

Deep Learning at Indiana University



RESEARCH TECHNOLOGIES
UNIVERSITY INFORMATION TECHNOLOGY SERVICES

rt.iu.edu

Ben Fulton @benfulton

Deep Learning at Indiana University

Big Red II (est. 2013)



- Cray XE6/XK7 hybrid
- 344 dual socket, 16 core (AMD x86-64) nodes
- 676 single socket, 16 core (AMD x86-64) AND one NVIDIA K20 GPU

#PyDataIndy @benfulton



Data Storage: Long-Term



Scholarly Data Archive

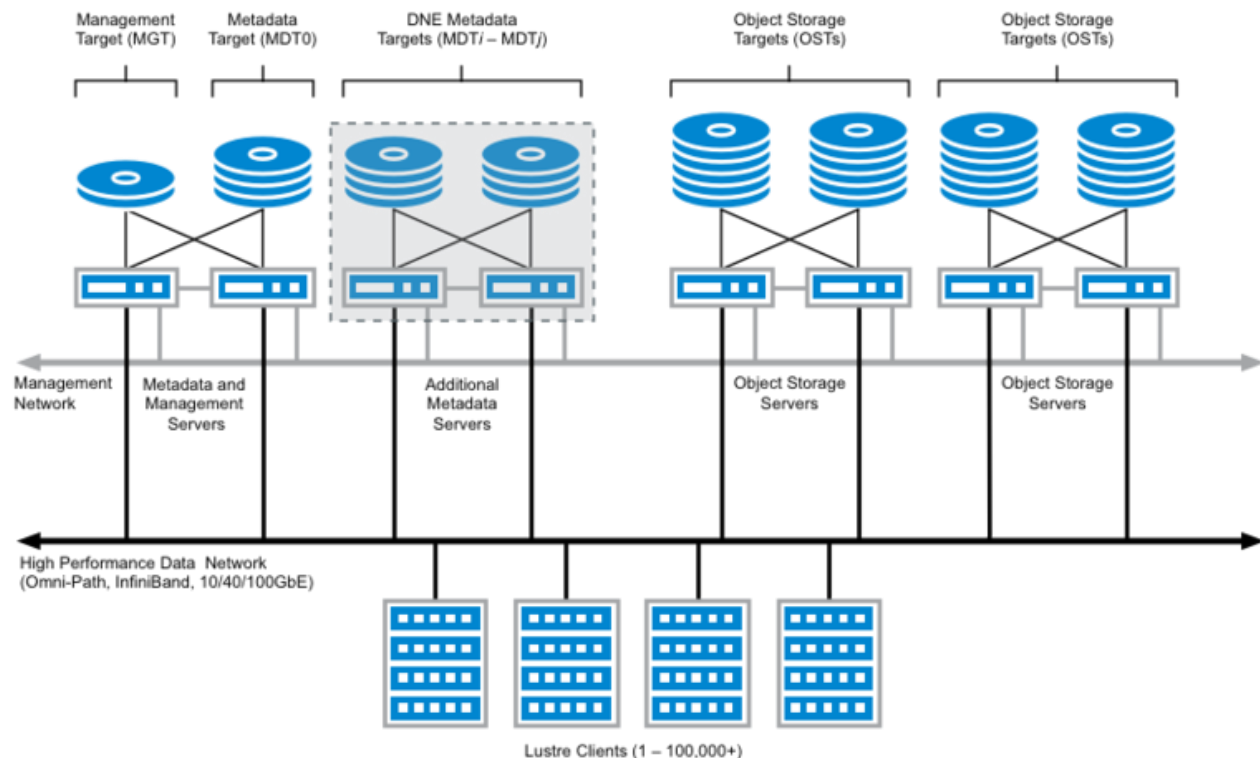
- Long-term Tape Data Storage
- 75 PB of storage
- Two copies of data made
- One copy lives in Bloomington, the other in Indianapolis for disaster recovery
- Best with large files

#PyDataIndy @benfulton

Data Storage: Short-Term

Data Capacitor

- 5 PB storage (Lustre file system)
- 56Gb Infiniband connection
- Not backed up
- No quotas
- Automatically deleted after 60 days



#PyDataIndy @benfulton

Other Computing Options



Karst

- Lenovo NeXt Scale system with ~300 CPU nodes
- Compute nodes: 32 GB of RAM and 250 GB of local disk storage
- Data nodes: 64 GB of RAM and 24 TB of local storage

#PyDataIndy @benfulton

Other Computing Options



Carbonate

- 72 dual-socket Haswell compute nodes
- Dual E5-2680v3 (12 core, 2.5GHz)
- 256GB of memory (some with 512GB)
- Four 480GB SSD's (/tmp)

#PyDataIndy @benfulton

The Future is (almost) Here

INDIANA UNIVERSITY
BICENTENNIAL
1820-2020

CELEBRATING *200* YEARS

#PyDataIndy @benfulton



INDIANA UNIVERSITY BICENTENNIAL

The Future is (almost) Here

Personal Computing
1981-Today



Supercomputing
1981-Today



Research Desktop

#PyDataIndy @benfulton

The Future is (almost) Here

Research Desktop



- Making HPC more user friendly
- A new way to login and interact with HPC
- GUI/desktop instead of a terminal
- Replaces immensely popular Karst Desktop service
- Thinlinc, a Linux remote desktop server based on VNC



