

# Critical Capabilities for Cloud Database Management Systems for Operational Use Cases

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Initiatives: [Data Management Solutions](#)

Data and analytics leaders can use this research to plan against their operational use cases for relational and nonrelational cloud DBMSs, which increasingly require features for augmented operations via machine learning, multicloud scenarios and effective financial governance to achieve leadership.

**This Critical Capabilities is related to other research:**

[Magic Quadrant for Cloud Database Management Systems](#)

[View All Magic Quadrants and Critical Capabilities](#)

## Overview

### Key Findings

- Relational database management systems (RDBMSs) still dominate the market, but nonrelational offerings, now with 15% of DBMS revenue, are demonstrably suitable for many use cases.
- Of the top 10 vendors by overall DBMS revenue, seven are also cloud service providers (CSPs), and all but IBM and Oracle are growing at faster rates than their non-CSP competitors. Three CSPs (IBM, Microsoft and Oracle) scored in the top four for all use cases evaluated here.
- The operational use cases in this year's research are unchanged. The level of core DBMS feature maturity has increased, even as more vendors have brought their cloud offerings to market, and has driven some modifications to the capabilities evaluated and their weightings.

### Recommendations

For data and analytics leaders responsible for data management solutions:

- Avoid selecting a product based on the latest “hot” feature, because the DBMS market is dynamic and frequent product updates are no longer exceptional. Instead, take a broader view of the product based on its likelihood to fit your environment longer term.
- Determine the right product by mapping your operational use cases to the data formats, languages and processing techniques supported by the DBMS. These aspects can vary widely from product to product, so you must not assume that cloud DBMSs are interchangeable.
- Link your strategic cloud and DBMS provider choices based on fit to your required use cases. These decisions can be independent — choice of platform need not dictate choice of DBMS. If you expect to use multiple clouds, independent software vendors (ISVs) are more likely to fit best.

## Strategic Planning Assumptions

By 2025, cloud preference for data management will substantially reduce the vendor landscape while the growth in multicloud will increase the complexity for data governance and integration.

By 2022, cloud database management system (DBMS) revenue will account for 50% of the total DBMS market revenue.

## What You Need to Know

Data and analytics leaders can use this research to guide their evaluation and initial vendor selection of cloud DBMS offerings for operational use cases. This document is one of a family of three documents that should be considered together:

1. **[Magic Quadrant for Cloud Database Management Systems](#)**. This research evaluates selected vendors of DBMSs that run in the cloud — for both analytical and operational use cases. The Magic Quadrant is used to judge the suitability of cloud DBMS vendors for either analytical or operational use, or for both.
2. **[Critical Capabilities for Cloud Database Management Systems for Analytical Use Cases](#)**. This research evaluates particular cloud DBMS products provided by the vendors in the Magic Quadrant for their suitability to support four analytical use cases, using nine core capabilities. The findings from this document feed into the evaluations of the cloud DBMS vendors in the Magic Quadrant.

3. **Critical Capabilities for Cloud Database Management Systems for Operational Use Cases** (this document). This evaluates particular cloud DBMS products provided by the vendors in the Magic Quadrant for their suitability to support four operational use cases, using 12 core capabilities.

The Critical Capabilities research evaluates individual products — each vendor has identified the product that it wishes to represent it in the research. For each vendor in the Magic Quadrant, there may be the same product, or two different products, in each of the Critical Capabilities documents. Most of the capabilities are common to the two Critical Capabilities documents, but may be interpreted differently for the analytical and operational use cases. The scores for each capability may also carry different weights in each document.

Enterprises use cloud DBMSs for operational use cases to provide support for:

- **Intercloud, multicloud and hybrid operation.** Increasingly, enterprises require support for transactions and other operations that may be deployed across multiple clouds, that involve both cloud and on-premises storage, or that involve data exchange between clouds.
- **Multiple data stores.** It is now common for transactions, interactions and observations to involve a wide variety of unstructured data along with traditionally structured information. The Internet of Things (IoT), social media, video, audio, documents and weblogs are commonly used as part of these operations.
- **Real-time or near-real-time analysis for augmented transactions.** The need for analytical results in real time or near real time, to provide information to mainstream business processes, is now the norm. Such capabilities may include querying analytical data stores in real time, mixing real-time and offline analytics, performing real-time analytics on an event stream, and feeding real-time data through APIs.

The following trends are also appearing in the market:

- The emergence of data ecosystems as the basis for competition. This is where products or vendors are evaluated not on single-product solutions, but on an ensemble of products that are integrated to work together. Integration of the data warehouse, data lake and machine learning (ML) services would be typical.

- The need to choose between a single database product for both transactional and analytical use cases, or separate products — even from CSPs, which may offer both. In some cases, the same product may be used, but it may be configured differently for the two types of use cases.
- Increasing interest in distributed transactional DBMSs, which is reflected in this year's addition of CockroachDB.

Our analysis synthesizes insight gleaned from the following sources over the past 12 months:

- Product information provided by the vendors
- Information gathered from interactions with Gartner clients
- Information gathered through various other sources, including Gartner Peer insights and secondary research

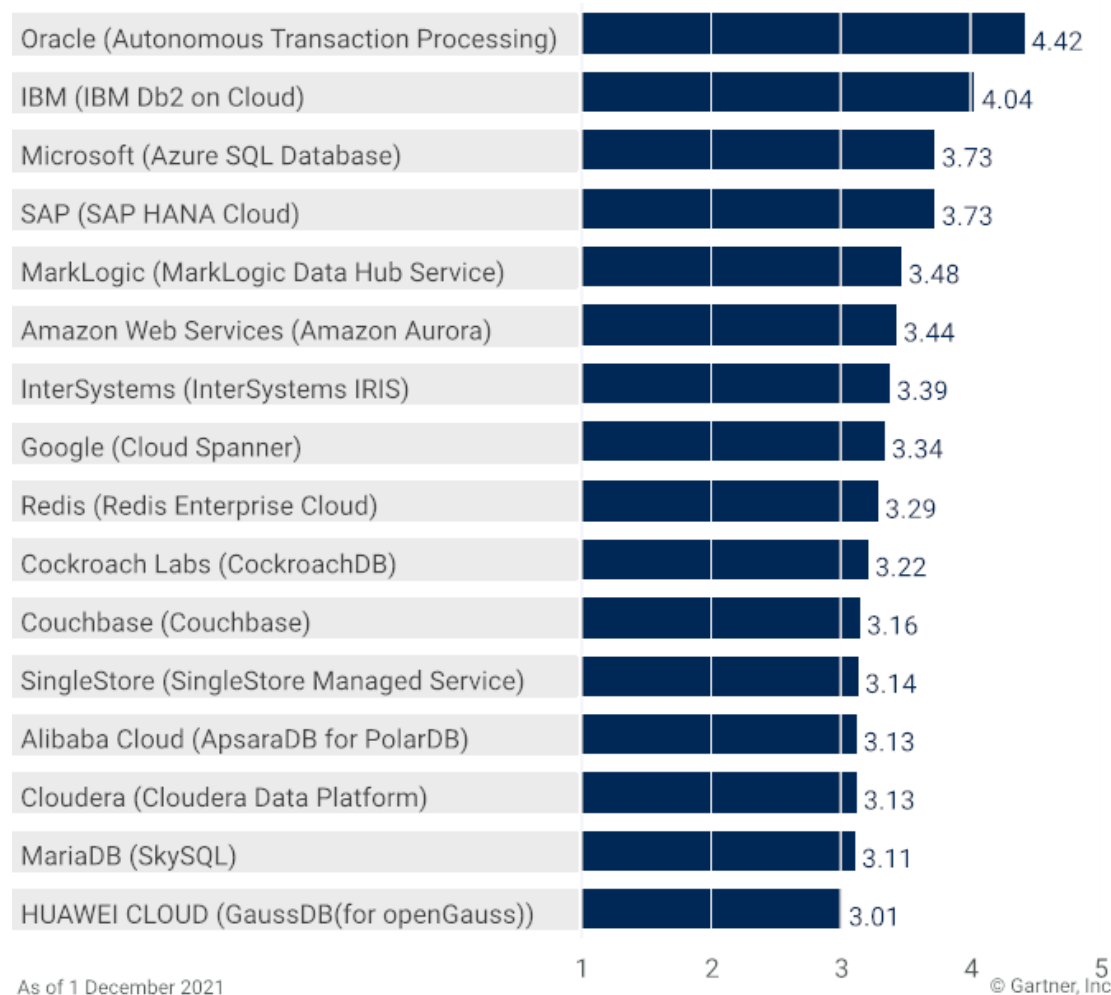
The scores used here, where a score of 3.0 represents “Good: meets requirements,” will enhance the breadth of information available to you, supporting a better-tuned decision process. Most scores achieve or exceed this level. Nonetheless, any decision process you adopt should include proof of concept (POC) tests with your data, on the cloud platform and configuration of your choice, and against your production business requirements and service-level agreements (SLAs).

