



JBoss Application Server

STANDARDS BASED INFRASTRUCTURE FOR THE ENTERPRISE



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EXECUTIVE SUMMARY

Java 2 Enterprise Edition (J2EE) middleware has matured. This has created opportunity for lower cost alternatives including open source. Open source application server JBoss Application Server (JBoss AS) is one of the most popular J2EE application servers. A recent survey [16] indicates JBoss AS is the most deployed application server with deployments exceeding those of BEA Systems WebLogic Server and IBM WebSphere. Moreover, JBoss Inc. has combined the best of open source and commercial software in a unique enterprise-friendly methodology called Professional Open Source. Professional Open Source adapts the best features of open source development with enterprise friendly license policies, indemnification against intellectual property issues, and world class support, training, and consulting services.

JBoss AS is a key component in a low-cost open source grid infrastructure for blade computers. This infrastructure includes Linux, Apache, MySQL, and JBoss AS. JBoss AS provides a standard J2EE platform at an unbeatable zero cost software license, enabling radical scaling out of applications without prohibitive per CPU licensing costs. Unlike comparable offerings from other vendors, this structure provides a fixed cost that does not increase as you add CPUs. A key technology for the J2EE open source grid is JBoss AS Clustering which can radically scale unmodified J2EE applications across large grids of servers. JBoss AS Clustering delivers “transparent middleware” that requires no special changes to applications to take advantage of massive scalability and management.

JBoss AS is a foundational component of the JBoss Enterprise Middleware System (JEMS) which provides a fully integrated and tested middleware suite of products, including JBoss AS, Hibernate, Apache Tomcat, JBoss Cache, JBoss jBPM, and JBoss Eclipse IDE. The entire JEMS suite is covered by JBoss’ Professional Open Source processes, support services, indemnification and enterprise friendly license policies. Organizations can comfortably reduce the cost overhead of their enterprise platform middleware without compromising on world-class reliability, support, or functionality.

Developers achieve unparalleled productivity, maintainability and clarity of code using JBoss AS. Unlike other application servers that lock you in or limit the pool of knowledgeable developers, JBoss AS programming is standards-based and designed with a transparent middleware philosophy. This means that programmers only need to focus on Java programming while receiving the benefit of enterprise class scalability, reliability and interoperability expected from the best application servers in the world. Organizations can hire from the largest pool of talent without having to request product specific knowledge beyond that of Java 2 Enterprise Edition experience.

Developers can focus on Java programming, while taking advantage of optional services like Aspect Oriented Programming, which can transparently inject middleware services such as persistence and transaction management that would otherwise have to be hand coded into every object. This transparent philosophy maximizes the simplicity of the source code without compromising the ability to leverage enterprise class features. Best of all, a single change to an aspect can save recoding thousands of class files by hand.

In conclusion, JBoss AS is the most popular, productive and cost effective application server on the market today. It forms an essential part of the open source grid computing infrastructure alongside key components such as Linux, Apache Web Server, and MySQL Database.

Scope

This white paper is for architects, senior development managers, and information officers who are seeking to learn more about how standards-based Java 2 Enterprise Edition (J2EE) middleware can help achieve organizational IT objectives.

This is a non-technical whitepaper, but it presumes familiarity with J2EE application servers and their uses in organizations. This whitepaper will focus on the following usage scenarios:

- 1 - Middleware Infrastructure for Grid Computing
- 2 - Migrating to Open Standards
- 3 - Simplifying and Accelerating Application Development

The term JBoss can refer to any of the following three things:

- The popular open source Application Server
- The company whose employees wrote the JBoss Application Server.
- Any of a collection of open source projects sponsored by JBoss Inc.

This paper is focused on the Application Server. However, the paper will also show the advantages of working with JBoss Inc. and it will show how the Application Server fits within the JBoss Enterprise Middleware System.

THE JBOSS APPLICATION SERVER

With over 5.5 million downloads to date, JBoss AS is the most popular open source J2EE application server in the market today. JBoss AS has achieved this level of popularity because of its maturity, technical excellence, robust support and platform ecosystem.

