Study of Creating Ad-hoc network in dormitory

Jiaran Zhang[1, a]

[1]North China Electric Power University, Baoding, China

[a]1454775058@qq.com

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Abstract: Through the study of self-organizing network, we can understand the characteristics of network topology, implementation technology and its characteristics. The characteristics of network topology are: nodes have the ability of message forwarding; Ad-hoc network has the characteristic of self-organization; Ad-hoc network is dynamic and changeable. The implementation technologies are Bluetooth and ultra-wideband technology. The topology of Bluetooth is piconet, and the number of devices is up to 8. Bluetooth has radio frequency characteristics. But it still has the problems of short transmission distance, high power consumption and low security. Compared with Bluetooth, UWB technology has high transmission rate, low power, Strong anti-interference and more security. Because of its short duration of narrow pulse, it has a strong spatial-temporal resolution. In the dormitory environment, we use the existing equipment to create and test the ad hoc network.

1. Learning of Ad-hoc network

1.1 Introduction

With the development of science and technology, the wireless network has been more and more popular, every aspect of people's life is becoming more and more inseparable from the wireless network. In general, the vast majority of the use of wireless network connected to the router or base station. We often mention the mobile communication network are generally has a base station, which are based on the default network infrastructure to run. But for some special occasions, a mobile network which must have the base station is not competent. Especially in same situations such as military, disaster, emergency and so on, we could not rely on any default network infrastructure to communicate. Instead, we need a way to create network temporarily and fast, which is named Ad-hoc network. Ad-hoc network is a kind of point-to-point wireless networking mode, which could realize temporary network. It divides several wireless signal into a separate service cluster temporarily, making them could communicate with each other in the form of point-to-point communication way.

However, for us college students, our dormitory has only one cable network interface and charge by time. It is well known that students use Internet cable to access the Internet is very wasteful and inconvenient. General people use traditional wireless router to convert addresses and wireless signals. By connecting the WIFI hotspot, students could surf the Internet freer ignoring the standard of limited distance. Frankly speaking, without the absence of the router, using our laptops also could share the Internet.

1.2 Ad-hoc network

Before the practical operation, we first studied WLAN. WLAN can be divided into two categories: one is with fixed infrastructure, the other is without fixed infrastructure. Obviously, in the dormitory environment, we choose the self-organized network without fixed infrastructure. This paper aims at Ad-hoc network.

Based on an in-depth study of Ad-hoc, we found that Ad-hoc is significantly different from the fixed communication network in several aspects:

Packet forwarding ability.In Ad-hoc network, the node has a packet forwarding ability. The communication between nodes may be go through multiple intermediate nodes. Different from

Multi-Hop Networks, communication in this network is done by the common network nodes, rather than by any dedicated routing equipment.

Self-organization. With the characteristic of self-organization, nodes in Ad-hoc network could create an independent network without any complicated operations. This network uses a hierarchical network protocols and distributed algorithm to coordinate with each other, which is the corn content of the network.

Dynamic network. Ad-hoc network is a dynamic network. The topology of the network will be changed at any time, allowing the network nodes move. And this network also permits the computer start-up and shutdown at any time.

1.3 Two main technologies

After deep learning of Ad-hoc network, we found two main technologies could create this network successfully. One is Bluetooth and the other is UWB. They both have their advantages and disadvantages, using in different situations.

1.3.1 Bluetooth

Bluetooth is a kind of radio technology supporting short distance communication of equipment. Bluetooth device connections must be paired within a certain range. This kind of pairing search is called short-range temporary network mode, also known as piconet, which can hold up to 8 devices. The Bluetooth device is connected successfully. There is only one master device and multiple slave devices.

Bluetooth technology also has RF characteristics [2]. The TDMA structure and network multilevel structure are adopted. Frequency hopping technology and wireless technology are applied in technology. It has the advantages of high transmission efficiency and high security, so it is applied in all walks of life.

Though Bluetooth is a mature technology and used in many aspects, it also has many problems that could not be ignored.

Bluetooth power consumption is main problem [2]. The frequency of Bluetooth data transmission is not high, and it consumes less energy in the process of data transmission. However, in order to respond to the connection request in time, the polling access in the waiting process is very energy consuming.

Bluetooth connection process is cumbersome. The process of Bluetooth connection involves many times of information transmission and verification. On the surface, it seems that users can not feel the complex connection procedure. However, the repeated data encryption and decryption process and the authentication process required for each connection are a great waste of computing resources for devices.

