Globus Community Updates and User Experiences

Paul Davé, Director of User Services, Computation Institute

April 12, 2011

Agenda

- **Globus Community Update**
- **Presentations by:**
  - ARCS: Graham Jenkins, VPAC
  - NERSC: Shreyas Cholia, Lawrence Berkeley Labs
  - iBi: Brigitte Raumann, University of Chicago
  - GARUDA: Prahlada Rao, C-DAC Bangalore

Globus Community Update

- **Over the past 12 months…**
  - Working closely with various communities and users
  - Jointly have made significant progress
- **Results:** Availability of Globus Online and Globus Connect
  - Fast and reliable file transfer
  - Secure hosted service
  - Make your local machine an endpoint

Sampling of User Accomplishments

- **Lattice QCD Community researcher – transferred 100 7-GB files in 90 minutes (normally could take days with scp)**
- **Argonne researcher moved 300,000 files totaling 586 TB to LBNL and ORNL – high end-to-end performance done by ordinary users**
- **Climate researchers at the University of Colorado achieved nearly a 160x speed-up for download times to a laptop with the benefit of 'fire-and-forget'**
- **MCS at ANL moved 75GB in about 10 min - same transfer took 108 min using globus-url-copy**

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In Closing

- **Be sure to attend tutorials tomorrow:**
  - GO Overview
  - GO and Clusters
  - Advanced CLI and Scripting
  - Transfer REST API
- **There's still time to enter Contests:**
  - Submit the best story
  - Move the most data
  - To participate: www.globusonline.org/gw11contests

Thanks for your time!

Australian Research Collaboration Service
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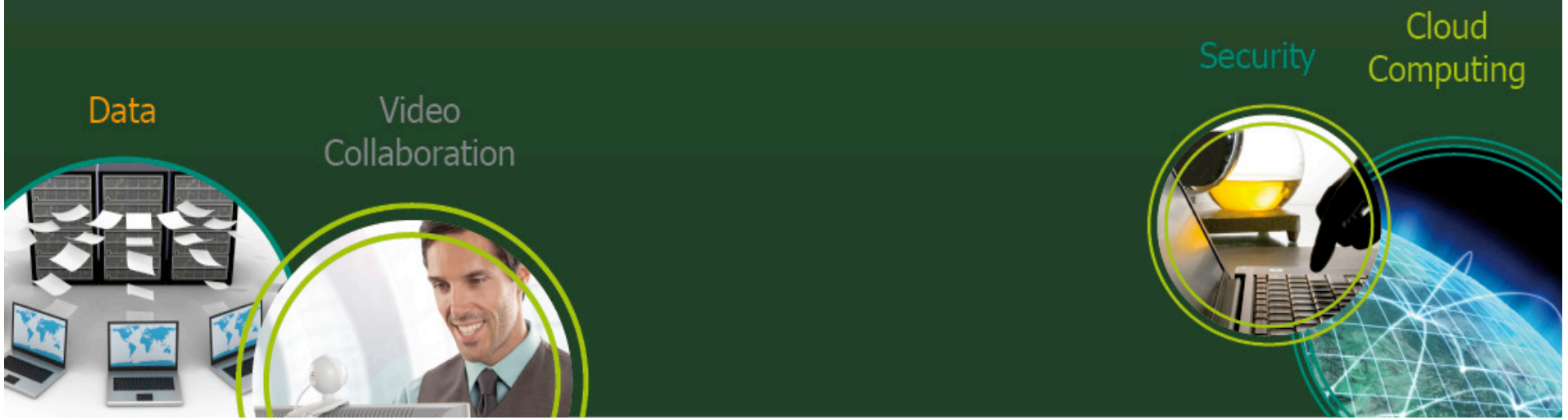
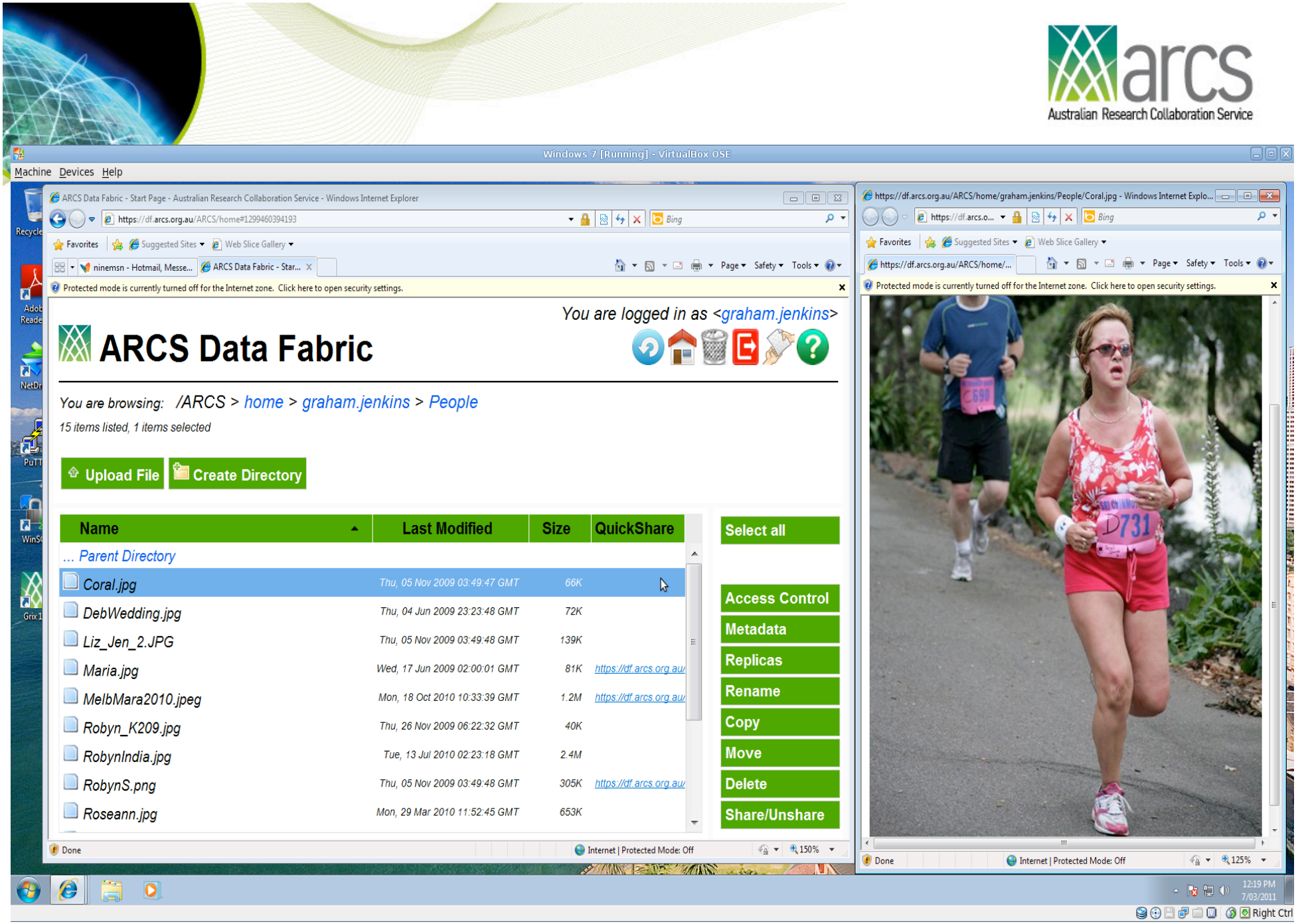
An Australian Government Initiative
National Collaborative Research Infrastructure Strategy

Globus Down-Under

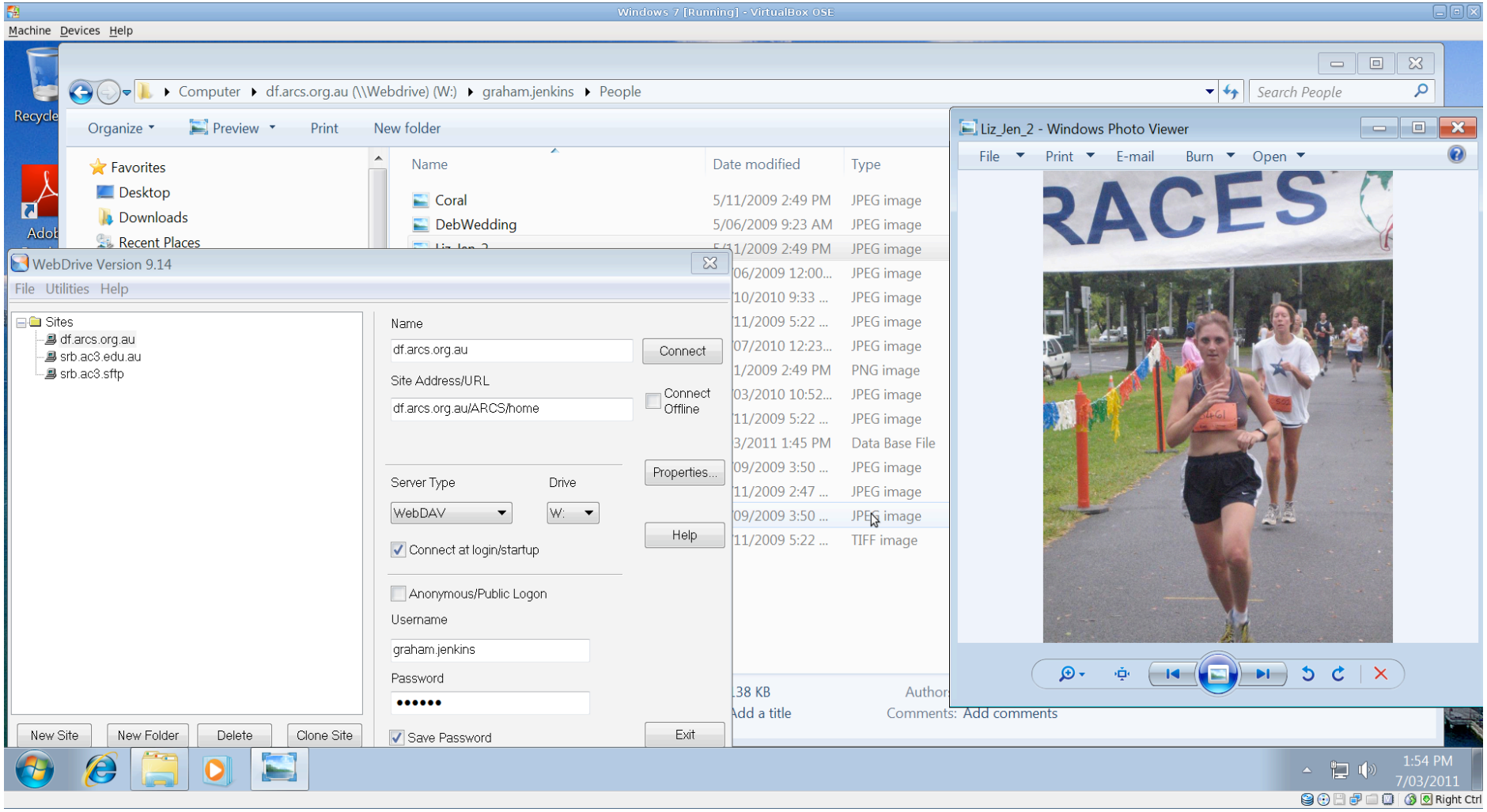
The ARCS Data Fabric



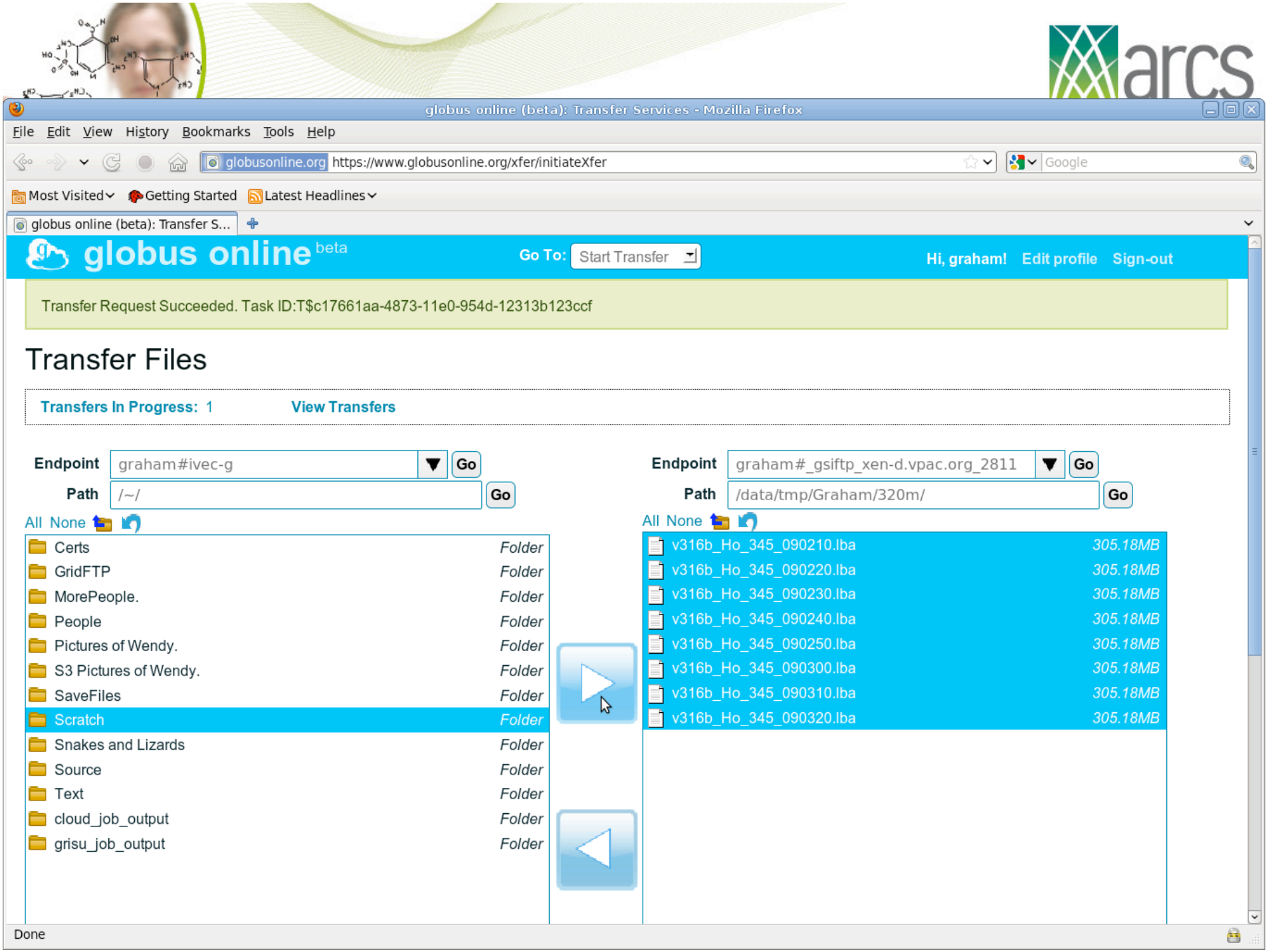
- **The ARCS Data Fabric is iRODS-based, with replication at storage resources in all States.**
- **Institution (Shib.) Certificates are used for authentication, together with a limited access myproxy CA.**
- **Web-based access is offered for convenience.**
- **Windows tools like WebDrive and WinSCP can be used with davfs2 and sftp interfaces.**


Windows 7 [Running] - VirtualBox OSE
Machine Devices Help
ARCS Data Fabric - Start Page - Australian Research Collaboration Service - Windows Internet Explorer
https://df.arcs.org.au/ARCS/home#1299460394193
Protected mode is currently turned off for the Internet zone. Click here to open security settings.
You are logged in as <graham.jenkins>
ARCS Data Fabric
You are browsing: /ARCS > home > graham.jenkins > People
15 items listed, 1 items selected
Upload File
Create Directory
Name
Last Modified
Size
QuickShare
... Parent Directory
Coral.jpg Thu, 05 Nov 2009 03:49:47 GMT 66K
DebWedding.jpg Thu, 04 Jun 2009 23:23:48 GMT 72K
Liz_Jen_2.JPG Thu, 05 Nov 2009 03:49:48 GMT 139K
Maria.jpg Wed, 17 Jun 2009 02:00:01 GMT 81K
MelbMara2010.jpeg Mon, 18 Oct 2010 10:33:39 GMT 1.2M
Robyn_K209.jpg Thu, 26 Nov 2009 06:22:32 GMT 40K
RobynIndia.jpg Tue, 13 Jul 2010 02:23:18 GMT 2.4M
RobynS.png Thu, 05 Nov 2009 03:49:48 GMT 305K
Roseann.jpg Mon, 29 Mar 2010 11:52:45 GMT 653K
Select all
Access Control
Metadata
Replicas
Rename
Copy
Move
Delete
Share/Unshare
https://df.arcs.org.au/ARCS/home/graham.jenkins/People/Coral.jpg - Windows Internet Explo...
Protected mode is currently turned off for the Internet zone. Click here to open security settings.
Right Ctrl

Australian Research Collaboration Service



- The Griffin GridFTP interface allows users to store and retrieve large files rapidly.
- Globus Online can be used for server-to-server transfers.
- Globus Connect makes it easy for those with Mac workstations.
- It's not so easy for those with Windows workstations.


globus online (beta): Transfer Services - Mozilla Firefox
File Edit View History Bookmarks Tools Help
globusonline.org https://www.globusonline.org/xfer/initiateXfer
Google
Most Visited Getting Started Latest Headlines
globus online (beta): Transfer S...
globus online beta
Go To: Start Transfer
Hi, graham! Edit profile Sign-out
Transfer Request Succeeded. Task ID:T$c17661aa-4873-11e0-954d-12313b123ccf
Transfer Files
Transfers In Progress: 1
View Transfers
Endpoint graham#ivec-g Go
Path /~/ Go
All None
Certs Folder
GridFTP Folder
MorePeople. Folder
People Folder
Pictures of Wendy. Folder
S3 Pictures of Wendy. Folder
SaveFiles Folder
Scratch Folder
Snakes and Lizards Folder
Source Folder
Text Folder
cloud_job_output Folder
grisu_job_output Folder
Endpoint graham#_gsiftp_xen-d.vpac.org_2811 Go
Path /data/tmp/Graham/320m/ Go
All None
v316b_Ho_345_090210.lba 305.18MB
v316b_Ho_345_090220.lba 305.18MB
v316b_Ho_345_090230.lba 305.18MB
v316b_Ho_345_090240.lba 305.18MB
v316b_Ho_345_090250.lba 305.18MB
v316b_Ho_345_090300.lba 305.18MB
v316b_Ho_345_090310.lba 305.18MB
v316b_Ho_345_090320.lba 305.18MB
Done

Australian Research Collaboration Service

globus online (beta): Transfer Services - Mozilla Firefox

File Edit View History Bookmarks Tools Help

globusonline.org https://www.globusonline.org/xfer/manageTasks#

Most Visited Getting Started Latest Headlines

globus online (beta): Transfer S...

