Advances in Computer Science Research (ACSR), volume 61
7th International Conference on Education, Management, Computer and Society (EMCS 2017)

Research on the Main Technologies of IPv6

Meilin Wu[1, a] and Sen Li[1, b*]

[1]Xinjiang Shihezi Vocational Technical College, Xinjiang, China

[a]59685686@qq.com, [b]82203719@qq.com

[*]The corresponding author

Keywords: IPv4; IPv6; Internet; Network security; Transition

Abstract. With the increasing demand for diversification, for example, the new mobile communications and real-time interactive multimedia communications, IPv4 will ultimately transit to IPv6 due to many of its problems, such as lack of address space, poor quality of services, complex configuration, poor mobility support and security. IPv6, comparing to IPv4, has many new features, the simplified IP header format, host address auto-configuration, authentication and encryption, and strong mobility support and so on. Since the early 1990s, countries, organizations, operators and experts all over the world have had a broad study of IPv6.

Introduction

Internet, being the fastest way of finding useful information[1], has Played a huge impact on human society and people’s ways of life after its birth more than 30 years ago, providing the most important information resource in this economic information society[2]. Since the first version of the internet communication protocols IPv4 actually used more than 30 years ago, Processor Performance has increased 1000 times, the typical memory size 400 times, the Internet backbone link bandwidth 150,000 times[3]. But it has not changed ever since. Research and promotion of next generation Internet have drawn attention of researchers and ISPs in many countries. In China，researchers，internet service providers and the government are enthusiastic on the promotion and immediate deployment of IPv6 due to the imminent problem of IPv4 address exhaustion. In this paper，we focus on IPv6 transition technologies which are the foundation of IPv6 transition[4]. We first summarize the technological challenges and analyses possible scenarios during the transition from IPv4 to IPv6[5]. Then we classify transition technologies into three categories，I. e. translation，IPv6 over IPv4 tunnel and IPv4 over IPv6 tunnel，and compare different technologies in the same category to further study their features and possible application scenarios[6]. Finally，we point out some future directions in the area of IPv6 transition[7].

The Internet of Things Network Trouble

The sheer scale of rich Internet application and node both has brought the huge potential of business at the same time also brought technical challenges.

First of all, the Internet of things is composed of many nodes connected, whether using the organization, or use of the existing public sites to connect, the communication between the nodes inevitably involves addressing the problem. The addressing system of the Internet of things can use two ways, one way is to use based on 164 number addressing way of addressing, but due to the most current Internet of things application of network communication protocol using TCP/IP protocol[8], the phone number of addressing way will need to phone number and IP address, it improved the technology difficulty, and increases the cost. At the same time due to e. 164 addressing the address space of the system itself is lesser, also can't meet the demand of a large number of node address. Another way is to apply directly to the IPv4 address addressing system for the Internet of things of node addressing, with the rapid development of the Internet itself, IPv4 addresses have been increasingly scarce, and consumption rates from the current address, the IPv4

address space has been difficult to meet the huge demand of network address the Internet of things. On the other hand, the Internet of things the need for huge amounts of address, and put forward the requirement to address allocation[9], the distribution of the mass address will not be able to use the manual allocation, using traditional DHCP allocation of DHCP server in the network also puts forward a high performance and reliability requirements, may cause the DHCP server performance, become a bottleneck of network applications.

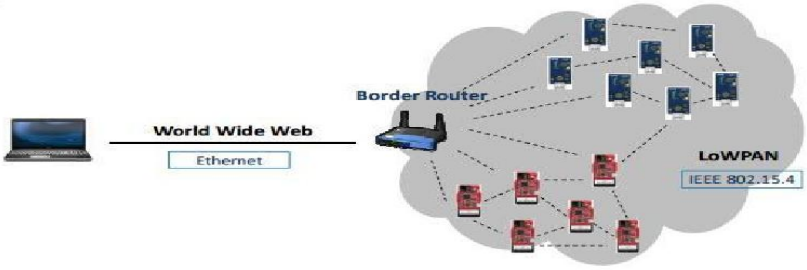

Figure 1. Finite Network topology structure

Secondly, the current Internet mobility is also caused the bottleneck of Internet mobility.IPv4 agreement at the beginning of the design are not fully considering the node mobility routing problem, namely when a node out of its network, how to ensure the accessibility of node access problem[10]. Due to polymerization characteristics of IP network routing, the path entries in network routers are according to the subnet for gathering, when nodes away from the original network, its original left the subnet IP address, and mobile node to the destination subnet, network routers equipment is not the node routing information in routing tables (in order not to destroy the entire network routing convergence, also does not allow destination subnet mobile node in routing), can lead to external node after the mobile node cannot be found. Therefore, how to support node mobility, is just a special mechanism to realize, in the IPv4 IETF proposed MIPv4 (mobile IP) mechanism to support mobile nodes. But the mechanism is introduced into the famous SanJiao Road by problems, for a small amount of mobile nodes with less network resources loss caused the problem, and to a large number of mobile nodes, especially the Internet of things in the group of mobile nodes and mobile, will lead to network resources are exhausted rapidly, the network is in a state of paralysis[11].

