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Managing the Cost of Usable Data Centers

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TABLE OF CONTENTS

TABLE OF FIGURES

ABREVIATION

Acronyms	Definitions
AMD	Architecture Programmer’s Manual
BPX	Battle Plan Execution
CPU	Central Processing Unit
DAS	Direct Attached Storage
EPO	Emergency Power-Off
FC	Fiber Channel
FCIP	Fiber Channel over IP
FEMA	Federal Emergency Management Agency
GB	Gigabyte
HVAC	Heating Ventilation and Air Conditioning
HTTP	Hypertext Transfer Protocol
IT	Information Technology
iSCSI	Small Computer System Interface
iFCP	Internet Fiber Channel Protocol
LUN	Logical Unit Number
RAID	Redundant Arrays of Independent Disks
SWRCB	State Water Resources Control Board
SONA	Cisco Service Oriented Network Architecture
SSL	Socket Layer
SAN	Storage Area Network
SATA	Serial Advanced Technology Attachment
SoIP	Storage over IP
SRM	Storage Resource Management
TCP/IP	Transmission Control Protocol/Internet Protocol
UPS	Uninterruptable Power Supply
US	United States
USGS	U.S. Geological Survey
VFrame	Variable-frame optimized audio/video file format

ABSTRACT

The main topic of this paper is to identify problems and present an overview of Data Center environments. To identify problems and present the overviews of business data environments and the cost of usable data center for small-midsize business organization based type of requirements on the design is one of the most important concepts of managing cost. To maximized data center efficiency administrators implement Blade Server, Virtualization, SOA, and other recent technologies. The project process will focus on most leased data centers with provided space rather than specific applications that trend the way of design, and eliminating the significant impact of multiple physical storage devices. Data Centers are complex systems with a variety of technologies that require constantly evolving skills and knowledge that range from routing and switching to load balancing and security. This project will include research, collecting sources, discussing the issues associated with network attacks Data Centers, and reviewing the other key areas related to data center development will be cover the way server availability will describes how to design a highly available infrastructure, and describes how a load balancing device can monitor the availability of applications and servers.

INTRODUCTION

The propose of this project paper is to present an overview of enterprise Data Center environments, and provide recommended data center design in light of current application environment trends, existing Data Center network architecture, and the projected services provided by such architecture. The term "Data Center" used in this paper is defined as a co-located set of critical computing resources in controlled environment. This definition includes resources like mainframes, web and application servers, file and print servers, messaging servers, application software and the operating systems. In addition to the application environment, the functionality provided by a Data Center includes facilitating business operations, lowering the total cost of operation, efficiently maintaining business functions, rapidly deploying applications, consolidating computing resources. This can be summed up as three main Data Center goals: scalability, flexibility, and high availability (13).

Today, Data Center network solution providers have recognized the need for both sound design and an ongoing strategy that maximizes business performance and minimizes both business process stoppage and data loss during natural or artificially induced disasters. In addition, good data center design facilitates centralized management, system upgrades, and the protection of enterprise data. Data protection in particular can only be accomplished by recognizing data center threats, addressing potential data disruption causes, planning for appropriate data failover, and implementing data mirroring where appropriate. For example: good data center design can mitigate the impact of disasters such as the lost of entire systems in the event of a fire. Additionally, disasters that impact the entire data center infrastructure must be addressed successfully, so that the data center can run in the face of power grid failure or weather events. A final category important in this design requirements list is the minimization of exposure of poorly configured systems that might otherwise compromised. Regarding regional disasters, data center design must be able to facilitate data and processes restoration in a reasonable and planned recovery time for disasters. This “Recovery time” is time required to restore the most recent backup and restart applications. This necessitates a data center design that can efficiently redirect clients to the recovery center for data restore. An additional benefit of creating failover links between deployed data centers is that when planned downtime of systems is required, administrators can shift live operations to the recovery center. Additionally, if business strategy changes, the disaster site can even become the permanent primary Data Centers.

Those systems known as protected system are well prepared for disasters that can incapacitate entire Data Centers, which depending on application requirements is replicate synchronously or asynchronously. The recovery time consists of the time required to check the integrity of file systems and databases at the recovery site provisioning with a sufficient hardware and software complement activated to perform the primary data center’s functions. In addition one must consider downtime as applications are migrated from the recovery site back to the primary data center.

The increasing server availability requirements with supporting load balancing drive the increasing number of traffic servers and the capacity of servers to share resources such as a storage disk subsystem or a tape drive. The placement of load-balancing devices is in the path between application servers and mainframes server. The expansion of the Internet, the growing complexity of protocols, and the applications used in Data Centers with each of application it uniquely would have its own purpose in architectural design. In order to understand the design of Data Centers, one must understand at a high level each application, and the design of application middleware even in the dynamic environment of upgrades to new software versions. The understanding security design of a Data Center and the need of deploy clustered applications for disaster recovery, this project will review the way of understanding how web and each application servers are deploy and store data. This project will describe the way Data Center enterprise applications used HTTP and the Secure Socket Layer (SSL) for the main task of host applications that the end user invokes remotely in order to retrieve data and retrieved documentation from servers. These servers provide the user interface (web servers), data access, and file access through a multitier application design. In addition to storage and with all of the application technologies, the ultimate goal of changing business processes. The project will describes how the incorporation of ongoing improvements in computer, storage, and networking, empowers IT departments to support Complex designs. Architectures like the Cisco Data Center solutions enable IT organizations to share all resources components, and accessed them through an intelligent network. Traditional isolated application environments result in operational inefficiencies that require a highly scalable, resilient, and secure data network in order to provide protected applications and data integrity with the appropriate resources. The improvement of IT organizations by introducing a framework that can addresses immediate data center demands of business, can lead to a design for storage technologies that best protected critical applications and confidential data, enhance data center operational efficiencies. In turn this infrastructure can better support the business processes by providing better aligned resources in IT initiatives that fuel the growth in a consistent network foundation and enables substantial cost reductions in sustaining the existing applications.

Many problems of efficiency and security are inherent in traditional data centers designs. Once the data center is designed a significant impact occurs on multiple physical storage devices and software can be configured, or the options for their topological connections. In addition to physical components, human engineering, human policies, security agreements with partners, disaster recovery plans, are also impacted by the datacenter design. Depending on scale, the ability to failover of critical systems to other data centers, to implement backup plans, and to implement reconstitution plans for less critical systems should be accommodated in the general Data Center design (5).

The virtualization of mid-range and desktop server systems can give the capability to do business on many different operating systems with greater flexibly while still retaining a sufficient amount of the security and stability one of single servers in many situations. This is similar to the advantages that virtual systems have traditionally demonstrated on mainframe operating systems. The key technology explored here that moves away from the single-operation-system-per-box is the combination of blade servers and software virtualization. This combined technology addresses today's, business information, which is growing at vast pace. Traditionally, storage had to be predefined and set aside in advance of a system configuration, but with the new technology for virtualized dynamically depends on the needs. This means that applications, such as databases, no longer need to get by with predefined storage; they can have storage that dynamically grows as needed. In addition to either virtualization of systems or consolidation of motherboards into blade chassis, storage virtualization is another related technology that offers the opportunity to improve the general design of data centers. Based on these new technologies, this project will make recommendations for developing high availability data centers that that enhances the ability to provide the availability, confidentiality, and integrity of mission critical applications using a layer of service-oriented architecture.

VIRTUALIZATION

Virtualization will be the core technology explored in this project, and will cover processes of present logical groupings of storage, subset virtual servers, view of computing resources that are tied to applications with a variety of benefits of storage networking, and I/O virtualization. Virtualization will be used at a higher layer in the data center for management and optimization the data center itself. The cost of virtualization of building blocks for data centers can show a return on investment by increasing efficiency when virtualization it has implemented. Virtualization of server network requires that all the different sources and foundation of data center network are adequate. According to Maurizio at Cisco, virtualized networks with advances of technologies can continue to provide the user with network services, access to data center, and additionally provide on-demand computing that allows organizations to respond faster of the needs. The net gain is the ability to respond quickly with new application platforms for data center, and aggregation of shared data center components. This includes data integrity, applications, servers, appliances, performance, and storage resources (13).

Today, organizations are relying more and more on the ability to be available online on a 24/7/365 presence with minimal downtime. This means that companies must have resilient access to the Internet. Before a team virtualizes systems within their data center there must be a proper analysis regarding feasibility and effectiveness of virtualization. For instance, once virtualization exists, can underlie applications be replicated in real time between redundant sites so that they can resolve request at any time and ensure that data is correct? It all comes down to the client facing application and seeing if it is feasible to use virtualization software while maintaining service level agreements.

From a data centers perspective virtualization is very attractive because of the scalability, feasibility and measurability. If there is a failure and a server on a Cisco VFrame fabric goes down it can be a matter of seconds before another server on this fabric is reallocated to compensate. VFrames are more flexible means of allocating services because they are distributed across hardware and maintain the current state of the service-providing applications operating at a higher level to make sure that the client facing services are uninterrupted.

Virtualization is becoming a hot topic in the management strategies of information technology departments. It is commonly touted as a technology that allows organizations to save money, increase availability, consolidate servers, reduce real estate, and maximize their infrastructure. These are just some of the many benefits that virtualization has been credited with generally.

Within many organizations today, saving money is the key to any project. Another factor is that if one can add more features to services, the services become more attractive. So many software vendors are realizing the popularity of virtualization based on these two drivers, and are starting to add features and compatibility for virtualization. Marketing of storage products generally relies on factors indicated in the list below. The promise of this marketing, particularly from Cisco, implies that much current functionality of maintaining availability will migrated from the stand-alone servers and isolated storage into network devices and the network will assume a significant role in actively supporting storage and applications.

The following are some of the most used promises of virtualization today, and suggest how each vendor is attempted to fulfill these promises with virtualization:

- Moves volume management out of the individual server and onto the storage network
- Enables reallocation of excess capacity to the applications that need it
- Under single interface unifies control of storage
- Allows administrators to buy storage as a pooled resource to offer to diverse applications, rather than for a specific server or application
- Masks the differences between a single storage array and heterogeneous storage
- Preserves the value of investments in legacy storage
- Increases the efficiency of utilization of extant storage

In addition to this list the virtualization of storage using VFrame allows for multiple secure operating systems to be used by different customers, thereby providing significant cost reductions for small-midsized companies that have a footprint in a data center. Thus they can collect the same benefits that large organizations have been realizing.

The methodology of implementing virtualization as complementary technologies, with the components mentioned earlier, is considered by the author to provide control business advances in a wide range of scales of technologies from mainframe through the PC and workstation. The virtualization technology can increase the density of components and consolidation of conventional network nodes into remote out-of-band-manageable device, including application servers, storage devices, and communications interfaces that share components, such as, power, cooling system, and storage gateways. For network technology platforms in this kind of architecture to achieve both high availability for business continuance and the capacity for growth, Cisco has enable enhanced server virtualization software that allows boot services to become truly stateless by combining the application over the network with storage security, and I/O resources. This can be used to facilitate data enterprises consolidation and should still be able to meet all of information storage regulation, the needs of protection against data loss, and functions like data mirroring, backup data for getting disruption. The gathering of information using Cisco's VFRAME interface allows administrators is asserted by Cisco as simplifying operations and increasing productivity throughout the data center (13).

