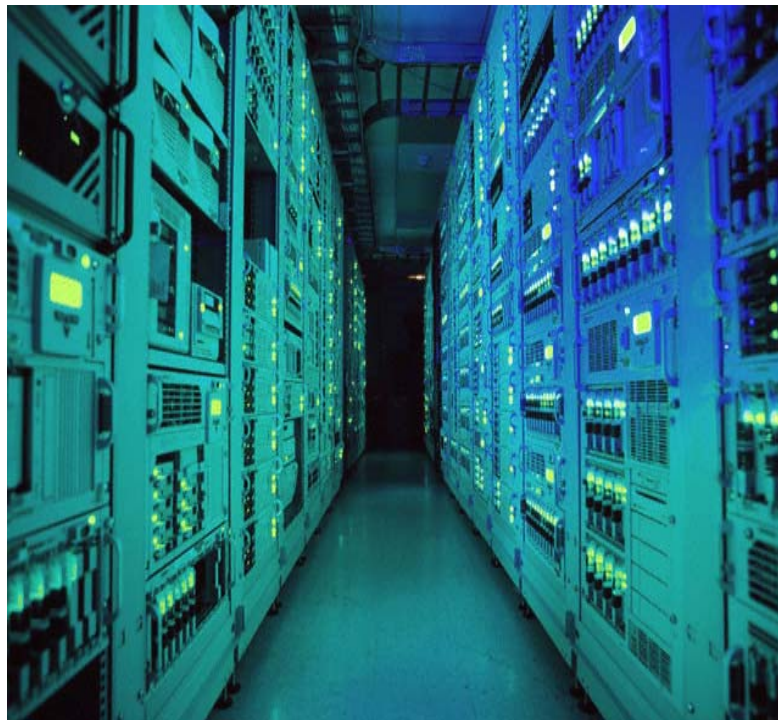


## Technology Tutorials

# SERVICE ORIENTED DATA CENTER (SODC) AND STORAGE NETWORKING TRANSCRIPT



### Program and Presenter Opening

*Monique LeFors Edmons*: Hello and welcome to this “Cisco on Cisco” tutorial, on Cisco IT’s deployment of Data Center and Storage Networking solutions. I’m Monique LeFors Edmonson and I’m a Program Manager in the IT Customer Strategy and Success team.

The theme of our show today is an overview of Cisco IT’s implementation of the Services Oriented Data Center, Storage Networking and other new Data Center solutions.

It is my pleasure to introduce the guest of today’s show, Sidney Morgan, an IT manager from the Cisco on Cisco team. Sidney thanks for coming.

*Sidney Morgan*: Thank you Monique. It’s a real pleasure to be here and to be able to present our Data Center solutions.

*Monique LeFors Edmons*: Sidney, let me hand over to you now to talk a little bit about the Data Center and Storage Networking solutions here at Cisco.

### Agenda

*Sidney Morgan*: Thank you Monique. So let’s take a look at our data center and storage

networking strategy. First, a quick review of our agenda.

## IT Overview

We'll look at the Cisco IT overview. We'll look at our data center transformation program followed by the services oriented data center for SODC overview, the technologies that have enabled SODC and then finally we'll wrap it up with the results and lessons learned from the SODC program.

## Cisco IT Mission

At Cisco our IT Department has very high expectations from our leader John Chambers. He really expects Cisco IT to support the business strategy, drive productivity through innovation and showcase Cisco technologies.

## Enable "Every" Move with IT: CEO sets the Vision, CIO enables the Vision

To accomplish these goals and vision that John sets out for IT, we've come up with a slogan, "Enable every move with IT." And that is just all about how Cisco IT enables John's vision.

At the foundation of our strategy is operational functionality. We would not be able to innovate and improve customers' experiences if we cannot keep our day-to-day business running so operational functionality is a key and the cornerstone to enable our vision. On top of that we levered business capabilities and that's all about improving the user experience in driving productivity. And finally, the top of the pyramid is all about our strategic growth and this is how we'll innovate into enable growth and drive solutions across the Cisco environment.

## Two Views

In order to accomplish this we really had to change the way that Cisco was viewed within the business. We really wanted to go and migrate away from a cost center which really has very little control about their strategic future and really drive to a strategic partner with our business units. That will allow us to set our priorities and drive the technologies that we needed to roll out to the business to facilitate John's visions.

## Production Data Center Transformation: Overview and Issues

So now let's look at the data center transformation program and these are the programs that would enable this SODC environment to be rolled out globally.

## Cisco Data Centers

Currently at Cisco we have 47 data centers plus a LINKSYS data center and a Scientific Atlanta data center. The data centers are divide it into two categories. Our business or production data centers and our development which are really our engineering R&D data centers.

