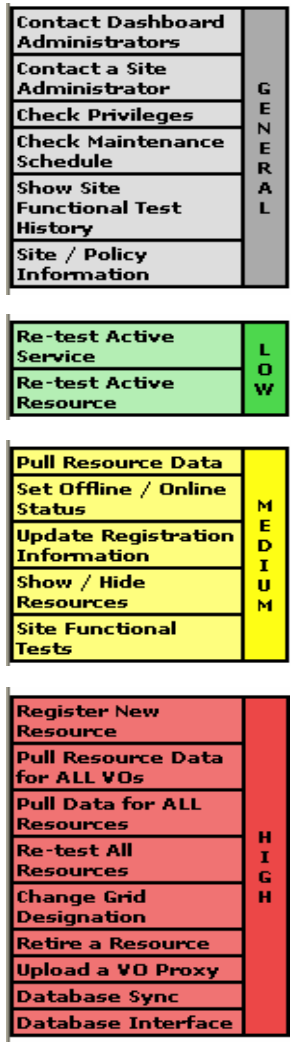
Site Resource – Service Matrix

- 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



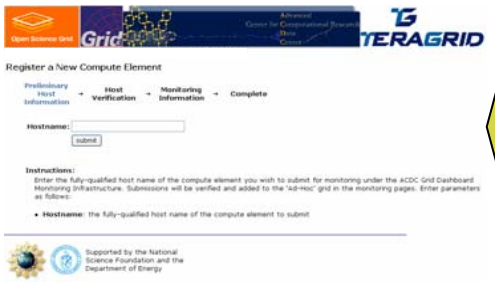
Action Items

Contact a site administrator regarding site status results

Establish a maintenance schedule for a remote site

Upload a proxy for VO-Specific Testing

Re-run a Site Functional Test on a compute resource

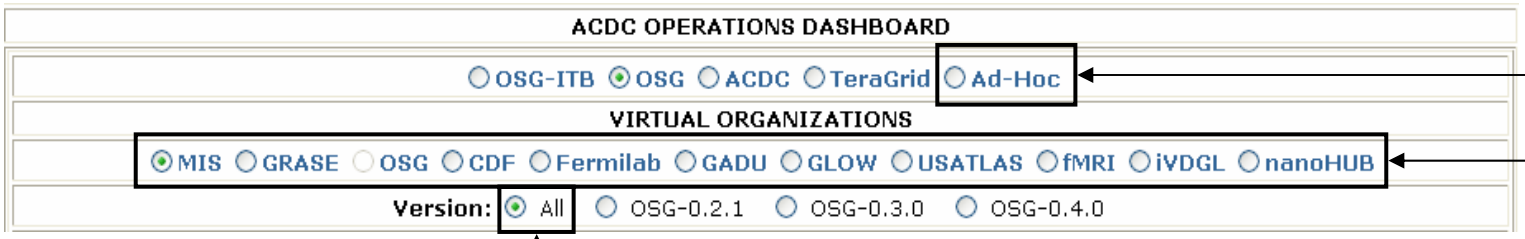


Register a new compute resource for monitoring

Off-Line Demonstration

Choose a Grid/VO/Version

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



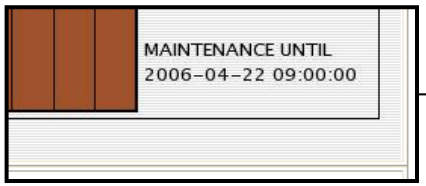
- The default grid designation for newly registered resources
- VO-Specific testing, with proxies on behalf of VO users
- The default version for non-OSG compute resources

