LPWAN WG

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BCP 25 (Working Group processes)

BCP 25 (Anti-Harassment Procedures)

BCP 54 (Code of Conduct)

BCP 78 (Copyright)

BCP 79 (Patents, Participation)

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Minutes are taken *
This meeting might be recorded **
Presence is logged ***

* Scribe; please contribute online to the minutes at: https://etherpad.tools.ietf.org/p/lpwan
** Recordings and Minutes are public and may be subject to discovery in the event of litigation.
*** From the Webex login

Agenda bashing

17:05	Opening, agenda bashing (Chairs) • Note-Well, Scribes, Agenda Bashing • Status of drafts	5mn
17:10	SCHC Updates since IETF 102 - Dominque	10mn
17:20	ACK-on-Error - Juan Carlos, Carles, Edgar	30mn
17:50	Discussion	10mn
18:00	AOB	QS

Reminder since IETF 102

- WGLC on Compression Section – success
- Fragmentation section needs to be improved
  - Text normative (confirm on ML?) – have the State Machine in the appendix

Fragmentation meeting @IETF102

- What to do with ACK-on-Error?
  - Keep it as it is (no fundamental problem with it)
  - Provide minor modifications
    - Need to understand the consequences (a modification can be an improvement for some cases and can be a degradation of for others)
  - Move to a separate document (for major modifications)

draft-ietf-lpwan-ipv6-static-context-hc-16
Draft rework, status post IETF102

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Note Well

- This presentation is about **editorial** changes
- This presentation is ***not*** about **protocol** changes
- « Don't shoot the pianist »

- All changes can be checked out at https://github.com/lp-wan/ip-compression/commits/master
  - Itemized commits, explicit commit messages, on-line diffs

Review by Charlie Perkins

- Thanks again, Charlie, for this thorough review!
- I applied all suggested edits, except
  - Section 8 Fragmentation/Reassembly
    - This section was to be reworked from the ground up
  - 7 points that I questioned or requested explanation for
    - Mail sent out Aug 29th

Few other changes

- A few edits on July 19th-20th, while still at IETF102
  - Reworked « L2 Data Unit » with Edgar
  - Gave structure to Appendix D, because fragmentation optional (Charlie)
  - ECN bits elision in IPv6 SCHC compression (Lars)
  - MIC computation fix-up (Soichi)

Major rework of F/R section

- Before:
  - Algorithmic specification spread out/replicated in many sections
  - Hard to read, to update and keep consistent, hard to add a new mode
- After:
  - Description of « tools » is independant of algorithm
  - Modes specification can be updated/added more easily

New organization of F/R section

- Sections 8.1, 8.2 and 8.3 are a mode-agnostic substrate for 8.4
  - No algorithmics, just description
- Full algorithmic description of F/R modes in 8.4
  - Currently empty
  - To be filled with Juan Carlos'es and Carles'es contributions
- What to do with 8.5, 8.6 ?

Next steps (1/2)

- Fill-up No-Ack, Ack-Always sections
  - Thanks again to Juan Carlos and Carles for providing text!
  - I will adjust it to the new « substrate » provided in 8.1-8.3
  - I will check for possible gaps, overlaps, mismatches and report on them
- Ack-on-Error
  - As draft secretary, I will implement text when WG has agreed on the desired behavior
  - As an individual, will contribute to the discussion

Next steps (2/2)

- Resolve 7 points under discussion with Charlie
- Check for inadvertently-dropped comments
- Awaiting WG decision on other pending decisions
  - State Machines in Appendix or in normative section
  - Other pending issues? (see discussion slot in this meeting)
- I'm committed to swift publication of -17
  - mid-Sept, end of Sept, Oct 22nd (IETF103 cut-off)?

Thank you!