globus online beta

Go To: View Transfers

Hi, graham! Edit profile Sign-out

Transfer Activity

Remove Data Filter

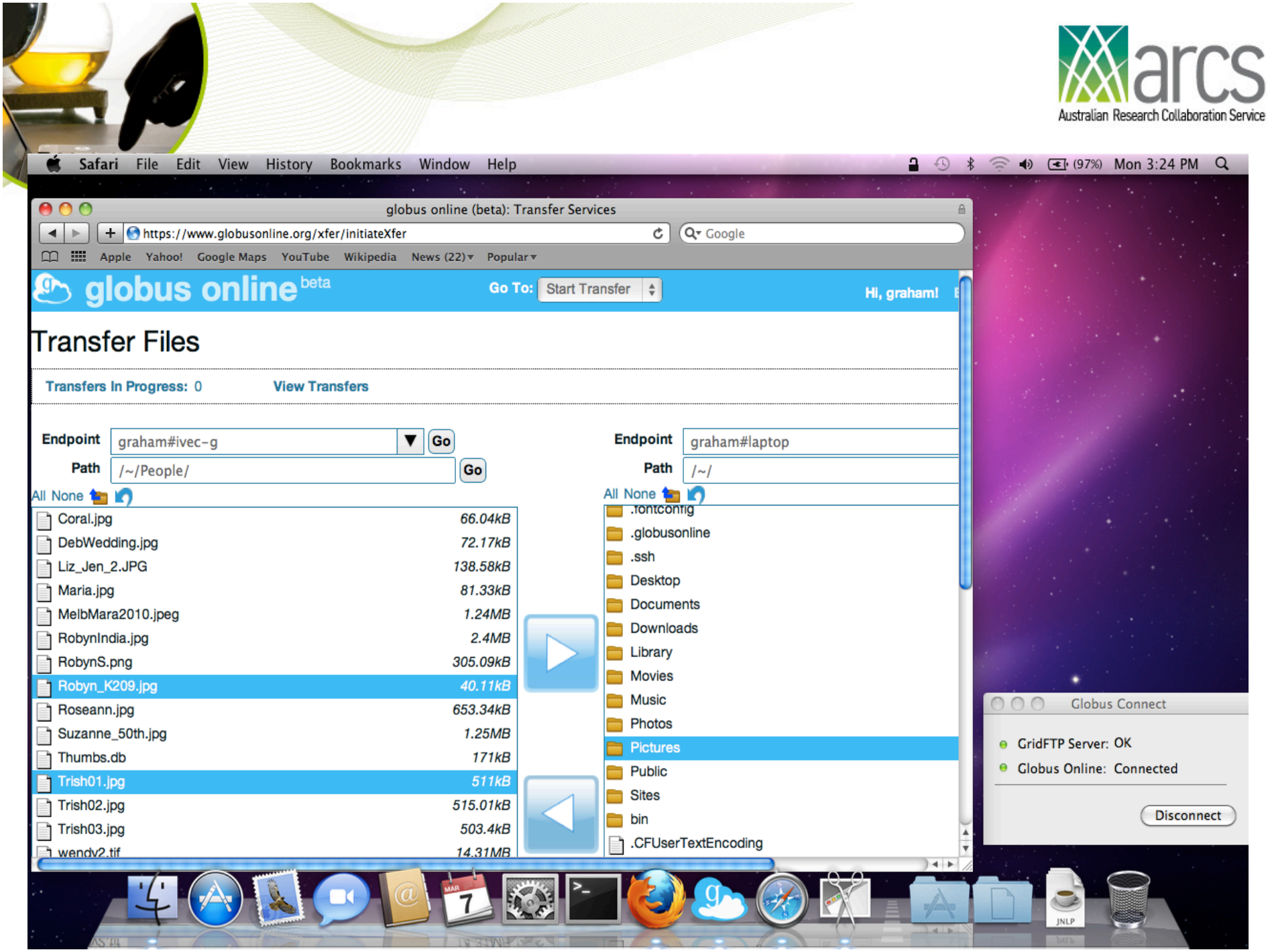
Cancel

1 of 8

View 25 Records

	Status	ID	Task Progress	Username	Completion Time	Request Time
☐		c1766...	4 / 8	graham		03/07/2011 04:32 AM
☐	✓	52d63...	28 / 28	graham	03/05/2011 12:53 AM	03/05/2011 12:50 AM
☐	✓	003b5...	15001 / 15001	graham	03/05/2011 07:03 AM	03/05/2011 12:48 AM
☐	✓	21d45...	15001 / 15001	graham	03/04/2011 12:05 AM	03/04/2011 09:25 AM
☐	✓	51c96...	15001 / 15001	graham	03/04/2011 06:09 AM	03/04/2011 03:58 AM
☐	✓	d99de...	15001 / 15001	graham	03/04/2011 02:32 AM	03/04/2011 12:21 AM
☐	✓	62f12...	10000 / 10000	graham	03/03/2011 05:37 AM	03/03/2011 02:34 AM
☐	✓	1464f...	1 / 1	graham	03/03/2011 12:55 AM	03/03/2011 12:51 AM
☐	✓	17b24...	17 / 17	graham	03/02/2011 10:11 PM	03/02/2011 10:10 PM
☐	!	eb8b5...	0 / 1 / 1	graham	03/02/2011 10:04 PM	03/02/2011 09:14 PM
☐	✓	55175...	10000 / 10000	graham	03/02/2011 09:26 PM	03/02/2011 09:13 PM
☐	✓	6ba30...	10000 / 10000	graham	03/02/2011 07:43 AM	03/02/2011 05:55 AM
☐	✓	b6299...	10000 / 10000	graham	03/02/2011 07:31 AM	03/02/2011 05:51 AM
☐	✓	a3957...	23 / 23	graham	03/02/2011 05:12 AM	03/02/2011 04:50 AM

Done


Safari File Edit View History Bookmarks Window Help
(97%) Mon 3:24 PM
globus online (beta): Transfer Services
https://www.globusonline.org/xfer/initiateXfer
Google
Apple Yahoo! Google Maps YouTube Wikipedia News (22) Popular
globus online beta
Go To: Start Transfer
Hi, graham!
Transfer Files
Transfers In Progress: 0
View Transfers
Endpoint graham#ivec-g Go
Path /~/People/ Go
All None
Coral.jpg 66.04kB
DebWedding.jpg 72.17kB
Liz_Jen_2.JPG 138.58kB
Maria.jpg 81.33kB
MelbMara2010.jpeg 1.24MB
RobynIndia.jpg 2.4MB
RobynS.png 305.09kB
Robyn_K209.jpg 40.11kB
Roseann.jpg 653.34kB
Suzanne_50th.jpg 1.25MB
Thumbs.db 171kB
Trish01.jpg 511kB
Trish02.jpg 515.01kB
Trish03.jpg 503.4kB
wendy2.tif 14.31MB
Endpoint graham#laptop
Path /~/
All None
.fontconfig
.globusonline
.ssh
Desktop
Documents
Downloads
Library
Movies
Music
Photos
Pictures
Public
Sites
bin
.CFUserTextEncoding
Globus Connect
GridFTP Server: OK
Globus Online: Connected
Disconnect

Australian Research Collaboration Service

Windows 7 [Running] - VirtualBox OSE

Machine Devices Help

Recycle Bin

Adobe Reader 9

NetDrive

Grix 1.2

PuTTY

WinSCP

Windows PowerShell

```
PS C:\Users\graham> myproxy -l graham -h myproxy2.arcs.org.au anonget
Enter MyProxy Pass Phrase:
 A proxy has been received for user graham in C:\Users\graham\AppData\Local\Temp\x509up_u_graham
PS C:\Users\graham> globus-url-copy -nodcau file:////c:\autoexec.bat gsiftp://arcs-df.ivec.org:2810//~/Scratch/a.bat
PS C:\Users\graham>
```

4:05 PM
7/03/2011

Right Ctrl

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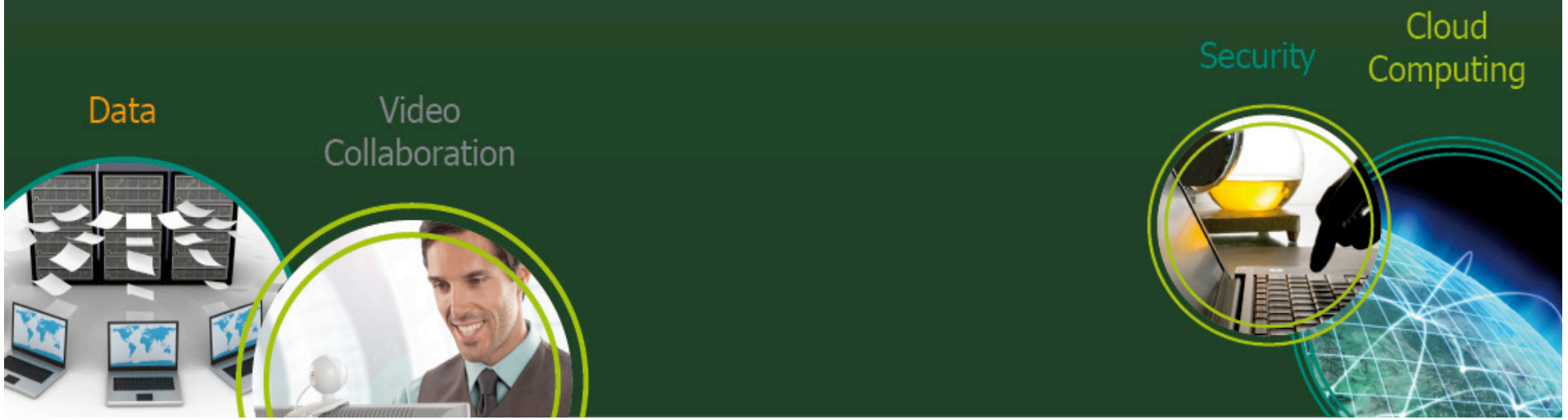
Globus Down-Under

The ARCS Compute Cloud



- VDT 2.0 with Globus 4.0.8 web-services and VOMS is installed on cluster gateway machines in all Australian States.
- Institution (Shib.) authentication is used.
- A web-based job-submission tool is available.

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ARCS - Welcome to the Frontpage - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.arcs.org.au/

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Robyn_K209.jpg (JPEG Ima... | ARCS - Welcome to the Fro... | VPAC Staff - Login

Services Login

News

February ARCS Insight Newsletter Available

ARCS Reaches 1000-User Milestone for its Access Service

Testimonials

"By using one integrated system for managing our data we've increased our research productivity." - IMOS

Brochures

Data Services

Desktop Video Collaboration

More brochures

Case Studies

CSIRO - Using desktop video collaboration for efficient virtual meetings

More case studies

Video Collaboration

- Desktop Video Collaboration (EVO)
- Group Video Collaboration (Access Grid)
- Launch EVO@AU

Compute Cloud & Grid

- Compute Cloud and Grisu
- Web-Based Compute Cloud (beta)
- Launch Grisu

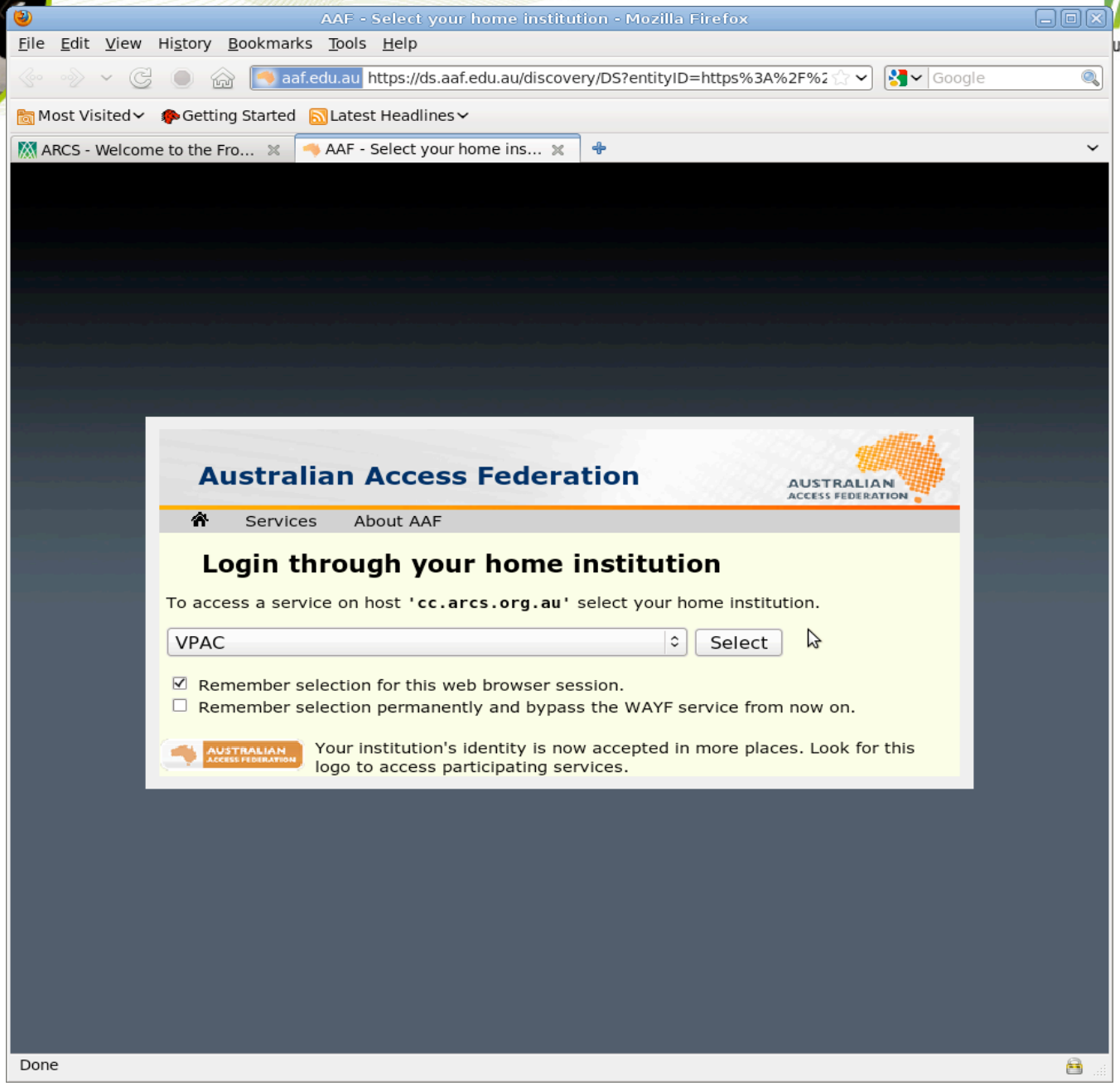
Security & Identity

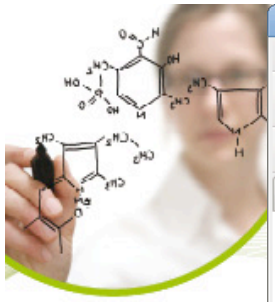
- Register to access ARCS services
- Obtain an ARCS identity
- Security information and advice

Data Services

- Data Services
- Get WebDrive
- Launch Data Fabric

Terminal | root@ng2:/opt | GlobusWorld.ppt - Ope... | ARCS - Welcome to th...


AAF - Select your home institution - Mozilla Firefox
File Edit View History Bookmarks Tools Help
aaf.edu.au https://ds.aaf.edu.au/discovery/DS?entityID=https%3A%2F%2
Google
Most Visited
Getting Started
Latest Headlines
ARCS - Welcome to the Fro...
AAF - Select your home ins...
Australian Access Federation
AUSTRALIAN ACCESS FEDERATION
Services
About AAF
Login through your home institution
To access a service on host 'cc.arcs.org.au' select your home institution.
VPAC
Select
Remember selection for this web browser session.
Remember selection permanently and bypass the WAYF service from now on.
Your institution's identity is now accepted in more places. Look for this logo to access participating services.
Done



VPAC Staff - Login - Mozilla Firefox

File Edit View History Bookmarks Tools Help

vpac.org https://idp.vpac.org/idp/Authn/UserPassword

Google

Most Visited Getting Started Latest Headlines

ARCS - Welcome to the Fro... VPAC Staff - Login

VICTORIAN PARTNERSHIP FOR ADVANCED COMPUTING

VPAC

VPAC Staff Login

Shibboleth Identity Provider Login to Service Provider https://cc.arcs.org.au/shibboleth

Username: graham

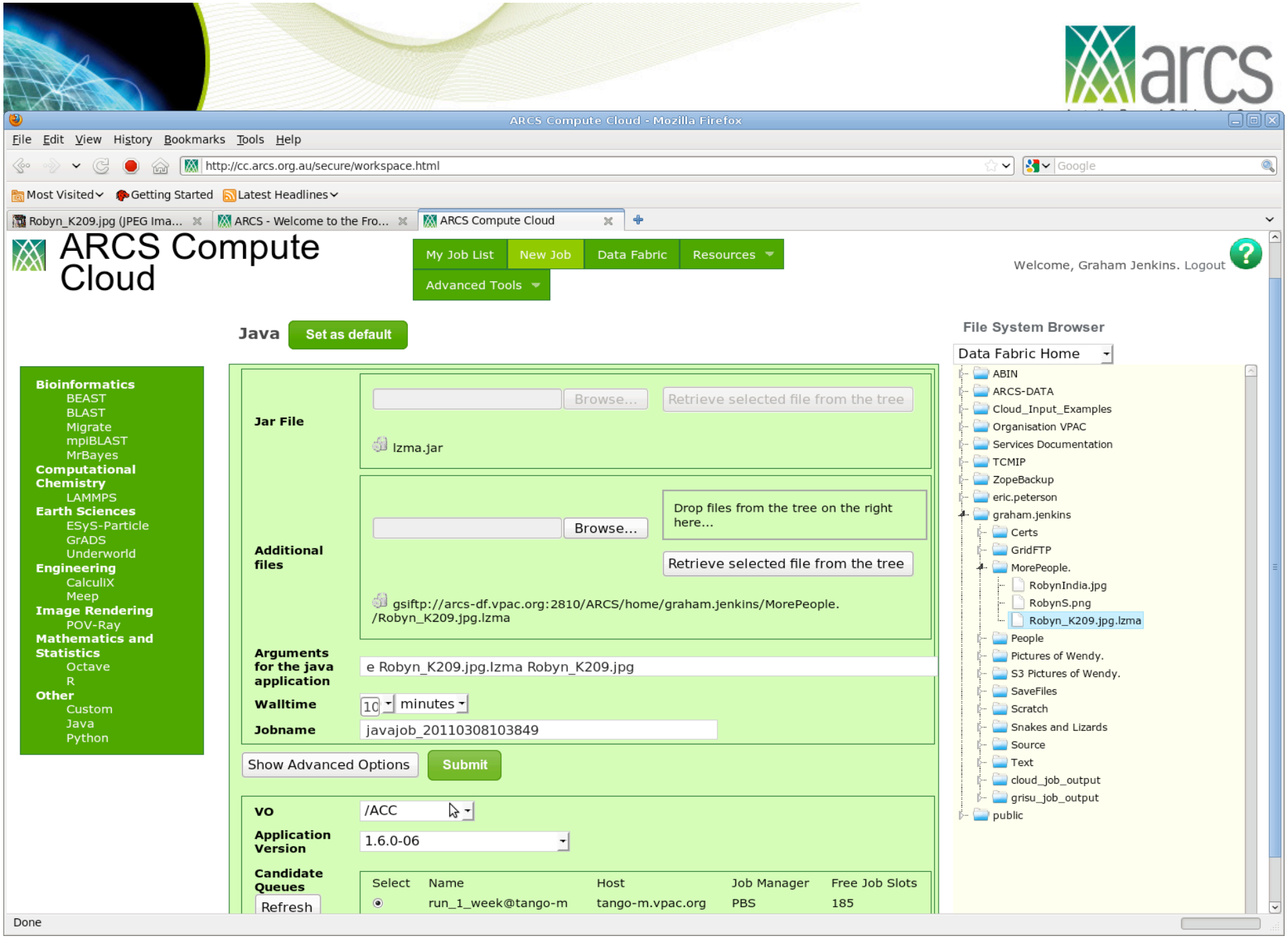
Password: ●●●●●●●

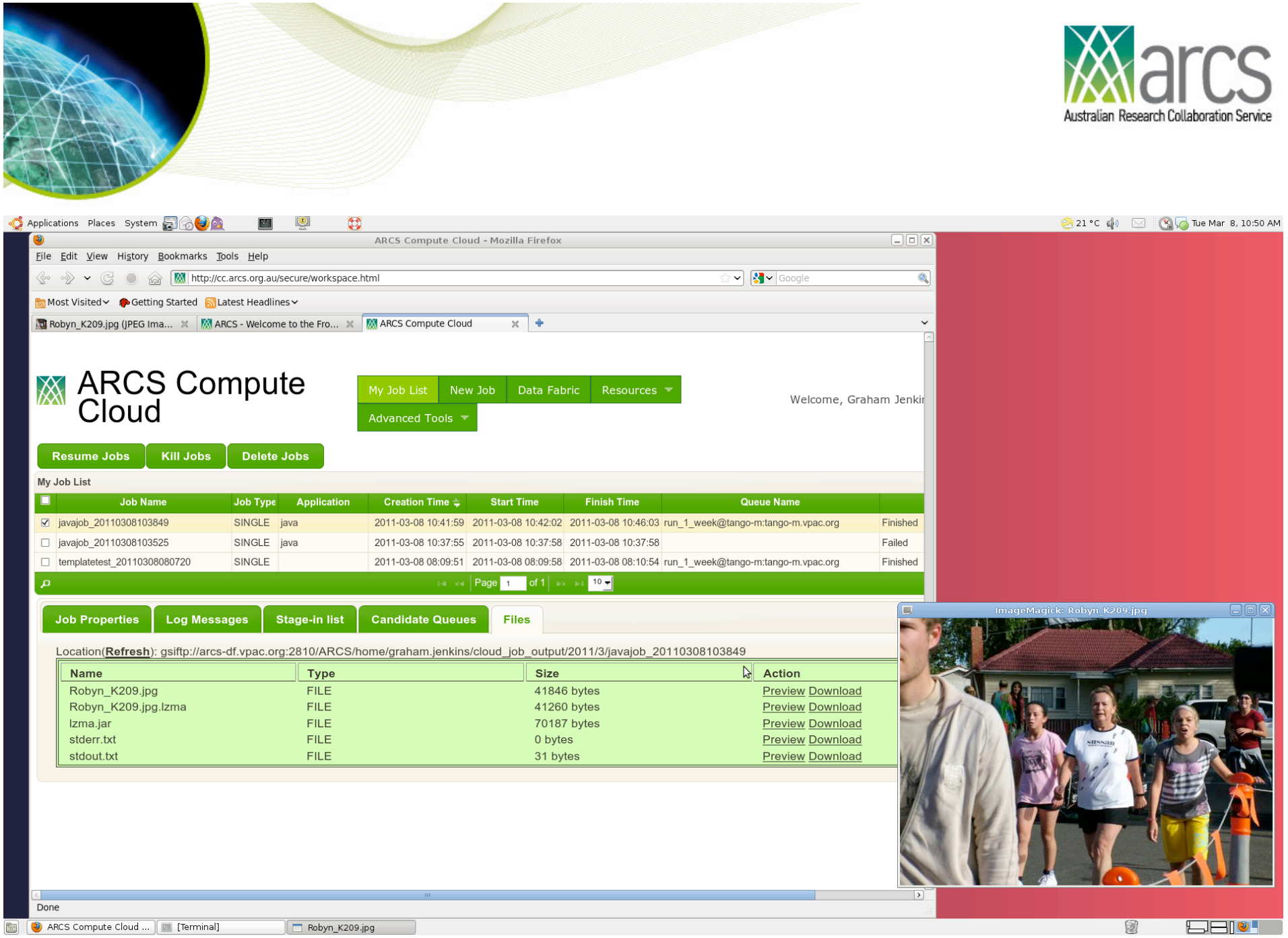
Login

Done

arcs

Australian Research Collaboration Service


ARCS Compute Cloud - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://cc.arcs.org.au/secure/workspace.html
Most Visited Getting Started Latest Headlines
Robyn_K209.jpg (JPEG Ima...
ARCS - Welcome to the Fro...
ARCS Compute Cloud
ARCS Compute Cloud
My Job List
New Job
Data Fabric
Resources
Advanced Tools
Welcome, Graham Jenkins. Logout
Java
Set as default
Bioinformatics
BEAST
BLAST
Migrate
mpiBLAST
MrBayes
Computational Chemistry
LAMMPS
Earth Sciences
ESyS-Particle
GrADS
Underworld
Engineering
CalculiX
Meep
Image Rendering
POV-Ray
Mathematics and Statistics
Octave
R
Other
Custom
Java
Python
Jar File
Browse...
Retrieve selected file from the tree
lzma.jar
Additional files
Browse...
Drop files from the tree on the right here...
Retrieve selected file from the tree
gsiftp://arcs-df.vpac.org:2810/ARCS/home/graham.jenkins/MorePeople./Robyn_K209.jpg.lzma
Arguments for the java application
e Robyn_K209.jpg.lzma Robyn_K209.jpg
Walltime
10
minutes
Jobname
javajob_20110308103849
Show Advanced Options
Submit
VO
/ACC
Application Version
1.6.0-06
Candidate Queues
Refresh
Select
Name
Host
Job Manager
Free Job Slots
run_1_week@tango-m
tango-m.vpac.org
PBS
185
File System Browser
Data Fabric Home
ABIN
ARCS-DATA
Cloud_Input_Examples
Organisation VPAC
Services Documentation
TCMIP
ZopeBackup
eric.peterson
graham.jenkins
Certs
GridFTP
MorePeople.
RobynIndia.jpg
RobynS.png
Robyn_K209.jpg.lzma
People
Pictures of Wendy.
S3 Pictures of Wendy.
SaveFiles
Scratch
Snakes and Lizards
Source
Text
cloud_job_output
grisu_job_output
public
Done


