CSE575 Summer Internship Report

Student name: Jeong Eungyo (004466292)

Field Supervisor: David Turner

Faculty Supervisor: Ken Han

PROJECT TITLE: Migrating Server room

Hours worked

7.13.17 – 8.31.17

Mon – Thurs, 1pm - 5pm

Stage of the process

Week 1-2	Draw a Diagram of the Current Server.
Week 3-4	Plan a migrate server's vlan.
Week 5	Ready to migrate server.
Week 6-7	Connect the cables.
Week 8	Check all servers are running.

OBJECTIVES

This project will migrate servers in College of Art and Letters server room to ITS Data Center. There is one server rack in the college of art and letters which have 17 different physical servers and they wanted to migrate 8 of them. I need to prepare a plan for moving ESXi server, vCenter server, RAID Storages and switches which are all connected to VLAN.

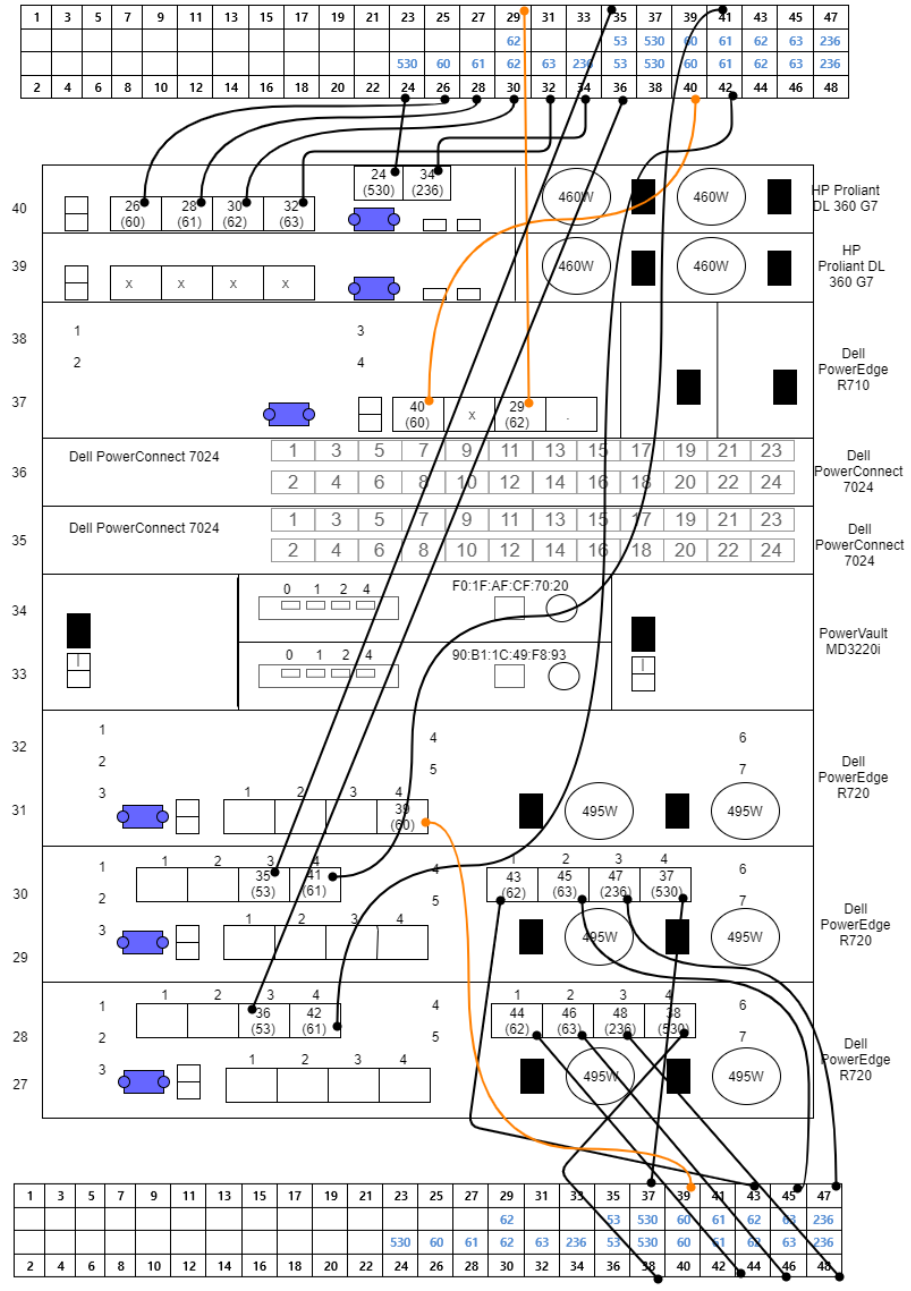
What I have studied and researched during this project are VLAN, Servers, Raid systems, Hardware and so on. Since I wanted to learn more details about servers, not only physically moving them.

