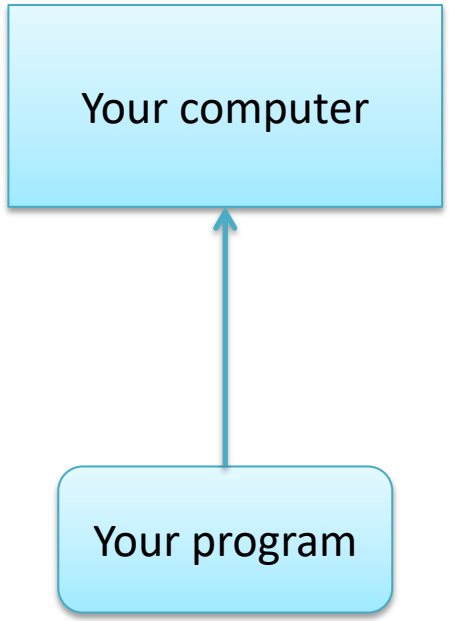
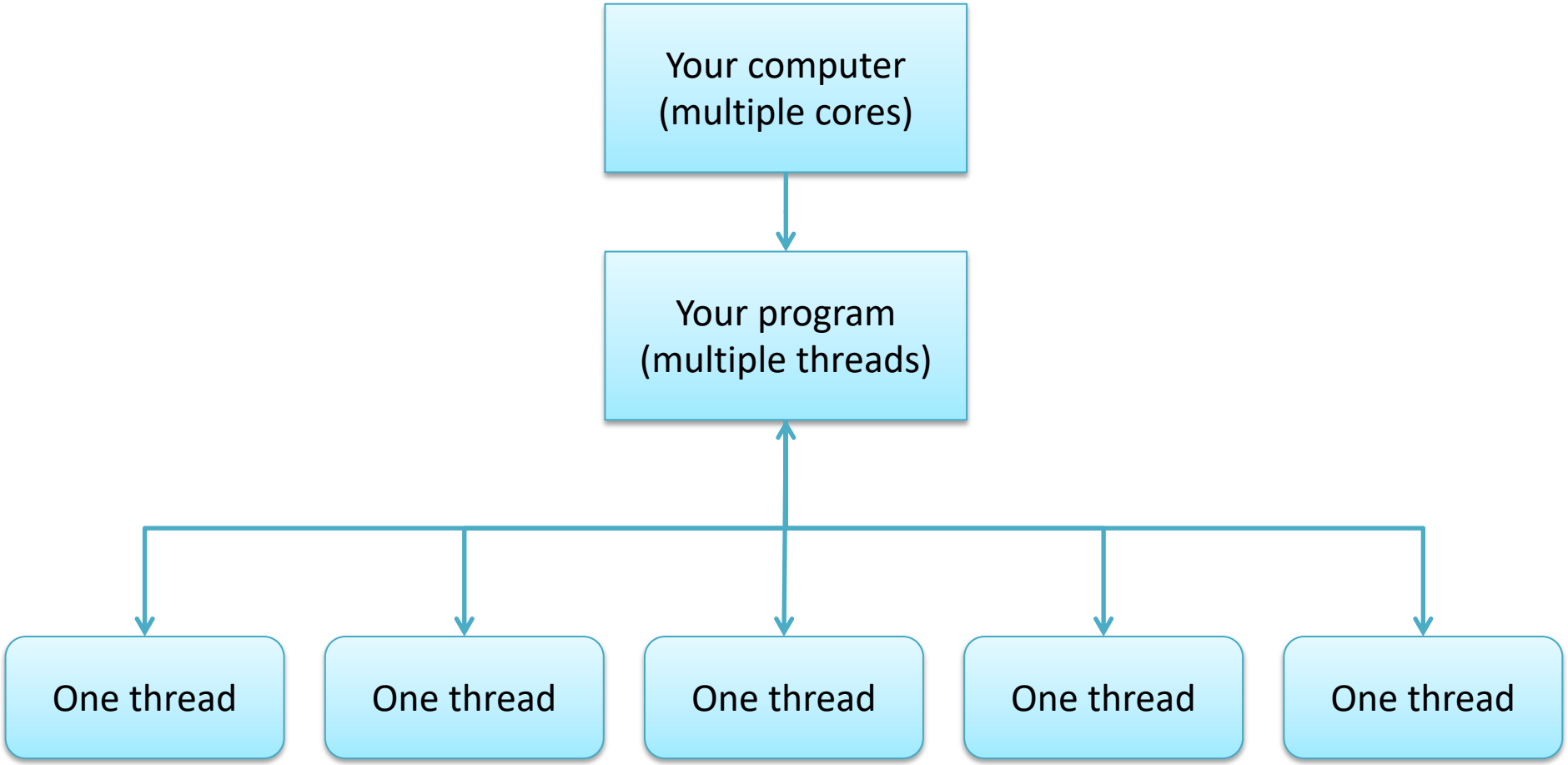
# An overview of batch processing

