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**RTCP Extension for Third-party Loss Report
draft-ietf-avtcore-feedback-supression-rtp-14**

Abstract

In a large RTP session using the RTCP feedback mechanism defined in [RFC 4585](#), a feedback target may experience transient overload if some event causes a large number of receivers to send feedback at once. This overload is usually avoided by ensuring that feedback reports are forwarded to all receivers, allowing them to avoid sending duplicate feedback reports. However, there are cases where it is not recommended to forward feedback reports, and this may allow feedback implosion. This memo discusses these cases and defines a new RTCP third-party loss report that can be used to inform receivers that the feedback target is aware of some loss event, allowing them to suppress feedback. Associated SDP signalling is also defined.

Status of this Memo

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1. Introduction

RTCP feedback messages [[RFC4585](#)] allow the receivers in an RTP session to report events and ask for action from the media source (or a delegated feedback target when using unicast RTCP feedback with SSM [[RFC5760](#)]). There are cases where multiple receivers may initiate the same, or an equivalent message towards the same media source or the same feedback target. When the receiver count is large, this behavior may cause transient overload of the media source, the network or both. This is known as a "feedback storm" or a "NACK storm". One common cause of such a feedback storm is receivers utilizing RTP retransmission [[RFC4588](#)] as a packet loss recovery technique, sending feedback using RTCP NACK messages [[RFC4585](#)] without proper dithering of the retransmission requests (e.g., not implementing the [RFC 4585](#) dithering rules or sending NACKs to a feedback target that doesn't redistribute them to other receivers).

Another use case involves video Fast Update requests. A storm of these feedback messages can occur in conversational multimedia scenarios like multipoint video switching conference [[RFC4587](#)]. In this scenario, the receiver may lose synchronization with the video stream when speaker is changed in the middle of session. Poorly designed receivers that blindly issue fast update requests (i.e., Full Intra Request (FIR) described in [RFC5104](#) [[RFC5104](#)]), can cause an implosion of FIR requests from receivers to the same media source.

RTCP feedback storms may cause short term overload, and in extreme cases to pose a possible risk of increasing network congestion on the control channel (e.g. RTCP feedback), the data channel, or both. It is therefore desirable to provide a way of suppressing unneeded feedback. This document specifies a new third-party loss report for this function. It supplements the existing the use of RTCP NACK packet and further is more precise in the uses where the network is active to suppress feedback. It tells receivers explicitly that feedback for a particular packet or frame loss is not needed for a period of time and can provide an early indication before the receiver reacts to the loss and invokes its packet loss repair machinery. [Section 6](#) provides some examples of when to send the Third Party Loss Report message.

2. Requirements Notation

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119](#) [[RFC2119](#)].

2.1. Glossary

TPLR - Third Party Loss Report
TLLEI - Transport layer third party loss Early Indication
PSLEI - Third Party Loss Early Indication
FCI - Feedback Control Information [[RFC4585](#)]
AVPF - The Audio-Visual Profile with RTCP-based feedback [[RFC4585](#)]
SSRC - Synchronization Source
BRS - Burst/Retransmission Sources [[RFC6285](#)]
FIR - Full Intra Request [[RFC5104](#)]
PLI - Picture Loss Indication [[RFC4585](#)]
SSM - Source Specific Multicast [[RFC5760](#)]
RAMS - Unicast based Rapid Acquisition of Multicast Stream
[[RFC6285](#)]
MCU - Multipoint Control Unit [[RFC5117](#)]

3. Protocol Overview

This document extends the RTCP feedback messages defined in the RTP/AVPF [[RFC4585](#)] defining a RTCP Third Party Loss Report (TPLR) message. The RTCP TPLR message can be used by the intermediaries to inform the receiver that the sender of the RTCP TPLR has received reports that the indicated packets were lost, and asks the receiver not to send feedback to it regarding these packets. Intermediaries are variously referred to as Distribution source, Burst/Retransmission Sources (BRS), MCUs, RTP translator, or RTP mixers, depending on the precise use case described [Section 6](#).