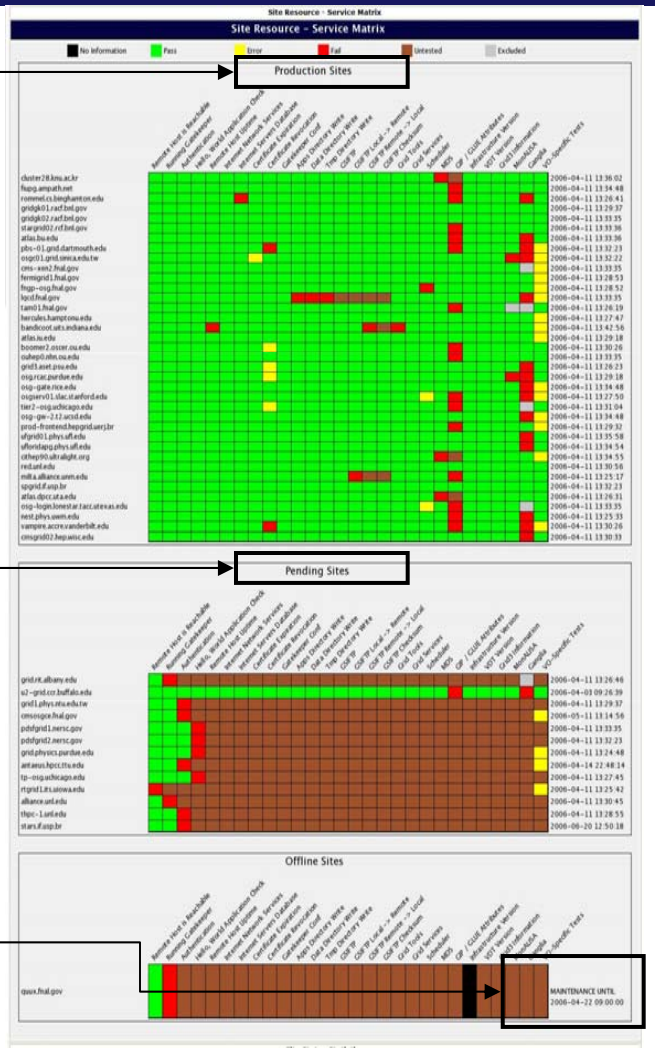
Dynamically draws the corresponding Site Resource – Service Matrix

