Exploiting Volatile Opportunistic Computing Resources with Lobster

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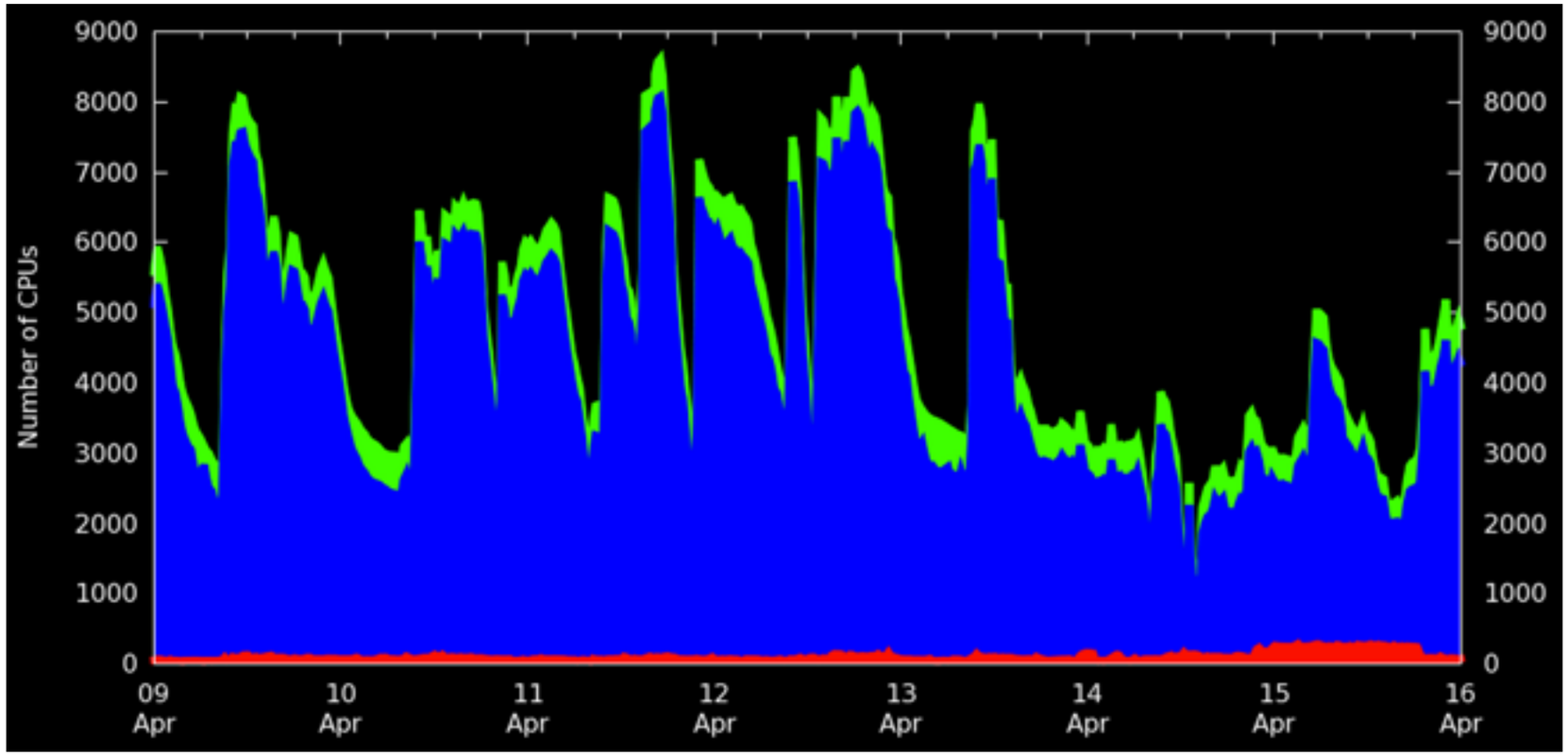
Why Lobster?

- **We have access to a lot of CPUs!**
  - Notre Dame (ND) Center for Research Computing: ~21k CPU cores + 2.5 PB storage
  - They belong to individual PIs— available opportunistically



Why Lobster?

