

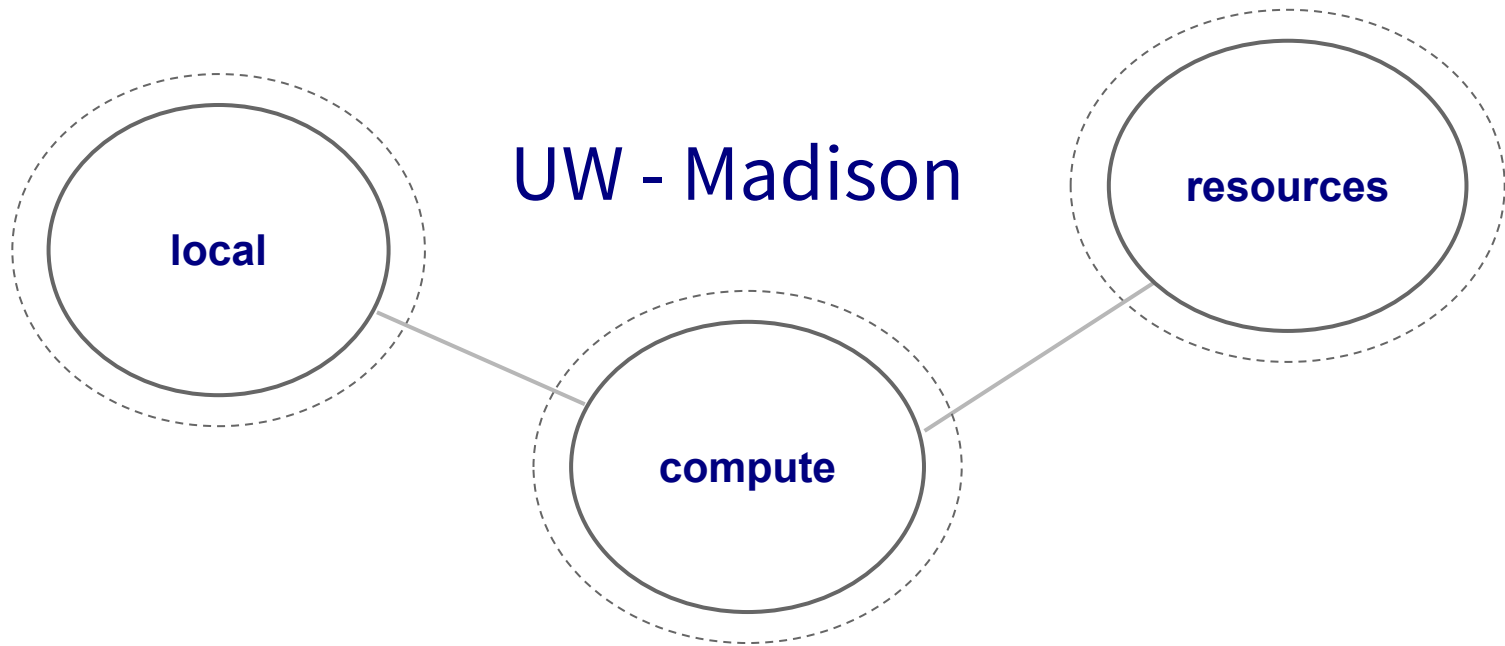
Introduction to DHTC

Brian Lin

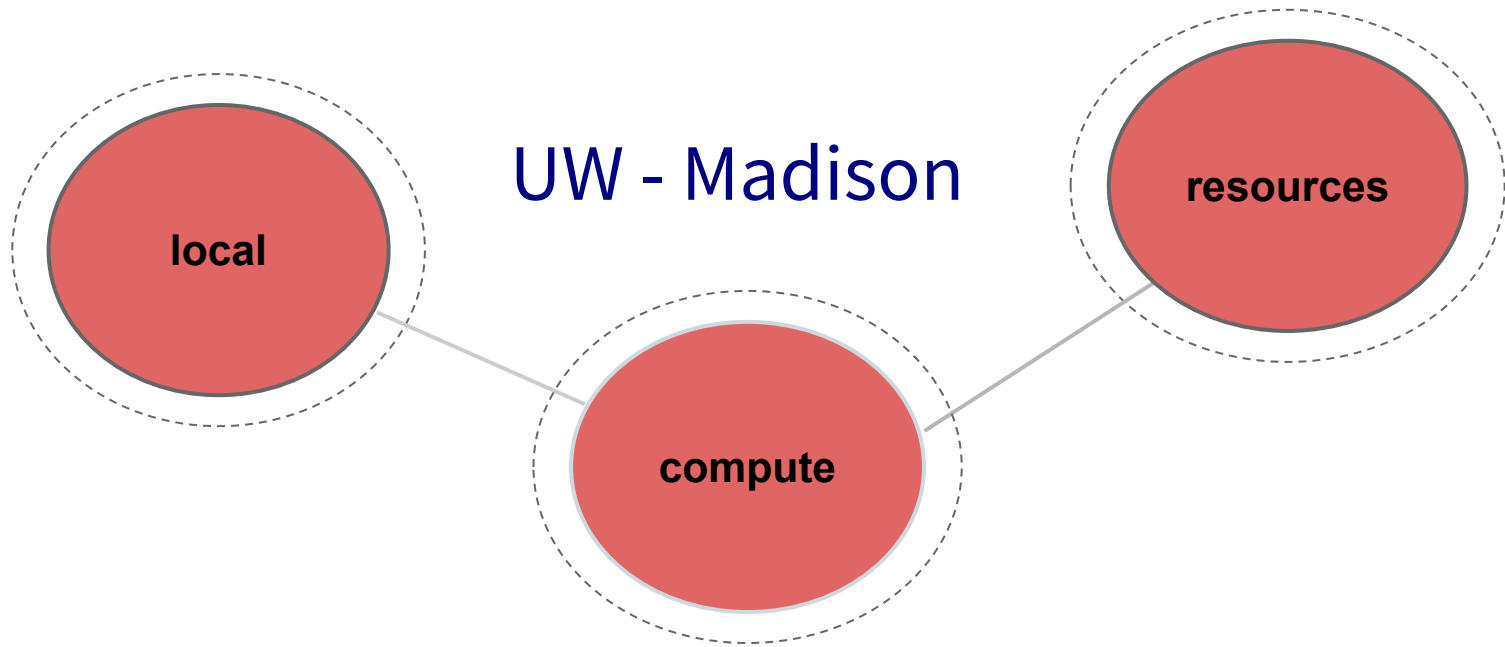
OSG Software Team

University of Wisconsin - Madison

Local High Throughput Computing



Local High Throughput Computing



How do you get more computing resources?

#1: Buy Hardware

#1: Buy Hardware

- Great for specific hardware/privacy requirements
- Costs \$\$\$
 - Initial cost
 - Maintenance
 - Management
 - Power and cooling
