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Current Trend in Wireless Networks

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Authors' contributions

This work was carried out in collaboration between all authors. Author AHY designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AFD and WMA managed the analyses of the study. Author ANF managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

In this study, a general overview of the current trend wireless network has been presented the explosive parallel growth of both the Internet and cellular telephone services are becoming the two most important phenomena that impact the required modern feasible and secure telecommunications. A wireless service technology has become well-known in technology markets. WLAN implemented the development of the wired LAN. Industries produce the required components, which lead to the fast developments in designing and implementing of such networks. The merging of wireless network deemed to be a solution to some of the problems of the wired

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networks. In this survey study, we will try to discuss the advantages of wireless devices and indicate the challenges involved in this technology from the point of view of its foundation, architecture, requirements, its components, and protocols.

Keywords: WLAN layers; WLAN configuration; WLAN architectures; IEEE 802.11; standards; protocols.

1. BACKGROUND

Open Systems Interconnection (OSI) model is the first reference model that is developed by the International Standards Organization (ISO) to describe the protocol stacks in a computer network. OSI model, which consists of seven layers perform well, with defined functions. [1,2,3,4] and [5]. In the current transmission control protocol (TCP) / Internet protocol (IP) model which is built based on the two primary protocols (TCP/IP) and consists of five layers. Application layer combines the session, presentation and application layer of the OSI model [4]. Wireless measurement plays an essential role in building a suitable technology to construct wireless networks based on the behavior and characteristics of the wireless conditions. Many measurement studies have been conducted and performed Fig. 1 shows Wireless internet access according to internet users worldwide as of June 2015, by device [6]. Most authors analyzed and suggested the characteristics and the network performance measure to some deployed WLANs [7].

2. INTERCONNECTION

A computer internetworking represents a hybrid of linked computers to perform different functions like processing and distributing data/information. The computer acts as workstations, servers, routers, modems, base stations, etc. Links of communication can be wired such as copper cables, fiber optic cables, and microwave/satellite/radio links [8]. The most popular example of computer networks is the Internet.

The Internet represents a network of networks, within which, a large number of networks interconnect a very large number of computers worldwide [9,8].

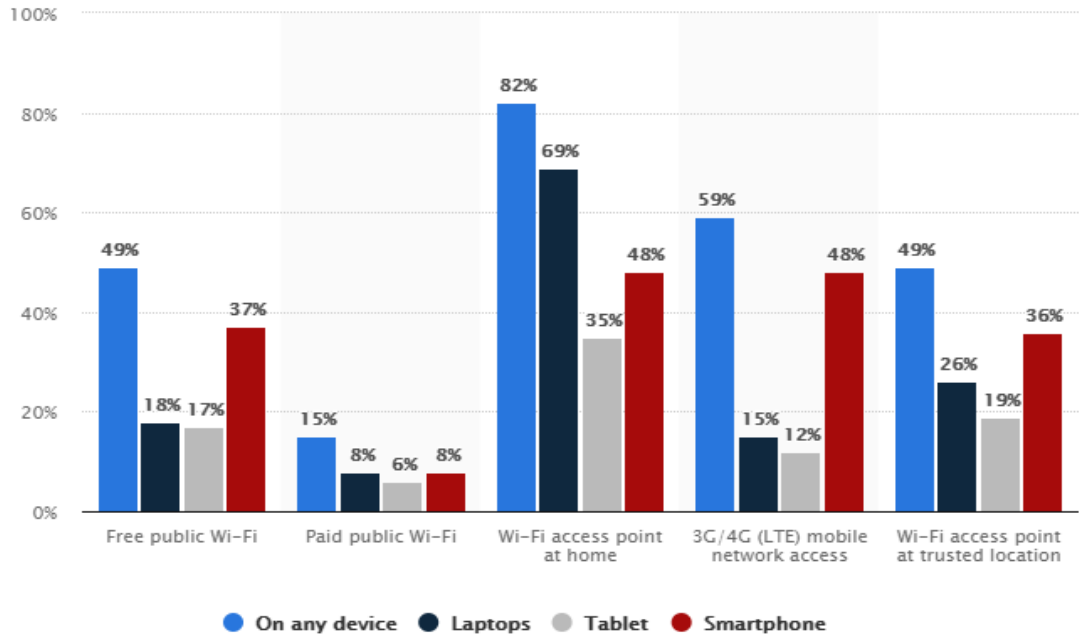

Fig. 1. Wireless internet access according to internet users worldwide as of June 2015, by device

3. NETWORK CHARACTERIZATION

The wireless network is suitable for many applications such as optimizing deployment of Access Points, network traffic characterization, network management, capacity planning, detecting network anomalies, and cognitive networking [1]. The cognitive networks are analyzed, gather, compact, and categorize the large amounts of temporally tagged network data as well as user network experience information to better optimize the network resource management. With the use of 802.11 technologies, the cost of collection, storage, and analysis of all the traffic generated in the air across various channels become too expensive. As a scalable means to monitor wireless network traffic, packet sampling has attracted much attention from both industry and research communities [10].

