CISCO BUSINESS READY DATA CENTER—BUSINESS CONTINUANCE NETWORKING SOLUTIONS

Enabling application, data, and access recovery to protect businesses from disruptions

EXECUTIVE SUMMARY

To protect, optimize, and grow the business, fundamental component of any business continuance plan is a reliable network infrastructure that supports an organization's need to protect data, rapidly recover applications, and ensure continuous user access. Based on an extensible and adaptable Business Ready Data Center Architecture, Cisco Systems® offers enterprise data center managers business continuance networking solutions that provide cost-effective communications between multiple data center and recovery sites along with multiple user access technologies.

CHALLENGES

The enterprise data center houses the applications that drive business operations. It is the focal point of an organization's business continuance strategy. When applications and data are unavailable or users cannot access them, enterprises lose both revenue and productivity. Worse, they can lose credibility with customers and partners or become vulnerable to litigation. In support of management goals to protect, optimize, and grow the business, many IT organizations are rethinking their business continuance plans. Business continuance is a priority concern for enterprises with heightened awareness of risks and threats, new regulations, and trends toward consolidation of IT and application resources in data centers.

Many of today's data center infrastructures are fragmented, difficult to manage and maintain, and slow to adapt to new technologies and applications. Furthermore, in the case of disruption or disaster, consistent and appropriate protection is both challenging and costly to maintain for isolated application environments.

Data center and business continuance managers face several challenges to building strong networks that support their business resilience strategy:

- *Limitations of tape backup*—The traditional mainstay of disaster recovery, tape backup is slow and limited in its ability to restore critical applications and data in time to meet recovery time goals. However, its role in maintaining integrity remains valuable.
- *Expense*—Although the cost of business continuance technologies has dropped in recent years, it remains expensive to invest in mirroring software, duplicate facilities and resources, telecommunication services, and appropriate amount of staff. Therefore, managers need a portfolio of solutions to help control capital and operational costs and assure that the organization can meet business continuance objectives.
- *Latency*—Zero-data-loss synchronous mirroring requires that data be written to both local and remote locations before confirming transactions, potentially impacting application performance. Transport technologies such as metro optical are well suited to minimize latency. In general, the speed of light limits the practical distance between synchronously mirrored sites to a maximum of 200 km for most real-time transactional applications.
- *Network Facility Costs*—Although bandwidth costs continue to decrease, large-scale data center mirroring and replication require substantial capacity. With traditional leased line services, this resulted in significant cost.

- *User Access*—Business continuance plans often focus on data and application availability, but they often overlook the need for users to access recovered data and applications.

BUSINESS CONTINUANCE FUNDAMENTALS

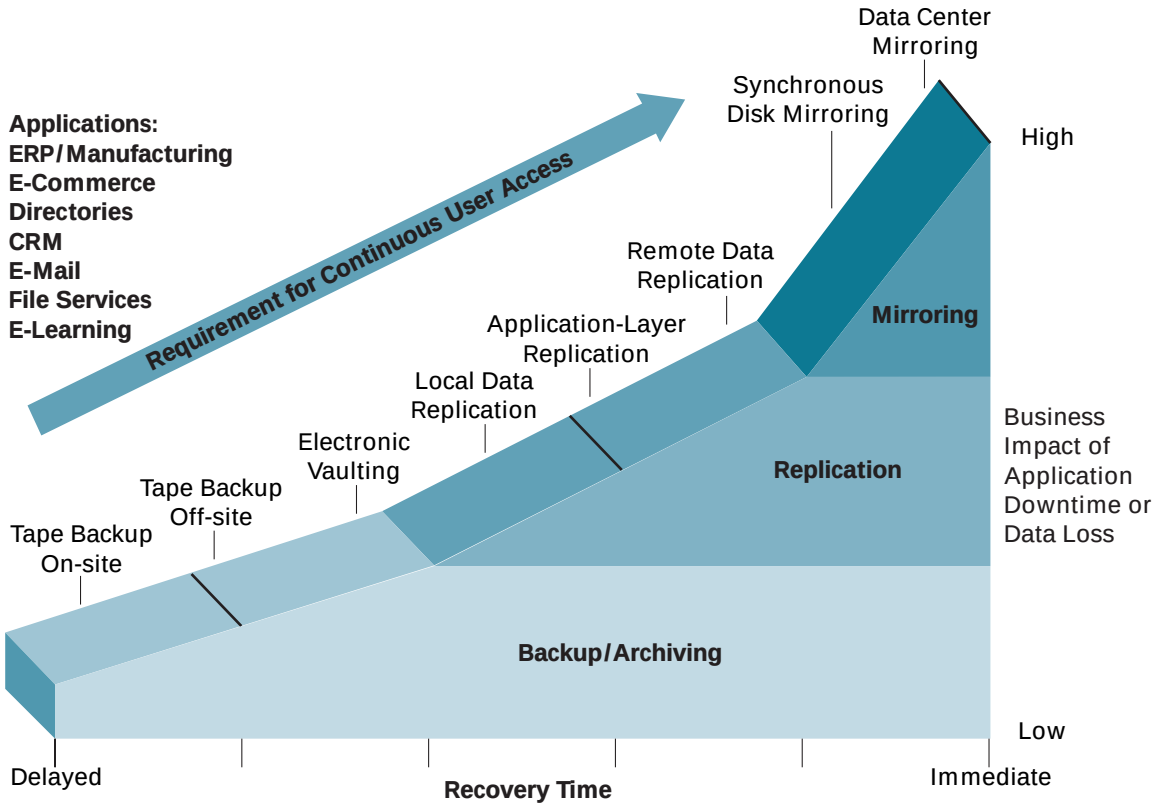
A business-impact assessment identifies the risks and potential costs associated with application downtime, data loss, and disrupted user access. Although it is ideal to provide all applications and data with maximum protection against disruption or loss, it is seldom affordable or practical to do so. Many applications can afford limited downtime, while specific mission-critical applications may need to remain available at all times. The risk assessment ranks applications using two business-continuance metrics:

- *Recovery Point Objective (RPO)*—Defines how much data loss the organization is willing to risk, from zero to minutes or hours
- *Recovery Time Objective (RTO)*—Quantifies the maximum amount of time that an application can be unavailable

Although RPO and RTO values are useful for data and application-level assessments, Cisco Systems defines a third metric, Recovery Access Objective (RAO), which applies directly to the network. An RAO defines the time required to reconnect users to a recovered application, regardless of where it is recovered. Without RAO, achieving application RPO and RTO has limited practical value. For example, during normal operations, branch office users may access a mission-critical application hosted at the primary data center through the enterprise intranet WAN. If the application fails, users need a fallback method, such as the use of a rapidly constituted site-to-site virtual private network (VPN) connection through an Internet service provider (ISP) network to a secondary data center that houses the recovered application.

Organizations must consider the proximity of any secondary data center or backup site. It must be far enough away to ensure survivability against identified risks, such as power outages, hurricanes, tornadoes, or earthquakes.

Figure 1
Business Continuance Solution Spectrum



Using RPO, RTO, and RAO values, together with distance requirements, business continuance managers can map each application to a technology solution that is appropriate to its business role (Figure 1). These solutions may include one or more of the following options:

- *High Availability Storage Networks*—A storage area network (SAN) or network attached storage (NAS) solution overcomes local server failures by providing access to a standby or clustered server system to ensure continuous operation. A shared storage environment can justify the use of advanced storage systems to ensure that disk failures do not impact applications.
- *Consolidated Backup*—Periodic backups are part of standard operating procedures for most business applications. As the least expensive solution, consolidated tape backup has the slowest recovery times; however, it is well suited for disruptions such as data corruption. As the cost of disk media approaches the cost of tape, "near-line" disk-based backup systems are an attractive alternative, offering shorter backup and faster recovery times.
- *Remote Asynchronous Replication*—Copies data changes to remote systems located in another location. Depending on data criticality, changes can be replicated as point-in-time copies at scheduled times throughout the day or asynchronously copied as changes occur, using advanced software in storage systems, NAS appliances, host systems or embedded in the network. The asynchronous character of these solutions is a strong advantage.

Because distance is not a performance factor, there are no latency limitations to overcome. Data replication offers faster recovery times than tape backup; however, its asynchronous nature cannot guarantee that all data is recoverable.

