BEA WebLogic Server® Virtual Edition

Overview

Version 10 v1.2
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WebLogic Server 10.0 MP1 Virtual Edition v1.2 (WLS-VE) enables WebLogic Server 10.0 MP1 (WLS) to run in LiquidVM-based computing environments. For this release, WLS-VE is available only as a distribution archive and does not include a BEA product installer mechanism. See Obtaining the WLS-VE Software.

Unlike previous releases of WLS-VE 9.2, WLS-VE 10 v1.2 does not include WebLogic Server or the WebLogic Domain Configuration Wizard to create new virtual domains. Instead, WLS-VE enables you to convert physical WLS 10.0 MP1-based domains hosted on traditional operating systems (OSes) into virtual domains that can be hosted on LiquidVMs in hypervisor environments.

The WLS-VE 10 v1.2 distribution archive includes the following components:

- *P2V Domain Conversion Utility*—Simplifies the conversion of WLS Managed Servers in a domain to *WLS-VE* instances in the hypervisor environment. You create one such *WLS-VE* virtual machine for each Managed Server (and optionally the Administration Server) in a domain.

  Note: In many cases, additional steps are required to complete the transformation of physical WebLogic domains into virtual domains.

- *LiquidVM 1.2*—Provides the tools needed to create, start, and control LiquidVM instances. LiquidVM 1.2 also provides an SSH service that provides a secure mechanism to transfer files to and from the LiquidVM instance on the hypervisor host (VMware ESX server).
- `wlsve1001.iso`—Contains an ISO image for WLS 10.0 MP1 that includes the WLS classes and LiquidVM executables used to run WLS-VE and the applications on the hypervisor host.

WLS-VE configuration and management procedures are documented in the WLS-VE *Configuration and User Guide*, which provides details for configuring, using, and administering WLS-VE domains.

The following sections describe the features of WLS-VE:

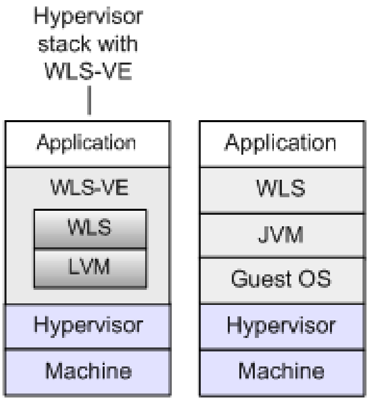
- Using WLS-VE to Leverage Your Virtualized Environment
- Comparison of WLS with WLS-VE
- Planning Your Virtualized Installation
- Recommended Topology
- Obtaining the WLS-VE Software
- Related Documentation

Using WLS-VE to Leverage Your Virtualized Environment

WLS-VE combines WLS 10.0 MP1, with LiquidVM 1.2, a Java Virtual Machine (JVM) that works with hypervisor software and provides only the set of OS features that WLS needs to offer its full range of services. Because hypervisor software recognizes LiquidVM as a guest OS, WLS-VE offers life-cycle control and monitoring features that are unavailable with other application servers.

In addition, WLS-VE removes layers of the software stack (see Figure 1-1), which reduces the number of software installations to license, patch, and monitor. This also makes it possible to avoid some of the performance degradation that is common in virtualized data centers.

Figure 1-1 WLS-VE Removes Layers of the Software Stack



Before using WLS-VE, you should familiarize yourself with the basic concepts of LiquidVM provided in Understanding LiquidVM in the WLS-VE *Configuration and User Guide*.

LiquidVM OS Features

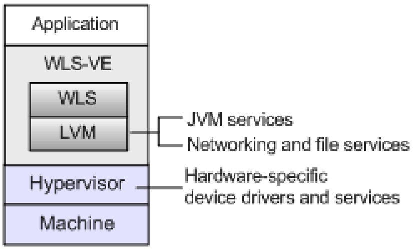
While application servers can consume large amounts of computing resources, even full-featured Java Platform, Enterprise Edition (Java EE) application servers such as WLS use only a subset of the services that a standard OS provides.

For example, while a standard OS typically provides a user interface (either a graphical user interface or a command-line interface), Java EE application servers do not need such services. Instead, application servers rely on the OS mostly for networking and file-system services, and they rely on the JVM for most other services, such as translating Java code into hardware-specific instructions, managing memory, and scheduling threads.