Underlying storage virtualization, another consideration for improving data centers is analyzing the storage subsystems that provide an internal switching capability. This means that different applications could potentially receive different path resources. For virtualization technologies to be successful, they require subsystems that have high density fast spinning devices with capacity of grow in the near future. This provides the scalability necessary for an environment that is simple to manage changes in workloads, and subsystems can dynamically manage changes to resolve outages. The subsystems, if they are to be dynamic, must participate in a dynamic provisioning scheme, and if applications or system policies has been defined, subsystems must adhere to them.

In the next few years, Massaglia and Evan suggest that the storage industry will see great improvements in technologies and a new role for storage consolidation. This will include new functionality in networks that can provide new hardware capabilities, imbedded storage applications for virtualization, applications that provide for remote replication and recovery in the event of any disaster. The new processes of these networks that specialized of supports will include advanced services that provide significant access for data center and network managers it facilitate the continued planning of specialized data center environments (19).

The approach taken in this project is to analyze the data center costs, considering network devices that are associated with Data Centers across a broad range of scales of virtualization when implemented. While there has always been a requirement for data storage to be better, faster, and cheaper, this must be balanced with the understanding that storage must be easier to manage, compatible with technological trends in virtualization, and provide scalable and highly available solutions. These criteria for designing network virtualization projects with multiple secure operating systems can provide different users with the enhanced cap abilities including a faster analysis of data traffic patterns, testing tools, testing metric, and data functions. The need for this type of agile design will be supported by a review of disaster risk, as found in geographic data.

GEOGRAPHIC'S AND TRENDS

The design of Data Center disaster recovery technologies is determined based on which functionalities are the top priorities to be considered and during a disaster. The level of estimated potential disasters functions as a guide. And all consideration of the projected most critical downtime-sensitive applications of the enterprise that must be recovery immediately are the basis for creation of a data centers development project. Some typical disasters are:

- Flood Frequency and Magnitude
- Hurricanes
- Snow and Ice
- Earthquake
- Lightning

It is very important within the data center geographic area to evaluate the stream flow statistic, flood frequency, magnitude. An example of a resource is the California State Water Resources Control Board (SWRCB) that has flow statistics. Estimating procedures for use in water restrictions rely on the accuracy of the USGS peak-flow equations, for example for the northern coast region. Below is a series of SWRCB maps that shows mean annual precipitation for locations in the northern coastal region of California, where long-term historical flow data trend to be lacking during disasters. This includes total annual and seasonal of stream flow, and magnitudes of selected flood frequencies (6).

Figure 1: Flood Frequency and Magnitude

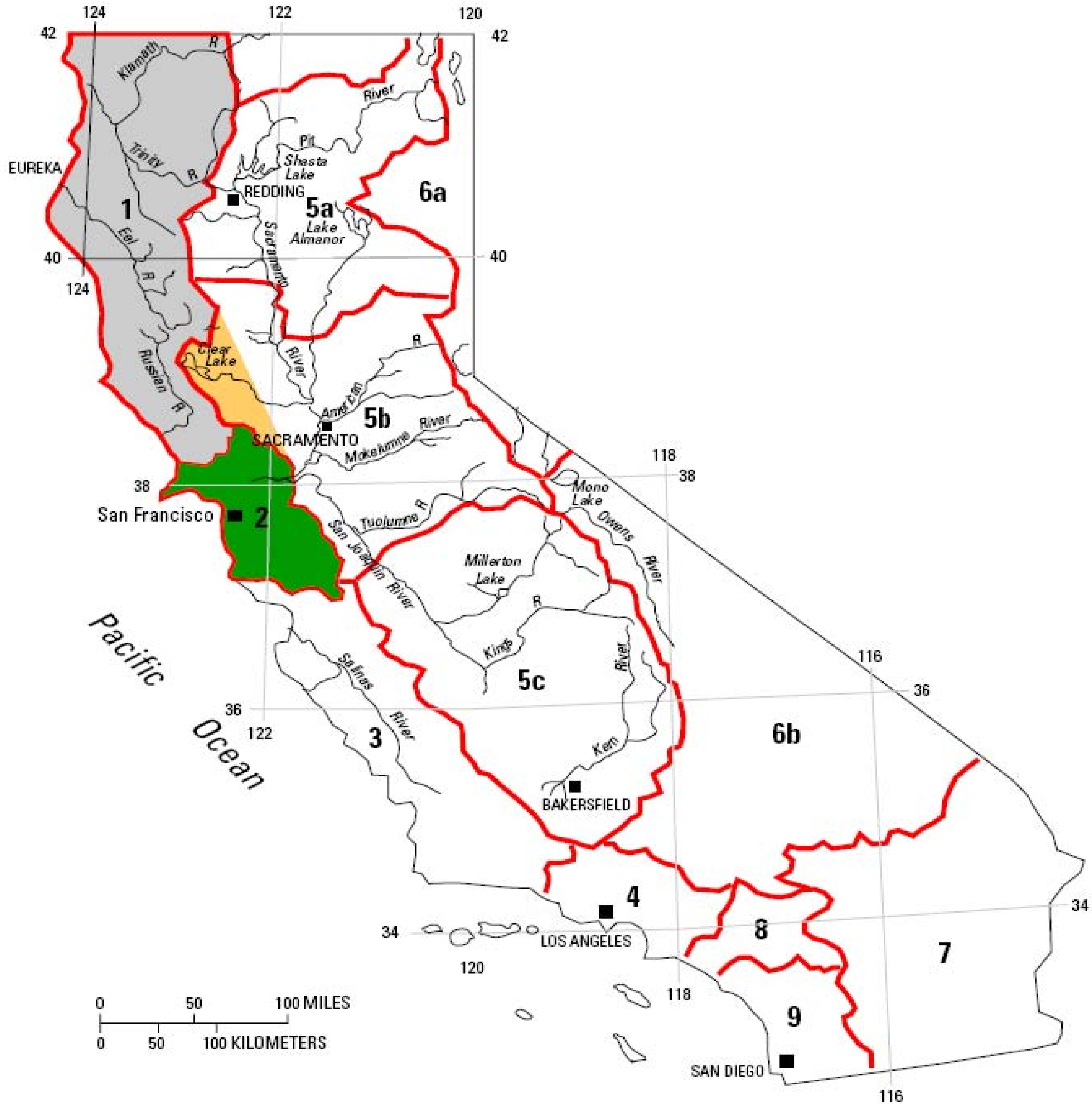
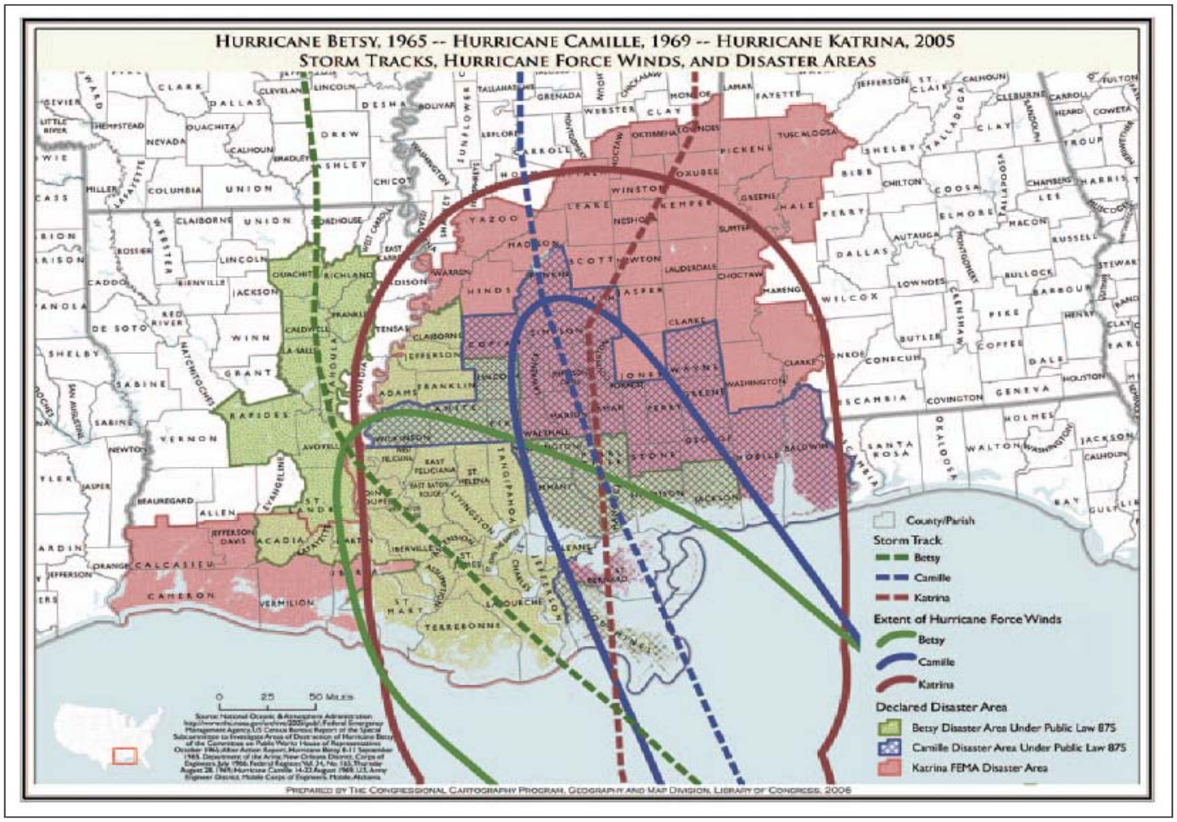


Figure 1. North coast region of California.
Numbered regions are Regional Water Quality Control Board regions. The study area is shaded.

Figure 1, illustrates reports showing, to a certain degree of accuracy and bias of stream-flow, statistics resulting from application of estimation by the SWRCB. Results indicate the natural disasters that might occur with flood throughout the State of California.

