



LEVERAGE VBLOCK™ INFRASTRUCTURE PLATFORM FOR ESRI'S ARCGIS SYSTEM

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WHITE PAPER



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Executive Summary

Organizations are pursuing virtualization initiatives to deliver better IT services faster, more reliably, and at a lower cost than with traditional data center models. Improved technology provides increased efficiencies, cost reductions, and faster processes that can enable you to overcome challenges and to take advantage of opportunities.

Understanding the benefits of virtualization, Esri has teamed up with the VCE Company to validate the ArcGIS System on the Vblock™ Infrastructure Platform, a converged infrastructure environment optimized for cloud computing. The Vblock solution enables ArcGIS System administrators to take advantage of the benefits of virtualization and converged infrastructure technology provided by three world-class corporations – Cisco®, EMC®, and VMware®. Through these technologies, administrators can manage their environment using service profile templates and an automation engine specifically designed for the Vblock platform, which greatly simplifies provisioning and configuring ArcGIS instances on blades and servers.

These simplified provisioning options allow administrators to focus on adapting ArcGIS to respond to business demands instead of focusing on infrastructure deployment. After deploying ArcGIS in a virtual environment, administrators can focus more of their time directing fire-power at increasing availability, performance, capabilities, and finding better and more creative solutions to drive the business.

This document provides:

- An introduction to Vblock platform and ArcGIS technology.
- A description of common ArcGIS deployment methods on a Vblock platform.
- An overview of the steps required to provision a new ArcGIS Server instance using an automation engine designed for the Vblock platform.

The Challenge

GIS data is being used for increasingly more purposes from generating maps to facilitating data integration. The increased use of GIS data also drives the increased collection of data. This growth of GIS data and its use has made the limitations of artifact systems evident. Building and maintaining computer clusters to perform computations and adding physical devices to store data is costly, inefficient and potentially limits data sharing.

The Solution

Simplified provisioning enables administrators to rapidly provision new ArcGIS instances on blades and purpose servers. Using the VCE developed solutions described in this paper, administrators can manage their ArcGIS landscapes in a virtualized environment and quickly adjust to meet business demands.

Audience

This paper is intended for ArcGIS architects, basis administrators, or other individuals tasked with evaluating, acquiring, managing, operating, or deploying ArcGIS in a virtualized data center environment.



Terminology

Term	Definition
Converged Infrastructure	An integration of Information Technology (IT) components, such as Storage, Network, Compute, and Virtualization, into a single optimized computing system.
Process Automation	A model to improve performance and provide cost savings by automating redundant tasks to drive value for the business and its customers.
Service Profile Templates	Logical representations of desired physical configurations and infrastructure policies.
Virtual Machine	A virtualized instance of an operating system that a virtualized host and hypervisor manage and abstract the virtual machine from the underlying physical hardware resources.



Technology Overview

Together VCE and Esri offer a robust, best-of-breed solution via technologies that enable enterprises to present GIS offerings to business users on a converged infrastructure.

Vblock™ Infrastructure Platforms

VCE, the Virtual Computing Environment Company formed by Cisco and EMC with investments from VMware and Intel, represents an unprecedented level of collaboration in development, services and partner enablement by established market and technology leaders. VCE accelerates the adoption of converged infrastructure and cloud-based computing models that dramatically reduce the cost of IT while improving time to market for customers.

VCE, through the Vblock platform, delivers the industry's first completely integrated IT offering that combines best-of-breed virtualization, networking, computing, storage, security and management technologies with end-to-end vendor accountability. VCE's prepackaged solutions cover horizontal applications, vertical industry offerings and application development environments, allowing customers to focus on business innovation instead of integrating, validating and managing IT infrastructure. VCE provides the fastest, most efficient and effective path to pervasive virtualization and cloud computing, available to customers through a large and growing network of value added resellers, system integrators and service provider partners.

