BPSec,
Interoperabilty Cipher Suites

IETF-103

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Overview

- BPSec
  - Updates from Last DTNWG.
  - Updates from CCSDS review.
  - Discussion points
- Interoperability Cipher Suites
  - Updates
- Open questions

BpSec Updated from IETF 102 (1/2)

1. Do we need to add a graphic to should multiple security sources?
   -]No

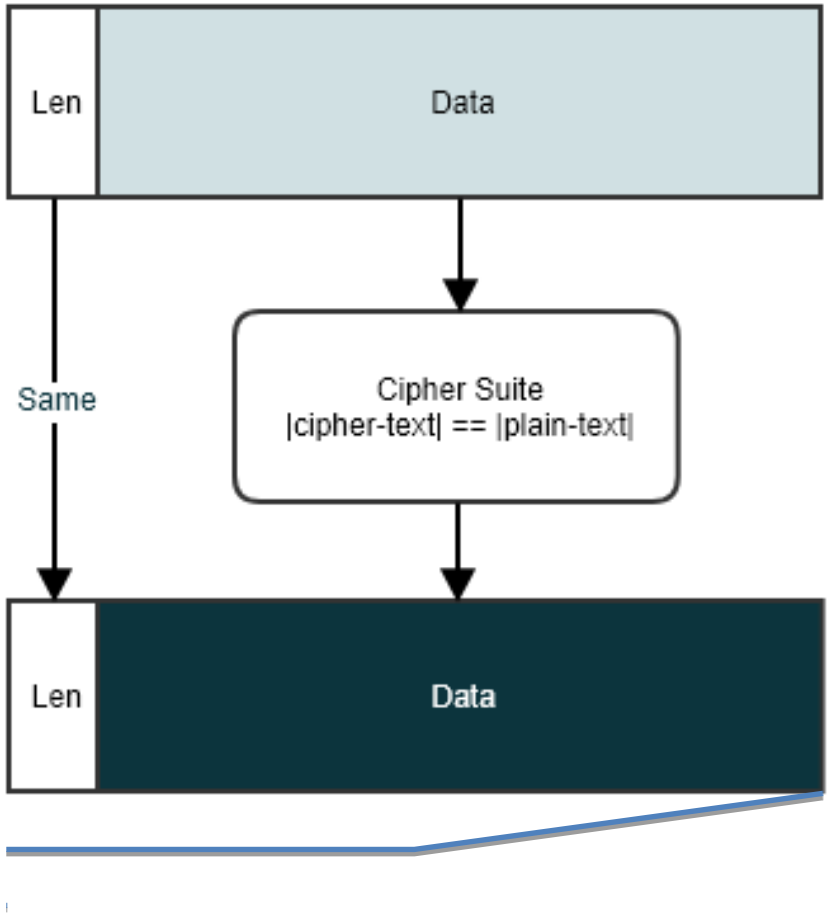
2. May certain cipher suites alter the size of the target block's data fields?
   - Yes.

3. Do we need language to explicitly allow cipher suites to remove blocks from a bundle?
   - No. BpSec should not disallow it. Individual cipher suite documents will describe how and when this would occur.

4. Do we require that a single node add *either* a BCB *or* a BIB for a target, but not both?
   - *No need to require this, but it is a recommended practice.*

BPSec Updates from IETF 102

- Block-type specific fields
  - BpBis will be updated to always represent these as CBOR byte strings.
  - This will allow a common handling mechanism when converting plaintext to cipher text.
    - *The CBOR byte string length bytes will NOT be considered part of the data sent to the cipher suite for processing. They do not represent user data.*
    - *The entire plaintext CBOR byte string (including length) will be discarded and replaced by the CBOR encoded cipher text.*
  - Cipher suites MAY generate cipher text that is not the same size as the original plain text.



