Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: TLV Format Signalling
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Source: Larry Taylor (DTC (UK)), Ben Rolfe (Blind Creek Associates), Tom Herbst (Silver Spring Networks)
E-Mail: larry.taylor@acm.org, ben@blindcreek.com, therbst@silverspringnet.com

Re: 802.15.4 Maintenance Standing Committee

Abstract: This contribution proposes some options for signalling TLV IE format in 15.4 frames.

Purpose: To suggest possible mechanisms for signalling TLV structure IE format

Possible Mechanisms to Signal TLV Format

TLV Team

Tom Herbst (SSN)
Ben Rolfe (BCA)
Larry Taylor (DTC (UK))

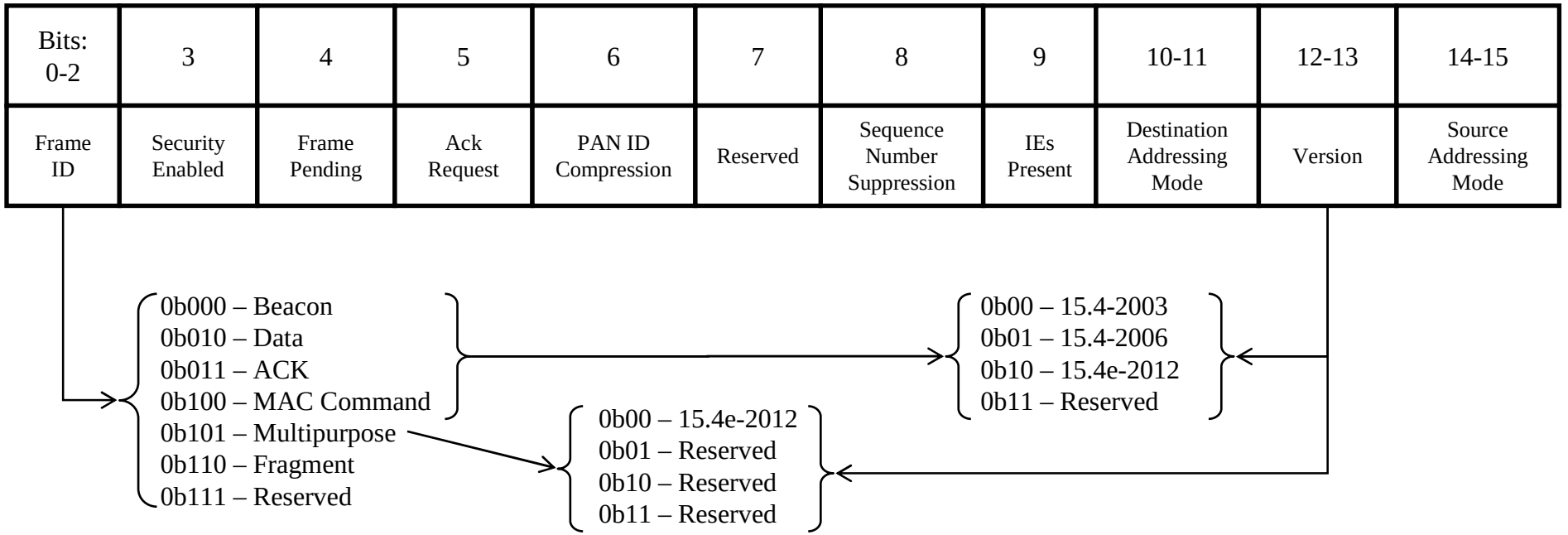
Summary

- Hawaii SC-Main meeting formed 3 teams to:
  - Suggest possible mechanisms for Frame ID extension
  - Suggest management method for 15.4 resource identifiers
  - Suggest possible mechanisms for differentiating between LTV and TLV format
- SC-M discussions had proposed:
  - Future Frame IDs use TLV format
    - But would lose compatibility with IE format defined for current versions of 15.4
  - Future Frame Version use TLV format
    - Allows updating IE format in ALL frame types
    - But only one Version number remains for 15.4-2011 frame types
- This submission proposes possible solutions to future 15.4 IE format
  - Goal is to bring 15.4 IE format in line with other standards
  - Possible side effect is to address limited version number space

