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Competitive Snapshot

Application Server Choices:
Important Considerations in Selecting an Application Server

By

Clay Ryder

The Sageza Group

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sageza.com
info@sageza.com

The Sageza Group
32108 Alvarado Blvd #354
Union City, CA 94587
510·675·0700

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ABSTRACT

Few organizations can claim a homogeneous IT environment. For most, the reality is heterogeneous, and the ability of future IT investments to not only coexist, but even thrive in this environment is an important deployment criterion. As is expected with IT products and services, there are several providers of applications servers, including offerings from major systems vendors and ISVs as well as from the open source community. Given the variety of offerings, organizations could face a potentially confusing array of choices in their application server deployment initiatives.

In this paper, we examine the role the application server has taken as well as review some of the more notable application server offerings available from commercial and open source providers. We offer our perspective on what are the most important criteria and considerations when selecting an application server and also review how the application server offerings from BEA, Oracle, and IBM in particular meet these criteria.

Application Server Choices

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Application Servers and their Role

An application server is a network-based software engine that delivers applications to end users on a variety of client devices. Unlike client/server approaches, the application server executes most of the application business logic, so no client software needs to be installed on the access device. As a result, from a management and operational perspective, the application server environment is more efficient and offers greater flexibility in delivering applications throughout an organization as well as to business partners, suppliers, and customers, among others. This is why application servers are a key building block in creating a Service-Oriented Architecture.

Few organizations can claim a homogeneous IT environment. The number of mergers and acquisitions of the past few years clearly drives this, but even for smaller independent operations, the "best of breed" mantra that was so prevalent in the 1990s led to IT solutions from multiple, competitive solution providers. For most organizations, the reality is heterogeneous, and the ability of future IT investments to not only coexist, but even thrive in this environment is an important deployment criterion.

Since application servers operate at the middleware layer, adherence to industry standards is essential to achieve maximum interoperability and allow for future growth. To maximize the efficiency and potential reach for applications it is essential to harmonize the architectural underpinnings of the infrastructure as much as possible. Accordingly, organizations can benefit by sharing a common architectural model across their application server environment. As needs scale, a common architecture will permit smooth growth even if the underlying platform is different from the legacy hardware. In addition, the addition of new capabilities such as application edition management, dynamic workload management, and virtualization can more easily be achieved when the application server environment has a consistent architecture.

While there are applications servers that are not J2EE focused, such as those supporting Microsoft's .NET environment, this paper focuses on J2EE-compliant application servers, which are the type most commonly in use.

Major Application Server Providers

There are several providers of applications servers, including the major systems vendors, ISVs, and the open source community. While most offerings include the basic functions of a J2EE application server, each has its own combination of additional middleware technology provided. Many vendors also provide complementary products and services beyond the core application server. In addition, as the J2EE specification continues to evolve, so the specific level of J2EE compliance offered by each solution varies as each provider works to ensure compatibility with the latest specification.

What follows are some of the more notable offerings currently available from commercial and open source providers.

BEA WebLogic Server

The BEA WebLogic Server (WLS) was released in late 1998 after BEA acquired WebLogic. Since the acquisition of BEA Systems by Oracle, WLS has now been embraced as Oracle's strategic product and rebranded as Oracle WebLogic Application Server. The server supports Java J2EE 1.5 and EJB 3.0. It also features Web Services and SOA support along with administration, operations, and management capabilities to help reduce operational costs and increase uptime. Oracle has also acquired complementary technologies for management

and with Coherence from Tangosol and WebLogic Operations Control from BEA. There are four editions of WLS available today:

- *WebLogic Server Standard Edition* is Oracle's entry-level J2EE application server.
- *WebLogic Server Enterprise Edition* includes Standard Edition components plus clustering and management capabilities for organizations with larger scale enterprise applications.
- *WebLogic Suite* targets mission-critical applications with full Java EE, clustering, and management capabilities as well as in-memory data grid and a real-time JVM.
- *WebLogic Application Grid* is a grid offering that can complement application server environments for organizations with higher scale-out or latency-sensitive needs.

