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CCNx 1.0 Wire Format
ICNRG Interim Meeting, Boston

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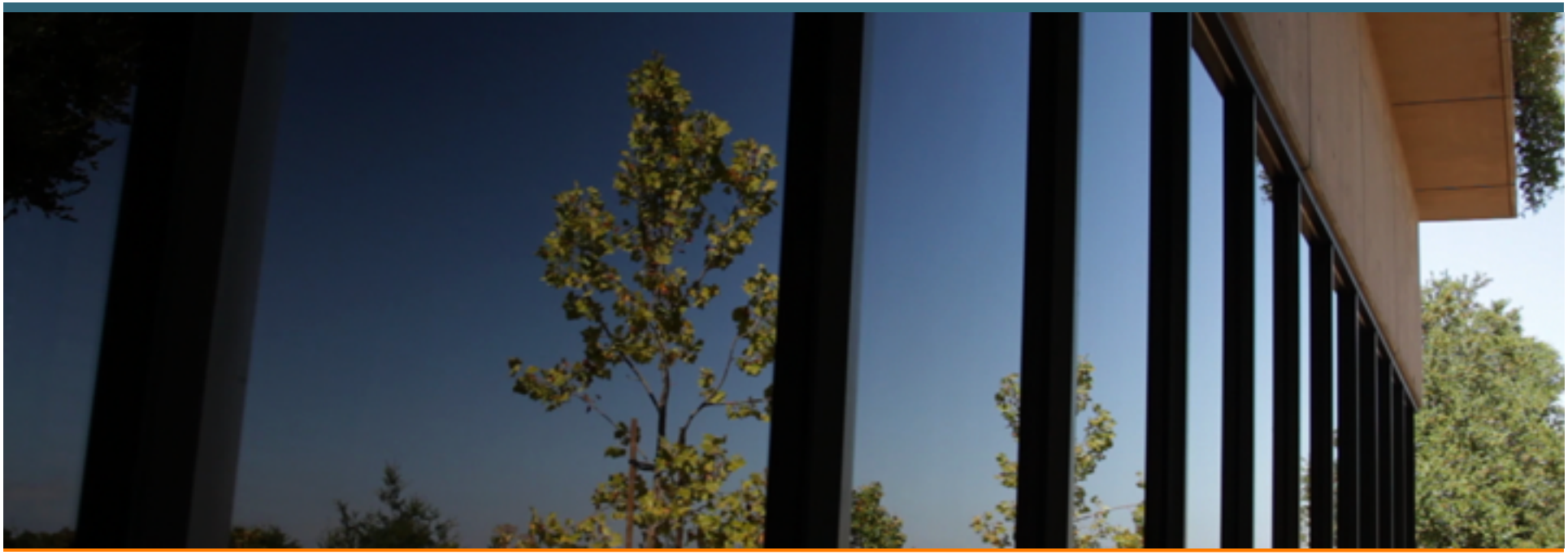

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Wire Format Goals

1. Unsigned part for network headers
2. Ability to sign without knowing signature length
3. No aliases of types
4. Independent Layer 3 operation
5. Fast to process
6. TLV types context-dependent

1. Unsigned part for network headers

- Some headers will change hop-to-hop
  - Interest lifetime
  - Priorities or class of service
  - HopLimit
- These should be grouped of efficiency and near the front of the packet, as only routers use them.
- They need to be outside security envelope

2. Ability to sign without knowing signature length

- Some signature algorithms have variable length signatures.
- The length of the signature should not change anything in the pieces being signed.

3. No aliases of types

- If variable length types, 0x01 ≠ 0x0001 ≠ 0x00000001, etc.

Boss: *Block that name /hacker/payroll*
Minion: *No problem.*
… create a signature for `0x08 0x06 'hacker'` ….
Hacker: *You are mine now!*
… create packet with `0xFD0008 0x06 'hacker'` ….

