



GridGain In-Memory Data Fabric: Empowering Payments With In-Memory Computing

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Payments Industry Is Growing

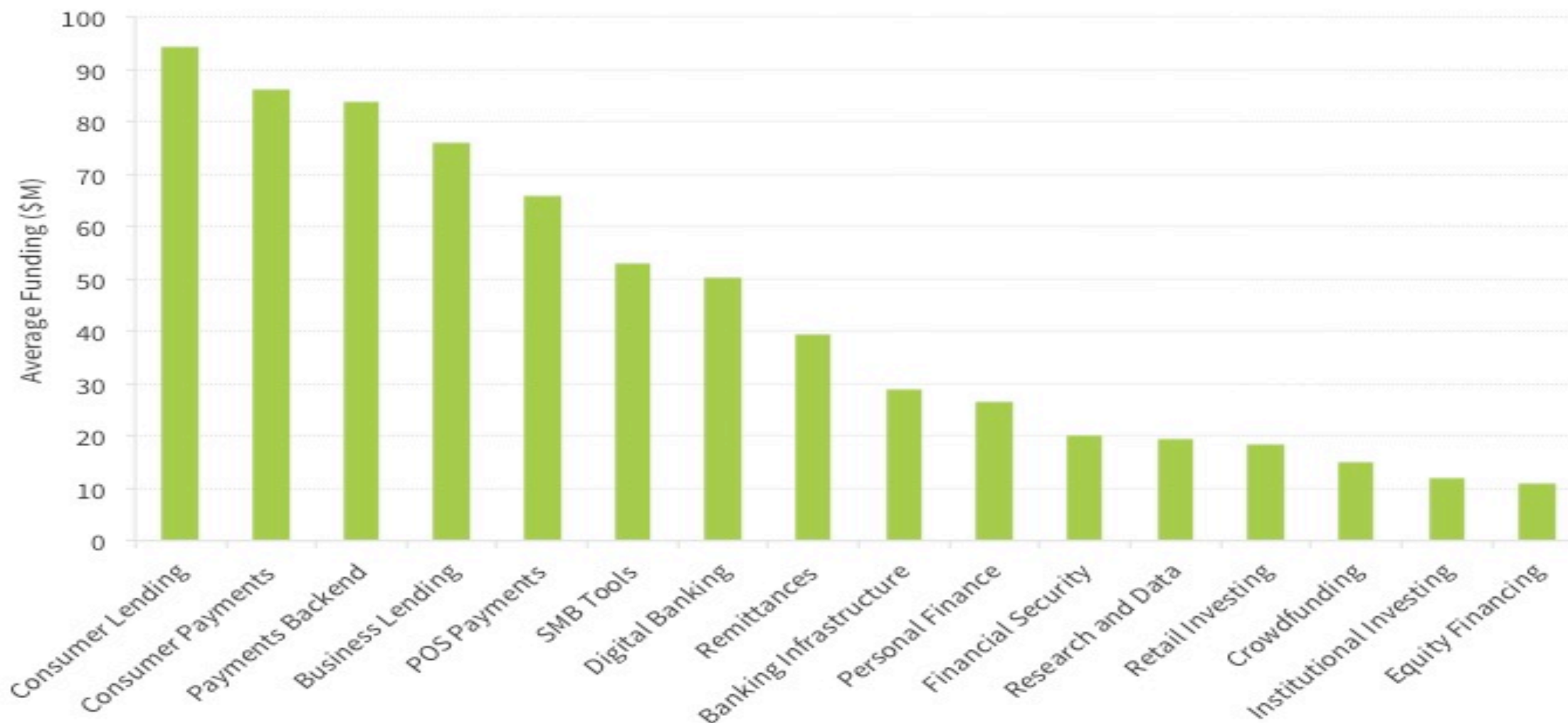
- Shift to Digital
- Startups
- Largest share of fintech
- Fintegration
- Global finance
- Low transaction costs
- Increased competition
- Buyer's market
- Customer rewarding
- Affordable technology
- Innovative services
- Reduction of steps to complete transaction
- Better and faster analytics
- Open source software
- Cloud and subscription-based computing
- Outsourcing

"Silicon Valley is coming" – Jamie Dimon

Investments Keep On Coming

Average Funding by Financial Technology Category

 **Venture Scanner**



Data as of January 2017

“Global Fintech Investment Grew 75 percent in 2015, Exceeding \$22 Billion” – Accenture report analyzing global fintech trends (Full report: www.fintechinnovationlablondon.co.uk/fintech-evolving-landscape.aspx)

Top Trends in Payments Processing

Mobile Payments

- Digital banking
- Instant and invisible payments
- Mobile and wearables apps
- IoT
- Social media and commerce integration (PSD2)
- Cooperation with banks and fintech

Digital Remittance

- Digital and mobile wallets
- Mobile and cloud-based point-of-sale
- Contactless spending
- Peer-to-peer
- Lower fees

Bitcoins and Blockchains

- Decentralized and distributed public ledger
- Payment hubs
- Reduced overhead
- Improved efficiency
- Growing competitiveness
- Lower fees

Payments Security

- Standard EMV security
- Cyber-security
- PSD2
- NFC (near field communication)
- Digital signatures
- Biometrics
- Authentication
- Authorization
- Audit

Challenges

- Increased fraud and hacking
- Global uncertainty
- Customer acquisitions
- Reputational risk
- Culture change
- Lack of cash reserves
- Complex regulations
- Consumer growth
- Customer service
- Performance
- Limitations of legacy technology
- Security concerns
- Lack of technology resources

Payment Predictions

“Within the next year, half of today’s smartphone users will use mobile payments as their preferred method for transactions” — <https://www.luxurydaily.com/why-mobile-wallets-are-the-new-credit-card-mobile-commerce-daily/>

“This year fewer than 25% of all in-store purchases will be cash-based transactions” — <http://www.business.com/credit-card-processing/little-known-facts-about-mobile-payments/>

“In 2017, mobile payments market is expected to be worth \$720 billion in transactions compared to \$235 billion in 2014” — <http://www.tomsguide.com/us/mobile-wallet-guide,news-20666.html>

“Mobile wallet market is predicted to reach \$142 billion by 2019” — <http://news.webindia123.com/news/Articles/India/20160612/2881035.html>

“In the middle of last year, there were more than \$1.46 trillion of bitcoin’s digital currency in circulation” — <http://www.businessinsider.com/satoshi-nakamoto-owns-one-million-bitcoin-700-price-2016-6>

Technology Trends

- Open source
- Software as a critical component of business
- Businesses make data-driven decisions
- Data: open, streaming, data lakes
- Open APIs
- Predictive analytics
- Performance, stability, security, scalability
- Recoverable transactions
- Serverless architectures
- Distributed systems
- Containers
- Microservice based architectures
- Machine learning
- Complex event processing

Why In-Memory Now?

Digital Transformation is Driving Companies Closer to Their Customers

- Driving a need for real-time interactions

Internet Traffic, Data, and Connected Devices Continue to Grow

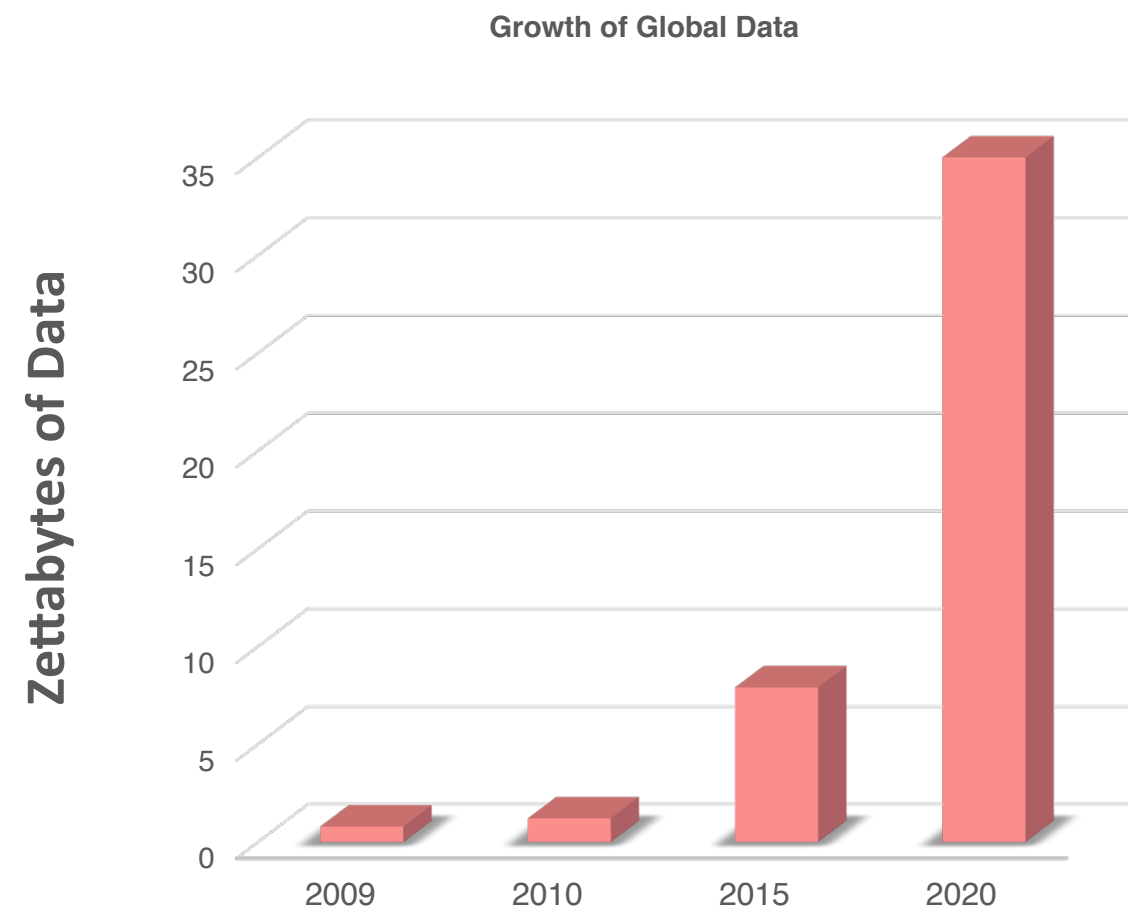
- Web-scale applications and massive datasets require in-memory computing to scale out and speed up to keep pace
- The Internet of Things generates huge amounts of data which require real-time analysis for real world uses

