Business Continuity and Workload Mobility for the Private Cloud

Cisco Validated Design (CVD) to support Multi-site Cloud Topologies

R. Wayne Ogozaly
Cloud Architect – Virtual Multi-Service Data Center (VMDC)

VMDC DCI Extends Cloud Data Centers to support Multi-Site Use Cases

"Interconnecting Data Centers to provide Business Continuity can be challenging because it impacts so many different teams, from compute and storage, to networking, security, and application teams",

VP of IT Operations, Large US Mobile Provider

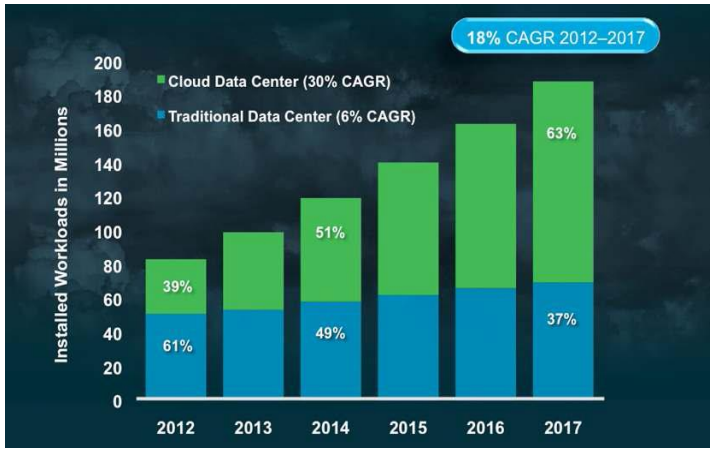
This Cisco Validated Design provides a simplified and validated design that supports critical Multi-site use cases such as:

Business Continuity across sites,
Workload Mobility across sites,
Active-Active Geo Clusters spanning sites
Disaster Recovery and Avoidance across sites,
Site Migrations,
Multi-site Data Center Maintenance Operations

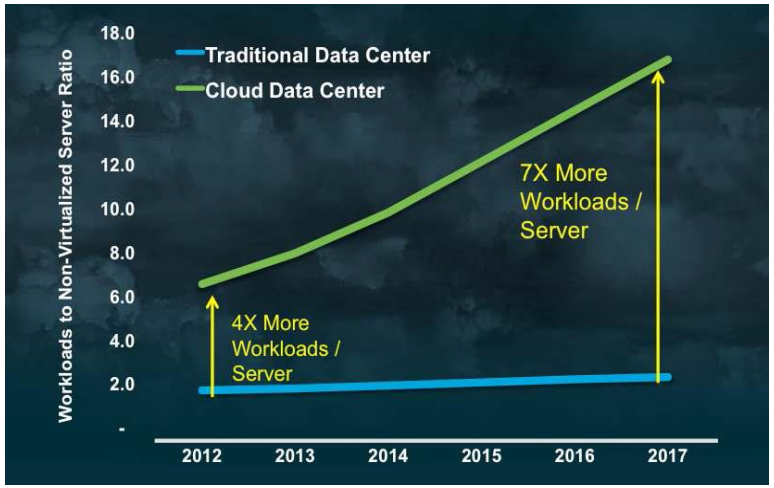
3 Important Trends Impacting the Data Center Evolution

The increasing density of Business Critical workloads hosted in the Cloud is driving new Multi-site designs to handle Business Continuity, Workload Mobility, and Disaster Recovery

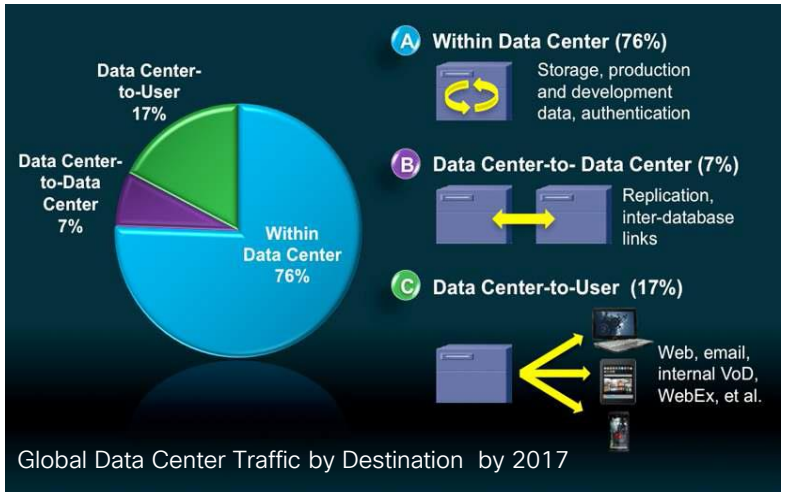
1 More Workloads are moving to Cloud Data Centers



2 Cloud Data Centers include more virtualized workloads per server



3 Traffic in each area of the Data Center is increasing dramatically



Source: Cisco Global Cloud Index, Forecast and Methodology, 2012–2017

Challenges of Building and Maintaining the Cloud

We build Validated Systems that are used by Global Cloud Customers (SPs and Enterprises)

How to Build

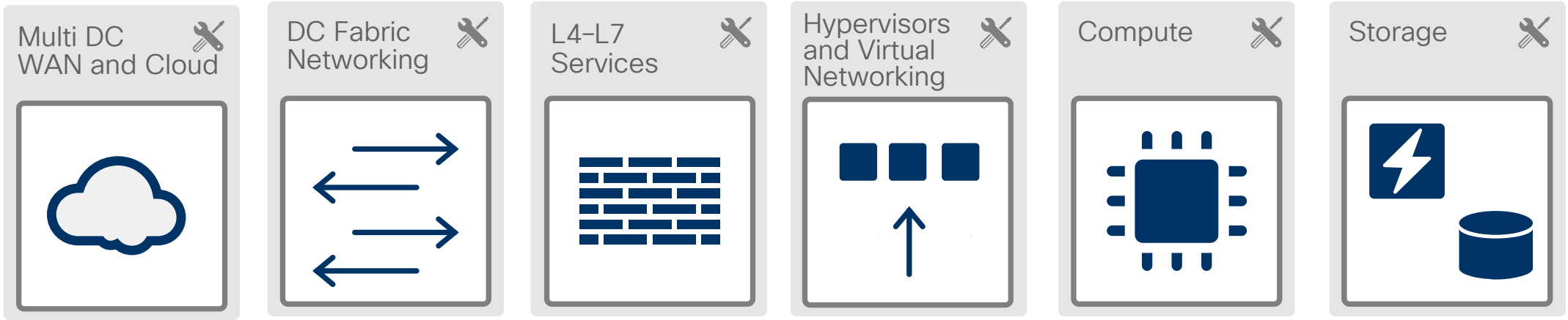
- Predictably grow the data center (compute, storage, network, services)
- Secure the data center from external and internal threats
- Protect the DC from HW and SW failures
- Assign virtual containers to consumers with pre-defined service policy profiles
- Securely separate these virtual containers across Multi-tenant resources
- Interconnect DCs to other DCs (Campus/Metro/Geo)

How to Manage and Operate

- Provision the DC resources
- Manage and Monitor the DC
- Provision virtual containers and assign to consumers
- Enable workload mobility and business continuity (Campus/Metro/Geo)
- Manage physical and virtual resources
- Provide orchestration for consumers of virtual containers and resources

Business Continuity and Workload Mobility for the Private Cloud
Cisco Validated Design

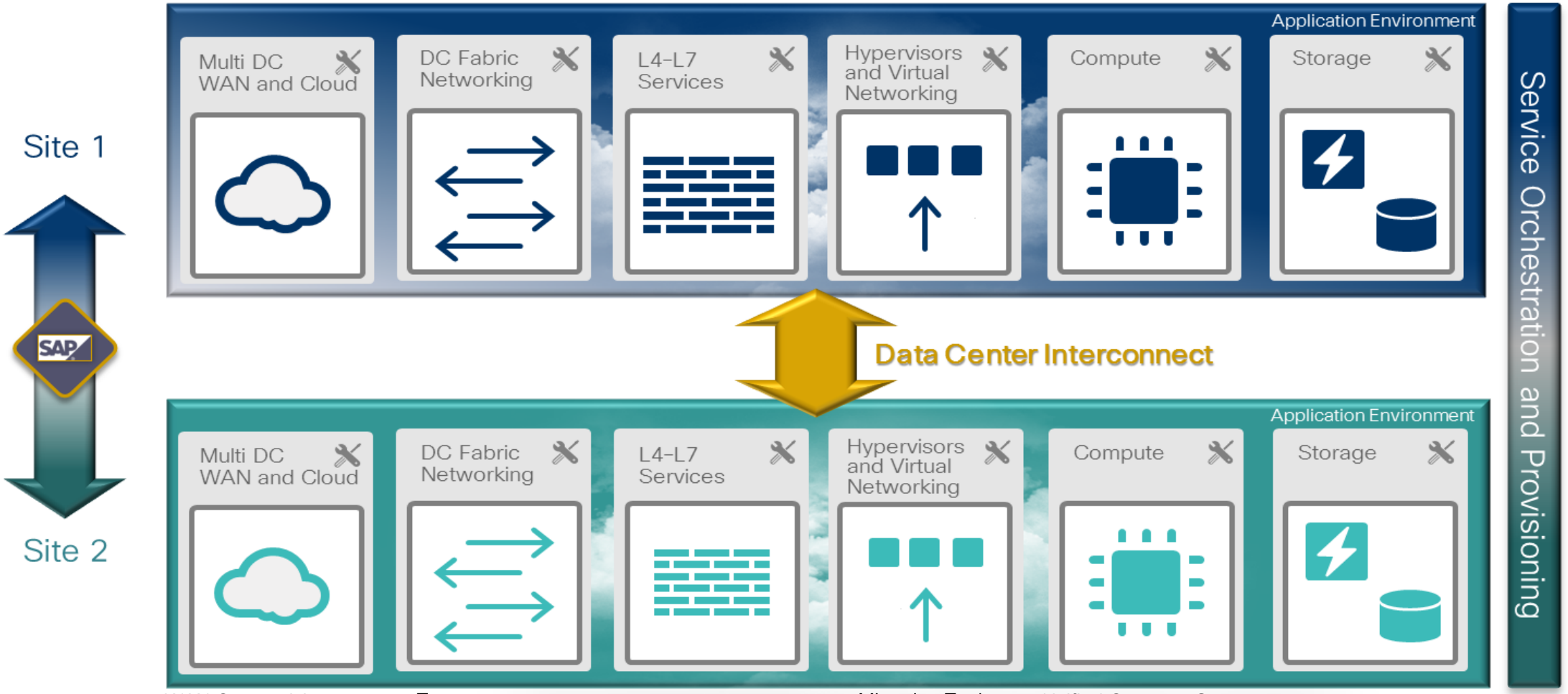
- Applications consume resources across the Cloud DC infrastructure
- If an Application moves between sites, each element of the Application Environment must also adjust to the new location
- Critical IT Use Cases including Business Continuity and Workload Mobility within Public and Private Clouds, impact each element of the Application Environment
- Cisco Data Center Interconnect extends the Application Environment between Geographic sites within Private Clouds and Public Clouds



CISCO DATA CENTER INTERCONNECT EXTENDS THE APPLICATION ENVIRONMENT ACROSS MULTIPLE SITES, SUPPORTING PHYSICAL AND VIRTUAL ELEMENTS

Cisco Data Center Interconnect extends the Application Environment between Sites

Extending Business Critical Operations between sites impacts each Infrastructure element



WAN Connectivity Path Optimization L3 Routing and IGP Data Center Interconnect IPSec & VPN Security	Tenancy Network Containers Traffic QoS Bandwidth Reservation	Security Physical L4-L7 Services Virtual L4-L7 Services Service Chaining	Migration Tools Extended Clusters High Availability Virtual Switching	Unified Compute System Port and Security Profiles Integrated PoDs	Storage NAS / SAN Virtual Volumes Storage Fabrics Data Replication

APPLICATION ENVIRONMENT INCLUDES PHYSICAL AND VIRTUAL COMPONENTS

VMDC DCI Enables Critical Use Cases within Private Clouds and Public Clouds

Including Business Continuity and Workload Mobility between Metro/Geo Sites

Site 1

Business Continuity
Workload Mobility
Disaster Recovery and Avoidance
Site Migrations
Load Balanced Workloads
Operations Maintenance
Operations Rebalancing
Application Geo-Clusters

Business Use Cases

Site 2

Application Environment

Multi DC WAN and Cloud

DC Fabric Networking

L4-L7 Services

Hypervisors and Virtual Networking

Compute

Storage

Service Orchestration and Provisioning

THE APPLICATION ENVIRONMENT IS EXTENDED TO SUPPORT MULTI-SITE USE CASES

VMDC DCI Value Proposition

Simply DCI Deployments, reduce CAPEX/OPEX of design, Reuse-Reclaim Recovery Resources

Simplify the DCI Design Process for Operations Teams - Interconnecting Cloud Data Centers involves many infrastructure elements and application components. Our simplified VMDC design reduces deployment risks because we've validated the performance across a real multi-site topology, using real enterprise applications, on Cisco's latest cloud products.

End-to-end Validation of the Application Environment - VMDC DCI delivers validated guidelines across the end-to-end layers of the cloud data center. Competitive offerings only focus on a few elements. VMDC DCI spans different sites, addressing each Application element including WAN connections, tenancy, network containers, distributed virtual switching, and L4-L7 services, hypervisor migration tools, and storage replication. This is a complete DCI solution.

Validates 2 of the most used Business Continuity Design Options - VMDC DCI validates the most common design options to achieve 2 major Recovery Point Objective (RPO) and Recovery Time Objective (RTO) targets. The first design option enables the movement of applications, their services, and network containers to support near zero RPO/RTO for the most business critical functions. Less business critical applications can be mapped to a second design option to achieve RPO/RTO targets of 15 minutes or more.

