GOOGLE'S LIGHTNING - FAST FIBER NETWORK

Dr.Veenu Saini, Dr. Namrata Jain
Assistant Professor (Computer Science)
Govt. College Barwala (Panckula)
vnusaini@gmail.com, namratagc@rediffmail.com

Abstract
Everyone, and I mean absolutely everyone, wants Google Fiber. And who wouldn't?
Its service, with 1000 Mbps downloads and uploads speeds, is 100 times faster than the Internet connection that most people have today. That means no more buffering videos; cloud gaming that doesn't slow down the entire house, and the genesis of HD videoconferencing for the average Joe. And it's cheap.
The lucky citizens of Kansas City—the first U.S. city to get it from Google—will only pay $120 or $70 for their gig of Internet access. And for those Midwesterners who are happy with a regular old 5Mbps connection, they can get it for free for seven years after paying a $300 construction fee.
Google Fiber has so much beauty; people are literally begging Google to bring it to their cities. Yet fiber doesn't come without caveats. This paper focuses on FTTH technology, WDM PON architecture behind Google Fiber, speed results and conclusion.
Keywords : Google Fiber, Fiber Internet Broadband, Fiber Network, FTTH, WDM PON

Introduction
Google Fiber is an Internet and television service provided by Google itself, and plans range from 5Mbps all the way to a blistering fast 1Gbps (or 1,000Mbps). The service also provides television channels for an extra monthly charge, but to put 1Gbps speeds into perspective, you could theoretically download a full 1080p movie in about a minute. Of course, you most likely won't get the full 1Gbps speed, since the connection loses a bit of quality from travelling through different loops before reaching your house. So, let's just say a 1080p movie can download in about five minutes – still, that's incredibly impressive.

Currently, Kansas City (both Missouri and Kansas), Austin, or Provo and their surrounding suburbs are the only areas in the U.S. with Google Fiber up and running. The figure below shows the current and potential Google Fiber cities.

If you're wondering why Google Fiber isn't available everywhere yet, or gigabit Internet in general for that matter, it mostly has to do with your areas Internet network infrastructure. Only a handful of cities in the U.S. are wired up for fiber optics, which means there's only so many places that you can get Google Fiber or other gigabit Internet service. For instance, Verizon's FiOS fiber optic Internet service is only available in a few states, and in those few states only a few cities are equipped with the necessary infrastructure to get gigabit Internet.

Google offers three different Google Fiber plans:
- 5Mbps Internet (one-time construction/installation fee)
- 1Gbps Internet for $70/month (fee waived)
- 1Gbps Internet with TV for $120/month (fee waived)

Google Fiber has Fiber Jack , Network Box, Storage Box , TV Box and remote control devices.

FTTH(Fiber to the Home) Deployment
Today our Internet and TV service are probably connected to our home via copper wires. This technology has been around for over 100 years, and it just wasn't built for what we're trying to use it for today. Google Fiber is to build thousands of miles of brand new fiber-optic cable, which is far better and faster than copper at transmitting information. Fiber-optic cables are made of glass, and they use lasers to transmit information — close to the speed of light! It's amazing technology, but unfortunately very few homes have direct access to fiber networks today.

There are a few big steps to plan and build brand new Google Fiber networks in cities.

Step 1: Figure out where we can put our fiber. We need to build thousands of miles of fiber — but we can't just put it wherever we want. First, we create a base map of where we can build (existing utility poles, conduit) and where we should avoid (water, sewer and electric lines). A team of surveyors and engineers hits the streets to fill in any missing details.

Step 2: Design the network. There are a few basic components to our Fiber networks that we need to design from scratch for every single city. In general, you can think of it as a hub-and-spoke design:

Every mile of this network has to be planned and diagrammed, which takes a huge amount of time (imagine planning a network that touches ~30 utility poles per mile, for thousands of miles).

Step 3: Build the network. Only once we have a solid plan — including diagrams of every utility pole our fiber will travel on, detailed maps of where we'll need to dig up streets to install new conduit, and the specs for every single hut and cabinet — can we get boots on the ground to start building our network. That's when you'll start to see crews out in the streets with their boom trucks, boring machines, and rolls of conduit and cables.
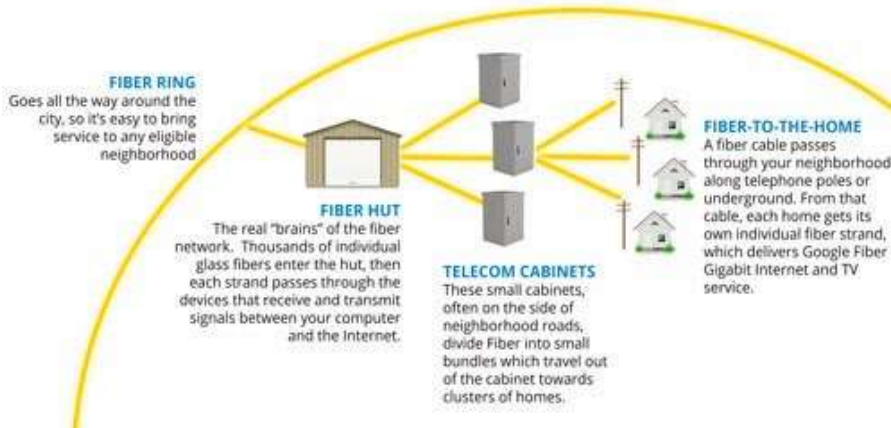
Behind the Google Fiber – WDM-PON Architecture
**(Wavelength Division Multiplexing Passive Optical networking)**

Exploring Several Research Papers available on the Web, I believe Google Fiber network uses the WDM-PON architecture versus the GPON architecture used by competitor Verizon. There are similarities and differences, notably regarding speed and cost, when comparing these two technologies.