Applications Places System
21 °C Tue Mar 8, 10:50 AM
ARCS Compute Cloud - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://cc.arcs.org.au/secure/workspace.html
Most Visited Getting Started Latest Headlines
Robyn_K209.jpg (JPEG Ima...
ARCS - Welcome to the Fro...
ARCS Compute Cloud
ARCS Compute Cloud
My Job List
New Job
Data Fabric
Resources
Advanced Tools
Welcome, Graham Jenkin
Resume Jobs
Kill Jobs
Delete Jobs
My Job List
Job Name | Job Type | Application | Creation Time | Start Time | Finish Time | Queue Name
javajob_20110308103849 | SINGLE | java | 2011-03-08 10:41:59 | 2011-03-08 10:42:02 | 2011-03-08 10:46:03 | run_1_week@tango-m:tango-m.vpac.org | Finished
javajob_20110308103525 | SINGLE | java | 2011-03-08 10:37:55 | 2011-03-08 10:37:58 | 2011-03-08 10:37:58 | | Failed
templatetest_20110308080720 | SINGLE | | 2011-03-08 08:09:51 | 2011-03-08 08:09:58 | 2011-03-08 08:10:54 | run_1_week@tango-m:tango-m.vpac.org | Finished
Page 1 of 1
Job Properties
Log Messages
Stage-in list
Candidate Queues
Files
Location(Refresh): gsiftp://arcs-df.vpac.org:2810/ARCS/home/graham.jenkins/cloud_job_output/2011/3/javajob_20110308103849
Name | Type | Size | Action
Robyn_K209.jpg | FILE | 41846 bytes | Preview Download
Robyn_K209.jpg.lzma | FILE | 41260 bytes | Preview Download
lzma.jar | FILE | 70187 bytes | Preview Download
stderr.txt | FILE | 0 bytes | Preview Download
stdout.txt | FILE | 31 bytes | Preview Download
ImageMagick: Robyn_K209.jpg
Done
ARCS Compute Cloud ...
[Terminal]
Robyn_K209.jpg

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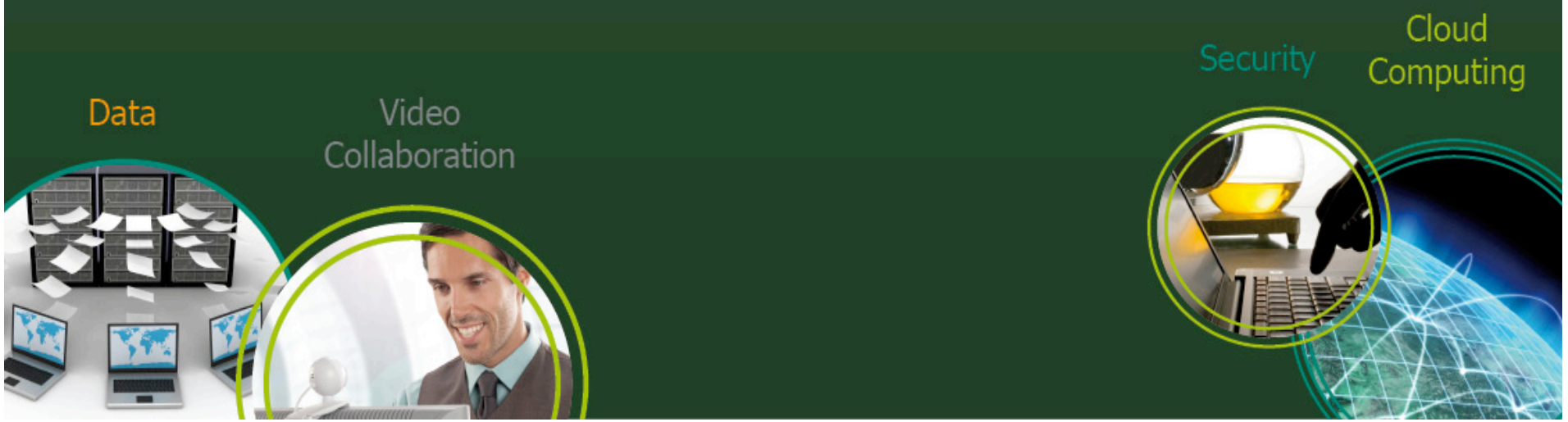
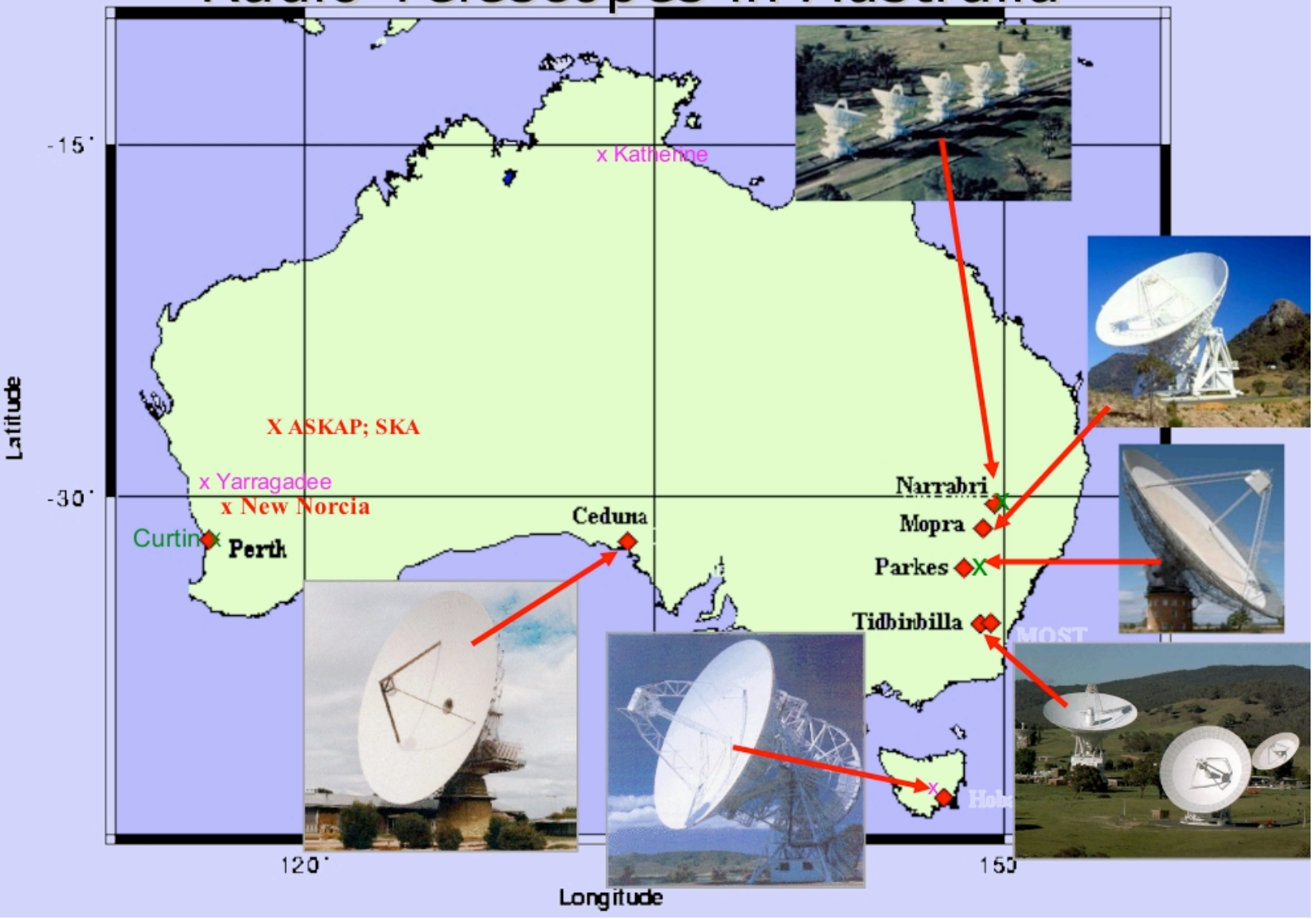
Globus Down-Under

Telescope Data Correlation

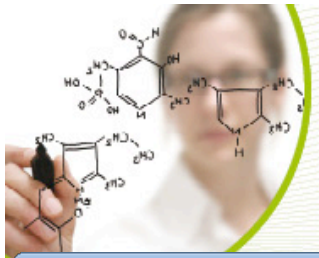


Radio Telescopes in Australia



- VLBI data from Australian telescope sites has traditionally been shipped to Perth on disks for correlation.
- It's now pushed there from each site using *globus-url-copy [-udt] -fast -cc 2 -p 4 file://.. sshftp://*
- udt tends to upset video conference customers using the same link!
- A major limitation is the speed at which data can be written at the destination.

- A wrapper script is use which checks existence and size of files at destination.
- This is necessary because destination site doesn't yet have sync-capable version of GridFTP.
- Remote sites don't allow GridFTP servers, don't like Grid Certificates.
- Globus Connect for Linux might be good!



Australian Research Collaboration Service

arcs@hovsi: ~

File Edit View Search Terminal Help

```
arcs@hovsi:~$ ~/bin/gloPut7T.sh /exports/xraid/Ar_1/v434d graham@pbstore.ivec.org $DESTIN/February11/v434d/Hobart
To Terminate gracefully,  enter: kill -TERM 8808
To switch to TCP/UDT mode enter: kill -USR1/USR2 8808
Generating a list of files to be copied .. wait ..
Tue 12:22:38 .. Pid: 8808 .. Files:
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110000.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110010.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110020.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110030.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110040.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110050.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110100.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110110.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110120.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110130.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110140.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110150.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110200.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110210.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110220.lba
 320004096 /exports/xraid/Ar_1/v434d/v434d_Ho_039_110230.lba
5120065536 total
```

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Globus Down-Under

The Christmas Outage Catastrophe

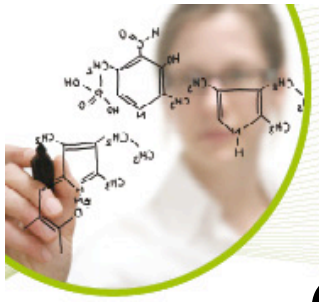
- Telescope data is stored in Perth on a Solaris SAM-FS (HSM) server.
- A one-week maintenance outage was scheduled beginning December 20.
- And there was a need to copy 7 terabytes of data from Hobart to Perth .. beginning December 20 .. over a 100 Mb/s link!
- Solution .. push data slowly to Monash University using GridFTP client with gsiftp.

- Then push the data to Perth using the scp command for Globus.Org ..
- But note the date!

graham@gridftp:~

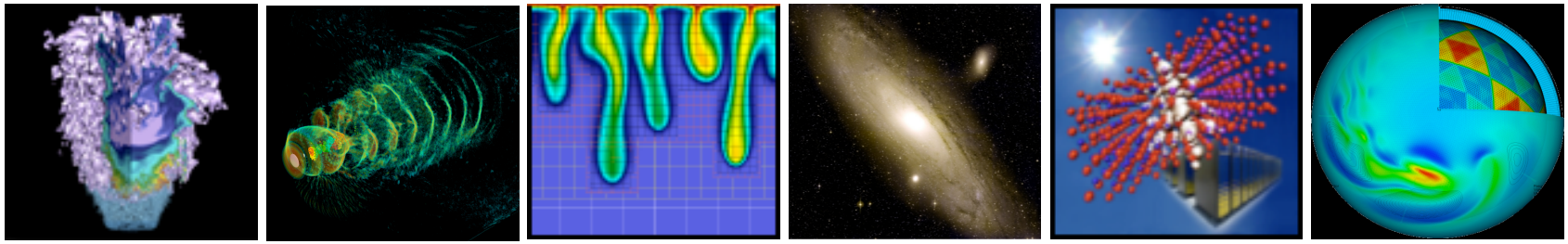
File Edit View Search Terminal Help

```
Task ID          : 0011a14c-23b0-11e0-ba83-12313916526c
Task Type        : TRANSFER
Parent Task ID   : n/a
Status           : ACTIVE
Request Time     : 2011-01-19 09:39:24Z
Deadline         : 2011-01-20 09:39:24Z
Completion Time  : n/a
Total Tasks      : 490
Tasks Successful : 143
Tasks Expired    : 0
Tasks Canceled   : 0
Tasks Failed     : 0
Tasks Pending    : 347
Tasks Retrying   : 0
Command          : scp -g -r -d 1d -D  hn3.its.monash.edu.au:/mnt/arcs/December10/vc137/Hobart/ pbstore.ivec.org:/pbstore/as03/ARCS-TRANSFERS
/December10/vc137/
Files            : 489
Directories      : 1
Bytes Transferred: 45343731712
MBits/sec        : 152.930
$
```



- Q. What happened here?
- A. The one-week outage turned into a one-month outage! :(
- Because we had spooled all the data to Monash University, we were able to unspool it rapidly to Perth over a fast link in a couple of days.
- And a lot of people are now very impressed with Globus Online :)


Sri Chinmoy Races



Globus Online @ NERSC

Shreyas Cholia

scholia@lbl.gov

NERSC - LBL

Globusworld – April 12th 2011

U.S. DEPARTMENT OF ENERGY | Office of Science

NERSC National Energy Research Scientific Computing Center

BERKELEY LAB Lawrence Berkeley National Laboratory

NERSC

- **National Energy Research Scientific Computing Center**
  - DOE Office of Science User Facility at Lawrence Berkeley National Laboratory
- **Mission:**
  - accelerate the pace of scientific discovery in the DOE Office of Science community by providing high-performance computing, information, data, and communications services.

Broad Range of Computing Needs

- **~3000 users, ~400 projects, ~500 code instances**
- **Focus on unique resources**
  - Multiple end compute and storage systems, archival storage, high speed network
- **Science drive**
  - Real science problems used in machine procurements and metrics
  - Science Services

The Data Transfer Problem

- **Users have data sitting somewhere else**
  - Home institution
  - Other National Labs
  - Personal Compter
- **Data often in the multiple TB range**

- **How do I easily get data in and out of NERSC, in a reliable manner and within a reasonable amount of time?**

Transfer tools

- **scp**
  - Simple and effective … but SLOOOOW
- **BBcp**
  - Lightweight with performance tuning options, but CLI options are tricky and cumbersome to get right.
- **GridFTP**
  - More advanced performance and firewall options but needs admin support
  - PKI is hard!
  - Reliable File Transfer not baked in

Enter Globus Online

Why Globus Online

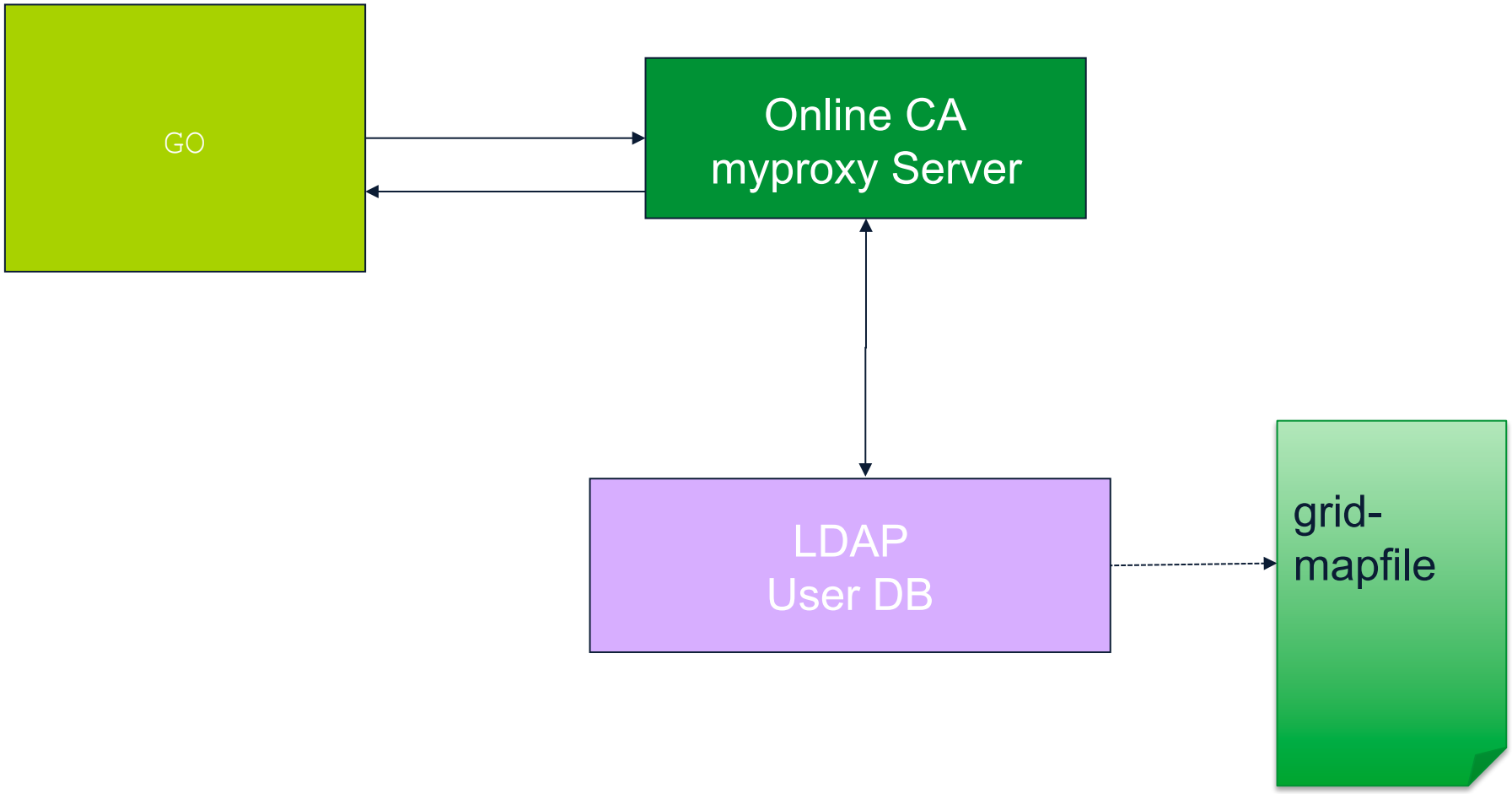
- Users confused by having to manage X509 certificates and trust roots
- Installing Grid software stack is non-trivial

Our Setup

- All NERSC users have access to a short lived cert via NERSC CA
- Offline processes populate grid-mapfiles on NERSC machines
- Dedicated data transfer nodes with GridFTP.
- GridFTP also runs on Compute systems and Tape Storage Archive

BTW - All of this stuff already existed at NERSC

NERSC CA Service



Globus Online Plugs Right In!

- NERSC public endpoints automatically configured to use NERSC CA
- User simply enters their NERSC user/pass combo and they have access to resource.
- This is really cool! Solves a lot of grid usability issues.

Something to think about: Our security folks are a little nervous about folks entering their NERSC passwords through a 3rd party website.

