Tarihi Yerlerde Kurulu Bilgisayar Ağları Verimlilik İyileştirme Uygulaması

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Özet

Günümüz bilgi toplumunda, bilgiye hızlı ve güvenli bir şekilde ulaşmak temel amaçtır. Bilgisayar ağları bilginin paylaşılmasında en sık kullanılan yoldur. Erişim ve paylaşım isteklerinin artması kullanıcıları yeni arayışlara götürmüştür. Artık insanlar mobilitenin sonucu olarak bilgisayar ağlarının bir parçası olmuştur. Son yıllarda ortaya çıkan IoE (her şeyin interneti) kavramı ile de bu durum pekiştirilmiştir. Her şeyin interneti dünyasında, günümüzdeki öğelerin %99'undan fazlasının bir bilgisayar ağına bağlı olmaması, gelecekte bilgisayar ağlarının önemini göstermektedir. Kablosuz ağlar, bu yapıda önemli bir rol oynamaktadır. Bilgisayar ağlarının fiziksel olarak yapılandırılamadığı ortamlarda, kablosuz teknolojiler kullanılmaktadır. Özellikle tarihi ve turistik mekânlarda yapılandırılan teknik alt yapı çalışmalarının zorlukları, kablosuz ağların vazgeçilmezliğini gösterir. Tarihi konaklar, hanlar, müze olarak kullanılan tarihi mekânlar, kaleler vb. ortamlarda yapılandırılacak olan bilgisayar ağlarında, kablosuz teknolojilerin kullanılması zorunluluğu, kullanılan topolojilerin verimliliğinin arttırılması noktasında önemlidir. Bu çalışmada dünya miras kenti, tarihi Safranbolu'da kurulan kablosuz mesh ağ ile verimlilik ve kullanılabilirlik çalışması yapılmıştır.

Anahtar Kelimeler: Kablosuz ağlar, İnternet, Mesh ağlar, IoE

Efficiency Improvement Application in Computer Networks Installed in Historical Places

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Abstract

In today's information society, reaching information fast and safely is the primary purpose. Computer networks are the mostly used way to share information. The increase in access and sharing demands has caused the users to look for new things. Today, people have become a part of computer networks as a result of mobility. With the IoE (internet of everything) concept that has appeared in recent years, this perception has been reinforced. In the internet of everything world, 99% of the components are not connected to a computer network and this shows how important computer networks will be in the future. Wireless networks have an important role to play in this structure. In the environments where computer networks cannot be structured physically, wireless technologies are used. Particularly, the difficulties of setting up a technical infrastructure in historical and touristic settings show the necessity of wireless networks. In computer networks installed in historical mansions, inns, historical places used as museums, castles and such kind of places, the necessity of using wireless technologies is important in respect to the increase in the efficiency of the topology used. In this study, with wireless mesh network installed in historical Safranbolu, efficiency and usability study has been performed.

Keywords: Wireless networks, Internet, Mesh, IoE.

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1. Introduction

In today's information technology, information and sharing this information as fast as possible are important. Therefore, computer networks are needed. Developing network technologies are more commonly used in almost every field. Especially, with the proliferation of computer networks, in accordance with the user desires and demands, many services are provided. Countries are able to provide citizenship services over their own users through e-state applications. Together with such services as e-commerce and e-banking, the number of applications making life easier has been increasing day by day. With wireless technologies, provided mobility enables saving in terms of physical infrastructure costs. On the other hand, enabling the desired standards with the devices produced for specific purposes and fields leads to the necessity of providing suitable and safe wireless networks for users. The desire of users to connect to a network constantly makes activation of the wireless access points necessary [1]. In the university campuses, in many public spaces, workplaces and houses, it is quite possible to come across with wireless networks. In parallel with wireless networks' being an inevitable part of our lives, we come across with the problems of efficiency and manageability [2]. Particularly, the cabling problems that we come across in historical places make the use of wireless networks necessary.

Current technologies' being easily influenced by external factors and the devices' have a low efficiency make more research in this field imperative. For example, in a computer network that will be installed in a museum built many centuries ago, the installment of topology, without damaging the historical fabric, is a prerequisite. This proves the importance of wireless mesh network in historical places more explicitly. In these places, what is usually performed in terms of the high performance of existing wireless networks is software updating and open field access points having more powerful antennas [3]. Here, preventing signal interference and the choice of access points sending signals to different ways affect the performance of computer network positively.

The main aim is to choose the device signaling in appropriate channel. In this study, wireless networks installed in historical places, apart from points given above, the installment of optimum topology with the choice of appropriate dipole angles and the calibration of channels have been aimed.

