A Web Commerce Group Case Study on PostgreSQL

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Customer

BASF is a return-focused global company generating long-term growth and profitability from its activities in chemicals, health and nutrition, and oil and gas. The company's product range includes high-value chemicals, plastics, dyestuffs, dispersions, automobile and industrial coatings, crop protection agents, fine chemicals, crude oil and natural gas. BASF's approach to integration, known in German as *Verbund,* is one of the company's particular strengths and provides a unique competitive advantage. With sales in 2001 of approximately 32.5 billion euros (approximately $29 billion US) and a workforce of 92,000+ employees, BASF is one of the world's top chemical companies.

Harvest Partners Network™

BASF Agricultural Products division in North America is spearheading an e-initiative, Harvest Partners Network™. It was developed by BASF to meet the connectivity needs of agribusinesses and producers living in rural America. The rural digital divide has left these businesses without access to broadband connectivity, unable to take full advantage of the Internet and eBusiness. As new developments in agriculture, such as product tracking, become more prevalent, eBusiness and high-speed Internet connectivity will play a more important role in the food and fiber production chain.

Customer: BASF (www.basf.com) Agricultural Product Division in North America. BASF is the world's leading chemical company with sales of 32.5 billion euros (approximately $29 billion US) in 2001 and has 92,000+ employees worldwide. It operates production facilities in 38 countries and has customers in more than 170 countries.

Challenge: Increase market share and revenue of BASF products in the agriculture industry, as well as increasing customer loyalty by leveraging the Internet; be a technology leader in the agricultural industry

Solution: Include a shopping platform (Arkdom^{SM} Commerce Enterprise Edition) to the BASF's agribusiness portal, Harvest Partners Network™ (www.hpnetwork.net), targeting BASF's customers

Why PostgreSQL: Web Commerce Group (WCG)'s product, Arkdom^{SM} Commerce Enterprise Edition, was developed with PostgreSQL and is powering the shopping platform on the BASF's portal. WCG selected PostgreSQL primarily for three reasons:
- Lower total cost of ownership
- Superior technology
- Better maintenance and support

Key Business Benefits: By using the Arkdom^{SM} Commerce Enterprise Edition, BASF is able to benefit from:
- 67% cost reduction
- Higher customer satisfaction
- Increased revenue potential

Harvest Partners Network™ provides high-speed Internet access along with online agriculture-focused information including detailed markets, weather, news, and shopping. This creates new opportunities for using the Internet, accessing business information, and connecting with customers and business partners.

Harvest Partners Network™ brings the full speed and power of the Internet to rural America, the same way that affordable satellite service brought premier TV to producers everywhere.

Challenge

I n the agricultural sector, BASF has been providing crop protection products and services related to retail dealers and growers (farmers). BASF is committed to retail dealers for a strategic reason: BASF is betting that in the future, dealers will exert more, not less, influence on input decisions, but that they will need more business and information management expertise to do their jobs. What has emerged from BASF's frank dialogues with the dealers are two basic needs – better grower-customer relationships, and better internal communication / data transfer – and a wish of sorts: an alternative to rural America's notoriously slow and unreliable dial-up Internet connections. In response, BASF is rolling out a high-speed, satellite-based Internet network and an array of Web-based information resources and services, the Harvest Partners Network™ portal.

BASF seeks to use the portal to increase customer loyalty, market share, and revenue from its agricultural products. Through creative use of the Internet, BASF intends to become a technology leader in the agricultural industry.

