University of Glasgow

School of Computing Science

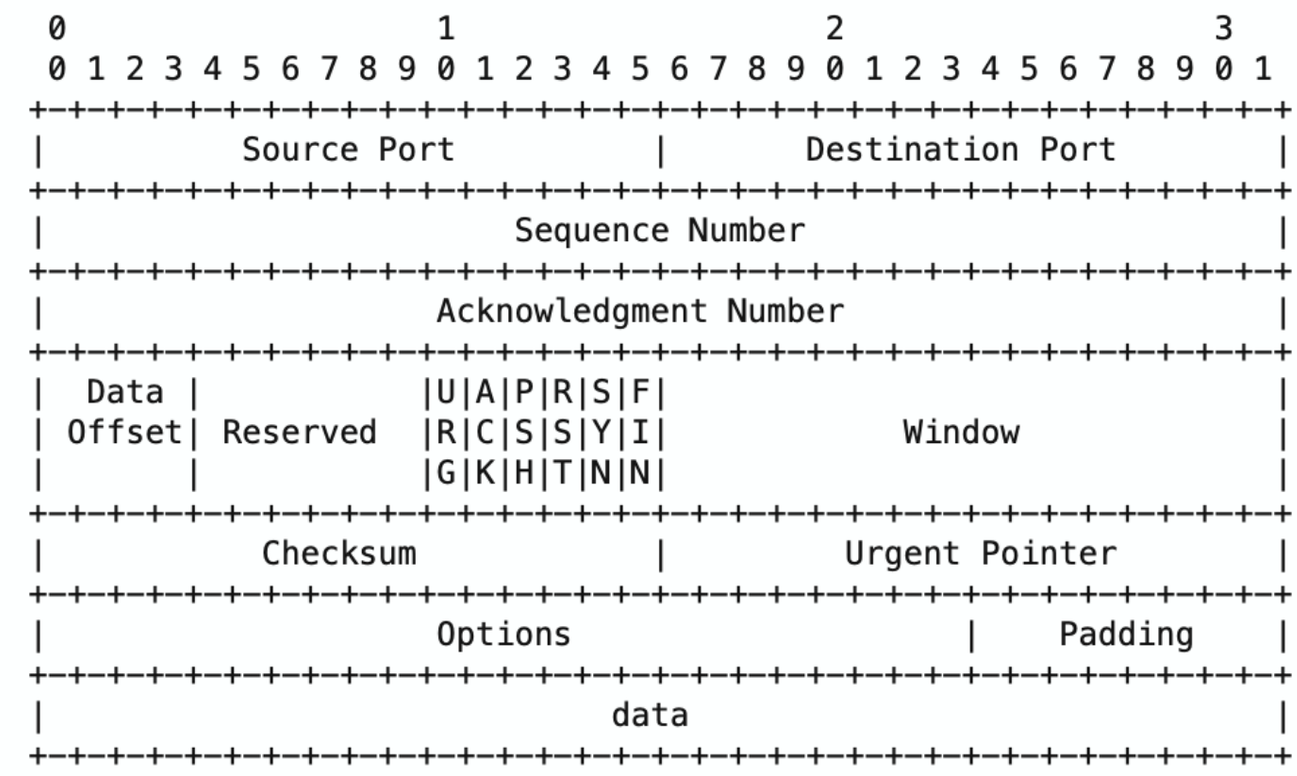
Structured Specifications in IETF Documents

Stephen McQuistin
Colin Perkins

HotRFC @ IETF 103

ASCII packet diagrams are useful

TCP Header Format



TCP Header Format

Note that one tick mark represents one bit position.

Figure 3.

Source Port: 16 bits

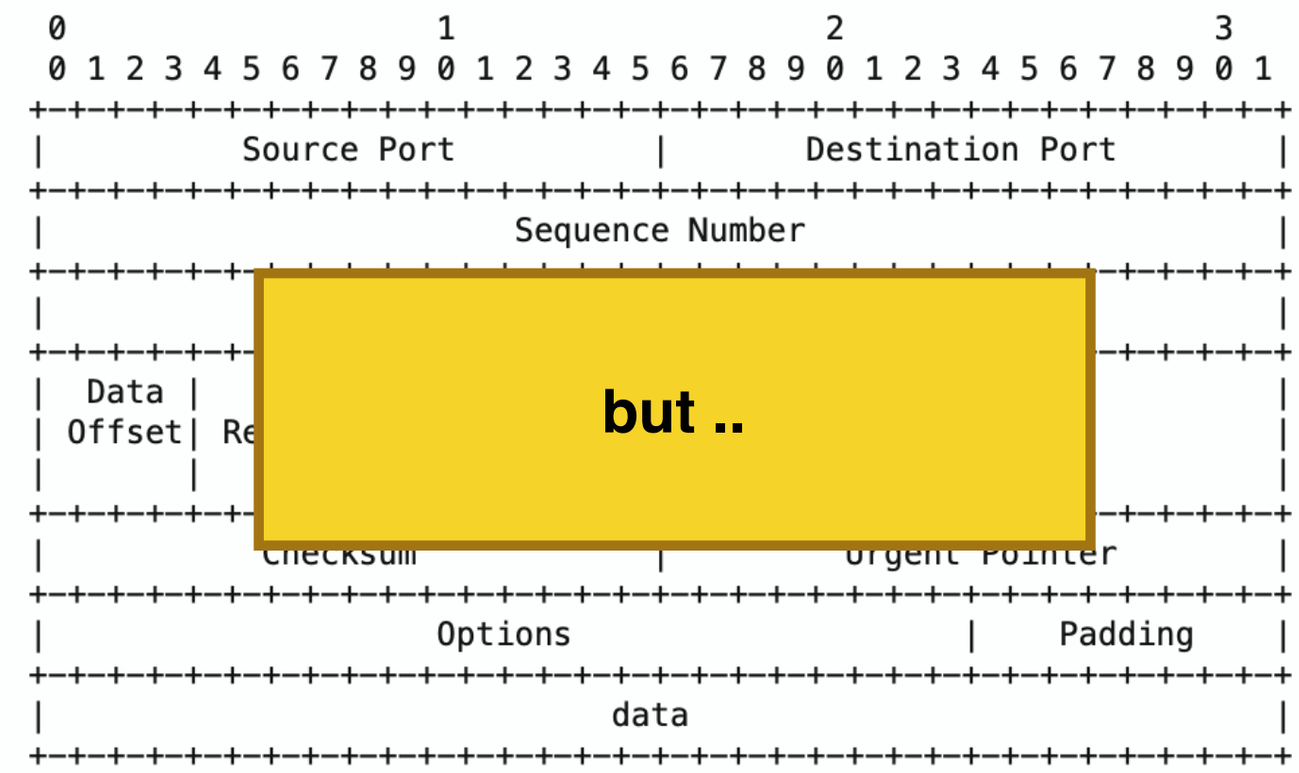
The source port number.

