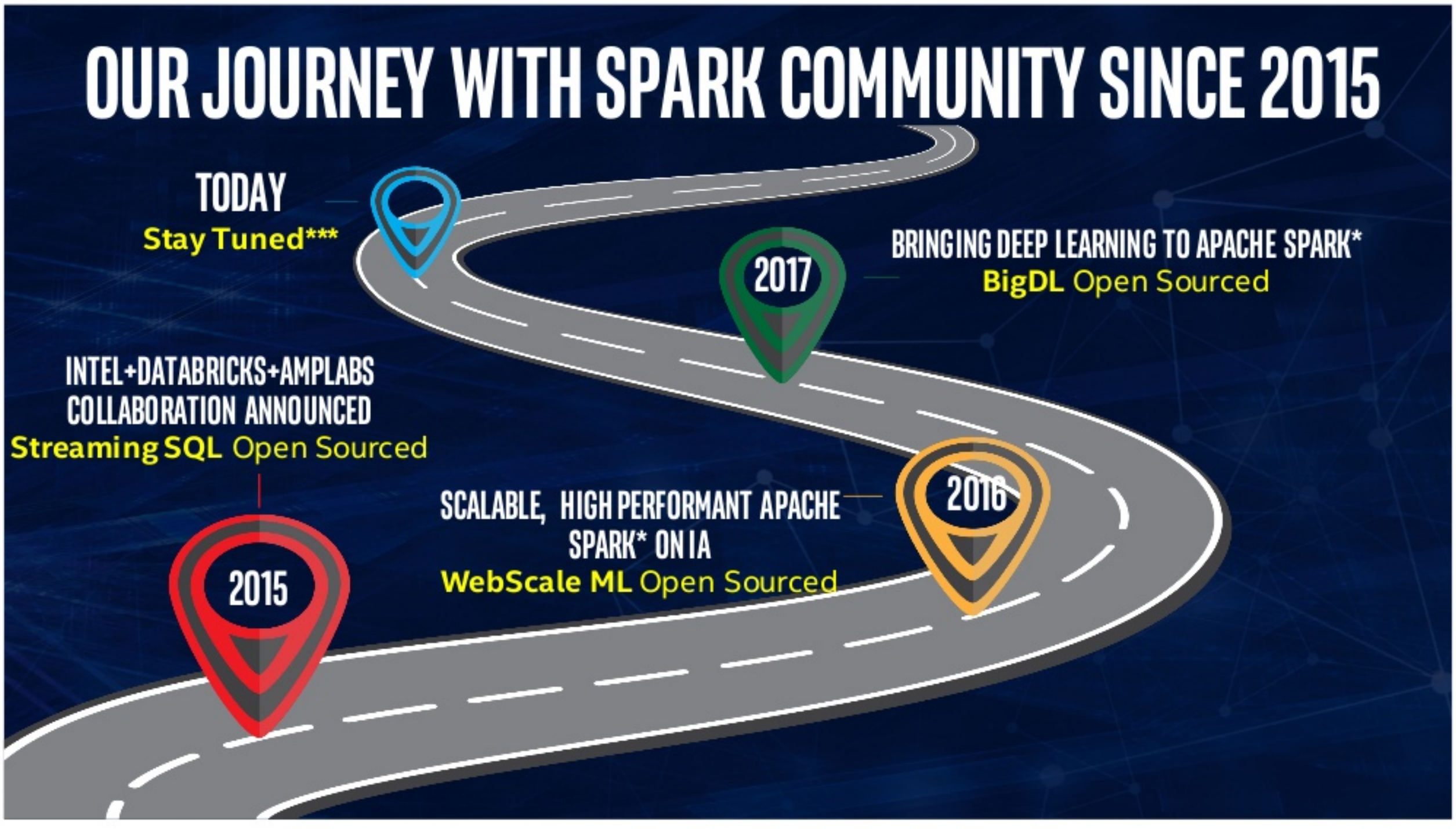
UNLEASHING DATA INTELLIGENCE WITH INTEL AND APACHE SPARK*

AI: UNLEASHING THE NEXT WAVE

MICHAEL GREENE

VICE PRESIDENT INTEL
SOFTWARE & SERVICES GROUP
@greene1of5

OUR JOURNEY WITH SPARK COMMUNITY SINCE 2015



CONTRIBUTION TO APACHE SPARK

EXAMPLES

PERFORMANCE & SECURITY

4.3X MLlib* with Intel® Math Kernel Library

1.28X Spark Shuffle File Encryption

1.35X Spark* Shuffle RPC Encryption

SCALABILITY

>10X Scalability Improvement For Customer Analysis Using Word2vec

>70X Scalability Improvement For Topic Modeling Using Latent DIRICHLET ALLOCATION

Configuration info available on legal notices & disclaimer page.

