

Homework 2

Frenetic Controller Implementation

Due Date: 10/21/2014 18:00:00 EST

1 Overview

In this homework, you are asked to write a set of Frenetic modules using NetKAT and compose them to implement a Frenetic controller. [1].

2 Background Concepts

Frenetic refers to both an open-source SDN controller and a family of languages for programming distributed collections of network switches. The languages provide a domain specific sub-language for specifying data plane packet processing in terms of packet functions and combinators inside of a general purpose programming language. NetKAT is a domain-specific language in the Frenetic project that is used to write applications on top of a Frenetic controller. It is based on OCaml and provides high-level abstractions and rich, compositional features that greatly simplifies SDN programming.

3 Question Specifications

We have 5 questions. Each solution should be located in Q_x where x is the question number. Use a MAC address of 00:00:00:00:00:0x to recognize host x.

Q1 Write a simple hub that floods all packets. (5 points)
sudo mn --topo single, 4 --controller remote --mac

Q2 Copy Q1 and expand it to work as a hub and a simple monitor that counts all packets leaving odd numbered ports. (15 points) (+5 extra points for using OCaml variables within your NetKAT code)
sudo mn --topo linear, 6 --controller remote --mac

Q3 Copy Q1 file and modify to block SSH (port 22) traffic coming from host 1 with destination host 3 or 4. (20 points)
sudo mn --topo single, 4 --controller remote --mac

Q4 Implement a firewalling and learning switch. For the firewall feature, block any HTTPS packets among host 1,2,3, but allow all other packets. Output the total number of packets sent and received in the network. (30 points)

```
sudo mn --topo single,4 --controller remote --mac
```

Q5 Implement a routing procedure for a tree topology and monitor per host statistics (number of sent and received packets for each host). (30 points)

Extra Credit (+20 points): Once a host has sent more than 10 packets, copy any new traffic and send it to a packet logger located at 10.0.0.4

```
sudo mn --controller remote --topo tree,2,2 --mac --arp
```

4 Preparation Steps

1. Download a VM image from “<http://storage.googleapis.com/arjun-umass-disks/Frenetic-Tutorial.ova>”.
2. Open the image from your VM environment (VMWare, VirtualBox, or etc.) and power on.
3. Follow Frenetic NetKAT Tutorial (see references). Note that the command for compiling is “netkat-build”.
4. Download hw2 git repo by typing ‘git clone https://github.com/jj2600/hw2.git’.

5 Work Steps

1. Since Frenetic follows OCaml syntax, if you have not programmed in OCaml before please read this <http://ocaml.org/tutorials/basics.html> and this “[http://ocaml.org/tutorials/structure of ocaml programs.html](http://ocaml.org/tutorials/structure_of_ocaml_programs.html)”.
2. It is also recommended to go over this interactive tutorial on OCaml <http://try.ocamlpro.com>
3. Modify the files for each question Qx.
4. Test your code by launching mininet. Please use the give mininet command for each question.
5. Create an archive by typing “/make archive.sh”. You should be able to see an archive file, named ‘sdn-hw2-UNI.tar’
6. Upload the archive file to the Courseworks hw2 page.

7 Late Policy

Follows the late submission guide in Grading Rules Section.

8 References

Carolyn Jane Anderson et al. NetKAT: Semantic Foundations for Networks. POPL'14, 2014.

<http://www.cs.cornell.edu/~jnfoster/papers/frenetic-netkat.pdf>

Overview of Frenetic

<http://www.frenetic-lang.org/overview.php>

Frenetic project page

<https://github.com/frenetic-lang/frenetic>

Frenetic tutorial

<http://frenetic-lang.github.io/tutorials/Introduction/>