Apache Ignite - In-Memory Data Fabric

Beyond the Data Grid

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#apacheignite

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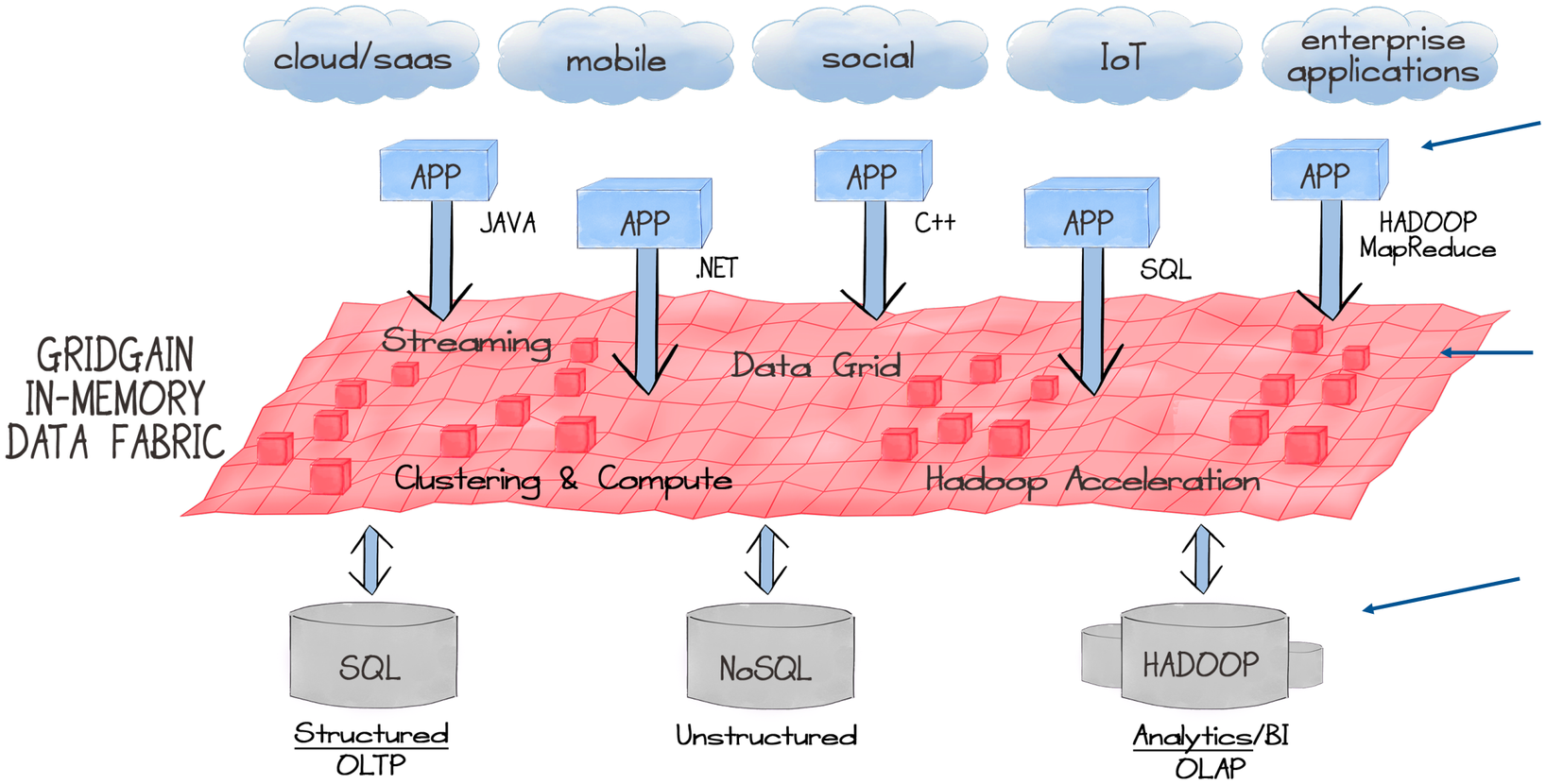
Agenda

- Project history
- **In-Memory Data Fabric**
  - Advanced Clustering
  - In-Memory Compute Grid
  - In-Memory Data Grid
  - In-Memory Service Grid
  - In-Memory Streaming & CEP
  - Plug-n-Play Hadoop Accelerator

In-Memory Data Fabric

Strategic Approach to IMC



- Supports Applications of various types and languages

- Open Source – Apache 2.0
- Simple Java APIs
- 1 JAR Dependency
- High Performance & Scale
- Automatic Fault Tolerance
- Management/Monitoring
- Runs on Commodity Hardware

- Supports existing & new data sources
- No need to rip & replace

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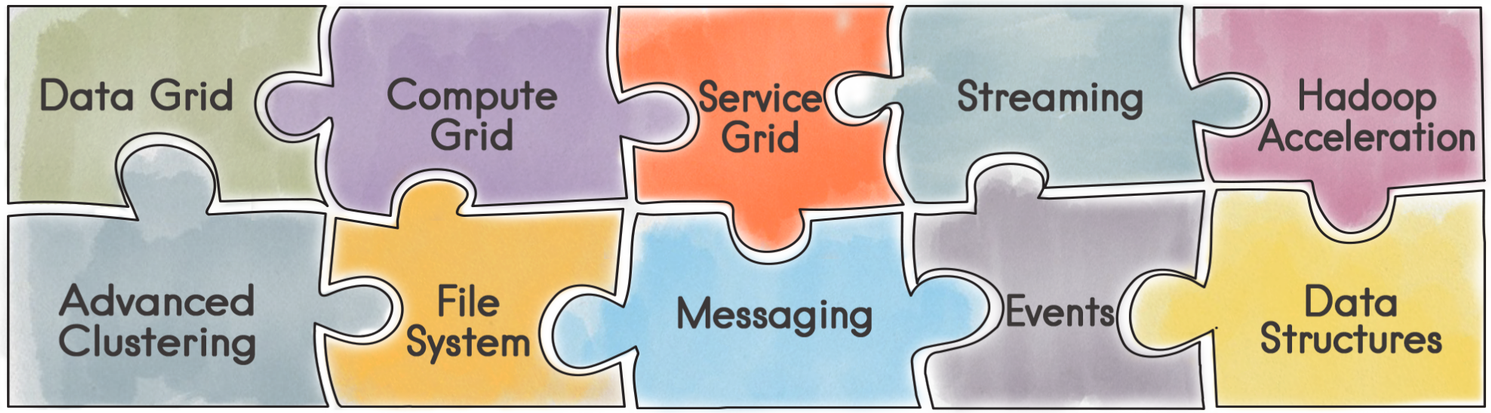
In-Memory Data Fabric

