# SIGCOMM 2017
# NDN Demonstrations

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# Night During Noontime (Aug. 21, 2017)

# Topics

- Platforms
  - NDN Testbed
  - Open Network Lab (ONL)
  - Amazon AWS
- NDN Topics
  - Producer/Consumer
  - Caching
  - Validation
  - Adaptive Forwarding
  - Intermittent Links

# NDN Testbed

- Currently 37 Nodes on 4 continents and in 15 countries
- Who participates?
  - 32 Universities and Academic institutions
  - 4 Companies
  - 1 Government Agency
- How to join?
  - https://named-data.net/ndn-testbed/policies-connecting-nodes-ndn-testbed/
- How to use if your site does not join?
  - https://named-data.net/codebase/platform/
  - http://named-data.net/doc/NFD/current/

# Open Network Lab (ONL)

- Remotely accessible network testbed
  - Operated and maintained by Applied Research Lab in Department of Computer Science and Engineering at Washington University in St. Louis
  - Real Hardware for running repeatable network experiments with trusted results. (NOT simulations)
- Use for NDN
  - NDN installed on each host/VM
  - NFD performance study
  - NDN Testbed Emulation to test new releases
- How to join?
  - https://onl.wustl.edu/
    - And "Get an account"

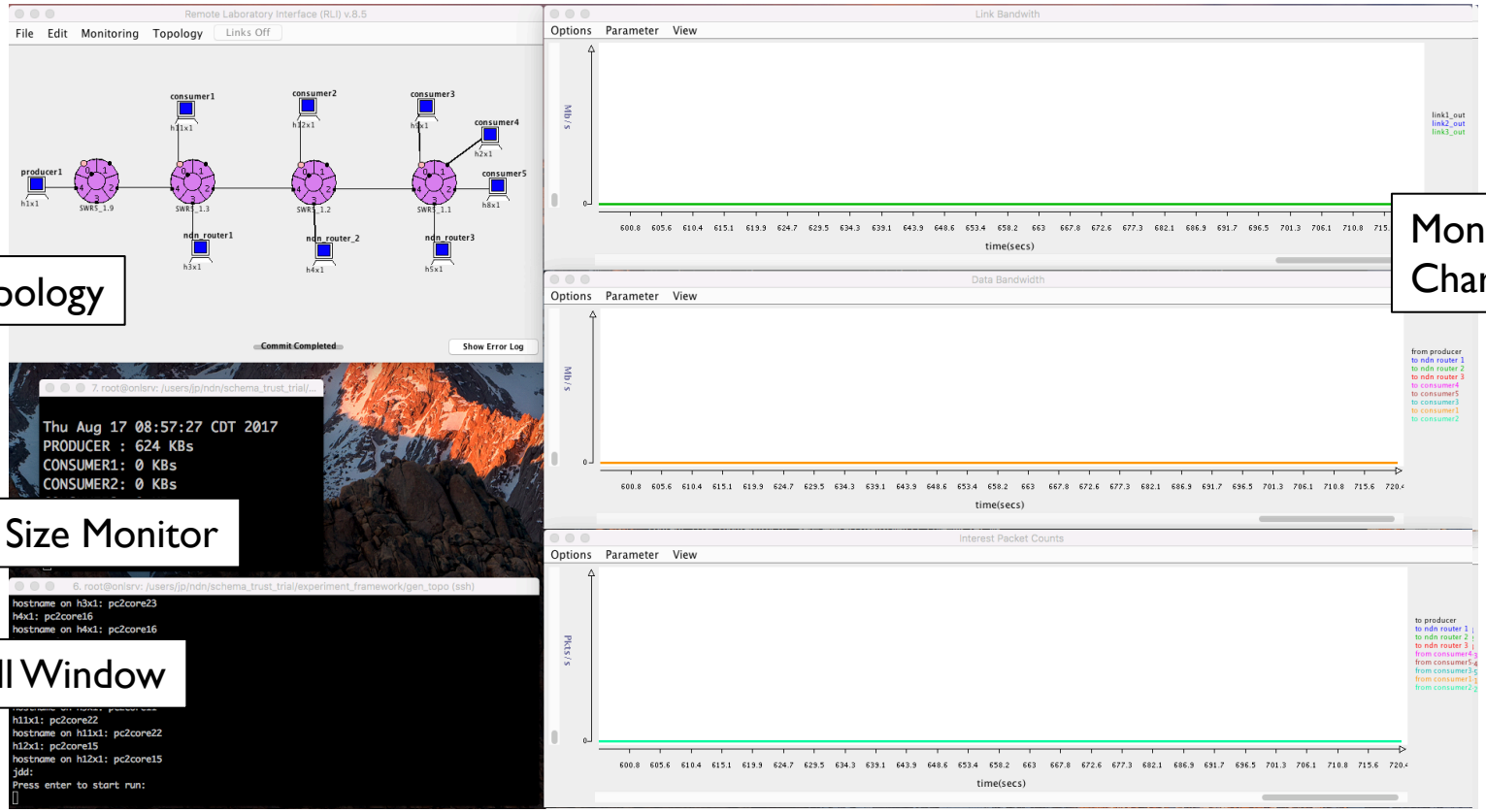
# NDN Topics

- Producer/Consumer
  - Consumer sends Interests asking for Data
  - Producer listens for Interests and sends Data
- Caching
  - Forwarding nodes cache data packets in their Content Store
  - Send Data for Interests matching named data in their Content Store
- Validation
  - Consumers may validate identity of the publisher of data
- Adaptive Forwarding
  - Forwarders adapt forwarding choices based on network conditions
- Intermittent Links
  - Using Caching and Adaptive Forwarding data can still be shared between Producers and Consumers when there is not a synchronous End-to-End path

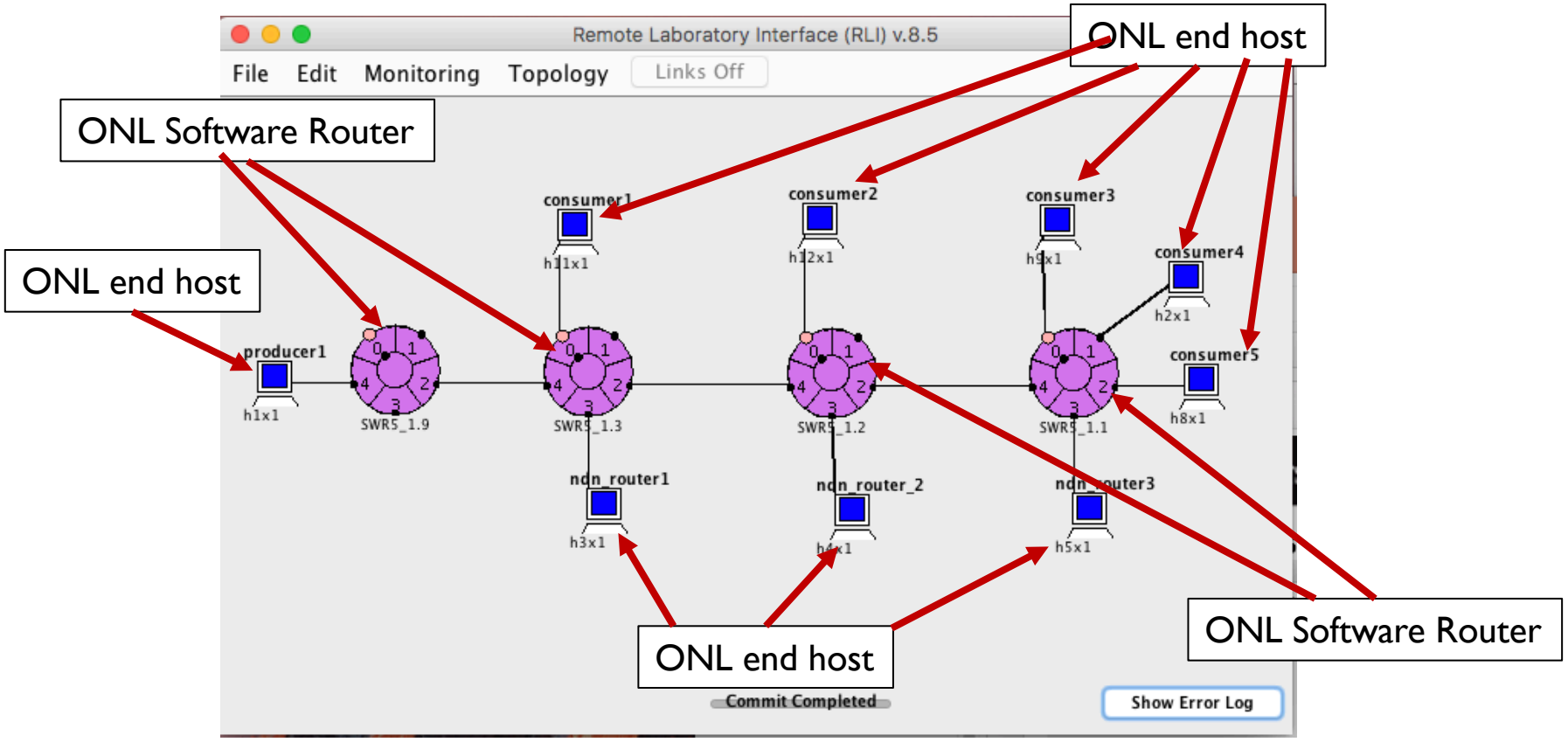
# NDN Demonstrations

- ONL: Simple Producer/Consumer illustrating caching
- ONL: Producer/Consumer with intermittent links
- NDN Testbed: Image transfer with Validation

