Packet Manipulation with MikroTik Firewalls

By Rick Frey

About the Presenter

- Rick Frey
  - 20+ years in IT & Communication Industries
  - Designed and implemented a wide array of networks all of the world
  - Introduced to the MikroTik product line in 2008
  - Areas of Focus:
    - Wireless services integration
    - ISP Solutions
  - Certifications
    - Certified –MTCNA, MTCRE, MTCTCE, MTCWE, MTCT

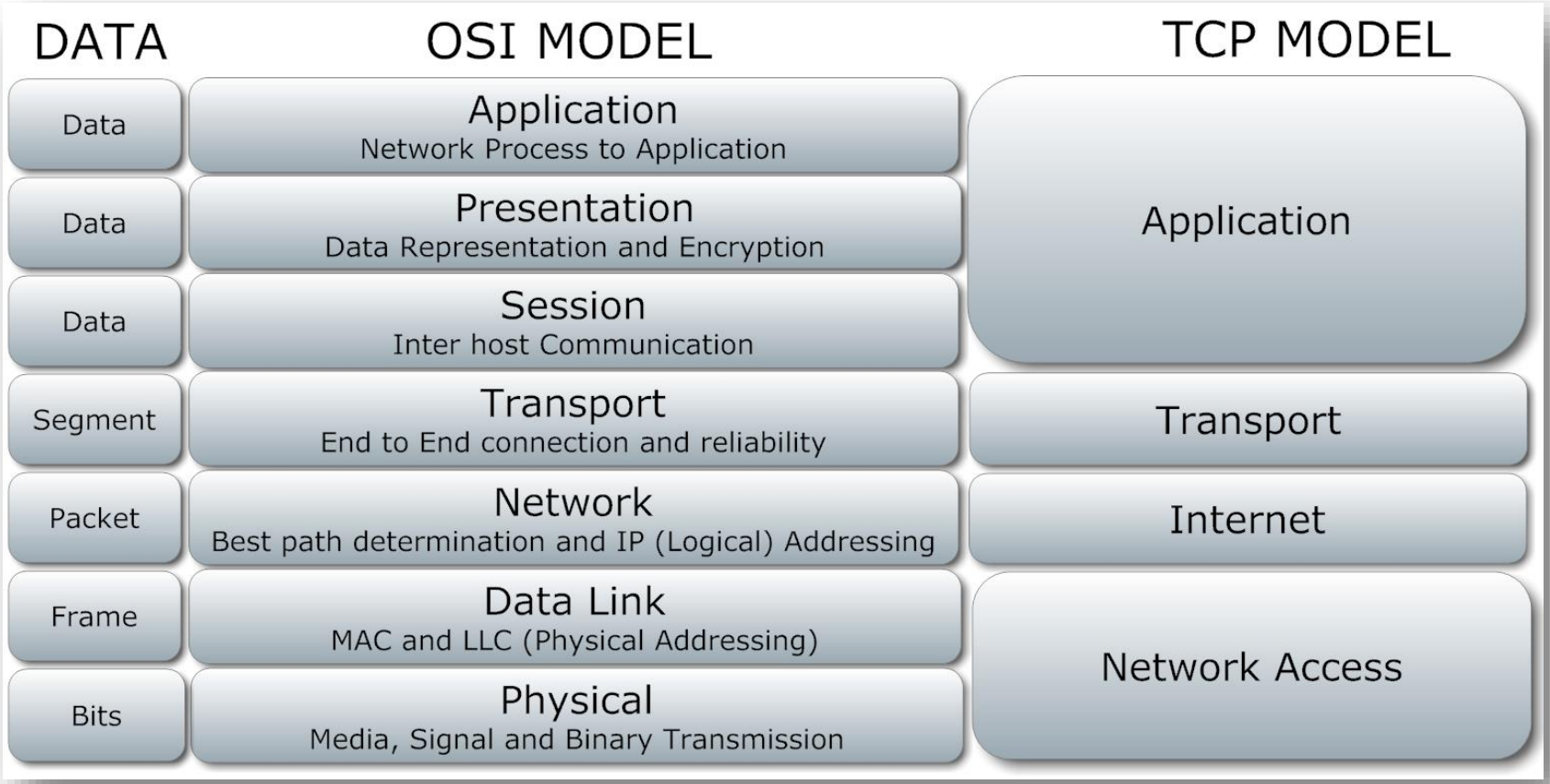
Upcoming Training Opprotunities

April 27-30	Dallas, TX	MTCTCE & MTCWE
May 25-29	Atlanta, GA	MTCNA & MTCRE
Jun 8-12	Kansas City	MTCNA & MTCRE
Jun 29-Jul 2	Omaha, NE	MTCWE & MTCTCE
Jul 6-10	Little Rock	MTCNA & MTCTCE
Jul 20-24	Phoenix, AZ	MTCNA & MTCRE
Aug 17-21	Norfolk, VA	MTCNA & MTCRE
Aug 24-28	D.C.	MTCNA & MTCRE
Sep 7-11	Dallas, TX	MTCNA & MTCWE
Sep 21-25	Albuquerque	MTCNA & MTCRE

