

Cluster Computing for Humans

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

Tim Ribaric
@elibtronic

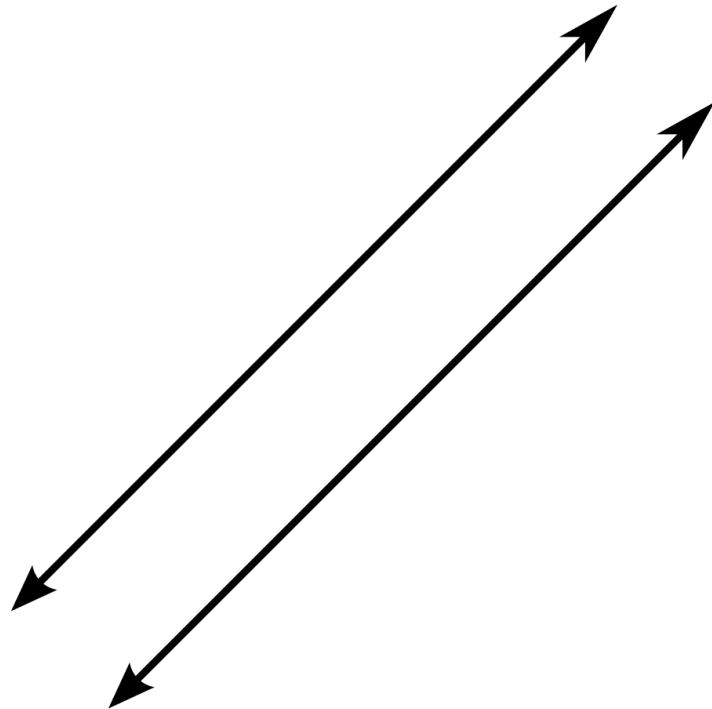
Ups and Downs

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

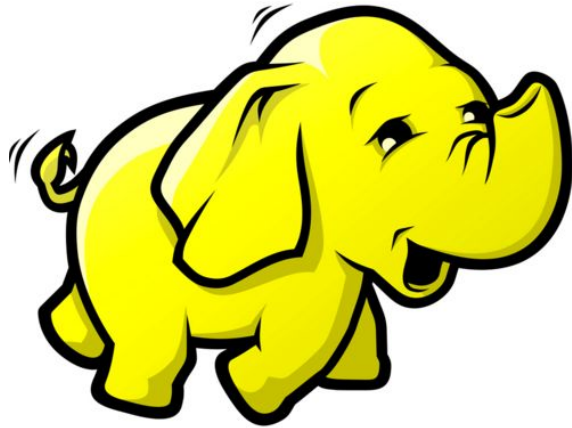
Compute nodes: Windows Server 2016, Windows Server 2012 R2, Windows Server 2012, or x64-based versions of Windows Server 2008 R2 SP1

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?



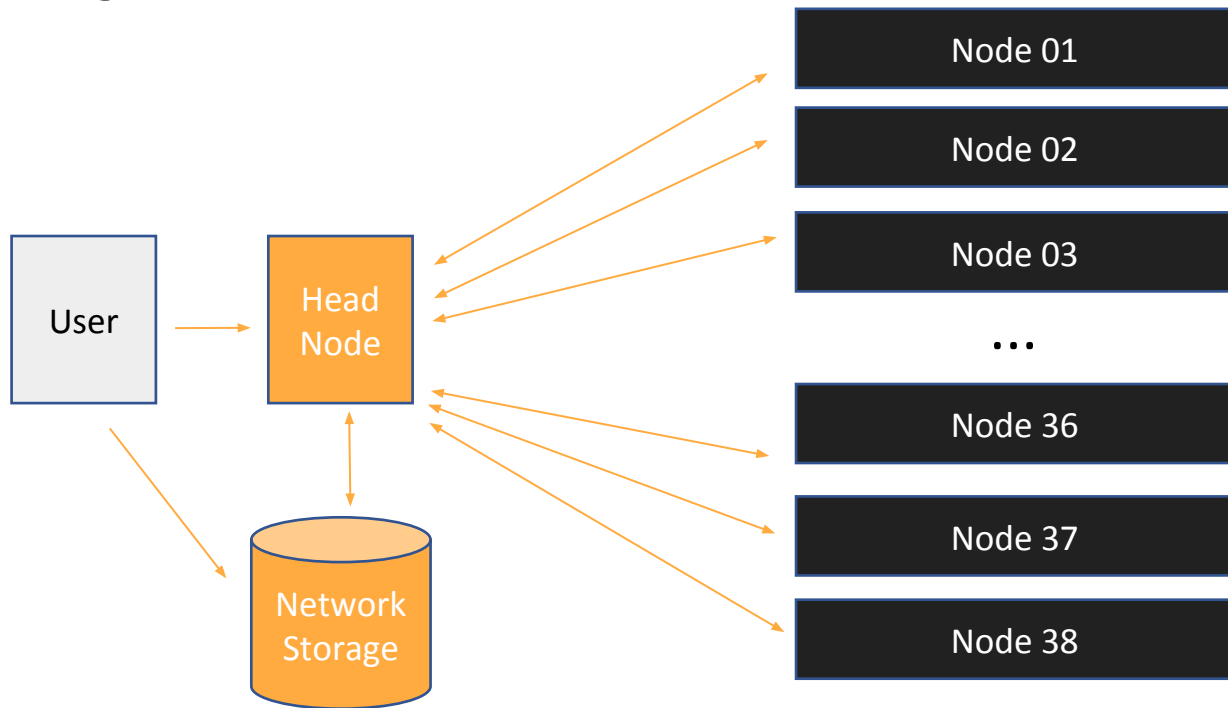
Probably many, many others...

