ITU-Telecommunication Standardization Sector Temporary Document -E **(WP 3/16)**

STUDY GROUP 16

Geneva, 7-18 February 2000

Question: 15/16

SOURCE: Rapporteur (Mr.Gary Sullivan - PictureTel/USA)

TITLE: Q.15/16 Meeting report

Question 15/16: ***Advanced Video Coding***

Working Party 3/16 addressed Question 15/16 under the chairmanship of Mr. Gary Sullivan (Microsoft/USA). The major objectives of the Question for this meeting were:

- Reviewing the draft text of Amendment 6 (number of lines in High and High 1440 profiles) to Rec. H.262 | ISO/IEC 13818-2 for Decision [COM16-99]
- Reviewing the draft text of Amendment 7 (supplemental information) to Rec. H.262 | ISO/IEC 13818-2 for Determination [TD (P) 26].
- Reviewing the draft texts of Annexes U (Enhanced Reference Picture Selection), V (Data Partitioned Slices), and W (Additional Supplemental Enhancement Information) of Rec. H.263 [TD (3) 12] for Determination, including consideration of:
  - Proposed alterations to add alternative back-channel support for Annex V (and for Annex N) [D.330]
  - Proposed alterations of the specified fixed-point IDCT method in Annex W [D.328]
  - Proposed addition of interlaced field coding indications in Annex W [D.329]
  - Proposed addition of a profile for broadband videotelephony [D.336]
- Furthering the work on the "H.26L" future video coding standard development effort, including consideration of:
  - Adding an intra mode suitable for encoding flat regions [D.360]
  - Modifying the motion compensation to support ¼-pel accuracy [D.361]
  - Modifying the test model aspects relating to rate-distortion quantization [D.362]
  - Consideration of the Nokia MVC coding technique proposal [D.454, 455, 456]

.1 Documentation

.1.1 Input Documents

White Contributions

Number	Source	Title
COM 16-099-E	*Q.15/16 Rapporteur*	Decision Draft Amendment 6 (Number of Lines in High and High-1440 Levels of All Profiles) to ITU-T Rec. H.262|ISO/IEC 13818-2
COM-16-113-E	*SG16 Management*	Draft Project MEDIACOM 2004 and Related Questions

Delayed Contributions

Number	Source	Title
COM-16 D.328	*PictureTel*	Proposed Alterations of IDCT Specification for H.263 Draft Annex W
COM-16 D.329	*PictureTel*	Proposed Addition of Interlaced Field Coding Indications in H.263 Draft Annex W
COM-16 D.330	*PictureTel*	Proposed Back-Channel Support for H.263 Annex N and Draft Annex U
COM-16 D.336	*AT&T*	Proposed H.263 Profile Definition for Broadband IP Videotelephony
COM-16 D.358	*Japan*	H.225.0 Packetization for ISO/IEC 14496-2 and -3
COM-16 D.360	*Telenor*	Proposed Alterations to H.26L Test Model: Improved Intra Coding of Smooth Pictures
COM-16 D.361	*Telenor*	Proposed Alterations to H.26L Test Model: Increased Motion Compensation Accuracy
COM-16 D.362	*Telenor*	Proposed Alterations to H.26L Test Model: Rate-Distortion-Optimized Chrominance Quantization
COM-16 D.405	*Siemens*	Concentrating Media Coding into One Study Group, and Number of Coding Questions
COM-16 D.454	*Nokia*	Proposed Alterations to H.26L Test Model: The Nokia “MVC” Video Codec Performance Results
COM-16 D.455	*Nokia*	Proposed Alterations to H.26L Test Model: The Nokia “MVC” Video Codec Encoder Design
COM-16 D.456	*Nokia*	Proposed Alterations to H.26L Test Model: The Nokia “MVC” Video Codec Decoder Design
COM-16 D.475	*France Telecom*	Video Packetization Issues in H.225.0 and H.245

Temporary Documents

Number	Source	Title
TD (P) 26	*Q.15/16 Rapporteur*	Determination Draft Amendment 7 (Supplemental Information for Video Elementary Streams) to Rec. H.262 | ISO/IEC 13818-2
TD (P) 10	*Intersector Coordination Group*	Report of 2nd Meeting of ICG on Satellite Matters
TD (G) 04	*ITU-R TG8/1*	LS re IMT-2000