IBM WebSphere Application Server

The IBM WebSphere Application Server (WAS) was first released in 1998, with early versions known as Servlet Express. The current release of WAS is V6.1, which provides a J2EE 1.4-compliant platform for assembling, deploying, and managing applications that are part of an SOA environment. Version 7.0, which is slated for release later in 2008, will be J2EE 1.5-compliant. WAS is the foundation of the IBM WebSphere software platform and offers Feature Packs as well as complementary technologies for management including WebSphere Virtual Enterprise, WebSphere Extended Deployment Compute Grid, and WebSphere eXtreme Scale. There are four major editions of WAS available today:

- *IBM WebSphere Application Server – Core* is a J2EE application server that is optimized for a single-server environment.
- *IBM WebSphere Application Server – Express* combines visual, IBM Rational development tool with a J2EE application server.
- *IBM WebSphere Application Server Community Edition (WAS CE)* is an open source J2EE 1.5 application server based on the Apache Geronimo project. WAS CE was first distributed at the end of 2005.
- *IBM WebSphere Application Server Network Deployment (WAS ND)* is targeted at organizations that need near-continuous availability, with advanced performance and management capabilities for mission-critical applications.

Oracle Application Server

Oracle Application Server 10g R3 is the current release of the application server and is focused on developing, integrating, and deploying enterprise applications, portals, and Web services. As noted by Oracle in its product roadmap announcement[1], this product is no longer the strategic application server. It will be maintained for current customers as Oracle converges some functionality with the WebLogic Server. The core of the Oracle Application Server consists of the Oracle HTTP Server (based on Apache HTTP Server) and OC4J (Oracle Containers for Java EE), which deploys J2EE-based applications and is J2EE 1.4-compliant. Oracle states its application server is optimized for tight integration into Oracle Database's security capabilities and was the first designed for grid computing. Oracle Application Server is a part of the Oracle Fusion Middleware stack and is available in two editions today:

- *Oracle Application Server 10g Standard Edition* features Oracle Portal, and is designed to unify access to organizations' information through a common organization portal.
- *Oracle Application Server 10g Enterprise Edition* targets organizations seeking to develop, integrate, and deploy applications with additional features including business

activity monitoring, business intelligence, identity management, and wireless deployment.

Other Commercial Offerings

Among the other commercial application server offerings available today are the SAP NetWeaver Application Server and the Sun GlassFish Enterprise Server. SAP NetWeaver has largely been focused on providing the application foundation for SAP's applications that are delivered as part of its Business Suite. The Sun GlassFish Enterprise Server is not a separate commercial applications server from Sun, but rather a comprehensive support offering for the GlassFish open source platform. This offering is focused on SOA and Internet applications utilizing Java EE, PHP, AJAX, and Ruby. Until recently, Adobe JRun, which was offered after Adobe's acquisition of Macromedia, was also commercially available; however, this product is no longer under active development.

Open Source Offerings

There are several open source applications server projects. Perhaps the best known are the Apache Geronimo Project, Glassfish Application Server, and JBoss Application Server. Each of these projects has some association or tie-in with commercial or for fee offerings, namely Apache Geronimo (IBM WAS CE), Glassfish (Sun Microsystems), and JBoss (Red Hat). The role of open source software within organizations is often a matter of intense debate. Nevertheless, open source technologies do garner the interest of organizations and for some play a notable role in their IT deployment strategies.

It is clear that organizations have many options in their choice of mainstream commercial and open source application servers as well as other more esoteric solutions not covered in this paper. In mainstream usage, the most commonly found application servers are from IBM and Oracle[2]. As an alternative, open source implementations are becoming an option.

Important Criteria in Selecting an Application Server

Given the variety of offerings and providers, organizations could face a potentially confusing array of choices in their application server deployment initiatives. While at one level all application servers provide the same basic function, there are differentiators. When evaluating an appropriate solution, there are certain key considerations that should be part of the selection process. What follows is a quick review of these considerations.

