Cisco Data Centers Today

[Map showing various Cisco Data Centers around the world, including locations like Iron Port, SJ, WebEx, Linksys, Richardson, CROS, RTP, Scientific, Atlanta, Amsterdam, and others.]
Cisco Data Center Server Landscape

- ~16,822 servers
- 1,263 DB’s (279 prod)
- 3,802 apps
- Over 17 PB of “raw” storage, Overall Growth Rate: FY’02=69%, FY’03=32%, FY’04=50%, FY’05=58%, FY’06=29%, FY’07=52%, FY’08=52%

- Elimination of all external direct attached storage, focus now on virtualization and orchestration in the DC
Global Data Centers – Target State 2013
Shared Resilient Infrastructure Enables Diversified Business Growth

2013 Target Global Data Center Presence

Key:
- Tier-III (Redundant) Dedicated building 2x = Dual DC, sync capable
- Tier-II (Less Redundant) Existing buildings Product Development

Globally Centralized: Traditional Business Apps
Continental Hub: Order Processing, Comms
Continental Hub: Communications
Latency-Sensitive Software Development

Seed & Scale Software-as-a-Service (SaaS): Resilient, Scalable, Cost-effective Presence in Each Continent

Traditional Business Model
New Business Models
Metro DC Pair

Metro-based Virtual DC (MVDC) Architecture

2x Tier-III Texas

Richardson, TX

Allen, TX

Active-active DC Pair to support mission-critical production services

RTP, NC
Non-Production + Repurpose-based DR

Tier-II, RTP
Cisco IT Data Center Design case study
(1MW, 10K ft sq)

Going from End of Row 6500
to Top of Rack 4948
to Nexus
to Nexus and UCS
in a single Pod
Top of Rack 4948 design

Legacy

Data Center Aggregation Block

Network Services Block

Catalyst 4948

Catalyst 6509

SAN A

SAN B

Ethernet

Fiber Channel

Server OOB Mgmt.
Nexus - Consolidation of Network Fabrics

Phase 1

**Count / POD** | Cat6/ 4948 TOR | N7/ N5 To3R
---|---|---
Access switch | 180 | 42
Distribution | 10 | 2
Service (Cat6) | 10 | 2

Nexus 5000 + 2000 Top of 3-4 racks
Nexus + UCS – Consolidation of Server Fabrics

Today

Data Center Aggregation Block

Nexus 7000

Catalyst® 6509

Network Services Block

SAN A

SAN B

SAN Aggregation
Cabling and Management

- Disparate technologies
- Multiple points of management for switches, blades, storage
- High cable and component count

- Unified fabric with FCoE and 10GbE
- Single point of management for UCS, single point for storage
- Reduced cabling and components
From cabling to your Data Center organization – UCS simplifies

What does your Data Center organization look like?

From ad hoc and inconsistent...

...to structured, but siloed, complicated and costly...

...to simple, optimized and automated
## Cisco IT’s Case Study – Summary

<table>
<thead>
<tr>
<th></th>
<th>Traditional</th>
<th>Unified Fabric</th>
<th>UCS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10,000 sq ft, 1 MW</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabling</td>
<td>$2.7 million</td>
<td>$1.6 million</td>
<td>$1.6 million</td>
</tr>
<tr>
<td>Physical Server Count</td>
<td>720</td>
<td>930 -1080</td>
<td>1200-1400</td>
</tr>
<tr>
<td>VM Count</td>
<td>7200</td>
<td>9300-10800</td>
<td>12000-28000</td>
</tr>
<tr>
<td>DC efficiency</td>
<td>100%</td>
<td>130-150%</td>
<td>130% 170-200%</td>
</tr>
</tbody>
</table>

Notes: Assumes pre-UCS average V2P ratio of 10 to 1 and post UCS average ratio of 20 to 1 due to the memory expansion technology. Unified Fabric efficiency gains result from power optimization. UCS efficiency gains result from additional power benefits of UCS.