One-on-one

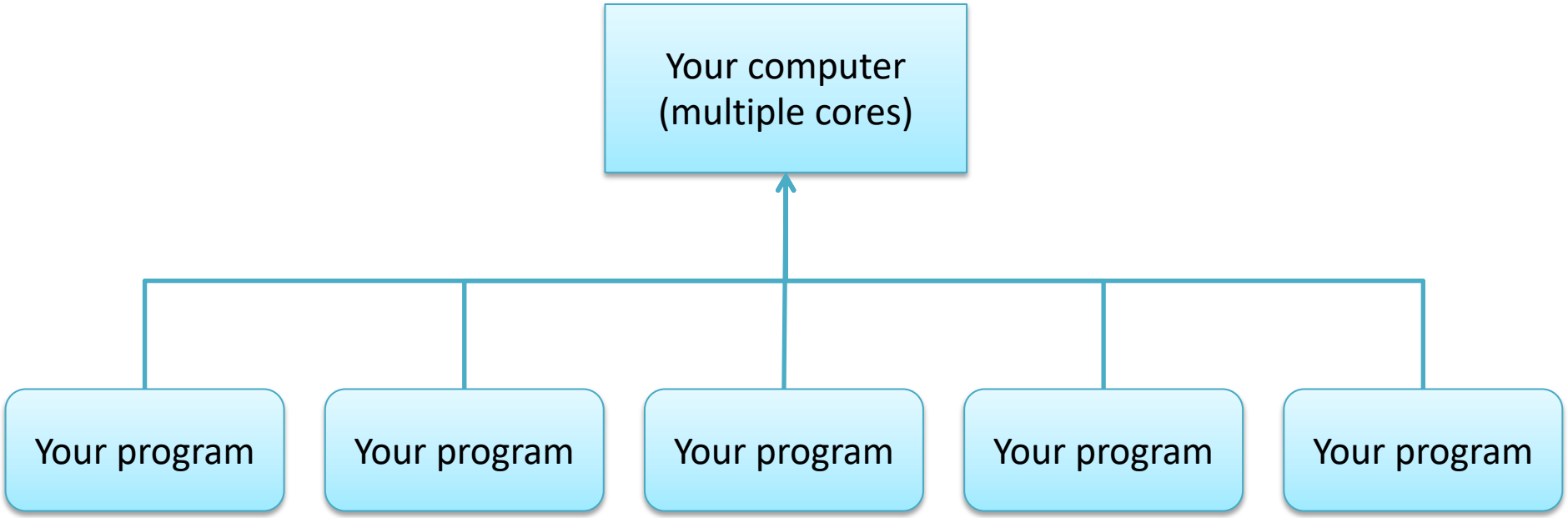


One way to speed things up within ROOT: multi-threaded code
(RDataFrame, PROOF)