Destination Port: 16 bits

The destination port number.

ASCII packet diagrams are useful

TCP Header Format



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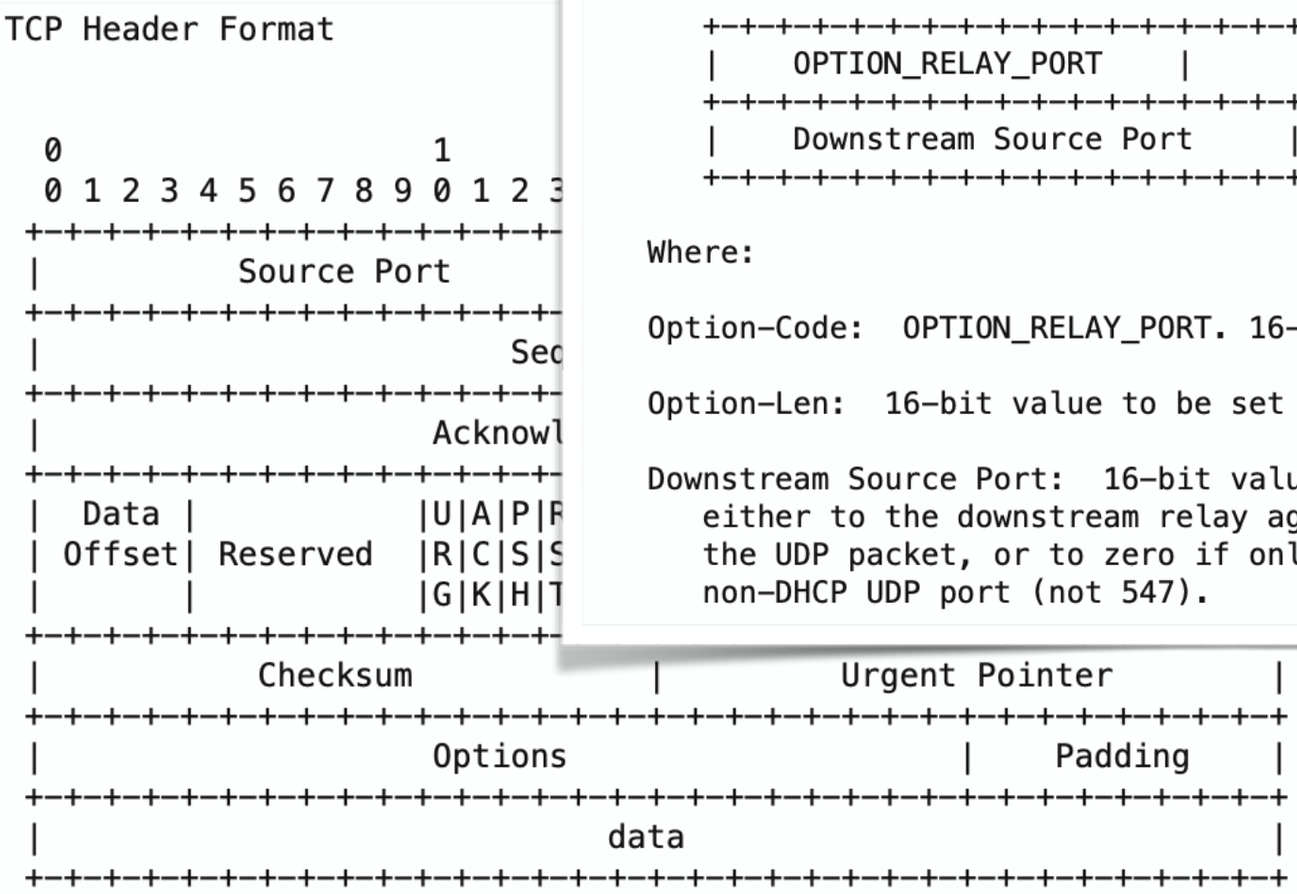

TCP Header Format

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Source Port: 16 bits

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Destination Port: 16 bits

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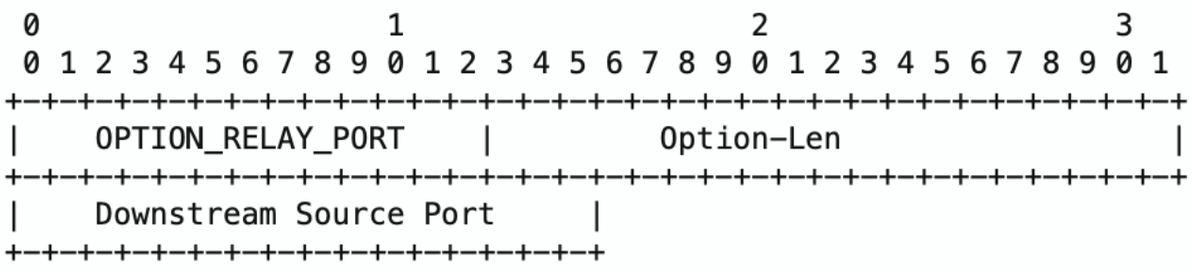
4.2. Relay Source Port Option for DHCPv6

