Esri® ArcGIS® 10.1 for Server
Esri ArcGIS 10.2 for Server
on VMware® vSphere®

July 2013

DEPLOYMENT AND TECHNICAL CONSIDERATIONS GUIDE

vmware®

Contents

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Introduction

Esri is an industry leader that specializes in geographic information system (GIS) software for the management, analysis, and visualization of spatial data. Esri develops GIS solutions that can function as an integral component in nearly every type of organization. These solutions are built on the philosophy that a geographic approach to problem solving ensures better communication and collaboration and stronger global ties.

This paper describes recent joint testing that VMware® and Esri conducted to characterize the performance and functionality of ArcGIS® 10.1 for Server Enterprise Standard running on the VMware vSphere® 5.1 virtualization infrastructure. It describes the architecture of ArcGIS 10.1 for Server, the testing that was performed, and the results, demonstrating the value of using VMware infrastructure to power ArcGIS 10.1. This paper also outlines the best practices for deploying the solution in the data center.

This paper is written for architects and engineers who are responsible for ArcGIS for Server and the VMware vSphere virtualization environment. This paper assumes that the reader has knowledge of Esri® ArcGIS products and the VMware vSphere virtualization platform and related VMware products.

Note: All testing was done using ArcGIS 10.1 for Server. However, since there is no significant difference in the overall architecture between ArcGIS 10.1 for Server and ArcGIS 10.2 for Server, this document applies to both releases.

Solution Overview

VMware and Esri jointly conducted testing to characterize the performance and functionality of ArcGIS 10.1 for Server Enterprise Standard running on VMware vSphere 5.1 virtualization infrastructure. The ArcGIS products and VMware vSphere used in this solution are described in the sections below.

Esri ArcGIS 10.1 for Server

ArcGIS for Server connects people with the geographic information they require. Organizations use ArcGIS for Server to distribute maps and other GIS capabilities provided by web mapping applications and services. This improves internal workflows, communicates vital issues, and engages stakeholders. ArcGIS for Server provides the user with these capabilities:

- **Publish fast, intuitive web maps tailored to a specific audience:** This dramatically strengthens business and resource decisions with real-time geointelligence.
- **Geographically enable IT investments:** This lessens data and application redundancy, optimizing system configurations and consolidating enterprise systems.
- **Centrally manage geodata:** This provides better data security and integrity for the user's most important information assets.
- **Simplify access to large volumes of imagery resources:** This significantly reduces storage costs and data processing overhead.

- **Extend GIS to the mobile work force:** This increases the accuracy and value of field data collection projects and asset monitoring, as well as provides resource and event management.

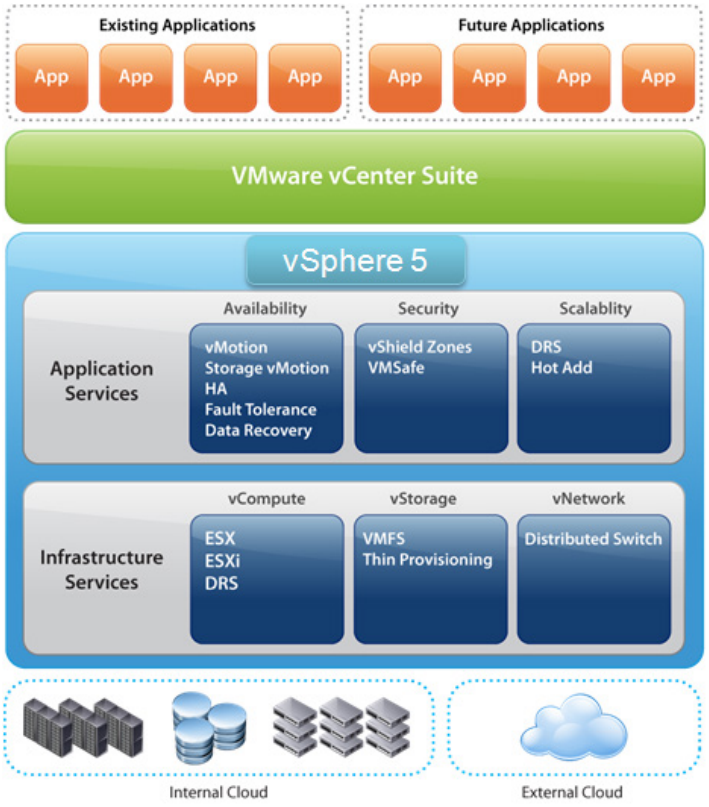
VMware vSphere 5.1

VMware vSphere is an optimal virtualization platform and enabler for cloud computing architectures (see figure 1). vSphere enables IT to meet service-level agreements (SLAs) for the most demanding business-critical applications at the lowest total cost of ownership (TCO). VMware vSphere delivers control over all IT resources with the highest efficiency and choice in the industry, as shown below.

VMware vSphere virtualization solutions provide the following:

- **Consolidation:** VMware virtualization allows multiple application servers to be consolidated into one physical server, with little or no decrease in overall performance. This helps minimize or eliminate underutilized server hardware, software, and infrastructure.
- **Provisioning:** VMware virtualization encapsulates an application into an image that can be duplicated or moved, greatly reducing the cost of application provisioning and deployment.
- **Manageability:** The live migration of virtual machines from server to server and associated storage is performed with no downtime using VMware vSphere vMotion®, which simplifies common operations such as hardware maintenance, and VMware vSphere Storage vMotion®.
- **Availability:** High availability can be enabled to reduce unplanned downtime and enable higher service levels for applications. VMware vSphere High Availability (HA) ensures that in the event of an unplanned hardware failure, the affected virtual machines are automatically restarted on another host in a VMware cluster.
- **Automation:** VMware automated load balancing takes advantage of vMotion and Storage vMotion to migrate virtual machines among a set of VMware ESXi® hosts. VMware vSphere Distributed Resource Scheduler™ (DRS™) and VMware vSphere Storage DRS enable automatic resource relocation and optimization decisions for virtual machines and storage.