Open source, open standards

Gartner Group (Natis November 2003) suggests that J2EE infrastructure is being commoditized and that the response of the major vendors will be to increase the proprietary features of their Application Platform Suites through 2006 [14]. Accordingly, Gartner suggests great care be taken in vendor selection, because the lock-in will result in a long (greater than five year) commitment to fully realize the investment. Organizations can protect themselves from lock-in by identifying open, standards-based infrastructure components.

JBoss AS is J2EE 1.4 certified, having passed all 23,000 plus tests in the Sun Microsystems Compatibility Test Suite. This represents a significant measure of assurance that standard enterprise Java applications will run seamlessly on JBoss AS and other J2EE certified application servers without requiring costly modifications. Today, open source provides a safe, standards compliant way to address commodity and high volume computing needs. Instead of being locked in to a vendor, IT departments can rely on open source solutions like JBoss AS.

Simpler

Simplification is a powerful way to reduce risk in delivering IT applications. In an effort to simplify IT, organizations are consolidating their software. Consolidation reduces complexity by decreasing the number of standards, vendors, products and technologies. In the J2EE market, the emergence of Application Platform Suites decreases the number and complexity of middleware components and focuses on delivering a tightly integrated suite of products focused on the entire application lifecycle. By reducing the number of standards, vendors, products and technologies, organizations decrease the number of integrations needed when they are deploying a new technology. In addition, the cost and risks go down as companies realize the benefits of simpler IT.

JBoss AS is loved by developers for its ability to deliver powerful enterprise features without sacrificing the simplicity of Java objects. JBoss AS fits within a fully integrated and tested JBoss Enterprise Middleware System, or JEMS. JEMS is similar in scope to the integrated platform suite offerings from the other major commercial vendors, but it avoids the monolithic nature of its competitors by providing a modular architecture that supports unfettered plug and play.

Better

Simplicity and cost are not the sole reasons for the success of JBoss AS. Customers are delighted by the technical excellence, robust developer community, and advanced features such as caching, clustering, persistence, and Aspect Oriented Programming. JBoss has created a superior model for enterprise open source called “Professional Open Source”. Professional Open Source combines the best of commercial software reliability and accountability with the tremendous advantages of open source. Customers prefer it; JBoss Professional Open Source Support services are preferred over the support services supplied by closed source Application Server vendors [20].

Hundreds of the world’s biggest and best organizations use JBoss AS and Professional Open Source in production, including Continental Airlines, Corporate Express, Nielsen Media Research, La Quinta Corporation, MCI, Travelocity, and many others. Enterprises everywhere are leveraging the power of a rapidly maturing open source development community to meet their needs.

The following three sections provide scenarios that show how your organization can get the most out of JBoss AS and Professional Open Source from JBoss Inc.

SCENARIO: MIDDLEWARE INFRASTRUCTURE FOR GRID COMPUTING

One of the watchwords of today’s computing infrastructure is utility computing powered by a vast number of computing devices assembled in a grid. The emergence of grid computing is powered by virtualization technologies such as Hyperthreading (virtual processor threads), Java Virtual Machines and Storage virtualization. These technologies provide hardware and Operating System (OS) abstraction – eliminating the reliance on vendor-specific hardware and OS platforms. They also enable stable and commoditized scale out of many servers to be provisioned as a single virtualized computation environment for deploying a large number of diverse applications.

The most prominent use of grid technologies in the data center is the rise of blade computing. Performance can be flexibly scaled to meet application demand by increasing the number of blades. Blades provide an energy, space and cost effective infrastructure for managing the scalability of server infrastructure.

x86, Linux, and JBoss AS

Organizations are increasingly benefiting from high volume, low cost standards in many parts of their infrastructure.