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



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.

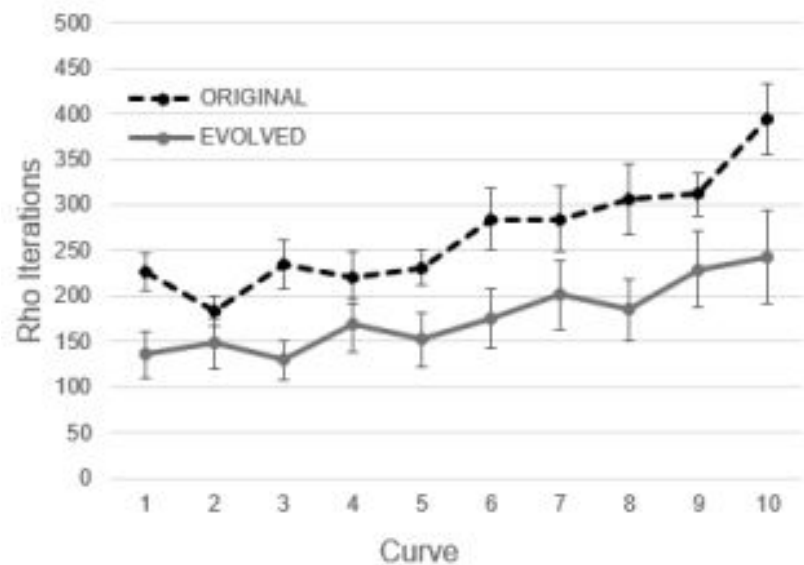


Fig. 4. Number of Iterations Required for the 10 Curves with 5 Digits

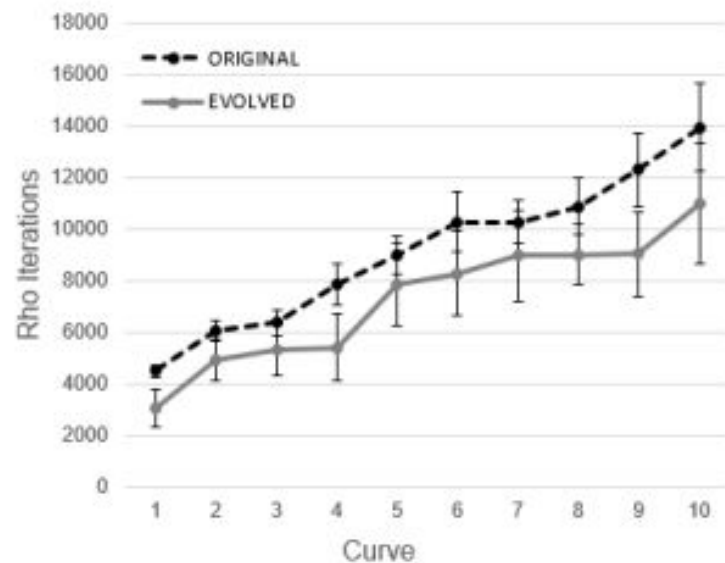
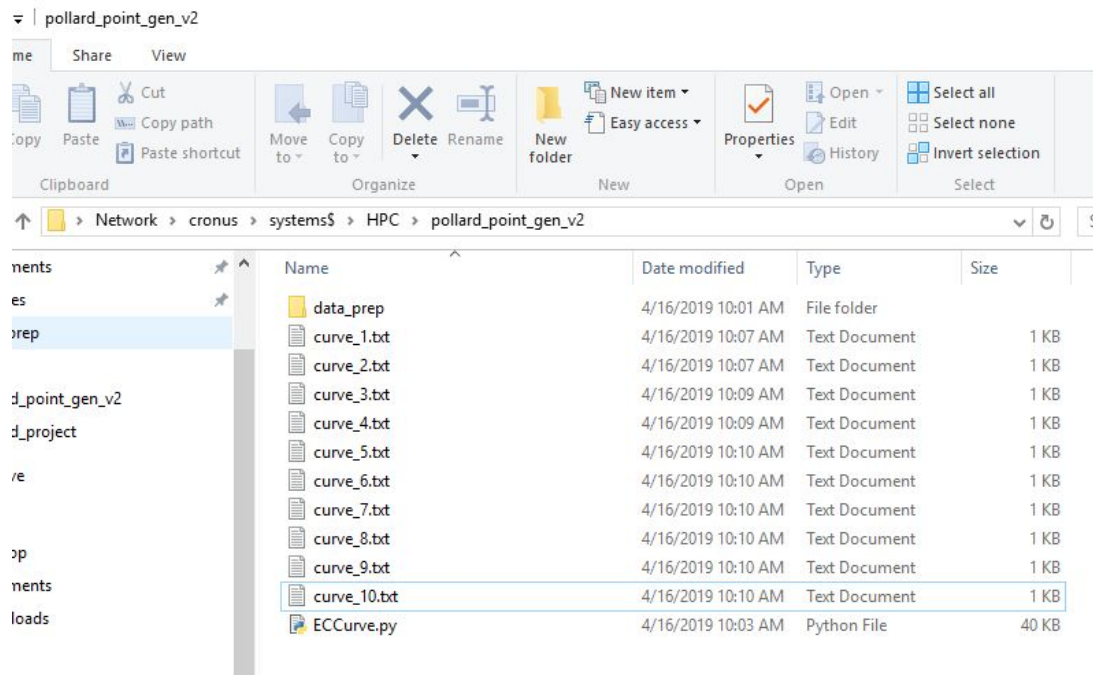


Fig. 7. Number of Iterations Required for the 10 Curves with 8 Digits

EG.


- Place scripts / data on network accessible storage



EG.

- Connect to Head Node and Configure Task

task name	type	Command Line	Requested Resources
curve 1	Basic	python ECCurve.py p ...	1-1 Cores

 Task Details and I/O Redirection

Task name:

Command line:

```
python ECCurve.py p curve_1.txt
```

Working directory:

Standard input:

Standard output:

Standard error:

Specify the minimum and maximum number of resources to use for this job. The job resource type is set to core.

Minimum:

Maximum:

EG.

New Job

Specify tasks for this job. [More about tasks and task types](#)

Job Details

Edit Tasks

Resource Selection

Licenses

Environment Variables

Custom Properties

Advanced

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 range
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
- By Job Template

All Jobs (2)

Job ID	Job Name	State	Owner	Pro
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

 Job Name : Pollard_card_9_point_gen


Task	Job Details	Activity Log
		4/26/2019 10:21:14 AM Created by CAMPUS\tribaric