THE NEXT BIG WAVE

MAINFRAMES

STANDARDS-BASED SERVERS

CLOUD COMPUTING

- DATA DELUGE
- COMPUTE BREAKTHROUGH
- INNOVATION SURGE

ARTIFICIAL INTELLIGENCE

AI COMPUTE CYCLES WILL GROW **12X** BY 2020

Source: Intel Forecast

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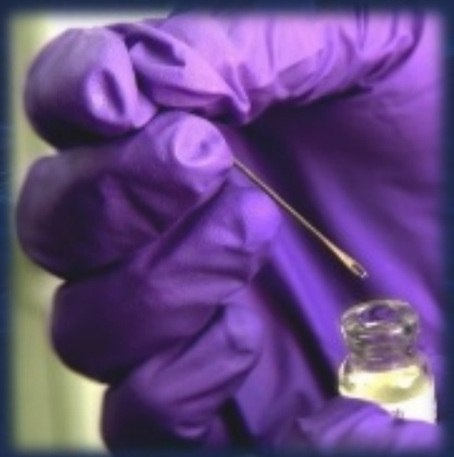
AI WILL USHER IN A BETTER WORLD

ON THE SCALE OF THE AGRICULTURAL, INDUSTRIAL AND DIGITAL REVOLUTIONS



ACCELERATE

Large scale solutions

Cure Diseases
Prevent Crime
Unlock Dark Data

UNLEASH

Scientific Discovery

Explore New Worlds
Decode the Brain
Uncover New Theories

EXTEND

Human Capabilities

Personalize Learning
Enhance Decisions
Optimize Time

AUTOMATE

Undesirable Tasks

Automate Driving
Save Lives in Danger
Perform Chores

Source: Intel

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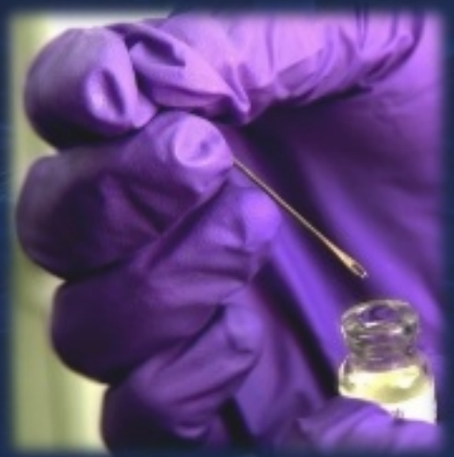

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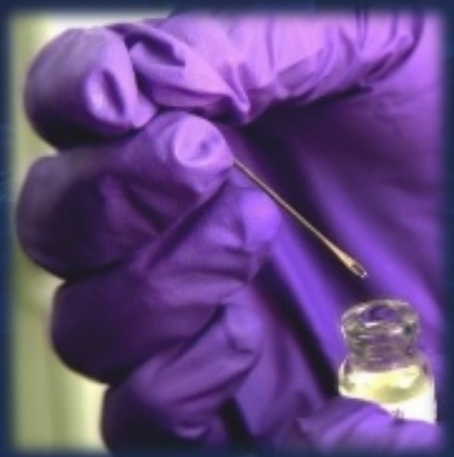

