Client-Server Explicit Performance Measurements: 2bit Packet Loss

draft-cfb-ippm-spinbit-measurements-01

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2bit Packet Loss Explicit Measurement

Our 2bit Packet Loss measurement it's an enhancement of the methodology described in: draft-ferrieuxhamchaoui-quic-lossbits

In the above draft two bits of a protocol header (e.g QUIC, TCP,...) are used to mark the production traffic between Client and Server.

The 2 bits are the sQuare bit (Q-bit) and Loss bit (L-bit):

- The Q-bit creates square waves of a known length (e.g. 64 packets): RFC 8321 Alternate Marking
- The L-bit is set in a packet by the end-point when the protocol signals a retransmission.

In our draft the R-bit substitutes the L-bit.

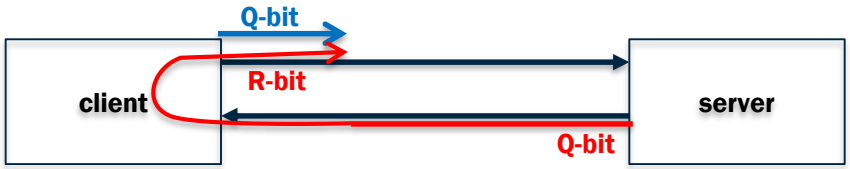
The Reflection square bit (R-bit).

Our idea is to reflect the Q-bit in the opposite direction using the R-bit.

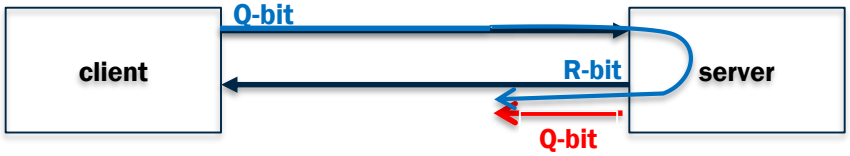
The sizes of the transmitted R-bit blocks are the **"average sizes"** of the received Q-bit blocks.

This idea allows to have continuous alternate marked packet blocks in both directions.

The Client generates the Q-bit signal and reflects the received Q-bit signal using the R-bit signal:



The Server does the same in the opposite direction:



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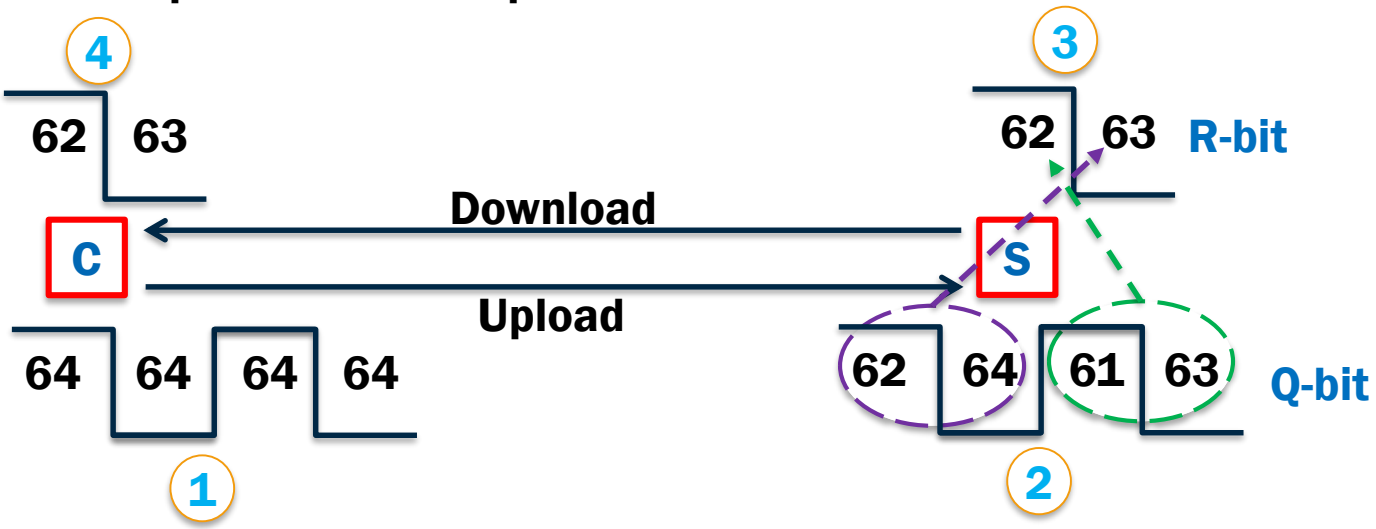
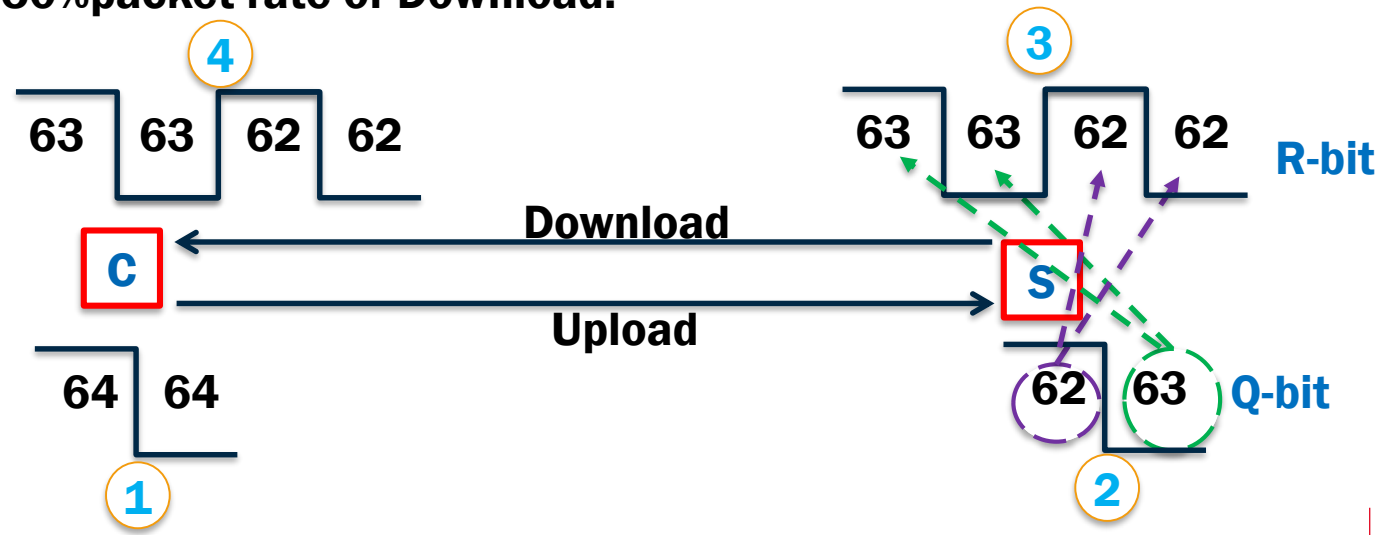
Example: Upload Packet Loss with different packet rates

Download 50% packet rate of Upload:



Upload 50%packet rate of Download:



R-bit Algorithm

«When the transmission of a new R-block starts, its size M is set equal to the size of the last Q-marked period whose reception has been completed;

if, before transmission of the R-block is terminated, the reception of at least one further Q-marked period is completed, the size of the R-block is updated to the average size of the further received Q-marked periods»

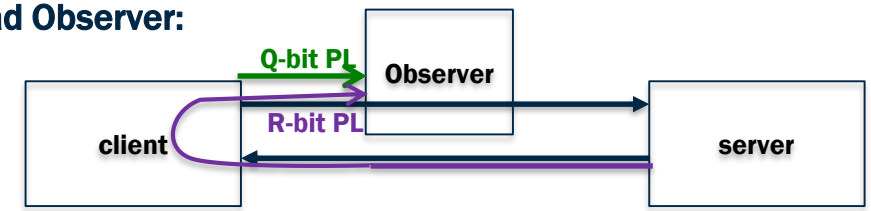
Algorithm properties:

- It works in both cases when the reflected packets number is greater than those received and when the reflected packets number is lower.
- All traffic is measured (all the production traffic has both the Q-bit and the R-bit marked)