Vblock platforms provide pre-engineered, production-ready (fully tested) virtualized infrastructure components, including the best-of-breed private cloud offerings from Cisco, EMC and VMware. Vblock platforms are designed and built to satisfy a broad range of specific customer implementation requirements. Vblock platforms scale to deliver the right performance and capacity to match the needs of business applications. The following Vblock platforms are available:

Vblock Platform	Description
Vblock Series 700	Designed for deployments of very large numbers of virtual machines and users. Ideally suited to meet the higher performance and availability requirements of an enterprise's business critical applications.
Vblock Series 300	Designed to address a wide spectrum of virtual machines, users, and applications. Ideally suited to achieve the scale required in both private and public cloud environments.
Vblock 1 and 1U	Designed for medium to high numbers of virtual machines. Ideally suited to a broad range of usage scenarios, including shared services, e-mail, file and print, virtual desktops, and collaboration.
Vblock 0	Designed to support virtual machines in small to medium size enterprises. Ideally suited to test and development deployments, shared services, file and print, and other smaller production environments.

The following table lists components of each Vblock platform:



Table 1:
VBLOCK INFRASTRUCTURE PLATFORM CONFIGURATIONS

	VBLOCK 0	VBLOCK 1U / VBLOCK 1	VBLOCK SERIES 300	VBLOCK SERIES 700
STORAGE	EMC Celerra Unified Storage NS-120 Drive Types <ul style="list-style-type: none"> • EFD • Fibre Channel • SATA 	Vblock 1U- EMC Celerra Unified Storage NS-480 or NS960 Vblock1- EMC CLARiiON CX4 Model 480 Drive Types <ul style="list-style-type: none"> • EFD • Fibre Channel • SATA 	300HX EMC VNX 7500 300GX EMC VNX 5700 300FX EMC VNX 5500 300EX EMC VNX 5300 Drive Types <ul style="list-style-type: none"> • EFD • SAS • NL-SAS 	700MX EMC Symmetrix VMAX Drive Types <ul style="list-style-type: none"> • EFD • Fibre Channel • SATA
COMPUTE	Cisco UCS <ul style="list-style-type: none"> • B200M2 • B250M2 • B230M1 	Cisco UCS <ul style="list-style-type: none"> • B200M2 • B250M2 • B440M1 • B230M1 	Cisco UCS <ul style="list-style-type: none"> • B200M2 • B250M2 • B440M1 • B230M1 	Cisco UCS <ul style="list-style-type: none"> • B200M2 • B250M2 • B440M1 • B230M1
NETWORKING	Cisco Nexus 1000V Cisco Nexus 5000 series switches Cisco MDS 9000 Series SAN Switch	Cisco Nexus 1000V Cisco Nexus 5000 series switches Cisco MDS 9000 Series SAN Switch	Cisco Nexus 1000V Cisco Nexus 5000 series switches Cisco MDS 9000 Series SAN Switch	Cisco Nexus 1000V Cisco MDS 9000 Series SAN Switch
VIRTUALIZATION	VMware vSphere 4 Enterprise Plus Suite			
SECURITY	Individual component security tools and protocols RSA enVision, RSA SecurID® (both optional)			
ORCHESTRATION	Ionix Unified Infrastructure Manager 2.1 Advanced Management POD (AMP) (optional)			
VIRTUALIZATION	Virtualization vSphere ESX 4, 4.1, or ESXi 4.1i, vCenter, Nexus 1000V with per CPU license			
COMPUTE/ NETWORKING MANAGEMENT	Cisco UCS Manager / Cisco Fabric Manager			
STORAGE	EMC Unisphere®	EMC Unisphere®	EMC Unisphere®	EMC Symmetrix Management Console

Notes: This table shows the major components of Vblock platforms. Additional options are available. For specific ordering information or to determine which Vblock is right for your applications, utilization, scale, and topology, please contact your VCE, VMware, Cisco, and/or EMC representative.

