

Welcome to the Big Data Workshop

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Who am I?

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What I mostly do:

Parallelize codes with

- MPI, OpenMP, OpenACC, Hybrid
- Big Data, Machine Learning

Primarily for XSEDE platforms. Mostly to extreme scalability.

XSEDE

Extreme Science and Engineering
Discovery Environment



XSEDE HPC Monthly Workshop Schedule

- June 6-9 *Summer Boot Camp*
- August 15 *HPC Monthly Workshop: OpenMP*
- September 12-13 *HPC Monthly Workshop: Big Data*
- October 3-4 *HPC Monthly Workshop: MPI*
- November 7 *HPC Monthly Workshop: OpenACC*
- December 5-6 *HPC Monthly Workshop: Big Data*
- January 9 *HPC Monthly Workshop: OpenMP*
- February 7-8 *HPC Monthly Workshop: Big Data*
- March 6 *HPC Monthly Workshop: OpenACC*
- April 3-4 *HPC Monthly Workshop: MPI*
- May 1-2 *HPC Monthly Workshop: Big Data*
- June 4-7 *Summer Boot Camp*
- August 7 *HPC Monthly Workshop: OpenMP*
- **September 5-6** ***HPC Monthly Workshop: Big Data***
- October 2-3 *HPC Monthly Workshop: MPI*
- November 6 *HPC Monthly Workshop: OpenACC*
- December 4-5 *HPC Monthly Workshop: Big Data*

Agenda

Thursday, August 9

- 8:30 Welcome
- 9:00 A Brief History of Big Data
- 9:30 Intro To Spark
- 10:00 Break
- 10:30 Spark
- 12:00 Lunch
- 1:00 Recommender System
- 2:30 Break
- 3:00 Exercises
- 4:30 Adjourn

