

December 29, 2004

Open Source Databases Come Of Age

by Noel Yuhanna

TECH CHOICES

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Increased Adoption, Reliability, And More Choices Drive The Transition

by **Noel Yuhanna**

with Mike Gilpin and Carey Schwaber

EXECUTIVE SUMMARY

Open source databases continue to make inroads into enterprises, offering more robust, high-performance, and advanced DBMS features and functionality as enterprises look for low-cost solutions. More enterprises are deploying open source databases than ever before, with many looking at mission-critical deployments in the coming years. And with more than five viable open source database products available, enterprises now have more flexibility in choosing one that meets their requirements. More vendors are gearing up to offer comprehensive support and services to meet the growing demand. The future of open source databases remains bright, with products expanding to include advanced features and continuing innovation, in addition to enabling evolving technologies like XML, Web services, and content management. All enterprises should consider open source databases as part of their overall DBMS strategy to benefit from potential cost savings, starting with small application deployments.

TABLE OF CONTENTS

- 2 Open Source Databases Have Become More Viable**
- 8 The Current State Of Open Source Databases Is Healthy**
- 12 The Future Of Open Source Databases Remains Bright**
- RECOMMENDATIONS
- 13 Open Source Databases Should Be Part Of Your DBMS Strategy**
- 15 Supplemental Material**

NOTES & RESOURCES

Forrester interviewed 10 user companies and five vendors, including: Computer Associates (CA), IBM, MySQL, PostgreSQL, and Sleepycat Software.

Related Research Documents

- "CA's Ingres Goes Open Source"
June 25, 2004, Quick Take
- "How To Manage DBMS Efficiently"
April 2, 2004, Best Practices
- "Criteria For Selection: Enterprise Relational DBMS"
July 3, 2003, Planning Assumption

OPEN SOURCE DATABASES HAVE BECOME MORE VIABLE

Open source databases are not new; they have existed for more than two decades and do not differ much from commercial DBMSes in their support for basic database technology. So why are open source databases becoming more important and viable now than ever before? There are four key reasons. First, enterprises continue to look for opportunities to reduce infrastructure costs, and commercial DBMS licenses can significantly add to a company's costs. Second, databases are becoming a commodity, with fewer enterprises demanding advanced database features. We estimate that the majority of advanced features offered by commercial DBMS products are hardly used by enterprises; they are sometimes needed, but they aren't required for many projects. Third, enterprises want to avoid vendor lock-in, and open source is one option. Finally, the community resources behind open source projects are often larger than any single vendor can muster, and communities can add new features that enterprises want, rather than what commercial DBMS vendors choose to add based on more factors than just customer needs.

