The 21st Century Data Center

Business agility and resiliency are top-priority goals for a consolidated, service-oriented data center. So is being green.

How do you plan a data center that will do what your organization needs it to do over the next 10 to 15 years? A lot needs to happen, both in your business and strategic planning and within IT execution.

Throughout the entire process, your top-of-mind goal should be to make the new data center an "accelerant to growth," advises Doug Gourlay, director of product management, Data Center Solutions at Cisco. The data center should not limit your company’s ability to grow, but contribute to that growth unfettered.

In day-to-day operational terms, your data center must be resilient, highly available, and easy to manage, with an IT infrastructure that supports application demands and enables rapid provisioning of new applications and services. Security must also permeate the data center—all its systems, both hardware and software, its governing policies, and even the second-nature behavior of its staff. The facility must also use power efficiently; it should be as green, or as environmentally responsible, as possible.

Some companies have many data centers that support operations (as opposed to development), a result of the move to distributed client/server architectures over the past 10 to 15 years. These siloed resources make efficient, flexible responses to new business needs difficult: There may be pockets of server and storage capacity in Idaho, Texas, and New Jersey that could handle a new application, but not enough in any one place.

Like Cisco, many enterprises are already consolidating their data centers, as both IT personnel and company executives recognize the limitations of silos and the benefits of centralization. It’s the next step, however, in the data center evolution that makes a consolidated data center fulfill its promise of business enhancement: virtualization.

Virtualization basically means treating all servers, storage, and other data center furnishings as single, large pools from which capacity can be assigned as needed and then reconfigured to meet changed or new needs. Thus, server A and storage network A might serve a customer relationship management (CRM) application during business hours, even bringing in capacity from other systems during peaks, and change over to handle data dumps from finance at night.

Of course, the data center should be more broadly flexible as well, so new applications can be provisioned very quickly, with resources such as server and storage capacity, firewall and other security functions, and internal, incoming, and outgoing bandwidth assigned quickly and dynamically.

In this way, the data center shifts from being server-centric to service-centric. And in the service-oriented model, your data center is capable of efficiently supporting your business's strategic goals and growth (for coverage of the Cisco IT service-oriented data center model, see “Further Reading”).
Centering the Data Center

Data center design considerations should encompass its scale, required level of availability, and role in the business—how the center can promote business agility and business resiliency, emphasizes Gourlay.

Resiliency depends largely on availability, which in turn depends largely on location, security, and governance. The matter of site selection requires consideration just as careful as planning the functionality—in particular, the four P’s: people, property, power, and politics:

- The site needs to be geographically central to the business, readily accessible to employees and perhaps customers.
- Real estate costs should be moderate, and the surrounding area should have plenty of fiber capacity for the facility’s communications. Especially important: the site should be a low risk (as possible) for hurricanes, earthquakes, or other natural disasters.
- Utility power should also be moderately priced, as power now accounts for one of the largest costs in a data center.
- Local governmental units should be disposed to grant permits and perhaps tax abatements or other assists.

Agility, too, depends on governance, but even more on a service-oriented architecture that can accommodate horizontal-, rather than vertical-oriented, applications and services. Your data center needs to thrive in the Web 2.0 world, where applications and services are standardized into modules that can communicate with one another via e-commerce technologies such as Extensible Markup Language (XML).

The Active:Active Data Center

The platinum standard for resiliency and availability is paired central data centers, Gourlay points out, each running part of the total load and in complete synch with each other. If disaster strikes one, the other takes over instantly with no loss of data and an extremely minimal loss of transactions. Disaster recovery is the prime benefit, but it is also comforting to know that the other data center is already operational and has proven itself ready to act when the other goes down.

Even if you think your company can recover quickly without such a redundant architecture, it may well not. Gourlay cites a large financial services company that expected its data center to be back in service in an hour; the time required was actually four and a half, during which innumerable transactions could not be completed and the company might not have been able to prove to the US Federal Reserve that it did, indeed, have the monetary reserves its business required.

Counting Kilowatt Costs in the Green Data Center

It’s not just what’s expected of data centers in the 21st century that needs to change. So does what goes into them, especially in the area of being green.

