Servers

Agenda

- Understand the difference between servers and workstations

- Discuss the common IT issues surrounding servers, including server virtualization

- Outlay the various types of servers and operating systems

IST346: Info Tech Management & Administration

Servers vs. Workstations

IST346: Info Tech Management & Administration

What is a Server?

- A **server** is a computer that supplies **services** to users via other computers, called **clients**. The clients are usually **workstations** (but not always).

- A **service** is the function of the server. **Services** are what differentiates a structured computing environment from bunch of standalone computers on a network.

- Popular services:
  - **Infrastructure**: DHCP, DNS, Authentication, LDAP
  - **User**: File Sharing, Printing, Web, Database, Email

How are they different?

A Workstation has...
- One "concurrent" user
- A broad range of roles
  - Email, Web, Word, etc...
- Hardware optimized for interactivity
- Reliability and uptime are lower priority

A Server has...
- Several "concurrent" users
- A narrow range of roles
  - "File" server / "web" server
- Hardware optimized for background processing
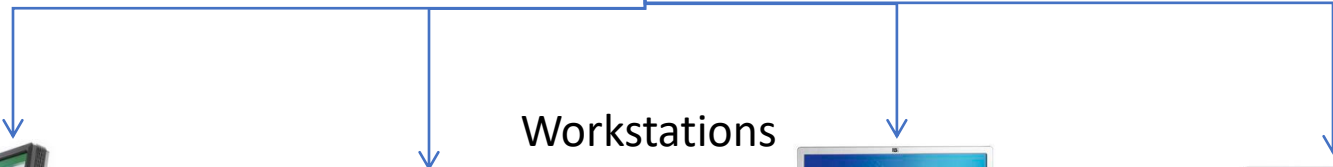- Reliability and update are high priority

What Makes a Server a Server?

- Server hardware:
  - Extensible/expandable
  - Increased performance (multiple cpus/cores)
  - High performance I/O (input/output)
  - High availability
  - Maintenance contracts
  - Management options

-

IST346: Info Tech Management & Administration

The Client-Server Model

filer.fauxco.com
192.168.1.10

Server

Workstations

ctl02.fauxco.com
192.168.1.202

ctl03.fauxco.com
192.168.1.203

ctl04.fauxco.com
192.168.1.204

ctl05.fauxco.com
192.168.1.205

IST346: Info Tech Management &
Administration

Servers and their role in IT

IST346: Info Tech Management & Administration

Servers:

- Service 100's if not 1,000's of users

- Require high reliability and security due to lengthy required uptimes for services.

- Are expected to last longer than workstations

- Cost much more than workstations

- Cost accounting for servers is spread over the users who use them, not responsibility of IT.

IST346: Info Tech Management & Administration

Servers:

- Have different OS configurations than workstations

- Are deployed in a data center

- Have disk backup systems

- Have maintenance contracts with the Vendor

IST346: Info Tech Management & Administration

Server-Class Hardware

- More internal space.
- More CPU/Memory.
  - More / high-end CPUs.
  - More / faster memory.
- High performance I/O.
  - PCIe/x vs. PCI
  - SCSI/FC vs. IDE/Sata
- Rack mounted (typically)
- Redundancy
  - RAID Storage arrays / Hot-swappable hardware.
- Highly Tested, Certified
- Management interfaces
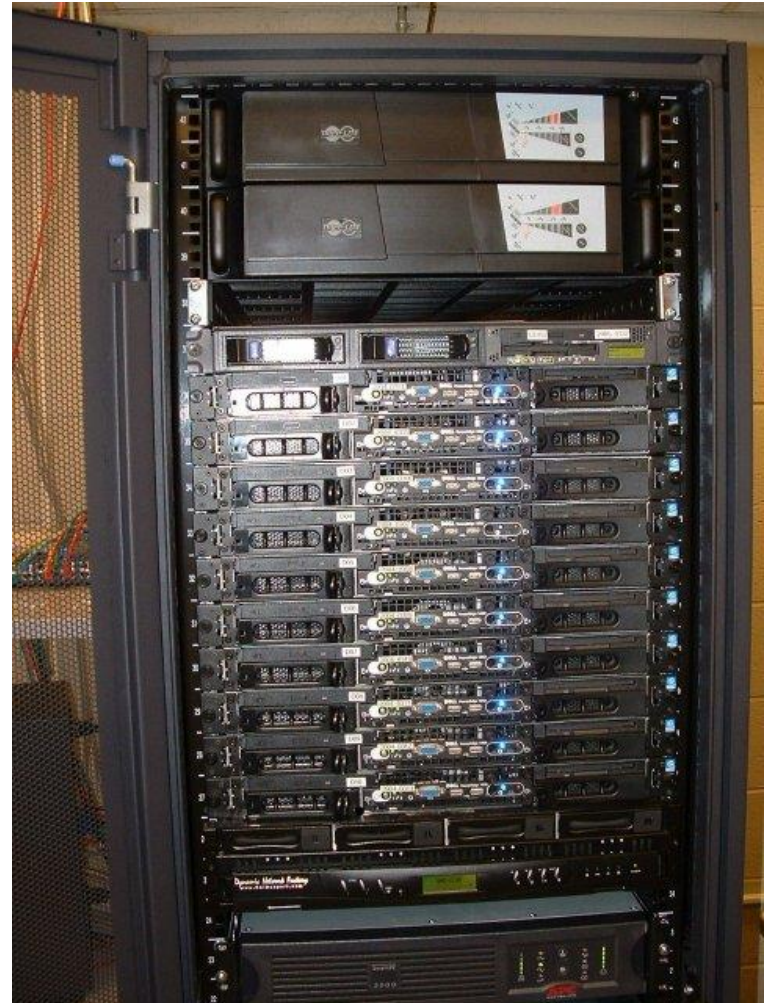
Servers belong in a server room!

- Servers should be kept in their own rooms: **data centers** special homes for servers

- They have:
  - Adequate power
  - UPS / Generators
  - Fire Suppression
  - Air Conditioning
  - Networking
  - Physical Security

Nobody likes to work in a data center

- They're cold, noisy and cramped.

- Efficient space for servers, no so much for people!

- Remote Administration is key
  - Access to system consoles remotely
    - SSH / VNC on Linux
    - Remote Desktop on Windows
  - Hard Boot (Power On/Off) servers can be problematic
  - Media insertion can be an issue, too.

Maintenance Contracts

- Let's face it, hardware fails.
  Longer running time ➜ Greater chance of failure

- Hardware on maintenance contracts will guarantee replacement parts and may even include a service dispatch technician (on site).

- Mission critical servers should have 2-4 hour response, on-site coverage. NBD, SBD, 9x5, 24x7,4 hours, 2 hours.

- 2 Hour response means vendor will respond within 2 hours.

- Having spare parts on hand, "on the shelf" is a common practice.

- Service contracts can be purchased from the hardware vendor, but also from 3rd parties.

What is most likely to fail on a server?

- Anything with "moving parts"
- #1 – Disk Drive (lots of moving parts)
  - Redundant Disks RAID 1, 5, 6 are common
  - Server keeps working despite disk failure
  - Most servers have hot-plug in / hot-spare technology
  - Good idea to keep a spare disk on the shelf "OTS."
  - The more disks in your RAID, the better the performance.
- #2 – Power supply (fans, power surges)
  - Redundant power supplies means server can continue to operate if one PS fails.
  - Most Servers have hot plug-in technology for PS
  - Redundant PS's should have separate power cords on separate power sources.
- #3 – Network Interface Card (NIC)
  - Redundant NIC's with automatic failover are common.

