G00235042

Hype Cycle for Big Data, 2012

Published: 31 July 2012

Analyst(s): Anne Lapkin

Big data is one of the most hyped terms in the market today. The first Big Data Hype Cycle helps enterprises develop strategies to address the growing business need for insight from datasets of increasing volume, velocity and variety.

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What You Need to Know

Gartner defines big data as "high volume, velocity and/or variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision-making, and process automation." It is the single most hyped term in the market today. Vendors isolate certain aspects of the big data issue to create demand for their offerings. End-user organizations recognize that there is something fundamentally different in both business demands and technology solutions, while struggling with identifying the benefits that can accrue to the organization from the ability to achieve new business insight from large and complex datasets. Increasingly diverse datasets complement each other and permit the business to fill in gaps in the corpus which can improve operations and decisions and thus enhance business delivery. However, information assets are the less complex side of the issue. The more complex aspect is the demand for new forms of processing from capture, through storage, into access and all the way to analytics.

The Hype Cycle

Big data is big money. And big confusion. As with every new term that creates excitement in the market, every vendor is marketing "big data solutions" and many organizations are expending significant resources on "big data projects." The objective of this Hype Cycle is to help CIOs and information and business intelligence leaders to navigate through this complex topic.

As enterprises come under more pressure from the business to provide access to (and analysis of) increasingly complex information sets to increase business insight, vendors continue to attach the

term "big data" to an ever-widening set of products, causing additional confusion in the market. This increased focus on big data is driven by several factors:

- There is an increased focus on information from the business. Business leaders are demanding more and more information with the hope of gaining more and more insight — allowing them to make better business decisions. This focus has been repeated in our CEO and business leader surveys over the last several years, including the 2012 survey, where 100% of respondents were able to identify one piece of information, which (if they had it) would allow them to run their businesses better (see "CEO Survey 2012: The Year of Living Hesitantly").
- Innovative processing approaches have emerged that leverage low-cost servers/CPUs and an increasingly robust, wide array of open-source or freeware technology, thereby fundamentally changing the cost-benefit equation.
- Increased availability of scalable, elastic resources in the cloud have allowed organizations to begin big data projects without investing in infrastructure.

There are a number of misconceptions about big data that contribute to the confusion in the marketplace:

- Many of the technologies currently being marketed as big data solutions are not net new. MapReduce, a commonly cited "big data technology," is a software framework designed to support the distributed processing of large volumes of data residing on clusters of computers that was first introduced by Google in 2004.
- Big data is not just about volume. Volume is an issue when the quantity of information to be processed exceeds the capacity of the existing technology to do so, but velocity (speed of delivery or speed of change) or variety (significant business value can be derived by combining information of one type with information of another type) can also overwhelm existing processing infrastructure.
- Big data is not just about MapReduce and Hadoop. Although many organizations consider these distributed processing technologies to be the only relevant "big data technology," there are alternatives. In addition, many organizations are using these technologies for more traditional use cases, such as preprocessing and the staging of information to be loaded into a data warehouse.

It is important to remember that the *only* reason to pursue any big data initiative is to deliver against a business objective. Gartner has seen many of these efforts founder because the business outcome has not been adequately defined. This does not mean that organizations should presuppose the answer — simply that they should adequately define the questions and understand how they will use the answers to create a positive impact for the business. It is also important to remember that many organizations lack the skills required to exploit big data — this is pointed out in the entry for the data scientist, which is an emerging role encompassing a wide range of skills. These include:

- Skills to work with business stakeholders to understand the business issue and context.

- Analytical and decision modeling skills for discovering relationships within data and proposing patterns.
- Data management skills are required to build the relevant dataset used for the analysis.

Additionally, a focus on big data is not a substitute for the fundamentals of information management. Organizations that substitute activity in the big data space for attention to the basic principles of data quality, information governance and metadata management will continue to suffer from the negative effects on the business that are caused by poor information management practices. Big data projects will not solve this problem. It should be noted, however, that some of the fundamental assumptions that drive existing information quality and governance programs are significantly challenged by the sheer volume, velocity and variety of big data assets. Organizations with information management practices in place should not try to apply them as-is to these new information types, as they will likely cause existing governance structures and quality programs to collapse under the additional weight of the information being processed. Instead, organizations should rethink their expectations of quality and governance in the context of their control over the information and the quality requirements of the use case. (The quality requirements for clickstream analysis are very different if you are trying to figure out why people are abandoning their shopping carts than they are if you are doing fraud detection.)

The first Hype Cycle for Big Data illustrates the current condition of market hype for this topic. There is a significant clustering of data points at the Peak of Inflated Expectations, indicating that interest in this topic — and experimentation — is very high. We expect many of these items to fall into the Trough of Disillusionment within the next year or two, as organizations speed up their experimentation with big data projects. A number of entries, such as MapReduce and alternatives, text analytics and in-memory data grids are already sliding into the trough, reflecting the fact that these technologies have been in the market for some time, though their use as "big data technologies" is a fairly recent development.

With all of the above, it is important to say that Gartner does not believe that big data will be a hyped term for very long. Unlike other Hype Cycles, which are published year after year, we believe it is possible that within two to three years, the ability to address new sources and types, and increasing volumes of information will be "table stakes" — part of the cost of entry of playing in the global economy. When the hype goes, so will the Hype Cycle.

This Hype Cycle is extremely crowded, which is consistent with the level of hype around the topic. To assist the reader in navigating, we have divided the technologies into three discrete categories (see Table 1). Each should be used differently.

- **Entries that describe enabling technologies for big data.** These are technologies that might (or might not) be used in big data scenarios. Many of them are also used for more conventional applications. Assess these technologies based on your big data requirements (you might choose different approaches if you are dealing with sheer volume compared to trying to combine disparate datasets) and your organization's tolerance for technological innovation.
- **Entries that describe typical use cases for big data.** Although by no means an exhaustive list, these are use cases that we often find where big data scenarios may apply. An interesting

example is predictive modeling solutions, which is gaining traction in the insurance industry to analyze historical and current data, and generate models to help predict future outcomes. Although this entry is only half way up the Peak of Inflated Expectations, it makes use of predictive analytics — a technology that has almost reached the Slope of Enlightenment. Use these entries to inform yourself about what other people in your industry and others are doing with big data with an eye toward building your own value propositions.

- **Entries that describe new information types, sources and roles.** Use these entries to investigate which new information types and sources can be combined with your existing information to provide additional business insight. Think also about the new skills required for exploiting these new sources.

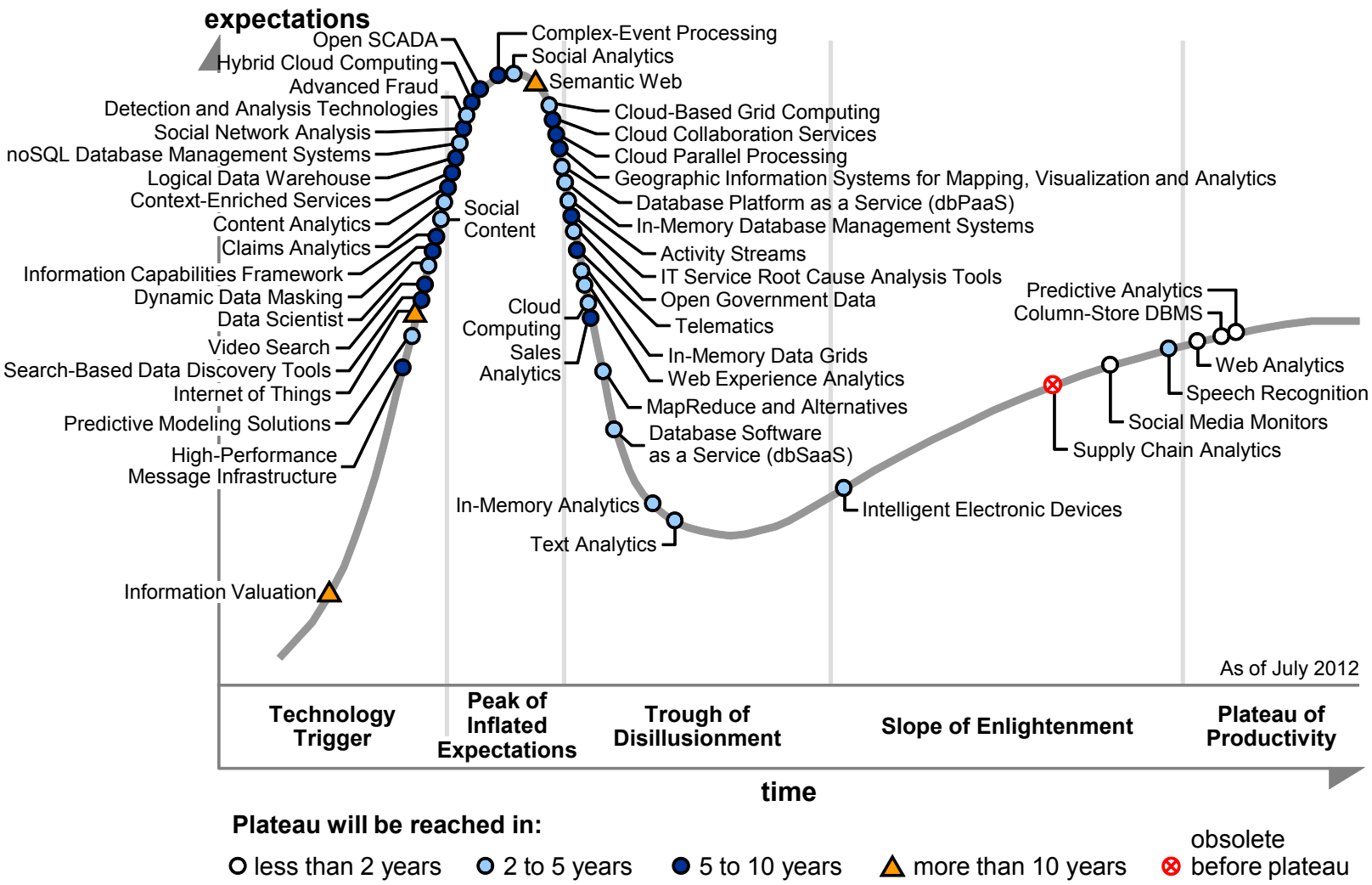
Table 1. Technology Entry Categories, 2012

Category	Technologies
Entries that describe enabling technologies for big data	high-performance message infrastructure, hybrid cloud computing, Internet of Things, video search, dynamic data masking, information capabilities framework, content analytics, logical data warehouse, noSQL database management systems, search-based data discovery tools, in-memory database management systems, complex-event processing, cloud-based grid computing, cloud collaboration services, cloud parallel processing, database platform as a service (dbPaas), in-memory data grids, MapReduce and alternatives, database software as a service (dbSaaS), in-memory analytics, text analytics, intelligent electronic devices, speech recognition, predictive analytics, column-store DBMS
Entries that describe typical use cases for big data	information valuation, predictive modeling solutions, claims analytics, context-enriched services, social network analysis, advanced fraud detection and analysis technologies, social analytics, sales analytics, telematics, Web experience analytics, supply chain analytics, social media monitors, Web analytics, IT service root cause analysis tools
Entries that describe new information types, sources and roles	social content, data scientist, open SCADA, Semantic Web, geographic information systems for mapping, visualization and analytics, activity streams, open government data

DBMS = database management system; SCADA = supervisory control and data acquisition

Source: Gartner (July 2012)

Figure 1. Hype Cycle for Big Data, 2012



Source: Gartner (July 2012)

The Priority Matrix

There are two interesting phenomena in the Priority Matrix: the lack of transformative technologies that will mature in the short term (less than two years) and the number of use cases judged to be transformative. From the first phenomenon, the reader might conclude that due to the small number of transformative technologies that will mature in the short term, the priority matrix indicates that big data need not be a focus in organizations. This is not true. The business demand for information is not going to decrease — rather it will continue to increase. New data sources will continue to appear and enterprises that master the use of information of all kinds for business insight will enjoy significant competitive advantage. Although each of the technologies taken individually might not be transformative, their use together to provide significant new business insights may very well be.

From the second phenomenon, the user might conclude that since few use cases for big data may be transformative, the whole discussion of big data is "much ado about nothing." However, we believe that the answer lies in most enterprises' lack of ability to imagine the possibilities. Indeed, in our 2012 CEO survey, fully 40% of business leaders had no response when asked what types of information would transform their industries over the next 10 years (see "CEO survey 2012: The One Piece of Information the CEO Needs").

A significant barrier to succeeding with big data will be the ability to ask the right questions, and use the right technologies to get the answers. It will take time to learn how to do both of these things, and most IT organizations will need to acquire a host of new skills. IT groups and CIOs who are not already thinking about big data should begin a program of experimentation, with an eye toward acquiring experience both with the technologies and the information. Take the following steps to begin addressing big data issues in your organization:

- Work closely with business counterparts to discover what types of information would improve business outcomes and where that information might come from. Leverage existing big data use cases, like advanced fraud detection, claims analytics or telematics to understand how big data might be affecting your industry.
- Begin to develop data scientist skills within your organization — you will need familiarity with the information, the ability to perform complex analyses using some of the technologies mentioned here (for example, in-memory data grids and predictive analytics) and the ability to visualize the results of the analysis in a meaningful way.
- Begin to explore potential new sources of information (for example, activity streams, open government data or open supervisory control and data acquisition [SCADA]) to understand how that information might contribute to your business insight.
- Experiment with new ways of capturing information, like complex event processing, or text and video analytics.
- Begin experimenting as soon as possible — if you wait for the train to be ready to leave the station, your competitors will be on it and you will not.

Figure 2. Priority Matrix for Big Data, 2012

benefit	years to mainstream adoption			
	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational	**Column-Store DBMS**	**Cloud Computing** **In-Memory Database Management Systems**	Complex-Event Processing Content Analytics Context-Enriched Services Hybrid Cloud Computing Information Capabilities Framework Telematics	Information Valuation Internet of Things
high	**Predictive Analytics**	Advanced Fraud Detection and Analysis Technologies Cloud-Based Grid Computing Data Scientist In-Memory Analytics In-Memory Data Grids Open Government Data Predictive Modeling Solutions Social Analytics Social Content Text Analytics	Cloud Parallel Processing High-Performance Message Infrastructure IT Service Root Cause Analysis Tools Logical Data Warehouse Sales Analytics Search-Based Data Discovery Tools Social Network Analysis	Semantic Web
moderate	Social Media Monitors Web Analytics	Activity Streams Claims Analytics Database Platform as a Service (dbPaaS) Database Software as a Service (dbSaaS) Intelligent Electronic Devices MapReduce and Alternatives noSQL Database Management Systems Speech Recognition Web Experience Analytics	Cloud Collaboration Services Dynamic Data Masking Geographic Information Systems for Mapping, Visualization and Analytics Open SCADA Video Search	
low				

As of July 2012

Source: Gartner (July 2012)

On the Rise

Information Valuation

Analysis By: Debra Logan

Definition: Information valuation is the process by which relative value or risk is assigned to a given information asset or set of information assets. The term "information asset" encompasses any digital or physical object or corporate data. An information asset is any information artifact owned or controlled by a company that can produce value for it. One of the main characteristics of an asset is that it can also be viewed as a liability in different circumstances.

Position and Adoption Speed Justification: The question of the value of information has been around for a long time. The phrase "knowledge is power" sums it up nicely as the value of keeping and sharing information has been recognized since the beginning of oral and written communications. However, only since the dawn of the information age, or more precisely the computer age, has the question of "information as an asset to be exploited on a massive scale" become an issue. Gartner clients have struggled with these questions for at least a decade.

We believe that a more formal approach to information valuation is beginning to take hold in leading-edge organizations. Issues such as how much to invest in IT systems, information security, information security and cloud computing for example, all depend on the underlying question of "how much is this information worth to us as a business?"

In "Infonomics: Valuing Information As a Corporate Asset" we introduce a more formal approach to valuing information. When considering how to put information to work for your organization it is important not only to think about information as an asset, but also to actually value it and treat it as if it were an asset. Although information meets accounting standards criteria for an intangible asset, it is not found on public companies' balance sheets. If you're not measuring the actual and potential value generated from information assets, then you're in a poor position to close that gap. You will not be in a good position to reap any of the other potential benefits that come from quantifying the value of information. Any number of established methods for valuing intangibles (market approach, cost approach or income approach, for example) can be used, or organizations can select valuation methods that map to nonfinancial key performance indicators (KPIs).

When we consider information as the newest class of enterprise asset, we must determine how it stands up to the formal definition of an asset. The common understanding of an asset is "something of value." However, this lack of complete appreciation for the concepts of "future economic benefit" and "control and ownership" results in organizations neglecting to quantify information's future potential. Moreover, we believe that information meets the criteria of an intangible asset as defined by both U.S. and international accounting standards.

The speed at which these conventions are adopted will, however, be slow as the value of information and its relation to more established and recognized KPIs can be difficult to establish. Valuing information as an intangible asset in its own right will also require individuals and organizations to build up the methods and skills for doing so.

Business leaders are often slow to understand that they are the ones who must establish the value of information and the ways in which it relates to their businesses. Information management as such is seen as IT's responsibility, so we believe that the formal methods for information valuation will be slow to take hold in the marketplace and will remain, to a large degree, subjective.

User Advice: Understand the characteristics of information, which will help you to value it, for example:

- **So much exists that you cannot value it easily.** In this case, information must be categorized in many different ways. Its use in a business context should determine what categories should be created.
- **Valuable information is scarce and difficult to obtain.** If you can Google it, so can everyone else. Focus on the information that you believe to be unique in the context of your business. This is usually generated internally (innovation and R&D) or constructed by carefully analyzing what is available externally (Internet reputation management).
- Storing information results in significant costs and if there is no medium- or long-term business value, information that cannot be shown to be related to business advantage should be deleted. Determine what is needed for legal and compliance reasons and keep only what is necessary. User-generated ephemera, which is 80% to 90% of what you are now storing, should have a short life span.
- Finding useful, targeted information — especially textual or graphical information — is not simple and never will be. In other words, the quest for the perfect balance between search precision and recall is like the quest for the holy grail.
- An individual or a business can never have "complete" information but it must have a means of determining when it is time to stop looking and when it is time to make a decision.
- The ultimate limitation on the value of information is the extent to which individuals or groups can process it and make decisions about it.

Note that information valuation is not a task that many people have experience in carrying out. A combination of business and IT professionals, along with others with a financial background, may be needed to make these decisions.

Business Impact: To be an asset information must have the potential to deliver improved enterprise performance. It is this potential that gives it its value. In Gartner research, we have identified four mutually exclusive value categories, from low to high.

1. Nuisance information adds no value and may contribute to the glut of data. Its applicability is limited and it may only be deemed "valuable" by one or just a few people in the enterprise.
2. Compliance information, which an enterprise is required to keep by law or regulation, is more like an insurance policy: invest in it, just in case.

3. Operational information is related to faster, less costly and more effective operations. It can provide competitive advantage but, more often, is part of the cost of doing business and is required to stay even with competitors, not to outpace them.
4. Growth-related information comes from R&D and is associated to innovation, process improvement or mission enhancement.

Once a high-level categorization has been established, the valuation effort must move to the next level of detail. To do this, use business-based frameworks for analysis. For each business function or role and for each process, work through the types of document and data that are required to achieve business goals. Many individual projects exist that manage different types of information and, although information management disciplines share common goals of information consistency and usability, they lack ways of discussing concepts and coordinating efforts. Enterprise information architecture, defined in "Gartner Defines Enterprise Information Architecture" guides such activities to ensure organizations gain business value from enterprise information.

In "A Master Vocabulary for Ensuring Consistency Across Information Management Disciplines" we establish a number of terms and definitions that are important to this work. Those that have most impact on the valuation exercise are "information asset" and "enterprise information."

An enterprise information valuation project can quickly turn into an impossible "conquer the universe" exercise unless the information to be managed is more narrowly defined. It is a question of business value: practitioners must identify the information that matters most, which then justifies additional levels of rigor and attention (management).

The process of identifying what matters most is an exercise in information valuation. The decision to treat certain data as enterprise information is a conscious business decision, based on a specific set of benefits that the business expects to achieve from such treatment.

Such business benefits might include:

- Fewer errors due to data inconsistencies
- Greater efficiency in sharing resources across the enterprise
- Improved ability to compare and aggregate information such as sales, balances, inventories and prices
- Greater ability to relate different behaviors, activities and relationships — for example, 360-degree views of customers or citizens
- Economies of scale

However, without a more detailed examination of the essential properties of information, this too can become a circular exercise as well as one that risks straying into the thicket of "IT metrics" when what is really aimed for is metrics that are relevant to the business.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

High-Performance Message Infrastructure

Analysis By: W. Roy Schulte; Massimo Pezzini

Definition: Message infrastructure consists of software and appliances that provide program-to-program communication with high quality of service (QoS), including assured delivery and security. High-performance message infrastructure products leverage innovative design paradigms to support higher throughput (in messages per second), lower latency (in milliseconds for end-to-end delivery time) and more message producers (senders) and consumers (receivers) than traditional message-oriented middleware (MOM) products.

Position and Adoption Speed Justification: The volume of data used in business, science and governmental applications is increasing, because the cost of recording data, moving it across a network and computing is dropping. Simultaneously, enterprises need the data to be delivered faster as they move toward real-time analytics and straight-through processing. High-performance message delivery used to be an issue for only a few applications in financial trading and certain operational technology (OT) systems, such as aerospace and digital control systems. These applications have become more demanding, while many other new kinds of high-end message-based applications — including Web-based gaming systems, CRM, social computing, smart electrical grids, smart cities and other systems — have appeared.

Standard wire protocols and traditional communication middleware can't support the speed (low latency), high message volume or the large numbers of message producers and consumers found in a growing number of applications. This has driven vendors to develop a new generation of high-performance message delivery products that exploit a variety of innovative design paradigms. Some products leverage hardware assists (appliances); others use brokerless peer-to-peer architecture, parallel processing (for grids that scale out) and other optimizations. All of these products are examples of in-memory technology because the data is never put out to disk except for recovery purposes (and even this is handled asynchronously to avoid delaying message delivery). Moreover, when message senders and receivers are on the same server (for example, running on different cores), the communication is done through in-memory, interprocess communications (IPC), thus avoiding the network protocol stack. Such messages can be delivered in less than a microsecond. These products are somewhat faster and better than earlier high-performance MOM products, and much faster and better than conventional MOM or standard wire protocols — such as unadorned TCP/IP or HTTP. Some of the high-performance message infrastructure products originated in the OT world — designed for embedded systems — while others were initially designed for financial or telco applications. However, virtually all of them can be used for OT, financial and other applications.

The hype associated with big data is spilling over from MapReduce and Hadoop, which are technologies for big data at rest, to the world of high-performance message delivery products — which are technologies for big data in motion. High-performance message technology is part of the big data movement because of its ability to handle high volumes of data with high velocity processing and a large variety of message types. High-performance message delivery has received

less notice than big database technologies, so it is only beginning its journey along the Gartner Hype Cycle. However, as companies implement more big data solutions, the need to use high-performance message delivery with those systems will grow. Moreover, the demands of real-time systems, particularly including the Internet of Things, mobile devices, and cloud applications, will also drive adoption of high-performance message delivery even when big data database technology is not involved.

User Advice:

- Architects and middleware experts should become familiar with the capabilities and nonfunctional characteristics of emerging high-performance message delivery products, including software- and appliance-based products.
- Companies should expect to support a variety of standard protocols, MOM and high-performance message products to handle the variety of communication requirements in their applications — one size does not fit all.
- Architects, business analysts and development managers should fully evaluate the communication requirements of every new application, paying particular attention to the future potential needs for throughput, latency and QoS. They should not assume that conventional MOM or industry standard wire protocols will be able to handle all applications.
- Architects and middleware experts should select high-performance message infrastructure primarily on the quality of the product and the vendor, with secondary consideration for whether the product happens to support industry standards such as Java Message Service (JMS), Data Distribution Service (DDS) or Advanced Message Queuing Protocol (AMQP).

Business Impact:

- The availability of good, commercial high-performance message delivery products makes it practical to implement demanding applications without having to write custom communication protocols into the application.
- High-performance message infrastructure can be used for fan-in: which means collecting data from many distributed message producers such as users on mobile devices or stationary workstations, embedded devices or sensors.
- It also helps load big databases and move data from one big database to another quickly.
- Finally, it can be used to distribute (fan-out) the results of analytics, betting odds, or gaming or other data to many consumers — which may be people, devices, systems or distributed databases.

The new generation of commercial, high-performance message delivery products can support most or all of today's applications, and most of those likely to emerge during the current five-year planning horizon (2012 to 2017). Companies that plan ahead and build a high-performance communication infrastructure before the demand occurs will enjoy relatively smooth operations. Those that underestimate their message workloads or wait too long to build a sound infrastructure will endure slow performance, unhappy customers, lost messages and service interruptions.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: IBM; Informatica; PrismTech; Real-Time Innovations; Red Hat; Solace Systems; Tervela; Tibco Software

Recommended Reading:

"What You Need to Know About Publish-and-Subscribe"

"Understanding the Implications of the AMQP Messaging Standard"

Predictive Modeling Solutions

Analysis By: Kimberly Harris-Ferrante

Definition: Predictive modeling solutions are a form of data-mining technologies that work by analyzing historical and current data, and generating a model to help predict future outcomes. These technologies can be used to generate a score (for example, a credit score), to assess behavior (for example, fraud detection or customer acquisition), or to analyze needed reserves to help improve decisions such as underwriting risk selection or future actions required.

