Multi Router Configurations and Project I

ECE544 Communication Networks II

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Includes teaching material from Bart Braem, Michael Voorhaen and previous TA Francesco Bronzino
Click Routers: Main Concepts

- Elements
- Ports
- Packets
- Configuration
- More...
Elements

• Most important user-visible abstraction in Click
• Elements (they are C++ classes)
• Element instances: C++ objects
Elements

- Input port(s): Interface where packets arrive, triangles
- Output port(s): Interface where packets leave
- Inside: packet processing!
Ports

FromDevice → Null → Null → ToDevice

receive packet $p$

push($p$) → push($p$) → enqueue $p$ → pull() → pull() → ready to transmit

return

dequeue $p$

and return it

return $p$

return $p$

send $p$
Packets

- Packet consists of **payload and annotations**:
  - **Payload**:
    - raw bytes (char*)
    - Access with struct*
  - **Annotations**: metadata to simplify processing, “post-its”
    - E.g. start of IP header or TCP header
    - Paint annotations
    - User defined annotations
Intro to Configurations

- Text files describing the Click graph:
  - Generally has .click filetype extension
  - Elements with their configurations
  - Connections between elements
  - Flexible syntax

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

or

FromDevice(eth0) -> Counter -> Discard;
```
Intro to Configurations

• Identified by number (0,1,..)
  • Input port: -> [nr1]Element ->
  • Output port: -> Element[nr2] ->
  • Both: ->[nr1]Element[nr2]->
  • In case only one port ➔ number can be omitted

mypackets::IP Classifier(dst host $myaddr, -);
FromDevice(eth0) → mypackets;
mypackets[0]→ Print(mine)→[0]Discard;
mypackets[1]→ Print("the others")→ Discard;
Intro to Configurations

• Lots of data types supported
  • Integers
  • Strings
  • IP addresses e.g. 192.168.1.100
  • Elements
Element Configuration Example

• SimpleElement("data")
• SimpleElement("data",ACTIVE false)
• SimpleElement("moredata" 800)
• SimpleElement("data" 800,DATASIZE 67,SOURCE 1.2.3.4)

• Later: Details on compound 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
Playground 2(A): Two Routers

• Use provided script to create 2 virtual interfaces
  (check tools directory)
  • Run: $ sudo createNet1
    • The script will create the virtual interfaces veth1 and veth2
  • Run: $ifconfig or $ip a
    • You should see a list of available interfaces with their IP and MAC addresses
  • Obtained Topology
Playground 2(A): Two Routers

• Write two click configuration files: sender.click and receiver.click
  • sender.click: generates packets and transmits them into the device (*interface*)
  • receiver.click: reads the packets from the device (*interface*) and prints them

• Hints:
  • Ethernet and ip encapsulation?
  • Encapsulation elements are available and ready to be used
  • Did you try `sudo`?
  • Start receiver click first!
Multi-Directional Communications

• For now we only implemented a generator and a sink
• Normally a router processes packets and forwards them.
Playground 2(B): Ping

- Same as 1(C), 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 playground

Hints:
- Use a bigger collection of elements
- Use proper MAC addresses
Submission Info

• Due:
  • Playground2: Feb 15th *(before class)*

• Technical questions: use the mailing list. It is better for all of us.
  • comnet2@winlab.rutgers.edu

• Submission instructions:
  • Submit a single archive (zip or tar.gz) to sumitm@winlab.rutgers.edu with subject “ECE544 P1PG2”
  • Include in the archive 1 folder named “PG2”. It should contain only the click configuration file(s).
  • If you want to include additional information, write a README file.
  • *Do not include the whole click resources!*

• *In not in list already,*
  • Apply at: https://groups.google.com/a/winlab.rutgers.edu/forum/#!forum/comnet2