Evaluation of SCReAM and GCC

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Ericsson Research

BASIC TEST CASES

INTRODUCTION

Tests done according to draft-sarker-rmcat-eval-test-01

Presented results have

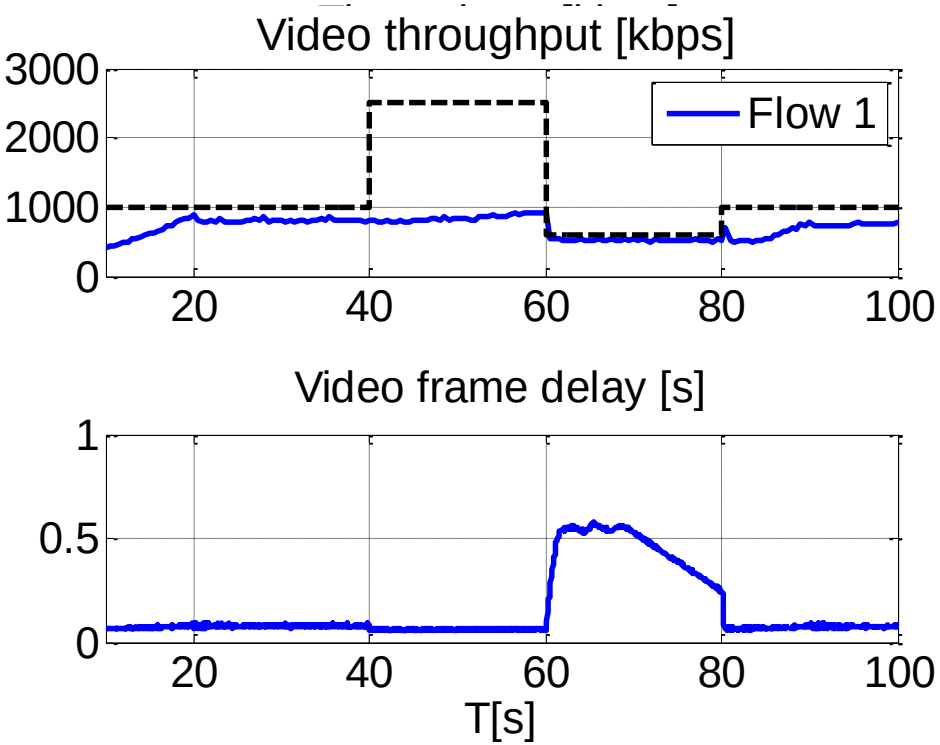
- one way propagation delay = 50ms
- More test results are provided in extra slides section at the end of this slide deck.

Algorithms

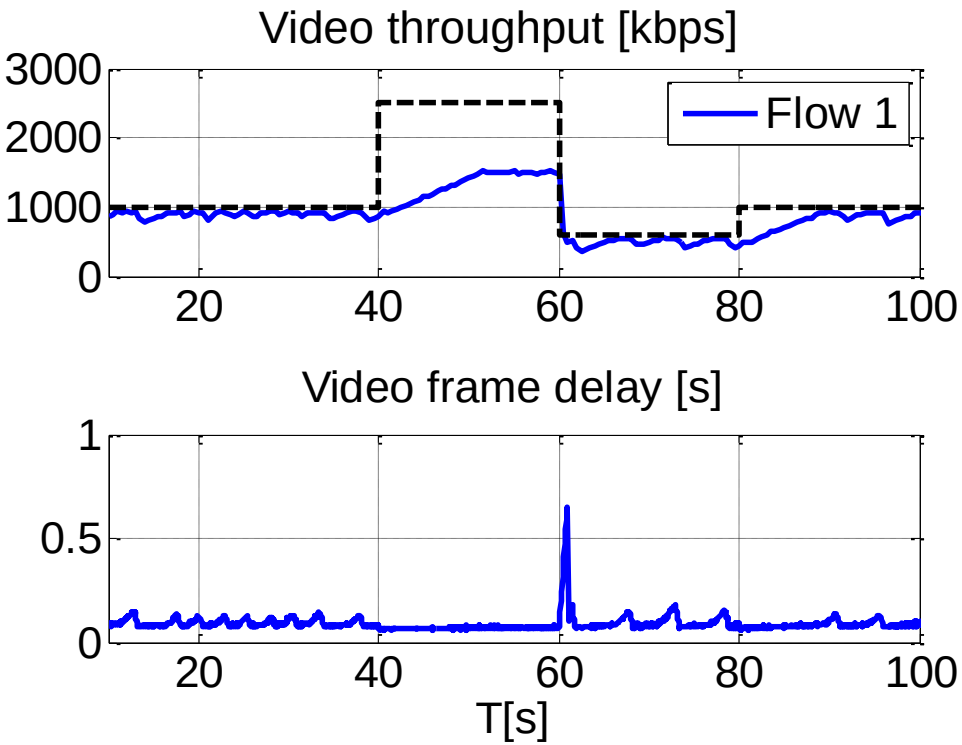
- Google Congestion Control (GCC)
  - draft-alvestrand-rmcat-congestion-02
- **S**elf-**C**locked **R**at**e** **A**daptation for **M**ultimedia (SCReAM)
  - draft-johansson-rmcat-scream-cc-02
    - Video codec frame skipping enabled (threshold 100ms)

VARIABLE BW SINGLE FLOW (DROP TAIL 300MS)

SCReAM utilizes the available bandwidth better than GCC and still keeps the latency low.



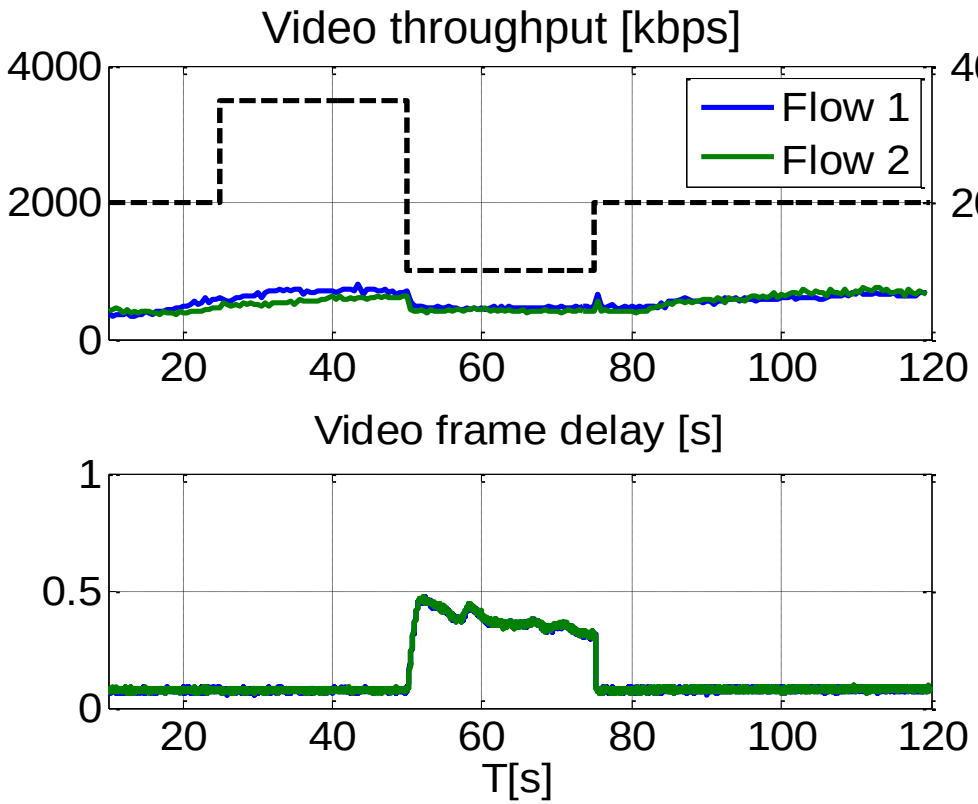
GCC



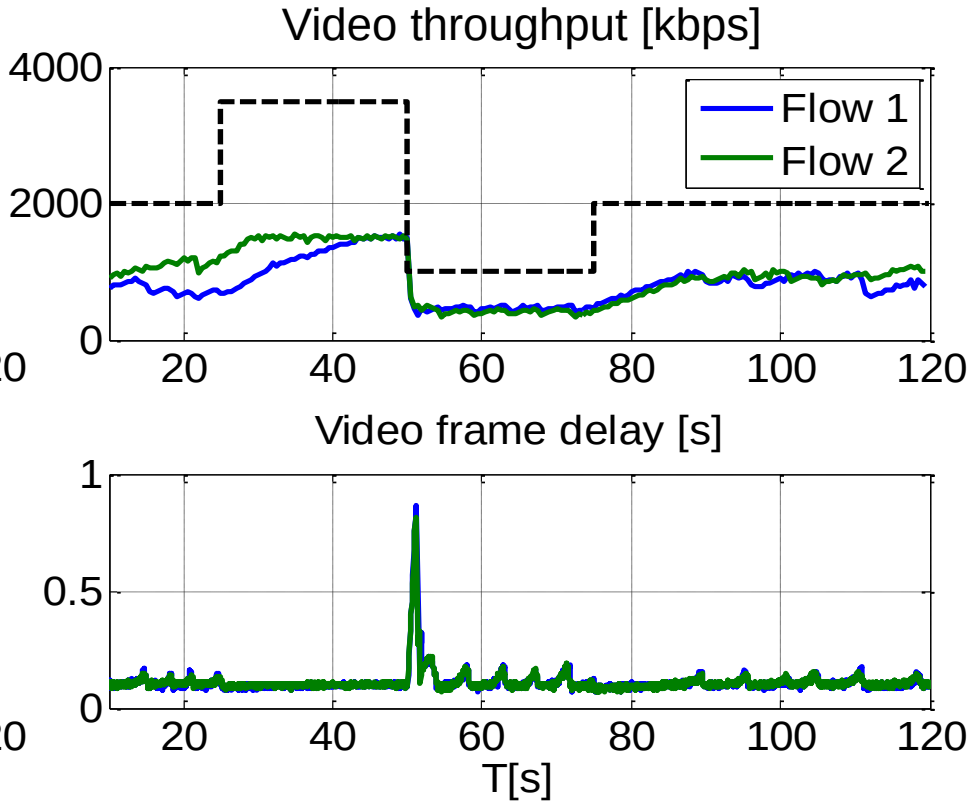
SCReAM

VARIABLE BW MULTIPLE FLOWS (DROP TAIL 300MS)

SCReAM achieves higher bandwidth utilization while keeping the fairness reasonable. GCC achieves better fairness at the cost of bandwidth utilization.



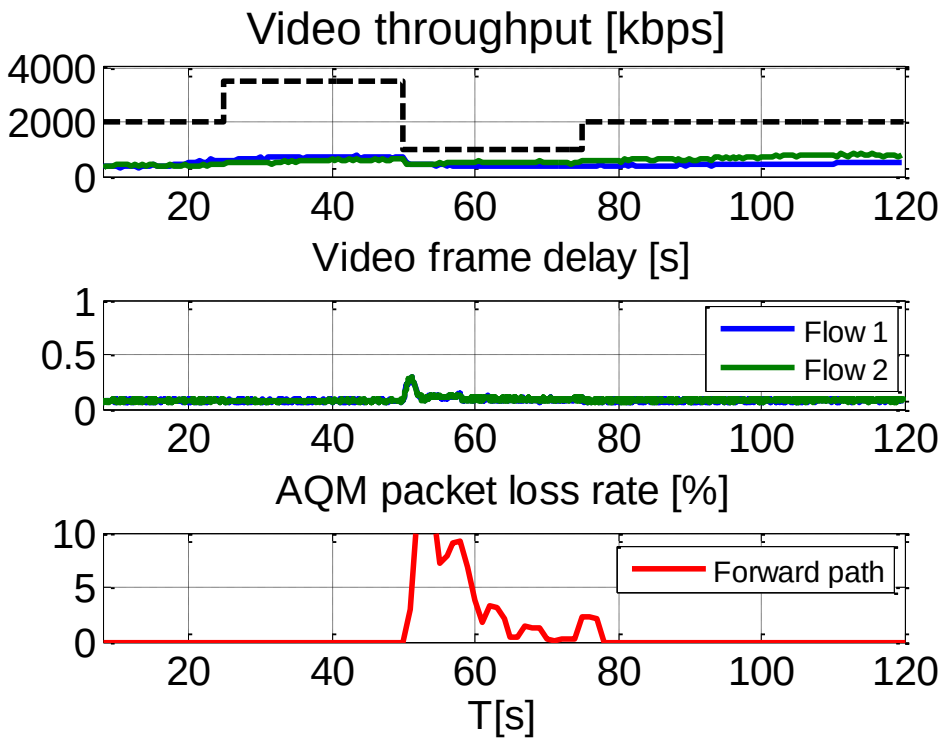
GCC



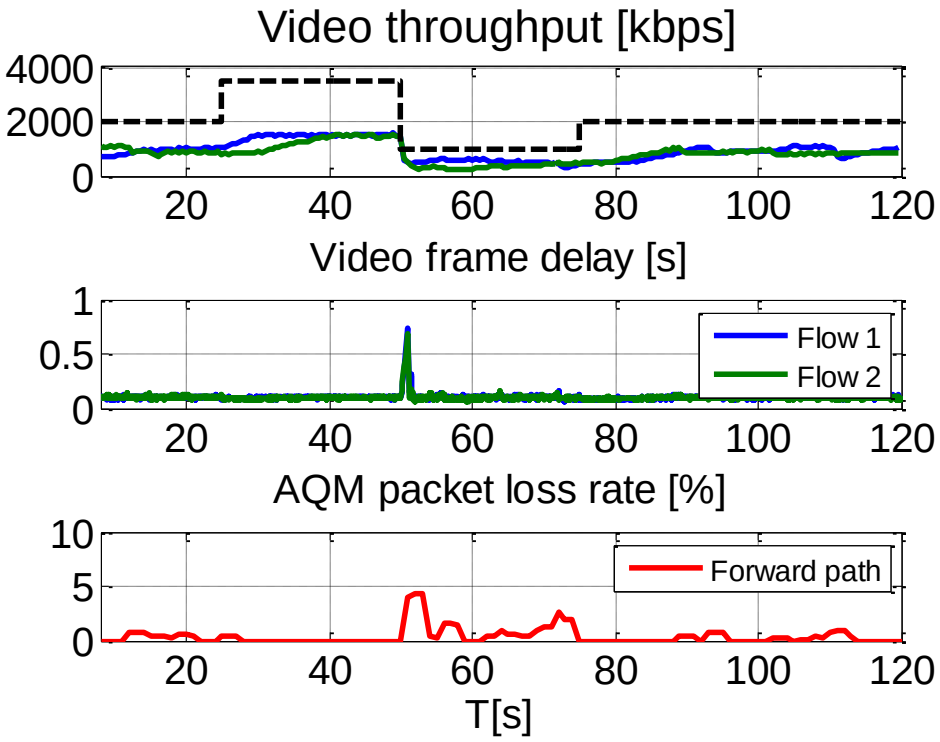
SCReAM

VARIABLE BW –MULTIPLE FLOWS (CODEL AQM)

With SCReAM the packet loss is reduced. With GCC even if the flows have lower throughput, they still observes higher packet loss.