RTCP TPLR follows the similar format of message type as RTCP NACK or Full Intra Request Command. However, the RTCP TPLR is defined as an indication that the sender of the feedback has received reports that the indicated packets were lost, while NACK [[RFC4585](#)] just indicates that the sender of the NACK observed that these packets were lost. The RTCP TPLR message is generated by an intermediary that may not have seen the actual packet loss. It is sent following the same timing rule as sending NACK defined in [RFC4585](#) [[RFC4585](#)]. The RTCP TPLR message may be sent in a regular full compound RTCP packet or in an early RTCP packet, as per the RTP/AVPF rules. Intermediaries in the network that receive a RTCP TPLR SHOULD NOT send their own additional Third Party Loss Report messages for the same packet sequence numbers. They SHOULD simply forward the RTCP TPLR message received from upstream direction to the receiver(s), additionally, they may generate their own RTCP TPLR that reports a set of the losses they see, which are different from ones reported in the RTCP TPLR they received. The RTCP TPLR does not have the retransmission request [[RFC4588](#)] semantics.

When a receiver gets a RTCP TPLR message, it MUST follow the rules for NACK suppression in [RFC 4585](#) if the message is integrity protected and authenticated and refrain from sending a feedback request (e.g., NACK or FIR) for the missing packets reported in the message, which is dealt with in the same way as receiving NACK.

To increase the robustness to the loss of a TPLR, The RTCP TPLR may be retransmitted. If the additional TPLR arrives at receiver, the receiver SHOULD deal with the additional TPLR in the same way as receiving the first TPLR for the same packet and no additional behavior for receiver is required.

A receiver may have sent a Feedback message according to the RTP/AVPF scheduling algorithm of [RFC4585](#) [[RFC4585](#)] before receiving a RTCP TPLR message, but further feedback messages for those sequence numbers SHOULD be suppressed for a period of time after receiving the RTCP TPLR. Nodes that do not understand the RTCP TPLR message will ignore it, and might therefore still send feedback according to the AVPF scheduling algorithm of [RFC4585](#) [[RFC4585](#)]. The media source or intermediate nodes cannot be certain that the use of a RTCP TPLR message actually reduces the amount of feedback it receives.

4. Format of RTCP Feedback Messages

This document introduces two new RTCP Feedback messages for Third Party Loss Report. Applications that are employing one or more loss-repair methods MAY use the RTCP TPLR together with their existing loss-repair methods either for every packet they expect to receive, or for an application-specific subset of the RTP packets in a session. In other words, receivers MAY ignore RTCP TPLR messages, but SHOULD react to them unless they have good reason to still send feedback messages despite having been requested to suppress them.

The following two sections each define a RTCP TPLR message. Both messages are feedback messages as defined in [section 6.1 of RFC4585](#) [[RFC4585](#)], and use the header format defined there. Each section defines how to populate the PT, FMT, length, SSRC of packet sender, SSRC of media source, and FCI fields in that header.

4.1. Transport Layer Feedback: Third Party Loss Report (TPLR)

This TPLR message is identified by RTCP packet type value PT=RTPFB and FMT=TBA1.

Within the common packet header for feedback messages (as defined in [section 6.1 of RFC4585](#) [[RFC4585](#)]), the "SSRC of packet sender" field indicates the source of the request, and the "SSRC of media source"

denotes the media sender of the flow for which the indicated losses are being suppressed.

The Feedback Control Information (FCI) field MUST contain one or more entries of transport layer third party loss Early Indication (TLLEI). Each entry applies to the same media source identified by the SSRC contained in the SSRC of media source field of Feedback header. The length field in the TLLEI feedback message MUST be set to $2+1*N$, where N is the number of FCI entries.

The FCI field for TLLEI uses the similar format of message Types defined in the [section 6.2.1 of RFC4585](#) [RFC4585]. The format is shown in Figure 1.

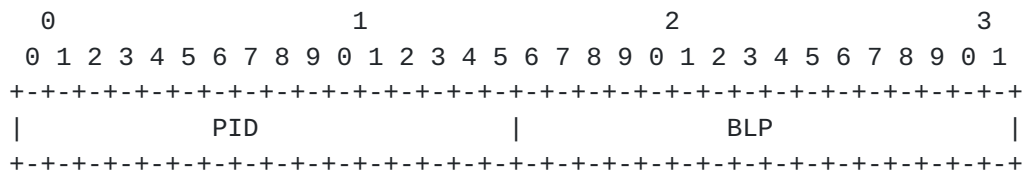


Figure 1: Syntax of an FCI Entry in the TLLEI Feedback Message

Packet ID (PID): 16 bits

The PID field is used to specify a lost packet. The PID field refers to the RTP sequence number of the lost packet.

bitmask of lost packets (BLP): 16 bits

The BLP allows for reporting losses of any of the 16 RTP packets immediately following the RTP packet indicated by the PID. The BLP's definition is identical to that given in the [section 6.2.1 of \[RFC4585\]](#).