- **We also have access to CCTools people!**
  - Team at ND, led by Doug Thain, that develops CCTools suite (WorkQueue, Parrot, Chirp, etc) is ‘down the hall’
- **Free CPUs + CCTools people = Lobster**

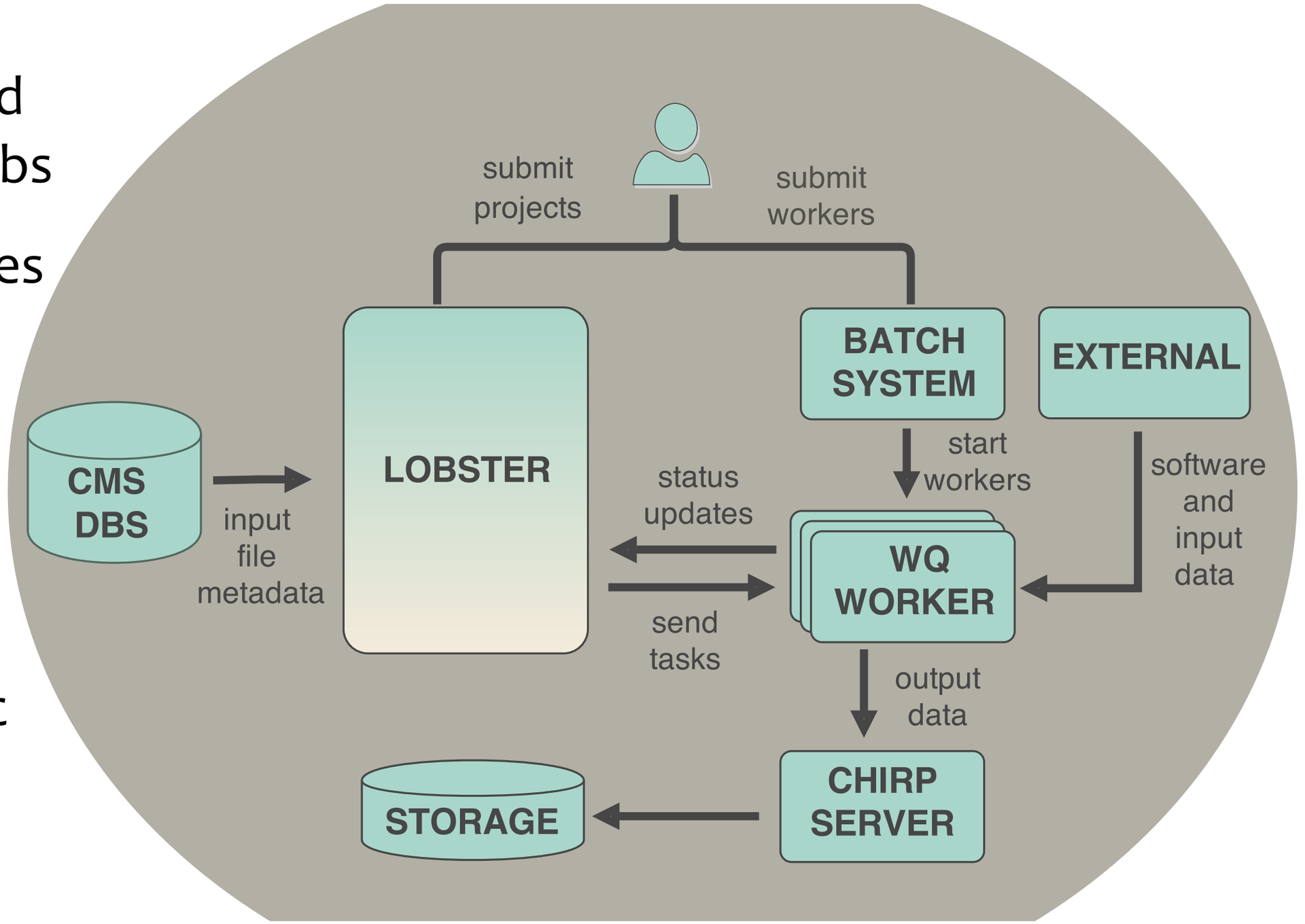
Why Lobster?