TD (G) 05	*ITU-D SG2*	LS re Fostering Telecom in Healthcare – Success Factors in Telemedicine
TD (G) 20	*Q.12-14 Rapporteurs*	Comments on Draft New Questions
TD (3/16) 02	*SG12*	LS re Perceptual Audiovisual Quality Assessment
TD (3/16) 03	*ISO/IEC JTC1 SC29/WG11*	LS re MPEG-4 Coding Efficiency Verification Tests
TD (3/16) 04	*ISO/IEC JTC1 SC29/WG11*	LS re MPEG-4 Advanced Real-Time Simple Profile Verification Tests
TD (3/16) 05	*ISO/IEC JTC1 SC29/WG11*	LS re MPEG-4 Advanced Coding Efficiency Profile Verification Tests
TD (3/16) 06	*ISO/IEC JTC1 SC29/WG11*	LS re MPEG-4 Core Profile Temporal Scalability Verification Tests
TD (3/16) 07	*WP3 Chair*	Agenda and schedule for Working Party 3/16 (Signal Processing)
TD (3/16) 08	*ITU-R Joint TG 10-11 and TG 11/5*	LS re Data Compression
TD (3/16) 09	*Q.15/16 Rapporteur*	Report of eighth meeting of Q.15/16
TD (3/16) 10	*Q.15/16 Rapporteur*	Report of ninth meeting of Q.15/16
TD (3/16) 12	*Q.15/16 Rapporteur*	Working Draft H.263++ Annexes
TD (3/16) 17	*WP3 Chair*	Documentation for Working Party 3/16 (Signal Processing)
TD (3/16) 18	*Q.15/16 Rapporteur*	Q.15/16 Meeting Agenda and Status Report

.1.2 Output Documents

Temporary Documents

Number	**Source**	**Title**
TD (G) 28	*Q.15/16 Rapporteur*	Determination Draft Changes to Rec. H.245(v7) to Support H.263++
TD (G) 32	*Q.11/16 Rapporteur*	Working Draft Implementers Guide to H.230 to Support Video Bad Macroblocks Capability and Command Signals
TD (P) 25	*Q.15/16 Rapporteur*	Determination Draft H.263++ Annexes
TD (P) __	*Q.15/16 Rapporteur*	LS to ISO/IEC JTC1 SC29/WG11 re: Video Coding Projects and Status
TD (P) __	*Q.15/16 Rapporteur*	LS to ITU-T SG12 re: Video Coding Projects and Status

TD (P) __	*Q.15/16 Rapporteur*	LS to ITU-D SG2 re: Video Coding for Telemedicine
TD (P) __	*Q.15/16 Rapporteur*	LS to ITU-R TG 8/1 re: Video/Audio Synchronization
TD (3/16) 35	*Q.15/16 Rapporteur*	Working Draft Appendix II to Rec. H.263
TD (3/16) 36	*Q.15/16 Rapporteur*	Clarification of Proposed Changes to IDCT Specification

.2 Summary

The goals of Q.15 for this meeting were accomplished, including:

- Decision of Amendment 6 to H.262 by SG16 Plenary
- Forwarding of Amendment 7 to H.262 for Determination
- Forwarding of H.263++ (H.263v3) for Determination
- Progressing the work on H.26L

.3 Results

The group adopted the following agenda:

- Opening remarks
- Agenda approval, meeting schedule, document assignment review ..... [TD (3/16) 07, 17]
- Status review and report of interim and ad-hoc activities .... [TD (3/16) 09, 10]
- Patent policy remarks (**http://www.itu.int/ITU-Databases/TSBPatent/**)
- Liaison Statements Received..... .....[TD (3) 02, 03, 04, 05, 06, 08, TD (G) 04, 05, TD (P) 10], ... Output: [TD (P) __, __, __, __]
- Maintenance and coordination issues for current recommendations, including:
  - MPEG-4 packetization in H.225.0.....[D.358]
  - Video packetization in H.225 and H.245 .....[D.475]
- Reviewing the draft text of Draft Amendment 6 (number of lines in High and High 1440 profiles) to Rec. H.262 | ISO/IEC 13818-2 for Decision [COM16-099]
- Reviewing the draft text of Amendment 7 (supplemental information) to Rec. H.262 | ISO/IEC 13818-2 for Determination .....[TD (P) 26]
- Reviewing the draft texts of Rec. H.263 Draft Annexes U (Enhanced Reference Picture Selection), V (Data Partitioned Slices), and W (Additional Supplemental Enhancement Information) for Determination, including consideration of: ..... [TD (3) 12], Output: [TD (3) 35, 36, (G) 28, 32, (P) 25]
  - Proposed alterations to add alternative back-channel support for Draft Annex U (and for Annex N) .....[D.330], Output: [TD (G) 28, 32]
  - Proposed alterations of the specified fixed-point IDCT method in Draft Annex W .....[D.328], Output: [TD (3) 36]
  - Proposed addition of interlaced field coding indications in Draft Annex W ..... [D.329], Output: [TD (P) 25]
  - Proposed addition of a profile for broadband videotelephony .....[D.336], Output: [TD (3) 35]
- Furthering the work on the “H.26L” future video coding standard development effort, including consideration of:
  - Adding an intra mode suitable for for encoding flat regions .[D.360]