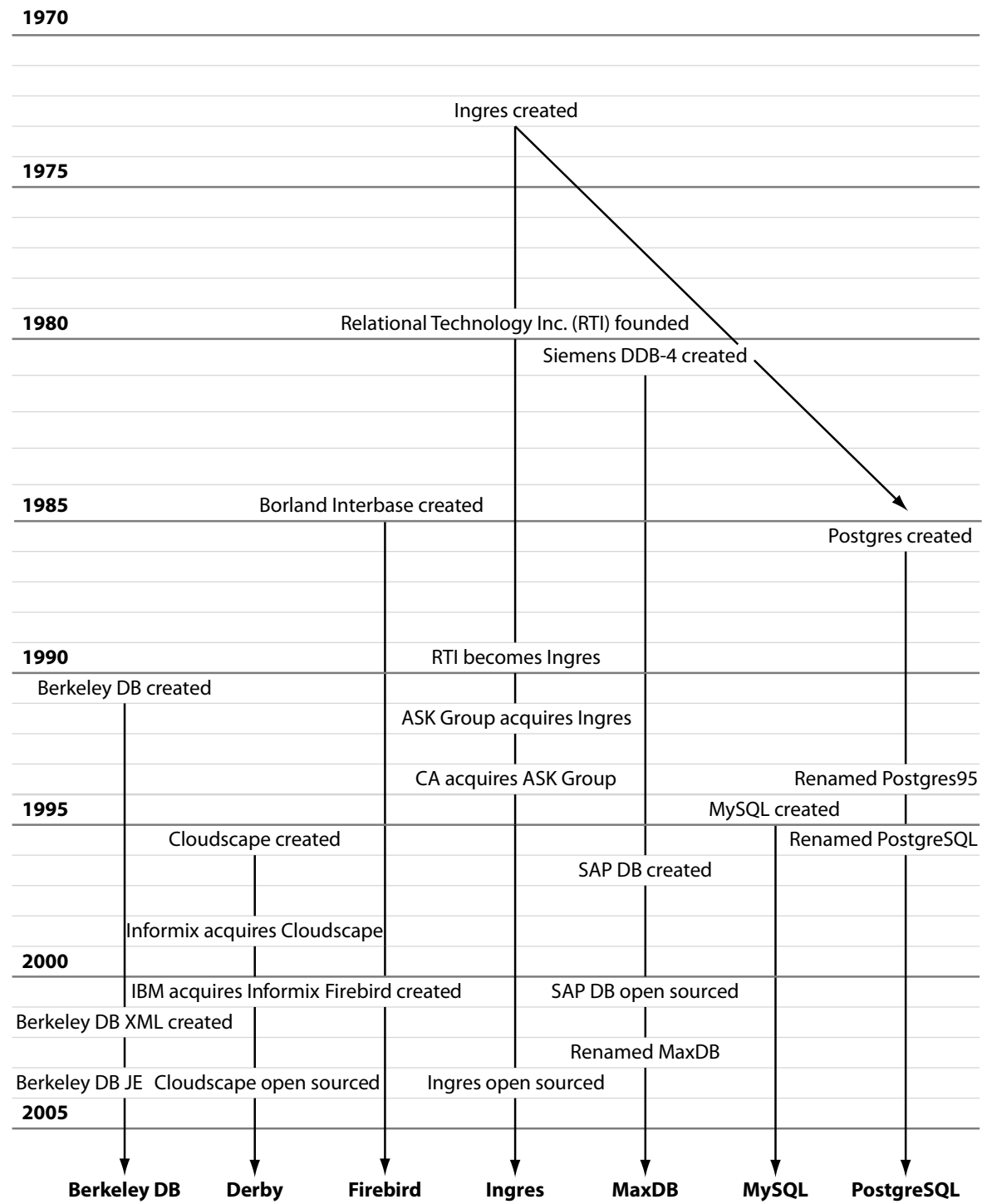
Open Source Databases Offer More Choices Than Ever Before

There are more than a dozen open source databases today, and that number is increasing. Five key products dominate the market: Berkeley DB, Cloudscape/Derby, Ingres, MySQL, and PostgreSQL. Most of these products have a long history of releases, with proven track records in commercial deployments (see Figure 1). There is no doubt that open source products continue to raise the bar with expanded feature lists and advanced capabilities that previously only commercial DBMS vendors offered. We expect more features and functions to be added to open source databases in the coming years, enhancing their scalability, performance, automation, integration, and availability. Also, as open source databases offer support for more commercial applications, their adoption rate will increase. A recent Forrester survey of 140 large companies in North America found that more than 52% of firms use or plan to use MySQL DBMS.¹

The Open Source Database Market Is Small, But It's Growing Rapidly

While open source databases represent only a fraction of the \$10 billion overall market for new DBMS licenses, the market potential is huge in the areas of support and services. As more enterprises start to use open source databases over the coming years, the demand for 24x7 technical support will increase and so will the need for services to help with planning, migration, and tuning initiatives. We estimate that the current open source database market — comprising new licenses, support, and services — is about \$120 million; this figure is likely to grow to more than \$1 billion by 2008. More ISVs will jump on the open source bandwagon to offer support and services over the next one to two years.

Figure 1 Open Source Databases Timeline



Source: Forrester Research, Inc.

Several Benefits Have Driven The Adoption Rate Still Higher

In a recent series of interviews, customers indicated that the main reason open source databases were being used was because of the cost savings. However, Forrester has found that low acquisition costs can be offset by somewhat higher integration, maintenance, and support costs over the lifetime of an open source product, so firms should conduct a careful analysis to see how these factors apply in their situation.² The key reasons why enterprises want open source DBMS are:

