REDUCE COMPLEXITY AND SAVE MONEY WITH DELL ENGINEERED SOLUTIONS FOR VMWARE EVO:RAIL

Reduce costs and enjoy simplified deployment with Dell™ Engineered Solutions for VMware® EVO:RAIL™*

UP TO
63.9%
REDUCED COSTS
for acquisition and projected
salary costs over 3 years

The Dell Engineered Solutions for VMware EVO:RAIL offers:

Rapid deployment and scaling with less expertise required

Three clicks to update the entire cluster

OPEX reductions due to space savings and estimated decreased power consumption

The Dell Engineered Solutions for VMware EVO:RAIL took 633 fewer steps to deploy.

*versus Cisco® UCS® blades + NetApp® storage

Whether you're embarking on a new venture or refreshing servers, it's time to decide on a virtualization solution that fits your IT and business goals. The Dell Engineered Solutions for VMware EVO:RAIL hyper-converged appliance can provide an easy-to-set-up and manage solution that reduces complexity and lets you save on initial setup and ongoing operational costs.

In the Principled Technologies data center, we set up a Dell Engineered Solutions for VMware EVO:RAIL (virtualization edition) and a do-it-yourself environment with Cisco UCS blades and NetApp storage, each supporting a VMware vSphere® cluster. Dell Engineered Solutions for VMware EVO:RAIL was vastly easier to deploy, reducing steps from 683 to 50 compared to the Cisco UCS blades with NetApp storage, which reduces the opportunity for errors and resulting downtime. Also, Dell Engineered Solutions for VMware EVO:RAIL provides admins with a single, easy-to-use management tool, while the Cisco UCS solution has a steep learning curve with four different tools across three different technologies. Dell Engineered Solutions for VMware EVO:RAIL took 88.0 percent fewer steps to update software and was easy to scale, taking just five steps to increase the size of the virtualization environment. We found that it could even reduce power consumption by as much as 67.8 percent, to help keep operating costs low.

Because you can avoid adding specialized administrators, Dell Engineered Solutions for VMware EVO:RAIL could save as much as 63.9 percent over three years compared to the Cisco UCS and NetApp solution. Reducing complexity for administrators and freeing up funds makes Dell Engineered Solutions for VMware EVO:RAIL a solution that both IT staff and executives can feel good about for the long haul.

THE BENEFITS OF CHOOSING DELL ENGINEERED SOLUTIONS FOR VMWARE EVO:RAIL

Dell Engineered Solutions for VMware EVO:RAIL is a hyper-converged appliance for VMware environments that combines computer, storage, and network access infrastructure into one solution with the goal of easing deployment, management, and scaling. Designed to power virtual infrastructure, general-purpose workloads, VDI, and private cloud deployments, the Dell Engineered Solutions for VMware EVO:RAIL solution combines a 2U, four-node Dell server platform and VMware virtualization software to provide an integrated user interface to simplify management. Dell Engineered Solutions for VMware EVO:RAIL (2U) provides 96 logical processors, 768 GB of RAM, and 13.1 TB of storage in 80 percent less rack space than a similarly configured Cisco UCS chassis with external storage (10U).

To learn more about Dell Engineered Solutions for VMware EVO:RAIL, visit www.dell.com/learn/us/en/04/campaigns/vmware-evo. For information about the specific systems we used and steps we followed in our tests, see Appendix A and Appendix B.

HOW MUCH CAN YOU SAVE WITH DELL ENGINEERED SOLUTIONS FOR VMWARE EVO:RAIL?

Meet ManuCorp, a hypothetical company we'll use to illustrate the benefits a Dell Engineered Solutions for VMware EVO:RAIL solution can deliver. ManuCorp is a medium-sized company where the majority of employees work on the manufacturing floor. The company makes some of the best furniture on the market today, but they're facing a tech problem: the servers that house their data are aging and starting to fail. It's been a while since the servers were replaced, and office staff are excited about what new technology might bring. ManuCorp has a limited IT staff who have been doing a good job holding down the fort for day-to-day maintenance, but lack expertise in advanced infrastructure deployment and management.

ManuCorp is faced with a choice: replace the aging hardware with a virtualized, do-it-yourself solution featuring Cisco UCS servers and external NetApp storage, or deploy the needed vSphere cluster using Dell Engineered Solutions for VMware EVO:RAIL. As our analysis shows, ManuCorp would likely be better off choosing Dell Engineered Solutions for VMware EVO:RAIL. Deploying a cluster with the Dell solution is something that their limited, generalist IT staff could do comfortably, because it takes fewer steps and a single tool. The do-it-yourself solution with Cisco UCS blades and NetApp storage would require intimate knowledge of multiple technologies across multiple different tools and in-depth knowledge of Cisco UCS service profiles and

---

NetApp OnCommand interface to perform a successful deployment. (See Appendices B and D for details.)

Even better for ManuCorp, the company would save money by not having to re-train their existing staff or hire expensive, expert systems administrators. ManuCorp could also reduce the risk of errors with the deployment by leveraging the automation from Dell Engineered Solutions for VMware EVO:RAIL versus manually executing a run book of tasks using the Cisco UCS and NetApp solution. Large companies who want to free their specialized experts from doing repetitive management tasks could also realize the value of Dell Engineered Solutions for VMware EVO:RAIL, because the reduced complexity would let them instead spend time optimizing performance of mission-critical applications.

Calculating cost savings

If ManuCorp wanted to purchase a Cisco UCS and NetApp solution with external storage, they'd have to hire someone with the expertise to set it up and run it. By forgoing the cost of an expert administrator, the Dell Engineered Solutions for VMware EVO:RAIL could save a company like ManuCorp as much as 63.9 percent over three years compared to a Cisco UCS and NetApp solution (see Figure 1). Depending on the scope, what you already have in place, and the choices you make for deployment, this cost difference could vary—in some cases more, in others less.
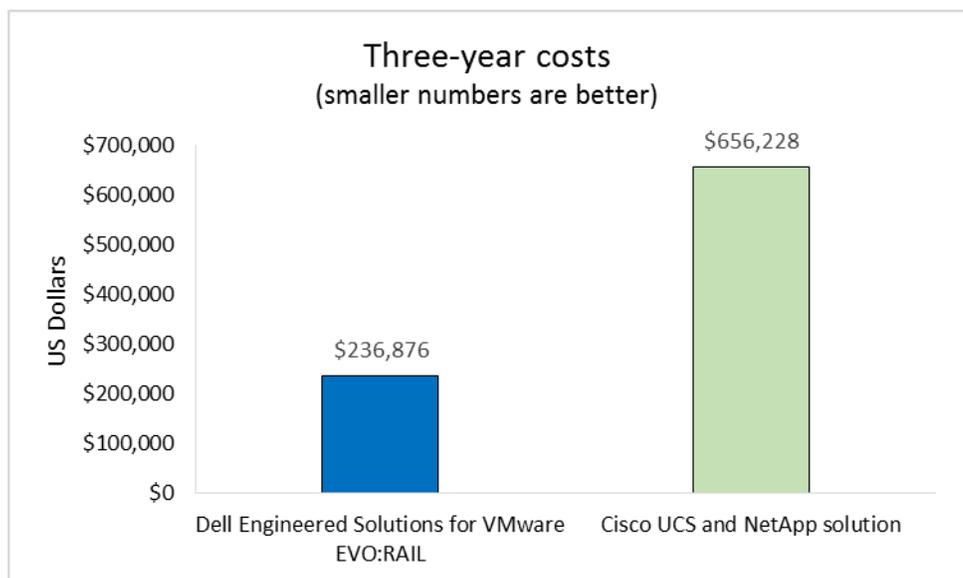
Figure 1: Dell Engineered Solutions for VMware EVO:RAIL could reduce costs over three years by as much as 63.9 percent vs. a Cisco UCS and NetApp solution.

Three-year costs
(smaller numbers are better)

Solution	Cost
Dell Engineered Solutions for VMware EVO:RAIL	$236,876
Cisco UCS and NetApp solution	$656,228

The total savings are a result of lower acquisition costs and salary savings over three years, as Figure 2 shows.

Cost comparison[1]	Dell Engineered Solutions for VMware EVO:RAIL	Cisco UCS and NetApp solution
Total acquisition costs	$236,876	$265,859
Total additional salary for 3 years	N/A	$390,369
Total cost for 3 years	**$236,876**	**$656,228**

Figure 2: Dell Engineered Solutions for VMware EVO:RAIL not only has lower acquisition costs, but could allow you to avoid additional salary costs with the more complex Cisco UCS and NetApp solution.

By choosing Dell Engineered Solutions for VMware: EVO:RAIL, ManuCorp could keep generalized IT staff on the payroll because they would be able to set up the solution without additional training; picking the Cisco UCS and NetApp solution would likely mean adding at least one expensive expert into the mix as well.

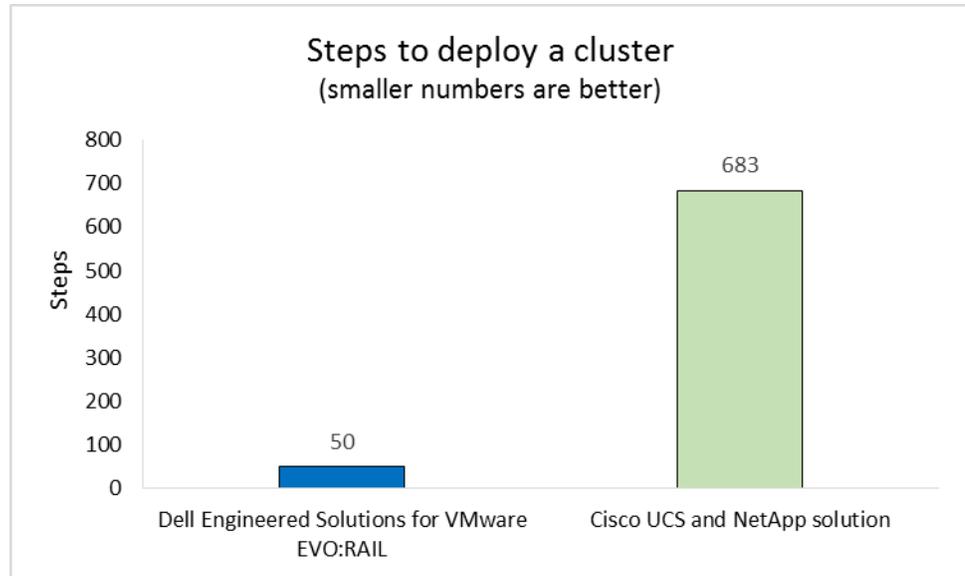See Appendix C for the detailed costs and assumptions we made for this analysis.

