

FECFRAME Working Group
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Watson
Digital Fountain
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FECFRAME requirements
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Abstract

This document defines requirements for a "FEC Framework" to be defined by the IETF FECFRAME working group. The object of this group is primarily to develop specifications for using forward error correction (FEC) codes with applications in the Internet to provide protection against packet loss.

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1. Introduction

This document defines requirements for a "FEC Framework" to be defined by the IETF FECFRAME working group. The purpose of this working group is defined in the working group charter as follows:

"The object of this group is to develop specifications for using forward error correction (FEC) codes with applications in the Internet to provide protection against packet loss. The group will develop a protocol framework for application of FEC codes to arbitrary packet flows over unreliable transport protocols over both IP multicast and unicast."

This document defines requirements for this protocol framework. Both 'essential' ('SHALL') and 'non-essential' ('SHOULD') requirements are considered.

A 'protocol framework' is a partial specification of a protocol, along with a formal description of the missing aspects which are required to form a full protocol specification - i.e. a protocol framework is a protocol with 'holes' and a detailed description of the 'shape' of those holes. Protocol frameworks provide for maximum commonality between different complete protocols which provide similar functions and therefore simplify implementation and understanding of a set of alternative protocols which perform similar functions. In this case, support for different complete protocols is valuable for two reasons. Firstly because there exist many different forward error correction codes, with different properties in terms of error correction capability, computational complexity, flexibility and intellectual property rights. Secondly, there are many applications which could benefit from the use of forward error correction. The FEC framework therefore replaces the "full mesh" of application/FEC code combinations with a single general approach which specifies how any FEC code meeting the FEC code requirements defined in the framework can be used with any application meeting the application requirements defined in the framework.

The FEC protocol framework must therefore define as much as possible of a protocol for providing forward error correction for arbitrary packet flows over unreliable transport, without defining a particular FEC code or assuming a particular application. Furthermore, the protocol framework specification will define a clear interface between the specified parts and the unspecified, FEC-code-specific and application-specific, parts. For this purpose, the building block techniques applied in the Reliable Multicast (RMT) working group will be re-used, specifically the FEC Building Block [I-D.ietf-rmt-fec-bb-revised]

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The term "Forward Error Correction" refers here to application/transport layer techniques for recovering lost packets of data. More accurately, the term "Forward Erasure Correction" should be used. In many contexts the term "Application Layer FEC (AL-FEC)" is also used, although the mechanisms considered here could be considered as either application or transport layer (the important point being that they are end-to-end).

Generally, an "FEC Code" is defined in terms of the operations required to construct encoded data from source data (at an encoder) and to reconstruct source data from encoded data (at a decoder). In order to apply an FEC Code to arbitrary packet flows, additional elements are required such as protocol elements to identify encoded data within packets, pre-processing of source data (e.g. segmentation and/or addition of FEC-related indications into the source data). Therefore, in order to adapt an FEC Code for use in the context of the FEC Framework, additional FEC-code specific specification is required. Following the approach of the FEC Building Block, this specification is known as an "FEC Scheme". The FEC Framework will define the requirements that FEC Schemes must meet for use with the framework.

Generally, it is required to add forward error correction to existing applications, for example media streaming applications. In this case, the application protocols must be extended to support this. The FEC framework will describe the requirements that application protocols must meet in order to be used with the FEC framework.

This version of this document is a first draft for discussion in the

[2.](#) Terminology

'FEC' Forward Erasure Correction.

'AL-FEC' Application Layer Forward Erasure Correction

'FEC Framework' The protocol framework which is to be defined by FECFRAME and for which this document provides requirements.

'Source data flow' The packet flow or flows to which FEC protection is to be applied.

'Repair data flow' The packet flow or flows carrying forward error correction data

'Source protocol' A protocol used for the source data flow being protected - e.g. RTP.

'Transport protocol' The protocol used for transport of the source data flow being protected - e.g. UDP, DCCP.

'Application protocol' Control protocols used to establish and modify

the source data flow being protected - e.g. RTSP.

'FEC Code' An algorithm for encoding data such that the encoded data flow is resilient to data loss or corruption.

'FEC Scheme' A specification which defines the additional protocol aspects required to use a particular FEC code with the FEC framework, or (in the context of RMT), with the RMT FEC Building Block.

'Source Block' the group of source data packets which are to be FEC protected as a single block

'Protection amount' The relative increase in data sent due to the use of FEC.

3. Essential requirements

Req-10: The FEC Framework shall support a wide range of FEC codes, using the abstractions of the FEC Building Block defined in RMT [[I-D.ietf-rmt-fec-bb-revised](#)] (including short and long block FEC codes, systematic and non-systematic codes). Specifically, the FEC Framework shall define the requirements that FEC code specifications shall meet in order to be used with the framework, re-using, as far as possible, the FEC code specification approach and requirements from the FEC Building Block and specifying any further requirements that must be met for the FEC Framework.

Req-20: The FEC Framework shall support a wide range of application protocols, using the abstractions of the FEC Building Block [[I-D.ietf-rmt-fec-bb-revised](#)]. Specifically, the FEC Framework

shall define the requirements that application protocol specifications shall meet in order to be used with the framework, re-using, as far as possible, the Content Delivery Protocol specification approach and requirements from the FEC Building Block and specifying any further requirements that must be met for the FEC Framework.

Req-30: The FEC Framework shall support variable source block sizes, including real-time variation of source block size between blocks of a given source data flow.

Req-30: The FEC Framework shall support variable protection amounts, including real-time variation of protection amount between blocks within a given source data flow.

Req-40: The FEC Framework shall be independent of the source protocols (provided that source protocol uses one of the supported transport protocols).

Req-50: The FEC Framework shall place minimal requirements on the application protocols.

Req-60: The FEC Framework shall support variable source data flow rates.

Req-70: The FEC Framework shall support variable source data flow packet sizes.

Req-80: The FEC Framework shall provide support of combined protection of multiple source data flows.

Req-90: The FEC Framework shall provide support of multiple transport protocols for the source data protocols (UDP, DCCP, others ?).

Req-100: The FEC Framework shall provide support for definition of backwards-compatible FEC protocols (i.e. where the source packets are not modified in any way).

Req-110: The FEC Framework shall provide support for different source

data protocols (RTP, MIKEY, others ?).

Req-120: The FEC Framework shall shall address the security issues, if any, associated with the use of FEC.

[4.](#) Non-essential requirements

The FEC Framework should be constructed such that the FEC streaming protocol defined by 3GPP in TS26.346 is a valid protocol according to the FEC Framework.

5. Security Considerations

This document defines requirements for the work of the FECFRAME working group and includes a requirement that the security implications of the use of FEC, if any, should be addressed in that work.

6. References

[I-D.ietf-rmt-fec-bb-revised]

Watson, M., "Forward Error Correction (FEC) Building Block", [draft-ietf-rmt-fec-bb-revised-03](#) (work in progress), January 2006.

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Author's Address

Mark Watson
Digital Fountain
39141 Civic Center Dr.
Suite 300
Fremont, CA 94538
US

Email: mark@digitalfountain.com

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