Real-Time Data Management Delivers Faster Insights, Extreme Transaction Processing, And Competitive Advantage

June 2013

Forrester Consulting
Making Leaders Successful Every Day

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Executive Summary

Enterprises are on the cusp of a major opportunity to advance their business efficacy and capability. The majority of businesses realize that the new goal is to deliver performance and responsiveness as quickly as possible — at the speed of real-time business. In addition, businesses acknowledge that new paradigms, such as the intersection of big data and predictive analytics, offer rewards to organizations that are agile enough to take advantage of the insights discovered. To achieve the agility demanded by real-time business and next-generation applications requires a new set of interconnected data management capabilities. This paper examines the opportunities and the vision required to deliver this next-generation, real-time business.

Enterprises face growing challenges in using disparate sources of data managed by different applications, including problems with data integration, security, performance, scalability, and quality. Business users want trusted data to make enhanced business decisions in real time, while IT wants to lower cost, minimize complexity, and improve operational efficiency. In addition, growing use of smart devices in enterprises is putting pressure on IT to support real-time data platforms. To meet these new business requirements and stay competitive, enterprises need to revisit their data management strategies by investing in new technologies and architectures to support a real-time business.

> *"Real-time data is relative. 'Real-time' data management would be able to access the data quickly enough to be able to react to whatever data is showing up. Real-time data is critical for our business; without access to such data, we would lose our competitive advantage."*
> (CIO, retail, North America)

Real-time data management (RTDM) is an emerging framework that includes several new technologies that overcome data issues to deliver an agile, scalable, and affordable data platform. RTDM offers several key benefits to the enterprise, including 1) faster queries, reports, and insights; 2) an on-demand, scalable, transactional platform; 3) shorter time-to-market for new products; 4) in-depth predictive analytics; 5) collaboration among business users and partners; 6) elimination of data silos; 7) support for big data initiatives; 8) improved data quality; 9) lowered IT costs; and 10) competitive advantages.

> *"Real-time data management is about business users and customers having access to all of your business data in less than 10 seconds once that data becomes available in any application or system. A few years ago, this took an hour."* (IT manager, large service organization)

In December 2012, SAP commissioned Forrester Consulting to conduct a study of how customers are using real-time data management in their organizations. Forrester surveyed 367 IT professionals and conducted 10 in-depth interviews with enterprises in the US and Europe. Each of the 10 enterprises had more than 5,000 employees and represented the financial services, healthcare, manufacturing, retail, telecommunications, public services, and media industries. The interviews were conducted with decision-makers and influencers of their firm's data management strategies and purchases. Forrester found that most companies interviewed agreed that RTDM offers tremendous benefits, ranging from faster queries, better transactionality, and reports and insights to support predictive analytics and ignite collaboration among business users.

Key Findings

Forrester's study yielded several key findings:

- **Most enterprises agree that RTDM has become critical for their business.** Today, data is a key asset of any enterprise, but it needs to be readily available in real time to employees, partners, and customers. Most of the enterprises surveyed cited support for real-time and near real-time data as a top data management requirement.

"I think everything — manufacturing, inventory, shipping — is getting the world to the point where you are measuring what you're supposed to be delivering every day. To me that's just with everything; the competitive edge is just about speed and accuracy. We can't outspend all of our competitors, but we can certainly outspeed them with real-time data; that's our competitive advantage." (Director of IT, retailer, North America)

- **The majority of organizations plan to implement RTDM over the next two years.** Seventy-two percent of the surveyed enterprises that have not deployed RTDM plan to do so over the next two years (see Figure 1). Forrester has seen similar significant momentum in interviews across various vertical industries, especially in financial services, retail, manufacturing, and telecommunications. Most organizations realize the importance of real-time data, and those that have successfully deployed are seeing competitive advantage.