Main Characteristics



Performance

- High Throughput
- Low Latencies

Scalability

- Add Cluster Members (cores)
- Add Memory (RAM)

High Availability

- Data Backups
- Datacenter Replication

Transactions

- Fully ACID Compliant
- Optimistic & Pessimistic

Persistence

- SQL, NoSQL, Hadoop

Security

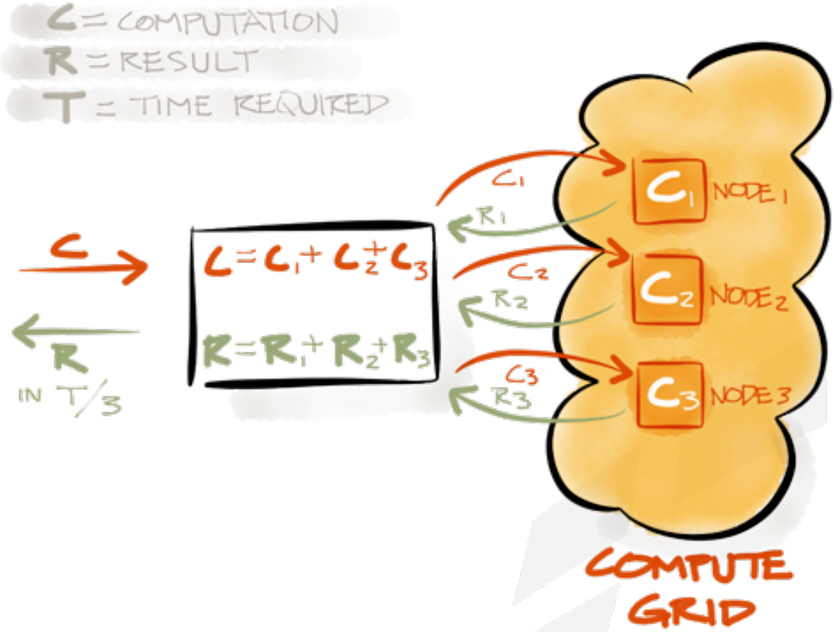
- Authentication
- Authorization
- Tracing & Auditing

In-Memory Clustering & Deployment

- Ease of Getting Started
  - Automatic Discovery
- Any Environment
  - Public Cloud
  - Private Cloud
  - Hybrid Cloud
  - Local Laptop
- Zero-Deployment
  - Auto-Deploy Code
- Full Cluster Management
- Pluggable Design

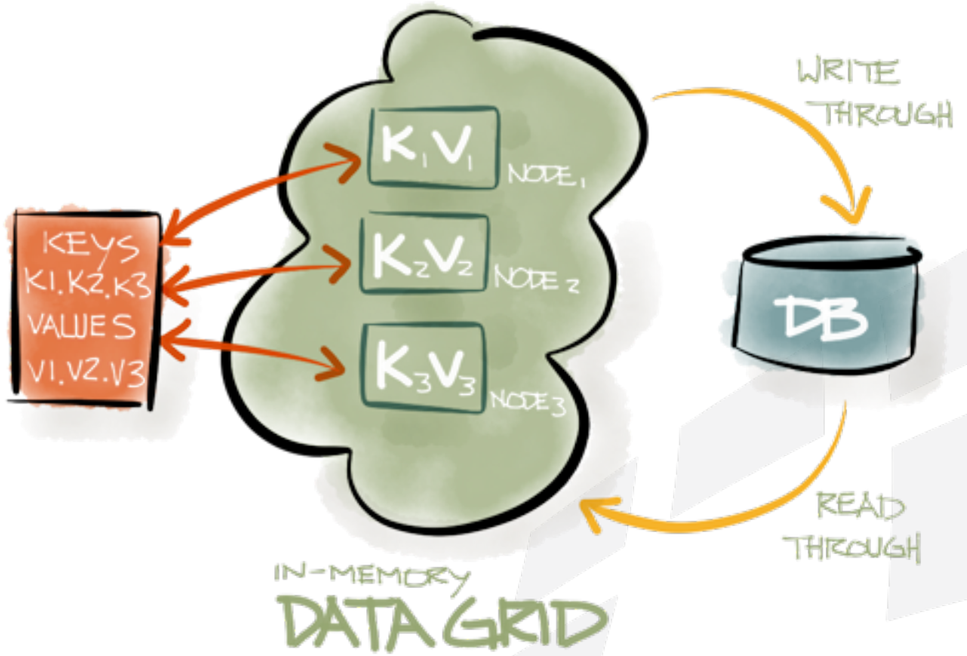
In-Memory Compute Grid

- Direct API for MapReduce
- Zero Deployment
- Cron-like Task Scheduling
- State Checkpoints
- Load Balancing
- Automatic Failover
- Full Cluster Management
- Pluggable SPI Design



In-Memory Data Grid

- Distributed In-Memory Key-Value Store
- Replicated and Partitioned data
- TBs of data, of any type
- On-Heap and Off-Heap Storage
- Highly Available In-Memory Replicas
- Automatic Failover
- Distributed ACID Transactions
- SQL99 queries and JDBC driver
- Collocation of Compute and Data



