

# **Constrained Application Protocol (CoAP) Performance Measurement Option**

**draft-fz-core-coap-pm-01**

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# Motivation

A mechanism to measure the performance in CoAP can be useful to verify and meet the operational requirements.

- ✓ It should be a simple mechanism for network diagnostic to be developed on constrained nodes requiring just a minimal amount of collaboration from the endpoints.

It is resource consuming to read IDs / sequence numbers and store timestamps for constrained nodes.

- Performance Measurement in constrained environment needs straightforward methodologies!

# Changes from -00 to -01

Most of the changes are to address the comments and inputs from Christian Amsuess and Thomas Fossati:

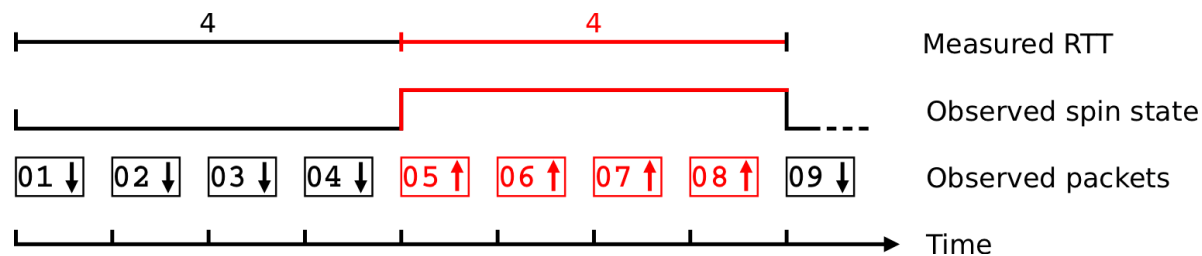
- New considerations in the Introduction and regarding the Structure of the PM Option
- New section on Application Scenarios (end-to-end or segmented measurements)
- Added considerations in the Security section (OSCORE ensures end-to-end integrity protection)

# Spin Bit and sSquare Bit

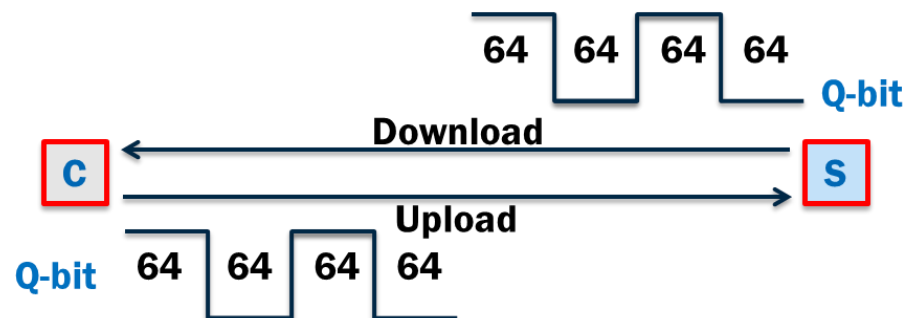
Explicit Flow Measurement (EFM) techniques employ few marking bits, inside the header of each packet, for loss and delay measurement.

These are described in [draft-ietf-ippm-explicit-flow-measurements](#)

- The **Spin bit** idea is to create a square wave signal on the data flow, using a bit, whose length is equal to RTT. It is optional in QUIC (RFC9000)

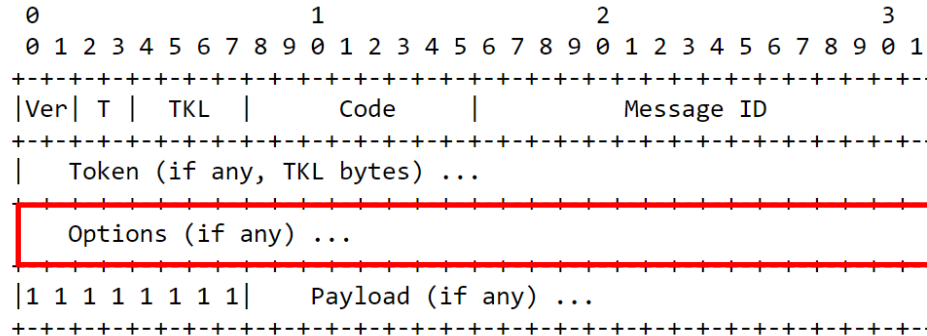


- The **sSquare bit** creates square waves of a known length as defined in the Alternate Marking (RFC8321). This can be used for packet loss (and delay) measurements.