The Cost of RAM Continues to Fall

- In-memory solutions are increasingly cost effective versus disk-based storage for many use cases

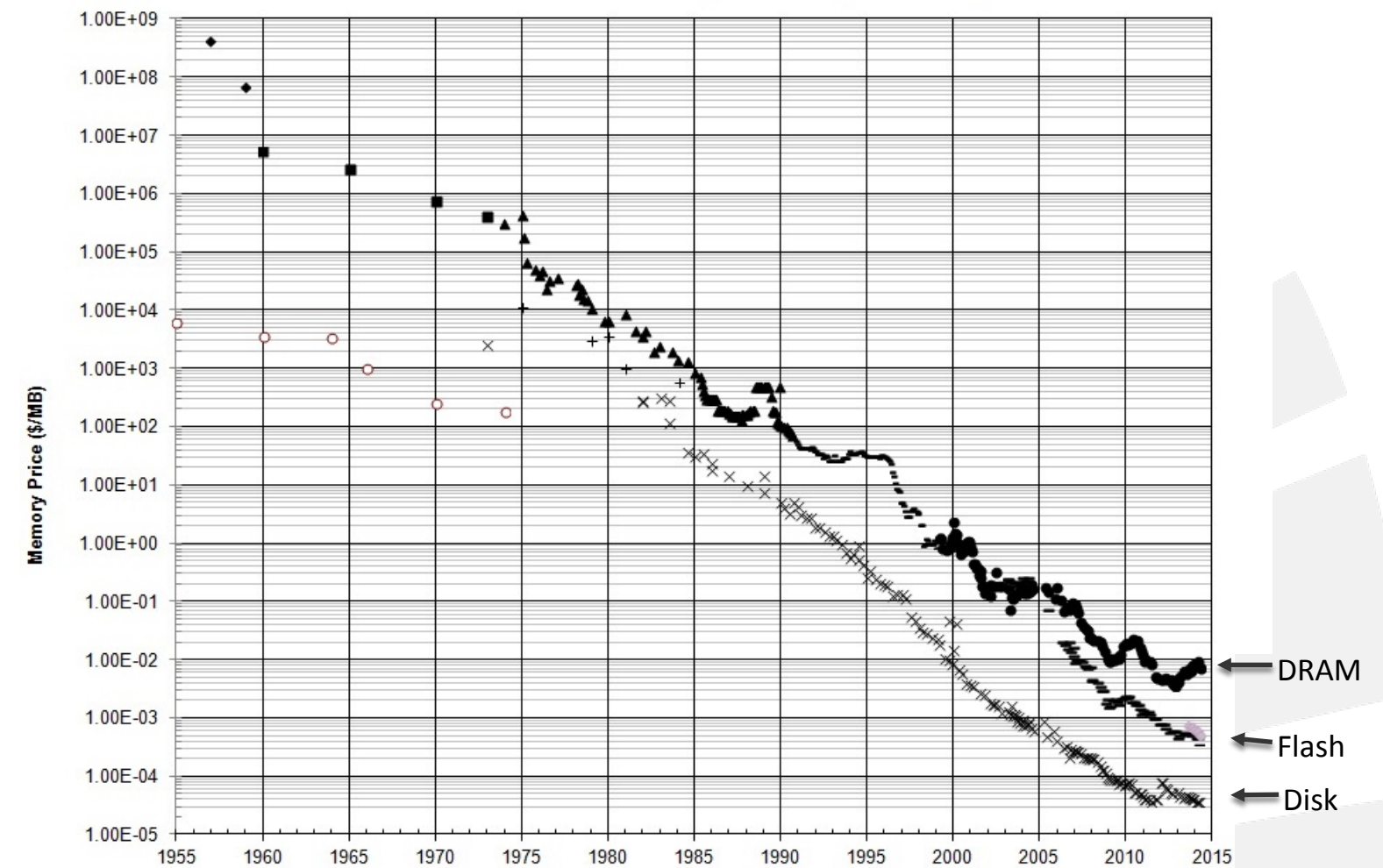
Why Now?

Data Growth and Internet Scale Driving Demand



8 zettabytes in 2015 growing to 35 in 2020

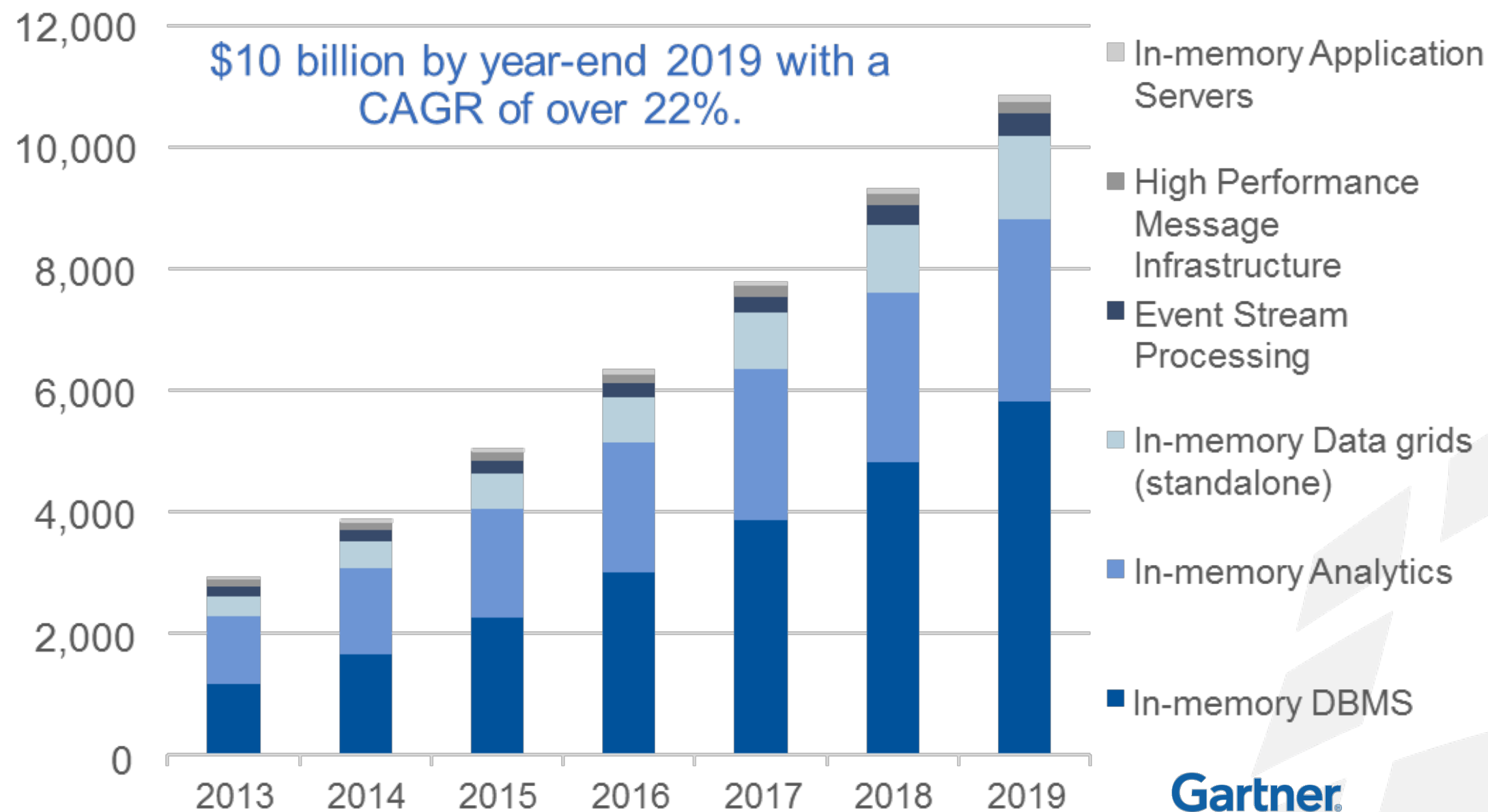
Declining DRAM Cost Driving Attractive Economics



Cost drops 30% every 12 months

The In-Memory Computing Technology Market Is Big — And Growing Rapidly

IMC-Enabling Application Infrastructure (\$M)



Evolution of In-Memory Grid Computing

- Move from Disk to 100% In-Memory (RAM)
- Leverage Clustered Memory and Parallel Distributed Processing
- Results: 1000x Faster, 10x ROI Improvement
- Making “Big Data” Fast

“In-memory will have an industry impact comparable to web and cloud.”

“RAM is the new disk, and disk is the new tape.”

Gartner

In-Memory Computing Market:

- \$10B in 2019
- CAGR 22%

Gartner

What is an In-Memory Computing Platform?

• Multi-Featured Solution

- Supports data caching, massive parallel processing, in-memory SQL, streaming and much more

Does Not Replace Existing Databases

- Slides in between the existing application and data layers

Supports OLTP and OLAP Use Cases

- Offers ACID compliant transactions as well as analytics support

Multi-Platform Integration

- Works with all popular RDBMS, NoSQL and Hadoop databases and offers a Unified API with support for a wide range of languages

Deployable Anywhere

- Can be deployed on premise, in the cloud, or in hybrid environments

The GridGain In-Memory Computing Platform

- A high-performance, distributed, in-memory platform for computing and transacting on large-scale data sets in real-time
- Built on Apache® Ignite™

