Today’s consumers expect amazing feats of speed and service delivered through easy-to-use apps and personalized interactions. Modern conveniences have taught consumers that their experience is paramount—no matter how big the company, how complex the problem, or how regulated the industry. The first step to building all-new customer experiences is to select the operational database that will power your application and, in essence, run your business. Your choice of operational database can abstract away the complexity of enabling modern applications and empower your team to innovate.

Google Cloud sponsored this research by Harvard Business Review Analytic Services to understand how digital innovators are delighting their customers by using modern cloud databases. The report analyzes why operational databases are an essential building block for transformative experiences and highlights some of the critical capabilities leaders should prioritize. Through interviews with technology executives, data leaders, and industry experts, it provides real-world examples of benefits companies are realizing with cloud databases.

At Google, we have been at the forefront of innovating database technologies to power consumer-scale applications, like Search, YouTube, Gmail, and Maps, used by billions around the globe. Google Cloud databases provide you with a groundbreaking platform for innovation based on our decades of firsthand experience shaping the digital world. We have partnered with leading companies to modernize their operational databases in the cloud.

Here are ways our database services help you transform your business.

- Google Cloud databases offer global scale and industry-leading availability, reliability, and security, enabling you to deliver the best possible experiences for your customers from anywhere in just a few clicks. Make your applications highly reliable, continuously available, and seamlessly scalable to ensure every user in every region has a positive experience.

- Our databases integrate with the larger ecosystem of market-leading services that make up Google Cloud, such as BigQuery, Google Cloud’s enterprise data warehouse, and Google Kubernetes Engine, the industry’s first fully managed Kubernetes service. Together, these services help you break down operational silos, build data pipelines, generate real-time insights, and make better business decisions.

- Google Cloud gives you the freedom to work the way you want and provides an easy on-ramp for migrating applications from legacy databases. Our database services support MySQL, PostgreSQL, Oracle, SQL Server, and Redis, the most popular commercial and open-source engines, which helps you shorten your learning curve, benefit from the latest enhancements and fixes, and ease your migration to the cloud.

- Our fully managed database services empower your developers to iterate and deploy quickly through our intuitive user interface and automated provisioning and management. They unlock new ways for developers to be creative and keep your business agile and responsive in today’s digital-first world.

I hope you find the findings and real-world examples in this report insightful and inspiring. If you would like to learn more about how Google Cloud databases can help you transform your business, please contact us or review our solutions.

Andi Gutmans
GM and VP of Engineering for Databases
Google Cloud
Cloud Databases:
An Essential Building Block for Transforming Customer Experiences

Around the globe, companies realize that iterating and innovating the customer experience (CX) is the key to their business transformation and success goals. Customers expect exceptional and speedy service from organizations through personalized experiences and easy-to-use apps.

In retail, for example, omnichannel experiences with order online and in-store pickup options have become the new normal for many customers. Financial services empower consumers to interact with their bank in real time through mobile or online apps. Every day, millions of people book and pay for a rideshare in a few minutes.

Across industries, customers have been educated to expect that their needs will be not just met but anticipated. In this environment, success hinges on constant innovation and savvy use of data. As a result, by 2026, enterprises that successfully generate digital innovation will drive over 25% of revenue from digital products, services, and/or experiences, says IDC, the Needham, Mass.-based research firm.

However, while most companies want data-driven innovation, many of them overlook a key mechanism to do so: operational databases. These databases run a company’s day-to-day operations and power applications around the globe.

“Operational databases are often overlooked because they are behind the scenes,” says Kumar Menon, senior vice president of data fabric and decision science technology at Atlanta-based Equifax, the multinational consumer credit reporting agency. “Companies often focus on providing strong customer-facing applications, but the application will only achieve the desired results with a well-architected operational data capability that helps drive the real-time analytics needed to make the customer experience effective and memorable. It is the backbone of anything that you will build on top of it.”

HIGHLIGHTS

While most companies want data-driven innovation, many companies overlook a key mechanism to do so: operational databases.

Moving from a traditional on-premises database to a modern database in the cloud, or simply building new applications in the cloud, allows companies to address operational overhead, unlock new possibilities, implement new features quickly, increase application reliability, and serve users across more regions.

