SharkFest '16

SDN/OpenFlow Analysis

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SDN/OpenFlow Analysis

- SDN basics

- OpenFlow basics

- OpenFlow comms

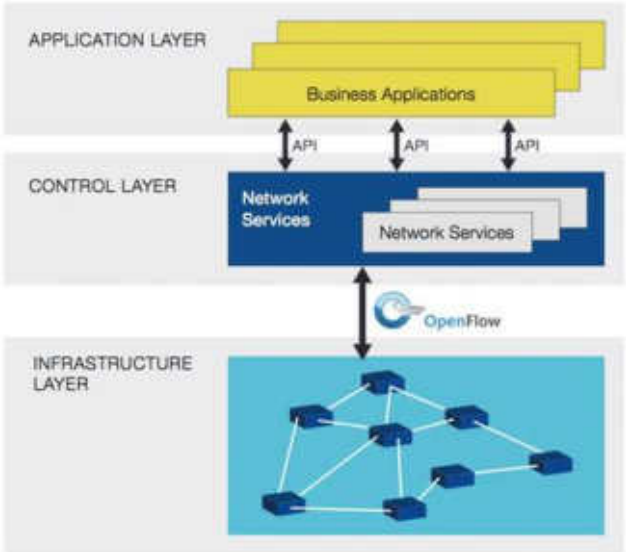- Demonstration and examining OpenFlow trace

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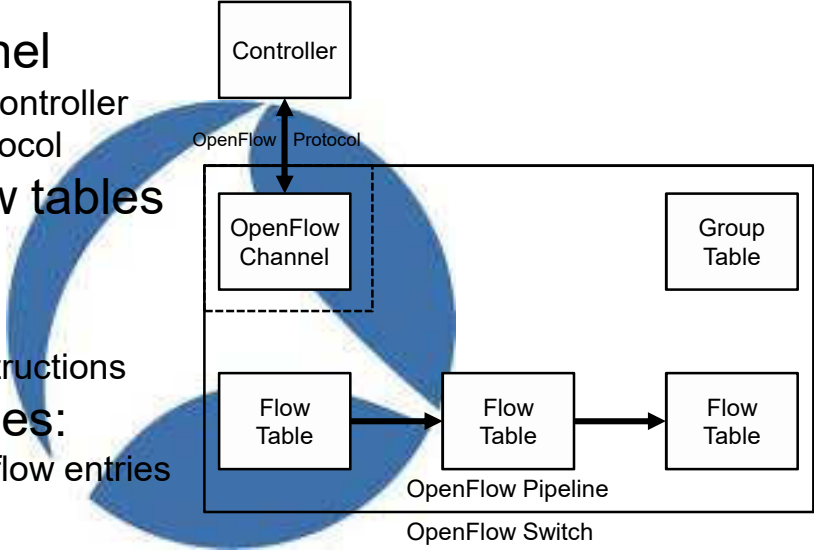
SDN/OpenFlow Analysis

SDN/OpenFlow Systems View
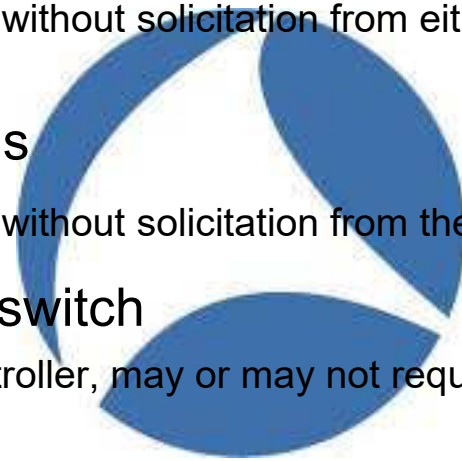
OpenFlow switch main components

- **OpenFlow channel**
  - Comms to external controller
  - Uses OpenFlow protocol
- **One or more flow tables**
- **Group table**
- **Flow table**
  - Match, counters, instructions
- **Controller provides:**
  - Add, update, delete flow entries

SDN/OpenFlow Analysis

OpenFlow Messages

- Symmetric
  - Messages sent without solicitation from either the controller or the switch
- Asynchronous
  - Messages sent without solicitation from the controller
- Controller to switch
  - Initiated by controller, may or may not require a response from the switch

Symmetric OpenFlow messages

Message	Description
Hello	Hello messages are exchanged between the switch and controller upon connection startup, an important element is OpenFlow version negotiation.
Echo	Echo request/reply messages can be sent from either the switch or the controller, and they must return an echo reply. They are mainly used to verify the liveness of a controller-switch connection (a timeout indicates disconnect), and may also be used to measure latency or bandwidth.
Experimenter	For additional functionality, generally proprietary per vendor.

