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Research Article

Analysis of a Wireless Local Area Network Based on the Zigbee Technology Applied to Agro-food Safety Production and Monitoring

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Abstract: With increasing maturity and development of information technology, local area network has been widely used in all areas of social life including the agri-food grown field. As a new technology, applications and application of local area network has its huge advantage. Considering the socio-economic development requirements of the 21st century agri-food grown, building local area network to facilitate communication and improve agri-food grown efficiency is very urgent and necessary.

Keywords: Agro-food, local area network, safety production and monitoring, Zigbee technology

INTRODUCTION

Wireless Local Area Network (Wireless LAN) using wireless mobile devices (mobile terminal) in the access to the local area network LAN, enable information exchange between the LAN network equipment, LAN network has been access to the INTERNET, mobile devices (mobile terminal) through various forms on the INTERNET and can also access other devices for information exchange. Building local area network to facilitate communication and improve agro-food safety production and monitoring efficiency is very urgent and necessary (Blunk and Vollbrecht, 1998; IEEEP802.1x, 2001).

Wireless LAN (WLAN) standards followed by (IEEE802.11) was originally used for industrial and scientific research, is recommended and 2.4 G wireless band, so the band open; the transmission bandwidth in the 2.4 G band of 11 MbpS, 5 G band of up to 54 MbpS. Band of open networks easily and high speed data access more favored by users. At present, wireless local area network technology applies to the following places:

- Traditional alignment methods cannot be used in the local, traditional cabling destructive is large or difficulty, wiring for historical and other reasons unable to wiring area
- Regions not easily crossed the barrier where the waters
- Repeat temporaries settings and schedule the place where the communication
- Need to quickly establish communication and using cable inconvenience and costly or lengthy
- Local area networks for mobile computing users need larger places

Particularly noteworthy is the public service, in the United States known as the "hot spot" services, principally at the airport, bus station, cafe, conference rooms and other public places use WLAN to provide wireless access to Internet services. The premise of this service is to use a laptop and PDA users more and more, they need when on the road or casual entertainment, or send and receive useful information in a timely manner and hoped that their position is not subject to the binding of the network cable (cabling and maintenance interfaces in public places is a major problem and cost of the thing), WLAN, l point can easily provide such a service. Now United States in nearly every major hotel, airport and Starbucks coffee houses with WLAN access (Rigney *et al*., 2000; Satyanarayanan, 1990; Sandberg, 1985).

The other hand, the 3G of the traditional telecommunications operators have similarities with WLAN to provide services. However, WLAN compared to 3G there are two main advantages:

- WLAN to 11 MbpS access digital bandwidth, by 802.1 LA or HiperLAN2 standards, digital bandwidth is as high as 54 Mbps and 3 G provide only 2 Mbps of bandwidth.
- WLAN has experience in successful operations, but 3 G does not have. Now the industry consensus is: 3 G and WLAN complement each other. Channel characteristics seen from the air, for access processes, data transfer and farther, passing through obstructions or bypass the more, the higher the bit error rate, the actual transfer rate, the less. Indoor environment or so for the crowded public places, WLAN more fit than the 3 G and geographically broad, relatively scarce local users, such as on a train, on the freeway of mobile

communication have evolved from the traditional 3 G is able to provide adequate digital services at a

- lower cost (Zou and Jai, 2006; T-Engine Forum, 2003).

OVERVIEW OF WLAN SYSTEM

Mainstream wireless LAN products as early as from the IEEE 802.11 standard approved by the organization in June 1997. Subsequently in order to have a higher data communication bandwidth, more functionality and can contribute to more rapid development of wireless local area network, IEEE 802.11 standards to form a new working group be extended and strengthened. Gives the current most popular of the three different characteristics of the IEEE802.11 standard extension.

Because of the broad development prospect of WLAN, when WLAN standards the birth of China Telecom enterprises based on current network operations, use WLAN asking of the China Telecom Wireless Ethernet access technology requirements, planning application of WLAN in the Chinese telecommunications market. Subsequently, China Mobile moves combined with existing technology, has established the China Mobile WLAN business overall technical requirements and other relevant norms. This suggests that WIJAN technology in China will be based on the large-scale development of the national standards and applications.

Spectrum division: 802.11b working internationally on the 2.4 GHz band of license-free band. In our country, 2001 Ministry of information industry Ministry has issued a letter No [2001]653 notice clearly set out in 2400~2483.5 MHZ the 83.5 MHZ band, indoor WLAN does not require approval to use.

