ns3 -Tracing System

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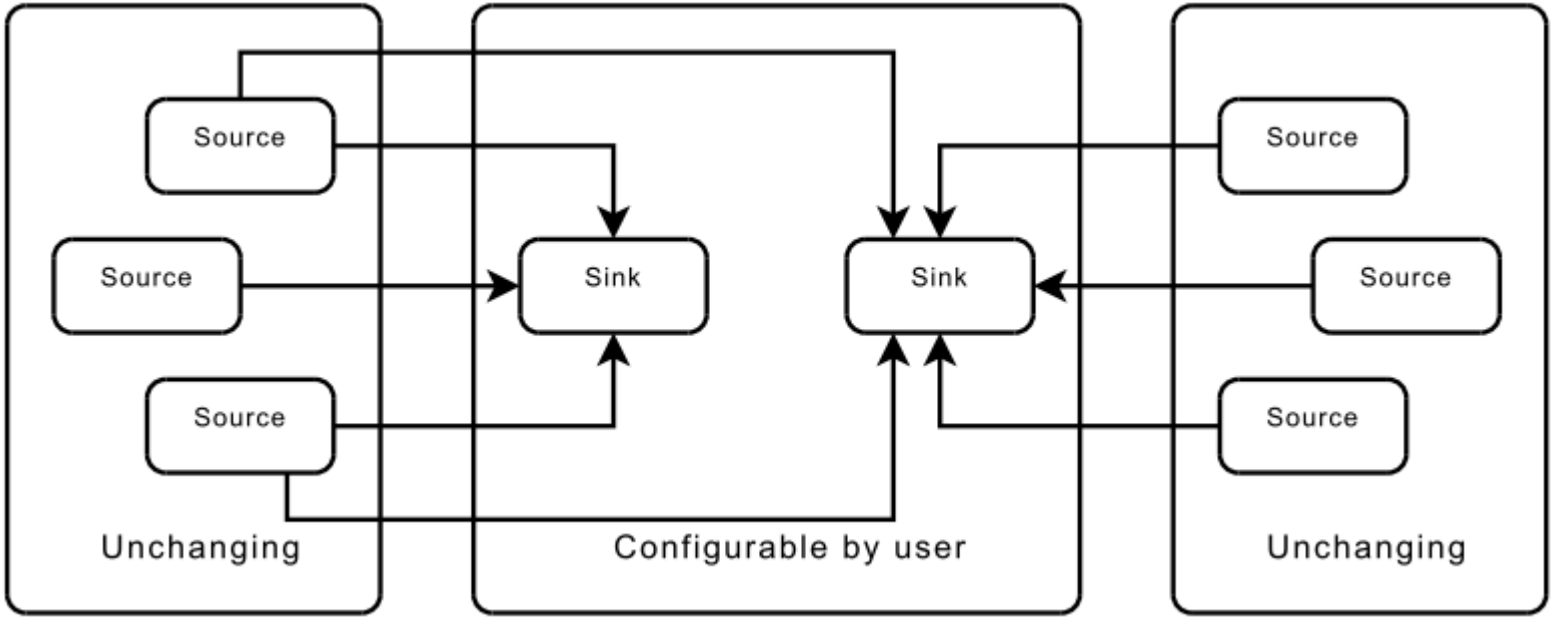
Tracing Overview

