JEDI:- A VOTE WITH NO VOTE APPROACH TO DEFEND SDN's FROM MALICIOUS ADMINISTRATORS

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The Misbehaving Administrator Problem

- Administrators affect SDN routing by misconfiguring a correctly functioning controller upon link failure
- Human Error is responsible for 50-80% of all network outages
- Fleet (Matsumoto et al) proposes a single configuration approach using threshold switch signatures and voting wherein the problem is resolved if at least n-k administrators (out of n) are not malicious.

Switch Intelligence Layer

- Intermediary layer between the Administrators and the Controller
- Initiates the voting process
- Validates the confidence score proposed by each Admin
- Accepts vote only if the proposed vote has a confidence score greater than the current maximum score among the other Admins
- Applies the best configuration onto the network at the end of the voting cycle

Implementation

- Prototype implemented in Python-based POX controller and Mininet SDN framework.
- Tested on random sparse and dense topologies of 20 switches and multiple hosts
- Voting simulated using Zookeeper Kazoo library
- Python scripts simulate admin behavior

Key Contributions

- Propose Jedi- an extension of Fleet that uses a multi-configuration approach and a Vote with No Vote protocol.
- The best path is chosen as long as at least 1 administrator is non-malicious contrary to Fletts k-malicious admin adversary model.

EVALUATION

Focus:

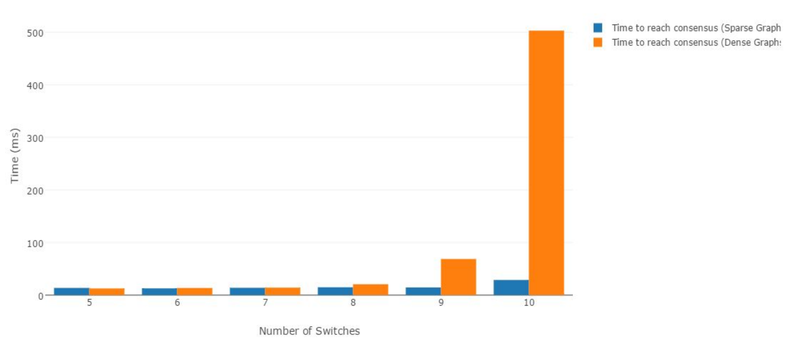
- How does number of administrators and number of malicious administrators affect link recovery time?
- How does the metric chosen for alternate paths affect the link recovery time?

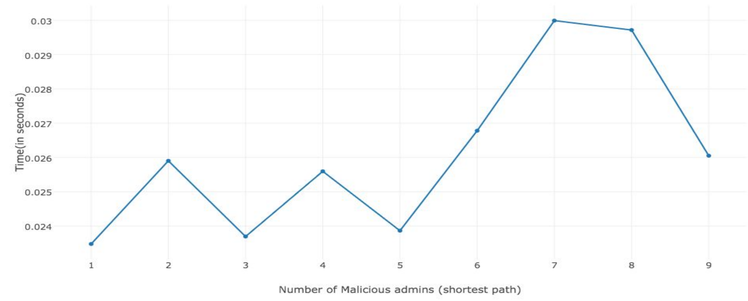
Metrics considered for best alternate path:

- Maximum bottleneck path
- Minimum Latency
- Minimum number of hops

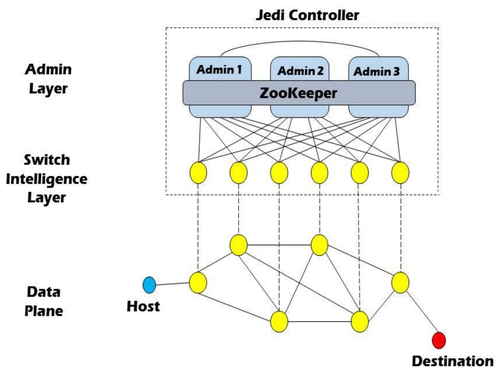
Jedi's Approach

- Administrators are
  - time-synchronised
  - preconfigured using SSL Certificates
  - looe the same network topology
  - share the same routing policy if not malicious
  - cast vote through zookeeper
- Vote- a tuple (path,confidence score) is sent to switch intelligence layer for validation through zookeeper





Jedi Model



COMPARISON WITH FLEET

- Jedi is more resilient and allows administrators to create network configurations more independently of each other.
- Jedi computes the best path as long as atleast one administrator is non-malicious.
- Jedi requires more changes to the existing SDN architecture than Fleet.
- Jedi's switch intelligence needs to maintain more information because it stores each administrator's configuration.

Limitations and Future Work

- Metrics evaluated on the static Network.
- If evaluated dynamically it would become reactive than preventive. Is that optimal?
- What is the correct metric? That in itself is a research question!
- Reactive approach based on application Flow?