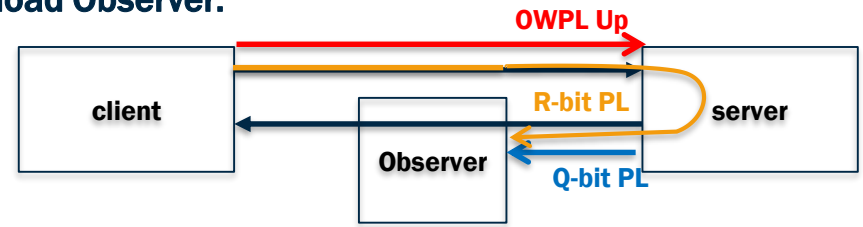
One direction Observer:

- **Download Observer:**

- **Upload Observer:**

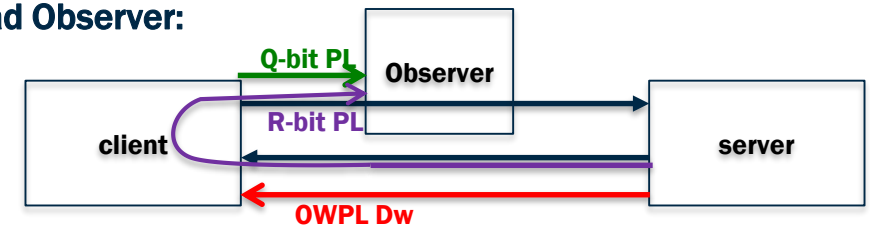


- **Download Observer:**



OWPL Up = R-bit PL Dw – Q-bit PL Dw

- **Upload Observer:**

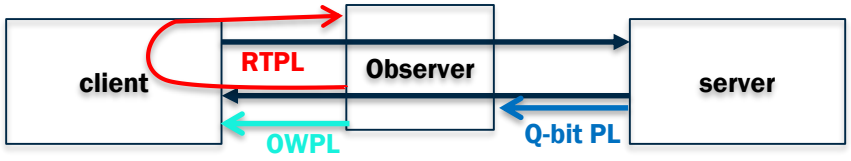


OWPL Dw = R-bit PL Up – Q-bit PL Up

OWPL: One Way Packet Loss

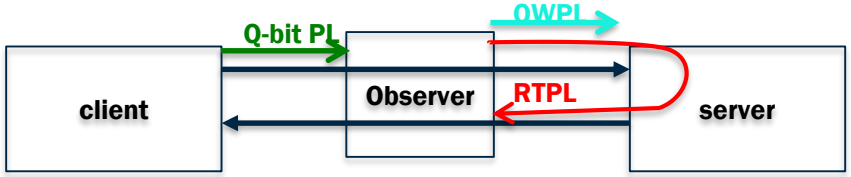
Two direction Observer:

- **Observer-Client RTPL and OWPL:**



RTPL =R-bit PL Up – Q-bit PL Dw ⇨ RTPL – Q-bit PL Up= OWPL

- **Observer-Server RTPL and OWPL:**



RTPL =R-bit PL Dw – Q-bit PL Up ⇨ RTPL – Q-bit PL Dw= OWPL

RTPL: Round Trip Packet Loss
OWPL: One Way Packet Loss

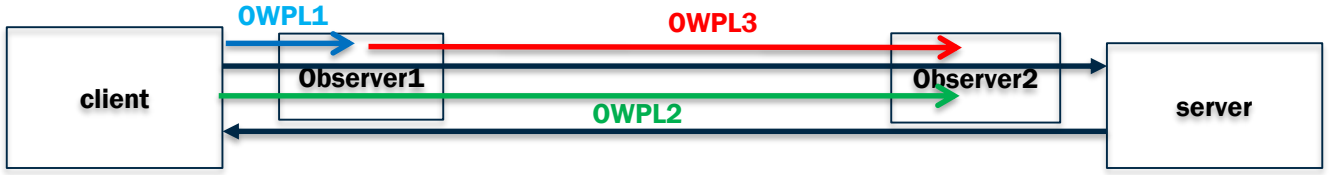
L-bit versus R-bit

L-bit weaknesses (& R-bit strengths):

1. The dependence from an internal protocol variable not directly connected to losses but to retransmissions.
2. Ack packet losses are not correctly detected.
3. The loss measurement signal is inaccurate in case of losses.

2Point One-Way Packet Loss (Q-bit only)

- Observer2-Observer1 OWPL:



Observer2-Observer1 One-Way: OWPL2 – OWPL1 = OWPL3

- Observer1-Observer2 OWPL:

Observer1-Observer2 One-Way: OWPL1 – OWPL2 = OWPL3