4. Independent Layer 3 operation

- Should be able to operate directly over L2
  - provide own loop detection
  - have total packet length
  - have own fragmentation
  - Own headers outside of upper-layer message

5. Fast to process

- Minimize branches
  - adversarial branching patterns up to 6x slower[1]
- If variable length, know length before writing?
  - Construct packets backwards?
  - How do you know how far back to start?
- Works with kernel-bypass
  - Kernel buffers, where you need to start at “0”

1. http://igoro.com/archive/fast-and-slow-if-statements-branch-prediction-in-modern-processors/

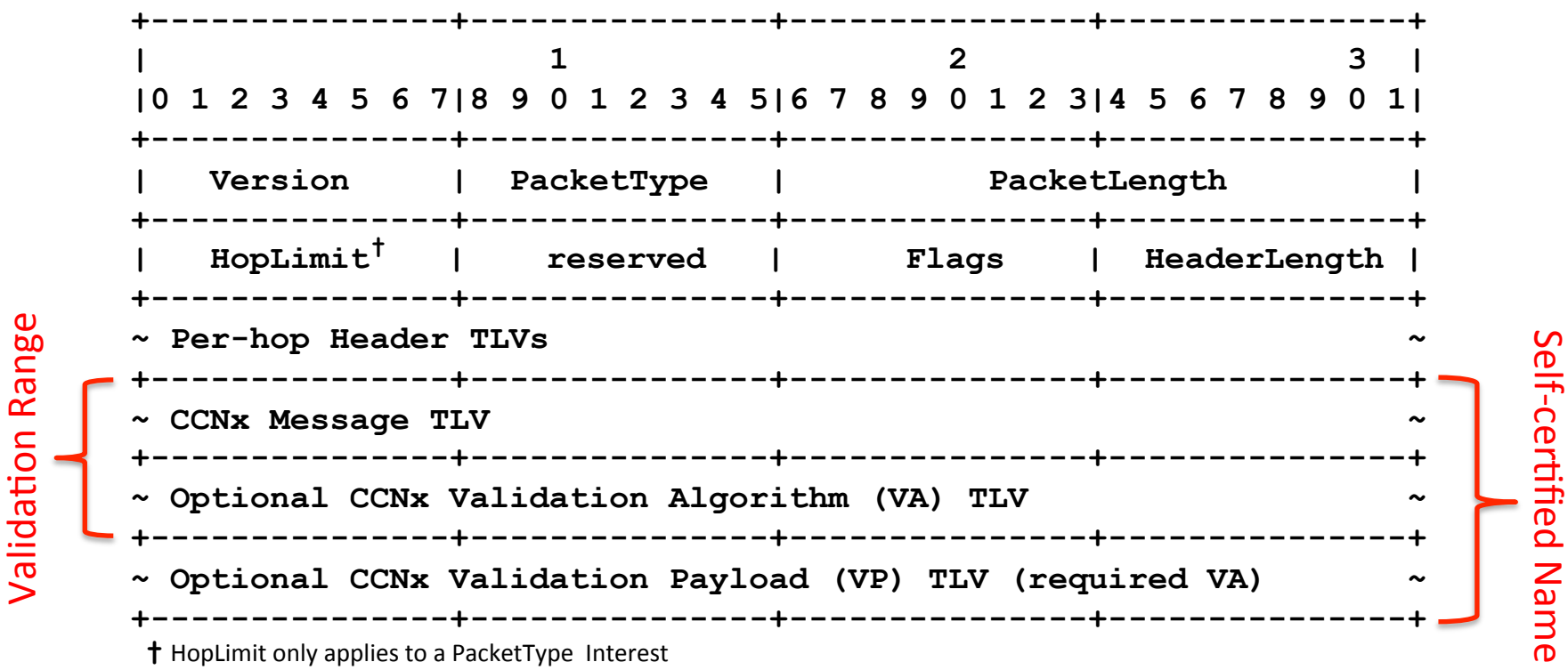
6. TLV types context-dependent

- Vendor TLV containers should not depend on anyone else's TLV types.
- Vendors should not need to register all their types, only the parent container type.

PARC Wire Format

- Fixed Header for L3 operation and fast access to Name, even with per-hop headers.
- Per-hop headers outside signature envelope.
- Signature payload own TLV at end, size only matters in Fixed Header ‘packetLength’.
- 2+2 TLV format, no aliases, fast.
- TLV types context-dependent.