3.1 WLAN Standards

Wireless Networks aims to provide all benefits of the LAN technologies in a wireless manner. The transmission of wireless like Bluetooth and WLAN is standardized by IEEE 802.11 and they have a good unlicensed frequency band, but, they are not designed for real time applications [11]. There are many problems faced the use of wireless networks like the power consumption, unreliability in its medium due to the reflection, multipath and interference when other devices use the same frequencies. The large industrial development helps in implementing of new standards generation of 802.11 for enhancing the Quality of services (QoS) such as WLAN usability in real time applications. Packets time out, delays represent many defections that designers' goal in this area is to improve the suitability of WLAN in addition to its security [12,13]. A family of WLAN specifications was initially developed by the Institute of Electrical and Electronic Engineers (IEEE) [6]. The following IEEE standards [2,3,4] are : IEEE 802.11a; IEEE 802.11 b; IEEE 802.11d; IEEE 802.11e; IEEE 802.11f; IEEE 802.11g; IEEE 802.11h; IEEE 802.11i; IEEE 802.11j ,IEEE 802.11k, IEEE 802.11m, and IEEE 802.11n [7,12].

These standards define the following four standards for WLANs [2,14]:

1. Frequency Hopping Spread Spectrum (FHSS).
2. Direct Sequence Spread Spectrum (DSSS)
3. Infrared (IR)
4. Orthogonal Frequency Division Multiplexing (OFDM). Fig. 2, shows the Standard architecture of WLAN [7].

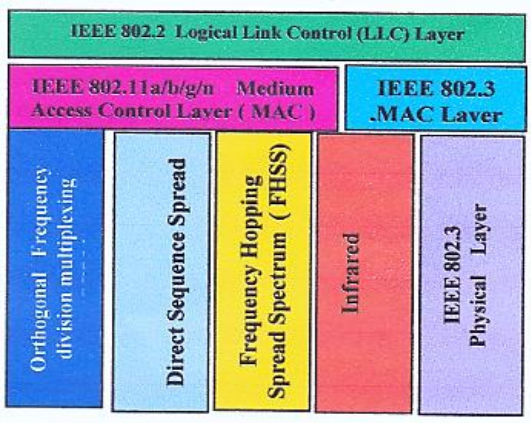

Fig. 2. Standard architecture of WLAN

3.2 WLAN Component

All the standard IEEE 802.11 is defining two pieces of equipment, a wireless station, which is usually a PC equipped with a wireless network interface card (NIC), and an access point (AP), which acts as a bridge between the wireless and wired networks [7,9,14]. Each network access point consists of a radio, a wired network interface (e.g., 802.3), and bridging software conforming to the 802.11d bridging standard. It may acts as the base station for the wireless network, aggregating access for multiple wireless stations onto the wired network. Wireless end stations may be IEEE 802.11 PC Card, PCI, or ISA NICs, or embedded solutions in non-PC clients (such as an IEEE 802.11-based telephone handset) [5,12]. The element that interconnects the standard BSSs within the ESS via access points is defined by IEEE 802.11. Such a distribution system may support the IEEE 802.11 mobility types by providing the necessary logical services to handle address-to-destination mapping and seamless integration of multiple BSSs. Each access point represents an addressable station, providing an interface to the distribution system for stations located within various BSSs [7,12].

3.3 WLAN Configuration and Requirements

The basic WLAN configurations can be easily changed and ranged from peer-to-peer networks

suitable for a small number of customers to full infrastructure networks of thousands of customers that enable roaming over a broad area. Micro cells (the physical areas covered by each of the LAN) can be established to provide coverage to all customers, Fig. 3; shows a simple WLAN configuration [1, 12].

An efficient use of the transmission medium is (Throughput) and good use of bandwidth. A large number of nodes may be needed. Usually, a connection with a wired network is needed. The Service area is typically 100 to 300 m. efficient management of mobile station battery [2]. WLAN may be interference prone and may be eavesdropped (Transmission robustness and security). More than one WLAN may be in the same area. It is a user oriented approach or (License free operation), like ISM band (Industrial, Scientific and Medical band) which consist of free frequencies for everybody to use [14]. So ISM band is preferred because it would be cheap. Moving between cells and even networks may be needed. Addition, deletion and relocation of end systems without affecting the network functionality are required [4,13].

3.4 WLAN Architecture

Two modes of WLANs were defined by the IEEE 802.11 standard. It may be either infrastructure-based WLANs or ad-hoc WLANs. It represents a group of stations (as wireless nodes) which are located in a limited physical area. Fig. 4; presents the general architecture. In each network, there is an access point which is connected to the hub, switch or router [5]. In the case of infrastructure, one will need a wireless host and access point base station, while in an ad-hoc network; one will not need a base station. IEEE 802.11 generally supports three basic topologies for WLANs: the Independent Basic Service Set (IBSS), the Basic Service Set (BSS), and the Extended Service Set (ESS). All three configurations are supported by the MAC layer implementation [15,16].

