

# CRON: Cyber-infrastructure of Reconfigurable Optical Networks Tutorial

<http://www.cron.loni.org>

Seung-Jong Park, Chui-Hui Chiu

LSU Advanced Networking Lab

Computer Science &

Center for Computation & Technology

Louisiana State University

- Group into **10** groups of **2** members.
- Install a Mozilla FireFox, Microsoft Internet Explorer, Google Chrome, or Opera browser.
- Install the **Oracle VM VirtualBox** and **extension pack** (copy the VirtualBox folder on the USB drive to your local disk and install them).
- Copy the **LSU-CRON-Tutorial** folder on the USB drive to your local disk.
- Import the **LSU-CRON-Tutorial-32bit.ova** in the LSU-CRON-Tutorial folder to the VirtualBox.

# Overview

- Time Table
- Introduction to the CRON Testbed
- Tutorial
  - Scenario 1: Self-contained Experiment
  - Scenario 2: Federation Experiment

# Time Table

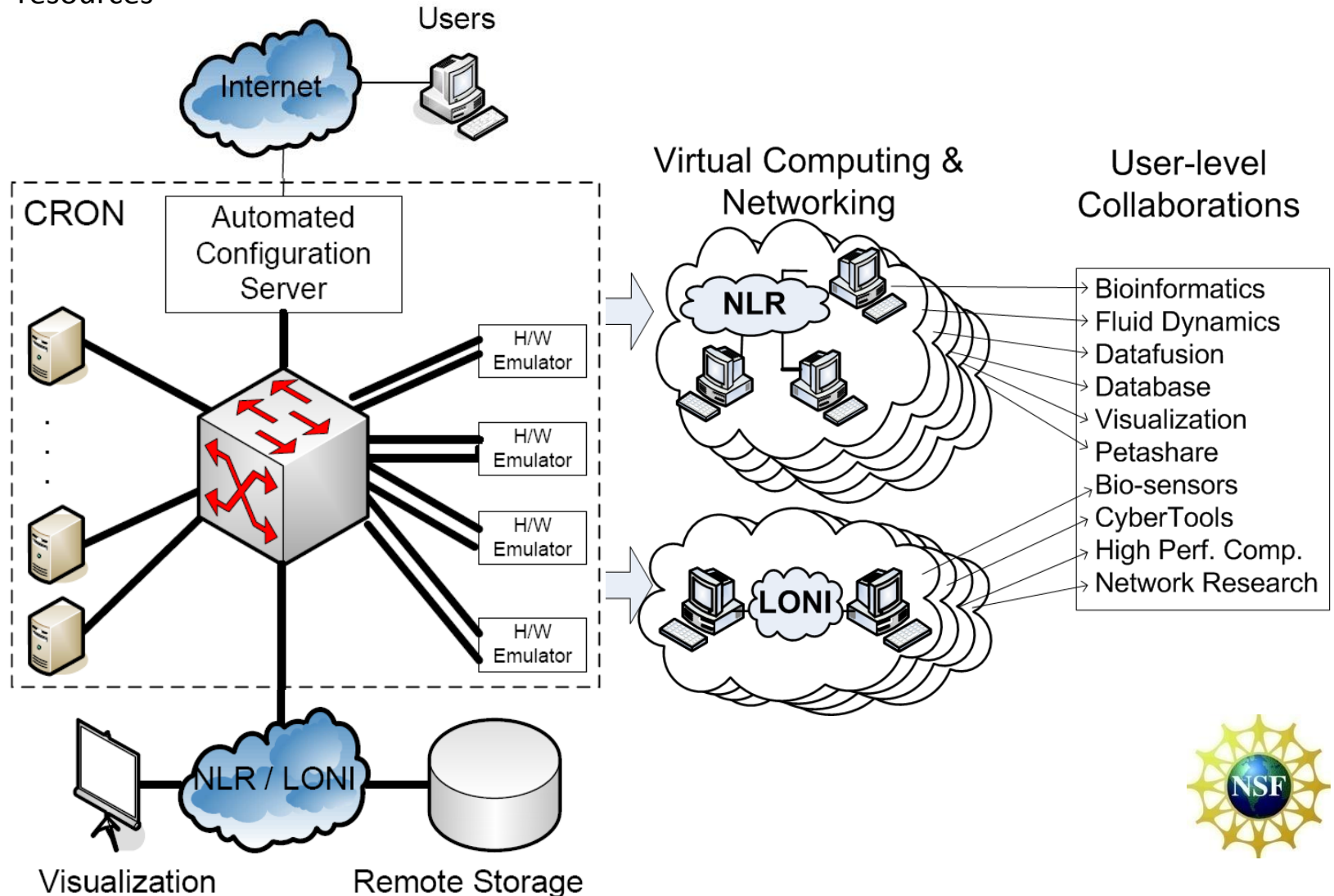
- Introduction to CRON testbed – 10 min
- Scenario 1: Self-contained Experiment - 30 min
- Scenario 2: Federation Experiment - 30 min