4.2. Payload Specific Feedback: Third Party Loss Report (TPLR)

This TPLR message is identified by RTCP packet type value PT=PSFB and FMT=TBA2, which is used to suppress FIR [RFC5104] and PLI [RFC4585].

Within the common packet header for feedback messages (as defined in [section 6.1 of RFC4585](#) [RFC4585]), the "SSRC of packet sender" field indicates the source of the request, and the "SSRC of media source" is not used and SHALL be set to 0. The SSRCs of the media senders to which this message applies are in the corresponding FCI entries.

The FCI field for a Payload Specific Third Party Loss Early Indication (PSLEI) consists one or more FCI entries. Each entry

applies to a different media Source, identified by its SSRC. the content of which is depicted in Figure 2. The length field in the PSLEI feedback message MUST be set to $2+1*N$, where N is the number of FCI entries.

The format is shown in Figure 2.

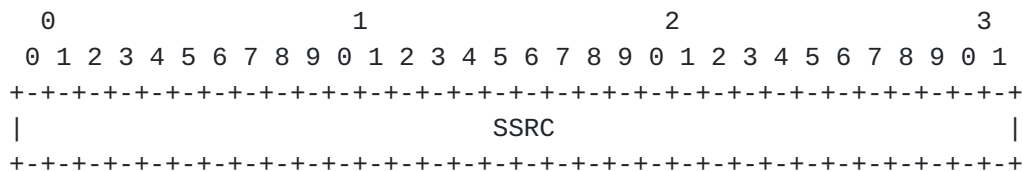


Figure 2: Syntax of an FCI Entry in the PSLEI Feedback Message

Synchronization source (SSRC):32 bits

The SSRC value of the media source that is already aware, or in the process of being made aware, that some receiver lost synchronization with the media stream and for which the PSLEI receiver's own response to any such error is suppressed.

5. SDP Signaling

The Session Description Protocol (SDP) [[RFC4566](#)] attribute, rtcp-fb, is defined in the [Section 4 of RFC4585](#) [[RFC4585](#)] and may be used to negotiate the capability to handle specific AVPF commands and indications. The ABNF for rtcp-fb is described in [section 4.2 of RFC4585](#) [[RFC4585](#)]. In this section, we extend the rtcp-fb attribute to include the commands and indications that are described for third party loss report in the present document.

In the ABNF [[RFC5234](#)] for rtcp-fb-val defined in [RFC4585](#) [[RFC4585](#)], the feedback type "nack", without parameters, indicates use of the Generic NACK feedback format as defined in [Section 6.2.1 of RFC4585](#) [[RFC4585](#)]. In this document, we define two parameters that indicate the third party loss supported for use with "nack", namely:

- o "tllei" denotes support of transport layer third party loss early indication.
- o "pslei" denotes support of payload specific third party loss early indication.

The ABNF for these two parameters for "nack" is defined here (please refer to [section 4.2 of RFC4585](#) [[RFC4585](#)] for complete ABNF syntax).


```
rtcp-fb-val      =/ "nack" rtcp-fb-nack-param
rtcp-fb-nack-param = SP "tllei"
                  ;transport layer third party
                  ; loss early indication
                  / SP "pslei"
                  ;payload specific third party
                  ; loss early indication
                  / SP token [SP byte-string]
                  ; for future commands/indications
token =          <as defined in section 9 of \[RFC4566\]>
byte-string = <as defined in section 4.2 of \[RFC4585\] >
```

Refer to [Section 4.2 of RFC4585 \[RFC4585\]](#) for a detailed description and the full syntax of the "rtcp-fb" attribute.

