NET2 Evolution

Facilities Meeting
October 30, 2019
Saul Youssef

100 miles

MGHPCC
MASSACHUSETTS GREEN HIGH PERFORMANCE COMPUTING CENTER

Wonderland   1 min   7:58
Wonderland   4 min

HARVARD
VE RI TAS

Tufts
UNIVERSITY

MIT

1 mile

11 min
every 5 min

BOSTON
UNIVERSITY

1 Summer Street

BOSTON
COLLEGE

NORTHEASTERN UNIVERSITY
LVX VERITAS VIRTVS
BOSTON, MASSACHUSETTS

UMASS

MGHPCC

Boston University
Harvard University
MIT
Northeastern University
University of Massachusetts

- 15 megawatt $90M single purpose data center
- Near zero Carbon footprint
- Space power and cooling for 780 racks
- More than 300,000 x86 cores, millions of gpu cores
- 100Gb/s multi-fiber ring to internet2 and Esnet
- Three new top500 in the past few months
- Exascale storage plans via NESE project
- Located in Holyoke, MA
- Thousands of researchers, >100,000 student population

FAS RC CANNON
HARVARD'S LARGEST CLUSTER

- 100,000 CPU CORES
  3,000+ NODES
- 500 TB RAM
  40PB STORAGE
  2.5M CUDA CORES
- 29 MILLION JOBS/YR
  300 MILLION CPU HR/YR
- 3 DATA CENTERS @ 10K+ FT²
  BOSTON, CAMBRIDGE, & LEED PLATINUM
  GREEN DATA CENTER IN HOLYOKE, MA
- 500+ LAB GROUPS
  OVER 5500 USERS

CANNON: THE FASRC CLUSTER IS NAMED IN HONOR
OF ANNIE JUMP CANNON, A PIONEER IN ASTRONOMY.

top500

M.I.T. Plans College for Artificial Intelligence, Backed by $1 Billion

The Massachusetts Institute of Technology is taking a particularly ambitious step in preparing students to develop, and consider the implications of, artificial intelligence. It is creating a new college, backed by a planned investment of $1 billion.
Cody O'Loughlin for The New York Times

Boston University launches University-wide Computing and Data Science initiative, new building.

MIT News
ON CAMPUS AND AROUND THE WORLD

NEWS   VIDEO   SOCIAL   FOLLOW MIT

An $11.6 million artificial intelligence computing cluster donated by IBM to MIT will come online this fall at the Massachusetts Green High Performance Computing Center (MGHPCC) in Holyoke, Massachusetts.

Photo: Helen Hill/MGHPCC

IBM gives artificial intelligence computing at MIT a lift
Nearly $12 million machine will let MIT researchers run more ambitious AI models.

Kim Martineau | MIT Quest for Intelligence
August 26, 2019

IBM designed Summit, the fastest supercomputer on Earth, to run the calculation-intensive models that power modern artificial intelligence (AI). Now MIT is about to get a slice.

IBM pledged earlier this year to donate an $11.6 million computer cluster to MIT modeled after the architecture of Summit, the supercomputer it built at Oak Ridge National Laboratory for the U.S. Department of Energy. The donated cluster is expected to come online this fall when the MIT Stephen A. Schwarzman College of Computing opens its doors, allowing researchers to run more elaborate AI models to tackle a range of problems, from developing a better hearing aid to designing a longer-lived lithium-ion battery.

RELATED	
Satori	
MIT Quest for Intelligence	
MIT-IBM Watson AI Lab	
Department of Brain and Cognitive Sciences	

▼ Press Inquiries

Lincoln Laboratory's new AI supercomputer is the most powerful at a university

TX-GAIA is tailor-made for crunching through deep neural network operations.

SEPTEMBER 26, 2019 | Kylie Foy | Communications & Community Outreach Office

TX-GAIA is housed inside of a new EcoPOD, manufactured by Hewlett Packard Enterprise, at the site of the Lincoln Laboratory Supercomputing Center in Holyoke, Massachusetts. Photo: Glen Cooper

The new TX-GAIA (Green AI Accelerator) computing system at Lincoln Laboratory's Supercomputing Center (LLSC) has been ranked as the most powerful artificial intelligence (AI) supercomputer at any university in the world. The ranking comes from TOP500, which publishes a list of the top supercomputers in various categories biannually. The system, which was built by Hewlett Packard Enterprise, combines traditional high-performance computing hardware — nearly 900 Intel processors — with hardware optimized for AI applications — 900 Nvidia GPU accelerators.

