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Software Defined Networking



In this course, you will learn about software defined networking and how it is changing the way communications networks are managed, maintained, and secured.

Module 8.1: The (Near) Future of SDN

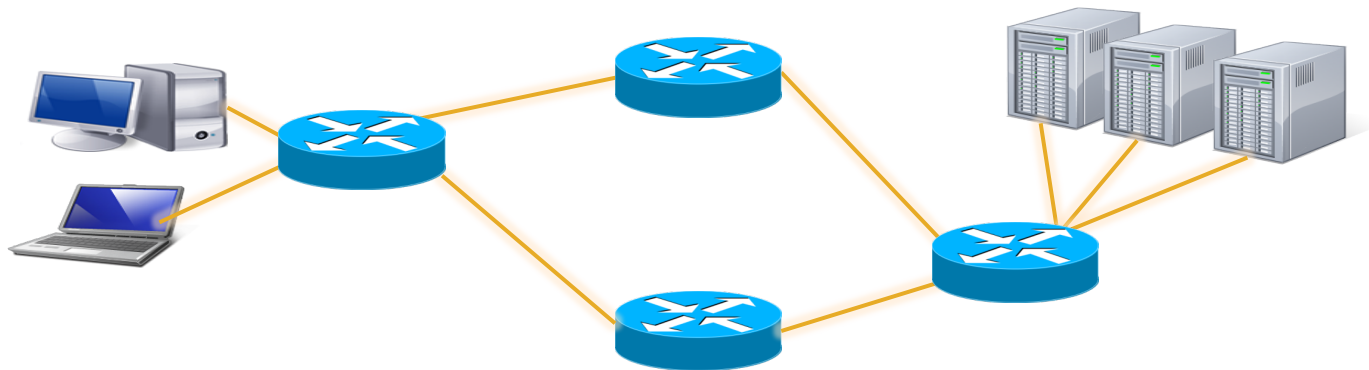
◎ Two Lessons

- **A Broader Vision of SDN**
- Open Problems and Challenges

◎ Quiz

Current SDN Paradigm: Match/Action

Match	Action
10.2.3.4:10.2.3.3	Fwd Port 1
A2:e3:f1:ba:ea:23:*	Drop



- Limited actions and matching
 - **Match:** Ethernet, IP, TCP/UDP port numbers
 - **Action:** forward, drop, rewrite header, etc.

Expanding SDN Beyond Match/Action

- ⦿ Expand the OpenFlow standards
 - Requires consensus, vendor support
- ⦿ Implement richer data plane in controller
 - Incurs performance penalties
- ⦿ **Send traffic through custom devices (e.g., middleboxes, custom hardware)**
 - Requires orchestration

