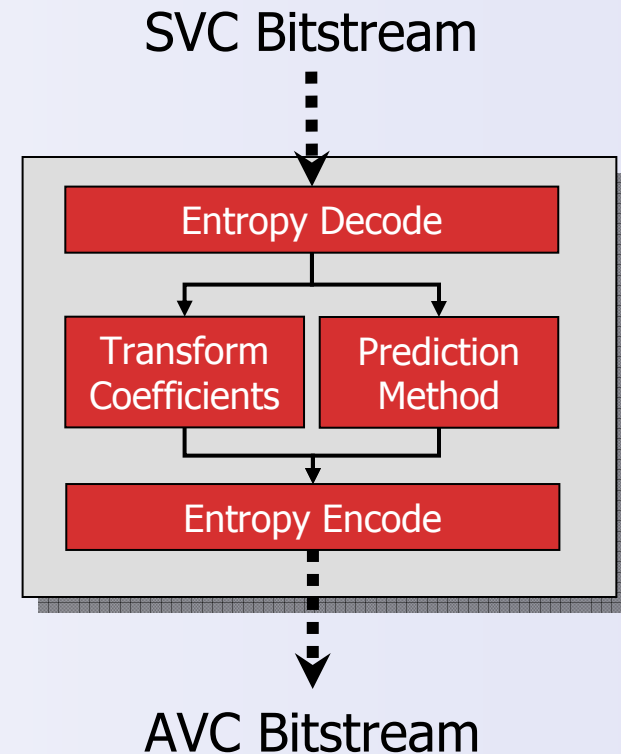


SVC-to-AVC Bit-stream Rewriting for Coarse Grain Scalability

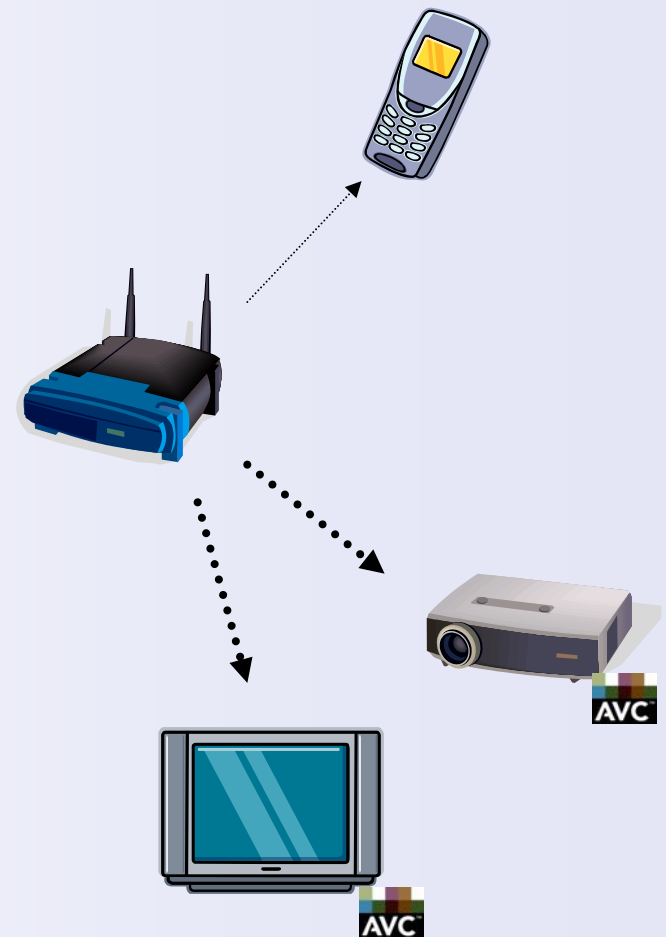
JVT-T061

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Sharp Labs of America
July 13, 2006