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INTEL® AI PORTFOLIO

EXPERIENCES

TOOLKITS

Intel® DL Training & Deployment

Intel® Nervana™ DL Software & Cloud

Intel® Computer Vision SDK

Intel® GO™ Automotive SDK

Movidius Fathom

FRAMEWORKS

Spark MLLib BigDL

neon

TensorFlow

mxnet theano torch Caffe Chainer

LIBRARIES

python

Intel Distribution

Intel® DAAL

Intel® Nervana™ Graph*

Intel® MKL MKL-DNN Intel® MLSL

HARDWARE

Compute

Memory/Storage

Networking

Computer Vision

END TO END AI

*Future

AI ON INTEL: UNLEASHING THE NEXT WAVE

BIG DATA BROUGHT AI TO ENTERPRISE

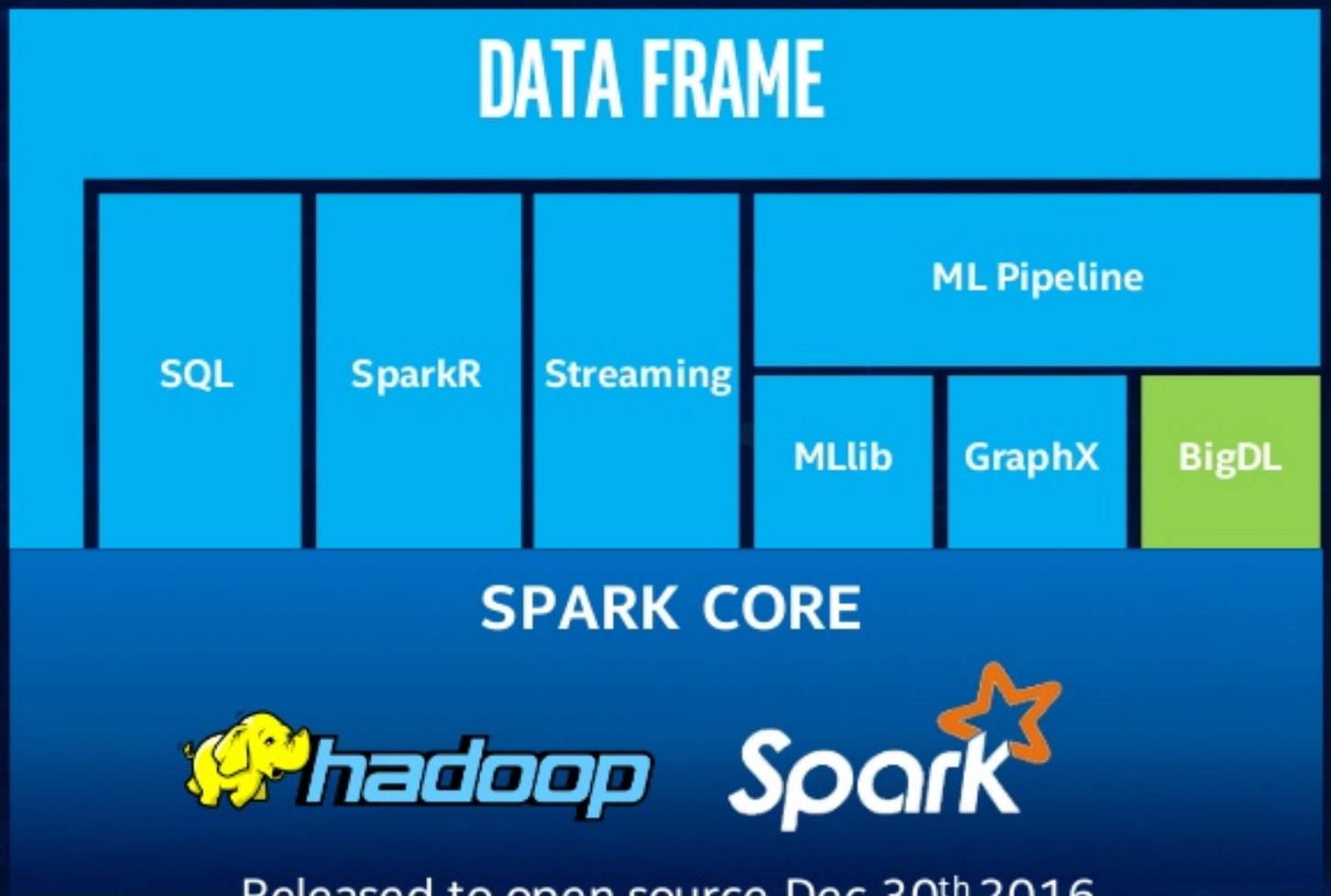
Increasing trend of AI workloads (ML/DL) in data center

Spark has emerged as The Big Data Analytics OS in data center and cloud

Spark is evolving to meet the Enterprise Needs - Intel continues to be part of that Journey ...

BIGDL

BRINGING DEEP LEARNING TO BIG DATA



Released to open source Dec 30th 2016


BIGDL VIDEO

BIGDL: WHAT'S NEW?