15.4 Frame Format

- 15.4 Frame Format
  - Frame Control (16-bits)
  - Addressing
  - IEs
- Frame Control
  - Version number
  - 1 Reserved bit
    - Can’t be used to signal version number as may/should be ignored on reception
  - All other bits used
- Frame Version
  - 0b10 Version 15.4-2011 frames may carry IEs
  - 0b00 Version 15.4e Multipurpose frames may carry IEs

Existing15.4 Frame Control Field Format



Note: there is a precedent (see Table 4 15.4-2011) of using Frame Version & Security Enabled combinations to invalidate earlier frames

Options

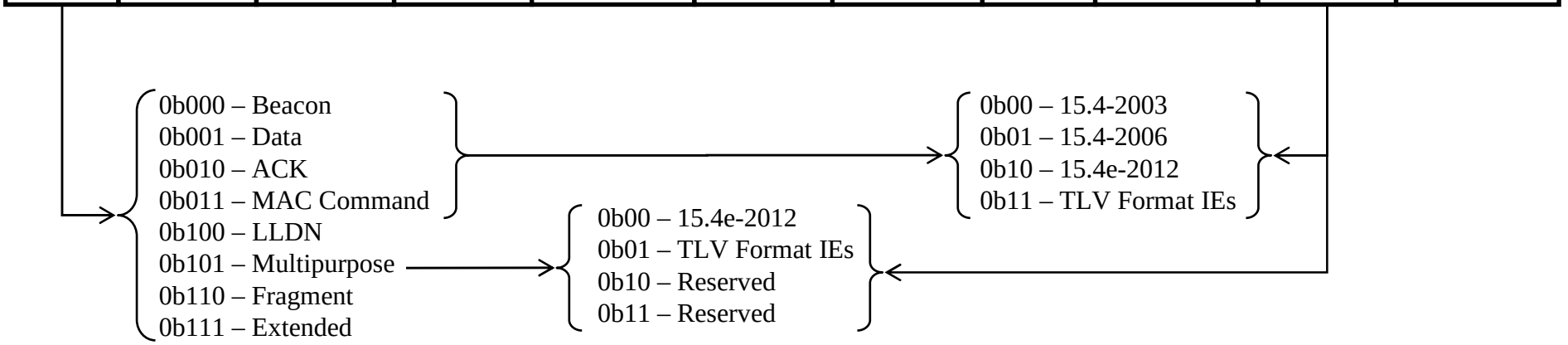
1. Update IE Format using Version Number
   - Uses last version value available in 15.4-2011 frame format
   - Define Multipurpose frame version 0b01
   - ALL future functionality via
     - Updated Multipurpose frames and IEs
     - Extended Frame ID values

2. Define new Frame Control Field format for Version = 0b11
   - Provide expanded Version number space

3. Define last remaining Reserved bit as TLV
   - But must be used in conjunction with a version increment

TLV Options - #1 Version Number Field

Bits: 0-2	3	4	5	6	7	8	9	10-11	12-13	14-15
Frame ID	Security Enabled	Frame Pending	Ack Request	PAN ID Compression	Reserved	Sequence Number Suppression	IEs Present	Destination Addressing Mode	Version	Source Addressing Mode

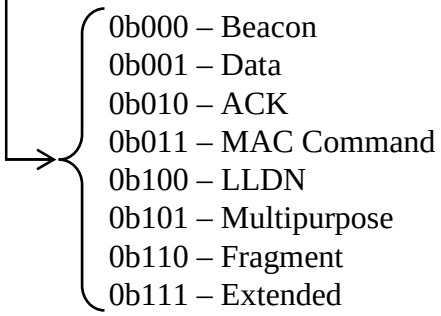


Note:

- There is no future Version space available for legacy frame types. ALL future enhancements MUST be via IEs
- LLDN does not use IEs, has a 1-bit Version field which is set to 0b0 for 15.4e-2012
- There is no Version field in Fragment frames