Again, the network quality assurance is also in the development of the Internet of things have to solve the problem. At present there are two kinds of Quos IPv4 network technology[12], the one with the method of reserve resources, using the RSVP protocol such as reserved for the data flow of network resources[13], guarantee the quality of its transmission in the process of packets; Secondly the Diffuser technology, the IP packet carries priority tag, network equipment, according to these markers to determine priority packet forwarding priority strategy. Basic from the division of the current IPv4 network quality of service flow according to the type of use Diffuser to implement end-to-end service quality assurance, such as video business with low packet loss, delay and jitter, give it a high level of service quality[14]; Data service is not sensitive to packet loss, delay, jitter, is assigned a lower quality of service level, the distribution methods only consider the quality of the network side of the business requirements, does not take into account the business side of the application of the quality of the demand, for example, a common video business demand for service quality than a bit sensor based operation application requirements of the quality of service. So the service quality of Internet of things security must be combined with specific application.

Finally, the safety and reliability of the Internet of things node also need to consider. Due to limited to cost a lot of iot node is based on simple hardware, impossible to deal with complicated application layer encryption algorithm, at the same time, the reliability of single node could not have done is very high, its reliability is still mainly rely on redundancy to ensure more nodes. Therefore, on the application level of the traditional encryption technology and the network redundancy technology is difficult to meet the needs of the Internet of things.

IPv6 Internet Technology Solutions

IPv6 Technology. IPv6 has a large address space, at the same time, the 128 - bit IPv6 address is divided into two parts, namely the address prefix and interfaces. Unlike IPv4 addresses division, the division of IPv6 address in strict accordance with the address of the digits, instead of using the subnet mask to distinguish between IPv4 network number and host number.IPv6 address of the first 64 prefix is defined as the address, the address prefix used to represent the address belongs to which address prefix used in the IPv6 network routing. And address after 64 is defined as the interface address and interface address used to identify the node in the network. In the Internet of things applications can use the interface address to identify nodes in IPv6 address, under the same subnet, 264 nodes can be identified. This identifier space about 18.5 billion address space, the address space can completely meet the needs of the node id.

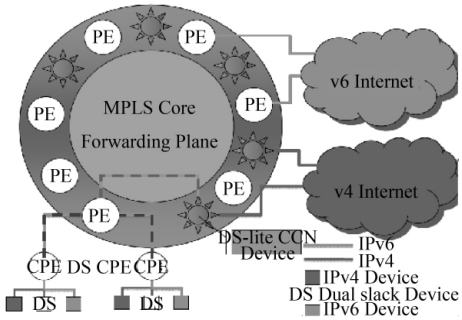

Figure 2. Finite IPv6 hierarchy chart

IPv6, on the other hand, statelessness address allocation scheme is used to solve the problem of efficient mass address assignment. The basic idea is IPv6 network side not management status, including node should use what kind of address, how long is the period of validity, and basic don't participate in the process of address allocation. Node device connected to the network, will automatically choose the interface address (IPv6 address generated by algorithm after 64), plus prefix FE80 address, as local node link address, local link address only effective in the communication between nodes and neighbor[15], router equipment will not routing to the address as the source address of the packet. In the generated after the local link address, the node will be DAD (address collision detection), have been used to detect the interface address whether there is a neighbor node, if the node found address conflict, the stateless address allocation process will be terminated, and the node will wait for manually configure IPv6 address. If still have not found after test timer timeout address conflict, the node that can use the interface address, this terminal sends a router prefix notice request, to find in the network routing equipment, when the network configuration of the routing device receives the request, will send the address prefix circular response, the node should be configured before the IPv6 address of a 64 - bit address prefix notification to the network nodes, the network node will address prefix and the interface combination, constitute a node's own world IPv6 address.

After using a stateless address assignment, the network side will no longer need to keep the node address state, maintain address update cycle, which greatly simplifies the process of allocation, network can at very low resource consumption to achieve the goal of mass address assignment.

