Solution Guide

Abstract
This solution guide describes the main features of Dell EMC Native Hybrid Cloud version 1.4, an application production platform for cloud-native applications. Native Hybrid Cloud is integrated with VxRail Appliance, VxRack FLEX, or VxRack SDDC hyperconverged infrastructure that consolidates compute, storage, virtualization, and management.
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CHAPTER 1

Introduction

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Business case

Businesses are embracing hyperconverged infrastructure and cloud-native frameworks to go beyond conventional business models, differentiate themselves from competitors, and explore new business opportunities.

A requirement for growing a business is the ability to analyze consumer data and rapidly and continuously deliver new, innovative, and unique content to consumers. Consumers have come to expect applications to always be available, secure, and updated.

This trend is driving a shift in application production platforms and processes. Application developers are moving to new practices and technologies such as development and operations (DevOps), continuous delivery, agile methodology, twelve-factor application frameworks, microservices, and API-based collaboration. These practices and technologies speed application production and quickly deploy features into production. However, many enterprises encounter challenges when transitioning to these new application production methods.

- Application development groups struggle with decisions about the best system to manage growing application production needs.
- Short-term revenue goals can displace proper planning for an integrated application production environment. Consequently, disparate applications are installed at different times in various functional areas, resulting in process inefficiencies and software and hardware integration challenges.
- Many challenges arise when high-growth software development groups have several applications in silos. These challenges include wasted effort, lack of real-time visibility, and increased integration complexity and cost.
- IT departments, often with shrinking budgets, are also under pressure to provide enterprise-quality development environments.

An integrated development platform that is based on cloud computing and storage, offering performance and convenience, addresses these challenges. An integrated development platform can also help software developers decrease the time to market, increase operational agility, and facilitate automated deployment of applications.

The variety and complexity of proprietary and public cloud offerings increase the difficulty of choosing an integrated cloud platform. Several new open-source technologies are also available to help create a cloud platform for software development, testing, and deployment. However, IT departments must know how to best use these technologies to drive standardization, integrate open-source and proprietary systems, minimize cost, and support service-level agreements.

The availability of the public cloud and the ease with which it can be accessed create the perception that IT can easily duplicate the same level of service in-house. Planning, designing, and building a private cloud to support cloud-native applications can be a complex project that takes too long if you must address immediate business needs. IT also must maintain and manage the infrastructure that supports these new applications to ensure that the environment is reliable, secure, and upgradeable.

As a result, IT departments must make difficult decisions when implementing or creating a cost-effective, cloud-based software development platform. Dell EMC has solved these challenges with Native Hybrid Cloud.
Native Hybrid Cloud is a fully engineered development platform that is integrated with an elastic infrastructure and monitoring tools to support an application production environment. IT professionals can easily monitor, manage, and scale the platform to ensure its fitness for current and future application production needs.

Native Hybrid Cloud provides a predictable, accurate, and protected Pivotal Cloud Foundry (PCF) deployment that is optimally sized and installed on:

- VxRail™ Appliance, a hyperconverged infrastructure appliance that is powered by VMware vSphere.
- VxRack™ FLEX, a modular hyperconverged infrastructure system that delivers extreme scalability and flexibility
- VxRack SDDC, a hyper-converged infrastructure that provides the easiest path for a VMware software-defined data center

VxRail Appliance and VxRack System hardware-sizing configurations are based on expected PCF utilization and system testing. The virtual infrastructure is sized based on PCF utilization.

Native Hybrid Cloud Monitoring and Reporting monitors and reports consumption and billing information transparently.

Deployment options that include Native Hybrid Cloud deployments on multiple sites with multiple availability zones (AZs) per site, or multiple sites with single AZs, provide high availability (HA).

An S3-compatible Blobstore that is provided by the Dell EMC Elastic Cloud Storage™ (ECS™) solution stores customer code, applications, buildpacks, and so on. VMware vSphere, PCF, and VMware vSAN, which enables data replication and redundancy for PCF deployments, provide data protection, including backup and restoration.

### Pivotal Cloud Foundry

PCF is a cloud-native platform (CNP) on which developers can create, test, deploy, update, and scale applications on public and private clouds. PCF enables developers to code in multiple languages and frameworks.

PCF provides developers with a ready-to-use cloud computing environment and application development services, all hosted on a VxRail Appliance or a VxRack System. The services include:

- **PCF Operations Manager (Ops Manager)**—A web application that is used to deploy and manage PCF and associated services such as SSO and PCF Metrics. Ops Manager is the industry's first turnkey enterprise CNP management platform with infrastructure-as-a-service (IaaS) integration.
- **PCF JMX Bridge**—A tool that monitors PCF Elastic Runtime and helps operators and developers better understand the health and performance of the PCF platform and all applications running on it. JMX Bridge collects and exposes system data from PCF components with a JMX endpoint to help monitor the installation and assist in troubleshooting. It also enables application developers to monitor the health of their deployed applications.
- **PCF Elastic Runtime**—The framework that hosts running applications, manages system health, and provides client access to the runtime environment, including running applications through the cloud controller API endpoint.
- **Buildpacks**—Scripts that provide framework and runtime support for applications. Buildpacks typically examine user-provided artifacts to determine what
dependencies to download and provide instructions about how to configure applications to communicate with bound services.

- Pivotal Marketplace—A self-service catalog that provides developers with a robust user experience that boosts productivity with on-demand access to a large marketplace of mobile and data services, an intuitive console, and open APIs. The Marketplace’s managed and user-provided services can be used without the need for IT action.

**Native Hybrid Cloud Monitoring and Reporting**

Native Hybrid Cloud Monitoring and Reporting is resource management software that provides detailed relationship and topology views of virtual or physical hosts, including the underlying infrastructure.

Native Hybrid Cloud Monitoring and Reporting helps you visualize infrastructure relationships, analyze and report on the infrastructure's capacity and health, and optimize resources in traditional and software-defined environments.

This software also provides performance and utilization views across physical and virtual infrastructure layers to help you understand the impact that infrastructure has on enterprise applications.

**Elastic Cloud Storage**

ECS object storage features a flexible software-defined architecture that provides the simplicity and low-cost benefits of the public cloud without the risk, compliance, and data sovereignty concerns.

ECS provides the following benefits:

- Enables infinite scalability with strong global consistency
- Offers flexible on-premises deployment as an appliance or a software-only solution, or a combination of both
- Provides enterprise-class object storage in a secure and compliant system
- Enables you to free your primary storage by moving inactive data to a low-cost storage tier, which significantly reduces primary storage capacities

ECS provides public-cloud-like scalability and user experience at a fraction of the cost to enable your businesses to accelerate cloud-native application development.

**Native Hybrid Cloud automated deployment**

Manual and automated tools simplify the deployment of Native Hybrid Cloud on a VxRail Appliance or VxRack System.

Dell EMC Professional Services deploys the Native Hybrid Cloud Controller as a virtual machine. It is used to run automated tasks that validate previously collected customer-site-related data (network, DNS, and so on), run automated scripts that deploy prerequisite components, and automatically deploy and configure the Native Hybrid Cloud Monitoring and Reporting virtual machine.

