



Introduction to Condor-G

The Globus Project™

Argonne National Laboratory
USC Information Sciences Institute

<http://www.globus.org/>

What Is Condor-G?

- Enhanced version of Condor that uses Globus Toolkit™ to manage Grid jobs
- Two Parts
 - Globus Universe
 - GlideIn
- Excellent example of applying the general purpose Globus Toolkit to solve a particular problem (I.e. high-throughput computing) on the Grid

Condor

- High-throughput scheduler
- Non-dedicated resources
- Job checkpoint and migration
- Remote system calls

Globus Toolkit

- Grid infrastructure software
- Tools that simplify working across multiple institutions:
 - Authentication (GSI)
 - Scheduling (GRAM, DUROC)
 - File transfer (GASS, GridFTP)
 - Resource description (GRIS/GIIS)

Why Use Condor-G

- Condor
 - Designed to run jobs within a single administrative domain
- Globus Toolkit
 - Designed to run jobs across many administrative domains
- Condor-G
 - Combine the strengths of both

Globus Universe

- Advantages of using Condor-G to manage your Grid jobs
 - Full-featured queuing service
 - Credential Management
 - Fault-tolerance

Full-Featured Queue

- Persistent queue
- Many queue-manipulation tools
- Set up job dependencies (DAGman)
- E-mail notification of events
- Log files

Credential Management

- Authentication in Globus Toolkit is done with limited-lifetime X509 proxies
- Proxy may expire before jobs finish executing
- Condor-G can put jobs on hold and e-mail user to refresh proxy
- Condor-G can forward new proxy to execution sites

Fault Tolerance

- Local Crash
 - Queue state stored on disk
 - Reconnect to execute machines
- Network Failure
 - Wait until connectivity returns
 - Reconnect to execute machines

Fault Tolerance

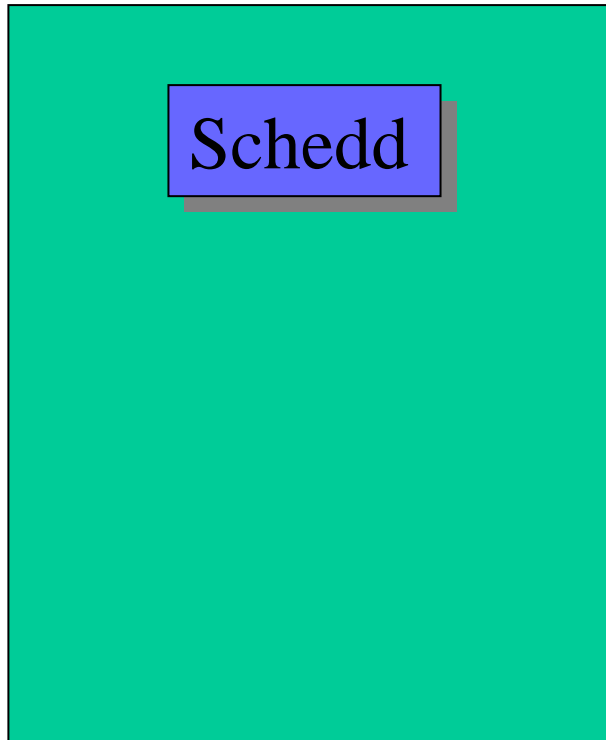
- Remote Crash – job still in queue
 - Job state stored on disk
 - Start new jobmanager to monitor job
- Remote Crash – job lost
 - Resubmit job

GRAM-1.5 Changes

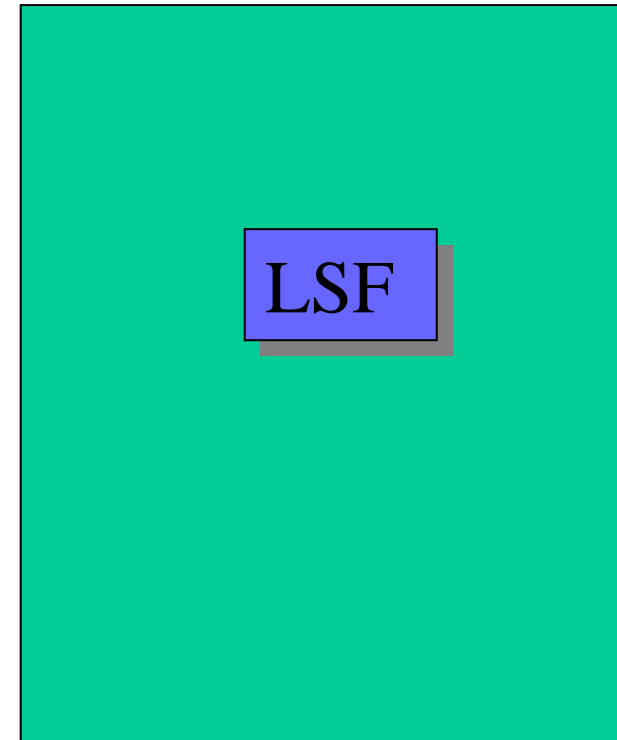
- Changes to improve recoverability from faults, to better support Condor-G
 - U Wisconsin contributed these changes
- Added Features
 - Jobmanager checkpoint & restart
 - Two-Phase commit during job submission
- GRAM-1.5 protocol (Globus Toolkit v2.0) is backward compatible with GRAM-1 (Globus Toolkit v1.x)

