# Increasing Internet Speed and Bandwidth by Using Laws of Physics

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# INCREASING INTERNET SPEED AND BANDWIDTH BY USING LAWS OF PHYSICS

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*Abstract* - **Internet Speeds plays an important role in all internet-based utility/ service we use in our daily life. The speed of the internet we get is dependent on the bandwidth which is provided by the Internet Service Provider (ISP).In any discussion fast internet connectivity is a necessary requirement, for everyone who uses a computer. Thus, this idea evolved, which is a method of amplification of signal strength, which will result in a faster internet. This is done by twisting a new cable over the existing transmission cable. Now, how it works?**

**The answer can be put in multi-dimensions relating to physics, electronics principles and so on. This explanation is done with the Physics point of view. We vary the famous law of physics and add some physics concepts to the cables conducting abilities. The laws that we use are the Gauss's law, the Ohm's law and the Kirchhoff's law. Initially, this idea was implemented over an existing simple LAN set-up (2- terminals, 1-network adapter and 1-ADSL modem). The idea was to twist a new cable over the existing cable that are of equal length and just to tape it for a firm grip. Thus, the standards are kept intact as there is no physical connection between the two cables.**

**The challenge here is to reduce the cost and to offer the same hike in the bandwidth, some optimizations are done.**

***Keywords***- **Increased, Internet Bandwidth, Internet Speed, Optimized, Packet Transmission.**

## I .INTRODUCTION

To increase “internet speed and bandwidth “is the main objective throughout this project .This is achieved by twisting a new cable over the existing transmission data cable without any physical connections. This means that the standards are followed and we get a faster internet that has an increased internet speed and packet transmission. Basically, the idea is to amplify the signals flowing through the transmission cables. This is done by the twisted cable; the general assumption is that we consider these cables to have the properties of an inductor and a capacitor. These assumptions coupled with some Physics concepts and phenomena like mutual induction, etc. help in proving these phenomena theoretically. This method is found to increase the speed of the internet by 20-40% depending on the bandwidth offered and the topographic properties of the network.

## II. HOW DATA FLOWS THROUGH THE CABLE

We assume the transmission cable and the cable that is to be twisted to possess the characteristics of both a capacitor as well as an inductor. When we assume the cables to behave like an inductor, the following are the analogies made:

1.) In an inductor the electric charges are transmitted in magnetic field that are produced around the inductor surface; in the same way data is considered like an electric charge and the twisted cable like an inductor.

2.) When a current carrying inductor is brought near /adjacent to another inductor that has no charges conducting through it, a phenomenon called Mutual Induction takes place making this non-conducting inductor to conduct electric charges that are induced by the conducting inductor. In this case, when current of data flows through the transmitting cable, there is a magnetic field that is produced (the extent of impact of such fields on data transmission depends on the type of cables used). In this case, we find an induced data flow taking place along the twisted cable just as mutual induction occurs in an inductor. This mutual inductance-like phenomenon taking place inside the cable nullifies all magnetic fields and disturbances as an opposition fields (field acting in the opposite direction), thus facilitating only data to flow through the transmission cable . The role of the insulation done in each of the cables used has no role to play during this mutual inductance -like phenomenon.

Now, when we contemplate as to how the cable acts like a capacitor? The simple answer is the transmission cable acts like one plate of the capacitor and each twist of the other cable acts like the other plate of a parallel plate capacitor with the gaps between the two acting like the dielectric medium.

## III. VARIATIONS IN PHYSICS LAWS

### A. VARIATIONS IN THE GAUSS'S LAW:

[2] The Gauss's Law relates the flux through any closed surface and the net charge enclosed within the surface .The law states,"the total flux (Φ) of the electric field E over any closed surface is equal to $\frac{1}{\varepsilon_0}$ times the net charge enclosed by

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the surface". When this law is applied, we consider the existing transmission cable to be a Gaussian planar.

The following are the assumptions and the modifications that are done to this law.

