# Cisco Connect

Dubai, UAE
20th March 2013

# Cloud Service Orchestration and Management with Cisco VMDC

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Systems Engineer

# Agenda

- Cloud Refresher

- Cisco Strategy

- What does the market want?

- Deploying Cloud using VMDC and CIAC

  – CIAC orchestration stack

  – Multi-tenant network architecture

- Recap

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# Cloud Computing

Visual Model of NIST's Working Definition of Cloud Computing

**Essential Characteristics**

Measured Service

Rapid Elasticity

On-Demand Self Service

Broad Network Access

Resource Pooling

**Service Models**

Software as a Service (SaaS)

Platform as a Service (PaaS)

Infrastructure as a Service (IaaS)

**Deployment Models**
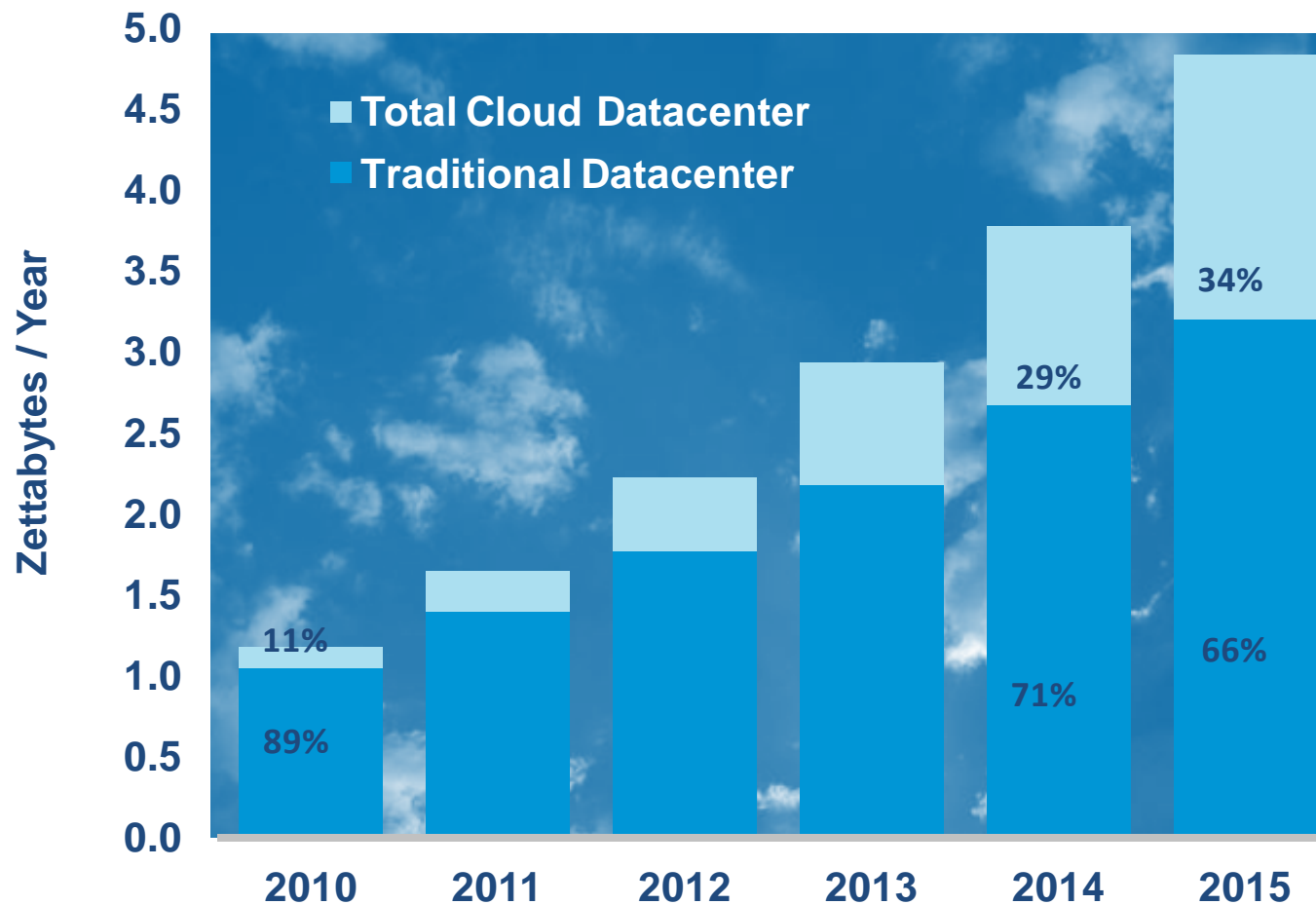
Public

Private

Hybrid

Community

http://www.csrc.nist.gov/groups/SNS/cloud-computing/index.html

IT resources and services that are abstracted from the underlying infrastructure and are provided "On-Demand" and "At Scale"

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# Cloud Traffic Increases 12x 2010 - 2015

## Cloud Traffic Will Be Over One-Third of DC Traffic by 2015



Legend:
- **Total Cloud Datacenter**
- **Traditional Datacenter**

**33% CAGR 2010-15**

Y-axis: Zettabytes / Year (0.0 to 5.0)

X-axis years: 2010, 2011, 2012, 2013, 2014, 2015

Data labels:
- 2010: 11% / 89%
- 2014: 29% / 71%
- 2015: 34% / 66%

# Cisco's Cloud Strategy

*Enabling* Cloud Applications/Services by Uniquely Combining the Unified Data Center and Cloud Intelligent Network

## Tailored Solutions for Building Clouds



Enable customers to build and operate private, public or hybrid clouds

## Rich Ecosystem of Integrated Solutions



Enable customers to deploy tested, best of breed solutions
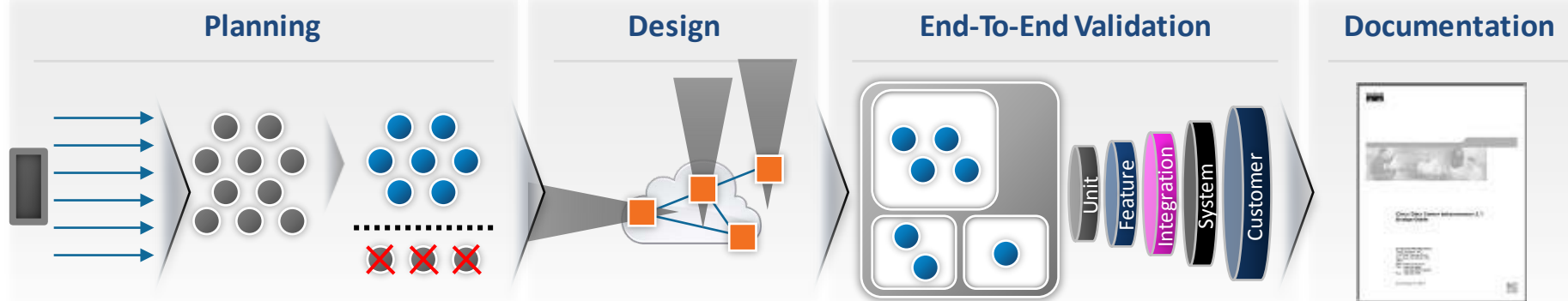
## Innovative Cloud Services



Enable cloud services including people-centric collaboration and other applications

# Cisco Validated Design Process

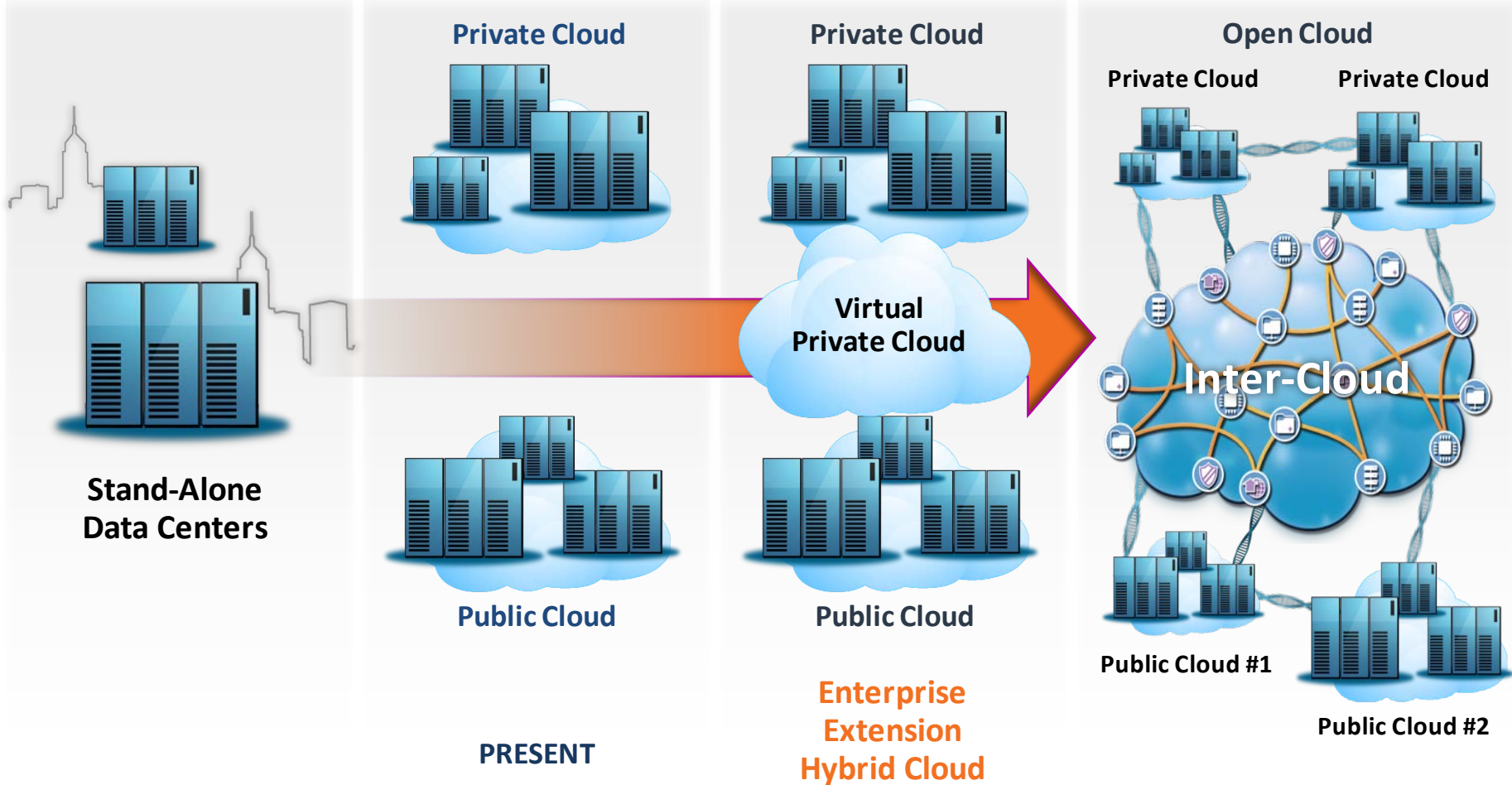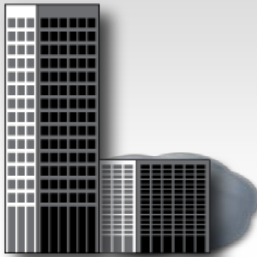## Innovation and Quality Through System Level Design and Validation