- **Low acquisition cost.** Commercial enterprise DBMS licenses currently cost an average of \$25,000 per processor, so this can add up to a significant budget item, especially when deployed for hundreds and thousands of databases across the organization. With open source databases, enterprises experience dramatic savings over new DBMS licenses.
- **Strong support from the community.** Open source is all about the community, tapping into hundreds and thousands of developers, contributing to increased reliability, robustness, and low-cost deployment. Most enterprises using open source databases claim to have very good support from the community, with responses provided by actual developers rather than by support personnel, as is often the case with commercial DBMSes.
- **Lower support and maintenance costs.** The annual maintenance costs for DBMSes often run high for many enterprises. Although open source databases can lower acquisition costs, they may not lower lifetime data management costs. Administrative support, migration, and upgrade efforts are often the same regardless of whether or not open source or commercial DBMSes are deployed.
- **More hardware and software choices.** With open source databases, enterprises often have more flexibility in choosing the hardware and operating system platform that meets their business and technological requirements. Unlike Microsoft SQL Server, open source databases can run on a variety of operating systems, including Linux, Windows, and several flavors of Unix. However, the value of this flexibility is somewhat offset by the advantages SQL Server can provide in tighter integration with the Windows operating system.
- **Access to source code.** Enterprises that need to support complex applications often find that open source databases offer greater flexibility in application integration by allowing developers to change source code when necessary. This can be particularly desirable when the database is deployed along with the application, with a common install.

- **Less database vendor lock-in.** With open source databases, there is no need to fear that a DBMS vendor might cease to exist or change its strategy. The major open source databases are supported by more than one vendor, and enterprises always have access to source code. This ensures long-term protection, although the cost of dealing with the worst-case scenarios must also be considered as part of the risk profile.

Concerns Exist, But They're Slowly Fading Away

Enterprises that are looking to adopt open source databases are concerned about the level of support and the time it takes to resolve issues. Many enterprises are used to the 24x7 support offered by commercial database vendors, with quick turnaround and resolution. While open source database vendors might not have a large support staff, enterprises certainly have a choice of vendors available to meet their support requirements. Recent user interviews revealed that key concerns around open source DBMSes include:

- **Support quality.** Although open source support is improving, it's still not comparable to commercial DBMS support. Commercial DBMSes have always offered high-quality 24x7 support for enterprises, surpassing the best level of support offered by open source databases, although this is beginning to change. Many open source database vendors are gearing up to offer higher-quality support and improved, searchable knowledge bases. Large vendors will offer even more support options and services over the next two years.
- **Product maturity.** While many enterprises encountered a high degree of reliability with many open source database products, the concern about product maturity remains. Yet the top five open source databases are mature and stable, surpassing this expectation. For example, one enterprise that runs Ingres for a mission-critical production database application stated that it ran Ingres for more than a year without shutting down, except when an upgrade was necessary. And most open source databases have a long history of product releases, some even surpassing those found in commercial DBMSes.
- **Support for packaged applications.** Although there are not as many packaged applications supported for open source databases, the number continues to grow and should largely eliminate this concern over the next two to three years. Many large ERP, CRM, and other business application vendors are considering supporting open source databases because of the growing market. Some are also building their own open source stacks to ship along with their applications.

- **Security.** All database products, whether commercial or open source, are vulnerable, largely because a DBMS is a complex piece of software. Many commercial DBMSes have experienced several security vulnerabilities over the past few years. Enterprises remain concerned about the security and reliability of open source databases, given that source code is easily available to any hacker. While this is true, it is at least partly offset by the larger community of the open source initiative driving the product to undergo a rigorous review to ensure robustness and reliability. Having access to the open source database source code also reduces anxiety about whether the vendor will exist in the future, helping to ensure long-term protection, although in some cases, source escrow programs for commercial DBMS provide the same benefit.

Most Deployments Are Not Mission-Critical, But That's Changing

While most of the open source database deployments are for non-mission-critical applications or edge workloads, we estimate that more than 35% of applications using open source DBMS will be mission-critical by 2006. Most open source database deployments support applications developed in-house, reporting databases, read-only applications, and data warehouses. Over the next two years, there will be a major push toward deployment of transactional databases using open source databases for both existing and new applications. Most enterprises typically spend more than 12 months testing and understanding open source database products before deploying them for mission-critical applications. This approach not only flushes out unknowns around support, product limitations or issues, and reliability, but it also gets the staff trained on the platform. Most customer deployments start out small and grow once the staff feels comfortable with the technology and as administrators get a handle on its operations. The most common applications using open source databases today include:

- Web-based applications.
- Small to midsize transaction-processing applications.
- Small to midsize data warehouses and data marts.
- Scientific applications like DNA sequencing or seismic analysis.
- Reporting databases.
- Directories and email repositories.
- Data repositories.