The reason why we keep the data centers separate is that the business responsibilities and requirements for each data center especially around security and regulatory environments are about 180 degrees out of phase. So for operational excellence and really streamlining the operations we decided it was best to maintain two separate functional data center environments: a business environment and an engineering R&D environment.

## Cisco's Next-Gen Production Data Center

So as part of our production \_\_\_\_\_ this presentation is really gonna focus on the production data centers and to enable a next generation production data center strategy we realized that it was more than just deploying technologies and architectures into our global data centers. We really needed to come up with a two prong approach. One that would enable Cisco's growth. We're growing about 20 percent a year. And to really improve the user experience which will drive productivity.

So to do this from a foundational point of view we needed to come up with a global architecture and then global operational business practices and architectures around that. Each one of these will feed into our business resiliency program which will be built into the overall SODC architecture and then business agility.

It's a key to Cisco's growth that we become a very agile company in this new global environment that we operate within and we do believe that the agile and nimble corporations will be the successful corporations in the next decade.

### Problem Statement

So what led us to putting the SODC program together? Well, basically we were out of capacity and this capacity was providing a huge business risk to Cisco. And capacity ten years ago was measured in floor space in data centers. We no longer measure capacity as floor space within our data centers. Really capacity measurements and planning is all done around power and cooling.

So in our new modular x86 based environment capacity and the limiting factors are really around how can we cool our data centers and how can we get enough power per square foot to our data centers? And this really is gonna be the challenge that the services in our data centers is going to solve.

### Data Center Operational Impact

Also trying to figure out what our global data center environment would look like. We had to understand the operational impact to a data center and all the participants involved. So if you look at and analyze what any one hour of the on time would cost Cisco it's probably somewhere between \$40,000.00 per hour and probably well exceeding \$100,000.00 per hour. But that's a very microscopic look only at that Cisco impact.

At Cisco we have a very leveraged environment here where we have lots of contractors, suppliers and vendors accessing our network plus our data center. So if you look at the total Cisco ecosystems we expect the impact of one hour of downtime to really be magnified by at least ten times, maybe 20 times in worst case scenarios.

So truly the impact of our data center outage is anywhere from \$1 million to way over \$2 million per hour and this is really what was one of the driving factors behind needing a strong robust and agile global business data center architecture and one that can meet the resiliency needs of a five nines environment.

*Monique LeFors Edmons:* Sidney, you mentioned that the business requirements are changing to demand this no business downtime. How would you say the requirements are changing?

*Sidney Morgan:* Well, Monique, Cisco has a dual headquarters. We have our primary headquarters here in San Jose and the secondary headquarters in Bangalore. So, to do this John's moved some of his SVPs out and we really run a global environment now so if you think from a global business perspective there's no time in a global environment to have downtime for upgrades or maintenance or even preventive

maintenance.

So we've had to develop an architecture and business processes that enable us to do upgrades, maintenance and even install new modules for the SODC architecture that has no interruption to our services. That way we can maintain our service level agreements with our business units.

*Monique LeFors Edmonsens:* That makes sense. Thanks.

*Sidney Morgan:* You're welcome.

### **PDC, Opportunity Enable Every Move with IT**

*Sidney Morgan:* To enable every move with IT we've looked at the challenge that we had ahead and realized that it was a two-pronged approach that we needed to take. There's the traditional architecture around the technologies, the storage, the server, the application acceleration. Also the automation within the VFrame Data Center. These are all technology architectures that we've built into the SODC program.

However, there's also an operational excellence and functionality that we needed to build. And to accomplish this we felt that we needed to build programs around the architecture to take advantage of the new technologies that we are rolling out.

And the first and foremost one was to develop a common management database. This will be the single source of truth where you'll go and automate the entire global data center environment from.

To accomplish this you need to come up with an application delivery mapping and dependency mapping capability so as you want to automate all the applications within a data stream you need to understand all the interdependencies of the application so you can automate them end to end.

And then we wanted to build in some best practices around Enterprise architecture so we not only want to build architectures around business processes and technology but we also wanted to develop a new application architecture that will take advantage of the new SODC environment. And all this will drive agility and availability going forward.

### **PDC Site Selection**

So now let's look how we selected the site for a new production data center.

### **PDC Tier**

*Sidney Morgan:* Traditionally Cisco's data centers, existing data centers both development engineering and production data centers, are a combination of either Tier 1 or Tier 2 data centers. And as you can see on this slide the availabilities that come with the tiering.

These availabilities really didn't meet Cisco's new business requirements. So we decided that we needed to upscale all of our data center architectures and really build a Tier 3, Tier 4 combination data center to provide us somewhere between 1.4 and .4 hours of downtime per year.