   The "Relay Source Port Option" is a new DHCPv6 option. It MUST be used by either 1) a DHCPv6 relay agent that uses a non-DHCP UDP port (not 547) communicating with the IPv6 server and the upstream relay agent or 2) an IPv6 relay agent that detects the use of a non-DHCP UDP port (not 547) by a downstream relay agent.

   The format of the "Relay Source Port Option" is shown below:



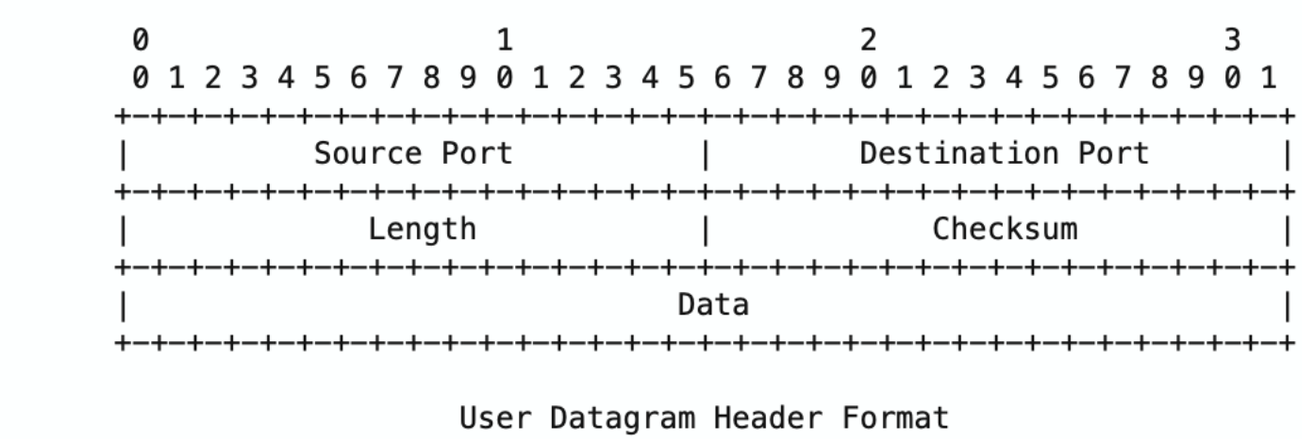
   Where:

   Option-Code: OPTION_RELAY_PORT. 16-bit value, 135.

   Option-Len: 16-bit value to be set to 2.

   Downstream Source Port: 16-bit value. To be set by the IPv6 relay either to the downstream relay agent's UDP source port used for the UDP packet, or to zero if only the local relay agent uses the non-DHCP UDP port (not 547).

Format



User Datagram Header Format

Fields

Source Port is an optional field, when meaningful, it indicates the port of the sending process, and may be assumed to be the port to which a reply should be addressed in the absence of any other information. If not used, a value of zero is inserted.

Destination Port has a meaning within the context of a particular internet destination address.

Length is the length in octets of this user datagram including this header and the data. (This means the minimum value of the length is eight.)

Checksum is the 16-bit one's complement of the one's complement sum of a pseudo header of information from the IP header, the UDP header, and the data, padded with zero octets at the end (if necessary) to make a multiple of two octets.

The pseudo header conceptually prefixed to the UDP header contains the source address, the destination address, the protocol, and the UDP length. This information gives protection against misrouted datagrams. This checksum procedure is the same as is used in TCP.

Source Port: 16 bits

The source port number.

Destination Port: 16 bits

The destination port number.

4.2. Relay Source Port Option for DHCPv6

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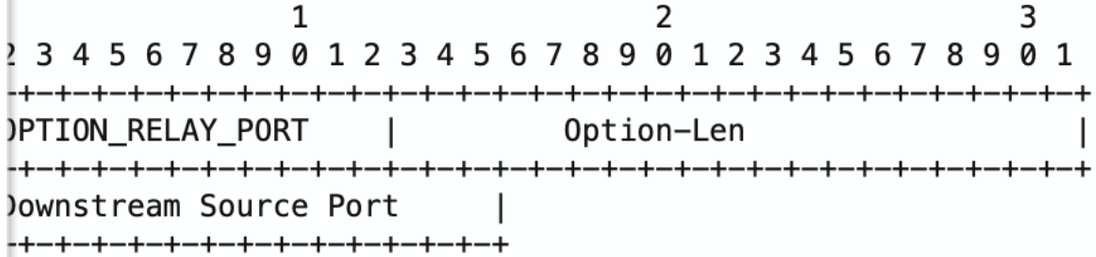
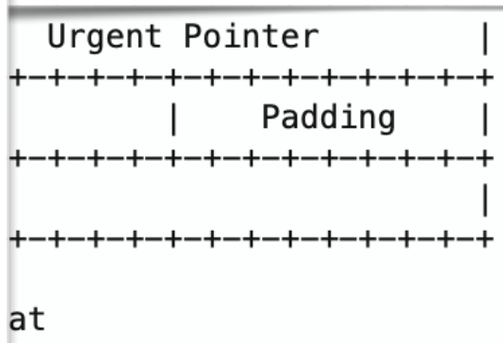


ode: OPTION_RELAY_PORT. 16-bit value, 135.

en: 16-bit value to be set to 2.

am Source Port: 16-bit value. To be set by the IPv6 relay to the downstream relay agent's UDP source port used for DP packet, or to zero if only the local relay agent uses the HCP UDP port (not 547).



