Condor from the user point of view

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Acknowledgement

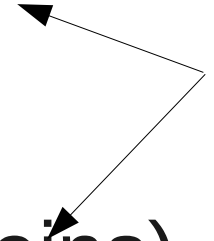
- These slides are heavily based on the presentation Todd Tannenbaum gave at CERN in Feb 2011
  https://indico.cern.ch/conferenceTimeTable.py?confId=124982#20110214.detailed

What is Condor

- Condor is a Workload Management System
  - i.e. a batch system
- Strong points
  - Fault tolerant
  - Robust feature set
  - Flexible
- Development team dedicated to working closely w/ scientific community as priority #1

How can Condor be used

- Managing local processes (local)
- Managing local cluster (~vanilla)
- Connecting clusters (flocking)
- Handling resource overlays (glideins)
- Swiss-knife for accessing other WMS (Condor-G)
  - e.g. Grid, Cloud, pbs, etc.



Submitting Jobs to Condor

- Get access to submit host
- Choose a “Universe” for your job
- Make your job “batch-ready”
  - Includes making your data available to your job
- Create a submit description file
- Run condor_submit to put your job(s) in the queue
- Relax while Condor manages and watches over your job(s)

Choose the job “Universe”

- Controls how Condor handles jobs
- Condors many universes include:
  - Vanilla (aka regular single node job)
  - Parallel
  - Grid
  - Java
  - VM
  - Standard

Hello World Submit File

```
# Simple condor_submit input file
# (Lines beginning with # are comments)
# NOTE: the words on the left side are not
#       case sensitive, but filenames are!
Universe   = vanilla
Executable = cosmos
Arguments  = -k 1543.3
Output     = cosmos.out
Input      = cosmos.in
Log        = cosmos.log
Queue 1
```

- Job's executable
- Job's args
- Job's STDOUT
- Job's STDIN
- Log the job's activities
- Put the job in the queue!

condor_submit & condor_q

```
% condor_submit sim.submit
Submitting job(s).
1 job(s) submitted to cluster 1.

% condor_q

-- Submitter: perdita.cs.wisc.edu : <128.105.165.34:1027> :
 ID      OWNER          SUBMITTED     RUN_TIME ST PRI SIZE CMD

  1.0    frieda         6/16 06:52   0+00:00:00 I  0   0.0 sim.exe

1 jobs; 1 idle, 0 running, 0 held

%
```

View the full ClassAd

```
% condor_q -long

-- Submitter: perdita.cs.wisc.edu : <128.105.165.34:1027> :
MyType = “Job”
TargetType = “Machine”
ClusterId = 1
QDate = 1150921369
CompletionDate = 0
Owner = “frieda”
RemoteWallClockTime = 0.000000
LocalUserCpu = 0.000000
LocalSysCpu = 0.000000
RemoteUserCpu = 0.000000
RemoteSysCpu = 0.000000
ExitStatus = 0
…
```

Monitor progress through logs

- The log file you specified is updated every time something happens to the job
  - e.g. submit, start, termination
- Example log file

```
000 (001.000.000) 05/25 19:10:03 Job submitted from host: <128.105.146.14:1816>
...
001 (001.000.000) 05/25 19:12:17 Job executing on host: <128.105.146.14:1026>
...
005 (001.000.000) 05/25 19:13:06 Job terminated.
    (1) Normal termination (return value 0)
...
```

condor_status

gives information about the pool:

```
% condor_status
Name          OpSys  Arch   State     Activ LoadAv Mem   ActvtyTime
perdita.cs.wi LINUX  INTEL  Owner     Idle  0.020   511  0+02:28:42
coral.cs.wisc LINUX  INTEL  Claimed   Busy  0.990   511  0+01:27:21
doc.cs.wisc.e LINUX  INTEL  Unclaimed Idle  0.260   511  0+00:20:04
dsonokwa.cs.w LINUX  INTEL  Claimed   Busy  0.810   511  0+00:01:45
ferdinand.cs. LINUX  INTEL  Claimed   Suspe 1.130   511  0+00:00:55
```

