Database caching hits the mainstream

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THE DATABASE INDUSTRY has been racing to keep up with the growth of data volume and its uses since the dawn of the computer age. As a result, the database market is full of different kinds of databases and myriad ways to speed up reads/writes to the database to take advantage of some of the new, more exotic hosting modalities.

Database caching has crossed the chasm to mainstream use as organizations seek to increase application performance, meet ever-growing scalability needs and elevate the resilience of applications and databases under demanding and unpredictable operating conditions.

Digital business transformation and user expectations for digital experiences demand that applications deliver real-time data access capability, exceeding the performance, latency and scalability of traditional databases. Mobile and web applications, distributed data, cloud-native microservices architecture and demanding use cases like gaming require ever-higher levels of database performance and resiliency. Improved latency and performance can translate to substantial revenue improvements and deliver positive digital experiences. However, failure to deliver these performance improvements could be the difference between success and failure for many organizations.

Database caching is no longer a parlor trick used in specific use cases and on certain database models. It has become a staple of database performance tuning. It is a reliable and battle-tested technology, able to deliver increased performance as databases contend with the ever-increasing

Key Findings

1. Caching is a top priority for reducing latency and improving scalability, along with a number of other benefits.

2. Caching has reached a critical mass of adoption, with 64.8% of respondents already using caching and another 13.8% evaluating it.

3. Three solutions represent over 40% of the market for database caching. The research shows Amazon ElastiCache, Redis and NGINX are the leading caching solutions, adopted by over 40% of organizations polled.

4. Buyers emphasize core performance and reliability as the most critical factors when evaluating new caching technologies. Respondents also seek outside expertise for optimal caching design and implementation.

5. Most respondents view caching as an essential technology to accelerate database performance for demanding, real-time applications and digital experiences.

volume of data and the analysis and queries required by today's applications.

> *Database caching has evolved beyond query optimization for table databases to a suite of data models, patterns and structures.*

Leading caching solutions support diverse patterns, including the commonly used cache-aside pattern. Caching technologies also address data integration, integrity and consistency between databases and caches as data changes between databases and backend systems.

In mid-2023, Techstrong Research polled our community of DevOps and cloud-native readers and viewers to understand their perspectives on database caching. The results clearly indicate some critical facts in terms of caching technology adoption.

TECHSTRONG RESEARCH ANALYST VIEW

The velocity of digital transformation and exponential growth of our data stores has placed ever-increasing demands on developers and DevOps teams to deliver increased functionality in real-time applications. This has forced them to leverage technological advances to meet these demands. These conditions will continue to accelerate.

Microservices and containerization, automated development workflows and cloud platforms may increase developer velocity, but new and demanding use cases like multi- and hybrid cloud, edge computing, real-time analytics, AI/ML, large language models (LLMs) and vector databases bring with them even higher performance requirements. These new use cases use massive volumes of new and existing data, some of which is distributed. The complexity of this data stack strains developers' (and DevOps', operations' and securities') ability to deal with it. Data storage and analysis continue to be an unwieldy and non-efficient model that can easily overwhelm developers' cognitive load–which is already overburdened.

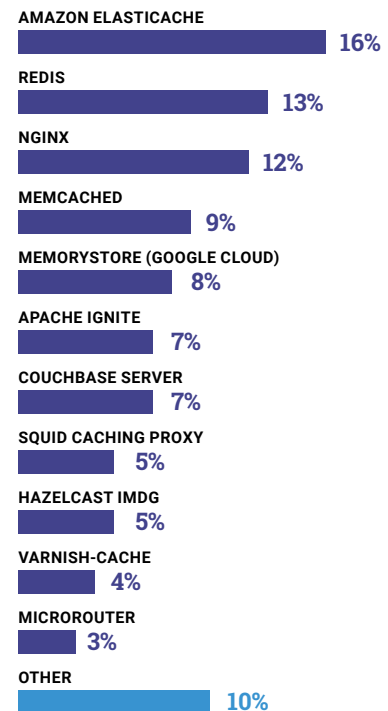Engineering leadership must focus on developer experience and productivity when creating demanding real-time,

Do you currently use caching in your database?

Database caching is an essential technology for application and database performance. Caching is adopted or under consideration in most organizations we polled.

14%
CURRENTLY
CONSIDERING

21%
NO

65%
YES
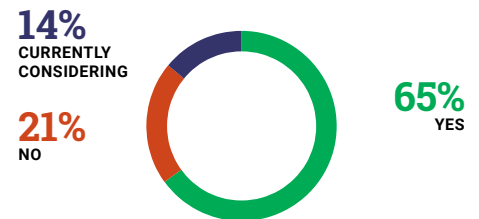
What caching technologies do you currently use?

While many caching options exist, there are a few clear leaders. Our research shows Amazon ElastiCache, Redis and NGINX are the most common caching technologies in use.

AMAZON ELASTICACHE
16%

REDIS
13%

NGINX
12%

MEMCACHED
9%

MEMORYSTORE (GOOGLE CLOUD)
8%

APACHE IGNITE
7%

COUCHBASE SERVER
7%

SQUID CACHING PROXY
5%

HAZELCAST IMDG
5%

VARNISH-CACHE
4%

MICROROUTER
3%

OTHER
10%

distributed and AI applications. A top priority must be to consider data architecture, data volume and database type. Now, caching performance and selection must be added to that focus.

