

Evaluation of MPEG-DASH over CCNx over different TCPs and UDP

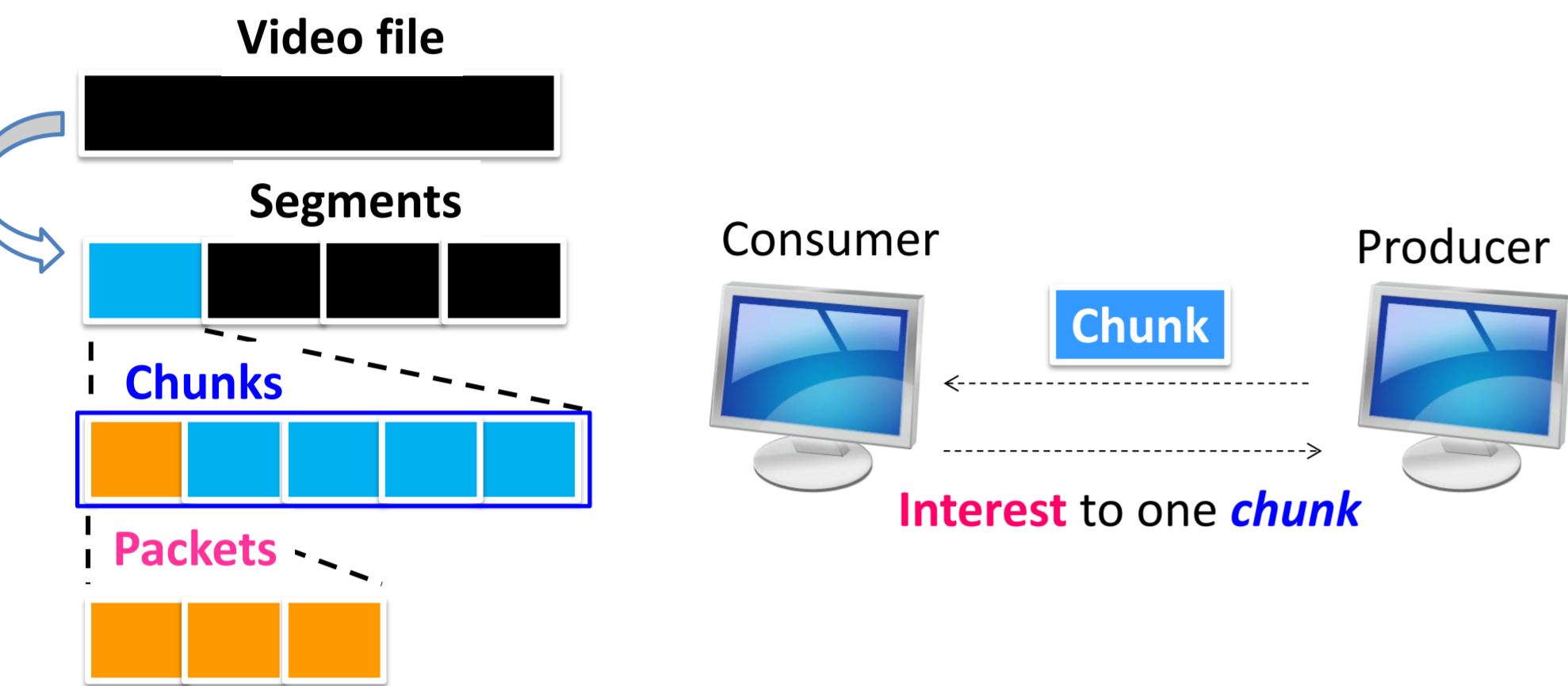
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Background

