Preamble to Video Services Forum (VSF) Technical Recommendation TR-06-4 Part 9

February 12, 2026

The Reliable Internet Stream Transport (RIST) project was initiated as an Activity Group under the auspices of the Video Services Forum in 2017. The RIST Protocol is defined by TR-06-1 (RIST Simple Profile, published in 2018 and updated in 2020), TR-06-2 (RIST Main Profile, published in 2020 and updated in 2021 and 2022), and TR-06-3 (RIST Advanced Profile, published in 2021 and updated in 2022).

The TR-06-4 series of recommendations define ancillary features for the RIST protocol that are applicable to multiple profiles. This series includes:

- TR-06-4 Part 1, Source Adaptation, published in 2022.
- TR-06-4 Part 2, Use of Wireguard VPN in RIST Devices, published in 2023.
- TR-06-4 Part 3, RIST Relay, published in 2023.
- TR-06-4 Part 4, RIST Decoder Synchronization, published in 2024
- TR-06-4 Part 5, RIST Multicast Discovery, published in 2023.
- TR-06-4 Part 6, RIST Transport Stream Program Selection, published in 2024.
- TR-06-4 Part 7, RIST Satellite-Hybrid: In-Band Method, published in 2025.

This document is TR-06-4 Part 9, RIST OTA-Hybrid: IP Transport Method. RF distribution is the ideal way to send the same content to many locations that are geographically distributed. This applies both to satellite for covering very large areas, and to Over-The-Air (OTA) for more local applications. These distribution methods are typically unidirectional and may be subject to various forms of interference. TR-06-4 Part 9 describes a method to use the unidirectional one-way RF transmission method employing RTP packets as the main distribution channel (e.g., ATSC 3.0 systems), with RIST as a backup to recover data that is lost or corrupted in the RF segment.

Work continues within the group towards developing additional RIST specifications that include additional features. As the Activity Group develops and reaches consensus on new functions and capabilities, these documents will also be released in support of the RIST effort. For additional information about the RIST Activity group, or to find out about participating in the development of future specifications, please visit Activity Groups – Video Services Forum.

Video Services Forum (VSF)
Technical Recommendation TR-06-4
Part 9

Reliable Internet Stream Transport (RIST)
OTA-Hybrid: IP Transport Method

Approved February 12, 2026

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Executive Summary

RF distribution is the ideal way to send the same content to many locations that are geographically distributed. This applies both to satellite for covering very large areas, and to Over-The-Air (OTA) for more local applications. These distribution methods are typically unidirectional and may be subject to various forms of interference.

This Technical Recommendation describes a method to use the satellite or any similar unidirectional one-way transmission method employing RTP packets as the main distribution channel (e.g., ATSC 3.0 systems), with RIST as a backup to recover data that is lost or corrupted in the RF segment.

Recipients of this document are invited to submit technical comments. The VSF also requests that recipients notify us of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the Recommendation set forth in this document, and to provide supporting documentation.

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1 Introduction (Informative)

As broadcasters and others increasingly utilize unconditioned Internet circuits to transport high-quality video, the demand grows for systems that can compensate for the packet losses and delay variation that often affect these streams. A variety of solutions are currently available on the market; however, incompatibility exists between devices from different suppliers.

The Reliable Internet Stream Transport (RIST) project was launched specifically to address the lack of compatibility between devices, and to define a set of interoperability points using existing or new standards and recommendations.

RF distribution is the ideal way to send the same content to many locations that are geographically distributed. This includes satellite for covering large areas, or Over-The-Air (OTA) for more local applications. However, these transmission modes may be subject to localized degradation due to rain fade, interference, and other factors. Additionally, in most cases, the link is unidirectional, from one source to a multitude of receivers – no return channel exists. One possible approach to solving this content delivery problem is to augment the delivery using the Internet. The basic idea is to use the RF link for the "heavy lifting" (transmitting as much data as viable), with the Internet to "fill in the gaps". In other words, any data that is corrupted or lost in transit is retransmitted over the Internet using RIST, and only to the locations that need it. If there is a complete fade (e.g., due to rain), the Internet can be temporarily used to deliver the complete signal. This way, if a region is experiencing any sort of fade or interference, only the receivers in that region need to use the Internet.

This Technical Recommendation describes a method to use the RF forward path for bulk distribution, and RIST to correct any lost data. This solution can be used to augment any large-scale point-to-multipoint network that uses a transport stream with an IP/RTP layer. This includes IP satellites (possibly using DVB-S2 GSE or DVB-S MPE), as well as terrestrial technologies such as ATSC 3.0.

