Opportunities for R&D in Named Data Networks

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Outline of the presentation

- Overview of Named Data Networks
- NDN terminologies
- NDN Forwarding and Transport
- Our contributions: BCON and GCPiN
- ndnSIM: ns-3 based Named Data Networking Simulator
- NFD: NDN Forwarding Daemon
- NDN Applications: ChronoChat
- Next goals

Overview of Named Data Networks

- *IP architecture*: communication oriented, difficult to scale
- *Why*: it is IP (location) centric, not suitable for one-to-many applications
- *Today's demand*: efficient architecture to do content distribution
- *Potential solution*: focus more on content than the location of content
- *Ongoing discussions*: Information Centric Networking (ICN)
- *NDN*: a specific architecture design under the umbrella of ICN
- *NDN Project*: Funded by NSF, led by UCLA and Van Jacobson
- *Project website:* http://named-data.net/

Overview of Named Data Networks

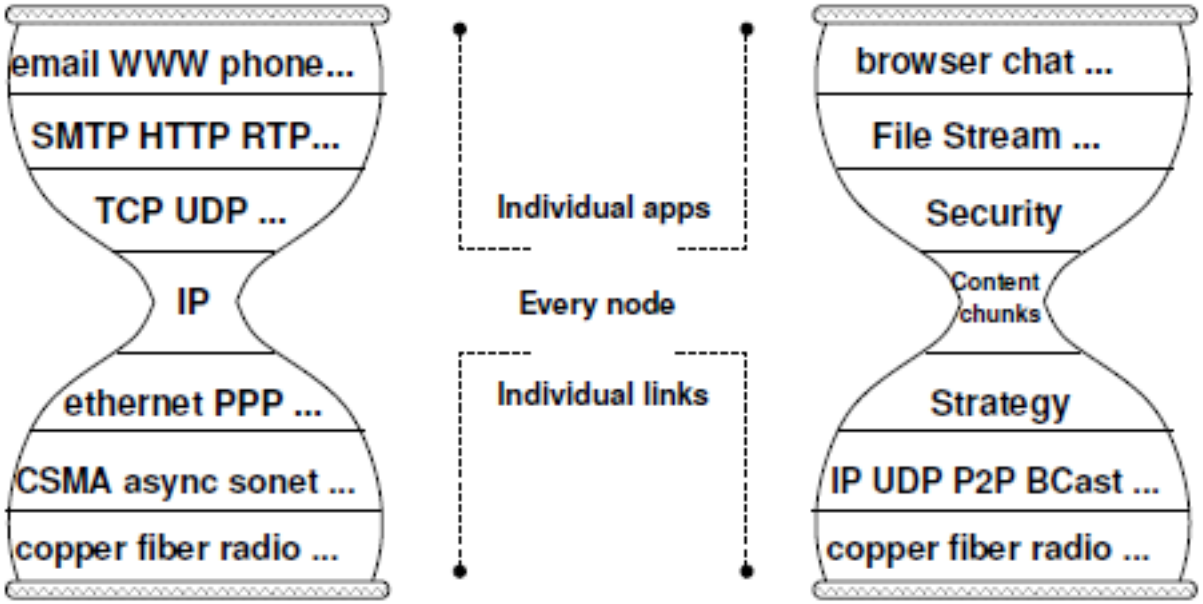
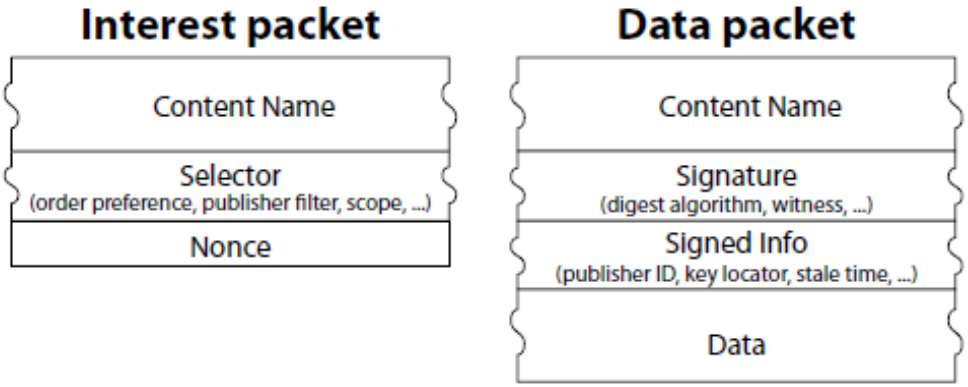


Image credits: Jacobson, Van, et al. "Networking named content." Proceedings of the 5th international conference on Emerging networking experiments and technologies. ACM, 2009.