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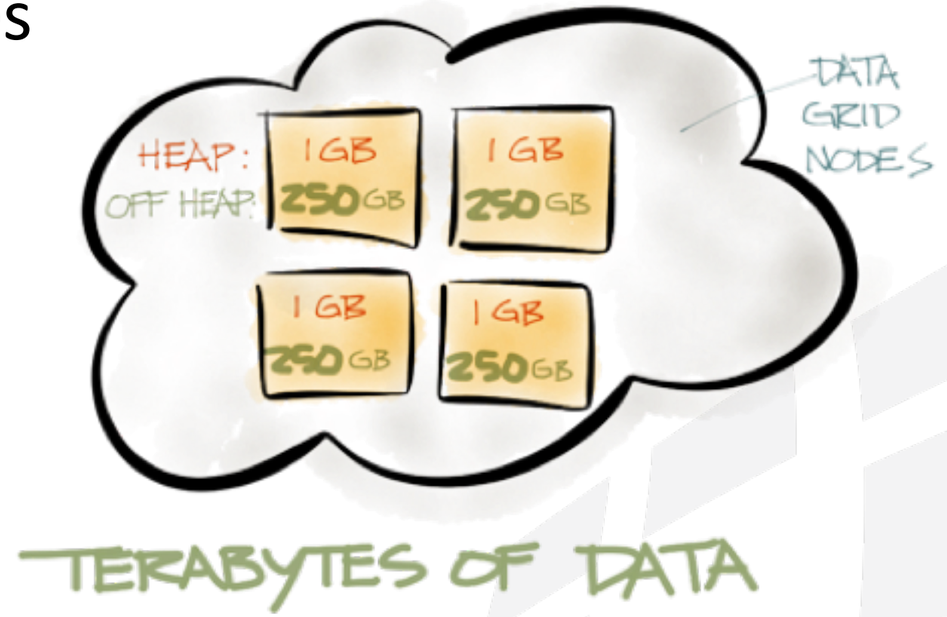
In-Memory Data Fabric: Off-Heap Memory

- Unlimited Vertical Scale
- Avoid Java Garbage Collection Pauses
- Small On-Heap Footprint
- Large Off-Heap Footprint
- Off-Heap Indexes
- Full RAM Utilization
- Simple Configuration



Distributed Java Structures

- Distributed Map (cache)
- Distributed Set
- Distributed Queue
- CountDownLatch
- AtomicLong
- AtomicSequence
- AtomicReference
- Distributed ExecutorService

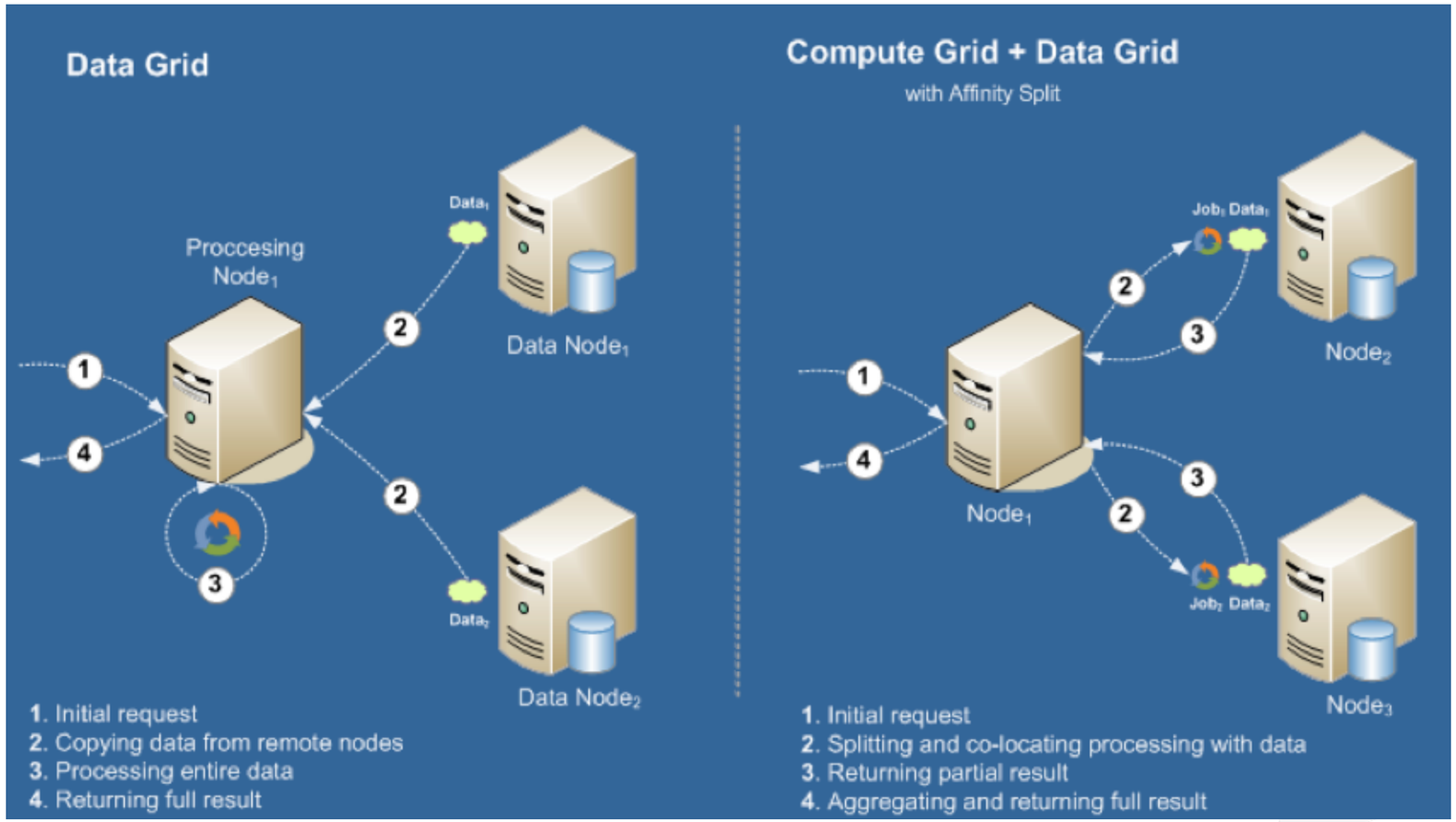
```
GridCacheQueue<Integer> queue =
    dataStructures.queue("myQ",

// Distribute queue elements
// across grid.
for (int i = 0; i < 20; i++)
    queue.add(i);

// Poll queue elements.
for (int i = 0; i < 20; i++)
    queue.poll();
```