In a virtualized software stack, the responsibilities of the JVM and OS are unchanged, but an additional layer of software—the hypervisor—resides between the OS and the hardware. The hypervisor coordinates low-level calls from multiple OSes that are running on a single physical machine. To fill its coordinating role, the hypervisor provides hardware-specific device drivers and other hardware-specific services.

LiquidVM provides the JVM services and operating-system services that WLS needs to offer its full set of services, and it relies on hypervisor software to provide hardware-specific device drivers and other hardware-specific services (see Figure 1-2).

Figure 1-2 LiquidVM OS Features



Benefits of WLS-VE

WLS-VE offers the following advantages over running WLS in a Windows or UNIX-based guest OS within a virtualized environment:

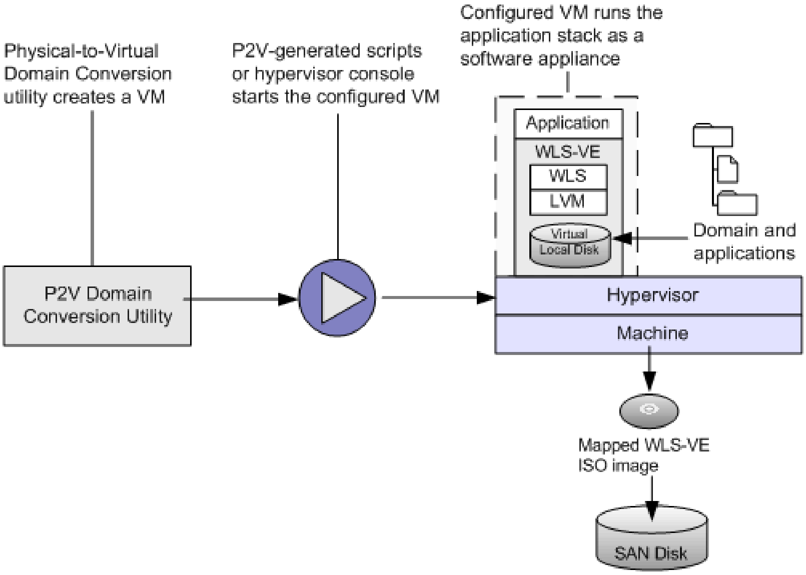
- *Greater efficiency* — WLS-VE dynamically adapts the size of the Java heap to the momentarily available memory. For example, when memory is plentiful, your application will automatically use it for better performance. Conversely, when memory is scarce, WLS-VE minimizes its use of memory, thereby avoiding having to swap memory to disk. The net effect is simpler configuration and efficient use of memory under varying conditions.
- *Increased maximum memory* — In standard 32-bit OSes, it is usually not possible to allocate more than 2.5 GB of memory address space to a Java application. In WLS-VE, the maximum limit is 3.5 GB. Exact amounts, however, depend on OS and application.
- *Improved disk I/O performance* — The availability of a virtual local disk for each virtual machine provides fast and secure file transfers.
- *Less disk space* — Because LiquidVM contains only a fraction of the services and programs of a standard OS, WLS-VE requires significantly less disk space than a stack of WLS, JVM, and a standard OS.
- *Less memory* — Because LiquidVM provides basic operating-system services, WLS-VE instances consume only as much memory as required for basic operations. A virtual machine that runs WLS-VE does not need to reserve memory for the hundreds of programs that are in a standard OS but are unused by WLS.
- *Improved security with smaller footprint, OOTB secure configuration, and SSH service:*
  - Vastly simplified OS configuration, with little need to lock down the OS since everything unneccessary has already been removed.
  - Greatly reduced attack area, with few services running that listen to the network.
  - The OS level has no shell and cannot start new programs. After the JVM is started at boot time, no more programs, besides the already running JVM, can be started.
  - Standards-based, secure SSH protocol for transferring data to and from the LiquidVM instance on the hypervisor host.

Manage Your Applications as Software Appliances

In a virtualized environment, a software appliance is a pre-configured software stack that the hypervisor can start, stop, hibernate, and resume. Some software vendors package software appliances as a single file. WLS-VE includes utilities that enable you to manage a WLS-VE application stack as a software appliance, even though your application and WLS-VE are packaged as a collection of files (see Figure 1-3).