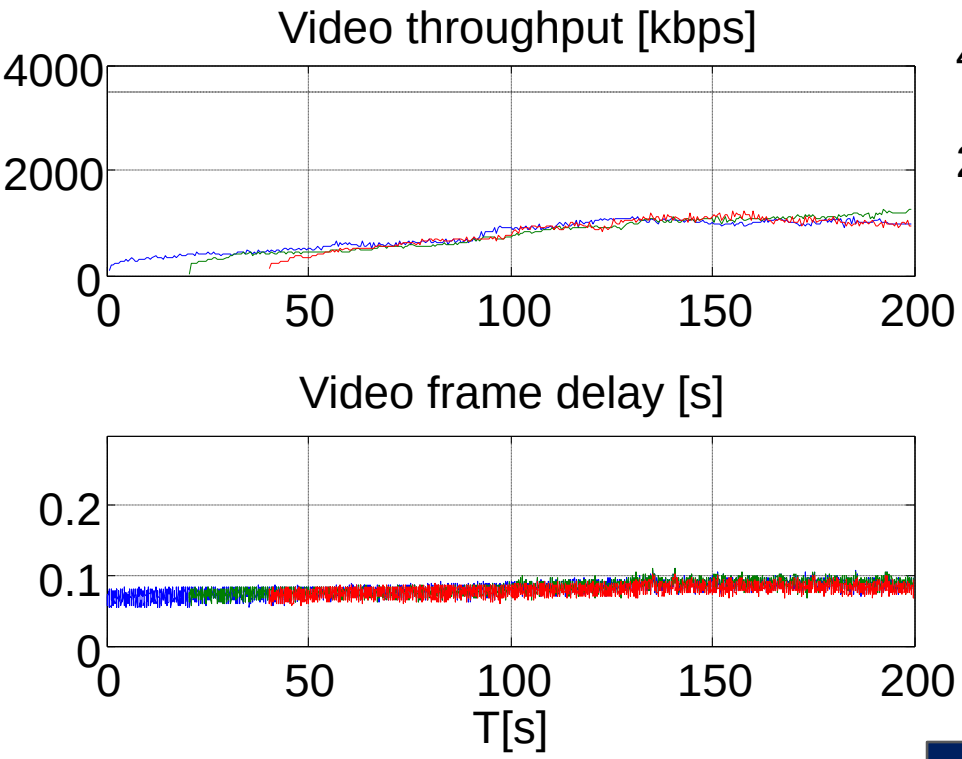
GCC



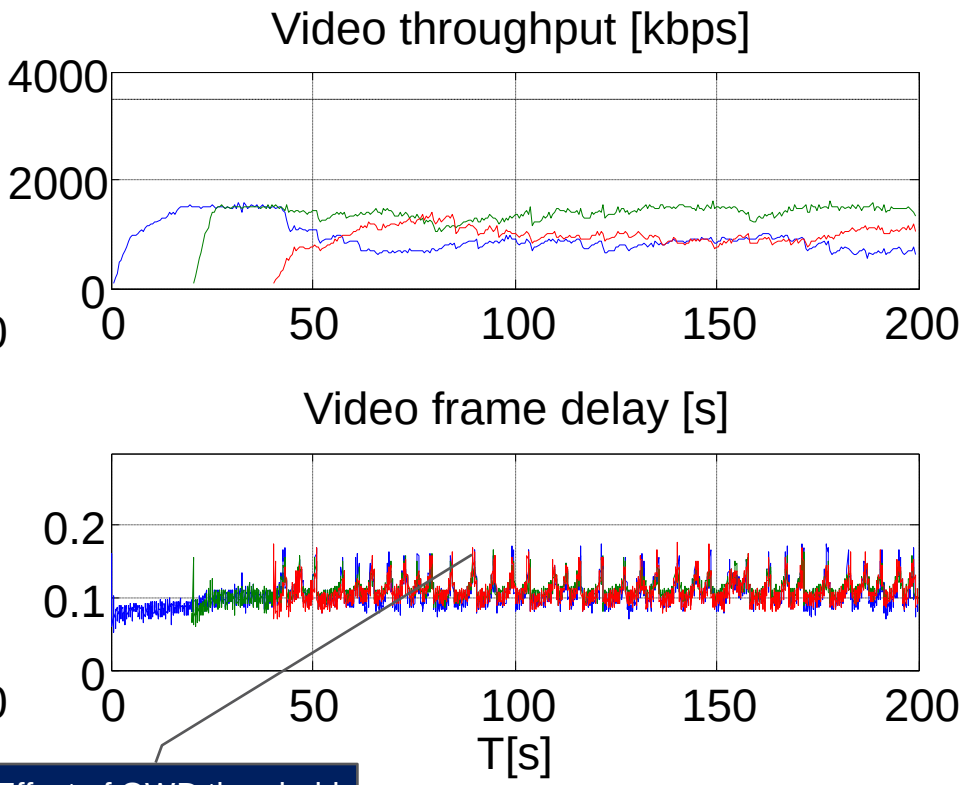
SCReAM

COMPETING RMCAT TRAFFIC

SCReAM achieves higher bandwidth throughout the session but GCC achieves more fairness.



GCC

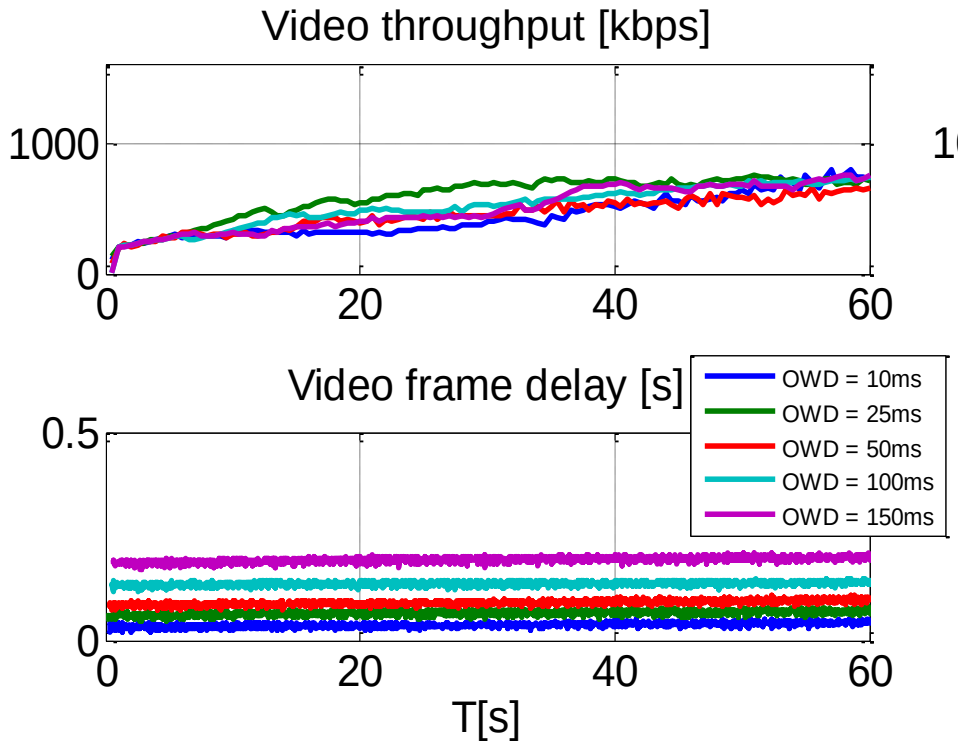


Effect of OWD threshold

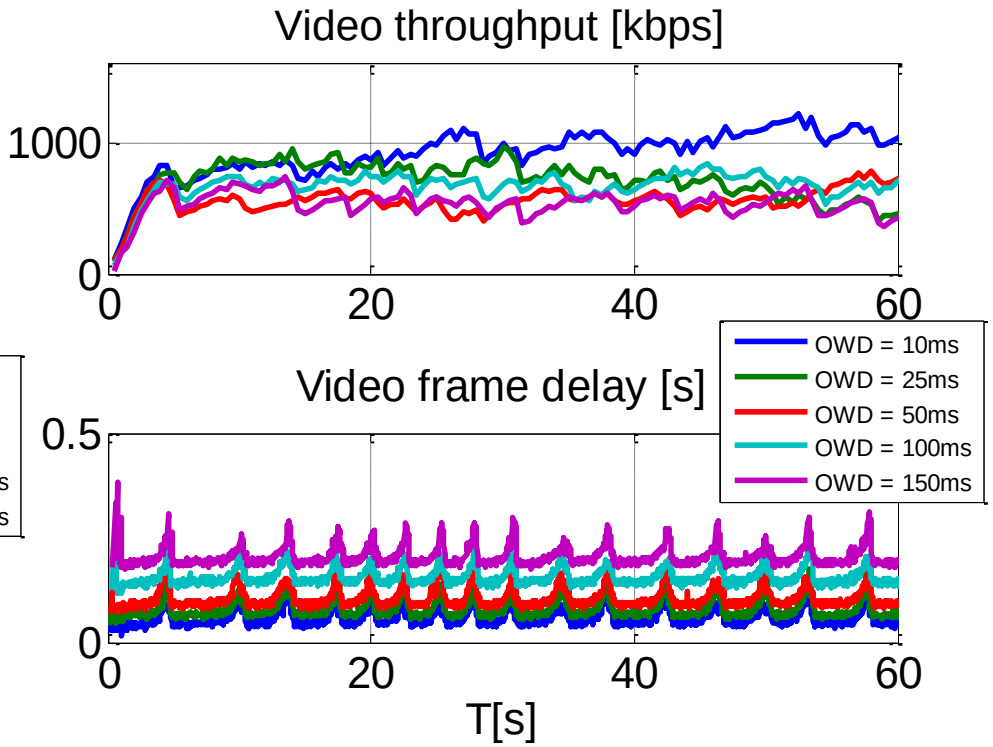
SCReAM

RTT FAIRNESS

GCC is more fair in terms of video throughput distribution.



GCC

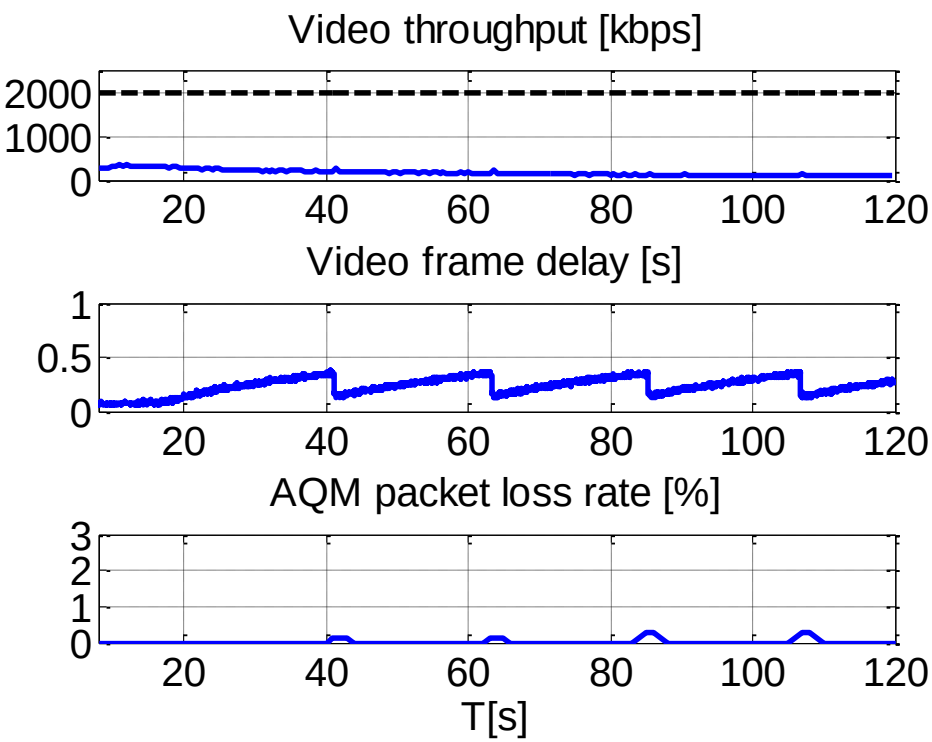


SCReAM

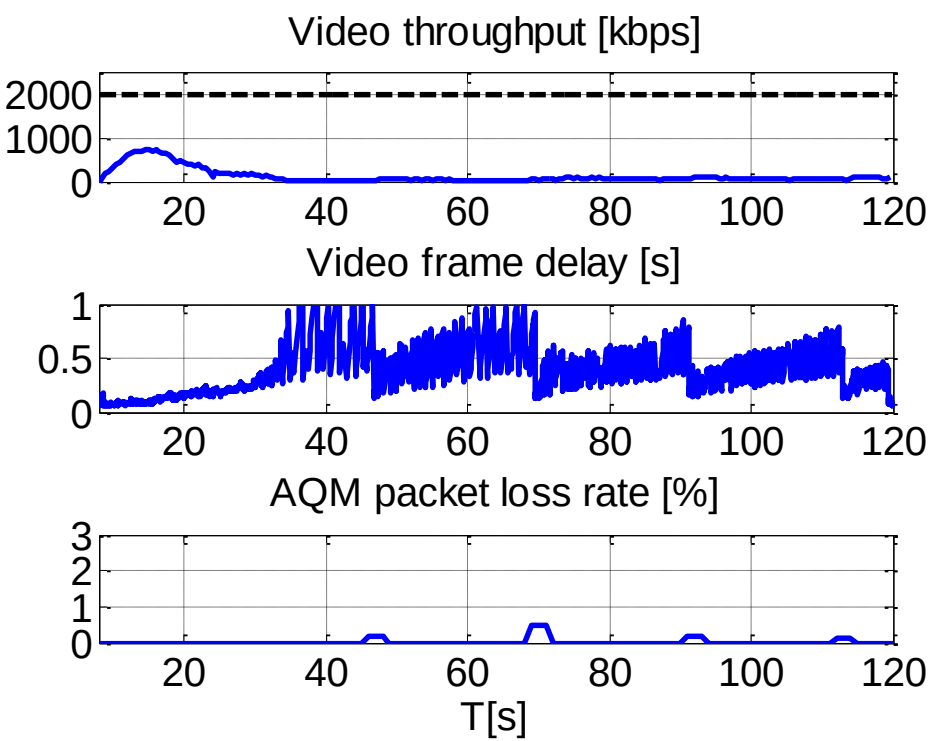
COMPETING TCP TRAFFIC
(DROP TAIL 300MS)

Additional delay with SCReAM

- video frames are queued up as the SCReAM network congestion control backs off more in response to packet loss.



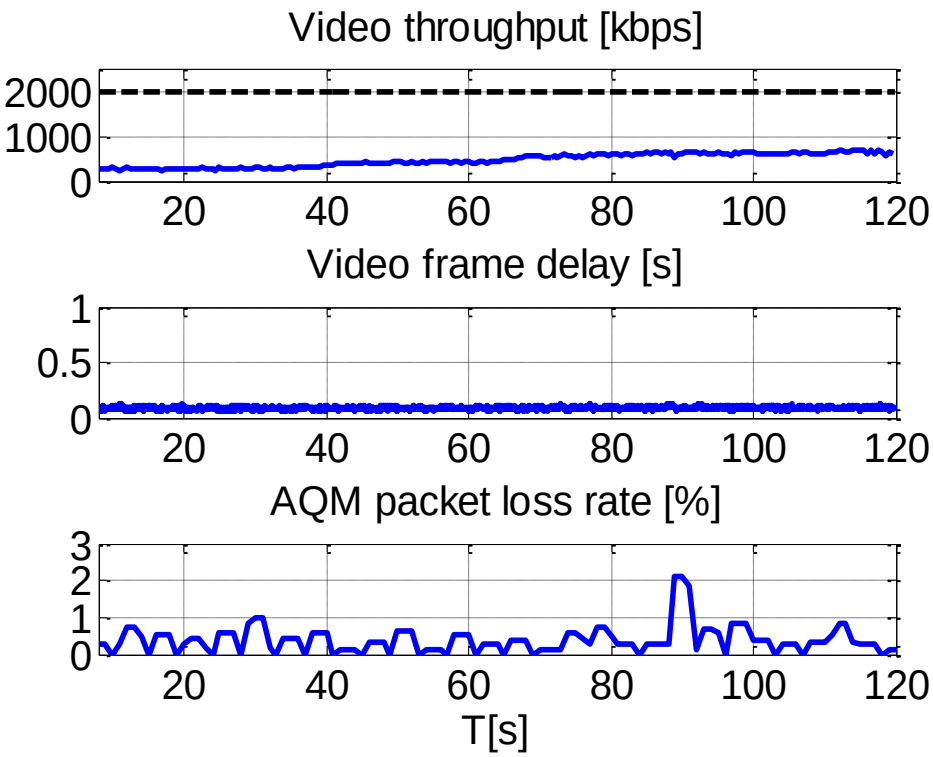
GCC



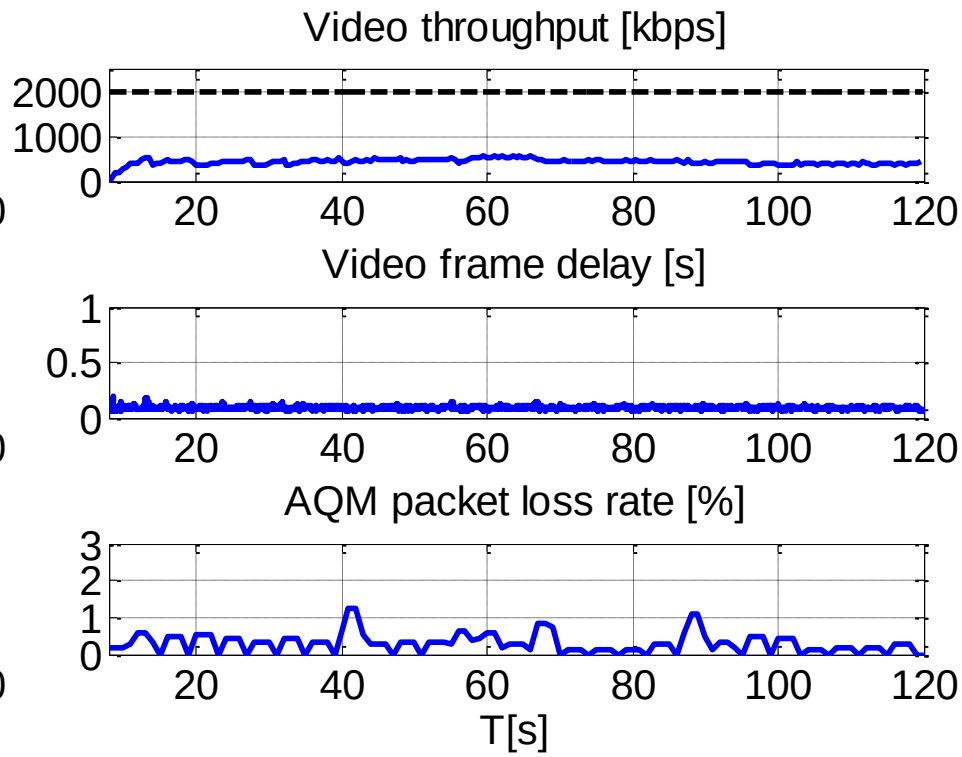
SCReAM

COMPETING TCP TRAFFIC
(CODEL AQM)

With AQM, SCReAM is able to overcome low video throughput issue and does it with lower packet loss rate.