To inspect full ClassAds: condor_status -long

General User Commands

• condor_submit	Submit new Jobs
• condor_run	Submit and block
• condor_q	View Job Queue
• condor_status	View Pool Status
• condor_rm	Remove Jobs
• condor_history	Completed Job Info
• condor_hold	Put a job on hold
• condor_release	Release a job from hold

http://www.cs.wisc.edu/condor/manual/v7.6/9_Command_Reference.html

Condor File Transfer

- Condor will transfer files between submit and execute nodes (eliminating the need for NFS) if desired:
  - **`ShouldTransferFiles`**
    - **`YES`**: Always transfer files to execution site
    - **`NO`**: Always rely on a shared filesystem
    - **`IF_NEEDED`**: Condor will automatically transfer the files if the submit and execute machine are not in the same FileSystemDomain (Use shared file system if available)
  - **`When_To_Transfer_Output`**
    - **`ON_EXIT`**: Transfer the job's output files back to the submitting machine only when the job completes
    - **`ON_EXIT_OR_EVICT`**: Like above, but also when the job is evicted

Condor File Transfer, cont

- **`Transfer_Input_Files`**
  - List of files that you want Condor to transfer to the execute machine
- **`Transfer_Output_Files`**
  - List of files that you want Condor to transfer from the execute machine
    - If specified, the files must exist when job terminates, or the job will fail (put on hold)
    - If not specified, Condor will transfer back all new or modified files in the execute directory (but not subdirectories)

Simple File Transfer Example

```
# Example submit file using file
transfer
Universe                    = vanilla
Executable                  = cosmos
Log                         = cosmos.log
ShouldTransferFiles         = YES
Transfer_input_files        = cosmos.dat
Transfer_output_files       = results.dat
When_To_Transfer_Output     = ON_EXIT
Queue
```

These annoying emails

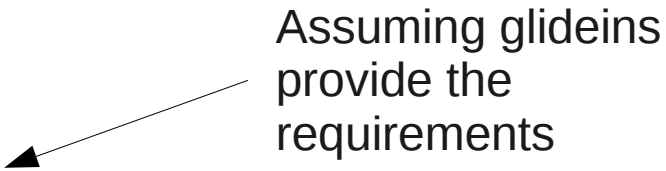
- Condor will send an email every time a job finishes
  - Which is potentially nice if you have 10 jobs
  - But it is annoying when you have O(10k)!
- To disable this behavior, add **`Notification = Never`** to the submit file

Referencing job id

- Each job has a unique ID
  - Composed of (Cluster,Process) pair
- Can reference them in the submit file with
  - $(Cluster)
  - $(Process)

Adding arbitrary attributes

- The job can add arbitrary attributes
  - Useful both as mnemonic
    e.g. AnaType=”Higgs”
  - and for use during Machmaking
    e.g. DESIRED_Sites=”FNAL,UCSD,Nebraska”



- Condor syntax expects a “+” sign
  e.g. +DESIRED_sites=”FNAL,UCSD,Nebraska”
  - Anything starting with a letter must be a Condor recognized attribute

Example submit file

```
# Example submit file using file
transfer
Universe                    = vanilla
Executable                  = cosmos
Arguments = cosmos.dat $(Cluster)
Log                         = cosmos.log
ShouldTransferFiles         = YES
Transfer_input_files        = cosmos.dat
Transfer_output_files       = results.dat
When_To_Transfer_Output     = ON_EXIT
Notification                = Never
+MyAna                      = “Higgs”
+DESIRED_Sites = “FNAL,UCSD,Nebraska”
Queue
```

We just scratched the surface

- Many more options available
- See Condor Manual
  http://research.cs.wisc.edu/condor/manual/v7.6/condor_submit.html
- See CondorWeek User tutorial
  http://research.cs.wisc.edu/condor/CondorWeek2011/tuesday_condor.html

Priorities

Priorities

- Priorities between users set by the Negotiator administrator
  - User cannot really influence that
  - More details tomorrow
- But user can set priorities relative to his own jobs
  - FIFO by default
  - User can designate some jobs as higher priority (or even lower priority)
    - Again FIFO within the same priority level

http://research.cs.wisc.edu/condor/manual/v7.6/condor_prio.html

Managing priorities

- Check with `condor_q`
- Modify with **`condor_prio`**

```
% condor_q 366701.193

-- Submitter: santa1.claus : <192.168.130.11:9615?sock=9763_cd4c_2> : santa1.claus
 ID      OWNER            SUBMITTED     RUN_TIME   ST PRI SIZE CMD
366701.193 frida          12/25 12:01   0+00:00:00 I  0   0.0  cosmis -k 3.4
% condor_prio -10 366701.193
% condor_q 366701.193

-- Submitter: santa1.claus : <192.168.130.11:9615?sock=9763_cd4c_2> : santa1.claus
 ID      OWNER            SUBMITTED     RUN_TIME   ST PRI SIZE CMD
366701.193 frida          12/25 12:01   0+00:00:00 I  -10 0.0  cosmos -k 3.4
```