ACK-on-Error discussion

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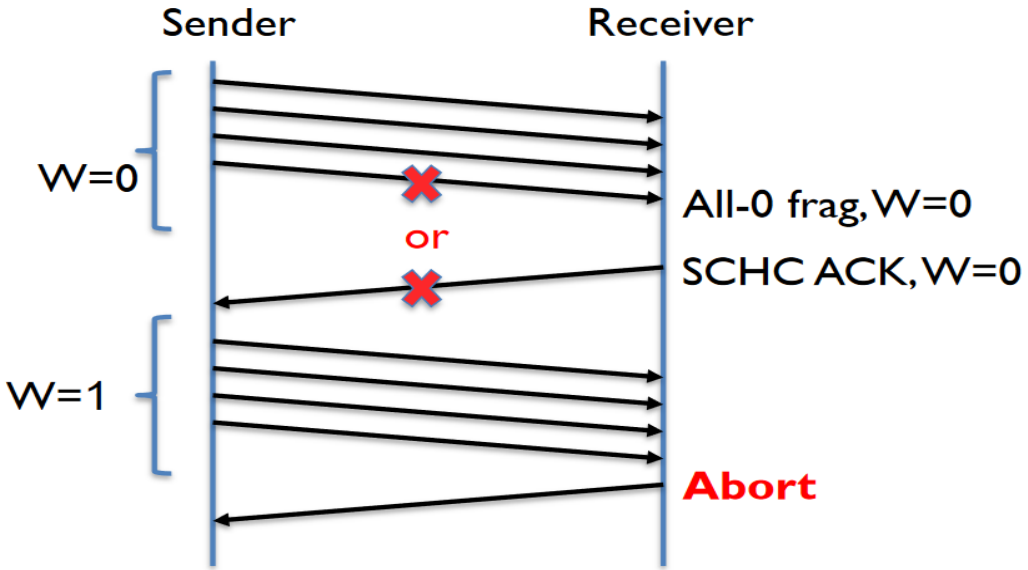
Probability of "Issue" in ACK-on-Error