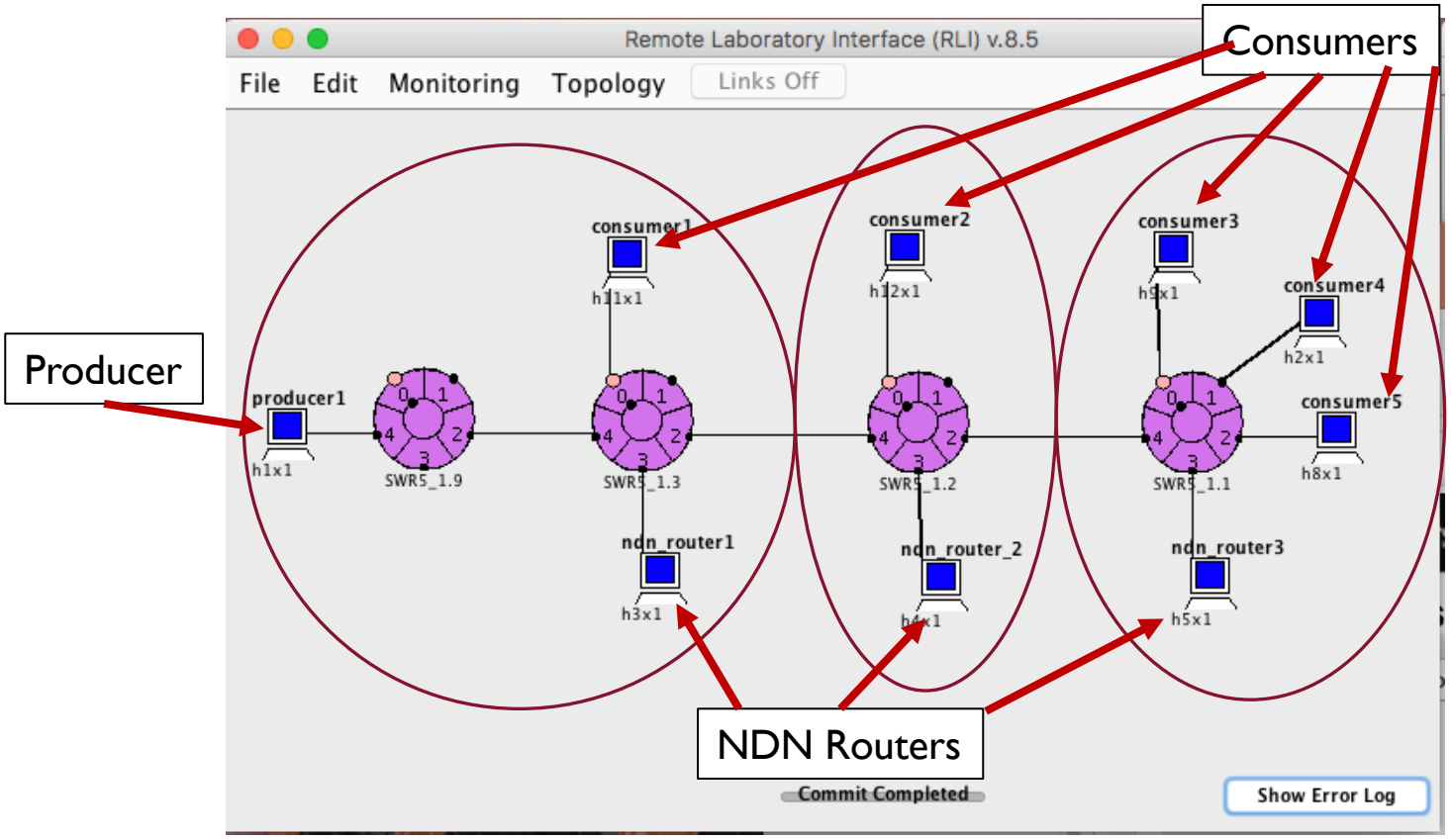
# ONL Demonstrations: Here is what you will see…



