FinTech Data Pipelines and Storage I/O
Related Benchmarks in Public Cloud

Reduce Wall Clock Time for "Tick Analytics" with Weka Data Platform

Shailesh Manjrekar, Head of AI, Weka
THE PROBLEM

Exponential growth in modern Pharmaceutical\LS, AI/ML, Financial Services and cloud applications is fueling unheard-of data growth

Organizations desire competitive advantage through digitalization by 10x faster processing of 10x bigger datasets

Traditional hardware and cloud storage cannot meet rapidly escalating requirements for performance AND scale across core, multi-cloud and edge data centers

...A NEW APPROACH IS NEEDED.
SEPARATE PRODUCTS SERVICE CUSTOMER NEEDS

SIMPLICITY
- AMAZON EFS
  - FSx for Windows
  - FSx for Lustre

SPEED
- AMAZON EBS

SCALE
- AMAZON S3
WEKA DATA PLATFORM FOR ALL WORKLOADS

FOR MODERN ENTERPRISE APPLICATIONS

- Performance of EBS
- Ease of Use of FSx....
- Scale of S3
- SIMPLICITY
- SPEED
- SCALE
Welcome to WEKA

Our Mission
Make storage a utility by delivering simplicity, speed, scale, and better economics

8 of the Fortune 50 are customers

Backed by industry leaders

Cisco
Hewlett Packard Enterprise
NVIDIA
Mellanox
Hitachi
Qualcomm
Micron
Western Digital
Seagate
Solution: zero-copy architecture

High-speed ingest

Fastest business outcomes

After Weka

1. Collapse into single system, reducing infrastructure costs by up to 75%

2. 95% - 98% reduction in time for data to be actionable (first to market advantage)

3. Immense scalability up to 14EB’s in single namespace (no additional software needed)

4. 20x reduction in management overhead
AWS + WEKA JOINT HYBRID OPPORTUNITY

- 230 PB Managed in AWS S3 per year across verticals
  - Financial Services
  - Life Sciences
  - Greenfield Machine Learning market

- Available in AWS Marketplace and AWS Outposts certified
  - SaaS listing - BYOL, Marketplace license
  - Cloud Formation front end
    https://start.weka.io/
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STAC Audit Summary
Who is STAC?
Securities Technology Analysis Center

STAC® provides technology research and testing tools based on community-source standards.
The standards are developed by the STAC Benchmark Council™, a group of 390 of the world’s leading banks, hedge funds and financial services technology companies.

Several Research Domains -
A2 - Risk Computation, A3 - Backtesting, M3- Tick Analytics

Why STAC-M3?
The STAC-M3 Benchmark suite is the industry standard for testing solutions that enable high-speed analytics on time series data, such as tick-by-tick market data (aka "tick database" stacks).
STAC-M3 Benchmarks

- defines parameters for testing and validates the results through careful audit

- Antuco
  - The baseline suite - Antuco - uses a limited dataset size with constraints to simulate performance against a full-size dataset residing mostly on non-volatile media. It tests a wide range of compute-bound and storage-bound operations to probe the strengths and weaknesses

- Kanaga
  - The scaling suite - Kanaga - uses a subset of Antuco queries without constraints against a significantly larger data set. The key metric for the STAC-M3 benchmark suite is query response time. Latency is the enemy of the finance market

- In total there are 17 mean response time benchmarks in the Antuco suite and 24 mean response time benchmarks in the Kanaga test suite
  - and they test the system in two dimensions - number of concurrent clients and quantity of data under analysis
Where STAC-M3 matters?

Risk Analytics
- Banks, Insurance, Exchanges, Retail
- Credit Risk
- Insurance Risk
- Fraud Detection
- Operational Risk

Trading System
- Brokerages, Hedge Funds, Exchanges
- Quant Trading
- Tick Analytics
- Strategy Back-testing
- Trade Reporting and Processing

Banking Systems
- Banks, Clearing Houses
- Electronic payment processing
- Time Bound / Compliance Reporting
Kdb+ AND WEKA SOLUTION

Data feeds - NYSE, NASDAQ
Aggregators - Bloomberg, Thomson Reuters

KX RDB - Real time database
KX HDB - Historical database hosted on WekaFS

- KX processing spread over multiple CPU cores to maximize Analytics performance
- Data ingested at massive rates (ex: IOT)
- Records stored on per time-stamp basis (ex: per day for stock tickers)
- Record accessed in parallel for high performance Analytics
ALTERNATIVE SOLUTIONS FOR TICK ANALYSIS

