EMC HYBRID CLOUD
With VMware Infrastructure and VCE Vblock Systems

EMC Solutions

Abstract

This Solution Guide supplements the *EMC Hybrid Cloud Solution Guide*. This guide focuses on VCE Vblock System specifications for an EMC® Hybrid Cloud solution that includes the VMware vCloud Suite, a VCE Vblock System, and the EMC hardware, software, and services portfolio.

May 2014

EMC Hybrid Cloud
With VMware vCloud Suite and VCE Vblock Systems
Solution Guide Supplement

Part Number H13022

EMC^2

Contents

Chapter 1   Executive Summary

This chapter presents the following topics:

EMC Hybrid Cloud   5
with VMware vCloud Suite and VCE Vblock Systems
Solution Guide—Supplement

Document purpose

This document enables you to plan and design an EMC® Hybrid Cloud solution on VCE Vblock Systems. This solution enables you to quickly deploy an on-premises hybrid cloud that delivers infrastructure as a service (IaaS).

This supplement complements the *EMC Hybrid Cloud Solution Guide* to provide the specific feature differences when deploying as part of a VCE Vblock converged infrastructure solution. Use this supplement in conjunction with the Solution Guide to deploy an EMC Hybrid Cloud solution with VCE Vblock Systems.

Audience

This document is intended for executives, managers, architects, cloud administrators, and technical administrators of IT environments who want to implement a hybrid cloud IaaS platform. You, the reader, should be familiar with VMware vCloud Suite, EMC storage technologies, and the VCE Vblock converged infrastructure.

Solution purpose

VCE Vblock Systems provides a robust foundation for the EMC Hybrid Cloud solution and enable EMC customers to build enterprise-class, scalable, multitenant infrastructures that provide the following:

- Factory integration and validation accelerate deployment, ensure interoperability, and deliver predictable performance

- Complete management of the infrastructure service lifecycle; VCE not only ensures that Vblock components are interoperable from the start, but also validates Vblock patches and updates before you install them for low risk, low total cost of ownership (TCO), and maximum uptime

- On-demand access to and control of network bandwidth, servers, storage, and security

- Provisioning, monitoring, and management of the infrastructure services by the line-of-business end user, without IT administrator involvement

- Maximum asset utilization

- Comprehensive infrastructure support means that you have a single point of accountability for your entire infrastructure and data protection solution; VCE Support eliminates the need to manage multiple vendors to diagnose and resolve issues, and reduces the time to problem resolution

6   EMC Hybrid Cloud
with VMware vCloud Suite and VCE Vblock Systems
Solution Guide—Supplement

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This EMC Hybrid Cloud solution provides a reference architecture and best practice guidance that is necessary to integrate all the key components and functionality of a hybrid cloud. This guide focuses on the implementation of vCloud Suite, EMC ViPR, and the core VCE Vblock System configuration.

Business challenge

All organizations are trying to achieve the following goals at all levels of their businesses:

- Lower operational costs

- Increase revenue

- Reduce risk

While many organizations have successfully introduced virtualization as a core technology within their datacenter, the benefits of virtualization have largely been restricted to the IT infrastructure owners. End users and business units within these organizations have not experienced many of the benefits of virtualization, such as increased agility, mobility, and control.

Transforming a traditional IT model to an IaaS model involves overcoming the following challenges of legacy infrastructure and processes:

- Inefficiency and inflexibility

- Slow, reactive responses to customer requests

- Inadequate visibility into the cost of the requested infrastructure

- Limited choice of availability and protection services

The difficulty in overcoming these challenges opens business opportunities to public cloud providers. Those who have built technology and business models that specifically cater to the requirements of end-user agility and control can meet these challenges.

Many organizations are under pressure to provide these same service levels within the secure and compliant confines of the on-premises datacenter. As a result, IT departments need to create cost-effective alternatives to public cloud services—alternatives that do not compromise enterprise features, such as data protection, disaster recovery, and guaranteed service levels.

Technology solution

This EMC Hybrid Cloud solution integrates the best of EMC and VMware products and services. It empowers IT organizations to accelerate implementation and adoption of a hybrid cloud while still enabling customer choice for the compute and networking infrastructure within the datacenter. The solution caters both to customers who want to extend their existing infrastructure and to those who want to build out new infrastructures dedicated to a hybrid cloud.

This solution takes advantage of the strong integrations between EMC technologies and the VMware vCloud Suite that are developed by EMC and VMware product and services teams. This includes using EMC scalable storage arrays and integrated EMC and VMware monitoring and data protection suites to ensure that this hybrid cloud solution becomes the foundation for enabling IaaS within the customer environment.

Because the EMC Hybrid Cloud solution is built on the vCloud Suite, it seamlessly integrates into the VCE Vblock infrastructure running vSphere ESXi.

This solution includes the following key components:

- VCE Vblock Systems with EMC VNX® and EMC Symmetrix® VMAX® storage systems
- VCE Vblock Data Protection with EMC Avamar® and EMC Data Domain® powered backup and recovery solutions
- EMC ViPR™ software-defined storage
- VMware vSphere virtualization platform
- VMware vCloud Suite cloud management and infrastructure
- EMC and VMware integration solutions

Note that some of the EMC and VMware components used in this solution are not included in the VCE Vblock System and must be acquired and installed separately. For more details about the key components, refer to Key components on page 24.

8   EMC Hybrid Cloud
with VMware vCloud Suite and VCE Vblock Systems
Solution Guide—Supplement

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Terminology

Table 1 lists the terminology used in the guide.

Table 1.   Terminology used in this guide

Term	Definition
API	application programming interface
Blueprint	A blueprint is a specification for a virtual, cloud, or physical machine and is published as a catalog item in the common service catalog
Business group	Users that often correspond to a line of business, department, or other organizational unit, that can be associated with catalog services and infrastructure resources
Fabric group	A collection of virtualization compute resources and cloud endpoints and is managed by one or more fabric administrators
PKI	public key infrastructure
VXLAN	virtual extensible LAN

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Chapter 2 Hybrid Cloud Overview

This chapter presents the following topics:

Overview

This chapter identifies and briefly describes the following major features and functionality required to support this Hybrid Cloud solution, as shown in Figure 1:

- Self-service and automation

- Multitenancy and secure separation

- Security and compliance

- Availability and data protection

- Monitoring and service assurance

- Metering

Figure 1.   EMC Hybrid Cloud overview

Self-service and automation

VMware vCloud Automation Center (vCAC), integrated with EMC ViPR, vSphere, and either VMware NSX (next generation of network virtualization) or VMware vCNS Edge, provides the compute, storage, network, and security virtualization platforms for the software-defined datacenter.

These platforms enable you to rapidly deploy and provision business-relevant cloud services across a private cloud and physical infrastructure. Acting as a service governor, vCAC provides a cross-cloud storefront for infrastructure, storage, and platform as a service deployments. This empowers organizations to enforce business and IT policies throughout the service lifecycle, helping them to transform virtualized environments into software-defined cloud datacenters.

vCAC enables users to request and manage their compute resources within established operational policies, while cutting IT service delivery times from days or weeks to minutes, through the following:

- **Cross-cloud storefront**—Acts as a service governor that provisions infrastructure and cloud workloads based on business and IT policies

- **User-aware self-service portal**—Delivers a user-appropriate catalog of IT services, as shown in Figure 2

- **Resource reservations**—Enable resources to be allocated for use by a specific group and ensure resources are not inadvertently consumed by other groups

- **Service levels**—Define the amount and type of storage, network, and backup services that cloud systems can receive either during the initial provisioning or as part of any configuration changes