- Takes time
- Rack/floor space
- Obsolescence
- Plan for peak loads, pay for all loads

#2: Use the Cloud

#2: Use the Cloud - Pay per cycle

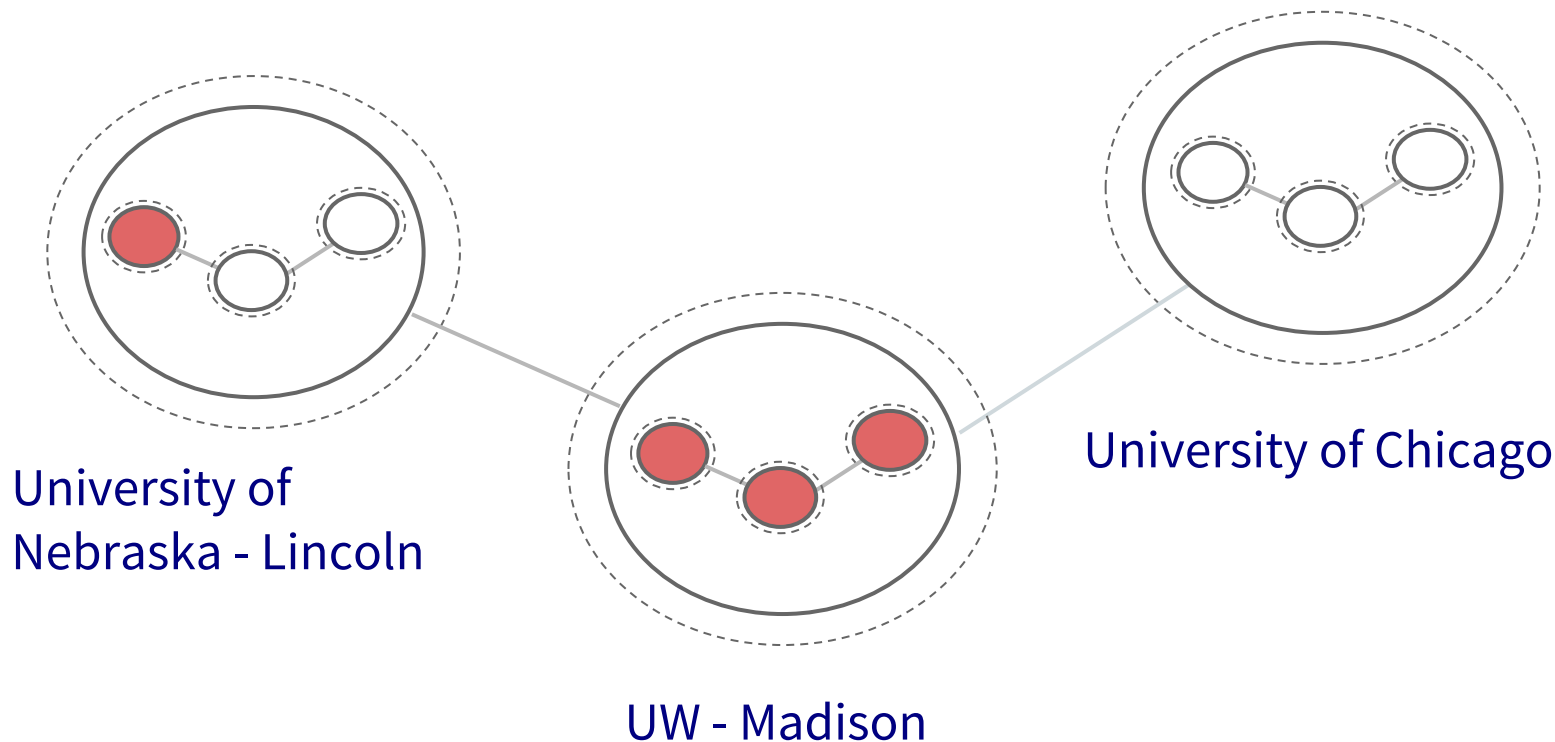
- e.g. Amazon Web Services, Google Compute Engine, Microsoft Azure, Rackspace
- Fast spin-up
- Costs \$\$\$
- Still needs expertise + management
 - Easier than in the past with the `condor_annex` tool
- Does it fit with your institution's policies?