Features Released EOQ1:

- ✓ Python Support
- ✓ Notebook Integration
- ✓ Tensorboard Support
- ✓ Better RNN Support
- ✓ Improved Robustness

Coming Out EOQ2:

- ✓ Functional API support
- ✓ Tensorflow Model Read/Write
- ✓ Recursive Net Support
- ✓ 3D Convolutions
- ✓ Python 3.5 Support
- ✓ Spark 2.1 Support

Developer Centric Zone: software.intel.com/bigdl

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BIGDL READY FOR WIDE ADOPTION

cloudera

databricks

Alibaba Cloud
aliyun.com

amazon
web services™

CRAY
THE SUPERCOMPUTER COMPANY

Microsoft
Azure

Lightbend

UnionPay
银联

FINANCE

STEEL

TELCOM

BIGDL READY FOR WIDE ADOPTION

cloudera®

"The integration of BigDL with Cloudera Data Science Workbench allows organizations to leverage deep learning libraries on CPU architecture and an easy way to create native Spark data science pipelines and integrate them with BigDL and other Spark/Hadoop components."

--Charles Zedlewski, Sr. Vice President, Products, Cloudera

BIGDL READY FOR WIDE ADOPTION

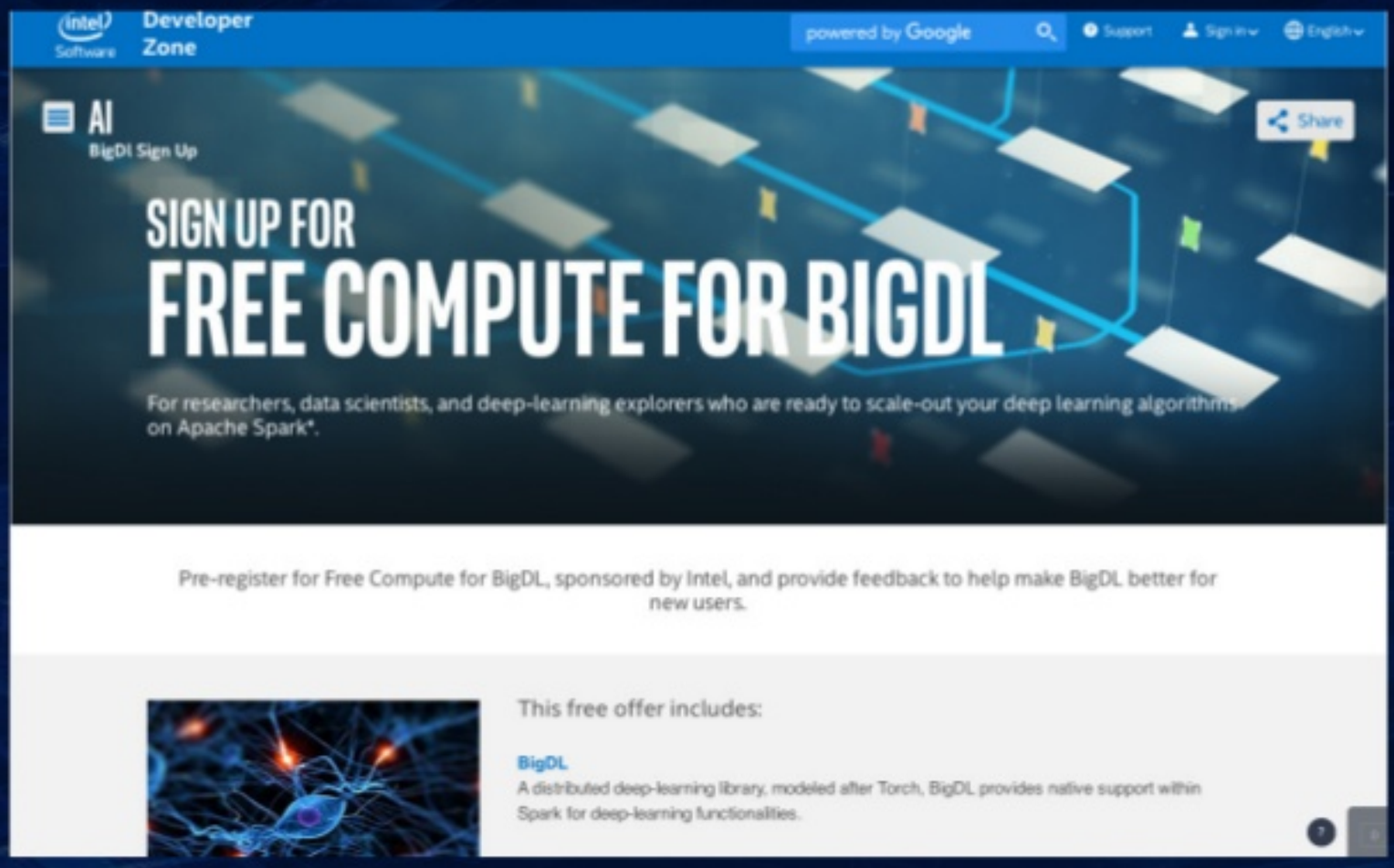
Lightbend

"BigDL is featured in our sample app, and it's our preferred library to date for DL."

--Mark Brewer, President & CEO, Lightbend, Inc

FREE COMPUTE FOR BIGDL

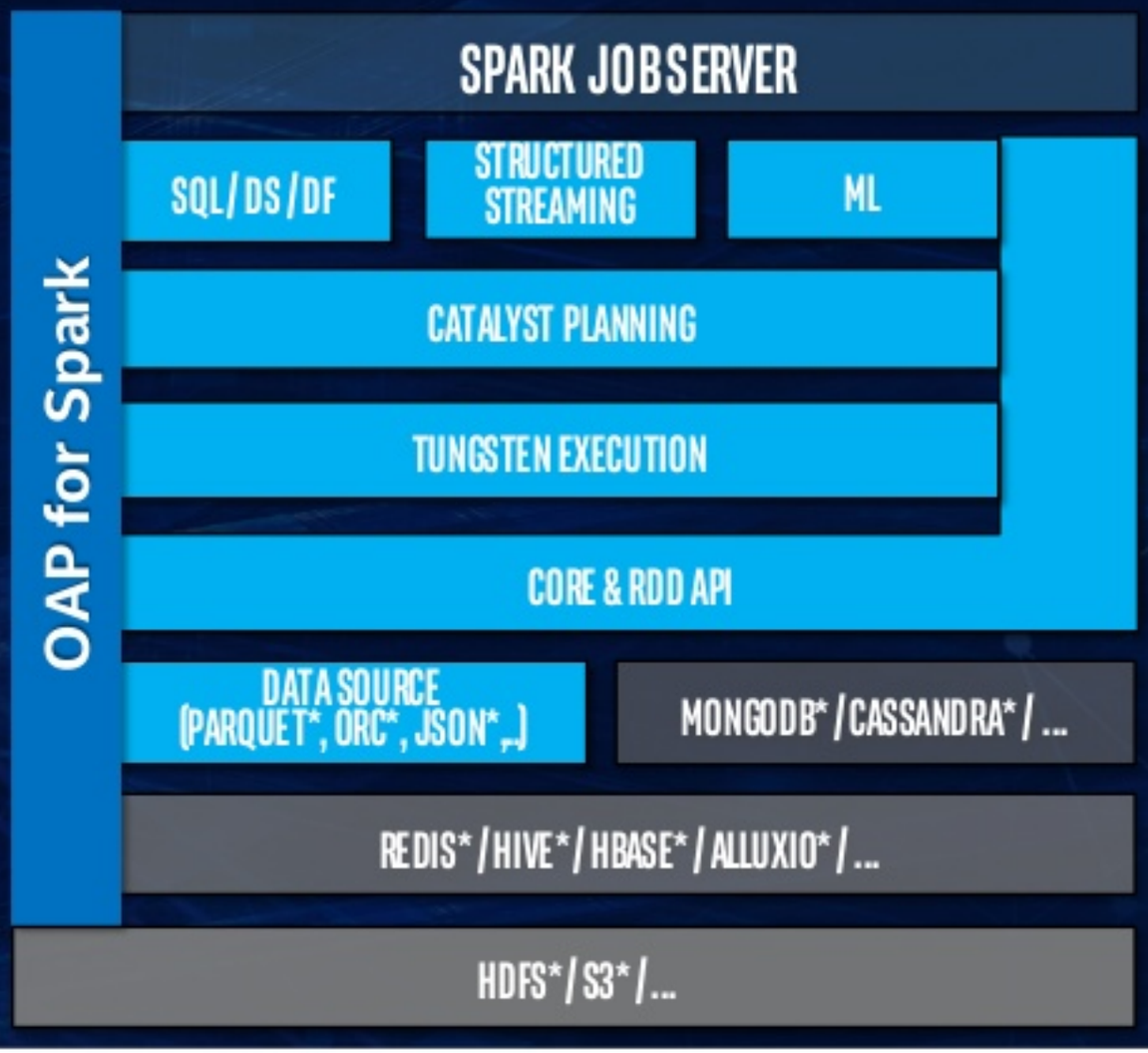
Visit https://software.intel.com/bigdlcompute