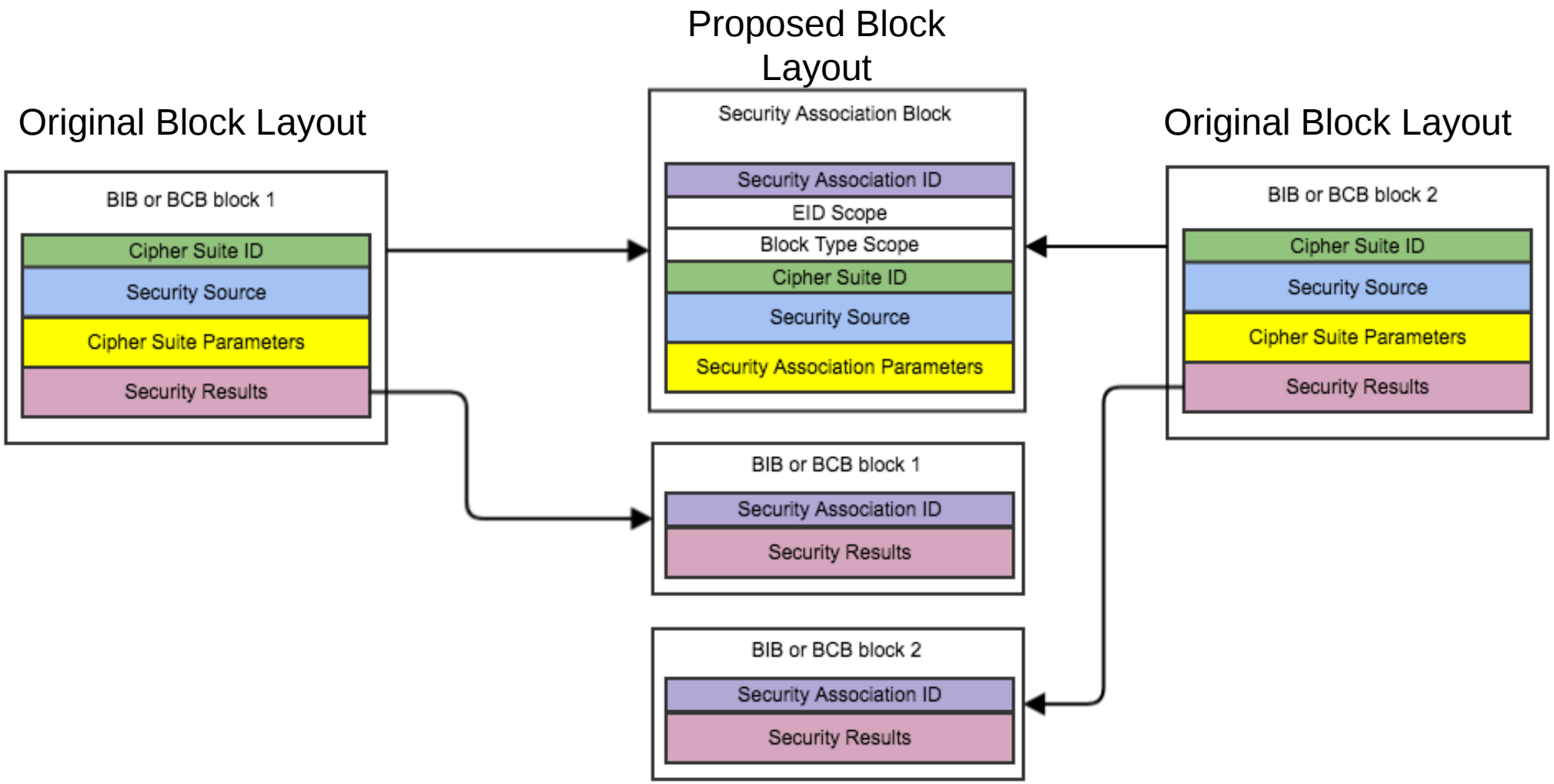
CCSDS SEA-SEC Review Comments

- Additional minor comments
  - Most review requests relate to cipher suite selection and background context material that is not relevant to this document and specific to CCSDS.
- Significant comment: Security Associations
  - Currently: each BIB or BCB is associated with a cipher suite Id and parms.
  - Could also associate BIBs and BCB with other kinds of use cases and events
  - Consider compressing ALL non-security-result information into a single security association identifier.
    - *The same bundle could define the security association.*
    - *Some other bundle could define the security association.*
    - *Some out-of-band mechanism could define the security association.*
- Does not necessarily change information from original BPSec.
  - Consolidates cipher suite parms into a single place and not per-BIB/BCB.
  - Allows an easier way to talk about rekey, out-of-band config, etc…
  - Familiar terminology from IKE, etc…

What is a Security Association?

- An Identifier
  - The Security Association Id (SAID) is a scoped one-way association.
  - It MUST be unique within its scope, which is:
    - *A set of block types from a set of sources to a set of destinations.*
    - *For example: All Payload Blocks from EID1 to EID2*
- A definition block
  - An association is an identified set of security-related information
    - *Extract existing security-related information from BIB/BCB and place it in an association block.*
    - *Place scope and SAID information in that block.*
  - BIB and BCB blocks now reference an SAID