Figure 1. VMware vSphere Virtual Infrastructure



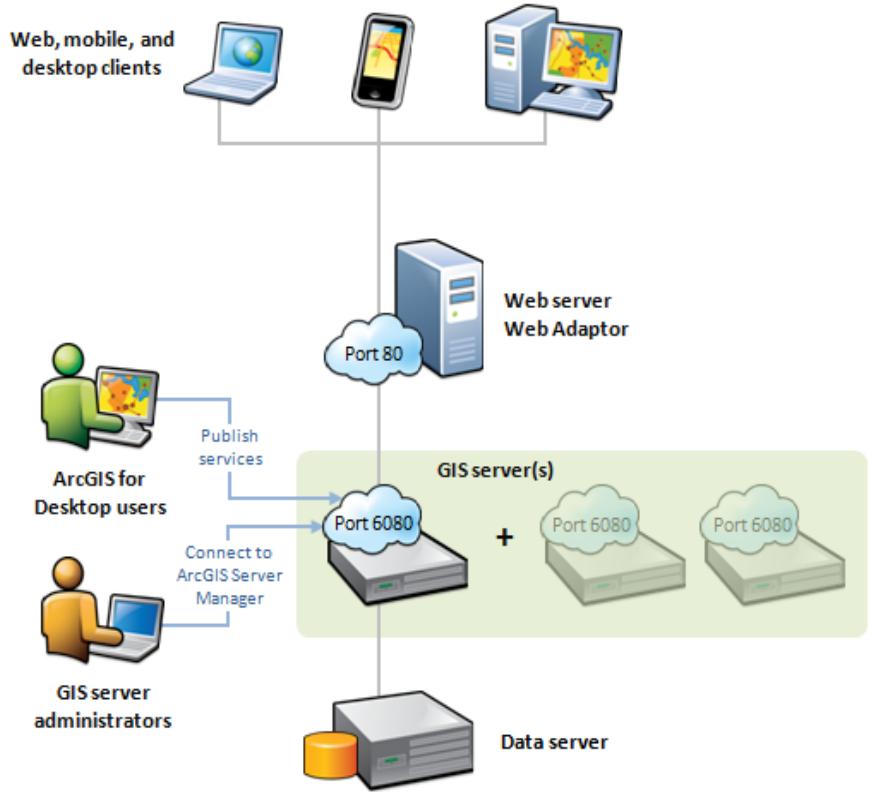
vSphere creates a layer of abstraction between the resources required by an application, the operating system, and the underlying hardware that provides those resources. vSphere enables multiple, isolated execution environments to share a single hardware platform. It implements each environment with its own set of hardware resources.

For more information about vSphere, see the Resources section later in this paper.

Solution Architecture

The ArcGIS for Server system architecture used in this testing is shown in figure 2.

Figure 2. ArcGIS for Server System Architecture



For more information, see the ArcGIS for Server Installation Guide available at resources.arcgis.com/en/help/install-guides/arcgis-server/10.1/index.html#//01nm0000000m000000.

The ArcGIS for Server architecture components and the basic ArcGIS deployment strategies that can be used with this solution are described in the sections below.

Esri ArcGIS for Server Architecture

An ArcGIS for Server system includes the following components:

- GIS server
- ArcGIS Web Adaptor (IIS)
- Web server
- Data server

Each of these components is described in the sections below. For more information, see the Resources section later in this paper.

GIS Server

The GIS server fulfills requests to web services. It draws maps, runs tools, queries data, and performs any other action required with a service. The GIS server can consist of one machine or many machines working together. The machines all have access to the same data and configuration information, and the number of participating machines can easily increase or decrease in response to demand.

The GIS server exposes services through the common HTTP web protocol. An installed GIS service immediately has a set of web services that can be used with apps. The GIS server can be supplemented with an enterprise web server for more functionality, such as the ability to host web apps.

GIS servers can be organized in groups called clusters. Each cluster runs a dedicated subset of services, as configured by the server administrator. For example, one cluster can run all the map services and another cluster of servers (perhaps with higher processing power) can be used to run geoprocessing services.

ArcGIS Web Adaptor

To integrate GIS servers with an existing enterprise web server, ArcGIS Web Adaptor can be installed. ArcGIS Web Adaptor receives web service requests through a common URL (on a chosen port and site name) and sends them to the various GIS server machines on the site.

Alternatively, the site can be exposed through other types of web gateway technologies, such as an HTTP load balancer, network router, or third-party load balancing software. In some cases, it may be appropriate to use Web Adaptor in tandem with an existing load balancing solution.

Web Server

A web server can host web applications and provide optional security and load balancing benefits to the ArcGIS for Server site. The basic hosting of GIS services can use the site that is created after installing ArcGIS for Server.

To go beyond the simple hosting of services or to use the organization's existing web server, a user can install Web Adaptor. Web Adaptor integrates the ArcGIS for Server site with IIS, WebSphere, WebLogic, and other web servers.

Data Server

Data can be placed directly on each GIS server, or it can be accessed from a central data repository, such as a shared network folder or an ArcSDE® geodatabase. In either case, the data includes all GIS resources that have been published as services on the GIS server. These resources can be maps, globes, locators, geodatabases, and so on.

Deployment Strategies

The scalable architecture of ArcGIS for Server can be deployed at a Workgroup or Enterprise level, each with Basic, Standard, and Advanced editions. Large deployments may require multiple installations of ArcGIS Web Adaptor, web servers, and GIS servers, while smaller organizations may want to consolidate these resources on only one or two machines.

The deployment of ArcGIS for Server depends on its usage and the workload demands. For example, if the product is used for development or testing purposes, a smaller deployment configuration might be appropriate. When GIS services are published for access by a large community of users, extra consideration and resources might be required to deal with factors such as increased processing loads, eliminating single points of failure, and added security.

The scenarios described in the sections below are presented as considerations for building the ArcGIS for Server site. These configurations are flexible and can be adjusted to fit specialized needs and hardware resources to meet an organization's specific requirements.

The following terms help explain each deployment scenario:

- **Site:** A site consists of several components, such as a GIS server and ArcGIS Web Adaptor, that can optionally be distributed across multiple machines to increase computing power and redundancy.
- **GIS server:** The main component of the site that satisfies requests issued to GIS web services. A GIS server can draw maps, run tools, serve imagery, and perform many other operations offered by ArcGIS.
- **ArcGIS Web Adaptor:** An optional component that allows a web entry point to be configured into the site. It integrates with the web server and distributes incoming requests among GIS servers.
- **Server directories:** A set of directories that contain certain types of files that support the services. These files include caches, search indexes, and geoprocessing job results.
- **Configuration store:** A location that contains configuration information, such as the list of GIS servers participating in the site. The configuration store must be available for the site to function.
- **Data:** Data supports web services, such as feature classes, tools, imagery, and locators.

For more information, see the Resources section later in this paper.

Types of Deployments

The ArcGIS for Server architecture is designed to accommodate all sizes of deployments. For example:

- When initiating a first deployment, it might be useful to start small and install all components on a single machine.
- For the production site deployment or to handle more users, more GIS servers can be added.

- The site can be integrated into the existing IT infrastructure by using the enterprise web server (via ArcGIS Web Adaptor) or data server.

In addition, many of the components in the ArcGIS for Server architecture can be duplicated or run in parallel to avoid a single point of failure.

