

Flexible SDN Control in Tactical Ad Hoc Networks



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Motivation

- SDN is an attractive approach for applying to Tactical Ad Hoc Networks due to its new capabilities:
 - programmability facilitating “on the fly” deployment of new services,
 - (logically-) centralized control facilitating implementation of end-to-end network policies.
- But...
 - SDN is designed for wired networks, unsure if/how to accommodate the unreliability and dynamism of an ad hoc environment.
- **Idea:** evolve SDN by borrowing ideas from (robust & adaptive) MANET protocols.

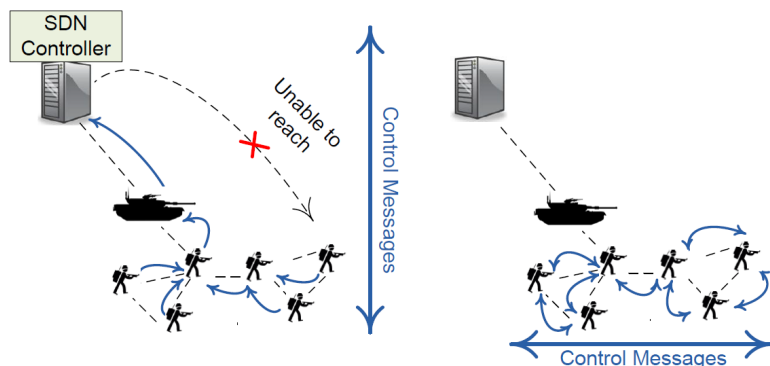


Figure 1: Centralized (SDN) vs distributed (MANET) control.

Flexible SDN architecture

- Data plane nodes “mimic” basic operations of MANET protocols:
 - detect link failures/additions (network state),
 - maintain state information in their memory,
 - disseminate state information each other.
- Hybrid (between centralized & distributed) control:
 - nodes dynamically decide whether to follow SDN controller instructions or unilaterally change their packet forwarding actions.
 - how? Stateful SDN [1]:
 - “Backup” forwarding rules matching against both packet headers and current network state (failed/added links).

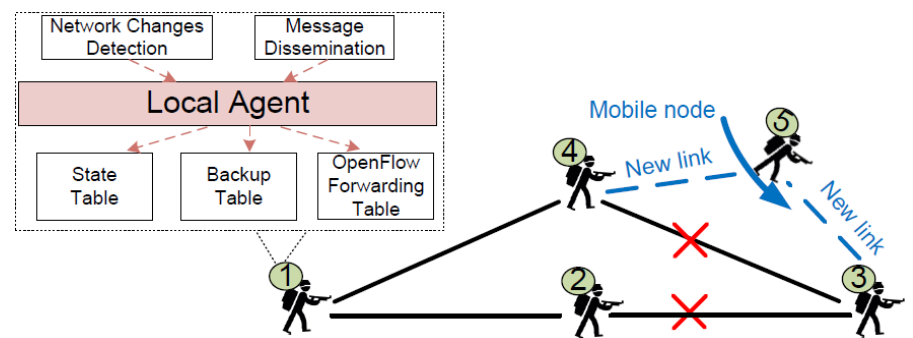


Figure 2: Overview of flexible SDN architecture.

Key technical questions

- Which nodes should disseminate state information to which nodes and for which links?
- Which backup rules to store at each node?

Fundamental tradeoff between overheads (state dissemination & rule storage) and performance (supported backup paths).

Proof-of-concept prototype & experimentation

- Implemented a flexible SDN prototype with modern smartphones and laptops.
- Faster reaction to link failures than traditional SDN.

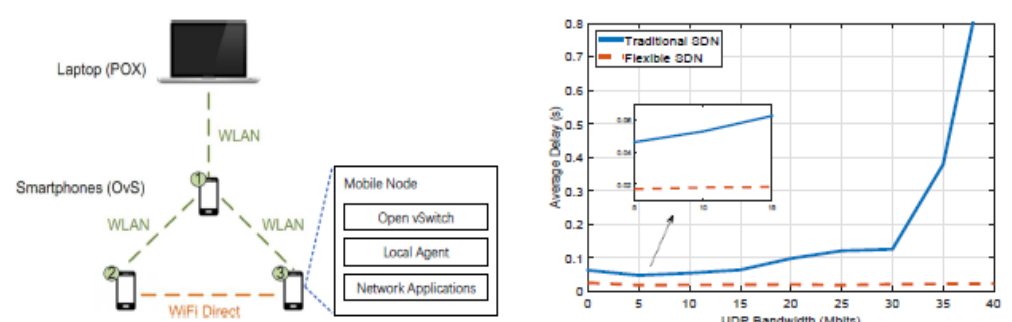


Figure 3: Flexible SDN prototype & delay of reaction to link failures.

References

[1] G. Bianchi, et al., “OpenState: Programming Platform-independent Stateful OpenFlow Applications Inside the Switch”, ACM Sigcomm CCR 2014.