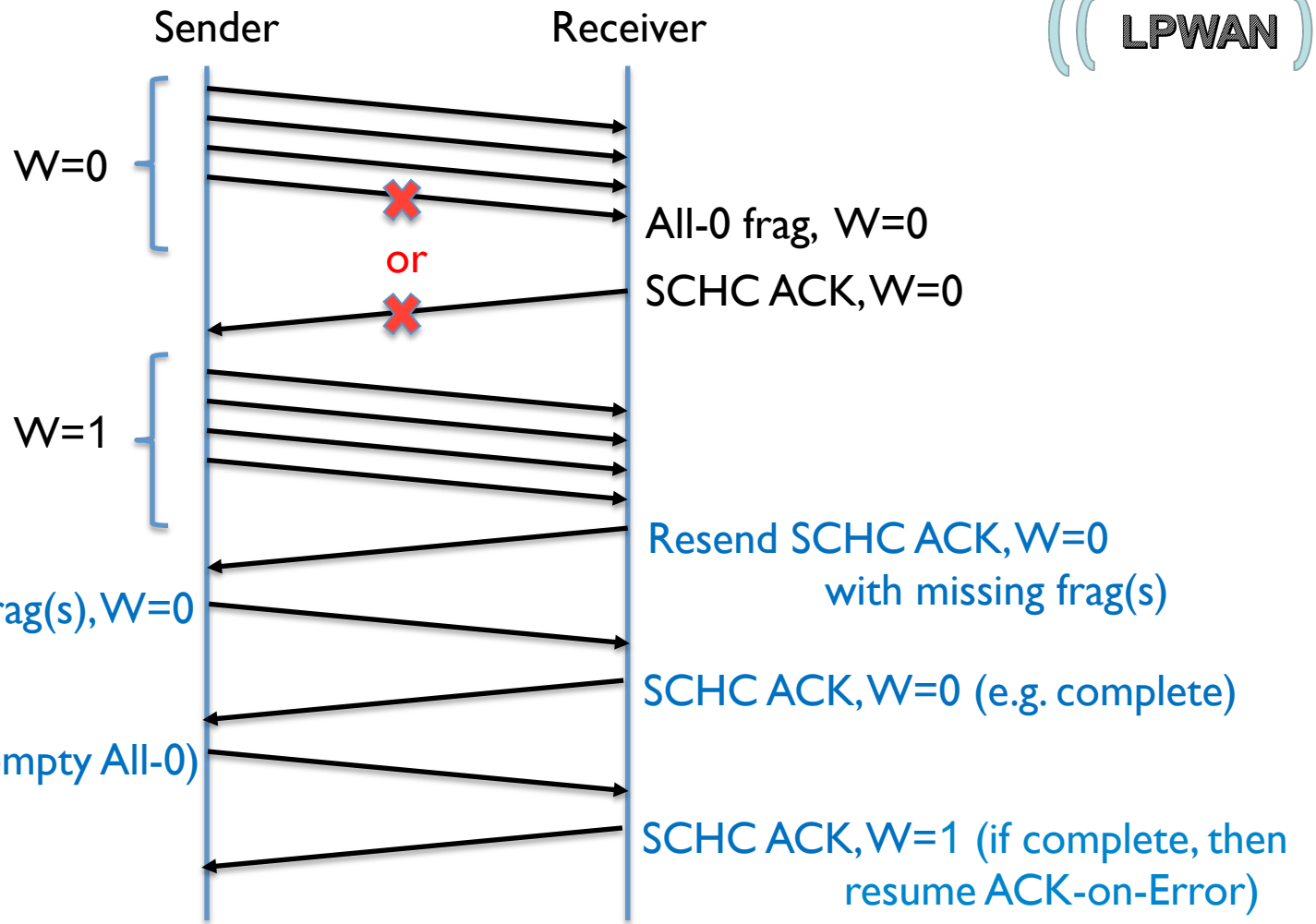
Numeric Analysis

The Issue

- Any of the two "red crosses" in JCZ's IETF 102 slide 5, leading to **packet transmission Abort (Issue)**



JCZ's proposal (slide 6, IETF 102) ACK-on-Error Proposed

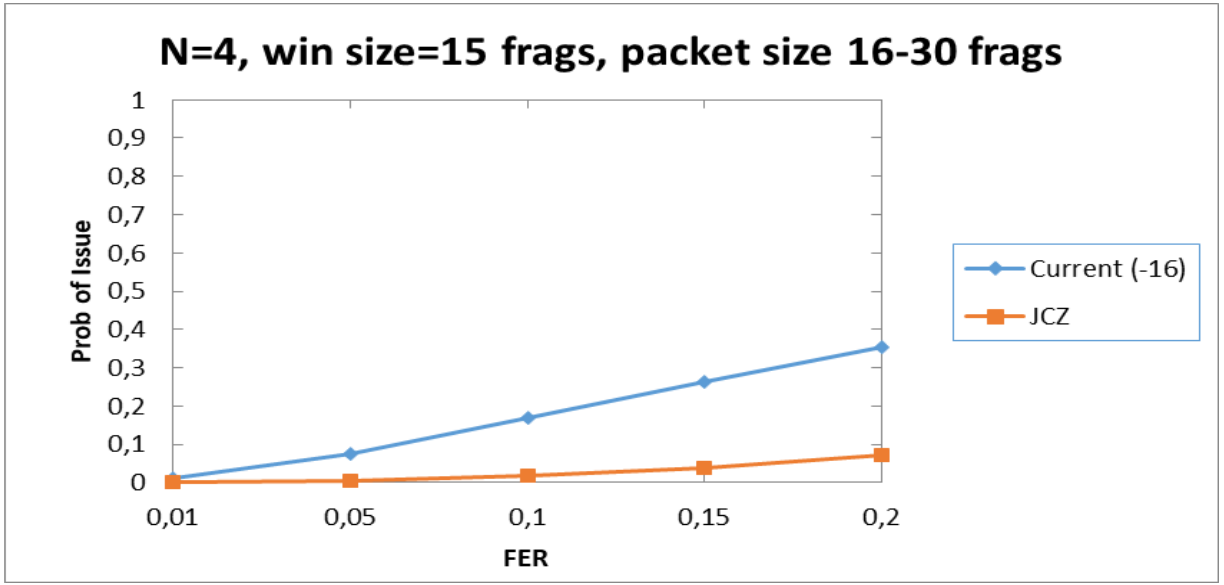


Goal and Assumptions

- Goal
  - To illustrate the **probability of Issue** for the current ACK-on-Error (-16) and JCZ's proposal
  - Simple mathematical analysis
    - To get a hint on how severe the problem may be
- Assumptions
  - Fragment losses are uncorrelated
  - Same error rate in uplink and downlink
  - Range of Fragment Error Rate (FER) values
    - Up to 0.2