The Site Resource – Service Matrix

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

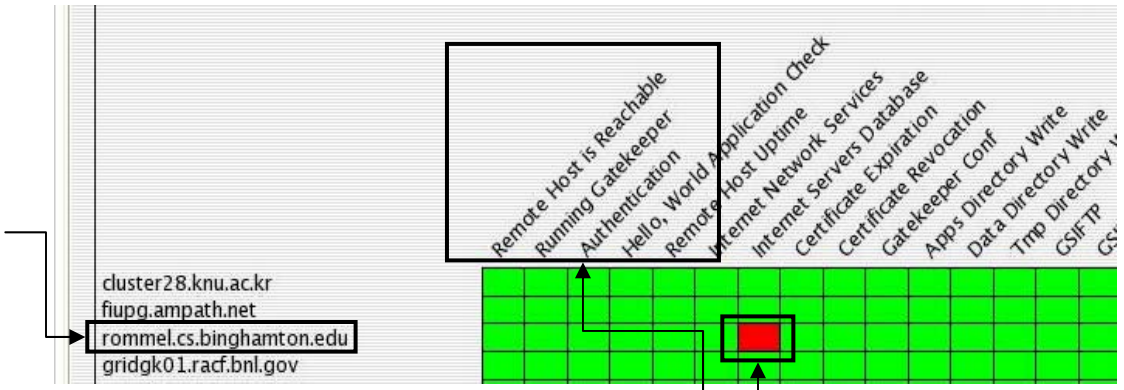




The Site Resource – Service Matrix

The **Site Resource – Service Matrix** is organized by computer resource and SFT

- Compute resources make up the rows of the matrix

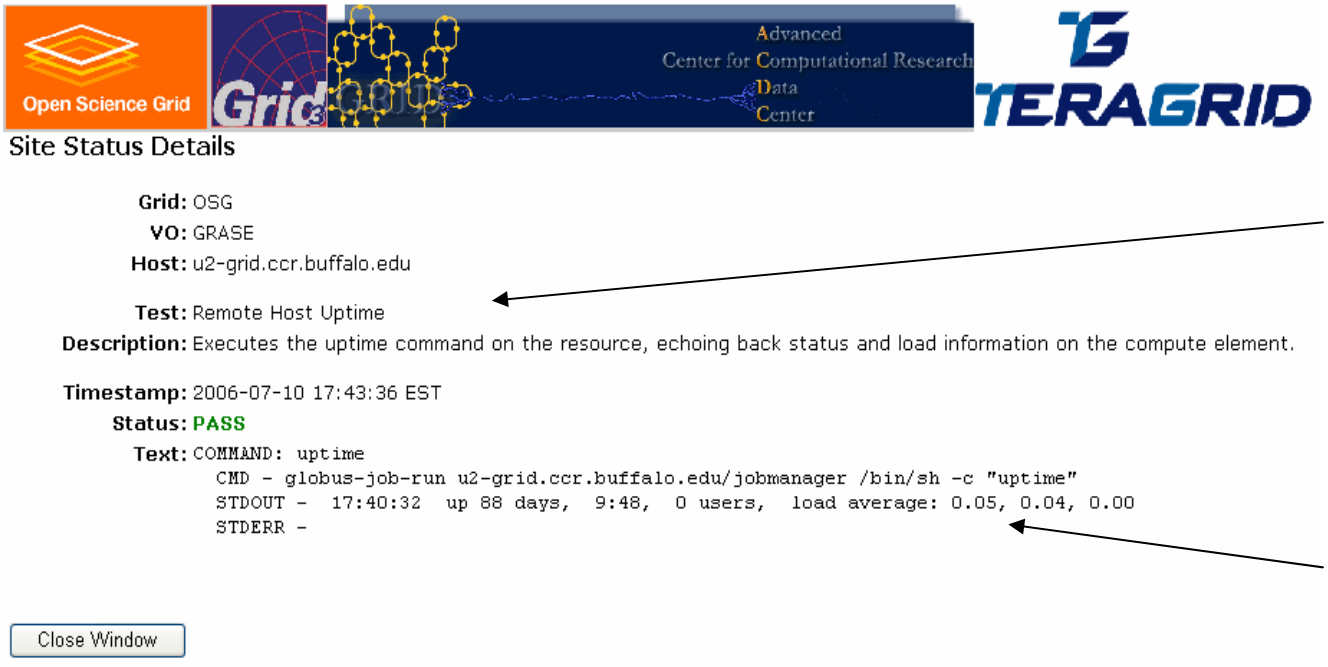


- Site Functional Tests make up the columns of the matrix

- 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:

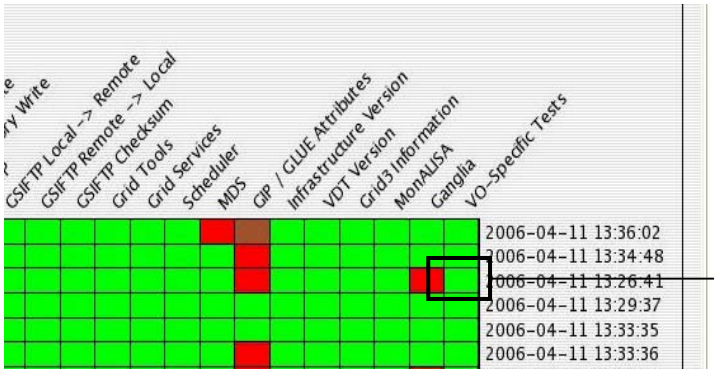


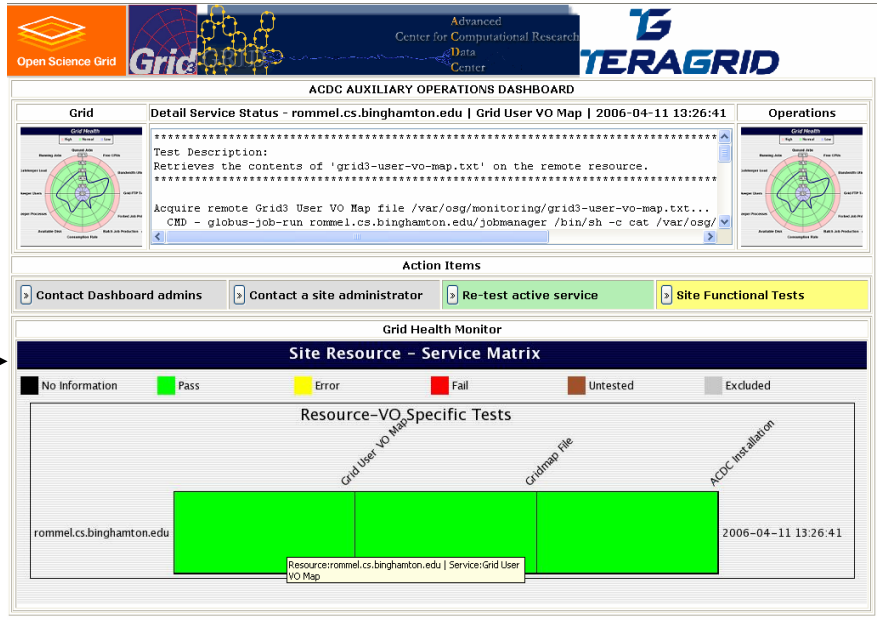
- SFT and runtime information
- Full text SFT results from the compute resource

