Compact Alternate Marking Methods

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Alternate Marking - Background

Monitor data traffic from MP 1 to MP 2

- Loss
- Delay

MP = Measurement Point
Alternate Marking (draft-ietf-ippm-alt-mark)

Every data packet includes a color bit.

Traffic Flow:
- MP 1: AAAAA BBBBB AAAAA BBBBB
- MP 2: AAAAA BBBBB

Marking Bit:
- Time: 00000 11111 00000 11111

Time:
Scope of the Current Draft

• New alternate marking methods with low overhead.
  – Single bit per packet.
  – Zero bits per packet.

• Summary of alternate marking methods.
Existing Alternate Marking Methods
(draft-ietf-ippm-alt-mark)
Double Marking

Traffic Flow

Color Bit: $C=\begin{array}{c}00000 \\ 00100\end{array}$

Timestamp Bit: $T=\begin{array}{c}11111 \\ 00100\end{array}$

• Color indication.
• Timestamp indication.
Method 1: Single Marking – 1st Packet

Traffic Flow:
- AAAAA BBBBB AAAAA BBBBB

Color Bit: C=
00000 11111 00000 11111

First packet of each block is timestamped.

Delay measurement
Method 2: Single Marking – Mean Delay

Traffic Flow: AAAAA BBBBB AAAAA BBBBB
Color Bit: C = 00000 11111 00000 11111

Delay measurement:
All packets are timestamped, compute average of each block.
New Methods for Single-bit Marking
Method 3: Multiplexed Marking

- **A single bit** is used for C / T
- Same measurement resolution as double marking

Traffic Flow

<table>
<thead>
<tr>
<th></th>
<th>AAAAA</th>
<th>BBBBB</th>
<th>AAAAA</th>
<th>BBBBB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Bit: C=</td>
<td>00000</td>
<td>11111</td>
<td>00000</td>
<td>11111</td>
</tr>
<tr>
<td>Timestamp Bit: T=</td>
<td>00100</td>
<td>00100</td>
<td>00100</td>
<td>00100</td>
</tr>
</tbody>
</table>

Using only one bit: \( T \oplus C \)

Packets that should be timestamped

<table>
<thead>
<tr>
<th></th>
<th>AAAAA</th>
<th>BBBBB</th>
<th>AAAAA</th>
<th>BBBBB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>00100</td>
<td>11011</td>
<td>00100</td>
<td>11011</td>
</tr>
</tbody>
</table>
Method 4: Pulse Marking

Packets used for timestamping, counter-stamping

Both measurement points capture the value of the:
- Counter.
- Timestamp.
Methods for Zero-bit Marking
Hash-based Selection

• Hash is computed over packet header.
• If Hash = `SelectedValue`
  Packet is selected for measurement

• It is possible to use a mixed approach:
  – Color bit
  – Hash-based sampling for delay measurement
Summary
<table>
<thead>
<tr>
<th>Method</th>
<th># of bits</th>
<th># of LM</th>
<th>DM</th>
<th>Resilience to Reordering</th>
<th>Resilience to Packet drops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double marking</td>
<td>2</td>
<td>2</td>
<td>Step</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Single marking</td>
<td>1</td>
<td>2</td>
<td>Step</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>- 1st packet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single marking</td>
<td>1</td>
<td>2</td>
<td>Mean</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>- mean delay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiplexed marking</td>
<td>1</td>
<td>2</td>
<td>Step</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Pulse marking</td>
<td>1</td>
<td>1</td>
<td>Pulse</td>
<td>--</td>
<td>+</td>
</tr>
<tr>
<td>Hashed pulse marking</td>
<td>0</td>
<td>1</td>
<td>Hashed</td>
<td>--</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pulse</td>
<td></td>
</tr>
<tr>
<td>Hashed double marking</td>
<td>0</td>
<td>2</td>
<td>Hashed</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>step*</td>
<td></td>
</tr>
<tr>
<td>Mixed hashed marking</td>
<td>1</td>
<td>2</td>
<td>Step</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pulse</td>
<td></td>
</tr>
</tbody>
</table>

+ Accurate measurement.
- No measurement in case of disturbance (detectable).
-- False measurement in case of disturbance (not detectable).
* Hashed step works only when the hash is monotonically increasing.
IETF 99 Bits-n-Bites Alternate Marking Demo

- Alternate marking using one bit.
- Multiplexed marking approach.
- TimeFlips* are used for the color toggling.

Draft History and Status

• October 2016 – draft 00 submitted.
• Discussed at IETF 97, IETF 98.
• Draft 02 – major revision.

• Next step:
  – Ask for working group adoption.
Thanks!
Multiplexed Marking using **Two Values**

Instead of a single marking bit ➔ A marking field with **two values**: U, W.

E.g., two MPLS labels

[draft-bryant-mpls-rfc6374-sfl]

Traffic Flow

```
AAAAA BBBBB AAAAA BBBBB
```

Using a **field with two values**:

```
UUWUU WWUWW UUWUU WWUWW
```

The value of the field in timestamped packets is toggled.

Packets that should be timestamped
Related Work

• This presentation summarizes [1].
• The alternate marking method was first presented in [2], and later evolved into [3], [4]. Alternate marking using a conventional timestamp field is discussed in [5].
• The most updated version of the alternate marking working document is [3].
• Security considerations are discussed in [3] and in [1]. Security considerations of time protocols are discussed in [6].
References