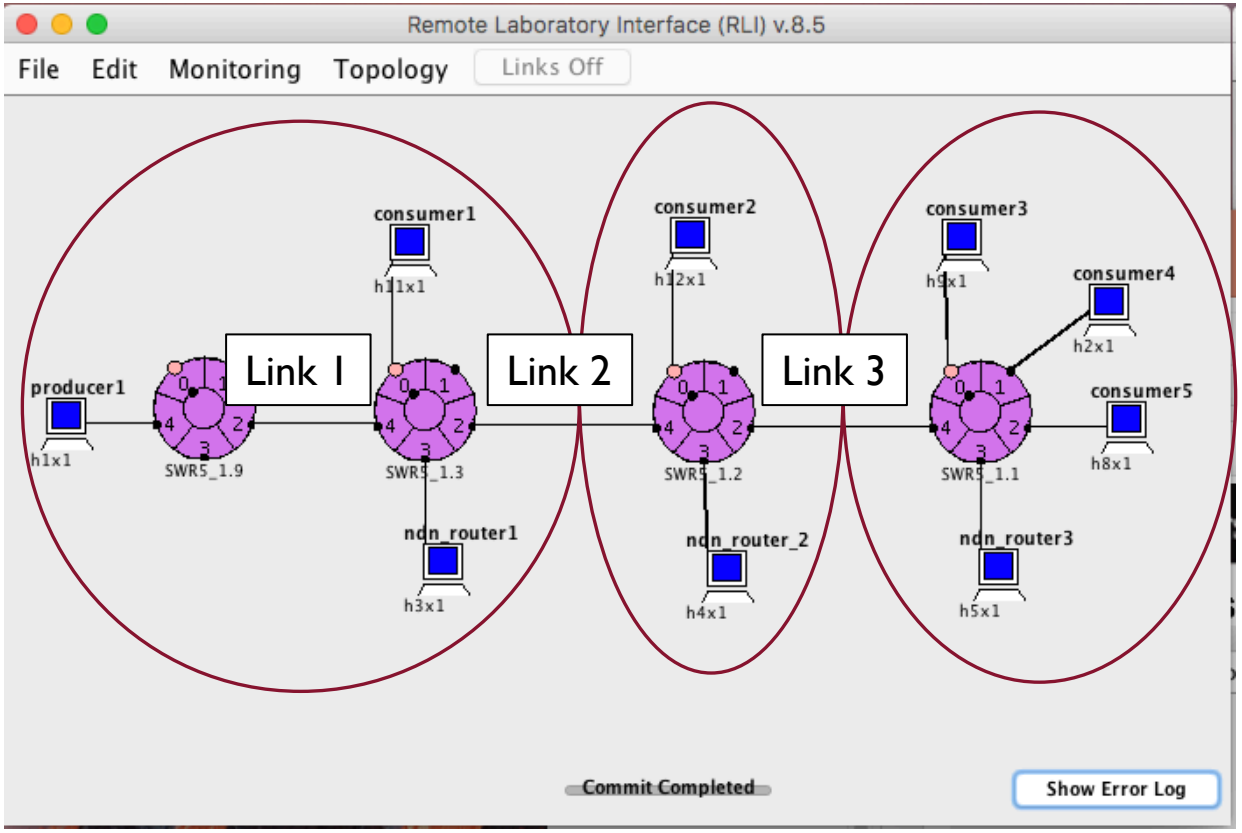
# ONL Demonstrations: ONL resources



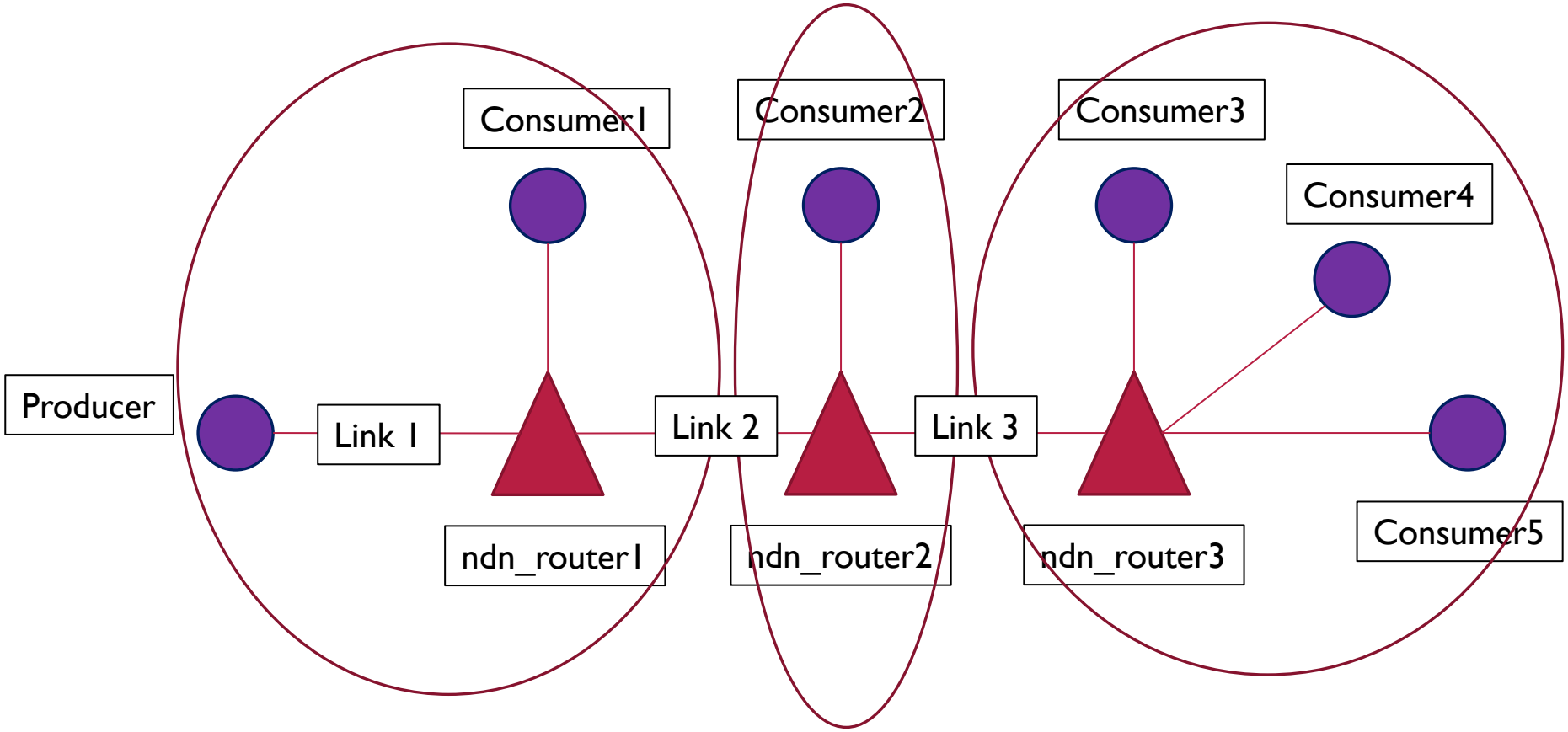
# ONL Demonstrations: NDN relationships



# ONL Demonstrations: Links we are watching…



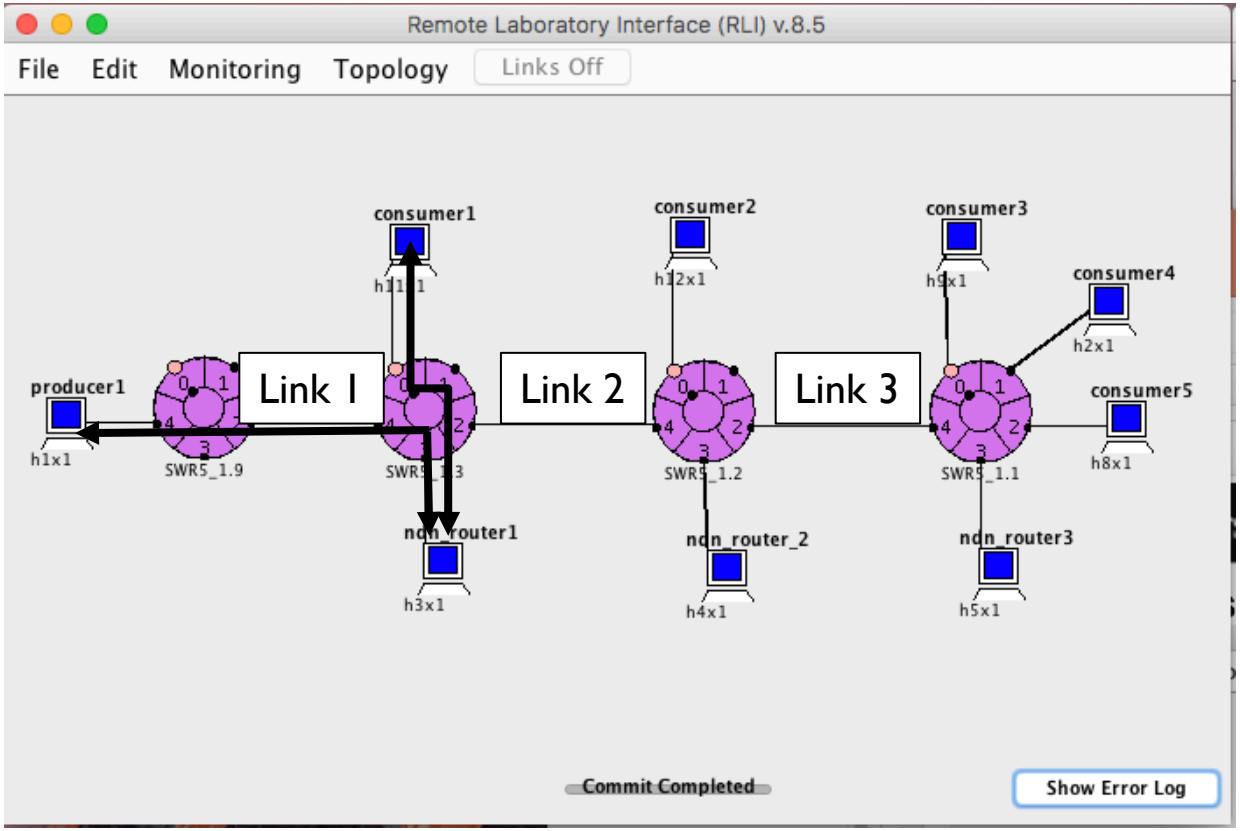
# ONL Demonstrations: NDN Topology



# NDN Demonstrations

- **ONL: Simple Producer/Consumer illustrating caching**
  - **Producer and Consumers in action**
  - **Visualize that caching is taking place and being used**
  - **ChronoSync is used by Producer and Consumers to share the state of the Data in their namespace.**
    - **Causes some artifacts in the monitoring charts…**
- ONL: Producer/Consumer with intermittent links
- NDN Testbed: Image transfer with Validation

