



The Gigaphone

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The Shouting Ground Newsletter

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From the frigid cubicle of the resident President up North ...

Riding the Light: Electrons vs. Photons

As the demand for bandwidth increases, the need for faster transport increases. Think of it as a wider pipe. Engineers long ago knew that copper wasn't going to cut it. With copper, greater bandwidth requires higher frequencies in order to transmit (and receive) more data. Higher frequencies degrade more quickly as they travel down the "pipe," requiring more equipment to boost the signal as you travel (also known as repeaters.)

Enter fiber optics. The concept is rather simple ... instead of moving electrons down a piece of copper, we move photons through a very thin strand of glass. Think of it as an Aldis lamp, but the transmitters have extremely quick thumbs.

There are two main types of fiber in use today. Multi-mode carries multiple light rays or "modes" where each ray has a slightly different angle of deflection. These modes tend to disperse over long distances, so multi-mode is typically used in short-distance applications. Multi-mode often comes in two different wavelengths:

850nm, which is visible, and 1300nm, which isn't. (N.B.: NEVER EVER look into a fiber-optic transmitter! I'm not kidding -- it is VERY easy to burn holes in your retina!)

Single-mode, as the name implies, only carries one "mode" or ray of light. Operating typically at 1310nm and 1500nm, it can travel much farther without the need for repeaters (often more than 50 kilometers!)

But just how fast is fiber? First, some fun acronyms:

DS = Digital Signal (e.g., DS-1, DS-3)

OC = Optical Carrier (e.g., OC-3, OC-48)

With optical carriers, the number after the OC- is basically the number of DS-3s it can carry (plus a bit of overhead for signalling, error correction, and framing.)

Copper

DS-0 64 kbps (or a single phone line)

DS-1 1.544 Mbps (24 phone lines)

DS-3 44.536 Mbps (672 phone lines)

Fiber

OC-3 155 Mbps (2016 phone lines, or 3 DS-3s)

OC-12 622 Mbps (... you get the idea)

OC-48 2.488 Gbps

OC-192 10 Gbps

OC-256 13.271 Gbps

OC-768 40 Gbps (now in deployment ...)

The higher rates above would not be possible with copper, unless you were, perhaps, trying to transmit across the room and not the continental US. By the way, with OC-768, you can transmit over 6 full-length audio CDs in one (yes, one) second.

Dang.

*Bryan Holloway,
President*



Getting The Most From Your Hard Drive

A Great Project for the Kids!

After a few years of owning computers, many people accumulate parts from upgrades or replacements, where they frequently sit on shelves or in boxes while technology passes them by. Of all the parts you might find in an old computer, the hard drive yields the best stuff.

Early hard drives used a stepper motor to move the heads over the drive platters. By counting the steps, the head position could be determined. As drive density increased, new techniques for head positioning were needed to maintain accuracy and speed. The most popular solution was the "voice coil", which was constructed similarly to a radio speaker or meter movement. A coil is mounted at the end of a pivoting arm, counterbalancing the heads on the other end. The coil is suspended between two magnets, and by modulating the current flowing through the coil, the heads could be positioned rapidly.

To ensure that the heads could be accurately positioned, an entire disk surface and head are devoted to the "servo track", a position map for the drive.

For this project, you will need a driver with an assortment of bits, especially very small torx bits (t6, t8, t10) and phillips head bits. You may also need a small pair of pliers.

** Note – you will not be able to use this disk drive for anything but decorative purposes when we are finished. Don't use your best drive.

Open the drive by removing all the visible screws from around the top. Then probe under the stickers and decals for one or two additional hidden screws. Remove those too. Some drives may have foil tape around the sides, which you can cut with a utility knife. This will void your drive warranty. You should be able to pull or gently pry the top off the drive. You will then see the disk platters and head assembly.

The platters may be made out of aluminum, ceramic, or glass. They are coated with a high-coercivity oxide, which means it takes a really strong magnet to affect it. That's why they can

Continued on back

Getting the most..., continued from front

locate strong magnets inside the disk drive without affecting your data. They'll really do a number on a CRT display, though, so keep them far away from your monitor and TV.

The magnets are usually held on the drive frame by a couple of screws. Remove the screws from the top magnet assembly and you should be able to lift it away. It'll take a lot more effort than you'd imagine! These are very strong rare earth magnets. To get the bottom magnet, you'll probably have to remove a screw from the head assembly pivot, swing the heads around for clearance, remove a couple of screws from the bottom magnet assembly, and release it.

These magnets are usually strong enough to attract through your hand. Be careful not to get a finger caught between them. The magnets may be removed from the metal assemblies, mostly by luck. I haven't found anything that dissolves the glue that's used to stick them to the metal.