PROCEDURE

Step1: Draw a Diagram of the Current Server.

It shows where the cables are connected from vlan and I also draw cables for inner connections between the switches and other servers.

Old VLAN



Text

Server

iSCSI SAN

iSCSI, which stands for Internet Small Computer System Interface, works on top of the Transport Control Protocol(TCP) and allows the SCSI command to be sent end-to-end over LANs, WANs or Internet.

iSCSI works by transporting block-level data between an **iSCSI initiator on a server** and an **iSCSI target on a storage device**. The iSCSI protocol encapsulates SCSI commands and assembles the data in packets for the TCP/IP layer. Packets are sent over the network using a point-to-point connection. Upon arrival, the iSCSI protocol disassembles the packets, separating the SCSI commands so the operating system will see the storage as a local SCSI device that can be formatted as usual.

Today, some of iSCSI's popularity in businesses have to do with the way **server virtualization** makes use of **storage pools**. In a virtualized environment, the storage pool is **accessible to all the hosts** within the cluster and the cluster nodes that communicate with the storage pool over the network through the use of the iSCSI protocol.

An iSCSI initiator is a piece of software or hardware that is installed in a server to send data to and from an iSCSI-based storage array or iSCSI target.

Redundancy

There are two switches and three Dell PowerEdge R720 Server. The reason of existence of the two switches is because when one switch crashes, still available to use the other switch. One of the three server has installed vCenter and the other two has installed ESXi servers. Also same with the switches, there are two ESXi servers for redundant prepare for the emergency.

PowerVault MD3220i (rack 34 to 33)

*The front side of MD 3220i looks like this.

24-2.5” SFF SAS drives

– – –

2U

– – –

RAID Capacity Calculate

Number of disks: 24

Single disk size, GB: 900

RAID Type: RAID 5 (Parity)

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Capacity: 20700 GB

Speed gain: 23 x read speed, no write speed gain

Fault tolerance: 1-drive failure

Hard Drives

The MD 3220i support SAS hot-pluggable **HDDs (hard-disk drives)** and SSD (solid-state drives). It allows for 2.5-inch from factor drives. We are using HDDs but It is not a hot-pluggable HDDs in our case, so you cannot replace it while the server is running.

In our case, we are using Dell 900GB 10K SAS 2.5” Hard Drive. Each of the single hard drive is **2.5 inches** and 2.5” SAS supports HHDs up to 6Gb/s. The **10K** stands for **speed (rpm, revolutions per minute)** and 900GB for **capacity**(**GB**). We have 24 of them and it is using **2U** of the server rack.

Storage Capacity

MD 3220 I systems is capable of supporting up to **96 total hard drives**. Users can mix and match the other products in any combination provides them the best mix of drives for their environment as long as they don’t exceed a total of 96 drive slots.

Dell PowerEdge R720(32-27)

_ _ _ 8-3.5” SAS drives

2U 

_ _ _

RAID Capacity Calculate

Number of Disks: 8		Capacity: 4200 GB
Single disk size, GB: 600	→	Speed gain: 7 x read speed, no write speed gain
RAID Type: RAID 5 (Parity)		Fault tolerance: 1-drive failure

**In our case, we are using only 4 of the disks, so re-calculate it and we can see it is not exactly half of the capacity compare to 8 disks. It seems because usually hard drive is not using 100 % of the space, but almost 80%.

RAID Capacity Calculate

Number of Disks: 4		Capacity: 1800 GB
Single disk size, GB: 600	→	Speed gain: 3 x read speed, no write speed gain
RAID Type: RAID 5 (Parity)		Fault tolerance: 1-drive failure

Features

Form Factor	2U rack
Hard Drives	3.5” 600GB SAS (15K, 15000 RPM)

ESXi

There are total three servers of PowerEdge R720. The first one is vCenter and the rest two of them are ESXi server.

In the PowerEdge R720, **VMware ESXi 5.5.0** is installed.

It’s using Intell® Xeon® CPU E5-2620 0 @ 2.00GHz and 32 GiB Memory.

The static IP: **192.168.0.3** (rack 30-29), **192.168.0.4** (rack 32-31)

Hard Drive

A hard disk drive (HDD), hard disk, hard drive or fixed disk is a data storage device that uses magnetic storage to store and retrieve digital information using one or more rigid rapidly rotating disks (platters) coated with magnetic material.

1. Actuator that moves the read-write arm. In older hard drives, the actuators were stepper motors. In most modern hard drives, **voice coils** are used instead. As their name suggests, these are simple electromagnets, working rather like the moving coils that make sounds in loudspeakers. They position the read-write arm more quickly, precisely, and reliably than stepper motors and are less sensitive to problems such as temperature variations.
2. Read-write arm swings read-write head back and forth across platter.
3. Central spindle allows platter to rotate at high speed.
4. **Magnetic platter stores information in binary form**.
5. **Plug connections** link hard drive to circuit board in personal computer.
6. **Read-write head** is a tiny magnet on the end of the read-write arm.
7. Circuit board on underside controls the flow of data to and from the platter.
8. Flexible connector carries data from circuit board to read-write head and platter.
9. Small spindle allows read-write arm to swing across platter.

