Exercise for Lecture Software Defined Networking

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Problem 4.1 - Network Virtualization and Slicing

a) Duties of an SDN Controller

Name three duties of a typical SDN controller and state at least two examples for each of them.

b) Network Virtualization with VLANs

Two datacenters D and E use VLANs for traffic isolation between their hosts. The datacenters are connected over a L3 connection, e.g. the Internet, and need to share their network segments.

I Propose a solution (without using SDN or VXLAN) for preserving the slices, even when communication is carried out over the L3 link.

II On an example of two hosts A (in Datacenter D) and B (in Datacenter E), draw a communication diagram of a packet sent from A to B over a common network segment. This diagram should include every intermediate hop (except pure L2 switches and simple routers on the Internet).

III Draw the protocol stack (except Layer 1 and everything above the Transport Layer) of the packet into the diagram, between each two intermediate hops. Example: (Ethernet, IP, UDP)

IV Make yourself familiar with VXLAN and the VXLAN header. Name at least *two* advantages of VXLAN compared to your solution (Hint: Think about an intermediate NAT between the datacenters).

V Name at least *one* advantage of OpenFlow compared to (pure) VXLAN in the context of network slicing.

c) Energy saving

Imagine at least one scenario in which SDN can save energy.

Problem 4.2 - FortNOX

a) FortNOX Authentication

How does FortNOX guarantee that only certain users can add/modify/delete flow rules? Which steps are required to be performed by the FortNOX administrator in advance w.r.t. the authentication mechanism.

b) FortNOX Rule Conflicts

How can FortNOX solve rule conflicts? Give an example.

Problem 4.3 - Case Study 4 - Home Router Virtualization

a) This task is a case study. You are supposed to demonstrate theoretical concepts defined in the lecture in an applied setting. Only the problem and its rough context is defined. The context may be extended, if necessary. You are intended to define processes and procedures to solve the problem. Your solution should be defined to an extent allowing a team of skilled staff to implement your solution, i.e., details may be omitted, if they do not have a large impact on your solution. The solution should be presented in a text-based form. Additional literature may be used.

Scenario and Setting:

MVA GmbH is the vendor of the well known BoxFritz home router series. The Software Defined Networking trend is a major threat to MVA's business model: most Internet Service Providers (ISPs) want to get rid of home routers, as the monetary expenses for the device and maintenance constitute the majority of costs per subscriber. MVA's management fears that ISPs will enter the home router market with cheap and "dumb" data planes controlled by an ISP owned controller.

In order to prevent a disadvantageous strategic position, the management decides to offensively anticipate the SDN trend.

As a first step, MVA equips the BoxFritz home router series with OpenFlow capabilities controlled by an MVA owned controller. Based on this setup, MVA wants to offer value added services to their customers.

MVA plans to start a field test offering the following service to private subscribers:
Over-the-Top (OTT) service providers like YouTube or Hulu often apply country barriers to traffic coming from foreign IPs due to legal issues. MVA wants technical means to identify requests to foreign blocked OTT services using a predefined list of domain names per country (e.g., http://www.hulu.com in Germany). Whenever a user in country A requests a blocked service in country B, the traffic should be redirected transparently to a proxy in country B to circumvent the barrier.

Create a system architecture to implement the service. Include a description of the involved components, the necessary communication between components and the necessary OpenFlow rules.