Emerging Technology: Translytical Databases Deliver Analytics At The Speed Of Transactions

Next-Generation Databases Seamlessly Support Both Transactions And Analytics

by Noel Yuhanna and Mike Gualtieri

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Why Read This Report

Blazing-fast performance for both transactions and analytics is the goal of the new and emerging database category that Forrester calls translytical databases. Powered by in-memory technology and a scale-out architecture, this new class of database is designed to support both transactions and analytics without sacrificing transactional integrity, performance, scale, and analytical capacity. Translytical databases can have a hypertransformative effect on enterprise architects' ability to deliver analytical insights at lightning speed. Oracle, SAP, and VoltDB are among the vendors that offer this technology now.

Key Takeaways

Separate Systems For Different Workloads Are Affecting Business Growth And Innovation

Enterprises have built technology stacks comprising transactional, operational, and analytical systems, making it extremely challenging for enterprise architects to access the right information at the right time to support the new business requirements.

Translytical Delivers A Single Database For Transactions And Analytics

Recent advances and innovations around distributed in-memory, data compression, multimodal data format, and tiered storage are enabling a new generation of distributed databases that can support practically any workload in real time.

The Translytical Database Market Is Ramping Up Rapidly With New And Traditional Vendors

Big database vendors such as IBM, Microsoft, Oracle, and SAP are expanding existing database platforms to support translytical, while smaller niche vendors such as Aerospike, MemSQL, and VoltDB are focusing on innovative and economical platforms.

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with Gene Leganza, Shreyas Warrier, and Diane Lynch

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Notes & Resources

Forrester interviewed vendor and user companies, including DataStax, IBM, MemSQL, Microsoft, Oracle, SAP, and VoltDB.

Related Research Documents

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

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

Market Overview: In-Memory Data Platforms

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The Speed Of Business Demands Information Without Latency

Today, data is a key asset to any enterprise, and this asset needs to be readily available to employees, partners, and customers. We find that enterprise architects have built separate technology stacks for transactional, operational, and analytical workloads, making it extremely challenging to access the right information at the right time to support real-time business (see Figure 1).

Data has to move from transactional systems to operational systems and then to analytical systems. This architectural separation causes delays in delivering timely analytics and real-time insights — business intelligence (BI) is often far from optimal. Stale reports, missing data, the lack of advanced analytics, and a complete absence of real-time analytics is an unbearable state for any enterprise that needs fresh insights to remain competitive in the age of the customer.[1] Business users don't want yesterday's data tomorrow. Organizations have built too many siloed technology stacks, including those for BI, big data, Internet of Things (IoT), enterprise resource planning (ERP), CRM, supply chain management (SCM), cloud, and mobile. Managed separately, these complicate timely, integrated data delivery to business users, customers, and partners (see Figure 2).

While all these stacks aim to improve organizations' business outcomes, they often fail to support real-time business needs, creating data gridlock, guaranteeing latency, and creating administrative challenges. The reality is that most enterprises struggle to:

- **Integrate transaction and reference data.** Most enterprises have a growing portfolio of hundreds of applications that are all sources of critical business and customer data. Siloed, opaque pools of data are an enterprise reality and the bane of BI professionals. Data sourced from traditional technology stacks often creates gridlock that slows down data transformation, movement, and processing.
- **Source the hypergranular analytics needed to understand customers.** Most firms store the customer data they collect in silos with limited availability. But increasing volumes of consumer-generated content on social media like Facebook, Instagram, and Twitter makes rich information about your customers available. Mobile connectivity via smartphones and tablets collects even more data, such as geolocation, that you can use to learn how your customers behave throughout their days. An integrated view of these sources can give you unprecedented levels of detail about your customers.
- **Provide real-time analytics need to run the business.** Data is a key asset to any enterprise, but this asset needs to be readily available in real time to employees, partners, and customers. Enterprises often cite support for real-time and near-real-time data as a top data management requirement, especially as users increasingly adopt mobile business apps. However, traditional technology stacks slow down data processing and delivery, largely because of slower hardware platforms, nonscalable data platforms, nonoptimized computing architecture, or batch data integration processes.