NDN terminologies

- Two types of packets in NDN:
  - *Interest* packet (= *request* packet)
  - *Data* packet (= *reply* packet)



- Two end entities:
  - *Consumer*: asks for content
  - *Producer*: provides content

- NDN router: different from a traditional IP router

NDN Forwarding and Transport

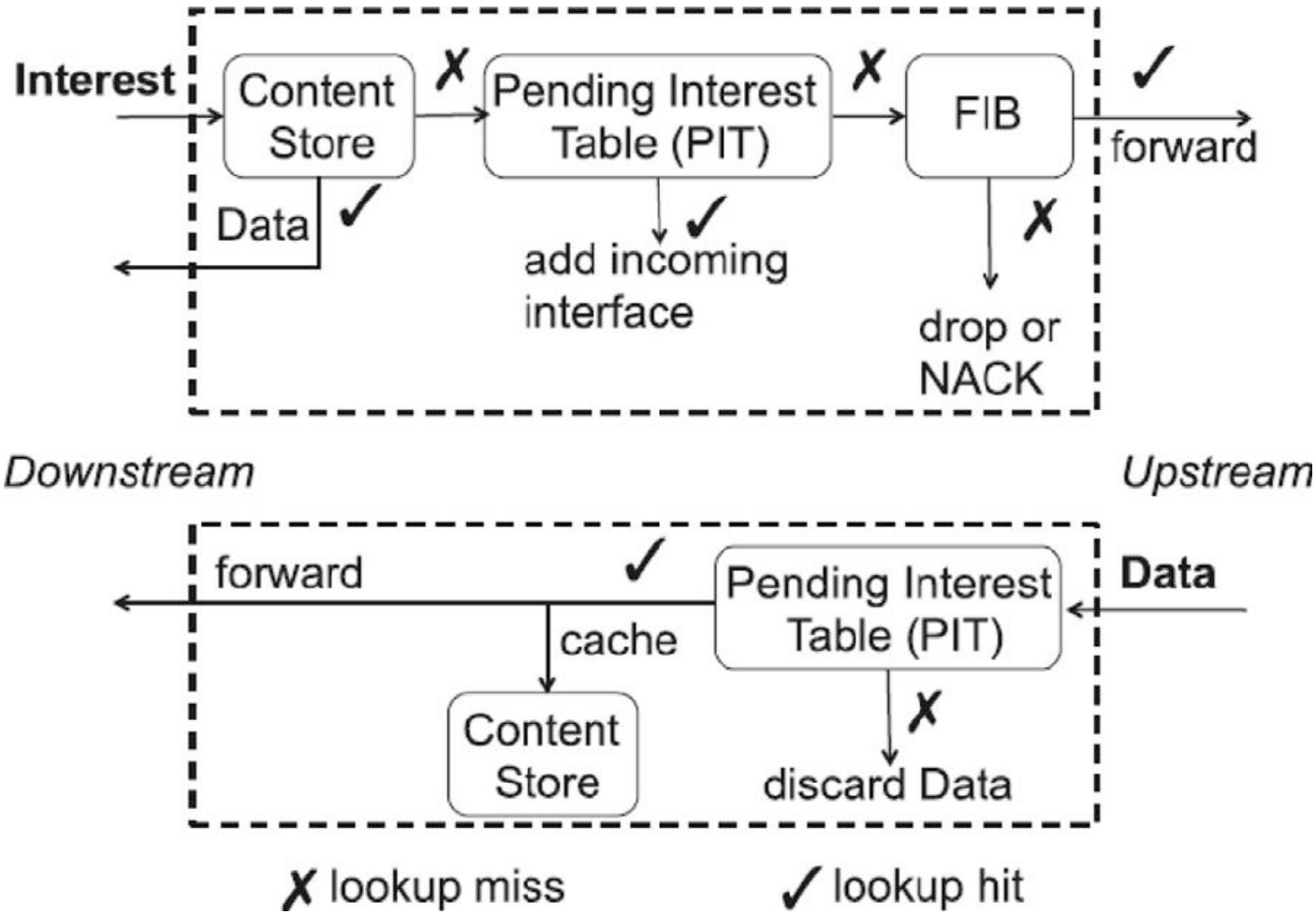


Image credits: Jacobson, Van, et al. "Networking named content." Proceedings of the 5th international conference on Emerging networking experiments and technologies. ACM, 2009.

NDN Forwarding and Transport

- *TCP*: is being considered for use in NDN
- *Issues*: RTT and RTO measurements might be highly inaccurate
- *Interest Rate Shaping*: controlling the sending rate of Interest packets
- *Three categories of Interest Rate Shaping algorithms*:
  - receiver (*or consumer*) driven
  - hop-by-hop
  - hybrid

Our contributions: BCON

- *Designed a new model for congestion avoidance in NDN*

  Result - Back pressure based Congestion Avoidance Model (BCON)

