BGP Flowspec Payload Matching

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Background and Motivations

- BGP Flowspec is widely deployed today for n-tuple type filtering using header fields such as IP Prefix, IP protocol, TCP/UDP port number etc...

- Recent advancements to IP router forwarding plane filter implementation can allow matches at arbitrary location within the packet header or payload

- In the context of DDoS mitigation, this new capability can be used to essentially match a signature for the attack traffic and can be combined with traditional n-tuple filter criteria to mitigate volumetric DDoS attacks and reduce false positive to a minimum.
Background and Motivations

- New Flowspec component type for matching a pattern value with the IP packet header or payload

- Enhances DDoS mitigation capability by matching a pattern within the data in addition to IP/Port typical match

- Allow to match header fields not defined in Flowspec RFC yet or across fields

- Allow to match across headers

Component Encoding: `<type (1 octet), length (1 octet), value>`

Value field encoding: `<offset-type (4 bits), offset-value (2 octets), pattern-type (4 bits), pattern-value (variable)>`
Specifications - Offset

- **Offset-type** and **offset-value** define where the match should begin for the pattern-value
  - Offset type 0 - start of the IP header
  - Offset type 1 - start of the data portion of the IP header after the IP options
  - Offset type 2 - start of the TCP or UDP data

- The **offset-value** defines the number of bytes to ignore in the packet from the offset-type to match the pattern value.

- Examples:
  - The combination of offset-type 0 (Layer 3) and offset-value 0 defines an offset at the very beginning of the IP header.
  - The combination of offset-type 2 (Payload) and offset-value 10 defines an offset ten bytes after the beginning of the TCP/UDP data payload.
Specifications - Pattern

- The pattern-type defines how the pattern value is matched
  - Pattern Type 0 – Bitmask match
  - Pattern Type 1/2 – Regular expressions (software forwarding planes, appliances …)

- Bitmask match encoded as \{prefix, mask\} of equal length
  - prefix - Provides a bit string to be matched. The prefix and mask fields are bitwise AND'ed to create a resulting pattern.
  - mask - Paired with the prefix field to create a bit string match. An unset bit is treated as a 'do not care' bit in the corresponding position in the prefix field. When a bit is set in the mask, the value of the bit in the corresponding location in the prefix field must match exactly.
Specifications - Example

- Matching on the UDP NTP Request Code value 0x2a can be achieved using:
  - Component type 4 for IP Protocol UDP
  - Component type TBD for Flexible Match Condition with:
    - Offset type = 2 for TCP/UDP Payload
    - Offset value = 3 (for 3 bytes after the beginning of the data)
    - Pattern type = 0 (bitmask)
    - Pattern value Prefix = 0x2a
    - Pattern value Mask = 0xFF
Further Action

• Comments and feedbacks?

• Registration of a new component type?
Thank You