



SVC ADAPTATION IN CONTENT-AWARE NETWORKS

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OUTLINE

- Introduction
- SVC Streaming and Adaptation in ALICANTE
- Distributed Adaptation
- SVC Encoding Guidelines
 - Bitrate Recommendations
 - Encoder Performance: bSoft
- QoE Monitoring
- Conclusions



INTRODUCTION

- SVC streaming enabling in-network adaptation
- Which scalability features are useful?
- Decent bitrates?
- How many bitrates?
- Encoder performance?
- How to guide adaptation through quality monitoring?

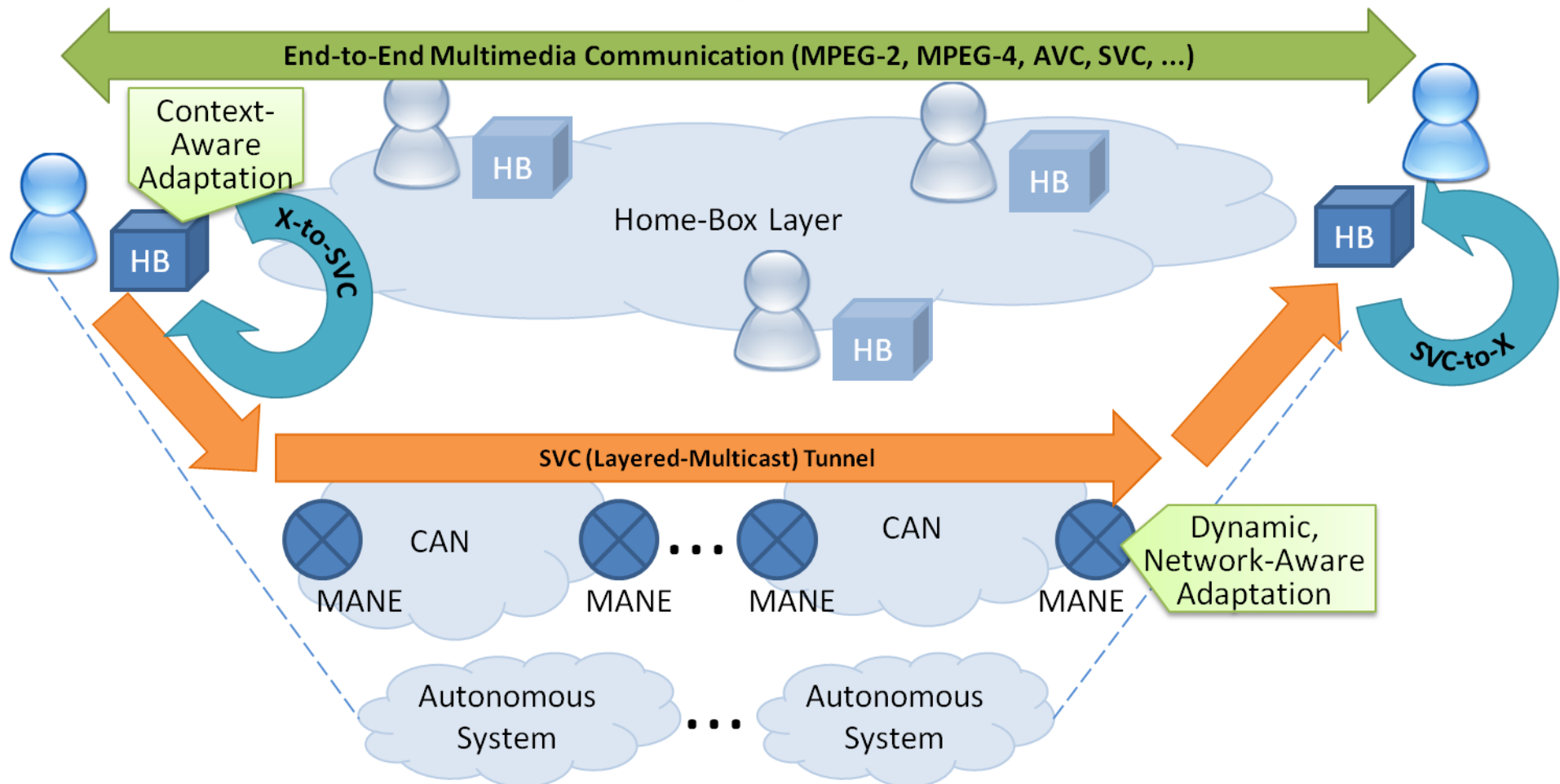


SVC STREAMING AND ADAPTATION IN ALICANTE

- ALICANTE
 - "Media Ecosystem Deployment through Ubiquitous Content-Aware Network Environments"
 - Goal: New Home-Box layer and CAN layer with cross-layer adaptation enabling cooperation between providers, operators, and end-users
- 2 new virtual layers
 - Home-Box (HB) Layer: enhanced home gateways
 - CAN Layer: content-aware adaptation of SVC at Media-Aware Network Elements (MANEs)