Solution

A critical component of the Harvest Partners Network™ portal is the shopping platform powered by Web Commerce Group's Arkdom Commerce Enterprise Edition which is part of the Arkdom Commerce suite of products. Arkdom Commerce suite is composed of the following editions that have been designed to run optimally on market-leading Web application servers, such as JBoss, as a plug-in:

- *Arkdom Commerce Affiliate Edition*: Software components that enable affiliates, who participate in Internet affiliate marketing, to generate more sales

- *Arkdom Commerce Business Edition*: Software components for enabling businesses to conduct more robust and profitable e-commerce

- *Arkdom Commerce Enterprise Edition*: Software components from both Affiliate and Business editions, which can be customized to meet each individual customer's need

The shopping platform allows the customers (retail dealers and growers) to shop for local, regional, and national brand name products in one place, while earning HARVEST POINTS® that they can use to purchase BASF products. HARVEST POINTS® is a loyalty program sponsored by BASF and its business partners. It is available at www.harvestpartners.com.

Besides the shopping on the portal, the customers can view a "kiosk" type screen with weather, news, and commodity prices, as well as enjoy the interactivity that the Web provides. The customer will be able to drill down into more detailed and localized weather information including wind speed/direction, heat index, etc. Commodity prices from the USDA will be featured, along with news, analysis, commentary – some of it presented in streaming video, which customers can start, stop, and reverse. The countertop, kiosk-type presentation also will enable growers to browse the Harvest Partners Network™ portal when they are visiting the dealership. When access is made available to farmers this summer, this exposure could prove doubly beneficial to dealers interested in signing up their grower-customers for the Harvest Partners Network™. This will be a key step for dealers planning to use the Harvest Partners Network™ as a customer development tool.

System Architecture

Figure 1 is a high-level system architecture of the shopping platform. It is designed in n-tier architecture for optimal scalability, security, reliability, and performance.

To protect BASF's interest, only parts of the overall system architecture, which are directly related to PostgreSQL, are shown. It should be noted that the exact number of servers being used is not shown either.
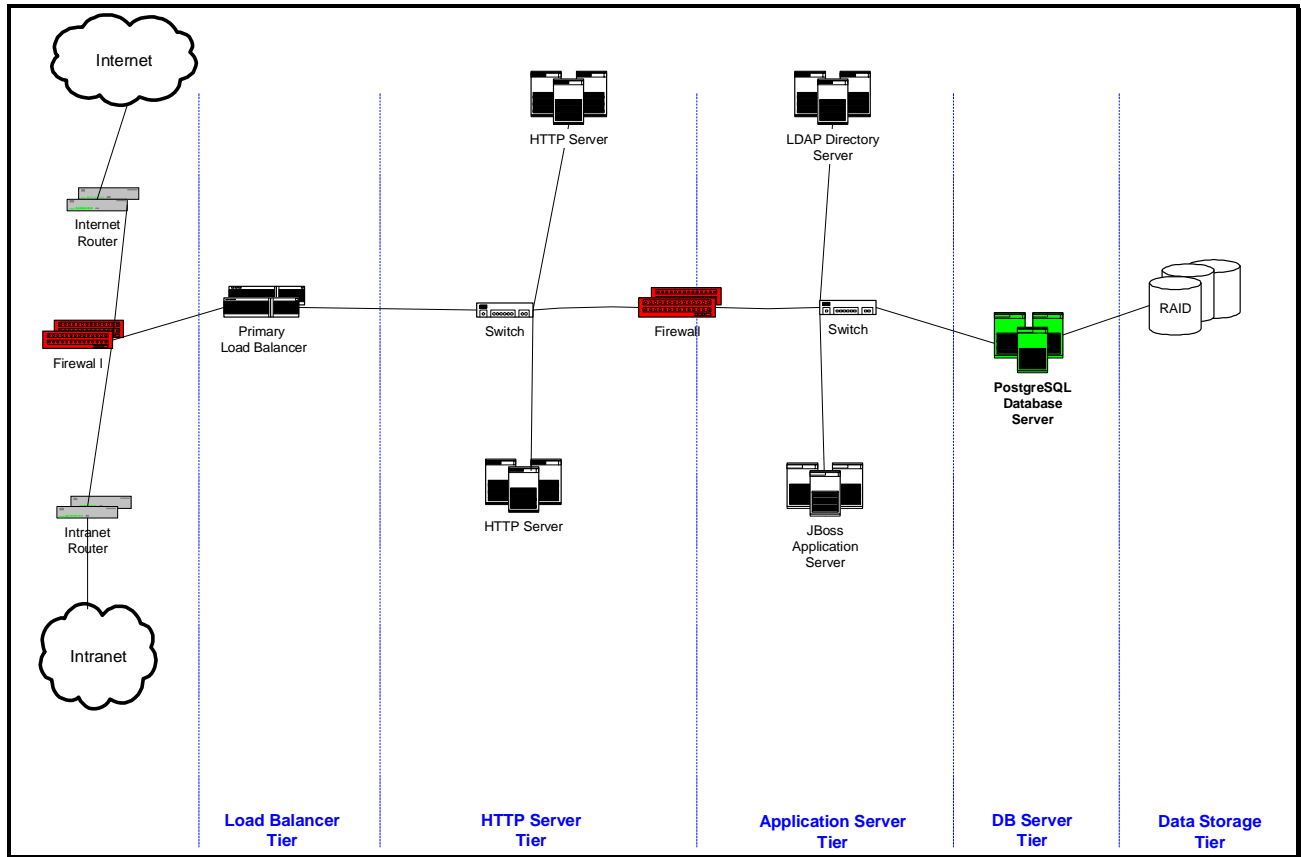