Client-Server vs Affinity Colocation

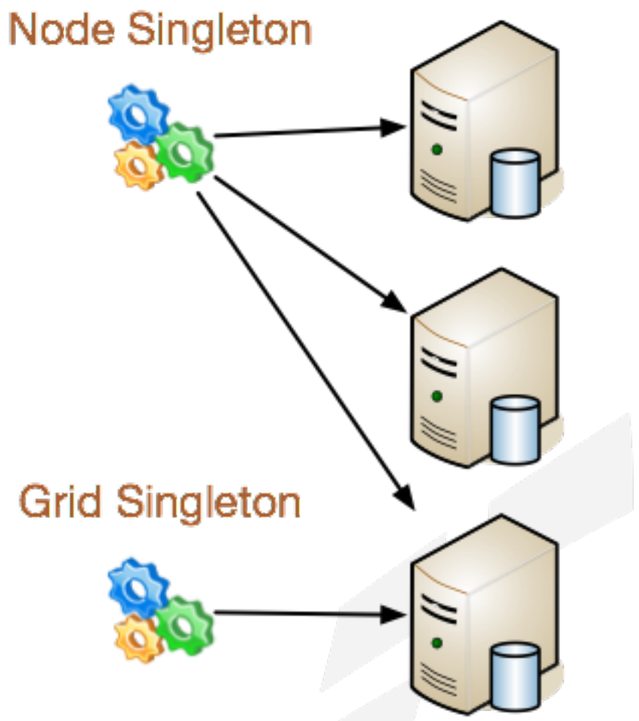
Client-Server



Affinity Colocation

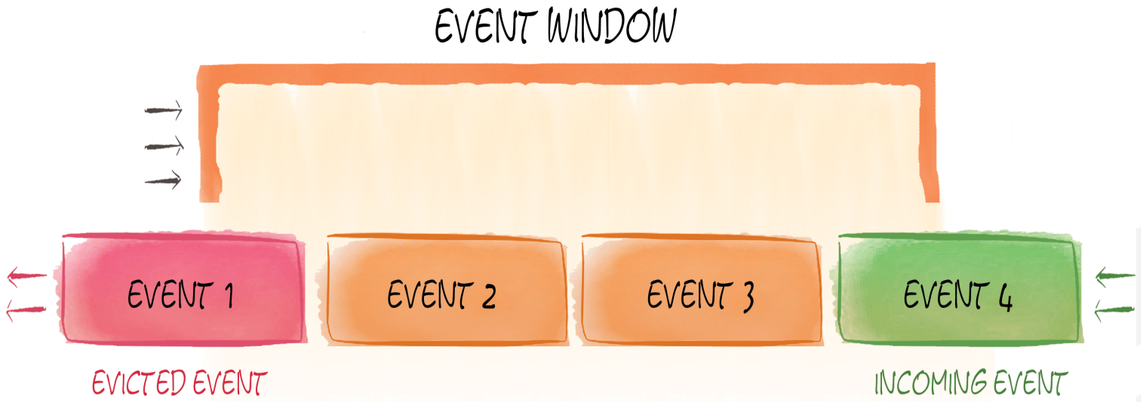
In-Memory Service Grid

- Distribute Any Data Structure
  - Available Anywhere on the Grid
  - Automatic Remote Access via Proxies
- Controlled Deployment
  - Support for Cluster Singleton
  - Support for Node Singleton
  - Support for Custom Topology
  - Load Balanced
- Guaranteed Availability
  - Auto Redeployment in Case of Failures



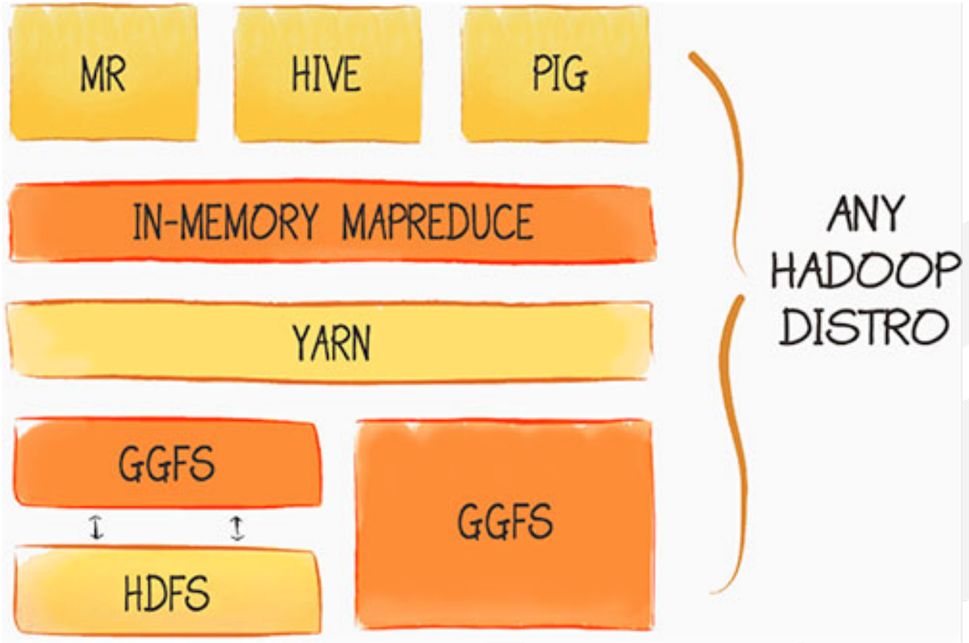
In-Memory Streaming and CEP

- Streaming Data Never Ends
- Branching Pipelines
- Pluggable Routing
- Sliding Windows for CEP/Continuous Query
- Real Time Analysis