# ONL Demonstrations: First Scenario -- Caching




- Consumers start one at a time, 20 seconds in between
- Consumer 1

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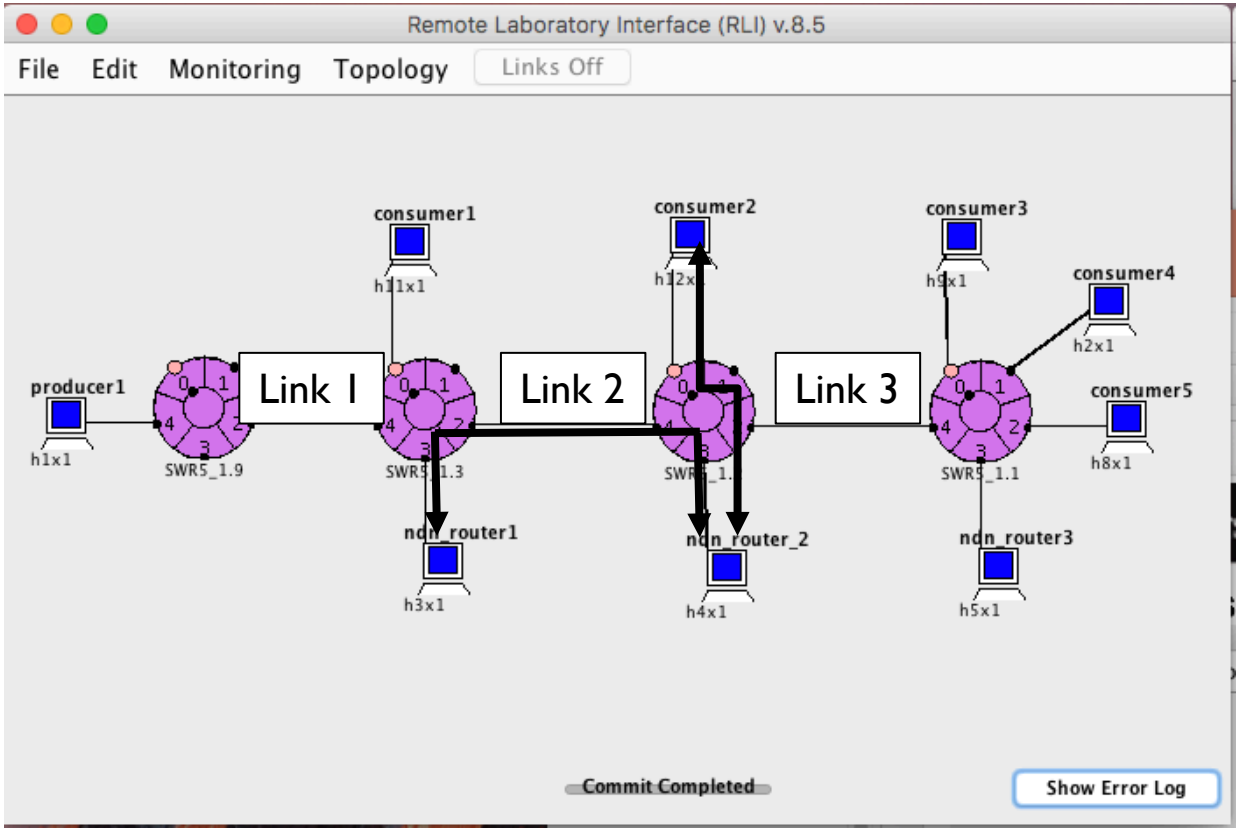


- Consumers start one at a time, 20 seconds in between
- Consumer 1
- Consumer 2

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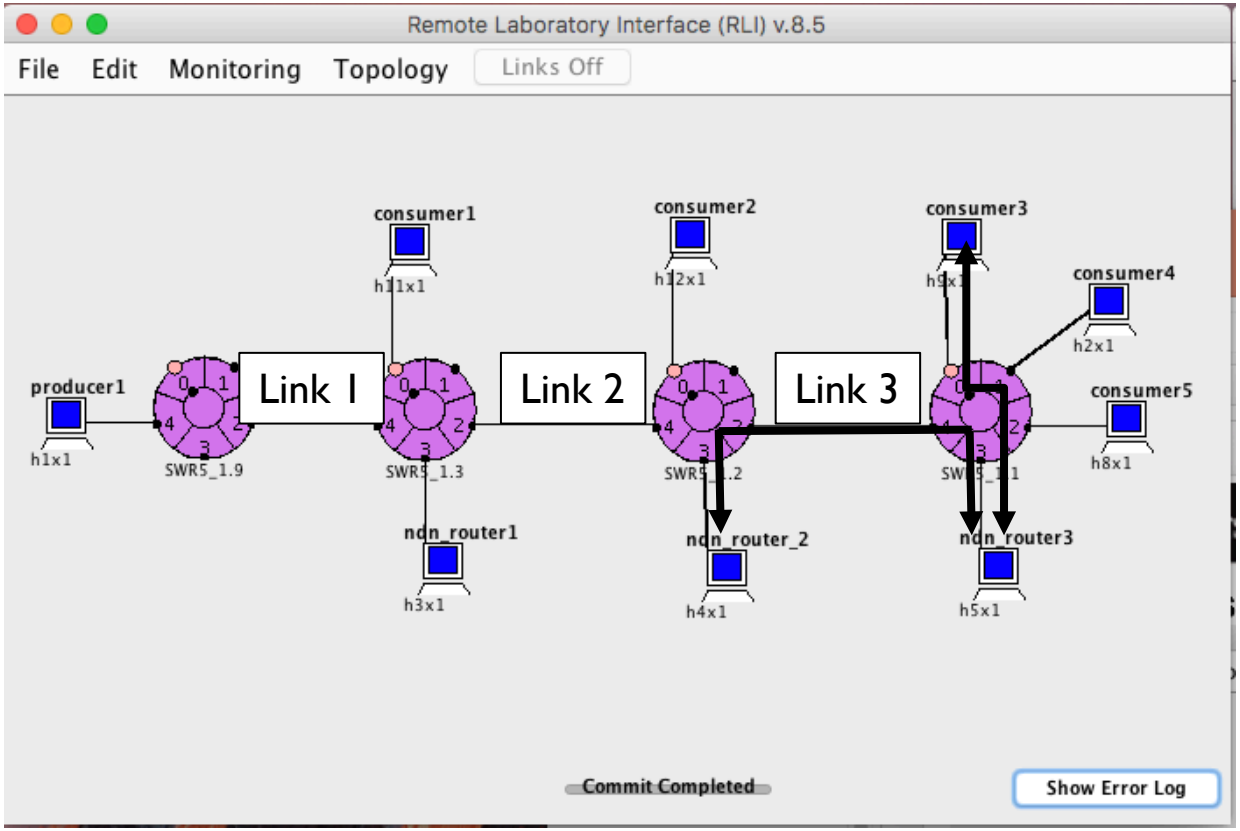
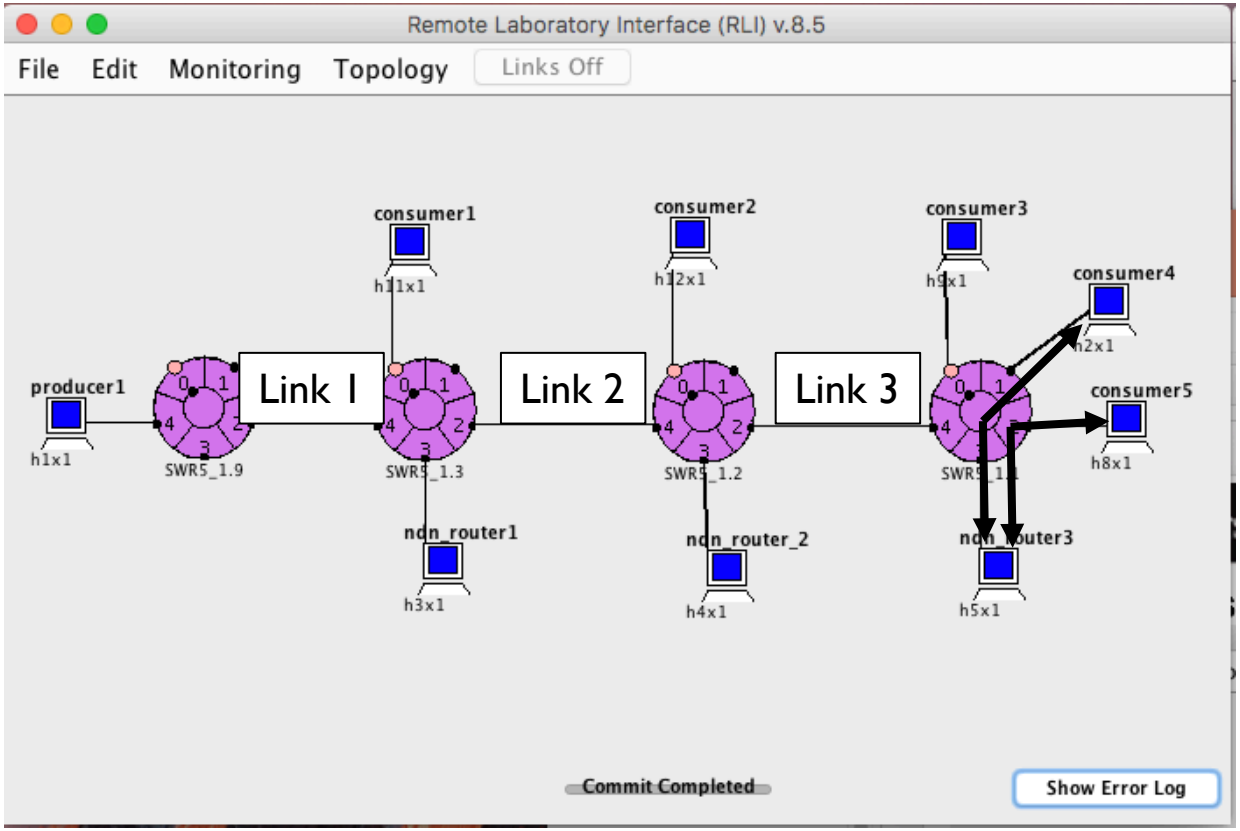