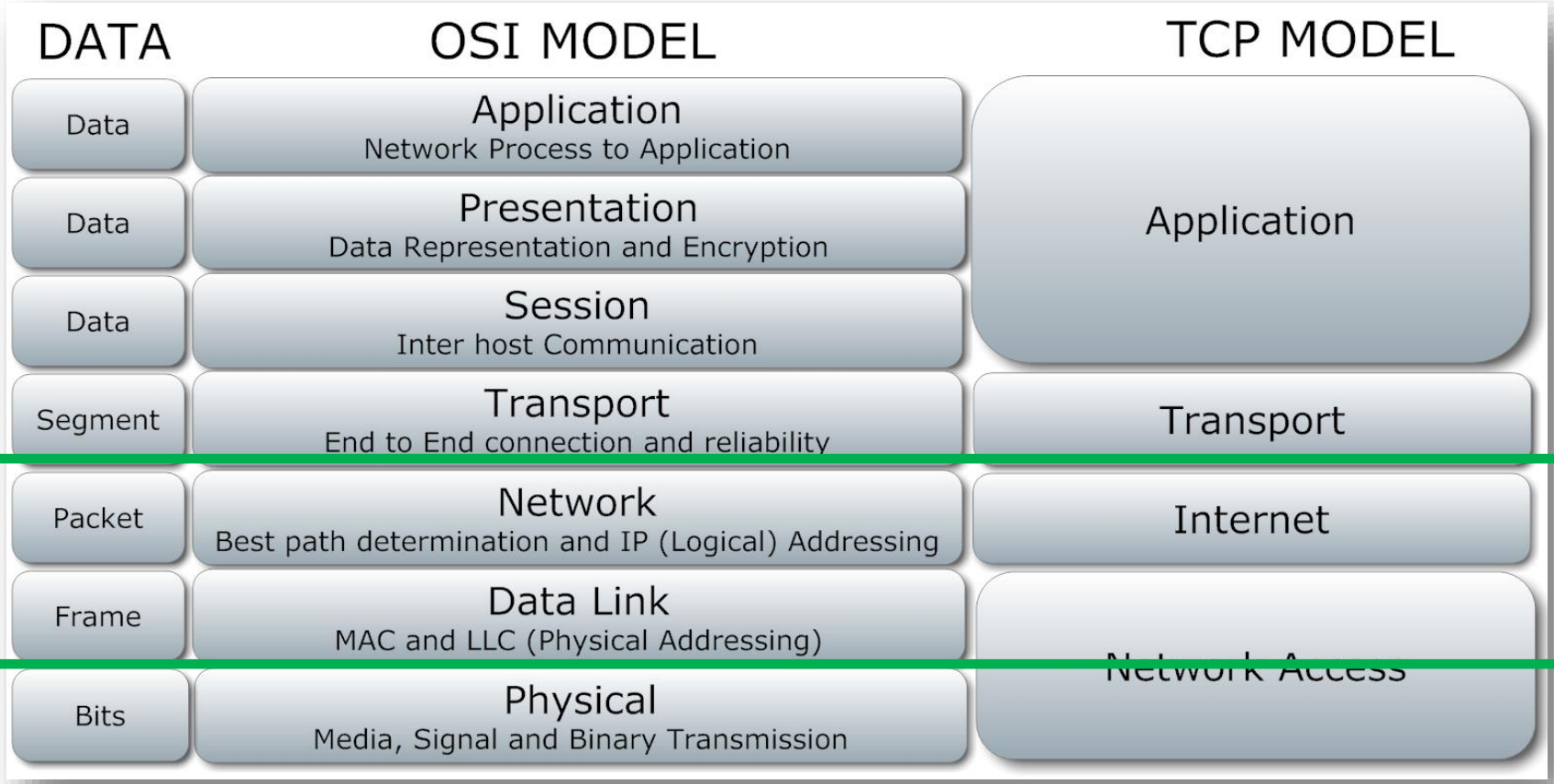
Objectives

- Explain what/ how much of a Layer 2 Frame can be manipulated
- Explain what parts of the Layer 2 Frame can be filtered against
- Explain what/ how much of the Layer 3 Packet can by manipulated
- Explain what parts of the Layer 3 Packet can be filtered against
- Explanation of the firewall rules that apply

Networking Models



Networking Models



Layer 2 Ethernet Frame

Layer	Preamble	Start of frame delimiter	MAC Destination Address	MAC Source Address	802.1Q tag (optional)	Ethertype (Ethernet II) or length (IEEE 802.3)	Payload	Frame Check Sequence (32-bit CRC)	Interpacket Gap
	7 octets	1 octet	6 octets	6 octets	(4 octets)	2 octets	46(42 min with 802.1Q tag)–1500 octets	4 octets	12 octets
Layer 2 Ethernet frame			← 64–1518(1522) octets →						
Layer 1 Ethernet packet	← 72–1526(1530) octets →								

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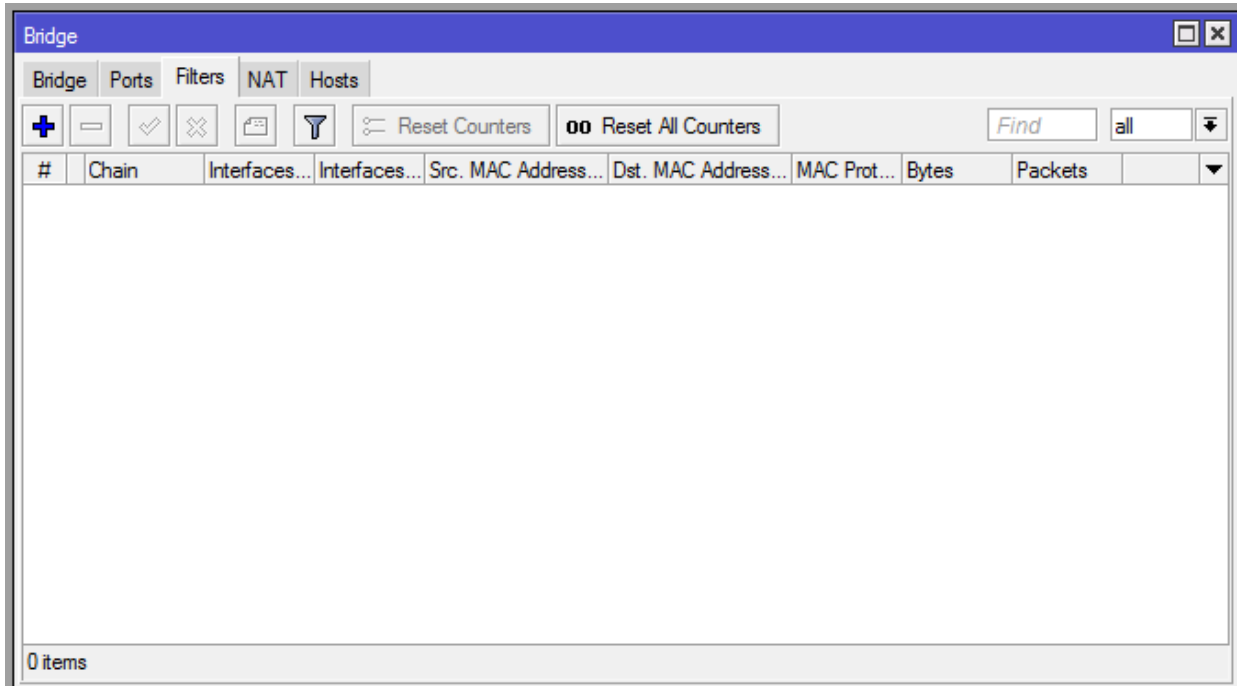
Portion which can be captured for analysis

