The interconnection between wireless sensor networks and IPv6 networks

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Abstract: Nowadays, WSN and TCP/IP (V6) network interconnection has become one of the most popular research directions. First of all, this paper analyzes the main ways of interconnection, and then makes a brief analysis on the whole IP way, hoping to provide some valuable reference and reference for the majority of readers.

Key words: wireless sensor network; IPV6 network; Interconnect

Introduction

Wireless sensor networks have the characteristics of high reliability, good economy and high detection accuracy, which are widely used in various fields and have broad prospects. For the wireless sensor network, it is not a separate existence, but through a certain way and the external network interconnection, in this way, to achieve its management and access, or with the existing network facilities, through this way to achieve the large-scale networking of WSN network. At present, with the wide use of IPv6 network, it has become an important standard protocol. Therefore, the current hot research direction is to realize the interconnection between WSN and TCP/IP(v6) network. With the gradual development of science and technology, TCP/IP(v6) and WSN can now be realized interconnection, the main contact methods are various, such as overlapping, all-IP and peer to peer, of which all-IP is the current research hotspot in the field of communication. Whether to adopt IPv6 network will have a serious impact on WSN protocol design.

1. Analysis of the interconnection between WSN and IPv6 network

1.1 peer to peer mode

This method is very special. First of all, network nodes need to be set, and it needs to be converted back and forth between protocol layers, so as to realize the interconnection of internal and external networks. Because of the different protocol levels, network nodes can be divided into two ways, namely application gateway and NAT gateway.

1. Application gateway mode

One of the simplest ways to connect the two is to set up one or more proxy servers between the Intranet and the extranet. From the point of view of the protocol, because the working position of the proxy server is the application layer, this way is also called the application gateway way. However, because there is a very big difference between the internal and external network in the protocol layer, the communication protocol can be designed according to the characteristics of WSN, and only the application gateway node needs to obtain the IPV6 protocol.

2.NAT gateway mode

This mode of interconnection is built on a certain basis, assuming that the private network layer protocol is selected in the Intranet, and the external network uses IPv6 network, forming this mode layer protocol, NAT gateway completes the address and protocol transformation between the Internet of Things and the external network in the network level. This way is very similar to the NAT gateway under IPV4, but at the same time, there are some differences, mainly reflected in: the implementation of the two there are similarities. Each Intranet node not only needs a local internal address, but also needs to assign a permanent or temporary IP address. The former is mainly used to route addressing and identify nodes within the Intranet, while the latter is mainly used to identify nodes and route addressing on the extranet. There is a difference between the two in the pursuit of purpose.

1.2 Overlapping ways

There is another way of interconnection is the overlapping way, that is, in the case of different protocols in the internal and external network, the purpose of interconnection can be achieved through the bearer mode of the protocol, that is, the so-called overlapping way. This way of interconnection can be divided into two kinds. The first is the wireless sensor network (v6) based on tcp/ip. Today, this approach is similar in many places to the current VPN approach that connects to private networks. The gateway nodes that connect to the extranet and the communication nodes with WSN are unified into virtual nodes of WSN. The network formed by these nodes is the virtual network, which is regarded as an extension of the real network. In the real network, each WSN node needs to run a matching protocol, and the smooth communication between each node is based on the effective private protocol. The second type is IPV6 OVER WSN. For extranet users, since they need to access and control these special nodes, these special nodes also need protocols. Affected by the communication ability, these nodes are not reachable at the same time. Therefore, in order to achieve better data transmission, IPV6 OVER WSN came into being. In this context, the main part of WSN is still based on private communication protocols, while on special nodes, only IPv6 protocol is used. Therefore, to some extent, ordinary nodes do not advocate the use of IPv6 protocol.

1.3 All IP mode

Whether it is overlapping mode, or the use of peer to peer WSN and TCP/IP(v6) network to achieve mutual connection, all need to

use some specific nodes to carry out protocol transformation or protocol bearer between internal and external networks. In order to realize network interconnection, in recent years, scientists have put forward a new interconnection method, all-IP interconnection. This way has special requirements, each sensor node needs to have IPv6 protocol, therefore, want to achieve the correlation between each other, you need to use a unified network layer protocol, which is to achieve a special seamless combination of each other. Some researchers are very supportive of this way, they think this way will be one of the most convenient ways to achieve network interconnection, while some researchers are not optimistic about this way, they think that the possibility of all IP way to achieve network interconnection is very low, the main reason is that the mechanism followed by IP is address centered. And WSN mechanism is not address as the center, but data as the center, the use of this way, which means that the work effect will be greatly affected, resulting in low work effect. Many data-centered working mechanisms will be affected to a certain extent. Routing functions will be implemented at the application layer or MAC layer, and a separate network layer will not be set up. Current researchers have been debating the use of all-IP mode, and it has not ended.

