Software-Defined Opto-Acoustic Network Architecture for Internet of Underwater Things

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Speaker:

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Abstract:

The internet of things (IoT) is a technological revolution towards integrating physical and digital worlds by interconnecting smart objects to enhance the quality of life in all aspects. Communication networks undergo the next major change towards fifth-generation (5G) networks to realize this revolution. Lying at the heart of this evolutionary step, network function virtualization (NFV) and software-defined networking (SDN) are recognized as key enablers of a flexible, scalable, agile, and programmable network platform. However, current efforts mostly focus on developing terrestrial IoT solutions without giving sufficient notice on the internet of underwater things (IoUT) applications. Noting that a continuous body of water covers approximately 71% of the Earth's surface, oceans provide great benefits to humankind, including climate regulation, food supply, transportation, natural resources, recreation, and medicine. Hence, IoUT can mark a new era for scientific, industrial, and military underwater applications, including environmental monitoring, offshore exploration, disaster prevention, tactical surveillance, and assisted navigation. Nevertheless, 95% of the oceans are still unexplored because of the peculiarities of underwater communications, networking, and localization.

In this seminar, I will share a vision towards a hybrid opto-acoustic network architecture design for the internet of underwater things (IoUT). Software-defined underwater networking (SDUN) is an enabler of hybridizing benefits of optic and acoustic systems and adapting IoUT nodes to the challenging and dynamically changing underwater environment. I will explain inextricably interwoven relations among functionalities of different network layers and analyze their impacts on key performance attributes. I will introduce the network function virtualization (NFV) concept, which can realize application-specific cross-layer protocol suites through an NFV management and orchestration system. Such a revolutionary architectural paradigm shift is not only a cure for chronicle underwater networking problems but also a way of smoothly integrating IoUT and IoT ecosystems. Finally, I will share recent scientific results on end-to-end performance analysis of underwater optical wireless relaying and routing techniques under location uncertainty

Bio:

Abdulkadir Çelik received the B.S. degree in electrical-electronics engineering from Selçuk University in 2009, Konya, Turkey. He received M.S. degrees in Electrical Engineering in 2013 and in Computer Engineering in 2015, and a Ph.D. degree in co-majors of Electrical Engineering

and Computer Engineering in 2016 from Iowa State University, Ames, IA, USA. He is currently a senior postdoctoral research fellow at Communication Theory Laboratory of King Abdullah University of Science and Technology (KAUST). His current research interests include but not limited to 5G networks and beyond, flying networks, wireless data centers, underwater optical wireless communications, networking, and localization.