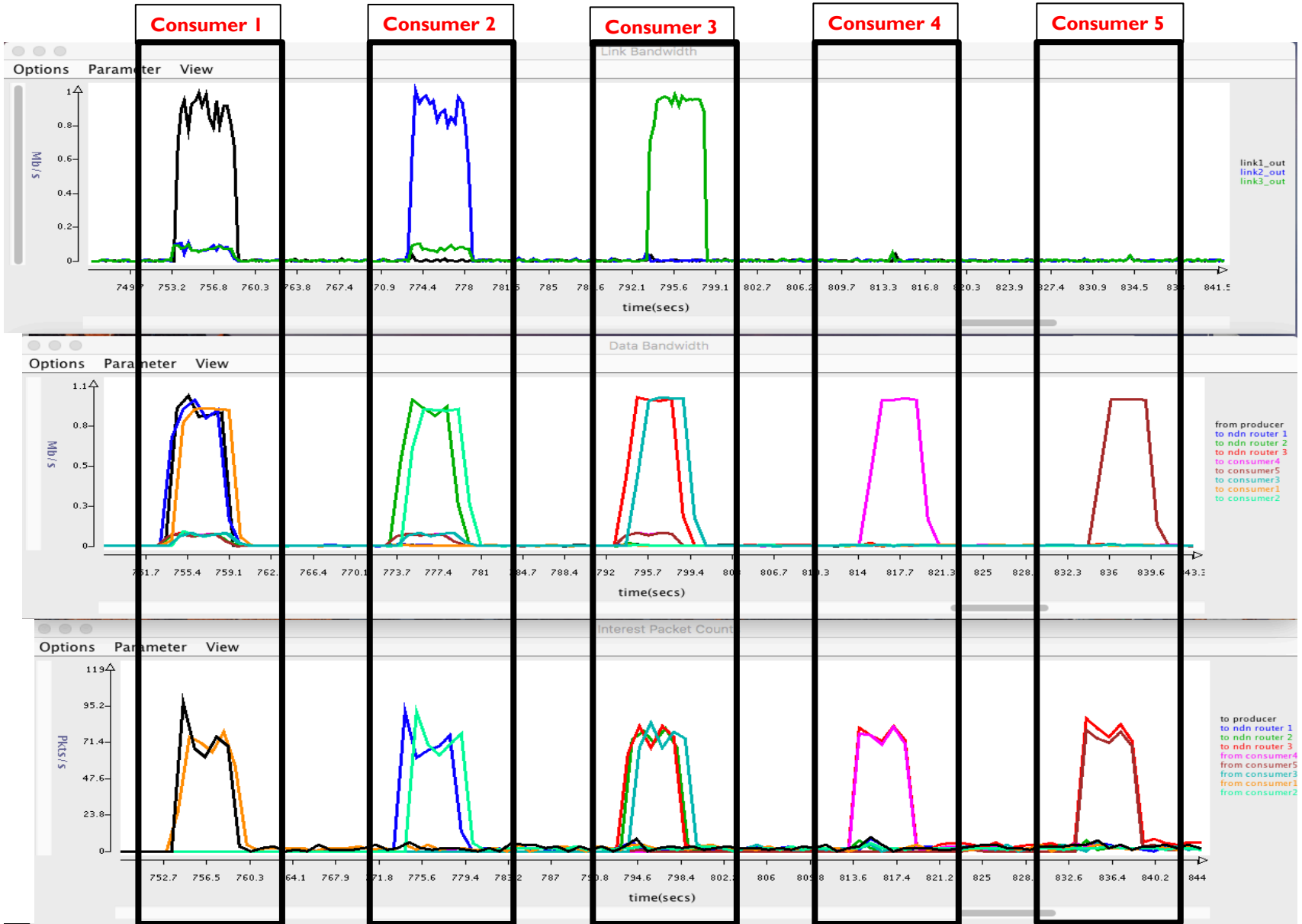

- Consumers start one at a time, 20 seconds in between
- Consumer 1
- Consumer 2
- Consumer 3

# ONL Demonstrations: First Scenario -- Caching




- Consumers start one at a time, 20 seconds in between
- Consumer 1
- Consumer 2
- Consumer 3
- Consumer 4
- Consumer 5

# ONL Demonstrations: First Scenario: Charts



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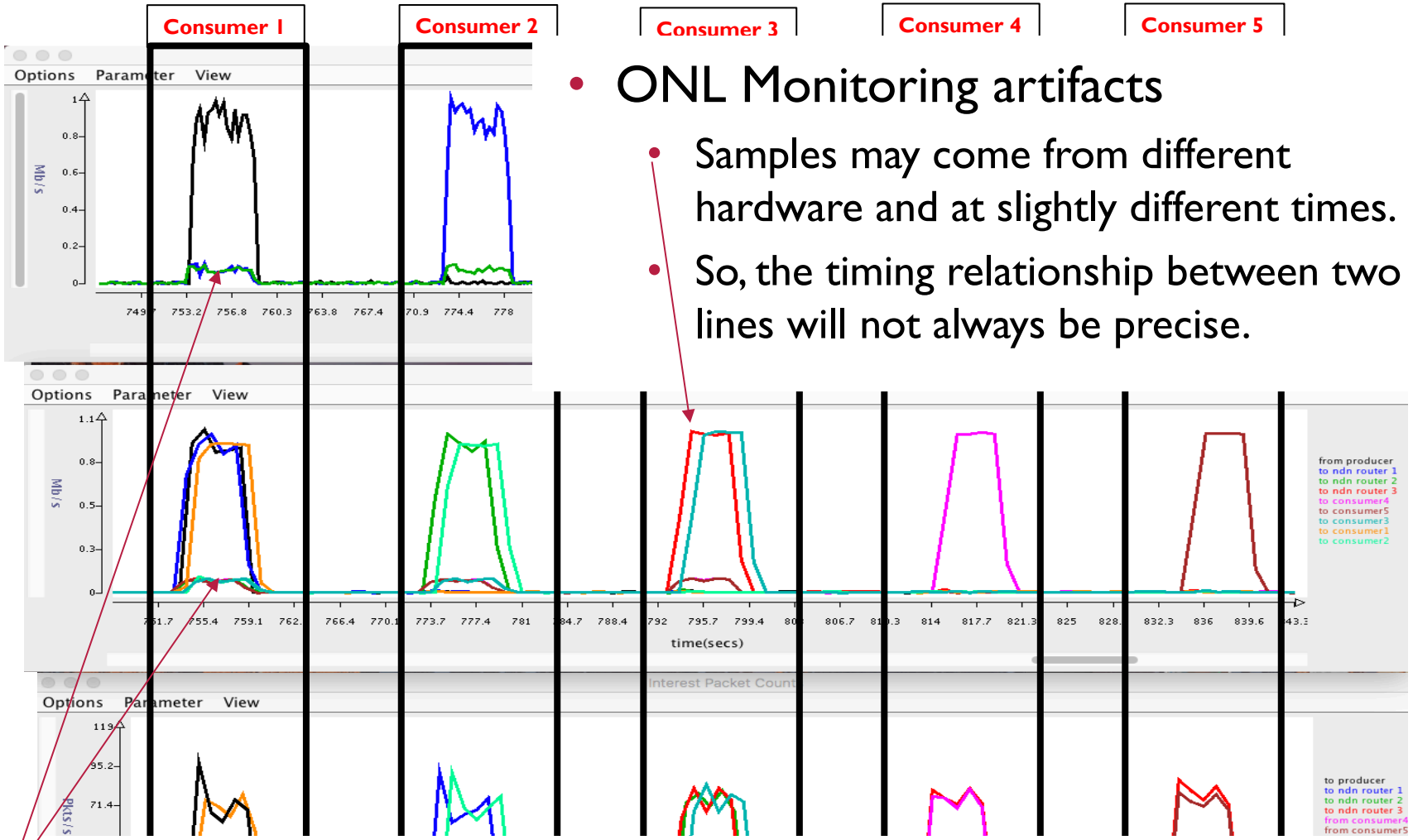



- ONL Monitoring artifacts
  - Samples may come from different hardware and at slightly different times.
  - So, the timing relationship between two lines will not always be precise.

