

## A Revolutionary Breakthrough in Database Performance

KOSAR is the only caching middleware that delivers best-in-class elastic scalability, dramatically improved performance and data consistency with zero software development for real-time data-driven businesses



## Exponential Growth in Real-Time Data and Transactions

The explosion of data and transactions online are driven by three distinct yet related factors – more people online, more connected devices and more applications.

### Ongoing Growth in People with Internet Access:

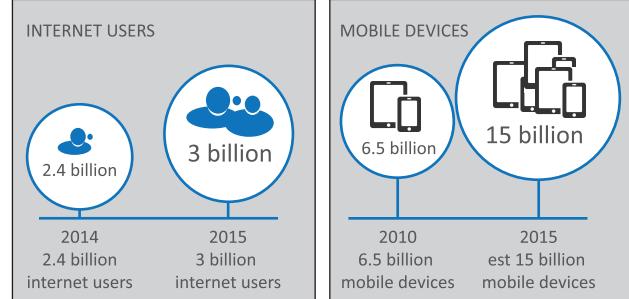
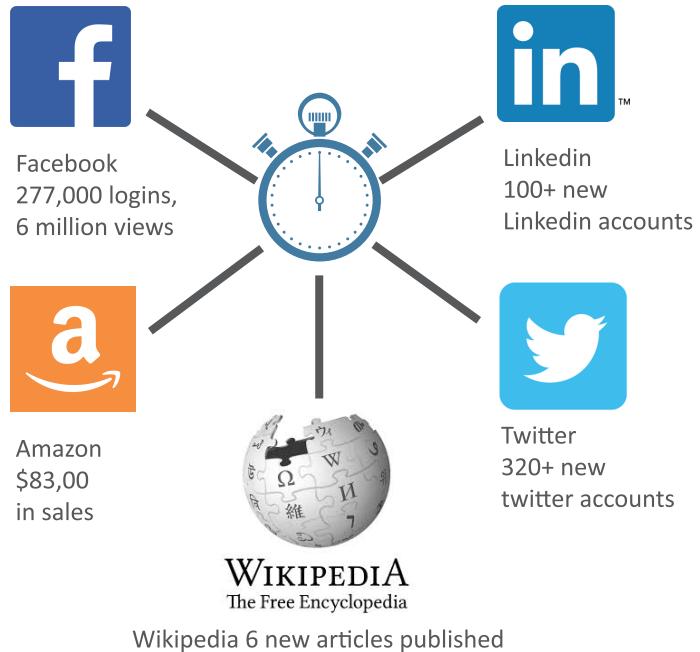
Nearly 2.4 billion people worldwide have Internet access today. This number is expected to climb to 3 billion by 2015. Current world Internet penetration is approximately 35% and expected to rise steeply in the coming years.

### Continued Growth In Connected Mobile Devices:

Today there are nearly 6.5 billion mobile devices in use worldwide with a significant percentage of device users owning multiple devices. Smartphones and tablets account for an increasing share of Internet traffic providing users with anytime, anywhere access to real-time applications. Social media networking accounts for a significant portion of mobile online activity. Transactions such as stock trading, online banking and retail purchase are increasingly conducted online and via mobile devices as consumers move past initial security concerns and embrace lower costs with increased convenience.

**Explosive Growth in Apps:** App downloads grew 60% in one year. In 2012 there were 64 billion apps downloaded while in 2013 the number grew to 102 billion. The typical mobile device user has on average 100 installed applications on her connected device(s).

### What Happens In An Internet Minute?



### Data Explosion Poses Challenges for Real-Time Data Driven Businesses

While the growth trends outlined above represent real revenue opportunities for online service providers, they also present real technical and business challenges.

#### Latency Impacts Revenues:

With increased load, maintaining acceptable response time for user transactions becomes a technical challenge with serious business implications. Even small increases in latency can have a significant negative impact on revenue.

#### Data Errors Impact Consumer Retention:

Increasing data and transaction volumes make it challenging to maintain data integrity and consistency which can negatively impact the consumer experience. For example, a customer purchasing online might accidentally have an order shipped to him twice. Or someone could post on a social network intended for a restricted list and end up sharing publicly. Research from the *RightNow Customer Experience Impact Report* indicates that 89 percent of customers take their business elsewhere following a single poor experience.