Open Source Databases Will Continue To Affect Commercial DBMSes

While open source databases will not replace the commercial enterprise DBMSes like DB2, Oracle, SQL Server, and Sybase, they will certainly take a bite out of large DBMS market share. As a result:

- **Commercial DBMS prices will fall.** DBMS vendors continue to feel competitive pressure from open source DBMSes and are likely to lower prices over the next 12 to 24 months in an effort to directly compete with them. The current impact of open source databases is in the low-end market, but it will expand into the mid- and high-end markets over the next three to five years. Earlier this year, Oracle reduced its pricing for entry-level DBMS products, and other vendors are likely to follow suit in one to two years. Other likely competitive responses include incorporating open source technology into the vendor's own offering, especially for vendors like IBM that already embrace open source in other areas.
- **Some vendors will adopt a free database strategy.** Sybase recently announced a free version of its Adaptive Server Enterprise (ASE) product on Linux; its free ASE has attracted some customers but, because of usage limits, will likely fall short of customers' expectations. Its limitations include a maximum 2 GB database size, one CPU server, and 2 GB of memory. More vendors will adopt this strategy in an effort to attract new customers, but these vendors will set higher limits.
- **Commercial DBMSes will have to innovate to retain customers.** The features gap between open source databases and commercial DBMS products is narrowing. While commercial DBMSes offer hundreds and thousands of database features, we estimate that only 40% of such features are typically needed by enterprises. This is one of the reasons why open source databases have become attractive; open source databases provide the basic database features and functions that most applications need. But commercial DBMS vendors will add highly innovative new features to retain large enterprise customers.

Source Code Is Nice To Have But Not A Necessity

A DBMS is a complex piece of software, which is why the majority of enterprises look at the source code to better understand how to use the DBMS but do not modify it. Enterprises that do modify the code usually do so to ensure tighter integration of their applications or to extend the product beyond its existing capabilities. Having access to the open source database source code also reduces anxiety about whether the vendor will exist in the future, helping to ensure long-term protection.

Support Remains Critical When Choosing An Open Source Database

Open source databases offer two ways to obtain support for the product. The first option is to get support from various vendors that offer technical support through phone and email, often for less than the price of commercial DBMS support. The benefit of vendor support is that most offer 24x7 phone support, which is essential for mission-critical applications. Some vendors also offer an extensive knowledge base; some are free while others are available for a small fee. The second option is to get support from the open source community via message boards and emails. The benefit with community support is that a response usually comes directly from actual developers, who know the code inside-out and therefore often resolve the issues quickly.

Most Deployments Are For Newer Applications

The majority of open source database deployments are for new applications, rather than migrations of existing ones, at least for now. Enterprises typically use open source databases for small, non-mission-critical database deployments initially before extending their usage within the organization. Database migrations are time-consuming, resource intensive, and costly. Also, most DBMS products differ in the data types they support and often use proprietary SQL extensions for creation of triggers, stored procedures, and functions. Therefore, we expect that the majority of initial open source database deployments will be for new applications, with migrations of existing databases rolling out over the next two to three years as more migration tools become available and enterprises become more comfortable with the technology.

The Database Tools Market For Open Source Is Growing

Over the past year, the number of database tools that focus on open source databases has increased. Enterprises are demanding more robust and integrated tools for open source databases to ensure their availability and performance. In the near term, various vendors will introduce tools in the areas of migration, replication, archiving, and security. Quest Software now offers its popular Toad tool on the MySQL platform to help both administrators and developers. By 2007, the growth in database tools support should largely eliminate the current deficit in support relative to commercial DBMS, which inflates the cost of ownership of open source options.

THE CURRENT STATE OF OPEN SOURCE DATABASES IS HEALTHY

More enterprises are ready to commit to open source than ever before, and others are extending their portfolio to support mission-critical applications. This year alone, two new large vendors joined the open source database bandwagon: Computer Associates with Ingres, and IBM with Cloudscape. The move to open source these databases has certainly raised the bar on the quality, performance, and reliability of open source databases.

