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WI-FI RANGE INCREMENT USING MOBILE HOTSPOTS

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Abstract - — *If you're one amongst the millions of Wi-Fi users, then the general wonderment of how to increase the range of the router for no cost using simple tricks is inevitable. This is a problem many of the users face because of the general Wi-Fi waves obstructers like walls and other electronic gadgets. There are options to increase the range and strength of the signal, but who would like to spend more money when they would have just invested in a wireless router and an internet connection, and the frustration of not being able to use the internet in all corners of their homes is just kicking in? Mobile hotspots are an effective way of connecting to the internet, by turning a device that is already connected to the server into a wireless router. They are available in almost all smartphones and handheld computers that are being manufactured today. By effectively using a combination of mobile hotspots and an existing router already connected to the internet, we can increase the range of our Wi-Fi networks, to fit our requirements without any additional costs.*

Key Words*: *Wi-Fi router, IEEE 802.11, Hotspot, Wi-Fi extender, Station (STA), Access point (AP).

1. INTRODUCTION

The number of people who are installing Wi-Fi connections in their houses are increasing by the day. Every single day, thousands of new connections are established in the houses, just because of the sole reason that mobile internet connectivity is poor in many areas, though the download/upload speeds achieved in the current day are astounding. Though many people do not buy Wi-Fi speeds that are as fast as the Long-Term Evolution (LTE) or the 4th generation of broadband cellular technology network (commonly known as 4G), Wi-Fi speeds are consistent i.e. they do not increase or decrease in a haphazard manner compared to the cellular network speeds, due to various barriers which may be artificial like buildings or natural like the weather. This is the major reason why people prefer to use a Wi-Fi network when they are in their houses. Also, the downloading of large files which are over a specified limit can only be done via Wi-Fi networks and not cellular networks, the reason being the same again. Thus, most people prefer cellular networks only when they are on the move.

However, as a common saying goes, necessity is the mother of all inventions. People devised a method of sharing their cellular connection to other devices using a method known as the "hotspot". This means that a mobile device whilst being connected to the internet, can start an Access Point (AP) so that it can now act as a Wi-Fi router. Now, devices that lack a cellular internet connection can connect to the mobile device and use the internet. This is a great method to share the internet connection of one device with many other devices. This feature which was a premium, paid feature when it was first launched, is now a free-of-cost feature in almost all devices. Now arises the question of whether the Wi-Fi connection of a device can be shared with other devices that do not have access to the main Wi-Fi router that a device is connected to.

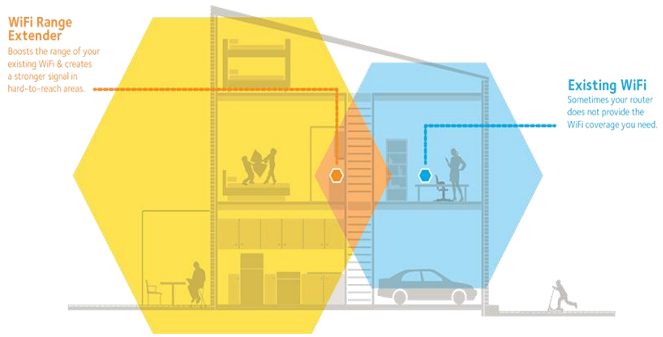
2. EXISTING SYSTEM

A few years ago, Wi-Fi repeaters were introduced to solve a problem that many of the Wi-Fi users were facing. Normally, a person subscribes to one Wi-Fi connection per house. Only one router can be used with a single connection, i.e. two or more routers cannot be used with a single connection. But sometimes, the house would be a little big, and the router's range doesn't cover the entire house, or leaves apart a portion of the house where Wi-Fi is much needed, or the received signal strength required for a particular application may be way too less than what is actually required. Wi-Fi signal strength is usually measured and expressed in units such as milli-watts (mW) or Received Signal Strength Indicator (RSSI).[5] A Wi-Fi repeater (also called as a wireless range extender) takes an existing signal from a wireless router or a wireless access point and rebroadcasts it to create a second network. When a device must connect with a router over the IEEE 802.11 protocol and the distance is too long for a direct connection to be established, a wireless repeater is used to bridge the gap. A repeater is placed within the range of the Wi-Fi router and is connected to it as a normal device. It then starts an Access Point(AP) of its own and extends the signal of the router to a greater distance than a single router can normally provide.

Normally, the range of any decent wireless router is around 40 meters. But in houses, there are many obstacles like doors, walls, other electrical appliances, floors and so on which further reduces the range of the routers. In public buildings, there are a wide range of obstructers such as bullet-proof glasses and steel doors which attenuate the signal to a great extent. [2] Suppose the range of a router is 40 meters, a Wi-Fi extender would be able to increase this range by about 30 meters. Hence, the range of the router-

repeater setup would now be at least 70 meters. But the drawback is that any decent Wi-Fi repeater would cost as much as a new Wi-Fi router. When we normally buy an internet connection, the Wi-Fi router costs about thousand five hundred rupees roughly. If we require a router that supports a higher range or greater speeds, we may need to shell out another two thousand rupees roughly. The installation charges of the internet connection may go up to a thousand rupees, depending upon the company to which we subscribe.

