2 September 2016 Webex

IPv6 over the TSCH mode of IEEE 802.15.4e

Chairs:
Pascal Thubert
Thomas Watteyne

Etherpad for minutes:
http://etherpad.tools.ietf.org:9000/p/6tisch?useMonospaceFont=true

Note Well

This summary is only meant to point you in the right direction, and doesn't have all the nuances. The IETF's IPR Policy is set forth in BCP 79; please read it carefully.

The brief summary:

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For further information, talk to a chair, ask an Area Director, or review the following:

- BCP 9 (on the Internet Standards Process)
- BCP 25 (on the Working Group processes)
- BCP 78 (on the IETF Trust)
- BCP 79 (on Intellectual Property Rights in the IETF)

Reminder:

Minutes are taken *
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* Scribe; please contribute online to the minutes at http://etherpad.tools.ietf.org:9000/p/6tisch?useMonospaceFont=true
** Recordings and Minutes are public and may be subject to discovery in the event of litigation.
*** From the Webex login

Agenda

- Administrivia [3min]
  - Agenda bashing
  - Approval minutes from last meeting
- IETF update [Chairs] [5min]
- update 6top [Thomas] [20min]
- update security [Michael, chairs] [10min]
  - introduce new DT / New angle
  - Potential for both minimal/PSK (based on Art)
  - and a more ANIMA-like solutions (DT task)
- Next steps for SF0 [Pascal] [20min]
  - Target: Experimental?
  - Cell allocation Scheme
- AOB [1min]

Administrivia

Admin is trivia

- Approval Agenda
- Approval minutes

IETF update

IETF update

Document	Date	Status	IPR	AD / Shepherd
Active Internet-Drafts				
draft-ietf-6tisch-6top-protocol-02 **6top Protocol (6P)**	2016-07-25 28 pages	I-D Exists WG Document		
draft-ietf-6tisch-6top-sf0-01 **6TiSCH 6top Scheduling Function Zero (SF0)**	2016-07-08 10 pages	I-D Exists WG Document		
draft-ietf-6tisch-architecture-10 **An Architecture for IPv6 over the TSCH mode of IEEE 802.15.4**	2016-06-10 49 pages	I-D Exists (IESG: Dead) WG Document: Informational *Apr 2017*	3	Suresh Krishnan Shwetha Bhandari
draft-ietf-6tisch-minimal-16 **Minimal 6TiSCH Configuration**	2016-06-28 28 pages	AD Evaluation::AD Followup **for 130 days** Submitted to IESG for Publication: Best Current Practice		Suresh Krishnan Pascal Thubert
draft-ietf-6tisch-terminology-07 **Terminology in IPv6 over the TSCH mode of IEEE 802.15.4e**	2016-03-21 14 pages	I-D Exists WG Document *Apr 2017*		
RFC				
RFC 7554 *(was draft-ietf-6tisch-tsch)* **Using IEEE 802.15.4e Time-Slotted Channel Hopping (TSCH) in the Internet of Things (IoT): Problem Statement** **Errata**	2015-05 23 pages	Informational RFC		Ted Lemon Pascal Thubert

Suresh can send it to IETF Last Call once the reviewers have looked at the latest version. Hope to get it done in the next two weeks.

Milestones

Apr 2016 - Second submission of draft-ietf-6tisch-minimal to the IESG

Apr 2016 - WG call to adopt draft-ietf-6tisch-6top-sf0

Apr 2016 - WG call to adopt draft-ietf-6tisch-6top-sublayer

Jul 2016 - ETSI 6TiSCH #3 plugtests

Jul 2016 - Initial submission of draft-ietf-6tisch-6top-sublayer to the IESG

Should be 6P

Should be 6P

Oct 2016 - Initial submission of draft-ietf-6tisch-6top-sf0 to the IESG

Dec 2016 - Evaluate WG progress, propose new charter to the IESG

Apr 2017 - Initial submission of 6TiSCH terminology to the IESG

Apr 2017 - Initial submission of 6TiSCH architecture to the IESG

Dec 2017 - 6TiSCH architecture and terminology in RFC publication queue

Discussing the update with Suresh. What is the delay for 6P?

