Update on Video Traffic Model with New Trace Data

draft-ietf-rmcat-video-traffic-model-00

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Outline

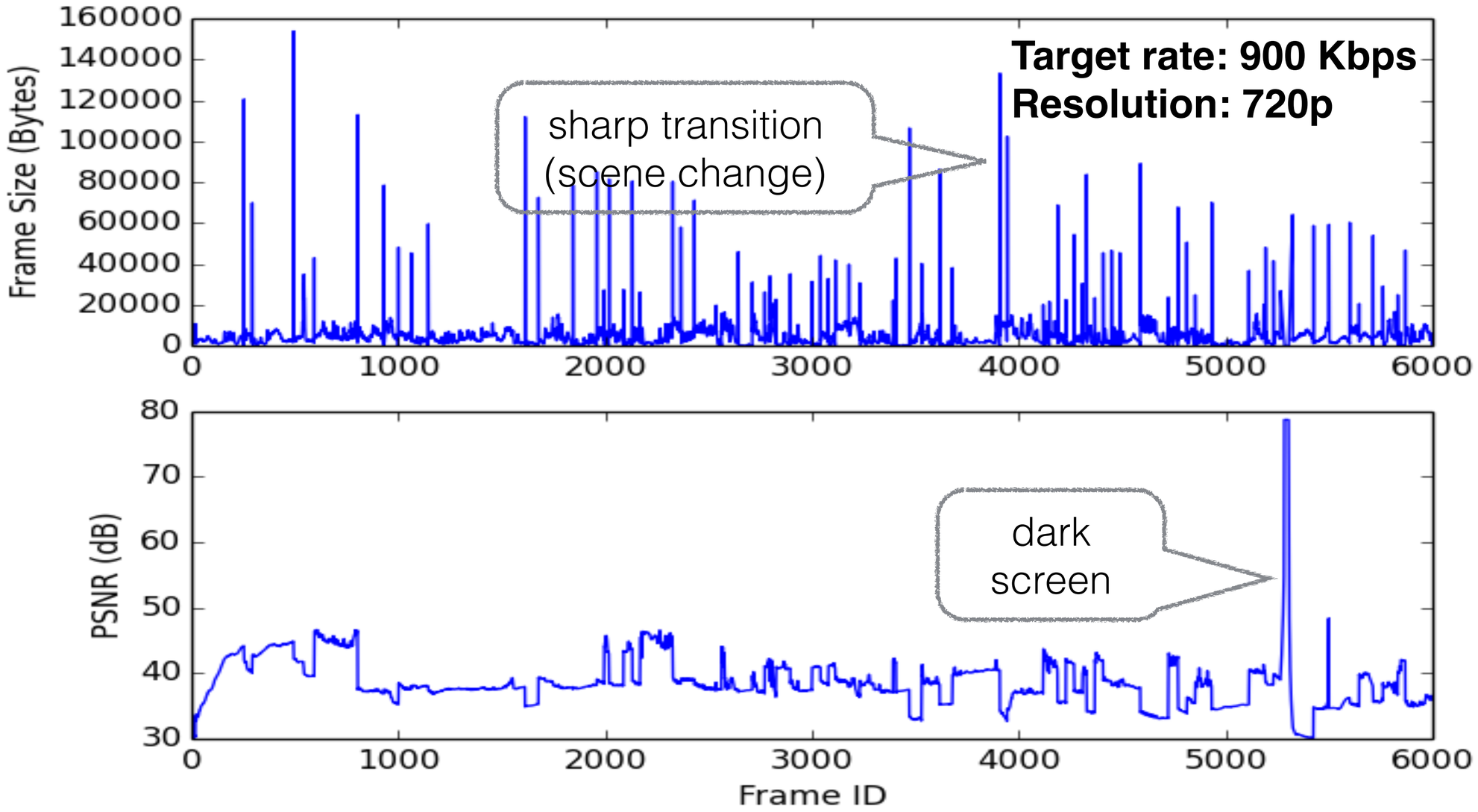
- Update on Syncodecs:
  - New URL for open source code
  - New collection of video traffic traces for Syncodecs
- Analysis of video traces from live video conferencing
- Analysis of video trace data from x264 encoding
- Summary and next steps

Update on *Syncodecs*

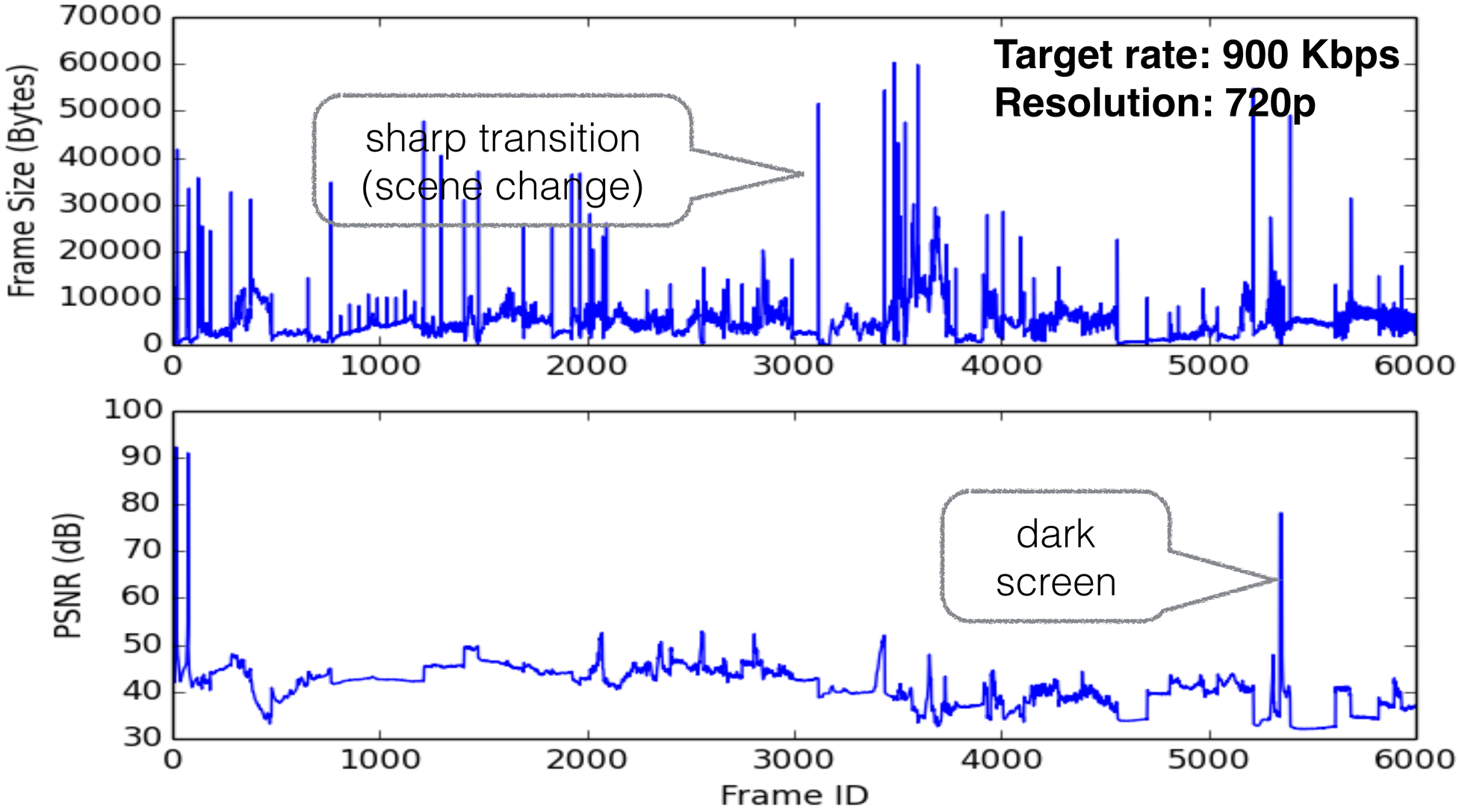
- New URL for open source code: https://github.com/cisco/syncodecs
- New set of video traffic traces:
  - Motivation: need long sequences at sufficiently high resolution (>1080p) to avoid repetitive pattern in trace-driven tests;
  - Video sequences: *Big Buck Bunny* and *Elephant Dreams*
  - Frame rate and resolution of original sequence: 1080p@24fps
  - Duration: over 250 second each (i.e., 6000 frames)
  - Set of 15 available rates: 100Kbps ~ 1.5Mbps, incremental by 100Kbps;
  - Set of 6 resolutions: 180p, 240p, 360p, 540p, 720p, 1080p
  - Codec: x264 with zero-latency setting and no recurring I frames. Command line options:

```
--profile baseline --preset ultrafast --tune zerolatency -I "infinite"
```