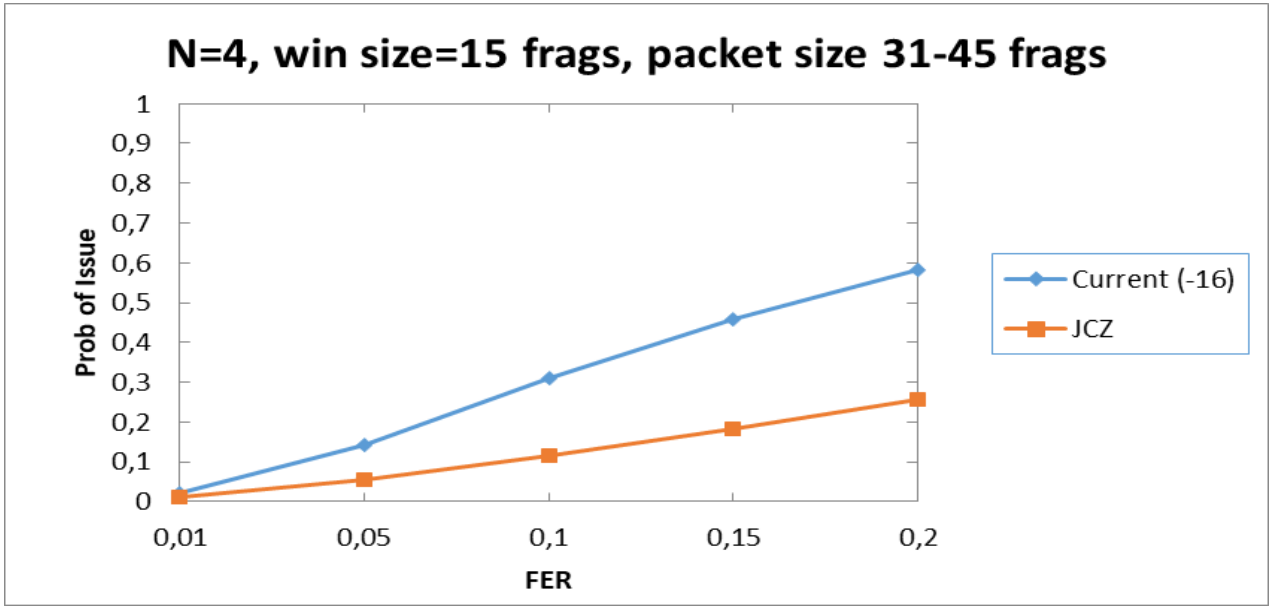
Results (I/IV)

- Prob of Issue = 0 for packets that fit a single window
- For a packet size between 1 and 2 windows:



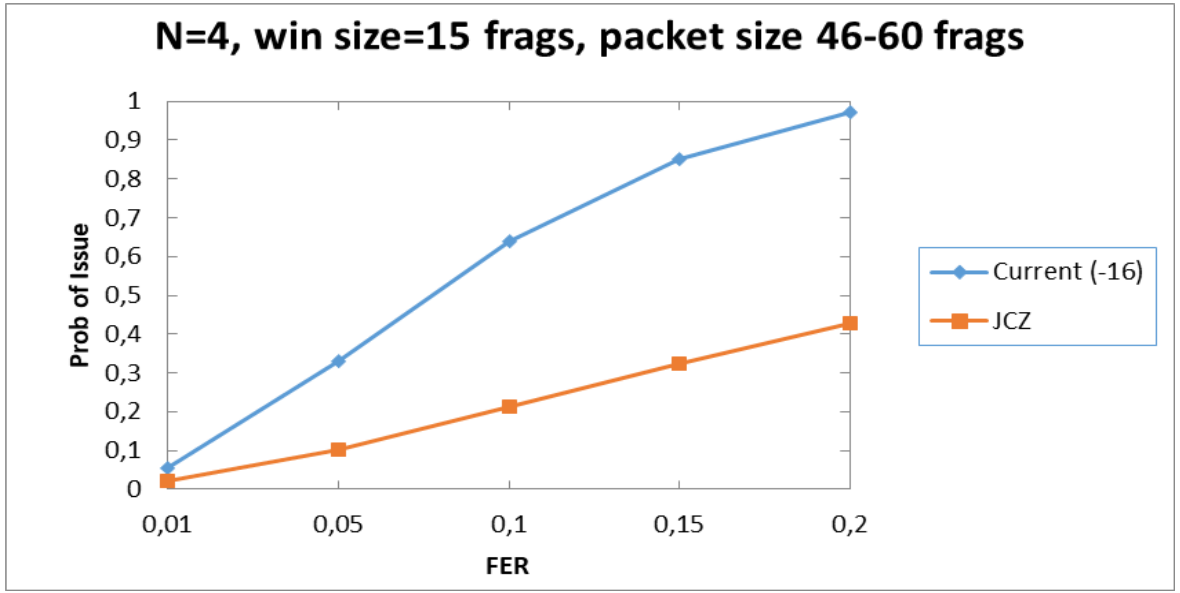
Results (II/IV)

