JUNE 2017 Cooper Union Copper and Optical Fiber Technology Update

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Brian Smith's Background

AT&T
Lucent Technologies
Bell Labs Innovations
AVAYA
CABLEWORX
ANIXTER
ACI

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TALKING POINTS

OCC History and US Manufacturing Plants
History of Copper Cabling IT Technology
Pros & Cons and Choosing the Right Copper Cabling Category
Power Over Ethernet and Issues with utilization of POE
Pros & Cons and Choosing the Right Optical Fiber Cable
Standards and Codes as they pertain to Infrastructure Designs

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OCC Headquarters

Roanoke VA Fiber Manufacturing

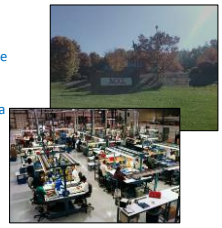
WHERE IT ALL STARTED

- Incorporated in 1983
- Technology & cable design based on US Government funded cable development programs at ITT
- Headquarters and Production Facility based in Roanoke, VA
- ISO 9001:2008 Certified
- MIL-STD-790F Certified

OCC US Copper and Component Manufacturing

OCC Asheville Facility:

- Acquired SMP Data Communications on June 2nd, 2008
- Located just outside of Asheville, North Carolina
- ISO 9001:2008 Certified



OCC Harsh Environment and Speciality Connectors

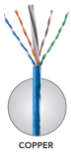
- Acquired Applied Optical Systems (AOS) on November 1st, 2009 and became our OCC Dallas facility
- Located just outside of Dallas, TX in Plano.
- MIL-STD-790 Quality Systems
- QPL/QPD Qualified Parts List Products

History of Copper Cabling

AT&T started structured cabling systems called PDS in mid 80's

Was implemented as a method to sell more "phone" cable

Initially there was confusion for customers as to what cable should they use…
"Type"/"Levels"/"Category"



Decision Time??!!
Copper Pros and Cons

Copper Pros

- Client Familiarity
- Most Common Media
- All Contractors Familiar
- Multiple Vendor Support
- POE Power Over Ethernet
- Shielded and Unshielded
- Cat 8 Up to 40 Gb/sec

Copper Cons

- Distance Limitations
- POE Bundle Heating
- Fill Factor with Cat 6A
- EMI issue with UTP
- Shielded Cable needs Ground
- Cat 8 good to ONLY 30M

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Choosing the Right Copper Cable

- Category 5 or lower should NEVER be used today
- Category 5e should only be used in existing and used to match existing infrastructure
- Category 6 should be the MINIMUM choice for all new installations. This category gives a path for 1 Gb Ethernet
- Category 6A SHOULD be considered for all new Enterprise installations. Larger cable conductors give increased margin for POE+ and eventual POE++

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Choosing the Right Copper Cable

- Consider the use of Shielded Cat 6A due to EMI
- It should be noted that Category 7 was never approved by ANSI and TIA. There IS an ISO Standard that would have mirrored the Cat 7 standard. This ISO Class "FA" is a 1000 MHz shielded Solution. This solution is NOT widely deployed.
- Category 8 has recently been approved and is a 40Gb infrastructure for a LIMITED distance of 30M. This solution is a Data Center ONLY option.

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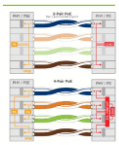
POWER OVER ETHERNET (POE)

PRESENT STANDARDS FOR POE

POE 802.3af Initial Standard 15.4W/13W

POE+ 802.3at (type 2) Present Standard 30W/25.5W



PROPOSED STANDARDS FOR POE

POE++ 802.3bt (type 3) 60W/51W

POE++ 802.3bt (type 4) 99W/71W

POE ++ Expected ratification 1Q 2018

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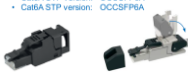
OCC Category 6A AND *NEW Cat 8* Field Terminable Plug

- Performance:
  - Meets ANSI/TIA-568-C.2 Category 6A specifications
  - Supports IEEE 802.3an 10GBASE-T Ethernet
  - Supports 802.3at & 802.3bt POE+ & POE++
  - Supports Cable OD up to .335"
  - Supports 24-22AWG conductors
- Tool less design:
  - Simple to install -consistent, reliable terminations
  - No special crimp tools required
- Cat6A UTP version: OCCUFP6A
- Cat6A STP version: OCCSFP6A



- Performance:
  - Meets ANSI/TIA-568-C.2-1 Category 8 Supports IEEE 802.3bq 40GBASE-T Ethernet
  - Supports Cable OD up to .335"
  - Supports 24-22AWG conductors
- Same overall dimensions/installation procedures as Cat6A shielded field plug
- Cat8 STP version: OCCSFP8

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Decision Time??!!
Fiber Pros and Cons