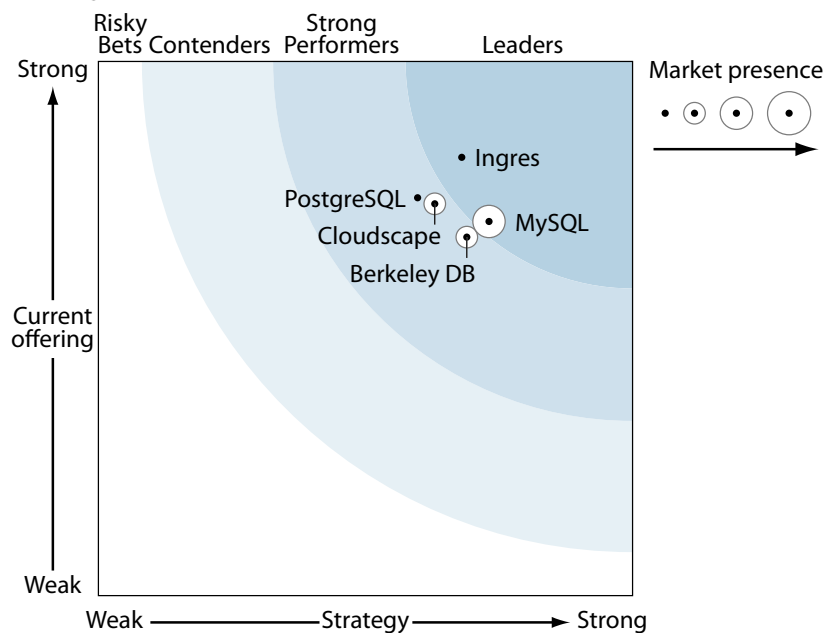
We conducted a Forrester Wave™ evaluation of the five key open source database products, namely Berkeley DB, Cloudscape, Ingres, MySQL, and PostgreSQL. We compared these tools in a number of areas, including transactional capability, security, market presence, and data warehousing capability, standards, and support (see Figure 2). Our findings:

- **MySQL remains the most widely used but lacks some key features.** MySQL continues to have a very high adoption rate across several industries and is known for its reliability, ease of use, and performance. It is a full, relational DBMS, and it supports row-level locking and deadlock detection functionality. However, it lacks some key DBMS features, such as triggers, stored procedures, and views, which are likely to be available in Version 5. These features are likely to boost MySQL to even higher adoption rates and may open doors for support for more packaged applications and tools. At present, there are many large enterprises that run MySQL to support both mission-critical and non-mission-critical applications.

“We have more than 20 MySQL production databases supporting our mission-critical applications. Basically, we depend on it. MySQL is the back end for our Web site, which gets more than 30 million hits a day. We are satisfied with the performance, availability, and support with MySQL. Besides, it saves us lots of money over commercial DBMSes like Oracle.” (Online community Web site)

Figure 2 Forrester Wave™: Open Source Databases, Q4 '04

 The spreadsheet detailing this Forrester Wave™ is available online.



Source: Forrester Research, Inc.

“We use MySQL extensively in our environment. For our Web site, which has more than 6 million unique visitors per month, we track all events created by user activity and store the state and session in MySQL. We also use MySQL to track the emails that we send out each week in a large data warehouse that has more than 300 million rows. MySQL doesn’t have some of the advanced features that Oracle has, but it meets our business requirements. Our application is mainly written in Java and some PHP/Perl. The MySQL community is very active, so getting support and guidance has been very effective. MySQL is easy and flexible to work with; we can get MySQL and our application running very quickly.” (Entertainment company)

“We looked at MySQL and Oracle at the very beginning and found that MySQL was a lot easier to configure, set up, and run, even though we had experience with Oracle. With Oracle we often had to hire an outside consultant to come to help with administration; with MySQL we never had to. MySQL has not only saved us money on licensing fees, but it also made our databases easier to manage. Adopting MySQL has been one of the better decisions that we have made. We do not see any limitations with MySQL DBMS for our application.” (Online retailer)

“We have not changed the source code of MySQL for our application, but being able to review it is incredibly valuable to us. It is a lot easier to troubleshoot with open source than to go to commercial support all the time. We are always looking to deploy more applications with MySQL because it’s easy to use, it’s flexible, and it saves us money.” (Entertainment company)

- **Ingres raises the bar for open source databases with expanded features.** Ingres is the most complete open source relational database. It has been around for more than two decades and is well known to have advanced enterprise-class features and reliability on par with many commercial DBMSes. CA recently made Ingres open source in an effort to make Ingres more visible and grow CA’s services and tools business. With Ingres going open source, the bar for features, functionality, and support is certainly higher for open source databases. CA’s move to open source Ingres might trigger other, smaller, commercial DBMS vendors to follow suit, especially for their slow-moving database products.