Key Customer Engagements
Consider end-to-end view

Thought Leadership
System level innovations

**System Development Fundamentals**

Product Development
Cross platform collaboration

System Delivery
Tested and validated designs

System Development Guidelines

CISCO | Cisco Validated Design ✓

| Planning | Design | End-To-End Validation | Documentation |

Unit · Feature · Integration · System · Customer

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# Cloud Deployment Models—

Private, Public, Hybrid



**Stand-Alone Data Centers**

**Private Cloud**

**Public Cloud**

PRESENT

**Private Cloud**

Virtual Private Cloud

**Public Cloud**

Enterprise Extension Hybrid Cloud

**Open Cloud**

Private Cloud        Private Cloud

Inter-Cloud

Public Cloud #1

Public Cloud #2

# Cloud Deployment Models

**Ownership**

All cloud resources owned by or dedicated to enterprise

All cloud resources owned by providers; used by many customers

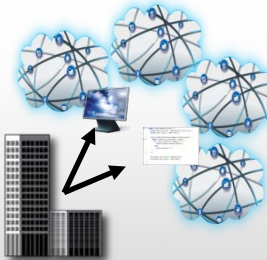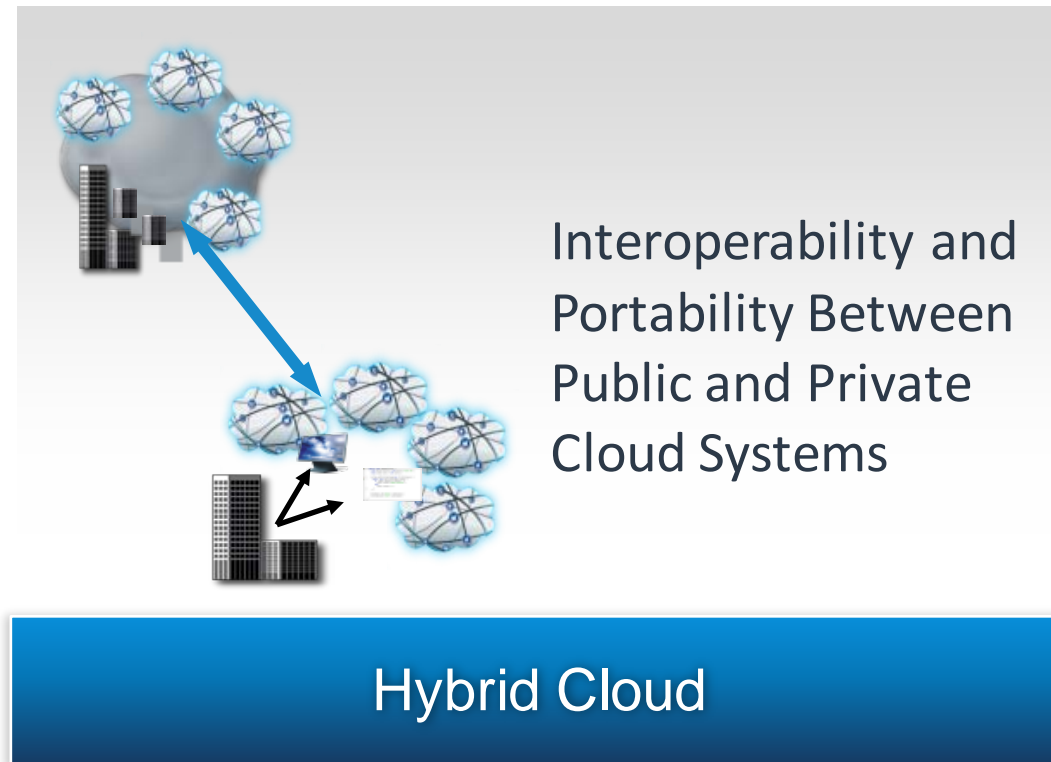| Internal Resources | External Resources |
| --- | --- |
| Private Cloud | Public Cloud |

**Control**

Cloud definition/ governance controlled by enterprise

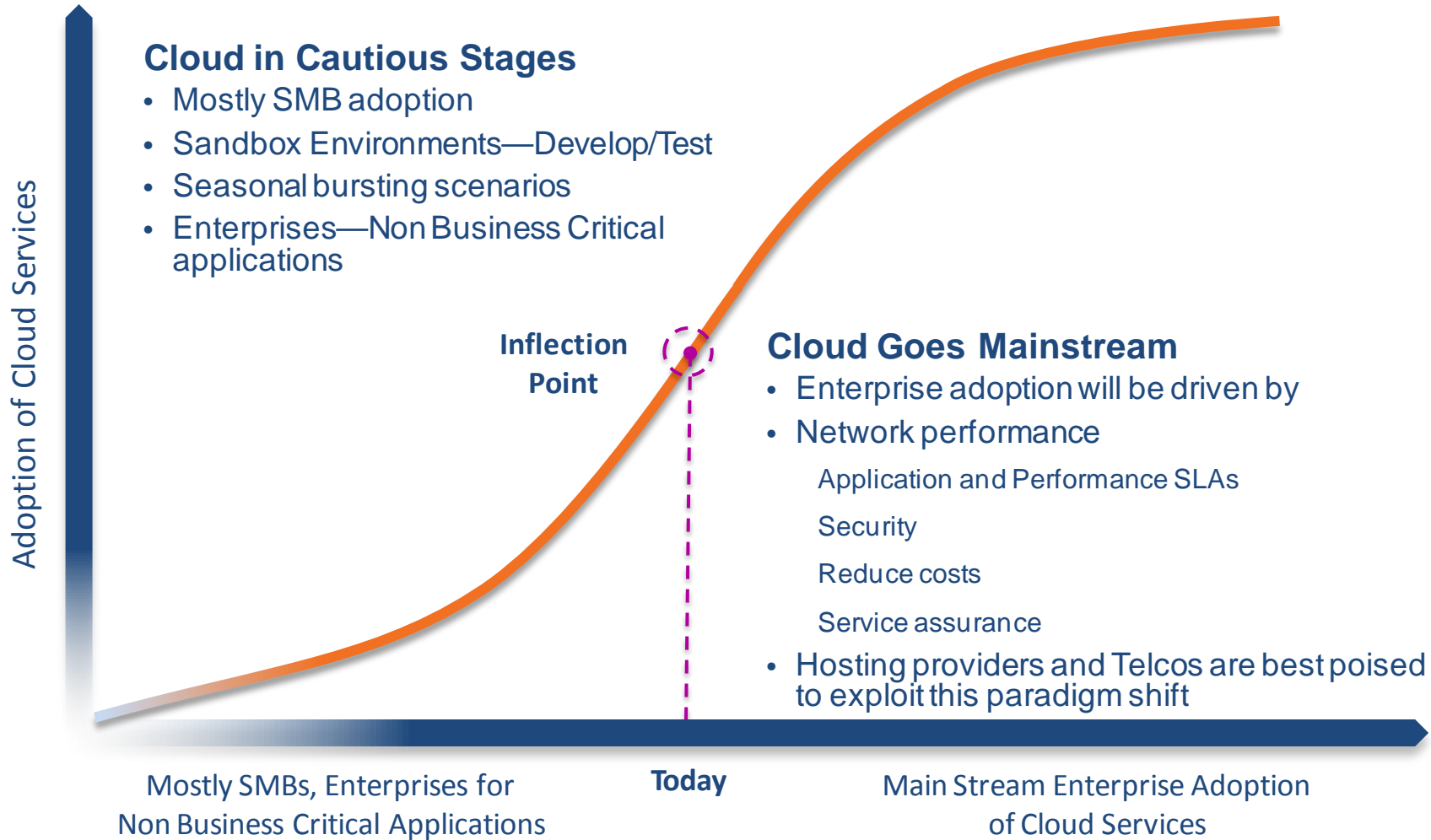Cloud definition/ governance controlled by provider

# Cloud Deployment Models



Interoperability and Portability Between Public and Private Cloud Systems

**Hybrid Cloud**

# The Journey to Cloud

## Evolution of IT + Business Agility

| Consolidation (Reduce Costs) | Virtualization (Improve Agility) | Automation (Transform IT) |
|---|---|---|

**Microsoft**

**ORACLE** **SAP**

Platinum

Gold

IT Infrastructure            Business Applications            IT-as-a-Service

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# Cloud Adoption Curve

**Adoption of Cloud Services** (y-axis)

**Cloud in Cautious Stages**
- Mostly SMB adoption
- Sandbox Environments—Develop/Test
- Seasonal bursting scenarios
- Enterprises—Non Business Critical applications

**Inflection Point**

**Cloud Goes Mainstream**
- Enterprise adoption will be driven by
- Network performance

  Application and Performance SLAs

  Security

  Reduce costs

  Service assurance
- Hosting providers and Telcos are best poised to exploit this paradigm shift

Mostly SMBs, Enterprises for Non Business Critical Applications

**Today**

Main Stream Enterprise Adoption of Cloud Services

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# Cloud Delivery Using Cisco Stack

# Cloud Building Blocks

## Common Physical Infrastructure

Network Services

Data Centre Fabric

| Virtualized Resources | Virtualized Resources |
| --- | --- |
| Compute Network Storage | Compute Network Storage |
| Pod | Pod |

