Constrained Application Protocol

(RFC 6690, RFC7252, draft-ietf-core-block-17, draft-ietf-core-observe-16)

The Constrained Application Protocol (CoAP) is a specialized web transfer protocol for use with constrained nodes and constrained (e.g., low-power, lossy) networks.

CoAP Message 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Ver| T |  TKL  |      Code     |          Message ID           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Token (if any, TKL bytes) ...
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Options (if any) ...
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|1 1 1 1 1 1 1 1|    Payload (if any) ...
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Ver: Version, T: Type, TKL: Token Length

Message types

Type	Name
0	CONfirmable
1	NON-confirmable
2	ACKnowledgement
3	ReSeT

Method codes

Code	Name
0.00	EMPTY
0.01	GET
0.02	POST
0.03	PUT
0.04	DELETE

Response codes

```
 0
 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+
|class|  detail |
+-+-+-+-+-+-+-+-+
```

Class	
2.xx	Success
4.xx	Client Error
5.xx	Server Error

Code	Description
2.01 (65)	Created
2.02 (66)	Deleted
2.03 (67)	Valid
2.04 (68)	Changed
2.05 (69)	Content
4.00 (128)	Bad Request
4.01 (129)	Unauthorized
4.02 (130)	Bad Option
4.03 (131)	Forbidden
4.04 (132)	Not Found
4.05 (133)	Method Not Allowed
4.06 (134)	Not Acceptable
4.12 (140)	Precondition Failed
4.13 (141)	Request Entity Too Large
4.15 (143)	Unsupported Content-Format
5.00 (160)	Internal Server Error
5.01 (161)	Not Implemented
5.02 (162)	Bad Gateway
5.03 (163)	Service Unavailable
5.04 (164)	Gateway Timeout
5.05 (165)	Proxying Not Supported

Options

No.	C	U	N	R	Name	Format	Length	Default
1	x			x	If-Match	opaque	0-8	(none)
3	x	x	-		Uri-Host	string	1-255	(see note 1)
4				x	ETag	opaque	1-8	(none)
5	x				If-None-Match	empty	0	(none)
7	x	x	-		Uri-Port	uint	0-2	(see note 1)
8				x	Location-Path	string	0-255	(none)
11	x	x	-	x	Uri-Path	string	0-255	(none)
12					Content-Format	uint	0-2	(none)
14		x	-		Max-Age	uint	0-4	60
15	x	x	-	x	Uri-Query	string	0-255	(none)
17	x				Accept	uint	0-2	(none)
20				x	Location-Query	string	0-255	(none)
35	x	x	-		Proxy-Uri	string	1-1034	(none)
39	x	x	-		Proxy-Scheme	string	1-255	(none)
60			x		Size1	uint	0-4	(none)

C=Critical, U=Unsafe, N=No-Cache-Key, R=Repeatable

Note 1: taken from destination address/port of request message

Content-Formats

Media type	Id.
text/plain;charset=utf-8	0
application/link-format	40
application/xml	41
application/octet-stream	42
application/exi	47
application/json	50
application/cbor	60

URI schemes

```
coap-URI = "coap:" "//" host [ ":" port ] path-abempty [ "?" query ]
coaps-URI = "coaps:" "//" host [ ":" port ] path-abempty [ "?" query ]
```

Transmission parameters

name	default value
ACK_TIMEOUT	2 seconds
ACK_RANDOM_FACTOR	1.5
MAX_RETRANSMIT	4
NSTART	1
DEFAULT_LEISURE	5 seconds
PROBING_RATE	1 Byte/second

Link Format .well-known/core

Link format can be used to describe hosted resources, their attributes, and other relationships between links.
Example:

```
REQ: GET /.well-known/core

RES: 2.05 Content

</sensors>;ct=40;title="Sensor Index",
</sensors/temp>;rt="temperature-c";if="sensor",
</sensors/light>;rt="light-lux";if="sensor",
<http://www.example.com/sensors/t123>;anchor="/sensors/temp";rel="describedby",
</t>;anchor="/sensors/temp";rel="alternate"
```

ABNF:

```
Link           = link-value-list
link-value-list = [ link-value *[ "," link-value ]]
link-value     = "<" URI-Reference ">" *( ";" link-param )
link-param     = ( ( "rel" "=" relation-types )
                 / ( "anchor" "=" DQUOTE URI-Reference DQUOTE )
                 / ( "rev" "=" relation-types )
                 / ( "hreflang" "=" Language-Tag )
                 / ( "media" "=" ( MediaDesc
                       / ( DQUOTE MediaDesc DQUOTE ) ) )
                 / ( "title" "=" quoted-string )
                 / ( "title*" "=" ext-value )
                 / ( "type" "=" ( media-type / quoted-mt ) )
                 / ( "rt" "=" relation-types )
                 / ( "if" "=" relation-types )
                 / ( "sz" "=" cardinal )
                 / ( link-extension ) )
link-extension = ( parmname [ "=" ( ptoken / quoted-string ) ] )
                 / ( ext-name-star "=" ext-value )
ext-name-star  = parmname "*" ; reserved for RFC-2231-profiled
                              ; extensions.  Whitespace NOT
                              ; allowed in between.
ptoken         = 1*ptokenchar
ptokenchar     = "!" / "#" / "$" / "%" / "&" / "'" / "("
                 / ")" / "*" / "+" / "-" / "." / "/" / DIGIT
                 / ":" / "<" / "=" / ">" / "?" / "@" / ALPHA
                 / "[" / "]" / "^" / "_" / "`" / "{" / "|"
                 / "}" / "~"
media-type     = type-name "/" subtype-name
quoted-mt      = DQUOTE media-type DQUOTE
relation-types = relation-type
                 / DQUOTE relation-type *( 1*SP relation-type ) DQUOTE
relation-type  = reg-rel-type / ext-rel-type
reg-rel-type   = LOALPHA *( LOALPHA / DIGIT / "." / "-" )
ext-rel-type   = URI
cardinal       = "0" / ( %x31-39 *DIGIT )
LOALPHA        = %x61-7A   ; a-z
quoted-string  = <defined in [RFC2616]>
URI            = <defined in [RFC3986]>
URI-Reference  = <defined in [RFC3986]>
type-name      = <defined in [RFC4288]>
subtype-name   = <defined in [RFC4288]>
MediaDesc      = <defined in [W3C.HTML.4.01]>
Language-Tag   = <defined in [RFC5646]>
ext-value      = <defined in [RFC5987]>
parmname       = <defined in [RFC5987]>
```

Block

In order to transfer larger payloads with CoAP — for instance, for firmware updates — the Block option can be used.

No.	C	U	N	R	Name	Format	Length	Default
23	x	x	-	-	Block2	uint	0-3 B	(none)
27	x	x	-	-	Block1	uint	0-3 B	(none)

```
 0
 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+
|  NUM  |M| SZX |
+-+-+-+-+-+-+-+-+

 0                   1
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           NUM           |M| SZX |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    NUM                  |M| SZX |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Observe

In order to follow state changes of CoAP resources the Observe option can be used.

No.	C	U	N	R	Name	Format	Length	Default
6		x	-		Observe	uint	0-3 B	(none)

References

This cheatsheet is based on and heavily stole from the following documents:

Link-format: http://tools.ietf.org/html/rfc6690
CoAP: http://tools.ietf.org/html/rfc7252
Block: http://tools.ietf.org/html/draft-ietf-core-block-17
Observe: http://tools.ietf.org/html/draft-ietf-core-observe-16