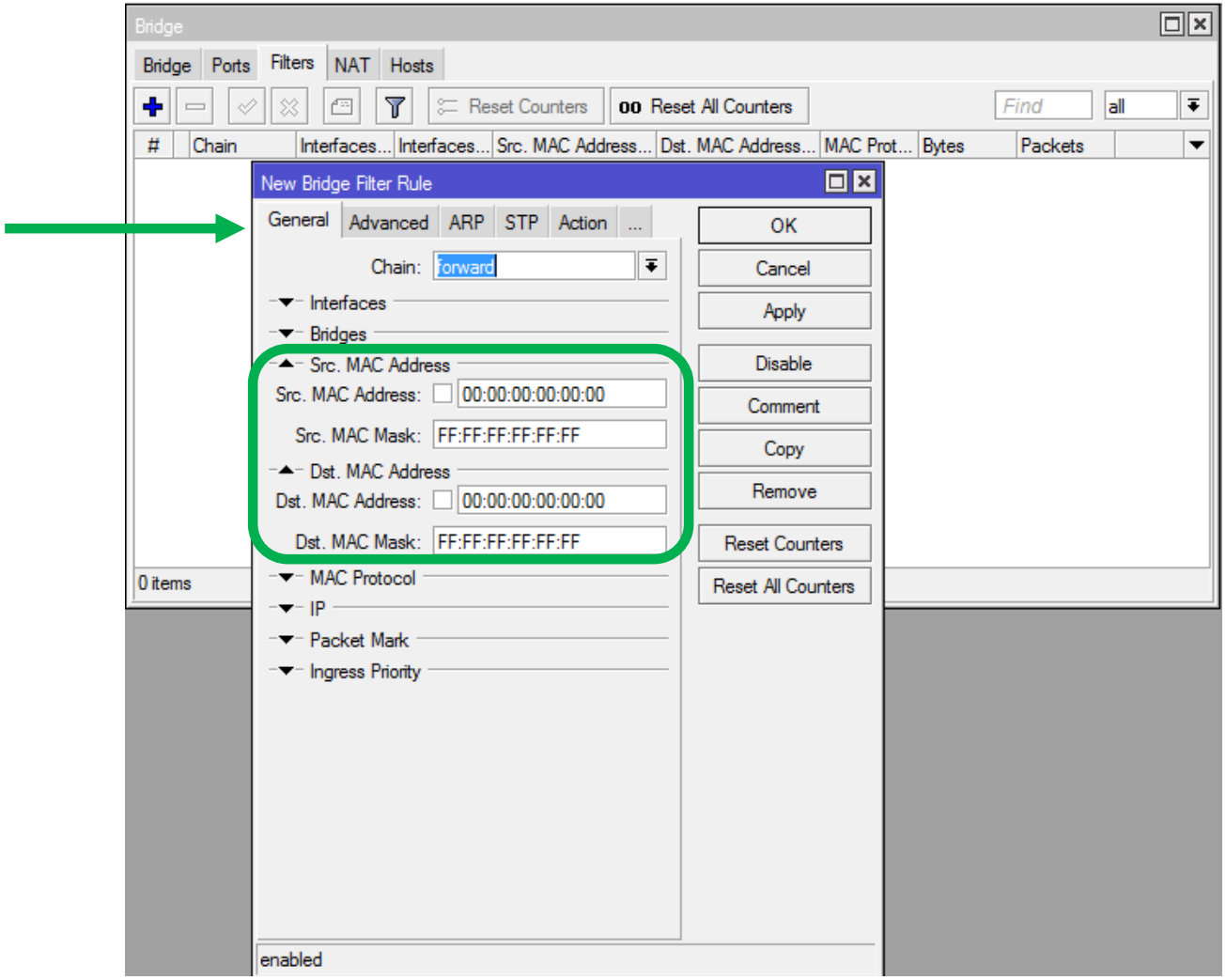
Filtering the Layer 2 Packet with the Bridge Firewall

Bridge Filters & NAT

- Both the Filters & NAT tabs have the same filtering options. Only the actions are different.