**Key benefits**

Native Hybrid Cloud enables organizations to quickly begin using an on-premises cloud-native development platform without the cost, time, complexity, or uncertainty that is associated with adopting an in-house solution.

The VxRail Appliance or VxRack System and subsequent Native Hybrid Cloud deployments are designed to meet current and future software development needs.
Dell EMC Professional Services also helps with installing and testing the VxRail Appliance or VxRack System and Native Hybrid Cloud in your IT environment. IT professionals tasked with planning compute, network, and storage capacity can work with Dell EMC Professional Services to determine the correct amount of capacity for each component.

Native Hybrid Cloud enables developers to create cloud-native applications in multiple programming languages and track application quality. The platform is based on an integrated infrastructure, which enables IT operators to easily monitor, manage, and scale the development environment. vCenter Server, VxRail Manager, SDDC Manager, Dell EMC Monitoring and Reporting, ECS Portal, PCF Ops Manager, and PCF Metrics give you the tools to manage and monitor Native Hybrid Cloud.

With the Native Hybrid Cloud, customers benefit from:

- A fully tested and integrated application development, deployment, and management platform
- A virtual infrastructure that can be deployed quickly to reduce the time from planning to coding
- A single platform to develop and store code and publish applications
- A highly available platform that can be deployed across multiple sites with multiple availability zones per site
- A turnkey, private cloud and infrastructure service that eliminates the time that IT spends on complex deployments
- A modern developer platform that boosts developer productivity by combining application services, service discovery, container management, and orchestration with an ecosystem of plug-ins for developer tools
- Support for isolated networks for network segmentation and increased security
- Increased cloud solution portability and agility
- Utilities, metrics, backup and restore features, and security that enable you to easily manage day 2 operations
- Integration of best-in-class open-source technologies, professional services, and single-call support into a cloud-native application development platform that is easy to consume and deploy

**Document purpose**

This solution guide introduces the main features and functionality of Native Hybrid Cloud, describes its components, and lists its validated hardware and software environments.

This guide also describes the integrated components and functionality of Native Hybrid Cloud and the VxRail Appliance or VxRack System.

**Audience**

This solution guide is for DevOps cloud architects, DevOps cloud operators, and software development managers who want to design, manage, and deploy cloud-native applications with Native Hybrid Cloud on a VxRail Appliance or VxRack System.

Readers should be familiar with the VxRail Appliance or VxRack System, VMware vSphere, ECS, PCF, virtualization, networking, storage technologies, and general IT functions.
We value your feedback

Dell EMC and the authors of this guide welcome your feedback on Native Hybrid Cloud and the solution guide.

Contact EMC.Solution.Feedback@dell.com with your comments.

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Platform architecture

The diagrams in this section illustrate the layout of the major components of Native Hybrid Cloud.

The following figures depict a high-level overview of the components in the Native Hybrid Cloud architecture, which include:

- PCF—An industry-standard, open-source-based, and cloud-native application platform that developers can use to build, deploy, run, and scale applications on public and private clouds.
- Native Hybrid Cloud Monitoring and Reporting—Resource management software that IT can use to visualize usage relationships; analyze and report on capacity, performance, and health; and optimize resource consumption.
- VxRail Appliance—An infrastructure-as-a-service (IaaS) platform that provides a converged infrastructure for cloud computing. The elastic, scale-out, and hyperconverged design can concurrently host multiple services.
- VxRack FLEX—A modular hyperconverged infrastructure system that delivers extreme scalability and flexibility.
- VxRack SDDC—A hyper-converged infrastructure that provides the easiest path for a VMware software-defined data center.
- ECS—A software-defined object storage platform that provides a highly available, replicated, persistent, and external S3 Blobstore for PCF.
Native Hybrid Cloud can also be deployed on a VxRack System, which is a rack-scale engineered system comprised of self-contained units of servers, networking, and storage, that is well suited for use cases that require a highly scalable infrastructure. Two types of VxRack Systems, VxRack FLEX and VxRack SDDC, are available for Native Hybrid Cloud.
The hardware and software provided by Native Hybrid Cloud and the VxRail Appliance or the VxRack System includes redundant physical and logical network connections to ensure connectivity. Dell EMC Customer Service provides Native Hybrid Cloud installation restoration, if required.

**Key components**

Native Hybrid Cloud uses several key components in addition to PCF and the VxRail Appliance or VxRack System.

**Native Hybrid Cloud Monitoring and Reporting**

Native Hybrid Cloud Monitoring and Reporting and PCF Metrics analyze health, configurations, and capacity use.

You can quickly identify service-level agreement (SLA) problems through custom dashboards and reports that meet the needs of a wide range of users and roles. With Native Hybrid Cloud Monitoring and Reporting, you can also see storage and compute capacity consumption across your PCF deployment, including applications, with built-
in views to help you understand who is using capacity, how much they are using, and when more capacity will be required.

**Solution Packs and Collectors**

Organizations can take advantage of Native Hybrid Cloud Monitoring and Reporting Solution Packs and Collectors, which are plug-ins, extensions, and management packs that add functionality to management tools that are already deployed in data centers.

For example:

- The Generic Host Solution Pack provides custom component monitoring.
- The JMX Collector that is delivered with Native Hybrid Cloud enables administrators to get a complete and in-depth view of the health, capacity, and resource availability of PCF.

**Logging**

Loggregator is the PCF component that is responsible for logging.

Loggregator provides a stream of log output from your applications and from PCF system components that interact with your applications during updates and execution. Log data is collected by the Elastic platform of applications, Elasticsearch, Logstash, and Kibana, and is viewable in Native Hybrid Cloud Monitoring and Reporting dashboards.

**Data protection**

PCF, VMware vSphere, and VMware vSAN provide data redundancy capabilities for Native Hybrid Cloud on VxRail Appliance and VxRack FLEX. VxRack SDDC uses ScaleIO instead of vSAN.

All Native Hybrid Cloud and Pivotal virtual machines, which include Native Hybrid Cloud Controller and Native Hybrid Cloud Monitoring and Reporting, and PCF Ops Manager, Ops Manager Director, and Elastic Runtime, are stored on vSphere datastores. The datastores are created on vSAN storage that is provided by the VxRail Appliance or VxRack System.

Native Hybrid Cloud Controller and Monitoring and Reporting virtual machines are cloned. The cloned virtual machine contents include installation and configuration settings that can be used to rebuild a Native Hybrid Cloud deployment. The cloned virtual machines are also stored on vSphere datastores created on vSAN storage that is provided by the VxRail Appliance or VxRack FLEX, or on vSphere datastores created on ScaleIO volumes provided by VxRack SDDC.

Native Hybrid Cloud does not provide data protection for PCF components such as Ops Manager or Ops Manager Director. Customers must use standard Pivotal backup procedures to create backups of PCF components.

Customers can use Ops Manager to export PCF installation settings and assets. When you export an installation, the exported file contains the base virtual machine images, necessary packages, and references to the installation IP addresses.