#2: Use the Cloud - 'Managed' clouds

- e.g. Cycle Computing, Globus Genomics
- Pay someone to manage your cloud resources — still costs \$\$\$
- Researchers and industry have used this to great success
 - Using Docker, HTCondor, and AWS for EDA Model Development
 - Optimizations in running large-scale Genomics workloads in Globus Genomics using HTCondor
 - HTCondor in the enterprise
 - HTCondor at Cycle Computing: Better Answers. Faster.

#3: Share Resources

#3: Share Resources - Distributed HTC



i.

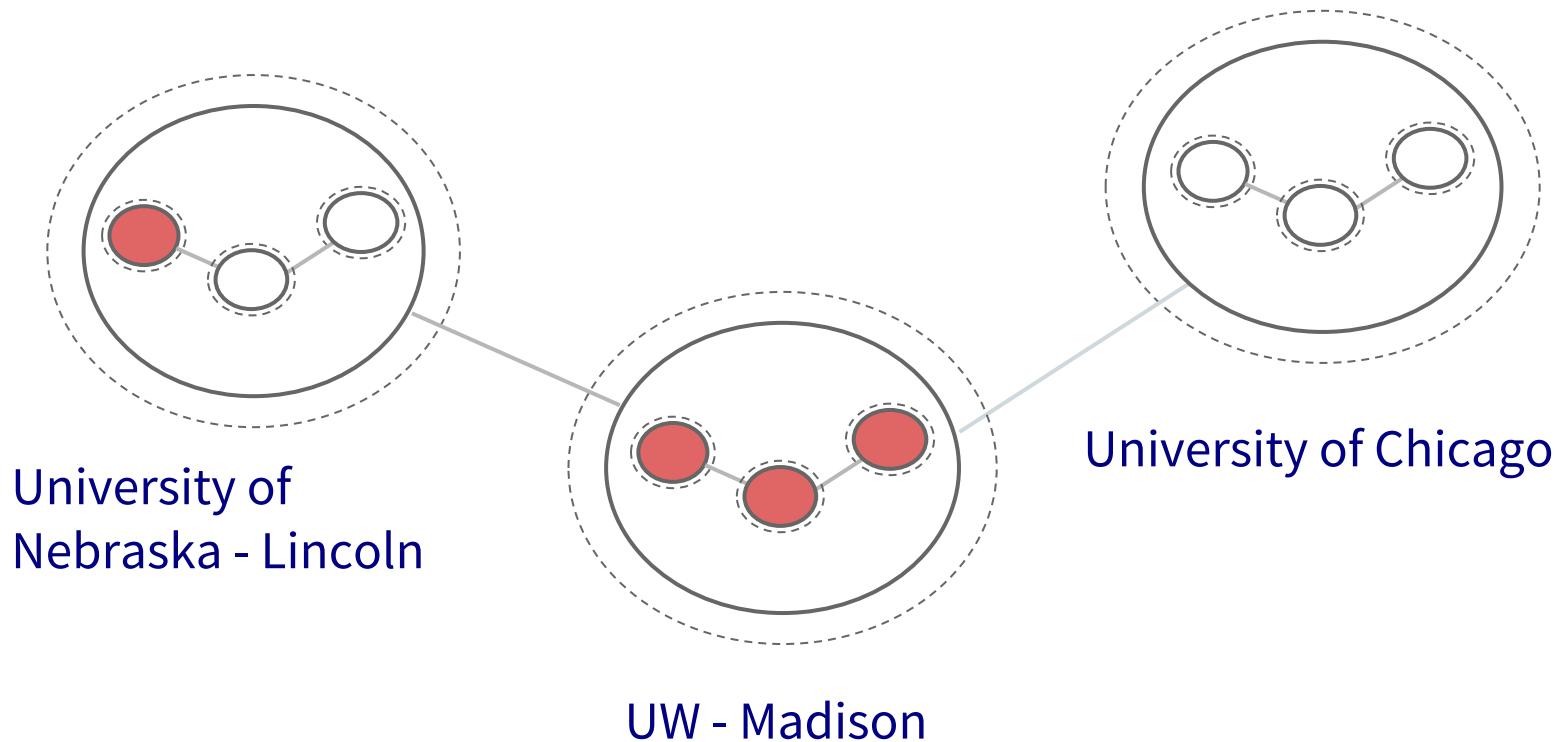
Manual Job Partitioning

Let's start sharing!