Figure 2, shows tracks of hurricanes storms with forced winds across some of the area:

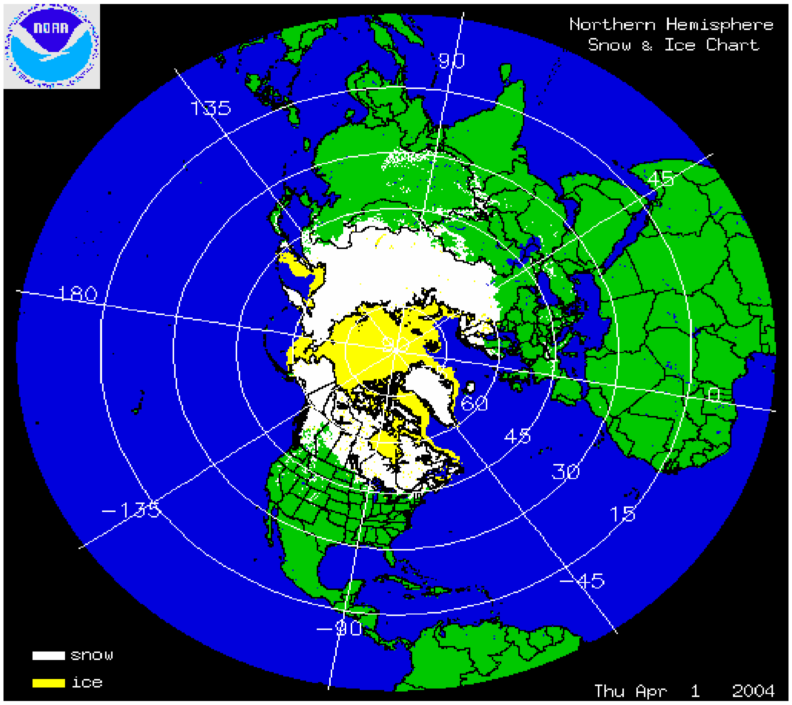
Figure 2: Hurricanes Betsy, Camille, and Katrina



Hurricanes Betsy, Camille, and Katrina
Geography and Map Division, The Library of Congress

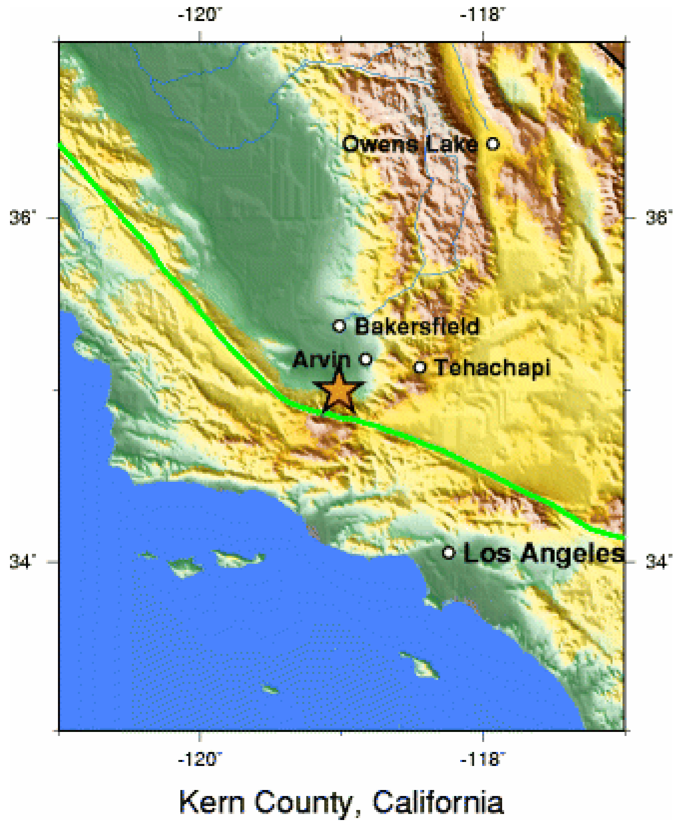
Hurricane analysis and the Gulf Coast maps, as exampled above in Figure 2, help to determine areas that are most impacted by hurricanes and at risk of the most physical damage from major hurricanes landfalls during the hurricane season. Any spot in this region comes with assumptions of cost of damage, most pertinent here, the risk to data centers. It is crucial to place at least recovery data centers outside of hazardous areas such as gulf coast hurricane activity region if one operates systems with high availability requirements there. (7).

Figure 3: Northern Hemisphere Snow and Ice Maps (Source: Google Map)



The map above is provided by the National Oceanic and Atmospheric Administration/National Environmental Satellite, Data, and Information Services (NOAA/NESDIS). It shows the history of monitoring snowfall and ground ice data throughout the Northern Hemisphere. The data set also contains the location of Sub Sea ice, permanent frozen ground, and ice that occurs on land of beneath earth surface (11).

Figure 4: USGS (Hazards Center) Map that Showed a historic earthquake of Kern County, California (Source: The Historic Earthquake)



Earthquake maps as seen in Figure 4, help to determine areas that are most prone to earthquake in the continental United State since the San Francisco shock of 1906. Earthquakes cause a lot of damage, especially to data centers. Waveform data on earthquakes has to be converted into the modern archival formats in order to create such visual resources. It is crucial to place a disaster recover data center outside of hazardous area such as those identified in California that are prone to many earthquakes if one is required by a business in such regions(8).

Figure 5: Lightning Incident Map for the Areas Most at Risk (Source: The Weather Channel)

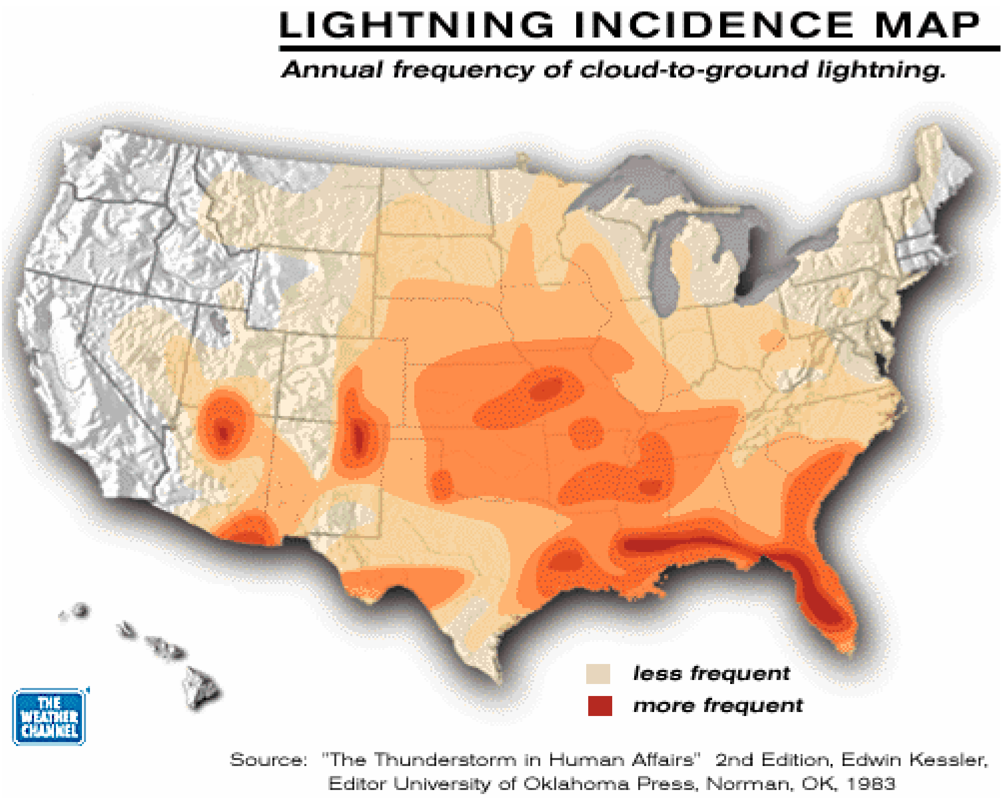


Figure 5, illustrates the annual frequency of cloud to ground lightning throughout the Unite States. The map also, indicates in dark orange some of the areas that have a high frequency for lightning (17).

Figure 6 map shows areas that have been declare a disaster by the President.

Figure 6: Presidential Disaster Declarations in the United States (Source: Google Maps)

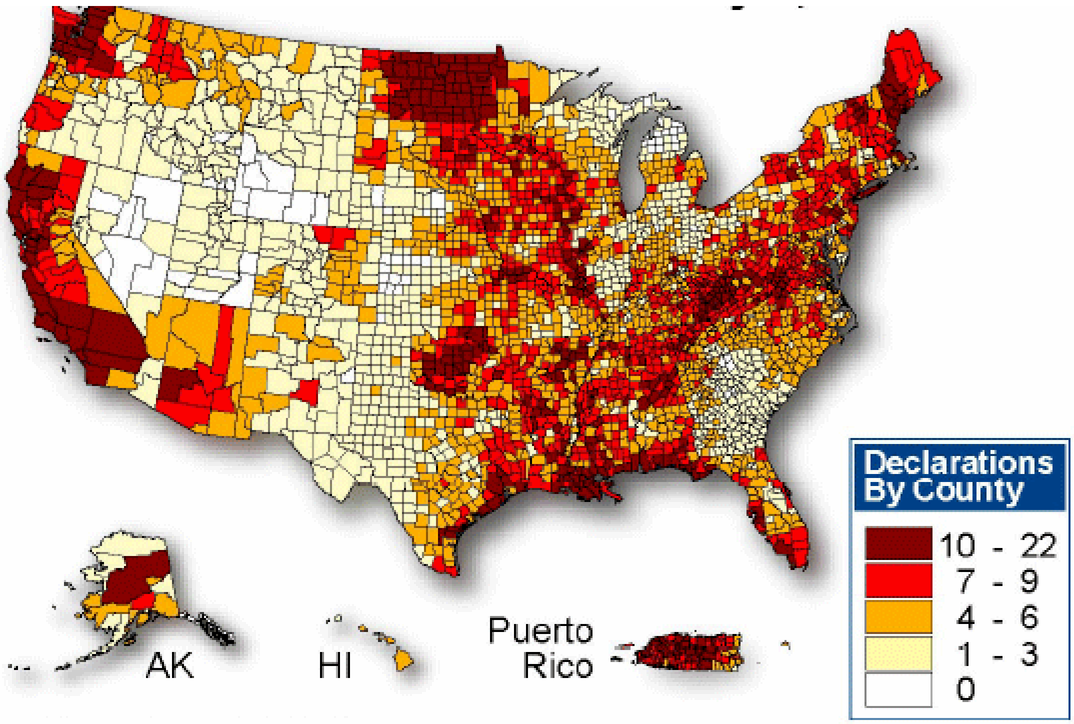


Figure 6, mapped total: 1,214 Prior to January 1, 1965 – June 1, 2003

In the figure above, 185 declarations did not have county designated. Therefore, of the total declared disasters (1,399), only 1,214 are included in the mapped total. The disasters and emergencies declared by presidents includes state and county level information retrieval with maps, and these declarations can be announces for any number of reasons (terrorism, tornado, etc). Places that have a high presidential disaster declaration are not optimal places to implement a data centers of there is no business (14).

The following pie chart in Figure 7 shows various categories of presidential disaster declarations of natural disasters and emergency throughout the United States.