Native Hybrid Cloud uses ECS object storage to spread Elastic Runtime components on volumes across multiple ECS nodes. ECS provides data resiliency if one of the ECS nodes is unavailable, so data handled by Elastic Runtime persists if an ECS node is unavailable.
VMware vSAN

In Native Hybrid Cloud on the VxRail Appliance or VxRack FLEX, vSAN is fully integrated with VMware vSphere to provide full-featured, efficient, and cost-effective software-defined storage for Native Hybrid Cloud virtual machines.

vSAN aggregates locally attached disks of vSphere cluster hosts to create a pool of distributed shared storage. vSAN is a software-based distributed storage solution that is built into the ESXi hypervisor. It is preconfigured and managed through VMware vCenter Server to provide storage capacity across all VxRail Appliance nodes or VxRack System servers.

Elastic Cloud Storage

PCF uses the Dell EMC ECS platform as its Blobstore location to store application code, buildpacks, and applications. The Blobstore uses the S3 protocol and is managed by the ECS management nodes.

The ECS platform provides software-defined object storage that is designed for modern cloud-scale storage requirements. The ECS platform provides the simplicity and low-cost benefits of the public cloud without the risk, compliance, and data sovereignty concerns. ECS benefits include:

- Cloud-scale economics—Sixty percent TCO savings versus public cloud services
- Simplicity and scale—Single global namespace and unlimited applications, users, and files
- Universal accessibility—Support for object, file, and HDFS on a single platform
- Faster application development—API-accessible storage and strong consistency, which accelerates cloud applications and analytics
- Turnkey cloud—Multitenancy, and self-service access and metering capabilities

The following figure shows the data storage architecture of Native Hybrid Cloud on VxRail Appliance or VxRack SDDC.
For Native Hybrid Cloud on VxRack FLEX, virtual machines run on Dell EMC ScaleIO volumes. ScaleIO is software that creates a server-based SAN from the integrated Dell PowerEdge servers in VxRack FLEX. ScaleIO delivers flexible and scalable performance and capacity on demand, and combines storage resources to create a virtual pool of block storage with varying performance tiers.

ScaleIO is an efficient solution for hyperconverged deployments such as VxRack FLEX, as it reduces the need to add more hardware resources to the cluster. ScaleIO also provides enterprise-grade data protection, multi-tenant capabilities, and add-on enterprise features such as QoS, thin provisioning, and snapshots.

VxRack FLEX enclosures are high-density, two socket, two rack unit (2RU), rack-mount enclosures that contain either one node or four node systems. The minimum configuration for Native Hybrid Cloud workloads is four enclosures that contain four nodes total. Eight nodes are recommended, and Native Hybrid Cloud can use up to 28 server nodes per rack. ScaleIO uses the server nodes' local disks and network to create to create a virtual SAN.

Dell EMC Professional Services creates ScaleIO volumes to match a customer's desired application instance (AI) count and Native Hybrid Cloud storage requirements. Customers can create additional ScaleIO volumes and create additional vSphere datastores on those volumes.
The following figure shows the data storage architecture of Native Hybrid Cloud on VxRack FLEX.

**Figure 4** Native Hybrid Cloud on VxRack FLEX data storage

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**Native Hybrid Cloud network separation**

Network separation in Native Hybrid Cloud provides greater security and network traffic monitoring and control.

Separate networks are created for Native Hybrid Cloud and PCF infrastructure and deployment, Pivotal Marketplace services, and user-provided services. Multiple separate networks are a requirement for Pivotal CF continuous integration/continuous deployment (CI/CD) pipelines and high availability, as well as production PCF deployments.

The separate networks are open within and outside of a standard Native Hybrid Cloud deployment. Dell EMC Professional Services works with customers to determine how to protect these networks, which ports to block, and how to keep essential network services open.

The following diagram shows network separation in Native Hybrid Cloud.
Figure 5 Native Hybrid Cloud network separation

Hardware resources

The following table lists the minimum resource requirements for Native Hybrid Cloud 1.4.

Table 1 Hardware requirements

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Version/configuration</th>
<th>Minimum resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dell EMC VxRail Appliance</td>
<td>4.0</td>
<td>4 physical nodes per VxRail Appliance</td>
</tr>
<tr>
<td>Dell EMC VxRack FLEX</td>
<td>3.0.6</td>
<td></td>
</tr>
<tr>
<td>Dell EMC VxRack SDDC</td>
<td>Dell PowerEdge 13G R630 Server</td>
<td></td>
</tr>
<tr>
<td>Dell EMC ECS Appliance with a dedicated management switch for ECS</td>
<td>Extra small (XS) configuration</td>
<td>12 x 2 TB HDD per node</td>
</tr>
<tr>
<td>Dell PowerEdge R730XD rack servers for ECS with a</td>
<td>Used with ECS software version 3.0 HF 2 or later</td>
<td>PowerEdge R730XD x 5</td>
</tr>
</tbody>
</table>
Table 1 Hardware requirements (continued)

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Version/configuration</th>
<th>Minimum resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>dedicated management switch for ECS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note

PowerEdge switching duties can be shared with VxRail Appliance switches.

The VxRail Appliance website lists complete VxRail hardware details. Dell EMC supports all VxRail configurations that can run Native Hybrid Cloud. The VxRack System website lists complete VxRack FLEX and VxRack SDDC hardware details.

The Elastic Cloud Storage (ECS) Appliance website has more information about the appliance specifications. ECS software is available here. The Elastic Cloud Storage Software on Dell R730XD Reference Architecture is available here.

Work with Dell EMC Presales and use the PCF Sizing Tool to determine the correct amount of compute, memory, network, and storage resources.

Included software

The following table lists the software used in Native Hybrid Cloud.

Table 2 Included software

<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dell EMC VxRail Manager</td>
<td>4.0</td>
<td>Manages VxRail Appliance</td>
</tr>
<tr>
<td>Dell EMC VxRack SDDC Manager</td>
<td>2.1.1</td>
<td>Manages VxRack SDDC</td>
</tr>
<tr>
<td>Dell EMC ECS</td>
<td>3.0 HF 2</td>
<td>Provides the S3 Blobstore for PCF</td>
</tr>
<tr>
<td>Dell EMC ScaleIO</td>
<td>2.0-7120.0</td>
<td>Creates datastores for Native Hybrid Cloud virtual machines</td>
</tr>
<tr>
<td>PCF Ops Manager</td>
<td>1.11.3</td>
<td>Provides a graphical interface to manage PCF components</td>
</tr>
<tr>
<td>PCF JMX Bridge</td>
<td>1.9.1</td>
<td>Helps you monitor your installation and assists in troubleshooting</td>
</tr>
<tr>
<td>PCF Elastic Runtime</td>
<td>1.11</td>
<td>Provides a scalable runtime environment to deploy applications</td>
</tr>
<tr>
<td>Dell EMC Native Hybrid Cloud</td>
<td>1.4</td>
<td>Provides monitoring for Native Hybrid Cloud</td>
</tr>
<tr>
<td>Dell EMC ViPR™ SRM</td>
<td>4.0.2</td>
<td>Provides monitoring for Native Hybrid Cloud</td>
</tr>
<tr>
<td>Elasticsearch</td>
<td>1.7.1</td>
<td>Provides log collection and analysis</td>
</tr>
<tr>
<td>Logstash</td>
<td>1.5.3</td>
<td>Provides log collection and analysis</td>
</tr>
<tr>
<td>Kibana</td>
<td>4.1.1</td>
<td>Provides log collection and analysis</td>
</tr>
</tbody>
</table>

The ScaleIO website has more information about ScaleIO software.
Hardware and software upgrades

Dell EMC Professional Services provides all Native Hybrid Cloud and Pivotal Cloud Foundry software upgrades. Hardware upgrades, including VxRail Appliances, VxRack Systems, and their associated networking and storage hardware, are also performed by Dell EMC Professional Services.
CHAPTER 3
Deployment Considerations

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- **Integration with existing IT infrastructure** ....................... 25
- **Integration with external identity providers** .................... 26
Introduction

This chapter provides an overview of the Native Hybrid Cloud deployment process, including a summary of the work that Dell EMC Professional Services performs to deploy Native Hybrid Cloud and the information that you need to provide to Dell EMC Professional Services.