In-Memory Hadoop Accelerator

- **Plug and Play installation**
- 10x to 100x Acceleration
- In-Memory Native MapReduce
- In-Process Data Colocation
- IgniteFS In-Memory File System
- Read-Through from HDFS
- Write-Through to HDFS
- Sync and Async Persistence



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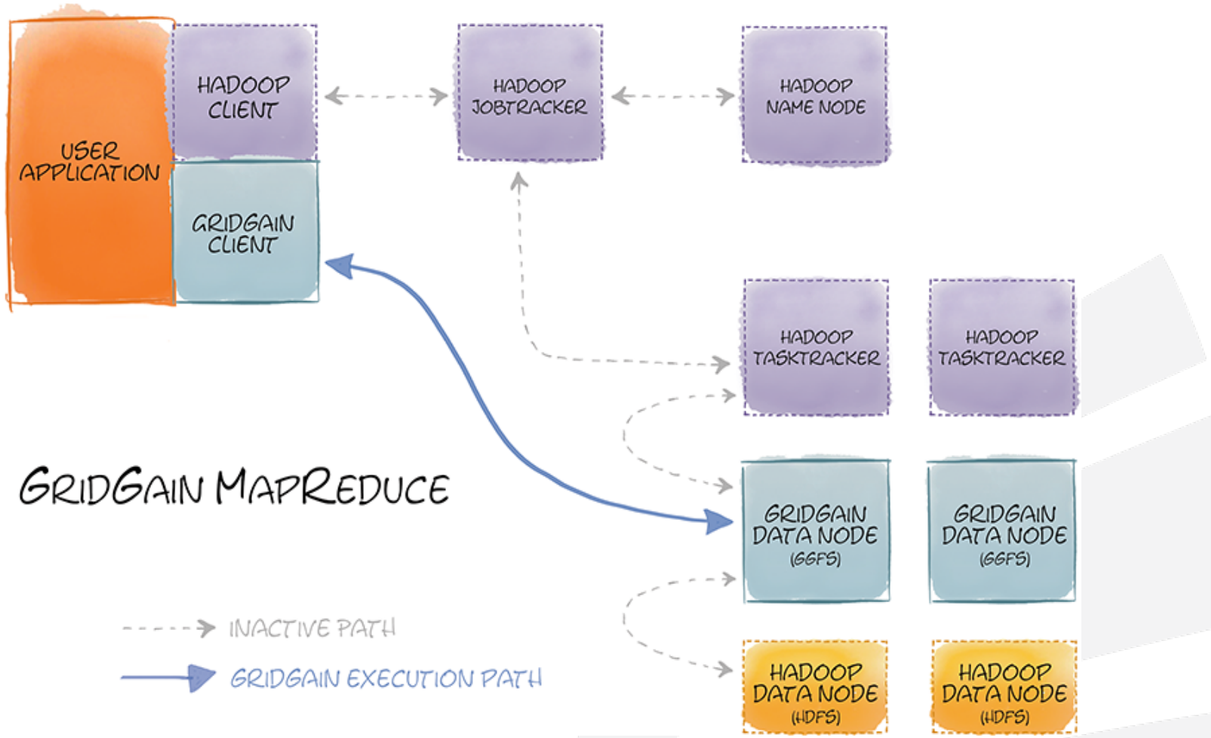
In-Memory Hadoop Accelerator

- **Zero Code Change**
- In-Memory Native Performance
- Use existing MR code
- Use existing Pig/Hive queries
- No Name Node
- Eager Push Scheduling



