AEROSPIKE

The Aerospike® Real-time Data Platform

Realizing the dream of real-time in the big data era

Overview

The Aerospike Real-time Data Platform is a shared-nothing, multi-threaded, multimodal data platform designed to operate efficiently on a cluster of server nodes, exploiting modern hardware and network technologies to drive reliably fast performance at sub-millisecond speeds across petabytes of data.

The Aerospike Real-time Data Platform enables organizations to act in real time across billions of transactions using massive parallelism and a hybrid memory model to ensure the smallest possible server footprint. It ingests and acts on streaming data at the edge and can combine edge data with data from systems of record, third party sources, data warehouses, or data lakes for operational, transactional, or analytical workloads - all in real time.

Highlights

- Predictable real-time performance at petabyte scale
- Cluster node reduction up to 80%
- No-code integrations with Spark, Kafka, Presto/Trino, Pulsar, JMS
- Fault and disaster tolerant
- Multi-site, multi-cloud clustering and data replication
- Real-time transactions with strong consistency for maximum accuracy
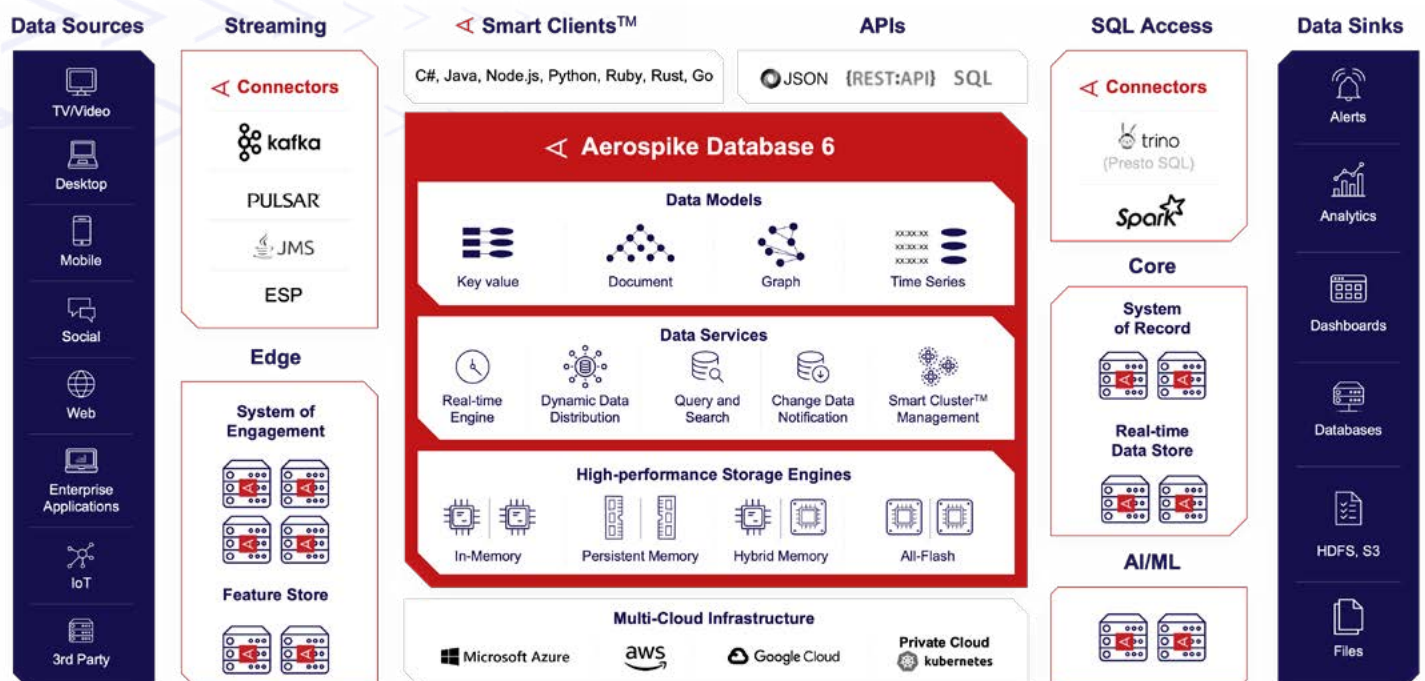

