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Differentiated Service Code Point and Explicit Congestion Notification
Monitoring in Two-Way Active Measurement Protocol (TWAMP)
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Abstract

This document describes an optional extension for Two-Way Active Measurement Protocol (TWAMP) allowing the monitoring of the Differentiated Service Code Point and Explicit Congestion Notification fields with the TWAMP-Test protocol.

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[1.](#) Introduction

The One-Way Active Measurement Protocol (OWAMP) [[RFC4656](#)] defines the Type-P Descriptor field and negotiation of its value in OWAMP-Control protocol. The Two-Way Active Measurement Protocol (TWAMP) [[RFC5357](#)] states that only a Differentiated Services Code Point (DSCP) [[RFC2474](#)], [[RFC3168](#)], [[RFC3260](#)] value can be defined by Type-P Descriptor and the negotiated value must be used by both Session-Sender and Session-Reflector. The TWAMP specification also states that the same DSCP value (found in the Session-Sender packet) MUST be used in the test packet reflected by the Session-Reflector. However the TWAMP-Test protocol does not specify any methods to determine or report when the DSCP value has changed or is different than expected in the forward or reverse direction. Re-marking the DSCP (changing its original value) in IP networks is possible and often accomplished by a Differentiated Services policy configured on a single node along the IP path. In many cases, a change of the DSCP value indicates an unintentional or erroneous behavior. At best, the Session-Sender can detect a change of the DSCP reverse direction assuming such change is

actually detectable.

This document describes an OPTIONAL feature for TWAMP. It is called the DSCP and ECN Monitoring. It allows the Session-Sender to know the actual DSCP value received at the Session-Reflector. Furthermore

this feature tracks the Explicit Congestion Notification (ECN) [[RFC2474](#)], [[RFC3168](#)], [[RFC3260](#)] value received at the Session-Reflector. This is helpful to determine if ECN is actually operating or if an ECN-capable node has detected congestion in the forward direction.

[1.1.](#) Conventions used in this document

[1.1.1.](#) Terminology

DSCP: Differentiated Services Code Point

ECN: Explicit Congestion Notification

IPPM: IP Performance Measurement

TWAMP: Two-Way Active Measurement Protocol

OWAMP: One-Way Active Measurement Protocol

[1.1.2.](#) Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

[2.](#) TWAMP Extensions

TWAMP connection establishment follows the procedure defined in [Section 3.1 of \[RFC4656\]](#) and [Section 3.1 of \[RFC5357\]](#) where the Modes field is used to identify and select specific communication capabilities. At the same time the Modes field been recognized and used as an extension mechanism [[RFC6038](#)]. The new feature requires a new flag to identify the ability of a Session-Reflector to return value of received DSCP and ECN values back to a Session-Sender, and

to support the new Session-Reflector packet format in the TWAMP-Test protocol. See the [Section 3](#) for details on the assigned bit position.

[2.1.](#) Setting Up Connection to Monitor DSCP and ECN

The Server sets the DSCP and ECN Monitoring flag in the Modes field of the Server Greeting message to indicate its capabilities and willingness to monitor them. If the Control-Client agrees to monitor DSCP and ECN on some or all test sessions invoked with this control connection, it MUST set the DSCP and ECN Monitoring flag in the Modes field in the Setup Response message.

[2.2.](#) TWAMP-Test Extension

Monitoring of DSCP and ECN requires support by the Session-Reflector and changes the test packet format in all the original (unauthenticated, authenticated and encrypted) modes. Monitoring of DSCP and ECN does not alter the Session-Sender test packet format but certain considerations must be taken when and if this mode is accepted in combination with Symmetrical Size mode [[RFC6038](#)].

[2.2.1.](#) Session-Reflector Packet Format for DSCP and ECN Monitoring

When the Session-Reflector supports DSCP and ECN Monitoring it constructs the Sender DSCP and ECN (S-DSCP-ECN) field, presented in Figure 1, for each test packet it sends to Session-Sender according to the following procedure:

- o the six (least-significant) bits of the Differentiated Service field MUST be copied from received Session-Sender test packet into Sender DSCP (S-DSCP) field;
- o the two bits of the ECN field MUST be copied from received Session-Sender test packet into Sender ECN (S-ECN) field.