Position and Adoption Speed Justification: Predictive modeling interest is being driven by the intensified interest in data management and analytics. Using predictive techniques provides great value to insurers in multiple business units, including underwriting, claims, customer service, product pricing and risk management. Overall, the use of predictive modeling helps to provide greater insight into decision outcomes, early triggers on upcoming issues (for example, likelihood of customer churn), or model analysis to determine the long-term impact of an event (for example, a catastrophe). Examples of the use of predictive modeling include:

- Actuarial and pricing to run models to test pricing of products and to assess risks. Many life and property and casualty (P&C) insurers are applying predictive modeling in areas such as pricing products, testing the effect of pricing changes, stochastic modeling, and assessing the adoption of new products to be launched (including the impact on existing products and the overall impact on product profitability). This, combined with product development strategies (including the use of product configurators), will help insurers with the launch of new products and ensure the quality of these products, including accurate pricing for risk and meeting customer coverage needs.
- Website quoting in P&C insurance. Many insurers are shifting to direct-to-consumer business models, and looking to reduce the number of questions needed for quote creation and/or underwriting. Using predictive modeling, insurers can identify the most predictive data elements correlated with risk and losses, and those that are not correlated with outcomes can be removed from the application process or not used in screening. For example, predictive

modeling uses factual data to assist underwriters in making better decisions for identifying and segmenting risks.

- Claims. Insurers are analyzing incoming event data for early detection of fraud, to generate a risk score to determine the next action (for example, fast path or handoff to a skilled adjuster), and to determine needed procedures to improve return for product lines, such as disability. These predictive techniques can be deployed stand-alone, but many are now being leveraged in claims analytics, which may come embedded in a claims management module for a holistic process.
- Pricing optimization. Insurers can use predictive modeling tools to help determine appropriate pricing models for consumers or segments based on profitability, pricing tolerance and other models.
- Marketing and customer churn. Predictive modeling can help insurers identify customers and segments, which would have a greater response rate for new marketing campaigns, and churn, which would allow them to identify customers that they should focus on preserving relationships with in advance.

During the past 12 months, the adoption of predictive modeling has significantly increased among life and P&C insurers. To date, adoption has been mostly for Tier 1 companies and those with strong statistical/modeling skills. Adoption is projected to continue, slowing during the next few years, with predictive modeling reaching the Plateau of Productivity within two to five years. Mainstream adoption will be driven by the embedding of predictive modeling into business solutions (for example, claims analytics solutions or underwriting risk scoring), in which the technology comes with business models and is preintegrated out of the box, rather than companies needing to buy horizontal solutions that they then have to implement and build out in their own models. Small to midsize companies lack the skills to use predictive modeling in many cases, and vendors often lack expertise in insurance to help guide implementations. Core insurance vendors (such as those dealing in underwriting, policy, billing and claims) are just starting to add embedded predictive modeling into their solutions, and most predictive modeling tools are still sold as stand-alone or combined with larger business intelligence (BI) toolsets. Using predictive modeling on top of existing data investments, including underwriting tools and BI platforms, will multiply the value derived from those investments. Also, models will advance with continued use of predictive modeling. Most companies, however, now have basic deployments for predictive modeling solutions with simple models being deployed.

User Advice: P&C and life insurers should include predictive modeling as a key element of their information management strategies, and should deploy predictive modeling solutions to support CRM, risk management, pricing/actuarial, claims and underwriting initiatives. Insurers launching direct-to-consumer sales portals will find the use of predictive modeling helpful in identifying a reduced question set to generate more-accurate quick quotes, without compromising risk or price accuracy.

Insurers should look for solutions that have prebuilt models (for example, underwriting for workers' compensation or long-term care), which will enable insurers to better evaluate constantly evolving data and provide a basic model that they can adapt during implementation. Finding tools with

prebuilt models is particularly important for small to midsize insurers that lack experience in predictive modeling.

In addition, insurers should look for solutions that have been used in their lines of business to reduce deployment requirements and the time they will need to spend on customizing the solution. More insurers will begin using predictive modeling in commercial lines as these models become productized, rather than a custom build with vendors or a solution that is built in-house.

Business Impact: The use of predictive modeling solutions will enable insurers to more accurately predict customer behavior or trends, manage risks, improve fraud detection, reduce claims leakage, improve underwriting profitability and assist with product pricing. Insurers can analyze historical patterns or trends in the data, thereby learning more about how operations or business functions perform over time (for example, historical claims patterns can help determine the key characteristics of policyholders that contribute to a higher rate of claims submission). This will enable insurers to identify customer segments that are more profitable, identify risk factors and characteristics that are more correlated with high claims risk, identify fraud indicators to apply to current claims handling, launch direct-to-consumer retail operations, assist in pricing and actuarial tasks, and — ultimately — improve year-over-year performance.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Claim Analytics; Eagle Eye Analytics; Earnix; FICO; IBM (SPSS); ISO; SAS; Valen Technologies

Recommended Reading:

"Improving Property and Casualty Underwriting Results Through Process and Innovation"

"Insurers Must Build Information Management Strategies"

"BI Becomes Ingrained in Insurance Operations"

"P&C and Life Insurance: Hot Topics in Data Management and Analytics, 2010"

Internet of Things

Analysis By: Hung LeHong; John Mahoney

Definition: The Internet of Things is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.

Position and Adoption Speed Justification: Applying the definition for the Internet of Things to industry, government and consumer areas produces many rich scenarios and opportunities. For

example, televisions and cars are starting to connect to the Internet to access and provide content and services. Similarly, smart meters, parking meters and agricultural sensors are public and enterprise assets that can also be connected to the Internet to provide new services and information.

Although many opportunities are possible, this year, the Internet of Things has seen the most interest in the areas of smart grid, smart city, the connected car, the connected home, healthcare and operational technology (OT). Many of the recent business cases for the Internet of things have been rooted in energy savings, sustainability and content delivery, while shorter equipment outages have been made possible by safety and reliability monitoring.

Over the past decade of progression, there have been many variations on the "network of things." Some have used proprietary networks (for example, for manufacturing control). The network of things has also varied from large numbers of simple objects (for example, sensor nodes) to smaller numbers of complex objects, such as cars. In these networks, some things have been full Internet members with IP connections. Others, such as sensor nodes, have been limited in that they don't support the full range of IP behavior, and may talk to the Internet only via gateways.

The point has already been reached where the number of things connected to the Internet has surpassed the number of PCs and mobile devices that connect to the Internet — making the Internet more of an Internet of Things, than a PC or mobile Internet. The number of things that connect to the Internet will continue to increase exponentially. There will be many variations in the way things connect and are networked. For example, enterprises can have an "intranet" of things to control security and access. Things may be connected to one another as part of a mesh network and have only a handful of nodes actually connected to the Internet (a common approach in connected lighting). Ad hoc networks of things can be established and changed on the fly. For example, all cars in an area may communicate with one another and traffic lights to optimize traffic flow and avoid accidents.

The Internet of Things concept will take more than 10 years to reach the Plateau of Productivity — mainly due to security challenges, privacy policies, data and wireless standards, and the realization that the Internet of Things requires the build-out of a topology of services, applications and a connecting infrastructure.

User Advice: As you plan how the Internet of Things will be applied in your enterprise or area, start by identifying opportunities and the benefit areas, and then, work out all the elements that will be required to implement the opportunities. For benefits, base your business case on tangible areas, such as energy savings, reduced operational costs, new revenue from connected services or content monetization, and then, add intangible areas, such as customer experience and citizen well-being. For implementation considerations, expect the need for a topology of services, applications and a connecting infrastructure. This will require most enterprises to seek out an ecosystem of partners, such as system integrators, real-time data vendors and architects, telecom operators, middleware vendors that specialize in machine-to-machine technology, and specialists in the area of choice (for example, smart buildings, telematics or telemedicine).

There is still much to innovate in the Internet of Things, so budget for much experimentation. Enterprises seeking to gain competitive advantage from technology should consider the Internet of Things as one of the top areas of opportunity because of the undiscovered opportunities.

Business Impact: The value of the Internet of Things is in its applications. For example, cities can become "smart cities" as sensors on buildings, lampposts, parking spots and many other city infrastructure items become connected. Energy savings, sustainability and citizen well-being are at the forefront of the benefits in areas such as energy efficiency programs drawing on building occupancy, temperature and humidity data, along with weather data; real-time traffic management and in-vehicle information applications; and agricultural applications capturing in real time soil moisture levels to control irrigation.

On the consumer side, retailers and consumer product companies can provide added services and marketing channels or completely transform products by having their products connected to the Internet and to one another. The connected home and car are examples.

The benefits can range from incremental improvements (such as having parking meter sensors communicate the availability of parking spots) to transformational changes (for example, connected healthcare scenarios).

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Search-Based Data Discovery Tools

Analysis By: James Richardson; Rita L. Sallam; Whit Andrews

Definition: Search-based data discovery tools enable users to develop and refine views and analyses of structured and unstructured data using search terms. Like visualization-based data discovery tools, they have: (1) a proprietary data structure to store and model data gathered from disparate sources, which minimizes reliance on predefined metadata; (2) a performance layer using RAM or indexing that lessens the need for aggregates, summaries and pre-calculations; and (3) an intuitive interface, enabling users to explore data without much training.

Position and Adoption Speed Justification: Search-based data discovery tools have been around for some years, but they have not been taken up as quickly as their visually driven cousins.

Although the use of search to find pre-existing business intelligence (BI) platform artifacts (such as reports) is becoming more common, the broader use of search as a means to explore varied data types in a more free-form manner remains low. While the inclusion of key word search of BI platform objects and object content (reports, queries, dashboards, metadata including keywords, date, time, author and so on) is a valuable addition to standard BI interactions, this does not constitute search-based data discovery, which covers a broader set of use cases, specifically with respect to unstructured and semi-structured data.

Adoption is likely accelerate given the rising interest in analytics on "big data," which by its nature is diverse and a good fit with a search-based data discovery approach, and due to greater focus on this area by megavendors, evident in Oracle's late 2011 acquisition of Endeca (one of the leading lights in search-based data discovery) and IBM's of Vivisimo in early 2012.

User Advice: Organizations wanting to give users the chance to go beyond the analysis and reporting of structured data alone should examine the potential use of search-based data discovery tools (for more information on combining BI and search, see "Integrating BI and Content Analytics Gives Better Results Than Using Them Separately"). In addition, those looking to make analytics more pervasive might consider using these technologies, as they make it easier for workers not accustomed to traditional structured BI tools to find the information they need to make decisions. However, organizations should consider how they'll fit search-based data discovery into their business analytics solution architecture and, more widely, how it relates to their enterprise search tools, by working with the IT staff (who are often remote from BI and analytics) that "own" search in the organization. It should be noted that the evaluation and adoption of search-based data discovery is something that IT must drive as, unlike visualization-based data discovery tools, these products tend not to be sold directly to individual lines of business, so this technology is unlikely to self-propagate without IT leadership.

Business Impact: The business impact of search-based data discovery technology is potentially significant, as it can extend the frame of reference beyond that commonly associated with structured reporting and help drive adoption in areas resistant to normal models of interaction with data. Critically, search-based data discovery can unify fact and context, enabling users to explore the "what" and the "why" in one step; for example, using search to combine a classic structured query with qualitative, often external, information (for example, "show my 50 best performing products by revenue and region with associated online reviews and ratings"). In addition, it can assist users who would normally be too intimidated to use an ad hoc query tool, but who are quite comfortable with a search engine, to find the information they need in a structured database.

Search-based data discovery fits into the "Describe" category in Gartner's Information Capabilities Framework and we expect that, despite the relatively low level of adoption now, these types of capabilities will be one of the most critical parts of the information infrastructure of the future. For more details, see "The Information Capabilities Framework: An Aligned Vision for Information Infrastructure."

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Attivio; Coveo; EasyAsk; Exalead; IBM; Information Builders; MarkLogic; Oracle; SAP BusinessObjects

Recommended Reading: "The Rise of Data Discovery Tools"

"IBM Will Boost Analytics Ability by Buying Search Provider Vivisimo"

"Endeca Buy Extends Oracle's Ability to Support and Discover Diverse Data"

Video Search

Analysis By: Whit Andrews

Definition: Video search refers to the ability to search within a collection of videos (whether inside or outside an enterprise, under enterprise control or in another company's domain) and is attracting interest in areas of content management. Video search will incorporate elements of social networking, social tagging, metadata extraction and application, audio transcription and conventional enterprise search. Audio transcription is the most established means of achieving search.

Position and Adoption Speed Justification: Expectations driven by YouTube are intriguing consumers, because they see the possibility for improved searchability in rich media. This is why the excitement around this technology has not yet reached its zenith. Some vendors still rely on human transcription or metadata; others are adding speech-to-text facilities. Ultimately, enterprise search will subsume video search as simply another format, just as it did with audio and graphical media, and video search will become a presumptive feature in video content management and delivery systems.

Video search will not be fully and effectively understood and exploitable for another five years, because where textual search (and to a lesser degree audio search) came with vocabularies and grammars intact from conventional communication, video does not. Video talk tracks are an appropriate means of developing some searchability, but the objects, people and actions inside videos, as well as the relationships and action paths they follow, are not yet consistently identifiable or reliably describable either as content or query objects. Transcription works most effectively where there is a definitive soundtrack from either a speaker central to the goal of the video or a narrator intending to elucidate what happens in it. Videos without soundtracks, such as security videos, documents capturing behaviors, training videos without narration, obviously require more sophisticated ways of establishing their meaning — that are still nascent.

User Advice: Only enterprises with the greatest ambition for video in their operations should invest in video-specific search capabilities. Others are more likely to turn to cloud vendors (expect search to be a feature in a variety of formal and informal enterprise editions of video hosting from Web conferencing vendors and others, including Google and Microsoft), or wait for video search as an element of enterprise search or video content management and delivery.

Business Impact: Making video easier to locate will boost the use of nontextual elements in training and communications in the enterprise. Video search powers use cases for analytic examinations of crowd and individual behaviors in retail, service and public locations. It improves the understanding of what a video is "about." It allows for analysis of video from public places to identify criminal and collective actions.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: 3VR; Altus365; Cisco; Flex Analytics; HP (Autonomy); Koemei; Limelight Networks; LTU Technologies; OpenText; Sonic Foundry

Recommended Reading:

"Apply Analytics to Your Internal Video Share Usage to Maximize Its Value"

"Metadata Will Improve the Return on Your Video Investments"

"MarketScope for Video Content Management and Delivery"

"Multi-Perspective Video Will Further Strengthen the Medium's Value for Training and Process Documentation"

"Video in Customer Service Grows in Significance"

"Serve Users Best and Use Video Most Effectively With In-Context Chunks"

At the Peak

Data Scientist

Analysis By: Roxane Edjlali

Definition: The data scientist role is critical for organizations looking to extract insight from information assets for "big data" initiatives and requires a broad combination of skills that may be fulfilled better as a team, for example:

- Collaboration and team work is required for working with business stakeholders to understand business issues.
- Analytical and decision modeling skills are required for discovering relationships within data and detecting patterns.
- Data management skills are required to build the relevant dataset used for the analysis.

Position and Adoption Speed Justification: Big data initiatives for most organizations are still in the exploratory phase. There are two main factors slowing down organizations:

- The ability to articulate a business case justifying the investment is difficult, as the business doesn't always perceive the benefits of such initiatives.
- The lack of skills, both internally and externally makes it difficult to get started.

Vendors and service providers have clearly identified the availability of skills as a major impediment to the development of big data initiatives and are offering services and training to help organizations ramp up their initiatives. At the same time, university programs, sometimes in collaboration with vendors are starting to offer such tracks as part of their curriculums. These programs are now

offered in major North American universities such as Stanford and Northwestern University and in Europe, such as Oxford University.

The availability of skills is already a problem for many organizations and market demand will increase as big data projects start to develop. The situation will improve over time as new graduates specializing in these areas enter the workforce.

User Advice: The data scientist role is broad and requires a broad combination of soft and technical skills and individuals that are passionate, creative thinkers who enjoy working in a collaborative and iterative way.

The overall project from the data collection process to the data mining activities and analysis can combine a variety of technologies. This means that enterprises will need to create a multiskilled team, including data consumers within the business, analytics professionals, motivated internal IT staff with the potential to learn big data approaches, and external consultants.

Organizations may also consider leveraging the training provided by the various vendors, as well as service offerings to help them get started. Enterprises should consider developing data scientist roles within their organizations, as understanding business needs, identifying the proper sources of data and mining data to support these business requirements, requires business understanding, strong business recognition and buy-in to succeed.

Business Impact: Organizations looking at starting big data initiatives will require the skills provided by data scientists to succeed. Starting small and delivering business value quickly on simple projects is of key importance in mitigating the risk, building skills and developing business buy in toward the value of big data initiatives.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: EMC-Greenplum; Infochimps; Kaggle; Opera Solutions

Recommended Reading:

"Toolkit: Role Description: Data Scientist"

"Emerging Role of the Data Scientist and the Art of Data Science"

Dynamic Data Masking

Analysis By: Joseph Feiman

Definition: Dynamic data masking (DDM) is an emerging technology that aims at real-time data masking of production data. DDM changes the data stream so that the data requester does not get access to the sensitive data, while no physical changes to the original production data take place.

Position and Adoption Speed Justification: Sensitive data (such as credit card numbers), personally identifiable information, medical diagnoses and even nonpersonal sensitive data (such as corporate financial information and intellectual property) are exposed to abuse or negligence from enterprise employees and outsiders. Data masking aims to prevent the abuse of sensitive data by hiding it from users. Data masking comes in two forms: static data masking (SDM) and DDM.

An example of a business case when DDM is necessary is when a customer representative of a firm (such as a bank), by invoking the respective application, accesses a client's profile (for example, to change a credit card limit per a client's request), and the application displays all the related information retrieved from the database, including that which is sensitive. In this case, SDM does not help protect sensitive data. SDM deals with data at rest — for example, data that has been copied from a production database into a nonproduction database in advance of masking. In the example just mentioned, production data is in transit. A possible solution to the problem is a re-engineering/rewrite/modification of the existing applications to make them hide sensitive data according to the entitlements of the users. Yet, this solution is too expensive and lengthy, and it would not even solve the problem in the case of ad hoc queries. DDM is an emerging solution that can help.

Gartner has long predicted that the data-masking market would eventually split into these two (static and dynamic) segments, and this prediction is now being realized. Since this market began to develop, most data-masking providers have offered — and prospective buyers have asked for — only SDM technologies. Recently, however, Gartner has identified a shift in the market. Some vendors have begun offering DDM solutions, and Gartner's client interactions make it clear that security professionals and other stakeholders are recognizing that certain problems of sensitive data abuse cannot be solved by SDM or by other currently available data security technologies. The result is that a differentiated DDM market is beginning to emerge to address business cases whose requirements cannot be met by SDM. We also expect that synergy between DDM and database auditing and protection (DAP) will take place, resulting in more comprehensive and intelligent security detection and protection capabilities, and that potentially DAP and DDM capabilities will merge in a single tool. DDM technology, in order to mature should address concerns that modifying session in real-time might impact applications' logic and performance — factors that slow technology evolution.

User Advice: Enterprises should start evaluating DDM. They also should:

- Pressure existing SDM and other data security vendors (for example, DAP vendors) to deliver DDM technology.
- Make DDM enablement a criterion in their static data-masking vendor selection process.
- Leverage the evolution of DDM where applicable, once its maturity is reached or as requirements dictate.

SDM and DDM will typically target two different adoption centers within IT. SDM will be mainly used by application development teams, while DDM will be mainly used by operations. At the same time, the buying center — the one that makes the decision to implement data masking — will be an enterprise's compliance/risk management/auditing team (see "Securing Production Data With Dynamic Data Masking").

The application of data-masking technologies and best practices should be a strategic enterprise objective, but provider and product selection still remain tactical. The DDM market is just emerging. DDM vendors are few, though some large vendors have started offering their newly developed DDM technologies or acquired DDM startups. SDM and DDM are not necessarily a pair, and a DDM vendor is not necessarily an SDM vendor also.

Business Impact: Adopting data masking will help enterprises raise the level of security and privacy assurance against insider and outsider abuses. At the same time, data masking will make enterprises compliant with the security and privacy standards recommended by regulating/auditing organizations.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: GreenSQL; IBM-Guardium; Informatica; Mentis; Oracle

Recommended Reading:

"Securing Production Data With Dynamic Data Masking"

"Key Trends in Securing Sensitive Data With Data-Masking Technologies"

Information Capabilities Framework

Analysis By: Ted Friedman

Definition: The information capabilities framework is the people-, process- and technology-neutral set of capabilities needed to describe, organize, integrate, share and govern an organization's information assets in an application-independent manner in support of its enterprise information management (EIM) goals.

Position and Adoption Speed Justification: Organizations increasingly attempt to move from architectures of tightly coupled systems and self-contained applications to modular software components, reusable services and multipurpose content. These transitions expose information management infrastructure vulnerabilities: poor data quality, lack of metadata transparency, inconsistent business intelligence and analytics, conflicting master data and the lack of an integrated view across the content continuum. Although organizations have technologies and processes to address such challenges, they are scattered throughout the organization.

For most enterprises, the current approaches to information management technology are heterogeneous and complex, often with information silos affecting data sources, databases and application environments, and legacy data. At the technology core of new approaches to information management there will be an information environment, a series of co-dependent services, repositories, tools and metadata management that enable the describing, organizing,

integrating, sharing and governing of all types of information in an application-neutral manner, giving users the information and tools they need for their specific use case. The innovators understand that the optimal path to adding capacity and capabilities is no longer through the simple addition of storage, applications and databases, without consideration of how the information will move throughout the supporting infrastructure and a sense of interlocking and interactive management services. Rather, a focus on transparency and optimization (via rich metadata capabilities) and standardization and reusability of functions commonly required across information-intensive use cases is the key. However, through 2015, 85% of enterprises will fail to adapt their infrastructures for information management to align with these ideals.

User Advice: Organizations must rethink their approaches to delivering information management infrastructure, with a focus on capabilities that are required across multiple use cases, and independent of specific applications and physical representations of data. By viewing information as a peer strategic asset, alongside applications and business processes, they can develop stronger competencies in the governance of information assets, and greater value from leveraging them, while also increasing consistency, shareability and reuse. The information capabilities framework is a vision for how these goals can be achieved. Organizations should begin to work toward this vision by identifying opportunities to align and standardize various information management capabilities in support of closely related initiatives, while also filling in capability gaps that may currently exist in their environment.

The information capabilities framework concept does not dictate specific architectural approaches, implementation tactics, or specific tools and technologies. Rather, organizations should use it as a guiding description of the set of capabilities that, when properly aligned and integrated, can enable the fulfillment of EIM principles, including:

- Management of information in an application-independent manner
- Providing type- and source-neutral views of and interaction with information assets
- Supporting a range of use cases, and providing consistency of these capabilities across them
- Enabling consistent reuse, sharing and governance of information for exponential increase in value

The information capabilities framework addresses critical components of information management, and organizations can and should adopt these principles to promote a better understanding of the meaning and value of information assets, to expose and share them in a variety of formats and contexts, and to do so with the appropriate conformance to information governance policies. In effect, organizations should adopt the information capabilities framework concepts as their vision for how to fulfill the information management infrastructure requirements of the enterprise in a strategic manner.

Business Impact: Organizations will move to this at different speeds and in different ways. However, the evolution toward a cohesive information infrastructure is inevitable. Enterprises are beginning to recognize that information management technologies should be approached as a coherent set of capabilities that operate on the enterprise's information assets. Gartner believes that through 2015 organizations integrating high-value, diverse, new information types and sources into

a coherent information management infrastructure will outperform their industry peers financially by more than 20%. Furthermore, the gap between organizations which are leaders in information management practices and those which are not will expand rapidly. Those failing to adopt these new principles articulated via the information capabilities framework concepts will continue to fall behind. This gap will increase, ensuring the eventual dominance of these top-performing organizations.

Those that apply this approach can capture a range of specific benefits, such as:

- Enabling business growth by improving the timeliness and quality of decision making through access to a more comprehensive set of information sources
- Improving the agility of enterprise processes for introducing new context-aware products/ services
- Improving the ability to predict new opportunities or challenges through pattern seeking, matching and discovery
- Reducing/managing risk by improving enterprise compliance with regulations and policies through improved information quality and governance
- Reducing the cost of storing, locating and integrating information across the information continuum

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Recommended Reading:

"Information Management in the 21st Century"

"The Information Capabilities Framework: An Aligned Vision for Information Infrastructure"

"How to Use (And Not Use) Gartner's Information Capabilities Framework"

"Predicts 2012: Information Infrastructure and Big Data"

Social Content

Analysis By: Mark R. Gilbert; Karen M. Shegda

Definition: Social content is unstructured data created, vetted, marked-up or delivered through a social process or channel and destined for human consumption. Social content scenarios range from the use of enterprise-managed blogs and wikis, to externally hosted environments (Twitter, Facebook, YouTube, and others) for document sharing and collaboration, to tools for supporting project teams.

Position and Adoption Speed Justification: As consumerization and mobility have driven demand for enterprise social tools and techniques, so their adoption has increased dramatically in enterprise use cases. In enterprises, social software and collaboration tools are empowering information workers: giving them more control over content creation, sharing and dissemination. Vendors of document-centric and collaboration-centric applications are adding social features to their tools, so that their content has similar attributes to the content produced by socially-focused applications. Social content — including video — is the fastest growing category of new content in the enterprise, and the pace has accelerated during the past 12 months.