Web Services and SOA Standards Compliance: One of the basic tenets of SOA and network-based applications is the leverage and reuse of applications and business logic across the enterprise. To reach the largest possible audience, applications and their access must be achieved through commonly accepted industry standards. Compliance with J2EE, and Java specifications, among others, is paramount.

Common Architectural Model: As an organization's scale and needs change over time, it is important to be able to migrate and/or redeploy applications on different physical hardware with minimal effort and disruption. It is advantageous for the application servers deployed to share a common architecture so that the applications can be easily migrated.

Developer Leverage: There are several classes of developers with varying skill sets and platform expertise. By choosing a standardized application architecture, organizations can leverage a larger portion of their developer talent pool as the choice of the underlying platform has minimal impact on the ability to develop and maintain network applications.

Performance: Overall performance is an important consideration not only for immediate user satisfaction, but for long-term efficiency and ROI. Maximized efficiency can provide headroom for future growth without automatically requiring new capital investment.

Scalability: Organizations' IT needs vary over time. Application servers should be able to seamlessly scale with organizations' needs without requiring service disruptions or substantial redeployment efforts. Software scalability combined with savvy hardware choices can also reduce energy, floor space, and operational management demands.

Application Infrastructure Virtualization (AIV): There are many components to a successful virtualization initiative, namely: server, storage, networking, and AIV. To realize the maximum ROI, organizations should ensure that their application environments achieve a comprehensive level of virtualization. This includes the dynamic allocation of application infrastructure resources for better utilization of existing hardware and application servers to reduce energy requirements while minimizing expenditures on additional hardware and software assets.

Licensing and Support Costs: As a final consideration, when choosing between comparable solutions, the initial software price as well as ongoing update and support costs are important factors in selecting the solution that achieves the maximum ROI and value.

How Current Application Servers Meet these Criteria

Since organizations have a choice in application servers, it is important to consider the strengths and weaknesses of each solution prior to investing capital and human resources. As each organization is unique, the relative strength of each solution's components will vary according to the needs of the customer. In other words, some criteria may be less important to one organization than to another. The overall capability of a solution and the ability of the provider to support it are the prevailing concerns for most customers.

When comparing the leading commercial application servers, namely IBM and Oracle, it is noteworthy that both vendors are well established players with the technical acumen, support, and training prowess expected by organizations that are making strategic investments in their IT infrastructure. At first glance, these similarities may assuage potential concerns with respect to application server deployments, but there are differences between IBM and Oracle solutions that are worthy of careful consideration. The following sections examine how these providers address the criteria previously outlined to help differentiate the relative value of the solutions.

Web Services and SOA Standards Compliance

As we have indicated, standards compliance is a top consideration. The major commercial vendors as well as the open source providers support the requisite J2EE and Web services standards. At any point in time, the specific revision supported by a given server may vary, but within relatively short order, all of the offerings support the latest industry standards.

In looking at the track record on standards for the major commercial vendors, BEA has tended to lead adoption and implementation with its WLS. IBM has been more conservative in its approach, but generally has kept pace. Oracle has tended to lag a bit in its standards adoption. Overall, the standards support of these products is comparable. It remains to be seen if Oracle will continue the push for standards adoption that BEA had begun.

Common Architectural Model

A common architectural model is the second most important criteria for application servers discussed previously. Oracle has two established application servers in the marketplace: the Oracle Application Server and BEA WLS, which became an Oracle product when Oracle acquired BEA Systems. WLS is a well established solution that has transcended past ownership changes to remain a leader in the marketplace[3].

On July 1, 2008, Oracle announced that its BEA WLS would be the preferred application server in most circumstances and would integrate complementary components from the Oracle Application Server where it made sense, and that WLS would be integrated into Oracle's middleware stack over the next twelve to eighteen months[4]. As indicated in table 1, this would constitute the sixth time that Oracle has offered a different application server.

