Slick: A control plane for middleboxes

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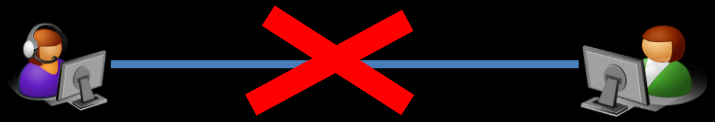
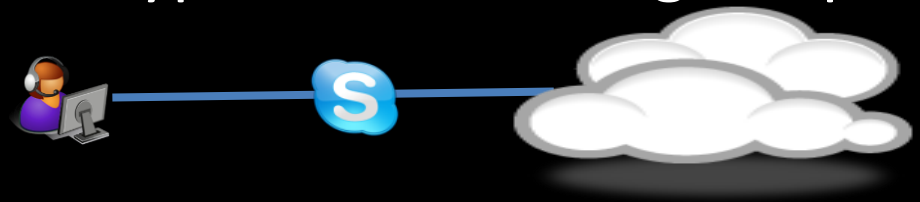
Network Policies

- Reachability
  - Alice can not send packets to Bob

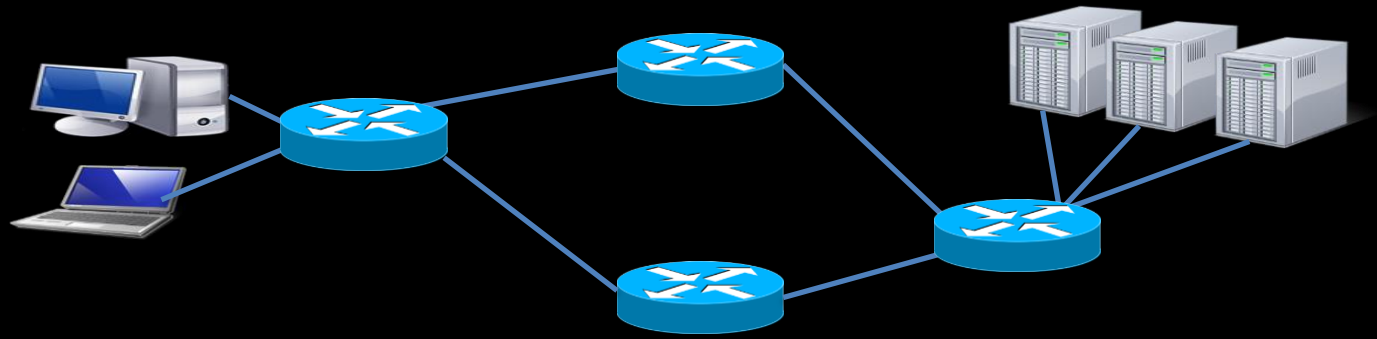


- Application classification
  - Place Skype traffic in the gold queue



Limitations of SDN Data Plane

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



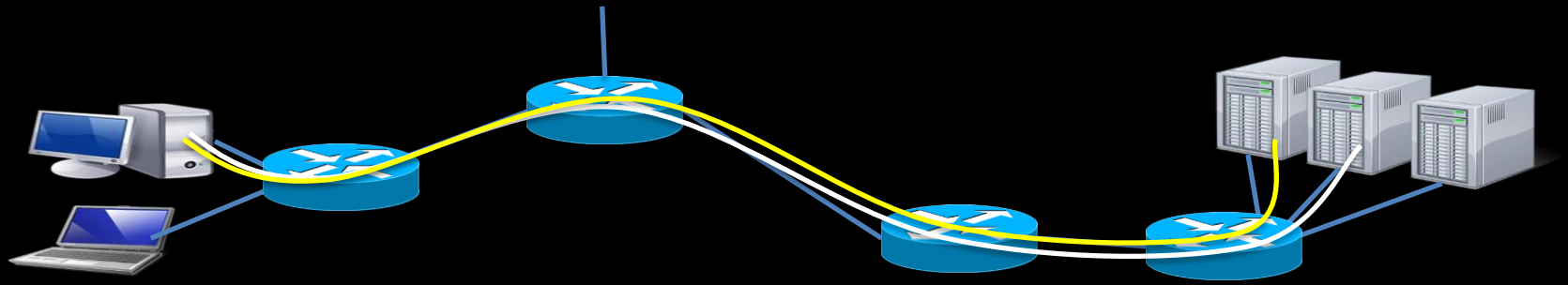
- Limited actions and matching
  - Match: Ethernet, IP, TCP/UDP port numbers
  - Action: forward, drop, rewrite header, etc.