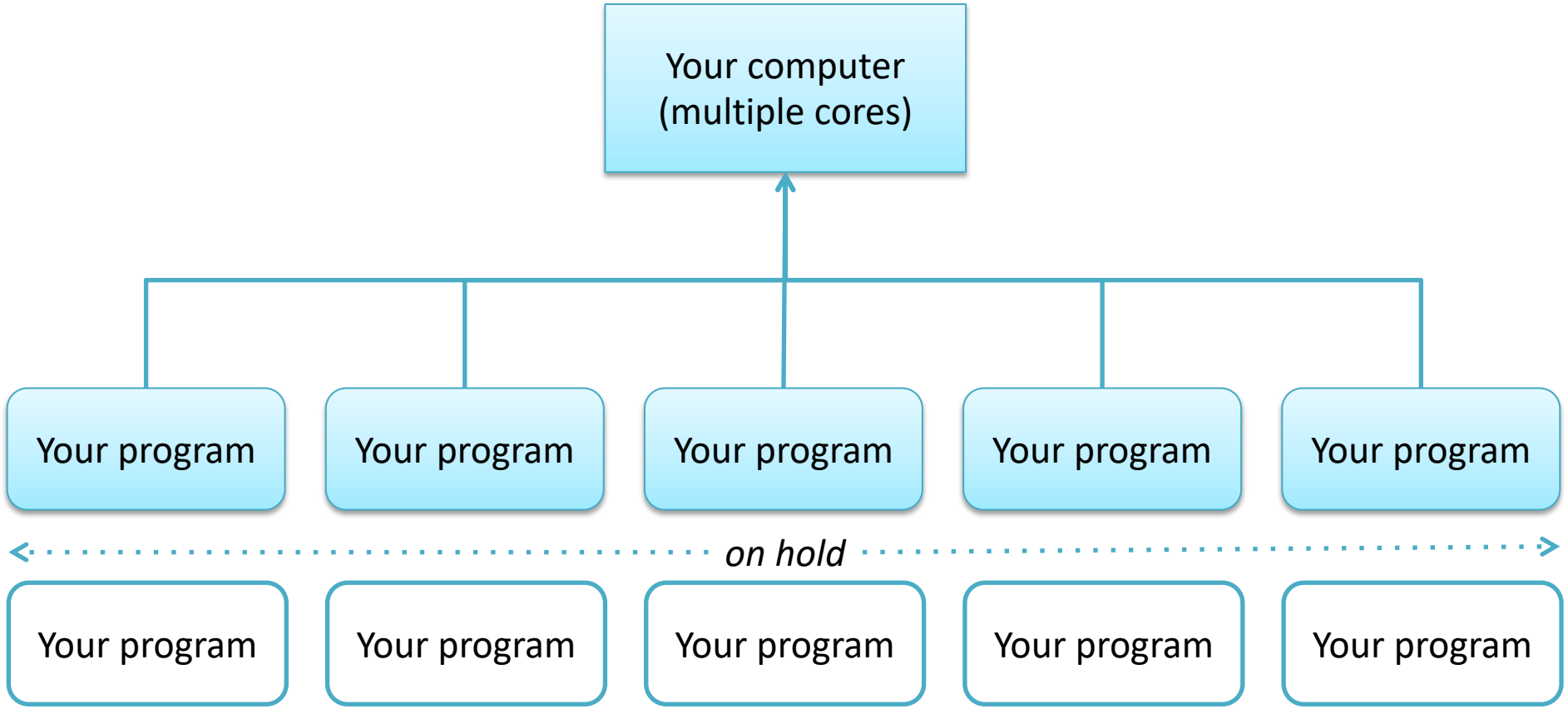


Outside of ROOT, you can have multiple programs on a single computer (UNIX command “at”)

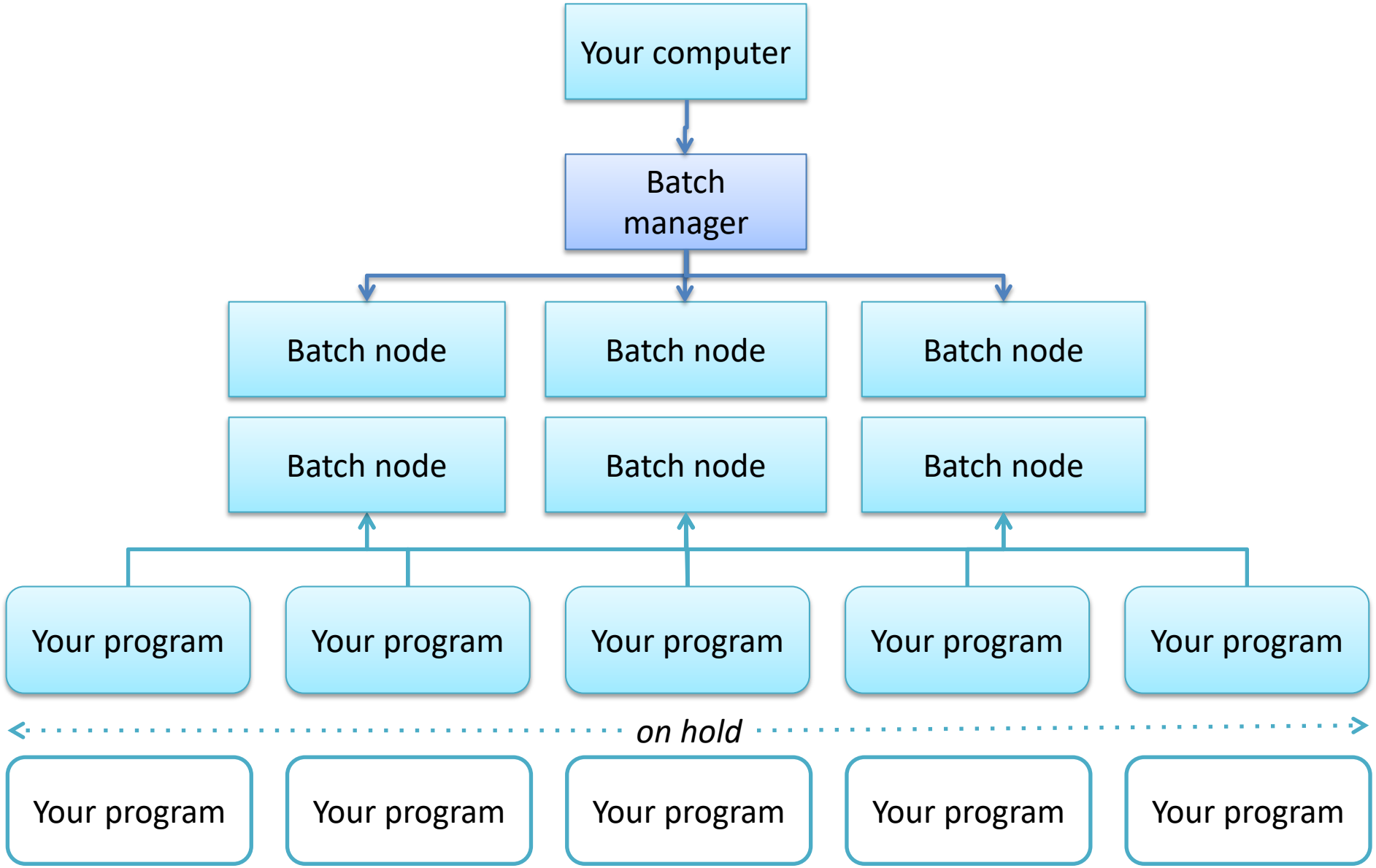
You have to remember not to submit too many jobs or you’ll overload the computer



