Project 1

ECE544 Communication Networks II

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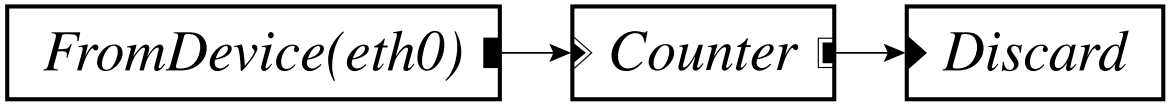
Includes teaching material from Bart Braem and Michael Voorhaen

Project Goals

- Get familiar with Click's environment
- Get familiar with our virtualized environment
- Practice with existing elements and create first running configurations
- Use existing interfaces to communicate between multiple click instances

Click Routers: Main Concepts

- Router: Elements connected by edges
- Output ports to input ports
- Describes possible packet flows through directed graphs



Intro to Configurations

- Text files describing the Click graph:
- Elements with their configurations
- Connections between elements
- Flexible syntax (this is just one possible format)

```
src :: FromDevice(eth0); ctr :: Counter;
sink :: Discard;
src -> ctr; ctr -> sink;
```

or

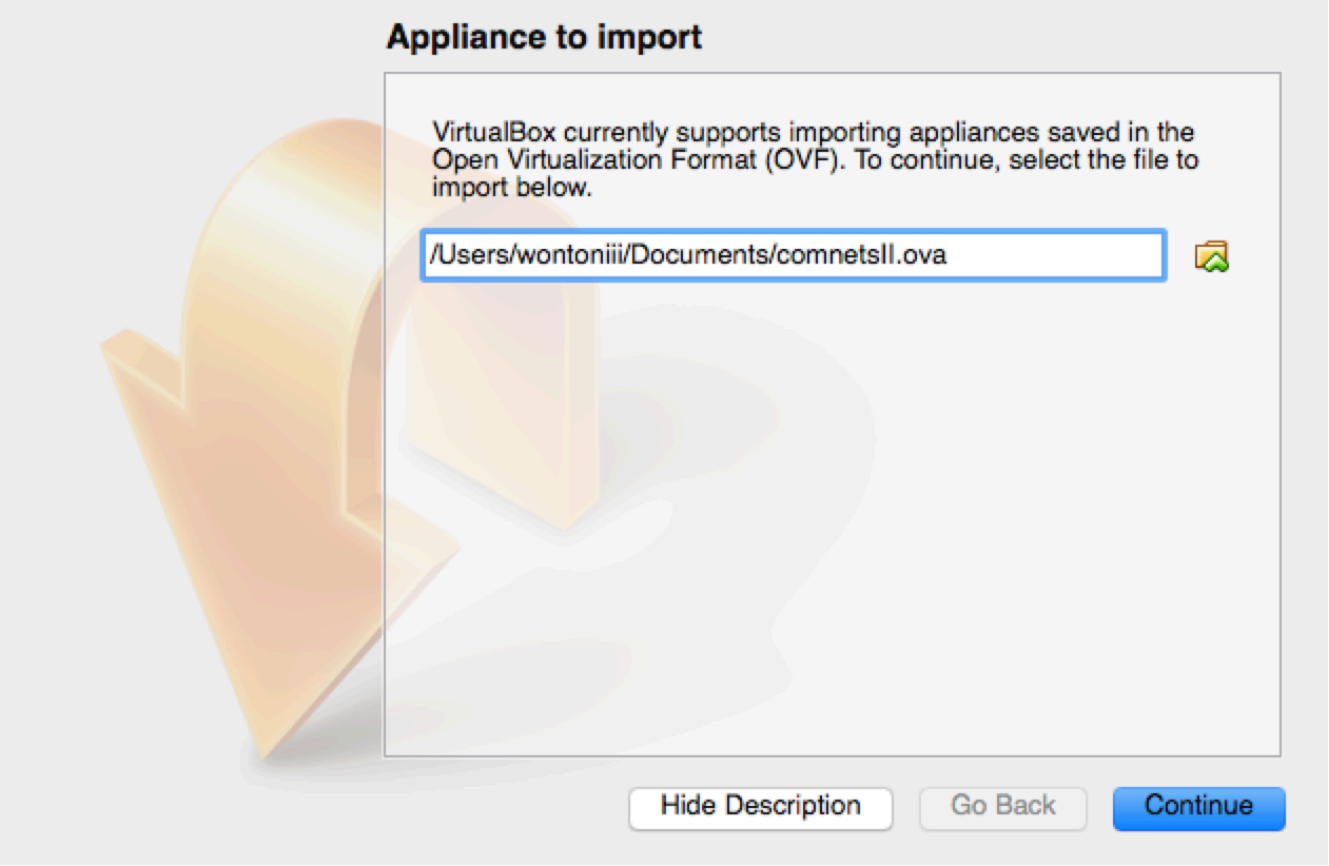
```
FromDevice(eth0) -> Counter -> Discard;
```

