

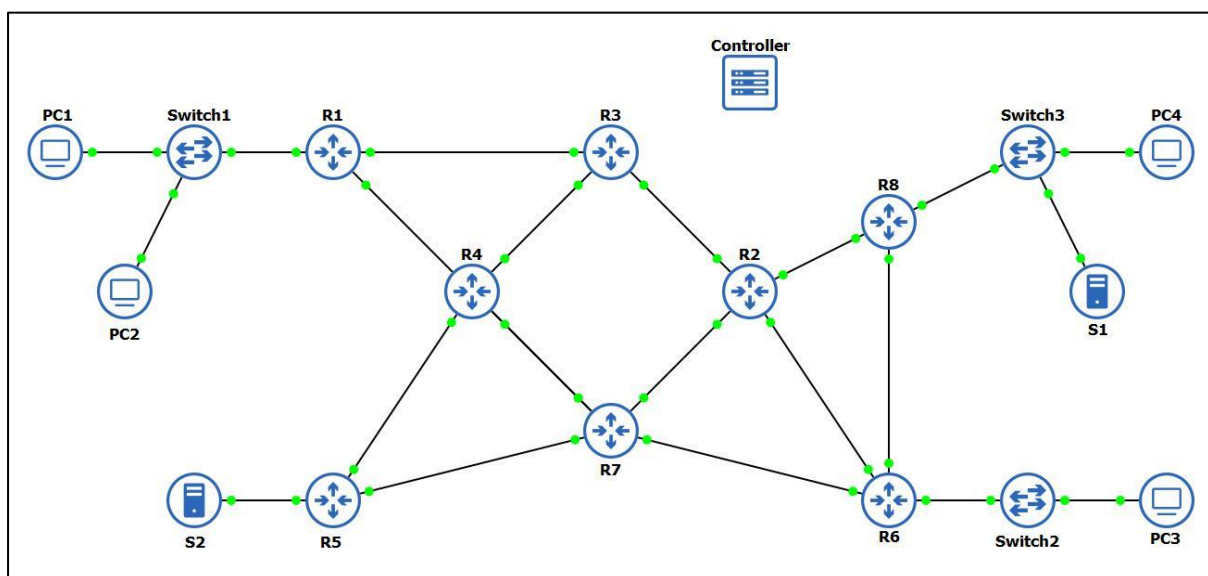
Thesis Proposal: SDN-based network management in emulated environment

Introduction

In this era of network virtualization and automation, many functions are moving towards virtualized and more centralized control, allowing for more dynamic functions and easier optimization. For networking it would mean spinning up the virtualized versions of traditional network functions allowing for more complex decisions making, automating the networks, and changing network configuration more efficiently.

Software-Defined Networking (SDN) is an approach to networking that uses software-based controllers and application programming interfaces (APIs) to communicate with underlying hardware infrastructure and direct traffic on a network. This method is different from that of traditional networks, where the configuration of dedicated hardware devices like Routers and Switches needs to be done node by node to control network traffic. SDN can create and control a virtual network or also control a traditional hardware via software. Because the control plane is software-based, SDN is much more flexible than traditional networking. It allows administrators to control and manage the network from a centralized user interface, without adding more hardware.

Following figure shows the tentative network architecture with SDN controller. A network could be created with several networking devices, network services and access networks. A SDN controller would be connected to these networking devices to manage the flow of traffic.



Problem Definition

Due to advances in the Information and Communication Technology, the configuration and management of the network components becomes highly complex and time-consuming. A fundamental characteristic of SDN is the logically centralized, but physically distributed controller component. SDN offers to batch-configure automatically multiple components in one step, while the traditional way would mean to log into each device. Many operators struggle with the migration from IPv4 to IPv6, SDN with its centralized control and the possibility to reduce human error due to increased poses an opportunity to help make this migration easier. The controller maintains a global network view of the underlying forwarding infrastructure and programs the forwarding entries based on the policies defined by network services running on top of it. The traditional networking approach has very limited facilities to explore these aspects of networking and the goal would be to study these futuristic characteristics of networking.

Possible Tasks

- Build a suitable network with different network devices in the emulation software.
- Manage different services and network configurations with SDN controller in an emulated environment.
- Create and distribute the network configurations for network devices.
- Develop a rationale and setup an IPv4 and IPv6 scheme for the network.
- Create different paths through the network based on QoS requirements.
- Provide services and user groups that have different requirements.
- Evaluate advantages and disadvantages of network with SDN controller over traditional network.
- Proof and validation of functioning failover mechanisms to improve resilience.

Associated Research Questions

- Literature review.
- Research possible open-source SDN controllers to implement.
- Research alternative configuration methods with the goal of finding the best possible method to configure and manage the network through Network Controller.
- How to provide different paths in the network with different QoS properties?
- Algorithms that are responsible for the optimization of the paths.
- When a service is accessible at multiple times, how to choose the best one?