# Overview

- Time Table
- Introduction to the CRON Testbed
- Tutorial
  - Scenario 1: Self-contained Experiment
  - Scenario 2: Federation Experiment

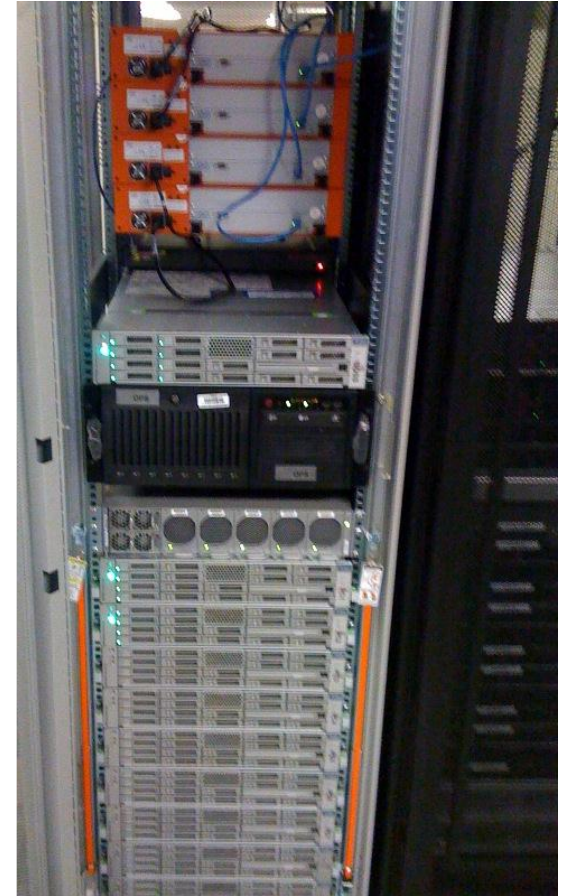
# CRON

- Objectives :Developing virtually shared 10Gbps networking and high-end computing resources



# Components

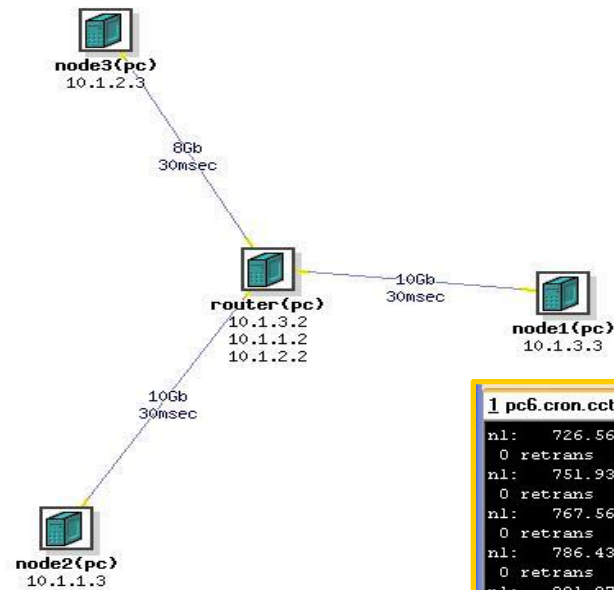
- Switches
  - Data plane: Cisco Nexus 5020 switch consisting 50 X 10GE ports
  - Control plane: Cisco 3560 switch
- Emulators
  - Hardware Emulators: 4 X Anue 10GE emulators for upto 10Gbps bandwidth
  - Software Emulators: modified Dummynet for upto 10Gbps bandwidth
- Workstations
  - 20 X Sun X4250 servers (two quad-core CPUs with 10GE)