BU Rafik B. Hariri Institute for Computing and Computational Science & Engineering

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Collaboration Awarded an NSF Grant of $5M to Create New Cloud Computing Testbed

Last month the National Science Foundation (NSF) awarded a significant grant to a team of researchers from Boston University, Northeastern University and UMass Amherst. The grant will support the development of a testbed for new cloud

NESE: Northeast Storage Exchange

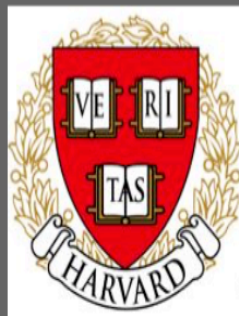National Science Foundation CIF21 DIBBs award 1753840

Boston University

Harvard University

Massachusetts Institute of Technology

Northeastern University

University of Massachusetts

PHASE I: HARDWARE SPECS

12 x 10TB HDD — Data Drive

4 x 480GB SSD — 3x RocksDB 1x CephFS metadata OSD

1 x 64GB NVMe Optane — ~~RockDB WAL~~

2x 100GB SATADOM — SW RAID1 Root Filesystem

Single Socket Intel Xeon 4114 Skylake 2.2 Ghz (3.0 Ghz Turbo), 10C/20T with AVX-512 (AES Encryption offloading)

Bonded 2x10G SFP+ (NESE Net)
Single 1Gbps OBM (Admin net)

Deployed at two sites with 100Gb ethernet.

Starter deployment is 15 PB raw already with ~50% buy-in.

Respond effectively to data growth

The Dell EMC PowerEdge R740xd2 helps you plan for future growth with large internal storage and cost-efficient drive capacities. Deliver two-socket compute performance with flash and fast networking options to meet streaming demands. Simplify management of large data sets with automated administration and front-serviceable drives. The R740xd2 lets you keep your data safely on-premise with built-in security, even as you scale capacity.
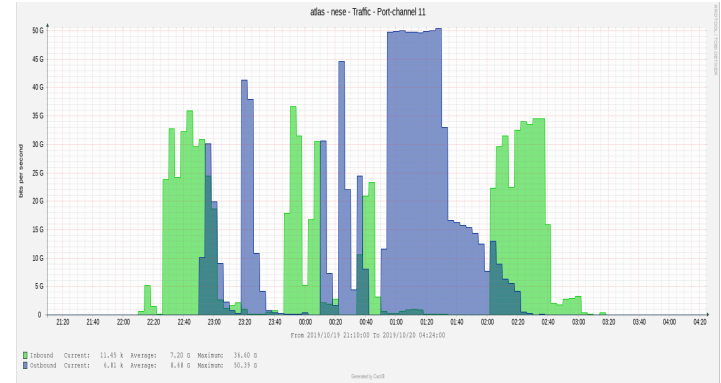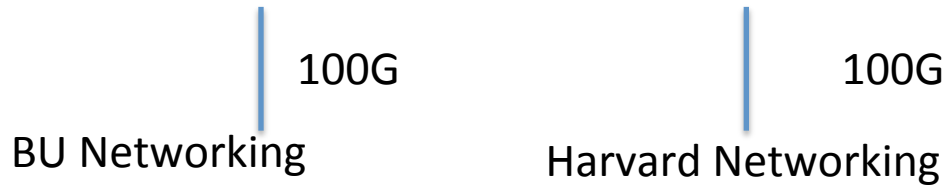
<- Major buy of DELL r740xd2 with 14TB drives, 25G nics