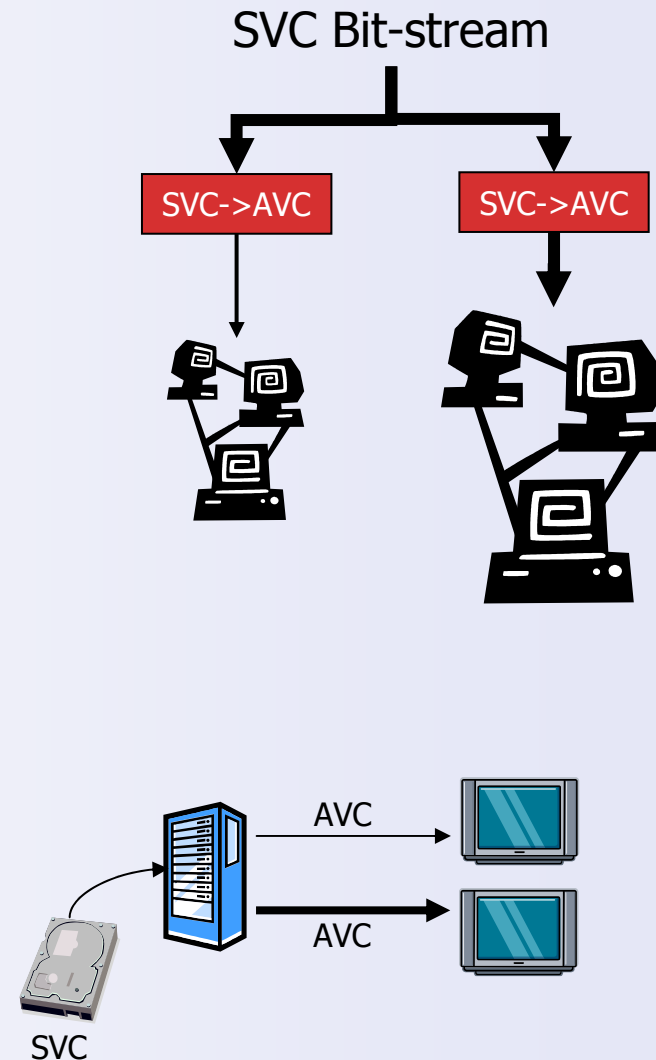
- What is SVC-to-AVC Bit-stream Rewriting?
 - Translate an SVC bit-stream into an AVC bit-stream within the network
 - Advantages
 - Exploit single loop structure of SVC
 - Easier than transcoding
 - Drift free
 - Minimal computational effort
 - Decode bit-stream and scale transform coefficients
 - No need to reconstruct intensity data



- Applications that benefit from SVC-to-AVC rewriting
 - System where the final link is rate constrained
 - Example: wireless link to display device
 - No need to send SVC overhead to device
 - Discard data by rewriting
 - System with legacy, high fidelity displays
 - Convert baselayer+multiple enhancement layers to a single AVC bit-stream
 - Maximize visual quality of these devices



- Applications that benefit from SVC-to-AVC rewriting (cont.)
 - Heterogeneous network with a large number of AVC devices
 - AVC devices may receive a higher quality than the baselayer
 - SVC stream re-written within the network
 - Media servers
 - SVC bit-stream utilized for file storage
 - Server supports both AVC and SVC devices at any quality
 - Bit-stream translated during playout



- What is being proposed
 - Changes to SVC to facilitate SVC-to-AVC translation
 - Syntax to signal if SVC-to-AVC translation is supported by a bit-stream
 - To be clear
 - This is a proposal for additional functionality
 - Applications that do not need this functionality can disable the changes