To configure your WLS-VE-hosted application to run as a software appliance, you create a WLS domain and deploy your applications onto the WebLogic Managed Servers in the domain. Then you use the P2V Domain Conversion utility to convert the physical WLS domain (or selected servers in the domain) to WLS-VE instances in the hypervisor environment. You create one such WLS-VE virtual machine for each Managed Server (and optionally the Administration Server) in a domain.

Figure 1-3 WLS-VE Applications as Software Appliances


Physical-to-Virtual Domain Conversion utility creates a VM
P2V-generated scripts or hypervisor console starts the configured VM
Configured VM runs the application stack as a software appliance
Application
WLS-VE
WLS
LVM
Virtual Local Disk
Domain and applications
P2V Domain Conversion Utility
Hypervisor
Machine
Mapped WLS-VE ISO image
SAN Disk

Application Versioning and Patching Model for WLS-VE Appliances

Because for each WLS-VE virtual machine, the application files are installed in a dedicated local disk for the VM, you can deploy a new version of your application without stopping all your WLS-VE instances and without interrupting your application's clients. (See Deploying Applications to WebLogic Server in *Deploying Applications to WebLogic Server*.)

In addition, WLS patches can be installed on each WLS-VE virtual machine separately without shutting down the entire domain or cluster (see WebLogic Server Rolling Upgrade in *Upgrading WebLogic Application Environments*).

Which Application Types Benefit from WLS-VE?

Applications that never or only occasionally experience performance barriers due to lack of CPU, memory, or networking resources are good candidates for running in a virtual environment and are therefore good candidates for WLS-VE. For these applications, deploying and serving from WLS-VE is indistinguishable from standard WLS.

Applications that frequently experience performance barriers due to lack of CPU, memory, or networking resources usually require dedicated hardware resources and so are *not* good candidates for running in a virtual environment or on WLS-VE. See Determining Appropriate Applications for WLS-VE.

WLS-VE in Production or Testing Environments

WLS-VE delivers the same high-availability, security, and deployment features of WLS that are required for production environments, and its support for virtual environments enables you to maximize the use of the computing resources in your data center.

In a testing (QA) environment, WLS-VE simplifies the process of configuring machines or entire collections of machines for running tests. Using a single script, QA engineers can instantiate an entire WLS domain running on machines with pre-configured amounts of memory, CPU, and network resources. When the tests have completed, another script can reconfigure the same physical machines for additional tests that use different amounts of computing resources.

Limitations of WLS-VE

Note the following limitations when using WLS-VE:

- WLS-VE is a platform for production and testing, not for development.

  The WLS-VE distribution archive does not include WLS 10.0 MP1, WebLogic Workshop, or the WLS samples.

- WLS-VE cannot coexist with other processes in the same VM. For example:
  - You cannot run Microsoft Windows in the VM that hosts WLS-VE, so your applications cannot use DCOM/ActiveX to access Microsoft Office applications. However, you can run a Microsoft Windows in a separate VM on the same physical machine (i.e., ESX server).
  - You cannot use BEA Node Manager.
  - You cannot use startup scripts or classes that attempt to start additional processes on the same machine but outside the JVM (such as a database, a Perl script, or monitoring software). For example, you cannot start a Perl script by invoking `System.exec` from your WLS.
  - You cannot use Type 2 JDBC drivers. Instead, use Type 4 drivers.

- BEA Node Manager cannot be used with WLS-VE; therefore:
  - You cannot start, suspend, or resume managed servers from the administration console. But you can still stop servers from the administration console.
  - You cannot perform whole server migration in WLS-VE.
  - You cannot perform service migration in WLS-VE.

Tip: BEA's WebLogic Operations Control (WLOC) and VMware's VI Client provides similar Node Manager functionality to suspend or resume virtual servers and perform virtual machine migration. For more information, see the WLOC 1.0 documentation and Working with WLS-VE Using the VMware VI Client in the WLS-VE *Configuration and User Guide*.

- WLS-VE and applications that run in WLS-VE cannot execute non-Java (native) code.

Comparison of WLS with WLS-VE

Table 1-1 compares how managed servers are distributed on hardware with WLS and WLS-VE.