- **Build specifications**—Contain the automation policies that specify the process for building or reconfiguring compute resources
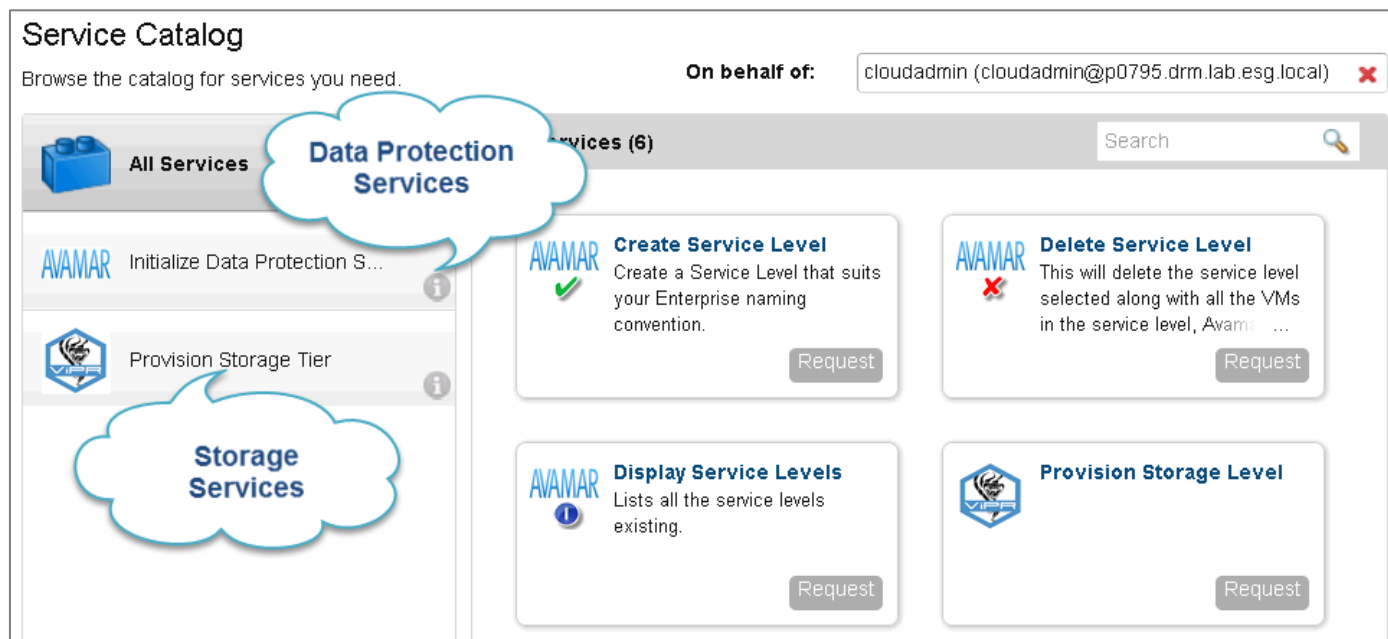
Figure 2. Self-service provisioning with the vCAC Service Catalog

vCAC provides the ability to take a shared infrastructure and divide it into logical units and reservations that can be handed over to different business units. vCAC achieves this with virtual machine blueprints, leveraging ViPR storage services and either VMware NSX or VMware vCNS network services. Cloud administrators and users can choose from a self-service catalog, as shown in Figure 2. This catalog of custom defined blueprints contains specific resources appropriate to different roles, applications, or business units.

Blueprints can be a single machine or multiple machines, covering both bare metal server deployments and virtual machine deployments. Multitier enterprise applications that require multiple components (application, database, and web) and service levels can be deployed easily from predefined blueprints.

Multitenancy and secure separation

vCAC provides secure multitenancy by using existing authentication and business groupings. The vCAC user portal exposes only the appropriate views, functions, and operations to end users in line with their role within the business.

Virtualized compute resources within the hybrid cloud are objects inherited from the vSphere endpoint, which most commonly represent vSphere ESXi hosts, host clusters, and resource pools. Compute resources are configured at the infrastructure layer on the Vblock and vSphere levels to ensure physical and logical separation of resources between business units, which removes possible resource contention across critical applications.

Compute resources are also organized into vCAC fabric groups from which virtual reservations are made for the various departments and organizational units. Various business units can deploy their systems from their respective fabric and business groups, as specified by their blueprints.

Secure multitenancy at the virtual network level is achieved by enforcing Layer 2 network isolation for any provisioned networks, because VMware virtual networking does not suffer from the same vulnerabilities as those found in the physical network in Layers 2 and 3.

Security and compliance

This solution enables enterprise customers to further enhance a hardened security baseline across the hardware and software stacks supporting their private cloud infrastructure, as shown in Figure 3. It addresses the challenges of securing authentication and configuration management to aid compliance with industry and regulatory standards through:

- Securing the infrastructure by integrating with a public key infrastructure (PKI) to provide authenticity, nonrepudiation, and encryption

- Converging the various authentication sources into a single directory to enable a centralized point of administration and policy enforcement

- Using configuration management tools to audit the infrastructure and show compliance
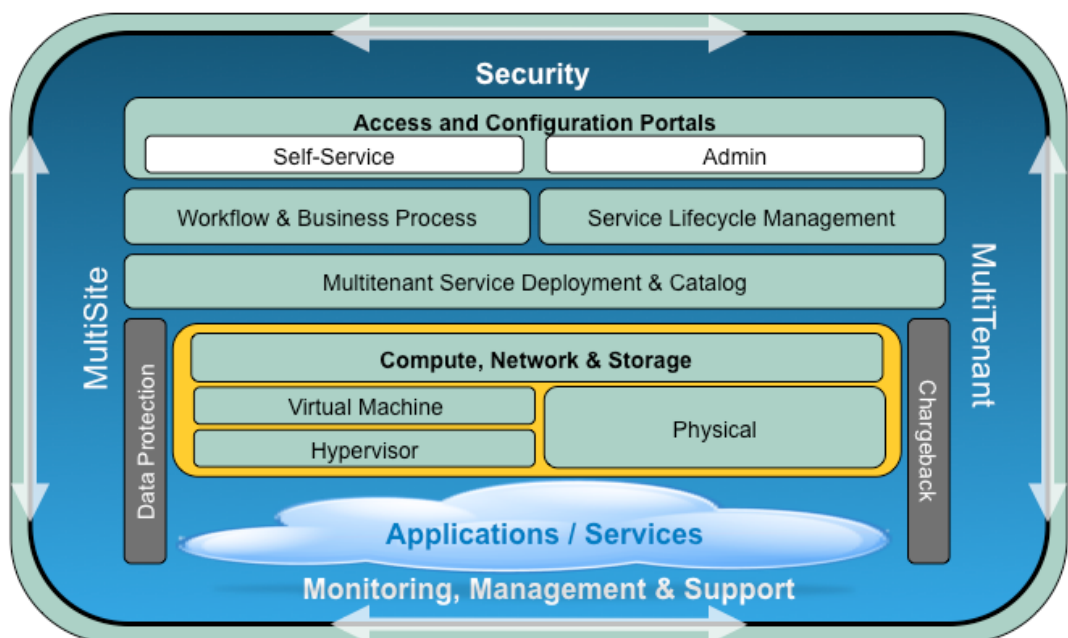

Figure 3.   Logical view of the hybrid cloud solution stack

This solution helps to reduce the concerns around the complexities of the underlying infrastructure by demonstrating how an as-a-service solution stack

can be tightly integrated with PKI and a common authentication directory to provide centralized administration and tighter control over security.

During testing of the solution, we[1] verified:

- Integrating with a PKI implementation that enables encryption of management activities

- Building and testing of a fully functional solution where all components use trusted certificates for authentication

- Integrating with a centralized point of authentication and authorization for common system components

Availability and data protection

VCE Vblock provides end-to-end high availability (HA) at the hardware level. Vblock is a fully validated, production-ready, virtualized infrastructure built on offerings from EMC, VMware, and Cisco. The Vblock System inherits all features designed for HA from the components of each Vblock.

Built for availability and scalability, EMC Symmetrix VMAX uses specialized engines that provide full redundancy to ensure that access to critical information is never in doubt and that service levels are never compromised. Similarly, the EMC VNX unified storage family delivers innovation and enterprise capabilities, providing customers with a choice of file, block, and object in a unified, scalable, easy-to-use system with five-9s (99.999 percent) availability.

EMC PowerPath®/VE is an integral part of the Vblock package, enabling even higher levels of availability and performance by managing paths through the SAN. PowerPath/VE optimizes the distribution of I/O across available paths, proactively managing the failover and restoration of paths for failures.

The EMC Avamar® backup deduplication software and system provides scalable backup and restore capabilities with integrated data deduplication, reducing total disk storage by up to 50 times, and enabling cost-effective long-term retention on Avamar datastore servers.

Using the vCAC application programming interface (API) and extensibility toolkits, this solution implements custom functionality, with common interfaces based on Avamar, to develop and offer backup and restore services directly to cloud users.

This solution offers data protection of cloud resources, using the cloud infrastructure to automatically back up data to a shared, rather than

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[1] In this document, "we" refers to the EMC Solutions engineering team that validated this solution.

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dedicated, backup infrastructure. Cloud administrators can offer backup as a service (BaaS) to end users who want a flexible, on-demand, and automated backup infrastructure without having to purchase, configure, or maintain it themselves.

By integrating Avamar with vCAC, this solution provides customized access to the backup, restore, configuration, and reporting aspects of Avamar without requiring direct access to the Avamar management console GUI.