6. Example Use Cases

The operation of feedback suppression is similar for all types of RTP sessions and topologies [[RFC5117](#)], however the exact messages used and the scenarios in which suppression is employed differ for various use cases. The following sections outline some of the intended use cases for using the Third Party Loss Report for feedback suppression and give an overview of the particular mechanisms.

6.1. Source Specific Multicast (SSM) use case

In SSM RTP sessions as described in "RTP Control Protocol (RTCP) Extensions for Single-Source Multicast Sessions with Unicast Feedback" [[RFC5760](#)], one or more Media Sources send RTP packets to a Distribution Source. The Distribution Source relays the RTP packets to the receivers using a source- specific multicast group.

As outlined in the [RFC5760 \[RFC5760\]](#), there are two Unicast Feedback models that may be used for reporting, the Simple Feedback model and the Distribution Source Feedback Summary Model. In the simple Feedback Model, there's no need for distribution source to create the RTCP TPLRs, instead, RTCP NACKs are reflected by the distribution source to the other Receivers. However in the Distribution Source Feedback Summary model, the distribution source will not redistribute the NACK for some reason(e.g., to prevent revealing the identity or existence of a system sending NACK)and may send a RTCP TPLR message to the systems that were unable to receive the NACK, and won't receive the NACK via other means. The RTCP TPLR can be generated at the distribution source when downstream loss is reported (e.g., downstream loss report is received), which indicates to the receivers that they should not transmit feedback messages for the same loss event for a certain time. Therefore the distribution source in the

feedback summary model can be reasonably certain that it will help the situation (i.e., unable receive the NACK) by sending this RTCP TPLR message to all the relevant receivers impacted by the packet loss.

6.2. Unicast based Rapid Acquisition of Multicast Stream (RAMS) use case

The typical RAMS architecture [[RFC6285](#)] may have several Burst/Retransmission Sources(BRS) behind the multicast source (MS) placed at the same level. These BRSSes will receive the primary multicast RTP stream from the media source and cache most recent packets after joining multicast session. If packet loss happens at the upstream of all the BRSSes or the downstream of BRSSes. One of the BRSSes or all the BRSSes may send a RTCP NACK or RTCP TPLR message to the DS, where the SSRC in this RTCP NACK or RTCP TPLR message is the BRS that is sending the message. The DS forwards/reflects this message down on the primary SSM. The details on how DS deal with this message is specified in [[RETRANSMISSION-FOR-SSM](#)].

6.3. RTP Transport Translator use case

A Transport Translator (Topo-Trn-Translator), as defined in [RFC5117](#) [[RFC5117](#)] is typically forwarding the RTP and RTCP traffic between RTP clients, for example converting from multicast to unicast for domains that do not support multicast. The translator may suffer a loss of important video packets. In this case, the translator may forward RTCP TPLR message received from upstream in the same way as forwarding other RTCP traffic. If the translator acting as the monitor [[MONARCH](#)] is aware of packet loss, it may use the SSRC of monitor as packet sender SSRC to create NACK message and send it to the receivers that are not aware of packet loss.

6.4. Multipoint Control Unit (MCU) use case

When the speaker is changed in a voice-activated multipoint video switching conference [[RFC4587](#)], an RTP mixer can be used to select the available input streams and forward them to each participants. If the MCU is doing a blind switch without waiting for a synchronization point on the new stream it can send a FIR to the new video source. In this case the MCU should send a FIR suppression message to the new receivers. e.g., when the RTP Mixer starts to receive FIR from some participants it can suppress the remaining session participants from sending FIR by sending out a RTCP TPLR message.

6.5. Mixer use case

A Mixer, in accordance with [RFC5117](#) [[RFC5117](#)], aggregates multiple RTP streams from other session participants and generates a new RTP stream sent to the session participants. In some cases, the video frames may get badly screwed up between media source and the mixer. In such case, the mixer need to check if the packet loss will result in PLI or FIR transmissions from most of the group by analyzing the received video. If so the mixer may initiate FIR or PLI towards the media source on behalf of all the session participants and send out a RTCP TPLR message to these session participants that may or are expected to send a PLI or FIR. Alternatively, when the mixer starts to receive FIR or PLI from some participants and like to suppress the remaining session participants from sending FIR or PLI by forwarding the FIR/PLI from one session participant to others.