2. Background

Wireless network, as can be understood from its name, is the transmission of knowledge through radio frequency without using any cables [4]. In this method, the use of wireless networks has been getting more popular thanks to such reasons as its low cabling cost, practical operation, easy and free access of information from everywhere desired. Especially, in university campuses, schools, reading halls, libraries, exhibition and convention centers, hotels, holiday resorts, public places, at airports and subway stations and even in our houses, wireless network is more commonly used. Wireless networks are used in places where physical cabling is impossible. Mesh networks are types of networks designed with statically located devices on points for which band width is important. Mesh Peer Management Protocol is a type of protocol used to form a nethood with mesh supported devices. While forming nethood, if two devices have no problem, they send Peer Open and Peer confirm frames. Following this process, nethood continues until Peer Close frame is sent [5].

In the research conducted so far, what is commonly referred to is the devices using Wi-Fi (Wireless Fidelity) technologies. One of the main problems of the standards that can be used between 70-100 meters and at 300 Mbps speed is reduction of signal strength. In these types of situations, Wi-Fi technologies have the capacity of maintaining data communication quality by reducing data transfer speed. The high speed of information technologies has enabled the ViMax technology to take place in our daily life. With this technology, in places having 50 or 60 km distances, it is possible to have wireless connection having a wider network zone. In the 80s, the structure developed with a logic similar to the working style of TV technologies is based on strong signals sent from a high transmitter. The operations related to the internet of everything have increased the importance of personal networks. The IEEE (The Institute of Electrical and Electronics Engineers) 802.11x standard for wireless networks which are internationally accepted and widely used is determined and checked by IEEE. Despite the changing and developing improvements, 802.11x family maintains the same basic communication rules. Taking the technological developments and user requirements into consideration, new wireless network standards supporting the 802.11x network protocols have been formed. Among these, the most important difference can be said to be the newly produced standard's being safer and reaching a wider area. ViMax 802.16e standard has been developed as a result of this basic protocol's sending signals to a wider

area [6]. In the literature review made, it has been observed that related to the installment of wireless networks needed in historical places comprehensible scientific studies haven't been done. In the research done about the optimization methods of wireless networks without considering the places they are located on, at the installment stage, to reduce the cost, studies have been done related to the linear programming models and correct positioning. To increase the performance of wireless network, the optimization of predefined routes is necessary. Connection quality measurement has been performed metrically between the points and its effect on network performance has been observed with the media access control protocols developed, minimizing the poorness of data flow has been aimed. With the chain models developed, the importance of choosing the appropriate angles in the jump of points to optimize the connection from one point to another has been emphasized [7]

3. Methods

In historical places where physical cabling cannot be performed, the use of wireless network becomes a must. The increase of hardware and software support compatible with 802.11x standard has made the use of this standard safe. Thanks to the efficiency in wireless data transfer speed with 802.11 ac standard, the development in wireless network has been continuing [8].

Table 1. Comparing data speed of wireless networks with the channels from which signals are sent [10]

Modulation Coding Plan	Code rate	Modulation	Spatial Data Flow Number	Maximum Data Speed (20 Mhz)	Maximum Data Speed (40Mhz)
0	1/2	BPSK	1	6.5	13.5
1	1/2	QPSK	1	13	27
2	3/4	QPSK	1	19.5	40.5
3	1/2	16-QAM	1	26	54
4	3/4	16- QAM	1	39	81
5	2/3	64- QAM	1	52	108
6	3/4	64- QAM	1	58.5	121.5
7	5/6	64- QAM	1	65	135
8	1/2	BPSK	2	13	27
9	1/2	QPSK	2	26	54
10	3/4	QPSK	2	39	81
11	3/4	16- QAM	2	52	108
12	1/2	16- QAM	2	78	162
13	2/3	64- QAM	2	104	216
14	3/4	64- QAM	2	117	243
15	5/6	64- QAM	2	130	270

The insufficiency in data security has affected the attitude towards wireless network negatively. Apart from the studies related to the provision of safe data transfer, studies to increase wireless performance has been increasing [9]. In Table 1 given above, the channels over which signals are sent and data flow speed among these channels are observed [10]. When compared considering modulation coding plan, for the signals that will be sent over 40 Mhz, it is possible to say that data flow speed efficiency is enough.

4. Application

The study has been done in a historical mansion built 200 years ago. 802.11n, being the top priority, wide 40 Mhz channel in topology and wide 6 channel, devices over 6-2.412 Ghz have been configured. In the application, wireless access points, switch, dsl modem, outdoor range extender, access points and tablets of different brands and models have been used.