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(not 547) by a downstream relay agent.

at of the "Relay Source Port Option" is shown below:

```
                    1                   2                   3
8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Format

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Source Port          |       Destination Port        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|             Length            |            Checksum           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                               Data                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

User Datagram Header Format

Fields

Source Port is an optional field, when meaningful, it indicates the po
of the sending process, and may be assumed to be the port to which
reply should be addressed in the absence of any other information.
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The pseudo header conceptually prefixed to the UDP header contains t
source address, the destination address, the protocol, and the U
length. This information gives protection against misrouted datagram
This checksum procedure is the same as is used in TCP.

4.1. Availability SCSI-TLV

The Generalized SCSI is defined in [RFC8258]. This document d
a new type of Generalized SCSI-TLV called the Availability SCS
The Availability SCSI-TLV can be included one or more times.
the following format:

```
 0                   1                   2
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               Type            |             Length
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   Availability level
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   LSP Bandwidth at Availability level n
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Type: 0x000A, 16 bits

Length: 2 octets (16 bits)

Availability level: 32 bits

This field is a binary32-format floating-point number as
defined by [IEEE754-2008]. The bytes are transmitted in
network order; that is, the byte containing the sign bit
transmitted first. This field describes the decimal val
the availability guarantee of the Switching Capability i
Interface Switching Capability Descriptor object [RFC420
The value MUST be less than 1. The Availability level f
usually expressed as the value 0.99/0.999/0.9999/0.99999

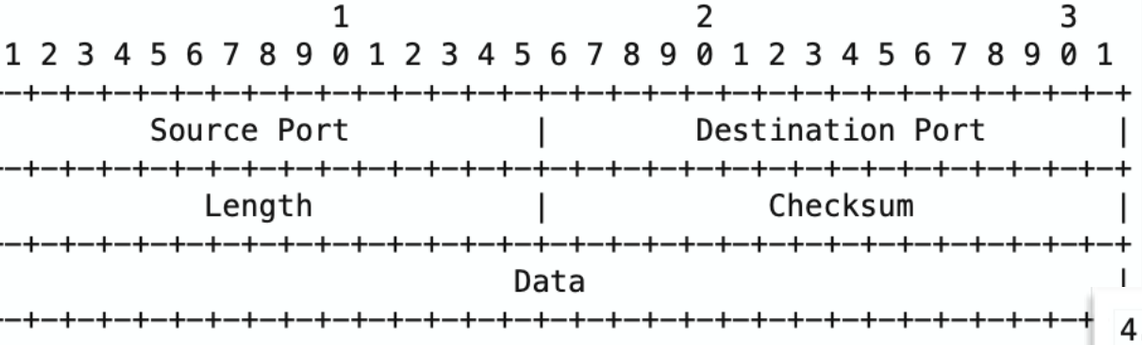
Source Port: 16 bits

The source port number.

Destination Port: 16 bits

The destination port number.

Format



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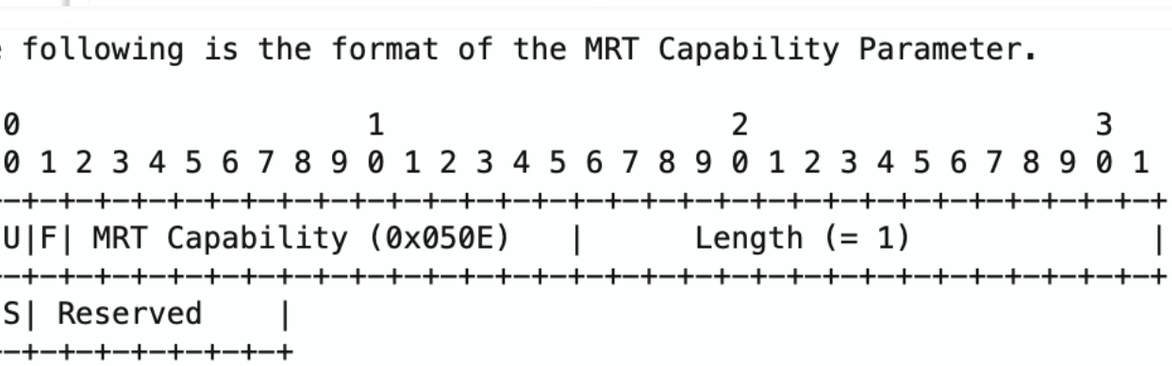
Destination Port has a meaning within the context of a particul
internet destination address.

following is the format of the MRT Capability Parameter.



MRT Capability TLV Format

re:

it: The unknown TLV bit MUST be 1. A router that does not
recognize the MRT Capability TLV will silently ignore the TLV and
process the rest of the message as if the unknown TLV did not
exist.

it: The forward unknown TLV bit MUST be 0 as required by
Section 3 of [RFC5561].

uding th
e length

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er, and t
to make

ontains t
nd the U
datagram

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(not 547) by a downstream relay agent.