Dell EMC Professional Services performs the site survey, sizes your Native Hybrid Cloud deployment, allocates resources, and integrates existing IT infrastructure. In addition, you must prepare your environment.

Customer information requirements

Dell EMC Professional Services collects information needed for the deployment, using the Customer Configuration Worksheet, deployment readiness list, and sizing prerequisites. Contact Dell EMC Professional Services for more information about these prerequisites.

The Pivotal Cloud Foundry Sizing Tool helps to estimate the necessary resources to deploy PCF, including vCPU, memory, storage, and available IP addresses.

Network separation considerations

Dell EMC Professional Services deploys Native Hybrid Cloud and PCF components as a series of separate networks to isolate traffic. These networks are created apart from the VxRail Appliance virtual network.

Native Hybrid Cloud does not provide built-in firewall protection for its networks. By default, separate networks in Native Hybrid Cloud are open to each other and to external networks. Customers must decide which parts of Native Hybrid Cloud are allowed access to external networks. The site survey conducted by Dell EMC Professional Services determines port numbers that must remain open.

Firewall and internet proxy considerations

PCF supports a deployment environment that is protected by a customer-provided firewall.

Preparing Your Firewall for Deploying Pivotal Cloud Foundry on Pivotal's website provides instructions about how to configure your firewall for PCF and how to verify that PCF can resolve DNS entries behind your firewall.

Note

Dell EMC recommends that customers prepare their firewall before Dell EMC Professional Services arrives on site.

PCF relies on accessing external websites to download components that are required in the buildpacks, which compile applications that are pushed to PCF. If access to external websites from the PCF network is not possible, use offline or custom buildpacks. Working with Custom Buildpacks on Pivotal's website provides more information.
DNS considerations

Native Hybrid Cloud relies on an external customer-supplied DNS service for its application name resolution. The DNS service must be provided through an existing customer DNS.

An existing customer DNS server must be configured with at least one wildcard DNS domain, such as *.nhc.example.com, to facilitate the publishing to and access of applications hosted by Native Hybrid Cloud. Verify PCF Resolves DNS Entries Behind a Firewall on Pivotal’s website provides more information.

Note

For production deployments, if the system and applications must be separate, Dell EMC recommends that you use two wildcard domains.

Load balancer considerations

The typical PCF deployment for lab and test environments uses a single internal instance of HAProxy. Production environments use a highly-available and customer-provided load balancing solution for forwarding application traffic to the Elastic Runtime router IP address.

The customer-provided external load balancer must:

- Provide load balancing to each of the PCF router IP addresses.
- Support SSL termination with a wildcard DNS location.
- Insert appropriate X-Forwarded-For and X-Forwarded-Proto HTTP headers to incoming requests.
- Optionally, support WebSockets for application logging with PCF Loggregator. The Loggregator Guide for Cloud Foundry Operators on Pivotal’s website provides more information.

Dell EMC recommends using a load balancer with the ECS platform. Options include manual assignment of data node IP addresses to applications; and physical, virtual, and geographic load balancing.

Integration with existing IT infrastructure

Dell EMC Professional Services performs the Native Hybrid Cloud integration with both the VxRail Appliance or VxRack System and existing customer IT infrastructure, including existing ECS deployments.

The service includes integrating or installing the following services:

- SSO and LDAP servers
- DNS and NTP servers
- Customer's load balancer
- Customer's SSL certificates and SSL ciphers
- MySQL database, if a customer is only using external databases for PCF
- Customer's log aggregators
SMTP endpoints

Integration with external identity providers

Native Hybrid Cloud uses local accounts for the Native Hybrid Cloud Controller virtual machine. Dell EMC Professional Services can help you integrate Native Hybrid Cloud with external identity providers (IDPs) such as Microsoft Active Directory.

**Note**

Integration with external identity providers is not part of the standard Native Hybrid Cloud deployment and can be performed post-deployment by Dell EMC Professional Services.

**VxRail Appliance or VxRack System IDP integration**

VMware vSphere users are defined in an identity source. You can register more than one identity source with the VMware vSphere Web Client. Customers have several identity source options:

- A directory service such as Active Directory or OpenLDAP, and open source implementation of the Lightweight Directory Access Protocol (LDAP)
- A database that is internal to the system where VMware vCenter Single Sign-On is installed
- Operating-system users that are local to the system where vCenter Single Sign-On is installed

**Pivotal Cloud Foundry IDP integration**

Dell EMC Professional Services can connect PCF Elastic Runtime to a customer's Active Directory services by integrating the Cloud Foundry User Account and Authentication (UAA) server with LDAP. The Cloud Foundry UAA server provides identity management for Elastic Runtime in several ways:

- Issues tokens for use by client applications when they act on behalf of Elastic Runtime users
- Authenticates users with their Elastic Runtime credentials
- Acts as a single sign-on (SSO) service using Elastic Runtime or other credentials

UAA can be integrated with an LDAP server. Connecting Elastic Runtime to LDAP enables the UAA to authenticate users via LDAP search and bind operations.
This chapter presents the following topics:

- Scaling compute and storage resources for Native Hybrid Cloud
- Scaling Pivotal Cloud Foundry
Scaling compute and storage resources for Native Hybrid Cloud

You can add additional resources to Native Hybrid Cloud by adding compute and storage resources to the VxRail Appliance or VxRack System layers.

You can add compute and storage capacity to an existing vSphere cluster or as a new independent vSphere cluster. When you add new VxRail Appliances or VxRack Systems to an existing cluster, their compute resources are automatically added to the cluster and their disks are added to the existing vSAN datastore.

You might be required to add storage capacity to ECS when you add storage resources.

When VxRail or VxRack resources are added to the existing infrastructure and to vCenter, PCF Ops Manager can immediately use the added resources to scale out the PCF environment. Adding resources can include adding nodes to each VxRail Appliance server or adding VxRail Appliance or VxRack System servers to create additional clusters. For example, multiple availability zones require more than one vSphere cluster.

A VxRail Manager administrator can add VxRail nodes or VxRail Appliances to an existing VxRail deployment. When a VxRail Appliance is added, it is discovered through VxRail Manager and added through the VxRay Manager interface.

**Note**

Contact Dell EMC Professional Services for assistance with adding VxRail Appliances or nodes or VxRack Systems.

