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TSG-S4 Codec Working Group Status Report

Executive Summary

TSG-SA WG4 (also called in this report TSG-S4 or Codec Working Group) held two meetings since TSG-SA#2. These meetings were essentially dedicated to the preparation of the Baseline Specifications for the Mandatory speech codec and Codec for Circuit Switched Multimedia Telephony services, to be presented to TSG-SA#3.

Following the selection of the AMR speech codec by TSG-SA#2, TSG-S4 agreed on a structure for the 3GPP AMR specifications, based on the corresponding GSM specifications. Six specifications (Versions 1.0.0) are presented to TSG-SA for information or approval if felt necessary. These specifications are considered stable at more than 80%. They include a General Description (TS 26.010), the Transcoding functions (TS 26.011), the Comfort noise aspects (TS 26.014), the Error concealment of lost frames (TS 26.015), the Source controlled rate operation (TS 26.016) and the Frame structure (TS 26.018).

Because of some inconsistencies in the approved versions of the GSM AMR ANSI C-Code and VAD specifications, it was not possible to agree on a version of these specifications to be forwarded to TSG-SA before these inconsistencies are resolved by ETSI SMG11. The presentation of the corresponding specifications was postponed to TSG-SA#4.

TSG-S4 exchanged a couple of Liaison Statements with TSG-R1 on the support of the speech service. The item under discussion relates to the possibility to include a dedicated channel coding scheme for the speech service implementing Unequal Error Protection/Detection. TSG-S4 believes that UEP/UED is likely to improve the quality and capacity performances of the speech service in 3G system. TSG-S4 has indicated its preference for a channel coding scheme providing UEP/EUD with enough flexibility to be efficiently adapted to future services (wideband speech for example) without requiring major network hardware upgrade.

TSG-S4 agreed on a set of Mandatory Characteristics for Terminal supporting the Circuit Switched H.324 based Multimedia Telephony service. These characteristics are related to the support of the AMR speech codec in addition to the H.263 video codec, H.223 Annex C Multiplex option and a minimum data rate of 32 kbit/s.

These choices are amending the reference ITU specification H.324. They mean that interworking between 3G Terminals with CS Multimedia Telephony Service capability and fixed access terminals with an equivalent capability will not always be possible without a transcoding or gateway function in the network. However, these choices were made to optimize the service in the scope of the 3G system, at the same time as understanding the relatively low number of exiting multimedia terminals and the absolute necessity to support the Mobile extensions of H.324, which are not mandatory for fixed access implementations of the service.

The CS Multimedia Telephony Service specifications presented for information to TSG-SA#3 include a General description (TS 26.110), a set of Modifications to H.324 (TS 26.111), a set of Call set up requirements (TS 26.113) also provided to TSG-CN, TSG-S2 and TSG-R3 and a Technical Report providing additional recommendations for best implementation of the service in 3G Terminals (TR 26.115).

TSG-S4 has reviewed a number of test results on the evaluation of video codecs for Multimedia services. These results will be provided in a related Technical Report (TR 26.116) under preparation.

The Stage 1 specification for Tandem Free Operation in 3G systems or between 2G and 3G systems was reviewed and sent to TSG-S1 for comments. Limited progress is possible on this work item until TSG-S2 has agreed on the location of the Transcoders in the 3G system and Tandem Free Operation is fully defined for the GSM AMR since AMR will be the default 3G speech codec.

A new work item for the definition of the Acoustic and Visual requirements for 3G Terminals is presented to TSG-SA for approval (SP-99129).

Finally, an updated list of TSG-S4 deliverables is provided in SP-99128.

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1. Introduction

The 3GPP Codec Working Group held two meetings since the last TSG-SA#2. TSG-S4#3 took place on March 24-26, 1999, hosted by NTT DoCoMo in Yokosuka, Japan. TSG-S4#4 took place on April 20-22, 1999, hosted by Siemens in Munich, Germany. Both meetings were essentially dedicated to the review of the work programs for all approved work items, to the identification of editors for the required specifications and to the review of the first available draft specifications to be presented as Baseline Specifications to TSG-SA#3.

As a result of these two meetings, a total of 10 specifications are presented to TSG-SA for information (or approval).

Meetings held:

TSG-S4#3: March 24-26 in Yokosuka, Japan	hosted by NTT DoCoMo
TSG-S4#1: April 22-22 in Munich, Germany	hosted by Siemens

Next Meetings dates:

TSG-S4#5: June 14-16	hosted by multiple North America 3GPP members in Miami, FL
TSG-S4#6: September 8-10	host required
TSG-S4#7: October 20-22	host required
TSG-S4#8: December 1-3	host required

2. Mandatory Speech Codec

Following the approval by TSG-SA#2 of the selection of the GSM AMR as the mandatory 3G speech codec, TSG-S4 has defined the structure of the specifications for this work item, identified editors for these specifications and started reviewing preliminary drafts to the forwarded to TSG-SA.