For a more in depth overview of Vblock platforms, go to: <http://www.vce.com/pdf/solutions/vce-vblock-infrastructure-technical-overview.pdf>



ArcGIS Introduction

Esri's ArcGIS is a complete system for designing and managing solutions through the application of geographic knowledge. ArcGIS provides the kind of deep analysis, understanding, and high-level decision-making that users and their organizations have come to depend upon for their desktop, mobile, and server GIS solutions. ArcGIS Desktop provides tools for spatial analysis, geographic data management, and high-end cartography. Desktop is used to produce geographic content (maps, models, tools) that can be distributed and optimized for mobile and web solutions. ArcGIS Mobile delivers GIS capabilities and data from centralized servers to a range of mobile devices. Mobile users can collect, edit, and update GIS data in real time and share information with colleagues promptly. ArcGIS Server connects people with the geographic information they need. Organizations use ArcGIS Server to distribute maps and other GIS capabilities provided by Web mapping applications and services to improve data management, planning and analysis, field worker optimization, visualization, and constituent engagement. With ArcGIS Server, you can:

- Publish fast, intuitive Web maps tailored to your audience
- Geographically enable your IT investments
- Centrally manage your geo-data
- Simplify access to large volumes of imagery resources
- Extend GIS to your mobile workforce

ArcGIS System Components

An ArcGIS Server includes the following components:

- Web Application server – The web application server acts as a gateway between the core GIS services and clients. Within an ArcGIS Server deployment, the web tier supports web service handlers, which funnel http requests from clients via REST or SOAP protocols into the underlying GIS Server component. Additionally, ArcGIS Server Manager, the web administration tool for ArcGIS Server, resides in the web tier.
- GIS server – The GIS Server enables multi-user access to GIS resources such as map-services, globe-services, and locator-services. The GIS Server distributes GIS requests across the computing resources available on a single, or multiple servers.

The GIS server itself is composed of two distinct parts: the *Server Object Manager* (SOM) and *Server Object Containers* (SOCs). The SOM, as the server resource manager, performs load balancing, distributing the server load across multiple SOCs. The SOCs run server processes. GIS administrators can configure servers to behave as the SOM (load balancer), SOCs (process hosts), or both. Please see figure 1 below for a load balancing configuration example.

Typically, the GIS Server is configured to have access to:

- Vblock platform Storage Area Network (SAN), especially for the purpose of serving as the store for imagery, read-only vector data and map caches.
- Databases, either running in virtual machines or on bare-metal within the Vblock platform infrastructure, or outside in physical servers.

Along with a typical ArcGIS Server deployment, ArcGIS Desktop machines are generally configured within the Vblock platform infrastructure to facilitate authoring of GIS resources such as maps and geoprocessing tools that will eventually be published to ArcGIS Server as GIS Web Services.

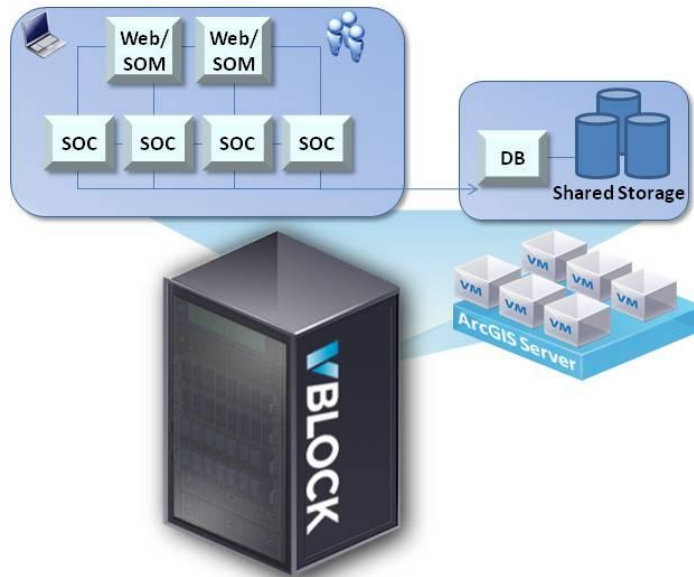


Figure 1 – ArcGIS Server Load Balancing

Vblock Platform Logical Components

The IT staff can manage Vblock platform using standard management tools, such as Unified Infrastructure Manager (UIM). UIM manages the configuration, provisioning, and compliance of a single Vblock platform and pools of aggregated Vblock platforms, simplifying deployment and integration into IT service catalogs and workflow engines. It thus can simplify Vblock platform deployment by abstracting the overall provisioning of the Vblock system while offering granular access to individual components for troubleshooting and fault management. In addition, Vblock platforms have an open management framework that allows organizations to integrate them with their current management tools if they prefer.