GCC



SCReAM

CELLULAR TEST CASES

INTRODUCTION

Test cases according to draft-sarker-rmcat-cellular-eval-test-cases-01

- Downlink
  - RTT : 40ms, UE speed : 3km/h, AQM : On; FTP load 4Mbps/cell
- Uplink
  - RTT : 40ms, UE speed : 3km/h, AQM : On; FTP load 2Mbps/cell
- More results are in the extra slides section at the end

Algorithms

- 300kbps fixed bitrate
- Google Congestion Control (GCC)
  - draft-alvestrand-rmcat-congestion-02
- **S**elf-**C**locked **R**at**e** **A**daptation for **M**ultimedia (SCReAM)
  - draft-johansson-rmcat-scream-cc-02
    - Video codec frame skipping enabled (threshold 100ms)

METRICS

Latency (IP packet and video frame)	• Average latency • Tail latency : 95% of all users have a e2e latency that is lower than X for 98% of the packets (or frames)
Packet loss rate	• Average Loss rate (whole session) • 98%ile • 90%ile
Bitrate (measured on the receiving side = goodput)	• Average bitrate (last 20 seconds of the user lifetime) • 10% bitrate: Average bit rate for the 10% worst off users
Cell throughput	
Average FTP throughput	

GENERAL VERDICT

GCC

- Adaptive gamma gives good throughput but still observe high delay spikes at increased load levels

SCReAM

- Functional stability with reasonably high load levels
- Large delay spikes are avoided because of self-clocking and frame skipping
- Generally highest throughput in downlink and uplink
- Overall achieves lowest packet loss rates

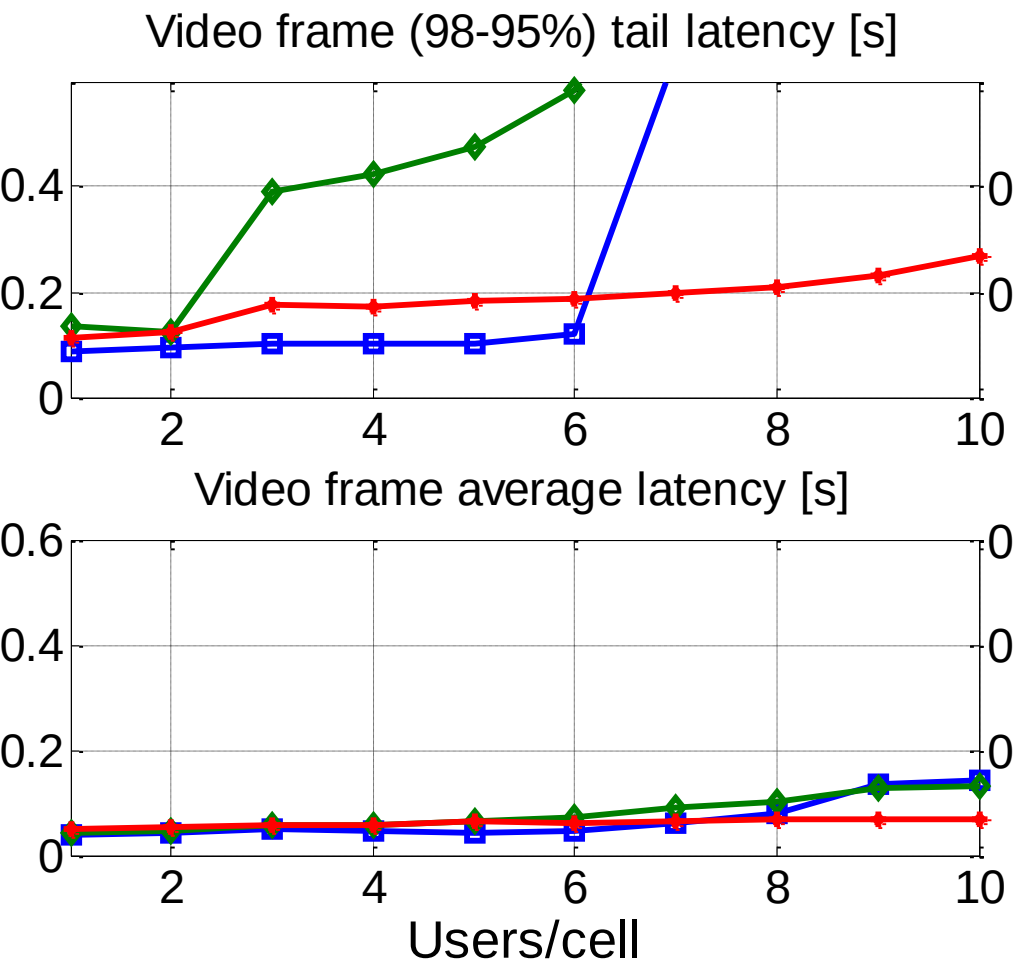
Disclaimer

- The users/cell indications and the associated performance metrics should not be treated as exact values as there are lots of dependencies on propagation models, antenna configurations, scheduler implementations, other cross traffic involved. Therefore, the figures should be read as a comparison between congestion control algorithms under the same given network conditions.

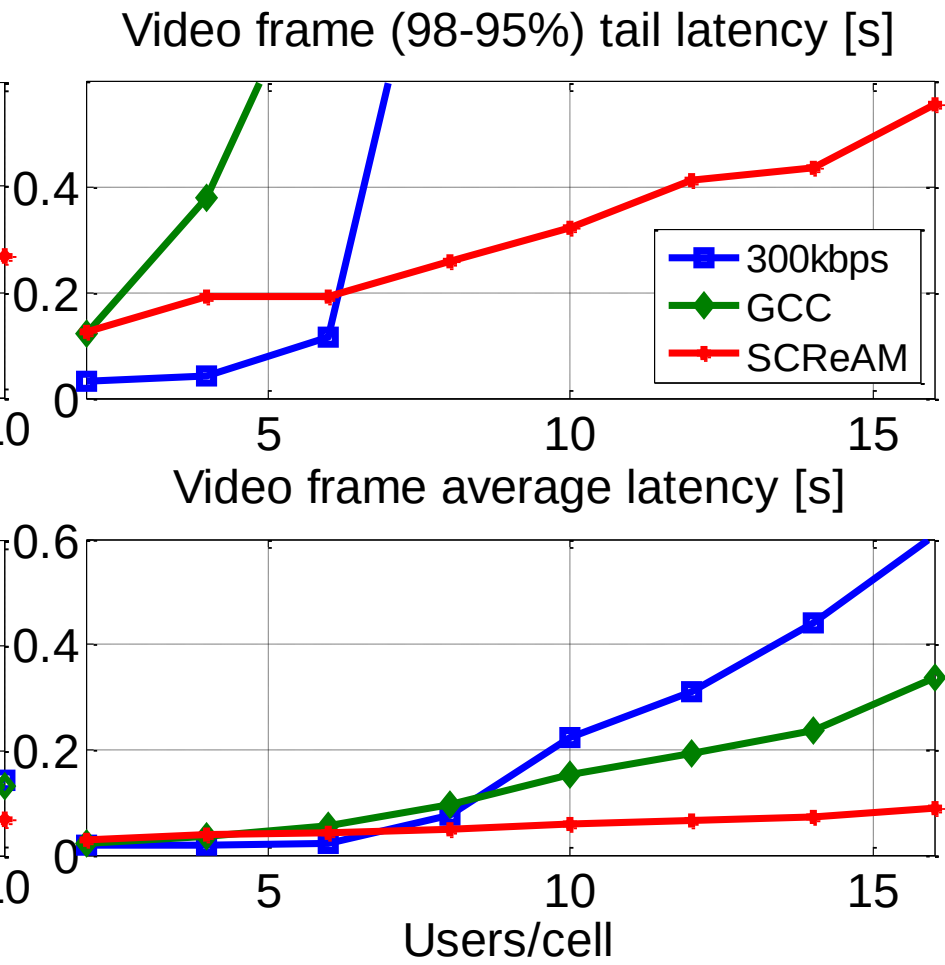
VIDEO FRAME LATENCY

SCReAM is able to keep latency low even in high load

Uplink

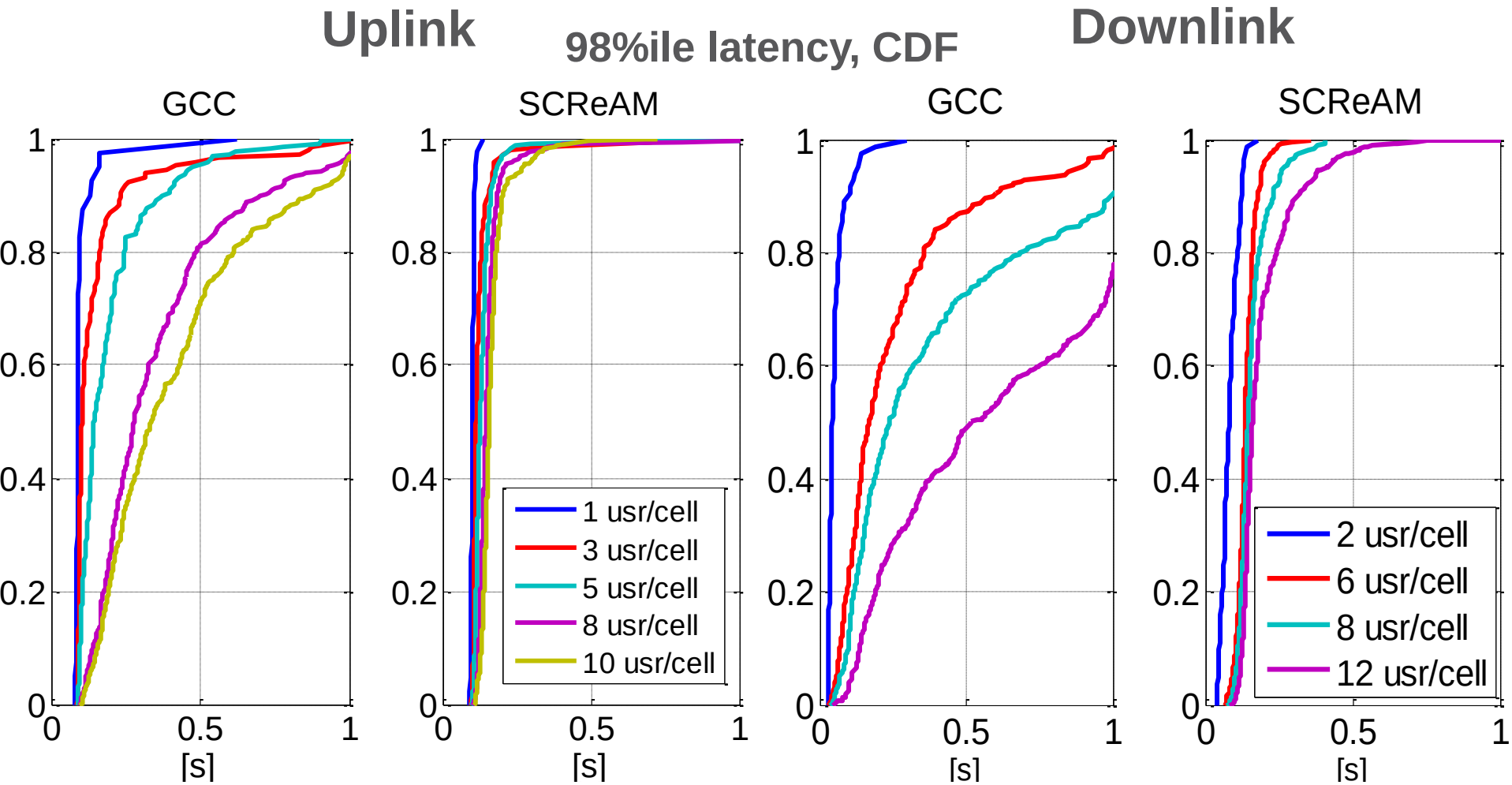


Downlink



VIDEO FRAME LATENCY

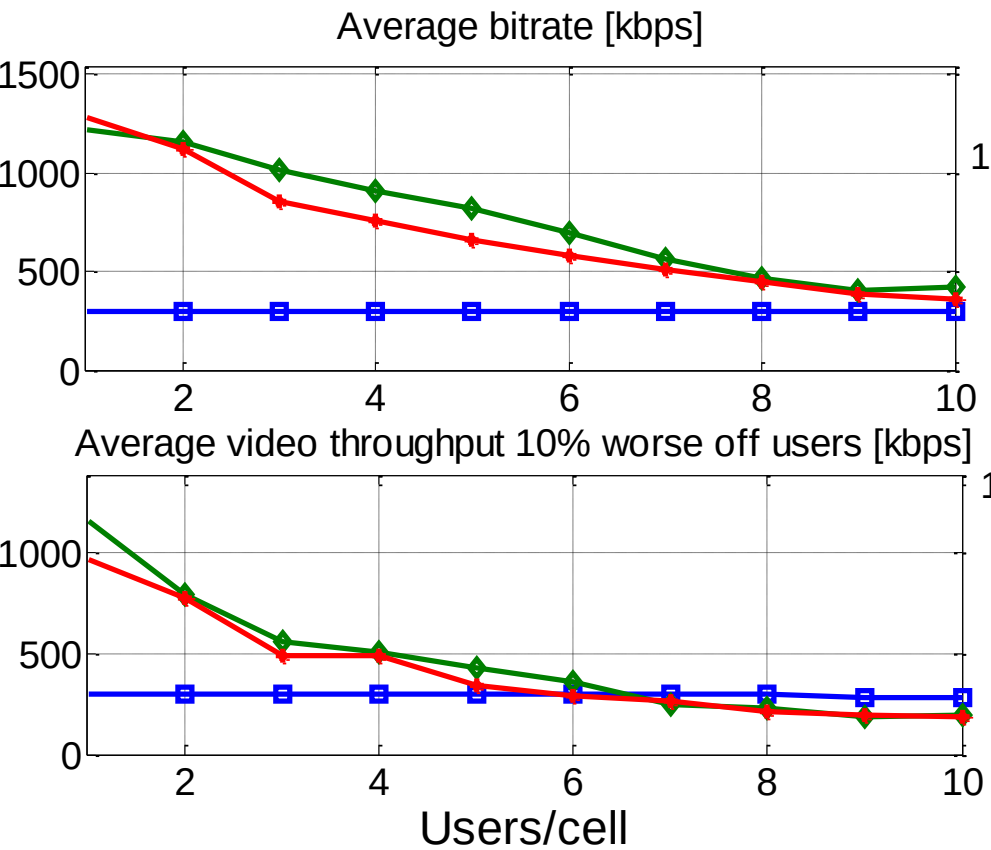
SCReAM is able to keep latency low even in high load