# CRON Experiment

## Visualization, NS File, and Details

### Experiment **CRONtest/Test**



- Emulab GUI and interface
  - [WWW.CRON.loni.org](http://WWW.CRON.loni.org)
- Resource Allocation to GENI
  - Up to 20 Servers
    - Quad-cores with 10GE NIC
    - 64bit Ubuntu and 64bit FreeBSD
- Measurement services available
  - OnTimeMeasure

```
1 pc6.cron.cct.lsu.edu...
nl: 726.5625 MB / 1.00 sec = 6094.9211 Mbps
0 retrans
nl: 751.9375 MB / 1.00 sec = 6307.6900 Mbps
0 retrans
nl: 767.5625 MB / 1.00 sec = 6438.8002 Mbps
0 retrans
nl: 786.4375 MB / 1.00 sec = 6597.0038 Mbps
0 retrans
nl: 801.8750 MB / 1.00 sec = 6726.7428 Mbps
0 retrans
nl: 809.8750 MB / 1.00 sec = 6793.6356 Mbps
0 retrans
nl: 822.9375 MB / 1.00 sec = 6903.2794 Mbps
0 retrans
nl: 829.7500 MB / 1.00 sec = 6960.5449 Mbps
0 retrans
nl: 836.0625 MB / 1.00 sec = 7013.2323 Mbps
0 retrans
nl: 842.6875 MB / 1.00 sec = 7069.1518 Mbps
0 retrans
nl: 845.8750 MB / 1.00 sec = 7095.6428 Mbps
0 retrans
nl: 852.2500 MB / 1.00 sec = 7149.2698 Mbps
0 retrans
nl: 853.3750 MB / 1.00 sec = 7158.6284 Mbps
0 retrans

1 pc3.cron.cct.lsu.edu...
nl: 243.5625 MB / 1.00 sec = 2043.1585 Mbps 0
retrans
nl: 248.5625 MB / 1.00 sec = 2085.0955 Mbps 0
retrans
nl: 247.5625 MB / 1.00 sec = 2076.6508 Mbps 0
retrans
nl: 249.0625 MB / 1.00 sec = 2089.3420 Mbps 0
retrans
nl: 248.2500 MB / 1.00 sec = 2082.4740 Mbps 0
retrans
nl: 249.0625 MB / 1.00 sec = 2089.2772 Mbps 0
retrans
nl: 250.8125 MB / 1.00 sec = 2103.9741 Mbps 0
retrans
nl: 247.8750 MB / 1.00 sec = 2079.3179 Mbps 0
retrans
nl: 252.4375 MB / 1.00 sec = 2117.6098 Mbps 0
retrans
nl: 250.0000 MB / 1.00 sec = 2097.1520 Mbps 0
retrans
nl: 250.5000 MB / 1.00 sec = 2101.3463 Mbps 0
retrans
nl: 253.6875 MB / 1.00 sec = 2128.0871 Mbps 0
retrans
nl: 253.4375 MB / 1.00 sec = 2125.9878 Mbps 0
retrans
```



# Overview

- Time Table
- Introduction to the CRON Testbed
- **Tutorial**
  - Scenario 1: Self-contained Experiment
  - Scenario 2: Federation Experiment

# Tutorial

- **Scenario 1: Self-contained Experiment**

Providing experience on creating a 10Gbps experimental network on the CRON.

- **Scenario 2: Federation Experiment**

Providing experience on creating an experimental network consisting of the resources on the CRON and another testbed through the Internet2.