- For a packet size between 2 and 3 windows



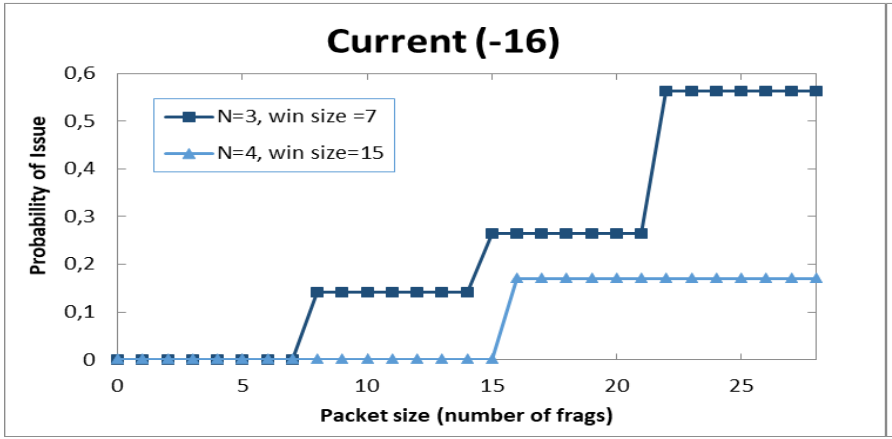
Results (III/IV)

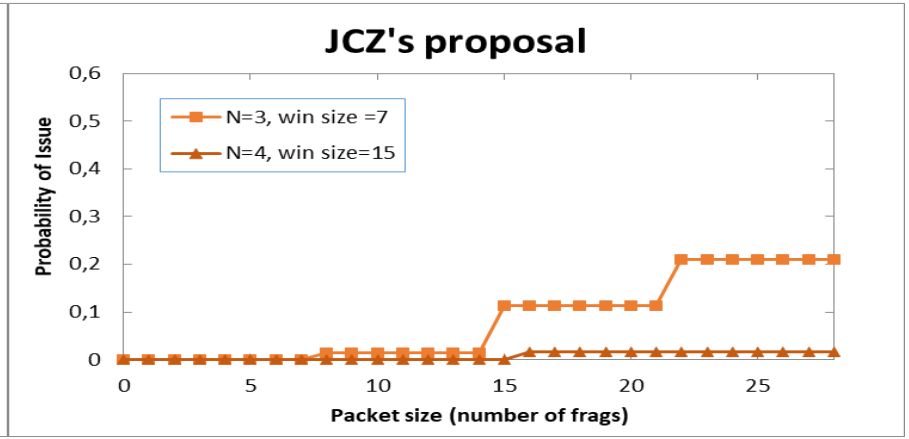
- For a packet size between 3 and 4 windows



Results (IV/IV)

- Impact of window size
  - FER=0.1 (i.e. 10%)





  - The probability of a real out-of-sync with the W bit can be reduced with a relatively larger window size, e.g. 15 (N=4)