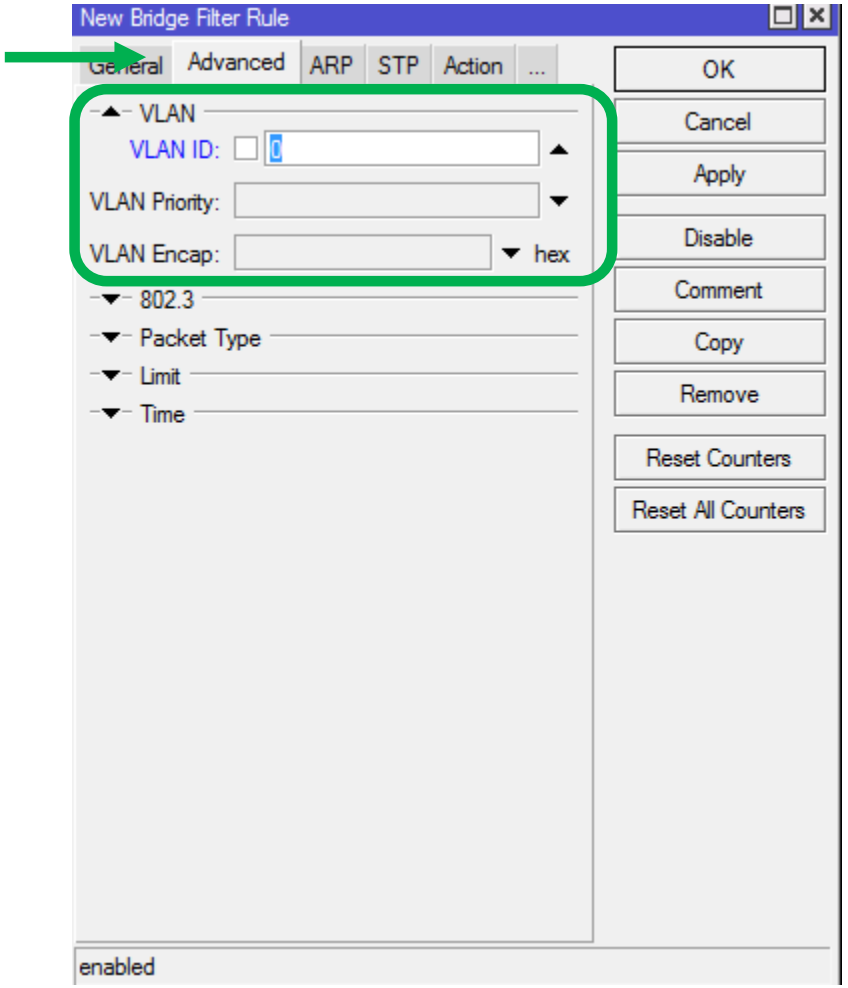


Source /Destination MAC Field



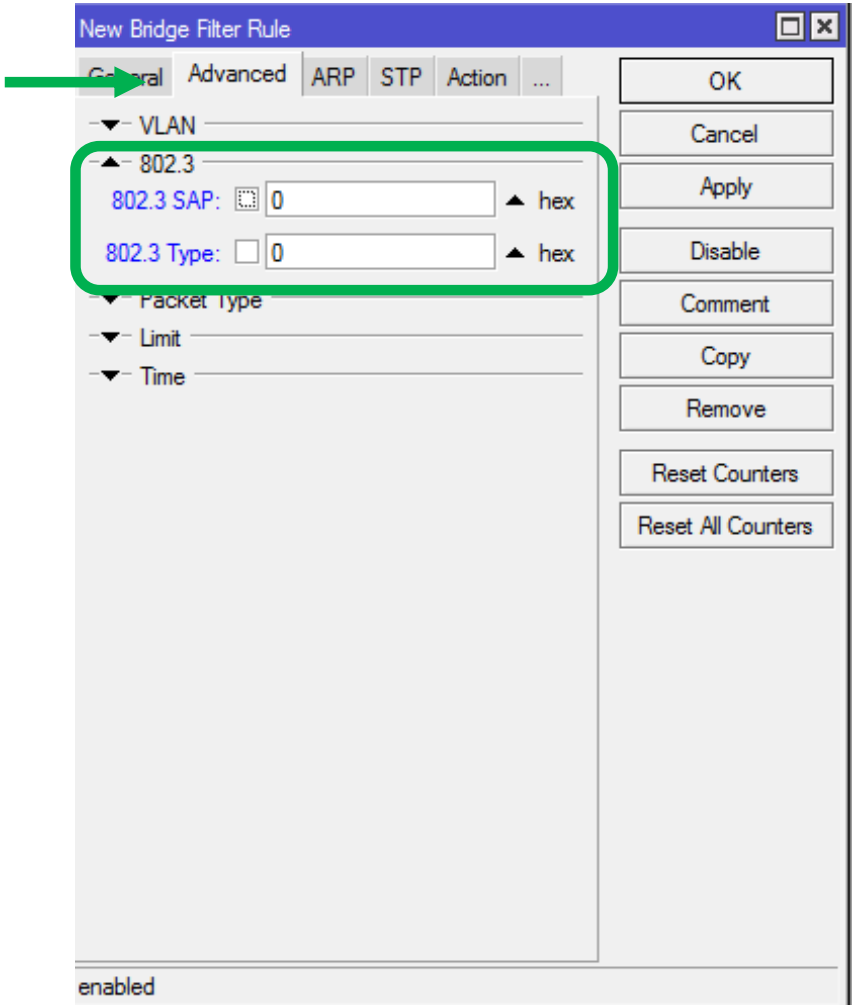
802.1Q Tag Field

- **vlan-id** (*integer 0..4095*)
- **vlan-priority** (*integer 0..7*)
- **vlan-encap** (*802.2 | arp | ip | ipv6 | ipx | length | mpls-multicast | mpls-unicast | pppoe | pppoe-discovery | rarp | vlan or integer: 0..65535 decimal format or 0x0000-0xffff hex format*)



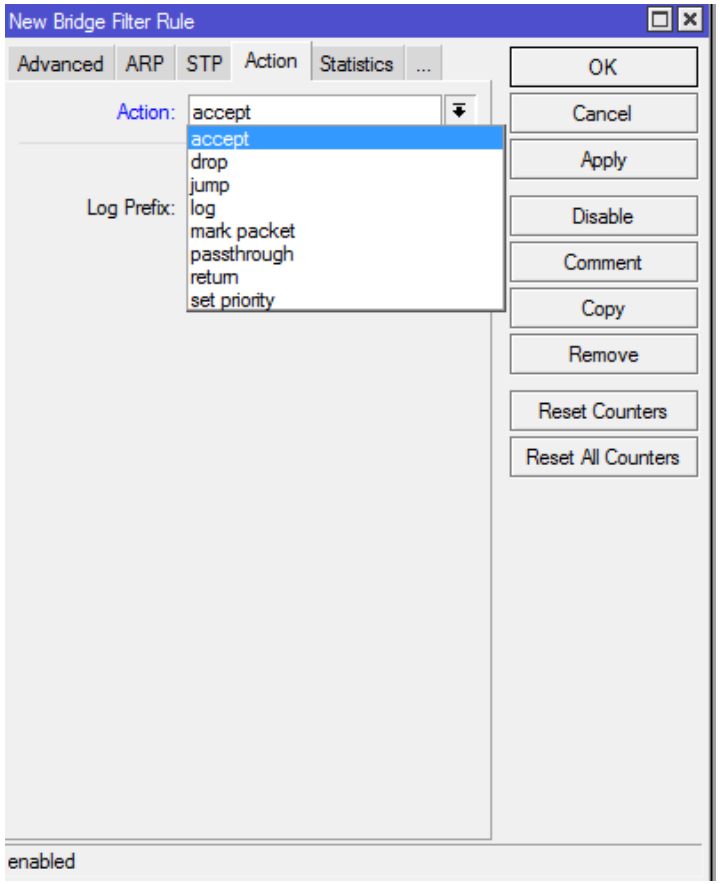
Ethernet Type Field

- **802.3-sap** (*integer*)
  - Example: 0xAA
- **802.3-type** (*integer*)
  - Example: 0x809B