Table 2. Network device list.

Device Name:	Models:
Access Point	TP Link 300 Mbps Wireless N Range Extender
Switch	Zyxel Ethernet Switch ES1100-8P
DSL Modem	Airties Air5453 DSL Modem
FireWall	Draytek 2925 Dual Wan Security Router

In the study, network devices seen in Table 2 have been used. Considering the performance, economical and dipole antenna compatible devices have been preferred. While choosing the devices, what was taken into consideration was their being able to be found easily in market conditions. In this study, firstly, the location of the access points has been determined. In a four historical building, where above-wall cabling was not possible, mesh network topology has been focused on not to damage the historic fabric. Related to the location gateway, a network with dipole antennas has been designed in a way in which access points will be able to see one another at appropriate dipole angles. In the places where possible, the existing wireless network has been supported with open area access points. Thanks to wireless signal measurement softwares, impairment in signal levels and lower level problems have been minimized. The impairments and reduction of signal strength observed in the previous wireless network installation have been observed to be less in the wireless network topology installed.

In Figure 1, the wireless network model designed in the application can be seen. When the structure of historical places is taken into consideration, there occurs the necessity of installing an efficient network with economical devices. In this topology, an economical mesh network has been formed over alternative routes. To enable fast data flow, devices supported with dipole antenna have been located in places called dead spot.

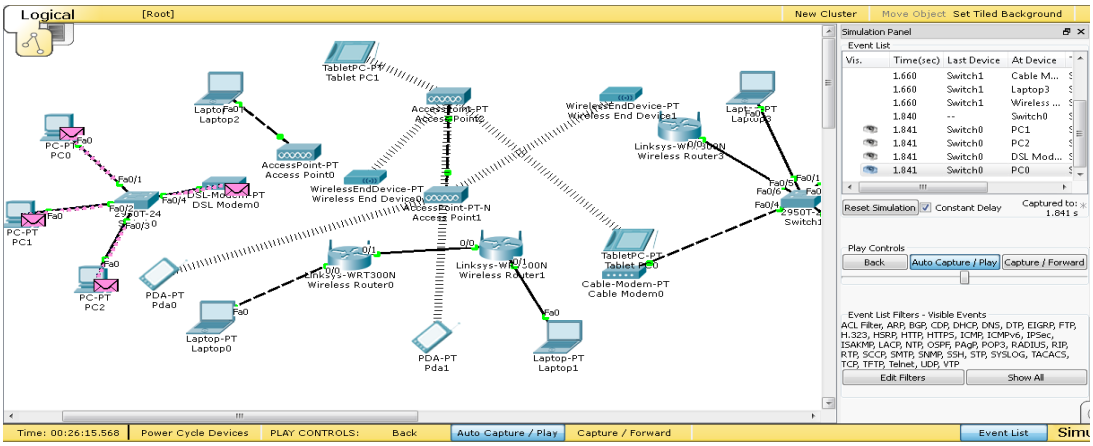

Figure 1. Wireless network topology

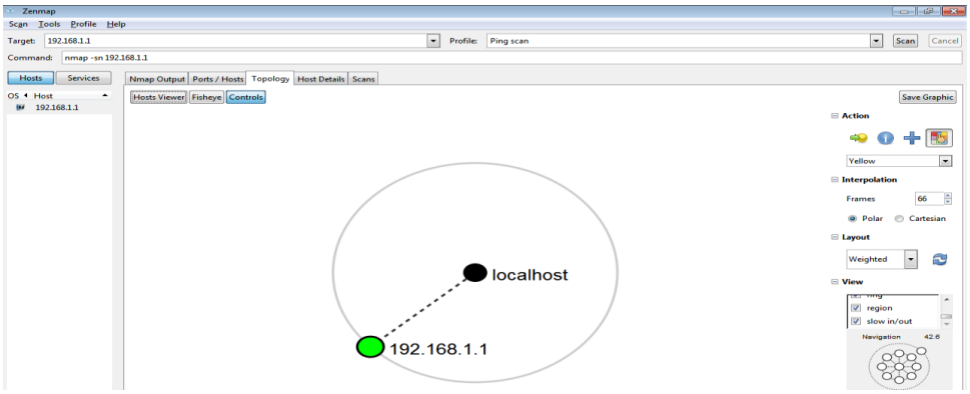

Figure 2. Wireless access point topology

In Figure 2, what was mostly considered was the determination of the correct point that will reach the devices to the extranet by locating the gateway of each device. The determination of the efficiency of the routes has been made by protecting the signal levels in efficient points. In figure 3, the channels that wireless access points use and signal levels taken from these channels can be seen. In the points where measurement has been performed, firstly, the improvements in points where signal levels are low have been taken into consideration. After determining the dipole angles in wireless mesh points, no problem has been observed in data flow in the channels.