#PyDataIndy @benfulton



The Future is (almost) Here

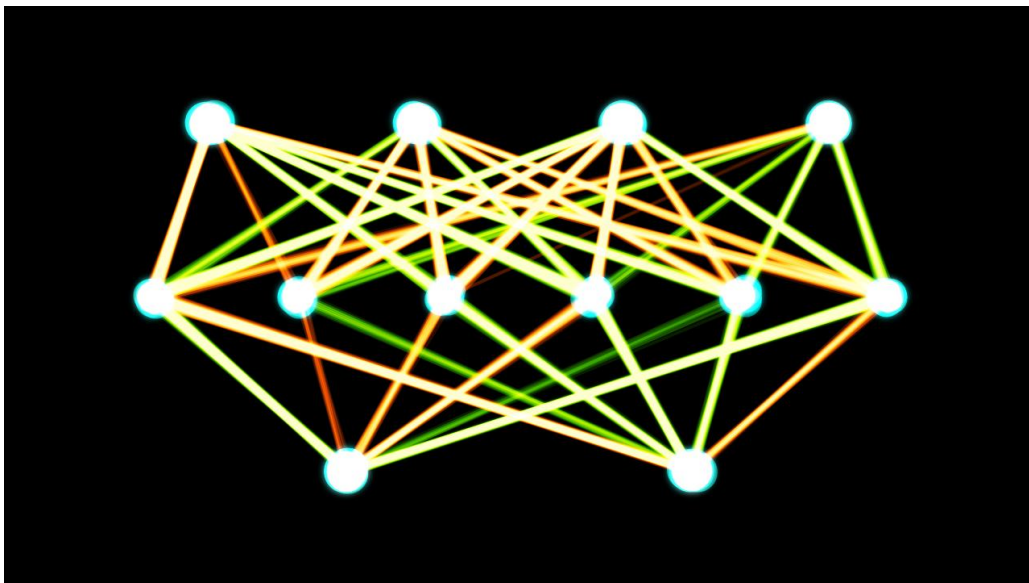


Slate

- Lustre file system
- Aimed at data-intensive workflows and analytics
- 10 PB total capacity
- 64 GB/s throughput
- Not subject to a purge policy.

#PyDataIndy @benfulton

Deep Learning



By Akritasa - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=41652686>

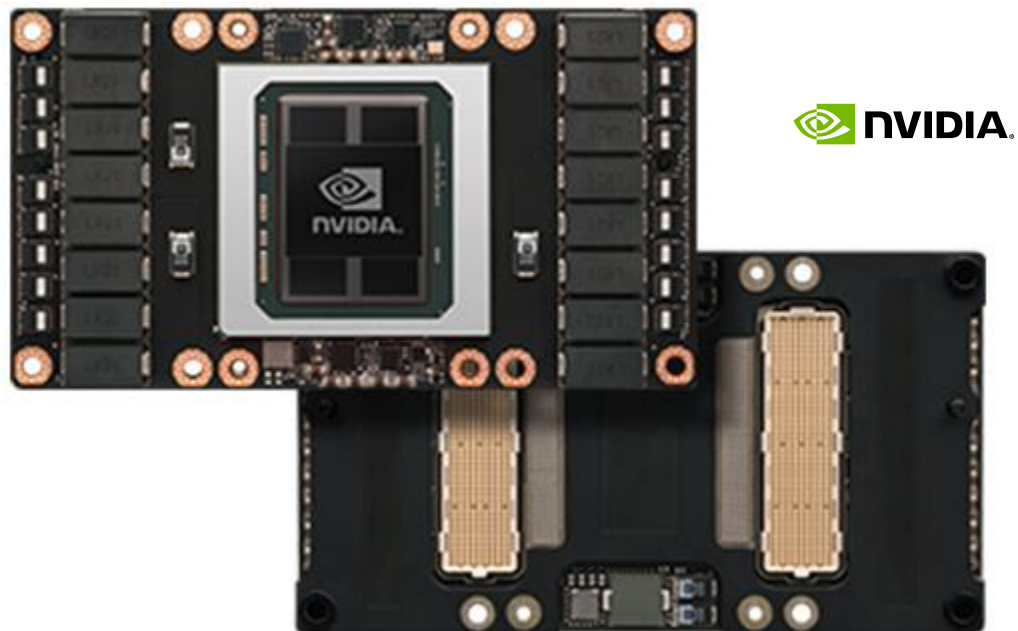
Carbonate

- 12 nodes added to Carbonate
- Dual 12 core SKX, 192GB, 2TB SSD)
- 8 nodes have dual P100 GPUs
- 4 nodes have dual V100 GPUs

#PyDataIndy @benfulton

Deep Learning

Pascal Tesla P100



- Double-Precision: 4.7 teraFLOPS
- Single-Precision: 9.3 teraFLOPS
- Half-Precision: 18.7 teraFLOPS
- Interconnect: 32 GB/s