IT 488 Information Technology Management & Administration

Virtualization of Servers

- Problem with physical server hardware is:
  - Management, the more servers you have, the harder they are to manage.
  - It can be grossly under-utilized in CPU, Memory or Storage for a given service
  - When it goes over resource capacity, you need to buy new hardware or upgrade.
  - Space, physical servers require more space in your data centers.
- Organizations have been turning to virtual server infrastructure to address these limitations.
  - Capacity can be scaled up or down based on the needs of the service at the times they are required
  - Maximizes the investment in hardware – get the most bang for your buck.
  - Makes it easer to power on/off servers and deal with media insertion issues.
  - Virtualized servers have the same hardware configuration

SU virtual server infrastructure

IST346: Info Tech Management & Administration
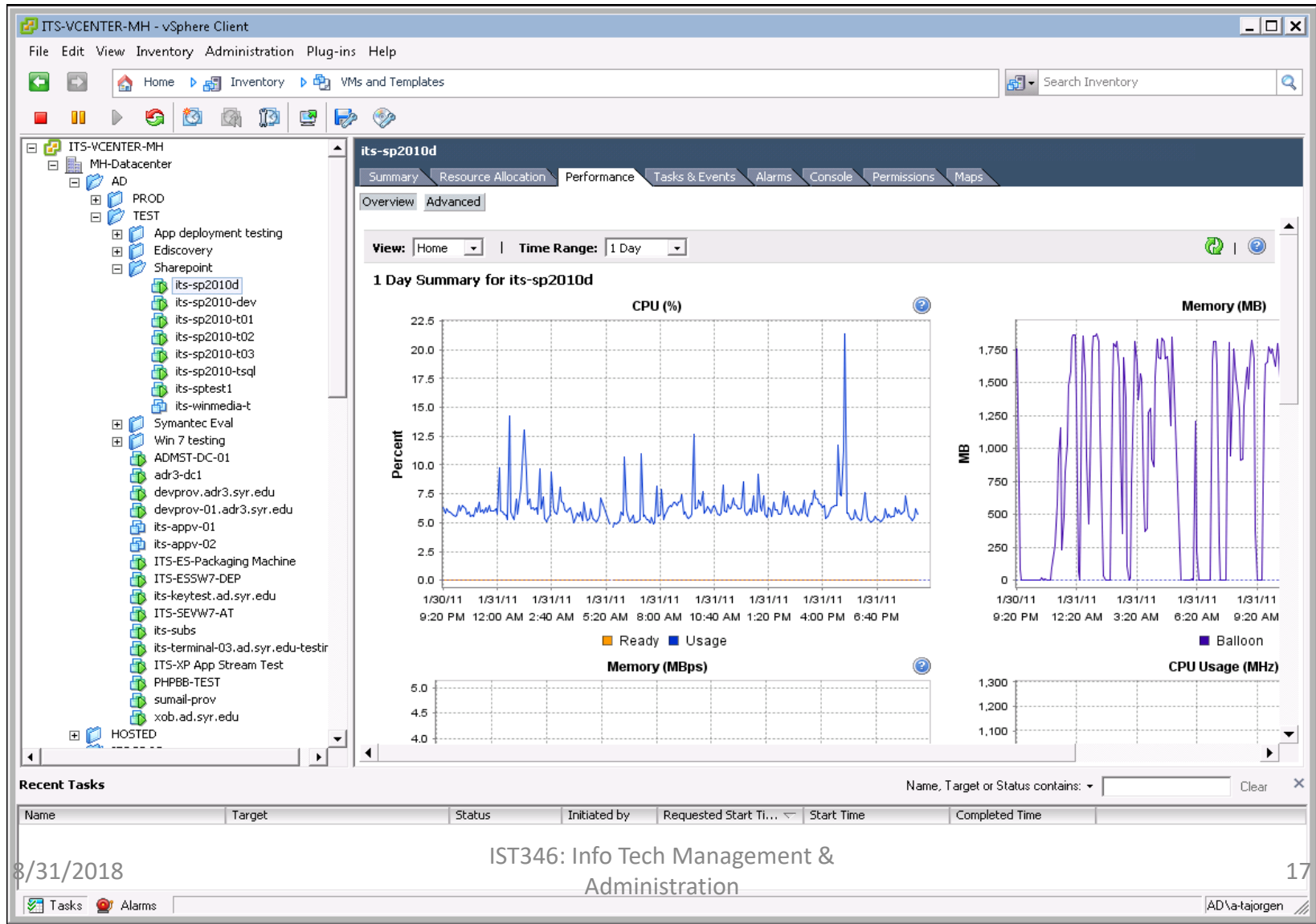
Types of Servers: Hardware Options Operating Systems

