

A Survey of Techniques for Internet Traffic Identification and Classification

Mingwei Wei, *Member, IEEE*

Abstract—The techniques for Internet traffic identification and classification are developed rapidly in recent years, as it widely used in network management, monitor, design, security and research. In the past decade, the traffic identification and classification techniques have been evolved along with development of Internet protocols and applications, and many approaches have been proposed to optimize these techniques. Nowadays, traffic measurement remains one of the hot areas in network research. This is mostly based on the ever increasing network bandwidth, the growth number of network users, the constantly sophisticated applications and the development of technique about confusing traffic identification and classification. In this paper, we present popular traffic identification and classification techniques, include port-based, payload-based, flow-based and host-based, then analyze each technique from challenge aspect and make some remarks and recommendations that contribute to optimize traffic measurement.

Index Terms—traffic identification, traffic classification, challenges, application detection, recommendations.

I. INTRODUCTION

WITH the development of Internet technology and the advent of the era of mobile Internet, our life has been inseparable from the Internet nowadays. According to the 35th statistical report on development of Internet in China published by CNNIC [1], the Internet users of China have reached 6.49 hundred million by the end of 2014.

As shown in Fig. 1, the Internet population of China has been increasing rapidly in recent years, almost half of Chinese people are using Internet for work or daily life.

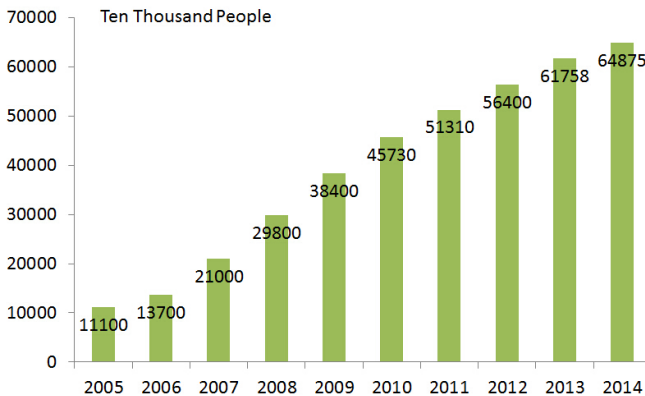


Fig. 1. Internet population of China

Mingwei Wei is with the Department of Computer Science and Technology, Beijing Institute of Technology, Beijing, 100081 China (phone: 152-0161-3264; e-mail: weimw0417@163.com.)

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As shown in Fig. 2, the Internet Penetration of China is higher and higher over the years, more and more people felt the charm of the Internet, and the Internet has penetrated into all walks of life of people.

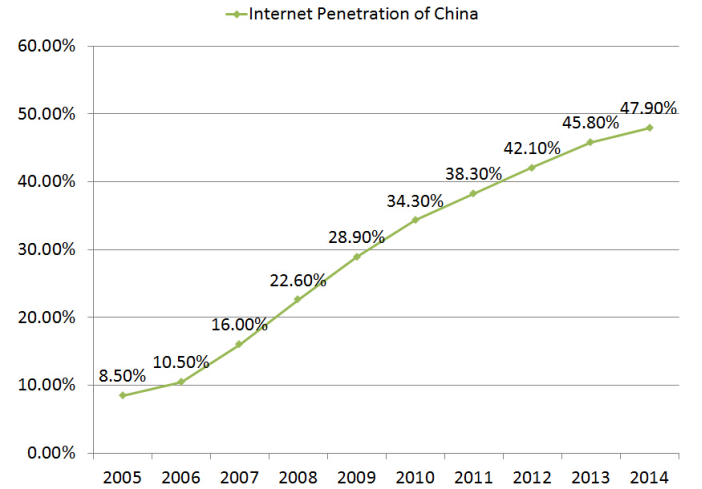


Fig. 2. Internet population of China

Increasingly serious network security problems is in contrast with the rapid development of Internet technology. In the past few years, constantly exposures of network security event make the network security problem get more and more attention. If the security problem is not solved, especially in Internet Finance and Internet Payment, the further development and employment of Internet technology will be severely impeded.

Traffic is the carrier of the Internet. In large number of Internet traffic, a wide variety of malicious traffic is hidden. These malicious traffic carrying viruses, trojans and worms threats the security of Internet. It not only affects the network service provide's service quality, but also threatens the Internet user's privacy and data security, even the national security. So how to find malicious traffic and intercept them is the challenge of Internet security.