User Advice:

- Where possible, consider exposing the social features that are emerging in content and collaboration environments.
- Build strategies for enterprise uses and governance of social content.

Business Impact:

- Use cases include driving teamwork and innovation, as well as integrating internal and external content and contributors into the work product.
- Socially-oriented content has significant advantages over more rigid traditional content management environments in terms of improved transparency, usability and information reuse.
- Social content can be used to create and expand informal repositories for exposing knowledge and expertise, and maintaining technical documentation, client communication, product and service innovation, issue tracking, e-learning and training.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Ektron; Google; IBM; Microsoft; OpenText; Oracle

Recommended Reading:

"Magic Quadrant for Enterprise Content Management"

"Predicts 2012: Plan for Cloud, Mobility and 'Big Content' in Your ECM Strategy"

"Tablets and Smartphones Are Changing How Content Is Created, Consumed and Delivered"

"Social Content Demands an Enterprise Strategy"

Claims Analytics

Analysis By: Kimberly Harris-Ferrante

Definition: Gartner defines "claims analytics" as the use of business intelligence (BI), reporting solutions, dashboards, data mining and predictive modeling technologies to manage and analyze claims data, which can result in improved performance. Overall, three processes are supported in claims analytics tools — claims analysis, reporting and predictive modeling.

Position and Adoption Speed Justification: Property and casualty (P&C) insurers are increasingly launching claims transformation initiatives, which include a variety of steps such as claims management system replacement, process improvements, service supply enablement, mobile claims handling and claims analytics. P&C insurers need greater insight into claims performance to improve their claims operations. Having a tool that provides claims managers real-time insight into claims performance, and a claims dashboard to show trends, throughput and team performance, is fundamental. Additionally, they are looking for tools to analyze claims data to help with decision support and predictive actions. The use of claims analytics will help insurers analyze data, apply predictive models (such as predict the impact of pending weather events for property insurance lines), improve decisioning and track claims performance.

Overall interest in claims analytics has broadened in reach during the past year, moving from Tier 1 companies to becoming a focus for midsize insurers alike. Investment in claims analytics is expected to continue to rise among Tier 1 and Tier 2 insurers, especially those in regions where major claims transformation and system replacement initiatives are occurring. The use of packaged claims analytics solutions lags overall — only a small percentage of Tier 1 and Tier 2 P&C insurers have solutions currently implemented. Most insurers are looking for claims analytics capabilities in their claims management solutions, rather than buying stand-alone analytical tools. However, most claims management solutions lack out-of-the-box claims analytics or partnerships with BI vendors that would provide an analytical foundation for analyzing claims data. Some vendors are starting to build out basic claims analytics capabilities in their claims management solutions; however, more functionality, models and dashboards are needed to fulfill the needs of the P&C insurance buyer. Furthermore, few solutions are capable of bringing in other sources of data, including that from the data warehouse, from customer information files or from specialty data sources, such as environmental, catastrophic and contributory claims databases (ClaimSearch, for example), to fully assess claims patterns and trends. As a result, claims analytics has moved in 2012 on the Hype Cycle, moving closer to the Peak of Inflated Expectations, with anticipated speed to the Plateau of Productivity of two to five years.

User Advice:

- Evaluate the claims analytics functionality in your existing claims administration or management systems to determine their capability to support claims analytics.
- When buying new claims management solutions, evaluate their ability to support claims analytics, as well as future investment in claims data management, reporting and analysis. Often, claims management vendors will lack claims analytics, leading buyers to purchase additional BI and analytical tools to augment claims management systems. Evaluate the vendor's product road map, and determine whether this functionality will be added in future releases, or whether the vendor is partnering with a BI or business analytics tool that will provide claims analytics.

- Look at the existing BI solutions you have internally deployed to determine whether any of them offer prebuilt claims analytics models in their toolsets. If it's possible, then using an existing vendor will be easier than buying a new BI tool.
- Look for BI and toolset vendors that have built out key performance indicators specific to P&C claims and that offer a dashboard with claims performance indicators. Even if these are not used completely by the user, they will provide an illustration of what can be delivered via the tool, and the data requirements needed for full implementation.
- Build out new claims key performance indicators that are more business-oriented to track performance in the claims department, including the cost of claims handling and the relationship between claims handling and the outcomes for customer satisfaction and renewal rates. These will be loaded into the claims analytics tool for valuable insight into claims performance.

Business Impact: P&C insurers using claims analytics will gain better insight into their claims operations, including the impact of claims servicing on customer retention, the cost of claims handling, process bottlenecks, and better financial intelligence to identify leakage and losses. Greater insight will give claims managers the ability to run their units effectively, and make a better contribution to corporate profitability and operational efficiency. The biggest benefit will come from using these tools to view claims adjusters' work performances and to see who is opening claims, the type of claim, the amount of reserve and the time to close, which will enable claims managers to be better at fraud management overall.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Accenture; CCC Information Services; Claim Insights; CSC; IBM (SPSS); Innovation Group; LexisNexis; MSB; SAP; SAS

Recommended Reading:

"MarketScope for North American Property and Casualty Insurance Claims Management Modules"

"Eight Industry Trends Drive Essential Requirements for P&C Core Systems"

Content Analytics

Analysis By: Carol Rozwell; Rita L. Sallam

Definition: Content analytics defines a family of technologies that processes content, and the behavior of users in consuming content, to derive answers to specific questions. Content types include text of all kinds, such as documents, blogs, news sites, customer conversations (both audio and text), and the interactions occurring on the social Web. Analytic approaches include text analytics, rich media and speech analytics, as well as sentiment, emotional intent and behavioral analytics.

Position and Adoption Speed Justification: In this year's Hype Cycle, we "backed up" the position of content analytics to pre-peak because of our reassessment of its usage and market penetration. The multiplicity of applications and diverse range of vendors indicates that content analytics is still emerging. There is a great deal of hype surrounding some deployments of content analytics, such as sentiment analysis, while use of other techniques — such as emotional analysis — is still very nascent.

Use of both general- and special-purpose content analytics applications continues to grow as both stand-alone applications and extensions to search and content management applications. The greatest growth comes from generally available content resources, such as social data, contact center records and post-sale service accounts. This leads to heavy uptake in CRM. Also, open-source intelligence is seeking to use content analytics for more effective understanding of public and semipublic sentiment. Software as a service vendors are emerging, offering APIs to let snippets of content be programmatically sent to and analyzed in "the cloud." This is an important development and will help to speed up adoption.

Another factor driving the interest in content analytics is the huge volume of information available to be analyzed and the speed with which it changes.

User Advice: Enterprises should employ content analytics to replace time-consuming and complex human analyses, such as reading, summarizing and finding actionable insight in service records or postings resident in social media. Firms should identify the analytics functions most able to simplify and drive new intelligence into complex business and analytic processes. Users should identify vendors with specific products that meet their requirements, and they should review customer case studies to understand how others have exploited these technologies. An oversight group can support application sharing, monitor requirements and understand new content analytics to identify where they can improve key performance indicators. Appropriate groups for such a role may already exist. They might already be devoted to associated technologies or goals, such as content management, advanced analytics, social software, people-centered computing or specific business application categories — such as marketing, CRM, security or worker productivity. Social networking applications can be used to deliver information, gain access to customers and understand public opinion that may be relevant. It is important to note that there are risks in the assumption that content analytics can effectively substitute for human analysis. In some cases, false signals may end up requiring more human effort to sort out than more rudimentary monitoring workflows. The best practice is to optimize the balance between automation and oversight.

Business Impact: Content analytics is used to support a broad range of functions. It can: provide new insights into analytic processes to identify high-priority clients, the next best action, product problems, and customer sentiment and service problems; analyze competitors' activities and consumers' responses to a new product; support security and law enforcement operations by analyzing photographs; relate effective treatments to outcomes in healthcare; and detect fraud by analyzing complex behavioral patterns. Increasingly, it replaces difficult and time-consuming human analyses with automation, often making previously impossible tasks tractable. Complex results can be represented as visualizations and embedded in analytic applications, making them easier for people to understand.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Attensity; Basis Technology; CallMiner; Clarabridge; Connotate; HP (Autonomy); IBM; Ixreveal; Nexidia; Nice Systems; Raytheon BBN Technologies; SAS; Temis; Thomson Reuters (ClearForest); Trampoline Systems; Transparensee; Utopy

Recommended Reading:

"Turn Information Into Insight with Social Analytics"

"The Impact of VoC on Sales"

"The Impact of VoC on Marketing"

"The Impact of VoC on Customer Service"

Context-Enriched Services

Analysis By: Anne Lapkin

Definition: Context-enriched services are those that combine situational and environmental information with other information to proactively offer enriched, situation-aware and usable content, functions and experiences. The term denotes services and APIs that use information about the user to optionally and implicitly fine-tune the software action with better situational awareness. Such services can proactively push content to the user at the moment of need, or suggest products and services that are most attractive to the user at a specific time.

Position and Adoption Speed Justification: Context enrichment refines the output of services and improves their relevance. Since Gartner began covering this topic more than five years ago, context-enriched services have gone beyond simple scenarios (for example, one category of context information — such as location) to more complex services that use several categories of context information (for example, location, group behavior and purchase history) to further refine the output. The majority of implementations today are consumer facing, in mobile computing, social computing, identity controls, search and e-commerce — areas in which context is emerging as an element of competitive differentiation. Gartner believes that enterprise-facing implementations, which use context information to improve productivity and decision making by associates and business partners, will begin to emerge in the next several years (see "Context-Enhanced Performance: What, Why and How?").

Current context-aware solutions are fragmented — they are individually designed, custom-developed and deployed and, because of their competitive importance, are often not widely distributed or advertised. The movement in social computing toward open and shared social relationship (social graph) information is an early step toward the standardization of context-aware computing APIs; however, most of the required standardization effort has not yet begun. Context-

enriched services will require multiple stages of innovation and platform technology evolution before their essential benefit is well-understood in the broad mainstream computing markets.

Context-enriched services continue to steadily climb toward the Peak of Inflated Expectations in 2012. We are seeing an increasing number of applications that, while they may not use the term "context-aware computing," are clearly using context information to improve the user experience. In addition, we are seeing "platform level" services offered by context providers such as Apple and Google that allow advertisers to plug content into certain situations. Previously, these services were custom-built for a specific service.

Currently, most services are reactive: that is, while they may use some information about the user to personalize the interaction, they fundamentally provide content to a user based on a specific request. As context-aware computing becomes more prevalent, proactiveness will become the norm. That means that a service will deduce what the user requires based on detection of a context event (for example, the appearance of a user in a particular location), an analysis of all the available information (including situational and environmental information) pertaining to that user and a determination of the best course of action. This course of action may be the presentation of a personalized offer or content, or it may be "do nothing" if it is determined that the user is not receptive at that time.

User Advice: Application developers and service providers should take advantage of the wide range of contextual opportunities in their e-commerce, security, social computing and mobile computing systems. Some early context processing can be achieved using event processing and complex-event-processing technologies; enterprises need to plan to incrementally develop or source more context-enriched services in step with their ambition levels for improving the user experience.

Business Impact: Context-enriched services will be transformational for solution providers; context enrichment is the next frontier for business applications, platforms and development tools. The ability to automate the processing of context information will serve users by increasing the agility, relevance and precision of IT services. New vendors that are likely to emerge will specialize in gathering and injecting contextual information into business applications. New protocols such as real-time bidding will allow for the mashing up of and delivery of context-enriched services. Most context-aware applications are likely to arrive as incremental enhancements to service-oriented architecture, without a major disruption to the prior architecture. However, the new kinds of business applications — especially those driven by consumer opportunities — will emerge, because the function of full context awareness may end up being revolutionary and disruptive to established practices.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Apple; Atos; Google; Microsoft; Pontis; Sense Networks

Recommended Reading:

"Cool Vendors in Context Aware Computing, 2012"

"Predicts 2012: Context Aware Computing Changes Consumer-facing and Security Strategies"

"Context-Aware Computing and Social Media Are Transforming the User Experience"

"A World-Class Patient Experience Is the Disney Family Cancer Center's Focus"

"Evaluating Privacy Risks and Business Benefits in Four Context-Aware Technologies"

Logical Data Warehouse

Analysis By: Mark A. Beyer

Definition: The Logical Data Warehouse (LDW) is a new data management architecture for analytics combining the strengths of traditional repository warehouses with alternative data management and access strategy. The LDW will form a new best practice by the end of 2015.

Position and Adoption Speed Justification: Leading Gartner clients began reporting new combinations of data management and access strategies in combination with traditional repository warehouses in 2009. At first, these were outliers and largely unique occurrences. However, by the first quarter of 2010, approximately 3% of data warehousing inquiries were reporting dual warehouses, warehouses combined with data service buses, warehouse combined with federation/ virtualization technology and the inclusion of MapReduce and Graph analysis (completed in server clusters outside the warehouse with results being loaded to the warehouse).

At the same time, organizations began reporting the use of separately managed alternative data ontologies and taxonomies, which were made available to various classes of end-users for their use in analysis and applications. During May to October 2010, the instances of combined technologies (often including three or more approaches to accessing data for analytics, including the traditional data warehouses and marts) had risen to approximately 5% of Gartner data warehouse inquiries.

Since 3Q10, Gartner inquiries have become more focused. Approximately 8% to 11% of data warehouse inquiries now include three or more of the seven aspects (repository, virtualization, distributed process, performance auditing, service-level management, logical semantics, metadata reuse) of the LDW and organizations are reporting faster time to delivery, greater flexibility and an ability to include additional forms of processing such as virtualization and even content analytics in their analytics solutions — all managed by a common semantic layer or engine to deliver the assets to multiple different analytic applications.

Early adopters so far, have been advanced data warehouse and analytics practitioner organizations and implementers. During the next two years, new organizations will begin to encounter the more difficult issues of managing service-level agreements for each delivery type possible under the LDW and many will fail to manage the still prevalent performance and availability issues of virtualization and batch distributed processes running on server clusters external to the warehouse. This will lead

the LDW into the Trough of Disillusionment and at this time, it is possible that the LDW will fail to emerge (just as distributed warehouses failed during 2008 to 2009).

However, Gartner believes that the current technologies and expected advances in dynamic metadata-driven services engines will advance the LDW from the Trough of Disillusionment and toward the Plateau of Productivity by late 2015.

The LDW is a major disruption to traditional data warehousing approaches, but is effectively an evolution and augmentation of practices, not a replacement. A data services platform is a key component in the LDW, which delivers a middleware basis for data virtualization and data access (see "Conceptual Leap: Bridging Data Silos With Semantic Mediation"). The LDW solves the data access dilemma (see "A Model for Evaluating Data Access Tools"). The LDW permits an IT organization to make a large number of datasets available for analysis via query tools and applications. While still early, many vendors are supporting this approach as it further rationalizes the concepts of information management away from both repositories and applications.

User Advice:

- Perform query analysis of existing analytics to determine how the current system performs (the current warehouse, mart or federated views) and what data/information is included in those queries. Use the results of this analysis to identify when users are leaving the warehouse to obtain data from other information resources.
- Determine if your current warehouse software systems are capable of managing external data access and if they are capable of managing external processing clusters in terms of specifying jobs, initializing jobs and monitoring/managing the job flows as they complete or if new technology should be evaluated.
- Accumulate taxonomic, ontological, performance metrics and service-level quantifier metadata into a single location. It demands quantifiable and qualifying metrics. Organizations should identify a single area of analytics, which requires a combination of three information access and management approaches; real-time access to operational systems (to pilot virtualization); an embedded use of distributed processing (such as, MapReduce of large datasets and graph analysis of networks of information or content analytics).
- Build a pilot analysis collecting inputs from all three information access and management approaches.

Business Impact: A LDW has the potential to eliminate the constant level of compromise between comprehensive data needs, performance optimization and time to delivery cycles. By introducing virtualization and distributed processes as peers to the repository, it is now possible to select the deployment architecture based on the driving service-level expectation instead of defaulting to existing practices. For example, a business case may require a fully comprehensive dataset in which the analytic model and the source identification model is currently "fluid," but the demand is current and time-to-delivery expectations are justified and short.

A distributed process deployment with highly variable inputs might be initially preferred and later changed to a formal extract/transform/load process when the analytic model and the sourcing

model become more stable. Similarly, the demand for highly structured, high quality data may be subordinate to the demand for immediate access to operational data at the second it is created. A virtualization view of the operational system could be the immediate solution, and then it could be changed to a distributed process like Graph later.

In addition, many information assets deployed in a repository-only style warehouse are forced to follow a single ontologic/taxonomic pairing. In the LDW, a semantic layer can contain many combinations of use cases, which are effectively deployed as new variations of data taxonomies and ontologies. Many business definitions of the same information are the result. From a technical perspective, the LDW also needs a query normalization interface. Every database management system (DBMS) requires a unique set of SQL or data access interface technologies (for example, search and API access). This capability opens up many options for end-user tools and removes the current design requirement to closely coordinate the BI tools with the DBMS choice.

Early adopters have reported that the LDW does not have to follow the 80/20 analytics rule (specifically, 80% of analysis needs can be met by 20% of the data and thus designed easily into an optimized layer of the data warehouse). Instead, the LDW is using an 80/10/5 rule in which 80% of analytic needs are met by the repository, but 10% of the demand is met by virtualized solutions and 5% are met via distributed analytics (such as content analytics, MapReduce or Graph). This leaves a remaining 5% and LDW practitioners are pleased to acknowledge that the remaining 5% will never be solved, by even this advanced infrastructure and will remain in end-user specific control.

These same customers report that 5% of needs are never met in a fixed architectural choice and acknowledge the credibility of undefined access using any combination of the three choices or creating their own direct access and extract outside of the LDW. The LDW does resolve the traditional challenges of inconsistent data marts. Resolving redundant, partially inconsistent representation of data will still require traditional data warehousing consolidation practices.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

noSQL Database Management Systems

Analysis By: Merv Adrian

Definition: NoSQL databases — key-value stores, document-style stores, table-style database management systems (DBMSs) and graph databases — are designed to support new transaction/interaction use cases that involve Web scale, mobile and clustered environments. Most NoSQL offerings, not intended for typical transactional applications, relax one or more atomicity, consistency, isolation and durability (ACID) properties. Adoption is increasing as commercial providers add increasing functionality, support, training and community building.

Position and Adoption Speed Justification: Interest in NoSQL within the programmer community has expanded — customer counts, use cases and download volumes are increasing, and packed conferences are springing up in multiple geographies. Commercialization has continued to increase,

driving NoSQL toward the Peak of Inflated Expectations. Venture capital has flowed in. In September 2011 alone, Neo Technology, Couchbase and 10gen collectively raised over $54 million in funding; Basho Technologies raised $13 million during 2011 and 10gen raised an additional $42 million in May 2012. Job listings and inquiries to Gartner also reflect this rise in interest.

Big vendors are responding. Oracle's new Oracle NoSQL Database 11g, derived from BerkeleyDB, is a core element of its Big Data Appliance. Amazon's DynamoDB became available in January 2012, representing a significant tradeup from its SimpleDB, and there are aggressive plans for NoSQL in the cloud, especially in concert with Amazon's Elastic MapReduce. Microsoft and IBM remain on the sidelines, although IBM has made a tentative probe into the graph database market with triplet and SPARQL support in DB2 v.10. Also, Microsoft has partnered with HortonWorks to connect to Apache Hadoop environments. The batch limitations of Hadoop Distributed File System are driving increased interest in NoSQL datastores from Hadoop distributors — specialists like Cloudera and big vendors like IBM and EMC are reporting increased use of HBase. Another trend is the continued growth of distributions to include other developing open-source projects, such as DataStax's addition of Apache Solr to its Cassandra-based Hadoop distribution.

Increasing adoption and growing customer demands have opened a significant gap between commercially-supported noSQL DBMSs and open-source projects with only community support available. The latter remain immature and are used by Web developers for applications outside the mainstream. The commercial products are using their added funding to build enterprise-class features intended to widen adoption and win new business: 10gen's MongoDB management service claims over 5,000 users and Couchbase's CouchSync targets integration between cloud and mobile devices.

NoSQL DBMS usage continues to be driven by programmers, not the typical database team. The growth of the ecosystem — partners and supporting products — will have an impact on broadening adoption. Quest Software reports that its Toad for Cloud Databases, with support for HBase and Mongo as well as Cassandra, HBase, and Amazon SimpleDB, is gaining traction in shops that use its tools for mainstream DBMSs. Informatica 9.5, announced in May 2012, added support for Hadoop source data integration and Gartner believes added support for leading NoSQL targets will not be far behind. Hosting players — not just Amazon and Rackspace, but specialists like MongoLab — offer a lower cost of entry and a place to experiment.

Continuing market penetration, and follow-on project growth in existing customers, is expected in 2012. Nonetheless, although the offerings and ecosystems continue to mature, there is still a long way to go. Awareness remains limited and the leading players remain off the direct sales playing field, slowing their penetration of corporate IT strategic plans.

User Advice:

- For most multi-user, complex applications, NoSQL DBMS are generally not an option due to their lack of ACID properties, and should not be considered.
- For Web-scale applications requiring large data stores with high performance, especially when the transactions are read-only or not complex and can be supported by a non-ACID model,

some of the more mature NoSQL DBMSs can be used. For transactions that do not require ACID properties and have complex, mixed data types, these can be very effective.

- Special purpose commercial NoSQL DBMSs can be used effectively for use cases well-served by graph, document or key-value architectures.
- Expect applications built using NoSQL DBMSs to have frequent updates. Scale and new requirements will demand rapid iteration.

Business Impact: Current business impact is moderate and is increasing as more organizations investigate and experiment. Decisions about how to persist data for many new-wave applications are being made by a new generation of programmers, who are willing to use special-purpose NoSQL data stores that make their work less complex and provide greater flexibility. Programmers should not drive enterprise procurement, but their influence is being felt. The emergence of in-memory DBMSs has the potential to capture many of the same use cases, but language choices and commercial considerations may push NoSQL onto the table despite in-memory DBMS's success.

Organizational unwillingness to build on open source has been a key blocker, but the rise of commercializers is beginning to shift perceptions. The availability of data integration tools that offer an understanding of data structure in the DBMS to support data movement into other systems (such as data warehouses and other applications) will be a key enabler. NoSQL vendors are pursuing this and the recent emergence of Apache HCatalog, a data dictionary for the Hadoop stack, will accelerate developments in this area.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: 10gen; Amazon; Apache Software Foundation; Cloudera; Couchbase; DataStax; Neo Technology; Oracle

Recommended Reading:

"Who's Who in NoSQL DBMSs"

"How to Choose the Right Apache Hadoop Distribution"

"Cool Vendors in Data Management and Integration, 2011"

Social Network Analysis

Analysis By: Carol Rozwell

Definition: Social network analysis (SNA) tools are used to analyze patterns of relationships among people in groups. They are useful for examining the social structure and interdependencies (or work patterns) of individuals or organizations. SNA involves collecting data from multiple sources (such

as surveys, emails, blogs and other electronic artifacts), analyzing the data to identify relationships, and mining it for new information — such as the quality or effectiveness of a relationship.

Position and Adoption Speed Justification: SNA applications are used to analyze organizations and other explicitly collaborative environments; for example, R&D teams, organizational units and supplier networks. Organizational network analysis is the form of SNA that examines the information flow among individuals. It depicts the informal social network — typically of groups working in the same enterprise. Value network analysis (VNA) examines the deliverables exchanged among roles — typically groups of people from multiple organizations that need to work together. Social influence network analysis scans social media to identify influential people, associations or trends in the collective.

These applications will increasingly be used to mine data from social media sites. In addition, they can be used to establish perspectives on user behavior in enterprises — where linkage is explicit in communications such as email or IM. SNA is also being used in electronic-discovery (e-discovery) and other investigative applications. The products that are commercially available simplify the creation of network diagrams: using survey data, as well as creating network visualizations based on electronic communication records. Tools that perform analysis of the relationships, interactions and behavior of networks can be instrumental in diagnosing a variety of workplace issues. Variations of SNA tools are also making their way into collaboration platforms.

Adoption of SNA has been hampered by the perception that it is highly conceptual and the information collected is difficult to translate into practical actions. Of late, more vendors are incorporating SNA concepts into their products. They provide features such as suggesting people to follow, which helps to reduce SNA's perception as overly conceptual.

User Advice: SNA can be very valuable for identifying active, virtual teams that are succeeding despite virtual hurdles. IT should study those teams, experiment with them and pilot new approaches to improving communication and collaboration processes. Surveys of social networks don't just turn up info sharing and interaction, they uncover trust networks.

Traditional uses of SNA in enterprises include identifying groups that need to collaborate. Use SNA/VNA to determine which informal communities already exist that can be augmented, who appears to lead them, and to work directly with the informal leadership. The simplest forms of SNA might be accomplished by adding a small number of questions to an annual HR employee survey. When previously hidden patterns of information sharing and interaction can be made explicit, these patterns can be studied to make improvements. Additionally, SNA can be used to target key opinion leaders and to enable more effective dissemination of product information. It can also be used investigatively: to determine patterns of interaction that may hold clues to proving guilt, or innocence, in legal or regulatory actions. However, users should be mindful of privacy laws and the concerns of employees who may feel threatened.

Business Impact: SNA can be used by organizations to:

- Understand the flow of information and knowledge
- Identify the key knowledge brokers

- Highlight opportunities for increased knowledge flow to improve performance

Companies use organizational network maps to help them manage change, to facilitate mergers and reorganizations, to enhance innovation, spot talent and plan for succession.