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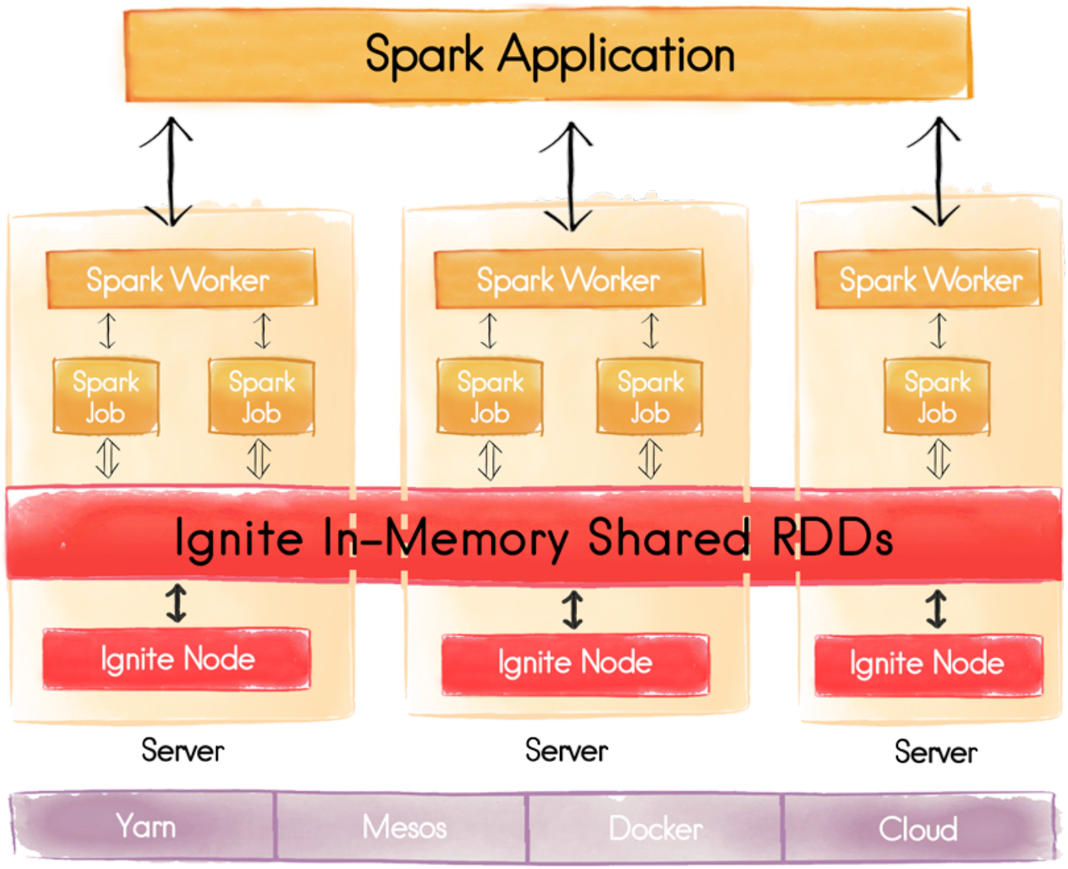
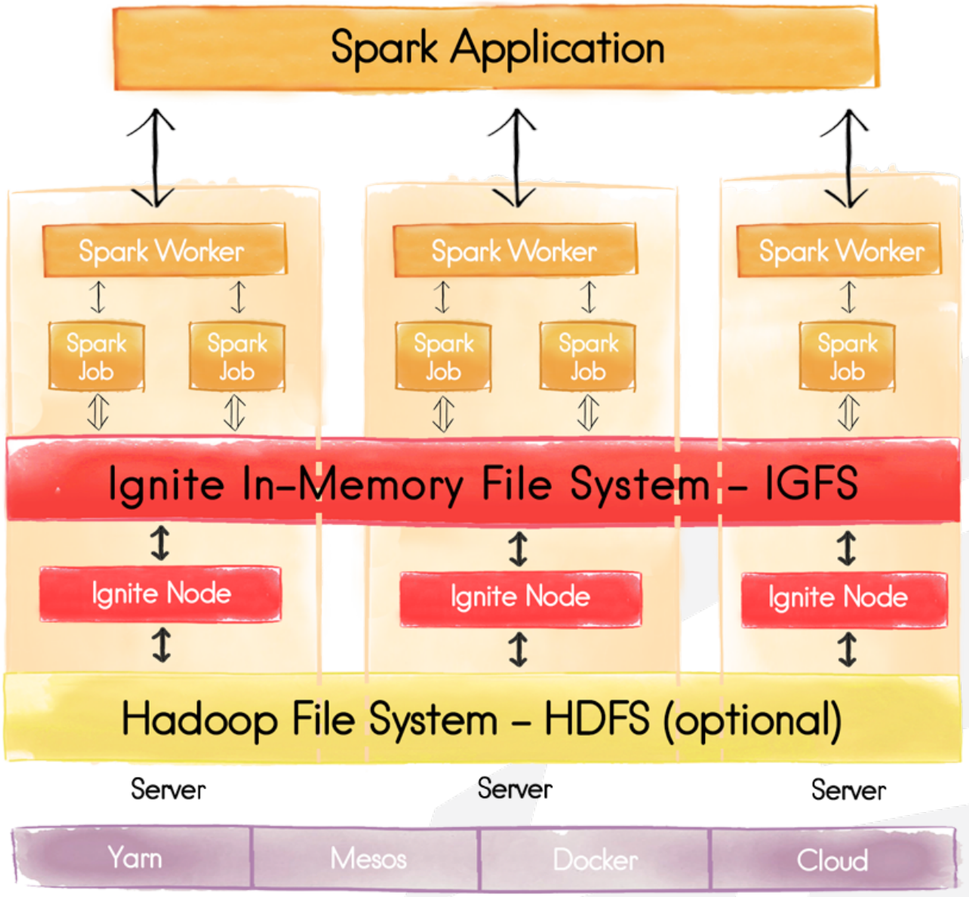
Spark Integration – IGFS & Shared RDD





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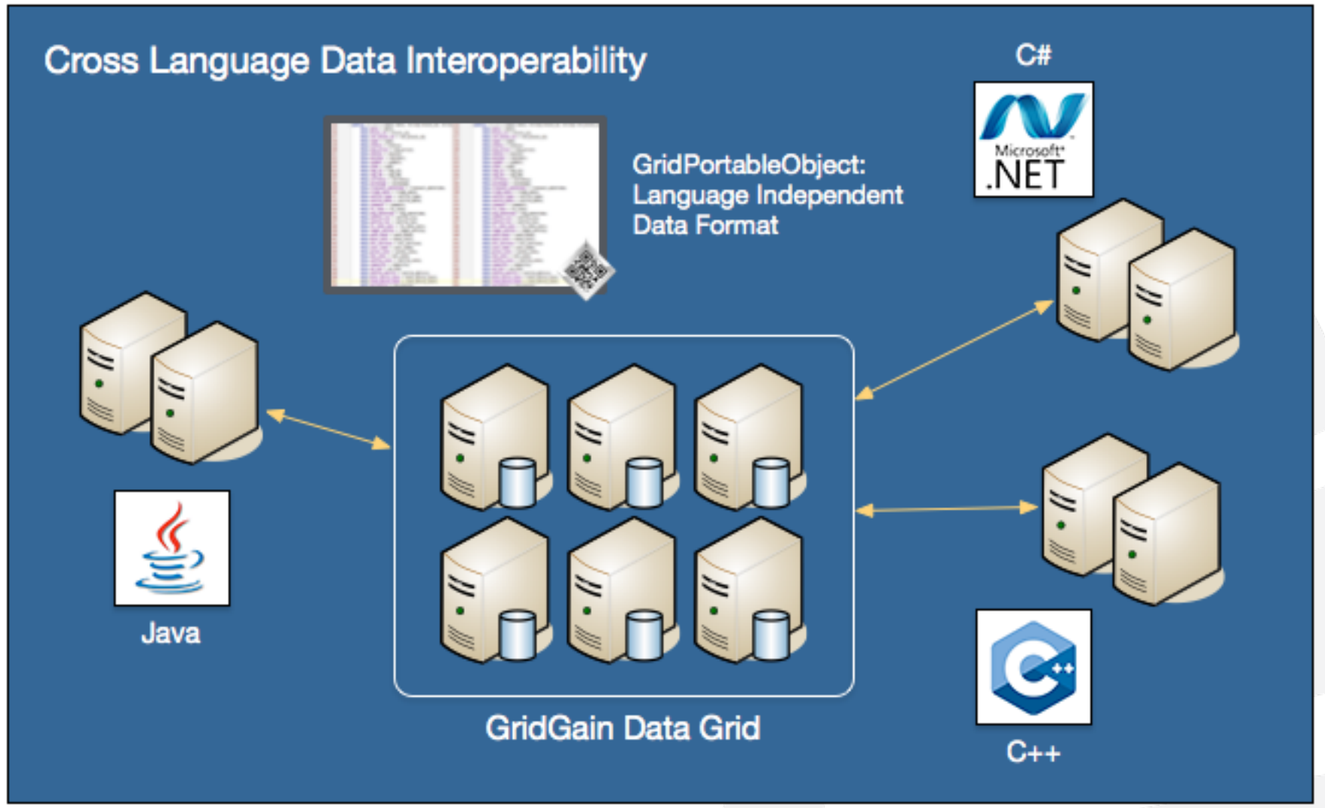
Cross-Language Interoperability