How It Works

Condor-G



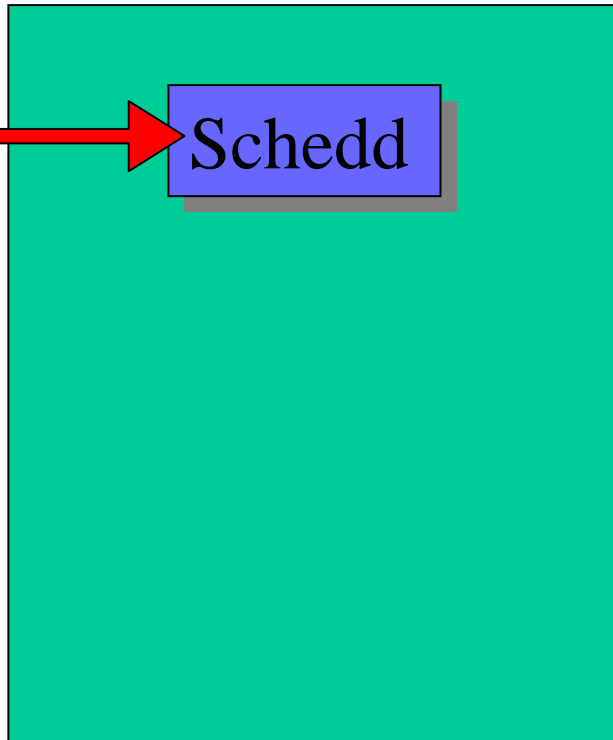
Grid Resource



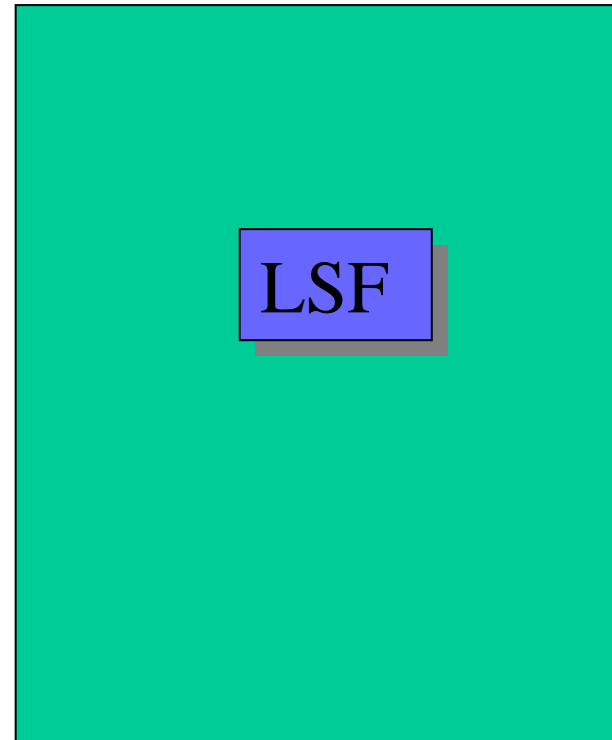
600 Grid jobs

How It Works

Condor-G



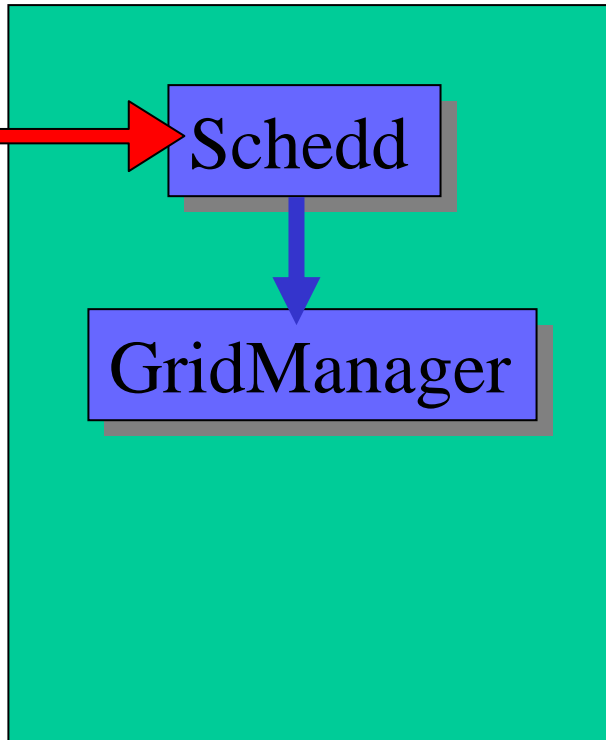