## Analysis

### Critical Capabilities Use-Case Graphics

#### Vendors' Product Scores for Traditional Transactions Use Case

Product or Service Scores for Traditional Transactions

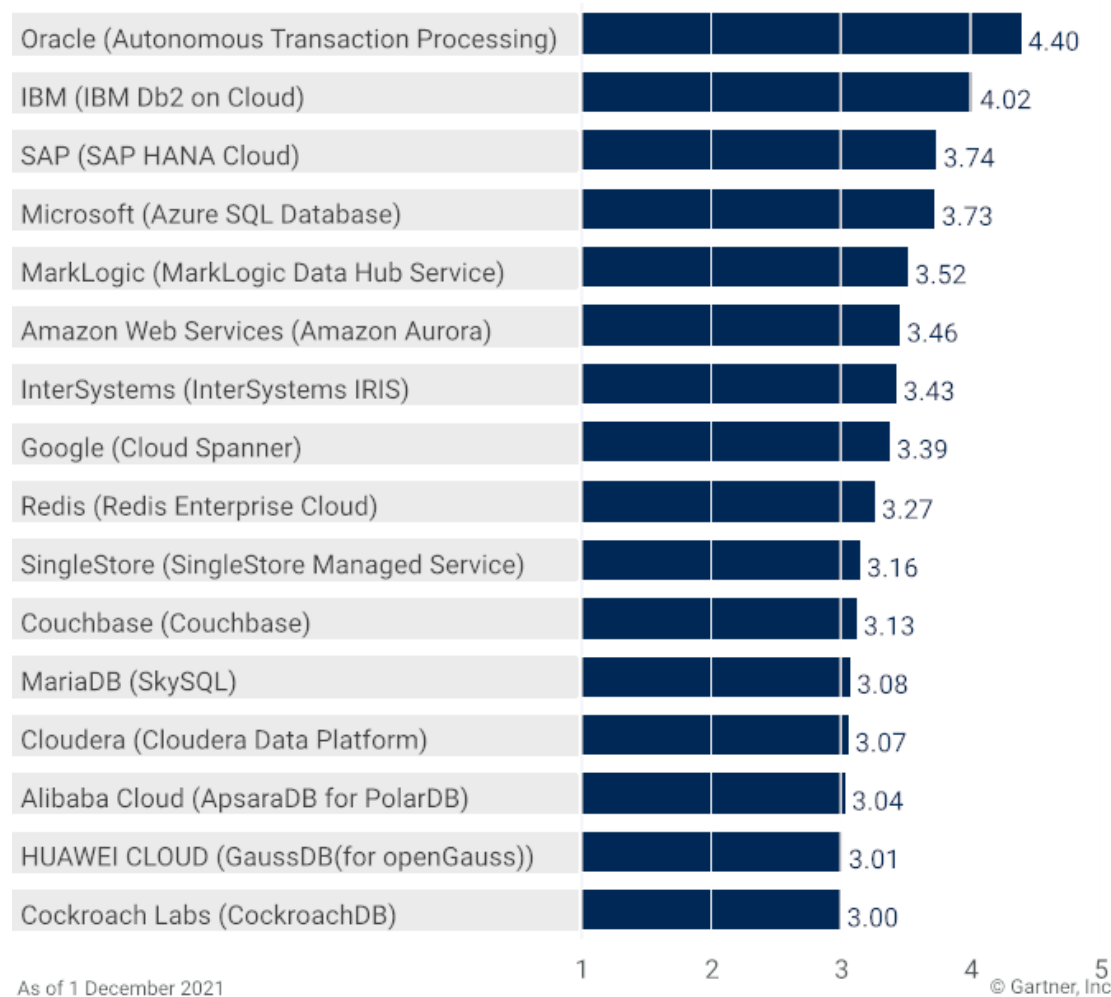


**Gartner**

Source: Gartner (December 2021)

## Vendors' Product Scores for Augmented Transaction Processing Use Case

Product or Service Scores for Augmented Transaction Processing

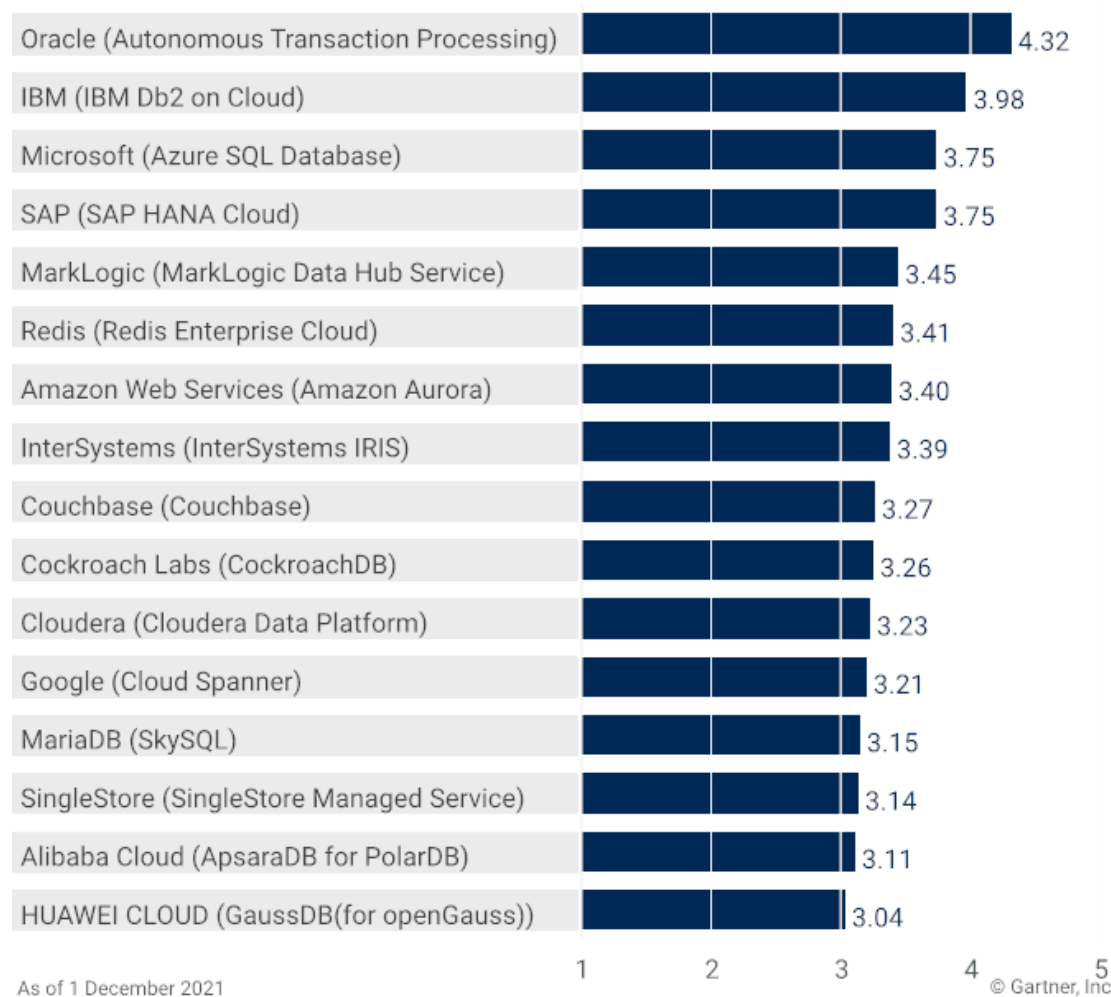


**Gartner**

Source: Gartner (December 2021)