- **C++/.NET/PHP/Java/Node.js**
- Portable Objects
- Performance Across Languages
- Client Feature Parity
- Dynamic Schema Changes
- Searchable/Indexable
- Version Independent



In-Memory Data Fabric: Data Center Replication

- Up to 32 Data Centers
- Active-Active & Active-Passive
- Smart Conflict Resolution
- Durable Persistent Queues
- Automatic Throttling

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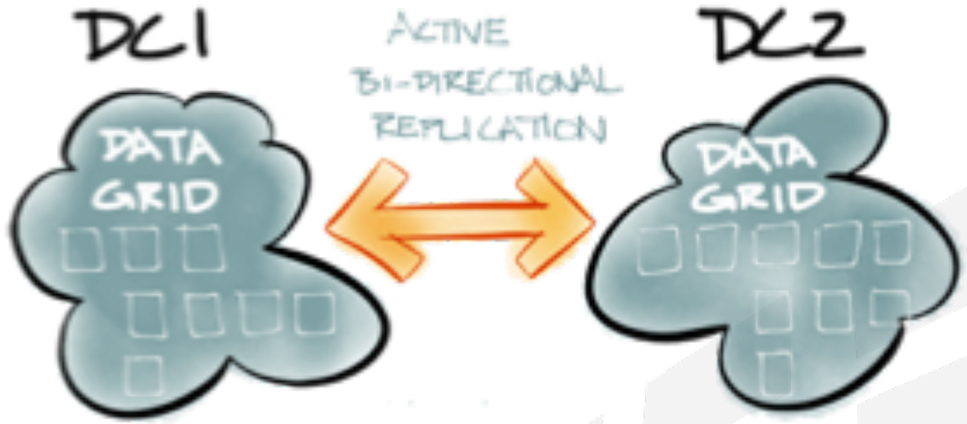
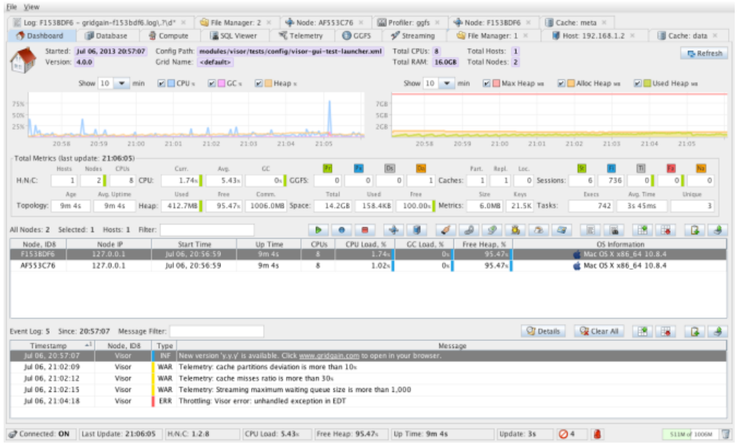
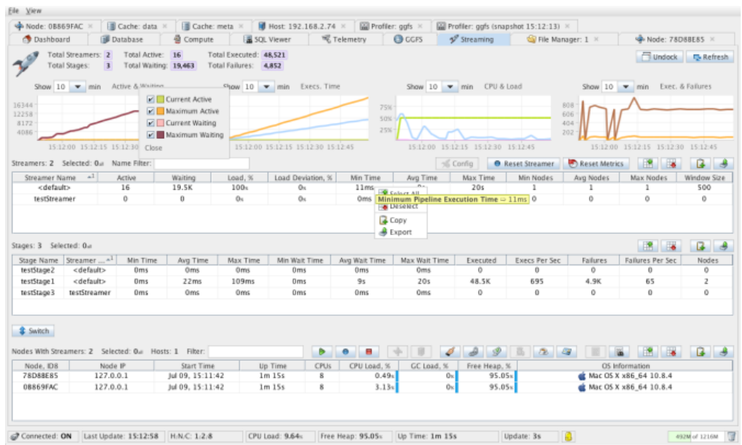
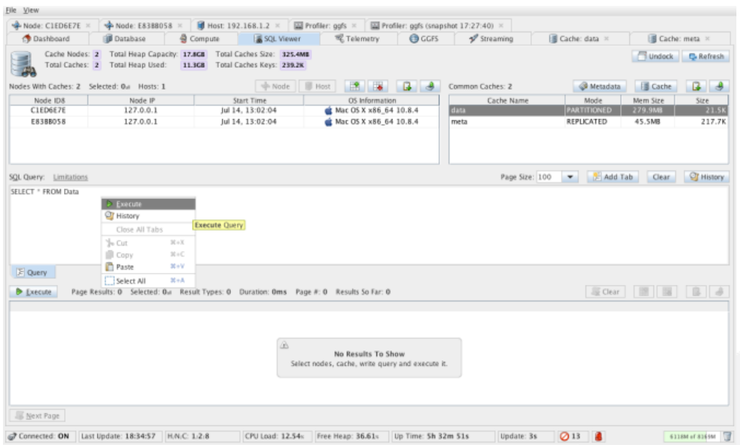
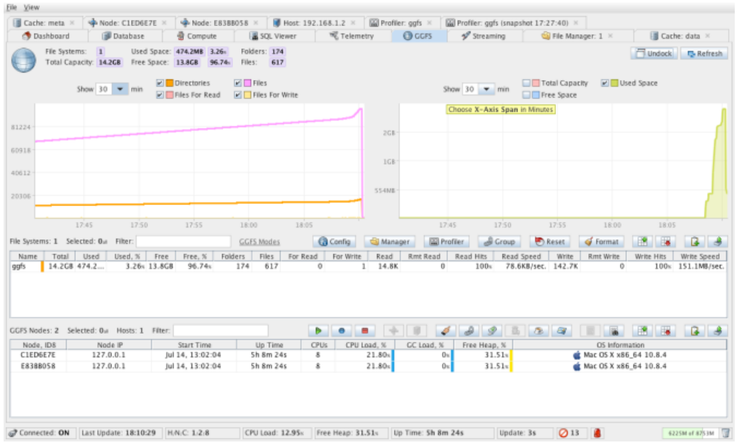


