

END TO END SOLUTION USING GLIDEINWMS & GLOBUS ONLINE

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Overview

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 - Running jobs on FermiGrid
 - Running jobs outside Fermilab
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Problem Statement

⦿ Current Model

- Intensity Frontier Community uses glideinWMS to run workflows
- Transfer output files -
 - to Bluearc experiment mount points mounted on worker nodes and many other servers
 - using custom scripts (CPN)

⦿ Problem

- Output files transferred back are owned by glidein user and not by the actual user

Approach

- ◎ Provide an End-To-End Solution
 - Data transfer done by the infrastructure and not by the job
 - Integrates with the WMS
 - Independent of the glideinWMS release
 - Integrates with the data transfer layer
 - Independent of the transfer protocol/service
- ◎ Use Condor's transfer plugin architecture
 - Globus Online: one of the first transfer protocol/service considered
 - Can be extended to different data transfer services/protocol like -
 - SRM
 - IRODS
 - Gridftp
 - rcp
 - scp

Proposed Solution

⦿ Proposed Solution

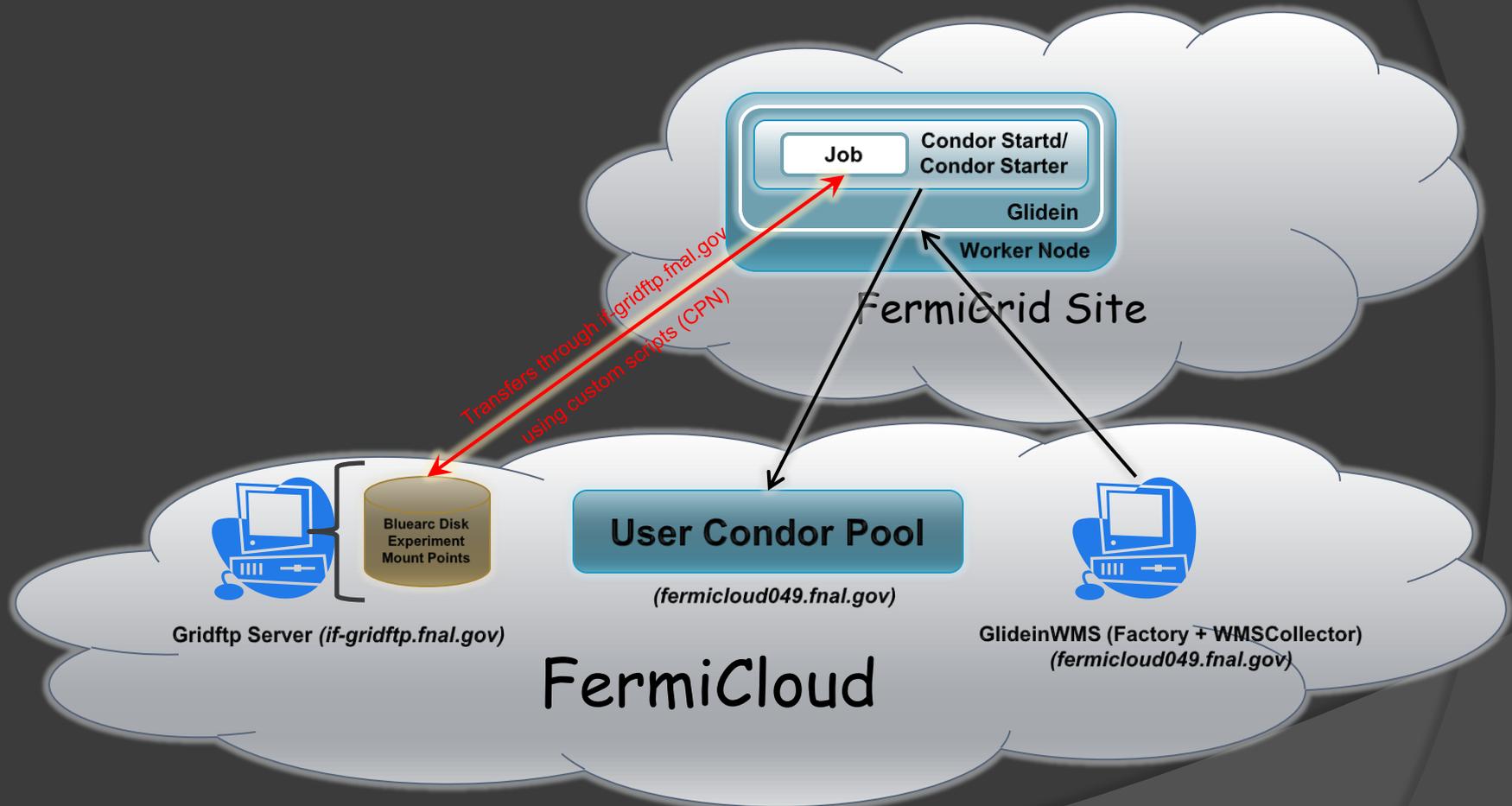
- Provide an end-to-end solution that would integrate well with glideinWMS and the custom data transfer solutions
- Two sub-projects
 - Setup gridftp server to facilitate data transfer
 - Required component to preserve the file ownership
 - Integrate with the Globus Online Service
 - Optional component that leverages on the modern techniques and solutions like Globus Online as provided by the Grid community
 - Futuristic – CPN script can not work outside Fermigrad setup