- ~40% Savings from cabling
- 12,000 to 28,000 VMs -- In the same size DC!
Compute Service: Foundation Stack

Operating System
- redhat
- Windows Server

Virtualization Platform
- vmware
- vSphere 4.x

Hardware
- Blade Chassis
- B2xx
- B4xx
- C2xx
Global UCS Implementation
Driving Adoption and Virtualization

6050+ Total UCS Blades Deployed Globally*

*Count covers all lifecycles and all stages of blade commissioning. Data as of May 11, 2011
Legacy to UCS ESX VM Migration

- VM Decomms
- Provisioned on UCS
- Migrated to UCS
- VMs on HP (at end of Qtr)
- % on UCS

100% VM's on UCS TODAY!

Q1CY09: 0
Q2CY09: 15%
Q3CY10: 32%
Q4FY10: 60%
Q1FY11: 90%
Q2FY11: 100%
### Critical DBs running in HPUX

<table>
<thead>
<tr>
<th>DB Names</th>
<th>DB Size</th>
<th>Migration to Linux / UCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (Goal to Commission) *</td>
<td>4 TB</td>
<td>Completed Q2FY11</td>
</tr>
<tr>
<td>Quote to Cash *</td>
<td>6 TB/4 TB</td>
<td>Completed Q3FY11</td>
</tr>
<tr>
<td>E-Customer</td>
<td>8 TB</td>
<td>Completed Q3FY11</td>
</tr>
<tr>
<td>Conf &amp; Ordering Exper.</td>
<td>3 TB</td>
<td>Completed Q1FY12</td>
</tr>
<tr>
<td>Corporate Finance (iPROC and iExpense)</td>
<td>2.3 TB</td>
<td>Completed Q1FY12</td>
</tr>
<tr>
<td>Comp (EBS)</td>
<td>10 TB</td>
<td>In progress Q2FY12</td>
</tr>
<tr>
<td>Customer Care (EBS)</td>
<td>40 TB</td>
<td>In progress Q3FY12</td>
</tr>
<tr>
<td>BI (ODS and CORE)</td>
<td>24 TB/ 3 TB / 28 TB (TD)</td>
<td>Planned in Q2FY12</td>
</tr>
<tr>
<td>Mfg (EBS – SJ &amp; APAC)</td>
<td>1 TB</td>
<td>Planned in Q4FY12</td>
</tr>
<tr>
<td>Ordering Store (CMRS)</td>
<td>2.5 TB</td>
<td>Planned in Q1FY13</td>
</tr>
<tr>
<td>Mfg (SJPROD)</td>
<td>7 TB</td>
<td>Will be decom Q1FY13</td>
</tr>
</tbody>
</table>
Goal to Commission (G2C)

Migration Benefits

- Goals to Commission (G2C) platform supports Cisco Sales compensation platform
- Nine applications were migrated as part of this platform migration
- Complex system with multiple dependencies using 3 tier Oracle E-Business suite architecture
- No additional certification was required - UCS hardware is already certified for target Oracle E-Business Suite applications
- No application rearchitecture was required

Source System (Legacy)
- 1. 2 Node, Oracle RAC cluster with 32 CPU cores total 64 GB Memory each (128 GB)
- 2. E-Business version 12.0.4 using Oracle Incentive Compensation (OIC) module
- 3. Oracle database version 10.2.0.4
- 4. Tier-II DC

Target System (Cisco UCS B200)
- 1. 4 Node Cisco UCSB200-M1, Oracle RAC cluster with 8 CPU Cores total 48 GB Memory each (192 GB)
- 2. E-Business version 12.0.4 using Oracle Incentive Compensation (OIC) module
- 3. Oracle database version 11.2.0.1
- 4. Tier-III DC
Cisco UCS database systems footprint is 1/10 compared to legacy – 0.4 vs. 4 Tiles

Cisco UCS database systems are at least 200% more power efficient than legacy – 4 vs. 13 kW

Cisco UCS database systems use approximately 50% less data cables than legacy – 10 vs. 24 data cables
Cisco UCS B200 vs. Legacy
User Experience and CPU Utilization

- Overall application response time for G2C applications ("1_Tier" and "Visibility") is better for database hosted on the Cisco UCS systems.