## Orchestration and Management Software

Network Manager

Compute Manager

Server Provisioner

Virtualization Manager

Orchestration Engine

User Portal & Service Catalog

# Orchestration and Management Software

**Orchestration:**
Cisco Intelligent Automation for Cloud (CIAC)

**Network Architecture:**
Virtual Multi-Tenant Data Center (VMDC)

**Domain Managers**

Network: Cisco Network Services Manager
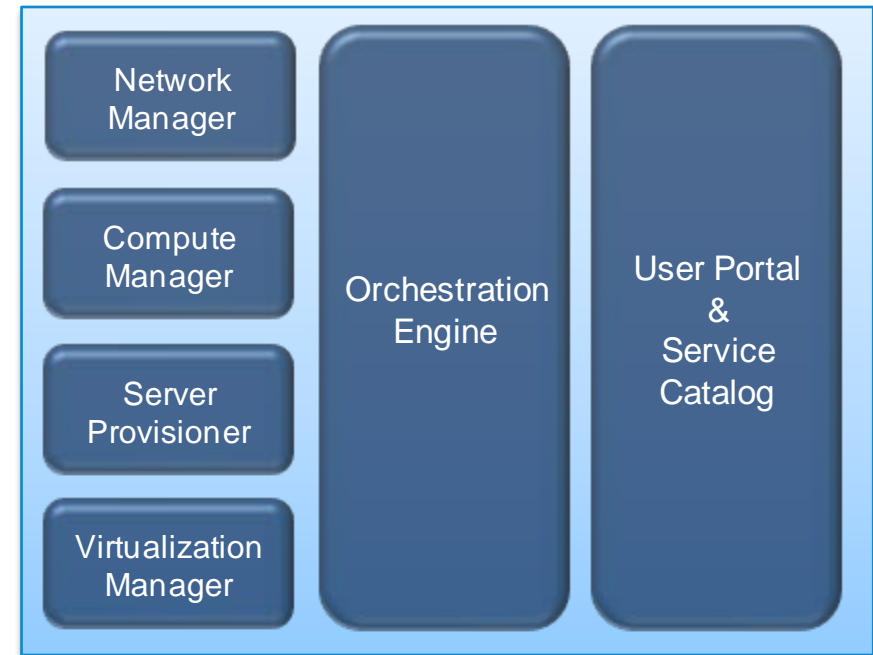Compute: Cisco UCS Manager
Virtualization: vCenter
OS/Server: Cisco Server Provisioner

**Orchestration:**
BMC Cloud Lifecycle Management (CLM)

**Network Architecture:**
Virtual Multi-Tenant Data Center (VMDC)

**Domain Managers**

Network: Blade Logic for Networks (BBNA)
Compute: Cisco UCS Manager
Virtualization: vCenter
OS/Server: Blade Logic for Servers (BBSA)

# Cisco Intelligent Automation for Cloud

## Orchestration and Management Software

- Service catalog and self-service portal – Cisco Cloud Portal

- Global orchestration and reporting – Cisco Process Orchestrator

- Multi-tenant network provisioning – Cisco Network Services Manager

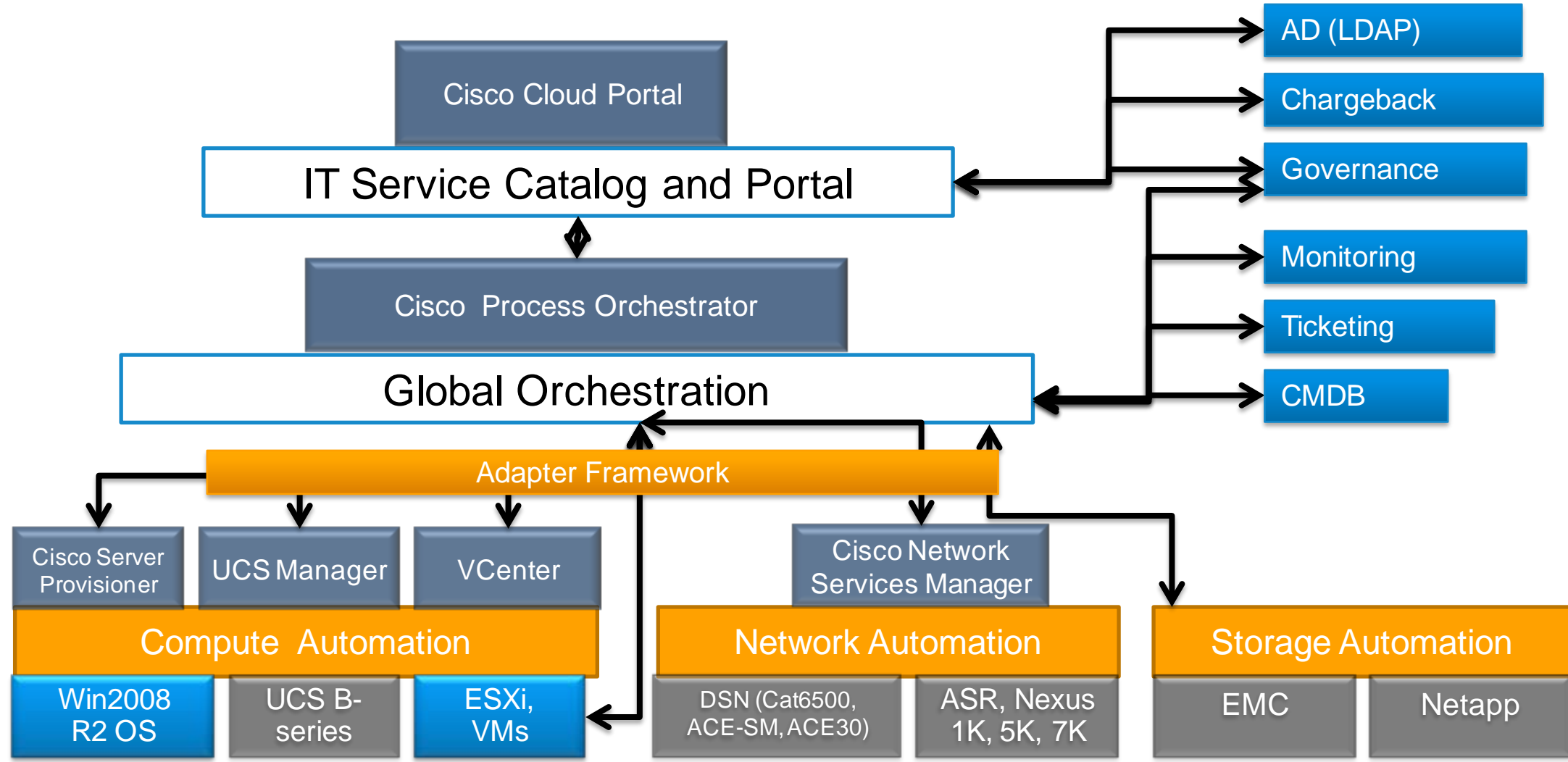- Adapter framework to communicate to compute, virtualization and storage domain managers

| Network Manager | | |
| --- | --- | --- |
| Compute Manager | Orchestration Engine | User Portal & Service Catalog |
| Server Provisioner | | |
| Virtualization Manager | | |

# CIAC Components Explained

**Compute Manager**

UCS Manager

**Virtualization Manager**

vCenter

**Network Manager**

LINE SIDER TECHNOLOGIES

**Server Provisioner**

Cisco Server Provisioner

**Orchestration Engine**

TIDAL SOFTWARE

**User Portal & Service Catalog**

newScale

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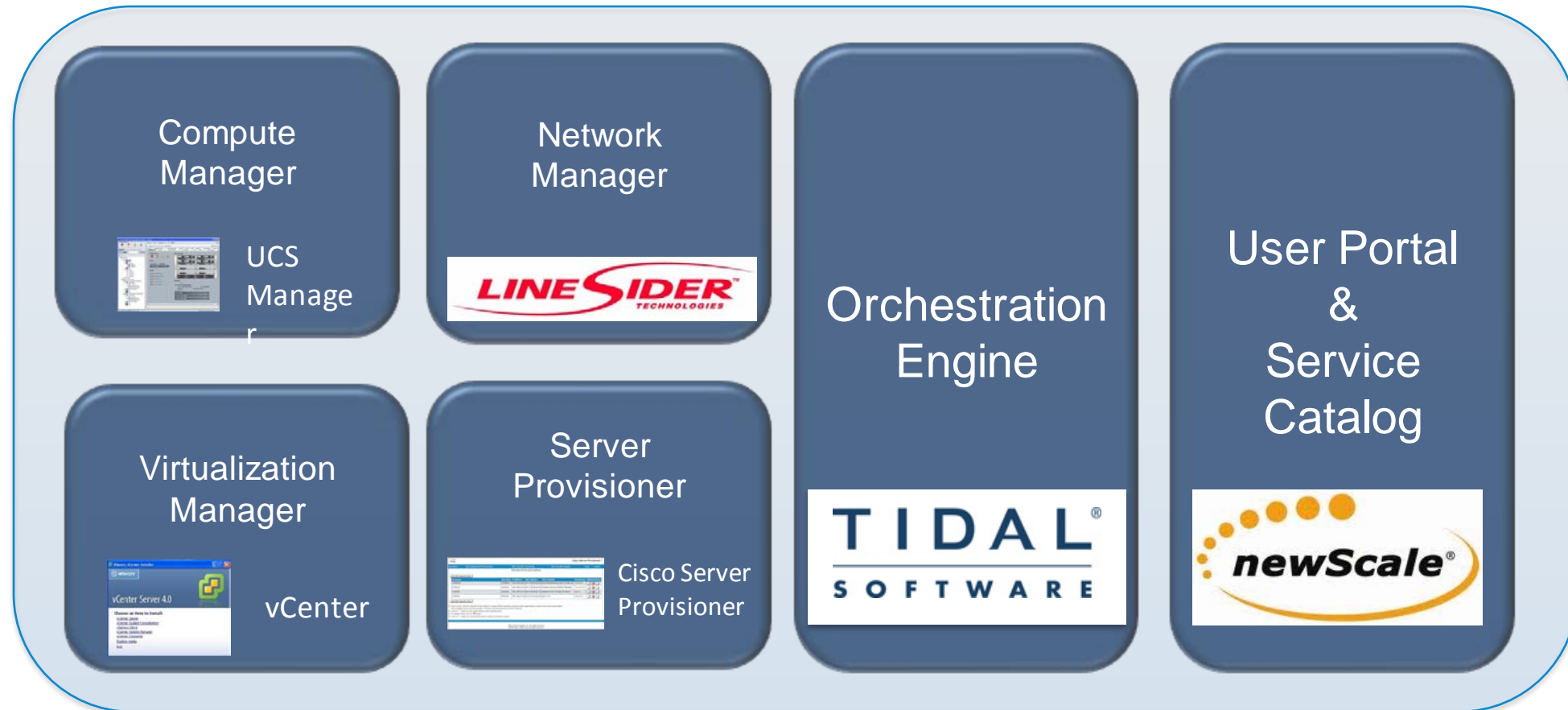
# CIAC Orchestration Framework



Catalog,
Order, Offer,
Metering,
Billing,
Chargeback

Cisco Cloud Portal

AD (LDAP)