# Overview

- Introduction to the CRON Testbed
- Time Table
- **Tutorial**
  - **Scenario 1: Self-contained Experiment**
  - Scenario 2: Federation Experiment

# Self-contained Experiment

- Experimental network topology  
1 sender connects to 1 receiver through 1 link having 120 ms of delay.
- Physical resources  
PC: Sun Fire workstation with Myri 10GE NICs.  
H/W Emulator: Anue 10Gbps network emulator.  
Link: 10Gbps Ethernet connection.

# Self-contained Experiment (cont'd.)

- TCL script

```
set ns [new Simulator]
```

```
source tb_compat.tcl
```

```
set sender [$ns node]
```

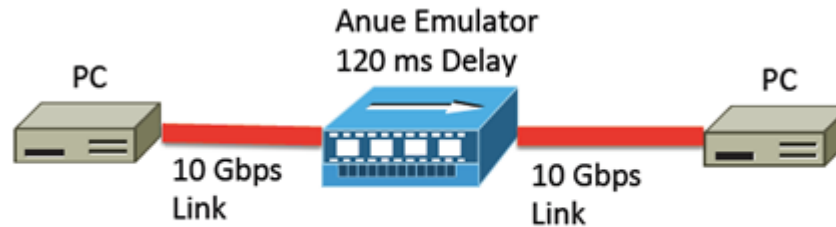
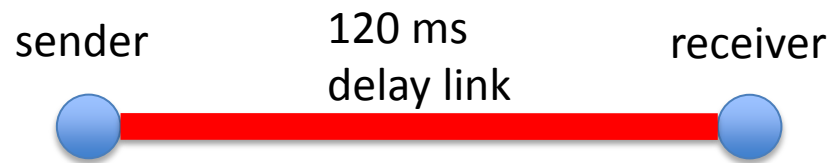
```
set receiver [$ns node]
```

```
set link [$ns duplex-link $sender $receiver 10000Mb H120ms  
DropTail]
```

```
$ns rtproto Static
```

```
$ns run
```

# Self-contained Experiment (cont'd.)



# Self-contained Experiment (cont'd.)

- Start the Mozilla FireFox, Microsoft Internet Explorer, Google Chrome, or Opera browser.  
**Apple Safari is currently incompatible!**
- Visit <http://www.cron.loni.org>
- Logon with the access information on your paper strip.
- Follow the presenter's instructions.

# Self-contained Experiment (cont'd.)

- Attention! Do **NOT** click any “submit” button until the presenter suggests you to do.



# Overview

- Introduction to the CRON Testbed
- Time Table
- **Tutorial**
  - Scenario 1: Self-contained Experiment
  - **Scenario 2: Federation Experiment**