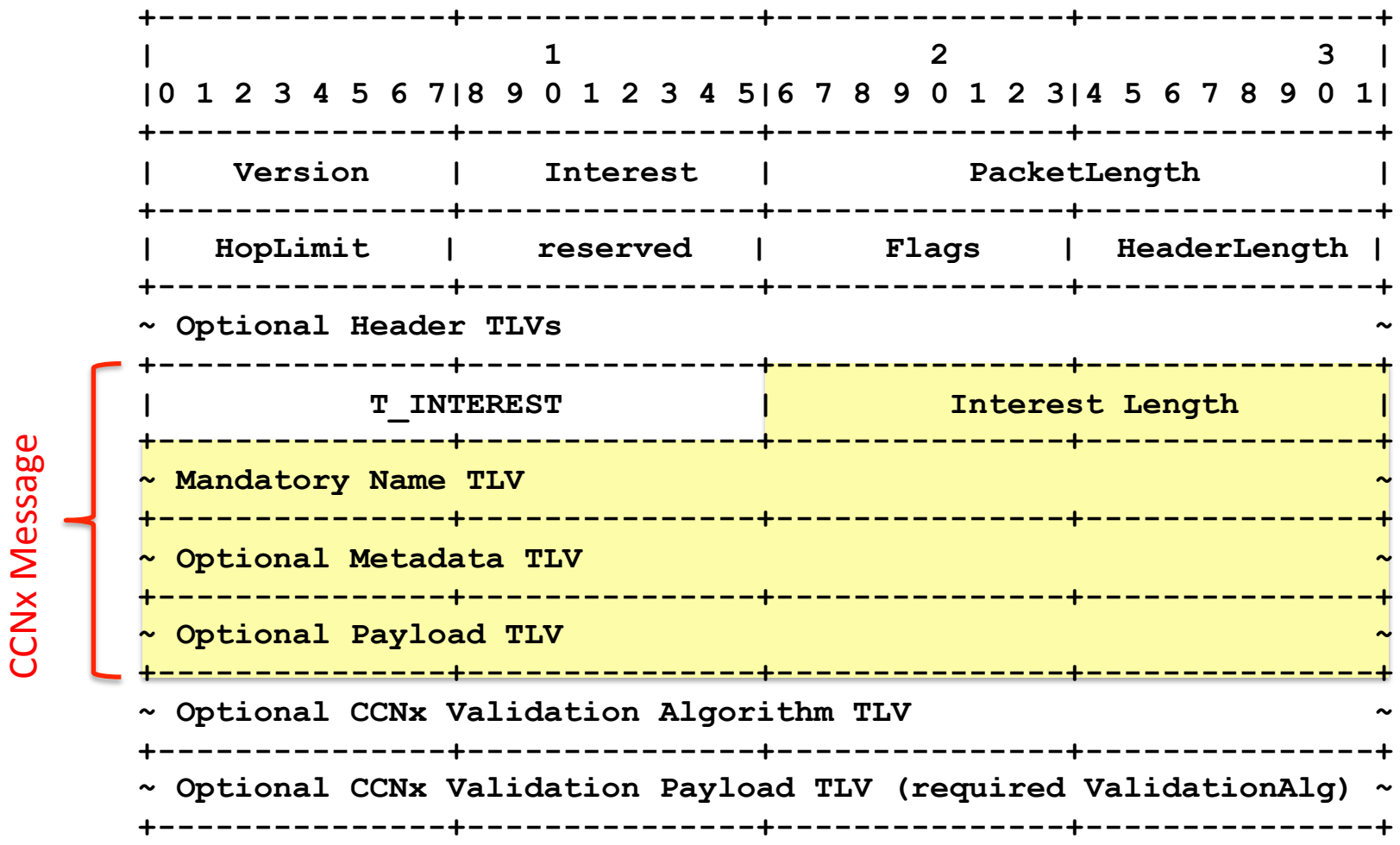
TLV PACKET



† HopLimit only applies to a PacketType Interest

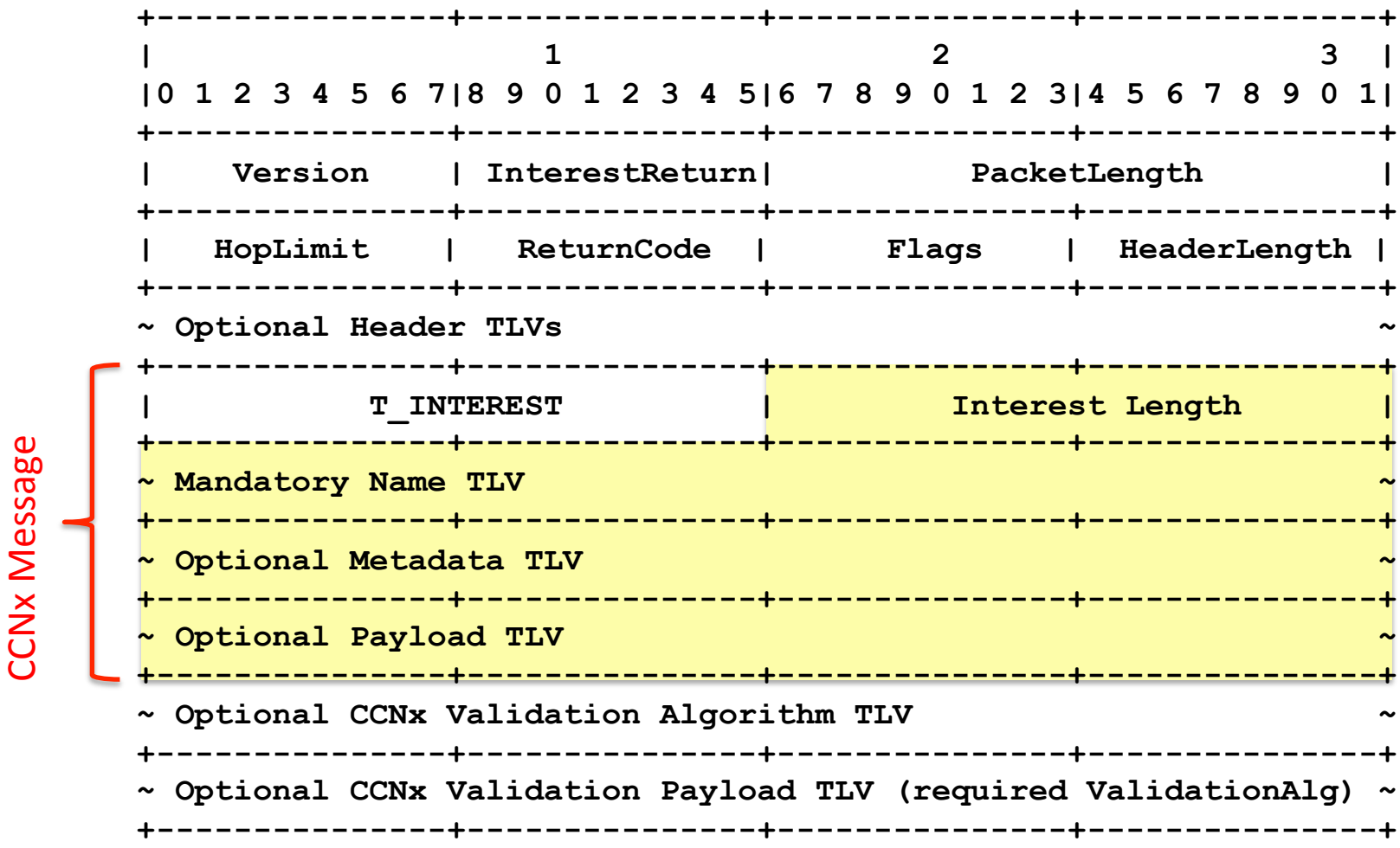
```
PacketLength         = 0 to end of packet
HeaderLength         = 0 to end of per-hop headers
CCNx Message         = Interest / ContentObject / (other)
ValidationAlgorithm  = CRC32C / Checksums /HMAC-SHA256 / VMAC-128 /
                       RSA-SHA256 / EC-SECP-256K1 / EC-SECP-384R1
ValidationPayload    = (validation payload)
Validation Range     = (CCNx Message plus VA)
Self-certified Name  = SHA-256(CCNx Message, VA, VP)
```

