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In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document describes:

- Test cases needed to ensure an adequate level of RTP operation and RTP stream monitoring.
- Test methods capable to verify that information contained in the RTP header and in RTCP is correct and consistent with the observed characteristics of the related RTP streams:
    - Between RTP/RTCP within the scope of a single RTP stream (e.g. between an RTP stream and the corresponding RTCP reporting from the remote party, or between an RTP stream and the corresponding RTCP metadata, e.g. for sampling clock accuracy compensation between RTP sender and RTP receiver).
    - Between RTP/RTCP across RTP streams in the same RTP session (e.g. between sent and received RTP streams, or between audio RTP streams and video RTP streams).
- Requirements on what constitutes acceptable RTP/RTCP protocol field values, including RTP payload header and RTP payload length, based on the observed characteristics of the related RTP streams.
- A method for an RTP/RTCP implementation to announce on the network that it has passed the necessary tests and conforms to the new specification.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] IETF RFC 3550 (2003): "RTP: A Transport Protocol for Real-Time Applications".

[3] IETF RFC 3158 (2001): "RTP Testing Strategies".

[4] IETF RFC 3551 (2003): "RTP Profile for Audio and Video Conferences with Minimal Control".

[5] IETF RFC 3711 (2004): "The Secure Real-time Transport Protocol (SRTP)".

[6] IETF RFC 3556 (2003): "Session Description Protocol (SDP) Bandwidth Modifiers for RTP Control Protocol (RTCP) Bandwidth".

[7] IETF RFC 4585 (2006): "Extended RTP Profile for Real-time Transport Control Protocol (RTCP) – Based Feedback (RTP/AVPF)".

[8] IETF RFC 5506 (2009): "Support for Reduced-Size Real-Time Transport Control Protocol (RTCP): Opportunities and Consequences".

[9] 3GPP TS 26.114: "IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

[10] 3GPP TS 26.131: "Terminal acoustic characteristics for telephony; Requirements".

[11] 3GPP TS 26.132: "Speech and video telephony terminal acoustic test specification".

[12] 3GPP TS 34.229-1: "Internet Protocol (IP) multimedia call control protocol based on Session Initiation Protocol (SIP) and Session Description Protocol (SDP); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification".

[13] IETF RFC 3611 (2003): "RTP Control Protocol Extended Reports (RTCP XR)".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 Symbols

For the purposes of the present document, the following symbols apply:

=	Equal to.
≠	Not equal to.
<	Less than.
≤	Less than or equal to.
>	Greater than.
≥	Greater than or equal to.
+	Addition.
−	Subtraction.
·	Multiplication (when unambiguous, also by juxtaposition of expressions, e.g. $a \cdot b = ab$).
/	Division.
%	Modulo, e.g. a % b, where the result is the remainder from a divided by b.
Σ	Sum, e.g. $\sum_{i=1}^{n} expression$ is the sum of $expression$ over index i ranging from 1 to n.
&	Bitwise AND.
|	Bitwise OR.
≪	Logical shift left, e.g. $a \ll b$ where a is shifted left b bits, shifting in 0 in least significant bit.
≫	Logical shift right, e.g. $a \gg b$ where a is shifted right b bits, shifting in 0 in most significant bit.
∈	Belongs to.
∀	For all.
∃	Exists.
∄	Does not exist.
$[a..b]$	Range of values, from a to b, inclusive.
$\{expression\}$	Set of unordered, unique values created from $expression$.
$\|expression\|$	Absolute value of $expression$.
$\lfloor expression \rfloor$	Integer value of $expression$, the floor value, rounded towards zero.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

SUT System Under Test

4 Background

Today's 3GPP conversational and real-time services (e.g. MTSI [9] and mission critical services) all use the RTP protocol [2] or the Secure RTP protocol [5] on top of UDP/IP as media transport. (S)RTP has a companion control protocol, (S)RTCP (also in [2] and [5]), which is optional but is typically also used. In the rest of the present document,

only the terms RTP/RTCP are used for brevity but should be understood to be equally applicable to SRTP/SRTCP if nothing else is said.