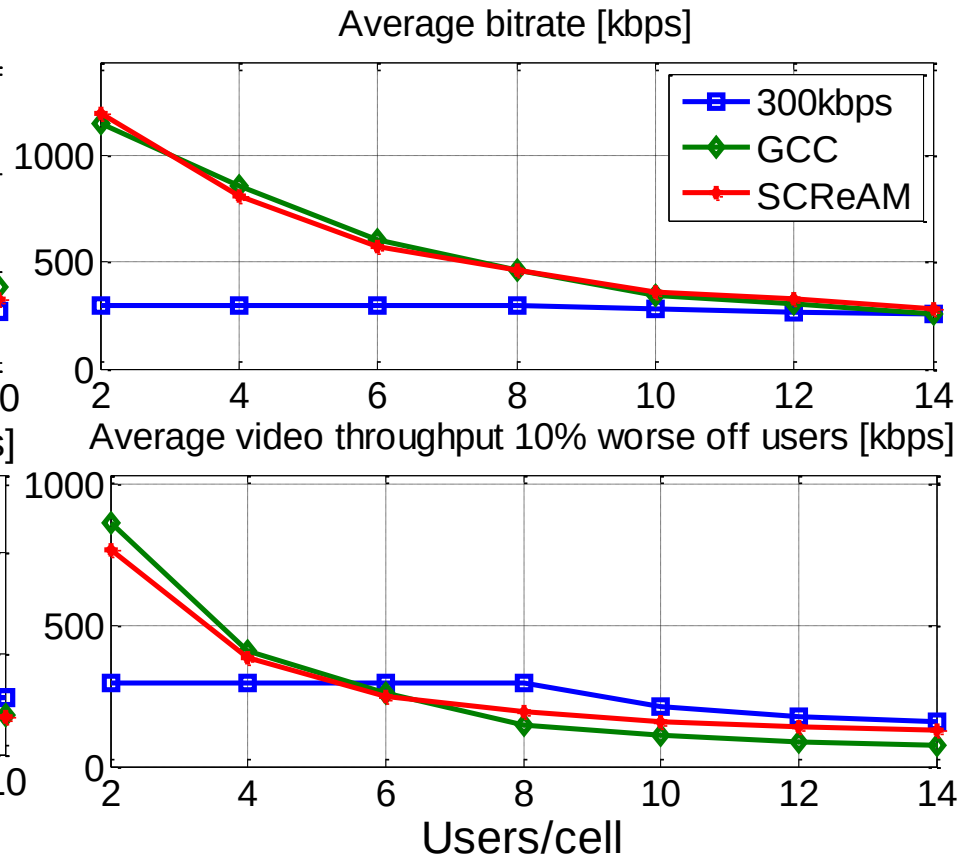
BITRATE

SCReAM achieves almost same or higher bitrate while keeping the latency low

Uplink



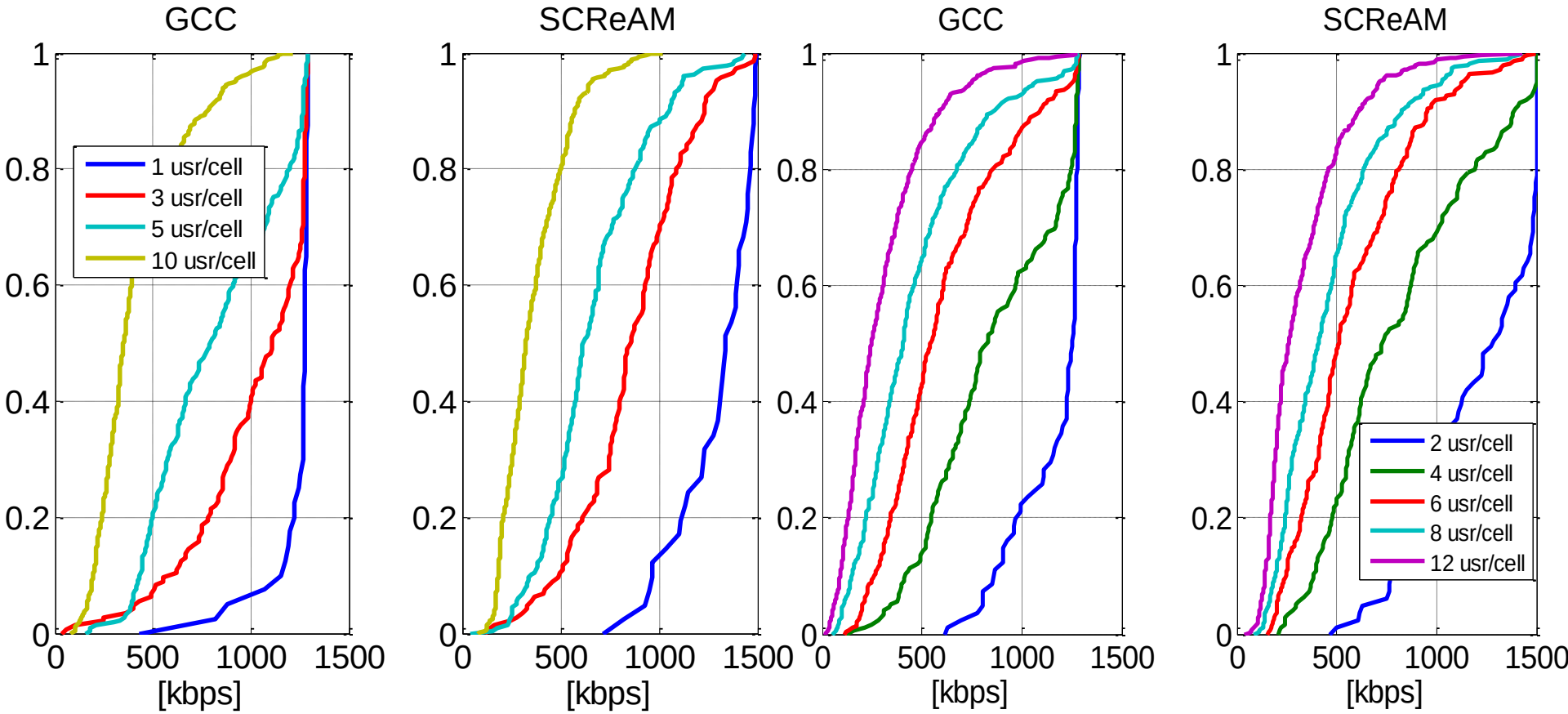
Downlink



BITRATE

SCReAM achieves almost same or higher bitrate while keeping the latency low

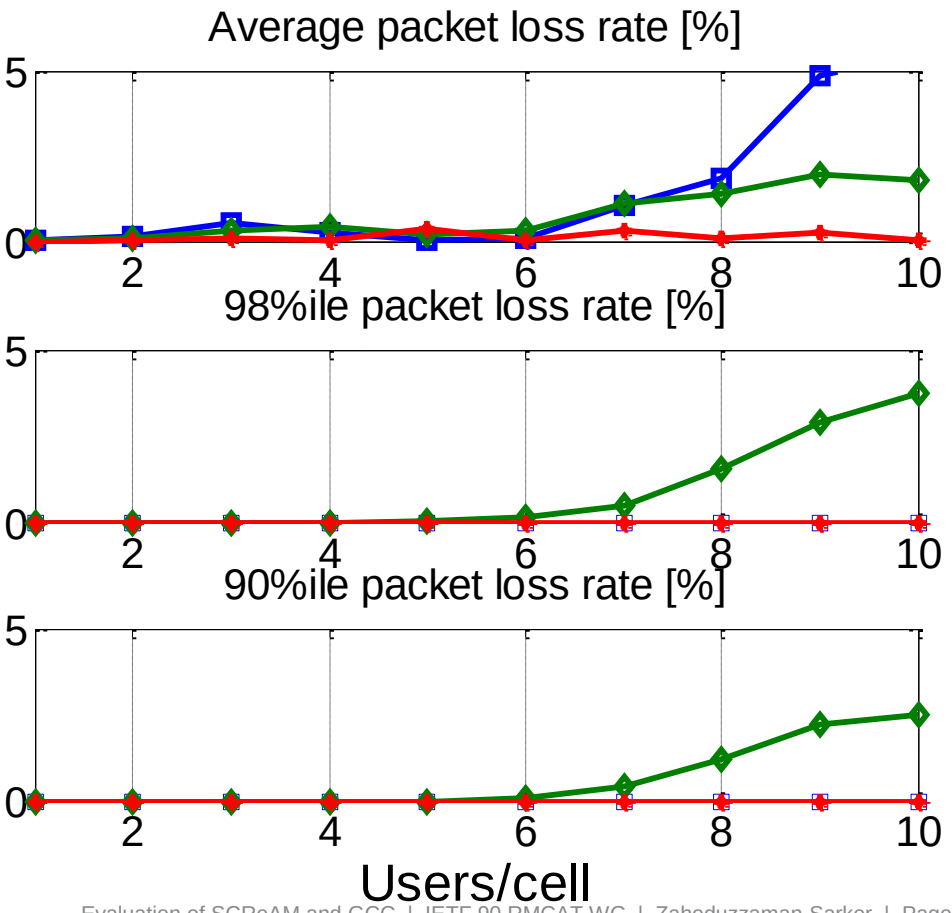
Uplink **Average Bitrate, CDF** **Downlink**



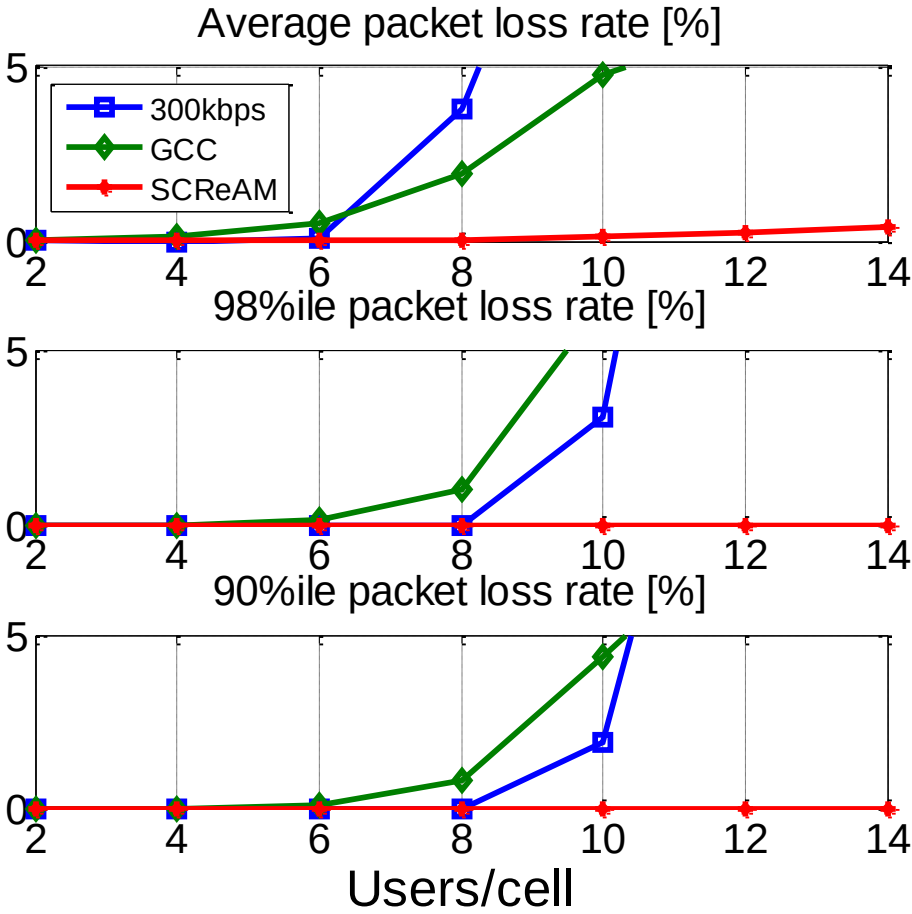
LOSS

SCReAM improves loss rate by big margin

Uplink



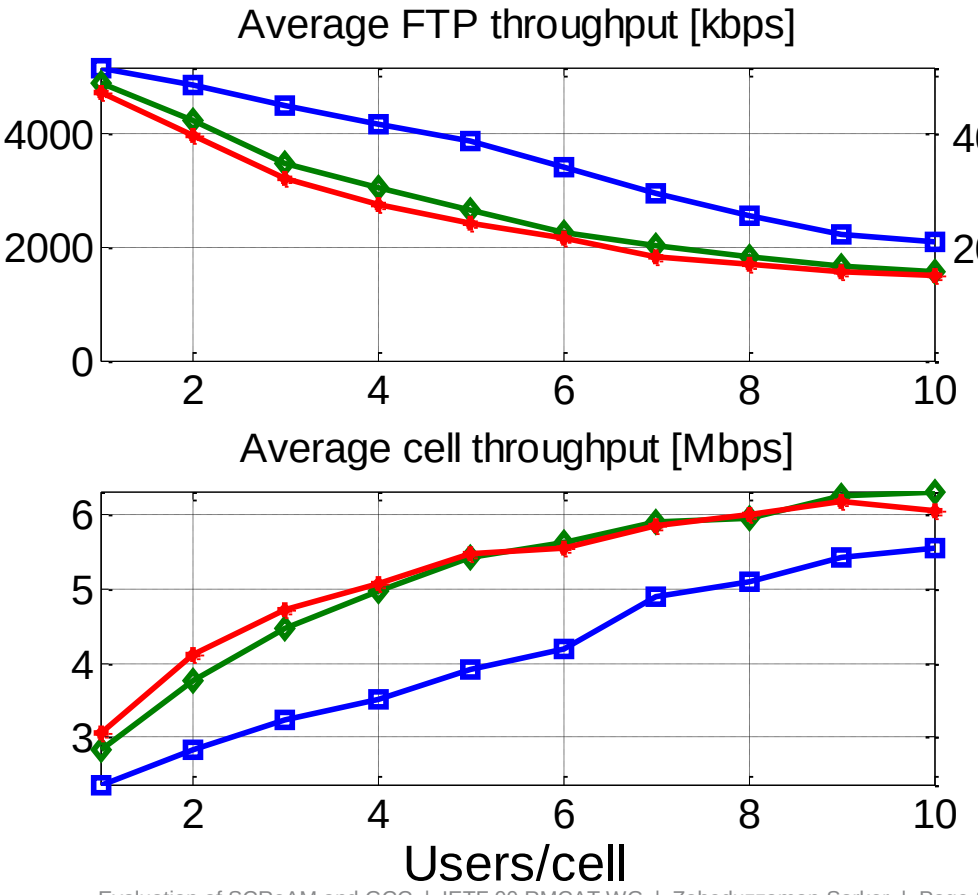
Downlink



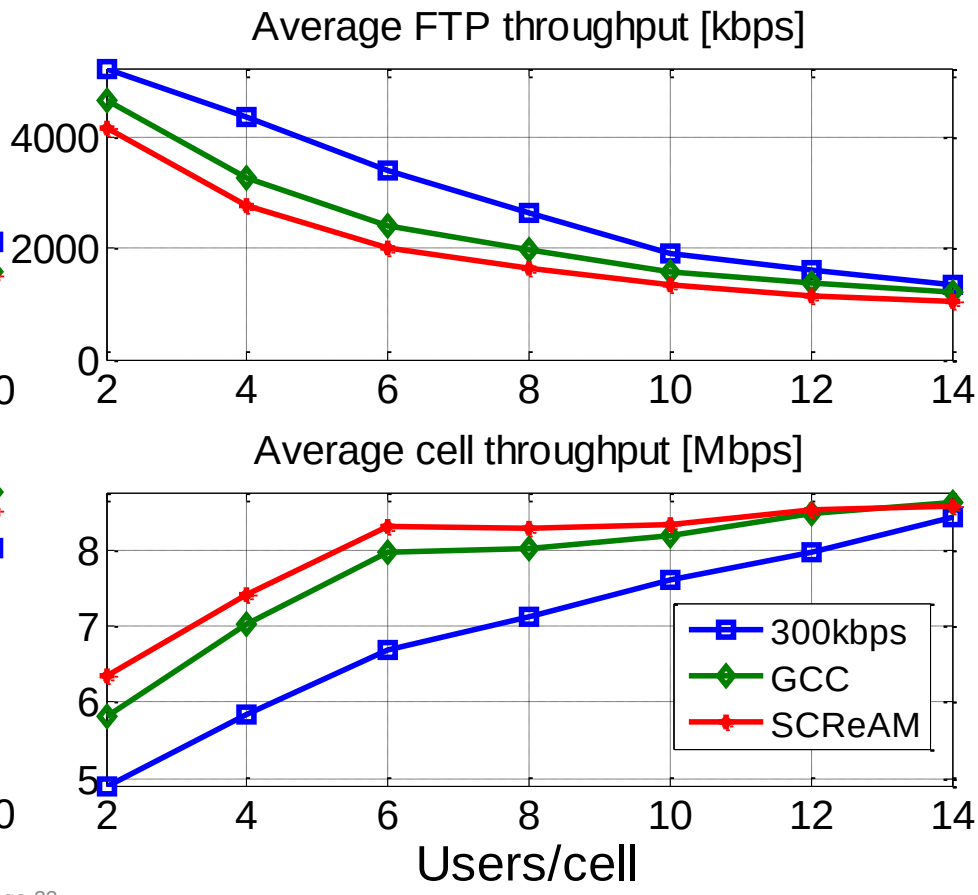
THROUGHPUT

SCReAM achieves higher cell throughput

Uplink



Downlink



SUMMARY

Basic test cases	SCReAM	In most of the cases achieves higher bandwidth utilization and reasonable fairness
		However it introduces some delay spikes (around ~150ms)
		Shows higher reaction towards packet loss and achieves higher media throughput when AQM is used.
Cellular test cases	SCReAM	Stable function up to reasonably high load levels
		Large delay spikes avoided because of self-clocking and frame skipping
		Generally highest throughput in downlink and uplink
		Overall achieves lowest packet loss rates