Year	Product Action
1998	Oracle Application Server includes a J2EE runtime
1998	Oracle Developer Server offered as an application server for Oracle Developer Applications, which is marketed independently from Oracle Application Server
1998	Oracle WebDB introduced as a fast and easy way to "Web-enable" Oracle databases, and create Web database applications and content-driven Web sites.
1999	Oracle ships Java application server runtime as Oracle 8i JServer, embedded into Oracle 8i database.
2001	Oracle licenses the Orion Application Server from IronFlare and later buys the source code. Oracle packages separate products to create Oracle 9iAS (Application Server including OC4J)
2008	Oracle announces WebLogic Application Server will be adopted as the preferred application server platform roadmap for most customers. BEA products will be incrementally redesigned to integrate with Oracle Fusion Middleware over the next twelve to eighteen months.

Table 1: Oracle Application Server Offerings since 1998

Organizations that have implemented either the BEA or Oracle application server face some uncertainty, both around potential technical issues and the timing. As Oracle moves functionality from OC4J into WLS and in turn fully integrates WebLogic Sever into its Fusion Middleware stack, there may be hurdles that arise that will impact the ability to deliver in the promised twelve- to eighteen-month timeframe. Organizations with the Oracle Application Server will need to plan for a future transition to the WLS once it is integrated. With Oracle's announced roadmap, staying with Oracle Application Server seems to be a risky choice as Oracle's longer-term commitment to the product appears limited. This choice places organizations in the position of choosing to either deploy now and migrate later, or wait a considerable amount of time for the new solutions to come to market.

This history of providing a variety of differing application servers is in sharp contrast with the IBM commercial WAS offerings, which feature a consistent end-to-end architecture and programming model. There are multiple products targeting different markets; however, there is a great deal of commonality, which allows for simplified management, reduced operational complexity, and increased flexibility. These commonalities offer a future path where a consolidated yet flexible platform is a given.

Developer Leverage

Developers are the lifeblood for in-house applications; however, given the heterogeneous environments of most IT organizations, developers are typically limited to the specific platforms that match their skill set. Fortunately, assuming that developers are Java-fluent, Java applications can broaden the transferability of developer skills, if the underlying application servers have a consistent programming model.

The sometimes not-so-subtle differences between the various Oracle application servers can mean that developers with expertise on one server would not necessarily be able to leverage their expertise with another. For example, the more proprietary underpinnings for PL/SQL make Oracle Application Server's administration reliant on knowing this code. Contrast this with the more standards based WLS that has greater ease of use and administration for a

wider group of developers. Bridging such gaps would require additional skill development or personnel to maintain a given set of applications. The resultant inefficiency can limit an organization's flexibility and raise the cost of application deployment and maintenance.

The IBM commercial WAS products have a shared architecture, so that developer investments in applications can be repurposed across the commercial WAS offerings as circumstances dictate. For example, applications originally written for and deployed on a WAS Express for Windows server can be moved without any coding changes to any other WAS server, including WAS for z/OS. Each application can be migrated and will be fully operational since all commercial WAS offerings are built on the same code base. This also contributes to easier administration and improved developer productivity.

Performance

Performance is ultimately a measure of efficiency, which is a prime metric in any IT setting. SPECjAppServer2004 is a client/server benchmark for measuring the performance of a representative J2EE application and each of the components that make up the application environment. The important question is: how is this relevant in choosing an application server? The key is not focusing on the total of JOPS (Java Operations per Second) but rather the JOPS/Total Processor Cores; i.e., the level of application server performance per hardware resource. Organizations should also consider whether the tested configuration is reflective of their environment and if this performance is repeatable in real-life deployments.

As illustrated in figures 1 and 2, as of April 23, 2008, the performance of IBM WAS on the SPEC jAppServer2004 benchmark exceeded that of all other results submitted. IBM holds the record for the total number of JOPS and separately for the highest number of JOPS per processor core in the SPEC jAppServer2004 benchmark[5]. No open source application server benchmarks have been submitted to SPEC.

