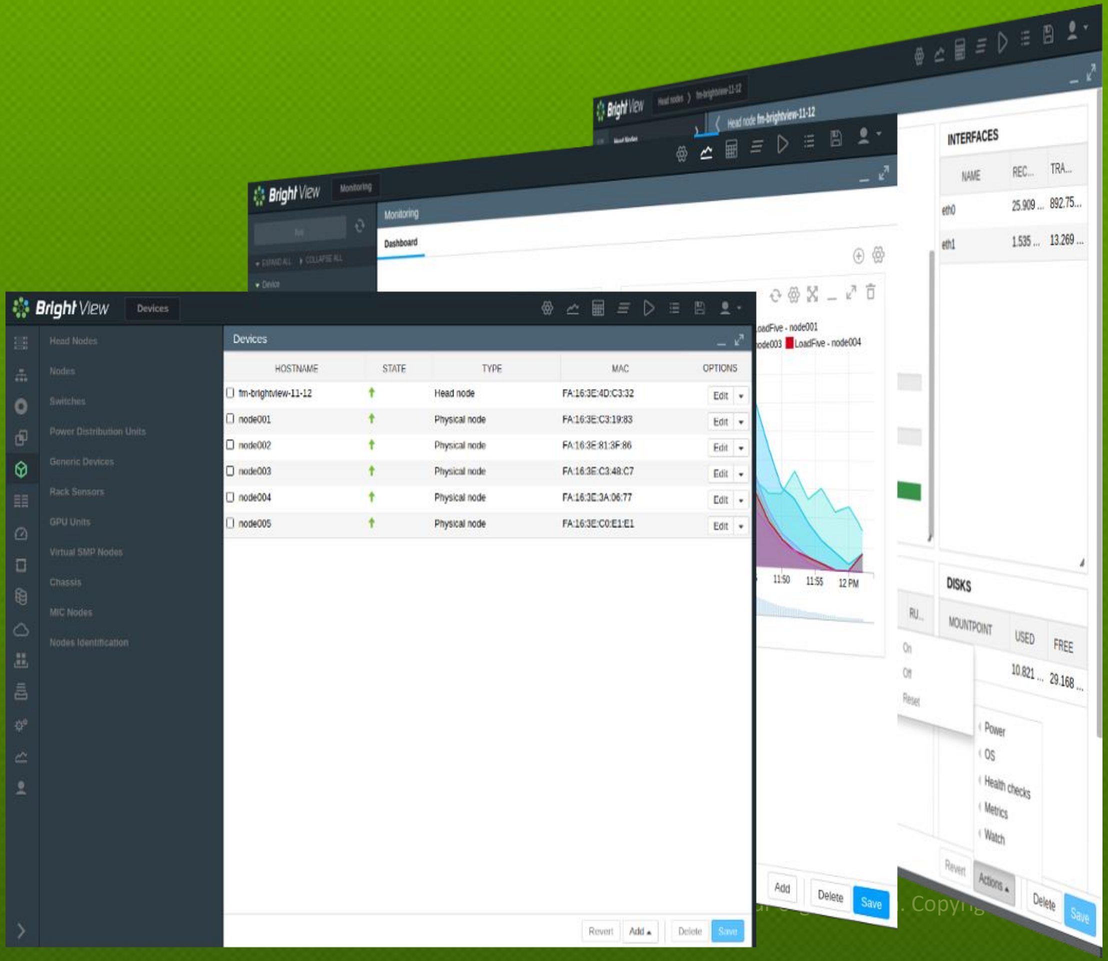
Bright Computing

Advanced cluster & cloud management made easy



Devices

HOSTNAME	STATE	TYPE	MAC	OPTIONS
□ fm-brightview-11-12	↑	Head node	FA:16:3E:4D:C3:32	Edit ▾
□ node001	↑	Physical node	FA:16:3E:C3:19:83	Edit ▾
□ node002	↑	Physical node	FA:16:3E:81:3F:86	Edit ▾
□ node003	↑	Physical node	FA:16:3E:C3:48:C7	Edit ▾
□ node004	↑	Physical node	FA:16:3E:3A:06:77	Edit ▾
□ node005	↑	Physical node	FA:16:3E:C0:E1:E1	Edit ▾

INTERFACES

NAME	REC...	TRA...
eth0	25.909 ...	892.75...
eth1	1.535 ...	13.269 ...

DISKS

MOUNTPOINT	USED	FREE
	10.821 ...	29.168 ...

Panos Labropoulos
Bright Computing, Inc.

1 ABOUT

About Bright

Who we are

- Enterprise infrastructure software company
- Incorporated in 2009
- Headquarters
  - San Jose, California
  - Amsterdam, Netherlands

What we do

- Bare-metal & cloud provisioning, monitoring, management of clustered systems in the data center: Hadoop, private cloud, HPC, storage, database and other "clustered" systems
- From a number of servers to →
  - HPC
  - Hadoop cluster/ Machine Learning
  - OpenStack private cloud

Our success

- Customers around the world: Boeing, ING Bank, Lincoln Financial, Novartis, NASA, DoD, DoE, Stanford, Oracle, HP, Intel, Sinopec and >600 more
- Resellers around the world:
  - OEMs: Atos/Bull, Cray, DDN, Dell, Huawei, Lenovo, SGI, HPE
  - Integrators: >75 around the world
- Award winning …

RED HERRING
WINNER
100
N. AMERICA
Deloitte.
Technology Fast50
Bio·IT World
CONFERENCE & EXPO '13
BEST of SHOW
MERCK
MERCK GLOBAL SERVICES TECHNOLOGY SYMPOSIUM
BEST NEW EXHIBITOR
Main
50
WINNER
2013
HIGHEST GROWTH

2 CUSTOMERS

Bright Computing

Customers – USA

Enterprise

PACCAR
VOITH
FloDesign
CD-adapco
ion
SANOFI
AEROJET
Genomic Health
SRI International
R&D for Government and Business
HALLIBURTON
Genus
ATK
DataDirect NETWORKS
ExxonMobil
Cincinnati Children's
change the outcome
hp
DAWSON
Dawson Geophysical Company
life technologies
MERCK
Roche
454 SEQUENCING
NETEZZA
3M
SEITEL
PGS
PALL
ORACLE
Synapse Technologies
RSI
Torch Technologies
REGAL
The Boeing Company
parc
Palo Alto Research Center
ALTHEA Dx
Lincoln Financial Group
B&W
CISCO
REGENERON

Government

Los Alamos
NATIONAL LABORATORY
Fermilab
NIH
National Institutes of Health
NAVAL MEDICAL RESEARCH CENTER
U.S. NAVY
OAK RIDGE
National Laboratory
NASA
LPS
The Laboratory for Physical Sciences
TACC
The Children's Hospital of Philadelphia
Argonne
NATIONAL LABORATORY
Sandia National Laboratories
ITA
NCSA
NERSC
MCT
INPE
SickKids
tgen
NAVSEA
WARFARE CENTERS
NCAR
LOCKHEED MARTIN

Education

NORTHERN NEW MEXICO COLLEGE
EST. 1909
UNIVERSITY of HOUSTON
UPMC
University of Pittsburgh Medical Center
WASHINGTON STATE UNIVERSITY
UT SOUTHWESTERN MEDICAL CENTER
UNIVERSITY OF PITTSBURGH
THE CITY UNIVERSITY OF NEW YORK
College of Staten Island
UCSF
THE UNIVERSITY OF TOLEDO
1872
CLARK STATE COMMUNITY COLLEGE
UC DAVIS
UNIVERSITY OF CALIFORNIA
W
UNIVERSITY of WASHINGTON
UCSD
UNIVERSITY OF MARYLAND
STANFORD UNIVERSITY
BOISE STATE UNIVERSITY
Stony Brook University
The University of Georgia
GEORGE MASON UNIVERSITY
WAKE FOREST UNIVERSITY
Berkeley
UNIVERSITY OF CALIFORNIA
University of Connecticut
Drexel
UNIVERSITY
CU NY
The City University of New York
TEXAS A&M UNIVERSITY
UMASS
FURB
Rensselaer
Western University
OF HEALTH SCIENCES
The discipline of learning. The art of caring.
SAINT LOUIS UNIVERSITY
WILKES UNIVERSITY
THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON, DC
ESF
Carleton UNIVERSITY
SUNY DOWNSTATE Medical Center
WESLEYAN UNIVERSITY
CMU
CENTRAL MICHIGAN UNIVERSITY
VANDERBILT UNIVERSITY
NYU Langone
MEDICAL CENTER
Jefferson
COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK
AUBURN
MONTGOMERY
UniVap
Universidade do Vale do Paraíba
OLD DOMINION UNIVERSITY
NPS
VirginiaTech
NC STATE UNIVERSITY

Customers – EMEA

Enterprise

- Electrolux
- TOYOTA
- Masdar A MUBADALA COMPANY مصدر
- PI المعهد البترولي THE PETROLEUM INSTITUTE
- ING
- EREDA
- MARK IV Automotive
- Dolphin geophysical
- DNV
- ERAMET
- OSK-ShipTech A/S
- AMD
- EMD International A/S
- AWE
- أرامكو السعودية Saudi Aramco
- MUREX™
- ARMINES
- GLO OPERATING 24/7
- WÄRTSILÄ
- Fraunhofer ITWM
- DELPHI
- globalcollect™ international payment services
- MeteoConsult
- Constellium
- Erasmus MC Universitair Medisch Centrum Rotterdam
- VATTENFALL
- Lundin
- T··Systems···
- CeresPower

