draft-ietf-6tisch-minimal-security

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Status

- Published -07 and -08
  - WGLC resolutions, reviews from:
    - Göran Selander
    - Tero Kivinen
    - Xavier Vilajosana
    - Klaus Hartke
    - Jim Schaad
    - Tengfei Chang
    - William Vignat
    - Thomas Watteyne
- Goal of the presentation
  - Discuss WGLC resolutions

- For a full list of WGLC issues resolved in -07 and -08, see:
  https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues?content=%7EWGLC

WGLC resolutions 1/8

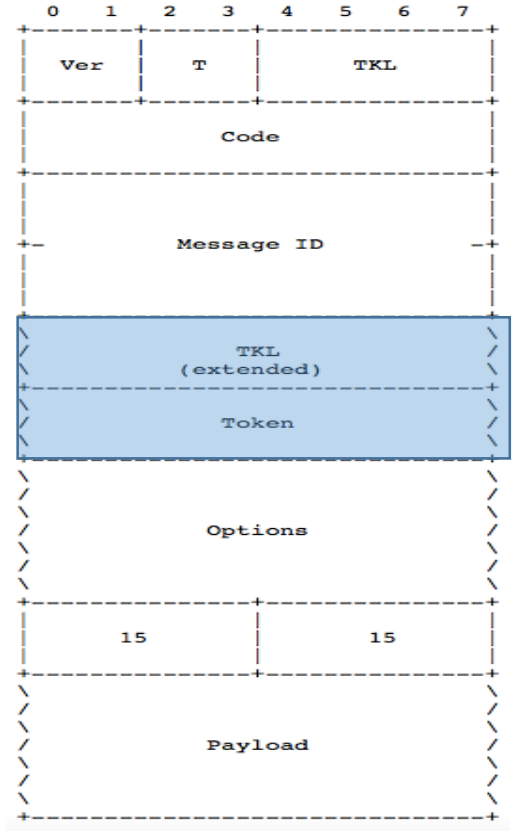
Stateless-Proxy

https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues/29/stateless-proxy

- New work in CoRE: draft-hartke-core-stateless
  - Adopted by CoRE and soon in WGLC. Thanks!
  - Extended the base CoAP token definition to support longer tokens
- Removed the definition of Stateless-Proxy option from minimal-security
- Added Section 8.1 “Statelessness of the JP”
  - RECOMMENDED that the JP operates in a stateless manner
  - Use CoAP token to transport state. If it doesn’t fit => use hartke-core-stateless extended token
  - Informative reference to hartke-core-stateless

New text to accommodate implementations where stateless proxy is not possible:

Note that in some networking stack implementations, a fully (per-pledge) stateless operation of the JP may be challenging from the implementation point of view. In those cases, the JP may operate as a statefull proxy that stores the per-pledge state until the response is received or timed out, but this comes at a price of an additional DoS vector.



CoAP base header w/ Extended Token

WGLC resolutions 2/8

Use of confirmable CoAP message for Join Request

https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues/49/use-coap-con-messages-at-pledge

- When proxy makes a request on behalf of a pledge (client), it does not need to use the same message type
- Pledge MUST send a CON Join Request, proxy MUST forward it as NON to avoid maintaining state
- Removes previous minimal-security-specific retransmission mechanism
- Retransmission now handled exclusively by CoAP, same (old) behavior of pledge retransmitting

Name	Default Value: Pledge	Default Value: JP
ACK_TIMEOUT	10 seconds	(10 seconds)
ACK_RANDOM_FACTOR	1.5	(1.5)
MAX_RETRANSMIT	4	(4)

Default values for CoAP parameters. Values enclosed in () have no effect when JP operates in a stateless manner.

WGLC resolutions 3/8

Bandwidth cap at JP in -08

https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues/40/specify-the-usage-of-coaps-probing_rate-as

