

Contents

Chapter 1	Introduction	1
1.1.	Background.....	1
1.2.	Problem definition	2
1.3.	Research objectives.....	3
1.4.	Research methodology	4
1.5.	Activities and contributions	5
1.6.	Structure of the document and contributions.....	7
Chapter 2	Video streaming over broadband networks.....	9
2.1.	Video streaming over broadband IP networks.....	9
2.1.1.	Compression and codification of video content.....	9
2.1.2.	MPEG-4 part 2, Advanced Simple Profile.....	11
2.1.3.	MPEG-4 part 10, Advanced Video Coding/H.264.....	11
2.1.4.	MPEG-4 part 10, Scalable Video Coding/H.264.....	12
2.1.5.	MPEG-H part 2, High Efficiency Video Coding/H.265	12
2.1.6.	MPEG-I part 3, Versatile Video Coding/H.266.....	13
2.1.7.	Streaming over managed networks, IPTV, RTP/UDP.....	13
2.1.8.	Streaming over unmanaged networks, Internet, HTTP/TCP.....	14
2.1.9.	Dynamic Adaptive Streaming over HTTP.....	14
2.2.	QoS and QoE in video streaming scenarios	16
2.2.1.	QoS video traffic evaluation parameters	16
2.2.2.	QoE video evaluation parameters	17
2.3.	Chapter Summary	20
Chapter 3	Video Streaming Services over OBS Networks.....	21

3.1. Optical Burst Switching Networks.....	22
3.1.1. OBS network architecture	23
3.1.2. Burst assembly in OBS networks	24
3.1.3. Resources reservation and signalling in OBS networks	27
3.1.4. Channel scheduling in OBS networks.....	29
3.1.5. Contention resolution schemes in OBS networks	30
3.1.6. Routing and wavelength assignment in OBS networks	31
3.1.7. Quality of Service in OBS networks	31
3.2. QoE & QoS video traffic over OBS network evaluation setup	32
3.2.1. Simulation tools for OBS networks	32
3.2.2. Video traffic OBS network simulator	34
3.2.3. Video transmission evaluation methodology and set-up.....	34
3.2.4. Simulation scenarios for video over OBS networks	36
3.3. Effect and optimization of burst assembly algorithms for video traffic transmissions over OBS networks.....	40
3.3.1. Simulation scenario.....	41
3.3.2. Length-Based burst assembly algorithm.....	42
3.3.3. Time-Based burst assembly algorithm.....	48
3.4. Adaptive burst assembly algorithm to improve video QoE	55
3.4.1. Adaptive Burst Assembly Algorithm - ABAA	57
3.4.2. Experimental evaluation.....	58
3.5. Scheduling scheme to provide QoE to video traffic	61
3.5.1. QoS preemptive scheduling scheme	61
3.5.2. Preemptive LAUC-VF based channel scheduling	62
3.5.3. Experimental analysis.....	65
3.6. Chapter summary	67
Chapter 4 Video streaming traffic patterns to Energy Efficient Ethernet analysis	69
4.1. Video Traffic profile in IPTV networks.....	70
4.1.1. IPTV testbed.....	70
4.1.2. H.264/AVC traffic pattern	71
4.1.3. H.264/SVC traffic pattern.....	74

4.2. Evaluation of Energy Efficient Ethernet in video streaming servers	75
4.2.1. Overview of Energy Efficient Ethernet	75
4.2.2. Energy efficiency transmitting a single H.264/AVC encoded video.....	77
4.2.3. Energy efficiency transmitting a single H.264/SVC encoded video	81
4.3. DASH traffic pattern	83
4.3.1. DASH testbed	83
4.3.2. DASH traffic pattern	84
4.3.3. Ethernet DASH traffic pattern	89
4.4. Energy Efficient Ethernet on DASH streams	90
4.4.1. Segment efficiency.....	90
4.5. Chapter Summary	94
Chapter 5 Discussion and future work	95
5.1. General conclusions	95
5.2. Future work.....	98
References 99	
Appendix A. Publications and Research Activities	107
Appendix B. List of related publications	111
Appendix C. Strategic Research Agendas contributions	113
Appendix D. Projects, Research Networks, Strategic Platforms.....	115
Appendix E. Research Mobility.....	117
Appendix F. Multimedia Networking Developments	119