VCF 9 Design Overview

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Module Overview

Importance

The goals of VCF 9 is to make the design of the infrastructure as simple as possible without compromising availability, security or functionality. By understanding the flow of VCF 9 components, the design library and blueprints, you will learn how to quickly and efficiently design the infrastructure while maintaining simplicity without compromise.

Module Lessons

1. Architectural Options: Overview of VCF components and their available deployment models.
2. Design Library: Detailed requirements and best practices for each component model.
3. Design Blueprints: Pre-defined, end-to-end architecture topologies for common deployment scenarios
4. Planning and Preparation Workbook

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Architectural Options

Learner Objectives

- Understand VCF Components
- Understand Deployment Models

Core Concepts – VCF Fleet, Instances, and Domains

VCF Fleet

- A collection of one or more VCF Instances managed by a single VCF Operations and VCF Automation instance.

- Provides a unified framework for operating and managing resources across your private cloud.

VCF Instance:

- A logical unit containing its own management components (vCenter, NSX Manager, SDDC Manager).

- Can be scaled up to support multiple workload domains.

VCF Domain:

- A logical unit of infrastructure grouping ESX hosts into Clusters, managed by a vCenter.

  - **Management Domain:** The first domain in a VCF Instance; hosts management components.

  - **Workload Domain:** Contains customer workloads with a dedicated vCenter.

VCF Fleet Deployment Models - Availability & Recovery

Tailoring Your Fleet for High Availability and Disaster Recovery

1. **Basic Design (Single Site):**

    *   Ideal for single availability zone deployments.

    *   Relies on vSphere HA for host-level protection. No site-level HA or DR.

2. **Site High Availability (Across Zones):**

    *   Builds on the Basic Design, distributing resources across two fault domains (availability zones).

    *   Provides active-active availability across zones but requires low-latency, high-bandwidth connectivity and stretched IPs.

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VCF Fleet Deployment Models - Availability & Recovery - Cont

Tailoring Your Fleet for High Availability and Disaster Recovery

3. **Disaster Recovery (Across Regions):**

   - Protects against site-wide failures like natural disasters or cyber-attacks

   - Uses a second instance in a separate region for DR, often leveraging tools like VMware Live Recovery.
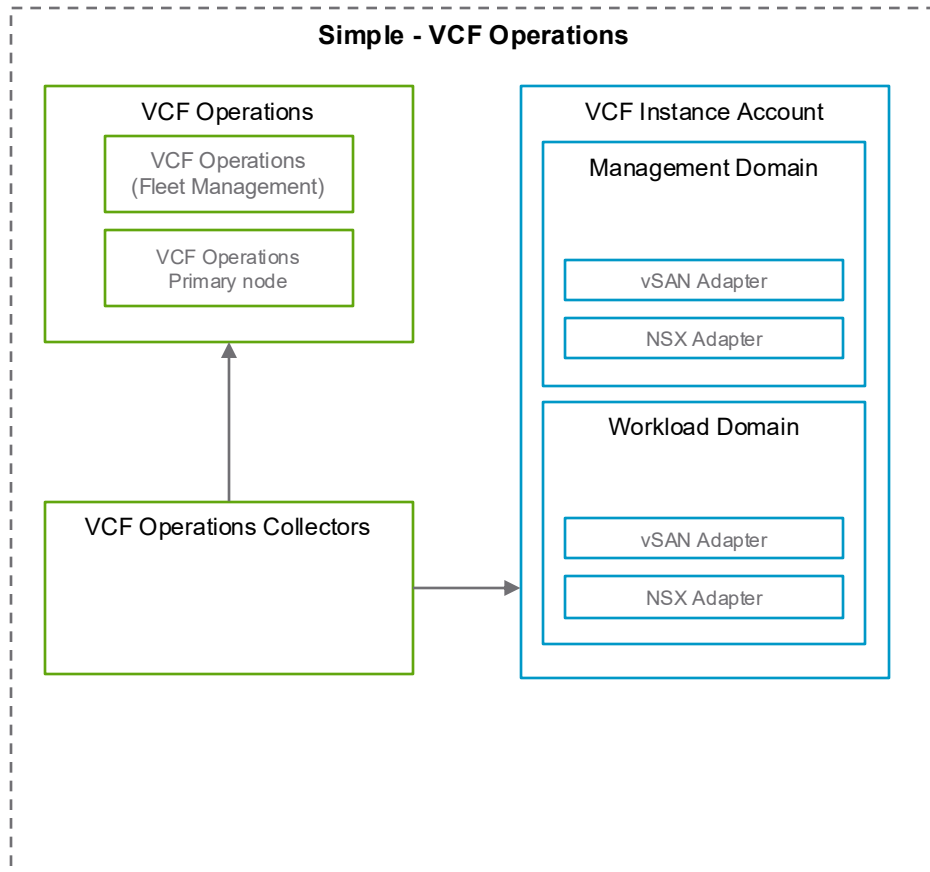
4. **Site High Availability and Disaster Recovery:**

   - The most comprehensive solution, combining site-level HA (fault domains) with cross-region DR.

   - Provides dual-layered protection for mission-critical environments

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VCF Operations Models

- VCF Operations is the central console for operating your VCF fleet.

- Deployment is mandatory, and a model must be selected at install time.