Figure 1

PostgreSQL is an integral part of the overall system, handling all of the shopping platform's database needs.

Software Architecture

The Arkdom Commerce Enterprise Edition designed using the Model-View-Controller framework powers the shopping platform. It also incorporates some of the best-of-breed design patterns such as facade. This product is primarily developed with JSP pages and J2EE/EJB components that are implemented as managed beans (MBeans) using JMX (Java Management extension) technology. JMX allows the product to be a simple plug-in to JBoss, making the integration with JBoss much simpler and easier for those developers who want an e-commerce product that can run optimally along with their own components in a seamless fashion.

Database Architecture

As shown in Figure 2, Arkdom Commerce Enterprise Edition distributes data to multiple servers for a performance reason. Each application server has an instance of PostgreSQL with read-only data such as product catalog. Each read-only database is currently about 600 megabytes and Web Commerce Group expects that it will grow to about 6 gigabytes within a year.
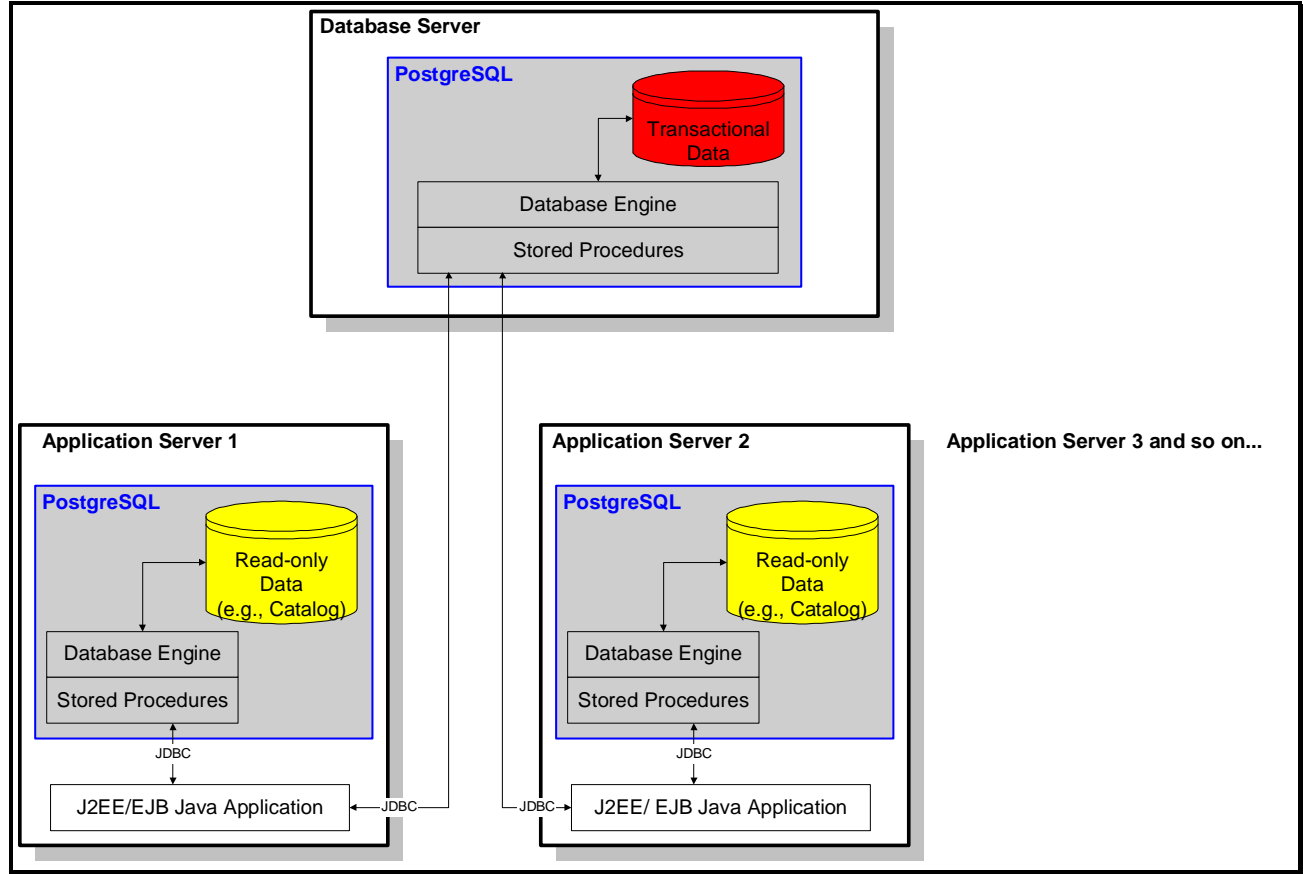
Figure 2

The database server also has an instance of PostgreSQL that primarily manages transactional data requiring frequent insertion, deletion, and update. The transactional database is currently relatively small (about 10 megabytes) but Web Commerce Group expects that it will grow to over 10 gigabytes within a year.

All access by the J2EE/EJB Java application is achieved through stored procedures which provide higher performance, as well as making development and maintenance efforts more efficient.