We assume the cable to be a capacitor that has the dielectric medium between the two parallel plates as air. There exists a voltage component for this capacitor that is 'C' which is referred to as Capacitance Voltage. Thus, we deduce a relation between this voltage and the Electric flux that exists in the cable as:

$$C = \varepsilon_0 * \oint E.dA \quad (1)$$

Here C=Capacitance Voltage; E= Electric field and A=cross-sectional area of the cable.

By the general expression for Flux .We expresses the electric flux (Φ) as a product of the electric field (E) and the cross-sectional area (A).

$$\Phi = E.\Delta A \quad (2)$$

Assume the cable to be cylindrical in shape. The cross-sectional of area of a cylinder is thus given by

$$CSA = 2*\pi*r*l \quad (3)$$

where 'r' and 'l' are the radius and length of the cable respectively.

Substituting the area formula in the expression for flux we get;

$$\Phi = E.\,d(2*\pi*r*l) \quad (4)$$

Substituting equation (3) in (1);

$$C = \varepsilon_0 * \oint E.d\,(2*\pi*r*l) \quad (5)$$

Assume the area under consideration to be very small, then $\oint d\,A\ = dA$

$$C = \varepsilon_0 * E.d(2*\pi*r*l) \quad (6)$$

Comparing equations (4) and (6) we get the following expression; $\varepsilon_0 = 1$.

The above value is described as the Electrical Permittivity in free-space. As the existing transmission cable is considered to be a Gaussian plane having a uniform electric field. The flux (Φ) is given by;

$$\Delta\Phi = E.\Delta A \quad (7)$$

where ΔA is the small area that is considered.

The field is assumed to be in the positive direction as that of the normal acting upwards from the plane of the paper. This modification thus verifies that the flow of data through the cable takes place without the presence of any opposing forces.

## B. VARIATIONS IN THE OHM'S LAW:

[3]Ohm's law relates the Voltage gain or drop across two terminals of a conductor and the resistance offered by the conductor. In the cable, we have the capacitance voltage (C) as the voltage component and the inductance (impedance) produced by the inductor (L) as the resistance component. The current equivalent is denoted by the term “Information Coefficient". The Information Coefficient for a particular cable is defined as the amount of data flowing through the cable. Thus we get another expression relating to the Capacitance voltage and the Inductance;

$$C = I.L \quad (8)$$

## C.VARIATIONS IN THE KIRCHHOFF’S LAW:

The data flowing inside the cable is considered to be a sinusoidal signal having a period $2\pi$ . As the signal completes a half cycle the following assumption is made. For the positive half cycle, we consider the twisted cable carries the ' return signal ' and the existing transmission cable carries the 'incoming signal '. The direction for the flow of signals is found by keeping the reference point. As we have found that only data flows through the cables we can find an increase in the signal strength (internet bandwidth), when another cable is twisted around the existing transmission cable.[4] The Kirchhoff's law states that," the sum of all currents directed towards a point is equal to the sum of all currents directed away from the point". When we have the connector as the reference point, we find the magnitude of the two current of data are equal and that there is no disturbances caused by any magnetic / electric field. Thus, only data flow is present as there is an amplification of the signal strength, thus the band-width increases. Let $I_1$ and $I_2$ be the inward and outward directed flow of data. Then,

$$I_1 + (-I_2) = 0$$

This implies that $I_1 = I_2$ (9)

## IV. PROPOSED METHOD FOR INCREASING THE INTERNET SPEEDS

Based on the assumptions made on the characteristics of the cable, we now deduce an expression to theoretically increase the internet speed .The results obtained by modifications done to the Gauss's Law, Ohm's Law and Kirchhoff's Law is used to prove the increase in the internet speed in this theory. The following are the preset conditions set for mathematical ease:

(1) The length of the transmission cable and the cable that is twisted is considered to be of the same length.

(2) The transmission cable has a uniform electric field that is uniformly distributed over a Gaussian Plane.

From the expression that describes the Capacitance Voltage along the cable which is given by;

$$C = \varepsilon_0 * \oint E.dA \quad (10)$$

where C=Capacitance Voltage; E=Electric Field and A=cross-sectional area of cable.