Supported by the National Science Foundation and the Department of Energy

Auxiliary Operations Dashboard

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

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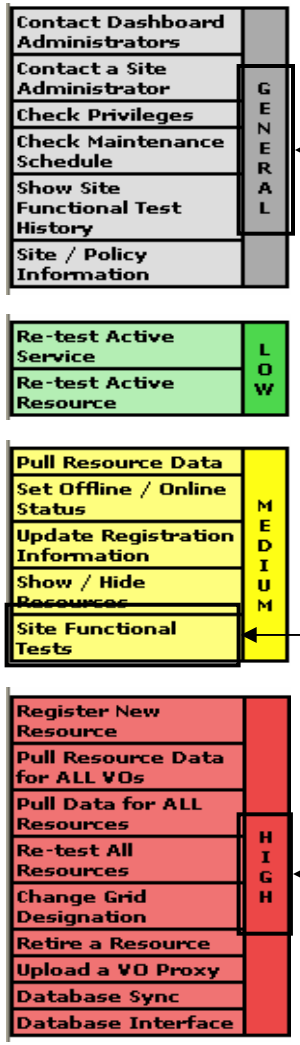
Action Items



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

Authorization Level:

LOW action item privilege authorized: ✔
MED action item privilege authorized: ✔
HIGH action item privilege authorized: ✔

close window

Supported by the National Science Foundation and the Department of Energy

- Verifies the browser certificate to determine individual privilege levels

Contact a Site Administrator

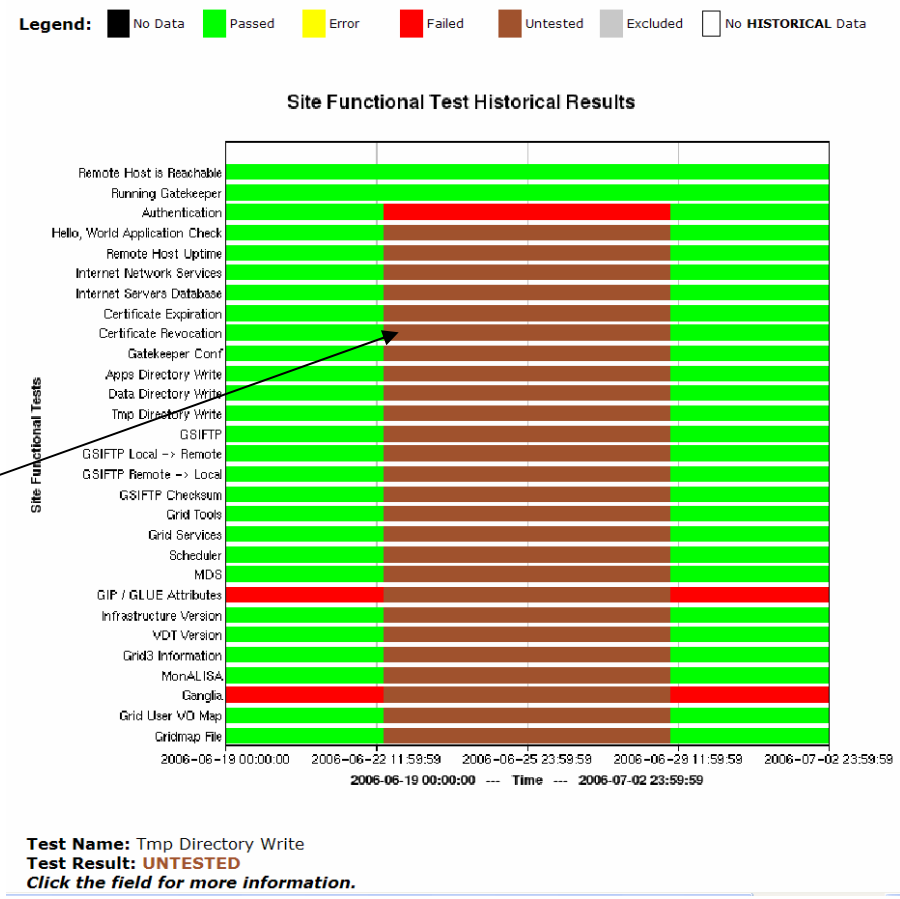
Collaborate with site administrators by contacting them directly from the dashboard

