

Investigation of Data Transmission Rate Dependence in WI-FI Network

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Abstract – This paper shows the influence of different factors on wireless network productivity

Key words – TCP, Basic Service Set, Extended Service Set, WLAN, Wi-Fi, Access Point, Ad-Hoc.

I. Introduction

Wi-Fi is a modern wireless technology of unifying the communicative devices into the local network.

With the increasing number of mobile users the urgent necessity in fast creation of communication between them, exchanging data, fast reception of information appears. So, naturally the intensive development of wireless communications technology takes place. Especially it concerns the wireless networks of so-called WLAN (wireless local area network). The development of such networks is recommended when the development of cable system is impossible.

However, Ethernet technology has developed and settled over a long time and it is regarded as the most popular LAN technology in today use. Now a Wi-Fi network is admired because it strikes a good balance between speed, cost and simple installation. But some business and home users are reluctant to migrate from their existing, wired LANs because they are confused over the abilities of wireless network.

On account of the roaming function between Access Points the users can migrate along the territory of Wi-Fi network coverage without breaking the connection.

Wi-Fi network segment can be used as independent system or as the part of more complex system that has wireless and ordinary cable segments.

This paper shows investigations in Wi-Fi networks, at their current abilities and their potential for becoming a mainstream connectivity solution. The investigation concentrates on IEEE 802.11b and IEEE 802.11g standards.

But during the work of Wi-Fi networks problems rise, that are connected with unpredictable decrease of data transmission rate, with inadmissible delays in multimedia information passing, and in general in many cases the protocol declared parameters are not maintained. It most likely is connected with the occurrence of various interferences and other destabilizing factors or nonconformance of hardware devices.

Accordingly, this article is assigned for signification of the quantitative influence of above named factors on the wireless network work.

II. The Review of a Situation on the WI-FI

Standards describe only two ways for creation wireless networks, there are Ad-hoc and Infrastructure modes. As they are similar on each other, also they have some differences are prior known before planning network.

You may to use Ad-hoc mode when it's necessary to make fast connection between several PC users (no more than five) for mobile network. If you use Ad-hoc mode the very important factor is that all computers must be against each others, because PC's position has huge influence on the data transmission rate. It is related to that transmitters power in wireless adapters is lower, than power of access point. According to that, in such kind of network working radius is half as much, than radius of network, which was built with the infrastructure mode.

Data transmission rate in network will be depended from standards which are used between wireless adapters. It's recommended to use adapters with same standards.

If a user is going to send a file to another used, data exchange rate with other PCs significantly decreases, that leads to certain delays in data transmission. It is also possible that several users would simultaneously exchange their files or download data from a single PC. In that case overall network throughput decreases rigidly. This is why it is recommended to limit number of connections down to 2-5 for proper network operation in Ad-hoc mode. If this number is bigger, it is recommended to switch access point to Infrastructure mode.

Access point is equipped with high-power radio, and this allows keeping link alive at greater distances. But this won't mean that bypassing such obstacles as walls, ceilings, trees, buildings etc becomes easy effort.

In case access point is being located inside a building, it should be placed between the PCs approximately at the center, to reach as many PCs within a direct sight as possible. This would allow users to operate in network with maximum data transfer rates and minimal interferences.

In case when access point is being located outdoors, clear line of sight between it and most distant network objects should be provided.

III. Investigation of Co-Influence of Wi-Fi Working on Neighbouring Channels

The wireless network coverage area can be broadened with the help of increasing the number of APs (Access Point). But in this case the co-influence of APs on the network work is observed. For the removal of co-influence the APs are to be customized for the work on different frequency. In connection with the bandwidth that is only 83,5MHz broad the situations appear when few wireless networks work in channels that are partly overlaid. For the investigation of wireless network work in such conditions the experimental test networks were built, that gave the possibility of reproduction the conditions of two neighbouring working wireless networks on different frequency. The series of dimensions

were conducted along with the decreasing of frequency interval between channels with every following dimension. As a result the dependency between the network rate and the breadth of interchannel interval was received.

IV. Network Productivity and their Topology

Network topology has great influence on passing information speed. The investigation of Ad-hoc mode makes sense only by the work on neighbouring point-to-point networks.

The most widespread variant of wireless network building is Infrastructure method. During the work process several experiments with BSS (Basic Service Set) and ESS (Extended Service Set) network building variants were hold.

During the result analysing that the network productivity changes within 20-30 per cent according to the topology.

The wireless networks differ by their flexible architecture. But, although co-operation between Wi-Fi devices is described by protocols, there are interferences and various collisions in the real wireless networks.

The topology of the network has a substantial influence on data transmission rate. Because of simple connection to Wi-Fi network, there is a necessity in enciphering or in application of other protective measures to increase the data safety which substantially influences on fast-action.

Rate will also depend on the numbers of subscribers and on casual interferences which always are available. The casual interferences are caused by Wi-Fi devices, which are working in a nearby network by the operation of domestic and medical technique.

V. Investigation of Network Transmission Rate

If you are using wireless network for transmission different types of information (files, data, multimedia, sound) generated Access Points character of transfered data will be different. For example a video data transmission needs the delivery of a large number of useful information in a package.

Despite the high capacity pronounced in the standard 802.11g, it turns up to be much lower when building the real experimental network consisting of two AP, or when there is no neighbouring networks and other destabilizing points and interferences.

For quantitative estimation of the capacity point-to-point (Ad-Hoc) topology network according to the distance between APs and with different types of information the research network consisting of two portable PCs was built.

Experiment was hold on with the gradual change of distance between two APs and measurement of average data transmission rate during one minute after every 25 meters.

The experimental measurement results are shown in Fig. 1

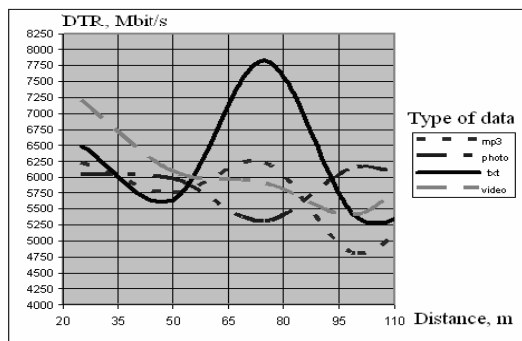


Fig.1 DTR of different information types

In case of passing the information by TCP protocol in the 802.11g network one should take into account that the confirmation for every passed TCP package with data should be provided.

So with the increase of distance between the APs data transmission rate falls down, that is clearly seen on distances up to 50 meters. After more than 50 meters the passing of photo data abruptly falls, and video data rate falls incidentally. With further increase of distance the network fast-acting for text and music data passing abruptly increases on the interval from 50 to 75 meters, but the activity of video and photo data transmission continues to fall. It means that after distance in 50 meters devices changed to mode of increasing the power that influences on data transmission efficiency. After 75 meters abrupt fall of data transmission rate is observed again. When further increasing of distance between APs the tendency to falling down network fast-acting is preserved, although insignificant falls is observed on account of changing the adapters to higher level of signal power.

Conclusion

In given article the quantitative estimation of various factor influence on Wi-Fi network productivity is made.

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