802.11A 5 GHZ band in the United States for the U-N11 band, as well as license-free band. In our country is different. In July 2002, Ministry of information industry Ministry has issued a letter No "2002) Notice No. 277, clearly 5725~5850 MHZ 125 MHZ band, high speed wireless LAN to the point to point or point to multipoint spread spectrum communication systems, broadband wireless access systems, Bluetooth wireless technology, equipment and vehicles, such as automatic identification systems sharing this band radio station. Set the 5.8 GHZ band radio transmitting stations, must be reported to the provinces, autonomous regions and municipalities directly under the radio authority for approval. Outdoor settings of the wireless local area networks required to obtain a radio licence. While 5725~5850 MHZ in principle this frequency band for public wireless access communication, operation enterprise based telecommunications business shall obtain the appropriate license.

Wireless LAN topology: According to the functions of different wireless access point AP, WLAN can achieve

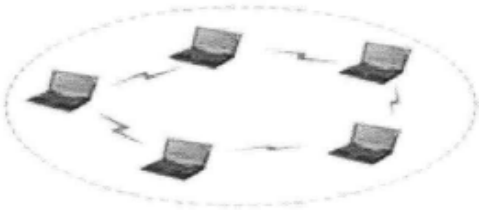

Fig. 1: Ad-hoc mode network

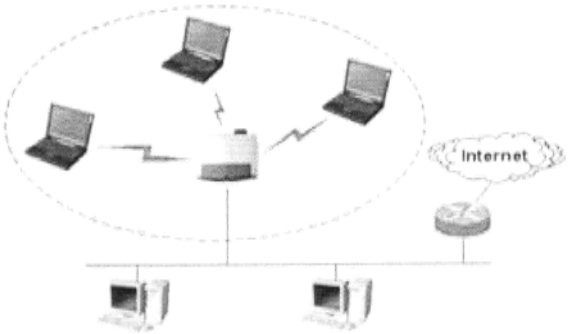

Fig. 2: Infrastructure mode network

a variety of networking. Point mode, infrastructure mode, is now a bit more AP mode, wireless bridge mode of five network and wireless Repeater mode.

Point to point mode Ad-hoc (Peer-to-peer): Composed by wireless workstations, for wireless station and another one or more other direct communication of the wireless station, the network cannot be connected to a wired network, can only be used independently. No AP, security up to the individual client to maintain.

One node of a point to point mode required can also "see" to other nodes in the network, or think that network outages, peer network can only be used for a small number of users of the network environment, such as 4 to 8 users (Fig. 1).

Infrastructure mode: The wireless Access Point (AP), a wireless station (STA) and distributed Systems (DSS) that area covered by the Basic Service area (BSS). Wireless access point or wireless hub, used to receive between wireless STA and cable networks, caching and forward the data, all wireless communications are completed through the AP. Wireless access points can usually cover dozens of to hundreds of users, covering a radius of up to hundreds of meters. AP can be connected to a wired network, wireless networks and wired network connectivity (Fig. 2).

Multi-AP mode: Multi-AP mode Mean by more than one AP and distributed systems that connect them (DS) make up the infrastructure mode network, also known as Extended Service area (ESS). Extended service area of each AP is an independent wireless network Basic

Service area (BSS), all AP designator in sharing the same extension service area (ESSID). Distributing System (the DS) the 802.11 standards did not defined, currently mostly refers to Ethernet. The same ESSID can roam between wireless networks, different wireless network ESSID form logical subnet.

Wireless bridge mode: Using a pair of AP connects two wired or wireless LAN segment.

Wireless repeater mode: Wireless repeaters used to in the communication path forward in the middle of the data, so as to extend coverage of the system.

WIRELESS LOCAL AREA NETWORK DESIGN PRINCIPLES

Network systems design focus is to complete the network system design of the structure and composition to determine network and a design can be complex, it can be very simple. In fact, network systems design work early in the understanding of the situation when it started and in the process, was what should be a sub network system has a certain degree of choice. That is, information-gathering process and the system design process are often not very clear boundaries, now need to do is to analyze information and then refined and quantified analysis conclusions, on the end to the text, allow users to clearly understand what future own the application of wireless local area network.

At the time of network design, you need to hold several important principles, asked in some places there may be a contradiction between these principles, we need to practice and balanced against the resources according to user needs.

Advance and maturity: To ensure that adequate bandwidth to the network system as a whole, communication network node has sufficient processing power to ensure that the network response time for users. Build a wireless local area network take a significant amount of human, material and financial resources, for a large and complex history of wireless local area network is true. This kind of input for a family, a business is not a small sum of expenses, must ensure that the design of the options are more advanced in technology, the equipment and technology in a number of years you choose does not lag behind. At the same time, to try to ensure the selection of technical standards and maturity, in line with international standards of equipment and technology to ensure that a variety of equipment interoperability, compatibility, maintainability and the protection of investment. Is developing the latest technology and equipment may provide users with higher performance, but if in the future may not become the industry standard or de facto industry standard, will soon be weeded out, this will cause infinite has built a network of affected, such as the manufacturer's maintenance services, spare parts delivery as well as other issues such as interoperability of devices.

