Data Center Management and Best Practices

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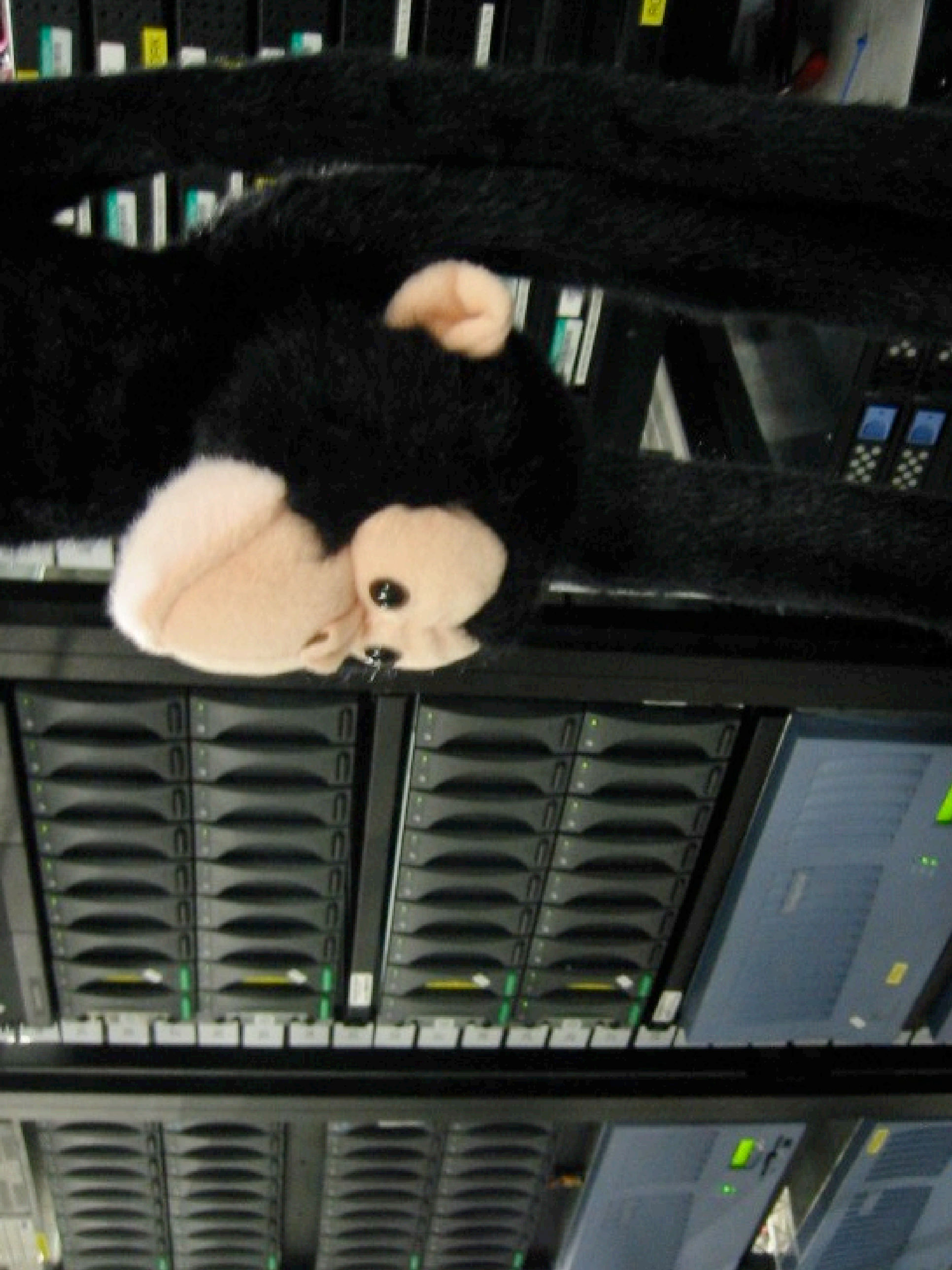


Assumptions and Premises

- Mostly talking about organizations with > 1 rack
- But the concepts are important to everyone
- It's never too early to start planning to scale up

Eight Commandments

- Nothing is temporary
- Things change
- Prepare for growth
- Label everything
- Follow your system
- Checklist!
- Assembly line-ize
- Thou Shalt Steal