  Goal - minimize packet drop rate and enhance link utilization

  Proof of concept - by using ARED, CoDel and PIE AQM algorithms

- *Compared BCON model with traditional NDN-AIMD approach*

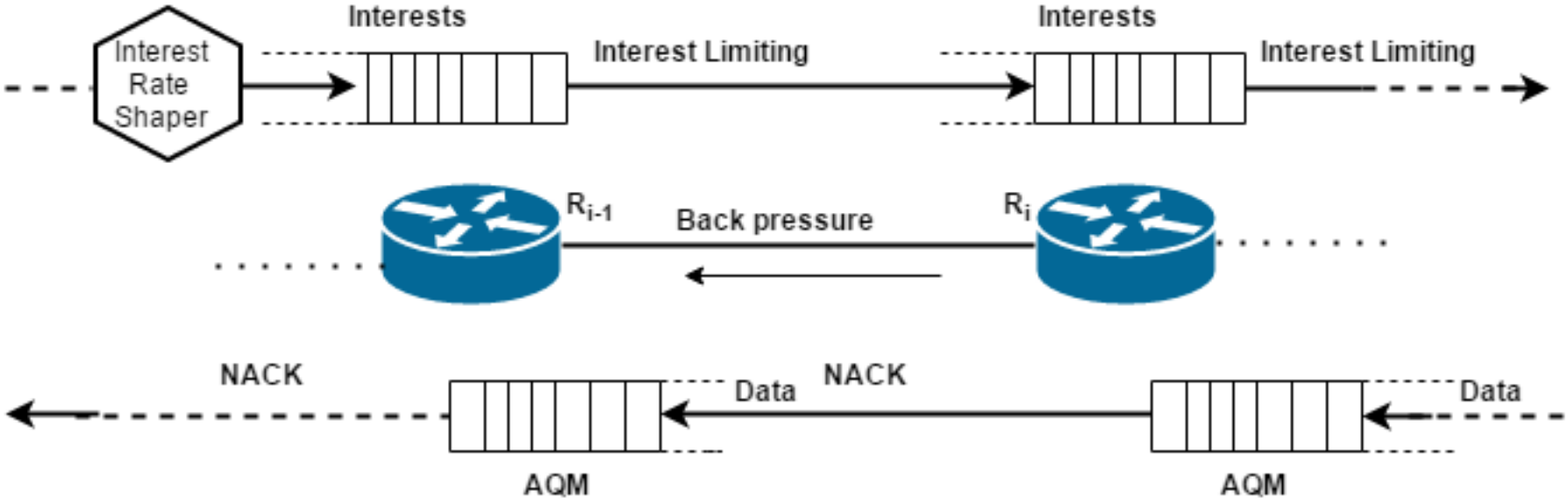
  Tools used - ndnSIM

  Performance metrics - packet drop rate, link utilization

- *Extended ndnSIM to support Adaptive RED and PIE algorithms*

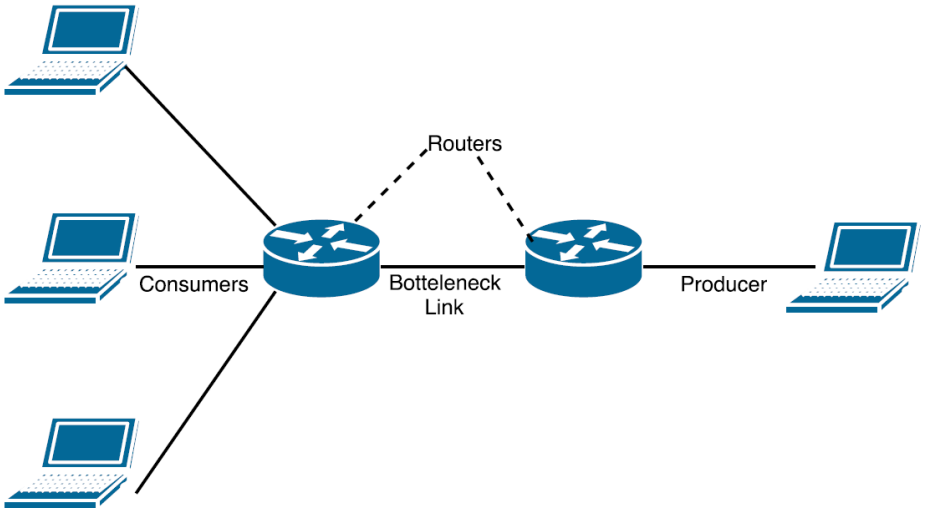
BCON: Model overview

- Three main components:
  - *Queue monitoring using AQM*
  - *Interest limiting using Back pressure technique*
  - *Interest window decrement at the consumer*