- SNA can be used in the consumer space to identify target markets, create successful project teams and identify unvoiced conclusions. It can also be used to detect implicit connections.
- Some e-discovery vendors use SNA to find patterns in interactions, especially to identify additional legal custodians of data.
- SNA is also gaining traction in sales organizations that see it as a means of identifying decision makers and determining relationship strength.
- As enterprises become more virtualized (with people from different organizations, in different locations and time zones, operating under different objectives), bridging these virtual gaps becomes a key element of collaboration initiatives; these initiatives will only succeed if there is an understanding of the structure of informal relationships and work patterns — which SNA/VNA can reveal.
- SNA is also gaining momentum in industries with significant quantities of customer information to be mined; for example, telecommunications, banking and retail. In telecommunications, SNA uses information from call distribution records (such as number dialed, incoming number, call count and types of call) to find out about the individual consumer and their calling circle. This basic information can then be added to other information: to provide specific datasets for different activities, such as preventing churn or planning marketing expenditures.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Analytic Technologies; GalaxyAdvisors; IBM; Idiro Technologies; Ni3; Optimice; Orgnet.com; Saba; Trampoline Systems; ValueNet Works

Recommended Reading:

"Turn Information into Insight with Social Analytics"

"Competitive Landscape: Vendors Providing CSP Social Network Analysis"

"Emerging Information Use Cases Challenge Traditional Information Environments"

Advanced Fraud Detection and Analysis Technologies

Analysis By: Kimberly Harris-Ferrante

Definition: Advanced fraud detection and analysis technologies employ sophisticated analytics and predictive modeling to identify potential fraud in real time during data entry, rather than during a

later batch run after a transaction is complete. It can be applied to both claims and underwriting fraud.

Position and Adoption Speed Justification: Focus on operational efficiencies and loss control is accelerating the adoption of fraud solutions among P&C and life insurers. However, both industry segments have different approaches and adoption rates.

P&C insurers have the highest use of fraud solutions to date, but have primarily used tools for claims. Coupled with strategies aimed at claims transformation, investment in claims processing, including fraud analysis, continues to rise, especially among P&C carriers. Focus on underwriting fraud remains low, however, because most companies do not have a strategy (other than improved data entry precision) to tackle this problem. Typically, investment in fraud solutions has lagged due to P&C insurers' inability to accurately assess levels of incurred fraud, their fears regarding the impact of false positives when running untested models and the immaturity of the vendor market. During the past few years, many companies have begun to investigate the power of predictive modeling and advanced analysis (including social network analysis) in early detection of claims fraud. Furthermore, most P&C insurers tend to use old, traditional, batch-oriented claims processing and fraud identification, which gives them little ability to perform real-time identification of potentially fraudulent claims at the point of data entry, or tend to use more-granular data analysis to improve the precision of fraud detection. Traditional fraud analysis techniques use analysis procedures to establish a risk score leveraging established claims data, as well as third-party data feeds from services, such as ISO ClaimSearch for P&C insurance, which is mined using visual link analysis and data mining to create models to be used to assess and predict fraud. These traditional solutions, however, normally run in batches using historical pattern analysis or rule engine execution, lacking the capability to detect fraud at the first notice of loss. In addition, many of these solutions lack predictive capabilities using complex models. Modern tools are beginning to integrate with tools such as geocoding, mapping sites and social networking sites, to allow for more in-depth analysis. The tools may also offer case management capabilities to support investigation processes.

In contrast, life insurers are at a very early stage in their search for fraud tools, but Gartner projects increased interest and investment during the next few years. Most interest has been targeted at claims fraud in product lines, such as disability, but is broadening with rising focus in other product areas and for underwriting fraud. Many companies seeking ways to identify false information during the new business and application process to help reduce underwriting losses and be more precise with risk management during sales. Gartner expects interest among life insurers to rise as strategies mature during the next 12 months.

Overall, advanced fraud detection and analysis technologies tend to be limited in scope to certain product lines (for example, workers' compensation). They must mature to become more complete by supporting a range of product lines off the shelf, adding advanced techniques (such as predictive modeling) and running in real time to identify potentially fraudulent claims. As technologies mature during the next few years, interest in these applications among insurers is expected to grow. The focus on gathering additional data from policyholders and analyzing it will become a priority among leading insurance companies. New methods of data collection will be established, including the purchase of third-party data, as well as the use of telematics and monitoring devices to record and monitor automobile driving behavior to reduce litigation costs, and

to provide premiums based on driving patterns for P&C insurance. In the future, insurers will need to assess structured and unstructured data to build accurate fraud algorithms. Furthermore, there will be a greater emphasis on analyzing unstructured data in addition to structured data, and the addition of social network analysis to assess fraud rings.

The result of this attention in both life and P&C insurance has pushed this technology to cresting the peak of the Hype Cycle, and vendor offerings matured to "adolescent" during the past 12 months. However, today only 5% to 20% of the target audience has adopted advanced fraud detection and analysis technologies, with greater rates projected from the P&C insurance sector.

User Advice: P&C and life insurers should look for new ways to identify and flag potentially fraudulent claims at the first notice of loss at data entry, including predictive models. Analysis of structured and unstructured data is required for effective and accurate fraud scoring. Look for solutions that come with prebuilt data models specific to your line of business. These will enable you to know what variables to model and what data is needed to build a predictive model. Enhance fraud efforts to support real-time and more in-depth data analysis, and ensure that your existing claims administration systems can integrate with fraud technologies. Look for solutions that use predictive models to help with the early identification of fraudulent claims. Midsize insurers may find software as a service and hosted fraud detection solutions a better alternative than on-premises software.

Business Impact: The use of advanced fraud detection and analysis technologies will help P&C and life insurers improve their capabilities for real-time and improved identification of fraudulent claims. This will enable organizations to reduce claims losses, reduce the cost and time associated with investigating fraudulent claims, and improve customer satisfaction due to the ability to control premium increases better as losses are minimized. Tools with case management will provide greater efficiency in investigation, and further help with loss control and reduction in processing costs.

For underwriting, the use of advanced fraud technologies will help improve pricing accuracy and risk acceptance. Applications with bad or false information can be identified during the sales process, resulting in either impact on pricing or denial of the policy.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Apara; CSC; Detica; FICO; Infoglide; ISO; IxReveal; LexisNexis; SAS

Recommended Reading:

"Insurers Turn Attention to Fraud Detection, but the Solution Market Is Still Emerging"

Hybrid Cloud Computing

Analysis By: David W. Cearley; Donna Scott

Definition: Hybrid cloud computing refers to policy-based and coordinated service provisioning, use and management across a mixture of internal and external cloud services.

Position and Adoption Speed Justification: Virtually all enterprises have a desire to augment internal IT systems with those of cloud services for various reasons, including for additional capacity, financial optimization and improved service quality. Even enterprises that primarily outsource their runtime operations want to augment their systems with cloud resources. Some IT organizations envision third parties providing an infrastructure to their companies, while managing the operations themselves to meet SLAs. While hybrid cloud computing envisions use of a combination of internal and external cloud services, hybrid IT expands the hybrid notion to include more-traditional environments. Hybrid cloud computing refers to the combination of external public cloud computing services and internal resources (either a private cloud or traditional infrastructure, operations and applications) in a coordinated fashion to assemble a particular solution or to manage and control services uniformly. Hybrid IT and hybrid cloud computing does not refer to using internal systems and external cloud-based services in a disconnected or loosely connected fashion. They imply significant integration or coordination between the internal and external environments at the data, process, management or security layers.

Hybrid IT and hybrid cloud computing can take a number of forms. These approaches can be used individually or in combination to support a hybrid cloud computing approach:

- Joint security and management — Security and/or management processes and tools are applied to the creation and operation of internal systems and external cloud services.
- Workload/service placement and runtime optimization — Using data center policies to drive placement decisions to resources located internally or externally, as well as balancing resources to meet SLAs (e.g., real-time infrastructure).
- Cloudbursting — Dynamically extending an application or a portion of it from an internal, private cloud platform to an external public cloud service based on the need for additional resources.
- Cloud services composition — Creating a solution with a portion running on internal systems, and another portion delivered from the external cloud environment in which there are ongoing data exchanges and process coordination between the internal and external environments. Mashups are a form of integrated solutions where public cloud-based services are combined with internal application components to create a composite application using Web APIs and data success mechanisms (such as RSS feeds).
- Dynamic cloud execution — The most ambitious form of hybrid cloud computing combines joint security and management, cloudbursting, and cloud services compositions. In this model, a solution is defined as a series of services that can run in whole or in part on an internal private cloud platform or on a number of external cloud platforms, in which the software execution (internal and external) is dynamically determined based on changing technical (e.g., performance), financial (e.g., cost of internal versus external resources) and business (e.g., regulatory requirements and policies) conditions. Most companies will use some form of hybrid cloud computing during the next three years. Early adopters are already using mashups and joint security and management approaches. Some are building simple integrated solutions or

implementing cloud management platforms to drive policy-based placement and management of services internally or externally. They may also be experimenting with cloudbursting. The grid computing world already supports hybrid models executing across internal and external resources, and these are increasingly being applied to cloud computing. More-sophisticated, integrated solutions and dynamic execution interest users, but are beyond the current state of the art.

Because most vendors of cloud computing services and technologies have moved their marketing beyond the cloud to hybrid cloud, yet hybrid cloud computing is still in its infancy, we have moved this technology near the Peak of Inflated Expectations. Technologies that are used to manage hybrid cloud computing include cloud management platforms, but also specific services supplied by external cloud providers that enable movement and management across internal and external cloud resources. Most hybrid cloud computing technologies and services seek to lock in customers to their respective technologies and services, as there are no industry standardized approaches.

User Advice: When using public cloud computing services, establish security, management and governance models to coordinate the use of these external services with internal applications and services. Where public cloud application services or custom applications running on public cloud infrastructures are used, establish guidelines and standards for how these elements will combine with internal systems to form a hybrid environment. Approach sophisticated integrated solutions, cloudbursting and dynamic execution cautiously, because these are the least mature and most problematic hybrid approaches. To encourage experimentation and cost savings, and to prevent inappropriately risky implementations, create guidelines/policies on the appropriate use of the different hybrid cloud models. Consider implementing your policies in cloud management platforms, which implement and enforce policies related to cloud services.

Business Impact: Hybrid cloud computing leads the way toward a unified cloud computing model in which there is a single cloud that is made up of multiple sets of cloud facilities and resources (internal or external) that can be used, as needed, based on changing business requirements. This ideal approach would offer the best-possible economic model and maximum agility. It also sets the stage for new ways for enterprises to work with suppliers and partners (B2B) and customers (business-to-consumer) as these constituencies also move toward a hybrid cloud computing model. In the meantime, less-ambitious hybrid cloud approaches still allow for cost optimization, flexible application deployment options, and a coordinated use of internal and external resources.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: BMC Software; CloudStack; HP; IBM; Microsoft; OpenStack; ServiceMesh; VMware

Recommended Reading:

"Design Your Private Cloud With Hybrid in Mind"

Open SCADA

Analysis By: Randy Rhodes

Definition: Supervisory control and data acquisition (SCADA) systems include a human-machine interface, control interfaces for plant systems, data acquisition units, alarm processing, remote terminal units or programmable logic controllers, and communication infrastructure. Open SCADA systems are built on industry and de facto standards rather than closed, proprietary platforms. They may include open-source software.

Position and Adoption Speed Justification: Early SCADA systems were built on proprietary, event-driven operating systems. Today's SCADA systems increasingly depend on commonly available hardware and operating systems. Microsoft and Linux operating systems have been more readily accepted and are common among utility SCADA applications, particularly on client workstations. Most communication subsystems now depend on standard, openly published protocols — such as IEC 60870-5-101 or IEC 60870-5-104, IEC 61850 and Distributed Network Protocol 3 (DNP3) — rather than vendor-specific protocols of the past. Support for the OPC Foundation's Unified Architecture is widespread (based on Microsoft Windows technology, OPC originally meant OLE for Process Control, but now it stands for Open Process Control), and extensions for communications over TCP/IP are available from most vendors.

For electric, gas and water utility applications, open SCADA will be more commonly adapted by small and midsize municipal organizations, where there is less need for complex analytical applications requiring in-depth vendor customization of the overall technology stack. Adoption of open SCADA has slowed due to industry awareness of security issues. Utilities are showing some caution due to the mission-critical nature of modern utility SCADA systems; a worst-case SCADA security disruption could cause costly equipment failure. The North American Electric Reliability Corporation's (NERC's) Critical Infrastructure Protection (CIP) requirements caused North American utilities to review SCADA architectures and security policies. Network security vendors are addressing specialized security risks with ruggedized industrial firewall solutions for SCADA networks. SCADA vendors are adding enhanced security management and compliance monitoring features.

User Advice: Utilities should rely on not only the business unit technical operations staff, but also the internal IT support staff to ensure that these systems are fully maintained throughout their entire life cycles. The IT staff should assist in establishing operational technology (OT) governance on all SCADA projects — including network security, access monitoring, patch administration, and backup and restoration management. The IT staff also should take the lead in establishing clear accountability for ongoing operational support and maintenance via service-level agreements between the IT and OT staffs.

While open architecture systems offer improved flexibility and lower costs, commoditized platforms typically offer a broader "attack surface" to potential intruders. Additional security controls will likely introduce more technical complexity, unexpected implementation delays and increased support requirements.

Business Impact: Open SCADA changes will affect process control and distribution automation functions in electric, gas, water and wastewater utilities.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: CG Automation; Efacec ACS; GE Intelligent Platforms; Open Systems International (OSI); Survalent Technology

Recommended Reading:

"Security Lessons Learned From Stuxnet"

"Vulnerability Management for Operational Technology"

"Five Mistakes to Avoid When Implementing Open-Source Software"

Complex-Event Processing

Analysis By: W. Roy Schulte; Zarko Sumic

Definition: Complex-event processing (CEP) is a kind of computing in which incoming data about events is distilled into more useful, higher level "complex" event data that provides insight into what is happening. CEP is event-driven because the computation is triggered by the receipt of event data. CEP is used for highly demanding, continuous-intelligence applications that enhance situation awareness and support real-time decisions.

Position and Adoption Speed Justification: Companies can get CEP functionality by custom coding it as part of their application, or by acquiring a general purpose event-processing platform and tailoring it to their specific business requirements. Before about 2004, almost all CEP was custom coded into the application because commercial general-purpose platforms were not widely available. Gartner is now tracking 17 commercial platforms, and developers are using them in a growing number of applications. However, companies still get most of their CEP capability by buying a packaged application or tool with custom-coded CEP logic. For example, security information and event management, supply chain visibility, fraud detection, network and system management, and some financial services trading platform products have purpose-built CEP logic built into the respective applications. In many cases, the fact that the product is using CEP is transparent to the buyers, because they deal only with features that are specific to the application.

Companies, governments and other enterprises are greatly increasing their use of real-time analytics — including (but not only) CEP — because the cost of sensors and adapters to acquire data, networks to move data and computers to process data continues to drop dramatically. The accelerating pace of business is increasing the emphasis on speed. Speed is a major component in most modern business strategies, including time-based competition, just-in-time inventory, "zero latency" enterprise, real-time enterprise and other strategies.

CEP is the basis for a growing number of Pattern-Based Strategies, particularly those that leverage low-latency operational intelligence. CEP adds real-time intelligence to operational technology (OT) and business IT applications. OT is hardware and software that detects or causes a change, through the direct monitoring and/or control of physical devices, processes and events in the enterprise. OT goes by various names in different industries, and is often owned and operated independently of IT systems. For example, utilities use CEP as a part of their smart grid initiatives, to analyze electricity consumption and to monitor the health of equipment and networks. CEP helps process feeds of event data such as temperature, vibration and revolutions-per-second that, when analyzed together, may predict impending equipment failure. CEP is also used in business-activity monitoring (BAM) applications that have a high rate of input data (high throughput), require very fast response (low latency) or require the detection of complex patterns (especially temporal or location-based patterns). CEP is one of the pillars of the emerging "big data" movement because of its capability for handing large volumes of data quickly.

User Advice:

- Companies should use CEP to enhance their situation awareness. Situation awareness means understanding what is going on so you can decide what to do.
- CEP is used to help people make faster and better decisions (decision support), and to trigger automated processes that require no human involvement.
- The most common scenario for CEP use involves operational activities that run continuously and need ongoing monitoring, using a sense-and-respond approach.
- CEP can be used wherever a stream of current event data is available from business applications, business partners, social computing, news feeds, sensors, digital control systems or other sources.
- CEP can be used to identify predictable situations that require attention, to identify exceptional threats and to alert users to opportunities that require previously unplanned intervention.

In a utility context, CEP can be used to process a combination of supervisory control and data acquisition events and "last gasp" notifications from smart meters to determine the location and severity of a network fault, and then to trigger appropriate remedial actions. Other common CEP applications include near-real-time precision marketing (cross-sell and upsell), fraud detection, factory floor and website monitoring, customer contact center management, trading systems for capital markets and transportation operation management (for airlines, trains, shipping and trucking). Event-processing platforms are sometimes used in conjunction with intelligent business process management suites to provide more intelligent process monitoring, and to help make flow decisions on a dynamic, context-aware basis.

Business Impact: CEP provides business value in four ways, it:

- Improves the quality of decision making by presenting information that would otherwise be overlooked.
- Enables faster response to threats and opportunities.

- Helps shield business people from data overload by eliminating irrelevant information and presenting only a distilled version of the important information.
- Reduces the cost of manually processing the growing volume of event data in business.

CEP is often structured as an overlay on a conventional application portfolio, enabling a new layer of operational monitoring and real-time response without disrupting the installed base of applications. CEP is one of the key components of emerging intelligent business operations strategies, an approach that integrates event management technology (including CEP and business activity monitoring), decision management technology (including rule engines, predictive analytics, optimization and simulation) and business process management technology (such as workflow and process orchestration) with transactional, run-the-business systems.

- The biggest single source of future demand for CEP may be the emerging "Internet of Things."
- Social computing may be the second largest source of new data and demand for CEP.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: EsperTech; FeedZai; Guavus; HStreaming; IBM; Informatica; Kx Systems; LG CNS; Microsoft; Oracle; Progress Software; SAP; Software AG; StreamBase Systems; Tibco Software; Vitria; WestGlobal

Recommended Reading:

"Sourcing Strategies for Complex-Event Processing"

"How to Choose Design Patterns for Event-Processing"

"Apply Three Disciplines to Make Business Operations More Intelligent"

Social Analytics

Analysis By: Carol Rozwell

Definition: Social analytics describes the process of collecting, measuring, analyzing and interpreting the results of interactions and associations among people, topics and ideas. These interactions may occur on social software applications used in the workplace, in internally or externally facing communities, or on the social Web. Social analytics is an umbrella term that includes a number of specialized analysis techniques, such as social filtering, social network analysis, sentiment analysis and social media analytics.

Position and Adoption Speed Justification: The desire to find meaning in the myriad sources of social information available on the social Web, as well as internal information, is spurring interest in social analytics. There are huge volumes of data that appear in a variety of forms and much of this information is changing very rapidly. These issues contribute to the complexity of analysis.

Social software vendors, such as IBM and Microsoft, have added tools for social analytics to their applications that measure adoption and growth to provide an understanding of community dynamics. The data makes individual behaviors, content and interactions visible. Social media monitors look for patterns in the content of conversations across all social media spaces. They extract actionable or predictive information from social media and, in some cases, offline media. The acquisition of Radian6 by salesforce.com is an example of a social software platform vendor extending its social analytics capability to include social media monitoring.

User Advice: Organizations should ensure that their initiatives are positioned to take advantage of social analytics to monitor, discover and predict. Some enterprises will be content to monitor the conversations and interactions going on around them. Enterprises with social software platforms that provide social analysis and reporting can use this information to assess community engagement. They can also easily monitor what is being said about the company, its products and the brand using simple search tools or more sophisticated sentiment analysis applications.

The results of social analytics (for example, discovered patterns and connections) can be made available — often in real time — to the participants of the environment from which the data was collected to help them navigate, filter and find relevant information or people. Other enterprises will mine the social analytics data, actively looking to discover new insights using a wide range of business intelligence applications. At this time, the use of social analytics information for predictive purposes is a largely untapped source of value. However, marketing and product development teams express great interest in this capability.

In many organizations, social analytics applied to external activity (for example, sentiment analysis across the Web) will be sourced by marketing professionals and others (such as the legal department, product development and customer support). In those cases, IT needs to play a leadership role in orchestrating a coordinated set of activities across departments to, for example, minimize duplication of effort, ensure coordination between efforts and standardize taxonomies.

Business Impact: Social analytics is useful for organizations that want to uncover predictive trends based on the collective intelligence laid open by the Internet. For example, a biopharma researcher could examine medical research databases for the most important researchers, first filtering for the search terms and then generating the social network of the researchers publishing in the biopharma's field of study. Similarly, social analytics could be used by marketers who want to measure the impact of their advertising campaigns or uncover a new target market for their products. They could look for behaviors among current customers or among prospects that could enable them to spot trends (deterioration in customer satisfaction or loyalty) or behaviors (demonstrated interest in specific topics or ideas).

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Attensity; BuzzLogic; galaxyadvisors; IBM; News Patterns; salesforce.com; SAS; Trampoline Systems; Visible

Recommended Reading:

"Turn Information into Insight With Social Analytics"

"Marketing Essentials: How to Build a Social Analytics Strategy to Mine Customer Insights"

"Competitive Landscape: Social Analytics"

Semantic Web

Analysis By: Gene Phifer

Definition: The Semantic Web is a grand vision of a machine-readable Web, and a collection of technologies to implement that vision.

Position and Adoption Speed Justification: The Semantic Web was first described in detail by Tim Berners-Lee in 2000, and envisions a shift from a "Web of documents" to a "Web of data," where information is richly described by tags or links embedded in documents and Web pages or other data structures. The Semantic Web (http://webknox.com/blog/2010/05/linked-open-data-on-the-Web-visualization/) uses an array of technology standards, formats and languages (for example, XML, Resource Description Framework [RDF] and Web Ontology Language [OWL]) to define information properties and relationships, and to connect Web components to each other.

The World Wide Web Consortium (W3C) Semantic Web standards define how to connect content components without regard for what the components themselves contain or define. Those specifics are developed and maintained by groups with domain expertise, for example, the subgroup for publishing works on branding and digital rights, and a healthcare subgroup that works on disease monitoring and linking patients to clinical trials. There's no structural similarity or relationship among the different subgroups, or an overarching model that's evolving. Domains have their own Semantic Web models (for example, Systematized Nomenclature of Medicine [SNOMED] for healthcare, and eXtensible Business Reporting Language [XBRL] for finance) that provide specific value, but are not attempts to define syntactic or Semantic Web models that can cover all information.

The traditional use of Semantic Web has a lot of baggage associated with it. Lack of definitive progress and confusion would drive the traditional Semantic Web into the Trough of Disillusionment. However, significant new advances are breathing new life into Semantic Web, and are causing their own new hype to occur.

A major advance in the vision of the Semantic Web, the one that has pushed it along on the Hype Cycle, has been the explosion of social networking and social tagging with sites such as Facebook, YouTube, Myspace, Flickr, Wikipedia and Twitter. Users directly and indirectly add tags by making comments, adding pointers to other websites and embedding links in everything they communicate about. The "social graph" generated by this tagging is a form of the "Giant Global Graph" as envisioned by Berners-Lee. However, the constrained implementation of this in closed and controlled platforms falls short of Berner-Lee's vision of an open, interoperable Semantic Web. In fact, the Semantic Web has fallen short of many expectations. The startup ventures that arose in the early 2000s have faded or been absorbed into larger initiatives (e.g., Bing absorbed Powerset, and Google absorbed Metaweb) without much user-visible impact.

The term "linked data" has been used a lot recently to denote efforts to bring sanity to the world of big data. Linked data is an old Semantic Web concept, but one that has seen some recent activity. The W3C has an outreach group on Semantic Web, and sponsors the Linking Open Data (http://www.w3.org/wiki/SweoIG/TaskForces/CommunityProjects/LinkingOpenData) community project. The goal of this project is to publish multiple open datasets as RDF and to establish links between data from different sources (http://webknox.com/blog/2010/05/linked-open-data-on-the-web-visualization/). As of September 2011, this effort has produced 31 billion RDF triples, interlinked by around 504 million RDF links.

Since its unveiling, the Semantic Web has been full of promise, which has been largely unfulfilled. In the latter part of the 2000s, this changed as interest in and awareness of semantic tagging and mining technologies grew, and then subsided as many of the pioneering ventures were acquired or absorbed, and disappeared from the radar. However, interest continues, as evidenced by the following:

- Enterprises are investigating how to mine their huge content corpora to extract intellectual property, prior thinking, research findings and other information that may be relevant for solving today's problems. Some content dates back many years and includes both electronic and nonelectronic records.
- Some enterprises are revisiting their data to see whether they have conducted research or pursued product development in the past relevant to what they're investigating in 2011. This is to learn from the earlier work, but also to avoid pursuits that may lead to failure or suspended projects, as they have in the past.
- A few enterprises are working to make their corporate memory accessible to all who need it. They are looking to Semantic Web technologies to see how they might do this.

The effort to leverage the wisdom of the crowds via analysis of big data is moving forward. There are vast amounts of information buried in data created by the collective. Where tags and relationships are included, this data becomes available for analysis via Semantic Web approaches. Early implementations of this include Google's move toward semantic search.