Intro to Our VM

- Download from:
  - http://www.winlab.rutgers.edu/comnet2/Projects/downloads/comnetsII.ova
- VM OVS Format compatible with most virtual environments.
- Suggestion: Virtual Box from Oracle. It is free, multiplatform.
- The following instructions will be based on Virtual Box.

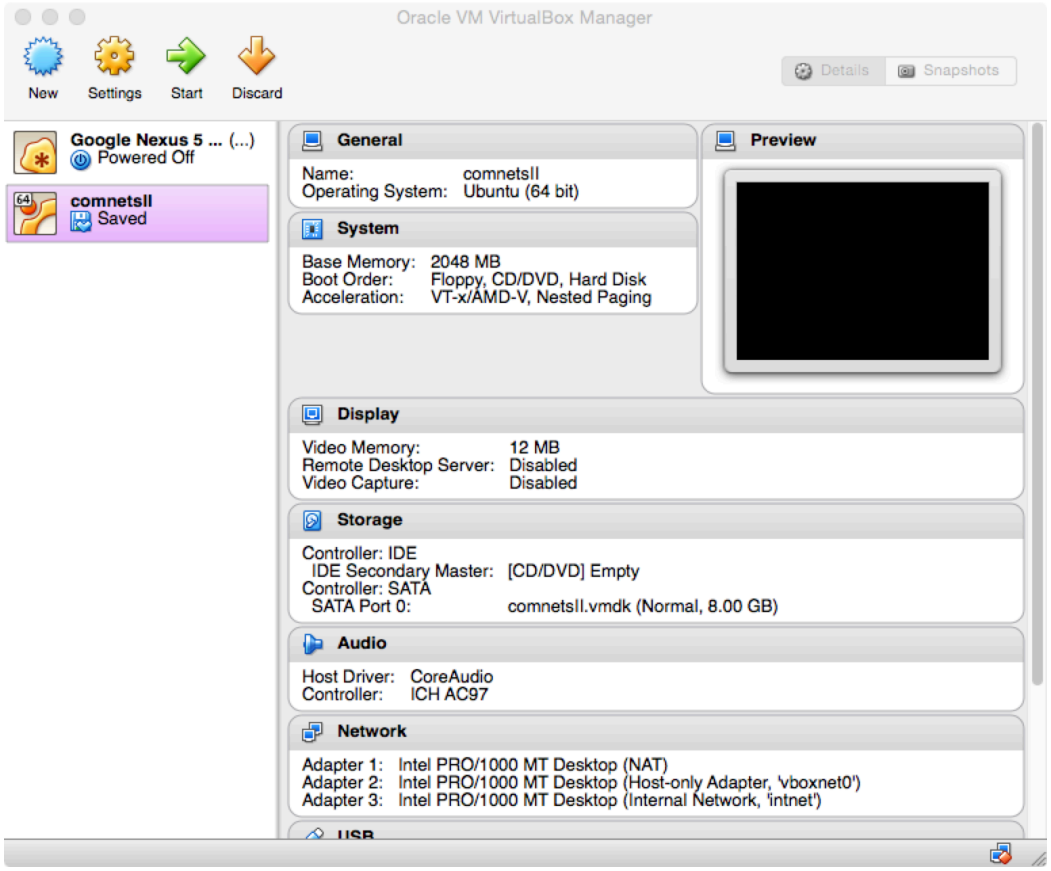
Loading the VM into VBox

- File -> Import Appliance



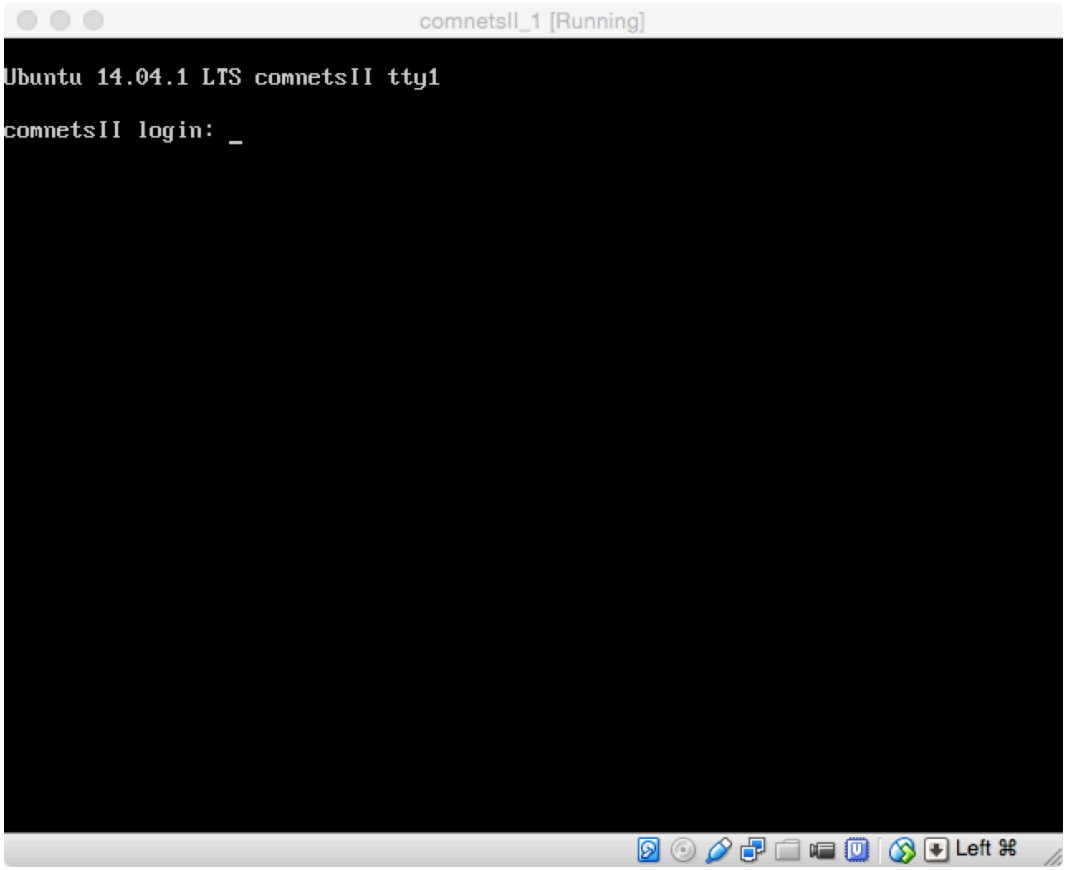
SSH into the VM

- Start the VM



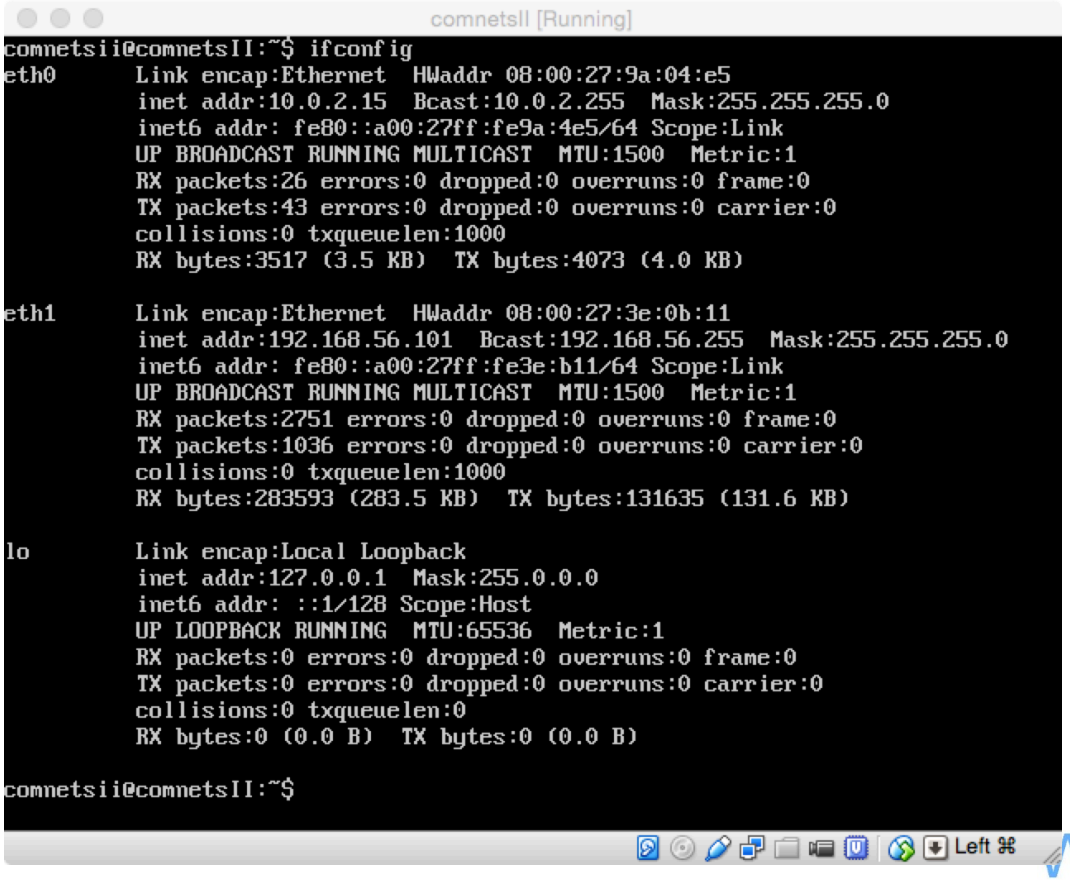
SSH into the VM

- Login: username=comnetsii password=comnetsii



SSH into the VM

- Activate interface eth1:
  - $ sudo ifconfig eth1 up
  - $ sudo ifconfig eth1 192.168.56.101



SSH into the VM

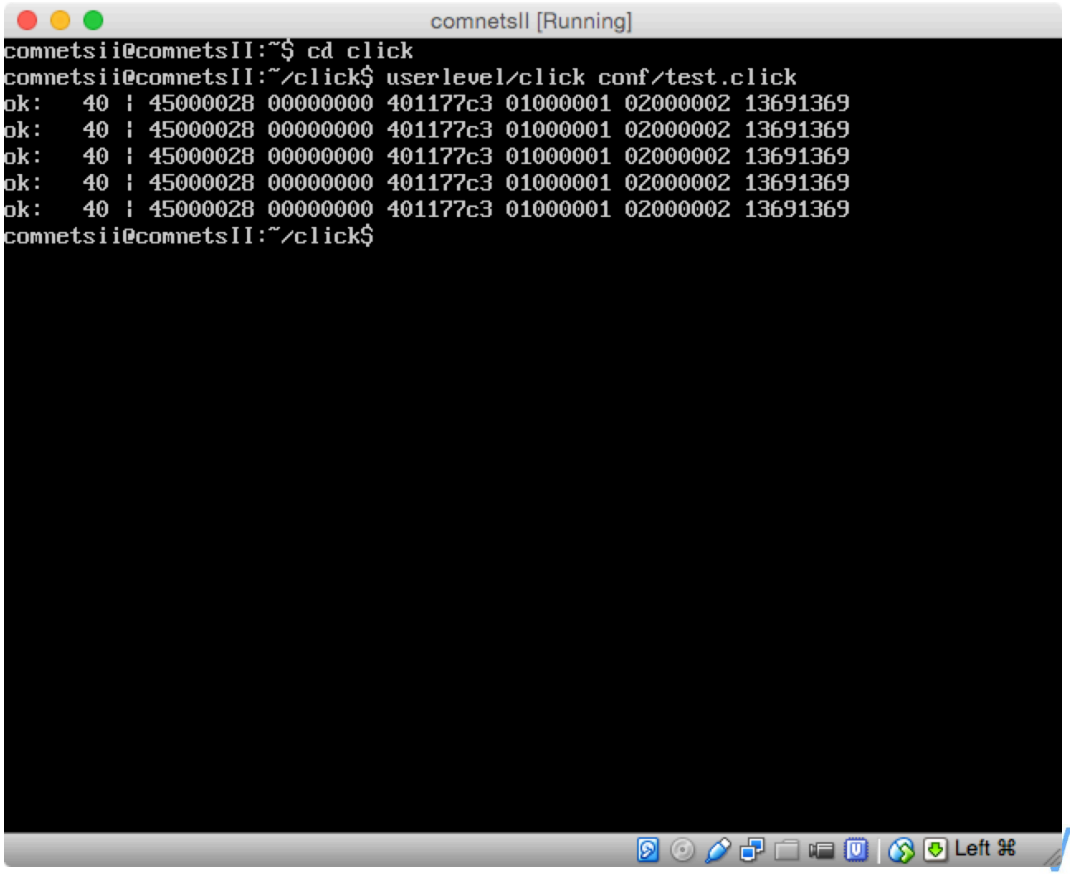
- You can now ssh into the VM from your hosting OS
- On Unix machines:
  - $ ssh comnetsii@192.168.56.101
- On windows: use Putty or similar tools that provide ssh