<table>
<thead>
<tr>
<th></th>
<th>Avg. CPU Utilization (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legacy</td>
<td>16.445</td>
</tr>
<tr>
<td>Cisco UCS</td>
<td>11.22</td>
</tr>
</tbody>
</table>

- Average CPU utilization for the target Cisco UCS database systems is ~25% better than source legacy systems (11.22 vs. 16.45 average CPU utilization).
Quote to Cash
Migration Benefits

- 100% of Cisco revenue flows through the Quote to Cash systems
- Quote to Cash is a mission-critical, core set of applications for Cisco, supporting more than $40B annual revenue
- Oracle Order Management application supports all Cisco order processing from start to finish, including pricing and product configurations for customer orders
- UCS occupies one-sixth the data center space that replaced legacy
- Consumes less than 65% power and uses 40% fewer cables
- Maintenance costs are significantly less than legacy Unix systems

<table>
<thead>
<tr>
<th>Source</th>
<th>Legacy</th>
<th>Target (Cisco UCS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Server Configuration</td>
<td>4 legacy Risc based Systems (North America &amp; Europe)</td>
<td>4 Cisco UCS B440 Blade Servers (North America &amp; Europe)</td>
</tr>
<tr>
<td>Operating System</td>
<td>HP-UX Version 11.11</td>
<td>Red Hat Enterprise Linux Version 5.5</td>
</tr>
<tr>
<td>CPU Cores</td>
<td>144</td>
<td>128</td>
</tr>
<tr>
<td>Memory</td>
<td>288 GB</td>
<td>1024 GB</td>
</tr>
<tr>
<td>Performance</td>
<td>Capacity for current workload</td>
<td>Capacity for double the current workload</td>
</tr>
<tr>
<td>Database</td>
<td>Oracle RAC 9i</td>
<td>Oracle RAC 10g</td>
</tr>
<tr>
<td>Space and Power</td>
<td>1.5 racks, 5.5 kW</td>
<td>1/7 rack, 3.5 kW</td>
</tr>
</tbody>
</table>
Quote to Cash Migration Results

Faster processing, accelerating allocation time from 180 to 50 minutes

Performance comparison

<table>
<thead>
<tr>
<th>Application Job</th>
<th>Source: HP Integrity rs8640 (1 node)</th>
<th>Target: Cisco UCS (1 node)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing 7.2 M records</td>
<td>60 5</td>
<td>180 50</td>
</tr>
<tr>
<td>Processing 29.9 M records</td>
<td>180 50</td>
<td>650 140</td>
</tr>
<tr>
<td>Reporting 516.7 M records</td>
<td>650 140</td>
<td>140</td>
</tr>
</tbody>
</table>

Source: HP
UCS – Provisioning time today

- Relocate 1000 running applications in 45 minutes
- Bare metal to platform in 5 minutes
- Bare metal to running service in 15 minutes
- 750 servers in 30 minutes
Cisco Intelligent Automation for Cloud (part of CITEIS 2)

Service Catalog and Self-Service Portal
newScale FrontOffice Suite

Global Orchestration and Reporting
Cisco Tidal Enterprise Orchestrator

Adapter Framework

Hardware Managers
e.g., UCS Manager, Nexus manager

Virtualization Managers
e.g., VMware vCenter

OS/Software Provisioning
Cisco Tidal Server Provisioner

Compute Resources
Virtual Infrastructure
Network Resources
Storage Resources

CMDB
IT Service Management Tools
Billing/Chargeback
Monitoring and Governance
Cisco IT Elastic Infrastructure Services (CITEIS) – Product and Feature Integration

Integration of the following products and features required to provide CITEIS end-state services

**CITEIS**

**Hardware**
- UCS
- Nexus 7000
- ACE
- GSS
- MDS
- NAS Storage
- SAN Storage
- Catalyst 6500

**Software**
- Nexus 1000v
- Global UCS Manager
- Virtual Security Gateway (VSG)
- Service Catalog
- EMAN
- VMware ESX
- Windows Server
- Linux