• Features

• Data Grid

Compute Grid

SQL Grid

Streaming

Service Grid

Hadoop Acceleration

Architecture

Advanced Clustering

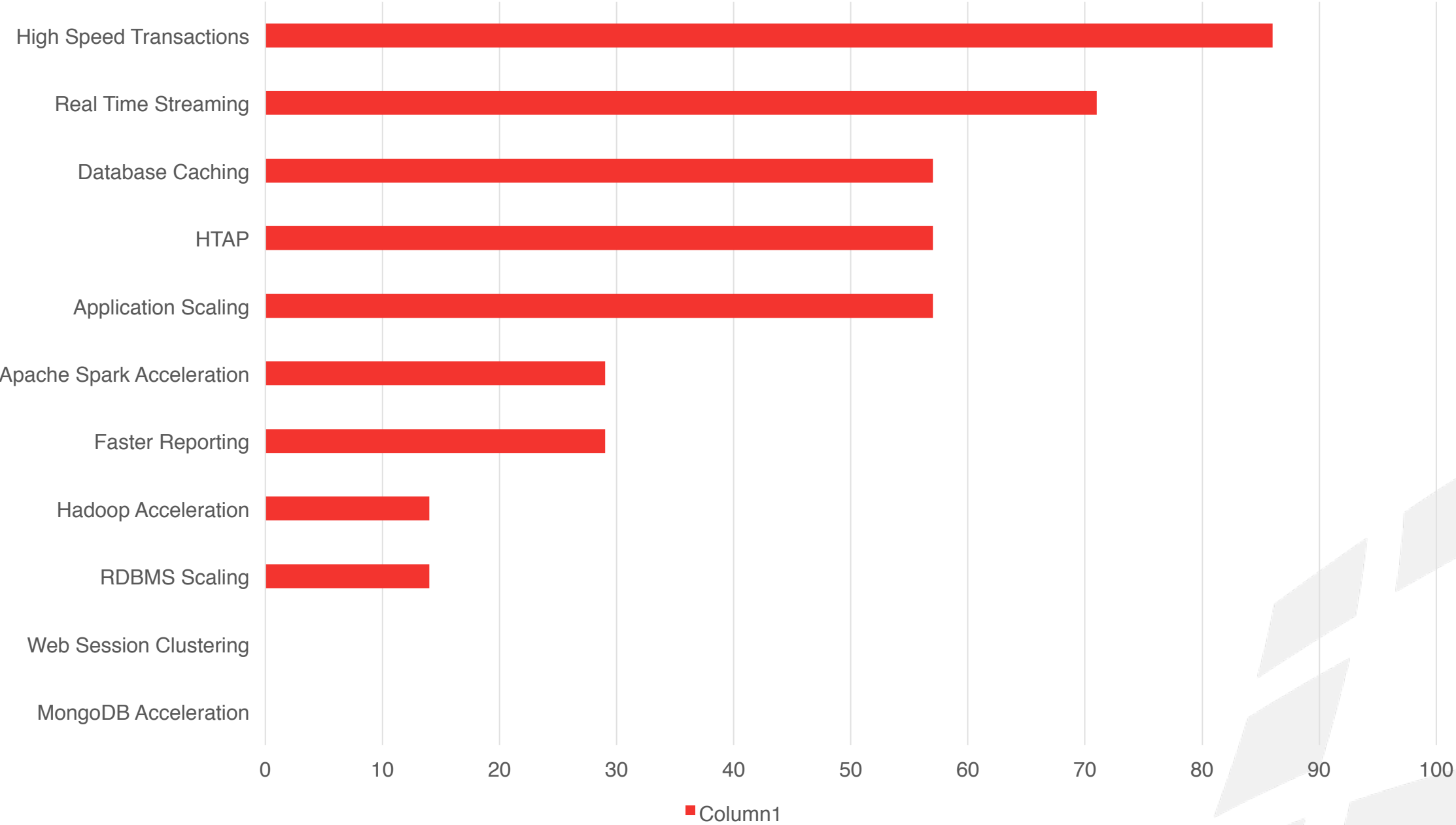
In-Memory File
System

Messaging

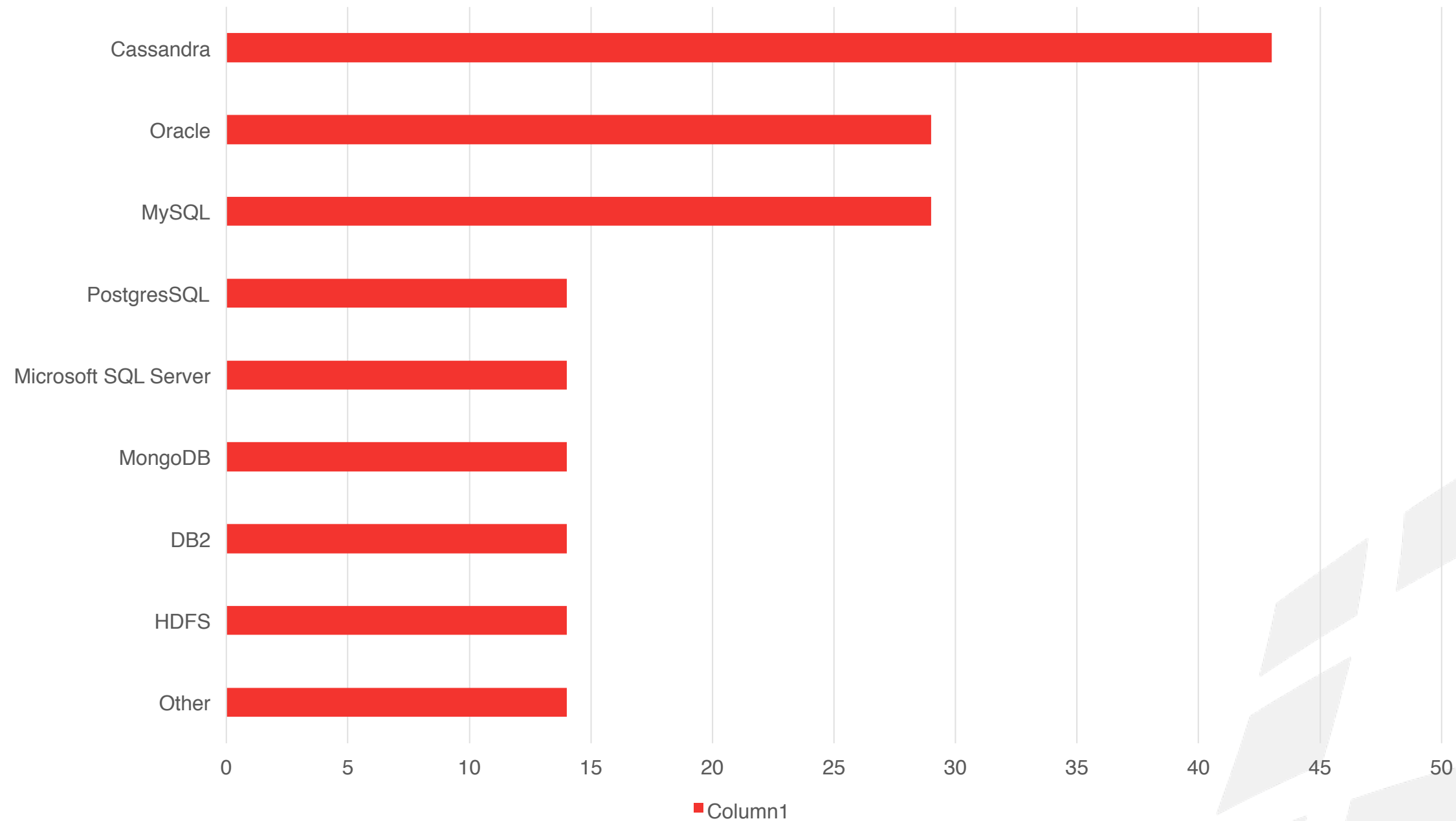
Events

Data Structures

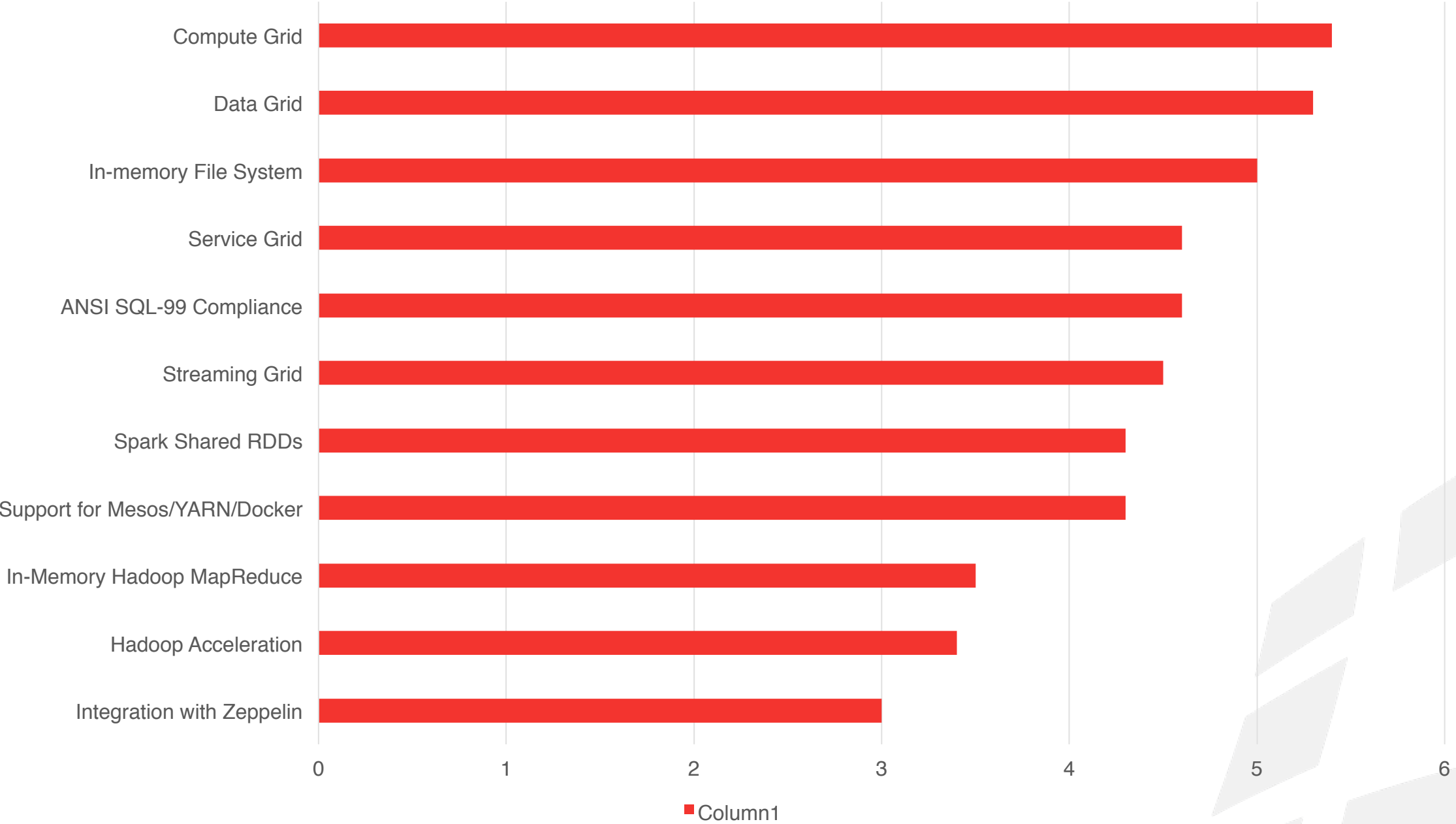
Survey Results: What uses were you considering for in-memory computing