IST346: Info Tech Management & Administration

Rack Mountable Servers

- Server hardware in configured in to fit in a Rack chassis.

- Measured in Rack Units (U's)

- Servers Accessible via Front/Back

- Server can be maintained, repaired and upgraded while in the rack.

IST346: Info Tech Management & Administration

Server Appliances

- A server appliance is dedicated hardware and software

- The appliance fits a specific role: File Server, Web server, Load Balancer, Firewall, Router, etc.

- You can use a OTS server to perform these tasks, so why buy?

- Advantages:
  - Easy to setup, Reliable, Performance

- Disadvantages
  - Cost, Integration

Blade Servers

- Very high density: They offer the maximum horsepower for the allotted space.

- Pros:
  - Flexible
  - High-Performance
  - Can Grow with your needs

- Cons:
  - Expensive
  - High power / cooling demands
  - Vendor Lock-in
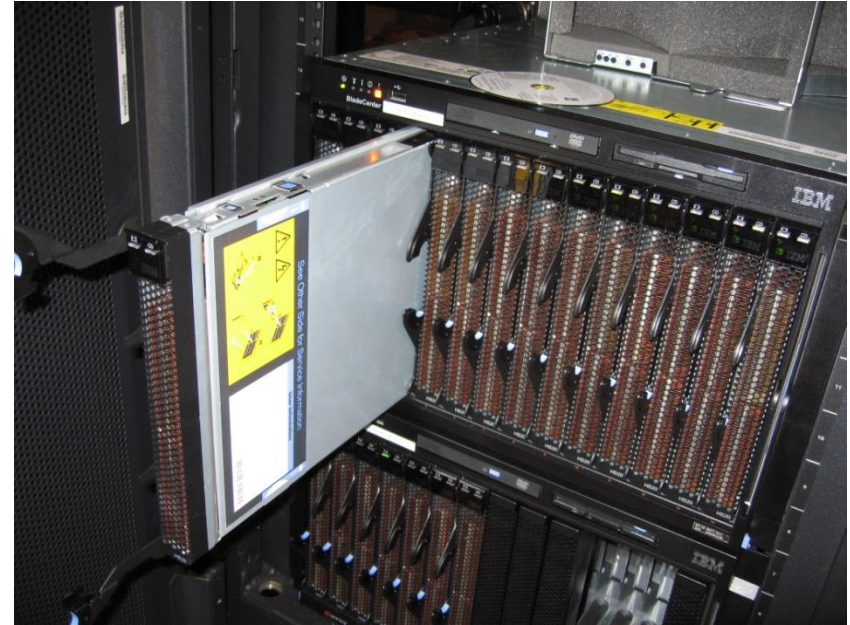
Server Operating Systems

- Unix-Like:
  - Ubuntu, Red Hat Enterprise, Sun Solaris, IBM AIX

- Windows
  - Windows Server 2003 / 2008 Standard, Enterprise, and Datacenter editions.

- Embedded Operating Systems in appliances
  - Used in appliances: Routers, Firewalls, Load Balancers, Video streaming, etc.
  - Linux, FreeBSD, Windows

- It should be noted that each operating system specializes at different services, and no one OS is good at everything.

IST346: Info Tech Management & Administration

Data Centers

IST346: Info Tech Management & Administration

Data Centers

- What is a datacenter?
  - A data center is a place where you keep machines that are a shared resource"
  - A.K.A
    - Server room
    - Machine room
    - Server closet (hopefully not literally a "closet")

IST346: Info Tech Management & Administration

Data Centers - Options

Build

- $100 - $400 per square foot to build

Rent

- This is known as a "co-location Facility"
- IaaS
- Paas

you don't care about the **physical servers,** just the **services** running on them. Everything you do is for the **services**.