Use Cases

- Moving large datasets
- HPSS Archiving

Use Case: STAR Experiment

- **STAR: Large NP Experiment at BNL's Relativistic Heavy Ion Collider (RHIC)**
  - ~500 physicists, 54 institutions, 12 countries, annual datasets at ~PB scale, primary data storage at BNL: RACF/HPSS
- **PDSF at NERSC/LBNL is STAR Tier 1 facility**
  - 500 cores, 300TB of disk storage, ~PB scale HPSS tape allocation, 100s TB/yr of managed production data transfers between BNL/RACF to NERSC/PDSF
- **Many edge cases for data transfers not met by normal production**
  1. Smaller production datasets that do not conform to normal pipeline system
  2. Common-use data not managed by the experiment but by smaller working group
  3. Individual scientist's dataset
- **Common features of edge cases:**
  - ~TB scale datasets
  - need to have data at both sites & archived on one or both HPSS systems
- **Currently handled case by case:**
  - varied skillset of person doing the transfers: scp aware <---> grid-savvy

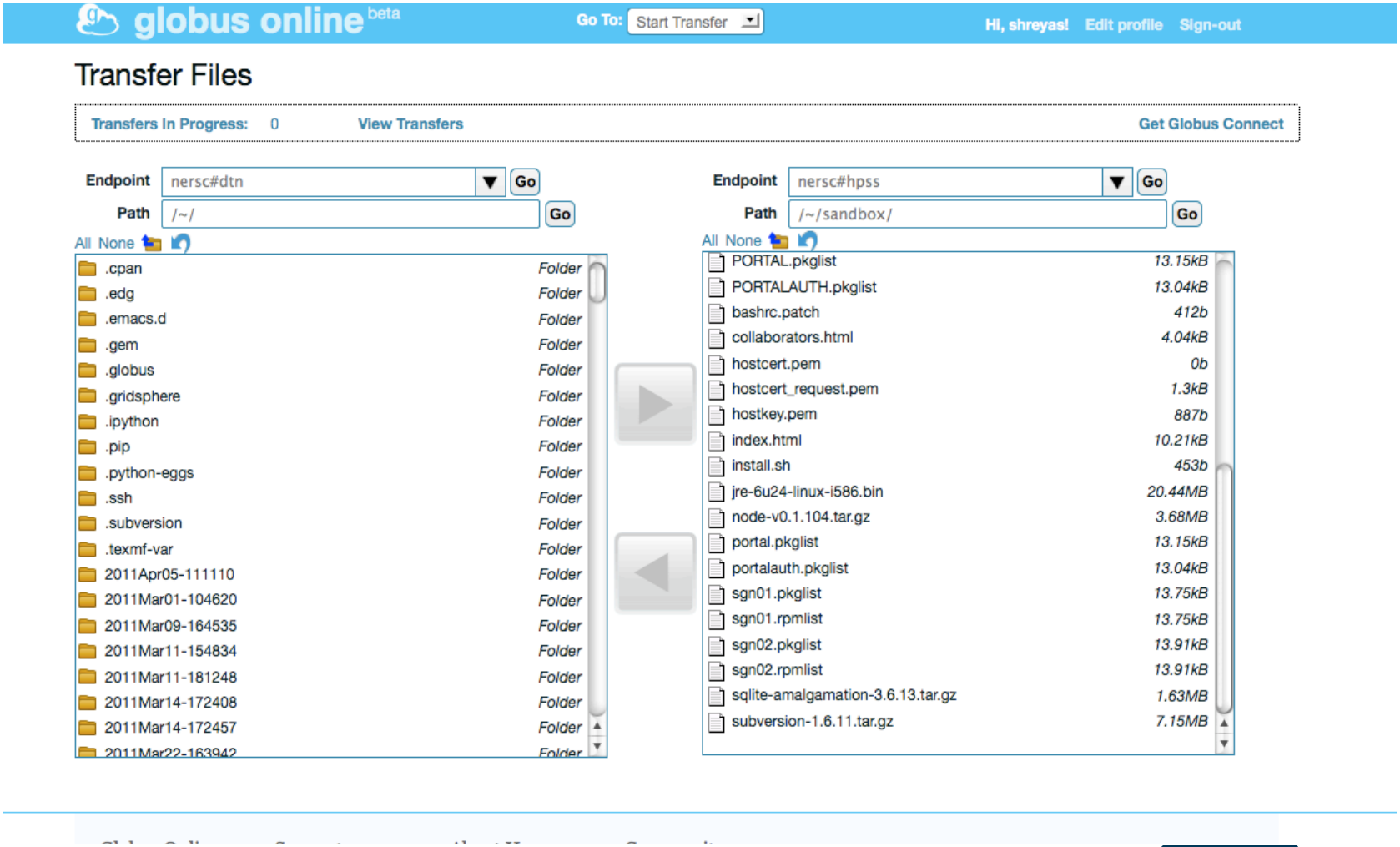
STAR Evaluation with use case #1 – Jeff Porter, LBL

- **Use Case: routine transfers of irregular production data sets**
  - Data is typically assembled in a directory tree, source & destination by production requirement
  - Size range: 0.01-1 TB, 1k-100k files.
- **3 Step process with Globus Online CLI**
  - Activate endpoints: ssh –t cli.globusonline.org. endpoint-activate porter#* --myproxy-lifetime=168
  - Transfer data (examples is from BNL to NERSC/PDSF): echo "star4/star/data14/embed/production2009_200GeV/ pdsf1/eliza15/star/starprod/hpss/staging/embedding/production2009_200GeV/ -r -s 1" | ssh cli.globusonline.org transfer
  - Receive email when transfer is completed
- **Results**
  - Have used ~twice a week for several months
  - GO is simple to use, appears quite reliable, achieve adequate bandwidths (10s MB/s)
  - Currently recommending to users for other edge cases
    - **Pain threshold is certificate installation at BNL**
  - Still evaluating HPSS interactions & web interface

Use Case: HPSS Archival

- **NERSC has an HPSS storage system for long term archival storage of data**
- **Currently, archiving data involves manually running command line tools**
  - HSI, HTAR, PFTP, g-u-c
- **Several users have requested a data archival GUI to move data between HPSS and Compute Systems – much easier to backup or restore relevant data using a visual interface**

Drag and Drop Archiving



HPSS Evaluation

- **This is an incredibly useful feature**
- **User was trying to use GridFTP to manage her data between NCAR machine and HPSS. Kept getting bitten by out of date CRLs. Using GO essentially solved her problem.**
- **Uncovered some bugs in the HPSS API**
  - need to fix these before we can open it up.
  - Turning down parallelism to 1 is a workaround, but we need to be able to default to this without user intervention

Other Grid related Efforts

- **NEWT**
  - RESTful JSON API to access NERSC resources.

    eg. https://portal-auth.nersc.gov/newt/file/hopper/global/scratch/sd/shreyas
- **OSG at NERSC**
  - OSG has allocation at NERSC so all NERSC resources are availiable to OSG users through the NERSC VO

- NERSC Web Toolkit

- NEWT - Web Service that makes NERSC HPC resources available as http URLs
- Build web applications through REST API
- User interacts with a web application that exposes the necessary components of the underlying application

  - Upload/download files
  - Authentication
  - Submit jobs
  - Accounting information
  - View Batch Queue
  - Key Value Store

http://newt.nersc.gov

- Uses GT5 under the covers
- We'd like to use Globus Online as the file transfer engine?

Wishlist

- **Ability to configure ||-ism, default buffer sizes on a per endpoint basis.**
- **Full feature file operations (delete, rename, etc.)**
- **HPSS file transfer bugs**
  - team is working on this now.
- **Fewer references to X509 certs, MyProxy etc. in basic UI.**
- **Globus Connect is a great start in addressing the last-mile problem – cross platform support highly desirable. Java Web Start perhaps?**
- **Single MyProxy Logon**
  - If endpoint has the same MyProxy service as the GO login, can we pre-activate the endpoint?

Pitfalls

- **NERSC has everything automated for users**
  - Auto-generated DNs and grid-mapfiles
  - MyProxy keyed against NERSC system password.
- **But other sites may not be set up.**
  - Users often have to figure out how to get their certificates into site grid-mapfiles etc. Once the user has to grapple with PKI commands, you've lost them.

Solutions

- Site support - this is not strictly a technical problem. Outreach to resource provider sites may be the only answer
- Separate Authentication to endpoints really helps address the federated issues. This has been a huge leap.
- Services like CI-Logon may help as well

Conclusions

- We are recommending Globus Online for users with data transfer needs between GridFTP enabled sites
- A lot of work has been put into making this system usable
- More outreach needed to insulate the user from setting up on less grid-friendly sites.

Thanks!

- **Contacts:**
  - Shreyas Cholia – scholia@lbl.gov
  - Jason Hick – jhick@lbl.gov
  - David Skinner – deskinner@lbl.gov

- **Questions?**

Use Case: DNA Sequencing Center at UChicago

Using Globus Online to Deliver Data to the Customer

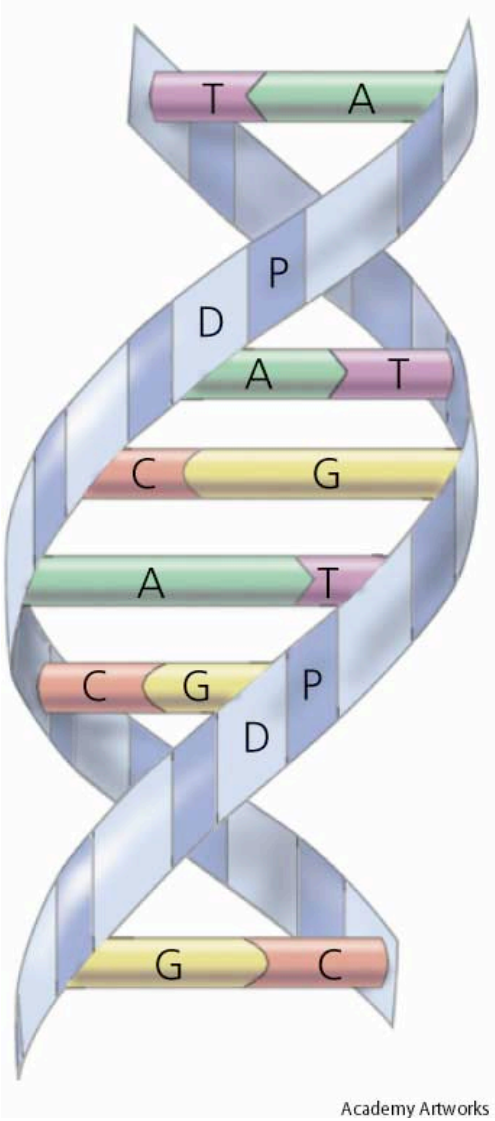
April 12, 2011

Brigitte Raumann, Ph.D.
Initiative in Biomedical Informatics
University of Chicago

Globus Online for Data Delivery to Customer

- **The use of Globus Online by service provider to deliver product to customer.**
- **Service Provider: UChicago DNA Sequencing Facility**
  - fee for service DNA sequencing
  - product = data
  - 3 next generation sequencing instruments
- **Customer: Biologists**
  - paying to have their biological sample sequenced

DNA Sequence



Academy Artworks

ACATAATGTGCACATAACTAGTCAAAACATCCAACT
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GTTTAGTTTGAACAAGTATCAAGTTGGCTAAAATAA
TTTAAAGACTGAAGCTAGCCAGTAAACAGCCTTAAA
TTAGCATGTTGTTAGCATGATTGTAGTATAAATTAG
TGTTGTTAGCTTAATCTAGCATAAATTAGCATGTTG
AGCTTATTCTAACACGAATTAGCATGTAACTAGCAT
TTCTAACATTAATTAGCATGTTGTTAGCATGAATTA
GAATTAGCAAGTTGGTAGCATGTTTATAACATGTAT
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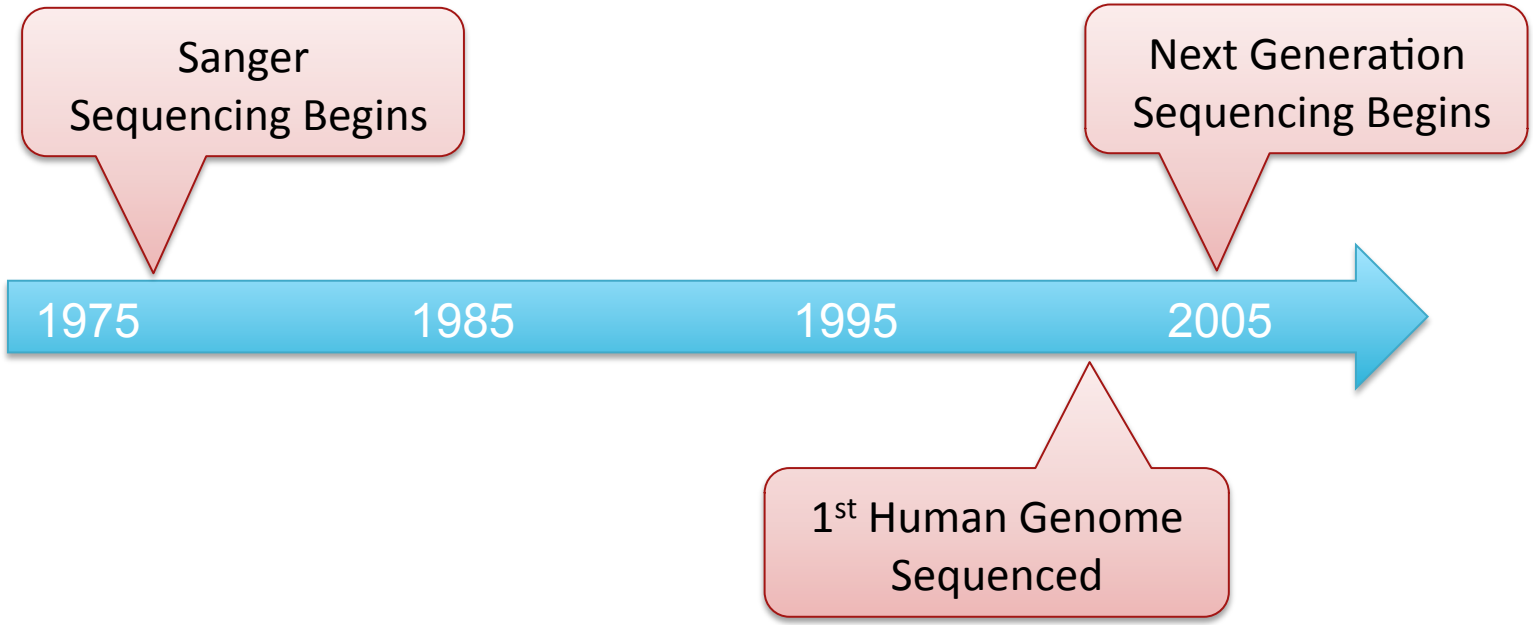
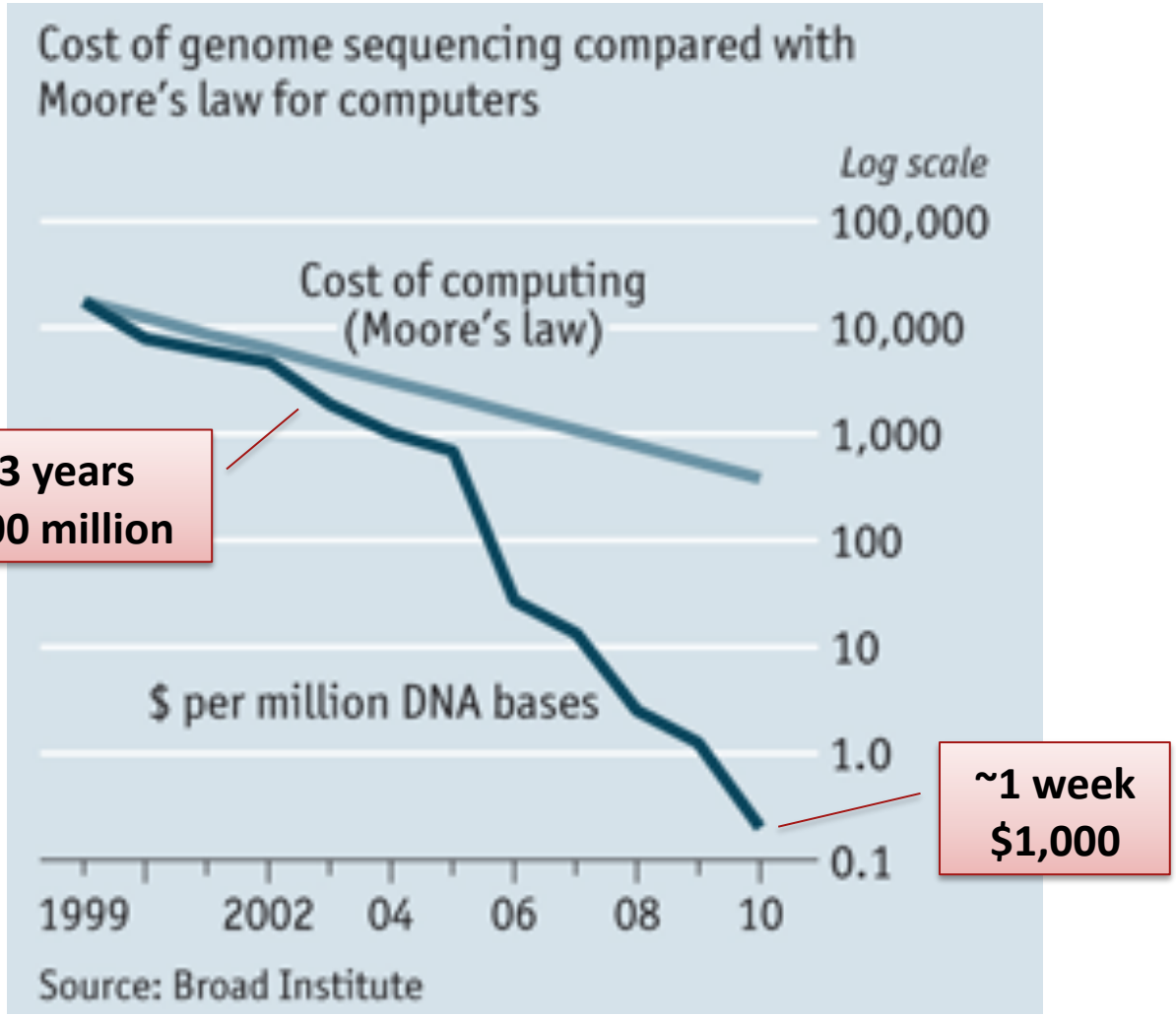
ATTTTGAAGCAAAAACAGTAGGCTACAAGATCCAGT