Extending SDN's Data Plane

- Expand the OpenFlow standards
  - Requires hardware support
- Implement richer data plane in controller
  - Introduces additional latency to packets
- Add new devices (Middleboxes)

Example: Detecting Network Attacks

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



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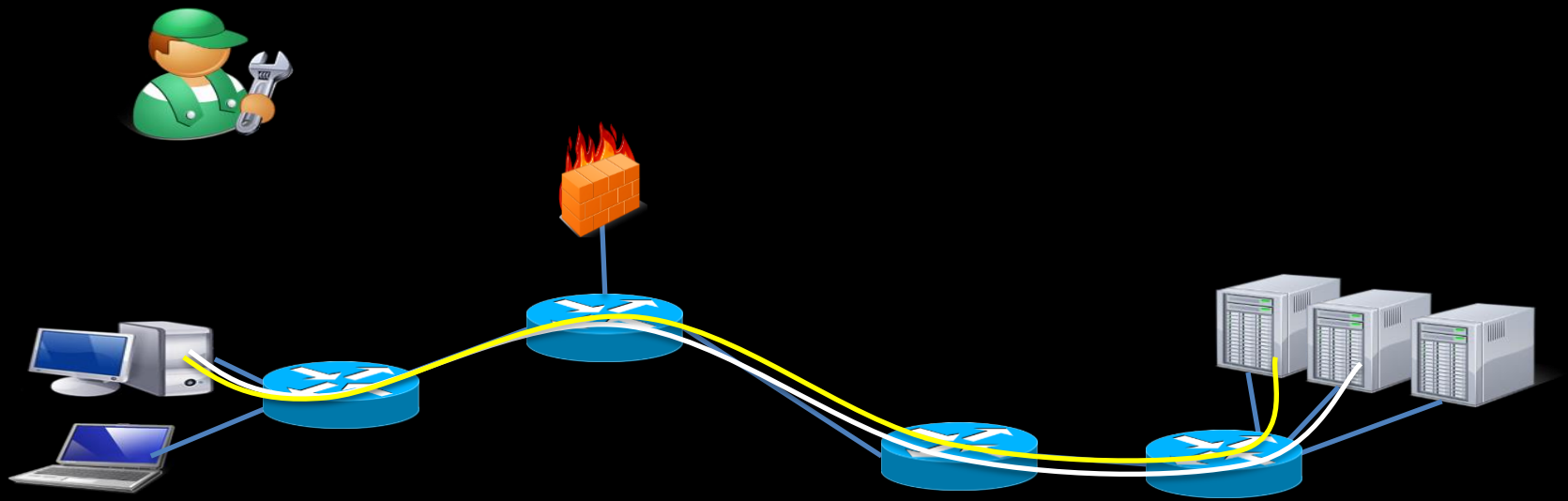