Security and reliability: Security of wireless LAN design including the legitimacy of user access to the network and data security aspects. There is no security is clearly impossible, even for security does not have too many requests, to safeguard your system, you need to have security requirements. Adopting measures such as user accounts, user ID, user password in most cases is sufficient, but if the data to be processed by the Web application is very sensitive, you must take additional security measures, such as data encryption and so on. It must be noted, to ensure the security of network systems in order to take certain costs and complexity of the system use may increase, performance may be degraded. In many cases, the wireless LAN security measures that may need more than a wired network. This includes the security requirements, the use of a secure way (VPN, firewall, etc) small intent, using security technologies and systems and data security management strategy.

Security is essential for the operation and development of the network, such as networking equipment and network operating system with network security, has a lower error rate and better anti-interference ability of communication line, with certain encryption equipment. Where security has two meanings: the security of network systems security and application software system. Implement the security principle, from internal and external network users to prevent unauthorized access and destruction of the network resources. Depending on your needs, we should consider the purchase of necessary network security software and hardware, such as firewalls, antivirus software and hardware, the system should have a strong ability of fault tolerance and recovery. Development of application software system should have a strictly graded rights management to prevent illegal users in excess of use of system resources. Reliability refers to system design, you should consider if the system runs continuously and to long-term, used by the device must ensure a high level of stability and usability, if necessary, consider whether data needs to double backup or distributed storage and fail-back measures.

Openness and scalability: On one hand, must protect existing investment in hardware, application for some good application software can be protected and if possible, use of public domain and existing communications resources to form a wide area network, avoid significant investment on the communication line. The other hand, short replacement cycle due to network devices, application needs change very frequently, so if the network is designed, as far as possible to prevent network equipment quickly

eliminated. As the application needs of the development and expansion of the scale of the network, the network should have a good programme of open and scalable to ensure increased network node, the expansion of business volume growth, networking the extension distance and multi-media application. For example, you can use standard interfaces and protocols, networking equipment and network topology with excellent expandability as possible method of structured cabling system. Choice of network design and network equipment to comply with international standards and industrial standards, enables the network to have a high degree of openness and taking into account the future investment in the equipment provided by the technical compatibility. At the same time, network design must fully take into account the current situation at the same time, must also take into account the longer-term needs of the business development in the future. 1111 of the other party must also be extensions of leave sufficient room for your network, select a tile and with good mutual compatibility and interoperability of devices and software products, software development should pay attention to when in conjunction with other products, for consistency. Wireless LAN standard update soon, new products are constantly emerging, while designing and planning for wireless LAN system, taking into account their compatibility, interoperability and the future development of new technologies impact on existing systems, to the future of new technologies to ensure a smooth transition, protecting early input.

Affordability and practicality: Economics that has high performance-cost ratio. Unless the demands of business, no Bell lJ do not blindly pursuing the latest technology and equipment, performance and price change because new technologies very quickly, spending's going to be very cost-effective. Transmission of information is available by the hour breaks per day, which can help designers determine the peak traffic. Peak traffic can help find problems in the design, select the appropriate device. Most networks are based on average traffic, rather than the peak traffic design. For most units and peak traffic design and purchase took the costs of the network is not cost-effective, because the peak traffic only occurs in very little time, results in network transmission capacity in the other time wasting. In addition, different users for the application of wireless local area networks also have a lot of different. In many cases, equipment utilization rate is very low, so emphasize purchased to meet the demand of the device, do not buy extra equipment, increase equipment utilization. Usability refers to our purpose built wireless local area network is rather experimental, so design should focus on practical, phased construction, built to use, without seeking the latest and excessive "nice but false appearance". At the same time, should have good manageability of the system, enabling network managers to easily maintain network equipment and promptly grasp of statistics such as the network topology, network performance, network fault information, can be easily configured and adjusted to the network, make sure that the network is working in good condition.

SUMMARIZES AND FORECASTS

Wireless network is to address the emergence of cable networks could not overcome the difficulties, the current wireless LAN cannot be completely divorced from the wired network, wireless and cable networks are complementary, rather than competition, is wired networks complement rather than replace. It should be noted, in some specific area and has its important advantage over traditional wired local area network, wireless local area network is a wired local area network extension of the effective and complementary point of view, is an indisputable fact. Therefore, precisely because of its irreplaceable advantage, future growth of the wireless LAN market is irreversible. In particular, in recent years, as applied to wireless LAN product prices fell gradually, the software has matured, the wireless LAN through the combination of wide area network and provide mobile Internet in the form of multimedia services.

At present, China's wireless LAN market is still dominated by public services, but the next two years, more and more enterprise users using a wireless local area network, at the same time as the standard configuration of the wireless network card is becoming portable, use will rapidly increase in the number of wireless LAN. Believe in the near future, wireless local area network to transfer to its high speed and flexibility will play a more important role and building local area network to facilitate communication and improve agro-food safety production and monitoring efficiency will be more and more important.

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