Cluster Computing for Humans

-OR- How I learned to ~~love~~ be ok with HPC Pack

Tim Ribaric
@elibtronic

Ups and Downs

- I'm not a fan of Windows, Microsoft, or any large commerical platforms

- I barely stomach this whole story so no need to point out how ironic this is

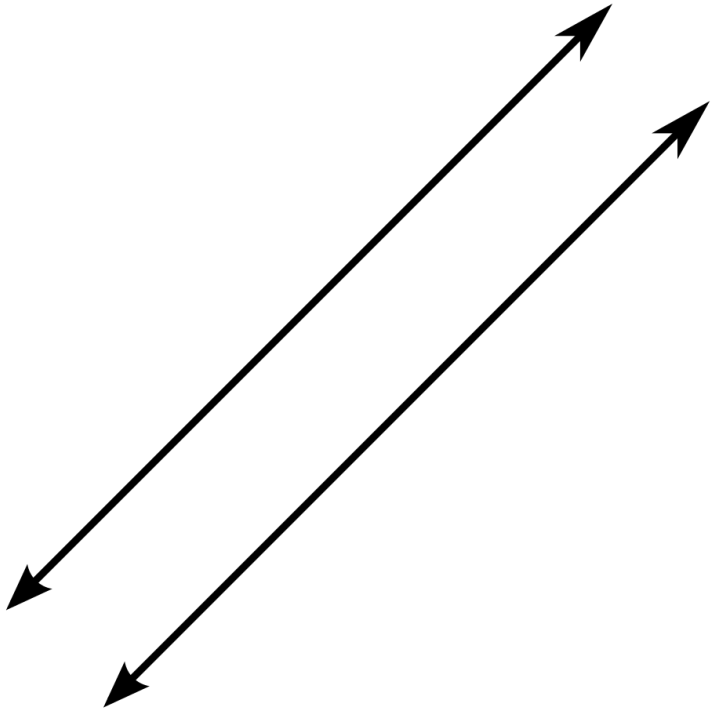
- Also please don't point out I'm currently using a Mac

Parallel Computing

- Is complicated

- Takes a lot of effort to change a serial task in a parallel one

- If this is for a one-off project, that is a big ask



Your Computer Lab(s)

- Probably have a bunch of PCs sitting in them

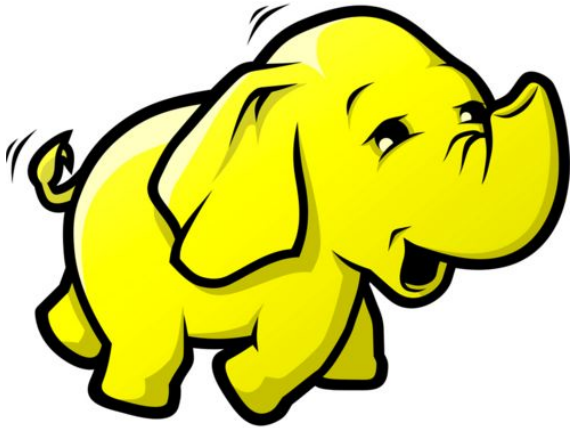
- Is closed at least part of the day, presumably your patrons and staff need to sleep here and there

- There's a free MS tool that lets you harness those idle resources

Parts


Client
System Requirements
Supported Operating System
Windows 7, Windows 8, Windows 8.1, Windows Server 2012, Windows Server 2012 R2
HPC Pack 2016 Update 2 supported Operating Systems
Head nodes: Windows Server 2016, Windows Server 2012 R2
Compute nodes: Windows Server 2016, Windows Server 2012 R2, Windows Server 2012, or x64-based versions of Windows Server 2008 R2 SP1
Broker nodes: Windows Server 2016, Windows Server 2012 R2, Windows Server 2012
Workstation nodes: x86 or x64 versions of Windows 8.1 Pro or Enterprise, windows 10
Unmanaged server nodes: Windows Server 2016, Windows Server 2012 R2, Windows Server 2012, or x64-based versions of

Other Clustering Paradigms?



Probably many, many others...

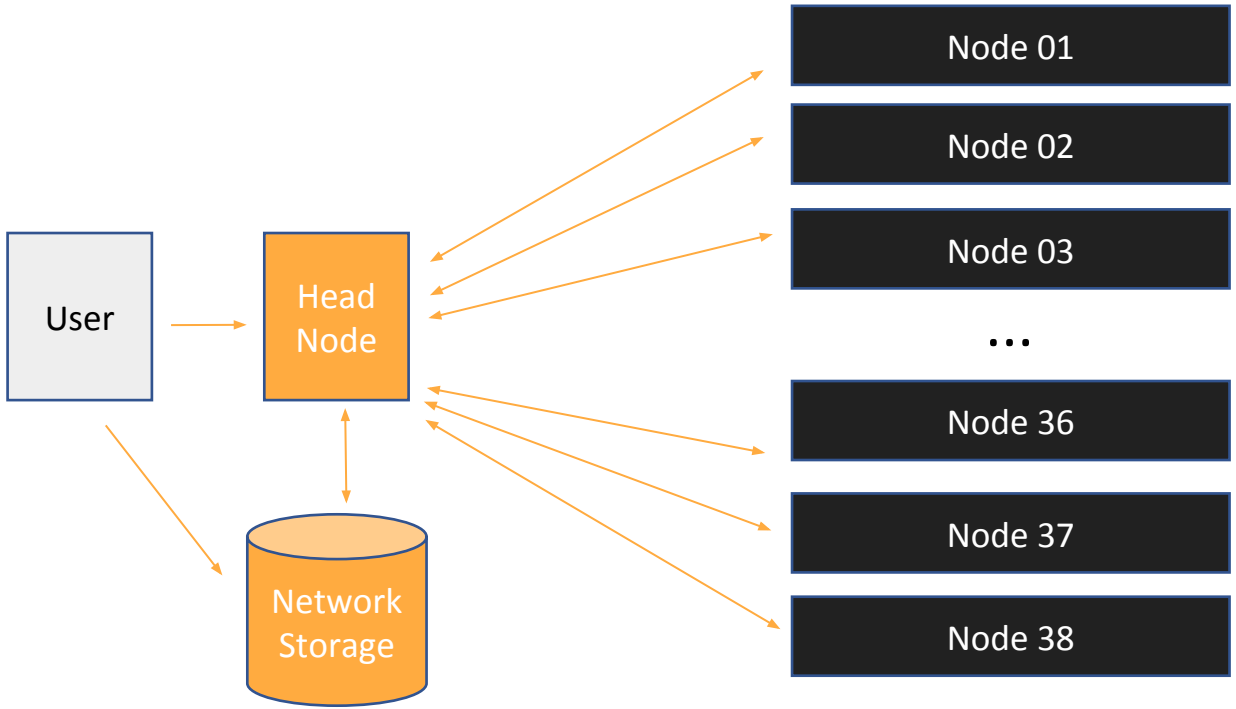
Small Example

- Normally your computer has 2-4 cores of processing power

- **38** terminals in Classroom A (our main lab space) x 4 Cores = **152** Available Cores