Fiber Pros

- High Bandwidth
- LOMM OM3 300M @ 10 Gb
- LOMM OM4 550M @ 10Gb
- SM Fiber Supported for Miles!!
- NO EMI Issues or Concerns
- Has Enterprise use with PON
- Small OD and High Strand Count

Fiber Cons

- No POE
- Moderate skill Level for Terminations
- Metallic armor needs Ground
- Fiber core Sizes not interchangeable

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OPTICAL FIBER CONNECTORS CHOICES

VINTAGE AND LESS COMMON OPTIONS

- BICONIC

FDDI

MTRJ

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OPTICAL FIBER CONNECTORS CHOICES

COMMONLY USED CONNECTORS TODAY

ST

SC

LC

MPO/MTP

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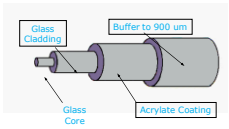
What is a Fiber?

- A Multilayer Optical Filament, with a….
  - Core: carries the light
  - Cladding: keeps the light in the core
  - Buffers: plastic buffers and coatings to protect the fiber



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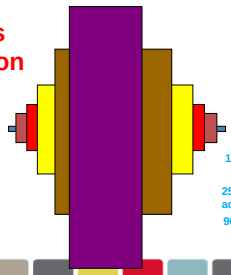
Fiber Cross Section



8.3 SM

50 MM

62.5 MM

125 micron cladding

250/500 micron acrylate coating

900 micron tight buffer

What Fiber Should We Implement

- **OM1 Fiber, 62.5 micron fiber, should only be implemented where it is an extension of an existing network is necessary and not used in any greenfield project**
- **OM2 Fiber,, original (non LOMM) 50 micron fiber, should only rarely be used and NOT generally installed.**
- **OM3 Fiber, LOMM 50 micron fiber is generally a good choice for most Enterprise Networks. It is an appropriate choice for 10Gb networks up to 300M**

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What Fiber Should We Implement

- OM4 Fiber, LOMM 50 micron Fiber is another choice for Enterprise Networks, this fiber is necessary for networks greater than 300M and less than 550M. Some consultants suggest OM4 as their default choice unless the distance is greater than 550M
- OM5 Fiber, LOMM 50 micron fiber, called Short Wave Division Multiplexing and is now known as Wide Band Multimode Fiber. This solution uses four frequencies, each up to 25 Gb/s for total of 100Gb/s. Distance is limited to 100Meters.
- The Cable Color for OM5 is LIME GREEN

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DATA CENTER ISSUES AND CONCERNS

- Density within Racks and Cabinets
- Should I use Copper/LOMM Fiber or Singlemode Fiber
- Cooling/Eliminating or Removing Heat from DC
- Overhead Cabling or Under Floor Cable

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Important Code issues for Copper&Fiber

COPPER CABLE NEC CODE

Plenum (CMP) Rated Copper Communications Cable

Riser (CMR) Rated Copper Communications Cable

Low Smoke Zero Halogen (LSZH) Rated Comm Cable*

*Not approved by NEC, but used in locations like RR

OPTICAL FIBER CABLE NEC CODE

Plenum (OFNP) Fiber Non-Conductive Plenum

Plenum (OFCP) Fiber Conductive Plenum

Riser (OFNR) Fiber Non-Conductive Riser

Riser (OFCR) Fiber Conductive Plenum

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IMPORTANT STANDARDS

ANSI/TIA 568 SUITE OF STANDARDS

- 568.0-D GENERIC TELECOM CABLING
- 568.1-D COMMERCIAL BUILDING TELECOM
- 568-C.2 TWISTED PAIR CABLE AND COMPONENT
- 568-C.3 OPTICAL CABLE AND COMPONENT
- 568-C.4 COAXIAL CABLE

OTHER ANSI/TIA IMPORTANT STANDARDS

- 569-D COMMERCIAL BUILDING PATHWAY AND SPACES
- 606-B ADMINISTRATION FOR TELECOM AND INFRASTRUCTURE IN COMMERCIAL BLDG
- 607-C BONDING AND GROUNDING
- 942-A DATA CENTER INFRASTRUCTURE

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Evolution of the Ethernet Standard

1983	802.3 The Standard was for Thick Coax ONLY
1990	802.3i *10 Base T* UTP for 10 Mb Ethernet
1995	802.3u *100 Base TX* UTP for 100 Mb
1999	802.3ab *1000 Base T* UTP for 1 Gb
2003	802.3af Initial POE @ 15. 4 Watts
2009	802.3at Present POE Standard @ 25.5 Watts

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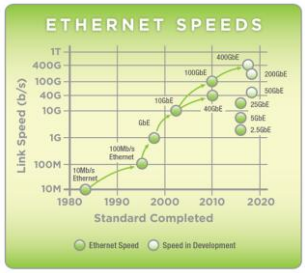
NEXT GEN ETHERNET

IEEE Standards Update:
As of May 2017
802.3bs Task Force

200 and 400GbE



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QUESTIONS PLEASE

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