Now I do like to make one slight modification with the up times \_\_\_\_\_ is that I do feel it's more important to have mean time between failures as a measurement of your data centers but nonetheless as a business owner of a data center you need to

understand the requirements for what type of a downtime that you need to build to enable your business and meet your SLAs.

These tierings are very expensive to go from a Tier 1 to a Tier 4 so we recommend you align the data center tiering to meet the business requirements.

### **PDC Site Selection Strategy from 420 Metro Areas Down to 8, Then 1**

What were the must haves? So since we were consolidating our data centers within the United States and North America we preferred that the data center be within the United States or Canada. We had to have negligible environmental impact. So currently our data centers are at risk from earthquakes and floods. We wanted to get to a very benign environmental environment. We needed plenty of fiber service and bandwidth and we wanted at least two long distance providers and two suppliers for our electrical power grid that give us true diversity.

Additional requirements that I think all data center managers should think about when trying to find a new site would be the cost of electricity. Make sure that there are two dual power grids. Any incentives from the government that would be handed out as far as tax offsets to migrate into that environment. The existing head count from an IT perspective. Is their talent there?

We wanted to be close to our customers. And just make sure that it was an environmentally friendly environment for a data center business.

With that we've mapped out the earthquakes, tornadoes, fiber map and hurricanes for the past 200 years within the United States. Decided what cities that we needed to migrate.

### **The Winner! - Richardson**

*Sidney Morgan:*

With that we came up with three selections. The runner-ups being Boulder and Phoenix and our final selection being Richardson, Texas. With really the tipping point and the major factor being that we have a campus in Richardson, Texas and we could really accelerate our build process by about 18 months. And being at capacity within our current production data centers this was a key factor to really accelerate the application migration to Richardson, Texas.

### **Service Oriented Data Center (SODC) – Section Start**

Now let's look at the service oriented data center.

### **Service Oriented Data Center (SODC)**

So the service oriented data center is really built with the vision and enablers of people. So we're gonna upskill our people to be very agile and flexible across all disciplines of the data center. We're re-engineering the business processes. We're also installing new software technology, the VFrame Data Center. And hardware technology \_\_\_\_\_ consolidated fabric to really enable the SODC vision which is a virtual pool of resources that can be automated based on your business practices to be at the right place at the right time when the business requires them.

*Monique LeFors Edmons:*

Sidney, on the business processes, the others are very tangible and easy to grasp on to but business practices, which ones do you see as making the biggest changes in?

*Sidney Morgan:*

So currently right now the one we're focused on because VFrame Data Center is a key component and automation really is the biggest win for

the service oriented data center. We're concentrating a lot of our change control processes. 'Cause in the past where it took six to eight weeks to revision a service, our change management and change control systems allowed for that. Now I can provision a service in less than three days. I need to reengineer all of my processes to make sure that my change management and change control and access control to the different elements of the data center will allow the SLAs three days to be enabled.

*Monique LeFors Edmonsens:* That \_\_\_\_\_.

### SODC Meeting Business Objectives

*Sidney Morgan:* So meeting this objective we wanted to enhance the business agility, improve business continuance and overall reduce the cost. As I mentioned earlier we want to drive it down to three days and actually within 24 hours and we want a recovery time of less than six seconds. This will allow a lot of our TCP timeouts to be satisfied. That way we'll have that interrupted service that we are looking for. And really to reduce or actually optimize the cost of operating our data centers.

### SODC Design Phases

There's three phases to the SODC rollout. The first one is consolidation and when we started we were around 55 data centers. We've consolidated down to 47. We're gonna keep on driving down the consolidation to increase resource utilization and obviously optimize the data center resources as sort of a key cost-saving component.

Virtualization. And I know virtualization is a very important and a big buzz word right now but being at Cisco we've actually been virtualizing since the 1990s that we're calling VLANs. So building on the VLAN concept we've created VSANs and we've rolled out VMware and we've virtualized our networking services within the ACE module. This has all helped optimize our data center environment and really helped with our power budget because we were able to put more services and increase the utilization of not only our servers but across all of our network services at the same.

And then probably the biggest return and the cornerstone of SODC automation – and this is where VFrame Data Center plays a key part. And it's really an adaptive orchestration so if we were to lose a service the VFrame Data Center would automatically reprovision it. This is the cornerstone of our disaster recovery. And then the rapid delivery of services. VFrame Data Center will enable us to deliver our services with an SLA date to start with of three days and we'd like to drive that down to around a 24-hour SLA.

### ... Data Center Evolution

Here's our roadmap. The main driver behind this roadmap is just I know this sometimes seems overwhelming. It's like eating an elephant but really just divided into doable chunks. We've been at this since 2004 and if we have our active active production data center fully automated based on business policies by the end of 2010 that will be a success.