## Vendors' Product Scores for Stream/Event Processing Use Case

Product or Service Scores for Stream/Event Processing

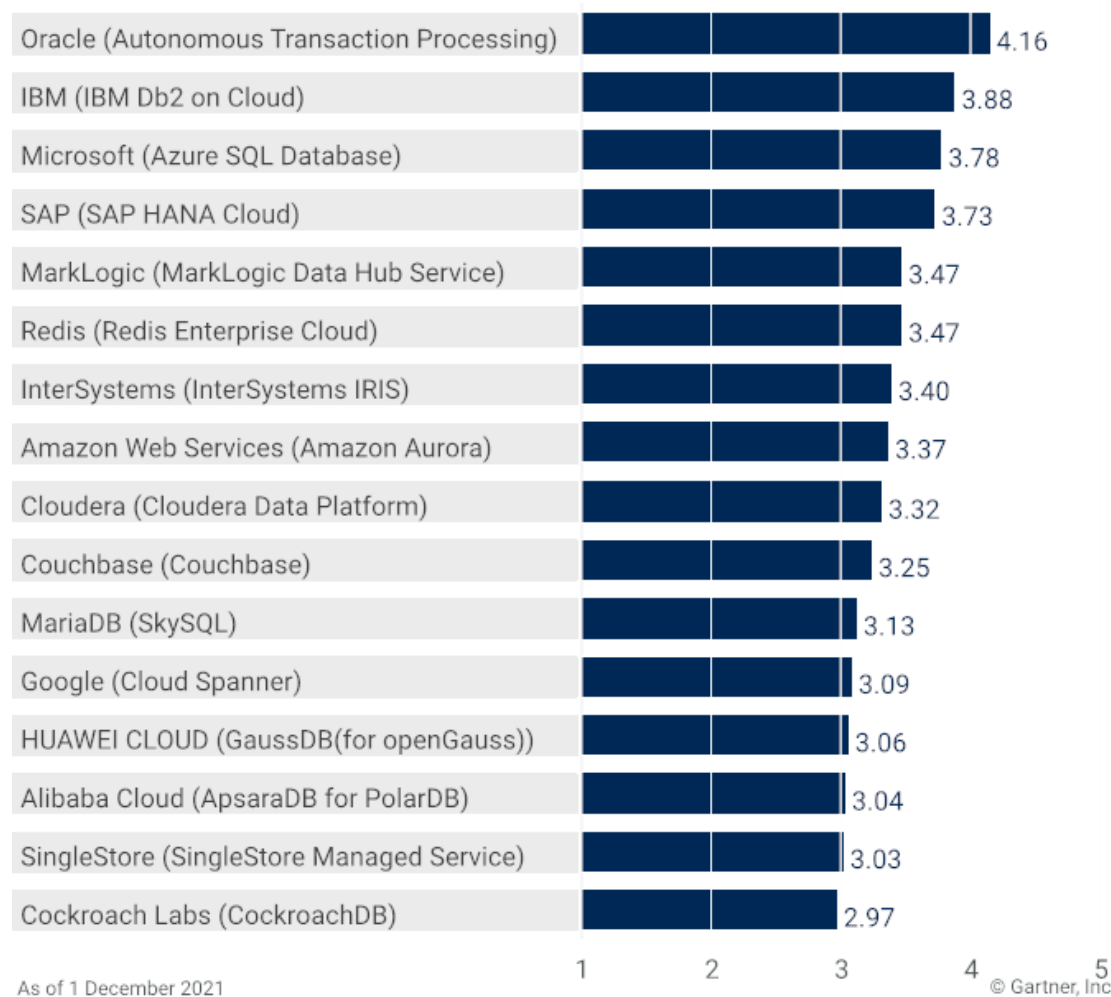


Gartner

Source: Gartner (December 2021)

## Vendors' Product Scores for Operational Intelligence Use Case

Product or Service Scores for Operational Intelligence



Gartner

Source: Gartner (December 2021)



## Vendors

### **Alibaba Cloud (ApsaraDB for PolarDB)**

Alibaba Cloud is a global cloud computing company headquartered in Hangzhou, China, with international operations based in Singapore and its largest investor, SoftBank, based in the Cayman Islands. Alibaba Cloud is the largest provider of public cloud platforms in China.

Operational database services include ApsaraDB for PolarDB (compatible with MySQL, PostgreSQL and Oracle), RDS.MyBase and PolarDB-X (formerly known as DRDS).

Analytical database services include AnalyticDB, MaxCompute, Data Lake Formation and E-MapReduce (EMR).

ApsaraDB for PolarDB was developed in-house by Alibaba. ApsaraDB for PolarDB is a serverless, cloud-native database with effective separation of compute and storage, a master write node with multiple read replicas, and the ability to automatically scale in response to a fluctuating demand.

It meets requirements for all transactional use cases, and excels at high-speed, high-volume processing that requires high availability, high concurrency and very high scaling of processing. This ability is demonstrated each year when PolarDB powers the Alibaba Double 11 Global Shopping Festival. In 2020, PolarDB and AnalyticDB handled peak processing of 583,000 orders per second and 1.7 exabytes of data per day.

### **Amazon Web Services (Amazon Aurora)**

Amazon Web Services (AWS), headquartered in Seattle, Washington, U.S., offers a wide range of database management services and capabilities. Some are aimed at operational use cases, as is the case with Amazon Relational Database Service (RDS), Amazon Aurora and Amazon DynamoDB, for example. Others are aimed at analytical use cases, as is the case with Amazon Redshift, Amazon Athena and Amazon EMR, for example. AWS also offers memory-intensive services and offerings aimed at specialized use cases.

Amazon Aurora is the product evaluated in this research.

Amazon Aurora placed in the upper half of the stack in all four use cases, with scores of 3.37 or higher.

Amazon Aurora scored 4.0, a full point higher than meeting requirements, for both the dynamic elasticity and the high-speed processing and ingest critical capabilities, making the offering particularly suited for use cases that depend on these capabilities.

## **Cloudera (Cloudera Data Platform)**

Cloudera is headquartered in Santa Clara, California, U.S. Cloudera Data Platform (CDP) consists of multiple integrated cloud data services, including CDP Data Hub, CDP Data Warehouse, CDP Machine Learning, CDP Data Engineering, CDP DataFlow and CDP Operational Database. It is offered for both operational and analytical uses. Cloudera Replication Manager is used to migrate workloads in hybrid and multicloud scenarios. Cloudera Shared Data Experience (SDX) provides intercloud and multicloud unified security, governance and metadata management.

This is the first Critical Capabilities participation by CDP Operational Database, an RDBMS based on Apache HBase and Apache Phoenix with wide-column support and relational, nonrelational and other APIs, such as the Python Database API.

CDP scores above 3 on all four use cases considered here, reflecting the significant functionality that the addition of Apache Phoenix (which is largely driven by Cloudera's committers) has brought. Its effective multicloud and hybrid capabilities, along with autoscaling, make it attractive for enterprises contending with the transition to cloud, and its strong focus on governing across platforms from a single view enhances that value.