Software and Hardware

The shopping platform is developed in100% open-source software. Some of the key software components used are:

Software	Function
Apache 1.3.26	HTTP server
JBoss 2.4.4	Java Web application server for managing J2EE/EJB components
OpenLDAP 2.0.21	LDAP directory
PostgreSQL 7.2.1	Database management system
Red Hat Linux 7.2	Operating system for 32-bit and 64-bit Intel processors
Tomcat 3.3.1	JSP (Java Server Page) enabling for dynamic content generation

All servers use 32-bit Pentium IV and Xeon Intel processors except for the database servers, which use 64-bit Itanium processor.

Other Information

The shopping platform is initially designed to support about 100,000 subscribers primarily located throughout the United States, with 25,000 concurrent users. The n-tier architecture of the shopping platform allows BASF to scale up horizontally and vertically to accommodate more users as the shopping platform expands. Advanced system- and application-level performance and tuning techniques equip the shopping platform to meet 3 – 5 second response time that end users expect.

Why PostgreSQL

Web Commerce Group invested extensive research before deciding which Database Management System (DBMS) to use, in order to find a product suitable for use in the Arkdom Commerce products. Major products considered included Firebird (InterBase), IBM Universal Database, Microsoft SQL Server, MySQL, Oracle, and SAP DB. Web Commerce Group selected PostgreSQL for three primary reasons: Total cost of ownership, Technology, and Maintenance and support.

