Inter-flow Consistency in SDN Network Updates


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Motivation

**Broken links:** require updates to the network (e.g. new routing rules)

**Constraints:** isolation between critical flows (e.g. control) vs. non-critical (e.g. debug)

Given correct old and new configuration, transient states may break constraints

Problem Statement

Preserve inter-flow constraints on the flows during transient states in network updates

Approach

- Inter-flow Consistency Abstraction
  - **Version Isolation (VI)**
  - **Spatial Isolation (SI)**

Both flows need to be updated either by the old rules or by the new ones!

- **Steps involve**
  1. Use Dependency Graph
  2. For SI constraints - Impose constraints by mutex nodes
  3. Schedule updates (with forwarding operations for VI)
  4. For VI constraints, forward flows to the controller based on criticality or flow rate value and using a flow classification algorithm
  5. Update the rules for both flows
  6. Send buffered packets back

- **Flow Classification Algorithm & Heuristics**
  - Mapped to Weighted Maximum Independent Set Problem
  - Greedy approach

- **Optimization Parameters**
  - Flow rate
  - Criticality

Results

**Isolation Constraints are always preserved with the inter-flow consistency abstractions proposed**

- Update time overhead (for 10-30 update percentage)
  - Flows with VI constraints: at most 30%
  - Flows with no VI constraints: at most 10%

- Number of rules installed: 14% more rules installed for VI approach

![Figure 1. Avg Number of Rules Installed vs Update Percentage](image1)

![Figure 2. Avg Number of SI Constraints & Rules Installed](image2)

![Figure 3. Avg Isolated Flow Update Time for VI DG](image3)

![Figure 4. Number of critical flows that are forwarded to the controller vs Different VI set size](image4)

Reference


Acknowledgments

This work is funded in part by the DoE under Award Number DEOE000079 and DE-OE0000780, and by the Air Force Research Laboratory and the Air Force Office of Scientific Research, under agreement number FA8750-11-2-0084.