Minimal Disruption to the Application - For your most critical applications, our VMDC solution provides live workload migrations that maintain active user connections, security, and stateful services, while less critical applications can use cold migrations with minimal service disruption. VMDC DCI allows operators to preserve IP addresses of moved applications and their services between sites.

VMDC DCI Value Proposition

Simply DCI Deployments, reduce CAPEX/OPEX of design, Reuse-Reclaim Recovery Resources

Reduction in CAPEX/OPEX for DCI Deployments – VMDC DCI helps customers align the correct DCI design to achieve application RPO/RTO targets. The most stringent recovery targets typically require the highest CAPEX/OPEX. VMDC DCI provides a framework to map Applications to different Criticality Levels, and then select the most cost effective design option that meets application requirements.

Planned Usage of Recovery Capacity – Recovery capacity at remote sites can be used for other applications during "normal operations" and "reclaimed" as needed during recovery events. This "Reuse-Reclaim" strategy allows for planned utilization of extra capacity and many-to-one resource sharing, reducing CAPEX/OPEX.

Multiple Hypervisors supported – Both VMware and Microsoft Hyper-V environments are supported.

DCI Use Cases Validated with Business Applications – VMDC DCI used traditional business applications across each workload migration and business continuity use case. The test applications include Oracle database servers, Microsoft SharePoint and SQL, for single tier and multi-tier test applications.

Simplified orchestration and measured product performance – Our solution provides simplified orchestration, management, and provisioning across multiple sites topologies. We've also measured and documented the performance of Cisco products and partner products across multi-site environments. Design recommendations, scaling, and restrictions are provided for our validated solution.

Links to Virtual Multi-service Data Center Collateral

Blog – Cisco Business Continuity and Workload Mobility for the Private Cloud

http://blogs.cisco.com/datacenter/business-continuity-and-workload-mobility-for-the-private-cloud-cisco-validated-design-part-1

Design Guide (PDF) - VMDC DCI Business Continuity and Workload Mobility Solution

http://www.cisco.com/c/en/us/td/docs/solutions/Enterprise/Data_Center/VMDC/DCI/1-0/DG/DCI.html

Virtualized Multiservice Data Center (VMDC): www.cisco.com/go/vmdc

Vblock: http://www.cisco.com/go/vblock

FlexPod: http://www.cisco.com/go/flexpod

Agenda

VMDC Data Center Interconnect (DCI)

Cisco Cloud Strategy

- VMDC Overview
- VMDC DCI Use Cases and Value Proposition
- Mapping Applications to Business Criticality Levels
- Active-Active Metro Design
- Active-Backup Metro/Geo Design

Tomorrow's IT – World of Many Clouds
Enabled by a Network-Centric Architecture

Cisco Cloud Strategy

Provide SaaS Services in Selected Categories

- Collaboration
- Security
- Network Operations

Enable Cloud Providers to Deliver Differentiated Cloud Services

- Enterprise Workloads
- Collaboration & Desktop
- Native Cloud Applications
- Video & Mobility
- Big Data & Analytics
- Virtual Private Clouds & IaaS

Enable Enterprises to Build Private Clouds

- On Premise
- Managed
- Hybrid

Unified Platform

End-to-End Infrastructure

Cisco Cloud Credentials

Provide SaaS Services in Selected Categories

- Collaboration
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Enable Enterprises to Build Private Clouds

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- Managed
- Hybrid

≈$1B 2013 Revenue

Webex: #2 SaaS
Meraki: Rapid Growth

≈$2B 2013 Revenue

74 IaaS/VPC Partners, 79 resellers
1.1M Partner Hosted Collaboration Seats

≈$1B 2013 Revenue

Forrester: Cisco #1 in Private Cloud Strategy

Synergy: Cisco #1 Cloud Infrastructure Vendor
UCS #2 Blade Market Share and 60% Data Center Growth in FY13

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VMDC Data Center Interconnect (DCI)

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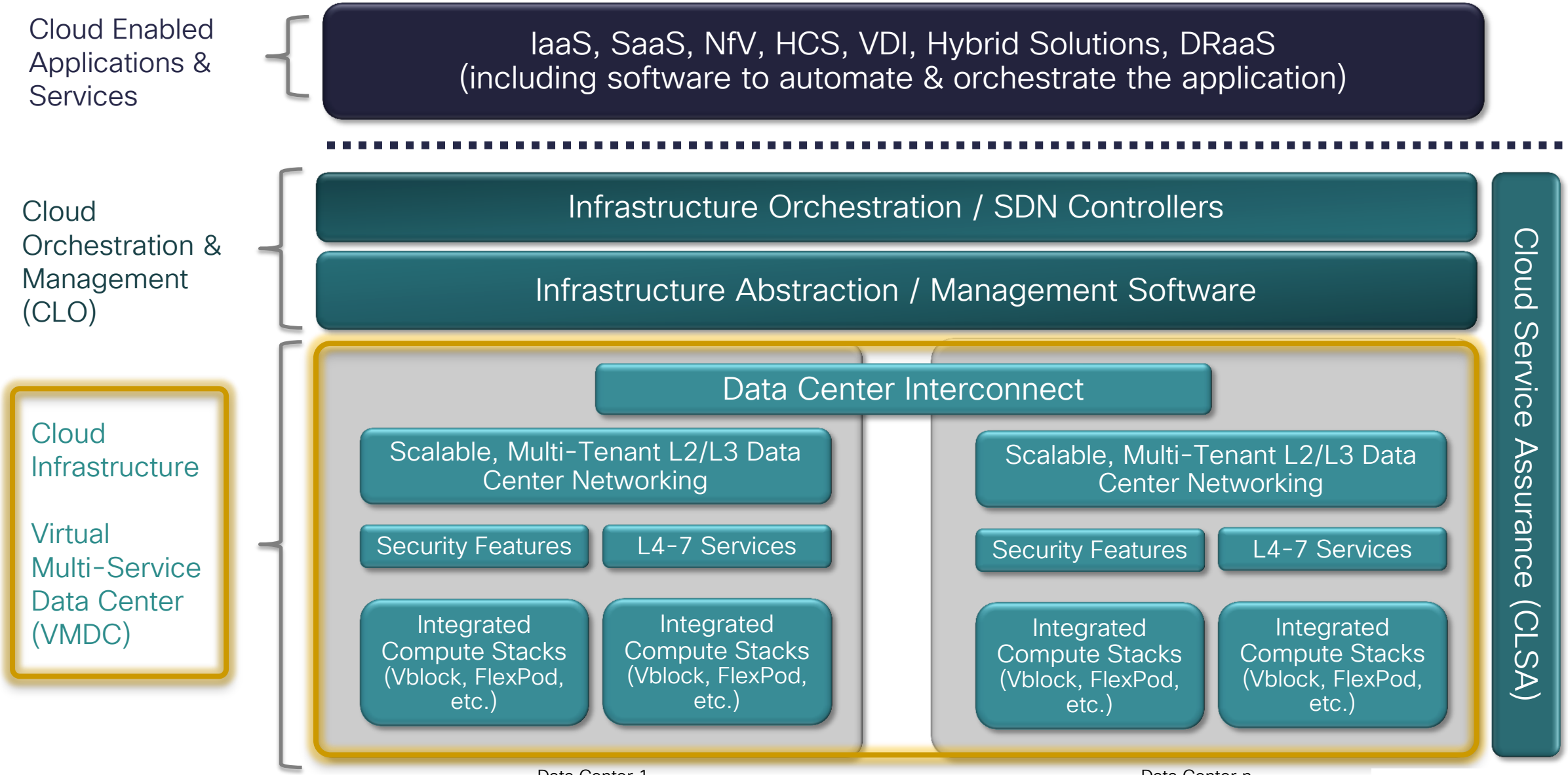
VMDC Overview

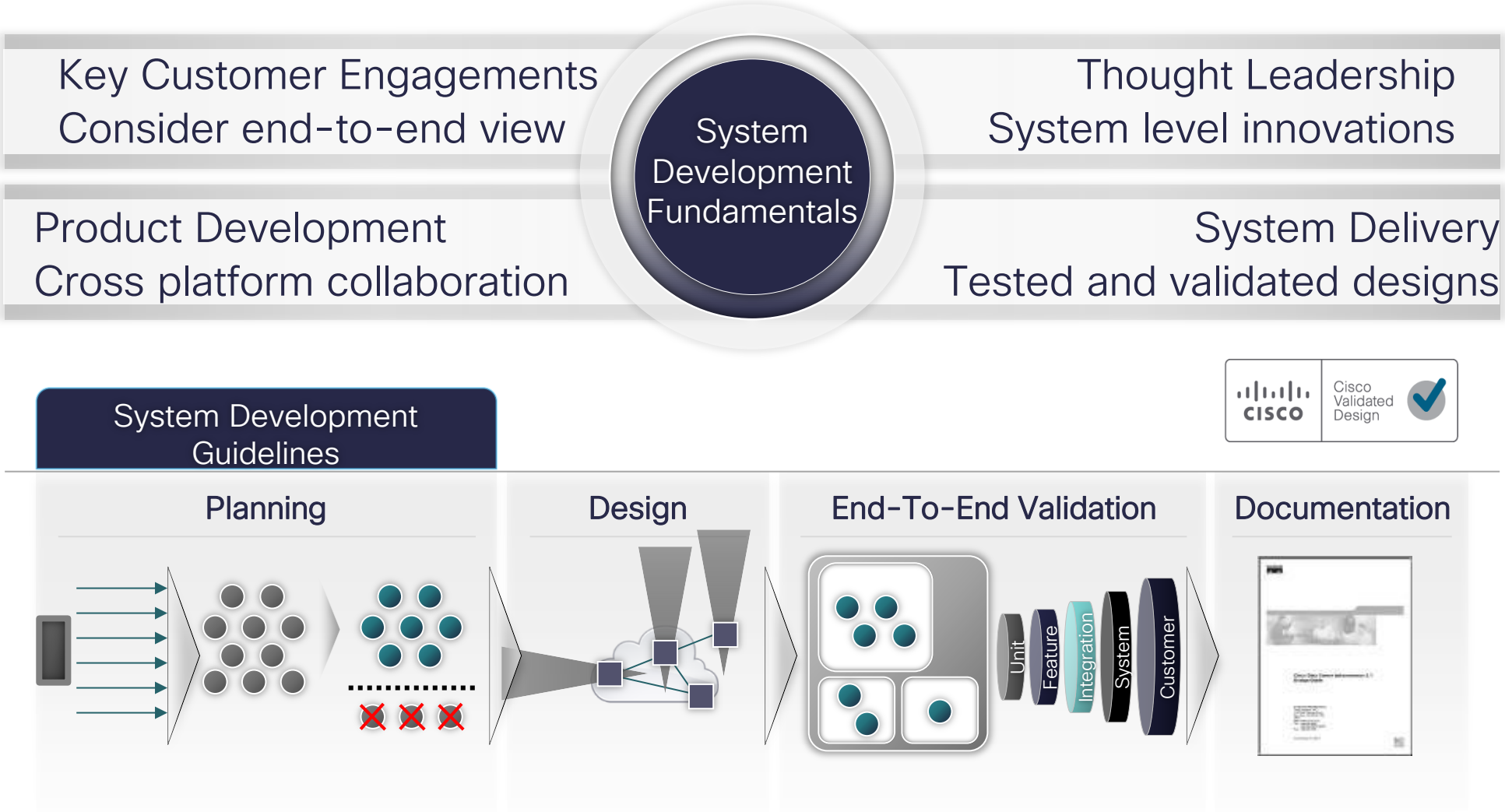
- VMDC DCI Use Cases and Value Proposition
- Mapping Applications to Business Criticality Levels
- Active-Active Metro Design
- Active-Backup Metro/Geo Design
- Live Workload Mobility Detailed Example and Results

Cisco Cloud Systems Foundation



Cisco Validated Design Process

Innovation and Quality Through System Level Design and Validation



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VMDC DCI Use Cases and Value Proposition