"Before, we called our systems real-time, but it was only real time to probably 40% of our existing data; for the other 60%, we drilled in through the databases and data warehouses manually. We're trying to move to real time; hopefully, within 12 to 18 months we will have a true real-time platform — that's our goal." (Director of IT, social services agency, USA)

- **Most enterprises are looking at ways to improve analytics and predictive analytics.** Fifty-seven percent of enterprises claim that they are looking at new ways to improve analytics and predictive analytics in their organization. Many enterprises are looking at new ways to acquire and retain customers, but without customer intelligence, integrated data, or predictive analytics, it's extremely challenging to deliver new insights.

"We're still looking at ways to improve our analytics and predictive analytics support. Certainly, our marketing people have that on their minds. If a customer stopped in front of the cornflakes for 45 seconds and didn't buy, why is that? It's interesting stuff, and we want to know about it. We believe we will eventually be able to get to that information to help the customer and grow our business." (Director of IT, retailer, North America)

- **Integration of heterogeneous data sources is a key challenge for many enterprises.** Support for heterogeneous data sources is the second biggest challenge for the enterprises surveyed. Most enterprises today have thousands of applications, databases, and data repositories, which are becoming harder to integrate and use for reporting, real-time, and predictive analytics.

"Processing the amount of data from a variety of sources and delivering the data to business users in a way that is quick and relevant is right now challenging for us. We have more than 500 applications, and data is stored in many different databases, which creates a challenge when integrating them. We're looking for solutions that can help us." (Director of IT, retailer, North America)

- **Data volume growth continues to put pressure on IT.** Forrester estimates that, on average, data volumes for critical applications are growing by 50% annually. Today, most large enterprises have petabytes of data stored in all data repositories; this is likely to grow to an exabyte in coming years. Enterprises continue to raise the bar on how much data is stored, mostly driven by compliance requirements and new application use such as composite applications, RFID- and geolocation-driven apps, and other mobile apps. All of these exacerbate the problems of data management, especially when supporting data in real time.

"Our data stores are becoming so large that it's becoming difficult to extract the information that we want in a reasonable amount of time. We've experienced a tremendous explosion in data for some of our critical

applications over the past year; some data repositories are growing by more than 100% annually." (Director of IT, social services, US)

- **Real-time analytics, new customer insights, and customer sentiment analysis are top use cases for RTDM.** RTDM offers a flexible platform that spans many use cases, including transactional, analytical, and predictive. Our interviews with enterprises reveal that they are using real-time data for many new use cases such as fraud detection, customer sentiment analysis, real-time stock inventory control, scale-out transactions, and real-time bus and train tracking, many of which were not possible without an RTDM framework in place.

"Real time allows us to be proactive as opposed to reactive. If I get the information, I need sufficient time in advance to be able to react to it in a way that will either increase my sales or reduce my costs." (Director of IT, telco, North America)

- **New insights are deferred because of lack of a comprehensive data management platform.** Fifty-seven percent of the enterprises surveyed said that new insights, reports, and analytics are being deferred because of a lack of a comprehensive data platform. We find that traditional data management platforms are lagging when it comes to delivering new business requirements such as predictive analytics, real-time insights, and extremely scalable transactions.

"I think the biggest challenge is that there is a lot of data out there, but what is relevant? How do you slice and dice that data? You've got to be able to separate the relevant data from the irrelevant data." (Associate director of IT, telco, North America)
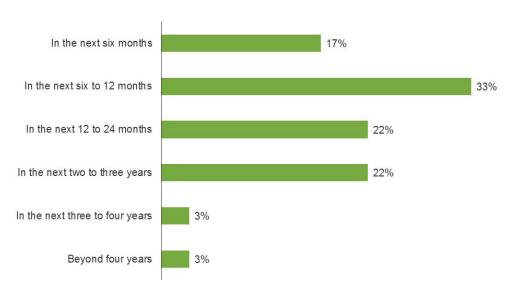
- **The self-service data management trend is growing rapidly.** Forrester finds that more enterprises are starting to implement a self-service data management platform to support growing business requirements. This allows business users and other consumers to directly access data they need when they need it, reducing the involvement of IT to support these users.