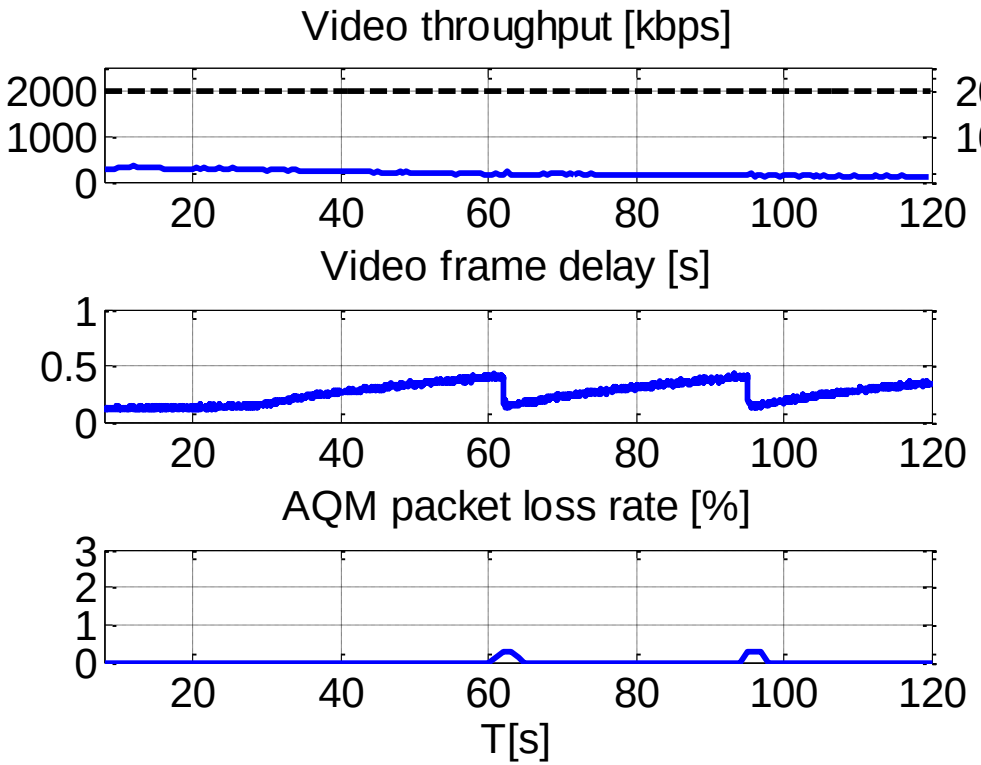
EXTRA SLIDES

Results from selected test cases with different settings

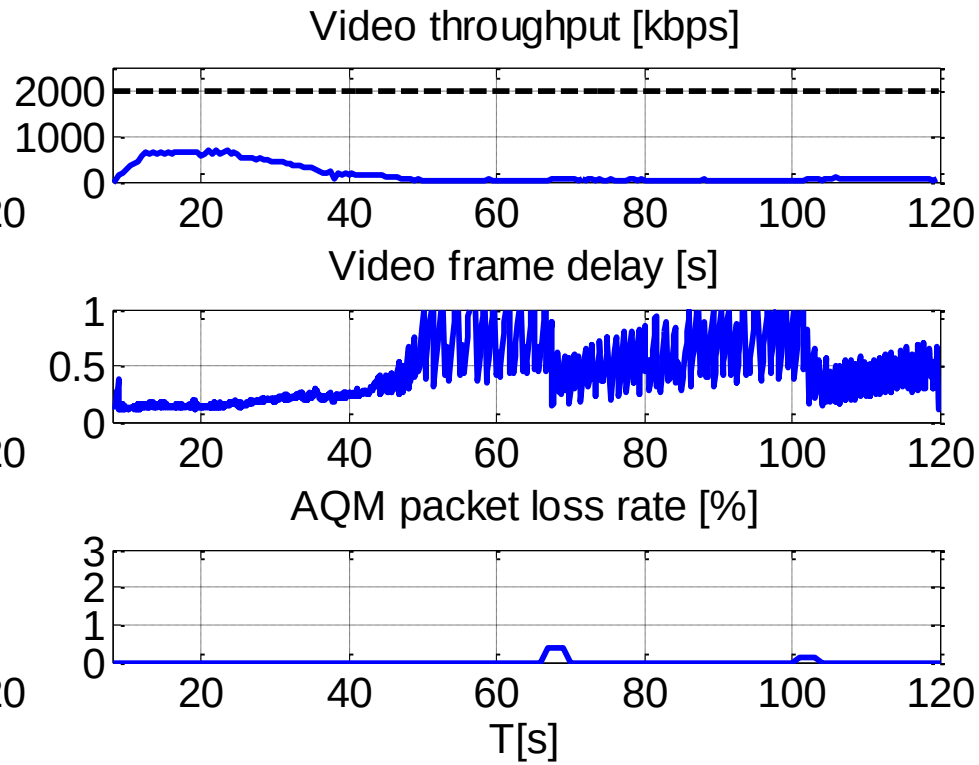
BASIC TEST CASES

COMPETING TCP TRAFFIC (DROP TAIL 300MS)

› One way delay 100ms



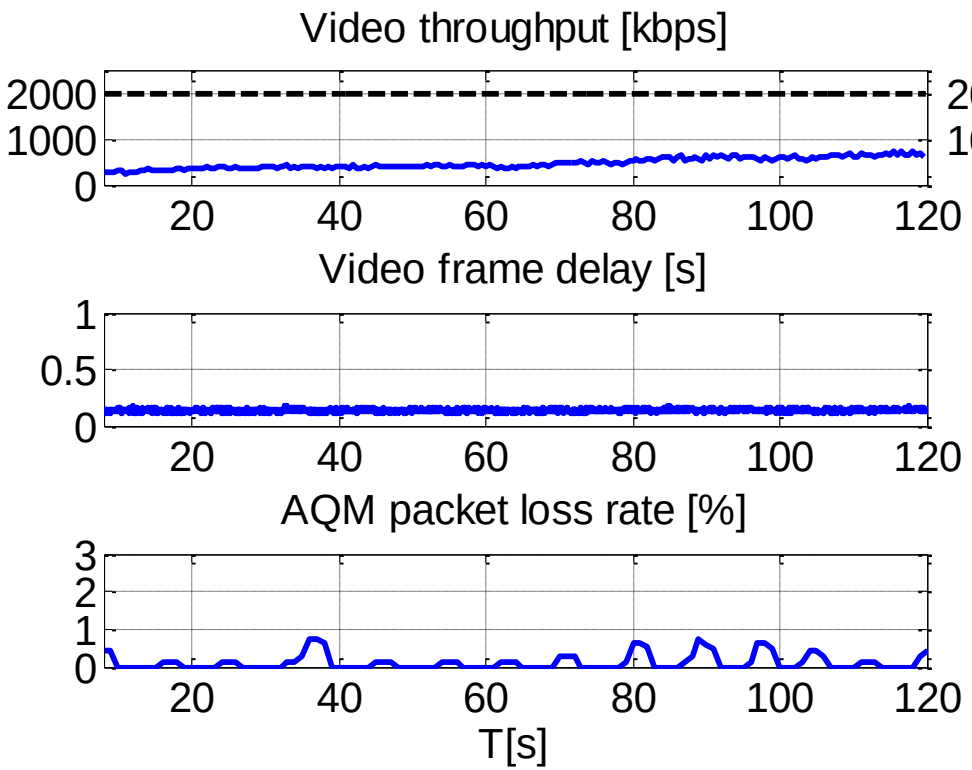
GCC



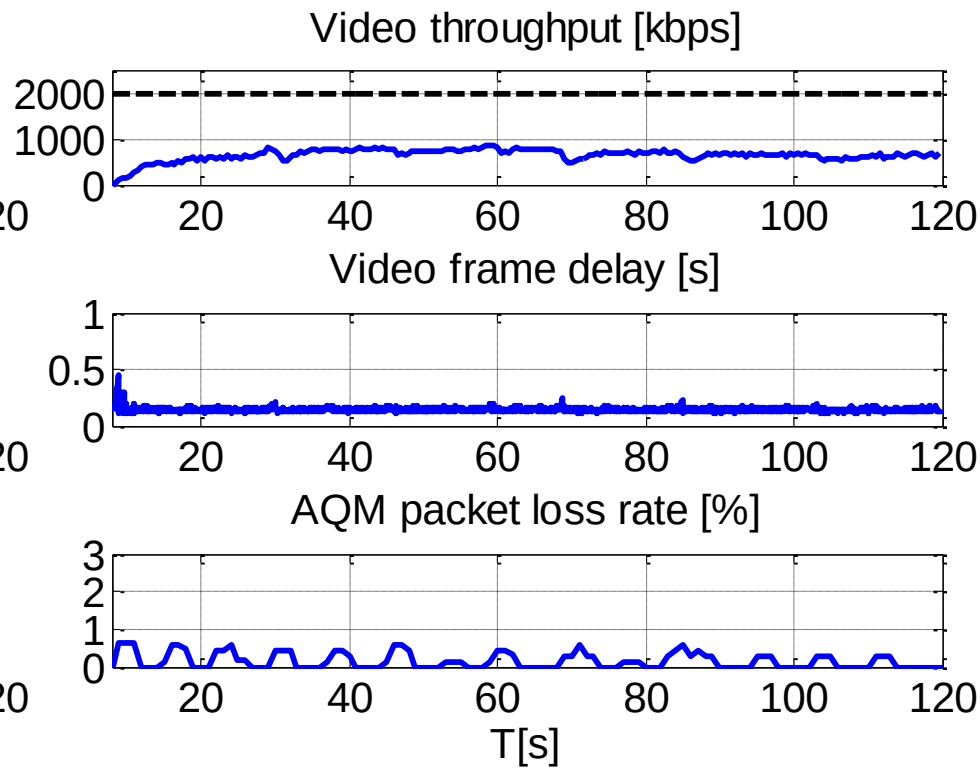
SCReAM

COMPETING TCP TRAFFIC (CODEL AQM)

› One way delay 100ms



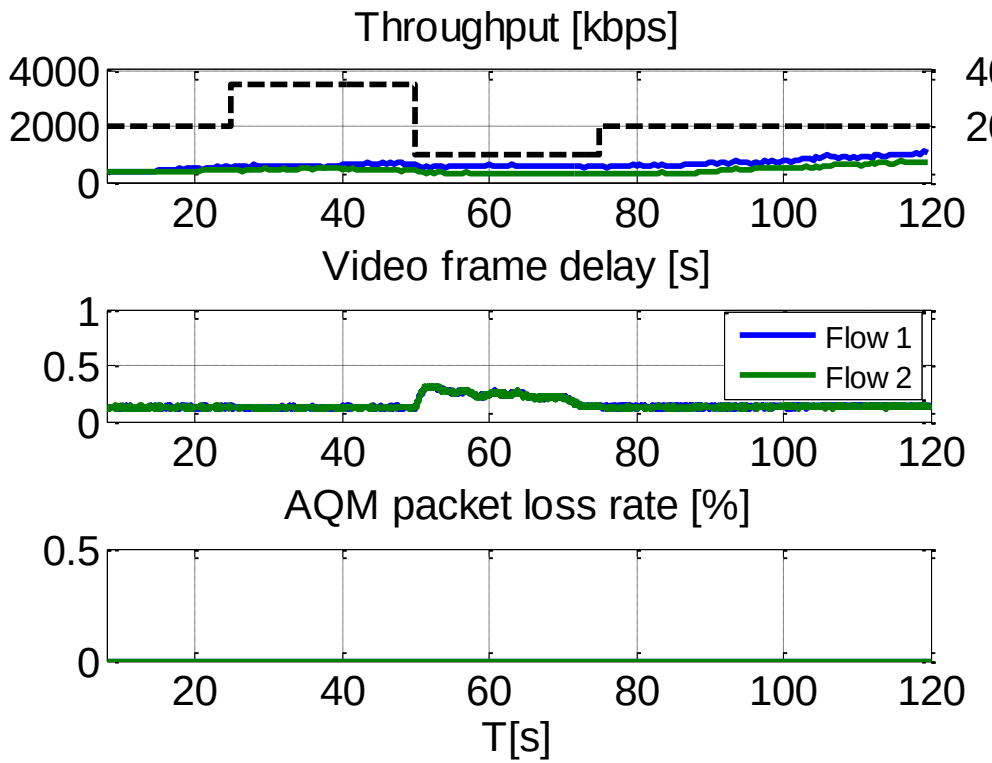
GCC



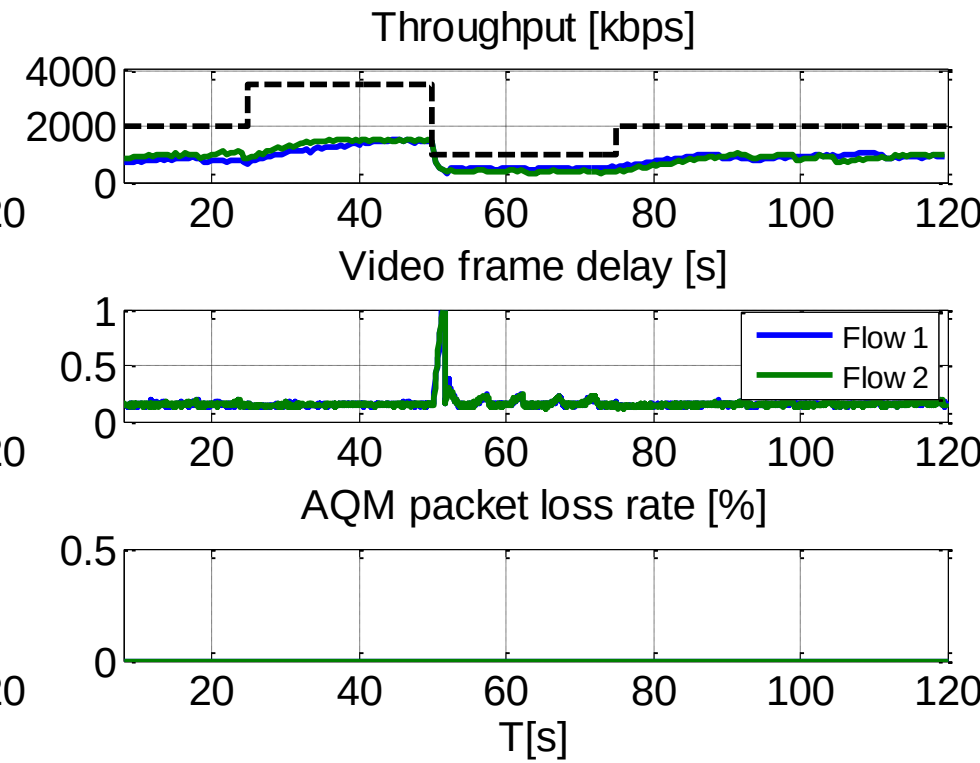
SCReAM

VARIABLE BW –MULTIPLE FLOWS (DROP TAIL 300MS)