CDP's above-average performance for multicloud/intercloud/hybrid operations is a standout here and is well worth exploration by companies with widespread deployment needs. Below-average scores for programming augmented transactions and for high-speed processing and ingest in operational use cases reflect the early nature of the Apache Phoenix integration. Similarly, modest enhancements in consistency and security will be required to improve scores going forward, especially for traditional transaction use cases.

## **Cockroach Labs (CockroachDB)**

Cockroach Labs is headquartered in New York, New York, U.S. It is active in multiple markets, including finance and retail. It offers CockroachDB, available on Amazon Web Services and the Google Cloud Platform, in three deployment options: Serverless and Dedicated, both managed; and Self-Hosted, which customers manage themselves. This research assesses the managed offerings.

The CockroachDB offering is specifically aimed at use cases that require distributed transactions. The service achieved its highest scores in the traditional transactions and stream/event processing use cases, but did not perform as well for the augmented transaction processing and operational intelligence use cases. The service scored very high on the consistency and the multicloud/intercloud/hybrid deployment capabilities, with scores of 4.8 and 4.9, respectively. However, it scored below a 3 (meets requirements) for certain other capabilities, such as advanced analytics and programming augmented transactions.

## **Couchbase (Couchbase)**

Couchbase, based in Santa Clara, California, U.S., is new to this year's Magic Quadrant and Critical Capabilities research. It offers a multimodel DBMS, with a heritage in high-performance, nonrelational operational databases.

Couchbase meets requirements for all four operational use cases. It has expanded its SQL capabilities in recent releases, making it more attractive to organizations that find nonrelational DBMSs less appealing. It rated high for multicloud/intercloud/hybrid features, but was well below average in automated performance tuning/optimization and distributed access capabilities. Those latter areas should see continued improvement in future evaluations as Couchbase's cloud versions mature.

Other areas that fell below average included security and consistency, which are increasingly a focus for organizations deploying distributed operational use cases with high-performance requirements.

## **Google (Cloud Spanner)**

Google Cloud Platform (GCP), a subsidiary of Google, is located in Santa Clara, California, U.S. GCP supports many database platform as a service (dbPaaS) products, from fully managed versions of products from third-party providers to its own dbPaaS products. Operational dbPaaS offerings include Cloud SQL (PostgreSQL, MySQL and SQL Server), Cloud Spanner, Firestore and Firebase Realtime Database. Analytical dbPaaS offerings include Cloud Bigtable, BigQuery and Dataproc.

GCP's operations are geographically diversified, with presence in all regions of the world. It has clients of every size across all industries. Cloud Spanner is the dbPaaS product evaluated here.

Cloud Spanner's scores for all use cases were above "meets requirements," with relatively stronger placements for traditional transactions and augmented transaction processing. Its weakest use-case scores were for stream/event processing and operational intelligence. The latter was impacted by relatively less proficiency in advanced analytics capabilities. While Cloud Spanner scored well in high-speed processing and ingest — a highly weighted criterion for stream/event processing — its relatively lower score for multicloud/intercloud/hybrid deployment adversely impacted its rating.

Due to Cloud Spanner's reliance on specific hardware present only in Google data centers, multicloud will persist as a potential issue for this offering. In general, Cloud Spanner scored 3.0 or higher for all but two evaluated criteria. These ratings make it an excellent choice for operational use cases deployed within GCP, where deeper integration with other GCP offerings is available through services like Cloud Data Fusion, Dataflow and Dataplex. Google also documents greater than or equal to 99.999% high availability for multiregional instances of Cloud Spanner in its SLAs for customers.

#### **HUAWEI CLOUD (GaussDB(for openGauss))**

HUAWEI CLOUD is headquartered in Shenzhen, China. It provides GaussDB in a range of offerings. Relational DBMS offerings include GaussDB(for MySQL), GaussDB(for openGauss), GaussDB(for PostgreSQL) and GaussDB(DWS). Nonrelational offerings include GaussDB(for Mongo), GaussDB(for Influx), GaussDB(for Cassandra) and GaussDB(for Redis). All are available on Huawei CLOUD and Huawei CLOUD Stack for on-premises deployment.

GaussDB(for openGauss), considered here, is positioned by HUAWEI CLOUD for high-performance, mission-critical workloads. GaussDB(for openGauss) meets requirements for the evaluated use cases, joining the increasingly mature offerings it must compete with. It falls below average for multicloud/intercloud/hybrid deployment, as well as for security. Closing these gaps will substantially improve its suitability for operational use cases.

While it is somewhat below average in other capabilities, GaussDB(for openGauss) is above average for high-speed processing and ingest, reflecting HUAWEI CLOUD's experience in the demanding telecommunications market.

## **IBM (IBM Db2 on Cloud)**

IBM, based in Armonk, New York, U.S., offers a broad range of dbPaaS offerings coalescing around Cloud Pak for Data, a unified integration layer for containerized services built on Red Hat OpenShift. Cloud Pak for Data serves as a platform for many other IBM data management offerings, including IBM Db2 on Cloud, IBM Db2 Warehouse on Cloud, IBM Cloud SQL Query, IBM Cloudant, the IBM Cloud Databases family and IBM Event Streams. The IBM Cloud Databases family provides a variety of managed data technologies, such as PostgreSQL, MongoDB, Elasticsearch, Redis, RabbitMQ, DataStax and EnterpriseDB. IBM Cloud Object Storage serves as a landing zone and clearinghouse to complete IBM's offerings for operational and analytical use cases.

IBM's multicloud support covers Amazon Web Services, Microsoft Azure, Google Cloud Platform, IBM Cloud and private cloud deployment (most offerings are also available on-premises). IBM Cloud Satellite service provides multicloud and edge capabilities, with management from a unified console.

IBM's operations are global, with significant penetration in all industries and all sizes of organization. Db2 on Cloud is the dbPaaS product evaluated here.

Db2 on Cloud met requirements for all four use cases, placing second among all solutions evaluated for each. Db2 on Cloud scored a 4.0 or above in nine out of 12 evaluated criteria, and did not score below a 3.2 in any of them. Of particular note were high scores for multicloud/intercloud/hybrid support. Db2 on Cloud, via Cloud Pak for Data, can be deployed on the end user's cloud of choice or on-premises, providing continuity for hybrid use-case requirements. Scores for security and consistency were also notably high. Because IBM is a larger vendor with a deep portfolio, Db2 on Cloud should be evaluated in the context of the broader ecosystems provided in Cloud Pak for Data, and the additional functionality available through this approach.

## **InterSystems (InterSystems IRIS)**

InterSystems is headquartered in Cambridge, Massachusetts, U.S. It offers InterSystems IRIS, a multimodel hybrid DBMS. InterSystems has a global presence, primarily in healthcare, but also in other industries such as financial services.

InterSystems IRIS is available as a public, fully managed dbPaaS cloud service on Amazon Web Services, Google Cloud Platform, Microsoft Azure and Tencent. A private fully managed dbPaaS version is also available.

InterSystems IRIS meets requirements for all four operational use cases. It placed in the top half of the products evaluated, across all use cases. This positioning is not surprising, given InterSystems' long history of producing operational DBMSs, and it makes InterSystems IRIS a good choice for all the operational use cases. Of particular note is InterSystem IRIS's strong showing for augmented transaction processing, which is attributable to the strength of the embedded analytics, machine learning and artificial intelligence in InterSystems IRIS Enterprise.

The solution scored below "meets requirements" for dynamic elasticity, workload management and financial governance. It exceeded requirements in many capabilities, especially advanced analytics, distributed data access, multicloud/intercloud/hybrid deployment and programming augmented transactions. It also received a relatively high score for security — expected, due to InterSystems' strength in healthcare.

## **MariaDB (SkySQL)**

MariaDB has headquarters in Redwood City, California, U.S. It offers MariaDB SkySQL, a fully managed cloud offering of the MariaDB database. The MariaDB database is also available as an on-premises offering in both MariaDB Enterprise and the fully open-source MariaDB Community Server.

