Video Services Forum (VSF)
Technical Recommendation TR-06-3

Reliable Internet Stream Transport (RIST)
Advanced Profile Levels Annex

March 29, 2023

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Executive Summary

The VSF has previously published Technical Recommendation TR-06-3, RIST Protocol Specification – Advanced Profile. This TR-06-3 Levels Annex establishes Interoperability Levels within the Advanced Profile.

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1   Introduction (Informative)

VSF TR-06-3, RIST Advanced Profile, includes a number of major and minor features. Not every vendor will implement every feature of the Advanced Profile. This could cause confusion in the marketplace, causing devices implementing different sets of features to interoperate at some levels but not at others.

This TR-06-3 Levels Annex defines interoperability levels for the RIST Advanced Profile. Devices compliant with a given level should interoperate with each other at that level, as far as RIST is concerned. This simplifies the task of communicating to end users the feature set of a given device, and improves interoperability.

This document defines required features for each of the interoperability levels. A set of optional features is also defined. Optional features are enhancements and optimizations that may or may not be present. Implementations do not need to include any of the optional features to be compliant with the Levels defined in this document. If a device which implements optional features claims to be compliant with this Technical Recommendation, then the optional features must be implemented as described herein. Note that it is possible for two implementations to be compliant with the same level as defined in this Technical Recommendation and still fail to interoperate if one of them implements optional function(s) and the other does not.

The interoperability levels defined in this Annex represent a compact way of describing and labeling the capabilities of a given implementation. These levels are intended to help end-users and manufacturers easily request or describe some key characteristic of a RIST implementation.

1.1   Contributors
The following individuals participated in the Video Services Forum RIST working group that developed this technical recommendation.

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1.2   About the Video Services Forum

The Video Services Forum, Inc. (www.videoservicesforum.org) is an international association dedicated to video transport technologies, interoperability, quality metrics and education. The

VSF is composed of service providers, users and manufacturers. The organization's activities include:

- providing forums to identify issues involving the development, engineering, installation, testing and maintenance of audio and video services;
- exchanging non-proprietary information to promote the development of video transport service technology and to foster resolution of issues common to the video services industry;
- identification of video services applications and educational services utilizing video transport services;
- promoting interoperability and encouraging technical standards for national and international standards bodies.

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2   Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except the Introduction and any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3   References

VSF TR-06-3:2022, Reliable Internet Stream Transport (RIST) Protocol Specification – Advanced Profile

VSF TR-06-4 Part 2:2023, Use of Wireguard VPN in RIST Devices

4   Advanced Profile Level Labeling

RIST Advanced Profile includes multiple encryption modes, multiple content encapsulation modes and multiple packet recovery methods. The Advanced Profile Levels have three dimensions, namely **encryption**, **content encapsulation** and **protection**. The Advanced Profile Level Label is a kind of shorthand to describe each of these three dimensions, allowing someone to determine if two RIST devices are likely to be able to interoperate.

The first step for communication between two Advanced Profile devices is for them to have a consistent encryption mode. Once encryption (or lack thereof) is established, the devices exchange Advanced Profile packets using one of the payload formats defined by the Type field described in TR-06-3 Section 5.2.3. Finally, the devices may or may not employ common packet recovery methods. Therefore, the first interoperability dimension is encryption, the second is related to the format of the content exchange, and the third is related to protection.

Advanced Profile Level Label shall be constructed as the concatenation of the encryption level, the content encapsulation level and the protection level separate by periods, as follows:

Encryption_Level . Encapsulation_Level . Protection Level

If a device supports multiple encryption, encapsulation, and/or protection levels, the various levels shall be separated by colons. Examples are provided in Section 9.

The remainder of this document defines the Encryption, Encapsulation and Protection Levels.

5 Advanced Profile Encryption Levels

5.1 Baseline Level

Baseline Level provides the minimum required interoperability for a device to be considered compliant with RIST Advanced Profile. Implementations claiming to operate at the Baseline Level shall implement the following features:

Feature	VSF TR-06-3 Section(s)
Standard RTP Header	5.2.1
Sequence Number Extension	5.2.2
Advanced Profile Flags	5.2.3
Mandatory Control Packets	5.3 Table 2, 5.3.1, 5.3.4, 5.3.6

Devices compliant with Baseline Level shall implement both the RTT Echo Request and Response messages defined in in TR-06-3 Section 5.3.4, in order to provide a fallback mechanism to ensure that the Advanced Profile connection is alive and functional. The use of RTT echo messages ensures that this mechanism is available even if the devices do not have a common Encapsulation Level.

As indicated by TR-06-3 section 5.2.1, support for SSRC multiplexing is optional. However, when presented with a packet flow with multiple SSRCs, Baseline Level devices without SSRC multiplexing support shall select one SSRC to process, and discard the others.

5.2 DTLS Level

DTLS Level provides end-to-end-encryption where keys are negotiated using DTLS. Implementations claiming to operate at the DTLS Level shall implement the following features:

Feature	VSF TR-06-3 Section(s)
All Required Features in Baseline Level	See table in Baseline Level
DTLS Support	7.1
Support for all five cipher suites in TR-06-3	7.2

5.3 PSK Level

PSK Level provides end-to-end encryption with pre-shared keys. Implementations claiming to operate at the PSK Level shall implement the following features:

Required Features:

Feature	VSF TR-06-3 Section(s)
All Required Features in Baseline Level	See table in Baseline Level
PSK Support	8.2

Feature	VSF TR-06-3 Section(s)
Key Rotation	8.3
Required Ciphers	AES-CTR 128/256 – PSK field in section 5.2.3 set to 001
PSK Authentication using EAP-SHA256-SRP-6	8.5