Dell Engineered Solutions for VMware EVO:RAIL made deploying a cluster easier

Do-it-yourself blade environments consisting of multiple servers and external storage can require a lot of work to set up. The plug-and-play model of Dell Engineered Solutions for VMware EVO:RAIL means that administrators without expertise, like those on staff at ManuCorp, could deploy end-to-end virtual infrastructure quickly and in just 50 steps by using a single, easy-to-navigate tool.[2] They wouldn't need any additional training to get a cluster up and running. That's 92.8 percent fewer steps with Dell Engineered Solutions for VMware EVO:RAIL than the 683 steps it would take to set up the Cisco UCS and NetApp solution (see Figure 3). Less complexity through fewer steps means reduced hands-on time and a smaller chance for human error, which reduces the risk of expensive downtime.

---

[1] See Appendix C for detailed source information and acquisition cost breakdown.
[2] See Appendix D for additional testing details and results.

Steps to deploy a cluster
(smaller numbers are better)

(Bar chart: Y-axis labeled "Steps", scale 0 to 800. "Dell Engineered Solutions for VMware EVO:RAIL" = 50. "Cisco UCS and NetApp solution" = 683.)

It wasn't just the quantity of steps that the Dell solution reduced, but also the complexity. Most steps using the Dell Engineered Solutions for VMware EVO:RAIL consisted of clicking on a guided interface, while the Cisco UCS and NetApp solution required knowledge that is more advanced. See Appendix B for the detailed steps to deploy a cluster.

Dell Engineered Solutions for VMware EVO:RAIL further reduced complexity with the single streamlined management interface used to configure the solution. The Cisco UCS and NetApp solution required four tools to deploy the cluster, while the Dell Engineered Solutions for VMware EVO:RAIL required administrators to use just a single tool for configuration and ongoing systems management (see Figure 4).[3]

---

[3] See Appendix D for details.

Figure 4: Administrators can take advantage of the Dell Engineered Solutions for VMware EVO:RAIL user-friendly interface for rapid deployment and administrative maintenance tasks.
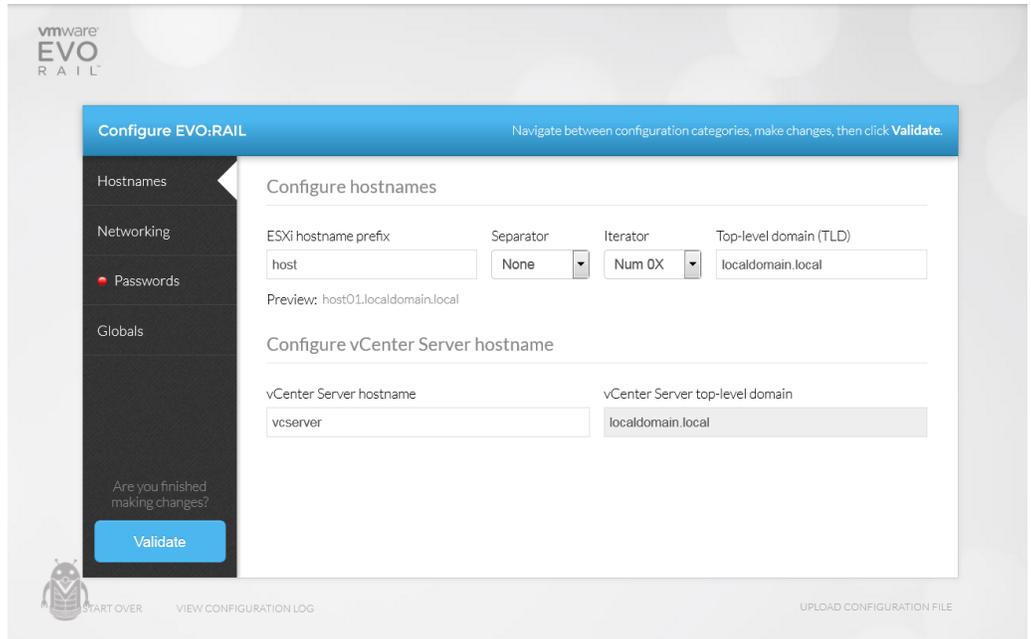
In contrast to the Dell Engineered Solutions for VMware EVO:RAIL interface, the Cisco UCS Manager interface is more complicated to navigate, as Figure 5 shows.

Figure 5: The Cisco UCS Manager interface.
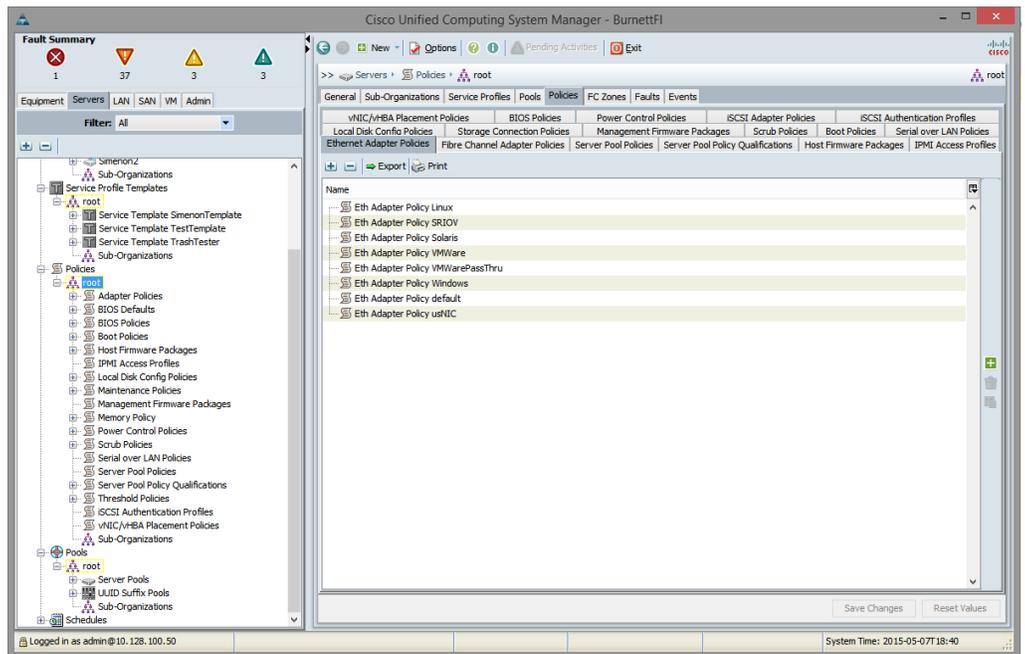
As we noted above, the Cisco UCS and NetApp solution requires administrators use multiple tools for deployment and management. Figure 6 shows the NetApp storage interface.

Figure 6: With the Cisco UCS and NetApp solution, administrators have to use multiple tools, including a specific tool to manage the storage.
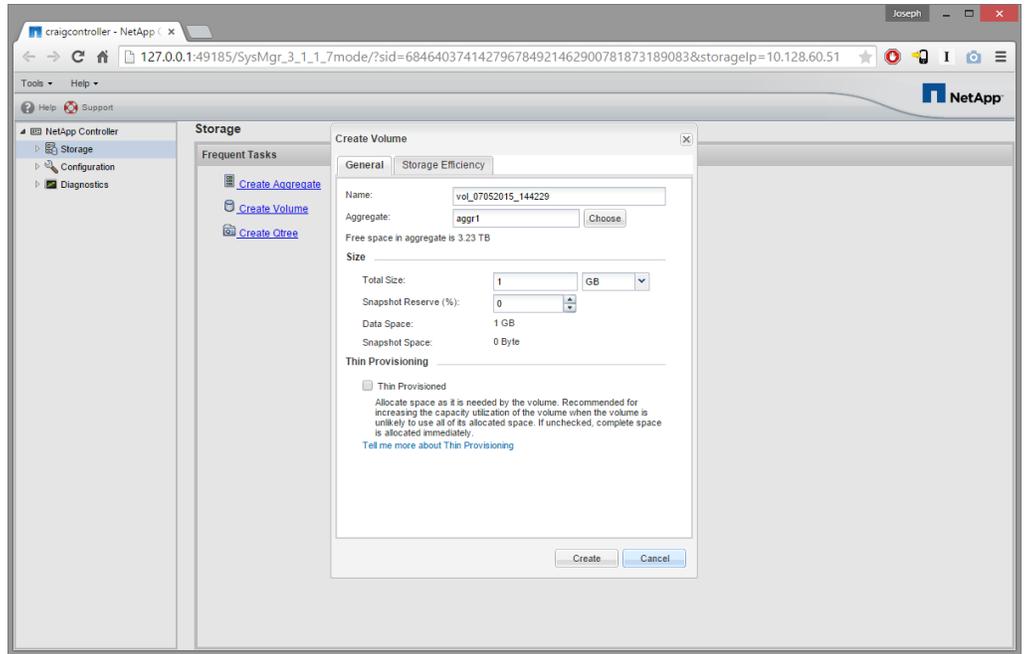
Dell Engineered Solutions for VMware EVO:RAIL made updates easier

The easy-to-use interface and reduced complexity of Dell Engineered Solutions for VMware EVO:RAIL means that updating is also easier. The fewer steps IT staff must follow to get the infrastructure up to date, the less chance a mistake gets made during the update process. Updating on the Dell Engineered Solutions for VMware EVO:RAIL would take just six steps—88.0 percent fewer steps than the Cisco UCS and NetApp solution (see Figure 7).