- Modifying the motion compensation to support ¼-pel accuracy ....[D.361]
- Modifying the test model aspects relating to rate-distortion quantization .....[D.362]
- Consideration of the Nokia MVC coding technique proposal..... .....[D.454, 455, 456]

- Future work ..... [TD (G) 20, D.405, COM16-113]
- AOB

.3.1 Coordination Issues on Packetization

Video codec packetization was discussed in D.358 on MPEG-4 video packetization and D.475 on H.263 packetization. In response to D.475, it was noted that RFC 2429 is the preferred packetization format for H.263. The problems discussed in D.475 were not known to the group, and it was not clear how interoperability could be achieved at all (even in the absence of packet losses) if the packetization format were not understood by both the encoder and decoder.

.3.2 Amendments 6 and 7 to H.262 | ISO/IEC 13818-2

The group was pleased with the Decision of Amendment 6 to H.262 (number of lines in high level of all profiles) as found in COM-16-99 by the SG16 plenary prior to the Q.15-specific sessions.

The group was pleased to note the development of the new Draft Amendment 7 to H.262 (supplemental information for video bitstreams) as found in TD (P) 26, and forwarded the draft for Determination by SG16 at this meeting. (This amendment is referred to within ISO/IEC 13818-2 as Amendment 1 to the 2nd edition, in reference to the anticipated publication of a 2nd edition encompassing the original recommendation and the first six amendments and two corrigenda.)

.3.3 Review of H.263++ Draft for Determination

The draft of H.263++ as submitted in TD (3) 12 was reviewed and the experts were pleased with the progress of work on this project. A couple of minor technical errors were found in the draft and corrected (including omission of a mode indication bit in the picture header for Annex U and correction of an erroneous remark regarding header marker emulation in motion vector data in Annex V). After review of the contributions proposing changes to the draft as described below in this section, a revised draft was generated as TD (P) 25 along with a draft revised version of Appendix II as TD (3) 35. The group was pleased to forward the H.263++ draft in TD (P) 25 to SG16 with a recommendation of Determination at this meeting. The draft Appendix II generated as TD (3) 35 is expected to be approved at the November meeting of SG16 after further interim work. H.245 syntax was also drafted for support of the new H.263++ features and was forwarded as TD (G) 28 in coordination with Q.14 for Determination at this meeting in H.245 version 7. H.230 syntax work also commenced toward adoption into an implementer's guide at the November meeting of SG16 from an initial draft generated as TD (G) 32.

.1 Proposed Alternative Back-Channel Signal

The group reviewed a delayed contribution D.330 which proposed the addition of an allowed alternative back-channel signal for operation of Draft Annexes U and N. It was noted that some such alternative back-channel signals had already been defined to some extent without any need for text in H.263. These include, for example, the videoNotDecodedMBs and videoFastUpdateMBs commands in H.245 and similar signals in H.230.

After discussion of this proposal, the group concluded that the addition of a new signal and associated capability for providing feedback on decoding operation would be useful. Such syntax was therefore drafted in coordination with Q.14 for addition to H.245 as TD (G) 28 and was forwarded for Determination at this meeting within H.245 version 7. Similar syntax was drafted as TD (G) 32 in coordination with Q.14 for adoption into a H.230 implementer's guide at the November meeting of SG16.