Table 1-1 Distribution of Managed Servers

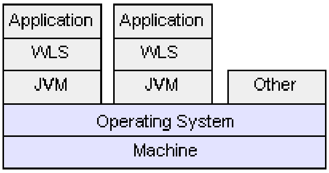
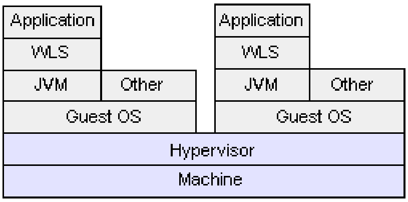
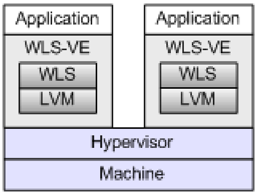
WLS in Non-Virtualized Environment	WLS in Virtualized Environment	WLS-VE
On a single machine, you can run multiple managed servers and you can run multiple additional processes.	On a single machine, the hypervisor layer enables you to run multiple VMs. Each VM runs a full guest OS, which can host multiple managed servers and additional processes.	On a single machine, the hypervisor layer enables you to run multiple VMs. Each VM runs only WLS-VE, which includes its own guest OS, a WLS instance, and one or more Java applications.
 Application Application WLS WLS JVM JVM Other Operating System Machine	 Application Application WLS WLS JVM Other JVM Other Guest OS Guest OS Hypervisor Machine	 Application Application WLS-VE WLS-VE WLS WLS LVM LVM Hypervisor Machine

Table 1-2 compares the location of file storage for WLS and WLS-VE.

Table 1-2 Location of File Storage

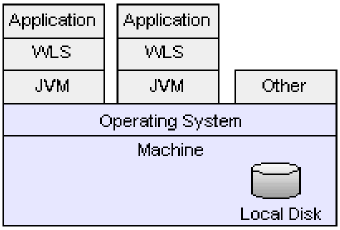
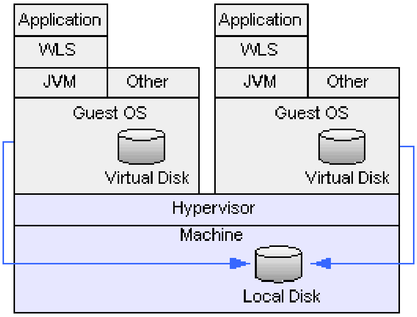
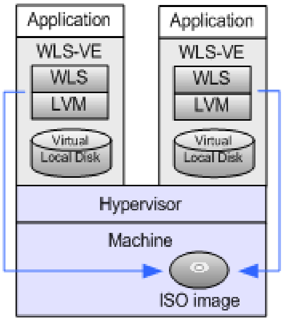
WLS in Non-Virtualized Environment	WLS in Virtualized Environment	WLS-VE
All artifacts related to WLS (BEA classes, domain configuration documents and runtime caches, application classes, descriptors, file stores, and log files) can reside on local disk or network-attached storage (NAS).	All artifacts related to WLS can reside on the virtual machine's virtual disk, which can be implemented as a local disk, SAN, or NAS.	WLS-VE classes are packaged in a file that conforms to the ISO standard for CD-ROM images (ISO-9660). This ISO image file and the virtual disk of the virtual machine can reside on the local disk of the hypervisor's host machine, SAN, or NAS. The ISO image and the virtual disk are mounted on the LiquidVM's file system.
 Application Application WLS WLS JVM JVM Other Operating System Machine Local Disk	 Application Application WLS WLS JVM Other JVM Other Guest OS Guest OS Virtual Disk Virtual Disk Hypervisor Machine Local Disk	 Application Application WLS-VE WLS-VE WLS WLS LVM LVM Virtual Local Disk Virtual Local Disk Hypervisor Machine ISO image

Table 1-3 compares life-cycle control options for WLS and WLS-VE.