CCNx

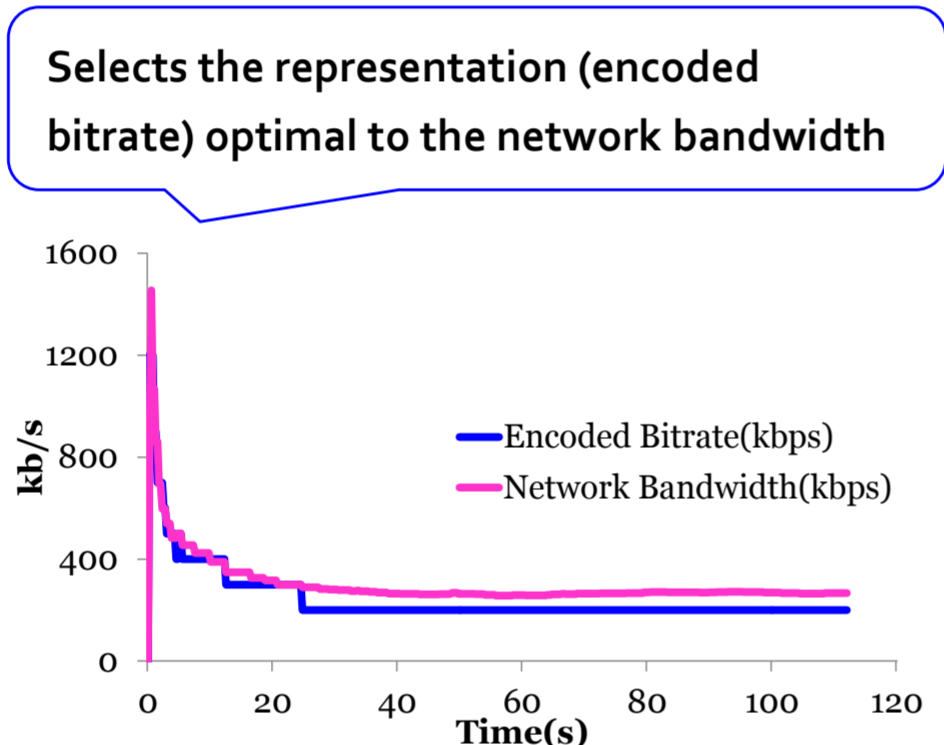
- Open source project to develop and evaluate a new approach in CCN, developed by Palo Alto Research Center (PARC)
- Runs as an **overlay of the current IP based network**, and supports both TCP and UDP.

Mechanism of Video Streaming over CCNx



MPEG-DASH (Dynamic and Adaptive Streaming over HTTP)

| Animation |
|----------------------|
| 100 kbit/s, 320x240 |
| 200 kbit/s, 320x240 |
| 300 kbit/s, 320x240 |
| 400 kbit/s, 480x360 |
| 500 kbit/s, 480x360 |
| 700 kbit/s, 480x360 |
| 900 kbit/s, 1280x720 |
| 1.2 Mbit/s, 1280x720 |
| 1.5 Mbit/s, 1280x720 |

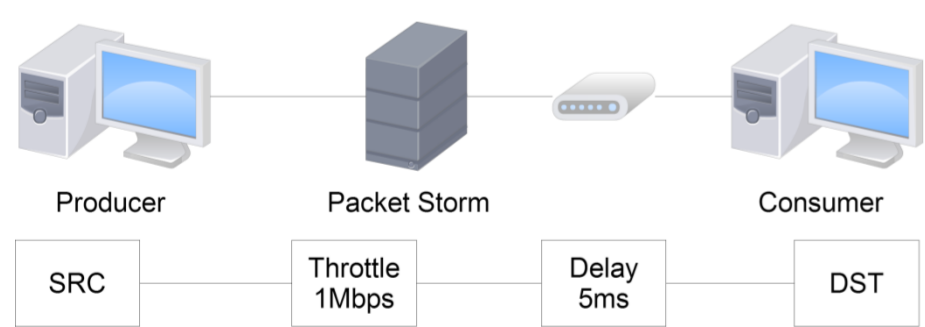


- Stores multiple encoded-bitrates
- Client observes the network bandwidth and **dynamically changes content bitrate**

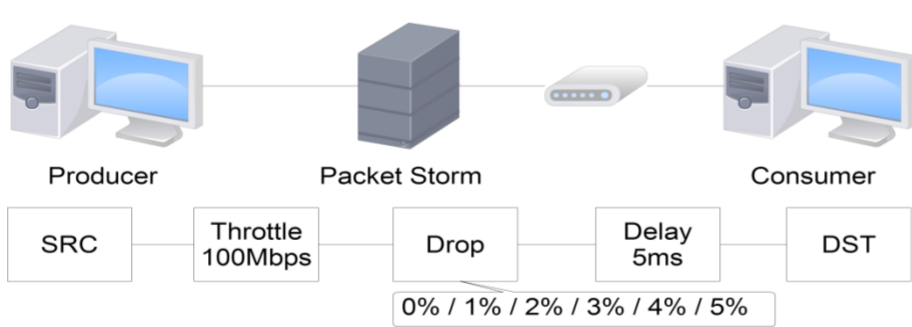
Experiment

Topology

Fixed Network Bandwidth



Fixed Packet Loss Ratio



Dataset

- 1280x720 YUV format
- Video content is encoded into multiple bit rates: 100kb/s, 200kb/s, 300kb/s, 400kb/s, 500kb/s, 600kb/s, 700kb/s, 800kb/s, 900kb/s, 1Mb/s, 1.2Mb/s, and 1.5Mb/s