Chargeback

IT Service Catalog and Portal

Governance

Monitoring

Orchestration

Cisco Process Orchestrator

Ticketing

Global Orchestration

CMDB

Adapter Framework

Domain
Managers

Cisco Server
Provisioner

UCS Manager

VCenter

Cisco Network
Services Manager

Compute Automation

Network Automation

Storage Automation

Win2008
R2 OS

UCS B-
series

ESXi,
VMs

DSN (Cat6500,
ACE-SM, ACE30)

ASR, Nexus
1K, 5K, 7K

EMC

Netapp

Cisco software
OEM software
Infrastructure elements/devices

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# Hypervisor Support
## Popular Hypervisors

**vmware®**

Supported in CIAC 3.0

**Windows Server 2008 Hyper-V™**

Future

**KVM**

Future

**Xen**

Future

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# CIAC 3.0 - Intuitive User Interface

## Service Catalog
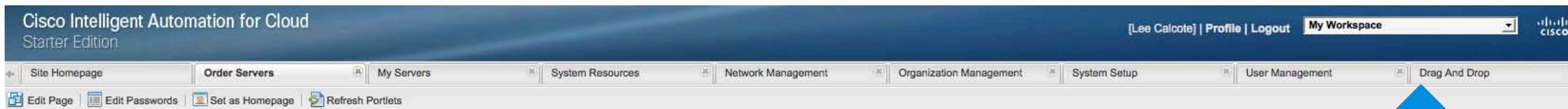


**Easily accessible User and Admin options**

**Clearly laid out ordering choices**

# CIAC 3.0 – User Interface
## VM Ordering

**Order a Virtual Machine From Template**

### Order a Virtual Machine From Template
Order a new virtual machine from a template you select.

Submit Order    Reset

**Virtual Machine**

| | | |
|---|---|---|
| ★ | Operating system family: | Linux | Select the operating system family (Ex: Windows, Linux) of the desired VM template from the list. |
| ★ | Operating system: | - - - | Select the operating system of the desired the VM template from the list. |
| ★ | VM template: | | Select the VM template you wish to use for deploying the virtual machine from the list. |
| ★ | Computer Name (Host): | | Enter a host name for the new virtual machine. This name must be unique within the domain. |
| ★ | Virtual Machine Size: | - - - | Select the hardware configuration (CPU, memory, storage) you'd like to have for your virtual machine from the list. |
| | vCPUs: | | |
| | vRAM (GB): | | |
| | Strorage (GB): | | |

VM parameter selection

**Network Selection**

| | | |
|---|---|---|
| ★ | Deploy to Network: | - - - | Select the network on which to deploy the server. The server will be assigned and set up with a static IP address on this network. |

**Lease Term**

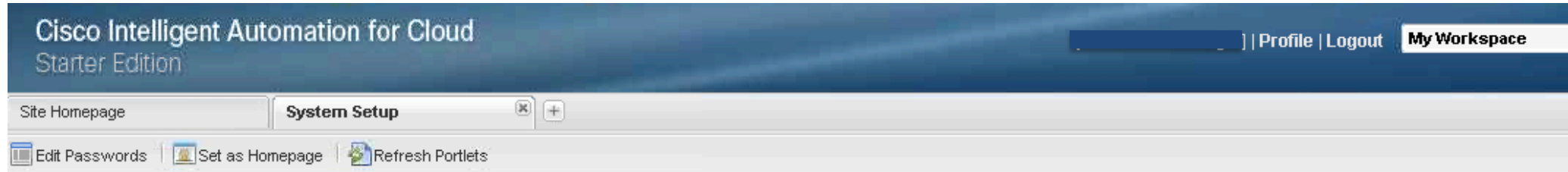| | | |
|---|---|---|
| | Term: | No Lease | Select the duration of the lease term from the list. The server will be automatically decommissioned by the end of this term, unless you extend the lease. |

**Administrator Password**

| | | |
|---|---|---|
| ★ | Enter Password: | | |
| ★ | Re-enter Password: | | |

Submit Order    Reset

# CIAC 3.0 – User Interface

Template Management



**Templates**

- Register VM Template
- Remove VM Template
- Register Operating System Template
- Remove Operating System Template
- Register Service Profile Template
- Update Service Profile Template
- Remove Service Profile Template

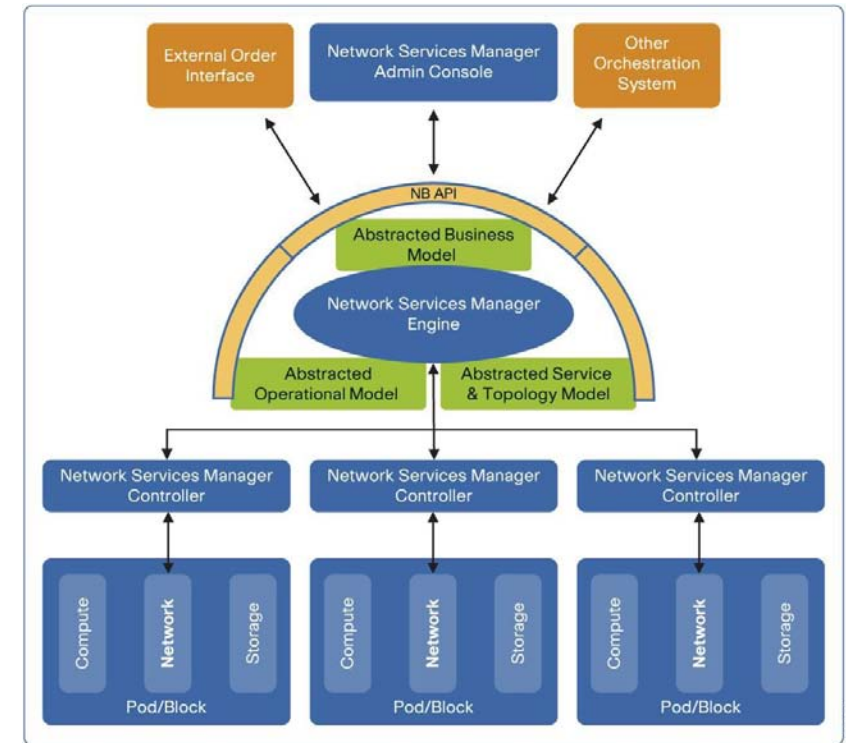Admin options to update, delete and add templates

# Network Orchestration

# Network Services Manager

## Key Features



- Common network abstraction layer

- Standardized API

- Flexible and easily consumable interface

- Fast deployment of virtual data centers in cloud

- Device support in various roles

- Multi-Pod support

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# Network Services Manager Overview

Network Services Manager

Instantiate Tenant Metamodel (Logical Topology, Tenant resources)

NSM Engine

Object Model (Physical Topology, Resources, Credentials etc)

Service directives

NSM Controller

Network Device Configurations

POD

Network

**Virtual Tenant N/W**

Compute

SAN

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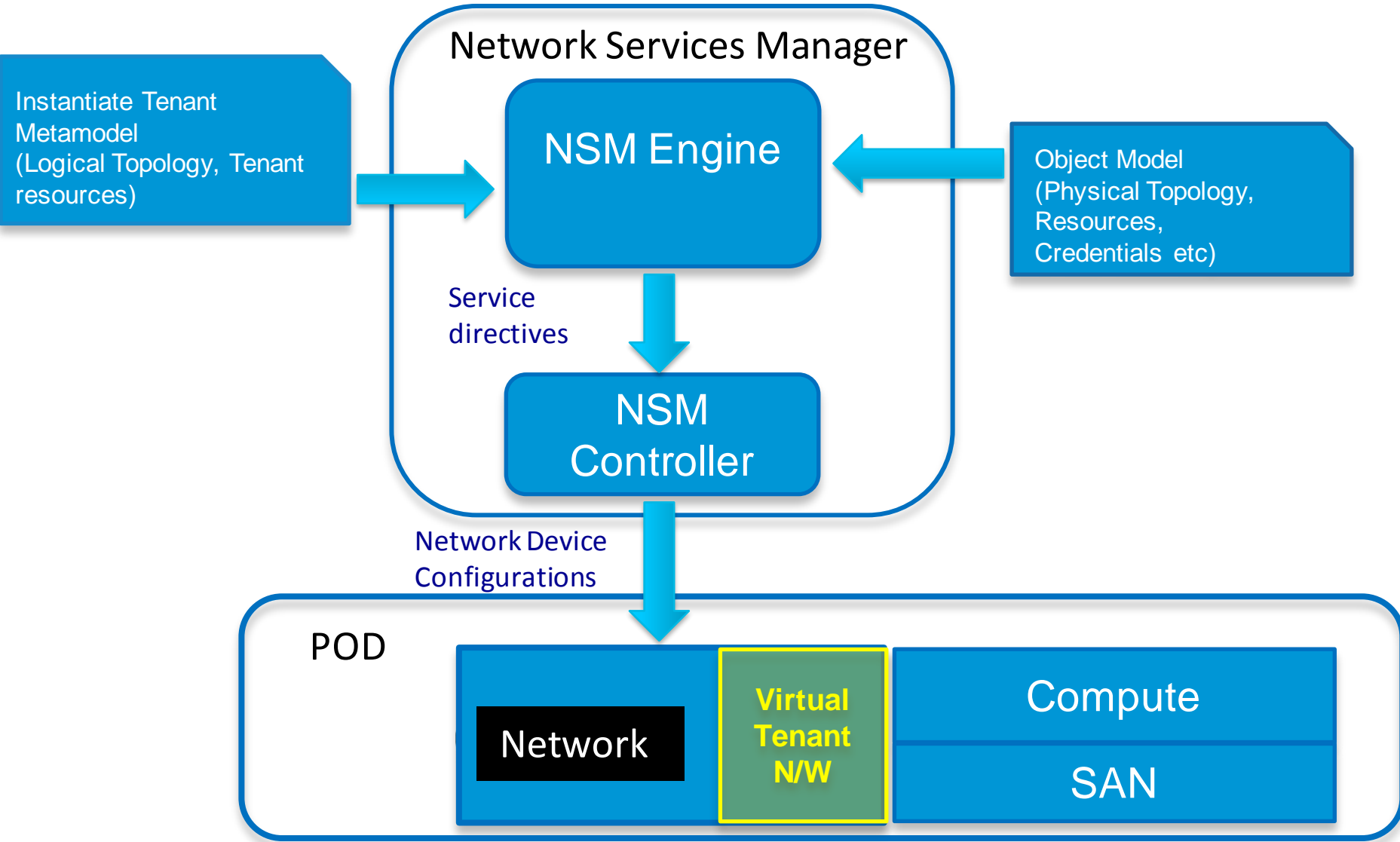
# Network Services Manager
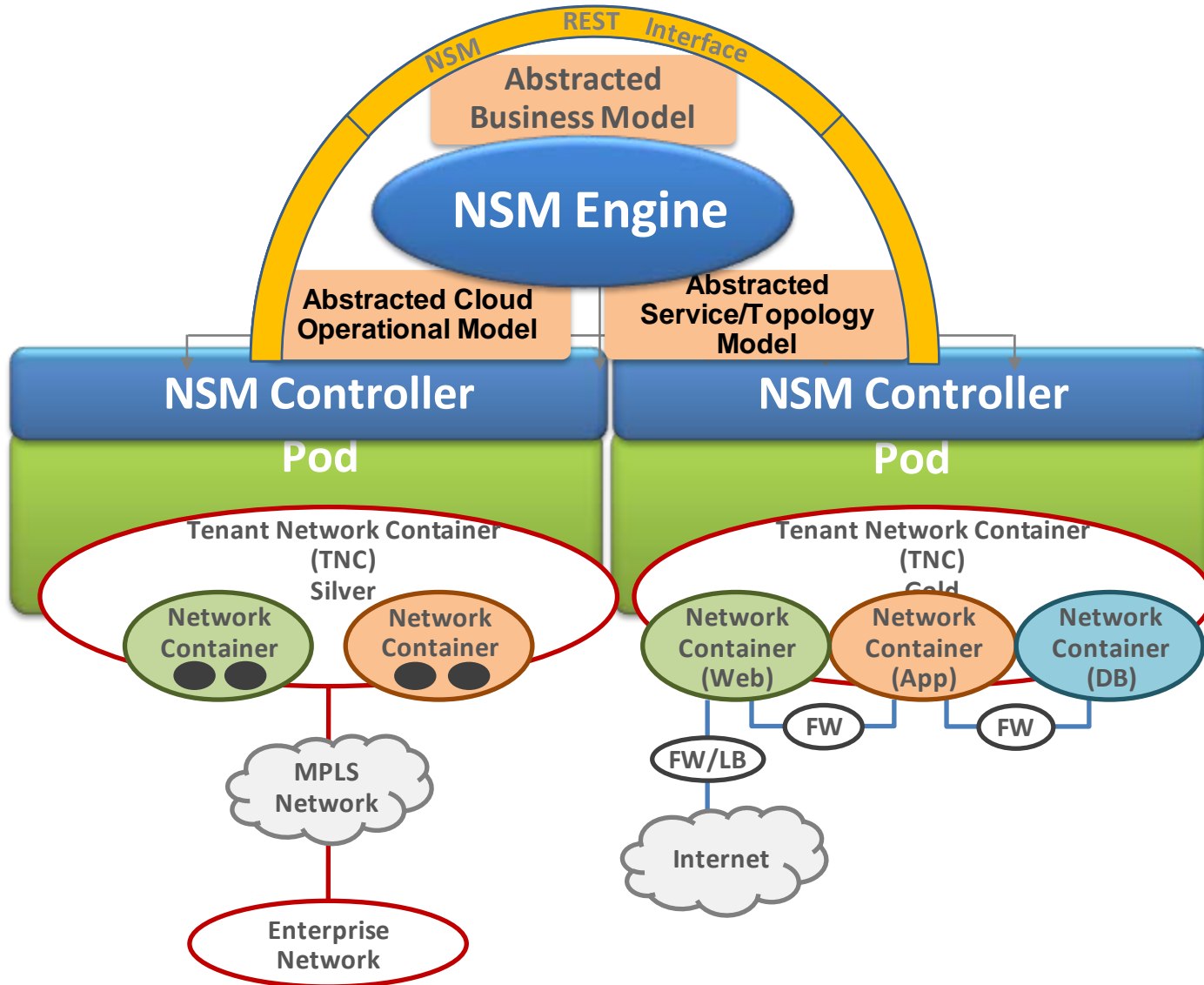