- Mapping Applications to Business Criticality Levels
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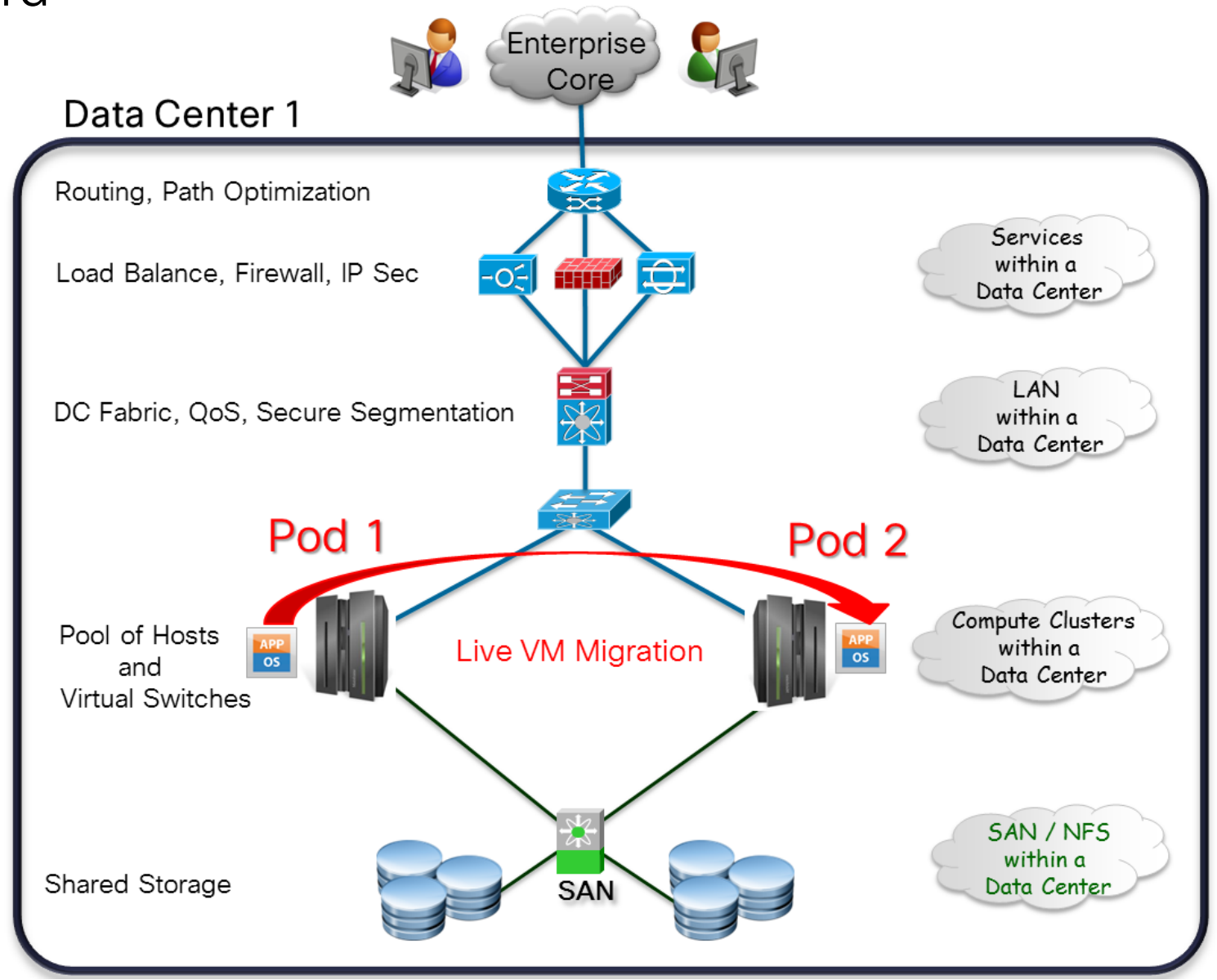
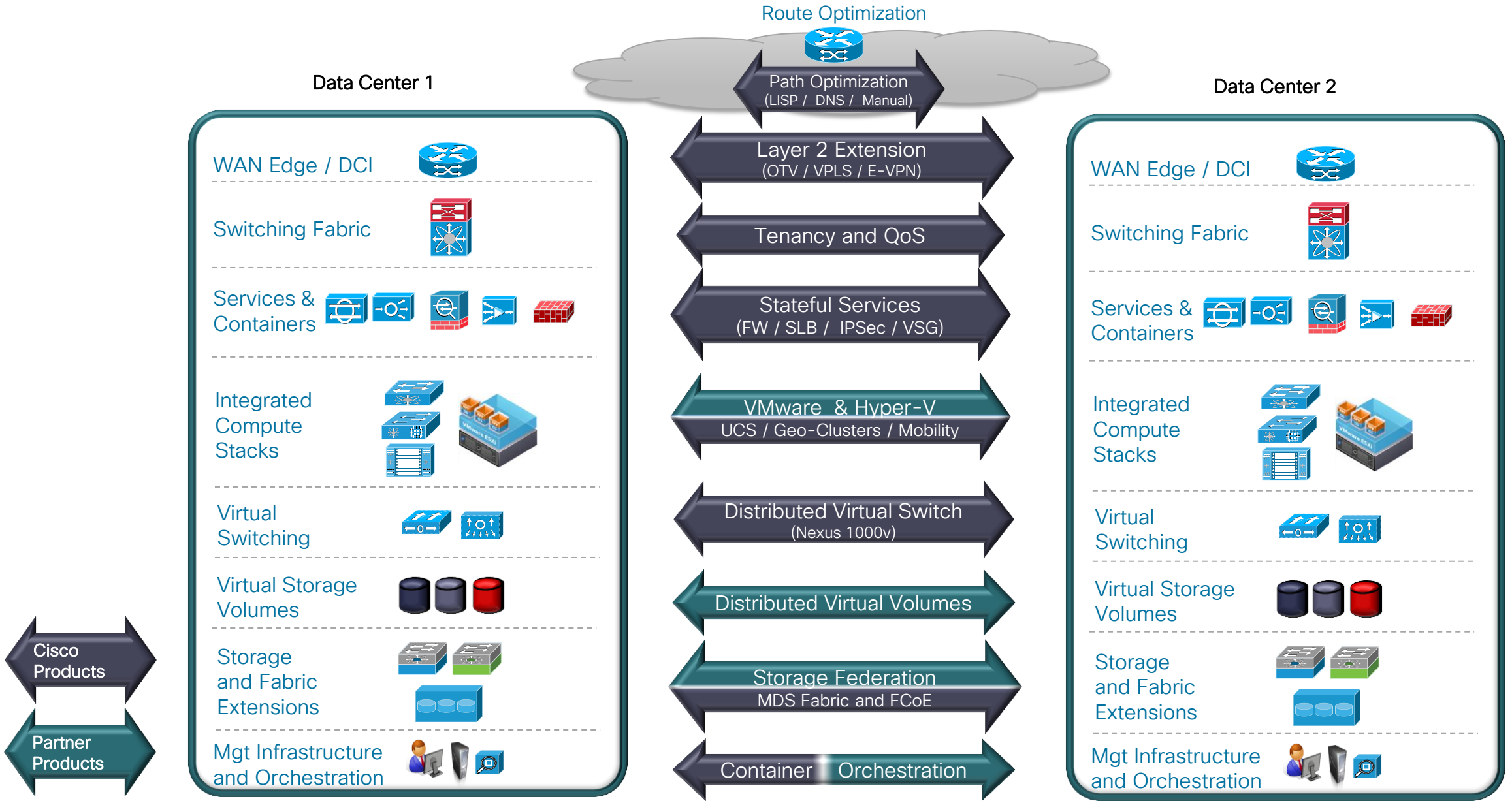
Moving or Recovering an Application within a Cloud Data Center is Straight Forward



Because the Application Environment is contained within a single site

VMDC DCI Extends Cloud Data Centers to support Multi-Site Use Cases



VMDC DCI Enables Critical Use Cases within Private Clouds and Public Clouds

Including Business Continuity and Workload Mobility between Metro/Geo Sites

Site 1

Business Continuity
Workload Mobility
Disaster Recovery and Avoidance
Site Migrations
Load Balanced Workloads
Operations Maintenance
Operations Rebalancing
Application Geo-Clusters

Business Use Cases

Site 2

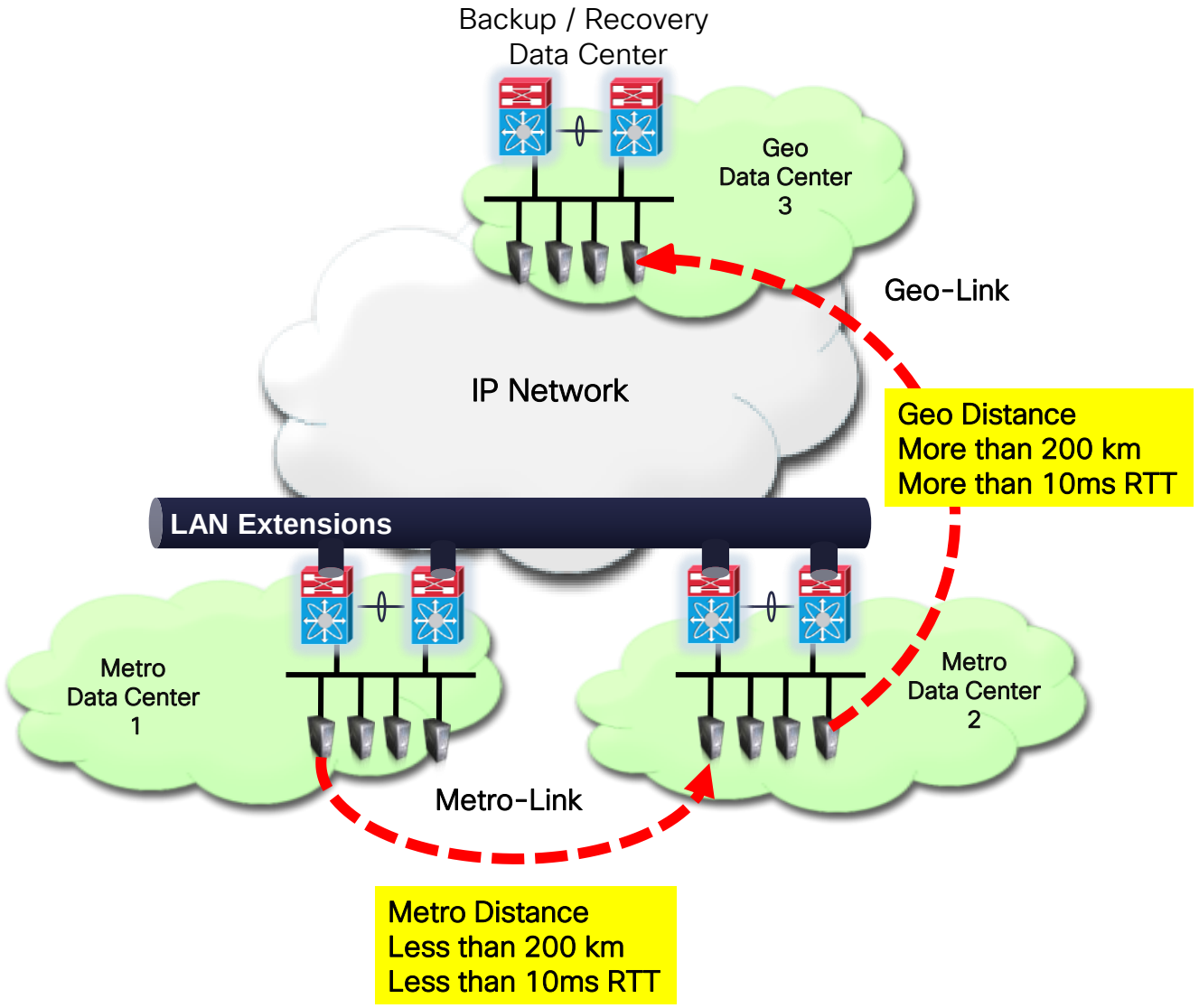
Application Environment

Multi DC WAN and Cloud	DC Fabric Networking	L4-L7 Services	Hypervisors and Virtual Networking	Compute	Storage
WAN Connectivity Path Optimization L3 Routing and IGP Data Center Interconnect IPSec & VPN Security	Tenancy Network Containers Traffic QoS Bandwidth Reservation	Security and Data protection Physical L4-L7 Services Virtual L4-L7 Services Service Chaining	Migration Tools Extended Clusters High Availability Virtual Switching	Unified Compute System Port and Security Profiles Integrated PoDs	Storage NAS / SAN Virtual Volumes Storage Fabrics Data Replication

Service Orchestration and Provisioning

THE APPLICATION ENVIRONMENT IS EXTENDED TO SUPPORT MULTI-SITE USE CASES

VMDC DCI Design Validated using a 3-Site Model



Geo Data Center with Optional LAN Extensions

Workload Mobility Across Subnets or within Extended Subnets

Geo Data Center (DC-3)

Cold Workload Migration

National Disaster Recovery

Application Members contained to Single Site

Metro Data Centers with LAN Extensions

Workload Mobility with Extended Subnets

Metro Data Centers (DC-1 and DC-2)

Live + Cold Workload Mobility

Regional Disaster Recovery

Distributed Applications Clusters

Application Members may be Distributed between Sites

The Application Environment Spans many Cloud Resources

VMDC DCI Extends Cloud Resources to Support DCI Use Cases

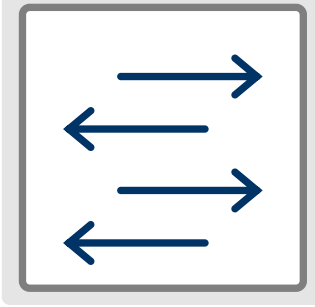
Multi DC WAN and Cloud

WAN Connectivity
- IP Internet Access
- MPLS VPN Access
- Physical or Virtual WAN router
- IP Path Optimization (LISP, DNS, Site Selector)

L3 Routing and IGP
- OSPF
- ISIS
- BGP

Data Center Interconnect
- Overlay Transport Virtualization (OTV)
- EoMPLS, VPLS
- E-VPN

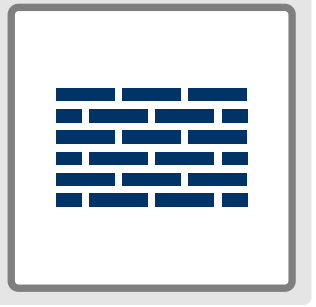
DC Fabric Networking



Data Center Fabrics
- Virtual Port Channel (vPC)
- FabricPath (DFA)
- Application Centric Infrastructure (ACI)

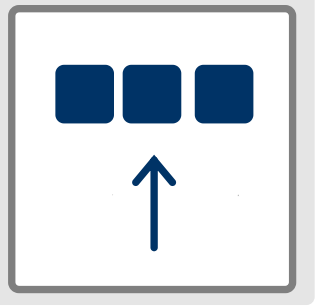
Fabric Services
- Tenancy
- Secure Segmentation (VRF, VLAN, VxLAN)
- Traffic QoS
- Bandwidth Reservation

L4-L7 Services



Physical and Virtual Services
- Firewalls
- Load Balancers
- IPSec VPN Termination
- WAN Acceleration Service
- Network Analysis
- Data Encryption

Hypervisors and Virtual Networking

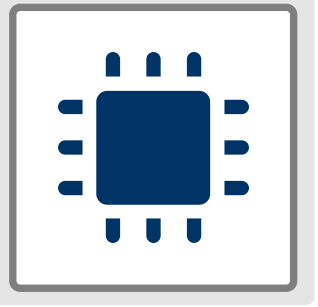


Hypervisors
- VMware vSphere
- Microsoft Hyper-V
- Redhat

Hypervisor Services
- Live and Cold Application Migrations
- Extended Clusters
- High Availability and Recovery Services
- Site Affinity Services