Cloud databases are a key part of building intelligent applications, which can use historical and real-time data from interactions with users to deliver personal and adaptable customer experiences and maximize opportunities.
Better customer experience is a business outcome of using cloud databases to build applications. This dictum stands to reason because moving from a traditional on-premises database to a modern database in the cloud, or simply building new applications in the cloud, allows companies to address operational overhead, unlock new possibilities, implement new features quickly, increase application reliability, and serve users across more regions—all the things that enhance CX and make it possible.

“Enterprises want to be more digital. They want to be more agile, and they are looking for real-time insights that they can provide to their customers,” says Sanjiv Chawla, vice president at HCL Technologies, a global information technology services and consulting company headquartered in Noida, Uttar Pradesh, India. “Enterprises want to be more agile like how Amazon does price changes on a product quickly or how banks are becoming digital and can service customers without any physical branches, and they wonder why they lack those capabilities. Every company wants to become a technology company, but you can only enable those digital processes through application modernization and database modernization.”

Going through that enablement process requires thoughtful consideration, including examining the benefits that companies are enjoying from cloud databases, such as creating transformational customer experiences, advancing intelligent applications to maximize opportunities, and becoming more agile and innovative. Also necessary is determining the capabilities that companies need to carefully consider when selecting a modern operational database—such as scalability, availability, security, flexibility, and support for the entire data life cycle—to ensure they can meet their business objectives.

**Creating Transformative Customer Experiences**

Creating transformative experiences for customers depends on the ability to manage and use massive amounts of data effectively.

“The issue isn’t the data, but where it sits, how it’s processed, and how it’s consumed. “Traditional databases were not built to handle very high volumes of data,” says Sanjeev Mohan, a former Gartner research vice president who now heads his own advisory firm, SanjMo, in San Francisco. “If the data volume increased, you just got a bigger box.”

Mohan explains that the traditional approach of simply increasing the number of on-premises resources isn’t enough to meet the need to process massive amounts of data rapidly in order to understand and predict customer behavior and then offer the products and services customers desire. What is needed is a highly distributed database with high availability and millisecond response time.

“Traditional databases were not built to handle very high volumes of data. If the data volume increased, you just got a bigger box,” says Sanjeev Mohan, head of advisory firm SanjMo.

Consider ShareChat, India’s leading social media platform, which has leveraged cloud databases to create transformative experiences for customers.

As its name suggests, ShareChat’s 160 million monthly users share and view videos, images, songs, and other content. In July 2020, ShareChat also launched a short-video platform, called Moj, that quickly gained 80 million monthly users. “As we grow, we found new use case studies that were beyond the functionality of traditional databases,” says Bhanu Pratap Singh, the Bangalore-based company’s co-founder and chief technology officer (CTO).

Most of these use cases involve scaling up and down quickly to accommodate users, a capability that is critical to ShareChat’s success. When a celebrity posts material on ShareChat, or when lots of users are on the app during one of India’s many festivals, traffic can triple quickly. “A database’s ability to scale out is the primary factor in our ability to monetize and achieve our business objectives,” Singh says.

ShareChat modernized its operational databases to take advantage of new functionality and to improve its scalability. For example, the new database seamlessly replicated data in multiple locations in real time, so any required data could be retrieved quickly, even if one region in which the data was stored failed in its task. The company also runs custom machine learning algorithms on top of the database to determine what content its users want to see in their feeds. All these capabilities create compelling experiences because ShareChat can use data to anticipate and satisfy customers’ demands.

“Our current and future growth depends on having an infrastructure and databases that can handle compute-intense workloads which can process data sets in many regional languages in real time and make accurate predictions,” Singh says.

Companies using cloud databases can leverage data more effectively across all the channels and functions that impact interactions with customers. The Home Depot, the world’s largest home-improvement retailer, was feeling the pain of a
legacy technology landscape that was fragmented, duplicated, inflexible, and aging. One pitfall was inconsistent and disparate customer experiences because data was hosted and resided on different individual applications, and because it was passed between operational data stores and the data warehouse, where everything had to be reconciled.