Most businesses reliant on data-intensive real-time applications for revenue operate large complex systems consisting of vast arrays of hardware and software systems that must be maintained and scaled as data and transaction volumes rise. While some performance bottlenecks can be solved by increasing network bandwidth and adding web servers or application servers, often the most critical bottleneck impacting speed and accuracy is the database.

#### Latency Impacts Business:

Amazon found every 100 milliseconds of latency cost them 1% in sales.

Google found an extra 0.5 seconds in search page generation time dropped traffic by 20%.

A brokerage firm could lose \$4 million in revenues per millisecond if their electronic trading platform is 5 ms behind the competition.

## Current Approaches to Database Performance & Scalability

A number of different approaches enable databases to scale to handle very large data and transaction volumes.

#### Scale-Up or Scale-Out:

Scaling-up refers to making the SQL server more powerful – with more CPU power, more memory, or more storage throughput – depending on which of those three proves to be the performance bottleneck. This is generally not a cost-effective option due to unfavorable price/performance ratios for high-end servers.

Scaling-out involves adding SQL servers that run on commodity hardware, which is less expensive than scaling-up. However, this option involves other related costs that can include additional software licenses (database, applications), rewriting the application to scale-out, and buying additional hardware such as switches to handle the scale-out.

#### In-Memory Caching:

Caching has long been used to speed up dynamic database-driven applications by storing data and objects in RAM thereby reducing the number of times an external data source must be read. It requires the design and implementation of software to dictate what should be inserted in the cache and how the cached data is kept consistent in the presence of updates to the database. This increased application complexity must be maintained over time, slowing down the rate at which the application software can be extended with new features.

**Local Cache:** Data is stored in the same memory space as the application. This approach is not practical when the data is too big to fit in the application server memory space or when the data is updated and shared by users across servers. A local cache has no built-in fault tolerance.

**Distributed Cache:** Data is distributed across a cluster of cache servers for handling larger data sets and increased transaction volumes. Distributed caches include fault tolerance but cannot scale dynamically – i.e., without downtime.

**Elastic Cache:** This is the latest development in caching middleware which provides application developers with data caching services distributed across two or more server nodes that scale without downtime; and provides a range of fault-tolerance levels.

**NoSQL:** NoSQL is a recent database framework that does not have the rigid structured data requirement of relational databases. NoSQL systems are designed to scale horizontally and work across large clusters of commodity hardware. However, many NoSQL stores compromise consistency. Barriers to the greater adoption of NoSQL stores include their use of low-level query languages, the lack of standardized interfaces, and the major investments made in the existing SQL database.

## Current Caching Options Fall Short

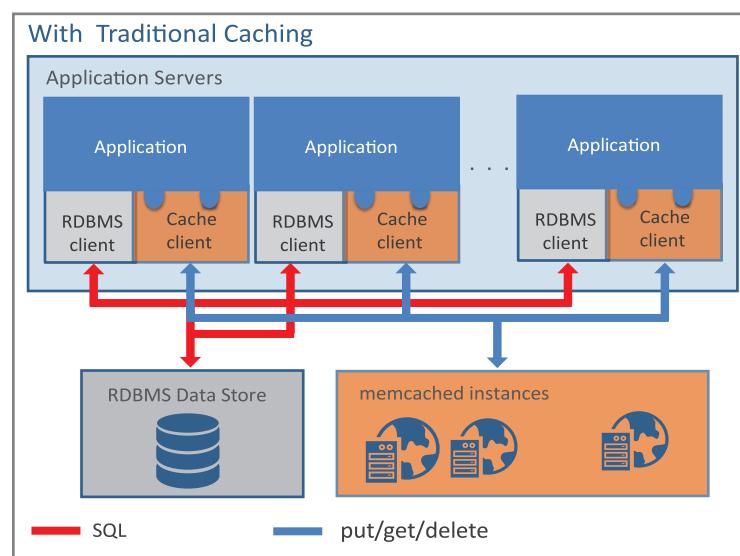
Neither distributed caching or elastic caching address the growing demands for delivering quality consumer experience. Real-time data driven businesses must not only scale dynamically on-demand but must also meet the exacting requirements for speed and accuracy.

### Current Caching Options Require Costly Software Development:

Implementing any of the existing types of caching systems such as memcached requires the development, testing, deployment and maintenance of new components as well as changes to existing application software. These changes are costly and introduce additional risk.

### Current Caching Options Introduce Caching Related Data Errors:

Caches reduce transaction latency, and help databases scale. However, they introduce undesirable race conditions that introduce application errors. This adds to development and operational costs and yet is not 100% effective in preventing errors.



