A Quantum Secure Direct Communication Protocol Based on Six-qubit Cluster State

Danjie SONG, Chun LONG, Wei WAN, Jing ZHAO, Shaojie WANG

Computer Network Information Center, Chinese Academy of Sciences, China

songdanjie@cnic.cn, longchun@cnic.cn, wanwei@cnic.cn, jingzhao@cnic.cn, wangshaojie@cnic.cn

***Abstract*—To enhance the efficiency of eavesdropping detection in quantum secure direct communication, a quantum secure direct communication protocol based on six-qubit cluster state is proposed. In the security analysis, the method of the entropy theory is introduced, and three detection strategies are compared quantitatively by using the constraint between the information eavesdroppers can obtain and the interference introduced. If the eavesdropper obtains the same amount of information, she must face a larger detection probability in the presented scheme than the other two, and if obtains the whole information, the detection rate of the PingPong protocol is 50%; the second protocol which used two particles of EPR pair as detection particles is also 50%; while the presented protocol is 94%. At last, the security of the proposed protocol is discussed. The analysis results indicate that the protocol in this paper is more secure than the other two.**

***Keyword*—quantum secure direct communication, six-qubit cluster state, eavesdropping detection**

Danjie Song **is a Network Security R&D Engineer of Computer Network Information Center, Chinese Academy of Sciences, interested in research on cybersecurity security, information security, quantum communication security, cybersecurity situational awareness, big data analysis. (Email: songdanjie@cnic.cn)**

Chun Long **Ph.D., Senior Engineer of Computer Network Information Center, Chinese Academy of Sciences, CISSP, interested in exploration and research on frontier of cyberspace security technology, and has made breakthroughs in the research of cybersecurity situational awareness, secure big data mining and analysis, and has made innovation and improvement in key technologies such as aggregation of security events, multi-source secure data fusion and composite attack prediction. He received Ph.D. degrees from University of Chinese Academy of Sciences in 2015, B.S. degrees from Huazhong University of Science and Technology in 2004, and M.S. degrees from Huazhong University of Science and Technology in 2001. (Email: longchun@cnic.cn)**

Wei Wan **Ph.D., Senior Engineer of Computer Network Information Center, Chinese Academy of Sciences, CISA, interested in research on network security, cloud computing security, cybersecurity situational awareness. He received Ph.D. degrees from University of Chinese Academy of Sciences in 2015, B.S. degrees from Beijing Information Technology Institute in 2004, and M.S. degrees from Graduate University of Chinese Academy of Sciences in 2007. (Email: wanwei@cnic.cn)**

Jing Zhao **Ph.D. candidate, Network Security R&D Engineer of Computer Network Information Center, Chinese Academy of Sciences, PMP, interested in cybersecurity and system security research and project management. She received B.S. degrees from Beijing University of Posts and Telecommunications in 2009 and M.S. degree from Beijing University of Posts and Telecommunications in 2012. (Email: jingzhao@cnic.cn)**

Shaojie Wang **is a Network Security R&D Engineer of Computer Network Information Center, Chinese Academy of Sciences, interested in research on cybersecurity and next generation network architecture. He received M.S. degrees in Computer Science and Technology from University of Chinese Academy of Sciences in 2015. (Email: wangshaojie@cnic.cn)**