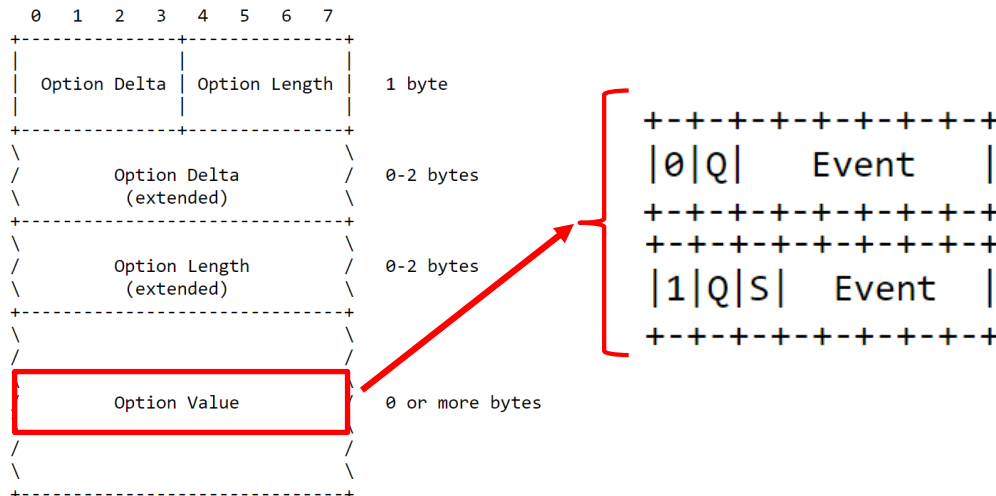


# COAP PM Option

- A new option for CoAP carrying PM bits (in particular Spin bit and sSquare Bit) can be defined



- The PM Option Value can be defined with 1 bit or 2 bits. 2 bits are defined as follows:
  - sSquare Bit (Q) for Packet Loss (and delay) measurement in both Client-Server and Server-Client directions
  - Spin Bit (S) can also be added for RTT measurement (reinforced by the Q bit)



**Example:** the Event bits can be divided into two parts: loss event bits and delay event bits.

- An end point can define different levels of thresholds and set the delay/loss event accordingly.

An on-path observer (Proxy or Gateway) knows the network condition by reading the Event bits.

- It MAY communicate with Client and Server to set some parameters based on the performance.

# Application Scenarios

The main usage of the CoAP PM Options is for end-to-end measurement between the client and the server

Split measurements are also allowed. The intermediaries or on-path observers could be:

- Network Functions or Probes that must be able to see deep into application.
- Gateway or Proxies, tasked by CoAP clients to perform requests on their behalf (RFC7252)
- If the on-path observers are network functions or probes, the CoAP PM Option can be applied end-to-end between client and server.
  - The on-path network probes can read Q bit and S bit and implement the relevant algorithms to measure losses and RTT. Otherwise they can simply read the Event bits and be informed about the performance without implementing any algorithm.
- If the on-path observers are CoAP proxies, the CoAP PM Option can only be applied to the different separate connections between client and server.
  - The measurements can be segmented: between the Proxies or between a Proxy and a Client or between a Proxy and the Server.
  - It could also be possible to bundle different clients if they are mixed. An alternative can be to use the Option only for a single client at once.
  - Communication may happen with different servers, and in this case it is necessary to check the other fields to understand the server.

# Key Points and Benefits

- No IDs/sequence numbers for packet loss and flexible timestamp handling to measure RTT. The method is simple to meet the requirement of constrained nodes.
  - Equip the CoAP with Performance Measurement bits to enable RTT and Loss metrics.
- Proposal to improve the Q bit mechanism and find a synergy with S bit in order to simplify the application. Q bit can also be used alone to measure loss and delay.
  - Constrained nodes need simple way to do performance measurements
- Possible advanced usage:

Addition of event signaling bits for on-path observers. The on-path observer can be the Proxy or a Gateway to interconnect disjointed CoAP networks.

  - This information could be used to adjust protocol parameters (e.g. timeout values) based on the real network performance.
  - It could also be possible to decide whether to use reliable or unreliable message transmission based on network conditions

# Next Steps

- This draft is based on well-known methodologies applied in RFC9000 (Spin Bit) and RFC8321 (sSquare Bit).
- It aims to meet the limited resources of constrained environment.

Welcome questions, comments

Thank you