Figure 1: The Aerospike Real-time Data Platform architecture

Aerospike Database 6 - real-time data engine

Aerospike Database 6 is the engine that drives the Aerospike Real-time Data Platform. It is responsible for all of the core cluster management and data services of the platform and is now a true multi-model database. It supports key-value and document database functions as well as graph database and time-series capabilities.
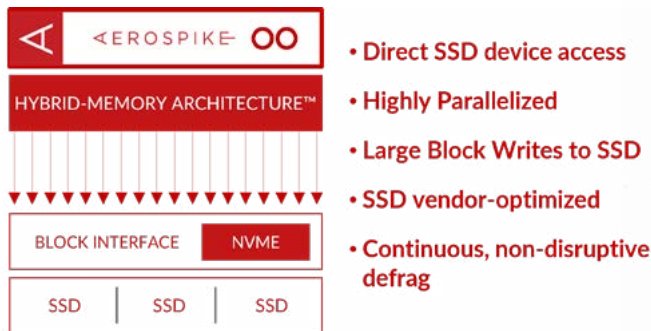

Figure 2: Aerospike exploits SSDs in ways other systems don't

Real-time performance with tiered storage

Aerospike has a patented Hybrid Memory Architecture™ (HMA), which places data on solid-state drives (SSDs) and indexes in DRAM. Aerospike treats SSDs as raw devices, writing data in large blocks using a highly efficient custom file format that avoids wear-leveling issues common with other providers. Net-net: you can get the performance of DRAM for the price and reliability of SSDs.How was Aerospike able to do this? Simply put, Aerospike is software that was written in C to natively talk to hardware, not an API layer. Aerospike treats SSDs as a large parallel memory space, not a file system.

Node reduction by up to 80 percent

In-memory DRAM can only store a fraction of the hot data that Aerospike Hybrid Memory Architecture™ SSDs store per node. Figure 3 illustrates this node reduction. It compares an in-memory system using AWS Memory Optimized instance nodes versus an Aerospike HMA system using Storage Optimized instances. The critical difference is in the addressable space: In-memory only has 122 GiB/node, whereas Storage Optimized nodes have 3.2 terabytes of addressable space per node - a whopping difference.
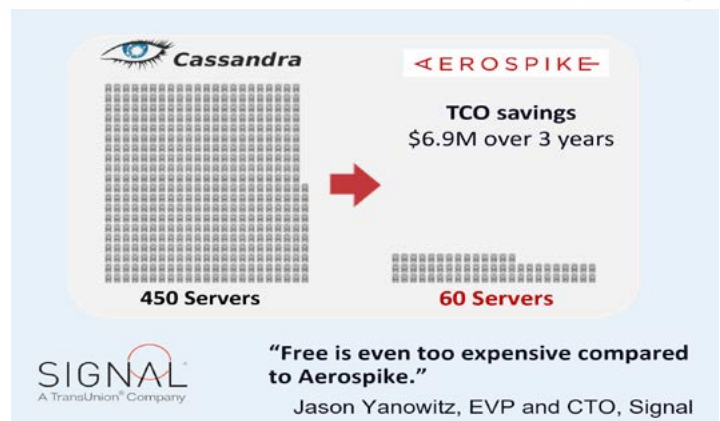
Figure 3: Node reduction up to 80% using HMA vs. In-memory
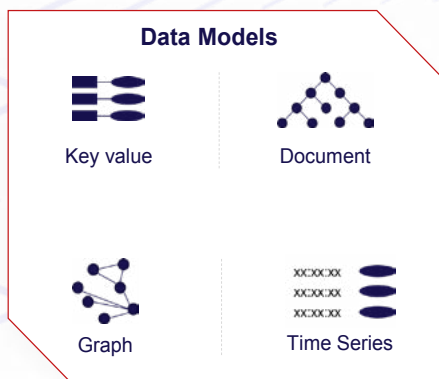
Figure 4: Aerospike Data Model Implementations

Multi-model data operations

Aerospike Database 6 is the first expansion of our flagship NoSQL database beyond its initial key-value data model to include full document database capabilities including both document storage, indexing and query. Key-value data operations are native and document database capabilities are new in Aerospike Dabase 6. Graph database capabilities and time series database capabilities are deployed today in customer production environments and will be integrated services of the product in upcoming releases.