Update 6top

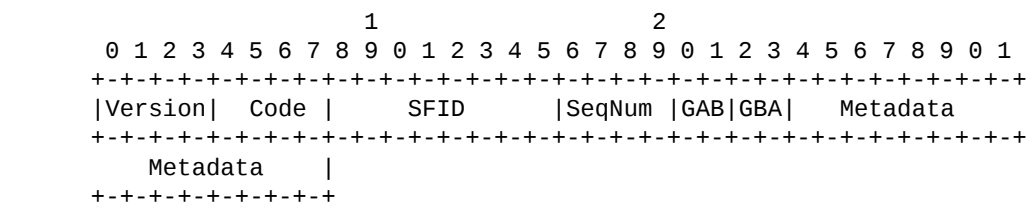
6top@IETF96

- ETSI 6TiSCH6lo plugtests just before IETF96 triggered a lot of changes to draft-ietf-6tisch-6top-protocol
- Presented by Xavi Vilajosana at IETF96
  - http://recs.conf.meetecho.com/Playout/watch.jsp?recording=IETF96_6TISCH&chapter=chapter_1
- Publication of draft-ietf-6tisch-6top-protocol-02 on 25 July 2016
- implemented changes
  1. 6P STATUS command
  2. Pagination in 6P LIST
  3. Consistency checking
  4. Clearing Schedule
- Further proposals

6P STATUS command

IETF96 change 1/4

4.2.8. 6P STATUS Request Format

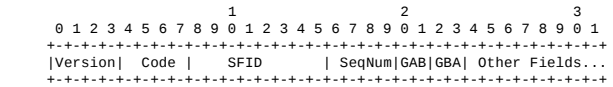


Version: Set to IANA_6TOP_6P_VERSION.
Code: Set to CMD_STATUS for a 6P STATUS Request.
SFID: Identifier of the SF to be used by the receiver to handle the message.
SeqNum: Packet identifier to match request and response.
GAB: Schedule Generation for the cells scheduled from node A to node B.
GBA: Schedule Generation for the cells scheduled from node B to node A.
Metadata: Metadata used as extra signaling to the SF. The contents of the Metadata field is an opaque set of bytes, and passed unmodified to the SF. The meaning of this field depends on the SF, and is hence out of scope of this document. One example use can be to specify which slotframe to read the cells from.

6P STATUS command

IETF96 change 1/4

4.2.12. 6P Response Format



Version: Set to IANA_6TOP_6P_VERSION.
SFID: Identifier of the SF to be used by the receiver to handle the message. The response MUST contain the same SFID value as the value in the SFID field of the 6P Request is responds to.
Code: One of the 6P Return Codes listed in Section 4.2.4.
SeqNum: Packet identifier to match request and response. The response MUST contain the same SeqNum value as the value in the SeqNum field of the 6P Request is responds to.
GAB: Schedule Generation for the cells scheduled from node A to node B.
GBA: Schedule Generation for the cells scheduled from node B to node A.
Other Fields: The contents depends on the Code field in the request, and listed below.

When responding to an ADD, DELETE, LIST_AB or LIST_BA command, the "Other Field" contains a list of 0, 1 or multiple 6P Cells. The format of a 6P Cell is defined in Section 4.2.5.

When responding to an STATUS command, the "Other Field" contains

- **The number of cells scheduled from node A to node B, encoded as a 2-octet unsigned integer.**
- **The number of cells scheduled from node B to node A, encoded as a 2-octet unsigned integer.**

This is shown in Figure 8.

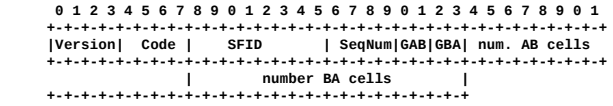


Figure 8

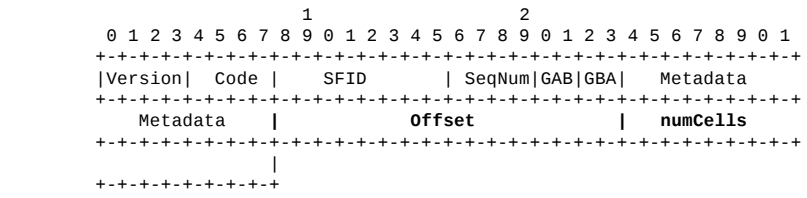
When responding to an CLEAR command, the "Other Field" is empty.

Pagination in 6P LIST

IETF96 change 2/4

4.2.9. 6P LIST_AB Request Format

The command lists the cells scheduled from node A to node B.

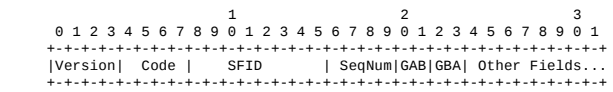


Version: Set to IANA_6TOP_6P_VERSION.
Code: Set to CMD_LIST_AB for a 6P LIST_AB Request.
SFID: Identifier of the SF to be used by the receiver to handle the message.
SeqNum: Packet identifier to match request and response.
GAB: Schedule Generation for the cells scheduled from node A to node B.
GBA: Schedule Generation for the cells scheduled from node B to node A.
Metadata: Metadata used as extra signaling to the SF. One example use can be to specify which slotframe to schedule the cells to. The contents of the Metadata field is an opaque set of bytes, and passed unmodified to the SF. The meaning of this field depends on the SF, and is hence out of scope of this document.
Offset: The Offset of the first scheduled cell that is requested. The mechanism assumes cells are ordered according to some rule. The ordering rule is defined by the SF.
numCells: The number of requested cells.