"Our teams are exploring some new technologies (big data, Hadoop, in-memory), but most of our activities are on the consumer side. We want to give this information to the businesses so that they can get their work done rapidly without heavy-handed IT intervention." (Director of IT, consumer services, North America)

- **Business users and consumers want to leverage all types of data.** Traditionally, enterprises focused primarily on structured data, which was sufficient to support basic reporting and queries. However, to perform in-depth insights, advanced analytics, and predictive analytics, support for other unstructured data such as XML, logs, video, audio, and documents has become critical.

Figure 1

Most Enterprises Plan To Implement RTDM In The Next 12 Months

"When do you plan to implement a real-time data management platform?"

In the next six months	17%
In the next six to 12 months	33%
In the next 12 to 24 months	22%
In the next two to three years	22%
In the next three to four years	3%
Beyond four years	3%

Base: 69 IT decision-makers who have not implemented a real-time data management platform

Source: A commissioned study conducted by Forrester Consulting on behalf of SAP, January 2013

What Is Real-Time Data Management And Why Does It Matter?

Today, most enterprises face growing challenges caused by using disparate sources of data managed by different applications, including problems with data integration, security, performance, availability, and quality. Business users want reliable information in real time to make better business decisions, while IT wants to lower costs, minimize complexity, and improve operational efficiency. RTDM offers the ability to integrate heterogeneous data in real time and delivers it as a service to various business users, processes, and applications. Forrester defines real-time data management as:

Integration of a diverse set of structured and unstructured data from internal and external sources that delivers an agile platform to support faster insights, high-performance transactional capabilities, and predictive analytics.

The key benefits of RTDM are that it:

- **Delivers an agile platform to support several business use cases.** RTDM is not just about faster data access; it helps support many read/write applications and analytics including extreme transaction processing and in-memory and predictive analytics.

- **Supports integration of all types of data, including structured and unstructured data.** RTDM can support the access and integration of various types of data, including structured and semistructured data such as XML, logs, and text files, and unstructured data such as documents, video, audio, and spatial data.

- **Caches data in memory using distributed scale-out architecture.** A key characteristic of RTDM is delivering fast responses to any data request through distributed in-memory technology that can span hundreds of physical servers.

- **Supports faster insights and predictive analytics.** RTDM can deliver faster insights and predictive analytics — from streaming data to data stored in big data repositories like Hadoop — with minimal effort. It can support standard operational, tactical, and strategic analytics; when combined with BI tools, it delivers a standard RTDM platform.

- **Improves performance and scalability to allow aggregation of data silos and reduce redundancy.** A key characteristic of RTDM is its ability to allow integration and aggregation of data silos, thereby reducing redundancy. RTDM offers a centralized platform to support data requirements, which delivers trusted data and improves data quality.

- **Automates integration of data across disparate data sources.** RTDM can also integrate disparate data sources such as packaged applications, legacy and custom applications, and content in real time to support any business requirement.

- **Minimizes complexity.** RTDM minimizes complexity and hides heterogeneity by automating various data management processes and procedures and using industry-standard interfaces.

Enterprises Defer New Insights Because Of Lack Of Real-Time Data

Data management is more than data integration, data quality, or database administration; it also includes several components that ensure the trustworthiness, availability, security, and ease of access to enterprise data and its integration with other related business data. Just as data is one of the chief assets of any enterprise, data management is an enterprisewide responsibility and competency. However, over the years, the requirements have changed to support more agile, scalable, and real-time data management that can deliver new insights, real-time queries, predictive analytics, an on-demand, scalable transactional platform, and answers and interactions out to the edge of the enterprise. Our survey and interviews revealed that, in the present state of data management:

- **Data is too fragmented.** Most enterprises have thousands of applications and databases to support their business requirements; this has resulted in data being too fragmented. To perform in-depth analytics and comprehensive reporting, integration of such disparate data has become critical to any business. Forrester estimates that more than 30% of the data in an organization is duplicated to support siloed and decentralized applications.