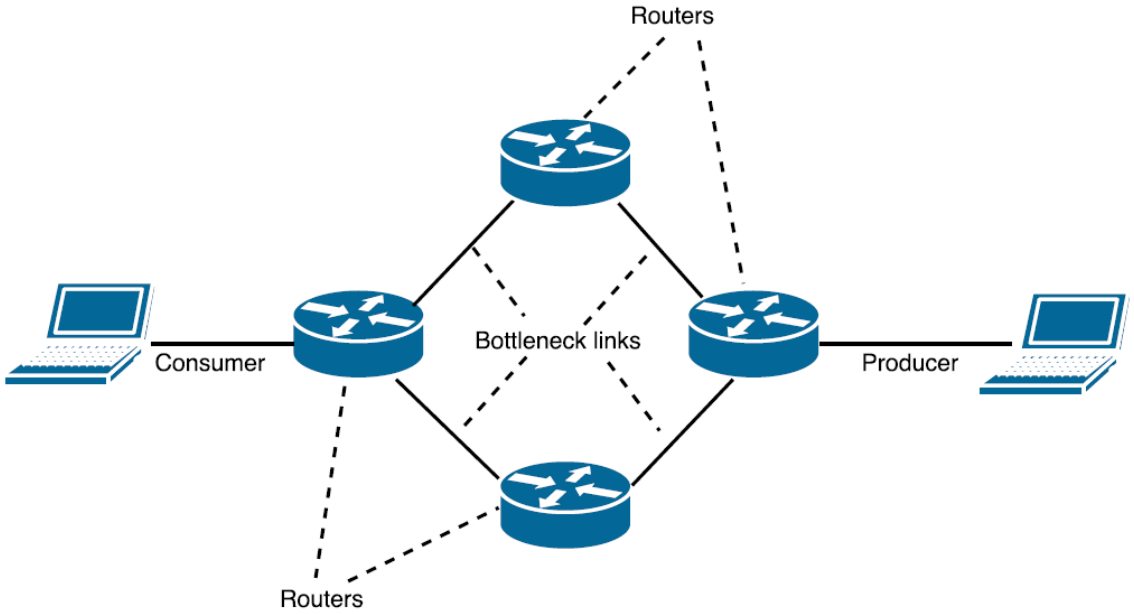


BCON: Performance evaluation

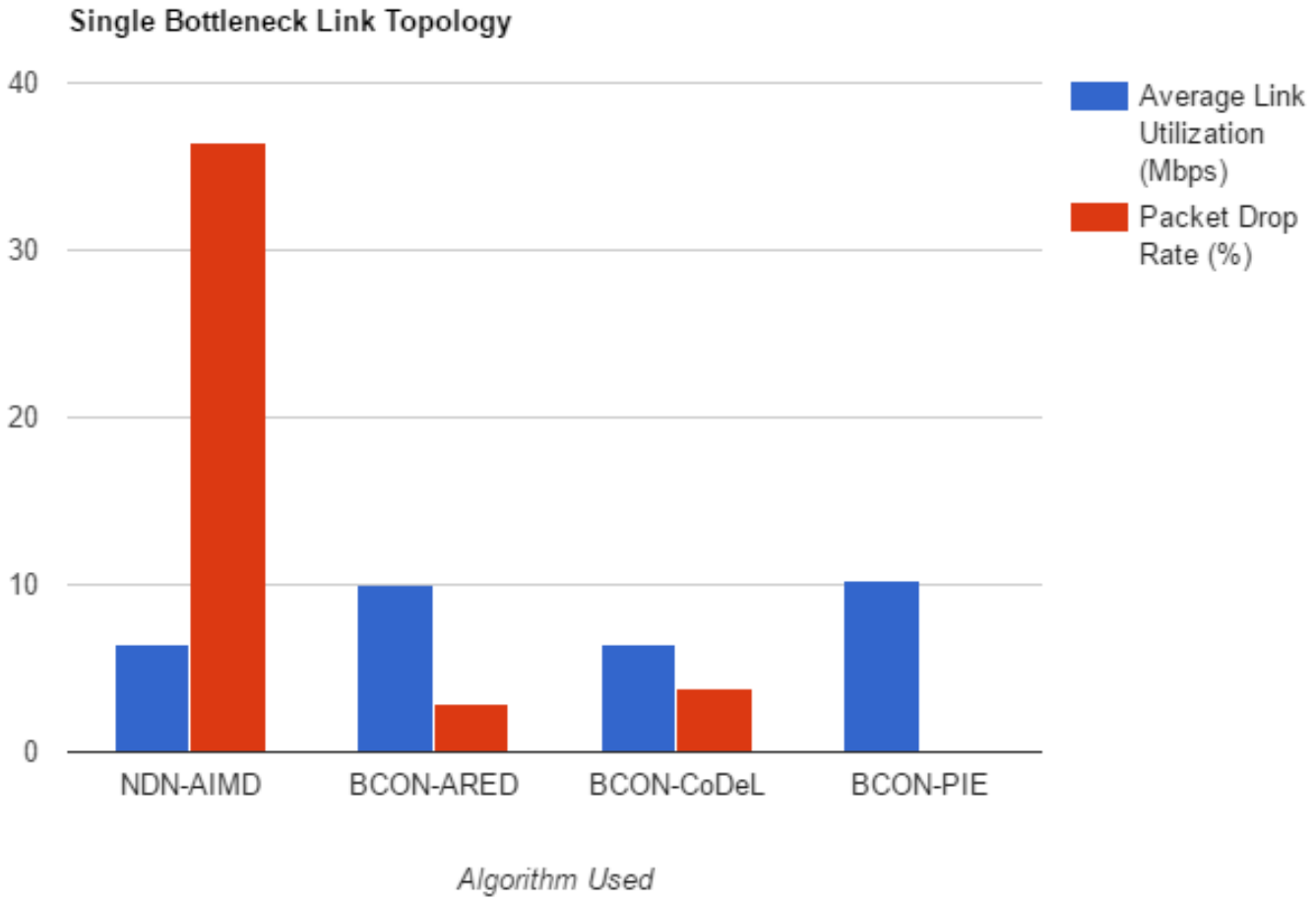
Single bottleneck topology



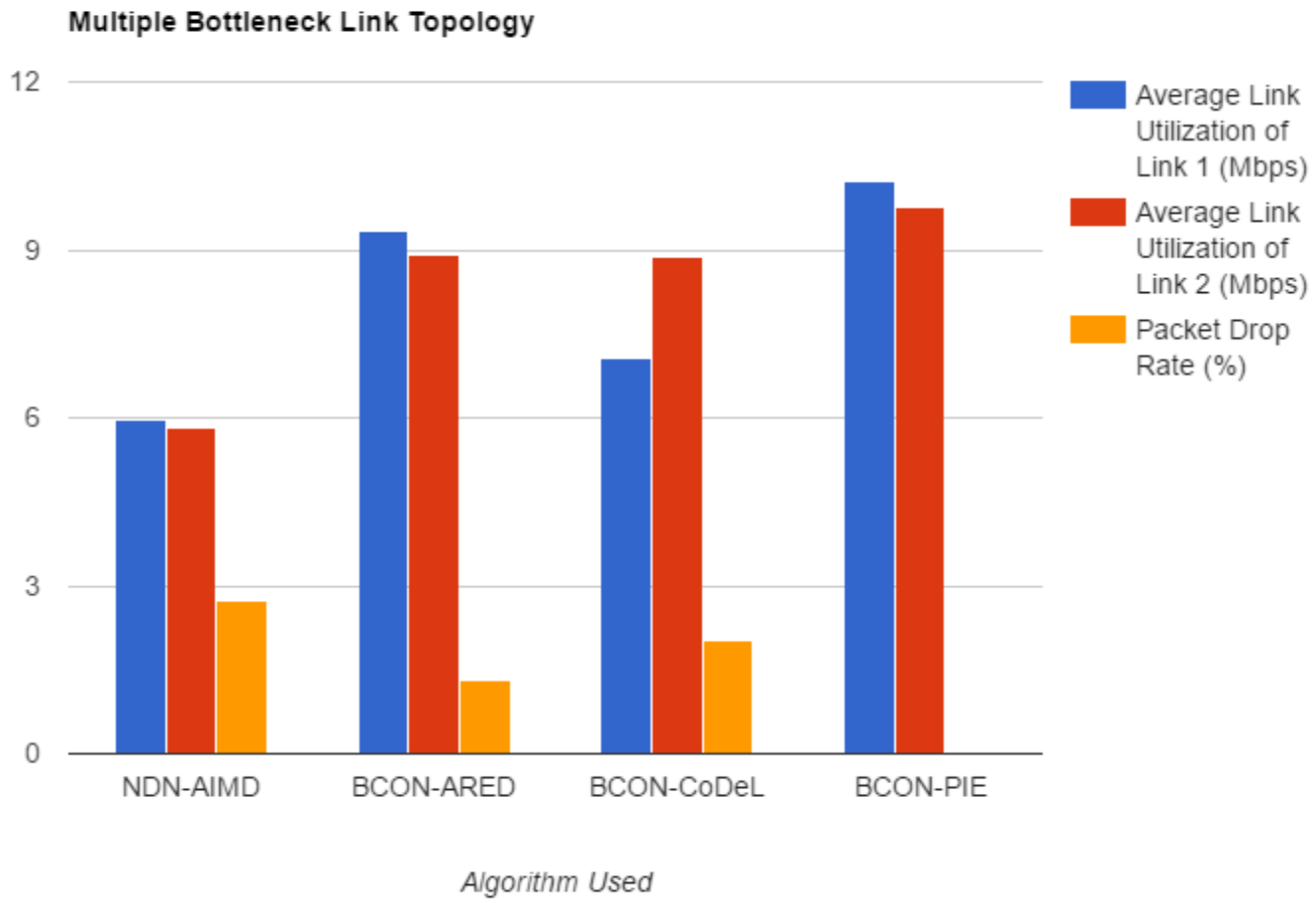
Multiple bottleneck topology



BCON: Results



BCON: Results



BCON: Summary and the next goals

- BCON seamlessly integrates AQM in the NDN architecture
- BCON reduces the packet drop rate and enhances link utilization
- Initial results of BCON model are promising

Next goals:

- Test the performance of BCON model in the presence of bursty traffic
- Check the feasibility of using NACK in a real NDN setup
- Setup a small testbed using NFD to evaluate the working of BCON

Our contributions: GCPiN

- *Designed a new model for Privacy in NDN*

  Result - Group Caching for Privacy in NDN (GCPiN)

