The Impact of Artificial Intelligence on Storage and IT

Live Webcast
April 1, 2020
10:00 am PT
Today’s Presenters

Alex McDonald
Chair, SNIA CSTI
NetApp

Glyn Bowden
Chief Architect, AI & Data Science Practice
HPE

James Myers
Director, Data Center Storage Solutions Architecture
Intel
@DoeboizMyers
The material contained in this presentation is copyrighted by the SNIA unless otherwise noted.

Member companies and individual members may use this material in presentations and literature under the following conditions:

- Any slide or slides used must be reproduced in their entirety without modification
- The SNIA must be acknowledged as the source of any material used in the body of any document containing material from these presentations.

This presentation is a project of the SNIA.

Neither the author nor the presenter is an attorney and nothing in this presentation is intended to be, or should be construed as legal advice or an opinion of counsel. If you need legal advice or a legal opinion please contact your attorney.

The information presented herein represents the author's personal opinion and current understanding of the relevant issues involved. The author, the presenter, and the SNIA do not assume any responsibility or liability for damages arising out of any reliance on or use of this information.

NO WARRANTIES, EXPRESS OR IMPLIED. USE AT YOUR OWN RISK.
SNIA-At-A-Glance

185 industry leading organizations

2,000 active contributing members

50,000 IT end users & storage pros worldwide
What We Do

Educate vendors and users on cloud storage, data services and orchestration

Support & promote business models and architectures: OpenStack, Software Defined Storage, Kubernetes, Object Storage

Understand Hyperscaler requirements. Incorporate them into standards and programs

Collaborate with other industry associations
Agenda

- What is Intelligence, Artificial Intelligence and Machine Learning?
- The anatomy of an AI / Analytics Solution
- Typical Storage profiles in the data pipeline
What is intelligence?

Intelligence is a person’s mental capability to perceive, reason, act, learn quickly, and solve problems (among other things).

- Knowledge
- Interacting
- Learning
- Reasoning
- Problem Solving
- Perception
- Manipulate, Sense, and Move Objects
What is Artificial Intelligence?

Definition

- The ability of computer systems to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

  - Example
    - Turing Test: Inability to distinguish computer responses from human responses.
History of AI

- AI has been around for more than 50 years
- The term AI was introduced in 1956 by John McCarthy, an American computer scientist
- The growth and adoption of Machine Learning and Deep Learning have made AI real

Evolution of Artificial Intelligence

Artificial Intelligence (AI)

Machine Learning (ML)

Deep Learning (DL)

© 2020 Storage Networking Industry Association. All Rights Reserved.
AI Adoption is Accelerating

In a recent McKinsey report... of surveyed business have embedded at least one AI capability.

47%

According to Accenture... of surveyed C-suite executives believe they must deploy AI to grow

84%

KPMG recently reported... of surveyed business will deploy AI at scale in 3 years

50%

2 types of AI customers. **WILL** adopt AI. **HAVE** adopted AI.
AI Market Opportunity

37% Compound Annual Growth Rate!

2018-2025

Chart 3.5 Annual Artificial Intelligence Revenue by Technology, World Markets: 2016-2025

(Source: Tractica)

https://www.tractica.com/research/artificial-intelligence-market-forecasts/
Many Approaches to Analytics & AI

No One size fits all…

- Supervised Learning
- Unsupervised Learning
- Semi-Supervised Learning
- Reinforcement Learning

AI

Machine learning

Deep learning

- Regression
- Classification
- Clustering
- Decision Trees
- Data Generation
- Image Processing
- Speech Processing
- Natural Language Processing
- Recommender Systems
- Adversarial Networks
## Why is Everyone Talking about AI Now?

<table>
<thead>
<tr>
<th><strong>Actionable data</strong></th>
<th><strong>Algorithms</strong></th>
<th><strong>Compute power</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Enormous amount of data of all types</td>
<td>Availability of New Algorithms, Neural Network Research and Software</td>
<td>GPU based computing with super compute power</td>
</tr>
<tr>
<td>Critical for machines to learn</td>
<td></td>
<td>Relatively low cost</td>
</tr>
</tbody>
</table>
From Descriptive to Prescriptive

- What happened (Descriptive)
- Why did it happen (Diagnostic)
- What is happening (Monitoring)
- What will happen (Predictive)
- What should be done (Prescriptive)

Value & Benefits

Competitive Advantage

Reactive → Proactive
Data Challenge

Data Silos
- Separated by org structure
- Integrating data as it grows
- Disjointed vendor solutions

Misaligned organizations create data problems

Poor Data
- Incorrect entries & data capture
- Duplicates & mislabeling
- Data transformation errors

Strategic Solution

a) Move to Shared Data Storage Architecture for AI
b) Unify Data Life Cycle and c) Unify End-to-End Data Pipeline

Misaligned organizations create data problems
Shared Data Storage Architecture for AI