Modern Distributed Data Services

The data services of the Aerospike Real-time Data Platform are the internal processes of the Aerospike Database 6 that enable global operations, enterprise grade availability, sub-millisecond performance, and from gigabyte to terabyte scale.

Figure 5: Aerospike Data Operations and Services

Real-time Engine

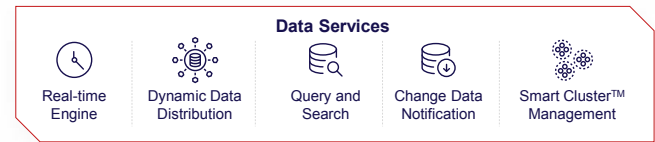Aerospike's real-time engine delivers the maximum performance possible and can scale to millions of transactions per second at sub-millisecond latency. Aerospike's real-time engine can seamlessly scale out across nodes, and can scale up on one node.

Query and Search

Aerospike utilizes technologies such as set indexes, secondary indexes and Aerospike Expressions to power real-time query performance on data at the edge, in a System of Record, and across data centers and clouds. Massively parallel secondary indexes enable complex querying and SQL queries. Aerospike Expressions enable highly efficient value-based searches closer to the data.

Dynamic Data Distribution

Aerospike provides dynamic data distribution via its shared-nothing cluster architecture, where all nodes are peers and there is no single point of failure. Using the Aerospike Smart Partitions™, data is distributed evenly across all nodes in the cluster for maximum performance and scale.

Change Data Notification

Aerospike's Change Notification feature enables outside databases and message queues to be updated in parallel with writes from database clients. This is a key usability feature when Aerospike is used as the database of record.

Smart Cluster Management

Aerospike's dynamic cluster management handles node membership, network fault detection, and ensures a single consistent view of current cluster members.

cybereason	Adobe	DBS
AI-DRIVEN SECURITY	**CUSTOMER DATA PLATFORM IDENTITY GRAPH**	**GLOBAL BANKING CUSTOMER MODEL**
1.4 PB analyzed/day	4 MILLION transactions/second @edge	Global API layer Across datacenters
250% data growth/6 mo.	100 BILLION keys	Mainframe offloading

Figure 6: Some Aerospike customer milestones

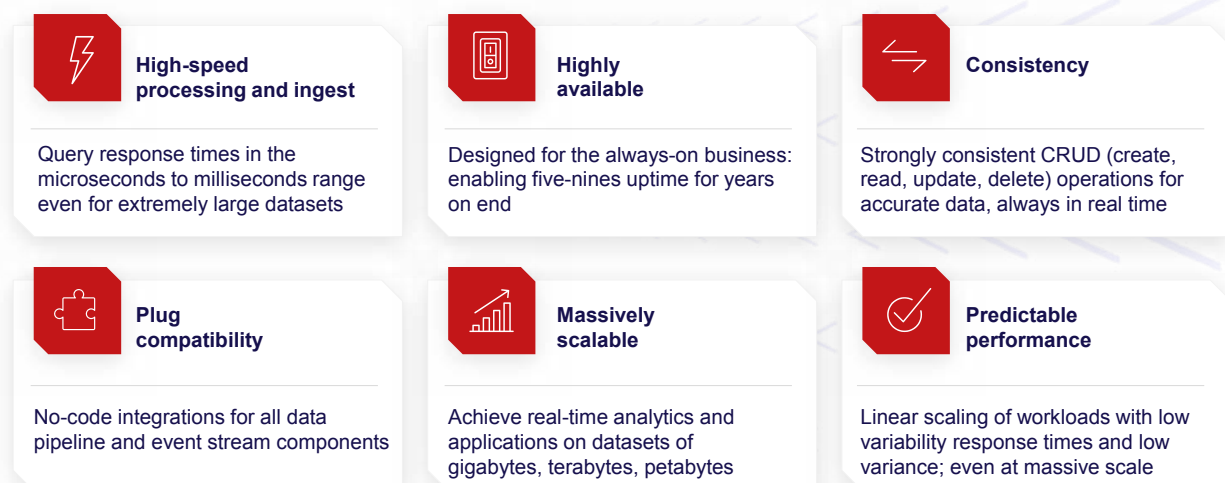| **High-speed processing and ingest**	**Highly available**	**Consistency**
Query response times in the microseconds to milliseconds range even for extremely large datasets	Designed for the always-on business: enabling five-nines uptime for years on end	Strongly consistent CRUD (create, read, update, delete) operations for accurate data, always in real time
Plug compatibility	**Massively scalable**	**Predictable performance**
No-code integrations for all data pipeline and event stream components	Achieve real-time analytics and applications on datasets of gigabytes, terabytes, petabytes	Linear scaling of workloads with low variability response times and low variance; even at massive scale