Scaling storage resources on VxRack FLEX

Dell EMC Professional Services creates the initial ScaleIO volumes and datastores for Native Hybrid Cloud on VxRack FLEX. When you need more storage capacity, you can create additional ScaleIO volumes in vSphere, and create new vSphere datastores from those volumes. Then you can update PCF Ops Manager with the new datastore to scale out storage for Pivotal Cloud Foundry.

Scaling Pivotal Cloud Foundry

PCF offers several scaling strategies that increase the capacity and availability of the PCF platform and the applications deployed on the platform, and decrease the chances of downtime.

The strategies include:

- Scaling out or scaling up the PCF platform and its components
- Scaling out applications
- Scaling out services

[Scalable Components](#) on Pivotal's website provides more information.
Scaling Pivotal Cloud Foundry platform components

You can scale out the PCF platform to deploy multiple instances of platform components to achieve redundancy. 

Scaling Elastic Runtime on Pivotal's website provides more information.

Scaling Pivotal Cloud Foundry applications

Factors such as user workload can change the amount of disk space and memory that an application uses. For many applications, increasing the available disk space or memory can improve overall performance. Similarly, running additional instances of an application can enable the application to handle increased user workload and concurrent requests.

Applications deployed on PCF can be scaled up in size by increasing CPU, memory, and storage. PCF also enables you to scale out an application by creating multiple instances of an application.

When you scale out an application, incoming requests to an application are automatically load balanced across all instances, and each instance handles tasks in parallel with every other instance. Adding more instances enables an application to handle increased use and network traffic.

You can scale out applications deployed on PCF in the following ways:

- Using the Pivotal Apps Manager console, as shown in the following figures
- Using the `cf scale` command in the PCF command-line interface

The menu shows the autoscaling option when you connect to the Pivotal Apps Manager console.

![Figure 6 Autoscaling page](image)

The autoscaling page contains a list of installed applications. Click an application to view the Overview tab, as shown in the following figure. Here you can scale the number of application instances.
Scaling Hardware and Software

**Figure 7** Scaling an application

Scaling an Application Using cf scale on Pivotal's website provides more information.

**Scaling Pivotal Cloud Foundry managed services**

Managed services, which are integrated with PCF by using APIs, enable users to provision reserved resources and credentials on demand.

PCF offers managed services that enable users to provision on-demand reserved resources, as shown in the following figure. Examples of reserved resources include databases on a shared or dedicated server, or accounts on a software-as-a-service (SaaS) application. These resources are called *service instances* and the systems that deliver and operate these resources are called *services*.

Service instances are bound to applications using service brokers. A service broker can provide additional instances of a service to serve multiple application instances.

*Services* on Pivotal's website provides more information.
Figure 8 Pivotal Cloud Foundry managed services

Pivotal Cloud Foundry Elastic Runtime

Cloud Controller API
- Provision
- Bind
- Unbind
- Deprovision

Cloud Controller database

Service broker API
- Catalog
- Provision
- Bind
- Unbind
- Deprovision

Application environment
- VCAP_SERVICES
  - Inst0: URL, credentials
- Inst1: URL, credentials

Application A

Application B

Service broker

Service instance 0

Service instance 1

Service back end
CHAPTER 5

High Availability

This chapter presents the following topics:

- High availability with multiple sites and multiple availability zones ..................34
- VxRail and Pivotal Cloud Foundry scale-out for high availability ....................36
- Multiple-site, multiple Native Hybrid Cloud Foundation deployment .............36
High availability with multiple sites and multiple availability zones

Multiple Native Hybrid Cloud deployments across multiple sites with multiple availability zones (AZs) provide a highly available development platform and ensure that the platform is available if one site or AZ fails.

Note

This type of deployment is only available for Native Hybrid Cloud deployed on VxRail Appliances.

In this deployment, PCF is installed in two separate locations, and the S3 bucket for the Pivotal Blobstore is replicated between both locations. Native Hybrid Cloud runs at each site, and each site has a separate ECS Appliance and Native Hybrid Cloud Monitoring and Reporting deployment. Each of these deployments is unique to its respective site and no cross-site data replication or monitoring is provided by Native Hybrid Cloud or PCF.

Spreading components across AZs to a sufficient level of redundancy maintains high availability during upgrades or outages and helps prevent downtime. AZs enable operators to balance running applications across multiple deployments at a single site. If one zone fails, application instances continue uninterrupted in another zone.

A multisite, multifoundation, multi-AZ deployment can survive site and AZ failure while maintaining PCF Elastic Runtime availability. In the case of a site or AZ failure, developers continue to have access to their development platform and applications continue to function.

If a VxRail Appliance fails at a site, Native Hybrid Cloud virtual machines can be restored to a point-in-time backup on the secondary or tertiary vSphere clusters. The Pivotal Blobstore remains constantly available at each site as ECS replicates the Blobstore contents at each site. In the event of a site failure, applications continue to run and new applications continue to be pushed.

A customer's continuous integration and continuous deployment (CI/CD) pipeline ensures that applications are simultaneously pushed to both sites. Access to applications is load balanced across both locations using an external load balancer, and applications remain available in the case of a single site failure. Data services external to Native Hybrid Cloud can provide persistent data replication for PCF applications.

Existing customer geo-replicated data services, such as Cassandra or Oracle databases, can provide persistent data replication for applications. Native Hybrid Cloud Foundations and applications remain current and available in case of a single site failure.

The following diagram outlines the architecture for this deployment.
Figure 9 Multiple Native Hybrid Cloud deployments across multiple sites with multiple AZs
VxRail and Pivotal Cloud Foundry scale-out for high availability

The configuration of multiple PCF AZs enables true high availability across AZs. Each VxRail Appliance can be deployed as a separate vSphere and vSAN cluster, which allows each new cluster to act as a new PCF availability zone (AZ).

Multiple-site, multiple Native Hybrid Cloud Foundation deployment

Native Hybrid Cloud can be deployed across multiple sites with multiple Native Hybrid Cloud Foundations to support high availability (HA).

Note

This type of deployment is only available for Native Hybrid Cloud deployed on VxRack Systems.

This HA scenario deploys Native Hybrid Cloud and PCF to a single availability zones (AZs) and vSphere cluster per site. HA for each site is enabled by native VMware HA capabilities. In this type of deployment, Native Hybrid Cloud Foundation is deployed at two geographically diverse sites. Each Native Hybrid Cloud Foundation is completely independent of the other site, and no Native Hybrid Cloud or PCF data synchronization is performed between sites.

In this deployment, PCF is installed in two separate locations, and the S3 bucket for the Pivotal Blobstore is replicated between both locations. Native Hybrid Cloud runs at each site and each site has a separate ECS Appliance and Native Hybrid Cloud Monitoring and Reporting deployment. Each of these are unique to their respective sites and no cross-site data replication or monitoring is provided by Native Hybrid Cloud or PCF.

With a highly available, multiple site, multiple Native Hybrid Cloud Foundation deployment providing full PCF HA across multiple sites, developers can create, test, deploy, and update applications without interruption. The infrastructure and platform environment is always available, so applications are always available to end users.

A customer's continuous integration and deployment pipeline (CI/CD) ensures that applications are simultaneously pushed to both sites. Access to applications is load balanced across both locations using an external load balancer, and applications remain available in the case of a single site failure. Persistent data replication for PCF applications can be provided by data services external to Native Hybrid Cloud.