* Information you need to consider when you choose hard drive:

    Size, Capacity, Connecter(SATA), RPM, etc.

SATA (Serial ATA)

Serial ATA (Serial AT Attatchment) is a computer bus interface that connect host bus adapters to mass storage devices such as **hard disk drives**, optical drives and solid-state drives.

The previous version was **Parallel ATA (PATA)** standard, Serial ATA offering several advantages over the older interface: reduced cable size and cost, native hot swapping, faster data transfer through higher signaling rates, and more efficient transfer through an I/O queuing protocol.

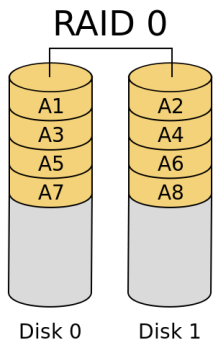
RAID

RAID (redundant array of independent disks) is a data storage virtualization technology that combines multiple physical disk drive components into a single logical unit for the purposes of data redundancy, performance improvement, or both.

In computer storage, the standard RAID levels comprise a basic set of RAID configurations that employ the techniques of **striping**, **mirroring**, or **parity** to create large reliable data stores from multiple general-purpose computer hard disk drives (HDDs).

RAID Level

RAID 0



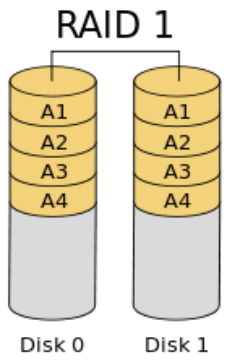
RAID 0 known as a **stripe**, splits data evenly across two or more disks, without parity information, redundancy, or fault tolerance.

The **failure** of one drive will cause the entire array to fail, as a result of having data striped across all disks, the failure will result in total data loss. It is normally used to increase **performance**.

A RAID 0 setup can be created with disks of differing sizes, but the storage space added to the array by each disk is limited to the size of the **smallest disk**. For example, if a 120 GB disk is striped together with a 320 GB disk, the size of the array will be 120 GB x 2 = 240 GB.

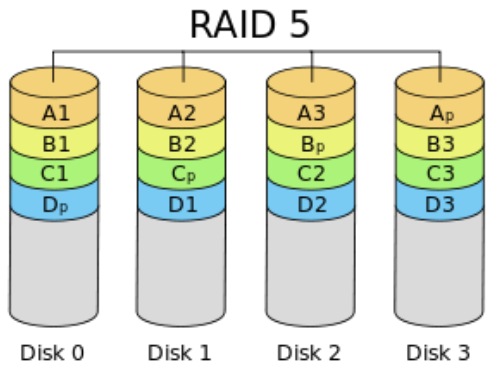
The diagram shows how the data is distributed into Ax stripes on two disks, with A1:A2 as the first stripe, A3:A4 as the second one, A5:A6, A7:A8, etc.

RAID 1



RAID 1 consists of an exact **copy** (or **mirror**) of a set of data on two or more disks; a classic RAID 1 mirrored pair contains **two disks**. The configuration offers no parity, striping, or spanning of disk space across multiple disks, since the data is mirrored on all disks belonging to the array, and the array can only be as big as the smallest member disk. This layout is useful when **read** performance or **reliability** is more important than write performance or the resulting data storage capacity.

RAID 5



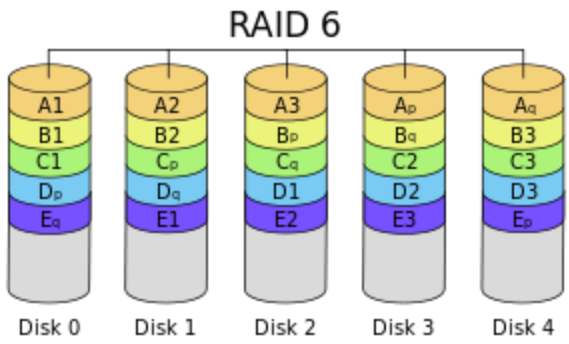
RAID 5 consists of **block-level striping** with distributed parity. **Parity** information is distributed among the drives. It requires that all drives but one be present to operate.

Upon failure of a single drive, subsequent reads can be calculated from the distributed parity such that **no data is lost**.

RAID 5 requires at least **three disks**.