Figure 7: Disaster by Type (Source: Google Maps)

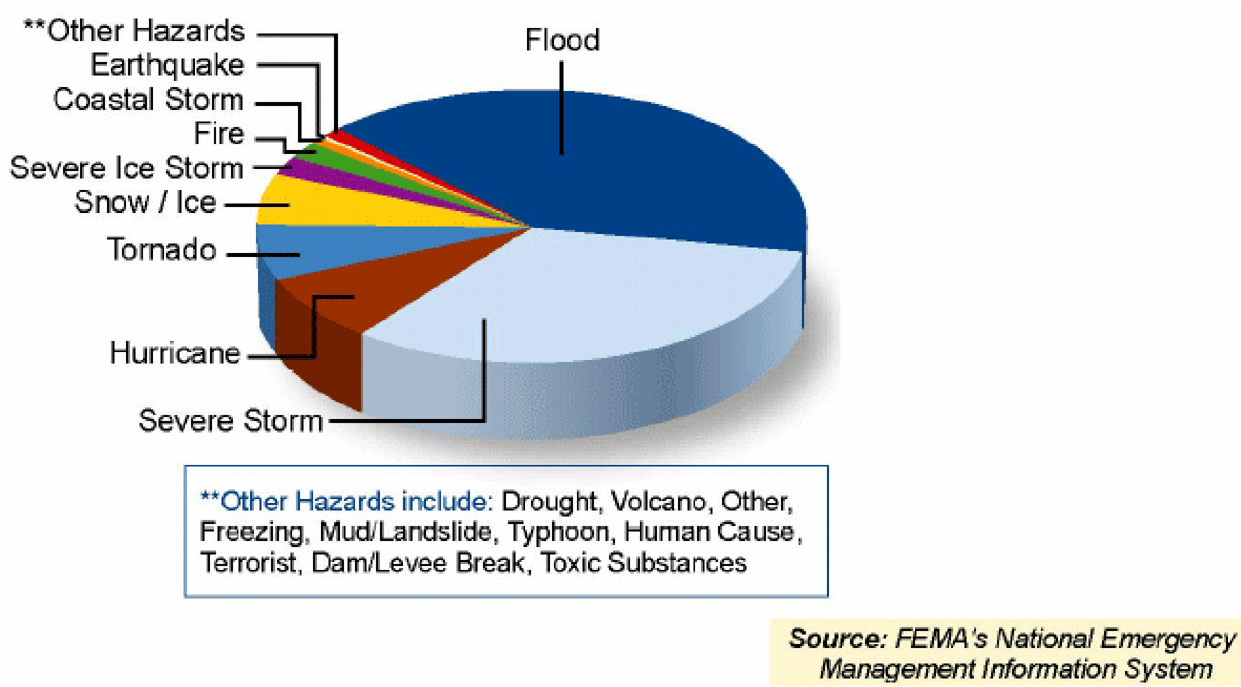


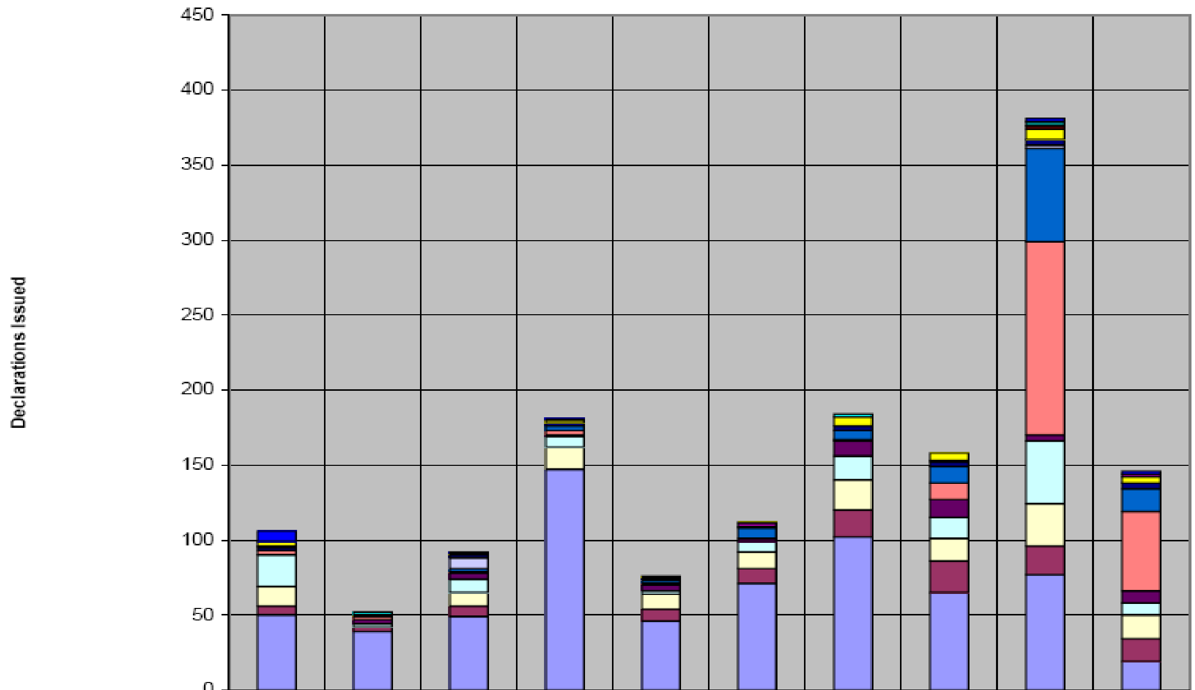
Figure 7, is updated on the source site whenever a disaster occurs or during of emergency. It is very crucial for planners/architects to survey the land and make sure that the data center design and location, in one form or another, mitigates most natural disasters (16).

The presidential disasters are not the only type of disasters that can happen. One of the biggest problems in data center design is building a data center in a disaster area. There are many disasters that sometime worse that those listed the above resources. For instance, terrorists striking an area are a potential vulnerability to a data center. When a disaster occurs, recovery communications in a disaster region can be complicated when large volumes of people try to call into the city to find out what is going on with the love ones. Because of this communication lines can be so over utilized that making calls becomes problematic because the affected central office cannot handle the surge in call volume. In actual disasters and emergencies, the president may exercise extraordinary authority in circumstances such as, terrorist attack, natural disaster, etc. But these actions are still limited by extant resources at the time. The president may declare for emergency to later provide recovery help to develop, and expand presidential emergency powers that tend to centralize authority within the executive branch. However, a president may exercise emergency power to provide assistance like the emergency medical care, disaster unemployment assistance, etc. that may not have been related to a disaster that could affect data centers (14).

An according to former Federal Emergency Management Agency (FEMA) Director James Lee Witt, the president declared issues emergency to address ongoing events that approves as declarations of major disaster. Each event or incident is evaluated individually on its own merits such as, the severity and magnitude of the incident, the impact of the event, and whether the incident is beyond the capabilities of the State and affected local governments. FEMA Director With, recommended the State Federal declaration to address disaster in a petition for help. In a major disaster or emergency, a governor and other state officials should be able to access a flexible path for securing federal budgets disbursed during severe snowstorms, tornadoes, lightning, flooding, and wildfires. He also recommends that governors and other parties involved in the declaration request process work to anticipate when a disaster might exceed the responsive capacity state and local resources. The governor may request a presidential disaster declaration in order to receive federal disaster assistance under the Stafford Act. When a disaster occurs, FEMA evaluates the amount of support necessary to distribute to local government, and all counties estimates for these types of hazards are created prior to the disaster, with the support of other federal assistance. Under the individual assistance program, factors FEMA will consider include: concentration of damage, degree of trauma, impacts of low income people, the elderly, or the unemployed, the assistance received from voluntary agencies, the amount of insurance coverage, and the average amount of individual assistance by state (14).

Figure 8 below is a visual representation of the outcomes.

Figure 8: Summary Chart President (Source: Google Chart)



	Eisenhower	Kennedy	Johnson	Nixon	Ford	Carter	Reagan	GHW Bush	Clinton	GW Bush
Other	7		1	1					2	2
Fishing Losses									3	
Human Caused									2	
Terrorism Attack										2
Toxic Substances		2					2			
Fire	3	1	1	2	1	1	6	5	7	4
Volcano	1					2		1		
Earthquake	2		2	2	1	1	3	3	4	4
Drought			7		1				2	
Snow			2	3	2	7	6	11	62	15
Severe Storms	3	2	1	3	1		1	11	129	53
Typhoon		3	4	1	4	2	10	12	4	8
Hurricane	21	2	9	7	2	7	16	14	42	8
Tornado	13		9	15	10	11	20	15	28	16
Flood & Tornado*	6	3	7		8	10	18	21	19	15
Flood	50	39	49	147	46	71	102	65	77	19

Figure 8 shows the different presidential emergency power associates with the authority and actions of protect, and defend in time of crisis during natural disaster or various categories (15). This indicates that a significant consideration of disasters is required if data center services are to provide continuous service over long periods of time.

CISCO SERVICE ORIENTED NETWORK ARCHITECTURE (SONA)

SONA is intended to be the data center management infrastructure that can improve the support for groups that will manage a data center. Intended for use in an enterprise data center, SONA provides the fundamental network resources and a greater agility by evolving data center infrastructures towards improving productivity, enhancing business processing, and growing strategies of data network throughout the next generation of network infrastructures (14). It is intended, at least in part, to meet the challenge of maintaining networks during regional disasters like those indicated above.

The Cisco data center network SONA is intended as the heartbeat of the businesses organization in the data center. SONA, with storage networking capabilities, provides a platform for the storage with secure deployment as of a service oriented and within storage network resources. The SONA architecture allows customers to scale-up and scale-out servers and consolidate storage, thus resulting in lower capital costs and higher virtualization strategy utilization. The SONA architecture adopted a new IT strategy that emphasizes virtualized infrastructure, so that it has the ability to respond faster to new application demands of business organization (3).

The SONA network architecture will include:

- Networked Infrastructure: Gigabit/10Gigabit Ethernet, and Server Farm
- Interactive Services: Storage Fabric Services, and Security Services
- Management Framework: Configuration, Provisioning, and Fault Management Services

In addition, SONA, for network storage environments, is advertized as providing resilient network infrastructure that supports security, availability, and the benefit of consolidation in providing end-to-end segmentation across each application that is dispersed across multiple data centers during disruptions, potentially caused by natural disasters. Additionally, if a data center has grown rapidly, managers face several challenges in the fulfillment of the significant changes. According to Cisco Data Center solution, their ultimate goal is an agile infrastructure that empowers ongoing services by using consolidation and virtualization technologies, which are intended to improve computer, storage, networking and application technologies. The resources solutions within SONA are presented as enabling IT organizations with the changes and processes to respond through an intelligent network (3).

VFRAME INFRASTRUCTURE

A virtual network has the potential to accomplish the virtualization of computing and storage resources, and enhance network adaptability while reducing the costs. Cisco VFrame Data Center resource solutions includes virtualized provisioning of applications and creates a network definition based on the logical network coordinate workflow assigned. The systems will help Data Center administrators to optimize using VFrame for data center resources. Ti also virtualizes an overview of configured physical network devices, and can define each layer of application infrastructure as logical devices. The VFrame system introduced service-oriented provisioning, where application services are associated within the data center based on usage patterns and availability requirements. The SONA infrastructure is defined in the form of a logical topology that provides the catalog for the need of applications, and the resource types that are shared among server configurations or service operations (3). The type of service-oriented data center provisioning is claimed by Cisco to provide the following benefits.

Service-Oriented Data Center Provisioning:

- Utility resource pooling, reducing the time to add devices – by pooling resources, shared each resource for a specific application, the potential fewer resources.

- Dynamic repurposing of the service network – when a service does not need to be deployed independently, it can use the same equipment as other services, if that equipment is designated for use by more than one services.

- Automated service level management – the service includes templates and specifies the type of equipment involving processor speed, amount of memory, and provides high-performance of service level.

- Automated failover – the process of reducing downtime of applications in case of failover resources.

- Automated provisioning to handle increased application load – due to a heavy load of application resources, VFrame can automatically perform provisioning of addition resources.

- Improved resource usage – run application resources at higher usage level, and used servers at high capacity.

