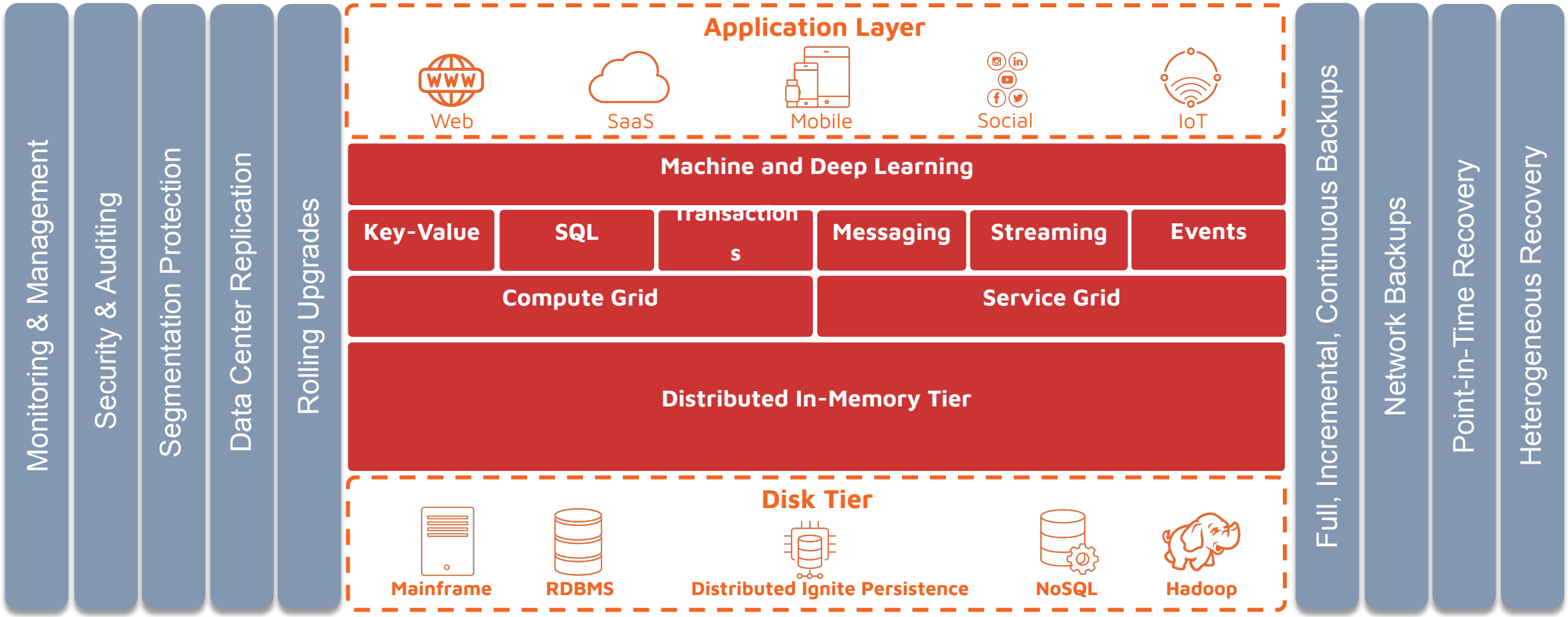
GridGain

New Advances in GridGain's Multi-Tier Database Engine

Valentin Kulichenko, Mirza Aliev

02/03/2020

Apache Ignite In-Memory Computing Platform

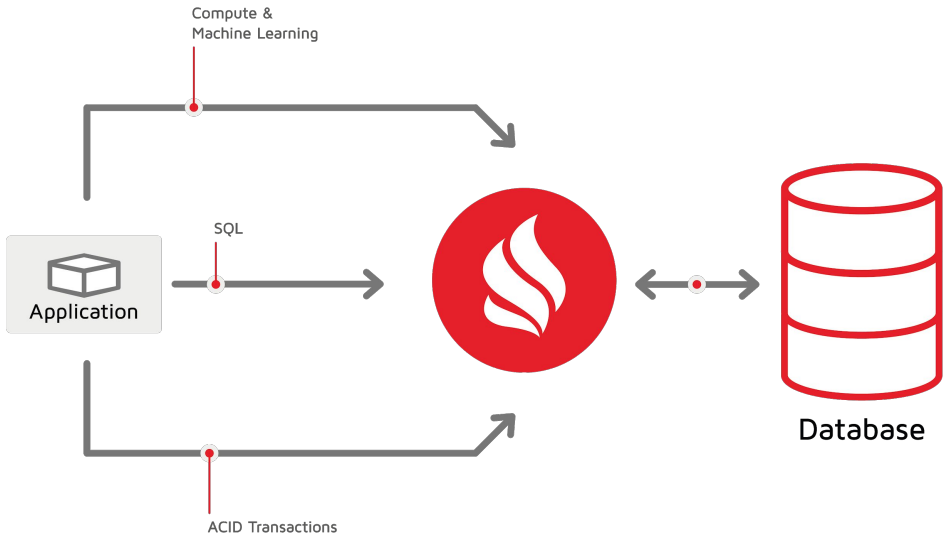


Apache Ignite Features

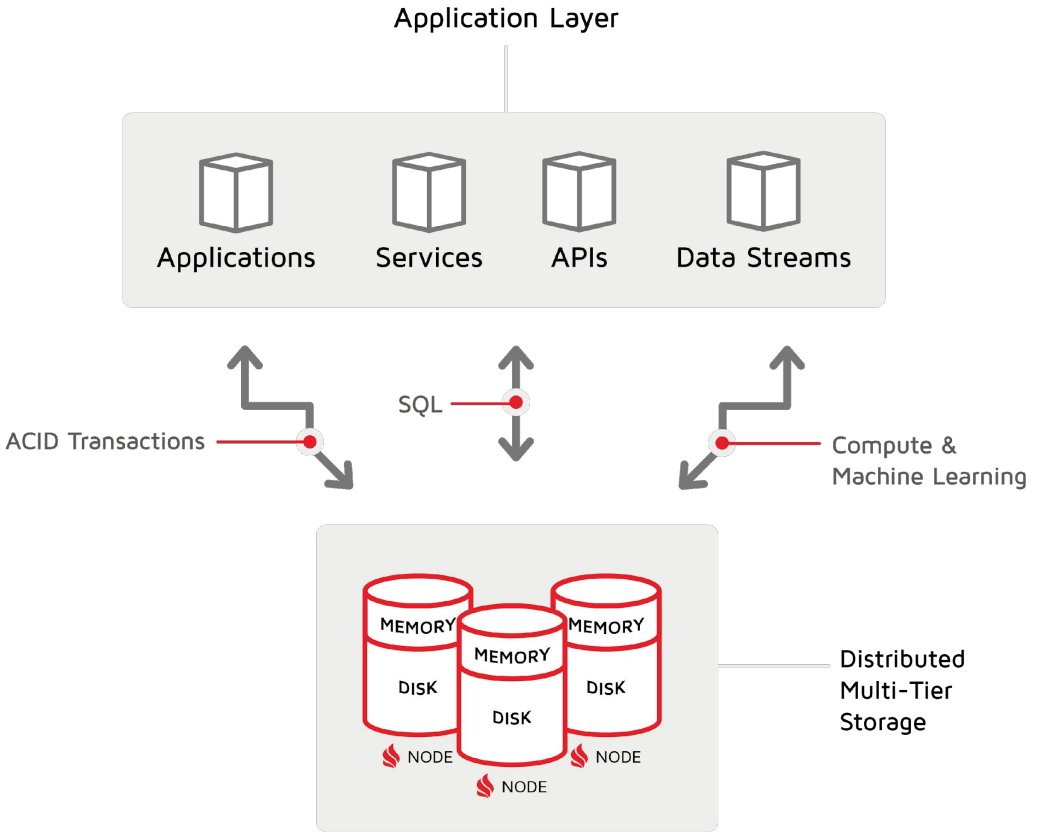
GridGain Enterprise Features

GridGain

Apache Ignite as a Cache or as a Database