So we've really divided up the different technology tiers and what we wanted to accomplish migrating to a virtual services oriented data center. So my recommendation is find the area that drives the biggest return quickly. Leverage that to drive your metrics and show that you are driving the productivity that you can and drive the funding forward.

Because like most organizations it's pretty hard to go out and get a seven-year plan and funding to do that. You really need to prove that your driving value to the business on a quarter by quarter basis.

## Service Oriented Data Center Technologies: Servers

Now we're gonna look at the server technologies behind the service oriented data center.

### SODC Server Landscape

Currently at Cisco we have approximately 12,000 servers, a combination of both virtual and physical servers which support over 12,000 applications. The focus is to actually migrate to an x86 commodity based or value based platform with Linux being the goal. If we can't migrate Solaris or the HP environment, HP UX environment to Linux, we'll migrate it to Windows. And the driver behind this is the fact that automation VFrame Data Center right now is really focused on x86 based provisioning. So that's where we're trying to drive all our applications.

### SODC Server Virtualization

So what are the four components to server virtualization at Cisco? Obviously we spoke about consolidation. So server consolidation really improves the operational agility and lowers our overall expense. Increased utilization of our physical server environment.

And this is really a key because our data centers are out of capacity specifically being power and cooling and we really need to optimize every component within the data center. I think the biggest operational win is reduced server provisioning time. Six to eight weeks down to less than three days. And then the ability to increase operational efficiencies.

And this has allowed us to reduce our planned and unplanned maintenance downtime so that they are the same. So that we can do upgrades without any interruptions to our services that we provide out of our data centers.

### Server Virtualization Considerations

So what are some of the considerations when you embark on a server virtualization? Well, first you need to figure out a support model and make sure that it can be managed by a team that you put in place so we put together a static data center team called the service oriented data center team.

There's a risk versus virtualization targets. We've noticed very good return on installing VMware and virtualizing our servers. However, the speed at which you make that also adds risk so you do need to be very pragmatic. Take it one step at a time and make sure that you don't do two steps at one time.

We did get ahead of ourselves in one of the applications deployed. We migrated from Solaris all the way to a virtual world all in one fell swoop. It turned out that there were some intermittent hangs so we had to go back and take it one step at a time.

So it's our recommendation that if you're migrating from a Solaris environment or a traditional use environment to an x86 environment and virtualizing, please be very cautious and take it one step at a time. The benefits will be there.

And then also you need to look for ISV support. You need to make sure that your independent software vendor or your application provider will support your virtualization environment.

Keep your clients in mind. You need to put together a strong communications plan. Let them understand where they're going and the benefits. The what's in it for them. Why you're going there. And allow them enough time to redesign your applications and to renegotiate any contracts they might need. And that drives to the strategy and the communications plan.

It's really important. I can't emphasize enough that you put in a very robust and strong communication plans are the benefits for your end user community on migrating to VMware.

*Monique LeFors Edmonsens:* And Sidney –

*Sidney Morgan:* Yes.

*Monique LeFors Edmonsens:* For the clients, how have you found the reception been so far with the what's in it for them type of communication?

*Sidney Morgan:* Well, as usual, since a great communication plan was kind of a lessons learned after the fact, it was kind of like pushing a boulder up a hill. Until we hit that tipping point. But once you hit the tipping point, the water cooler talk went from why are you migrating us to VMware to why aren't you migrating us to VMware.

So I really feel by putting together a very strong communication plan up front that tipping point would happen a lot quicker with a lot less effort after the fact by the SODC team.

*Monique LeFors Edmonsens:* Good lesson learned. Thanks.

### **SODC Virtual Data Centers**

*Sidney Morgan:* Yes. So currently out of our 47 data centers, we have VMware deployed in seven of our data centers globally with the Asia Pac to be rolled out in FY08.

### **SODC VMware Architecture**

And here's an overview of our VMware architecture. It's a distance environment. As I mentioned earlier we wanted planned and unplanned downtime to compress as close to the same as is possible so we run a distance environment based on x86 hardware with no single point of failure. So there's two HBA cards in each server. Those feed off the two separate MDS 9509s into a high availability dual SAN fabric environment.

One lesson learned about the VM environment is that the system boards and the BIOS need to be exactly the same. So when building up your VMware for farm, we recommend that you buy the single capacity at a time. That way you make sure that you have exact same servers. We found that even Gen 1 and Gen 2 servers could not work properly in a VMotion environment so right now you need to make sure that all of your servers within your VMware farm are exactly the same.