It was decided to edit the following set of specifications, following a structure already adopted for the GSM speech codecs:

TS 26.010: AMR Speech Codec; General Description (derived from GSM 06.71)
TS 26.011: AMR Speech Codec; Transcoding Functions (derived from GSM 06.90)
TS 26.012: AMR Speech Codec; ANSI C-Code (derived from GSM 06.73)
TS 26.013: AMR Speech Codec; Test Sequences (derived from GSM 06.74)
TS 26.014: AMR Speech Codec; Comfort Noise Aspects (derived from GSM 06.92)
TS 26.015: AMR Speech Codec; Error Concealment of Lost Frames (derived from GSM 06.91)
TS 26.016: AMR Speech Codec; Source Controlled Rate Operation (derived from GSM 06.3)

TS 26.017: AMR Speech Codec; Voice Activity Detection (derived from GSM 06.94)
TS 26.018: AMR Speech Codec; Frame Structure
TS 26.019: AMR Speech Codec; Interface to Iu and Uu
TR 26.020: AMR Speech Codec; Performances Characterization

Most specifications should be derived from the corresponding GSM specifications to the exception of the TS 26.018, TS 26.019and TR 26.020, which should be dedicated to the 3G systems.

TSG-S4 agreed to use new specification numbers for these specifications rather than using the GSM numbers for the following reasons;

- The GSM specifications were considered too much GSM specific and required a number of changes to be adapted to the 3G system;
- The numbers adopted for the GSM AMR specifications tried to follow the numbering 'philosophy' adopted in GSM for the previously standardized speech codecs while being limited to the few number still available at the time of the AMR selection. As a result, the GSM AMR specification numbers are quite inconsistent and difficult to follow for someone not familiar with the ETSI specifications. Using transposed GSM numbers for the derived 3GPP AMR specifications and new 3G numbers for the new AMR specifications would have made things worse.

Preliminary drafts for most specifications were reviewed during TSG-S4#3 and TSG-S4#4, to the exception of the Test Sequences specification (TS 26.013), for which TSG-S4 excepts an input from ETSI SMG11. The Technical Report on the Performance Characterization (TR 26.020) will be prepared after the execution of the corresponding tests planned for 4Q99.

Most specifications were considered stable enough to be forwarded to TSG-SA for information (Version 1.0.0 included in SP-99131 to SP-99136). These specifications are highly derived from the corresponding GSM specifications and are considered fairly stable (more than 80%). If required they could also be immediately approved by TSG-SA.

The presentation of the ANSI C-Code (TS-26.012) and VAD (TS 26.017) specifications were postponed to TSG-SA#4. The original GSM specifications approved by the last SMG plenary present some inconsistencies (only one VAD option included in the C-Code, VAD specification made of the concatenation of two documents). TSG-S4 was unable to solve these inconsistencies before the next SMG11 meeting planned for May 3-7, 1999.

In order to benefit from the experience of the SMG11 Speech Quality group, which is currently carrying out the Characterization of the GSM AMR speech codec, it was agreed to ask SMG11 to take the responsibility to prepare the test plan and perform the tests required for the Characterization of the AMR speech codec in 3G radio channels. TSG-S4 will keep the responsibility for the management of this project and for finding organizations willing to contribute financially or actively to the execution of this activity.

Finally, TSG-S4 exchanged a couple of Liaison Statements with TSG-R1 regarding the support of the speech service over the Radio Access Network. One of the key questions relates to the definition of a dedicated channel coding scheme for the speech service supporting Unequal Error Detection and Protection. TSG-S4 believes that this solution is likely to provide some quality and capacity improvements. TSG-S4 is also concerned that the final channel coding scheme selected by TSG-RAN should be flexible enough to support efficiently any future speech codec without requiring a major Base station (or User Equipment) hardware upgrade. Obviously, the definition of the channel coding for the speech service is absolutely essential to complete this work item in time for the approval of the Release 99 of the 3GPP specifications.

3. Codec for Circuit Switched H.324 Based Multimedia Telephony Service

TSG-S4 reviewed the scope of this work item before agreeing on a structure for the set of specifications. The key decisions of TSG-S4 are listed below:

- First, it was agreed that this service should focused on Multimedia Telephony service within the 3G system and consider the interoperability with other or existing systems as a lower priority. This

choice was first justify by the requirement to define a system suitable for Wireless Communications, which could be supported with a cost effective implementation. It was also justified by the currently low penetration of fixed access Multimedia Terminals and services. A consequence of this choice is that transcoding or gateway functions will be required when interoperability with existing Multimedia Terminals not supporting the 3G Multimedia Characteristics (essentially H.324 Annex C) must be provided.

- TSG-S4 also agreed to specify the related codec requirements assuming that the 3G systems will carry the Multimedia data flow as one single data flow at the output of the H223 Multiplex and not separate the different media flows before the H.223 Multiplex to send them over separate radio access bearers. This decision was essentially guided by time constraints for the completion of the corresponding specification and the well established performances of H.324 in this configuration.
- It was also decided to adopt the AMR speech codec as the only mandatory speech codec for CS Multimedia Telephony services to offer the same level of speech quality as the basic speech service. Note that the ITU H.324 mandates the support of the G.723.1 speech codec, which is considered by the experts as providing a lower quality level than the higher modes of AMR.
- It was decided to adopt H.263 as the only Mandatory Video Codec. Note that H.324 also mandates terminals to support the less advanced H.321 video codec.
- TSG-S4 specified H.223 Annex B (which includes Annex A) as the minimum Multiplex Error Detection and Protection level. This level was considered to provide an acceptable performance/complexity trade-off.

