

NDN Messages and NDN Packets

Mark Stapp
Cisco Systems

mjs@cisco.com

IETF ICNRG, 31/7/2013, Berlin

NDN in One Slide

- . Clients send Interest messages
 - . All communication is request-driven
- . The messages name content
- . Nodes who have the content can reply with a Content message
 - . May be an authoritative publisher of the content
 - . May be a CDN-like cache
 - . May be a router that has built-in cache
- . Content includes a signature, so the source “doesn't matter”
- . All routing and forwarding is based on the name in the messages
 - . No source or destination addresses
- . Messages are “balanced”: one Interest produces one Content
- . Messages need to be put into packets

Things That are Good

- . Clear distinction between
 - . What's required by the protocol
 - . What's “application-specific”, or an extension that may be optional
- . Protocol versioning
- . Find the important things fast
 - . D\$ cache misses really matter
- . Carry required things in the header (if they're of reasonable size)
- . Reasonable encode/decode expectations
 - . Avoid ambiguity, redundancy
- . TLVs - flexible, extensible, chance for some cross-version compatibility
- . Interoperable running code

NDN Numeric Encoding

NDN messages contain numerical values with ranges that vary widely. For efficiency, we define a variable-length encoding for numbers in NDN as follows:

`VAR-NUMBER := BYTE+`

The first octet of the number carries the actual numeric value, or signals that a variable-length encoding is required. The encoding scheme:

if the first octet is < 253 , the number is encoded in that octet

if the first octet $== 253$, the number is encoded in the following 2 octets, in net byte-order

if the first octet $== 254$, the number is encoded in the following 4 octets, in net byte-order

if the first octet $== 255$, the number is encoded in the following 8 octets, in net byte-order

NDN TLVs

- . An NDN message body is mainly a collection of TLVs.
 - . Some TLVs will, in turn, contain sub-TLVs.
- . The TLVs' Type and Length use the the NDN variable-length number encoding.

NDN-TLV := TLV-TYPE TLV-LENGTH [TLV-DATA]

TLV-TYPE := VAR-NUMBER

TLV-LENGTH := VAR-NUMBER

TLV-DATA := BYTE+

- . We expect that many (most) T and many L will be able to use the one-byte encoding
- . Potentially large T number-space
 - . Allows us to allocate ranges for experimental, vendor, etc. use

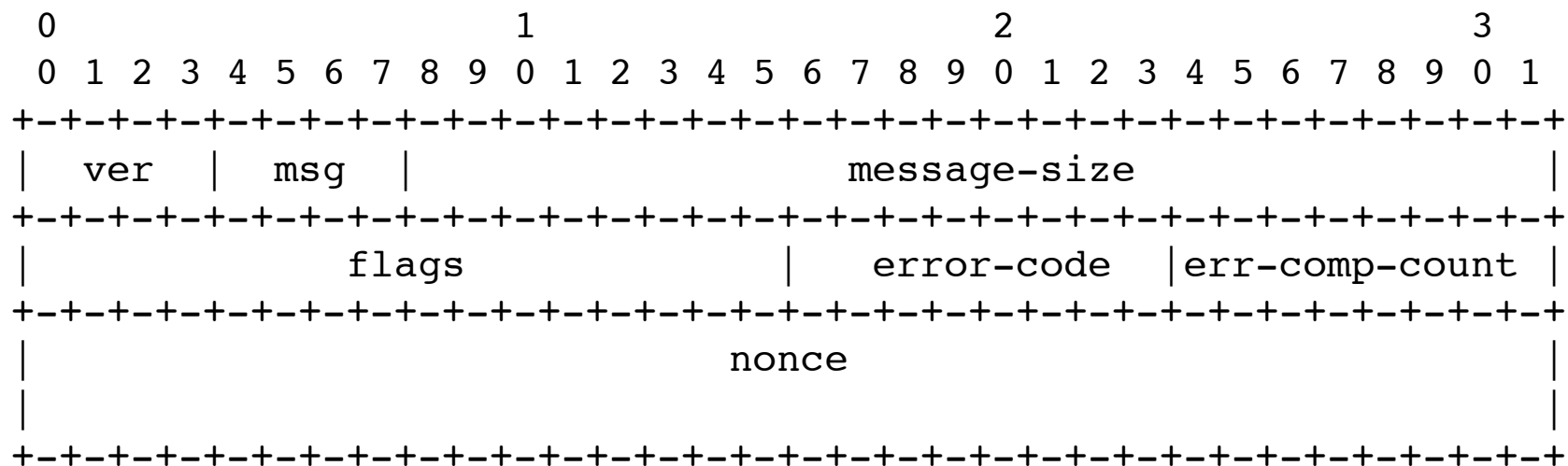
Interest Message (1)

```
INTEREST-MESSAGE := INTEREST-HEADER  
                   NAME-TLV  
                   [ NDN-TLV ... ]  
INTEREST-HEADER  := specified below  
NAME-TLV         := NDN-TLV with Type == Name
```