- About a **5** times increase in computing resources

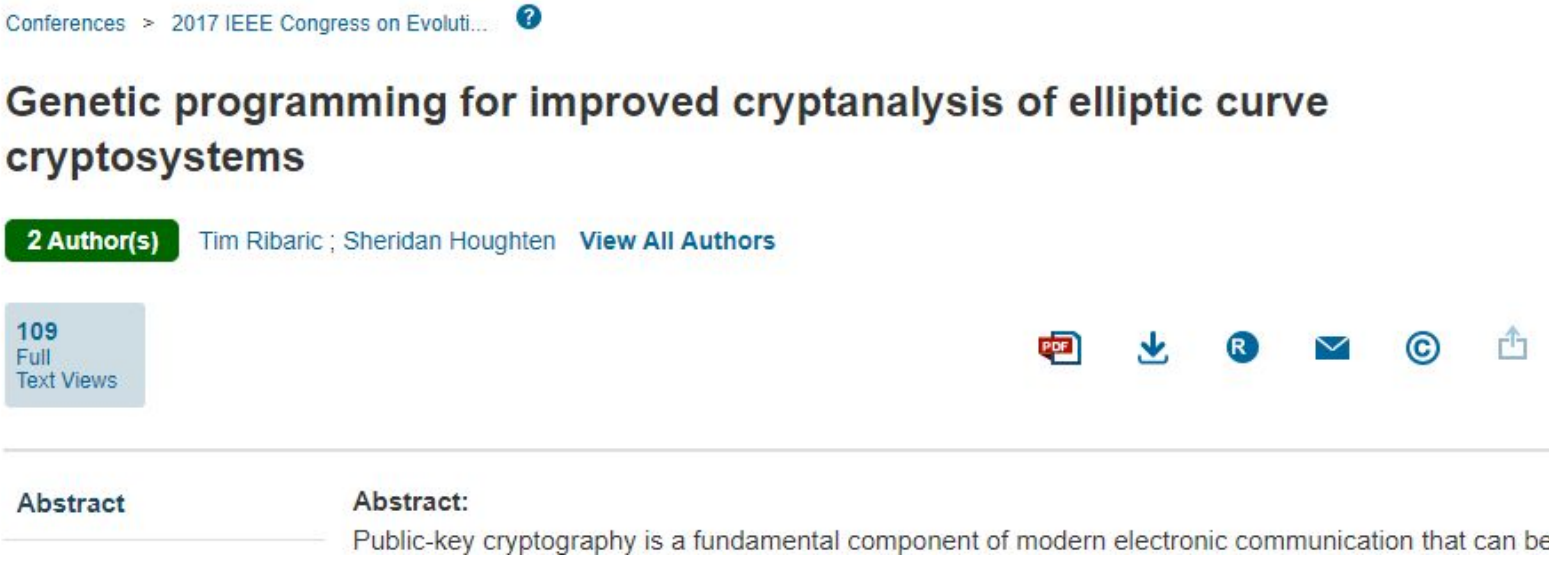
Diagram


User
Head Node
Network Storage
Node 01
Node 02
Node 03
...
Node 36
Node 37
Node 38

What can you do?

- You can use **any application** on the machine (eg. Rendering frames with Blender)
- A **script** written in Python, Java, etc.
- GPUs can be treated as addressable units for all your cryptocurrency needs *ahem*

EG from Real Life



Conferences > 2017 IEEE Congress on Evoluti...

Genetic programming for improved cryptanalysis of elliptic curve cryptosystems

2 Author(s) Tim Ribaric ; Sheridan Houghten **View All Authors**

109
Full
Text Views

Abstract

Abstract:
Public-key cryptography is a fundamental component of modern electronic communication that can be

EG.