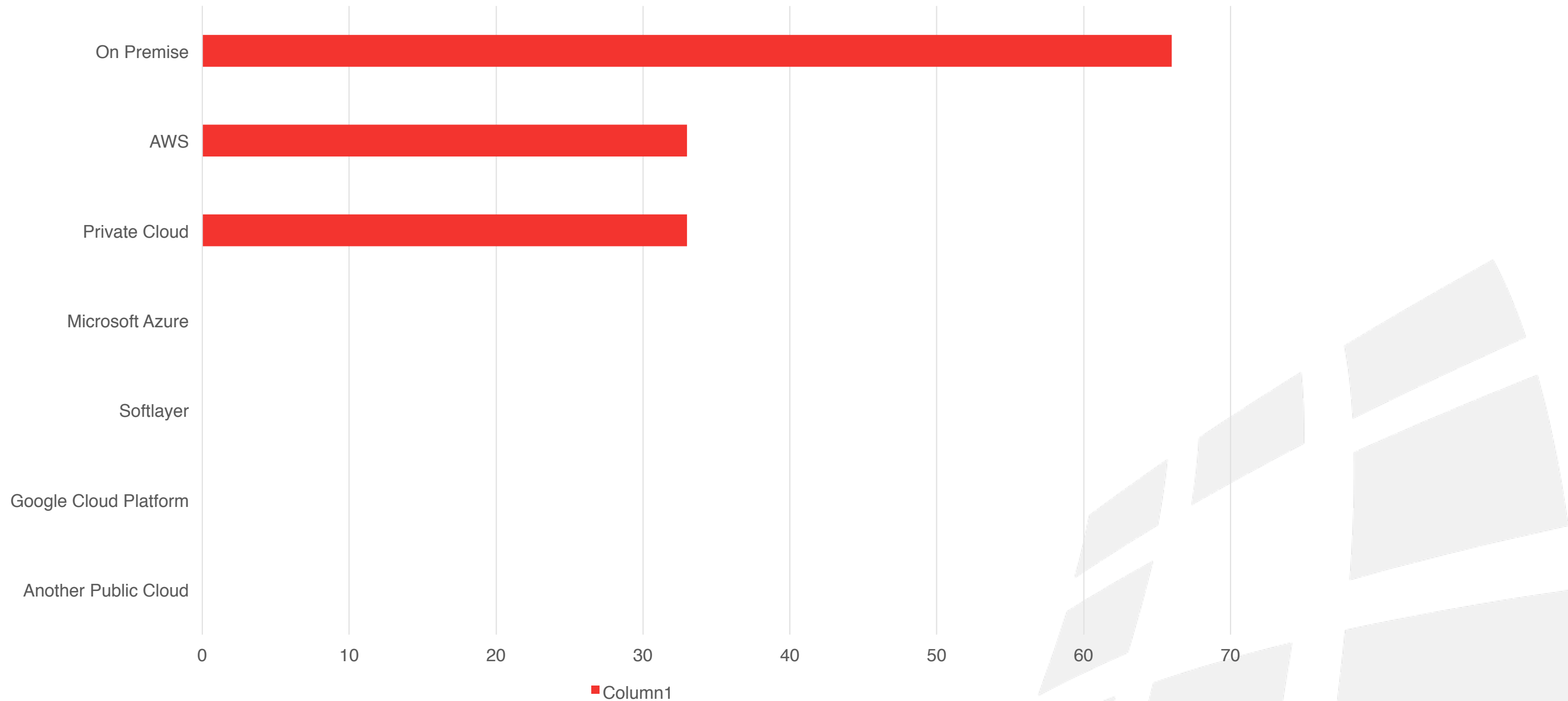
Survey Results: Which data stores are you/would you likely use with GridGain/Apache Ignite?



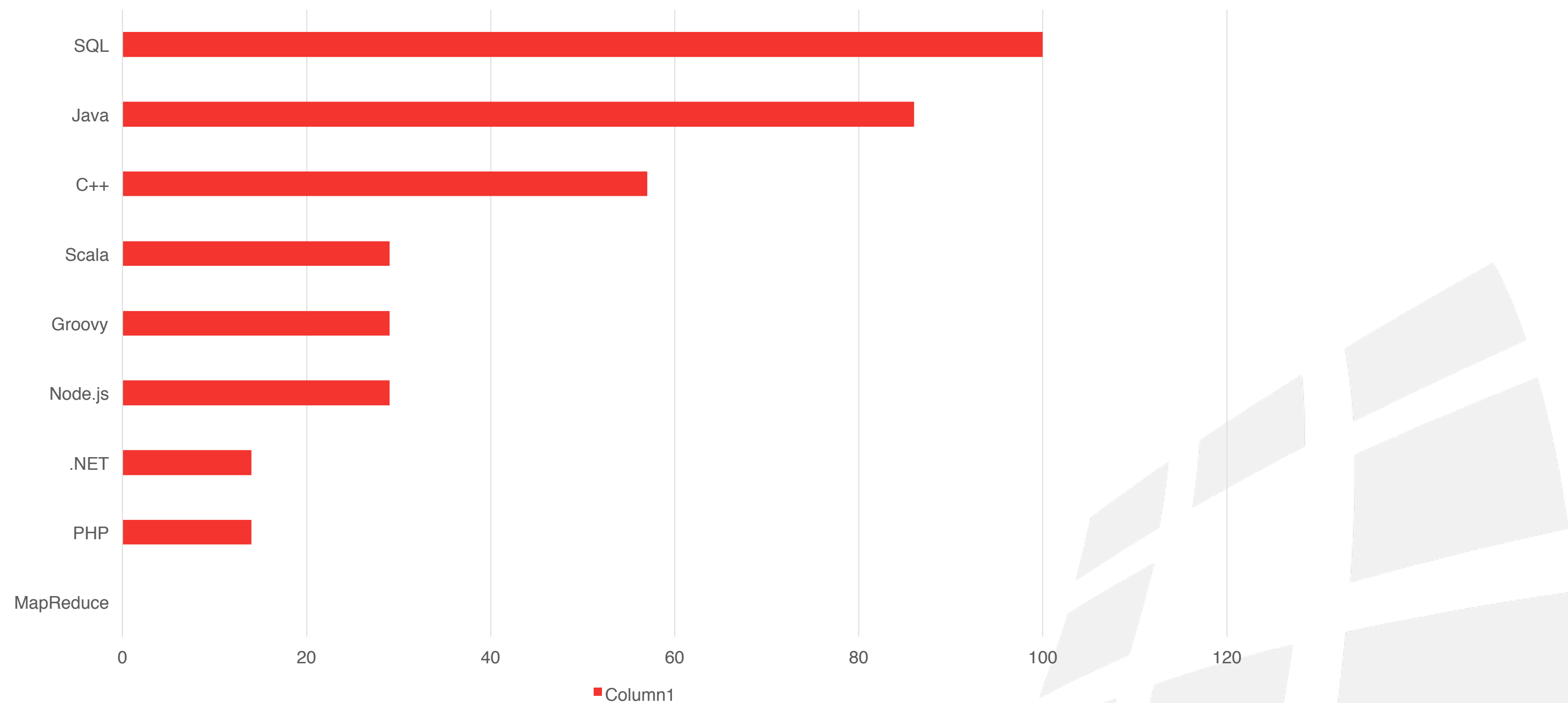
Survey Results: How important are each of the following product features to your organization?



Survey Results: Where do you run GridGain and/or Apache Ignite?



Survey Results: Which of the following languages do you use to access your data?



Financial Customer Use Cases

Data Velocity, Data Volume, Data Consistency, Real-Time Performance and Analysis

- **Core Banking and Trading Platforms**
Treasury systems, payment hubs, order management systems, algorithmic trading, high volume transactions, ultra low latencies.
- **Risk Management**
Modeling, financial engineering, pricing, hedging, what-if analysis, reporting.
- **Financial Analytics**
Real time analysis of trading positions, trending, market data analysis, sentiment analysis, complex event processing, hedging, transaction cost analysis, time series, volatility analysis, Monte Carlo simulations, Black-Scholes, derivatives pricing.
- **Big Data Analytics**
Customer and counter party 360 view, master data management, securities masters, reference data, real-time analysis of P&L, up-to-the-second operational BI.
- **Compliance and Monitoring**
Fraud, AML, KYC, market manipulation and abuse, pre and post trade compliance modeling.
- **Financial SaaS Platforms**
High performance next-generation architectures for Software as a Service Application vendors.



THOMSON REUTERS



Jefferies



APOLLO

Julius Bär



CAMBRIDGE



ASSOCIATES



Case Study:



- Financial services software
 - Retail and corporate banking
 - Lending
 - Treasury
 - Capital markets
 - Investment management
 - Enterprise risk
- More than 2,000 customers in 130 countries
- Used by 48 of the world's 50 largest banks
- The Challenge: Eliminating Data Processing Bottlenecks
 - Huge amounts of trade and accounting data
 - Customers need
 - High-speed transactions
 - Real-time reporting
 - New Java-based IT stack with data lake support
 - Global regulatory compliance

Case Study:



- Commodity servers (256GB RAM)
- Data stored in memory
 - Transactions
 - Market data
- Parallel processing across cluster
 - Calculation heavy reporting for regulatory compliance

Case Study:



FusionFabric.cloud

- Integrates trading systems with cloud-based components
 - OTC derivatives
 - Exchange traded derivatives
 - Inflation
 - Fixed income
 - FX/MM
 - Hybrids
 - Developing additional modules

“With GridGain, we have achieved real-time processing of massive amounts of trade and transaction data, eliminating bottlenecks and enabling us to offer next-generation financial services to our customers.”