In addition, IT can manage the workloads running on the Vblock platform with VMware management solutions: VMware vCenter Server and vCloud Director.



Vblock Platform Automation

Automation on the Vblock platform occurs through element (storage, network, and compute) manager applications. These element managers provide automation and virtualization of individual elements without requiring a specific end-to-end business solution.

However, using APIs for each of the element managers (like “wrappers” around each API), the automation engine can perform a number of end-to-end provisioning steps on the Vblock platform allowing you to aggregate and simplify complex tasks, including:

- Selection of self-service portal choices (service offering, cost/capacity usage)
- Allocation of compute resources (service profiles, policies)
- Allocation of storage resources (devices, capacity)
- Configuration of network resources (VLAN, SAN)
- Configuration of ESX Server and cluster (ESX installation, cluster configuration)
- Allocation of Virtual Machines (VMs) (template cloning, Operating System and ArcGIS Server configuration)

Element managers drive standardization, agility, and operational efficiency, allowing agile business process definitions.

Service Profiles

Service profiles are instances of a template (known as a “personality”) used to specify attributes to configure various aspects of a server’s functionality such as:

- UUID
- vNIC and vHBA
- MAC address
- VLAN
- WWNN and WWPN
- Policies
- Server assignment

After creating a service profile, you associate it with a blade to set that blade’s attributes. In this way, you can deploy multiple blades in your environment with the same configuration.



Service Profile Templates

Service profile templates enable the rapid deployment of multiple service profiles using the same policies, pool attributes, number of vNICs and vHBAs, and other settings from an initial service profile.

Before creating a service profile template, you need to consider how you want to use the template as two categories of service profile templates exist: initial and updating.

You can use either type of template to create a new service profile; however, the type of template that you use sets the conditions for how changes are propagated to the service profiles created from that template as follows:

Template Type	Changes
Initial Template	Not automatically propagated to service profiles created from that template. Any changes you make to the template, you must almost make to any service profile created from that template, since the service profile is not connected to the template.
Updating Template	Automatically propagated to service profiles created from that template as the service profiles remain connected to it.

ArcGIS Configurations on a Vblock Platform

This section shows several typical ArcGIS configurations as deployed on a Vblock platform.

A typical deployment of ArcGIS on a Vblock platform uses the following virtual machine (VM) templates:

VM Template	Description
Web/SOM	Includes both the Web Application Server and the Server Object Manager component.
SOC	Includes the Server Object Container only.
Web/SOM/SOC	Includes all components of ArcGIS Server.

After creating these templates, you instantiate and configure any one of them as needed to support business demands. This section shows the following typical configurations:

- Ad-hoc GIS Analysis
- Highly Available Map Services
- On-Demand GIS Servers



Ad-hoc GIS Analysis

In this configuration, a Web/SOM virtual server front-ends a cluster of multiple SOC's for a very large GIS analysis task such as:

- Building a large map cache to display maps on the web quickly
- Pre-computing derived GIS layers such as slope or aspect from a digital elevation model
- Running spatial data analysis for workforce optimization, etc.

This configuration provides high data throughput to storage and high computing resources.

Generally, you create this configuration temporarily for the duration of the job. Once the job is completed, you may terminate the Web/SOM and SOC VMs and use the output on a separate ArcGIS Server configuration optimized for publication. For example, once a map cache is built, it is sufficient to use a modest ArcGIS Server failover configuration with two small Web/SOM/SOC VMs to publish the map tiles. This configuration and pattern is applicable to data management, planning and analysis, workforce optimization, and constituent engagement pattern of use.