The types of ArcGIS deployment configurations include the following:

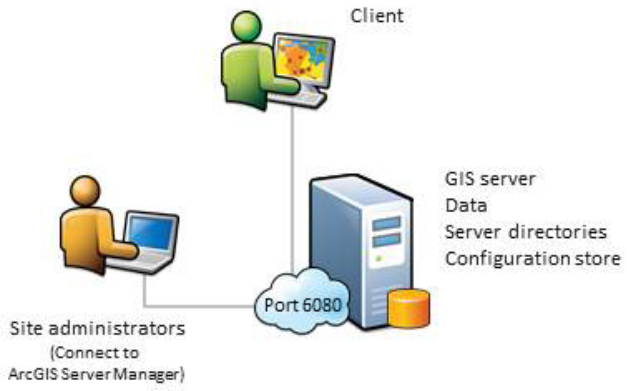
- Developer sandbox site
- Single machine site
- Multiple machine site

Each of these deployment configurations is described in the sections below. For more information, see the Resources section later in this paper.

Developer Sandbox Site

When developing or experimenting with ArcGIS for Server, simply install the GIS server without installing a web server or ArcGIS Web Adaptor. The developer sandbox site scenario is configured with only one GIS server. Data, server directories, and the configuration store reside locally on the GIS server, as shown in figure 3.

Figure 3. Developer Sandbox Site



A Microsoft SQL Server Express database is a good option for setting up a small instance of a geodatabase on the GIS server.

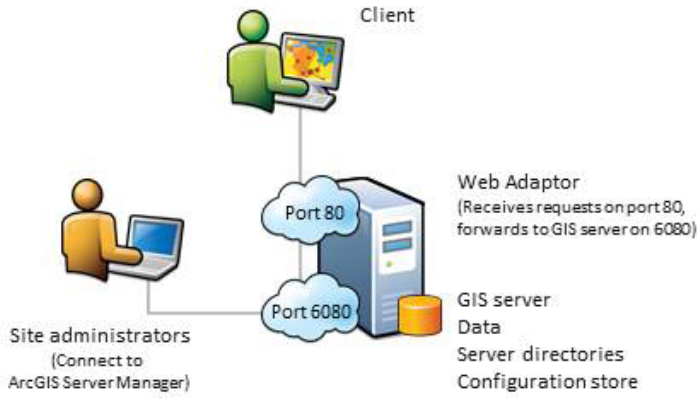
Clients access the developer sandbox site by connecting directly to the GIS server through HTTP on port 6080. For example, the URL to the site would be http://myserver:6080. The GIS server hosts services only. There is no web server in this configuration for hosting web applications.

Single Machine Site

The simplest appropriate configuration for a production site is to expose one GIS server through ArcGIS Web Adaptor. ArcGIS Web Adaptor is recommended because it enables incoming requests to go through the established web server. This provides more security options and the ability to host web applications. If there are limited resources or few concurrent requests, both the GIS server and Web Adaptor can be installed on a single machine. This machine must also have a web server installed.

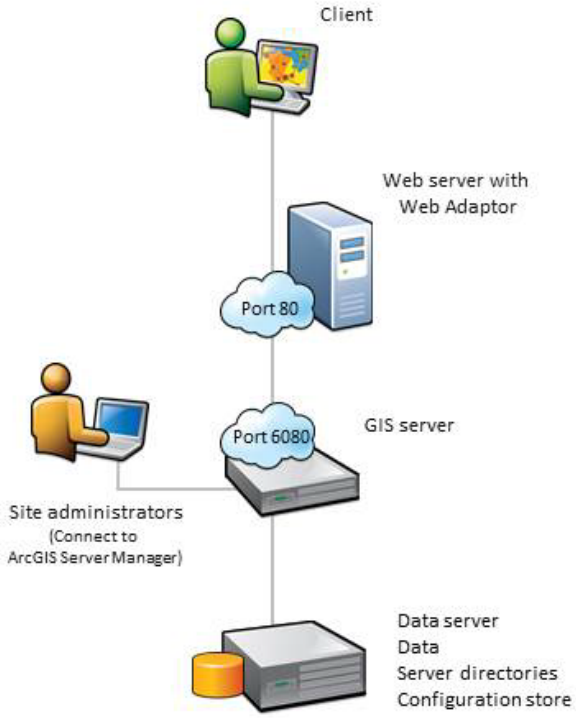
For example, the site in figure 4 is configured with ArcGIS Web Adaptor on port 80 and accessed using the URL http://myserver. Web Adaptor forwards incoming client requests to the GIS server on port 6080. Server administrators can log on to ArcGIS Server Manager or the Administrator Directory through port 6080.

Figure 4. Single Machine Site (ArcGIS Web Adaptor is installed on the GIS server.)



Note that the site architecture can use parts of the organization's existing IT infrastructure. In figure 5, Web Adaptor has been off-loaded to a web server on a separate machine. Similarly, the data, server directories, and configuration store have been put on a dedicated data server. This shows that the phrase *single machine site* technically means *single GIS server site*.

Figure 5. Site with One GIS Server with Web Adaptor (data off-loaded to separate machines)



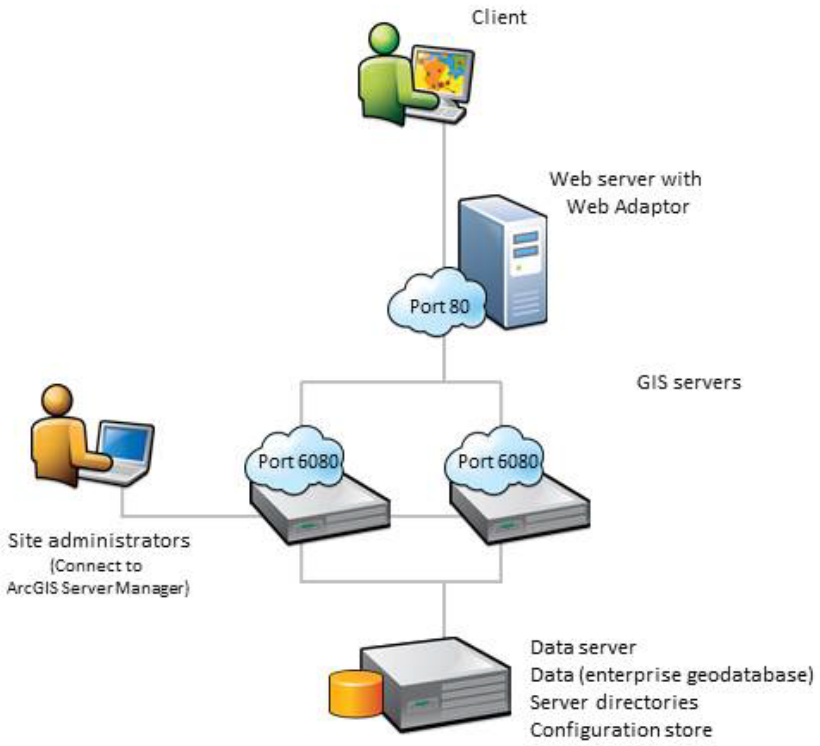
Deploying the web server on its own machine may be desirable in organizations where the web server has a different set of administrators or access policies than the GIS server.