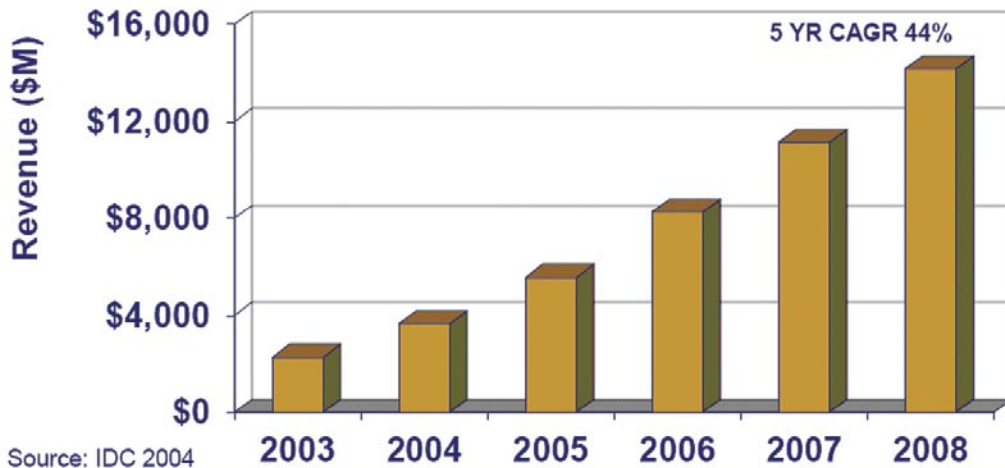
Commodity x86 Hardware

At the hardware level, the x86 instruction set provides a standard interface for processors that drive a commodity market supplied by Intel and AMD. Gartner (July 2003) states “We expect a new breed of servers to appear in data centers composed of common building block modules in high-density, rack-mounted configurations that employ proprietary backplane designs for delivering the high performance of traditional SMP designs” [12]. These “Blade” servers are the basis of the “scale out” rather than “scale up” paradigm of system performance—configured in a large network of low cost servers.

Linux Operating System

In the operating system, the rise of Linux shows the power of open source in providing enterprise-class features and performance. Gartner predicts that Linux will attain parity with UNIX in functionality and performance by 2009 (0.7 probability) [10]. Research firm IDC, in a paper titled “The Linux Marketplace – Moving From Niche to Mainstream” predicts the overall market revenue for desktops, servers and packaged software running on Linux will exceed \$35 billion by 2008, and that the growth rate for Linux will ramp up from 15% annually (CAGR) to 44% by 2008. [22]

WW Linux Software Revenue



Key packaged software markets on Linux include database, application server software, applications and management tools. These software revenues dwarf revenues for the Linux distributions.

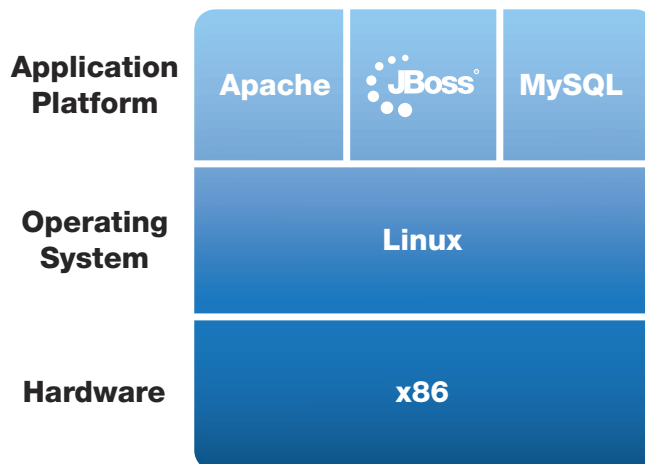


December, 2004

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Application Platform

As described in the IDC report, the key packaged software markets on Linux include database, application server software, applications and management tools. The three elements common to most modern enterprise applications are the Web Server, the Application Server, and the Database – representing the presentation, business logic, and data layers respectively.



The emerging leaders in each of these areas are depicted above in the open source infrastructure for grid computing. While each of these components are designed to be interoperable with other solutions including closed source options, the configuration depicted above represents the most popular, best of breed open source configuration which can provide compliant, scalable and reliable J2EE application delivery across a grid of low cost servers.