#PyDataIndy @benfulton

Deep Learning

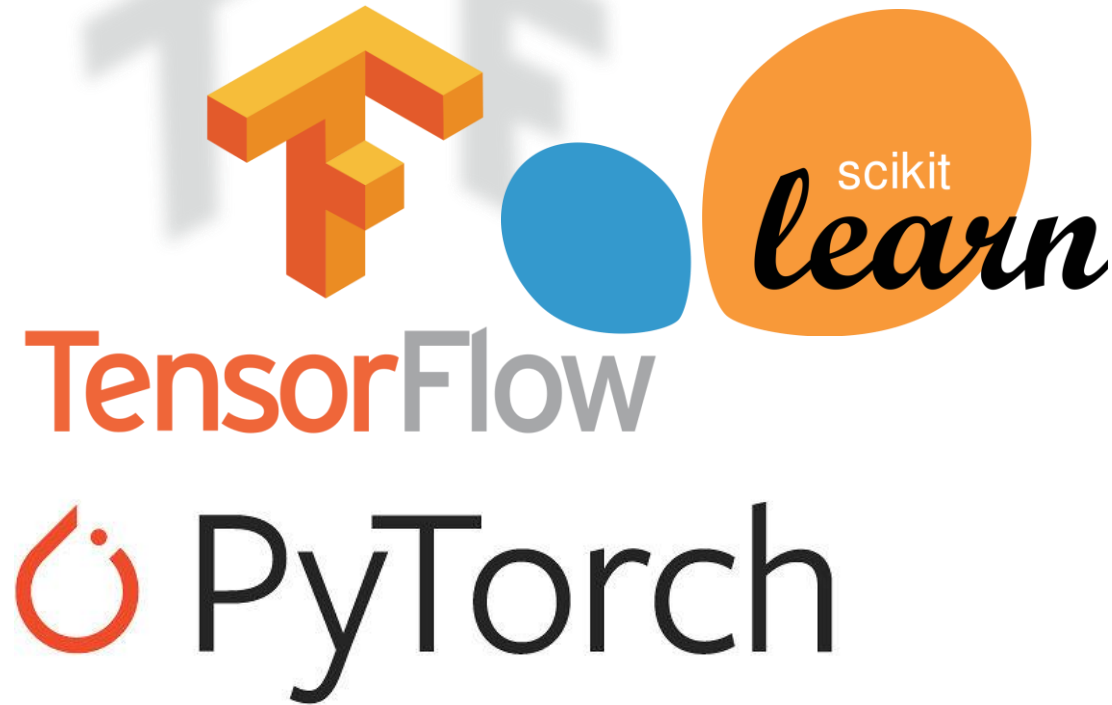


Volta Tesla V100

- Double-Precision: 7 teraFLOPS
- Single-Precision: 14 teraFLOPS
- Deep Learning: 112 teraFLOPS
- Interconnect: 32 GB/s

#PyDataIndy @benfulton

Deep Learning



Software

- Tensorflow (Python), Caffe2 (Python), Mxnet (Python), pyTorch (Python), CNTK (Python, C++, C#), scikit-learn (Python)
- Comprehensive set of algorithms in R
- Standalone implementations exist as well: e.g. H2O, Weka, etc
- Or roll your own: CUDA, OpenACC

#PyDataIndy @benfulton

Deep Learning



Big Red 200

- First university to deploy a Cray Shasta system
- Similar to the National Energy Research Scientific Computing Center (NERSC) Perlmutter system
- Cray Slingshot™ interconnect
- Cray Urika® AI Suite for Shasta
- Grand Challenges
 - Precision Health
 - Preparing for Environmental Change
 - Responding to the Addictions Crisis

#PyDataIndy @benfulton



Big Red 200

IU's next supercomputer

~6 petaFLOPS

Installation in early 2020

Cray Shasta supercomputer

- AMD "Rome" CPUs
- NVIDIA V100 GPUs
- Cray interconnect



RESEARCH TECHNOLOGIES
UNIVERSITY INFORMATION TECHNOLOGY SERVICES

How **big** is Big Red 200?

The new supercomputer is the latest major milestone in IU's decades-long leadership in pushing the boundaries of computing to advance world-class research.

Big Red 200 can process **53 times more data** in memory than Big Red and **10 times more** than Big Red II. For example, it can process **71,000** 3 GB brain scans in RAM simultaneously.

Big Red: **1,300 brain scans processed simultaneously**



Big Red II: **7,100**



Big Red 200: **71,000**



Big Red 200 is almost **300 times faster** than Big Red and **6 times faster** than Big Red II...

Big Red: **20.48 teraFLOPS**



Big Red II: **1 petaFLOPS**



Big Red 200: **5.9 petaFLOPS**



... which is almost **6 million times faster** than an iPhone XS.

 OFFICE OF THE
**VICE PRESIDENT FOR
INFORMATION TECHNOLOGY**
and Chief Information Officer

Q&A?



Flickr user Oiluj Samall Zeid - Lejos de Yulín



RESEARCH TECHNOLOGIES
UNIVERSITY INFORMATION TECHNOLOGY SERVICES

#PyDataIndy @benfulton