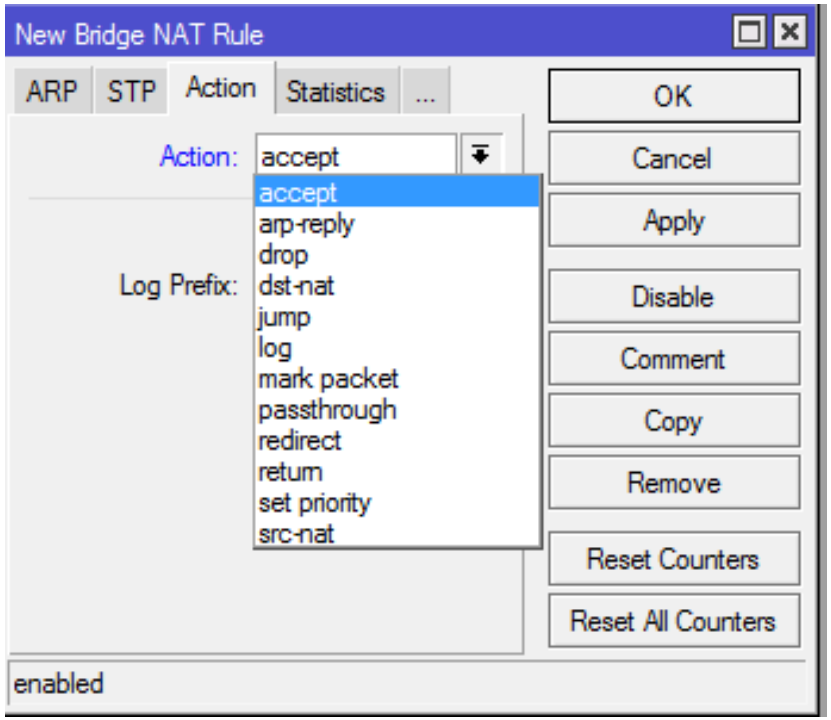


Bridge Firewall Actions

Filter Actions



NAT Actions

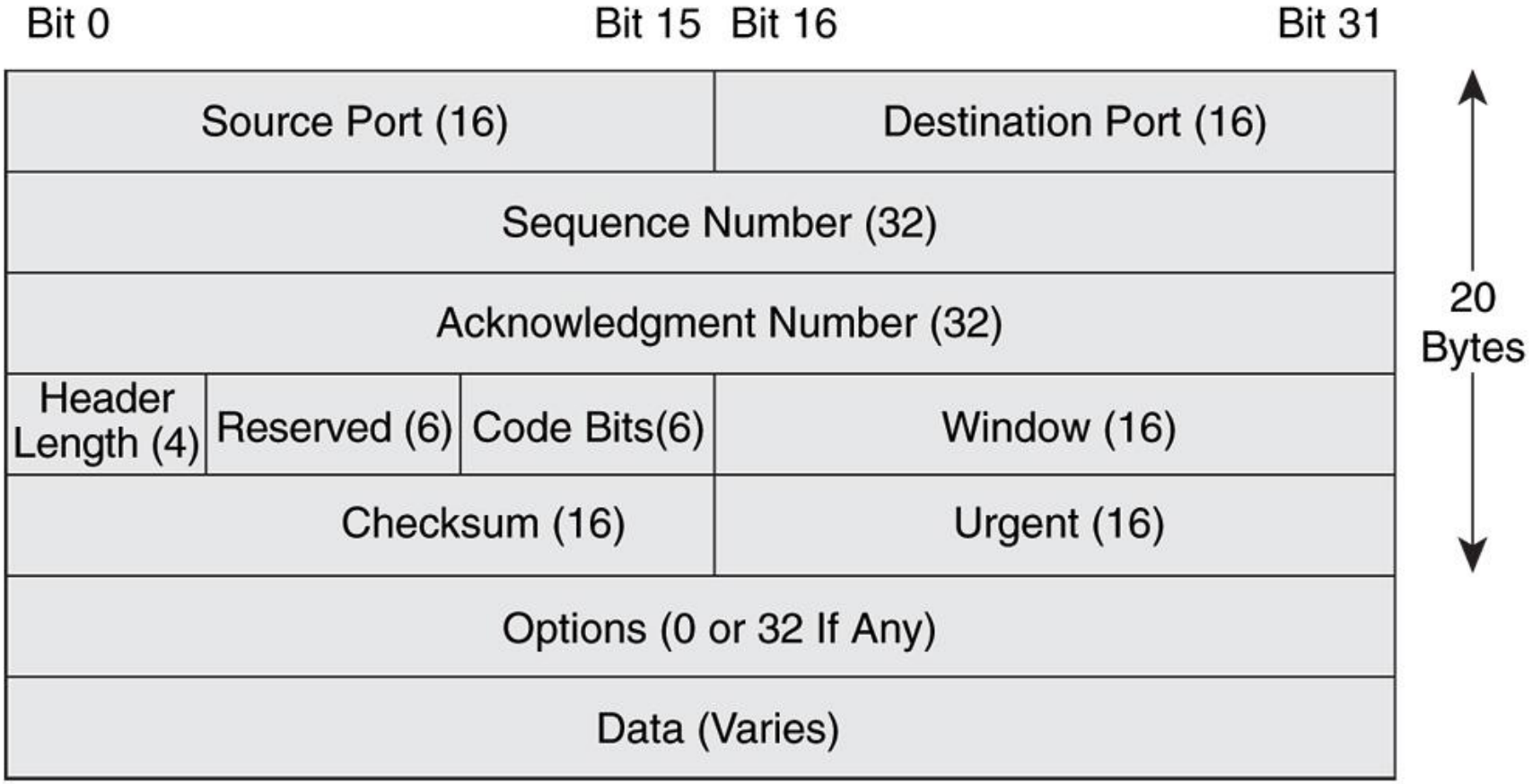


Primary Actions for Bridge Firewall

- Drop
- Set Priority
- Src-NAT
- Dst-NAT

Layer 3 Packets

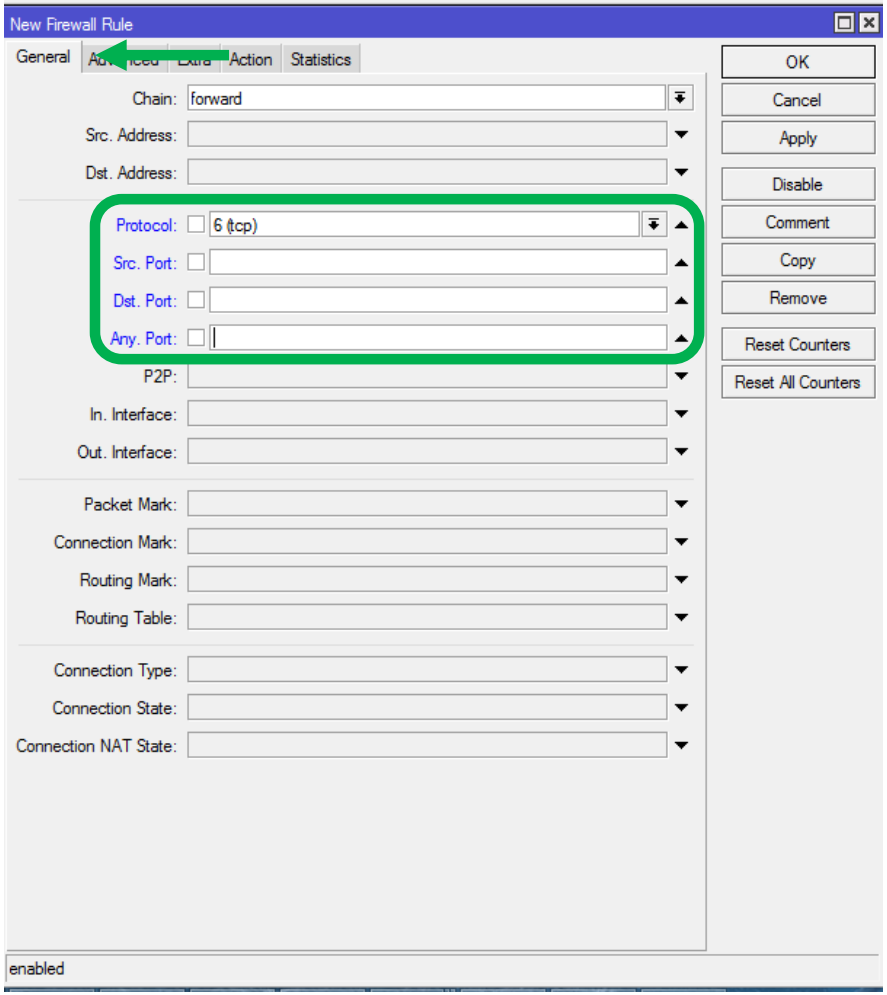
TCP Header (L2 Frame Payload)



Filtering Layer 3 Packets with the Firewall

Source/ Destnation Port Fields

- Protocol (25 Supported)
- Src Port