“We wanted a single source of the truth to provide the next generation of interconnected experiences for customers and associates,” says Fahim Siddiqui, senior vice president of information technology for The Home Depot, which is headquartered in Atlanta. To understand the customer, the company needed to understand the customer’s intent. Meanwhile, customers needed to see the same pricing and delivery time on the different channels. They needed to be able to order online and buy at the store.

For The Home Depot, cloud databases have unlocked the ability to enable personalized and consistent experiences across all selling channels and provide the kind of inventory management that an omnichannel environment requires.

“A database’s ability to scale out is the primary factor in our ability to monetize and achieve our business objectives,” says Bhanu Pratap Singh, cofounder and CTO, ShareChat.

Consider a large music festival. A hotel in a nearby town might find itself unexpectedly booked to capacity. But if the hotel can accurately predict that heavy demand, it can set higher rates in advance, ensuring maximum revenue.

“The ability to see those patterns coming is in your historical data,” SanjMo’s Mohan explains. “The applications have to interact with the backend databases that contain three to five years of historical data, while integrating with a slew of internal and external data sources. These data sources may be relational or multi-structured NoSQL databases, message queues, or even IoT devices.”

With traditional databases, it can take many hours for an artificial intelligence and machine learning algorithm to identify whether a viable pattern exists. Cloud databases allow companies to distribute that workload across multiple database environments to enhance performance and gain actionable insights much more rapidly.

“You are able to get those performance benchmarks 10 times faster,” Mohan says. “That enables you to build intelligent applications faster and improve the applications’ performance.”

Building Intelligent Applications to Maximize Opportunities

As the ShareChat example demonstrates, cloud databases are a key part of building intelligent applications. These applications use historical and real-time data from interactions with users to deliver personal and adaptable customer experiences and maximize opportunities.

Quicker Feedback, Quicker Implementation

Building applications in the cloud might seem to be a technical exercise, but its true focus is creating efficiencies that drive business outcomes. These efficiencies include lower
Building applications in the cloud might seem to be a technical exercise, but its true focus is creating efficiencies that drive business outcomes.

operational costs, reduced total cost of ownership, and greater innovation and agility.

“If you are not looking at ways to achieve these operational efficiencies, you will have slower application release cycles and customers might lose interest in those specific applications,” HCL Technologies’ Chawla says.

A modern operational database can lessen the complexity of enabling real-time capabilities for modern applications and empower IT teams to innovate. “For most companies, especially in the early stage of their life, the quicker they can iterate, the quicker they can deploy the application to the customer; and the quicker they can get feedback, the quicker they can implement that feedback,” says ShareChat’s Singh. “Keeping the application development cycle short helps us arrive at the right product market fit very early.”

These capabilities are becoming critical for companies in most industries. Sixty-nine percent of respondents to Salesforce’s “State of the Connected Customer” survey in June 2020 said they want companies to offer digital versions of existing products and services, while 54% said they want to use digital platforms to expand customer engagement methods. **FIGURE 1**

PayPal is a San Jose, Calif.-based financial technology company that offers financial services to make commerce more convenient, affordable, and secure. As part of PayPal’s focus on digital transformation, the company is on a journey of moving its data into the public cloud to ensure it can continue to innovate, iterate rapidly, and be more agile.

In many use cases involving PayPal, there was a 95% improvement in SQL, or structured query language, execution time. “Instead of taking a day to run our reports, we were able to run them in under an hour,” says Sri Gopalakrishnan, the company’s vice president of enterprise data platforms. “Those improvements have given us a step function improvement in business agility.”

For a fast-moving company like PayPal, agility is critical. In the next five years, PayPal expects to double its revenue and double the size of its user group. “It’s very important that we invest in modernizing all parts of our infrastructure so we can discover the data and derive operational and analytical insights from the data with agility,” he says.

The need to iterate the customer experience quickly in a competitive industry is a key factor behind the company’s transformation efforts. PayPal constantly runs thousands of experiments, determining the experiences that customers have when new features or algorithms are released. “This data needs to be consumed almost instantaneously by our product managers and our engineers, as new features are launched,” Gopalakrishnan says. “In order to get these insights quickly, we needed to modernize our databases and the platforms that bring this agility.”