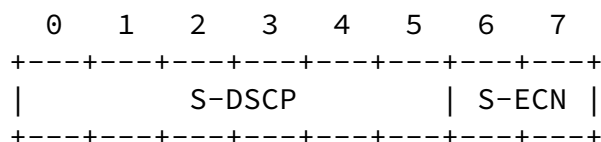
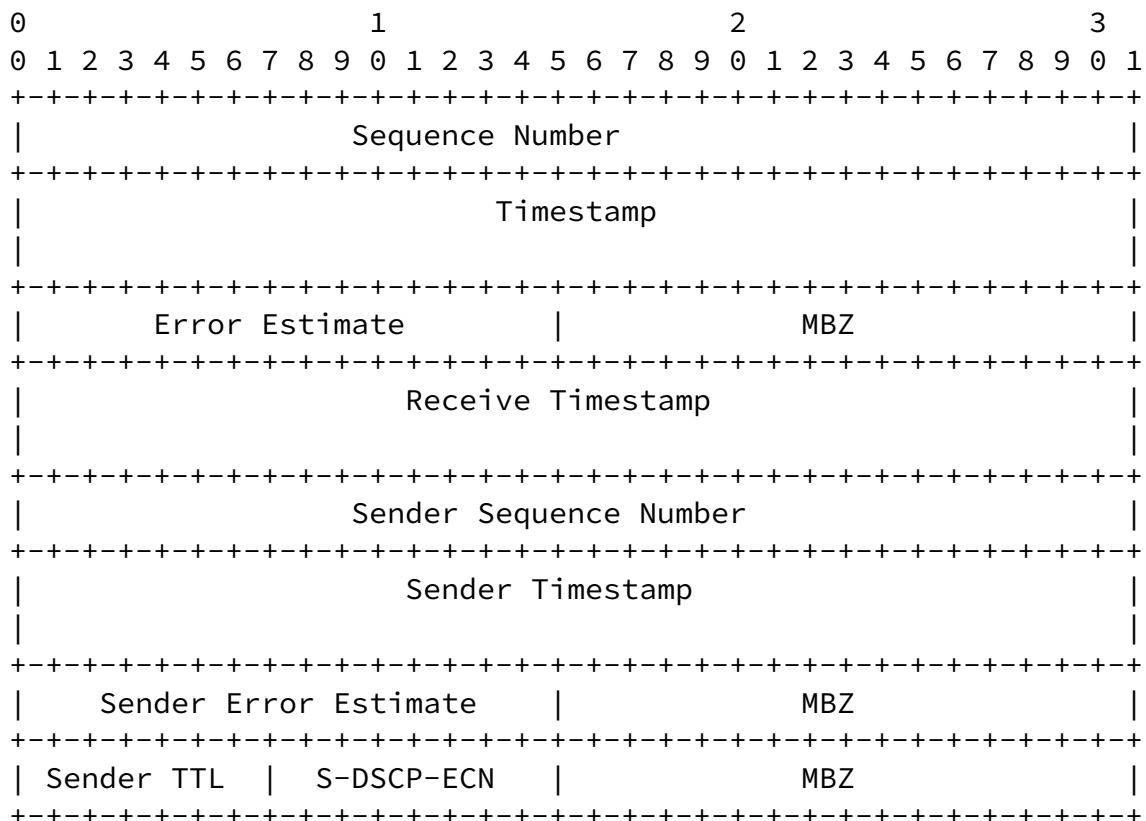


Figure 1: Sender DSCP and ECN field format

Formats of the test packet transmitted by the Session-Reflector in unauthenticated, authenticated and encrypted modes been defined in [Section 4.2.1 \[RFC5357\]](#). For the Session-Reflector that supports DSCP and ECN Monitoring these formats are displayed in Figure 2 and Figure 3.

For unauthenticated mode:



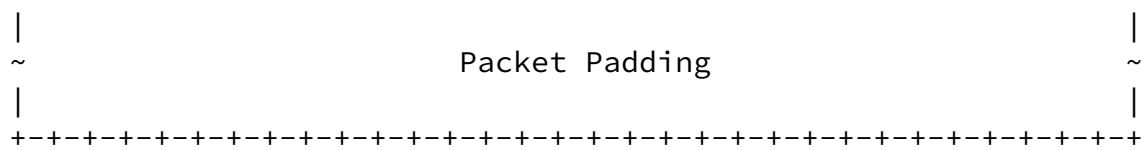


Figure 2: Session-Reflector test packet format with DSCP and ECN Monitoring in unauthenticated mode