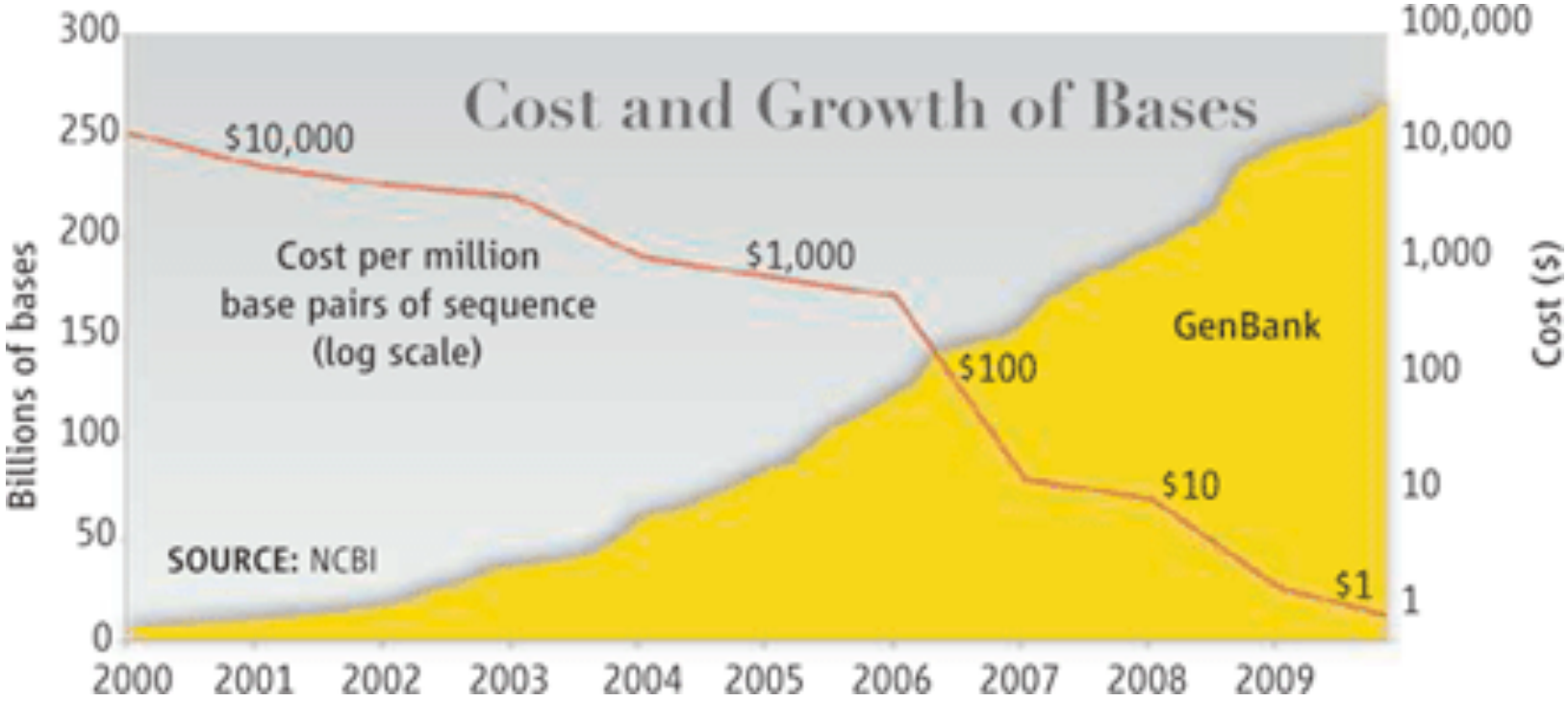
DNA Sequencing Time Line



DNA Sequencing Costs are Declining

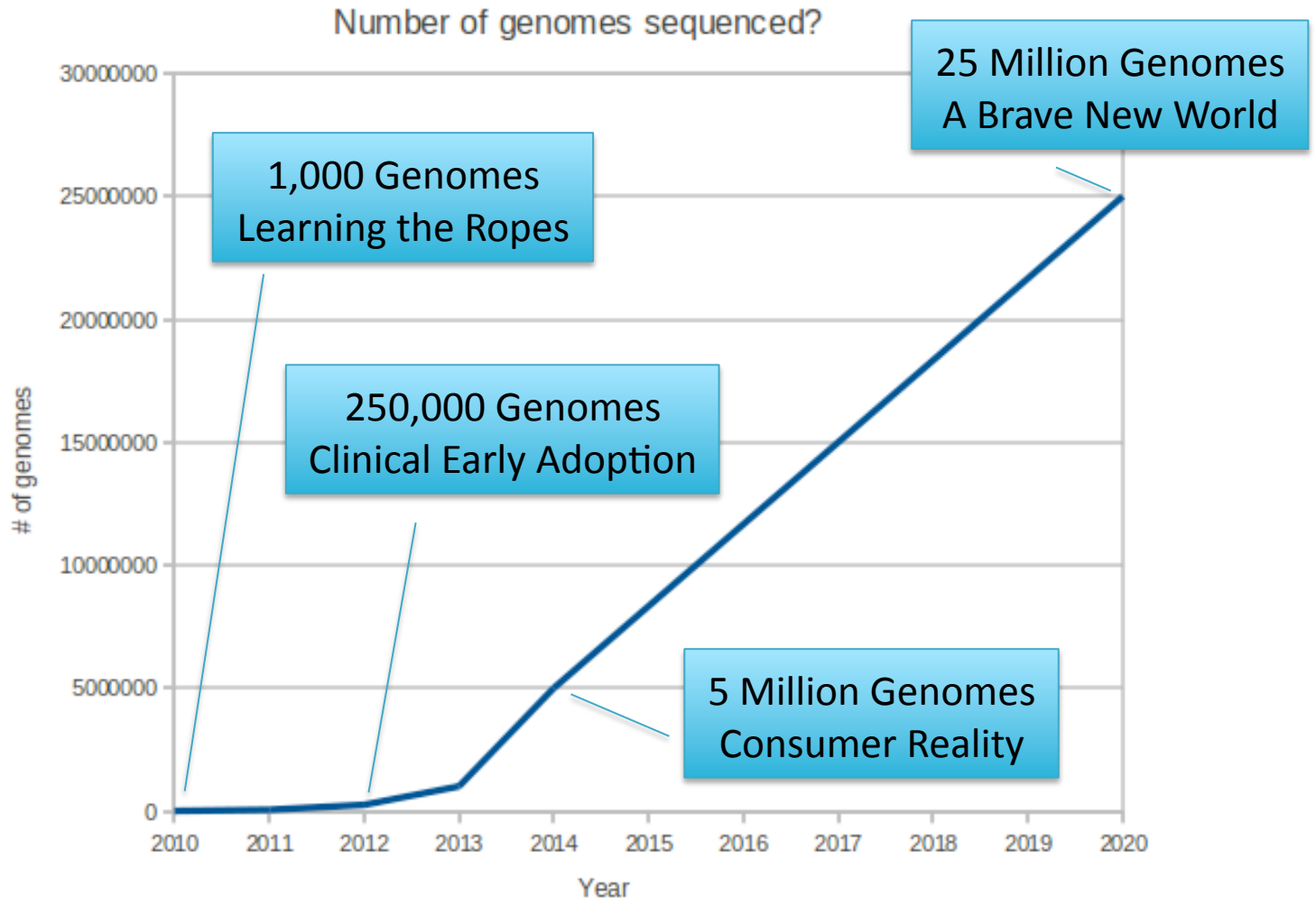


Sequencing Data is Increasing



Source: Pennisi, E., Science 2011 **331**:6018 pp. 666

Prediction of Number of Sequenced Genomes



Source: Resnick, Richard , “Implications of exponential growth of global whole genome sequencing capacity.” GenomeQuest. July 9, 2010. Retrieved April 7, 2011.

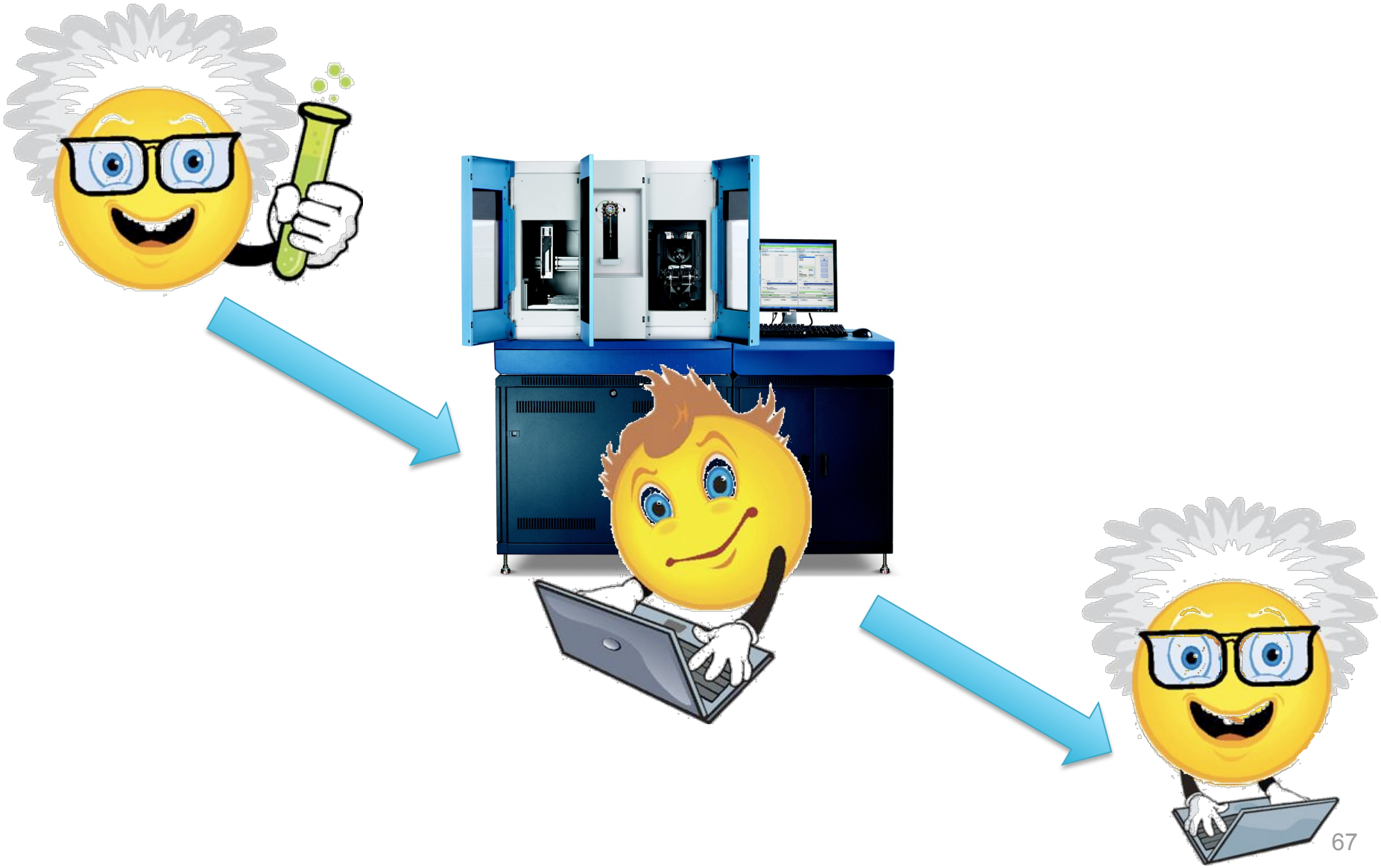
Current Computing Infrastructure will not Support Increasing Data

Will Computers Crash Genomics?

Pennisi, E., Science 2011 **331**:6018 pp. 666

CREDIT: ALVARO ARTEAGA/ALVAREJO.COM

Sequencing Center Work Flow

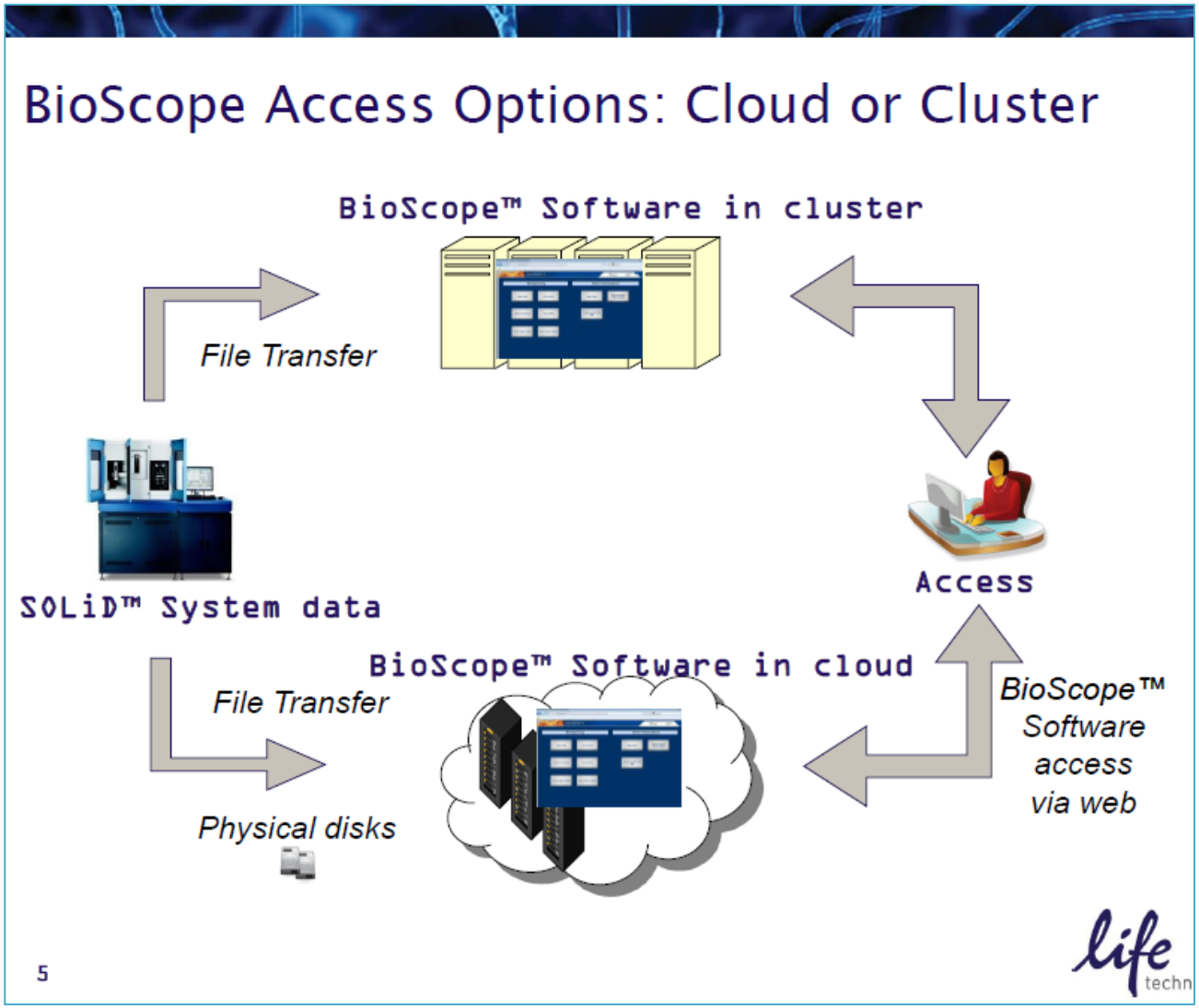


ABI SOLiD Sequencing Instrument

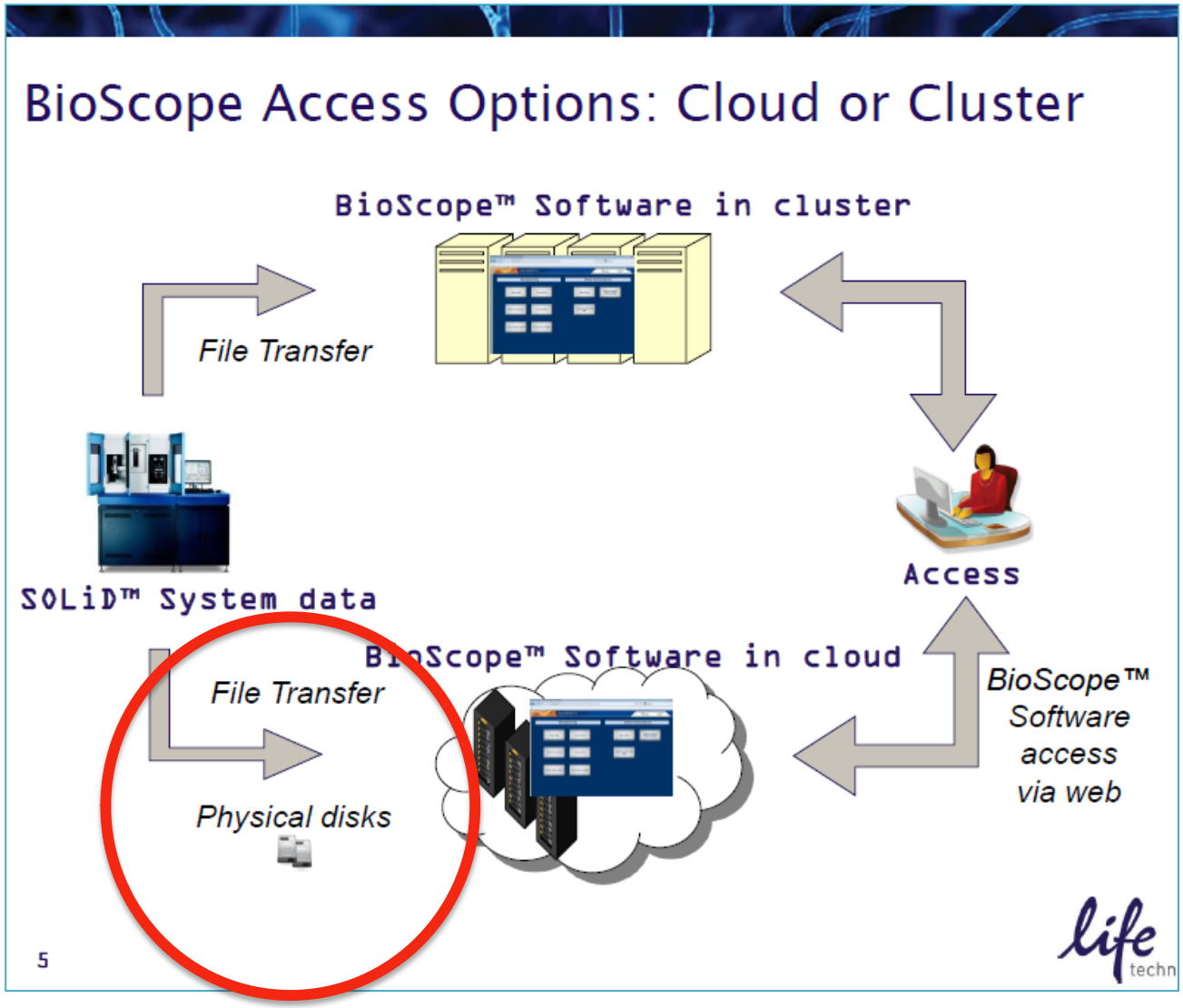
-
-
-

File Transfer = Product Delivery

Current File Transfer Methods



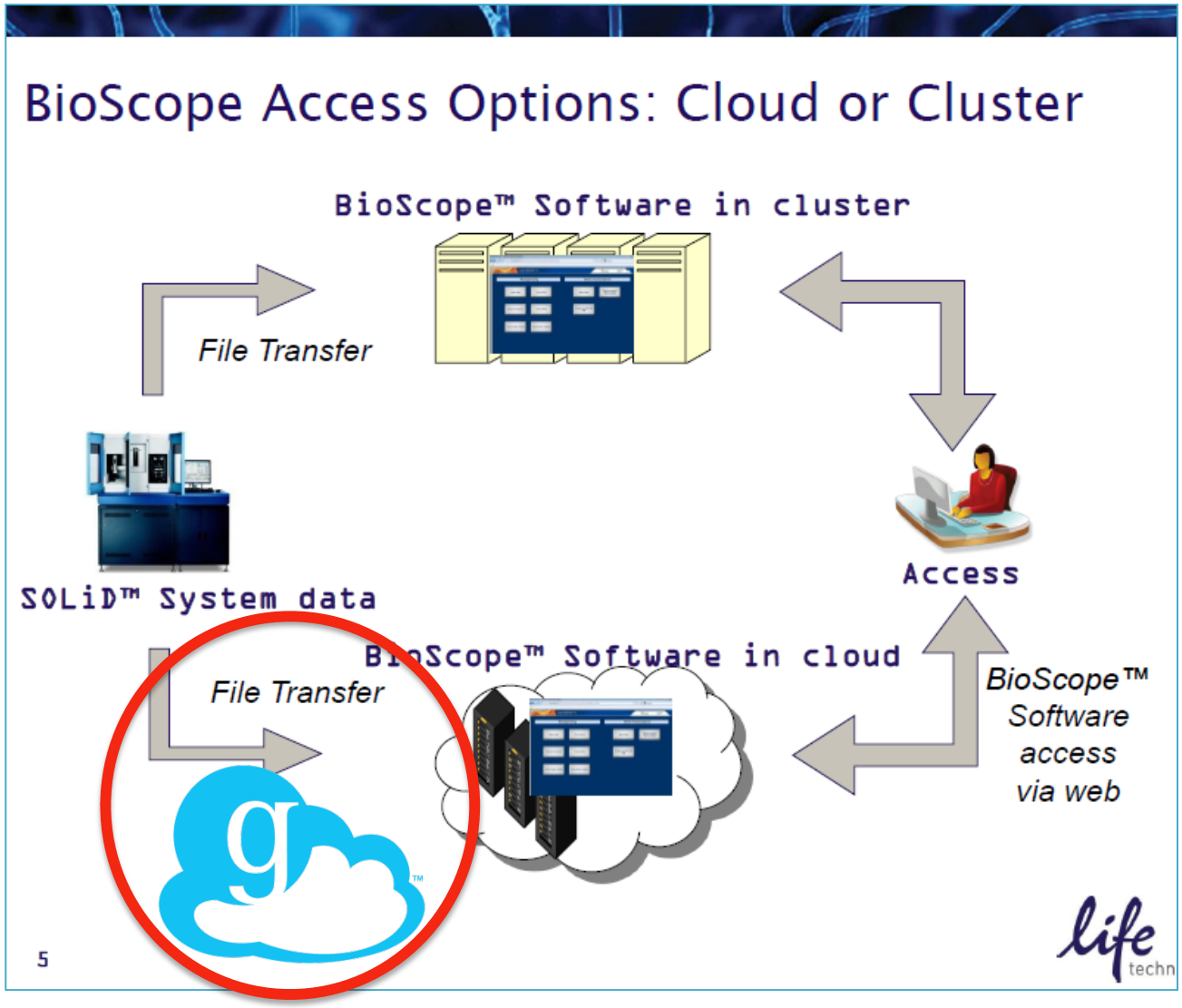
Current File Transfer Methods



overnight shipment of data-laden hard drives

Pennisi, E., Science 2011 **331**:6018 pp. 666

Globus Online Can Replace Current Methods



overnight shipment of data-laden hard drives

Pennisi, E., Science 2011 **331**:6018 pp. 666

Why Globus Online?

- **Fire-and-forget usage**
  - re-trying failed transfers
  - logs to identify reasons behind failed transfers.
- **Simplicity**
  - simple logon and authentication
  - web interface for execution and monitoring
  - Globus Connect for sequencing facility endpoint
- **Reliability**
  - checksum option (~$10K/genome)
- **Performance**
- **Secure enablement**

Globus Online at UC Sequencing Facility

Mac using Globus Connect

Sequencing Instrument

iBi File Server

iBi General Purpose Compute Cluster

Sequencing Specific Compute Cluster

Extend Use Case to Other Sequencing Centers

Extend Use Case Beyond Sequencing Centers

- **Future Use Case = Biologists**
  - "Moreover, as so-called third generation machines—which promise even cheaper, faster production of DNA sequences (*Science*, 5 March 2010, p. 1190)—become available, **more, and smaller, labs will start genome projects of their own**." Pennisi, E., Science 2011 **331**:6018 pp. 666.

