Newsletter of the North Orange County Computer Club

range Bytes

Volume 49 No 4 April 6, 2025 $1.50

NOCCC meetings for Sunday April 6, 2025

MAIN MEETING

Human- Centered AI: Enhancing Human Capabilities

By Devyn Miller

Special Interest Groups (SIGs) & Main Meeting Schedule

9:00 AM – 10:30 AM

Beginners Digital Photography .....Science 131
Questions and Answers about Digital Photography

Linux for Desktop Users……Science 129
Beginners' Questions about Linux

10:30 AM – 12:00 PM Noon

3D Printing .....Science 127
Questions and Answers about 3D printing

Advanced Digital Photography… .....Science 131
Questions and Answers about Digital Photography

Linux Administration .....Science 129
More topics about the Linux operating system

Mobile Computing.....Science 109
We discuss smart phones, tablets, laptops, operating systems and computer related news. **Waiting for a new leader.**

12:00 PM Noon – 1:00 PM

3D Printing…… Science 127
Questions and Answers about 3D printing if requested.

PIG SIG …… Irvine Courtyard
Bring your lunch. Consume it in the open-air benches in front of the Irvine Hall or join the group that goes to the student cafeteria. Talk about your computer(s) and life experiences.

1:00 – 3:00 PM Main Meeting

Enhancing Human Capabilities

One example is a company wants to start producing a product. John is tasked with documenting everything required to get the product out the door and make a profit for the company. Working with a customized AI, John can quickly create a production plan. A plan that includes timelines for multiple supply chains, component costs, quantity discounts, and much more.

I have copied Gemini's definition in the Editor's Corner starting on page 2.
Devyn Miller was ill for the March meeting. But this month he will expand our knowledge this topic.

BOD…..3-4PM…….. Science 129

Verify your membership renewal information by checking your address label on the last page. If it is not right, let the treasurer know.

Mark your calendars for these meeting dates
2025: Apr 6, May 4.

Coffee, cookies and donuts are available during the day in room 129 .

"Friends Helping Friends" since April 1976

Table of Contents

Special email addresses
Jim Sanders is: editor@noccc.org
membership@noccc.org

Our Website
WWW.NOCCC.ORG

Reminder: Membership expiration dates are based on the date that you joined the club. **Example**, you joined or re-upped your membership in the club in October of 2024. That means that in October 2025 you should pay your membership dues. In the address label area of the Orange Bytes

Reprint Policy

Board of Directors

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Editors Corner

Gemini's overview:
Human-Centered AI can enhance human capabilities by automating repetitive tasks, providing personalized support, augmenting human intelligence through data analysis, improving decision-making by offering insights, facilitating collaboration between humans and machines, and ultimately allowing people to focus on more creative and strategic aspects of their work, all while prioritizing human needs and values in the design process

March Main Meeting

As Devyn was ill at the time of the March meeting and had to postpone his presentation till the April meeting.

Club member Bill Thornton agreed to pinch hit for Devyn and did a presentation on COLOR. His presentation covered both the computer world and the real world. RGB, Red Green and Blue, those are the colors of the computer world and what your monitor generates. Typically dealing

with 8 bits of intensity for each resulting in a possible 16,777,216 different colors that the eye can see. In the real world CYMK deals with reflected color. It stands for Cyan, Magenta, Yellow, and Key (Black), a color model used in printing and graphic design to create a wide range of colors. We learned a lot about how colors are created.

A Data Communication glass fiber tutorial

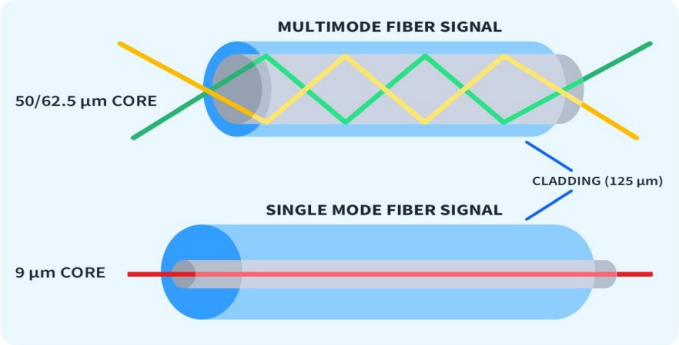
Article by Larry McDavid, a NOCCC founder.