Ignite as a Cache and Data Grid



Ignite as a Database

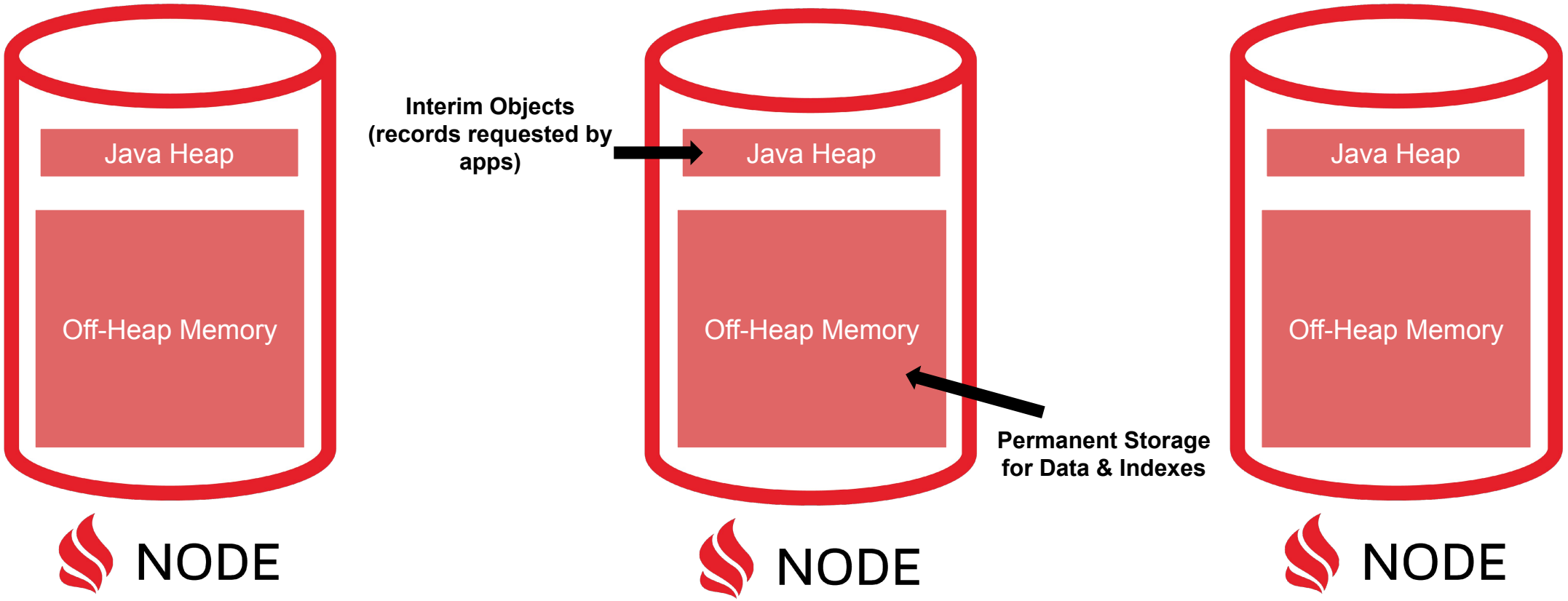
GridGain

Multi-Tier Architecture Advantages

Mode	Description	Major Advantage
In-Memory	100% data in the In-Memory Store (only)	Maximum performance possible (data is never written to disk)
In-Memory + 3rd Party DB	Data in the In-Memory Data Store as a caching layer (aka. in-memory data grid) 3rd Party DB (RDBMS, NoSQL, etc) used for persistence	Horizontal scalability Faster reads and writes
In-Memory + Ignite Persistence	The whole data set is stored both in memory and on disk	Survives cluster failures
100% on Disk + Subset in Memory	100% of data is in Ignite Persistence and a subset is in memory	Unlimited data scale beyond RAM capacity