The data protection in this EMC Hybrid Cloud solution provides automated image-level backup services for applications and file systems, within a single or multi-organization hybrid cloud environment, as shown in Figure 4.
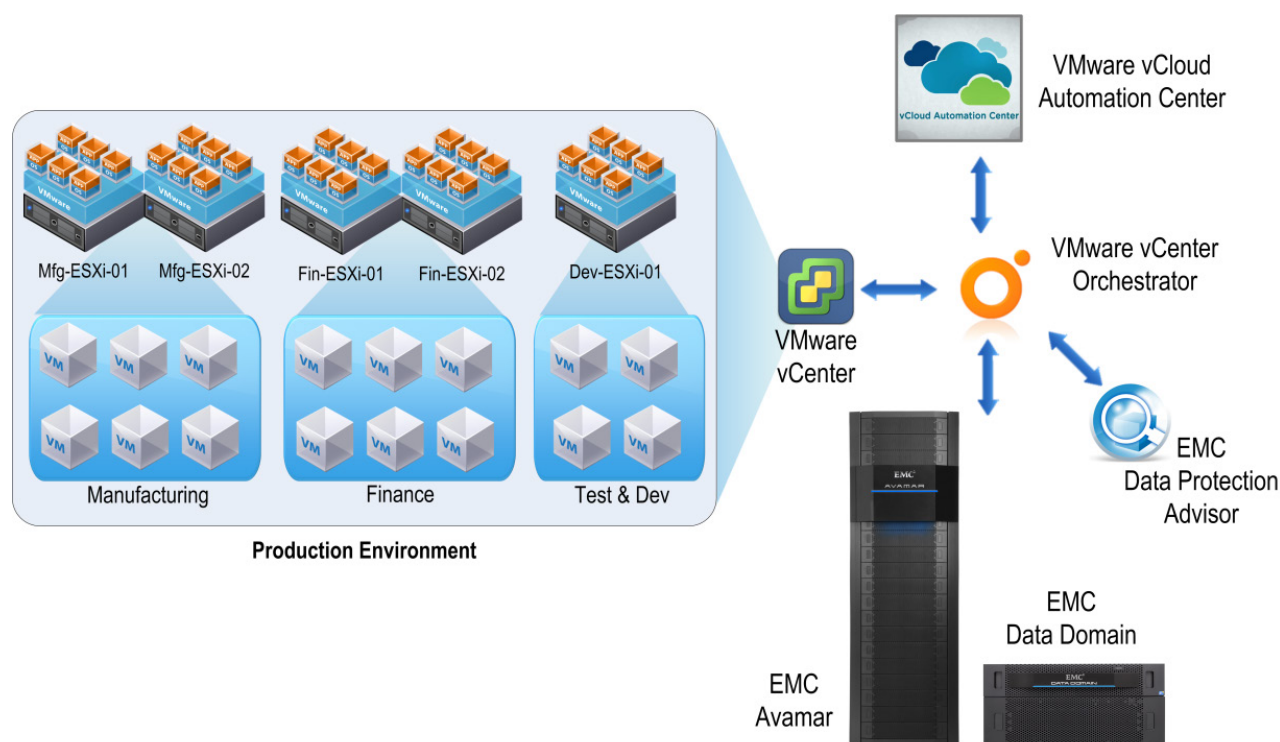
Figure 4.   Production environment

Monitoring and service assurance

VMware vCenter Operations Manager (vC Ops) provides an integrated approach to performance, capacity, and configuration management. This solution uses analytics to provide the intelligence and visibility required to proactively ensure service levels in virtual and cloud environments.

VMware vCenter Log Insight enables users to perform advanced analytics on log data aggregated across physical, virtualized, and cloud infrastructures, leading to system-wide improvements in IT metrics. Correlating performance

and capacity events with system log events greatly enhances the ability to track down the root cause of problems in the virtual infrastructure.

vCenter Log Insight is integrated with vC Ops to enable users to open and correlate events in context. vC Ops provides prebuilt and configurable dashboards for real-time performance, capacity, and configuration management.

Figure 5 depicts the centralized operations monitoring and log management in this Hybrid Cloud solution.

Figure 5.   Centralized operations monitoring and log management of the hybrid cloud environment

Performance data is abstracted to health, risk, and efficiency measures that enable IT to efficiently identify evolving performance problems. Capacity analytics identify overprovisioned resources so that resources can be right-sized for the most efficient use. "What-if" scenarios eliminate the need for spreadsheets, scripts, and rules.

Integrating vC Ops with EMC ViPR Analytics and EMC Storage Analytics (ESA) enables full end-to-end visibility of the entire infrastructure from virtual machine to back-end LUN and every point in between. This integration enables IT administrators to quickly observe the health of their software-defined storage environment using a single view, as shown in Figure 6.
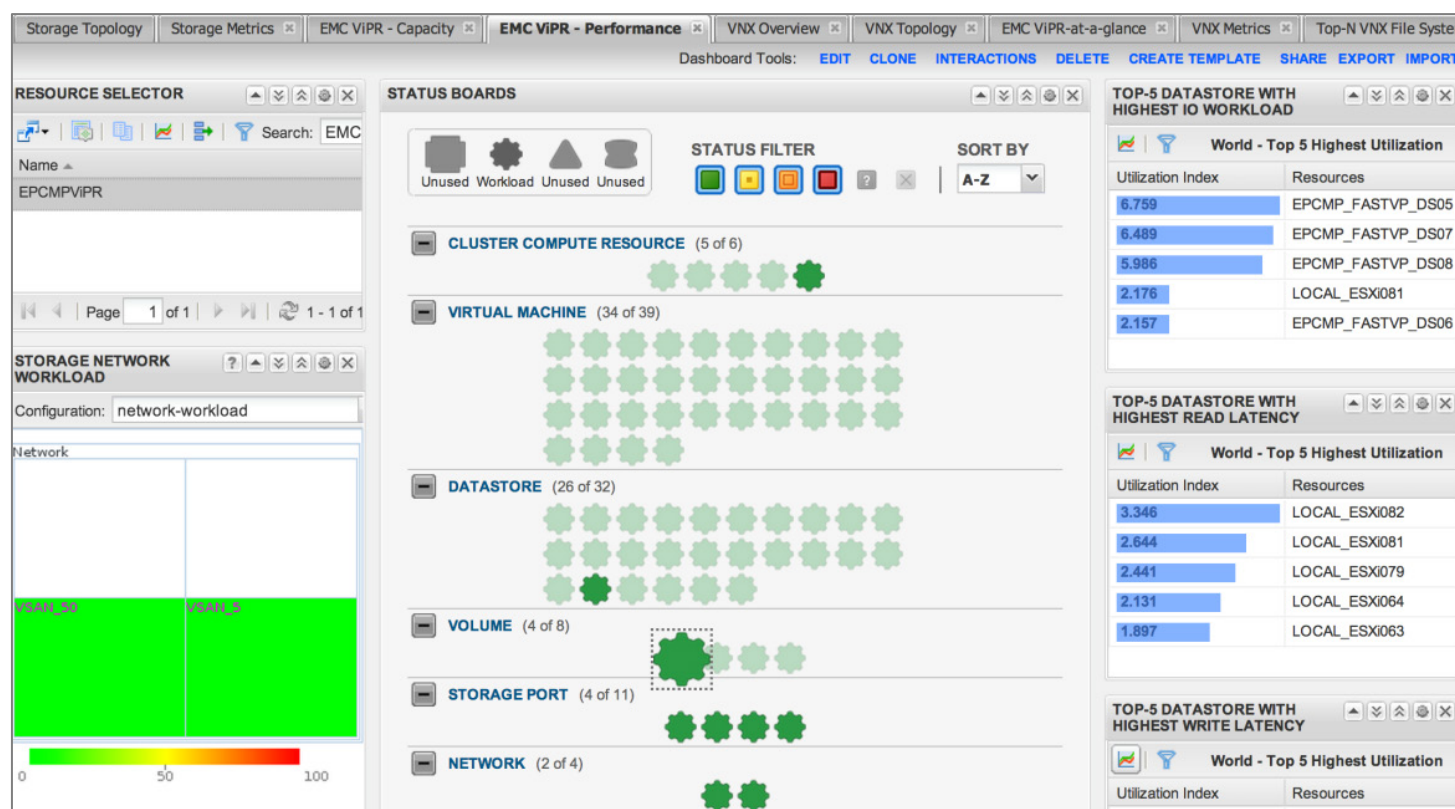
Figure 6.   EMC ViPR analytics with VMware vC Ops

vC Ops displays inventory, performance, and capacity metrics from EMC software-defined storage, such as the following:

- EMC ViPR inventory, metering, and event data
- Preconfigured dashboards for troubleshooting issues in EMC ViPR and individual storage arrays
- Collections of volume, storage port, storage system, and virtual pool data for computing key resource status scores used in EMC ViPR
- Connecting to and collecting data from block and file systems
- Converting the data into a format that vC Ops can process

- Improving the health scores of EMC ViPR resources by utilizing performance data from VNX/VMAX adapters

vC Ops presents the aggregated data through alerts and dashboards, and in predefined reports that end users can easily interpret. The EMC ViPR Analytics and ESA packs are presented through the vC Ops custom interface.

