NDN Real Time Conferencing Library

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Introduction

Design Goals

- Real-time audio/video/text chat library which allows many-to-many conferencing over the NDN network and requires no direct communication between peers
- Starting point for NDN traffic congestion control algorithm research
- Test NDN-CPP library and NFD
- Traffic generator for the testbed

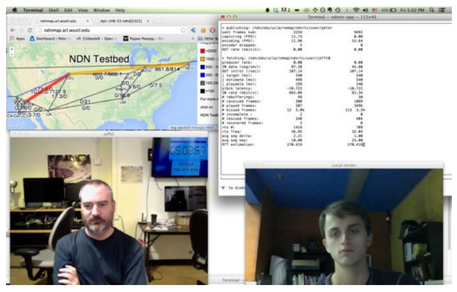

Figure 1. NDN-RTC 1-to-1 conference b/w users in REMAP and NEU

Publishing

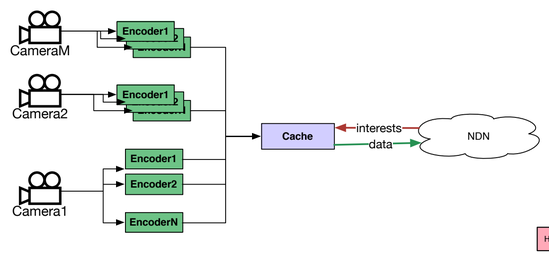

Figure 2. NDN-RTC Producer

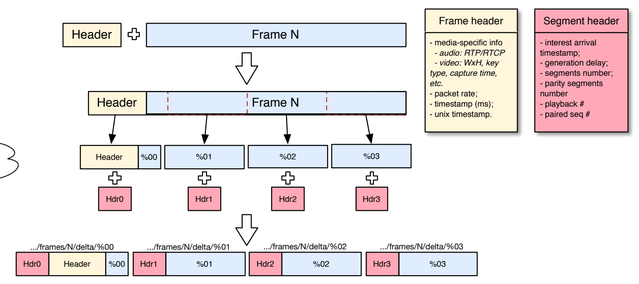

Figure 3. Frame segmentation; header structures

Namespace Design

- **Root**: User prefix (username)
- **Media streams**
- **Encoding threads:** Individual encoding parameters
- **Frame type: Key** and **Delta** frames
- **Packet:** Individual media packets
- **Data type:** Data and Parity segments
- **Segments:** Actual NDN-data objects

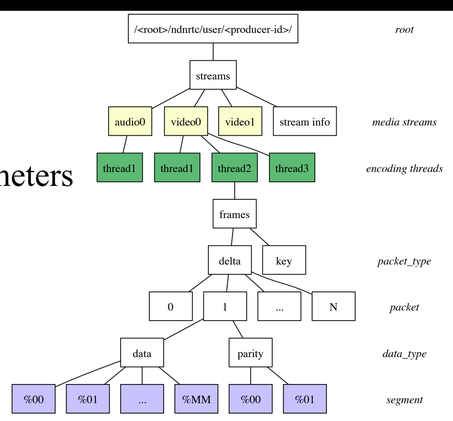

Figure 4. NDN-RTC namespace

Frame fetching

- **Generation delay d_n^{gen}** – time interval between receiving an interest and satisfying it with data (*producer-side*)
- **Assembling time d_n^{asm}** – time needed to fetch all frame segments (*consumer side*)
- **RTT_n** – round trip time for the interest (*consumer side*)

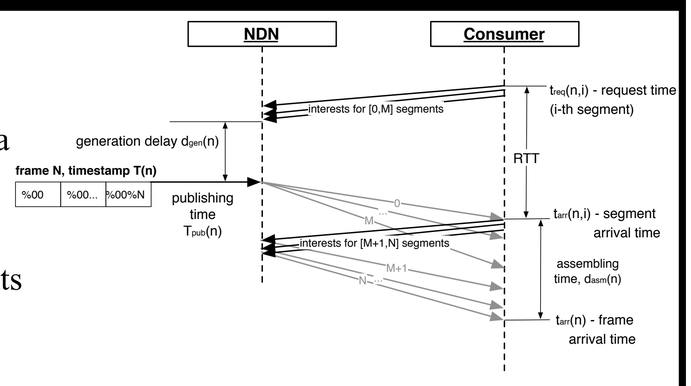

Figure 5. Frame fetching

Buffering

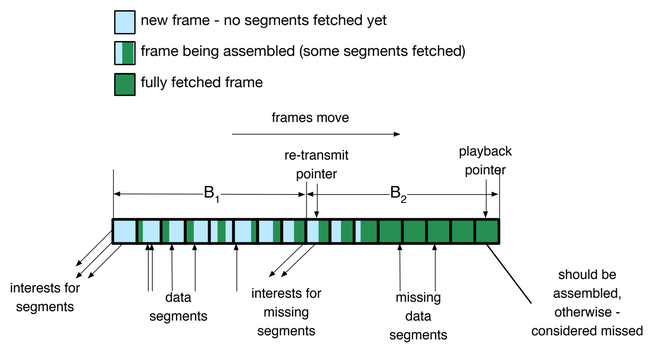

Figure 6. Buffering process

Start-up

- Cache exhausting:
  - Latest data can't arrive faster producing rate
  - Cached data arrives at the rate it was requested
- Chase mode:
  - Issue interest for the RIGHTMOST segment
  - Pipeline interests for first segments of the following frames with higher than producer rate
  - Monitor segments arrival interval
- **Future improvement:** use audio stream for chasing video