› OWD = 100ms



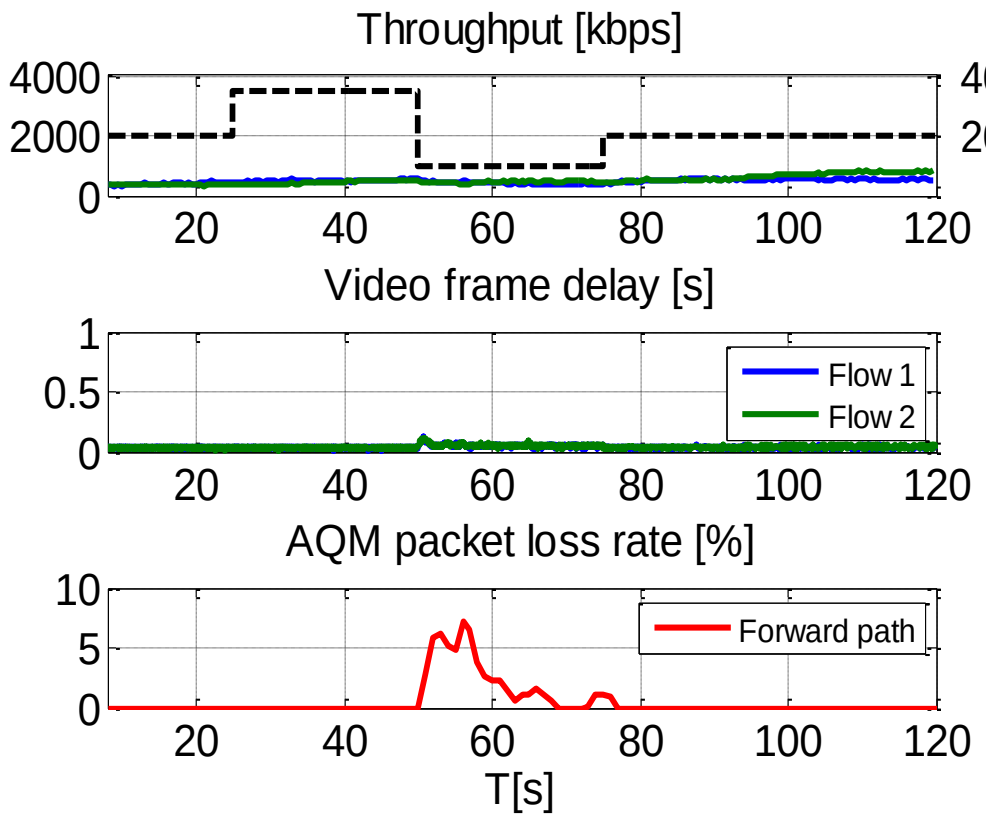
GCC



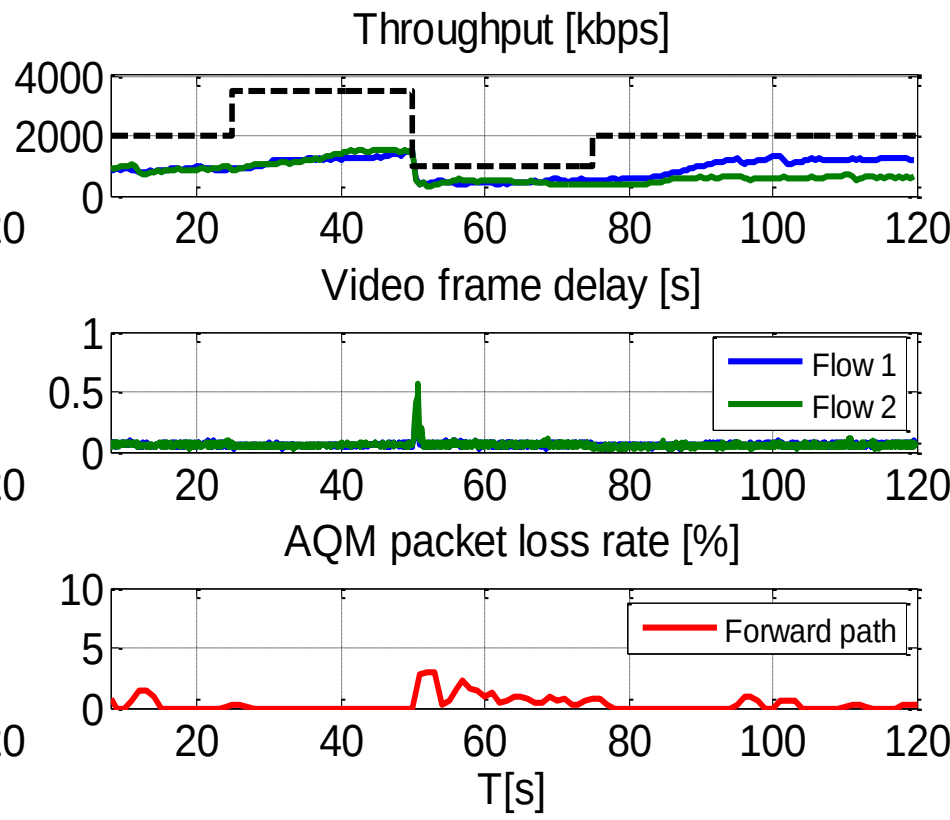
SCReAM

VARIABLE BW –MULTIPLE FLOWS (CODEL AQM)

› OWD = 10ms



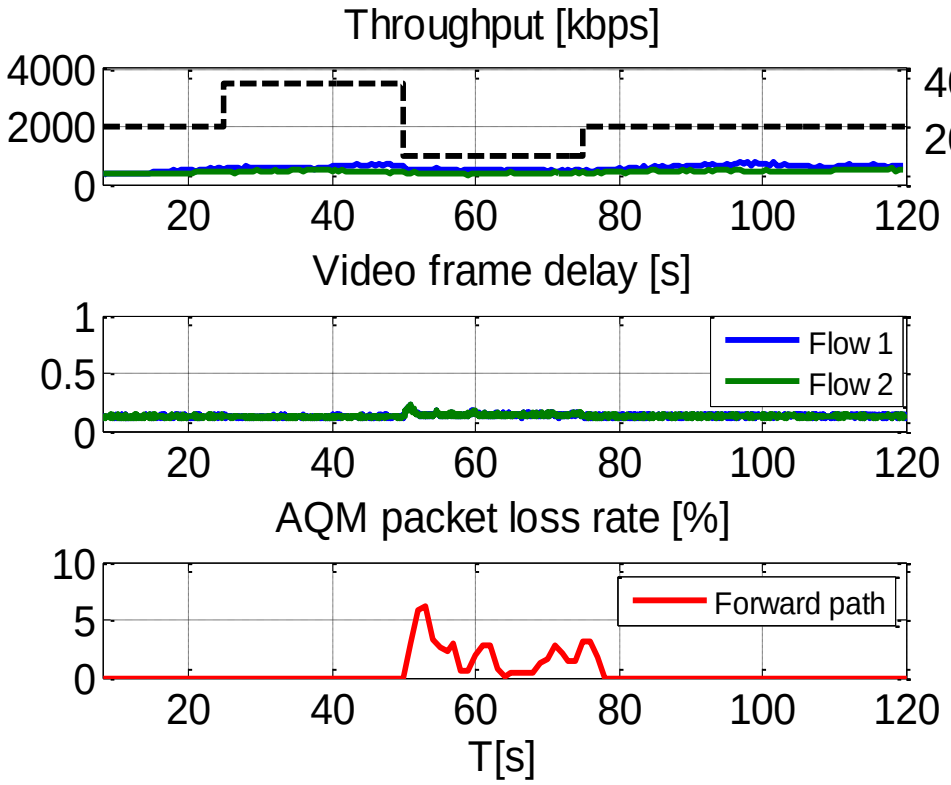
GCC



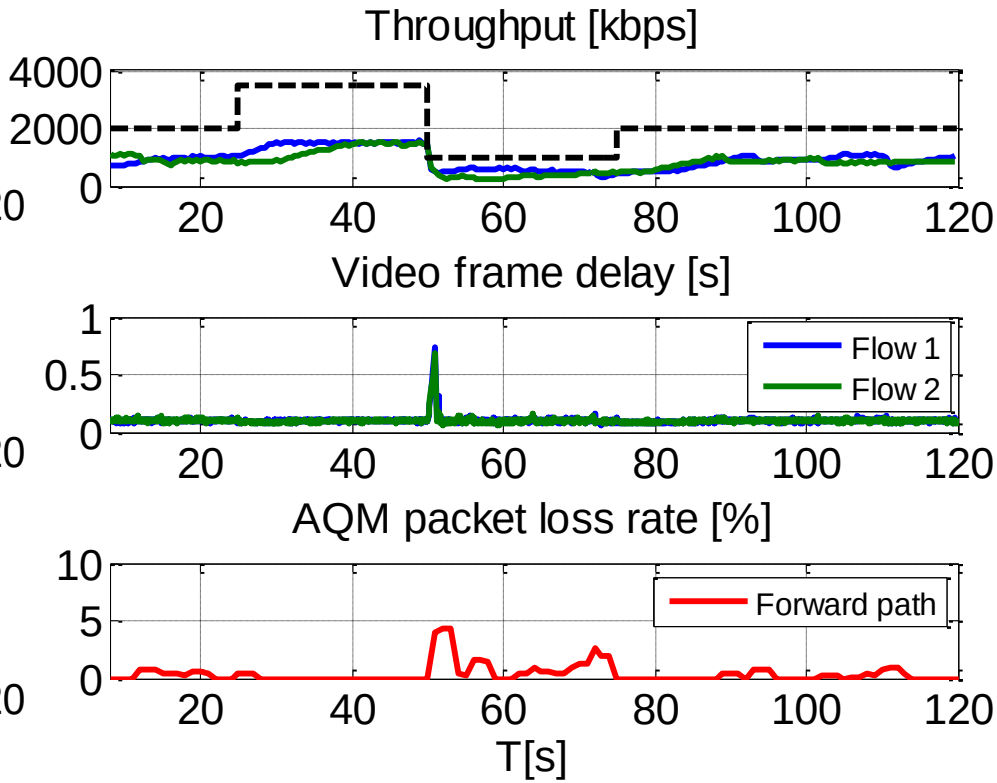
SCReAM

VARIABLE BW –MULTIPLE FLOWS (CODEL AQM)

