

Are you interested in exploring with us in the next generation of networking technology? Do you want to work with state-of-the-art technologies like Software Defined Networking, Network Coding, and more? Then: JOIN US!

**We offer a research project
(Forschungsprojekt)**

Network softwarization based on the techniques, such as, Software Defined Networking (SDN) is changing and will continue reshaping the way of building our network [1]. In SDN, the control plane and forwarding plane are separated from each other, and network controllers determine the behaviors of switches or routers in the network. As the size of the network scales, single controller cannot fulfill all the controlling workload from the switches in its management domain. To resolve this issue, researchers have proposed the distributed control plane for SDN to manage large scaled networks [2]. Several popular SDN controller frameworks, such as Floodlight, ONOS, OpenDayLight, etc., already support programming over the distributed control plane model. Distributed controller instances rely on the exchange of messages to obtain the global view of the network being partitioned into the different administrative domains.

SDN plays an important role in the foreseen trend of manufacturing based on the wireless networking, since it provides rich methods to control the dynamic behaviors of the wireless production networks [3]. Achieving reliable and timely inter-controller communication, however, is challenging in this environment. The distributed SDN control plane can be built upon a dedicated out-of-band wireless channel for the benefits of traffic isolation and flexibility, or implemented as the in-band control channel sharing the network resource in a wireless mesh networks (WMNs) [4]. Due to the volatile nature of wireless networks, the inter-controller messages can be corrupted or lost in the control plane atop wireless channels. In addition, the common electro-magnetic interference in the industrial environment may cause phenomenon like bit flipping on the networking components, no matter of intermediate switches or controlling servers. In this case, the integrity of inter-controller communication no long exists.

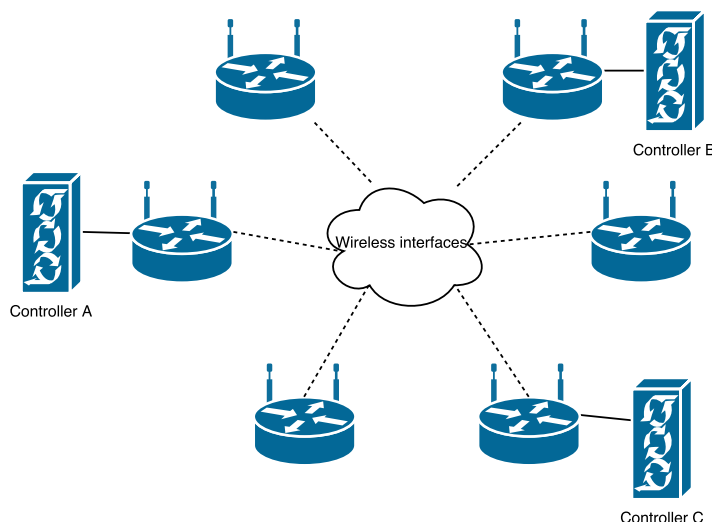


Figure 1: Wireless mesh network with the distributed control plane

In this project, we take a look at the application of SDN in the industrial wireless mesh network and focus on achieving reliability and timeliness of the inter-controller communication, with the help of Network Coding (NC) techniques [5]. The goal of the project is to design a transmission mechanism based on NC for the distributed SDN control plane so as to provide reliability and timeliness. In particular, the following tasks are foreseen:

- Review the existing literature on reliable inter-controller communication for SDN;
- Investigate relation between the packet loss of inter-controller channel and the performance of inter-controller communication;
- Design and implement a mechanism based on NC to overcome the unreliable transmission channel among controllers.

Requirements:

- Interest in working with the cutting-edge networking technology
- Knowledge in networking architecture, network reliability and security
- Experience with Linux/Unix OS, Python and Java programming language

References:

- [1] SDN Definition, <https://www.opennetworking.org/sdn-resources/sdn-definition>
- [2] Oktian, Yustus Eko, SangGon Lee, HoonJae Lee, and JunHuy Lam. "Distributed SDN controller system: A survey on design choice." *Computer Networks* 121 (2017): 100-111.
- [3] Li, Dong, Ming-Tuo Zhou, Peng Zeng, Ming Yang, Yan Zhang, and Haibin Yu. "Green and reliable software-defined industrial networks." *IEEE Communications Magazine* 54, no. 10 (2016): 30-37.
- [4] Haque, Israat Tanzeena, and Nael Abu-Ghazaleh. "Wireless software defined networking: A survey and taxonomy." *IEEE Communications Surveys & Tutorials* 18, no. 4 (2016): 2713-2737.
- [5] Szabo, David, Andras Gulyas, Frank HP Fitzek, and Daniel E. Lucani. "Towards the tactile internet: Decreasing communication latency with network coding and software defined networking." In *European Wireless 2015; 21th European Wireless Conference; Proceedings of*, pp. 1-6. VDE, 2015.