CCITT SGXV
Working Party XV/1
Experts Group for ATM Video Coding

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TITLE : REPORT OF THE SIXTH MEETING OF THE EXPERTS GROUP FOR ATM VIDEO CODING IN STOCKHOLM/HAIFA (March 18-27, 1992) - PART II
Purpose: Report

PART II JOINT SESSIONS

1. General

Joint sessions with ISO/IEC JTC1/SC29/WG11 (MPEG) were held in Haifa at the kind invitation of Zoran Microelectronics Ltd during 23-27 March 1992. At the opening session, Dr. Aharon Gill welcomed the CCITT Experts Group. The Experts Group appreciated the support and hospitality of the hosting organization.

A list of documents considered during the joint sessions is attached to this report as Annex 1.

2. Requirements sub-group (by S. Okubo)

2.1 General

The Requirements Group met on Monday (16:30-18:00) and Tuesday (9:00-10:15, 14:00-15:00) to discuss requirements for MPEG-2 video, audio and system. It had a joint session with Audio group on Wednesday (11:00-12:30) for planning the phase 2 work. It also had an editorial group meeting on Thursday (9:30-12:00) for completing the two documents concerning the requirement listing.

2.2 Requirements listing for video

2.2.1 Ad hoc group work

Outcome of the ad hoc group on this subject is contained in MPEG92/130 (AVC-253) which describes general requirements in Annex 1 and a guide for the video work in Annex 2. Application profile work initiated at the Singapore meeting should be continued for various cases because Annex I to Annex VI (Report of Requirement Group) only shows examples for three typical applications. Ranking of each requirement according to the degree of necessity should be used as described in Section 4.2 of MPEG92/130 (AVC-253).

During the discussion, one particular requirement was pointed out that the 3:2 pull-down system needs indication of exact field repetition when editing is involved. This fact should be taken into account in the video coding design; MPEG-1 does not have this capability.

As to the guide for video work in Annex 2, the meeting recognized the necessity of such a document, but agreed to the view that it should be shorter, crispening and of a pointing nature.

2.2.2 Broadcasting applications

The last section of Document MPEG92/141 listed some considerations to increase the utility of MPEG-2 for use in broadcast digital video, stressing that MPEG-2 should strive for maximum interoperability with broadcast digital video, including perhaps HDTV.

Document MPEG92/131 provided an extensive list of user requirements for broadcasting purposes and requested MPEG to keep close contact with CCIR. The meeting appreciated this input for inclusion in the above mentioned "requirements listing" document.

During the discussion, it was clarified that though coding of CG (Computer Graphics) may be under responsibility of another ISO group, we should be able to sufficiently encode such source materials which include CG pictures as part of them. It was also clarified in response to a question that a possible yardstick to the "drastic loss of coding efficiency" mentioned related to scalability and compatibility (Item 6 in Section 3/Appendix of MPEG/92131) is one point in the five grade subjective scale.

There was some discussion on the broadcasting chain consisting of source, studio, emission (or primary/secondary distribution), receiver and recorder. A particular concern expressed was the receiver and recorder part. The question was whether received digital signals be recorded directly and used for trick mode, editing etc. One view was that the encoding should be ready for such uses. Another view was that in the short term the received digital signals be decoded and analog signals be recorded in the conventional equipment and processed as is widely done now, because such digital recorders may be equipped with analog input in any case. This matter be further considered, awaiting contributions.

2.2.3 Scalability

Documents MPEG92/141,174,198 and another oral presentation expressed a US view stressing the need of scalability feature in the MPEG-2 standard. The meeting renewed recognition of such requirements.

2.2.4 Refinements of the requirements listing

A small group, consisting of A.Lippman, S.Okubo, T.Homma, T.Tanaka, M.Tinker, N.Wells, refined the general requirements listing and guide for the video work incorporating contributions and views obtained at the meeting at large.

The outcome has been issued as two separate documents; MPEG92/229 and 230.

2.3 Materializing the "generic standard" philosophy through the TM work

At the Singapore meeting, it was agreed that the objective of our work should be to achieve the "single standard" as far as possible, but in practice the "toolkit with maximum core" may be the solution. There was also raised a notion of "supercore" for consideration.