.2 Proposed Alterations of the Fixed-Point IDCT in Draft Annex W

The group reviewed a delayed contribution D.328 which advocated some changes to the fixed point IDCT specification found in Draft Annex W, primarily motivated toward reducing implementation complexity. The proponent indicated that the suggested changes could be made without losing compliance with the required accuracy. The group noted that some of the suggestions in the document had already been reflected in the submitted draft. In regard to the remaining differences between the proposal and the current draft, the experts judged that the differences in complexity appeared difficult to judge at this time and requested further information as to the exact nature of the changes proposed. A document was produced as TD (3) 36 to clarify the proposed changes. Some questions for clarification arose in response to TD (3) 36, particularly whether additional changes to those marked at the top of the document were being requested (as controlled by missing flags CHANGE_E1 through CHANGE_E4), and are expected to be resolved by interim correspondence. It was noted that the actual implementation complexity of the IDCT method would be platform-dependent, although the group should chose a method likely to minimize complexity across the mix of expected platforms. The experts expect to conduct further study of the proposed changes in the interim period after this meeting.

.3 Proposed Addition of Interlaced Field Coding in Draft Annex W

The group reviewed a delayed contribution D.329 which advocated the addition of an indication of interlaced field coding in Draft Annex W. This proposal noted the continued prevalence of interlaced cameras and displays in today's systems and the increased availability of sufficiently high bit rates to support telecommunication operation with high temporal resolution. The proponent noted that field coding of interlaced material can provide reduced delay relative to frame-based coding of interlaced material or to progressive-scan coding of such material by de-interlace processing, and that Annexes N and U can be used to provide high performance within the field coding method of operation. The proposal had the vocal support of representatives of several manufacturers of videoconferencing equipment, who indicated that they had system designs under way to support interlaced material and that immediate standardization was required to enable interoperability of such systems. In view of the simplicity of form of the proposal (without alteration of the basic decoding process, and even with backward-compatible indications reminiscent of H.261 Annex D), the group adopted the proposal and reflected this adoption in the draft TD (P) 25 forwarded for Determination.

.4 Proposed Definition of a New "Profile" of Operation for Broadband IP

The group reviewed a delayed contribution D.336 which advocated the definition of a new "profile" of operation suitable for broadband videotelephony on IP networks, providing enhanced error resilience and high coding efficiency. The proponent described the targeted environment as terminals having capabilities up to several hundreds of kbits/sec in the near term and reaching into the Mbits/sec in the longer term. IP packet losses would be expected and robustness to such packet losses is required, although quality-of-service capabilities may become available in the near future. Annexes N and U were discussed as addressing such needs due to their

ability to provide packet loss resilience and temporal scalability. The group discussed the proposal and the various potential actions that could be taken in response. Doubt was expressed as to whether an agreement could be rapidly reached on a normative profile definition. The group decided to work toward a revised version of Appendix II containing non-normative definitions of recommended optional enhancement. The “levels” in the existing Appendix II were renamed to “profiles”, some new “levels” of resolution, frame rate, and bit rate capability were defined, and one new profile (#4) was added to meet the needs of the broadband packet network teleconferencing application. The new profile (#4) contains Advanced Prediction (Annex F), Advance Intra Coding (Annex I), Deblocking Filter (Annex J), Picture Freeze Requests (part of Annex L), Factor-of-Four Reference Picture Resampling (part of Annex P), Modified Quantization (Annex T), and both the original and enhanced Reference Picture Selection modes (Annexes N and U) with four additional picture memories. The defined levels consist of QCIF 15 frames/sec at 64 kbits/sec, CIF 15 frames/sec at 128 kbits/sec, and CIF 30 frames/sec at 1920 kbits/sec. The resulting draft of Appendix II was produced as document TD (3) 35, and is expected to reach approval at the November meeting of SG16.

.3.4 Progress of Work on H.26L Project

The group discussed several proposals in regard to progressing the work on the H.26L project toward the development of a future improved video codec specification. The result of this work was the decision to modify the current H.26L test model (TML-2) to produce a new modified test model (termed TML-3) in the interim period as the basis for future work. The new TML-3 design should become the reference for comparison (rather than the reference for this meeting which was not quite up to TML-2 in performance), subject to appropriate software availability. TML-3 consists of the prior TML-2 design plus the changes described below in this section.

.1 Modification of Coding Method for Flat Regions

A delayed contribution D.360 was presented which proposed several changes to the current H.26L test model (TML-2) in order to enhance intra coding performance of the codec for coding smooth areas of pictures. The proposal advocated four changes: 1) use of a larger prediction block size in intra operation, 2) addition of a linear prediction method for intra, 3) combination of CBPY and CBPC with prediction mode into a single mapping to the UVLC table, and 4) addition of a 4x4 transform on the DC coefficients of the 4x4 blocks in a 16x16 macroblock. Since the proposed changes appeared to fix a known problem in the test model and appeared to provide a good design, the group adopted the proposed changes into TML-3.