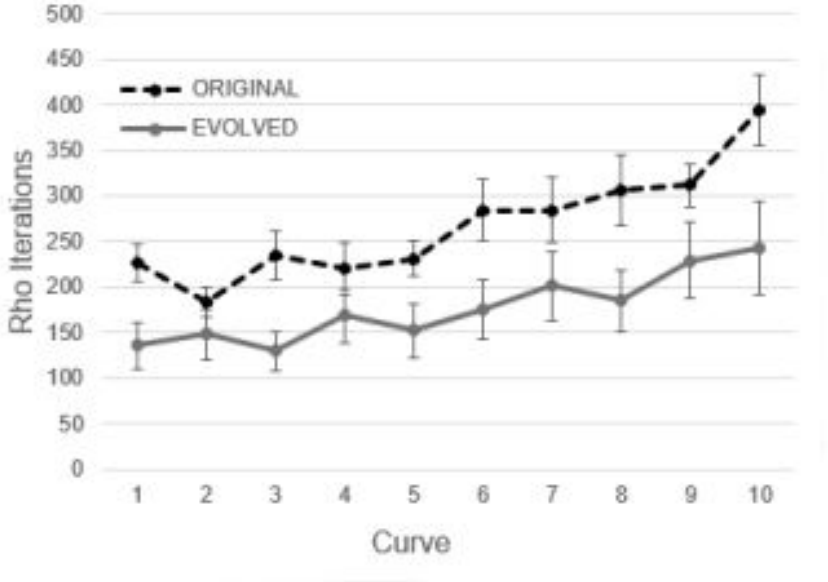


Fig. 4. Number of Iterations Required for the 10 Curves with 5 Digits

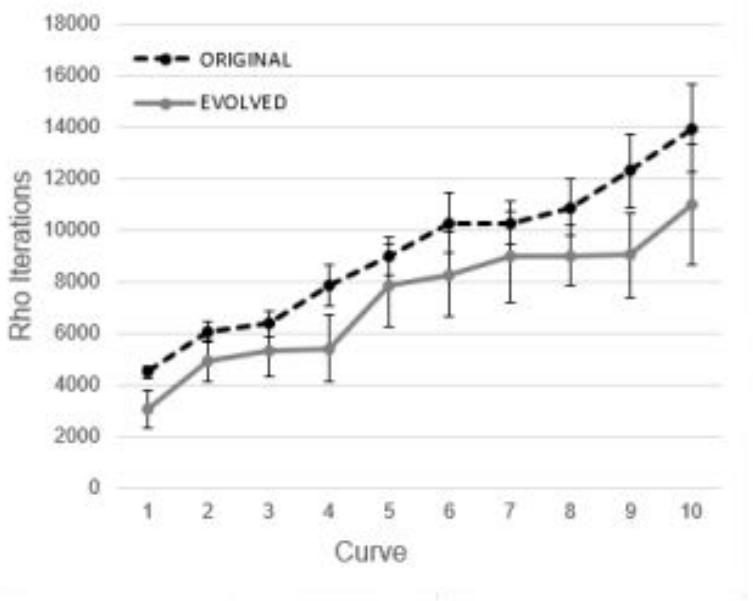
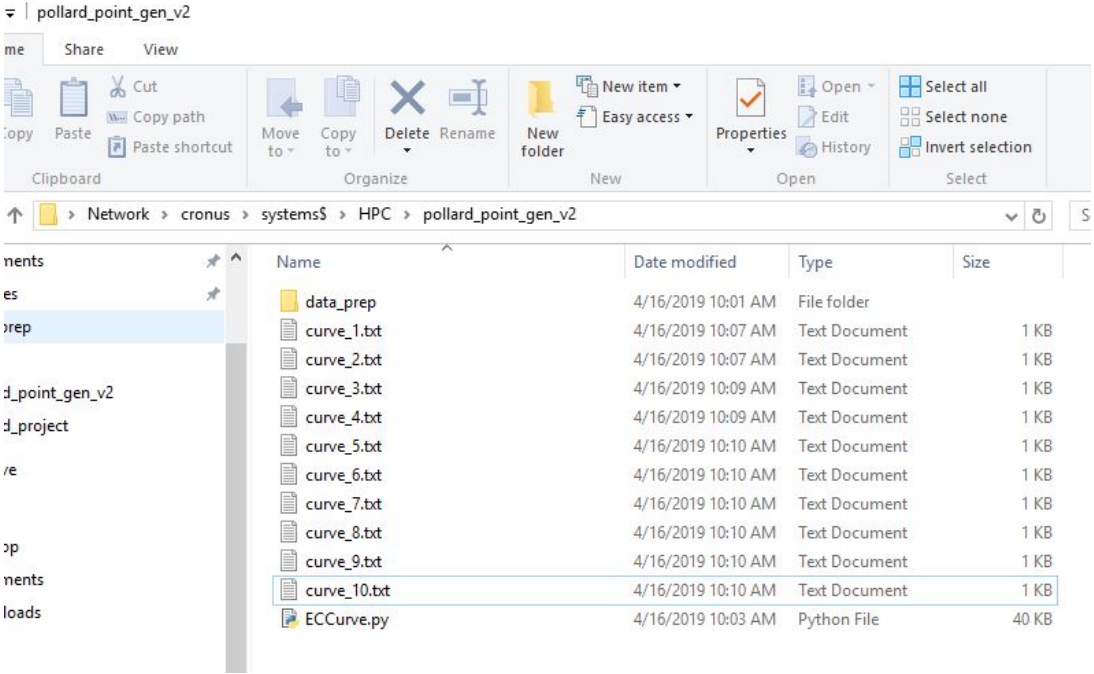


Fig. 7. Number of Iterations Required for the 10 Curves with 8 Digits

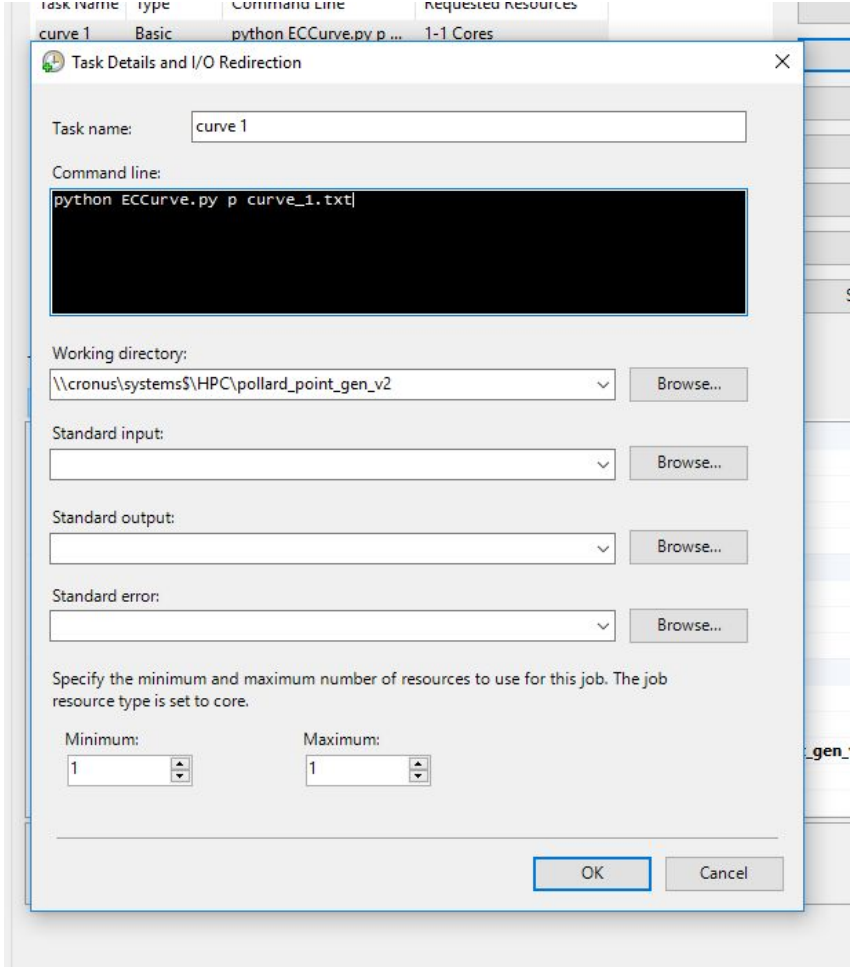
EG.

