# The Forrester Wave™: In-Memory Databases, Q1 2017

**In-Memory Databases Are Driving Next-Generation Workloads And Use Cases**

by Noel Yuhanna

February 28, 2017

## Why Read This Report

In-memory database initiatives are fast on the rise as organizations focus on rolling out real-time analytics and extreme transactions to support growing business demands. In-memory offers enterprise architects a platform that supports low-latency access with optimized storage and retrieval by leveraging memory, SSD, and flash. Forrester identified the 13 most significant companies in the category — Aerospike, Couchbase, DataStax, IBM, MemSQL, Microsoft, Oracle, Red Hat, Redis Labs, SAP, Starcounter, Teradata, and VoltDB —and researched, analyzed, and scored them against 24 criteria.

## Key Takeaways

**Thirteen In-Memory Databases Compete In This Hot Market**

Among the commercial and open source in-memory database vendors Forrester evaluated, we found five Leaders, six Strong Performers, and two Contenders.

**In-Memory Has Become Critical For All Enterprises**

The in-memory database market is growing rapidly, largely because enterprises see in-memory as a way to support their next-generation real-time workloads, such as extreme transactions and operational analytics.

**Scale, Performance, And Stack Distinguish The In-Memory Database Leaders**

The Leaders we identified offer high-performance, scalable, secure, and flexible in-memory databases. The Strong Performers have turned up the heat as high as it will go on the incumbent Leaders, with innovations that many customers find compelling.

# The Forrester Wave™: In-Memory Databases, Q1 2017

## In-Memory Databases Are Driving Next-Generation Workloads And Use Cases

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## Related Research Documents

The Forrester Wave™: In-Memory Database Platforms, Q3 2015

The Forrester Wave™: In-Memory Data Grids, Q3 2015

Market Overview: In-Memory Data Platforms

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## In-Memory Databases Deliver Real-Time Data Needs

An in-memory database is not just a nice-to-have option anymore — it has become critical to support next-generation transactions, analytics, and operational insights. No one needs yesterday's data tomorrow! Businesses are demanding actionable insights and operational analytics at the speed of transactions. Every second counts when you want to deliver real-time recommendations to customers based on their location, activity, or status. The traditional approach of storing data on disk and later integrating and analyzing it isn't good enough. But until recently, storing and processing larger amounts of data in memory was not an option, largely because it was prohibitively expensive and the innovation to a support larger-memory footprint was not ready for prime time. Today's in-memory databases are changing the way we build and deliver systems of engagement, and they are transforming the practice of analytics, predictive modeling, and business transaction management.

Forrester defines an in-memory database as:

> *A database that stores all or most critical data in DRAM, flash, and SSD on either a single or distributed server to support various types of workloads, including transactional, operational, and/or analytical workloads, running on-premises or in the cloud.*

Today the top in-memory database workloads commonly seen across various vertical industries include:

- **Real-time apps that need low-latency access to critical business data.** In-memory data platforms help deliver real-time apps to support operational applications such as fraud detection, machine monitoring, network analysis, geolocation-enabled apps, and earthquake monitoring. These apps require data 24x7 with low-latency access, and even persisting data causes slowdowns and sometimes cannot be accepted. Although many companies have been using real-time apps for decades, such apps previously required extensive application coding and customization to deliver extreme performance, besides being cost prohibitive.
- **Customer analytics to deliver improved customer experience.** Customer-obsessed retailers and eCommerce sites have started to leverage in-memory databases to support applications and insights. Customer data stored and processed using in-memory databases creates opportunities for businesses to upsell and cross-sell new products to customers based on their likes, dislikes, circle of friends, buying patterns, and past orders. In-memory data is critical to support granular, personalized customer experiences by delivering faster predictive modeling, enabling real-time data access, and processing big data quickly.
- **Internet-of-things (IoT) applications that can improve operational efficiency.** Today most manufacturers deal with highly sophisticated machinery to support their plants, whether they're building airplanes or bottling wine. When a machine goes down, it can cost a manufacturer millions of dollar every hour — in some cases, every minute. With IoT sensors, streaming, machine learning, and in-memory technologies, manufacturers are able to track machines every minute — even every second — to predict if a machine is likely to fail as well as to decide what parts or resources might be needed for repairs if a breakdown occurs.