A friend recently needed to extend a gigabit Ethernet connection to an adjacent building and chose to use fiber optics because of the nearly 150 foot distance and cost. He was successful and I decided to improve my understanding of fiber optics for data comm. I quickly discovered there is a complex nomenclature and alphabet soup of acronyms associated with fiber optics. Learning the essentials turned into a journey and I want to share what I learned. My goal is not to engineer a system but give you the information you need to make informed decisions when selecting components to use.

FIBER OPTIC BASICS

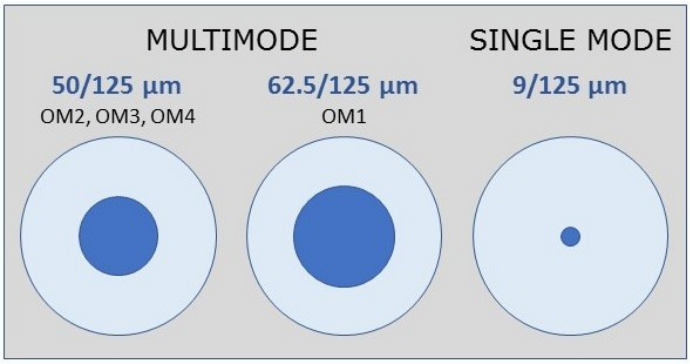
First, let's talk about the optical fiber itself. Fiber optics use light to send data over very small diameter glass fibers. The light can be of three commonly used infrared wavelengths but all are longer wavelength than the human eye can see. If you were to look down a fiber optic cable you would see no light! For safety, you could project the light from the fiber optic cable onto reflective paper but you would still see no light. The light used in fiber optics is produced by a laser diode or a light emitting diode (LED). Lasers produce coherent light, LEDs do not. Optical fiber is identified as either single-mode (SM) or multimode (MM) based on the coherence of the light it can carry. Single-mode fiber excels in long-distance, high-bandwidth applications, while multimode fiber has been used for shorter-distance, cost-sensitive installations. Today, single-mode is more common in data comm.

Single-mode optical fibers are glass waveguides that propagate only a single optical mode produced by a laser diode. The physical design of a SM fiber is a two-concentric-part glass cylinder that is 125 microns in diameter (that's only five one-thousandths of an inch, slightly larger in



diameter than a hair) over its outer glass cladding. The inner "core" (where the laser diode light propagates) is about 9 microns or about one-tenth the diameter of a human hair.

Multimode glass fibers are glass waveguides that can propagate many optical modes produced by a non-coherent LED. The physical design of a MM fiber is similar to that of a SM fiber with the same 125 micron clad diameter but with a larger inner core, usually 50 microns in diameter, about the diameter of a human hair).



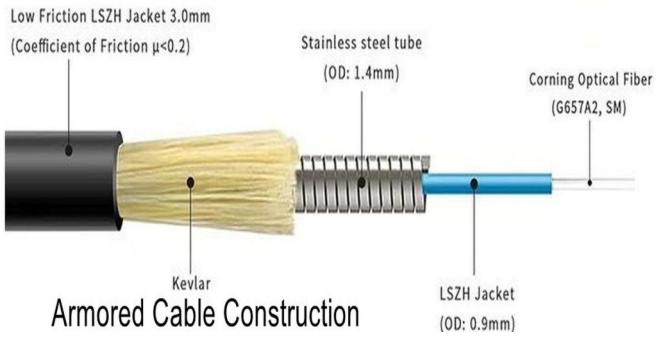
Please note the size of the light-carrying inner glass fiber: it is so small it is almost invisible to the naked eye. That glass fiber is clad with more glass that does not actually carry the light but just serves to protect the tiny signal-carrying glass fiber. This glass fiber is smaller than any copper wire you will ever encounter yet it can carry


100 Foot Armored Cable With SC Connectors

data at much higher rates than any wired Internet access you can get. As discussed later, a single optical fiber can carry data in both directions.