Virtual Switching
- Nexus 1000v
- Virtual Interfaces

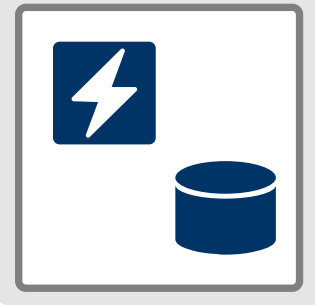
Compute



Unified Compute System (UCS)
- C-Series Rack Servers
- B-Series Blade Servers
- Physical and Virtual Interfaces
- Port and Security Profiles

Integrated PoDs
- FlexPod
- vBlock
- Low Cost Compute PoDs

Storage



Storage
- NetApp
- EMC
- Direct Attached Storage

Storage Fabrics
- FC
- FCoE
- 10GE

Data Replication
- Synchronous
- Asynchronous
- Hypervisor Based
- DWDM / IP / FCIP

APPLICATION TEAMS CHOOSE FROM AVAILABLE DESIGN OPTIONS...
THESE FUNCTIONS ARE EXTENDED TO SUPPORT MULTI-SITE USE CASES

Application Environment used in this VMDC DCI Release

Application Components support DCI Use Cases including *Business Continuity and Workload Mobility*

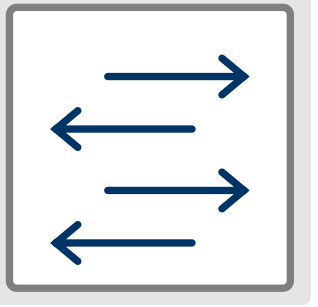
Multi DC WAN and Cloud

WAN Connectivity
- IP Internet Access
- ASR-9K, ASR-1K, Nexus 7K

L3 Routing and IGP
- OSPF and ISIS

Data Center Interconnect
- Overlay Transport Virtualization (OTV)

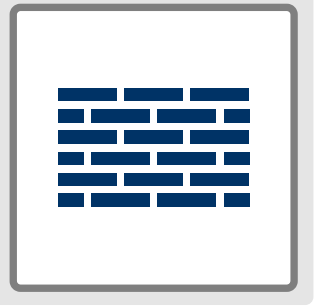
DC Fabric Networking



Data Center Fabric
- FabricPath
- Nexus 7K, 6K, 5K, 2K

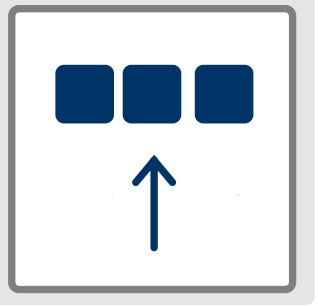
Fabric Services
- Tenancy
- Secure Segmentation (VRF, VLAN)
- Traffic QoS

L4-L7 Services



Physical and Virtual Services
- Firewalls (Cisco ASA)
- Load Balancer (Citrix SDX)
- Virtual Service Gateway (VSG)
- Expanded Palladium Network Container

Hypervisors and Virtual Networking



Hypervisors
- VMware vSphere
- Microsoft Hyper-V

Hypervisor Services
- Live and Cold Application Migrations
- Extended Clusters
- VM High Availability and Recovery Services
- Site Affinity Services

Virtual Switching
- Nexus1000v

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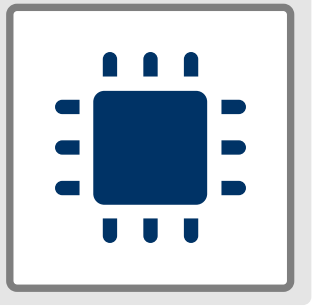

Unified Compute System (UCS)
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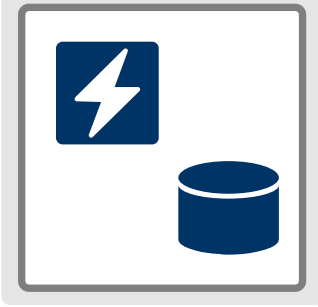
Storage



Storage
- NetApp

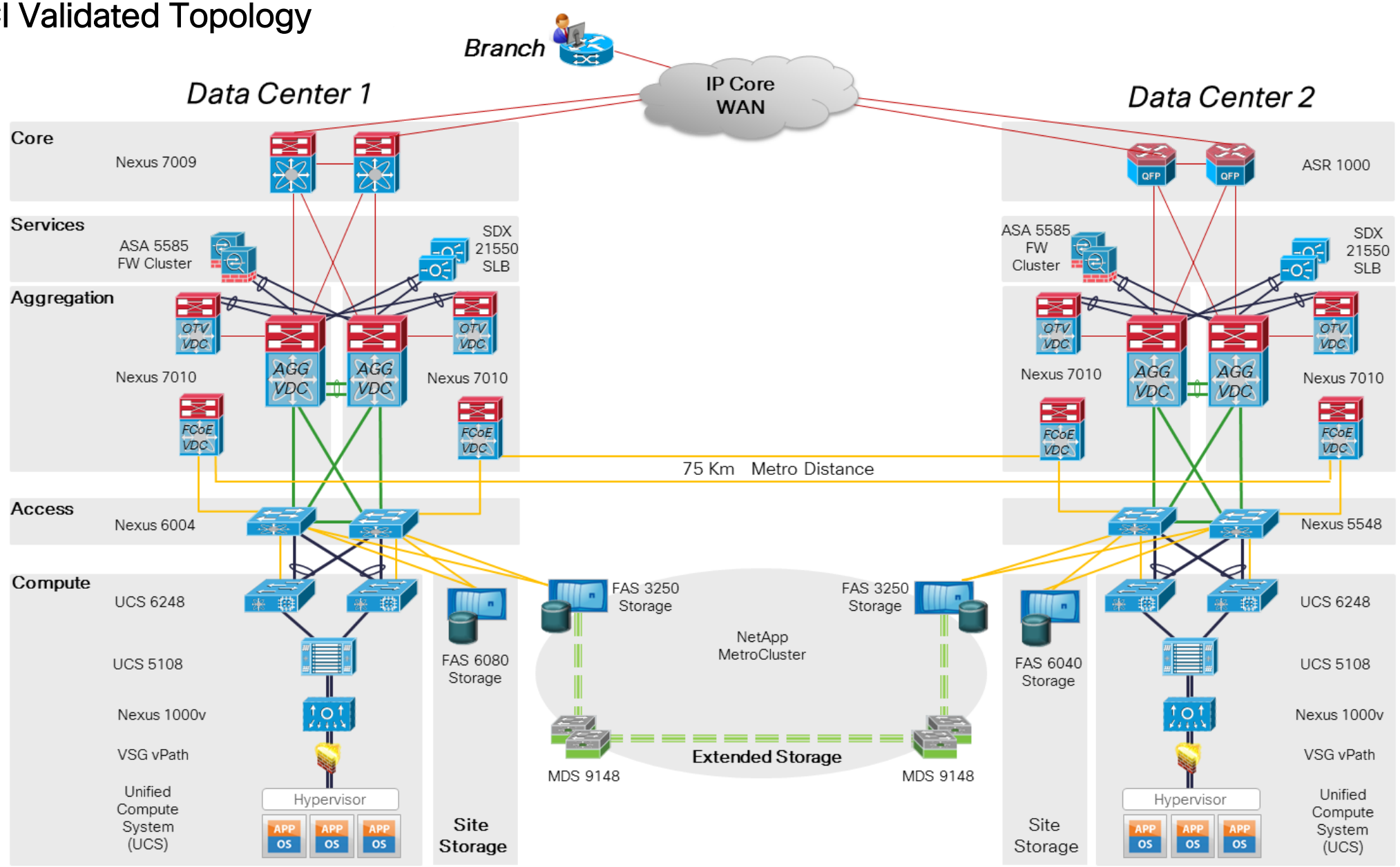
Storage Fabrics
- FCoE and FC
- 10GE
- DWDM & IP Extensions

Data Replication
- Synchronous (NetApp MetroCluster)
- Asynchronous (NetApp SnapMirror)
- Synchronous (Microsoft Shared Nothing Live Migration)
- Asynchronous (Microsoft Replica)

CISCO VALIDATED DESIGN

CLOUD INFRASTRUCTURE INTEGRATES PHYSICAL AND VIRTUAL COMPONENTS
REQUIRED BY BUSINESS CRITICAL APPLICATIONS

VMDC DCI Validated Topology



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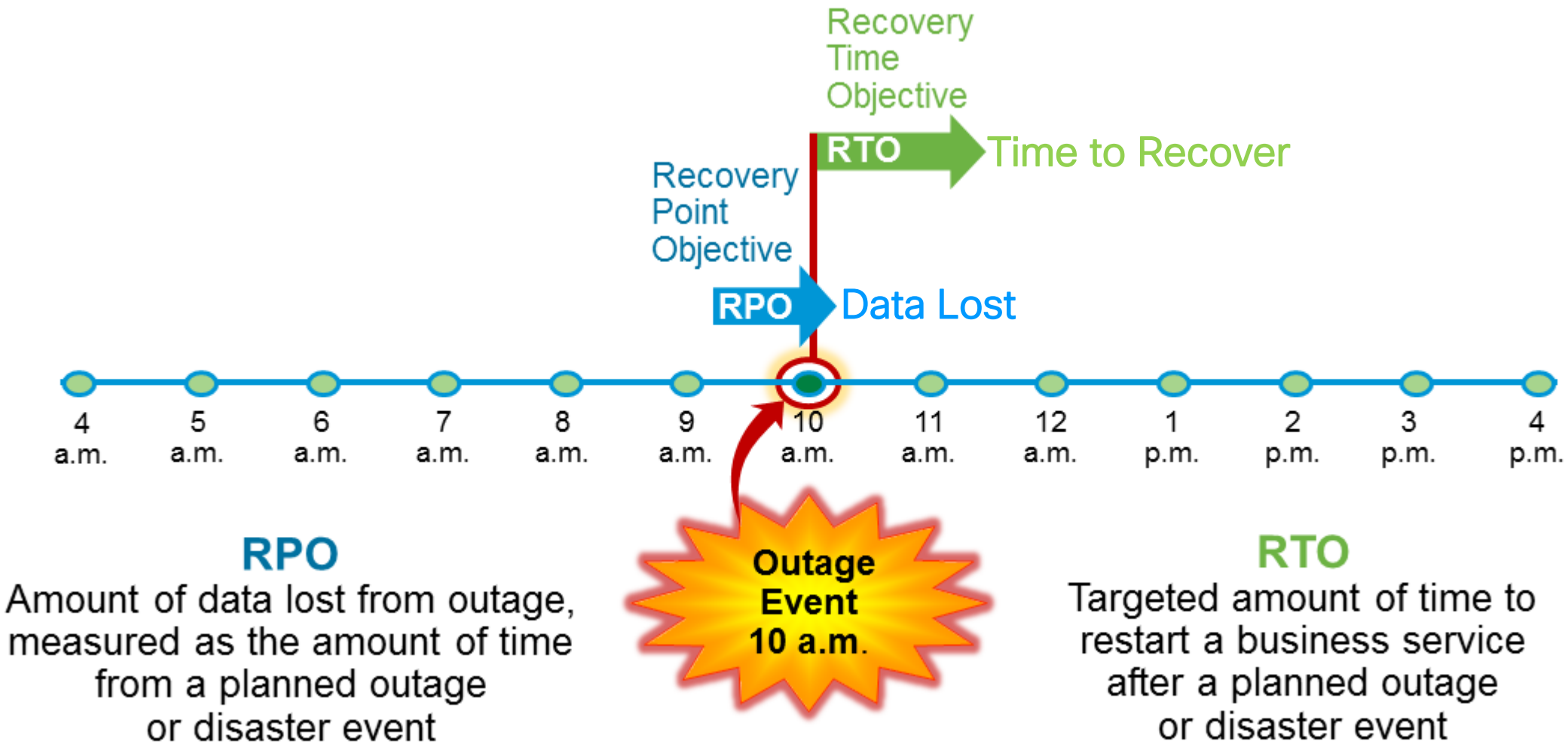
- VMDC DCI Use Cases and Value Proposition

Mapping Applications to Business Criticality Levels

- Active-Active Metro Design
- Active-Backup Metro/Geo Design

Industry Standard Measurements of Business Continuity



Application Resiliency and Business Criticality Levels

Defining how a Service outage impacts Business will dictate a redundancy strategy (and cost)

Each Application is mapped to a specific level… Each Data Center should accommodate all levels… Cost is important factor

Lowest RTO/RPO

Highest RTO/RPO

Criticality Levels	Application Level	Impact Description	Typical App Distribution	Typical Cost $
C1 RTO/RPO 0 to 15 mins	Mission Imperative	Any outage results in immediate cessation of a primary function, equivalent to immediate and critical impact to revenue generation, brand name and/or customer satisfaction; no downtime is acceptable under any circumstances	~ 20% of Apps	*100% Duplicate Resources, 2x Cost Multiplier (Most Costly)*
C2	Mission Critical	Any outage results in immediate cessation of a primary function, equivalent to major impact to revenue generation, brand name and/or customer satisfaction;		
C3 RTO/RPO 15 mins	Business Critical	Any outage results in cessation over time or an immediate reduction of a primary function, equivalent to minor impact to revenue generation, brand name and/or customer satisfaction	~ 20% of Apps	*Many-to-One Resource Sharing, Lower Cost Multiplier (Less Costly)*
C4	Business Operational	A sustained outage results in cessation or reduction of a primary function	~ 40% of Apps	
C5	Business Administrative	A sustained outage has little to no impact on a primary function	~ 20% of Apps	