Based on the modified form of Ohm's law that is applied for the cable, we deduce that

$$C = L*I \quad (11)$$

where C=Capacitance Voltage and L=Inductance in the cable.

Here 'I' is the equivalent for current that is called as "Information Coefficient”, which is defined as” the amount of data flowing through the cable".

Substituting equation (11) in (10), we get;

$$L*I = \varepsilon_0 * \oint E.dA \quad (12)$$

where A=area of cross-section of the cable. We had already assumed the cables are in the shape of cylinders whose cross-section area is given as;

$$CSA=2*\pi*r*l \quad (13)$$

where 'r' and 'l' is the radius and length of the cable respectively.

Substituting the above expression in equation (12), we get:

$$L*I=\varepsilon_0 * \oint E.d(2*\pi*r*l) \quad (14)$$

Upon removing the constants in the above expression we get the following expression relation the Information coefficient and the Area of cross section of the Cable.

$$I\alpha \oint dA \quad (15)$$

Let the area of cross-section of the existing transmission cable be $A_1$ such that the area is given by

$$A_1 = 2*\pi*r*l \quad (16)$$

Now, we twist another cable around the transmission cable, thus the initial radius ‘r’ becomes 'R' such that R=2*r. The new area of cross-section of the existing transmission cable along with the twisted cable is $A_2$ that is given by;

$$A_2 = 2*\pi*R*l \quad (17)$$

$$A_2 = 2*\pi*(2*r)*l \quad (18)$$

Thus, when we have an area of cross-section$A_1$, the corresponding information coefficient is $I_1$ and when we have an area of cross-section$A_2$, the corresponding information coefficient is $I_2$ .

Now based on the relation between the Information coefficient and cross-sectional area of the cable;

$$\frac{I}{A} = a\ constant$$

$$\frac{I_1}{I_2} = \frac{A_1}{A_2} = \frac{2*\pi*(r)*l}{2*\pi*(2*r)*l} = \frac{1}{2} \quad (19)$$

This implies $I_2 = 2 * I_1$ , which means that the information coefficient doubles upon twisting another cable over the existing transmission cable.

## V. EXPERIMENTAL RESULTS AND DISCUSSIONS:

### A. DOWNLOAD TEST:

Table 1: results table for the download package and the time-taken to download with the % gain

| s.no | Name of the packet | Site from which packets downloaded | Size of the package (MB) | Download time (in min.) | | % gain |
|---|---|---|---|---|---|---|
| | | | | With the cable | Without cable | |
| 1. | Dev C++ Portable v5.4.2 | www.softpedia.com | 31.08 | 17 | 23 | 35.29 |
| 2. | Mozilla Firefox v22.0 | www.filehippo.com | 20.83 | 10 | 14 | 40 |
| 3. | VLC media player v2.0.7 | www.get.vediolan.org | 21.9 | 9 | 13 | 44.4 |
| 4. | Mini tool partition wizard | www.download.cnet.com | 14.4 | 9 | 12 | 33.3 |
| 5. | YTD Video Downloader | www.download.cnet.com | 10.59 | 7 | 10 | 42.8 |
| | | | | | Average % gain | 39.2 |

AIM:

This test aims to prove the difference in the time taken to download a particular package with the twisted cable over the existing transmission cable and without the twisted cable.

The purpose for doing this test is to practically prove the increase in the internet bandwidth and internet speed .The average % gain calculated proves that there is an increase in the internet speed as the time taken to download the package decreases. From this we find the Internet Speed and Bandwidth is inversely proportional to the Time Taken.

### B. THE SPEEDTESTS

AIM:

The speed-tests are a series of tests that involves monitoring the rate of packet transmission and also the internet speeds.

The packet transmission (or) the number of packets that is sent and received by a particular terminal in a network helps us estimate the increase in internet bandwidth and speeds. There are two components in internet speed they are (1) download speed- amount of data downloaded per second, (2) upload speed -amount of data uploaded per second and (3) ping. The upload speed is insignificant is this test as it is generally constant based on the I.S.P. The packet transmission is taken from the operating system's "network connection” tool. The host server taken in the website www.speedtest.net was “Bharti Airtel, Bangalore", that was kept constant for all the experiments carried out and the readings are as tabulated.