GridGain

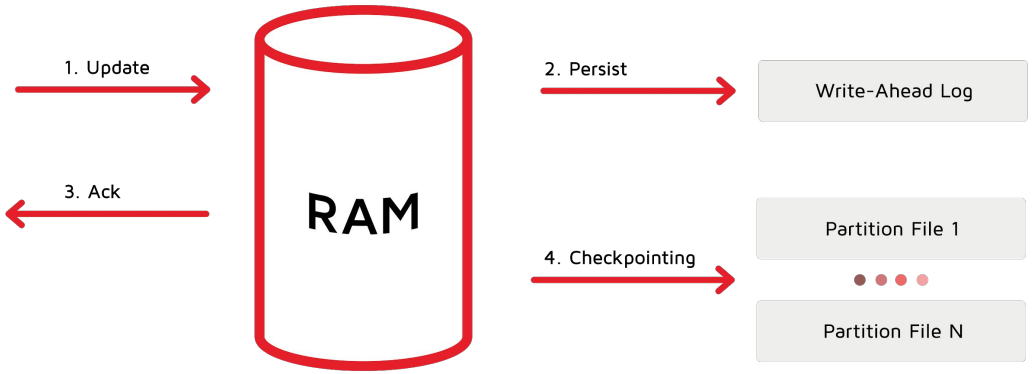
Ignite Memory Tier



GridGain

Ignite Native Persistence

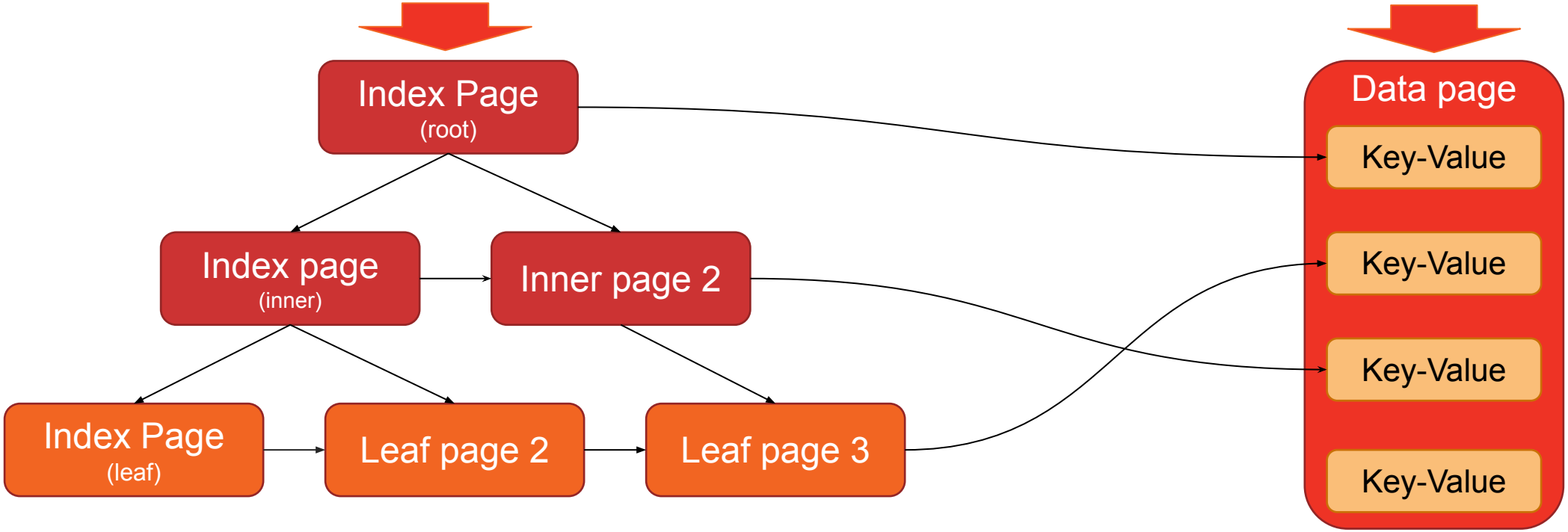
- Distributed Persistence Tier
  - Fully transactional and consistent
  - No need to cache 100% of data in RAM
  - No need to warm-up RAM on restarts
- Performance vs. Cost Tradeoff
  - Cache more for fastest performance
  - Cache less to reduce infrastructure costs