- 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

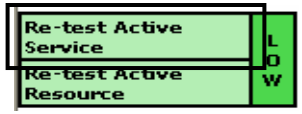
View historical SFT information for a compute resource and VO

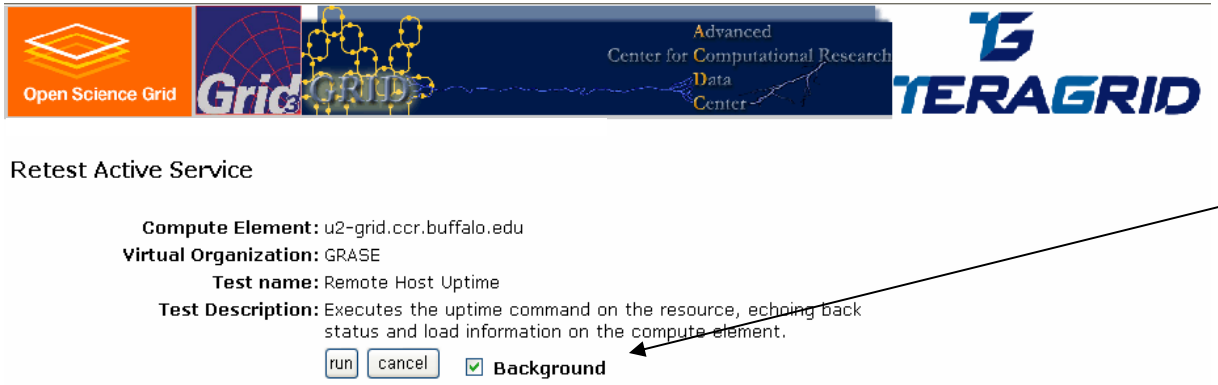
- Choose a time range for a compute resource and a VO to view historical SFT results over
- Click a region of the dynamic chart to view specific full text SFT results which caused the change.



Re-run a Site Functional Test

Troubleshoot and **publish** the latest test results by invoking SFTs directly

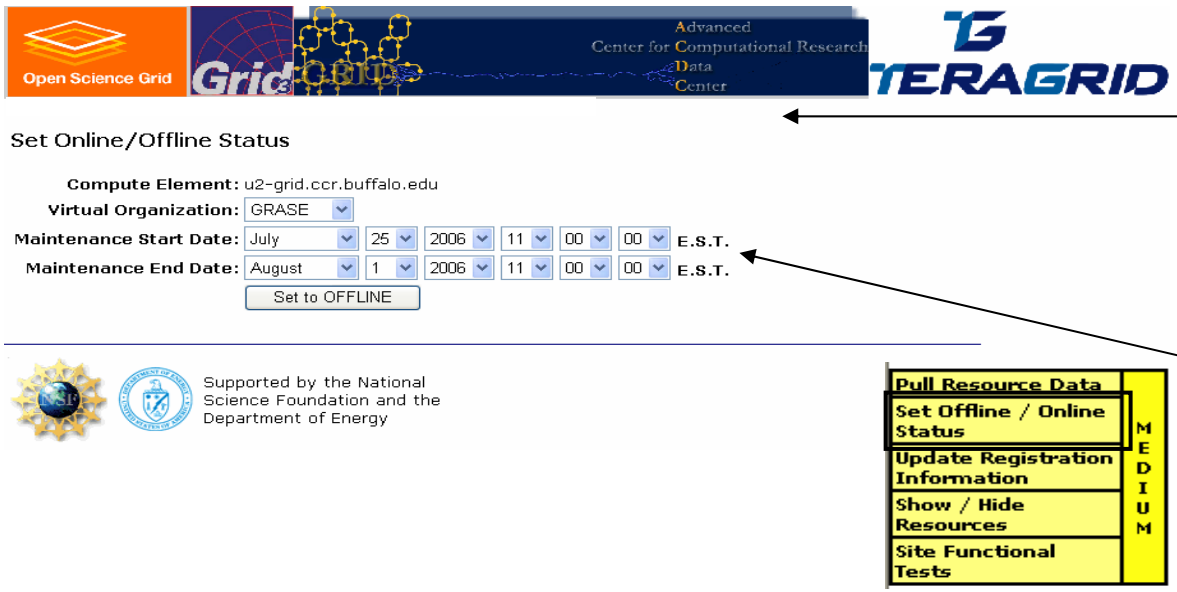




- Run tests in the background or in the foreground through the popup window
- Results are visible by all users once the test is complete

