An overview of batch processing

3-June-2015
One-on-one

Your computer

Your program
Multiple programs on a single computer

Your computer (multiple cores)

Your program
Your program
Your program
Your program
Your program
A batch system managing multiple programs on a single computer
A batch system managing multiple programs on multiple computers

Your computer

Batch manager

Batch node

Batch node

Batch node

Batch node

Your program

Your program

Your program

Your program

Your program

on hold

Your program

Your program

Your program

Your program

Your program
The standard software for managing batch systems in scientific computing is HTCondor (or just Condor)

Main web page
http://research.cs.wisc.edu/htcondor/

Quick start
http://research.cs.wisc.edu/htcondor/quick-start.html

Full manual

- We use an older version of Condor in the Nevis particle-physics systems.
- Stick to the “vanilla” universe; the “standard” universe won’t work for ROOT or any other particle-physics software (so you don’t need condor_compile).
Condor managing multiple programs on multiple computers with multiple queues

Condor pool

Condor master

Submit machine

Batch node

Batch node

Batch node

Batch node

Batch node

Batch node

Your program

Your program

Your program

Your program

Your program

Your program

Your program

Your program

Your program

on hold
Condor will halt a queue in favor of an interactive program.

Submit machine

Condor master

Condor pool

Batch node
Batch node
Batch node
Batch node

Your program
Your program
Your program
Your program

on hold
Condor managing multiple programs on multiple computers with multiple configurations

Submit machine

Condor master

Condor pool

Batch node

Batch node

Batch node

Batch node

Your program

Your program

Your program

Your program

Your program

Your program

Your program

Your program

Your program

on hold
Condor uses “ClassAds” to match your requirements with what each node offers.

Your program

Your program

Your program

Your program

Your program

Your program

Submit machine

Condor master

Batch node

Batch node

Batch node

Batch node

Batch node

Condor pool

on hold

Your requirements (job ClassAd)

What a node offers (machine ClassAd)
Resource Planning

• Condor can’t do *everything* for you.
• Think about input files (including programs) and output files and how they’ll be accessed.
• Think about disk space. “df -h” and “du -sh x *” can help.
• Fun fact: The particle-physics Condor pools *can’t* see your home directory!
• Moral: Let condor transfer your files... when possible.

When you can’t let condor transfer your files, here are disk-sharing methods outside of condor:

• NFS – used at Nevis
• CVMFS – Fermilab and CERN
• Grid, BlueArc – only used at Fermilab
• AFS – obsolete, still used at CERN
Resource Planning

- Condor can’t do *everything* for you.
- Think about input files (including programs) and output files and how they’ll be accessed.
- Think about disk space. “df -h” and “du -shx *” can help.
- Fun fact: The particle-physics Condor pools **can’t** see your home directory!
- Moral: Let condor transfer your files... when possible.

What we **don’t** do

Your server

/home
Resource Planning

- **Condor** can’t do **everything** for you.
- Think about input files (including programs) and output files and how they’ll be accessed.
- Think about disk space. “`df -h`” and “`du -shx *`” can help.
- Fun fact: The particle-physics Condor pools **can’t** see your home directory!
- Moral: Let condor transfer your files... when possible.

![Diagram showing file servers and nodes](image-url)
Computer Systems at Nevis
Linux Cluster

Administrative servers
- hypatia
  - administration, NIS
- hermes
  - DNS, batch
- shelley
  - backup server
- annex
  - off-site backup & mail

Virtual machines
- franklin
  - Mail
- ada
  - web server
- sullivan
  - mailing-list server
- hogwarts
  - staff
- tango
  - SMB

Workgroup/Login servers
- kolya
  - ATLAS
- karthur
  - ATLAS
- tehanu
  - VERITAS
- houston
  - Neutrino
- shang
  - DOE

File servers
- xenia
- xenia2
- serret
- ged
- vetch
- amsterdm
- morningside
- westside
- bleeker
- riverside

Workstations
- batch
- nodes
- student boxes

<http://www.nevis.columbia.edu/linux/>
<http://www.nevis.columbia.edu/linux/cluster-names.html>
Bringing the job to the data

Some wrapper script

requirements = (machine = node04.nevis.columbia.edu)

Submit machine

Condor master

node01
bigfile1.root

node02
bigfile2.root

node03
bigfile3.root

node04
bigfile4.root

node05
bigfile5.root

node06
bigfile6.root
Final tips

• Split up your task so each condor job takes 20-60 minutes

• If your job must be preempted, it will have to run from the beginning on the same machine that cancelled the job

• Test your job with one process before submitting it for 10,000 processes!
Resources

Main web page
http://research.cs.wisc.edu/htcondor/

Quick start
http://research.cs.wisc.edu/htcondor/quick-start.html

Full manual

Nevis particle-physics condor guide
https://twiki.nevis.columbia.edu/twiki/bin/view/Nevis/Condor

Basic Condor@Nevis tutorial
http://www.nevis.columbia.edu/~seligman/root-class/