Using SDN-OpenFlow for High-level Services

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Agenda

- SDN … Critical properties
- What are L4-L7 services?
- Challenges catering to L4-L7 service in SDN-OpenFlow
- Possible deployment models
- Taking advantage of L7 intelligence
- Integration with NFV
- Next steps.
ONF’s SDN Architecture .... Opportunities for API Standards

**Network Controller**
- Provides network stats up to Apps
- Translates requirements down to Devices

**SDN-enabled Application**
- App’s Explicit Requirements
- Network Statistics, Hints and Events

**Opportunity to Standardize**
- Configures Network Policy
- Monitors Performance
- Standardized API/Protocol
- Enforced Behavior
- Low-level Control
- Capability Discovery
- Statistics and Faults
Critical Properties of SDN Architecture

1. Applications are network-aware: **SDN-enabled Applications**
   - Communicate their requirements/policies to the network
   - Can monitor network state and adapt accordingly

2. Network is logically centralized: **SDN Network Controller**
   - Controller translates from app requirement to low-level rules
   - Controller summarizes the network state for applications

3. Well-understood driver-like model for devices: **SDN Datapath**
   - Programmatic low-level control of all forwarding and configuration
   - API for capabilities advertisement and publishing statistics
   - No resource contention with other entities
     → Controller “owns” this device, subject to capabilities advertisement/negotiation
What are L4-L7 Services?

- **Layer 2 / Layer 3**
  - Switching
  - Routing
  - Packet forwarding
  - OpenFlow
  - Architectures optimized to process individual packets.

- **Layer 4 through 7**
  - Security
  - Load balancing
  - WAN optimization
  - Architectures optimized to process flows and content

Categorized by depth of Layer 4-7 inspection:

- **No Flow Inspection**
  - OpenFlow switch

- **Partial Flow Inspection**
  - Load balancer
  - Next-generation firewall
  - WAN optimization
  - Web application firewall

- **Flow Monitoring**
  - Test and measurement
  - Policing and metering
  - Quality of Service (QoS)
  - Traffic analysis

- **Full Flow Inspection**
  - Anti-virus / anti-spam
  - Intrusion prevention system (IPS)
  - SSL inspection
  - VPN
Challenges with L4-L7 Service in SDN-OpenFlow Environment

- Inefficient use of network bandwidth and compute resources, due to lack of L4-L7 visibility
- Bottlenecks and lack of coverage due to inability to rapidly respond to new networking and application requirements
- Hosting on controllers results in reduced throughput, increased latency and limited scalability of the network, due to limited compute resources
- Lack of feedback from L4-L7 services, which could potentially reprogram network paths, based on L4-L7 analysis
Many Deployment Models

1. Running as applications on the controller
   • Controller programs SDN switch on per-flow basis

2. Standalone network appliance
   • Inline OF-based appliance
   • Traffic directed to “legacy” appliance either based on static policy, or dynamically driven by controller
   • Or just in-line

3. Full L4-L7 network services running on intelligent switch
   • Intelligent switch becomes L2-L7 device
Use Case Example: Advanced Traffic Analysis

Embedded DPI feeds network intelligence to services on Layer 7 network service devices.

Application flows forwarded directly to specialized service processing.
- Requires Layer 4 through 7 intelligence embedded directly in switches
Integrating SDN-OpenFlow in NFV Architecture Framework
Netronome Integrates SDN & NFV vLAN -to- MPLS Gateway

- Netronome SDN/NFV gateway combines the advantages of both worlds
  - NFV is ideal for L4-L7 devices
  - SDN is ideal for network-aware applications
- Gateway hosts VNF applications
  - Under OF1.3 control
Next Steps

- Define phases of OpenFlow enhancement
  - Traffic steering
  - Adding “Stateful” inspection
- Is it possible to extend OpenFlow to cater to L4-L7 without making it more complex?
  - Controlling L4-L7 devices
- Integration with NFV architecture model