GridGain

Multi-Tier Storage Architecture

Memory segment



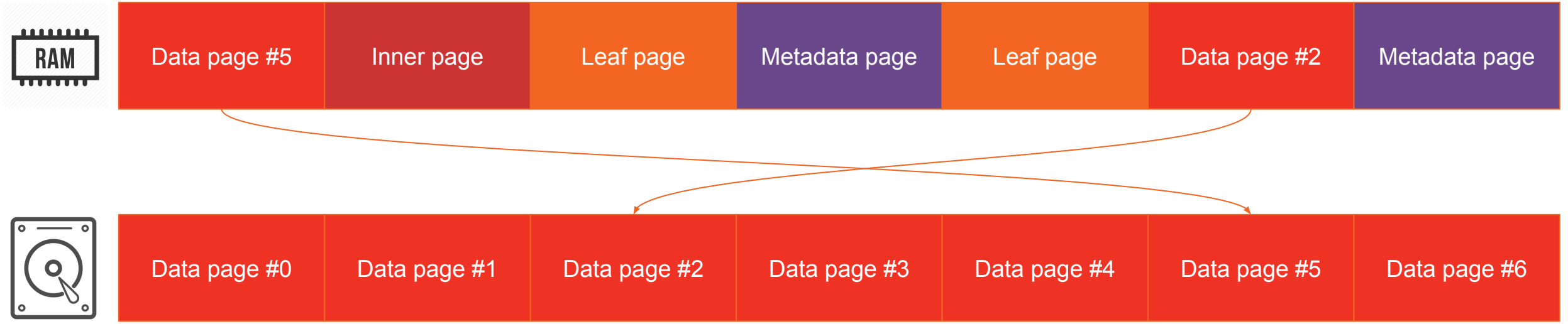
Index

Data

GridGain

Multi-Tier Storage Architecture

Memory segment



Partition file with Data

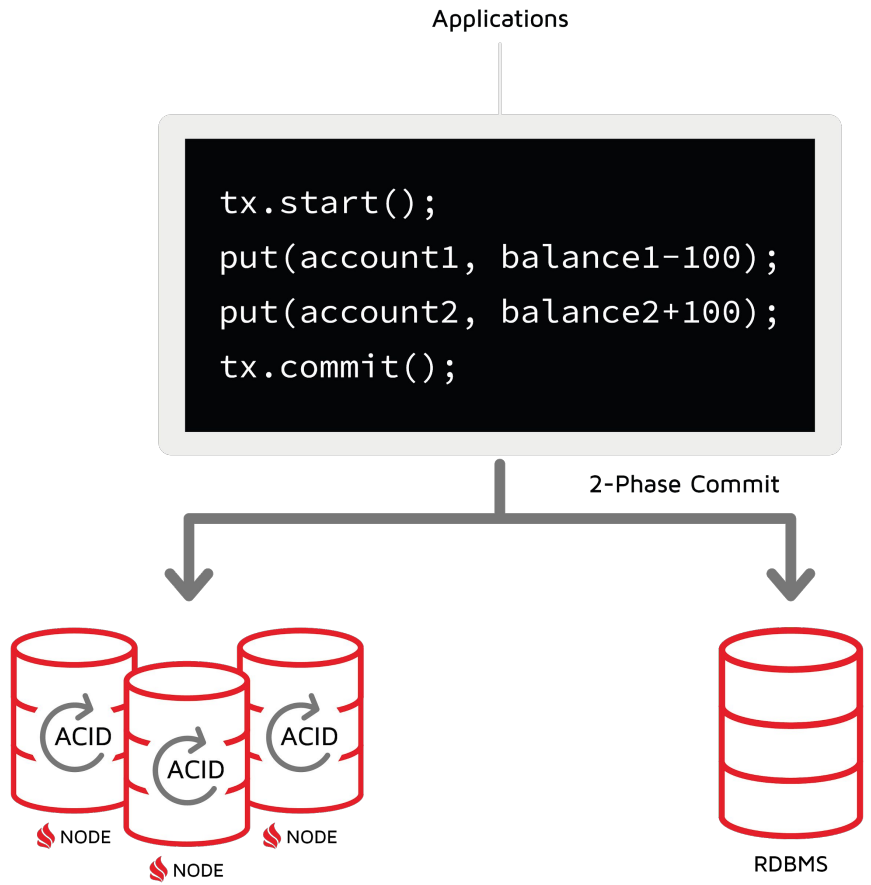
PageId → **Pages map** → **Pointer in a memory segment** (read/write ops)

PageId → **Position in a file** (load page/checkpoint)