- **Doing physics on the ND cluster is challenging:**
  - Only for members of the university
  - Does not have our software, and we do not have root privileges
  - Evicted when owners reclaim resources

Lobster is an opportunistic workflow submission and management tool

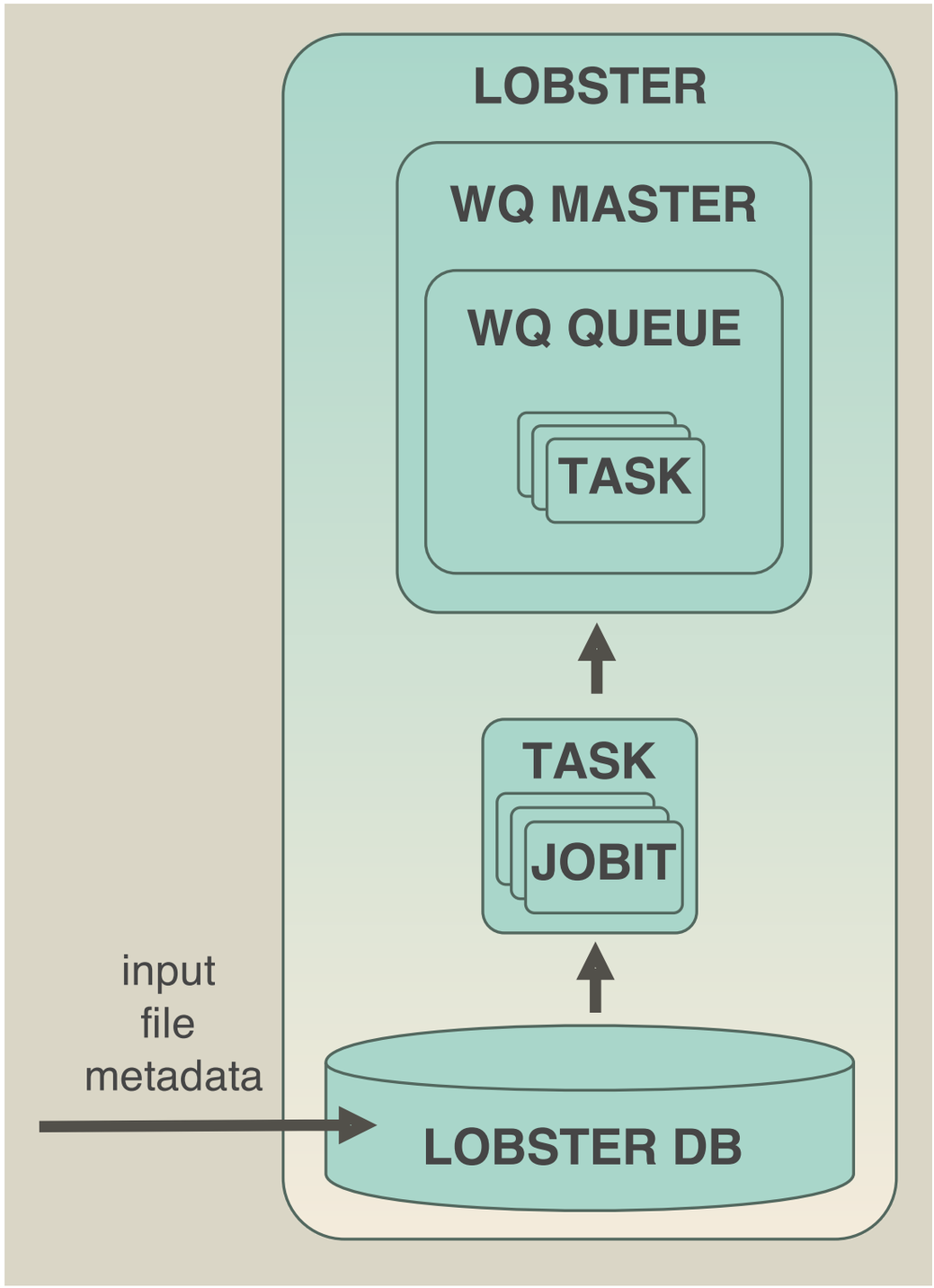
What does Lobster do?