Globus Online – Part of the Computing Infrastructure to Support Genomics

CREDIT: ALVARO ARTEAGA/ALVAREJO.COM

Globus Online – Part of the Computing Infrastructure to Support Genomics

CREDIT: ALVARO ARTEAGA/ALVAREJO.COM

Acknowledgements

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  Initiative in Biomedical Informatics
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  Argonne National Laboratory

- **Ti Legget**
  Computation Institute
  University of Chicago

Grid Technology Services for Operational Phase of GARUDA-Indian National Grid Computing Initiative

GlobusWorld 2011

Apr. 12, 2011

Prahlada Rao B.B.

prahladab@cdac.in

Centre for Development of Advanced Computing,
CDAC Knowledge Park, Bangalore, India

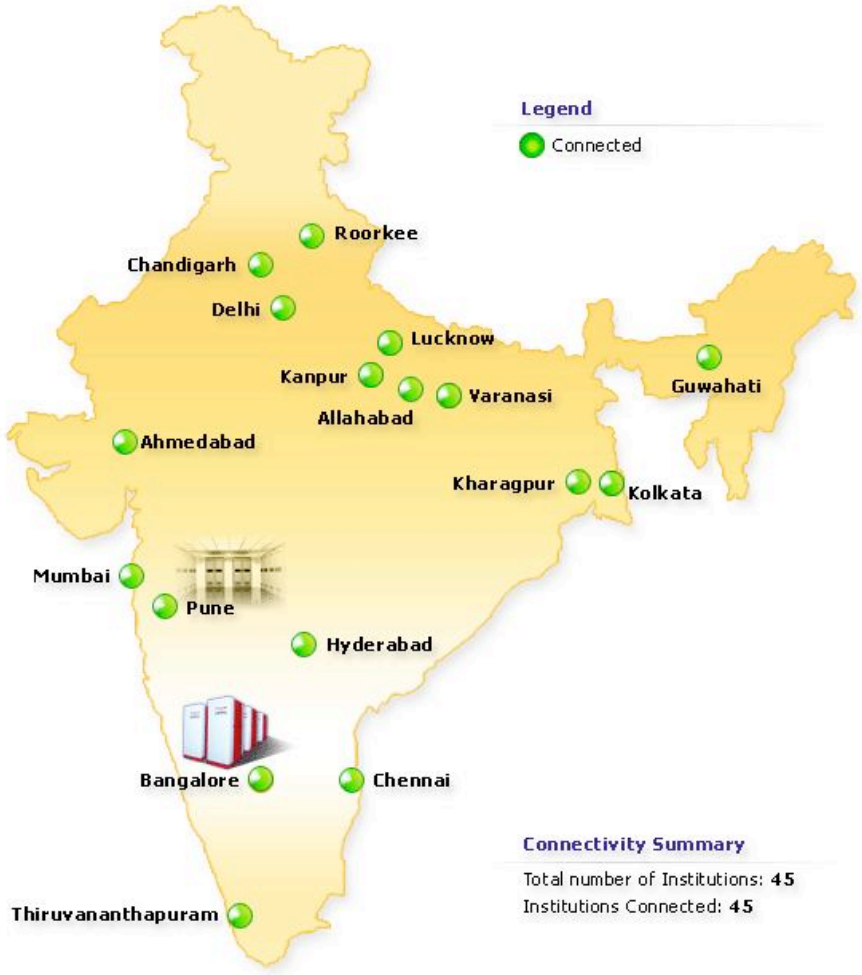
GARUDA - Overview

Motivation

- Collaboration of Scientific and Technologic Researchers on Nation wide Compute/Stora Instrument/ Grid to enable 21 century Scienc
- Collaborations on Research and Engineerin Technologies, Architectures, Standards and Applications in Grid Computing
- Contribute to the aggregation of resources i Grid

Partners

- Total of 45 + institutions
- 36 3esearch & Academic institutions , and centres of C-DAC, ERNet
- Institutes with NKN Con



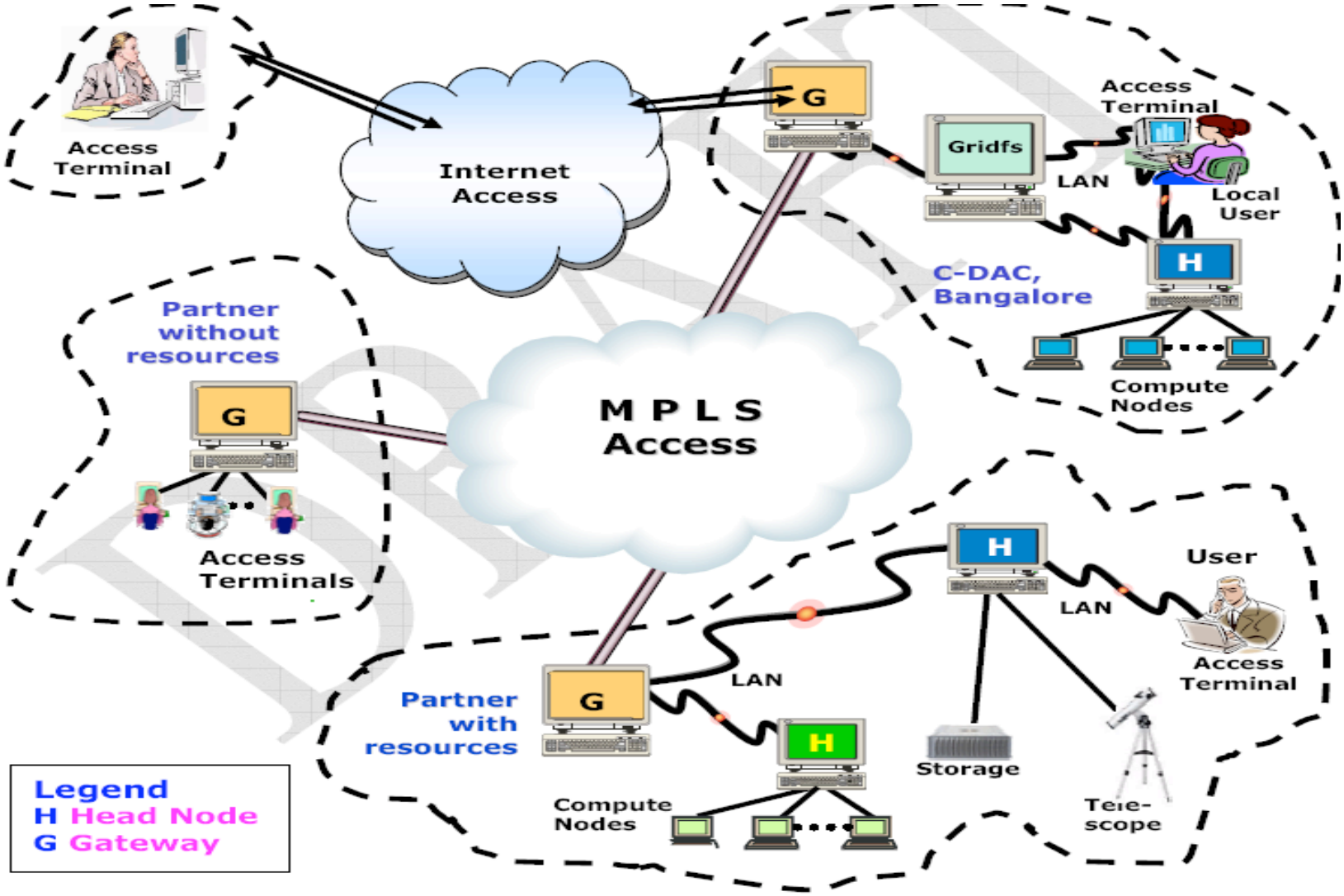
Objectives

- Development of enhanced Grid Middleware & Tools
- Migration towards operational grid and extension of GARUDA services to cloud service
- Standardization and interoperations with other grids
- Application enablement and large scale collaboration
- Deployment, Dissemination, Operations and User Support Services

GARUDA Achievements

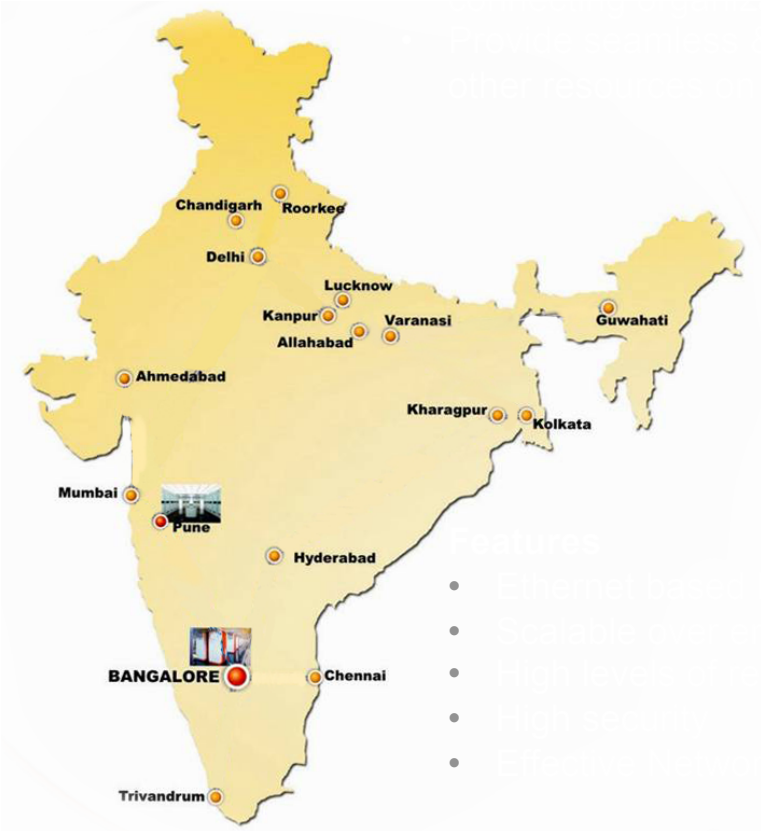
- **Garuda migrated to NKN**
- **Established IGCA for Participation in GARUDA and International Grids**
- **Interoperability with Intl Grids: EGEE, and CaBIG**
- **Dissemination & Trainings: Partners' meets, Boot Camps, GGOA workshop, DAC Workshop**
- **Compute /Storage resources**
  - IIT-Delhi - HPC cluster and C-DAC Pune Param Yuva and PRL, Ahmedabad
  - **6000+ CPUs , 70TF, 15TB Storage**
- **GARUDA SaaS-Tools**
- **Initiated Mobile network integration to Garuda**
- **Collaborations: EU-India, OSDD, CaBIG, National Institute of Disaster Management (NIDM), and INCOIS**

Garuda MPLS Network

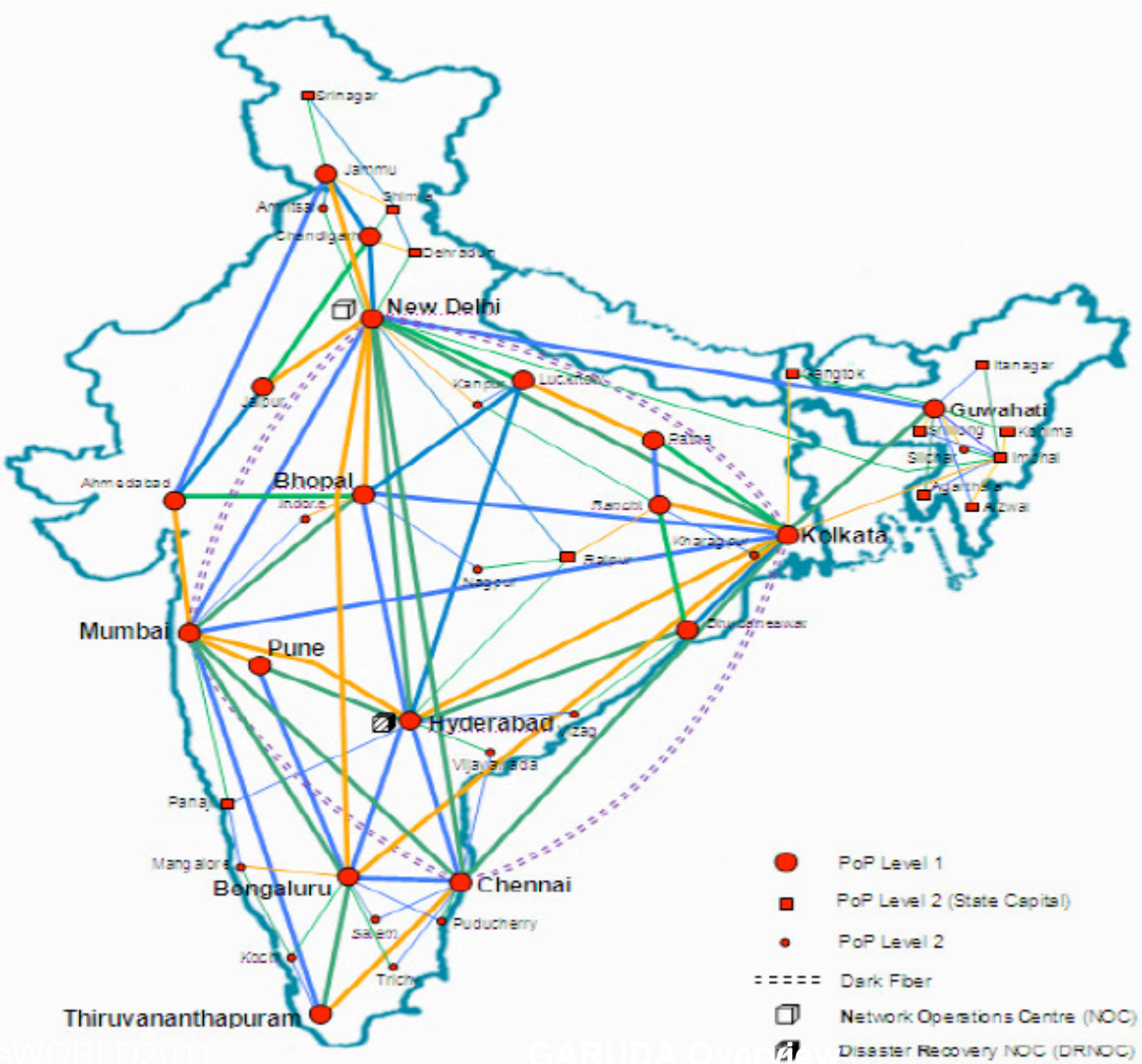


GARUDA Communication Fabric

NKN



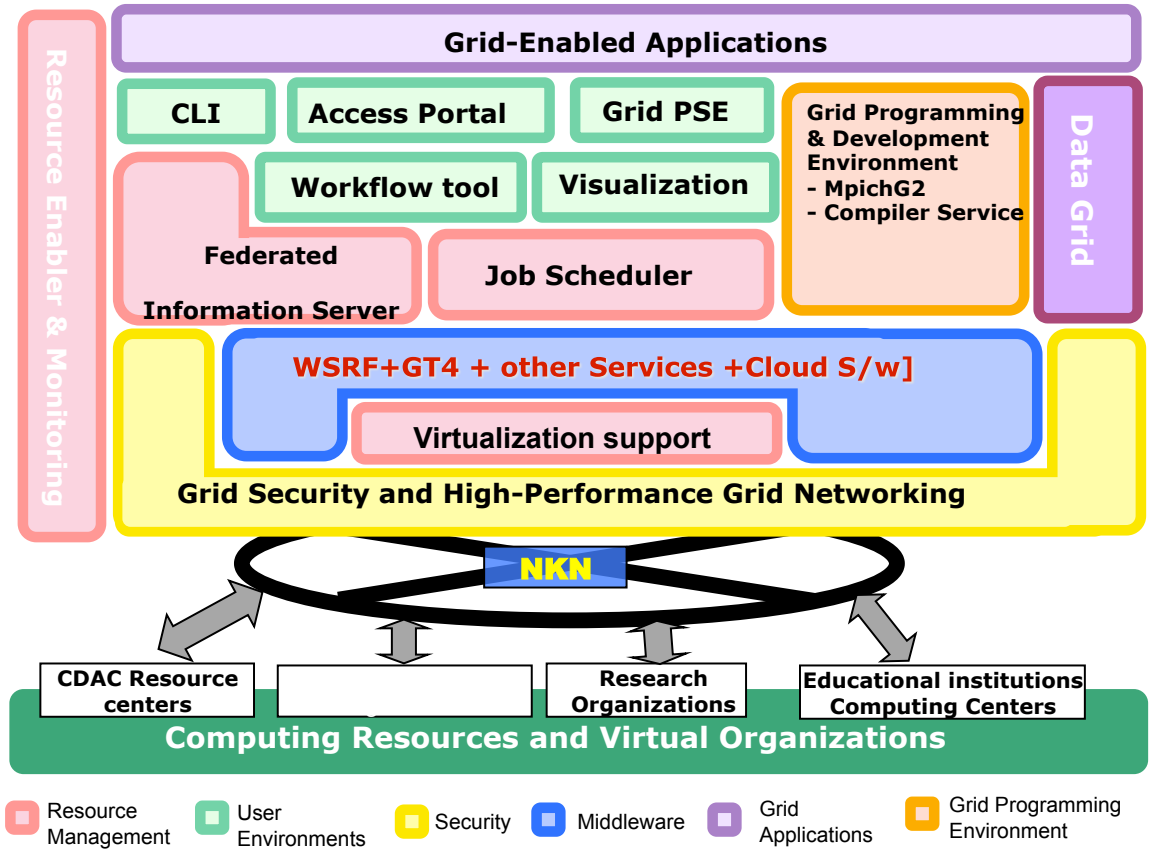
NKN Topology



Grid Infrastructure – Resources

- CDAC Clusters: PARAM Padma PARAM-Yuva, AiX Clusters, 4TF Linux Clusters at Bangalore, Hyderabad & Chennai
- Grid Labs have been setup at Bangalore, Pune & Hyderabad
- Fourteen of the partner institutions are contributing resources including satellite terminals (compute aggregating to more than 6000+ CPUs)

High level Garuda Architecture



GARUDA Middleware

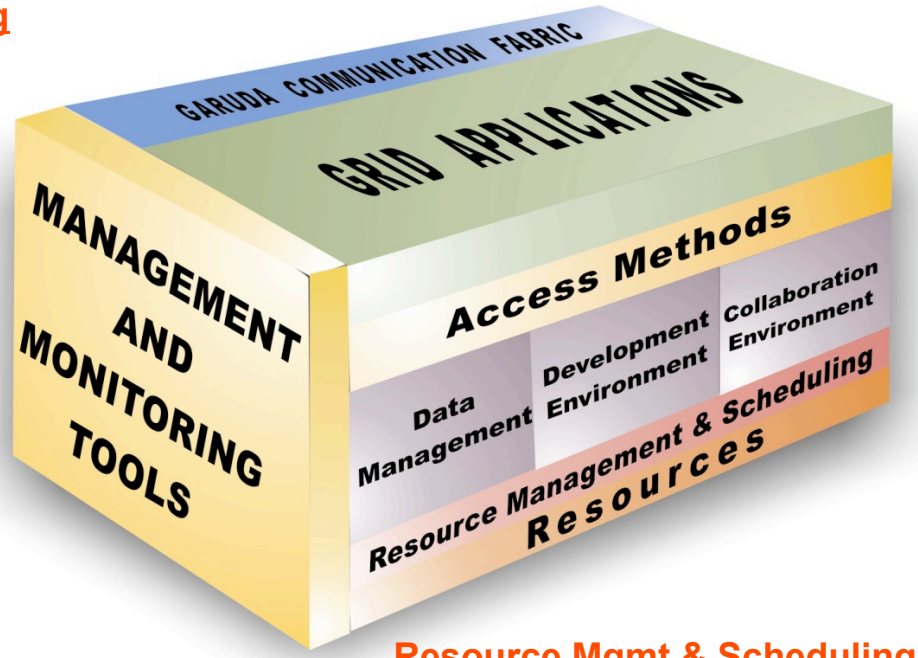
- Grid Tools
  - Garuda Access Portal and GSRM
  - Grid Monitoring through Paryavekshanam
  - Short Lived Certificate

- Architecture & Middleware
  - VOMS and Login service integration
  - Reservation and QoS monitoring
  - Portal job resubmission and monitoring through mobile

- Next Generation Technologies
  - GARUDA Test bed interoperability to support Scientific Clouds

GARUDA Middleware components

Management, Monitoring & Accounting
- Paryaveekshanam
- GARUDA Accounting
- GARUDA Information Service
- Web MDS



Access Methods
- Access Portal
- Problem Solving Environments
- Cmd line interface
- Visualization gateways
- workflow

Security Framework
- IGCA Certificates
- VOMS
- MyProxy

GARUDA Resources
-
-
-

Resource Mgmt & Scheduling
- Resource Reservation
- GridWay Meta-scheduler
- Torque Load Leveler
- Globus 4.x (WS Components)

CDAC Development Customization
Open Source

GARUDA Components

- Architecture & Middleware
  - **VOMS and Login service integration**
  - **Reservation and QoS monitoring**
  - **Portal jobs re-submission and monitoring through mobile**

- Garuda Tools
  - **Automatic Grid Service Generator (AGSG) v1.0**
  - **Protein Structure prediction (PSE4PSP) v1.0**
  - **GARUDA Access portal V2,0 and GSRM 1.0 released**
  - **Improving monitoring through Paryavekshanam**
  - **Security Assessment System (SAS) developed on testbed and plan to Integrate with Paryavekshanam**
  - **Study and prototype deployment of Garuda Scientific Visualization Gateway (GVG)**
  - **Garuda – OSDD portal integration and support**
  - **Testbed for interoperability between Grid and Cloud**

GARUDA Production Phase -Summary

- Migration to SOA.
  - GT4.x based Grid Middleware stack
- Open Source Grid meta scheduler
  - Gridway :
- Open Source based Data Grid solution
  - GSRM
- Viability of commercial applications / services
  - CAE (Zeus Numerix) and
  - Molecular Docking (C-DAC & Jubilant BioSys) on SOA GARUDA
- IGTF accredited Certification Authority
  - IGCA was setup - First CA in India to address security issues of grid
- Demonstrate Performance benefits for selected pilot applications
  - Improved processing time from 6.1hrs to 54 mins for processing one set of Radar data (9GB) for the DMSAR application using the new resources of GARUDA (272 cores)
  - Winglet applications for processing 6000 winglets taking nearly 30 days to complete on ordinary machines were able to complete in 3 hours by harnessing the large computational power offered by GARUDA.