“Ingres has been our primary database platform for the past 10 years. We have a large subscription system that processes information about members who need to access airport lounges across the world. This application is running on a Linux/Red Hat environment. We wanted an enterprise database that was affordable to us; we invited Oracle to give us a quote, and it was laughable. Ingres R3 is a lot easier to install and use, and because it’s an open source product, more vendors are likely to offer plug-ins into their tools and applications, which will broaden the market. With Ingres you get an enterprise database at a very low cost.” (Travel services company)

“We’ve deployed Ingres for several in-house applications, including for a report server. We have been using Ingres for more than nine years, and we are pleased with its performance, reliability, and enterprise-class functionality. Our report server, which tracks information from various stores, is around 750 GB in size and growing. While the number of users is not high with the report server, we load more than a million transactions a day on it. We also use Ingres for the general ledger mission-critical application that has close to 250 concurrent connections. Our business depends on Ingres to support our critical applications.” (Retail company)

- **IBM’s Cloudscape/Apache Derby remains a viable DBMS.** Recently, IBM open sourced Cloudscape RDBMS and contributed it to the Apache Software Foundation (ASF) under the code-name Derby. Cloudscape is an embedded Java database that supports SQL92 and parts of SQL99. It has a small footprint and requires no administration. It was originally part of Informix’s product line; Informix was acquired by IBM in 2001. Cloudscape has always been behind the scenes, having a very low customer base and lack of visibility across the industry. However, open sourcing Cloudscape might spur higher adoption and increased innovation. Besides Cloudscape, other open source Java databases include Berkeley DB Java Edition from Sleepycat and the less well-known McKoi SQL Database.

While there aren’t many customers using Cloudscape, IBM has used the technology quite extensively to support more than 70 projects, including WebSphere, Tivoli, and Lotus Workplace. For customers that outgrow Cloudscape/Derby and wish to upgrade, IBM offers a full upgrade path to DB2. Potential uses of Cloudscape include support of Java applications for data repositories, directory services, and Web-based applications. Besides Java, Cloudscape also supports .NET programming environments using the ODBC interface. IBM offers an optional 24x7 support for Cloudscape/Derby through the IBM Cloudscape package.

- **PostgreSQL has good features with moderate adoption.** PostgreSQL and Ingres share a family history; both were created by Michael Stonebraker and his grad students at Berkeley. Because of this, PostgreSQL has strong enterprise DBMS features and functionality. PostgreSQL is a full, relational DBMS with core transactional capability like ACID properties and deadlock detection. It has many database features that are essential for business applications, such as triggers, functions, BLOBs, and views. The current version supports stored procedures using functions, but 100% SQL-syntax-compatible stored procedures will be available in version 8.1.

“We are using PostgreSQL in production for our critical applications, including running our Web site. PostgreSQL had all of the features and functionality that we needed for our application, including embedded SQL and transactional capability. It certainly has saved us money, besides giving us a high-quality database. The speed of

the PostgreSQL database has been phenomenal, besides being reliable and running without any issues. The PostgreSQL Web site contains a lot of documentation and FAQs that have been helpful.” (Entertainment company).

“We run real-time, mission-critical databases using PostgreSQL for our registry of Web sites. PostgreSQL is the core of the application, and if it goes down, all registrations and modification will cease. We found PostgreSQL very easy to administer; it conforms to the best practices in the industry. PostgreSQL has a very rich set of tools that cover broad areas from an end-user graphical tool to a command-line utility for experts. PostgreSQL is a mature database; we run it every day supporting our mission-critical applications. It has very good database features and supports high availability and mission-critical usage.” (Internet company)

- **Berkeley DB is widely used and well integrated with applications.** Berkeley DB is a developer database that is available as a C library or Java JAR file for easy integration with applications. It comes in three flavors: Berkeley DB Java Edition, Berkeley DB, and Berkeley DB XML. Key features include ACID properties to preserve transactional integrity and automatic recovery after failures, concurrent access, deadlock detection and resolution, and replication for high availability. While Berkeley DB supports many enterprise-class features, it is not a relational database and does not support SQL. Berkeley DB offers easy-to-use, programmatic APIs with language bindings for C, C++, Java, Tcl, Perl, Python, and PHP.