Tenant: An organization or individual subscribed to service offering

Tenant Network Container: A layer 3 partition for a tenant. Can contain multiple Network Containers

Network Container: A layer 2 or 3 network for tenant machines and services such as FW and LB

Metamodels: Definition of and relationship between various entities and resources that exist in the network

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# Using Network Services Manager

Abstracting the Network



REST Calls

Provisioning System

API

Network Services Manager Engine

NSM Controller

NSM

Config Push

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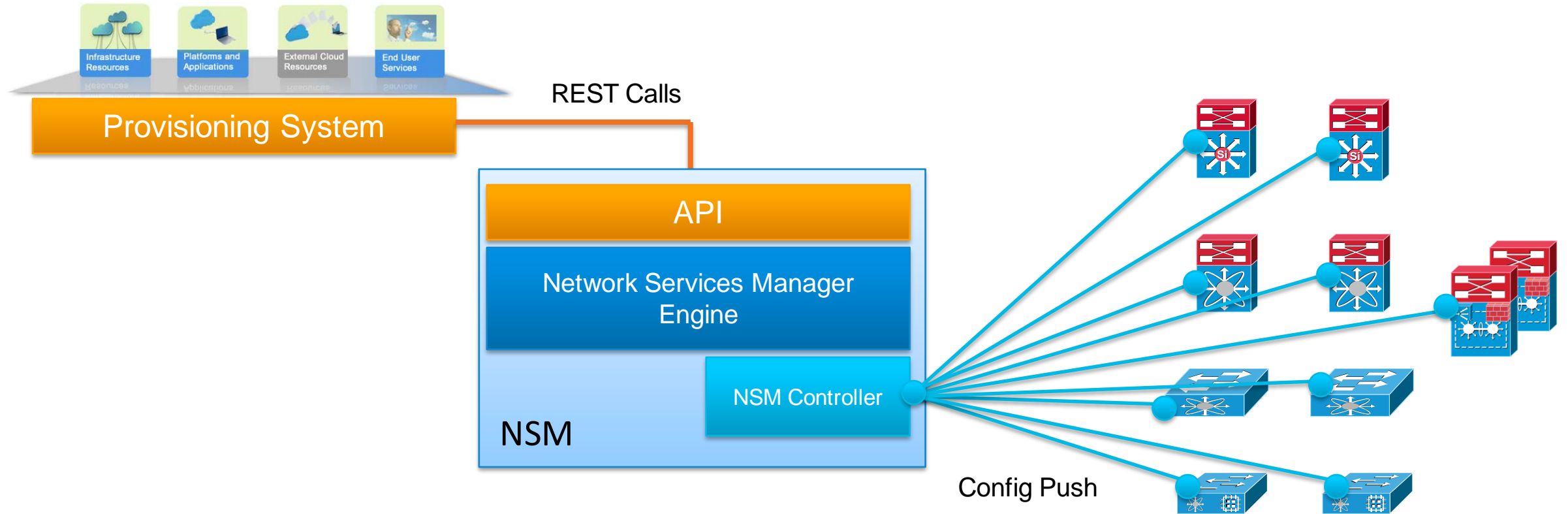
# What does the market want?

# Service Class Examples



| Bronze | Silver | Gold |
|---|---|---|
| VM ratio 4:1, Queue bandwidth- 20% (dedicated vlan and VRF) | VM ratio 2:1 , ACE , Queue bandwidth – 30% (dedicated vlan, VRF , and SLB. Local Data protection and recovery using Snap. ).  Remote replication to the DR site | VM ratio 1:1 , ACE and FWSM, Queue bandwidth – 40% reserved, (Highly secure : dedicated vlan, VRF, firewall and SLB. 100% local data protection and recovery using clone (full copy).  Remote replication to the DR site |

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# Create offers with Service Profiles for the

## Application Lifecycle (Leveraging the DC & the Network)

**Application Requirements** ↑

### Service Level

**Mission Critical**
Enterprise

*Premier* →

99.995% SLA for HA
Stateful Firewalls
3x Private VLANs
1 Gbps Guarantee
3-Tier ILM Storage

---

**Enterprise Web Hosting**
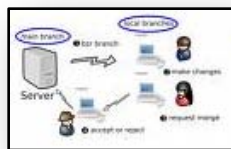Web Hosting, eCommerce

http://

*Balanced* →

99.99% SLA
Stateful Firewalls
1x Private VLAN
100 Mbps Guarantee
2-Tier ILM Storage

---

**"Test/Dev"**
Start using clouds for application development and testing environments

*Essential* →

99.9% SLA
Lowest Cost
Easy On-boarding

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# Virtual Multi-Tenant Data Center (VMDC)

# Cloud Infrastructure

Virtual Multi-tenant Data Center (VMDC)

- **Modular design** to enable easy expansion and incremental growth
- **Resilient and fault tolerant** infrastructure
- Tiered security and end to end tenant **traffic separation**
- Layer 4-7 **services** including Firewall and Load Balancing
- Role based access control

Data Centre Network Fabric

| Virtualized Resources | Virtualized Resources |
|---|---|
| Compute Network Storage | Compute Network Storage |
| Pod | Pod |

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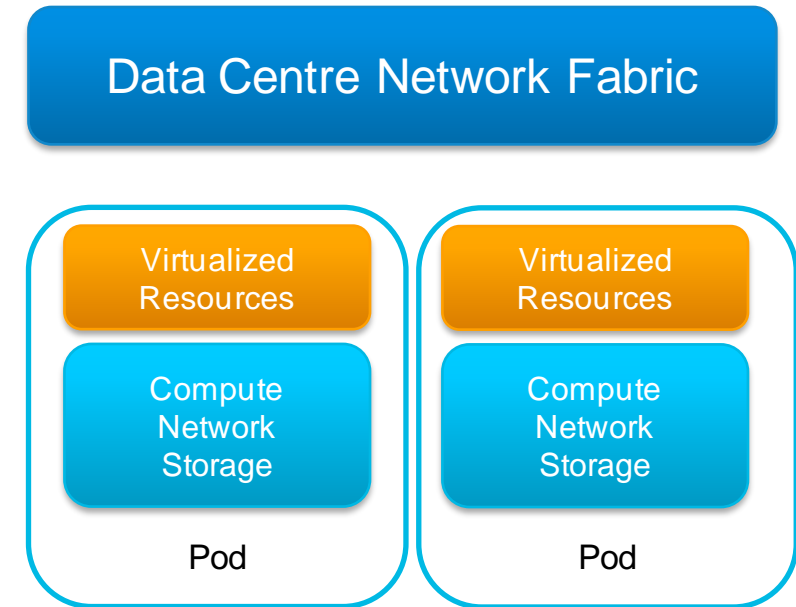
# What Is VMDC?