Example Trace on Frame Size and Quality: *Big Buck Bunny*



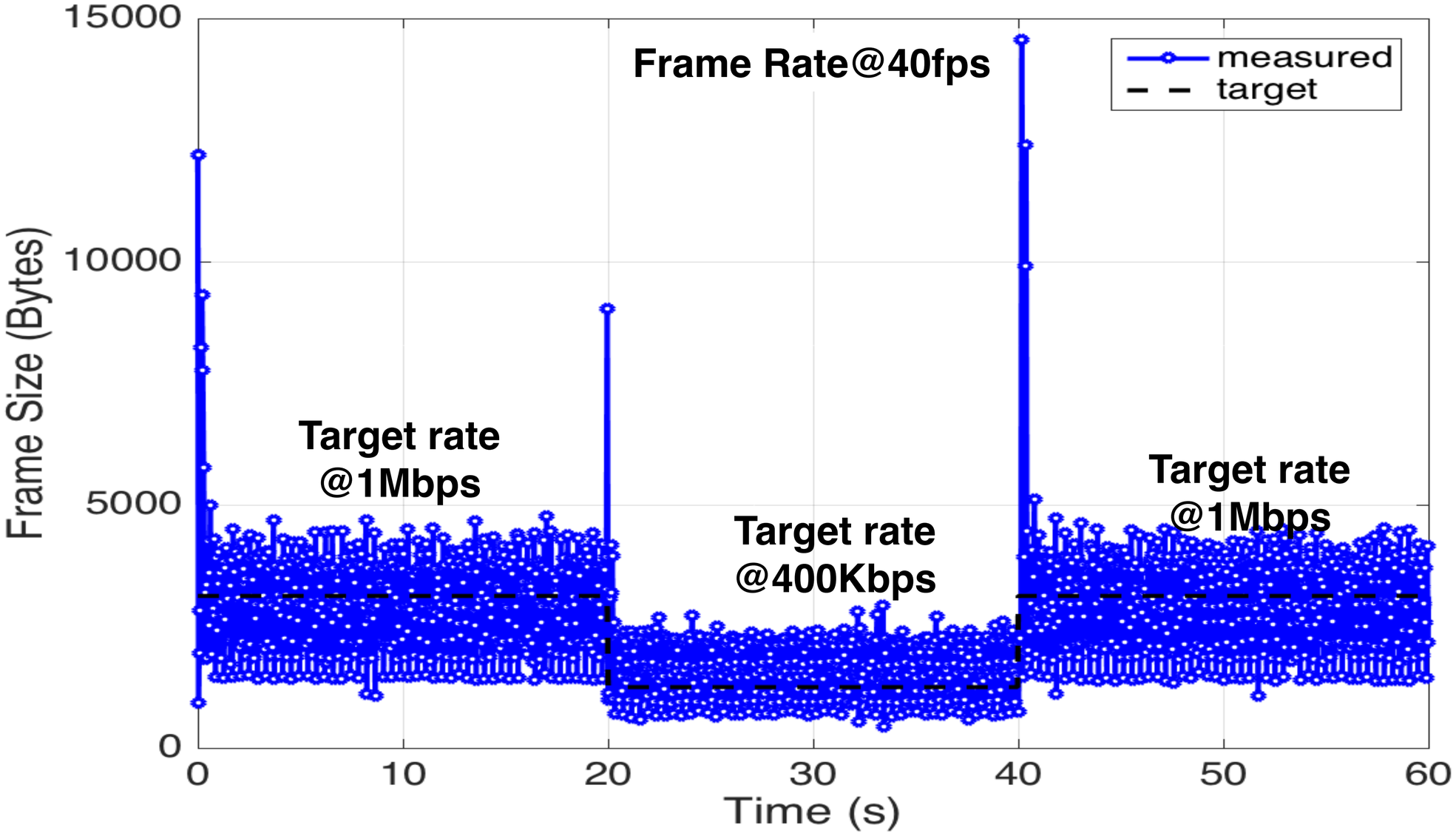
Example Trace on Frame Size and Quality: *Elephant Dream*



Choice of Video Sequences

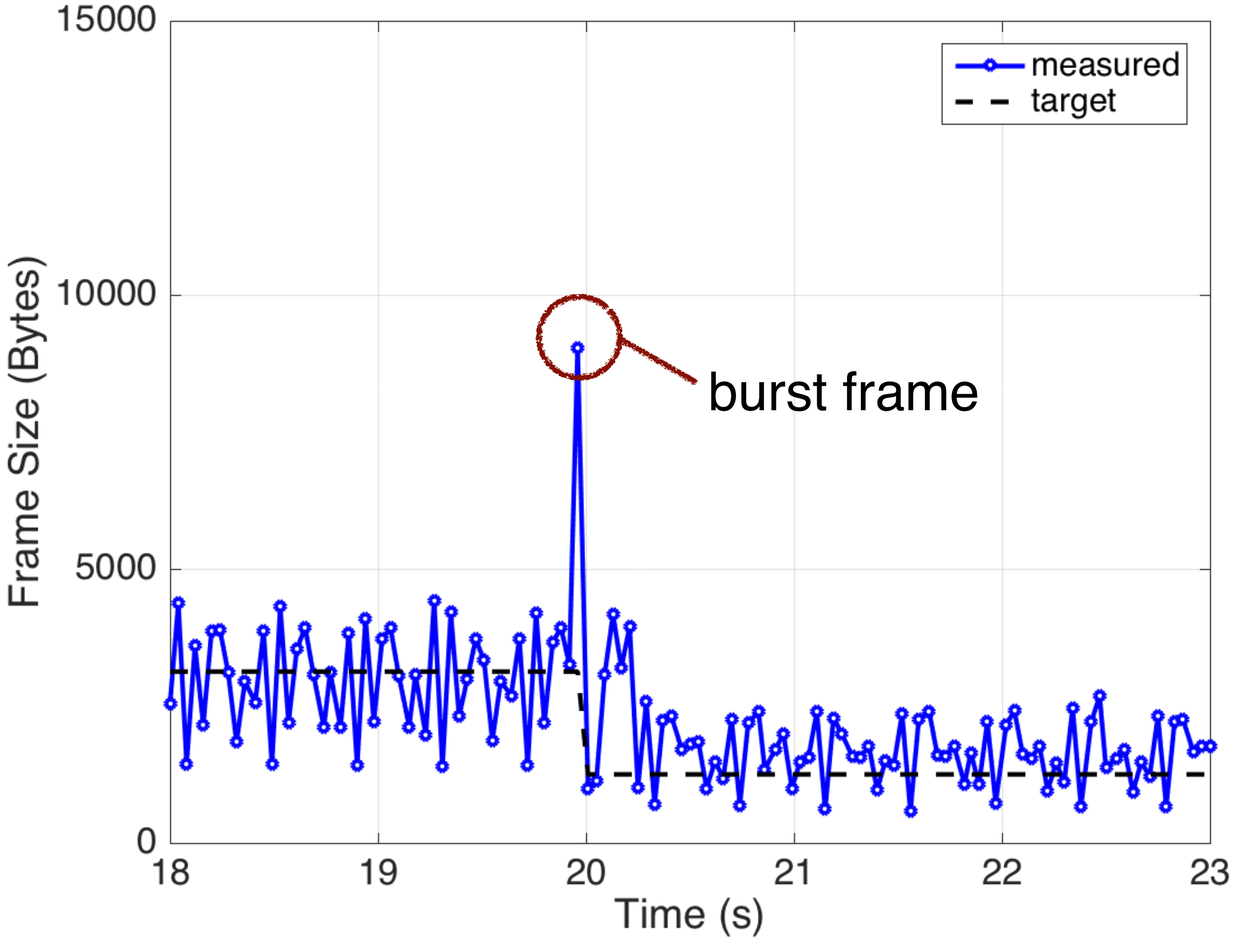
- Long test video sequences avoids artificial repetitive pattern in trace-driven testing
- Currently, Big Buck Bunny and Elephant Dreams reflect computer-generated video contents, may be useful for testing screen-sharing application scenarios
- Need more contents:
  - “Conference-like” scenes
  - Document/Slide sharing?