SVC STREAMING AND ADAPTATION IN ALICANTE





DISTRIBUTED ADAPTATION

- Challenges for Distributed Adaptation Decision-Taking:
 - Where to adapt? – at source, in-network, receiver, and combinations thereof
 - When to adapt? – at request and during delivery
 - How often to adapt? – too often (risk: flickering), too seldom (risk: stalling)
 - How to adapt? – optimization towards resolution, framerate, SNR (bitrate), accessibility, etc.; (too) many possibilities
- Rule of thumb:
 - At network edges, adapt to user context (terminal capabilities, preferences, etc.)
 - Within the network, dynamically adjust to network conditions (bandwidth, packet loss, etc.)



SVC ENCODING GUIDELINES

- Which SVC encoding configurations are best suited for edge and in-network adaptation under realistic bandwidth constraints for realistic user terminals?
 - Typical resolutions as used by:
 - MS Smooth Streaming, Apple HLS, Adobe HDS, Youtube, MTV, Facebook Video Calling (based on Skype plugin), Google+ Hangout, Netflix, Hulu, etc.
 - How many and which bitrates for multi-rate streaming
 - Internet traffic forecasts (e.g., CISCO VNI)
 - Capabilities and performances of different encoders
 - Relevant scenarios
 - Taking Spatial and Temporal Complexity of content into account
 - Quality evaluation metrics: PSNR, VQM



BITRATE RECOMMENDATIONS

Resolution	Suggested bitrates (4 streams) [kbps]	Suggested bitrates (2 streams) [kbps]
3840x2160	17000; 14000; 11000; 8000	17000; 10000
1920x1080	8000; 6000; 5000; 4000	8000; 5500
1280x720	6000; 4000; 2500; 1500	4500; 2500
960x540		2250; 1800
640x360		1600; 600
512x288	1700; 1200; 600; 300	1500; 450
352x288	1500; 900; 450; 300	1200; 300
176x144		100; 50

Table 1: Guidelines for bitrates in multi-rate streaming derived from recommendations of industry players.



VIDEO ENCODER

- Software encoder implementing AVC/SVC
- Scalability tools:
 - Temporal
 - Spatial
 - Coarse grain
 - Medium grain
- Designed for portability
 - Strict ANSI C
 - Specific target optimizations
- Testing with typical HD material (1080p)





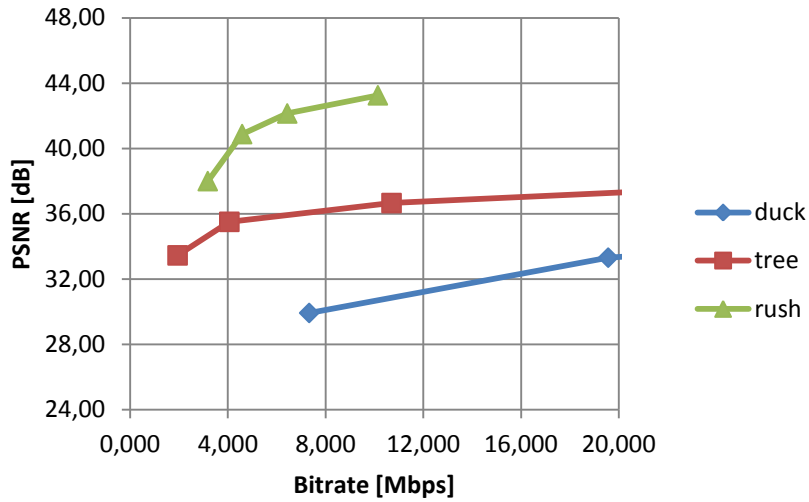
VIDEO ENCODER TESTS

- R&D curves
- Bitrate penalty:
 - Spatial & Coarse grain ca. 20%
 - Medium grain ca. 10%
- Four test conditions:

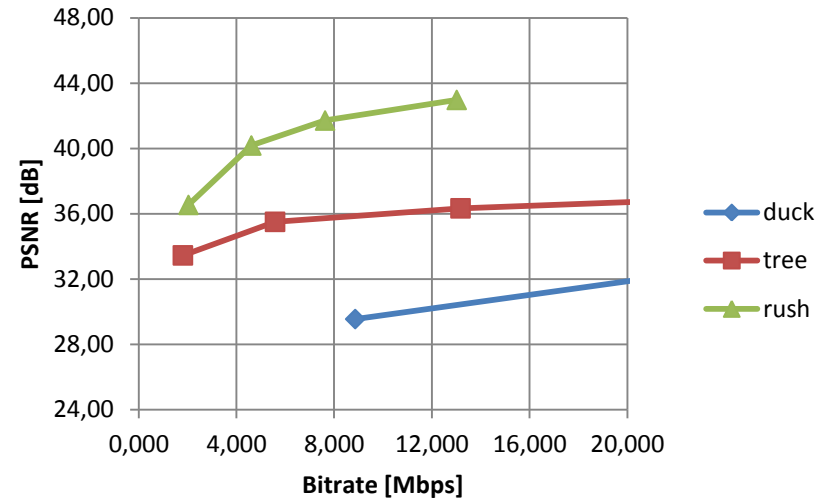
AVC	SVC Spatial
SVC Medium grain	SVC Coarse grain



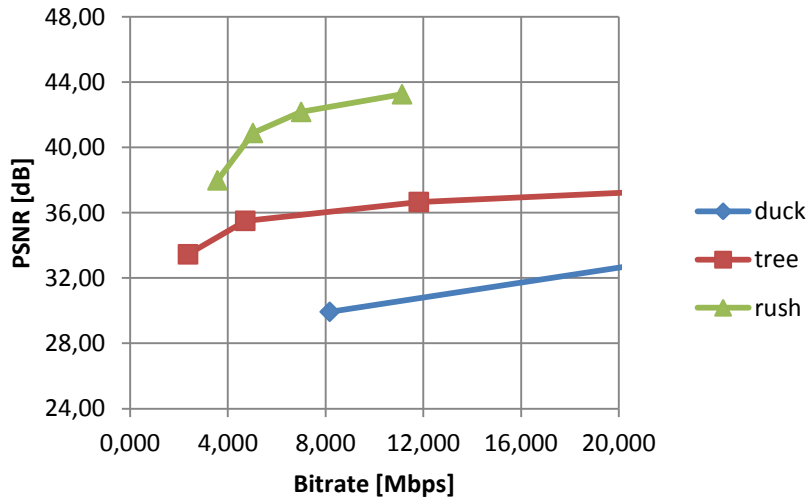
AVC



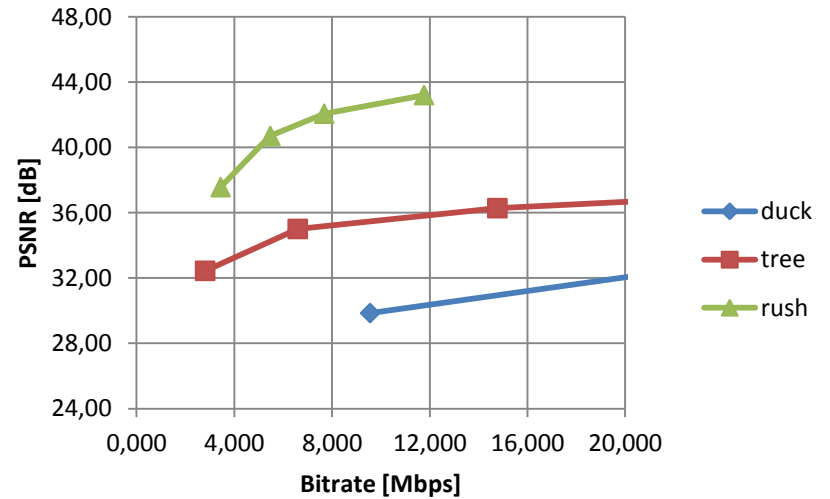
SVC Spatial



SVC Medium grain



SVC Coarse grain





QoE MONITORING

- Tool for Quality of Experience (QoE) estimation based on:
 - Network QoS monitoring
 - Media QoS monitoring
- Applied in commercial applications for streaming monitoring



QoE MONITORING SPEC

- Network QoS parameters:
 - Packet loss, delay, jitter (RTP streaming)
- Video QoS parameters:
 - Frame size, frame rate, bitrate
 - Coding parameters (based on coding standard)
- Audio QoS parameters:
 - Sample rate, bitrate
 - Coding parameters (based on coding standard)
- Non linear combination of Network & Media parameters → Video MOS, Audio MOS



CONCLUSIONS

- ALICANTE relies on SVC for content delivery
 - Enables distributed adaptation
- SVC encoding configuration determines adaptation options
 - Work towards guidelines based on analysis of industry solutions
 - SVC encoder & performance tests
- QoE monitoring tool to guide adaptation



THANK YOU FOR YOUR ATTENTION!

Questions?