Government

- Centre de Recherche Public Gabriel Lippmann
- FMI
- INSA RENNES
- BGS British Geological Survey NATURAL ENVIRONMENT RESEARCH COUNCIL
- CEH Centre for Ecology & Hydrology NATURAL ENVIRONMENT RESEARCH COUNCIL
- departement Mobiliteit en Openbare Werken
- l'Observatoire de Paris
- LERMA
- ENBG
- INRA SCIENCE & IMPACT
- MAX-PLANCK-GESELLSCHAFT
- iit istituto italiano di tecnologia
- caesar center of advanced european studies and research
- NATIONAL OBSERVATORY OF ATHENS
- ONERA THE FRENCH AEROSPACE LAB
- British Antarctic Survey NATURAL ENVIRONMENT RESEARCH COUNCIL
- CERN
- CIRA
- National Nuclear Laboratory
- Inria
- Proudman Oceanographic Laboratory NATURAL ENVIRONMENT RESEARCH COUNCIL
- IAEA International Atomic Energy Agency
- epcc
- CSCS Centro Svizzero di Calcolo Scientifico Swiss National Supercomputing Centre
- JRC EUROPEAN COMMISSION
- sara
- mfi METEO FRANCE INTERNATIONAL
- MARIN

Education

- UNIVERSITY OF CAMBRIDGE
- UCL
- TECHNISCHE UNIVERSITÄT DRESDEN
- Universität Rostock
- UNIVERSITÄT SIEGEN
- UZ LEUVEN
- L'ECOLE DES HAUTES ETUDES EN SCIENCES SOCIALES
- US University of Sussex
- Weill Cornell Medical College
- UNIVERSITÄT DUISBURG ESSEN
- vrije Universiteit amsterdam
- Universität Potsdam
- KAUST
- TU Delft
- Heidelberg Institute for Theoretical Studies
- HITS
- ECOLE DES MINES DE PARIS
- UNIVERSITÄT PADERBORN Die Universität der Informationsgesellschaft
- Universitat d'Alacant Universidad de Alicante
- WARSAW UNIVERSITY OF TECHNOLOGY
- Queen's University Belfast
- Universiteit Utrecht
- FIAS Frankfurt Institute for Advanced Studies
- Technische Universität München
- VUmc
- UNIVERSITÉ DE GENÈVE
- UNIVERSITÉ DE BORDEAUX
- technische universität dortmund
- HLRS
- UNIVERSITY OF OXFORD
- SCUOLA NORMALE SUPERIORE
- Freie Universität Berlin
- The University of Nottingham
- TECHNISCHE UNIVERSITÄT ILMENAU
- IPGP
- Universidad Zaragoza
- Catalysis Leibniz-Institut für Katalyse e.V.
- northumbria UNIVERSITY
- University of Wales Prifysgol Cymru
- University of Leicester
- UNIVERSITÉ DE STRASBOURG
- ÖAW
- institut Curie Together, let's beat cancer.
- Leibniz Universität Hannover
- TU/e Technische Universiteit Eindhoven University of Technology
- University of BRISTOL

Customers – Asia

Enterprise

Panasonic

中国石化 SINOPEC

Petrofac

National Heart Centre Singapore
SingHealth

BingoCloud™

CD-adapco

TATA

AVIC 中国航空工业集团公司
Aviation Industry Corporation of China

TOWER
INTERNATIONAL

Government

KAERI

A*STAR
Institute for Infocomm Research

NCI

iVEC

CSIR INDIA

CSIRO

CHINESE ACADEMY OF SCIENCES

JAXA

NICT National Institute of Information and Communications Technology

Queensland Government

DGIST
대구경북과학기술원

KMA Korea Meteorological Administration

Shanghai Astronomical Observatory, CAS

Education

東京工業大学
Tokyo Institute of Technology

TOKAI

CATHOLIC UNIVERSITY OF KOREA

TAT 国立大学法人 東京農工大学
Tokyo University of Agriculture and Technology

ibs Institute for Basic Science

東京大学
THE UNIVERSITY OF TOKYO

IAP CAS

Keio University
1858
CALAMVS GLADIO FORTIOR

KYOTO UNIVERSITY
KYOTO JAPAN
FOUNDED 1897

重庆大学
CHONGQING UNIVERSITY

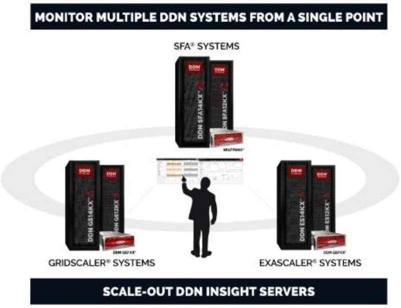
清華大学
Tsinghua University

UNIST
Ulsan National Institute of Science and Technology

NANYANG TECHNOLOGICAL UNIVERSITY

INDIAN INSTITUTE OF SCIENCE

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA


MONITOR MULTIPLE DDN SYSTEMS FROM A SINGLE POINT

SFA® SYSTEMS

GRIDSCALER® SYSTEMS

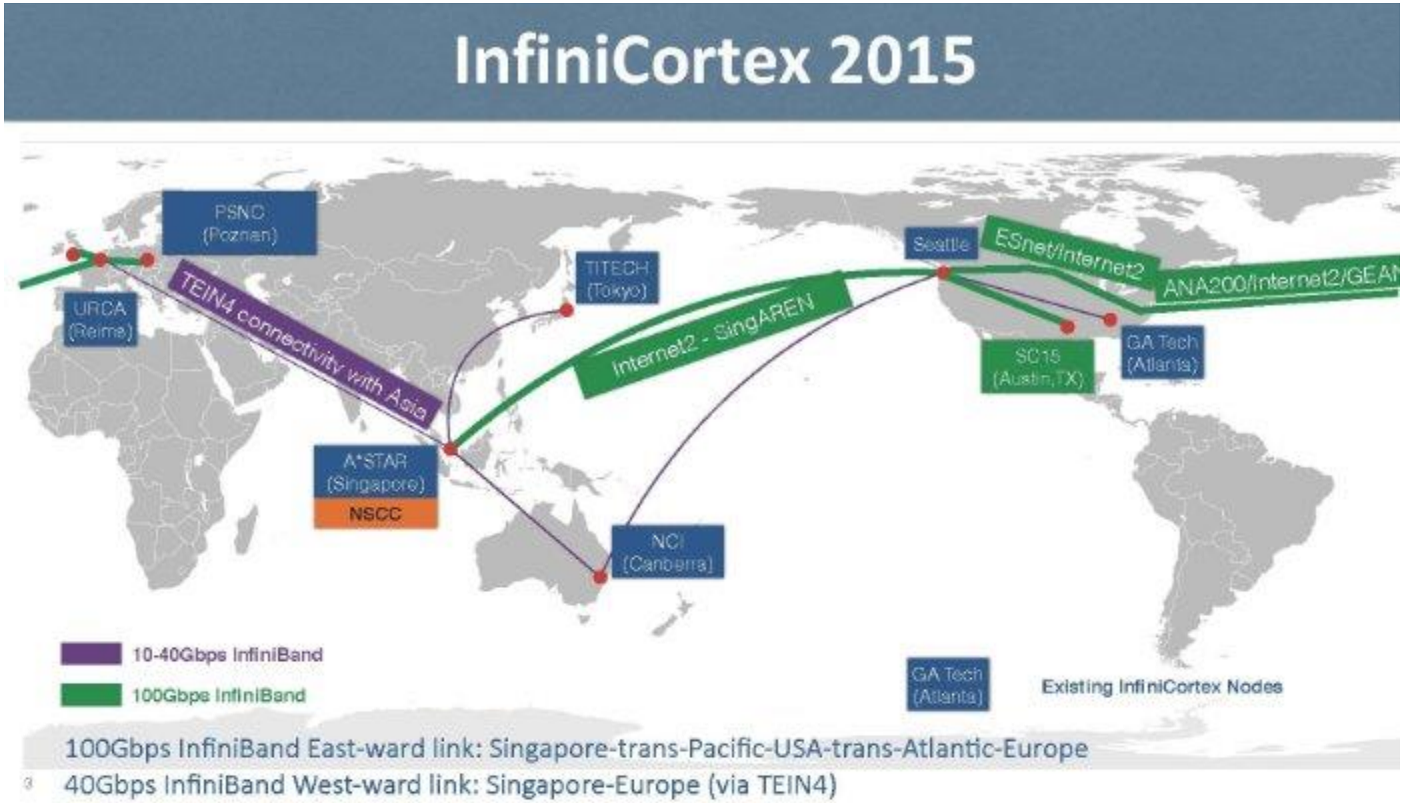
EXASCALER® SYSTEMS

SCALE-OUT DDN INSIGHT SERVERS

Embedded in other solutions

In the open seas

Management nodes 6300km away



InfiniCortex 2015

100Gbps InfiniBand East-ward link: Singapore-trans-Pacific-USA-trans-Atlantic-Europe