    - *Individual BIB/BCB blocks no longer need to carry cipher suite information and parms.*
  - Added benefits
    - *Some security policy provided by scoping rules.*
    - *Security associations can be communicated out-of-band. This was also the intent for cipher suite IDs, but security association IDs is a cleaner way of reasoning about this.*

Security Association Block



Security Association Block Specifics

- SAID
  - CBOR Unsigned Integer
- Security Association Flags
  - CBOR Unsigned Integer. Determines inclusion of optional fields.
- EID Scope (optional) – Which destinations the SA applies to.
  - If missing, SA can apply to any destinations (pursuant to policy)
  - CBOR Array with each element an encoded EID (pursuant to BpBis encoding rules).
- Block Type Scope (optional) – Which block types the SA applies to.
  - If missing, SA can apply to any block types (pursuant to policy)
  - CBOR Array with each element an encoded block type (pursuant to BpBis encoding rules).
- Cipher Suite Id, Security Source, Association Parameters
  - All optional.
  - These fields are defined as they were for BIB/BCB.
  - Just moved them from BIB/BCB to the SAB.

Proposed Changes to BIB/BCB

- Replace Cipher Suite ID with Security Association ID
- Security Association Flags replace Cipher Suite Flags
  - Currently only 1 field defined: Security Source
- Remove Cipher Suite Parameters from BIB/BCB
  - Security Association Block (or out of band mechanism) captures cipher suite parms.
- Unchanged Items
  - Security Targets
  - Security Source
  - Security Results