A batch system managing multiple programs on a single computer (UNIX command “batch”)



A batch system managing multiple programs on multiple computers



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

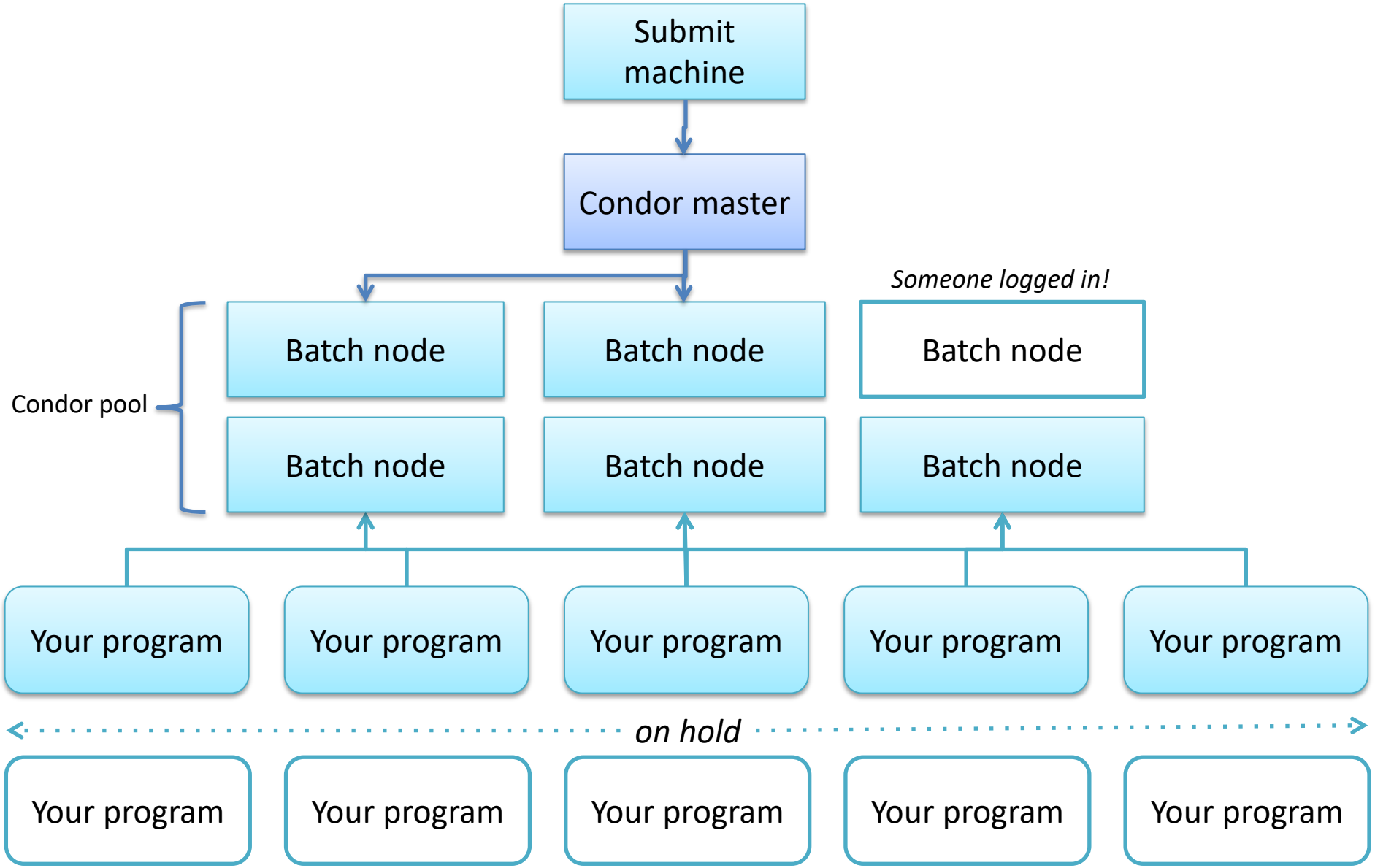
https://htcondor.readthedocs.io/en/latest/users-manual/quick-start-guide.html