- *Synchronous Disk Replication and Mirroring*—For applications that require the fastest recovery with no data loss, synchronous disk replication and mirroring is an appropriate solution, using advanced software in storage systems, on hosts or centralized in the storage network. All disk writes are synchronously copied to a remote site across a high-performance network before a transaction is acknowledged, eliminating any transaction loss. The limitation of this method is latency, which limits the practical distance between sites. This is especially true for write-intensive and online transaction processing applications, such as enterprise resource planning and customer relationship management.
- *Data Center Mirroring*—For the highest level of continuance, enterprises increasingly operate duplicate active data centers, running stretched server clusters between the two sites. Although some enterprises keep one data center active and reserve the other for use only when a disruption occurs, it is common to operate both centers simultaneously as "hot" or active data centers, where all transactions in one are synchronously mirrored to the other. This solution has two modes of operation. In the first, both data centers share the transaction load of the same applications and are fully synchronized, using global load balancing to distribute user traffic between sites. Mirrored, active data centers ensure that disruption recovery in either data center is transparent to users. It also better utilizes expensive resources for improved return on investment. In the second mode, each data center acts as primary host for different application sets, while mirroring transactions from the other data center. If one data center fails, the other assumes support for the applications of the failed site. In either mode, data center mirroring provides the highest level of business continuance possible.
- *Continuous User Access and Connectivity*—Business continuance must incorporate a strategy for RAO to keep users connected to applications as conditions change. A succession of access methods can be either transparent to users or require manual reconfigurations, depending on the severity of the disaster. Technologies that are transparent to users include global load balancing between mirrored data centers, automatic reroutes around failed links, and automatic failover to standby components or devices. Technologies that require reconfigurations involve a change of user connectivity. For example, if a LAN is destroyed in a fire at the corporate building, users could telework and access applications using a VPN connection.

CISCO BUSINESS READY DATA CENTER

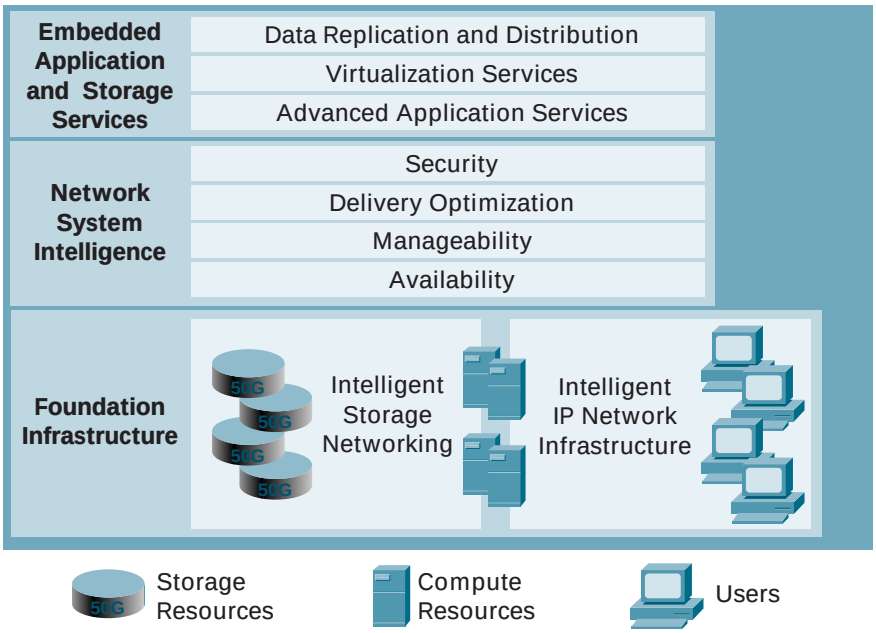
The Cisco® Business Ready Data Center is a cohesive network architecture that supports immediate data center demands such as consolidation, business continuance, and security, while enabling the data center for emerging service-oriented and utility computing technologies such as blade servers, virtualization, Web services, and GRID. Through this architecture, Cisco Systems, the worldwide leader in data center networking, offers IT and network managers the infrastructure to support a complete and extensive business continuance strategy. Based on an intelligent network foundation, the Cisco Business Ready Data Center addresses immediate risks to application disruption and provides a roadmap to achieve more advanced business continuance capabilities across geographically dispersed data centers. Cisco helps IT managers adopt this architecture to reduce risk, time, and investment with tested and validated reference architectures, proven design best practices, and both generic and partner-specific configuration templates. Its flexibility allows enterprises to deploy the compute, storage, and software technologies that best support their business goals at the time and enables more efficient implementation of new services and applications. By taking action to implement this adaptive data center networking architecture, IT

organizations are well positioned to advance management goals to protect, optimize, and grow the business. It protects critical applications and confidential data; it enhances data center operational efficiencies, and rapidly creates new secure application environments to support new business processes. With a highly resilient, efficient, and adaptive data center network in place, businesses can realign resources for growth by addressing competitive pressures, extending market reach, and speeding time-to-market of new services.