Table 1-3 Life Cycle Control

WLS in Non-Virtualized Environment	WLS in Virtualized Environment	WLS-VE
To **start** WLS instances, you can do any of the following: • Log on to the host machine and run a startup script. • Configure the OS to run WLS as a Windows service or daemon. • Use Node Manager. You can also configure Node Manager to restart a server when the server's health has failed.	To **start** WLS instances, you can do any of the following: • Log on to the VM's guest OS and run a startup script. • Configure the guest OS to run WLS as a Windows service or daemon. • Use Node Manager. You can also configure Node Manager to restart a server when the server's health has failed.	To **start** a WLS-VE instance, you can use either of the following: • A WLS-VE startup script. • The hypervisor's management console. You cannot use Node Manager or the WLS Administration Console to start or manage WLS-VE appliances.
To **stop** servers, you can: • Use the WLS Administration Console. • Use Node Manager.	To **stop** servers, you can: • Use the WLS Administration Console. • Use Node Manager. Note that the VM and its guest OS **continue to consume resources** until you use the hypervisor to stop the VM.	To **stop** a WLS-VE instance, you can: • Use the WLS Administration Console. • The hypervisor's management console.
	The hypervisor software makes it possible to suspend (**hibernate**) and resume an entire VM.	The hypervisor software makes it possible to suspend (**hibernate**) and resume an entire VM. LiquidVM facilitates this process by instructing the hypervisor to store only the JVM data that is needed to restore WLS-VE's state.

Planning Your Virtualized Installation

This section describes some aspects you should consider in planning your WLS-VE installation.

Verifying That Your Environment Supports WLS-VE

Before planning any WLS-VE version implementation, you must verify that your environment has a supported configuration of hardware, operating system, application server, and database. See the BEA Products Supported Configurations documentation.

Note: LiquidVM itself is a 32-bit VM (meaning that it cannot use more than 4GB of memory).

Determining Appropriate Applications for WLS-VE

For most applications, deploying and serving from WLS-VE is indistinguishable from WLS; that is, WLS-VE is no more CPU-intensive, memory-intensive, or network-intensive than WLS. On the other hand, certain applications will not perform as well in a virtualized environment as in a non-virtualized one. Consider the following factors in deciding whether using WLS-VE is appropriate for your applications:

- A key feature of WLS-VE is that it frees applications from the need for an operating system. Consequently, WLS-VE is solely focused on pure Java applications. If your application requires execution of any non-BEA native code in order to work, it will not work in a virtualized environment.

- Hardware-intensive applications that need a full ESX server to themselves are not good candidates to virtualize.

- WLS-VE uses a 32-bit JVM and therefore cannot make use of more than 4 GB memory. WLS-VE's small footprint means that the heap can be as large as 3.5 GB, but if this is not enough you must use some other solution than WLS-VE that supports 64-bit memory address space.

- Applications that launch startup scripts or classes that attempt to start additional processes on the same machine, but outside the JVM (such as, a database, a Perl script, or monitoring software), will not work in a virtualized environment. For example, you cannot start a Perl script by invoking `System.exec` from your WLS domain.

- Applications that require a local GUI will not run on WLS-VE as it does not provide a platform for displaying a window. If you need to run a GUI-based program in conjunction with an application running on WLS-VE (for example, one of the BEA JRockit Mission Control tools), you must run it on a separate machine running a normal OS.

Understanding Machine Roles

Installing and using WLS-VE involves multiple machines. It is important to understand the roles and requirements of each.

- Launcher machine — The Windows or Linux machine on which you run the LiquidVM Configuration Wizard**,** the P2V Domain Conversion utility, and initiate the creation of WLS-VE instances on the VMware ESX machine.
- VMware ESX machine — The hypervisor machine with VMware installed that is available for the creation of WLS-VE instances. The LiquidVM launcher accesses the ESX server through the VirtualCenter.
- VMware VirtualCenter machine — The primary controller for configuring and managing the virtual environment. Users can connect to the VirtualCenter server using the Virtual Infrastructure Client (VI Client).

For more detailed information, see Configuration Overview and Roadmap in the WLS-VE *Configuration and User Guide*.

Using an NFS Share

WLS-VE provides a virtual local disk for each virtual machine, which removes the dependence on NFS and provides faster and more secure file transfers. The virtual local disk can reside on the ESX host's local disk, or on a SAN or NAS attached to the ESX server.

However, if you prefer to use an NFS file server as the location for the BEA Home directory, refer to the Creating and Sharing Directories section in the WLS-VE v1.0 *Installation and Configuration Guide*.

Note: When using NFS, applications that use file stores extensively (or that frequently write files directly to the file system) could experience some performance degradation if you use a NFS file server for reading and writing files. Generally, input and output with a local disk is faster than with a file server.

Designing a File Storage Solution

Because of the importance of non-local storage to WLS-VE, there are some critical questions you need to address before you can successfully run WLS-VE:

- How will the application and data be stored?

- What sort of storage solution—or combination of storage solutions—will best support your version of WLS-VE?
- What affect does running on VMware have on how you configured your storage?