Using cloud databases has also enabled PayPal to develop important features that are key differentiators, like determining which payment method a customer would like if a merchant doesn’t accept the customer’s preferred method. “We use our data to make sure customers are happy to another extreme,” he says.

**Key Attributes of Modern Cloud Databases**

As companies look to improve efficiencies, spur innovation, and create compelling customer experiences, they should carefully determine whether their operational databases provide the scaling, availability, security, data life cycle integration, freedom, and flexibility they require.

**Scaling**

During the Covid-19 pandemic, PayPal has seen new purchasing patterns, as customers expanded their use of e-commerce. Beyond that, products in the company’s portfolio have different peak periods of use, depending on seasonality.
“We used to have a phrase called ‘holiday readiness,’ meaning we would be ready for a peak during the holiday season,” Gopalakrishnan says. “Now we use the phrase ‘peak readiness,’ because we aren’t sure when we’ll have to scale. We need always-on scalability.”

Mohan calls scaling “a nuanced decision” because it involves many different technical considerations. For example, organizations should determine precisely which technology components—such as instances, storage, or connections—they need to scale. Then they need to consider whether the scale is manual or automatic, how fast the scaling will be, and whether it will scale up/out and then back down/in.

Databases should have flexibility to spin up or down quickly based on customer needs. “On our lower environments, like performance testing, we would like to scale down and even tear it down, if there is no activity,” says Menon of Equifax. “That flexibility is absolutely critical for us to manage the cloud costs.”

Mohan says it’s also important to look at the granularity of the databases’ ability to scale. “Large databases often go by T-shirt size—extra small, small, medium, large, and extra-large. If I need to go only a little above 16 CPUs [central processing units] but am required to go to 36, that creates a lot of waste that goes against the purpose of using the cloud in the first place,” he says. “That’s one of the things people don’t think about, but scaling can cost them more than they anticipate if they don’t think about it.”

Finally, data use needs to be governed, especially to protect sensitive data and comply with the various regulatory requirements.

**Availability**

The percentage of time a network component or service is accessible to a user in a given period—usually a year—is known as availability. It’s critical to the performance of an operational database. “Availability, along with high consistency and low latency expectations, are critical inputs to determine the architecture and design that create an always-on experience where the customer does not feel disrupted in any way,” says Navin Y. Warerkar, managing director for Deloitte Consulting.

The level of availability a company needs depends on the use case. When an Equifax customer is applying for a home loan, for example, high availability is critical. “Anything that impedes them isn’t just a bad customer experience,” Menon says. “It is affecting an action that could literally be life-changing for them.”

Given the negative effects that performance issues and unplanned downtime can have on a business, it’s not surprising that “downtime/high availability” is the number one thing that keeps IT people responsible for databases “up at night,” according to the 2020 “Open Source Data Management Software Survey” of IT personnel responsible for databases by Percona, a provider of database software and services based in Raleigh, N.C. **FIGURE 2**

At the same time, Menon advises companies to look for availability that is configurable for certain requirements. “Not all products need high-level availability, so you don’t have to run all products at the highest cost,” he says. One example might be batch ingestion capabilities, in which data is collected and transferred in batches at regular intervals.

PayPal’s aspiration is to operate at five nines of availability, meaning the service is available to users 99.999% of the time. Availability and scaling are interlinked. “The higher you scale, the higher availability you need to have to ensure you have a great experience for all your customers,” says Gopalakrishnan, the vice president of enterprise data platforms. The company measures availability not by availability to the business, but by failed customer interactions.

Mohan notes that a critical aspect to consider is whether the data is highly available in a single region, or available across multiple regions. “If there is a problem in one region, how quickly will the data be available in another region?” he says.

**FIGURE 2**

**High Availability is a Top Concern**

Companies’ biggest database worry is unplanned downtime

What keeps you up at night?

- **Downtime/high availability**: 59%
- **Performance issues**: 51%
- **Fixing emergencies**: 35%
- **Security issues**: 29%
- **Bad queries**: 23%
- **Lack of resources**: 16%
- **Staffing issues**: 15%
- **Cost concerns**: 13%

Source: Percona survey, 2020
“The higher you scale, the higher availability you need to have to ensure you have a great experience for all your customers,” says Sri Gopalakrishnan, vice president of enterprise data platforms at PayPal.