“We have been using Sleepycat Berkeley DB for the past two years for our enterprise software. Our applications are becoming more complex, with SAN storage and complex hardware infrastructure. We use the Berkeley DB to share information among various applications related to resources. Berkeley DB is a small, easy, and fast database that is critical for our product. We did not need complex queries or complex databases; we just needed a simple and easy-to-use database with no administration requirements, and Berkeley DB delivered that. We hardly ever use Sleepycat’s support because of the product’s reliability. Although we have looked at the source code, we haven’t felt the need to modify it.” (Technology company)

THE FUTURE OF OPEN SOURCE DATABASES REMAINS BRIGHT

In the future, open source databases will continue to grow in adoption and will become part of the overall DBMS strategy for all enterprises. More innovations in the areas of automation, security, unstructured data management, availability, and integration will come from open source databases. Future open source database trends will include:

- **Higher adoption and increased support for packaged applications.** Open source databases will continue to make inroads to enterprises that are looking for low-cost DBMS alternatives in the future. We estimate that 30% of enterprises will be using open source databases in production by 2008. More enterprise packaged applications, such as ERP and CRM applications, will support open source databases over the next two to three years.
- **More features, automation, and innovation.** In the near future, more open source databases will support semistructured and unstructured data, along with advanced data searching capability. Advanced automation of administrative tasks will roll out in the areas of performance tuning, backup recovery, archiving, replication, patch deployments, and upgrades. Some open source databases will lead in innovation to offer highly advanced features for availability, performance, and reliability.
- **Growing demand for robust, reliable, and cross-DBMS tools.** As more enterprises use open source databases for mission-critical deployments, the need for database tools will grow. Enterprises will demand more cross-DBMS tools that support not only their current portfolio of databases but also open source databases. More database tools will be offered that will support high-end open source database deployments.

RECOMMENDATIONS

OPEN SOURCE DATABASES SHOULD BE PART OF YOUR DBMS STRATEGY

- **Start with small deployments and then expand.** Use open source databases for small deployments initially to understand the product's strengths, weaknesses, and administration requirements before using them for larger applications.
- **Join the open source community and contribute.** Open source is all about the community. Therefore, no matter which open source database you use, you should have your administrators and developers join the community not only to understand more about the product but also to actively contribute to it. However, when contributing code, the company needs to develop procedures and ensure that none of the company's intellectual property is inadvertently lost to the community.
- **Make sure you have visibility into source code.** This can help when dealing with complex applications. Given the complexity of open source database source code, only a few enterprises modify it. However, having access to source code remains helpful, especially when requiring tighter integration with any complex in-house application or when dealing with large applications.

- **Look for vendor support besides the community for critical applications.** Many vendors are offering highly improved 24x7 technical support coverage for open source databases to meet the growing demand. Besides tapping the community for support, enterprises should choose vendor support, especially when supporting mission-critical database applications. Most vendors offer quick response for critical issues, in addition to services around installation, tuning, and migrations.
- **Plan for considerable effort for rip and replace, on top of high costs.** Migrating a DBMS to any product, whether commercial or open source, remains a complex effort, especially for large applications. Ensure that planning is given utmost importance when migrating. Also consider using tools that can help in the migration process, as automation minimizes human errors.
- **Standardize on one or two open source databases.** Just as with commercial DBMSes, firms should standardize on one or two key products to ensure lower cost, manageability, and operational efficiency.
- **Benchmark before deploying any large database.** Most deployments of open source databases are centered around small databases. To ensure performance and scalability, consider benchmarking your application.

SUPPLEMENTAL MATERIAL

Online Resource

The underlying spreadsheet detailing the Forrester Wave in Figure 2 is available online.

Companies Interviewed For This Document

BMC Software	PostgreSQL
Computer Associates	Quest Software
IBM	Sleepy Cat Software
MySQL	Sybase

ENDNOTES

- ¹ Forrester surveyed 140 large companies in North America to find out their open source plans. See the March 16, 2004, Trends “Open Source Moves Into The Mainstream.”
- ² Open source is cheap to acquire, but the integration, maintenance, and support costs can add up, therefore enterprises should proceed after careful analysis of the benefits. See the March 16, 2004, Trends “Open Source Moves Into The Mainstream.”

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Helping Business Thrive On Technology Change

Headquarters

Forrester Research, Inc.
400 Technology Square
Cambridge, MA 02139 USA
Tel: +1 617/613-6000
Fax: +1 617/613-5000
Email: forrester@forrester.com
Nasdaq symbol: FORR
www.forrester.com

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