Figure 7: Updating virtual infrastructure took just six steps with the Dell Engineered Solutions for VMware EVO:RAIL.
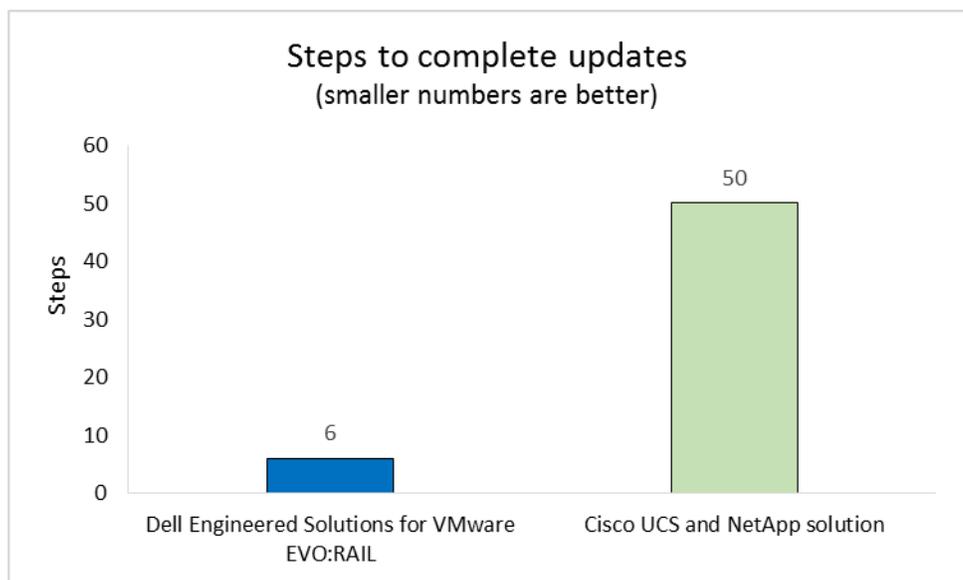
Dell Engineered Solutions for VMware EVO:RAIL was easier to scale

Every business, including ManuCorp, hopes to grow at a fast pace. When you buy hardware now, it's important to consider how easy it will be to add to your environment when you need more performance in the future.

We doubled both solutions, adding a single Dell Engineered Solutions for VMware EVO:RAIL appliance with four nodes and four more Cisco UCS blades with NetApp storage. Once again, the Dell Engineered Solutions for VMware EVO:RAIL eased the administrative burden and lowered the chance for error: It took only 17 steps to add another appliance versus 329 steps to scale the Cisco UCS and NetApp solution (see Figure 8).
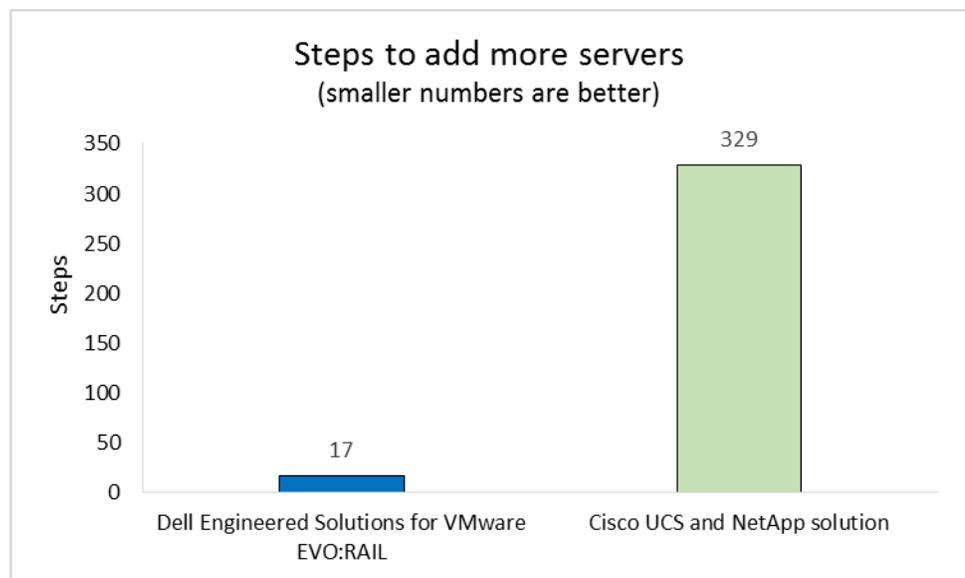
Figure 8: Scaling to two appliances for eight nodes took just 17 steps with the Dell Engineered Solutions for VMware EVO:RAIL.

Lower operating expenses through increased power efficiency

Operating costs are part of doing business, but it doesn't mean you can't keep them as low as possible. It costs money to power and cool systems, even when they're sitting idle. Choosing new, more power-efficient technology can help reduce these costs.

The Dell Engineered Solutions for VMware EVO:RAIL used 67.8 percent less power while idle than the Cisco UCS and NetApp solution we tested in our data center did (see Figure 9), which can mean significant savings whether you're in manufacturing like ManuCorp or have a business with an even larger infrastructure.

Figure 9: The Dell Engineered Solutions for VMware EVO:RAIL used an average of 67.8 percent less power while idle than the Cisco UCS and NetApp solution in our data center.

Average idle power consumption
(smaller numbers are better)
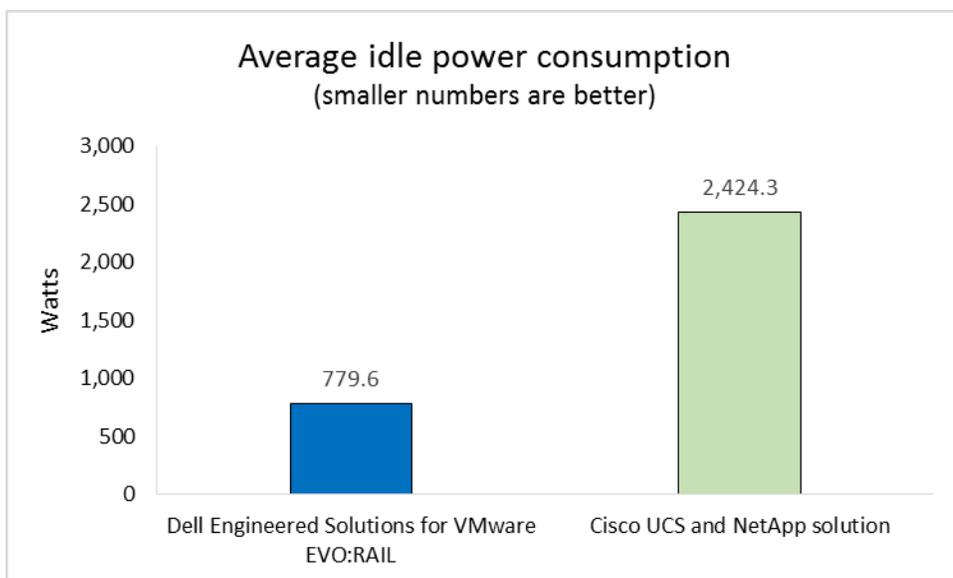
The Cisco and NetApp solution we tested in our data center was a different model than the one we compared for pricing, but based on the power consumption of the individual components, the Dell Engineered Solutions for VMware EVO:RAIL achieved power savings even without considering the external storage array. See Appendix D for a breakdown of power consumption for each component along with the potential savings the Dell Engineered Solutions for VMware EVO:RAIL can deliver.

CONCLUSION

Companies like ManuCorp have seemingly contradictory goals for their virtualized infrastructure: They want a solution that eases the deployment and management burden for generalized IT staff while simultaneously saving money over the long term. According to our analysis, ManuCorp would do well to choose Dell Engineered Solutions for VMware EVO:RAIL, saving up to 63.9 percent in costs over three years compared to a solution with Cisco UCS blades and NetApp storage.

Less experienced administrators like ManuCorp already has in house would be able to plug in the Dell Engineered Solutions for VMware EVO:RAIL and use its single, easy-to-use interface to deploy end-to-end virtual infrastructure and complete updates without any additional training or instruction. The Cisco UCS and NetApp solution required extra tools and a wider skillset, which can mean adding a more experienced person and inviting the chance for human error. In addition, the hyper-converged Dell Engineered Solutions for VMware EVO:RAIL appliance reduced power consumption compared to the do-it-yourself environment with Cisco UCS blades and NetApp, which can contribute to big operating cost savings.

If your company is like ManuCorp, or if you simply want to free specialized experts already on staff from doing repetitive tasks, choosing the converged Dell Engineered Solutions for VMware EVO:RAIL could ease your administration burden while saving you money over the next three years.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figures 10 through 14 provide detailed configuration information for the hardware we used in our lab tests.

System	Dell Engineered Solutions for VMware EVO:RAIL
Power supplies	
Number of power supplies	2
Vendor and model number	Dell D1200E-S1
Wattage of each (W)	1,400
Cooling fans	
Total number of fan modules	4
Vendor and model number	Dell FHXGY-A00
Storage	
Number of slots	24
Number of disks	20
Model	Dell AL13SXB300N, Dell ST1200MM0007, Intel SSDSC2BA400G3T
Type	HDD, SDD
Size (GB)	4 × 300 GB - 15k, 12 × 1200 GB - 10k, 4 × 400 GB - SSD

Figure 10: Configuration information for the blade enclosure for the Dell Engineered Solutions for VMware EVO:RAIL appliance.

