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XI'AN TECHNOLOGICAL UNIVERSITY

IOT and IPv4、6 and IPv9

Wang Zhongsheng
Xi'an Technological University,

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Overview

In recent years, with the rapid development of network technology, communication and intelligent embedding technology, the word "Internet of things"(IOT) appears frequently in front of us. As an important part of the next generation network, the concept of IOT has received extensive attention all over the world, and attracted attention from developed countries such as Europe, the United States, Japan and South Korea. All countries have plans and put them into practice.



1. The concept of IOT

Experts believe that IOT will bring a new technological revolution. It is the **third** wave of global information industry after **personal computer**, **Internet** and **mobile communication network**.

The English full name and abbreviation name are the **Internet of things** and **IOT**, In general, the Internet of things is a network that connects everything together.

The IOT system consists of the following four layers:



(1) Perception layer (Sensor)

"Perception" is at the core of the IOT. In order to make the object perceptive, it is necessary to install different types of recognition devices on the object, such as **electronic Tag**, **barcode** and **QR**(Quick Response) code, or to perceive its physical and chemical features through **sensors** or **infrared** sensors. With these devices, the information of objects can be obtained at anytime and anywhere.



(2) Reliable transport layer

In order to realize the information interaction between networks and objects, a unified communication protocol must be designed. As the IOT is a heterogeneous network, protocol between different entities are different, which requires transformation through software and hardware to ensure real-time and accurate transmission.



(3) Intelligent processing

The purpose of IOT is to realize intelligent identification, positioning, tracking, monitoring and control. This requires the cloud storage; analysis and processing of massive data through intelligent computing technologies such as cloud computing and artificial intelligence, and intelligent control of items according to different application requirements.



(4) The application layer

Through the development of various applications, to finished the intelligent control.

About the explanation of the IOT, it's defined as follows: the IOT is a **network** which through the **RFID** (Radio Frequency Identification), **sensors**, **infrared sensors**, **global positioning system (GPS)**, **laser scanner** and other information **collection equipment**, according to the protocol, connect with the Internet, to finished information exchange and communication, and implement intelligent Identification, location, tracking, **monitoring and control**.



2. Main Technologies of IOT

At present, the Internet of things still has many problems to be solved, involving a wide range of scientific fields and many technologies, which still require considerable time to development and research.

The main technologies of IOT include: RFID, sensor technology, network and communication, data mining and fusion, cloud computing and cloud storage, etc..

Today we will focus on IP technology. 敦德励学 知行相长



3. IPv4 and IPv6

Vinton Cerf (温顿·瑟夫) and Robert Kahn (罗伯特·卡恩) worked at Stanford University in the United States from 1972 to 1976. They developed the **TCP/IP** protocol together. They insisted that they did not apply for patent and did not regard it as private property, which enabled the rapid application and development on the Internet.

IPV4 was one of the **TCP/IP** protocols.



In 2004, they won the **Turing Award** from the American computer society (ACM) for their outstanding achievements in Internet protocols.

The Turing award is called the Nobel Prize in computer science.

The full name of IPv6 is “Internet Protocol Version 6”, it is a **new IP Protocol** designed to replace the **current IPv4** (current IP) Protocol by the **IETF team** (the Internet Engineering Task Force).



(1) The structure of IPv4

IPV4 consists of 32 binary bits, four groups which is divided by the symbol ".", each group of has 8 bits, which is from 0000, 0000~1111, 1111, convert to decimal is between 0~255.

In network, Different computers have different IP addresses.

As shown in figure 1.



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Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

☐ Obtain an IP address automatically

☒ Use the following IP address:

IP address:

192 . 168 . 0 . 200

Subnet mask:

255 . 255 . 255 . 0

Default gateway:

. . .

☐ Obtain DNS server address automatically

☒ Use the following DNS server addresses:

Preferred DNS server:

. . .

Alternate DNS server:

. . .

☐ Validate settings upon exit

Advanced...

OK

Cancel

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(2) The structure of IPv6

The difference between IPV6 and IPV4 is their binary bits number.

IPV6 consists of 128 binary bits. And is expressed in hexadecimal, with segments separated by the symbol of colon ":", the addresses **length is 128 bits** long, but are usually written in groups of eight, each in the form of four hexadecimal Numbers.

