**3GPP TSG- Meeting #**

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| *CR-Form-v12.1* |
| **Pseudo CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | Description of existing media protocols in media production |
|  |  |
| ***Source to WG:*** | EBU, Ericsson LM, BBC, Sennheiser |
| ***Source to TSG:*** | S4 |
|  |  |
| ***Work item code:*** | FS\_NPN4AVProd |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***Release:*** |  |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | The new study FS\_NPN4AVProd includes some objectives around existing media delivery protocols. The present document introduces some relevant protocols, like SRT, RIST and NDI. |
|  |  |
| ***Summary of change:*** | A short overview of some existing Media Production protocols are provided. |
|  |  |
| ***Consequences if not approved:*** |  |
|  |  |
| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

\*\*\*\* First Change \*\*\*\*

# 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".

[x1] M.P. Sharabayko, M.A. Sharabayko, J. Dube, JS. Kim, JW. Kim: "The SRT Protocol", draft-sharabayko-mops-srt-01

[x2] VSF: "Reliable Internet Stream Transport (RIST) Activity Group", https://www.videoservicesforum.org/RIST.shtml

[x3] VSF TR 06-1: "Reliable Internet Stream Transport (RIST) Protocol Specification – Simple Profile", <https://vsf.tv/download/technical_recommendations/VSF_TR-06-1_2018_10_17.pdf>

[x4] VSF TR 06-2, "Reliable Internet Stream Transport (RIST) Protocol Specification – Main Profile", [https://www.vsf.tv/download/technical\_recommendations/VSF\_TR-06-2\_2020\_03\_24.pdf](https://protect2.fireeye.com/v1/url?k=cc406e56-93db577d-cc402ecd-866038973a15-a3187c63f11b10f6&q=1&e=1f3c54ba-abd4-4509-b7b2-0816901e7741&u=https%3A%2F%2Fwww.vsf.tv%2Fdownload%2Ftechnical_recommendations%2FVSF_TR-06-2_2020_03_24.pdf)

[x5] NewTek: "NDI Encoding/Decoding", <https://support.newtek.com/hc/en-us/articles/218109667-NDI-Encoding-Decoding>

[x6] NewTek: "NDI Network Bandwidth, <https://support.newtek.com/hc/en-us/articles/217662708-NDI-Network-Bandwidth>

[x7] David Aleksandersen: "What is NDI® (Network Device Interface)?", <https://newsandviews.dataton.com/what-is-ndi-network-device-interface>

[x8] Kieran Kunhya and Ciro Noronha: "RIST and SRT: What’s the difference?", <https://www.tvbeurope.com/ip-migration/rist-and-srt-whats-the-difference>

[x9] Tofik Sonono: "Interoperable Retransmission Protocols with Low Latency and Constrained Delay: A Performance Evaluation of RIST and SRT", Masters Thesis, KTH Stockhol, 2019, http://kth.diva-portal.org/smash/get/diva2:1335907/FULLTEXT01.pdf

\*\*\*\* Next Change \*\*\*\*

# 6 Review of existing media protocol solutions

## 6.1 General

Editor’s Note: This is a placeholder for some general introduction.

Editor’s Note: Explain that NACK refers to Negative ACKnowledgement.

Editor’s Note: Existing media protocols are used between different production functions in various combinations. The protocol end-points are deployment specific and will be clarified.

## 6.2 Secure Reliable Transport (SRT)

Secure Reliable Transport (SRT) [x1] is an open-source media transport protocol that uses the UDP transport protocol. SRT provides connection and control, reliable transmission similar to TCP at the application layer. It supports packet recovery while maintaining low latency. SRT also supports encryption using AES.

The protocol was derived from the UDT project, designed for fast file transmission. UDT provides its reliability mechanism by using similar methods for connection, sequence numbers, acknowledgements and retransmission of lost packets. UDT uses selective and immediate (NACK-based) retransmission.

SRT has all these features, but also adds several more to support live streaming mode:

1. Controlled latency, with source time transmission (timestamp-based packet delivery).

2. Sender bandwidth control.

3. Conditional "too late" packet dropping (prevents head-of-line blocking caused by a lost packet that wasn't recovered on time).

4. Eager packet re-transmission (periodic NACK report).

## 6.3 Reliable Internet Stream Transport (RIST)

Reliable Internet Stream Transport [x2] is an open source, open specification transport protocol designed for reliable transmission of media over lossy networks (including the internet) with low latency and high quality. It is currently being developed and maintained by the Video Services Forum (VSF).