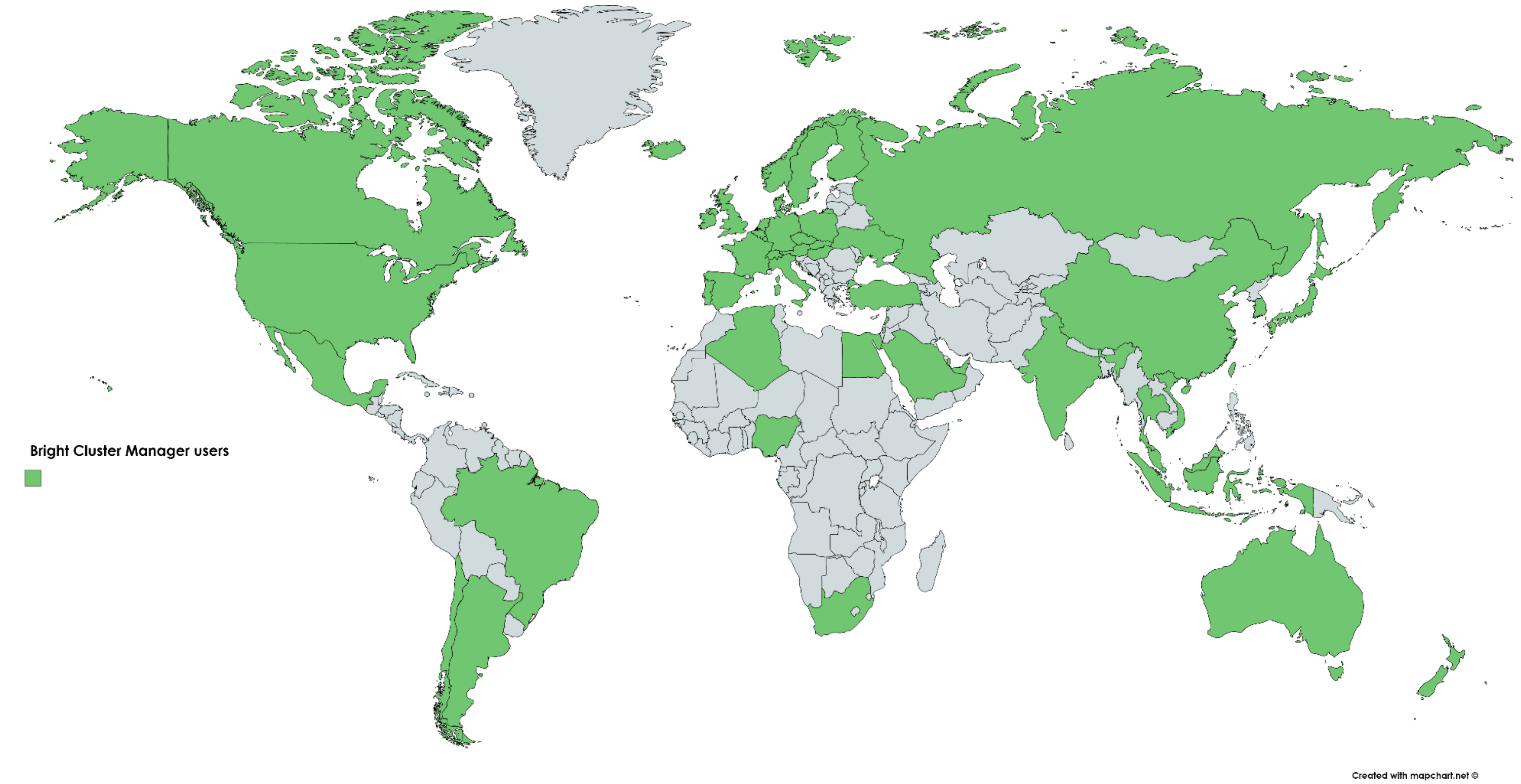
40Gbps InfiniBand West-ward link: Singapore-Europe (via TEIN4)

Dark sites

Partners

Resellers / OEMs / ISVs

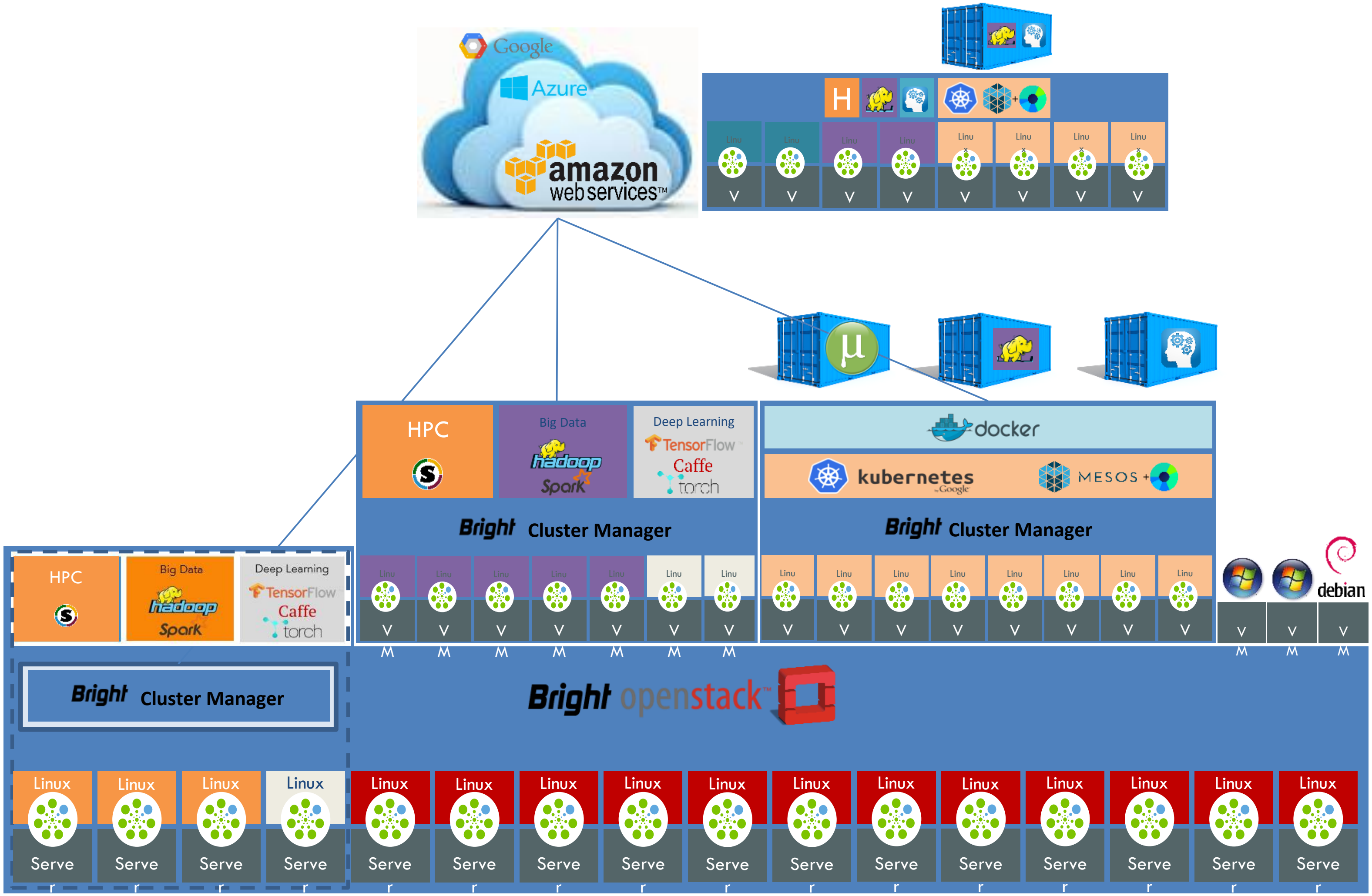
DELL Bull atos technologies HUAWEI CRAY Hewlett Packard Enterprise lenovo



- From 4 to 8,000+ nodes
- Single user to few million jobs/day
- Multiple architectures: x86, Power 8/9 and soon ARMv8
- Multiple Linux distributions: RHEL/Centos/SL 6 and 7 , SLES 11 & 12, Ubuntu LTS
- Multiple interconnects: Infiniband, OmniPath, HSE, ROCE, usNIC, PCI-E switches, iWARP, NVlink
- Multiple types of accelerators, NVIDIA GPUs, AMD GPUs, Intel Xeon Phis, FPGAs and other ASICs
- Bare-metal vs virtualized
- Bare-metal vs containerized
- On-premise vs on the cloud

Heterogenous clusters are the rule, not the exception!