Persistent data replication for applications can be provided by existing customer georeplicated data services such as Cassandra or Oracle databases, so that Native Hybrid Cloud Foundations and applications remain current and available in case of single-site failure.

The following diagram outlines the architecture for this deployment.
Figure 10 Multiple site deployment

**SITE A**
- External vCenter Server
- vSphere Cluster 1
  - Native Hybrid Cloud Controller
  - Native Hybrid Cloud Monitoring and Reporting
  - PCF Ops Manager
  - PCF Ops Manager Director
  - PCF Ops Elastic Runtime

**SITE B**
- External vCenter Server
- vSphere Cluster 2
  - Native Hybrid Cloud Controller
  - Native Hybrid Cloud Monitoring and Reporting
  - PCF Ops Manager
  - PCF Ops Manager Director
  - PCF Ops Elastic Runtime

**Customer CI/CD pipeline to push to both sites**

**Customer-provided persistent data replication for Pivotal applications**

**Dual cross-site replication of Native Hybrid Cloud buckets**

- Native Hybrid Cloud Foundation site 1 buckets
- Native Hybrid Cloud Foundation site 2 backup replica

- Native Hybrid Cloud Foundation site 2 buckets
- Native Hybrid Cloud Foundation site 1 backup replica
CHAPTER 6

Native Hybrid Cloud Monitoring and Reporting

This chapter presents the following topics:

- **Overview** .......................................................... 40
- **Monitoring and Reporting architecture** .................. 41
- **SolutionPacks and Collectors** .............................. 42
- **Dashboards** ...................................................... 44
- **Reports** .......................................................... 45
Overview

Native Hybrid Cloud Monitoring and Reporting is an embedded software technology that is common across Dell EMC ViPR, Dell EMC ViPR SRM, and Dell EMC Service Assurance Suite. By using common technology, Dell EMC provides customers with a consistent look, feel, and experience as they use these products together to manage their data center. The common technology also simplifies deployment, ongoing maintenance, and resource use.

Native Hybrid Cloud Monitoring and Reporting resource management software provides the following benefits:

- Provides comprehensive monitoring, reporting, and analysis for heterogeneous physical and virtual environments.
- Enables IT personnel to visualize relationships; analyze and report on capacity, performance, and health; and optimize resources in traditional and software-defined environments.
- Provides the core of an out-of-the-box monitoring and reporting solution that you can customize and scale based on your environment and performance requirements.
- Includes SolutionPacks that are customized to support a wide variety of Dell EMC and third-party devices, hosts, and networks.
- Along with PCF metrics, helps you analyze health, configuration, and capacity growth. You can quickly spot SLA problems through custom dashboards and reports that meet the needs of a wide range of users and roles.
- Enables you to view capacity consumption across your PCF deployment with built-in views to help you understand capacity utilization and future requirements.
- Increases cost transparency through multitenant, chargeback, or show-back reporting.

PCF JMX Bridge helps operators and developers better understand the health and performance of the PCF platform and all applications running on it. It includes Java Management Extensions (JMX) Bridge for Elastic Runtime. PCF Metrics collects and exposes system data from PCF components through a JMX endpoint to help you monitor your installation and assist in troubleshooting.

The following figure illustrates the metrics collection.
Monitoring and Reporting architecture

All Native Hybrid Cloud Monitoring and Reporting components, including the front end, primary back end, and collectors, reside on a single virtual machine.

The components use built-in Solution Packs and Collectors, including:

- Generic Host Solution Pack for monitoring all Native Hybrid Cloud virtual machines
- JMX collector for data collection from PCF Metrics
- Stream collector for data collection from PCF Ops Manager REST API
- Native Hybrid Cloud Monitoring and Reporting Health Collector

The following figure shows the Native Hybrid Cloud Monitoring and Reporting architecture.
SolutionPacks and Collectors

A SolutionPack is an installable application that provides data collection and reporting capabilities for specific entities in your infrastructure.

SolutionPacks provide a list of reports, preconfigured alerts, and automation required for Native Hybrid Cloud Monitoring and Reporting dependencies to monitor the managed infrastructure's performance.

The SolutionPack Center makes updating a SolutionPack or changing a configuration, such as device credentials, as simple as picking applications from an application store. SolutionPacks support server, application, and virtualization systems along with many common third-party infrastructure components.

Collectors retrieve raw data from multiple sources. Collectors can easily be scaled and deployed as business needs grow.
Generic Host SolutionPack

The Generic Host SolutionPack discovers and monitors physical and virtual servers and provides a global view of hosts in a data center.

This SolutionPack provides reports and alerts for host and storage capacity utilization and performance measurements. The Host Enterprise Dashboard provides the following Generic Host reports:

- Host information and details
- Performance metrics such as CPU, memory, and disks for host devices
- File systems summary report
- Local and remote disk capacity reports

Health Monitor SolutionPack

The Native Hybrid Cloud Monitoring and Reporting Health Monitor SolutionPack monitors the health of your Native Hybrid Cloud Monitoring and Reporting infrastructure to keep the monitoring and reporting services at optimal performance levels. The Health Monitor SolutionPack provides instant access to performance data, reports, and alerts.

Native Hybrid Cloud Monitoring and Reporting Health main reports include:

- Modules performance
- Collecting-level performance
- Back-end and database events and utilization
- Server summary

Native Hybrid Cloud Monitoring and Reporting Health metrics include:

- Collectors
- Event processing manager
- Back ends
- Tomcat and front end
- Databases

JMX Collector

The JMX Collector collects raw values from JMX-enabled applications, such as JMX Bridge. The JMX Collector generates raw values and properties from MBean (managed beans, part of the JMX API) attribute values and uses regular expressions to transform values obtained from attributes and operations. You can apply multiple transformations on the same value.

Stream Collector

The Stream Collector imports data from various text-based sources using text streaming APIs.

Unlike other text-based collectors, it parses data as it is received, instead of storing all the data in memory before parsing it.
The Stream Collector retrieves absolute values for PCF virtual machine memory, virtual CPUs, and ephemeral and persistent disks. It also retrieves the PCF application chargeback information.

Dashboards

The Native Hybrid Cloud Monitoring and Reporting user interface provides end-to-end visibility into the performance, health, availability, and configuration of infrastructure; this visibility includes hosts, storage, adapters, and switches.

You can also view virtual storage, storage chargeback, and capacity for object and file storage. The following figure shows an example of a failure and alerts dashboard.

Figure 13 Native Hybrid Cloud Monitoring and Reporting dashboard

The following figure shows the Native Hybrid Cloud Monitoring and Reporting Health dashboard, which displays a summary of component health. Green, yellow, and red indicate, respectively, good health, potential problems, and components that need immediate attention.
**Reports**

The Native Hybrid Cloud report library includes reports for logs, PCF runtime resources and operations, chargeback, and PCF health.