GridGain

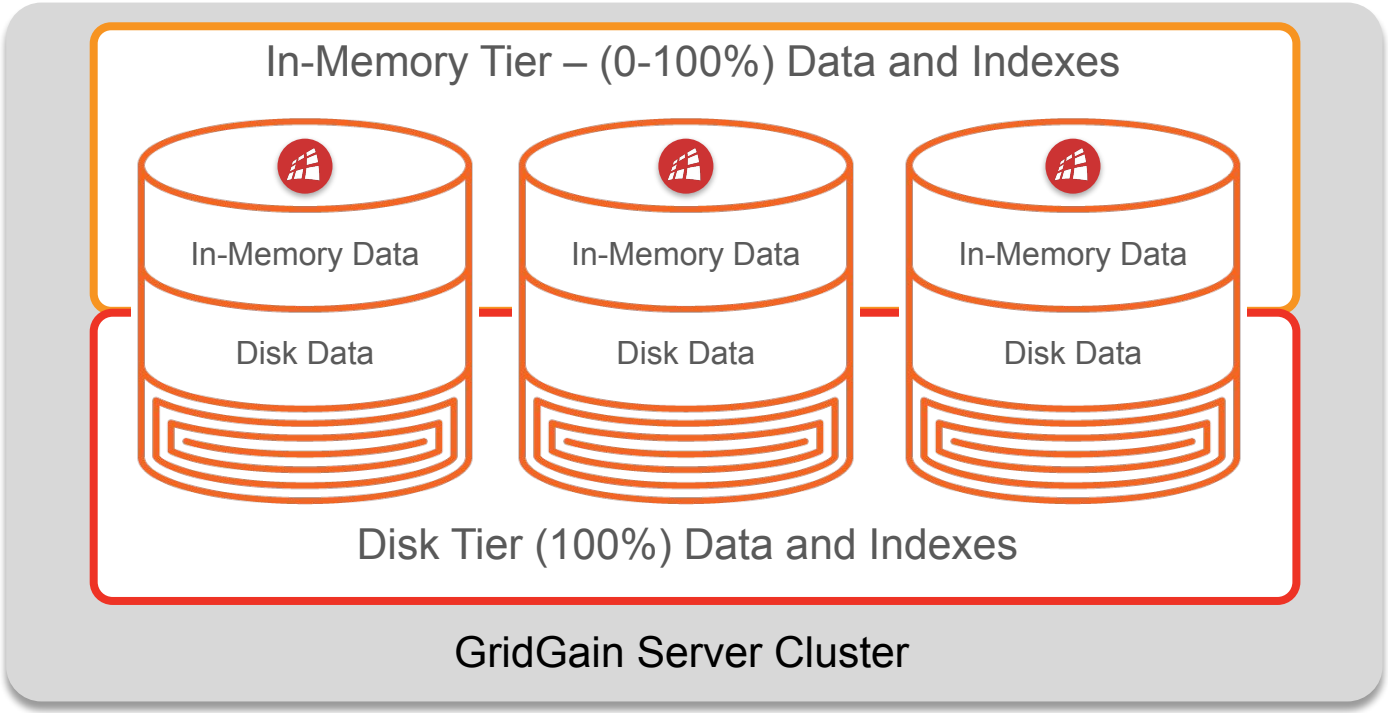
Strong Consistency and Distributed Transactions

- Strong or relaxed consistency
  - Transactional and atomic caches/tables
  - Tunable WAL settings (for Ignite Native persistence)
- Distributed ACID Transactions
  - 2-phase commit protocol
- Transactions supported for key-value APIs
  - MVCC for SQL transactions is in experimental mode