JBoss Clustering

JBoss AS achieves scalability and fault tolerance through its clustering technology. This makes it suitable for deployment across large numbers of lower cost servers.

Scalable and Reliable

The Clustering technology provides reliability through fail-over and load balancing for JNDI, RMI, Entity Beans, and Stateful Session Beans including those with in-memory state replication.

Easy to Deploy

The clustering technology was designed to be transparent to the application. Cluster nodes automatically discover one another on boot up—with no additional configuration. Additionally, they automatically synchronize their state with the rest of the group. Any application can be made to run on a JBoss cluster.

Clustering is included with the standard JBoss AS distribution and can be activated by simply setting a single flag in a JBoss deployment descriptor, which is enough to enable load balancing, state replication and failover for your Java beans.

Easy to Manage

The JBoss JMX microkernel forms the basis of JBoss Farming. With a JBoss farm, copying a deployable component to one node's deployment directory causes it to be deployed across the entire cluster, with no downtime. Similarly, components can be updated or uninstalled. Since this is a microkernel level feature, not only can your applications be hot-deployed, the entire cluster could update the version of the JBoss AS, Tomcat, or any other JEMS component in this fashion. All of these components are configured and managed through a standard Java Management eXtensions (JMX) interface.

SCENARIO: MIGRATING TO OPEN STANDARDS

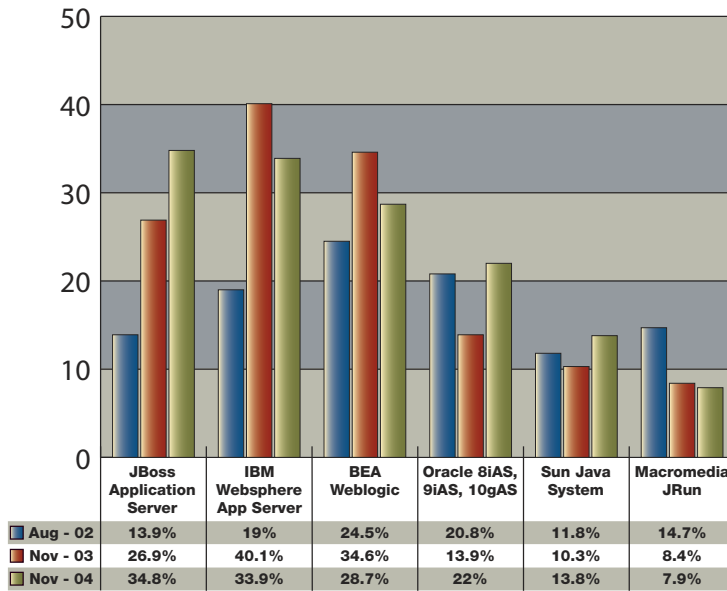
Recent primary research shows strong momentum for JBoss AS. Unlike earlier studies which emphasized the magnitude of software license revenue generated by various application servers, these newest surveys focus on the number of deployments. Number of deployments indicates the strength of the community and the rate of acceptance of the technology across a large number of organizations.

The Most Popular J2EE Application Server

BZ Media, publisher of SD Times magazine conducted survey research based titled "Fourth Annual Java Use and Awareness Study". One of the survey's questions included "Which Java application servers are currently in use at your company (or at the companies to whom you consult)?"