The question for this meeting was how to reflect this objective into the Test Model work currently being carried out.

MPEG92/154 (ISO/IEC Technical Report) provides a concept of "profile" for

possible use in our standard, which defines combination of "base standards" and particular subsets of options to provide specific functions. MPEG92/188 (Annex 5 to AVC-256R) proposed provision of a test method to optimize the low delay mode in the Test Model experiments.

Taking these input contributions into consideration, the meeting reached a common view as follows;

1) Since the generic standard is intended to meet the performance and functionality requirements of each particular application, one way is to emulate the situation in the Test Model work.

2) Each contributor may have some application in mind as user of the standard and be willing to do his/her best efforts to optimize the Test Model for the particular application, Test Model refinement should be integration of such efforts in a harmonized way.

3) To avoid divergence in the current convergence phase work, above mentioned improvement efforts should be done using a single syntax defined in the Test Model.

4) Based on the analysis to relate functionality with necessary elements in the standard, the following items are suggested for inclusion in the Test Model experiments;

a. Basic performance
b. Scalability
c. Low delay
d. Simplest decoding (for such as broadcasting environments)
e. Robustness to bit error and cell/packet loss
f. MPEG-1/H.261 compatibility
g. Trick mode
h. Extension to higher formats

5) The improved syntax should be reviewed each time to implement the "maximum core" objective as well as to reflect the coding efficiency and implementation consideration. Use of good engineering sense is expected.

2.4 Procedures to improve the Test Model

A process from a new idea to its inclusion in the Test Model was discussed and clarified as in the separate document WG11 N0158 (see Annex 2 to this report), which defines a process from a new idea to its inclusion in the Test Model through experiments, documentation, core experiments and verification.

2.5 General requirements for audio and system

2.5.1 Purpose

This part of Requirement session was the first free discussion occasion to obtain an overall view of the MPEG phase 2 as a total system. Main topic was identification of general requirements which can not be met by the MPEG-1 standard.

2.5.2 Alignment of the time schedule

At the moment, discussion is directed toward aligning audio and system works

with that of video; freezing the specifications at the end of 1992 and official standard in 1994.

2.5.3 Necessary works for MPEG phase 2

One area identified as needing additional work is "multi-channel" system which may be a video with several high quality audio channels and associated multiple language channels, or furthermore a set of multiple such programs.

CCIR study programs for such multi-channel audio systems were brought to attention of the meeting.

Audio coding experts expressed that a possibility to cope with this need under the phase 2 time frame is to extend the current standard, by exploiting the characteristics of multiple coded sources as well as by lowering the sampling frequency for e.g. language channels.

Another item raised for consideration is constraints in the satellite broadcasting; noisy channel, switching bitstreams, adaptive multiplexing, etc.

For the system part, there were two input documents for this meeting which proposes to work on error resilience (MPEG92/088) and control & indication signals (MPEG92/089).

It was also pointed out that during the video requirement survey, the following items had been identified as additional requirements to the system (see Section 4 of Annex VI to the Singapore meeting report);

- signal encryption and/or scrambling for authorized receivers etc.
- mechanism to implement backward compatibility between systems with different bit rates
- editing coded signals in such applications as home video

Since this discussion was of a general nature, deeper considerations were expected in the individual audio and system sessions.

2.6 Work plan for Audio

Joint Audio/Requirements meeting reviewed the possible work items taking into account the time frame set for overall MPEG phase 2. After some discussion, the following study items were agreed upon as targets achievable by means of extending the MPEG-1 audio coding;

- compatible commentary grade audio coding (Note)
- compatible multi-channel audio coding (multi stereos, multi languages; Note)
- transcodability

Note: These may allow scalability.

Furthermore, the following items were identified as requiring longer term study;

- lossless coding
- 7kHz videoconferencing
- fast mode
- ATM mode

- N-ISDN distribution;

See the Report of Audio group for more details.

3. Video sub-group (by G. Bjoentegaard)

3.1 General

The activity in the video group was divided into three parts:

- Comments to the MPEG-1 CD.
- Conformance testing.
- Work towards TM1.