VMDC DCI will focus on two common RTO/RPO Targets

VMware Redundancy and Mobility Options can extend across Geographies

VMDC DCI will match Application Business Continuity requirements to a cost effective design

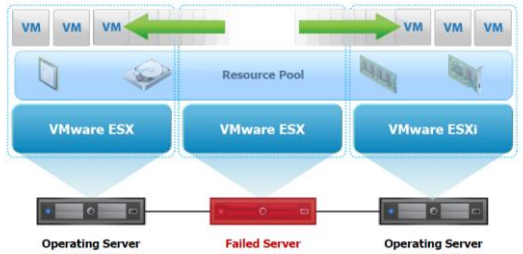
VM High Availability

VMware vSphere High Availability (HA)

Restarts Virtual Machines After Operating System or Hardware Failure

Automatically restarts VMs in the event of:
- Hardware failure
- VM failure (loss of heartbeat)

Transparent to OS and Applications
Downtime: Minutes

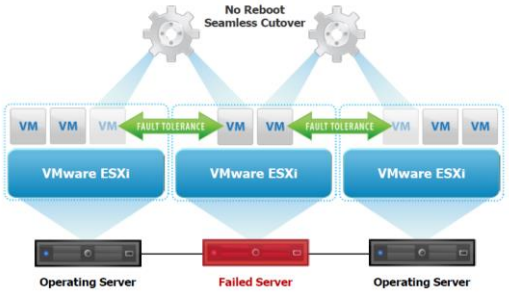


DC-1 ⟷ DC-2

VMware vSphere Fault Tolerance (FT)

Eliminates Workload Disruption Due to Hardware Failure

- A protected VM has a shadow VM in lockstep on another host
- Zero downtime and zero data loss in the event of host failure
- Downtime: Zero (Continuous Availability)

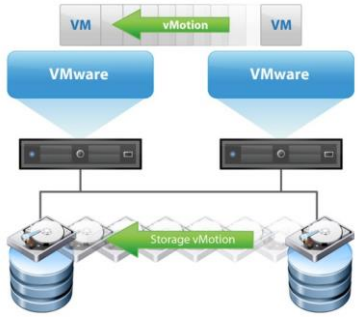


DC-1 ⟷ DC-2

VM Mobility

VMware vMotion and Storage vMotion

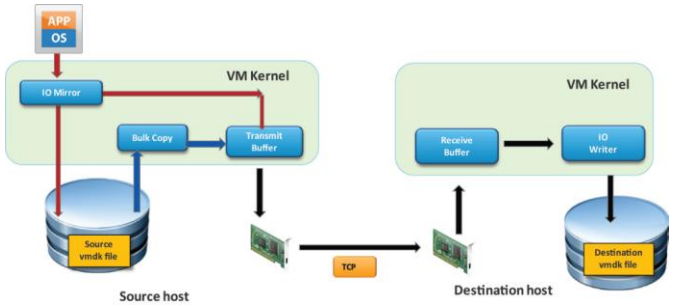
Live Migration of VMs and VM storage
- Non-disruptive migration of VMs
- Non-disruptive migration of Virtual storage



DC-1 ⟷ DC-2

"Shared Nothing" VMware vMotion

Live Migration of VMs and storage WITHOUT shared storage
- Simple management of recovery and migration plans
- Non-disruptive testing

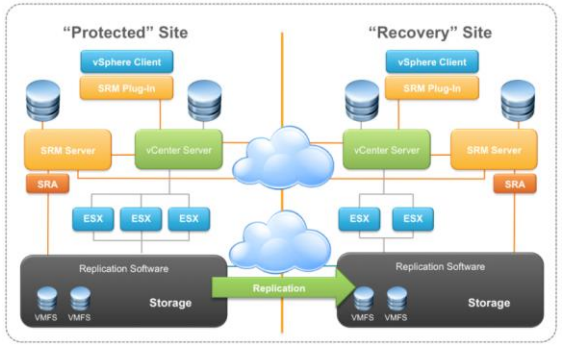


DC-1 ⟷ DC-2

Site / VM Recovery

VMware Site Recovery Manager (SRM)

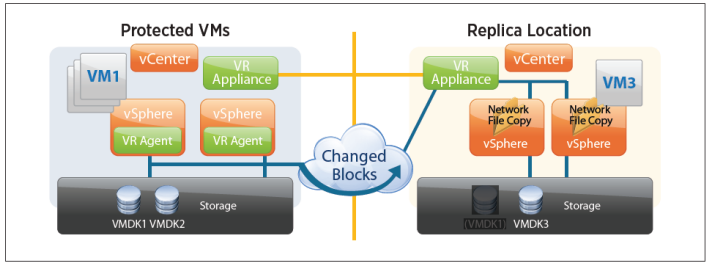
Fully automated site recovery and migration
- Simple management of recovery and migration plans
- Non-disruptive testing



DC-1 ⟷ DC-2

VMware vSphere Replication

Creates VM snapshot copies available for restoration through the vCenter
- Continuous replication to another location, within or between clusters
- Hypervisor based replication, VM granularity



DC-1 ⟷ DC-2

Agenda

VMDC Data Center Interconnect (DCI)

- Cisco Cloud Strategy
- VMDC Overview
- VMDC DCI Use Cases and Value Proposition
- Mapping Applications to Business Criticality Levels

Active-Active Metro Design

- Active-Backup Metro/Geo Design

Live Workload Mobility Requirements for the Active-Active Metro Design

Move an "Active" Virtual Workload across Metro Data Centers while maintaining Stateful Services

Business Continuity Use Cases for Live Mobility

- Most Business Critical Applications (Lowest RPO/RTO)
- Live Workload Migrations
- Operations Rebalancing / Maintenance / Consolidation of Live Workloads
- Disaster Avoidance of Live Workloads
- Application Geo-Clusters spanning Metro DCs

Hypervisor Tools for Live Mobility

- VMware vMotion or Hyper-V Live Migration
- Stretched Clusters across Metro DCs
- Host Affinity rules to manage resource allocation
- Distributed vCenter or System Center across Metro DCs

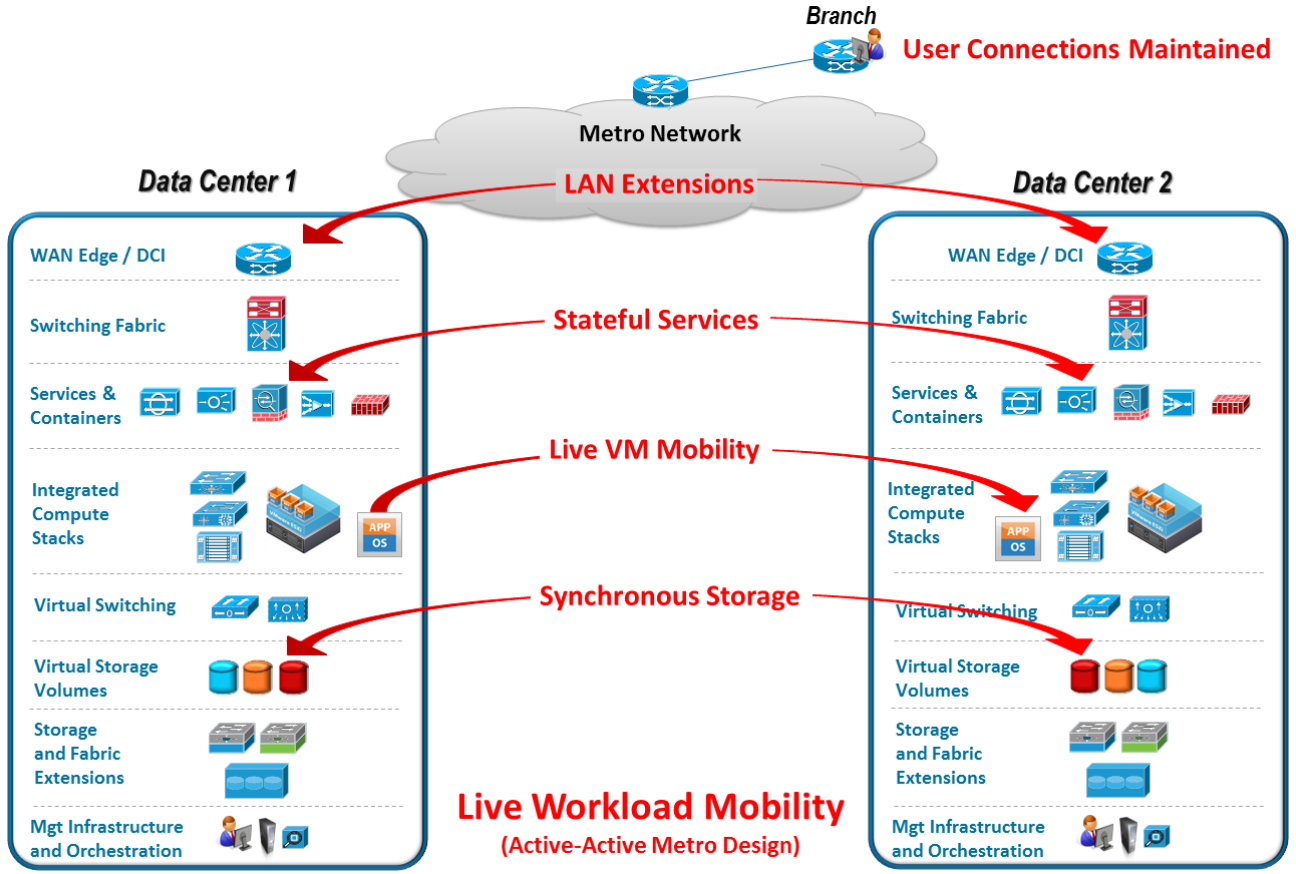
Metro DC Infrastructure to support Live Workload Mobility

Network: Data Center Interconnect and IP Path Optimizations
Virtual Switches Distributed across Metro
Maintain Multi-Tenant Containers

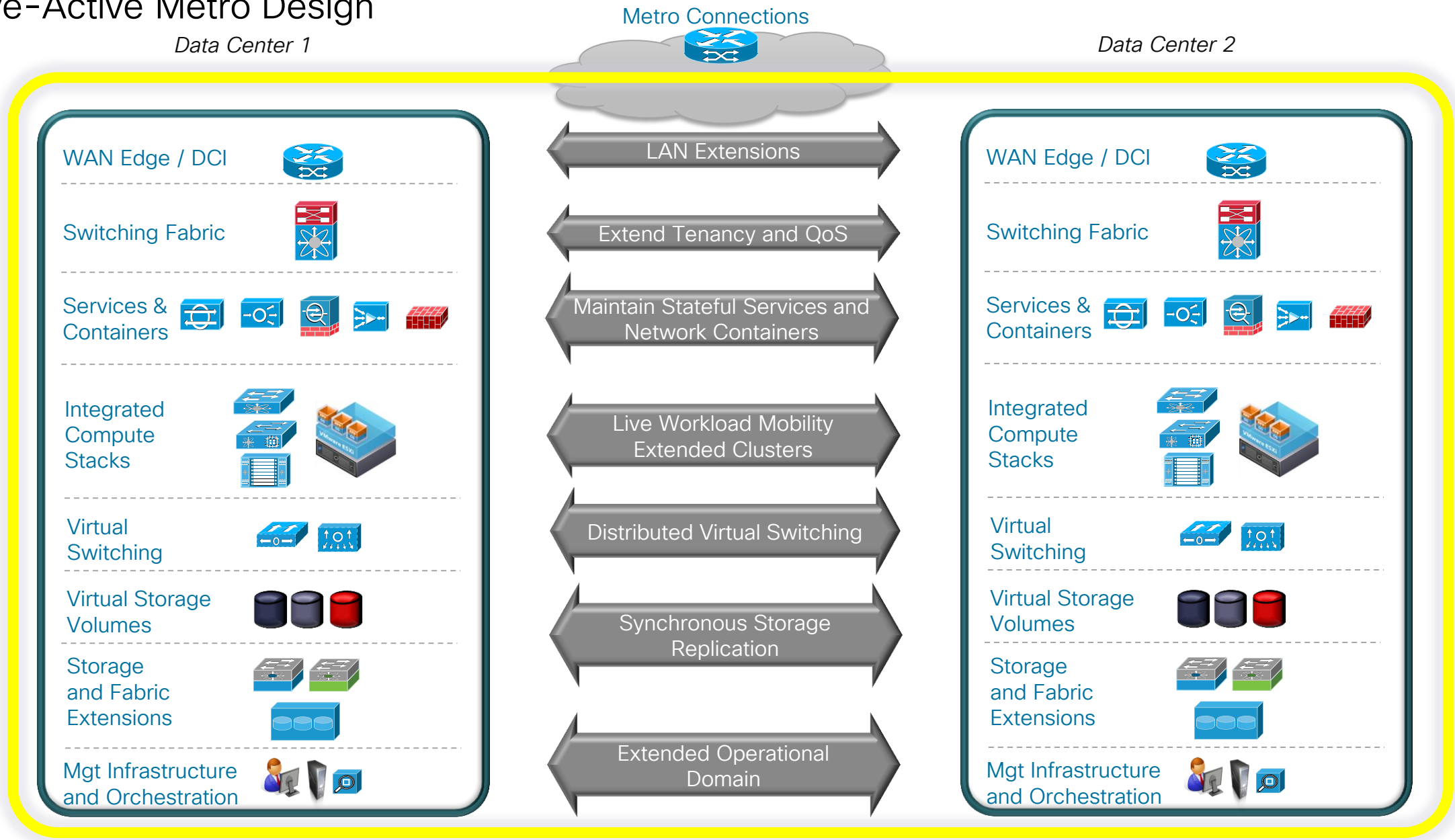
Services: Maintain Stateful Services for active connections
Minimize traffic tromboning between Metro DCs