5.4 Wireguard Level

VSF TR-06-4 Part 2 introduced support for Wireguard VPN in RIST devices, as an encryption and tunneling alternative. RIST Advanced Profile Baseline Level communication can be combined with Wireguard VPN encryption and tunneling. Implementations claiming to operate at the Wireguard Level shall implement the following features:

Feature	VSF Technical Recommendations
All Required Features in Baseline Level	See TR-06-3 feature table in Baseline Level
Wireguard VPN support	All mandatory items in TR-06-4 Part 2

6 Advanced Profile Encapsulation Levels

The encapsulation level is based on the Type field in the Advanced Profile Header, as per TR-06-3 section 5.2.3. An Advanced Profile RIST device shall support at least one of the levels defined below:

- **IPv4-Tunnel Level:** Device supports Type 1 encapsulated packets.
- **IPv6-Tunnel Level:** Device supports Type 2 encapsulated packets.
- **Layer2-Tunnel Level:** Device supports Type 6 encapsulated packets.
- **Main-Profile-Tunnel Level:** Device supports Type 8 (RIST Main Profile) encapsulated packets.
- **Media Levels:** Device supports Type-5 packets (direct payload). A few common media formats are defined, named **Media-XXX**, where XXX defines a specific type of media being supported. At this time, the following **Media** levels are defined:
  - **Media-TS**: Payload is a transport stream without RTP or any other wrapper, using PFD=0x41AFD040.
  - **Media-ST2022-6:** Payload is an uncompressed ST 2022-6 full raster SDI signal, using PFD=0x23F30600. Devices supporting this level are required to generate and parse the Advanced Profile Flow Attribute Control Message.
  - **Media-ST2110:** Device must support uncompressed video, audio and ancillary data essences, corresponding to PFD=0x241F1400, 0x241F1E00, and 0x241F2800 respectively. Devices supporting this level are required to generate and parse the Advanced Profile Flow Attribute Control Message.

7 Advanced Profile Protection Levels

RIST Advanced Profile supports both ARQ and FEC packet recovery methods. These methods are independent of encryption and encapsulation. RIST Advanced Profile implementations with consistent encryption and encapsulation methods will interoperate at a basic level (i.e., they will be able to send and receive packets from each other), but unless they implement the same protection level, they will not be able to provide packet loss recovery.

An Advanced Profile RIST device shall support at least one of the following Protection Levels defined below:

- **None:** Device does not support any packet recovery method.
- **ARQ:** Device supports lost packet recovery using ARQ. This includes support for sending and receiving both the NACK Bitmask (TR-06-3 section 5.3.2) and NACK Range (TR-06-3 section 5.3.3) messages.
- **ST2022-**1: Device supports lost packet recovery using FEC as per SMPTE ST 2022-1. Compliance with this level requires support for the ST 2022 FEC messages as per TR-06-3 section 5.3.2, with Control Index = 0x0022 and 0x0023.
- **ST2022-5**: Device supports lost packet recovery using FEC as per SMPTE ST 2022-5. Compliance with this level requires support for the ST 2022 FEC messages as per TR-06-3 section 5.3.2, with Control Index = 0x0020 and 0x0021.
- **ST2022-7:** Device supports Seamless Redundancy operation as per SMPTE ST 2022-7.

8 Optional Features

The following are Advanced Profile optional features that are negotiated between devices. If, in a communications link, one device supports the feature and the other does not, the feature is disabled:

- Lossless compression support.
- Fragmentation support.

The following are Advanced Profile optional features that may cause interoperability issues. This means that, if two devices attempt communication and one of them does not support the feature, they will fail to communicate, either immediately or later. For each item, the failure mode is described in detail.

- **SSRC multiplexing**: When receiving an Advance Profile stream with multiple SSRCs, TR-06-3 requires all implementations to at least select one SSRC and ignore the others. Implementers are encouraged to provide the operator some means to select which SSRC is processed.
- **TLS-SRP authentication for the DTLS level**: An implementation configured for TLS-SRP authentication will fail to connect to another implementation without TLS-SRP

support. Since authentication policy is set by the user, implementers are encouraged to clearly identify support (or lack thereof) for this feature.

- **On-the-fly passphrase change for the PSK level**: A PSK receiver without support for this feature will lose the signal on a passphrase change until configured with the new passphrase. Implementers are encouraged to clearly identify support (or lack thereof) for this feature.

9 Level Examples (Informative)

The list below contains examples of level assignments:

1. An Advanced Profile device with no encryption capabilities, the ability to encapsulate IPv4, and no lost packet recovery:
   Level: Baseline.IPv4-Tunnel.None
2. If ARQ capability is added to the system of item 1:
   Level: Baseline.IPv4-Tunnel.ARQ
3. If DTLS encryption support is added to the system of item 2:
   Level: DTLS.IPv4-Tunnel.ARQ
4. If PSK encryption support is added to the system of item 2:
   Level: PSK.IPv4-Tunnel.ARQ
5. If both DTLS and PSK encryption are added to the system of item 2:
   Level: DTLS:PSK.IPv4-Tunnel.ARQ
6. If Wireguard VPN tunneling is added to the system of item 2:
   Level: Wireguard.IPv4-Tunnel.ARQ
7. An Advanced Profile device with no encryption capabilities supporting SMPTE ST 2110 streams using direct payload format:
   Level: Baseline.Media-ST2110.None
8. If IPv4 support is added to the system of item 6:
   Level: Baseline.Media-ST2110:IPv4-Tunnel.None
9. If SMPTE ST 2022-5 FEC is added to the system of item 6:
   Level: Baseline.Media-ST2110.ST2022-5