State Machine

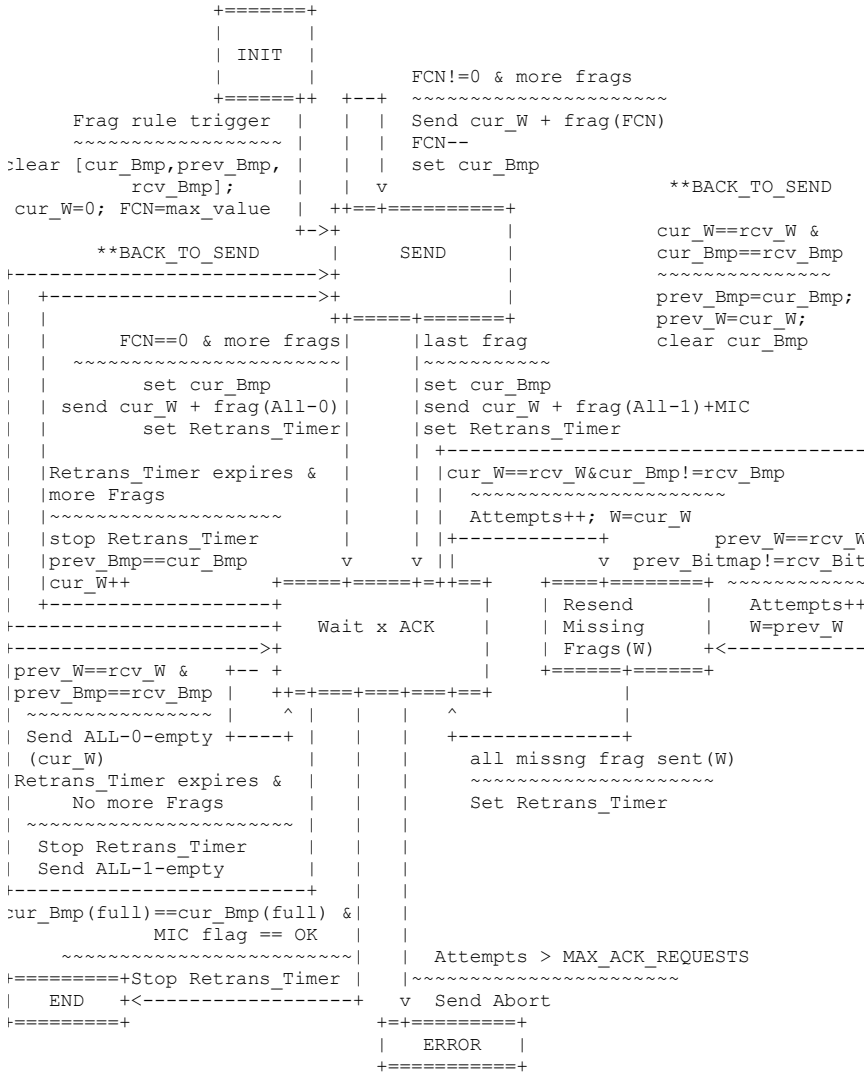
ACK-on-Error

As proposed at IETF 102

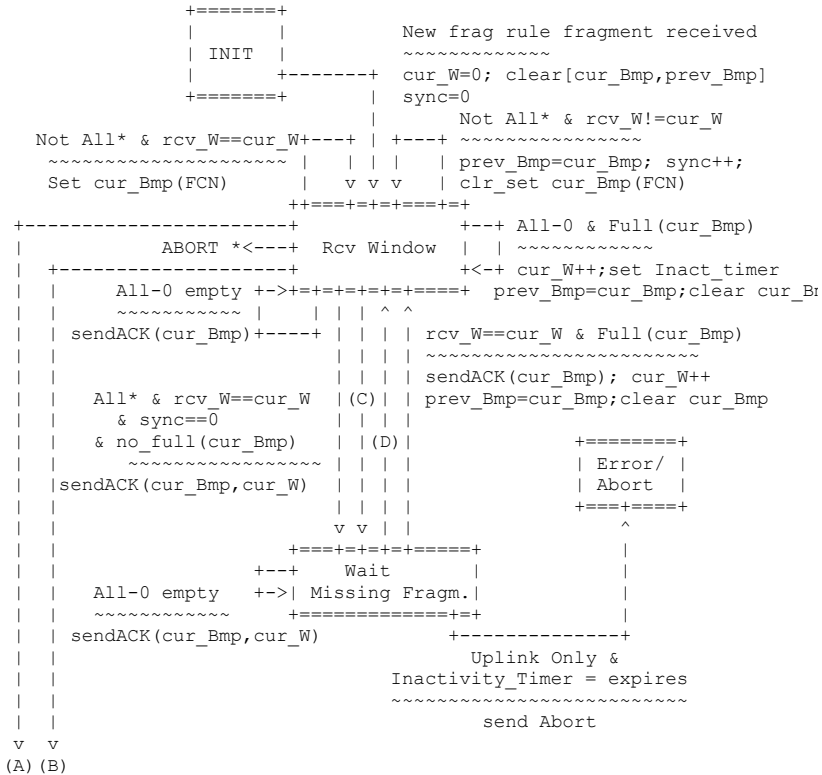
Modified State Machine

- Objectives
  - Implement the ACK-on-Error proposal as a minimal modification to the current State Machine (draft SCHC-16)
  - Changes implemented as per JCZ's proposal and text distributed on the mailing list
  - Maintain the same number of States