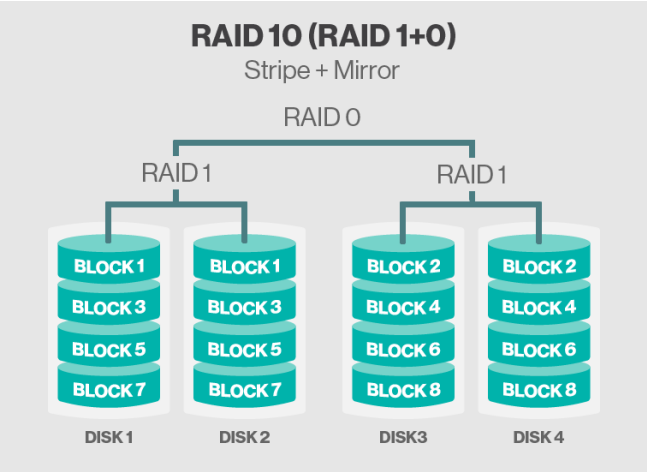
Diagram of a RAID 5 setup with distributed parity with each color representing the group of blocks in the respective parity block (a stripe).

RAID 6



RAID 6 extends RAID 5 by **adding another parity block**; thus, it uses **block-level striping** with two parity blocks distributed across all member disks. Any form of RAID that can continue to execute read and write requests to all of a RAID array's virtual disks in the presence of any two concurrent disk failures.

RAID 10

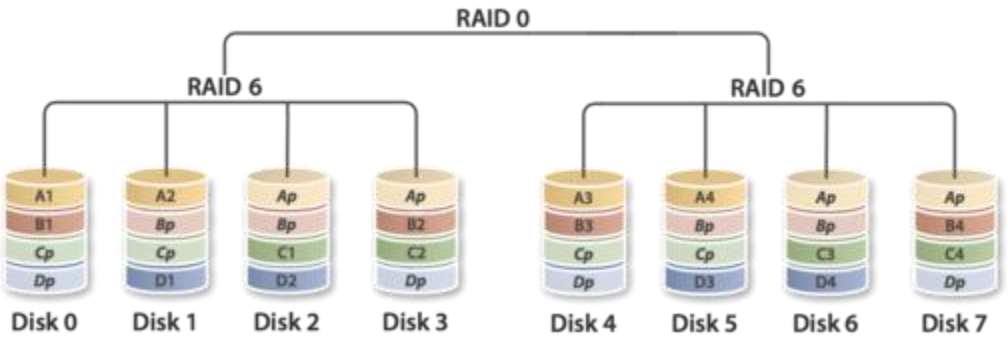


RAID 10, also known as RAID 1+0, combines disk mirroring and disk striping to protect data.

A RAID 10 configuration requires a **minimum of four disks**, and **stripes** data across **mirrored** pairs. As long as one disk in each mirrored pair is functional, data can be retrieved. If two disks in the same mirrored pair fail, all data will be lost because there is no parity in the striped sets.

RAID 10 provides **redundancy** and **performance**, and is the best option for I/O-intensive applications. One disadvantage is that **only 50%** of the total raw capacity of the drives is usable due to mirroring.

RAID 60



RAID 60, also called RAID 6+0, combines the straight block-level striping of RAID 0 with the distributed double parity of RAID 6, resulting in a RAID 0 array **striped** across RAID 6 elements. It requires **at least eight disks**.

KVM Switch

A KVM Switch (with KVM being an abbreviation for "**keyboard**, **video** and **mouse**") is a hardware device that allows a user to **control multiple computers** from one or more sets of keyboards, video monitors, and mice. Although multiple computers are connected to the KVM, typically a smaller number of computers can be controlled at any given time. Modern devices have also added the ability to share other peripherals like USB devices and audio.

It is important to simulate the keyboard and mouse signals to each PC and **not influence the CPU operations during switching**. Other important factors to consider when buying a KVM switch is the **stability of the monitor resolution** whether or not it supports multiple platforms, and the compatibility of operating systems with different branded keyboards and mice.

Every KVM Switch has a maximum number of PC connections. A single KVM switch can provide as few as two CPU ports, while a multiple KVM switch installation can offer more than 4000 CPU ports. As the number of connected PCs increase, the technology needs are higher (for example, signal identification) and the different ways of management increase (for example, remote control, multiple segmentation, high-level security, etc.) in order to meet the management demands of different environments.

To connect between KVM and a computer, you need an adapter which have USBs and a monitor cable. You can switch one to another by moving the adapters.

Step2: Plan a migrate server's vlan.

I tried to make the same ports numbers to stay together and sort the numbers from lower to high. That will make it easy to organize the cables neat.

Once all the preparations were done, they asked the system administrator from library to set the VLAN follows the plan below.