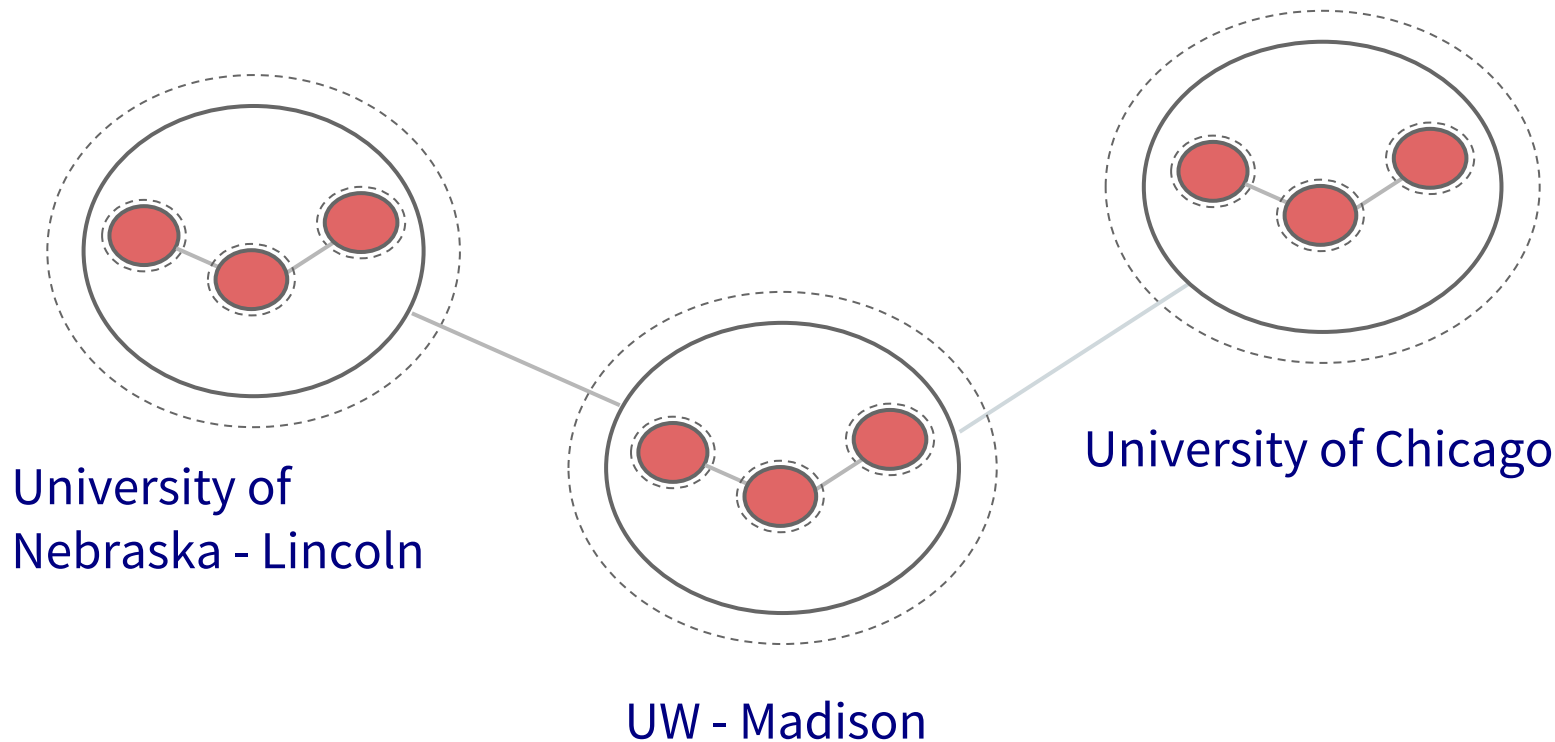
Manual Partitions

- Obtain sharing agreements
- Query each site for idle resources
- Partition and submit jobs based on availability

#3: Share Resources - Distributed HTC



#3: Share Resources - Distributed HTC



Manual Partitions - Shortcomings

- Querying and partitioning is tedious and inaccurate
- Are you allowed to share? Do you have anything to share?
- Not all sites use HTCondor — other job schedulers e.g., SLURM, PBS, etc.
- Pools are independent — workflows must be confined to a single pool

ii.

Automatic Job Partitioning

Let the computers do the work

Automatic Partitions - Shortcomings



Homer: Kids: there's three ways to do things; the right way, the wrong way and the Max Power way!