The Cisco Business Ready Data Center architecture is comprised of three tiers (Figure 2):

- The FOUNDATION INFRASTRUCTURE includes the intelligent IP network infrastructure, intelligent storage networking and data center interconnect
- NETWORK SYSTEM INTELLIGENCE include, security, delivery optimization, manageability and availability
- EMBEDDED APPLICATION AND STORAGE SERVICES include storage virtualization, data replication and distribution and advanced application services

Figure 2
Business Continuance Networking: Integral to the Business Ready Data Center Architecture



CISCO BUSINESS CONTINUANCE NETWORKING SOLUTIONS

Business continuance networking is a critical foundation for any business continuance strategy. It provides connectivity between applications and storage/backup resources, connectivity between production and secondary data centers, and optimizes user access to applications before, during, and after a disruption. Cisco provides the most advanced and comprehensive suite of business continuance networking solutions that are integrated with the business continuance technologies of our industry-leading partners.

Cisco offers enterprises the resilient, high-capacity networking solutions that support the complete portfolio of business continuance IT solutions from backup to data center mirroring. Cisco business continuance networking solutions provide the following features:

- A highly resilient data center IP network
- A scalable, intelligent storage network
- High-capacity, low-latency SAN extension and data center interconnect
- Resilient, flexible user access

These attributes are detailed below.

BENEFITS OF CISCO BUSINESS CONTINUANCE NETWORKING

These solutions deliver the following benefits:

- *Flexibility*—The broadest offering of business continuance networking solutions to meet the various RTO and RPO of different enterprise applications
- *Optimal network availability*—Through proven designs, layered hardware and link redundancy and software resilience features
- *Validated interoperability with the leading storage and system vendors*—Ensuring lower risk and faster, less costly integration and deployment
- *Lower total cost of ownership*—Enabling enterprises to consolidate business continuance communications onto a single, flexible network infrastructure that reliably supports many applications, distributing telecommunications costs
- *Industry-leading technology*—From advanced data replication intelligence and multiprotocol support within the storage network to high-density traffic and protocol flexibility in optical networks

A HIGHLY RESILIENT DATA CENTER IP NETWORK INFRASTRUCTURE

The data center IP network infrastructure should be designed and deployed to ensure continuous access to applications, servers, and interconnections between servers in the data center. Network availability depends on several design aspects: redundant modular components within switches and routers; redundant links between switches, routers, and servers; and high-availability intelligence for rapid, transparent failover to backup components, devices, and links. Recovery should also address higher-layer services, such as server and application load balancing and security. The data center staff follows through with operational best practices, tools, and support, ensuring rapid response to technical difficulties and preventing failures due to human error.

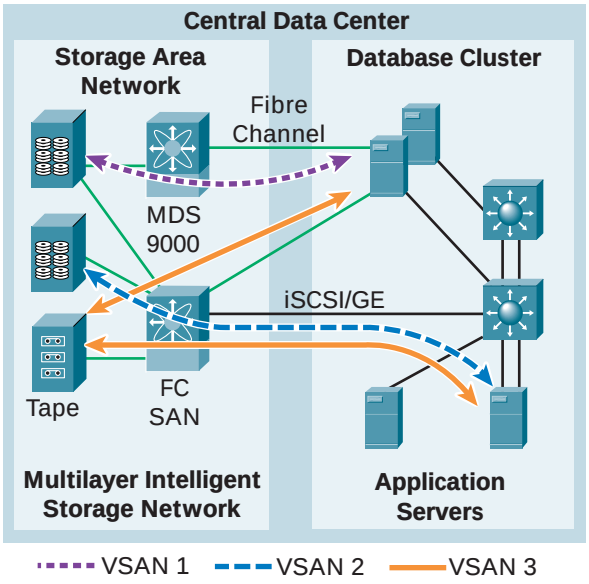
A SCALABLE, ROBUST STORAGE NETWORK

The storage network is a critical component of a business continuance strategy. It improves data availability by separating storage from servers, creating a storage “pool” that is accessible from multiple servers. This approach is more resilient than direct-attached storage because data remains available in case of server failure.