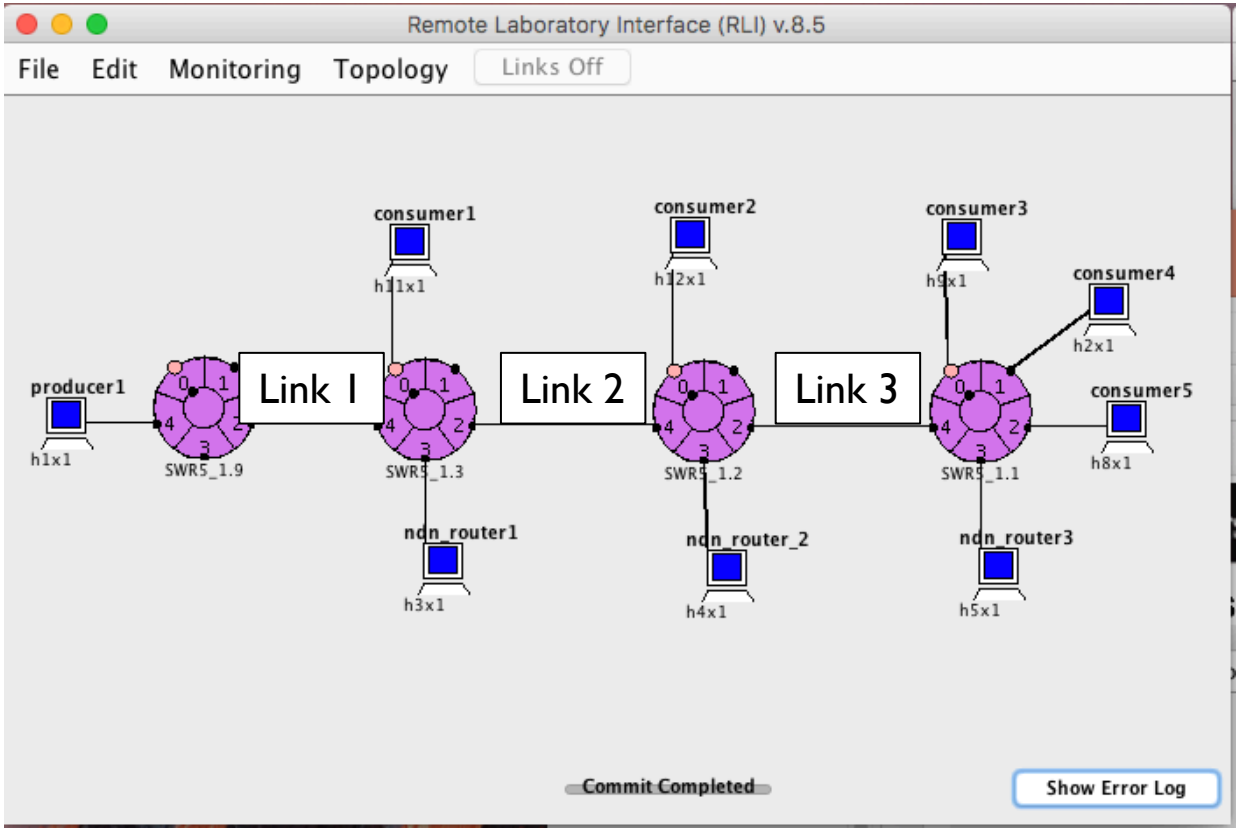
- Artifacts like these, are due to ChronoSync.

# Lets go to the demo….

# NDN Demonstrations

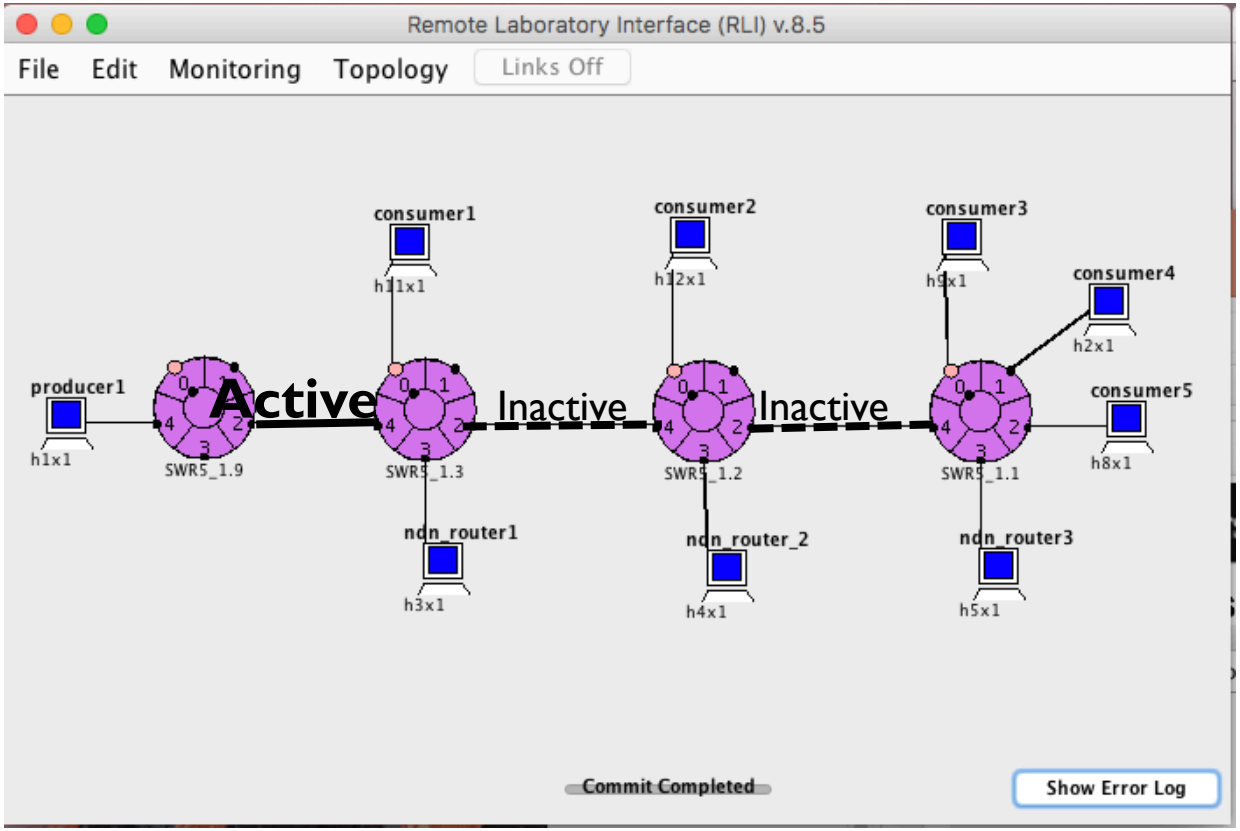
- ONL: Simple Producer/Consumer illustrating caching
- **ONL: Producer/Consumer with intermittent links**
  - **In addition to what we saw in previous demo…**
  - **Data retrieved without a synchronous end-to-end path.**
    - **How would IP handle that?**
- NDN Testbed: Image transfer with Validation

# ONL Demos: Second Scenario – Intermittent Links




- Intermittent links
- One link at a time is up for **two seconds**
- **Never a complete path from producer to all consumers**
- Consumers 1,2,3 start at the same time
- Consumer 4 and 5 start later