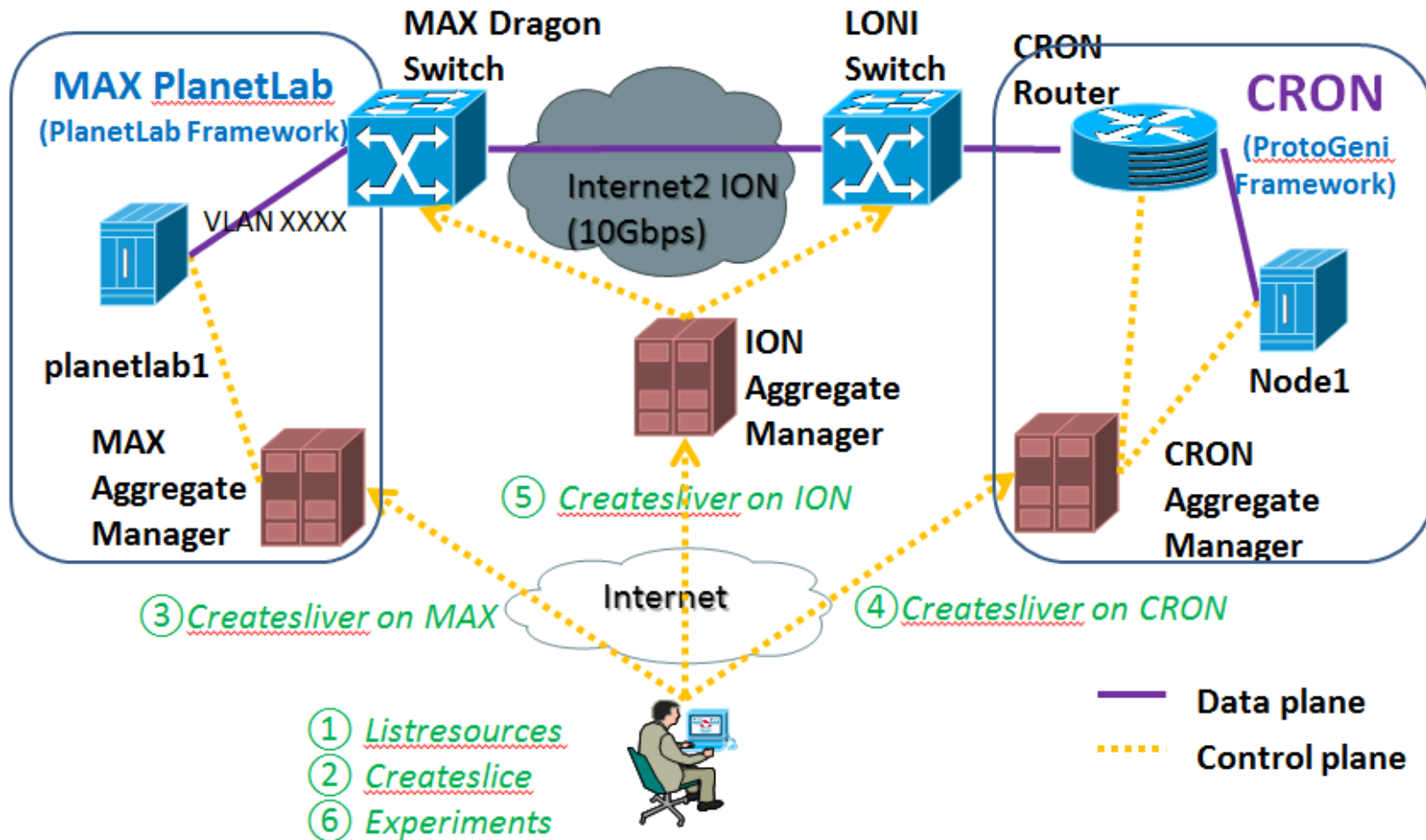
# Federation Experiment

- Experimental network topology  
1 receiver on the CRON connects to 1 sender on another testbed through the Internet2.



- Physical resources  
Sender: Linux Container VM on the MAX PlanetLab Central.  
Receiver: Sun Fire workstation on the CRON.  
Link: Internet2 ION Circuit.

# Federation Experiment (cont'd)



# Federation Experiment (cont'd)

- Sending 1 Rspec to each of the CRON, MAX PlanetLab Central, and Internet2 ION Service to request for resources.
- For the RSpec for CRON, it requests for 1 physical machine.
- For the RSpec for MAX PlanetLab Central, it requests for 1 VM and connects the VM to its access switch.
- For the RSpec for Internet2 ION Service, it connects the physical machine on CRON to its access switch and connects the 2 switches through the Internet2.

# Federation Experiment (cont'd)

- Use the access information on your paper strip to logon to the VirtualBox VM.
- Follow the presenter's instructions.
- The Omni tools and all credentials are already properly configured.
- Use the helper shell script, **LSUCRONTutorial\_Omnitools**, in \$HOME to submit the RSpecs.

# Federation Experiment (cont'd)

- To logon to the VM on MAX PlanetLab Central,  
ssh -i ~/.ssh/<account name>.id\_rsa \  
cronloniorg\_<slice name>@planetlab5.dragon.maxgigapop.net
- To logon to the machine on CRON,  
ssh -i ~/.ssh/<account name>.id\_rsa \  
<account name>@<machine id>.cron.loni.org