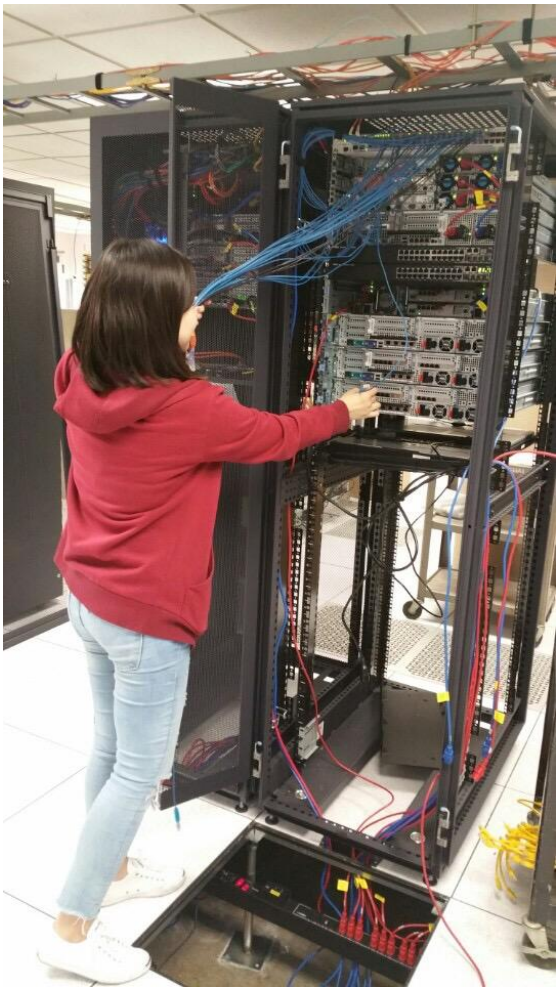
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47
.	.	.	.	52	53	53	60	60	61	61	62	62	62	63	63	63	236	236	236	530	530	530	562
.	.	.	.	53	53	59	60	60	61	61	62	62	62	63	63	68	236	236	520	530	530	560	559
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48

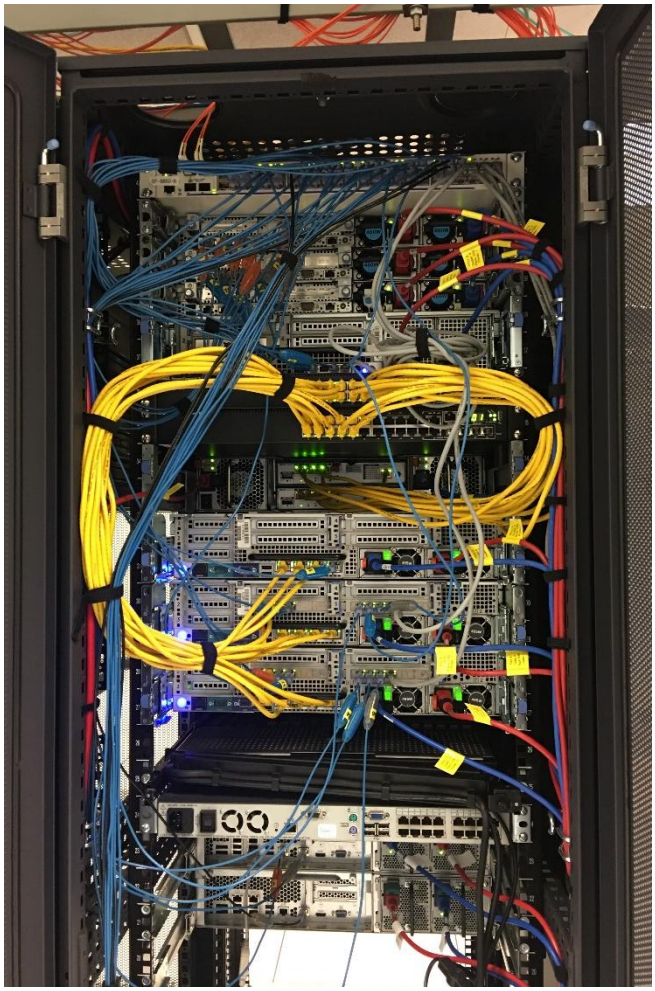
Step 3: Ready to migrate server.

You need to turn off the servers, unplug powers and take out the servers carefully. Servers needed to come together with rack rails to install in the rack. The servers are too heavy, so we rent a golf cart to move them.

Step 4: Connect the cables.

The cables needed to be connected exactly where they are, otherwise the servers will not work properly. Also the cables needed to be organized and put them to the side that can make air flow well.





Power Management

UPS - Uninterruptible Power Supply

UPS is an electrical apparatus that provides **emergency power** to a load when the input power source or mains power fails.

