

Overview of the Real-time H.264 SVC

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- Real-time SVC Encoder

- Conclusion : **Already Done. (2-Spatial Scalability with VGA and QVGA)**

- References

1. 'Implementation on a Real-time SVC Encoder for Mobile Broadcasting' @ IEEE CCNC 2008.
2. 'Motivation and implementation of a software SVC real-time VGA encoder for mobile TV' @ Applications of Digital Image Processing, Aug., 2008.
3. 'Real-Time System for Adaptive Video Streaming Based on SVC' @ IEEE Transactions on Circuits and Systems for Video Technology, Sep., 2007.

- Real-time SVC Decoder

- Conclusion : **Already Done. (1080p HD Decoding)**

- References

1. 'Real-time H.264/AVC Codec on Intel Architectures' @ International Conference on Image Processing 2004.
2. 'Implementation of H.264 Encoder and Decoder on Personal Computers' @ Journal of Visual Communication and Image Representation (submitted).
3. 'Towards Efficient Multi-Level Threading of H.264 Encoder on Intel Hyper-Threading Architectures' @ IPDPS 2004.

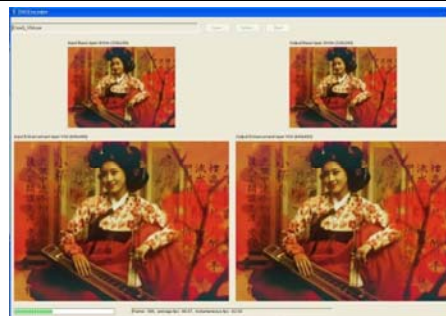


PART 1 : **REAL TIME SVC ENCODER**

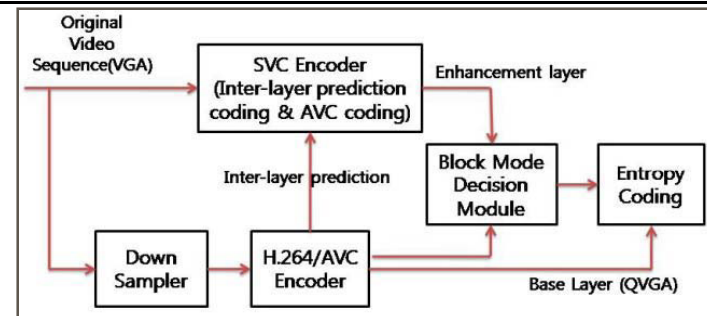
H.264 SVC Real-time Encoder (1)



KBS with ICU @ Korea		
Layer	Base layer	Enhanced Layer
Size	QVGA(320x240)	VGA(640x480)
	Compatible with H.264/AVC	
Remark	<p>Encoding speed from 50 to 70 fps with acceptable PSNR</p> <p>PC : Intel core 2 duo E6600, 2.4GHz CPU</p> <p>Memory : DDR2 800Mhz 4GB</p> <p>Motion Estimation method : Diamond search</p> <p>Supports 2-Spatial Scalability</p> <p>Optimization :</p> <ul style="list-style-type: none"> -Multi-thread and SIMD(Single Instruction Multiple Data) assembly code -Optimize H.264/AVC (the base layer) -Fast zero motion block detection and modified fast intra prediction algorithm -Fast mode decision between intra and inter mode algorithm 	



UI of SVC encoder

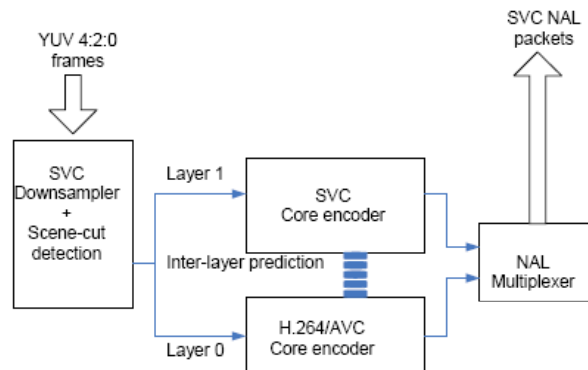


SVC encoder structure

H.264 SVC Real-time Encoder (2)



Thomson R&D @ France		
Layer	Base layer	Enhanced Layer
Size	QVGA(320x240) @ 25fps 250kbps to VGA@25 fps 1Mbps	VGA(640x480) @ 25fps
	Intel Xeon 5160 Processor	
Remark	Optimization : -SIMD assembly code (SSE2 : Intel's MIS) -EPZS motion search algorithm -Fast decision algorithm for MB -Tuned SVC residual prediction -Several heuristics for selecting MB mode candidates	



SVC encoder structure

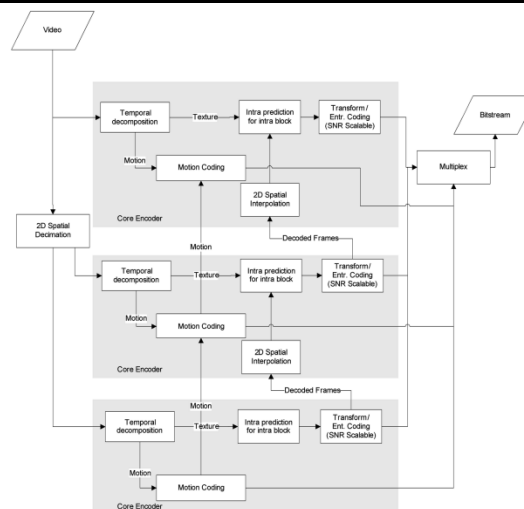


Thomson SVC Player GUI

H.264 SVC Real-time Encoder (3)



RWTH Aachen Univ. @ Germany	
Layer	Base layer with Enhanced Layer
Size	QCIF(176x144) @ 25fps to CIF(352x288) @12.5 fps
Remark	As a part of DANA E Project PC : Intel Pentium D Processor Optimization : -Modified JSVM reference S/W -SIMD code -Motion vector search : SAD calculation -Optimize quarter-pel filter and 2-D spatial up-sampling filter



SVC encoder structure



PART 2 : **REAL TIME SVC DECODER**

H.264 SVC Real-time Decoder



KBS(Broadcasting Station) & ICU @ Korea	
Size	HD 1080p
Remark	Environment : Decode HD(1080p) Content with <u>PC</u> Optimization : - Intra Period Level Multi-Threading - Assembly Language Level Optimization (SSE1/SSE2/SSE3) - C-Language Level Optimization

HD-200 model : Commercial video conference equipment of Vidyo Corp.	
Size	2 - HD 720p @ 60fps
Remark	Environment : Decode HD(720p@60fps) Content with H/W Equipment 

Performance of Current JSVM



- Performance of Current version of JSVM(ver. 9.15) (experimented by Ryu)

- Experiment Condition

- 2-Spatial Scalability : 704x576 and 352x288
 - GOP and Intra Period : 2 and 4 ~ 16 and 32
 - Reference Frames : 1 ~ 3 frame
 - Encoded Frames : 300 frames
 - Frames per Second : 30fps (for real-time -> $300 / 30 = 10$ sec)

- Results

Decoded Layer : Decoding Time (sec)	Remark
Base layer (352x288@30) : 8 sec	Real-time
Enhancement layer with Base (704x576@30) : 42 sec	Need optimization

- The Way for Optimizing JSVM Decoder (if needed)

- Adding MIS(Multimedia Instruction Set : SIMD) with SSE(Intel) instruction
 - Adding multi-threading
 - Using in-line assembly
 - Optimizing C-code (floating point calc -> integer calc , using pre-calculated table , etc.)