- Virtualized, Multi-Tenant Data Center (VMDC) is a cloud blueprint that enables customer to readily deploy services or applications
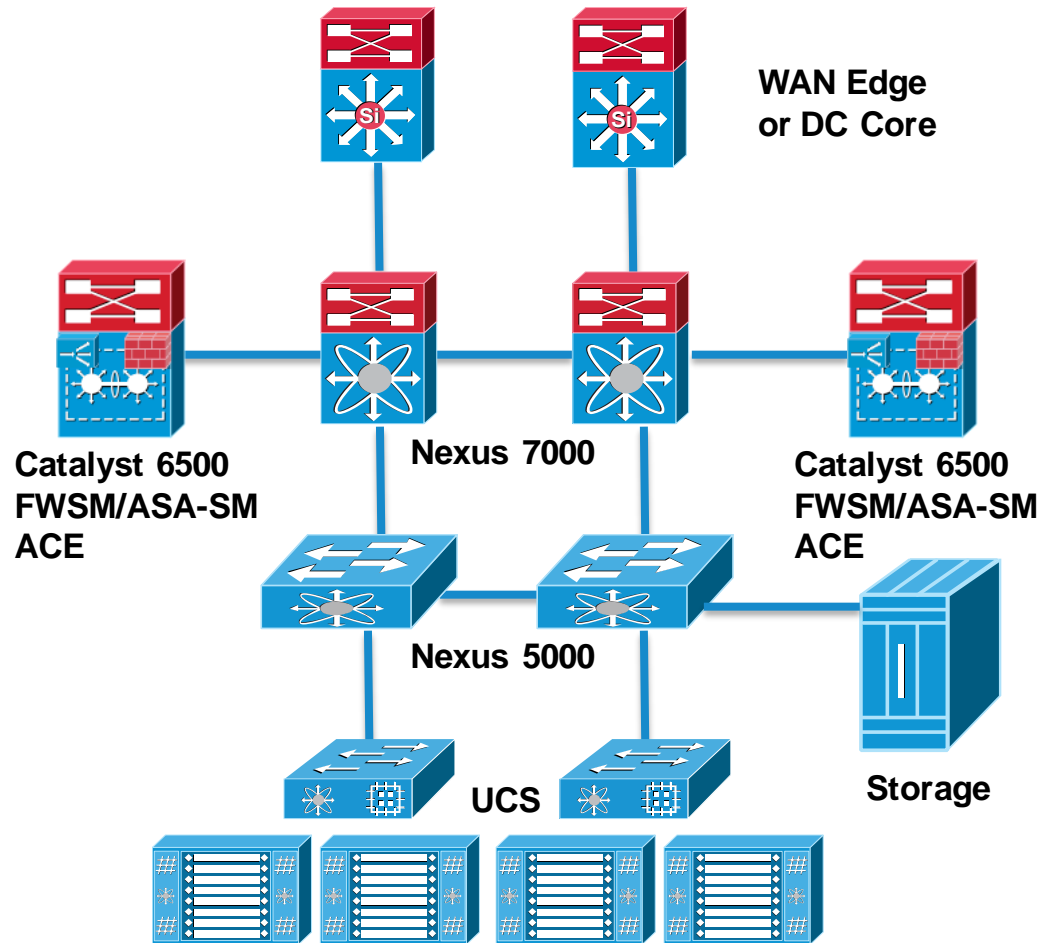
- A validated, full-system architecture for customers deploying virtualized services (application workloads) in a "cloud-style" environment, sharing common infrastructure for multiple cloud consumers or "tenants"

- A flexible, modular design that can be used as a blueprint for cloud deployments

- An architecture built to scale

- An architecture that aggregates integrated compute stacks, unified data center, and data center interconnect into an end-to-end architecture
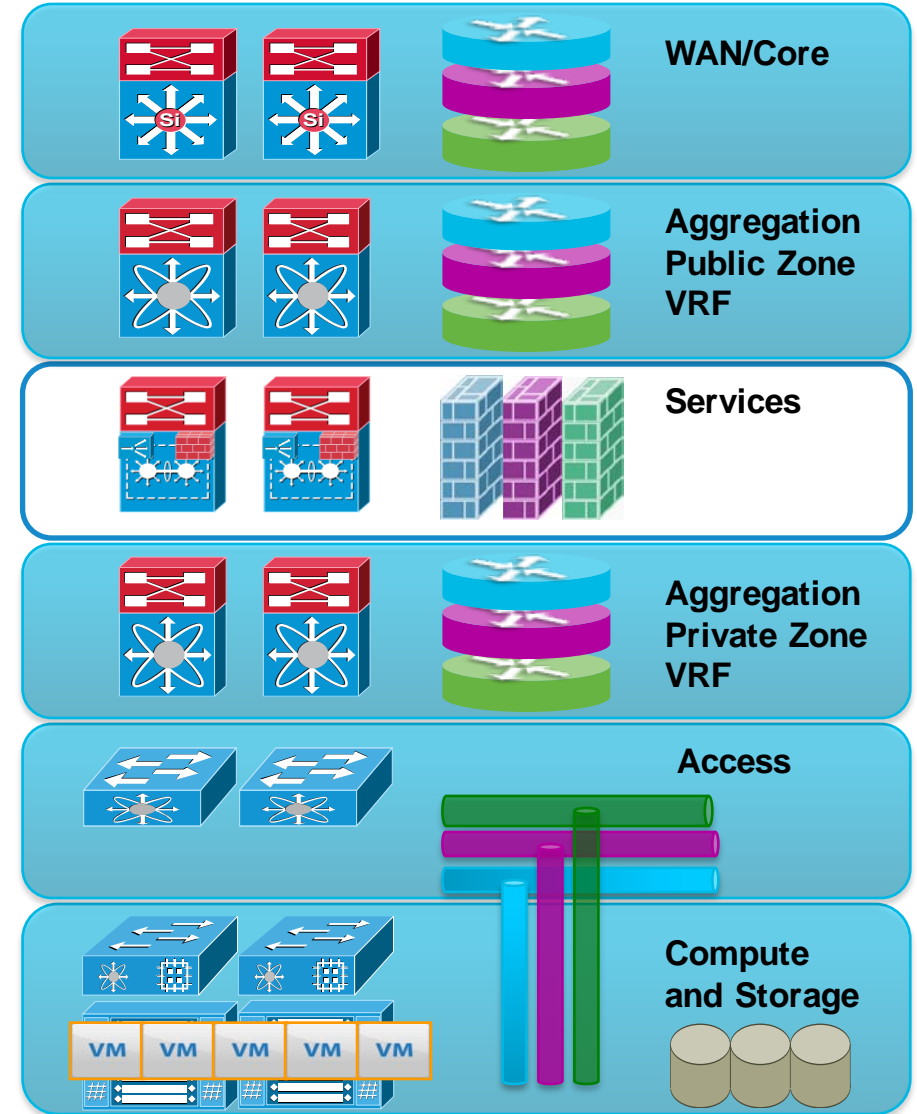
Validated Designs, Modular Approach, Flexible Deployment Options

# VMDC – Concept and Design

WAN Edge
or DC Core

Catalyst 6500
FWSM/ASA-SM
ACE

Nexus 7000

Catalyst 6500
FWSM/ASA-SM
ACE

Nexus 5000

UCS

Storage

Redundant connections are not shown for clarity

WAN/Core

Aggregation
Public Zone
VRF

Services

Aggregation
Private Zone
VRF

Access

Compute
and Storage

VM VM VM VM VM

# VMDC - customer view of network design



WAN/Core

Public Zone

Compute and Storage Resources

Firewall, LB and other services

Private Zone

Compute and Storage Resources

Customer A requests new resources from IT provider

Customer B requests new resources from IT Provider

WAN/Core

Public Zone

Compute and Storage Resources

Firewall, LB and other services

Private Zone

Compute and Storage Resources
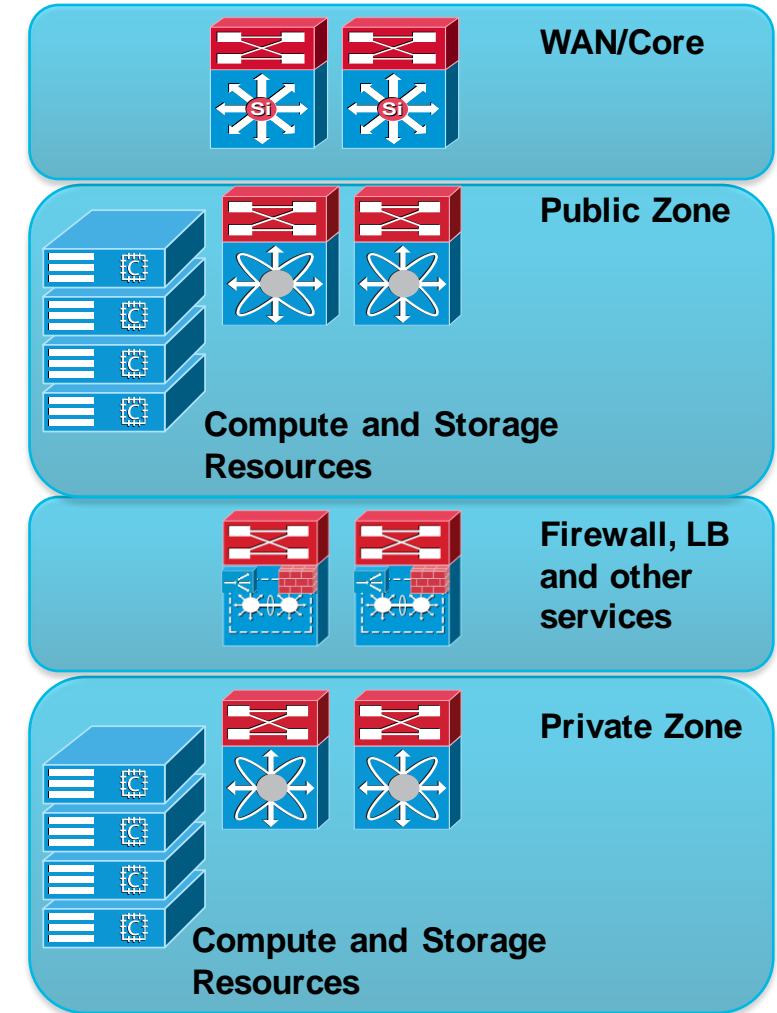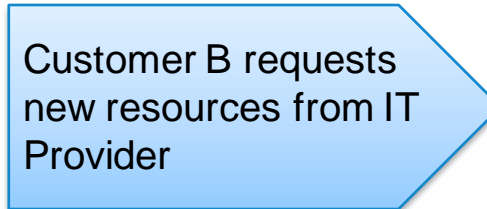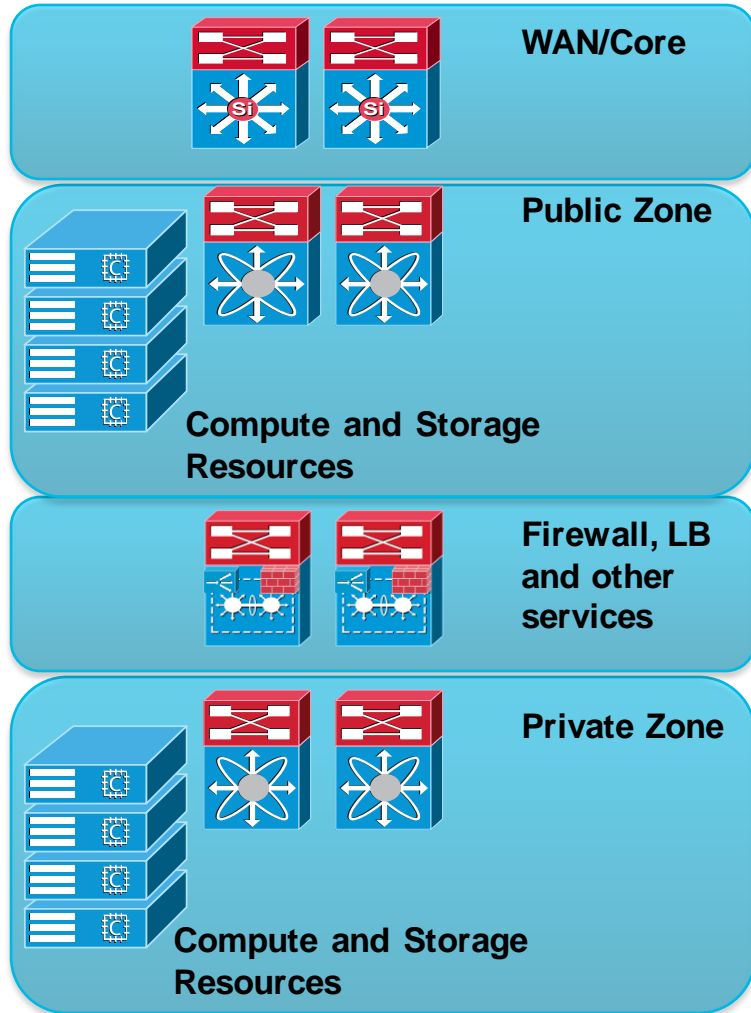
# VMDC Validated Infrastructure Containers