  Goal - Enhance the privacy of content cached inside the Content Store

  Proof of concept - a basic analytical proof

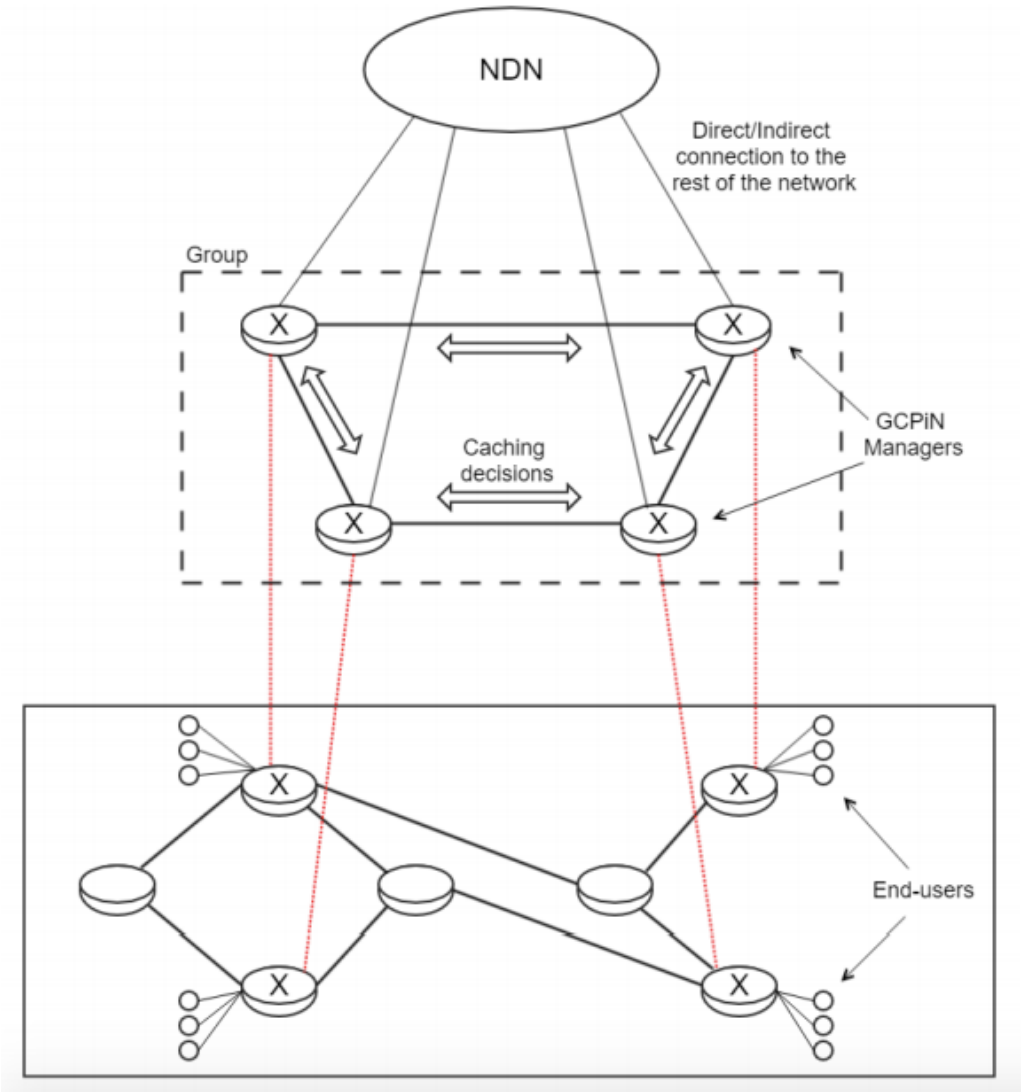
- *Ongoing work on this project*

  Implementation - using ndnSIM

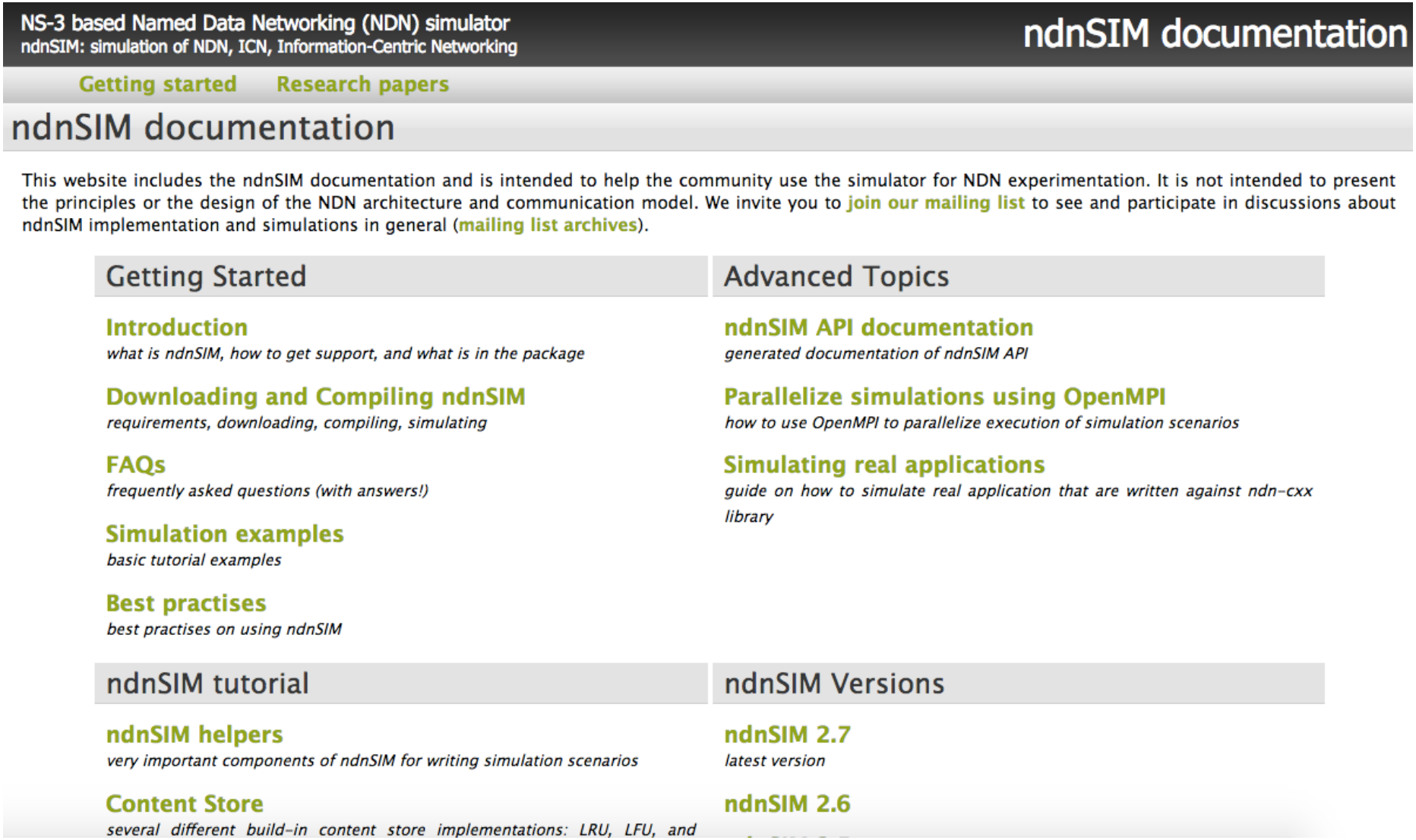
  Tentative Performance metrics - Cache hit and Cache miss times