- Dst Port
- Any Port

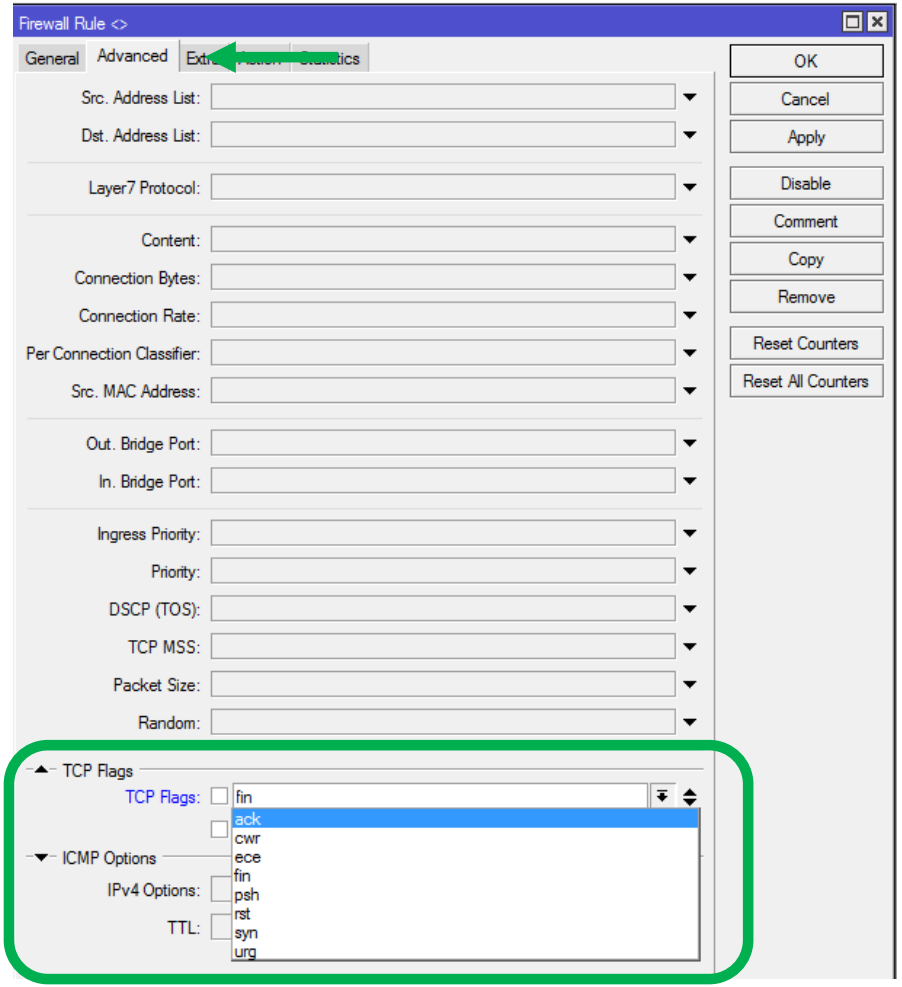


Sequence #, Ack#, Header Len Fields

- Difficult to match exact values

Code Bits/Flags Field

- **ack** - acknowledging data
- **cwr** - congestion window reduced
- **ece** - ECN-echo flag (explicit congestion notification)
- **fin** - close connection
- **psh** - push function
- **rst** - drop connection
- **syn** - new connection
- **urg** - urgent data