Security
Traditional databases often have security vulnerabilities that cybercriminals target. For Gopalakrishnan, operational database security can be divided into several elements. First, organizations must understand where all the customer data is and then keep it secure. They then must ensure that only people with the right level of authorization have access to the databases. They also must actively scan databases, operating systems, and software for vulnerabilities. And finally, organizations must make sure databases don’t have any drift in configurations.

Security is built into cloud databases with techniques that allow database encryption at the file level and automatic encryption when data is in transit and at rest, as well as automated patching, tuning, upgrades, and system restores. Cloud providers are also enhancing their offerings with emerging security technology.

Unified Data Life Cycle
While data begins in operational databases, it doesn’t remain there. The data life cycle is a journey that brings together databases, analytics, and artificial intelligence and machine learning in a seamless connected environment. Operational databases in the cloud provide the ability to break down operational silos, build new data pipes, and improve business decisions.

“Modernizing your operational database serves as an opportunity to improve and simplify your entire IT architecture landscape,” Warerkar says. “You can look at this holistically and say, ‘It’s not just about moving to a new operational database. It’s about how can I then use that to reduce data hops and improve data hygiene that enables better insights to fortify my customer experience agenda and delight my customers?’”

Freedom and Flexibility
Increasingly, companies are adopting cloud databases that support commercial and open-source engines, such as MySQL and PostgreSQL, according to Chawla. They want to function in hybrid and multi-cloud environments, get value from their existing technology investments, and enjoy the newest enhancements and capabilities that are available from cloud-based technology.

“Avoiding vendor lock-in is one of the prime concerns at this moment,” Chawla says. “A lot of customers are looking at a lot of open-source environments. That way, they don’t need to spend millions in licensing if their applications are scaling out, or they do mergers and acquisitions.”

Consider The Home Depot. As Covid-19 took hold, the Atlanta-based retailer was able to add curbside pickup functionality to its customer-facing app. Siddiqui says that was only possible because it had a modern data stack and modern databases built on open-source software and open application programming interfaces.

In its desire to provide cutting-edge technology, The Home Depot needs an agile infrastructure. “Being able to deploy
“Modernizing your operational database serves as an opportunity to improve and simplify your entire IT architecture landscape.”

Navin Y. Warerkar, managing director, Deloitte Consulting
“The investments in operational databases must be done to create the technology foundation that will be needed for the new era. There is a boom coming in the next 10 years. Operational databases are very unsexy decisions, but if the investments are not done, the company will lose,” says Jan Trhon, vice president of information technology for MediaMarktSaturn.

into multiple clouds is good in terms of competition and resilience,” he says. “We want to be a best-in-class operation, and we need the flexibility to make best-in-class choices.”

**Conclusion**

In a digital-first world, cloud databases are the key to improving customer experience and efficiency.

“Before you can change the customer experience, you need to understand the databases as a foundational element of that experience,” says Jan Trhon, vice president of information technology for Ingolstadt, Germany-based MediaMarktSaturn, a major European retailer for consumer electronics and related services. “Changing the user interface is much easier and less expensive than changing the back end.”

Indeed, to create strong customer applications, The Home Depot focused on the operational databases and other infrastructure that supported the applications. “You start by aligning the data, getting control of the data, and then improving,” Siddiqui, the senior vice president of information technology, says. “If you start with the customer-facing app, you never know what the truth is.”

Knowing the truth can only be accomplished by understanding the critical part that operational databases play in providing the scalability, availability, and security that are necessary to support new applications, break down data silos, boost reliability, and increase efficiencies.

MediaMarktSaturn’s Trhon believes that the pandemic, which required companies like his to speed their digital transformation, has changed customer expectations forever. Companies that are savvy in using data to provide the ever-richer experiences that customers demand, and that have invested in modern infrastructure and modern operational databases, will be part of the wave of prosperity that he expects to follow over the next decade.

“The investments in operational databases must be done to create the technology foundation that will be needed for the new era,” Trhon says. “There is a boom coming in the next 10 years. Operational databases are very unsexy decisions, but if the investments are not done, the company will lose.”
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