Nothing is temporary

- Resist pressure to “Get It Working” as quickly as possible
  - “A stitch in time saves nine”
  - “Oh.. I’ll just fix it later”
  - "I'll make it messy so that I'll notice and fix it later" (Jason)

Things Change

- Environments aren't static
  - Some change more than others
    - Can't predict the future... but try anyway
- Starting off neat is easy
  - BUT keeping it that way is hard
- One vision helps

Prepare for Growth

- Always have spare servers
- Always have more (prepared) cabinet / rack space
- Always have more floor space / power (in contract)
- Tools, servers, cage space, cables, screws, tie wraps

Label Everything

- Servers, cables, network ports, racks, storage containers, patch panels, etc.
- Must be up to date, and follow a consistent format / naming scheme
- Label anything that's broken (e.g., flaky hard drives or memory)

Follow Your System

A system followed **inconsistently** is worse than no system

- Leads to big screw-ups
- So design the system so it's easy to follow

Checklist

- The only way to get it “right” every time.
- Very important with a team of people.
- Drudgery, but saves exponential future time
- First time a particular mistake is made, add it to the checklist

Assembly Line-ize

- Heny Ford was onto something. Really.
  - What: Cabinet setup, unpacking servers, cable labeling, hardware/software upgrades.
  - Create a prototype when necessary

Thou Shalt Steal

- Some of the best ideas come from other people's setups
- See what works - and what doesn't work

Data Center Basics

Tools of the Trade

- Snips

- GOOD cordless screwdriver

- Assortment of screwdrivers

- Diagonal pliers / clippers

Tools of the Trade

- Needle-nose Pliers

- Punchdown Set

- Socket Wrench Set

- Toolbox

Other basics

- USB to Serial Adaptors

- Serial Adaptors

- Organizer boxes

- Loopback connectors

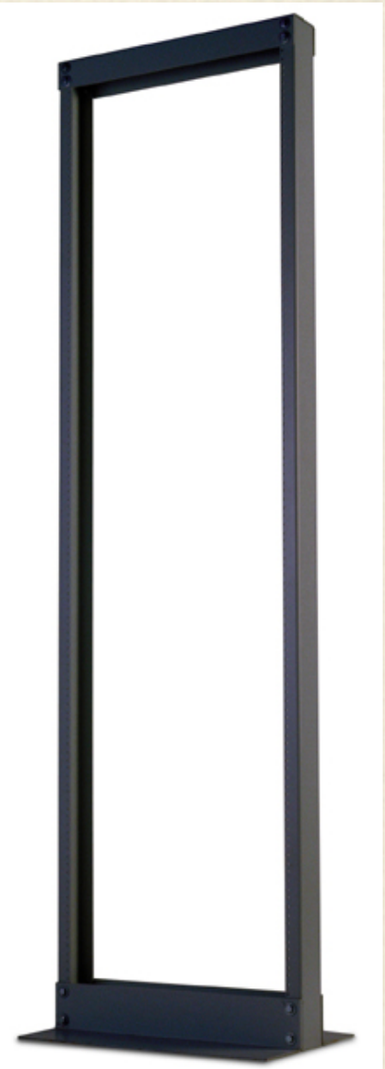
- Fiber couplers

- Extra Screws

Terminology

- Rack Unit (“U”) - 1U = 1.75”
- Standard widths - 19” / 24” - most computer racks are 19”, 45U
- “raised floor” - floor with tiles and crawl space for cabling below
- 2 post rack / “relay rack” - telco style
- 4 post rack / “cabinet”

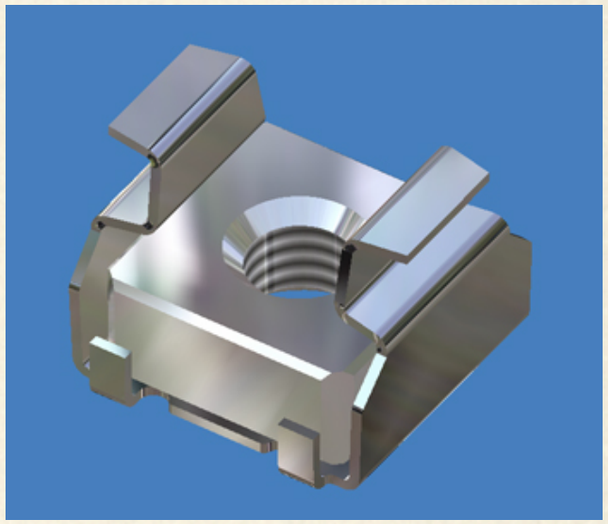
Raised Floor



Relay Rack

Rack Hardware

- Cage nuts - why?
  - To cause pain and suffering
  - Better than stripping the threads of a tapped rail
    - Use a screwdriver and light tap to (carefully) remove
    - Or get one of those fancy insertion / removal tools
- Common sizes for datacenter nuts / bolts - M6, 10-32, 12-24