> *Database caching can be a game-changer in solving a variety of digital experience, performance and scalability issues.*
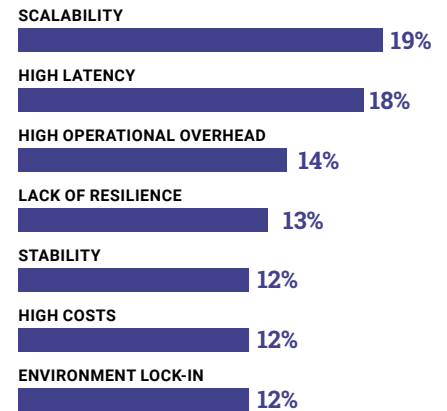
Picking the right solution and tuning it to your environment, which may require outside expertise, is essential. Fortunately, caching patterns like cache-aside are relatively straightforward to implement in many situations, and additional caching patterns, including prefetching and write-through, solve specific or more complex use or edge cases. Understanding when to use these patterns and how best to optimize for performance and maintain data consistency and integrity are skills needed by developers, DevOps, platform engineers, operations and site reliability engineers (SREs).

There are so many deployment options for databases and data today; in the cloud- hybrid/multi. In the data center, on the edge, everywhere/anywhere. Caching represents a buffer to ensure the smooth operation of your application regardless of where that data may eventually reside. Organizations of any size would be wise to avail themselves of a state-of-the-
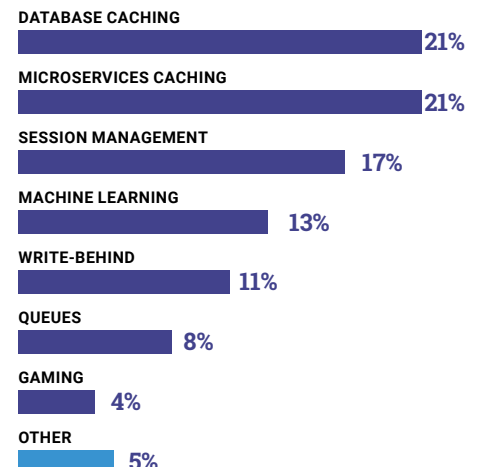
What are your biggest challenges with your current database applications?

Organizations understand that all database challenges cause pain, but our research reveals priorities emerging. Respondents struggle with high latency, scalability, operational overhead and more, indicating a significant need for caching.

SCALABILITY
19%

HIGH LATENCY
18%

HIGH OPERATIONAL OVERHEAD
14%

LACK OF RESILIENCE
13%

STABILITY
12%

HIGH COSTS
12%

ENVIRONMENT LOCK-IN
12%

Which use-cases best fit your current or future caching requirements?

Caching technology is frequently used for database and cloud-native (microservices) caching and session management. Understandably, machine learning benefits from caching, given the large amounts of data necessary for machine learning algorithms.

DATABASE CACHING
21%

MICROSERVICES CACHING
21%

SESSION MANAGEMENT
17%

MACHINE LEARNING
13%

WRITE-BEHIND
11%

**QUEUES**
8%

GAMING
4%

OTHER
5%

art caching solution to keep up with the ever growing needs of higher performance and data access and scalability.

An often-overlooked aspect of implementing caching technologies is collecting data from diverse sources, data ingestion, transformation and consistency requirements. Attempting to solve this problem by building your own reliable prefetch caching solution is more challenging than it may first appear. Data and streams that are mapped to the appropriate cache and data synchronized between caches and data sources oftentimes require cache-specific expertise available from third-party providers. Data integration solutions along with open source data capture platforms like Debezium and commercial offerings like Redis Data Integration can automate many of the data transformation and consistency issues, establishing data stream pipelines that mirror data from an existing database.

In the end, organizations delivering real-time applications require caching and database technology partners who continually innovate to meet the greater scale and performance needs of new types of applications and delivery modes. An essential element of this innovation must focus on easing the adoption and application of caching technologies while lessening the workloads of development and operations teams.

Which caching patterns best fit your current or future application needs?

Caching patterns work best when matched to the characteristics of the application and database workloads. Query caching has long been used to improve overall query performance. Other patterns in frequent use include cache-aside (optimizing cache data) and prefetching data.

QUERY CACHING 29%
CACHE-ASIDE 21%
PREFETCHING 21%
WRITE-THROUGH 17%
WRITE-BEHIND 12%
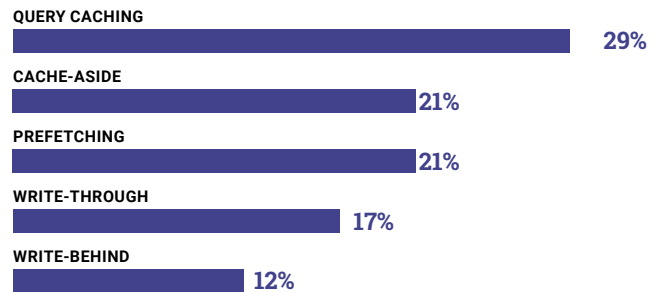
How important are the following capabilities for a caching solution?

When evaluating caching solutions, performance reigns supreme, followed closely by scalability, resilience and cost efficiency. Organizations emphasize resilience, the ability to adapt to rapid changes and withstand unexpected conditions, moving beyond just mean-time-to-failure (MTTF), mean-time-to-recovery (MTTR) and uptime metrics.

PERFORMANCE 24%
SCALABILITY 20%
RESILIENCE 17%
COST EFFICIENCY 15%
EASE-OF-USE 11%
PROGRAMMABILITY 8%
EXPERT SUPPORT 4%

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