6PB raw for NET2
3PB raw for Northeastern University
7PB more expected soon

Northern Crossroads at MGHPCC

100G   100G

BU Networking   Harvard Networking

atlas - nese - Traffic - Port-channel 11

Demo saturating 2 gateways

2 x 100G
dedicate
for NET2

gridftp.nese.mghpcc.org -> DNS round robin

DELL S5048-ON

ARISTA 100G
ARISTA 100G

DELL S5048-ON
DELL S5048-ON

NESE gateway 25G

OSD
OSD

26 x 10G

NESE gateway 25G

```
nic.host--------nic.name----nic.inet_addr----nic.RX_bytes_s----nic.TX_bytes_s----nic.RX_errors----nic.TX_errors
r1n1.nut.bu.edu.bond0....192.168.3.216.....256.94 MB/s.....763.09 MB/s.....15985......0
r1n2.nut.bu.edu.bond0....192.168.3.217.....255.57 MB/s.....755.20 MB/s.....0......0
r6n1.nut.bu.edu.p1p1....192.168.3.222.....5.62 MB/s.....0.08 MB/s.....0......0
r6n2.nut.bu.edu.p1p1....192.168.3.223.....6.12 MB/s.....0.08 MB/s.....1......0
r6n3.nut.bu.edu.p1p1....192.168.3.224.....17.76 MB/s.....0.10 MB/s.....0......0
r7n1.nut.bu.edu.p1p1....192.168.3.225.....168.67 MB/s.....0.30 MB/s.....0......0
r7n2.nut.bu.edu.p1p1....192.168.3.226.....214.91 MB/s.....0.30 MB/s.....0......0
r7n3.nut.bu.edu.p1p1....192.168.3.227.....521.25 MB/s.....0.74 MB/s.....0......0
r8n1.nut.bu.edu.bond0....192.168.3.228.....2.00 MB/s.....0.54 MB/s.....0......0
r8n2.nut.bu.edu.bond0....192.168.3.229.....1.75 MB/s.....0.45 MB/s.....0......0
r8n3.nut.bu.edu.bond0....192.168.3.209.....236.70 MB/s.....331.93 MB/s.....0......0
r8n4.nut.bu.edu.bond0....192.168.3.210.....192.14 MB/s.....383.73 MB/s.....107087822......0
r9n1.nut.bu.edu.bond0....192.168.3.212.....227.13 MB/s.....239.07 MB/s.....0......0
r9n2.nut.bu.edu.bond0....192.168.3.213.....359.11 MB/s.....237.79 MB/s.....3......0
r9n3.nut.bu.edu.bond0....192.168.3.214.....273.79 MB/s.....719.65 MB/s.....3......0
r9n4.nut.bu.edu.bond0....192.168.3.215.....261.62 MB/s.....721.84 MB/s.....433......0
@.home.gadget:GPFS.section:current.nics
```

NESE gateway 25G

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NESE gateway 25G

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NESE gateway 25G

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5PB GPFS

4 more on order

OSD

8.2 PB raw -> 6.0 PB useable for NET2 with 8+3 EC[7]

1. Retire old Harvard worker nodes
2. Retire LSM software, switching to rucio-mover
3. 100G dedicated networking NET2-NESE
4. Docker containers with Gridftp & Wei's adler32 callout
5. DNS round robin from gridftp.nese.mghpcc.org to gridftp01,02,…

ATLAS Grid Information System

| RC Site | ATLASSite | DDMEndpoint | PANDA Queue | Service | Central Services | DDM Groups | | Service object details | | Docs | TWiki | OLD |

Service

Name: BU_ATLAS_Tier2_SE_173	Site.state: ACTIVE	State: ACTIVE	
Type: SE	Last modified: 2019-10-22 15:55	State updated: 2019-10-22 15:59	Operations: Show Changes log Edit
Site: BU_ATLAS_Tier2	Implementation:	State comment: Object state auto changed to ACTIVE after the creation of DDMEndpoint (NESE_DATADISK)	
is_new: True		Description:	

Associated Protocols

Name	Flavour	Endpoint	Basepath	State	Status	Activities	is_monitored	Description	Settings	Operations
BU_ATLAS_Tier2-SE-GRIDFTP-gridftp.nese.mghpcc.org	GRIDFTP	gsiftp://gridftp.nese.mghpcc.org:2811		ACTIVE		delete_wan/0, read_wan/0, third_party_copy/0, write_wan/0	False			✎ ✖

Add new Service protocol

Manage Service protocols for activity: [READ WAN] [WRITE WAN] [DELETE WAN] [READ LAN] [WRITE LAN] [DELETE LAN] [Third party copy]

Service Resources

Name	Basepath	Endpoint	DDMEndpoints	Extra settings	Operations
ATLASDATADISK		/atlas/datadisk/rucio	NESE_DATADISK	path=		✎ ✖

Add new Service resource

The plan is to use both   NET2_DATADISK   (read/write)
                             NESE_DATADISK   (read only)

…for our PanDA queues

We might give Globus endpoint space to our BU/Harvard/UMass Tier 3 peeps at some point.

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