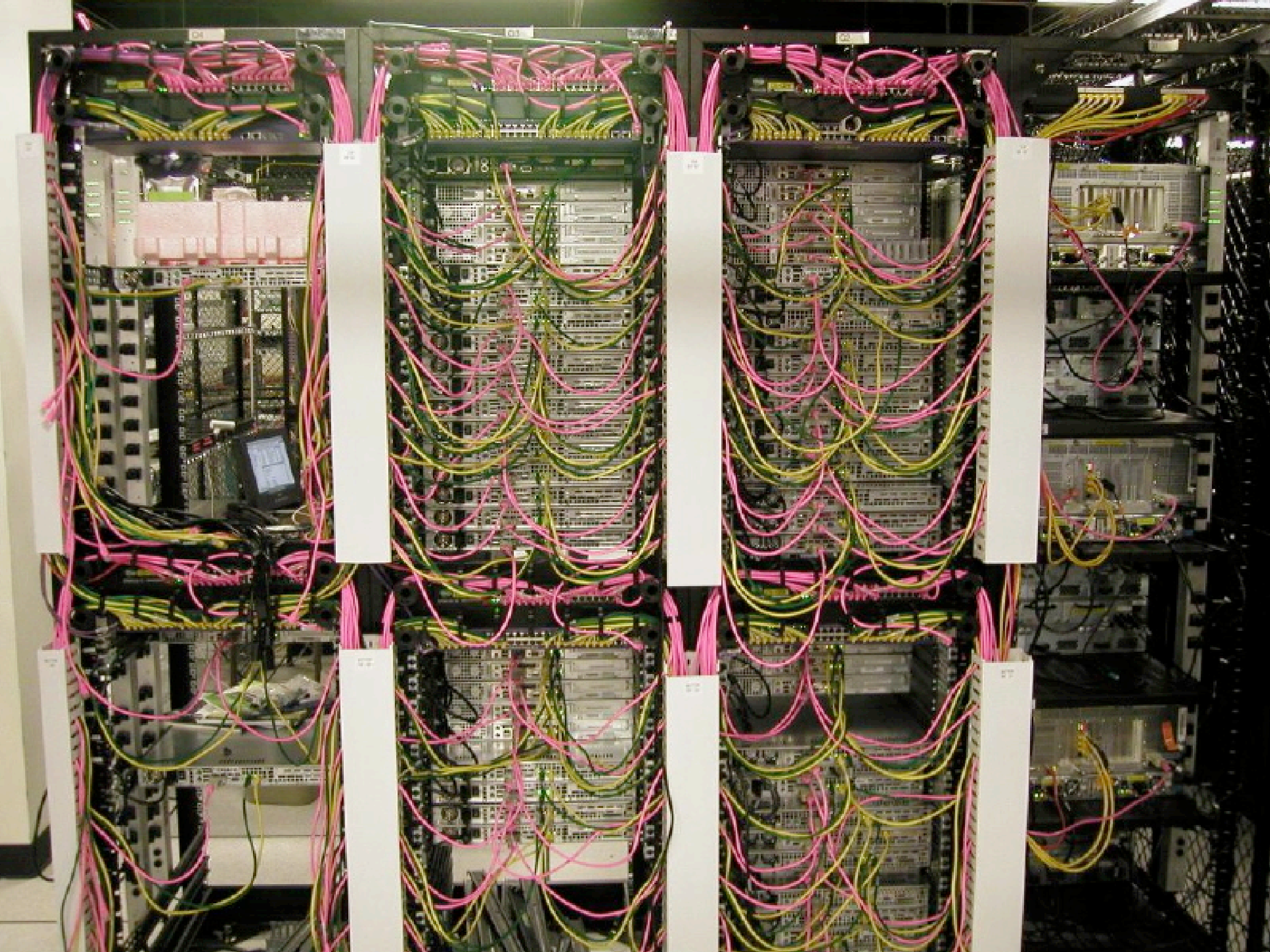
Cabinet Setup / Layout

Cabinet Deployment Strategies

1. Cable and Rail “As You Go”
2. Bulk Setup
3. Hybrid

Bulk Cabinet Setup

- Servers require resources: power outlets, network ports, terminal ports, space, rails, cooling
- Plan
- Prototype
- Setup with or without servers