Full manual

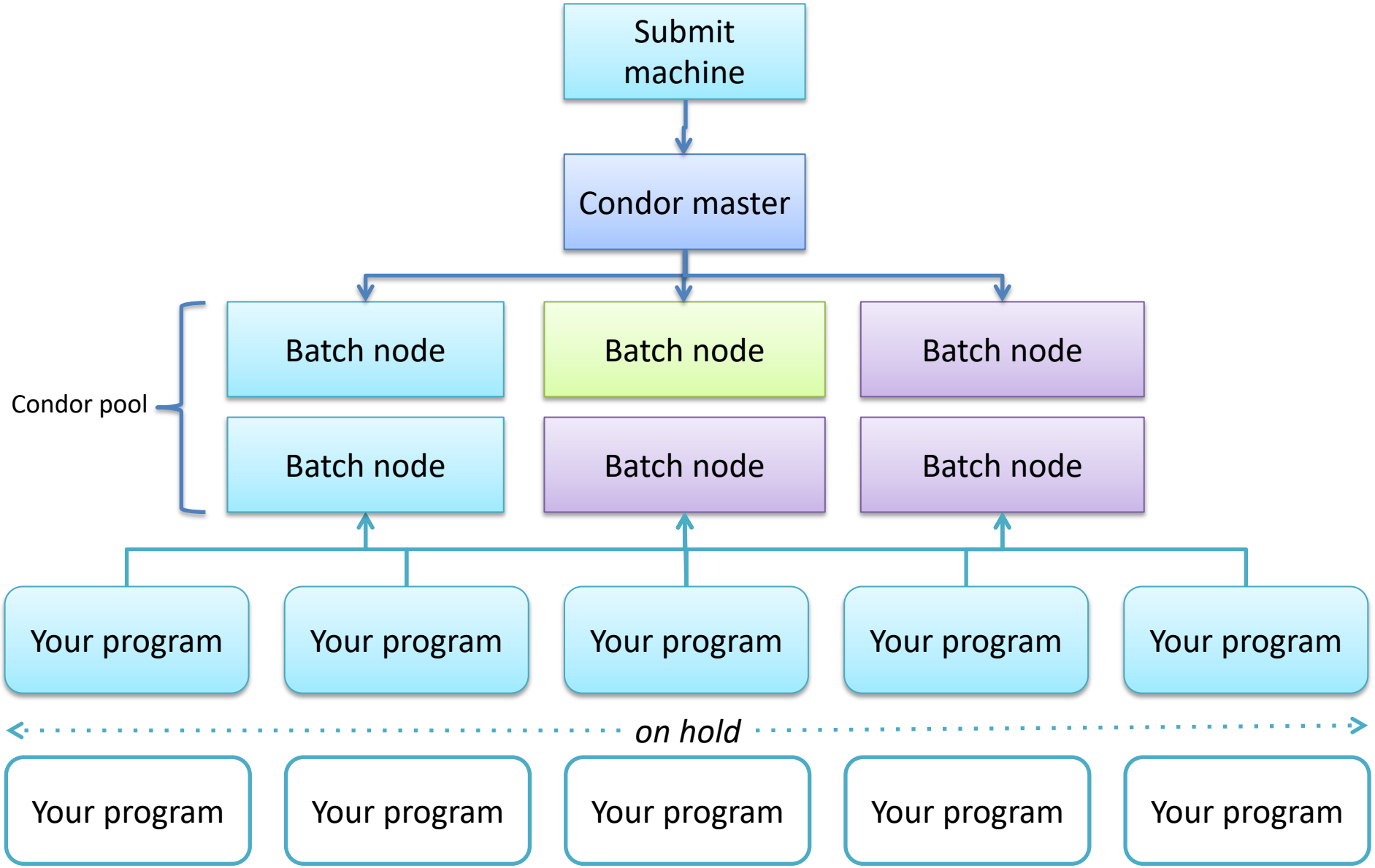
https://htcondor.readthedocs.io/en/latest/

- 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).

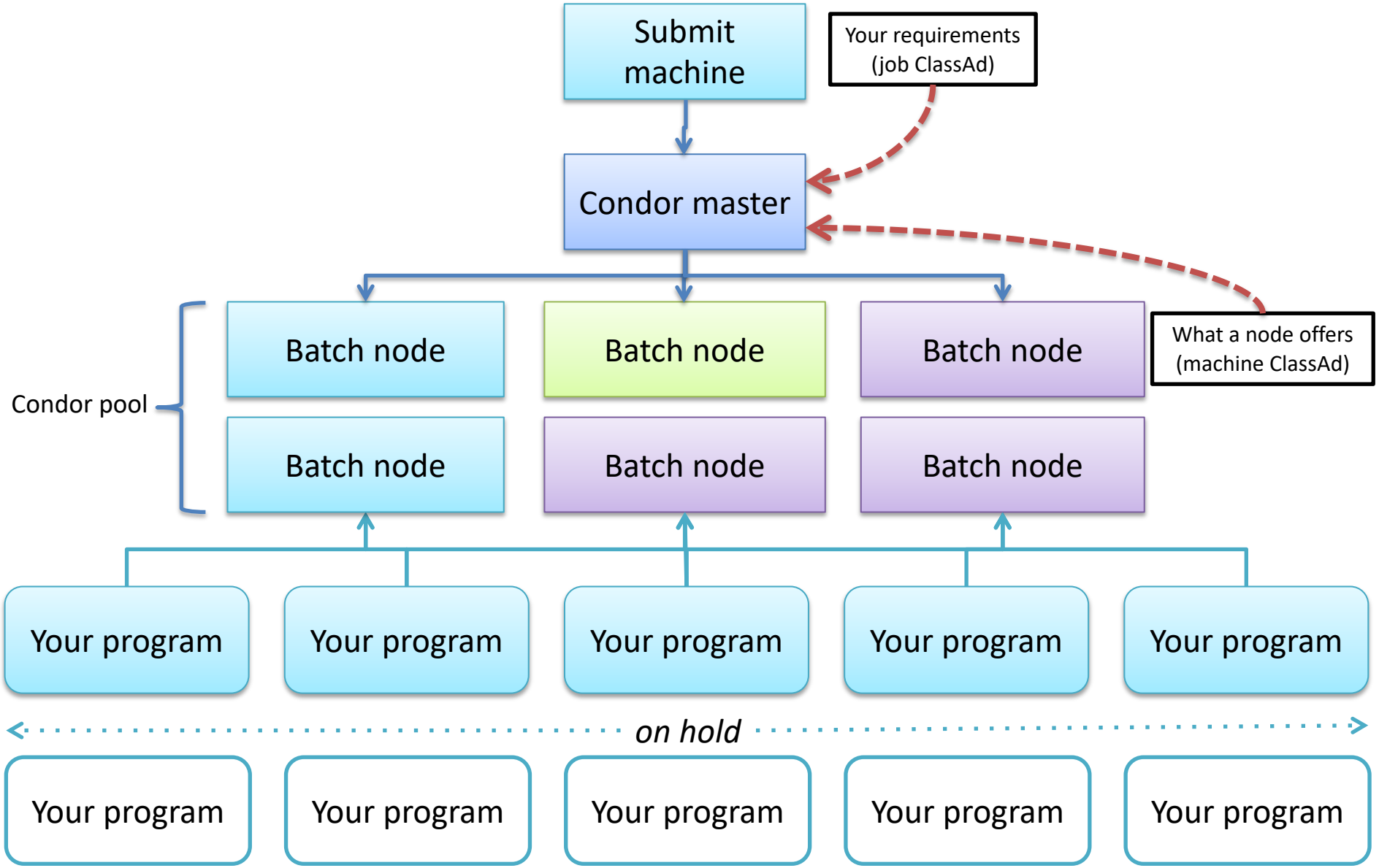
Condor will halt a queue in favor of an interactive program