- Equipment standardization – set standards for devices such as servers, storage, network equipment for standardization.

- Standardized application deployments – within VFrame system, service network can share many application service networks, and deploy standard, tested setups throughout an organization.

The type of VFrame includes these features:

- Service Template Design – the template service network with the ability to maintain control applications and shared network designs.

- Services Network Design – the design of networks to run an application based on templates that will required service terms of resources while deploy the service network.

- Service Network Operation – the features operation of VFrame is to manage a service network to run an application.

- Service Network Policies – provides network operation with automate features such as server failover and dynamic resource provisioning.

- End-to-End Infrastructure Visualization – the system provides network maps for physical resources and other network design.

- Device Discovery and Management – the system for mapping features, it allows administrators to view the types of devices contents, such as modules for switches, or logical storage area networks (SAN).

- Resource Pooling – the system allows administrators to create resource pools to choose which segment fits the organization's requirements, which includes the criteria of devices with automatically for dynamic pools.

- Virtual Contexts – limits user access to VFrame features, limits resources assigned to a context in order to prevent a shortage of resources.

- User Management - specifies what types of actions it can perform in users roles, based on storage creation.

- Fault Management - helps to monitor feature operation such as syslog messages server for logging system, and identify problems in a network.
- High Availability (Redundancy) - the system works as a redundant pair for backup control in case of data center director failures.

The VFrame server is system management software. The main purpose is to enable software delivery of utilities for computing in the data center. The systems management software connects the server fabric and creates virtual computer services by programming and coordinating a fabric of server switches together with high performance, high security features to connect the server fabric with shared pools of I/O. Also, it provides a platform with the ability to interconnect discreet server resources with highly available products. This allows devices work together in many configurations and on different paths, from the installation of the product down to the deployment of networks. VFrame is purported to provide high availability enables cost effectively in a way that is independent of any specific hardware component or operating systems. Additionally, VFrame can be used to consolidate a centralized backup facility for virtual machines, such as admin context or a specific virtual context that will define service a network entire end-to-end, including workflow. VFrame provides significant advances in network adaptability that can be implemented within an admin context for user account and roles, and provides user accounts for people with specific area of expertise appropriate access to the system. For example, the storage administrator will be able to define storage device credentials and restrict access as appropriate policies and discovery storage devices (3).

From a design perspective point of view, Cisco asserts that there are many benefits to virtualized resources that can deliver applications. VFrame features for data center networks present it as a efficient and reliable product. VFrame maximizes the use of hardware resources. This means that a lot more performance can be obtain for the same expenditure and a lower cost of servers is necessary to support particular data storage as needed. This is true in network environments, and with the virtual machine. Cisco claims that some configurations yield increased efficiencies of up to ten fold. If this is true, the system brings in costs saving. Cisco also suggests that it incorporates a better infrastructure design that essentially has greater availability and efficiency for the overall system.

To determine credentials of VFrame, and the administrator creates roles for users, and local user accounts. During normal procedure operation, the administrator must of course perform maintenance the tasks of physical devices to the network. They may need to be upgraded before the initialization of the VFrame begins. When maintaining a VFrame, as changes take place to the network it impacts the VFrame database, and it is important to understand how the database and related backup files are affected, so that recovery can occur appropriately. When using this type of VFrame server, an administrator can disable redundancy to guard against data corruption. The VFrame mapping feature defines the credentials templates to use for discovery of servers and storage devices for the best fits within organization.

POWER AND COOLING PROCESSORS

Today’s data centers build in-house racks upon racks of servers, rack systems, power systems, data storage, cooling systems, networks. These components and communications components from all of these require power utilization density. The heat generated by this power consumption requires that cooling system. Another method is to reduced power usage. When full CPU performance is not needed, planners can select CPUs that can shut down portions of the CPU, or mother boards that shut down unused when stocking servers in a data centers. In order to maintain data centers the cooling systems must be stable, and one must monitor the temperature of all devices in a data center in order to prevent overheating and possible fires and component failure. The heat cannot build up unnecessarily, even in extremely discontinuous workload scenarios. One of the most important aspects of any data center is cooling. There are standards that provide specifications for encouraging airflow and reducing the amount of heat generated by concentrated equipment. They generally recommend the use of adequate cooling equipment as well as a raised floor system for more flexible cooling. They also state that cabinets and racks should be arranged in an alternating patter to create hot and cold aisles. In the cold aisle, equipment racks arranged face to face. In the hot aisle, they arranged back to back. Perforated tiles in the raised floor of the cold aisles allow cold air to drawn into the face of the equipment. This cold air washes over the equipment and expelled out the back into the hot aisle. In the hot aisle, there are no perforated tiles. Instead there are exhaust ducts that suck the hot air out of the aisle, keeping the hot air from mingling with the cold.

Compared to providing infrastructure for cooling an expanding stable of devices that have their components always on, it is significantly less expensive long-term to replace older blades and racks with systems that include an integrated memory controller to enhances the energy assumption. The cooler systems have multiple levels of lower clock speed and voltage. The availability of these devices in the context of a given data center's total power savings is significant. The CPU power analysis and power saving level can be achieved with no measurable performance impact. The benefits are measured in the amount of computing power per watt, per speed.

Figure 9: Low Power Cooler Systems with Heat Density (Source: AMD Opteron)

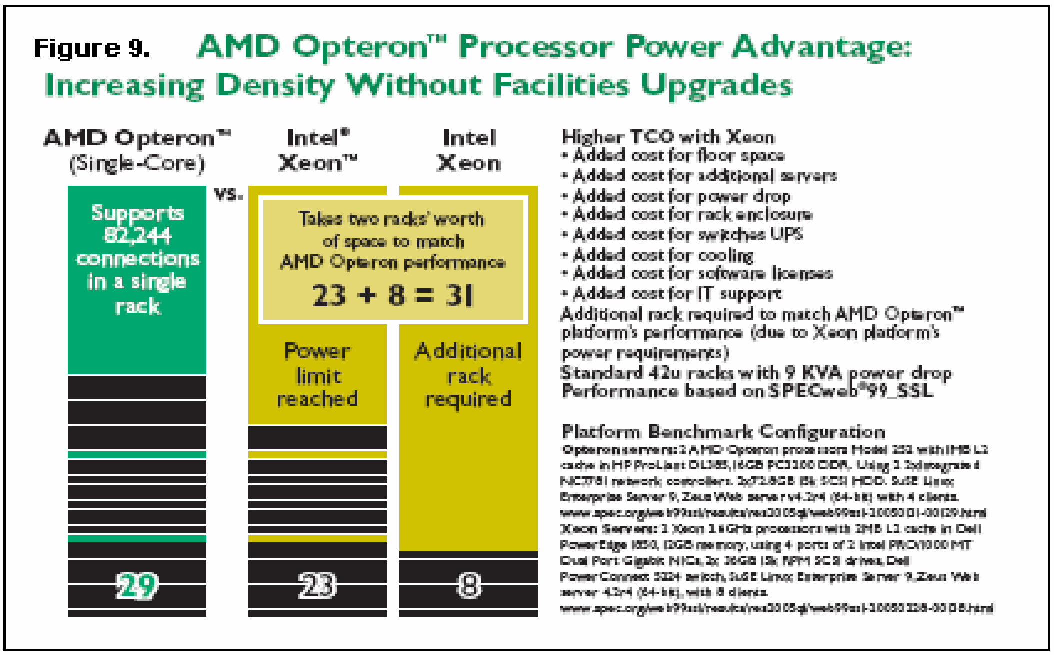


Figure 9 above, explains the advantages of low power CPUs in terms of heat density without facilities upgrades. The total power and the numbers are estimates provided by AMD, and any such comparisons need to be made in the context of a given data center with benefits measured in computing power per watt, per square foot, and in relation to the workload.

Most data centers need cooling versus heating units. Cooling requirements can be determined by calculating the square footage built to house rack upon rack of servers, power systems, data storage, underlying technologies power requirements. The AMD Opteron processor has is touted by ADM as being system well deserved with high performance of resulting reduced heat generated and power consumption that can yield a dramatic reduction in the cost of running a data center. The advantage is that the generated heat is reduced, thus allowing for higher density of components inside the data centers. The Opteron Processor has designed cooler with technology enabled systems fixed cost based on the demands of the workload, with processors designed with multi-core capabilities, and has been designed from its inception to be multi-core processors technology (20). Figure 10 below shows the rise time's density systems per square foot of data processing and the operating temperatures.

Figure 10: Power Density Systems (Source: AMD)

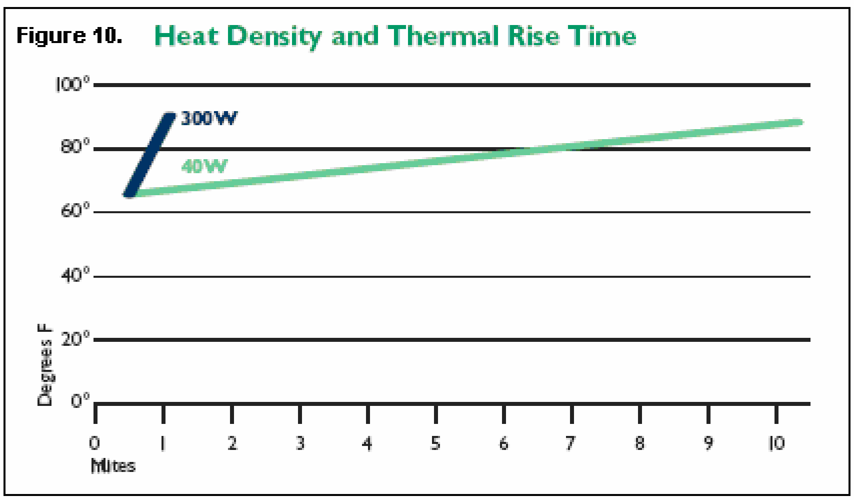
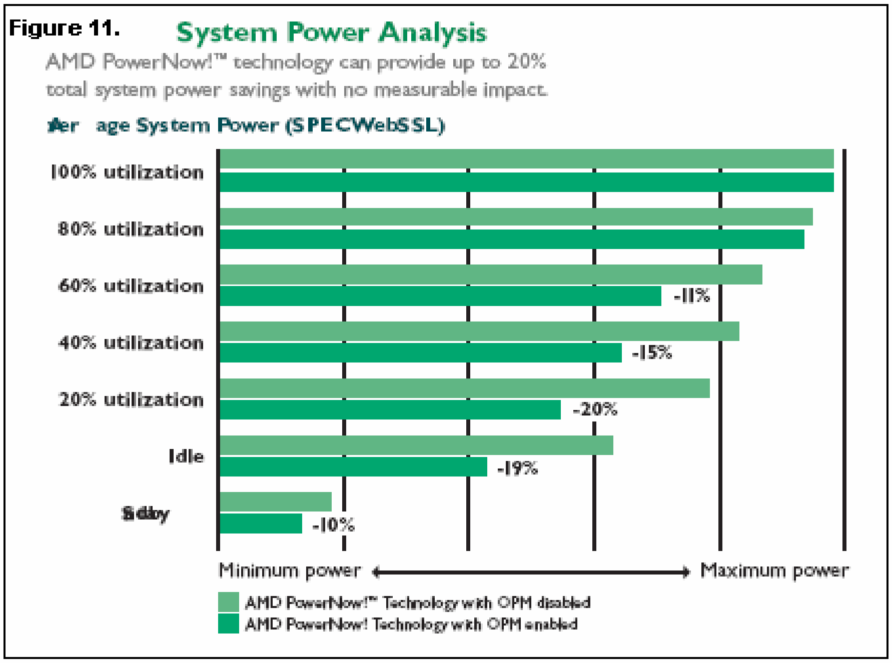