- Place scripts / data on network accessible storage

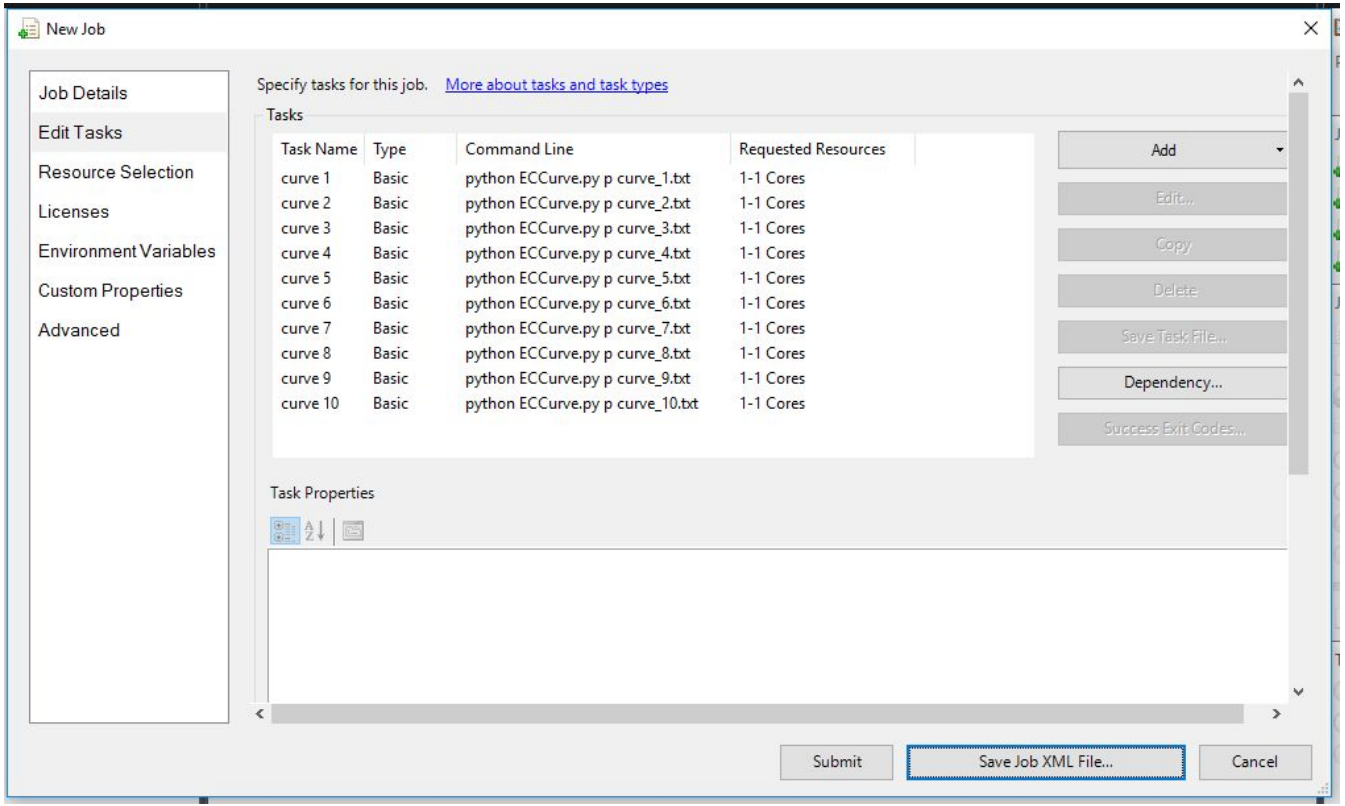


EG.

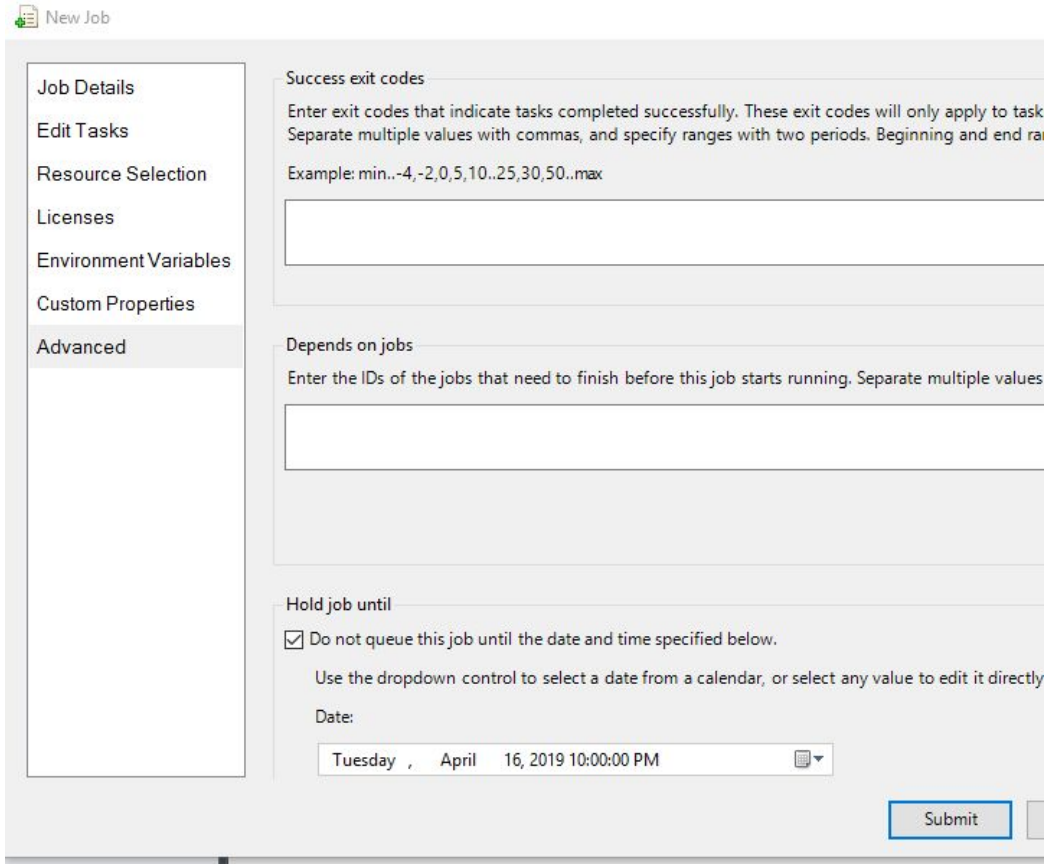
- Connect to Head Node and Configure Task



