CoAP over Everything

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Familiarity with CoAP

- Heard of CoAP?
- Used CoAP?
- ...on a different transport than UDP or DTLS?
CoAP in 100 words or less

- Protocol for embedded devices
- REST Semantics very similar to HTTP
  GET, PUT, POST, URIs and paths
- compact encoding, easy to process
- UDP based
- extra features: notifications, FETCH method, powerful proxies
Different framing / ... Modified details ... Identical options

Fully specified

Draft

Sketch

Ideal

UDP

DTLS

OSCORE

TCP

WebSocket

TLS

GATT

SLIP

I²C

SPI

1-wire

CAN bus

Zigbee

(Web)USB

XMPP

SCTP

LoRaWAN

NB-IoT

WebSockets

TCP

TLS
A protocol stack diagram is shown, with the following layers:

- **Device (Dev.)**
  - CoAP / UDP
- **IPv6 / Ethernet**
  - UDP
  - 6TiSCH (IEEE 802.15.4)
- **IPv6 / Ethernet**
  - CoAP / UDP
- **Application (App.)**
  - CoAP / UDP

The diagram illustrates the flow from CoAP/UDP to 6TiSCH, then to IPv6/Ethernet, and finally to CoAP/UDP and Application.
No common path to the wire.
App. CoAP / UDP

6TiSCH a5n

Application

Dev.

Proxy

SM

Setc FQLA TLA

Proxy

Dev.
111: ECONNREFUSED
Issues?

- Fragmentation
- Security terminated
End to end security

Application
Dev.

CoAP / UDP
DTLS

Proxy

CoAP / UDP
DTLS

CoAP / UDP
Proxy

CoAP / UDP
OSCORE

Dev.

CoAP / UDP
OSCORE

Dev.
Different framing / ... Modified details ... Identical options

Legend:
- no shared IP
- IP available
- uses IP

Maturity

Similarity with CoAP-over-UDP

Identical

Modified details

Di f f e r e n t framing / options

OSCORE

UNIX sockets

SLIP

NB-IoT

LoRaWAN

SMS

GATT

Bundle

QUIC

WebSockets

TCP

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I²C

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TCP

TLS
Why not IP?

Stack limits
Security
Others

Legend:
- no shared IP
- IP available
- uses IP

Different framing / ... Modified details ... 
Identical options

GATT
SLIP
NB-IoT
LoRaWAN
SMS

UNIX sockets
QUIC
SCTP
LoRaWAN
NB-IoT
WebSockets
TCP
TLS
OSCORE
CoAP on RIOT

- CoAP-over-UDP and DTLS
- Others useful?
Different framing / ... Modified details ... Identical

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Maturity

Similarity with CoAP-over-UDP
Identical Modified details ... Diff erent framing / options
CoAP over UDP

- Base transport: UDP
- Header items: Type (CON/NON/ACK/RST), Code, Message ID, Token
- Reliability: CoAP does retransmits
- Ordering: None – Observe option carries numeric value
CoAP over Serial / slipmux

- Base transport: Serial line running an extended SLIP
- Header items: Type (CON/NON/ACK/RST), Code, Message ID, Token
- Reliability: CoAP does retransmits
- Ordering: Full ordering, but Observe defined as in UDP
- Extras: 2 Byte check-sum integrated in CoAP side
CoAP over TCP

- Base transport: TCP
- Header items: Length, Code, Token
- Reliability: Provided
- Ordering: Provided – Observe is empty
CoAP over GATT

- Base transport: Bluetooth Low Energy’s GATT
- Header items: 1-bit Message ID and confirmation, Code, Token
- Reliability: Partially provided
- Ordering: Provided – Observe is underspecified
CoAP-over-everythin in RIOT: What do we need?

- Header details hidden from application code
- Transport type metadata provided to application
  Alternatively: Higher level abstractions.
- Flexible representations of underlying addresses
- Driver-like model for CoAP transports
Thanks for having me here

Slides and more links on http://christian.amsuess.com/presentations/2023/summit-coap-over-everything/