"We have many silos of information; across the life cycle of a piece of information, we have some overlap, derivatives, and enrichment of data across different lines of business. I think that something that's relatively new to the information is that we've just started to collect consumer data over the past couple of years. It's an

incredible amount of information, but we lack the ability to perform any analytics on it." (Director of IT, entertainment, North America)
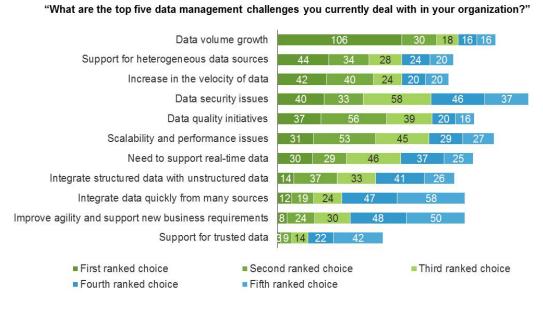
- **Data growth is a challenge for most organizations.** Most enterprises that we interviewed said that the data explosion is creating a major challenge for data storage, security, administration, and quick access (see Figure 2). Forrester finds that, on average, data doubles each year for critical applications; for some, it doubles every few months.

- **Scalability and performance remain top issues.** Despite processor speeds, processor cores, and processor threads quadrupling over the years, enterprises continue to struggle with scalability and performance issues, largely because of unpredictable workloads, increasing data growth, unoptimized data access and integration approaches, and — most importantly — poorly designed applications.

"Data explosion and increasing user populations are creating performance issues for us. Scaling our mission-critical applications to support more users has become a top priority for us. We're already constantly trying to address these issues with new architectures and products. We could potentially lose customers if our applications don't perform or scale — so performance and scale counts!" (Director of IT, financial services, North America)

- **Support for real-time data has become a critical need.** Most of the enterprises interviewed said that RTDM has become critical to their business. In addition, 72% of the surveyed enterprises that have not yet deployed RTDM plan to do so over the next two years, reflecting urgency in obtaining a real-time platform.

"We certainly have data integration challenges. We are doing direct-to-database access; we are making joins across hundreds of databases, and these are not efficient — requiring a lot of tuning and optimization. We do have a technical effort under way to develop a new data integration service layer that will be real-time and support the integration of any data type." (Director of IT, entertainment company, North America)

Figure 2

Data Volume, Heterogeneous Sources, And Velocity Are The Top Challenges That Enterprises Face

"What are the top five data management challenges you currently deal with in your organization?"

Base: IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of SAP, January 2013
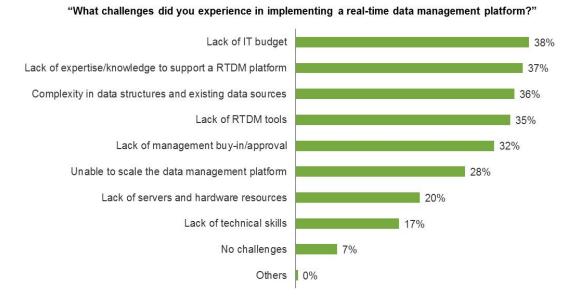
Implementing Real-Time Data Management Hasn't Been Straightforward

The concept of RTDM is not new; it has been around for decades. However, only a few enterprises have been successful in building a real-time platform from the ground up to support agility, scale, and real-time requirements. The interviews indicated that implementing a RTDM platform is not straightforward, especially when it comes to integrating data from disparate data sources in real time and supporting an on-demand transactional platform that can support unpredictable workloads. In the past, many organizations have faced various roadblocks when implementing RTDM:

- **Lack of IT budget.** Thirty-eight percent of the organizations surveyed ran into IT budget issues when implementing a RTDM platform (see Figure 3). Our interviewees noted that, despite budget challenges, most expect increasing RTDM expenditures in the coming years to support agility and meet new business requirements.

- **Lack of expertise or knowledge to support RTDM.** Although 37% of organizations reported staffing and expertise issues, most interviewees said that traditional in-memory solutions often required considerable programming, administration, and integration. Newer RTDM solutions have improved significantly on automation and ease of use by simplifying implementation. You don't need programmers to write code for caching specific data sets in-memory or for integrating data. RTDM lets you focus on the business rather than dealing with low-level technology challenges.