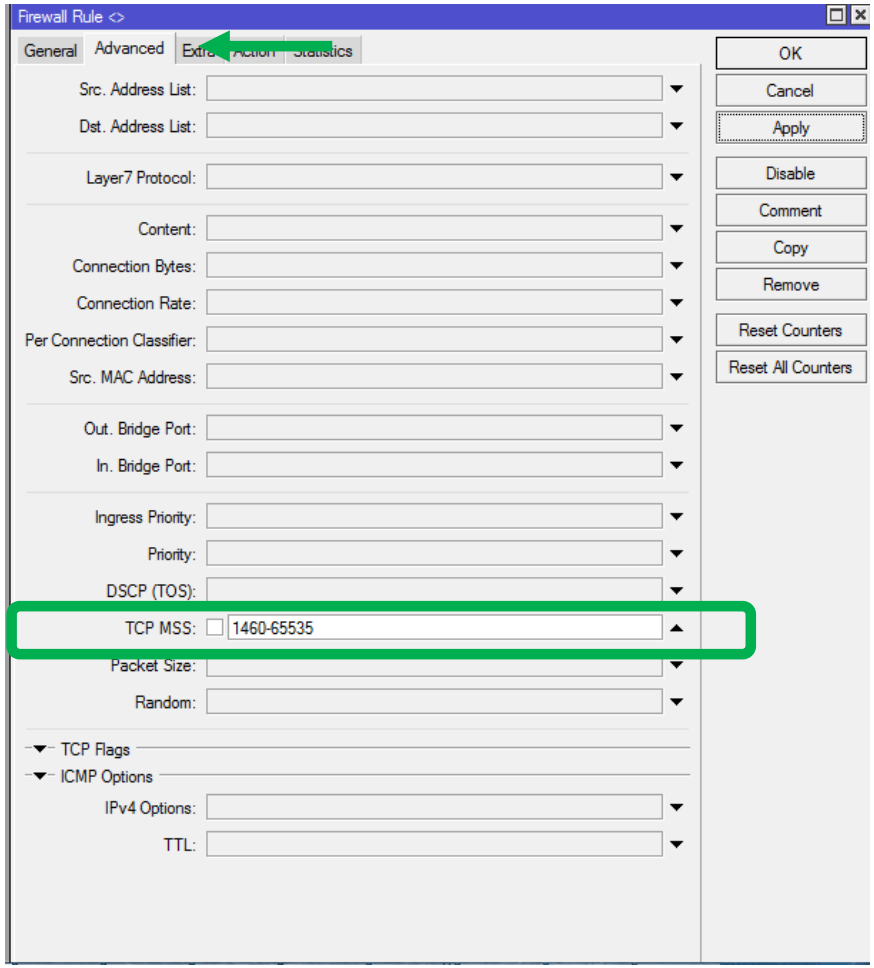


Window, Checksum, Urgent Pointer Fields

- Can not be directly matched against

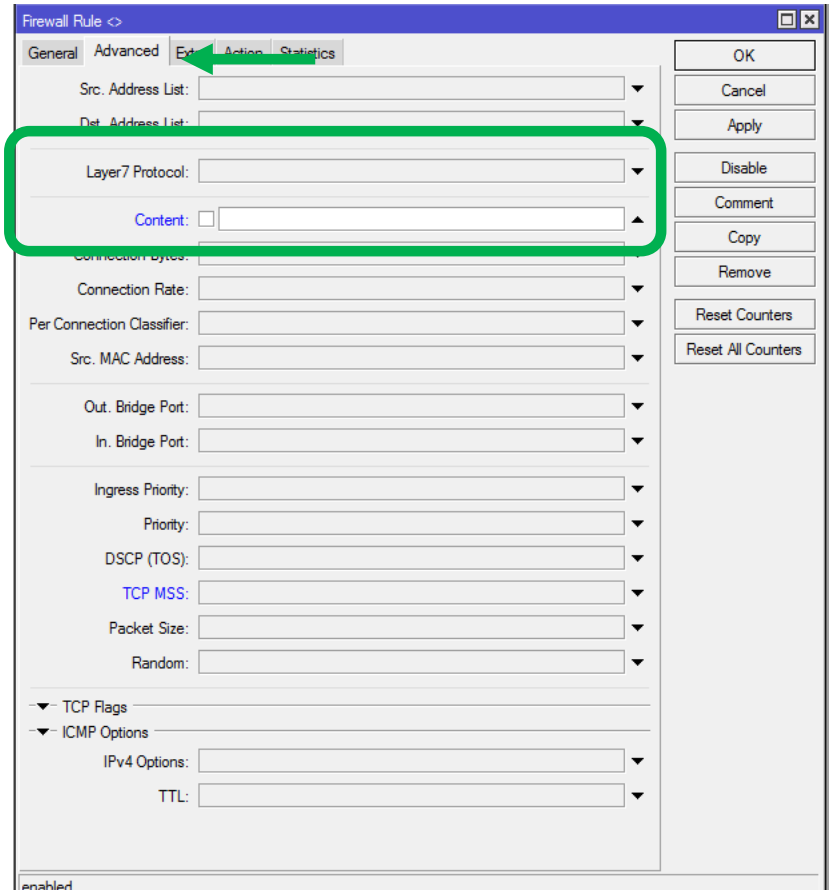
Options Field

- 45 Options have been standardized
- Only is applicable 99% of the time
  - MSS (Maximum Segment Size)