Even with this growing interest in exploiting semantic technologies, it will be a long time before a significant part of the Web is semantically tagged with rich OWL/RDF ontologies. It is social tagging that is preceding formal processes. This informal Semantic Web of linked references lacks the reasoning power afforded by RDF. The tags don't capture the explanation for why the content is linked. The links aren't labeled — with "is," "has" or "happened earlier" — as they are with RDF. This tagging achieves the goal of creating a Web of connected information, but leaves finding and navigating the connections to the users.

Proprietary schemes such as those used by Facebook have superseded open standards like "friend of a friend" (FOAF), and have themselves been challenged by competing initiatives (e.g., Google+), resulting in fragmentation and lack of data portability, as well as limited interoperability.

The formal principles of the Semantic Web are being adopted earlier by some groups, such as life sciences, where there are complex data relationships and the value of highly structured ontologies

is high. Web pages are adding semantics via semantic hypertext. Maturing technologies and standards, along with a broader view of the Semantic Web that embraces multiple approaches to creating linked data (for example, tagging schemes using microformats), are generating a renewed interest in semantics. As Semantic Web experiences a resurgence with the social Web, we expect to see it continue to move along the Hype Cycle curve.

Multiple projects exist that are advancing the concepts of the Semantic Web. These include:

- DBpedia — with structured data from Wikipedia
- FOAF — describes social connections
- GoPubMed — provides Semantic search for life sciences
- GoodRelations — for e-commerce; expresses product information for e-commerce applications
- SmartData, FIBO — for financial services transactions
- Linking Open Data — links RDF data

User Advice: Identify existing ontologies that are specific to your domain, and use them where there is a need to define extensive formal vocabularies or complex data relationships. If possible, use vocabularies that are specific to a smaller community (for example, business partners or suppliers), but have growing adoption and developing support by vendors. Industries where there is the most activity and that are most likely to be financially valuable include life sciences, healthcare, library sciences, defense, government and financial services.

Business Impact: Delivering information across the Web with machine-readable and interpretable semantics offers the potential for enhanced application/site interoperability, automation of information discovery, more contextually relevant searches, and search options that are difficult or impossible without rich semantic information. In addition to tagging data elements with basic vocabularies (for example, tagging items to identify personal and organizational information), Semantic Web ontologies enable the creation of more sophisticated concepts, enabling systems to infer relationships across datasets where they have not been explicitly defined, thus improving the quality of content management, information access, system interoperability and database integration.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Google; IBM; Microsoft; Mondeca; Ontoprise; Oracle; Reuters; SAS; SchemaLogic; Thetus; TopQuadrant

Cloud-Based Grid Computing

Analysis By: Carl Claunch

Definition: Grid computing involves using computers in a public cloud service, or a hybrid of public cloud and internally owned computers, to collectively accomplish large tasks such as derivative risk analysis, candidate drug screening and complex simulations. We do not include grids that use private cloud or traditional in-house servers only, those are treated as "grid computing not using public cloud computers."

Position and Adoption Speed Justification: Grid computing using public cloud resources is an extension of the general use of grids. Because of the new issues introduced by the public cloud services — including the lack of appropriate software licensing terms, challenges dealing with data related to the computations, security and privacy concerns, and deriving an adequate chargeback model — cloud-based grid computing is considerably earlier on the Hype Cycle than its more-mature incarnation, which runs wholly within enterprise and partner walls. The substantive change of position is the result of grid computing becoming interesting and closely watched by a much larger segment of the high-performance computing (HPC) market. It was the most common topic of discussion among users this past year and is the basis of many inquiries from our clients.

When it was less mature and perceived to be risky, those that moved forward tended to have situations where the benefits were huge, warranting the risks of very early adoption. Now that it is perceived as less risky and appeals to many more in the market, the bar to moving forward is lower; the average benefit will be high, while a smattering will apply this for transformational gains.

User Advice: Conceptually, grid computing can be used in two ways. It can help lower costs to process a fixed amount of work or, more importantly, it can offer business advantage by accomplishing what wasn't feasible with more-traditional approaches. Often, this means increasing the accuracy of a model, producing results in an unprecedentedly short time, looking for interactions earlier, reducing the time it takes to search libraries of compounds as drug candidates or enabling new business models.

When business advantage can be gained by scaling up computing-intensive or data-intensive processing in parallel, add grid computing to the list of potential implementation approaches. When the objective of sourcing the computing resources from a public cloud provider is to access additional power that can't be justified in a traditional long-term acquisition model, add this as an option. However, be wary of the many unique issues that arise in this deployment model. When the objectives are mainly to reduce costs, compared with traditional sourcing of the computers for a more fixed and long-term workload level, consider alternatives (e.g., an in-house grid using a traditionally acquired computer) that are more mature and have fewer issues to overcome.

Public cloud resources offer the ability to dynamically scale to meet varying computing needs, on short notice, and often with a cost model that is appropriately short term, or perhaps charges based only on usage. We have provided a list of sample vendors below that offer public cloud computing services (such as Amazon Elastic Compute Cloud [EC2] or Microsoft Azure) or that sell software that enables and supports access to public clouds or hybrids of public and private cloud machines.

Business Impact: Investment analysis, drug discovery, design simulation and verification, actuarial modeling, crash simulation and extreme business intelligence tasks are all areas in which grid computing may provide a business advantage. The potential to deal with wide swings in compute

requirements or short-term projects, using a cloud provider to deliver a reasonable cost structure, is the main reason cloud-based grid computing is soaring up the Hype Cycle.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Amazon; Gridcore-Gompute; IBM; Microsoft; Penguin Computing; SGI; Univa UD

Recommended Reading:

"How Cloud Computing Relates to Grid Computing"

Cloud Collaboration Services

Analysis By: Jeffrey Mann

Definition: Cloud collaboration services typically include email, IM, document repositories, team workspaces, discussion forums, wikis, blogs, Web/audio/video conferencing and many types of social software provided from a shared, multitenant public cloud infrastructure.

Position and Adoption Speed Justification: Collaboration services are particularly well-suited to cloud-based deployment. They are: generally well understood and reasonably mature technologies; require less integration and tailoring than many other software categories; and are most valuable when deployed widely.

Collaboration services in some form have been available from the cloud for some time. In fact, Web conferencing was the first technology to gain widespread acceptance using the cloud deployment model. Cloud-based email and team workspaces have also existed for many years. However, reports of sporadic outages and privacy, data sovereignty, confidentiality and security concerns with other cloud collaboration services have limited widespread adoption. Gartner believes many of these attitudes are poised to change. Cloud email in the consumer market from services like Yahoo, Hotmail and Gmail has convinced many that the model works, even though business requirements for availability, confidentiality, archiving, security and compliance are higher for enterprise users. Although cloud email is usually the primary driver for cloud collaboration services, usage usually expands into other areas as the services prove their worth.

Although some vendors provide narrow offerings that concentrate on one or two of these technologies, the larger trend is to provide a bundled suite of capabilities across the spectrum of collaboration services. Megavendors like Microsoft (with its Office 365 offering), Google (with Google Apps for Business) and IBM (with SmartCloud for Social Business) provide these cloud-based collaboration suites. At the other end of the market, many social software startups are launching specific collaboration services based on cloud deployment models.

Two more recent drivers for cloud-based collaboration services are the increasing need for mobile access, and requirements for interenterprise collaboration. IT departments find it difficult to keep up

with the technical demands of supporting many different devices. Moving responsibility for mobility and providing widespread network access needed for mobility and remote access makes cloud deployments more attractive. Cloud-based systems provide a somewhat neutral ground when collaborating with other enterprises. They reduce the complexity of traversing firewalls and managing external users.

User Advice: Unless the cloud model is unappealing or impossible due to organizational culture or compliance, privacy and security concerns, most organizations should be evaluating some form of cloud collaboration services, especially if they are facing necessary change in their current collaboration infrastructure due to major upgrades or vendor swaps. At a minimum, understand your incumbent collaboration vendor's plans (or lack of plans) to support cloud deployment. However, in the absence of other compelling drivers, organizations that are happy with their current infrastructure need not abandon what they have to move to the cloud. Cloud collaboration services are not suited to all organizations.

Business Impact: Although the expected growth in movement to the cloud for collaboration services will have wide implications for the industry as a whole, it will have a moderate to low impact on individual organizations. They will experience lower costs and more flexibility, as fewer resources will be needed to provide collaboration services to employees. Although these benefits will allow companies to provide more employees with access to these services, they will not suddenly enable large shifts in business practices or new capabilities. The potential benefits are real, however. For those organizations comfortable with the idea of cloud deployment, collaboration services will be a natural contender.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Cisco; Google; IBM; Microsoft; salesforce.com; Yammer; Zoho

Recommended Reading:

"The Cloud E-Mail and Collaboration Services Market"

"Google Apps for Business: Leading with Gmail"

"Explore Microsoft's Office 365 Plans and Suite Options Now in Advance of IT Operations Inquiries"

Cloud Parallel Processing

Analysis By: Daniel Sholler

Definition: Cloud parallel processing techniques are algorithmic and code-structuring methods that enable parallelization of program functions. These techniques have been automated at the processor level, but the availability of large-scale grid systems through the adoption of cloud

architectures creates an opportunity to apply the techniques to application system design. Approaches to parallelism at this level are becoming necessary for applications to leverage the massive amounts of data available from the Web, social networks and large-scale systems.

Position and Adoption Speed Justification: While the concepts of parallel processing have been studied for years, the reality has not affected most developers. Parallelism techniques have been used to improve the performance of system software, databases and other specialty programs, but the typical enterprise developer has been shielded from the need to understand how to structure programs for parallelization through increasingly sophisticated middleware and other system components. Most parallelization progress has focused on moving serial workloads onto multicore and multithreaded processes. However, as cloud computing concepts become reality, the need for some systems to operate in a highly dynamic grid environment will require the techniques to be incorporated into some mainstream programs. This is particularly true for analytical tasks that incorporate large datasets. The popularity of the Hadoop implementation of the map/reduce technique is a good example of this trend, as are the growing popularity of in-memory data grids (IMDGs), and the use of parallel programming languages and infrastructure, such as the combination of Scala and Akka. While vendors will continue to package middleware and extreme transaction processing components that simplify parallelization, the application developer can no longer ignore this as a design point for applications that leverage huge sensor networks, social media and other Internet-generated data, as well as global-class transactional systems, such as online gaming and other consumer transactions.

Currently, few developers are trained in these tools and techniques, and there will likely be a flurry of interest as large-scale grids (public and private clouds) become readily available. While only a small percentage of applications require these techniques, the applications will be high-value systems. During the next four years, related knowledge and skills will penetrate the market. By 2015, we expect a sufficient percentage of developers to use the techniques to build the required applications. Systems supporting parallelization techniques exist, but will develop in range and sophistication during this evolution. For most purposes, developers will rely on improvements in automated parallelization techniques, but a small number of applications that leverage high-volume or high-scale information sources will require these manual or assisted techniques. Generally, the applications will be those in which the cloud infrastructure enables a truly differentiated user experience, or that enable previously unfeasible capabilities. The applications are likely to be linked to contextual computing, where (for example) the relationships among millions of locations must be recalculated every time one changes, or for Pattern-Based Strategy processes, where systems will sift masses of information for relevant patterns or global-class systems.

Finer distinctions will be made among sets of capabilities. Moving applications to a highly virtualized and distributed cloud environment can help certain classes of problems, and moving to an infrastructure presenting huge shared memory spaces and many processor cores can help a different class of problem. From 2014 to 2015, vendors will start offering problem-specific solution packages that incorporate and expose parallelization techniques.

User Advice: Users should determine the timeline for using cloud- and grid-based computing, and should ensure that, as these infrastructures become available, the developer community has the appropriate skills to fully utilize their potential.

Business Impact: Parallelization will make economically viable the implementation of many algorithms and workloads not currently feasible at a cost that is reasonable for mainstream organizations. The types of problems, the granularity of the analysis (and simulation), the scope of data and the speed with which it can be accomplished will be affected. Currently, this is a challenge in fraud detection, predictive analytics, algorithmic trading and online gaming, but this class of uses will expand rapidly in the next few years. The widespread use of these techniques will enable many organizations to produce truly global-class applications, and business data providers will be the most aggressive in developing systems that use these techniques. In many cases, parallelization can create a qualitative shift in user experience, which results from dramatically speeding certain processes. By enabling decisions to occur in seconds that currently take days and weeks, businesses create new opportunities for managing their processes, and for increasing the accuracy and cycle times of decision making.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Recommended Reading:

"Selecting the Right Software to Run Parallel HPC Applications"

"How to Choose the Right Apache Hadoop Distribution"

"Search Analytics Trends: Hadoop Is Getting Hot"

"What IT Leaders Need to Know About In-Memory Data Grids"

Geographic Information Systems for Mapping, Visualization and Analytics

Analysis By: C. Dwight Klappich

Definition: A geographic information system (GIS) is a series of computer-based technologies used for producing, organizing, analyzing and presenting spatial (geographical) data, as well as other associated textual, numeric and graphical data. These provide database management, mapping, image processing and statistical analysis that support the display and analysis of geographic information. In transportation, GIS allows for viewing and analyzing freight movements geographically for trends, as well as monitoring current and historic activities.

Position and Adoption Speed Justification: The ability to view and analyze freight movements visually and geographically is critical for spotting trends, as well as monitoring current and historic activities. The saying that "a picture (or graphical representation, in this case) is worth a thousand words" is readily apparent in transportation, where highlighting data on a map can enable users to easily see things that might be more difficult to infer from reports and spreadsheets.

For example, displaying move density in a specific geography might reveal the appearance of movement bottlenecks more clearly than trying to infer a potential problem from the same data in a spreadsheet. Using a GIS in a transportation context enables the visualization of freight operations on maps. More importantly, it provides analytical capabilities based on this geographical information. Because of the geographical nature of freight movements, it is common for daily routes and shipment plans to be displayed on maps, but less common for historical information to be analyzed and displayed geographically, and even less common for predictive, future information to be analyzed.

Most transportation management system (TMS) applications provide basic mapping capabilities, but many simply display planned routes and shipments that are overlaid on the map for visualizing the day's activities. Although this may be acceptable for showing daily delivery and pickup information, the use of geographical visualization and analysis is limited in most TMSs. Many transportation groups use other GIS tools for more analytical work, such as assessing lane density, traffic congestion, traffic problems (such as seasonal road construction) or other situations by geography. Commercial GIS solutions are mature, but users will have to build their own transportation models to exploit these tools. Over time, TMS vendors will build more geographical analytics into their core TMS solutions, marrying this with their performance management capabilities. But, this is several years away.

Users might benefit from considering scenarios, such as viewing daily congestion in certain areas, so that shipments could be scheduled to avoid these locations at a particular time of day, or viewing the density of deliveries and pickups in a particular area to determine whether there might be ways to better exploit combining deliveries. Although TMS vendors have added enhanced reporting-centric performance management capabilities, we anticipate that some vendors will consider adding more GIS-based analytics, even going as far as considering simulation capabilities to make this analysis more predictive.

Initial GIS analytical solutions will focus on historical reporting and analysis. However, combining GIS with other information, such as weather reports, could provide additional predictive management capabilities. Finally, systems that use GIS-based interfaces for interactions with the system, rather than just reporting functions, could provide more-intuitive access to complicated business transactions, which would be a dramatic step forward in driving the adoption of this technology. Some users are considering having users, like dispatchers, interact with the system directly from a map, supporting things like dragging and dropping loads to routes or other shipments right on the map.

User Advice: For daily route visualization, use the functionality provided by your TMS provider. For more GIS-based analytical capabilities, users must build their own solutions, using commercial GIS tools, at least for the near future.

Business Impact: Understanding geographical considerations in managing freight operations is necessary, given the point-to-point nature of transportation.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Autodesk; Descartes Systems Group; Esri; Google (Google Maps); Intergraph; Navteq (Traffic.com); Oracle (Oracle Transportation Management); Pitney Bowes Business Insight (MapInfo); Roadnet Technologies; TomTom

Recommended Reading:

"Magic Quadrant for Transportation Management Systems"

Database Platform as a Service (dbPaaS)

Analysis By: Donald Feinberg

Definition: A database platform as a service (dbPaaS) is a database management system (DBMS) or data store engineered as scalable, elastic, multitenant service, and sold and supported by a cloud service provider. They are available as one-to-many cloud services, are not necessarily relational, and they offer a degree of self-service. EnterpriseDB's Postgres Plus Cloud Database and Microsoft's Windows Azure SQL Database are examples of complete DBMSs, while products like Amazon's SimpleDB are nonrelational data stores with different persistence models.

Position and Adoption Speed Justification: All the currently available dbPaaS offerings are relatively new. EnterpriseDB entered this market in 2012 with its Postgres Plus Cloud Database. Microsoft's Windows Azure SQL Database entered full production at the beginning of 2010 and still has some size restrictions, though Microsoft plans eventually to lift these. The other fully relational dbPaaS offerings with atomicity, consistency, isolation, durability (Acid) properties are salesforce.com's database.com and Oracle's Application Express (Apex).

There are several non-Acid dbPaaS offerings that allow for eventual consistency, which restricts them to less complex, and normally single-user, transactions — especially where data is used by only one transaction at a time and locking is not required. Non-Acid dbPaaS technology is becoming more widely used for Web 2.0 development projects, where sharing of data among multiple tenants in the cloud is not a requirement of the application.

The low number of offerings in the market is due to the difficulties of creating multitenant, automatically elastic database services. But dbPaaS will mature quickly as more offerings become available.

Most of the DBMS engines are available on a cloud infrastructure (for example, Amazon's Elastic Compute Cloud, but these are not dbPaaS according to our definition. The standard DBMSs are not specifically engineered to take advantage of the cloud: this includes Amazon's Relational Database Service (available for MySQL and Oracle implementations), IBM's DB2, Oracle's offerings and many others. These are offered as hosted services, not as cloud services, since the data store software in question makes no provision for elasticity or other cloud capabilities, and users are expected to manage the DBMS instances and infrastructure as a service (IaaS). In addition, users normally purchase the licenses separately from the IaaS.

Currently, dbPaaS is used primarily for the development and testing of applications — where database sizes are small and issues of security and sharing with multiple users are not a concern. Recently, we have seen examples of applications using dbPaaS in production applications deployed in the cloud on Windows Azure SQL Database, database.com and others. This growing use for development and production, coupled with the growing number of offerings, moves the technology past the Peak of Inflated Expectations.

Many Web 2.0 applications may be experimenting with some of these services, but most still rely on non-cloud-based DBMS implementations. One exception is where all the data already exists in the cloud and it is desirable to have the application there, with the data. One advantage of dbPaaS is that it doesn't use license-based pricing, but rather elastic pricing (the more you use, the more you pay; the less you use, the less you pay) or fixed subscription pricing (a flat price per user). This flexibility is an advantage as long as the "rental" price does not exceed the standard licensing cost.

The rate of adoption of dbPaaS will depend on its increasing maturity, the acceptance of cloud system infrastructure in general, and the maturation of dbPaaS offerings. It will also depend on the usage model and whether the relaxed consistency model can be used by an application. Gartner believes additional dbPaaS products will become available as true cloud services during the next few years, in line with what Microsoft has done with Windows Azure SQL Database. As more products become available and their use increases, we expect to see the maturity level and market acceptance grow, although this will be closer to the five-year horizon.

User Advice: Advice for users in the next two years:

- Restrict use of dbPaaS to development and test systems, single-user systems, or those requiring file storage in the cloud with one writer and multiple readers. This is especially important when the time to delivery is short and resources and funding are scarce.
- Know that use of the few proven products, such as Windows Azure SQL Database, Apex and database.com, in a production environment for smaller applications is becoming realistic if the costs in that environment meet your requirements.
- Consider limited use of dbPaaS for hosting Web-specific content.
- Be cautious about dbPaaS, as there are still issues with security and reliability, and with non-relational DBMSs there are issues with concurrent user control.
- Exercise care with systems with high levels of data transference — most cloud infrastructure vendors charge for movements of data in and out of the cloud.
- Recognize that latency is another data transfer issue — the time available to transfer large amounts of data to the cloud (for example, to support a data warehouse in the cloud) can be restricted. Hence, initial usage for development systems (with minimal data transfer) can be beneficial, before moving the systems in-house after development.

Business Impact: Initially, dbPaaS will have an impact on software vendors (especially smaller ones) requiring a less-expensive platform for development. Increasingly, Gartner's clients report similar use for application development within IT organizations. As dbPaaS gains maturity (especially in scalability, reliability and security), implementations used for short-term projects (such

as small departmental applications and rapid development platforms) will show some marked cost reductions, compared with implementations within IT departments. These cost savings will be primarily based on the ability to set up a dbPaaS environment without the use of expensive IT personnel. The speed of setup will be a primary driver of the rapid deployment of systems — without the usual requirements and planning necessary for IT projects within the IT department. This will also reduce the need for IT staff to respond to short-notice and short-duration projects, so reducing overall IT costs.

Elasticity is a requirement for a DBMS to be classified as a dbPaaS. Elastic resource allocation for the virtual machines and the storage must be provided by the DBMS for both simple and complex transactions. This can have an impact on overall cost as usage requirements change over time, especially if usage is seasonal (as, for example, in the retail sector).

As dbPaaS offerings mature during the next two to five years, it will be possible for an organization to host its entire DBMS infrastructure as dbPaaS, with potential reductions in the cost of servers, storage, DBMS licenses, maintenance and support, storage management and database administration. This will be of interest, particularly for financial managers monitoring costs and desiring to reduce the overall cost of IT.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Amazon; EnterpriseDB; Google; Microsoft; Oracle; salesforce.com

Recommended Reading:

"Platform as a Service: Definition, Taxonomy and Vendor Landscape, 2012"

In-Memory Database Management Systems

Analysis By: Roxane Edjlali; Donald Feinberg

Definition: An in-memory database management system (IMDBMS) is a DBMS that stores the entire database structure in memory and accesses all the data directly, without the use of input/output instructions to store and retrieve data from disks, allowing applications to run completely in-memory. This should not be confused with a caching mechanism, which stores and manages disk blocks in memory cache for speed. IMDBMSs are available in both row-store and column-store models.

Position and Adoption Speed Justification: IMDBMS has been around for many years (for example, IBM solidDB and Oracle TimesTen), but many available now are new within the past two or three years: VoltDB and SAP Sybase ASE were new in 2010, SAP Hana was released in mid-2011, and new vendors such as ParStream continue to emerge While several IMDBMSs are mature, many are new or have limited adoption, and so we have retained its position on the Hype

Cycle from last year. However, we expect adoption to accelerate in the next two years, based on client interactions demonstrating a high level of interest and growing adoption of these technologies.

Many use cases are supported by IMDBMS: solidDB, StreamBase and TimesTen were originally developed for high-speed processing of streaming data for applications such as fraud detection, with the data then written to a standard DBMS for further processing. Others such as Altibase, SAP Sybase ASE and VoltDB focus on high-intensity transactional processing. Some IMDBMSs, such as Exasol, ParStream or Kognitio are dedicated for in-memory analytical use cases. SAP Hana, although primarily for analytics and data warehousing, has begun to support both online transaction processing (OLTP) and analytics in the same database (with the general availability [GA] of BusinessOne powered by Hana).

Given the different maturity levels across the various vendors, the level of support for high availability and disaster recovery can vary. The perceived risk involved with memory failures and lack of reliable high-availability disaster recovery, and sufficiently fast backup and recovery techniques continue to be an issue when selecting an in-memory DBMS. As this functionality is added often through a combined software and hardware offering including clustering, this inhibitor will decrease in importance. The other limiting factor in terms of adoption is the availability of skills and practices.

User Advice: Continue to use IMDBMS as a DBMS for temporary storage of streaming data where real-time analysis is necessary, followed by persistence in a disk-based DBMS.

For the next several years, IMDBMS can be used for OLTP with the understanding that extra care must be exercised to assure a high-performance environment and logging to a persistent store, such as disk, solid-state drive and Flash.

IMDBMS for analytic acceleration is an effective means to achieve increased performance. However, given the diverse level of maturity of the vendors, organizations should verify references and run a thorough proof of concept to ensure the technology meets their expectations.

The single most important advancement will come as IMDBMS matures as a column-store, combined OLTP and online analytical processing model as a basis for new, previously unavailable applications; taking advantage of real-time data availability, with IMDBMS for increased performance and reduced maintenance.

Organizations should evaluate the business innovation opportunities from new IMDBMSs as they mature — to address OLTP and real-time analytical use cases.

Organizations evaluating the IMDBMS should revisit data governance and data warehouse practices and design in order to take advantage of the increased performance without losing in data quality or data consistency.

Business Impact: Once these IMDBMSs become mature and proven — especially for reliability and fault tolerance — and as the price of memory continues to decrease, the potential to the business is transformational:

- These systems utilize hardware systems that require far less power (as low as 1% of the power of an equivalent disk-based system, according to several hardware vendors) and cooling — leading to huge cost savings.
- The high performance implies that smaller systems will do the same work as much larger servers, again with major cost savings.
- Column-store IMDBMS has the potential for a combined OLTP and data warehouse (DW) single database model that will enable an entire set of new applications that were not possible before because of the latency of data moving from the OLTP system to the DW.
- The speed of IMDBMS for analytics has the potential to simplify the DW model by removing development, maintenance and testing of aggregates, summaries and cubes. This will lead to saving in terms of administration and increased flexibility for meeting diverse workloads.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Exasol; IBM; Kognitio; McObject; Oracle; ParStream; QuartetFS; SAP; VoltDB

Recommended Reading:

"Cool Vendors in Advancing Data Management Maturity, 2012 "

"What CIOs Need to Know About In-Memory Database Management Systems "

"SAP Throws Down the Next-Generation Architecture Gauntlet With HANA "

Activity Streams

Analysis By: Nikos Drakos

Definition: An activity stream is a publish-and-subscribe notification mechanism and conversation space typically found in social networking. It lists activities or events relevant to a person, group, topic or everything in the environment. A participant subscribes to, or "follows" entities (e.g., other participants or business application objects) to track their related activities. For example, a project management application may add status information, while a physical object connected to the Internet may report its state (e.g., tunnel lane closure).