Available Resources

- In the home folder you will find the following resources:
  - click: click sources and resources.
  - examples: small set of examples that can be used as reference
  - elements: a few provided elements used in the exercises
  - tools: script utilities used to model our virtual environment (more on this later..)

How to Run a Click Instance

- Run your first click instance (inside the click folder):
  - $ userlevel/click conf/test.click



Exercise 1

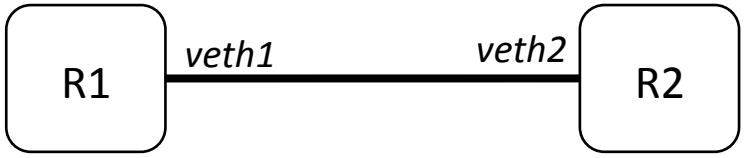
- Single Click instance
- Create a new packet with payload “hello”
- Print its content to terminal
- Drop the packet
- Hints:
  - Only use of existing elements
  - Configuration should use 3 elements
  - Click provides a collection of “source” elements

Interaction Between Multiple Instances: Interfaces Use

- Click provides elements used to interact with the system network interfaces
- FromDevice: read packets from the device
  - Element with one outgoing push port
- ToDevice: write packets into the device
  - Element with one incoming pull port
- Multiple click instances can interact using these elements
- Which interfaces to use?
  - We will provide scripts to simplify your life
  - Feel free to explore what these scripts do

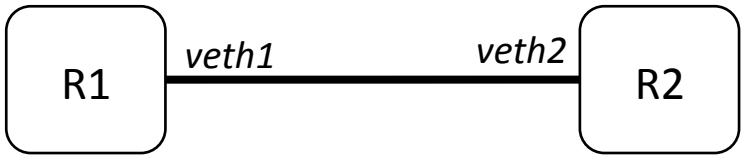
Exercise 2

- Use provided script to create 2 virtual interfaces
  - Run: $ sudo createNet1
  - The script will create the virtual interfaces *veth1* and *veth2*
  - Run: $ ifconfig
  - You should see a list of available interfaces, complete with the their IP and MAC addresses
- Obtained topology



Exercise 2

- With the given topology:



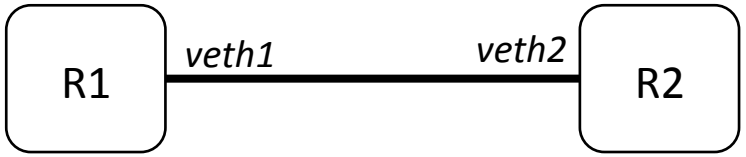
- One click instance: generates packets and transmits them into the device
- Second click instance: reads the packets and print them
- Hints:
  - ethernet and ip encapsulation?
  - Encapsulation elements are available and ready to be used.

Multi-Directional Communications

- For now we only implemented a generator and a sink
- Normally a router processes packets and forwards them…

Exercise 3

- Same as exercise 2, but the message has to be echoed back to the origin router
- If you need to recreate the network, use the same script from the previous exercise



- Hints:
  - Nothing new, except for a bigger collection of elements

General Suggestions

- Get comfortable with the Virtual Machine as soon as possible
  - You do not want to get stuck at the last minute without even having the chance to do the exercises
- These exercises are just a Click warm up
  - There is a lot more to learn
  - Some will be covered in the next project
  - More exercises can be found here:
    - http://www.read.cs.ucla.edu/click/tutorial1
    - http://www.pats.ua.ac.be/software/click/

General Info

- Due: March 13th, by the end of the day
- Technical questions: use the **mailing list**. It is better for me, it is better for you.
- Submission instructions:
  - Submit a single archive (zip or tar.gz) to bronzino@winlab.rutgers.edu with subject "ECE544 Project 1"
  - Include in the archive 3 folders named "exercise1", "exercise2", "exercise3". They should contain only the click configuration files. If you want to include additional information, write a README file.
  - **Do not** include the whole click resources!