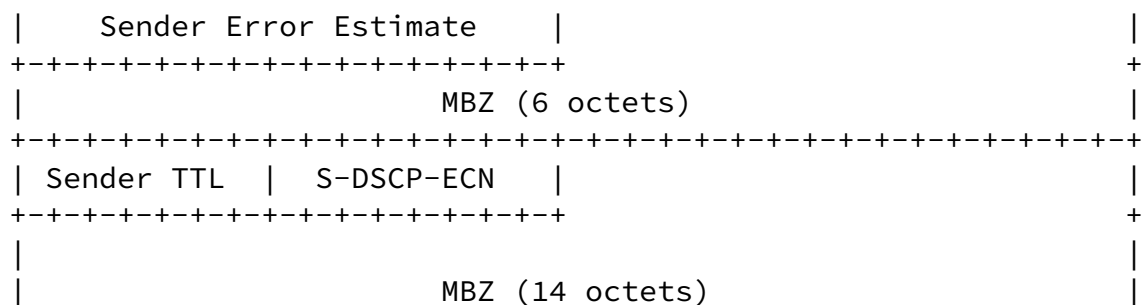
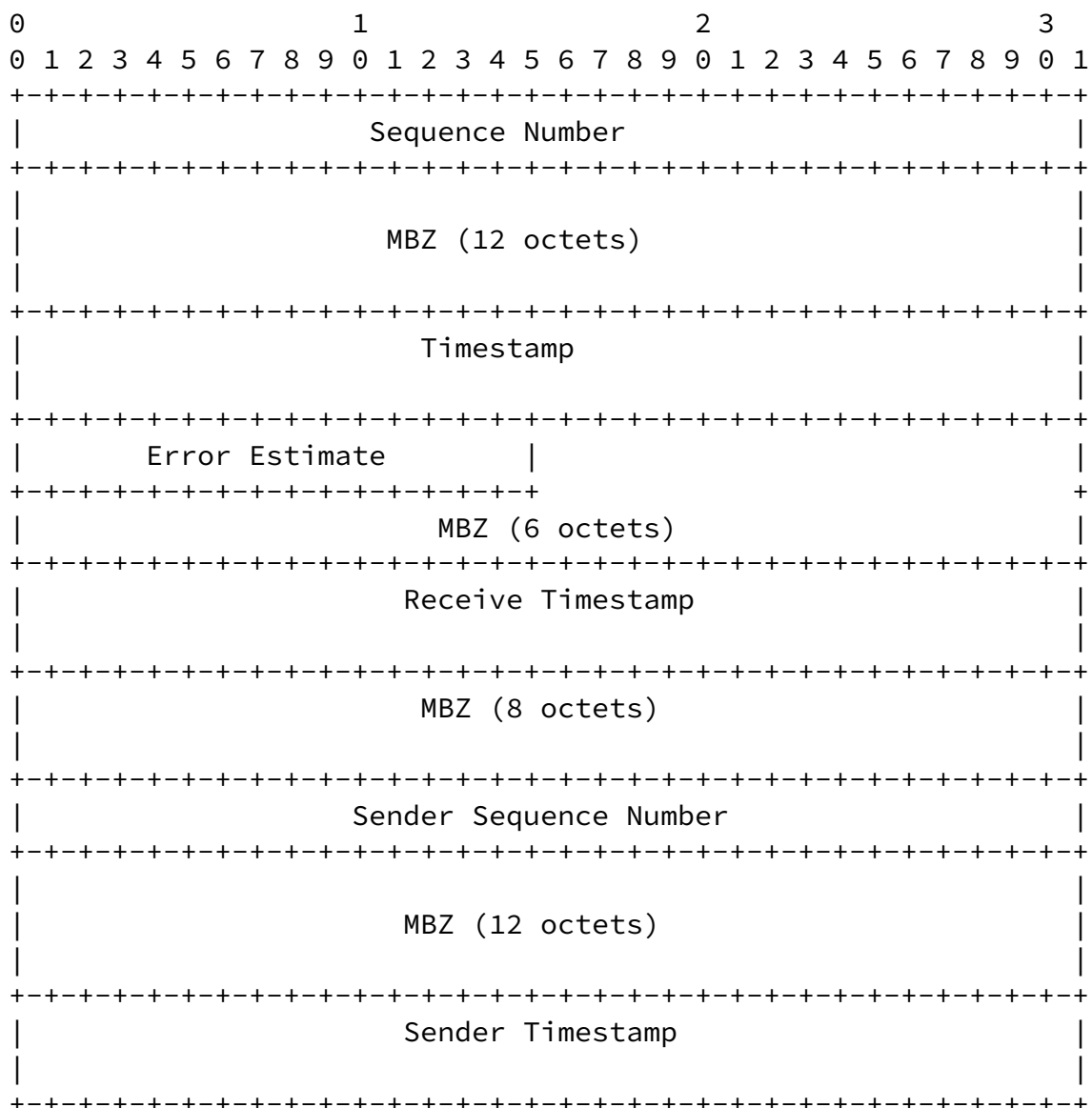
The DSCP and ECN values (part of the Type-P Descriptor [[RFC4656](#)]) can be provisioned through TWAMP-Control or by other means (CLI or Central Controller). The DSCP and ECN values are often copied into reflected test packets with current TWAMP implementations without TWAMP-Control protocol. With DSCP and ECN Monitoring Extension, the Session-Reflector handles DSCP as following:

- o the Session-Reflector MUST extract the DSCP and ECN values from the received packet and MUST populate with them S-DSCP-ECN field of the corresponding reflected packet;
- o the Session-Reflector MUST transmit each reflected test packet with DSCP set to the provisioned value;
- o if the provisioned DSCP value is not known (e.g. TWAMP Light), the choice of the DSCP is implementation specific. For instance, Session-Reflector MAY copy the DSCP value from the received test

- packet and set it as DSCP in a reflected packet. Alternatively Session-Reflector MAY set DSCP value to CS0 (zero) [[RFC2474](#)];
- o if the provisioned ECN value is not known, ECN SHOULD be set to Not-ECT codepoint value [[RFC3168](#)]. Otherwise, the provisioned ECN value for the session SHALL be used.

A Session-Reflector in the DSCP and ECN Monitoring mode does not analyze, nor acts on ECN value of the received TWAMP test packet and therefore ignores congestion indications from the network. It is expected that sending rates are low enough, as TWAMP deployment experience had demonstrated since TWAMP base [RFC 5357](#) publication in 2008, that ignoring these congestion indications will not significantly contribute to network congestion.

For authenticated and encrypted modes:



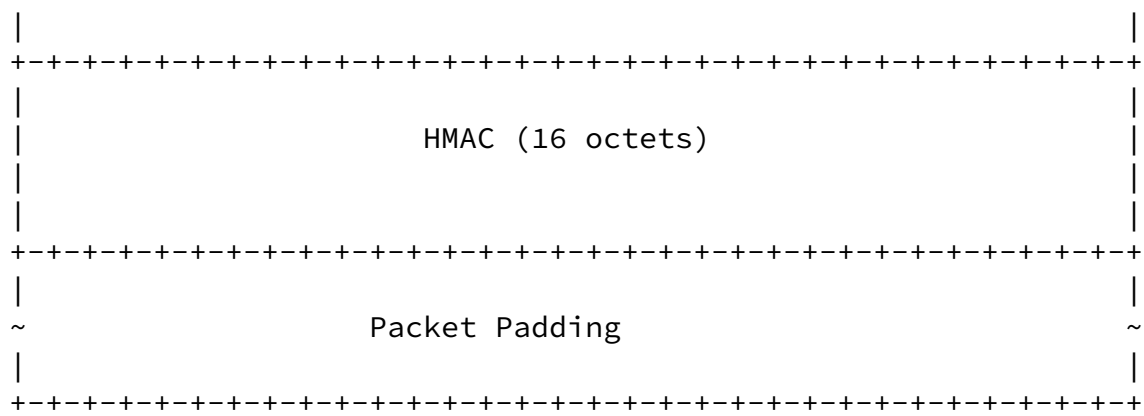


Figure 3: Session-Reflector test packet format with DSCP and ECN Monitoring in authenticated or encrypted modes

2.2.2. DSCP and ECN Monitoring with [RFC 6038](#) extensions

[RFC6038] defined two extensions to TWAMP. First, to ensure that Session-Sender and Session-Reflector exchange TWAMP-Test packets of equal size. Second, to specify number of octets to be reflected by Session-Reflector. If DSCP and ECN Monitoring and Symmetrical Size and/or Reflects Octets modes are being negotiated between Server and Control-Client in Unauthenticated mode, then, because Sender DSCP and Sender ECN increase size of unauthenticated Session-Reflector packet by 4 octets, the Padding Length value SHOULD be ≥ 28 octets to allow for the truncation process that TWAMP recommends in [Section 4.2.1 of \[RFC5357\]](#).