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# Cisco Virtualized Multi-Tenant Data Center

## Comprehensive, Modular, and Flexible Approach



**Enhanced Data Center Interconnect**

**Unified Data Center Networking**

**Integrated Compute Stacks**

Data Center — VMDC

Core

Aggregation — VMDC

Services

Access

NAS   Compute   SAN — VMDC

**Cloud Service Management**

Business Support

Provisioning Configuration

Portability/ Interoperability

VMDC

VMDC

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# Cisco Virtualized Multi-Tenant Data Center

## Comprehensive, Modular, and Flexible Approach



**Enhanced Data Center Interconnect**

**Unified Data Center Networking**

**Integrated Compute Stacks**

FlexPod™

Data Center

Core

Aggregation

Services

Access

VMDC

**Cloud Service Management**

Business Support

Provisioning Configuration

Portability/ Interoperability

VMDC

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# Cisco Virtualized Multi-Tenant Data Center

Modular for Each Step of the Journey



**Enhanced Data Center Interconnect**

**Unified Data Center Networking**

**Integrated Compute Stacks**

DCI and Hybrid

Network and Services Virtualization

Server and Application Virtualization

Data Center

Core

Aggregation

Services

Access

NAS | Compute | SAN

VMDC

**Enhanced DCI**
- Cisco ASR 9000 and 1000
- Cisco Nexus 7000

**Unified Data Center Networking**
- Cisco Nexus 7000
- Cisco Nexus 5000
- Cisco Data Center Service Node
- Service Appliances

**Integrated Compute Stacks**
- NetApp FlexPod
- VCE Vblocks
- Cisco Unified Computing System
- Cisco MDS
- Cisco Nexus 1000v
- Hypervisors

VMDC

# Data Center Interconnect



|  | Overlay Solution | PE-Based Solution |
|---|---|---|
| Ethernet | (e)TRILL / 802.1ad | |
| MPLS | | VPLS, A-VPLS, EVPN, EoMPLS |
| IP | OTV, LISP, VXLAN | |

- Interconnection Models:
  - Enterprise to Enterprise (E2E)
  - Enterprise to Service Provider (E2SP)
  - Service Provider to Service Provider (SP2SP)
- Overlay-Based Techniques
  - OTV, LISP, VXLAN
- Suitable for intra-Ent DC interconnect
  - NGN-Based DCI Solution:
  - Addresses E2SP for workload migration
  - Addresses SP2SP for regional or distributed data centres
- Standalone DCI Network
  - Provides interconnection between main SP DCs
  - Owned by SP DC team
  - Addresses SP2SP only
  - Very high bandwidth—packet/optical solution likely the most cost effective

# VMDC Security Framework

## Security Management

- Visibility
- Event correlation, syslog, centralized authentication
- Forensics
- Anomaly detection
- Compliance

## Services

- Initial filter for DC ingress and egress traffic; Virtual Context used to split polices for server-to-server filtering
- Additional firewall services for server farm specific protection
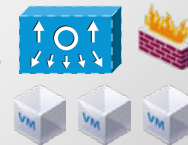


**Core**

**Aggregation**

**Services**

**Access**

ACLs, Port Security, VN Tag, Netflow, ERSPAN, QoS, CoPP, DHCP snooping

**Storage**

Data security, authentication and access control

**Virtual Access**

Virtual Firewall Real-Time Monitoring Firewall Rules

**UCS**

Port security, authentication, QoS features

## Infrastructure Security

- Infrastructure Security features are enabled to protect device, traffic plane, and control plane
- 802.1ae provides separation through encryption

## Services

- IPS/IDS provide traffic analysis and forensics
- Network Analysis provide traffic monitoring and data analysis
- Server load balancing masks servers and applications

# VMDC Consumer Models

Addressing Application Requirements

- **Network Requirements**
  - Session persistence
  - High Availability
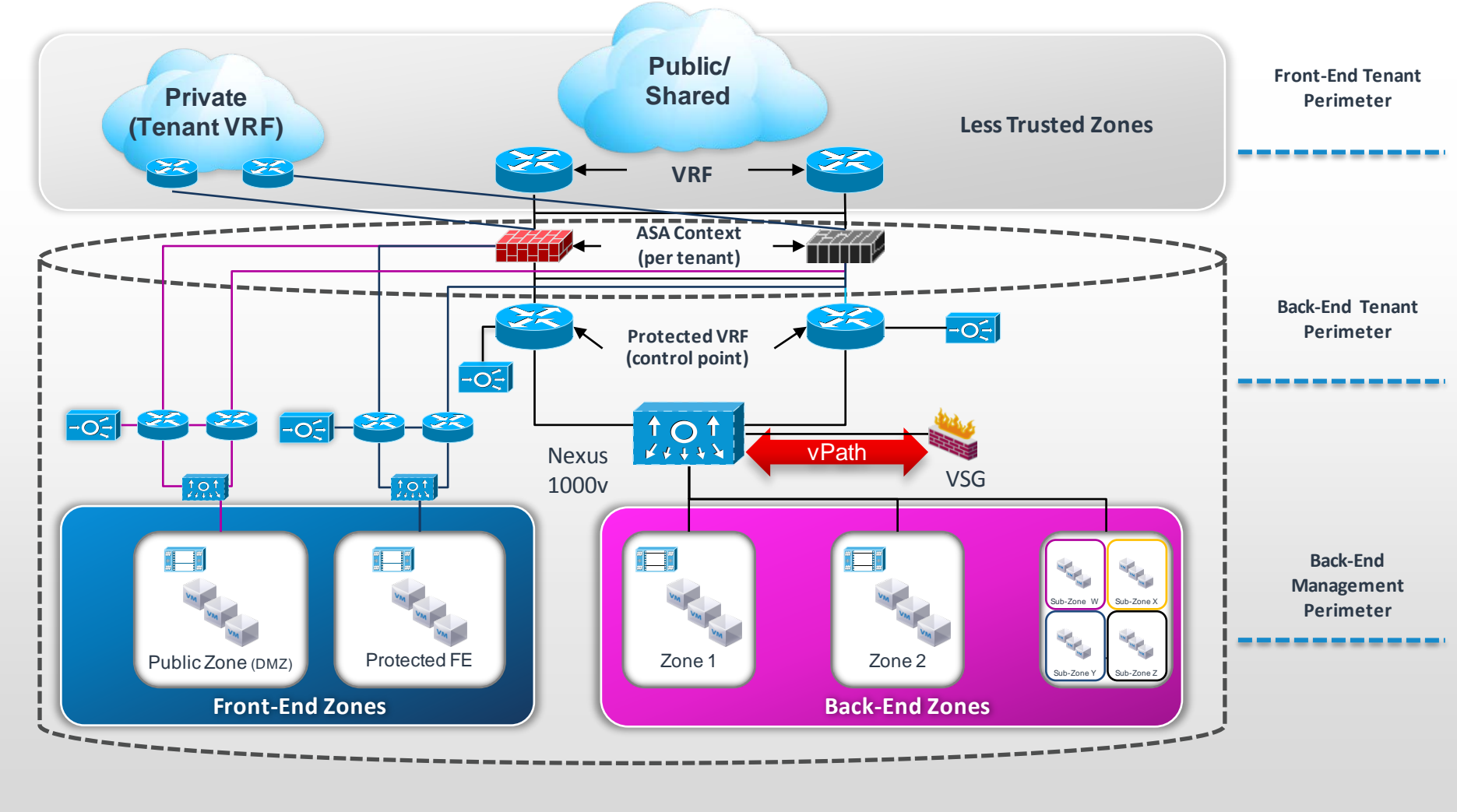  - Scalability
  - Latency Mitigation
  - Reliable transport

- **Security Requirements**
  - Secure sessions with encryption may be required
  - Each layer of the application stack authenticates data transport

Collaboration

**Cloud Consumer "X"**

N-tier Applications

SAP | Microsoft

**Cloud Consumer "Y"**

Virtual Desktops

**Cloud Consumer "Z"**

# VMDC Consumer Model

## Tiered Security in VMDC



Private (Tenant VRF)

Public/ Shared

VRF

Less Trusted Zones

Front-End Tenant Perimeter

ASA Context (per tenant)

Protected VRF (control point)

Back-End Tenant Perimeter

Nexus 1000v

vPath

VSG

Back-End Management Perimeter

Public Zone (DMZ)