This section describes WLS-VE's requirements for storage and offers ideas for successfully implementing these solutions.

Understanding the WLS-VE Storage Architecture

What LVM sees as a local disk is actually implemented by VMware ESX as a large file. To the virtual machine (LiquidVM), however, the virtual local disk looks like a normal physical disk drive and, therefore, it performs the corresponding I/O instructions necessary to write to a physical disk drive. VMware detects these I/O instructions and transforms them into corresponding writes to the large file. Since the representation of the virtual disk is a file, writes to this file will eventually be stored somewhere on the physical storage. The location of this storage is under the control of the VMware administrator. Similar to a typical OS case, the administrator has three choices: the ESX machine's physical hard disk, a disk-partition on a SAN (best practice), or a large file on a NAS.

Storage Requirements

Due to its virtualized nature, the storage requirements for WLS-VE somewhat differ from those you need to address for a non-virtualized WLS. The basic requirement is accessibility of storage locations: for some of its data storage activities, WLS-VE requires exclusive access, while for other activities, it assumes that other processes might access the data (as in a standard file system).

Storage for Exclusive File Access

WLS-VE requires exclusive access to a storage system for the following activities:

- To access the WLS-VE ISO image that contains the LiquidVM executables and WLS classes.

  Note: Because the ISO image is read-only, it can be stored on a SAN disk allowing multiple machines to have simultaneous access to the same ISO image without violating its exclusivity. See "WLS-VE ISO Image Considerations" on page 1-15.

- To write internal, temporary files that are used to maintain runtime state, caches, and so on.
- When using a virtual local disk, to store files that contain domain and application configuration data.

To store its exclusive data, WLS-VE needs to use the virtual disk that is made available by the hypervisor layer. Generally, a SAN implementation is optimal for WLS-VE because it usually performs at a higher level than a NAS due to NAS requiring a higher protocol overhead than a SAN. Moreover, it is more expensive to reference a file somewhere in a NAS's potentially deep directory structure than it is to just access a certain block on a certain disk partition, as a SAN stores data. Finally, a SAN requires less state on the storage side than a NAS does.

Storage for Shared File Access

Optionally, you can use the NFS client in LiquidVM to mount a NFS share for files that require or expect shared access. For example:

- Monitoring applications that want to read log files.
- Storing files that contain domain and application configuration data.

LiquidVM can access only (virtual) disk drives and (virtual) network cards, which are configured by the LiquidVM launcher when creating a WLS-VE instance.

Note: If you are using an NFS share, the communication between the NFS client and the NFS server is not secure. The NFS client authenticates itself to the NFS server by using user-provided credentials, but this traffic is not encrypted, which makes it vulnerable to security breaches. Please refer to NFS Security Measures section in the WLS-VE v1.0 *Installation and Configuration Guide* for details on how to work around this situation.

WLS-VE ISO Image Considerations

BEA recommends that you store the WLS-VE ISO image on a SAN. The ISO image is a file in ESX storage and appears as a CD drive to LiquidVM. It also differs from normal local disks because it is read-only. This implies that no one can modify it; therefore, multiple machines can have simultaneous access to the same ISO image without violating its exclusivity, and thereby reducing disk footprint.

Planning System Capacity

How much system capacity to plan for is greatly dependent on the applications you are running on WLS-VE. This section provides information that can help you make decisions about your minimal capacity requirements as they apply to WLS-VE. However, you will need to factor in the needs of your application to fully determine the appropriate amount of disk space, number of machines, and physical memory allocation.

- Determine Physical Disk Space Requirements

- Determine the Number of Physical Machines
- Determine Physical Memory Requirements

Determine Physical Disk Space Requirements

The amount of physical disk space that you need to configure on the ESX server depends upon the size of your application and the amount of data you anticipate processing. At a minimum, you need to provide enough disk space for writing images when hibernating an instance of WLS-VE, which is generally an amount equal to your Java heap plus some native memory (for a large application, 300MB should be a reasonable amount of native memory, but the amount of memory you should reserve is highly workload dependent). In addition, you also need to plan for database requirements and other storage needs.