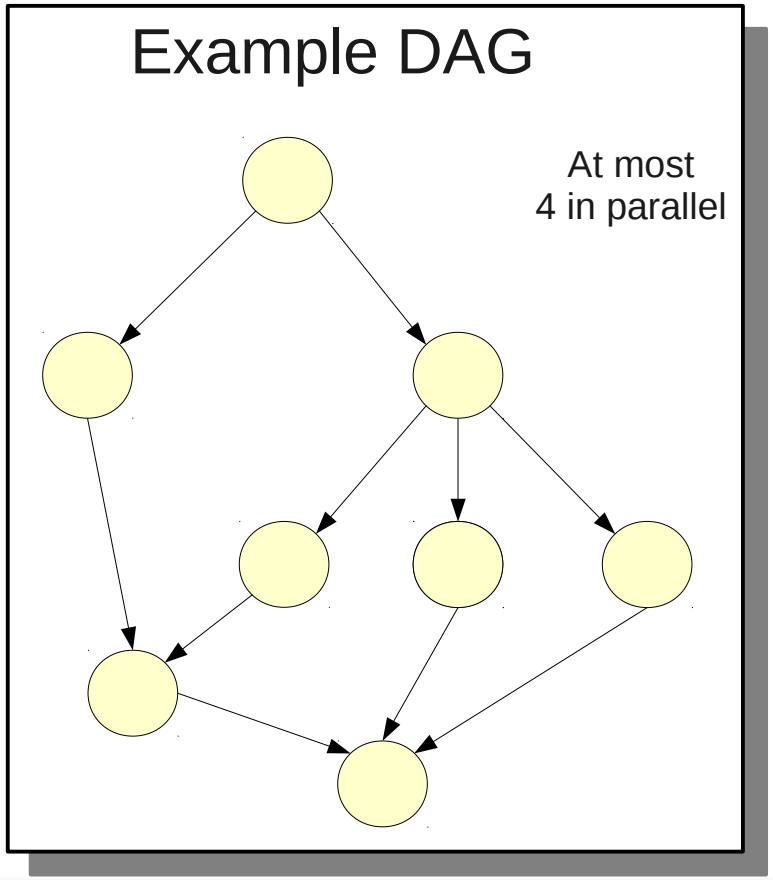
Workflows

What is workflow?

- HTC all about using many CPUs
  - **Workflow = collection of jobs solving one task**
- Often users have workflows that are more than “a bunch of jobs”
  - May have dependencies
- Condor provides a tool to handle dependencies
  - The Condor DAGMan

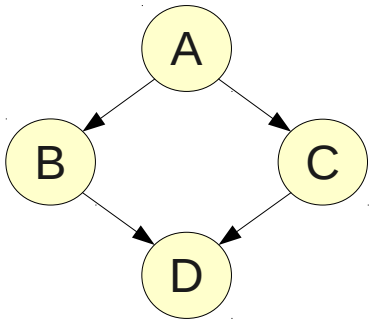
condor_dagman

- condor_dagman is a program to manage a DAG
  - DAG = Direct Acyclic Graph
- Effective way to handle a large workflow
  - Condor will make sure the workflow is completed
  - Or tell you which node failed
- Will have one running per submitted workflow



How to submit a workflow

- In a nutshell
  - Create submit files for nodes
  - Create a dagman submit file
  - Submit the DAG using condor_submit_dag
- Condor takes care of rest




```
# Example dagman file
JOB  A  A.condor
JOB  B  B.condor
JOB  C  C.condor
JOB  D  D.condor
PARENT A CHILD B C
PARENT B C CHILD D
```

http://research.cs.wisc.edu/condor/manual/v7.6/2_10DAGMan_Applications.html

The End

The Condor Project (Established ‘85)

- Research and Development in the Distributed High Throughput Computing field
- Team of ~35 faculty, full time staff and students
  - Face software engineering challenges in a distributed UNIX/Linux/NT environment
  - Are involved in national and international grid collaborations
  - Actively interact with academic and commercial entities and users
  - Maintain and support large distributed production environments
  - Educate and train students

Pointers

- Condor Home Page
  http://www.cs.wisc.edu/condor/
- Condor Manual
  http://www.cs.wisc.edu/condor/manual/v7.6/
- Support
  condor-user@cs.wisc.edu
  condor-admin@cs.wisc.edu