For example:



2001:0db8:85a3:08d3:1319:8a2e:0370:7344

If all four Numbers are zero, they can be omitted.
Such as:

2001:0db8:85a3:0000:1319:8a2e:0370:7344

can be written as:

2001:0db8:85a3::1319:8a2e:0370:7344



If there are more than two colons due to omission, you can compress them into one, but this zero compression only occurs once in the address.

Therefore:

2001:0DB8:0000:0000:0000:0000:1428:57ab

2001:0DB8:0000:0000:0000::1428:57ab

2001:0DB8:0:0:0:0:1428:57ab

2001:0DB8:0::0:1428:57ab

2001:0DB8::1428:57ab

The IP above are all legal, and they are equal.



The IP addresses above are all legal addresses, and they are equal. But:

2001::25de::cade

It's illegal. (because it would make it unclear how many total zeros are in each compression)



And the zero before the number can be omitted,
therefore:

2001:0DB8:02de::0e13 is equal to:

2001:DB8:2de::e13



(3) IPv4 and IPv6 Each other

In order to achieve ipv4-ipv6 interworking, IPv4 addresses will be embedded into IPv6 addresses, where addresses are often expressed as: $X:X:X:X:X:X:d.d.d.d$, The first 96bits is separated by a colon with hexadecimal, while the last 32bits is by the IPv4's dot decimal.

For example $::192.168.0.1$ and $:FFFF:192.168.0.1$ are two typical examples.



(4) IPv4 and IPv6 transform each other

IPv4 can be easily converted to IPv6, the method is to convert IPV4's decimal to hexadecimal, such as:

IPv4 is: 135.75.43.52

(hexadecimal is: 0x87.4B.2B.34)

it can be convert to IPv6:

0000:0000:0000:0000:0000:0000:874B:2B34

or ::874B:2B34



(5) The specific address

Special addresses include unspecified addresses and loopback addresses. An unspecified address (0:0:0:0:0:0:0:0 or ::) is used only to indicate that an address does not exist. It is equal to IPv4 address 0.0.0.0.

An unspecified address is usually used to verify the source address of a tentative address unique packet, and is never assigned to an interface or used as the target address.



The loopback address (0:0:0:0:0:0:0:0:0:0:1) identifies the loopback interface and allows the node to send the packet to itself.

It is equal to IPv4 loopback address 127.0.0.1. Packets sent to the loopback address will never be sent to a link, and will never be forwarded to an IPv6 router.



4. IPV9

At present, the widely used IPv4 protocol address space is theoretically 2^{32} .

Due to the insufficient estimation of the development of the Internet in the early stage, the IP allocation is not reasonable and the resource is very limited.

By 2010, there will be no available addresses to be allocated.



IPv6 theoretically has 2^{128} addresses, but only 1 in 8 addresses can be assigned to end users, so only 2125 is equal to 1037. The current 128 bar code is already 10128, so it is not covered, with certain limitations.

IPV9 is not an upgrade of IPv4 and IPv6, it has 10^{256} addresses, and its massive address can meet the requirements of the domain address resource of 750 years of human activities, and it is the simplest domain address system.



In 1998, Chinese researcher Xie Jianping proposed IPV9, which full name is “Method of using whole digital code to assign address for computer” .
To distinguish it from American IPv4 and IPv6, the **V** in Chinese **IPV9** is **upper case**, not **lower case**.
The technology can be connected and compatible with IPv4 and IPv6 covering existed networks.
And it has used in China and many other countries. And will be used in the “**One Belt And One Road** countries”.



The IPV9 protocol USES 0-9 Arabic numerals as the virtual IP address and USES decimal system as the representation method of text.

It has an infinite number of distributable IP addresses.

It has the largest 2×2048 bits address and is the base of digital world.

About IPV9 technologies will be introduced detailed in future lectures.



Summarize

IPv4 supports a maximum of 2^{32} addresses, and it had run out by 2010, while IPv6 supports a maximum of 2^{128} . The number is large, but it has certain limitations. IPV9 is not an upgrade of IPv4 and IPv6, it has 10^{256} addresses, and its massive address can meet the requirements of 750 years of human activities. This solves the problem of things identification thoroughly; it lays the foundation for the interconnection of all things.



西安工业大学
XI'AN TECHNOLOGICAL UNIVERSITY

计算机科学与技术

Prof. Wang Zhongsheng
wzhsh1681@63.com

Contact :

**School of Computer Science and Engineering,
Xi'an Technological University,
Xi'an, 710032, China
VK, id506332858
Wechat: diamond-wzs
QQ-mail: 59483672@qq.com**



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