Storage networks increase application and data availability by helping to standardize and centralize administration of business continuance solutions, such as tape backup, data replication, and data mirroring across multiple systems. The storage network enables consolidated tape backup services using either Fibre Channel or Internet Small Computer System Interface (iSCSI) protocols. It offers shorter backup and restoration times over traditional SCSI

backup solutions, because backup occurs on a network separate from the production data center LAN. A storage technology unique to Cisco is the virtual storage area network (VSAN), which allows consolidation of isolated storage "islands" into a single, scalable, centrally managed and administered physical network, without impacting the availability or security of logically separate SANs. For example, a VSAN can create a logically separate network for tape backup. Dedicated bandwidth for tape backup does not impact the performance or availability of other time-critical applications using the SAN (Figure 3). Another benefit of Cisco storage networking solutions is the ability to integrate advanced storage intelligence into the network fabric. Such intelligence includes virtualization and data replication software provided by Cisco partners. This allows storage managers to centrally control the addition of storage and to achieve consistent, transparent data replication and mirroring.

Figure 3
Multilayer Intelligent Storage Network

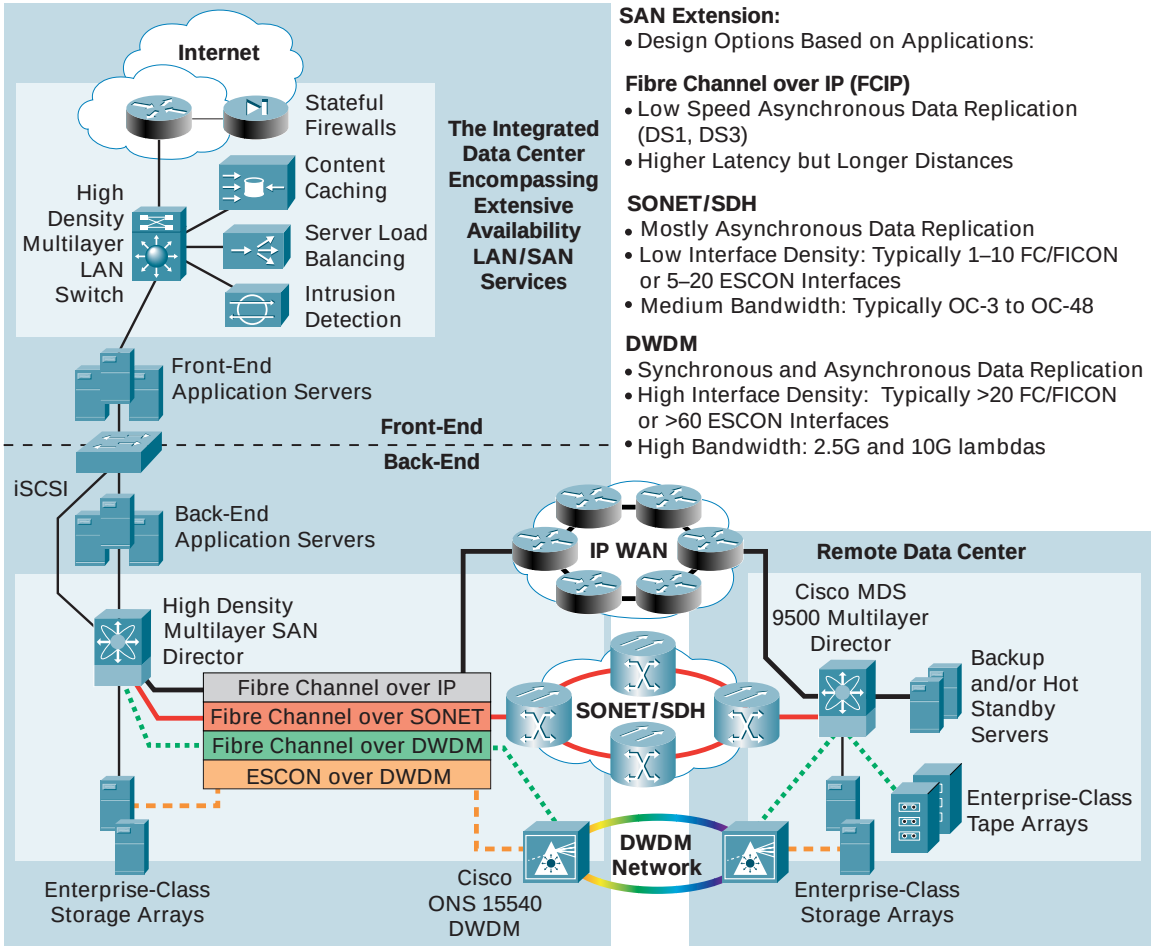


Cisco offers this intelligent robust storage-networking infrastructure based on the Cisco MDS 9000 Series multilayer switches.