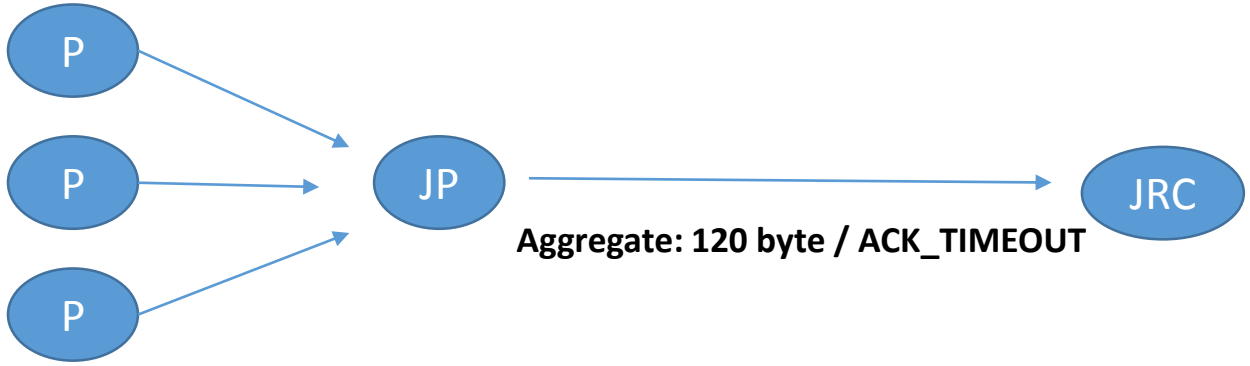
- CoAP already provides a bandwidth cap through its congestion control mechanism
  - **NSTART** in number of requests for Confirmable messages
    - (useful for **statefull** JP)
  - **PROBING_RATE** in bytes/second for non-confirmable
    - (useful for **stateless** JP)
- No need for *any* new code
- Values in -08 (see next).

WGLC resolutions 3/8

Bandwidth cap at JP in -08 (cont)

https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues/40/specify-the-usage-of-coaps-probing_rate-as

- Considerations:
  - Stateless proxy limited by upstream bandwidth
    - React *fast* to a potential attack, do not overwhelm the network
  - Statefull proxy limited by RAM
    - NSTART=3 ?
    - 3 pledges concurrently joining
- Some numbers:
  - *Join Request message size* ***~40 bytes*** *(CoAP + CBOR)*
  - Bandwidth available upstream of JP: at least **~67 bytes/second**
    - ~60 bytes of 802.15.4+6LoWPAN+UDP overhead
    - at minimum 1 cell with preferred parent
    - 101 slots of 10ms in a slotframe



Per request: 40 byte / ACK TIMEOUT

Name	Default Value: Pledge	Default Value: JP
ACK_TIMEOUT	10 seconds	(10 seconds)
NSTART	1	(3)
PROBING_RATE	4 byte/second	12 byte/second

WGLC resolutions 3/8

Bandwidth cap at JP in -08 (cont)

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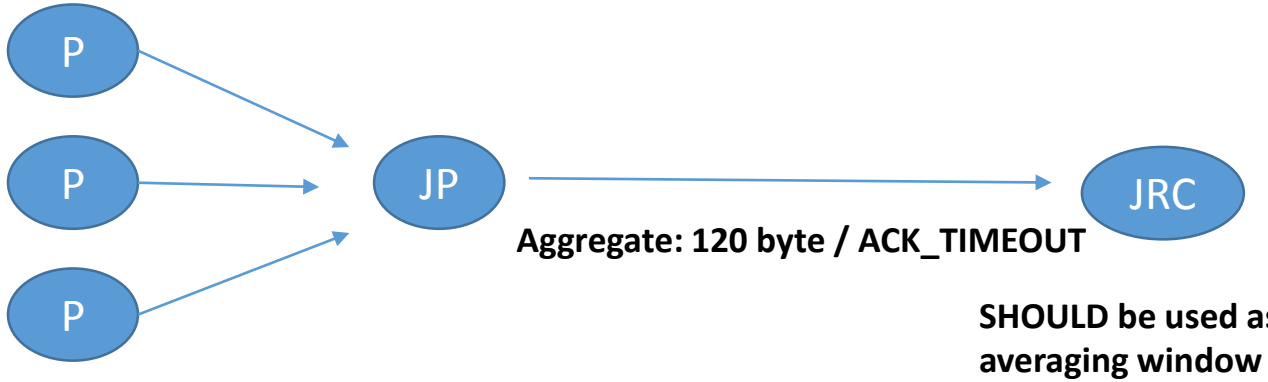