From a high availability side on the network services, we have two 1-GB teamed environments going to two separate catalyst 6509 switches followed up with VMotion connectivity and non-routable Layer 2 VMotion connectivity again to two separate connections and then an out-of-band hi-lo management connectivity.

That on the next layer up is the networks services layer where we do the load balancing so we do trunk in all the VLANs that we need at the cluster. This simplifies the day-to-day operations about trunking in VLANs. You do need to be careful that you don't exceed the limitations of the switches depending on how many networks you can span within

your VMware farm. And then into the DC core and then finally out to the aggregation layer out of the data center.

*Monique LeFors Edmonsens:* Sidney, you mentioned that the VMware servers had to be exactly the same. Why is that and what kind of business impact would there have been or was there if they weren't the same?

*Sidney Morgan:* So it's to enable the VMotion capability so VMotion enables VMware to automatically load balance across servers or if you lose a server to migrate all the VMs into the existing servers in the VM farm.

And there was no impact with business because we discovered that idiosyncrasy in our test environment. So at Cisco we have a development environment, a test environment, and then we roll into production so we run everything through the rigors before actually going into production. That was found in our development environment.

*Monique LeFors Edmonsens:* Okay. Thanks.

### SODC Server Virtualization Highlights

*Sidney Morgan:* So the highlights of our server virtualization initiatives. We've improved our ROI and driven down the total cost of ownership. We've deployed about 2,500 VMs and I think one of the things that we're still struggling with that we hope to improve this through a better process is we've only been able to remove about 350 servers. What we're gonna really focus \_\_\_\_\_ on removing those servers because the applications have been migrated.

The keys to migration of the servers was platespin. We've leveraged that to do all the physical to virtual migrations and then VM Converter for physically to a virtual conversion for the Windows environments.

### SODC Server Virtualization Metrics

And to sum it all up, lessons learned. We're averaging about 14 VMs per ESX server. Hope to drive that up to around 20 on average. We've cost avoided about \$14 million to date. Over 2,500 VMs have been deployed and 95 percent of our environment meets the SLA of the three days and under and trying to keep on driving that down to as low as possible. Hopefully less than 24 hours.

### Service Oriented Data Center Technologies: Storage

*Sidney Morgan:* Now, let's look at our storage environment.

### Cisco Data Center Storage Landscape

Storage has grown rapidly here at Cisco Systems in the past few years, peaking out at 52 percent last year. We're about 7.8 petabytes. Primarily trying to drive the storage environment to SAN. We have NAS environment in the engineering and DAS is something that we're actively migrating away from.

### SODC Storage Architecture consolidation - 1

So how did we get to where we are today from a global SAN fabric? Well, we have deployed the MDS starting in 2002. Took our siloed SAN environment, consolidated that down. Tiered it from bronze to gold. Further consolidated leveraging the modules within the MDS, the fiber channel IP switch module we were able to do fiber channel over IP in our existing WAN link and scavenger mode to consolidate down all the fabrics and then leveraging our VSAN technologies to be able to create a global virtual SAN fabric.

## SODC Storage Architecture consolidation - 2

With that we've also added another tier, platinum, so we'll have a four-tiered strategy. This will enable us to keep on driving down the total cost of storage as we be able to delineate the different types of storages that we'll provide.

The MDS chassis will also be the foundation for active active Data Center that we're deploying in Richardson, Texas and using SRDF we'll be able to recover the data center in case we lose it. And I'll show you the details behind that.

## Cisco IT SODC Storage Architecture

For our long-term disaster recovery strategy we'll be using fiber channel over IP and assynchracy replicating all of our critical databases to RTP in the case that we would lose both data centers in Richardson, Texas.

## Richardson Floor Plan

Here is a current model of the Richardson data center. It's a two roomed environment about 28,300 square feet of floor. We've zoned it off within the halls and we purposely built it this way so that we haven't completed the second Active Data Center so in the process we'll be putting an ONS 15454 optical ring with 40 miles of latency in there to really practice doing a load balancing in a metro data center area which will be the SODC active active architecture.

## Richardson Detailed View

And then here's a detailed view of the SAN core and edge within the data center so it's an A and a B fabric dual core, no single point path of failures. This will allow us to upgrade and do maintenance without any impact to the services. As you can see, the ONS 15454 in the middle right now. That will be spanning the two rooms. And then the ONS 15454 DWDM will be spanning the two data centers in the Richardson metropolitan area.

## SODC Storage Results

So results to date. We've driven our FTE from managing 25 terabytes five years ago all the way up to 600 terabytes. The total cost of ownership has in the past six years come down from 21 cents per megabyte to a penny per megabyte. At the same time, which was kind of a key component to driving the total cost of ownership was the overall utilization of our SAN fabric and is being driven from 20 percent up to 67 percent.