GridGain

Centralized Backup and Recovery Management

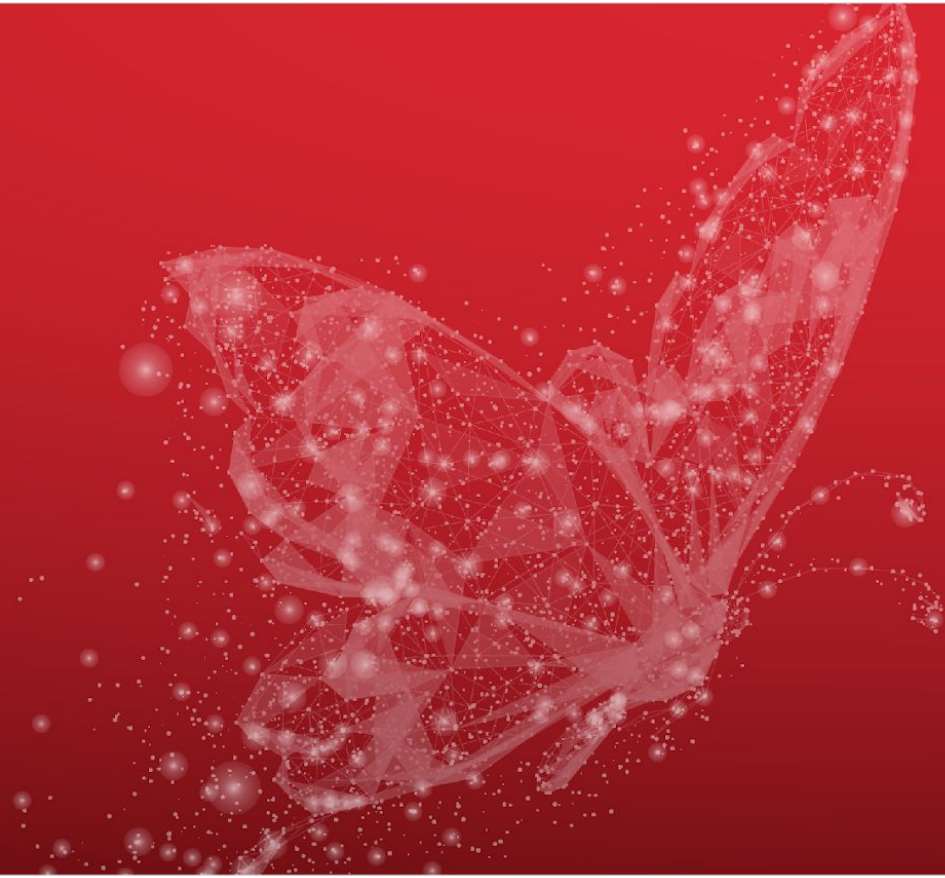


- Full and incremental snapshots
- Continuous archiving (WAL)
- Network backups

- Point-in-time Recovery
- Heterogeneous Recovery

GridGain

Latest Enhancements



GridGain

Advanced Disk Defragmentation

- Prior to GridGain 8.8:
  - Entry removal does not reclaim disk space (but can be reused)
  - Defragmentation requires rolling restart and manual file cleanup

- GridGain 8.8:
  - Advanced tooling to perform defragmentation, shrink files and reclaim space

```
control.(sh|bat) --defragmentation schedule --nodes <consistentIds> [--caches <cacheNames>]
```

SQL Memory Quotas

- Prior to GridGain 8.8:
  - Heavy queries can lead to out-of-memory issues
- GridGain 8.8:
  - Ability to specify maximum amount of RAM used
  - Per-node and per-query limits
  - Optional offload to disk

