

## Master thesis proposal:

### **Flexible SDN testing in production with Shadow Policies**

The recent advent of SDN made it much easier to test network application using virtual environments such as Mininet. Yet, testing applications in a virtual environment is not enough as it fails to catch subtle runtime or performance issues that only arise when the software is run on real hardware. As an illustration, not all OpenFlow switches implement the specification completely, rendering perfectly running application Mininet useless when deployed in production. Besides specification issues, the difference in performance and timing between virtual and hardware environments could also create numerous problems. For instance, slow reaction time can impact negatively running applications to such an extent that it might necessitate a complete redesign of the application or could lead to race condition that would not have otherwise never happened in Mininet.

To solve this problem, this master thesis will aim at developing a complete framework on top of the Pyretic controller that will provide SDN software developers with a way to test their application directly in the production network and this, without impacting the rest of the network traffic. To guarantee isolation of the production traffic, a shadowed version of the new network application will be installed in the network. Once installed, the behavior and performance of the shadowed application will be assessed using specifically crafted test traffic or by duplicating real traffic. If the behavior of the new application matches the requirement of the operator, the shadowed policy is activated, effectively replacing the original policy.

#### **Related work:**

1. Richard Alimi, Ye Wang, and Y. Richard Yang, "*Shadow Configuration as a Network Management Primitive*", Proc. ACM SIGCOMM, August 2008
2. Mark Reitblatt, Nate Foster, Jennifer Rexford, Cole Schlesinger, and David Walker, "*Abstractions for network update*," Proc. ACM SIGCOMM, August 2012
3. Christopher Monsanto, Joshua Reich, Nate Foster, Jennifer Rexford, and David Walker, "*Composing Software-Defined Networks*," in Proc. Networked Systems Design and Implementation, April 2013
4. Aggelos Lazaris, Daniel Tahara, Xin Huang, Erran Li, Andreas Voellmy, Y. Richard Yang, and Minlan Yu. 2014. *Tango: Simplifying SDN Control with*

*Automatic Switch Property Inference, Abstraction, and Optimization.*  
In Proceedings of the 10th ACM International on Conference on emerging  
Networking Experiments and Technologies (CoNEXT '14)

5. Maciej Kuzniar, Peter Peresini, and Dejan Kostić. 2014. *Providing Reliable FIB Update Acknowledgments in SDN.* In Proceedings of the 10th ACM International on Conference on emerging Networking Experiments and Technologies (CoNEXT '14).
6. Charalampos Rotsos, Nadi Sarrar, Steve Uhlig, Rob Sherwood, and Andrew W. Moore. 2012. *OFLOPS: an open framework for OpenFlow switch evaluation.* In Proceedings of the 13th international conference on Passive and Active Measurement (PAM'12)
7. Xin Jin, Hongqiang Harry Liu, Rohan Gandhi, Srikanth Kandula, Ratul Mahajan, Ming Zhang, Jennifer Rexford, and Roger Wattenhofer. *Dynamic scheduling of network updates.* In Proceedings of the 2014 ACM conference on SIGCOMM (SIGCOMM '14)