The first two points are not considered to be of specific interest to the CCITT group. The focus will therefore be on the third item which reflects the actual collaboration between CCITT and MPEG.

3.2 Work towards TM1

A preliminary document (PWD) for definition of the first test model was available prior to the meeting. The goal of the HAIFA meeting was to complete the definition of the first test model (TM1) and define experiments to be performed until the next meeting.

3.3 Procedure for improvement of the test model

The procedure for incorporating new ideas in the test model was clarified (see Annex 2 to this report):

- Assume that a promising idea is presented at a meeting. If more than one lab finds the idea interesting for further testing, sufficient documentation is included in the test model to be able to make comparative tests at different labs.

- If the result of this test is positive (the definition of "positive" is not clearly defined) the idea is incorporated in the test model.

According to the present time schedule, it will be very difficult to alter the TM significantly after November 1992. This means that ideas produced after July 1992 will have a minimal chance of getting into the test model.

3.4 Profiles

The coding standard shall be "generic". It must therefore fulfil requirements set by different applications. In order to ensure that all the requirements are fulfilled, a set of profiles is defined.

A profile is a subset of the features defined in the test model and is intended to correspond to specific applications. The intention is that experiments shall be performed within each profile to ensure that the standard fulfils the corresponding requirements.

Four different profiles have been defined:

- High quality profile. Within this profile there is no constraint concerning e.g. scalability, low delay etc.

- Compatibility. The main restriction within this profile is compatibility with MPEG-1 and/or H.261. This profile is also somehow connected to spatial scalability.

- Scalability. Within this profile the constraint is more general scalability.

- Low delay. The main applications connected to this profile is two-way communication.

Definitions of the different profiles and corresponding core experiments were produced at the meeting and will be part of the revised version of the TM1 description.

3.5 Prediction modes

Many experiments had been performed and the results were presented at the meeting. Most of the experiments focused on improving the picture quality. Much focus was on the use of different prediction modes. A small group was therefore set up to define the set of prediction modes to be included in TM1. This resulted in a considerable increase of prediction modes and therefore also complexity of the test model. The intention is that experiments shall make it possible to point out the most useful prediction modes and that a large amount of the others may be discarded at a later stage.

3.6 Ad hoc groups

Several ad hoc groups were formed for doing collaborative work until the next meeting. The groups of most interest for CCITT are:

- TM1 editorial group. (Arian Koster)
- Compatibility. (A. Koster)
- Scalability. (C. Gonzales)
- Quantisation. (N Wells)

3.7 Items of particular interest to CCITT

Of the four profiles, the ones on compatibility (with H.261) and low delay seems to be of particular interest to CCITT. In addition it is important to focus on cell loss characteristics in connection with ATM.

The new prediction modes is of particular importance for the low delay profile. The increased number of choices will give better predictions also for P-frames.

> Authors note: In order to get good low delay prediction modes, CCITT members must be very active both in presenting simulation results and in the meeting.

4. System sub-group (by B.G. Haskell)

The MPEG Systems Committee spent most of its time reviewing comments on the MPEG-1 Committee Draft. Subjects covered briefly during a short meeting on requirements included error correction, cell loss, and encryption.

5. Implementation Study sub-group (by D.G. Morrison)

5.1 Sessions and attendance

	25th am	26th pm	27th am
John Gooding	x	x	x
Colin Smith	x	x	x
Kwok Chau	x	x	x
C J Lee	x	x	x
Marco Gandini	x	x	x
Sam Narashiman	x	x	
Ben Yung	x		
Eiichi Kowashi		x	
Don Shaver		x	x
Geoff Morrison	x	x	x

5.2 Comments on TM0

Many participants had not seen the preliminary test model agreed at the Singapore meeting. Clarification of several aspects of 'field' and 'frame' motion compensation and coding were sought but could not be adequately answered from the available documents. The meeting decided to join the Video subgroup meeting on Wednesday afternoon where presentations on these aspects were taking place. The Implementation Studies subgroup subsequently were of the opinion that this area was becoming rather complex and drafted some resolutions to voice this concern and suggest joint ways forward with the Video subgroup.