The dynamic data center



3 THE PROBLEM

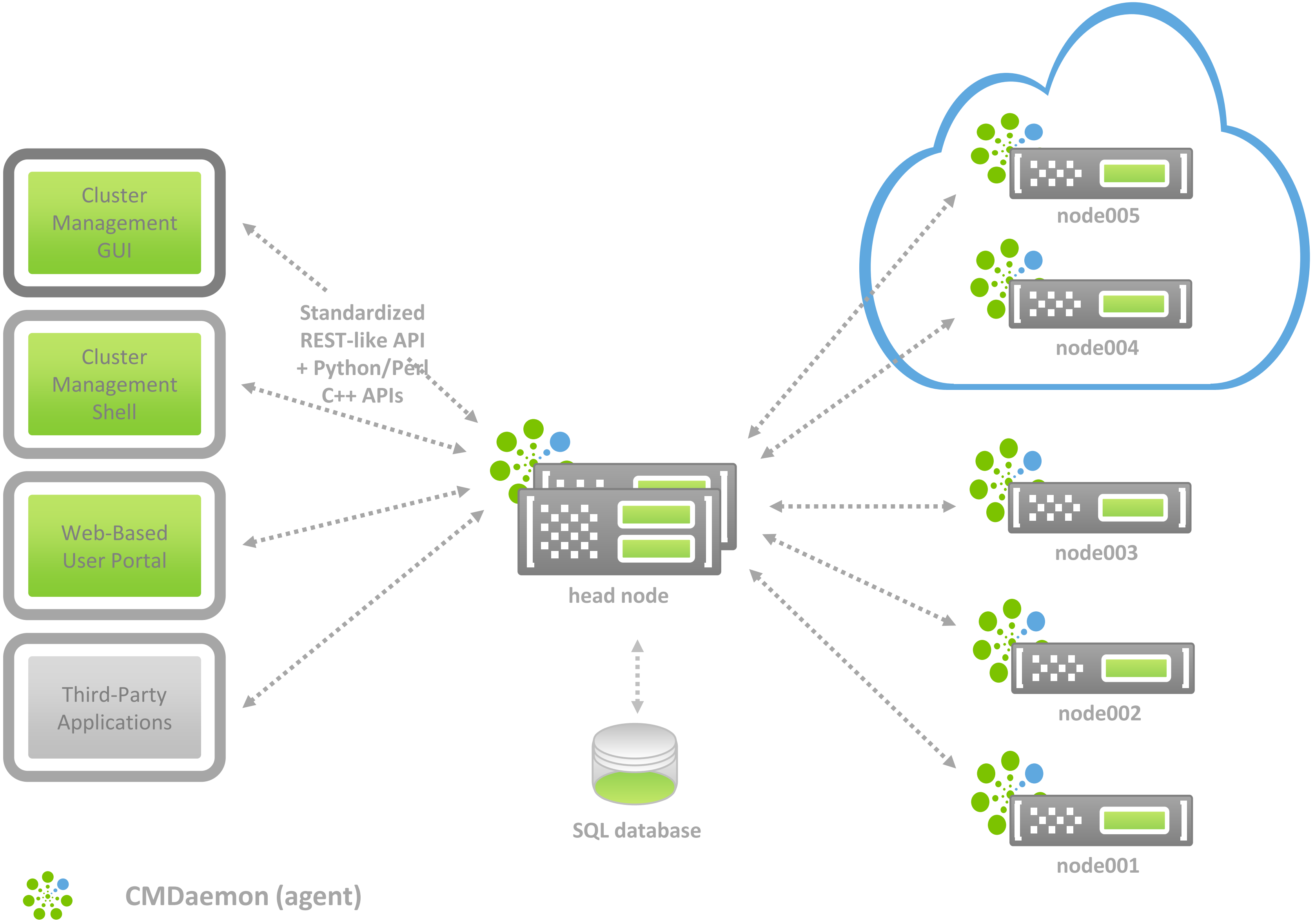
The Problem According to IDC

- Clusters are still hard to setup, operate, use and manage
- New buyers require “ease-of-everything”
- The shortage of skilled people is a major hindrance
- Software is still the #1 roadblock
- Better management software is needed

A Better Solution

- Bright Cluster Manager takes a much more fundamental & integrated approach
  - Designed and written from the ground up
  - Single cluster management agent provides all functionality
  - Single, central database for configuration and monitoring data
  - Single UI for ALL cluster management functionality
  - Enterprise-level support
- Which makes Bright Cluster Manager …
  - Extremely easy to use
  - Extremely scalable
  - Secure & reliable
  - Complete
  - Flexible
  - Maintainable

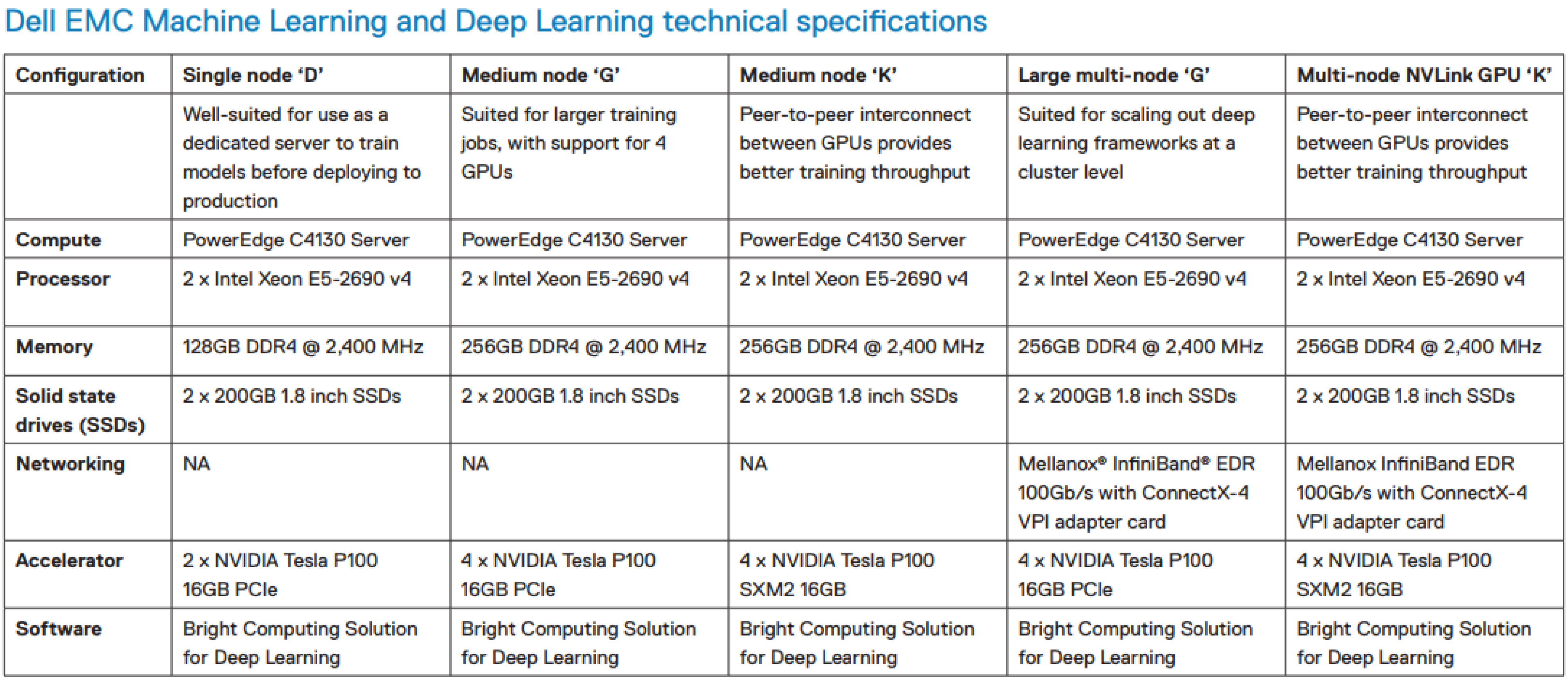
Bright Architecture



Bright Cluster Manager and Deep Learning

- BCM DL packages is the default AI stack for a number of OEMs including:

DELL CRAY Hewlett Packard Enterprise



Dell EMC Machine Learning and Deep Learning technical specifications

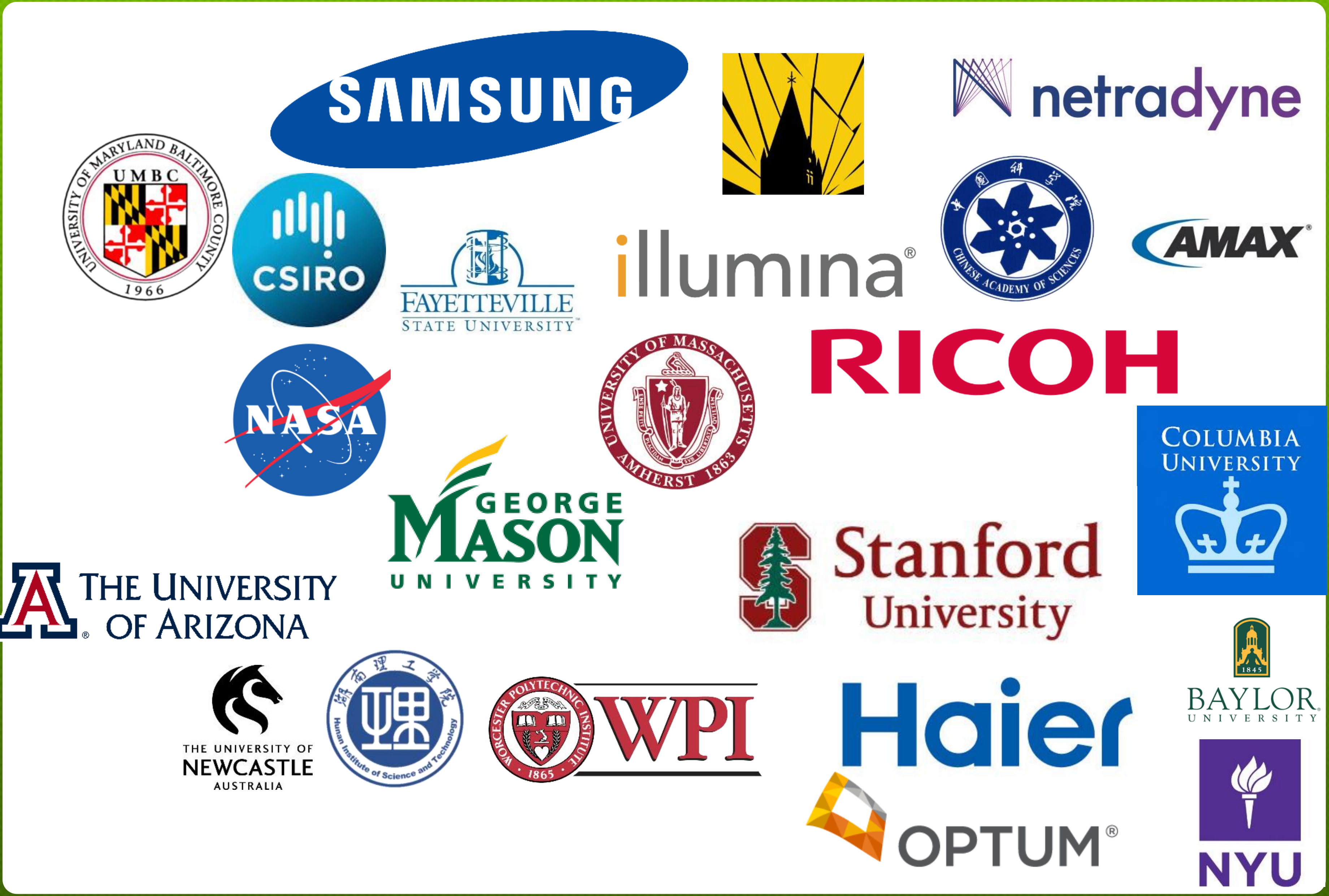
Configuration	Single node 'D'	Medium node 'G'	Medium node 'K'	Large multi-node 'G'	Multi-node NVLink GPU 'K'
	Well-suited for use as a dedicated server to train models before deploying to production	Suited for larger training jobs, with support for 4 GPUs	Peer-to-peer interconnect between GPUs provides better training throughput	Suited for scaling out deep learning frameworks at a cluster level	Peer-to-peer interconnect between GPUs provides better training throughput
Compute	PowerEdge C4130 Server	PowerEdge C4130 Server	PowerEdge C4130 Server	PowerEdge C4130 Server	PowerEdge C4130 Server
Processor	2 x Intel Xeon E5-2690 v4	2 x Intel Xeon E5-2690 v4	2 x Intel Xeon E5-2690 v4	2 x Intel Xeon E5-2690 v4	2 x Intel Xeon E5-2690 v4
Memory	128GB DDR4 @ 2,400 MHz	256GB DDR4 @ 2,400 MHz	256GB DDR4 @ 2,400 MHz	256GB DDR4 @ 2,400 MHz	256GB DDR4 @ 2,400 MHz
Solid state drives (SSDs)	2 x 200GB 1.8 inch SSDs	2 x 200GB 1.8 inch SSDs	2 x 200GB 1.8 inch SSDs	2 x 200GB 1.8 inch SSDs	2 x 200GB 1.8 inch SSDs
Networking	NA	NA	NA	Mellanox® InfiniBand® EDR 100Gb/s with ConnectX-4 VPI adapter card	Mellanox InfiniBand EDR 100Gb/s with ConnectX-4 VPI adapter card
Accelerator	2 x NVIDIA Tesla P100 16GB PCIe	4 x NVIDIA Tesla P100 16GB PCIe	4 x NVIDIA Tesla P100 SXM2 16GB	4 x NVIDIA Tesla P100 16GB PCIe	4 x NVIDIA Tesla P100 SXM2 16GB
Software	Bright Computing Solution for Deep Learning	Bright Computing Solution for Deep Learning	Bright Computing Solution for Deep Learning	Bright Computing Solution for Deep Learning	Bright Computing Solution for Deep Learning