Interoperability Cipher Suites

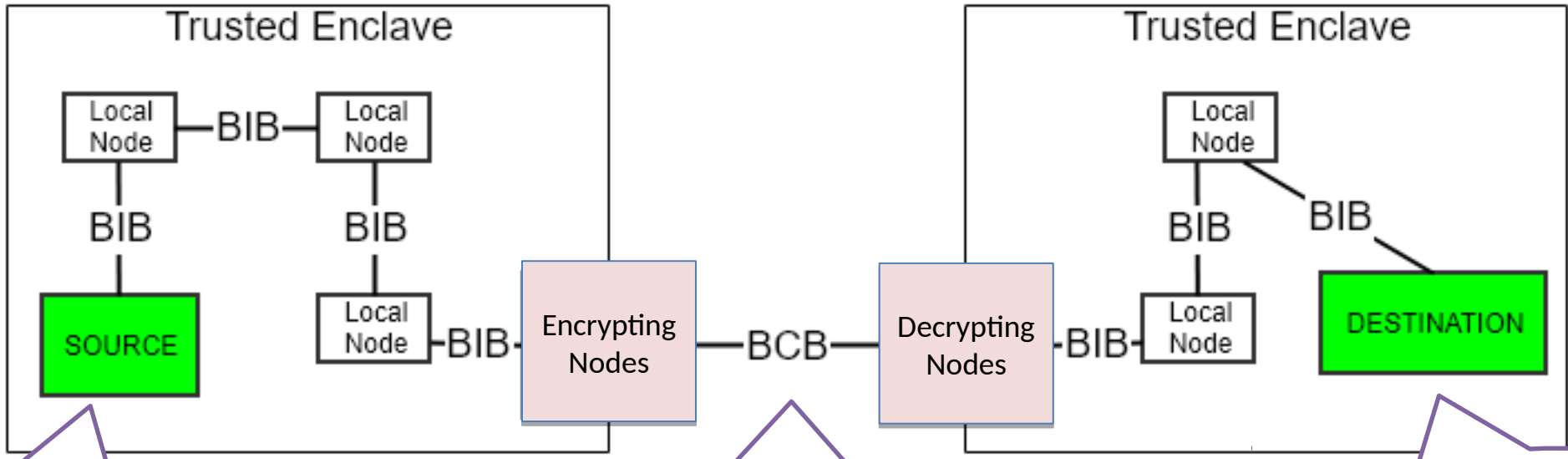
- Reminder
  - BIB-HMAC256-SHA256
    - *The integrity cipher suite provides a signed hash over the security target based on the use of the SHA-256 message digest algorithm [RFC4634] combined with HMAC [RFC2104] with a 256 bit truncation length. This formulation is based on the HMAC 256/256 algorithm defined in [COSE] Table 7: HMAC Algorithm Values.*
  - BCB-AES-GCM-256
    - *The confidentiality cipher suite provides cipher text to replace the data contents of the target block using the AES cipher operating in GCM mode [AES-GCM]. This formulation is based on the A256GCM algorithm defined in [COSE] Table 9: Algorithm Value for AES-GCM.*
- Changes
  - Updated to explain CBOR byte string updates discussed earlier.

Questions

- Do we want to use security associations?
- Do we want to use them as described in this document?
- Are there any proposed changes to the interop cipher suites?
- What are the next steps?

Backup Material from Last Time

BPSec Ex: Multiple Security Sources



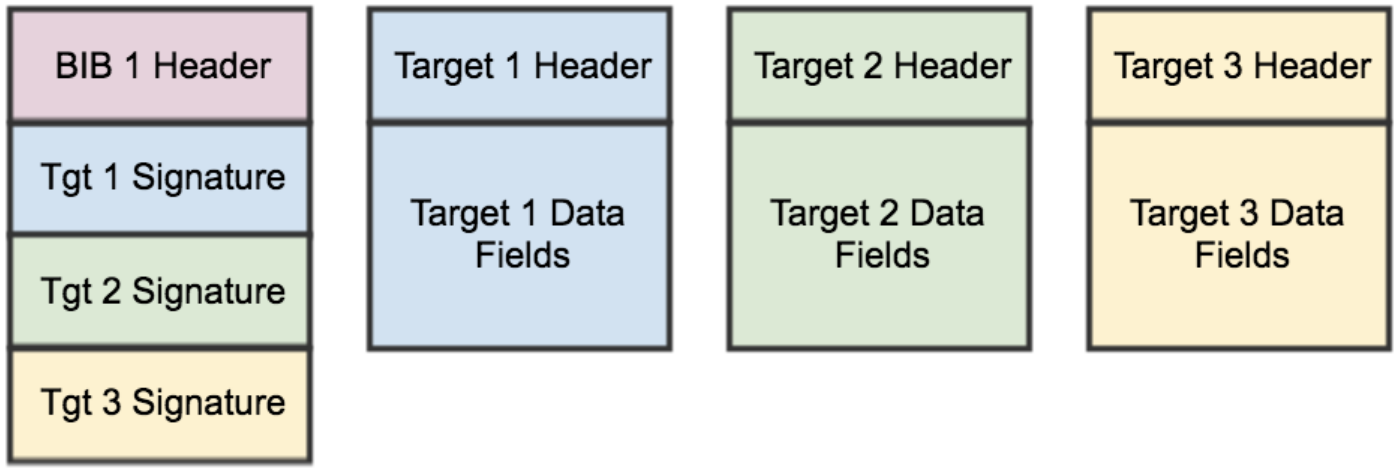
A bundle might not contain all of its security at creation.

