An Intelligent Radio monitoring Architecture Based on Edge Computing

Qian Nan Lu[(1)], Mei Xia Yang [(1)], Ming Huang* [(1)], and Jing Jing Yang*[(2)]

(1) School of Information Science and Engineering, Yunnan University, Kunming 650091, China; e-mail: huangming@ynu.edu.cn

(2) Wireless Innovation Lab. of Yunnan University, Kunming 650091, China; e-mail: yangjingjing@ynu.edu.cn

Radio spectrum resources are owned by the state, and radio spectrum security is the premise and foundation of national cyberspace security. In this paper, the current status and development trend of radio monitoring and management of china is introduced, and an intelligent radio monitoring framework based on edge computing is proposed. The intelligent radio monitoring framework consists of the edge computing layer, cloud computing layer and data visualization layer. Finally, taking the radiolocation, interference analysis and hazard judgment as examples implementation of the system is discussed.

With the development of wireless communication, the demand for spectrum has increased. In order to better manage and utilize the radio spectrum resources, the project "Radio Management Technology Facilities Construction and Investment Demand investigation in Border Areas of China" is issued by the Radio Management Bureau of the Ministry of Industry and Information Technology of China in 2015[1]. We undertook the project and made an investigation of the state of the art and challenges of China radio monitoring. Subsequently, an Internet of Things-based spectrum sensing approach using information system architecture is proposed and a radio monitoring and management prototype system was constructed in Honghe Prefecture of China in 2017 [2]. However, the above research does not involve the working mode of the sensor node, signal analysis and the interaction between sensor node and the cloud, and does not involve how to implement data analysis, data mining, abstraction, reasoning and decision making in the cloud. This paper proposes an intelligent radio monitoring framework based on edge computing. The main feature is that the computational load is offloaded from the cloud to the edge of the network by adding computing and storage capabilities to the edge computing layer, which resolves contradiction between multi-dimensional massive monitoring data acquired at the edge nodes and the transmission bandwidth. A schematic diagram of intelligent radio monitoring architecture based on edge computing is shown in Figure 1. The edge computing layer is composed of radio monitoring stations, monitoring vehicles, spectrum sensor nodes. It is responsible for acquiring multi-dimensional sensing data, including spectrum data, IQ data, geographic location, temperature and humidity of the sensor nodes, and video data. The modulation type, characteristics and content of signal is obtained through IQ date processing at the edge nodes, so the amount of data transmitted to the cloud could be greatly reduced. The cloud computing layer is mainly in charge of data processing, mining, abstraction, reasoning, and decision making The data visualization layer is responsible for data visualization and provides application services such as routine monitoring, special monitoring, key signal monitoring and radio security.
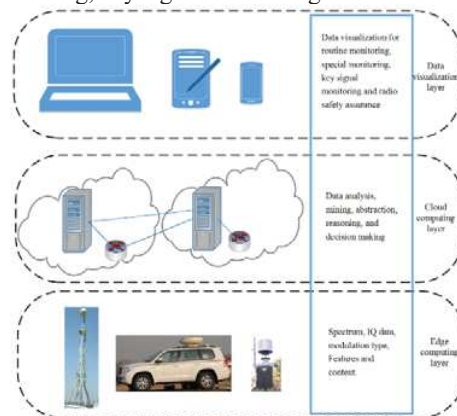

Figure 1. A schematic diagram of intelligent radio monitoring architecture based on edge computing

1. J. J. Yang, M. Huang, Q. N. Lu, State-of-the-art and Investment Demand of Radio Spectrum Management Technical Facilities in Borderlands of China. Kunming, China: Yunnan University Press, Dec, 2015, ISBN: 978-7-5482-2532-4.

2. Q. N. Lu, J. J. Yang, Z. Y. Jin, D. Z. Chen, and M. Huang, "State of the Art and Challenges of Radio Spectrum Monitoring in China," *Radio Science*, **52**, 10, September 2017, pp. 1-7, doi: 10.1002/2017RS006409.