

Hybrid SDN Control in Mobile Ad Hoc Networks



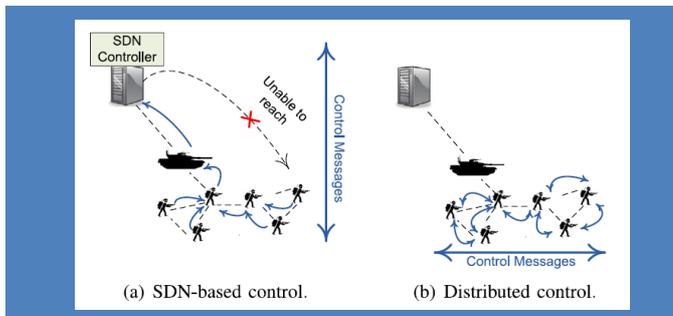
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Objectives

Software defined networking (SDN) can be beneficial in mobile ad hoc networks (MANET) to increase flexibility, provide programmability and simplify management.

The high dynamics in mobile networks, however, raise new reliability challenges to the conventional centralized control plane of SDN. To address this issue, we aim at:

- Analyzing strengths and weaknesses of both centralized and distributed control plane in mobile networks.
- Designing mechanisms achieving hybrid SDN control taking advantages of both ways and taking mobile features into consideration.
- Developing a prototype verifying the control scheme in realistic scenarios.



Technical Challenges

- For traditional SDN centralized management, the links from controller to data plane nodes are crucial, which may suffer from high latency and even disconnection in MANETs and the nodes therefore cannot update their flow rules in time.
- For traditional distributed protocols (e.g., OLSR, AODV), although they provide routing functionality with higher robustness, it is difficult to have more advanced functions than the basic routing (e.g., load balancing, middleboxes), which may be required in modern mobile networks.

Military & Coalition Relevance

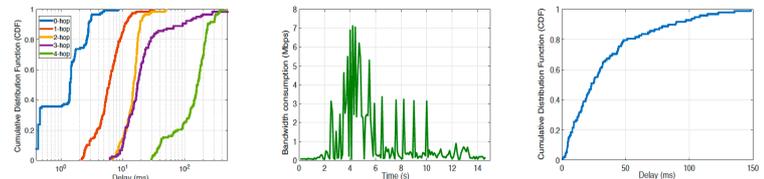
- Modern tactical operations have complex communication and computing requirements which benefit from SDN centralized control. On the other hand, sometimes such operations have to be executed in a harsh environment through MANET, which may suffer from low data rate and unreliable connectivity. Our approach provides a solution to both problems in these scenarios.

Mobile SDN Testbed

Integrating SDN components into commercial smartphone devices interconnected via WiFi links.

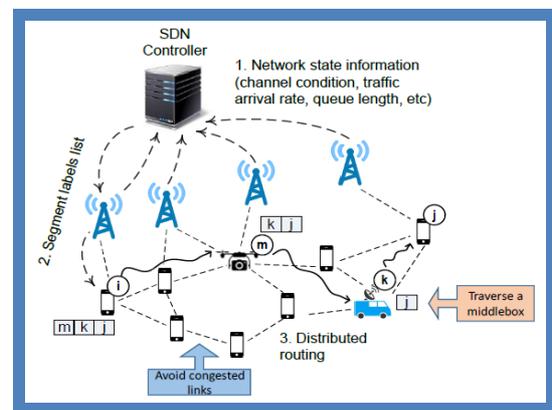


1. Measure delay of SDN control over multi-hop WiFi paths.
2. Measure overheads of controller migration among devices.
3. Measure overheads of re-assigning data plane to controller devices.



Hybrid SDN Architecture Design

Split routing task among centralized controller and distributed mobile nodes using segment routing technique.



Summary & Future Work

- We studied the application of SDN technology to support communication and service requirements in MANETs. We proposed a hybrid control architecture in MANETs and implemented it in a testbed built from commercial mobile devices. Open issues and technical challenges related to the proposed architecture can be rich areas for future work.

Publication(s) & Impact

- Poularakis, K., Qin, Q., Marcus, K. M., Chan, K. S., Leung, K. K., & Tassiulas, L. (2019). Hybrid SDN Control in Mobile Ad Hoc Networks. 2019 IEEE International Conference on Smart Computing (SMARTCOMP).