Publish Maintenance Information

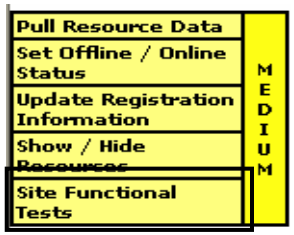
Publish maintenance information by establishing a maintenance schedule and setting the resource to offline



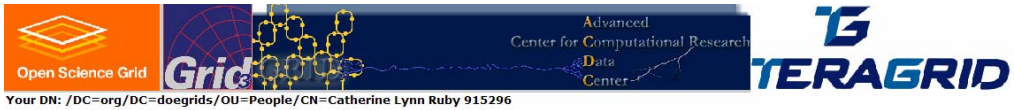
- Access is restricted to administrators of the site and dashboard administrators
- Establish a maintenance schedule by setting maintenance dates

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



Your DN: /DC=org/DC=doegrids/OU=People/CN=Catherine Lynn Ruby 915296

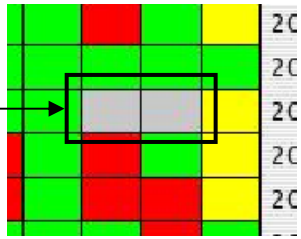
Include / Exclude Site Functional Tests

Grid: OSG
Resource: u2-grid.ccr.buffalo.edu
VO: ◉ MIS ○ ALL

#	Test Name	Type	Description	↓
1	Remote Host is Reachable	GENERAL	Determine if the host is reachable by attempting to establish connections to ports 2119, 22 and 23, respectively. This is the FIRST CRITICAL TEST and sites must pass this to be considered a production resource.	☑
2	Running Gatekeeper	GENERAL	Verifies that the site is running a gatekeeper by attempting to establish a connection to port 2119. This is the SECOND CRITICAL TEST and sites must pass this to be considered a production resource.	☑
3	Authentication	GENERAL	Verifies that users can authenticate on the compute element. This is the THIRD CRITICAL TEST and sites must pass this to be considered a production resource.	☑
4	Hello, World Application Check	GENERAL	Tests the ability to run a simple Globus command by executing an echo command. This is the FOURTH CRITICAL TEST and sites must pass this to be considered a production resource.	☑
5	Remote Host Uptime	GENERAL	Executes the uptime command on the resource, echoing back status and load information on the compute element.	☑
6	Internet Network Services	GENERAL	Retrieves the contents of '/etc/services' on the remote host.	☑
7	Internet Servers Database	GENERAL	Retrieves the contents of '/etc/xinetd.conf' on the remote resource.	☑
8	Certificate Expiration	GENERAL	Searches the contents of 'hostcert.pem' for information on the expiration of the certificate.	☑
9	Certificate Revocation	GENERAL	Retrieves the contents of all $GLOBUS_LOCATION/TRUSTED_CA/ .r0 files and among them attempts to determine the days left until revocation of the DOEGRID CA.	☑
10	Gatekeeper	GENERAL	Retrieves the contents of 'globus-gatekeeper.conf' from	☑

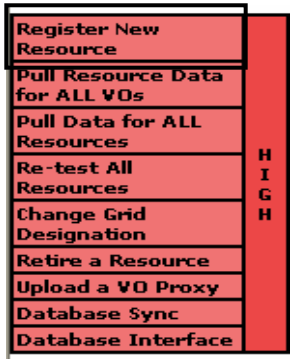
- Mark SFTs to be tested or not tested during status updates

- Excluded SFTs are grey on the Site Resource – Service Matrix and are not run for the compute resource and VO