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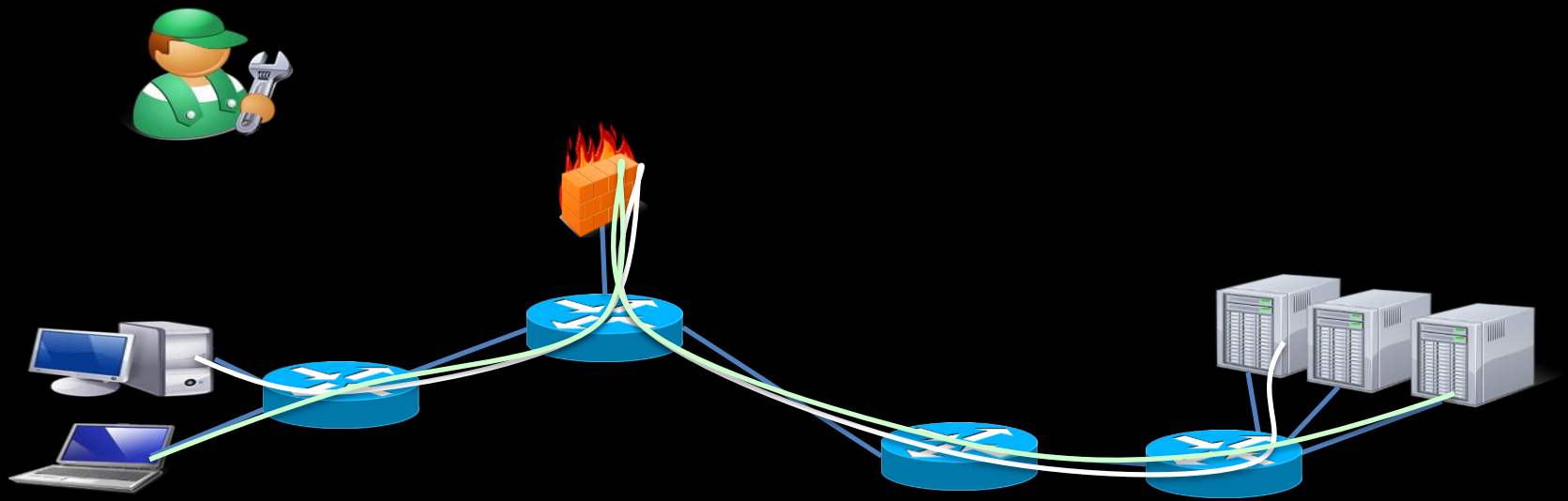

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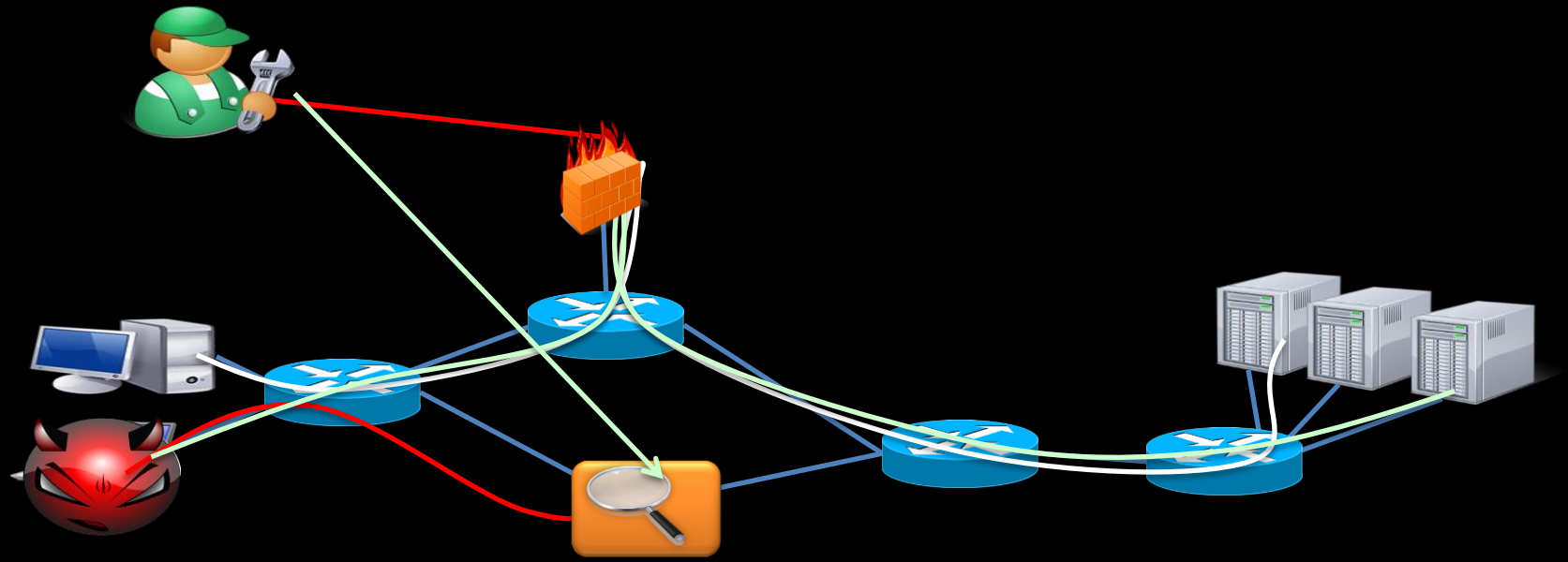