SHOULD be used as averaging window

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WGLC resolutions 3/8

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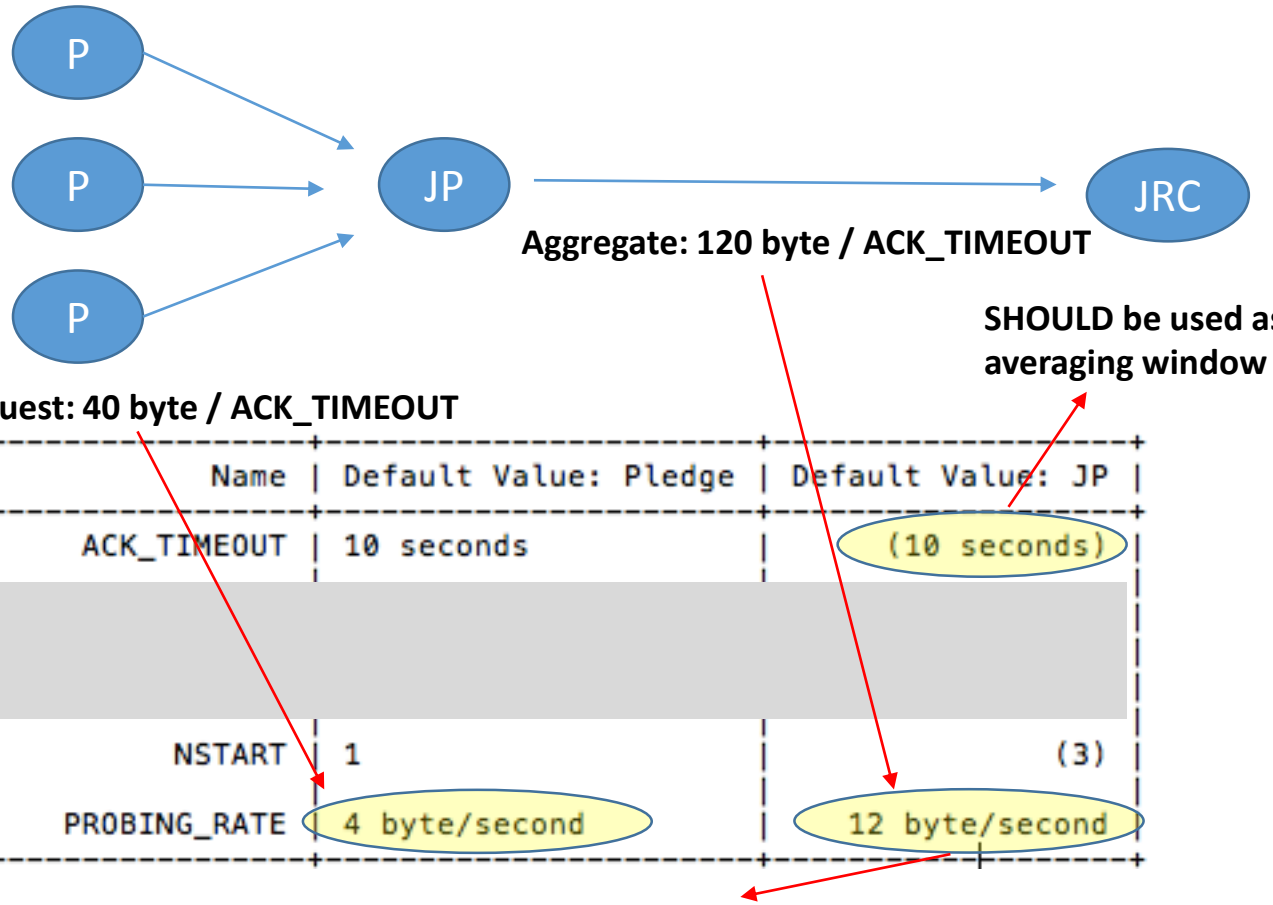

WGLC resolutions 4/8

CoJP Error Handling

https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues/41/error-handling-for-cojp-parameters

New CBOR structure “Error”: transported over OSCORE secure channel

```
Error = [
        error_code        : int,
        error_addinfo     : int / bstr / tstr / nil,
      ? error_description : tstr,
]
```

Description	Value	Additional info	Additional info type	Reference
Invalid Join_Request object	0	None	nil	[[this document]]
Invalid Configuration object	1	None	nil	[[this document]]
Invalid parameter	2	Label of the invalid parameter	int	[[this document]]
Invalid link-layer key	3	Index of the invalid key	uint	[[this document]]
Significant OSCORE partial IV mismatch	4	Next acceptable OSCORE partial IV	bstr	[[this document]]

Table 4: CoJP error codes.

