Submission Title: [802.15.4 Profile for IETF SCHC]
Date Submitted: [14 March 2019]
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Re: [SC IETF topic for SCHC header compression]

Abstract: [Discussion about ways to use SCHC with 802.15.4]

Purpose: [Develop document text for IETF [lpwan] submission]

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Activities in some relevant groups

• 802.15.4w sent out for Letter Ballot
• 802.15.4x approved by IEEE-SA
• 802.15.10a approved by IEEE-SA
• Coexistence concerns between 802.11ah and 802.15.4g
• Progress in 802.15.12 – API definitions
  ➢ Next: internal module structure / interfaces
SCHC – Static Context Header Compression

- Static Context:
  - Topology
  - Application (i.e., kind of traffic)
  - Packets always delivered in order

- Fragmentation modes
  - Never Ack
  - Always Ack
  - Ack on Error
Minimal SCHC Fragment Header sizes

- RuleID: two or three bits minimum
- Dtag: can be zero
- W: at least one bit if windows are used
- FCN: probably at least two bits
  Let’s say one byte.

Plus, MIC
Comparing Fragmentation

- For SCHC, fragmentation overhead is:
  - ~1 byte / fragment
  - plus SCHC MIC
  - Request SC IETF to recommend Profile setting MIC=0, since 802.15.4 *will* check
  - plus 802.15.4 header per fragment (5-7 bytes)
  - How much can we compress MHR?
Goal 1: Optional SCHC MIC

- No need to have FCS and MIC on every reassembled frame, may well be identical
- SC IETF agreed it would be proper to request MIC = 0
Frame Composition

<table>
<thead>
<tr>
<th>Octets: 2</th>
<th>1</th>
<th>2</th>
<th>2</th>
<th>0</th>
<th>2</th>
<th>1</th>
<th>4</th>
<th>1</th>
<th>0</th>
<th>Variable</th>
<th>Max Frame Size-?all other fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Control</td>
<td>Sequence Number</td>
<td>Addressing Fields</td>
<td>Security Header (optional)</td>
<td>Auxiliary Security Header (optional)</td>
<td>Header IEs</td>
<td>Payload IEs</td>
<td>Data Payload</td>
<td>MIC</td>
<td>FCS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dest PAN ID</td>
<td>Dest Addr</td>
<td>Source PAN ID</td>
<td>Source Addr</td>
<td>Security Control</td>
<td>Frame Counter</td>
<td>Key Identifier</td>
<td>0/1/59</td>
<td>Variable</td>
<td>Variable</td>
<td>0/4/8/16</td>
<td>2/4</td>
</tr>
</tbody>
</table>

2 | 1 | 2 | 2 | 0 | 2 | 1 | 4 | 1 | 0 | Variable | Max Frame Size-?all other fields |
<table>
<thead>
<tr>
<th></th>
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MHR | MAC Payload | MFR
802.15.4 Fragmentation overhead

- 802.15.4 only defines for LECIM
- FCSD IE required prior to fragments (4)
- Fragment acknowledge – Table 23-4
- Fragment header (2)
- FICS on every fragment – (2) or (4)
Minimal 802.15.4 frame format

- General frame format defined in 7.2
- 3 bits for Frame type
- 0 bits for PAN IDs, Source/Dst Address
- 0 bits for IEs
- 2/4 bytes for FCS
## Frame type values

<table>
<thead>
<tr>
<th>Frame type value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>b₂ b₁ b₀</td>
<td></td>
</tr>
<tr>
<td>'000</td>
<td>Beacon</td>
</tr>
<tr>
<td>'001</td>
<td>Data</td>
</tr>
<tr>
<td>'010</td>
<td>Acknowledgment</td>
</tr>
<tr>
<td>'011</td>
<td>MAC command</td>
</tr>
<tr>
<td>'100</td>
<td>Reserved</td>
</tr>
<tr>
<td>'101</td>
<td>Multipurpose</td>
</tr>
<tr>
<td>'110</td>
<td>Fragment or Frak</td>
</tr>
<tr>
<td>'111</td>
<td>Extended</td>
</tr>
</tbody>
</table>

The Fragment and Frak formats are defined in 23.3.3 and 23.3.6.2, respectively.
Possibility for a new Frame Type

- Frame type 0b'100' is “Reserved”
- Frame type 0b'111' is “Extended”
- Frame type 0b'110' is “Interesting”

If a new frame type is possible, the next bits could be the SCHC header

- RuleID, DTAG, W, …
Questions

• How to minimize 802.15.4 MAC header overhead?
• Should the document be only for 15.4w?
• Should we consider specifying an extended frame type?
• Does SCHC require security? How shall we compare 802.15.4 security versus SCHC security?
Observations

- 802.15.4 MIC is cryptographically secure and typically is done on-chip
- SCHC MIC is a CRC checksum and not secure. Should call it FCS, not MIC