

SCHC Streaming Mode

Authors:

Sergio Aguilar Romero <sergio.aguilar.romero@upc.edu>

Carles Gomez <carles.gomez@upc.edu>

SCHC Streaming Mode

- Draft objective:
 - Provide SCHC with an optimized mode for a continuous stream of data
 - Unfragmented and/or uncompressed SCHC Packets
 - Reliable data
 - Support for large MTU sizes and delay tolerant applications
 - Examples
 - Sensor measurements
 - Location coordinates of an asset tracker
 - Continuous stream of compressed and unfragmented SCHC Packets

SCHC Streaming Mode

- Motivation
 - Current SCHC F/R modes are not optimized for streams of data
 - ACKs are required on a per SCHC Packet basis
 - Other methods have been used over ACK-on-Error (using RuleIDs)
 - New technologies using SCHC have large MTU sizes and require reliability but not necessarily fragmentation

SCHC Streaming Mode

- Based on ACK-on-Error mode
- Supports variable MTU size
- Support of out-of-order-delivery to some extent
- Transfer Cycles for continuous transmission:
 - Window Cycle
 - DTag Cycle

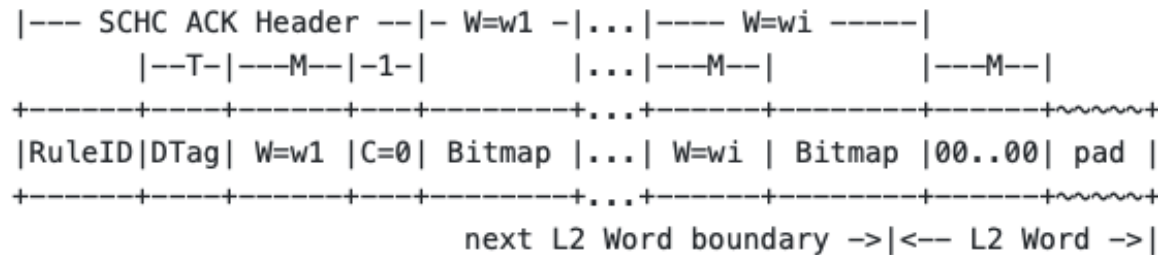


SCHC Streaming Mode

- Windows Cycle
 - A window cycle ends once the last SCHC Fragment of the last window (window with the highest possible values) is sent.
 - At the end of the cycle the window number resets and increases the DTag value.
- DTag Cycle
 - A DTag Cycle is finished once the DTag value reaches its maximum value
 - A successful SCHC ACK closes current DTag Cycle and opens a new one

SCHC Streaming Mode

- ACK Behavior
 - SCHC Compound ACKs MAY be sent after every All-0 message
 - SCHC Compound ACKs MUST be sent after the All-1 message
 - A SCHC Compound ACK is identified by DTag value, and can acknowledge all windows from a Window Cycle



SCHC Streaming Mode Examples

```

Sender                                     Receiver
|-----DTag= 0, W=0, FCN=6 ----->|
|-----DTag= 0, W=0, FCN=5 ----->|
|-----DTag= 0, W=0, FCN=4 ----->|
|-----DTag= 0, W=0, FCN=3 ----->|
|-----DTag= 0, W=0, FCN=2 --X |
|-----DTag= 0, W=0, FCN=1 ----->|
|-----DTag= 0, W=0, FCN=0 ----->| Bitmap: 1111011
(no ACK)
|-----DTag= 0, W=1, FCN=6 ----->|
|-----DTag= 0, W=1, FCN=5 ----->|
|-----DTag= 0, W=1, FCN=4 ----->|
|-----DTag= 0, W=1, FCN=3 ----->|
|-----DTag= 0, W=1, FCN=2 ----->|
|-----DTag= 0, W=1, FCN=1 --X |
|-----DTag= 0, W=1, FCN=0 ----->| Bitmap: 1111101
(no ACK)
|-----DTag= 0, W=2, FCN=6 ----->|
|-----DTag= 0, W=2, FCN=5 --X |
|-----DTag= 0, W=2, FCN=4 ----->|
|-----DTag= 0, W=2, FCN=3 ----->|
|-----DTag= 0, W=2, FCN=2 ----->|
|-----DTag= 0, W=2, FCN=1 ----->|
|-----DTag= 0, W=2, FCN=0 ----->| Bitmap: 1011111
(no ACK)
|-----DTag= 0, W=3, FCN=6 ----->|
|-----DTag= 0, W=3, FCN=5 ----->|
|-----DTag= 0, W=3, FCN=4 ----->|
|-----DTag= 0, W=3, FCN=3 ----->|
|-----DTag= 0, W=3, FCN=2 ----->|
|-----DTag= 0, W=3, FCN=1 ----->|
|-----DTag= 0, W=2, FCN=0 ----->| Bitmap: 1111111
|<--- DTag= 0, Compound ACK -----| [C=0, W=0 - Bitmap:1111011, W=1 - Bitmap:1111101, W=2 - Bitmap:1011111]
|-----DTag= 0, W=0, FCN=2 ----->|
|-----DTag= 0, W=1, FCN=1 ----->|
|-----DTag= 0, W=2, FCN=5 ----->|