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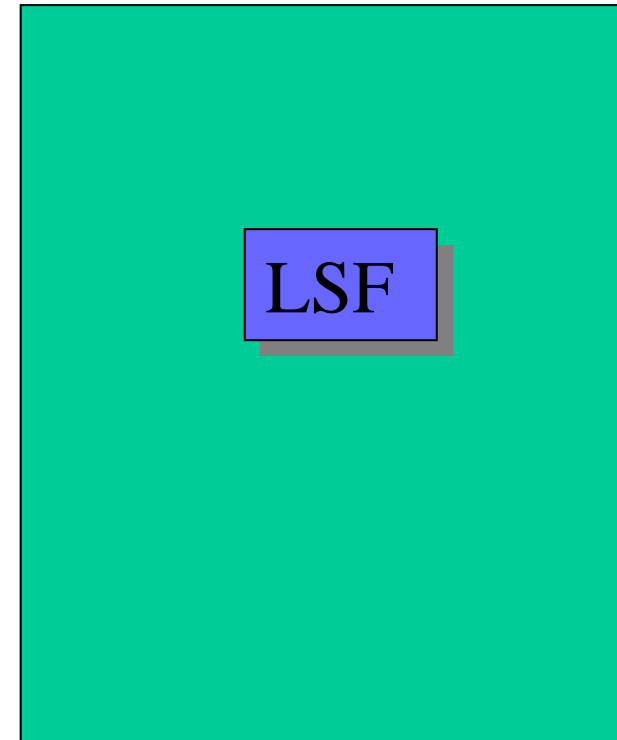
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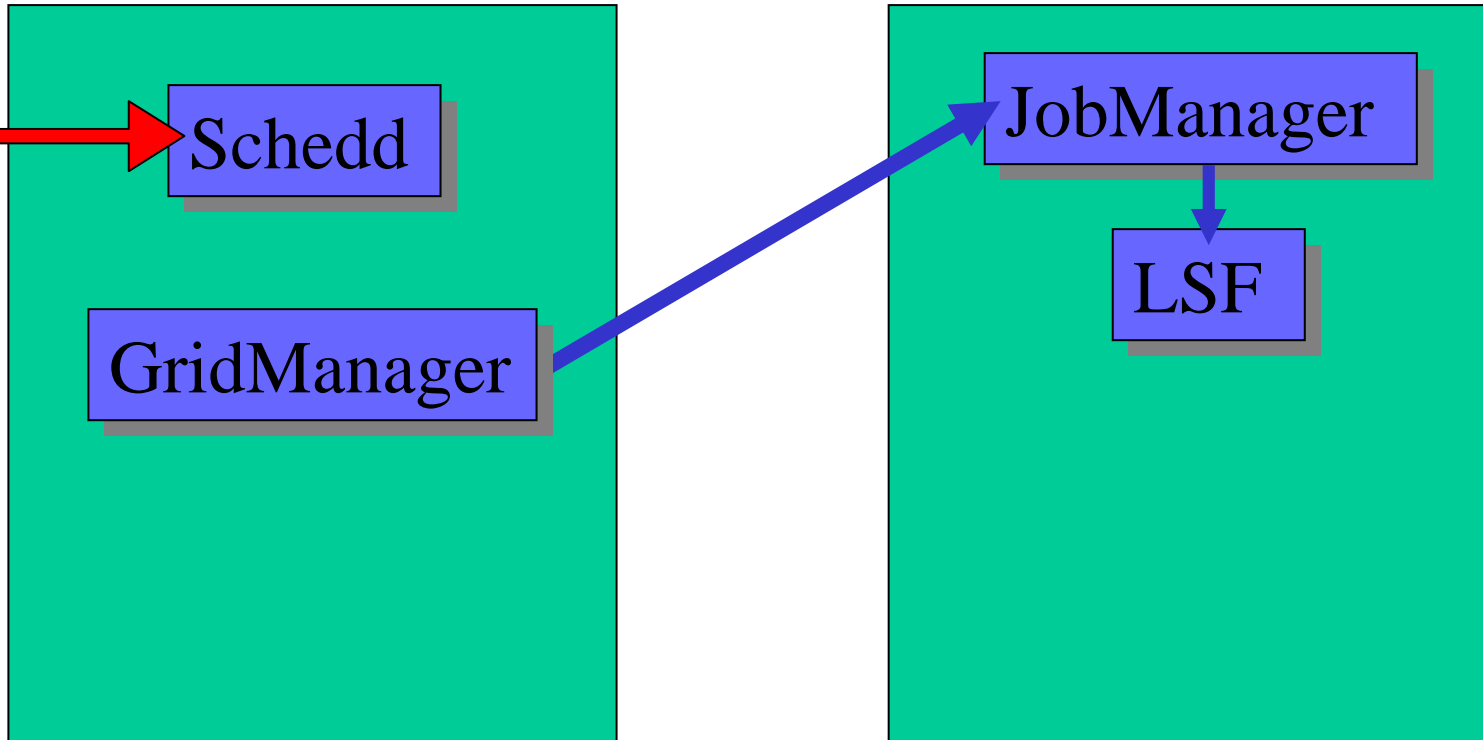