› OWD = 100ms



GCC



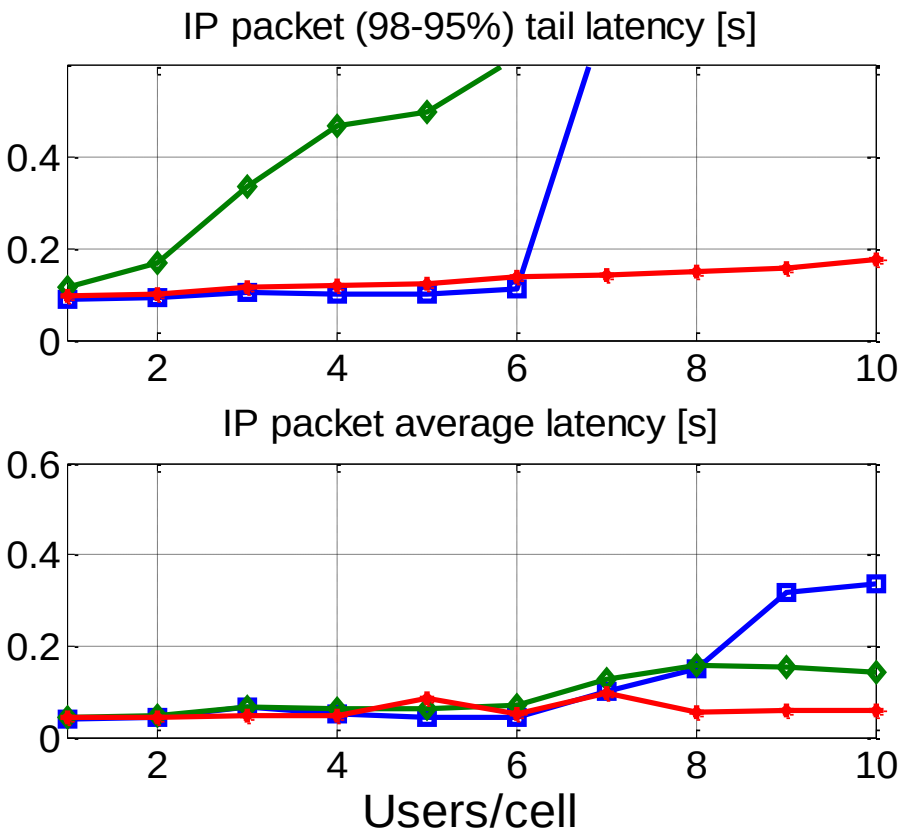
SCReAM

ERICSSON

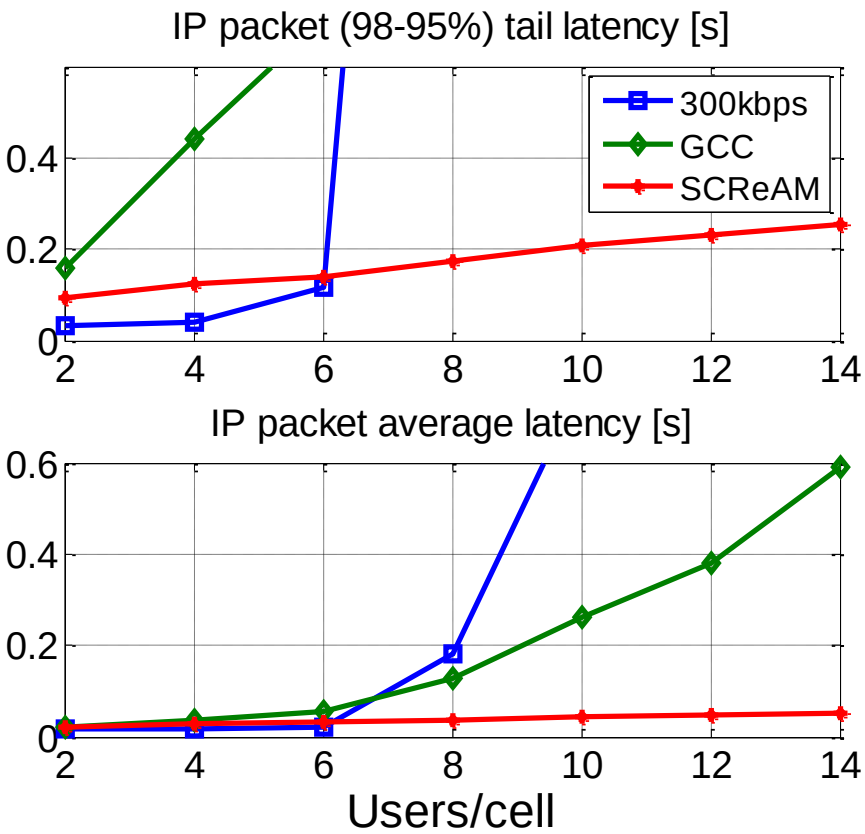
CELLULAR TEST CASES

RTT 40MS, 3KM/H, AQM OFF
IP PACKET LATENCY

Uplink

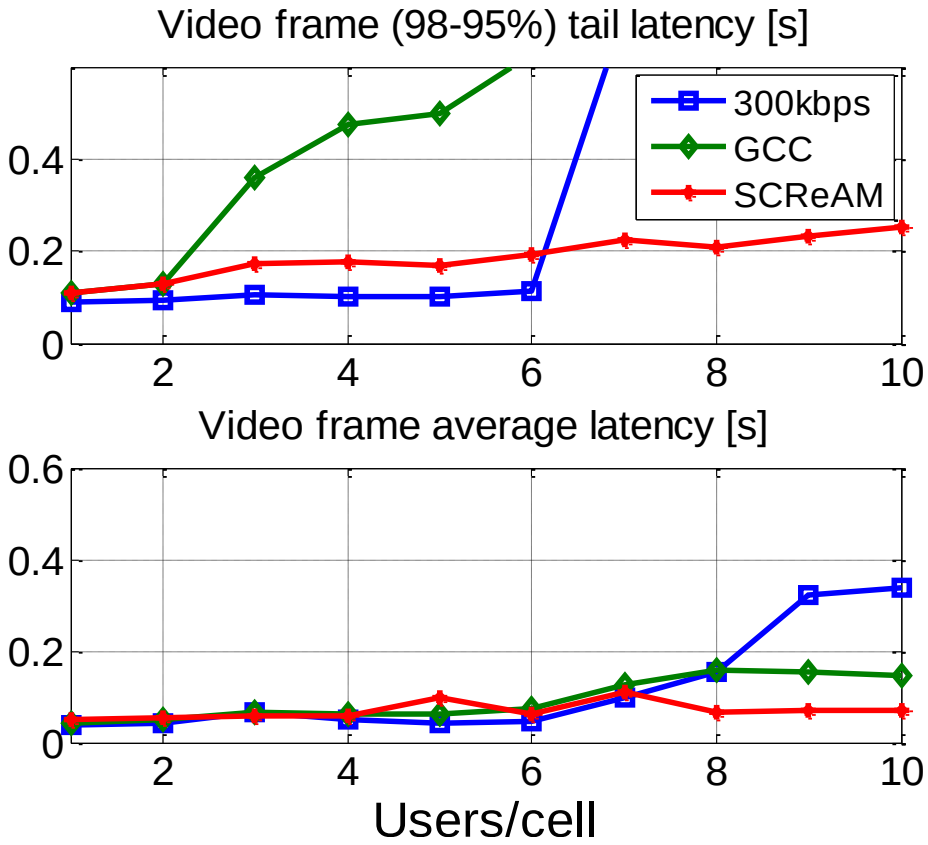


Downlink



RTT 40MS, 3KM/H, AQM OFF
VIDEO FRAME LATENCY

Uplink



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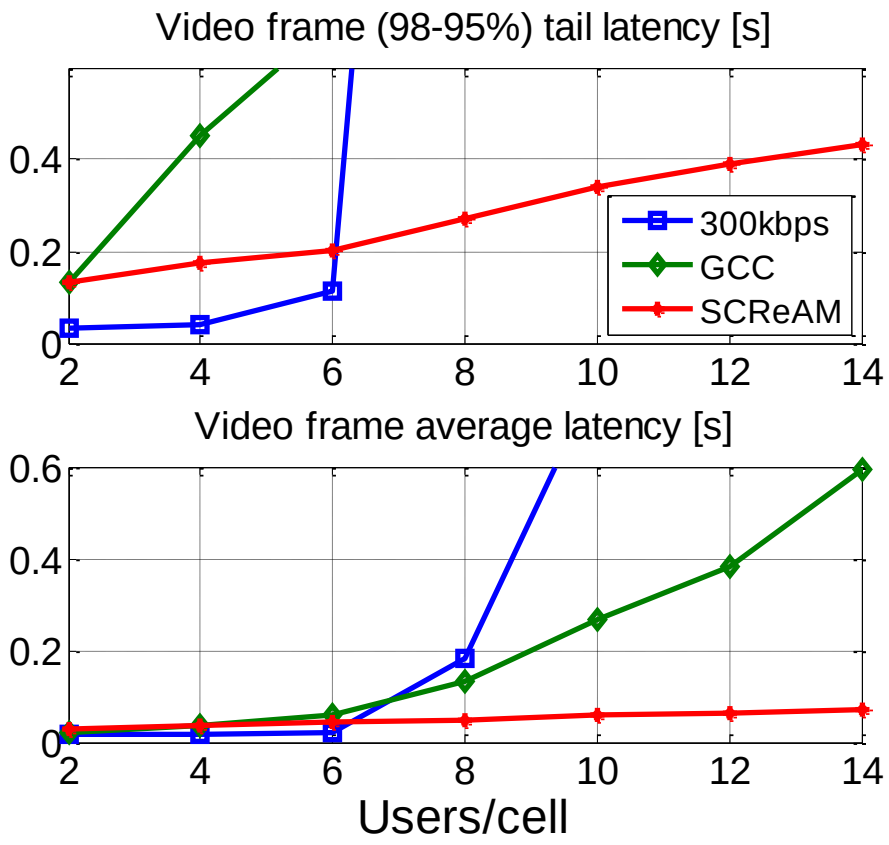
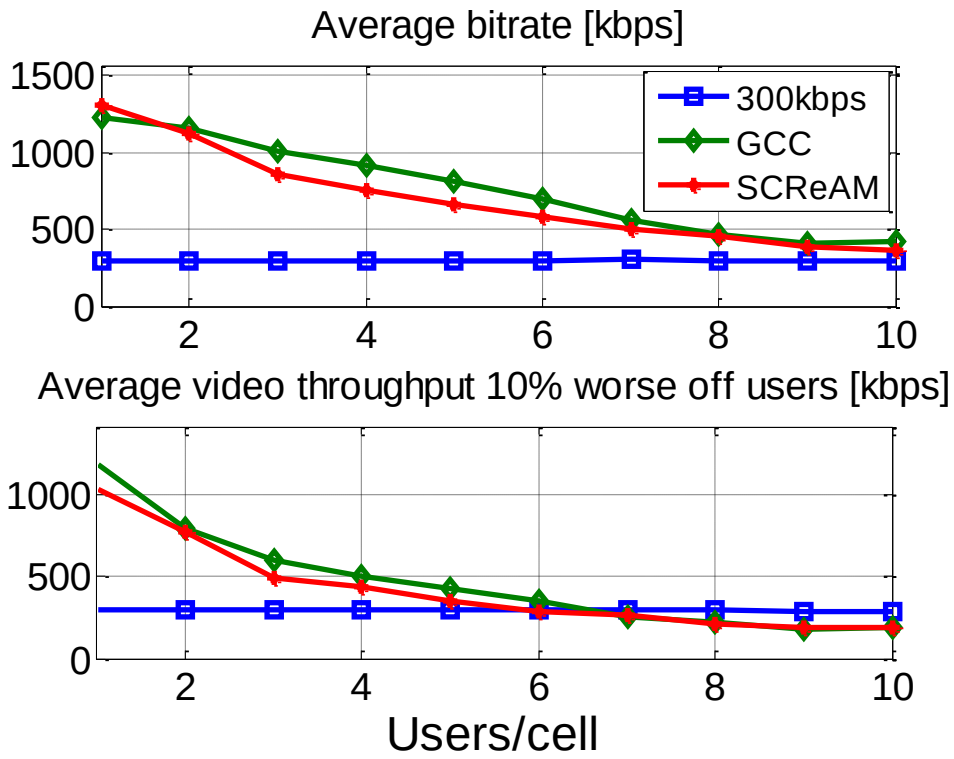


RTT 40MS, 3KM/H, AQM OFF
BITRATE

Uplink



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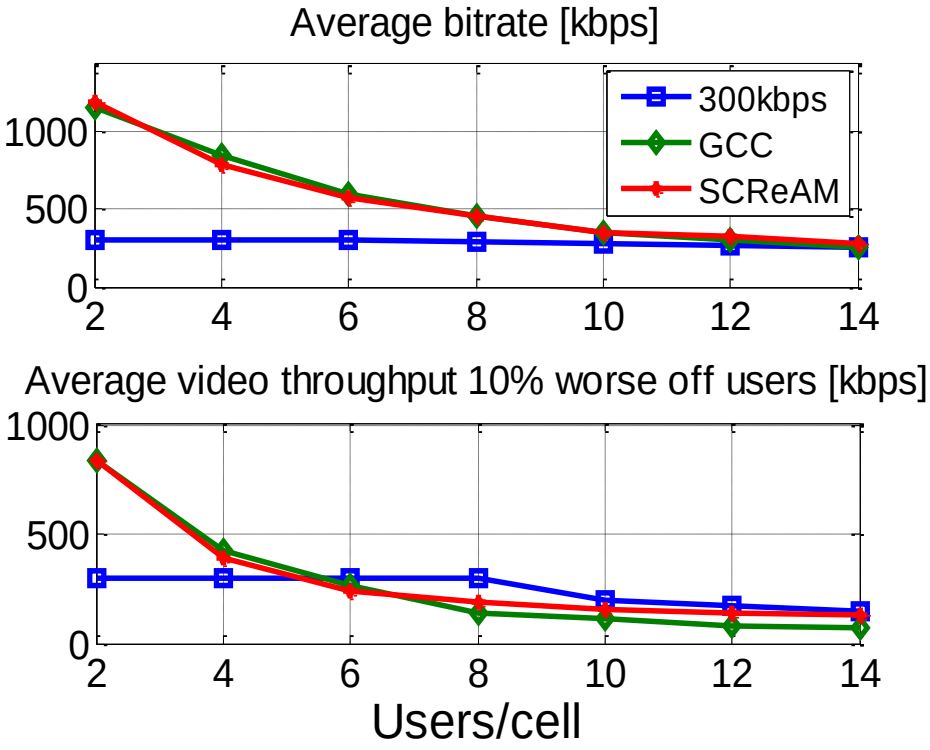
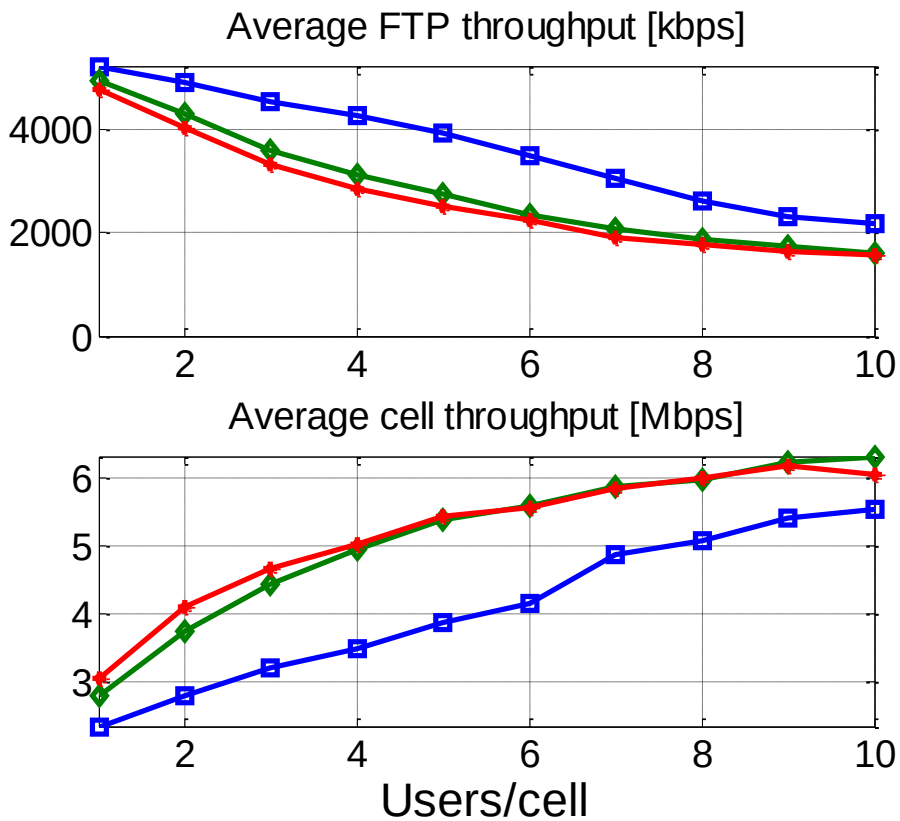


RTT 40MS, 3KM/H, AQM OFF
FTP AND CELL THROUGHPUT

Uplink



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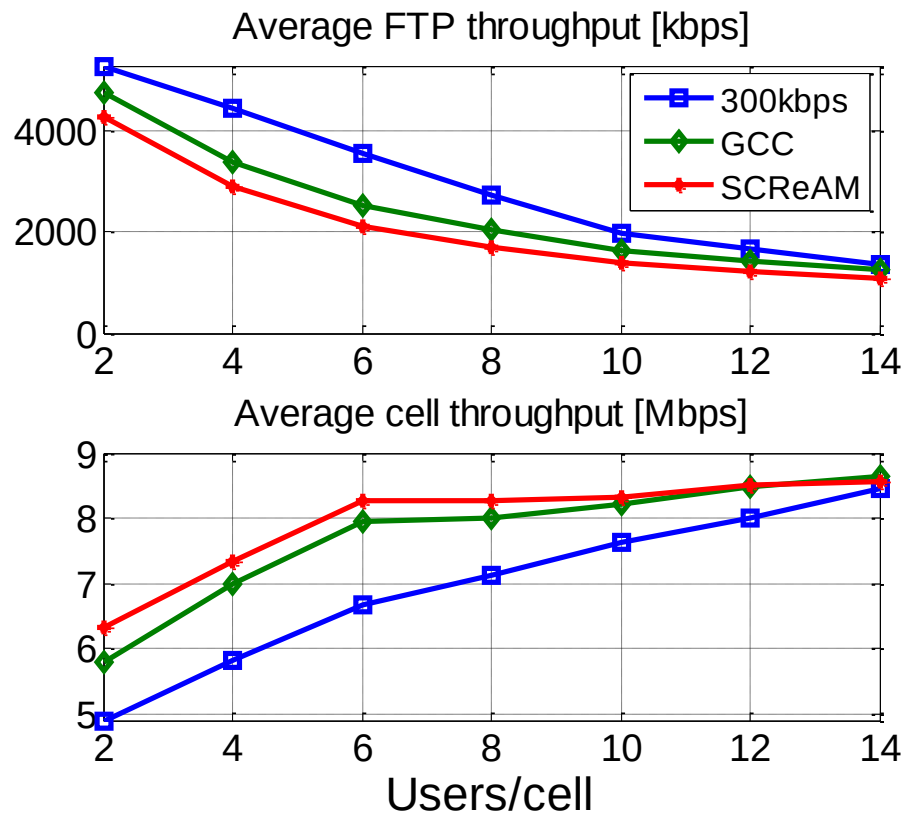
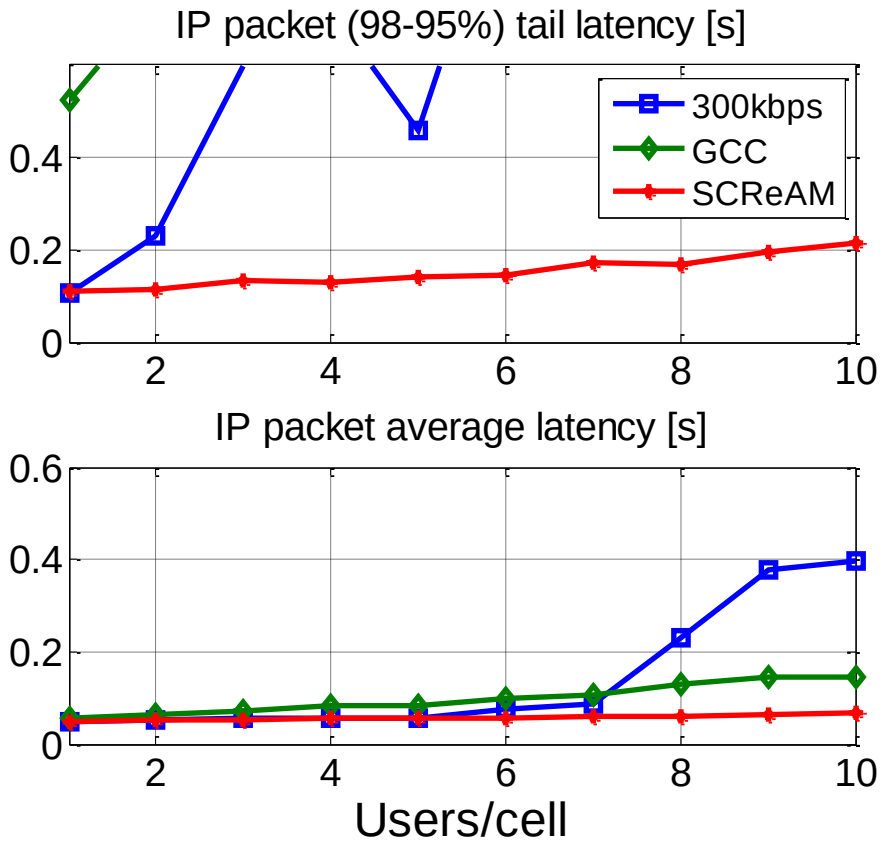