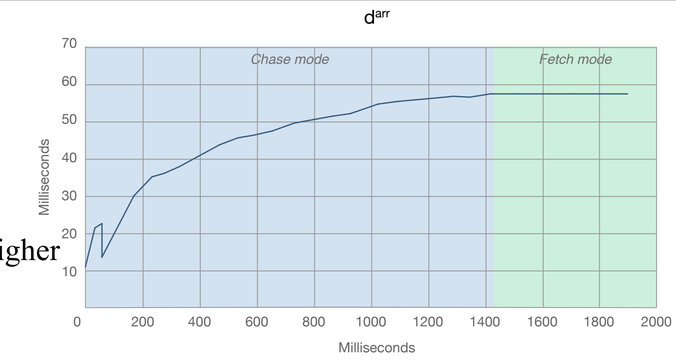

Figure 7. Data inter-arrival delay

NDNComm 2014 Demo

- **Producer 1:** Live NDNComm HD streaming (1080p 30fps, 1.5Mbps)
  - connected to **REMAP NFD**
  - NDN-RTC prefix: ***/ndn/edu/ucla/remap,*** NDN-RTC username: ***ndncomm***
- **Producer 2:** REMAP office webcam producer (SD, 30fps, 500Kbps)
  - connected to **CAIDA NFD**
  - NDN-RTC prefix: ***/ndn/org/caida,*** NDN-RTC username: ***remap1***
- **Demo 1:**
  - **Consumer for 3 streams:** NDNComm, REMAP and Demo-2
  - **Producer:** webcam producer (SD, 25fps, 500Kbps)
    - connected to **UA NFD** (Ariona)
    - NDN-RTC prefix: ***/ndn/edu/arizona,*** NDN-RTC username: ***demo1***
- **Demo 2:**
  - **Consumer for 3 streams:** NDNComm, REMAP and Demo-1
  - **Producer:** webcam producer (SD, 25fps, 500Kbps)
    - connected to **UA NFD** (Ariona)
    - NDN-RTC prefix: ***/ndn/edu/arizona,*** NDN-RTC username: ***demo2***
- **Simulated link break b/w Arizona and CAIDA every minute**

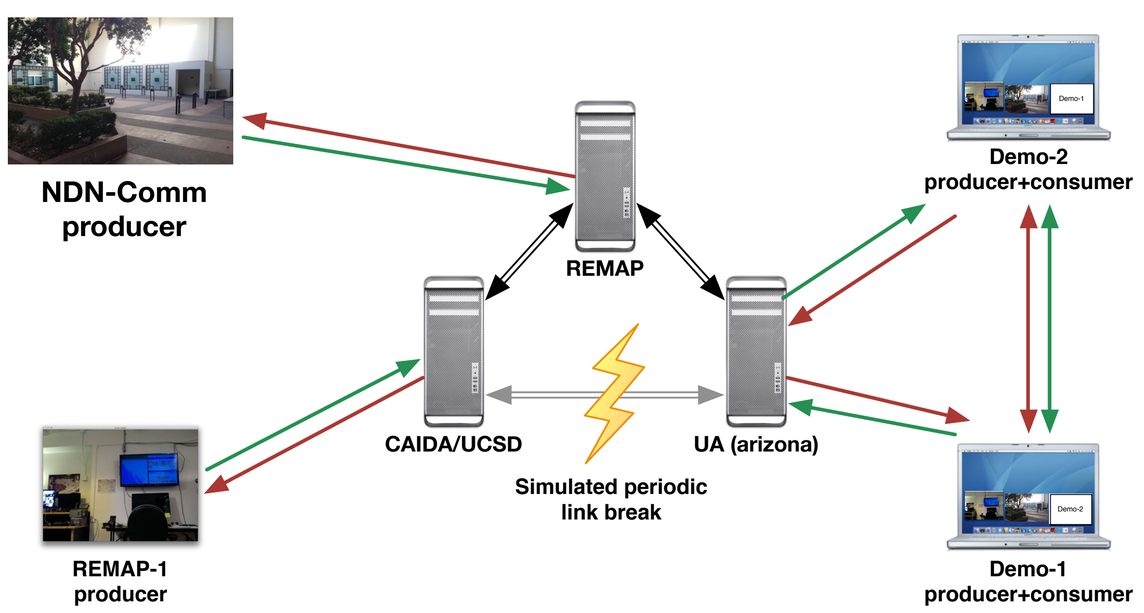

Figure 8. NDNComm demo scenario

Future Work

- **Real-time Adaptive Rate Control**
  - In collaboration with Panasonic R&D department (Muramoto-san, Yoneda-san)
  - Keep low-latency transmission & best throughput
  - Maintain RTT fairness (self-fairness)
  - Consumer-driven
  - NW bandwidth estimation based on RTT and timeouts
  - Control interest rate according to bandwidth estimation
- **Conference discovery**
- **Browser integration**
  - NDN-RTC Firefox NPAPI plug-in
- **Security:**
  - Web of Trust model
  - Media encryption
- **Desktop conferencing tool**