4.2.10. 6P LIST_BA Request Format

The 6P LIST_BA Request has the **exact same format** as the 6P LIST_BA Request, except for the code which is set to CMD_LIST_BA. 6P LIST_BA lists the cells scheduled from note B to node A.

4.2.12. 6P Response Format



Version: Set to IANA_6TOP_6P_VERSION.
SFID: Identifier of the SF to be used by the receiver to handle the message. The response MUST contain the same SFID value as the value in the SFID field of the 6P Request is responds to.
Code: One of the 6P Return Codes listed in Section 4.2.4.
SeqNum: Packet identifier to match request and response. The response MUST contain the same SeqNum value as the value in the SeqNum field of the 6P Request is responds to.
GAB: Schedule Generation for the cells scheduled from node A to node B.
GBA: Schedule Generation for the cells scheduled from node B to node A.
Other Fields: The contents depends on the Code field in the request, and listed below.

When responding to an ADD, DELETE, LIST_AB or LIST_BA command, the "Other Field" contains a list of 0, 1 or multiple 6P Cells. The format of a 6P Cell is defined in Section 4.2.5.

When responding to an STATUS command, the "Other Field" contains

- The number of cells scheduled from node A to node B, encoded as a 2-octet unsigned integer.
- The number of cells scheduled from node B to node A, encoded as a 2-octet unsigned integer.

This is shown in Figure 8.

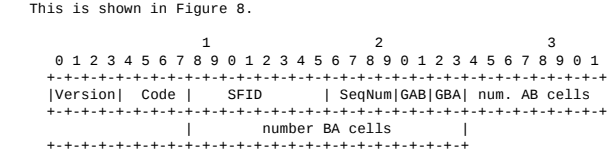


Figure 8

When responding to an CLEAR command, the "Other Field" is empty.

Pagination in 6P LIST

IETF96 change 2/4

Consistency checking

IETF96 change 3/4

4.3.11. Generation Management

For each neighbor, a node maintains 2 two-bit generation numbers. These numbers are variables internal to the node.

- o GTX is the generation number for the transmission cells to the neighbor.
- o GRX is the generation number for the receive cells from the neighbor.

4.3.11.1. Incrementing GTX and GRX

GTX and GRX are 2-bit variables. Their possible values are:

Value	Meaning
0b00	Clear or never scheduled
0b01-0b10	Lollipop Counter values
0b11	Reserved

Figure 9: Possible values of the GRX and GTX generation numbers.

GTX and GRX are set to 0 upon initialization, and after a 6P CLEAR command. GTX and GRX are incremented by 1 after each time a cell with that neighbor is added/deleted from the schedul (e.g. after a succesful 6P ADD or 6P DELETE transactions). The value rolls over to 0b01 after 0b10. This results in a lollipop counter with 0x00 the start value and 0b01 and 0b10 the count values.

Consistency checking

IETF96 change 3/4

4.3.11.2. Setting GAB and GBA fields

Each 6P message contains a GAB and GBA, used to indicate the current generation counters of the node transmitting the message. The value of the GAB and GBA fields MUST be set according to the following rules:

- When node A sends a 6P Request of 6P confirmation to node B, node A sets GAB to its GTX and GBA to its GRX.
- When node B sends a 6P Response to node A, node B sets GAB to its GRX and GBA to its GTX.

4.3.11.3. Detecting and Handling Schedule Generation Inconsistencies

Upon receiving a 6P message, a node MUST do the following checks:

- When node B receives a 6P Request of 6P confirmation from node A, it verifies that GAB==GRX and GBA==GTX.
- When node A receives a 6P Response from node B, it verifies that GAB==GTX and GBA==GRX.

If any of these comparisons is false, the node has detected a schedule generation inconsistency.

When a schedule generation inconsistency is detected:

- If the code of the 6P Request is different from CMD_CLEAR, the node MUST reply with error code RC_ERR_GEN.
- If the code of the 6P Request is CMD_CLEAR, the schedule generation inconsistency MUST be ignored.

It is up to the Scheduling Function to define the action to take when an schedule generation inconsistency is detected. The RECOMMENDED action is to issue a 6P CLEAR command.