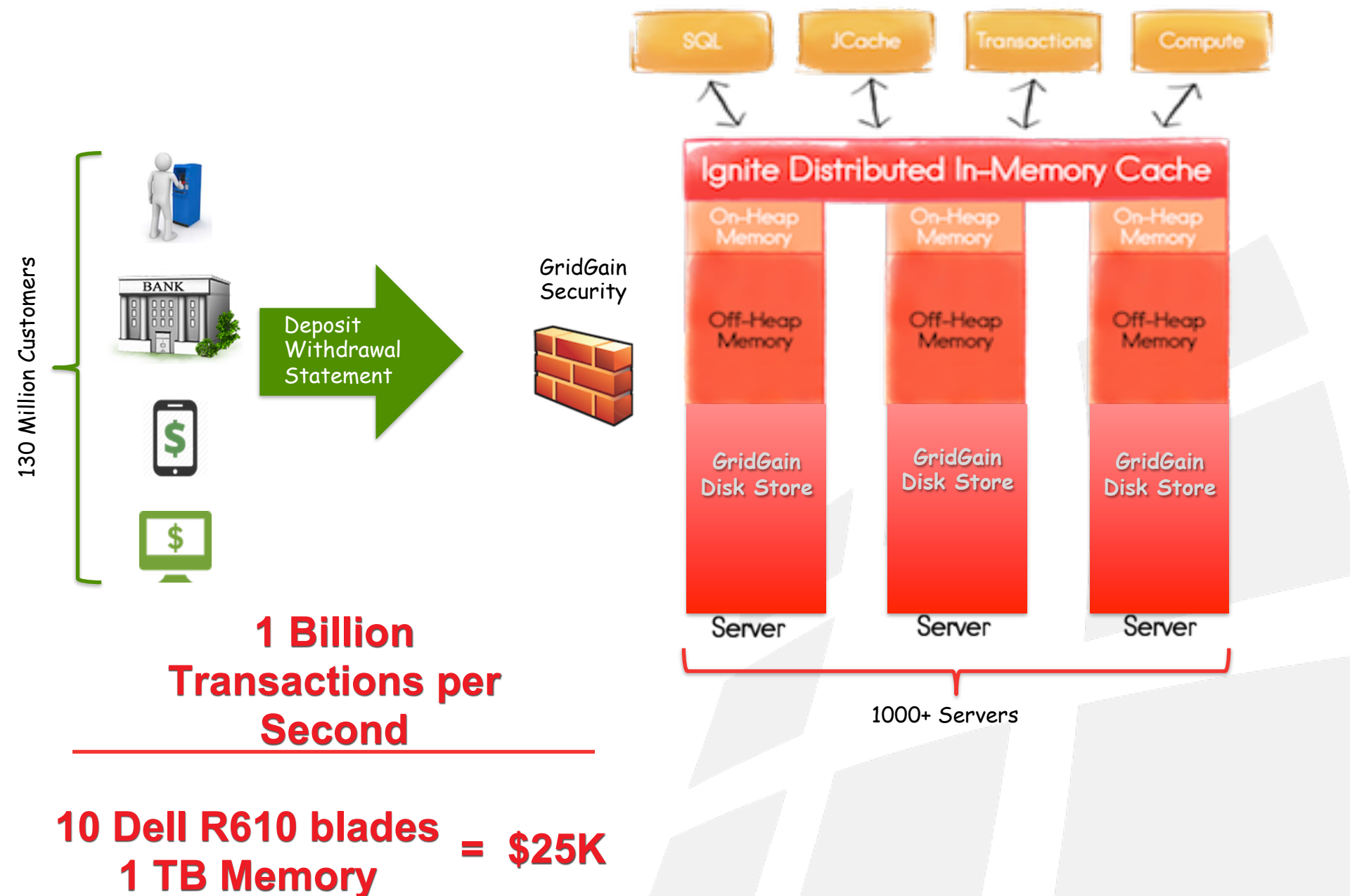
-Felix Grevy, Director of Product Management for FusionFabric.cloud at Misys

Use Case:



Largest bank in Russia and Eastern Europe, and the third largest in Europe

- Sberbank Requirements
 - Expect significant transactional volume growth
 - Migrate to data grid architecture to build next generation platform
 - Minimize dependency on Oracle
 - Move to open source
- Why GridGain Won
 - Best performance
 - 10+ competitors evaluated
 - Demonstrated best
 - Fault tolerance & scalability
 - ANSI-99 SQL Support
 - Transactional consistency
 - Strict SLAs
 - Less than 5 min cluster restart (regulatory requirement)
 - Fully Operational from disk & memory
 - Compliance with personal data law and cyber-security regulations



From RBC article – January, 2016



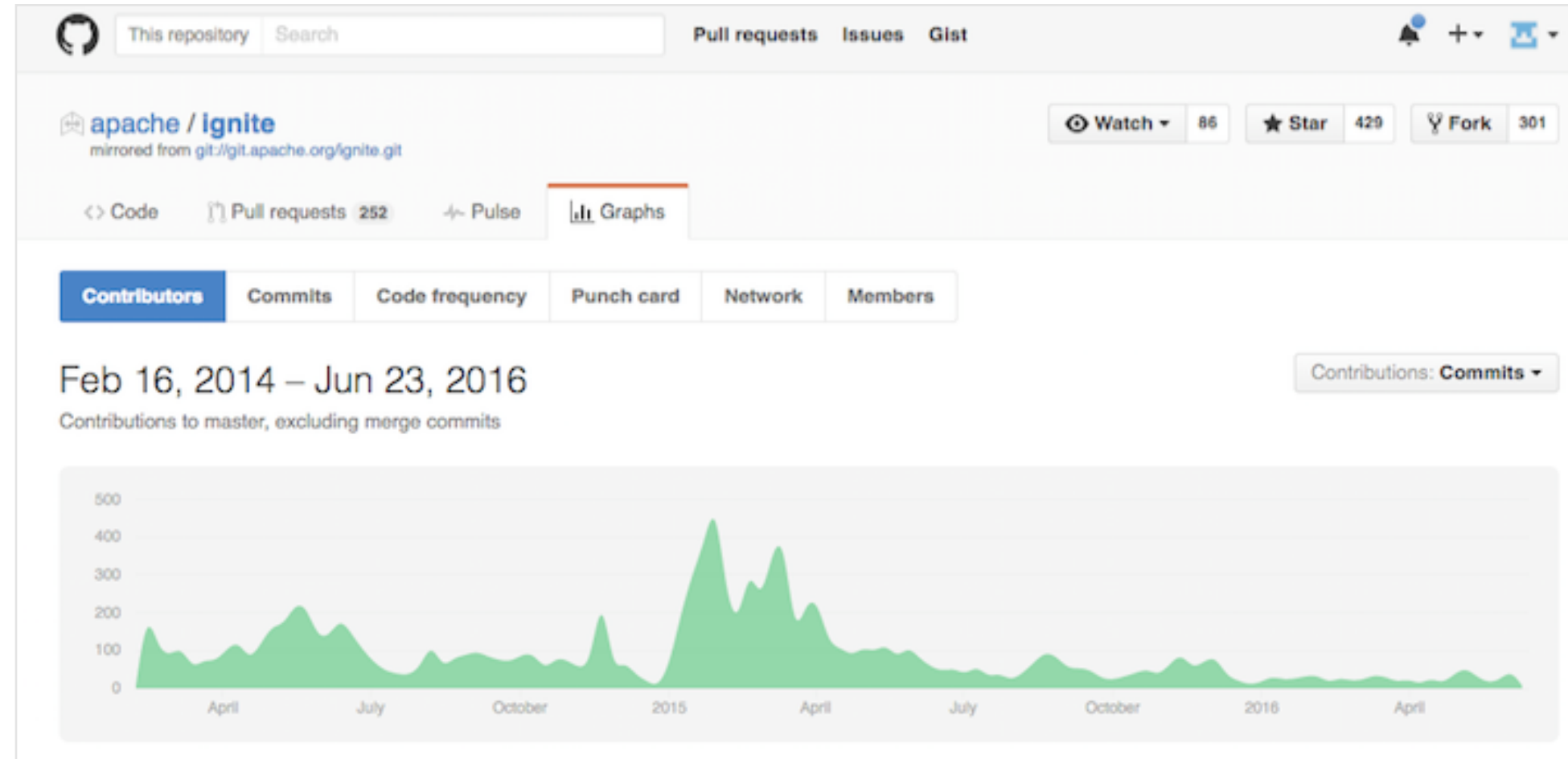
Herman Gref
CEO & Chairman, Sberbank

“The new Sberbank IT plan is to create a platform that enables the bank to introduce new products in hours, not weeks. The platform will have virtually unlimited performance and very high reliability. It will be much cheaper and will significantly reduce human interaction during customer transactions. The system will use machine-learning, flexible pricing, and artificial intelligence,” said Herman Gref, head of Sberbank.

“The new system will use technology from GridGain, which won the tender from Oracle, IBM and others, and turned out to deliver an order of magnitude higher performance than those of the largest companies,” he added.

Apache Ignite Project

- 2007: First version of GridGain
- Oct. 2014: GridGain contributes Ignite to ASF
- Aug. 2015: Ignite is the second fastest project to | graduate after Spark
- Today:
 - 60+ contributors and rapidly growing
 - Huge development momentum - Estimated 192 years of effort since the first commit in February, 2014 [\[Openhub\]](#)
 - Mature codebase: 1M+ lines of code

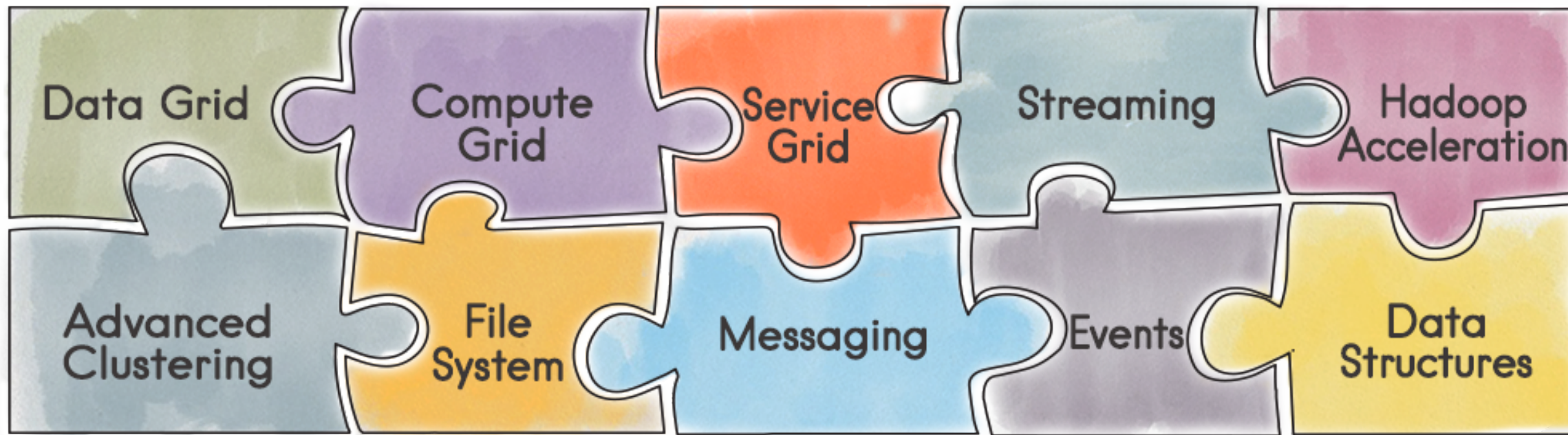


GridGain Enterprise and Open Source Strategy



- GridGain Enterprise Edition is based on Apache Ignite
- Open source is intended to provide an easy entry point for learning, testing and non-critical use
- Enterprise Edition customers benefit from many exclusive enterprise-class features along with support and indemnification

What is an In-Memory Data Fabric?