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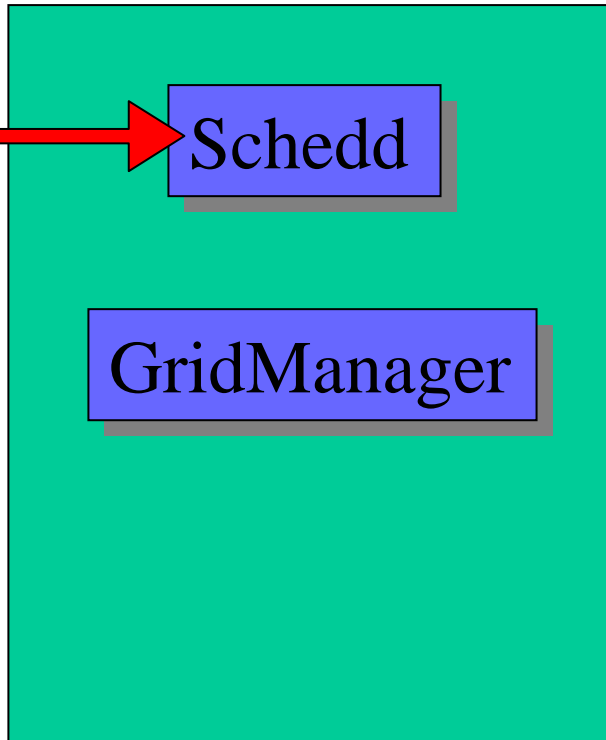
Grid Resource



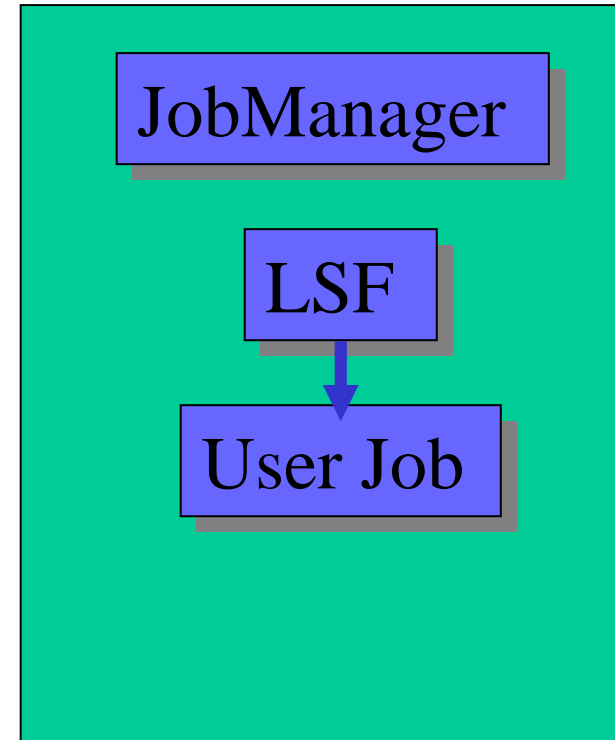
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Grid Resource



Globus Universe

- Disadvantages
 - No matchmaking or dynamic scheduling of jobs
 - No job checkpoint or migration
 - No remote system calls

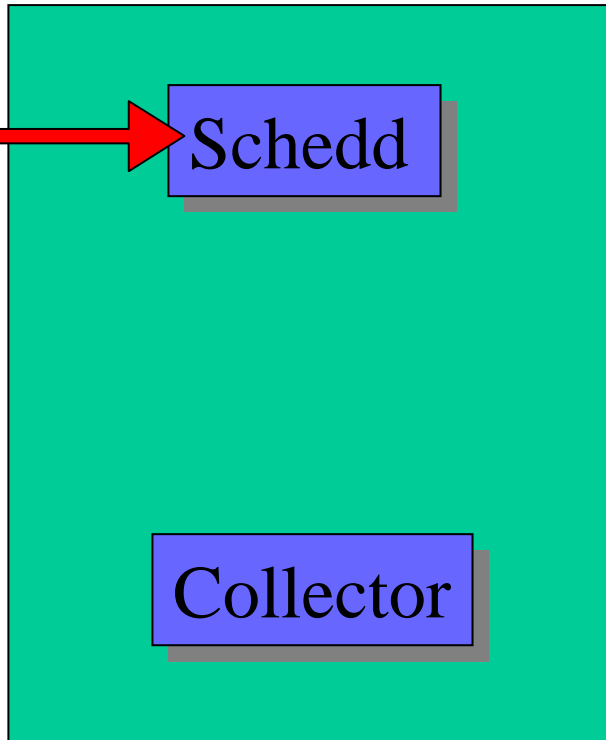
Solution: GlideIn

- Use the Globus Universe to run the Condor daemons on Grid resources
- When the resources run these GlideIn jobs, they will join your personal Condor pool
- Submit your jobs as Condor jobs and they will be matched and run on the Grid resources