CRAY® CS-STORM™ ACCELERATED GPU SYSTEM

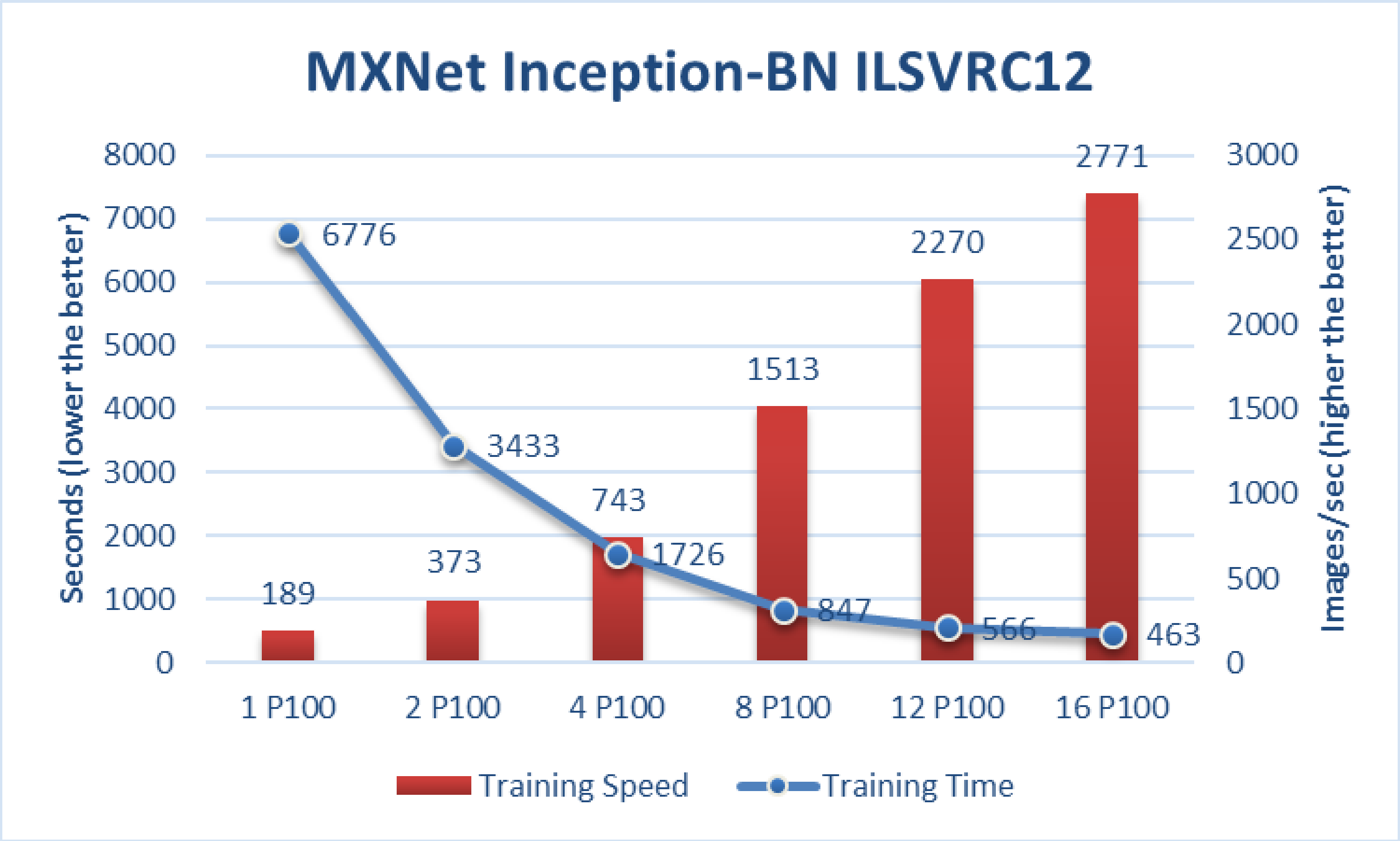
Cray® CS-Storm™ cluster supercomputers tackle the toughest extreme HPC and artificial intelligence (AI) workloads. Designed for speed, architected for scale and integrated for production use, the Cray CS-Storm GPU-accelerated supercomputer is your path to exploiting the performance available from the latest NVIDIA® Tesla® GPUs.

AI Software	Supports Bright Cluster Manager™ for HPC and an optional Bright Deep Learning extension
	Machine learning frameworks including Caffe, Chainer, CNTK, Keras, MXet, Pytorch, Scikit-learn, Tensorflow, Theano, Torch, Dynet, Intel Neon, TensorFlowOnSpark, BigDL, Deeplearn4j

Bright DL users

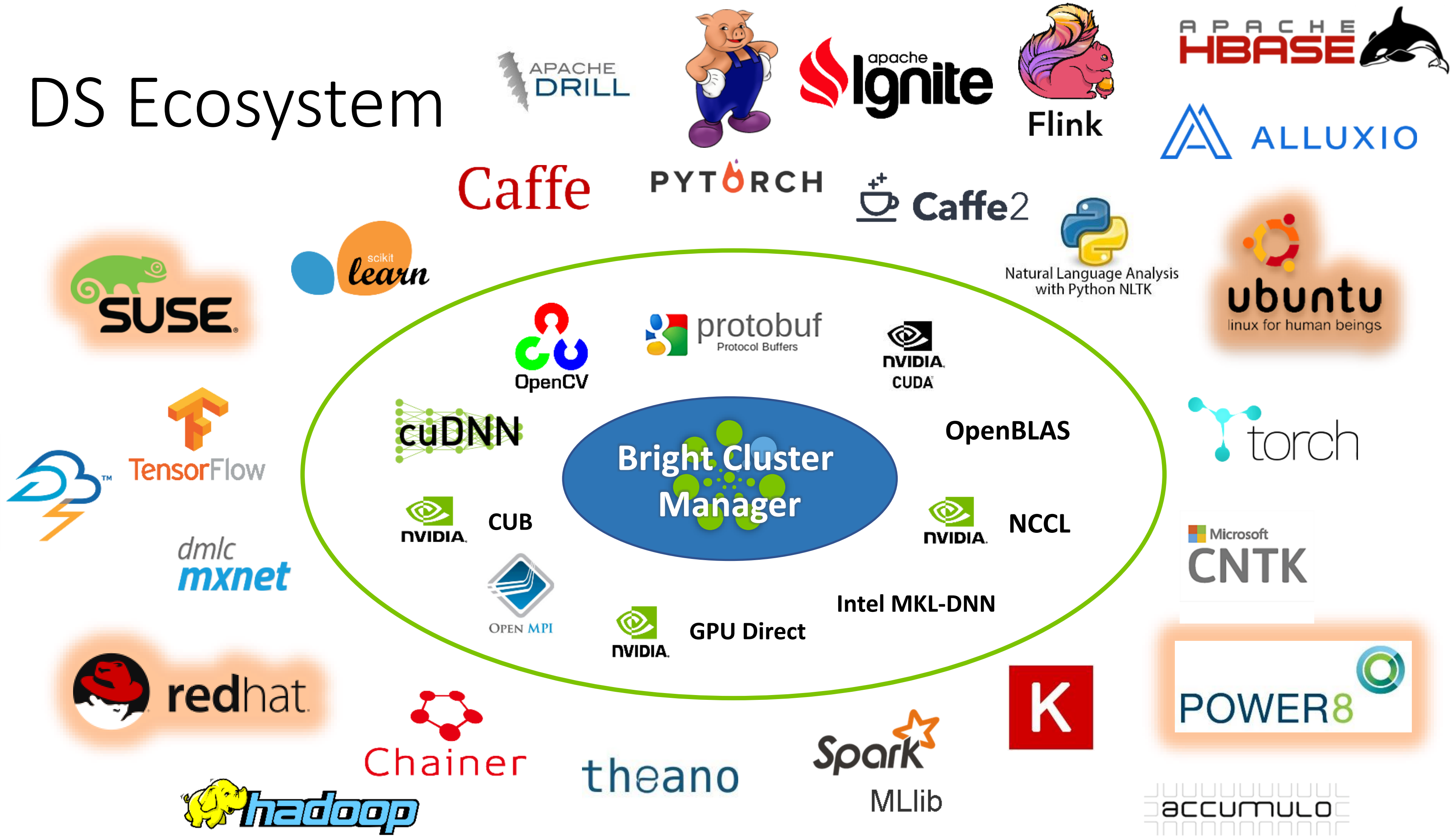


Dell benchmarks



http://en.community.dell.com/techcenter/high-performance-computing/b/general_hpc/archive/2016/11/11/deep-learning-performance-with-p100-gpus