Resources

Your local TAs

Questions from the audience

On-line talks

bit.ly/XSEDEWorkshop

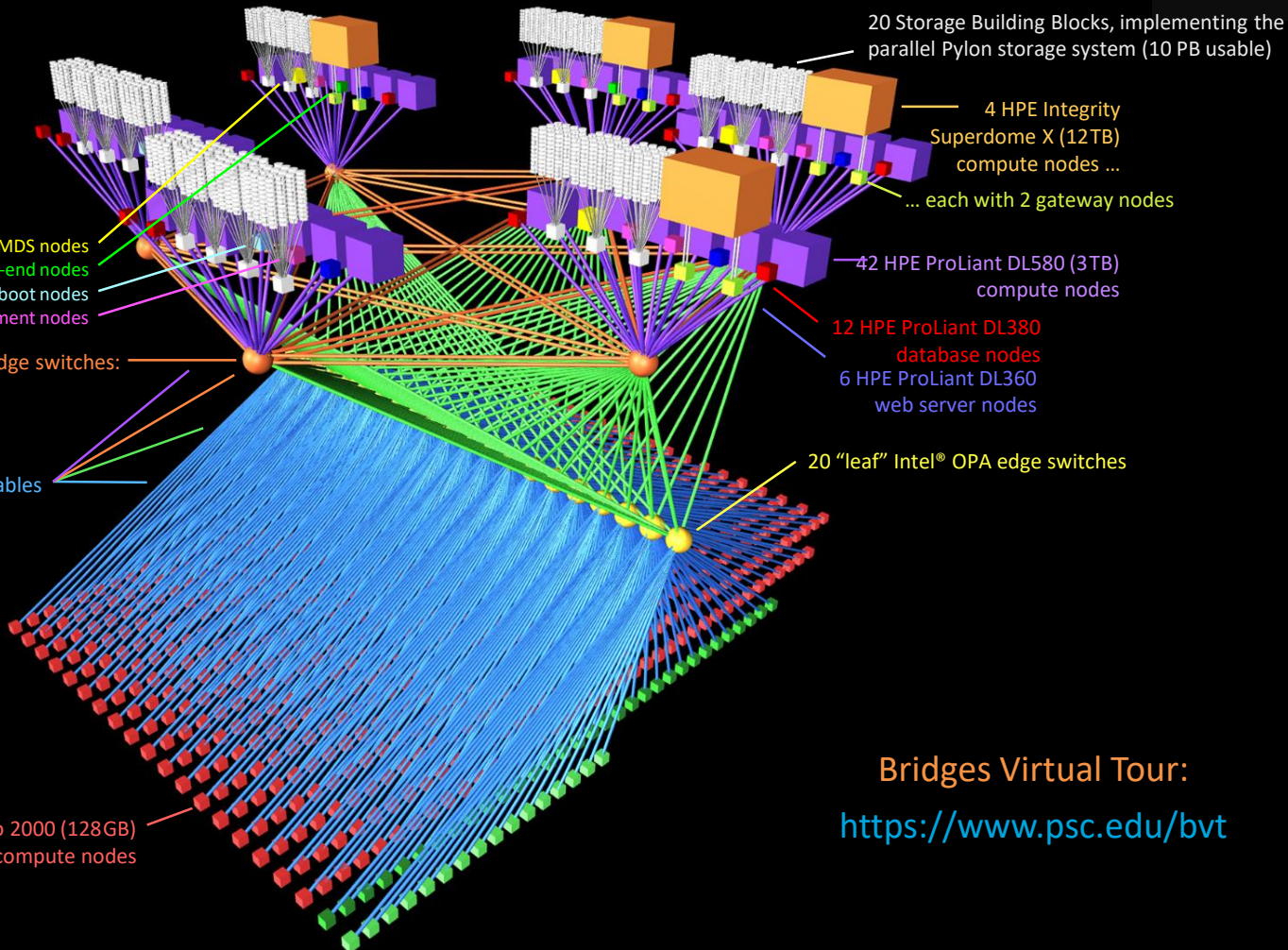
Copying code from PDFs is very error prone. Subtle things like substituting “-” for “-” are maddening. I have provided online copies of the codes in a directory that we shall shortly visit. I strongly suggest you copy from there if you are in a cut/paste mood.

The YouTube Channel Has Arrived!

Due to overwhelming demand, and a lot of editing, we have begun to post workshop videos on the XSEDE Monthly Workshop Training Channel:

XSEDETraining

They will be incrementally appearing in the coming months. Subscribe and give us feedback.



Purpose-built Intel® Omni-Path Architecture topology for data-intensive HPC

Bridges Virtual Tour:
<https://www.psc.edu/bvt>

Node Types

Type	RAM	Phase	n	CPU / GPU / other	Server
ESM	12TB ^b	1	2	16 × Intel Xeon E7-8880 v3 (18c, 2.3/3.1 GHz, 45MB LLC)	HPE Integrity Superdome X
	12TB ^c	2	2	16 × Intel Xeon E7-8880 v4 (22c, 2.2/3.3 GHz, 55MB LLC)	
LSM	3TB ^b	1	8	4 × Intel Xeon E7-8860 v3 (16c, 2.2/3.2 GHz, 40 MB LLC)	HPE ProLiant DL580
	3TB ^c	2	34	4 × Intel Xeon E7-8870 v4 (20c, 2.1/3.0 GHz, 50 MB LLC)	
RSM	128GB ^b	1	752	2 × Intel Xeon E5-2695 v3 (14c, 2.3/3.3 GHz, 35MB LLC)	
RSM-GPU	128GB ^b	1	16	2 × Intel Xeon E5-2695 v3 + 2 × NVIDIA Tesla K80	HPE Apollo 2000
	128GB ^c	2	32	2 × Intel Xeon E5-2683 v4 (16c, 2.1/3.0 GHz, 40MB LLC) + 2 × NVIDIA Tesla P100	
DB-s	128GB ^b	1	6	2 × Intel Xeon E5-2695 v3 + SSD	HPE ProLiant DL360
DB-h	128GB ^b	1	6	2 × Intel Xeon E5-2695 v3 + HDDs	HPE ProLiant DL380
Web	128GB ^b	1	6	2 × Intel Xeon E5-2695 v3	HPE ProLiant DL360
Other ^a	128GB ^b	1	16	2 × Intel Xeon E5-2695 v3	HPE ProLiant DL360, HPE ProLiant DL380
	64GB ^b	1	4	2 × Intel Xeon E5-2683 v3 (14c, 2.0/3.0 GHz, 35MB LLC)	
Gateway	64GB ^b	1	4	2 × Intel Xeon E5-2683 v3 (14c, 2.0/3.0 GHz, 35MB LLC)	HPE ProLiant DL380
	64GB ^c	2	4	2 × Intel Xeon E5-2683 v3	
Storage	128GB ^b	1	5	2 × Intel Xeon E5-2680 v3 (12c, 2.5/3.3 GHz, 30 MB LLC)	Supermicro X10DRi
	256GB ^c	2	15	2 × Intel Xeon E5-2680 v4 (14c, 2.4/3.3 GHz, 35 MB LLC)	
Total	281.75TB		908		