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› **Mobile apps that need integrated data.** Today data mobilization enables rich interactions and advanced analytics using devices such as tablets, smartphones, and wearables. Mobile app developers demand data from multiple technology stacks and in real time to deliver a 360-degree view of the customer, product, employee, or business. For example, a mobile app might deliver a dashboard that tracks investments from multiple sources in real time. In-memory offers the ability to deliver integrated data that's critical to support such applications.

## In-Memory Database Evaluation Overview

The in-memory market is extremely competitive because it has become a critical category in data management. Both pure-play in-memory vendors and traditional database vendors are gunning for a piece of this rapidly emerging market. Customers will benefit as the pace of innovation increases and the cost of in-memory further declines to support petabyte-scaled environments.

### Evaluation Criteria: Current Offering, Strategy, And Market Presence

After examining past research, user requirements, and vendor interviews, we developed a comprehensive set of 24 evaluation criteria, which we grouped into three high-level buckets:

› **Current offering.** To assess the breadth and depth of each vendor's in-memory product set, we evaluated each solution's architectural and operational functionality.

› **Strategy.** We reviewed each vendor's strategy to assess how it plans to evolve its in-memory solution to meet emerging customer demands. We also evaluated each vendor's go-to-market approach, commitment, and direction strategies.

› **Market presence.** To establish each in-memory database product's market presence, we evaluated each provider's company financials, adoption, and partnerships.

### In-Memory Database Evaluation Assessed The Capabilities Of 13 Vendor Offerings

Forrester included 13 vendors in the assessment: Aerospike, Couchbase, DataStax, IBM, MemSQL, Microsoft, Oracle, Red Hat, Redis Labs, SAP, Starcounter, Teradata, and VoltDB. Each of these vendors has (see Figure 1):

› **An enterprise-class in-memory offering.** Vendors offer the following core in-memory database functional components, tools, and features: 1) core in-memory database features and functionality, including high availability, security, performance, scalability, and management; 2) data storage for persistence; 3) data integrity and consistency; 4) native tools or integration with third-party vendors to support data loading, unloading, administration, security, integration, data quality, archiving, etc.; 5) support for multiple concurrent queries, transactions, reports, or data access patterns; 6) on-premises or public cloud deployment, or both; and 7) access to data using a standard connectivity such as SQL, ODBC/JDBC, XML, or REST.


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- **A standalone in-memory database solution.** We included only in-memory database products that are not technologically tied to any particular applications (such as ERP or CRM) or particular business intelligence (BI), business performance solution (BPS), predictive analytics, ETL, or middleware stack and that don't require embedding in other applications.[1] Products must be supported in a standalone environment.
- **A publicly available in-memory database release.** Each participating vendor must actively market an enterprise in-memory database solution that is clearly mentioned in its website's marketing literature and brochures. The product version included in the evaluation must have been generally available prior to October 1, 2016.
- **A referenceable install base.** There should be 20 or more enterprise customers using the in-memory database product. Customers must span more than one major geographic region.
- **Interest from Forrester clients.** We included only in-memory database vendors that have been mentioned by customers in at least five Forrester inquiry calls over the past 12 months.
- **Client inquiries and/or technologies that put the vendor on Forrester's radar.** Forrester clients often discuss the vendors and products through inquiries and interviews; alternatively, the vendor may, in Forrester's judgment, warrant inclusion or exclusion in this evaluation because of technology trends and market presence.


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**FIGURE 1** Evaluated Vendors: Product Information And Inclusion Criteria