7. Security Considerations

The defined messages have certain properties that have security implications. These must be addressed and taken into account by users of this protocol.

Spoofed or maliciously created feedback messages of the type defined in this specification can have the following implications:

Sending the spurious Third Party Loss Report packet(e.g., the RTCP TPLR with the wrong sequence number of lost packet) that causes missing RTP packets to not be repaired in a timely fashion. If a receiver accepts such unauthenticated packet, an attacker could cause packet loss disrupting an important part of a session, preemptively sending feedback suppression. An attacker that is also a receiver has enough information to suppress all the feedbacks from any other listeners that don't accept unauthenticated packets.

To prevent these attacks, there is a need to apply authentication and integrity protection of the feedback messages. This can be accomplished against threats external to the current RTP session using the RTP profile that combines Secure RTP [[RFC3711](#)] and AVPF into SAVPF [[RFC5124](#)].

Note that intermediaries that are not visible at the RTP layer that wish to send the Third Party Loss Reports on behalf of the media source can only do so if they spoof the SSRC of the media source. This is difficult in case SRTP is in use. If the intermediary is visible at the RTP layer, this is not an issue, provided the intermediary is part of the security context for the session.

Also note that endpoints that receive a Third Party Loss Report would be well-advised to ignore it, unless the security is in place to authenticate the sender of the Third Party Loss Report. Accepting Third Party Loss Report from un-authenticated sender can lead to a denial of service attack, where the endpoint accepts poor quality media that could be repaired.

8. IANA Consideration

This document instructs IANA to add two values in "ack" and "nack" Attribute Values registry for use with "nack"[[RFC4585](https://www.rfc-editor.org/rfc/rfc4585)]:

The value registration for the attribute value "nack":

Value name:	tllei
Long name:	Transport Layer Third Party Loss Early Indication
Usable with:	nack
Reference:	RFC 4585 .
Value name:	pslei
Long name:	Payload Specific Third Party
Usable with:	nack
Reference:	RFC 4585 .

The following value have been registered as one FMT value in the "FMT Values for RTPFB Payload Types" registry located at the time of publication at: <http://www.iana.org/assignments/rtp-parameters>

RTPFB range

Name	Long Name	Value	Reference
TLLEI	Transport Layer Third Party Loss Early Indication	TBA1	[RFCXXXX]

The following value have been registered as one FMT value in the "FMT Values for PSFB Payload Types" registry located at the time of publication at: <http://www.iana.org/assignments/rtp-parameters>

PSFB range

Name	Long Name	Value	Reference
PSLEI	Payload Specific Third Party Loss Early Indication	TBA2	[RFCXXXX]

9. Acknowledgement

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10. References

10.1. Normative References

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- [RFC5760] Ott, J., Chesterfield, J., and E. Schooler, "RTP Control Protocol (RTCP) Extensions for Single-Source Multicast Sessions with Unicast Feedback", [RFC 5760](#), February 2010.

[Appendix A.](#) Change Log

Note to the RFC-Editor: please remove this section prior to publication as an RFC.

[A.1.](#) [draft-ietf-avtc core-feedback-suppression-rtp-01](#)

The following are the major changes compared to previous version:

- o Remove the merge report from SSM use case and additional text to address report merging issue.
- o Revise [section 3](#) and [section 6](#) to address FEC packet dealing issue and Leave how to repair packet loss beyond the scope.
- o Modify the SSM use case and RAMS use case to focus on uses.
- o Other Editorial changes.

[A.2.](#) [draft-ietf-avtc core-feedback-suppression-rtp-02](#)

The following are the major changes compared to previous version:

- o In [Section 4.1](#), fix typo: change [Section 4.3.1.1](#) of section [\[RFC5104\]](#) to [section 6.2.1 of \[RFC4585\]](#).
- o In [Section 3](#): Clarify how to deal with downstream loss using Third party loss report and upstream loss using NACK.

- o Update title and abstract to focus on third party loss report.
- o In [Section 6.1](#): Update this section to explain how third party loss report is used to deal with downstream loss.
- o In [section 6.1.2](#): Update this section to explain how third party loss report is used to deal with downstream loss.
- o In [section 6.2](#): Rephrase the text to discuss how BRS deal with the third party loss report.