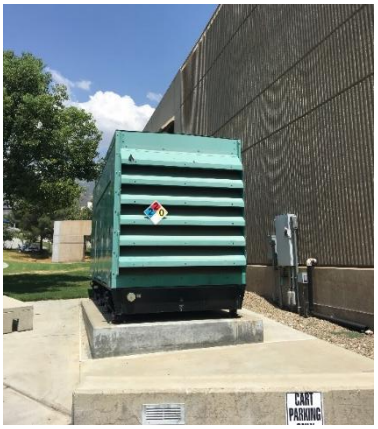
It will provide near-instantaneous protection from input power interruptions, by supplying energy stored in **batteries**.

The on-battery **runtime** of most ups is relatively short (only a few minutes) but sufficient to start a standby power source or properly shut down the protected equipment.

A UPS is typically used **to protect hardware** such as computers, data centers, telecommunication equipment or other electrical equipment where an unexpected power disruption could cause injuries, fatalities, serious business disruption or data loss.

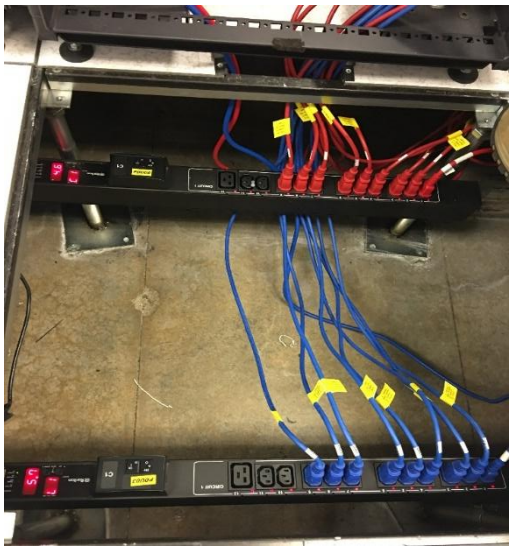
Emergency Power System

An emergency power system is an independent source of electrical power that supports important electrical systems **on loss of normal power supply**. A standby power system may include a standby generator, batteries and other apparatus. Emergency power systems are installed to protect life and property from the consequences of loss of primary electric power supply.



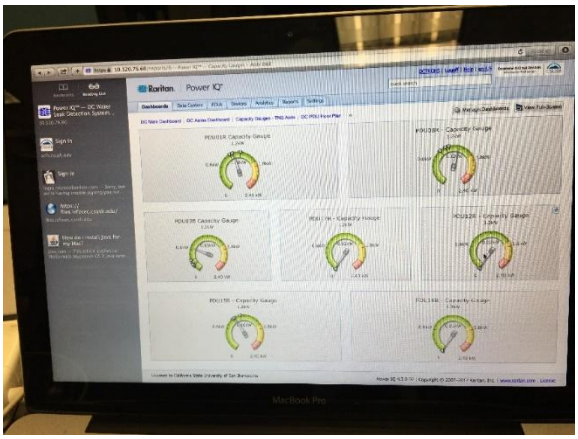
The power generator above in the picture is located beside of the John M. Pfau library for emergency power supply. When the main power is out, it will supply electricity to avoid loss.

Dual Power Supply



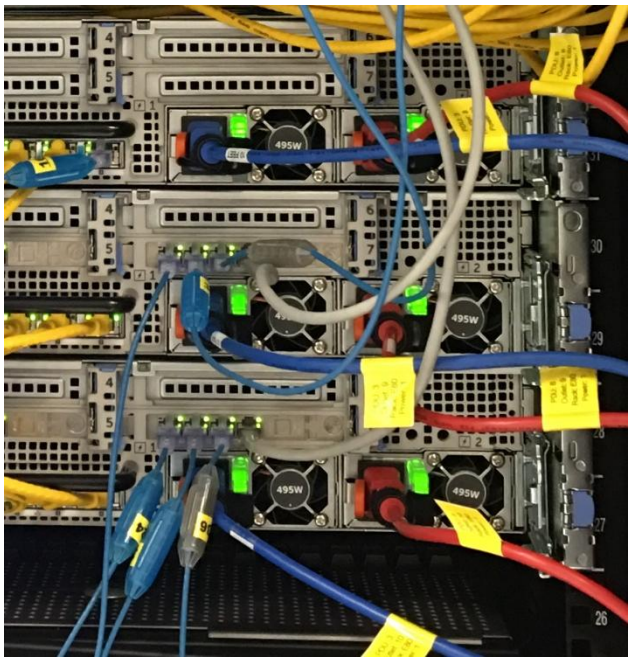
In the floor, you can take out the tiles using **floor puller** but you need to be careful since the edges of the tiles are sharp enough to cut the fingers.

When you take out the tiles, you can see **power outlet strip** with two colors, one with red and one with blue. Those are from different routes and one of the power go out, still you can get supply from the other side so make the power more redundancy.