Data Center- Major Components

What makes a data center more than just a closet with a bunch of servers?

1. Location
2. Access
3. Security
4. Power, Cooling, Humidity
5. Fire Suppression
6. Racks
7. Cable Management
8. Communications
9. Console Access
10. Workbench
11. Tools, parts, etc

Location

- Talking geography and on site.
  - If your area is susceptible to flooding, don't put your data center in the basement.
- "One company I've read about has two data centers, one in Florida and one in Colorado. They change primary data centers every 6 months."
- Why?
- Florida → hurricanes
- Colorado →snow storms.

Access

- What type of access is required?
  - Wheelchair, ramps, loading docks to unload equipment?
- Some equipment is wider than the average sized door. Need double-doors.
- Restrict access to people who don't need it.

IST346: Info Tech Management & Administration

Security

- What type of security do you require?
  - Numeric key pads – bad idea. Anyone can share the code. No way of knowing who came in.
  - Keys, - better, at least you know who you gave the key to originally
  - Card swipes – even better, logs entry information and controls access
  - Proximity detectors – better still, same advantages as card swipes but more convenient
  - Biometrics – almost there. Thumb print reader or voice recognition. Disadvantages ?
  - Two Factor, -best, something you have and something you know. A numeric keypad that requires both a static or non-changing code and a one-time-password security token.

IST346: Info Tech Management & Administration

Cooling

- For every watt of power used in the data center, you need to plan for the same amount of power to *cool your equipment*.

- Direct your cool air where you need it

- New types of cooling concepts, "cool the servers, not the entire room" (SU Green DC)

- Rear door heat exchangers. Cools only the servers and not surrounding room air. Most efficient.

IST346: Info Tech Management & Administration

Large Data Center Air Conditioner and Rear Door Heat Exchanger

IST346: Info Tech Management & Administration

Hot and Cold Isles and Humidity

- Cold air goes in front of rack, heated by server, exited out back.

- Arrange your data center so the backs of the racks are towards each other. This forms hot and cold isles.

- Easier to collect the hot air. Heat rises.

- Keep server room humidity between 45% - 55%. Too low, static, too high, condensation.

IST346: Info Tech Management & Administration
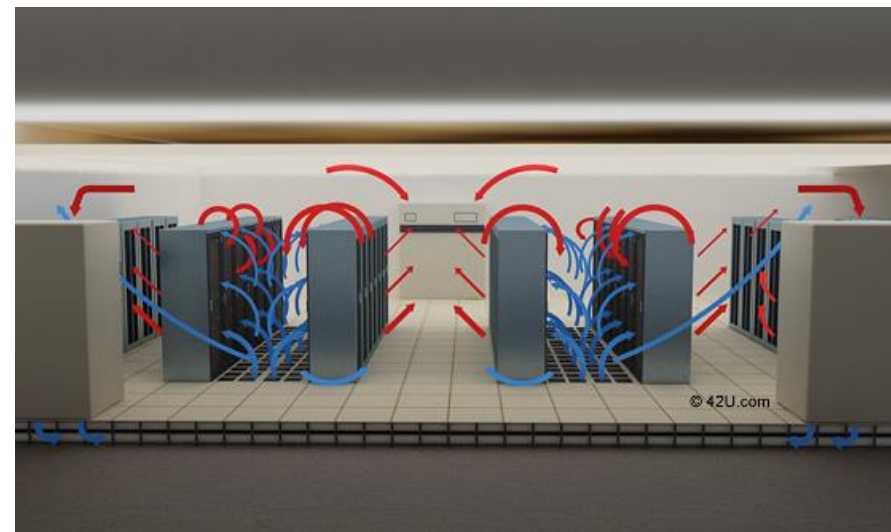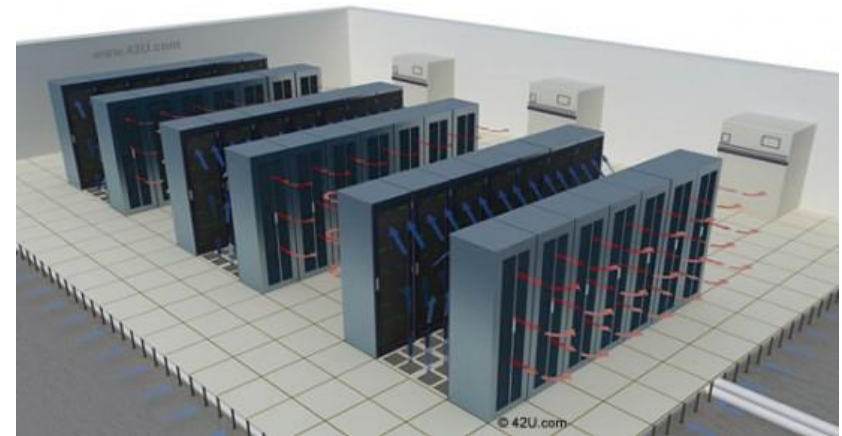
Power