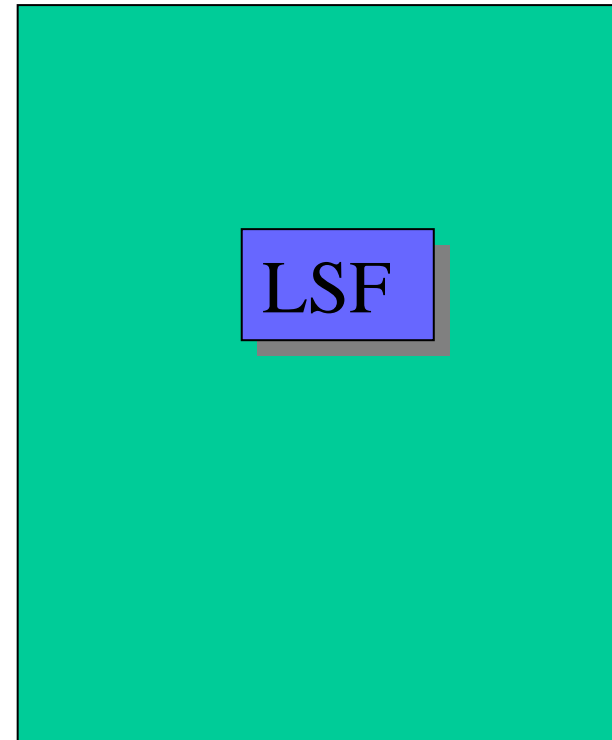
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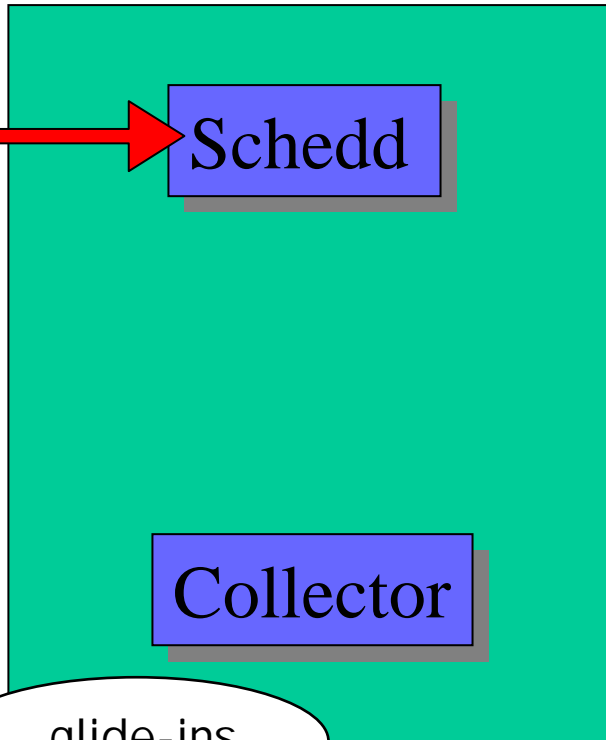
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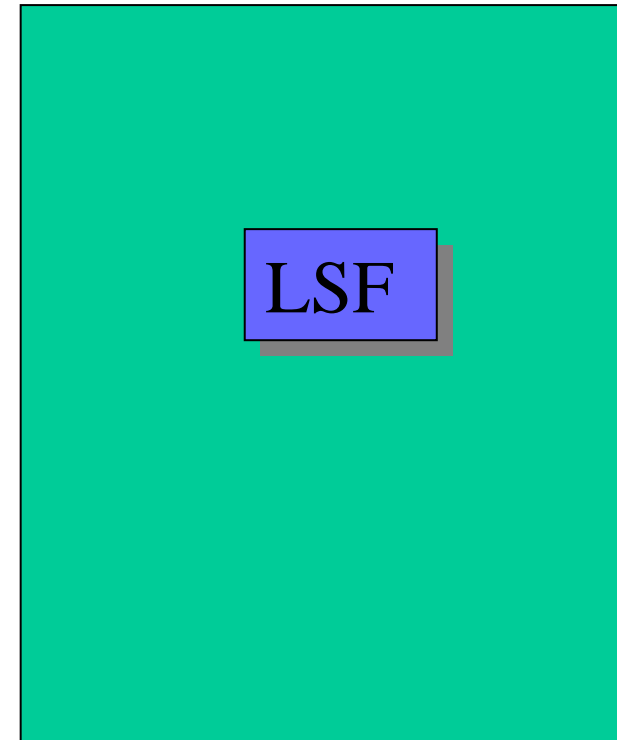
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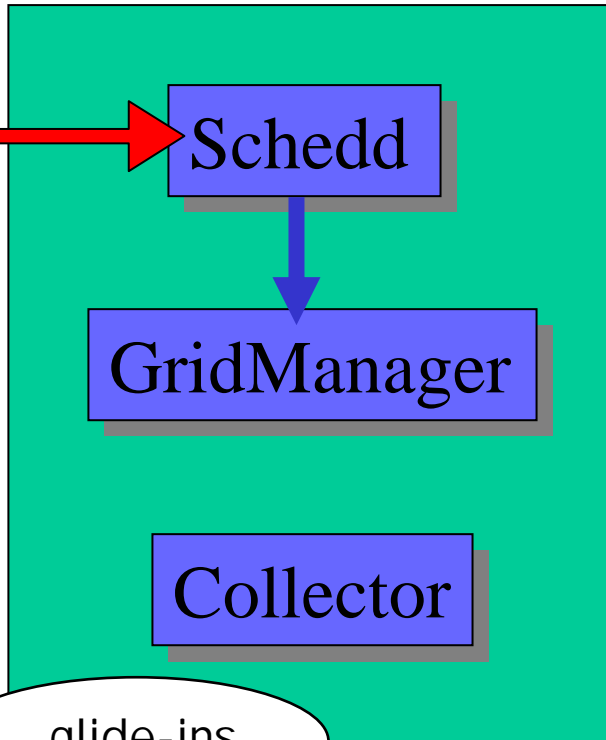
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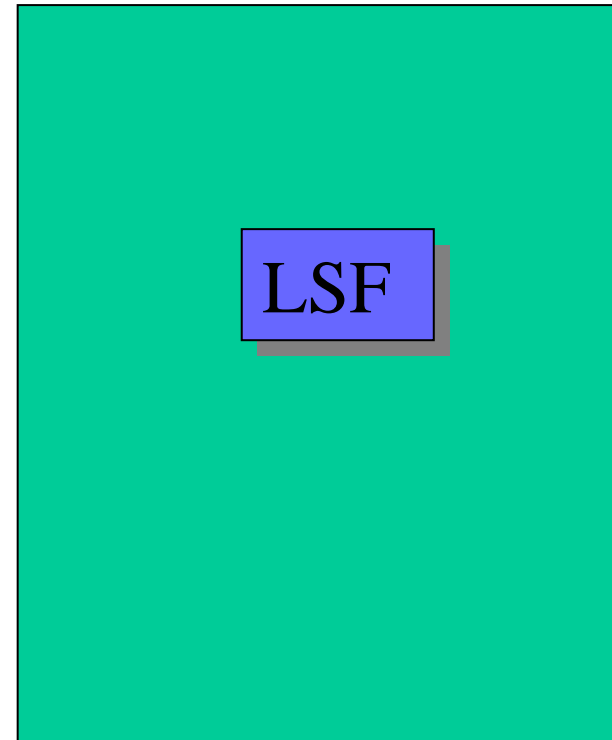
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glide-ins