Metering

This Hybrid Cloud solution uses the VMware IT Business Management (ITBM) Suite to provide cloud administrators with metering and cost information across all business groups in the enterprise. ITBM provides data on the IT costs of cloud, storage, and networking resources according to business organizational structures and needs.

ITBM Standard Edition is integrated into the vCAC portal for the cloud administrator and presents a default dashboard overview of the private cloud infrastructure, as shown in Figure 7.

Figure 7.   ITBM Suite overview dashboard for hybrid cloud

ITBM Standard Edition uses its own reference database, which is preloaded with industry-standard data and vendor-specific data to generate the base price for vCPU, RAM, and storage values. These prices, which default to cost of CPU, RAM, and storage, are automatically consumed by vCAC, where they can be changed as appropriate by the cloud administrator. This eliminates the

need to manually configure cost profiles in vCAC and assign them to compute resources.

ITBM is also integrated with VMware vCenter and can import existing resource hierarchies, folder structures, and vCenter tags to associate private cloud resource usage with business units, departments, and projects.

Summary

This solution enables enterprise customers to build an enterprise-class, scalable, multitenant platform for complete management of their compute service lifecycle. This solution provides on-demand access and control of compute resources and security while enabling enterprise customers to maximize asset use. Specifically, this solution integrates all the key functionality that enterprise customers demand and provides a framework and foundation for adding other services.

This solution supports a VMware vCloud Suite stack with EMC storage and data protection services, providing enterprise customers with the flexibility to deliver cloud-based services with the functionality to which they are accustomed.

Chapter 3 Technology Overview

This chapter presents the following topics:

Overview

This solution integrates the key components of a hybrid cloud, as shown in Figure 8, to provide the following:

- Self-service portal for end-user and administrative provisioning
- Service catalog of available compute services
- Rapid, precise, automated service provisioning
- Multitenant, capable of monitoring, reporting, and billing
- IaaS and storage-as-a-service (STaaS) framework on which enterprise customers can build additional as-a-service offerings
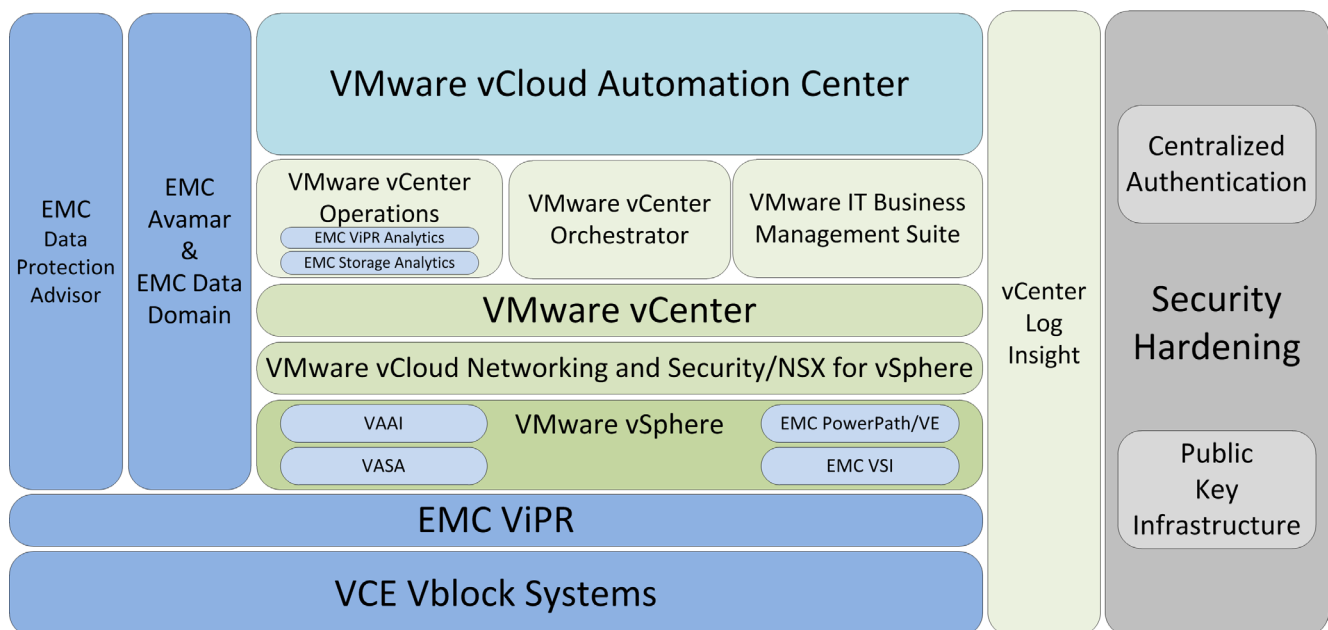
Figure 8.   Key components of a hybrid cloud

Key components

The following components are used in this hybrid cloud solution.

VCE Vblock Systems

Vblock Systems combine compute, network, storage, virtualization, and management technologies into pre-packaged units of infrastructure. Vblock System 720 and Vblock System 340 are enterprise-class and service-provider-class systems designed to help organizations benefit from virtualization and cloud computing.

Compute

The Cisco Unified Computing System (UCS) is based on a standard set of components, familiar to most IT staff. Cisco UCS Manager manages the entire

UCS system by communicating with firmware embedded in every device in the system. Each UCS 5108 server chassis supports up to eight UCS B-series blades. B-series blades provide up to 24 Intel Xeon cores. Vblock System 720 supports up to 48 chassis, for a total of 384 server blades with up to 9,216 cores. Vblock System 340 supports up to 16 chassis, for a total of 128 server blades with up to 3,072 cores.

Network

Cisco UCS Fabric Interconnects are a core part of Cisco UCS and provide both network connectivity and management capabilities to all attached blades and chassis. The Cisco UCS Fabric Interconnects offer line-rate, low-latency, lossless 10 Gigabit Ethernet (GbE), Fibre Channel (FC), and Fibre Channel over Ethernet (FCoE) functions. These interconnects provide the management and communication base for the Cisco UCS B-Series blades and UCS 5100 Series blade server chassis.

Cisco Nexus offers an end-to-end solution for aggregation, and end-of-row and top-of-rack server connectivity in a single platform. The switch series, using cut-through architecture, supports line-rate 10 GbE on all ports while maintaining consistently low latency, irrespective of the enabled packet size and services.

Cisco MDS 9500 Series Multilayer Director layers a broad set of intelligent features onto a high-performance, open-protocol switch fabric. By addressing the stringent requirements of large data-center storage environments, Multilayer Director provides HA, security, scalability, ease of management, and transparent integration of new technologies.

Storage

EMC VNX and EMC Symmetrix VMAX storage systems are powerful, trusted, and smart storage array platforms that provide the highest level of performance, availability, and intelligence in the hybrid cloud. VNX and VMAX systems offer advanced storage tiering features and efficiencies to deliver multiple storage service levels to organizations, accelerating, and simplifying their as-a-service offerings in the private cloud environment.

Optimized for virtual environments and applications, EMC storage systems provide simplicity and efficiency while providing storage replication for business continuity and disaster recovery solutions.

Datacenter virtualization and cloud management

VMware vCloud Automation Center

vCloud Automation Center (vCAC) enables customized, self-service provisioning and lifecycle management of cloud services that comply with established business policies. It provides a secure portal where authorized administrators, developers, and business users can request new IT services

and manage existing computer resources from predefined user-specific menus.

VMware vSphere and VMware vCenter Server

VMware vSphere is a virtualization platform for building cloud infrastructures. vSphere enables you to run your business-critical applications confidently to meet your most demanding service level agreements (SLAs) at the lowest TCO. vSphere combines this virtualization platform with the award-winning management capabilities of VMware vCenter Server. This solution enables you to get operational insight into the virtual environment for improved availability, performance, and capacity utilization.

VMware vCenter Orchestrator

VMware vCenter Orchestrator (vCO) is an IT process automation engine that helps automate the cloud and integrates the vCloud Suite with the rest of your management systems. vCO saves time, removes manual errors, reduces operating expenses, and simplifies IT management. vCO enables administrators and architects to develop complex automation tasks within the workflow designer, and then quickly access and launch workflows either directly within the vSphere Client or using various triggering mechanisms.