Two Future Directions

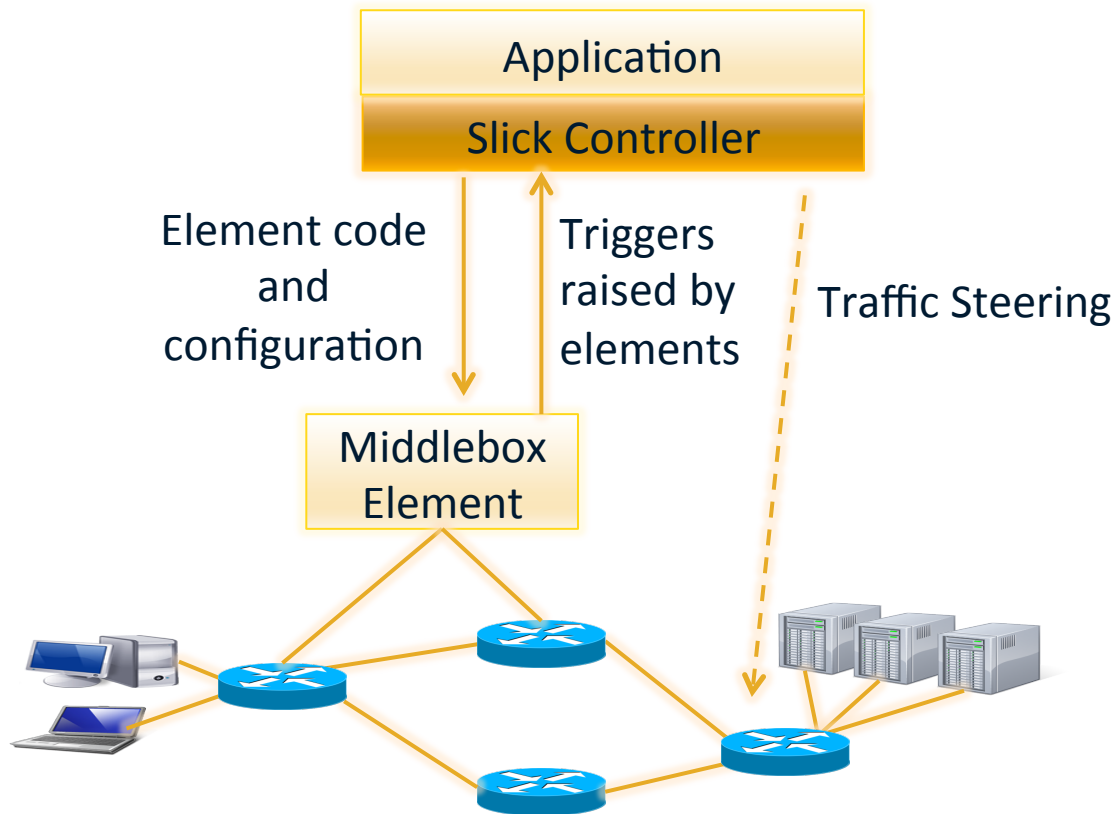
◎ Middlebox Orchestration

- SDN control plane for network middleboxes

◎ Custom Data Plane Orchestration

- SDN control plane for directing packets through custom hardware

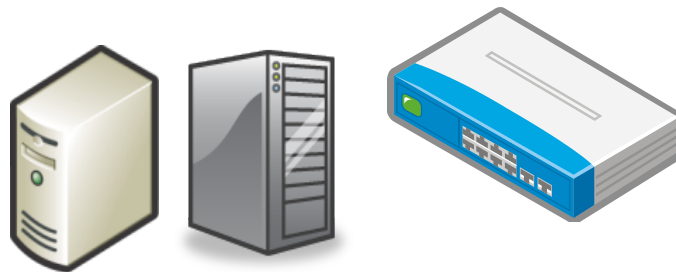
Slick: Middlebox Orchestration



- Installs, configures elements
- Steers traffic to elements
- Handles triggers from elements

Slick Elements

- ⦿ Arbitrary code
 - Functions implement Slick API
 - Raises triggers at controller
- ⦿ Self-describing manifest
 - Hardware requirements
 - List of exposed triggers
 - Network requirements:
 - flow affinity: needs to see both sides of traffic, or all traffic from a host

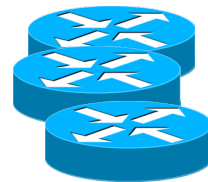


Slick Application

- ◉ Implements network policies
 - What element to run on which traffic
 - How to react to changes in network conditions
- ◉ Does not specify
 - Where to place the element
 - How traffic should be routed