Frame Size Trace from Live Video Conferencing

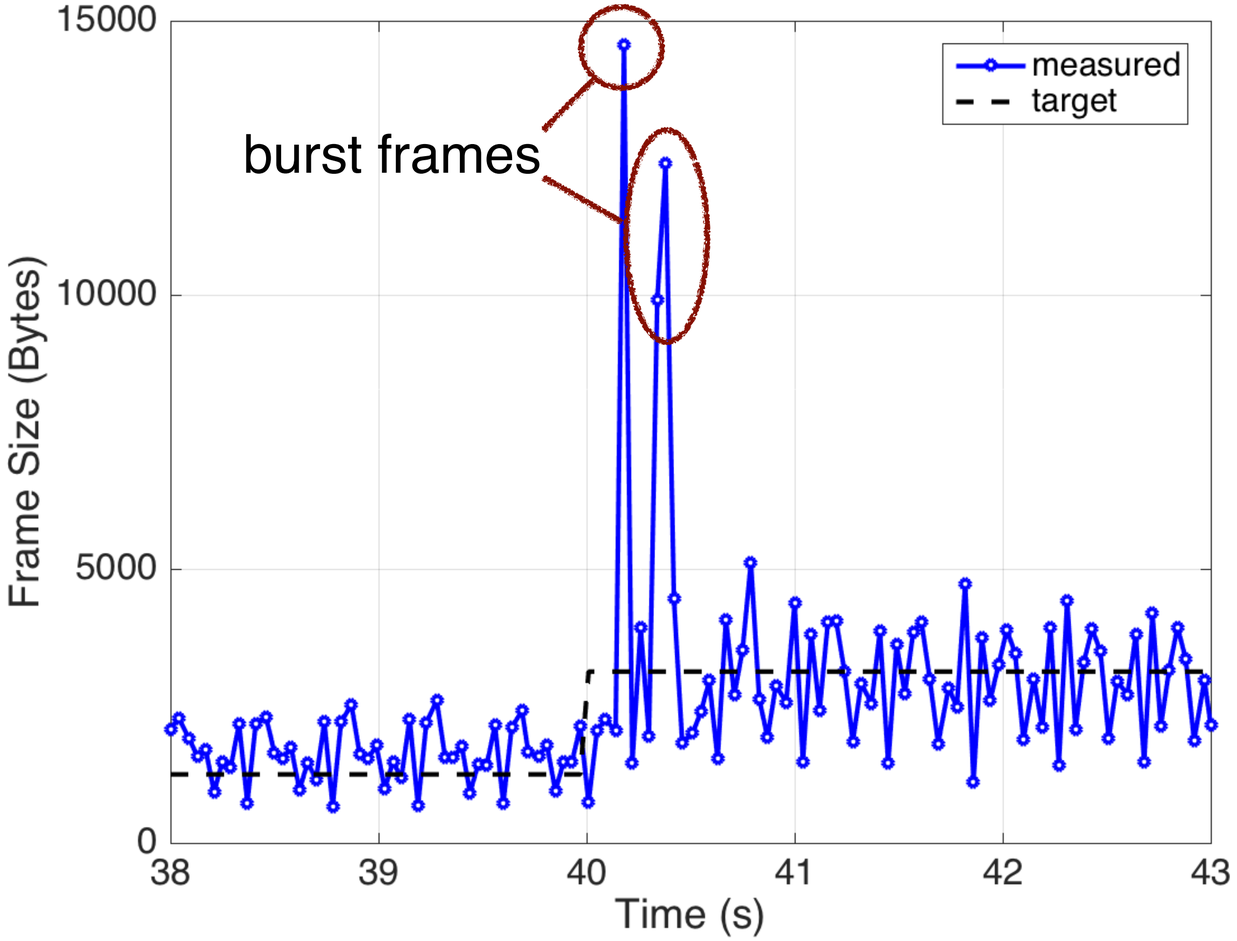


Zoom-In View on Rate Transitions

1Mbps -> 400 Kbps

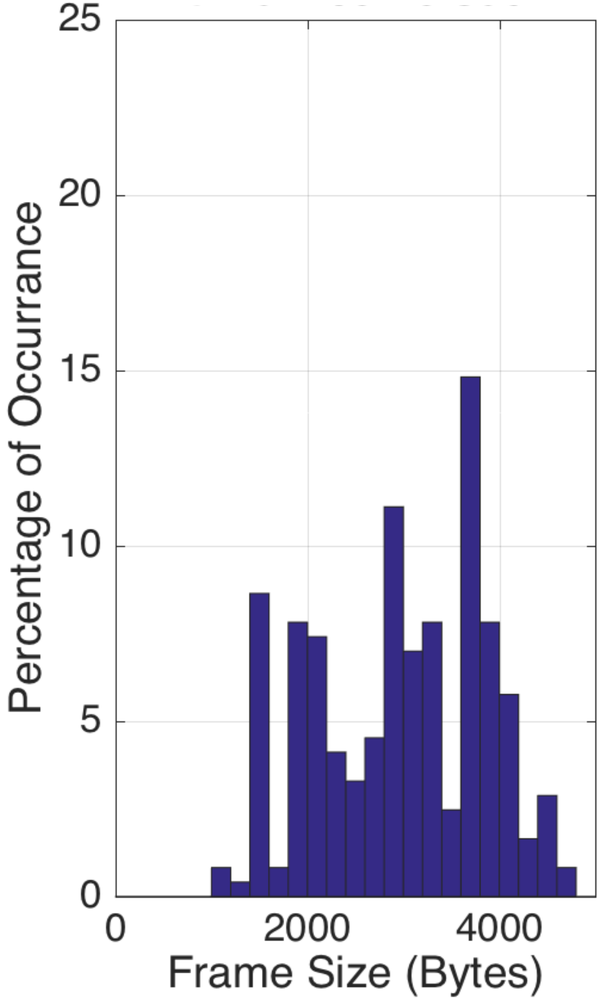


400 Kbps -> 1 Mbps

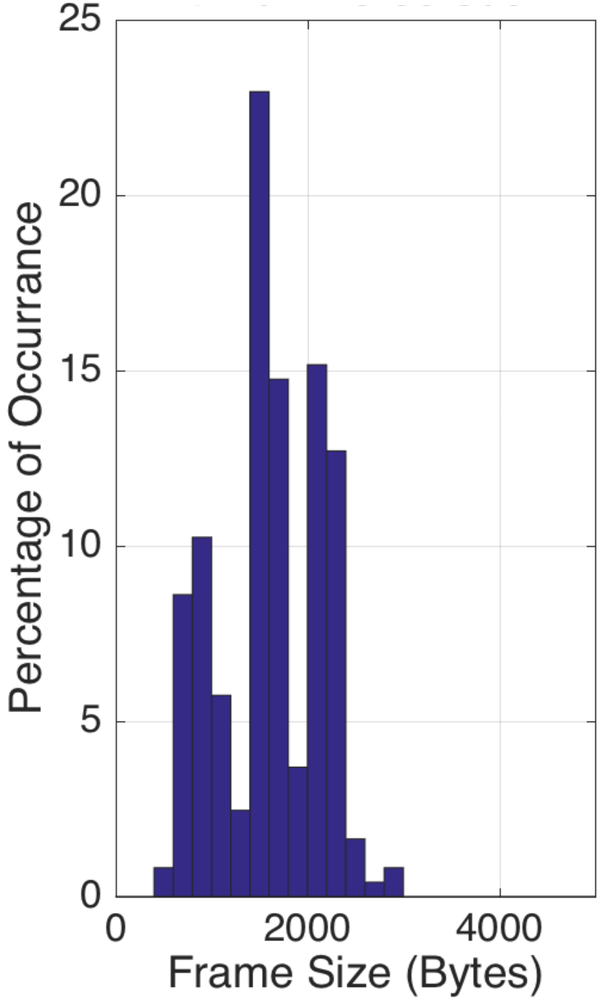


Steady-State Frame Size Distribution

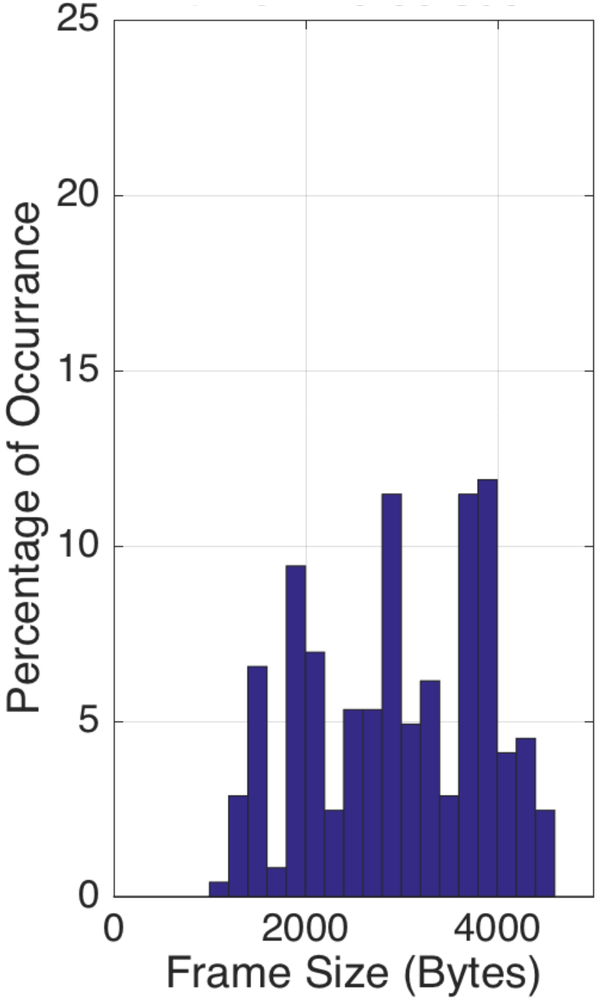
Rate = 1Mbps
t = 5-15s



Rate = 400Kbps
t = 25-35s



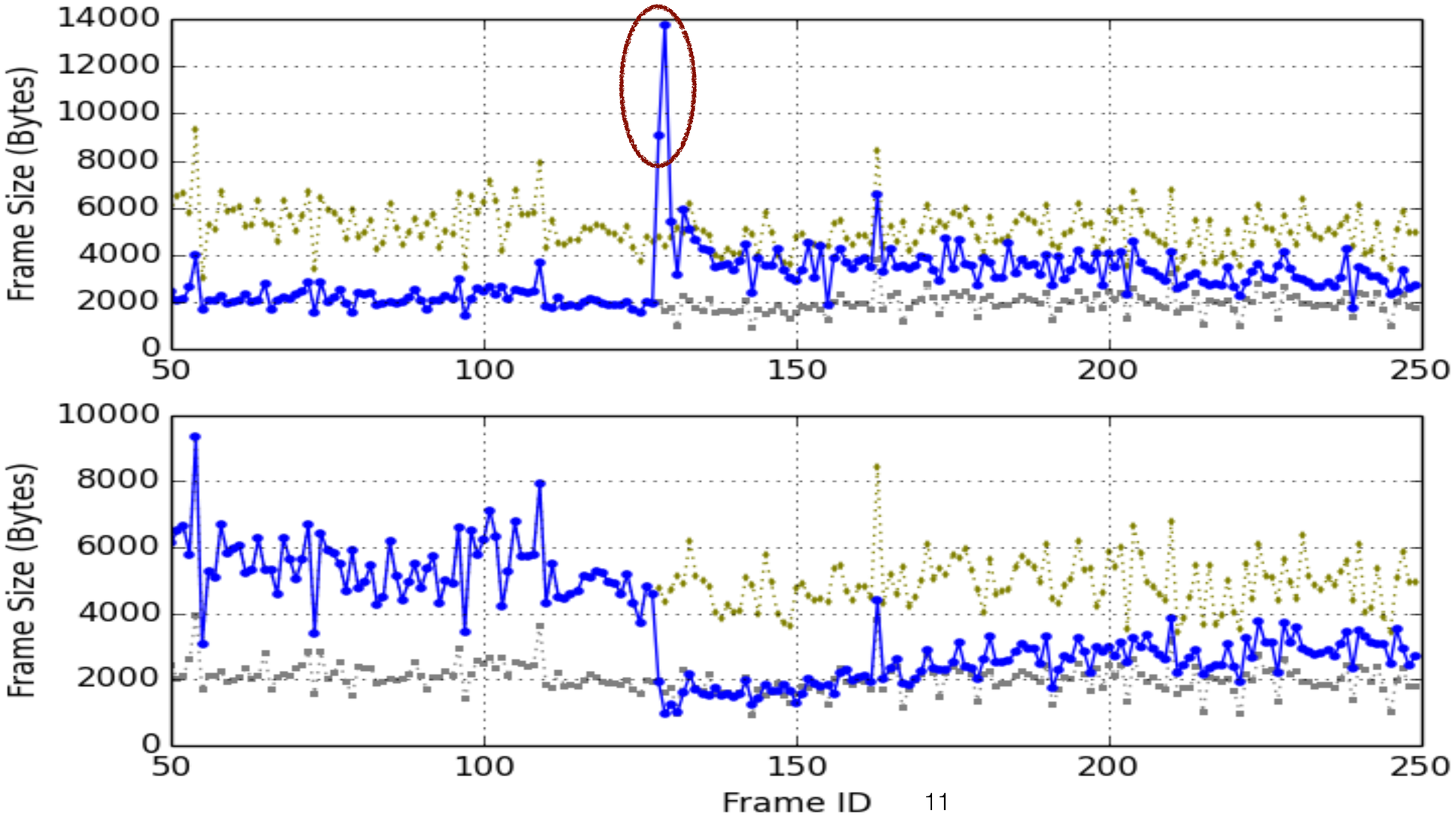
Rate = 1Mbps
t = 45-55s



Recap of Observations

- Transient behavior:
  - Introduces burst frames when rate up-shifts and down-shifts;
  - Burst frame size: 5~7 x target size
- Steady-state behavior:
  - Frame size distribution somewhat arbitrary within range: may need more data
  - Frame size fluctuates around target size by 28-42%