And then we cost avoided close to \$70 million in the past four fiscal years by deploying the MDS VSAN global fabric.

## Service Oriented Data Center Technologies: Network

Now let's look at the network behind SODC.

## Mode of Operation Choices

*Sidney Morgan:*

When we looked at the type of data centers that we wanted to build on the completely centralized version we had an active standby environment which is what we currently have today and this does not meet our business environments. However, it has minimum complexity and minimal operational requirements.

On the far end of the spectrum completely distributed as an active active environment which meets our requirements but is a very complex and somewhat expensive operational environment to manage. And we felt that our business recruitments didn't quite need that complexity.

So we decided to take the best of both worlds leveraging the VFrame data center and come up with active active hybrid data center design and I'll explain what that is in the next slide.

### Cisco IT Active/Active-Hybrid Data Center

So an active active hybrid design you'll have both data centers. They'll both be active. Cookie cutter images of the architecture within them. And then leveraging our Global Site Selector when the user comes in and activates an application or within our data center environment, he'll be routed to with Global Site Selector to the data center whether it's data center one or data center two to where the application has been provisioned by VFrame Data Center.

So if your application is provisioned on data center one you'll go with data center one and you'll be self-contained but completely load balanced and virtualized within data center one. Or if your application happens to reside and been substantiated by VFrame Data Center in data center two, you'll be routed by Global Site Selector into data center two and completely contained within that.

The hybrid part is that the database won't be load balanced across the data centers. It will be actively load balanced within a single data center. That's the hybrid part of this architecture.

*Monique LeFors Edmonsens:* And with this hybrid is there gonna be any kind of impact to the business? I mean they're active, active. They sound like the exact same architecture. So is there any impact to the users of these applications?

### Continuous Availability with Disaster Recovery

*Sidney Morgan:* No, there won't be and I'll show you this in the next slide with what VFrame and data center will accomplish. So if we were to lose data center one, VFrame Data Center since it has a synchronized database from both data centers, it would know the exact applications that were missing when data center one was lost and then they would reprovision them in data center two.

And the only real business justification that you need to do is to figure out how much extra capacity. So VFrame Data Center can take down your lower proprietary applications and then substantiate your higher priority applications from the data center that was lost. Or you can just maintain a 50 percent extra capacity. So that's just a business decision that you need to make from how much extra cost you want to endure by having capacity that might not be utilized. But VFrame Data Center gives you complete flexibility to make that business decision.

*Monique LeFors Edmonsens:* Okay.

*Sidney Morgan:* And then the data bases, they will be synchronized between the two data centers. VFrame Date Center will activate the standby data center and all the data centers will then be contained in a single data center.

Now, we do have a disaster recovery, worst case scenario failover and that is if we were to lose both data centers, VFrame Data Center would again substantiate the applications remaining but lost within both data centers into our RTP facilities. Now since this is a disaster bunker type architecture, this will not be spare capacity that will keep an RTP. We'll have to cannibalize our development environment and substantiate it

leveraging VFrame Data Center and this will take at least 24 hours to bring up the most critical applications and then weeks. But this is a worst case scenario losing both data centers.

The VFrame Data Center will bring up the app servers, the web servers and then substantiate the new and activate the databases within RTP.

### **SODC Orchestration**

So let's take a quick look on how VFrame Data Center will orchestrate our data center environment here at Cisco. Within the VFrame Data Center you create a virtual service template and within this example we're just basically gonna bring up a basic web service.

So an engineer or developer logs in to our ISM, our Integrated Service management framework. Is authenticated. Makes sure that he has the permissions to bring up a web service. At that point he selects the web service that he wants to bring up through his VFrame options and templates. VFrame goes out, brings down the right switch network services whether that's load balancing, SSL offload or firewalls. It next creates a VLAN and then instantiates that VLAN. Then goes out with fabric manager. Creates or either puts you in an existing VLAN. Then through scripting it can talk with leading storage providers out there and create a LUN for you.

Next, it analyzes the server polls, brings down the proper type of server and instantiates the right operating system and then activates the application. And all this happens within a matter of minutes. So this is really the key to orchestrating and having the agility that we need to run our global business.

### **SODC Architecture**

And then just a drill down on how the network architectural pod will look like within the Richardson data centers. And this is designed to be very modular so that way we don't have to build you the entire data center at once. We can expand and upgrade the architecture or the SODC pods as required per the business requirements.

### **SODC POD Network Architecture**

Basically it will have either top of rack switching over inter-row switching depending on what your architecture prefers going up to an access or distribution layer. Those are Catalyst 6509s. Then we've broken out our network services layer and that's kind of a key design. This allows you to provide network services, the entire data center and really helps increase utilization because currently the network power budget within a data center is about, you know, depending on what survey you look at, anywhere between 5 and 15 percent max.