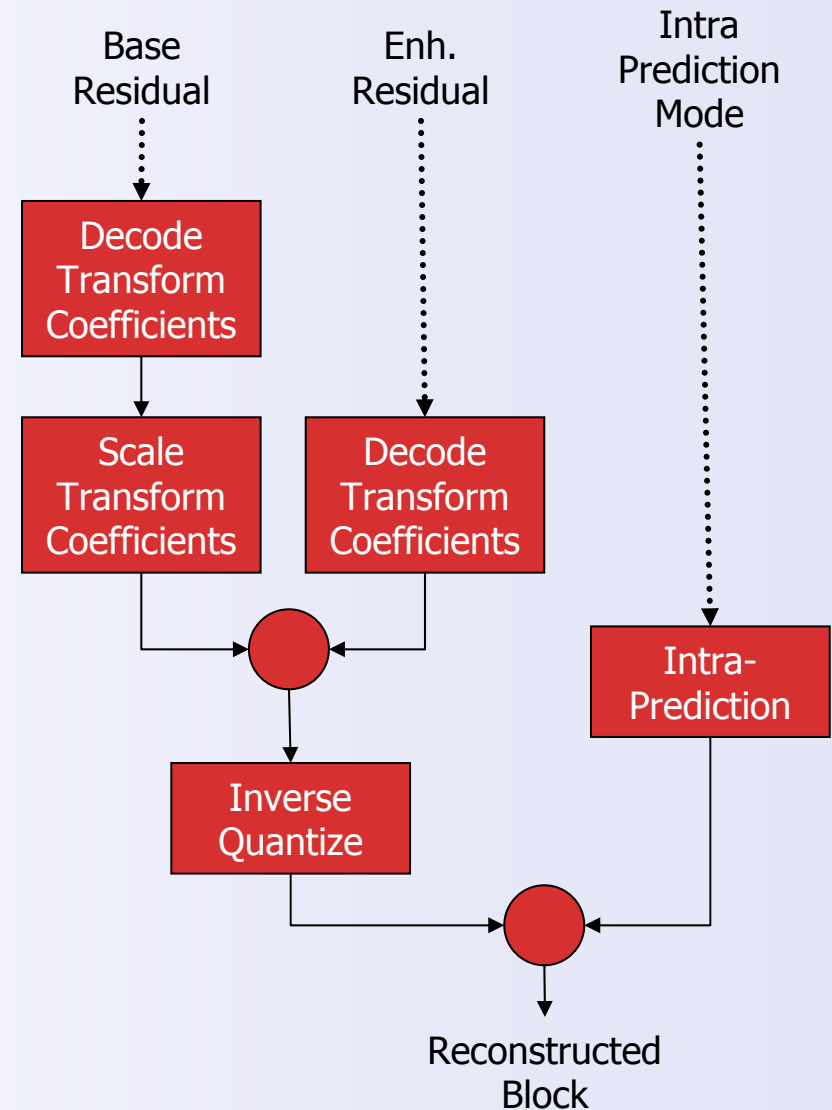
- Proposed Changes to SVC
 - Inter-predicted blocks
 - Restrict transform type in enhancement MBs
 - **base_mode** flag true
 - **residual_prediction_flag** true
 - **transform_size_8x8_flag** shall be the same as reference block
 - Note: flag still transmitted for independent parsing
 - Modify residual prediction process
 - Identical to current PR slice
 - F.8.11.3.1-4 instead of F.8.11.4
 - Scale transform coefficients and refine in transform domain
 - Smoothed reference disabled when SVC-to-AVC functionality enabled

F.8.2 Base slice decoding process without resolution change

- ...
- Otherwise (the macroblock mbAddr is not coded using an I macroblock type), the following applies.
 - When EnhIdx is equal to 0, the motion data derivation process as specified in subclause F.8.5 is invoked with mbAddr, mbType[mbAddr], subMbType[mbAddr], predFlagL0[mbAddr], predFlagL1[mbAddr] (if applicable), refIdxL0[mbAddr], refIdxL1[mbAddr] (if applicable), mvL0[mbAddr], mvL1[mbAddr] (if applicable), refPicList0, and refPicList1 (if applicable) as the inputs and the outputs are modified versions of predFlagL0[mbAddr], predFlagL1[mbAddr] (if applicable), refIdxL0[mbAddr], refIdxL1[mbAddr] (if applicable), mvL0[mbAddr], and mvL1[mbAddr] (if applicable).
- If the syntax element **avc_rewrite_flag** is equal to 0
 - When the syntax element **residual_prediction_flag** of the macroblock mbAddr is equal to 1, the following applies.
 - The residual accumulation process as specified in subclause F.8.11.4 is invoked with mbAddr, lumaTrafo[mbAddr], sTCoeff[mbAddr], rSL, and, when chroma_format_idc is not equal to 0, rSCb and rSCr, as the inputs and the outputs are modified versions of rSL, and, when chroma_format_idc is not equal to 0, rSCb and rSCr.
 - The transform coefficient scaling process as specified in subclause F.8.11.2 is invoked with the luma transform type fieldMb[mbAddr], lumaTrafo[mbAddr] as the input and the outputs are assigned to the list of scaled transform coefficient values sTCoeff[mbAddr], the list of significance indicators sigBCoeff[mbAddr], and the list of context identifiers ctx4x4Id.
 - Otherwise the progress refinement process for scaled transform coefficients as specified in subclause F.8.11.3 is invoked with fieldMb[mbAddr], the luma transform type lumaTrafo[mbAddr] and the list of scaled transform coefficient values sTCoeff[mbAddr] as the inputs and a modified version of the list of scaled transform coefficient values sTCoeff[mbAddr] as the output.