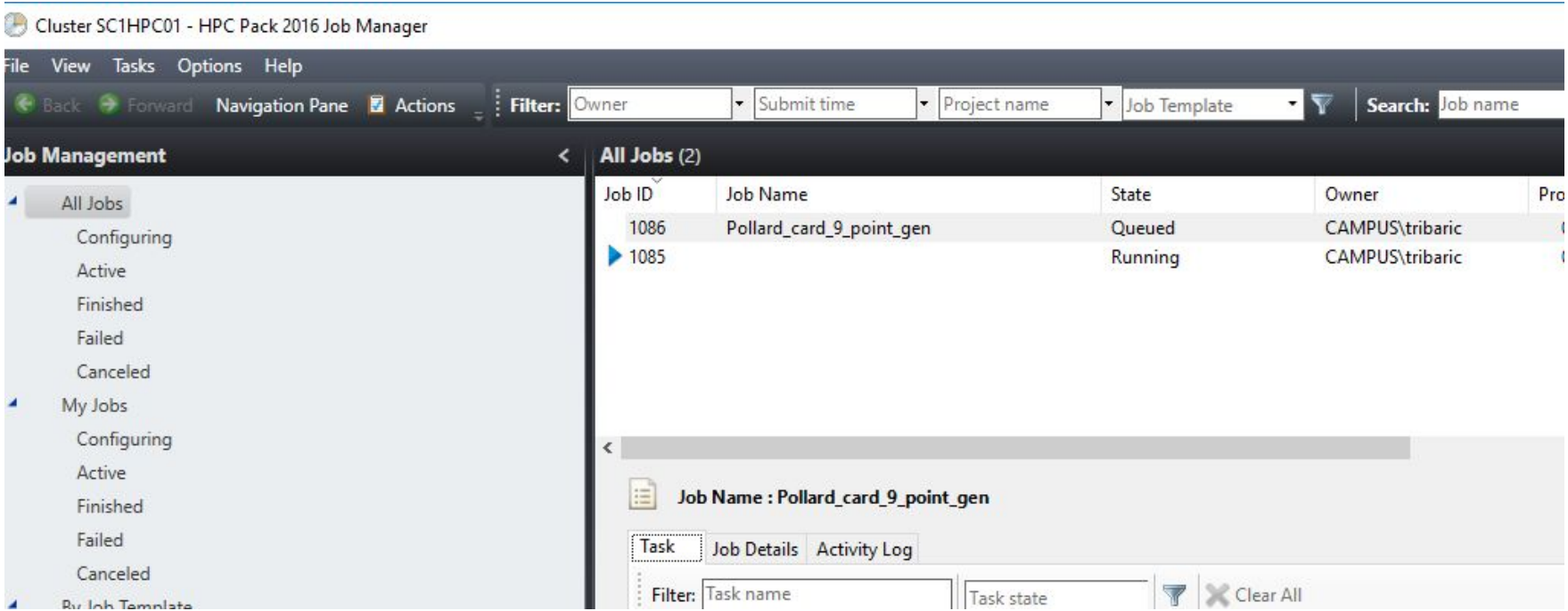
EG.


New Job
Job Details
Edit Tasks
Resource Selection
Licenses
Environment Variables
Custom Properties
Advanced
Specify tasks for this job.
More about tasks and task types
Tasks
Task Name | Type | Command Line | Requested Resources
curve 1 | Basic | python ECCurve.py p curve_1.txt | 1-1 Cores
curve 2 | Basic | python ECCurve.py p curve_2.txt | 1-1 Cores
curve 3 | Basic | python ECCurve.py p curve_3.txt | 1-1 Cores
curve 4 | Basic | python ECCurve.py p curve_4.txt | 1-1 Cores
curve 5 | Basic | python ECCurve.py p curve_5.txt | 1-1 Cores
curve 6 | Basic | python ECCurve.py p curve_6.txt | 1-1 Cores
curve 7 | Basic | python ECCurve.py p curve_7.txt | 1-1 Cores
curve 8 | Basic | python ECCurve.py p curve_8.txt | 1-1 Cores
curve 9 | Basic | python ECCurve.py p curve_9.txt | 1-1 Cores
curve 10 | Basic | python ECCurve.py p curve_10.txt | 1-1 Cores
Add
Edit...
Copy
Delete
Save Task File...
Dependency...
Success Exit Codes...
Task Properties
Submit
Save Job XML File...
Cancel