- *Extend ndnSIM to support Distributed Content Store*

Our contributions: GCPiN



ndnSIM: ns-3 based Named Data Networking Simulator



URL: https://ndnsim.net/2.7/index.html

NFD: NDN Forwarding Daemon

NFD - Named Data Networking Forwarding Daemon

NFD is a network forwarder that implements and evolves together with the Named Data Networking (NDN) protocol. NFD is a core component of the NDN Platform.

NFD Documentation

- NFD Overview

  A brief overview of NFD and its major modules.

- Getting Started with NFD

  Instructions for obtaining, installing, and running NFD.

- FAQ

  Suggestions for configuring and running non-standard NFD setups.

- Manpages

Additional documentation

- NFD Developer's Guide

  A comprehensive guide to the design and implementation of NFD. The developer's guide also contains suggestions and hints for anyone wanting to modify or extend NFD.

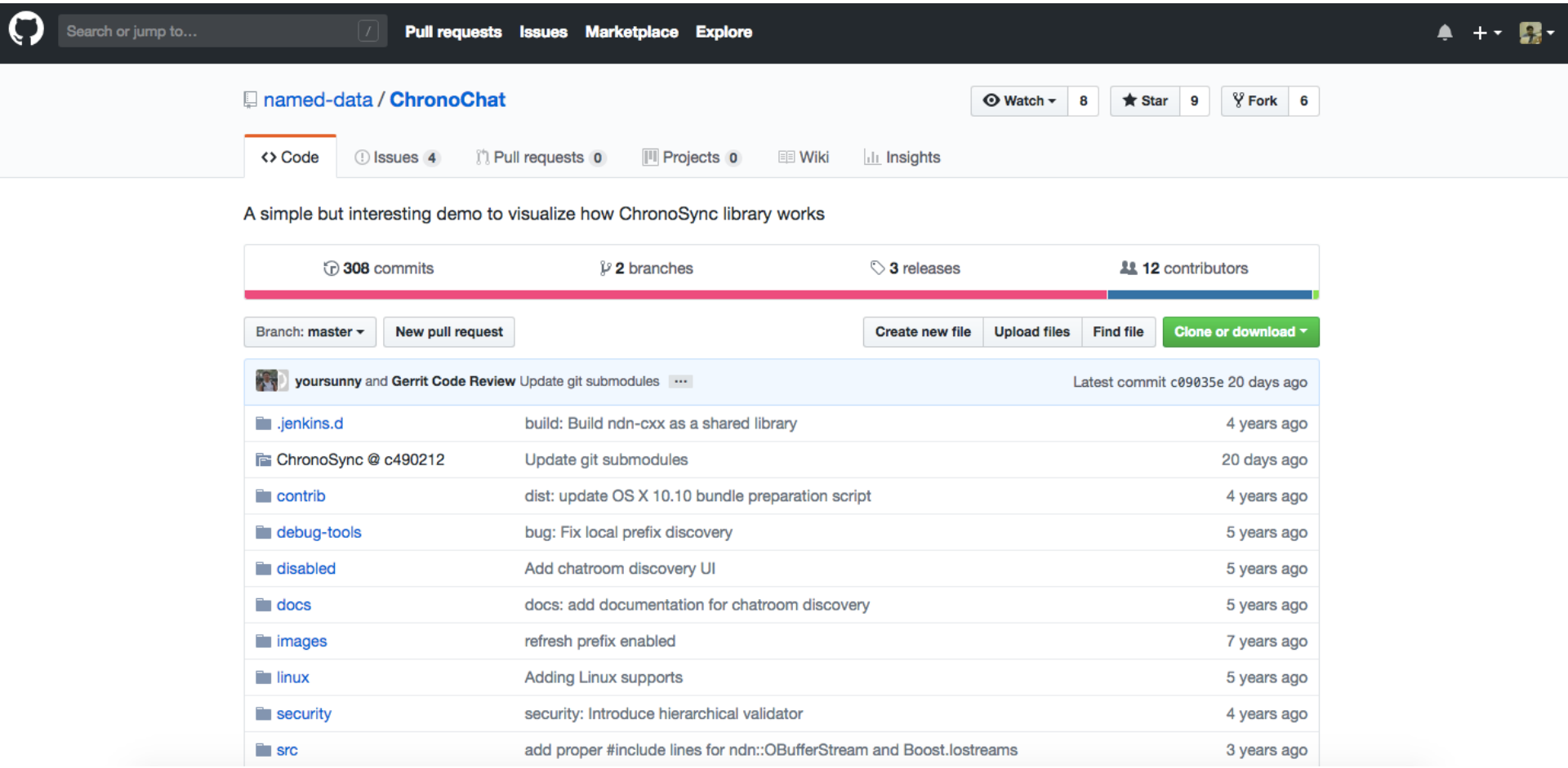
- NDN Software Contributor's Guide (guide for newcomers to the NDN community of software)
- NFD Wiki
  - NFD Management protocol
  - NFD Configuration file format

  The NFD Wiki contains detailed protocol specifications and information for building on unsupported platforms.

