IEEE P1722 enhanced fragmentation/reassembly proposal

Version 0.02, 2007-08-21

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Revision History

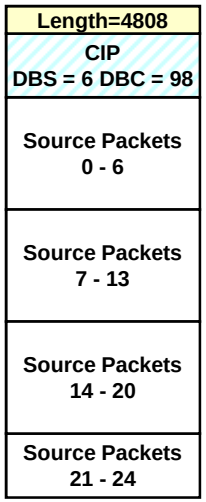
\Rev	Date	Comments
0.01	2007-08-19	First version . Edited from previous works and amended to show how enhancing it some could allow for both source packet alignment and with still allowing to reassemble into original from if desired.
0.02	2007-08-21	Updated from comments via email from multiple emails between myself and Chuck Harrison and also comments on Monday 2007-08-20 Teleconference (copied full CIP proposal to backup).

Design Goals

- Continue work from design discussed to date
- Add features:
  - Force it so CIP data payload (data blocks) can be at the same fixed location for each fragment
  - Copy length field and CIP packet header into each fragment to allow for possible partial recovery if First Fragment lost.
- NOTE:
  - So far, I've only had time to show a 61883-4 example with MPEG packets, but concepts are transferable to all 61883 types and IIDC.
  - IIDC could also do something similar with length fields, but would not have to bother with copying CIP headers on fragmentation and stripping them on reassembly.

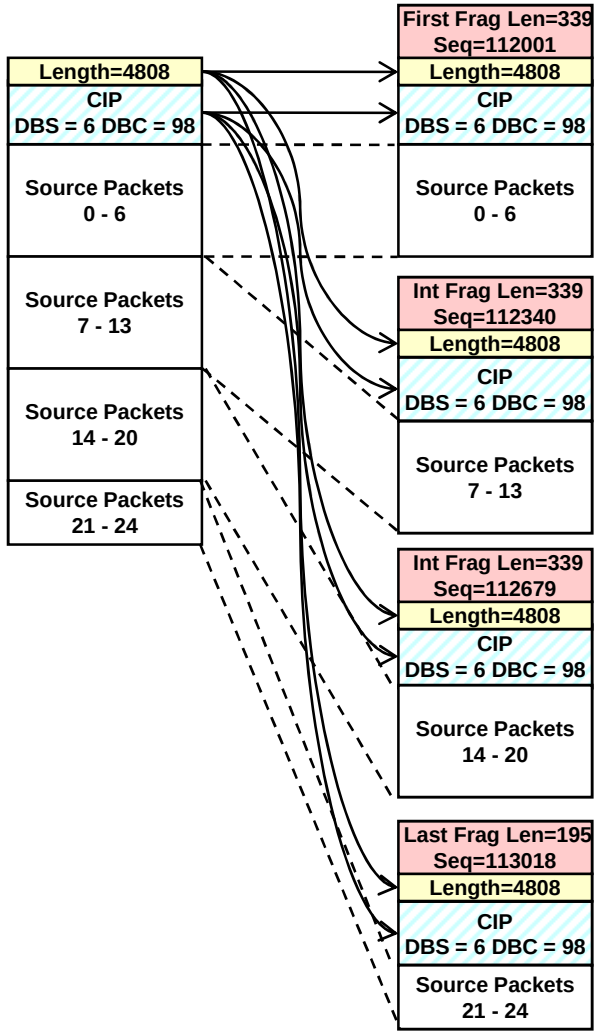
Example Source Packet Fragmentation

- Example fragmentation based on Source Packets
- Use case, 300 megabits/second 422P@HL MPEG-2 (1920x1080 @ 30Hz)
  - ~ 25 MPEG packets per 8 kHz cycle
  - 188 byte packets with 1 quadlet header(192 bytes per Source packet), 8 x 6 quadlet Data Blocks per source packer as per 61883-4 specification.
  - SYT field in source packet headers, not in CIP header.