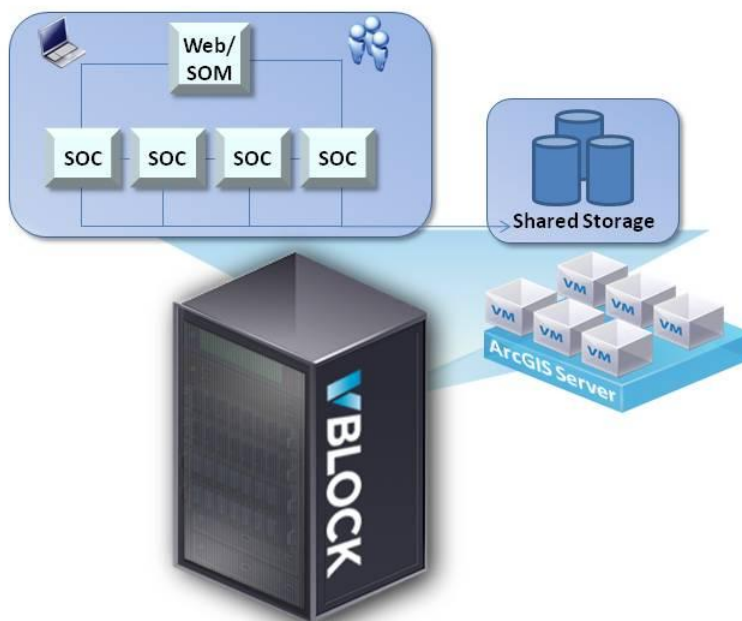


Figure 2 – ArcGIS Ad-hoc GIS Analysis



Highly Available GIS Services

This configuration uses a redundant configuration of ArcGIS Servers fronted by a load balancer. You create this configuration using Vblock platform VM-Templates that include all the components of ArcGIS Server: the Web, the SOM and the SOC. Multiple ArcGIS Server clones point to a common repository of data (shown as a SAN in the following diagram but could also be a database). The ArcGIS Server clones are configured for fail-over using Vblock platform load balancing capabilities, for example to provide active-passive fail-over where a passive ArcGIS Server automatically comes online if the active one fails.

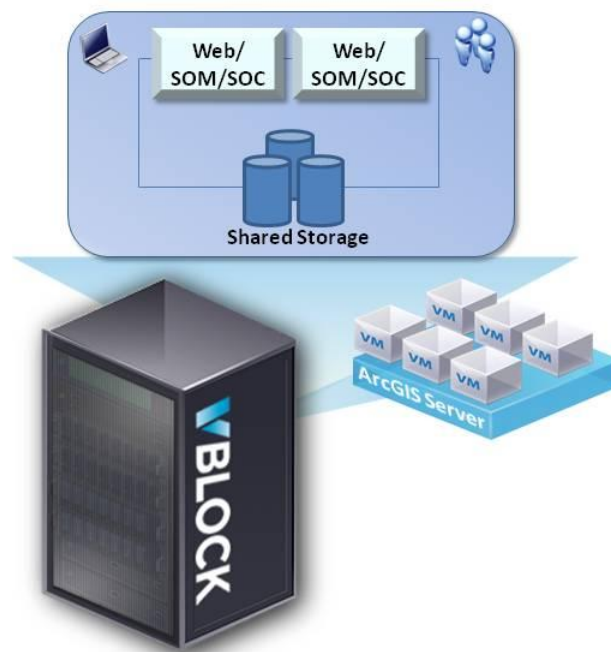


Figure 3 – ArcGIS Highly Available GIS Services



On Demand GIS Servers

This configuration allows you to respond to an unanticipated load on a particular application or web service. Through the use of Vblock platform automation, you can create SOC VM-Templates and then add SOCS to the ArcGIS Server deployment on demand.

The following figure shows four SOCs configured to power an average workload in the GIS Server. It also shows how, using the Vblock platform and ArcGIS Server APIs, you can dynamically allocate two additional virtual servers (performing as SOCs) when required. You can use this configuration to add virtual machines to ArcGIS at scheduled times or as needed depending on the load of the system.