High-performance distributed in-memory platform for computing and transacting on large-scale data sets in near real-time.

GridGain In-Memory Computing Use Cases

•Data Grid

Web session clustering

Distributed caching

Scalable SaaS

Compute Grid

High performance computing

Machine learning

Risk analysis

Grid computing

SQL Grid

In-memory SQL

Distributed SQL processing

Real-time analytics

Streaming

Real-time analytics

Streaming Big Data analysis

Monitoring tools

Hadoop Acceleration

Faster Big Data insights

Real-time analytics

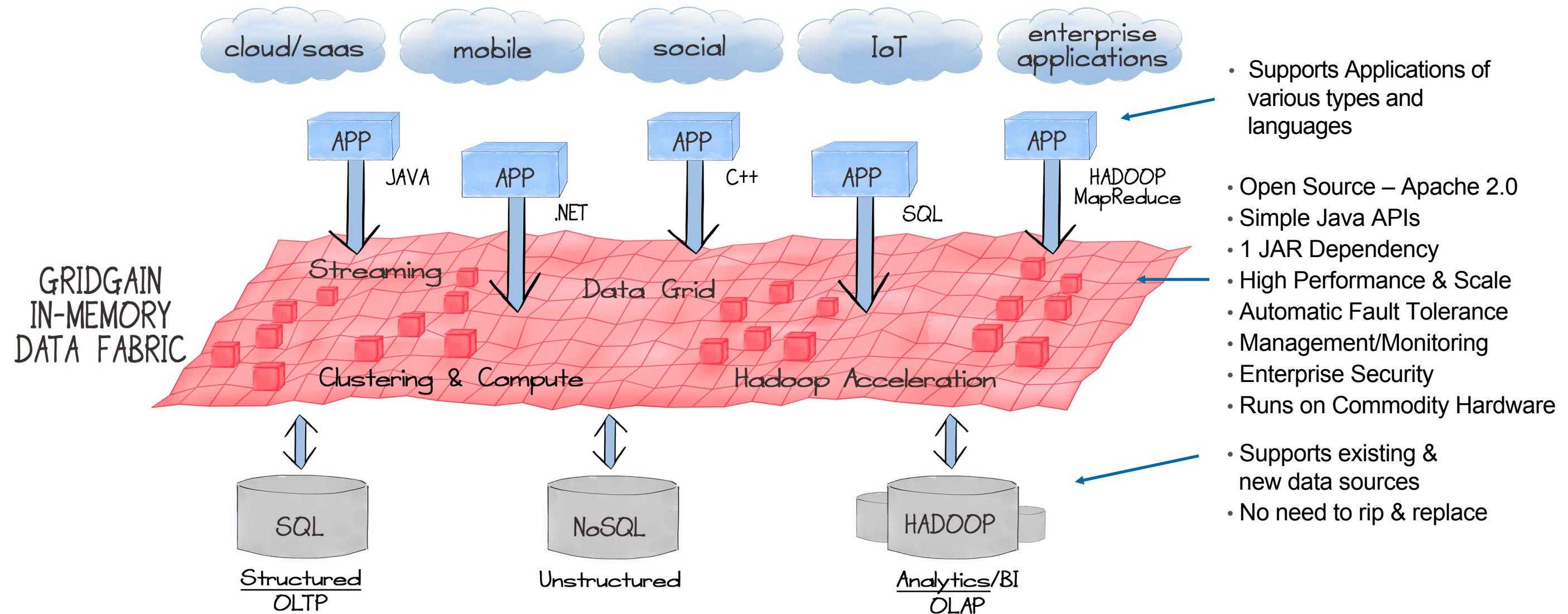
Batch processing

Events

Complex event processing (CEP)