MariaDB's operations are primarily split between North America and Europe, with a limited presence in the Asia/Pacific region. Its customers span a wide range of industries and enterprise sizes. MariaDB SkySQL is the dbPaaS product evaluated here.

SkySQL meets requirements for all four use cases evaluated in this research. Its strongest showings were in the stream/event processing and the operational intelligence use cases, reflective of MariaDB's converged approach to both operational and analytical use cases with a combined row-and-column store and flexible storage engines. SkySQL scored at least a 3.0 (meets requirements) for all capabilities evaluated, except dynamic elasticity and workload management. It is a good choice for a broad range of operational use cases.

Its bottom-third placement for traditional transactions, augmented transaction processing and event/stream processing should be viewed against the backdrop of a highly competitive market with a plethora of highly capable offerings. MariaDB SkySQL is a significant, differentiated offering for MySQL users with distributed use cases.

## **MarkLogic (MarkLogic Data Hub Service)**

MarkLogic has headquarters in San Carlos, California, U.S. The MarkLogic Data Hub Service is offered on the Amazon Web Services and Microsoft Azure clouds.

MarkLogic focuses on data management, built around a transactional document store and an integration hub. The integration hub enables users to access data stored remotely through a universal index, which reduces remote data movement through optimization of remote access.

The MarkLogic Data Hub Service, evaluated for this research, placed in the top third for all four use cases, with scores above 3.4. in each.

The MarkLogic Data Hub Service scored particularly well in the programming for augmented transactions and security critical capabilities. The service scored above 3.0 in all but one of the critical capabilities for operational use cases.

## **Microsoft (Azure SQL Database)**

Microsoft is headquartered in Redmond, Washington, U.S. It provides a broad range of cloud DBMS offerings, including Azure Synapse Analytics, Azure SQL Database, Azure SQL Managed Instance, Azure SQL Edge, Azure Cosmos DB, Azure HDInsight, and Azure Database for PostgreSQL, MySQL and MariaDB. Azure SQL Database is evaluated here. Microsoft's operations are geographically diversified, and its customers are spread across a wide range of industries and deployment sizes worldwide.

Microsoft is focused on delivering a cohesive cloud data management ecosystem that spans all the use cases that we have defined for DBMS markets and associated Critical Capabilities research.

Azure SQL Database meets requirements for all four operational use cases, and it scores in the top quarter for each use case. Thus, Azure SQL Database is a highly capable DBMS, due to a pedigree tracing back to the on-premises SQL Server product. Its highest use-case scores are for stream/event processing and operational intelligence, revealing that this DBMS has strong real-time and data-in-motion practices.

Azure SQL Database achieved its best scores in dynamic elasticity and security. It also received high scores in other operational capabilities, including advanced analytics, financial governance, multicloud/intercloud/hybrid deployment, consistency, distributed access, and high-speed processing and ingest.

## **Oracle (Autonomous Transaction Processing)**

Oracle is based in Austin, Texas, U.S. Oracle Autonomous Transaction Processing (ATP) is available in Oracle Cloud Infrastructure (OCI). It is also available on Oracle Exadata Cloud@Customer (ExaCC) private cloud and Oracle Dedicated Region Cloud@Customer private cloud, which run all Oracle cloud services in the customer's data center.

Oracle ATP has full compatibility with the Oracle Database, with added functionality to manage the database automatically (e.g., automated security patching, upgrades and other patches with zero downtime; automated index maintenance; and enhanced optimization using ML).

Oracle ATP leads all products evaluated for all four use cases. It exceeds average scores by over a full point for automated performance tuning/optimization, consistency, workload management and security. Other capability scores, such as for advanced analytics and dynamic elasticity, also exceed the average scores substantially.

Oracle Database is available on cloud platforms other than OCI; ATP is not. Oracle ATP has a strong hybrid capability, but Oracle's multicloud and intercloud strategy still drives customers to the vendor's own cloud for dbPaaS via a pricing model that has higher costs on other platforms. However, Oracle has an agreement with Microsoft for colocation of data centers, allowing Oracle ATP on OCI to be used with tools and applications on Microsoft Azure. Gartner believes other openings to more heterogeneous environment support will follow. Enterprises with substantial commitments to other cloud platforms should watch developments closely.

## **Redis (Redis Enterprise Cloud)**

Redis is headquartered in Mountain View, California, U.S. It offers the Redis Enterprise Cloud on Amazon Web Services, Google Cloud Platform and Microsoft Azure clouds, plus Redis Enterprise Software is available for on-premises deployment. The Redis product is an in-memory, nonrelational, multimodel data store. It has primarily been used as a cache but is expanding into more traditional DBMS operational use cases.

Redis Enterprise Cloud placed in the middle of the pack for each of the four operational use cases. This positioning resulted from Redis meeting requirements in all four use cases. Redis' highest use-case score was in operational intelligence, followed by stream/event processing. The in-memory nature of the Redis product is well-suited to the type of rapid ingestion required for these two operational use cases.



The Redis solution scored 3.0 (meets requirements) for workload management, security and automated performance tuning/optimization. In addition, Redis Enterprise Cloud exceeded requirements for other capabilities, such as multicloud/intercloud/hybrid deployment and high-speed processing and ingestion.

## **SAP (SAP HANA Cloud)**

SAP, which is based in Walldorf, Germany, offers SAP HANA Cloud, SAP Data Warehouse Cloud, SAP BW/4HANA, SAP Adaptive Server Enterprise, SAP IQ and SAP SQL Anywhere. Products address both operational and analytical DBMS use cases. SAP operates on a global basis from diverse locations. It has enterprise customers of all sizes and from all industries.

SAP HANA is available on multiple public clouds, as an appliance on a virtual machine, and as software only. For analytical use cases, SAP offers SAP Data Warehouse Cloud for SQL-based development of data warehouses with both SAP- and non-SAP-based data.

SAP HANA Cloud, reviewed here, provides unified analytical and transactional processing, against a single copy of data. Transactions can be augmented with analytics, including predictive analytics, multimodel graph, language processing and online analytical processing (OLAP) engines.

SAP HANA Cloud scored in the top quarter for all four use cases. At 4.5, multicloud/intercloud/hybrid deployment was SAP HANA Cloud's highest-scoring capability. SAP HANA Cloud also scored a 4.0 or above on several other capabilities, including advanced analytics, distributed access, programming augmented transactions and security. Although clients might view SAP HANA Cloud purely as a platform for SAP applications and not consider it as a general-purpose database, its placement in this Critical Capabilities shows that it is suitable for general development.

## **SingleStore (SingleStore Managed Service)**

SingleStore is headquartered in San Francisco, California, U.S. It offers SingleStore Managed Service, which is a fully managed cloud DBMS known for its patented Universal Storage technology. SingleStore Universal Storage technology provides an automated, life-cycle-aware, tiered storage model across in-memory rowstore, persisted columnstore and cloud object storage, while also providing multimodel and serverless capabilities.

SingleStore Managed Service is available as SaaS on Amazon Web Services, Google Cloud Platform and Microsoft Azure. The Dedicated edition of SingleStore Managed Service can be deployed on private clouds, and SingleStore instances can interoperate across multiple clouds and on-premises deployments.

SingleStore Managed Service meets the requirements for all four operational use cases, while ranking midstack or below among the competing firms evaluated here. SingleStore's highest-scoring use case is augmented transactions, where analytics functions are embedded in transaction processing to make that process more automated and intelligent. The single-engine approach taken by SingleStore is well-suited to this use case.

SingleStore scored below a 3.0 (meets requirements) for a few critical capabilities, including dynamic elasticity, distributed access and automated performance tuning/optimization. It met requirements for other operational capabilities, including workload management, programming augmented transactions, consistency, and multicloud/intercloud/hybrid deployment. SingleStore's highest score (among operational capabilities) was for high-speed processing and ingesting. This makes sense, given SingleStore's long-standing support for in-memory processing, coupled with multiple approaches to data ingesting.