Challenges

- Specify network policies across middleboxes
  - Difficult to automatically react to middlebox events
- Dynamically place sophisticated middleboxes
  - Difficult to determine efficient placement
  - Difficult to adjust placement to traffic patterns
- Support for arbitrary middlebox functionality
  - Difficult to capture hardware requirements

Slick Contributions

- Abstraction for programming middleboxes
  - Simplifies the development of network policies
  - Separates specification of intent from implementation
- Dynamic placement of middlebox functionality
  - Online resource allocation algorithm
- Support for heterogeneous devices
  - Maintains performance profiles of middlebox

Slick Architecture

Your network operator

Application

Slick Controller

- Encodes network policy
- Provides handlers for triggers

Triggers from elements

3rd party element developers

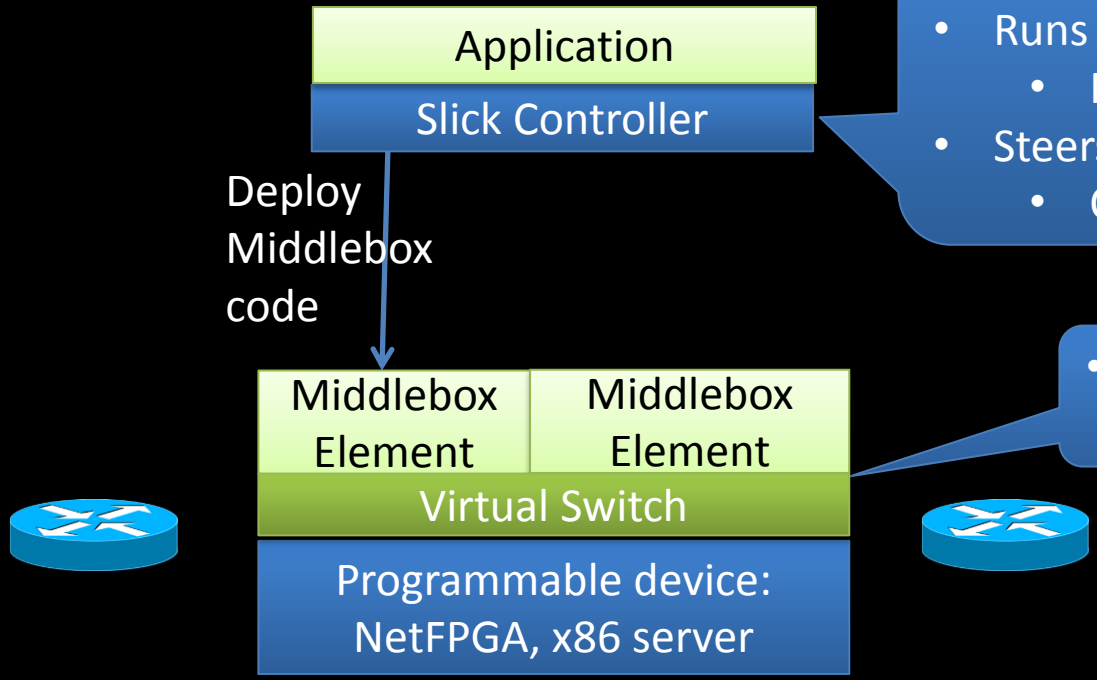
Middlebox Element | Middlebox Element

Virtual Switch

Programmable device: NetFPGA, x86 server

- Piece of code encapsulating middlebox functions

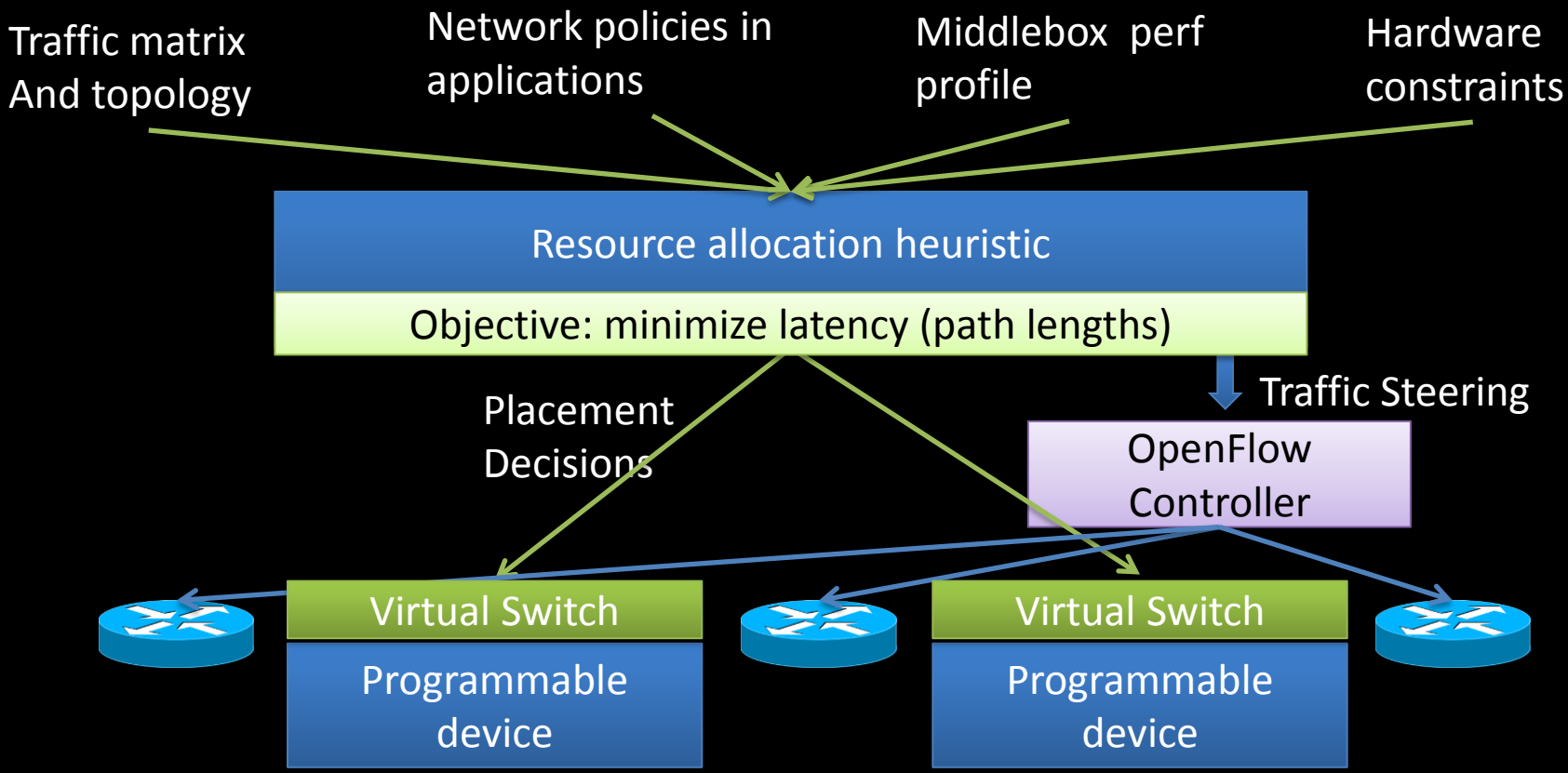
Slick Architecture



- Runs applications
- Runs resource allocation algo.
  - Places middlebox elements
- Steers traffic through middleboxes
  - Configures switches

- Installs/uninstalls middlebox functions

Resource Allocation Heuristic



Current Status

- Slick is implemented in python
  - Slick controller as a module on NoX 0.5.0
  - Developed 2 applications and 3 middlebox elements

Conclusion and Open Questions

- Slick: control plane for middleboxes
  - Presented an initial architecture
  - Discussed algorithmic challenge
- Open questions
  - How can developers help guide placement?
  - What is the optimal solution for resource allocation?

Questions?