Condor managing multiple programs on multiple computers with multiple configurations

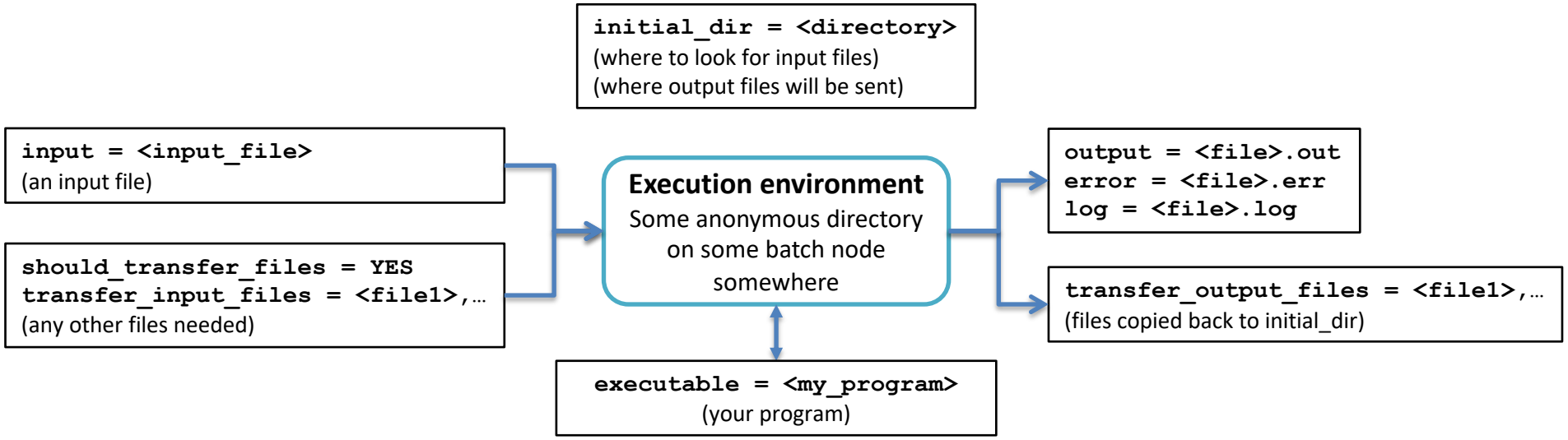


Condor uses “ClassAds” to match your requirements with what each node offers



# 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.



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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 – In particle physics, only used at CERN (old protocol)

