

A Method for Controlling Scan Rate Based on Estimated Retransmission Rate of Background Traffic

Kenta SUZUKI*, Takuya KURIHARA*, Kazuto YANO*, Yoshinori SUZUKI*

*Advanced Telecommunications Research Institute International (ATR), Kyoto, Japan.

*{kenta-suzuki, tkurihara, kzyano, yoshinori.suzuki}@atr.jp

Abstract—For efficient network scan to narrow-band wireless networks, this paper proposes a method for controlling a scan rate based on the estimated retransmission rate of background traffic from a scan response delay obtained at a scan rate. This proposed method is aiming to select the highest scan rate that can keep the estimated retransmission rate of the background traffic below a predetermined retransmission threshold. First, through computer simulations considering a Wi-SUN sensor network with two different network situations and multiple scan rates, we derive a regression function between the mean of scan response delay and COR (Channel Occupation Rate) of the background traffic, and that between the COR and the retransmission rate of the background traffic, for each the network situation and the scan rate using the least-squares method. Then, we propose a method for estimating the retransmission rate of the background traffic at a different scan rate using three kinds of estimators; network situation estimator, COR estimator, and retransmission rate estimator. After that, we propose a control scheme of scan rate based on the estimated retransmission rate of the background traffic. We evaluate the estimation accuracy of the retransmission rate of the background traffic using the proposed estimation method. We confirm that the proposed estimation method can estimate the retransmission rate of the target network with the average error lower than 0.058 regardless of the situation of the target network and the scan rate. Moreover, we evaluate the performance of scan rate control using proposed method. We confirm that proposed method can scan faster by 0.18~pps and decrease the retransmission rate of the background traffic by 0.015 compared with a fixed scan rate.

Keyword—Network scan, Wi-SUN, Scan rate control, QoS estimation, Network simulation



Kenta Suzuki was born in Japan, 1988. He received his B.S. degree in Computer Science from Hirosaki university, Japan in 2011, and received his M.S. degree in Computer Science from Tohoku university, Sendai, in 2013. In 2013, he joined Mobile Techno Corp., where he was engaged in development on broadcast radio system for disaster prevention and system level simulator for network simulation. Since April 2019, he has been assigned to Advanced Telecommunications Research Institute International (ATR) as a researcher, and he is engaged in research and development on network scan systems. He is a member of the IEICE.



Takuya Kurihara was born in Japan, 1988. He received his B.E., M.E., and Ph. D. degrees in electrical engineering from Nippon Institute of Technology, Saitama, Japan, in 2011, 2013, and 2017, respectively. In 2018, he joined Advanced Telecommunications Research Institute International (ATR), Kyoto, Japan, where he is currently a researcher of Wave Engineering Laboratories. His research interests include nonlinear systems, signal processing, and optimization. He received the 2013 Presentation Award in Nonlinear Problems from IEICE Technical Committee on Nonlinear Problems and the IEICE Young Researcher's Award in 2014. He is a member of IEICE.



Kazuto Yano was born in Japan, 1977. He received the B.E. degree in electrical and electronic engineering, and the M.S. and Ph.D. degrees in communications and computer engineering from Kyoto University in 2000, 2002, and 2005, respectively. He was a research fellow at the Japan Society for the Promotion of Science (JSPS) from 2004 to 2006. In 2006, he joined the Advanced Telecommunications Research Institute International (ATR). Currently, he is the Head of Dept. Wireless Communication Systems at Wave Engineering Laboratories, ATR. His research interests include spacetime signal processing for interference suppression, MIMO transmission, and PHY/MAC cross-layer design of wireless communication systems for ISM bands. He is a member of IEEE and a senior member of IEICE.



Yoshinori Suzuki was born in Japan, 1970. He received the B.E., M.E. and Ph.D. degrees from Tohoku University, Sendai, in 1993, 1995 and 2005 respectively. He joined NTT Wireless Systems Laboratories in 1995. Since then, he engaged in researching microwave signal processing techniques for satellite onboard applications and onboard multiple beam antenna feed techniques. He worked as a parttime lecturer at Niigata University in 2012 and 2014. From 2013 to 2014, he was in charge of sales engineering of satellite communication services in NTT Software Corporation (currently NTT Techno Cross Corporation). Since then, he was a research engineer in NTT Access Network Service Systems Laboratories working on future mobile satellite communication systems. From June 2018, he has been engaged in the research of innovative radio communication systems at ATR Wave Engineering Laboratories, Kyoto, Japan. He received the Younger Engineer Award from the IEICE Japan in 2003. He is a senior member of IEICE.