The following information is available through various reports, alerts, and dashboards:

- **Alerts**—Alert summaries, components with critical alerts, and high impact alerts
- **Chargeback reports**—Chargeback by organization, space, service plan, and application
- **Health reports**—Host information, storage use, vCPU use, memory use, and database health
- **Blobstore alerts and reports**—ECS health reports and alerts, CloudController health, and etcd key-value health
- **Applications and dashboard overviews**—Organizational summaries by space, service, applications, users, and quotas
- **Space reports**—Services, service plans, and application summaries
- **Service summaries**—Reports for service plans, buildpacks, Droplets, and users
• Monitoring and Reporting dashboard that shows:
  ▪ Alert summaries and alert summary history
  ▪ Total PCF resource consumption
  ▪ Free resource availability
  ▪ Space and organization resource utilization
  ▪ Storage capacity
  ▪ Resource consumption by the top five applications and organizations
  ▪ Log files

• PCF Operations runtime resources reports that include:
  ▪ A heatmap of PCF components by health and alerts
  ▪ CloudController health
  ▪ Droplet health, performance, and status
  ▪ DopplerServer health
  ▪ Application health
  ▪ Loggregator health
  ▪ Router health and performance
  ▪ Collector performance
  ▪ etcd key-value store health
  ▪ UAA health

• PCF runtime resources monitoring—PCF virtual machine runtime resources reports for vCPU, memory, and storage

The following figure shows the Native Hybrid Cloud Reports dashboard.
Custom reports

Native Hybrid Cloud Monitoring and Reporting reports enable operators to combine information from various existing reports into a customized report that is specific to your enterprise.

You can edit report definitions, including timespans and sampling types, and make customizations visible to other users.

The pinned reports feature enables you to create reports that suit your needs by reusing existing tables and graphs and combining them onto a single customized report. Each pinned report becomes an element on the customized report. You can rearrange those elements in the My Reports node.

The My Reports node is a workspace for creating customized reports and testing changes before making the reports available to other users. In a fresh installation, this node might not be available until you create a report. When the customized report is ready, you can make it visible to other users by placing it in a new location in the report tree.

Additional report customization features are available in Edit mode. This mode lets you change items such as the style of the report graphs, the frequency of displayed samples, and the range of data to be included. Your changes are saved in the original report and are visible to all users immediately after you apply them. The changes apply to all views of the report, whether the report is viewed from its original location in the report tree or pinned as an element in a customized report.
Edit mode also permits more advanced operations, such as applying filters and expansions, creating formulas for new statistics, and defining new reports. You can export and schedule customized reports as you would existing reports.

Scheduled reports

Scheduled reports are generated according to a schedule you set. Using scheduled reports enables you to run a report on a regular basis, according to your specification (for example, offload, off-hours, sent by mail, stored, and so on). You can choose and adjust the report so it displays the information that you need and set various parameters of a scheduled report. You can export reports in a wide variety of standard formats and share them using email or a URL.

Thresholds

Native Hybrid Cloud Monitoring and Reporting uses threshold settings to apply visual cues to values that fall within defined ranges. When a value’s threshold is breached or it falls outside of the defined range, an alert is generated. The visual cues are for informational purposes only. They do not have any other effects in the reporting system. The visual cues can enhance your interpretation of the metrics. For example, they can:

- Help you classify the data
- Draw attention to high or low values
- Provide reassurance that connections or availability are working
- Provide additional information useful in your working environment

Some reports include predefined thresholds. You can edit existing threshold boundaries and threshold types, add new thresholds, and delete thresholds. The following figure shows the memory utilization report with Major (70%) and Critical (90%) threshold lines.
Alerts

Native Hybrid Cloud Monitoring and Reporting generates threshold alerts based on metric data that is consolidated from external sources.

Enable the threshold alert definitions for each source. You can use the default alert definitions or create and then enable a custom definition.

Alert reports support features that allow you to examine data in greater detail:

- From the summary-level bar and pie charts, you can click a bar or a section in a pie chart to open a tabular report that lists the alerts in the summarized category.
- From most of the tabular reports, you can click a row in the table to open a detailed report for a single alert.

When an alert recurs, the latest alert is displayed in a report and the state of the existing alert changes from ACTIVE to INACTIVE. When an alert becomes INACTIVE, it is automatically closed.

Administrators can mark alerts as acknowledged and take ownership of alerts. These actions are convenient, optional ways to track and organize alerts:

- When a MOMENTARY alert is acknowledged, the state of the alert changes from ACTIVE to INACTIVE and the alert is closed. Closed alerts are not available on the All Alerts report.
- When a DURABLE alert is acknowledged, it remains ACTIVE and remains on the alerts reports with Yes in the ACK column.

The following figure shows the Native Hybrid Cloud Alerts dashboard.
Active Directory and LDAP server integration for reporting

Native Hybrid Cloud Monitoring and Reporting uses a Java interface that is contained within Apache Tomcat to connect to an external managed-security server such as Active Directory or LDAP servers.

This interface consists of multiple plug-ins that support connections to different types of user access databases. JNDIRealm is the plug-in that is used for LDAP server integration.

Realm is a database that Tomcat uses to identify authorized web application users. The default realm in ViPR SRM is a local realm. In a local realm, the user accounts and roles are stored in the local master database.

LDAP authentication mechanisms rely on the JNDI Directory Realm. Java Naming and Directory Interface (JNDI) is a set of APIs that is used to interact with naming services and directory services. When connecting with an LDAP user, Native Hybrid Cloud Monitoring and Reporting creates a user entry in the local database and classifies the user as an external user so that the administrator can add access rights.
CHAPTER 7

Logging

This chapter presents the following topics:

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- Loggregator ................................................................................................. 52
- Native Hybrid Cloud logging ....................................................................... 52
Introduction

Native Hybrid Cloud logging capabilities are an integral part of the existing customer logging technologies and process.

In addition to the existing PCF log aggregation features, Native Hybrid Cloud also uses open-source tools such as Elasticsearch, Logstash, and Kibana. Native Hybrid Cloud also includes preconfigured log filters and dashboards to simplify the analysis of event logs and log-based troubleshooting.

Loggregator

Loggregator, the PCF component that is responsible for logging, provides a stream of log output from your application and from PCF system components that interact with your application during updates and execution.

Overview of the Loggregator System on Pivotal's website provides more information.

By default, Loggregator streams logs to your terminal. To retain more than the limited amount of logging information that Loggregator can buffer, Native Hybrid Cloud uses the Elastic Stack (Elasticsearch, Logstash, and Kibana) to collect, analyze, and display logs for management and operational analysis. The logs that are visualized in Kibana are presented to the user by a Native Hybrid Cloud Monitoring and Reporting report that is configured as an external report type.

Native Hybrid Cloud logging

Native Hybrid Cloud logging uses the Elastic platform of open-source projects that enables you to search, analyze, and visualize your data, and get actionable insight in real time.

Elasticsearch

Elasticsearch is a distributed open-source search and analytics engine, designed for horizontal scalability, reliability, and easy management. It combines search capabilities and powerful analytics with a sophisticated, developer-friendly query language covering structured, unstructured, and time-series data.

Elasticsearch is based on Apache Lucene. It provides a distributed, multitenant-capable full-text search engine with a RESTful web interface and schema-free JSON documents. Based on a Performance and Scale (P&S) evaluation of Elasticsearch, Dell EMC Professional Services might require fewer or more Elasticsearch server nodes. These server nodes house the search service and its indexes and databases.