Take the blade server, for example. It performs the work previously done by a regular-sized server in the form factor of a blade. Suddenly, the processing power of a rack or box increases many-fold. So do the power and cooling demands. A rack that used to draw perhaps 5 kilowatts to run now needs 15. The heat generated rises proportionately and so do the cooling costs.
It is estimated that anywhere from 4 to 20 percent of electricity generated in the US goes to data centers, according to Rob Aldrich, marketing manager for Data Center Solutions at Cisco. Even the lower edge of that range is a big bite, and a costly one. A typical corporate data center draws 5 megawatts of electricity, at a time when the average cost in the US is $0.10 per kilowatt/hour (costs in populated coastal regions are 50 percent or more higher).

Moreover, each watt consumed by IT infrastructure carries a burden multiplier of 1.8 to 2.5 for power consumption associated with cooling, lighting, and conversion/distribution.

According to American Power Conversion, fully 50 percent of the power draw in a typical enterprise data center goes for cooling. Servers and storage systems take another 26 percent, with the remainder split between conversion (11 percent), network needs (10 percent), and lighting (3 percent). As storage grows an estimated 40 to 70 percent annually and server capacity expands by at least 10 percent, the electric bill is climbing to 30 percent of the typical IT budget, overreaching the budget for servers themselves.

What can be done? Virtualization is a big part of the solution, as it enables much more efficient use of equipment. For example, according to Gartner research, virtualization of storage area networks and IVR using Cisco MDS 9000 Directors can increase disk utilization by 70 percent, which doubles the storage available for the same power usage.

“By taking just one tape subsystem offline,” Aldrich says, “Cisco has saved [US]$3,800 a year in power and cooling costs.”

In addition, the combination of the Cisco Application Control Engine and Firewall Services Module deployed in a Cisco Catalyst 6500 Series Switch reduces power by 85 percent. These modules provide the same services within the network fabric as the multiple appliances and their requisite load otherwise required by an application server.

Another avenue for cost and energy savings is identifying areas within the building that can be automated, such as heating, lighting, ventilation, and air conditioning. A good first step, says Aldrich, is to audit energy use, both broadly and on a small scale—to install sensors that will detect even higher temperatures between rows of racks in the data center. Then you can fine-tune
Cisco on Cisco: Inside Cisco IT Data Center Featured Content – May 2007

Air conditioning so it goes where it is most needed, says Aldrich. It is not too soon to start. Air conditioners will need to offset some 700 to 800 watts per square foot in the typical data center by 2008.

Cooling your equipment based on rack density is another energy-saving step. Cooling options range from simply identifying which machines generate the most heat and distributing them throughout the room to prevent hotspots to implementing more sophisticated cooling methods that enable you to put more density into a given space (see Figure 1, “Cooling Strategies by Rack Density”).

From being environmentally responsible to functioning effectively in a Web 2.0 world, the expectations for and demands placed on data centers over the past decade have changed in many ways. For the future, your data center needs most of all to be flexible and resilient—service-oriented and ready to take your company where it needs to go.

FURTHER READING

• “Roadmap for a Cisco IT Service-Oriented Data Center” [link]
• “Cisco Data Center Lays Foundation for Greater Business Agility and Resiliency” [link]
• “Design for a Productive Data Center: the Distributed Cabling Model” [link]
• Cisco IT Case Study: Redesigning toward the Service-Oriented Data Center [link]
• Design Zone for Data Centers: Cisco Validated Designs for Data Center Networking [link]
• Cisco Data Center Networks Blog [link]

For more featured content from Cisco on Cisco, visit [link].

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at [link].

©2006 Cisco Systems, Inc. All rights reserved. CCVP, the Cisco logo, and the Cisco Square Bridge logo are trademarks of Cisco Systems, Inc. Changing the Way We Work, Live, Play, and Learn is a service mark of Cisco Systems, Inc. and Access Registrar. Aironet, BPX, Catalyst, CCIE, CCDA, CCDP, CCIP, CCNA, CCNP, CCSP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, Follow Me Computing, FormShare GigaDrive, Gigabit, HomeLink, Internet Quotient, IEO, I², IP Expertise, the I² logo, IQ Net Readiness Scorecard, Quick Study, LightStream, Lindaya, MeetingPlace, MGX, Networking Academy, Network Registrar, Packet, PIX, ProConnect, RateMUX, ScriptShare, SlideCast, SMARTnet, StackWise, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company.