Whether single-mode or multimode, the clad fiber is always covered in some kind of protective plastic layer to protect the glass cladding from moisture and physical damage, bringing the final diameter of the protected clad fiber to 250 microns. An additional protective outer plastic jacket provides an extra layer of defense against damage and bending, bringing the finished diameter to about 3 mm or about 1/8 of an inch. Fiber manufacturers use many kinds of plastic for these layers to prevent fire/smoke hazards and to reduce friction when pulling through conduit. Direct burial fiber often includes an additional helical steel layer to protect against burrowing animals.

There are inexpensive “Fault Finder” tester tools that use visible red light sent down the fiber cable. If there is a break in the fiber, red light is visible at the break even through a plastic sheaf (this won’t work for an armored cable).



Armored Cable Construction

FIBER OPTIC CONNECTORS

These small glass fiber cables need to be connected together and to various electronic devices, so pluggable connectors are used. These connectors come in a large variety of types and have evolved substantially over the years fiber has been used. Today, for data comm, two types of connectors are common: SC (Square or Subscriber Connector) and the smaller LC (Lucent Connector, named for the company that developed it). Fiber optic cables can be also spliced by fusing the glass but that requires very special equipment and is not often attempted by end users.

LC Connector

It is noteworthy that, when connected, the glass fiber must actually touch in physical contact with another fiber or the electronic/optical interface device. The end of the glass fiber and its cladding are bonded within a ceramic ferrule 2.5 mm diameter for a SC connector and 1.25 mm diameter for the smaller LC connector. The objective is to precisely align the small innermost glass fiber to ensure optimal light transmission.

It is vital that the end of the glass fiber be polished and smooth. Over the years various types of ferrule-end polishes have been developed but today two polishes are standard: UPC (Ultra Physical Contact) and APC (Angled Physical Contact). The connector must ensure both alignment and physical contact of the


SC Connector

polished optical surfaces. The connectors include an internal spring that forces the ferrule ends together when mated.

Angled Physical Contact Connector

The “Ultra” in UPC just means the ferrule end is more

highly polished and the shape better controlled than in the earlier “PC” polish. UPC ferrule-end polish is more common in fiber optics for data comm. The ferrule end is highly polished and with a slight convex curvature. Visually, the ferrule end looks square. Today most data comm systems use the UPC polish even if the polish is not specified.

The APC ferrule-end polish is angled 8 degrees and polished flat. The angle ensures any reflected light is directed into the fiber cladding and absorbed rather than transmitted back down the fiber. Reflected light can degrade very high-performance optical systems but is less of a problem in data comm applications. The orientation of the angled flat on APC connectors is carefully maintained by a key in the connector. When two APC cables are mated, the ferrules are oriented so that the angled flat surfaces touch each other over the flat surfaces. City-wide, multigigabit systems often use APC polish connectors but local data comm networks more often use UPC polish connectors.

The ferrule-end polish is clearly indicated by the standard for connector body color: UPC polish connectors are BLUE while APC polish connectors are GREEN. This is true for both SC and LC fiber connectors. It is vitally important that only like polishes be mated. Mating a UPC cable to an APC cable can damage the connectors, limit the number of successful connector matings and degrade optical performance. There are even short fiber patch cables available with UPC on one end and APC on the other end for use when different types of cables must be connected.