Several organisations had found a problem with chrominance vertical sample rate reduction and six solutions had been proposed in the Video subgroup. The Implementation Studies subgroup should look at this topic to see if there is a preferred solution from the complexity viewpoint.

5.3 Implications of scalability and compatibility on implementations

The video subgroup was receiving input documents on scalability and compatibility and some of these were drawing conclusions about the effect on implementation complexity. These should be checked by the Implementation Studies subgroup. As these issues could not be adequately considered during the meeting they were deferred. Topics to be covered include:

- frequency domain separations
- pel domain separations
- separation of coded bits performed by video multiplex or system multiplex.

5.4 Others

1) The subgroup decided to attend the meeting on compliance on Thursday morning (26th).

2) It was recognised that lack of a quantitative methodology for assessing implementation complexity is a hindrance to the work of the subgroup. For the benefit of newcomers, the procedures used to assess proposals in the competitive phases of MPEG-1 and MPEG-2 were related and their strengths and weaknesses discussed. Though the difficulties were

acknowledged there was interest in continuing to find better methods.

3) It was agreed to seek the establishment of an ad hoc group to continue working on the above issues until the July 1992 meeting.

4) Recommendations were prepared for the WG11 plenary to be held in the afternoon of 27th April. These are reproduced elsewhere, incorporated with all those from WG11.

END

List of documents for the Haifa joint sessions

Note: * indicates that the content of the document is also covered by AVC-numbered document.

MPEG92/		
086*	PWD EC	Preliminary Working Draft (AVC-212)
087	UNINFO	Proposal for a discussion on audio coding activities
088	Gold et al	Use of MPEG System in non error-free applications
089	Gaspar et al.	MPEG control and identification functions
090	TI	A proposed solution for Chrom. Mot. Comp. in the 4:2:0 format
091	OLYMPUS	Study of modified quantization for non-intra
092	NEC	Study on modified Q for non-intra block
093	Sugiyama	Core experiments for TM1
094	Hanamura	Comparison among some motion estimation methods
095	SC29 Secret.	Voting summary on SC29 N071 CD11172
096	Canon	Simulation results of half-pel refinement on decoded pictures
097	Toshiba	Result of core experiment (half-pel refinement on decoded pictures)
098*	Saitoh et al.	Simulation results on half-pel accuracy motion estimation (AVC-237)
099	KDD	Results on simulation framework for MPEG 2
100*	Yukitake	Field-time adjusted MC for frame-base coding (AVC-232)
101	Noguchi et al.	Simulation results of TM0
102*	Saitoh et al.	Coding efficiency comparison between multi-field prediction and adaptive frame/field prediction (AVC-231)
103	Sony	Comparison between field based coding (TM0 MPEG92/079) and frame based coding (MPEG92/080)
104*	Toshiba	Simulation results on compatible coding (AVC-234)
105	Toshiba	Results of core experiments
106*	Fujitsu	Low delay coding mode (AVC-233)
107	Sanyo	Simulation results of IBP versus IP versus IPP'
108	GCT	Vertical/zigzag scan and dynamic Huffman coding
109	Matsushita	Adaptive DCT/non DCT core experiment
110	NHK	Basic study on an alternative 8x8 DCT
111	Sony	Adaptive DCT/non DCT coding for test model
112	NEC	Study on overlapped block MC and Wavelet transform
113	Katayama	Elements of TM0 and its simplification
114	Sony	Simplification of Test Model (MPEG92/080): Frame/field adaptive coding
115	Sony	Introduction of field base coding in frame base coding
116	Mitsubishi	Field/frame adaptive DCT coding and adaptive scanning of DCT coefficients
117	Sony	Field flip problem in frame/field adaptive coding (MPEG92/117)
118	Japan MPEG	Results of the simulation framework for TM in Japan
119	TI	Report on TM0 core experiments
120*	CCITT/EUR	Proposal for the joint work between ISO/MPEG and CCITT/AVC (AVC-217)
121*	CCITT/J	Study items for embedded coding (AVC-229)
122	Ng et al.	Fully-compatible hierarchical MPEG decoder