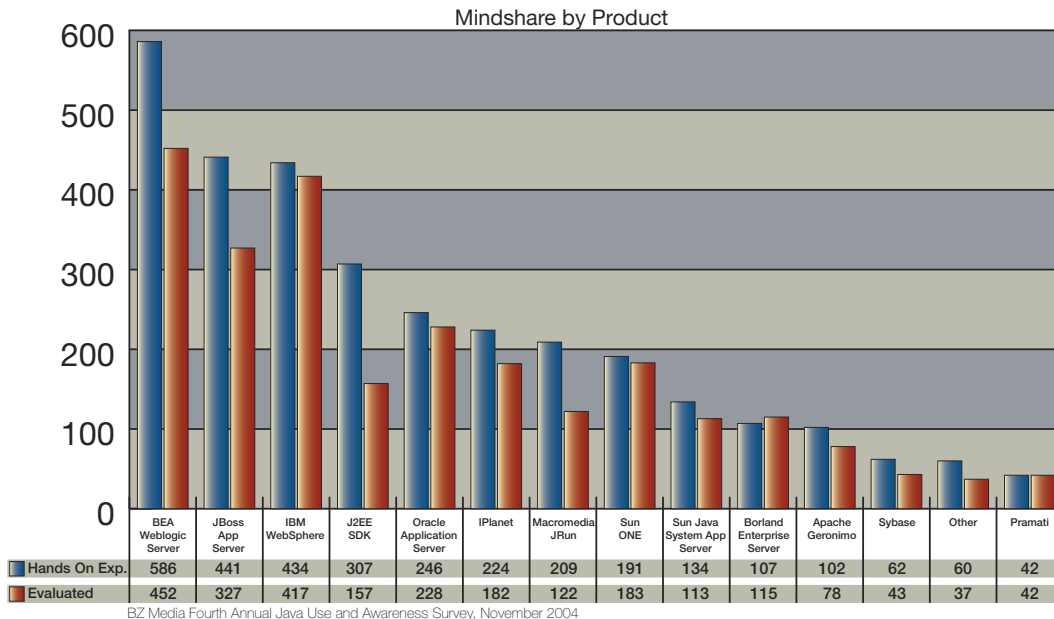
Responses indicated that JBoss is the preferred Java platform, ahead of proprietary application servers from IBM, BEA and Oracle [16]. Statistics released by BZ Research have 34.8% of respondents using JBoss, while fewer respondents cited using closed-

source commercial application servers. IBM WebSphere fell to 33.9%, BEA WebLogic to 28.7%, and Oracle to 22.0%. The chart below shows the changes in percentage use across all of the major application servers in the study (scoring at least 10% market share in any of the three years of the study).



The BZ Research findings corroborate those revealed in an earlier 2004 research paper released by conducted by O'Reilly ONJava in which JBoss topped the list as the most popular J2EE platform in use with 41 percent versus 19 percent for BEA WebLogic and 17 percent for IBM WebSphere[17]. The ONJava survey also ranked other JEMS products as market leaders including Apache Tomcat with 86 percent use and Hibernate Object/Relational Mapping and Persistence Service with 29 percent use.

In addition to the reports published in SD Times and from O'Reilly, The Middleware Company also corroborated the significant growth in their research project "Application Server Survey 2004". This research showed JBoss as the number two application server in terms of respondent's "Hands on experience", and a strong third place in evaluations [23]. The differences between these results and those of BZ research could be reflected by sample bias, or by the publication date. As the BZ research study shows, growth over three years for JBoss outpaced that of any other J2EE Application Server.



All three research studies corroborated what can easily be seen in the market, JBoss Application Server is the fastest growing Application Server in the market, and is being used in a significant number of deployments across the industry.

The J2EE Technology Leader

JBoss AS is widely recognized for supporting standards and was the first open source application server to achieve J2EE 1.4 certification with JBoss AS version 4.0. This demonstrates the strength and speed of the Professional Open Source development model.

Increasingly, JBoss is not only setting the pace in implementing standards, but is becoming a leader in setting industry standards. JBoss was recently elected to the executive committee of the Java Community Process (JCP). JBoss will help guide the development of Java during its three year term including voting on all Java Specification Requests (JSRs). JBoss sits on the expert group for Enterprise Java Beans version 3.0 and already has a preview release built on top of Hibernate.

EJB 3.0 focuses on providing the value of Enterprise Java Beans, but with a much simpler programming model focusing on “Plain Old Java Objects” (developers refer to this trend by its acronym, POJOs). EJB 3.0 reflects JBoss’ vision of simplified enterprise POJO development—a vision that JBoss takes even further with its “Transparent Middleware” philosophy.