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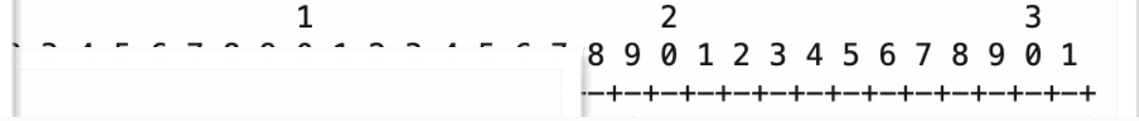

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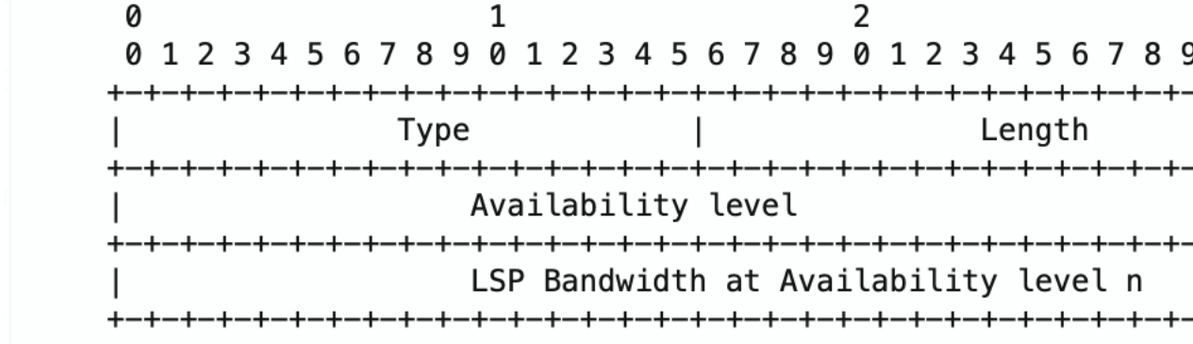

Type: 0x000A, 16 bits

Length: 2 octets (16 bits)

Availability level: 32 bits

This field is a binary32-format floating-point number as
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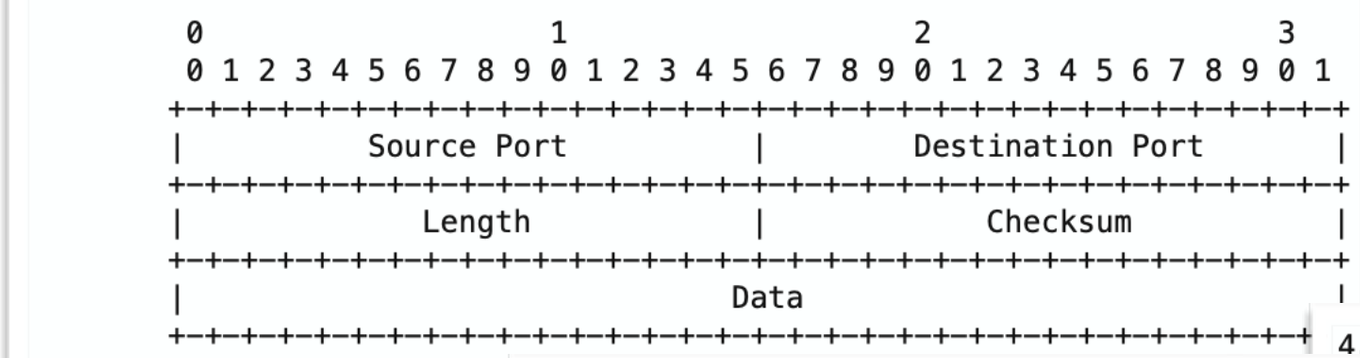

Fields

Source Port is an optional
of the sending process,
reply should be addressed
not used, a value of zero

Destination Port has a me
internet destination addre

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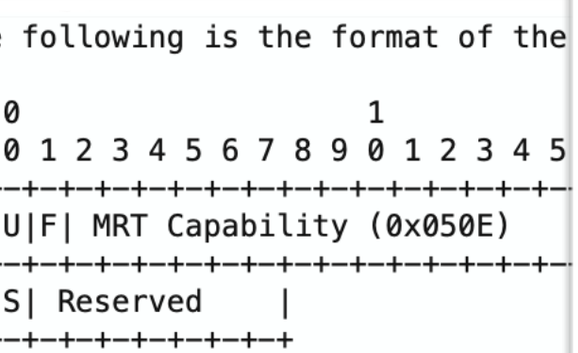

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2. ICMP Extended Echo Request

The ICMP Extended Echo Request message is defined for both ICMPv4 and ICMPv6. Like any ICMP message, the ICMP Extended Echo Request message is encapsulated in an IP header. The ICMPv4 version of the Extended Echo Request message is encapsulated in an IPv4 header, while the ICMPv6 version is encapsulated in an IPv6 header.

Figure 1 depicts the ICMP Extended Echo Request message.

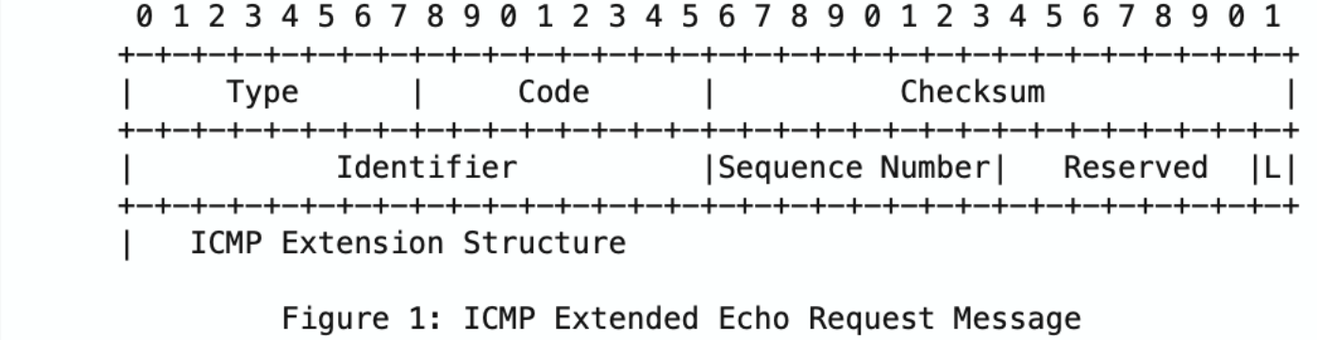

Figure 1: ICMP Extended Echo Request Message

IP Header fields:

- Source Address: The Source Address identifies the probing interface. It MUST be a valid IPv4 or IPv6 unicast address.