Frame Size Trace in x264: 400Kbps to/from 1Mbps



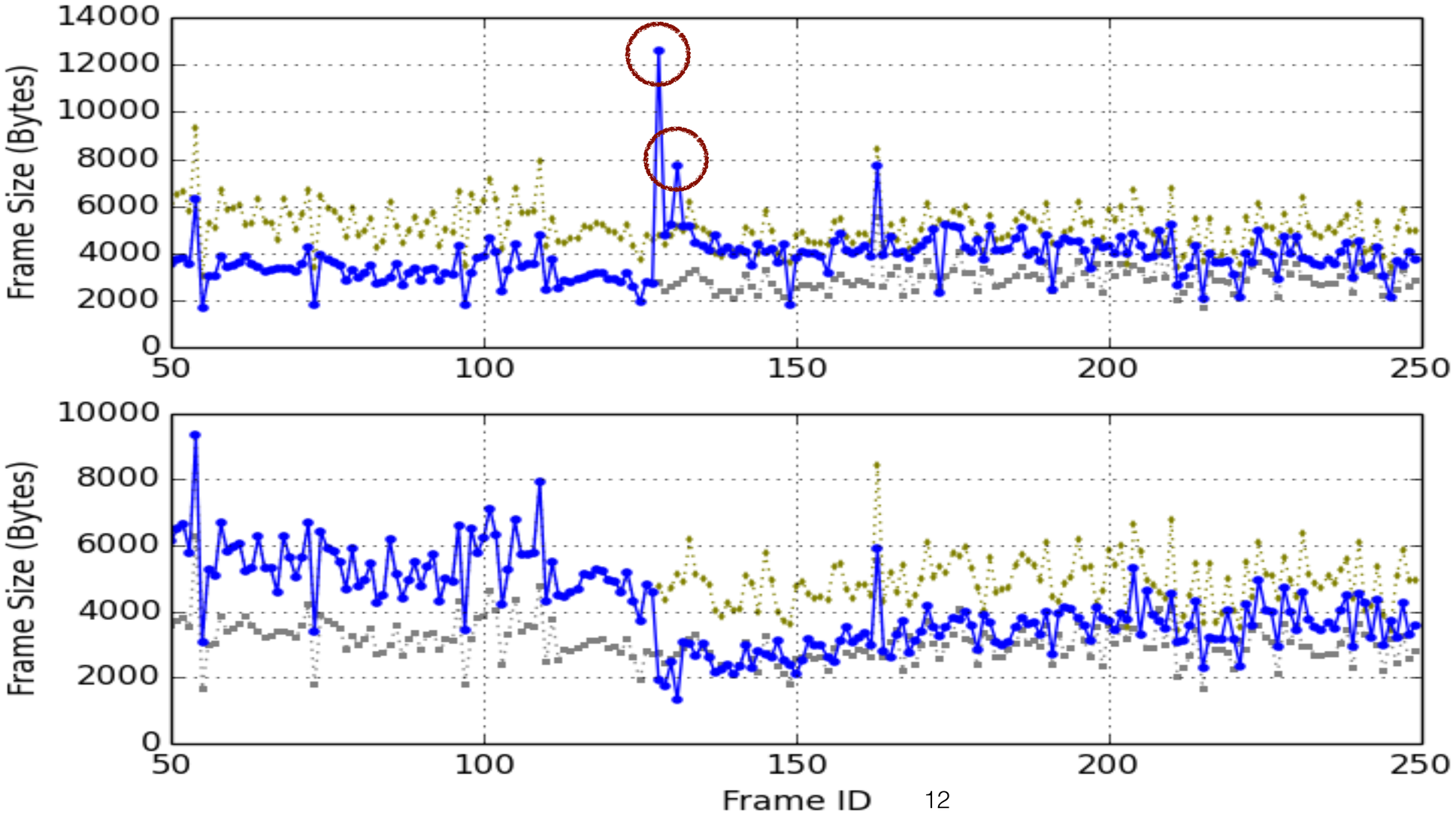
400Kbps -> 1Mbps

- 150% rate increase
- 2 burst frames
- burst ratio: 2.2~3.5

1Mbps -> 400Kbps

- 60% rate decrease
- no burst frame

Frame Size Trace in x264: 600Kbps to/from 1Mbps



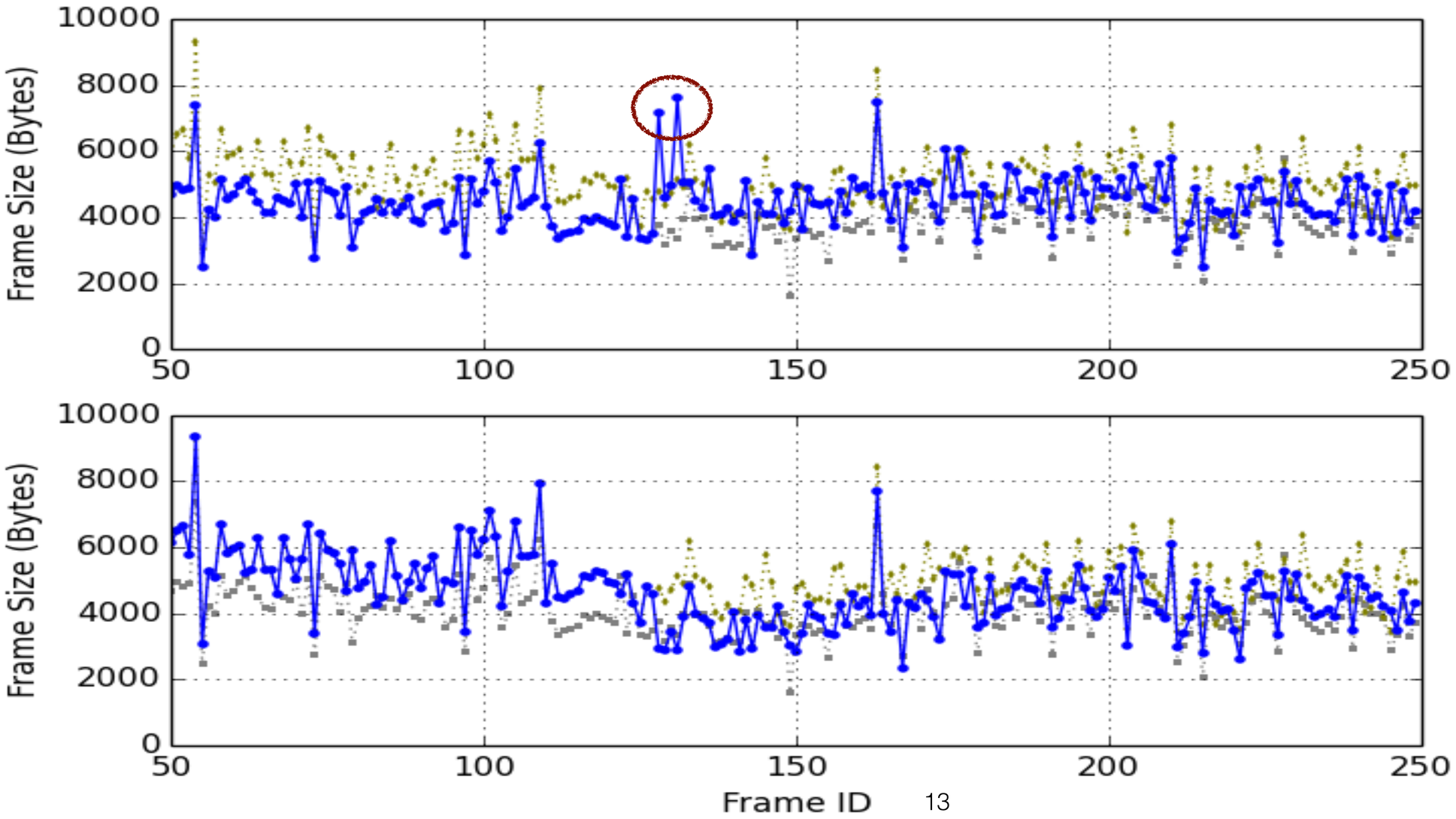
600Kbps -> 1Mbps

- 67% rate increase
- 2 burst frames
- burst ratio: 2~3

1Mbps -> 600Kbps

- 40% rate decrease