By deploying the data on a separate machine, GIS servers can be added to and removed from the site without any disruption to the data path settings. Deploying the server directories and configuration store on a redundant network storage device allows improved backup and recovery of those resources.

Multiple Machine Site

A site can include multiple GIS servers to handle increased traffic or provide a backup in case one of the GIS servers goes offline. Figure 6 shows the simplest way to configure a site with multiple GIS servers. Web Adaptor detects the GIS servers that participate in the site and forwards requests to each in a round robin fashion. The GIS servers also perform some degree of request distribution among themselves.

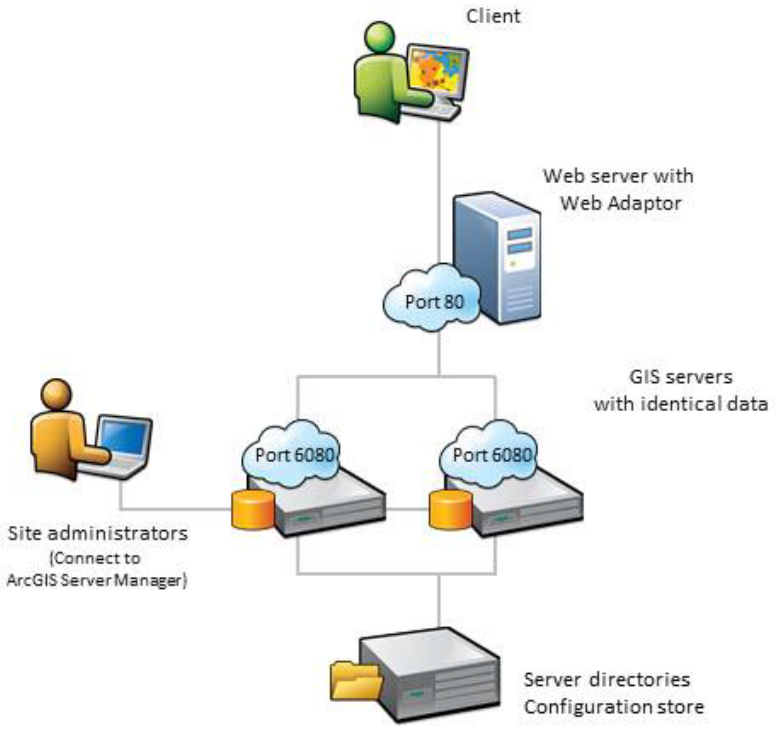
Figure 6. Site with Multiple GIS Servers (Data resides on a highly available data server.)



There are two strategies for storing the data when using multiple GIS servers. The approach shown in figure 6 keeps the data in one centralized location visible to each GIS server. The data only has to be maintained in one place, and this configuration is recommended if a good intranet connection is available.

The other approach for data storage is to put a local copy of the data on each GIS server machine on an identical path, as shown in figure 7. This strategy cuts down on network calls and can increase performance if the intranet connection speed is slow. However, it is difficult to maintain large, frequently changing datasets with this architecture.

Figure 7. Site with Multiple GIS Servers (Data is stored locally on each GIS server.)

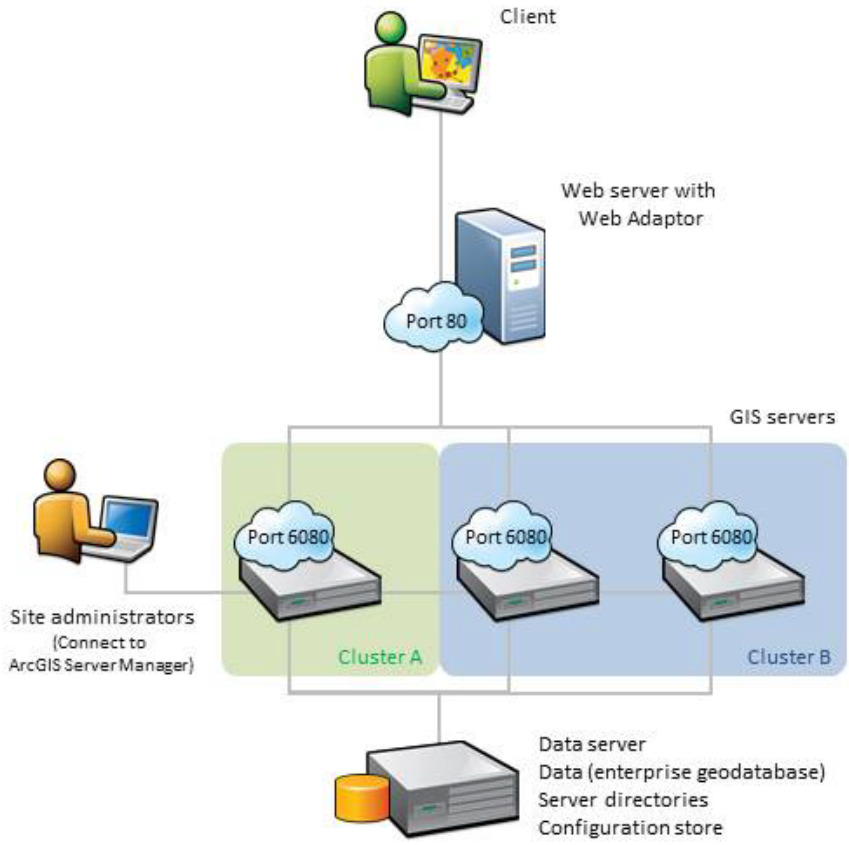


If demand increases in either of the preceding scenarios, additional GIS server machines can be added to the site either manually or automatically (through scripts). This architecture is well suited to cloud computing, where any GIS server can be added or removed from the site at any time.

Using Clusters

Large sites with two or more GIS servers can take advantage of clusters. A cluster is a group of GIS servers that has been configured to run a dedicated subset of services. In figure 8, cluster A could potentially be configured to run map services, while cluster B (with higher processing power) could be configured to run geoprocessing services.

Figure 8. Multiple Machine Site with Clusters (Each cluster runs its own subset of services.)



Some server operations such as batch geocoding are CPU intensive. Using clustered servers for this type of operation might help free up other machines in the site, enabling the remaining services to stay online unencumbered.