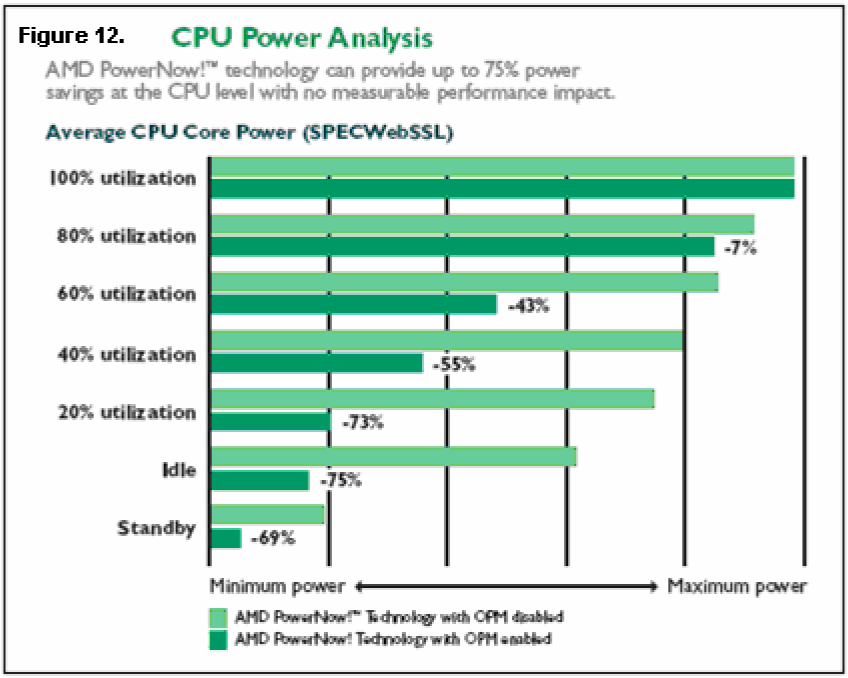
Figure 11: System Power Analysis (Source: AMD)



As mentioned of the technologies designed with AMD, includes an integrated memory controller, the devices with multiple levels of lower clock speed and voltage, the reducing power consumption during idle times. One of the key benefits to virtualization is minimizing hardware requirements, but one of the biggest disadvantages is concentrated heat load. Most equipment is going to generate a large amount of heat regardless of processor efficiencies because with virtualization they will be operating at higher utilization. This is mean that the server will require more cooling in concentrated areas. This creates new design requirements for data centers as many companies begin to reduce hardware in data center because of virtualized software (20).

Figure 12 demonstrates how AMD minimizes CPU power consumption as load decreases, and how optimized power management maximizes the benefit of CPU utilization with efficient power supplies, and lower cooling condition infrastructure. Even with virtualization these systems can control power consumption of processors as density increases by decreasing power consumption per blade.

Figure 12: CPU Power Consumption (Source: AMD)



The table above shown in Figure 12, illustrates some power savings of various CPU levels with no measurable performance impact. When there is idle processor time, it can create efficiencies, but maximum power that must addressed in order to provide proper cooling.

Data Center with racks of cooler CPU architecture oriented towards higher rack density will still have increasing heat loads, energy consumption per cubic foot. There will also be a cost of new and upgraded technology with higher computation power of lower heat dissipation per unit of computational power. In addition, AMD claims these chips represent the most efficient power technology in relation to workloads and offer increased uptime under the most adverse conditions for all CPUs because if their minimal heat dissipation. Additionally, the total system power saving can provide measurable impact within the performance of individual rack in terms of cooling. AMD claims to have provided the lowest power processor driver to provide standard capabilities to operating systems. These chips also have the potential for interoperation with cooling systems, power systems, and facilities management software.

Figure 13: Multiple Combinations of P-States (Source: AMD)

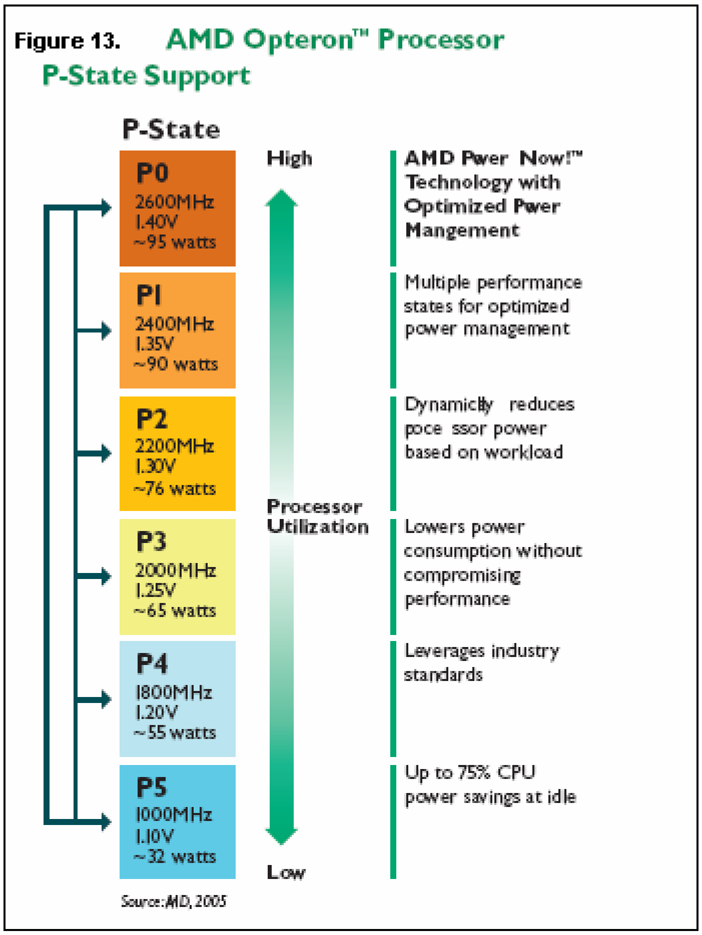


Figure 13, shows above how processor can respond to requirement changes with P-State to the lowest voltage/frequency state to reduce the thermal emissions during states of low processing requirements. Because of these lower processor states, heat do not build up unnecessarily, even in extremely discontinuous workload scenarios.

POWER SOURCES

Because Data Centers contain high value intellectual property and business driving data for many size organizations, it is important to develop effective strategies for addressing issue of vulnerability to natural disasters that can affect the power grid capabilities and at the same time minimize energy costs. Power is one of the most important elements in a data center that directly affects processing and indirectly affects cooling needs. That is why it is important to including redundancy in power. Data center architects usually underestimate power requirements because they do not account for peak load utilization and cooling. Most architecture are accountable for utilization of equipment with the ultimate goal with 100% uptime capabilities place into a data center. Additionally in order to achieve higher tier availability in service level agreements, specific requirements in power must be met. To protect against outages and failures, it is important to understand what the requirements are for data protection. The applications protection strategies must be designed to protect against failure, by providing failover to other servers, but this is not enough. There are many ways to protect against loss of power to the cooling sources, and to maintain sufficient capacity to cool down system components. For server protection, making sure the underlying infrastructure includes redundant network infrastructure (switches, hubs, routers, and cabling) with access to diverse power. For storage infrastructure, it is generally necessary to configure multiple connections to their associated servers and also include off-site storage backup of all data and applications that are stored off site. Transactions ever may need full data replication with automated remote failover site (19).

Data Center designs with high availability features an infrastructure core of Tiers that conduct the activities for multiple power and cooling distribution paths, the redundant components, fault tolerance, the integrated configuration of spaces, and the variety of power density options involving Uninterruptible Power Supplies (UPS) and multiple generators with on-site fuel storage (20). Data Center designs can be classified into separate "Tiers" where each tier constitutes an increase in reliability, power paths, redundancy and availability of infrastructure design that all four key elements of Tiers introduces to address issues with power implementations in data centers as of following:

- Tier I Data Center is a single path for power and cooling distribution with susceptibility to disruption by human errors. A power system within data center space, the ultimate goal of managed the uptime levels based on the need and requirements with standardization. Access to direct connections with lower cost carrier services provides cross connections, cabling, testing of all most every major telecommunications component.

- Tier II Data Center is a single path for power and cooling distribution with redundancy components of 99.741% availability, the power outages tends to occurred very frequently with uninterruptable power supplies, and paths are designed with single threaded distribution.

- Tier III Data Center is a multiple power and cooling distribution paths with redundant components availability, all fiber optic connections, multiple carrier neutral connections for data center features and advances of scheduled maintenance, testing, and repair carried out without shutting applications down.

- Tier IV Data Center. The features and advances of managed data center with multiple active power and cooling distribution paths, redundant components and fault tolerance. This functionality is the capacity to conduct any planned activity without disruption. Once of the paths are in place to support the systems. This is especially true in IT infrastructure that offers secure storage space with wide range of options for space, primary power, bandwidth, and access control devices throughout the facility.

In order to protected redundant power sources and in order to provide stable redundant power, a UPS is a device that maintains a continuous supply of electric power connected equipment by supplying power from a separate source when utility power is not available. There are two distinct types of UPS: off-line and line-interactive. An off-line UPS remains idle until a power failure occurs, and then switches from utility power to its own power source, almost instantaneously. An on-line UPS continuously powers the protected load from its reserves, while simultaneously replenishing the reserves from the main power. The on-line type of UPS, which is considered for this project, provides not only protection against complete failure of the utility supply, but also protection against all common power problems. Below are listed the major options of power sources for data centers:

- Redundancies power level
- Power distribution
- Emergency power
- Dual power feeds
- Dual network drops
- Backup battery plants
- Dual Interlock
- Primary power
- Secondary power
- Temperature/climate

Figure 14, illustrates a range of UPS systems with lower cost and of power loads. We can see the costs of implementing these.

Figure 14: Comparison of UPS Configurations (Source: UPS)

Comparison of UPS configurations

Technology Type	Benefits	Drawbacks	
Standby Off-Line	Lower purchase cost. Provides basic protection.	May not have power conditioning. Transfers to backup may interrupt load.	150 – 1,250 VA $150 – $1,000
On Line/ Double Conversion	No interruption to loads. Provides power conditioning.	Highest purchase cost. Slightly lower efficiencies. Complex internal electronics.	600 – 2,000 VA $500 – $3000
Line Interactive	Continuously regulates power to load.	More sensitive to line disturbances. May have shorter battery life.	250 – 2,000 VA $200 – $2,500

It is important to evaluate the condition of every UPS frequently to ensure that when a UPS unit detects a primary power failure, the UPS will provide complete isolation of the load from main service, and provides backup power without interruption. When installing, the grounding of a UPS requires proper design. When a Datacenter manager selects a UPS, there are several design options: the standby or off-line system, the double conversion on-line system, and the line interactive system.