- no burst frame

Frame Size Trace in x264: 800Kbps to/from 1Mbps



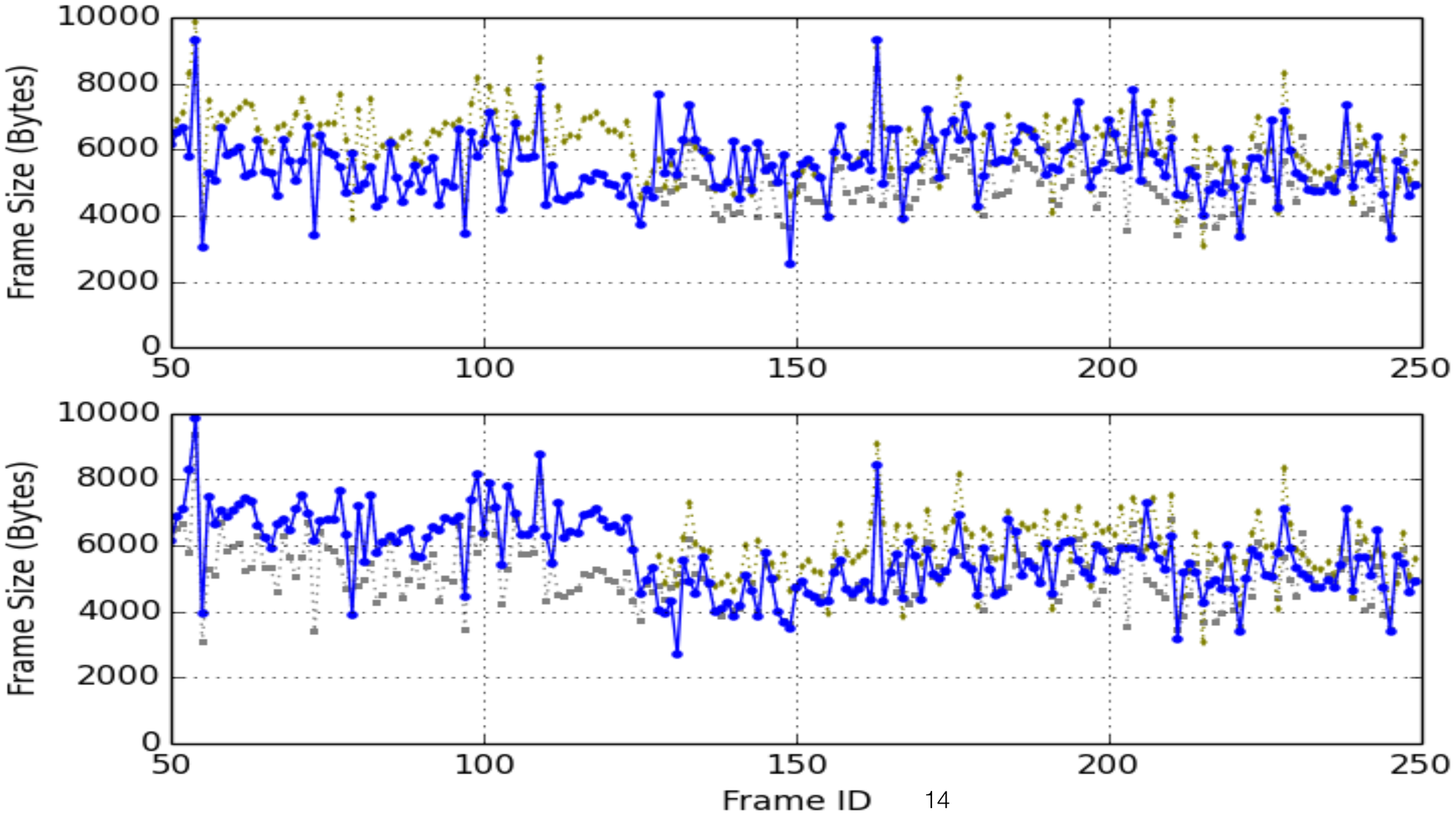
800Kbps -> 1Mbps

- 25% rate increase
- 2 burst frames
- burst ratio ~ 1.8

1Mbps -> 800Kbps

- 20% rate decrease
- no burst frame

Frame Size Trace in x264: 1.2Mbps to/from 1Mbps



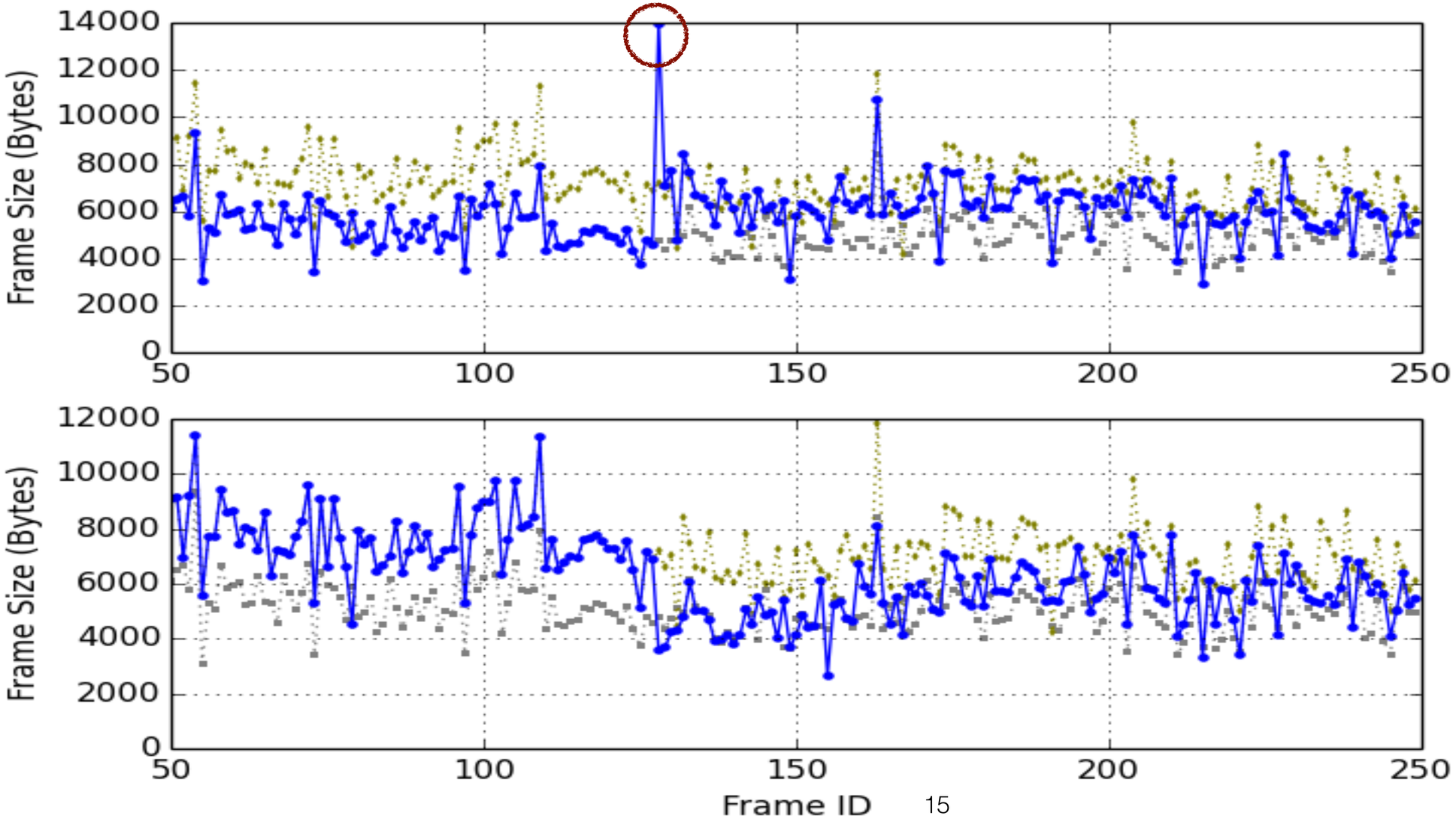
1Mbps -> 1.2 Mbps

- 20% rate increase
- no burst frame

1.2 Mbps -> 1Mbps

- 17 % rate decrease
- no burst frame