It is convenient to purchase fiber optic cables pre-terminated with connectors on both ends. These can be short, small and flexible “patch” cables but can also be much longer and armored cables meant to pull through conduit (that’s what all that orange tubing you see being installed underground actually is). The connectors, either SC or LC, are factory-installed with either UPC or APC polish. Again, the connector color indicates the type of ferrule-end polish.

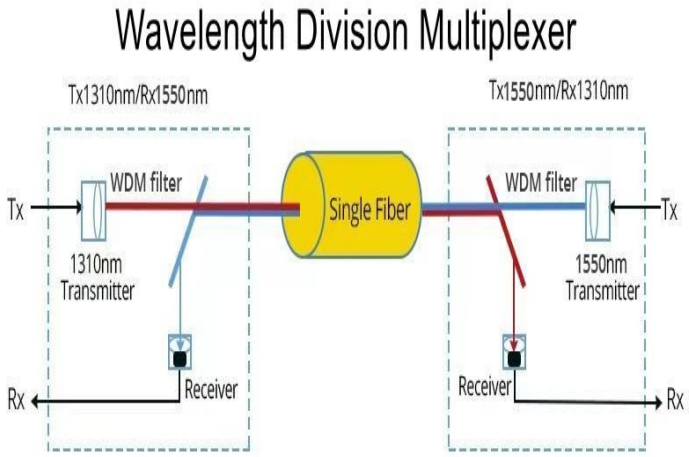
There are also field installable connectors for high-volume applications. These require some specialized tooling to install and are seldom practical for small or casual fiber users.

Cleanliness is important to fiber optic performance. The fiber is so small that connector interfaces must be kept clean or performance is seriously degraded. There is a wide array of single-use and wound-cartridge cleaning supplies available. It is good practice to clean the connector ferrule end and its mate every time a fiber connector is mated.

SINGLE FIBERS FOR BI-DIRECTIONAL DATA

Data communication implies data travel in both directions. Multiconductor Ethernet cables have separate copper wires for the Receive and Transmit directions. Separate Receive and Transmit single-fiber cables were originally used and still are used in some cases; you can easily buy pre-terminated fiber cables with connectors holding two separate fiber cables. However, the technology has evolved and now it is common to use a single fiber cable for both Receive and Transmit directions; these require different type electronics, called “BiDi” for Bi-Directional. How is it possible to use one fiber for both directions?

Remember we are talking about light traveling inside a glass fiber and that light can have different wavelengths or “color.” BiDi fiber systems use a different wavelength light for Receive and for Transmit within the same single-fiber cable. This technology is called Wavelength Division Multiplexing (WDM) and has evolved so much and has become so economical that it has become the standard today because it reduces the number of fiber cables needed. The electronic device connected to the fiber cable is more complex as a different wavelength laser diode is needed at each end of the fiber link and additional light-beam splitting optics are needed.



BiDi devices specify a particular pair of light wave-

lengths used; different manufacturers use different wavelengths so one must be careful not to mix the wavelengths used. These devices are typically sold in pairs so that you always get devices with the correct pair of wavelengths.

That's a very brief overview of fiber optic cables and connectors but explains the most important details. I will next describe the devices needed to extend an Ethernet connection. These devices and the many kinds of cables and connectors are all offered by on-line retailers, including Amazon. However, you need to understand all those acronyms to know what to select!

USING FIBER OPTICS TO EXTEND AN ETHERNET CONNECTION

Fiber optic cables use a glass fiber and Ethernet cables use copper wires. Optoelectronics are required to convert one to another. The key device is a Media Converter and features a fiber optic connector and an Ethernet RJ-45 connector. Fiber optic technology is capable of very high data rates so typical media converters are rated for up to Gigabit Ethernet. That's 1000 Mbps (Mega bits per second), faster than most ISP (Internet Service Providers) offer today. 10 Gbps and even 100 Gbps devices are available but not yet for typical home use.