## Context

This Critical Capabilities report focuses on key cloud DBMS capabilities for the operational use of data. You can change our capability weightings by use case on the interactive version of this document to suit your needs.

Cloud-based DBMS (also known as database platform as a service, or dbPaaS) is increasingly important and growing fast. The capabilities, and their weightings in this year's research, reflect priorities driven by cloud deployment.

As organizations delegate the operation of their systems in the cloud, they need to trust that their respective cloud DBMS vendor will employ the usage and performance information gathered there to ensure cost-effective optimization. This concept is captured in the **automated performance tuning/optimization** capability. Similarly, **financial governance** reflects the importance of forecasting and taking control of your spend, and gauges how well products allow you to do so. Managing scarce budgets rather than scarce physical resources is rapidly becoming the new normal.

To reduce the overall number of criteria, the **high-speed processing and ingest** capability combines last year's separate entries for high-speed ingest and high-speed, high-volume processing. And to reflect the focus on reading and writing external data, the multiple data types/structures capability has been replaced with **distributed access**.

For several of the use cases, we have added **advanced analytics**, reflecting the degree to which in-line analytics has become an expected part of many operational applications. **Dynamic elasticity** is assumed by cloud users, but its implementation varies. Thus, it is evaluated here. Descriptions of all the use cases and capabilities appear below.

The rate of movement to the cloud has been much slower for some vendors than others. Cockroach Labs and Couchbase may be less familiar, but they established their offerings in the early days of the cloud transformation.

You may find opportunities for improvement beyond your present suppliers. Scores are quite close; ranking may not reflect substantial differences. For example, less than half a point separates the bottom three-quarters of the solutions for traditional transactions, the foundation of operational DBMS usage. You should use this research to qualify candidates as you consider new projects. Investigate the details, and compare to your requirements.

## Product/Service Class Definition

The critical capabilities named here address the major needs identified in this research. Operational DBMS vendors provide key DBMS capabilities for processing transactions, interactions, events and observations. In addition to "traditional" transactional uses (such as ERP and financial systems), these vendors are increasingly involved in adding analytics directly into transactional streams for the convergence of transactional and analytical use cases. We have also seen evidence of deployments in other new use cases, such as global scalability for web applications and emerging IoT applications involving event processing/data in motion.

## Critical Capabilities Definition

### Advanced Analytics

The product's ability to perform advanced analytics operations within the dbPaaS. It is evaluated on the basis of what functionality is offered in the current version of the product and what functionality is being used by customers.

In addition, the extent and richness of available in-DBMS analytics libraries of AI/ML algorithms are taken into consideration.

## **Automated Perf Tuning/Optimization**

The ability to optimize performance for queries, transactions and workloads to meet performance SLAs. This will vary according to the workload being optimized.

## **Consistency**

DBMS-guaranteed properties of atomicity, consistency, isolation and durability (ACID) to ensure reliable, recoverable database transactions with multiple nodes accepting writes to the same data. Strong consistency is a requirement.

Additionally, the engine can include forms of relaxed, eventual or tunable consistency for specific use cases.

## **Distributed Access**

The ability to access data outside of the internal storage of a DBMS. This capability includes products that can optimize access to outside storage by sharing processing or reducing data transfer.

## **Dynamic Elasticity**

The capability to easily scale both up and down based on policy in response to changing workloads or user specifications. The aim is to deliver predictable cost and performance against SLAs when confronted with workload variability.

## **Financial Governance**

The ability to forecast, budget usage, monitor and control costs by throttling, workload reduction or other means. It can include governing types and numbers of instances used, allowed users or groups; spinning down unused resources; and recommending and implementing less costly storage strategies.

Cost predictability and blended pricing models are beneficial.

## **High-Speed Processing and Ingest**

The ability to continuously process and load data from multiple endpoints and in different formats (including in-stream computations), and to durably write and make data quickly available.

## **Multicloud/Intercloud/Hybrid**

The ability to deploy and operate analytical and operational activities across one or more cloud environments and on-premises.

## **Performance Monitoring and Admin**

Supports administration and management during implementation and ongoing use. It includes resource utilization, database activity monitoring, role-based activities, security alerts and advisors. Recommendations supplement automated optimization.

## **Programming Augmented Transactions**

Support for embedding analysis within applications (as part of transaction processing) while sustaining high SLAs, and/or invoking distinct augmented analytical applications (including AI/ML) in the completion of a transaction under DBMS control.

## **Security**

Includes policy-based DBMS access controls (e.g., row- and column-level authorization), encryption, data masking and obfuscation, separation of concerns, and support for regulatory standards (e.g., General Data Protection Regulation [GDPR]).

Integrations with database activity monitoring and vulnerability scans are advanced capabilities.

## **Workload Management**

The ability to manage different types and sizes of workloads without an excessive increase in resources; to handle varying and conflicting workloads without a corresponding variance in response times; and to manage the workloads to meet defined service levels.

## **Use Cases**

### **Traditional Transactions**

A centralized transaction focus, with fixed, stable schema. High speed, high volume, concurrency, data insert/update, ACID properties and security are important.

### **Augmented Transaction Processing**

Augmenting transactions via analytics, including AI/ML, through multiple states within the transaction scope in a single database, while maintaining low latency.

### **Stream/Event Processing**

Involves events and observations, typically captured “at the edge,” including processing and transmitting results to other business process stages.

## Operational Intelligence

Operational and analytical operations within a business activity in separate process spaces on the same infrastructure and the same physical database.

## Vendors Added and Dropped

### Added

- Cloudera was added, as it added Operational Database to the services included in CDP.
- Cockroach Labs was added, as it met the Gartner market momentum threshold.
- Couchbase was added, as it met the Gartner market momentum threshold.
- MariaDB was added, as it met the Gartner market momentum threshold.
- SingleStore was added, as it met the Gartner market momentum threshold.

### Dropped

- Tencent was dropped because it did not meet Gartner's market momentum threshold. Please note that this change is not a reflection of its products, but more likely due to its heavy focus on China.

## Inclusion Criteria

This Critical Capabilities research begins with the same inclusion criteria as the companion Magic Quadrant, and may add limits based on the use cases supported.

The following inclusion criteria represent the specific attributes that Gartner analysts considered necessary for a vendor to be included in this Critical Capabilities. Gartner imposes an upper limit of 20 vendors to aid identification of the most relevant providers.

To qualify for inclusion in this Critical Capabilities, a vendor had to:

- Offer a generally available software product that met Gartner's definition of a Cloud DBMS.

- Support at least three of the following cloud DBMS use cases:
  - Traditional transactions
  - Augmented transaction processing
  - Stream/event processing (Internet of Things)
  - Operational intelligence
- Rank among the top 20 organizations in a market momentum index defined by Gartner for this Critical Capabilities. Data inputs used to calculate market momentum include the following measures, among others:
  - Gartner customer search and inquiry volume and trend data
  - Volume of job listings on a range of employment websites in the U.S., Europe and China
  - Frequency of mentions as a competitor to other cloud DBMS vendors in reviews on Gartner's Peer Insights during the year ending March 2021
- Have market presence in at least three of the following regions (regional market presence is defined as a minimum of 5% of the revenue of the verified production customer base, as well as the existence of dedicated sales offices or distribution partnerships in a specific region):
  - North America (Canada, Mexico and the U.S.)
  - Central and South America
  - Europe (including Western Europe and Eastern Europe)
  - Middle East and Africa (including North Africa)
  - Asia/Pacific
  - Japan

- Have a cloud DBMS service generally available as of midnight, U.S. Eastern Daylight Time on 1 July 2021. This included any new functionality added to the service by the specified date. We did not consider beta, “early access,” “technology preview,” or other not generally available functionality or services. Additionally:
  - Any acquired product or service must have been acquired and offered by the acquiring vendor as of 1 July 2021. Acquisitions after this date were considered under their preacquisition identities, if appropriate, and are represented separately until the publication of the following year’s Critical Capabilities.