[A.3. draft-ietf-avtcare-feedback-suppression-rtp-03](#)

The following are the major changes compared to previous version:

- o In [Appendix A](#), fix typo: [Appendix A](#). [Appendix A](#). -> [Appendix A](#).
- o Update abstract to clarify when third-party loss reports should be sent instead of NACKs.
- o Update [section 3](#) Paragraph 2 to differentiate when a third-party loss report should be used compared to a NACK.
- o Update [section 3](#) Paragraph 3 to explain when media source to send a third-party loss.
- o Move specific rules for [section 6.1.1](#) and [section 6.1.2](#) to [section 6.1](#) as generic rules and delete [section 6.1.1](#).

[A.4. draft-ietf-avtcare-feedback-suppression-rtp-04](#)

The following are the major changes compared to previous version:

- o Reference Update.
- o Clarify the use of the third party loss report in [section 3](#) and [section 6.1.1](#).

[A.5. draft-ietf-avtcare-feedback-suppression-rtp-05](#)

The following are the major changes compared to previous version:

- o Remove 3rd and 4th paragraphs of [section 6.1](#) and replaced them with 2nd and 3rd paragraphs of [section 3](#).
- o Remove [section 6.1.1.1](#).
- o Revise the last paragraph of [section 1](#) to clarify the rationale of using new message.

- o Update RTP transport translator case in [section 6.3](#) to correct the use of the third party loss report.
- o Update MCU case in [section 6.4](#) to correct the use of the third party loss report.
- o Revise SSM use case to address multiple DS issue.
- o References Update.
- o Move one rationale on preventing sending unicast NACK in introduction section to SSM case section.
- o Other Editorial changes to [section 6.1](#), 6.1.1, 6.2.

[A.6. draft-ietf-avtcore-feedback-suppression-rtp-06](#)

The following are the major changes compared to previous version:

- o A few Editorial changes to the whole document.

[A.7. draft-ietf-avtcore-feedback-suppression-rtp-07](#)

The following are the major changes compared to previous version:

- o Restructuring the protocol overview section to clarify the round trip time calculation and receiver behavior to the additional TPLR.
- o Restructuring the SSM use case section to focus on the use of TPLR.
- o Editorial changes to the abstract, introduction, message format, use cases and IANA sections.
- o References update

[A.8. draft-ietf-avtcore-feedback-suppression-rtp-08](#)

The following are the major changes compared to previous version:

- o Clarify which RTT is used and how timer is refreshed in the [section 3](#).
- o Editorial changes to the Introduction, Protocol Overview, SDP Signaling, Message Format, Use case, Security Consideration and

IANA sections.

- o Remove Seq Nr field in the figure 2 for payload specific feedback.
- o References reorganizing.

[A.9. draft-ietf-avtcore-feedback-suppression-rtp-09](#)

The following are the major changes compared to previous version:

- o Clarify to suppression interval with regard to how long to receive the
retransmitted packet. Treating TPLR in the same way as receiving NACK.
- o Replace timer based approach with timeless based approach.

[A.10. draft-ietf-avtcore-feedback-suppression-rtp-10](#)

The following are the major changes compared to previous version:

- o Fix the definition of Synchronization source for TPLR in [section 4.2](#).
- o Associate SDP parameters tllei and pslei with "nack".
- o Remove the packet loss recovery from TPLR loss handling part.
- o Other typo fixed.

[A.11. draft-ietf-avtcore-feedback-suppression-rtp-11](#)

The following are the major changes compared to previous version:

- o Additional Editorial changes.

[A.12. draft-ietf-avtcore-feedback-suppression-rtp-12](#)

The following are the major changes compared to previous version:

- o Additional Editorial changes.

[A.13. draft-ietf-avtcore-feedback-suppression-rtp-13](#)

The following are the major changes compared to previous version:

- o Additional Editorial changes.

[A.14. draft-ietf-avtcore-feedback-suppression-rtp-14](#)

The following are the major changes compared to previous version:

- o Two References moving to normative refereces.
- o Revise IANA section to clarify whether to create new registry or add new value to the existing registry.
- o Revise Security section to clarify ill effect of accepting unauthenticated messages.
- o Add a glossary to fix acronym issue.
- o Other Editorial changes.

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