- Multiple sources of electricity.
  - Multiple feeds from multiple substations.
  - Generator, not only for emergencies but also for normal operations.
  - What type of power does it produce, do you need? 110V, 220V, 480V?
  - Discussion is driven by what type of power your servers require. Not all servers require 110V "standard line power".
  - Can you use DC power? 240 Volts? More efficient than 110V. Save up to 4% in electric usage.
  - Be "Green" in your data center. Where does your electricity come from?

Power

▶ Do you have a Uninterruptable power supply (UPS)? How big?

▶ How long does it need to last, 10 minutes, 1 hour, 4 hours?

▶ Varies depending if you have a generator or not.

▶ Do you have automatic transfer switches, (ATS)?

> ▶ Switches that 'sense' if line power or in Syracuse, National Grid power if present, and if not, automatically starts generator and transfers load. When line power returns, shuts off generator and returns load to line power.

IST346: Info Tech Management & Administration

Power Distribution Unit (PDU)

- Looks like a power strip, much more.

- Can be horizontally or virtually mounted

- Monitor, record, and control each outlet remotely via network.

- Should have two per server, one connected to line power and one connected to UPS / Generator power

- A PDU is not a UPS. They're **different.**

IST346: Info Tech Management & Administration

Monitor your Power
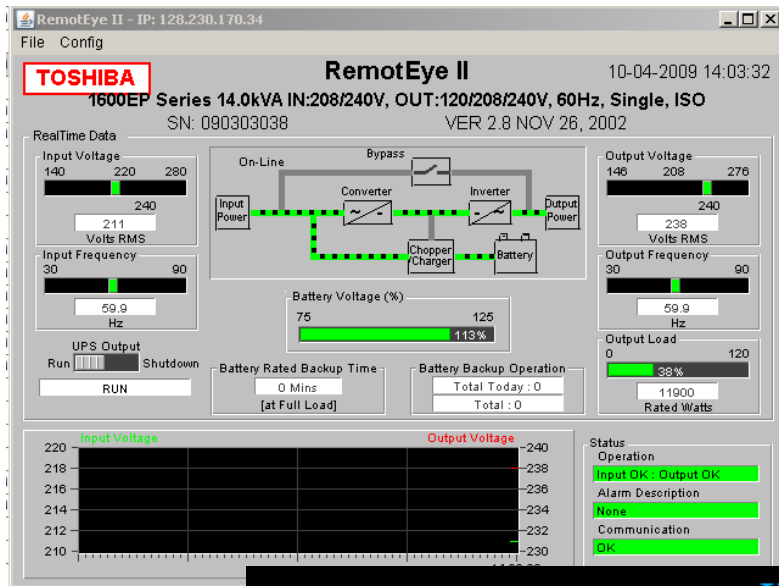
Comprehensive View

UPS Mode	On-Line
Input Voltage (V)	211
Output Voltage (V)	238
Output Load (%)	38
Input Frequency (Hz)	59.9
Output Frequency (Hz)	59.9
Date On RemotEye II (mm/dd/yyyy)	10/04/2009
Time On RemotEye II (hh:mm:ss)	14:04:03