Position and Adoption Speed Justification: Activity streams are available and popular on consumer social networking sites, such as Facebook, as well as in business social software products used within an organization. Users can usually control how much of their activity stream is visible to other users. Activity streams in business environments may also contain information about business events that are "injected" into a stream from business applications, as well as individual user activities. Activity streams have the potential to become a general-purpose mechanism for personalized dashboards, and general information dissemination and filtering. Beyond notifications

and conversations, it is also possible to embed "live widgets" or gadgets — for example, a simple browser interactive application — through which someone will not only be notified about an event, but also will interact with the notification. For example, a notification about a survey may contain a live survey, or a notification about an expense report may contain action buttons that can open the report or allow the user to approve it.

In addition, many people are reluctant to participate within social network sites when they are limited to posting simple status messages. This inhibition is to be expected, yet participation is essential for information sharing, collaboration and community building. Activity streams populated with automated notifications enables a low overhead mechanism that can stimulate conversation and broaden community participation.

Activity streams can be surfaced within many contexts, including various places within a social network site (for example, a profile, a group or topic page) as well as embedded within an application (for example, an email sidebar or beside a business application record).

Activity streams can provide a conversation space populated with intersecting discussions that are sparked by activities or events.

User Advice: Tools that help individuals expand their "peripheral vision" with little effort can be useful. Being able to choose to be notified about the ideas, comments or activities of others on the basis of who they are, or the strength of a relationship, is a powerful mechanism for managing information from an end user's perspective. Unlike email, with which the sender may miss interested potential recipients or overload uninterested ones, publish-and-subscribe notification mechanisms such as activity streams enable recipients to fine-tune and manage more effectively the information they receive.

Activity streams should be assessed in terms of their relevance as general-purpose, information access and distribution mechanisms. Most established enterprise software vendors, as well as many specialist ones, have introduced activity streams in their products and it is important to be ready to understand their implications in terms of business value, cost and risk. There are several aspects of enterprise implementations that will require particular caution. They include: the richness of privacy controls that enable users to manage who sees what information about their activities; the ability to organize information that has been arbitrarily gathered through an activity stream and to determine its authoritativeness; the ability to mitigate compliance and e-discovery risks; the ability to cope with information overload with over-popular activity streams; and increasingly, the possibility of multiple, overlapping activity streams in the same organization as each internal or external system introduces its own activity stream.

Business Impact: There is an obvious application of activity streams in managing dispersed teams or in overseeing multiparty projects. Regular updates of status changes that are collected automatically as individuals interact with various systems can keep those responsible up to date, as well as keep different participants aware of the activities of their peers. Activity streams can help a newcomer to a team or to an activity understand who does what and, in general, how things are done. Activity streams are extremely popular with users of consumer social networks such as Facebook, Twitter or Google+, and their popularity will drive interest and usage of activity streams

in business environments. Activity streams are likely to become key mechanisms in business information aggregation, distribution and filtering.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: BroadVision; Cisco; Citrix Systems; Facebook; IBM; Jive; Moxie Software; NewsGator; Oracle; Qontext; salesforce.com; SAP; Socialtext; Tibco Software; VMware; Yammer

IT Service Root Cause Analysis Tools

Analysis By: Jonah Kowall; Donna Scott; Debra Curtis

Definition: In the context of real-time infrastructure (RTI), root cause analysis (RCA) tools identify IT infrastructure performance and availability issues and determine the underlying root cause so an automated corrective action can be taken, such as reallocating IT resources. RCA tools have made progress in terms of IT service components and application monitoring. However, there does not yet exist an end-to-end IT service topology; thus, RCA represents a significant impediment to achieving RTI.

Position and Adoption Speed Justification: Root cause analysis is enabled through instrumentation, which is embedded in component hardware and software agents, that can investigate other components that make up the RTI. It is a functional attribute of a number of availability and performance management tools such as infrastructure monitoring, event correlation and analysis (ECA), application performance monitoring (APM), business service management (BSM) and IT operations analytics. These tools may take advantage of many IT operations management technologies, such as APM dimensions including end-user experience monitoring, application runtime architecture discovery, modeling, display and the application of IT operations analytics technologies. The instrumentation, along with availability and performance management tools, intends to enable an end-to-end view from the user device and provide a perspective of learned understanding of bottlenecks, permitting automated corrective action to be taken. Increased virtualization, infrastructure complexity and lack of instrumentation standards challenge the ability to achieve RCA in a heterogeneous environment. In individual technology domains, such as networking, RCA is quite advanced; however, application components' root causes can be isolated, as can the root cause of specific infrastructure components, but the relationship between these two views does not currently exist.

There have been advancements in the area of APM providing an understanding of the end-user perspective, through the application stack, of what issues are occurring, as well as a probability-based root cause presented to users. The use of these types of features enables more rapid triage, without having to perform a manual assessment of graphs and other types of data. Additionally, progress has been made in the correlation of application components, which are loosely coupled in terms of being related at the metric level. These accomplishments have been facilitated by more-advanced analytics approaches in APM tooling. These APM tools have also been deployed in use

cases to allow cloud bursting or the management of public cloud infrastructures to dynamically scale applications based on metrics or end-user experience. Although these improvements help facilitate RCA, they still leave a gap between the infrastructure elements and the application elements. This gap is only currently somewhat bridged by using standardized components from single vendors or abstractions such as platform as a service (PaaS). Even then, a definitive cause of the bottleneck may not be known, making a dynamic response potentially problematic, since the response could help relieve the bottleneck, but may do nothing or make it worse. Thus, RCA is still quite distant for most applications and infrastructures and is at least 5 to 10 years (or longer) from mainstream maturity.

User Advice: Technology that enables automatic detection and diagnosis of projected IT service failures and application components to infrastructure components does not exist yet, but positive results have been seen with various component RCA technologies, some of which can correlate across multiple instrumentation streams. Today's incident and problem resolution process, as well as RCA technology, typically requires manual effort that can be somewhat mitigated once standardization and effective tooling has been implemented. Be aware that standardization has benefits in terms of RTI, but can often have high costs due to vendor lock-in, and lose the financial leverage that multiple vendor solutions can provide. Additionally, vendor lock-in decreases choice in terms of applications and infrastructure that will be RTI enabled. As the technology matures in this area, it will take time to implement because administrators must trust the new technology before they are willing to take automated actions based on the root cause advice. This technology has emerged and proved its value in some focused areas, such as APM and IT operations analytics technologies. We recommend evaluating and implementing these tools to become more proactive for targeted business and IT services. As the tools and technologies evolve and confidence increases in the accuracy of the service performance and availability predictions, consider adopting automated actions that could resolve IT service issues. Such automated detection and resolution is the foundation of RTI.

Business Impact: RCA tools have the potential to greatly improve business execution by ensuring applications are available and able to perform by dynamically determining the root cause of an underlying incident or problem versus today's often manual collaboration across multiple application and infrastructure engineering groups. If root cause can be dynamically determined, then corrective action can also be automated, thus improving service quality through shorter resolution time. Additionally, with this technology the agility of the software release and delivery upon business demand can be increased, thus providing a business advantage.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AppDynamics; AppFirst; BlueStripe Software; BMC Software; CA Technologies; Compuware Corp.; EMC; Hitachi; HP; ManageEngine; Opnet Technologies; OpTier; Oracle; Splunk; VMware; Zenoss

Open Government Data

Analysis By: Andrea Di Maio

Definition: Open government data is public data that is machine-readable, raw and not in aggregate form, accessible to anyone without any requirement for identification or registration, available for any purpose (possibly in an open format), and not subject to any trademark or copyright. The purpose of open government data is to increase transparency, encourage the participation of citizens and other stakeholders, and support the emergence of new services that are based on that data.

Position and Adoption Speed Justification: Early examples of open data were feeds provided by state and local governments to provide the visibility of their performances. In 2009, the U.S. federal government launched Data.gov, a website that provides an increasing number of datasets from across the U.S. government as mandated by the Open Government Directive. Several other countries, states and cities have created similar websites since then. Examples include the U.K., Australia, Massachusetts, Victoria (Australia), Seattle, Washington; New York, New York; San Francisco, California; and Edmonton, Alberta, Canada — and open data initiatives are mushrooming around the world. An Open Government Partnership is grouping nations with a commitment to open government and an open data initiative.

The open government data movement gained momentum through 2010, mostly thanks to government initiatives in the U.S. and U.K. Efforts in the U.K. involving Tim Berners-Lee have promoted the use of linked open data. The phenomenon is still mostly a technology push, as demonstrated by the lack of examples of applications of open data besides those already exposed through the many application contests conducted at all government levels around the world. In fact, the application areas remain limited to land registries, and traffic and environmental data. The main beneficiaries remain activists and advocacy groups with a vested interest in developing various views of how government performs, or individual citizens who possess sufficient skills and interest to develop applications based on open data.

While interest grew in 2010, there has been relatively little progress in improving accessibility, uptake and a prioritization process to drive open data publication. The U.S. federal budget decisions in 2011 significantly reduced resources available for open government, and lead executives left between 2011 and 2012.

On the upside, open data is helping with financial and performance transparency initiatives, and it is being used inside governments to cross organizational silos.

There are still few vendors in this space providing true support for developing and exposing open data, while most aim at establishing their own information marketplaces

User Advice: Government organizations that either are required to comply with the mandate of publishing open government data or decide to do so autonomously should keep focusing on prioritizing open datasets in order to maximize the value generated for the organization. The total cost of ownership, as well as the benefits and risks, should drive such prioritization. Although some (if not most) of the uses of the data and its value are hard to predict in advance, particularly when

the data is used in mashups, government organizations should take a more direct role in examining potential avenues to value creation rather than leaving this entirely to external stakeholders, such as the application development community. Jurisdictions with significant budgetary challenges should focus on how open data can help reduce operational cost, as well as on how open data initiatives can be made sustainable over time by connecting the use of open data to specific business outcomes and by promoting its internal use. Greater emphasis should be put on the internal use of open data. However open data needs to be timely and accurate as well as sustainable going forward: governments should plan for expected demand and related costs. Metrics should be in place to assess actual uptake (both in quantity and quality).

Business Impact: The publication of open government data impacts the role of public information officers, as well as the processes required to deal with freedom of information. Moreover, statistical offices will be affected as citizens and intermediaries aggregate data the way they see fit, rather than relying on statistical reports. Finally, executive leadership will be under more intense scrutiny as a result of greater transparency and the unpredictable use of open data. The impact may be more transformational in jurisdictions exhibiting significant financial sustainability challenges and seeking community support for services they may be no longer to provide with the same level.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Google; Infochimps; Microsoft; Socrata

Recommended Reading:

"How to Determine the Value of Open Government Data"

"How to Build an Open Government Plan"

"How Do Open Government and Government 2.0 Relate to Each Other?"

"Gartner Open Government Maturity Model"

"Innovation Insight: Linked Data Drives Innovation Through Information-Sharing Network Effects"

"Open for Business: Learn to Profit by Open Data"

Sliding Into the Trough

Telematics

Analysis By: Kimberly Harris-Ferrante

Definition: Telematics refers to the use of in-car installed and after-factory devices to transmit data in real time back to an organization, including vehicle use (e.g., miles driven, speed, and location

using GPS), maintenance requirements, air bag deployment or automotive servicing. Telematics serves as the platform for usage-based insurance, pay-per-use insurance, pay-as-you-drive (PAYD) insurance, pay-how-you-drive (PHYD) programs for fleet insurance, or teen driving programs for retail business.

Position and Adoption Speed Justification: Telematics is based on the idea of the "connected vehicle," in which new technology is embedded that can send intelligence to an insurer on location, miles driven, vehicle condition and driving behavior. For insurers, telematics has been gaining attention for auto and motor insurance during the past five years; however, interest fluctuates. To date, many large Tier 1 insurers have launched pilots and limited deployments of telematics-based insurance in the U.K., the U.S., Canada, France and Australia. The early deployments of Progressive and Aviva (formerly Norwich Union) made news around the globe. Since then, deployments have broadened to include teen driving programs in the U.S., and commercial fleet deployments in various regions. Adoption has spanned across the globe in both personal and commercial line property and casualty (P&C) insurers for telematics- and usage-based insurance during the past three years, and it is expected to accelerate in the next few years as consumers look to save money on auto insurance and as insurers look to differentiate through new products.

Overall, telematics will have a dramatic effect on the overall auto/motor insurance industry during the next 10 years, revolutionizing it with the addition of new products that were not offered in the past and that are targeted at niche consumer groups (for example, green products). Insurers will offer consumers a greater selection of products with PAYD pricing models, and will support improved service for existing policyholders.

Technology and business issues must be overcome, such as:

- The need for after-factory boxes to be installed, and the prices associated with the technology.
- The cost of real-time data collection and the systems/skills required to manage and analyze this data.
- The need to have core systems support usage-based pricing, and manage or mine the amount of incoming data, especially around billing and pricing calculation, the calculation of recurring premiums when monthly costs are less predictable, and the implications on financial forecasting.
- Concerns about privacy protection for consumers, especially regarding vehicle tracking
- Selecting the right services and solution partner to build this product line. Today, the market is crowded and confusing, including submarkets such as: (1) large services firms providing consulting plus setup (including hardware, software and telecom selection/setup); (2) telematics solutions providers; (3) telecom companies establishing telematics offerings including telecom and data services; (4) telematics/behavioral feedback for fleet management; (5) one-stop shopping companies (hardware, consulting, transport); (6) telematics data collection companies; and (7) business process outsourcing (BPO) players to support core systems processing for insurance policies, including policy administration, claims handling, and billing. Finding the right match to the technology and business expertise may be difficult in the short term.

User Advice: Mainstream insurers should continue to monitor pilot projects and PAYD initiatives that are public, and analyze the long-term impact that telematics devices are having on the personal and commercial auto/motor insurance industry. Tier 1 insurers should begin to assess their customer bases and target customers to understand their preferences regarding PAYD insurance products. New strategies should be developed that are targeted at building knowledge on telematics devices; developing competitive intelligence on its use; and defining system requirements for processing real-time, telematics-based data. Companies that aren't pursuing telematics should ensure that all investments made in core system replacements and enhancements — including those to support product configuration, policy management and billing — will meet the product and process needs for PAYD and other telematics-based insurance products in the future.

Early adopters should quantify the ROI for telematics projects, including the number of new customers attained, the reduction in claims for volunteers and the improved customer satisfaction scores among volunteers. For example:

- Perform comparisons of claims costs of those in the telematics program versus those in overall customer groups, and conduct assessments of the risk characteristics of telematics program volunteers.
- Build new underwriting models based on unique characteristics of driving behaviors, and purchase or build new systems to support billing procedures (for example, utility-based pricing).
- Implement additional functionality (such as notification of air bag deployment) to initiate a claims process or determine the location of stolen vehicles.

Business Impact: Telematics will open up new opportunities for the automobile insurance industry by providing a mechanism to offer products that are based on individualized risk and driving behavior. When telematics is applied to underwriting, insurers can more accurately assess risk and price insurance coverage, based on real-time data that's sent wirelessly from the vehicle. In the long term, the use of telematics will help with the recovery of stolen vehicles, faster claims submittals and improved roadside assistance for drivers.

Long term, telematics can help reduce claims and driver risks. A study conducted by Zurich Financial Services in late 2010 reported that the use of telematics can reduce motor fleet accidents by 30% (Source: http://www.automotiveit.com/zurich-insurance-telematics-can-reduce-fleet-crashes-by-30-percent/news/id-00541). This will help promote profitability overall for commercial P&C insurers.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Hughes Telematics; Octo Telematics; Qualcomm; Verizon

Recommended Reading:

In-Memory Data Grids

Analysis By: Massimo Pezzini

Definition: In-memory data grids (IMDGs) provide a distributed, reliable, scalable and consistent in-memory data store — the data grid — shareable across distributed applications. These concurrently perform transactional and analytical operations in the low-latency data grid, thus minimizing access to high-latency, disk-based data storage. IMDGs maintain data-grid consistency, availability and durability via replication and partitioning. Although they can't be classified as full application platforms, IMDGs can host application code.

Position and Adoption Speed Justification: IMDG technology (see "What IT Leaders Need to Know About In-Memory Data Grids") is a key component of emerging in-memory computing technology, which includes in-memory database management systems (IMDBMSs), event processing platforms (EPPs), in-memory analytics and other technologies (see "Innovation Insight: Invest in In-Memory Computing for Breakthrough Competitive Advantage"). IMDGs partially overlap in functionality with IMDBMSs and EPPs. IMDGs also typically have a much greater ability to scale out than both of the other platforms, but less sophisticated data manipulation and definition languages than IMDBMSs, and less powerful query/rules management capabilities than EPPs. These technologies are partly on a convergence path, as evidenced by EPPs from IBM, Oracle, Software AG and Tibco Software, leveraging the underpinning IMDG technology and at least one IMDBMS layered on top of the IMDG technology (VMware's vFabric SQL Fire).

Multicore and 64-bit hardware architectures, and the availability of relatively inexpensive DRAM, are paving the way for the mainstream use of IMDGs and other in-memory computing technologies. IMDG is emerging as foundational for several products in cloud-enabled application platforms (CEAPs), complex-event processing (CEP) and analytics. Numerous commercial and open-source products are available (some have been in the market for several years), and vendors are experiencing fast revenue growth (approximately 35% in 2011 over 2010) and installed base expansion.

Established products continue to mature in functionality, manageability, high availability and support for multiple technology platforms, programming environments and computing styles. In addition to the established use of IMDGs to support transaction processing applications, over the past 12 months, these technologies have been increasingly adopted in the context of big data analytics applications, typically to preprocess (i.e., absorb, filter, aggregate, process and analyze) high-volume, low-latency data and event streams. Several independent software vendors (ISVs) bundle IMDGs in tools and packaged applications. Large application infrastructure vendors have introduced support for IMDGs as performance and scalability boosters in other application infrastructure packages, such as portal products, application servers, enterprise service buses (ESBs), EPPs, business process management (BPM) and analytical tools.

Because of their ability to support an arbitrary and varying number of applications sharing a large in-memory, transactional and highly available data store, IMDGs are increasingly used to support

application deployments in highly distributed and elastically scalable cloud environments, including software as a service (SaaS) and social networks. Many vendors (e.g., GigaSpaces Technologies, IBM, Microsoft and VMware) incorporate IMDG technology in their cloud application platforms, and others are expected to do the same in the near future. A small, but growing, ecosystem of system integrators (SIs) and ISV partners has emerged to support some leading IMDG vendors.

An increasing number of organizations — in telecommunications, financial services, automotive, e-commerce, media and entertainment, online gaming, defense, social networks, cloud services, SaaS and other industries — successfully use IMDG to support large-scale production, business-critical transactional systems and, increasingly, big data analytics applications. IMDG adoption will continue to grow, because of the push from large middleware vendors, the emergence of open-source products and bundling into larger software stacks, such as application platforms (including CEAPs), ESBs, EPPs, business activity monitoring (BAM) tools, BPM products, business intelligence tools and packaged applications.

Given the small number of pure-play vendors left in this market segment, mergers and acquisitions will slow, but OEM activity is likely to grow, as established application infrastructure players, packaged application vendors and cloud/SaaS/social network providers realize they need to secure access to this key, but hard to develop, technology. Products will continue to mature rapidly, and adoption will accelerate as users address initiatives such as cloud transaction processing, CEP, high-performance computing (HPC), big data analytics, cloud computing and mainframe/database management system (DBMS) offloading projects.

Users will acquire IMDGs to boost the performance and scalability of established portal products, application servers, ESBs and BPMs. By 2014, at least 40% of large organizations will have deployed one or more IMDGs (an increase from fewer than 15% in 2012). In most cases, they will endorse this technology unintentionally, because IMDG adoption will happen primarily through transparent bundling into other software products and cloud/SaaS services. Nevertheless, IMDG will remain a visible and growing stand-alone market serving the most demanding requirements and usage scenarios.

The main limiting factors for more widespread adoption of these products are:

- The small size of the available skills pool
- A lack of commonly agreed-on standards
- Limited SI and ISV support in skills and third-party tools
- Complexity in deployment, configuration and management

Some of these issues are being addressed. Consolidation continues, and proven technology is now available from large and viable vendors. Some standardization attempts are being made in the Java Platform, Enterprise Edition (Java EE) and Spring communities, and vendors are aggressively developing tools to help users reduce deployment, configuration and management complexity. As these efforts come to fruition, they will further encourage user adoption.

User Advice: Mainstream organizations should consider IMDGs when they are:

- Looking for minimally invasive solutions to boost the performance and scalability of data-intensive applications, or to offload legacy system workloads in such areas as Web commerce, Internet banking, online gaming, online travel booking and certain types of analytical applications
- Developing big data analytics applications and needing to preprocess large and low-latency data streams that must be stored in traditional databases for further processing
- Implementing loosely coupled, high-performance, low-latency application interoperability, especially in financial and energy trading or CEP-style scenarios

Despite their technical complexity, IMDGs are proven products with significant production deployments. They can be used as complementary extensions of mainstream application platforms to improve established application performance, and as platform foundations for new, cloud-based deployments and analytical applications.

Leading-edge users should look at IMDGs as products enabling innovative scenarios, cloud transaction processing, HPC, CEP and real-time big data analytics. In particular, users, IT vendors and service providers in markets such as cloud services, SaaS, social networks and big data should consider IMDGs as a key enabling technology for their businesses.

However, these products only provide limited support for atomicity, consistency, integrity and durability (ACID) transactional properties (although third-party products working around this issue are emerging from specialized vendors like CloudTran). Moreover, some well-established IMDGs come from small, albeit fast-growing, specialized companies (which are at risk of being acquired by large software firms). Some products — including from large, established software vendors — have hit the market over the past two or three years, thus are still immature and/or only partially proven. IMDG skills and consolidated industry best practices are still rare.

Business Impact: IMDGs enable organizations to retrofit (with minimal impact) established applications to increase their performance and scalability, offload transactional workloads from legacy systems and enable real-time analysis of large data volumes. Thus, organizations can enhance the productivity of their business processes, speed operations, support low-latency requirements, improve user/customer/supplier/employee satisfaction, extend application reach to larger user constituencies and enable a faster decision support process, while protecting investments in their established application assets.

In combination with Java EE or .NET platforms, IMDGs enable organizations to develop distributed, cloud-enabled, transaction-processing-oriented applications — for example, global-class e-commerce, real-time access to large databases, algorithmic trading, SaaS, cloud services and social networks — that cannot otherwise be supported by traditional platforms alone.

IMDG will increasingly enable users to run analytical applications concurrently with transactional systems on the same distributed in-memory data store. This will enable organizations to explore new business opportunities, while protecting their application platform purchases and skills.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Alachisoft; CloudTran; Couchbase; GigaSpaces Technologies; Hazelcast; IBM; Microsoft; Oracle; Red Hat (JBoss); ScaleOut Software; Schooner Information Technology; Software AG; Tibco Software; VMware

Recommended Reading:

"What It Leaders need to Know about In-Memory Data Grids"

"Emerging Technology Analysis: In-Memory Data Grids Are Enablers for High-Growth Software Markets"

"Predicts 2012: Cloud and In-Memory Drive Innovation in Application Platforms"

"Innovation Insight: Invest in In-Memory Computing for Breakthrough Competitive Advantage"

"Taxonomy, Definitions and Vendors Landscape for Application Platform Products"

Web Experience Analytics

Analysis By: Robert Hetu

Definition: Analytics tools are meant to measure consumer engagement and purchase activities in the e-commerce and m-commerce channels.

Position and Adoption Speed Justification: Web experience analytics are analytics tools that measure various aspects of Tier 1 retailers' commerce sites, including websites and mobile sites, to help ascertain customer sentiment. These analytics include more-mature analytics tools, such as page load times and shopping cart abandonment rates, as well as tools that are newer, such as multivariate A/B testing, interaction sequence and navigation tracking, and sentiment indexes.

These tools vary in maturity, which is why we show this technology as moving more slowly within Tier 1 retailers. The more direct measures, such as page load times, are relatively mature, while other measures, such as sentiment indexes, multivariate testing, information clarity measures and customer satisfaction, are just beginning to emerge. To some degree, some of these tools are as much art as they are science, such as neuromarketing, which measures consumer brain activity when consumers are engaged in shopping activities.

With innovations in big data, there is a possibility to use as an information base for experience analytics. SAP, through its Hana offering, and Oracle with Exalytics both provide in-memory computing that allows for fast processing of large amounts of data.

User Advice: These measures help Tier 1 multichannel retailers improve the customer experience on their sites and adjust elements of their commerce sites, such as rich-media applications, navigation and flow paths, and shopping aids to suit changing consumer tastes and preferences for

e-commerce sites. Multichannel feedback technology can also provide retailers an assessment of their customers' shopping experiences — especially for cross-channel shopping processes.