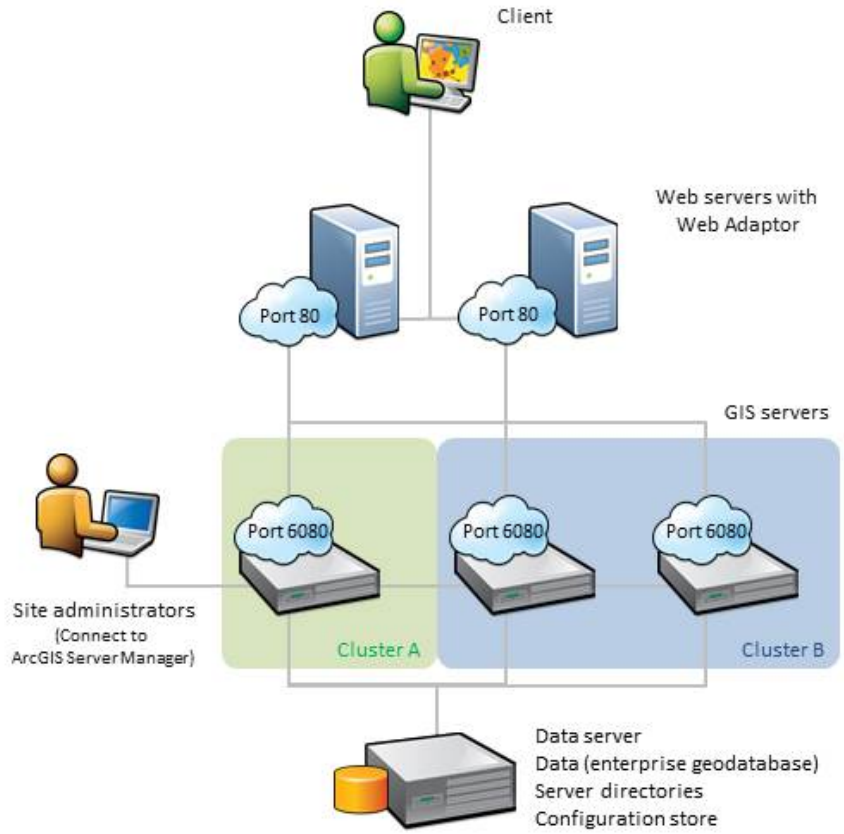
Clustering is also useful when there are disparate hardware resources. For example, an older or slower server could be placed in its own cluster to perform lower-priority jobs.

For more information, see the Resources section later in this chapter.

Using Multiple Web Servers

To help ensure high availability of the site, establish redundancy at the web server tier. In figure 9, the two web servers that are installed with ArcGIS Web Adaptor act as identical entry points into the site on port 80. This keeps the site running in the event of an unplanned outage on one of the web servers. It can also reduce the load on the first web server machine.

Figure 9. Site with Redundancy at the Web Server Tier (Clusters are optional.)



There are several other scenarios that might require two Web Adaptor installations, although these are less common. These scenarios include the following:

- Internal users need to connect to ArcGIS Server Manager through Web Adaptor, but external users need to be blocked from accessing the ArcGIS Server Manager login screen. This could occur if ArcGIS for Server is in a perimeter network (DMZ) and the firewall blocks it from receiving connections from the internal network through port 6080. In this case, set up a second Web Adaptor installation for internal users only that communicates through the port allowed by the firewall.
- External users need to be blocked from accessing the ArcGIS Server Manager login screen, but web-tier authentication is also being performed. In this case, set up a second Web Adaptor installation for internal users only that allows publishing and administrative access.

Testing

Testing was conducted jointly by VMware and Esri to characterize the performance and functionality of ArcGIS 10.1 for Server Enterprise Standard running on the VMware vSphere 5.1 virtualization infrastructure.

Testing Methodology

Testing had two primary objectives:

- To determine the optimal configuration of ArcGIS 10.1 for Server on the VMware virtual infrastructure to achieve maximum throughput with regard to the number of virtual machines, while holding the total number of CPUs constant
- To quantify any performance differences between a virtual machine environment and a comparable physical machine environment

Testing Configuration

The testing configuration is described below.

Hardware Configuration

Table 1 describes the configuration of VMware ESXi host servers, storage, and client hardware used for this testing.

Table 1. ESXi Host Hardware Configuration

Hardware	Configuration

Server	• 2 HP ProLiant BL G7 servers. Each server is equipped with
	  • 12-core (2 sockets) Xeon x5650, 2.67 GHz
	  • 64 GB RAM
	  • 1 GB NIC
	  • Hyperthreading enabled

Storage	• EMC VNX 5700 SAS drive, 15K RPM, Fibre channel • VMFS data store created on LUNs having 4 disks with RAID 1/0

Installed Software

Table 2 lists the installed software used for testing.

Table 2. Software Installation

Software Provider	Software Configuration
VMware	• VMware vSphere 5.1 • VMware vCenter Server 5.1
Microsoft	• Windows Server 2008 R2
Esri ArcGIS	• ArcGIS 10.1 for Server SP1

Virtual Machine Configuration

Each of the physical machines (identified in table 1 above) was used to support one of three environments:

- Load driver environment
- Physical environment
- Virtual environment

Each of these configurations is described in the sections below.

Load Driver Environment

The load driver environment contained a single virtual machine running Windows 7 where the load testing software Visual Studios 2010 Ultimate Edition was installed. The Windows 7 machine was responsible for applying load. It also collected throughput and response time values during each test. This environment also hosted ArcGIS Web Adaptor (IIS).

Physical Environment (Test A)

The machine used for the physical environment was configured to run with only 8 of its 12 cores enabled. This was accomplished using the Windows System Configuration tool (msconfig.exe). This was done to match the physical environment with the virtual environment servers, which were configured to have exactly 8 cores running for all testing (8 servers, 1 CPU each). ArcGIS 10.1 for Server Service Pack 1 (SP1) was configured with the CORINE6 map service set with maximum instances equal to the number of cores and with data on a local file geodatabase. See the Test Data and Map Document section below.

Virtual Environment (Tests B through E)

The virtual environment was used in four of the five test configurations. For all tests, only 8 cores out of a total of 12 were made available to the Windows operating system. The remaining four cores were not allocated in the virtual machine.

CPU over commitment, meaning more than 1 physical CPU assignment to the ESXi host, is a common practice, as long as all ESXi host CPU utilization is not completely saturated and the Hypervisor has adequate room to work.

Note that ArcGIS 10.1 for Server Service Pack 1 was configured with the CORINE6 map service set with maximum instances equal to the number of cores and with data on a local file geodatabase.