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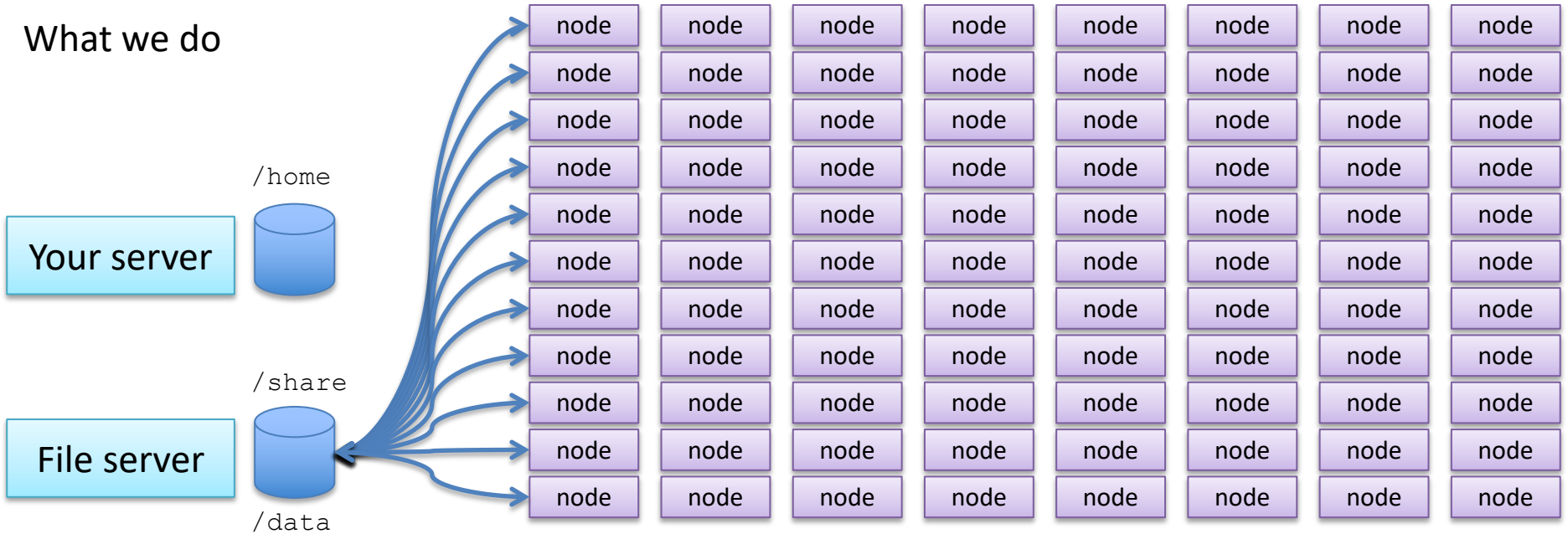
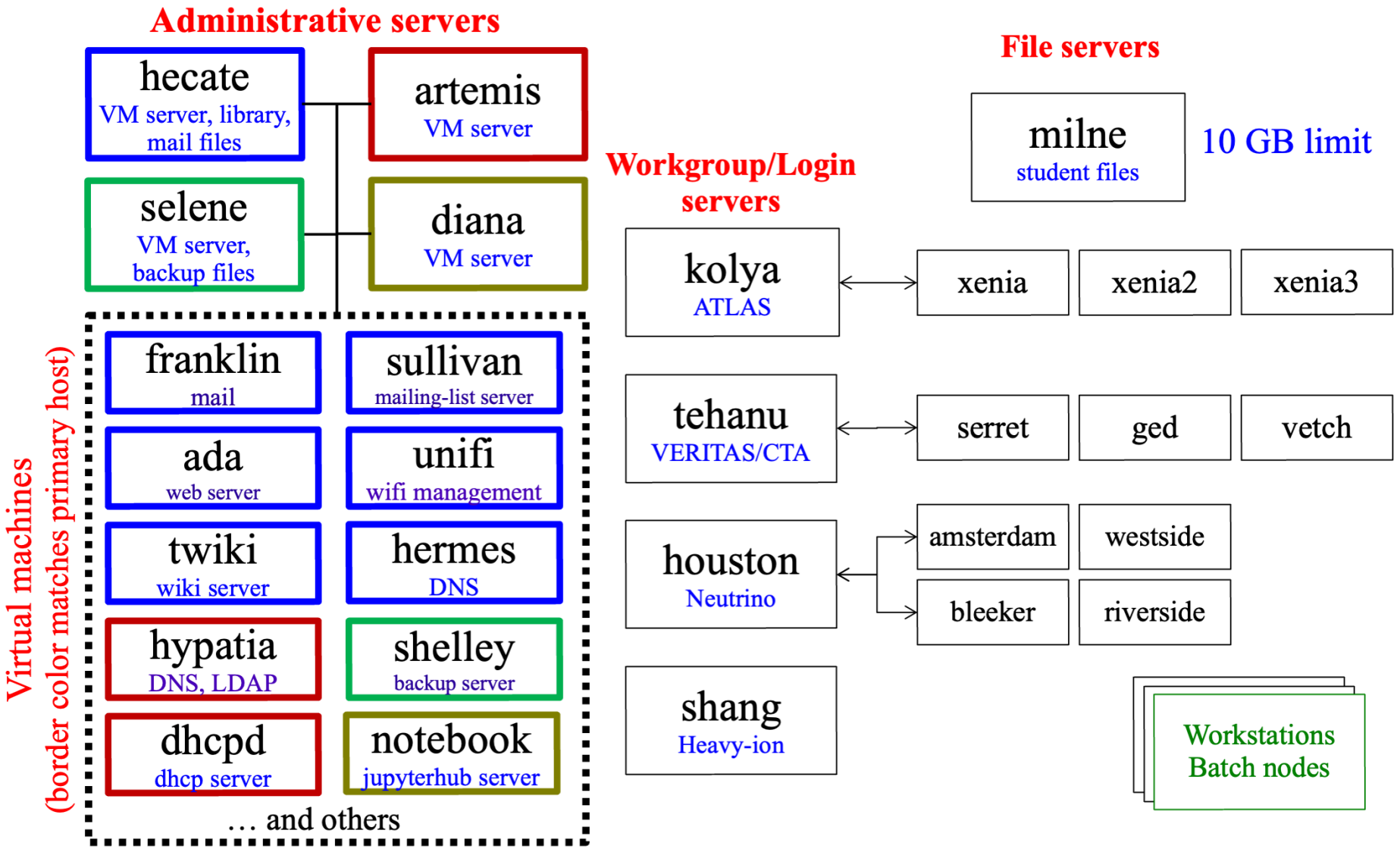