DS Ecosystem



APACHE DRILL

apache Ignite

Flink

APACHE HBASE

ALLUXIO

Caffe

PYTORCH

Caffe2

scikit learn

SUSE

Natural Language Analysis with Python NLTK

ubuntu
linux for human beings

OpenCV

protobuf
Protocol Buffers

NVIDIA CUDA

cuDNN

Bright Cluster Manager

OpenBLAS

torch

TensorFlow

NVIDIA CUB

NVIDIA NCCL

Microsoft CNTK

dmlc mxnet

OPEN MPI

NVIDIA GPU Direct

Intel MKL-DNN

redhat

Chainer

theano

Spark MLlib

K

POWER8

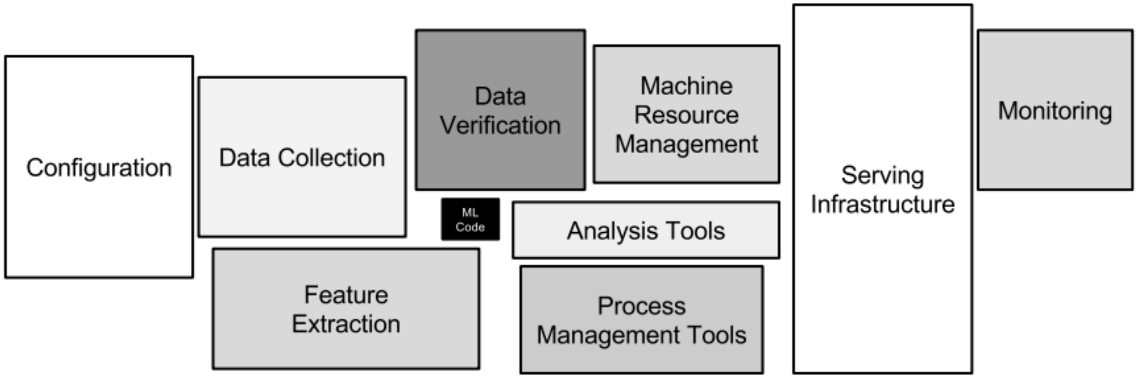
hadoop

accumulo

Goals

- Easily call deep learning libraries within existing Big Data workflows, making it immediately available to Big Data application developers.
- Seamlessly perform transfer learning of deep learning models
- Leverage existing Big Data installations to productionize high quality models at scale
- Exploit the already excellent support of Big Data tools when it come to SQL functions
- Process more easily complex data such as images, audio and video from Big Data pipelines
- Support all/most popular frameworks from Python, Java, Scala and R

A Deep Learning pipeline



Configuration

Data Collection

Data Verification

Machine Resource Management

Serving Infrastructure

Monitoring

ML Code

Analysis Tools

Feature Extraction

Process Management Tools

Zhang et al.

Figure 1: Only a small fraction of real-world ML systems is composed of the ML code, as shown by the small black box in the middle. The required surrounding infrastructure is vast and complex.

Anti-patterns

Glue code: DL package are developed as stand-alone solutions. Incorporating those in a data reduction pipeline results a glue code paradigm (5% DL code, 95% glue code). Makes it hard to take advantage of domain-specific properties

Pipeline jungles: Preparing data in an ML-friendly format may become a jungle of scrapes, joins, and sampling steps, often with intermediate files output. Often the result of separation between “Research” and “Engineering”

Dead experimental code paths: It becomes increasingly attractive in the short term to perform experiments with alternative frameworks. Increasing difficulties of maintaining backward compatibility and an complexity.

Goals (contd.)

- Turn-key solution: keys included (NCCL, CuDNN, HPC-X, MKL, CUDA)
- Optimized out of the box
- Native applications for the underlying distro
- Not enforcing the use of docker
- Use native package manager to install frameworks + dependencies
- Install on shared storage
- Much more aggressive optimizations on CPU part
- Integration with HPX/Big Data enabled (e.g. Tensorflow understands AmazonS3 and HDFS)
- QA testing and release engineering & leveraging expertise and feedback from more than 500 HPC sites

Goals (cont.d)

- -dev packages
- Common environment across all supported distros and archs (CUDA 9.1, CuDNN 7.0, MKL/OpenBLAS 0.2.20, GCC_cuda, OMPI 3.x+Mellanox extensions, NCCL2)
- Native Python + Python 3.6 support
- Examples should work out of the box

With Bright: Two simple commands

```
# yum install tensorflow cntk mxnet digits

# yum --installroot=/cm/images/default-image \
install cm-ml-distdeps
```

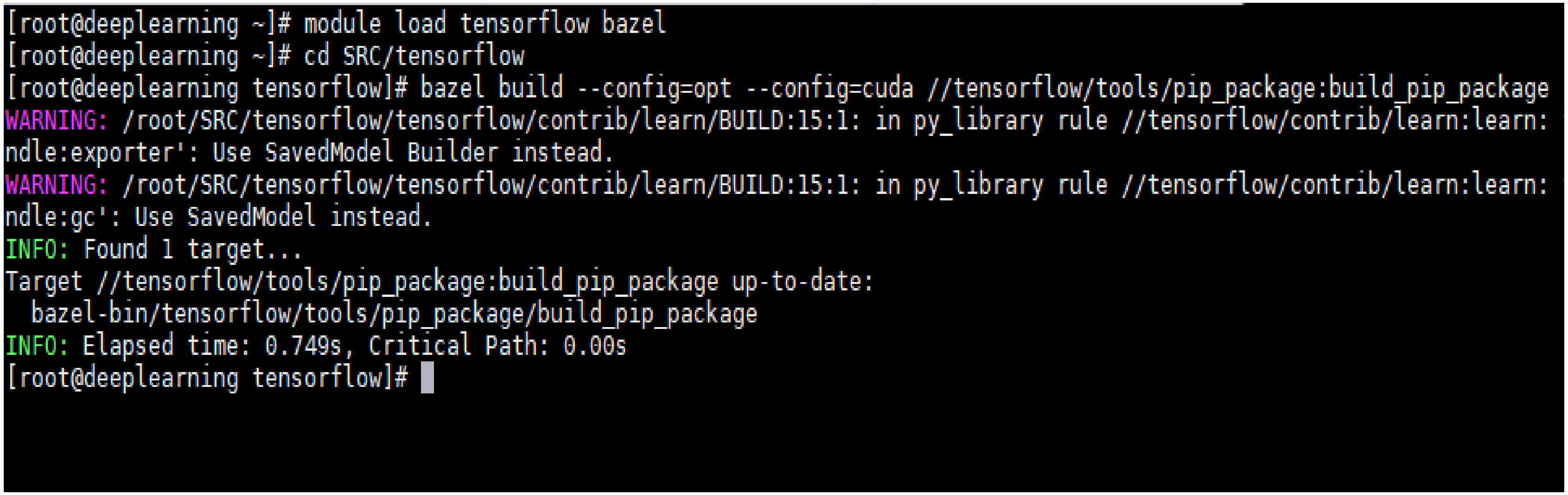
- 1st command installs Tensorflow etc in a shared directory on the head node; It is immediately available on every node in cluster
- Yum installs all dependencies for DIGITS including Caffe, Torch, and all Python dependencies
- 2nd command installs all library dependencies into default-image

Running an application is really simple

```
[root@bright80-r720 ~]# module load tensorflow/1.5.0rc1

[root@bright80-r720 ~]# cd  models/image/imagenet

[root@bright80-r720 imagenet]# python classify_image.py --image_file=Indochinese-Tiger-Zoo.jpg
I tensorflow/core/common_runtime/gpu/gpu_init.cc:102] Found device 0 with properties:
name: Tesla K40c
major: 3 minor: 5 memoryClockRate (GHz) 0.745
pciBusID 0000:05:00.0
Total memory: 11.92GiB
Free memory: 11.78GiB


tiger, Panthera tigris (score = 0.71628)
tiger cat (score = 0.11725)
lynx, catamount (score = 0.00376)
jaguar, panther, Panthera onca, Felis onca (score = 0.00371)
cougar, puma, catamount, mountain lion, painter, panther, Felis concolor (score = 0.00218)
[root@bright73-r720 imagenet]#
```

Developer-friendly

- Some users are Dl framework developers



```
[root@deeplearning ~]# module load tensorflow bazel
[root@deeplearning ~]# cd SRC/tensorflow
[root@deeplearning tensorflow]# bazel build --config=opt --config=cuda //tensorflow/tools/pip_package:build_pip_package
WARNING: /root/SRC/tensorflow/tensorflow/contrib/learn/BUILD:15:1: in py_library rule //tensorflow/contrib/learn:learn:
ndle:exporter': Use SavedModel Builder instead.
WARNING: /root/SRC/tensorflow/tensorflow/contrib/learn/BUILD:15:1: in py_library rule //tensorflow/contrib/learn:learn:
ndle:gc': Use SavedModel instead.
INFO: Found 1 target...
Target //tensorflow/tools/pip_package:build_pip_package up-to-date:
  bazel-bin/tensorflow/tools/pip_package/build_pip_package
INFO: Elapsed time: 0.749s, Critical Path: 0.00s
[root@deeplearning tensorflow]#
```

All the necessary tools to get started with Machine Learning development are installed by default.