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FIGURE 1 Traditional Stacks Support Various Workloads

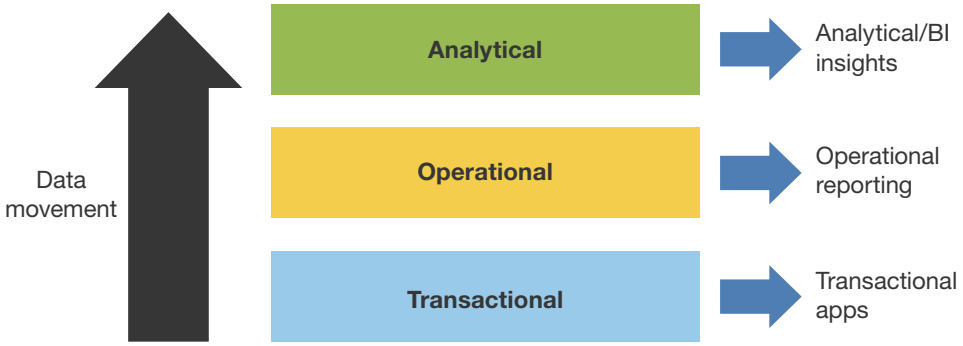
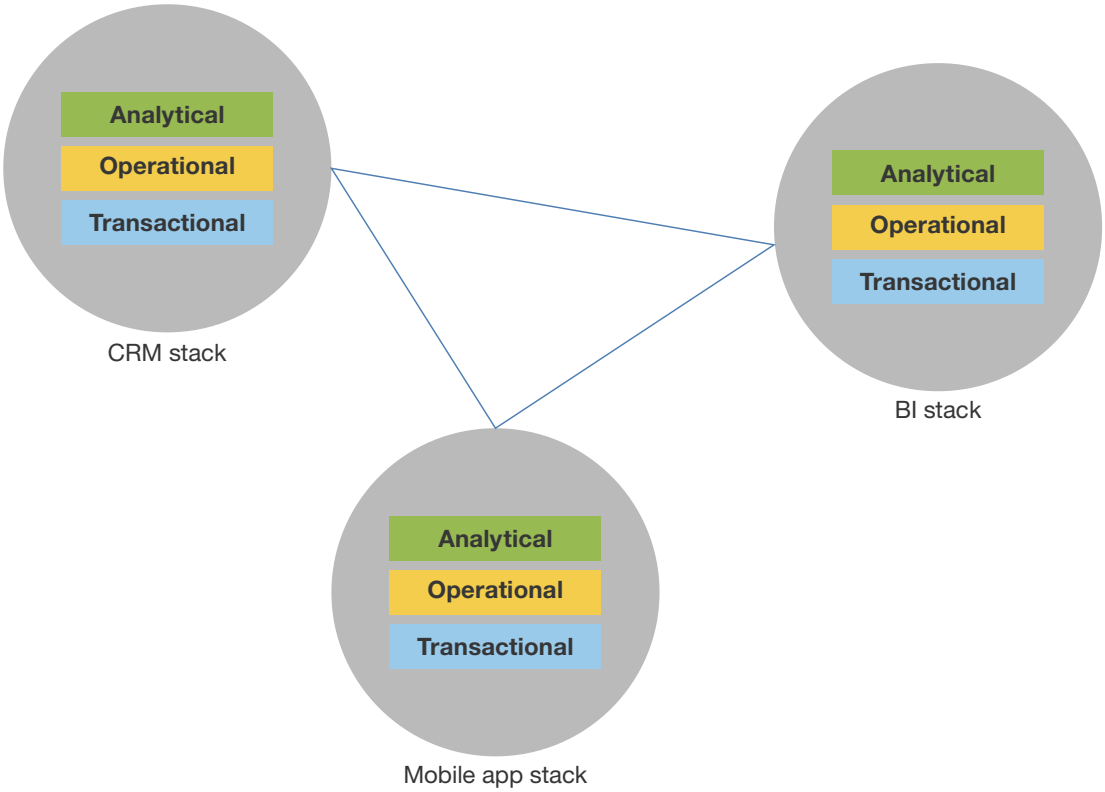