One analyst went so far as to predict that JBoss could eventually become the key player in defining standards for J2EE going forward. In one of their research reports, they write: “D.H . Brown Associates, Inc. believes there is a long-term possibility that the JBoss open source community processes may compete with and/or replace the Sun-led Java Community Process if JBoss becomes the dominant unit volume J2EE application platform leader.”[18]

A Safe Bet

The openness of JBoss AS enables users to feel confident that the technology will always have a robust and supportive community of developers. Fixes are easily and transparently implemented resulting in cost-effective and highly maintainable code. Open source also leverages economies of scale and the largest available developer skills pool.

In addition to being assured of high quality and high performing software, other assurances are needed to comfortably deploy open source software in mission critical systems. JBoss Professional Open Source provides these assurances. A reasonable concern with open source software is indemnification against intellectual property claims on the software you use. JBoss Inc. provides indemnification to their Gold and Platinum support customers to provide maximum assurance in this area.

Element	Summary	Coverage
Defense	Hire the legal team and defence of the case	Unlimited
Repair or Replace	Repairing or replacing the software to make it non-infringing	Unlimited
Damages	Paying any damage awards	Limited to 4x of the value of the contract

As a result of this indemnification, JBoss customers can rest assured that their infrastructure is secure and free from any intellectual property issues.

Another important component in ensuring JBoss AS is a safe bet is availability of expert support services. JBoss Inc. offers quality support services from the source – including Professional Support, Consulting, and Training. Professional Support helps customers overcome all product-related issues when designing, developing, deploying, and ultimately managing applications. It encompasses bug fixes, problem resolutions, and developer assistance including configuration and performance optimization. The aforementioned indemnification is included for Platinum and Gold level Professional Support customers.

Also included is the newly launched JBoss Network™, an integrated and customizable support environment that streamlines the support process for the entire JEMS suite, including JBoss AS. It provides knowledge access via a seamless and customizable portal, software distribution including delivery of patches specific to customer’s environments, and application management including administration, monitoring, and advanced deployment management tools. JBoss Network is currently being rolled out in phases to JBoss Inc. and JBoss Authorized Service Partner support customers.

JBoss Consulting Services provide customers expert assistance from knowledgeable consultants, all of which have an in-depth understanding of JBoss AS. JBoss Inc. accepts consulting engagements typically lasting from three to five days. Longer engagements are available from JBoss Authorized Service Partners.

Several JBoss AS training courses are available from both JBoss Inc. and Authorized partners. These courses range from two to four days and are held in large cities around the world on a rotating basis. Private on-site training courses are also available for customers that wish to train teams of developers more cost effectively or when customized training is required.

SCENARIO: SIMPLIFYING AND ACCELERATING DEVELOPMENT

Productive for Development

JBoss AS is the favorite application server among developers for good reason. JBoss AS makes it easy for developers to leverage enterprise features without undue complexity by focusing on bringing developers the value of “Transparent Middleware”. This is reflected in the design of features such as JBoss Clustering, which requires no changes or design time modifications to code in order to benefit from.

The JBoss Eclipse IDE development environment is based on the popular open source tool Eclipse. It adds the following features on top of the powerful features of Eclipse:

- Debug and monitor JBoss servers and control their life cycle (start/stop).
- Automate your code generation with powerful XDoclet support
- Configure your archive file layouts
- Easily deploy the packaged and/or exploded archive to a JBoss server
- Speed development with EJB, Servlet, and Web Services wizards
- JSP, HTML, and XML Editors
- Auto generate AOP declarations and aspect classes
- EJB3 smart annotations, EJBQL scratchpad, and visual CMP mapping
- In-depth real time monitoring and profiling

Developers can also work in their favorite IDE environments or text editors, since the programming paradigm of JBoss is focused on “Plain Old Java Objects” (POJOs).