The platter motor is also of interest. It's not a standard DC motor like you'd find in a toy car, so you can't just attach it to a battery and have it work. They are usually 4-phase stepper motors, and an electronic control circuit energizes each phase in turn to spin the motor.

But if YOU spin the motor, it will generate current like an alternator. Connect light-emitting diodes and resistors of different colors between the phases and ground, and they will light as you spin the motor. Use it to make your skateboard shine, build an emergency hand-powered flashlight, or connect it to your model steam engine for a power generator.

You've probably seen claims that you can get more out of your disk by using compression, but I prefer using a torx wrench.

*Mike Berger,
Director of Engineering*



Peeping Tom, Dick, and Harry

Who's that looking in your Windows? The pun was intended. With the huge security flaws inherent to Microsoft's Windows operating systems (yes, all versions of them) there are several ways malicious spyware or adware can obtain private or personal data from your computer and send it back to the author.

Usually these types of malware piggyback along with free software downloaded off of the Internet, but because of the lack of security in Microsoft's Internet Explorer web browser, a machine can get infected with malware simply by visiting a website or clicking on an advertisement link in your E-mail. Sure signs of an infection are pop up advertisements, being redirected to a different web site than the one you typed in (aka browser hijacking), and extra tool bars in Internet Explorer you didn't intentionally install. You may also notice a reduction in your computer's performance, or in some cases an operating system that just plain doesn't work anymore.

It's all about money. Malware authors usually aren't trying to break your operating system so that it is unusable, although that is often the result. They make money from each visit to their website, at the same time generating revenue by collecting your online habits and selling that personal information to shady advertising agencies.

Fight back, but be careful of the tools you use to remove the junk. Many of them are just as bad as the spyware itself. The most effective removal tools are Spybot Search & Destroy and

AdAware. Aside from a paid version of AdAware neither of these free utilities give real time protection against malware, but they are still highly effective in finding and eliminating the bad stuff. Just do a Google search to find a downloadable installer to get these essential programs.

If you aren't sure how to use these tools then another option is to bring your machine into a local computer chop shop and have it cleansed. Shouting Ground offers a flat rate spyware and virus removal service in which we also provide helpful tips in removing and avoiding any malware in your future adventures on the Internet. In most cases, your computer is usually ready for pickup in under a day, depending on how bad the infection is.

Whether you choose to clean your computer yourself or have a computer technician remove the nasties, git 'er done. You'll notice a significant boost in your computer's performance, and your personal information will be more secure giving you peace of mind that nothing is peeping through the windows.

*Bill Cline,
Technical Assistant*



More Keys Than on A Janitor's Belt

The popularity of Wi-Fi is such that even if you have had no use for it, you've undoubtedly heard the phrase, and that popularity is well deserved. A properly configured Wi-Fi network allows for wireless extension of a local area network enabling wireless devices like laptops, PDA's, etc. to access network resources such as servers and printers with giving greater mobility and flexibility to the end user. Wi-Fi's biggest thorn-in-the-paw has been security. Even with the clunky to configure WEP (wired equivalent privacy) protocol enabled, any would be intruder in range of the Wi-Fi network equipped with readily available software tools and enough time could gain access. The basic reason this was possible is that the security keys for different data packets were similar enough that over time enough data would yield the necessary information for access to the network. This basic flaw made this nigh unusable for anyone concerned with the integrity of their network. Enter the 802.11i standard, and the current subset WPA or Wi-Fi Protected Access. WPA uses 802.1x and Extensible Authentication Protocol as the basis of its authentication, which basically means you need to provide some sort of credentials which are checked against a database of valid users before access is given. On a corporate/larger level authentication can be handed off to a dedicated server. Small and home networks have another WPA mode alternative to an expensive authentication server called PSK or Pre-Shared Key. This uses a single password entered into each WLAN node (Wi-Fi routers, access points, etc.). A well chosen complex password used in conjunction with a non-broadcast (and non-default) SSID can give a very high level of security to the wireless portion of your network. Where WEP uses a single static key to encrypt data packets, WPA uses Temporal Key Integrity Protocol (TKIP), which dynamically generates and distributes via 802.1x unique keys for each computing session, and that unique key is then used to generate unique data encryption keys. This tiered key approach yields more than 500 trillion possible keys for each data packet, eliminating WEP's biggest flaw – the similarity of subsequent keys. All that being said, WPA is much easier to set up than WEP (no more gnarly hex keys to type in), and in choosing a strong password not susceptible to dictionary attacks, one can be quite confident in a secure Wi-Fi network.

*Jim Creason,
Director of Support Services*