| Vendor | Product evaluated | Product version evaluated | Product generally available by |
|---|---|---|---|
| Aerospike | Aerospike | 3.9 | October 1, 2016 |
| Couchbase | Couchbase Server | 4.5 | October 1, 2016 |
| DataStax | DataStax Enterprise | 5.0 | October 1, 2016 |
| IBM | IBM dashDB<br>IBM DB2 on Cloud<br>IBM DB2 for Linux, UNIX, Windows<br>IBM DB2 for z/OS<br>IBM PureData System for Operational Analytics | <br>11.1<br>11.1<br>12.0<br>11.1 | October 1, 2016 |
| MemSQL | MemSQL Enterprise | 5.5 | October 1, 2016 |
| Microsoft | SQL Server 2016 | N/A | October 1, 2016 |
| Oracle | Oracle Database In-Memory (part of Oracle Database)<br>Oracle TimesTen In-Memory Database | 12.1.0.2<br>11.2.2.8.0 | October 1, 2016 |
| Red Hat | Red Hat JBoss Data Grid | 7.0 | October 1, 2016 |
| Redis Labs | Redis Labs Enterprise Cluster (RLEC) (same tech that runs Redis Cloud) | 4.3 | October 1, 2016 |
| SAP | SAP HANA | SPS12 | October 1, 2016 |
| Starcounter | Starcounter | 2.3 | October 1, 2016 |
| Teradata | Teradata Database | 15.10 | October 1, 2016 |
| VoltDB | VoltDB | 6.6 | October 1, 2016 |


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**FIGURE 1** Evaluated Vendors: Product Information And Inclusion Criteria (Cont.)

**Vendor inclusion criteria**

- **An enterprise-class in-memory offering.** Each vendor offers the following core in-memory database functional components, tools, and features: 1) core in-memory database features and functionality, including high availability, security, performance, scalability, and management; 2) data storage for persistence; 3) data integrity and consistency; 4) native tools or integration with third-party vendors to support data loading, unloading, administration, security, integration, data quality, archiving, etc.; 5) support for multiple concurrent queries, transactions, reports, or data access patterns; 6) on-premises or public cloud deployment, or both; and 7) data access using standard connectivity such as SQL, ODBC/JDBC, XML, or REST.
- **A standalone in-memory database solution.** We included only in-memory database products that are not technologically tied to any particular applications (such as enterprise resource planning or CRM) or particular business intelligence; business performance solution; predictive analytics; extract, transform, and load (ETL); or middleware stack and that don't require embedding in other applications. Products must be supported in a standalone environment.
- **A publicly available, in-memory database release.** Each participating vendor must actively market an enterprise in-memory database solution that is clearly mentioned in its website's marketing literature and brochures. The product version included in the evaluation must have been generally available prior to October 1, 2016.
- **A referenceable install base.** There should be 20 or more enterprise customers using the in-memory database product. Customers must span more than one major geographic region.
- **Interest from Forrester clients.** We included only in-memory database vendors that have been mentioned by customers in at least five Forrester inquiry calls over the past 12 months.

Forrester reserves the right to include or exclude any vendor.

## Enterprises Have Lots Of Choices

Forrester's evaluation of in-memory database uncovered a market with five Leaders, six Strong Performers, and two contenders (see Figure 2):

› **Leaders have a comprehensive set of features and functionality.** Oracle, SAP, Teradata, Microsoft, and IBM are Leaders. These vendors offer the most comprehensive set of features along with proven and scalable in-memory database technology to support broad workloads and use cases.

› **Strong Performers are good choices but lag in use cases or broad features.** Red Hat, Redis Labs, Couchbase, Aerospike, DataStax, and VoltDB are Strong Performers. With innovation that many customers find compelling, this group has turned up the heat as high as it will go on the incumbent Leaders. These vendors don't have all of the features that Leaders do, but they are solid choices for most use cases.


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› **Contenders have some gaps but offer a viable option for small to midsized apps.** Although MemSQL and Starcounter are not Leaders or Strong Performers, they are viable choices for enterprises looking for a low-cost in-memory database solution to support new integrated applications that need low-latency data access.