		4/26/2019 10:21:14 AM Modified by CAMPUS\tribaric: Name("Pollard_card_9_point_gen"), IsExclusive(False), RunUntilCan
		4/26/2019 10:22:46 AM Modified by CAMPUS\tribaric: HoldUntil(Null to 4/27/2019 1:00:00 AM), PendingReason(None to I
		4/26/2019 10:22:46 AM Modified by CAMPUS\tribaric: RequestedNodes(Null)
		4/26/2019 10:22:47 AM Submitted
		4/26/2019 5:00:01 PM Started
		4/26/2019 5:00:01 PM Started on LIBR-W02MRTEST with 8 cores
		4/26/2019 5:00:01 PM Started on LIBR-WLCCA2A with 4 cores
		4/26/2019 5:00:01 PM Started on LIBR-WLCCA1E with 4 cores
		4/26/2019 5:00:01 PM Started on LIBR-WLCCA1H with 4 cores
		4/26/2019 5:00:01 PM Started on LIBR-WLCCA1C with 4 cores
		4/26/2019 5:00:01 PM Started on LIBR-WLCCA1A with 4 cores
		4/26/2019 5:00:01 PM Started on LIBR-WLCCA1B with 4 cores
		4/26/2019 5:00:01 PM Started on LIBR-WLCCA2B with 4 cores
		4/26/2019 5:00:01 PM Started on LIBR-WLCCA1D with 4 cores
		4/26/2019 5:00:01 PM Started on LIBR-WLCCA1F with 4 cores
		4/27/2019 2:44:03 PM Ended on LIBR-WLCCA1D
		4/27/2019 6:46:31 PM Ended on LIBR-WLCCA2B
		4/28/2019 2:53:36 AM Ended on LIBR-WLCCA1E
		4/28/2019 1:56:43 PM Ended on LIBR-WLCCA1A
		4/29/2019 11:36:39 AM Ended on LIBR-WLCCA1B
		4/29/2019 12:05:19 PM Ended on LIBR-WLCCA1C
		4/30/2019 1:58:50 PM Ended on LIBR-WLCCA2A
		4/30/2019 2:08:23 PM Ended on LIBR-WLCCA1H
		5/2/2019 3:56:06 AM Ended on LIBR-W02MRTEST
		5/2/2019 9:59:02 PM Ended on LIBR-WLCCA1F
		5/2/2019 9:59:02 PM Job Finished