GARUDA Production Ph -Summary

- **Architecture & Middleware**
  - VOMS and Login service integration
  - Reservation and QoS monitoring
  - Portal job resubmission and monitoring through mobile
- **Next Generation Technologies**
  - Test bed for interoperability between cloud and grid middleware.
- **Grid Tools**
  - Improved portal and GSRM released
  - Improving monitoring through Paryavekshanam
  - Short Lived Certificate

Welcome to GARUDA

dia.in/GridPortal1.3/

Garuda
India's National Grid Computing Initiative

Paryavekshanam | Garuda Overview | Contact Us

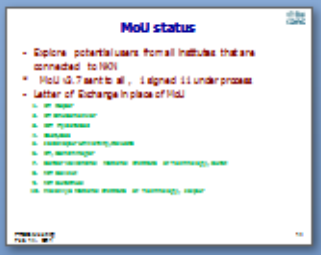
GARUDA Access Portal 1.3

GARUDA - India's National Grid Computing Initiative will unleash a comprehensive computational capabilility to enable the user community to participate in increasingly interdisciplinary scientific experiments and also conduct simulations on an unprecedented scale.

http://portal.garudaindia.in/ -through Internet

http://192.168.60.40/GridPortal1.3/ - through GARUDA Network

7



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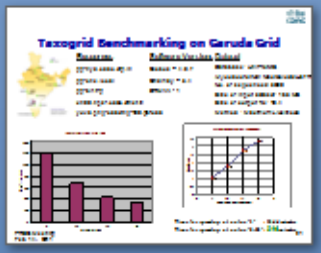

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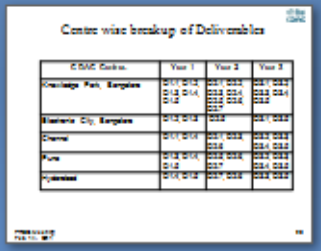

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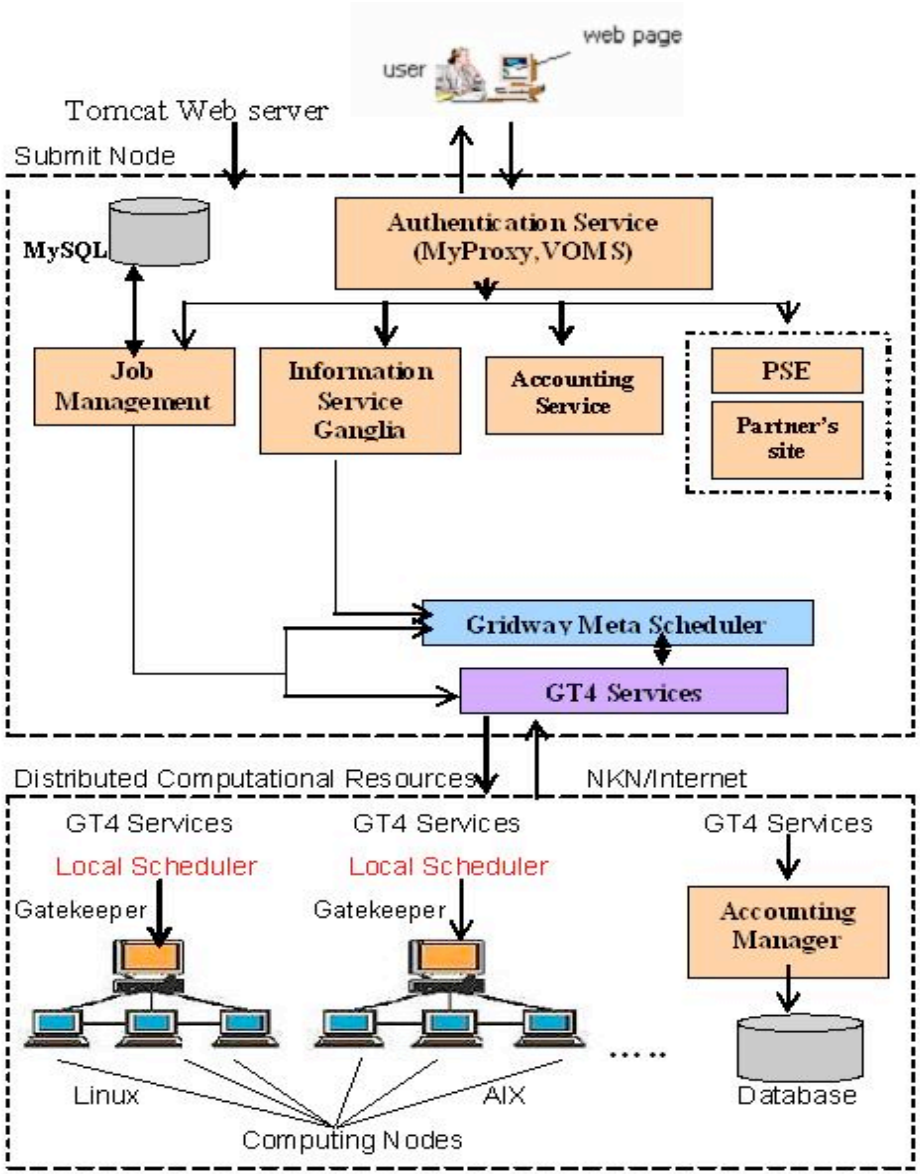
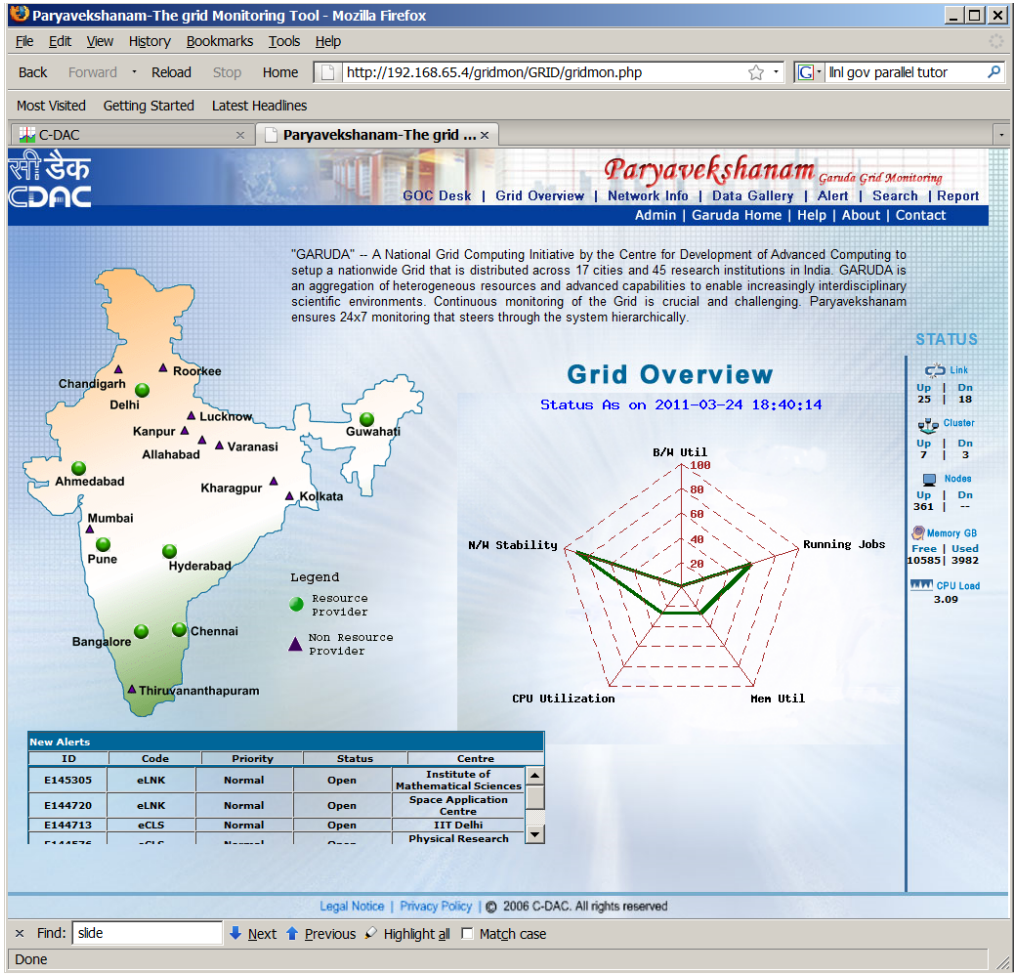
93

66%


user
web page
Tomcat Web server
Submit Node
MySQL
Authentication Service
(MyProxy,VOMS)
Job
Management
Information
Service
Ganglia
Accounting
Service
PSE
Partner's
site
Gridway Meta Scheduler
GT4 Services
Distributed Computational Resources
NKN/Internet
GT4 Services
Local Scheduler
Gatekeeper
GT4 Services
Local Scheduler
Gatekeeper
GT4 Services
Accounting
Manager
Linux
AIX
Database
Computing Nodes

Paryavekshanam– GARUDA Grid Monitoring Tool



Paryavekshanam Features:

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  1.
  2.
  3.
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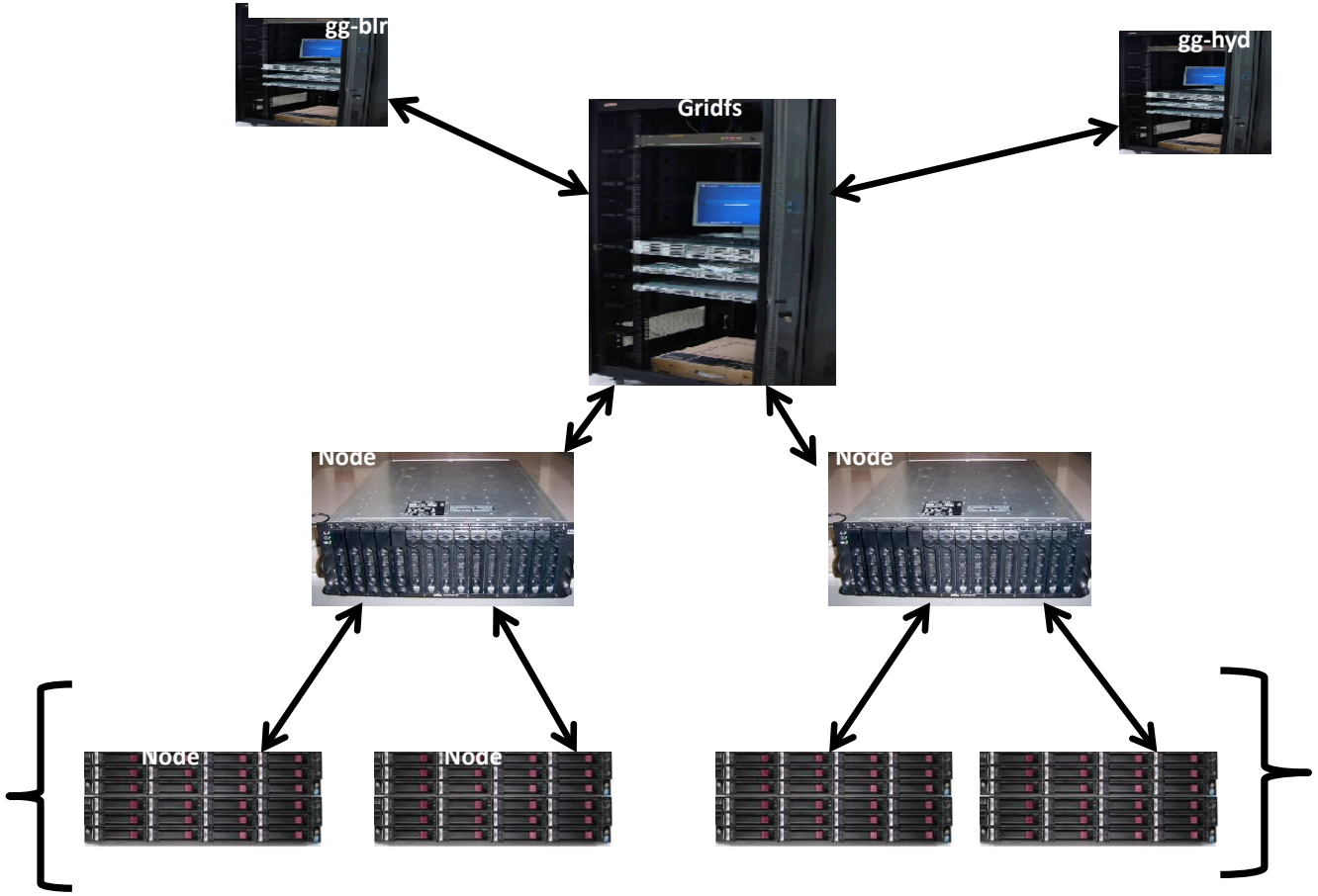
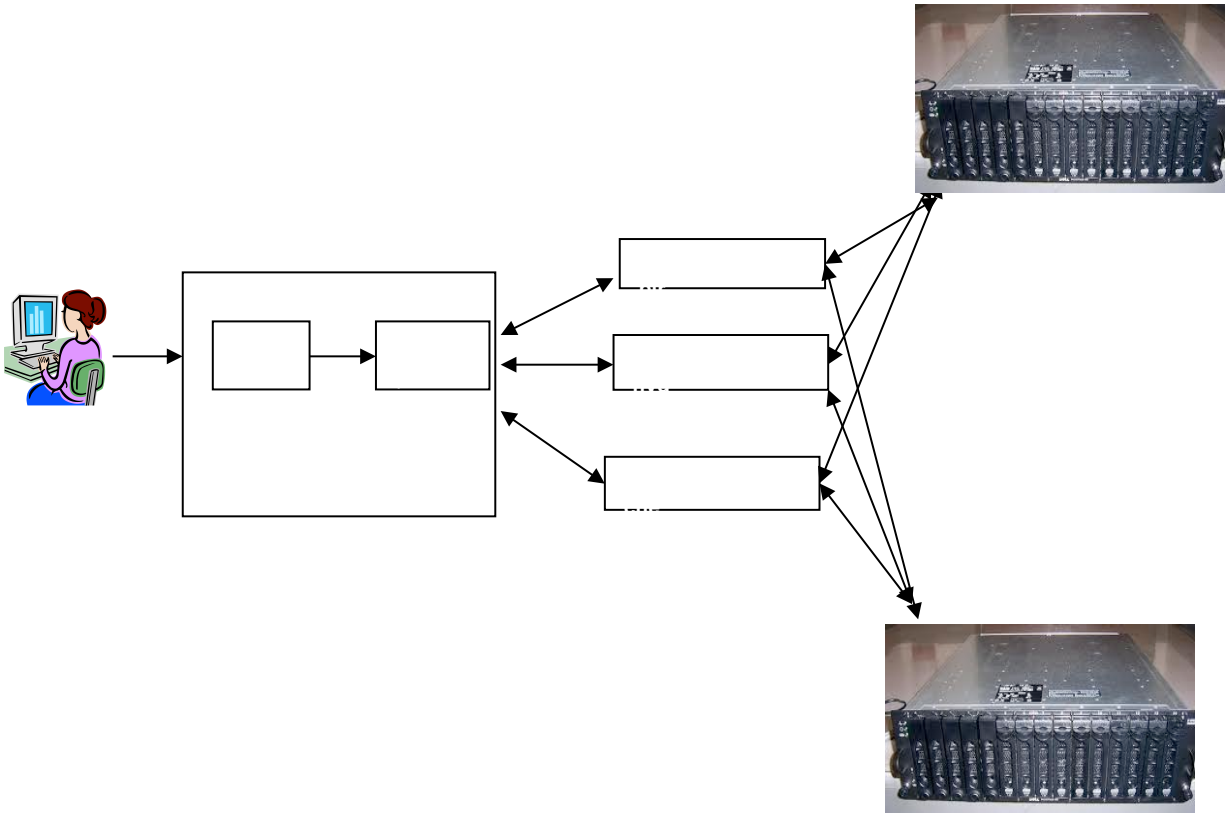
GSRM : GARUDA Storage Resource Manager

- GSRM is a peer to peer data grid solution managing the distributed storage resources of GARUDA.
- Based on open source, Disk Pool Manager, Disk based implementation of SRM-v2.2 spec
- GSRM Features and Highlights :
  - Global namespace
  - A single point access to distributed storage resources of GARUDA.
  - File and Directory management
  - Quota Allocation – Group
  - Dynamic Space Management- Reserve /modify/ Release Space
  - Security – GSI, VOMS and ACL
  - Interoperability with other SRM implementations
  - User friendly interfaces : Command line, APIs, Web Interface
  - Storage Accounting : Group/User
- Need for GSRM:
  - Allows scientists and researchers to collaborate and share data stored at distributed locations
  - Maintains the security & confidentiality of data.

GSRM Architecture



Users access to GSRM from GARUDA computation Grid



1GB data file transferred by gsiftp with default configuration throughput is 16Mbps, over NKN network with the link capacity of 1 Gbps

GSIFTP tuning options used :

- Parallel Streams
- Tcp-Buffer Tuning

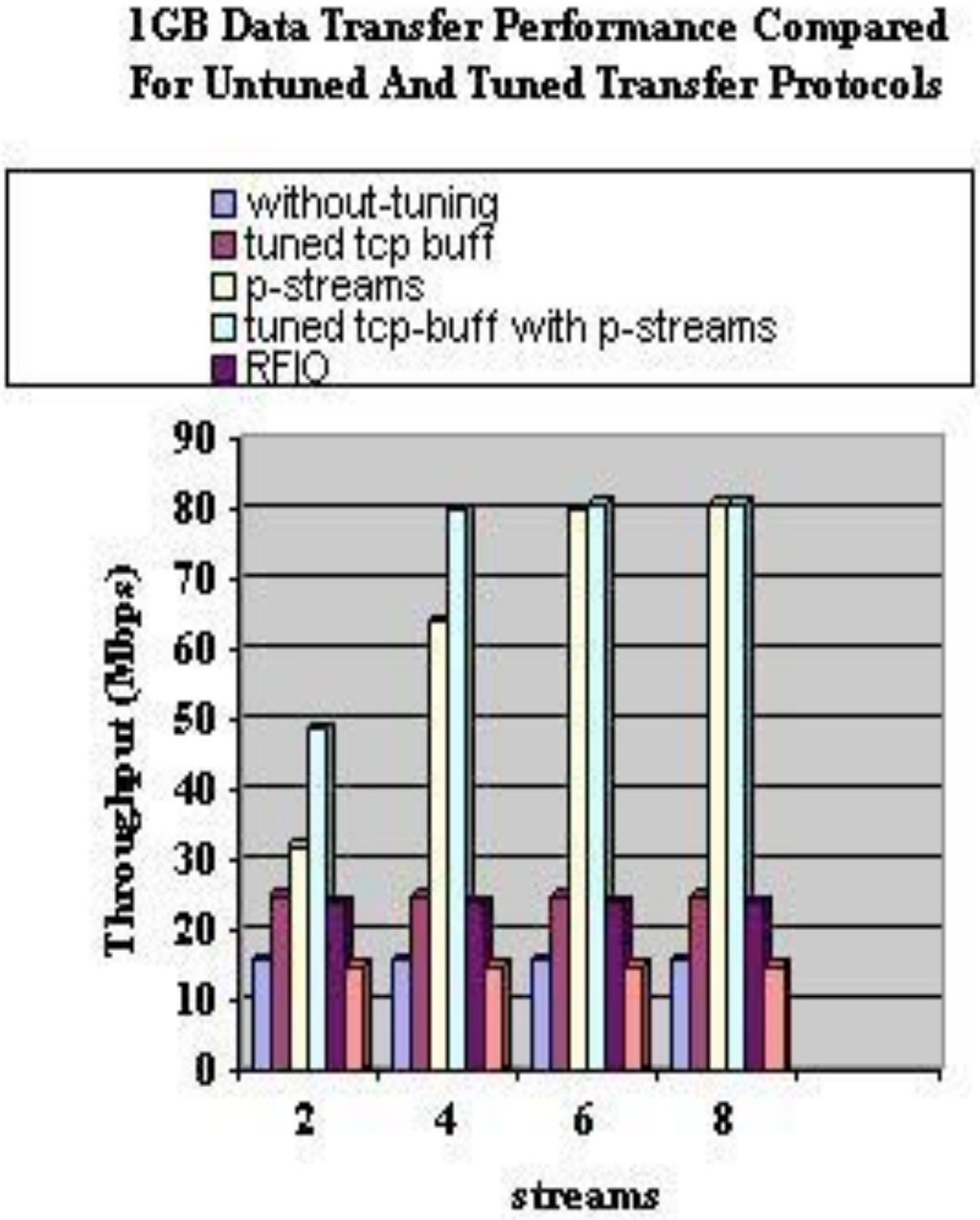
Performance enhancement:

•Combination of tuned tcp-buffer and multiple parallel streams.