.2 Modification of Motion Compensation to Support ¼-Sample Accuracy

A delayed contribution D.328 was presented which presented experiment results on 1/4 pel motion compensation with various filtering possibilities. In contrast to the current test model which uses adaptive motion accuracy selection between 1/2, 1/3, and 1/6 sample accuracy, an accuracy of ¼ sample was the focus of this proposal. Various interpolation filters were tested, in order to minimize filter length and thus complexity for a given level of performance. Filter lengths of 4 and 6 taps appeared to show good performance. Improvements in performance ranging from approximately 0.25 to 0.8 dB were reported. Some concepts from rapporteur-meeting contribution Q15-I-35 (Wedi) were confirmed in principle, including the use of bilinear filtering for the finest stage of interpolation after using longer filters for a coarser grid interpolation. A benefit continued to be shown by use of a stronger filter for some particular position in the fractional sampling grid. The group was favorably disposed to the ideas being reported. Higher motion accuracy appeared useful, particularly at higher bit rates. However, further study was requested to study the

relationship of these proposed modifications to the adaptive motion accuracy feature adopted in Red Bank but not used in these experiments. Experiment design was requested to further evaluate the appropriate course of action. No change to the test model was approved, although some change in the future was anticipated.

.3 Rate-Distortion Optimized Quantization

A delayed contribution D.362 was discussed which evaluated the effectiveness of the rate-distortion optimized quantization currently in the test model. Application of this technique to chrominance as well as luminance was reported to provide further gain and to clearly show that gain was obtained overall from this technique (approximately ¼ dB without requiring any special syntactical support), especially when scenes without a still camera were used (in order to avoid dominating the results with the performance of the first intra picture). In contrast to prior results which showed a loss of chrominance quality during application of this technique only to luminance data, the chrominance benefit was shown to be even greater than that for luminance. A change to the test model to add this chrominance quantization alteration was approved.

.4 The Nokia MVC Coder Design

Three delayed contributions D.454, D.455, and D.456 were presented describing a video codec design substantially differing from the current test model and reporting a significant benefit in performance (approximately 1.5 dB on average, although multiple reference picture memory and rate-distortion optimized quantization were not used in the proposal nor in the reference for comparison). The proposed design included the following major changes:

- Use of 6-parameter affine block-based motion compensation
- Altered pixel-domain prediction for Intra operation
- Use of DCT and KLT waveform coding for residual error
- Use of a different VLC structure

The visual quality demonstrated for the proposal appeared very significantly improved relative to the supplied reference results (based on TML-2 without multiple reference picture memory or rate-distortion quantization).

The group decided that further investigation of the presented methods was desired, including verification of coding performance and analysis of implementation complexity. The proponents indicated that the tested method actually had lower computational requirements than the current TML-2 design, and that they would make software available for testing the proposed algorithm. Further analysis of the presented methods is strongly encouraged. In particular, there is interest in testing whether the benefits of individual changes can be measured and evaluated, rather than judging the entire algorithm as a whole. Intra coding performance testing was particularly noted as a good starting point for analysis. The proponents indicated an interest in investigating multiple reference picture memory, 4x4 motion compensation, and simplified residual waveform coding.

.5 Additional Test Model Changes

The group noted that the “Forest” sequence specified for group use in experiments was not available and should therefore be removed from the common test conditions specified for testing by the group. There was also a remark that the current TML-2 document may neglect to specify the number of reference pictures to use in the testing, and a total of 5 pictures was considered the current group preference. These suggested changes to the test model were adopted.

The software generally used for reference testing at this meeting did not contain the rate-distortion quantization feature as planned. However, this is unlikely to have had any serious effect on the validity of the results. Although the group hoped that new software would be made available which more closely reflects the current TML-3 state of the test model, experiments with the current reference software used as a basis for comparison would be acceptable by the group unless improved reference software becomes available.

.4 Liaison Statements

Liaison statements generated by the group were as shown in the table below.