**FIGURE 2** Forrester Wave™: In-Memory Databases, Q1 '17

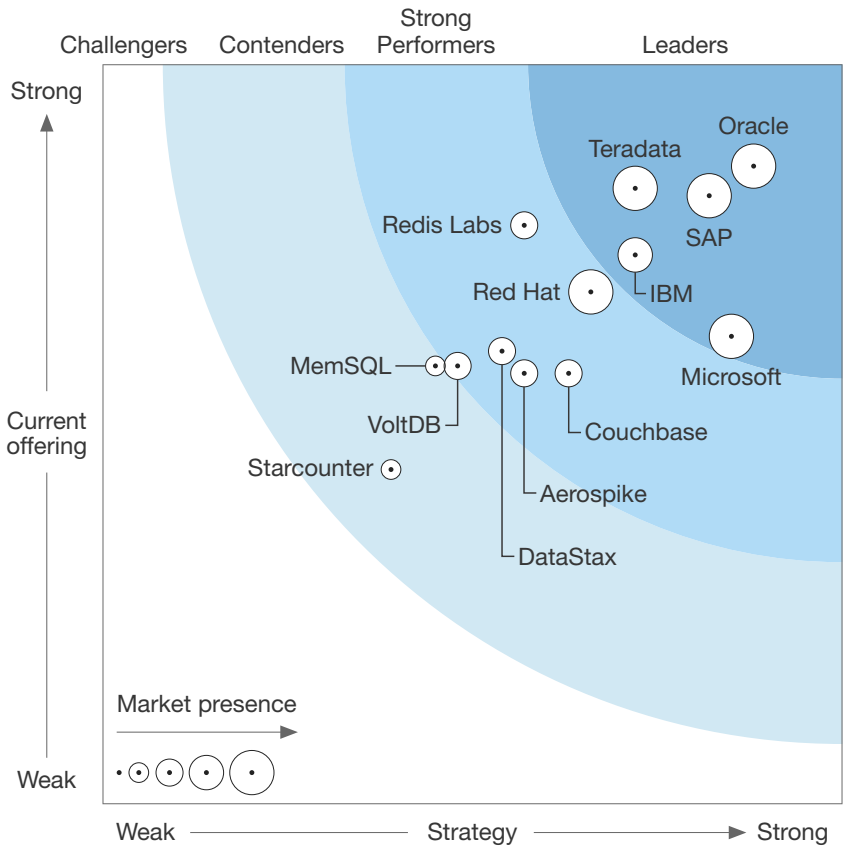


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**FIGURE 2** Forrester Wave™: In-Memory Databases, Q1 '17 (Cont.)

| | Forrester's weighting | Aerospike | Couchbase | DataStax | IBM | MemSQL | Microsoft | Oracle | Red Hat | Redis Labs | SAP | Starcounter | Teradata | VoltDB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Current offering** | 50% | 2.90 | 2.90 | 3.05 | 3.70 | 2.95 | 3.15 | 4.30 | 3.45 | 3.90 | 4.10 | 2.25 | 4.15 | 2.95 |
| Data management | 5% | 2.00 | 3.00 | 2.00 | 3.00 | 4.00 | 4.00 | 4.00 | 3.00 | 4.00 | 5.00 | 4.00 | 3.00 | 4.00 |
| Performance | 5% | 4.00 | 4.00 | 2.00 | 3.00 | 4.00 | 3.00 | 3.00 | 4.00 | 5.00 | 5.00 | 3.00 | 5.00 | 4.00 |
| Scalability | 5% | 4.00 | 5.00 | 4.00 | 3.00 | 4.00 | 2.00 | 3.00 | 4.00 | 4.00 | 3.00 | 2.00 | 3.00 | 2.00 |
| Languages supported | 10% | 2.00 | 3.00 | 3.00 | 4.00 | 3.00 | 4.00 | 4.00 | 3.00 | 5.00 | 4.00 | 2.00 | 4.00 | 3.00 |
| Server platform | 15% | 2.00 | 2.00 | 2.00 | 5.00 | 2.00 | 2.00 | 5.00 | 3.00 | 3.00 | 4.00 | 2.00 | 5.00 | 2.00 |
| Transaction capabilities | 5% | 4.00 | 4.00 | 3.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 5.00 | 3.00 | 3.00 | 4.00 |
| Analytics support | 10% | 2.00 | 3.00 | 3.00 | 4.00 | 3.00 | 3.00 | 4.00 | 3.00 | 5.00 | 5.00 | 2.00 | 5.00 | 3.00 |
| High availability and disaster recovery | 5% | 4.00 | 4.00 | 4.00 | 4.00 | 3.00 | 3.00 | 4.00 | 3.00 | 4.00 | 4.00 | 2.00 | 4.00 | 4.00 |
| Data movement | 5% | 2.00 | 3.00 | 3.00 | 3.00 | 3.00 | 4.00 | 5.00 | 4.00 | 3.00 | 3.00 | 2.00 | 5.00 | 2.00 |
| Security | 15% | 3.00 | 1.00 | 4.00 | 3.00 | 2.00 | 3.00 | 5.00 | 4.00 | 3.00 | 4.00 | 2.00 | 4.00 | 3.00 |
| Management and monitoring | 5% | 3.00 | 3.00 | 3.00 | 4.00 | 3.00 | 4.00 | 5.00 | 3.00 | 3.00 | 4.00 | 2.00 | 4.00 | 2.00 |
| Cloud support | 5% | 4.00 | 3.00 | 3.00 | 4.00 | 3.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 2.00 | 3.00 | 3.00 |
| Deployment options | 5% | 4.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 4.00 | 3.00 | 4.00 | 3.00 | 3.00 | 4.00 | 3.00 |
| Use cases | 5% | 4.00 | 5.00 | 4.00 | 3.00 | 4.00 | 3.00 | 4.00 | 4.00 | 5.00 | 4.00 | 2.00 | 4.00 | 4.00 |