a. Other nodes = front end (2) + management/log (8) + boot (4) + MDS (4)

b. DDR4-2133

c. DDR4-2400

Getting Time on XSEDE

XSEDE

Extreme Science and Engineering
Discovery Environment

<https://portal.xsede.org/web/guest/allocations>

Getting Connected

The first time you use your account sheet, you must go to apr.psc.edu to set a password. You may already have done so, if not, we will take a minute to do this shortly.

We will be working on bridges.psc.edu. Use an ssh client (a Putty terminal, for example), to ssh to the machine.

At this point will be on a login node. It will have a name like “br001” or “br006”. This is a fine place to edit and compile codes. However we must be on compute nodes to do actual computing. We have designed Bridges to be the world’s most interactive supercomputer. We generally only require you to use the batch system when you want to. Otherwise, you get your own personal piece of the machine. For this workshop we will use

```
interact
```

to get a regular node of the type we will be using with Spark. You will then see name like “r251” on the command line to let you know you are on a regular node. Likewise, to get a GPU node, use

```
interact -gpu
```

This will be for our TensorFlow work tomorrow. You will then see a prompt like “gpu32”.

Some of you may follow along in real time as I explain things; some of you may wait until exercise time, and some of you may really not get into the exercises until after we wrap up tomorrow. It is all good.

Modules

We have hundreds of packages on Bridges. They each have many paths and variables that need to be set for their own proper environment, and they are often conflicting. We shield you from this with the wonderful `modules` command.

Spark

```
module load spark
```

Editors

For editors, we have several options:

- emacs
- vi
- nano: use this if you aren't familiar with the others

For this workshop, you can actually get by just working from the various command lines.

Programming Language

- We have to pick something
- Pick best domain language
- Python
- But not “Pythonic”
- I try to write generic pseudo-code
 - If you know Java or C, etc. you should be fine.



Warning! Warning!

Several of the packages we are using are very prone to throw warnings about the JVM or some python dependency.

We've stamped most of them out, but don't panic if a warning pops up here or there.

In our other workshops we would not tolerate so much as a compiler warning, but this is the nature of these software stacks, so consider it good experience.

Our Setup For This Workshop

After you copy the files from the training directory, you will have:

/BigData

/Clustering

/MNIST

/Recommender

/Shakespeare

Datasets, and
also **cut and
paste code
samples** are in
here.

Preliminary Exercise

Let's get the boring stuff out of the way now.

- Log on to apr.psc.edu and set an initial password if you have not.
- Log on to Bridges.

```
ssh username@bridges.psc.edu
```

- Copy the Big Data exercise directory from the training directory to your home directory.

```
cp -r ~training/BigData .
```

- Edit a file to make sure you can do so. Use emacs, vi or nano (if the first two don't sound familiar).
- Start an interactive session.

```
interact
```