CS 490.31: Software Defined Networks

4th Lecture
1/4/2013

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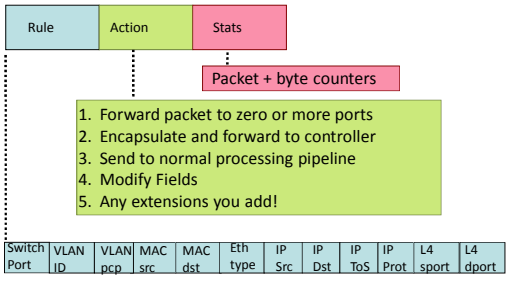
Flowspace revisited

OpenFlow Basics

Flow Table Entries



+ mask what fields to match

Examples

Switching

Switch Port	MAC src	MAC dst	Eth type	VLAN ID	IP Src	IP Dst	IP Prot	TCP sport	TCP dport	Action
*	*	00:1f:..	*	*	*	*	*	*	*	port6

Flow Switching

Switch Port	MAC src	MAC dst	Eth type	VLAN ID	IP Src	IP Dst	IP Prot	TCP sport	TCP dport	Action
port3	00:20..	00:1f..	0800	vlan1	1.2.3.4	5.6.7.8	4	17264	80	port6

Firewall

Switch Port	MAC src	MAC dst	Eth type	VLAN ID	IP Src	IP Dst	IP Prot	TCP sport	TCP dport	Action
*	*	*	*	*	*	*	*	*	22	drop

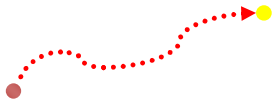
Examples

Routing

Switch Port	MAC src	MAC dst	Eth type	VLAN ID	IP Src	IP Dst	IP Prot	TCP sport	TCP dport	Action
*	*	*	*	*	*	5.6.7.8	*	*	*	port6

VLAN Switching

Switch Port	MAC src	MAC dst	Eth type	VLAN ID	IP Src	IP Dst	IP Prot	TCP sport	TCP dport	Action
*	*	00:1f..	*	vlan1	*	*	*	*	*	port6, port7, port9



What is a flow?

- Application flow
- All http
- Jim's traffic
- All packets to Canada
- …

Types of action

- Allow/deny flow
- Route & re-route flow
- Isolate flow
- Remove flow

Properties of a Flow-based Substrate

- We need flexible definitions of a flow
  - Unicast, multicast, waypoints
  - Different aggregations
- We need direct control over flows
  - Flow as an entity we program: To route, to move, …
- Exploit the benefits of packet switching
  - It works and is universally deployed
  - It is efficient (when kept simple)

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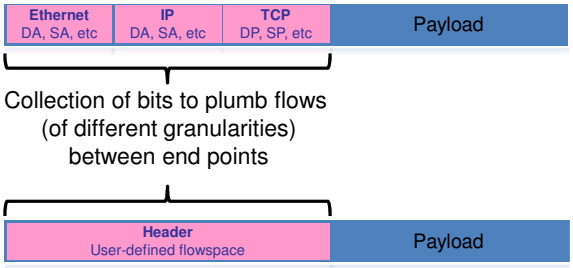
Substrate: "Flowspace"



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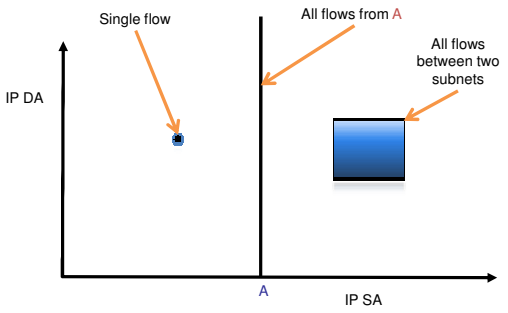
Flowspace: Simple Example



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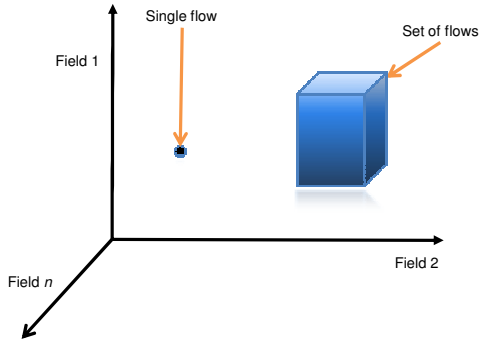
Flowspace: Generalization



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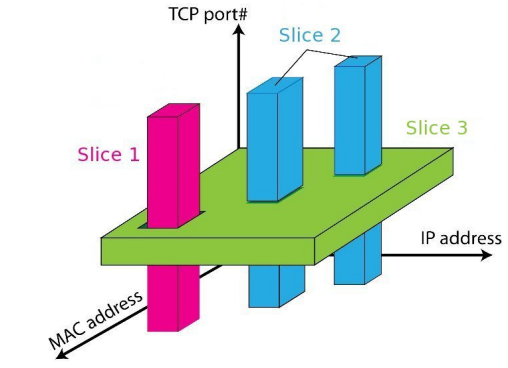
FlowSpace: Maps Packets to Slices



Properties of Flowspace

- Backwards compatible
  - Current layers are a special case
  - No end points need to change
- Easily implemented in hardware
  - e.g. TCAM flow-table in each switch
- Strong isolation of flows
  - Simple geometric construction
  - Can prove which flows can/cannot communicate

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Suggested Projects

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Route around outages

- Route around failures
  - Implement algorithm to compute shortest paths and install appropriate rules in a network
  - Upon receiving a notification for a broken link recompute shortest paths and update rules

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Rule management tools

- Implement and evaluate **rule management tools**.
  - Periodically check switches in a network (garbage collection).
  - **Defragmentation**: Merge rules when possible
  - **Clean up**: Remove unused rules
  - **Compress**: Create aggregate more compact rules
  - Other sanity checks

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Monitoring Radar

- Implement **a monitoring radar**
  - Use OpenFlow for measurements
  - Scan the flow space over time: Dynamically change the rules you have over time to do finer granularity measurements to specific areas.
  - Take live traffic into account to avoiding spending too much time in inactive regions.

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Inter-controller Access Control Signaling

- **Denial o Service attack mitigation mechanisms**
  - Assume two domains with separate controllers
  - Establish a connection between the controllers and write a simple protocol to notify the remote controller about blocking traffic from specific sources.

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Elastic SDN controller

- **Elastically scale SDN controller**:
  - Monitor load to controller and when it exceeds a threshold span an additional controller and reconfigure switches to balance load.
  - Monitor demand and when it goes bellow a threshold switch back to single controller.

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Next Steps: Draft Proposal

- Draft proposal (1 page) Due: **Thu. 4th of Apr**
  - Objectives, Work packages, Deliverables
- Meet with the instructor and discuss proposal: **Fri. 5th of Apr**
- Incorporate feedback and submit final proposal (2 pages max) Due: **Wed. 10th of Apr**

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This talk wouldn't be possible without:

- Past slides from:
  - Brandon Heller
  - Yashar Ganjali (CSC2203 Course)
  - Rob Sherwood
  - others

Further Project Ideas

- http://www.cs.toronto.edu/~yganjali/courses/csc2203/page27/#suggested-topics

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