Clearing Schedule

IETF96 change 4/4

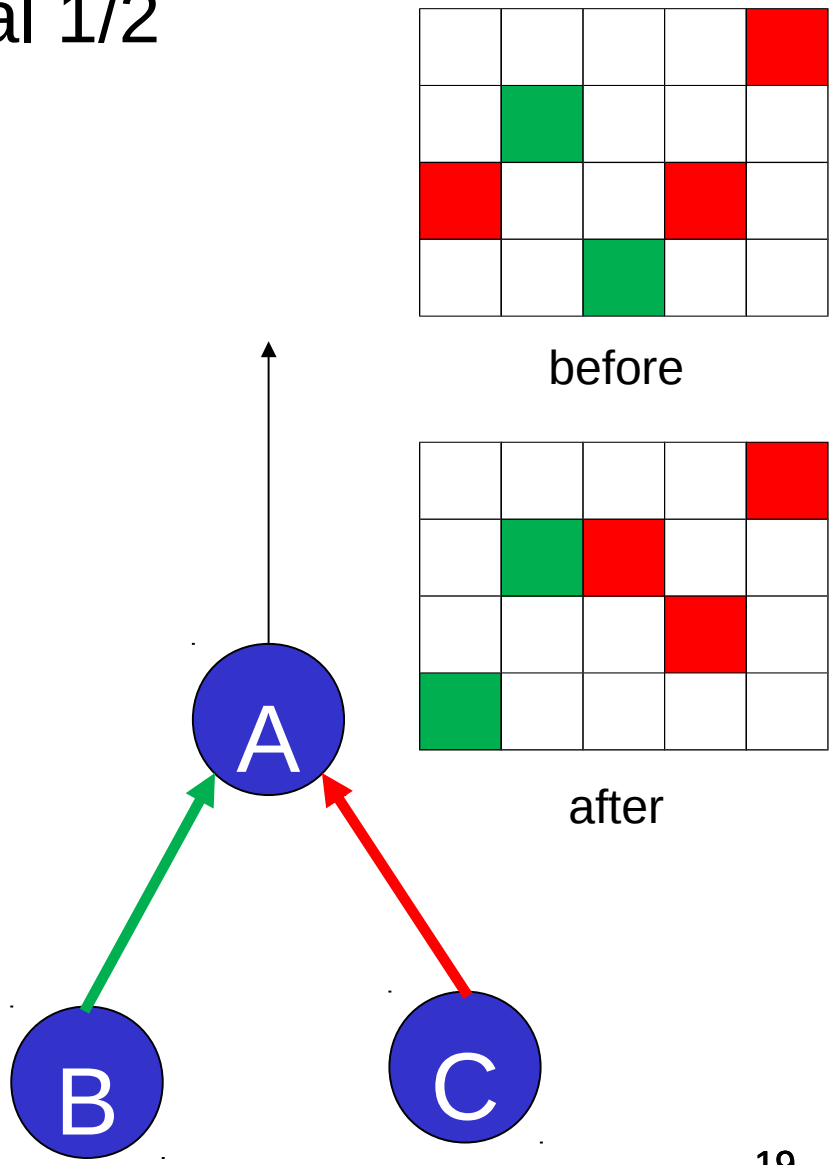
4.3.6. Clearing the Schedule

When a 6P CLEAR command is issued from node A to node B, **both nodes A and B MUST remove all the cells scheduled between them**. That is, node A MUST remove all transmit and receive cells with node B, and node B MUST remove all transmit and receive cells with node A. In a 6P CLEAR command, the generation counters GAB and GBA MUST NOT be checked. That is, their value is "don't care". In particular, even if a schedule generation mismatch is detected, it MUST NOT cause the transaction to abort.

Receiver Initiated 6P Transactions

Proposal 1/2

- Receiver might want to “defragment” its schedule
- Receiver can initiate the 6P transaction
- TX/RX flag in 6P message?



Receiver 6P Cell Suggestion
Proposal 2/2

- When an 6P ADD command fails, today the transmitter has to “guess” at new cells to suggest.
- It might take multiple (failed) 6P ADD transactions before finding the right cells
- On a failed 6P ADD, could the receiver side not use the 6P response to suggest a number of cells that would work?

Update Security

Update Security

- Need for a simple PSK solution,
  - based on Art
  - no need for the DT, based
- DT considering variations
  - Based on the original approach
  - to fit solutions deployed out there
  - Back to device pulling

Next steps for SF0

SF0: next steps

- Experimental vs. std track
- Cell allocation mechanism
  - Where do they come from?
  - Detail Xavi’s minimal method in SF0?

AOB ?

Thank you!