VMware vCloud Networking and Security

VMware vCloud Networking and Security (vCNS) is the leading software-defined networking and security solution that enhances operational efficiency, unlocks agility, and enables extensibility to rapidly respond to business needs. It provides a broad range of services in a single solution, including virtual firewall, virtual private network (VPN), load balancing, and virtual extensible LAN (VXLAN) networks.

Premium deployment option: VMware NSX for vSphere

VMware NSX for vSphere is an alternative deployment option to vCNS. NSX is the next generation of software-defined network virtualization and offers additional functionality and improved performance over vCNS and traditional network and security devices. This additional functionality includes distributed logical routing, distributed firewalling, logical load balancing, and support for routing protocols like BGP, IS-IS and OSPF. Where workloads on different subnets share the same host, the distributed logical router optimizes traffic flows by routing locally. This enables substantial performance improvements in throughput, with distributed logical routing and firewalling, with line-rate performance distributed across many hosts, instead of being limited to a single virtual machine or physical host.

NSX for vSphere also introduces the Service Composer, which integrates with third-party security services. These services can identify virtual machines on the network that are infected with malware, or with known vulnerabilities, and place them into a quarantine security group that restricts the virtual machines until the issue is resolved.

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VMware vCenter Operations Manager

VMware vCenter Operations Manager (vC Ops) is the key component of the vCenter Operations Management Suite. It provides a simplified approach to operations management of vSphere, and physical and cloud infrastructures. Using patented, self-learning analytics and an open, extensible platform, vC Ops provides you with operations dashboards that enable you to gain deep insights and visibility into the health, risk, and efficiency of your infrastructure, performance management, and capacity optimization capabilities.

VMware vCenter Log Insight

VMware vCenter Log Insight delivers automated log management through log aggregation, analytics, and search. With an integrated cloud operations management approach, it provides the operational intelligence and enterprise-wide visibility needed to proactively enable service levels and operational efficiency in dynamic hybrid-cloud environments.

VMware IT Business Management Suite

The VMware IT Business Management (ITBM) Suite provides transparency and control over the cost and quality of IT services. By providing a business context to the services that IT offers, ITBM helps IT organizations shift from a technology orientation to a service broker orientation, delivering a portfolio of IT services that align with the needs of line of business stakeholders.

Software-defined storage

EMC ViPR storage management

EMC ViPR is a lightweight, software-only solution that transforms existing storage into a simple, extensible, and open platform. ViPR extends current storage investments to meet new cloud-scale workloads, and enables simple data and application migration from public to private clouds and back in the control of IT (or the migration from private to public clouds as well). ViPR enables IT to deliver on premise, fully automated storage services at price points that are the same as, or lower than, public cloud providers. ViPR is an optional component that is available separate from the standard Vblock platform.

EMC Virtual Provisioning

EMC Virtual Provisioning™ reduces cost, improves capacity utilization, and simplifies storage management by simplifying data layout and reducing the steps required to accommodate capacity growth. Users can present a large amount of capacity to a host and then consume space only as needed from a shared pool. This improves TCO by reducing initial over allocation of storage capacity.

EMC Fully Automated Storage Tiering for Virtual Pools

EMC Fully Automated Storage Tiering for Virtual Pools (FAST™ VP) for VNX and VMAX optimizes array performance across all drive types in the array to improve system performance while reducing cost. FAST VP dynamically allocates workloads based on the configured service level, and moves workloads across storage types without interruption, to optimize overall system performance.

Network and server management

VCE Vblock Systems can be managed by a variety of industry tool sets, including EMC Ionix® Unified Infrastructure Manager (UIM), or with the individual Vblock component management tools. VCE Vision Intelligent Operations software provides a single-object perspective of Vblock Systems to management frameworks, such as VMware vC Ops and vCAC. This solution assumes that the Vblock Systems are being managed by the individual component management tools, including EMC Unisphere® software.

VCE Vision

VCE Vision Intelligent Operations software enables and simplifies converged operations by dynamically providing a high level of intelligence to your existing management toolset. VCE Vision software acts as a mediation layer between your system and your existing management tool. It enables intelligent discovery by providing a continuous, near real-time perspective of your compute, network, storage, and virtualization resources as a single object, ensuring that your management tools reflect the most current state of your Vblock Systems. Vision software is specifically designed for virtualized and cloud environments. It provides native integration with the VMware Virtualization and Cloud Management portfolio through a vCenter plug-in and vC Ops adapter. You can use the vC Ops adapter and vCenter Log Insight in the same instance for integrated network management.

VCE Vision has also enabled an ecosystem of other tools such as infrastructure monitoring, configuration management, and IT asset management tools to integrate with Vblock Systems.

EMC Ionix UIM

EMC Ionix UIM manages Vblock Systems as a single element and accelerates the deployment of hybrid cloud elements and resources through the creation of common service catalogs and templates. In addition to providing a powerful and simplified GUI for administrators, Ionix UIM provides a comprehensive set of APIs that can be used by any orchestration tool to integrate Ionix UIM functionality into existing or new workflows.

EMC Unisphere

EMC Unisphere is an intuitive management interface, common to both VNX and VMAX, which enables IT managers to dramatically reduce the time required to provision, manage, and monitor storage assets. Unisphere delivers

the simplification, flexibility, and automation that are key requirements for accelerating the transformation to a hybrid cloud.

EMC and VMware integration

EMC storage integration with VMware

Vblock Systems support vSphere Storage APIs for Array Integration (VAAI). VNX and VMAX both support vSphere Storage APIs—Array Integration (VAAI), which offloads virtual machine operation to the array to optimize server performance. Both platforms also support VMware vSphere Storage API—Storage Awareness (VASA), which enables VMware administrators to expose the underlying storage performance and protection details to assist them in creating virtual machine storage policies.

EMC ViPR and Storage Analytics

Powered by the vCenter Operations Management Suite, EMC adapters for ViPR and Storage Analytics combine to provide a powerful management tool for VMware and storage administrators to access real-time intelligent analytics for the ViPR software defined storage layer and the individual VNX and VMAX platforms. Administrators can obtain detailed statistics through customizable dashboards, heat maps, and alerts, while also accessing topology mapping in a VMware environment.

EMC Virtual Storage Integrator

EMC Virtual Storage Integrator (VSI) software is a free vCenter plug-in provided by EMC that extends the vCenter Server UI to add EMC-specific capabilities. VSI software provides multiple feature sets, including Storage Viewer, Path Management, and Unified Storage Management. Unified Storage Management simplifies the provisioning of both VNX and VMAX storage for a hybrid cloud.

EMC data protection workflows for vCenter Orchestrator

With vCO, cloud administrators can use the data protection workflows created by EMC to automate Avamar and Data Domain protection of virtual machines. These workflows are added to the vCAC virtual machine provisioning blueprints so that users can easily set up protection at provisioning time. In addition, workflows can be used to enable simple restore of the last good backup for a specific virtual machine.

Administrators can also use workflows that carry out the complete protection policy setup on Avamar and vCenter systems, to facilitate quick and easy deployment of the infrastructure needed to support all the end-user protection needs.

Hybrid cloud data protection

EMC Avamar backup and recovery

EMC Avamar backup and recovery is a fast, efficient system that is provided through a complete software and hardware solution. Equipped with integrated variable-length deduplication technology, Avamar backup and recovery

software provides integrated source and global data deduplication, which facilitates fast, daily full backups for hybrid cloud environments.

EMC Data Domain system

With Avamar backup and recovery, you can choose to direct backups to an EMC Data Domain system instead of to the Avamar server. Data Domain deduplication storage systems deduplicate data inline, so that it lands already deduplicated on disk, and requires less disk space than the original dataset. With the Data Domain system, you can retain backup and archive data on site longer to enable quick and reliable data restores from disk.

EMC Data Protection Advisor

With EMC Data Protection Advisor (DPA), you can automate and centralize the collection and analysis of all data across backup applications, replication technologies, the virtual environment, and supporting infrastructure. This provides a single, comprehensive view of your data protection environment and activities. In addition, when integrated with vCO workflows, DPA can be used to provide on-demand reporting of backup statistics and status.

Validated solution

Architecture　　This section describes the environment and supporting infrastructure for this EMC Hybrid Cloud solution.

As shown in Figure 9, the overall architecture for the solution depicts the VCE Vblock system, EMC Data Domain, EMC Avamar, and the following four sets of resources that are required to deploy an EMC hybrid cloud (EHC):

- EHC core pod
- EHC network edge infrastructure (NEI) pod
- EHC automation pod
- Business group resource pods (resources to be consumed by end users)

Deploy these resource sets in the order shown, as these resources have hierarchical dependencies.