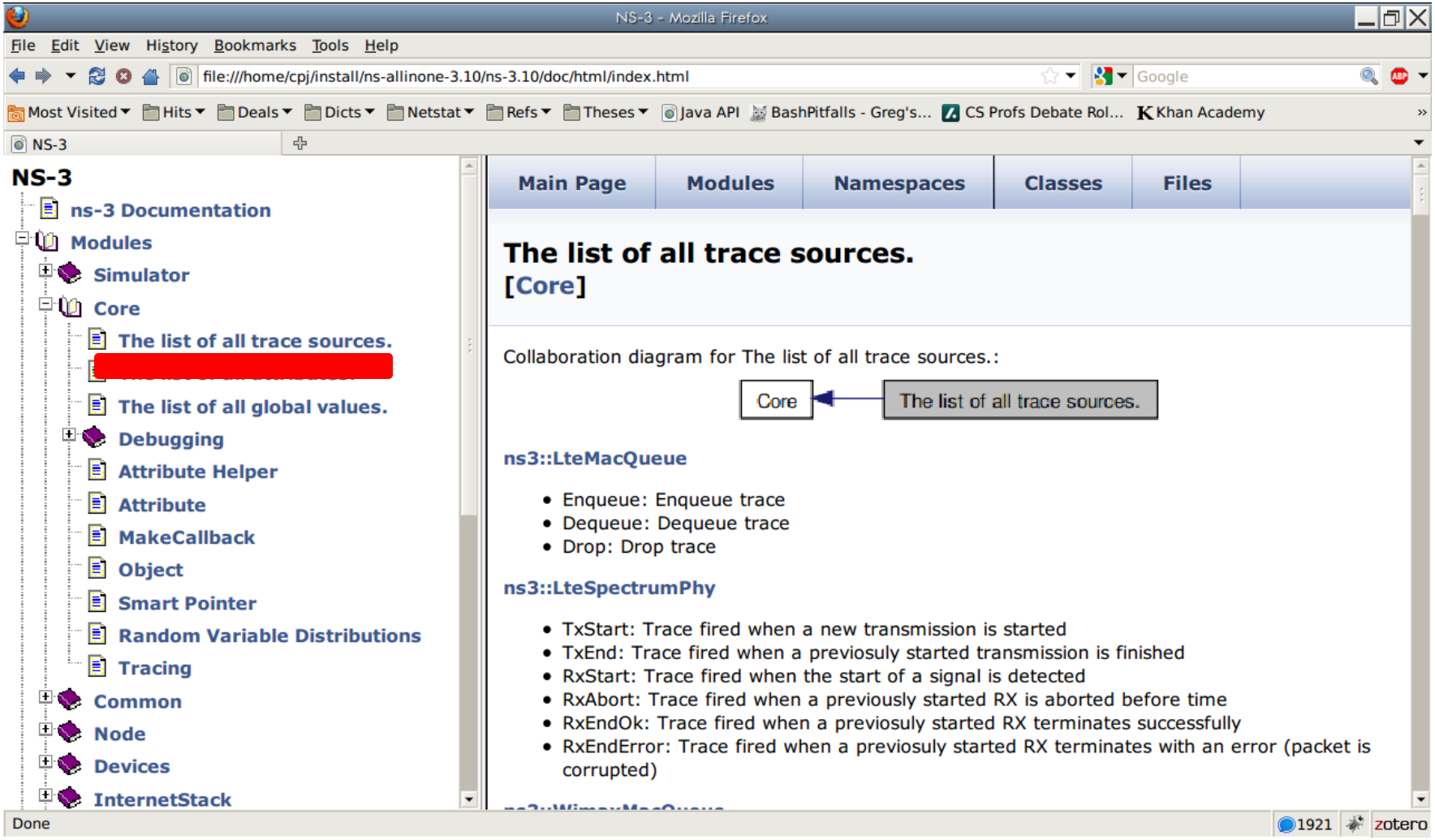
- ns-3 provides a set of pre-configured trace sources
- Users provide trace sinks and attach to the trace source
- Multiple trace sources can connect to a trace sink

ns-3 Tracing Model

- Decouple trace sources from trace sinks:



ns-3 Trace Sources



Multiple Levels of Tracing

- High-level
  - Use a helper to hook a predefined trace source to an existing trace sink (e.g., ascii, pcap)
- Mid-level
  - Hook an existing trace source to a custom trace sink
- Low-level
  - Add a new trace source and connect it to a special trace sink