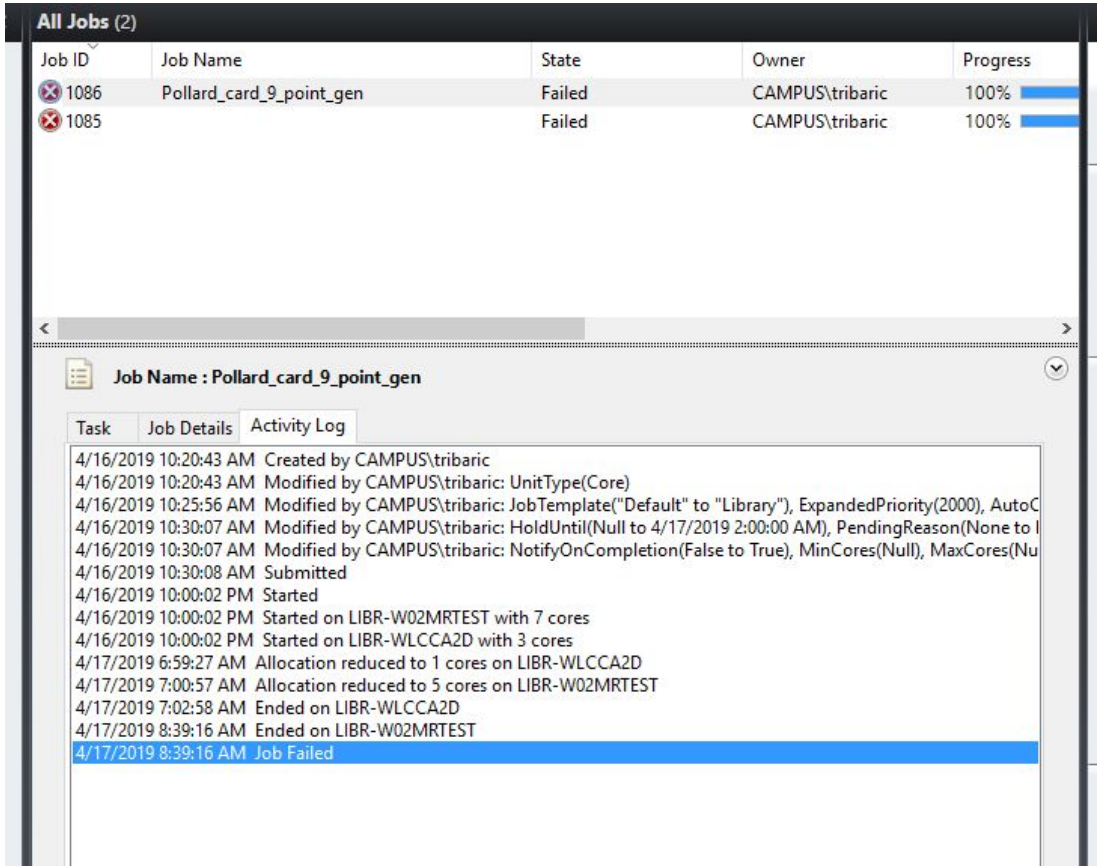
EG.


New Job
Job Details
Edit Tasks
Resource Selection
Licenses
Environment Variables
Custom Properties
Advanced
Success exit codes
Enter exit codes that indicate tasks completed successfully. These exit codes will only apply to task
Separate multiple values with commas, and specify ranges with two periods. Beginning and end ra
Example: min..-4,-2,0,5,10..25,30,50..max
Depends on jobs
Enter the IDs of the jobs that need to finish before this job starts running. Separate multiple values
Hold job until
Do not queue this job until the date and time specified below.
Use the dropdown control to select a date from a calendar, or select any value to edit it directly
Date:
Tuesday , April 16, 2019 10:00:00 PM
Submit

EG.