HIGH-CAPACITY, LOW-LATENCY DATA CENTER INTERCONNECTIONS

As many organizations consolidate applications, servers, and storage into fewer facilities, it is urgent to ensure that these consolidated data centers do not become a single point of failure. Depending on defined risk, secondary data centers can be located across campus, across town, across the country, or around the globe. Enterprises need an appropriate interconnection strategy to support the chosen business continuance solutions, consisting of two common deployment scenarios: the campus/metro data center interconnection and remote long-haul connectivity (Figure 4).

Figure 4
Data Replication and SAN Extension Options



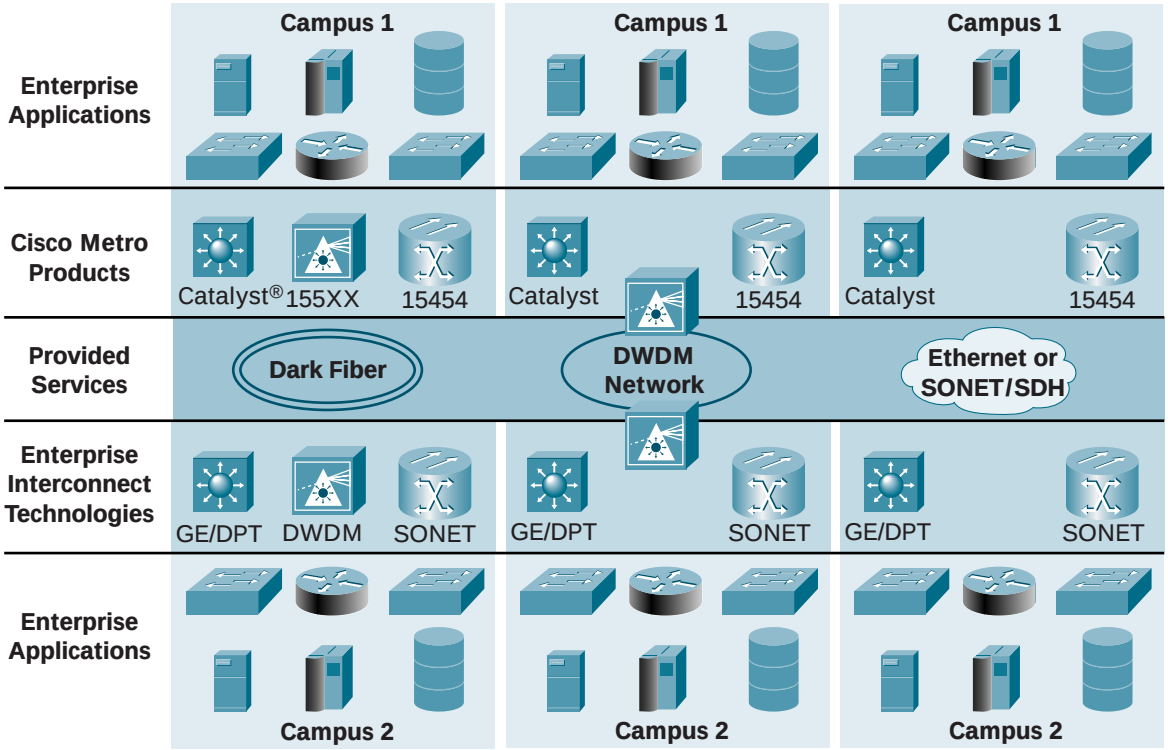
Campus/Metro Data Center Interconnection

The greatest number of options is available to enterprises that deploy secondary data centers within the same campus or metropolitan area. The short distances reduce network latency to a minimum and support any business continuance solution including synchronous disk and data center mirroring. A variety of high-capacity technologies, including dense wavelength-division multiplexing (DWDM), SONET, SDH, and Gigabit/10—Gigabit Metro Ethernet offer wide flexibility to balance cost, management, and technology objectives. Further, enterprises can build their own metro optical network, lease capacity from a service provider, or hire a managed service.

- *DWDM*—A Layer 1 technology, DWDM is a popular, cost-effective way to increase available bandwidth of optical fiber. It supports any storage protocol, including IBM Fiber Connection, Enterprise Systems Connection (ESCON), IBM Sysplex and coupling link, Fibre Channel, and iSCSI. DWDM supports all production LAN protocols enabling data, voice, and video transport. Cisco offers metro DWDM systems with very high network capacity (32 channels for a maximum throughput of 320 Gbps), high-density service aggregation, flexible transponder options for service transparency across a wide range of client interfaces, comprehensive service protection options, and amplification as needed.

