An IP Geolocation Method Based on Rich-connected Sub-networks

Shichang Ding, Xiangyang Luo, Meijuan Yin, Yan Liu and Fenlin Liu

State Key Laboratory of Mathematical Engineering and Advanced Computing,

Zhengzhou Science and Technology Institute, China

dscgongzuo@yeah.net, luoxy_ieu@sina.com, raindot_ymj@163.com, ms_liuyan@aliyun.com, liufenlin@vip.sina.com

Corresponding Author: luoxy_ieu@sina.com

***Abstract*—Recent years have seen a rapid growth of location-aware applications such as targeted marketing, restricted content delivery and location-based security check. Although existing delay-based IP geolocation techniques work well in some developed countries, the assumption of a strong delay-distance correlation that they often rely on may fail in many developing countries for poor network connectivity. To obtain more accurate delay-based IP geolocation results in poor-connected networks, an IP geolocation method based on rich-connected sub-networks is presented in this paper. At first, the network connectivity of one particular network is measured. Next, if the network is poor-connected, the method will divide it and search rich-connected sub-networks based on properties such as ISP and location information of probing hosts and landmarks. Then, based on the discovered rich-connected sub-networks, landmarks and probing hosts are deployed and selected to measure data such as delay, distance and topology, etc. At last, the location of the target host is estimated by modifying the processes of existing delay-based IP geolocation techniques based on selected landmarks and probing hosts. The experiments which cover 30 provinces and 3 major ISPs of China show that the proposed method can find corresponding rich-connected sub-networks and significantly improve the performance of existing typical delay-based IP geolocation techniques in an actual poor-connected network.**

***Keyword*—IP Geolocation, Delay-distance Correlation, Rich-connected Sub-network, Poor-connected Network, Network Measurement**

Shichang Ding was born in Shandong Province, China, in 1990. Ding received the B.S. degree from Zhengzhou Science and Technology Institute, Zhengzhou, China, in 2013. He is currently a M.S. candidate in the State Key Laboratory of Mathematical Engineering and Advanced Computing at Zhengzhou Science and Technology Institute. His research interests include IP geolocation and network measurement..

Xiangyang Luo was born in Hubei Province, China, 1978. Luo received the B.S. degree, the M.S. degree and the Ph.D. degree from Zhengzhou Science and Technology Institute, Zhengzhou, China, in 2001, 2004 and 2010, respectively. Luo is currently an associate professor of Zhengzhou Science and Technology Institute. He is the author or co-author of more than 70 refereed international journal and conference papers. He is also a guest editor for "International Journal of Internet" and "Multimedia Tools and Applications". His research interest is networking and information security.

Meijuan Yin was born in Anhui Province, China, 1977. She received the M.S. degree and the Ph.D. degree in Zhengzhou Science and Technology Institute, Zhengzhou, China, in 2003 and 2007. She is currently a lecturer of Zhengzhou Science and Technology Institute. Yin received the IEEE membership in 2010. Her current research interests include data mining, social network analysis, and information security.

LIU Yan was born in Shandong Province, China, 1979. She received Ph.D. in Zhengzhou Science and Technology Institute, Zhengzhou, China. She is currently an associate professor of Zhengzhou Science and Technology Institute. Her research interests include network information security and data mining.

FenLin Liu was born in in Jiangsu Province, China, 1964. He received the B.S. degree from Zhengzhou Science and Technology Institute, Zhengzhou, China, in 1986, the M.S. degree from Harbin Institute of Technology in 1992, and the Ph.D. degree from the Eastnorth University in 1998. Now, he is a professor of Zhengzhou Science and Technology Institute. His research interest is networking and information security.