Logstash

Logstash is a flexible, open-source data collection, enrichment, and transportation pipeline.

Logstash receives, processes, and produces logs using integrated connectors to common infrastructure. Logstash also presents a powerful pipeline for log storage, query, and analysis. Logstash is designed to efficiently process a growing list of log, event, and unstructured data sources for distribution into a variety of outputs, including Elasticsearch.
Logstash runs a Native Hybrid Cloud Monitoring and Reporting node inside a container. Logstash must be dynamically configured to communicate to a corresponding Elasticsearch service and Native Hybrid Cloud Monitoring and Reporting service.

**Kibana**

Kibana is an open-source data visualization platform for Elasticsearch that enables you to graphically interact with your data.

Kibana provides indexed log content on an Elasticsearch cluster. You can create bar charts, line and scatter plots, and pie charts and maps from large volumes of logs. Kibana's browser-based interface enables you to quickly create and share dynamic dashboards that display changes to Elasticsearch queries in real time.

You can construct search result visualizations on the **Visualization** page. Each visualization is associated with a search. The Kibana User Guide provides more information about configuring log visualization with Kibana.
Logging
CHAPTER 8

Data Protection

This chapter presents the following topics:

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- Pivotal Cloud Foundry data protection ............................................................... 56
- Native Hybrid Cloud Foundation data protection .............................................. 56
Introduction

The built-in capabilities of PCF, Native Hybrid Cloud, VxRail Appliance or VxRack System with vSphere, and ECS provide data protection and recovery functionality.

Native Hybrid Cloud uses native vSphere clones to back up its virtual machines and creates full clones of the Native Hybrid Cloud Controller and Monitoring and Reporting virtual machines. The clones capture any changes made by or for customers, including scheduling and reporting changes.

Pivotal Cloud Foundry data protection

Pivotal documentation provides backup and restore procedures.

Back up Pivotal Cloud Foundry on Pivotal's website describes the procedure for manually backing up each critical back-end Elastic Runtime component.

The PCF backup procedures include steps to export installation settings, download the BOSH Deployment Manifest, temporarily stop the Cloud Controller, create and export backup files for each critical backend component, and restart the Cloud Controller. Dell EMC Professional Services or an expert administrator can perform these procedures.

Pivotal recommends that you frequently back up your installation settings before making changes to your PCF deployment, such as changing the configuration of any tiles in PCF Ops Manager.

Restore Pivotal Cloud Foundry from Backup on Pivotal's website provides instructions for restoring Elastic Runtime. The PCF backup procedures include steps to import installation settings, temporarily stop the Cloud Controller, restore the state of each critical back-end component from its backup file, and then restart the Cloud Controller.

Native Hybrid Cloud Foundation data protection

The Native Hybrid Cloud Controller and Monitoring and Reporting systems are backed up automatically.

The Native Hybrid Cloud Controller virtual machine is protected by creating full vSphere clones at a customer-specified interval, which is typically once daily. These virtual-machine clone templates are stored in a datastore that is specified during the Native Hybrid Cloud installation.

Native Hybrid Cloud Monitoring and Reporting is deployed as a virtual machine. Daily backups, using full virtual machine clones, ensure the backup of all required files to restore the Monitoring and Reporting virtual machine in case of loss or failure.

Native Hybrid Cloud creates a backup schedule for the Native Hybrid Cloud Monitoring and Reporting virtual machine. The backup schedule preserves the historical data that is collected by Native Hybrid Cloud Monitoring and Reporting.

Note

Only the last Native Hybrid Cloud Controller and Monitoring and Reporting virtual machine backups are retained.
CHAPTER 9

Conclusion

This chapter presents the following topic:

- Conclusion................................................................. 58
Conclusion

Reducing IT operational expenditures while simultaneously increasing the reliability and capability of application production environments is a top priority for many businesses. Cost, stability, visibility, and ease of use are often key considerations when an enterprise evaluates new technology platforms.

The Native Hybrid Cloud platform with VxRail Appliance or VxRack Systems and PCF provides a flexible application production environment that can economically scale based on a business’s needs. Using Native Hybrid Cloud enables IT organizations to meet or exceed their goals to save money and maintain dependable service with an easily managed application production system. With Native Hybrid Cloud, customers realize the following benefits:

- Decreased costs that are associated with environment scalability
- Greater flexibility in cloud migration
- Rapid provisioning and application deployment and management
- Faster time to market for software applications
- Improved application quality through cloud-based quality-assurance services
- Integrated support for agile software-development practices, and integration with developer environments
- Failure detection and health remediation in addition to monitoring, logs, and metrics
- Single point of contact for support issues
Access to these documents depends on your login credentials. If you do not have access to a document, contact your Dell EMC representative. This chapter presents the following topics:

- Native Hybrid Cloud documentation ................................................................. 60
- VxRail Appliance documentation ................................................................. 60
- VxRack System documentation ................................................................. 60
- Pivotal Cloud Foundry documentation ................................................................. 60
- Native Hybrid Cloud Monitoring and Reporting documentation ......................... 61
- Elastic Cloud Storage documentation ................................................................. 61
Native Hybrid Cloud documentation

The following document, available at [EMC.com](http://EMC.com), provides additional and relevant information:

- Dell EMC Native Hybrid Cloud Solution Overview

VxRail Appliance documentation

The following documents and web pages, available at Dell EMC Online Support, [EMC.com](http://EMC.com), and [VMware.com](http://VMware.com) provide additional information:

- VxRail Appliance 4.0 Release Notes
- Dell EMC VxRail Appliance 4.0 Administration Guide
- Dell EMC VxRail Appliance: Hyper-Converged Infrastructure Appliance from Dell EMC and VMware Techbook
- VxRail Appliance Documentation
- VMware vSAN

VxRack System documentation

The following documents, available at [EMC.com](http://EMC.com), provide additional information:

- VxRack FLEX Data Sheet
- VxRack SDDC Data Sheet
- VxRack System SDDC General and Technical FAQ

Pivotal Cloud Foundry documentation

The following PCF web pages, available at [Pivotal.io](http://Pivotal.io), provide additional information:

- Pivotal Cloud Foundry Documentation Table of Contents
- Using Ops Manager
- Operator's Guide
- Administering and Operating Cloud Foundry
- Using Apps Manager
- Buildpacks
- Preparing Your Firewall for Deploying Pivotal Cloud Foundry
- Working with Custom Buildpacks
- Backing Up Pivotal Cloud Foundry
Native Hybrid Cloud Monitoring and Reporting documentation

The following resources, available on the Dell EMC Community Network or Dell EMC Online Support, provide additional information about the Dell EMC Storage Resource Management Suite, the basis for Native Hybrid Cloud Monitoring and Reporting:

- EMC ViPR SRM Version 4.0.2.0 Administrator Guide
- EMC ViPR SRM 4.0.x Product Documentation Index
- ViPR SRM 4.0.2 - SolutionPack Metrics and Reports Matrix
- Storage Resource Management Suite
- Storage Resource Management Fundamentals e-Learning

Elastic Cloud Storage documentation

The following documents, available at EMC.com, provide additional information about ECS:

- Elastic Cloud Storage Overview and Architecture White Paper
- Elastic Cloud Storage Data Sheet