The management infrastructure for this hybrid cloud solution is critical to the availability of its supporting components. These management components are separate from the Vblock advanced management pod (AMP-2) management pod, which are hosted within the Vblock infrastructure.
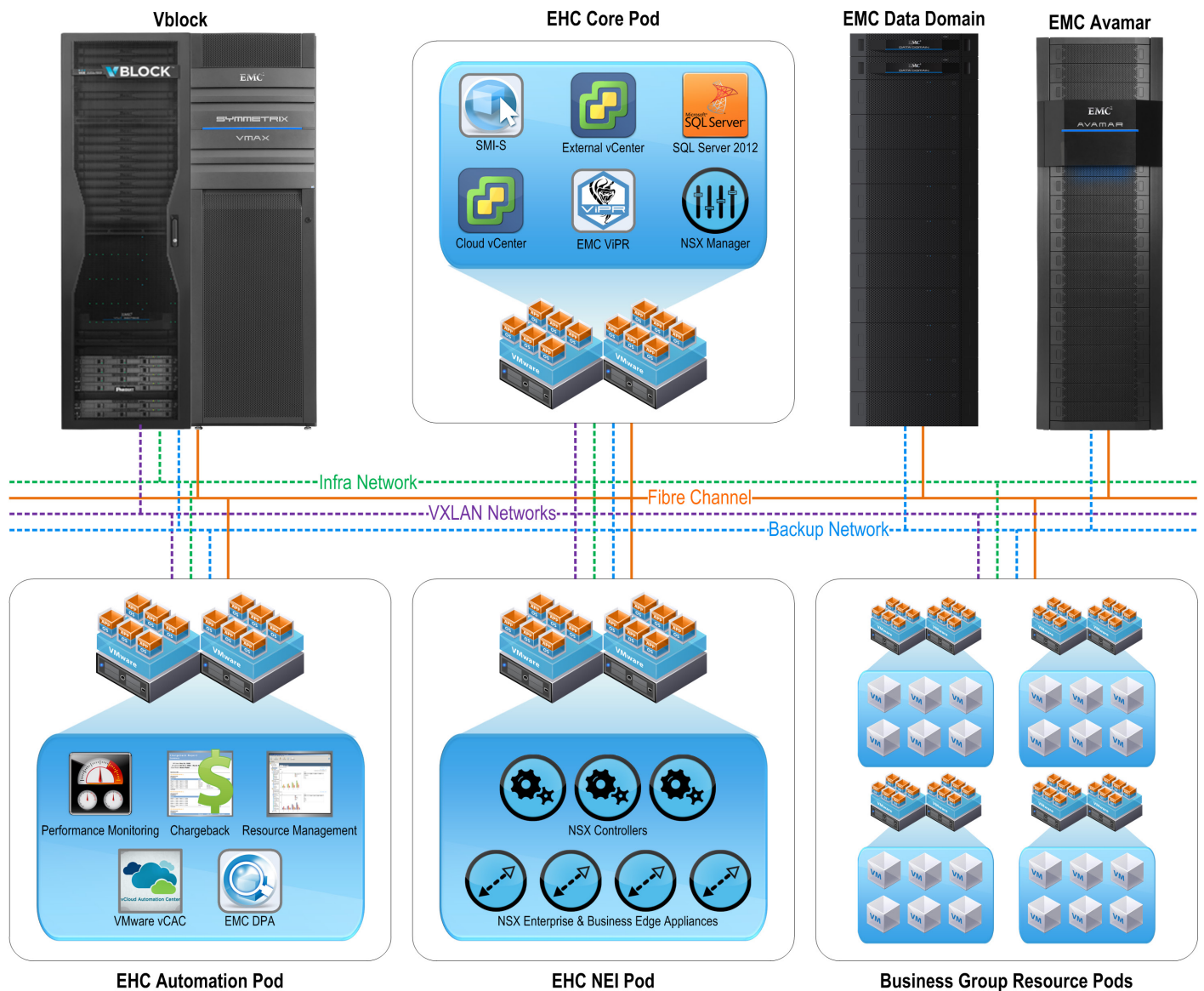
Figure 9.   EMC Hybrid Cloud solution architecture

Vblock platform

This solution used a Vblock 720 as the converged infrastructure platform. The configuration follows the best practices of the VCE Release Certification Matrix (RCM) to ensure that component parts of the infrastructure, such as compute, network, storage, and infrastructure software components, used the certified release levels or versions for drivers, firmware, and software.

The Vblock AMP-2 provides a centralized management point for Vblock Systems and hosts all virtual machines required for management of the Vblock System. The AMP-2 contains one vCenter Server to manage its own ESXi servers and virtual machines and another vCenter Server to manage the hybrid cloud management pod. Each Vblock AMP-2 is delivered preconfigured with the virtual machine components listed in Table 2.

Table 2.   Vblock AMP-2 virtual machine components

Components	
AMP-2 vCenter Server	EMC Unisphere
Cisco UCS Manager	EMC Ionix UIM (optional)
Microsoft SQL Server	VMware Management Pod vCenter Server
EMC PowerPath/VE	VCE Vision Intelligent Operations (optional)

EHC core pod

To deploy cloud automation components, such as vCAC, a base set of resources must first exist. The following base resources are in the EMC core pod:

- **Microsoft SQL Server**—Hosts the respective SQL Server databases used by the Cloud vCenter Server, vCenter Update Manager, and vCAC IaaS databases

- **Cloud vCAC**—VMware vCAC (deployed in the Cloud Management resource set) uses this vCenter Server as its endpoint from which the appropriate ESXi clusters are reserved for use by vCAC business groups

- **Network and Security Manager**—Used for both VMware NSX and VMware vCNS to manage the virtual networks used by business group resource pods and managing infrastructure

- **EMC ViPR Controllers**—Used to provide virtual storage for the business group resource pods

- **EMC SMI-S/Unisphere**—Management infrastructure required for EMC ViPR deployment

The virtual machine deployments required a set of VMware ESXi servers and an associated external managing VMware vCenter Server instance (separate to the Cloud vCenter instance mentioned). This external vCenter Server instance is included in the EHC core pod, as shown in Figure 9. However, it can exist elsewhere depending on the deployment. This deployment can be used the following environments:

- In an existing datacenter environment, an infrastructure to host the core resources might already exist. In this case, the need to deploy additional physical hosts or an additional external vCenter Server instance might be unnecessary. Redeployment is unnecessary because the EHC core pod (in Figure 9) exists elsewhere. The external vCenter Server instance might also preexist, as shown in Figure 9. The *EMC Hybrid Cloud Solution Guide* provides more considerations for the existing hardware resources consumed by the core virtual machines.

- In a true greenfield site, you might need to deploy specific hardware resources as the first step in getting the base resources online. As a minimum requirement for this preexisting situation, you can deploy a VMware ESXi host and create virtual machines for both the SQL Server and the external vCenter Server. After the vCenter Server is functional, you can use vCenter to manage the ESXi that hosts the server, any other hosts used in the core pod, and other deployed and configured virtual machines. These resources are shown in Figure 9 as a dedicated EHC core pod. The *EMC Hybrid Cloud Solution Guide* provides other requirement considerations for this type of EHC core pod.

The hardware that hosts the EHC core pod is not managed by any of the cloud components; however the virtual machines that the hardware hosts are a critical foundation of the hybrid cloud.

All components in the core pod are deployed on storage that is not controlled by ViPR. Depending on the scenario, they might be hosted by storage in the existing customer environment or by storage from one of the EHC arrays. For these scenarios, storage for the core pod is provisioned with EMC Virtual Storage Integrator (VSI) on the vSphere Client for the external vCenter Server instance, because the core pod is managed by vCenter Server.

EHC network edge infrastructure pod

The EHC network edge infrastructure (NEI) pod is used to host all of the Networking and Security Edge components of the virtualized network that are responsible for North-South communications. In the case of VMware NSX, it also hosts the NSX Controller appliances.

This pod becomes the convergence point at which the physical and virtual networks connect. It uses dedicated vSphere clusters to simplify the amount of configuration required to connect the physical and virtual networks. It also eliminates the critical networking components competing for resources as the solution scales, and the demands of other areas of the cloud management platform increase.

Storage for this pod is provisioned with VSI, as in the core pod; however it is slightly different in that VSI connects to the cloud vCenter Server, because the NEI cluster is managed by that vCenter Server instance. All storage should be RAID protected and all ESXi servers run EMC PowerPath/VE for automatic path management and load balancing. FC is recommended but not mandatory. The *EMC Hybrid Cloud Solution Guide* provides sizing guidelines for the NEI cluster.