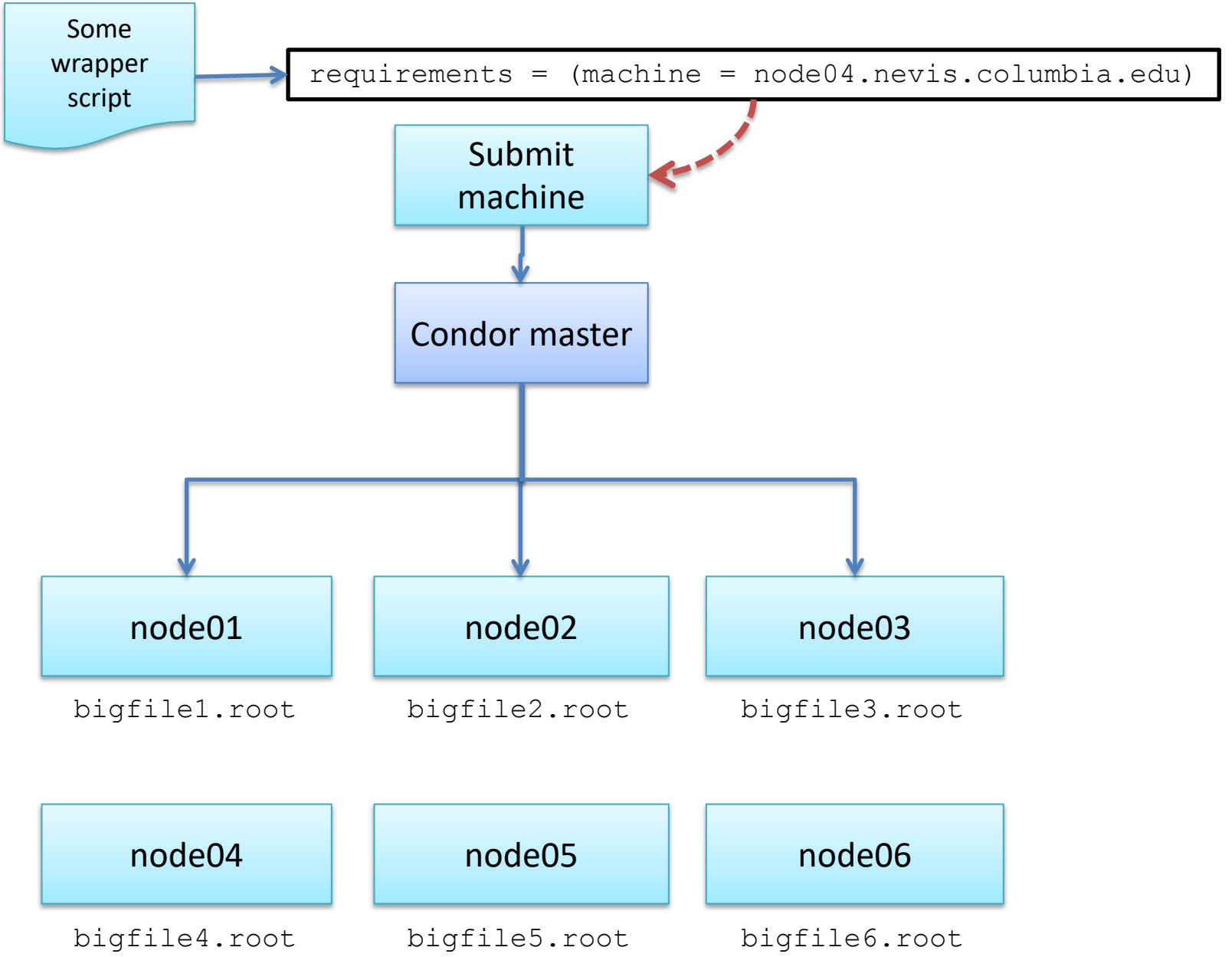
# Particle-Physics Computer Systems

## Linux Cluster




https://twiki.nevis.columbia.edu/twiki/bin/view/Main/LinuxCluster
https://twiki.nevis.columbia.edu/twiki/bin/view/Main/ListOfMachines

# Bringing the job to the data



# 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

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http://research.cs.wisc.edu/htcondor/

Quick start

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Full manual

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Nevis particle-physics condor guide

https://twiki.nevis.columbia.edu/twiki/bin/view/Nevis/Condor

Basic Condor@Nevis tutorial

https://www.nevis.columbia.edu/~seligman/root-class/html/appendix/batch/index.html