System	Dell Engineered Solutions for VMware EVO:RAIL
Enclosure	
Blade enclosure	Dell PowerEdge C6220
General	
Number of processor packages	2
Number of cores per processor	6
Number of hardware threads per core	2
System power management policy	Default
CPU	
Vendor	Intel®
Name	Xeon®
Model number	E5-2620 v2
Stepping	S1
Socket type	FCLGA2011
Core frequency (GHz)	2.1
Bus frequency (GHz)	3.6
L1 cache	32KB + 32KB (per core)
L2 cache	256 KB (per core)
L3 cache	15 MB

System	Dell Engineered Solutions for VMware EVO:RAIL
Platform	
Vendor and model number	Dell PowerEdge C6220 II
Motherboard model number	E145483
BIOS version	1.0.14
BIOS settings	Default
Memory module(s)	
Total RAM in system (GB)	192
Vendor and model number	Samsung M393B2G70DB0-YK0
Type	PC3L-12800
Speed (MHz)	1,600
Speed running in the system (MHz)	1,600
Size (GB)	16
Number of RAM module(s)	12
Chip organization	Double-sided
Rank	Dual
USB ports	
Number	2 (external)
Type	2.0
Firmware	
BIOS	2.4.2
MRC Version	2.0.00002
BMC Version	2.53
ME Version	2.1.7.328

Figure 11: Configuration information for the blade servers in the Dell Engineered Solutions for VMware EVO:RAIL appliance.

System	Cisco UCS 5108 blade server chassis
Power supplies	
Number of power supplies	4
Vendor and model number	Cisco Systems, Inc. N20-PAC5-2500W
Wattage of each (W)	2,500
Cooling fans	
Total number of fan modules	8
Vendor and model number	Cisco Systems, Inc. N20-FAN5
Chassis firmware	
Board Controller	11.0
CIMC Controller	2.2(1d)
IOM firmware	2.2(1d)
I/O modules	
Switch	Cisco UCS 2208XP
Occupied bay	1, 2

Figure 12: Configuration information for the blade enclosure of the Cisco UCS and NetApp solution.

System	Cisco UCS B200 M3 blade server
General	
Number of processor packages	2
Number of cores per processor	10
Number of hardware threads per core	2
System power management policy	Default
CPU	
Vendor	Intel
Name	Xeon
Model number	E5-2680 v2
Stepping	M1
Socket type	FCLGA2011
Core frequency (GHz)	2.8
Bus frequency (GHz)	4
L1 cache	10 × 32 KB instruction caches, 10 × 32 KB data caches
L2 cache	10 × 256 KB
L3 cache	25 MB
Platform	
Vendor and model number	Cisco UCS B200 M3
Motherboard model number	UCSB-B200-M3
BIOS version	B200M3.2.2.1a.0.111220131105
Memory module(s)	
Total RAM in system (GB)	384
Vendor and model number	SK Hynix HMT42GR7AFR4C-RD
Type	PC3-14900R
Speed (MHz)	1,866
Speed running in the system (MHz)	1,866
Size (GB)	16
Number of RAM module(s)	24
Chip organization	Double-sided
Rank	Dual
RAID controller	
Vendor and model number	LSI MegaRAID SAS 2004 ROMB RB2
Firmware version	20.11.1-0135
Firmware	
CIMC	1.40.40
Board Controller	2.2(1d)
BIOS	B200M3.2.2.1a.0.111.220131105
Cisco UCS VIC 1240	2.2(1d)

Figure 13: Configuration information for the blade servers of the Cisco UCS and NetApp solution.

System	NetApp FAS2240
Storage	
Filer	NetApp FAS2240
Power supplies	
Total number	2
Shelves	
Vendor and model number	NetApp DS4243
Total number of shelves	2
Disks	
Total number of disks	48 x 400 GB
Total storage capacity (GB)	19,200
Operating system	
Name	Data ONTAP 8.1
Network	
Vendor and model number	NetApp X1160A-R6 111-00810 Mezzanine Card 2-port 10Gbps

Figure 14: Detailed configuration information for the storage we used in our tests for the Cisco UCS and NetApp solution.

APPENDIX B – HOW WE TESTED

Setting up the Dell Engineered Solutions for VMware EVO:RAIL

Racking and cabling the Dell Engineered Solutions for VMware EVO:RAIL

1. Rack the Dell PowerConnect 8164F 10Gb switch.
2. Rack the Force10 S55 1Gb switch.
3. Rack the PowerEdge C6220.
4. The PowerEdge C6220 is comprised of four nodes; each node uses 2 SFP connections to the Dell PowerConnect 10Gb switch. Connect the first node via two SFP cables to ports 17 and 18 of the PowerConnect 10Gb switch.
5. Connect the second node via 2 SFP cables to ports 19 and 20 of the PowerConnect 10Gb switch.
6. Connect the third node via 2 SFP cables to ports 21 and 22 of the 10Gb switch.
7. Connect the fourth node via 2 SFP cables to ports 23 and 24 of the 10Gb switch.
8. Cable port 42 of the PowerConnect 10Gb switch to P0 of the Force10 1Gb switch.
9. Cable port 44 of the PowerConnect 10Gb switch to port 15 of the infrastructure switch (Dell PowerConnect 8024F).
10. Connect power for the C6220.
11. Connect power for the PowerConnect 8164F 10Gb switch.
12. Connect power for the Force10 S55 1Gb switch.

Dell Engineered Solutions for VMware EVO:RAIL Configuration and Cluster Building

1. Configure a laptop or management workstation to have the following network settings to communicate with the vCenter Server Appliance. We used a management workstation connected to the top of rack switch with one NIC configured with the following settings:
    - **IP Address:** 192.168.10.210
    - **Netmask:** 255.255.255.0
    - **Gateway:** 192.168.10.254
2. And a second NIC configured with the following settings:
    - **IP Address:** 10.128.0.20
    - **Netmask:** 255.255.0.0
    - **Gateway:** 10.128.0.1
    - Preferred DNS server: 10.128.0.10
3. This is to ensure that once the new vCenter IP is assigned, the Dell Engineered Solutions for VMware EVO:RAIL appliance can redirect the Web browser to the correct IP.
4. Open a Web browser on the workstation (we used Firefox 35.0.1) and navigate to the default Dell Engineered Solutions for VMware EVO:RAIL IP address: https://192.168.10.200:7443. Accept any certificate warnings.
5. Click Yes, Let's Go!
6. Click Yes, I do to accept the license agreement.
7. Click Customize Me!
8. At the Hostnames tab name the ESXi hostname prefix (default: host). We used esx.
9. Enter the Top-level domain (default: localdomain.local). We used emerson.local.
10. Enter the vCenter Server hostname (default: vcserver). We used vCenter1.

11. Click the Networking tab.

12. At the ESXi Hosts subtab, enter the Starting address for IP pool (default: 192.168.10.1). We used 10.128.20.100.

13. Enter the Ending address for IP pool (default: 192.168.10.4). We used 10.128.20.110.

14. Enter the Netmask (default: 255.255.255.0). We used 255.255.0.0.

15. Enter the Default gateway (default: 192.168.10.254). We used 10.128.0.1.

16. Click the vMotion subtab.

17. Enter the Starting address for IP pool (default: 192.168.20.1). We used 192.168.200.100.

18. Enter the Ending address for IP pool (default: 192.168.20.4). We used 192.168.200.110.

19. Enter the vSphere vMotion VLAN ID (default: 20). We used 200.

20. Enter the Netmask (default: 255.255.255.0). We used the default Netmask.

21. Click the Virtual SAN subtab.

22. Enter the Starting address for IP pool (default: 192.168.30.1). We used 192.168.201.100.

23. Enter the Ending address for IP pool (default: 192.168.30.4). We used 192.168.201.110.

24. Enter the vSphere vMotion VLAN ID (default: 30). We used 201.

25. Enter the Netmask (default: 255.255.255.0). We used the default netmask.

26. Click the vCenter Server subtab.

27. Enter the vCenter Server IP address (default: 192.168.10.200). We used 10.128.20.60.

28. Click the VM Networks subtab.

29. Enter the VM Network VLAN ID for VM Network A (default: 110). We used 1080.

30. Enter the VM Network VLAN ID for VM Network B (default: 120). We used 1081.

31. Click the Passwords tab.

32. Enter and confirm the ESXi hosts roots password. We used !Password1.

33. Enter and confirm the vCenter Server admin password. We used !Password1.

34. Click the Globals tab.

35. Select the Time zone.

36. Enter the vCenter Log Insight IP address (default: 192.168.10.201). We used 10.128.20.61.

37. Click Validate.

38. When Validation completes, click Build Appliance.

39. Write down the new IP address. Click I wrote down the IP address. Take me to it.

40. Accept any certificate warnings.

41. When you proceed to the new IP address, Dell Engineered Solutions for VMware EVO:RAIL will deploy.

Adding a Dell Engineered Solutions for VMware EVO:RAIL appliance (+4 nodes)

1. Open a Web browser on the workstation (we used Firefox 35.0.1) and navigate to the newly configured EVO RAIL address (https://10.128.20.60:7443). Accept any certificate warnings.

2. Enter the credentials as configured above (root / !Password1), and click Authenticate.

3. In the lower-right corner of the screen, under New EVO:RAIL Appliance Detected, you will see four green checkmarks. Click Add EVO:RAIL appliance.

4. The system checks to make sure you have a large enough pool of IP addresses. In the Passwords Section, enter the ESXi Password and vCenter server password you assigned to the first Dell Engineered Solutions for VMware EVO:RAIL appliance.

5. Click Add EVO:RAIL appliance.

Updating the Dell Engineered Solutions for VMware EVO:RAIL

1. Log into http://10.128.20.60:7443 using root/!Password1.
2. Click the Config icon in the left menu bar.
3. On the far right of the screen, click the Upload link to upload the update package into EVO RAIL.
4. Browse to the location of the update file, and click Open.
5. After the upload completes, click the Check Now link to determine whether any updates are applicable.
6. After the check completes, click the slider button beside the update you want to deploy, and click Update.