**Process**
- Provisioning
- Entitlement
- Lifecycle management
- Capacity and asset management
- Discovery and audit

**CITEIS Extension**
- Functional overflow
- External offering
- Shared hybrid model
CITEIS Gen2 at Work

Client Customized Offerings / Images via Image Store Front
Chargeback
Entitled Client Self-Service
Lifecycle Management

Tracking for Pay-Per-Use
Define and Publish Standard Options
Tenant Approvals & Controls
Policies & Governance

Orchestrate Delivery
Process Coordination and Delivery Automation
Report Consumption

APPLICATION SERVER
DATABASE SERVER
NETWORK
SECURITY OPS DR

Private Cloud Demo
http://www.youtube.com/watch?v=3Vae116QeBk
CITEIS TCO and Provisioning Times
Agility, Cost Benefits, Productivity

Compute TCO ($/Qtr/OS instance)

- **Legacy (rackmount); all physical**
  - Delivery Time: 6-8 weeks (on demand)
  - TCO Physical: $4,000

- **Legacy; medium virtualization (54%)**
  - Delivery Time: 2-3 weeks (manual)
  - TCO Virtual: $3,500

- **Current state; 46/54%; Legacy/UCS; 75% Virtualized**
  - Delivery Time: 15 mins VM (2-9 days E2E)
  - TCO Physical: $3,000
  - TCO Virtual: $2,500

- **Target state; 100%; UCS/Cloud; 80% virtualization**
  - Delivery Time: 15 minutes (self-service)
  - TCO Physical: $2,000
  - TCO Virtual: $1,500

**Virtualization > Unified Computing > Cloud**

**Average TCO**
- -37%
## Compute Unit Cost: TCO Benefits

<table>
<thead>
<tr>
<th>TCO ($/Qtr)</th>
<th>Typical Bare-Metal</th>
<th>Average Virtual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8 CPU core + 32 GB @ Dedicated Linux</strong></td>
<td>Legacy Rack Mount + Cat6k</td>
<td>UCS blade + Unified I/O (N7K) + CITEIS</td>
</tr>
<tr>
<td><em><em>2 vCPU core + 4 GB @ Silver</em> Linux</em>*</td>
<td>Legacy Rack Mount + Cat6k</td>
<td>UCS blade + Unified I/O (N7K) + CITEIS</td>
</tr>
<tr>
<td>Arch and Design</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>Implementation</td>
<td>122</td>
<td>20</td>
</tr>
<tr>
<td>Operation</td>
<td>421</td>
<td>271</td>
</tr>
<tr>
<td>Automation</td>
<td>-</td>
<td>41</td>
</tr>
<tr>
<td>Software</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Equipment</td>
<td>2212</td>
<td>1723</td>
</tr>
<tr>
<td>Facility</td>
<td>840</td>
<td>507</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3759</strong></td>
<td><strong>2727</strong></td>
</tr>
</tbody>
</table>

Using the same components (processor and memory), the combination of Unified Computing, Unified I/O and Automation results in 27% savings for bare-metal and 24% for virtual offerings.

*Silver = 50% CPU resource reservation; 75% Memory resource reservation, Includes DC Networking and SAN, excludes actual storage consumption, Based on normal discount for Legacy (3rd party) & Cisco UCS*

Updated: Q2FY1129
CITEIS Gen2 Key Features

- **Client Self Service Portal**
  - Complete Control in Requesting Infrastructure Resources
  - Simple, Easy to Use Interface
  - Your Request Automated End-to-End Reducing Time to Market

- **Customized Virtual Images and Appliances**
  - Upload Your Customized Images Into CITEIS and Make Them Available via the Self-Service Portal
  - Choose Pre-Configured Images Provided by NDCS and/or Other CITEIS Users

- **Metering and Billing**
  - Support for Subscription Based Billing with Pay-as-you-Go Capabilities
  - Single, Aggregated Billing for Purchased Infrastructure Resources

- **IaaS APIs**
  - Build Your Own Custom Tools that Interact with CITEIS via Available APIs

- **Security and Segmentation**
  - Ability to Define Entitlement Rights to Specific Users for Resource Access
  - Logical Segmentation Between Tenants – Your Resources Guaranteed and Segmented

