HOW TO BUILD A DATA HUB FOR THE UNKNOWN IN MODERN DATA
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Online translator helps federal workers ‘do their job,’ say defenders

French-English translator developed by National Research Council over 10 years

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Woes of Canada’s Translation Bureau

Compounded By Minister’s Response

by Martin Malik on October 28, 2016

Reactions ranged from “disappointing” and “lacking” to “insulting,” “shocking” and “jaw-dropping.” The Canadian government, already under fire from several quarters due to, among other things, the downsizing of the Translation Bureau’s workforce, the rollout of its homegrown machine translation tool, Portage, and the planned use of a vetting system that favors the lowest-bidding freelancers, is embattled once again.

The heat is specifically directed at the Department of Public Services and Procurement, which oversees the Translation Bureau. The reason, Minister Judy Foote’s response to the recommendations of the House of Commons Standing Committee on Official Languages regarding the Translation Bureau, which falls under Foote’s purview.

Foote, the most popular MP candidate in last year’s federal elections, topping it with an 82% landslide, heads the Department of Public Services and Procurement. A Liberal, Foote was sworn into the Cabinet along with Prime Minister Justin Trudeau in November 2015. Supported by, among others, Canada’s labor unions, the Liberal Party won last year’s elections for the first time in nine years by a huge margin.
Analytical Computing

\[ 1 + 1 = 2 \]
Analytical Computing

1 + 1 = 2

Algorithm
Analytical Computing

Logically

Source: Drexel University
Analytical Computing

Transistors

Source: Michael Kohn
Empirical Computing

\[(1, 1) \rightarrow 2\]
Empirical Computing

(1, 1) → 2

Algorithm?
Empirical Computing

DATA → AI → RESULT
DATA
DAWN OF 4TH INDUSTRIAL REVOLUTION
BIG DATA, AI DRIVING CHANGE IN EVERY INDUSTRY

1st Revolution
1760-1820's
Steam Power
Rural to Industrial

2nd Revolution
1870-1914
Electricity
Industrial to Mass Production

3rd Revolution
1980-2010
PC
Mass production to Digital

4th Revolution
2010-now
AI, Big Data & IoT
Digital to Intelligence
The Pure Storage Vision

PLATFORM FOR STORAGE INNOVATION

SOFTWARE + HARDWARE

FLASH + CLOUD

SIMPLE

DATA IS FOREVER

BUSINESS MODEL

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OUR VIEW OF THE WORLD 4 YEARS AGO

STRUCTURED (BLOCK, DBs, VMs)

UNSTRUCTURED (FILE, OBJECT, KEY-VALUE CONTAINERS)

ALL-FLASH ARRAYS

DBs & Apps

VM Farms

Scientific Media Dev

Analytic + Log

Build/Test

Backup & DR

Active Archive

Object

Build/Test

User Shares

Imaging & Transcoded

Machine Data, Sensor & Control

Tier 2 Apps
DATA IS VITAL TO MACHINE LEARNING

OBSERVATION BY PROF. ANDREW NG, AI LUMINARY

Andrew Ng
SOUL OF DGX-1 IS PARALLEL

**NETWORK INTERCONNECT**
4X InfiniBand™ 100 Gbps EDR
2X 10GbE

**GPUs**
8X NVIDIA Tesla® P100 16GB/GPU
28,672 Total NVIDIA CUDA® Cores

**GPU INTERCONNECT**
NVIDIA NVLink™
Hybrid Cube Mesh
IN 2016 WE PIONEERED A NEW APPROACH WITH FLASHBLADE

DirectFlash
MASSIVELY PARALLELIZED STORAGE

Flash Blades
- Capacity & Performance
- Differing capacities
- Hot Pluggable

Storage Unit
- Up to 52TB of Flash
- Embedded NVRAM
- DirectFlash™

Motherboard
- Intel CPU
- Dual 10Gb ports (SoC)
- Scale-out Object Store

Fabric
- Dual redundant switches
- Cluster communications
- External connectivity