The media converter is an electronic device so it needs power, typically supplied by a small modular plugin power supply. The converter typically has front panel indicator LEDs to show presence of data, speed of data and power; these LEDs are often grouped and labeled "FX" for Fiber Transmit and "TX" for Twisted Pair Transmit (that means Ethernet twisted pair copper cables, commonly known as CAT5 or CAT6 cables). There is a RJ-45 8-pin connector for an Ethernet cable.

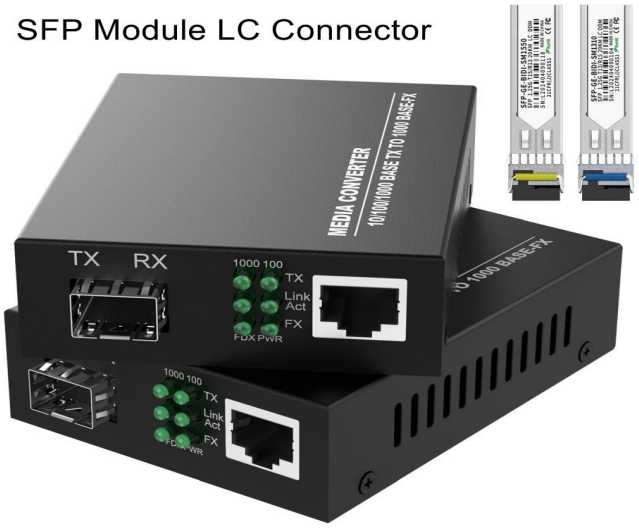
Internal SC Connector

There must also be a fiber optic connector in the media converter; different converters use different approaches for that fiber connector. The lowest-cost media converters have a built-in, integral fiber connector. There is another standard commonly seen in larger data centers that provides the capability to change the type of connector used. In this case, an additional module plugs into the media converter and this module has the fiber connector. This approach uses SFP (Small Form-factor Pluggable) modules that fit into an opening in the media converter and allow one converter to be adapted to different kinds of connectors by changing the SFP module. Various fiber optic connectors and wired connectors are available in SFP modules.

MEDIA CONVERTERS

Whether using media converters with internal, built-in fiber connectors or with interchangeable SFP modules, the fiber connectors can be either SC or LC. If you buy media converters using SFP modules you could in the future change the type of fiber connector by replacing the SFP module without replacing the entire media converter or other data device. Both media converter types are readily

SFP Module LC Connector



y available at on-line retail stores. Unless you anticipate the need to change connector type in the future, it is more economical to buy media converters with integral SC or LC connectors.

Remember that two media converters will be needed, one at each end of the fiber optic cable; media converters are typically sold in pairs for one combination price. You can also independently buy a variety of types of SFP modules to suit your needs. The SFP interface is standardized and is found on media converters, large data router/switches and other data center devices.

Typical pairs of both types of media converters are seen above. The type using SFP modules is shown with the SFP BiDi modules ready to insert into the converter front panel. Labels on each SFP module identify the transmit and receive wavelengths used. The SFP modules have a bail release to grab to ease their removal from the media converter; these bails are often colored to indicate the transmit light wavelength, usually BLUE for 1310 nm and YELLOW for 1550 nm. Yes, these are the same colors used to indicate UPC and APC ferrule-end polish but that is coincidental. Note that an Ethernet-to-fiber-to-Ethernet link using SFP modules will have one SFP of each transmit wavelength and bail color in the media converter at opposite ends of the link. Other wavelengths and other colors are common but there is no standard; you must use a SFP pair with matching wavelengths. Media converters with integral fiber connectors will have the wavelengths marked in labeling.

These options seem clear (and should be) but there is a problem. I have yet to find an advertised media converter or a SFP module that specifies the fiber optic connector ferrule-end polish. They all have fiber connectors, either SC or LC, but what polish does that connector use? Extensive on-line searching suggests that if the fiber connector ferrule-end polish is not specified, that polish is UPC, not APC. Why is this? The only justification for omitting this important detail I can imagine is that UPC polish is more common in data comm than is APC. In fact, I find one on-line comment stating, “APC polish is unheard of in data comm.” I can’t verify that statement but I find that lack of specificity of ferrule-end polish a poor practice. Intermating APC and UPC may work ok for shorter distances and a few mate/demate cycles but it is poor practice at best.