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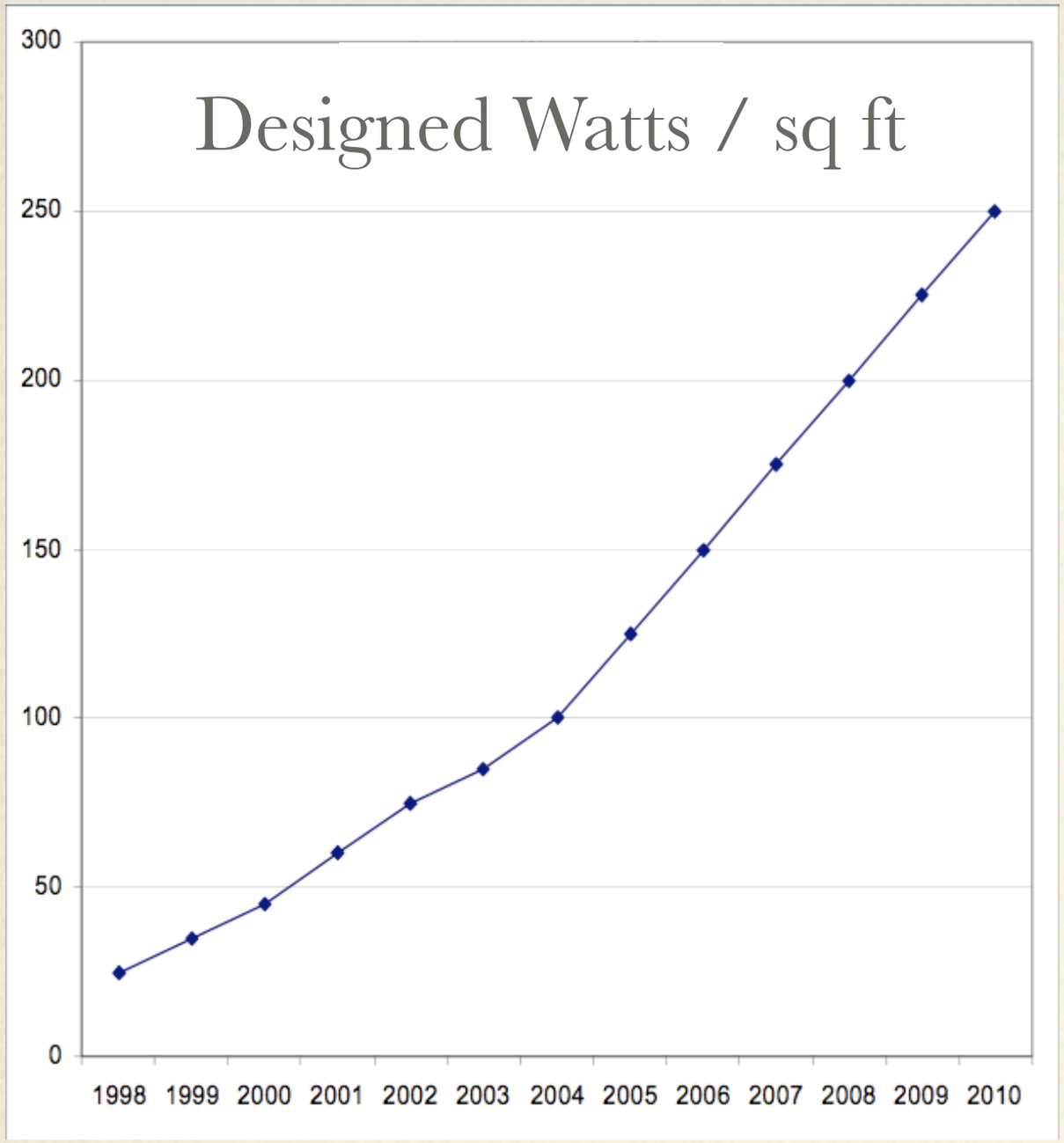
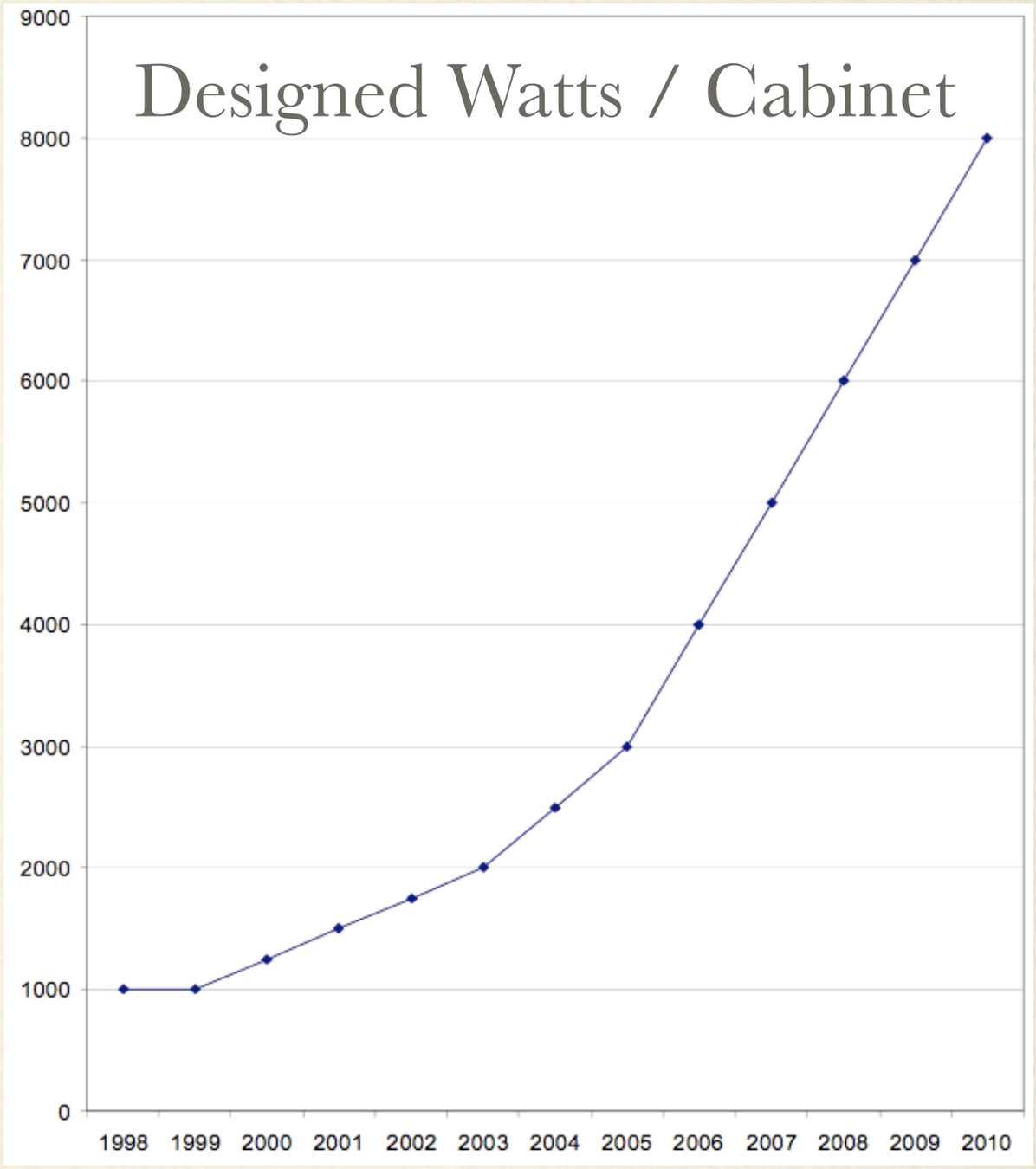
02
03