⦿ Work was done as part of CEDPS activity in the Fermilab

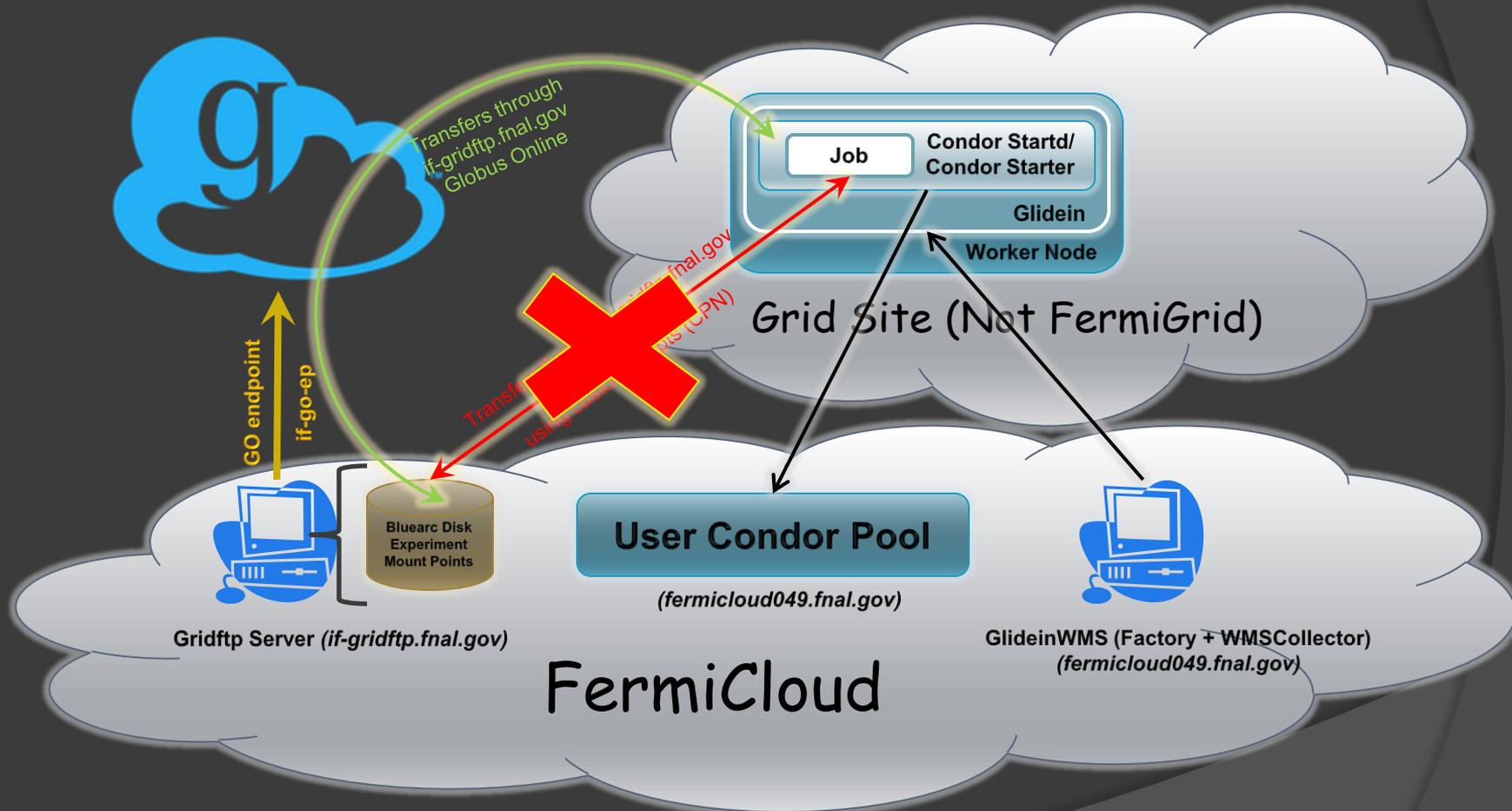
Proto-type

- ⦿ Services hosted on FermiCloud VMs
- ⦿ Core setup
 - Setup Gridftp service on FermiCloud VM (if-gridftp.fnal.gov)
 - VM per experiment (minerva-gridftp.fnal.gov, minos-gridftp.fnal.gov, ...)
 - VMs are identical
 - Easy to clone for different experiments from a base image
 - Scalability
 - Setup multiple VMs behind LVS
 - If using Globus Online (GO), it will do the load balancing of the gridftp servers
 - Tools to generate -
 - Gridftp access list (gridmap file) populated Fermilab VOMS server
 - Local user accounts from experiment NIS servers
 - Scale testing by Dennis Box
 - Ran ~500 jobs & ~600 files transferred using globus-url-copy
 - Enhance CPN to use globus-url-copy
 - Work in progress by Dennis Box

Proto-type Scenario: Computing on FermiGrid resources



End-To-End Solution using GlideinWMS & Globus Online



Proto-type [...contd.]

- ◎ Setup using third-party file transfer services
 - Running workflows on non Fermilab sites
 - Experiment disks not mounted on worker nodes
 - CPN script cannot be used for locking without major changes – is it even possible to use CPN?
 - Other solutions
 - Let infrastructure transfer the files rather than application
 - Use condor file transfer plugin (condor v7.6+)
 - Globus Online plugin through glideinWMS
 - Reuse the infrastructure from core setup
 - Register if-gridftp.fnal.gov as a Globus Online end point
 - Scheme can be extended to other file transfer protocols

Deployment: End-To-End Solution

- ⦿ Step 1: Setup a gridftp server
 - In our example: if-gridftp.fnal.gov
- ⦿ Step 2: Setup related to Globus Online (GO)
 - Create a Globus Online account (few simple steps)
 - Create a GO end point for the gridftp server

```
endpoint-add if-go-ep -p if-gridftp.fnal.gov
endpoint-modify --public if-go-ep
```
- ⦿ Step 3: Configure glideinWMS Frontend to use GO plugin
 - Add plugin, globusconnect & setup script as custom scripts in the frontend.xml
 - Reconfigure the frontend
- ⦿ Step 4: Run Test job
 - File URI in condor JDF

```
globusonline://go_user:endpoint:filepath_on_gridftpserver
```