EHC automation pod

The EHC automation pod cluster hosts all virtual machines that are used for automating and managing the cloud infrastructure, with the exception of the EHC core components, because those must exist before the creation of the automation pod. The automation pod supports the components responsible

for functions, such as the user portal and automated provisioning, monitoring, and metering. While the automation pod hardware is registered with the Cloud vCenter Server instance, the automation pod hardware is not reserved for use by vCAC business groups as its sole purpose is to host the automation and management components of a hybrid cloud solution.

The automation pod is supported by a number of vSphere ESXi servers, configured in a vSphere cluster using vSphere Distributed Resource Scheduler (DRS) and VMware vSphere High Availability (HA). This vSphere cluster uses server, network, and storage resources of its own, separate to the production resource clusters. The *EMC Hybrid Cloud Solution Guide* provides sizing details for the cloud management platform.

Storage for the automation pod should follow the same guidelines as the EHC NEI Pod. At a minimum, the automation pod consists of the components listed in Table 3. It may contain additional items, such as vShield App or Load Balancers, depending on the architecture. The *EMC Hybrid Cloud Solution Guide* provides sizing details for these architectures.

Table 3.   Automation pod components

Components	
VMware vCenter Automation Center (vCAC) Identity Server	VMware IT Business Management Suite
VMware vCAC Server	EMC PowerPath/VE*
VMware vCAC IaaS	EMC Data Protection Advisor
VMware vC Ops (two virtual machine vApps)	EMC Avamar Proxy 01
VMware vCenter Log Insight	EMC Avamar Proxy 02

*Note: The PowerPath/VE component is shipped as part of the AMP-2 as an option to deploy in the Automation Pod.

Business group resource pods

The business group resource pods are configured and assigned in vCAC as available resources, which will host all machines deployed by different business groups in the hybrid cloud environment. Each business group uses a dedicated ESXi cluster.

You can easily modify server, network, and storage resources for existing pods. Once new resources have been made available at the vSphere layer, a new data collection is required in vCAC, followed by the appropriate resource reservation changes in order to make the additional resources available for consumption. Storage to support the business group resource pods is provisioned using EMC ViPR services, and is initiated from the VMware vCAC catalog.

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All storage provisioned by ViPR is Fibre Channel attached, where the SAN zoning can be manually configured in advance or automatically configured by ViPR at deployment time. Where manual zoning is chosen, zoning best practices for HA should be implemented to provide HA on the server and the storage arrays. All ESXi servers run EMC PowerPath/VE for automatic path management and load balancing. The *EMC Hybrid Cloud Solution Guide* provides details for the sizing of production clusters.

Data protection

Avamar provides data protection for all levels of this hybrid cloud solution by using agent-free, image-level backup. While the virtual machines within the production resource clusters are automatically protected at provisioning time with customizations between VMware vCAC and Avamar, virtual machines in the management cluster are manually protected in the more traditional manner using the Avamar administrative console.

Use Avamar guest-level backup using the client agent, and the Avamar SQL Server plug-in, for Microsoft SQL Server database instances in the management cluster that support vCAC and vCenter Server. This level of backup can co-exist with image-level backup of the same machine.

Solution connectivity

The solution uses the following networks:

- **Fibre Channel**—Connects all block storage devices to the respective server hardware

- **Backup**—Dedicated network that transports all data between the production cluster resource and the EMC Avamar grid

- **Infrastructure**—Connects all hardware components of the solution

- **Management**—Connects all Cloud Management virtual machines

- **Business group**—Dedicated network for each business group

Architectural assumptions

The following assumptions and justifications apply to the EMC Hybrid Cloud solution architecture:

- The solution uses the vCenter Server full installation instead of the vCenter Server appliance for the following reasons:

  - Enables the vCenter Server Heartbeat and subsequent vCenter Server HA

  - Provides support for an external SQL Server database

- The solution uses the integrated SSO server with vCenter Server 5.5.0b instead of the vCAC Identity Appliance, because it enables HA of SSO in tandem with vCenter Server

- The solution uses the EMC VSI C# client instead of the web client for the following reasons:
    - At publication time, the web client only supports ViPR provisioning and this solution requires VSI to provision VMAX or VNX storage
    - All ViPR provisioning is with the vCAC portal, so the web client is unnecessary

High availability

VCE Vblock System provides HA at the hardware level. This solution, built on and operating on Vblock, inherits all the features designed for HA from the components of each Vblock, as shown in Figure 10.
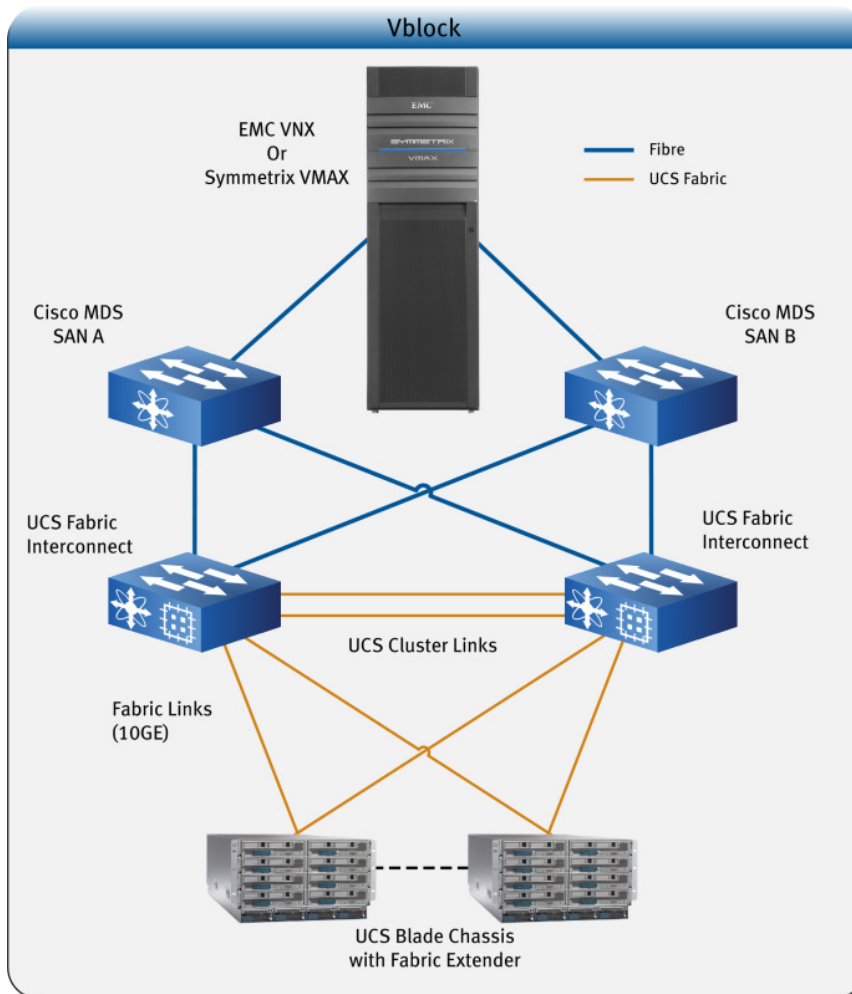

Figure 10. HA components of Vblock Systems

Each of the management pods required for this solution can be configured for HA.

The VCE Vblock AMP-2 that provides a centralized management point for Vblock Systems can be ordered in a HA configuration that consists of two

Cisco UCS C-series servers, a single EMC VNXe3150™, and two Cisco Catalyst Ethernet switches.

Hardware resources

You can order Vblock AMP-2 in an HA configuration, as specified in Table 4.

Table 4.   Vblock AMP-2 hardware

Component	Quantity	Notes
Cisco UCS C220 servers	2	Host vSphere ESXi servers
EMC VNXe3150	1	AMP storage
Cisco Catalyst 3560-X Ethernet switches	2	AMP networking

Table 5 lists the hardware used to validate this solution.

Table 5.   Solution hardware

Hardware	Quantity	Configuration	Notes
Storage			
EMC VMAX 10K	1	FC, SATA, and flash disks	VCE Vblock System 700 family and VMAX 10K offering multiple EMC FAST VP storage policies
EMC VNX5800	1	SAS, NL-SAS, and flash disks	VCE Vblock System 300 family and VNX unified storage providing block and file storage, including FAST VP and EMC FAST Cache
Compute			
Compute blades	10	• 2 six-core Intel Xeon 5600 series blades • 96 GB RAM • Converged network adapter	Cisco UCS B-series blade types that include all supported VCE blade configurations
Compute chassis	2	Up to 16 Cisco UCS Server chassis per domain	
Network/Fabric			
Cisco UCS Fabric Interconnect	2	6200 series, 48 port, unified (6248UP)	Converged network and fabric for compute
Cisco MDS	2	9500 series, 9-slot (9509)	SAN Fabric
Nexus	2	5000 series	Top of rack switch
Powered backup and recovery			
EMC Avamar	1	15.5 TB capacity	Backup appliance
EMC Data Domain	1	21.5 TB capacity	Data Domain appliance

Converged infrastructure

Each Vblock System has a base configuration, which is a minimum set of compute and storage components, and fixed network resources. These components are integrated within one or more 19-inch 42U cabinets. Table 6 and Table 7 summarize the base configuration and scaling for Vblock 720 and Vblock 340 Systems.

