Title:

Developing Applications for Programmable Protocol-Independent Packet Processors (P4) to Increase Network and Data Center Efficiency.

Abstract:

Fast packet switching and routing are essential to any network, especially the Internet, large campuses, and campus networks. P4 Switches are a recent networking technology that allows developers to customize a network device’s packet processing at a very low level. Traditional switches can only be configured and features rely upon hardware vendors. The purpose of our research was to explore the potential applications of this recent development in the networking field. Traditional CPU-based switches are too inefficient for low latency and high speed connections. When working at speeds in excess of 100s of gigabits per second, traditional congestion control is a major hindrance to throughput. Completely programmable packet processors (routers, switches, NICs, etc) allow for developers to create tailored software that can improve the efficiency in certain networking scenarios, such as within a supercomputer cluster. Throughout the research, there were many different tasks, such as running large-scale network congestion simulations, testing real-world hardware, and developing packet processing applications to run on the switch. By the end of my research, I had developed several switching applications that could vastly improve efficiency in campus networks and in data centers, for example, a high-speed load balancer or a switch-based intrusion detection system. When researching the potential applications of these P4 Switches, we found that an implementation of these switches has the potential to save millions of dollars as well as decrease the time certain processes take from 10s or 100s of milliseconds to a few nanoseconds.