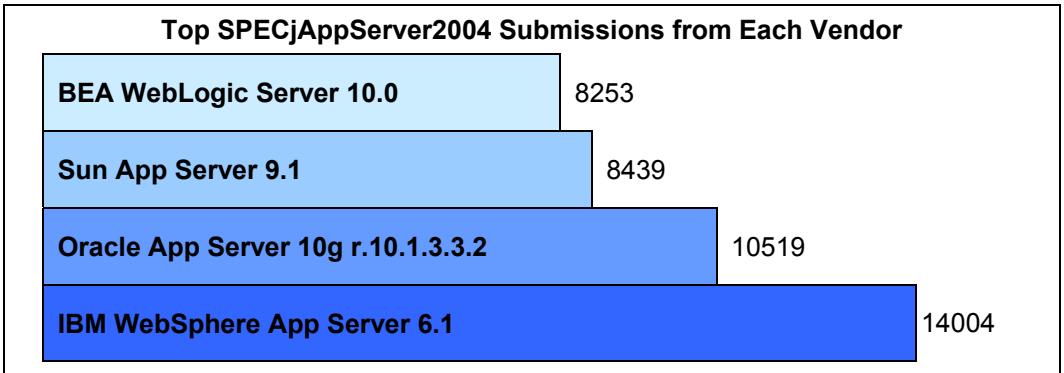

Figure 1: Total Java Operations per Second (JOPS) (higher is better)

Current as of April 2008

Source: http://www.spec.org/jAppServer2004/results/jAppServer2004.html

The Oracle and BEA application servers achieved SPEC performance ratings of10,519 JOPS[6] and 8,253 JPOS[7] respectively. The Sun Java System Application Server achieved 8439 JOPS[8]. IBM WAS achieved 14,004 JOPS[9] to rank the highest performing server. On a per processor core basis, Oracle and BEA rated 257 JOPS/core[10] and 192 JOPS/core[11] respectively, Sun Java System Application Server achieved 176 JOPS/core[12] and the IBM WAS rated at 299 JOPS/core [13].

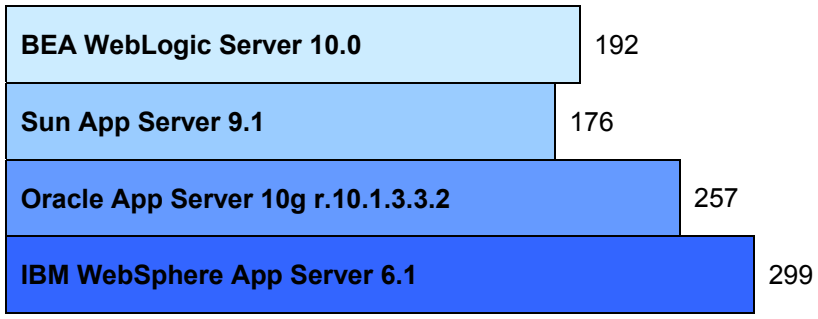

Figure 2: JOPS per Processor Core (higher is better)

Current as of April 2008

Source: http://www.spec.org/jAppServer2004/results/jAppServer2004.html

Higher performance can help organizations achieve increased efficiency while providing headroom for future growth without requiring new capital investment.

Scalability

Scalability can be achieved through a variety of methods, but for the most part it is ultimately focused on increased hardware and/or software performance. While hardware performance continues to ascend with every passing year, this does not mean that organizations replace their hardware in lockstep. As a result, scalability can more often be achieved through enhanced software efficiency or migrations of software from one hardware platform (already inhouse) to another. Commercial vendors recognize the importance of scalability not only in the design of their base application server, but in additional features or add-on technology as well. Open source projects are not generally focused on this issue.

Oracle's scalability is achieved through clustering technology, cross-domain management, and diagnostic tooling. Oracle offers Coherence, an in-memory data grid acquired from Tangosol. Coherence offers strong capabilities for scaling and wide support of programming models. WebSphere eXtreme Scale functions as an in-memory data grid that dynamically caches, partitions, replicates, and manages application data and business logic across multiple servers. It can also process high-transaction volumes efficiently and with linear scalability, while offering support for higher-level programming models.