Nodes, by security policy, may encrypt/decrypt a payload or extension blocks.

Destinations may not know extra security occurred, but may need to see source-signed material.

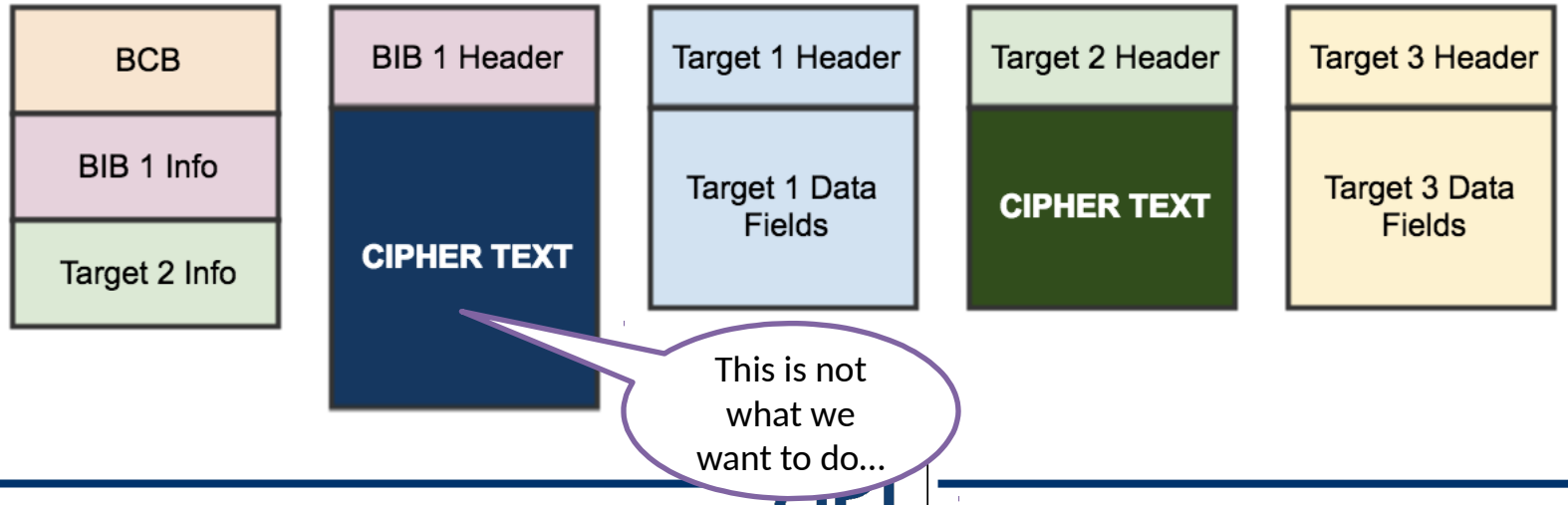
Multiple Integrity W/ Encryption (1/3)

- Context: We have a bundle with a BIB providing plain-text signatures on several blocks.
  - This will happen when signatures are added by same node, with same key info.
  - Prevents having 3 BIBs in the bundle (and thus, having redundant info).