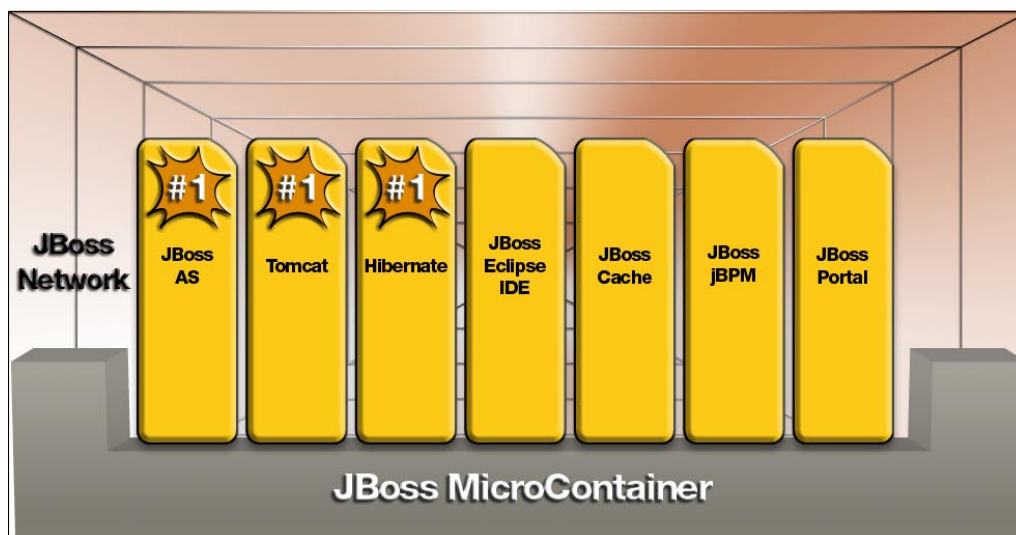
An advanced feature of the JBoss development model is the use of Aspect Oriented Programming (AOP). Aspects save developers

time by enabling them to call a common feature across a wide range of Java classes, without having to rewrite “hooks” into every object. This makes the common feature very easy to turn on and off for all objects, and changes to the common feature (sometimes called a “crosscutting concern”) can be contained within a single class, thus making the code maintainable and much cleaner.

AOP unleashes the power of Enterprise POJOs which is a key part of the JBoss approach to providing transparent middleware. AOP is an entirely optional feature of JBoss AS and developers can choose to tap into the power and elegance afforded them by using aspects, or they can stick with the standard J2EE development model.

The JBoss Enterprise Middleware System

Reflecting the industry trend towards consolidation, the JBoss Enterprise Middleware System (JEMS) provides a comprehensive suite of products for creating and deploying new applications and web services.



The JEMS products are designed to work together, standalone, or with your existing middleware solutions. JEMS is comprised of the following products:

- JBoss Application Server is the most widely used J2EE application server and provides all of the features expected in a J2EE 1.4 certified platform.
- Apache Jarkarta Tomcat is the most widely used JSP/Servlet Web application container and is the reference implementation for the J2EE 1.4 JSP/Servlet specification.
- Hibernate is the most widely used object/relational mapping (ORM) solution for Java environments.
- JBoss Cache is a replicated and transactional cache that can be used to manage frequently accessed Java objects within a local process or across distributed processes.
- JBoss jBPM is a powerful workflow engine that enables coordination between disparate applications and services.
- JBoss Portal provides a standards-based environment for hosting and serving a Portal’s Web interface, publishing and managing its content, and customizing its experience.
- JBoss Eclipse IDE extends Eclipse – the most widely used integrated development environment framework – with a series of tools that enable programmers to develop, deploy, test, and debug JEMS-based applications.

WHAT ARE OTHERS SAYING ABOUT JBOSS AS?