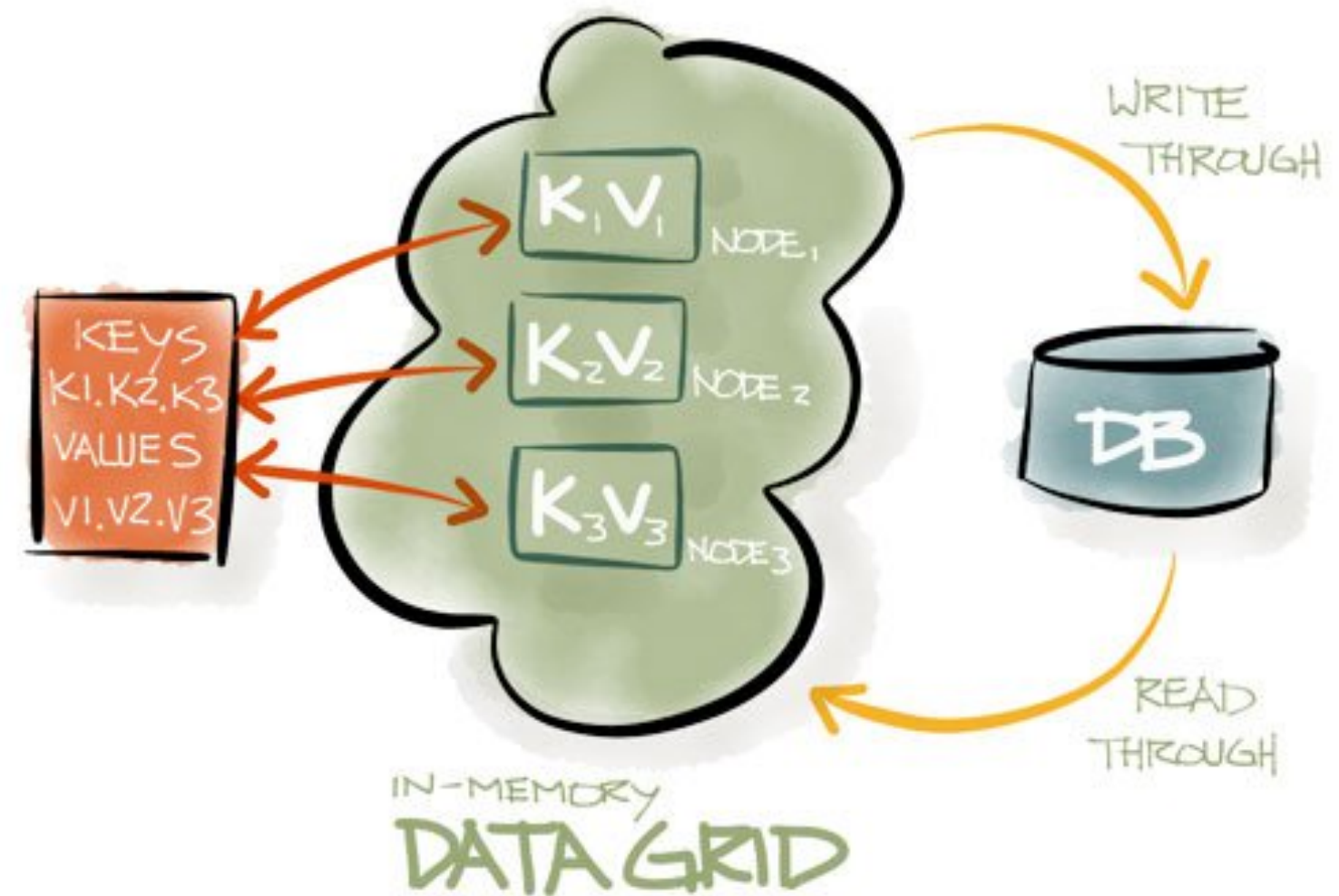
Event driven design

Flexibility and Enterprise Breadth of In-Memory Data Fabric



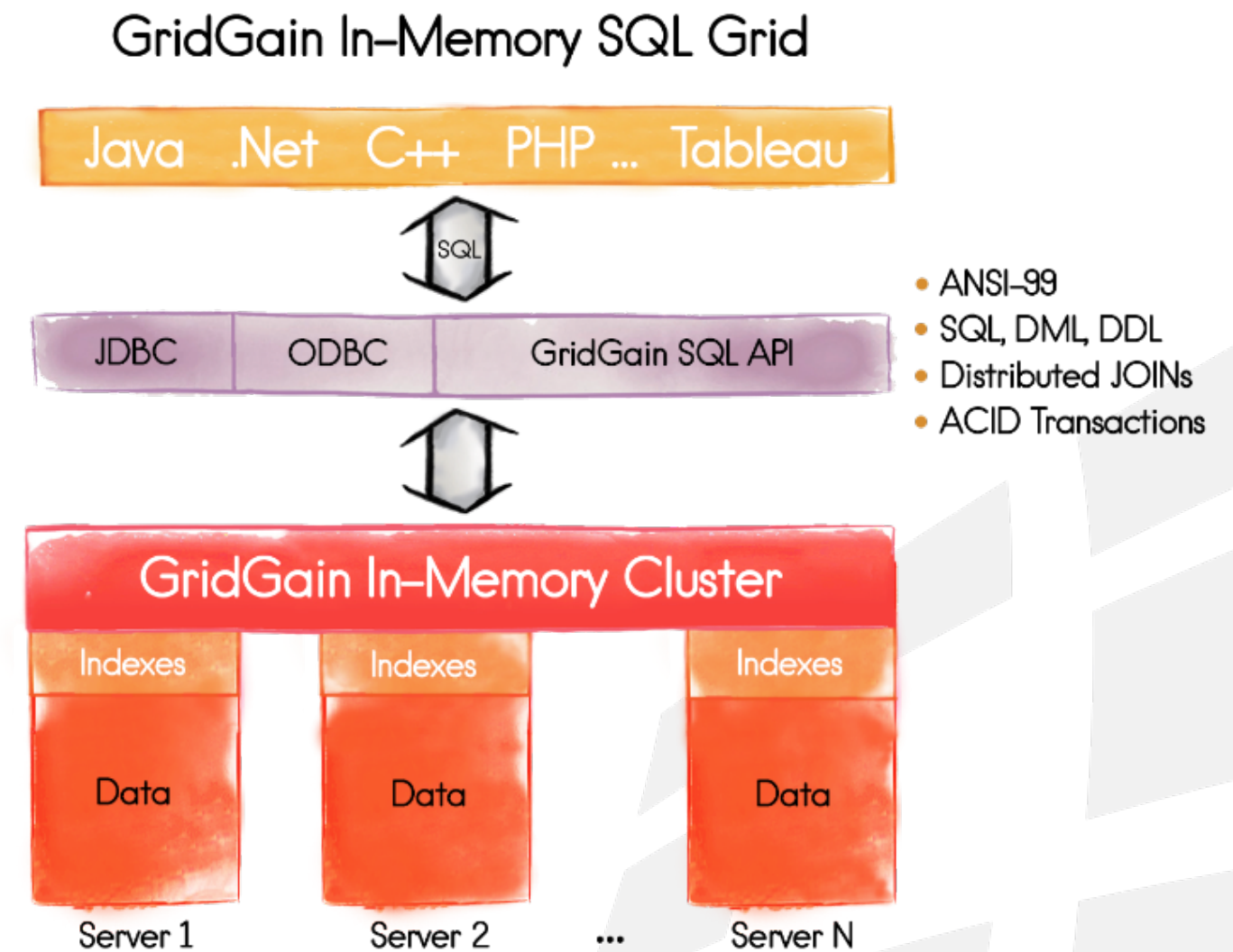
In-Memory Data Grid

- Inserted between the application and data layers. Moves disk-based data from RDBMS, NoSQL or Hadoop databases into RAM
- **Features:**
 - Distributed In-Memory Key-Value Store
 - Replicated and Partitioned Data Caches
 - Lightning Fast Performance
 - Elastic Scalability
 - Distributed In-Memory Transactions (ACID)
 - Distributed In-Memory Queue and Other Data Structures
 - Web Session Clustering
 - Hibernate L2 Cache Integration
 - On-Heap and Off-Heap Storage
 - Distributed SQL Queries with Distributed Joins



In-Memory SQL Grid

- Horizontally scalable, fault tolerant, ANSI SQL-99 compliant, and fully supports all SQL and DML commands
- **Features:**
 - Supports SQL and DML commands including SELECT, UPDATE, INSERT, MERGE and DELETE Queries
 - Distributed SQL
 - Geospatial Support
 - SQL Communications Through the GridGain ODBC or JDBC APIs Without Custom Coding
 - ANSI SQL-99 Compliance

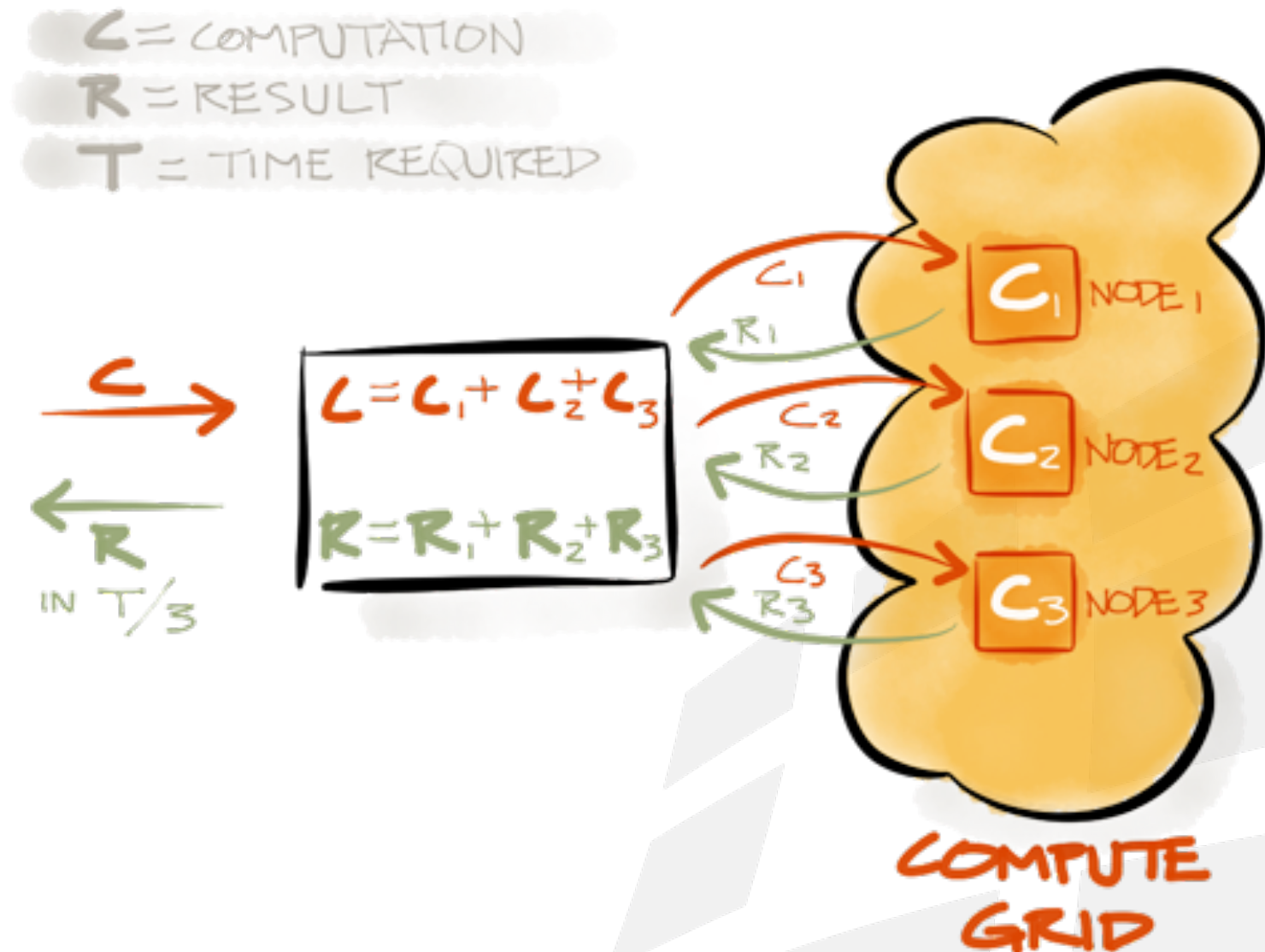


In-Memory Compute Grid

- Enables parallel processing of CPU or otherwise resource intensive tasks

- **Features:**

- Dynamic Clustering
- Direct API for Fork-Join & MapReduce Processing
- Distributed Closure Execution
- Adaptive Load Balancing
- Automatic Fault Tolerance
- Linear Scalability
- Custom Scheduling
- State Checkpoints for Long Running Jobs
- Pluggable SPI Design