Compute: Support Single-Tier and Multi-Tier Applications

Storage: Storage extended across Metro, Synchronous Data Replication
Distributed Virtual Volumes
Hyper-V Shared Nothing Live Migration (Storage agnostic)

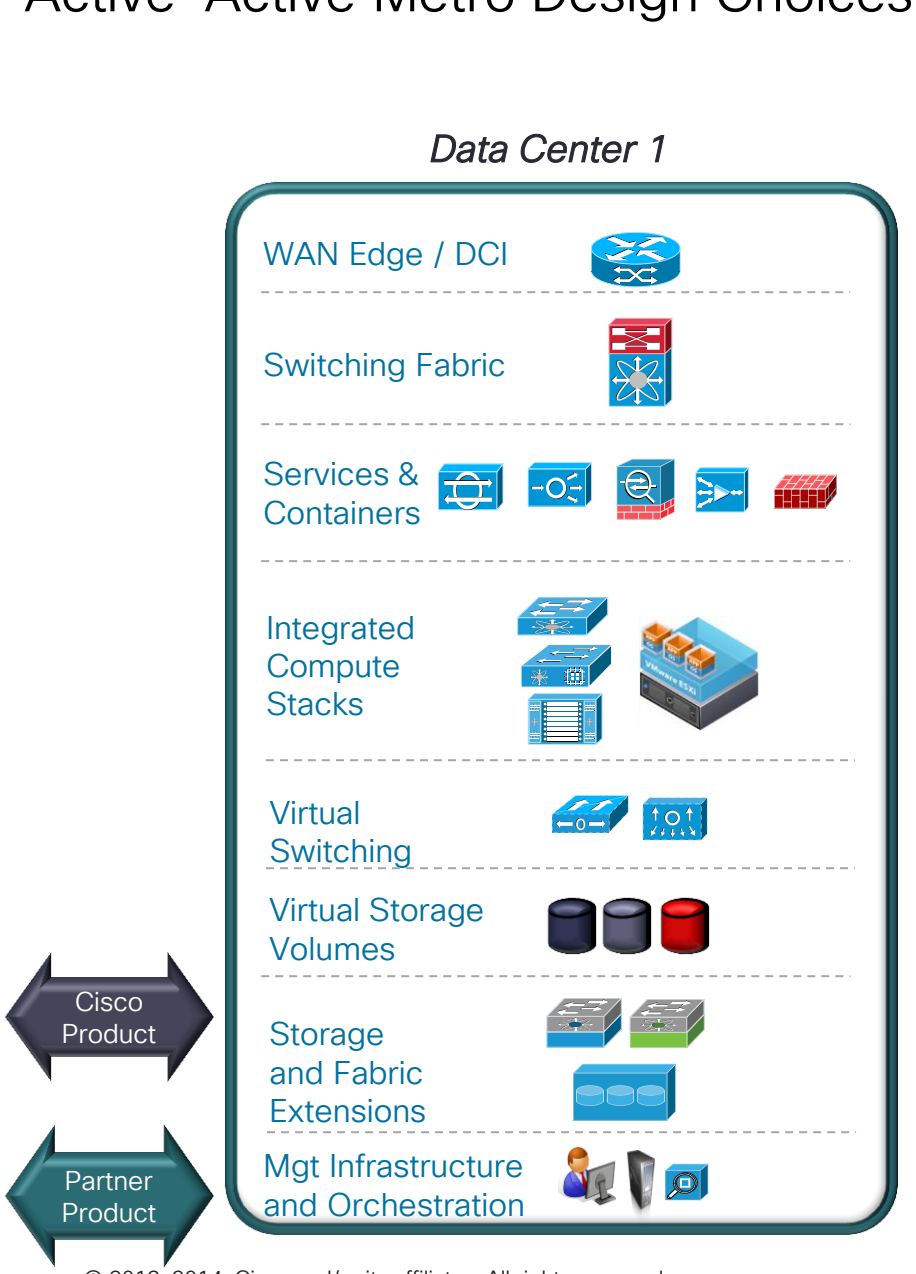


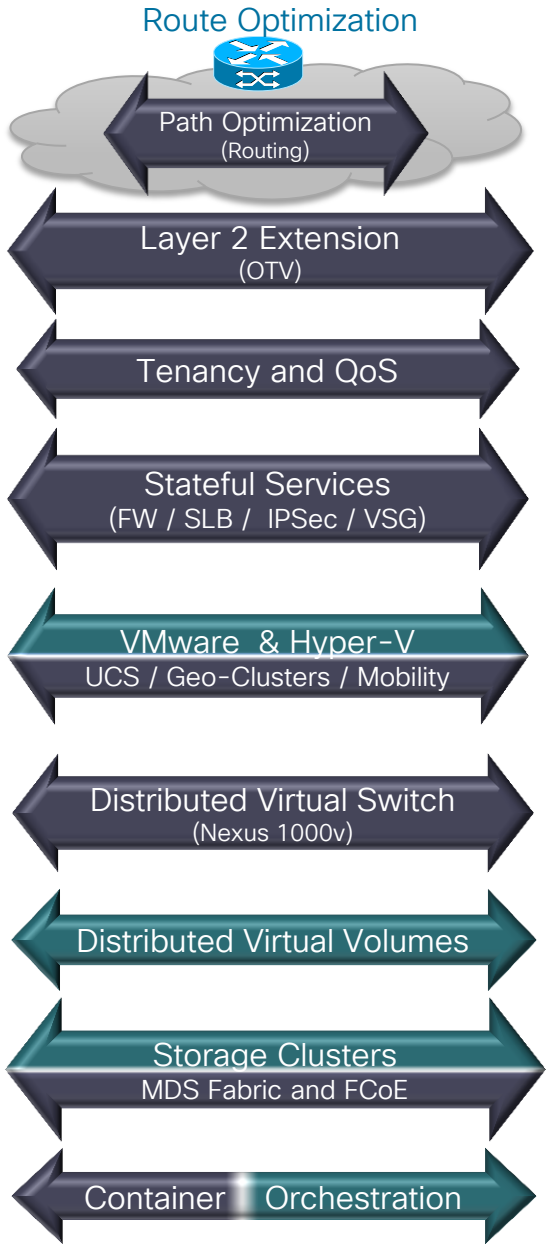
Active-Active Metro Design



These Sites are Operating as ONE Logical Data Center

Active-Active Metro Design Choices





VMDC DCI Design Choices

- External Path Re-direction thru routing update and orchestration
- Routing re-convergence to new site

- OTV LAN Extension, Preserve IP Addressing of Applications
- IP WAN Transport with 10ms RTT across Metro distance

- VMDC 3.0 FabricPath (Typical Design) with Multi-Tenancy
- Palladium Network Container

- Stateful Services between sites
- Citrix SDX SLB at each site (no Metro extension)
- ASA 5500 FW Clustering at each site (no Metro extension)

- Stretched ESX Clusters and Server Affinity
- VMware Live vMotion across Metro sites
- Distributed vCenter spanning Metro sites
- Single and Multi-Tier Application migration strategy

- Nexus 1000v with VSMs and VEMs across Metro sites
- Service and Security Profiles follow Application VMs
- Different Nexus 1000v's mapped to Application Domains as needed

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- Virtual volumes follow VM

- NetApp MetroCluster Synchronous Storage Replication
- ONTAP 8.1 Fabric MetroCluster, 160 Km long haul link (DWDM)
- FCoE to compute stack, Cisco MDS FC Switching for data replication

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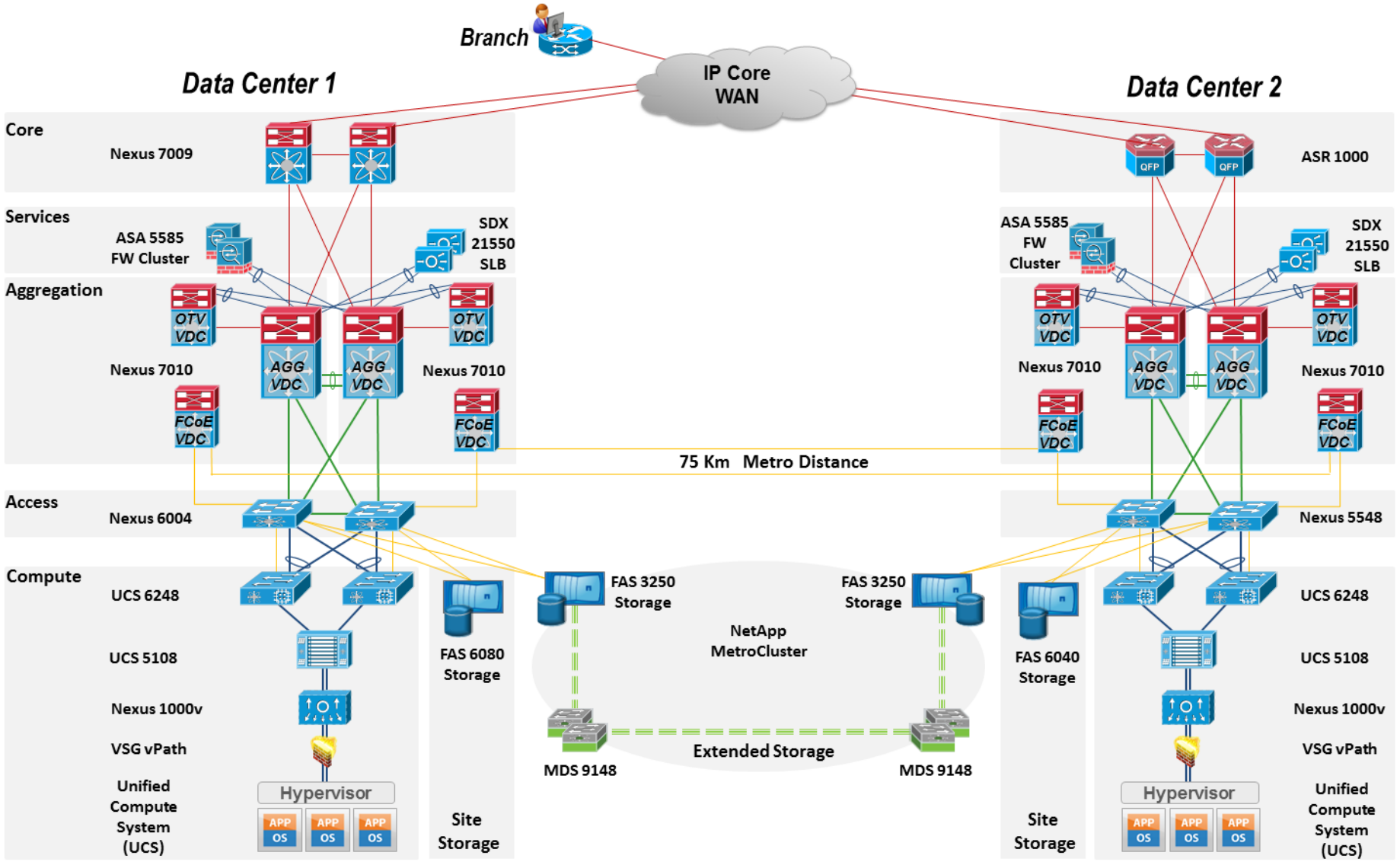
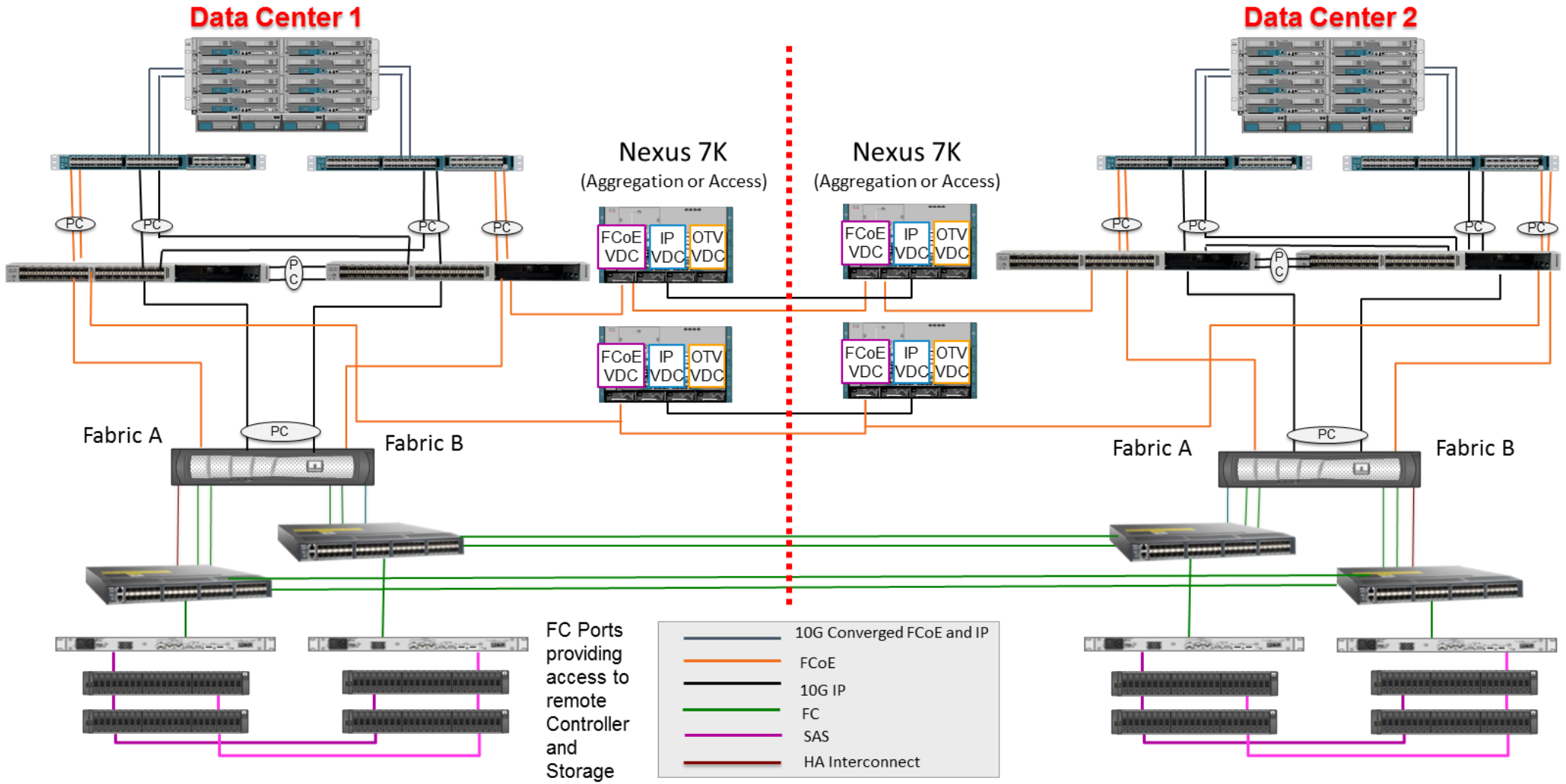
- Replicate Service Container to new site to support Mobile VM
- Virtual Mgt Infrastructure support across Metro