Traffic identification and classification is a technique that can detect applications the very traffic corresponded from mass of traffic. Internet traffic identification and classification systems are deployed in gateway normally, it monitors traffic flows though gateway and intercept malicious traffic to ensure smooth operation of network. Traffic identification and classification is basic of traffic control, this technique is widely used in network audit, content audit and intrusion detection, it plays a important role in increasing network management efficiency and guaranteeing network security.

The traditional traffic identification techniques concentrate on content of traffic packet, so it is only to the recognition of unencrypted traffic effectively. On this occasion, malicious users transfer illegal data with a safe data transmission protocol becomes possible. Therefore, to identify legal and illegal data from encrypted traffic and classify traffic according to its type and source becomes a new challenge in network and Internet security.

The techniques for Internet traffic identification and classification have been evolved along with development of Internet protocols and applications, and many techniques have been proposed, including port-based techniques [2], payload-based techniques [3], flow-based techniques [4], host-based techniques [5] and graph-based techniques. Some of them have been maturely and widely deployed in the current network, and some of them are still under researching. But all the existing techniques still have their critical limitations and issues. In addition, the existing techniques are facing more and more challenges as Internet protocols are becoming safer and applications are becoming more sophisticated. In this paper, we first present popular traffic identification and classification techniques, then do in-depth analysis for them, especially their issues and challenges, and address some recommendations that can improve performance of techniques for Internet traffic identification and classification at last.

The rest of the paper is organized as follows. Section II explains port-based technique and analyzes its issues. Section III explains payload-based technique and presents its drawbacks. Section IV and Section V focus on flow-based and host-based techniques and dwell on their challenges. Then it is followed by section VI with the general challenges of traffic identification and classification. Section VII makes some final remarks on traffic analysis and provides some recommendations for solving the current issues. Finally, we conclude the paper in section VIII.

II. ANALYSIS OF PORT-BASED TECHNIQUES

The port-based technique is used to identify application according to TCP/UDP port number on transport layer protocol. In the early stage of Internet, applications use specific port to set up communication. Most of them used well-known port numbers assigned by IANA (The Internet Assigned Numbers Authority). Table I shows the most popular well-known port number and its corresponding services and protocols.

TABLE I
POPULAR WELL-KNOWN PORT NUMBERS

APPLICATION/SERVICE	PROTOCOL	PORT-NO
THUNDER	TCP/UDP	80,8000,8888
QQ	UDP	4000
SSH	TCP	22
FTP	TCP	20,21
WEB	TCP	80,443
TELNET	TCP	23
TOMCAT	TCP	8080

To classify these applications or services, the port-based techniques only need to check source port number of IP data packet. It finished tasks perfectly, as it assumes that most applications or services use well-known fixed TCP/UDP port number.

A. Subsection Heading Here

Subsection text here.

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III. CONCLUSION

The conclusion goes here.

APPENDIX A

PROOF OF THE FIRST ZONKLAR EQUATION

Appendix one text goes here.

APPENDIX B

Appendix two text goes here.

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REFERENCES

- [1] CNNIC: Statistics Report of Development of China Internet Network. (Jan 2015). [Online]. Available: <http://www.cnnic.cn/hlwfzyj/hlwxzbg/201502/P020150203551802054676.pdf>
- [2] J. McPherson, K.-L. Ma, P. Krystosk, T. Bartoletti, and M. Christensen, "Portvis: a tool for port-based detection of security events," in *Proceedings of the 2004 ACM workshop on Visualization and data mining for computer security*, pp. 73–81, ACM, 2004.
- [3] K. Wang and S. J. Stolfo, "Anomalous payload-based network intrusion detection," in *Recent Advances in Intrusion Detection*, pp. 203–222, Springer, 2004.
- [4] A.-S. Kim, H.-J. Kong, S.-C. Hong, S.-H. Chung, and J. W. Hong, "A flow-based method for abnormal network traffic detection," in *Network operations and management symposium, 2004. NOMS 2004. IEEE/IFIP*, vol. 1, pp. 599–612, IEEE, 2004.
- [5] T. Karagiannis, K. Papagiannaki, and M. Faloutsos, "Blinc: multilevel traffic classification in the dark," in *ACM SIGCOMM Computer Communication Review*, vol. 35, pp. 229–240, ACM, 2005.



Mingwei Wei, is the corresponding author of this paper. He is working on master's degree in Network and Information Security Lab in school of computing in Beijing Institute of Technology. His tutor are Mingzhong Wang and Liehuang Zhu. His research interests include network security, business process management and traffic analysis.