```

(next Window Cycle)

- A single Compound ACK acknowledges a complete Window Cycle.
- The Compound ACK at the end of the Window Cycle is optional.
- This Window Cycle has a DTag = 0.
- All SCHC Fragment losses from this Window Cycle are recovered.

SCHC Streaming Mode Examples

```
|----DTag= 1, W=0, FCN=6 ---->|
|----DTag= 1, W=0, FCN=5 ---->|
|----DTag= 1, W=0, FCN=4 ---->|
|----DTag= 1, W=0, FCN=3 ---->|
|----DTag= 1, W=0, FCN=2 --X |
|----DTag= 1, W=0, FCN=1 ---->|
|----DTag= 1, W=0, FCN=0 ---->| Bitmap: 1111011
```

(no ACK)

```
|----DTag= 1, W=1, FCN=6 ---->|
|----DTag= 1, W=1, FCN=5 ---->|
|----DTag= 1, W=1, FCN=4 ---->|
|----DTag= 1, W=1, FCN=3 ---->|
|----DTag= 1, W=1, FCN=2 ---->|
|----DTag= 1, W=1, FCN=1 --X |
|----DTag= 1, W=1, FCN=0 ---->| Bitmap: 1111101
```

(no ACK)

```
|----DTag= 1, W=2, FCN=6 ---->|
|----DTag= 1, W=2, FCN=5 --X |
|----DTag= 1, W=2, FCN=4 ---->|
|----DTag= 1, W=2, FCN=3 ---->|
|----DTag= 1, W=2, FCN=2 ---->|
|----DTag= 1, W=2, FCN=1 ---->|
|----DTag= 1, W=2, FCN=0 ---->| Bitmap: 1011111
```

(no ACK)

```
|----DTag= 1, W=3, FCN=6 ---->|
|----DTag= 1, W=3, FCN=5 ---->|
|----DTag= 1, W=3, FCN=4 ---->|
|----DTag= 1, W=3, FCN=3 ---->|
|----DTag= 1, W=3, FCN=2 ---->|
|----DTag= 1, W=3, FCN=1 ---->|
|----DTag= 1, W=3, FCN=0 ---->| Bitmap: 1011111
```

```
|<--- DTag= 1, Compound ACK ----> [C=0, W=0 - Bitmap:1111011, W=1 - Bitmap:1111101, W=2 - Bitmap:1011111]
```

```
|----DTag= 1, W=0, FCN=2 ---->|
|----DTag= 1, W=1, FCN=1 ---->|
|----DTag= 1, W=2, FCN=5 ---->|
```

|<--- DTag= 1, ACK, W=3, C=1 ----> C=1 [success ACK is needed before moving to next DTag cycle]
(next Window and DTag Cycle)

- New Window Cycle with DTag = 1.
- A Compound ACK is sent at the end of the Window Cycle.
- At this point a Compound ACK from any previous Window Cycle can be sent.
- A successful ACK is sent at the end of the DTag Cycle.

SCHC Streaming Mode

- Why is a successful ACK needed at the end of the Dtag Cycle?
 - After a new DTag Cycle starts
 - DTag, Window Number and FCN combinations are repeated.
 - There is no way of recovering SCHC Fragments from previous Window Cycles.
- Out-of-order-delivery is supported in a per DTag Cycle basis.

SCHC Streaming Mode



- Closing communications:
 - The sender can close the communication using the All-1 message, which is confirmed by a successful SCHC ACK, after retransmissions (if needed).
 - The receiver can close the communication by sending a receiver-abort message.

SCHC Streaming Mode

- First proposal
 - Unfragmented SCHC Packets
- Future proposal
 - Support for fragmented SCHC Packets which are always fragmented in the same number of fragments (each 2 or N SCHC Fragments you have a SCHC Packet)

Thanks!

Question or Comments

Authors:

Sergio Aguilar Romero <sergio.aguilar.romero@upc.edu>

Carles Gomez <carles.gomez@upc.edu>