1.1 Contributors

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

Merrick Ackermans (CBS/Paramount)	Sergio Ammirata (SipRadius)	Paul Atwell (Media Transport Solutions)
Oded Gants (Zixi)	Ciro Noronha (Cobalt Digital)	Adi Rozenberg (AlvaLinks)
Manjinder Sandhu (Evertz)	Wes Simpson (LearnIPVideo)	Thomas True (Nvidia)

1.2 About the Video Services Forum

The Video Services Forum, Inc. (www.vsf.tv) 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.

The VSF is an association incorporated under the Not For Profit Corporation Law of the State of New York. Membership is open to businesses, public sector organizations and individuals worldwide. For more information on the Video Services Forum or this document, please e-mail opsmgr@vsf.tv.

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-06-1:2020, Reliable Internet Stream Transport (RIST) Protocol Specification – Simple Profile

VSF TR-06-2:2024, Reliable Internet Stream Transport (RIST) Protocol Specification – Main Profile

VSF TR-06-3:2024, Reliable Internet Stream Transport (RIST) Protocol Specification – Advanced Profile

VSF TR-06-4 Part 2:2023, Reliable Internet Stream Transport (RIST) – Use of Wireguard VPN in RIST Devices

VSF TR-06-4 Part 3:2023, Reliable Internet Stream Transport (RIST) – RIST Relay

VSF TR-06-4 Part 5:2023, Reliable Internet Stream Transport (RIST) – RIST Multicast Discovery

VSF TR-06-4 Part 6:2024, Reliable Internet Stream Transport (RIST) – Transport Stream Program Selection

VSF TR-06-4 Part 7:2025, Reliable Internet Stream Transport (RIST) – Satellite Hybrid: In-Band Method

Any mention of references throughout the rest of this document refers to the versions described here, unless explicitly stated otherwise.

4 Solution Requirements (Informative)

RF transmission is the ideal solution to the problem of simultaneously distributing the same content to many geographically distributed receivers. This can be done using satellites or OTA distribution, depending on the scale. Adding a new receiver only requires putting up an antenna and pointing it; there is no additional burden or extra capacity required on the system. However, such systems can suffer from degraded operation due to factors such as rain fade, interference, and similar issues.

The solution considered in this Specification is to augment the RF delivery with the Internet. Use the RF link for the "heavy lifting" bulk delivery, and "fix any remaining problems" with the Internet. If a site is suffering from interference or rain fade, send a recovery stream to that site only, and include in this recovery stream only the blocks of data that were lost or corrupted.

A diagram of the solution is shown in Figure 1. The solution is required to comply with the following requirements:

1. RF (satellite or OTA) is the primary distribution method.
2. The RF channel is unidirectional; there is no return channel.
3. The Internet is used only to recover dropped or corrupted data.
4. Data recovery is seamless with no glitches.
5. The solution needs to be capable of delivering complete feed in case of a full outage of the RF link.