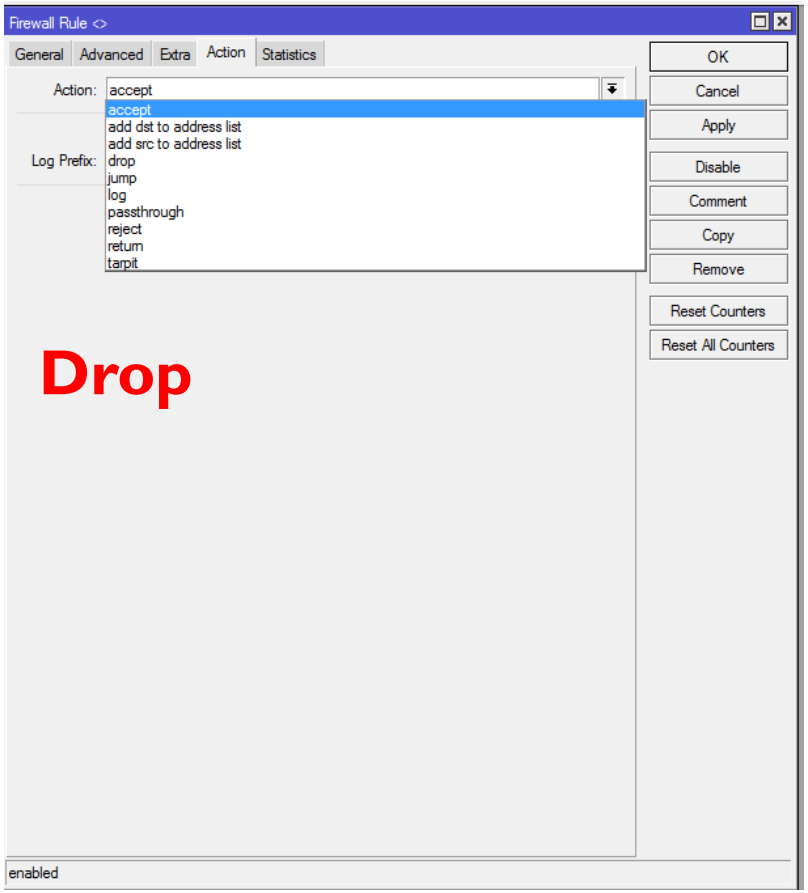
Data Field

- Can be filtered using the "Content" and/ or Layer 7 Filters
- Content Filter can be used for any know values not specifically filtered by other rules



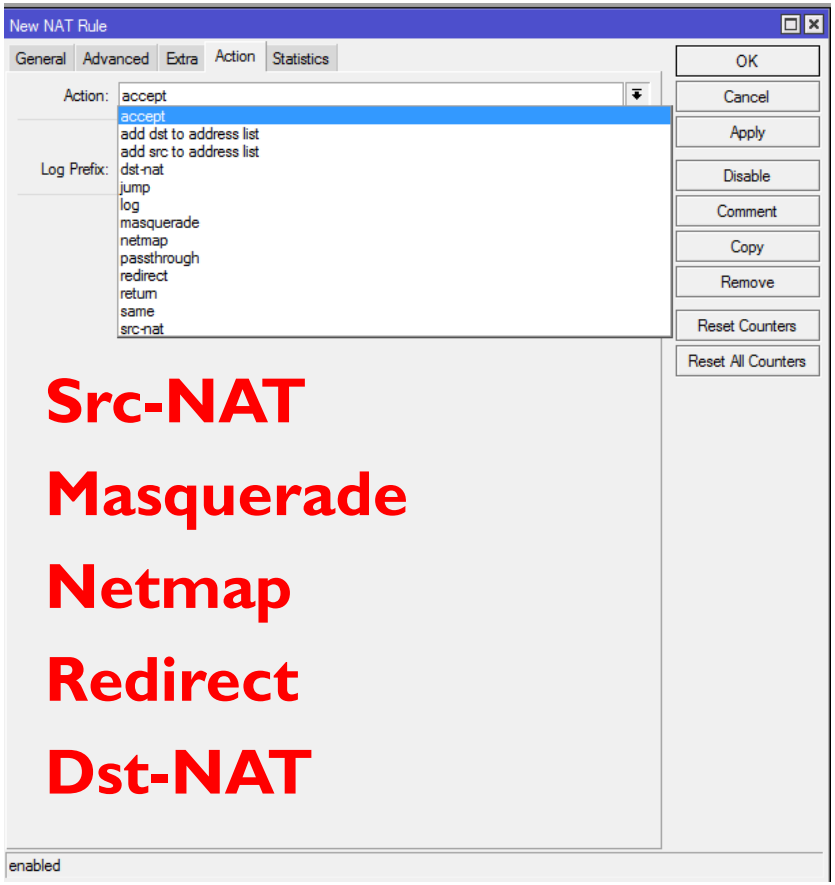
Firewall Actions

Filters



Drop

Nat



Src-NAT

Masquerade

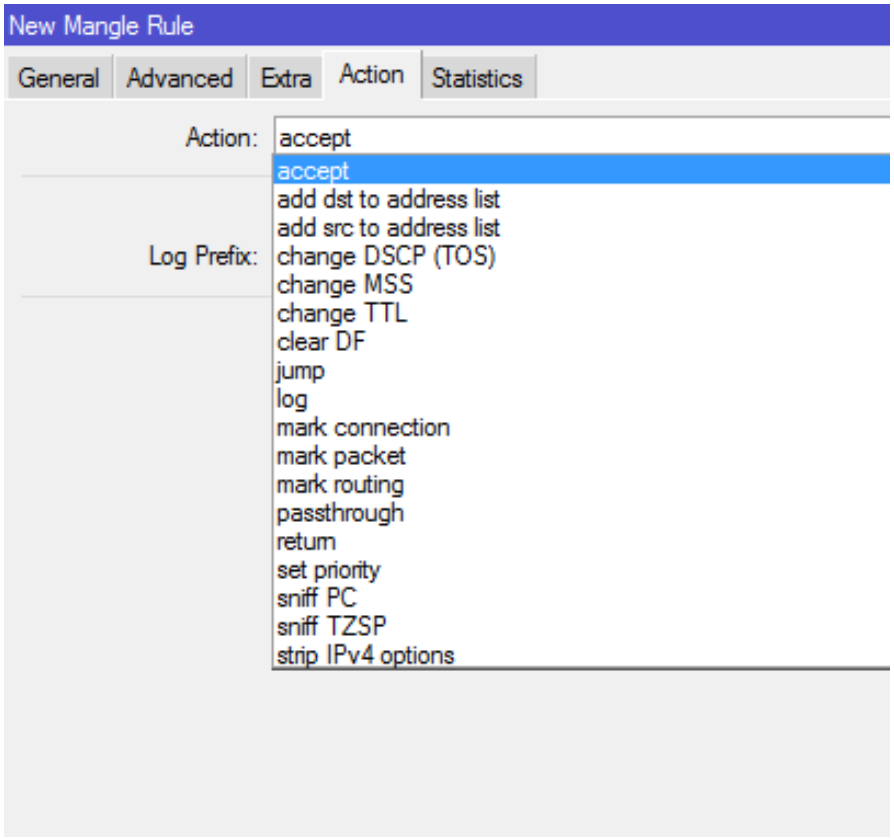
Netmap

Redirect

Dst-NAT

Firewall Mangle Actions

- Change DSCP (TOS)
- Change MSS
- Change TTL
- Clear DF
- Set Priority
- Strip IPv4 Options



Conclusion

- Layer 2 Frames
  - 100% of the 4 visible fields can be filtered
  - 75% can be changed
- Layer 3 Packets
  - Most Fields with standard values can be filtered or changed

Questions?