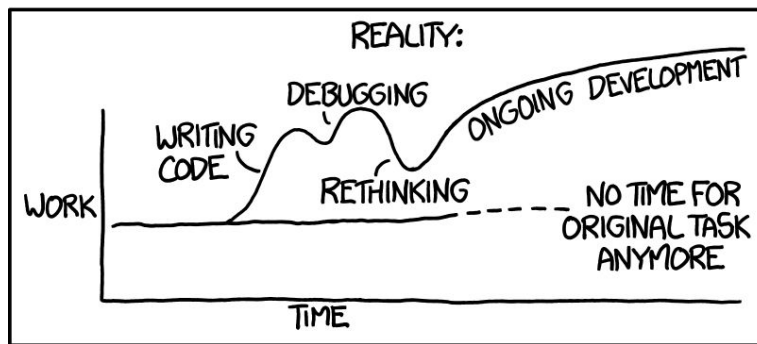
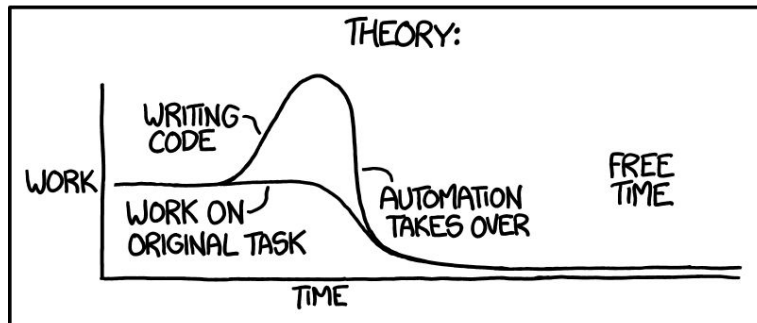
Bart: Isn't that the wrong way?

Homer: Yeah, but faster!

Groening, M (Writer), Michels, P. (Director) . (1999).
Homer to the Max [Television Series Episode]. In
Scully, M. (Executive Producer), *The Simpsons*. Los
Angeles, CA: Gracie Films

Automatic Partitions - Shortcomings

"I SPEND A LOT OF TIME ON THIS TASK.
I SHOULD WRITE A PROGRAM AUTOMATING IT!"



#3: Share Resources - Requirements

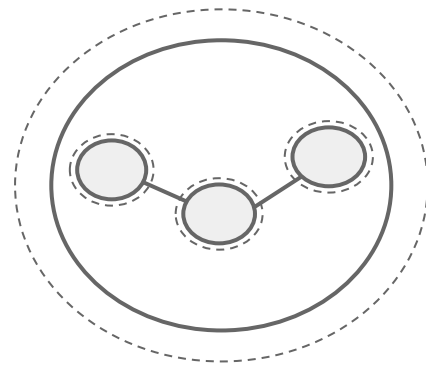
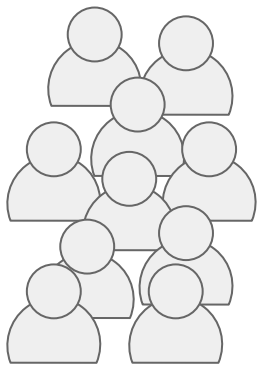
- Minimal account management
- No manual job partitioning
- DAG workflow functionality
- Don't have to learn additional job schedulers
- Don't have to share our own resources

iii.