Here are two examples of poor consumer experience resulting from cache inconsistencies:

- A customer wishes to purchase two items - say an iPhone and an iPhone case - either together or not at all. Cache inconsistencies may compromise this transaction such that the customer is sold the case with no iPhone.
- A job candidate posts about his interview on a social networking site. Cache inconsistencies could result in the prospective employer being able to see the post even though the candidate only shared it privately with a few close friends.

## KOSAR – A Revolution in Cache-Augmented Database Consistency, Performance, Scaling, and Elasticity

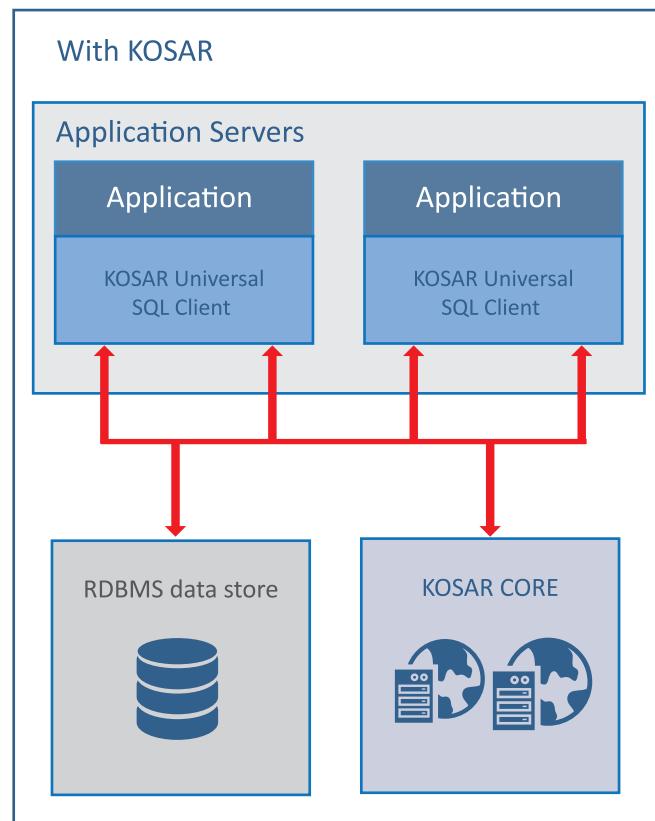
### What is Kosar?

KOSAR is a novel, application-transparent approach to cache consistency designed to enhance the performance of SQL-based data intensive applications. It is particularly effective at improving system performance when the workload is dominated by read queries, such as social networking websites or cloud-based computing solutions.

### Performance Enhancement with No Application Changes:

KOSAR provides greatly enhanced performance because it employs an intelligent memory management technique to cache results of common time consuming queries. KOSAR is configurable with a fixed amount of memory and supports client-side caching with intelligent dynamic placement of data that dramatically boosts performance.

KOSAR delivers without requiring additional software development – allowing software developers to focus on application requirements. With memcached and similar caching solutions, software engineers must develop software to integrate the caching components and then manage them. This software must be designed, developed, debugged, tested, and deployed for each application use case scenario, and then maintained over time. KOSAR eliminates this overhead all together.



**Data Consistency and Integrity with No Additional Overhead:** Using patented technology, KOSAR automatically detects when a cached instance has changed and handles its update transparently - avoiding complex software overhead typically required by caching systems to keep data consistent. One large social-networking company

dedicates approximately 70 engineers to solving these caching related data problems! KOSAR eliminates the need for this overhead completely.

### KOSAR vs. Traditional Caching Options:

	Distributed Caching	Elastic Caching	KOSAR
Performance Improvement	✓	✓	✓
Fault Tolerance	✓	✓	✓
Dynamic Scaling		✓	✓
Application Transparency			✓
Data Consistency			✓

### Conclusion:

Businesses relying on real-time data intensive applications are faced with ever increasing volumes of data and transactions while tasked with providing consumers a quality experience – consumers who have a very low tolerance for poor experiences caused by latency or data errors. The options available today for improving performance are cumbersome to implement and maintain, and introduce errors that call for expensive additional software to resolve. KOSAR is a unique solution that provides superior scalability, enhanced performance and data integrity with no impact whatsoever on the application software.



Exceptional Scaling & Performance



Zero Development Needed



Significant Cost Savings



Superior Data Consistency