By using WDM-PON, Google can guarantee a higher speed than in a commercially available GPON architecture. Passive optical networking (PON) architecture is similar regardless of the prefix: a single fiber is laid from a central point to a splitter, and each user gets an individual fiber strand from there.

In WDM-PON, each end user is assigned an individual wavelength (or 'color') with dedicated capacity of 1Gbps. This is higher than what will be generally possible in GPON, where a single wavelength with 2.4Gbps is distributed simultaneously to, and shared among, all end users.

With each user having their own wavelength in a WDM-PON system, the central office cost increases as each user needs its own port. As the number of required ports rises, so do power and cooling costs. Since a single wavelength is shared in a GPON system, the number of ports required is far lower. The following Figure Shows the Network Architecture of the WDM-PON Fiber Broadband.

A WDM-PON deployment dedicates a single wavelength, or 'color' per user

WDM-PON
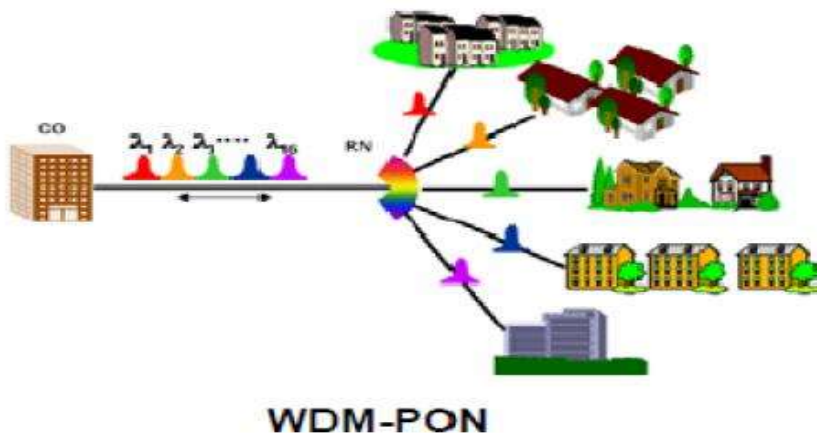
Speed Test Results

Many speed test sites are not designed for ultra-fast services like Google Fiber Gigabit Internet. To enable you to accurately measure your connection speed, there is a speed test that can handle Fiber and designed for Google Fiber connections only. Figures below are showing the speed test results.

To test your fiber connection speed:
- Open your browser and go to speedtest.googlefiber.net.
- Click Start the speed test.
- The speed test checks your upload and downloads speeds and displays the results.

For best speed test results, follow these **tips**:
- Make sure you use the latest version of your web browser to run the speed test.
- Quit all applications on your computer before running the test.
- If you have Fiber TV service: remember that both TV and data come into your home through your Fiber Jack, TV takes priority.
- To maximize results, run your speed test when you're not recording any programs, and turn your **TV** boxoff.
- If possible, run the test on a recent model computer with up-to-date networking hardware.

Google Fiber 1-GIG 'Speed Race'

Applications	100 Photos	100 Songs	Game	HD Movie
Google Fiber (up to 1 Gbps)	3 seconds	3 seconds	3 seconds	7 seconds
10 Mbps	4 minutes 40 seconds	5 minutes 28 seconds	4 minutes 56 seconds	10 minutes 56 seconds

Conclusion

There's really nothing you can do except pray that Google Fiber comes to your city. It'll be a long time before it reaches every nook and cranny of the U.S. (if it even does), so if you don't live in one of the Kansas Cities, Austin, or Provo, Google Fiber might as well be a dream about an Internet service that you wish you had. India is one of the countries where the average Internet speed is barely 1 Mbps. Search giant Google launched 1 Gbps Internet connection in Kansas City, USA. Corrupt Politicians and Bureaucrats in Government, Telecom Regulatory along with corporate entities have completely destroyed the progression of Indian Telecommunications Sector and the word innovation is out of their dictionary. So for now let us just read and hope some Good Samaritan will bring the light of fiber broadband to us.

References
1. FTTH Look Ahead – Technologies & Architectures
2. https://fiber.google.com
3. www.googlefiberblog.blogspot.com
4. www.pcworld.com/google-fiber
5. www.photonics.ntua.gr/.../Lecture_3_Network_Architectures.pdf
6. https://en.wikipedia.org/wiki/Google_Fiber