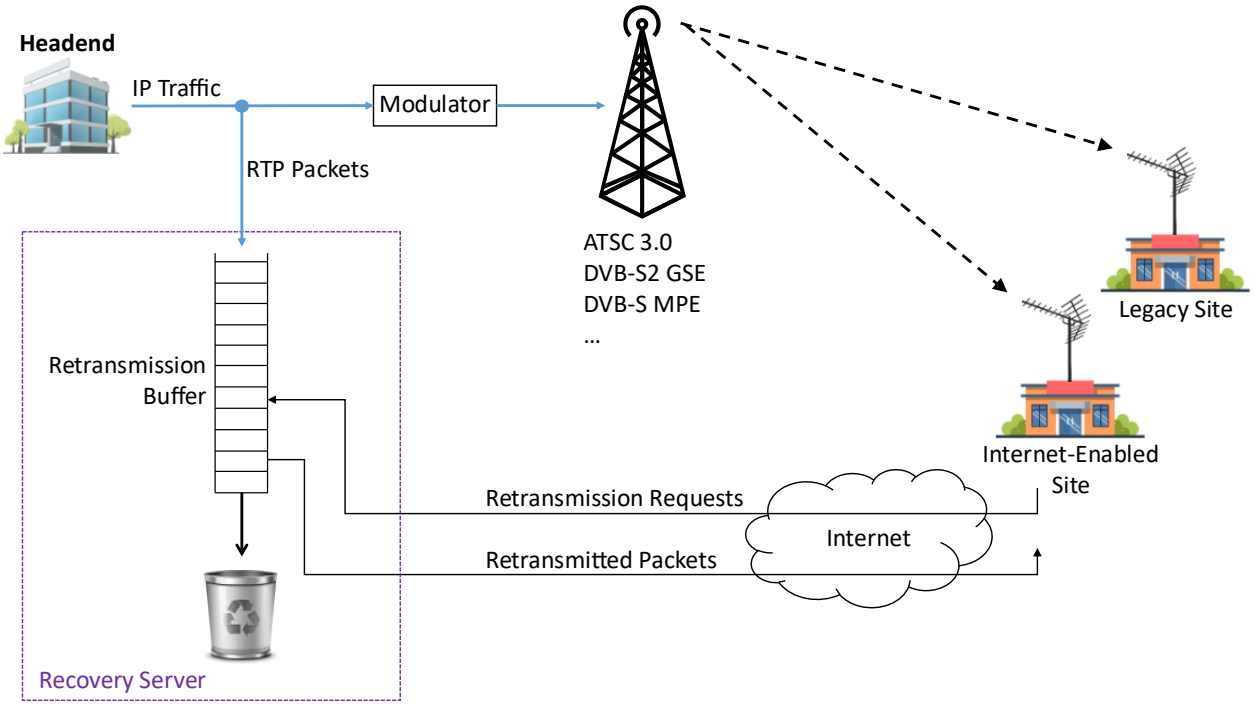

Figure 1: Solution Overview

5 Solution Architecture

The system shall operate as follows:

1. Headend generates IP packets to be transported by the RF link. A subset (maybe all) of these IP packets represents one or more RTP streams. The recovery mechanisms described in this Specification only apply to these RTP streams. These packets are typically multicast.
   Note: this Specification applies to any type of RTP packet and is not limited to Transport Streams. RIST Advanced Profile (TR-06-3) tunnels may be used to transport generic IP packets.
2. The RTP packets shall be transmitted to the Recovery Server, in addition to the RF link.
3. The Recovery Server shall buffer the RTP stream, as if it were sending this stream over RIST, using RIST Simple or Advanced Profiles.
   Note: the buffer at the recovery server needs to be large enough to accommodate the RF link round-trip latency, plus the worst-case Internet latency to all the receivers. This buffer size typically will be on the order of several seconds for satellite links.
4. Lost packets shall be requested by Internet-connected receivers using the standard ARQ method in RIST Simple Profile or RIST Advanced Profile. Internet-enabled sites may keep a connection to the Recovery Server using RIST Main Profile or RIST Advanced Profile tunnels.
5. In some cases, such as with ATSC 3.0, all RTP packets in a frame have the same sequence number. In such cases, in case of error or data loss, the whole block of packets with the same sequence number shall be retransmitted.
6. In case of a full outage, the Full Stream Request Messages from TR-06-4 Part 7 Section 7 shall be used to request the content. The mechanisms described in that section shall be used to enable/disable the transmission.
7. If the content is an MPEG Transport Stream with multiple programs, the Internet-connected receivers may use TR-06-4 Part 6 to select only a subset of programs they require, avoiding retransmission of unnecessary data.

RIST Simple Profile (TR-06-1) requires that the least significant bit (LSB) of the SSRC be set to zero on original packets, and to one on retransmitted packets. If this Specification is being used to transport pre-formed RTP packets, there are no constraints in the SSRC. The packets transmitted over the RF link will have the original SSRC. The Recovery Server shall set the SSRC for the packets transmitted to the receivers as follows:

- For all retransmitted packets, the Recovery Server shall set the LSB of the SSRC to "1" (one).
- For all original packets, the Recovery Server shall use the incoming SSRC. Original packets are only transmitted by the Recovery Server if a Full Stream Request from TR-06-4 Part 7 is active.

Unless a Full Stream Request is active, the receiver can differentiate between original packets and retransmissions by their source interface – original packets arrive from the RF link, retransmissions arrive from the Internet link.

If a Full Stream Request is active, and the original SSRC has the LSB set to “1” (one), the receiver will not generally be able to differentiate between an original packet and a retransmission. However, this is only an issue at startup, and a receiver that starts during a fade can safely assume that the first packet it receives after it issues a Full Stream Request is an original packet.

Appendix A Receiver Configuration (Informative)

The Receiver Configuration considerations listed in Appendix B of TR-06-4 Part 7 also apply to this Specification.

Appendix B Redundancy and Scalability Considerations (Informative)

In a typical RF distribution deployment, there is a large number of receivers, each of which may require the full signal in case of fade or any other outage. It is unlikely that a single Recovery Server will be able to service all the receivers. In such cases, it will be necessary to provide a bank of servers, all with access to the original stream, and these may even be geographically distributed and placed "closer" to a group of receivers.

The following options can be used in this case:

- All receivers are configured to contact the same server name or IP address, and a load balancer spreads the requests over multiple servers.
- Groups of receivers are configured to contact different servers. Receivers may be configured with a primary server and a fallback server.