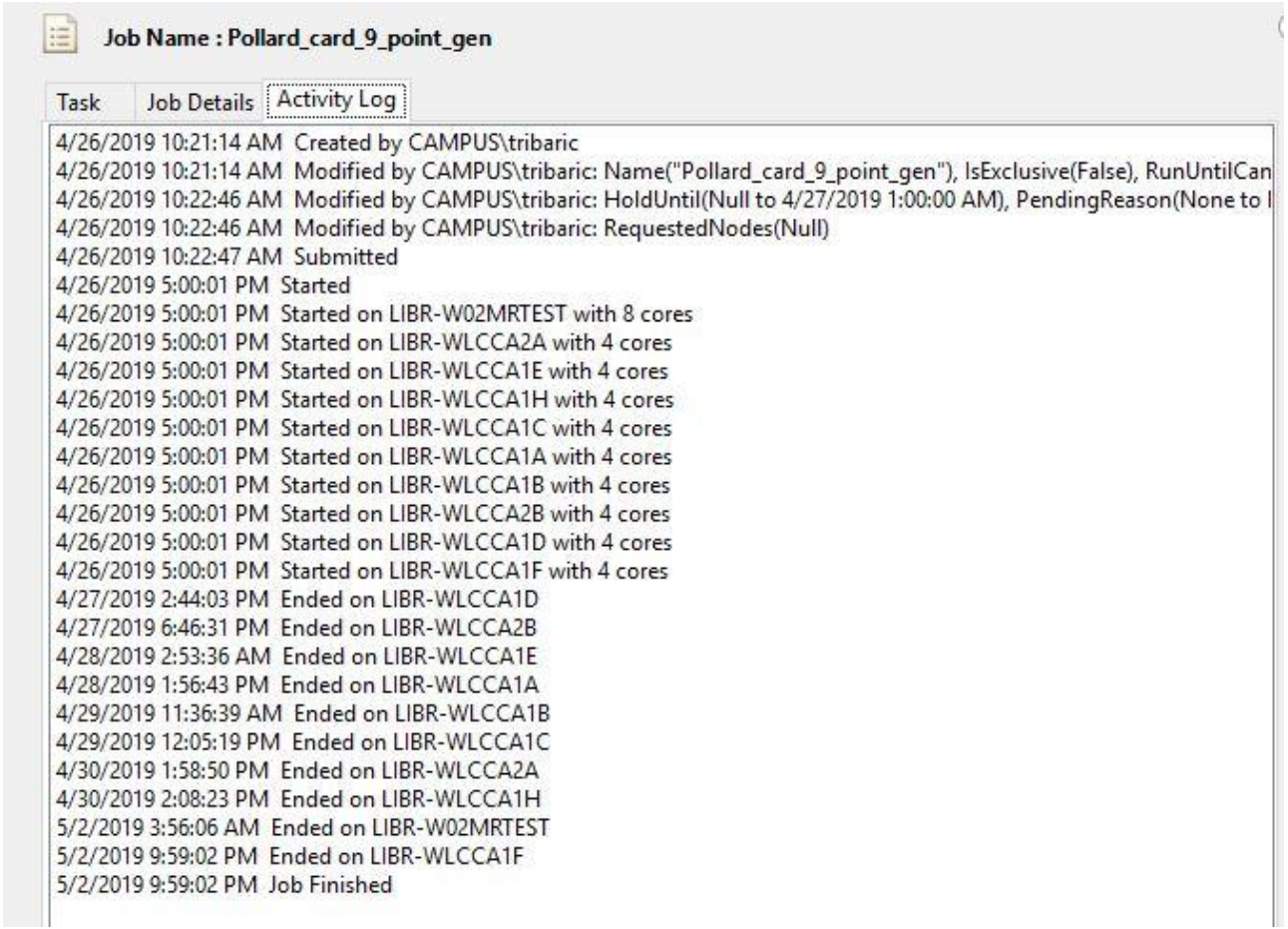

Cluster SC1HPC01 - HPC Pack 2016 Job Manager
File View Tasks Options Help
Back Forward Navigation Pane Actions
Filter: Owner Submit time Project name Job Template
Search: Job name
Job Management
All Jobs
Configuring
Active
Finished
Failed
Canceled
My Jobs
Configuring
Active
Finished
Failed
Canceled
All Jobs (2)
Job ID Job Name State Owner
1086 Pollard_card_9_point_gen Queued CAMPUS\tribaric
1085 Running CAMPUS\tribaric
Job Name : Pollard_card_9_point_gen
Task Job Details Activity Log
Filter: Task name Task state Clear All

EG.


All Jobs (2)
Job ID
Job Name
State
Owner
Progress
1086
Pollard_card_9_point_gen
Failed
CAMPUS\tribaric
100%
1085
Failed
CAMPUS\tribaric
100%
Job Name : Pollard_card_9_point_gen
Task
Job Details
Activity Log
4/16/2019 10:20:43 AM Created by CAMPUS\tribaric
4/16/2019 10:20:43 AM Modified by CAMPUS\tribaric: UnitType(Core)
4/16/2019 10:25:56 AM Modified by CAMPUS\tribaric: JobTemplate("Default" to "Library"), ExpandedPriority(2000), AutoC
4/16/2019 10:30:07 AM Modified by CAMPUS\tribaric: HoldUntil(Null to 4/17/2019 2:00:00 AM), PendingReason(None to I
4/16/2019 10:30:07 AM Modified by CAMPUS\tribaric: NotifyOnCompletion(False to True), MinCores(Null), MaxCores(Nu
4/16/2019 10:30:08 AM Submitted
4/16/2019 10:00:02 PM Started
4/16/2019 10:00:02 PM Started on LIBR-W02MRTEST with 7 cores
4/16/2019 10:00:02 PM Started on LIBR-WLCCA2D with 3 cores
4/17/2019 6:59:27 AM Allocation reduced to 1 cores on LIBR-WLCCA2D
4/17/2019 7:00:57 AM Allocation reduced to 5 cores on LIBR-W02MRTEST
4/17/2019 7:02:58 AM Ended on LIBR-WLCCA2D
4/17/2019 8:39:16 AM Ended on LIBR-W02MRTEST
4/17/2019 8:39:16 AM Job Failed

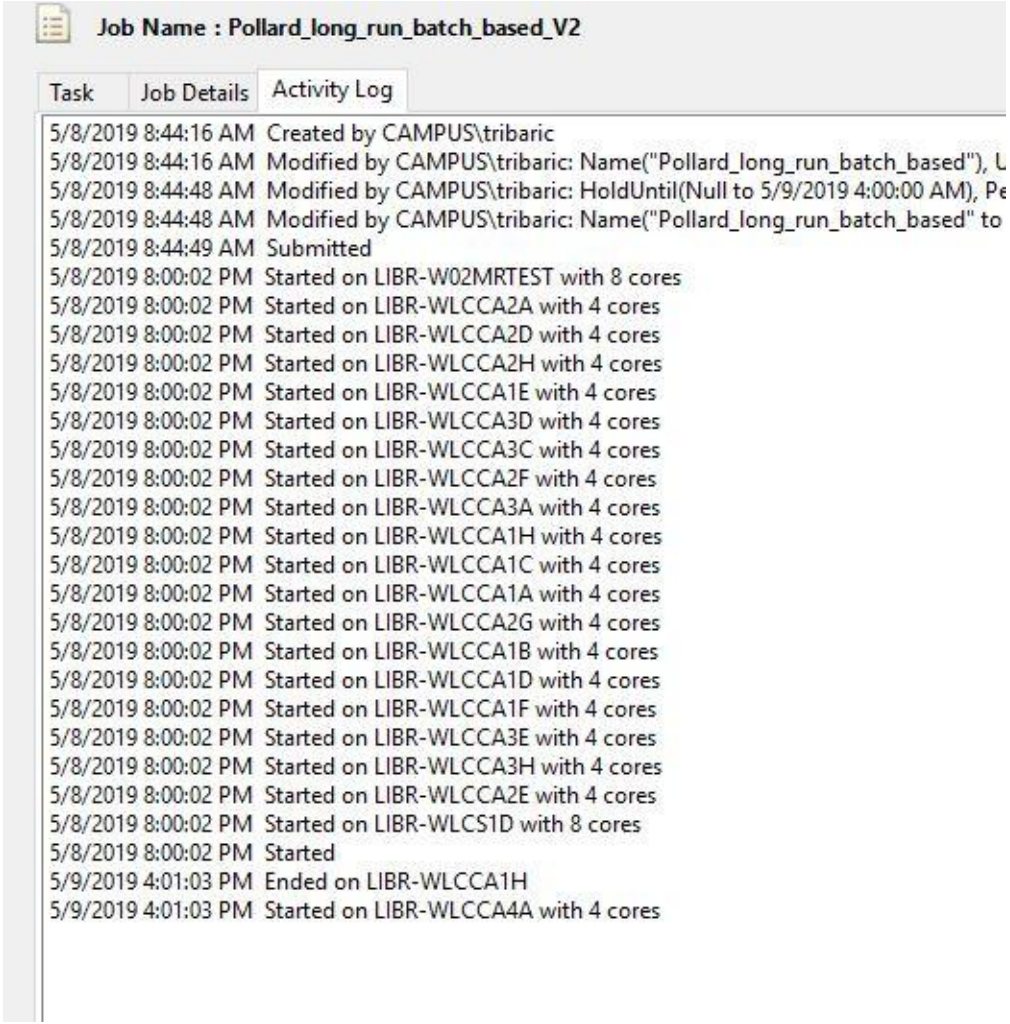
EG.