- Some queries which fall within a time interval could be served only by single individual server
- Query is not distributed across servers

- Block storage with limited scale
- Copy data to beefy server with lots of local NVMe
  - Data sets are limited to the size of the application server storage
  - Multiple copies

- NFS based All-Flash OR
- Throughput optimized parallel filesystems
  - Poor latency and IOPs
STAC-M3 AWS EC2 SUT – System under Test

- **Ethernet**
- **Storage cluster 40 x i3en.6xlarge instances**
  - (545.6 TiB total physical data storage, 425.54 TiB usable)

  - **AWS Database cluster**
    - 15 x c5n.9xlarge instances
    - **Database Host**
      - kdb+ 4.0 / Amazon Linux 2 / WekaFS 3.10.1
      - Intel® Xeon® Platinum 8124M @ 3.0GHz / 36 vCPU's, 96 GB DRAM, 50 GBps ENI
    - **AWS ENI**
    - **Storage Node**
      - Amazon Linux 2 / WekaFS 3.10.1
      - Intel(R) Xeon(R) Platinum 8124M
      - CPU @ 3.0GHz, 96 GB DRAM / 2 x 6.82 TiB SSD, 25 Gbps ENI

- **AWS Database cluster**
  - 15 x c5n.9xlarge instances

  - **AWS ENI**
  - **Control Host**
    - AWS t2.xlarge instance / Amazon Linux2
    - 4 vCPU, 16 GB/s DRAM

  - **Storage cluster 40 x i3en.6xlarge instances**
    - (545.6 TiB total physical data storage, 425.54 TiB usable)

  - **AWS ENI**

1 x client (not part of the SUT)

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3 RECORDS ON STAC-M3 Kanaga and 3 Records in throughput benchmarks - SUT #KDB210507

- WekaFS v3.10, was faster in several other benchmarks as below -

<table>
<thead>
<tr>
<th>STAC System Under Test #</th>
<th>WekaFSv3.10 in Kanaga benchmarks</th>
<th>WekaFSv3.10 in Antuco benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lustre + Appliance</td>
<td>#KDB200915</td>
<td>Faster by 20 of 24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Faster in 4 of 17 benchmarks</td>
</tr>
<tr>
<td>Direct attached 10 servers with Optane</td>
<td>#KDB200603</td>
<td>Faster by 16 of 24</td>
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<td></td>
<td>Faster in 9 of 17 benchmarks</td>
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<tr>
<td>All-Flash NAS</td>
<td>#KDB200914</td>
<td>All-Flash NAS did not submit to this benchmark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Faster in 15 of 17 benchmarks</td>
</tr>
</tbody>
</table>
PERFORMANCE IN AWS BEATS ON-PREMISES SOLUTIONS

- AWS + Weka used v3.10.1
- HPE + Weka SUT - KDB200401, AWS + Weka SUT - KDB210507,
- Lustre + appliance SUT - KDB200915; DAS + Optane - 200603

LOWER IS BETTER

17x higher
12x higher
18x higher
20x higher
3.5x higher
3.2x higher

RECORD-BREAKING STAC M3 (Antuco)

PERFORMANCE IN AWS BEATS ON-PREMISES SOLUTIONS

Antuco Monthly and Qtrly Query Response - HIBID Response Times

LOWER IS BETTER

- AWS + Weka used v3.10.1
- HPE + Weka SUT - KDB200401, AWS + Weka SUT - KDB210507,
- Lustre + appliance SUT - KDB200915, DAS + Optane - 200603, All-Flash NAS - KDB200914
Hybrid Cloud-native Workflow

Single Namespace - Hybrid Cloud

- GPU Servers
- CPU-based Application Servers
- Snap-to-S3

AWS S3 Bucket

GPU Servers in AWS for Elasticity

Weka Cluster in AWS Leveraging Auto-Scaling Groups

CPU Servers in AWS for Elasticity

Tier to S3 in AWS
Hybrid Cloudnative Workflow

Single Namespace - Hybrid Cloud

- GPU Servers
- CPU-based Application Servers

Weka Cluster in AWS
Leveraging Auto-Scaling Groups

GPU Servers in AWS for Elasticity

Local S3
On Prem S3 bucket

CPU Servers in AWS for Elasticity

S3
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