Overlay Systems

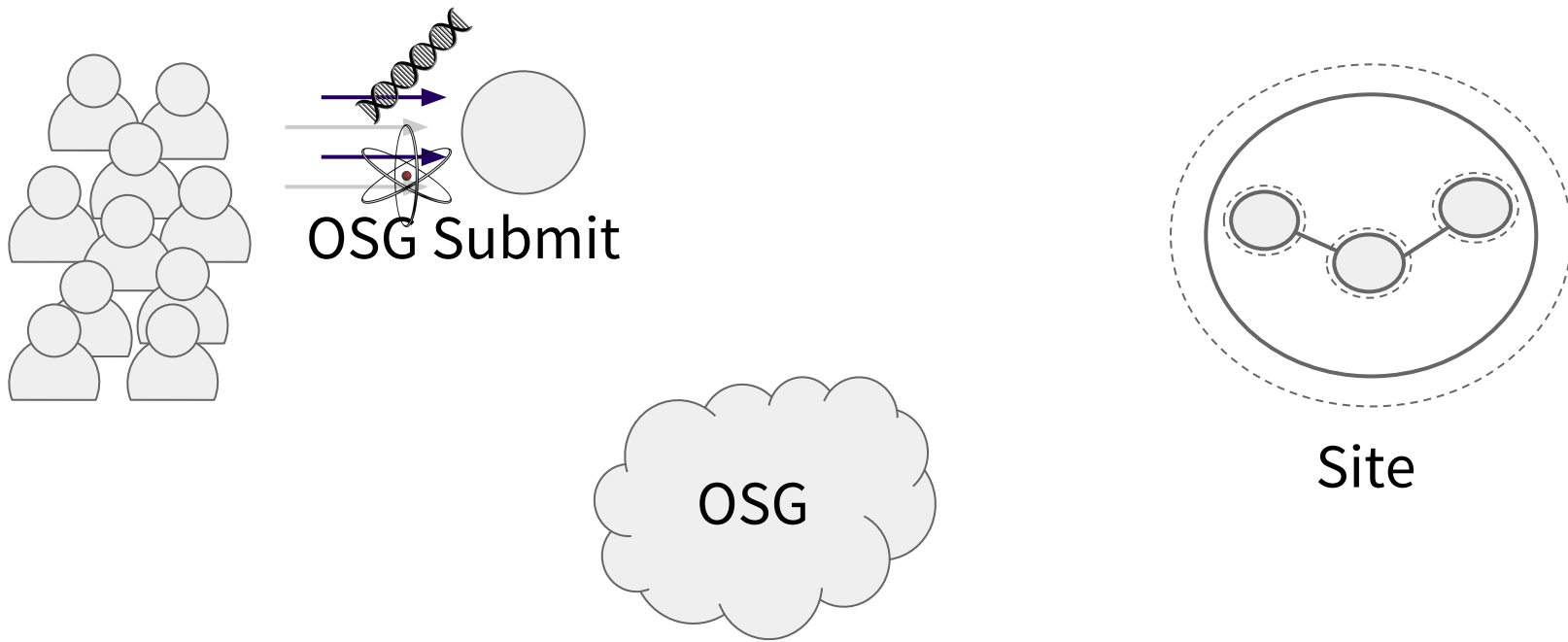
Let the OSG do the heavy lifting

The OSG Model

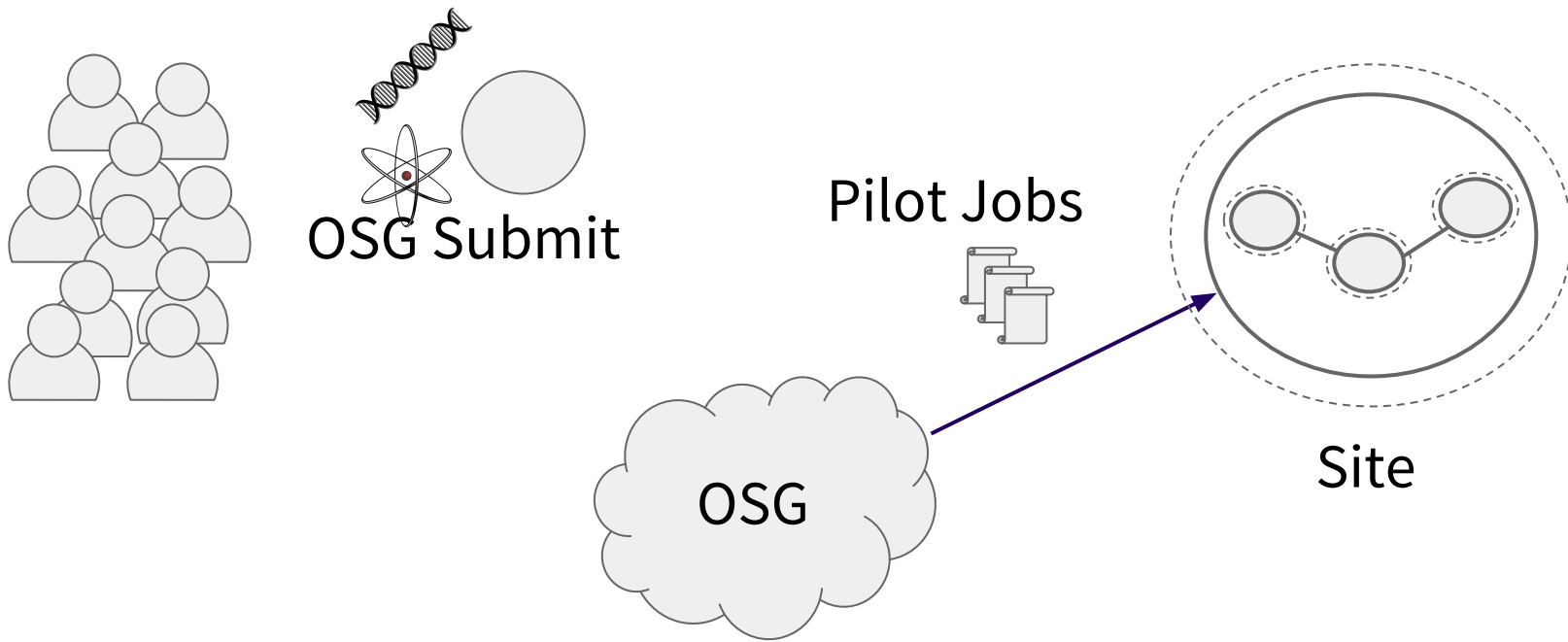


Site

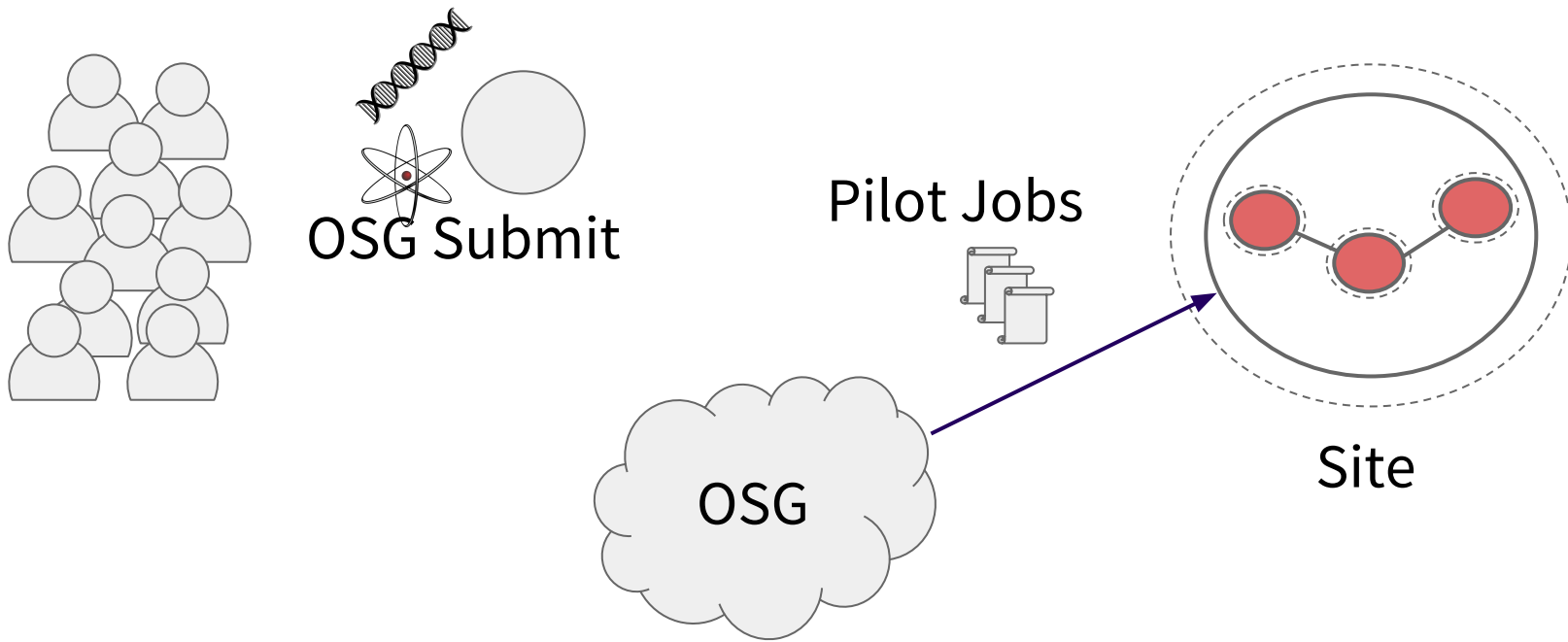
The OSG Model



The OSG Model

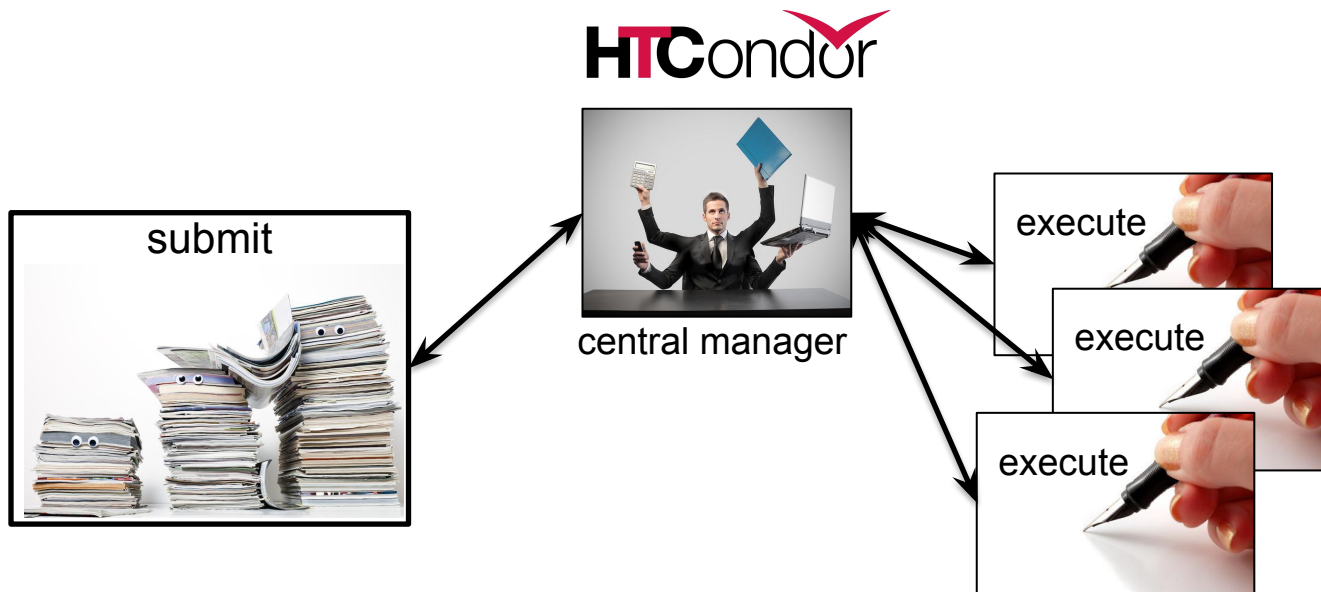


The OSG Model

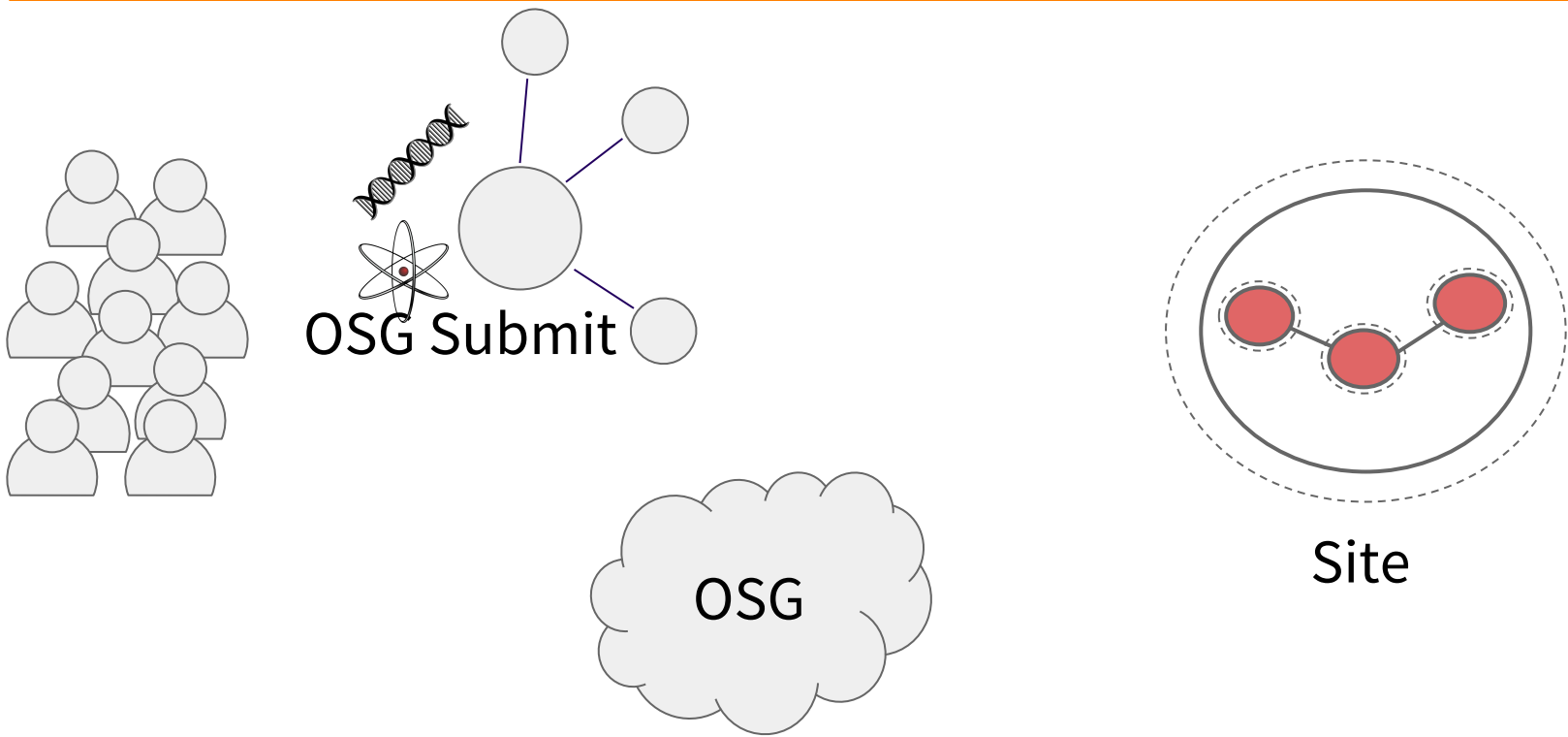


Job Matching

- On a regular basis, the central manager reviews Job and Machine attributes and matches jobs to slots.



The OSG Model



The OSG Model - Jobs in Jobs



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The OSG Model

- Pilot jobs (or pilots) are special jobs
- Pilots are sent to sites with idle resources
- Pilot payload = HTCondor execute node software
- Pilot execute node reports to your OSG pool
- Pilots lease resources:
 - Lease expires after a set amount of time or lack of demand
 - Leases can be revoked!

The OSG Model - Leasing the Cloud

- What if there aren't enough idle resources?
- Combine overlay system with cloud technology
- Expect some of your OSG jobs to automatically run in the cloud in the next few years
- ... but this should be completely transparent to you

The OSG Model - Collection of Pools

- Your OSG pool is just one of many
- Separate pools for each [virtual] organization (VO)
- Your jobs will be running on the OSG VO pool

The OSG Model - Getting Access

- During the school:
 - OSG submit node at UW (exercises)
 - OSG submit node via OSG Connect (Thursday)
- After the school:
 - Both of the above
 - VO-hosted submit nodes
 - Institution integration with the OSG

Thanks!

Questions?