# ONL Demos: Second Scenario – Intermittent Links

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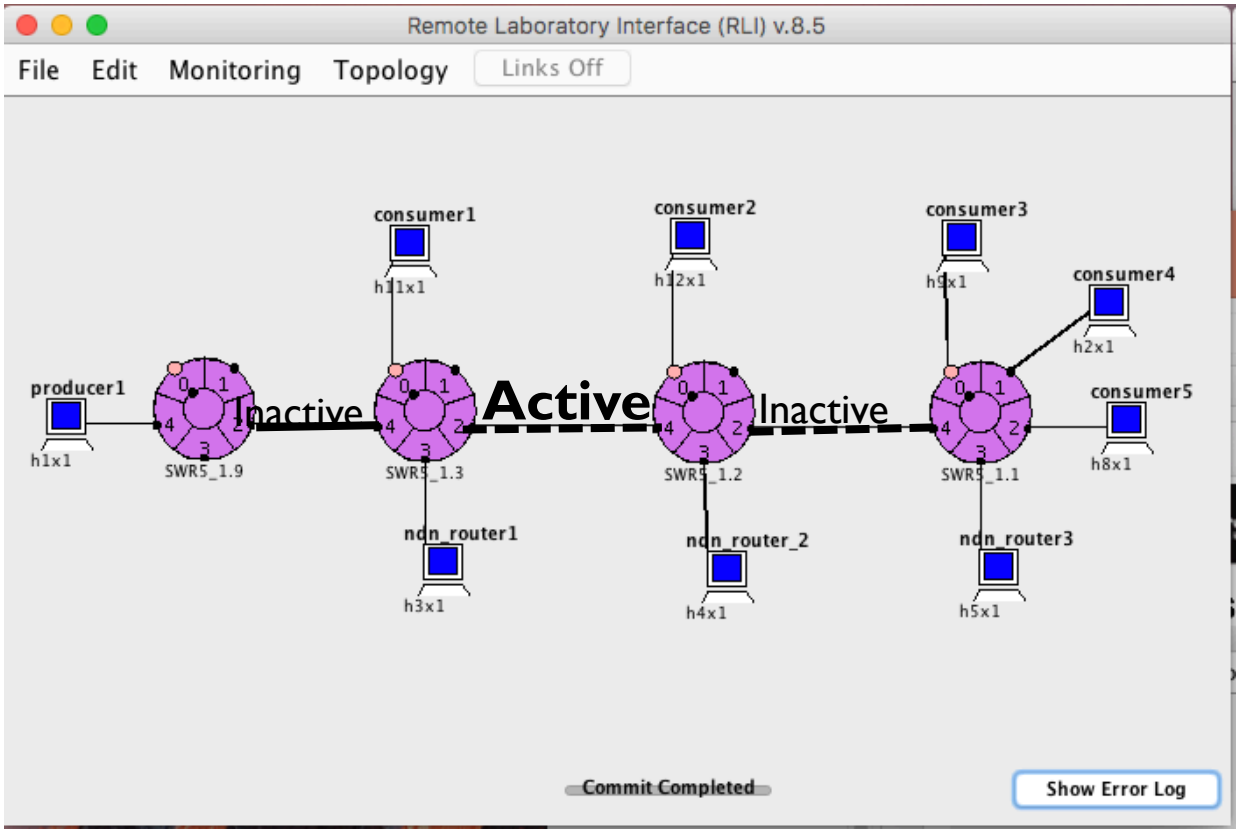


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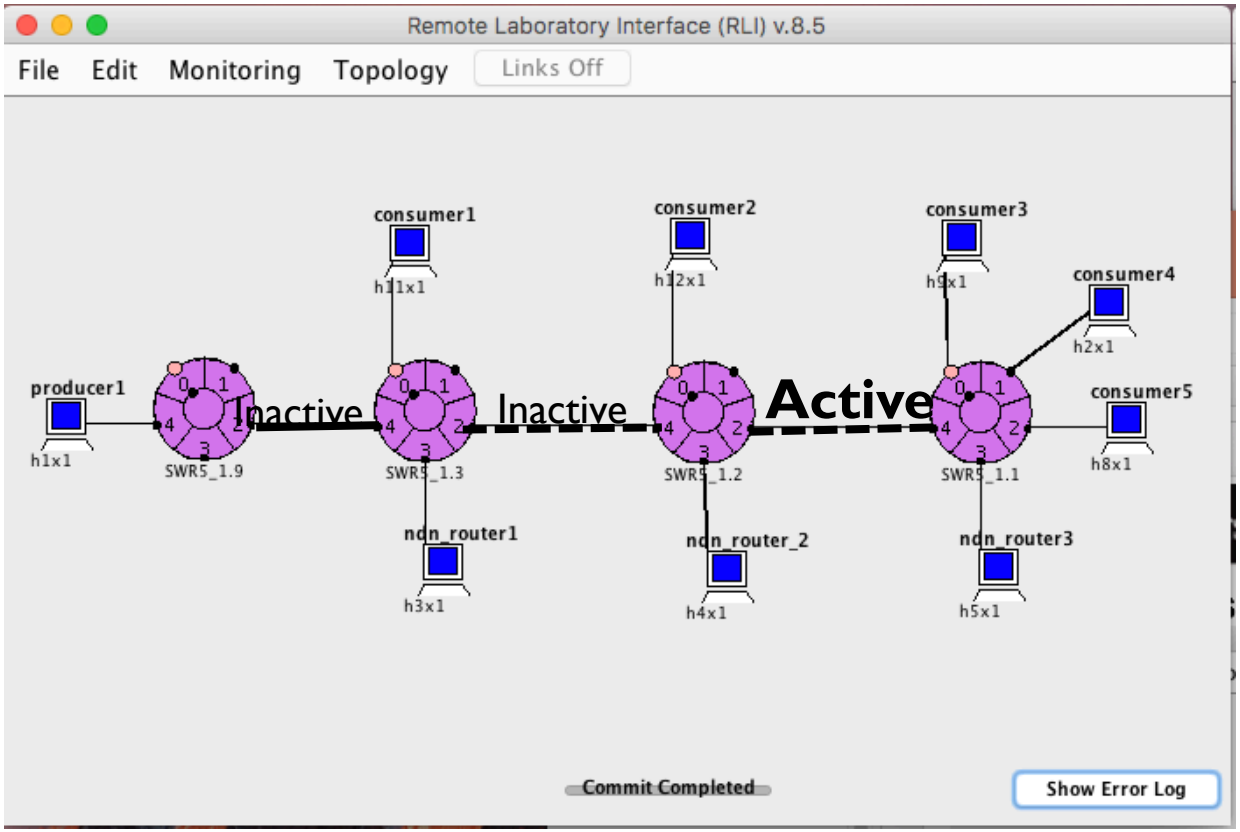


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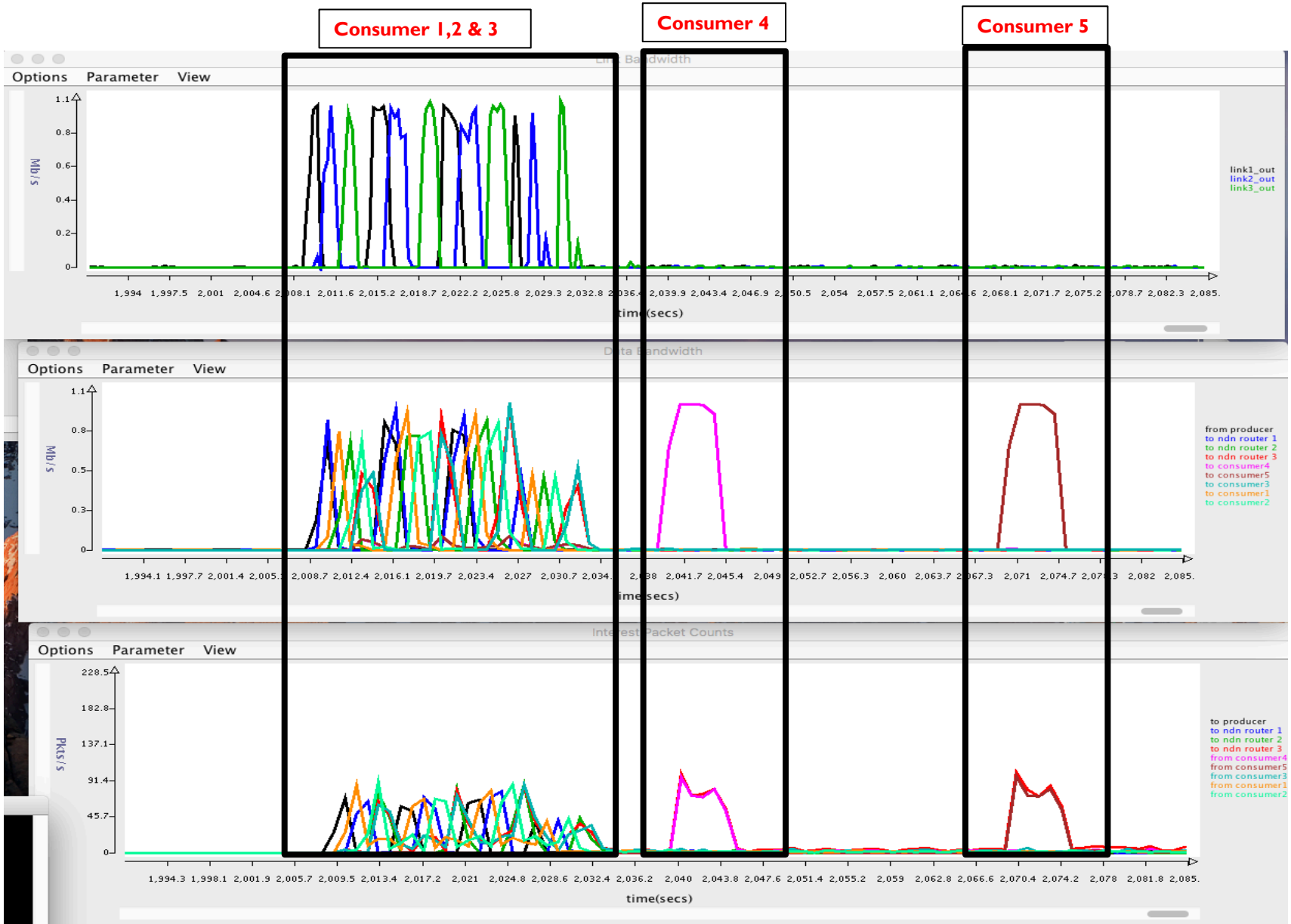
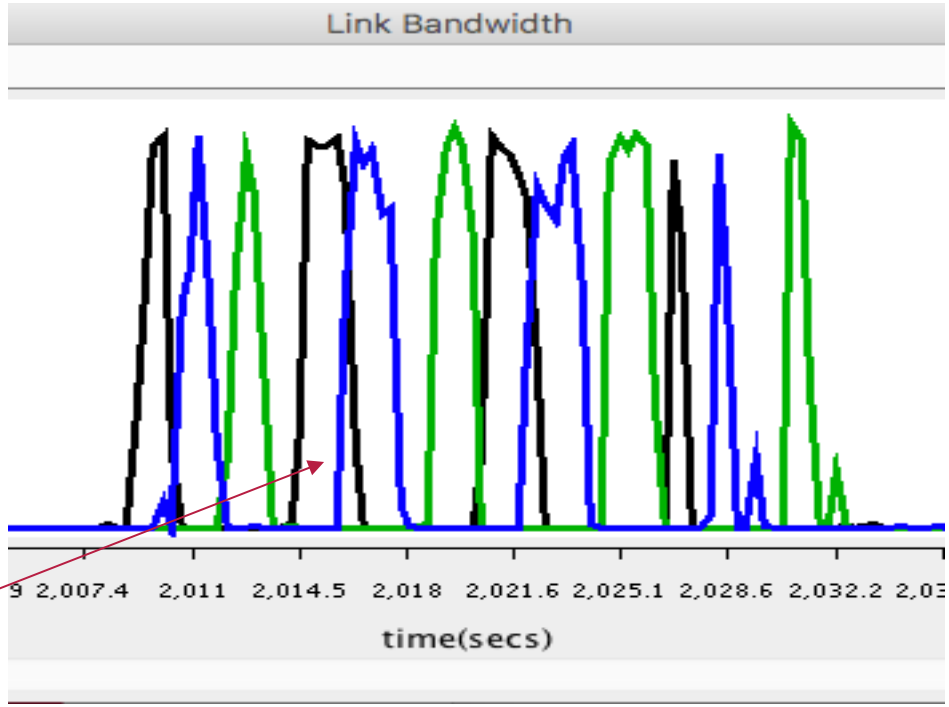
# ONL Demos: Second Scenario: Monitoring Charts