Setting up the Cisco blade solution

Racking and cabling UCS Chassis and Fabric Interconnect

1. Rack the Cisco UCS 5108 chassis.
2. Rack the first Fabric Interconnect (Cisco 6248UP).
3. Rack the second Fabric Interconnect (Cisco 6248UP). Designate the top Fabric Interconnect as 'A' and the bottom Fabric Interconnect as 'B'.
4. Cable the heartbeat ports via RJ45 between the Fabric Interconnects:
   a. Connect L1 of Fabric Interconnect A to L1 of Fabric Interconnect B.
   b. Connect L2 of Fabric Interconnect A to L2 of Fabric Interconnect B.
5. For the first UCS chassis I/OM, connect two SFP cables to ports 1 and 2 of Fabric Interconnect A.
6. For the second UCS chassis I/OM, connect two SFP cables to ports 1 and 2 of Fabric Interconnect B.
7. Connect Fabric Interconnect A port 3 via SFP to port 19 of the infrastructure 10Gb switch (Dell PowerConnect 8024F).
8. Connect Fabric Interconnect B port 3 via SFP to port 20 of the infrastructure 10Gb switch (Dell PowerConnect 8024F).
9. Connect Fabric Interconnect A MGMT0 via RJ45 to port 19 of the infrastructure 1Gb switch (Force10 S60-44T-AC).
10. Connect Fabric Interconnect B MGMT0 via RJ45 to port 21 of the infrastructure 1Gb switch (Force10 S60-44T-AC).
11. Connect power for the first Fabric Interconnect.
12. Connect power for the second Fabric Interconnect.
13. Connect power for the Cisco UCS 5108 chassis.

Racking and cabling NetApp Controller and Disk Shelves

1. Rack the NetApp controller.
2. Rack the first NetApp DS4243 storage shelf.
3. Rack the second NetApp D4243 storage shelf.
4. From the first controller node, connect 0b (square) via SAN cable to the 4th IOM's SAN circle port.
5. From the first controller node, connect 0a (circle) via SAN cable to the first IOM's SAN square port.

6. From the second controller node, connect 0b (square) via SAN cable to the third IOM's SAN circle port.
7. From the second controller node, connect 0a (circle) via SAN cable to the second IOM's SAN square port.
8. From the first IOM, connect the circle SAN port to the square SAN port of the third IOM.
9. From the second IOM, connect the circle SAN port to the square SAN port of the fourth IOM.
10. From the first controller node, connect the internal management port (indicated by a wrench icon with a lock) via RJ45 to the first IOM's square management port.
11. From the first IOM, connect the circle management port via RJ45 to the third IOM's square management port.
12. From the second IOM, connect the square management port via RJ45 to the third IOM's circle management port.
13. From the second IOM, connect the circle management port via RJ45 to the fourth IOM's square management port.
14. From the fourth IOM, connect the circle management port via RJ45 to the internal management port of the second controller node.
15. From the first controller node, connect e1a via SFP to port 17 of the core 10Gb switch.
16. From the second controller node, connect e1a via SFP to port 18 of the core 10Gb switch.
17. From the first controller node, connect the management port via RJ45 to port 31 of the 1Gb switch.
18. From the second controller node, connect the management port via RJ45 to port 30 of the 1Gb switch.
19. Connect power for the NetApp controller.
20. Connect power for the first NetApp shelf.
21. Connect power for the second NetApp shelf.

Configuring UCS Fabric Interconnect

1. Power on Fabric Interconnect A.
2. Using an Ethernet to serial to USB cable, connect a workstation to the console port of Fabric Interconnect A.
3. Establish a connection to the console port (9600 baud, 8 data bits, no parity, 1 stop bit).
4. Type `console` and press enter to select the configuration method.
5. Type `setup` and press enter to the setup mode.
6. Type `yes` and press enter to confirm the setup of a new Fabric Interconnect.
7. Type `no` and press enter to not enforce strong password.
8. Type the admin password, and press enter.
9. Type the admin password again, and press enter to confirm.
10. Type `yes` and press enter to configure the Interconnect as part of a cluster.
11. Type `A` and press enter to define the Fabric denomination.
12. Type the switch name, and press enter.
13. Type the physical switch Mgmt0 IPv4 address, and press enter (we used 10.128.100.5).
14. Type the physical switch Mgmt0 IPv4 netmask, and press enter (we used 255.255.0.0).
15. Type the IPv4 address of the default gateway, and press enter (we used 10.128.0.1).
16. Type the Cluster IPv4 address, and press enter (we used 10.128.100.50).
17. Type `yes` and press enter to configure the DNS Server IPv4 address.
18. Type the DNS IPv4 address, and press enter (we used 10.128.0.10).
19. Type `yes` and press enter to configure the default domain name.

20. Type the default domain, and press enter (we used mp-lab.local).

21. Type `no` and press enter to skip joining a centralized management environment.

22. Type `yes` and press enter to apply and save the configuration.

23. Power on Fabric Interconnect B.

24. Connect the workstation to the console port of Fabric Interconnect B.

25. Establish a connection to the console port.

26. Type `console` and press enter to select the configuration method.

27. Type `yes` and press enter to add the Fabric Interconnect to the cluster.

28. Type the admin password of the peer Fabric Interconnect, and type `enter`.

29. Type the Physical Switch Mgmt0 IPv4 address, and press enter (we used 10.128.100.6).

30. Type `yes` and press enter to apply and save the configuration.

Logging into UCS Manager

1. Navigate to the Cluster IPv4 Address (10.128.100.50). We used Google Chrome. Java was previously installed on the workstation.

2. Click Launch UCS Manager.

3. A .jnlp file will prompt for download; click Keep.

4. When the download completes, click the download to open it (ucsm.jnlp).

5. Check I accept the risk and want to run this application.

6. Click Run.

7. Log in with the admin credentials (username: admin, password: Password11).

Discovering UCSM Chassis/Blade

1. Assuming USCM launches in the default tab (Equipment), select the Equipment tree item, and click the Policies subtab.

2. In Global Policies, verify the Chassis/FEX Discovery Policy matches the physical configuration (our test used two 10Gb connections between each Fabric Interconnect and IOM, so we selected 2 Link).

3. Configure the power policy to match the chassis' configuration (for our test, we selected Grid).

4. Click Save Changes.

5. Click OK.

6. Click the Fabric Interconnects subtab.

7. In the Fabric Interconnects subtab pane, click the topmost + icon to extend all available ports.

8. For Fabric Interconnect A, select the server ports, right-click, and select Configure as Server Port (we used ports 1 and 2 as our server ports for Fabric Interconnect A).

9. Click Yes.

10. Click OK.

11. For Fabric Interconnect A, select the uplink port, right-click, and select Configure as Uplink Port (we used port 3 as our uplink port on Fabric Interconnect A).

12. Click Yes.

13. Click OK.

14. Scroll down to Fabric Interconnect B, select the server ports, right-click, and select Configure as Server Port (we used Ports 1 and 2 as our server ports for Fabric Interconnect B).
15. Click Yes.
16. Click OK.
17. For Fabric Interconnect B, select the uplink port, right-click, and select Configure as Uplink Port (we used port 3 as our uplink port on Fabric Interconnect B).
18. Click Yes.
19. Click OK.
20. Verify that the Overall Status changes to Up for all configured ports, and the Administrative State changes to Enabled.
21. Click the + icon in the Equipment tree to expand all items.

Setting up UCSM management pool addressing
1. Click the LAN tab.
2. Under the Pools tree, expand the root organization, and select IP Pools.
3. In the IP Pools pane, right-click IP Pool ext-mgmt, and select Create a Block of IPv4 Addresses.
4. Enter the beginning IP address range (we used 10.128.173.1).
5. Enter the size (we used 32).
6. Enter the Subnet Mask (we used 255.255.0.0).
7. Enter the Default Gateway (we used 10.128.0.1).
8. Enter the Primary DNS (we used 10.128.0.10).
9. Click OK.
10. Click OK.

Setting up UCSM WWNN & WWPN pool addressing
1. Click the SAN tab.
2. Under the Pools tree, expand the root organization, and select WWNN Pools.
3. In the WWNN Pools pane, right-click WWNN Pool node-default, and select Create WWN Block.
4. Enter the first WWN Block (we used 20:00:00:25:B5:00:00:00).
5. Enter the size (we used 64).
6. Click OK.
7. Click OK again.
8. Under the root organization, select WWPN Pools.
9. In the WWPN Pools pane, right-click WWPN Pool default, and select Create WWN Block.
10. Enter the first WWN Block (we used 20:00:00:25:b5:00:00:00).
11. Enter the size (we used 64).
12. Click OK.
13. Click OK

Setting up UCSM MAC pool addressing
1. Click the LAN tab.

2. Under the Pools tree, expand the root organization, and select MAC Pools.

3. Right-click MAC Pool default, and select Create a Block of MAC Addresses.

4. Enter the first MAC Address (we used 00:25:B5:12:00:00).

5. Enter the size (we used 64).

6. Click OK.

7. Click OK again.

Setting up UCSM UUID pool addressing

1. Click the Servers tab.

2. Under the Pools tree, expand the root organization, and select UUID Suffix Pools.

3. Right-click Pool default, and select Create a Block of UUID Suffixes.

4. Leave the default UUID Suffix, and enter the size (we used 10).

5. Click OK.

6. Click OK.

Creating the UCSM vNIC template and VLAN definitions

1. Click the LAN tab.

2. Under the Policies tree, expand the root organization, right-click vNIC Templates, and select Create vNIC Template.

3. Name the vNIC Template to match Fabric A (we used vNIC Template A).

4. Check Enable Failover.

5. In the VLANs section, click Create VLAN.

6. Name the management VLAN (we used management).

7. Enter the management VLAN IDs (we used 128 as our management VLAN ID).

8. Click OK.

9. Click OK again.

10. Click Create VLAN.

11. Name the vMotion VLAN (we used vMotion).

12. Enter the vMotion VLAN ID (we used 200 as our hypervisor migration VLAN ID).

13. Click OK.

14. Click OK again.

15. Click Create VLAN.

16. Name the storage VLAN (we used storage).

17. Enter the storage VLAN ID (we used 201 as our storage VLAN ID).

18. Click OK.

19. Click OK again.

20. Click Create VLAN.

21. Name the data VLAN (we used data).

22. Enter the data VLAN ID (we used 1080 as our storage VLAN ID).

23. Click OK.

24. Click OK again.
25. In the VLANs section, check the default, data, management, storage, and vMotion VLANs.
26. Select default as the Native VLAN.
27. Change MTU to 9000.
28. Change MAC Pool to the default pool.
29. Click OK.
30. Click OK.
31. Right-click vNIC Templates, and select Create vNIC Template.
32. Name the vNIC Template to match Fabric B (we used vNIC Template B).
33. Change Fabric ID to Fabric B, and check Enable Failover.
34. In the VLANs section, check the default, data, management, storage, and vMotion VLANs.
35. Select default as the Native VLAN.
36. Change MTU to 9000.
37. Change MAC Pool to the default pool.
38. Click OK.
39. Click OK.