Tests Performed

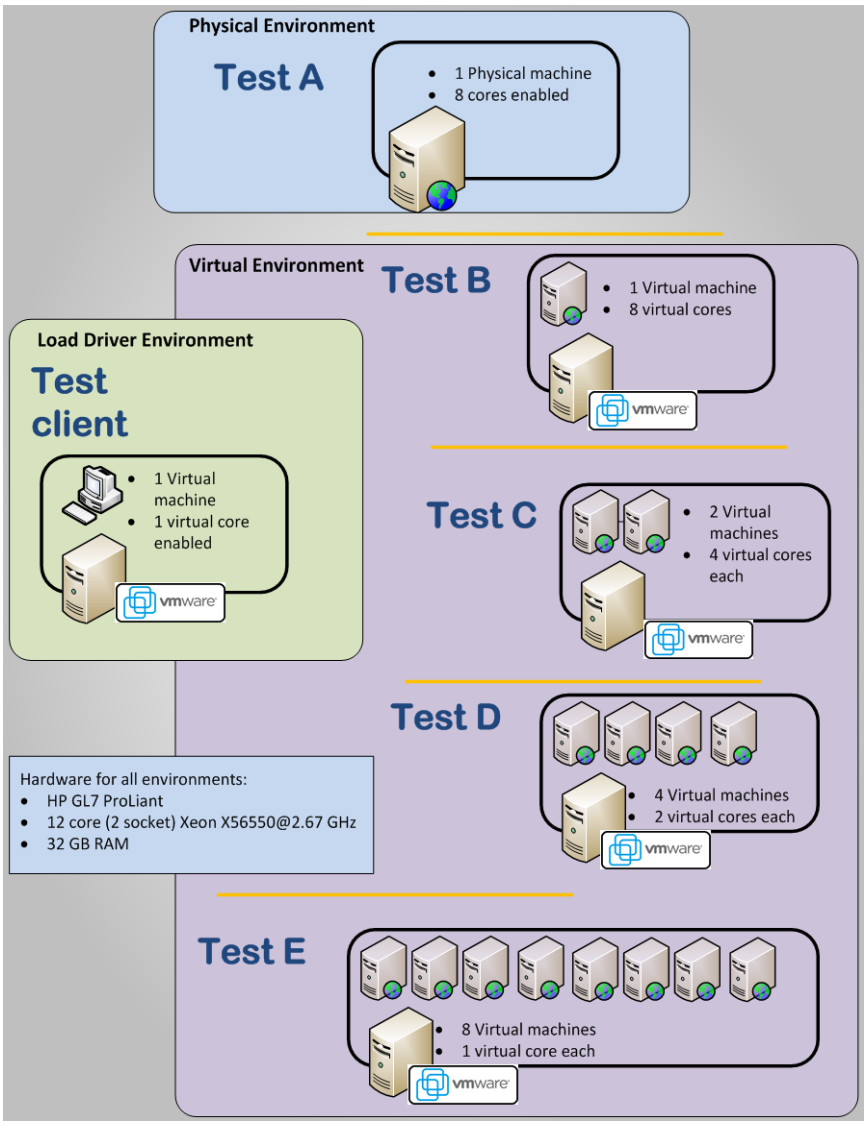
The following tests were performed:

- **Test A:** 1 physical machine with 8 cores
- **Test B:** 1 virtual machine with 8 cores
- **Test C:** 2 virtual machines, each with 4 cores (8 CPUs total)
- **Test D:** 4 virtual machines, each with 2 cores (8 CPUs total)

- **Test E:** 8 virtual machines, each with 1 core (8 CPUs total)

The tests were executed using the test environment architecture shown in figure 10.

Figure 10. Test Environment Architecture

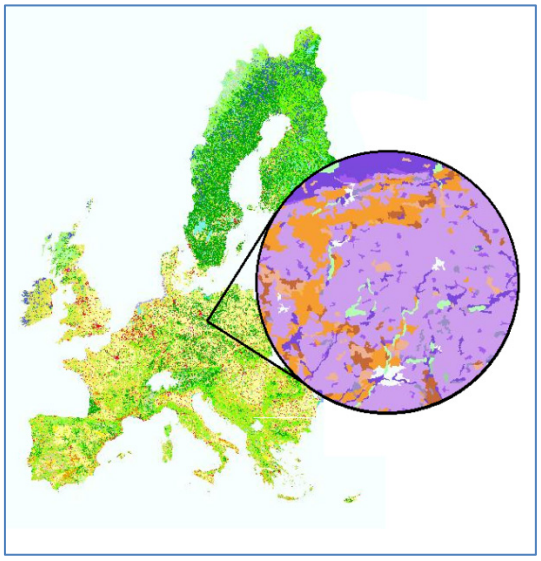


Workload Used

Test Data and Map Document

The test data used the Coordination of Information on the Environment (CORINE) European program dataset (see figure 11), which is publicly available from the European Environmental Agency. It is a dense dataset containing information on land cover, agricultural areas, wetlands, forests, and more. It is composed of over 1,800,000 polygon features that vary in size from approximately 25 to several thousand hectares. This dataset was chosen because of its high performance (subsecond response time) and scalability (ability to support hundreds of concurrent users while maintaining short response times).

Figure 11. CORINE European Program Dataset



The map document was optimized by setting scale dependencies for optimal response time viewing. This ensures certain features do not render until the map is zoomed to the appropriate scale.

Test Procedure

Setup

The test setup included the following:

- Load driver environment setup
- Visual Studio 2010 Ultimate Edition

The load was applied using Visual Studio 2010 Ultimate Edition. Each test was run for 33 minutes. The relevant components of the test are the web test and load test as described below.

Load Test

The load test is the component that applies load to the server. Load was applied in increments, stepping from 1 to 10. The duration of each step was 3 minutes.

Web Test

The web test defines the requests that are sent to the server. For all tests, two HTTP Get requests were sent to locations in five countries:

- England
- Finland

- Germany
- Italy
- Spain

Approximately 2,000 unique map locations for each country were available in a .csv file used by the web test.

Physical Environment Setup

Windows Server 2008 R2 Enterprise x64 was installed on the physical machine, and only 8 cores were made available to Windows. As mentioned earlier, this was done so the total number of cores being tested across all tests was 8. Physical box assigned RAM was 32 GB. This entire configuration was done by "msconfig" configuration setup (System Information → Boot → Advanced option).

Virtual Environment Setup

VMware vSphere 5.1 was installed on the virtual environment, and the following configurations were tested in turn:

- 1 virtual machine with 8 cores (2 sockets—4 cores) and 32 GB of RAM
- 2 virtual machines with 4 cores each (1 socket—4 cores) and 16 GB RAM each
- 4 virtual machines with 2 cores each (1 socket—2 cores) and 8 GB RAM each
- 8 virtual machines with a single core each (1 socket1 core) and 4 GB RAM each

All the above configurations of the VM had the following settings:

- 1 vNIC with VMXNET3 driver
- LSI Logic SAS (default) virtual SCSI adapter

Test Execution

Load Pattern

Load was applied in steps, starting from 1 thread (Initial User Count) and ending at 10 threads (Maximum User Count). Since no "think time" was inserted, the absolute maximum throughput of the system in maps per second was revealed. Each step was sustained for three minutes (Step Duration) before stepping up by one to the next step (Step User Count). The time allotted to introduce each new user was five seconds (Step Ramp Time). These parameters in Visual Studio are shown to the right in figure 12.