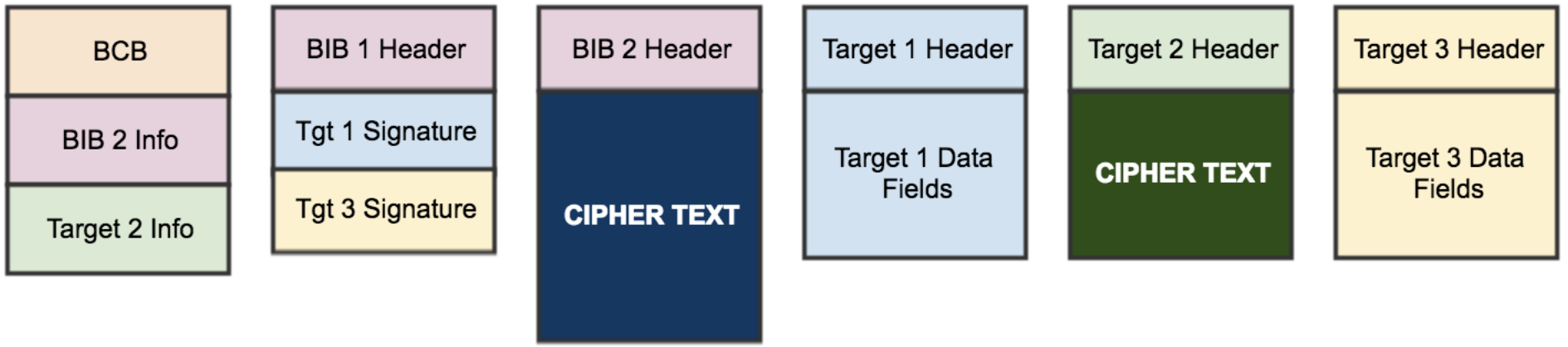
Multiple Integrity W/ Encryption (2/3)

- Later, another nodes wants to encrypt Target 2.
  - By BPSec it MUST encrypt block-specific fields of target 2 AND BIB signature on target 2.
- We cannot simply encrypt the BIB itself
  - We would hide the plain-text signatures for targets 1 and 3.
- We cannot simply encrypt pieces of the BIB
  - In BIB structure, information for target 2 would exist in multiple byte ranges. This adds a lot of processing complexity to support



Multiple Integrity W/ Encryption (3/3)

- Proposed solution
  - Split the BIB.
    - *BIB1 contains the original signatures NOT being encrypted*
    - *BIB2 contains any signature that must be encrypted.*
  - The original conditions that justified grouping the targets into a single BIB no longer apply.
  - Processing can now continue without issue.



Simple BPSec Example

Single Integrity Block holds signatures for multiple other blocks.

Confidentiality block encrypts its target and holds a signature on the encrypted target.