Table 6.   Vblock System 720 components

Resource	Details
Compute	• Cisco UCS 5108 blade server chassis • Cisco UCS B-Series M2 blade servers and Cisco UCS B-Series M3 blade servers • Cisco UCS Virtual Interface Card 1240 on M3 blades and Cisco UCS Virtual Interface Card 1280 on all M2 blades except M2 B250 (some M3 blades can include an optional port expander or Cisco UCS Virtual Interface Card 1280) • Cisco UCS 2204XP Series fabric extenders or Cisco UCS 2208XP Series fabric extenders • Cisco UCS 6248UP fabric interconnects or Cisco UCS 6296UP fabric interconnects
Network	• Cisco Nexus 7010 chassis or Cisco Nexus 5548UP switches or Cisco Nexus 5596UP switches required for two compute cabinets unless a Cisco Nexus 7010 chassis is selected • Cisco MDS 9148 multilayer fabric switch or Cisco MDS 9513 Multilayer Director • Cisco Nexus 1000V Series virtual switch *(not used in this solution)*
Storage	• EMC Symmetrix VMAX 10K, VMAX 20K, or VMAX 40K • (Optional) EMC VNX VG2 gateway or EMC VNX VG8 gateway • (Optional) EMC RecoverPoint®
Virtualization	• VMware vSphere ESXi 5.5 • VMware vCenter Server
Management	• Cisco UCS Manager • EMC Unisphere for VMAX on Windows • VMware vSphere Enterprise plus vCenter Server Additional optional management software tools are available.

VCE Vblock System 700 has more information. This solution was validated on a VCE Vblock 700 that was configured to conform to VCE Vblock 720 RCM 4.5.1.

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Table 7.   **Vblock System 340 components**

Resource	Details
Compute	• Cisco UCS 5108 blade server chassis • Cisco UCS B-Series blade servers–M3: B22, B200, B420, and M2: B440, B230 • Cisco UCS 2204XP Series fabric extenders or Cisco UCS 2208XP Series fabric extenders • Cisco UCS 6248UP Series fabric interconnects or Cisco UCS 6296UP Series fabric interconnects
Network	• Cisco Nexus 5548UP and 5596UP switches–segregated and unified networking • Cisco MDS 9148 Series storage switches (FC)–segregated networking • Cisco Nexus 3048 • Cisco Nexus 1000V Series virtual switch *(not used in this solution)*
Storage	EMC unified storage array • VNX5400: 16 GB/SP, 250 drives, FAST Cache: 1 TB • VNX5600: 24 GB/SP, 500 drives, FAST Cache: 2 TB • VNX5800: 32 GB/SP, 750 drives, FAST Cache: 3 TB • VNX7600: 64 GB/SP, 1000 drives, FAST Cache: 4.2 TB • VNX8000: 128 GB/SP, 1000 drives, FAST Cache: 4.2 TB
Virtualization	• VMware vSphere ESXi 5.5 • VMware vCenter Server
Management	• Cisco UCS Manager • EMC Unisphere Manager • VMware vCenter Server • AMP-2 Additional optional management software tools are available.

VCE Vblock System 300 has more information. This solution was validated on a VCE Vblock 300 that was configured to conform to VCE Vblock 720 RCM 4.5.1.

Software resources

Table 8 lists all of the software components used for Vblock AMP-2.

Table 8.   Vblock AMP-2 software components

Component	Version	Description
Microsoft Windows Server	2008 Standard R2 SP1 x64	Operating system for the server environment
Microsoft SQL Server	2012 Standard	Database server for vCenter Servers
VMware vSphere Server Enterprise Plus	5.5	Hypervisor server
VMware vSphere Hypervisor ESXi, VMware Single Sign-On (SSO) Service (version 5.1 and later), vSphere Web Client, vCenter Server, vCenter Update Manager, vCenter Client	vSphere 5.5	VMware hypervisor and vSphere suite
EMC PowerPath/VE vApps	V5.9 SP1	PowerPath VE licensing management
EMC Secure Remote Support (ESRS)	Latest available	EMC remote support
EMC Solutions Enabler with SMIS	7.6.1	CLI software for VMAX storage management
EMC Unisphere for VMAX	1.6.1.8	Management software for EMC VNX and EMC Symmetrix VMAX
Cisco Device Manager and Data Center Network Manager (DCNM)	6.2.(3)	Management system for the Cisco Unified Fabric
PuTTY, TFTP Server, Java, and so on	Latest available	System administration utilities
(Optional) EMC Ionix UIM	4.0 P02 (b4.0.0.2.359)	Vblock resource management

Table 9 lists the software used in this solution for the hybrid cloud management pod.

Table 9.   EMC Hybrid Cloud solution software

Software	Version	Notes
VMware virtualization and cloud infrastructure		
VMware vSphere ESXi	5.5.0	VMware hypervisor
VMware vCenter Server	5.5.0b	vSphere management server

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Software	Version	Notes
VMware vCloud Automation Center (vCAC)	6.0 SP1	VMware cloud management and infrastructure
VMware vCenter Orchestrator	5.5	vCenter orchestration engine
VMware vCenter Operations Manager (vC Ops)	5.8	Automated operations management
VMware vCenter Log Insight	1.5	vCenter log analytics and management
VMware IT Business Management Suite	1.0	VMware IT Business Management Suite Standard Edition
Microsoft SQL Server	2012 SP1	Database server for vCAC and vCenter Server
Microsoft Windows Server	2012	Operating system for the server environment
EMC storage		
EMC ViPR	1.1	EMC ViPR software-defined storage
EMC Enginuity™	5876.229.145	Operating environment for VMAX
EMC VNX Operating Environment	Release 33	Operating environment for VNX block
EMC PowerPath/VE	V5.9 SP1	Multipathing and load balancing for block storage
EMC Unisphere	1.6.1.8	Management software for EMC VMX and VNX
EMC Solutions Enabler	7.6.1	CLI software for Symmetrix VMAX storage management
EMC and VMware integration		
EMC ViPR Analytics	1.1	EMC ViPR Analytics pack for VMware vC Ops
EMC Virtual Storage Integrator	5.6.2	EMC storage plug-in for VMware vSphere Client
EMC Storage Analytics	2.1	EMC storage analytics adapter for VMware vC Ops (storage analytics is a validated but optional component of the solution)
EMC backup and recovery		
EMC Avamar	7.0 SP1	Avamar system software
EMC Data Domain	5.4.1.2	Operating system for Data Domain appliance
EMC Data Protection Advisor	6.1	Data protection management software

Chapter 4   Conclusion and References

This chapter presents the following topics:

Conclusion

This EMC Hybrid Cloud on VCE Vblock solution enables you to build an enterprise-class, scalable, multitenant platform for complete infrastructure service lifecycle management. This solution provides on-demand access and control of infrastructure resources and security while enabling you to maximize asset utilization. Specifically, this solution integrates key functionality demanded of a hybrid cloud while providing a framework and foundation for adding other services.

This solution incorporates the following principles:

- Self-service and automated provisioning
- Multitenancy
- Resource elasticity
- Metering and chargeback
- Automated monitoring
- Lifecycle management
- Backup and recovery
- Security

This solution uses the best of EMC and VMware products and services to empower customers to accelerate the implementation and adoption of a hybrid cloud, leveraging VCE Vblock Systems within a datacenter to create a fully converged solution.

For more information on how the EMC Hybrid Cloud with VMware vCloud Suite and VCE Vblock Systems can transform your business, contact your EMC representative or go to EMC.com.

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References

EMC documentation

The following EMC documents are available at EMC.com or EMC Online Support and provide related information about this solution. Access to EMC Online Support depends on your login credentials. If you do not have access and want it, contact your EMC representative:

- *EMC Hybrid Cloud Solution Guide*
- *EMC Hybrid Cloud Reference Architecture*
- *Everything VMware at EMC*
- *Cloud Playbook*
- *EMC VSI software and documentation*

VCE Vblock documentation

The following documents are available on the VCE Vblock website:

- *VCE Vblock System Resources*
- *VCE Vblock System 700*
- *VCE Vblock System 300*