Analysts

Industry experts agree that JBoss AS is a mature platform suitable for use in large organizations. Ted Schadler's April 2004 Forrester report "Evaluating the Health of Open Source Software" refers to JBoss as a "safe bet", and concludes:

"JBoss and Tomcat are making inroads in middleware markets. While Linux's future is assured in the data center, many firms are still wary of open source databases and application servers. However, the Forrester Wave™ analysis reveals that middleware products JBoss and Tomcat are more than ready for projects in the enterprise. Firms like CNBC are making big bets on the Java servlet engine Tomcat, while companies like MCI and Wells Fargo Bank use the JBoss application server." [7]

In addition to the Forrester report, Pierre Fricke, VP and Lead Analyst with D.H. Brown Associates Inc. writes: (January 2005)

"Open source J2EE, led by JBoss, is now 'good enough' for a larger share of workloads. With the Professional Open Source business model, value proposition, and burgeoning ecosystem, JBoss is moving into enterprise deployments and is a significant contender for leadership going forward." [8]

In Integration Developer News (January 2005), Bernard Golden analyzes JBoss AS using his Open Source Maturity Model (OSMM). He writes:

"with 78 OSMM points, JBoss qualifies it (sic) to be used broadly in commercial enterprise setting. The JBoss breadth of maturity across all lines would make JBoss appropriate for the whole gamut of deployments: experimentation, pilot and production. Further, the maturity of JBoss' internal systems and external partner network makes it appropriate for the whole range of users—from "cutting edge" early adopters all the way to extremely pragmatic IT organizations." [6]

The trend for open source J2EE is significant. Gartner Group (May 2004) states that "Open-source and other free application server technology is likely to continue to grow in adoption. Even the commercial leaders will be forced to adopt this approach, offering, by 2007, some of the basic technologies in their application server technology as free, open-source software (0.7 probability). [4]

CONCLUSIONS

JBoss Application Server

JBoss AS is a key component, alongside MySQL database and Apache Web Server, of the open source infrastructure for grid computing. This infrastructure enables blade servers to reliably and cost-effectively run standard J2EE applications on hundreds of Linux powered CPUs without incurring prohibitive per-CPU licensing costs.

JBoss AS has the fastest growing user base and by some measures is the most popular J2EE application server. This is in part due to the developer enthusiasm for the simple, standards-based approach that JBoss Inc. refers to as "Transparent Middleware". This provides for the maximum power of Enterprise-Class infrastructure services while retaining the cleanliness of pure Java programming. Completing the picture, JBoss AS is a part of the robust JBoss Enterprise Middleware System (JEMS) which is comparable in scope to leading closed source commercial Application Platform Suites.

Customers of JBoss Professional Open Source Services can deploy any JEMS product with world class Enterprise Software support, intellectual property indemnification and a single point of accountability for key business infrastructure. With JBoss AS and JBoss Professional Open Source, organizations can reap the cost and quality benefits of open source while retaining the accountability and indemnity of closed source commercial solutions.

Trying out JBoss Application Server

You can learn more about JBoss AS here:

<http://www.jboss.com/products/overview/jbossas>

You can download free documentation including "Getting Started with JBoss Application Server" here:

<http://www.jboss.org/docs/index#as>

You can download the JBoss application server here:

<http://www.jboss.org/downloads/index#as>

The getting started guide will help you with all the steps needed to establish a server and begin developing or deploying your projects.

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About the Author

Miko Matsumura is the former Chief Java Evangelist for Sun Microsystems. During this time he was a visible spokesperson for Java technologies. Additionally, Miko worked closely with Java ISVs and licensees to further the developer community. Since then he has b

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He holds an MBA from San Francisco State University and a master’s degree in Neuroscience from Yale University.

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ABOUT JBOSS INC.

Through its Professional Open Source model, JBoss, Inc. is making open source a safe choice for the enterprise. JBoss provides resources, technology direction and core development for popular open source projects and stands behind them with enterprise-grade support and services. These projects include JBoss Application Server, Hibernate, JBoss jBPM, JBoss Eclipse IDE and Apache Jakarta Tomcat, which are core components of the JBoss Enterprise Middleware System (JEMS). Companies like Corporate Express, La Quinta Inns and Nielsen Media Research rely on JEMS for mission-critical enterprise applications. Partners who embed or bundle JEMS and resell JBoss services include Computer Associates, HP, Novell and Unisys. JBoss has headquarters in Atlanta, Ga. and Neuchâtel, Switzerland. For additional information, please visit <http://www.jboss.com>.

