

BACHELOR THESIS

Automatic network emulator tuning

Background

Software-defined networkings (SDNs) is a new and evolving technology that gives network administrators new possibilities to control computer networks. At the moment, SDN is primarily used in research, experimental, and high-performance networks. To emulate large networks, emulation software such as Mininet/MaxiNet is used. This software can emulate very large networks on only few physical resources. This makes the emulation very cheap because only few resources can be used to emulate a large network consisting of a lot more resources.

However, emulation only works when the utilization of the emulated resources is not higher than what can be sustained by the physical resources. As an example, running five downloads on five clients from one server might take 20 s on a real network. An emulation, which has to emulate the switch and the six hosts, might take 68 s since the physical resources emulating that network are running at their capacity limit. Hence, the experiment is slowed down.

To overcome this limitation and to create a more realistic behaviour, the concept of time dilation can be used. By slowing down the time in the experiment by a constant factor, the load on the emulating host is reduced. In our simple example a slow-down factor of four might result in 80 s download time since the host is not overloaded anymore. A smaller slowdown factor will probably not work because then, the physical machines are still overloaded.

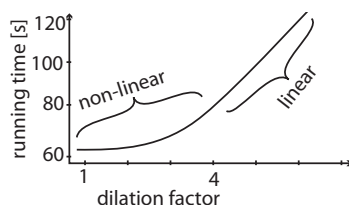


Figure 1: Comparing time dilation and running time

Fig. 1 shows a plot comparing dilation factor and running time of the experiment. As the dilation increases and the load decreases the relationship between the dilation factor and running time of the experiment becomes linear.

Thesis

In this thesis, the bachelor candidate will create and implement a method to automatically determine which is the smallest time dilation factor that can be used to execute a given experiment on a given pool of physical machines without overwhelming them. To this end, the candidate will work with MaxiNet, a distributed network emulator. To support various types of experiments, a metric, like maximal CPU usage, has to be found to determine when a MaxiNet cluster is overloaded and when an experiment is skewed.

Based on that metric an algorithm has been developed to quickly find the necessary dilation factor.

Keywords:

- Emulation
- Software-defined networking
- Mininet/MaxiNet

Previous knowledge (or willing to learn):

- Basic network knowledge
- Familiar with Linux
- Python