Shim: Virtual Switch

Programmable device:
NetFPGA, x86 server

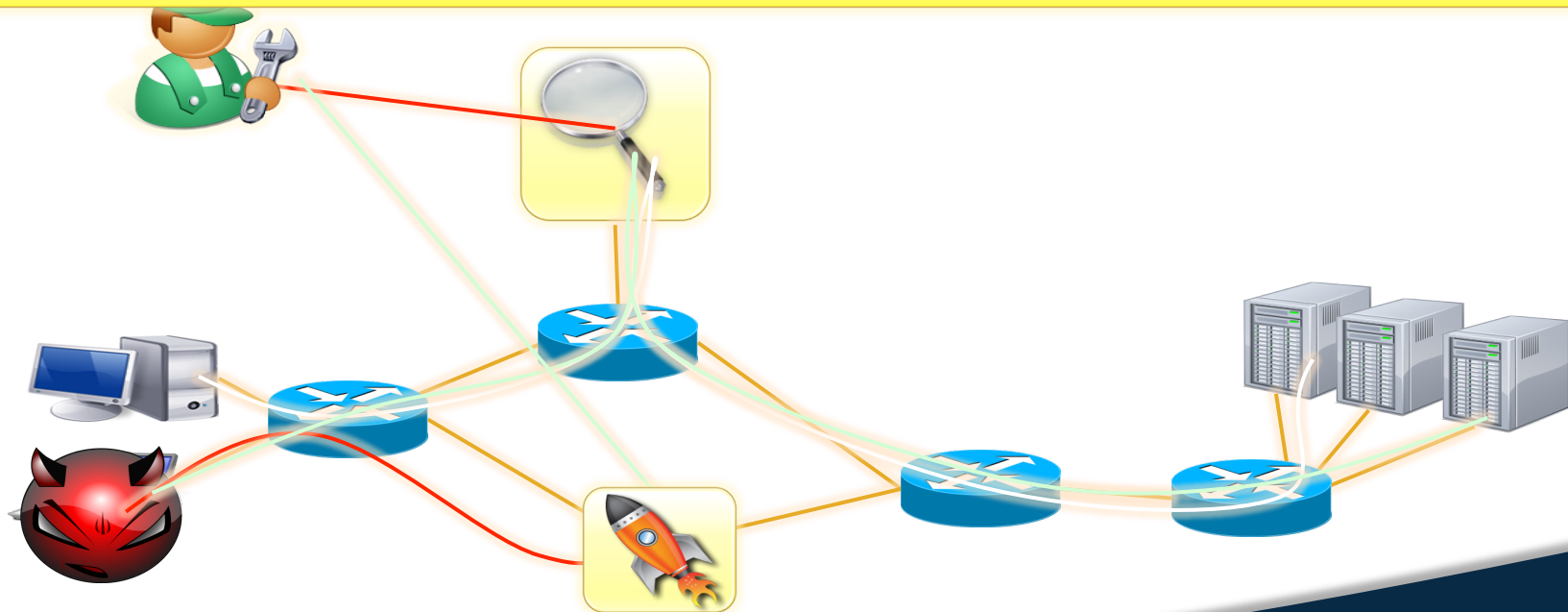


Slick Controller

- ⦿ Manages and configures network of middleboxes
 - Implements resource discovery
 - Deploys/removes elements on machines
 - Ensures element availability in the face of failures
- ⦿ Implements policy in an application
 - Automates element placement and traffic steering
 - Uses online resource allocation algorithm

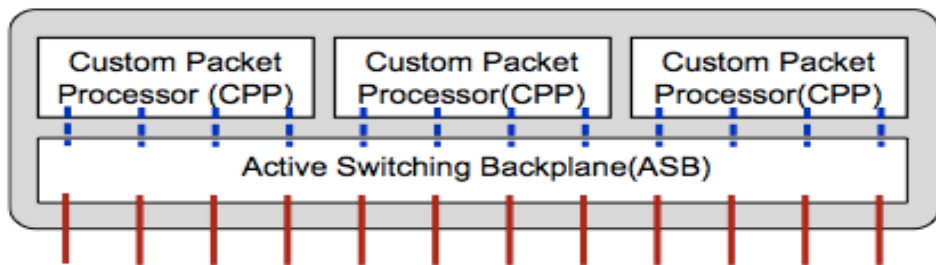
Application: Dynamic Redirection

- Inspect all DNS traffic with a DPI device
- If suspicious lookup takes place, send to traffic scrubber



Custom Data Plane Orchestration

- Augment OpenFlow switches with **custom packet processors**
- **Device abstraction layer** to allow programmability of this substrate
 - Single device
 - Network wide
- **Applications**
 - Big data applications
 - On-the fly encryption, transcoding, classification
 - Selective deep packet inspection



Summary

- ⦿ New frontiers for SDN: Orchestration beyond match/action on switches
 - Middlebox orchestration
 - Programmable substrate orchestration

- ⦿ **Next lesson:** Open problems