- API Documentation (doxygen)
- NFD Release Notes
- NFD Versions

URL: http://named-data.net/doc/NFD/current/

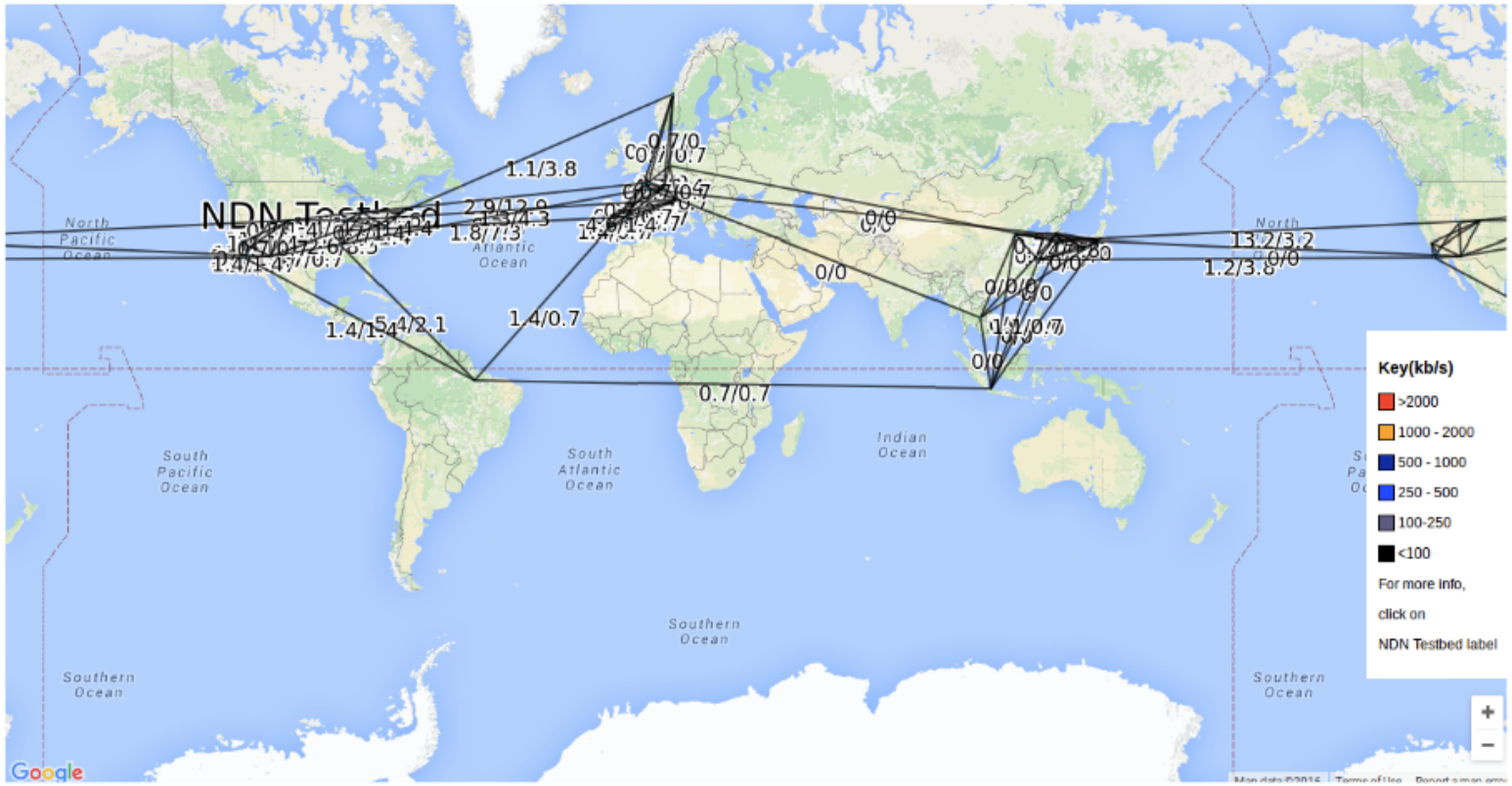
NDN Applications: ChronoChat



URL: https://github.com/named-data/ChronoChat

Next Goals

- Create a NDN node at NITK, and add it to NDN live testbed



FAQs

- *What are the best use-cases of NDN?*

  Vehicular Networking

  Internet of Things

  Secure Routing

- *Is there an active consortium for NDN?*

  Yes: https://named-data.net/consortium/

- *Is NDN active as of now?*

  Yes: please see the testbed in previous slide.

Thank you.