Figure 12. Load Pattern

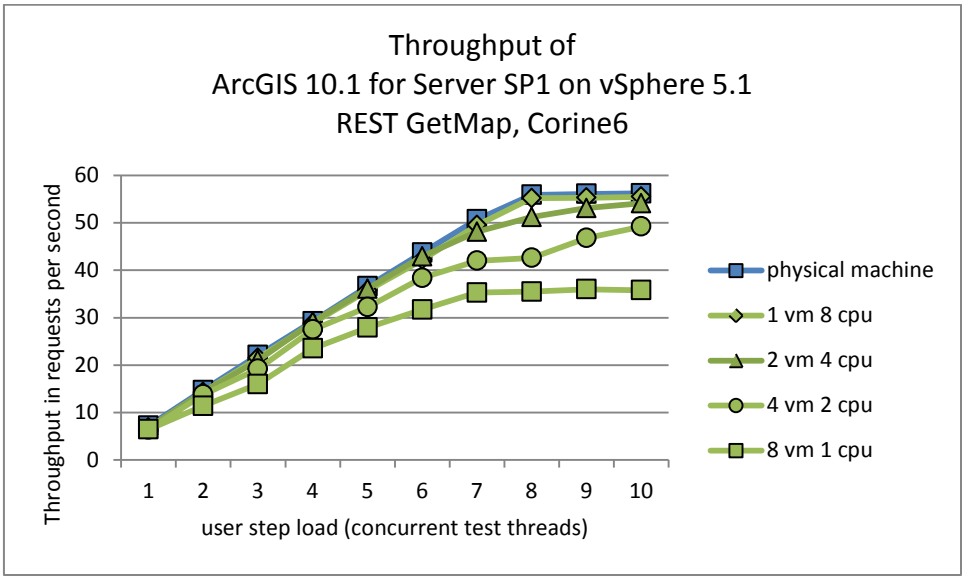
Load Pattern	
Pattern	**Step**
Parameters	
Initial User Count	**1**
Maximum User Count	**10**
Step Duration (seconds)	**180**
Step Ramp Time (seconds)	**5**
Step User Count	**1**

Results Observed

Throughput

A minimal difference (<1.26%) was observed between the maximum throughput of the physical system and a virtual system configured as one machine with 8 cores. As the number of virtual machines was increased in each successive round of testing, the virtual system throughput decreased as shown in figure 13. This is expected behavior, as ArcGIS for Server generally performs better when CPUs are distributed across fewer machines. This is primarily due to ArcGIS for Server being a CPU-bound product. ArcGIS for Server can better utilize idle CPU resources when there are more CPUs per machine.

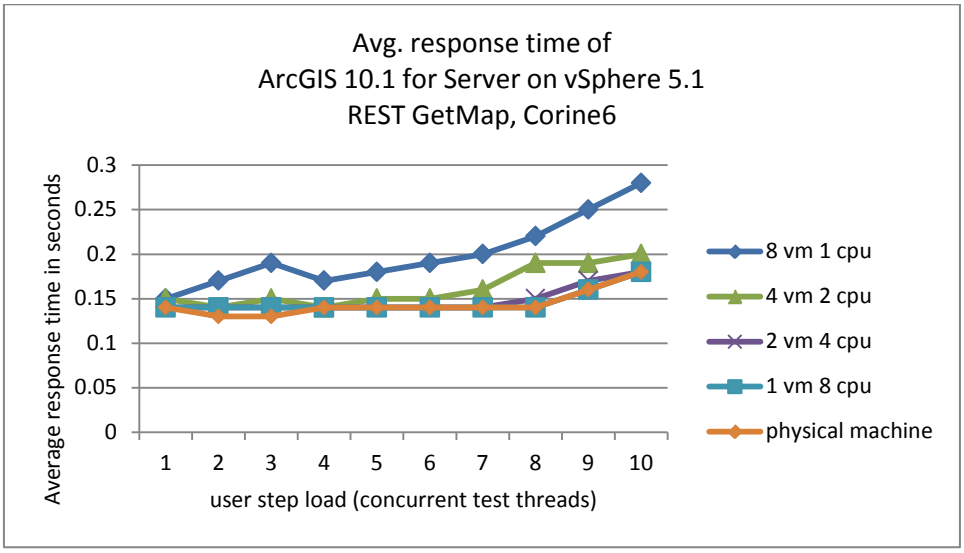
Figure 13. Throughput of ArcGIS 10.1 for Server on vSphere 5.1



Response Time

The response times were all subsecond at maximum throughput for all tests. The response times of each test case are shown in figure 14. Note that a lower response time is better.

Figure 14. Average Response Time of ArcGIS 10.1 for Server on vSphere 5.1



CPU Service Time

The CPU service time is the amount of time that the CPU is spending on processing a client request as shown in table 3.

Table 3. CPU Service Time

Environment	Maximum Throughput	CPU @ Maximum	CPU Service Time
Physical environment	55.9	99.3	0.14
1 virtual machine with 8 cores	55.5	99.5	---

Deployment

To deploy ArcGIS for Server successfully with VMware infrastructure, the organization's business and technical needs, availability requirements, and other operational requirements must be clearly delineated. In general, best practices in physical environments also apply to deployments on VMware infrastructure.

The considerations for deploying this solution in the data center include optimal throughput and a best practices approach. It is critical to follow the best practices guidelines for ArcGIS 10.1 for Server as well as practices applicable to VMware infrastructure.

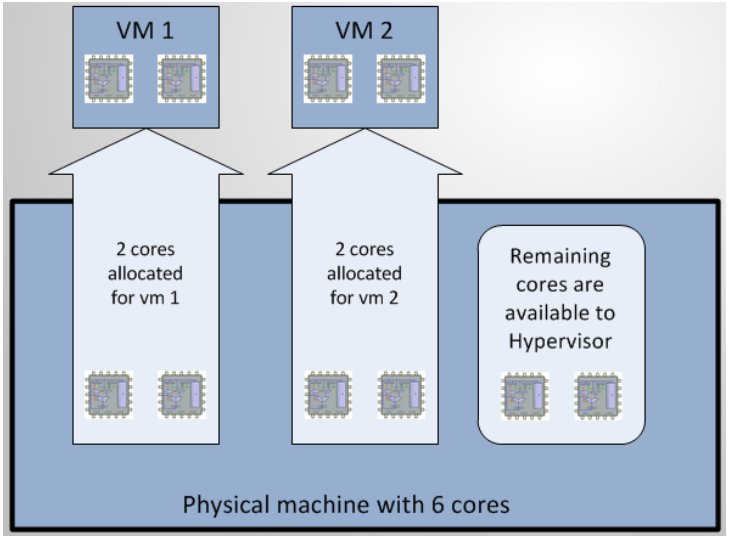
Optimal Throughput

The test results revealed that optimal throughput was attained for the virtual environment when the following criteria were met:

- A single virtual machine with multiple cores was used rather than multiple machines with fewer cores.