RTCP provides means to feedback statistical characteristics of a received RTP stream from RTP receiver to RTP sender, and to carry RTP stream metadata from RTP sender to RTP receiver, both during an active RTP session and in hold conditions where no RTP is sent. While RTP/RTCP information is designed to be useful to an ongoing real-time media session, the increased focus on automation and the consequential need for service observability and automatic performance measurements also makes it convenient and common to use RTP header and RTCP as one of the information sources to monitor the RTP streams for automation purposes. This is a very straightforward approach since it was one of the very design targets for RTP/RTCP, and both RTCP and RTP are extensible and can optionally carry various types of information. Service observability is paramount to enable any tuning or optimization to achieve a well-functioning system.

However, RTCP information has little or no end-user impact on basic, single-media communication services such as a voice-only call. The reasons for this are mainly twofold:

1) One of the intended usages of RTCP feedback reporting functionality is to allow the RTP sender to adapt its sending rate to available transport capacity since a non-acknowledged transport such as UDP/IP has no built-in congestion control, but most voice-only calls today are both low-rate and fixed-rate that has no use for adaptation; and

2) One of the other intended usages of RTCP is to provide enough metadata information to allow close time synchronization of different RTP streams, such as e.g. voice and video for a video call, but a voice-only call is single-media and has no use for such time synchronization.

Therefore, there is often no direct impact on the voice service performance if a UE or network-node implementation of the RTP stack includes incorrect (e.g. all-zero or random) data in RTCP for a voice-only call. RTCP information content only matters on service level when really making use of RTCP functionality such as for quality monitoring, somehow acting on varying transport characteristics (loss, delay, jitter), or when performing inter-media synchronization.

Also, while the call setup and modification protocol, SIP/SDP, is conformance tested in 3GPP scope (by TSG RAN WG5), no media-level tests are defined or performed there when the present document is written. RTP and RTCP are considered as media-level protocols in that conformance testing. The current overall level of RTCP implementation conformance and accuracy in 3GPP devices and in RTP/RTCP-terminating network nodes is therefore mostly unknown.

Since the information content in RTP/RTCP is often neither fundamental for the user-level experience nor explicitly tested today, there is a risk that automation, performance tuning efforts, and the application using the RTP/RTCP stack will work with incorrect data, potentially making wrong decisions that could result in worse rather than better performance.

5 Test Architectures

5.1 General

This clause describes a set of terms and possible ways to arrange the equipment used in the tests in subsequent clauses.

The "system under test" is the device or software to be tested.

The "test instrument" is the equipment used to observe RTP/RTCP output from the system under test, and in applicable cases also RTP/RTCP output from data injection, similar to e.g. a "System Simulator" (SS) in TS 34.229-1 [12]. Depending on the test architecture used, it may also act as RTP/RTCP receiver for data sent from the system under test. The test instrument also includes possibility to extract, calculate, and store information as described by the test procedures in clause 6 of the present document.

The "data injection" is the device or equipment used to generate RTP/RTCP data sent to the system under test. It may be collocated or integrated with the test instrument. For some tests and test architectures, e.g. when two systems under test are interconnected, it may be part of the system under test. Data injection may also act as RTP/RTCP receiver for data sent from the system under test, e.g. when the test instrument does not include this functionality.

In all tests, it is assumed that both systems under test, the test instrument, and the data injection are active and connected to the network before starting the test procedure.

Other test architectures than the ones suggested here may be used.

5.2 Active Test Instrument

In this test architecture, depicted in Figure 5.2-1, the test instrument is capable of both observing RTP/RTCP traffic and acting as fully functional counterpart to the system under test, including both RTP/RTCP sender and receiver.

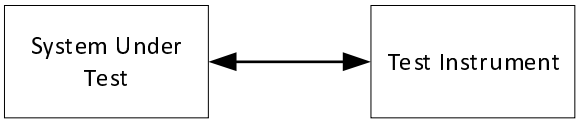

Figure 5.2-1: Active Test Instrument

5.3 Passive Test Instrument

In this test architecture, depicted in Figure 5.3-1, the test instrument is only passively observing RTP/RTCP traffic, and data injection including both RTP/RTCP sender and receiver is acting as a counterpart to the system under test.