UPS History Log Data

Log Date (mm/dd/yyyy)	Log Time (hh:mm:ss)	Input Voltage (V)	Input Frequency (Hz)	Output Voltage (V)	Load Percentage (%)	Battery Voltage (Vdc)	Ouput Status
10/04/2009	14:00:00	214	59.9	238	38	0	normal
10/04/2009	14:00:30	211	59.9	238	38	0	normal
10/04/2009	14:01:00	211	59.9	238	38	0	normal
10/04/2009	14:01:30	211	59.9	238	38	0	normal
10/04/2009	14:02:00	211	59.9	238	38	0	normal
10/04/2009	14:02:30	211	59.9	238	38	0	normal
10/04/2009	14:03:00	211	59.9	238	38	0	normal
10/04/2009	14:03:30	211	59.9	238	38	0	normal
10/04/2009	14:04:00	211	59.9	238	38	0	normal
10/04/2009	14:04:30	211	59.9	238	38	0	normal
10/04/2009	14:05:00	211	59.9	238	38	0	normal

IST346: Info Tech Management & Administration

Fire Suppression

- Require Fire suppression methods; required by law /code

- Conventional (Water and Sprinklers) = Bad

- Many other methods
  - CO_2 & Halon, good for servers, bad for people
  - Conventional extinguishers
  - Consult local fire authorities

- Cost plays a large factor.

IST346: Info Tech Management & Administration
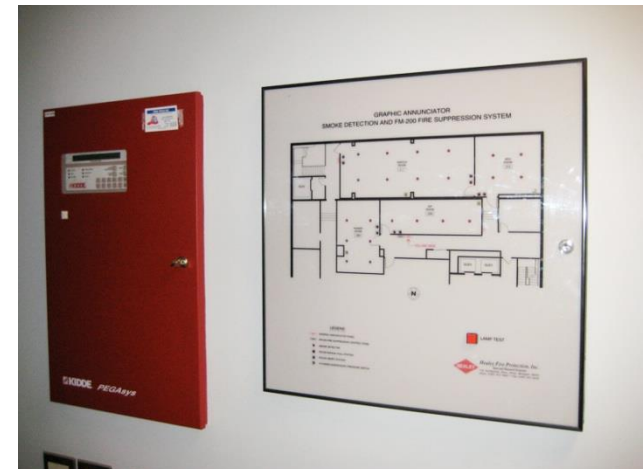
Racks

- The 'spine' of the data center

- Dictate other components
  - Wiring, cooling, power, etc
  - Not inexpensive, up to $10,000 per rack with required products (power, cooling, networking, etc)

- Standard 19" wide, width of standard mountable equipment. 19" between posts.

- Some telecomm equipment is wider. Special order

- May purchase racks wider and deeper than your needs as to leave room for networking, power, cooling, etc.

- 2 or 4 posts
  - 4 is better but more expensive.

- Rack equipment in U's or rack units,
  - 1.75 inches per "U"
  - Can use square nuts or screws to mount equipment

IST346: Info Tech Management & Administration

Rack Cooling

- Racks are typically open at the bottom to allow cool air to flow in.