Sender


INIT
FCN!=0 & more frags
Frag rule trigger
Send cur_W + frag(FCN)
FCN--
set cur_Bmp
clear [cur_Bmp,prev_Bmp,
rcv_Bmp];
cur_W=0; FCN=max_value
**BACK_TO_SEND
SEND
**BACK_TO_SEND
cur_W==rcv_W &
cur_Bmp==rcv_Bmp
prev_Bmp=cur_Bmp;
prev_W=cur_W;
clear cur_Bmp
FCN==0 & more frags
last frag
set cur_Bmp
set cur_Bmp
send cur_W + frag(All-0)
set Retrans_Timer
send cur_W + frag(All-1)+MIC
set Retrans_Timer
Retrans_Timer expires &
more Frags
stop Retrans_Timer
prev_Bmp==cur_Bmp
cur_W++
cur_W==rcv_W&cur_Bmp!=rcv_Bmp
Attempts++; W=cur_W
prev_W==rcv_W
prev_Bitmap!=rcv_Bit
Wait x ACK
Resend
Missing
Frags(W)
Attempts++
W=prev_W
prev_W==rcv_W &
prev_Bmp==rcv_Bmp
Send ALL-0-empty
(cur_W)
all missng frag sent(W)
Retrans_Timer expires &
No more Frags
Set Retrans_Timer
Stop Retrans_Timer
Send ALL-1-empty
cur_Bmp(full)==cur_Bmp(full) &
MIC flag == OK
Attempts > MAX_ACK_REQUESTS
Stop Retrans_Timer
END
Send Abort
ERROR

Receiver (I/II)



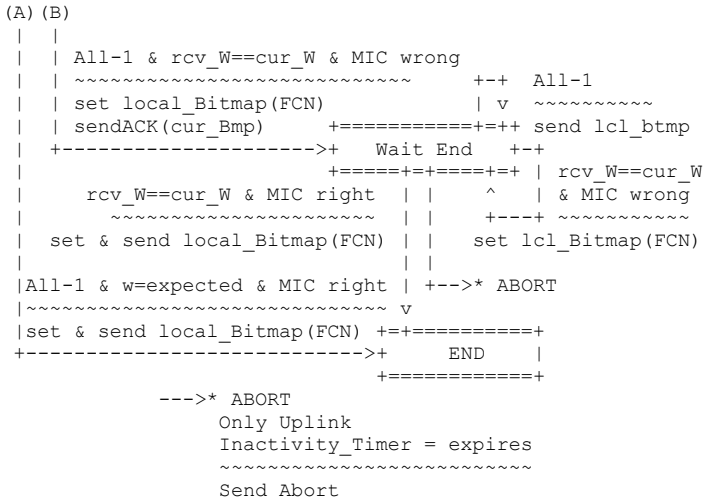
(C1) All* & rcv_W==cur_W
& sync==1
sendACK(prev_Bmp+prev_W)

(C2) All*||last_miss_frag &
& rcv_W!=cur_W
& sync==1 & Full(prev_Bmp)
sendACK(prev_Bmp+prev_W);
sync--

(D) rcv_W!=cur_W & sync==0
prev_Bmp=cur_Bmp; sync++;
clr_set cur_Bmp(FCN)

ABORT --> sync > 1
Send Abort

Receiver (II/II)