In support to this discussion, a number of organizations presented or demonstrated the performances and capabilities of diverse implementations of the Multimedia Telephony service or video codecs. TSG-S4 also reviewed the results of a comprehensive evaluation of video codecs sponsored by ARIB. These results will be included in a technical report (future TR 26.116) on the Quantitative Evaluation of Circuit Switched H.324 Based Multimedia codecs over 3G.

With these assumptions and decisions, TSG-S4 agreed on the following structure for the related specifications.

TS 26.110: Codec for CS Multimedia Telephony Service; General Description
TS 26.111: Codec for CS Multimedia Telephony Service; Modifications to H.324
TS 26.112: Codec for CS Multimedia Telephony Service; Call Set-Up Requirements
TR 26.115: Codec for CS Multimedia Telephony Service; Terminal Implementor's Guide

Versions 1.0.0 of these specifications are presented to TSG-SA for information (SP-99137 to SP-99140).

The mandatory characteristics described above are far from removing any option in H.324. TSG-S4 believed that it was essential to complete this set of mandatory requirements with a number of recommendations to help in the implementation of 3G Terminals in order to guarantee enough error resilience and favor efficient terminal interworking. Some of the key recommendations included in TR 26.115 are:

To support the optional G.723.1 speech codec
To support the optional MPEG-4 video codec

TSG-S4 also understands that it does not have the full expertise to define the call set-up requirement for this service. TS 26.113 was prepared to support the expert working groups in this field and was sent to TSG-CN, TSG-S2 and TSG-R3 for that purpose.

4. QoS for Audio and Multimedia Codecs

As explained above, a number of test results on the evaluation of video codecs sponsored by ARIB were reviewed by TSG-S4 and will be included in a Technical Report on the Quantitative evaluation of H.324 over 3G (future TR 26.116). A preliminary draft of this report was available for internal review.

Additional input on the transmission plan for 3G systems are expected for the upcoming meetings.

An updated work program for this Work tem was reviewed in TSG-S4 and is provided to TSG-SA for information (SP-99130).

5. Codec(s) for Wideband Telephony services

No contributions presented on this work item.

TSG-S4 will follow the outcome of the ETSI SMG11 feasibility study of a wideband mode for the AMR speech codec now expected by 6/99.

6. Tandem Free Operation in 3G systems and between 2G and 3G systems

An update of the GSM TFO Stage 1;Service Requirements (TS 02.53) was reviewed and sent to TSG-S1 for comment. After approval, this specification should be allocated the 3GPP number 22.053.

Limited progress on this work item is possible until the system transcoder location has been defined and TFO for the GSM AMR has been finalized. The transcoder location will have an impact on the preferred option for calling Tandem Free Operation (in band or out of band). TSG-S4 has planned to work on a Transcoder Architectural Model for the implementation of Tandem Free Operation in 3G systems. A draft outline of this specification was reviewed in TSG-S4#4 and sent to TSG-S2 for review and comments.

7. New Work Item proposal on 3G Audio-Visual Terminal Characteristics

In agreement with the TSG-S4 Terms of Reference, a new Work Item Description was prepared for the specification of Acoustic and Visual Characteristics of 3G Terminals.

The primary objective for this Work Item is to complete the required specifications for the Acoustic parts of the Terminals supporting the Narrowband speech and Multimedia Telephony services and the Visual parts of Terminals supporting Multimedia Telephony services by December 1999.

The corresponding Work Item description is included in Tdoc. SP-99129.

8. Other Work Item Proposals

TSG-S4 reviewed a proposal for the specification of a Very Low Bit-Rate speech codec for the 3G systems. This proposal was supported by preliminary listening test results of a potential speech codec candidate for that purpose. TSG-S4 considered that the proposal would require additional supporting information especially to define the expected and claimed capacity gain that this type of codec would bring.

Providing that the work item did not have the support of four active 3GPP members, it was postponed until further supporting documentation is provided.

9. Other Business

TSG-S4 provided a preliminary response to TSG-T and TSG-T2 regarding any identified mandatory and optional terminal implementation capabilities within the expertise of TSG-S4. The mandatory capabilities are related to the support of AMR for the speech service capability and the support of AMR, the H.263 video codec, H.223 Annex B and a minimum user data rate of 32 kbit/s for the CS Multimedia Telephony Service capability.

10. TSG-S4 Work Program

An updated list of TSG-S4 deliverables included in SP-99128 is provided to TSG-SA for information.

Draft work programs are available for most Work Items. They are currently restricted to internal use, except for the Work Program on the Work tem 3 on QoS for Audio and Multimedia Codecs.