- Destination Address: The Destination Address identifies the proxy interface. It MUST be a unicast address.

ICMP fields:

- Type: Extended Echo Request. The value for ICMPv4 is 42. The value for ICMPv6 is 160.

- Code: MUST be set to 0 and MUST be ignored upon receipt.

The FEC type for the P2MP PW Upstream FEC Element is encoded as follows:

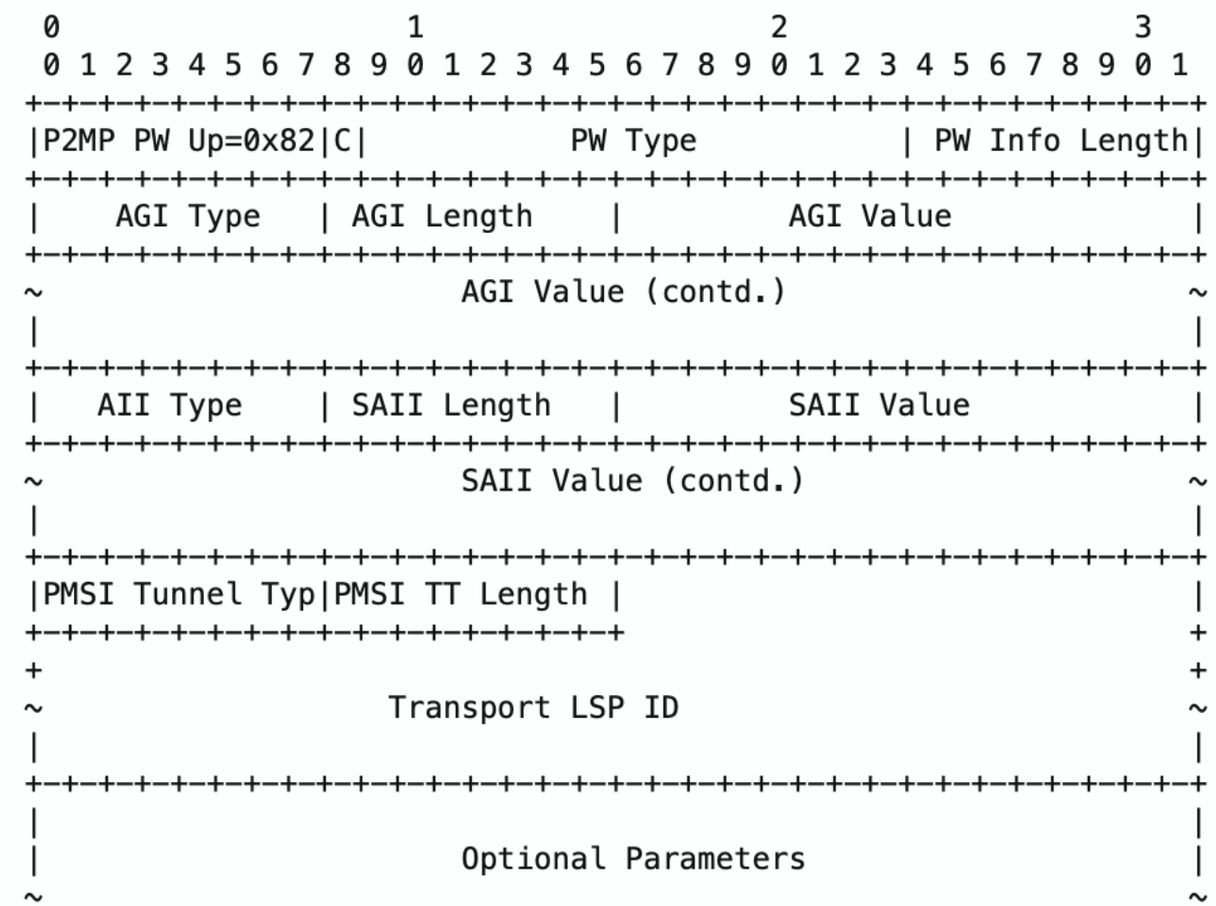

Figure 2: P2MP PW Upstream FEC Element

* P2MP PW Up:

  8-bit representation for the P2MP PW Upstream FEC type.

* C bit:

  A value of 1 or 0 indicating whether a control word is present or absent for the P2MP PW.

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capsulated in an IPv4 header,
lated in an IPv6 header.

Echo Request message.

Echo Request Message

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ICMP fields:

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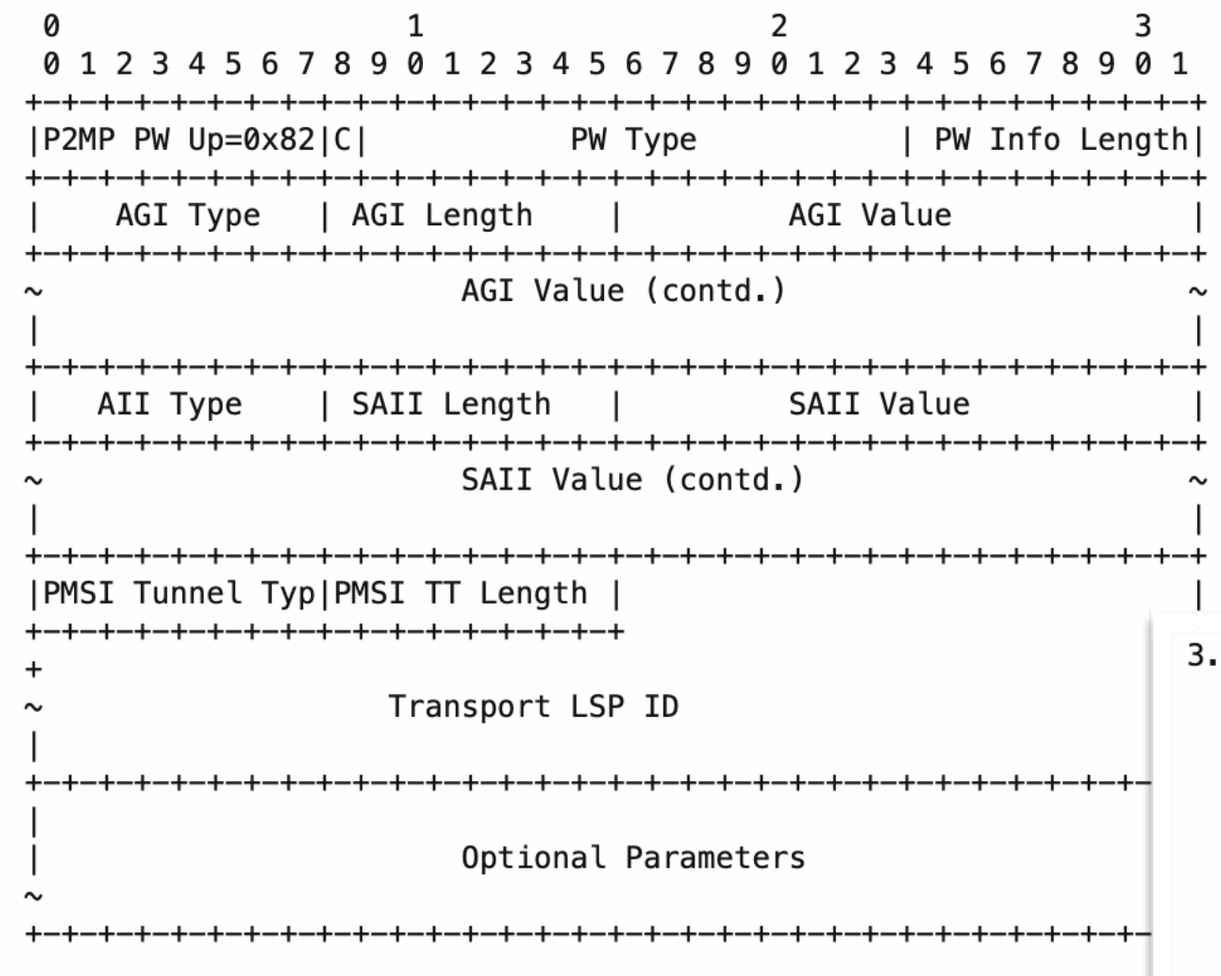

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3.2. Message Format

The CoAP message format defined in [RFC7252], as shown in Figure 3, relies on the datagram transport (UDP, or DTLS over UDP) for keeping the individual messages separate and for providing length information.

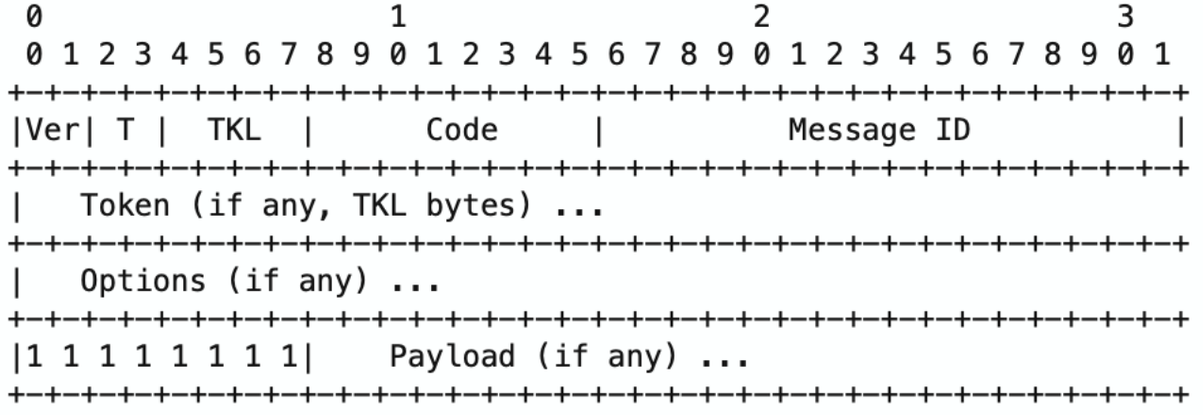

Figure 3: CoAP Message Format as Defined in RFC 7252

The message format for CoAP over TCP is very similar to the format specified for CoAP over UDP. The differences are as follows:

o Since the underlying TCP connection provides retransmissions and deduplication, there is no need for the reliability mechanisms provided by CoAP over UDP. The Type (T) and Message ID fields in the CoAP message header are elided.

o The Version (Vers) field is elided as well. In contrast to the message format of CoAP over UDP, the message format for CoAP over

re:

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Section 3 of [RFC5561].

interface. It MUST be a v

o Destination Address: The D
interface. It MUST be a u

ICMP fields:

o Type: Extended Echo Reques
value for ICMPv6 is 160.