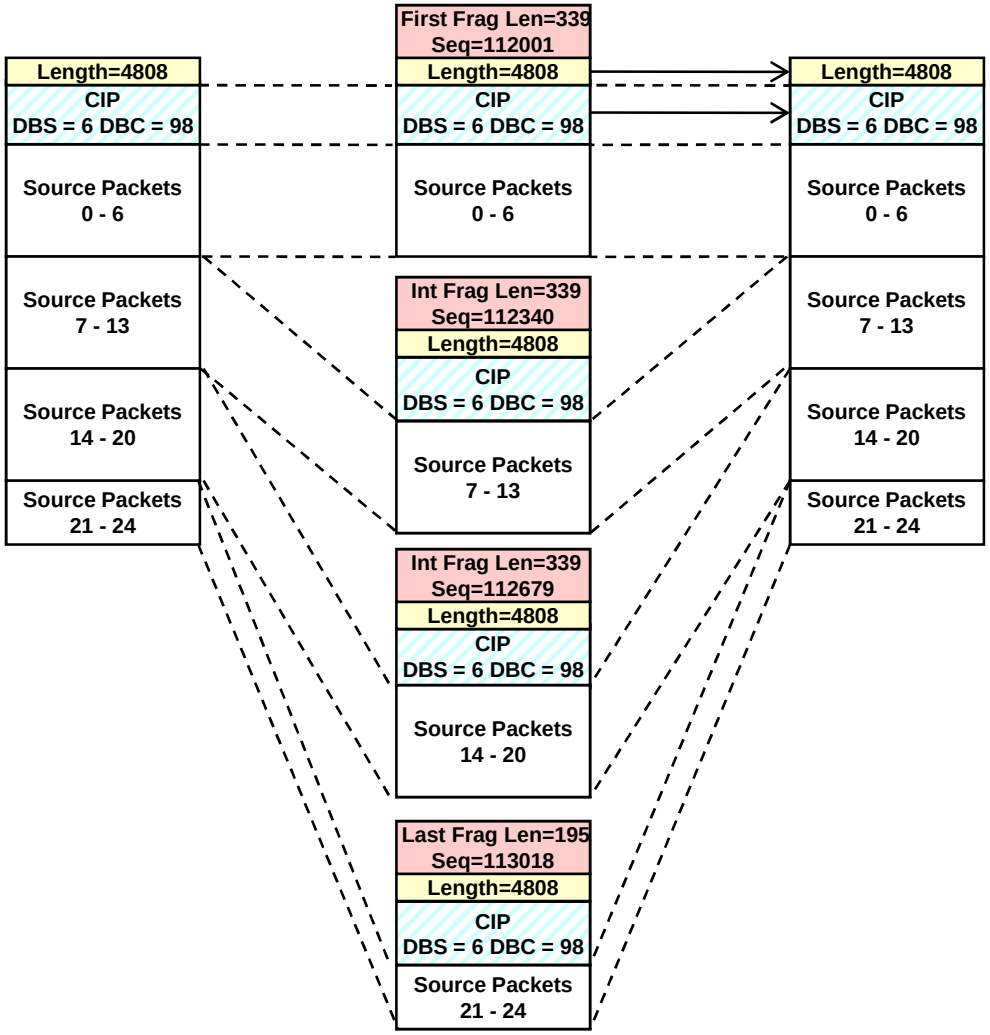
Example Source Packet Fragmentation

- Need to break into 4 Ethernet Frames
- First through Third Fragment:
  - 7 x 192 byte source packets
  - CIP packet byte length copied “as is” into Fragments
  - CIP header copied “as is” into Fragment
  - Length field set to byte count of source packets + CIP header length.
  - Fragment data:
    - First Fragment type set on first frame of sequence, second and third fragment set as Intermediate Fragment type.
    - Length = 339 quadlets
    - Sequence updated by adding quadlet length of each previous fragment Length 339 quadlets
- Last Fragment
  - 4 x 192 byte source packets
  - CIP header
    - Same processing as other fragments, just copy it.
  - Fragment Data
    - Last Fragment
    - Length = 195 Quadlets
  - Sequence updated by adding quadlet length of each previous fragment Length 339 quadlets