FIGURE 2 Most Enterprises Have Multiple Stacks



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The New Translytical Database Collapses The Technology Stack

The idea of translytical databases is a simple one: They combine transactional, operational, and analytical databases into one single database instance (see Figure 3). Why use two or three separate databases for transactions and analytics? Separate systems support performance and scalability but slow down the delivery of timely analytics and operational insights. Transactional databases are highly optimized for writes where transactional integrity and concurrency are of paramount importance. Analytical databases are optimized for reads where aggregates on large swaths of data are the norm. Translytical databases are optimized for both reads and writes using new and innovative technologies that support multiworkload concurrency. Forrester defines the translytical database as:

> *A unified database that supports transactions, analytics, and other workloads and access patterns in real time without sacrificing transactional integrity, performance, or scalability.*

Key benefits of translytical database include (see Figure 4):

- **Supporting faster everything.** Translytical delivers speed because it eliminates the movement of data to operational and analytic platforms. It can support standard operational, tactical, and strategic analytics, and when combined with BI tools, it delivers real-time analytics.
- **Minimizing complexity.** More systems mean more cost and administrative headaches. Translytical minimizes complexity by eliminating the need to support multiple databases, infrastructure, integration, and data movement technologies as well as the accompanying security challenges.
- **Helping deliver integrated data of data across disparate data sources.** Translytical can also support a database layer that can integrate disparate data sources such as packaged, legacy, and custom applications as well as content in real time to support business requirements.
- **Enabling data delivery for all kinds of data.** Translytical can support access and integration of various types of data, including structured and unstructured data such as XML, logs, text files, audio, documents, video, and spatial data.

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FIGURE 3 Collapsing The Stack To A Single Data Layer

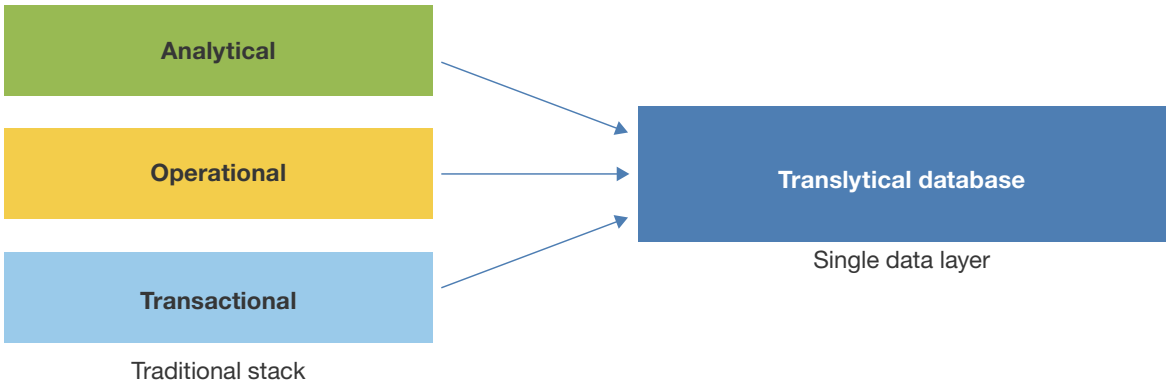
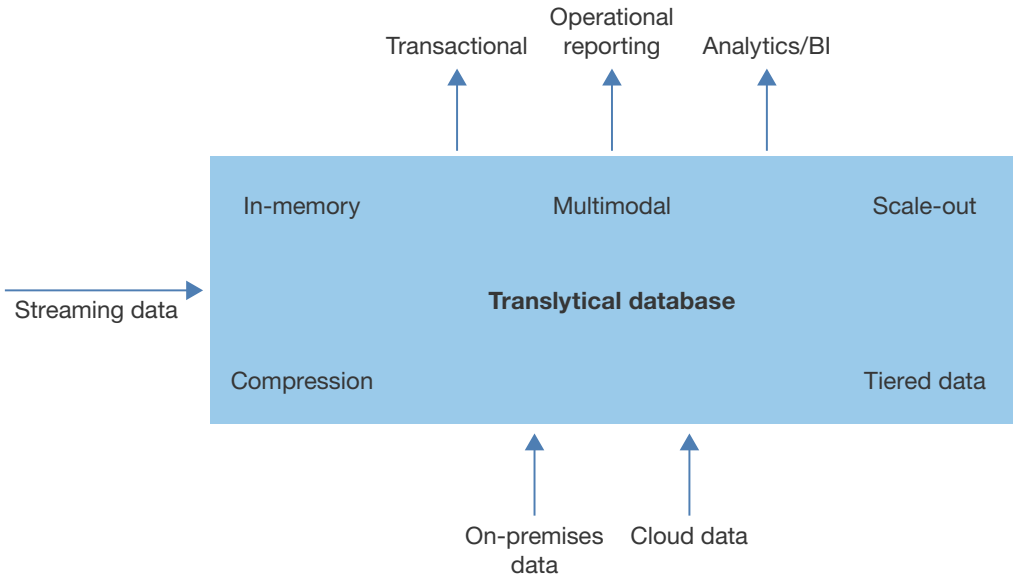