o Code: MUST be set to 0 and

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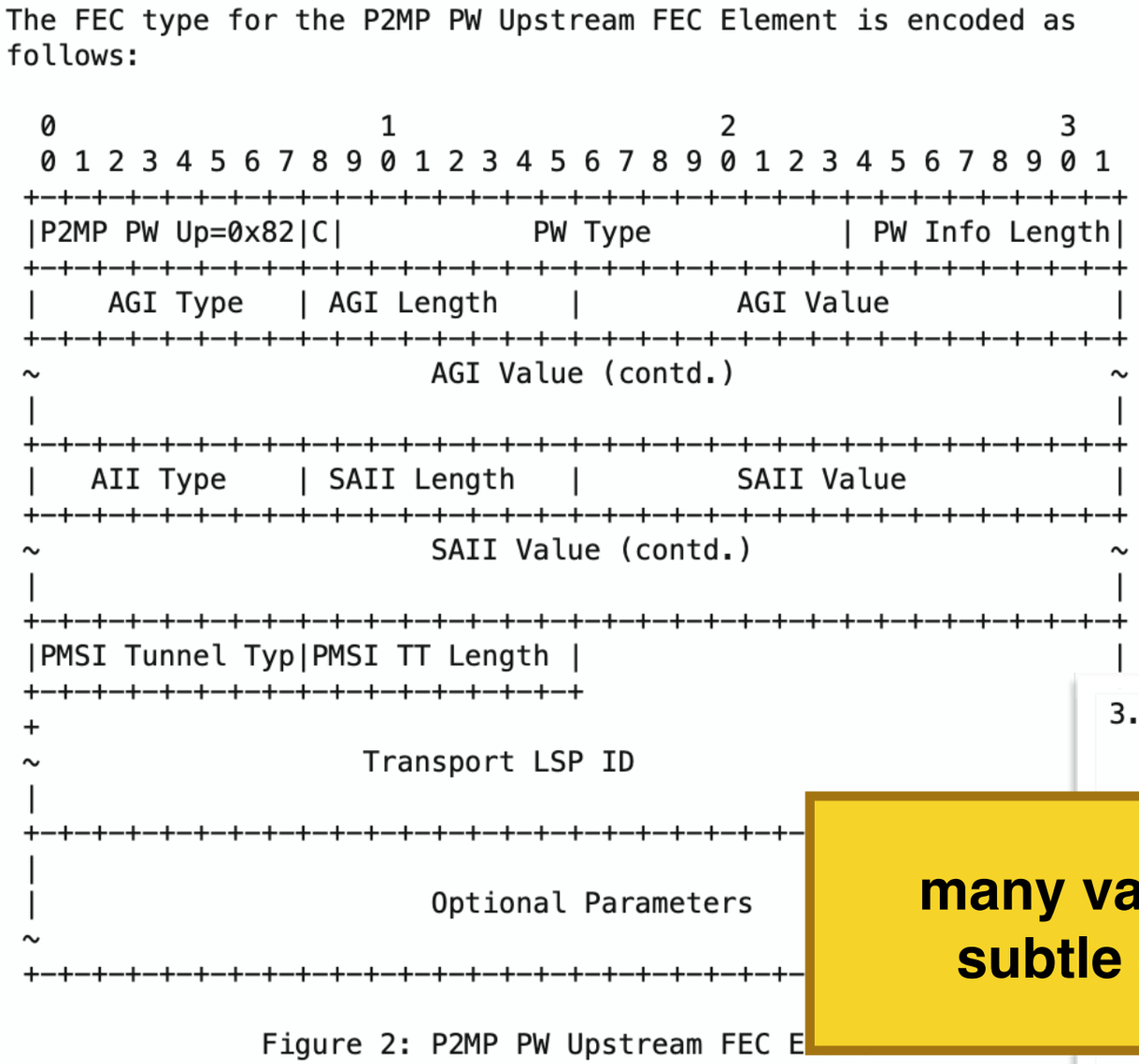

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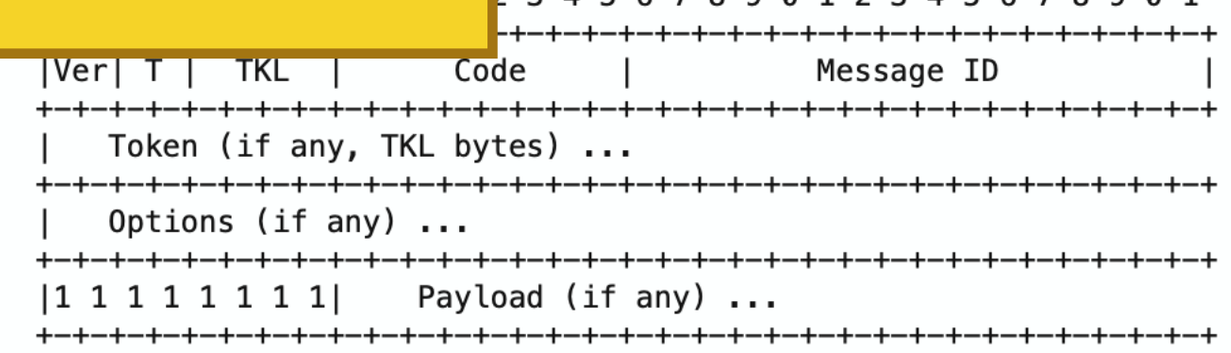

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value for ICMPv6 is 160.

o Code: MUST be set to 0 and

many variations with subtle differences

Parsing packet diagrams

- Subtle differences in structure and English prose make parsing packet diagrams difficult

- But many benefits if we can parse them: can generate parser code, perform continuous integration → better standards

- Many efforts to introduce structured descriptions: ABNF, ASN.1, TLS presentation language, ..

- Clusters of adoption → need a broad framework, not another description language

Discussion

- Help us understand: what are the technical and social obstacles to adoption of structured languages?

- Work is part of a broader project on improving the standards process using structured languages and formal methods

- Stephen McQuistin
  sm@smcquistin.uk

- Colin Perkins
  csp@csperkins.org