While it may seem that the Oracle and IBM products are similar, there are a couple of key differences. Oracle's Coherence uses a two-phase commit transaction protocol that lets all nodes in a distributed system agree to commit a transaction. The protocol results in either all nodes committing the transaction or aborting, even in the case of network failures or node failures. The greatest disadvantage of a two-phase commit is that a node will block while it is waiting for a message. This means that other processes competing for resource locks held by the blocked processes will have to wait for the locks to be released. Coherence also uses synchronous replication support which can slow down the system and affect recovery times. In both cases, this inhibits performance.

eXtreme Scale, on the other hand, uses a one-phase commit to offer better performance and scalability. The WebSphere product also offers support for both synchronous and asynchronous replication. Asynchronous replication allows for system activity to continue in the background to increase application responsiveness, accelerate data intensive applications, and provide high availability and fault tolerance.

Application Infrastructure Virtualization

Virtualization can help improve ROI through the increased utilization of existing resources and the corresponding reduction in expense for new technology. A simplified IT infrastructure can also minimize operational headcount required and permit reassignment of some IT resources to growth-oriented activities. Given the resource constraints faced by IT organizations, server, storage, and networking virtualization have already become key components to their IT operational and budgetary success; many organizations are now looking to AIV to complete the virtualization mosaic. Although AIV is not a goal of most open source application servers, it is a focus of the commercial offerings from Oracle and IBM.

To achieve a level of AIV from Oracle and BEA products, several offerings must be deployed together. These include VMware ESX Server, Windows or Linux OS (for install and administration purposes), LiquidVM, BEA WLS Virtual Edition, and Oracle WebLogic Operations Control. The acquired WebLogic Operations control and WLS Virtual Edition do offer strengths in management and resource control of VMware server virtual machines and in supporting Service Level Agreements with calculations for variety of statistics.

IBM's implementation is WebSphere Virtual Enterprise (WVE), which offers prioritization and flexibility of deployment of the applications using pooled resources. WVE provides functionality analogous to a server hypervisor, but for the application server. It is application aware and provides wide range of services for workload and transaction management, as well as service level agreements beyond what the Oracle and BEA solution can address.

The combination of three discrete Oracle products does not offer the same level of application management and quality of service as WVE. By comparison, IBM WVE provides lower cost of operations, greater flexibility and agility, and better health management via application infrastructure virtualization and server consolidation[14]. And unlike WebLogic Operations Control, which only supports BEA products, IBM's WVE supports other application servers including WLS and JBoss.

Licensing and Support Costs

The total cost of deploying and maintaining a network application environment is made up of many factors. Some of the most visible are the initial software acquisition cost as well as software updates and support. Open source solutions have no expense associated with software licenses, but this does not necessarily mean there are no costs to obtain service and support. While perhaps lower in initial expense than commercial offerings, the scope of support offered is typically limited to the core software itself, and not the integrated solution that is commonly the underpinning of most organizations' IT endeavors.

When taken as a whole, the cost for Oracle and/or BEA licenses and support are generally higher[15] than the equivalent IBM WAS solution[16]. Table 2 illustrates seven price scenarios for various levels of WAS, WLS, and Oracle Application Servers. These scenarios include the suggested retail price for the software license on the hardware platform specified as well as one year of software update service and support.

	IBM WebSphere Application Server	Oracle Application Server	Oracle WebLogic Server
Enterprise			
Single Core & x86 Dual Core	$15.550	$42,700	$30,500
x86 Quad Core	$31,000	$85,400	$61,000
HP Itanium Dual Core	$31,000	$42,700	$30,500
Power 6 Dual Core	$37,200	$85,400	$61,000
Standard			
Single Core & x86 Dual Core	$4,125	$14,030	$12,200
x86 Quad Core	$8,250	$14,030	$12,200
Express			
Single Core & x86 Dual Core	$2,060	$7,076	—-

Table 2: Platform Price Comparison

Oracle does bundle other products with its application server; however, these are not essential to the functioning of the application server itself. Assuming comparable levels of capability for the application server, price then becomes a deciding factor. From these scenarios, we see that in many cases with WAS, there may be more than comparable capability at a lower price.