- . The Name is *required* to appear immediately after the header, which is of fixed size

Interest Message (2)

- NDN Interest message header:



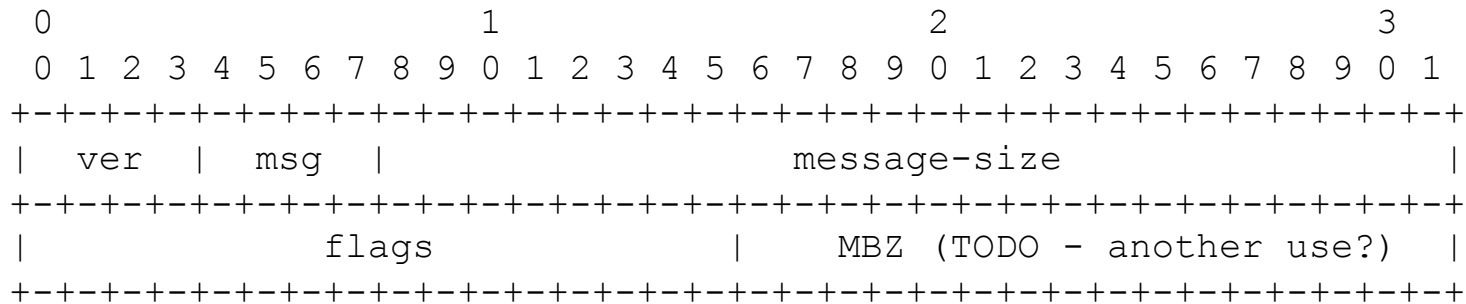
- The Name is *required* to appear immediately after the header, which is of fixed size
- The protocol is versioned
- The message has a size
- There's a place for flags and for error information
 - (there's experimentation on various kinds of error reporting)
- CCN/NDN uses a nonce value instead of a ttl counter
 - (ask me or Nacho); it has to be in every Interest, so...

Content Message (1)

```
CONTENT-MESSAGE := CONTENT-HEADER  
                  NAME-TLV  
                  [ NDN-TLV ... ]  
CONTENT-HEADER  := specified below  
NAME-TLV       := NDN-TLV with Type == Name
```

- . Again, the Name TLV is *required* to be immediately after the fixed header

Content Message (2)



- . The first 4 bytes of the header is shared with the Interest message
- . Content messages do not have other fixed fields (that we have come up with yet)
- . The Name TLV is present at a fixed offset

Some Proposed TLVs

NDN_TLV_Name = 1,
NDN_TLV_NameComponent = 2,
NDN_TLV_NameSegment = 3,
NDN_TLV_ContentData = 4,
NDN_TLV_Certificate = 5,
NDN_TLV_SignedInfo = 6,
NDN_TLV_ContentDigest = 7,
NDN_TLV_PublicKey = 10,
NDN_TLV_KeyName = 12,
NDN_TLV_KeyNameComponent = 13,
NDN_TLV_Signature = 14,
NDN_TLV_Timestamp = 15,

NDN_TLV_Witness = 16,
NDN_TLV_SignatureBits = 17,
NDN_TLV_DigestAlgorithm = 18,
NDN_TLV_ContentExpiration = 19,
NDN_TLV_CacheTTL = 20,
NDN_TLV_FinalSegmentID = 21,
NDN_TLV_PublisherPublicKeyDigest = 22,
NDN_TLV_VendorSpecific = 23,
NDN_TLV_VendorId = 24