As we go to more and more services going on in the ports and more applications being monitored by the network, this power budget of the network is gonna increase so you want to make sure that you maximize utilization of all components within your network architecture.

### **Service Oriented Data Center Technologies: Wide Area Application Services**

Now let's look at how we'll connect the global data centers together with our Wide Area Application Services or application acceleration.

### **ANS: Big Picture**

So this is our big picture model of our Internet's program and it really has three components that will eventually merge into a single or three

solutions that will eventually merge into a single solution. We have our ACNS is what we do for our content distribution.

That's how we put out all of our VODs and virus protection. We have symmetric which is what we do to bring back all of our NAS consolidation. And we have asymmetric which is really key for a mobile work environment. This is what does web and HTTP acceleration for remote users who may log into Cisco anywhere within the global infrastructure.

### **Content Switching: What is it?**

So content switching. What is it? Well, we have server farms. We have server load balancing and then we have content switching. And all of these three go within our overall content switching environment.

### **Content Switching**

So why are we doing it? Because we needed high availability. Also some people can call this virtual applications. We needed the functionality of being able to upgrade and migrate applications from server to server without any downtime.

We needed cache control. This allows us and part of what I said earlier about really driving user experience and productivity. This allows us to make sure you're as productive no matter where you're located or no matter where your data is located by caching your data and your access as close as possible. And then odyssey to improve security with SSL to make sure that every environment is encrypted and all the data in caching is encrypted too.

### **The www.cisco.com Paradigm**

So let's look at a quick paradigm of how this would work. So you're a remote user of access in the environment anywhere either through VPN or an environment Cisco. You'll come in. The ACE application will look at the content. Cache all the static parts. Maybe even do some dynamic. And then will load balance you across the three different servers or different servers you have there to run your application.

And all this was done to basically maximize and accelerate the application to make sure that you have as little latency as possible addressing any one of your applications within the Cisco environment.

### **Symmetric Acceleration (Now)**

So the second solution is the symmetric environment that I mentioned earlier and this is how we're going to consolidate really a lot of the environment for our NAS. So the biggest win was really bringing back all of our CIFS and NAS filers. NAS is a great application for really sharing files across the environment. However, it can be very expensive to manage because of the distributive nature of NAS. Plus there are some security risks by having it out in areas that don't have them locked down or armed guards.

So leveraging our WAAS or symmetric acceleration we're able to consolidate all of our filers into our key data centers and then accelerate it out to the end users and with our surveys of our environment we've noticed that most users don't even notice that their filers have been consolidated. However, we've been able to improve the data integrity but putting them into our DIG or data integrity process. Plus improve security and then be able to consolidate which drives down the overall cost of managing the storage.

## WAAS Bandwidth Savings

And then here's a kind of example. So as I mentioned earlier, the first solution was ACNS. This is how we do our video content distribution. After we put in ACNS we notice a 20 percent improvement in bandwidth and then we put in the WAAS environment that really helped us consolidate down and improve the CIFS and file distribution which we saved another 20 percent.

So we cost avoided about – we hoped about \$7 million so far. It really consolidated our overall bandwidth with what we had to allocate to each user within the data center environment.

## WAAS Acceleration Metrics

And then some performance of the different environments that we rollout. So you can see HTTP is two times faster. So is the Exchange. We expect this to improve as we optimize the software and then our Livelink documents and our CIFS documents are 15 times faster and mostly just because we've optimized our software around this plus there's a lot of static content.

So if you pull down a document actually the only change that's going back and forth across the WAN is just the exact change you made. So obviously there's room to improve on lots of the bandwidth and on keep the updates going without having the latency which can mean minutes to maybe even hours if you have a big enough file and you're deploying it from a long enough distance.

## Asymmetric Centralized Acceleration+

And then the third solution is the asymmetric centralized acceleration and this is the ACE appliance. This allows you to do HTTP content and payload offload and acceleration but basically allows you to whether you're at a different office or coming in through the VPN. Whatever content you have into it, this really helps you to optimize the HTTP and PTP transfer to cache it to really improve the overall performance from a remote access into your files.

## Service Oriented Data Center Results and Lessons Learned

So now let's look at our best practices and lessons learned from the SODC program.

## Cisco IT Data Center Lessons Learned

So first I really need to build the foundation with the business vision and value in mind. One of the things when we started doing it we were really focusing on the technology and not what the business needed. That caused us probably to have to spend some time really communicating with the business a lot more effectively.

So we recommend that you really do understand what business imperative and challenge that you're trying to satisfy with your environment. And really go from there and communicate an architecture around that.