Trace Helpers

- Ascii Trace Helper
- Pcap Trace Helper

Custom Trace Sink

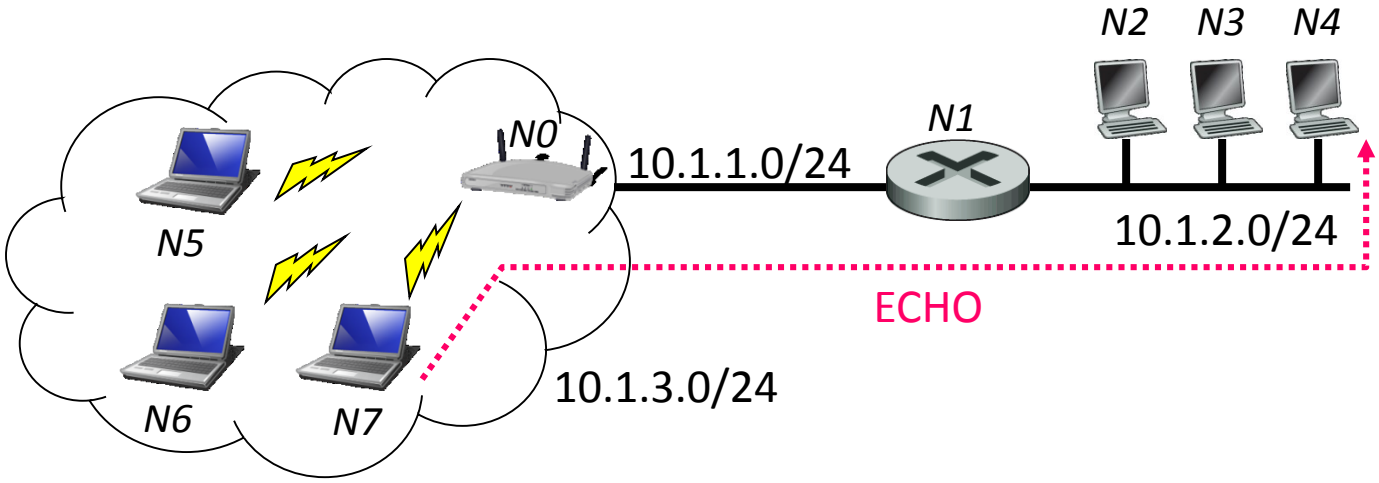
```
void
DevTxTrace(
   std::string context,
   Ptr<const Packet> p, Mac48Address address)
{
  std::cout << " TX to=" << address << " p: " << *p << std::endl;
}

:

Config::Connect(
    "/NodeList/*/DeviceList/*/Mac/MacTx",
    MakeCallback(&DevTxTrace));
```

Walk-Through Example I (1)

- Task: model the network topology below in ns-3 and capture ECHO packets transmitted from N7 to N4



- We can start from tutorials/third.cc

Walk-Through Example I (2)

- Create a copy of third.cc into the scratch dir and rename it to pm-ex1.cc

```
$ cp examples/tutorials/third.cc scratch/pm-ex1.cc
```

- Edit the source
  - Change port number from 9 to 7

```
UdpEchoServerHelper echoServer (7);
:
UdpEchoClientHelper echoClient (csmaInterfaces.GetAddress (nCsma), 7);
```

  - Change PCAP file prefix to pm-ex1

```
pointToPoint.EnablePcapAll ("pm-ex1");
phy.EnablePcap ("pm-ex1", apDevices.Get (0));
csma.EnablePcap ("pm-ex1", csmaDevices.Get (0), true);
```

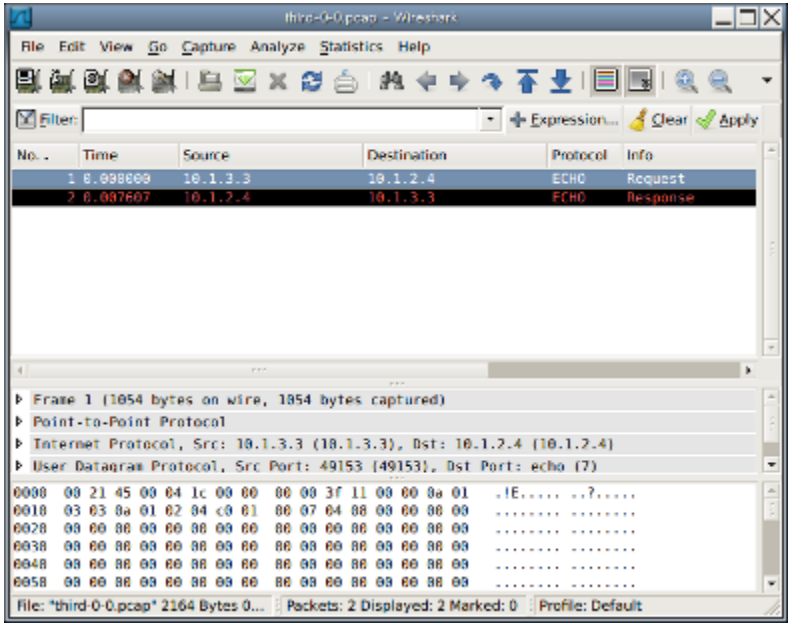
Walk-Through Example I (3)