Frame Size Trace in x264: 1Mbps to/from 1.4Mbps



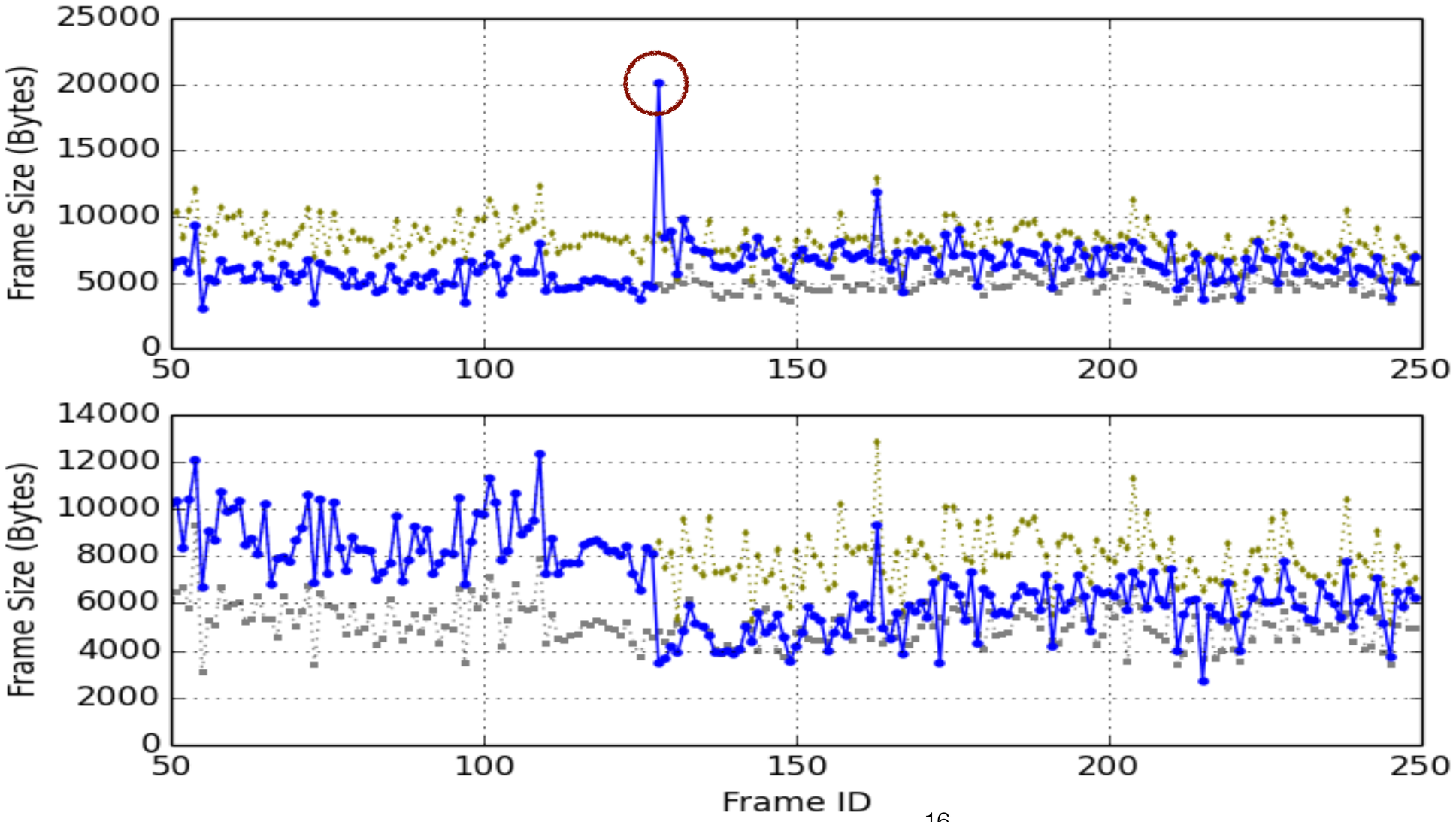
1Mbps -> 1.4Mbps

- 40% rate increase
- 1 burst frame
- burst ratio ~ 2

1.4Mbps -> 1Mbps

- ~30% rate decrease
- no burst frame

Frame Size Trace in x264: 1Mbps to/from 1.6Mbps



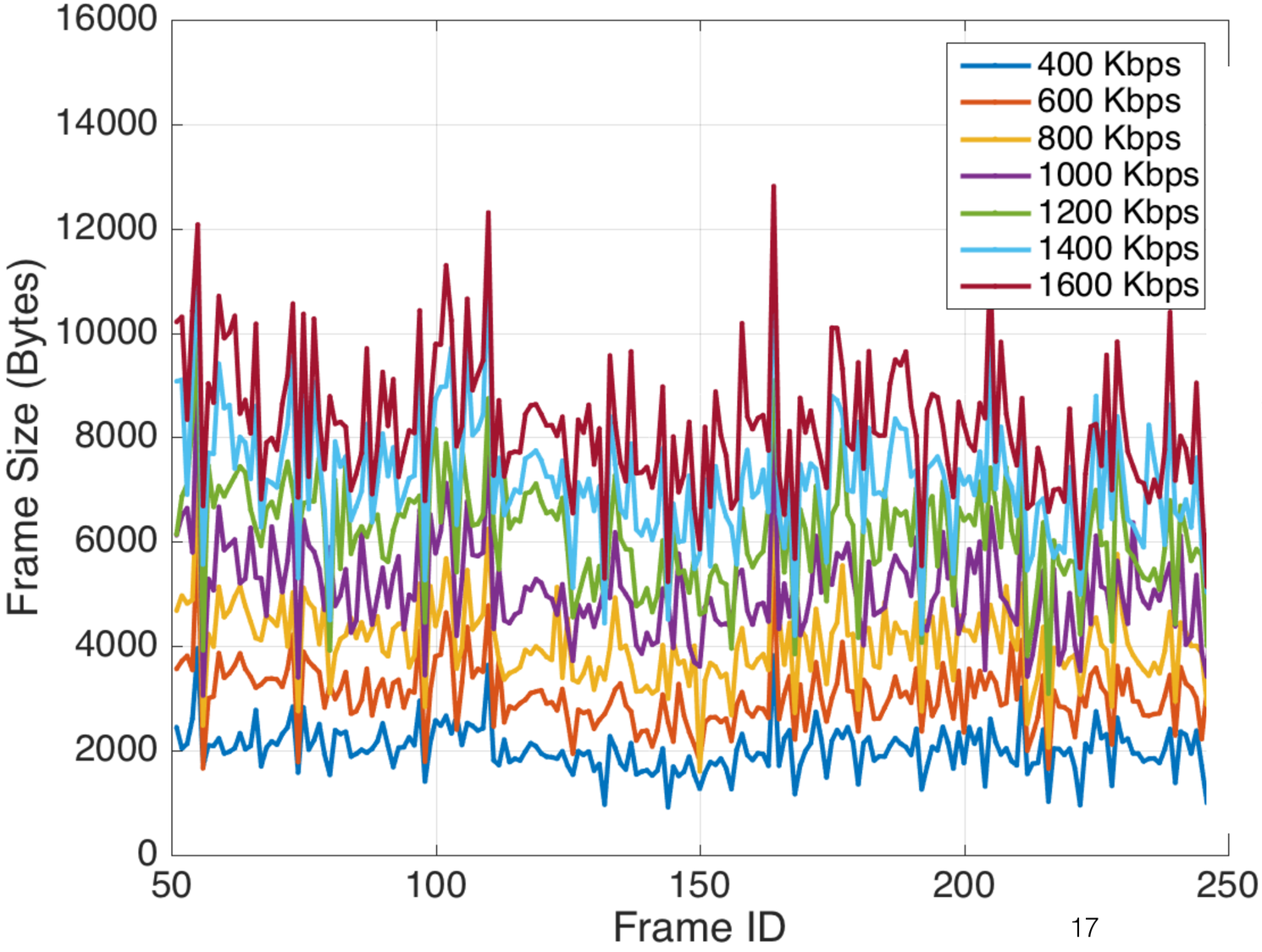
1Mbps -> 1.6Mbps

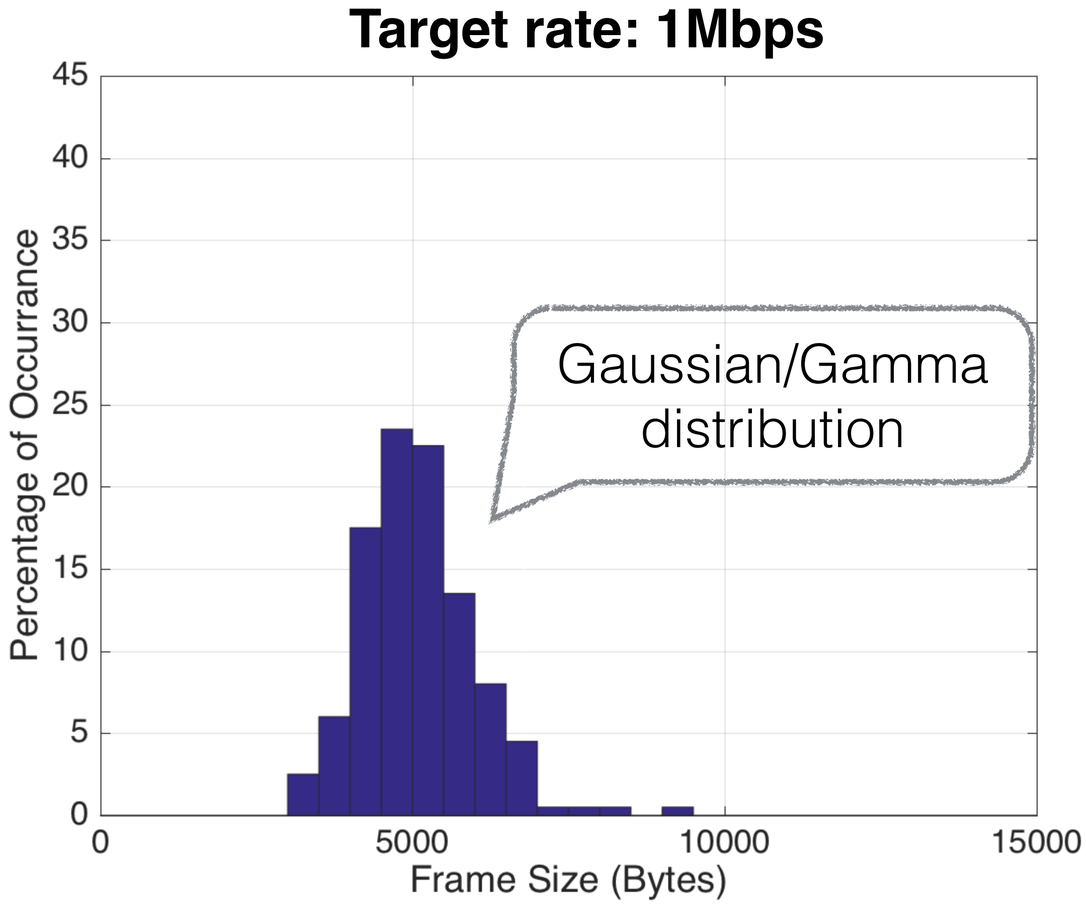
- 60% rate increase
- 1 burst frames
- burst ratio ~ 3.3