- **Too much complexity in the structure of existing data sources.** Although RTDM can support all data types, including structured, semistructured, and unstructured data, using unstructured data requires a deeper understanding of its association with structured data and how the integration will be enabled.

- **Lack of tools.** Most data management vendor solutions focus primarily on batch and semibatch environments that have created a gap in RTDM tools. However, with increasing demand for real-time data access, existing and new niche vendors are expanding their coverage to support RTDM tools.

- **Lack of management buy-in.** Thirty-two percent of the surveyed IT professionals indicated that lack of management buy-in hindered their RTDM project. Organizations that implemented RTDM over the years ran into management buy-in issues largely because of the complexity and cost of implementing the platform using traditional tools.

Figure 3

Lack Of IT Budget And Expertise And Data Structure Complexity Are Top Challenges When Implementing RTDM

"What challenges did you experience in implementing a real-time data management platform?"

Lack of IT budget	38%
Lack of expertise/knowledge to support a RTDM platform	37%
Complexity in data structures and existing data sources	36%
Lack of RTDM tools	35%
Lack of management buy-in/approval	32%
Unable to scale the data management platform	28%
Lack of servers and hardware resources	20%
Lack of technical skills	17%
No challenges	7%
Others	0%

Base: 298 IT decision-makers who have implemented a real-time data management platform

Source: A commissioned study conducted by Forrester Consulting on behalf of SAP, January 2013

New Technologies Help Deliver Real-Time Data Management

Data management frameworks have existed for decades but still lag in real-time data, real-time integration, on-demand scale, predictive analytics, and self-service data platforms for supporting agility and meeting new business requirements. However, recent technology advances, lower hardware costs, and innovation have helped overcome these
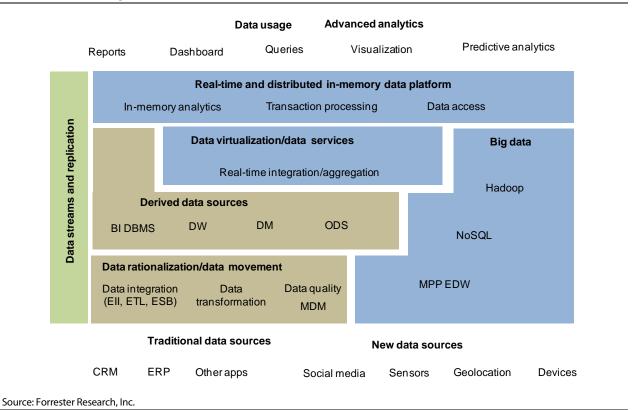
issues to deliver an economical real-time data management platform that all enterprises can leverage. Technologies that help implement RTDM include:

- **Distributed in-memory storage.** Disk latency is often the single largest factor in attenuating application response times, especially when large amounts of random data need to be accessed quickly or when data is distributed across many servers and clusters. Data stored in memory can be processed 10 to 50 times faster than traditional disk storage; with distributed in-memory technology, memory on low-cost commodity servers can be integrated to create a unified cache supporting a scale-out architecture. Until recently, in-memory data storage was not an option, largely because it was prohibitively expensive. In-memory technology is a critical component to support a real-time data platform, delivering faster data access, scalable transaction processing, predictive modeling, quick processing of big data, and new customer insights and opportunities (see Figure 4).

- **Data virtualization.** Data virtualization integrates disparate data sources in real time and near real time to deliver new insights and a single version of truth. Data virtualization can support all types of data: structured (text, relational data, and formatted data), semistructured (XML and files), and unstructured (emails, blogs, images, and video). It can integrate with big data, including the Hadoop, NoSQL, and EDW platforms, and various on-premises sources such as packaged, custom, mainframe, and legacy apps. Data virtualization can also integrate with external sources: social platforms such as Facebook, LinkedIn, and Twitter; software-as-a-service applications such as salesforce.com, SuccessFactors, and SugarCRM; and marketplace data-as-a-service applications such as DataMarket, Dun & Bradstreet, Factual, Infochimps, and Microsoft Windows Azure Marketplace.

