

Planning, Deploying, and Troubleshooting Ethernet

Adam Schechter
Precision Consulting

**Howto
piss off
your
designer
friends
and give
them a
migraine.**

Zag

MACTECH

What we'll cover

- Planning New Ethernet Deployments
- Troubleshooting Existing Ethernet Deployments
- Power Over Ethernet (PoE)
- Terminology
- Q&A



MACTECH

Saturday, September 29, 2012

Session Perspective

- Industry Standards
- Practical Methods
- Sharing of My Best Practices

Cabling a Location

- Planning a new office wiring layout
- Planning for the deployment of new cabling into an old building

FLUKE
networks
ABLEIQ QUALIFICATION TESTER

Wiremap Only Results

SIGNAL
PERFORMANCE

Q# 105 FT ✓

← TO SELECT



MACTECH

F1

F2

“No, I Won’t Do That!”

- Work Inside Walls and Ceilings
 - leave that to data cabling specialists - you own what you touch
- Violate Building and Fire Codes
 - fire marshals don’t like non-plenum cabling - not safe either
- Work with Existing Bad Cabling
 - decision maker will pay down the road - but YOU don’t have to

“No, I Won’t Do That!”

- Crimp My Own Patch Cables
 - leave that to the manufacturers - is your q/c as good as theirs?
- Swap “Solid-Core” and “Stranded” Cabling
 - cheaper solid core is for ‘non-flex’ use only - stranded is for patch cables
- Blame Systems or Software for a Cabling Problem
 - bad cabling appears like computer issues - know the difference

Physics vs. Money

- Cabling Works on an Analog Scale
works > works poorly
 - works intermittently > does not work
 - Poor Cabling = Less Cabling Costs
 - Pay less for cabling - pay more for troubleshooting
- Cat # Components Alone ! Cat # Performance
 - installation best practices are just as important as the components
- Physical Factors have Significant Impact
 - gravity, temperature, humidity, ozone, rodents, changes, time



Building out Physical Infrastructure

- Different wiring grades
- Types of patch panels

Planning for Office Buildings

- Future Proof
 - build growth now - adding later is very expensive
- Cabling Closet (MDF and IDF)
 - climate controlled space with clean electrical and restricted access
- ▶ Installation Sequence
 - run cable and inspect before walls/ceilings are closed, terminate after

Planning for Old Buildings

- Future Proof
 - build growth now - adding later is very expensive
- Cabling Closet
 - climate controlled space with clean electrical and restricted access
- Prepare for Rework and Troubleshooting
 - may not work even with best practices - many unknowns
- Use an Experienced Installer
 - some installers I know seem to sniff out what's behind a wall!



Ethernet Copper Cabling

- Ethernet Cabling uses T568A or T568B Scheme
 - 4 Pairs using specific colors and pin configuration
T568A and T568B can be mixed but not on the same cable run
- Connectors are Modular RJ-45
 - TERA shield quadrant plug for Cat 7
- ▶ 90 Meters + 10 Meters = 100 Meters
 - Up to 90 meters solid-core horizontal + 10 meters stranded patch cables

Ethernet Copper Cabling

	Type	Max. Performance	Max. Length	Cable Gauge (AWG)	Max. Frequency	Pairs Used
Cat 3	UTP	10baseT	100 m	24 - 26	16 MHz	2
Cat 5	UTP	100baseT	100 m	24	100 MHz	2
Cat 5e	UTP	1000baseT	100 m	22 - 24	350 MHz	4
Cat 6	UTP	1000baseT	100 m	22	250 MHz	4
Cat 6a or 6e*	UTP	10GbaseT	55 m	22	500 MHz	4
Cat 7*	S/FTP	10GbaseT	100 m	n/a	600 MHz	4
Cat 7a*	S/FTP	40GbaseT	50 m	n/a	1000 MHz	4

* Emerging Standards

* Emerging Standards

Cat 7a*

S/FTP

40GbaseT

50 m

n/a

1000 MHz

4

Cat 7*

S/FTP

10GbaseT

100 m

n/a

600 MHz

4

Cat 6a or 6e*

UTP

10GbaseT

55 m

22

500 MHz

4

Cat 6

UTP

1000baseT

100 m

22

250 MHz

4

Cat 5e

UTP

1000baseT

100 m

22 - 24

350 MHz

4

Cat 5

UTP

100baseT

100 m

24

100 MHz

2

Cat 3

UTP

10baseT

100 m

24 - 26

16 MHz

2

Power over Ethernet

- What devices use PoE?
- Classes
 - 802.3af
 - 802.3at

Power Over Ethernet

- Pass Power Safely with Data on Same Cabling
 - Power Sourcing Equipment (PSE) to Powered Device (PD)
- Low Power or High Power
 - 12.95 Watts with 802.3af (Type 1) or 25.5 Watts with 802.3at (Type 2)
- Common PSE's are Ethernet Switches or PoE Injectors
 - Smart PD Detection and Power On Sequence

Power Over Ethernet

- 10BaseT and 100BaseT Can Use Data Pairs or Spare Pairs
 - PoE with Data Pairs is Mode A, PoE with Spare Pairs is Mode B
- 1000baseT Uses all 4 Pairs
 - Phantom Power - Carries Power and Data on Same Cable Pairs
- Watch for Power Loss
 - Quality of Cabling Critically Important
- Saves Energy
 - Removes use of Power Bricks



Troubleshooting Cabling Problems

- Finding the problem
- Types of physical layer testing tools
- Remediating bad cable runs correctly

Not Enough
Wires in
Cable

Troubleshooting Ethernet

- Check Link Status & Traffic Lights
 - Check Both Ends of Connection
- Check Equipment
 - Ethernet Switch & Device for Bad Ports or Damaged Ports
- Check Cabling
 - Cable, Components, Termination, Workmanship
- Check Network Closet, Inside Ceilings
 - Damage, Climate Control, Improper Installation



Troubleshooting PoE

- Check Link Status, Power Status & Traffic Lights
 - Check Both Ends of Connection
- Check Equipment & Standards
 - Ethernet Switch & Device for Bad Ports or Damaged Ports & Ratings
- Check Cabling
 - Cable, Components, Termination, Workmanship
- Check Network Closet, Inside Ceilings
 - Damage, Climate Control, Improper Installation

Resources

- Training & Certification
 - <https://www.bicsi.org/Default.aspx>
- Panduit Wall & Patch Panel Jacks
 - <http://www.panduit.com/groups/MPM-OP/documents/SpecificationSheet/103589.pdf>
- Seimon Punch-Down Patch Panel
 - <http://www.siemon.com/network-patchpanels.asp>

Q&A

- “No, I Won’t Do That!”
 - Work with Existing Bad Cabling
 - Crimp My Own Patch Cables
- Planning for Installation in New and Old Buildings
 - Future Proof
 - Hire and Experienced Installer
- Ethernet
 - Stick to Standards (and the Entire Standards)

Tips from Q&A

- Don't point a "hot" fiber cable to your eyes
- Maintain minimum bend radius and don't bunch up excess cable
- Un-Plug/Re-Plug to clean and fix poor connection. Pushing connector is not enough
- Leave Pull-Strings when installing cable and adding cables to ease future additions
- Look for poor quality termination, cut ends off and re-terminate properly

Tips from Q&A

- Don't re-use connectors and jacks
- Don't use patch cables with broken clips
- Cut and throw away bad or suspect cable so, it won't haunt you or anyone else again
- Sheathing pulled back, more than 1/2" of un-twisting and loose conductors are bad