123*	CCITT/J	Countermeasures against cell loss from viewpoint of image deterioration and transmission efficiency (AVC-236)
124*	CCITT/N	TM0 simulation and improvements (AVC-245)
125*	CCITT/J	Coding efficiency comparison between multi-field prediction and adaptive frame/field prediction (AVC-231)
126	Madec	Simulation parameters of TM
127	Alvazzi et al.	Experience in the production of MPEG/MHEG software
128	MacInnis	System Compliance Testing ad-hoc group
129	Chair/DSM	MPEG DSM sub-group meeting report
130*	Okubo	List of requirements for MPEG 2 video (AVC-253)
131	Curet et al.	MPEG bit and byte stream scheme representation and channel zapping
132	Veldhuis	Proposal for MPEG 2 Audio
133	Tanton	"PEL ASPECT RATIO" values in video bitstream syntax
134	Vial	Graceful degradation with TM0 using frequency scanning
135	Kogure	Considerations for MPEG Audio phase 2
136	Kogure et al.	A proposal of chrominance coding method for the adaptive frame/field algorithm of the MPEG test model
137	Kogure et al.	Performance rate control and adaptive quantization method for the MPEG 2 TM0
138	Brusewitz	Documentation of CD 11172 verification
139	NHK	Requirements for broadcasting use
140	Nocture	Double checking of NTA results shown in Kurihama
141	Lippman	Scalability and related video service application requirements
142	AT&T	Report on quantizer/GOP experiments
143	AT&T	Scalability by DCT coefficient selection
144	AT&T	Quantizer modification: experiments and proposal
145	AT&T	Filtering for half-pixel prediction
146	AT&T	Report on coordination of experiments for Haifa
147	Gonzales et al.	Experiments with scalability and PWD0
148	Viscito et al.	Qualitative comparisons between spatial and frequency pyramids
149	Shepherd	Report of JTC1 delegation to JTAG 2 meeting, Geneva, 1991 December 3-4
150	AUS NB	Invitation to JTC1/SC29/WG11 Coding of moving pictures and associated audio
151	Touchton	Note from Cesar Gonzales, dated 2/3/92
152	Brannon	Letter to SC29 Secretariat
153	BR NB	General information for the participants of the meetings of ISO/IEC JTC1/SC29/WGs 11 and 12, 6-10 July 1992
154	JTC1/SGFS	First Working Draft TR 10000-1.3: Information Technology - Framework and taxonomy of international standardised profiles- Part 1
155	JTC1/SC18	Proposal for a new work item: Multimedia and Hypermedia Model/Framework
156	CMTT/2 SRG	Liaison letter from CMTT/2-SRG to ISO/IEC JTC1/SC29/WG11 (MPEG)
157	JTC1/SC29	Resolutions adopted during the first plenary meeting of ISO/IEC JTC1/SC29, 21-23 November 1991, in Tokyo, Japan
158	JTC1	Extracts from the JTC1 Directives
159	CCIR	Administrative circular on "Request for documents