Intra-Block Changes

- Proposed Changes to SVC
 - IntraBL blocks
 - Transform type same in baselayer and enhancement layer blocks
 - Intra-prediction performed in enhancement layer
 - Intra-prediction mode copied from reference (base-layer) block
 - Residual data predicted from baselayer; scaled and copied in the transform domain



Impact on Coding Performance

Sequence Resolution		QP	JSVM Bits	PSNR	Proposed Method Bits	PSNR	Delta Bits	Delta PSNR
Bus	CIF@30	37	378.3856	30.9644	378.3856	30.9644		
Bus	CIF@30	31	879.9856	34.4232	904.28	34.4304	1.027607724	-0.0072
Foreman	CIF@30	35	176.3912	34.4709	176.3912	34.4709		
Foreman	CIF@30	29	443.0896	37.5009	454.8272	37.4521	1.026490353	0.0488
Football	CIF@30	33	749.8477	33.7806	749.8477	33.7806		
Football	CIF@30	27	1626.637	37.6012	1778.348	37.3696	1.093266912	0.2316
Mobile	CIF@30	38	244.1904	29.1703	244.1904	29.1703		
Mobile	CIF@30	32	666.7128	32.4992	673.912	32.4942	1.010798053	0.005
City	CIF@30	33	266.5296	35.4983	266.5296	35.4983		
City	CIF@30	27	594.2056	38.6326	620.392	38.6528	1.044069595	-0.0202
Crew	CIF@30	34	377.1384	34.5975	377.1384	34.5975		
Crew	CIF@30	28	937.6312	37.8809	989.7528	37.7933	1.055588594	0.0876
Harbour	CIF@30	35	390.3632	30.8001	390.3632	30.8001		
Harbour	CIF@30	29	1042.09	34.2278	1073.857	34.2294	1.030483739	-0.0016
Soccer	CIF@30	33	363.2104	34.6388	363.2104	34.6388		
Soccer	CIF@30	27	854.3512	38.2697	887.768	38.1578	1.039113657	0.1119
MEAN							1.040927328	0.0569875

Two Layer CGS system with AVC compatible baselayer (FGS base points)

Impact on Coding Performance

Sequence Resolution		QP	Simulcast Bits	PSNR	Bit-rate Savings		
					Single Layer	JSVM	Proposed
Bus	CIF@30	37	378.3856	30.9644			
Bus	CIF@30	31	1148.134	34.553	67.0%	76.6%	78.8%
Foreman	CIF@30	35	176.3912	34.4709			
Foreman	CIF@30	29	543.1696	37.5876	67.5%	81.6%	83.7%
Football	CIF@30	33	749.8477	33.7806			
Football	CIF@30	27	2225.685	37.6807	66.3%	73.1%	79.9%
Mobile	CIF@30	38	244.1904	29.1703			
Mobile	CIF@30	32	818.7968	32.578	70.2%	81.4%	82.3%
City	CIF@30	33	266.5296	35.4983			
City	CIF@30	27	785.8488	38.6702	66.1%	75.6%	78.9%
Crew	CIF@30	34	377.1384	34.5975			
Crew	CIF@30	28	1174.436	37.9516	67.9%	79.8%	84.3%
Harbour	CIF@30	35	390.3632	30.8001			
Harbour	CIF@30	29	1334.668	34.3437	70.8%	78.1%	80.5%
Soccer	CIF@30	33	363.2104	34.6388			
Soccer	CIF@30	27	1116.436	38.3485	67.5%	76.5%	79.5%
MEAN					67.9%	77.8%	81.0%

Comparison to Simulcast

- Decoder complexity

		Rewrite Disabled	Rewrite Enabled
Intra	Number Transforms	$\leq \text{Num Layers}$	1
	Prediction Layer	Arbitrary	Fixed (Recon)
Inter	Number Transforms	$\leq \text{Num Layers}$	1
	Prediction Layer	Fixed (Recon)	Fixed (Recon)

- Identified changes to SVC to enable SVC-to-AVC translation
- Proposed syntax and semantics to enable these changes
- Quantified impact on coding efficiency