Available Machine Learning Frameworks (January 2018)

Framework	Graph	Version	Notes
caffe)(-nv)	static	0.16.5	half-precision support, nccl2
caffe2	static	0.8.1	OpenMPI, nccl2
caffe-mpi	static	2.0	OpenMPI+HPCX acceleration, nccl2
chainer	dynamic	3.2.0	
CafffeOnSpark	static	0.1	Spark 2.x
CNTK	static	2.3.1	OpenMPI, MKL
Keras	N/A	2.1.2	Theano, CNTK and Tensorflow backends
MXNet	static	1.0 post4	Scala bindings
Pytorch	dynamic	0.4.0a0	+Patches for CUDA 9.1 support and MPI Allreduce, nccl2, OpenmPI 3 + HPC-X
Scikit-learn	static	0.19.1	
Tensorflow	static*	1.5.0	Infiniband, HDFS, SPARK, Mesos, Docker, Kubernetes, Fold, Serving, nccl2
Theano	static	1.0.1	
Torch	static	7.0	+ patches for CUDA 9.1 support, nccl2, FP16 fixes
dynet	*dynamic*	*2.0.2*	
Intel Neon	*static*	*2.6.0*	
TensorFlowOnSpark	*static*	*0.12*	
BigDL	*N/A*	*0.1.1*	
deeplearning4j		*0.5.0*	

Available supporting libraries/tools (January 2018)

Package	Version	Notes
bazel	0.9.0	0.6.7 on Power
cub	1.7.4	
CUDA Driver	384.111	Tesla-certified version
CUDA	9.1	Only 9.1 is supported for DL
CUDNN	6.0,7.0	
digits	6.0.1	Plus bug fixes from ‘master’ branch
gflags	2.2.1	
glog	0.3.5	
HDF5	1.8.18	
leveldb	1.20	
lmdb	0.9.21	Scala bindings
NCCL	1.3.4-1 and 2.0	Patches for CUDA 9.1 support to NCCL 1.3.4
OpenCV	3.1.0	3.2.0 does not work with CNTK
Protobuf	3.2.0 and 2.5.4	
eigen3		
python	3.6.3 + 2.7.5	
Mellanox HPC-X	2.0	
EasyBuild	3.5.1	
OpenMPI	3.0.0	CUDA 9.1 and Mellanox MXM, Knem, HCOLL, FCA support
TensorRT	3.1.2	

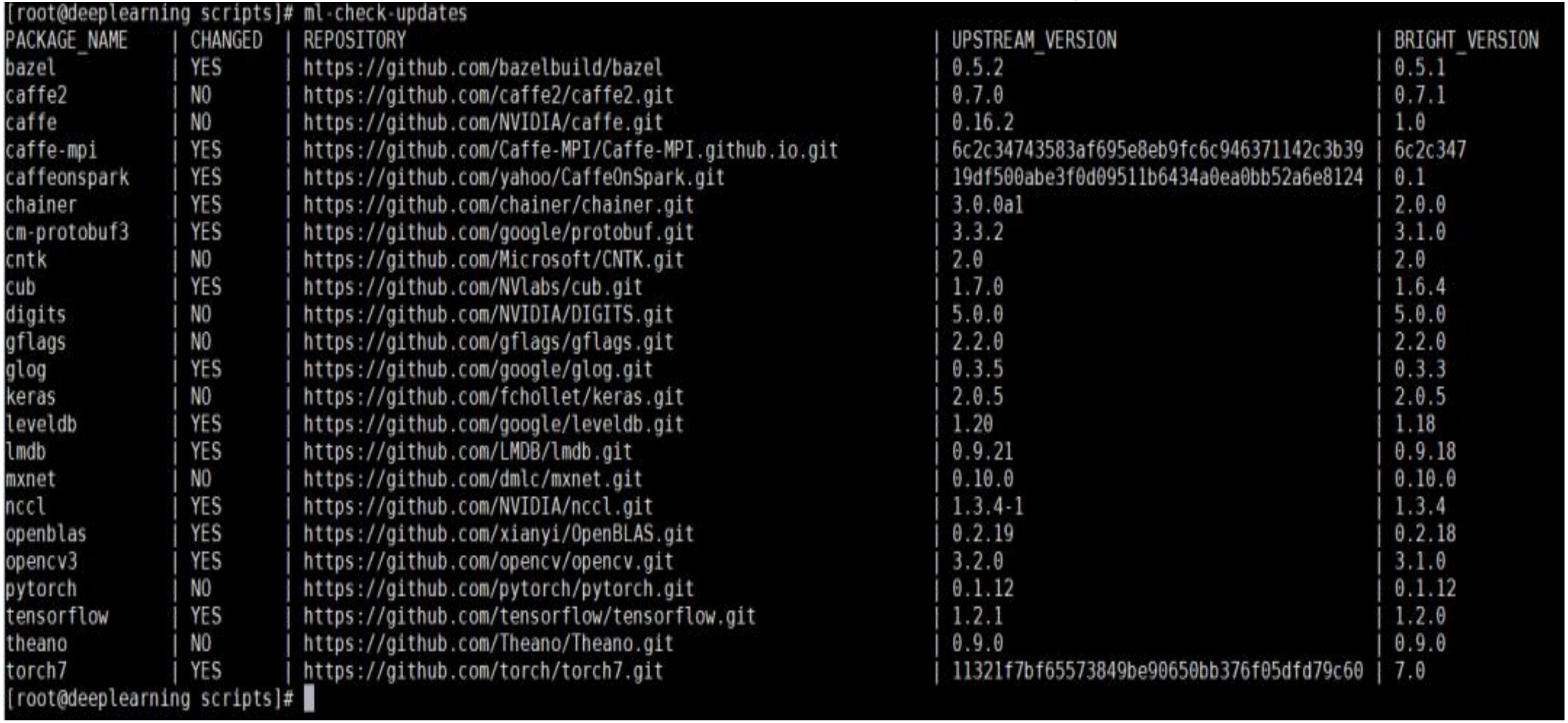
Python and friends

- Python package versions are the common denominator

chardet	3.0.2	pandas	0.19.2
configobj	4.7.2	pathlib2	2.2.0
Cython	0.25.2	pip	
Flask	0.10.1	protobuf	3.1.0.post1
Flask-SocketIO	2.6	psutil	3.4.2
Flask-WTF	0.12	py4j	0.10.4
gevent	1.2.1	pycuda	2015.1
gunicorn	17.5	pycurl	7.19.0
h5py	2.6.0	pydot	1.1.0
hypothesis		pydot2	1.0.33
iniparse	0.4	pyliblzma	0.5.3
ipython	5.1.0	python-gflags	3.1.0
Jupyter	4.3.0	pytools	
JupyterHub	`	PyYAML	3.12
kitchen	1.1.1	scikit-cuda	0.5.1
leveldb	0.194	scikit-fmm	0.0.9
lmdb	0.87	scikit-image	0.12.3
matplotlib	1.5.1	scikit-learn	
mercurial	2.6.2	scipy	
mock	2.0.0	selenium	3.0.2
netaddr	0.7.18	setuptools	
nltk		Sphinx	1.5.1
nose	1.3.7	wheel	0.29.0
nose-parameterized	0.5.0		

Always the latest upstream version

- Two week update cycle – DL frameworks change
- Upgradable via package manager e.g. apt-get dist-upgrade