**Table 1: Weighting for Critical Capabilities in Use Cases**

(Enlarged table in Appendix)

<i><b>Critical Capabilities</b></i>	↓ <i><b>Traditional Transactions</b></i>	↓ <i><b>Augmented Transaction Processing</b></i>	↓ <i><b>Stream/Event Processing</b></i>	↓ <i><b>Operational Intelligence</b></i>	↓
Advanced Analytics	0%	5%	0%	10%	
Automated Perf Tuning/Optimization	10%	5%	10%	10%	
Consistency	15%	15%	5%	0%	
Distributed Access	5%	5%	5%	10%	
Dynamic Elasticity	10%	10%	10%	15%	
Financial Governance	10%	10%	10%	10%	
High-Speed Processing and Ingest	10%	10%	15%	15%	
Multicloud/Intercloud/Hybrid	10%	5%	15%	15%	
Performance Monitoring and Admin	5%	5%	10%	10%	
Programming Augmented Transactions	5%	10%	0%	0%	
Security	10%	10%	10%	0%	
Workload Management	10%	10%	10%	5%	
As of 1 December 2021					

Source: Gartner (December 2021)



This methodology requires analysts to identify the critical capabilities for a class of products/services. Each capability is then weighed in terms of its relative importance for specific product/service use cases.

Each of the products/services that meet our inclusion criteria has been evaluated on the critical capabilities on a scale from 1.0 to 5.0.

## Critical Capabilities Rating

**Table 2: Product/Service Rating on Critical Capabilities**

(Enlarged table in Appendix)

Critical Capabilities	Alibaba Cloud (ApsaraDB for PolarDB)	Amazon Web Services (Amazon Aurora)	Cloudera (Cloudera Data Platform)	Cockroach Labs (CockroachDB)	Couchbase (Couchbase)	Google (Cloud Spanner)	HUAWEI CLOUD (GaussDB (for openGauss))	IBM (IBM Db2 on Cloud)	InterSystems (InterSystems IRIS)	MariaDB (MySQL)	MarkLogic (MarkLogic Data Hub Service)	Microsoft (Azure SQL Database)	Oracle (Autonomous Transaction Processing)	Redis (Redis Enterprise Cloud)	SAP (SAP HANA Cloud)	SingleStore (SingleStore Managed Service)
Advanced Analytics	2.6	3.3	3.7	1.0	2.9	3.0	2.8	4.0	4.0	3.0	3.6	3.9	4.0	3.1	4.0	2.8
Automated Perf Tuning/Optimization	4.0	3.7	3.2	2.4	2.2	3.2	2.9	4.1	3.1	3.0	3.4	3.4	5.0	3.0	3.4	2.5
Consistency	3.5	3.6	3.1	4.8	3.1	4.5	3.0	4.5	3.6	3.2	3.4	3.8	5.0	2.7	3.8	3.4
Distributed Access	3.0	3.2	3.1	1.8	2.3	3.6	2.8	4.0	3.9	3.0	3.7	3.8	4.0	3.1	4.1	2.5
Dynamic Elasticity	3.5	4.0	3.2	2.4	3.2	3.4	3.5	3.2	2.5	2.7	3.6	4.0	4.3	3.7	3.0	2.4
Financial Governance	2.9	3.6	3.0	3.6	3.5	3.0	3.0	4.0	2.9	3.0	3.5	3.9	4.0	2.9	3.3	3.0
High-Speed Processing and Ingest	3.0	4.0	3.0	3.4	3.7	4.0	4.0	3.8	3.8	3.5	3.6	3.8	4.4	4.0	3.6	4.0
Multicloud/Intercloud/Hybrid	2.5	2.3	4.0	4.9	4.4	1.3	2.5	4.3	4.0	3.6	3.3	3.9	3.5	4.3	4.5	3.3
Performance Monitoring and Admin	3.1	3.0	3.4	3.8	3.4	3.5	2.6	3.7	3.3	3.2	3.4	3.6	4.0	3.1	3.9	3.1
Programming Augmented Transactions	2.0	3.0	2.2	1.8	3.1	2.4	2.6	4.0	3.9	3.1	4.0	3.4	4.0	3.7	4.0	3.5
Security	3.6	3.9	3.0	2.6	3.0	4.0	2.7	4.4	4.0	3.1	4.0	4.0	5.0	3.0	4.0	2.9
Workload Management	2.5	2.9	2.9	2.0	2.5	3.0	3.0	4.0	2.6	2.7	2.7	3.2	4.5	3.0	3.8	3.6
As of 1 December 2021																

Source: Gartner (December 2021)

Table 3 shows the product/service scores for each use case. The scores, which are generated by multiplying the use-case weightings by the product/service ratings, summarize how well the critical capabilities are met for each use case.

**Table 3: Product Score in Use Cases**

(Enlarged table in Appendix)

Use Cases	Alibaba Cloud (ApsaraDB for PolarDB)	Amazon Web Services (Amazon Aurora)	Cloudera (Cloudera Data Platform)	Cockroach Labs (CockroachDB)	Couchbase (Couchbase)	Google (Cloud Spanner)	HUAWEI CLOUD (GaussDB (for openGauss))	IBM (IBM Db2 on Cloud)	InterSystems (InterSystems IRIS)	MariaDB (MySQL)	MarkLogic (MarkLogic Data Hub Service)	Microsoft (Azure SQL Database)	Oracle (Autonomous Transaction Processing)	Redis (Redis Enterprise Cloud)	SAP (SAP HANA Cloud)	SingleStore (SingleStore Managed Service)
Traditional Transactions	3.13	3.44	3.13	3.22	3.16	3.34	3.01	4.04	3.39	3.11	3.48	3.73	4.42	3.29	3.73	3.14
Augmented Transaction Processing	3.04	3.46	3.07	3.00	3.13	3.39	3.01	4.02	3.43	3.08	3.52	3.73	4.40	3.27	3.74	3.16
Stream/Event Processing	3.11	3.40	3.23	3.26	3.27	3.21	3.04	3.98	3.39	3.15	3.45	3.75	4.32	3.41	3.75	3.14
Operational Intelligence	3.04	3.37	3.32	2.97	3.25	3.09	3.06	3.88	3.40	3.13	3.47	3.78	4.16	3.47	3.73	3.03
As of 1 December 2021																

Source: Gartner (December 2021)

To determine an overall score for each product/service in the use cases, multiply the ratings in Table 2 by the weightings shown in Table 1.

## Evidence

Our analysis in this Critical Capabilities research is based on information gathered from interactions with Gartner clients during the 12 months leading up to June 2021.

We also took account of:

- Earlier information and any news about vendors' products, customers and finances that came to light during the time frame for our analysis.

- The findings in:
  - [Market Share: All Software Markets, Worldwide, 2020](#)
  - [Market Share: Enterprise Platform as a Service, Worldwide, 2020](#)
  - [Gartner Peer Insights](#)

## Critical Capabilities Methodology

This methodology requires analysts to identify the critical capabilities for a class of products or services. Each capability is then weighted in terms of its relative importance for specific product or service use cases. Next, products/services are rated in terms of how well they achieve each of the critical capabilities. A score that summarizes how well they meet the critical capabilities for each use case is then calculated for each product/service.

"Critical capabilities" are attributes that differentiate products/services in a class in terms of their quality and performance. Gartner recommends that users consider the set of critical capabilities as some of the most important criteria for acquisition decisions.

In defining the product/service category for evaluation, the analyst first identifies the leading uses for the products/services in this market. What needs are end-users looking to fulfill, when considering products/services in this market? Use cases should match common client deployment scenarios. These distinct client scenarios define the Use Cases.

The analyst then identifies the critical capabilities. These capabilities are generalized groups of features commonly required by this class of products/services. Each capability is assigned a level of importance in fulfilling that particular need; some sets of features are more important than others, depending on the use case being evaluated.

