Condor-G: Condor and Grid Computing

Condor Project
Computer Sciences Department
University of Wisconsin-Madison
Condor-G

Condor for the grid

- Same job management capabilities as a local Condor pool
- Use other scheduling systems' resources
Job Management Interface

- Local, persistent queue
- Job policy expressions
- Match-making
- Job activity logs
Gridmanager Daemon

- Runs under the schedd
- Similar to the shadow
- Handles all management of grid jobs
- Single instance manages all grid jobs for a user
Grid ASCII Helper Protocol (GAHP)

› Runs under gridmanager
› Encapsulates grid client libraries in separate process
› Simple ASCII protocol
› Easy to use client libraries when they can’t be linked directly with gridmanager

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How It Works

Condor-G

Schedd

Grid Resource

CREAM

LSF

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How It Works

600 Grid jobs

Condor-G

Schedd

Grid Resource

CREAM

LSF

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How It Works

Condor-G

Schedd

Gridmanager

Grid Resource

CREAM

LSF

600 Grid jobs

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How It Works

Condor-G

- Schedd
- Gridmanager
- GAHP

Grid Resource

- CREAM
- LSF

600 Grid jobs
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How It Works

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How It Works

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User Job

600 Grid jobs

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“Grid” Universe

- All handled in your submit file
- Supports a number of “back end” types:
  - Globus: GT2, GT4, GT5
  - CREAM
  - NorduGrid
  - UNICORE
  - Condor
  - PBS
  - LSF
  - EC2
  - Deltacloud

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Globus GRAM2

Used for a Globus GT2 back-end
- "Condor-G"

Format:
Grid_Resource = gt2 Head-Node
Globus_rsl = <RSL-String>

Example:
Universe = grid
Grid_Resource = gt2 beak.cs.wisc.edu/jobmanager
Globus_rsl = (queue=long)(project=atom-smasher)
Globus GRAM4

Used for a Globus GRAM4 backend

Format:
Grid_Resource = gt4 <Head-Node> <Scheduler-Type>
Globus_XML = <XML-String>

Example:
Universe = grid
Grid_Resource = gt4 beak.cs.wisc.edu Condor
Globus_xml = <queue>long</queue><project>atom-smasher</project>
Globus GRAM5

› Used for a Globus GRAM5 back-end
  • More scalable version of GRAM2

› Format:
Grid_Resource = gt5 Head-Node
Globus_rsl = <RSL-String>

› Example:
Universe = grid
Grid_Resource = gt5 beak.cs.wisc.edu/jobmanager
Globus_rsl = (queue=long)(project=atom-smasher)
CREAM

- Used for a CREAM back-end

- Format:
  
  Grid_Resource = cream <CREAM service>
  Cream_Attributes = <JDL attributes>

- Example:
  
  Universe = grid
  Grid_Resource = cream foo.edu/cream-pbs-normal_queue
  Cream_Attributes = CpuNumber=5
Condor

Used for a Condor back-end
• “Condor-C”

Format:
Grid_Resource = condor <Schedd-Name> <Collector-Name>
Remote_<param> = <value>
  • “Remote_” part is stripped off

Example:
Universe = grid
Grid_Resource = condor beak condor.cs.wisc.edu
Remote_Universe = standard
NorduGrid ARC

› Used for a NorduGrid back-end

Grid_Resource = nordugrid <Host-Name>

› Example:

Universe = grid

Grid_Resource = nordugrid ngrid.cs.wisc.edu
UNICORE

Used for a UNICORE back-end

Format:

Grid_Resource = unicore <USite> <VSite>

Example:

Universe = grid

Grid_Resource = unicore uhost.cs.wisc.edu vhost
PBS

› Used for a PBS back-end
› Format:
  Grid_Resource = pbs
› Example:
  Universe = grid
  Grid_Resource = pbs
LSF

- Used for a LSF back-end
- Format:
  Grid_Resource = lsf
- Example:
  Universe = grid
  Grid_Resource = lsf
Credential Management

- Condor will do The Right Thing™ with your X509 certificate and proxy
- Override default proxy:
  - X509UserProxy = /home/einstein/other/proxy
- Proxy may expire before jobs finish executing
  - Condor can use MyProxy to renew your proxy
  - When a new proxy is available, Condor will forward the renewed proxy to the job
Configuration Files

▶ One main config file and multiple additional files
▶ Can have multiple Condor installations on a machine, each with a different set of config files
Finding the Config Files