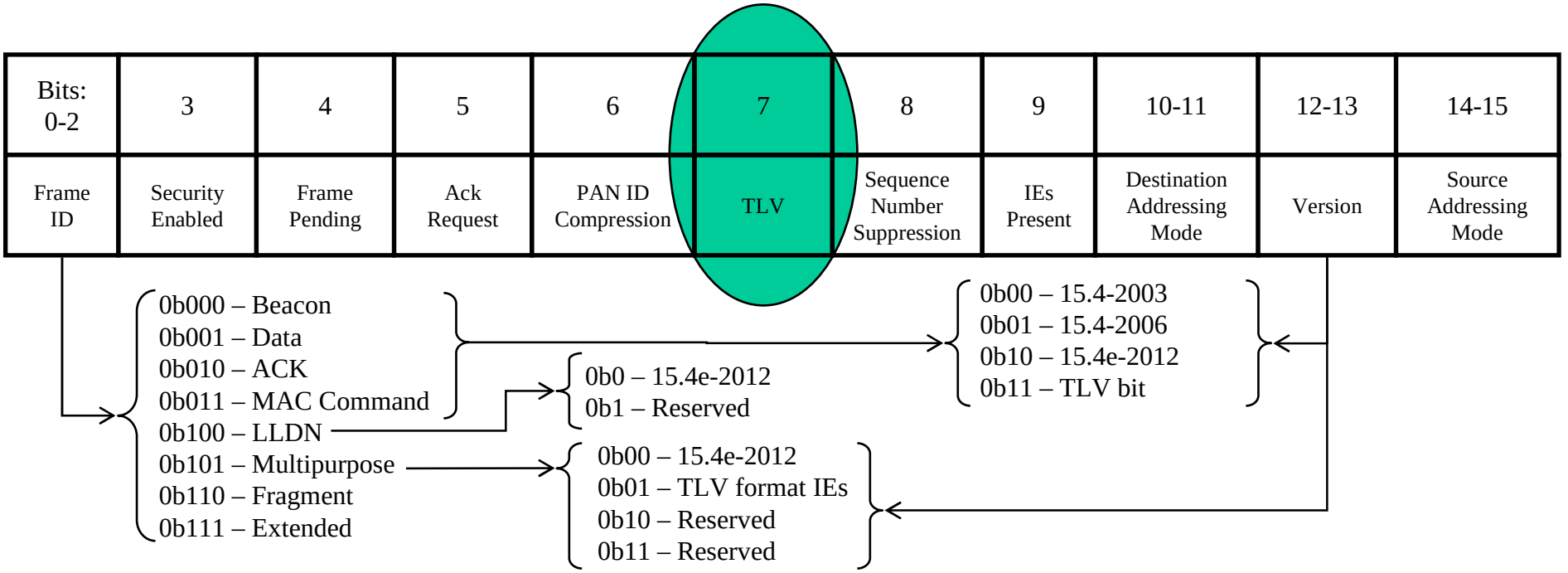
TLV Options - #2 New Frame Control Format

Bits: 0-2	3-11	12-13	14-15
Frame ID	Define new Frame Control format for Version 0b11 legacy frames (Beacon, Data, Ack, MAC Command) IEs are TLV Format	Version = 0b11	New Frame Control Format



- Allows extended Version Field definition
- Allows other updates to control field format

TLV Options - #3 Use Reserved Bit



- If TLV = 0 use existing LTV format IEs
- If TLV = 1 use TLV format IEs
- Still have to fix exhaustion of the Version number space as in Option #1/#2
- User Version 0b01 Multipurpose frame
  - No IEs in 1-octet Frame Control Multipurpose frame
  - LE Wakeup should be 2-octet Frame Control – otherwise cannot distinguish between Blink payload and LE Wakeup fields
  - Fix IEs as TLV format or extend Frame Control field definition

Recommended Action

- Option #2
  - Solve the exhausted Version number space problem
  - Define TLV IE Format
- Or
- Option #3
  - Use Reserved bit as TLV bit + Version = 0b11
  - Define Multipurpose Version 0b01
    - Fix IEs to TLV
    - Extend Frame Control Field and add TLV bit