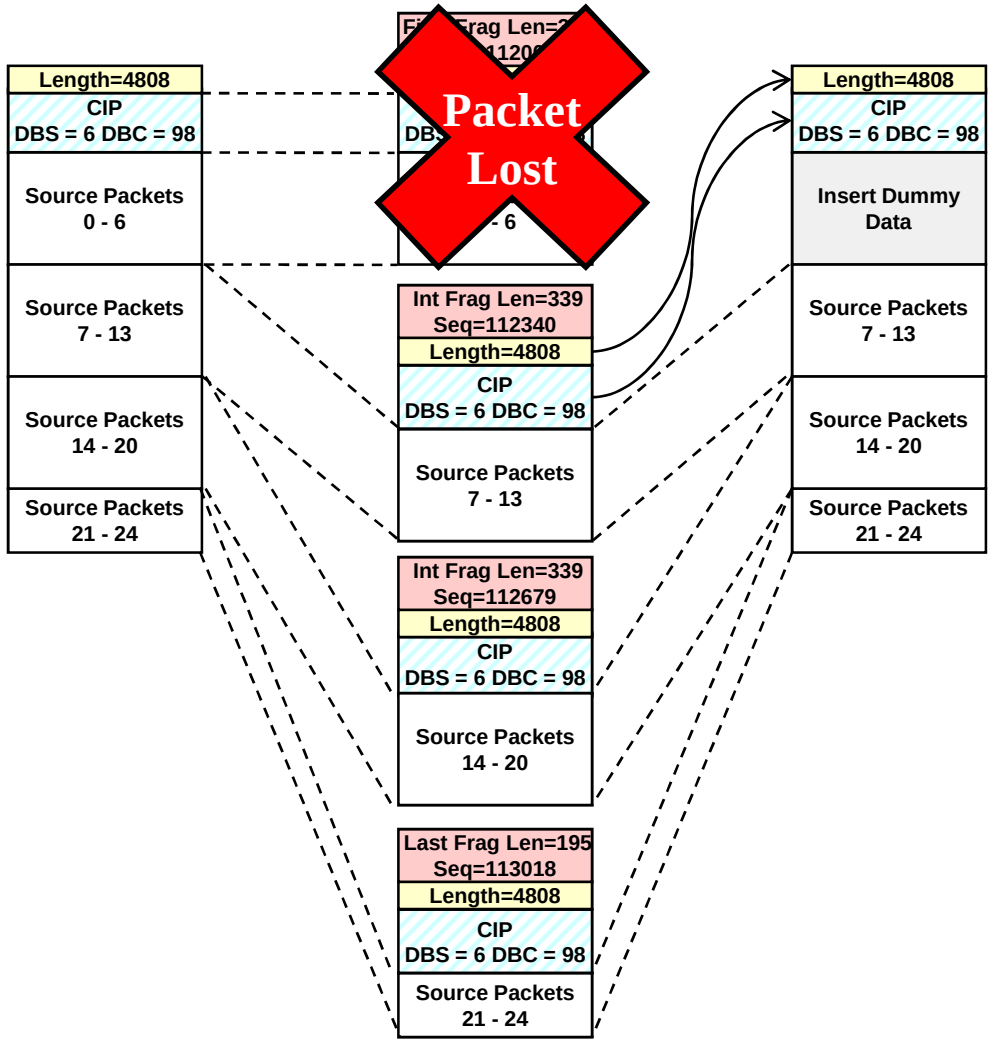
Example Source Packet Reassembly

- Reassembly if needed is straight forward:
  - Length, CIP header and Source packet data is copied from first fragment
  - For each intermediate fragment:
    - Length and CIP header fields are discarded.
    - Source packet data copied from start of source packet data , number of quadlets to copy fragment length field -3.
  - On last fragment, calculation is the same except the last fragment indicates that reassembly can complete.



Possible lost 1st fragment recovery

- Possible partial data Reassembly is possible as CIP header is duplicated in each fragment. Example
  - Talker sends 4 fragments, first one is lost in the network.
  - Listener sees a gap in the sequence number versus expected and can calculate how much data is lost.
  - Listener copies CIP header from Intermediate data and reassembles the rest of the data, creating dummy data in the place of the data from the lost fragment



Backup

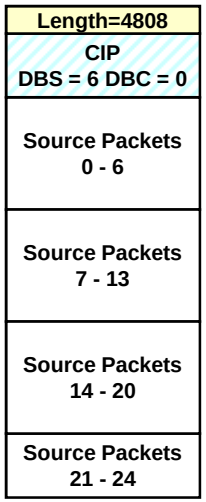
Original 0.01 proposal with full CIP header (packet level fragmentation) proposal

Design Goals

- Continue work from design discussed to date
- Add features:
  - Force it so CIP data payload (data blocks) can be at the same fixed location for each fragment
  - Bring back concept and put into this design of creating CIP headers in each Ethernet Frame so newer Ethernet only stations can process them as individual CIP packets
    - Also decreases latency, if device doesn't need to reassemble back to source, it doesn't need to.
- NOTE:
  - So far, I've only had time to show a 61883-4 example with MPEG packets, but concepts are transferable to all 61883 types and IIDC.
    - SYT field would be set to "no data" $FFFFFFFF_{16}$ for intermediate and last fragments for CIP packets with SPH=0.
  - IIDC could also do something similar with length fields, but would not have to bother with creating CIP headers on fragmentation and stripping them on reassembly.