RTT 40MS, 30KM/H, AQM ON
IP PACKET LATENCY

Uplink



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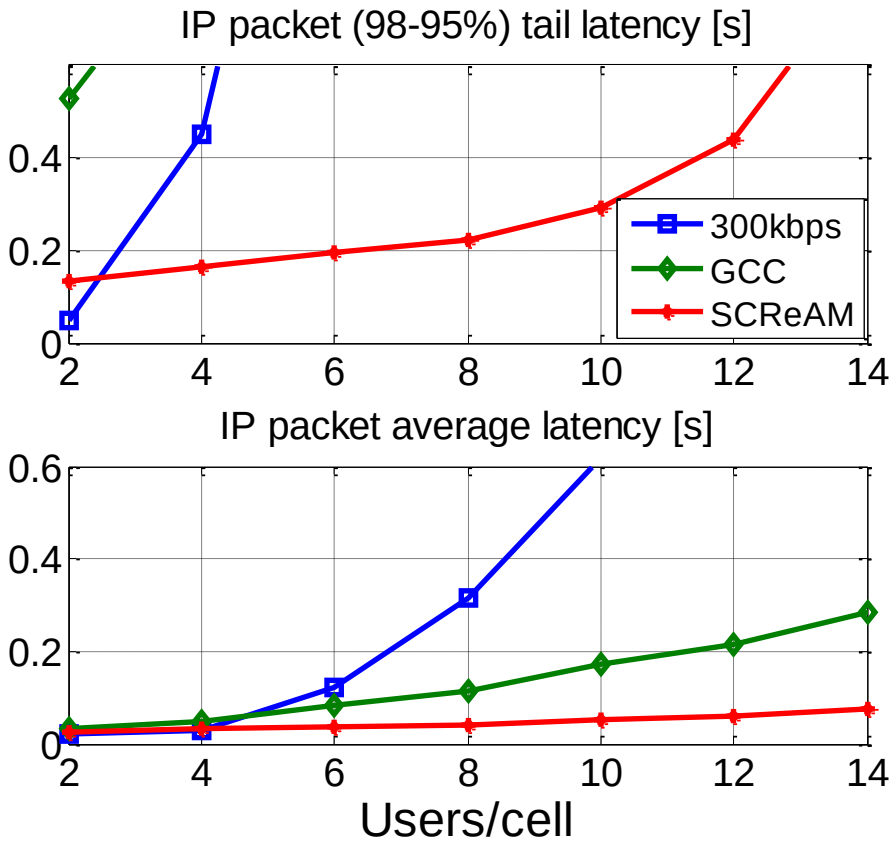
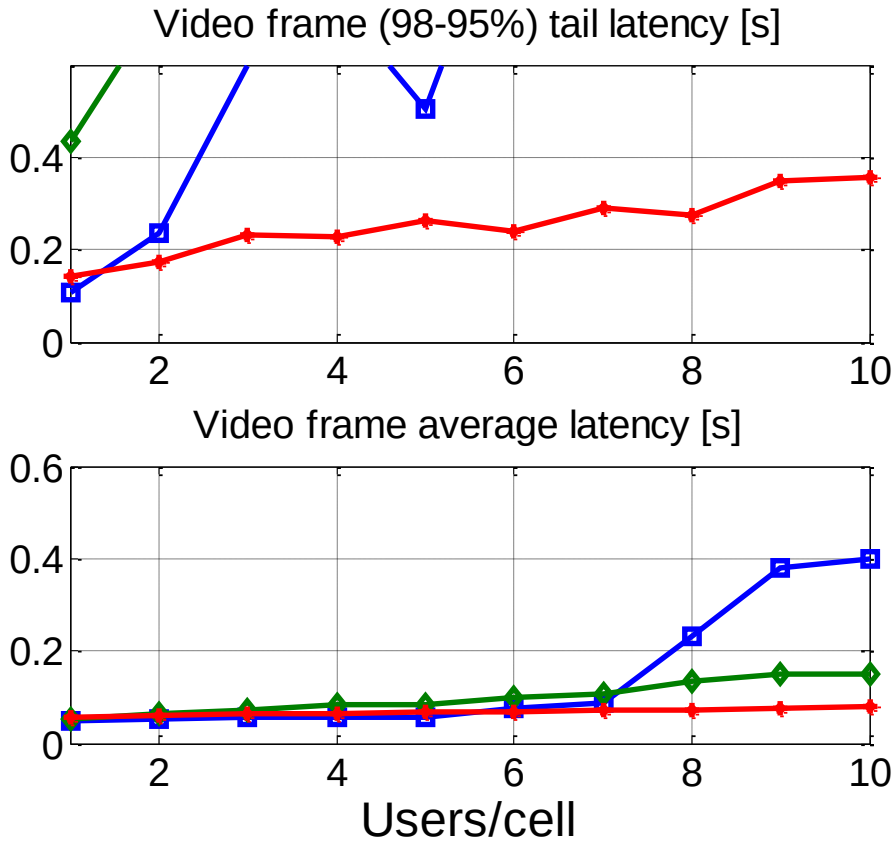


RTT 40MS, 30KM/H, AQM ON
VIDEO FRAME LATENCY

Uplink



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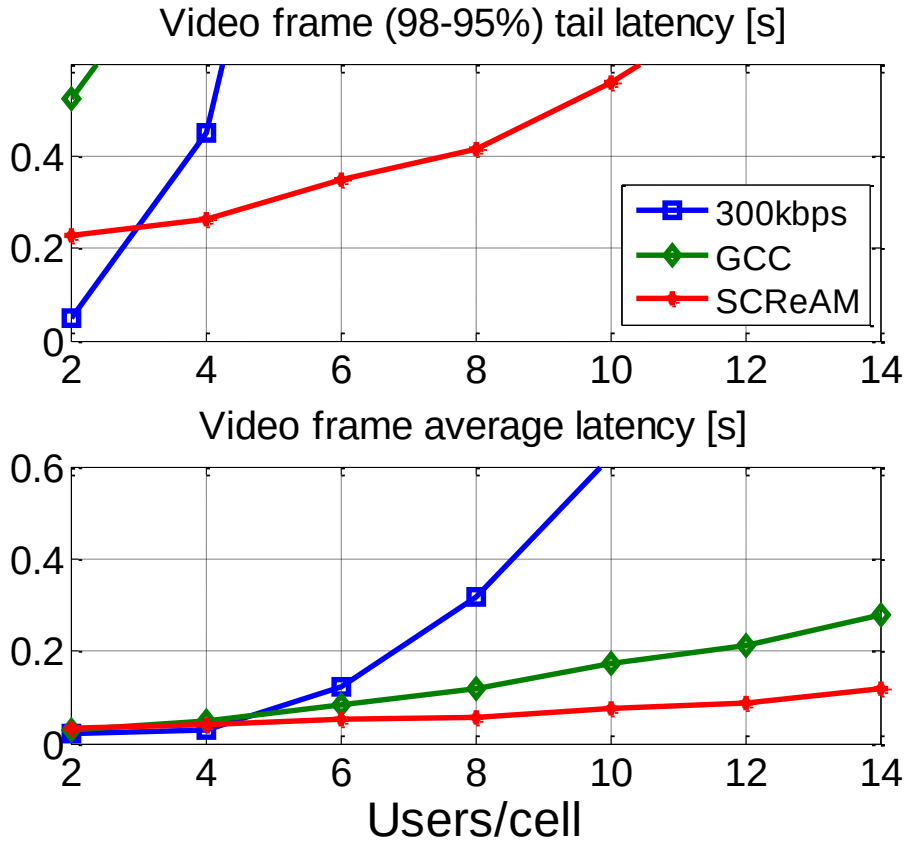
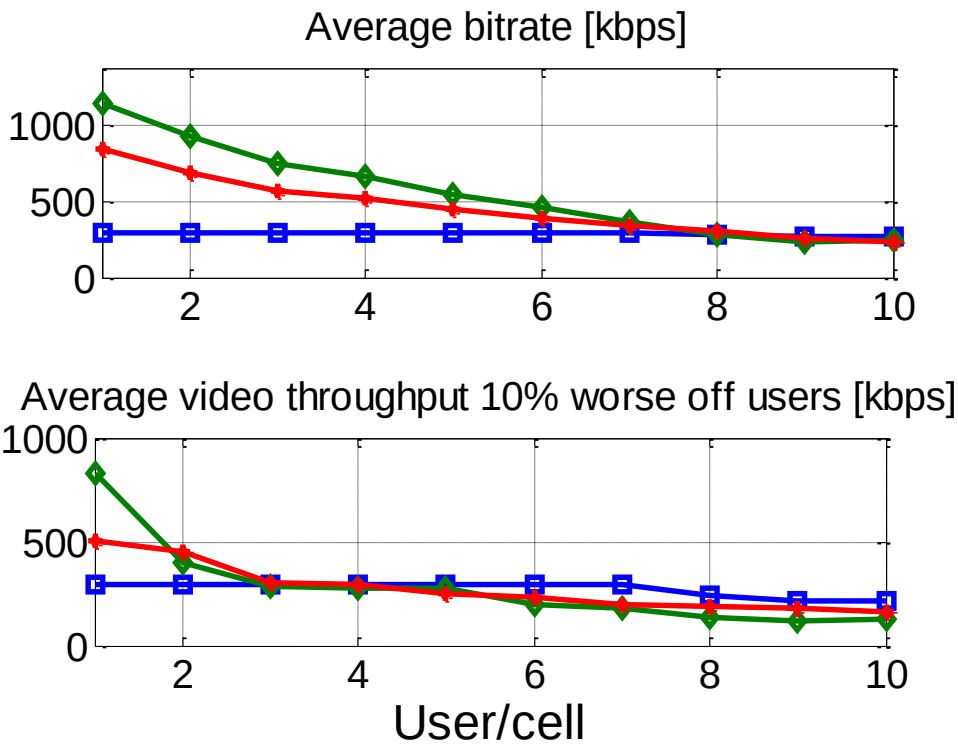


RTT 40MS, 30KM/H, AQM ON BITRATE

Uplink



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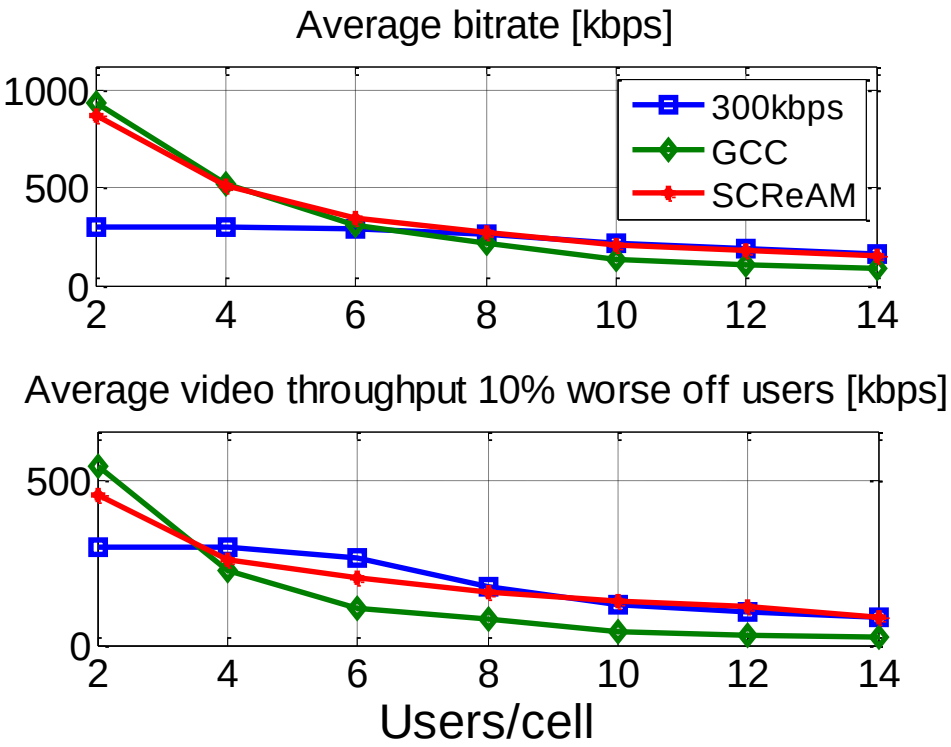
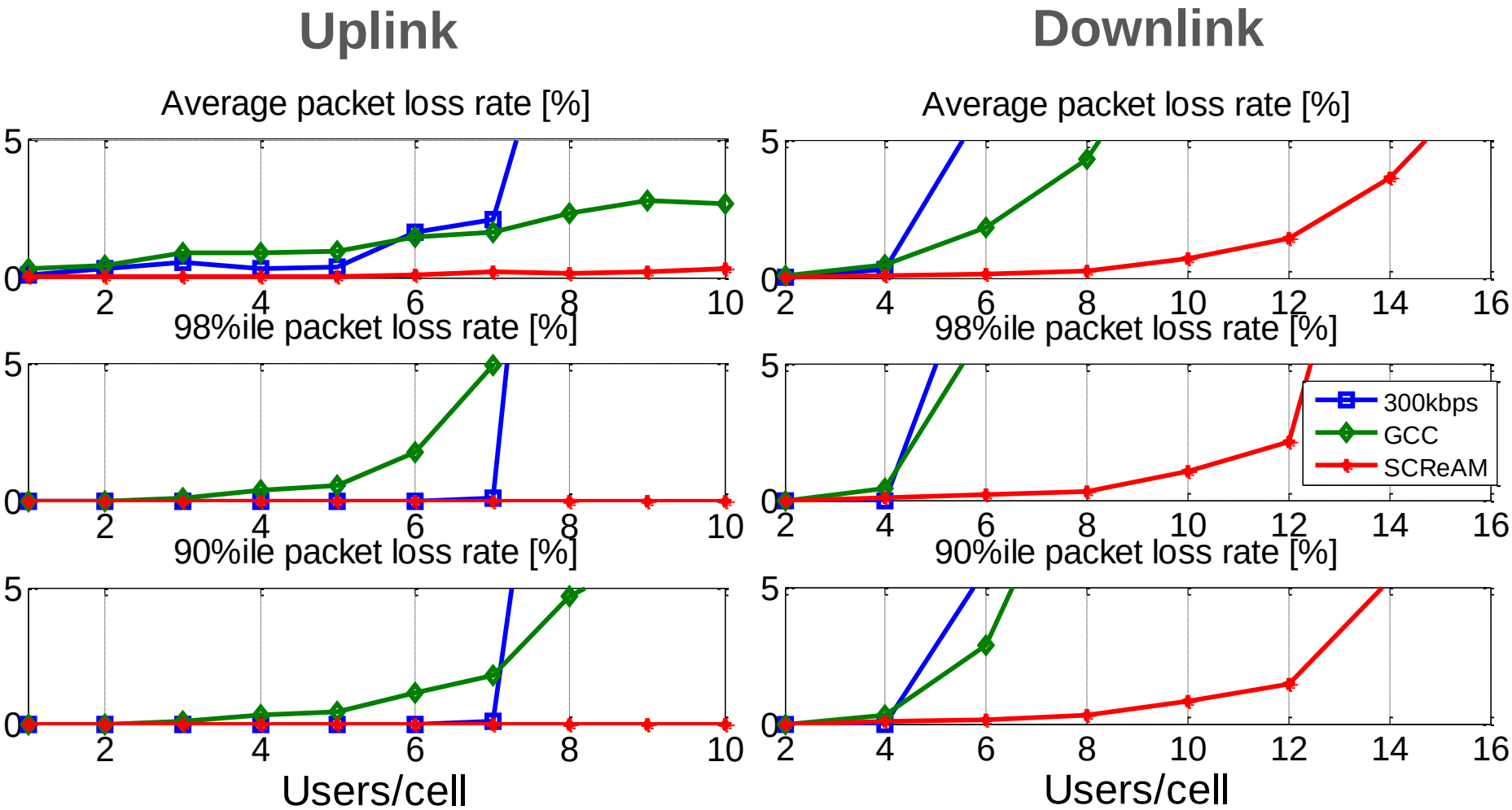
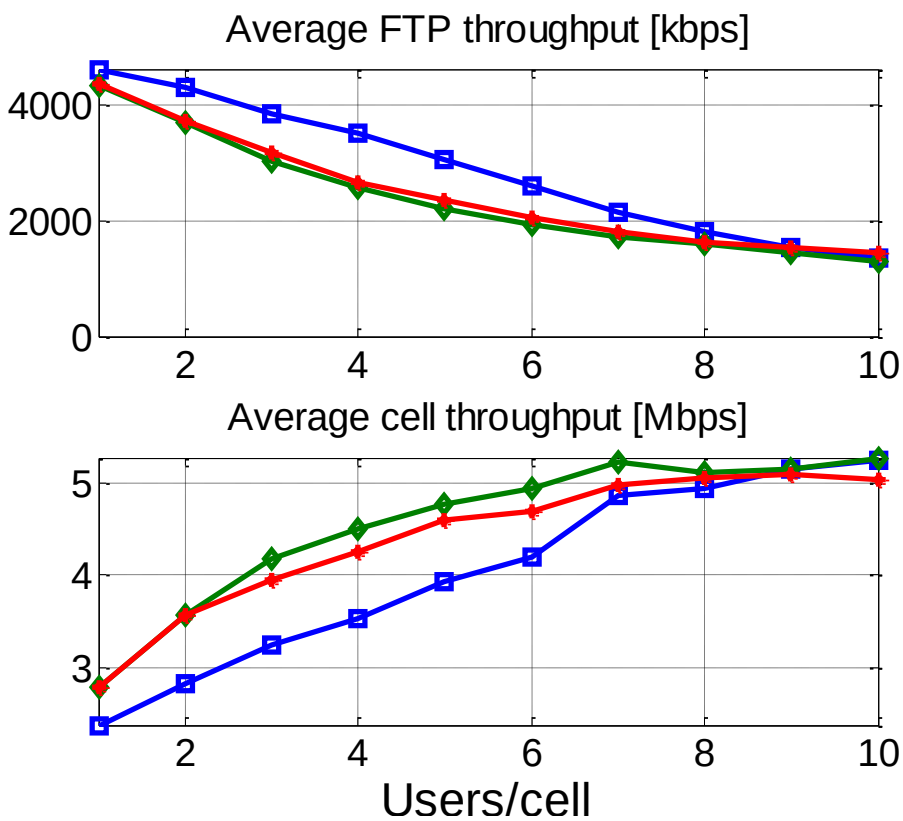


RTT 40MS, 30KM/H, AQM ON
PACKET LOSS



RTT 40MS, 30KM/H, AQM ON
FTP AND CELL THROUGHPUT

Uplink



Downlink