Buy-in from critical stakeholders. You are bringing in a lot of different teams. You really do need strong executive support. If it wasn't from the strong executive support that we had from management here it would have been very difficult to get all the different teams together to really focus on a single end-to-end application provisioning.

And then an IT cost model because one of the things that we were

seeing with virtualization is that there's the perception that it's easy and it's free and with things that are easy and free if one's good 40's 40 times better. And all the savings and capacity reduction that you have will be just completely absorbed if you don't put together some type of IT cost model to make sure that people really request only what they need and not more than they need because you can't provision it for them within 24 hours.

And then organizations and process. You do have to take full advantage of the new VFrame and automation end to end. You need to re-engineer all of your practices around your data center deployments and how you manage them.

Then also with the SODC team we brought together four disparate teams into a single operational team and that is a transformation that needs to go through and we've created a new class called the data center systems engineer here at Cisco Systems.

## Q&A

*Monique LeFors Edmonsens:* So Sidney overall what would you say some of the biggest challenges were with the SODC program?

*Sidney Morgan:* Organization. So one of the lessons learned if your people have IT or IPT experience you've brought two different groups together. I always have to say this is like IPT on steroids. Depending on how your organization is laid out you might be bringing four, maybe five different teams to the table and it really takes strong leadership and really strong architectural blueprints to bring it all together and to get teams that aren't used to working together working as one single cohesive unit.

That can be done under a single org structure or it can just be done by agreeing to work on the blueprints across the org structures. But depending on the different organizations you can be bringing two or three or four different teams together but it's imperative for the end-to-end success that it be brought together and I think one of our biggest challenges here was the applications teams.

From an infrastructure team we're used to working with our applications teams on a day-to-day basis but I think we both had an appreciation of what it will take to do an SODC environment and what it really means to work together and truly collaborate on an end-to-end automated provision environment.

*Monique LeFors Edmonsens:* Yeah. I was in the application team and I remember hearing what is the lesson for us to reduce our applications and not have redundant applications in the data center so that was definitely something that we had to consider as well.

What would you say, if you were to start all over again today, what would you do differently?

*Sidney Morgan:* Well, being an engineer by training probably sounds a little strange and probably strange for me but I think I would put together a lot stronger communications plan up front. I think a lot of us have the tendency to go run into the lab and start working on the black magic because we get very, very excited about it and then the business units and then really your end customer who's gonna benefit from it doesn't have any idea why you're doing this and when you come up and go voila, look at this great thing, they're like why is that so great?

So we have a communication team within Cisco. I wish I would have leveraged it a lot earlier to really get out in front of the business, in front of our clients and let them know the benefits that we're working on.

Also by doing that the applications teams need time to adjust. One of the feedbacks we had was that it would have been great but they needed at least another 18 months of notification. So I don't think if you decide to go into a service oriented architecture that you can get out and communicate your plan and your vision to your end clients or customers too soon. Even if things change along the way, it's still best to let them understand where you're going, why you're going and the benefit for them. That will get you past the tipping point a lot earlier.

*Monique LeFors Edmonsens:* Yep. Communication. Change Management. Thank you so much.

*Sidney Morgan:* You're welcome.

### Further Resources

*Monique LeFors Edmonsens:* And for more information about technologies and solutions deployed at Cisco, you can go to the Cisco on Cisco site where you can find Case Studies with information about: what we deploy, what benefits we've gained, what lessons we've learned, and some operational practices and presentations to help you learn more.

Below that, you'll see a toll-free number you can call for more information, or to place an order; and you can order Cisco resources on the web from the URL at the bottom of this page.

I'd like to thank you for watching for spending this time with us today, and for being interested in what the Cisco on Cisco Technology Tutorials are all about. We hope that you've enjoyed this seminar and that it has helped answer some of your questions about Data Center and Storage Networking at Cisco.

And thank you, Sidney, for spending this time with us and sharing with us your expertise.

*Sidney Morgan:* It was a pleasure Monique. Thank you and see you soon.



**Americas Headquarters**  
Cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, CA 95134-1706  
USA  
www.cisco.com  
Tel: 408 526-4000  
800 553-NETS (6387)  
Fax: 408 527-0883

**Asia Pacific Headquarters**  
Cisco Systems, Inc.  
168 Robinson Road  
#28-01 Capital Tower  
Singapore 068912  
www.cisco.com  
Tel: +65 6317 7777  
Fax: +65 6317 7799

**Europe Headquarters**  
Cisco Systems International BV  
Haarlerbergpark  
Haarlerbergweg 13-19  
1101 CH Amsterdam  
The Netherlands  
www-europe.cisco.com  
Tel: +31 0 800 020 0791  
Fax: +31 0 20 357 1100

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