- Three Models Available:

  - Simple Model

  - High Availability (HA) Model

  - Continuous Availability (CA) Model

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VCF Operations Model - Simple

Simple - VCF Operations

VCF Operations
- VCF Operations (Fleet Management)
- VCF Operations Primary node

VCF Operations Collectors

VCF Instance Account

Management Domain
- vSAN Adapter
- NSX Adapter

Workload Domain
- vSAN Adapter
- NSX Adapter

- Simple Model

- Single node with the smallest footprint

- Relies on vSphere HA for availability; slower recovery from failure

VCF Operations Model – Highly Available
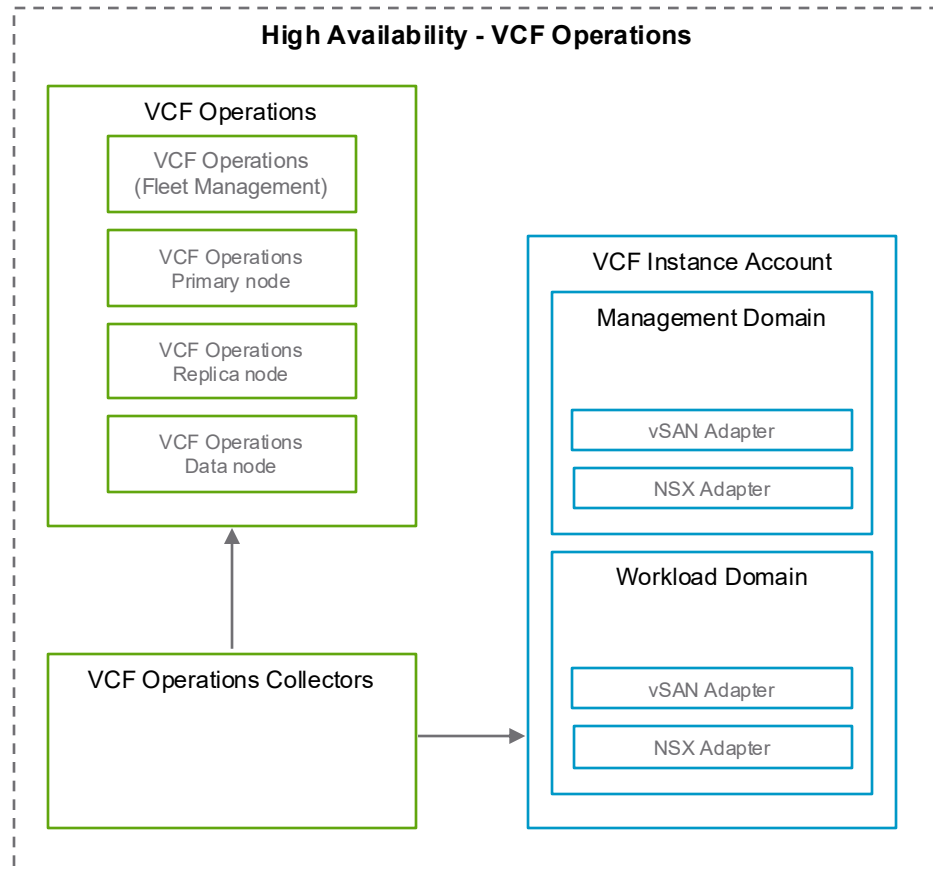
- High Availability (HA) Model

- Three-node cluster (Primary, Replica, Data) for data redundancy and rapid recovery

- Supports an optional external load balancer

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VCF Operations Model – Continuous Availability
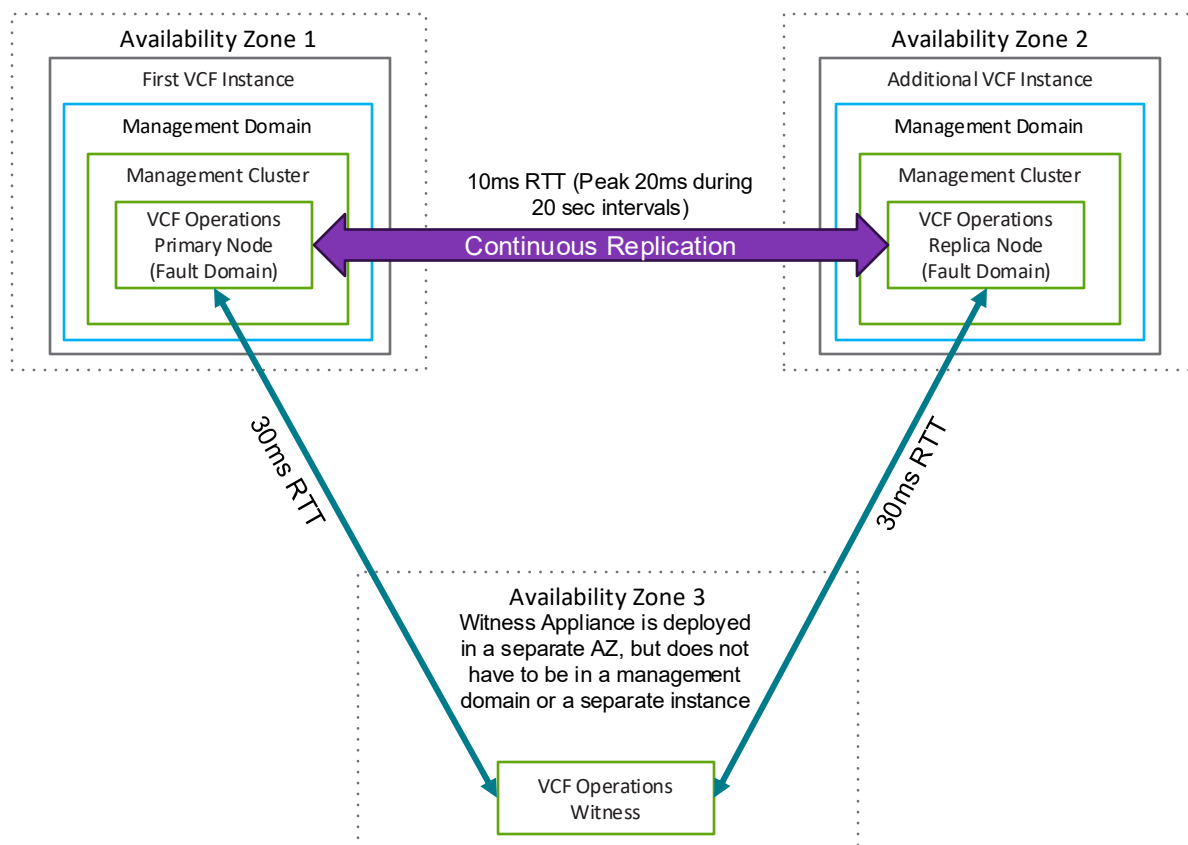
- Continuous Availability (CA) Model