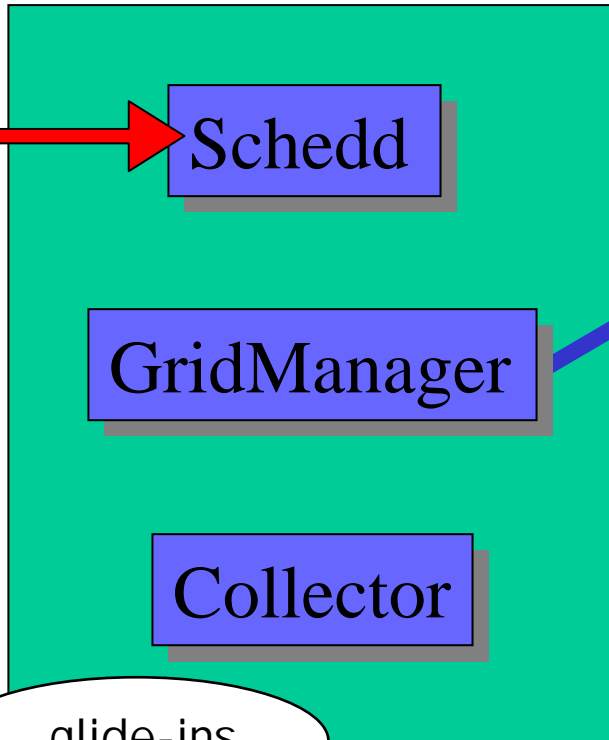
Grid Resource



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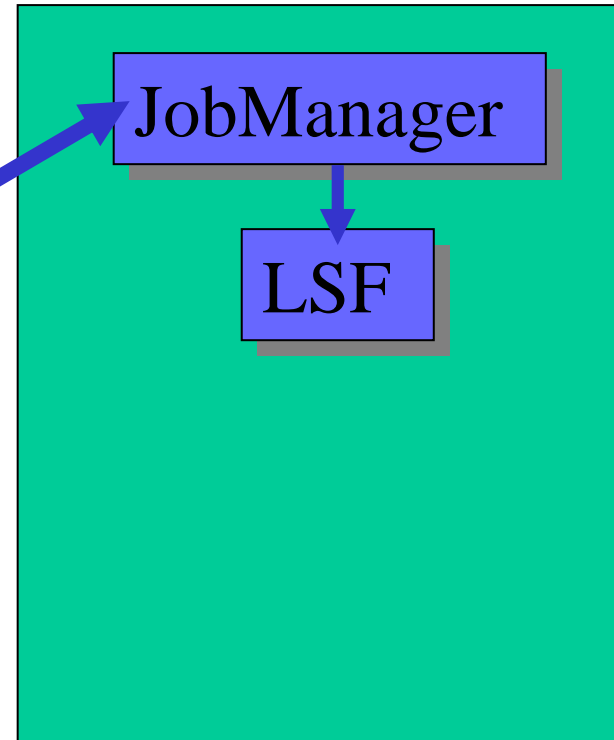
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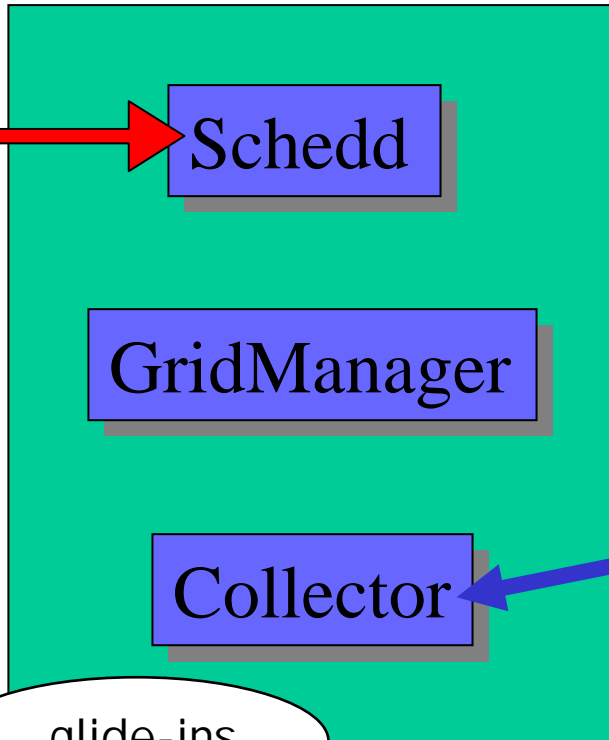
Grid Resource