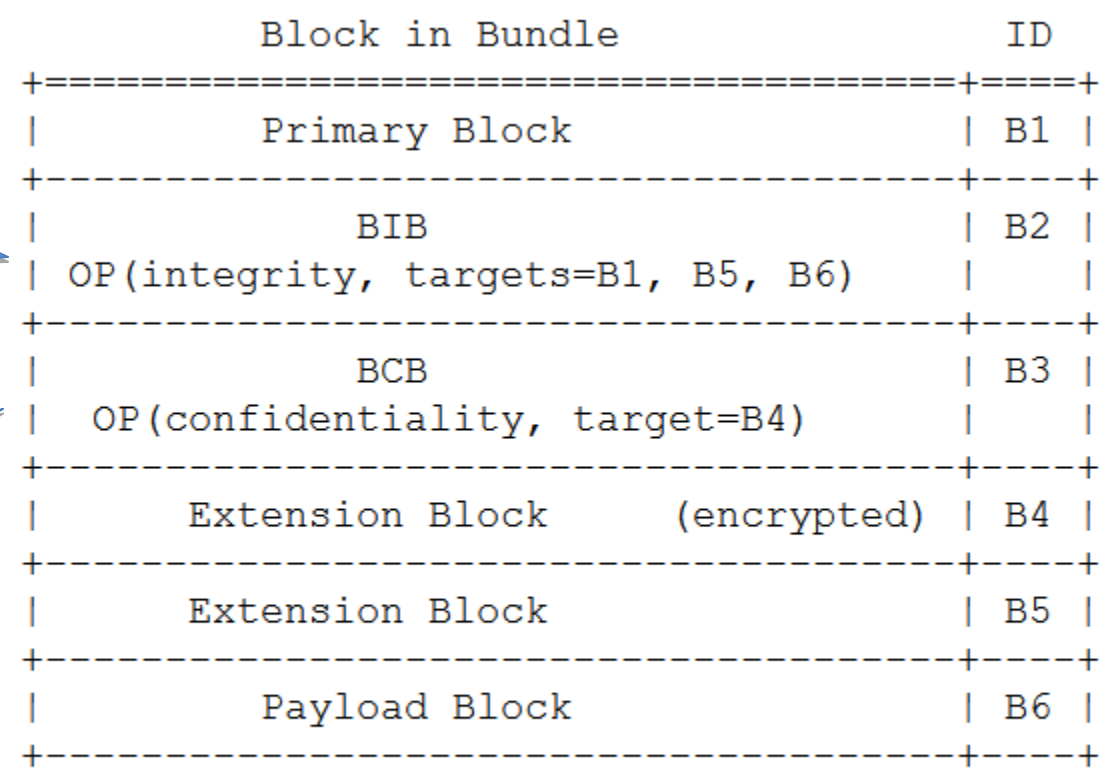


Figure 3: Security at Bundle Creation

Waypoint Encrypts Block B5, B6.

Block in Bundle	ID
Primary Block	B1
BIB OP(integrity, targets=B1, B5, B6)	B2
BCB OP(confidentiality, target=B4)	B3
Extension Block (encrypted)	B4
Extension Block	B5
Payload Block	B6

Figure 3: Security at Bundle Creation

1. Split BIB

2. Encrypt

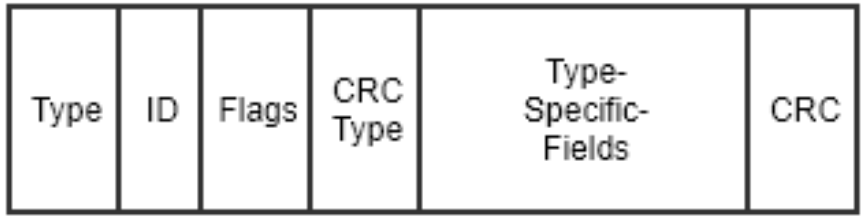
3. New BCB

Block in Bundle	ID
Primary Block	B1
BIB OP(integrity, targets=B1)	B2
BIB (encrypted) OP(integrity, targets=B5, B6)	B7
BCB OP(confidentiality, target=B4,B6,B7)	B8
BCB OP(confidentiality, target=B4)	B3
Extension Block (encrypted)	B4
Extension Block (encrypted)	B5
Payload Block (encrypted)	B6

Figure 4: Security At Bundle Forwarding

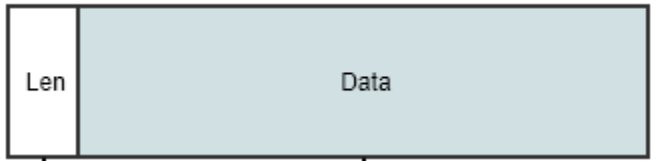
Bpbis Consideration: Encoding Block Data

- BPBis block captured as a CBOR array of 5-6 items:
  - {type, id, flags, crc_type, type-specific-fields, crc (opt)}
  - Type-specific-fields have no mandated CBOR encoding
    - *Except for payload block, which must be BYTE STRING.*



Is it secure to "parse" the plain-text block-type-specific data to determine it is a CBOR byte string?

- Ex: block with 3 fields with values 0x1, 0x2, 0x3
  - Encoded as a CBOR byte string (h'010203')
    - *0x43010203*
    - *4 bytes…*
  - Encoded as a CBOR array: [1,2,3]
    - *0x83010203*



Length-Encoding Cipher-Text