- Nodes are paired across two availability zones for the best service availability

- Requires an additional VCF Instance

- Protects against a single availability zone failure with no service interruption. Requires a separate VCF Instance in the second AZ and latency under 10ms

Availability Zone 1
First VCF Instance
Management Domain
Management Cluster
VCF Operations Primary Node (Fault Domain)

Availability Zone 2
Additional VCF Instance
Management Domain
Management Cluster
VCF Operations Replica Node (Fault Domain)

10ms RTT (Peak 20ms during 20 sec intervals)
Continuous Replication

30ms RTT

30ms RTT

Availability Zone 3
Witness Appliance is deployed in a separate AZ, but does not have to be in a management domain or a separate instance

VCF Operations Witness

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Workload and vSphere Cluster Models

Workload Domain Models:

- Management Domain: Hosts VCF management components. Can also run business workloads.

- Workload Domain: Dedicated resources for customer workloads, with its own vCenter for isolation and independent lifecycle management.

vSphere Cluster Models (within a domain):

- Single-Rack Cluster: Minimal footprint; protects against host failure but not rack failure.

- Layer 2 Multi-Rack Cluster: Spans multiple racks with a stretched L2 network. Protects against host and rack failure.

- Layer 3 Multi-Rack Cluster: Spans multiple racks with routed L3 networking. Offers isolated L2 broadcast domains per rack but has more complex networking needs.

- Stretched Cluster: Spans two availability zones for recovery from host and AZ failures

Storage Models - Choosing the Right Storage for Your VCF Private Cloud

- Principal Storage: Used during the creation of a workload domain or cluster (e.g., vSAN, Fibre Channel, NFSv3).

- Supplemental Storage: Added after creation for data-at-rest or additional workloads (e.g., iSCSI, NVMe/TCP)

Model	Architecture	Key Benefits	Implications
vSAN ESA	Single-tier, NVMe only	High performance, easy to manage, highly scalable.	Requires specific hardware (NVMe) and has CPU/memory overhead.
vSAN OSA	Two-tier (cache/capacity)	Flexible hardware (SATA, SAS, NVMe), highly scalable.	CPU/memory overhead, requires additional network configuration.
Storage Cluster	Disaggregated vSAN ESA	Allows compute and storage to scale independently.	Not recommended for running workloads directly on the storage cluster.
Fibre Channel	External Array	Can leverage existing storage arrays.	Provisioning is not automated by VCF workflows; requires dedicated fabric.
NFS	External Array	Can leverage existing storage arrays.	Provisioning is not automated by VCF workflows; requires additional tools

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Networking Consumption Models

VCF Automation All Apps Orgs Model:

- Consumption via VCF Automation UI/API.

- Provides a standardized, cloud-like experience. Administrator should not interact directly with NSX UI.

Virtual Private Cloud (VPC) Network Virtualization Model:

- Administrator uses vCenter or NSX UI/API to manage NSX VPCs.

- Offers self-service networking for non-specialists and embedded IPAM but cannot be consumed via NSX Global Manager.

NSX Segment Network Virtualization Model:

- Administrator uses NSX UI/API to create logical topologies with full access to advanced features.

- Allows full support for NSX Federation but requires networking-specific knowledge.

VLAN Networking Model:

- Traditional model where VMs connect to VLAN-backed port groups.

- Familiar to vSphere admins but lacks network virtualization benefits and is tightly coupled to the physical fabric

Design Library

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VCF 9 Design Library

VMware Cloud Foundation 9.0

- Architectural Options in VMware Cloud Foundation +
- Design Blueprints for VMware Cloud Foundation +
- Design Library for VMware Cloud Foundation −
  - VCF Operations Detailed Design −
    - Simple VCF Operations Model
    - High Availability VCF Operations Model
    - Continuous Availability VCF Operations Model
    - SDDC Manager Detailed Design
    - VCF Operations for Logs Detailed Design +
    - VCF Operations for Networks Detailed Design +
  - VCF Automation Detailed Design +
  - Workload Domain Detailed Design +
  - vSphere Cluster Detailed Design +
  - VCF Edge Detailed Design +
  - VCF Network Detailed Design +

What is the Design Library?

- A comprehensive collection of detailed requirements and recommendations for each VCF component model.

- It forms the foundation for architectural decisions, providing granular insights.