Creating the UCSM vHBA template and VLAN definitions
1. Click the SAN tab.
2. Under the Policies tree, expand the root organization, right-click vHBA Templates, and select Create vHBA Template.
3. Enter the vHBA Template Name (F-A).
4. Ensure Select VSAN is set to the default VSAN and WWPN Pool is set to the default pool.
5. Click OK.
6. Click OK again.
7. Right-click vHBA Templates again, and select Create vHBA Template.
8. Enter the vHBA Template Name (F-B).
9. Change Fabric ID to B.
10. Ensure Select VSAN is set to the default VSAN and WWPN Pool is set to the default pool.
11. Click OK.
12. Click OK.

Creating the UCSM Service Profile Template
1. Click the Servers Tab.
2. Expand the Servers tree, right-click Service Profile Templates, and select Create Service Profile Template.
3. Name the template (we used b200-template).
4. Click Next.
5. Change the configuration mode from Simple to Expert.
6. Click Add.
7. Name the vNIC for Fabric A (we used 0).

8. Check Use vNIC Template.

9. Change vNIC Template to vNIC Template A.

10. Change Adapter Policy to VMWare.

11. Click OK.

12. Click Add.

13. Name the vNIC for Fabric B (we used 1).

14. Check Use vNIC Template.

15. Change vNIC Template to vNIC Template B.

16. Change Adapter Policy to VMWare.

17. Click OK.

18. Click Next.

19. Change SAN connectivity to No vHBAs.

20. Click Next.

21. Click Next to skip the Zoning configuration screen.

22. Click Next to skip the vNIC/vHBA Placement screen.

23. Click Next to leave the default boot policy.

24. Click Next to skip the Maintenance Policy screen.

25. At the Server Assignment screen, change the selected power state to Down.

26. Click Next.

27. Click Finish.

28. Click OK.

Creating the UCSM Service Profiles
(Continues in the Servers tab from the Service Profile Template creation instructions above.)
1. Select the newly created template (Service Template b200-template), right-click, and select Create Service Profiles From Template.

2. Enter the Naming Prefix (we used server).

3. Enter the Name Suffix Starting Number (we used 1).

4. Enter the Number of Instances (we used 4).

5. Click OK.

6. Click OK.

Adding servers to the default server pool UCSM
(Continues in the Servers tab from the instructions above.)
1. Expand the Pools tree, expand the Server Pools tree, right-click Server Pool default, and select Add Servers to Server Pool.

2. Click the first server, shift-click the last server to select all servers, and click the >> arrow to move all servers into the Pooled Servers section.

3. Click OK.

4. Click OK.

Associating Service Profiles UCSM

(Continues in the Servers tab from the instructions above.)

1. Expand the Service Profiles tree, expand the root tree, select the first Service Profile, shift-click the last Service Profile to select all service profiles, right-click, and select Associate with Server Pool.
2. Change Pool Assignment to the default pool.
3. Change the power state to be applied when the profile is associated with the server to Down.
4. Click OK.
5. Click Yes to accept any warnings.
6. Click OK.

Installing ESXi [Node 1-4] UCSM

1. Click the Equipment tab.
2. Expand the Equipment tree, expand the Chassis tree, expand the Chassis 1 tree, expand the Servers tree, right-click Server 1, and select KVM console.
3. When the Security Warning appears, check I accept the risk and want to run this application, and click Run.
4. When the second Security Warning appears, check Always trust this certificate, and click Run.
5. When the Unencrypted KVM Session warning appears, select Accept this session, check Remember this configuration for future connections to this server, and click Apply.
6. Click the Virtual Media tab.
7. When the Unencrypted Virtual Media Session warning appears, select Accept this session, check Remember this configuration for future connections to this server, and click Apply.
8. Click Add Image…, and navigate to the folder where the ESXi 5.5 image is stored, select the image, and click Open.
9. Check the Mapped box next to the newly added image.
10. Click the KVM tab.
11. Click Boot Server.
12. Click OK.
13. Click OK again.
14. When the VMware ESXi 5.5.0 Installation welcome dialog appears, press Enter to continue.
15. Press F11 to accept the EULA.
16. Press enter to select the local storage device.
17. If a previous installation of ESXi exists, use the spacebar to select Install ESXi, overwrite VMFS datastore, and press enter.
18. Press Enter to select US Default as the keyboard layout.
19. Type and confirm the Root password (Password1), and press Enter.
20. Press F11 to install ESXi.

Rebooting ESXi after installation [Node 1-4]

Continues from the KVM session above.

1. When the installation completes, navigate to the KVM session, and press Enter to Reboot the server.
2. Repeat this process for nodes 2, 3, and 4.

Configuring ESXi Static IP [Node 1-4] UCSM
1. From Node 1's KVM session, press F2 to Customize System.
2. Enter the Root password (Password1).
3. Select Configure Management Network, and press enter.
4. Select VLAN (optional), and press enter.
5. Enter the management network VLAN (we used 128), and press enter.
6. Select IP Configuration, and press enter.
7. Select Set static IP address and network configuration, and press the spacebar.
8. Change IP Address to 10.128.15.201 for Node 1 (Node 2: .202, Node 3: .203, Node 4: .204).
9. Leave the default Subnet Mask, and change the Default Gateway to 10.128.0.10, and press Enter.
10. Press escape, and press Y to restart the management network.
11. Press escape again to log out.
12. Repeat this process for nodes 2, 3, and 4.

Deploying vSphere vCenter Server Appliance
1. From the management workstation, open the VMware vSphere client.
2. Enter the IP address for Node 1 (10.128.15.201).
3. Enter the user name (root) and Password (Password1) and log in.
4. Ignore any certificate warning dialogs.
5. Click OK to close the Evaluation notice.
6. Click File, and select Deploy OVF Template.
7. Navigate to the VMware vCenter Server Appliance .ova file (VMware-vCenter-Server-Appliance-5.5.0.10000-1624811_OVF10.ova), and click Open.
8. Click Next.
9. Click Next again.
10. Leave the default name, and click Next.
11. Select Thin Provision.
12. Click Next.
13. Check power on after deployment, click Finish.

Configuring vSphere vCenter Server Appliance Network
1. When the appliance boots, in the vSphere client, select the Console tab.
2. Click in the console field to lock the cursor, select Login, and press enter.
3. Type the login name (root), and press enter.
4. Type the default root password (vmware), and press enter.
5. Type /opt/vmware/share/vami/vami_config_net and press enter.
6. Type 6 and press enter to configure the IP Address Allocation for eth0.
7. Type n and press enter to skip configuring an IPv6 address for eth0.
8. Type y and press enter to configure an IPv4 address for eth0.
9. Type n and press enter to configure a static IP address.

10. Enter the IPv4 Address (10.128.15.75), and press enter.

11. Enter the Netmask (255.255.0.0), and press enter.

12. Verify the information is correct, type `y` and press enter.

13. Type `2` and press enter to set the global default gateway.

14. Type `0` and press enter to associate the default gateway with eth0.

15. Enter the default gateway (10.128.0.1), and press enter.

16. Press enter to leave the IPv6 Default Gateway blank.

17. Type `4` and press enter to set the DNS.

18. Enter DNS Server 1 (10.128.0.10) and press enter.

19. Press enter to leave DNS Server 2 blank.

20. Type `1` and press enter to exit the program.

Setting up vCenter Server

1. On the management workstation, open a browser and navigate to the IPv4 address (https://10.128.15.75:5480).

2. Accept any certificate warnings.

3. Log in with the default username (root) and password (vmware).

4. At the vCenter Server Setup dialog, check Accept license agreement, and click Next.

5. Select Set custom configuration, and click Next.

6. Leave the Database type as embedded, and click Next.

7. Enter and confirm the administrator password (Password1).

8. Click Next.

9. Do not check Active Directory Enabled; click Next.

10. Leave time synchronization at No synchronization, and click Next.

11. Click Start.

Creating vSphere vCenter Datacenter and cluster

1. From the management workstation, open the VMware vSphere client.

2. Enter the IP address for the vCenter Server Appliance (10.128.15.75).

3. Enter the user name (root) and Password (vmware) and log in.

4. Ignore any certificate warning dialogs.

5. Click OK to close the Evaluation notice.

6. Click Create a datacenter.

7. Enter the datacenter name (TestUCS).

8. Right-click the newly created datacenter, and select New Cluster…

9. Enter the new cluster Name (UCSCluster).

10. Check Turn On vSphere HA, check Turn on vSphere DRS, and click Next.

11. Leave the Automation Level Fully automated, and click Next.

12. Leave Power Management Off, and click Next.

13. Leave the default vSphere HA options, and click Next.

14. Leave the default Virtual Machine Options, and click Next.

15. Leave the default VM Monitoring settings, and click Next.

16. Leave EVC disabled, and click Next.

17. Leave the default Swapfile Policy for Virtual Machines, and click Next.

18. Click Finish.

Adding hosts to cluster vSphere

1. Select the newly created Cluster, and click Add a host.

2. Enter the IP address for Node 1 (10.128.15.201).

3. Enter the Username and Password for Node 1 (root/Password1).

4. Click Next.

5. Click yes to accept the certificate Security Alert.

6. Review the Host Summary, and click Next.

7. Leave the Evaluation Mode license, and click Next.

8. Do not enable Lockdown Mode, and click Next.

9. Click Finish.

10. Right-click the Cluster, and click Add Host…

11. Enter the IP address for Node 2 (10.128.15.202).

12. Enter the Username and Password for Node 2 (root/Password1).

13. Click Next.

14. Click Yes to accept the certificate Security Alert.

15. Review the Host Summary, and click Next.

16. Leave the Evaluation Mode license, and click Next.

17. Do not enable Lockdown Mode, and click Next.

18. Click Finish.

19. Right-click the Cluster, and select Add Host…

20. Enter the IP address for Node 3 (10.128.15.203).

21. Enter the Username and Password for Node 3 (root/Password1).

22. Click Next.

23. Click Yes to accept the certificate Security Alert.

24. Review the Host Summary, and click Next.

25. Leave the Evaluation Mode, and click Next.

26. Do not enable Lockdown Mode, and click Next.

27. Click Finish.

28. Right-click the Cluster, and select Add Host…

29. Enter the IP address for Node 4 (10.128.15.204).

30. Enter the Username and Password for Node 4 (root/Password1).

31. Click Next.

32. Click Yes to accept the certificate Security Alert.

33. Review the Host Summary, and click Next.

34. Leave the Evaluation Mode, and click Next.

35. Do not enable Lockdown Mode, and click Next.

36. Click Finish.

Configuring vSphere iSCSI Host Network [Node 1-4]