- Shared data lakes can **improve** AI effectiveness and efficiency
- Shared data lakes **service** multiple usages
- Shared data lakes **help with** streaming data - event-based data streams generated continuously

Unify Your Data Strategy for AI Deployments

**Setup**
Set up a unified corporate data framework to reduce data silos

**Ingest**
Ingest streaming data from drones using a software tool running on the CPU

**Store**
Store data in high-performance storage solutions to enable efficient data access for all systems

**Clean**
Clean data with popular software tools optimized for the CPU

---

~12 weeks iteration

<table>
<thead>
<tr>
<th>Source</th>
<th>Transmit</th>
<th>Ingest</th>
<th>Store</th>
<th>Clean up</th>
<th>Integrate</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>5%</td>
<td>5%</td>
<td>5%</td>
<td>55%</td>
<td>10%</td>
<td>10%</td>
</tr>
</tbody>
</table>

All products, computer systems, dates, and figures are preliminary based on current expectations, and are subject to change without notice. Optimization Notice
DATA PIPELINE OPTIMIZATION

**Capture** Your Data At or Near the Source

**Filter** for Specific Event Information

Take any **immediate actions** necessary

**Aggregate** By Time Interval

**Join** with Other Data Sources

**Analyze** with AI/ML, and Analytics Tools
Unify End-to-End Data Pipeline for AI

**IoT**
Edge processing of data in motion
- Data is
  - Acquired
  - Cached and stored locally
  - Applied with rules and analytic models
  - Queued, routed and orchestrated

**Fast data**
Core processing of data in motion
- Data is
  - Acquired
  - Ingested
  - Restructured, enriched
  - Persisted for real-time usage and offline analytics
  - Applied with rules and analytic models

**Big data**
Analysis of data at rest
- Data is
  - Hosted in data lakes
  - Transformed and restructured
    - Aggregated
  - Structured by rules/models
  - Prepared for DL

**AI**
Deep learning/machine learning
- Data
  - Trains and builds analytic models
  - Creates test models

**Primarily**
- Edge / Distributed
- Core Data Center
- Business systems

© 2020 Storage Networking Industry Association. All Rights Reserved.
The Anatomy of AI Solutions
The Anatomy of AI Solutions

- Business Systems
- Raw Archive Data
  - Transform / Clean Data Processing
  - Training Data
  - Test Data
  - Training Model

Data Science Workbench / Tooling

Primarily Core Data Center
The Anatomy of AI Solutions

Data Science Workbench / Tooling

Business Systems

Raw Archive Data

Transform / Clean Data Processing

Data Pipeline Config Management

Training Data

Test Data

Model Distribution

Model Packaging / Optimisation

Training Model

Data Transport

Transform / Clean Data Processing

Inference Model

Activity Function

Visualization Function

Primarily Core Data Center

Primarily Edge / Distributed

Live Data

Business Systems
The Anatomy of AI Solutions

Shared Central Data Lake
SDS or HCI
e.g. HDFS, CEPH, NFS, Object, etc.

Data Pipeline
Config Management

Model Distribution
Model Packaging / Optimisation

Data Science Workbench / Tooling

Primarily Core Data Center

Trad
New/NoSQL
Biz Process

Traditional
File Archive

Caching or Streaming layer
SSD
e.g. Cache, Redis, Kafka, NiFi etc.

Primarily Edge / Distributed

Streaming
Data Sources

Caching or Streaming layer...
SSD
e.g. Cache, Redis, Kafka, NiFi etc.

Local Data Lake
typically
Hyperconverged (HCI)
or Converged

Trad
New/NoSQL
Biz Process

© 2020 Storage Networking Industry Association. All Rights Reserved.
New Use Cases & Workloads Are Changing “Storage”

Delivered in a cloud-scale architecture with commodity economics across public and private clouds.
Summary

- AI is more than just training models!
- Data is no longer single purpose, but purpose+
- We need to simplify and unify data treatment
- Move to Shared Data Storage Architecture
- Unify Data Life Cycle
- Unify End-to-End Data Pipeline
- Pipelines are the new SAN
Additional Resources

- Presentation: Customer Support through Natural Language Processing and Machine Learning
  https://youtu.be/u1iRvWzMioM
- Presentation: Introducing the AI/ML and Genomics Workloads from the SPEC Storage Subcommittee
  https://youtu.be/47pmqFXYi-4
- White Paper: Is Your Storage Ready for AI?
- Article: Want optimized AI? Rethink your storage infrastructure and data pipeline
After This Webcast

- Please rate this webcast and provide us with feedback
- This webcast and a PDF of the slides will be posted to the SNIA Cloud Storage Technologies Initiative website and available on-demand at https://www.snia.org/forum/csti/knowledge/webcasts
- A Q&A from this webcast will be posted to the SNIA Cloud blog: www.sniacloud.com/
- Follow us on Twitter @SNIACloud
THANK YOU!