Frontend Configuration

```
<frontend .... >
....
<files>
  <file absfname="/tmp/globusconnect" after_entry="True" after_group="False"
    const="True" executable="False" relfname="globusconnect" untar="False"
    wrapper="False">
    <untar_options cond_attr="TRUE" />
  </file>
  <file absfname="/tmp/globusonline_plugin.py" after_entry="True"
    after_group="False" const="True" executable="False"
    relfname="globusonline_plugin.py" untar="False" wrapper="False">
    <untar_options cond_attr="TRUE" />
  </file>
  <file absfname="/tmp/condor-go-plugin_setup.sh" after_entry="True"
    after_group="False" const="True" executable="True" untar="False"
    wrapper="False">
    <untar_options cond_attr="TRUE" />
  </file>
</files>
</frontend>
```

Test job: Condor JDF

```
universe = vanilla
executable = /local/home/testuser/testjobs/info-from-go.sh
initialdir = /local/home/testuser/testjobs/joboutput
output = out.$(cluster).$(process)
error = err.$(cluster).$(process)
log = log.$(cluster).$(process)
should_transfer_files = YES
when_to_transfer_output = ON_EXIT_OR_EVICT

# Input files
transfer_input_files = globusonline://parag:paragtest:/grid/data/parag/data

# Output sandbox transfer
output_destination = globusonline://parag:if-go-ep:/tmp/uploaded_data-fnalgrid
transfer_output_files = data_to_upload

x509userproxy=/local/home/testuser/testjobs/x509up_u11017.fermilab
+DESIRED_Sites = "GR7x1"
Requirements = (stringListMember(GLIDEIN_Site,DESIRED_Sites)) && (Disk > 0 && (Arch == "INTEL" || Arch ==
"X86_64"))
queue
```

What plugin does?

- ⦿ Guess
 - X509_USER_PROXY
 - Globusconnect (GC)
 - GO user, GO endpoint & file location from the URI
- ⦿ Bootstrap Globusconnect
 - Unpack
 - Add GC endpoint
 - Run setup
 - Start GC
- ⦿ Activate the GO endpoint
- ⦿ Initiate scp between GC & GO endpoint
- ⦿ On scp completion
 - Stop GC
 - Remove the GC endpoint
 - Exit with the status of the transfer

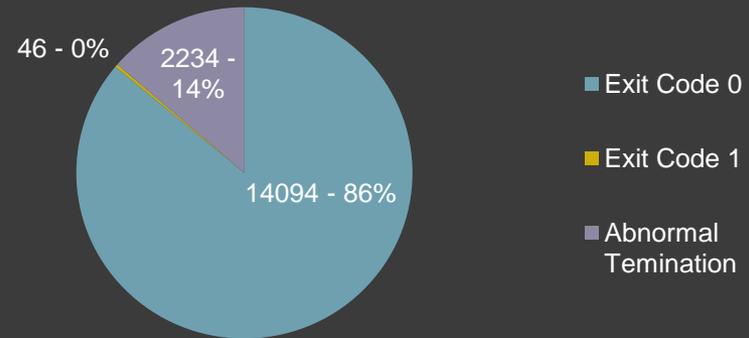
What does the plugin require?

- ⦿ Not dependent on the glideinwms release
- ⦿ Requires condor 7.6+
- ⦿ GC - transferred via custom scripts or pre-installed on the worker node
 - Globus connect version v1.1+
- ⦿ Transfers
 - Can only take place between a GC and a GO endpoint
 - File specified in the GO URI format