		and participation in the work of CCIR Task Group 11/3
160	CCITT	Liaison statement to ISO/IEC JTC1/SC29/WG11 (MPEG)
161	CCITT	Framework for recommendations for audiovisual services: objectives and status (as of November 1991)
162	JTC1/SC24	Image processing and interchange (IPI), background information to Part 3 (IIF)
163	JTC1/SC24	Image processing and interchange (IPI), Part 3: Image interchange facility (IIF) -- Working Draft --
164	CMTT	Liaison statement to JTC1
165*	PTT Research	Compatible coding structure (AVC-254)
166	Morris et al.	Coding the new field-based macroblock types
167	NL NB	Document distribution of JTC1/SC29/WG11 (MPEG)
168	Herpel	Experimental results towards TM0
169	Herpel	Requirements for video tape recording
170	Stautner	List of discussion items for MPEG-Audio
171	Pan	Progress report of the MPEG/audio ad hoc committee on software verification
172	KAIST	A core experiment on prediction structure (B/P structure and frame/field base coding)
173	Chiang et al.	Proposed syntax for field-based MPEG2 coding
174	Puri et al.	Scalability and compatibility by spatiotemporal pyramid coding
175	Mao	Full search, telescopic search and half pel refinement
176	JTC1/SC29	Title, area and programme of work of SC29
177	UNINFO	Future of project 1.29.08
178	JTC1/SC11	Proposed modified scope
179	Morrison et al.	Procedure for modifying the test model
180	IEC/ISO	Extracts from IEC/ISO Directives
181	EBU	Compliance aspects related to the CD 11172-3
182*	CCITT/J	A study on low delay mode (AVC-233)
183*	CCITT/J	Simulation results on compatible coding (AVC-234)
184*	CCITT/J	Cell loss compensation method (AVC-235)
185*	CCITT/D	Improved prediction for low delay video coding mode (AVC-251)
186*	CCITT/USA	Coding results for SCIF progressive images (AVC-252)
187*	CCITT/D	About the constraints of variable bit rate coding (AVC-255)
188*	CCITT EG	Proposal on low delay mode experiments (Annex 5 to AVC-256R)
189	Savatier	Modifications in PWD0
190	Savatier	Explanations of D1 demonstrations by TCE Los Angeles
191	Gerhaeuser	Proposal for MPEG II
192	Veltman et al.	Letter to Mr. Colcher
193	Le Gall	Report of the ad-hoc group for video conformance testing
194	Werner	Simulation results with TM0
195	Stoll	CD editing report
196	Koster	Report of ad-hoc group for video conformance testing
197	Brusewitz	Report from the ad-hoc group
198	Fernando	Networked workstations need for scalability
199	Reibman et al.	Coding results for SCIF progressive images
200	Chair/Test	Test sequences
201	Gonzales et al.	Report from ad-hoc group on experiments
202	Nocture	Proposal for vector labelling for field motion

		compensated mode
203*	CCITT/J	Evaluation of the TM0 algorithm at low bit rate (AVC-238)
204*	CCITT/D	Improved prediction for low delay coding mode (AVC-251)
205	Stoll	Report of the 3rd meeting of Test Group (CCIR-TC10/2)
206	Sugiyama	Hannover Audio Tape Demonstration
207	AUS NB	Comments to CD 11172
207	AUS NB	Comments to CD 11172
208	D NB	Comments to CD 11172
209	F NB	Comments to CD 11172
210	GB NB	Comments to CD 11172
211	I NB	Comments to CD 11172
212	IL NB	Comments to CD 11172
213	J NB	Comments to CD 11172
214	K NB	Comments to CD 11172
215	NL NB	Comments to CD 11172
216	P NB	Comments to CD 11172
217	S NB	Comments to CD 11172
218	USA NB	Comments to CD 11172
219	CDN NB	Comments to CD 11172
220	SF NB	Comments to CD 11172
221	Fritsch	Results of software audio decoder compliance testing
222	Lippman et al.	SNR scaling
223	US NB	Resolutions for consideration by MPEG
224	Gonzales	Application profiles for video scalability
225	Brandenburg	The ISO/MPEG-Audio codec: A generic standard for coding of high quality digital audio
226	Edit. group	Disposition of comments on CD 11172
227	Edit. group	TM-1 (as a delta from PWD-0)
228	Yonemitsu	D1 for the Brazil meeting
229*	Okubo	List of requirements for MPEG-2 Video (AVC-258)
230*	Okubo	Guide for the video work (AVC-259)
231	Farrett et al.	Proposal for MPEG II Audio

END

CONVERGENCE PROCESS through CORE Experiments

Definition: A CORE Experiment is an experiment where all the alternatives are fully specified within the test model.

The phases of convergence are the following

1/ Proposal for Core experiment

The alternatives to be considered are reviewed by the committee and aproved as part of the test model. To be considered, a proposal for C.E. need be sufficiently specific for a "no_mystery" implementation.

2/ Documentation as part of the test model

3/ Presentation of results by at leat two independant members.

4/ Consolidation of the test model

Selection of one of the alternative
or
Adoption of more than one alternative as "freedom" in the syntax

Experiments:

Experiments can be performed independantly and documented. If no concensus develops after presentation of the results, its technical content can be made a core experiment.