Figure 7: Aerospike Real-time Data Platform benefits at a glance

Aerospike Connect

No-code integrations with your data stack

Aerospike has created a series of connector products that provide tight integration with important components of a real-time data stack. Aerospike Connect products provide a direct and easy way to create real-time data pipelines with Spark, Kafka, Pulsar and more. These integrations require no special coding by developers and provide seamless SQL access and massively parallel data ingest for maximum throughput.
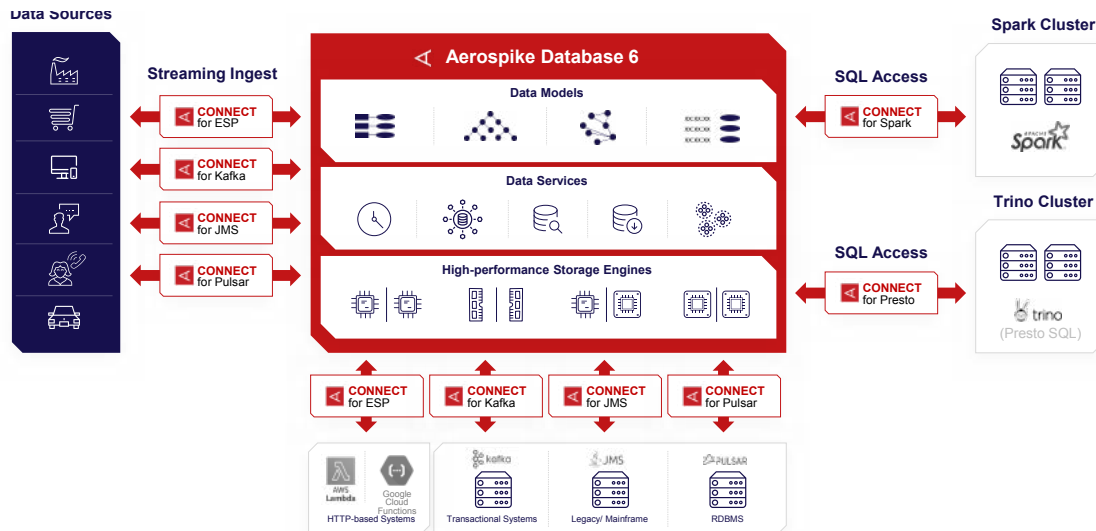

Figure 8: Aerospike Connect no-code integrations for streaming and SQL access

CONNECT for ESP

Connect for Event Stream Processing (ESP) integrates Aerospike with event stream processing systems that commonly rely on Change Data Capture (CDC) patterns to inform external systems when records are inserted, modified, or deleted in a database.

CONNECT for Kafka

Aerospike Connect for Kafka provides real-time data exchange between the Aerospike database and other data pipeline components that use Kafka to transport and consume data streams.

CONNECT for Spark

Aerospike Connect for Spark supports APIs that leverage Structured Spark Streaming and Spark SQL. This provides very low latency for both reads and writes, enabling AI/ML use cases to run against data stored in Aerospike, while simultaneously ingesting new data at high rates.

CONNECT for JMS

Aerospike Connect for JMS provides a simple and easy way to move data in and out of Aerospike to other enterprise systems via the JMS enterprise messaging system.

CONNECT for Pulsar

Aerospike Connect for Pulsar offers both an inbound connector to ingest Pulsar data into Aerospike and an outbound connector to ship change notifications from Aerospike to a Pulsar consumer for streaming data pipelines.

CONNECT for Presto

Aerospike Connect for Presto enables data analysts to use ANSI SQL to query data stored in Aerospike via Presto or Trino. Presto is a highly parallel distributed SQL query engine that is capable of running 100s of concurrent queries, and scaling to 1000s of workers.

Streaming Connectors   **SQL Access Connectors**