2. The analysis of the all-IP interconnection

In order to solve the heterogeneous network, TCP/IP is the earliest way proposed by researchers. It mainly uses the network layer protocol to shield the differences in the underlying details of different physical networks. In this way, the mutual information transmission between hosts on different physical networks is realized. In TCP/IP, IP protocol is the most important component, you can use the general identification of other IP address to each host or routing device interface for detailed identification. In the network, each data packet in the transmission process, according to the destination IP address carried by the packet, each forwarding node can choose a different route; TCP works at the transport layer to provide unreliable packet services; UDP also works at the transport layer, but it is mainly used to provide reliable packet services. At each node, a different port number function can be used to distinguish the upper-layer application processes. In addition to dealing with network layer protocols and transport layer protocols, TCP/IP defines a series of upper-layer application standards. IPV6 is built on the basis of IPv4, it is based on IPv4 years of operating experience to create inventions, mainly including simplified header format, extended header and extended addressing capabilities and other changes, more powerful than IPv4.

3. A brief analysis of the problems that are still being studied in the all-IP approach

Since TCP/IP was not specially designed for WSN at the beginning, there are some problems in the process of realizing interconnection in all-IP mode, which need to be solved urgently.

3.1 Analysis of the degree to which WSN nodes support IPV6

At present, most WSN are wireless multi-hop networks, and all or part of WSN nodes have routing and forwarding capabilities. Therefore, for WSN, it can not only provide support for the host side of IPV6, but also can provide support for the router side of IPV6, which is a problem worth thinking and in-depth research. This problem is inextricably related to the network structure and addressing mode of WSN. To solve this problem, we need to optimize and reform the addressing mode and networking mode comprehensively.

3.2 Analysis of TCP/UDP/IP header compression

In WSN, due to its traffic and data rate is very small, generally the main packaging format is the standard TCP/IP(V6) format, which will lead to excessive packet header overhead, for example, the standard IPV6 package needs to increase the header overhead of 40, TCP package needs to increase the header overhead of 40 bytes, UDP package needs to increase the header overhead of 8 bytes. Although in the traditional network, these control costs can be minimal for business data, but in WSN, because of its low traffic volume and the main purpose of data collection, these costs account for a larger proportion. Therefore, in order to reduce the energy loss, it is necessary to pay attention to these costs, you can compress some fields of these headers in a certain way, in order to achieve the cost control. Although the research in this area has made some progress and results, but the combination of WSN specific head compression methods are still worth studying.

3.3 Analysis of IPV6 address automatic configuration

Address automatic configuration is an important technical feature of IPv6, it not only supports stateless address configuration, but also supports stateful address automatic configuration, can be mistaken for interference in the case, each interface is set to IPv6 address, this technical feature and WSN self-organization and self-configuration function is very close. In addition, in WSN, there are also some problems in the existing IPV6 address auto-configuration. For example, the characteristics of central control lead to a large amount of control message overhead, and generate IPV6 addresses according to MAC addresses, which does not bring any benefits to the routing addressing between WSN nodes. In this regard, scientists put forward a distribution scheme according to the actual situation, which has strong applicability for WSN, but because of some problems, such as node mobility, node dense layout and so on, research work in this area still needs to be carried out.

3.4 It carries the data-centric business analysis

Compared with the traditional IP network, the most important feature of WSN is data query based on attributes and aggregation/fusion processing in the process of data return. Therefore, in the IPV6 address-centric framework, how to effectively carry out business is also one of the problems to be solved by the all-IP approach. In this regard, scientists put forward a solution, this solution is to address, aggregation and other functions on the application layer, TCP/IP can provide a broadcast function, in this way, whether in the broadcast service, or the application layer unicast, will be regarded as broadcast service, but also bring a lot of packet processing. This is not very beneficial to the energy saving of WSN, therefore, in the all-IP mode, how to effectively carry the data-centric business, still need to continue to study.

3.5 Analysis of TCP/IP protocol stack tailoring

Due to the characteristics of WSN itself, its storage capacity and processing capacity are very low, which has certain requirements for the size of the protocol stack. Therefore, in order to make WSN support the protocol stack, it is necessary to cut it. To this end, scientists have come up with a completely new scheme. The introduction of μIP was an important attempt to simplify the TCP/IP stack, although at the time it was still a long way from the desired all-IP approach. First, μIP is proposed, where IP is IPv4, however, there is a big difference between IPv4 and IPv6. Secondly, the function of μIP is not comprehensive, it can only realize the simplified IP function of the host side, and the function of the router side is not involved. Therefore, the protocol tailoring problem adapted to the characteristics of WSN is still well solved.

In short, how to realize network interconnection has always been a hot issue in the field of communication. This paper analyzes and stages the interconnection mode from multiple perspectives, hoping to provide some valuable reference for the general readers.

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