Deploy the straightforward measurement tools, such as page load times and shopping cart abandonment measures, if you haven't already done so, as these factors can have a significant impact on your overall revenue. As consumers grow tired of generic offers and retailers run the risk of losing customers, measures such as multivariate testing can be valuable tools for retailers in migrating toward a more personalized presentation of their website. The emergence of sentiment analysis and social media monitoring tools can give retailers insight into where changes are needed to ensure customer retention. Still, retailers should proceed with caution and confirm findings over time, rather than make changes that run a greater risk of alienating customers.

Business Impact: When used appropriately, these tools can lead to improvements in the customer experience and engagement for the e-commerce and m-commerce channels for the retailer. In addition, these tools can help retailers identify the right combination of media elements and applications that lead consumers to purchase more and that attain a higher degree of satisfaction from customers.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Adobe Systems; Celebrus Technologies; Google; iPerceptions; IBM Coremetrics; IBM Tealeaf; Oracle; ResponseTek; SAP; SAS; Teradata; Webtrends

Recommended Reading:

"An Overview of the Strategic Technology Map for Tier 1 Multichannel Retailers"

"E-Commerce Websites: Features That Make Consumers Buy"

"Key Challenges in Web Analytics, 2009"

"Key Issues for Customer Experience Management, 2010"

"Top 10 Mistakes in Web and User Experience Design Projects"

Cloud Computing

Analysis By: David Mitchell Smith

Definition: Cloud computing is a style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service using Internet technologies.

Position and Adoption Speed Justification: Cloud computing is still a visible and hyped term, but, at this point, it has clearly passed the Peak of Inflated Expectations. There are signs of fatigue,

rampant cloudwashing and signs of disillusionment (e.g., highly visible failures). Although cloud computing is approaching the Trough of Disillusionment, it remains a major force in IT. Users are changing their buying behaviors, and, although they are unlikely to completely abandon on-premises models or buy complex, mission-critical processes as services through the cloud in the near future, there is a movement toward consuming services in a more cost-effective way and toward enabling capabilities not easily done elsewhere.

Although the hype has peaked, there is still a great deal of hype surrounding cloud computing. Every IT vendor has a cloud strategy, although many aren't cloud-centric. Variations, such as private cloud computing and hybrid approaches, compound the hype and demonstrate that one dot on a Hype Cycle cannot adequately represent all that is cloud computing.

User Advice: User organizations must demand road maps for the cloud from their vendors. Users should look at specific usage scenarios and workloads, and map their view of the cloud to that of potential providers, and focus more on specifics than on general cloud ideas.

Vendor organizations must begin to focus their cloud strategies on more-specific scenarios, and unify them into high-level messages that encompass the breadth of their offerings.

Cloud computing involves many components, and some aspects are immature. Care must be taken to assess maturity and assess the risks of deployment. Tools such as cloud services brokerages can help.

Business Impact: The cloud computing model is changing the way the IT industry looks at user and vendor relationships. As service provisioning (a critical aspect of cloud computing) grows, vendors must become provider or partners with, service providers to deliver technologies indirectly to users. User organizations will watch portfolios of owned technologies decline, as service portfolios grow. The key activity will be to determine which cloud services will be viable, and when.

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Amazon; Google; Microsoft; salesforce.com; VMware

Recommended Reading:

"Agenda for Cloud Computing, 2012"

"The What, Why and When of Cloud Computing"

Sales Analytics

Analysis By: Patrick Stakenas

Definition: Sales analytics is used in identifying, modeling, understanding and predicting sales trends and outcomes while aiding sales management in understanding where salespeople can

improve. Specifically, sales analytic systems provide functionality that supports discovery, diagnostic and predictive exercises that enable the manipulation of parameters, measures, dimensions or figures as part of an analytic or planning exercise.

Position and Adoption Speed Justification: Sales analytics continues to move through the Hype Cycle and has advanced to post-peak 45% as sales management teams identify sales analytics as a priority to help them understand sales performance, market conditions and opportunities. This has been the case particularly with key analytic disciplines, such as forecasting and pipeline analyses, because many firms want greater revenue predictability and accuracy on forecasting.

Software as a service (SaaS) delivery models have taken a strong hold as companies like GoodData, Cloud9 and Birst, have entered the market in the past few years; this has eased sourcing efforts for IT, as these tools are designed essentially for the nontechnical user populations. However, more sophisticated technologies (such as data mining; optimization tools and advanced predictive analytics; SPSS and business objects) require significant planning for most sales organizations to exploit effectively, specifically with securing end-user adoption and acceptance of outputs or generated insights. Solutions vary in technical sophistication, from embedding simple, ad hoc querying capabilities in dashboards to supporting more complex multidimensional analyses to providing data-mining models that improve visibility into sales channels and market conditions, discern actual progress and generate forecasts. In contrast, the separate category of sales reporting encompasses relatively less sophisticated technologies that summarize and convey static information on sales results to various constituencies, as well as helping to identify actionable information that can be used to manage, teach and coach.

Sales management and supporting sales operations teams have tended to concentrate on specific sales analytics niches at the expense of pursuing broad deployments involving larger IT roll outs because of the expense and complexity of large deployments. Key niches presenting compelling, rapid ROI and gaining visibility include lead scoring, pricing guidance, product mix recommendations, modeling compensation, defining territory alignments, and improving sales pipeline visibility and forecasts. Even with more circumscribed initiatives, firms often find the market niches supported by fragmented vendor communities dominated by small, best-of-breed specialists. Most CRM suite vendors provide integrated sales reporting tools; however, the degree of functionality is generally limited compared to functionality of a sales analytics vendor.

A key aspect of analytic applications specifically designed for salespersonnel is the ease and usability of the tools at the various levels. Sales management will use analytic tools to track performance of the team, sell cycles and activity, whereas a salesperson is generally more interested in using analytics that are more account-specific or tied directly to their performance and opportunities to improve. Across the board, from call center personnel to territory managers to account managers, all are interested in viewing dashboards that illustrate their performance individually and compared to the team and in using analytics to better their performance.

User Advice: Enterprises facing intensely competitive and volatile markets with complex selling models (negotiated sales, consultative sales, solution selling, strategic account management, etc.), product lines and organizational structures should investigate sales analytics to enhance capabilities for identifying and exploiting revenue opportunities. Priority should be given to

delivering insight to line sales management, and dashboards/scorecards to an individual salesperson. Improved analytics can be accomplished with the aid of sales support and sales operations, or with the participation of outside departments, such as marketing and product management. The adoption of analytics should span several concerns, including understanding territory potential, market coverage (sales territory sizing and balancing), lead quality, pipeline health and forecast assumptions, ongoing deal quality, quota and objective setting, sales capability understanding and compensation implications.

If there are requirements for resources proficient with more advanced multidimensional analyses, simulation and data-mining tools, management should consider investing in business analyst teams to manage and monitor such initiatives. Such teams are often required to work with desired tools and necessary data, interpret outputs and convey insights. This often applies to key analytic efforts to determine and predict market conditions, pricing, product mix trends, competitive threats, long-term demand, and the alignment between demand and capacity.

Begin with a focus on providing basic querying and filtering capabilities that deliver immediate, tangible benefits to build end-user support for deployments. Confirm the goals and supporting metrics required for projects to be deemed successful. Focus on specific applications of analytics, such as scoring and prioritizing leads for call planning, account planning, pipeline analysis, identifying cross-sell/upsell opportunities, providing guidance on pricing and determining the compensation potential of deals. Invest in exposing insights through intuitive sales portal interfaces or incumbent sales force automation (SFA) applications, aligned with defined sales processes, to ease learning requirements and ensure that training and IT resources are available to facilitate use in the field.

Business Impact: Sales analytics delivers significant benefits by helping sales management more effectively recognize, understand and respond to emerging developments in sales cycles and markets, as well as improves overall sales planning and decision making regarding the deployment of resources. Sales analytics can also be used to allow the salesperson to perform self-directed initiatives to bolster their skill set or product knowledge. Successful sales analytic deployments can provide competitive advantages in improving agility, exploiting opportunities faster than competitors, and correcting institutional shortcomings.

In addition, improved analytics on sales performance can enable executives and line managers to better prepare and guide sales teams on meeting and exceeding targets. When carefully implemented to reflect user preferences or tolerance for technology, sales analytics can be extended to support fact-based selling in field and inside sales, as well as with partners, to increase the team-level knowledge of target buyers, opportunities and best approaches for closing deals.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Angoss Software; Birst; Cloud9 Analytics; IBM (Cognos); Lattice Engines; Microsoft (Microsoft Dynamics CRM); MicroStrategy; Oracle; QlikTech; Right90; SAP

BusinessObjects; SAS; Tableau; The TAS Group; Tibco Software (Spotfire); Vecta Sales Solutions; Vistaar Technologies

Recommended Reading:

"Discover Hidden Opportunities in Sales Performance Management With Gartner's Sales Analytics Framework"

"Sales Opportunity Management Analytics Are Key to a Successful Strategy"

"Strengthen Sales With the Eight Building Blocks of Sales Performance Management"

"Get to Know the Key SPM Technologies Before Determining Your Strategic Approach"

"Develop a Framework for Evaluating Sales Force Automation Application Functionality"

"Top Processes for CRM Sales"

"KPIs for the Top CRM Sales Processes"

MapReduce and Alternatives

Analysis By: Merv Adrian; Donald Feinberg

Definition: Apache MapReduce (MR), part of the original open-source Hadoop system described in 2004 by Google in "MapReduce: Simplified Data Processing on Large Clusters," is a programming model and framework for processing large volumes of data in parallel on clustered compute nodes. It runs on the Hadoop Distributed File System (HDFS). Other types of MR run inside relational database management systems (RDBMSs). Non-MR systems with similar capabilities are emerging as alternatives, such as LexisNexis's High Performance Computing Cluster (HPCC) Systems.

Position and Adoption Speed Justification: MR is still in its adolescence, with best practices for implementation emerging in experienced shops, while others are still experimenting at best. The Map and Reduce statistical primitive algorithms are used to evaluate distributed data in compute nodes (Map) and then to aggregate the results (Reduce), a process repeated in multiple batch job steps. Use of MR predated the current fascination with the term "big data," so it has moved farther along the Hype Cycle than big data has. Our interactions with users of Gartner's inquiry service have revealed that many organizations are using Apache Hadoop in "stealth mode" outside the IT department. Therefore, we believe the market penetration of MR in general is far deeper than previously noted. Two DBMS vendors — EMC (Greenplum) and Teradata (Aster) — have chosen to implement MR directly inside a DBMS. Extraction, transformation and loading (ETL) is a frequent use case; organizations move data from a Hadoop stack on a clustered file system into data warehouses. In some cases, a high-speed connector may be provided by the DBMS vendor to move data into the data warehouse (DW). Data integration vendors are eyeing this opportunity as well. Informatica was among the first movers with its HParser product. Quest Software's Data Connector for Oracle and Hadoop enhances Quest's Toad for Cloud Databases, which offers querying, data migration and reporting through SQL.

Interest in, and adoption of, MR has increased since last year's Hype Cycle. The Apache Foundation now lists nearly two dozen organizations that distribute Hadoop, and a number of new entrants have created Hadoop distributions that include additional Apache projects and alternatives, including replacements for the HDFS. The decision to use a stand-alone Hadoop implementation for MR, rather than an MR-enabled DBMS, will be influenced by whether the source data is to be stored in HDFS or in the DW.

Alternative data platforms for the Hadoop stack include Apache HBase, an open-source column-store DBMS for structured data deployed on HDFS. HBase can be used as data storage for MR, with the added advantage of random access instead of the batch-only reads required with HDFS alone. Another complete file system replacement for HDFS comes from MapR Technologies, whose API-compatible MapR Lockless Storage Services layer also boasts additional features for high availability and stability. EMC's Greenplum MR (which is MapR's M5 distribution) also includes such features; Greenplum HD includes a pluggable storage layer that supports EMC Isilon's OneFS for Hadoop storage outside HDFS. DataStax substitutes Apache Cassandra for continuous availability in one or more data centers.

IBM's Adaptive MapReduce also extends MR to improve performance and simplify job tuning. Zettaset adds SHadoop, a security layer, the Apache Oozie scheduler and other features, all manageable through a unified user interface. HPCC Systems from LexisNexis offers a mature alternative to MR that includes a full stack of its own, including an integrated toolset and data store that offers real-time data access, as well as availability for Microsoft Windows, but lacks the broad ecosystem and community that MR has attracted, since it is relatively new as an open-source solution. The number of vendors offering additional features for "enterprise-readiness" complicates and potentially slows adoption. This lengthening of the adoption cycle is the reason we have not moved MR forward on this year's Hype Cycle.

As these distributions become more mature and the skill base for them grows, more organizations will begin to consider using them to store large amounts of data outside the DW in lower-cost storage. We believe this is the primary reason why other DBMS vendors have not incorporated MR into DBMSs. As related tools or alternatives mature in the Apache distribution, there will be less need to incorporate MR as a function within a DBMS.

User Advice:

- Organizations with highly technical developers or skilled statisticians should consider using MR to process large amounts of data, whether stored in HDFS or alternatives, especially with complex mixed data types. The results of the MR programs can then be loaded into a repository, such as a DW, for further processing, or used directly from the programs.
- Organizations with large amounts of data stored outside the DW should consider MR as an alternative to, or a preprocessing step for, the data transformation functionality of data integration tools deployed in the traditional manner, as the parallel processing will drive better performance, especially when coupled with the ability to work with complex, mixed data types. This is one of the primary uses of MR. Note that since such data can come from many different sources, there is rarely any data quality governance or policy enforcement such as the security

or referential integrity normally found in a relational DBMS — this information will have to come from the source systems creating the data or be implemented in programs that use it.

- Organizations should carefully evaluate the use of DBMS MR as a strategy, due to the volume of data that may be loaded into the database. This could result in very large database sizes (particularly when loading complex, mixed types) and have a detrimental effect on performance with no clear benefit.

Business Impact: As more organizations require the ability to analyze large amounts of complex file-system-based data, the business value of MR is driven by the extra performance gained by processing these large sets of data in a parallel environment of inexpensive servers. Since most of this data is used infrequently as it ages, storing it outside the DW is preferable to reduce the impact on the DW's performance and to minimize the cost of RDBMS licenses. Due to the highly technical nature of the MR implementation process, it is costly for most organizations to do this, and it is therefore mainly used by mathematicians, statisticians and highly skilled programmers within organizations. Emerging boutique service organizations can help with development beyond the implementation and early-stage training provided by distribution vendors.

MR's other key use is as a data integration tool to increase performance in reducing very large amounts of data to just what is needed in the DW. Due to its parallel nature, MR increases the speed of extraction and transformation of data. MR has high potential to enhance performance by providing representative, scored and/or summarized data, while at the same time allowing for proper storage of detailed data outside the primary DW database.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Apache Software Foundation (Hadoop); Cloudera; EMC; IBM; Informatica; MapR Technologies; Teradata

Recommended Reading:

"How to Choose the Right Apache Hadoop Distribution"

"Hadoop Brings Benefits and Challenges to Storage Managers Addressing Big Data Needs"

"Big Data Challenges for the IT Infrastructure Team"

Database Software as a Service (dbSaaS)

Analysis By: Roxane Edjlali

Definition: Database software as a service (dbSaaS) is a database hosted for a customer off-site (relative to the customer and accessed by users and applications remotely) and managed by a vendor on behalf of the customer. The provider's services must also include some database

management system (DBMS) and database support, such as database administration. Broadly defined, dbSaaS vendors are organizations offering DBMS implementations and hosting off-site databases on behalf of their customers.

Position and Adoption Speed Justification: There are few solutions available for a dbSaaS and those that are available are mainly for data warehousing (see "Magic Quadrant for Data Warehouse Database Management Systems"), although some new entrants are offerings dbSaaS for Hadoop deployments.

Adoption continues to be slow with takeup by just 5% to 20% of the target audience and a longer than initially planned time to plateau. This is due to the limited selection of vendors and market confusion in differentiating between the following:

- Managing a database on a cloud infrastructure, by removing any of the hardware procurement aspects, but not any of the database deployment or administration.
- Data store platforms as a cloud service (dbPaaS) products that are DBMSs engineered as a scalable, elastic, multitenant service available from cloud providers (which still rely on customers administering the database).
- Managed services from IBM and HP/Vertica have experienced growing acceptance and penetration in the market. These products are not direct competitors to dbSaaS vendors, but customers view them as an equal alternative from more established vendors.

However, we believe that potentially, there will be more choices in future for Hadoop implementations or online transaction processing in addition to data warehousing, as creating an infrastructure to supply a complete DBMS solution is expensive and requires dedicated skills (database administrators or developers) especially for small or midsize businesses.

As cloud computing matures (especially in the areas of security and reliability), we believe that additional vendors will begin to offer dbSaaS, using cloud infrastructure as a service (IaaS) or dbPaaS. As more options become available, the speed of adoption for dbSaaS will increase, which generally, will mature in less time than traditional applications, such as software as a service (SaaS). This is because many of the lessons learned in SaaS implementations will be leveraged in the implementation of dbSaaS.

Based on the cost avoidance and savings experienced in the SaaS market, dbSaaS solutions are expected to deliver similar cost-benefit models. Customer acceptance of the solutions currently available is progressing, as evidenced from our customer interactions, and the solutions will continue to gain in popularity as customers realize that they offer cost savings and more rapid deployment than may be available from internal IT organizations.

User Advice:

- DbSaaS is useful for single-application implementations, such as a data mart or projects with a short life span. DbSaaS can realize savings in terms of total cost of ownership and speed to implementation.

- DbSaaS is useful for specific applications that an organization may not want to acquire, develop or support, or in which a vendor has greater expertise. These will include a dbSaaS implementation with an application from the vendor. These can now be leveraged without needing to bring the application or expertise into the organization. We see many of these in specific vertical industries, such as 1010data in financial services and retail sectors.
- DbSaaS is useful for smaller organizations lacking expertise in DBMS and data warehousing that require a dbSaaS to support their own applications, whether data warehouses or other database use cases.
- Business units that contract for these services must consider the political implications for their in-house IT support. It is important to secure the backing of the IT organization for these services, or the business will face longer-term relationship issues with IT.
- As new providers of dbSaaS emerge using cloud IaaS or dbPaaS, care must be taken to ensure the reliability, security and credibility of both the dbSaaS vendor and its cloud IaaS provider, especially around issues of multitenancy, security and latency.

Business Impact: DbSaaS has two primary benefits — time to market and cost. Currently, dbSaaS can be used for the deployment of a data warehouse or a Hadoop implementation without the attendant costs and overheads associated with the IT department, in addition to time savings, since dbSaaS providers have a rapidly deployable model that provides a database. According to our customer references, in the case of data warehousing, dbSaaS vendors receive the data and perform all the necessary tasks to create the data warehouse and make it accessible to the client.

As dbSaaS matures during the next few years, it will be possible for an organization to host its entire DBMS infrastructure as dbSaaS, with potentially far-reaching reductions in the cost of servers, storage, DBMS licenses, maintenance and support, storage management and database administration. This will be of particular interest either to small organizations lacking the resources to create their own data warehouse infrastructure or to organizations looking at adopting a technology such as Hadoop or in-memory DBMS where no skills are available internally.

As cloud IaaS matures, there will be an increase in the availability of dbSaaS as new vendors enter this market. However, as with dbPaaS, dbSaaS on cloud IaaS has many issues to be addressed.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: 1010data; Kognitio; MetaScale

Recommended Reading:

"Magic Quadrant for Data Warehouse Database Management Systems"

"The State of Data Warehousing in 2012"

In-Memory Analytics

Analysis By: James Richardson

Definition: In-memory analytics is an alternative business intelligence (BI) performance layer in which detailed data is loaded into memory for fast query and calculation performance against large volumes of data. This approach obviates the need to manually build relational aggregates and generate precalculated cubes to ensure analytics run fast enough for users' needs.

Position and Adoption Speed Justification: Declining memory prices, coupled with widespread adoption of 64-bit computing, continue to prime the market for in-memory analytics. Most BI vendors are now positioning in-memory analytics as a key component of their BI offerings — and the use of RAM-based processing to speed up analytics will soon be ubiquitous as part of vendor platforms. Hype is running ahead of uptake however, with most organizations still relying on traditional approaches, such as summary tables, to improve performance. This is because, in the main, these are the techniques most familiar to them. While the speed gains are undeniable when using this style of processing, it's evident that a note of realism is becoming apparent about how in-memory analytics is best used and its cost-benefit ratio — although RAM is cheaper than it used to be, it's still many times more expensive than disk.

User Advice: For response-time issues and bottlenecks, IT organizations should consider the performance improvement that in-memory analytics can deliver, especially when run on 64-bit infrastructure. Users should be careful to use in-memory analytics as a performance layer, not as a substitute for a data warehouse. In fact, users considering utilizing in-memory analytics should also be aware of how their requirement for speedier query processing and analysis could be addressed by the use of in-memory processing in the underlying databases feeding BI or via in-memory databases or data grids.

BI leaders need to be aware that in-memory analytics technology has the potential to subvert enterprise-standard information management efforts through the creation of in-memory analytic silos. Where it is used in a stand-alone manner, organizations need to ensure they have the means to govern its usage and that there is an unbroken chain of data lineage from the report to the original source system, particularly for system-of-record reporting.

Finally, it is becoming apparent as the scale of in-memory analytics deployments grow that there is still a need for performance tuning either by the return of some aggregation at data load, or by managing application design against user concurrency requirements and the sizing of hardware and available RAM.

Business Impact: BI programs can benefit broadly from the fast response times delivered by memory-based processing, and this in turn can improve the end-user adoption of BI. The reduced need for database indexing and aggregation enables database administrators to focus less on the optimization of database performance and more on value-added activities. Additionally, in-memory analytics by itself will enable better self-service analysis because there will be less dependence on aggregates and cubes built in advance by IT. However, from an analyst user perspective, faster queries alone are not enough to drive higher adoption. In-memory analytics is of maximum value to users when coupled with interactive visualization capabilities or used within data discovery tools for the highly intuitive, unfettered and fast exploration of data.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Board International; IBM; Microsoft; MicroStrategy; Oracle; QlikTech; Tibco Software

Recommended Reading:

"Need for Speed Powers In-Memory Business Intelligence"

Text Analytics

Analysis By: Gareth Herschel; Hanns Koehler-Kruener

Definition: Text analytics is the process of deriving information from text sources. It is used for several purposes, such as: summarization (trying to find the key content across a larger body of information or a single document), sentiment analysis (what is the nature of commentary on an issue), explicative (what is driving that commentary), investigative (what are the particular cases of a specific issue) and classification (what subject or what key content pieces does the text talk about).

Position and Adoption Speed Justification: Often, interest in text analytics has been cyclical, with several false starts for the technology moving toward mass adoption. However, interest in the application of text analytics in three areas has resulted in accelerating interest among users and more serious vendor support. These three areas are: voice of the customer, which looks at direct (for example, surveys) and indirect (for example, blog commentary, Facebook and Twitter) customer feedback; fraud and public security (identifying patterns that require further investigation); and categorization and classification, which involves trying to understand how a particular text objects fit into an existing structure, or creating structures from scratch. Although it is unlikely that text analytics will be the panacea that many organizations hope for, it is past the unsubstantiated hype phase of its evolution, and eventually will become a ubiquitous tool for organizations.

User Advice: Text analytics will be an increasingly important tool for organizations, as exhaustive analysis of structured data yields increasingly little competitive advantage. However, the text analytics solutions market is slowly maturing (the vendors with the longest track records have software-as-a-service offerings), though some of the underlying capabilities are not as robust as the attractive user interface may suggest (for example, dealing with non-English-language documents and documents with many domain-specific terms can still be a challenge for some vendors). The lack of understanding on the part of most users about the subtleties of information extraction theory makes most selection processes dependent on a proof of concept and careful evaluation of the resulting insights. Organizations considering investing in this space should do so incrementally. They should consider limited pilots to ensure that the application will work effectively in the chosen domain, and to establish business processes for dealing with the results before investing in a full-scale deployment.

Business Impact: The impact of text analysis varies depending on the use case. When providing a summary of the nature of commentary on an issue, the benefits are usually seen in better resource allocation, or in identifying areas of concern or opportunity so that action can be taken. When providing explicative analysis, the benefits usually come from faster and more accurate identification of the underlying issue. For example, customer dissatisfaction with a product may be traced to misrepresentation of its capabilities by marketing, to a design flaw that makes it unsuitable for a specific purpose or open to misuse by an untrained customer. The benefits of investigative analysis may be easily quantified (detecting fraudulent insurance claims) or more difficult to quantify (preventing a crime or identifying dissatisfied customers). In many cases, the largest impact of text analytics will come from allowing it to combine extracted unstructured data with traditional structured data to provide a more complete view of the issue that can then be analyzed using traditional data-mining or business intelligence tools.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Attensity; Autonomy; Clarabridge; IBM; IxReveal; Megaputer; Microsoft; Nice Systems; OpenText; Oracle; SAP BusinessObjects; SAS; Temis

Climbing the Slope

Intelligent Electronic Devices

Analysis By: Randy Rhodes; Zarko Sumic

Definition: Intelligent electronic devices (IEDs) are a category of operational technology (OT) within utilities. Included are field-deployed sensors, controls and communications devices deployed in control centers, power plants and substations, as well as on transmission and distribution lines. Examples include multifunction meters, digital protection relays, automated switches, reclosers, line sensors and capacitor controls.

Position and Adoption Speed Justification: Data communications are critical in the operational and administrative systems of energy utility companies. IEDs will provide the status of transmission and distribution systems, including connectivity information, loading conditions, voltage, temperature, gas analysis, fault conditions and other operational parameters of the asset. Information from these devices may be routed to supervisory control and data acquisition (SCADA) systems (commonly referred to as operational data) or brought back separately (as "nonoperational" data). With the current smart grid expansion, utilities can expect exponential growth of IED field devices.