The ping values without cable ranges from 94-105 ms and with the cable is 98-105ms. The upload and download speeds are given in Mbps.

TABLE II

A COMPARISON OF THE INTERNET SPEEDS

| S.No. | Download/ Upload Speed Variations | | |
|---|---|---|---|
| | Description | Without Cable | With Cable |
| 1 | No Browser | 0/0 | 0/0 |
| | Only with Browser | 0.56 / 0.20 | 0.70 / 0.20 |
| 2 | Browser with MS Excel | 0.48 | 0.86 |
| | Browser without MS Excel | 0.56 / 0.20 | 0.78 / 0.20 |
| 3 | Browser with a game(Fruit Ninja) | 0.50 / 0.21 | 0.75 / 0.20 |
| | Browser without a game(Fruit Ninja) | 0.48 / 0.20 | 0.84 / 0.20 |

TABLE III
A COMPARISON OF THE PACKET TRANSMISSION

| S.No. | Packet Sent / Packet Received Variations | | |
|---|---|---|---|
| | Description | Without Cable | With Cable |
| 1 | No Browser | 97 / 0 | 20,484 / 36,812 |
| | Only with Browser | 229 / 93 | 28,034 / 104,472 |
| 2 | Browser with MS Excel | 236 / 99 | 28,250 / 104,472 |
| | Browser without MS Excel | 256 / 110 | 28,358 / 104,595 |
| 3 | Browser with a game(Fruit Ninja) | 300 / 145 | 75,788 / 244,074 |
| | Browser without a game(Fruit Ninja) | 325/ 163 | 85,498 / 369,654 |

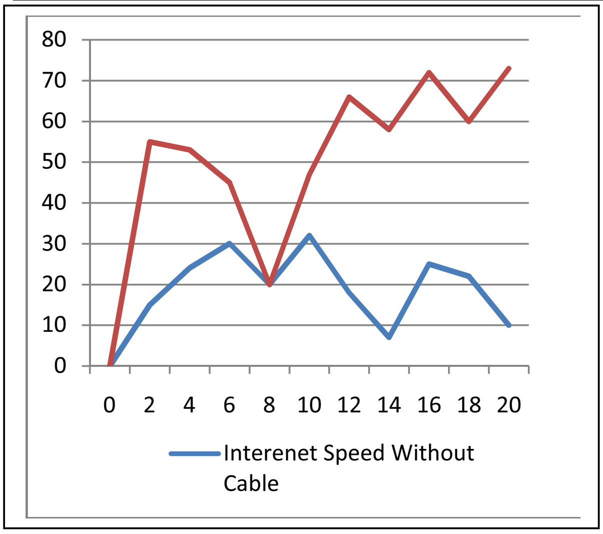



Fig.1.A graph that shoes the variations in the internet speeds where the horizontal axis represents the time (in seconds) and the vertical axis represents the internet speeds in (Kbps).This is the speed graph plotted when a torrent file of 300MB was being downloaded for a period of 20 minutes.

### C.ADVANTAGES

- This is a physical experiment which does not need any changes in the software. As the twisted cable works like an amplifier without sharing any physical connection with that of the existing transmission line, there are no standard protocols that are violated.
- This project replaces the use of TCP/IP software that claim to boost internet speed which is actually paving way for presence of malicious software in the system and traces of such programs become malware which harm's the computer. This project not only enhances the speed but also provides system stability as no programs are installed.
- The twisting of cable is an efficient method to enhance the connectivity in a network. This also is cost-effective and the user can get a faster internet without changing the data plan.
- There are numerous registry tweaks that are available in the web. Using the registry needs extreme patience and one has to be careful in changing the values, if not there are chances one maybe blocked by websites .Such difficulties are removed when we just twist a cable over the existing one.

### D. DISADVANTAGES:

- Cable Strength - The twisting done on the cable becomes loose over a period of time. Thus regular maintenance is required.
- Usability - The quality of the cable used determines the usability and also the longevity of the cable.
- Restricted Movement- The alteration in the topology of the network or its re-arrangement is difficult as the cable requirement varies .Thus there is situation where changes and mobility are restricted when optimization is done.