In addition, LiquidVM provides a virtual local disk for each virtual machine. The virtual local disk can reside on ESX host's local disk, or on a SAN or NAS attached to the ESX server. You specify the size of the disk by passing the `diskSize` parameter as a startup option to the LiquidVM launcher. By default, the size of the local disk is specified as 1 GB (1024). To determine the amount of physical storage capacity, BEA recommends that you refer to the VMware Infrastructure Documentation. For instructions about specifying the local disk size, see Using the Virtual Disk in the WLS-VE *Configuration and User Guide*.

How much data the domain needs is application-dependent. Before taking a server into production you should check the size of the domain in a development environment and make sure you have at least that much space left on the production server. Normally, the storage space requirements for most applications running on top of WLS are modest. The storage requirements for the domain are identical for standard WLS and WLS-VE.

Determine the Number of Physical Machines

When determining how many physical cores your implementation, BEA strongly recommends that you refer to the VMware Infrastructure Documentation.

Determine Physical Memory Requirements

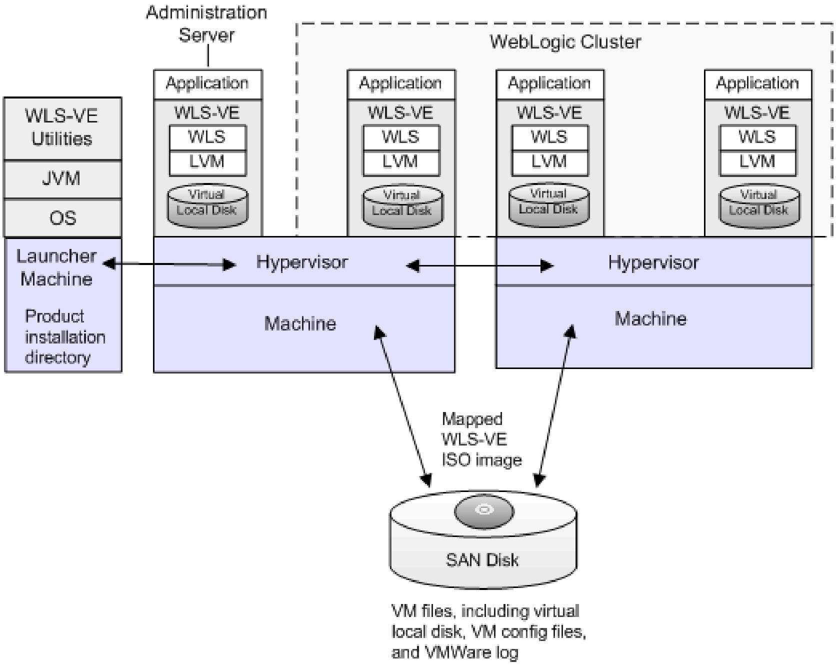
Much like disk space requirements, physical memory requirements depend significantly on the applications you are running on the machine. Because WLS-VE is available only as a 32-bit application, the maximum amount of physical memory available to the virtual machine is 4 GB. Ideally, you should plan to allow enough heap space to run your application, without making it resort to swapping or paging during processing, plus some additional memory for native application code and generated Java code. If you do not allow enough space for Java to run, you will quickly encounter out of memory exceptions and system failure.

Recommended Topology

While the combinations of hardware and software in data center environments can vary widely to support different business needs, BEA recommends the following general principles for the network topology of your production environments:

- To maximize use of computing power on available machinery, run multiple managed servers on a single machine.
- To ensure high availability, run at least one managed server on a separate physical machine.
- The Administration Server can run on any machine.

Figure 1-4 Recommended Topology



Configuring web servers and load balancers for WLS-VE is no different from WLS—when you configure a virtual machine, you assign it an IP address. Then you configure the web server and load balancer to listen for the IP addresses that you have assigned to the VMs in your cluster.

Configuration procedures are documented in the WLS-VE *Configuration and User Guide*, which provides details for using, administering, and troubleshooting WLS-VE.

Obtaining the WLS-VE Software

For this release, WLS-VE is only available as distribution archive and does not include a BEA product installer mechanism.

You can download the WLS-VE distribution archive from the BEA web site.

Related Documentation

For more information on configuring, using, and administering WLS-VE, refer to the following documentation:

- The WLS-VE *Configuration and User Guide* provides details for configuring, using, administering, and troubleshooting WLS-VE.
- The BEA Products Supported Configurations documentation provides supported hardware and software configurations for WLS-VE 10 v1.2.