Key Elements:

- Design Requirements: Mandatory configurations for VCF operation; no deviations allowed.

- Design Recommendations: Best practices, where deviations are permitted but with potential implications.

- Design Choices: Points where an option must be selected, often between elemental models from the library.

Role in VCF Design:

- Provides in-depth design for all architectural options.

- Serves as the source for prescriptive selections made in Design Blueprints.

- Enables customization of blueprints by substituting deployment models.

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VCF 9 Design Library - Example

VMware Cloud Foundation 9.0

English ▾

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Detailed Design

Simple VCF Operations Model

High Availability VCF Operations Model

Continuous Availability VCF Operations Model

SDDC Manager Detailed Design

VCF Operations for Logs Detailed Design ⊞

VCF Operations for Networks Detailed Design ⊞

VCF Automation Detailed Design ⊞

Workload Domain Detailed Design ⊞

vSphere Cluster Detailed Design ⊞

VCF Edge Detailed Design ⊞

VCF Network Detailed Design ⊞

Storage Detailed Design ⊞

vCenter Detailed Design

ESX Detailed Design

External Services Detailed Design ⊞

Information Security Detailed Design ⊞

VCF Identity Broker Detailed Design ⊞

VCF Single Sign-On Detailed Design ⊞

NSX Management and Control Plane Detailed Design ⊞

Network Consumption Models

Workload Networking Detailed Designs ⊞

Continuous Availability VCF Operations Model Design Requirements

Common VCF Operations Design Requirements for All Models

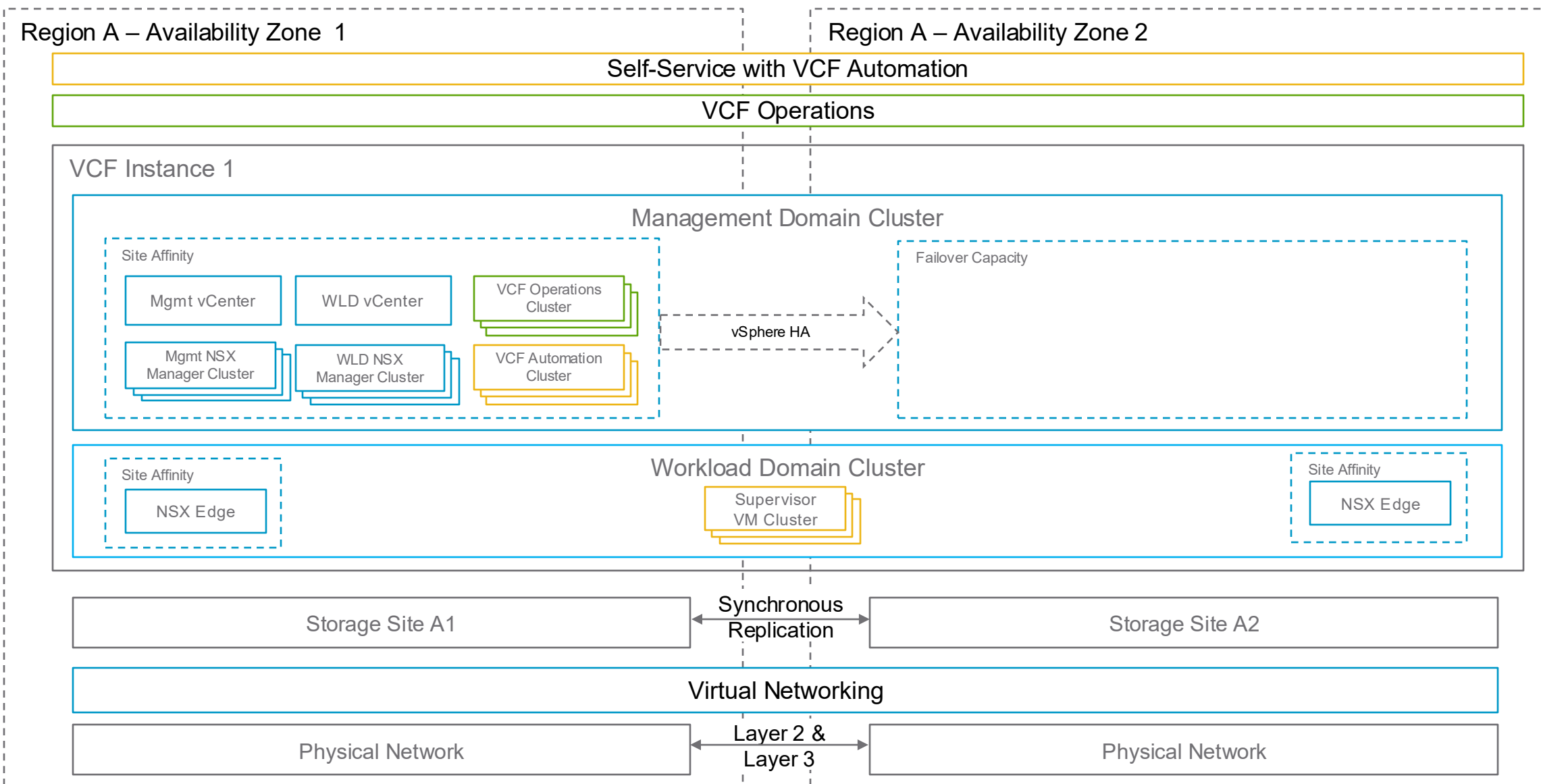| Design Requirement ID	Design Requirement	Justification	Implication
VCF-OPS-REQD-COM-001	Deploy a single VCF Operations fleet management appliance in the default management vSphere cluster.	Provides life cycle management operations for VCF Operations fleet management components.	None.
VCF-OPS-REQD-COM-002	Protect VCF Operations fleet management appliance by using vSphere HA.	Ensures availability of VCF Operations fleet management appliance without requiring manual intervention during an ESX host failure event.	None.
VCF-OPS-REQD-COM-003	Deploy a single VCF Operations collector appliance in the default management vSphere cluster.	• Removes the load from the VCF Operations analytic node(s) from collecting metrics from local-instance applications. • Reuse VCF Operations collectors to gather both logs and metrics across the VCF environment. • Centralized management of logs and metrics, reducing administrative overhead.	You may need to scale-up the VCF Operations collector nodes to a greater size based on the known or forecast virtual machine and object count across each connected VCF Instance to adhere to the scale limits.