INTEREST

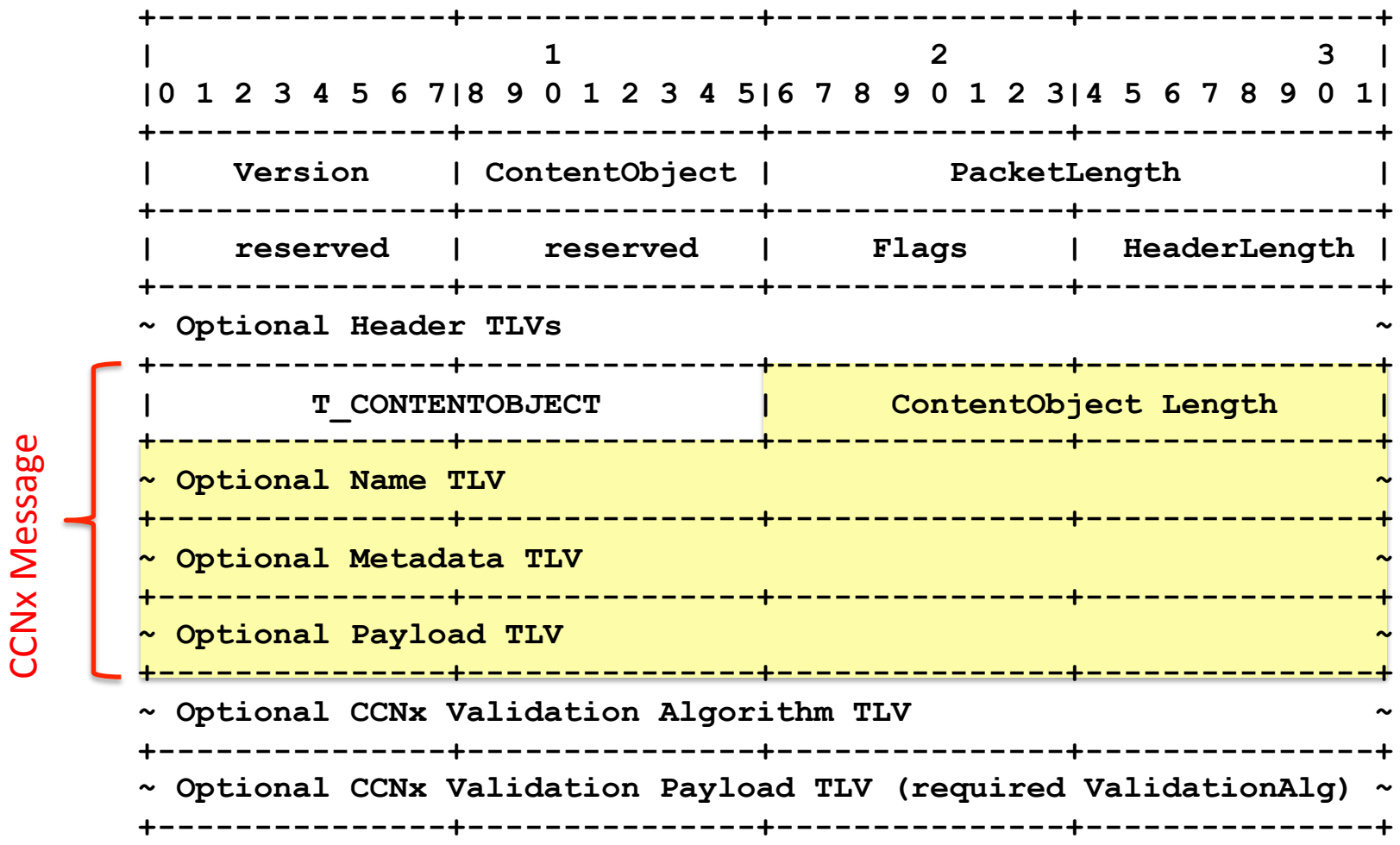



```
Headers    = Lifetime
Metadata   = KeyIdRestriction / ContentObjectHashRestriction
```