SENT				
TD /16	**Topic/Title**	**To**	**Purpose**	**Q./16 Assigned**
(P) __	Video Coding Projects and Status	ISO/IEC JTC1 SC29/ WG11	Information	15/16
(P) __	Video Coding Projects and Status	SG12	Information	15/16
(P) __	Video Telemedicine	ITU-D SG2	Reply	15/16
(P) __	Video/Audio Synchronization	ITU-R SG8	Reply	15/16

.5 Future work

The basic schedules for our future work are outlined in Annex Q15.A.

The experts from Questions 11, 13, and 14 have asked to continue to collaborate closely with us regarding the adoption of new video features into system standards such as H.230 and H.245, and regarding the use of video communication on mobile networks. We hope to make progress toward that goal of close coordination with experts from other Questions at our rapporteurs group meeting in May. Questions 11, 12, 13, and 14 are also planning to meet in the same week, which will provide an opportunity to coordinate any system issues regarding video in H-series terminals.

The primary means of document distribution within the Q15/16 Video Coding Experts Group is electronic, and our documents can be found on an ftp site that is maintained at PictureTel:

ftp://standard.pictel.com/video-site or
http://standard.pictel.com/ftp/video-site

This information is also linked to PictureTel's broader standards web site which is maintained by Patrick Luthi of PictureTel:

http://standard.pictel.com/

The group conducts its email conversations over an email reflector that is graciously maintained by PictureTel through a majordomo software system:

itu-adv-video@standard.pictel.com

Requests for subscriptions and "unsubscriptions" for this email reflector should be sent to the majordomo automated list manager address:

itu-adv-video-request@standard.pictel.com

The address of the email reflector maintained within the TIES system (**tsg16q15@ties.itu.int**) is included in the addresses for email to the **itu-adv-video** list as well, to ensure that those subscribing to the ITU-maintained list receive all group communcations.

We plan two interim rapporteur's group meetings between the Feb '00 and Nov '00 meetings of SG 16. These plans are shown below. The group plans to also continue the ad-hoc activities created at the Red Bank meeting and described in the report of that meeting (error resilience simulation conditions and evaluations, test model enhancement and software development, H.263++ development, and H.26L development). The Japanese national delegation has offered to host the first of the two interim meetings in Osaka, Japan, and the host organization plan for the second meeting is not yet complete. Judging by the level of interest in our prior work (between 40 and 50 participants at each meeting), we are expecting attendance at the two interim meetings of 40-50 people (generally widely scattered in geographical representation).

Tentative Dates	**Tentative Host/Place**	**Question**	**Detailed agenda items**
16-18 May	Japan/ Osaka	15	• Further the work toward H.26L long-term coding standard • Finalization of "H.263++" extensions of H.263 for white document generation and November decision • Finalization of H.263 Appendix II revision for adoption in November • Coordination of video coding needs for Q.11-14/16 standards • Study of H.263v2 and v3 capabilities and limits • Particular study of video coding for packet network and mobile applications • Coordination of relationship with video coding technology in ISO/IEC JTC1 SC29/ WG11 (MPEG) • Consideration of video coding needs for non-conversational services • Consideration of video coding needs for users of sign-language and lip-reading • Maintenance of existing ITU video coding standards (H.120, H.261, H.262, H.263) • Consideration of technology for compressed digital-to-digital video format bit rate reduction • Other business as necessary for Q.15
Aug/Sep	TBD	15	• Continuation of agenda shown above for May meeting (except for H.263++ extension work subsequent to white document generation)

Annex Q15.A
Terms of Reference for Advanced Video Coding Activities

Q15.A.1 Scope

The goal of this Question is to produce advanced moving image coding methods appropriate for conversational audio/visual services. However, moving image coding should also consider applications for non-conversational services. This Question will focus on advanced techniques leading to significant quality and performance improvements. Video coding standardization needs will be investigated for multimedia systems without regard to transport type (Internet, LAN, Mobile, N-ISDN, B-ISDN, GSTN, etc.). The Question will also include maintenance issues regarding existing video coding standards.

Q15.A.2 Current Projects

Two advanced video coding projects designated as H.263++ and H.26L are currently under way:

- H.263++ is to improve the performance of H.263 by means of incremental extensions to the H.263 algorithm. The target date for decision of H.263++ extensions is November, 2000, after Determination in February 2000. The workplan schedule for the H.263++ project is shown below.
- H.26L will investigate new video coding algorithms with the objective of achieving a significant improvement in performance relative to the best available version of H.263. The target date for decision of a new H.26L recommendation is around the middle of the year 2002. The workplan schedule for the H.26L project is shown below.