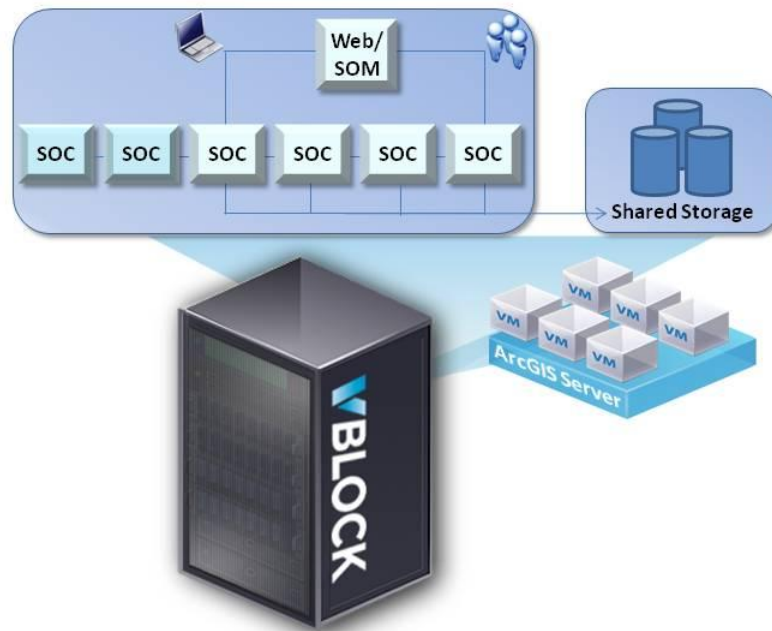


Figure 4 – On Demand GIS Servers



Provisioning a New ArcGIS Environment Using UIM and vCloud Director

Being able to quickly provision a new ArcGIS Server environment, or add resources or nodes to an existing array without significant manual work is an important part of maintaining applications. On the Vblock platform, you manage that process using the following tools:

Tool	Description
VMware vCloud Director	End user VM/vApp provisioning tool that allows application owners/users to deploy new resources.
Unified Infrastructure Manager	Simplifies the management and operations across multiple Vblock platforms, supporting private, public and hybrid cloud environments. Enables "single click" end-to-end Vblock resource provisioning that is 80% more efficient and 5 times faster than other methods.

These tools can help infrastructure administrators provide QA over ArcGIS Server deployments and streamline the hardware stack that supports those deployments. They are also essential to the rapid deployment and teardown of ArcGIS Server environments, including allowing multiple environments to co-exist in an isolated fashion. For detailed information, please review the "VMWARE VCLOUD ON VBLOCK SOLUTIONS BRIEF" available on the vce.com website.

The following steps illustrate how you can achieve simplified provisioning using a Vblock platform.

Creating and Deploying an ArcGIS Server vApp

To rapidly create a test ArcGIS Server system, perform the following steps:

1. Log into the vCloud Director portal.
2. Click on the "My Cloud" tab and select the "Esri ArcGIS Server" vApp from the appropriate catalog.
3. Select the Organizational vCD in which to run the vApp, as well as the external (public) network to which to connect.
4. Initiate a full copy of the vApp from the catalog to the local organization, and click the "Start" button to power on the vApp.

vApp includes a completely fenced internal vApp network by default; thus, vApp isolates every deployed instance from the others, even if those instances share the same IP addressing scheme.



Adding Application Resources to an Existing ArcGIS Server vApp

To add more application resources (or nodes) to an existing environment, perform the following steps:

1. Log into the vCloud Director portal.
2. Click on the “My Cloud” tab and select the required VM type from the appropriate catalog. Possibilities include:
 - a. Additional front-end web servers
 - b. Additional SOC/SOM servers
 - c. VMs to provide additional ArcGIS Server functionality (for example, mobile)
3. Select the Organizational vCD in which to run the vApp, as well as the external (public) network to which to connect.
4. Initiate a full copy of the vApp from the catalog to the local organization.
5. Once the vApp with the single VM you chose has been deployed, right-click the VM and select “Move to”.
6. Select the existing vApp to which to add resources to configure the VM name, Computer Name, and Networks, then click “Finish”.
7. Add the new server into the application as appropriate.