INTEREST RETURN

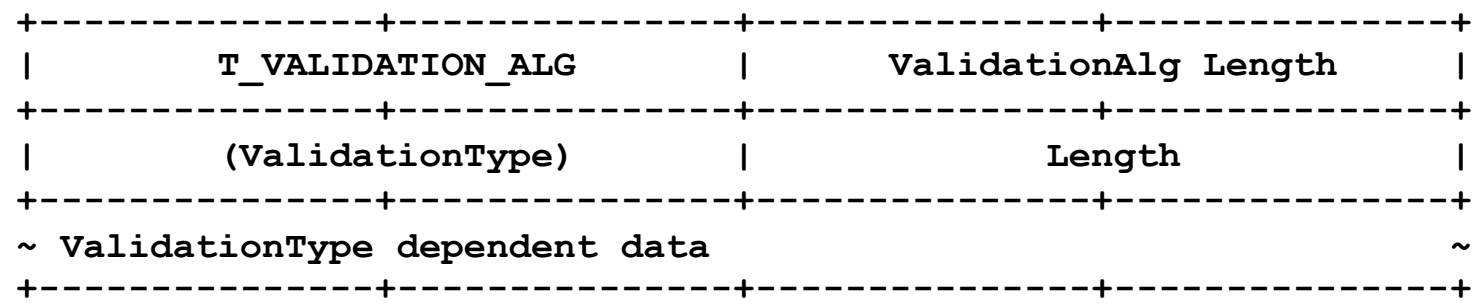


CONTENT OBJECT



Headers = RecommendedCacheTIme
Metadata = ExpiryTime / PayloadType

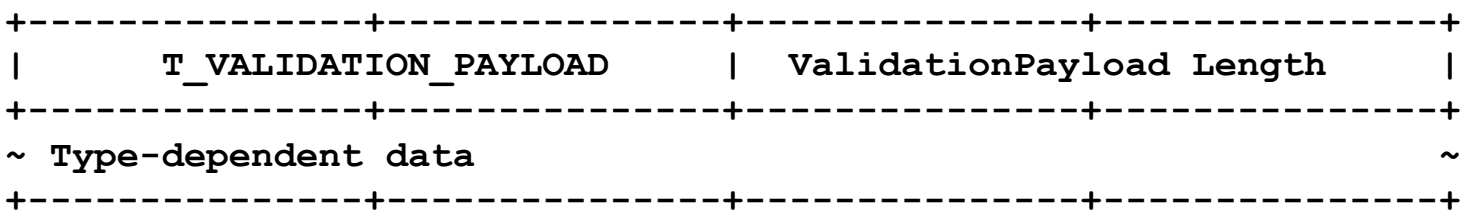
VALIDATION ALGORITHM




```
# Initial list of supported algorithms
ValidationType = CRC32C / RFC793 / HMAC-SHA256 / VMAC-128 /
                 RSA-SHA256 / EC-SECP-256K1 / EC-SECP-384R1

CRC32C      = (empty)
RFC793      = (emtpy)
HMAC-SHA261 = KeyId [SignatureTime]
RSA-SHA256  = KeyId [KeyLocator][SignatureTime]
EC-*        = KeyId [KeyLocator][SignatureTime]
KeyLocator  = PublicKey / Certificate / KeyName
PublicKey   = (DER encoded public key)
Certificate = (DER encoded X.509 certificate)
KeyName     = Link
Link        = Name [KeyIdRestriction] [ContentObjectHashRestriction]
```

VALIDATION PAYLOAD



The validation payload depends on the verification type in the previous TLV.

For a CRC32, it's the 32-bytes of CRC.
For an HMAC-SHA256, it is the 32-byte SHA256 output.
For RSA-SHA256, it's the RSA signature.
Etc.