The security of Bluetooth also is worth serious consideration. The first pairing of Bluetooth requires the user to pass the pin code verification. Generally, the pin code is only composed of numbers, with few digits, generally 4-6 digits. After the pin code is generated, the device will automatically use the E2 or E3 encryption algorithm of Bluetooth to encrypt the pin code, and then transmit for identity authentication. In this process, hackers are likely to intercept data packets, pretend to be the target Bluetooth device to connect or use "violent attack" to crack pin code [2].

Besides, base the network structure, it is impossible to communicate directly from device to device. Messages need to transition between the master and slave devices, so the selected route may not be the best one. When the data is too large and the users are too many, it is difficult to expand and the limited scope is small.

1.3.2 UWB

UWB is a kind of "unique" wireless communication technology. It will bring low power consumption, high bandwidth and relatively simple wireless communication technology to the interface card and access technology of WLAN LAN and personal LAN pan.

UWB can transmit information in a limited range (such as 4m) at a very high data rate (such as 480mbit / s) and a very low power (200 μ w), which is much better than Bluetooth [3]. Bluetooth has a data rate of 1 Mbit / s and a power of 1 MW. UWB can provide fast wireless peripheral access to transmit photos, files and videos. Therefore, UWB is particularly suitable for personal networks. With UWB, the content of video camera can be downloaded to PC for editing in the dormitory in a wireless way, and then sent to TV for browsing. It is easy to realize personal digital assistant (PDA), data synchronization between mobile phone and PC, loading game and audio / video file to PDA in a wireless way, audio file transfer between MP3 player and multimedia PC, etc.

Compared with Bluetooth technology, UWB technology has high anti-jamming performance. When transmitting, the weak radio pulse signal is scattered in a wide frequency band, and the output power is even lower than the noise produced by ordinary equipment. The signal energy is restored and the spread spectrum gain is generated during the demodulation process.

There are two aspects of UWB security: one is the use of time hopping spread spectrum, the receiver can only solve the transmission data when the sender's spread spectrum code is known; the other is that the transmission power spectral density of the system is very low [3]. It can't be received with traditional receiver.

Because it uses a very short duration of narrow pulse, so its temporal and spatial resolution is very strong, convenient for ranging, positioning, tracking and other activities, and narrow pulse has a good penetration, the ultra wideband encountered in infrared communication is also widely used.

2. Test in Dormitory

According to the above theoretical study, we choose to use UWB Technology in dormitory to realize the establishment of self-organized network.

The first thing is to ensure that the wireless network card is available and can automatically obtain the IP address. For laptops, there is usually a built-in wireless network card in the current market, but for desktops, there may not be a built-in wireless network card, so you need to buy it by yourself.

Then it's time to start creating ad hoc networks. Bridge "local connection" and "wireless network connection" in the network connection window to create the bridge we need. By setting the bridge to automatically obtain IP address and DSN server address, or manually setting effective network connection parameters such as IP address and DNS server address, to ensure the feasibility of temporary network and the development of subsequent functions such as Internet access.

Switch to the "manage wireless network" window, click "add" to start creating a wireless connection, first set a name for the wireless network to be created, and set a reasonable security type and security key for it.

Although the default security of Windows 7 is "WPA2 individual", according to the previous data query, it is found that choosing WEP to build ad hoc has a high success rate. A valid WEP key is any 5-bit (64 bit WEP) / 13 bit (128 bit WEP) character, or 10 bit / 26 bit hex character. If you plan to allow connection sharing after the computer restarts, you need to check "save this network". Otherwise, the temporary wireless network will disappear automatically after the restart.

Finally, we can find the Ad-hoc network we created in the computer, mobile phone and other terminal devices, input the correct key, and then we can connect to the point-to-point Ad-hoc wireless connection and share the Internet. After the connection is successful, you can chat online, open the browser's normal browsing page, transfer and share files with each other, or use the "Ping" program to test its connectivity. And the test result is shown in Figure 1.

Fig. 1 Test result

3. Summary

After the analysis of the practice results and the query of the data, we find that there are some improvements and precautions: for example, the steps of creating a "bridge" are optional, and if only two devices are interconnected, the support of the "bridge" is not needed. Moreover, although Ad-hoc supports WEP security well, WEP is no longer secure. Therefore, Ad-hoc is only suitable for temporary wireless connection and cannot be used for a long time. When it is no longer used, it should be deleted in time to avoid interference with normal Internet access.

References

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