- Errors can occur when processing CBOR objects both part of CoAP requests and **responses**
- For requests, transport Error object as part of 4.00 Bad Request response
- For responses, add Error object to the next Join_Request:

```
Join_Request = {
    ? 1 : uint,              ; role
    ? 5 : bstr,              ; network identifier
    ? 7 : Error,             ; response processing error
}
```

WGLC resolutions 5/8

AEAD Nonce Reuse on JRC failure

https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues/44/nonce-reuse-when-jrc-looses-mutable

```
Error = [
        error_code         : int,
        error_addinfo      : int / bstr / tstr / nil,
      ? error_description  : tstr,
]
```

Description	Value	Additional info	Additional info type	Reference
Invalid Join_Request object	0	None	nil	[[this document]]
Invalid Configuration object	1	None	nil	[[this document]]
Invalid parameter	2	Label of the invalid parameter	int	[[this document]]
Invalid link-layer key	3	Index of the invalid key	uint	[[this document]]
Significant OSCORE partial IV mismatch	4	Next acceptable OSCORE partial IV	bstr	[[this document]]

Table 4: CoJP error codes.

- New JRC knows that there has been a failure of the old JRC
- When first Parameter Update is sent by new JRC, AEAD nonce reuse occurs
  - New JRC MUST include dummy payload: at least 40 byte long randomly generated string
- Pledge detects significant mismatch in the received sequence number
  - e.g. Sequence number is 1.

WGLC resolutions 6/8

Add blacklist

https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues/39/specify-blacklist-parameter-for-parameter

```
Configuration = {
    ? 2 : [ +Link_Layer_Key ],    ; link-layer key set
    ? 3 : Short_Identifier,       ; short identifier
    ? 4 : bstr,                   ; JRC address
    ? 5 : bstr,                   ; network identifier
    ? 6 : bstr,                   ; network prefix
    ? 8 : [ +bstr ],              ; blacklist
}
```

When the joined node receives this parameter, it MUST silently drop any link-layer frames originating from the indicated pledge identifiers.

- JRC can include a “blacklist” parameter at any time
  - Parameter Update to JP
  - Join Response to pledge
- Contains a list of pledge identifiers
- Useful in case of misconfiguration, can help in case of a DoS attack

WGLC resolutions 7/8

Link_Layer_Key that supports all modes of 802.15.4

https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues/43/extend-link_layer_key-cbor-struct-to

New definition:

```
Link_Layer_Key = (
      key_id              : uint,
    ? key_usage           : int,
      key_value           : bstr,
    ? key_addinfo         : bstr,
)
```

o Key ID Mode 0x00 (Implicit, pairwise): key_id parameter MUST be set to 0. key_addinfo parameter MUST be present. key_addinfo parameter MUST be set to the link-layer address(es) of a single peer with whom the key should be used. Depending on the configuration of the network, key_addinfo may carry the peer's long link-layer address (i.e. pledge identifier), short link-layer address, or their concatenation with the long address being encoded first. Which address is carried is determined from the length of the byte string.

o Key ID Mode 0x01 (Key Index): key_id parameter MUST be set to a value different than 0. key_addinfo parameter MUST NOT be present.

o Key ID Mode 0x02 (4-byte Explicit Key Source): key_id parameter MUST be set to a value different than 0. key_addinfo parameter MUST be present. key_addinfo parameter MUST be set to a byte string, exactly 4 bytes long. key_addinfo parameter carries the Key Source parameter used to configure [IEEE802.15.4].

o Key ID Mode 0x03 (8-byte Explicit Key Source): key_id parameter MUST be set to a value different than 0. key_addinfo parameter MUST be present. key_addinfo parameter MUST be set to a byte string, exactly 8 bytes long. key_addinfo parameter carries the Key Source parameter used to configure [IEEE802.15.4].

WGLC resolutions 8/8

Misc

- Update of Security Considerations, uniqueness requirements
- Update of Privacy Considerations
- Encode short address lease time in hours instead of seconds
- PAN ID clarifications
- Mandate unique PSKs
- New appendix on “Lightweight implementation option” that does not require implementations of HKDF and SHA in firmware
- Remove ”network prefix” parameter in order not to go into 6LBR management
- …

Please see the full list of resolved/open issues:

https://bitbucket.org/6tisch/draft-ietf-6tisch-minimal-security/issues?content=%7EWGLC

Next steps

- Latest IETF103 discussions and proposals for -09.
  - Add ”bandwidth cap” parameter that JRC can use to configure JP
    - When not present, stateless JP uses all the available bandwidth
    - In case of an attack, JRC can use the recommended values to limit the affect on the network
    - Can also be useful to switch on/off the join process
  - At IETF102 we agreed on not provisioning the full configuration to 6LBR
    - A remnant in -08: “network identifier” parameter => Remove it.
    - 6LBR joins as any other pledge, *but* how it gets all other parameters is out of scope
- Publish -09
- Wait one week for additional comments?
  - Ship
- OSCORE is *still* blocked with one DISCUSS
- EDHOC to key OSCORE for zero-touch ?