Power and Physical Space





source: Equinix (http://www.utilityeda.com/Summer2006/Mares.pdf)

Dude, where's my power?

- 1500% increase in processor power consumption over last 15 years*
  - Smaller, denser servers
  - Shift from telco to content providers
  - Revival of dot-com fills datacenters

* http://www.processor.com/editorial/article.asp?article=articles/P2851/30p51/30p51.asp

Power, not space, is limitation

- Cost of power: $300 - $1500 / month / cabinet
- Cost of space: $200 - $1000 / month / cabinet
- Datacenters now limit power density

Rules of Thumb

- 80% continuous utilization of power; e.g., 30A circuit can only sustain a continuous 24A workload
- Leave some headroom - machines take more power under heavy load
- Cooling requirements linear to power consumption

Power Strips

- Horizontal / Vertical
- Features you may want
  - Meters with visible display of power and ability to query remotely
  - Measure true (RMS) power
  - Remote powercycle
  - Can stagger power-on
  - UL Listed
  - Correct type of connector / amperage for your circuit

Cooling

- Alternate “Hot Aisle / Cold Aisle”
- Blanks can force cold air through servers
- In hot environments, consider using environmental monitors

Cabling

Cabling Tips

- **CUT** and **THROW AWAY** damaged or broken cables
- Use velcro, not cable ties.
- Keep stock of sorted cables
- Keep cables long enough, but not too long
- Use 2’ raised floor tiles for quick measurements
- Use short (18” or 3’) power cables when possible.

Cable Management

- Can hide a lot
- **But** don't use as a crutch
- Build in space for cable management

Horizontal Cable Management

Vertical Cable Management

Storage and Care

- Use stacking bins or plastic bags for storage
- **Never** coil around your arm
- Follow natural inclination of the cable
- Close with twist-tie or velcro

Labeling

Brady TLS2200

Brother PT-1650

Labeler Features

- Serialization
- Wrap around labels are huge time saver
- Wide variety of label types
- Computer integration for large quantities


THIS END UP
WHEN PRINTING
BULK LABEL DISPENSER
BRADY

What to Label

- Cabinets
- Servers (both sides!)
- Cables (both ends!)
- Patch panels
- Broken or Decommissioned Hardware
- Network Ports

Installation and Management

Installation

- Image Based Systems
- Jumpstart / Kickstart type systems

Management: The Problem

- Configure machines for specific purpose
- Install / update / verify software
- Maintain users and access rights

Management: Solutions

- Home-brew systems
- Third Party tools (e.g., Puppet, cfengine)
- Packaging systems and tools
- Centralized services (e.g., LDAP)

Monitoring

Monitoring

- MRTG
- RRDTool
- Nagios
- Big Brother
- Cacti
- Intermapper
- Ganglia

Nomenclature

Coherent Naming Schemes:
A Case Study - Matthew F. Ringel, Tufts University

- http://www.nanog.org/mtg-0405/ringel.html
- A naming system should be:
  - Comprehensible
  - Extensible
  - Derivable
  - Self-Documenting
  - Unique

Keeping Track

Keeping Track: Why?

- Asset Management
- Administrative
  - What's where?
  - What's what?

Keeping Track: What?

- Physical Location
- Power port(s)
- Ethernet port
- Serial console
- Hostname
- MAC Address
- Asset Tag
- System Tag
- SSH Key(s)

Keeping Track: How?

- Central authority
  - Flat file
  - Spreadsheet
  - XML (DCML?)
  - Database (with frontend)
- Must be reliable
- Pull what you can automagically

Migrations

Migration Quick Tips

- Plan early and well
- Hire professional logistics people / movers
- Streamline equipment checkout
- Pre-label machines with physical destination
- Network should be functional before move

Datacenter Shopping

Negotiation 101

- Salespeople may misrepresent
- Prepare to walk
- Keep competitors secret
- Written quotes instead of verbal promises
- Believe nothing until signed

Finding a good Datacenter

- Tour Pintos and Rolls Royces
- Reputation:
  - webhostingtalk.com
  - other customers

Finding a good Datacenter

- Tier 5 Datacenters do not exist
- UPS and generator(s) required
- Extra capacity? Power, cooling, and space
- Metered power available?
- Cooling:
  - 20-ton CRAC =~ 500 one-U dual-proc servers

Finding a good Datacenter

- Carrier Neutral (what carriers?!)
- Talk to the engineers
- Two year contract is minimum
- 24/7 access required
- Remote hands?

Oh, The Fees You'll Experience

- Power Power Power
- Space
- Cross connects
- Contract Renewals

Artificial Contractual Limitations

- Safety of other customers
- Max amperage per cabinet or square foot
- Max number of power circuits per cabinet
- Max amperage per circuit
- Mismatched circuit vs powerstrip
- Use your own power strips?
- Max floor load
- Max heat generation

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