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Design Blueprints

VCF Design Blueprints

1. VCF Fleet in a Single Site with Minimal Footprint: Entry-level for small-scale, dev/test; single site, basic host-level HA.

2. VCF Fleet in a Single Site: Enhanced single-site resilience; tolerates host, network path, rack, and management component failures.

3. **VCF Fleet with Multiple Sites in a Single Region: Regional high availability using stretched clusters across multiple sites within one metro area.**

4. **VCF Fleet with Multiple Sites across Multiple Regions: Disaster recovery solution with separate VCF instances in distinct regions.**

5. **VCF Fleet with Multiple Sites in a Single Region plus Additional Region(s): Combines regional HA (stretched clusters) with cross-region disaster recovery for comprehensive protection.**

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VCF Fleet with Multiple Site (Multi-AZ) in a Single Region

Region A – Availability Zone 1 | Region A – Availability Zone 2

Self-Service with VCF Automation

VCF Operations

VCF Instance 1

Management Domain Cluster

Site Affinity

| Mgmt vCenter | WLD vCenter | VCF Operations Cluster |

| Mgmt NSX Manager Cluster | WLD NSX Manager Cluster | VCF Automation Cluster |

vSphere HA →

Failover Capacity

Workload Domain Cluster

Site Affinity

NSX Edge

Supervisor VM Cluster

Site Affinity

NSX Edge

| Storage Site A1 | Synchronous Replication | Storage Site A2 |

Virtual Networking

| Physical Network | Layer 2 & Layer 3 | Physical Network |

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VCF Fleet with Multiple Site (Multi-AZ) in a Single Region – Design Profile

This blueprint targets organizations with a primary data center spanning multiple sites within a single metropolitan area, leveraging stretched clusters for regional high availability.

Design Profile Highlights:

- Physical Site: Multiple sites in a single region with a single VCF instance.

- Availability: Tolerates single ESX host, network path, rack, management component, and single availability zone failures.

- Recoverability: Recovery to a second site for single site loss; backup & restore for region-wide events.

- Consumption: Self-service via VCF Automation, vSphere Supervisor, and direct vCenter.

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VCF Fleet – Multi-Site – Single Region – Key Elements

Key Design Selection Highlights:

- Management & Operations: High Availability models for VCF Automation, VCF Operations, NSX Manager, and Appliance VCF Identity Broker. Fleet-level components on shared management network (VLAN or NSX Segment), VCF Fleet Level Single Sign-On.

- Virtual Infrastructure (Management & Workload Domains):

  - vSphere Cluster: Stretched Cluster Model, spanning two availability zones.

- Storage: vSAN Stretched HCI Cluster Storage Model.

- Distributed Switch: Storage Separation Distributed Switch Model.