Heavy job on 10 nodes, 6 days to run

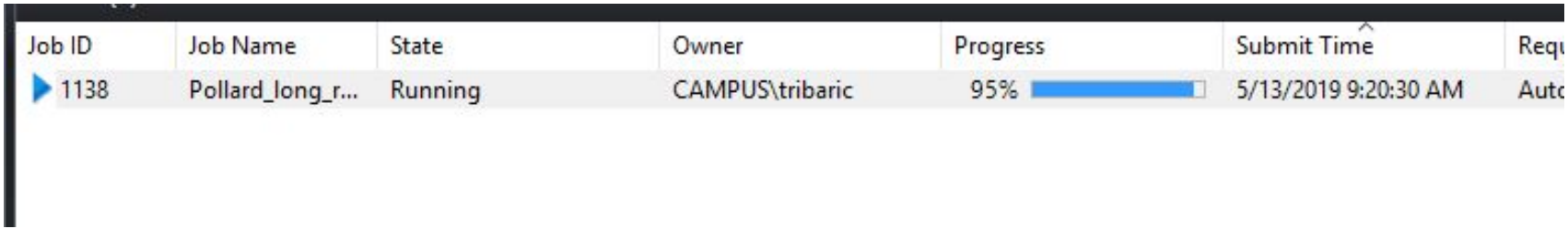


EG.

Heavy Job, 20 nodes
Ran for 2 day, power outage affected



EG.



Job ID	Job Name	State	Owner	Progress	Submit Time	Requ
1138	Pollard_long_r...	Running	CAMPUS\tribaric	95%	5/13/2019 9:20:30 AM	Auto

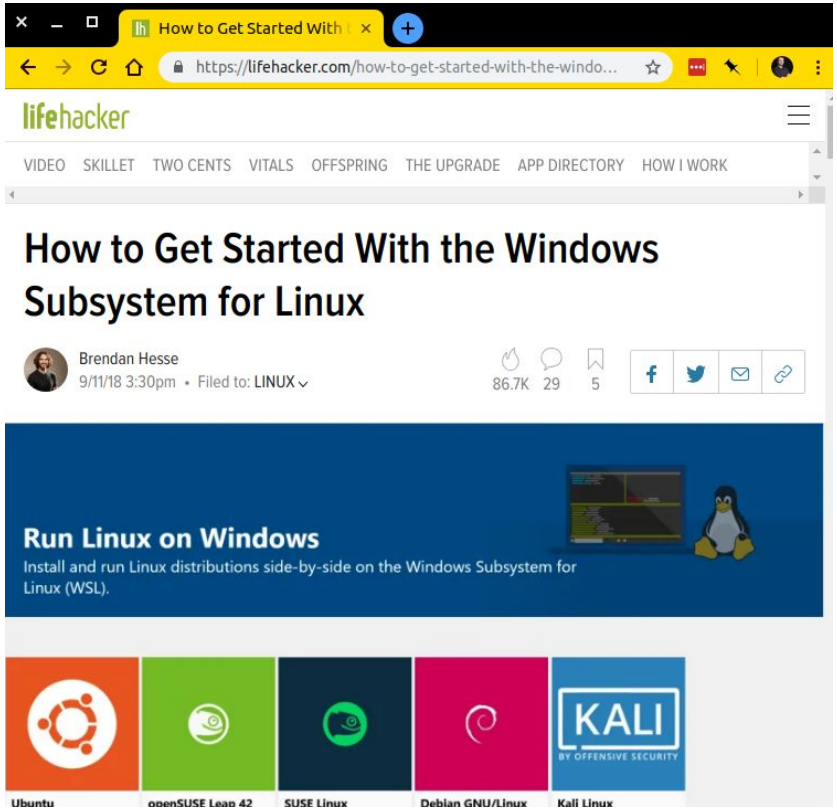
Heavy Job, 20 nodes
Going on 16 days and counting

Getting Sneaky

- Windows now has native support for Linux

- Can run those Linux specific scripts in Windows Yo!

Windows Subsystem for Linux



Getting Sneaky

- Easier to convince an overworked SysAdmin to install:
  - Head Node Software
  - Client on workstations

  As opposed to investigating another paradigm and configuring a ton of features

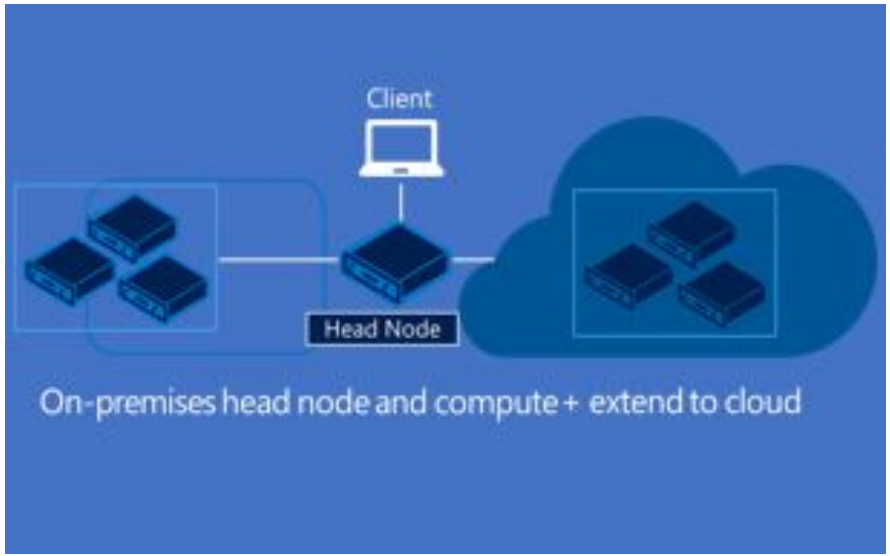
Potential at Brock

- Classroom A
  - 38 x 4 cores = 152
- All potential Library terminals
  - 130 x 4 cores = 520
- Potential Contribution from ITS Labs* (Kitchen Sink)
  - 350 x 4 cores = 1400

* https://brocku.ca/information-technology/info/computer-labs-and-printing/#computer-labs

Scaling outside of the institution

- This paradigm of clustering can be extended to Cloud Based Azure services!



Thanks for listening

- Would you have a use for this?
- How do you sell this to normal mortals?

Tim Ribaric

@elibtronic

tribaric@brocku.ca