C3 - Wireless Networks

Dimitris Chrisovalantis Zoumpakis [redacted]
Writing for Computer Science and Computer Engineering CSC215

Dr. Andreas Grondoudis
Department of Sciences, BSc Computer Information Systems, European University Cyprus
15/05/2024

Figure 1: EUC Logo

Wireless Networks

Wireless networks since the late 1970s have abruptly changed the world once and for all. From ALOHAnet and the Pure ALOHA protocol, invented by the university of Hawaii, to IEEE's first publicly available wi-fi 802.11 and now 5G with speeds as fast as 10Gbps. Undoubtedly wireless network have shaped the way we live, communicate and interact with not only one another but as a whole. In this paper a brief introduction into computer networks as well as wireless networks will be stated, followed by a brief summary of how wireless networks fit in with computer engineering as well as a research field. Later a view of wireless networks as an applied field and in the academia will be explored, ending with a brief summary of the job and career prospects in the field paired with some interesting facts about wireless networks.

Introduction

Before diving into wireless networks, one must have a robust understanding on the basics of networking. Firstly a network is simply one or more computers connected with each other using the same protocol (rules) to be able to communicate with each other. One of the most common computer network types are LAN(Local Area Network) which connects computers over a short distance allowing the to share data, files, and resources, this is pretty much the basis of most computer network types on which wireless network stand upon. Some important terms and concepts one should be familiar with before diving deeper are, the IP address, which is a unique number assigned to every device connected to a network that uses the Internet Protocol for communication and node. A connection point inside a network that can receive, send, create, or store data.

Definition

A wireless network is a computer network using wireless data connections between network nodes. Furthermore, wireless networks rely on radio frequency (RF) technology, which produces an electromagnetic field when an RF current is fed into an antenna. This field propagates through the surrounding space, enabling devices to establish wireless communication with one another. There are two basics modes(topologies), in which wireless network are able to work. The first is infrastructure mode in which wireless networks need physical support, like routers or network towers, to operate. Devices, like phones or computers, connect to these points to communicate. It's like how cell phones need cell towers to work. The second mode is Adhoc, in which wireless networks don't need a fixed infrastructure to function.

In these networks, every device can talk to each other directly, so there's no need for a central access point. Unlike infrastructure networks where routing is managed by the access point, in ad-hoc networks, devices themselves figure out the best way to send data from one to another. A simple Ad-hoc example would be you're at a park with a group of friends, and each of you has a walkie-talkie. Instead of needing a central radio station to relay messages, you can communicate directly with each other using your walkie-talkies. If someone wants to send a message to another friend who's farther away, they can ask everyone in the group to relay the message until it reaches the intended recipient.

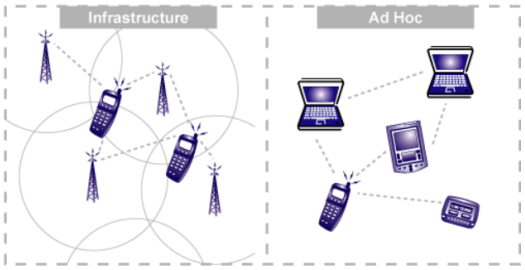

Figure 2: Wireless network topologies infrastructure (L) vs Ad-hoc (R)

Wireless Networks and computer engineering

A critical aspect in wireless networks is of course computer engineering, and its major role not only as one would guess in infrastructure topology, but mostly in the engineering and creation of network devices such as routers, switches, Access Points but also antennas and other critical infrastructure, as well as solutions which without nothing would be possible. Key aspects of computer engineering when it comes to wireless networks other than Hardware design, are first and mostly the protocols and standards, such as WiFi (IEEE 802.11), bluetooth and 5G. Another one would be Wireless Network Architecture, which refers to the design and deployment of wireless networks and Signal Processing and Modulation which as the name suggests are the techniques essential for extracting information from wireless signals. One of the hottest topic in recent years which is a key aspect is Network security and it refers to the techniques engineers use to secure wireless communications from various threats. Some of the major wireless network players that specialize in computer engineering are CISCO which is a leader of the industry providing both solutions and equipment. Followed by Qualcomm, Intel and Broadcom, all major semi-conductors manufacturers that develop wire-

less networking solutions such as WiFi chips. Last but not least are Ruckus Networks and Juniper offering enterprise networking solutions.

Wireless Networks as a research field

Furthermore, researchers in the field of wireless networks are looking for way to lower energy consumption costs and make the technology more energy efficient when it comes to algorithms and techniques. (Adamou et.al). Another major research theme for wireless networks is network security and cybersecurity, with the rise of black-hat hackers and threat actors security researchers are restlessly looking for the next vulnerability to patch before an attacker exploits it first.

Wireless Networks as an applied field

One of the most in demand applications of Wireless Networks is sensor technology, with two major applications. Firstly monitoring, mainly for environmental purposes such as water quality and monitoring for forest fires. And tracking as mentioned in detail by Adamou et al (2015), for fault detection, industry wise or even for military purposes such as locating enemy troop movements. Some of the major players in applied wireless networks, among other areas is Ericsson and Huawei leading the 5G technology evolution, followed by Nokia and Samsung, with ZTE following.

Wireless Networks in the academia

Academia plays a major role in the sustainability and obviously evolution of wireless networks, not only with active research but also by the plethora of degrees specializing in networking, wireless networks and network security. Moreover the future trends of academic research relating to wireless networking is going to focus on disruptive 6G technologies to potentially greatly improve performance upon 5G (Björnson, 2020).

Job and career prospects in the field of Wireless Networks

Following the latest hype on 5G and IoT the future occupational safety for wireless network engineers, IoT engineers and cybersecurity professionals cannot be questioned. As predicted by Vinton G. Cerf, one of the founders of the Internet Protocol, almost everything runs on IP, making it a crucial technology that needs to be constantly up and running. Thus both private and public sector as well as commercial users have a constant need for skilled employees to keep things working as they should. Moreover according to

TechTarget, a famous technological news website, the trends that drive hires in the networking sector arise from cloud adoption and migration as well as AI integration. With all that said, it would be illogical to believe that skilled, motivated professionals would struggle to find a position in the industry.

Interesting facts about Wireless Networks

Some interesting facts about wireless networks, other than the continuous rise of speeds for mobile and broadband connections is the story of the first wireless transmission which took place in 1895 when Guglielmo Marconi transmitted a radio signal across a distance of 2000 miles. Another interesting fact is the origin of the name Wi-Fi, which in reality doesn't mean anything. Its simply a wordplay on "High-Fidelity, because the organisation needed a name for their standard that would be easier to remember than "IEEE 802.11b Direct Sequence".

Conclusions

In conclusion, wireless networks have revolutionized communication since the late 1970s. From ALOHAnet to today's 5G, they've transformed how we live and interact. This paper explored their role in computer engineering, highlighting major players like CISCO and Qualcomm. Academia drives innovation, and companies like Ericsson and Huawei lead in practical applications. Job prospects are strong, with demand for skilled professionals in IoT and cybersecurity. Finally, some interesting facts, like Marconi's first transmission and the origin of "Wi-Fi," underscore the rich history and ongoing innovation in wireless networking.

References