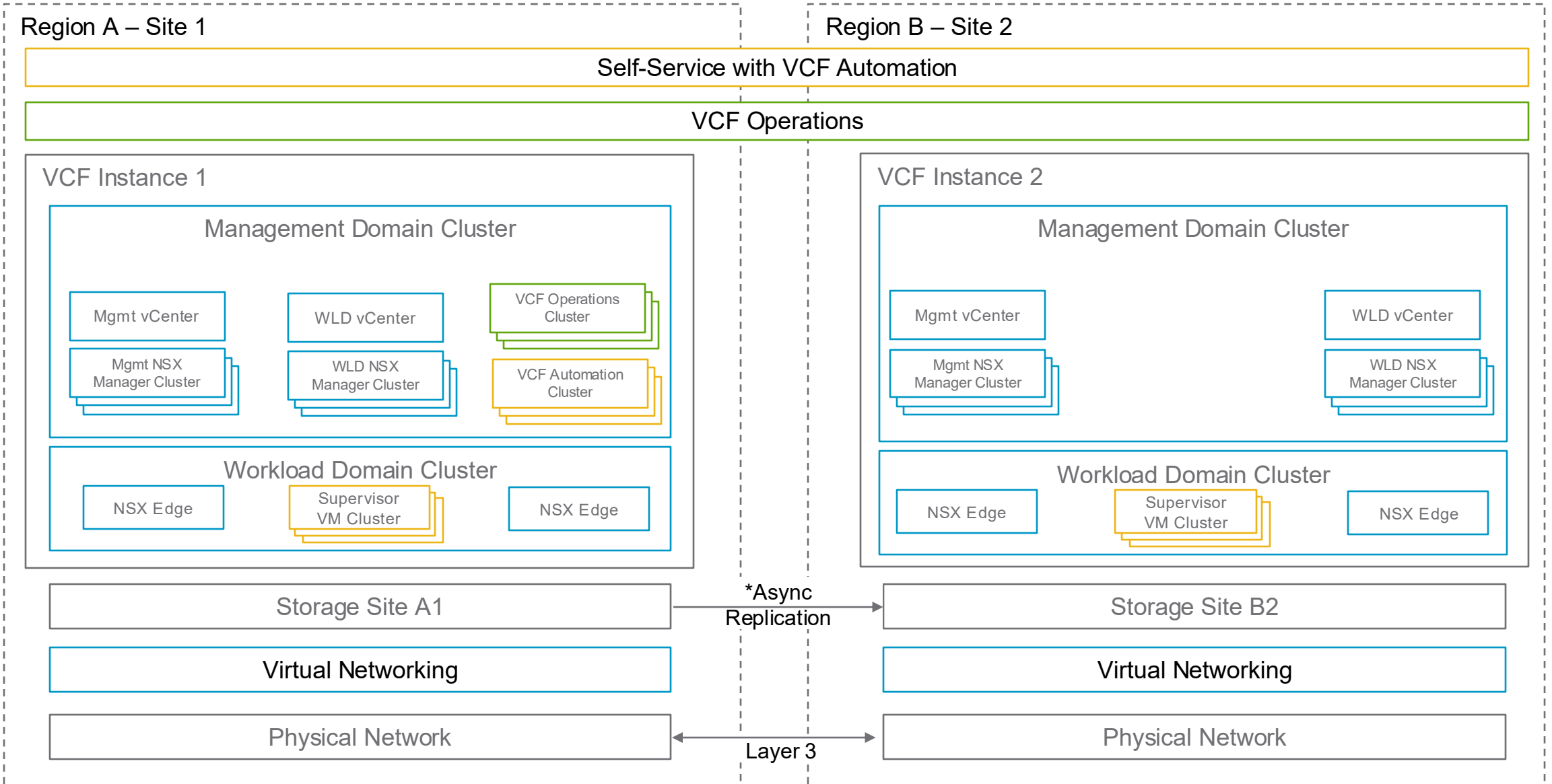- Network Fabric: Multi Availability Zone Network Fabric Model.

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Key Design Selection Highlights:

- Workload Specifics (vSphere Supervisor & Networking):

- vSphere Supervisor: Single Management Zone with Combined Workload Zones, High Availability Control Plane, Supervisor NSX Load Balancer Model.

- Workload Networking: VPC with Full Services Workload Networking Model (Active/Standby Tier-0 Gateway, Centralized Transit Gateway)

- NSX Edge Cluster: Dual Availability Zone Design based on NSX Edge Node HA (independent NSX Edge nodes in each AZ)

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VCF Fleet with Multiple Sites Across Multiple Regions

Region A – Site 1

Region B – Site 2

Self-Service with VCF Automation

VCF Operations

VCF Instance 1

Management Domain Cluster

- Mgmt vCenter
- WLD vCenter
- VCF Operations Cluster
- Mgmt NSX Manager Cluster
- WLD NSX Manager Cluster
- VCF Automation Cluster

Workload Domain Cluster

- NSX Edge
- Supervisor VM Cluster
- NSX Edge

VCF Instance 2

Management Domain Cluster

- Mgmt vCenter
- WLD vCenter
- Mgmt NSX Manager Cluster
- WLD NSX Manager Cluster

Workload Domain Cluster

- NSX Edge
- Supervisor VM Cluster
- NSX Edge

Storage Site A1 → *Async Replication → Storage Site B2

Virtual Networking

Virtual Networking

Physical Network ← Layer 3 → Physical Network

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*Optional data replication

VCF Fleet with Multiple Sites Across Multiple Regions – Design Profile

This blueprint provides comprehensive protection for geographically dispersed operations. Designed for a VCF fleet with sites located in different geographical regions.

Design Profile Highlights:

- Physical Site: Multiple Sites (across multiple regions), typically using Layer 3 networking.

- Availability: Tolerates single ESX host failure and individual network path failure.

- Recoverability: Leverages backup and restore for recovery to the same or another site. Provides a basis for workload data replication and fail-over to a recovery site using tools like VMware Live Recovery.

- Consumption: Self-service via VCF Automation, vSphere Supervisor, direct vCenter access.

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VCF Fleet with Multiple Sites Across Multiple Regions – Key Elements (Management)

Key Design Selections (Management Domain):

- Operations: High Availability VCF Operations Model (three-node cluster); Fleet Level Components on Shared Management Network Model.

- Automation: High Availability VCF Automation Model (three-node cluster).

- Security: Appliance VCF Identity Broker Model; VCF Fleet Level Single Sign-On Model (single IdP for all VCF Instances).

- Infrastructure: Single-Rack Cluster Model for vSphere clusters; Workload Separation Distributed Switch Model; vSAN Single-Rack HCI ESA Storage Model.