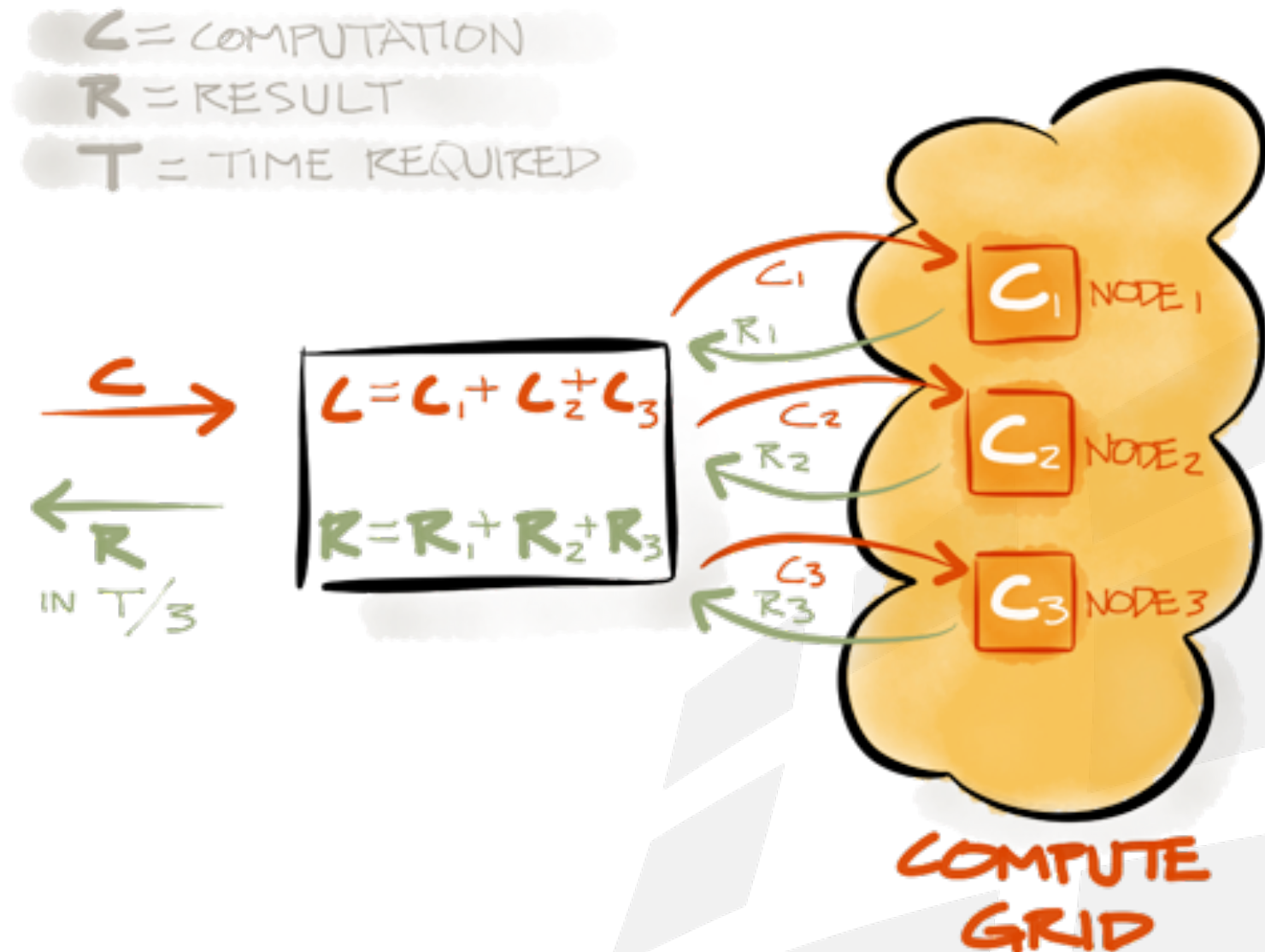


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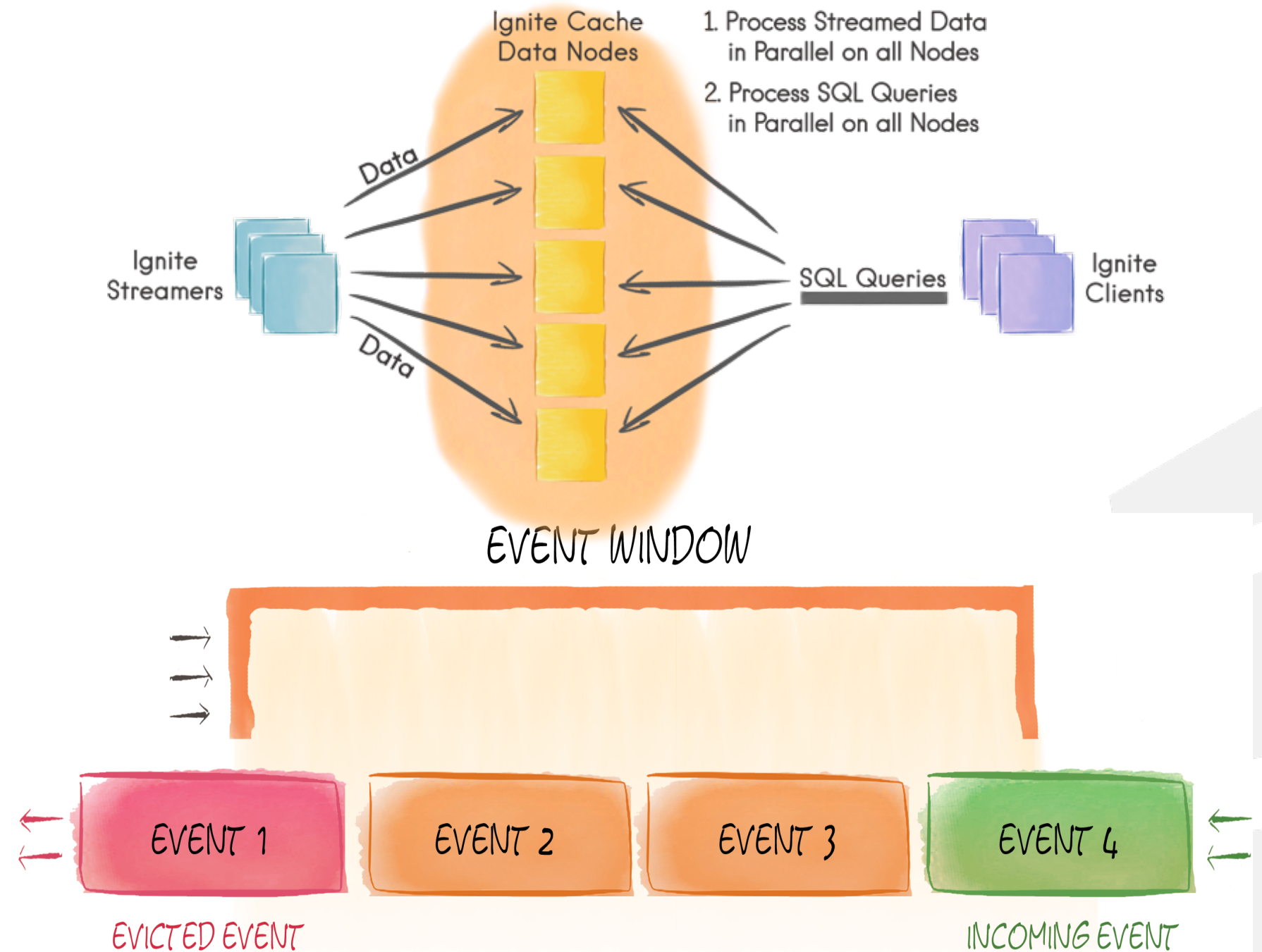
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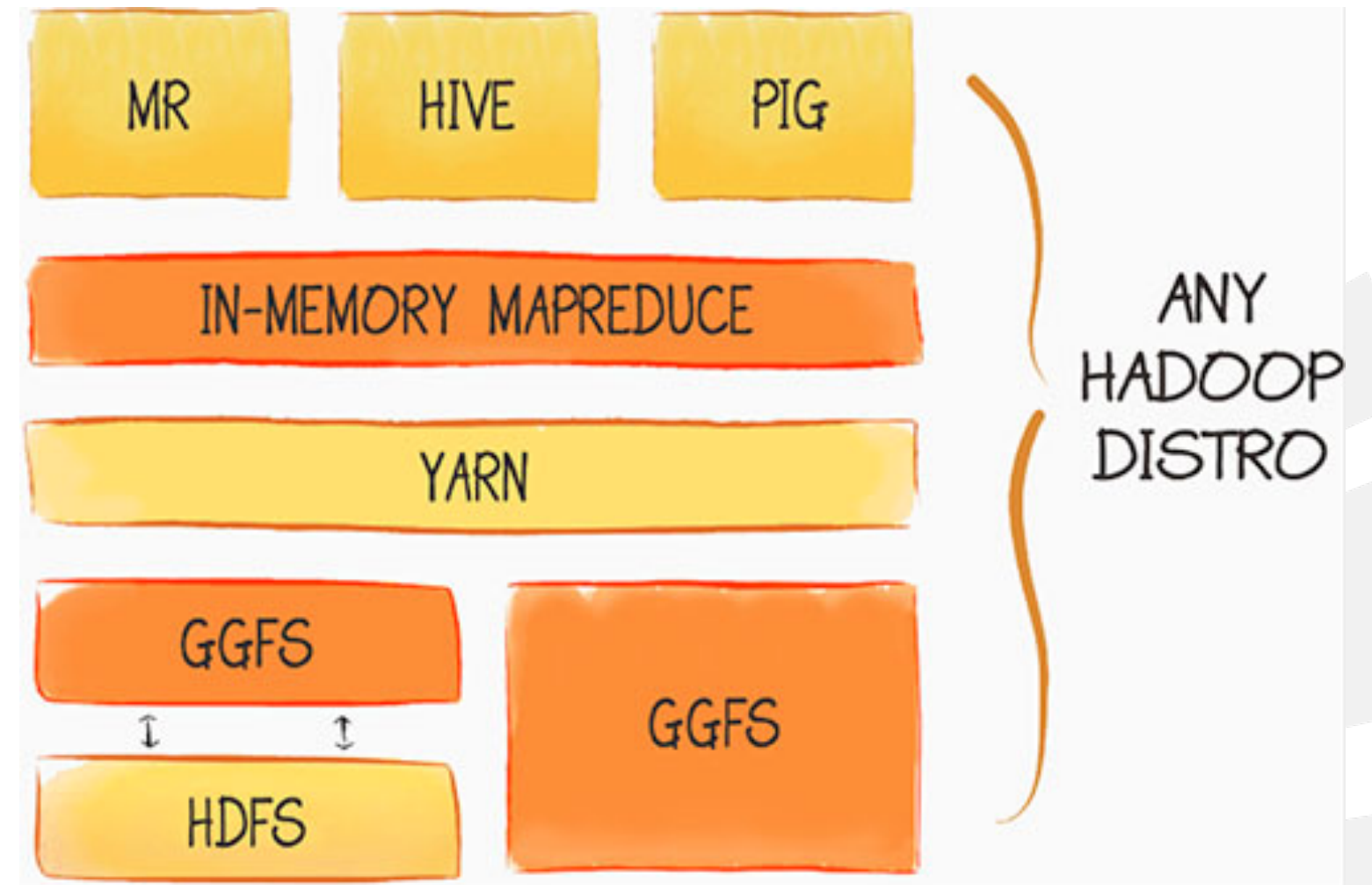
In-Memory Streaming and CEP

- Streaming Data Never Ends
- Sliding Windows for CEP/Continuous Query
- Customizable Event Workflow
- Branching Pipelines
- Pluggable Routing
- Real Time Analysis
- Data Indexing
- Distributed Streamer Queries



In-Memory Hadoop Acceleration

- Provides easy to use extensions to disk-based HDFS and traditional MapReduce, delivering up to 10x faster performance
- **Features:**
 - Use existing MapReduce / Pig / Hive
 - 10x Faster Performance
 - In-Memory MapReduce
 - Highly Optimized In-Memory Processing
 - Standalone File System
 - Optional Caching Layer for HDFS
 - Read-Through and Write-Through with HDFS



GridGain’s In-Memory Data Fabric Enterprise Edition

GridGain Enterprise Subscriptions include:

- > Right to use GridGain Enterprise Edition
- > Bug fixes, patches, updates and upgrades
- > 9x5 or 24x7 Support
- > Training and Consulting Services from GridGain

Features	Apache Ignite	GridGain Enterprise
<i>In-Memory Data Grid</i>	✓	✓
<i>In-Memory Compute Grid</i>	✓	✓
<i>In-Memory Service Grid</i>	✓	✓
<i>In-Memory Streaming</i>	✓	✓
<i>In-Memory Hadoop Acceleration</i>	✓	✓
<i>Distributed In-Memory File System</i>	✓	✓
<i>Advanced Clustering</i>	✓	✓
<i>Distributed Messaging</i>	✓	✓
<i>Distributed Events</i>	✓	✓
<i>Distributed Data Structures</i>	✓	✓
<i>Portable Binary Objects</i>	✓	✓
<i>Management & Monitoring GUI</i>		✓
<i>Enterprise-Grade Security</i>		✓
<i>Network Segmentation Protection</i>		✓
<i>Recoverable Local Store</i>		✓
<i>Rolling Production Updates</i>		✓
<i>Data Center Replication</i>		✓
<i>Integration with Oracle GoldenGate</i>		✓
<i>Basic Support (9×5)</i>	✓	✓
<i>Enterprise Support (9×5 and 24×7)</i>		✓
<i>Security Updates</i>		✓
<i>Maintenance Releases & Patches</i>		✓

Free
w/ optional Paid Support

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Subscription



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