IED manufacturers are driving the shift toward more-open communications, such as Modicon Modbus or DNP over TCP/IP. The Institute of Electrical and Electronics Engineers (IEEE) is formally mapping DNP (now IEEE standard P1815), with the International Electrotechnical Commission's (IEC's) 61850 object models. IED communication designs within substations increasingly feature

high-bandwidth Ethernet over fiber optics, IP network devices hardened for electromagnetic immunity, multiple protocol support, improved device diagnostics and improved redundancy.

Utilities must address technology governance requirements for the life cycle of IEDs. This should include configuration management, backup and recovery, patch management, security measures and upgrade planning.

User Advice: Utilities that have deployed IEDs are typically using only a fraction of the data available. In "big data" terms, this represents a large store of "dark data" that engineering and operations staff can leverage for business benefit. IEDs can give business applications new life through detailed asset and process information — helping energy and utilities companies manage their risks effectively.

Business Impact: This technology will affect supply and delivery, and will gain more prominence as an essential part of smart grid projects that will require timely access to real-time device operational parameters and asset-loading conditions.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: ABB; Advanced Control Systems; Cooper Power Systems; GE; Schneider Electric; SEL; Siemens; S&C Electric Company

Recommended Reading:

"A Guide to Adapting IT Tools for Smart Grid OT Management Challenges"

"How to Make Your Grid Smarter: An Intelligent Grid Primer"

"The Management Implications of IT/OT Convergence"

Supply Chain Analytics

Analysis By: C. Dwight Klappich

Definition: Supply chain analytics comprise the tools needed to support a subset of supply chain performance management (SCPM) at a departmental, process or functional level. Supply chain analytics provide the methodologies, metrics, processes and systems used to monitor and manage the performance of specific process domains like plan, source, make or deliver. It includes portals, dashboards, key performance indicators (KPIs), industry templates and business activity monitoring (BAM) solutions.

Position and Adoption Speed Justification: Supply chain analytics are used to monitor and measure supply chain activities and performance, typically at a process level such as manufacturing or logistics. Most enterprises have some, although often rudimentary, measurement systems. It will

be several years, however, for use to reach market-inflated expectations. It takes time to develop the measurement strategies and then deploy the necessary processes and integrated systems. Basic supply chain analytics will devolve into tactical departmental analytics, while a more strategic use of SCPM will replace it with an end-to-end view of supply chain management (SCM). Consequently, supply chain analytics will become obsolete before reaching the Plateau of Productivity, as it is superseded by SCPM.

Vendors of departmental SCM applications, such as supply chain planning (SCP), transportation management systems (TMSs) and warehouse management systems (WMSs), have been enhancing their supply chain analytics capabilities during the past several years, with most choosing commercial business intelligence (BI) tools as the foundation of their solutions. The vendors augment the generic BI tools with functionally specific metrics, KPIs and the views needed to satisfy the departmental users. One of the problems with this approach, and one that will cause this approach to evaporate as SCPM matures, is that companies often need to support multiple analytical tools and solutions, so linking performance information across these solution silos is difficult, if not impossible. SCPM will replace functionally specific analytics because of this reality.

User Advice: Enterprises should look first at analytic solutions that are seamlessly integrated with their core SCM applications to get benefits from visibility within functions as a stepping stone to longer-term improvements. Consider stand-alone systems only in the following circumstances:

- You have extreme SCM application heterogeneity. In this case, focus on the SCPM solutions.
- You are looking for a consolidated view of SCM metrics, in which the underlying data may reside in multiple applications. Again, focus on SCPM solutions.
- You find it impossible to choose a single solution from a single application vendor.

Business Impact: Supply chain analytics bring about the proactive, intelligent management of an enterprise's supply chain functions by using ongoing monitoring and feedback to adjust and fine-tune processes and activities. Furthermore, it provides the ability to evaluate the benefits and costs of trade-off decisions to ensure that the best decisions are made.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: IBM (Cognos); Informatica; Information Builders; JDA Software; Manhattan Associates; MicroStrategy; Oracle; RedPrairie; SAP; SAP (Business Objects); SAS; Teradata

Recommended Reading:

"Supply Chain Analytics: Driving Toward Product Performance Management"

Social Media Monitors

Analysis By: Andrew Frank

Definition: Social media monitors (SMMs) are software services that track topics of interest as they are mentioned and discussed in social media. They apply search, monitoring, and light analytics and filtering to vast sources of commentary on the Internet to provide a frequently updated view of significant attitudinal trends relative to a topic of interest (brand, product or issue) unfolding in social media, with access to discrete elements of commentary.

Position and Adoption Speed Justification: SMMs are a subset of, and also a precursor to, more comprehensive social analytics platforms capable of delivering deeper insights, as well as social media engagement platforms that also include workflow and tools to support organizational response capabilities. As such, they are more mature and less differentiated than full analytics or engagement tools.

Although these services have a long-standing legacy in public relations media clipping services and related brand protection offerings, they first emerged as distinctive offerings targeting the Web in 2004. In 2007, around the Peak of Inflated Expectations, a series of high-profile acquisitions at Nielsen and others lent credibility and marketing power to this category as marketing data providers bundled social media monitoring into more expansive service platforms. These acquisitions, combined with a low cost of entry, spurred investment and led to a glut of hundreds of solution providers. (In a sign that expectations really were inflated in 2007, one such acquisition [of Cymfony by TNS] was undone in April 2012, when Cymfony was sold again, this time to SMM vendor Visible Technologies.)

Although there is still a large number of independent players, consolidation is now well under way, following a wave of acquisitions and integrations, exemplified by salesforce.com's acquisition of Radian6, Lithium's acquisition of Scout Labs, Jive Software's acquisition of Filtrbox, and SDL's acquisition of Alterian (which, earlier, had acquired Techrigy).

Meanwhile, as predicted, several large vendors have released SMM products of their own, generally within the context of broader social analytics, including Adobe, SAS and IBM. For the many independent social media monitoring vendors that remain, opportunities for an exit are becoming rarer, and they will need to either move upstream to provide more advanced analytic or management capabilities or focus on specialized niche applications.

User Advice: There are several uses for SMMs: reputation management, marketing intelligence, product support and market research, to name a few. Generally, however, these applications require more capabilities than are offered by SMM alone. For general inquiry and monitoring applications, similar to Web search, keywords (typically brand, product or category names or phrases, often expressed as word pairs) are applied to a searchable index, and results are filtered to gauge qualities, such as sentiment or intent.

Although SMMs can provide a great deal of value in maintaining broad awareness of developments in markets of interest at a far greater scale and cost-effectiveness than prior conventional research methods, these are likely to be gateway products to the deeper world of social analytics, which can extract more comprehensive insights or engagement products that can also support response workflow.

Enterprises and ad agencies should, at minimum, use SMM to optimize media strategies and creative messaging, although they should increasingly expect to find them as features in more comprehensive packages.

Business Impact: These services will affect public relations and marketing services, as well as marketing research and media metrics services. Ultimately, SMM will become a pervasive tool in social marketing suites, which, in turn, will find homes in digital marketing suites.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Adobe; Attensity; Collective Intellect; Crimson Hexagon; IBM; Lithium; Nielsen; salesforce.com (Radian6); SAS; SDL; Visible Technologies

Recommended Reading:

"Turn Information Into Insight With Social Analytics"

"Competitive Landscape: Social Analytics"

Speech Recognition

Analysis By: Adib Carl Ghubril

Definition: Speech recognition systems interpret human speech and translate it into text or commands. Primary applications are self-service and call routing for contact center applications; converting speech to text for desktop text entry, form filling or voice mail transcription; and user interface control and content navigation for use on mobile devices, PCs and in-car systems. Control of consumer appliances (such as TVs) and toys is also commercially available but not widely used.

Position and Adoption Speed Justification: The cloud-based system introduced on Apple's iPhone in 2011 — Siri — fueled, if not revived, interest and usage of speech recognition systems. Furthermore, Nuance has an agreement with Intel that will see the support of voice-controlled command, content searching and short message dictation of up to 30 seconds on PCs and ultrabooks.

Speech recognition provides tangible benefits for a range of applications but still falls short of its potential — both in performance and in adoption levels. Accuracy can be highly variable, depending on background noise, size of the recognized vocabulary, level of natural-language understanding attempted, clarity of the speaker's voice, quality of the microphone and processing power available. For text entry in a quiet environment, where some users can achieve impressive accuracy, speech recognition still has not been widely adopted outside of medical and legal dictation, possibly due to the need to learn a new skill (dictation) for most general office workers.

Speech recognition as a whole has been climbing the Slope of Enlightenment for more than a decade. It will likely reach the Plateau of Productivity (that is, the start of mainstream adoption) in two to five years due to a growing number of consumer applications, particularly in the mobile space, including voice mail transcription and speech-to-speech translation. These applications provide useful functionality, even if not perfect, and we anticipate that the broader use of speech recognition embedded in interface and unified communications applications will drive a steadily increasing level of adoption.

Some applications of speech recognition are already further along, with higher levels of adoption; for example, simple self-service dialogues for call center applications are close to the Plateau of Productivity. Others, including desktop dictation and mobile device control, are closer to the Trough of Disillusionment as they struggle to attract broader use. Although speech recognition support in Windows 7 is adept at distinguishing a reasonably wide array of commands in a naturally spoken tone and pitch, it is of limited usefulness; nonetheless, its inclusion in enterprise software is a significant boost in users' access to speech control, which should accelerate its refinement and consequently raise worker productivity. Other interface advances, such as gesture-based gaming and touchscreens for media tablets, may also lead to broader inclusion of speech recognition as an additional (but not sole) means of input and control, and drive more-rapid adoption.

Stochastic models from advances and concepts in natural language processing will also help speed the maturity of speech recognition.

User Advice: With Siri, speech recognition takes a distinct evolutionary step. Indeed, the speech modality is best utilized for complex tasks — something that would take a lot more steps to describe with typing, pointing or using gestures (namely, dictation and search).

For call center applications, the most critical factors influencing success and reducing risk are designing the application to work within the accuracy constraints of speech recognition, designing the voice user interface, selecting the appropriate speech engine, and having thorough ongoing tuning and evaluation. Professional services that are experienced in speech recognition technology are recommended for a first foray into this space.

For general-purpose office text entry, deploy speech recognition "on demand" for individual users who express interest and motivation (for example, those with repetitive-stress injuries). Users who are already practiced in dictation are likely to be most successful. Also, examine non-mission-critical applications, in which a rough transcription is superior to nothing at all, such as voice mail transcription and searching audio files. In addition, consider speech recognition and its related technology, text to speech, for applications in which users must record notes, as they perform detailed visual inspections — for example, radiology, dentistry and manufacturing quality assurance.

For mobile devices, focus initial applications on selecting from lists of predefined items, such as city names, company names or music artists. This is where speech recognition has the strongest value-add by avoiding scrolling embedded lists, while maintaining a high level of accuracy.

Business Impact: Speech recognition for telephony and contact center applications enables enterprises to automate call center functions, such as travel reservations, order status checking, ticketing, stock trading, call routing, directory services, auto attendants and name dialing. Additionally, it is used to enable workers to access and control communications systems, such as telephony, voice mail, email and calendaring applications, using their voice. Mobile workers with hands-busy applications, such as warehousing, can also benefit from speech data entry.

For some users, speech input can provide faster text entry for office, medical and legal dictation, particularly in applications in which speech shortcuts can be used to insert commonly repeated text segments (for example, standard contract clauses).

For mobile devices, applications include name dialing, controlling personal productivity tools, accessing content (such as MP3 files) and using voice-mail-to-text services. These applications are strongly motivated to use speech to support in-car use and for unified communications among voice, text and email services.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Apple; IBM; Loquendo; LumenVox; Microsoft; Nuance; Sensory; Spansion; telisma

Recommended Reading:

"The Three Key Components of Industrial Speech Recognition Solutions"

"Emerging Technology Analysis: Voice-to-Text on Mobile Devices"

"MarketScope for IVR Systems and Enterprise Voice Portals"

Entering the Plateau

Web Analytics

Analysis By: Bill Gassman

Definition: Web analytics is a market of specialized analytic applications used to understand and improve online channel user experience, visitor acquisition and actions, and to aid optimization efforts in digital marketing. Products offer reporting, segmentation, analytical and performance management, historical storage and integration with other data sources and processes. The tools are used by marketing professionals, advertisers, content developers and the website's operations team, and provide input to automated marketing processes.

Position and Adoption Speed Justification: The maturity of this market moved forward by 5% this year, reflecting more complete adoption and better use of the products. Over the next few years,

there will be new opportunities at the high end of the market, but that market innovation is just emerging. More than 90% of the addressable market is using some form of Web analytics tools. Google reports over 10 million registrations and at least 200,000 active users of its free Google Analytics product, and there are over 20,000 customers of the leading fee-based products. While most organizations use one or more Web analytics service, less than 50% of the addressable market is using advanced functions, such as customer-based segmentation, data warehousing and exporting user activity events into search engine marketing, targeted email, banner advertising and content management engines.

Globally, Adobe, IBM and Webtrends lead in terms of market revenue. Teradata and SAS Institute have niche businesses at the high end, and some vendors with big-data technology are chasing opportunities. New entrants are gaining minor traction, such as KISSmetrics and open-source offering, Piwik, and there a number of solutions focused on mobile devices, such as Kontagent and Localytics. Deployment skills and process are inhibitors to this market, with big gaps between leading and trailing edge use cases. Delivery of Web analytics solutions continues to be predominantly (over 80%) software as a service (SaaS) rather than in-house products.

User Advice: Most enterprises with a website have a reporting package, but many receive less than the potential value from the tools. The degree to which the initiative should be improved is related to the strategic and potential value of an enterprise's website. Business users should be the primary users of the tools, with support from the IT organization in the areas of instrumentation, data integration, process management and complex report generation. A business executive champion is important to drive the analytic culture. Ensure there are sufficient skills, create a training program that teaches employees how to use the products in their role, promote success and use consultants (external or from a vendor) to overcome technology hurdles in using the tools. If still using log files rather than JavaScript tags for instrumentation, explore the value of tagging, mindful of user and data privacy issues. If not already doing so, start using the tools to analyze the impact of a/b or multivariate testing. Analyze users by segments, including those using mobile devices and social channels. Find opportunities to integrate cross-channel data, such as online data with the call center or point of sale. For advanced enterprises, start building a user-experience management ecosystem that blends analytics with search, context, social networking, content management, CRM master files and automated outbound marketing.

Business Impact: Investing in Web analytics is becoming more indispensable to a digital oriented strategy, because of the significant implications for marketing or service delivery oriented enterprises, and anywhere the Web channel is strategic. The core process is to collect, analyze and monitor customers' behavioral activities on websites, and social and mobile applications. A view into what is working, or not, helps to optimize the digital channels. The impact of search engine advertising, email campaigns, cross-sell or upsell targeting, and social media activity can be measured and refined through Web analytics. Customer data can be gathered and incorporated into personalized and context rich content for marketing campaign decisions (such as profitability analysis and segmentation), and leveraged for every interaction channel in a campaign management strategy. Subscriber behavior can be analyzed to identify satisfaction issues and potential churn candidates. It is not uncommon for the business metrics of Web channels to double over baseline benchmarks within six months of starting a Web analytics program.

It takes as long as three years to achieve advanced skills, at which point a continuous improvement process should be in place.

Benefit Rating: Moderate

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Adobe; AT Internet; comScore; Google; IBM; Webtrends

Recommended Reading:

"Tag Management Systems Bring High Value to Online Channel Stakeholders"

"Web Analytics Market Update, 2012"

"Use Web Analytics When Defining a Mobile Internet Strategy"

"Tutorial: Web Content Product Recommendation Engines"

"Incorporating the Web Into Cross-Channel Customer Analysis"

Column-Store DBMS

Analysis By: Donald Feinberg

Definition: A column-store database management system (DBMS) is a DBMS that indexes each column of a table, storing the indexes in lieu of row data — unlike traditional relational DBMSs using a row-store, where data is stored in rows, with indexes optional. In addition, most column-store DBMSs include additional optimization techniques (such as compression and tokenization) to further compress the data — using less storage and increasing input/output (I/O) performance. We do not include row-store DBMS engines that offer columnar forms of compression only.

Position and Adoption Speed Justification: Like many technologies, column-store DBMS technology is a mix of mature products (such as Sand and SAP Sybase IQ) and newer products (such as those of 1010data, Exasol, Infobright, ParAccel, SAP [Hana] and Vertica). There are thousands of installations of column-store DBMSs today — used for multiple purposes, from small analytics data marts to full data warehouses (DWs). With the increased popularity of data marts and interest in analytics in the past few years, the column-store DBMS has gained market share as an analytic engine, leading to a growing number of new products (see Gartner's "Magic Quadrant for Data Warehouse Database Management Systems"). Most analytic applications require a minimum number of columns when retrieving data, and this, coupled with the compression abilities of the column-store DBMS, leads to lower I/O ratios and higher performance.

An additional driver of the maturing position of this technology is that these DBMS engines are SQL DBMSs and, for the most part, atomicity, consistency, isolation, durability (Acid)-compliant. Those that are not Acid-compliant fit the Base model and still are fully consistent models. Support for full

SQL and consistency implies that they can be used interchangeably with row-store DBMSs without changes or the need to support an eventually consistent model.

During the past few years, we have seen increased use of column-store DBMS solutions as the DW, primarily due to vendors enabling more sophisticated workload management software. With workload management and the high compression available, the column-store can handle the more complex workloads found in today's DW environments. Several vendors have added column-store technology to their DBMS products for this reason, notably EMC/Greenplum, Microsoft (SQL Server 2012) and Teradata (Aster Data).

The other major technical breakthrough has come with creative methods of loading data into the column-store — traditionally an issue due to the high number of disk writes required. Many of the vendors have achieved much faster loading techniques, allowing for near-continuous loading of data.

Finally, due to the high-level of compression, the column-store has begun to be used as an in-memory DBMS, where terabytes of source data can fit into gigabytes of memory. Products such as Microsoft's PowerPivot, SAP's NetWeaver BI Accelerator and QlikTech's QlikView use an in-memory column-store. Recently we have seen a number of new entries to the in-memory column-store DBMS sector, notably from SAP (with its Hana database), Exasol and ParStream (see "Cool Vendors in Advancing Data Management Maturity, 2012").

With the ever-growing use of column-store DBMSs and the introduction of in-memory column-store offerings, we believe that this technology is approaching the Plateau of Productivity. Due to the number of new entries (such as SAP's Hana), we have decided not to place it actually on the Plateau.

User Advice: Column-store DBMSs should be considered:

- As primary candidates for analytic data marts — because of I/O performance gained from compression and retrieval of fewer columns (typical of analytic applications).
- In an overall archiving strategy — as one of the "near line" alternatives, because of their high compression ratios while making the data available with standard relational tools.
- For data warehouse implementations — as they continue to improve mixed-workload management capabilities and the ability to load data with much lower latencies — approaching continuous loading.
- For leading-edge organizations: begin using in-memory column-store DBMS implementations for applications requiring high performance. Many of these applications cannot be implemented on a traditional DBMS due to the resources and execution time needed.

Business Impact: As the column-store DBMS broadens its appeal within an IT architecture, so its impact on the business and IT is also growing. The column-store's original function was in archiving solutions, although that is no longer the primary use case. The automatic compression achieved by storing data in column form (reported by clients to be as great as 20 to one, or more), makes column-store DBMSs a good choice for moving data out of the primary storage DBMS, while

maintaining the relational structure of the data. In addition to the obvious advantages of the reduced storage necessary for data (a clear cost saving), compression has also been shown to increase performance due to much lower I/O. This also has implications for reducing the size of servers required for the DW — another clear cost saving.

As hardware systems with large amounts of memory become more available during the next few years, and as costs decline, we will see increased use of the column-store as an in-memory DBMS structure. In addition, tests are showing that in-memory, column-store technology reduces the need for complex structures such as aggregation, summaries and cubes, reducing maintenance while further increasing performance. This development will not only allow for faster performance for many classes of application in the fields of business intelligence and analytics, but will also enable the column-store to have a potential use as an online transaction processing (OLTP) DBMS. In the past, this use has been prevented by the large number of disk writes required to insert or update a row — but this is no longer an issue when handled in-memory. The potential for the column-store to be used for both OLTP and the DW has far-reaching implications, not only for the design of systems but also in terms of major cost savings in comparison with slower disk systems with higher power and cooling requirements. As column-store technology continues to mature and its use continues to grow, it has entered the early mainstream maturity phase as it move toward the Plateau.

Benefit Rating: Transformational

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: 1010data; EMC; Exasol; HP; Infobright; Microsoft; ParAccel; Sand; SAP; Teradata

Recommended Reading:

"Magic Quadrant for Data Warehouse Database Management Systems"

"The State of Data Warehousing in 2012"

"SAP HANA 1.0 Could Help Enterprises Realize Promise of In-Memory Technology"

"Cool Vendors in Advancing Data Management Maturity, 2012"

Predictive Analytics

Analysis By: Gareth Herschel

Definition: The term "predictive analytics" has become generally used to describe any approach to data mining with four attributes: an emphasis on prediction (rather than description, classification or clustering), rapid time-to-insight (measured in hours or days), an emphasis on the business relevance of the resulting insights, and an increasing emphasis on ease of use, thus making the tools accessible to business users.

Position and Adoption Speed Justification: The algorithms underpinning predictive analytic applications are reasonably mature. Although new techniques continually emerge from research laboratories, the 80/20 rule firmly applies with most of the commonly used algorithms (such as CHAID decision trees and k-means clustering) that have been in existence for more than a decade. The applications are also approaching maturity, although the development of packaged applications to address specific business problems (compared with the generic approach of turning more-traditional data mining workbenches into predictive analytic solutions) is less mature and more diverse in its maturity. When predictive analytic applications have added project and model management capabilities and more enhancements to aid ease of use, they will have achieved maturity.

User Advice: Predictive analytics is a more user-friendly and business-relevant equivalent of data mining that is applied specifically to predictions of future behavior. Although potentially lacking some of the mechanisms to fine-tune the model performance that a traditional data mining workbench might deliver, the benefits of rapid model development and easier maintenance are appealing for most analytical initiatives. The bigger distinction is between predictive analytic solutions and packaged applications built on these solutions for specific business issues. In these cases, the selection decision should be based on the domain expertise that the vendor has been able to package into the application, versus the domain expertise the business analyst can bring to the analysis.

Business Impact: Predictive analytics can bring clarity and consistency to any situation where the likely future behavior or condition is uncertain. Common applications include understanding the future behavior of customers (Will they renew the relationship? Which products or services are they likely to buy?), the future state of customers (What will their lifetime value be to the company?) or to predict the likely performance of equipment (predictive maintenance allows the identification of at-risk components so they can be proactively replaced). By understanding likely future circumstances, organizations are better able to allocate investments to maximize returns.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Angoss; FICO; IBM (SPSS); KXEN; Pitney Bowes Software; Revolution Analytics; SAS; StatSoft

Recommended Reading:

"How to Increase the Volume of Advanced Analytics"

Appendixes

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 2. Hype Cycle Phases

Phase	Definition
Technology Trigger	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
Trough of Disillusionment	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (July 2012)

Table 3. Benefit Ratings

Benefit Rating	Definition
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2012)

Table 4. Maturity Levels

Maturity Level	Status	Products/Vendors
Embryonic	▪ In labs	▪ None
Emerging	▪ Commercialization by vendors Pilots and deployments by industry leaders	▪ First generation High price Much customization
Adolescent	▪ Maturing technology capabilities and process understanding Uptake beyond early adopters	▪ Second generation Less customization
Early mainstream	▪ Proven technology Vendors, technology and adoption rapidly evolving	▪ Third generation More out of box Methodologies
Mature mainstream	▪ Robust technology Not much evolution in vendors or technology	▪ Several dominant vendors
Legacy	▪ Not appropriate for new developments Cost of migration constrains replacement	▪ Maintenance revenue focus
Obsolete	▪ Rarely used	▪ Used/resale market only

Source: Gartner (July 2012)

Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Understanding Gartner's Hype Cycles, 2012"

"Hype Cycle for Information Infrastructure, 2012"

"Hype Cycle for Enterprise Information Management, 2012"

"Hype Cycle for Analytic Applications, 2012"

"Market Trends: Big Data Opportunities in Vertical Industries"

This is part of a set of related research. See the following for an overview:

- Gartner's Hype Cycle Special Report for 2012

Regional Headquarters

Corporate Headquarters
56 Top Gallant Road
Stamford, CT 06902-7700
USA
+1 203 964 0096

Japan Headquarters
Gartner Japan Ltd.
Atago Green Hills MORI Tower 5F
2-5-1 Atago, Minato-ku
Tokyo 105-6205
JAPAN
+ 81 3 6430 1800

European Headquarters
Tamesis
The Glanty
Egham
Surrey, TW20 9AW
UNITED KINGDOM
+44 1784 431611

Latin America Headquarters
Gartner do Brazil
Av. das Nações Unidas, 12551
9° andar—World Trade Center
04578-903—São Paulo SP
BRAZIL
+55 11 3443 1509

Asia/Pacific Headquarters
Gartner Australasia Pty. Ltd.
Level 9, 141 Walker Street
North Sydney
New South Wales 2060
AUSTRALIA
+61 2 9459 4600