EG.

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

Job Name : Pollard_long_run_batch_based_V2		
Task	Job Details	Activity Log
5/8/2019 8:44:16 AM	Created by CAMPUS\tribaric	
5/8/2019 8:44:16 AM	Modified by CAMPUS\tribaric: Name("Pollard_long_run_batch_based"), L	
5/8/2019 8:44:48 AM	Modified by CAMPUS\tribaric: HoldUntil(Null to 5/9/2019 4:00:00 AM), Pe	
5/8/2019 8:44:48 AM	Modified by CAMPUS\tribaric: Name("Pollard_long_run_batch_based" to	
5/8/2019 8:44:49 AM	Submitted	
5/8/2019 8:00:02 PM	Started on LIBR-W02MRTEST with 8 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA2A with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA2D with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA2H with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA1E with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA3D with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA3C with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA2F with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA3A with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA1H with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA1C with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA1A with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA2G with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA1B with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA1D with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA1F with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA3E with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA3H with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCCA2E with 4 cores	
5/8/2019 8:00:02 PM	Started on LIBR-WLCS1D with 8 cores	
5/8/2019 8:00:02 PM	Started	
5/9/2019 4:01:03 PM	Ended on LIBR-WLCCA1H	
5/9/2019 4:01:03 PM	Started on LIBR-WLCCA4A with 4 cores	

EG.

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

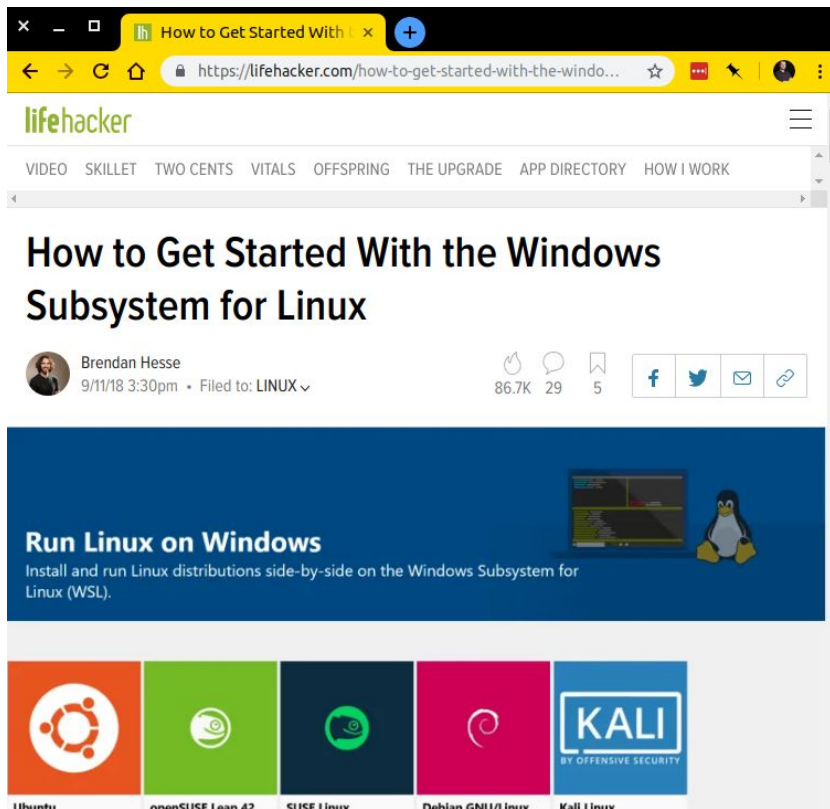
Heavy Job, 20 nodes
Going on 16 days and
counting

Getting Sneaky

- Windows now has native support for Linux
- Can run those Linux specific scripts in Windows Yo!



