

Exercise 1 – Review of Lecture I

1. Motivation for SDN (20P)

a. (20P) Please explain the problems current, large-scale production networks experience.

Many different control plane mechanisms which usually designed from scratch for specific goal and have variety of implementations.

Complexity has increased to “unmanageable” levels.

Closed equipment.

Software bundled with hardware.

They have vendor-specific interfaces which is over specified.

Equipment vendors write the code, so it slows protocol standardization, and few people can innovate.

Long delays to introduce new features.

2. History of SDN? (60P)

Please review the history of programmable networks in general:

a. (15P) What goals did the historical networking techniques discussed in the lecture (e.g., active networking) have?

Increasing traffic volumes, network sizes.

Opening up network control.

b. (15P) What means did they propose to achieve these goals?

Envisioned method: make network devices programmable via an API

API could be accessed via two models:

Capsule model: code included in data packets transmitted in-band

Programmable router/switch model: code transmitted out-of-band

c. (15P) Why did they fail?

Timing was off.

End of 1990s: no data-centers/clouds yet.

Hardware was expensive (compared to 2015).

Conceptual mistakes.

Programmable by end-users (security?).

Limited interoperability.

d. (15P) What are their intellectual contributions that are similar to SDN?

Programmable network functions.

Network virtualizations (de-multiplexing of packets according to their header).

3. Software-defined Networking - Basics (20P)

a. (10P) Please briefly describe the main characteristics of SDN.

Consist of control plane(logic for controlling the forwarding elements) and data plane(forward data based

on rules set by the control logic).

Data plane implemented by switches.

Switches act on local forwarding state.

Control plane implemented by controllers.

All forwarding state computed by SDN platform.

Open protocols.

b. (10P) What does a Network Operating System do in the context of SDN?

It is control layer, is the interface between application layer and infrastructure layer