Figure 15: The Actual Power Requirements Options Features (Source: UPS)

Typical UPS specifications by size

VA	Watts	Weight (kg)	Typical Back-Up	Physical Size (cm)	Input Volts	Input Amps
250	150	5	10 min.	15x8x25	120	2.0
400	260	7	12 min.	10x10x46	120	3.3
600	390	7	6 min.	10x10x46	120	5
800	525	14	8 min.	25x25x41	120	7
1,000	640	14	8 min.	25x25x41	120	8
1,250	850	16	7 min.	25x25x41	120	10
1,500	1,050	16	5 min.	25x25x41	120	13
2,000	1,300	16	4 min.	25x25x41	120	16

Figure 15 above list of the power requirements and other specifications to determine the correct UPS size based on the wattage rating of each device, the correct voltage output, the correct hot/neutral/ground, the power receptacle, etc. To select a UPS, add wattage ratings of all of the devices to be protected, and then determine the maximum backup time needed for equipment shutdown techniques inside a data center (20).

There are so many different components that are included in power system designed within a data center that has to do with initial design. The configuration of a UPS should include providing power for operation during both unplanned power interruptions and the cost of maintenance. Today most UPS systems are deployed within data center provide the needed protection against brownouts, surges, and outages before it corrupted data on devices such as network servers.

REDUNDANCY "Y" CABLE

The redundancy cable within all Cisco BPX 8600 series switches is generally a standard switch cable media that all Cisco BPX 8600 network devices will use to communicate with comes in different lengths,. The most important of cabling process is make sure the workstation and each terminal properly connected to network devices.

One way to connect trunk and data equipment to a BPX 8600 is with a "Y" for cable implemented the maximum length of 450 feet between the BPX switch and DSX-3/E3 cabling point connector for users who wish to construct their own receptacle.

Figure 16, shows the "Y" cable various specifications that used in IT and Telco networks for grounding cable. The connectivity with Aux-Port to modem in trunk for data interfaces control each port with control terminal. From Cisco point of views the cable lengths specified are connected to modems, and are generally available in standard of lengths.

Figure 16: Lists of Y-Cables (Source: Cisco BPX 8600 Series)

Y - Cable	Used On	Cisco P/N
T3 trunk	LM-3T3	TBS
E3 trunk	LM-3E3	TBS
Aux./Cont. ports	LM-BCC	TBS
Ext. Clk. In	LM-BCC	TBS
Ext. Clk. Out	LM-BCC	TBS

The following lists of the various cables prescribe directly from Cisco generally available for connection to data ports on computer control terminals and modems. BPX switch peripherals attached to the ports use specific pin configurations at both ends. Each auxiliary port controls the nodes in the data network terminal with a straight-through RS-232 cable or DB-25 subminiature cable that is used a terminal connectors.

Figure 17, provided by Cisco, explains the auxiliary and control ports specifications used for connecting to network stations in data center.

Figure 17: Auxiliary and Control Port Cabling (Source: Cisco PBX 8600 Series)

Cable Parameter	Description
Interface:	RS-232 DCE ports.
Suggested Cable:	24 AWG, 25-wire. A straight-through RS-232 cable is used for a terminal or printer connection. A null modem cable may be needed when interfacing with modems on either port.
Cable Connector:	DB-25, subminiature, male. Table B-5 contains a list of the port pin assignments.
Max. Cable Length:	50 feet (15 m.)

Figure 16 and Figure 17 are providing information about cable connectivity for network infrastructure for developers, engineer, in regard to design and testing (22).

Data center architects, vendors, and developers must determine proper cable requirements to enable resilient communications between business organizations and between media. It is important to make sure the proper cable is uses in order to achieve the function.

AVAILABILITY COMPONENTS

Today, data centers needs to be supported by architecture and with a knowledge base capable of delivering high availability, capability, and security in the development data center requirements redundant. These components will not be as critical as power and cooling but are significant component that must been accounted for when sharing resources and minimizing disruptions to components over time.

The following architectural components provide the ability to compose systems:

- Security Zones
- Port Mapping
- Multitier Design
- Client Tier
- Presentation Tier
- Application Tier

The number of devices with high performance and rapid growth in a Data Center require scalability of hosted devices in terms of adding more ports for servers, router, switches, firewalls, and a higher port density to increase the potential growth of the system. Regardless of the number of ports, in a Data Center design, it is important to measure recovery time from the both the network and the application perspectives to ensure a predictable network recovery time from the user's perception. From the vendor perspective, systems that are built using interchangeable active components can allow for hand-off of processes during upgrade or replacement.

STORAGE DISASTER IMPACTS AND SOLUTIONS

Many of the vendors of different storage solutions expect to have a higher volume of standards-based interconnect between their storage devices. Yet some of the issues that need to be solved in interconnection between different systems can still include data discovery, end-to-end binding, address mapping, address distribution. These problems need require human intervention, technical support personnel that can track the issues down where they reside. This issue is so significant that one of the greatest concerns for organizations is the type of equipment they are using can achieve the desired connectivity when it is connected to the existing network.

To effectively address encounter businesses challenges, companies must keep pace with evolving technology by providing a proper storage solution that is adequately compatible. This is very important and crucial for a data center for efficient and effective disaster recovery. If systems are not compatible the impact is that systems without compatibility to the core recovery regimen will increase the man-hours required to achieve full recovery. However, understanding recovery priorities for each application allows administrators to strike a balance between the cost of recovery infrastructure and time to recover from a disaster. It is possible that only the most critical systems must avoid downtime or need to be recovered immediately. Consideration of many issues such as, the direct financial impacts, and the lost of service functions that occur during downtime result in some sort of increased expense.

Each storage disaster can be characterizes according to their total impact, the impact on secondary functions, and geographic areas a disaster impacts. The more complicated and difficult the recovery the more each of these impacts is involved. In order to ensure the survival of data during a disaster, plans that assessing the impact of the disaster should include a broad range of possible disasters and the secondary and geographic effects. Each time the plan is invoked though there are few decisions that still need to be made at the beginning of the data recovery process (19).

As part of the data center a disaster recovery plan will be created. Within the disaster recovery plan, essential functions and key resources will be identified. The key resources will include data, hardware, software, networks and data communications. The plan will also prioritize the key functions of resources, the outline regarding how to protect the most important functions and resources of the system. One of the most significant of these is the security plan, which is one of the foundations of organization data, and provides a plan to achieve network reliability, the sufficient protection of data, the kind of privacy protection that with ensure that personal data are not lost, and the linkages between private and non-private information. The designers of a disaster plan need information and training regarding the handling of personal data, about the risks a company faces in regard to privacy of personal data, and the possibilities of protection technologies (24).

During initial implementation of a disaster recovery plan, each management group, and administrators must be involved and agree to participate in each process, both when the plan is developed and when it is used, even during the worst of disasters, organizing valuable fixes and distributing them among groups can lessen the duration of an incident and reduce risk. Another parts disaster plans is to notified groups of organizations and individuals with whom information about disasters threads of recovery activities should be communicated. This includes teams such as, system, network, database, and application administrators, as well as information service users. For storage solutions, the clients expect information about outages of service and expect feedback with information about the incident in terms of exactly what has failed, and when it will be repaired. Once the impact of an incidents has been determined and it has been decided whether to declare a disaster or not, each operation may require multiple technical solutions when determining the best recovery method with the teams. The availability of a range of methods of recovery should be considered when designing the system backup and recovery plan of a data center (24).

In order for the plan to be useful in terms data discover recovery, it is part its designed to provide immediate response and subsequent recovery from any unplanned interruption. The plan does address immediately, short-term and long-term recovery strategies of most types of events, such as a loss of utility services, building evacuation, or major fire. This might occur in the computer network, the labs environment, or other facilities.

Testing the disaster recovery plan, the plan must ensure that the requirements are specified for a testing of a plan. Where possible should be simulated, the conditions that might occurred to determine if the plan actually works. The criteria of testing should play the major ongoing role of standard working practice before a disaster regardless of the nature of the disasters expected. The completion of the testing process needs to be frequent. How frequent depends on how often the disaster recovery plan is likely to change and on a range of other criteria. In general, all server administrators should be responsible for understanding their additional responsibilities in a disaster recovery event. This is often limited to ensuring that backup systems are available and that there is a way to restore the data. In addition, the plan needs to be organized in such a way to provide specific steps for the activities necessary to recover. It is good to think of a disaster plan as a combination disaster checklist, reference document and training aid. When an incident occurs, the various recovery procedures should be reviewed and follows as relevant in relation to either the incident circumstances or the plan periodic testing exercises. A solid set of tasks is necessary in order to thoroughly train recovery personnel and ensure the strategies and actions accurately reflect current recovery requirements (25).

THIN PROVISIONING

Another growing methodology for data management in data centers is Thin for provisioning mechanism that applies to large-scale centralized computer disk storage systems, SANs, and storage virtualization systems. This mechanism allows for space to be easily allocated to servers with just enough data for certain periods, thus maximizing the efficient use of storage space. Thin provisioning is known as just-in-time storage. The application thinks it has 500GB of storage, but the storage system only gives it the capacity, as it needs it. The system administrators can set thresholds to be alerted when add more disks into the storage. Thin provisioning benefits data centers by improving storage utilization from 65% to 85% and reducing storage costs and complexity (12).

Dynamic storage capabilities within thin provisioning takes advantages of unused resources benefit, when it comes to storage allocation. Not only do applications have the ability to grow their footprint on an as needed basis, but the method also allows the overall storage pool can expand dynamically. Virtualization software such as VFrame now has the capability to tie into large storage centers using a thin provisioning methodology. Both of these technologies complement each other to provide a world class service for streamlining data centers. Most data center managers continually struggle with the challenges of avoiding unplanned downtime, thereby ensuring application data is available. Additionally they work to avoid data corruption and ensure that application data is current and active. Enterprise data centers must provide high levels of application availability and consistent data integrity in order to support business critical applications. Compromises to either data availability or integrity can have unfortunate consequences for a company’s bottom line and reputation. While regional disasters and site failures get the most attention by virtue of causing the most pain, the most common causes of unplanned outages is the operational failures of components or system failures. As a result, data centers require a comprehensive portfolio of resilient storage technologies that help support very high levels of application availability and protect against business interruption. Storage resiliency should build into every aspect of the storage solution. The storage disk space, growth of productivity, and the increased global competition increase demands on storage technologies that must continue to support high levels of application availability for storage solutions.

Storage solution should include tools to proactively prevent system failures and detect and preventing errors. This supports the process of recovery and should reduce the time it takes to recover data. A vendor’s solution should include tools to identify and repair disk drive faults on a proactive basis, protect against all forms of double disk failure cost-effectively and have minimal impact on performance. Some disk requirements can include maintaining data availability in spite of triple disk failure, enclosure and storage loop failures, problems with synchronous and asynchronous replication, or clustered failover (12).

Today’s devices have rapidly grown and especially in IT network environments, the growing storage requirements are expanding faster than ever before. For storage solutions it is very important that all information is gets forwarded to the authoritative instance, this means that every time the change have made with new updated or new addresses, that change is reflected in the authoritative data.