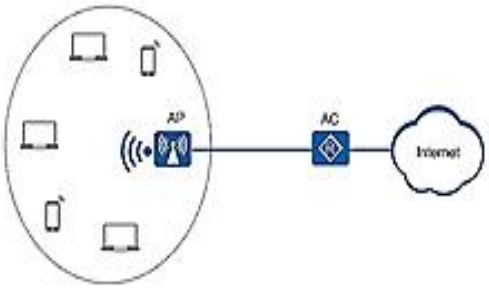

Fig. 3. WLAN configuration

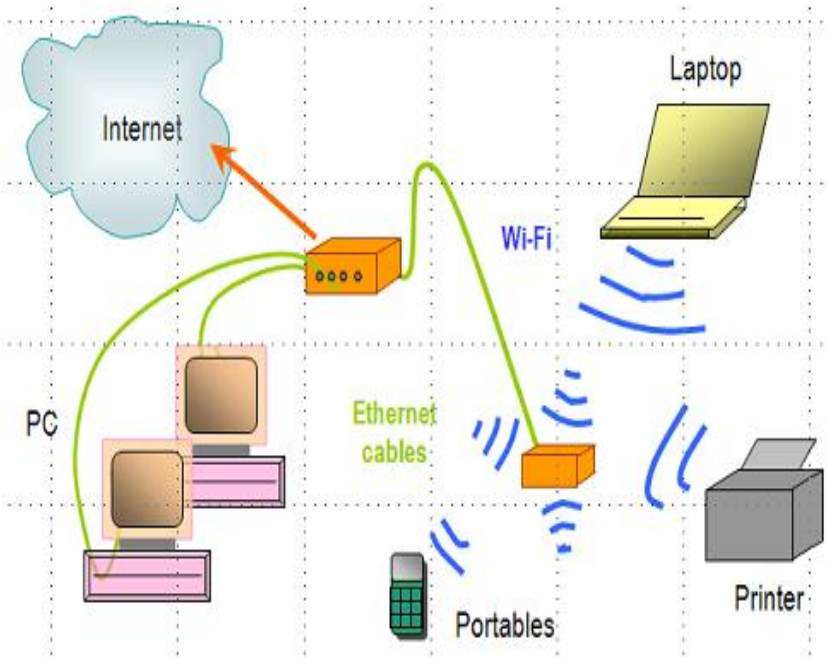

Fig. 4. Basic sketch of an infrastructure network

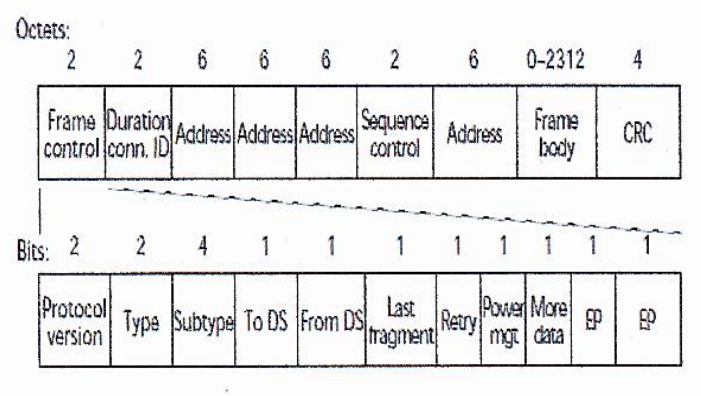

Fig. 5. IEEE 802.11 frame format

4. COLLISION AVOIDANCE AND 802.11 FRAME ADDRESSING

802.11 standard supports collision avoidance mechanisms [17,18]. Three main types of frames also used in the MAC layer: data, control, and management. Fig. 5; shows the main IEEE 802.11 frame format [5,6,14].

5. CONCLUSION

Users can access shared information in wireless LANs without looking for a place to plug in, and network managers can set up or augment networks without installing or moving wires. It offers the following advantages [19,20]: WLAN connectivity is great, It provides the users with access to real-time information anywhere in their organization, easier to add or move devices, its installing process is so fast and easy and can be configured in a variety of topologies, requires minimal battery power consumption, offers good use of bandwidth, it ensures the Internet customer, web-served mobile communication and field service productivity, and finally the WLAN Standards were seemed to be clearly better than wired in setup/shutdown time and effort. While the following other reasons make the multiple access difficult in the wireless environment, due to its dynamic physical channel characteristics, mobility and network topology, Spatial behavior and handoff, packet losses, congestion and its reduced ability to download and upload large data files.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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