Alternative proposal

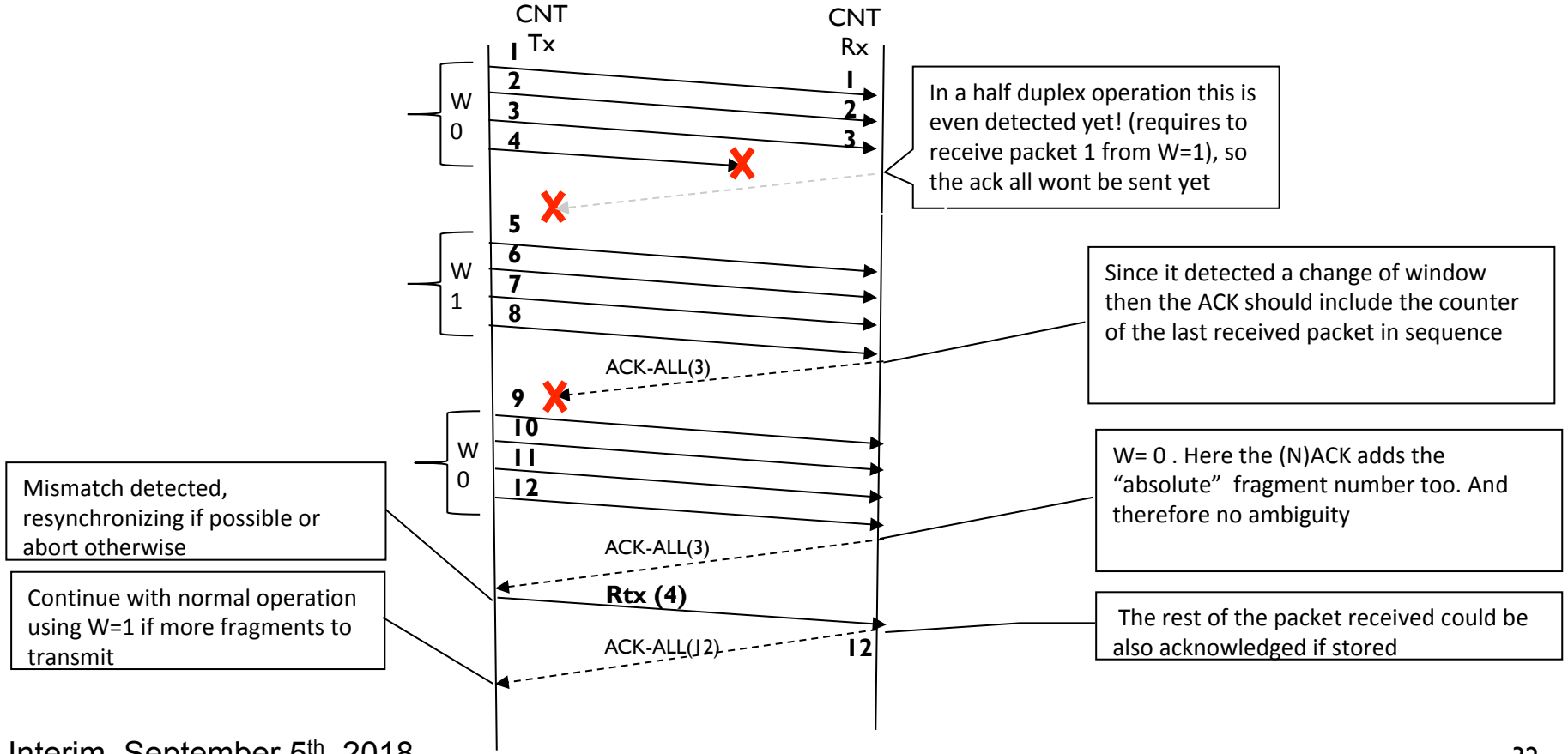
ACK-on-Error

Resync by fragment counting

Absolute fragment number

- Absolute count of fragments per IP packet
- Reset when new IP packet is processed
- Internal counter in Tx and Rx
- Transmitted in ACK only when window ambiguity (a packet span multiple windows)
  - The Rx transmits the counter of the last packet received in sequence
- The Tx keep fragments of at least a window otherwise left to implementation how many
  - Tx aborts if fragments are not available anymore

Example of operation with fragment counter



Fragment Counter - Considerations

- Memory requirements and how good recovery capability left to implementation
- Requires additional fields to signal the counter in the ACK
  - Only sent when danger of ambiguity and after recovery
  - Maximum number of fragments is not really determined.
    - Requires either fix size fields (maximum number of fragments is known)
    - Or a variable length indication

Conclusion

- Existing ACK-on-Error mode issue significantly decreases the performance
- Proposed text and State Machine changes based on draft-SCHC-16 can considerably mitigate the issue
- Other alternatives (e.g. absolute fragment number) would require changes to the protocol messages and to the state machine

AOB ?