The activities for this Question will continue the work on both H.263++ and H.26L. Both of these activities relate closely to work being conducted within the MPEG-4 project of ISO/IEC JTC1 WG11/SC29, and should be coordinated closely with that effort, including liaison communication.

Q15.A.3 Study Items

- Advanced coding methods in order to achieve the following objectives:
    - improvements in compression efficiency;
    - reduction of real-time delay;
    - improvements in picture quality;
    - robust operation in error prone environments (e.g., non-guaranteed-bandwidth packet networks or mobile wireless communication);
    - organization of the compressed data format to support packetization and streaming;
    - methods to allow sub-rate streams to be easily mixed by MCU's or terminals, including intra-only operation;
    - temporal and spatial alignment of streams of varying coding;
    - reduction of complexity;
    - additional features such as object coding and multi-view operation.
- Maintenance of existing H series video coding Recommendations, including H.120, H.261, H.262|ISO/IEC 13818-2, and H.263.
- Variable Bit Rate coding.
- Video coding needs for those using sign language and lip reading communication.
- Video bit rate reduction for compressed-digital to compressed-digital processing.

- The impact of colorimetry, video quality assessment, and quality control requirements on video codec development.
- Impact of downloaded video algorithm coding.

Q15.A.4 Methods of Work

Work will be conducted via correspondence to the maximal possible extent, especially using email and ftp communication (per the SG16 EDH policy) and also possibly fax/or and written letters. Rapporteur's group meetings will be conducted in the interim between meetings of Working Party 3 of Study Group 16 to further the work toward the above goals. The projected schedule and agenda for these meetings is provided above, and the target dates for future standardization within this Question are included in section Q15.A.2. Liaison communication should also be conducted with ISO/IEC JTC1 SG11/SC29 as authorized by the Q.15 experts group during this period.

H.263++ Workplan

Meeting	Approx Date	Type	Milestone
SG16-1	17 March '97	Study Group	
Q15-A	24 Jun '97	Experts	
Q15-B	8 Sep '97	Experts	Adoption of Workplan
Q15-C	2 Dec '97	Experts	Start of Significant Effort
SG16-2	26 Jan '98	Study Group	
Q15-D	21 Apr '98	Experts	
Q15-E	21 Jul '98	Experts	
SG16-3	14 Sep '98	Study Group	
Q15-F	3 Nov '98	Experts	
Q15-G	16 Feb '99	Experts	First Formal Draft Adoptions
SG16-4	17 May '99	Study Group	
Q15-H	Aug '99	Experts	Last Formal Draft Adoptions
SG16-5	Sep '99	Study Group	
Q15-I	Oct '99	Experts	Final Draft for Determination
SG16-6	Feb '00	Study Group	Determination
Q15-J	May '00	Experts	Bug-checking, Generating Final Draft for Decision
SG16-7	Jun '00	Study Group	-
Q15-K	Aug '00	Experts	Appendix II Refinement
WTSA	Sep '00	WTSA	-
SG16-1N	Nov '00	Study Group	Decision

H.26L Workplan

Meeting	Approx Date	Type	Milestone
SG16-1	17 March '97	Study Group	
Q15-A	24 Jun '97	Experts	
Q15-B	8 Sep '97	Experts	
Q15-C	2 Dec '97	Experts	
SG16-2	26 Jan '98	SG16	Issue Call for Proposals
Q15-D	21 Apr '98	Experts	
Q15-E	21 Jul '98	Experts	
SG16-3	14 Sep '98	Study Group	
Q15-F	3 Nov '98	Experts	First Formal Evaluations
Q15-G	16 Feb '99	Experts	
SG16-4	17 May '99	Study Group	
Q15-H	Aug '99	Experts	First Formal Draft Adoptions
SG16-5	Sep '99	Study Group	
Q15-I	Oct '99	Experts	
SG16-6	Feb '00	Study Group	
Q15-J	May '00	Experts	
SG16-7	Jun '00	Study Group	-
Q15-K	Aug '00	Experts	Final Major Feature Adoptions
WTSA	Sep '00	WTSA	-
SG16-1N	Nov '00	Study Group	
	Apr '01	Experts	
	Jul '01	Experts	
	Aug '01	Study Group	Determination
	Oct '01	Experts	Bug-Checking
	Jan '02	Experts	White Document Generation
	May '02	Study Group	Decision