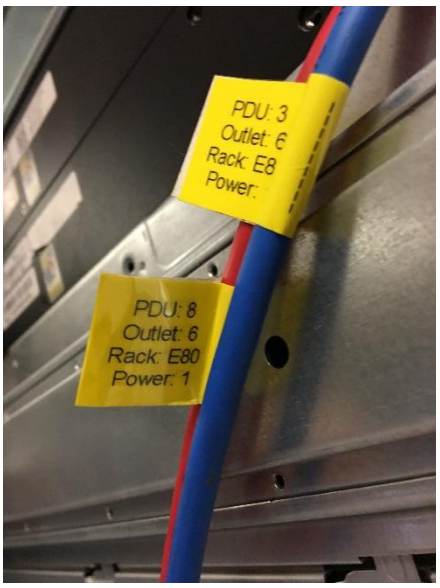
In server room, they use a program called Power IQ to manage the dual power supply. It shows present conditions of the electricity.

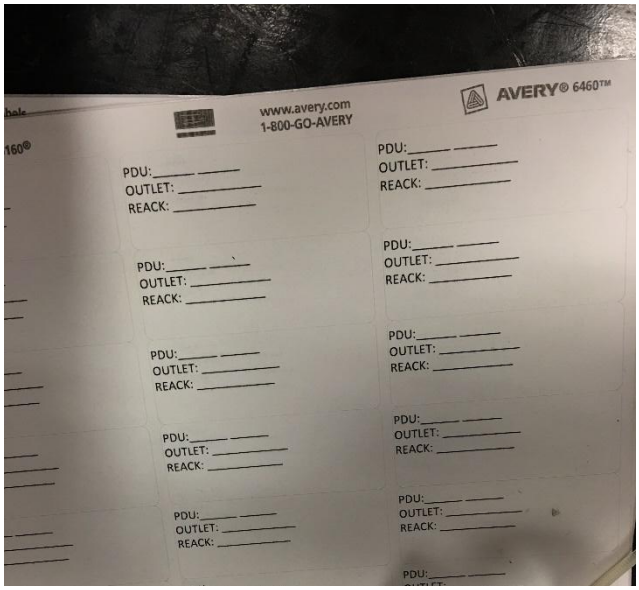
It helps them to check how much electricity was in used for each strip, so you can distribute the power more wisely and decide where to plug.



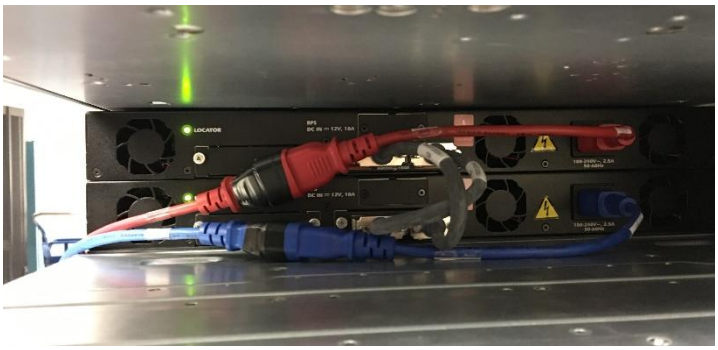
As you see, there are two sockets in each server to prepare for the emergency. Powers from different sources provides redundancy.

Cable Labeling and Ties





Without indicating label each cable, you will be lost. It is important to label each cable give some details where the power from, which sockets, and which racks, either keeping the documentation for later.

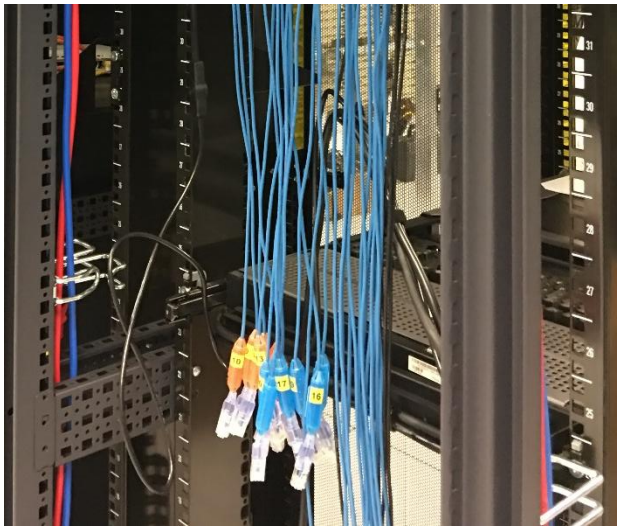


Tips for keeping the power safer is taping around the plugs to stick each other not to fall out accidently.

Another tip for holding the plugs from the server is using ties wrapping between the cable and the server.

For the **ethernet cables**, you want to know which ports the cables from. In this case, you can use the **capsule tags** to identify the port. It is a better choice than using tape since it doesn't affect by heat from the machine, so can be used longer.

Once you done with connecting the cables, you need to put the cables to a corner and fix it with ties not to interrupt the air flow of the machine.