- Run the script

```
$ ./waf --run pm-ex1
```

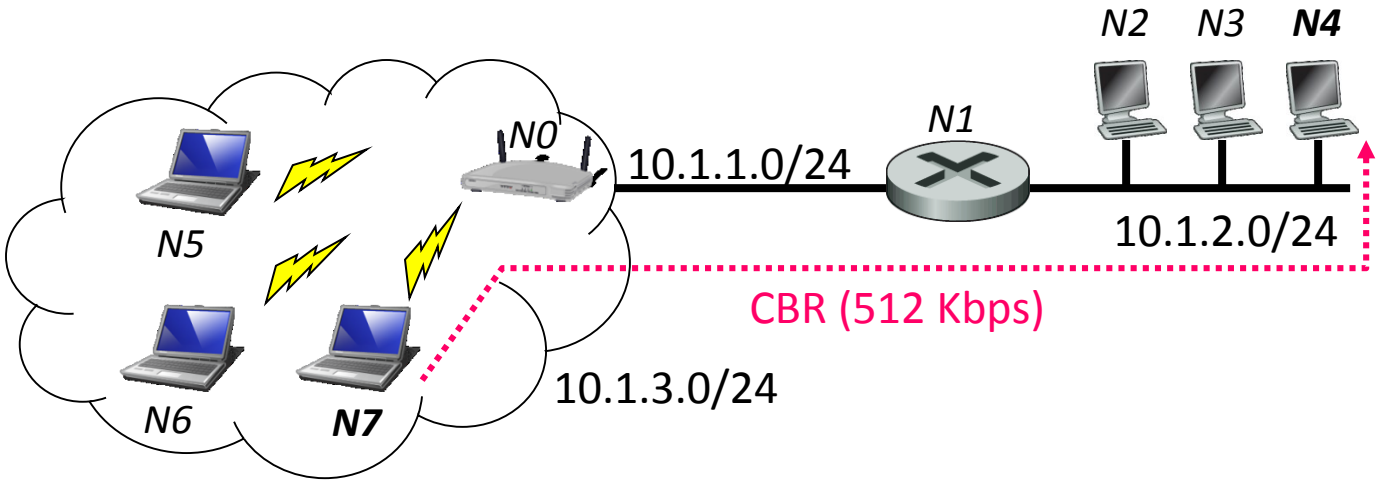
- Open the pcap files with WireShark

```
$ ls *.pcap
pm-ex1-0-0.pcap  pm-ex1-0-1.pcap
pm-ex1-1-0.pcap  pm-ex1-1-1.pcap
$ wireshark pm-ex1-0-0.pcap
```



Walk-Through Example II (1)

- Task: Using the previous topology, replace ECHO traffic with CBR (Constant Bit Rate) traffic



Walk-Through Example II (2)

- Create pm-ex2.cc from pm-ex1.cc

```
$ cp scratch/pm-ex1.cc scratch/pm-ex2.cc
```

- Use OnOffHelper to generate CBR traffic from the client

```
uint16_t port = 9;
OnOffHelper onoff(
    "ns3::UdpSocketFactory",
    InetSocketAddress("10.1.2.4", port));
onoff.SetAttribute("OnTime",StringValue("ns3::ConstantRandomVariable[Constant=1]"));
onoff.SetAttribute("OffTime",StringValue("ns3::ConstantRandomVariable[Constant=0]"));
onoff.SetAttribute("DataRate", StringValue("512Kbps"));
onoff.SetAttribute("PacketSize", StringValue("512"));
onoff.Install(wifiStaNodes.Get(nWifi - 1));
ApplicationContainer apps = onoff.Install(wifiStaNodes.Get(nWifi-1));
apps.Start(Seconds(5.0));
apps.Stop(Seconds(20.0));
```

Walk-Through Example II (3)

- Create a packet sink on the server

```
PacketSinkHelper sink(
    "ns3::UdpSocketFactory",
    InetSocketAddress("10.1.2.4", port));
sink.Install(csmaNodes.Get(nCsma));
```

- Set simulation time to 30 seconds

```
Simulator::Stop(Seconds(25.0));
```

- Don't forget to change the PCAP trace prefix

Walk-Through Example III (1)

- Task: calculate average throughput from previous scenario
- Idea:
  - Connect a custom trace sink to PacketSink's Rx trace source
  - Compute average throughput from
    - first and last packets' timestamps
    - total bytes received