12,480 NAND Die
SOUL OF FLASHBLADE IS PARALLEL
POWERING 75 BLADE-SCALE IN SINGLE IP WITH PURITY FOR FLASHBLADE

Purity

<table>
<thead>
<tr>
<th>NATIVE OBJECT</th>
<th>OBJECT</th>
<th>NATIVE NFS/SMB</th>
<th>&gt; NFS</th>
<th>&gt; SMB</th>
<th>BILLIONS &amp; BILLIONS OF OBJECTS</th>
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<tr>
<td>KEY-VALUE DATABASE STORE FOR DISTRIBUTED PARTITIONS</td>
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<tr>
<td>KEY</td>
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THREE ESSENTIAL THINGS FOR AI

FRAMEWORKS & APPLICATIONS

- Caffe2
- mxnet
- PyTorch
- TensorFlow

COMPUTE FROM CPU TO GPU SERVERS

STORAGE POWER ENTIRE AI PIPELINE
WIDE RANGE OF NEEDS IN THE PIPELINE
SIGNIFICANT CHALLENGE TO LEGACY STORAGE

INGEST
From sensors, machines, & user generated

CLEAN & TRANSFORM
CPU Servers

EXPLORE
GPU Server

TRAIN
GPU Production Cluster

IO PROFILE
REAL WORLD PIPELINE IN AN AUTONOMOUS CAR COMPANY

INGEST

CLEAN, LABEL, RESIZE

CPU Servers

EXPLORE

GPU Server

TRAIN

GPU Production Cluster

INFERENC IN VIRTUAL WORLD

GPU Production Cluster

10'S OF PB COLD STORAGE
AI TRAINING SYSTEM
GOAL IS TO KEEP THE GPUs 100% BUSY

FULL TRAINING WORKFLOW
- I/O
- decode
- scale
- evaluate
  - forward-propagation
- update
  - back-propagation

BENCHMARK SETUP
- GPU ONLY
  - Setup #1: Synthetic Data from System RAM into GPUs
- I/O + CPU + GPU
  - Setup #2: Real Image Data from FlashBlade into DGX-1
AI SYSTEMS DESIGN PATTERNS

HOW MUCH PERFORMANCE PENALTY DUE TO SHARED STORAGE?

FULL TRAINING WORKFLOW

I/O → decode → scale → evaluate (forward-propagation) → update (back-propagation)

CPU

GPU

BENCHMARK SETUP

Setup #1: DGX-1 with 4x Local SSDs

Setup #2: DGX-1 with 1x FlashBlade
RESULT: FLASHBLADE vs LOCAL SSDs

TENSORFLOW TRAINING BENCHMARK WITH RESNET-50

TIME TO SOLUTIONS (HOURS)

NVIDIA DGX-1 + Local SSDs

1.8 Hours to process 10M images

NVIDIA DGX-1 + Pure FlashBlade

1.7 Hours to process 10M images

6% Faster
RESULT: 3X FASTER END-TO-END

TENSORFLOW TRAINING BENCHMARK WITH RESNET-50

- NVIDIA DGX-1 + Local SSDs
  - 3.4 Hours to load 8TB into SSDs
  - 1.8 Hours to process 10M images

- NVIDIA DGX-1 + Pure FlashBlade
  - 1.7 Hours to process 10M images
  - 305% Faster
ANALYTICS FOR PRODUCTION DATA

“TUNED FOR EVERYTHING” DATA PLATFORM FOR BOTH TRAINING AND INFERENCING WORKLOADS

TRAINING

ANALYSIS ON INFERENCE DATA

DEPLOY TRAINED MODELS

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(BLOCK, DBs, VMs)

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VM Farms

Machine
Data, Sensor
& Control

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Training

Dev

AI

Explore

Analytic

Log

AI

Label

Active

Analytics

Ingest

Backup

& DR

Object

Build/Test

User Shares

Transcoded

Tier2 Apps

Imaging &

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The world’s most valuable resource

Data and the new rules of competition