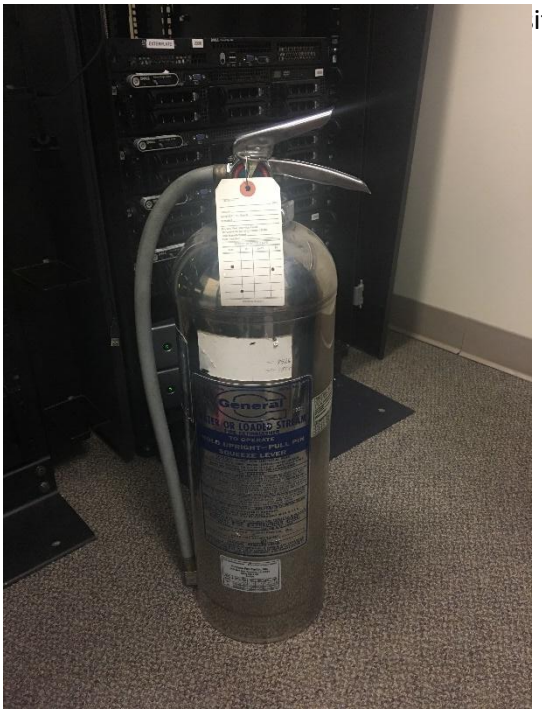


Air Conditioning Management

As with any type of electronic equipment, computer and networking devices are designed to operate within a fairly narrow temperature range. To ensure reliable operation and the longest possible life from components you need to ensure that the temperature stays within the acceptable range.

General recommendations suggest that you should not go below 50'F or above 82'F. This range should be considered as the extreme limits which may still reduce the life expectancy of the equipment. Keeping the ambient temperature **around 68- 71'F would be optimal** and would provide real benefits in terms of reliability and performance.

Fire Extinguisher

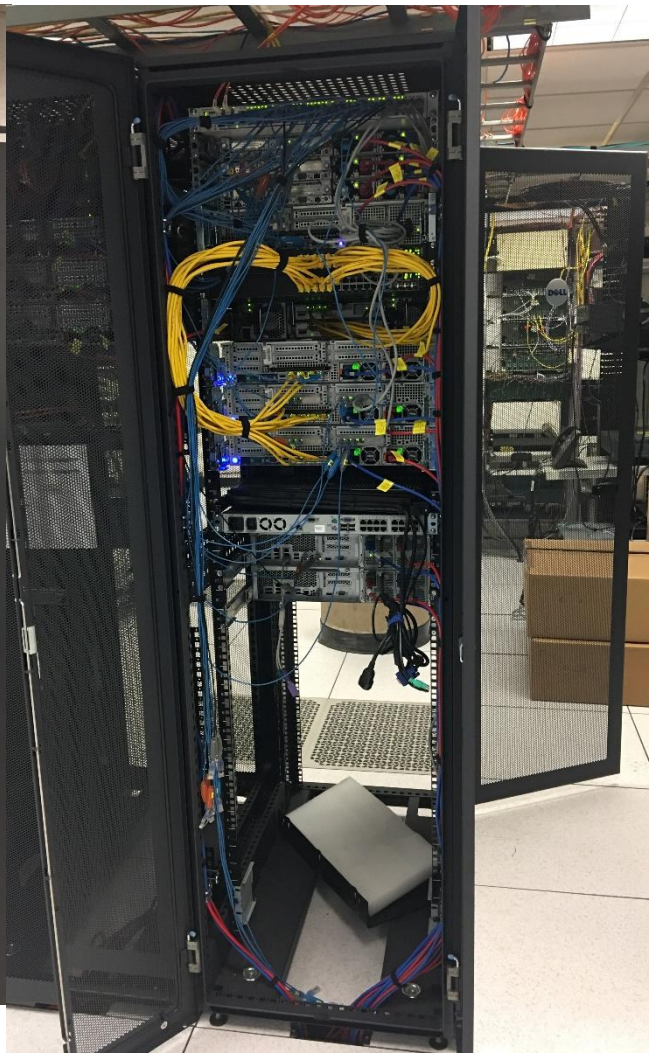


ified according to the type of fuel that is burning. If you use the wrong type of fire extinguisher on the wrong class of fire, you can make matters worse.

There are four different fire classifications, and Class C is for electrical, energized electrical equipment. Fire extinguishers with a Class C rating are suitable for fires in live electrical equipment. Both monoammonium phosphate and sodium bicarbonate are commonly used to fight this type of fire because of their nonconductive properties.

Step 5: Check all servers are running.

All the servers are running properly and organized.



CONCLUSION

Through the project, I learned how important providing an adequate environment for server room, and there are so many details that needed to be maintained, for example temperatures, power supplies, and solid inner structures, etc. In addition, I realized that documenting every single stuff is also important to keep the data safer because changes happen frequently. From this experience, I had a deeper understands of managing and keeping servers.