- **Scheduling:** schedules and dispatches jobs
- **Data:** manages input/output data and software
- **Execution:** runs tasks on opportunistic or dedicated resources



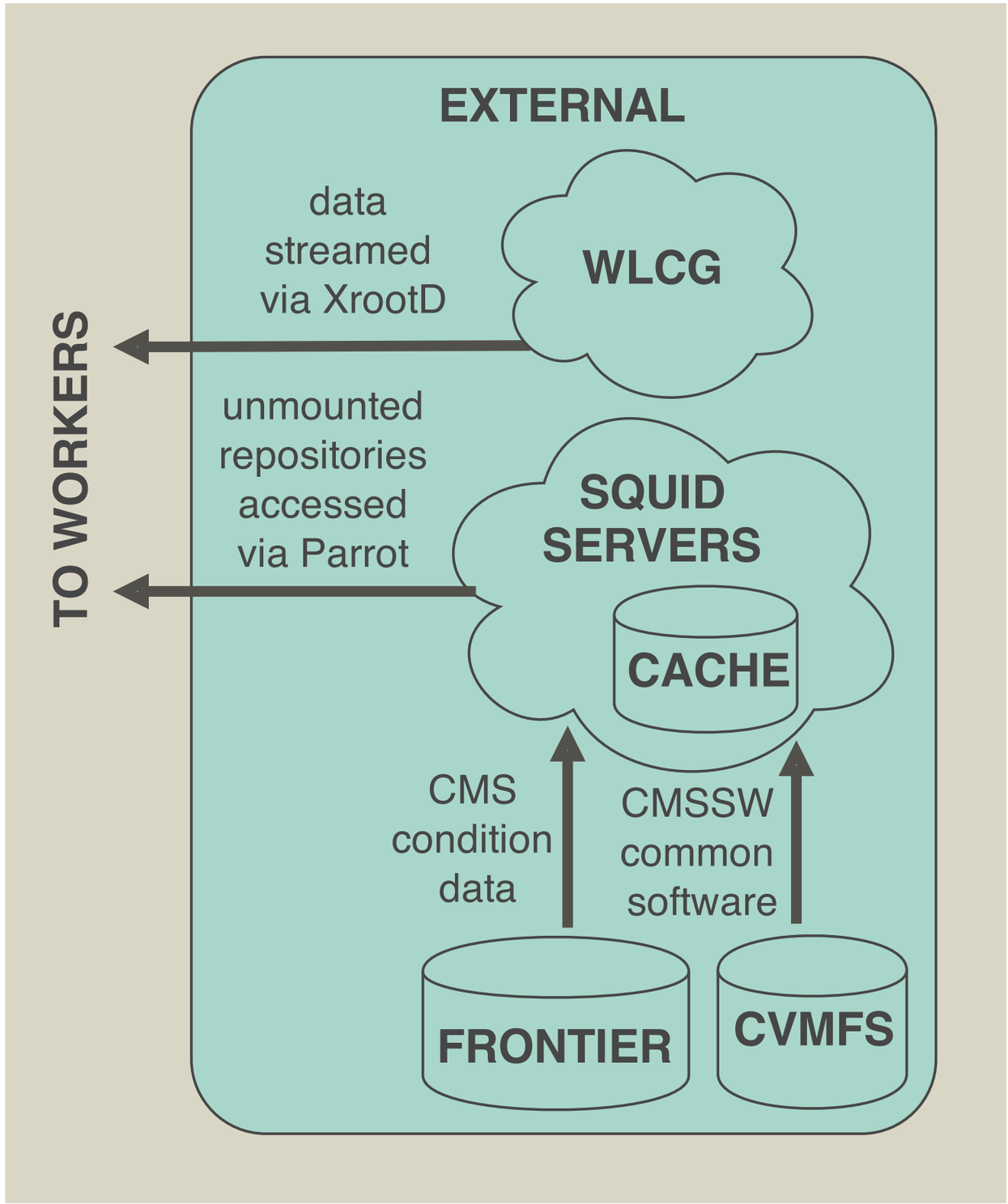
Scheduling

- Work broken down into smallest sensible quantum: **jobit**
- Jobs assembled from jobits **on-the-fly**—user does not need to think about jobs
- Job length can be adjusted **while running**