FIGURE 4 The Translytical Database Framework



Translytical Databases Offer New Innovative Features And Functionality

While it is technically possible to run multiple workloads against a single database with some traditional database solutions, these can't scale horizontally, support large data volumes, or deal with nonstructured data in an optimized manner to support new business demands. Translytical databases, on the other hand, are built around new and evolving technology innovations that make running multiple workloads feasible. The key technologies that comprise translytical database include:

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- **In-memory — providing extremely fast read and write performance.** Data stored in-memory can be accessed in orders of magnitude faster than data stored on-disk. While databases and data warehouses have used volatile memory since the 1980s to cache data to support higher hit ratios, these caches were usually a few megabytes in size. Over the years, with the decline of memory prices, they have gradually increased to gigabytes. But using distributed in-memory technology, you can store hundreds of terabytes to multipetabyte-scale databases completely in dynamic random-access memory (DRAM).
- **Scale-out architecture — enabling an elastic platform.** Distributed databases provide a scale-out (horizontal) architecture and support advanced features such as complex query processing, distributed lock management, distributed record management, and table management that can span hundreds and thousands of nodes in a cluster. With elastic scale, you can effectively support any type of high-performance application, including complex social networking apps, recommendation engines, pattern analysis, and other Internet-scale applications.
- **Data compression — storing more data in-memory.** Although data compression technology has been around for decades, it only recently became viable to support row-, column-, and table-level database compression. Typically, compression can reduce database size by 35% or more, and in some cases by as much as 75%, depending upon the type and pattern of data. Vendors have allayed historical concerns that compression could have an impact on performance with advances such as putting the compression algorithm on a chip, resulting in minimal system impact.
- **Data tiering — facilitating distribution of data across multiple storage tiers.** Dynamic data tiering gives the ability to create larger tables than available memory by using Flash, solid-state drive (SSD), and disk in addition to DRAM. Some translytical databases can automatically and intelligently move data between tiers based on usage, policies, and an analysis of query access and patterns.
- **Multimodal — delivering support for multiple data types within a database.** Traditionally, separate databases have existed to support rows, columns, XML, and objects. However, translytical databases support multimodal format, allowing multiple formats to be stored, processed, and delivered to the consuming application or process.

Translytical Databases Deliver New Business Use Cases

Translytical databases offer the ability to support many use cases, including real-time insights, predictive analytics, streaming analytics, real-time data access, and extreme transactional processing. Storing and processing customer data in a single integrated translytical platform enables businesses to upsell and cross-sell new products based on customer likes, dislikes, buying patterns, friend circles, and past orders. The top translytical database workloads Forrester has seen include:

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- **Real-time apps — where every second counts.** Translytical can help deliver real-time apps to support operational applications, such as stock trading, fraud detection, counter-terrorism, patient health monitoring, machine analysis, and earthquake monitoring. These apps require data 24/7 with low-latency access, and even persisting data can cause unacceptable slowdowns. While many companies have been using real-time apps for decades, before translytical databases, such apps required extensive application design, coding, and customization.
- **Mobile apps — where interactions needs to be fast.** Mobile use cases enable rich interactions and advanced analytics leveraging new devices such as tablets, smartphones, and wearables. Mobile applications are demanding data from multiple technology stacks in real time to deliver a 360-degree view of the customer, product, employee, or business.
- **IoT applications — where operational efficiency needs improvement.** Today, most manufacturers deal with highly sophisticated machinery to support their plants, whether building an airplane, car, or tire or bottling wine or soda. When a machine goes down, it can cost a manufacturer millions of dollar every hour, and in some cases, every minute. With IoT sensor, streaming, machine-learning, and in-memory technologies, manufacturers are able to track machines every minute, or even every second, to predict if any machine is likely to fail as well as decide what parts or resources they might need for repairs if a breakdown does occur.
- **Connected data apps — where integrated business data is critical.** Traditional extract, transform, and load (ETL) processes fail to deliver real-time changes. Translytical overcomes this challenge by delivering a real-time, trusted view of critical business data, ensuring that the source of information is accurate to guarantee consistency across the organization. For example, a customer's address might be stored on five or more different databases, and a change by one application might not be visible to other app users right away. In this case, storing all customer-critical data in-memory in a translytical database allows all business applications to use it, delivering consistency and integrity.

The Translytical Database Market Is Ready To Explode

Forrester expects that the translytical database platform market will see significant momentum in the coming years as organizations start to roll out unified data platforms to support continuous analytics, extreme transactions, and operational intelligence reporting. Vendors have just started to scratch the surface for the translytical database platform, with more innovation and feature-rich offerings likely to emerge in coming years as vendors execute on their strategies. Although there are many vendors starting to offer translytical databases, among the current top vendors:

- **DataStax offers a distributed scalable data platform.** DataStax Enterprise (DSE) is a database platform based on Apache Cassandra, built for the performance and availability requirements of Internet of Things, web, mobile, and extreme-scale applications. DSE has a masterless, shared-nothing architecture with in-memory capabilities and built-in analytics/search functionality that can scale across data centers and cloud platforms to deliver a secure distributed global data platform.

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- **IBM has multiple translytical database offerings to support a broad set of use cases.** IBM's DB2 with BLU Acceleration and Informix with Informix Warehouse Accelerator deliver transactional and analytical workloads on a variety of distributed platforms, leveraging an in-memory, columnar approach that requires no application changes or tuning. In addition, IBM DB2 for z/OS integrates with the IBM DB2 Analytics Accelerator (IDAA) to enable real-time analytics on transactional data.
- **MemSQL delivers a viable translytical database.** MemSQL is a distributed in-memory database that delivers full atomicity, consistency, isolation, and durability (ACID) compliance and extreme performance to support transactional, operational, and analytical workloads in a single database. MemSQL uses SQL and a horizontally scalable, distributed architecture that runs on commodity hardware or in the cloud. MemSQL also supports analytical processing on Apache Spark. Some large customer deployments for MemSQL include Comcast, Shutterstock, and Zynga. We find that several companies use MemSQL to better predict and react to opportunities by leveraging data in real time, offering a 360-degree view of the customer.
- **Microsoft's solution for unified OLTP and OLAP workloads is ramping up.** Although Microsoft has been offering multiple database engines for online transaction processing (OLTP) and online analytical processing (OLAP), its upcoming SQL Server 2016 release will deliver a single unified database for these workloads. In SQL Server 2012, Microsoft delivered an in-memory column-store for data warehousing to support faster business intelligence, analytics, and predictive analytics. And SQL Server 2014 provided an in-memory OLTP database platform to support high-performance transactional applications requiring minimal changes to the application. With SQL Server 2016, Microsoft offers the capability to use in-memory column store with in-memory OLTP for in-memory performance and real-time operational analytics.
- **Oracle's translytical database platform focuses on multiple workloads.** Oracle offers Oracle Database In-Memory, an option that extends Oracle Database 12c to support both transactions and analytics in the same database. It requires no change to existing Oracle applications and supports horizontal scale for OLTP and OLAP applications. Forrester spoke with several customers that run TimesTen along with Oracle Database In-Memory, supporting a platform for multiple workloads. For customers that need a larger memory footprint, Oracle delivers a scale-out in-memory platform using Oracle Exadata appliance or any Oracle RAC environment.
- **SAP offers a scalable translytical database.** SAP Hana is one of the leading distributed translytical databases. SAP developed Hana using a clean-slate approach to database and data management by taking the slow spinning disk layer out of the technology landscape to deliver real-time insights and data processing capabilities on a single copy of data — all resident in-memory and available for application processing. SAP Hana enables converged OLTP and OLAP data processing with ACID compliance, eliminates data redundancy, and delivers low-latency data access for real-time reporting, planning, and forecasting. Although SAP Hana can support any business application, Forrester sees it most commonly for SAP BW, SAP Business Suite, real-time applications, and custom analytics.