Windows Subsystem for Linux



A screenshot of a web browser displaying a Lifehacker article. The browser's address bar shows the URL <https://lifehacker.com/how-to-get-started-with-the-windo...>. The Lifehacker logo is in the top left, and navigation links like VIDEO, SKILLET, TWO CENTS, VITALS, OFFSPRING, THE UPGRADE, APP DIRECTORY, and HOW I WORK are in the top right. The article title is "How to Get Started With the Windows Subsystem for Linux". Below the title, it says "Brendan Hesse" and "9/11/18 3:30pm • Filed to: LINUX". There are 86.7K views, 29 comments, and 5 bookmarks. Social media sharing icons for Facebook, Twitter, Email, and Print are present. A large blue banner with the text "Run Linux on Windows" and "Install and run Linux distributions side-by-side on the Windows Subsystem for Linux (WSL)." is shown, featuring a terminal window and a penguin icon. Below the banner, five Linux distribution logos are displayed: Ubuntu, openSUSE Leap 42, SUSE Linux, Debian GNU/Linux, and Kali Linux.

lifehacker

VIDEO SKILLET TWO CENTS VITALS OFFSPRING THE UPGRADE APP DIRECTORY HOW I WORK

How to Get Started With the Windows Subsystem for Linux

Brendan Hesse
9/11/18 3:30pm • Filed to: LINUX

86.7K 29 5

f t e p

Run Linux on Windows
Install and run Linux distributions side-by-side on the Windows Subsystem for Linux (WSL).

Ubuntu openSUSE Leap 42 SUSE Linux Debian GNU/Linux Kali Linux



A screenshot of a web browser displaying a The Verge article. The browser's address bar shows the URL <https://www.theverge.com/2019/5/6/18534687/microsoft-...>. The article title is "Microsoft will ship a full Linux kernel in Windows 10". Below the title, it says "Available in testing this summer" and "By Tom Warren | @tomwarren | May 6, 2019, 7:24pm EDT". There are 74 comments. Social media sharing icons for Facebook, Twitter, and a SHARE button are present. A large blue banner with the text "Microsoft ❤️ Linux" is shown, featuring a man speaking at a podium.

Microsoft will ship a full Linux kernel in Windows 10

Available in testing this summer

By Tom Warren | @tomwarren | May 6, 2019, 7:24pm EDT

f t SHARE

Microsoft ❤️ 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

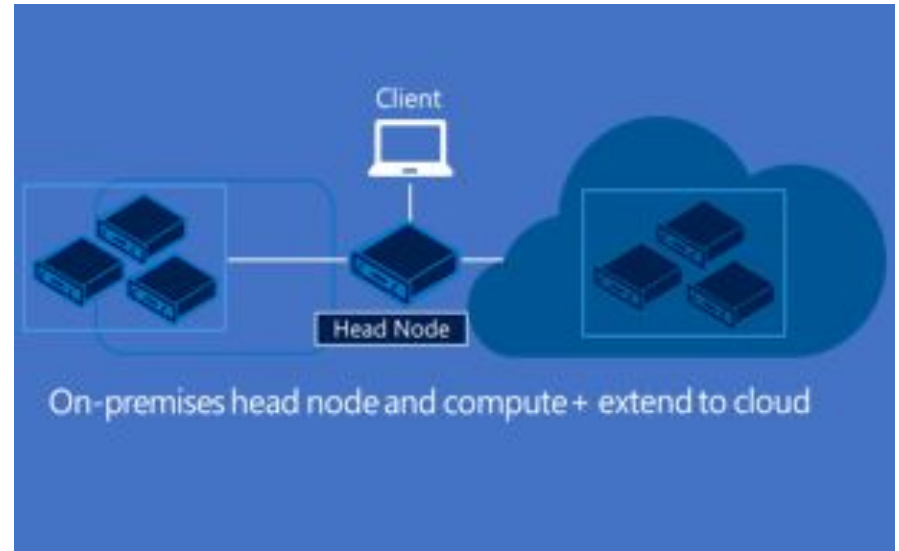
Potential at Brock

- 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