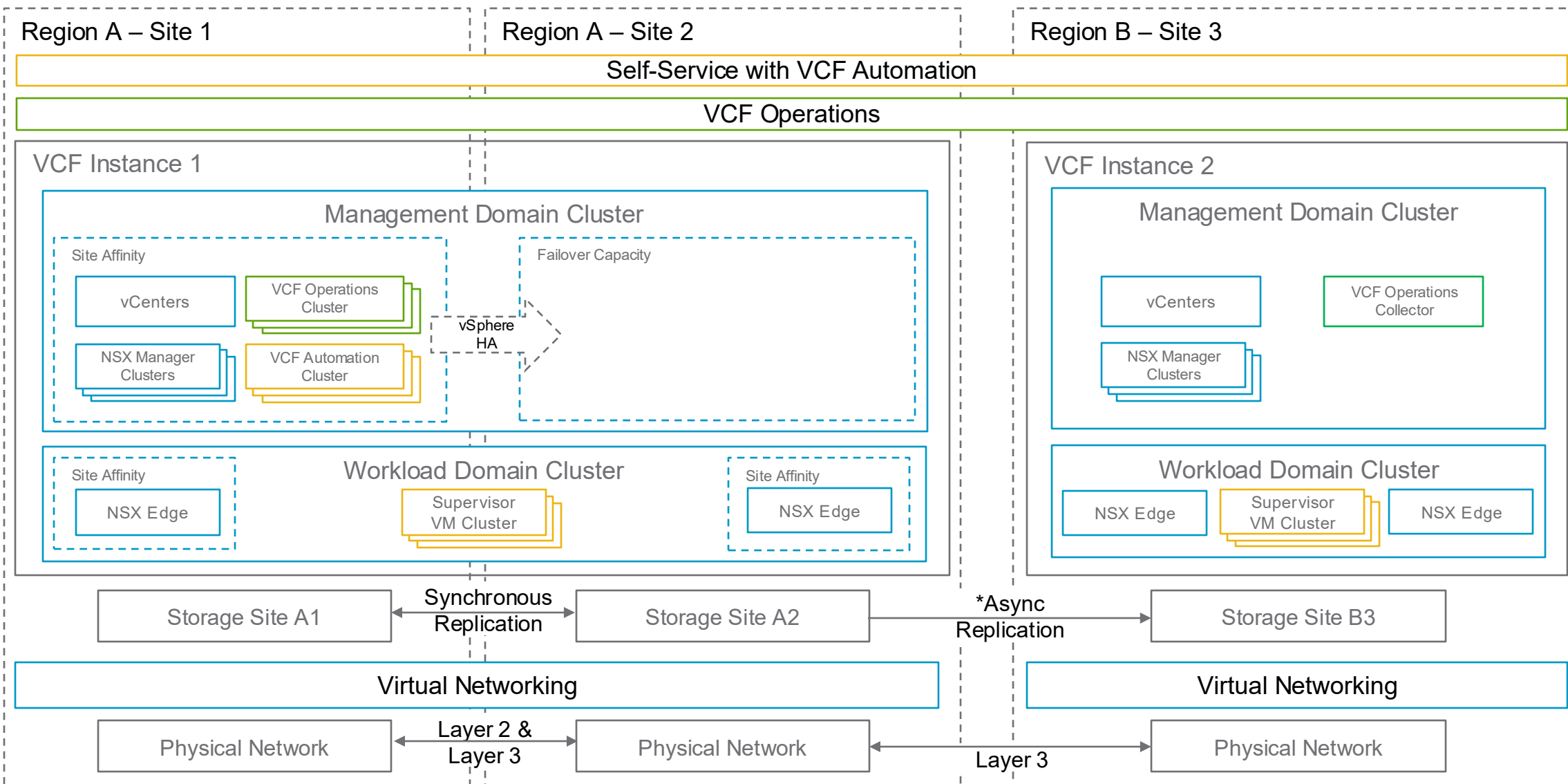- NSX: High Availability NSX Manager Model.

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Key Design Selections (Workload Domain):

- Consumption: Single Management Zone with Combined Workload Zones Model (vSphere Supervisor).

- Infrastructure: Single-Rack Cluster Model; Workload Separation Distributed Switch Model; vSAN Single-Rack HCI ESA Storage Model.

- Networking: VPC with Full Services Workload Networking Model.

- NSX: High Availability NSX Manager Model; Host Fault Tolerant NSX Edge Cluster Model.

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VCF Fleet with Multiple Sites Across Multiple Regions – Key Considerations

- Latency

- Replication / Recovery

- Physical Network

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VCF Fleet with Multiple Sites in a Single Region plus Additional Region(s)

Region A – Site 1 | Region A – Site 2 | Region B – Site 3

Self-Service with VCF Automation

VCF Operations

VCF Instance 1

Management Domain Cluster

Site Affinity
- vCenters
- VCF Operations Cluster
- NSX Manager Clusters
- VCF Automation Cluster

vSphere HA

Failover Capacity

Workload Domain Cluster

Site Affinity
- NSX Edge

- Supervisor VM Cluster

Site Affinity
- NSX Edge

VCF Instance 2

Management Domain Cluster

- vCenters
- VCF Operations Collector
- NSX Manager Clusters

Workload Domain Cluster

- NSX Edge
- Supervisor VM Cluster
- NSX Edge

| Storage Site A1 | Synchronous Replication | Storage Site A2 | *Async Replication | Storage Site B3 |

Virtual Networking

Virtual Networking

| Physical Network | Layer 2 & Layer 3 | Physical Network | Layer 3 | Physical Network |

*Optional data replication

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VCF Fleet with Multiple Sites in a Single Region plus Additional Region(s) - Design Profile

Designed for a VCF fleet with multiple sites spread across at least two regions, with some sites co-existing in a single region and others in different regions.

Design Profile Highlights:

- Consumption: Self-service via VCF Automation, vSphere Supervisor, direct vCenter access.

- Physical Site: Multiple Sites within a single region AND multiple sites across multiple regions.