Data

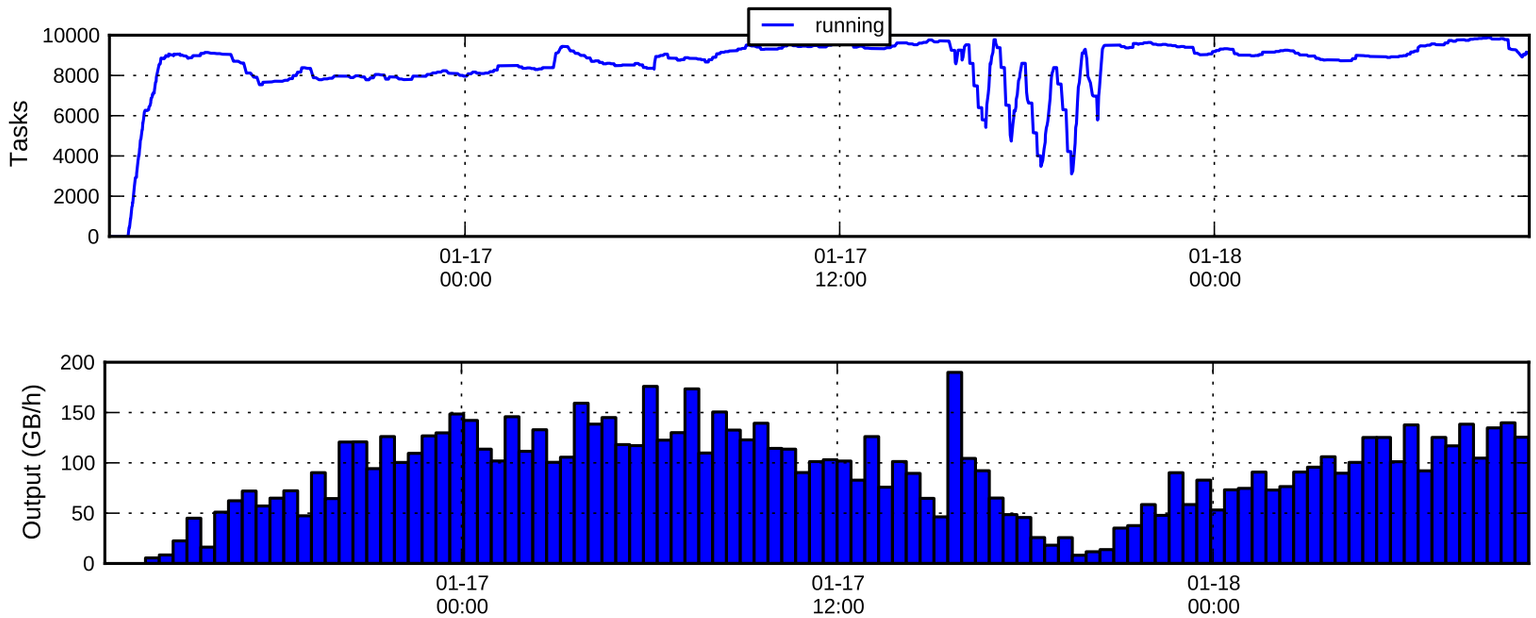
- Leverage a variety of tools (CVMFS, Parrot, Chirp, XrootD, WQ) in order to get data to jobs



Execution

- Workers can be submitted via HTCondor, SGE, PBS, etc— **only user permissions required!**
- Workers hold resources: they set up the environment and then run tasks until eviction or the work is finished
- Multi-core workers share local cache

Conclusions



Tasks running

Output transferred

- Lobster has enabled ND team to exploit opportunistic campus resources to ~10k core scale
- Similar in scale to some USCMS T2 sites