- Hypervisor had adequate resources (at least 1 core available on the underlying host machine) as shown in figure 15.

Figure 15. Hypervisor Resources for Optimal Throughput



Note that tests on the physical machine were executed with and without ArcGIS Web Adaptor to validate that this component did not add any overhead. The test results validated this assumption. All results shown in this paper are for tests run with Web Adaptor.

Deployment Best Practices

VMware best practices are available at http://www.vmware.com/support/pubs/. Please review the VMware hardware, storage, and network configuration best practices.

VMware also offers specific documents on VMware infrastructure performance enhancements, networking and storage performance, best practices for VMware VMFS, and resource management with VMware Distributed Resource Scheduler. For more information, see the Resources section below.

Additional specific recommendations for VMware infrastructure deployments include the following:

- Ensure that the host server and storage used to deploy VMware ESXi are listed on the VMware Systems and Storage Hardware Compatibility List (HCL) available at http://www.vmware.com/resources/compatibility/.
- Disconnect unused, unnecessary devices on both the guest and host. These include COM ports, LPT ports, floppy drives, CD-ROM drives, and USB adapters. Disabling devices on the host frees IRQ resources and eliminates IRQ sharing conflicts that can cause performance problems.
- Run the latest version of VMware Tools in the guest operating system of each virtual machine.

- Do not set resource reservations and limits unless required. Set the limit as "unlimited" (the default specified by VMware).
- To establish a network between two virtual machines that reside on the same ESXi host, connect both virtual machines to the same virtual switch. If the virtual machines are connected to different virtual switches, traffic goes through the "wire" and incurs unnecessary CPU and network overhead.
- Storage configuration is critical to any successful ArcGIS 10.1 for Server deployment, especially in virtual environments, to consolidate many different databases and/or file workloads on a single ESXi host.
- Using a SAN device for storage is recommended to best meet I/O requirements for applications and to leverage all VMware infrastructure features and capabilities. Using iSCSI or NFS provides the next best storage performance. If ArcGIS 10.1 for Server is deployed onto an iSCSI array or NFS server, VMware recommends at least a 1 Gbps connection.

Conclusion

Recently, testing was conducted jointly by VMware and Esri to characterize the performance and functionality of ArcGIS 10.1 for Server Enterprise Standard running on the VMware vSphere 5.1 virtualization infrastructure. This paper describes the results of this validation testing including the advantages and technical considerations for configuring this solution.

The results of this testing demonstrate that Esri ArcGIS 10.1 for Server performs successfully running on VMware vSphere infrastructure as compared to a physical environment. The majority of ArcGIS 10.1 for Server multiserver deployments are good candidates for virtualization and can benefit from advantages offered by a virtualized infrastructure, including improved management, availability, and scalability, all reducing the total cost of ownership.

In addition, VMware vSphere infrastructure makes it simpler and less expensive to provide higher levels of availability for ArcGIS 10.1 for Server. VMware vSphere advanced features such as VMotion, DRS, and HA eliminate planned downtime, reduce unplanned downtime, and ensure rapid recovery from component or system outages.

Resources

Customers can find more information about the VMware and Esri ArcGIS products described in this paper using the links listed below.

VMware

Deployment References

- VMware vSphere:
  http://www.vmware.com/products/datacenter-virtualization/vsphere/overview.html
- VMware Support and Downloads Website:
  http://www.vmware.com/support/product-support/vsphere/index.html

- Performance Best Practices for VMware vSphere 5.1:
  http://www.vmware.com/pdf/Perf_Best_Practices_vSphere5.1.pdf
- vSphere High Availability Deployment Best Practices:
  http://www.vmware.com/files/pdf/techpaper/vmw-vsphere-high-availability.pdf
- Compatibility Guides (VMware Certified Compatibility Guides):
  http://www.vmware.com/resources/guides.html?src=WWW_BestMatch_US#utm_source=WWW_BestMatch_US&utm_medium=src&utm_campaign=src-tagged-url
- VMware Compatibility Guide (compatible storage and networking devices):
  http://www.vmware.com/resources/compatibility/search.php

General Information

- VMware Website:
  http://www.vmware.com/
- Featured VMware Documentation Sets:
  http://www.vmware.com/support/pubs/
- VMware Licensing Help Center:
  http://www.vmware.com/support/licensing/
- VMware Product Podcasts:
  http://www.vmware.com/technical-resources/podcasts/
- VMware (Community) Website:
  http://communities.vmware.com/community/vmtn
- Community, VMware Knowledge Base:
  http://communities.vmware.com/community/vmtn/resources/knowledgebase
- VMware Support Insider:
  http://blogs.vmware.com/kbtv/
- VMware TV:
  http://www.youtube.com/user/vmwaretv
- VMworld TV:
  http://www.youtube.com/user/VMworldTV
- VMware KB TV (external):
  http://www.youtube.com/user/VMwareKB

Esri ArcGIS

- Esri ArcGIS Website:
  esri.com
- ArcGIS Resources:
  resources.arcgis.com/en/home/

- Installing ArcGIS for Server (ArcGIS for Server Installation Guide):
  resources.arcgis.com/en/help/install-guides/arcgis-server/10.1/index.html#/Welcome_to_the_ArcGIS_for_Server_install_guide/01nm00000002000000/
  resources.arcgis.com/en/help/install-guides/arcgis-server/10.2/index.html#//01nm0000003p000000

- Inside an ArcGIS for Server Site (for Windows):
  resources.arcgis.com/en/help/main/10.1/index.html#//0154000003p4000000
  resources.arcgis.com/en/help/main/10.2/index.html#/Inside_an_ArcGIS_Server_site/0154000003p4000000/

- About ArcGIS Web Adaptor (for Windows):
  resources.arcgis.com/en/help/main/10.1/index.html#//01540000028p000000
  resources.arcgis.com/en/help/main/10.2/index.html#/About_the_ArcGIS_Web_Adaptor/01540000028p000000/

- About Server Directories:
  resources.arcgis.com/en/help/main/10.1/index.html#//0154000002w5000000
  resources.arcgis.com/en/help/main/10.2/index.html#//0154000002w5000000

- About the Configuration Store:
  resources.arcgis.com/en/help/main/10.1/index.html#//015400000500000000
  resources.arcgis.com/en/help/main/10.2/index.html#//015400000500000000

- Making Your Data Accessible to ArcGIS for Server:
  resources.arcgis.com/en/help/main/10.1/index.html#//01540000039r000000
  resources.arcgis.com/en/help/main/10.2/index.html#//01540000039r000000

- About GIS Server Clusters:
  resources.arcgis.com/en/help/main/10.1/index.html#//015400000418000000
  resources.arcgis.com/en/help/main/10.2/index.html#//015400000418000000

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