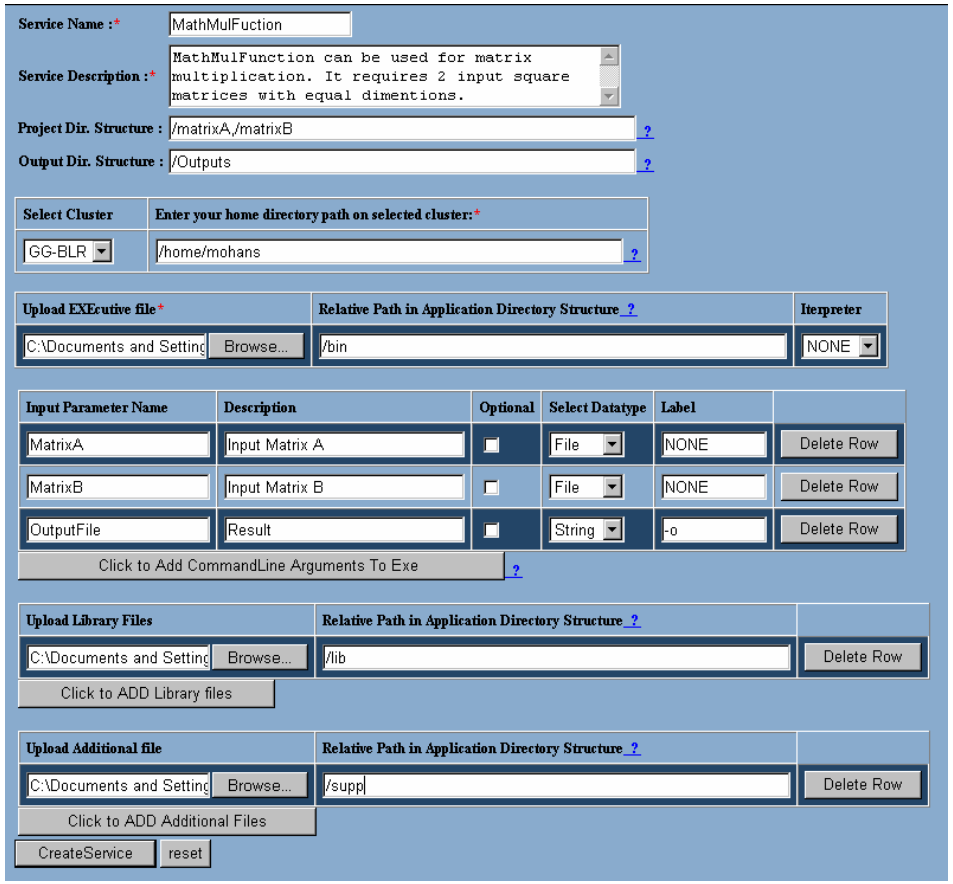
• With tcp-buffer size 181MB & 4 parallel streams, Throughput attained 80Mbps

•16 Mbps (default settings) to 80Mbp (Tuned)

•Gain in throughput is 5 folds.



Automatic Grid Service Generator



AGSG Features

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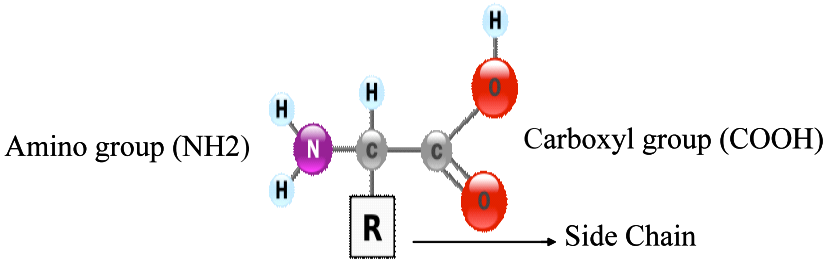
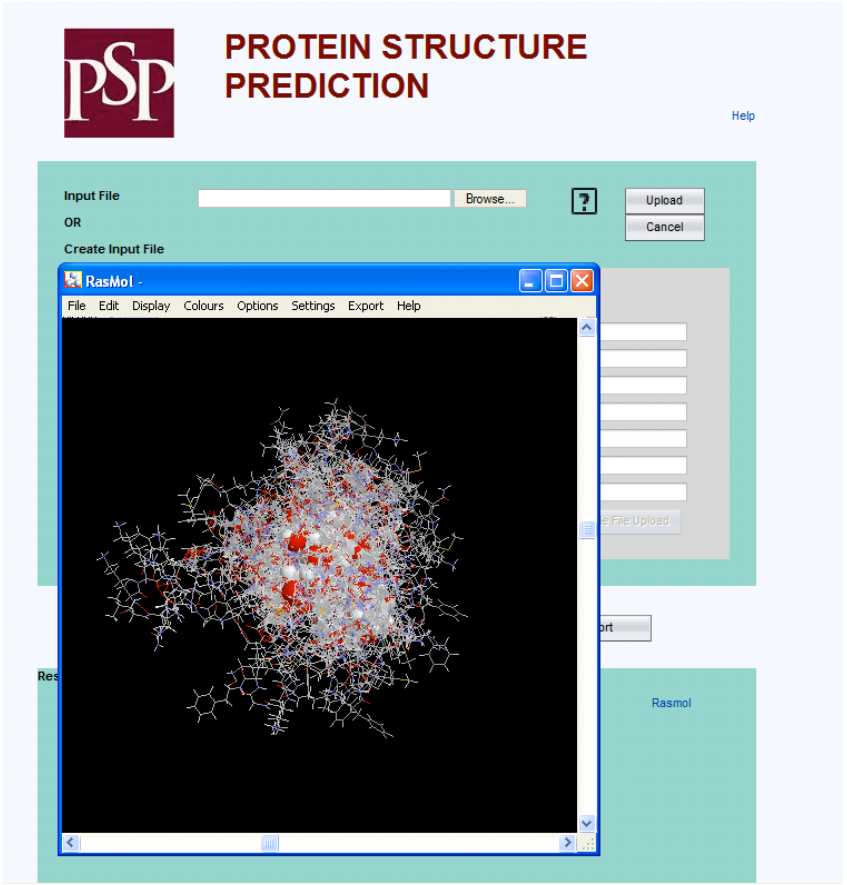
Can be contributed as a Globus Incubator Project

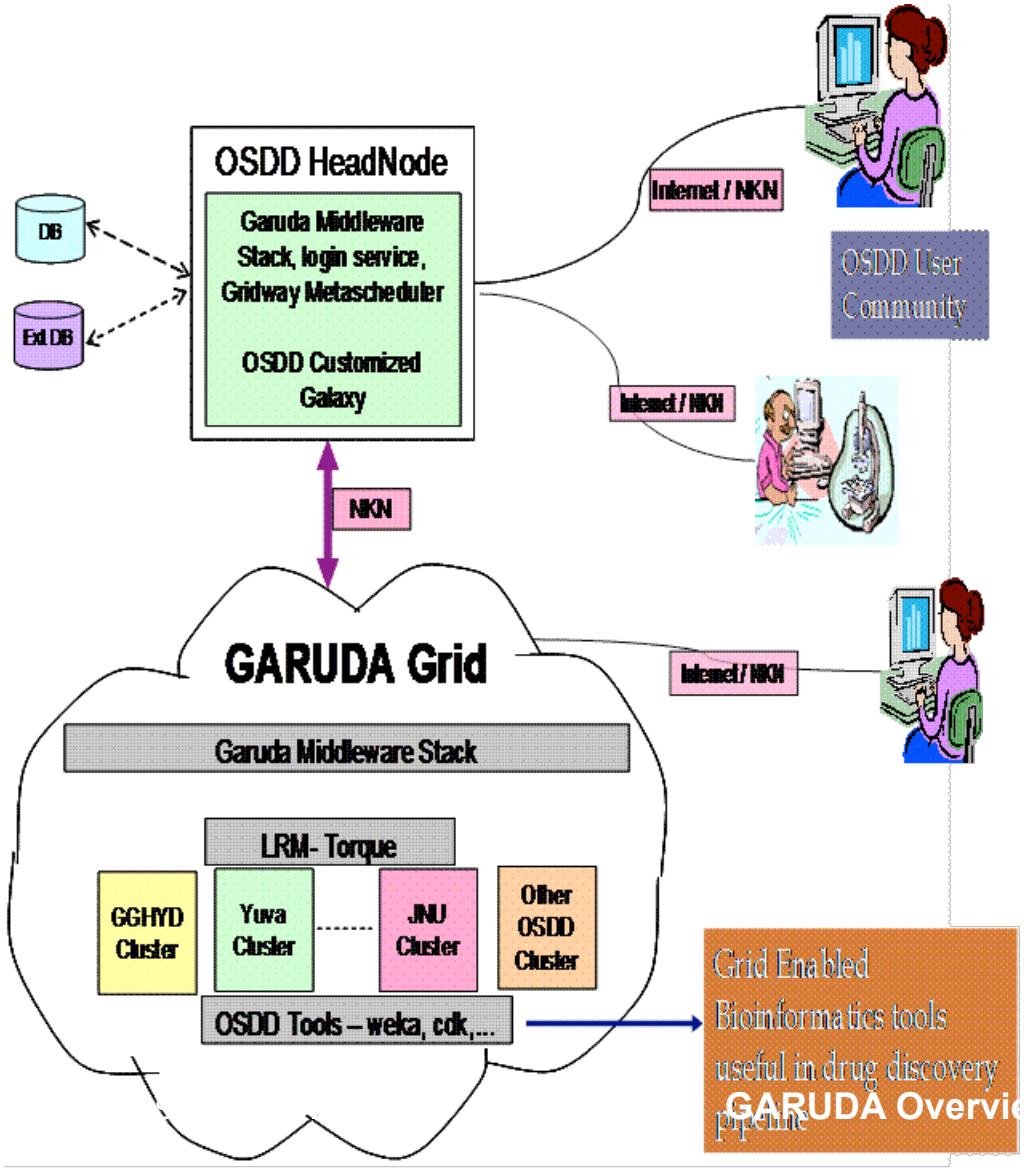
Protein Structure Prediction





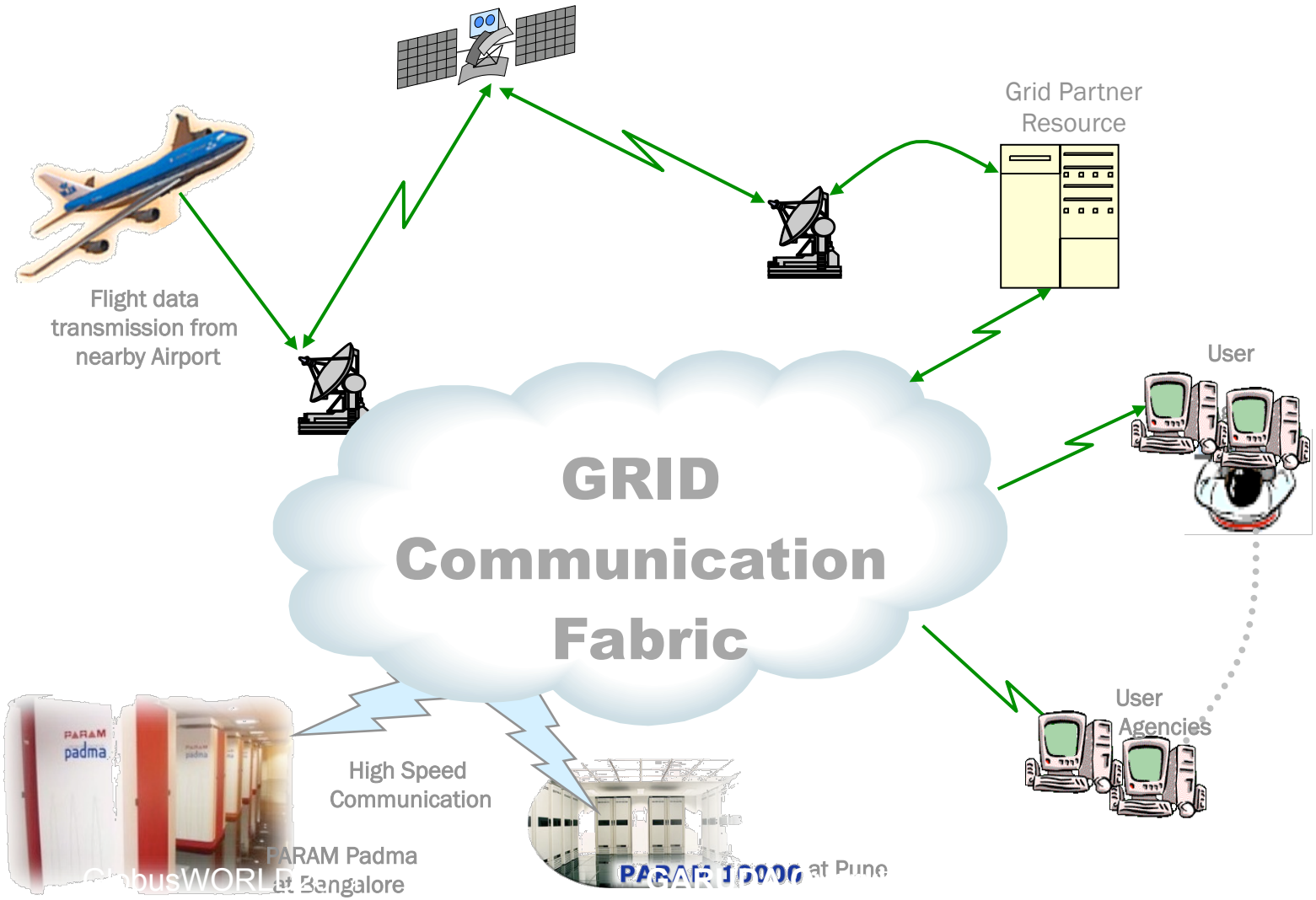
- **PSP based on evolutionary computing (GA) method**
- **Functional modules of the PSP application implemented as Services on Garuda (GT 4.0.7)**
- **Released PSE-PSP v1.0 in Feb 2010**

OSDD-GARUDA



- **26** **OSDD VO**
- **NKN**
- **Internet**
- **Galaxy Workflow**
- **Gridway**
- **bio-tools**

Disaster Management



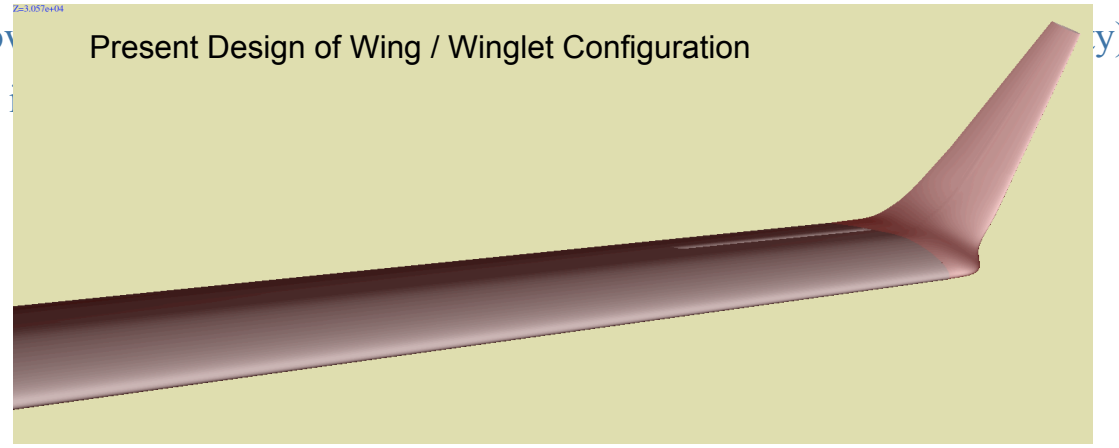
Disaster Management

- Further optimization of DMSAR code
- Porting DMSAR code to GP-GPU
- Enhancing scope of Disaster Management – collaborating with INCOIS and NIDM for pilot project under NKN

Data Size (in GB)	No of Blocks	GG Clusters (in mins)	YUVA (in mins)
1.6	48	12	12
5.5	182	42	20
8.3	276	72	26

Winglet Benefit

- Reduces aerodynamic drag by altering the flow field near tip
- Can convert some of the otherwise wasted energy in wing tip vortex to an apparent thrust
- Improved take-of f characteristics (but design optimized for it may pay penalty for cruise conditions & may be *vice versa*)
- Can improv y)
- Reduction i



Objective of the Study:

"*To design a b l*

Virtual User Community

- Astrophysics
- High Energy Physics & Astronomy
- Grid Technology
- Disaster Management
- Earth Science
- Bioinformatics (Genome)
- Computational Fluid Dynamics
- OSDD

IGCA

Indian Grid Certification Authority

- Indian Grid Certification Authority located at C-DAC, Knowledge Park, Bangalore, India.
- IGCA is the accredited member of APGridPMA.
- Issues X.509 Certificates to support the secure environment in Grid. (for GARUDA, institutes that do research in grid from India and foreign institutes that collaborates with GARUDA).
- *http://ca.garudaindia.in*

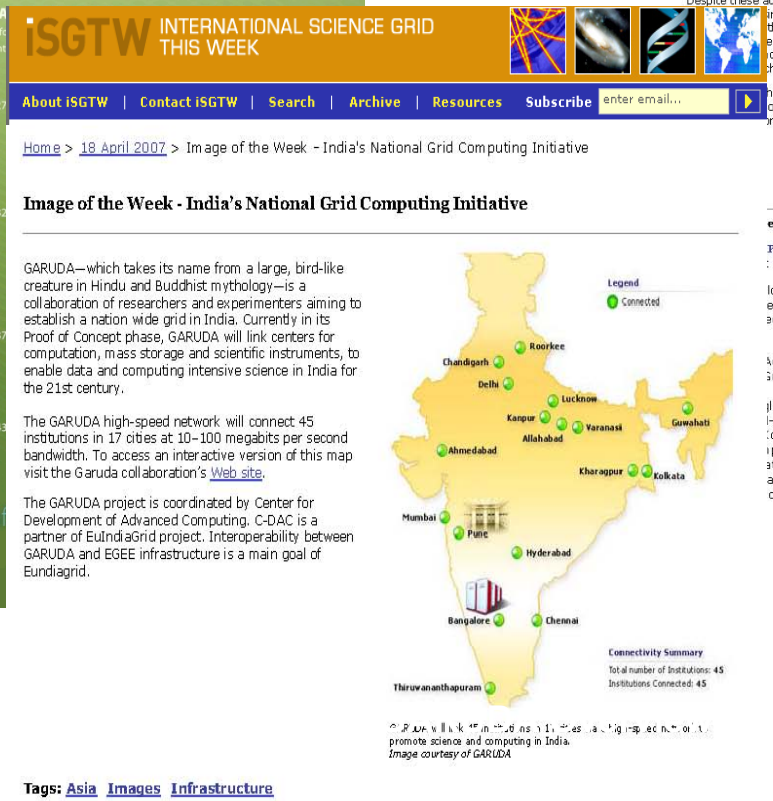
Roadmap & Collaborations

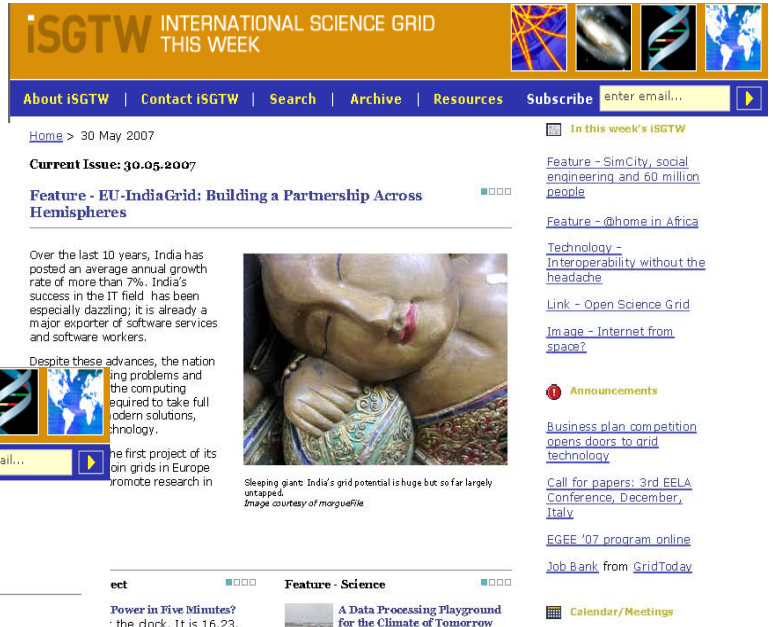
- Allignment with Globus Development Roadmap
- Globus Semantic Web Services
- Beta sight for Globus
- Globus Incubation Projects
- Interoperable Grids
- GT4 to GT5 Migration Service?
- Any Plans to support Realtime /Interactive type Applications
- Job Migration & CheckpointingSupport

Challenges:

1. Handling Commercial S/W- Licencing on Grids
2. Avoiding

International Visibility





Thank you!