VMDC DCI Active-Active Metro Topology



VMDC DCI Multi-Hop FCoE using NetApp Fabric MetroCluster



SAN Extension Options

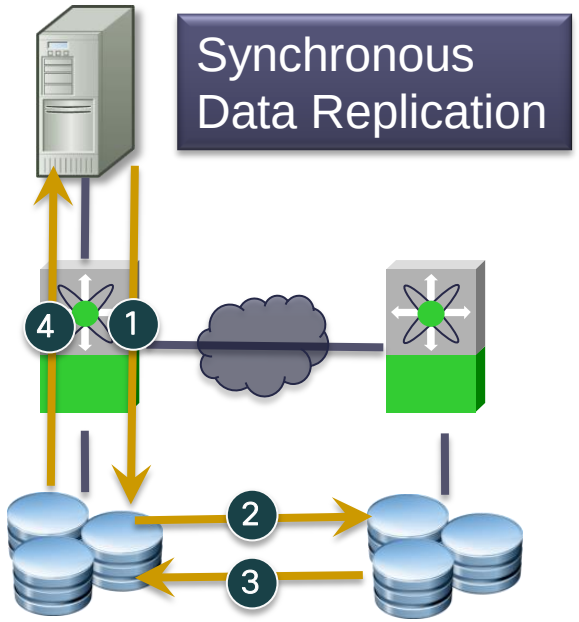
Synchronous versus Asynchronous Data Replication

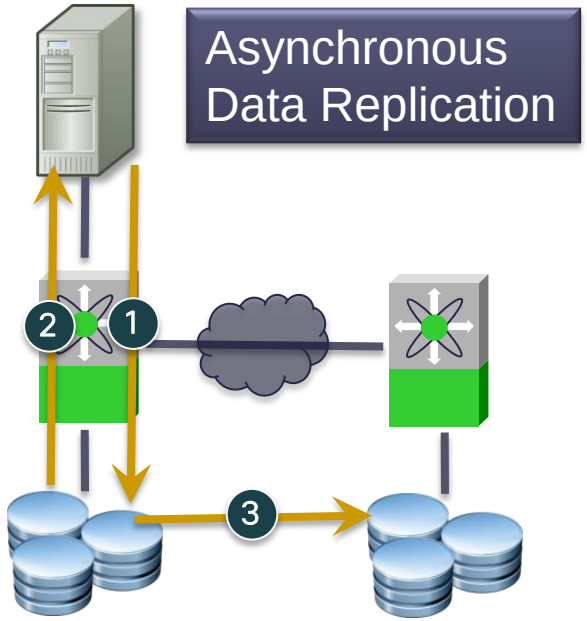
Synchronous Data replication: The Application receives the acknowledgement for I/O complete when both primary and remote disks are updated. This is also known as Zero data loss data replication method (or Zero RPO)

- Metro Distances (depending on the Application can be 50-200km max)

Asynchronous Data replication: The Application receives the acknowledgement for I/O complete as soon as the primary disk (local) is updated while the copy continues to the remote disk.

- Unlimited distances





Nexus 1000v extensions across Geographies

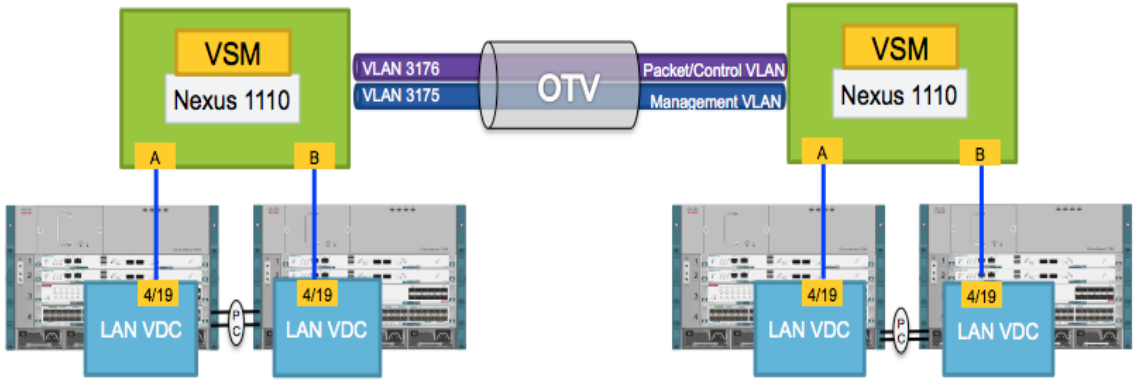
VSMs and VEMs can span Metro distances for enhanced availability

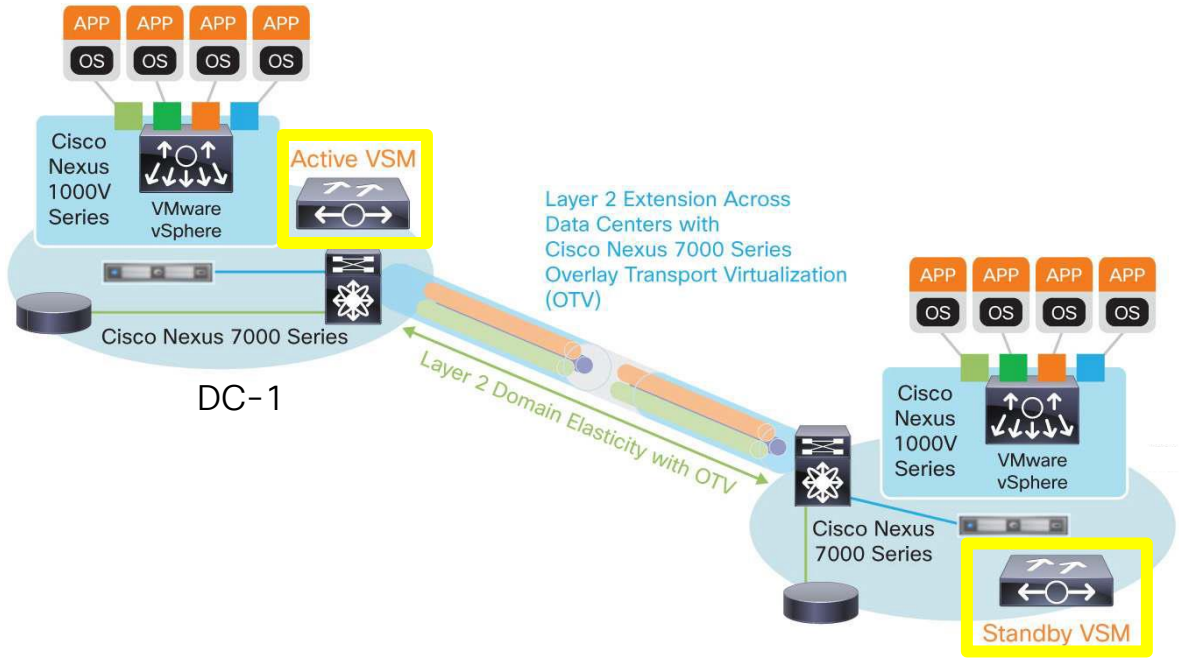
VSM Extended Across Data Centers:

Supports splitting Active and Standby Nexus 1000V Virtual Supervisor Modules (VSMs) across two data centers to implement cross-DC clusters and VM mobility while ensuring high availability.

VEM support across Metro distance:

VSM's in the data center can support VEM's at remote branch offices.





VMDC provides recommendations for mixed N1Kv environments, stretched clusters, and Metro N1Kv models

Agenda

VMDC Data Center Interconnect (DCI)

- Cisco Cloud Strategy
- VMDC Overview
- VMDC DCI Use Cases and Value Proposition
- Mapping Applications to Business Criticality Levels
- Active-Active Metro Design

Active-Backup Metro/Geo Design

Cold Workload Mobility Requirements for Metro/Geo Data Centers

Move a Stopped Virtual Workload across Metro/Geo DCs, create new Service Containers, reboot VM at new site

Business Continuity Use Cases for Cold Mobility

- Less Business Critical Applications (Medium to High RPO/RTO)
- Planned Workload Migrations of Stopped VMs
- Operations Rebalancing / Maintenance / Consolidation of Stopped Workloads
- Disaster Avoidance of Stopped Workloads
- Disaster Recovery of Stopped Workloads

Hypervisor Tools for Cold Mobility

- VMware Site Recovery Manager (SRM) or Hyper-V Failover Clustering
- Clusters across A/A or A/S Metro/Geo DCs
- Host Affinity rules to manage resource allocation
- Many-to-One Site Recovery Scenarios

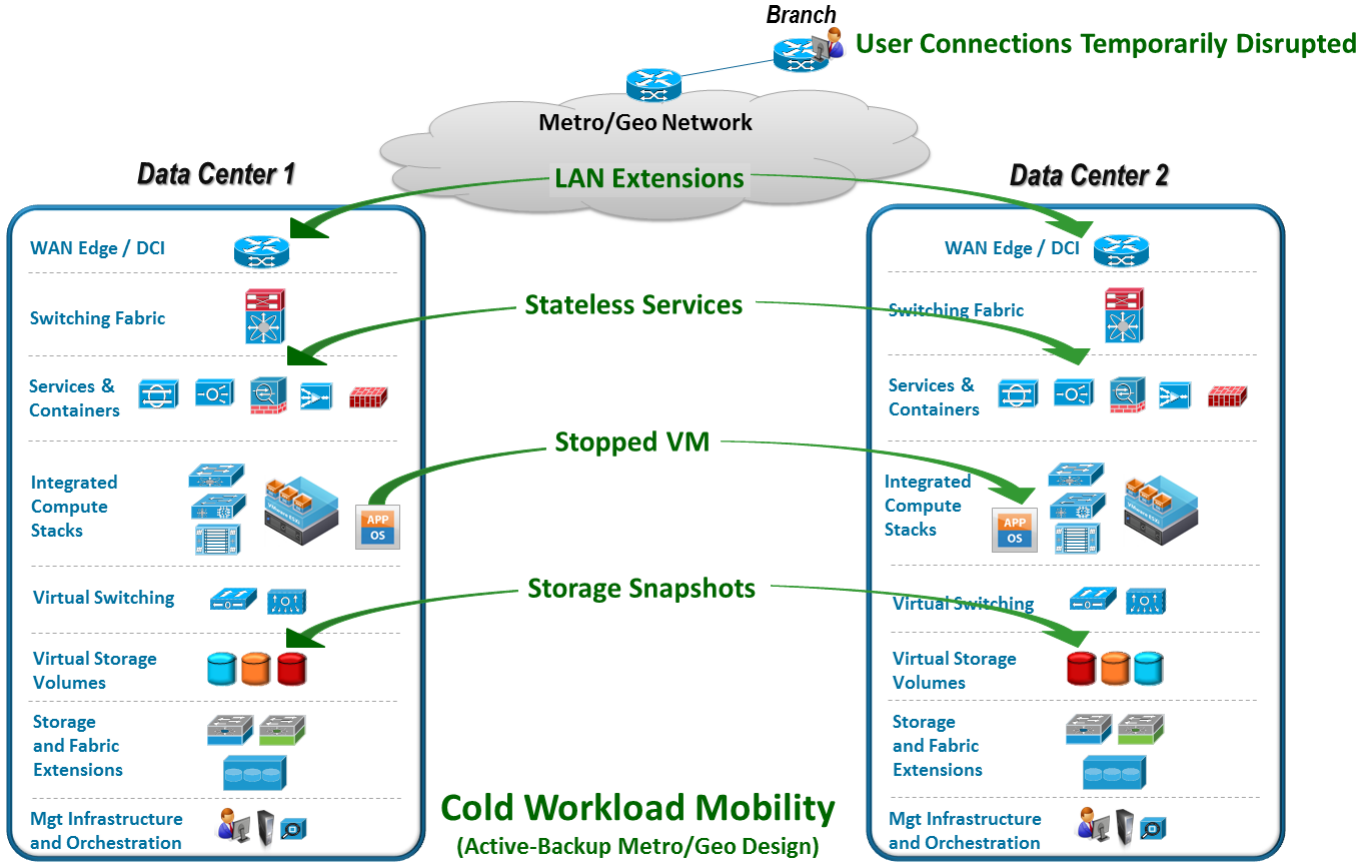
VMDC Infrastructure to support Cold Workload Mobility

Network: Data Center Interconnect optional , IP Path Optimizations
Create new Multi-Tenant Containers