I subsequently visited a local fiber optics manufacturer and fiber installer; staff there confirmed that LAN data comm installations use UPC polish connectors perhaps 99% of the time and that SFP modules offer only UPC polish connectors.

FINAL CONSIDERATIONS

When running fiber optic cables through walls, between buildings or underground, it is convenient to protect even armored fiber cables within plastic conduit, especially if running the cable outdoors or underground. Some armored fiber cables are safe to direct-bury and all have a steel helical wrap under the outer jacket to inhibit chewing by burrowing animals. However, the jacket is usually black and might go unseen if digging. Orange corrugated HDPE (High Density Polyethylene) non-split loom tubing or conduit will make the fiber cable more visible and add some protection. A 1-inch inside diameter loom or conduit will make the armored cable with attached connector easy to pull through. A rope or fish tape must be carefully attached when pulling to prevent bending the fiber cable or stressing the connector.

What about the price of fiber optics? The technology has matured and volumes are high so the prices have dropped. Surprisingly, fiber optic cables may actually cost less than Ethernet cables today. A 100 foot long, outdoor, steel-armored fiber optic cable pre-terminated with SC/UPC connectors costs about $30. A pair of media converters with integral fiber optic connectors and power supplies costs about $40. If you want future alternative interchangeable connectors provided by SFP modules, a pair of those media converters costs about $65. The same hardware could easily expand the Ethernet extension length to thousands of feet at gigabit speed. I see this as a real bargain!

This should give you a working knowledge of fiber optics for data comm and the many acronyms widely used. You should now be able to select appropriate fiber optic parts and a media converter pair to allow you to extend a local Ethernet connection over long distances. Fiber optic components are surprisingly inexpensive today and buying pre-terminated fiber cables means no special tools are needed.

A LITTLE HUMOR

Tim decided to tie the knot with his long time girlfriend. One evening, after the honeymoon, he was organizing his golfing equipment. His wife was standing nearby watching him. After a long period of silence she finally speaks: "Tim, I've been thinking, now that we're married maybe it's time you quit golfing. You spend so much time on the course. You could probably get a good price for your clubs."

Tim gets this horrified look on his face.

She says, "Darling, what's wrong?"

"For a minute there you were beginning to sound like my ex-wife."

"Ex-wife!" she screams, "I didn't know you were married before!"

"I wasn't," he replied.

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To All Members:

The line above your mailing address now shows your joindate. Please use your join month to choose when to renew your membership.

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Membership Level ($)	1 Year	3 Years
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Enrolled High School Student	15	
*Minimum 12 Semester Hours		
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Business Member + Ad (¼ Page, ½ Page)	65,	100
Business Member + Ad (Full Page)	175	
Contributing Member	75	
Supporting Member	100	
Advocate Member	250	
Patron Member	500	

Directions to the NOCCC meeting location

apcug An International Association of Technology & Computer User Groups

Enter CA-55 N (Costa Mesa Freeway) crossing Interstate 5 toward Anaheim/Riverside for 9 miles. *Notice freeway and street signs stating "Chapman University."* Exit toward E Chapman Ave. Turn right onto N Tustin St. Turn left onto E Walnut Ave.

1) Turn left past N. Center St. for the **best place to park** in the underground parking structure (Lastinger under the sports field). Pay the small fee ($2) to park Ask members or help@noccc.org about parking details, restrictions, and our price break!

2) Turn left onto N Center St. On the right is the Hashinger Science Center, 346 N Center St. Orange California. Parking on the University side is free. Parking on the residential side is a city violation that may cost you a **tow away and a ticket!**