Mobility of IPv6 Technology. At the beginning of IPv6 protocol design fully consider the support for mobility. For mobile IPv4 network SanJiao Road by problems, mobile IPv6 put forward the corresponding solutions.First of all, from the perspective of terminal IPv6 puts forward the concept of IP address binding buffer, namely the IPv6 protocol stack before forwarding packets need of IPv6 packets to the destination address binding address[16], if the query to the purpose in binding buffer IPv6 address binding to exist, the direct use of transfer the address for the purpose of the packet, so send data traffic won't after a mobile node's home agent, and forwarded to the mobile node itself directly[17]. Second, MIPv6 introduces a special way to explore the mobile nodes, namely an area access router at a certain time to prefix address of the router interface[18], when

mobile node found router prefix circular change, suggests that the node has been moved to the new access to the area.

Summary

IPv6 is an inevitable trend in the world of the Internet; the various countries' application deployment is in full swing on its development. With IPv6 technology matures, IPv6 network will lead to advancement speeding up unceasingly; will greatly promote the development of next generation network.

References

[1] Eric Grosse, Y.N.Lakshman, Network processors applied to EPv4/IPv6 transition[J], IEEE Network, 2003,17: 35.

[2] D.GWaddington, F.Chang,Realizing the transition to IPv6 [J], DEEE Communications Magazine, 2002,40: 138.

[3] RFC 5555,Mobile IPv6 Support for Dual Stack Hosts and Routers[S],America: IETF, 2009.

[4] Wenming Shi, Chuanhe Huang, Qinggang Wang, Yan Chen, Ming Huang, Yong Cheng, A Novel IPv4/IPv6 Translation Mechanism Based on NAT-PT [C]5 The 9th International Conference on Advanced Communication Technology, America: IEEE, 2007: 1037.

[5] LRaiciS-Zeadally, Evaluating IPv4 to IPv6 transition mechanisms [J],IEEE Telecommunications, 2003,(2): 1091.

[6] RFC 7040,Public IPv4-over-IPv6 Access Network[S], America: IETF, 2013.

[7] RFC 6219,The China Education and Research Network (CERNET) FVI Translation Design and Deployment for the IPv4/IPv6 Coexistence and Transition[S], America: IETF, 2011.

[8] RFC 6146,Stateful NAT64: Network Address and Protocol Translation from IPv6 Clients to IPv4 Servers[S], America: IETF, 2011.

[9] N.Kushalnagar, G.Montenegro, C.Schumacher. IPv6 over Low-Power Wireless Personal Area Networks(6LoWPANs):Overview, Assumptions, Problem Statement, and Goals[S]. IETF RFC 4919, Aug.2007.

[10] Bingqing Luo,Suning Tang,Zhixin Sun. Research of neighbor discovery for IPv6 over low-power wireless personal area networks[C].11th International Conference on QSHINE,2015:233-238.

[11] Montavont.J, C.Cobarzan, T.Noel. Theoretical analysis of IPv6 staeless address autoconfiguration in Low power and Lossy Wireless Networks[C].in Computing & Communication Technologies Research, Innovation ,and Vision for the Future (RIVF),2015:198-203.

[12] Shelby.Z. Neighbor Discovery Optimization for IPv6 over Low-Power Wireless Personal AreaNetwork[S].RFC 6775,Nov.2012.

[13] Supriyanto,R. Murugesan, A Osman, S. Ramadass. Security Mechanism for IPv6 Router Discovery based on Distributed Trust Management[J]. Proceeding of the 2013 IEEE International Conference on RFID Technologies and Applications, Sep.2013.

[14] ZhiHui Y,Gengsheng D,W.Junyun. SAVI-based IPv6 source address validation implementation of the access network[C]. Inproceeding of Computer Science and Service Systm,CSSS,2011.

[15] X.Wang, H.Qian.Hierarchical and low-power IPv6 address configuration for wireless sensor networks[J].Int.J.Commun.Syst.2012,25(12):1513-1529.

[16] T.Winter,P.Thubert,A.Brandt. RPL：IPv6 Routing Protocol for Low Power and Lossy Network[S]. IETF Internet Draft draftietf-roll-rpl-19 ,Mar.2012: 122-140.

[16] Eric Carmes.The Transition to IPv6[Z].Member Briefing #6,Internet Society, January 2002.

[17] Steve King,Ruth Fax,Dimitry Haskin et al. The Case for IPv6.Internet Architecture Board Drafts[Z].draft-ietf-iab-case-for-ipv6-06.txt,December 1999.

[18] Eun-Young Park,Jae-Hwoon Lee,Byoung-Gu Choe. An IPv4-to-IPv6 Dual Stack Transition Mechanism Supporting Transparent Connections between IPv6 Hosts and IPv4 Hosts in Integrated IPv6/IPv4 Network[J].Communications, 2004 IEEE International Conference on,2004,2(6):1024-1027.