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Asynchronous OpenFlow messages

Message	Description
Packet-In	Switch sends a packet to the controller.
Flow Removed	When switch removes a flow entry (due to hard or idle timeout or in-activity) informs controller.
Port Status	Switch informs controller when a port changes state (ie., interface up/down).
Error	Sent by switch or controller to inform of failure of an operation.

Controller to Switch OpenFlow messages

Message	Description
Features	Controller requests features/capabilities of switch. Switch replies with its capabilities.
Configuration	Controller can query and set configuration parameters in a switch. A switch will reply with parameter stings, but not a to a configuration set by the controller.
Modify-State	The controller can send message to switch to add, delete, modify flow or group entries, and also set port properties on a switch.
Read-State	Collect information from switch, such as statistics, capabilities, and current configuration.

SDN/OpenFlow Analysis

Controller to Switch OpenFlow messages

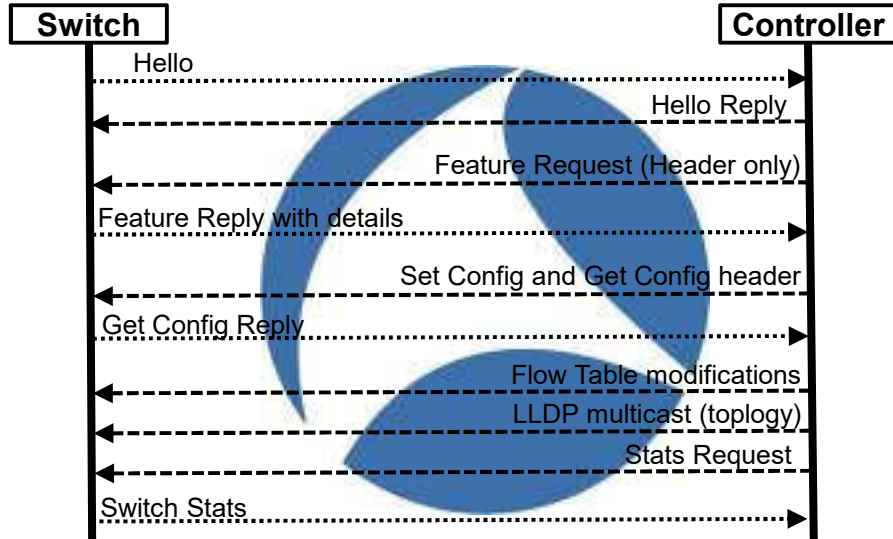| Message	Description
Packet-out	Direct packet to a specified port or ports on the switch.
Barrier	Barrier request/reply messages are used by the controller to ensure message dependencies have been met or to receive notifications for completed operations.
Role-request	Set or query role of the OpenFlow channel. Useful when switch connects to multiple controllers.
Asynchronous-Configuration	Set filter on asynchronous messages or query that filter. Useful when switch connects to multiple controllers.

OpenFlow Ports

OpenFlow capable switches must support three types of OpenFlow ports:

- Physical ports
  - Hardware interface
  - Virtual hardware interface (virtual switch)
- Logical ports
  - No hardware interface
  - Link-aggregation groups, tunnels, loopback interfaces
- Reserved ports
  - CONTROLLER, TABLE, IN_PORT, LOCAL, NORMAL and others

SDN/OpenFlow Analysis

OpenFlow Communications

Switch — Controller

Hello
Hello Reply
Feature Request (Header only)
Feature Reply with details
Set Config and Get Config header
Get Config Reply
Flow Table modifications
LLDP multicast (toplogy)
Stats Request
Switch Stats

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Thank You for Attending!

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