- Availability: Tolerates single ESX host failure, individual network path failure, single rack failure (via stretched cluster), vSphere cluster failure, single management component failure, and single availability zone failure.

- Recoverability: Provides recovery within a region for single site loss. Also provides recovery to an additional region for single site or single region loss. A backup & restore strategy can be layered for enterprise-wide incidents. The blueprint provides a suitable basis for data replication and workload failover using tools like VMware Live Recovery or third-party products, though its implementation is out of scope.

- Isolation: Hypervisor-based, network traffic type, cluster-based, tenant / tenant isolation.

- Expansion: Supports resource and availability expansions.

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VCF Fleet with Multiple Sites in a Single Region plus Additional Region(s) – Key Elements

Key Design Selections (Management Domain - First VCF Instance):

- Operations: High Availability VCF Operations Model (three-node cluster); Fleet Level Components on Shared Management Network Model.

- Automation: High Availability VCF Automation Model (three-node cluster).

- Security: Appliance VCF Identity Broker Model (cluster of appliances); VCF Fleet Level Single Sign-On Model (single IdP for all VCF Instances, with alternatives for VCF Instance Level).

- Infrastructure: Management Domain Model; Stretched Cluster Model (vSphere cluster spanning two AZs, management components active/standby); Storage Separation Distributed Switch Model (two vDS for traffic separation); vSAN Stretched HCI Cluster Storage Model (single-tier, NVMe, stretched).

- NSX: High Availability NSX Manager Model (three-node cluster with VIP); Dual Availability Zone Design based on NSX Edge Node HA (leverages independent NSX Edge nodes in each AZ).

- Physical Infrastructure: Multi Availability Zone Network Fabric Model (for stretched clusters).

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VCF Fleet with Multiple Sites in a Single Region plus Additional Region(s) – Key Elements (Workload domain)

Key Design Selections (Workload Domain):

- Consumption: Single Management Zone with Combined Workload Zones Model (Supervisor utilizes single vSphere Zone for management and workloads); High Availability Control Plane Model (deploys three Supervisor control plane VMs).

- Infrastructure: Workload Domain Model (additional domain); Stretched Cluster Model (vSphere cluster spanning two AZs, active/active or active/standby); Storage Separation Distributed Switch Model; vSAN Stretched HCI Cluster Storage Model.

- Networking: VPC with Full Services Workload Networking Model (primary Tier-0 Gateway Active/Standby, Centralized Transit Gateway, individual tenants with Active/Standby TGWs).

- NSX: High Availability NSX Manager Model; Dual Availability Zone Design based on NSX Edge Node HA.

- Physical Infrastructure: Multi Availability Zone Network Fabric Model.

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VCF Fleet with Multiple Sites in a Single Region plus Additional Region(s) – Key Considerations

- Network Latency

- IP Addressing

- Management Component Protection

- VCF Automation Latency

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Planning and Preparation Workbook

What is the Planning and Preparation Workbook?

- An Essential Pre-Deployment Tool: A workbook designed to gather all necessary information before starting a VCF implementation.

- Primary Goals:

  - To correctly size your environment, especially the Management Domain.

  - To collect all required physical network details.

  - To gather all necessary IP addressing information.

- Source: Downloadable from the Broadcom Technical Documentation site.

VMware Cloud Foundation and VMware vSphere Foundation Planning

Use this page to select your options for a VMware Cloud Foundation Deployment			v1.9.0.005	

At VMware we value inclusion. To foster this principle within our customer, partner, and internal community, we are replacing some of the terminology in our content. We have updated this document to remove instances of non-inclusive language.

Version

VMware Cloud Foundation				
		9.0.0.0		

Deployment Type

Select Option	Feature	Final Result	Information
9.0.0.0	VMware Cloud Foundation Deployment Version	Included	VMware Cloud Foundation Version 9.0.0.0 selected
VMware Cloud Foundation	Deployment Specification	Included	VMware Cloud Foundation Private Cloud will be deployed
First Instance	Instance to perform operation on	Included	Operation will be performed on the First VCF Instance
Deploy a new VCF fleet	Operation to be performed	Included	VMware Cloud Foundation Installer will deploy a new VCF fleet

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The Workbook's role in the Deployment process

A Foundational Step in VCF Design and Implementation

1. Understand VCF Architecture: First, familiarize yourself with VCF 9.0 architectural options and blueprints.

2. Populate the Workbook:

    - Fill out the "Prerequisite Checklist" tab to verify hardware and infrastructure readiness.

    - Use the "Management Domain Sizing" tab to ensure adequate resources for your VCF Fleet.

    - Complete the "Management Domain Creation" tab with network and IP details.

3. Collaborate & Validate:

    - Work with your network fabric vendor or customer team to review the physical network requirements you've gathered.

    - Validate the physical hardware and that ESX is installed and configured correctly

4. Deploy: With the workbook complete, proceed to deploy the first VCF instance using the VCF Installer appliance

Planning and Preparation Workbook – Key Points

- **Mandatory Step**: Completing the Planning and Preparation Workbook is a critical prerequisite for any new VCF 9.0 fleet deployment.

- **Reduces Risk**: It ensures all sizing, networking, and IP addressing details are collected and validated upfront, leading to a smoother implementation.

- **Centralizes Information**: Serves as the single source of truth for the inputs required by the VCF Installer, streamlining the deployment process.

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Workshop: Choosing a blueprint that meets the customers needs

Workshop 1: Choosing the right blueprint

In this workshop you will review the customer case study and choose which blueprint is most suited to meet the customers needs over the next 18 months.

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