A Proposal of Burst Cloning for Video Quality Improvement in Optical Burst Switching Networks

Grupo de Redes, Sistemas y Servicios Telemáticos

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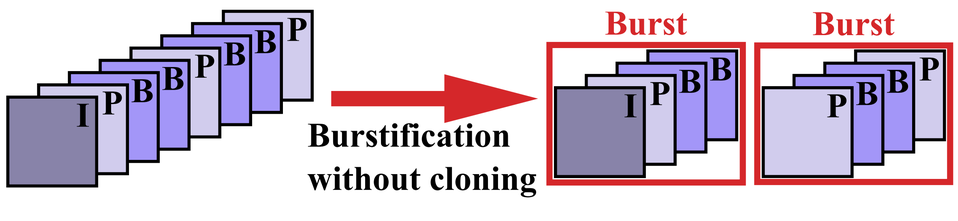
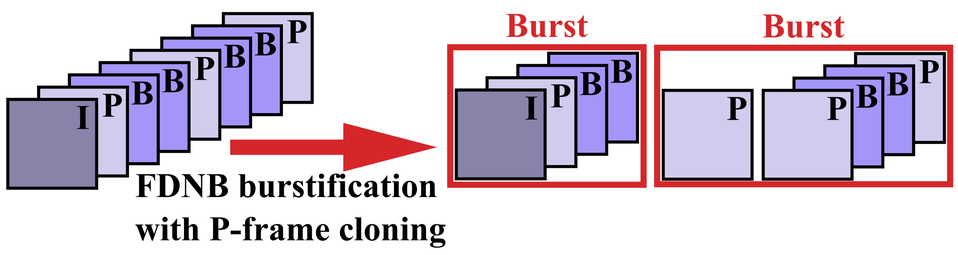
Burst Cloning Proposal



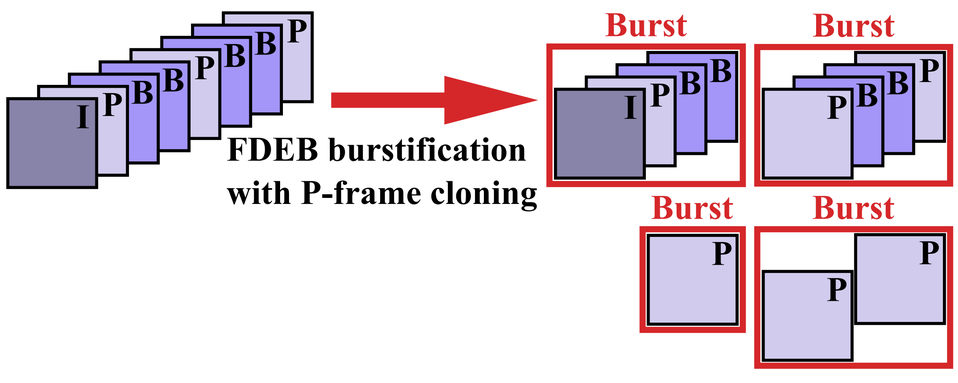
Frame Duplication at Next Burst: FDNB

Duplicates the priority frames into the next burst



Frame Duplication at Exclusive Burst: FDEB

Duplicates the priority frames creating an independent burst



Video quality measurement: VT_{nd}

User perceives time periods when video is not correctly decoded

VT_{nd}: Number of seconds over one hour that the video could not be displayed, i.e., is not correctly decoded

Q: Decodable Frame Rate = function(Frame Loss Probability, GoP)

$$VT_{nd} = (1-Q)*3600$$

Priority Frames Selection based on GoP

$$\delta = VT_{nd}[\text{cloning I-frames}] - VT_{nd}[\text{cloning P-frames}]$$

I-frames when $\delta < 0$

P-frames when $\delta > 0$

GoPs with one P-frame: best priority frames always I-frames

GoPs with two P-frames: best priority frames usually P-frames

Conclusions

Novel video quality improvement cloning schemes for OBS

Significant quality improvement with virtually no trade offs

Selection of frames to clone has strong dependence on GoP

Next works

Analytical model for any T_{out}

Full network validation (NSFNet)