## VI. OPTIMIZATION

The necessity of optimization in this project is to minimize the cost involved in cabling a network having a large connecting area. The optimizations that are also cost-effective alternatives by which the user can reduce cost and can experience the same efficiency.

The following are the various ways of optimization:

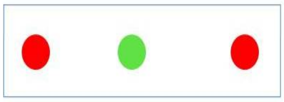
### A. TWISTING DONE ONLY AT THE ENDS:

Fig.2.twisting done at the ends of the cable only.

This optimization is the preferable optimization for a network which provides connectivity in a small-medium scale level. The sketch (*fig.2*) provided shows the application of the twisted cable at the end. The length of the cable depends on the user, preferably more than 500-1000cm, as this provides enough room to twist the cable comfortably. To ensure maximum efficiency, it is suggested to twist the cable to get a minimum two twist turns. More the number of turns, more firm the twist latches on to the existing transmission cable.

### B. LONG DISTANCE OPTIMISATION:

This optimization is done for long cables, which connect terminals and workstations in corporate organizations. This method involves twisting the cable at specific intervals along the length of the existing transmission cable. Let us take a cable of length say 50m, twisting only at the end is not going to offer the efficiency, offered by twisting a cable along the entire length. Since, the twisted cable acts as an amplifier, we give a boost to the signal strength by twisting small length of cables at specific intervals, thus the cost is reduced and the efficiency is retained.



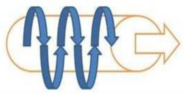

| colour | pictorial representation | description |
|---|---|---|
| red |  | a fractional length of the cable is twisted over the existing cable. |
| green |  | Unoptimised normal cable. |

Fig.3.twisting fragments of cables at specific intervals over a long cable.

C: EXTENSION TO A WI-FI NETWORK:

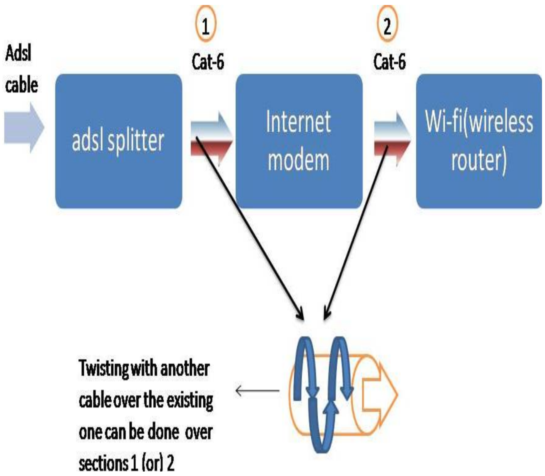



Fig.4. the extension of this idea for a WI-FI network

This optimization is done in a WI-FI network .There is an optimizer called an ADSL splitter which is primarily a junction box-like device that can use the ADSL line on one-end and can get a CAT-6 /CAT-5 pulled from the other along with a telephone line. Here, we can implement the twisting of cables from the splitter-to-the Modem (or) if an ADSL modem is fitted to a wireless network adapter, we can twist the cable either between the ADSL splitter- Modem (or) Modem-Network Adapter. The gain in speed and bandwidth solely depends on the connection.

CONCLUSION AND FUTURE WORK:

The twisting of the cable around the existing transmission cable is thus found to increase the internet speed and bandwidth by 20-50 % depending on the data plan and other factors. The optimizations performed and suggested in this paper offers a maximum gain with minimum costs. This project serves well for a simple LAN and the future works includes enhancing the speeds even more by some software companion for support. The future work also includes in enhancing the coverage area of the implementation region to other network topologies and also other types of networks like MAN, WAN, intranet and also internet .In future a study on how the OFC (optical Fiber Cable) has a transmission loss and how this idea can be modified and applied to the OFC to improve the transmission rate in them is also to be done. As, India heads on the race to become a super-power it needs a faster internet connectivity to back it up in this digital age and this is the first step in that direction.

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