- **Big data solutions such as Hadoop.** Hadoop, an open source initiative under the Apache License 2.0, delivers a distributed and scalable data processing platform to support customer big data. It supports mostly batch processing of analytics through parallel processing of large data sets using commodity hardware. Firms can download and use the open source distribution of Hadoop or buy commercial distributions from vendors like Cloudera, Hortonworks, and MapR Technologies. RTDM integrates with big data solutions to support offload processing of large volumes of data.

- **Predictive analytics.** Predictive analytics uses advanced statistical, data mining, and machine-learning algorithms to dig deeper to find patterns that you normally cannot see using traditional BI tools. Predictive analytics requires a breadth of tools and technologies to store, process, and access the volume, velocity, and variety of big data. Big data has breathed new life into many of these mature technologies, as more data can lead to better predictive models.

- **Enterprise data modeling.** A data model is used to structure data in a manner that all stakeholders can easily understand and which various applications and processes can leverage. Although data architects and data analysts are the principal authors of data models, application developers and DBAs use them extensively to support various enterprise applications and databases. RTDM takes traditional enterprise data modeling to the next level with the ability to easily and more dynamically create conceptual and logical data models to support new business requirements. RTDM creates new data models to support real-time data and services these models to support various predictive analytics, transactions, reports, and new insights.

- **Data quality and governance.** Data quality ensures that enterprise data used by business users and consumers supports critical business processes and decisions with no reservations as to its relevance, freshness, accuracy, or

integrity. RTDM helps improve data quality by eliminating data silos and enforcing data quality rules, policies, and processes in a centralized and controlled manner. The data quality software itself is essentially a fit-for-purpose business rules engine that standardizes, validates, cleanses, aggregates, enriches, matches, and merges data in real time. Data governance is a functional business capability and an important part of RTDM. Tools that can add early value to a data governance initiative include data profiling software and business glossary tools.

- **Data streams and replication.** Ensures that data moves from various sources to the destination in real time and near real time, whether for structured, unstructured, or semistructured data sets. Data can come from sensors, geolocation, devices, memory, cache or persistent storage, which is then processed by the RTDM platform.

- **Data mobilization.** A critical component of any RTDM platform is the consumption and delivery of information. Data mobilization supports the ability to perform rich interactions and advanced analytics in real time using smart devices such as tablets, mobile phones, and other emerging mobile technologies.

Figure 4

Real-Time Data Management

Source: Forrester Research, Inc.

The Benefits Of Real-Time Data Management Go Beyond Faster Data Access

RTDM offers several benefits to any size business — large or small. It delivers the first level of interaction with business data for any application, analytics, or transaction. RTDM can access data quickly, enable collaboration among teams and partners, and deliver new business insights and scalable transactions. It can also lower IT costs through automation and simplification, reduce hardware requirements, optimize data caching, and eliminate data duplication. The top benefits are that RTDM:

- **Stops data fragmentation.** A key benefit of RTDM is reduction of data redundancy by eliminating data silos delivering trusted information. Forrester estimates that more than 30% of data is duplicated, which often creates data quality issues and inconsistencies. RTDM overcomes this issue by centralizing access to critical data, ensuring consistency and eliminating data fragmentation.

- **Ensures real-time data access with low latency.** To support any real-time data access, data needs to be accessed quickly. RTDM's distributed in-memory technology helps ensure that data is stored, processed, and delivered with minimal latency.

- **Supports both analytics and transactions.** Unlike traditional real-time platforms that focused mostly on transactions, RTDM supports both analytics and transactions. Real-time analytics requires data movement from transactional systems into operational data store and data warehouses frequently. This is not an issue with RTDM, as analytics and transactions share the same platform.

- **Enables real-time data sharing and quality.** RTDM enables much richer data sharing and improved data quality. It allows any application to access any business data in real time.

- **Supports applications at the edge of the enterprise.** For example, mobile and the Internet of things.

- **Reduces time-to-action and decisions by integrating streams of data.** RTDM handles data that is so real time that it cannot be captured, cleansed, filtered, or ingested into traditional systems.