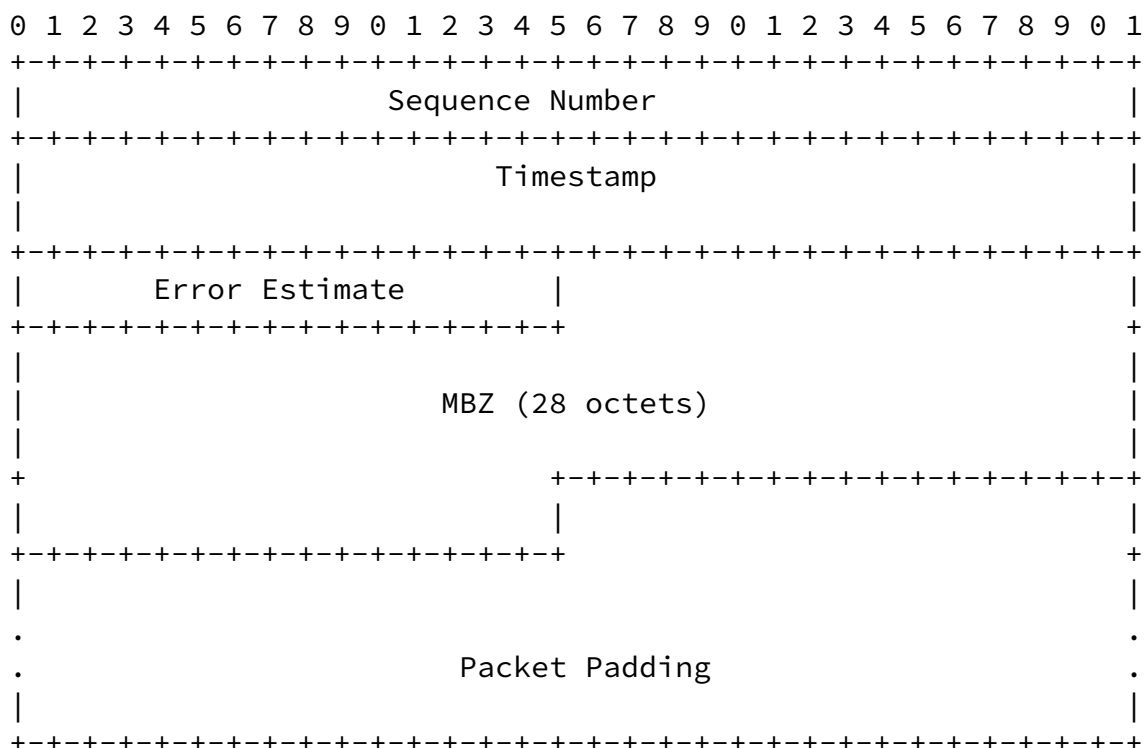


Figure 4: Session-Sender test packet format with DSCP and ECN Monitoring and Symmetrical Test Packet in unauthenticated mode

2.2.3. Consideration for TWAMP Light mode

[Appendix I of \[RFC5357\]](#) does not explicitly state how the value of the Type-P Descriptor is synchronized between Session-Sender and Session-Reflector and whether different values are considered as error condition and SHOULD be reported. We assume that by some means the Session-Sender and the Session-Reflector of the given TWAMP-Test session been informed to use the same DSCP value. Same means, i.e. configuration, could be used to inform Session-Reflector to support DSCP and ECN Monitoring mode by copying data from received TWAMP test packets. Then Session-Sender may be informed to use Sender DSCP and ECN field in reflected TWAMP test packet.

3. IANA Considerations

The TWAMP-Modes registry defined in [\[RFC5618\]](#).

IANA is requested to reserve a new DSCP and ECN Monitoring Capability as follows:

Bit	Description	Semantics Definition	Reference
TBA	DSCP and ECN Monitoring Capability	Section 2	This document

Table 1: New Type-P Descriptor Monitoring Capability

4. Security Considerations

Monitoring of DSCP and ECN does not appear to introduce any additional security threat to hosts that communicate with TWAMP as defined in [[RFC5357](#)], and existing extensions [[RFC6038](#)]. Sections such as 3.2, 4., 4.1.2, 4.2, and 4.2.1 of [[RFC5357](#)] discuss unauthenticated, authenticated, and encrypted modes in varying degrees of detail. The security considerations that apply to any active measurement of live networks are relevant here as well. See the Security Considerations sections in [[RFC4656](#)] and [[RFC5357](#)].

5. Acknowledgements

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