All scores are based on a scale of 0 (weak) to 5 (strong).


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**FIGURE 2** Forrester Wave™: In-Memory Databases, Q1 '17 (Cont.)

| | Forrester's weighting | Aerospike | Couchbase | DataStax | IBM | MemSQL | Microsoft | Oracle | Red Hat | Redis Labs | SAP | Starcounter | Teradata | VoltDB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Strategy** | 50% | 2.85 | 3.15 | 2.70 | 3.60 | 2.25 | 4.25 | 4.40 | 3.30 | 2.85 | 4.10 | 1.95 | 3.60 | 2.40 |
| Ability to execute | 15% | 4.00 | 5.00 | 4.00 | 4.00 | 3.00 | 5.00 | 5.00 | 3.00 | 4.00 | 5.00 | 2.00 | 4.00 | 3.00 |
| Road map | 15% | 3.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 5.00 | 3.00 | 3.00 | 4.00 | 3.00 | 4.00 | 3.00 |
| Open source and licensing | 15% | 3.00 | 5.00 | 3.00 | 1.00 | 1.00 | 1.00 | 1.00 | 5.00 | 5.00 | 0.00 | 1.00 | 1.00 | 3.00 |
| Professional services | 30% | 2.00 | 1.00 | 1.00 | 5.00 | 1.00 | 5.00 | 5.00 | 3.00 | 1.00 | 5.00 | 1.00 | 5.00 | 1.00 |
| Support | 25% | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 5.00 | 5.00 | 3.00 | 3.00 | 5.00 | 3.00 | 3.00 | 3.00 |
| | | | | | | | | | | | | | | |
| **Market presence** | 0% | 2.05 | 2.80 | 2.60 | 3.50 | 1.65 | 5.00 | 4.60 | 4.05 | 2.90 | 5.00 | 1.60 | 4.45 | 2.30 |
| Product revenue | 40% | 1.00 | 2.00 | 2.00 | 3.00 | 1.00 | 5.00 | 4.00 | 3.00 | 2.00 | 5.00 | 1.00 | 5.00 | 2.00 |
| Install base | 5% | 2.00 | 4.00 | 3.00 | 5.00 | 2.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 2.00 | 5.00 | 2.00 |
| Market awareness | 15% | 3.00 | 4.00 | 2.00 | 4.00 | 3.00 | 5.00 | 5.00 | 4.00 | 5.00 | 5.00 | 1.00 | 3.00 | 3.00 |
| Partnerships | 25% | 2.00 | 3.00 | 3.00 | 4.00 | 1.00 | 5.00 | 5.00 | 5.00 | 2.00 | 5.00 | 2.00 | 4.00 | 2.00 |
| Reach | 15% | 4.00 | 3.00 | 4.00 | 3.00 | 3.00 | 5.00 | 5.00 | 5.00 | 4.00 | 5.00 | 3.00 | 5.00 | 3.00 |

All scores are based on a scale of 0 (weak) to 5 (strong).

## Vendor Profiles

All 13 vendors in this Forrester Wave offer a credible solution to support new and emerging use cases. This evaluation of the in-memory database market is intended to be a starting point only. We encourage clients to view detailed product evaluations and adapt criteria weightings to fit their individual needs through the Forrester Wave Excel-based vendor comparison tool. Clients can also schedule an inquiry to have a conversation about the market and specific vendor products to discuss specific business and technology requirements.