- **Supports next-generation business applications.** RTDM supports new next-generation business applications such as mobile applications, social media, real-time analytics and reporting, heat maps, and real-time dashboards for tracking business events.

KEY RECOMMENDATIONS

All enterprises should support a real-time data management platform that delivers agility, new insights, improved performance, and competitive advantage. RTDM delivers real-time data with low latency, and supports analytics. Specifically, enterprises should:

- **Understand their business data.** The biggest challenge most customers face today is an overarching understanding of their business data — specifically, knowing what data exists, where it's located, where it came from, how it's managed, what its dependencies are, and how it integrates with other systems. While RTDM can help integrate data, it still requires deep knowledge of how various applications share and access enterprise data. Therefore, start by tackling a few applications at a time, understanding the metadata, interfaces, and application requirements and how quickly the data needs to be accessed.

- **Separate applications from data integration and data access.** Applications should focus only on the application logic and user interface, not on data integration, data access, or data management functions. Decoupling the two helps move to a RTDM platform quickly and with less effort. Applications should only focus on making generic data access calls to retrieve data from the RTDM platform, rather than hard-coding data access and integration. Consider all new applications being deployed with such decoupled architecture — and having the RTDM perform optimizations and gradually convert older applications as well.

- **Focus on using industry standards.** Although enterprises use proprietary interfaces to access disparate data and legacy platforms, the use of industry standard protocols like SQL, XML, SOAP, XQuery, and XPath can help make the transition to RTDM easier. Therefore, consider all new applications that use such standards to help achieve a more efficient, trusted, and scalable RTDM platform with less effort and complexity.

- **Use distributed in-memory technology for performance and scale.** Look at using distributed in-memory to achieve extreme high performance and scale for applications that need real-time data or faster access to critical data. Use memory cache across physical servers to support distributed scale-out. Focus on distributed in-memory that supports all kinds of data — structured, semistructured, and unstructured — and offers unified scale-out cache. Supplement cache with disk-based protection for persistence to support data recoverability and long-term retention.

- **Consider vendor solutions that help achieve faster time-to-value.** Vendor solutions can help achieve faster time-to-value through automation and simplification of various integration and implementation steps. Although most vendors lack a comprehensive RTDM solution, look at those that support broader solutions and can support your business data and applications.

- **Ask their vendor to provide an RTDM vision road map.** If you're looking at solutions, ask your vendor how it plans to provide the RTDM vision. Look at the various components that the vendor has integrated and how it plans to fill any gaps.

- **Start by integrating a few applications.** Don't take on the ambitious project of trying to integrate all enterprise applications into RTDM. Start with four or five key applications initially, adding other applications and infrastructure over time.

- **Implement data queries before transactions.** The initial focus of RTDM deployment should be data access, that is, getting applications to query real-time data using standard protocols such as SQL, XQuery, and XPath. Transactional support should be deployed only after the basic query framework has been established. However, don't hold back if you're already struggling with transactional scalability.
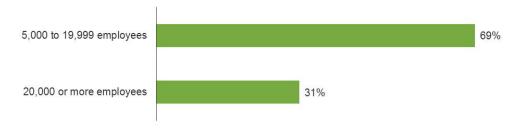
Appendix A: Methodology

Forrester conducted an online survey of 367 organizations with 5,000 or more employees in the US, the UK, Japan, India, Germany, France, China, Brazil, Switzerland, Mexico, and Austria to evaluate their real-time data management practices. Survey participants included decision-makers in IT, corporate management, and product/line-of-business management. Forrester conducted additional 45-minute phone interviews with 10 respondents fitting the same criteria as the quantitative study. Questions provided to the participants asked about data management challenges, real-time data management adoption and benefits/challenges of implementation. Respondents were offered a small incentive as a thank-you for time spent on the survey. The study began in December 2012 and was completed in January 2013.

Appendix B: Demographics/Data

Figure 5

Firm/Organization Size

"Approximately how many employees work for your firm/organization worldwide?"

5,000 to 19,999 employees — 69%

20,000 or more employees — 31%

Base: 367 IT decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of SAP, January 2013