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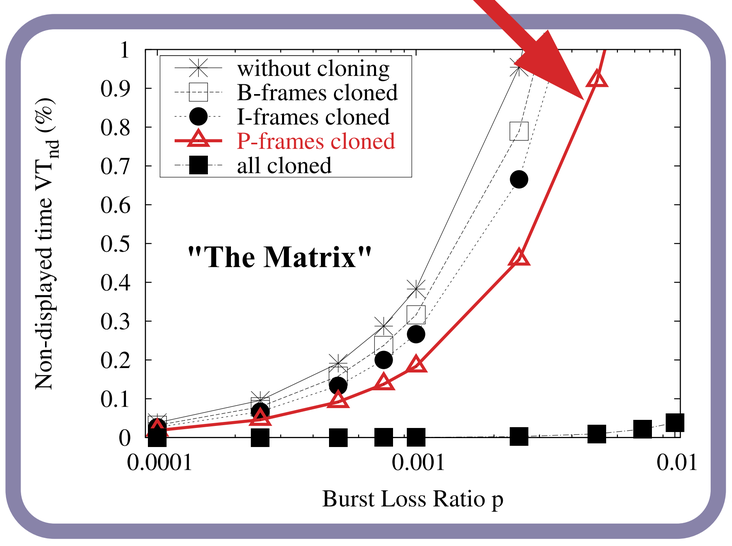
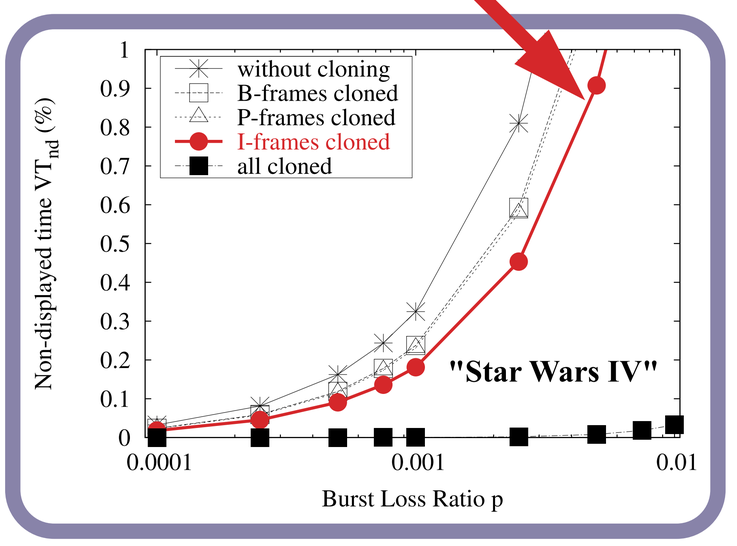
OBS network modelled by independent burst loss ratio p

Best configuration (excluding cloning all frames) depends on the movie characteristics