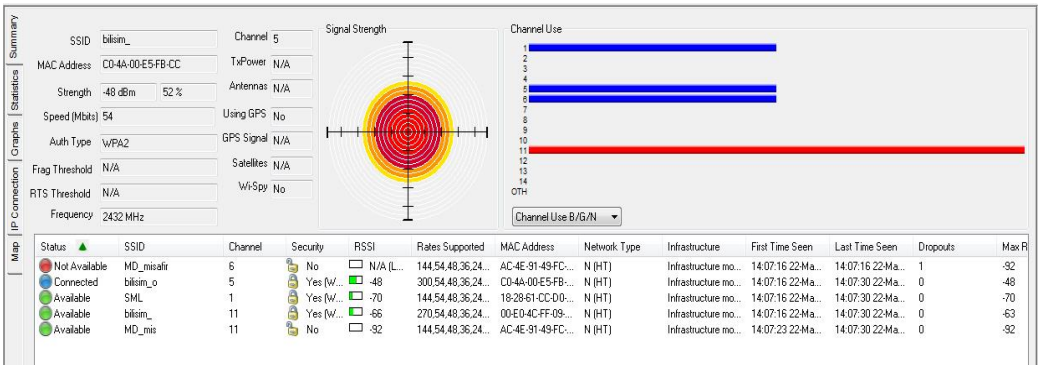

Figure 3.The channels where wireless access points have been used

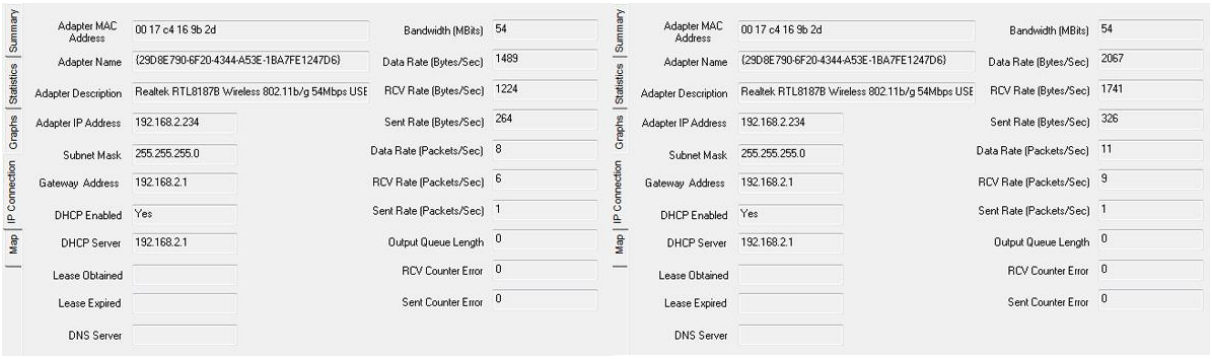

Figure 4. Wireless network access point information

When network topology is analyzed over any client, data flow as the one in figure 4 can be seen. As a result of the improvements made with these values taken over a standard network card of 54 Mbps, no problem has been observed related to the data flow. Based on the improvements made determining the dipole points, data measurement has been performed in wireless network. In the statistical values observed in figure 5, the efficiency profile of the network is seen. The performance of a wireless processor connecting to the system with a network card of 54 Mbps is seen. The point where measurement is performed and access point are two independent physical sites. Although thirty clients are simultaneously connected to the dipole antenna access point, no problem has been observed both in terms of data flow and signal level.

Figure 5. Wireless access point data flow statistics

5. Conclusion

In this study, the difficulty of computer networks asked to be performed in places having historical characteristics has been observed. Because it is not possible to lay a cable in historical places, wireless networks have been used. The process has been performed by installing wireless networks caring about the dipole angles of the devices and without damaging the architecture. Thus, reduction of the signal strength has been prevented. Possible dead spots in the area have been determined, and access points supported by dipole antennas have been located. Through alternative routes, the delinking between independent areas has been prevented. While determining the routes, considering the intensity of the users, routing to different gateways has been performed.

When historic fabric of our country is examined, it can be observed that the number of places needing wireless networks is quite high. It has been observed that with computer networks installed consciously, it is possible to prevent visual pollution and install computer networks having high efficiency with low cost.

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