Protected FE

Front-End Zones

Zone 1

Zone 2

Sub-Zone W

Sub-Zone X

Sub-Zone Y

Sub-Zone Z

Back-End Zones

# VMDC Building Blocks

## Scaling the Data Center



**The Data Center Core**

*Efficient replication of the PoD*

PoD

Service Appliances

Data Center Services Node

PoD

Service Appliances

Data Center Services Node

**Integrated Compute Stack**

*Storage*  *Network*  *Compute*

**Integrated Compute Stack**

*Storage*  *Network*  *Compute*

**Integrated Compute Stack**

*Storage*  *Network*  *Compute*

**Integrated Compute Stack**

*Storage*  *Network*  *Compute*
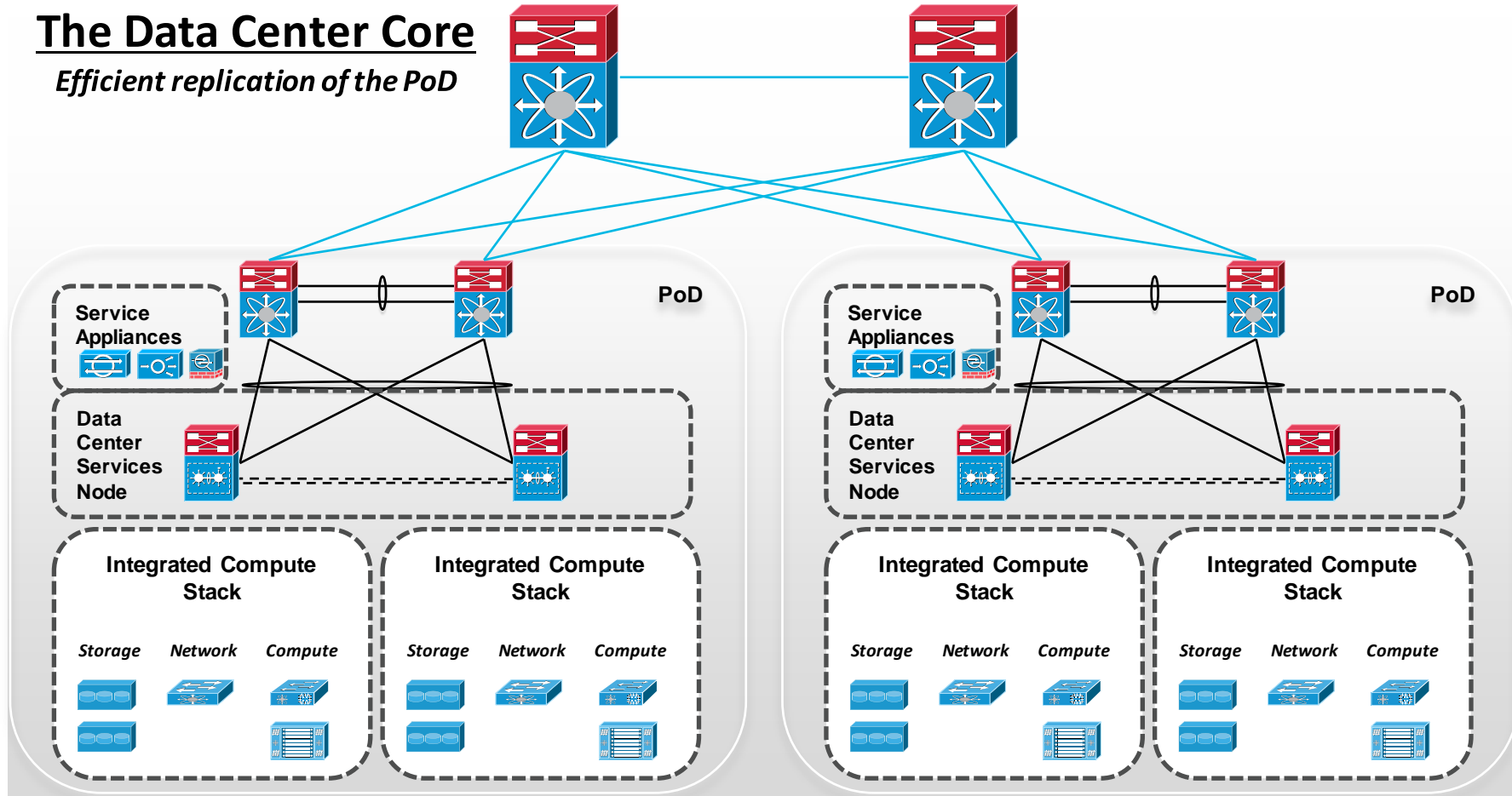
# Network Scale Considerations

## POD Scalability
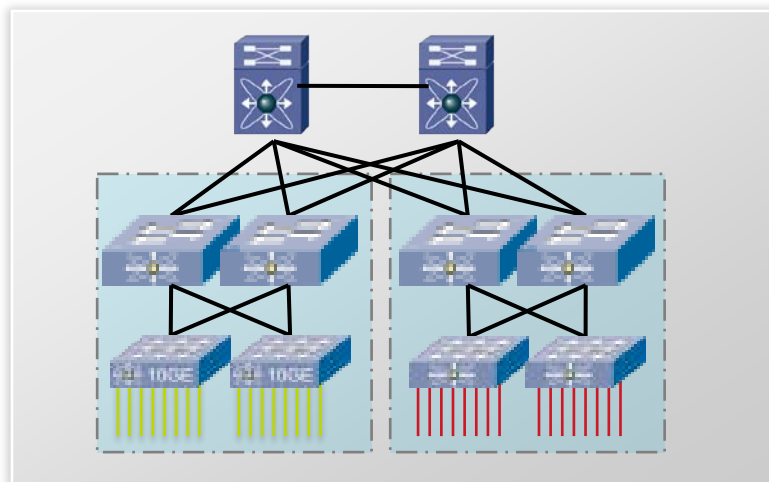


### What Determines the Host Scale in a POD?

- Aggregation—Number of PoDs

- Work-load domain

- Number of MAC address and VLANs

- Failure Domain

- Features to facilitate L2/L3 Boundary

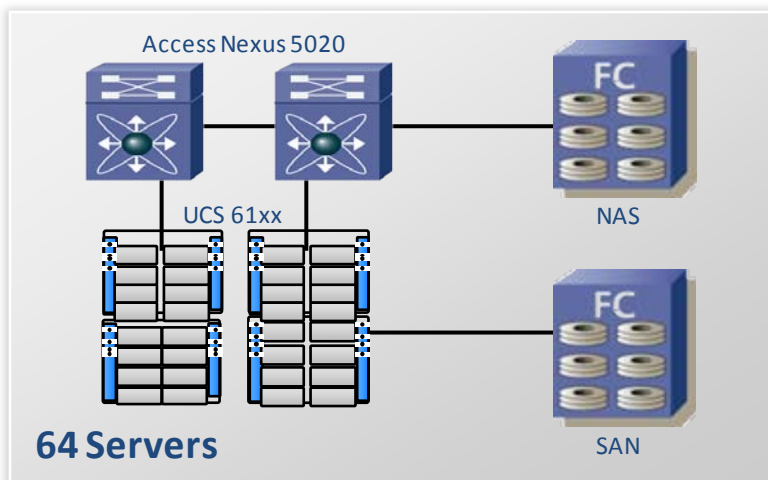| Compute/VMware | Network | Storage |
|---|---|---|
| • VM Density<br><br>• MAC per VM<br><br>• Logical Ports<br><br>• Virtual Switch | • Total number of MAC Addresses<br><br>• Total number of ARP entries<br><br>• STP logical ports | • Number of vFiler IP Space<br><br>• Number of VLANs supported<br><br>• Number of 10 Gig NICs |

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# Compact POD Sizing—VMDC



## 64 Server POD Characteristics

- 2 UCS clusters, each of 32 blades
- 64 x B200 Blade server at 96GB RAM
- 512 Cores
- 512 Gold VMs 1vCore per VM (1:1) ov
- 1024 Silver VMs 0.50vCore per VM (2:1) ov
- 2048 Bronze VMs 0.25vCore per VM(4:1) ov
- 5–8 VMs/VLAN

## Combination of All Three Service Tiers in a POD

|  | Number of Cores | Number of VMs |
|---|---|---|
| **Gold, 20%** | 102 | 102 (1:1 ov) |
| **Silver, 30%** | 154 | 308 (2:1 ov) |
| **Bronze, 50%** | 256 | 1024 (4:1 ov) |
| **Total VMs** |  | 1434 |

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# Large POD Sizing—VMDC
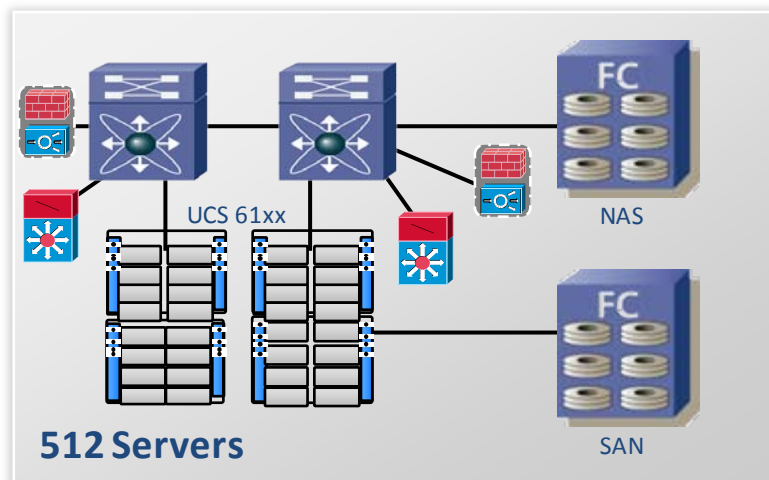


## 512 Server POD Characteristics

- 8x8-chassis UCS systems (Vblock Type 2 Max)
- 8 blades/ESX cluster
- 512 x B200 Blade server at 96GB RAM
- 4096 Cores
- 816 Large VMs  1vCore per VM (1:1) ov
- 2464 Medium VMs 0.50vCore per VM (2:1) ov
- 8192 Small VMs 0.25vCore per VM (4:1) ov
- 5–9 VMs/VLAN
- 500–1000 tenants = 12–23 VMs/VLAN

## Combination of All 3 Workload Types in a POD

|  | Number of Cores | Number of VMs |
|---|---|---|
| Large, 20% | 802 | 816 (1:1 ov) |
| Medium, 30% | 1232 | 2464 (2:1 ov) |
| Small, 50% | 2048 | 8192 (4:1 ov) |
| Total VMs |  | 11,472 |

# Value Proposition Recap

## Advantages of a Cisco Solution

- Standardized and automated IT infrastructure

- Validated, expandable and fault-tolerant architecture

- Support for standardized compute stacks: FlexPod and vBlock for Rapid Deployment

- User-friendly highly customizable service catalog

- Services led integration services with existing OSS systems

- Validated designs for assured system integration and risk reduction

Cisco Public

Thank you.

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