- *SONET/SDH*—Widely deployed and well known, SONET and SDH are trusted as a reliable way to transport data and time-division multiplexing (TDM) traffic over both electrical and optical interfaces. Recent additions allow integration of Ethernet and DWDM technologies with SONET/SDH, demonstrating its flexibility to meet ever-changing network requirements. It is useful for many services, such as SAN extension. Cisco is an industry leader in next-generation SONET/SDH solutions, offering multiple services, bandwidths, and interfaces in a single platform—the Cisco ONS 15454—which now supports both Fibre Channel and ESCON over SONET/SDH.
- *Metro Ethernet*—An industry leader in solutions delivering Gigabit and 10 Gigabit Ethernet in metropolitan-area network (MAN) environments, Cisco offers enterprises ease of operation and management by connecting IP and Ethernet-based business continuance solutions over an Ethernet MAN for smooth, high-capacity transport. By supporting standards-based protocols such as Fibre Channel over IP (FCIP), Cisco enables cost-effective business continuance deployments (Figure 5).

Figure 5
Choosing the Appropriate Metro Ethernet Technology



Remote Connectivity

For interconnecting data centers beyond metro distances (greater than 200 km), Cisco offers a variety of transport options. Because the distances cause excessive latency for most applications, Cisco does not recommend that enterprises attempt synchronous mirroring solutions beyond 200 km for most applications, and suggests asynchronous replication instead. The optimal service choices for business continuance applications are SONET/SDH and IP. The Cisco ONS 15454 Multiservice Provisioning Platform carries replication traffic over SONET/SDH with a choice of protocols, including FCIP, IP, and Fibre Channel. IP WAN services can transport FCIP and IP replication traffic over secure VPN services using IPSec and/or Multiprotocol Label Switching (MPLS) technologies.

Cisco enables remote asynchronous replication with intelligent networking solutions that provide protocol conversion, high availability, quality of service, and security to ensure that enterprises deploy remote business continuance reliably and cost effectively.

Resilient, Flexible User Access

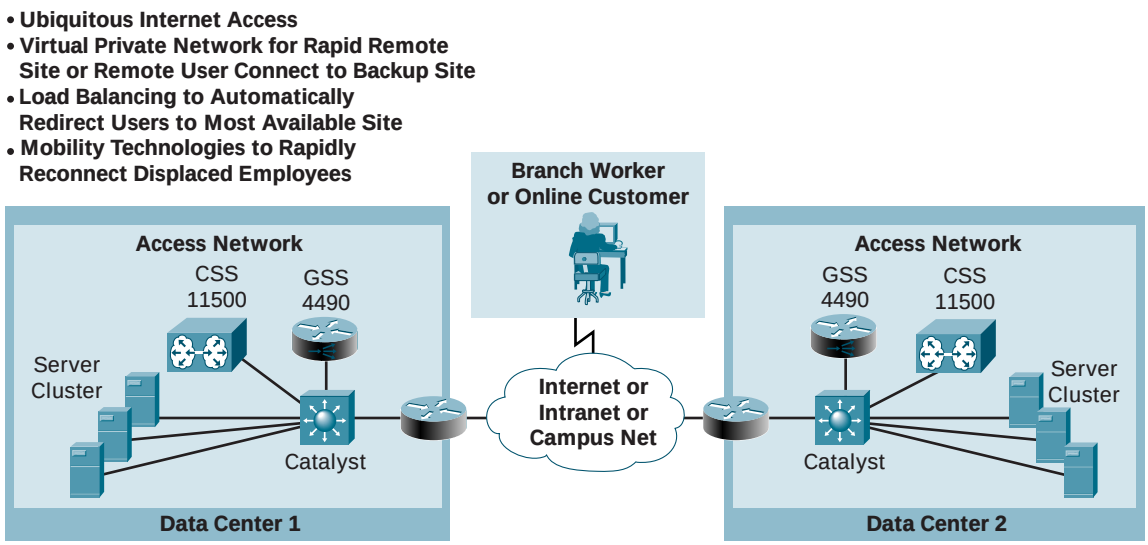
Resilient data center networks, high-capacity, low-latency interconnections between them, and robust storage networking comprise three important components of the business continuance networking solution. The fourth, equally important component is assuring user access to applications with resilient and flexible technologies to meet RAO goals. When creating the network infrastructure to support RAO requirements, network managers should consider the contingency and logistical plans for local and remote employees, applications, and communications. These considerations should address the following questions:

- Do users or remote sites need access to data center applications and communications services?
- Do users have appropriate ways to reconnect to a backup site in a timely manner?
- If a primary access method goes down, what fallback access methods are in place? Are these methods adequate to meet RAO goals?
- Is the network designed to automatically reroute around network-related failures?
- Do remote locations need multiple links to the data center/backup data center using separate ISPs?
- Do users need specific access capabilities, such as from a hotel room or home, if their primary workplace is not available?

These questions can be resolved in two ways: transparent redirection and manual reconnection.

- *Transparent redirection*—Invisible to users, it employs load balancing, server and "route health aware" routing, Internet multihoming, and advanced routing technologies. Load balancing can take place within or between data centers. Intelligent site selection discovers the physical location of users and sends them to the nearest or most responsive data center location. This technology detects if a location is online and determines the "health" of the route and servers. When a problem is detected, load-balancing technology redirects session traffic to another data center, usually without user knowledge.
- *Manual reconnection*—Requires users to establish a new connection to the application when there is a network disruption or when an application becomes unavailable in the primary location. Cisco is the industry leader in access networking, with a wide range of solutions. For manual reconnection, Cisco offers flexible, scalable VPN termination options in its routers, switches, firewalls, and VPN concentrators. Cisco IOS® Software includes robust failover and reroute technologies that enable fast recovery from any network and often transparent to the user experience. To meet the need to rapidly create mobile offices, Cisco offers secure wireless networking solutions based on IEEE 802.11 standards (Figure 6).

Figure 6
Ensuring Continuous, Balanced Access to Applications and Data



MIGRATING TO CISCO BUSINESS CONTINUANCE NETWORKING

Cisco suggests that enterprises follow these steps to develop and implement appropriate business continuance networking solutions:

1. Conduct a business impact assessment on all enterprise applications to identify the risks and costs of application disruptions
2. Develop a business continuance plan in conjunction with business, IT, and network stakeholders to meet the application impact assessment requirements
3. Engage with Cisco and its partners to deploy appropriate business continuance solutions
4. Continually revise and test plans and solutions to meet changing needs

Cisco provides guidance for deploying business continuance networks as a major component of a Business Ready Data Center networking architecture. Customers can offer advanced services to audit and design the appropriate data center infrastructure and the business continuance solutions that keep it available.

BUSINESS CONTINUANCE PARTNERSHIPS

Cisco intelligent networking and storage technologies provide the foundation of business continuance offerings by leading data center vendors to help ensure that business operations are resilient to disruptions. Cisco collaborates with industry leaders in a variety of disciplines to facilitate smooth, integrated delivery of data center infrastructure and business continuance solutions that enterprises can tailor to their unique requirements today and easily adjust as they grow and change. These partnerships give data center managers the resources they need to design, deploy, and maintain agile data centers that effectively support their business goals.

CISCO: THE LEADER IN BUSINESS CONTINUANCE NETWORKING

Business continuance is a vital function of doing business. Enterprises that are consolidating data center resources and increasing their efficiency should incorporate a business continuance strategy into all layers of IT, starting with the network, which is the foundation for all data center communications. The network can ensure continuous access to mission-critical applications and ensure appropriate recovery of applications and data through replication and mirroring. Cisco offers data center managers its validated designs, templates, best practices, and networking solutions that can keep business operational in the event of any disruption.

FOR MORE INFORMATION

URLs to:

The Cisco Business Ready Data Center home page

http://www.cisco.com/go/datacenter

Cisco Business Continuance Networking Home Page

http://www.cisco.com/en/US/netsol/ns340/ns394/ns224/ns378/networking_solutions_package.html

Cisco Storage Networking home page

http://www.cisco.com/en/US/netsol/ns340/ns394/ns259/networking_solutions_packages_list.html

Cisco Optical Solutions home page

http://www.cisco.com/en/US/netsol/ns340/ns394/ns113/networking_solutions_packages_list.html

Cisco Global Site Selection home page

http://www.cisco.com/en/US/products/hw/contnetw/ps4162/index.html

Cisco High Availability Networking

http://www.cisco.com/en/US/netsol/ns340/ns394/ns147/networking_solutions_packages_list.html

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