Open Source Alternatives

Open source solutions from JBoss, Apache and others are clearly an option for organizations looking for a basic, functioning application server to support lighter-weight applications. The business model of most open source vendors is predicated upon distribution of no-cost software bundled with support, training, and/or other for-fee consultative services. As with all software, it is important to recognize that the initial acquisition cost is not a complete measure of its lifetime cost. Ancillary tools, management features, service and support, and the degree of automation or human intervention required can notably affect the lifetime cost.

Do these relatively new offerings have the depth and proven track record of commercial application servers in the enterprise? Distributors of these solutions tend to have limited expertise in supporting mission-critical deployments and generally lack the broad scope of ancillary skills in areas such as security and legal issues. IBM and Oracle have demonstrated enterprise-class solutions and expertise in their products and support. Each, to varying degrees, has focused on technology innovation tailored to meet the corporate requirements for organizations of most any size. Open source communities would be hard pressed to deliver this scope of technical capability. In addition, larger-scale and mission-critical deployments would require levels of functionality and support from the open source vendors that would put total cost on par with the commercial options.

IBM is also uniquely differentiated from other vendors in that it offers an open source-based application server as well as a commercial solution. Based on Apache Geronimo open source project, WAS CE offers Apache Tomcat plus other services such as security, EJB, messaging, and Web Services support. WAS CE provides an open source-derived, entry-level option with an upgrade path to a commercial application server to address an organizations' changing needs over time. This is in contrast with other open source based offerings, notably RedHat and Sun Microsystems, who do not provide more advanced commercial application server for customers to grow into. All of Oracle's application server technology is commercial software; they do not offer a low-cost alternative for organizations seeking to support non-critical applications.

What It All Means

IT professionals today are charged with delivering dynamic applications and workflows across the organization to help create and drive competitive advantage in the marketplace. Yet at the same time, IT professionals are charged with being cost-effective and efficient. The application server environment is more efficient than legacy implementations and offers greater flexibility in delivering applications throughout the organization and beyond. This enables organizations to bring applications to a larger number of users while also reusing application components in new and advantageous ways. As a result, application servers have become a part of the long-term strategy and an integral part of the modern day IT landscape.

Application servers are available from a variety of commercial vendors and open source projects; however, given the strategic importance of these servers, it is important that organizations choose a solution that will provide the ease of deployment, scalability, value-added features, and customer service and support requisite for a strategic enterprise investment. The investment choices organizations make in application servers will play an important part in each organization's long-term strategy and marketplace position.

When considering application servers in light of these criteria, it becomes apparent that open source solutions, while providing base-level technology, do not include the depth of ancillary features and proven commercial deployments as do commercially sourced application servers. Organizations might choose to deploy such technology in a tactical fashion, but it is unlikely to meet the strategic needs of most organizations without substantial additional investments or integration of other third-party technologies.

Oracle is now in the process of integrating its latest acquired technology from BEA Systems, which includes WLS that will supplant Oracle's own offering as the strategic platform going forward. The challenge for Oracle's customers will be managing differing application server environments until the latest roadmap becomes reality and they can begin to migrate to the new standardized platform. There is a possibility of technical issues arising for customers of both platforms as Oracle undertakes product changes and eventual migration for some of its installed base. This may impact the timing of the roadmap implementation to reach beyond the announced 12-18 month timeframe. For organizations that are contemplating new application server deployments, choosing Oracle involves an element of risk.

IBM WebSphere Applications Infrastructure family, by contrast, offers a more stable and predictable roadmap with incremental enhancements that build on the strong portfolio that exists today. Organizations that are considering or have already begun to invest in application server technologies are well advised to consider the potential benefits afforded by the IBM offerings.

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