



# FLUTE+ or a New Transport Protocol

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# Requirements as documented in TR

- Enhance FLUTE delivery of a sequence of related objects
- Minimize number of objects needed to receive to recover each portion of content
- Provide advance information to FLUTE receivers before objects sent/received
- An object or an object flow may be directly linked to an application, for example to a DASH Representation.
- Enable chunk delivery/reception of objects
- Enable variable size source packets
- Enable delivery of source content with no FEC semantics
- Enable FEC object bundling
- Enable that delivered object contains all information of a complete HTTP GET response
- Add timing information to FLUTE delivery
- Reuse current standards, especially FLUTE, as much as possible





# LCT header fields

- CCI field:
  - Identifies the congestion control algorithm
  - Is not used
  - Proposal: remove it completely
- TSI field:
  - Identifies multiple channels of a session originating from single sender
  - Channels used for multiple rate congestion control, which is not used in 3GPP
  - Proposal: use TSI as an object flow identifier
- PSI field:
  - Is used to differentiate FEC payload ID for source from that for repair
  - source packets shall not be modified as a requirement from this WI
  - Proposal: change it to identifier of the data in a sub-flow



# LCT header fields

- A and B flags:
  - Indicate end of session and end of object transmission
  - Flags have no reliability whatsoever as protocol header is not protected by FEC and flag is only in one packet
  - Proposal: remove these flags
- Codepoint:
  - May be used in different purposes
  - One possible usage is to carry an identifier of the FEC scheme
  - Not useful for source packets as requirement decouples source packets from FEC
  - Proposal: remove it



# LCT header fields

- TOI field:
  - Identifies a particular transport object
  - Is scoped by the TSI
  - Proposal: should be scope by the object flow identifier
  - Useful as identifier for a segment, where the object flow is the Representation
- Header length:
  - Used because LCT has a variable length
  - Use of fixed size TSI and TOI fields make the header length unnecessary
- Header Extensions:
  - Sender clock is relevant to the use case of DASH over eMBMS
  - Can be used to synchronize clocks, calculate jitter, estimate DASH segment availability time, ...



# FEC Building Block

- The usage of the FEC building block results in the following:
  - End-to-end delay is increased by the time required to generate the file at the sender and to reconstruct it at the receiver. This is especially relevant for DASH over eMBMS.
  - Fixed size media unaware packetization makes partial object recovery more difficult
  - A single FEC scheme is allowed as the FEC payload ID is also carried by source packets
- FEC Building Block needs to be removed



# Session

- ALC/LCT session
  - Mandates multiple channel congestion control, but it is not used
  - Mandates FEC building block, but the enhancement requires it to be removed
  - Single source and multiple channels, but only one channel is used
- FLUTE+ session
  - Single destination address and port number, i.e. scoped by UDP/IP flow according to the current usage of FLUTE
  - Support for SSM and ASM as no concerns about multicast routing in eMBMS
  - Support for object flows as a sub-session



# Other Enhancements

- Enable low-delay mode
  - Object can be transmitted without being completely available at sender
  - Object can be consumed without being completely reconstructed at receiver
  - Proposal: operate on chunks such as movie fragments, i.e. enable a streaming mode. For this purpose, a payload header is added to signal the boundaries of the chunks
- Error resilience
  - Receiver should be able to recover from errors without reverting to file repair
  - Proposal: identify the content of each packet to facilitate error recovery. For this purpose, a payload header is added to signal the content of the payload



# FLUTE Protocol Enhancement

- Main issue is the dependency on the FDT
- Proposal
  - Carry object metadata inside the transport object
  - Identify object flows and establish mapping between URLs and TOI
    - Object flow is identified using the new OFI (Object Flow Identifier)
    - Several possible mappings
      - (Representation@id,Segment Number) => (OFI,TOI)
      - (BaseURL,Segment Number)=>(OFI,TOI)
      - Other mappings for example URL=>(OFI,TOI)
  - Define table to carry mapping
  - Table is delivered in-band or out-of-band together with the MPD and MPD updates, e.g. as part of the USD



# FEC

- Source packets are completely free of FEC information
  - Source packets carry a sequence number, which may be used by the FEC information to establish the source block boundary
- New FEC Framework is required to enable
  - FEC signaling
  - Flexible building of source blocks
  - Flexible bundling of objects for protection in a flexible way
- Proposal:
  - Use TOI and sequence number for addressing source symbols
  - Bundling is provided through usage of multiple tuples of (TOI, SN, SSBL)
    - SSBL: sub-source block length



# Backwards Compatibility

- Any changes made to ALC/LCT or any building block such as the FEC building block or to FLUTE will result in sessions that cannot be consumed by Release 11 and before FLUTE receivers
- Compatibility may be achieved as follows:
  - Release 12 UEs shall be able to consume FLUTE and FLUTE+ sessions simultaneously
  - FLUTE+ receivers may make use of some enhancements, e.g. FEC while consuming the FLUTE session
  - Future releases will remove FLUTE and require the upgrade to FLUTE+