TURN YOUR IDEA INTO REALITY

INTRODUCING OAP FOR SPARK*

Optimized Analytics Package for Spark* Platform – Accelerating Spark Queries!



https://github.com/Intel-bigdata/OAP

"OAP for Spark is quite fit for Baidu's data analytics requirements, and brings 1.5X-5X performance gain for ad-hoc query. We'd like to dive into the OAP open source community with Intel for more significant acceleration in the future releases, to unleash the power of new hardware platforms."

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Baidu 百度

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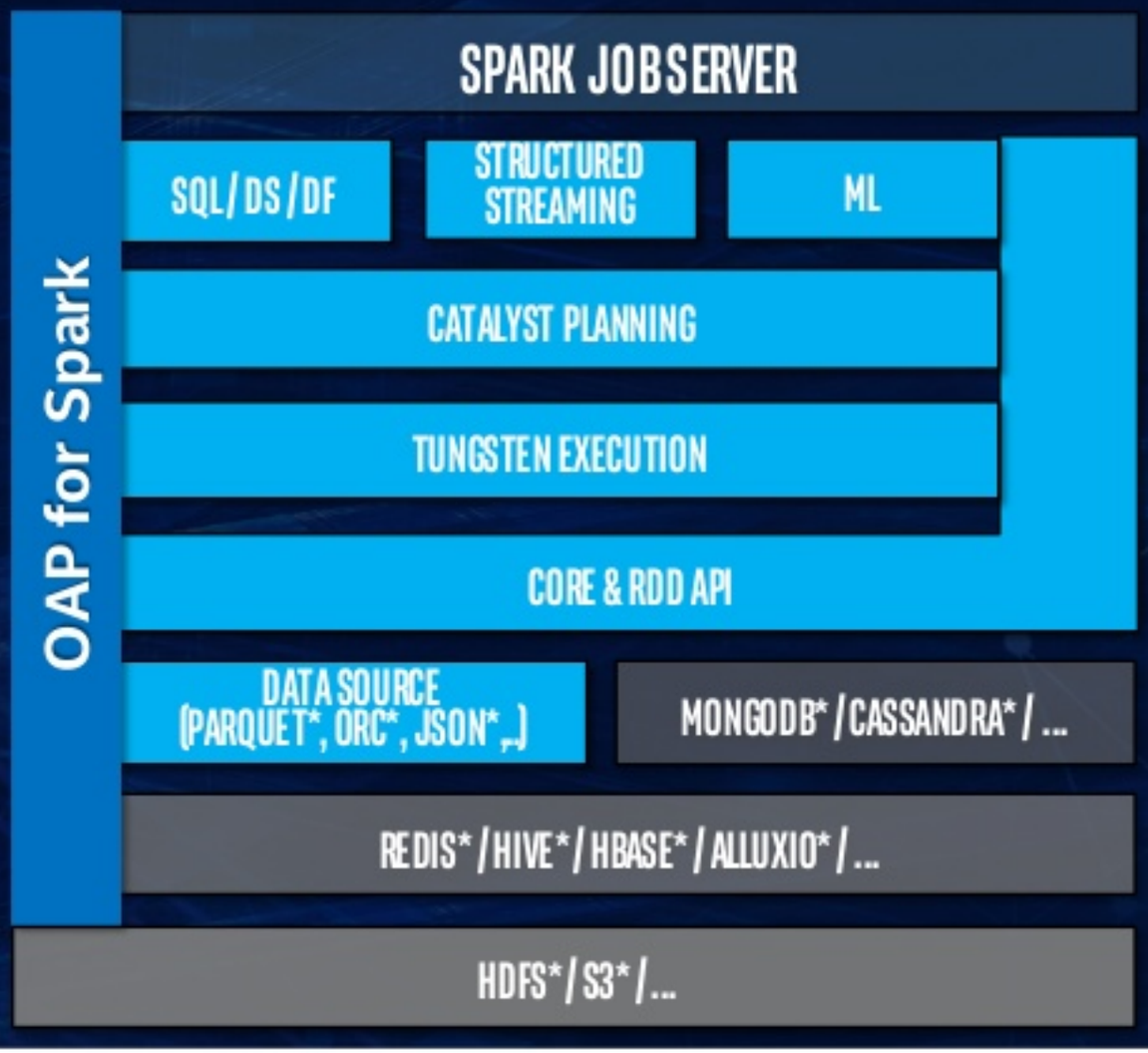