Experimental Results

Fixed Network Bandwidth

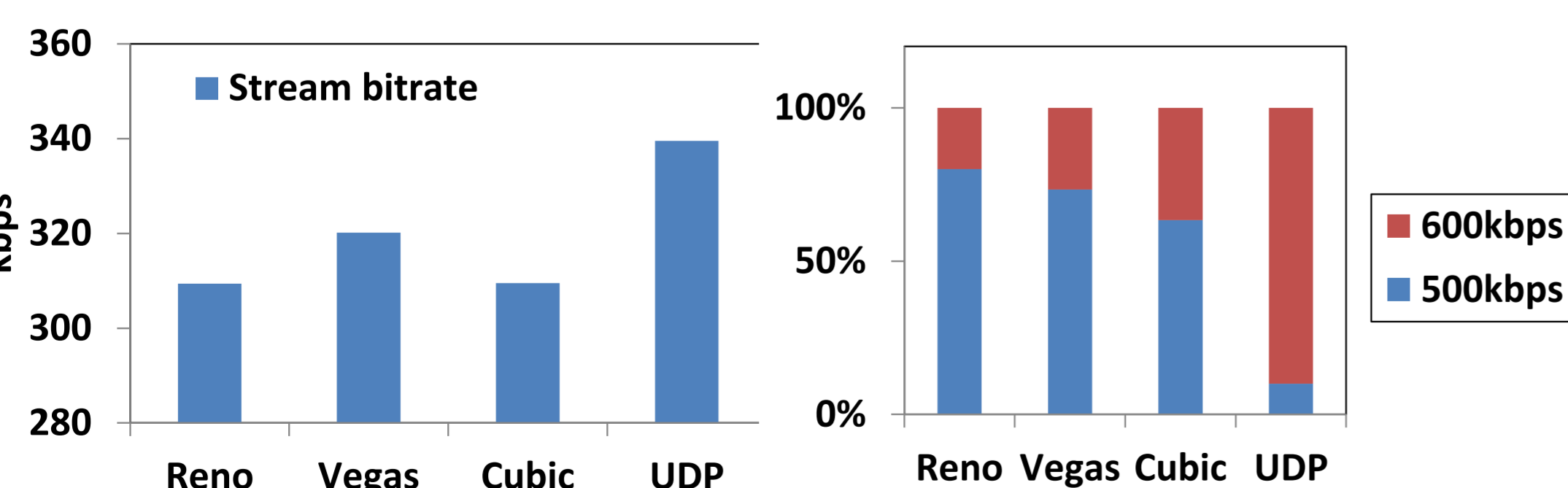


Figure: Average Streaming Bitrate (Left), Average Representation (Right)

Table: Results during Playback (Average)

| | Reno | Vegas | Cubic | UDP |
|------------------------|------|-------|-------|-----|
| RTT (ms) | 115 | 61 | 195 | |
| Cwnd (kb) | 206 | 86 | 599 | |
| Rate Estimation (kbps) | 575 | 578 | 581 | 602 |
| Packet Loss Ratio (%) | 0.26 | 0.22 | 0.58 | 1.4 |

UDP:

- Highest bitrate, packet loss ratio
- "Best-Effort Delivery" resulted in high rate estimation

CUBIC-TCP:

- Requested high representation
- Packet Losses affected the streaming bitrate

Vegas:

- Highest bitrate among the TCP variants
- Delay-based method is suitable

Fixed Packet Loss Ratio

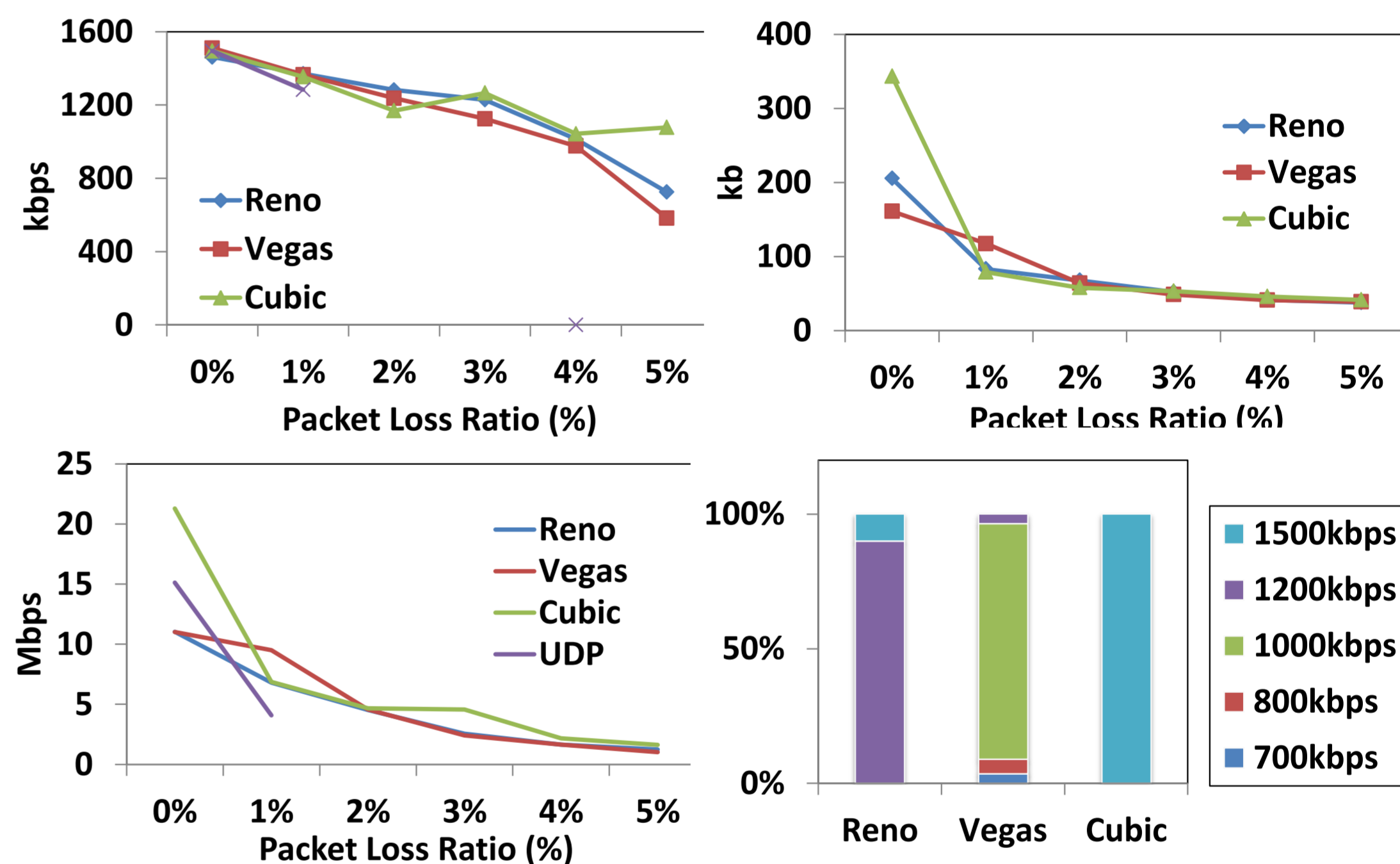


Figure: Average Streaming Bitrate (Top Left), Average Congestion Window (Top Right), Average Rate Estimation (Bottom Left), Percentage of Representation (packet loss ratio = 5%) (Bottom Right)

- Packet loss ratio affects the rate estimation

CUBIC-TCP:

- Aggressive algorithm results in highest bitrate
- Loss-based method is suitable

UDP:

- Packet loss over 2%: Unable to playback
- Interest flow control, timeout algorithm needs improvement

Conclusion and Future Work

- The advantages of delay and loss-based methods over CCNx does not differ from IP
- Rate estimation is the core for MPEG-DASH delivery since the selection of representation occurs
- Packet retransmissions disturb the rate estimation since UDP had the highest value and requested segments with higher representations
- When the packet loss is over 1%, it is unable to playback over UDP: Needs improvement (Interest flow control and timeout algorithm)
- To satisfy low latency without reducing large throughput, delay/hybrid system is desirable
- Implement a complex topology by using a complex topology. (ex. PlantLab, ICNTestbed)