### Leaders

› **Oracle offers more choices when it comes to in-memory solutions.** Oracle offers Oracle TimesTen In-Memory Database and Oracle Database In-Memory products. With the combination of these two options, customers can deploy any type of application — transactional, operational, and analytical. Forrester spoke with several customers that run both products to support a platform for multiple workloads. Oracle's on-premises strategy remains strong, while its cloud platform is still


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evolving. For larger-memory footprints, Oracle offers its Oracle Exadata appliance. Its road map includes performance enhancements with faster decompression using software-in-silicon, in-memory replication, a high degree of automation, in-memory flash extension, and NVRAM support. Oracle customers building new transactional or analytical applications should look at TimesTen, and existing Oracle databases would benefit by upgrading to the in-memory option in Oracle Database.

- **SAP leverages its HANA platform to further innovate and grow.** SAP HANA is a distributed, shared-nothing, in-memory data platform that supports many use cases, including real-time analytics, translytical, systems of insight, and advanced analytics. Enterprises use the platform for in-memory data marts, SAP Business Warehouse, SAP S/4HANA, and SAP Business Suite. It is also the core component in SAP's cloud offering, such as SAP Cloud Platform (HCP) and SAP HANA Enterprise Cloud (HEC). SAP HANA Vora extends the platform to support the Apache Spark execution framework to deliver enriched interactive analytics on Hadoop. HANA is also available on Amazon Web Services (AWS), although most AWS customers are small and medium-sized businesses, but that's starting to change. The platform might be overkill for customers that don't have performance issues with SAP apps, largely because it takes time and effort to migrate and tends to be more expensive than other in-memory solutions.
- **Teradata Intelligent Memory is a powerful accelerator of complex analytics.** Teradata Intelligent Memory (TIM) is integrated into the Teradata Database, which keeps active data in memory for faster and real-time analytics. It uses multi-temperature technology to store and optimize frequently used data in DRAM, warm data in SSD/flash, and cold data on economical disk drives. Teradata's approach is a hybrid focus, not a dedicated in-memory database. The vendor's strength lies in delivering high performance and scale for analytical workloads, appliance integration, and strong high availability and disaster recovery as well as broad integration with tools and programming languages. Teradata Database 16.0 offers additional enhancements in hash and outer joins, DMLs, AVX2 support, and Single AMP to build an in-memory-optimized spool. Teradata's additional strengths are in data warehousing, not in transactional capabilities; therefore, enterprises must move data using ETL and replication tools or custom scripts into the Teradata platform to leverage TIM.
- **Microsoft offers specialized in-memory databases for OLTP and OLAP.** Microsoft offers two in-memory database solutions within the SQL Server platform to address OLTP and OLAP workloads. In SQL Server 2016, Microsoft supports an in-memory column store for data warehousing to support faster BI, analytics, and predictive analytics as well as an in-memory OLTP feature to support high-performance transactional applications. Although these solutions are not completely in-memory, customers claim to see significant performance improvements for various workloads. Microsoft's road map focuses on improving its in-memory platform, broader use cases (including the IoT, big data, and real time), faster data ingestion, and supporting real-time analytic queries and global operations. Customers running Microsoft SQL Server should look at the SQL Server 2014 in-memory option — the upgrade is worth the effort. Microsoft planned Microsoft Azure support, automation, and elastic scale capabilities in the SQL Server 2016 release.


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› **IBM increases the adoption of its in-memory database.** IBM DB2 with BLU Acceleration is an in-memory columnar data platform that accelerates real-time and ad hoc analytical and operational workloads for IBM DB2. Enterprises using BLU Acceleration often require less data storage because of its data compression technology and the ability to optimize data access patterns without the need of tuning, indexes, and aggregates. IBM also offers in-memory cluster caching facility, software technology that delivers in-memory global buffer coherency management and global locking. IBM dashDB, a managed cloud service, shares its technology base with DB2 BLU, providing in-memory database capabilities in a cloud setting. IBM DB2 on Cloud also provides an in-memory database service in a hosted cloud environment. In the coming years, IBM BLU Acceleration will likely focus on supporting a broader set of advanced analytical workloads, deeper big data integration, an enhanced cloud solution, greater hardware acceleration, and security enhancements.