» Condor looks for the main config file in
  • $CONDOR_CONFIG
  • /etc/condor/condor_config
  • /usr/local/etc/condor_config
  • ~condor/condor_config
  • $(GLOBUS_LOCATION)/etc/condor_config
Finding the Config Files

› Main config file can specify additional files
  › LOCAL_CONFIG_FILE=foo,bar
    • List of additional files
  › LOCAL_CONFIG_FILE=wget http://foo.edu/config|
    • Execute program to produce config setting
  › LOCAL_CONFIG_DIR =/etc/configs/
    • Directory containing config files
Querying the Configuration

› `condor_config_val -config`
  • Prints list of config files being used
  • May not be same config used by daemons

› `condor_config_val LOG`
  • Prints value of LOG parameter

› `condor_config_val -v LOG`
  • Prints value of LOG parameter
  • Also prints where it’s set
Log Files

› User log
  • Records significant events in a job’s life

› Event log
  • Like user log, but for all jobs

› History file
  • Copy of job ad when it leaves the queue

› Gridmanager log
  • Gridmanager’s record of activity
User Log

- Can find with:
  
  `condor_q -format '%s\n' UserLog 17.0`

- Set with “log” in the submit file
- Contains the life history of the job
- Often contains details on problems
- Never rotates
Event Log

- Like the user log, but used for all jobs
- Set via EVENT\_LOG in the config file
History File

› Record of all jobs that leave the queue
› Snapshot of job state
› Can view via condor_history
› Can use PER_JOB_HISTORY_DIR to save non-rotating history
Gridmanager Log

› Find via GRIDMANAGER_LOG param
  • Contains job owner’s username

› When debugging, can enable more verbose logging
  • GRIDMANAGER_DEBUG = D_FULLDEBUG
  • MAX_GRIDMANAGER_LOG = 50000000
HELD Status

› Jobs will be held when Condor-G needs help with an error
› On release, Condor-G will retry
› The reason for the hold will be saved in the job ad and user log
Hold Reason

▶ condor_q -held

161.0  jfrey      2/13 13:58 CREAM_Delegate
         Error: Received NULL fault;

▶ cat job.log

012  (161.000.000) 02/13 13:58:38 Job was held.
    CREAM_Delegate Error: Received NULL fault; the
    error is due to another cause…

▶ condor_q -format '%s
' HoldReason

CREAM_Delegate Error: Received NULL fault; the error is
due to another cause…

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Common Errors

› Authentication
  • Hold reason may be misleading
  • User may not be authorized by CE
  • Condor-G may not have access to all Certificate Authority files
  • User’s proxy may have expired
Common Errors

- CE no longer knows about job
  - CE admin may forcibly remove job files
  - Condor-G is obsessive about not leaving orphaned jobs
  - May need to take extra steps to convince Condor-G that remote job is gone
Nonessential Jobs

› Jobs can be marked nonessential in the submit file
  • `+nonessential = true`

› This makes Condor-G more willing to leave orphaned jobs and files on the CE

› Use with caution
More Detail on Errors

› More details on errors can be found in the gridmanager log

› You’ll probably want to increase the debug level and log file size

  • GRIDMANAGER_DEBUG = D_FULLDEBUG
  • MAX_GRIDMANAGER_LOG = 5000000
Machines Down

› If a remote server is down, Condor-G will wait for it to come back up
› The time it went down is kept in the job ad
  • `GridResourceUnavailableTime = 1297628439`
› And in the user log

026 (163.001.000) 02/13 14:20:39 Detected Down
Grid Resource
  GridResource: gt2 chopin.cs.wisc.edu/jobmanager-fork
Throttles and Timeouts

- Limits that prevent Condor-G or CEs from being overwhelmed by large numbers of jobs
- Defaults are fairly conservative
Throttles and Timeouts

- `GRIDMANAGER_MAX_SUBMITTED_JOBS_PER_RESOURCE = 1000`
  - You can increase to 10,000 or more

- `GRIDMANAGER_MAX_JOBMANAGERS_PER_RESOURCE = 10`
  - `GRAM2` only
  - Default is conservative
  - Can increase to ~100 if this is the only client
Throttles and Timeouts

GRIDMANAGER_MAX_PENDING_REQUESTS = 50
  • Number of commands sent to a GAHP in parallel
  • Can increase to a couple hundred

GRIDMANAGER_GAHP_CALL_TIMEOUT = 300
  • Time after which a GAHP command is considered failed
  • May need to lengthen if pending requests is increased
Network Connectivity

- Outbound connections only for most job types
- GRAM requires incoming connections
  - Need 2 open ports per <user, X509 DN> pair