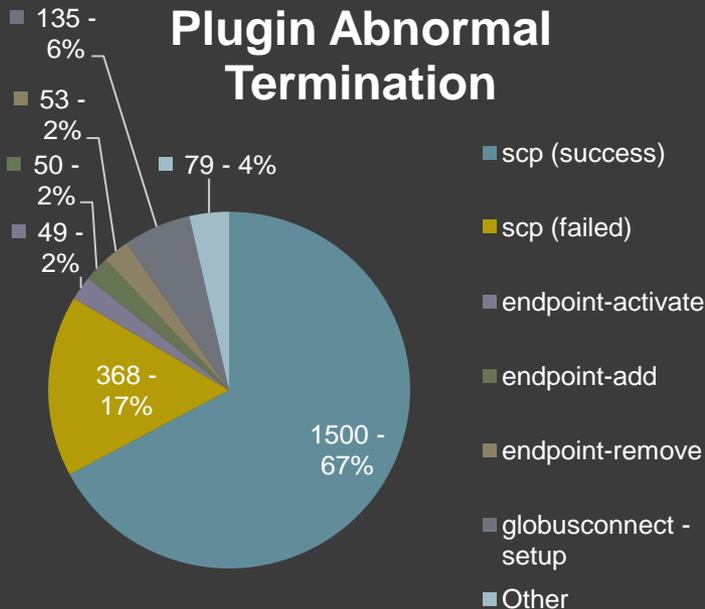
Stress Tests & Results

- 2636 Minerva Jobs submitted
- 16359 Output files transferred back through GO

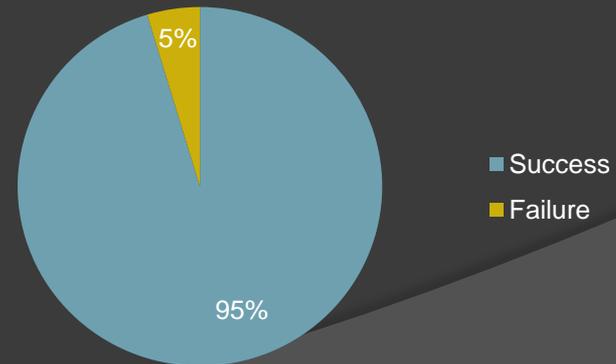
Plugin Exit Status



Plugin Abnormal Termination



File Transfers Status



Limitations

- Condor
 - X509_USER_PROXY
 - X509_USER_PROXY is correct when called for input file transfers but is different when plugin is called for output file transfers.
 - Getting Logs/Debugging Info back to the submitted
 - All the files go to the GO endpoints and nothing gets transferred back to submit node
 - If there is a problem accessing GO itself, logs are lost.
 - Supporting multiple transfers
 - Syntax too rigid: **plugin source destination**
 - Hopefully, newer plugin architecture in Condor will address these issues
- Globus Online
 - Fail earlier than 1 day default for Globus Online
 - Current limit of 3 active transfers per user. You can have more queued.
- Transfer Plugin
 - Which GLOBUSCONNECT
 - We need to do a better job of figuring out which GLOBUSCONNECT to use.
 - Reusing/Reducing number of Globus Online endpoints
 - Each file transfer creates a new GO endpoint.
 - Start the transfer in background and periodically poll it. Fail accordingly rather than the default GO deadline of 1d

Conclusion

- ⦿ End-To-End Solution
 - Independent of the glideinWMS release
- ⦿ Integrates WMS with data management layer
- ⦿ Solution using Condor's transfer plugin architecture, currently supports GO but can be extended to different data transfer services/protocol
- ⦿ Data transfer done by the infrastructure and not by job

References

- CEDPS
<http://cedps.net>
- Project:
<https://cdcvs.fnal.gov/redmine/projects/cedps-glideinwms>
<http://cd-docdb.fnal.gov/cgi-bin/ShowDocument?docid=4406>
- Test Results:
<http://cd-docdb.fnal.gov/cgi-bin/ShowDocument?docid=4474>
- Condor File transfer plugin:
<http://www.cs.wisc.edu/condor/CondorWeek2011/presentations/zmiller-cw2011-data-placement.pdf>
- Globus Connect:
<https://www.globusonline.org/>