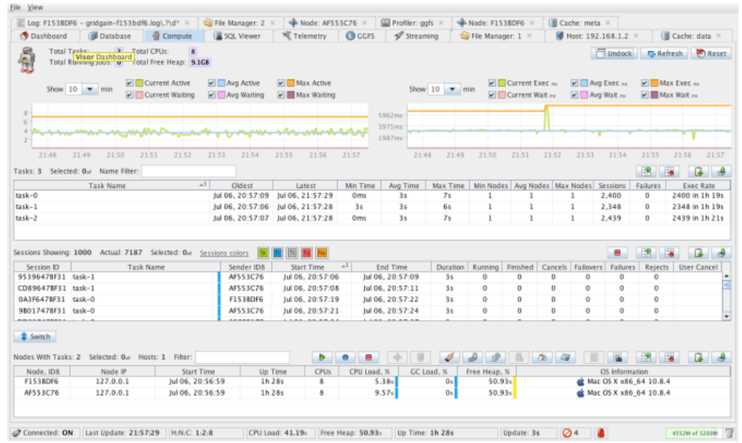
Management & Monitoring

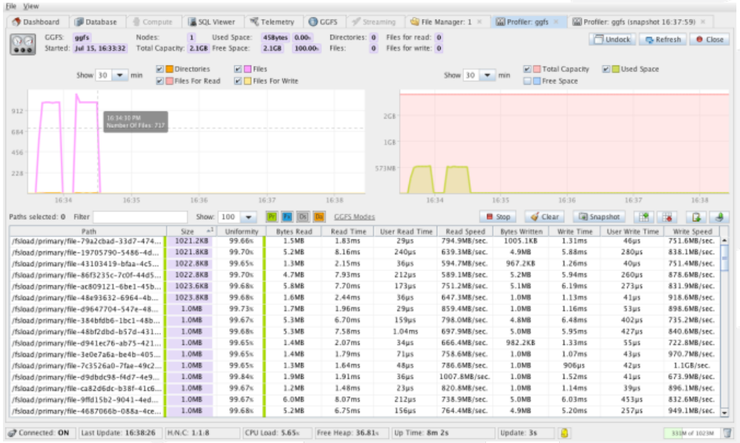












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Local Restartable Store

- Persistent On-Disk Store
- Fast Recovery
- Local Data Reload
  - Eliminate Network and Db impacts when reloading in-memory store
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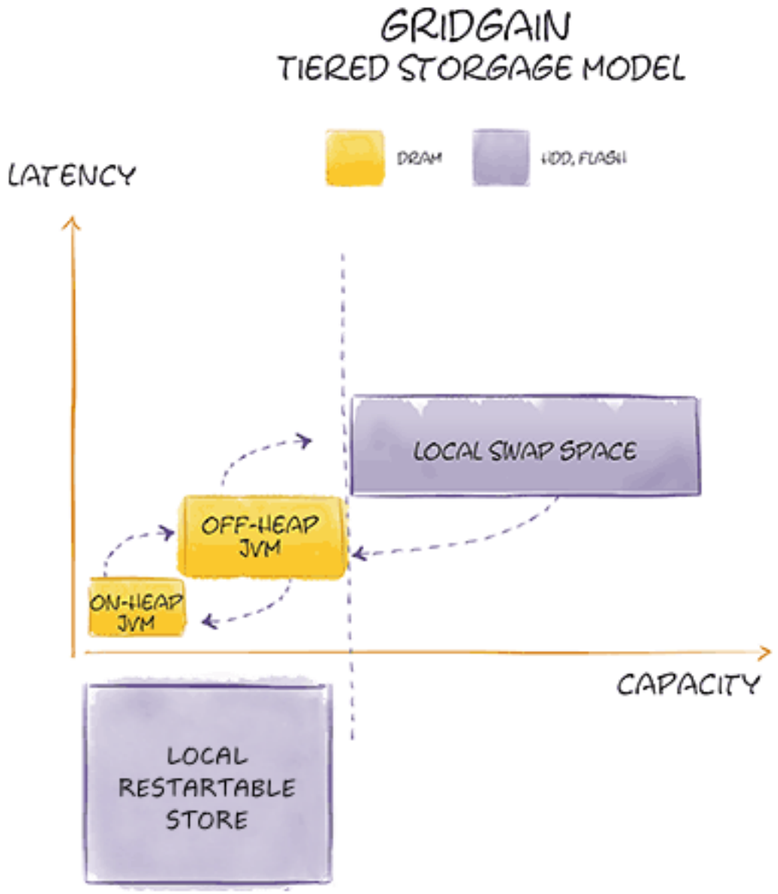

In-Memory Data Fabric: Security

- Pluggable Auth & Auth
  - JAAS, LDAP, JNDI, Kerberos
- In-Cluster Node Authentication
- Client Authentication
- Secure Client Sessions
- Fine-Grained Authorization
- Comprehensive Auditing
  - Who? What? When?

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