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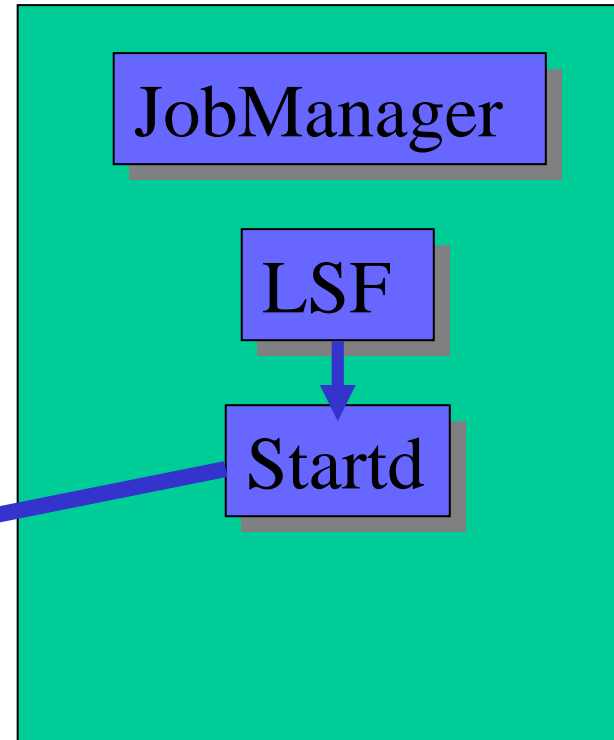
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glide-ins

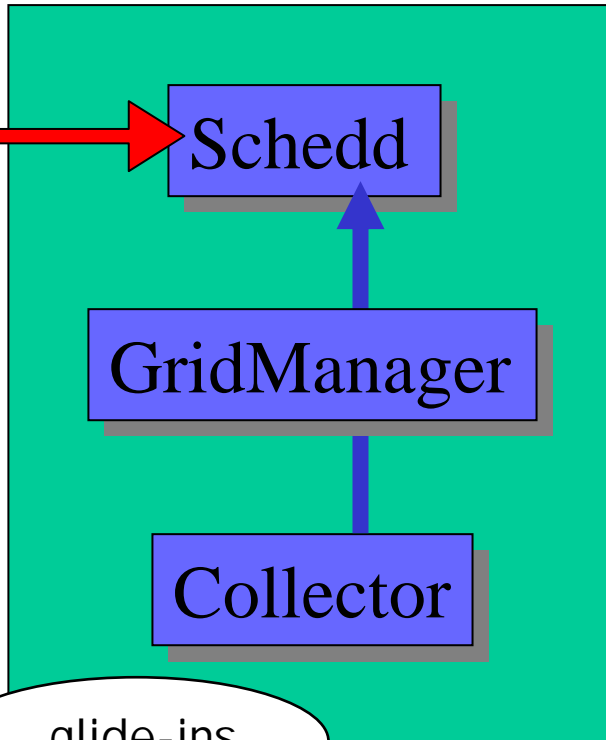
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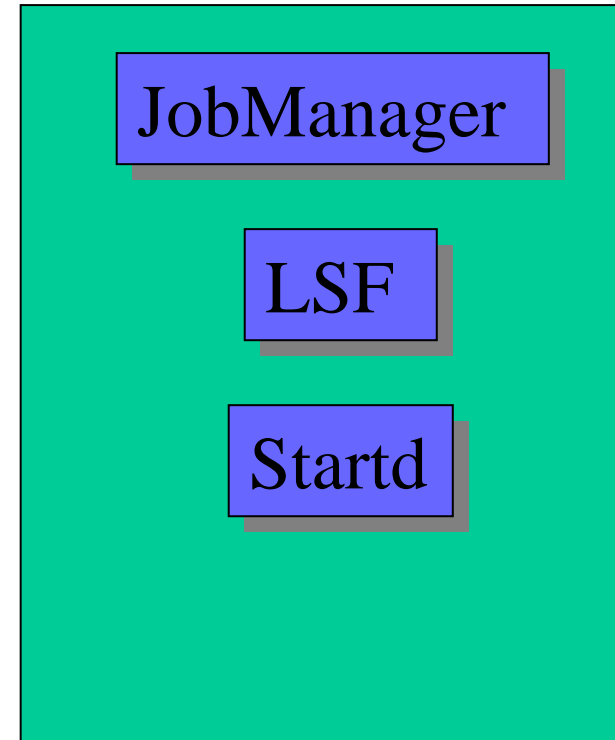
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glide-ins