1. Select the host (10.128.15.201, 202, 203, or 204), and click the Configuration tab.

2. Click the Networking link.

3. Click Add Networking…

4. Select VMkernel Connection Type, and click Next.

5. Select Use vSwitch0, and click Next.

6. Change the VLAN ID to the storage network VLAN (201).

7. Click Next.

8. Enter the VMkernel IP Address and Subnet Mask (192.168.201.161, .162, .163, .164 / 255.255.255.0).

9. Click Next.

10. Review the Summary, and click Finish.

11. Click the Storage Adapters link.

12. Click Add…

13. Click OK to add a Software iSCSI Storage Adapter.

14. Click OK.

15. Right-click the newly created iSCSI Software Adapter, and select Properties.

16. Click the Network Configuration tab.

17. Click Add…

18. Select the VMkernel (vSwitch0) Port Group, and click OK.

19. Click Close.

20. Click Yes to rescan the adapter.

21. Repeat this process for all nodes.

Configuring NetApp Controller

1. Using an Ethernet to serial to USB cable, connect a workstation to the console port of the storage array controller.

2. Establish a connection to the console port (9600 baud, 8 data bits, no parity, 1 stop bit).

3. Log in with the administrator password.

4. Type `setup` and press enter.

5. Type `yes` and press enter.

6. Enter the hostname, and press enter (testcontroller).

7. Type `no` and press enter to skip IPv6 setup.

8. Type `no` and press enter to skip configuring interface groups.

9. Enter the IP address for Network Interface e0a (192.168.201.201), and press enter.

10. Enter the netmask for Network Interface e0a (255.255.0.0), and press enter.

11. Type `no` and press enter to skip configuring failover for e0a.

12. Type `auto` and press enter to set the media type for e0a.

13. Type `full` and press enter to set the flow control for e0a.

14. Type `no` and press enter to not support jumbo frames for e0a.

15. Enter the IP address for Network Interface e0b (192.168.201.202), and press enter.

16. Enter the netmask for Network Interface e0b (255.255.0.0), and press enter.

17. Type `no` and press enter to skip configuring failover for e0b.

18. Type `auto` and press enter to set the media type for e0b.

19. Type `full` and press enter to set the flow control for e0b.

20. Type `no` and press enter to not support jumbo frames for e0b.

21. Enter the IP address for Network Interface e0c (192.168.201.203), and press enter.

22. Enter the netmask for Network Interface e0c (255.255.0.0), and press enter.

23. Type `no` and press enter to skip configuring failover for e0c.

24. Type `auto` and press enter to set the media type for e0c.

25. Type `full` and press enter to set the flow control for e0c.

26. Type `no` and press enter to not support jumbo frames for e0c.

27. Enter the IP address for Network Interface e0d (192.168.201.204), and press enter.

28. Enter the netmask for Network Interface e0d (255.255.0.0), and press enter.

29. Type `no` and press enter to skip configuring failover for e0d.

30. Type `auto` and press enter to set the media type for e0d.

31. Type `full` and press enter to set the flow control for e0d.

32. Type `no` and press enter to not support jumbo frames for e0d.

33. Enter the IP address for Network Interface e1a (192.168.201.101), and press enter.

34. Enter the netmask for Network Interface e1a (255.255.0.0), and press enter.

35. Type `no` and press enter to skip configuring failover for e1a.

36. Type `auto` and press enter to set the media type for e1a.

37. Type `full` and press enter to set the flow control for e1a.

38. Type `yes` and press enter to support jumbo frames for e1a.

39. Enter the IP address for Network Interface e1b (192.168.201.102), and press enter.

40. Enter the netmask for Network Interface e1b (255.255.0.0), and press enter.

41. Type `no` and press enter to skip configuring failover for e1b.

42. Type `auto` and press enter to set the media type for e1b.

43. Type `full` and press enter to set the flow control for e1b.

44. Type `yes` and press enter to support jumbo frames for e1b.

45. Enter the IP address for Network Interface e0M (10.128.60.51), and press enter. This will be the dedicated management network address.

46. Enter the netmask for Network Interface e0M (255.255.0.0), and press enter.

47. Type `no` and press enter to skip configuring failover for e0M.

48. Type `no` and press enter to skip finishing configuration through the Web interface.

49. Type the default gateway (10.128.0.1), and press enter.

50. Type `all` and press enter to accept all IP addresses as administrative hosts.

51. Type `EST` and press enter to set the time zone.

52. Press enter to leave the filer location blank.

53. Press enter to leave the language for multi-protocol files unset.

54. Press enter to leave the default root director for HTTP files.

55. Type `yes` and press enter to run DNS resolver.

56. Enter the DNS domain name (PT), and press enter.

57. Enter the IP address for the first name server (10.128.0.10), and press enter.

58. Type `no` and press enter to skip setting up another nameserver.

59. Type `no` and press enter to skip running the NIS client.

60. Type `yes` and press enter to configure the SP LAN interface.

61. Type `no` and press enter to skip enabling DHCP on the SP LAN interface.

62. Enter the IP address for the SP (10.128.60.41), and press enter.

63. Enter the netmask for the SP (255.255.0.0), and press enter.

64. Enter the IP address for the SP gateway (10.128.0.1), and press enter.

65. Enter the name or IP address of the mail host (mailhost), and press enter.

66. Type `reboot` and press enter for the changes to take effect.

NetApp OnCommand Discovery

1. From the management workstation, launch NetApp OnCommand.

2. Click Discover to launch the Discover Storage Systems wizard.

3. Enter the NetApp controller IP Address (10.128.60.51).

4. Click Discover.

5. When discovery completes, select the storage system, and click Add Selected Systems.

6. Select the newly added system, and click Login.

7. Log in with the appliance credentials (admin; Password1). Check Save my credentials.

Creating NetApp OnCommand Initiator Group

These steps assume the vSphere client is open from previous steps.

1. Expand the Controller and Storage tree, and click LUNs.

2. Click the Initiator Groups subtab.

3. Click Create.

4. Name the Initiator Group (UCS-IG).

5. Change the Operating System to VMware.

6. Click the Initiators tab.

7. Click Add.

8. Open the vSphere client window, and select the first host.

9. Click the Configuration tab.

10. Click the Storage Adapters link.

11. Assuming the iSCSI Software Adapter is selected, copy the iSCSI Name to the clipboard.

12. Paste the iSCSI Name into the NetApp OnCommand Add Initiator Name dialog.

13. Click OK.

14. Click Add.

15. Open the vSphere client window, and select the second host.

16. Assuming the iSCSI Software Adapter is selected, copy the iSCSI Name to the clipboard.

17. Paste the iSCSI Name into the NetApp OnCommand Add Initiator Name dialog.

18. Click OK.

19. Click Add.

20. Open the vSphere client window, and select the third host.

21. Assuming the iSCSI Software Adapter is selected, copy the iSCSI Name to the clipboard.

22. Paste the iSCSI Name into the NetApp OnCommand Add Initiator Name dialog.

23. Click OK.

24. Click Add.

25. Open the vSphere client window, and select the fourth host.

26. Assuming the iSCSI Software Adapter is selected, copy the iSCSI Name to the clipboard.

27. Paste the iSCSI Name into the NetApp OnCommand Add Initiator Name dialog.

28. Click OK.

29. Click Save and Close.

Creating NetApp OnCommand LUN

1. Click the LUN Management tab.

2. Click Create to launch the Create LUN Wizard.

3. Click Next.

4. Enter the LUN name (UCS-LUN).

5. Change the Type to VMware.

6. Change the size to 20 TB.

7. Click Next.

8. Leave the default flexible volume settings, and click Next.

9. Check the UCS-IG Initiator Group Name.

10. Click Next.

11. Review the LUN Summary, and click Next.

12. Click Finish.

vSphere iSCSI Dynamic Discovery

These steps assume the vSphere client window has been left open from previous steps.

1. Open the vSphere client window, and select the first host.

2. From the Storage Adapters pane, select the iSCSI Software Adapter, right-click, and select Properties.

3. Click Dynamic Discovery.

4. Click Add…

5. Enter the iSCSI Server IP address (192.168.201.101).

6. Click OK.

7. Click Close.

8. Click Yes to rescan the host bus adapter.

9. Select the second host.

10. From the Storage Adapters pane, select the iSCSI Software Adapter, right-click, and select Properties.

11. Click Dynamic Discovery.

12. Click Add…

13. Enter the iSCSI Server IP address (192.168.201.101).

14. Click OK.

15. Click Close.

16. Click Yes to rescan the host bus adapter.

17. Select the third host.

18. From the Storage Adapters pane, select the iSCSI Software Adapter, right-click, and select Properties.

19. Click Dynamic Discovery.

20. Click Add…

21. Enter the iSCSI Server IP address (192.168.201.101).

22. Click OK.

23. Click Close.

24. Click Yes to rescan the host bus adapter.

25. Select the fourth host.

26. From the Storage Adapters pane, select the iSCSI Software Adapter, right-click, and select Properties.

27. Click Dynamic Discovery.

28. Click Add…

29. Enter the iSCSI Server IP address (192.168.201.101).

30. Click OK.

31. Click Close.

32. Click Yes to rescan the host bus adapter.

Adding datastore to hosts vSphere

1. Open the vSphere client window, and select the first host.

2. From the Configuration tab, select Storage.

3. Click Add Storage…

4. Leave Disk/LUN selected, and click Next.

5. Select the NETAPP iSCSI Disk.

6. Click Next.

7. Leave the VMFS-5 File System Version selected, and click Next.

8. Review the Current Disk Layout, and click Next.

9. Enter a datastore name (UCSDatastore).

10. Click Next.
11. Leave Maximum available space selected, and click Next.
12. Review the Ready to Complete screen, and click Finish.