# ONL Demos: Second Scenario: Monitoring Charts

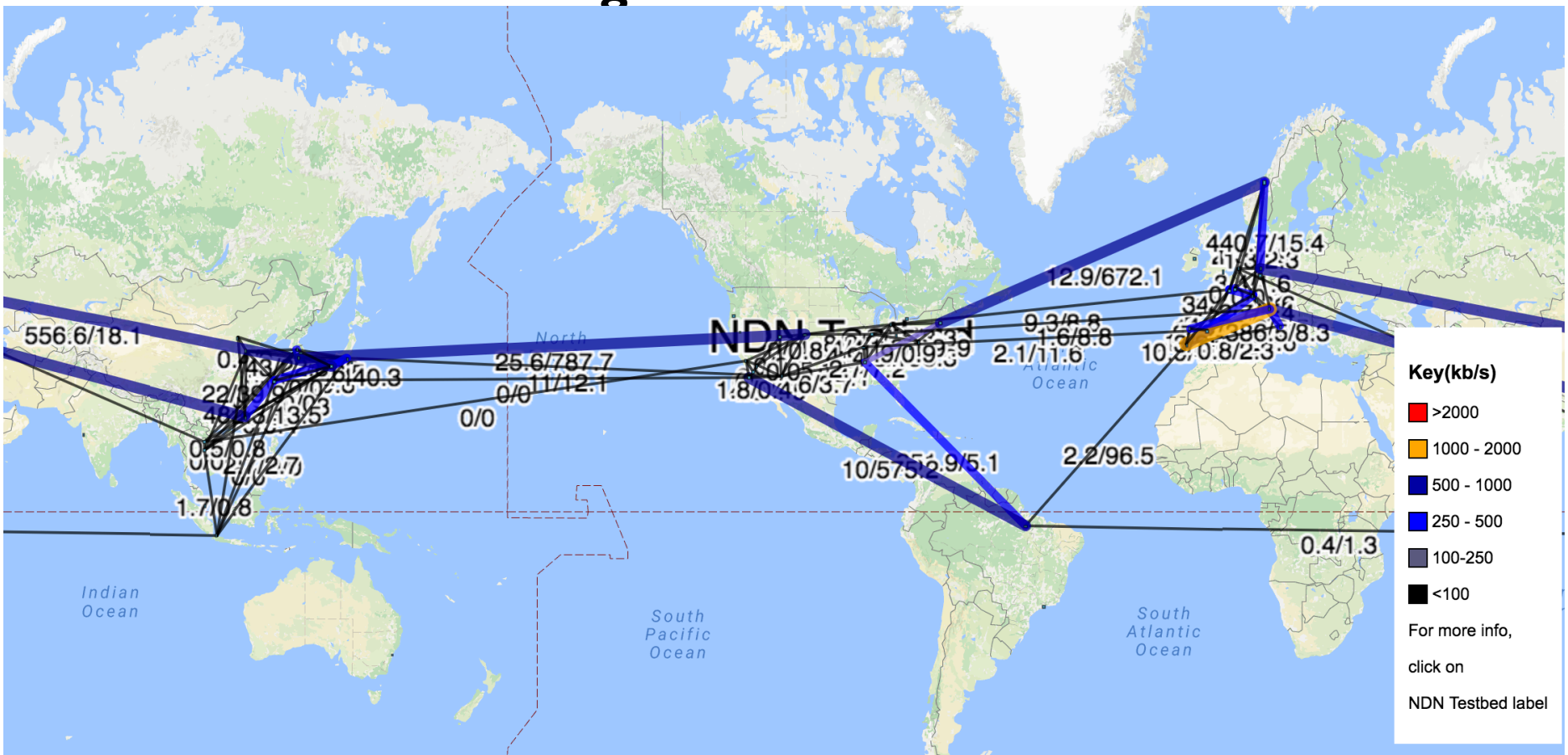



- ONL Monitoring artifacts
  - For the link rate chart we are sampling every 0.3 seconds.
    - Samples may come from different hardware and at slightly different times.
  - During that time, link 1 may be active at beginning and 2 at the end
  - Both would show up as data during that period and their lines may cross when we connect the dots of data points.

# Lets go to the demo….

# NDN Demonstrations

- ONL: Simple Producer/Consumer illustrating caching
- ONL: Producer/Consumer with intermittent links
- **NDN Testbed: Image transfer with Validation**



# NDN Testbed: Image transfer with Validation

- Over a world-wide network
  - Monitoring via: http://ndnmap.arl.wustl.edu/
- 30+ Consumers retrieving data simultaneously from 4 Producers
  - Uses modified ndnputchunks and ndncatchunks for file transfer
  - Producers not overloaded with 30 times the requests
  - With caching most consumer interests are satisified by intermediate forwarders.
- Each Producer publishes one quadrant of an image
- Each Producer signs their data with their own separate key
- Each Consumer receives all the data but some Consumers don't have all the certificates to validate the data from all Producers.

# NDN Testbed: Image transfer with Validation

- **On my laptop I will also run 3 Consumers:**
  - **Consumer 1: Can validate quadrant 1 and 3**
  - **Consumer 2: Can validate quadrant 2 and 4**
  - **Consumer 3: Can validate quadrants 1, 2, 3 and 4**

Consumer 1


Consumer 2

# Lets go to the demo….

- … after the demo we'll come back to wrap up & take questions.

# Summary: What did we see today?

- Producers and Consumers in action
- Visual evidence of NDN caching
- NDN operating over intermittent links
- Consumers validating Producers' data
- Visual evidence of adaptive forwarding
- NDN on a world-wide scale
- Any questions?