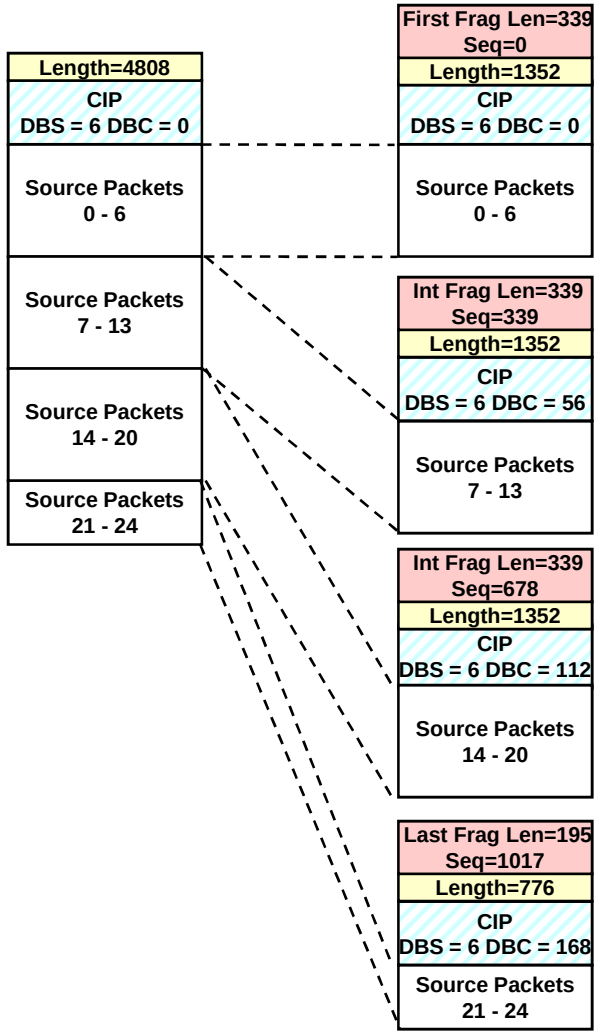
Example Source Packet Fragmentation

- Example fragmentation based on Source Packets
- Use case, 300 megabits/second 422P@HL MPEG-2 (1920x1080 @ 30Hz)
  - ~ 25 MPEG packets per 8 kHz cycle
  - 188 byte packets with 1 quadlet header(192 bytes per Source packet), 8 x 6 quadlet Data Blocks per source packer as per 61883-4 specification.
  - SYT field in source packet headers, not in CIP header.



Example Source Packet Fragmentation

- Need to break into 4 Ethernet Frames
- First Fragment:
  - 7 x 192 byte source packets
  - CIP header copied “as is”
  - Length field set to byte count of source packets + CIP header length.
  - Fragment data:
    - First Fragment
    - Length = 339 quadlets
    - Sequence 0
  - Length 339 quadlets
- Second & Third Frames
  - 7 x 192 byte source packets
  - CIP header
    - DBC calculated based on DBC plus number of data blocks from the previous fragment
    - other data copied.
  - Fragment Data
    - Intermediate Fragment
    - Length = 339 quadlets
    - Sequence updated by adding quadlet length of each previous fragment
- Last Fragment
  - 4 x 192 byte source packets
  - CIP header
    - Same processing as second and third Fragment
  - Fragment Data
    - Last Fragment
    - Length = 195 Quadlets



Example Source Packet Reassembly

- Reassembly if needed is straight forward:
  - Length, CIP header and Source packet data is copied from first fragment
  - For each intermediate fragment:
    - Length field is added to current length.
    - CIP header is discarded.
    - Source packet data copied from start of source packet data , length to copy = byte length field -8.
  - On last fragment, calculation is the same except the last fragment indicates that reassembly can complete.