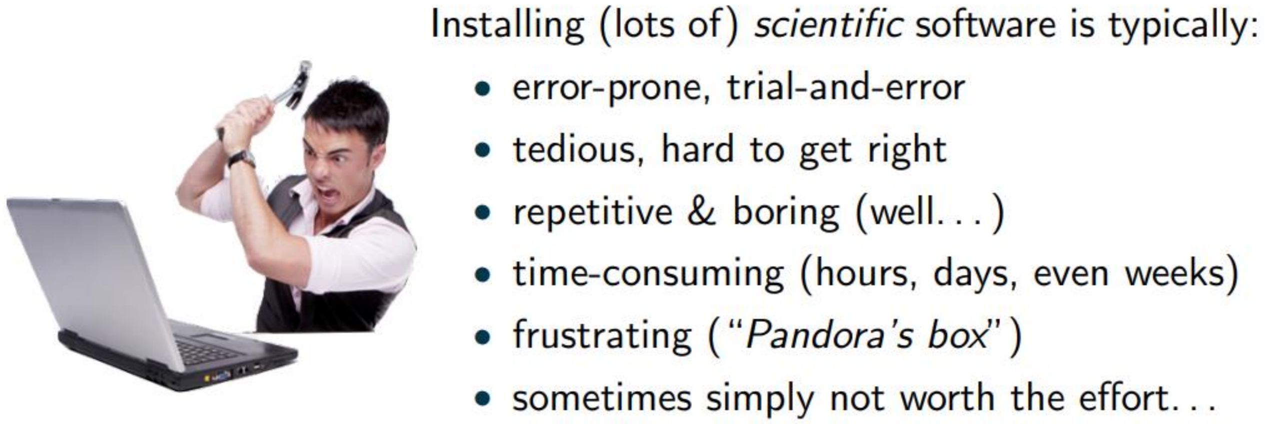


```
[root@deeplearning scripts]# ml-check-updates
PACKAGE_NAME  | CHANGED | REPOSITORY                                              | UPSTREAM_VERSION                         | BRIGHT_VERSION
bazel         | YES     | https://github.com/bazelbuild/bazel                     | 0.5.2                                    | 0.5.1
caffe2        | NO      | https://github.com/caffe2/caffe2.git                    | 0.7.0                                    | 0.7.1
caffe         | NO      | https://github.com/NVIDIA/caffe.git                     | 0.16.2                                   | 1.0
caffe-mpi     | YES     | https://github.com/Caffe-MPI/Caffe-MPI.github.io.git    | 6c2c34743583af695e8eb9fc6c946371142c3b39 | 6c2c347
caffeonspark  | YES     | https://github.com/yahoo/CaffeOnSpark.git               | 19df500abe3f0d09511b6434a0ea0bb52a6e8124 | 0.1
chainer       | YES     | https://github.com/chainer/chainer.git                  | 3.0.0a1                                  | 2.0.0
cm-protobuf3  | YES     | https://github.com/google/protobuf.git                  | 3.3.2                                    | 3.1.0
cntk          | NO      | https://github.com/Microsoft/CNTK.git                   | 2.0                                      | 2.0
cub           | YES     | https://github.com/NVlabs/cub.git                       | 1.7.0                                    | 1.6.4
digits        | NO      | https://github.com/NVIDIA/DIGITS.git                    | 5.0.0                                    | 5.0.0
gflags        | NO      | https://github.com/gflags/gflags.git                    | 2.2.0                                    | 2.2.0
glog          | YES     | https://github.com/google/glog.git                      | 0.3.5                                    | 0.3.3
keras         | NO      | https://github.com/fchollet/keras.git                   | 2.0.5                                    | 2.0.5
leveldb       | YES     | https://github.com/google/leveldb.git                   | 1.20                                     | 1.18
lmdb          | YES     | https://github.com/LMDB/lmdb.git                        | 0.9.21                                   | 0.9.18
mxnet         | NO      | https://github.com/dmlc/mxnet.git                       | 0.10.0                                   | 0.10.0
nccl          | YES     | https://github.com/NVIDIA/nccl.git                      | 1.3.4-1                                  | 1.3.4
openblas      | YES     | https://github.com/xianyi/OpenBLAS.git                  | 0.2.19                                   | 0.2.18
opencv3       | YES     | https://github.com/opencv/opencv.git                    | 3.2.0                                    | 3.1.0
pytorch       | NO      | https://github.com/pytorch/pytorch.git                  | 0.1.12                                   | 0.1.12
tensorflow    | YES     | https://github.com/tensorflow/tensorflow.git            | 1.2.1                                    | 1.2.0
theano        | NO      | https://github.com/Theano/Theano.git                    | 0.9.0                                    | 0.9.0
torch7        | YES     | https://github.com/torch/torch7.git                     | 11321f7bf65573849be90650bb376f05dfd79c60 | 7.0
[root@deeplearning scripts]# █
```

- Risk of breaking things or making users unhappy if they are unprepared for and upgrade

Please install this package on the cluster

- In some cases building from source is preferred as it allows to control libraries, compilers and optimizing the software for a particular architecture (AVX, network, Intel KNL, AMD GPUs,…)



Installing (lots of) *scientific* software is typically:

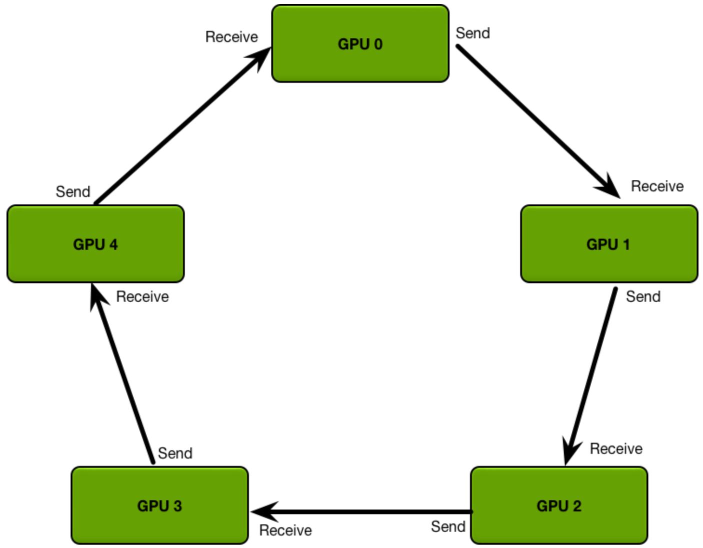
- error-prone, trial-and-error
- tedious, hard to get right
- repetitive & boring (well. . .)
- time-consuming (hours, days, even weeks)
- frustrating (“*Pandora’s box*”)
- sometimes simply not worth the effort. . .

OpenMPI

- ./configure --with-hcoll=/cm/shared/apps/hpcx/2.0.0/hcoll
- --with-mxm=/cm/shared/apps/hpcx/2.0.0/mxm
- --with-knem=/cm/shared/apps/hpcx/2.0.0/knem
- --with-fca
- --with-verbs --enable-mpi-thread-multiple
- --with-slurm **--with-platform=contrib/platform/mellanox/optimized**
- --with-cuda=/cm/shared/apps/cuda80/toolkit/current
- --with-cuda-libdir=/cm/local/apps/cuda-driver/libs/current/lib64 <other options>

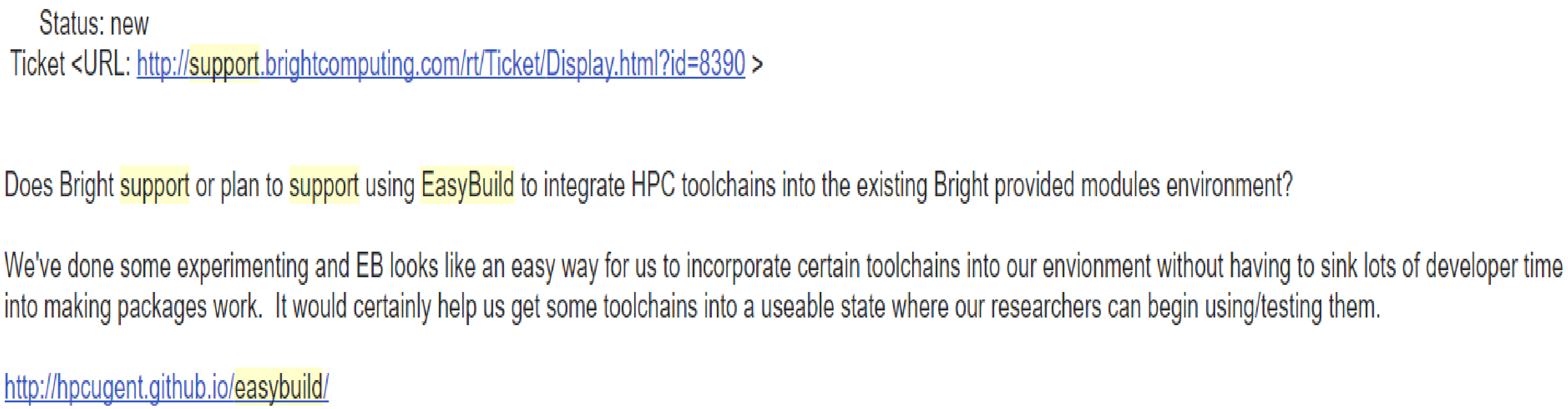
Ring all Reduce support in Tensorflow and PyTorch

- A ring allreduce is a bandwidth-optimal way to do an allreduce. To do the allreduce, the nodes involved are arranged in a ring:
- Each node always sends to the next clockwise node in the ring, and receives from the previous one.



EasyBuild

- We looked at several alternatives: EasyBuild, Spack, crazy things like setting up a Jenkins CI infrastructure



Status: new
Ticket <URL: http://support.brightcomputing.com/rt/Ticket/Display.html?id=8390 >

Does Bright support or plan to support using EasyBuild to integrate HPC toolchains into the existing Bright provided modules environment?

We've done some experimenting and EB looks like an easy way for us to incorporate certain toolchains into our envionment without having to sink lots of developer time into making packages work. It would certainly help us get some toolchains into a useable state where our researchers can begin using/testing them.

http://hpcugent.github.io/easybuild/

- EasyBuild and spack made it to the shortlist but most customers chose EB

Bundled compilers are standardize per Bright release

- Add cm- prefixed toolchains to distinguish from default ones

e.g. cmgcccuda

Need to support:

1. GCC native, 5.4, 6.4 and 7.2 (both old and new ABIs), Intel Par. Studio 2017/2018, PGI, Cray PE
2. CUDA 8.0 / 9.1
3. OpenMPI 1.10.x and 3.x, MVAPICH2

Other requirements

- Be able to re-use the installed modules e.g. do not rebuild OpenBLAS or protobuf unless knowing what you are doing
- Make sure that easyconfigs work with the Bright toolchains (happy that it is a separate repo!)

- Packages built by the admin should be installed in /cm/shared
- Ability to generate packages (FPM)
- Ability to generate containers

Benefits for Bright and partners

- Reduce the support load by leveraging the EasyConfigs collection
- Allow us to focus more on features that matter than building binaries to support uncommon use cases e.g. DL on very old hardware
- Provide optimized packages for each of our HW OEM partners

Benefits for EasyBuild

- Expand EasyBuild’s user base
- Enterprise support
- Contribute (mostly) DL-related EasyConfigs back to the community and expand EasyBuilds availability of supported frameworks
- Report back issues

Available now

- Bright Cluster Manager 8.1 released last Monday ships EasyBuild 3.5.1

yum/zipper/apt-get install cm-EasyBuild

module load cm-EasyBuild

Bright DL EasyConfig repo on Github soon

DANK JULLIE WEL ALLEMAAL!