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› **VoltDB offers a viable translytical database platform.** VoltDB is an in-memory database platform that combines streaming analytics with transactions in a single integrated platform. It supports ACID compliance, high performance, and low-latency data access in a scalable distributed shared-nothing in-memory database. VoltDB relies on horizontal partitioning of data to scale out on commodity hardware and the public cloud. It also supports synchronous replication within the database cluster to support high availability. Unlike other vendors, VoltDB is available as open source software under the Affero General Public License (AGPL) as well as under a commercial license. Typically, customers use VoltDB to support real-time analytics and low-latency transactional and operational applications across the telecom, financial services, energy, advertising, security, and gaming industries.

Recommendations

Translytical Databases Should Be Part Of Your Database Strategy

Delayed insights can have a devastating effect on a firm's ability to win, serve, and retain customers. Enterprise architects should look at translytical databases that focus on collapsing and consolidating technology stacks to help deliver business agility, new insights, improved performance, and competitive edge. Translytical databases enable enterprises to focus on core business functions and innovation rather than deal with challenges from complex technologies. To take advantage of this new technology:

› **Start with collapsing and consolidating a few technology stacks.** Don't take on the ambitious project of trying to consolidate all your enterprise applications and stacks into a translytical framework. Start with one or two key technology stacks such as BI or ERP initially, adding other stacks over time.

› **Build translytical databases based on a specific data domain.** Don't consolidate multiple technology stacks of different domains, such as engineering and financial data stacks, into one translytical database if there are no associations between the two data sets.

› **Use tiered storage for larger databases.** Although data in-memory will give you extreme performance, look at tiered storage such as Flash, SSD, and disk for larger databases that run into hundreds of terabytes or into petabytes.

› **Keep security in mind when integrating multiple workloads.** Most enterprises enforce different security controls for transaction-processing and analytics use cases. With these workloads working on the same data sets and database, new policies and controls might be necessary.

› **Use workload management to minimize impact to transactions.** Don't allow runaway queries or complex analytical queries to affect transactional activities. Consider workload management features within translytical databases that enforce restrictions on certain users, queries, or workloads on system resource consumption, such as central processing unit (CPU) or memory bandwidth.

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› **Look for solutions that require minimal coding or changes to your existing apps.** If you are looking to consolidate transactions and analytics for a specific application or analytical platform, look at solutions that can automate the integration and migration with minimal code and configuration changes.

What It Means

Traditional Transactional Database And DW Vendors Must Respond

Forrester believes that enterprise customers will find translytical databases extremely attractive because they will lead to lower costs, faster insights, and data agility. Pure transactional databases will survive for many years, as will data warehouses (DWs). But data technology disruption is all around, and it's not just about Hadoop, NoSQL, and Spark. The consolidation of technologies will dramatically simplify the impedance mismatch that enterprises have endured ever since the mainframe was the only compute and data platform available. Enterprise architecture professionals should look to technology alliances among database vendors, streaming analytics vendors, and big data platforms to create the next generation of translytical databases.

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Supplemental Material

Abbreviations Used In This Document

ACID: atomicity, consistency, isolation, and durability

CPU: central processing unit

CRM: customer relationship management

DRAM: dynamic random-access memory

ERP: enterprise resource planning

ETL: extract, transform, and load

IoT: Internet of Things

OLAP: online analytical processing

OLTP: online transaction processing

SCM: supply chain management

SSD: solid-state drive

Endnotes

[1] For more information on the age of the customer, see the "The Age Of The Customer Is Shaking Up Integration Technologies And Practices" Forrester report.

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