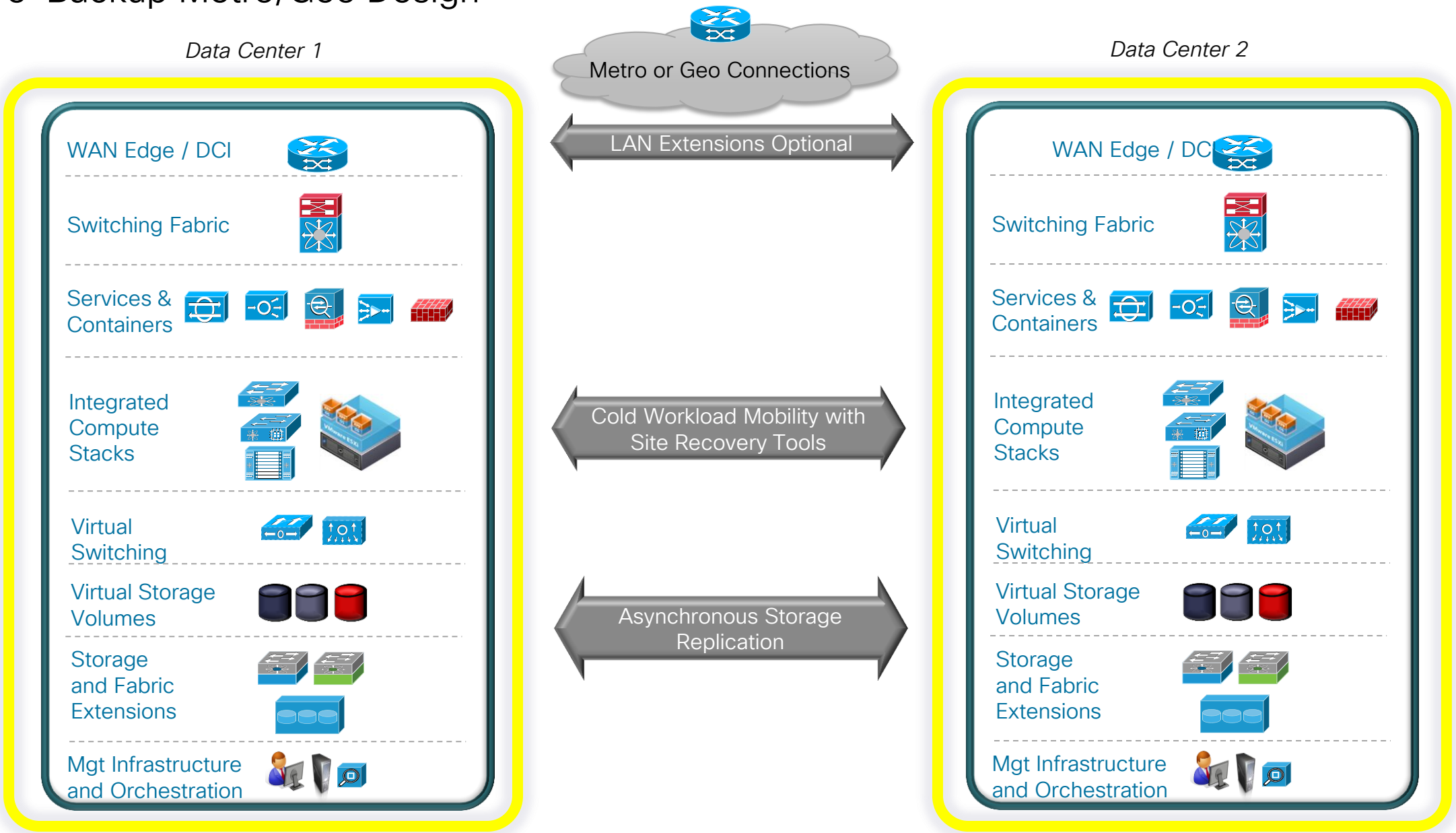
Services: Service connections temporarily disrupted
New service containers created at new site
Traffic tromboning between Metro DCs can be avoided

Compute: Support Single-Tier and Multi-Tier Applications

Storage: Asynchronous Data Replication to remote site (NetApp SnapMirror)
Hyper-V Replica Asynchronous Data Replication (Storage agnostic)
Virtual Volumes silo'd to each DC

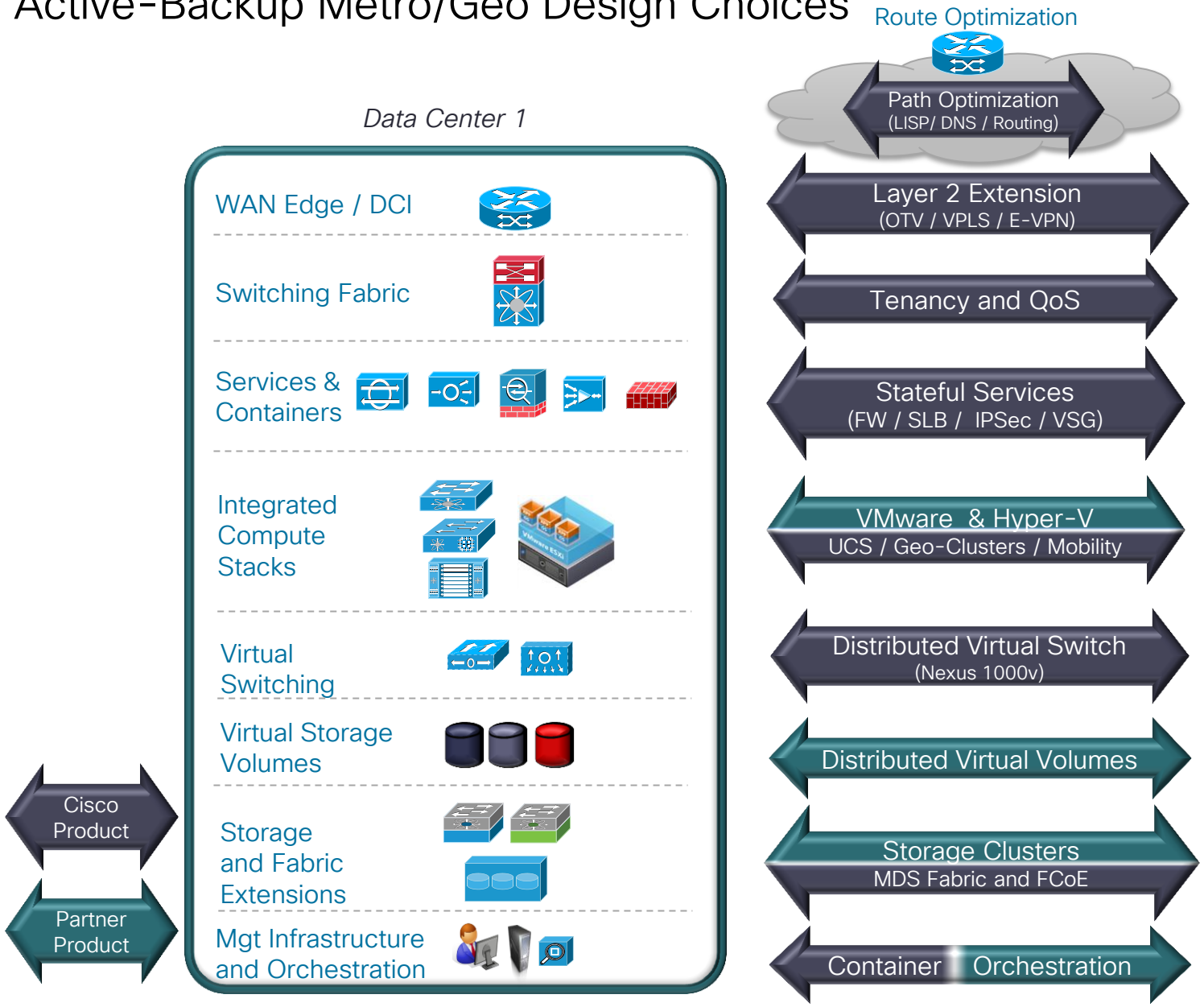


Active-Backup Metro/Geo Design



These Sites are Operating as TWO Independent Data Centers

Active-Backup Metro/Geo Design Choices



VMDC DCI Design Choices

- External Path Re-direction thru Orchestrated routing update
- Forced routing re-convergence to new site

- OTV LAN Extension , Preserve IP Addressing of Applications
- IP WAN Transport, greater than 10ms RTT across Metro/Geo distance

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- VMDC 3.0 FabricPath (Typical Design) with Multi-Tenancy
- Palladium Network Container

- Services Silo'd to each site
- Citrix SDX SLB at each site (no Geo extension)
- ASA 5500 FW Clustering at each site (no Geo extension)

- Separate ESX Clusters at each site with Server Affinity
- VMware SRM Cold Migration across Metro/Geo sites
- Silo'd vCenter at each Metro/Geo site
- Single and Multi-Tier Application migration strategy

- Nexus 1000v with VSMs and VEMs Silo'd to each site
- Service and Security Profiles follow Application VMs
- Different Nexus 1000v's mapped to Application Domains as needed

---

- Virtual volumes local to each site, replicated asynchronously

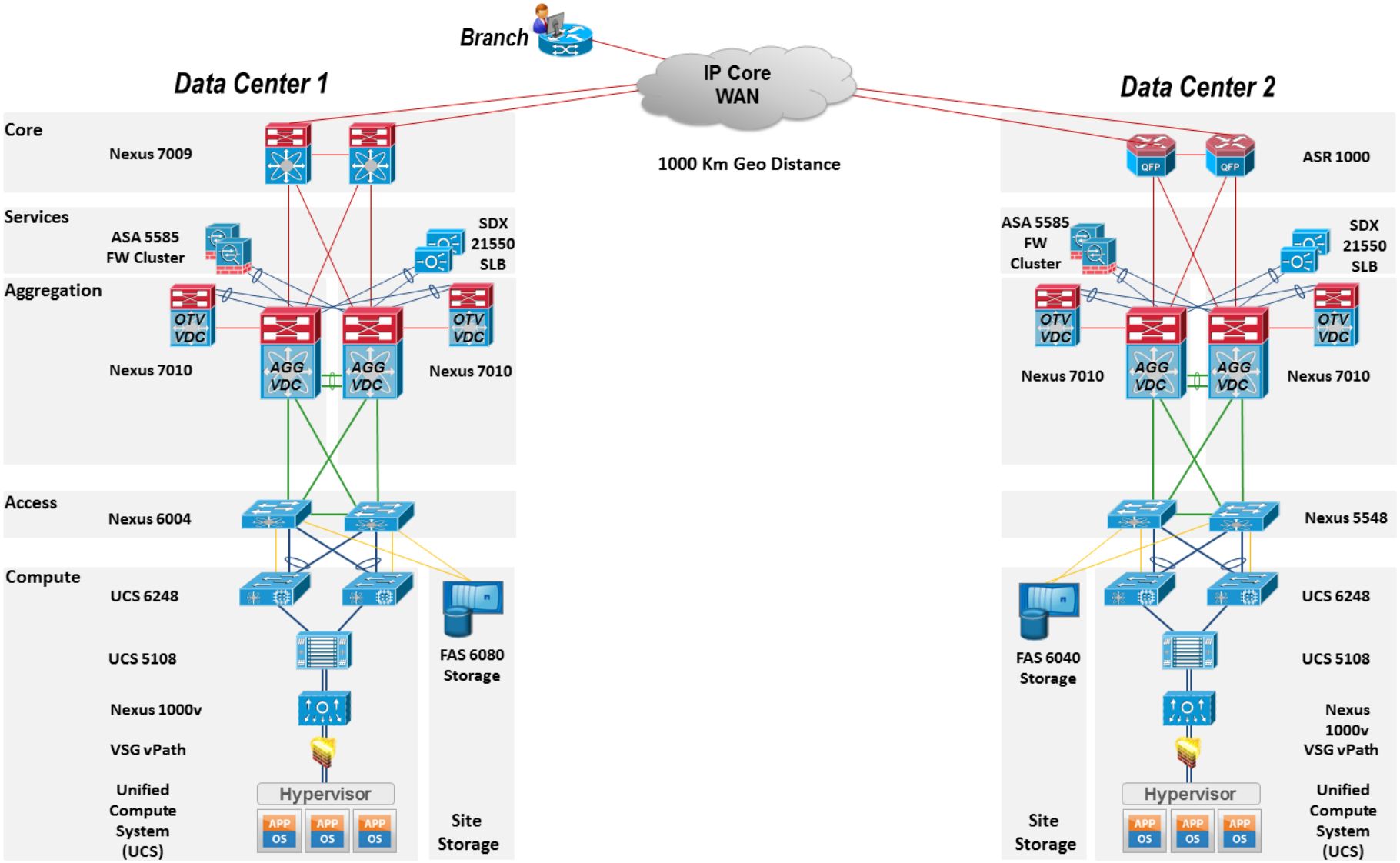
---

- NetApp SnapMirror ONTAP Asynchronous Storage Replication
- WAN based Storage Replicaion over long distance (200 RTT)
- MDS FC Switching for data replication

- Replicate Service Container to new site to support Mobile VM
- Virtual Mgt Infrastructure support across Metro/Geo sites

Migrate a **"Stopped"** Virtual Workload across Metro/Geo Data Centers, Stateless Services and VM reboot at new site

VMDC DCI Active-Backup Metro/Geo Topology



VMDC DCI… Key Take-Aways

Reduce CAPEX/OPEX of design, Reuse-Reclaim Recovery Resource and Simplify DCI Deployments

- End-to-end Validation of the Application Environment (physical & virtual resources)
- Minimal Disruption to the Application by stateful movement of applications AND application environment between sites
- Reduction in CAPEX/OPEX for DCI Deployments
  - Planned Usage of Recovery Capacity, minimize idle resources
  - Simplify the DCI Design Process for Operations Teams (validated design = reduced risk, preserve IP Addressing of applications and services)
  - Two Design Choices for different RPO/RTO targets, map applications to lowest cost design option
- Microsoft Hyper-V Release available in May 2014

Thank you.