In this way, you can add resources in a very granular fashion while taking advantage of pre-built and pre-configured server templates, thus improving deployment times and quality control.

Adding Hardware Resources to an Existing ArcGIS Server vApp

To add more host resources into a VMware vCloud Director environment running on a Vblock infrastructure platform using UIM and VMware vCenter, perform the following steps:

1. Add new blades into the Vblock platform and assign them to the appropriate server pool.
2. Configure those blades to belong to the Service Offering in which the Esri ArcGIS Server resides.
3. After UIM provisioning, verify that the new ESX server(s) have been added to vCenter.

VMware vCloud Director automatically recognizes and prepares the new host. No additional configuration is required. VMware vCloud Director adds the resources of the host to the server pool that can be assigned to Provider vCDs.

In this way, you can allocate additional hardware resources to the ArcGIS Server environments in a non-disruptive manner.



Conclusion

The Vblock solution enables ArcGIS administrators to manage their resources in a converged infrastructure environment and take advantage of the benefits of virtualization. This paper provides an administrator an understanding of the components that make up a Vblock platform and Esri ArcGIS, as well as the concepts of service profiles and service profile templates prior to provisioning a new server or blade in a Vblock platform environment.

Although this paper discusses provisioning new ArcGIS instances on a server, any component that uses Vblock platform follows the same model of using service profile templates and automation engines to rapidly provision new application instances on a Vblock platform.

For this use case, using service profile templates and the automation engine designed for the Vblock platform dramatically simplifies the provisioning process for new ArcGIS instances on blades and servers. Where the time it takes to provision a new ArcGIS instance is normally measured in hours, this is now reduced to minutes; thus eliminating the need to repeat steps. These templates allow administrators to quickly respond to changing business needs and requirements, while also maintaining operational efficiency and agility.

Combining ArcGIS Server with Vblock platform provides Esri ArcGIS customers with the following benefits:

- The best of the breed compute, networking, storage, and virtualization
- A fully virtualized environment with the flexibility to move resources from one VM to another VM
- Reduced complexity; preconfigured and centralized IT resources leads to standardized IT services
- Predictable performance and operational characteristics
- Ability to scale-up and down on the demand to meet peak and valley requirements
- Load sharing and balancing of resources among multiple users for higher efficiency and utilization
- Improved GIS service and operations

Further Reading

Vblock Infrastructure Platforms Tech Overview - <http://vce.com/pdf/solutions/vce-vblock-infrastructure-technical-overview.pdf>

Driving Business Value with Vblock Platform - <http://vce.com/pdf/solutions/vce-vblock-business-value-whitepaper.pdf>

Vblock Solution for Trusted Multi-Tenancy - <http://vce.com/pdf/solutions/vce-trusted-multi-tenancy-whitepaper.pdf>

Esri ArcGIS - <http://www.Esri.com/software/arcgis/index.html>

ArcGIS Server Functionality Matrix (white paper) - <http://www.Esri.com/library/brochures/pdfs/arcgis-server-functionality-matrix.pdf>

GIS in the Cloud: The Esri Example. By David Chappell - <http://www.Esri.com/library/whitepapers/pdfs/gis-in-the-cloud-chappell.pdf>

ABOUT VCE

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ABOUT ESRI

Since 1969, Esri has been helping organizations map and model our world. Esri's GIS software tools and methodologies enable these organizations to effectively analyze and manage their geographic information and make better decisions. They are supported by our experienced and knowledgeable staff and extensive network of business partners and international distributors. A full-service GIS company, Esri supports the implementation of GIS technology on desktops, servers, online services, and mobile devices. These GIS solutions are flexible, customizable, and easy to use.

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