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BETTER TOGETHER
LET'S COLLABORATE!
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SOFTWARE.INTEL.COM/AI
INTEL BOOTH: 301
WOMEN IN BIG DATA LUNCH/PANEL:
JUNE 7 IN ROOM 2014


intel
experience
what's inside™

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- No computer system can be absolutely secure.
- Tests document performance of components on a particular test, in specific systems. Differences in hardware, software, or configuration will affect actual performance. Consult other sources of information to evaluate performance as you consider your purchase. For more complete information about performance and benchmark results, visit http://www.intel.com/performance

Configurations:

- 4.3X for Spark MLlib thru Intel Math Kernel Library (MKL)
  - Spark-Perf (same for before and after): 9 nodes each with Intel® Xeon® processor E5-2697A v4 @ 2.60GHz * 2 (16 cores, 32 threads); 256 GB ; 10x SSDs; 10Gbps NIC
- 19x for HDFS Erasure Coding in micro workload (RawErasureCoderBenchmark) and 1.25x in Terasort, plus 50+% storage capacity saving and higher failure tolerance level
  - RawErasureCoderBenchmark (same for before and after): single node with Intel® Xeon® processor E5-2699 v4 @ 2.20GHz *2 (22 cores, 44 threads); 256GB; 8x HDDs; 10Gbps NIC
  - Terasort (same for before and after): 10 nodes each with Intel® Xeon® processor E5-2699 v4 @ 2.20GHz *2 (22 cores, 44 threads); 256GB; 8x HDDs; 10Gbps NIC
- 5.6x for HBase off heaping read in micro workload (PE) and 1.3x in real Alibaba production workload
  - PE (same for before and after): Intel® Xeon® Processor X5670 @ 2.93Hz *2 (6 cores, 12 threads); RAM: 150 GB; 1Gbps NIC
  - Alibaba (same for before and after): 400 nodes cluster with Intel® Xeon® processors
- 1.22x Spark Shuffle File Encryption performance for TeraSort and 1.28x for BigBench
  - Terasort (same for before and after): Single node with Intel® Xeon® Processor E5-2699 v3 @ 2.30GHz *2 (18 cores, 36 threads); 128GB; 4x SSD; 10Gbps NIC
  - BigBench (same for before and after): 6 nodes each with Intel® Xeon® Processor E5-2699 v3 @ 2.30GHz *2 (18 cores, 36 threads); 256GB; 1x SSD; 8x SATA HDD 3TB, 10Gbps NIC
- 1.35X Spark Shuffle RPC encryption performance for TeraSort and 1.18x for BigBench
  - Terasort (same for before and after): 3 nodes each with Intel® Xeon® Processor E5-2699 v3 @ 2.30GHz *2 (18 cores, 36 threads); 128GB; 4x SSD; 10Gbps NIC
  - BigBench (same for before and after): 5 nodes. 1x head node: Intel® Xeon® Processor E5-2699 v3 @ 2.30GHz *2 (18 cores, 36 threads); 384GB; 1x SSD; 8x SATA HDD 3TB, 10Gbps NIC. 4x worker nodes: each with Intel® Xeon® processor E5-2699 v4 @ 2.20GHz *2 (22 cores, 44 threads); 384GB; 1x SSD; 8x SATA HDD 3TB, 10Gbps NIC.
- 10X scalability for Word2Vec E5-2630v2 * 2, 128 GB Memory, 12x HDDs, 1000Mb NIC (14 nodes)
- 70X scalability for LDA (Latent Dirichlet Allocation)
  - Intel Xeon E5-2630v2 * 2, 288GB Memory, SAS Raid5, 10Gb NIC