**Fiber Optics**

The term Fiber optics everyone knows, is the transmission medium for broadband network. When I was a child, internet was not so popular, in order to connect to internet, we need to use telephone lines connect through a modem (Router), as I remember; the brand of the modem I use is “**Hayes**”, this modem not like the router we use now which supports several giga megabytes, it only supports 1.5 megabytes. The ISP (Internet Service Provider) I use is “**Aisa OnLine**”. The internet fees is base on the usage you use, so that’s why at that time web page is usually designed as words or context, not like now full of images and sometimes even embedded with videos. Talking about Fiber optics, who invented it and why it is so special?

The invention of fiber optics is attributed to several key figures:

1. **Charles K. Kao**: Often referred to as the "father of fiber optics," Kao made groundbreaking contributions in the 1960s by demonstrating that glass fibers could be used to transmit light for communication purposes. He was awarded the Nobel Prize in Physics in 2009 for his achievements.
2. **Narinder Singh Kapany**: An Indian-American physicist, Kapany is credited with coining the term "fiber optics" and popularizing the technology. He made significant advancements in the field and is often called the "father of fiber optics" as well.
3. **Robert Maurer, Donald Keck, and Peter Schultz**: Researchers at Corning Glass, they developed the first practical fiber optic wire in the early 1970s, which could carry significantly more information than traditional copper wires.

The material traditional used for data transition is coaxial cable which is copper wire. Data transmit through this wire by electrical signals. If there is data; this causes an electrical signal; otherwise no electric signal. You can think of a light bulb, by turning on the switch; there will be light; otherwise the light is off. This type of “On” and “Off” signals turns out to be like “1” and “0”, which can be represent as binary digits. Let’s take the traditional coaxial cable as an example. If there are 2 computers located at different country connected to as a network. If one computer sends an email which consists of words, images and video attached, sends to another computer. How does this work? First the one who sends, the operating system internal program will start to convert the email into binary digits. “Words” will be converted to “**ASCII**” characters which turns out to be binary digits. Image will be converted to “**Pixels**” which also turns out to be binary digits. Videos as you might know is combine of several what we call “Frames” which each frame is a picture “Image”, again turns out to “Pixels” then converted to binary digits. This type of conversion is done by “CPU” (Central Processing Unit), which consists of billions logical gates as the internal circuit. Powerful “CPU” perform faster. After the conversion, as you might know there will be a series of “1”s and “0”s, this type of a series of “1”s and “0”s data to be

transmitted, we called it as “Data Packets”, “Headers” (additional “1”s and “0”s) will be added to the data packets to differentiate the ordering and avoid data getting lost. Now it is time for transmission, data will pass though the telephone line connected to your house and from your building through coaxial cables to the what we call “MDF - Main Distribution Frame” building. Base on what type of network your country connects to other countries. For coaxial cable, both countries will be connect by tons and tons of copper cables through under the “**Sea**”. Otherwise, you might know “**Satellite**”. During transmission, electrical signals are being generated, if there is electric, that represent “1”, if no electric, that represent “0”.

Fiber Optics on the other hand is not made from copper, the material used is:

### Materials Used in Fiber Optics

1. **Glass Fibers**
   * **Core and Cladding**: The core, where the light travels, is made of ultra-pure silica glass (SiO₂). Surrounding the core is another layer called the cladding, also made of silica glass but with a slightly lower refractive index to keep the light signals within the core.
   * **Coating**: Glass fibers are usually coated with a protective layer of acrylate polymer to strengthen the fiber and protect it from moisture and physical damage.
2. **Plastic Optical Fibers (POF)**
   * **Core and Cladding**: Made from plastic materials such as polymethyl methacrylate (PMMA) for the core and a fluoropolymer for the cladding.
   * **Coating**: Similar to glass fibers, these fibers are coated with a protective layer to enhance durability.

How data transmitted through fiber optics is base on light. Light passes through the fiber optics from one end to another end by reflection. As you might know, if there is light, that represent “1”, if no light, that represent “0”. This type of transmission is much faster than traditional electrical signal. So that’s why you can use much faster broadband networks. This type of usage not only used on broadband network, but different kinds of product can be used. Such as connection cables between devices, now we are using “**USB**” as the major transmission between devices, however, to transmit 50TB of data between 2 devices such as PCs or laptop seems not feasible. By using “Fiber Optics” transmit such large size of data could be a choice. Gaming devices, now we are using “**HDMI**” cables for game console connecting to TV sets, fiber optics also could be an another option. “**Headphones**”, traditional headphone uses copper wires, if fiber optics; this will greatly increase the transmission rate, which one day we will hear “**True Voice**” music.