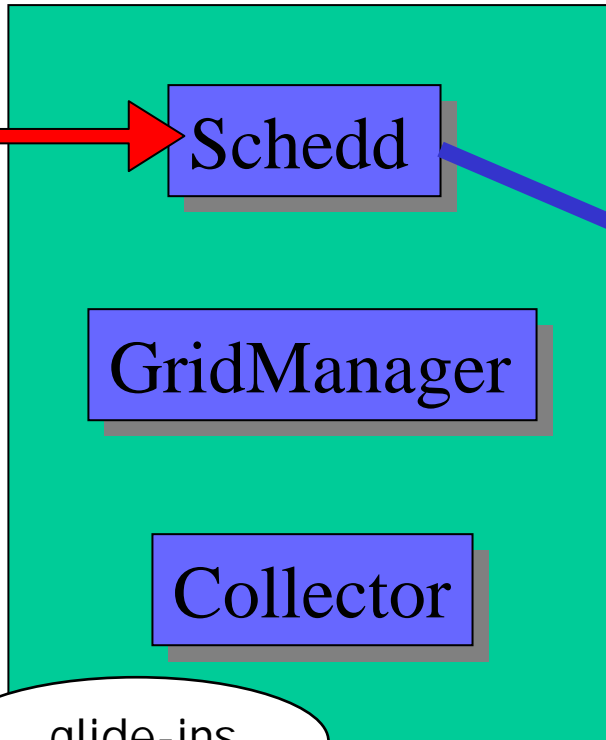
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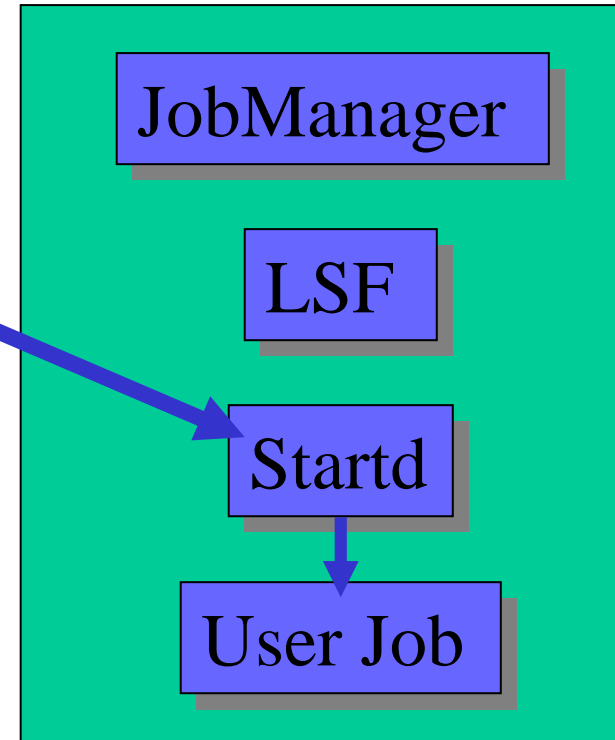
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glide-ins

Grid Resource



GlideIn Concerns

- What if a Grid resource kills my GlideIn?
 - That resource will disappear from your pool and your jobs will be rescheduled on other machines
- What if all my jobs are done before a GlideIn runs?
 - If the glided-in Condor daemons are not matched with a job in 10 minutes, they terminate

GlideIn Concerns

- Can others in the Condor pool run jobs on my GlideIn resources?
 - No
- Where do I get binaries for other platforms?
 - Repository with binaries for all platforms at UW
 - You can set up your own local repository

Who's Uses Condor-G?

- MetaNEOS (NUG-30)
- NCSA (GridGaussian)
- INFN (DataGrid)
- CMS

Current Status

- Production version out for several months
 - Runs jobs using Globus GRAM or DUROC
 - Stages executable and standard I/O using Globus GASS
 - Detects and uses refreshed proxies automatically
- GRAM-1.5 changes for reliability are part of Globus Toolkit v2.0

Future Work

- GridManager
 - Stage user jobs' data files
- Automatic GlideIn
 - Condor creates GlideIn jobs when more resources are needed
- Matchmaking in Globus Universe
 - Use Globus GRIS to create ClassAds for Grid resources and match them to job ClassAds
- Support for MPICH-G