Each vendor's product or service is evaluated in terms of how well it delivers each capability, on a five-point scale. These ratings are displayed side-by-side for all vendors, allowing easy comparisons between the different sets of features.

Ratings and summary scores range from 1.0 to 5.0:

1 = Poor or Absent: most or all defined requirements for a capability are not achieved

2 = Fair: some requirements are not achieved

3 = Good: meets requirements

4 = Excellent: meets or exceeds some requirements

5 = Outstanding: significantly exceeds requirements

To determine an overall score for each product in the use cases, the product ratings are multiplied by the weightings to come up with the product score in use cases.

The critical capabilities Gartner has selected do not represent all capabilities for any product; therefore, may not represent those most important for a specific use situation or business objective. Clients should use a critical capabilities analysis as one of several sources of input about a product before making a product/service decision.

## Document Revision History

Critical Capabilities for Cloud Database Management Systems for Operational Use Cases  
- 24 November 2020

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## Recommended by the Authors

Some documents may not be available as part of your current Gartner subscription.

[How Products and Services Are Evaluated in Gartner Critical Capabilities](#)

[Magic Quadrant for Cloud Database Management Systems](#)

[Critical Capabilities for Cloud Database Management Systems for Analytical Use Cases](#)

[How to Plan for Optimal Multicloud and Intercloud Data Management](#)

[The Impacts of Emerging Cloud Data Ecosystems: An Architectural Perspective](#)

[Overcome Economic Uncertainty Through Financial Governance of Your Cloud Data Management Environment](#)

[Choosing Between Multimodel DBMS and Multiple Specialized Engines](#)

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**Table 1: Weighting for Critical Capabilities in Use Cases**

<b>Critical Capabilities</b> ↓	<b>Traditional Transactions</b>	↓ <b>Augmented Transaction Processing</b>	↓ <b>Stream/Event Processing</b>	↓ <b>Operational Intelligence</b>	↓
Advanced Analytics	0%	5%	0%	10%	
Automated Perf Tuning/Optimization	10%	5%	10%	10%	
Consistency	15%	15%	5%	0%	
Distributed Access	5%	5%	5%	10%	
Dynamic Elasticity	10%	10%	10%	15%	
Financial Governance	10%	10%	10%	10%	
High-Speed Processing and Ingest	10%	10%	15%	15%	
Multicloud/Intercloud/Hybrid	10%	5%	15%	15%	
Performance Monitoring and Admin	5%	5%	10%	10%	
Programming Augmented Transactions	5%	10%	0%	0%	
Security	10%	10%	10%	0%	

<i><b>Critical Capabilities</b></i> ↓	<i><b>Traditional Transactions</b></i>	↓ <i><b>Augmented Transaction Processing</b></i>	↓ <i><b>Stream/Event Processing</b></i>	↓ <i><b>Operational Intelligence</b></i>	↓
Workload Management	10%	10%	10%	5%	
As of 1 December 2021					

Source: Gartner (December 2021)

Table 2: Product/Service Rating on Critical Capabilities

<b>Critical Capabilities</b>	<b>Alibaba Cloud (ApsaraDB for PolarDB)</b>	<b>Amazon Web Services (Amazon Aurora)</b>	<b>Cloudera (Cloudera Data Platform)</b>	<b>Cockroach Labs (CockroachDB)</b>	<b>Couchbase (Couchbase)</b>	<b>Google (Cloud Spanner)</b>	<b>HUAWEI CLOUD (GaussDB(for openGauss))</b>	<b>IBM (IBM Db2 on Cloud)</b>	<b>InterSystems (InterSystems IRIS)</b>	<b>MariaDB (SkySQL)</b>	<b>MarkLogic (MarkLogic Data Hub Service)</b>	<b>Microsoft (Azure SQL Database)</b>	<b>Oracle (Autonomous Transaction Processing)</b>	<b>Redis (Redis Enterprise Cloud)</b>	<b>SAP (SAP HANA Cloud)</b>	<b>SingleStore (SingleStore Managed Service)</b>
Advanced Analytics	2.6	3.3	3.7	1.0	2.9	3.0	2.8	4.0	4.0	3.0	3.6	3.9	4.0	3.1	4.0	2.8
Automated Perf Tuning/Optimization	4.0	3.7	3.2	2.4	2.2	3.2	2.9	4.1	3.1	3.0	3.4	3.4	5.0	3.0	3.4	2.5
Consistency	3.5	3.6	3.1	4.8	3.1	4.5	3.0	4.5	3.6	3.2	3.4	3.8	5.0	2.7	3.8	3.4



Distributed Access	3.0	3.2	3.1	1.8	2.3	3.6	2.8	4.0	3.9	3.0	3.7	3.8	4.0	3.1	4.1	2.5
Dynamic Elasticity	3.5	4.0	3.2	2.4	3.2	3.4	3.5	3.2	2.5	2.7	3.6	4.0	4.3	3.7	3.0	2.4
Financial Governance	2.9	3.6	3.0	3.6	3.5	3.0	3.0	4.0	2.9	3.0	3.5	3.9	4.0	2.9	3.3	3.0
High-Speed Processing and Ingest	3.0	4.0	3.0	3.4	3.7	4.0	4.0	3.8	3.8	3.5	3.6	3.8	4.4	4.0	3.6	4.0
Multicloud/Intercloud/Hybrid	2.5	2.3	4.0	4.9	4.4	1.3	2.5	4.3	4.0	3.6	3.3	3.9	3.5	4.3	4.5	3.3
Performance Monitoring and Admin	3.1	3.0	3.4	3.8	3.4	3.5	2.6	3.7	3.3	3.2	3.4	3.6	4.0	3.1	3.9	3.1
Programming Augmented Transactions	2.0	3.0	2.2	1.8	3.1	2.4	2.6	4.0	3.9	3.1	4.0	3.4	4.0	3.7	4.0	3.5
Security	3.6	3.9	3.0	2.6	3.0	4.0	2.7	4.4	4.0	3.1	4.0	4.0	5.0	3.0	4.0	2.9
Workload Management	2.5	2.9	2.9	2.0	2.5	3.0	3.0	4.0	2.6	2.7	2.7	3.2	4.5	3.0	3.8	3.6
As of 1 December 2021																

Source: Gartner (December 2021)

Table 3: Product Score in Use Cases

Use Cases	Alibaba Cloud (ApsaraDB for PolarDB)	Amazon Web Services (Amazon Aurora)	Cloudera (Cloudera Data Platform)	Cockroach Labs (CockroachDB)	Couchbase (Couchbase)	Google (Cloud Spanner)	HUAWEI CLOUD (GaussDB (for openGauss))	IBM (IBM Db2 on Cloud)	InterSystems (InterSystems IRIS)	MariaDB (SkySQL)	MarkLogic (MarkLogic Data Hub Service)	Microsoft (Azure SQL Database)	Oracle (Autonomous Transaction Processing)	Redis (Redis Enterprise Cloud)	SAP (SAP HANA Cloud)	SingleStore (SingleStore Managed Service)
Traditional Transactions	3.13	3.44	3.13	3.22	3.16	3.34	3.01	4.04	3.39	3.11	3.48	3.73	4.42	3.29	3.73	3.14
Augmented Transaction Processing	3.04	3.46	3.07	3.00	3.13	3.39	3.01	4.02	3.43	3.08	3.52	3.73	4.40	3.27	3.74	3.16
Stream/Event Processing	3.11	3.40	3.23	3.26	3.27	3.21	3.04	3.98	3.39	3.15	3.45	3.75	4.32	3.41	3.75	3.14

Operational Intelligence	3.04	3.37	3.32	2.97	3.25	3.09	3.06	3.88	3.40	3.13	3.47	3.78	4.16	3.47	3.73	3.03
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As of 1 December 2021

Source: Gartner (December 2021)