Updating the Cisco blade solution

Installing vCenter Server Update Manager

We created a new Windows VM (Windows Server 2012 R2) to house the vCenter Server Update Manager. The Update Manager installation can be installed on the same server as the vCenter Server or on a different server. This methodology begins in a vSphere Client logged into the vCenter Server that will issue updates, and assumes the vCenter Server prerequisites have been installed on the designated Update Manager VM.

1. From the vSphere Client, select the host to house the vCenter Server Update Manager, right-click, and select Open Console.
2. Assuming the VM is powered on, log into the Windows VM with the administrator credentials.
3. Click the Disk + Wrench icon, hover over CD/DVD Drive 1, and select Connect to ISO Image on Local Disk…, and locate the VMware vCenter Server installation media (VMware-VIMSetup-all-5.5.0-1750795-20140201-update01.iso). Click Open.
4. If the installer does not start automatically, manually start the VMware vCenter Installer from the DVD drive.
5. At the VMware vCenter Installer screen, assuming the necessary vCenter Server components have already been installed, select vSphere Update Manager.
6. Click Install.
7. Leave English (United States) selected, and click OK.
8. At the VMware vSphere Update Manager Welcome screen, click Next.
9. Accept the license agreement, and click Next.
10. Leave Download updates from default sources immediately after installation checked, and click Next.
11. Enter the IP Address of the vCenter Server that will be able to administer Update Manager (10.128.0.60).
12. Enter the credentials for the vCenter Server (root/vmware).
13. Click Next.
14. Leave Install a Microsoft SQL Server 2008 R2 Express instance selected, and click Next.
15. Leave the default IP naming schema, the default SOAP, Web, and SSL ports, and check Yes, I have Internet connection and I want to configure proxy settings now.
16. Click Next.
17. Uncheck Configure Proxy Settings.
18. Click Next.
19. Leave the default Destination Folders, and click Next.
20. At the Ready to Install the Program screen, click Install.
21. When installation completes, click Finish.
22. Close the VMware vCenter Installer window, and exit from the console session.

Installing vSphere Client Update Manager Plug-In

1. From the vSphere Client, select the Plug-ins dropdown, and click Manage Plug-ins…

2. Right-click VMware vSphere Update Manager Extension from the list of Available Plug-ins, and click Download and Install.
3. Click Run when the Open File Security Warning prompt appears.
4. Leave English (United States) selected, and click OK.
5. At the VMware vSphere Update Manager Client 5.5. Update 1 Welcome screen, click Next.
6. Accept the License Agreement, and click Next.
7. Click Install to begin the installation.
8. When Installation completes, click Finish.
9. When the certificate security warning appears, check Install this certificate and do not display any security warnings for "10.128.15.20", and click Ignore.

Administering vSphere Update Manager
1. From the vSphere Client, click Home.
2. Under the Solutions and Applications category, click Update Manager.
3. Click the Configuration tab.
4. Click Download Settings from the Settings vertical navigation menu.
5. Ensure Direct connection to Internet is selected, the default VMware repositories are checked (hostupdate.vmware.com), and click Download Now.
6. Click OK. View the download task progress in the Recent Tasks pane.
7. Click Compliance View in the upper right hand corner. Ensure the host you wish to update is selected in the vcenter host tree.
8. Click Attach…
9. At the Attach Baseline or Group window, check the Critical Host Patches (Predefined), and any other necessary updates.
10. Click Attach.
11. Click Scan…
12. Check Patches and Extensions, and Upgrades.
13. Click Scan.
14. When Scanning completes, click Remediate…
15. Leave the default Individual Baselines by Type selected, and the default Baselines selected, and click Next.
16. Leave all patches and extensions selected, and click Next.
17. Leave the Scheduling parameters default, and click Next.
18. Leave the Host Remediation Options default, and click Next.
19. Click Finish to Remediate the selected hosts.

APPENDIX C – COST CALCULATIONS

For our cost calculation, we used configurations that would host approximately 100 virtual machines for the purpose of easy comparison. Figure 15 shows the acquisition costs and three-year salary costs that come with a four-blade Cisco UCS and NetApp solution and the Dell Engineered Solutions for VMware EVO:RAIL with four nodes. The Dell Engineered Solutions for VMware EVO:RAIL lowers costs over three years by letting you avoid the cost of hiring an expensive system administrator.

	One Dell Engineered Solutions for VMware EVO:RAIL appliance with four nodes	One Cisco UCS chassis with four Cisco UCS blades and NetApp storage
Compute		$59,832[5]
Fabric Interconnect	$209,668[4]	$41,230[6]
Storage		$33,434[7]
VMware Software and Services Costs		$69,885[8]
Networking	$25,748[9]	$59,930[10]
Cables	$1,460[11]	$1,548[12]
Total acquisition costs	$236,876	$265,859
Total additional salary for 3 years[13]	N/A	$390,369
Total cost for 3 years	**$236,876**	**$656,228**
Savings with the Dell solution	**63.90%**	

Figure 15: Costs for the two solutions.

---

[4] It includes vSphere Enterprise Plus + LogInsight + VSAN and EVO RAIL Management + Full Hardware+ Software Support + Hardware Support

[5] 1 x UCS 5108 Blade Chassis with 4 x UCS B200 M3 Blade Servers (dual Intel Xeon Processor E5-2640 V2, 192GB memory (12x16GB), costs include 3-year NBD support

[6] 2 x UCS 6200 Fabric Interconnects with 12 port licenses each (8 ports total used per chassis),costs include 3-year NBD-critical support

[7] For 4 blades, 1x FAS 2552 mixed shelf with 4x 400GB drives and 20 900GB drives. 16.2 TB total HDDs, excluding hot spares; costs include 3-year NBD support

[8] 8 x VMware vSphere 5 Enterprise Plus and VMware vRealize Log Insight CPU licenses and 1 x VMware vCenter 5 Server license. Costs include 3-year basic technical support.

[9] 2 x N4032F SFP+ Network Switches

[10] 2 x Cisco Nexus 5548UP switch 3-year NBD support

[11] Mix of Copper Twinax and Cat6 cables

[12] Copper Twinax Cable to connect all components

[13] Based on the cost of a System Administrator III yearly salary of $130,123. Source: National averages from Salary.com (4/5/2015).

APPENDIX D – ADDITIONAL DETAILS

Dell Engineered Solutions for VMware EVO:RAIL took little hands-on administrator time to complete the tasks we tested (see Figure 16). This frees up staff so they can innovate elsewhere and focus on more strategic projects.

	Hands-on administrator time (minutes:seconds)
Time to deploy	12:24
Time to add an additional appliance	0:30
Time to update	03:21

Figure 16: Hands-on administrator time to complete the tasks we tested with Dell Engineered Solutions for VMware EVO:RAIL.

Figure 17 details the tools that the Dell Engineered Solutions for VMware EVO:RAIL and the Cisco UCS and NetApp solution used. Dell Engineered Solutions for VMware EVO:RAIL completed all the tasks from a single interface, which can make life easier for administrators.

Dell Engineered Solutions for VMware EVO:RAIL	Cisco UCS and NetApp solution
EVO:RAIL interface	Fabric Interconnects
	UCS Manager
	UCS KVM x4 (once for each node)
	NetApp OnCommand
	VMware vSphere client

Figure 17: The tools required for deployment, scaling, and updating with each solution.

Figure 18 shows that the reduced power consumption of the Dell Engineered Solutions for VMware EVO:RAIL can save on operating costs over three years.

Calculations for 1,000 hours of power usage while idle	Four-node estimate[14,15]	
	Quantity	Average idle watts
Dell Engineered Solutions for VMware EVO:RAIL		
Force10 S55	2	170.4
Dell PowerConnect 8164F	0	0.0
Dell C6220 (EVO RAIL Appliance)	1	609.2
Total average idle watts		**779.6**
Cisco UCS and NetApp solution		
Cisco UCS Fabric Interconnect A (6248UP)	1	366.1
Cisco UCS Fabric Interconnect B (6248UP)	1	335.3
UCS 5108 Chassis (with four blades)	1	286.8

---

[14] Assuming a Power Usage Effectiveness (PUE) ratio of 1.7. Source: www.datacenterknowledge.com/archives/2014/06/02/survey-industry-average-data-center-pue-stays-nearly-flat-four-years/.
[15] Assuming energy cost of $0.1074 per kWh. Source: www.eia.gov/electricity/monthly/pdf/epm.pdf.

Calculations for 1,000 hours of power usage while idle	Four-node estimate[14,15]	
	Quantity	Average idle watts
NetApp Cable Controller 10GbE	1	183.7
NetApp DS4243 Shelf 1, Node 1	1	237.3
NetApp DS4243 Shelf 1, Node 2	1	232.6
NetApp DS4243 Shelf 2, Node 1	1	239.4
NetApp DS4243 Shelf 2, Node 2	1	218.7
Total average idle watts		**2,424.3**
Savings with the Dell solution		**1,644.7**
3-year savings for power and cooling (per 1,000 hours idle)		**$900.84**

Figure 18: Three-year power consumption while idle (for 1,000 hours) estimates.

ABOUT PRINCIPLED TECHNOLOGIES

![Principled Technologies logo]

Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.