- The Matrix: P-frames cloning

- Star Wars IV: I-frames cloning





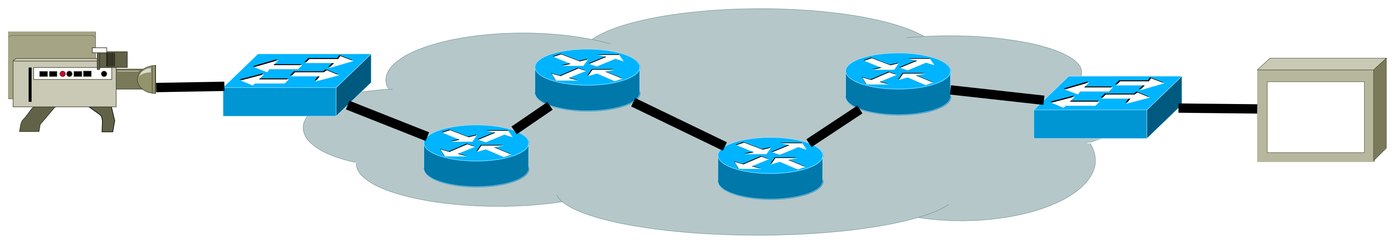
Network scenario

OBS path modelled by consecutive and independent bufferless links

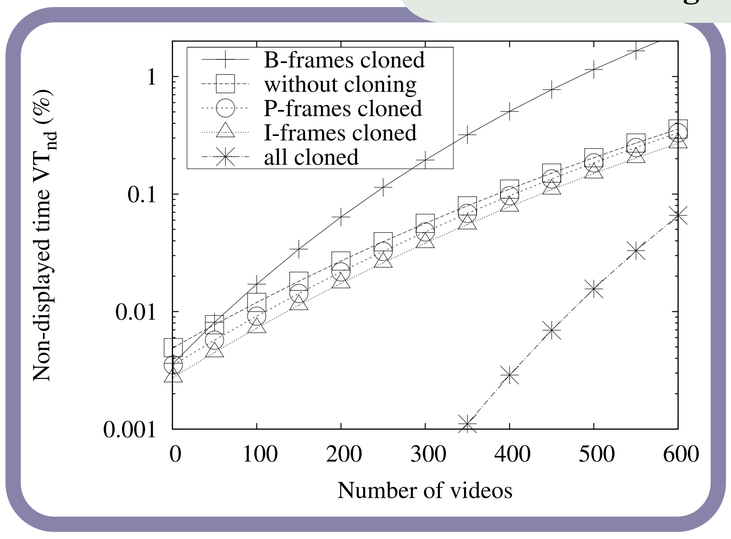
Background traffic + N videos

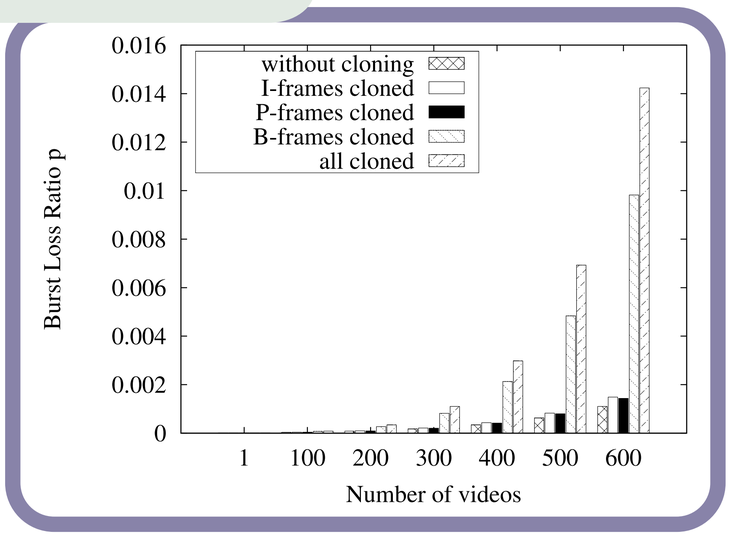
Each link burst loss ratio (p_0) computed by Erlang-B

Network burst loss probability $p = 1 - (1 - p_0)^4$



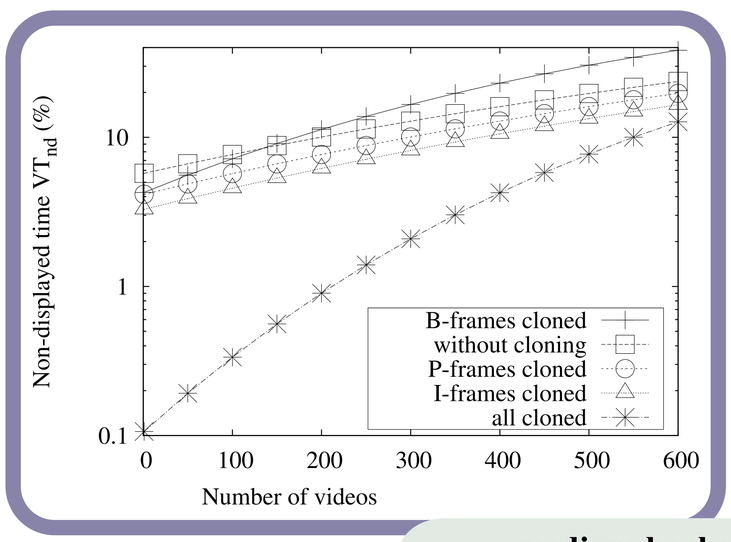
low background traffic

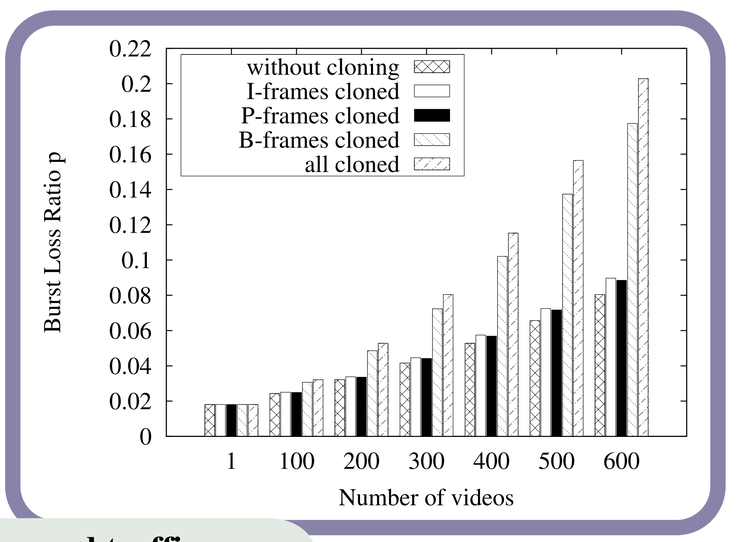




Cloning all frames: the best, but increases highly losses

I- or P-frames cloning: improves quality and increases few losses





medium background traffic