- Heat rises exits out the back

- Not a location to run wires. Run cabling overhead with above-the-racks wire trays

- Keep doors and sides on if using raised floor, off it using standard air-conditioning

- Monitor temperature inside racks

- iSchool uses a device called "Weather Goose"

IST346: Info Tech Management & Administration
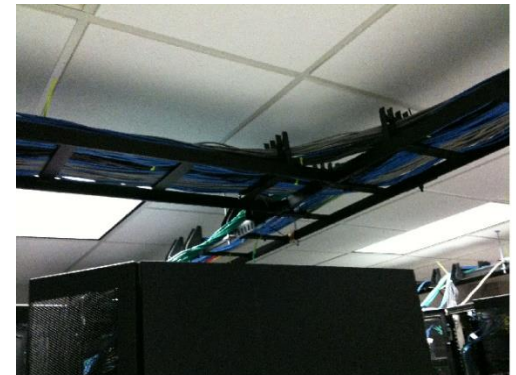
Racks Determine Cable Management

- A good cabling job is a pleasure to work with.

- Don't 'build-your-own' cables. Purchase cat6 (category 6) cables.

- Purchase special cable management products.

- Easily identify which cable connects to what.

- Color code or label your cables

- Separate power from network cables. Power down one side, network cables down the other

IST346: Info Tech Management & Administration
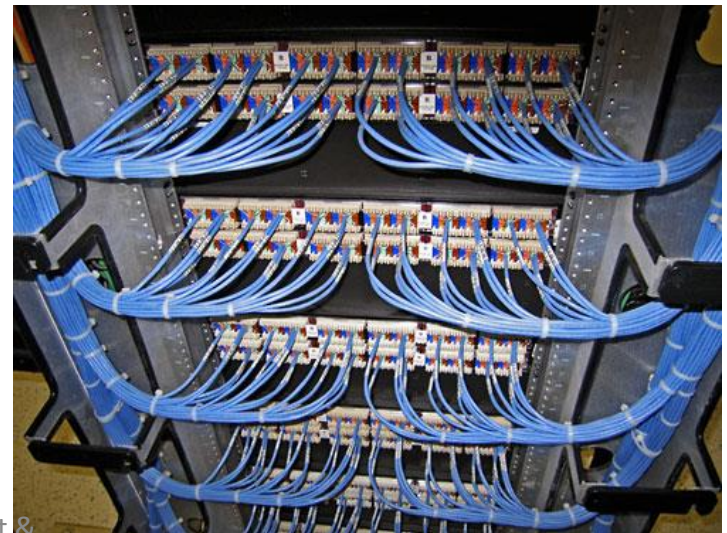
Cable Management Images

NP2K6BLACK   NP2K6BLUE   NP2K6GRAY   NP2K6GREEN   NP2K6RED

NP2K6YELLOW   NP2K6ORANGE   NP2K6WHITE   NP2K6PURPLE   NP2K6PINK

Come up with cabling Guidelines

For example:

- Blue / Green – production network
- Red / Orange – storage network (iSCSI)
- Yellow – KVM
- White – Private NAT

IST346: Info Tech Management & Administration

And why do we need cabling guidelines?

Bob, can you connect the email server to the new storage device, it's the yellow wire.

Communications

- Put a telephone in your server room incase you need to call someone in for assistance or be speaking with a vendor while standing in front of the server.

- "Bridge" the telephone line into a infrequently used circuit to save money.

- Don't rely on cell phones. Can be difficult to hear plus more interference in server room.

Console Access - KVM

- Discussed already

- In-band vs. out-of-band management

- KVM usage

- If no KVM or out-of-band management, consider using a 'crash cart' or setup cart.

  - Basically a vertical cart with a keyboard, mouse, and monitor used when 1st setting up servers or if they crash so bad you can't use other management techniques

IST346: Info Tech Management & Administration

Workbench, Tools, Parts

- Have a place where your staff can test out or 'burn in' a server before putting it into production.

- Place to troubleshoot failed servers

- Have extra patch cables, nuts, bolts, "spare parts" on hand.

IST346: Info Tech Management & Administration

Alternative data centers

- Sometimes you have to think "outside the box"...or in these cases, in a different box!

IST346: Info Tech Management & Administration

Summary

- Data center is much more than a standard room or closet.

- Many things make a server room unique.

- $100 / $400 or more per square foot to create a server room.

- Look for alternatives, outsource

- If you are going to build it, do it right the first time.