- **Support Services**
  - Upfront SLA Guarantee and Pre-Defined Maintenance Windows
  - Option for NDCS Support of Your Virtual Environments or You Can Support Your Own

- **Pre-Paid Resource Pools and On Demand Services**
  - Experimental Support for On Demand Services

- **Availability Allen DC**
  - Express – June 15, 2011
  - VDC – August 22, 2011

- **Customer Repeatable Solution**
  - UCS Based Virtualization Solution
  - NewScale Service Catalog
  - Tidal Enterprise Orchestrator
  - VMware vCloud Director
Physical Server Landscape

Growth and Trending

Server Trends

- Compute Environment Growth Trends
  - 1% Decrease in Physical Servers
  - 84% Increase in Virtual Machines
  - 30% of servers virtualized; goal = 70%-80%

- Op-Ex Costs as Percentage of Compute Instance TCO
  - <15% for Physical Servers

TCO Optimization focus is shifting from Virtualization to Automation
SODC Storage Architecture consolidation

**Timeline**

- 2002: Phase 1: SAN Islands
- 2004: Phase 2: BU SANs
- 2006: Phase 3: Shared SAN
- 2008: "Logical" Cisco Business Functions

**Utilization**

- Phase 1: 20%
- Phase 2: 34%
- Phase 3: 66%

"Physical" Cisco Business Functions

- SODC Storage Architecture consolidation

"Logical" Cisco Business Functions

- *Multiple Datacenters (campus/metro)
Cisco IT Storage TCO

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>TCO Per GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY04</td>
<td>$73.90</td>
</tr>
<tr>
<td>FY05</td>
<td>$47.22</td>
</tr>
<tr>
<td>FY06</td>
<td>$29.67</td>
</tr>
<tr>
<td>FY07</td>
<td>$13.28</td>
</tr>
<tr>
<td>FY08</td>
<td>$8.50</td>
</tr>
<tr>
<td>FY09 (Q3)</td>
<td>$7.50</td>
</tr>
</tbody>
</table>
Metro Virtual DC → Two-tier Resiliency
(FY12 Target state – Early adoption FY10)

“Operational Continuity”
Failure up to single-DC leads to recovery within the Metro (RCDN)

Both Datacenters will act as primaries
Active/Active services for capable applications
Active/Standby for the databases with 0 data loss option
Both DC1 and DC2 recovery will be done within the Metro Pair

“Disaster Recovery (DR)”
Failure of two DCs leads to recovery in remote DC (RTP)

If failure recovery can not be done within the MetroPair then failover will be initiated to the Disaster Recovery site in RTP.

Note: Other Distributed Virtual DC (DVDC) Variations not shown
Texas DC "Allen (DC2)"
World-class Tier-3 DC, 5/10 MW

- No raised floor
- Flexible cabling: Any rack anywhere
- IT Data Halls (5 MW)
- Future expansion (+5 MW)
- Air handling
- Chilled water plant (CHW) system
- Rotary UPS and Generator
- Inlet Temperature: 78F (25.5C)
- Air separation: Hot/cold air separation based on chimneys
- Cooling: Airside economizer (free cooling)
- Density: Average 6.5 kW/rack, Up to 19 kW/rack
- Certification: LEED Gold
- Renewable energy: ~50% in US (credits)
- PUE: 1.35 (annualized)
Europe DC – Design Stage

Flexible placement (anything anywhere)
Flexible power (5 kW/rack average, 20 kW/rack peak)
PUE <1.25
Free cooling, thermal storage (ATES*, no chiller)
Rotary UPS
Modular & expandable
Multi-tenant

*ATES = Aquifer Thermal Energy Storage
For VMs, average CPU utilization is in the range of 65%.

Bare Metals average utilization is ~14% [Majority under 5%].

Memory Utilization also mirrors similar trends.
Compute Service: Foundation Stack

Operating System
- Red Hat
- Windows Server

Virtualization Platform
- VMware
- vSphere 4.x

Hardware
- Blade Chassis
- B2xx
- B4xx
- C2xx