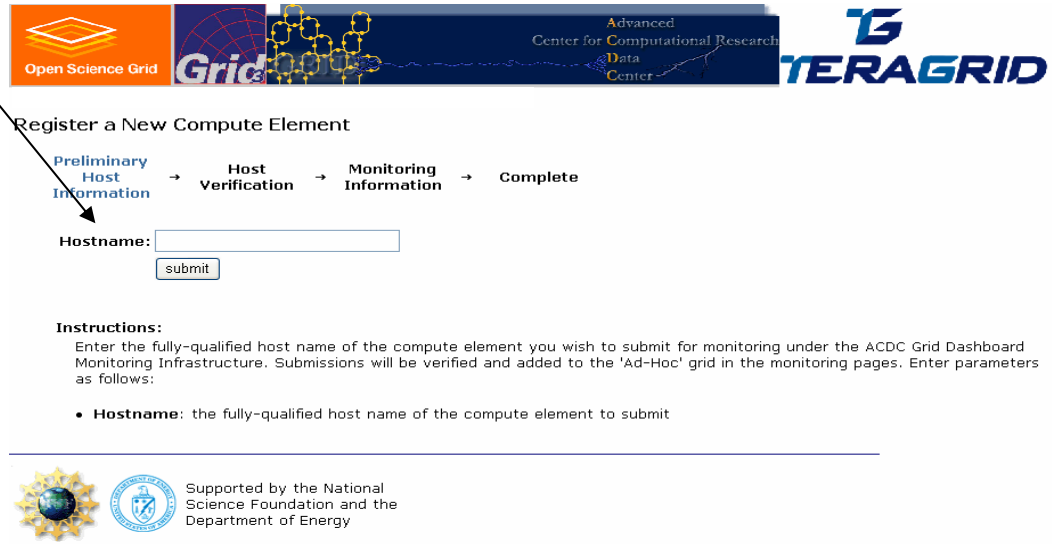
Add a New Resource

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



- Provide the hostname of the new compute resource

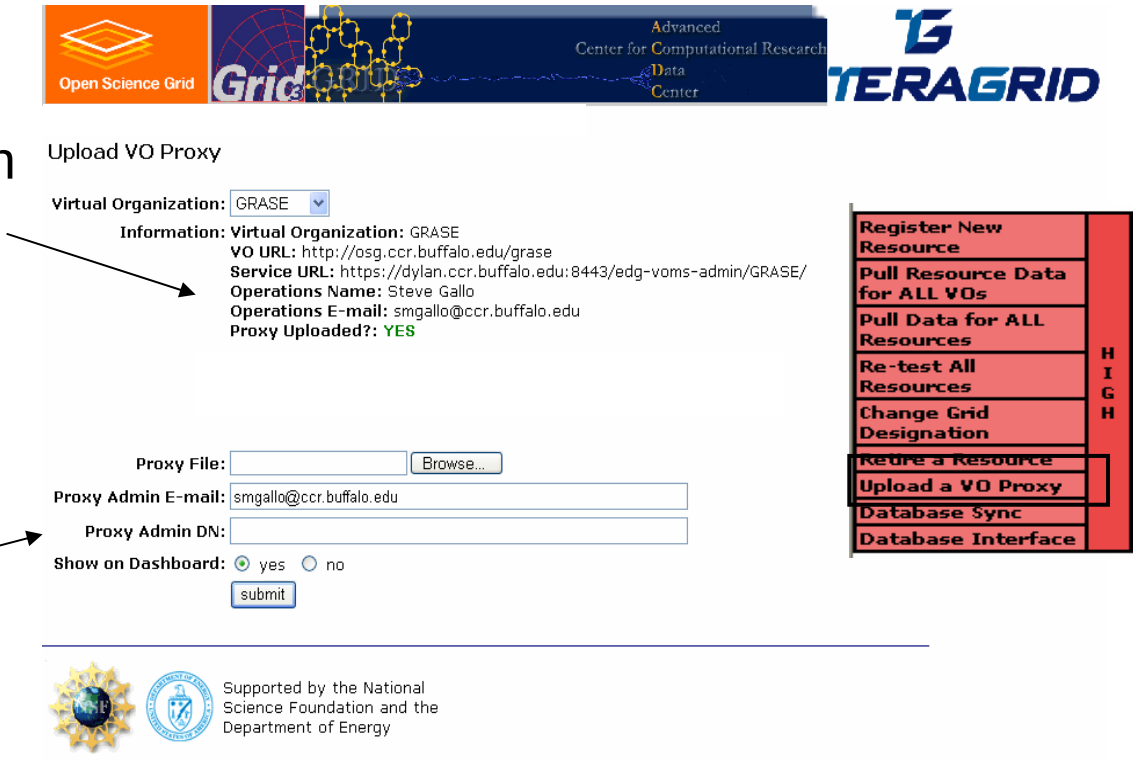
- Initial verifications and a prompt for administrative information fully register the compute resource in the *Ad-Hoc* grid where it can be monitored through the dashboard infrastructure.



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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