### Strong Performers

› **Red Hat offers a scalable in-memory data grid to build high-performance apps.** Red Hat JBoss Data Grid comprises a distributed cache and a NoSQL Database technology that delivers a peer-to-peer, no-master/slave architecture designed to scale to hundreds of nodes on commodity hardware. It supports transactional capabilities with configurable full ACID compliance and durability using data replication across servers and data centers. JBoss Data Grid integrates with Apache Spark to support real-time analytics, and it has broad security, offering role-based access control, node authentication, column-masking, and encryption. The database runs on AWS, Azure, and Google Cloud and uses the OpenShift Container platform for private cloud. Red Hat's road map includes fine-grained authorization, stateful scale-out on OpenShift, integration with additional big data technologies, and change data capture. Customers using Red Hat Data Grid in-memory database include REWE and Matsui Securities.

› **Redis Labs has a viable in-memory database with support for broad use cases.** Redis Labs offers an open source in-memory database that supports operational, analytical, and operational workloads. It supports both relaxed and strong consistency with a flexible, schemaless model that's built on a shared-nothing symmetric architecture. Today, Redis Cloud runs on AWS, Google Cloud, IBM SoftLayer, and Microsoft Azure and is integrated with several platform-as-a-service environments. Redis Labs has developed additional features and technology that encapsulate the open source software and provide an enhanced deployment architecture for Redis while supporting the open source API. Customers use Redis to support real-time analytics, translytical, data ingestion, social media, customer intelligence, operational reporting, and 360-degree-view-of-the-customer initiatives.

› **Couchbase offers a scalable NoSQL in-memory database.** Couchbase Server, an open source NoSQL key-value and document database, offers in-memory technology that appeals to enterprises that need to support higher performance, multimodel, scale, and simplified data access for next-generation applications. Firms use Couchbase to support social and mobile applications, content and metadata stores, eCommerce, and online gaming applications. Couchbase provides


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full support for documents, a flexible data model, indexing, full-text search, and MapReduce for real-time analytics. It has some large customers (such as AT&T, eBay, LinkedIn, McGraw-Hill Education, Orbitz, and Tesco PLC) that use the product to support various mission-critical workloads, including operational, analytical, and mixed workloads.

- **Aerospike's in-memory database offers very good performance and scale.** Aerospike is an in-memory database that supports various types of applications, including real-time systems of engagement and digital-business-transformation-driven applications. It is a flash-optimized in-memory NoSQL key-value store database that simplifies the development and deployment of applications needing low-latency access. Top use cases include fraud detection, real-time bidding, personalized web portals, eCommerce search, and context-driven applications. One large customer runs more than 4.5 million transactions per second with over 100 terabytes of data replicating across eight clusters in four data centers for a mission-critical, customer-facing application. It currently runs only on Linux and does not support ODBC or JDBC protocols. Aerospike's road map focuses on cloud, security, API integration, scale, and broader use cases. Aerospike is a good solution to replace existing cache-based applications or new apps requiring hybrid, scale-out in-memory architecture.
- **DataStax's shared-nothing framework delivers distributed in-memory capabilities.** DataStax is a database platform based on Apache Cassandra, built for performance and availability for the IoT, web, mobile, and extreme-scale applications. With more than 400 customers, DataStax continues to execute well to support global applications that demand low-latency access to critical information. Although DataStax cannot run completely in memory, its masterless, shared-nothing, peer-to-peer architecture scales across data centers to deliver a strong, distributed global data platform for applications that demand 24x7 availability and scale. DataStax's road map includes increasing the addressable in-memory option and automated tiered storage to support DRAM, SSD, and disk automatically. We expect DataStax to support a complete in-memory data platform in the coming years, leveraging its core distributed data platform. For customers that need a combination of extreme performance and availability, DataStax is one vendor to short-list.
- **VoltDB offers a high-performance and scalable in-memory database.** VoltDB's in-memory database combines streaming analytics with transactions in a single integrated platform. The product is an ACID-compliant, immediately consistent, and distributed shared-nothing in-memory database. VoltDB relies on horizontal partitioning of data to scale out on commodity hardware, on-premises, or in the cloud. It supports synchronous replication within the database cluster to support high availability. VoltDB is available as open source software under the Affero General Public License (AGPL) as well as under a commercial license. Enterprises use VoltDB to support IoT analytics, personalization, risk management, ad optimization, asset tracking, and other real-time and low-latency workloads. VoltDB's road map includes expanding support for real-time analytics, geospatial functions accessible with SQL, and additional use cases. Enterprises short-list VoltDB when building low-latency translytical applications to support self-service data platform capabilities.