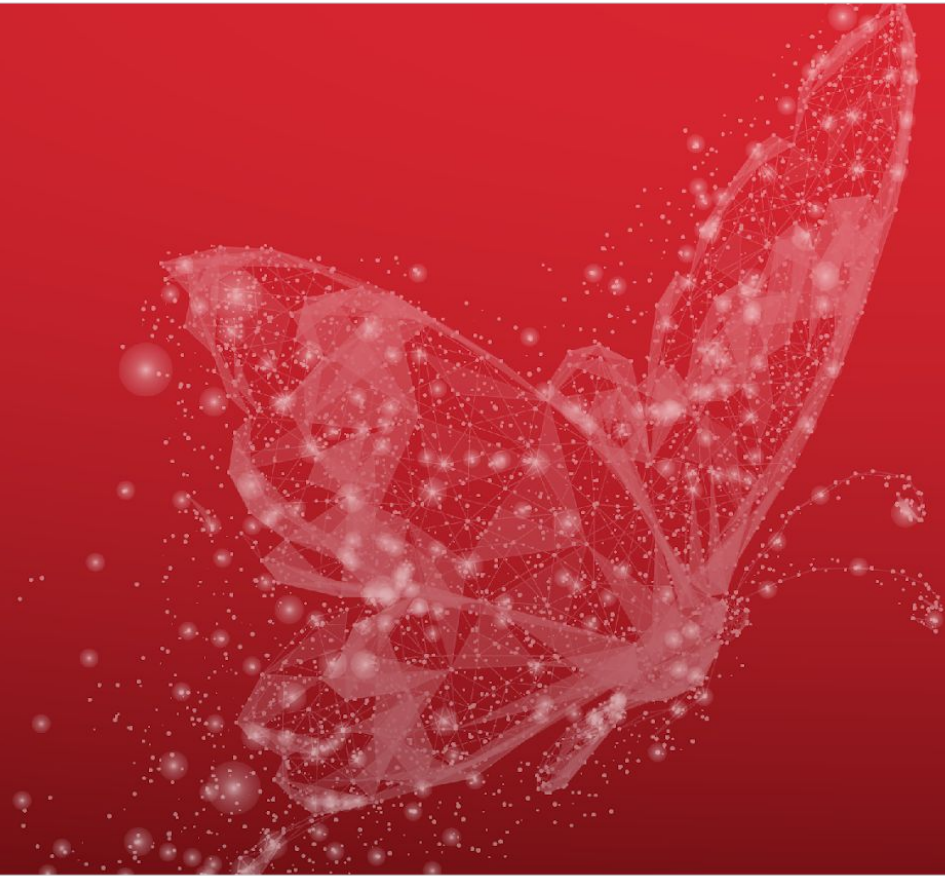
Data Compression

GridGain

Data Encryption

```
<bean class="org.apache.ignite.configuration.IgniteConfiguration">
    <!-- We need to configure EncryptionSpi to enable encryption feature. -->
    <property name="encryptionSpi">
        <!-- Using EncryptionSpi implementation based on java keystore. -->
        <bean class="org.apache.ignite.spi.encryption.keystore.KeystoreEncryptionSpi">
            <!-- Path to the keystore file. -->
            <property name="keyStorePath" value="ignite_keystore.jks"/>
            <!-- Password for keystore file. -->
            <property name="keyStorePassword" value="mypassw0rd"/>
            <!-- Name of the key in keystore to be used as a master key. -->
            <property name="masterKeyName" value="ignite.master.key"/>
            <!-- Size of the cache encryption keys in bits. Can be 128, 192, or 256 bits.-->
            <property name="keySize" value="256"/>
        </bean>
    </property>
    <property name="cacheConfiguration">
        <bean class="org.apache.ignite.configuration.CacheConfiguration">
            <property name="name" value="encrypted-cache"/>
            <property name="encryptionEnabled" value="true"/>
        </bean>
    </property>
</bean>
```

Demos



GridGain

Upcoming Events

Wednesday, February 10, 2021

Denis Magda

Developer Training

[Developer Training] Apache Ignite Essentials - Key Design Principles for Building Data-Intensive Applications

Detecting Potential Hazardous Situations in the Dutch Railway Planning with Apache Ignite

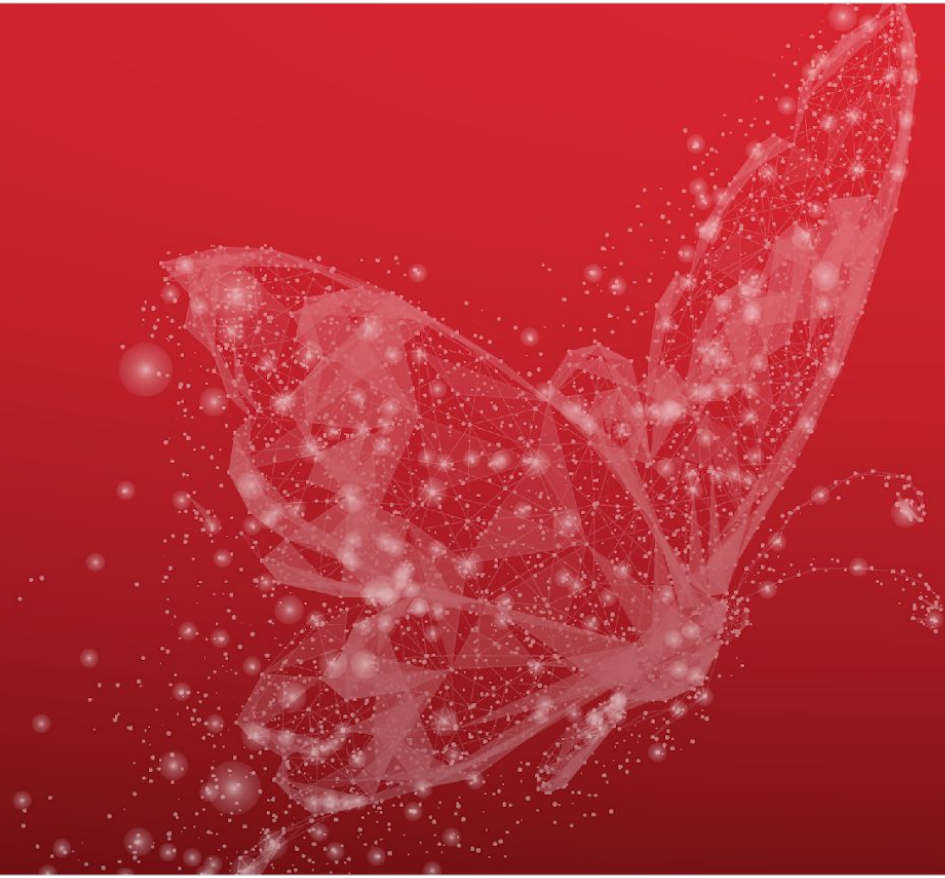
Tuesday, February 16, 2021

Apache Ignite Virtual Meetup

ProRail

GridGain

Thank You!



GridGain