Total Cost of Ownership (TCO). Because PostgreSQL is open-source software licensed under BSD, it is free. The following cost components were taken into account when evaluating TCO for PostgreSQL and other DBMS products:

- *Acquisition.* How much does it cost to acquire the DBMS?
- *Deployment and setup.* How much does it cost to set up and deploy applications developed in the DBMS?
- *Hardware and software working in conjunction with the DBMS.* What kinds of hardware and software are required to run the DBMS and how much do they cost? What kinds of software can the DBMS work with and what is the integration cost?
- *Maintenance and upgrades.* How much does it cost to maintain an application developed in the DBMS and how much does it cost to upgrade?
- *Staff training.* How much does it cost to hire and train people in the DBMS?
- *Removal of the DBMS from asset.* How much does it cost to remove the DBMS in order to use another replacement product?
- *Technical support.* How much does it cost to provide technical support for the DBMS?

PostgreSQL was the clear choice based on Web Commerce Group's TCO analysis.

Technology. PostgreSQL is a sophisticated object-relational DBMS that is a hybrid of relational and object-oriented DBMS. PostgreSQL provides a number of compelling, advanced technical features, including the features that guarantee ACID (Atomicity, Consistency, Isolation, and Durability), stored procedures, triggers, replication, transaction support as well as object-oriented features such as inheritance. Through the use of Multi-Version Concurrency Control (MVCC), PostgreSQL can optimally support heavy transactions load in a large multi-user environment in which there are many users trying to read and update data. A good example is a large e-commerce website. MVCC also allows PostgreSQL to make a full database backup while the database is live, without interrupting end users by shutting down the database.

Maintenance and Support. PostgreSQL has the same types of advantages as other popular open-source software such as Linux. New technologies and features tend to be implemented quickly and aggressively in open-source software. Since open-source development is an ongoing process involving potentially hundreds of talented developers, PostgreSQL can offer new features, architectures, and platform support as soon as the project can implement and support it. This is often long before standard commercial products can incorporate these innovations. Because the open-source development process is highly collaborative, the resulting code sees widespread peer review, improving the probability of turning out a solid and secure product. Unlike other open-source software that lack commercial support, PosgreSQL has numerous, reputable companies, such as Red Hat (www.redhat.com), that provide support and documents. There are also a fair amount of documentations and books (free and purchasable), in addition to an active, responsive developer forum and network.

Key Business Benefits

By incorporating PostgreSQL into the Arkdom Commerce Enterprise Edition along with other open-source software mentioned in Solution section of this document, Web Commerce Group was able to provide BASF with numerous business benefits. Some of the key business benefits were: Cost reduction, Higher customer satisfaction, and Increased revenue potential. The following is a summary of the benefits:

- *Cost reduction.* The combination of PostgreSQL and other open-source software used in the Arkdom Commerce Enterprise Edition resulted in reducing BASF's total hardware/software acquisition cost for the Harvest Partners Network^{TM} portal by 67%.

- *Higher customer satisfaction.* Web Commerce Group was able to design the Arkdom Commerce Enterprise Edition to achieve higher reliability and performance metrics, resulting in improved overall user experience.

- *Increased revenue potential.* The Arkdom Commerce Enterprise Edition generates HARVEST POINTS$^{®}$ that the customers, in turn, use to purchase BASF's products. Though it is early to tell how much revenue the Arkdom Commerce Enterprise Edition will have directly generated, it is clear that the projected revenue is significant.

This case study was written by Web Commerce Group (www.wc-group.com). Web Commerce Group is a software technology company that delivers wired and wireless Internet software components as a service to business entities, while remaining behind the scenes. All of its software products are marketed under umbrella brand Arkdom^{SM}, which are available on Web Commerce Group's product site: www.arkdom.com. Please direct any questions about this case study or inquiries on the Arkdom products to contact@wc-group.com or +1.919.841.5992.