The IT architecture of a data center has a design limitation that is defined by the storage technology. Architects have to design their infrastructure based on the growing demand for storage. They can provide a system that can be dynamic and can recover just as it was supposed to perform when emerging from a disaster. This can happen when everyone knows their roles and have a plan to follow that includes, the firm’s backup and restore, clustering, and data replication software all prescribed to accommodate the needs of business.

TRENDS IN STORAGE

Enterprise storage drives processing information across data center include business critical applications, the data planning, and the data management. Some enterprises use storage in the company with Direct Attached Storage (DAS) to networked storage working in a global. The Fiber Channel (FC) Storage Area Network (SAN) technologies in business applications are provide data storage while the demand growth of an enterprise defines the required service levels of high availability to their customer, and the increased management efficiency with scalability of large value of data cost of IT infrastructure and storage. The enterprise operations lead to the growth of more and more data stored by increasing numbers of users. Storage is made more efficient by the size of hard disks and tape drives and software method for improved storage capacity, reducing the cost of storage, and improving the efficiency of storage technology. But when a drive is external drives or on interconnection devices, such as hubs and switches, the administrator needs to allow for more ports for connection. As storage strategies evolve the use of SAN software that can increase efficiency will increase as it becomes more and more popular, and due to high initial costs of installing equipment for storage (5).

This report has reviewed some of backup and utilities trends in enterprise storage, which can be listed as five storages trend currently used in storage applications. Many organizations require data to be backed up and be stored as focused in a way to improve their storage strategies for backup, disaster recovery, and maximizing the efficiency of storage. This report will now focused on five storage strategies with technology ranging from interfaces, the transport protocols, and the storage trends on higher levels of developments in the field of critical for data backup and storage systems today.

These are:

- Tiered Storage
- Storage Over IP (SoIP)
- Storage Resource Management (SRM)
- Storage Virtualization
- Serial Advanced Technology Attachment (SATA)

TIERED STORAGE

The most valuable data collection should be separated into tiers that reflect the costs of performance for end user availability in order to benefits from a lower cost per terabyte in relation to the enterprise needs. In Tier 1 storage performance, this type of critical data is represented online with high speed of stored data. But both high performance and the reliable for storage are requirements. In Tier 2 storage performs less efficiently but with the lower cost. The data can be stored on NAS, a storage device with inexpensive disks, or any storage libraries. In tier 3 data that is stored off-line media including disk and tape which can reduces the storage cost. Tape can also facilitate off-site storage retrieval, once the decision has been made to move services to the IT disaster recovery. The IT recovery team should coordinate the retrieval of backup data from the off-site storage facility, and the backup systems administrator should maintain a current log of files stored off-site (2).

STORAGE OVER IP (SOIP)

Storage over IP is a framework for future storage devices, and extends the storage resources beside storage network, and each of frameworks integrated of legacy based on interoperability of storage and the current storage interfaces network using a Gigabit Ethernet connection with SCSI and Fiber Channel devices. The three primary SoIP protocols are iSCSI, iFCP (Internet Fiber Channel Protocol) and FCIP (Fiber Channel over IP). The subsystems over IP networks, which can provide level access to storage advances networks of scalability, availability for management of legacy systems in iSCSI protocol network, which allows for block level storage over common IP network infrastructure that is dealing with IP packets. This FCIP protocol is an enterprise-class protocol that uses Fiber Channel in different locations across IP networks, and FC evolved to be the default standards for storage networking devices, data storage device, and servers where the high speed of data to be transferred. iFCP lower level layer of interconnection of Fiber Channel devices and SAN with the transport of Gigabit Ethernet and TCP/IP. iFCP is used for extended Fibre Channel storage networks across the Internet in the conjunction of control as well as error detection and require for storage management applications, remote backup systems and the disaster recovery (2).

STORAGE RESOURCE MANAGEMENT (SRM)

SRM is local storage management industry and long term for storage advancement of building block with capabilities of supporting storage software vendors and providing storage consolidation through storage resource management. SRM functionality is to provide dynamic space and file types and file management, directory management, authorization management, and request administrative functions. The solution of SRM is needs to storing files in permanence location, the client has no needs to shared disk every time has been released (18).

STORAGE VIRTUALIZATION

The storage system presents the user with logical process space for data by physical location, and within process implementation mapping itself with limited of capabilities of the device, which may involved the separation of storage to the server from physical devices. The users will have access storage without knowing which physical devices have been configured in the actual form of the mapping. The options now exited between a single physical disk down to some small subset of the physical disk logical disks that required host or server. Using tier storage systems the disk itself can maximizes storage volumes efficiency in the environment, within disk expansion more of physical storage. Similarly disks can be reduced in physical size, and with storage virtualization that would required of fault management which include the creating, and maintenance of RAID arrays for backing out a failed implementation. Once problem determine with fault isolated, the complexity of each layer would be impossible reconstructed with logical drives without the mapping (2).

SERIAL ADVANCED TECHNOLOGY ATTACHMENT (SATA)

SATA is a bus that connects hard drives into computer systems, and uses serial signaling. SATA feature is parallel with interface that connected with drives and used the same as ATA drives. SATA enables organizations to managed inexpensive disk space and reduced the cost of data backup, the tape, and storage administrators can backup from expensive disk to SATA disks, with higher speed interface hard disk drive applications to improved in data reliability, and to provide more reliable solutions storage interface of the technology (2).

The storage enterprise has became increasingly with new technology with a greatest availability drives with exceeding the limits of the data storage, the benefit which includes inexpensive volume of space disk driver, and sharing storage devices that does not have to be physical to move storage from one driver to another.

Today, data enterprise operated in five storage trends that has being developed in data centers. Tiered storage is the most valuable online data collection which allows segmentation to analyses each application, and the multiple classes of storage enterprise in terms of costs of performance for end user availability in order to benefits from a lower cost per terabyte. Storage over IP is a framework for future storage devices, for extending the storage resources beside storage network, within each frame works integrated of legacy based on interoperability storage, and the current storage interfaces network using a Gigabit Ethernet connection with SCSI and Fiber Channel devices. SRM is developed within the storage management industry and long term for storage will likely be consolidated. Storage Virtualization represents the user accessing a logical process space for data by apparent physical location. The process implementation mapping itself is available only within limited number of devices, which may involve the separation of storage from the server and instead place it in external physical housings. SATA can connect hard drives into computer system; the hard drives use signaling, and are a serial signaling interface that specifies as signaling (2).

LESSONS LEARNED

The key concepts reviewed in this project are virtualization and data center efficiencies. Virtualization is a great solution for most data centers, which are constantly fighting limits in the storage environments. Organizations must adapt to changing workloads, capacity demands, and performance in their data centers. Virtualization, however it is defined, will assume a greater role in storage consolidation and the deconstruction of storage by moving some component functionality into the network, and making sure that each components of data centers can be easily replaced if needed.

Administrators of data centers are looking for upgrades of virtualization software to reduce costs for their storage environments. The costs of switching over to virtualized systems are not just direct fiscal costs, but include the massive amounts of downtime that might be incurred during a switch over to virtualization. Recently, there has been a constantly increasing budget for a data center as they must use newer technology in order to maintain a competitive edge. IT infrastructure can use DR systems to manage operational downtime with reduced costs to their operation; while being able to effectively address any disasters. The implementation of a storage strategy in order to produce the greatest impact on software costs should also include updates for management to keep track of the cost of new hardware. It would also be wise to have accurate costs value before initiating the process of buying any equipment.

There are so many different aspects of data centers where advance technology can be leveraged to resolve the needs of infrastructure and to facilitate more efficient methods on-line or off-line backup recovery processes. It is important to leverage the infrastructure technology while maintaining availability and flexibility to the system. In reality, most IT infrastructure designers are still expecting some issues that need to be resolved using storage networking utilities which include virtualization, discovery, and the type of data being generated. Another priority is ensuring that the data storage is stable in a heterogeneous environment. Therefore, it requires much closer multivendor cooperating. Make sure vendors are sufficiently motivated to take the standards-based technology seriously and move forward with a broadly compatible solution.

Virtualization in many ways uses a mainframe approach where one server does multiple separate operating system platforms within a single hardware system. This project probably has the same inherent limitation of getting at accurate information regarding system equipment and the networks in IT organization. Analyzing data is important in terms of understanding how much the IT is actually costing the institution. It seems that in defining service standards and the services costs of running a network it is important to define a reliable network with adequate throughput and response time, and determine how secure network in relation to a reasonable cost of security is.

CONCLUSION

Data centers operate as an IT process, evolving from transactions to interactions. Building on disruptive technology within large and small-midsized companies to tolerated data centers can be problematic. This project paper has reviewed methods of reviewing the current costs of capital items, the savings costs, the labor costs. It has also covered benefits from improvements in equipment, including servers for the data center. The purchases of new hardware/software upgrades, the maintenance of reduction, power/cooling costs, and the expansion reliability of components can all be addressed in some ways using virtualization. With a higher level of virtualization techniques to help the business network to ensure their applications are dynamically supported throughout networks, one can move to better security within the components that are involved within a data center (25).

This project paper also includes the most important aspects of deploying a data center, the roles. Responsibility have mapped out, including the implications for their own activities. It is important to decide whether to take a proactive response, or a passive approach that just meets legal requirements. This project also explored the services oriented architectures that provide flexible and agile information technology systems that are being offered by these technologies. These technologies enabling cost effective management, predictable behavior and the improvement of data systems. These factors and technologies include: location, power, cooling, cabling, virtualization, and storage solution. The location is one of the most important aspects of a data center and future data center deployment needs to make sure that it is keeping data safe and confidential to standards within a possible location.

The power sources are one of the main concerns in data center, the power grid can be important by providing the proper power, the heat range, fighting temperature shifts. The power grid has the transmission system vulnerability in the systems that bring electricity to a data center. Today, data centers developers would have reservations about developing new data center assets in isolated areas with relatively limited electricity transmission resources. This paper covered a variety of cooling strategies for data centers and explored ways to reduce the impact on power grid. Once cooling and power system have completed, the data center must be wired to allow communication between all the devices. One of the most important aspects in data center is cable selection. As many know, it is easier to lay cable during initial data center construction than to wait till later.

Server virtualization is where cost saving will be seen the most. One physical server can now handle multiple customers while providing high availability. Disaster recovery also can be handled easier and more efficiently with virtualization products such as VFrame (3).

To conclude the project task plan, system architects need to consider virtualization by building data centers around this concept. That can lead to availability, and the efficiencies that will lower costs of design. The VFrame Server for virtualization is a great solution that is used to build this type of project network platform, and permit sharing of all resources. VFrame has concluded that for the most important aspects of deploying data design still includes dynamic scalability, improved security, control, and server virtualization with data collaborated across the IT organization.

Storage is setup right after all of the servers are installed. This part is very important as applications are dynamic and require various storage limits. Following standards is also very important when developing a large scale IT solution such as, a data center. After the data center has deployed it is very important to hire the proper staff to monitor and maintain all of the systems.

As data center equipment and operations moves toward greater efficiency, cost can be effectively maintained. It will be challenging, but in reliability is achievable and identifying areas of uncertainly leads to increased information associated with the data about these systems that can be use confidently to make decisions.

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