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## Contenders

- **MemSQL delivers an in-memory platform to support real-time translytical workloads.** MemSQL Enterprise is a distributed in-memory database that delivers full ACID compliance and extreme performance to support transactional, operational, and analytical workloads. As a purpose-built database for low-latency data access, MemSQL uses SQL and a horizontally scalable, distributed architecture that runs on commodity hardware or the public cloud. MemSQL continues to execute well on its vision and is expanding its market share with some large deployments such as Akamai Technologies, Dell EMC, Kellogg, Pinterest, and Samsung. MemSQL's road map includes further improvement with Apache Spark; enabling further integration with cloud platforms; and improving performance, scale, and administration for larger in-memory deployments. Enterprises building new transactional and analytical applications that need extreme performance, a single unified database, and low-latency access should look at MemSQL's in-memory solution.
- **Starcounter's in-memory database focuses on faster deployment of modern apps.** Starcounter, founded in 2006, is a fully ACID-compliant, in-memory NoSQL database that is often used to support high-performance transactional and real-time applications. It combines an in-memory database engine and application server for faster development of high-performance business applications. Customers use Starcounter to build web applications, mobile services, and real-time applications in categories such as gaming, advertising, and telecom. In addition, it enables ISVs to build new business solutions without complex architecture or expensive infrastructure. Starcounter's road map includes extending the platform to support more use cases; integrating with the application stack to make development simpler; and improving performance and scale for larger, more complex deployments. Although Starcounter doesn't have all of the features found in the Leaders, it offers an economical platform for building next-generation business applications.


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## Supplemental Material

### Online Resource

The online version of Figure 2 is an Excel-based vendor comparison tool that provides detailed product evaluations and customizable rankings.

### Data Sources Used In This Forrester Wave

Forrester used a combination of two data sources to assess the strengths and weaknesses of each solution:

- **Product briefings and demos.** We asked vendors to conduct briefings and demonstrations of their product's functionality. We used findings from these product briefings and demos to validate details of each vendor's product capabilities.


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› **Customer reference calls.** To validate product and vendor qualifications, Forrester also conducted reference calls or conducted surveys with at least one of each vendor's current customers.

### The Forrester Wave Methodology

We conduct primary research to develop a list of vendors that meet our criteria for evaluation in this market. From that initial pool of vendors, we narrow our final list. We choose these vendors based on 1) product fit, 2) customer success, and 3) Forrester client demand. We eliminate vendors that have limited customer references and products that don't fit the scope of our evaluation.

After examining past research, user need assessments, and vendor and expert interviews, we develop the initial evaluation criteria. To evaluate the vendors and their products against our set of criteria, we gather details of product qualifications through a combination of lab evaluations, questionnaires, demos, and/or discussions with client references. We send evaluations to the vendors for their review, and we adjust the evaluations to provide the most accurate view of vendor offerings and strategies.

We set default weightings to reflect our analysis of the needs of large user companies — and/or other scenarios as outlined in the Forrester Wave document — and then score the vendors based on a clearly defined scale. These default weightings are intended only as a starting point, and we encourage readers to adapt the weightings to fit their individual needs through the Excel-based tool. The final scores generate the graphical depiction of the market based on current offering, strategy, and market presence. Forrester intends to update vendor evaluations regularly as product capabilities and vendor strategies evolve. For more information on the methodology that every Forrester Wave follows, go to http://www.forrester.com/marketing/policies/forrester-wave-methodology.html.

### Integrity Policy

All of Forrester's research, including Forrester Wave evaluations, is conducted according to our Integrity Policy. For more information, go to http://www.forrester.com/marketing/policies/integrity-policy.html.

## Endnotes

[1] ERP: enterprise resource planning; ETL: extract, transform, load.


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