The cost incurred till now is roughly two thousand five hundred rupees. After installation, if we learn that the signal strength is meagre in areas where we normally need it, we may need to buy a range extender. A wireless range extender too would cost about the same as a router, i.e. thousand five hundred rupees, again subject to its strength. There are wireless range extenders that cost as much as six thousand rupees.[4] Nobody would be happy to spend such a huge amount especially after spending so much on a router and its installation. It would be great to have this feature implemented with very little or no cost at all, because no one would like to spend any extra money on just getting every nook and corner of their house covered with Wi-Fi, when they just spent a lot on a Wi-Fi router and an internet connection.



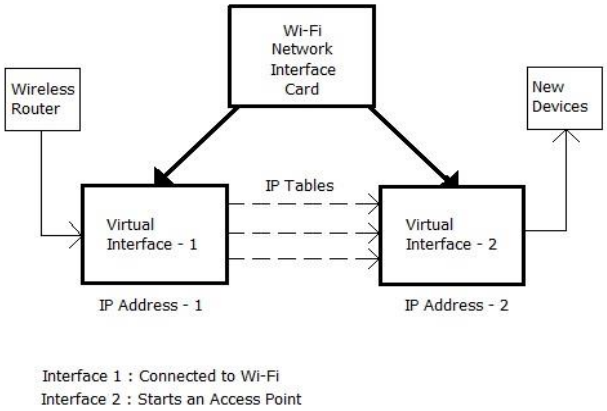
3. PROPOSED SYSTEM

Suppose there are two mobile devices namely device 'X' and device 'Y' that can connect to a Wi-Fi network, i.e. have a Wi-Fi network card. Device 'X' has the passwords and permissions to connect to a Wi-Fi network via a wireless router but device 'Y' does not. Device 'X' also has the hotspot mechanism that was discussed earlier about. Whilst being connected to the internet via a wireless router, if device 'X' can switch on its hotspot, then device 'Y' may connect to the Access Point created by device 'X'. This means that device 'X' must now share the Wi-Fi connection via the hotspot instead of the cellular network, to the devices connected to its Access Point. Therefore, device 'Y' may now be able to access the internet connection without actually connecting to the Wi-Fi router.

Now the question that arises is how this system can be implemented. In all existing mobile devices, only the hotspot or the Wi-Fi connection work at any given time, i.e. they do not work simultaneously. If a device is connected to a Wi-Fi network before an access point(AP) is started, then the connection would be broken after an AP is started. We need to develop a system wherein a mobile device's Wi-Fi network card could be connected to a wireless network as station (STA) and an access point (AP) could be started, providing connectivity to other devices, at the same time.

Essentially, we need to have two Wi-Fi interfaces in our devices bounded to two IP addresses, and then we must route data from one interface to another using IP tables. But physically, we only have one Wi-Fi interface in our devices. Now there are two ways in which the proposed system may be implemented. Mobile device manufacturers may themselves introduce an extra interface in the current mobile devices' hardware, which is not in our hands. Also, when two or more network cards are introduced in the same device, they are going to require addition energy, from the mobile device's battery, which in turn reduces the battery life of the mobile device.[1]

The second method is to virtualize the Wi-Fi network card, so that it now has two virtual interfaces. To add a new interface, we may use an open source solution such as VDE (Virtual Distributed Ethernet)[6] and Open vSwitch[7][3]. Once we virtualize a new interface, we just need to start an access point on that interface, and assign an IP address to it. The final step would be the setting up of IP tables and routing one interface to another to exchange packets of data. The data packets that the Wi-Fi router sends to Interface-1 is sent to Interface-2 via IP tables and the packets are sent from Interface-2 to other devices. This mechanism may be taken advantage of and the range of the wireless router maybe increased in the following manner.



If the range of the Wi-Fi router is around 40 meters, a mobile device maybe connected to the router and it maybe be placed at a point where about 70% of the strength of the signal is reduced, i.e. at about 30 meters. Then the hotspot maybe switched on and an Access Point can be started which would share the Wi-Fi connection of the mobile device via the hotspot. The range of any decent mobile hotspot is about 20 meters. Therefore, devices placed even at about 50 meters of distance from the Wi-Fi router would now be able to enjoy a decent signal strength.

4. CONCLUSION

There are many advantages of implementing a system that was as mentioned above. The primary advantage is being able to enjoy increased signal range without any additional cost. Any decent Wi-Fi extender would cost around thousand five hundred rupees. Nobody would like to shell out extra money, especially when they have spent so much on an internet connection and a Wi-Fi router. Almost all people own smartphones these days and all the smartphones have a Wi-Fi hotspot connection. Thus, the range of the Wi-Fi connection can be increased considerably without spending anything. Secondly, the simplicity of the proposed system when compared to an extender.

Using the proposed system is definitely easier when compared to the initial installations of a Wi-Fi extender. Also, an extender always requires an AC power source. Thus, it can only be placed at points where there is a plug point to connect it. Taking into consideration all these factors, the proposed system definitely enjoys an advantage when compared to the existing system. Therefore, everyone can enjoy the advantage of a Wi-Fi extender without actually buying one if such a system is implemented in all the mobile phones.

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