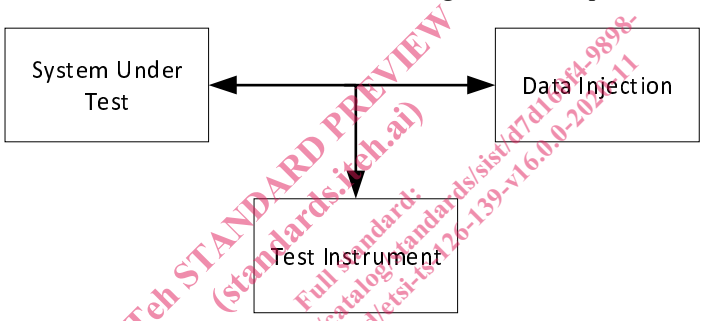

Figure 5.3-1: Passive Test Instrument

5.4 Interconnected Systems Under Test

In this test architecture, the test instrument is either only passively observing RTP/RTCP traffic, depicted in Figure 5.4-1, or actively forwarding RTP/RTCP traffic, depicted in Figure 5.4-2, while two interconnected systems under test act as each other's RTP/RTCP sender and receiver counterparts.

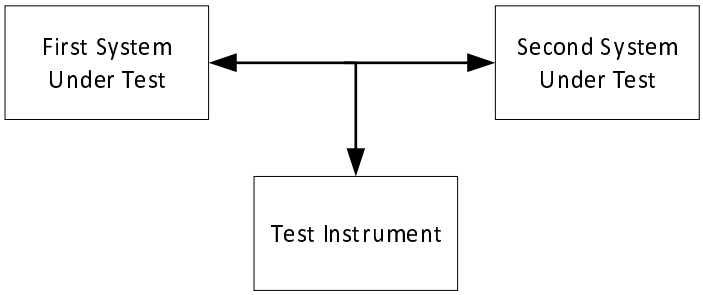

Figure 5.4-1: Interconnected Systems Under Test with Passive Test Instrument

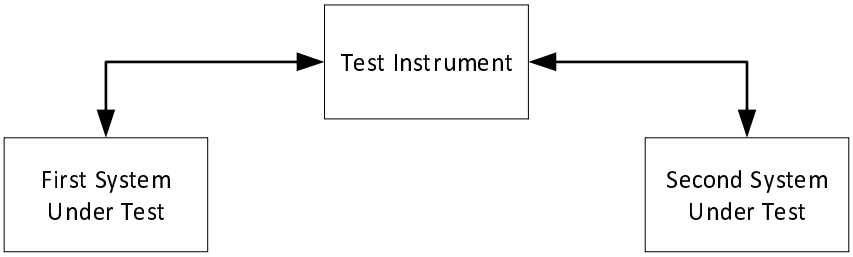

Figure 5.4-2: Interconnected Systems Under Test with Active Test Instrument

5.5 Interconnected Systems Under Test with Data Injection

In this test architecture, depicted in Figure 5.5-1, the test instrument is only passively observing RTP/RTCP traffic, while two interconnected systems under test act as each other's RTP/RTCP sender and receiver counterparts. Under the assumption that the systems under test lack necessary data injection capabilities, a separate data injection is included in the RTP/RTCP path with capability to make RTP/RTCP modifications on-path. Examples of such RTP/RTCP modifications could be setting certain sequence number or timestamp start values, dropping packets, duplicating packets, re-ordering packets, or adjusting the timing of sent packets. Individual test case procedures provide what RTP/RTCP modifications are applicable.

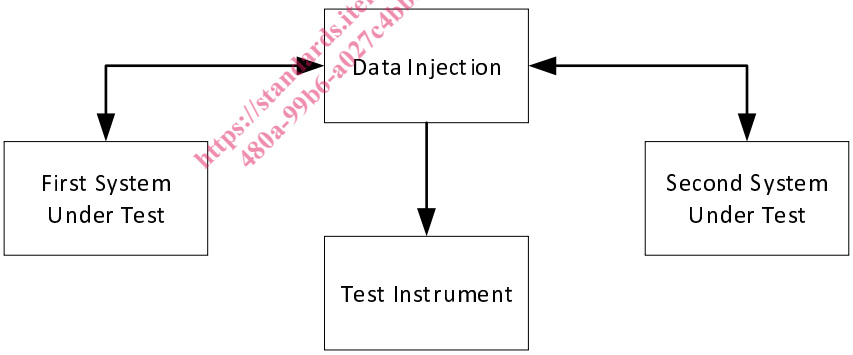

Figure 5.5-1: Interconnected Systems Under Test with Data Injection

6 Verification Tests

6.1 General

All test descriptions in this clause use the following layout:

Purpose: *Describes what is tested.*

Status: *Mandatory / Conditionally Mandatory*