1.6Mbps -> 1Mbps

- ~37% rate decrease
- no burst frame

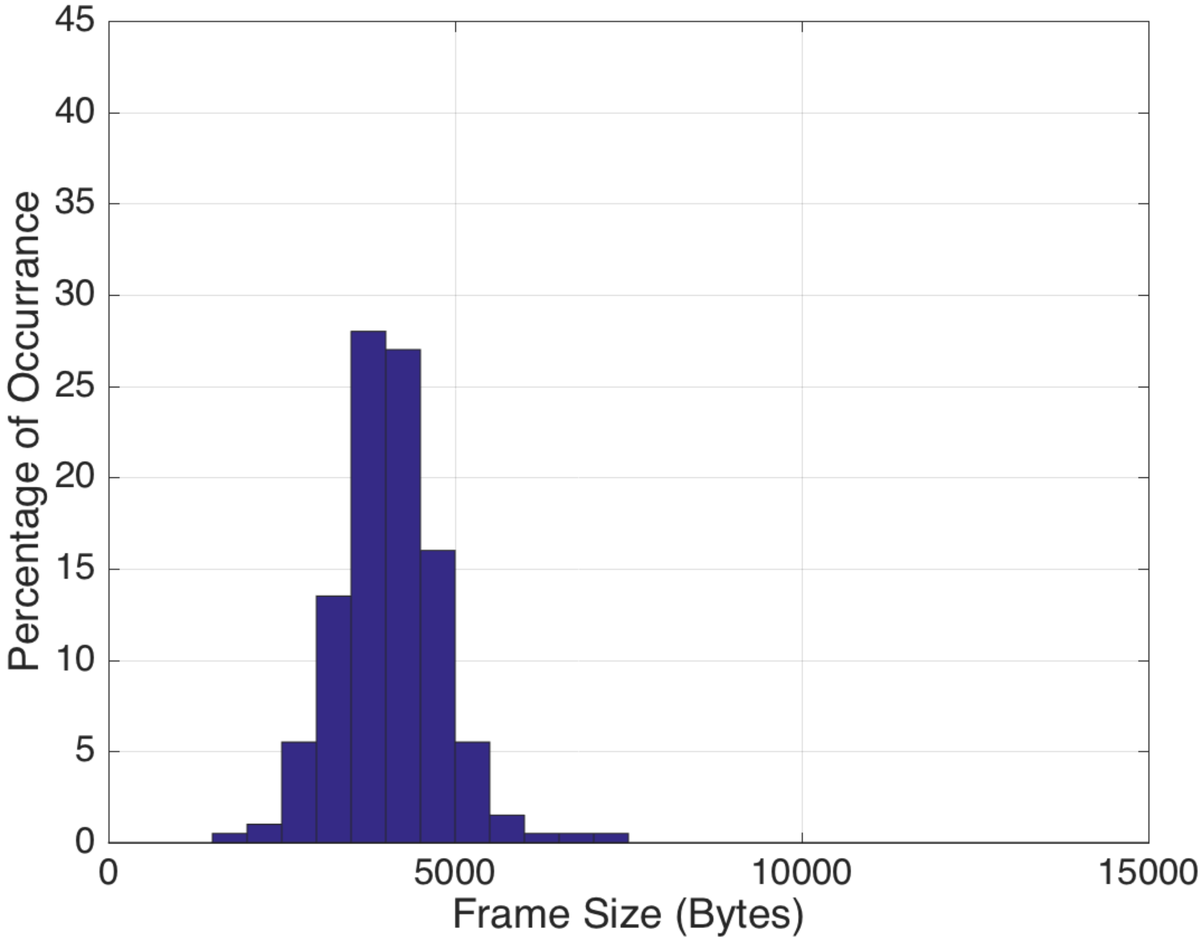
Frame Size Distribution at Steady-State



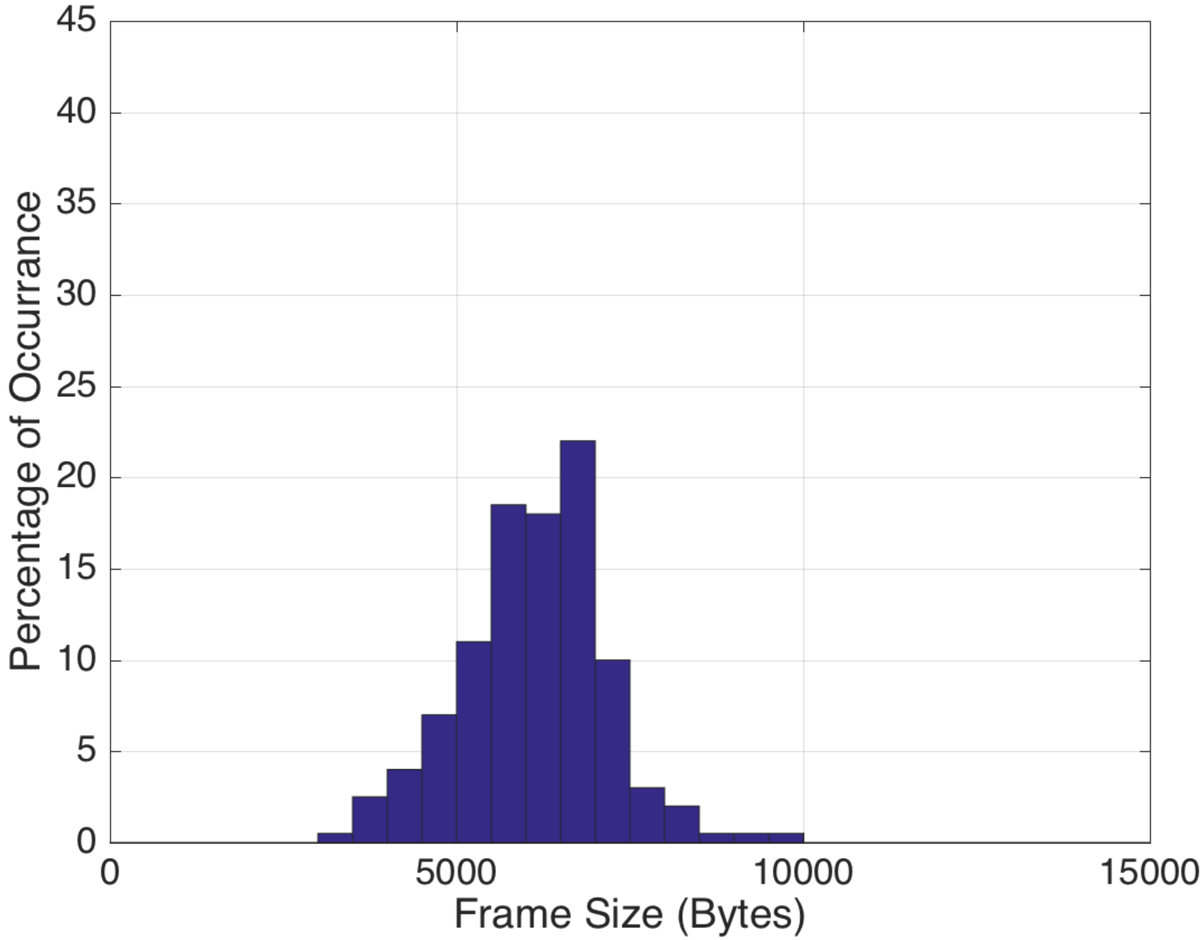


Frame Size Distribution at Steady-State

Avg. Rate = 800 Kbps

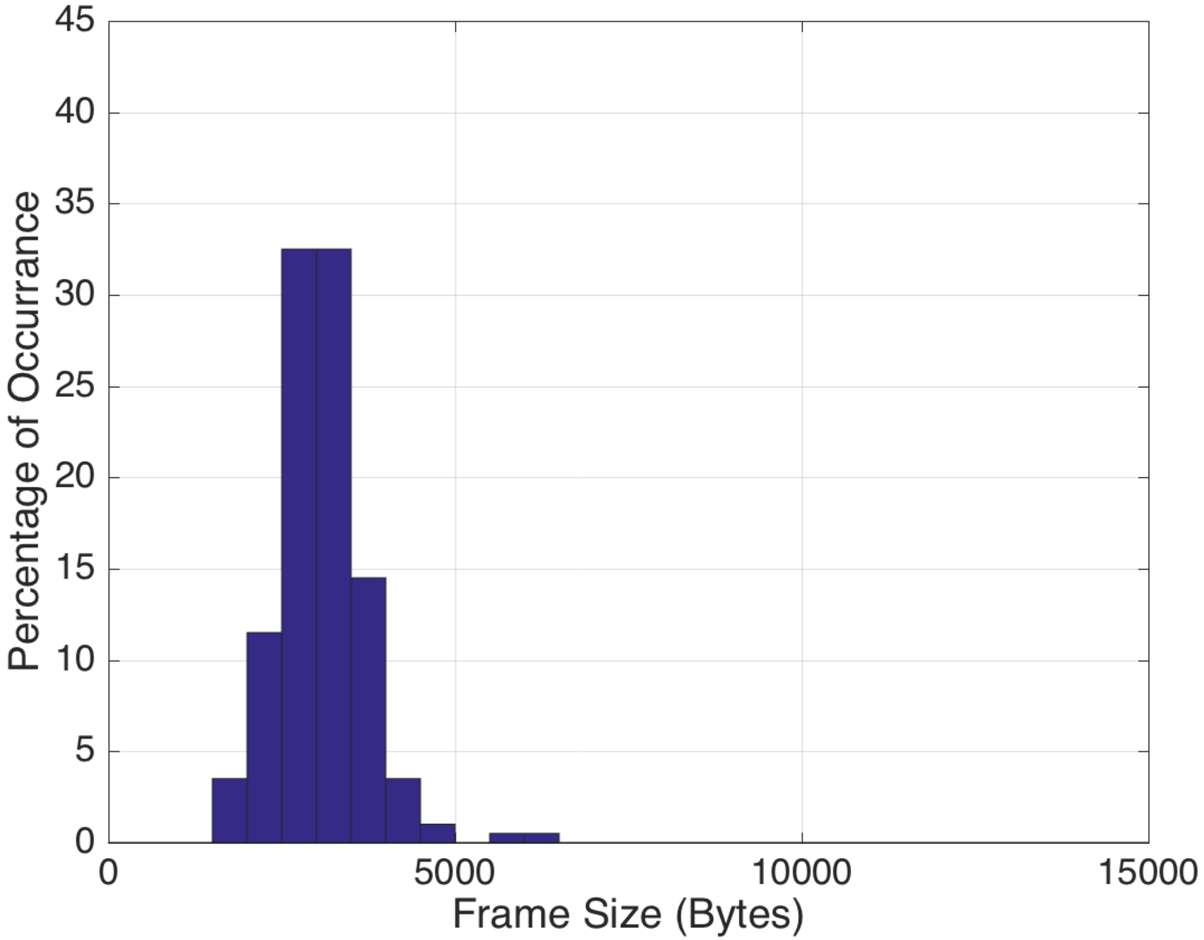


Avg. Rate = 1.2 Mbps

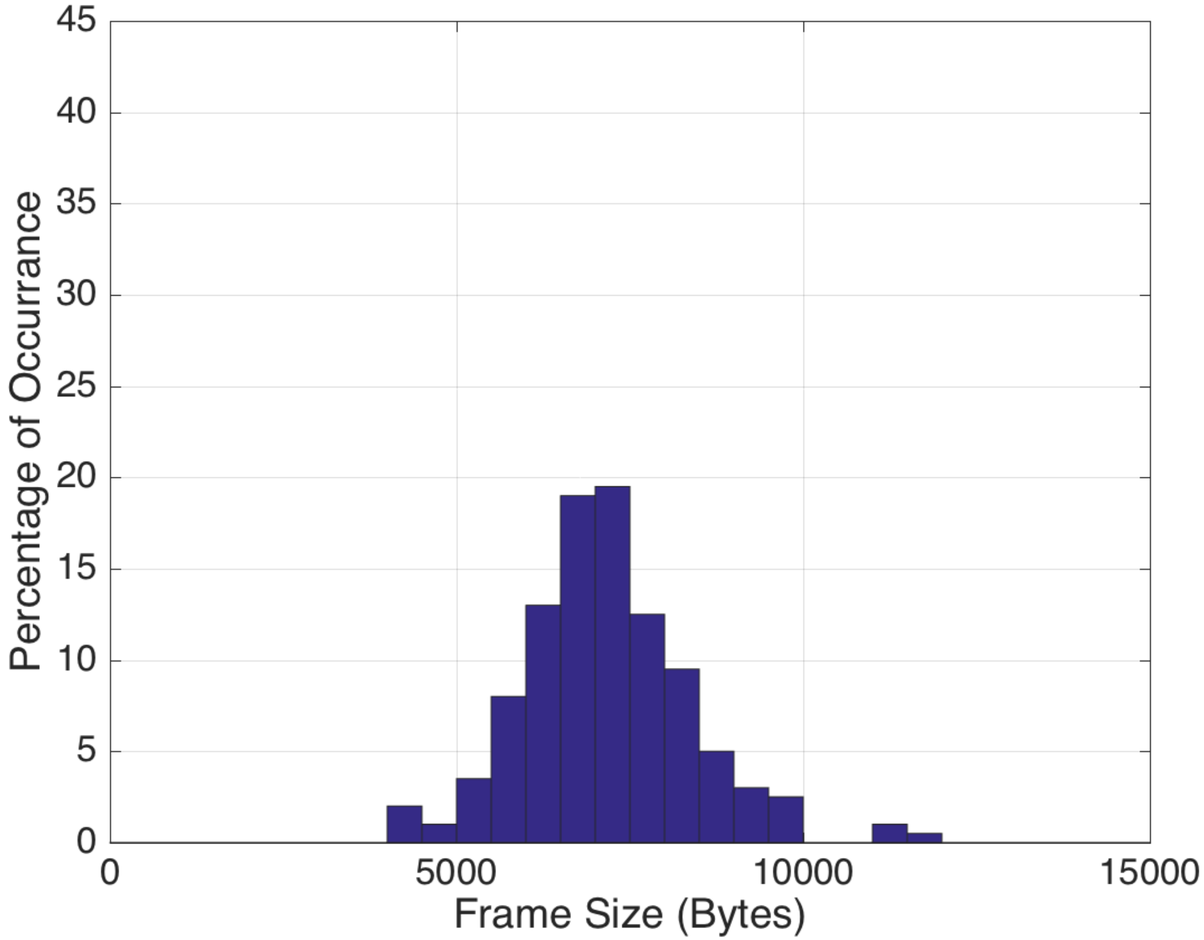


Frame Size Distribution at Steady-State

Avg. Rate = 600 Kbps

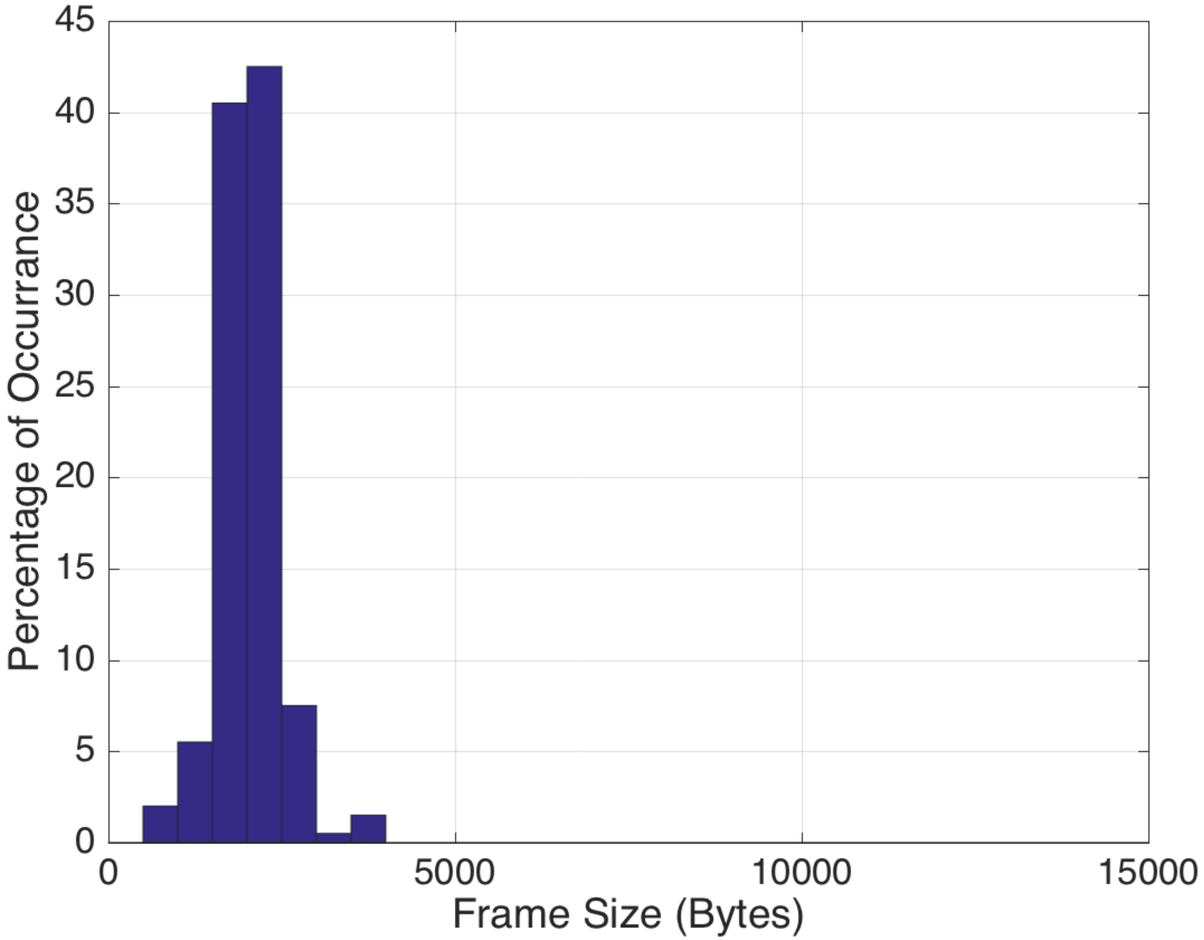


Avg. Rate = 1.4 Mbps

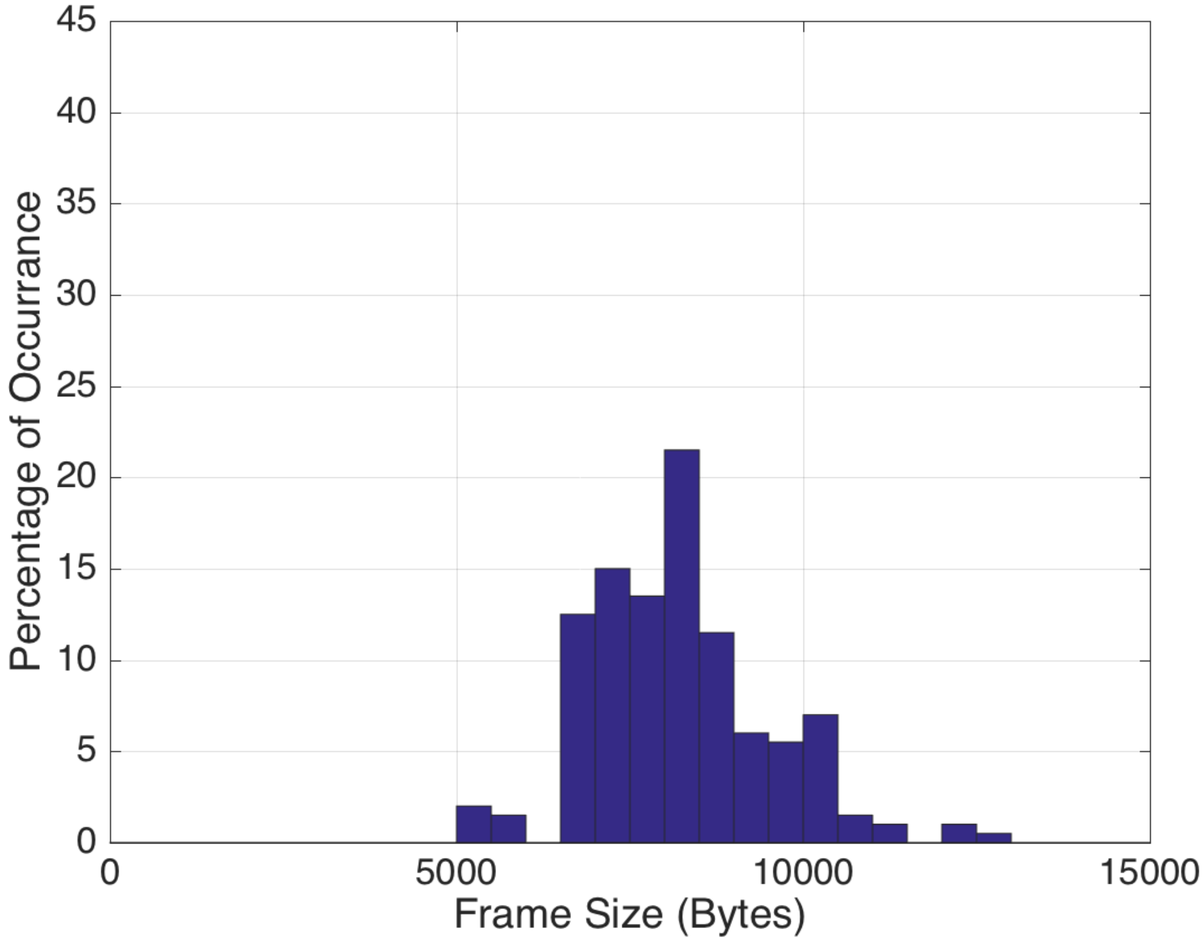


Frame Size Distribution at Steady-State

Avg. Rate = 400 Kbps



Avg. Rate = 1.6 Mbps



Recap of Observations

- Frame sizes after rate transition differ from those generated with a constant target rate: need further investigation with longer test video sequences
- Transient behavior:
  - Introduces burst frames only during rate up-shifting, for significant (e.g., 40%) rate increases
  - Burst frame size: 2-3 times target size
- Steady-state behavior:
  - Frame size distribution can be modeled as Gaussian or Gamma
  - Frame size fluctuates around target size by 16-22%

Summary and Next Steps

- New set of long traces representative of “non-natural” video contents:
- Two new set of traces from video conferencing and x264 codec shows slightly different behaviors in terms of:
  - Transient: presence and size of burst frame,
  - Steady-state: frame size distribution and range of fluctuation.
- Next steps:
  - Revise recommended model parameters in draft based on above analysis
  - A hybrid model to combine trace and statistical models
  - Investigate rate trace after transition for longer talking-head video sequences
- Input from WG? Reviews on Draft? Recommended video sequences?