Technically, RIST seeks to provide reliable, high performance media transport by using RTP/UDP at the transport layer to avoid the limitations of TCP. Reliability is achieved by using NACK-based retransmissions to realise an Automatic Repeat Query (ARQ) capability. SMPTE-2022 Forward Error Correction can be combined with RIST but is known to be significantly less effective than ARQ.

RIST Simple Profile [x3] was published by the VSF in October 2018 and includes the following features:

- The base stream uses RTP for compatibility with existing equipment.

- Retransmission requests use RTCP. Two types of retransmission requests are defined:

- A Bitmask-based NACK, defined in RFC 4585.

- A Range-based NACK, defined as an application-specific (APP) RTCP packet.

- Bonding of multiple links for load sharing.

- Seamless switching using SMTPE-2022-7.

- Out-of-band transmission of protection data (retransmissions may use a separate link).

RIST Main Profile [x4] was published in March 2020 and adds the following features to Simple Profile:

- GRE-in-UDP encapsulation based on RFC 8086, with bidirectional send/receive in the same tunnel.

- Multiplexing of multiple streams into the same tunnel.

- In-band data support in the tunnel, useful for remote management.

- Client/Server architecture.

- Firewall traversal.

- DTLS encryption or Pre-Shared Key encryption, with multicast support, access control, and authentication.

- Advanced authentication options using either public key certificates or TLS-SRP.

- Bandwidth optimization based on NULL packet deletion.

- Support for high bit-rate streams by extending the size of the RTP sequence number space.

## 6.4 Network Device Interface NDI

Network Device Interface (NDI®) [x7] is a software solution developed by NewTek™ to enable video-compatible products to communicate, deliver, and receive high-definition video over a network in a high-quality, low-latency manner that is frame-accurate and suitable for switching in a live production environment. In contrast to SRT and RIST, NDI is intended to transfer media streams within a facility, not for contribution over the public networks.

NDI is designed to run over gigabit Ethernet. The table below lists the approximate bandwidth required by NDI codec [x6] for different video streams.

Table 6.4-1:

|  |  |
| --- | --- |
| Video stream | Approximate bit raterequired by NDI codec |
| 2160p60 | 250 Mbps |
| 2160p30 | 200 Mbps |
| 1080p60 | 125 Mbps |
| 1080i60 | 100 Mbps |
| 720p60 | 90 Mbps |
| SD | 20 Mbps |

By default, NDI uses the multicast DNS (mDNS) discovery mechanism to advertise sources on a Local Area Network (LAN), although two other discovery modes (NDI Access, NDI Discovery Server) allow for operations across different subnets. When a source is requested, a TCP connection is established on the appropriate port with the NDI receiver connecting to the NDI sender. NDI 3.x has options to use UDP multicast or unicast with Forward Error Correction (FEC) instead of TCP, and can load balance streams across multiple Network Interface Controllers (NICs) without using link aggregation. NDI 4.0 introduces multi-TCP connections.

NDI carries video, multichannel uncompressed audio and metadata in XML form. Metadata messages can be sent in both directions allowing the sender and receiver to message one another over the connection with arbitrary metadata. This directional metadata system allows for functionality such as active tally information (on-air program/preview). NDI Receivers can opt to connect to various combinations of streams, to support things like audio-only or metadata-only connections where video is not required.

## 6.5 Comparison Table

Table 6.5-1: Comparison

| Parameter | SRT | RIST | NDI |
| --- | --- | --- | --- |
| Intended use | Contribution over unreliable links (e.g., public internet) | Contribution over unreliable links (e.g., public internet) | Transfer of media streams within a facility |
| Proprietary/Opensource | Opensource | Opensource | Proprietary |
| Based on protocol | UDT | RTP, e.g. TS-over-IP | TCP/UDP |
| Interoperability | Can be limited between different vendors | Good | Partially limited due to proprietary nature  |
| Latency | Configurable, 4 × RTT of the link is recommended | Configurable, 4 × RTT of the link is recommended | Practically one field latency, might be as low as 8 scan lines |
| Error correction | FEC/ARQ | FEC/ARQ | TCP or FEC |
| Encryption | Supported | Supported | Not supported natively |
| Authentication | Supported, PSK based | Supported, PSK and DTLS based | Not supported natively |
| Multicast | Not supported | Supported | Supported |
| Multiple links | Not supported | Supported | Supported |
| Codec | Codec agnostic | Codec agnostic | Built in |

\*\*\*\* Last Change \*\*\*\*