



# Mikrotik RouterOS

## QoS and VoIP



1 Presentación

2 Modelo OSI - TCP/UDP

3 Calculo Ancho de Banda

4 Packet Flow

5 Caso de Estudio

6 Laboratorio

## SERVICES

01

### DISTRIBUIDOR

- Mayorista MIKROTIK

02

### ENTRENAMIENTO

- Mikrotik
- Zycoo VoIP

03

### CONSULTORIA

- QoS
- PPP
- Firewall
- Routing
- ISP

04

### TELEFONIA IP

- Billing
- Call Center
- AGI Base de Datos
- IVR

## CONTACT US



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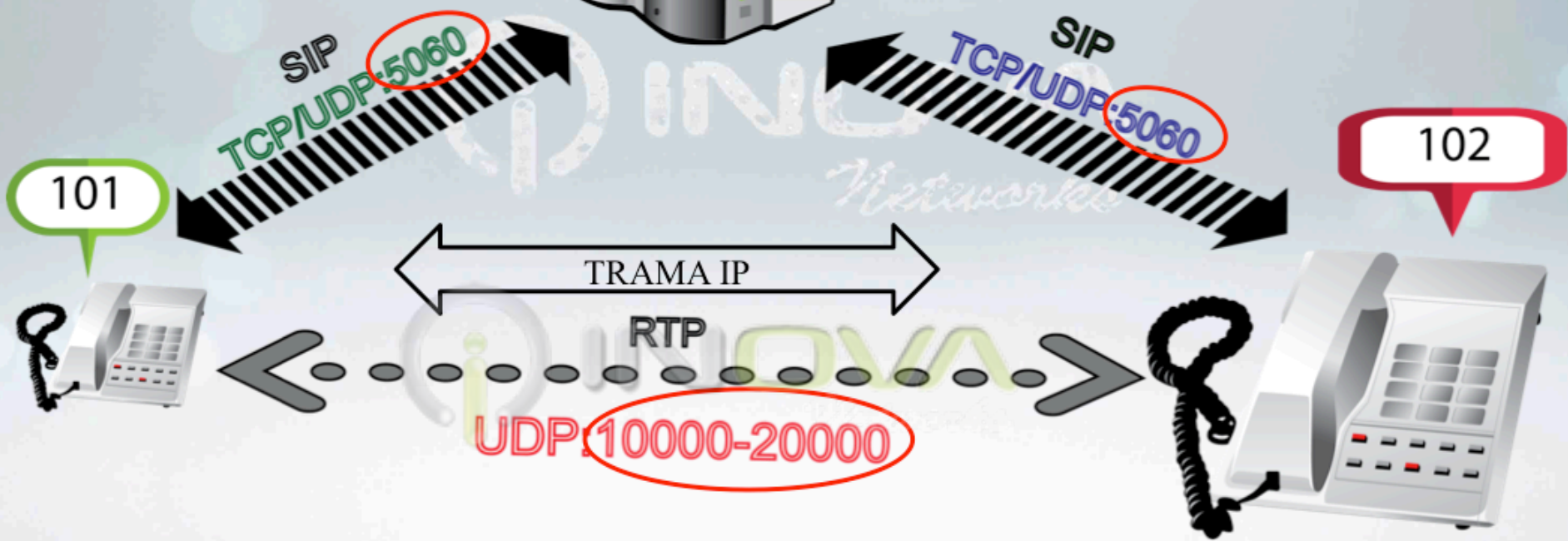
Tenemos la solución que necesitas.

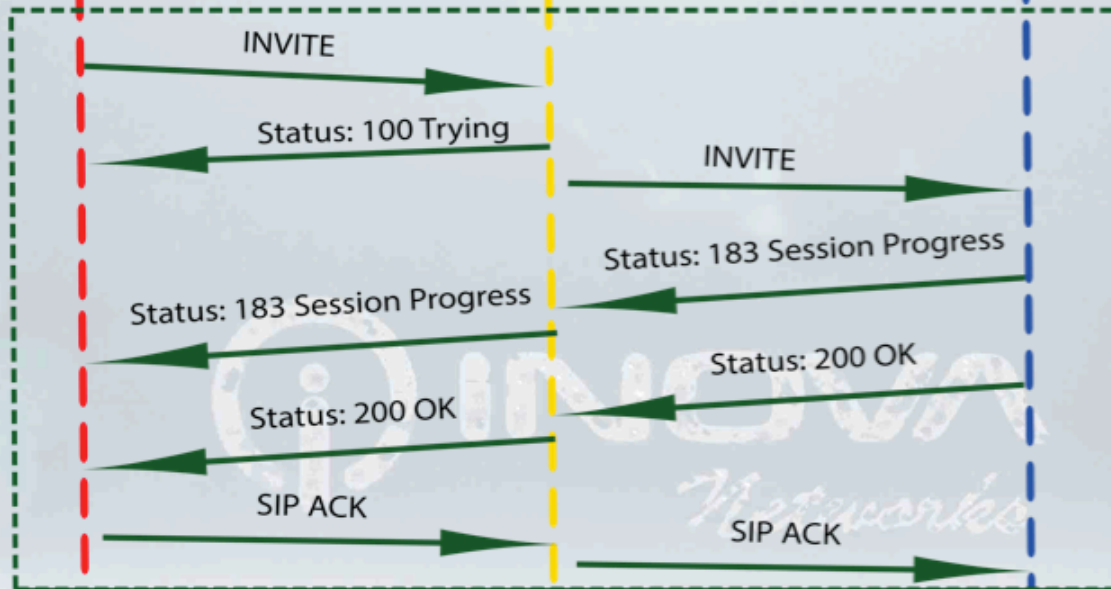


TRAINER's Mikrotik

Ing. Richart Rojas V.  
Ing. Edwin Rojas V.







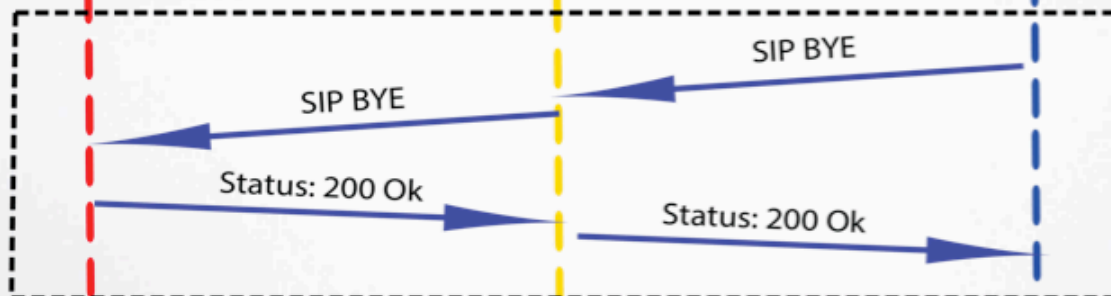
### Marcación

Se establece la sesión  
Protocolo: SIP  
Puerto: UDP/TCP 5060



### Transferencia de VOZ

Protocolo RTP  
Puerto aleatorio  
10000:20000



### Colgado

Se finalizó la llamada  
Protocolo: SIP  
Puerto UDP/TCP 5060

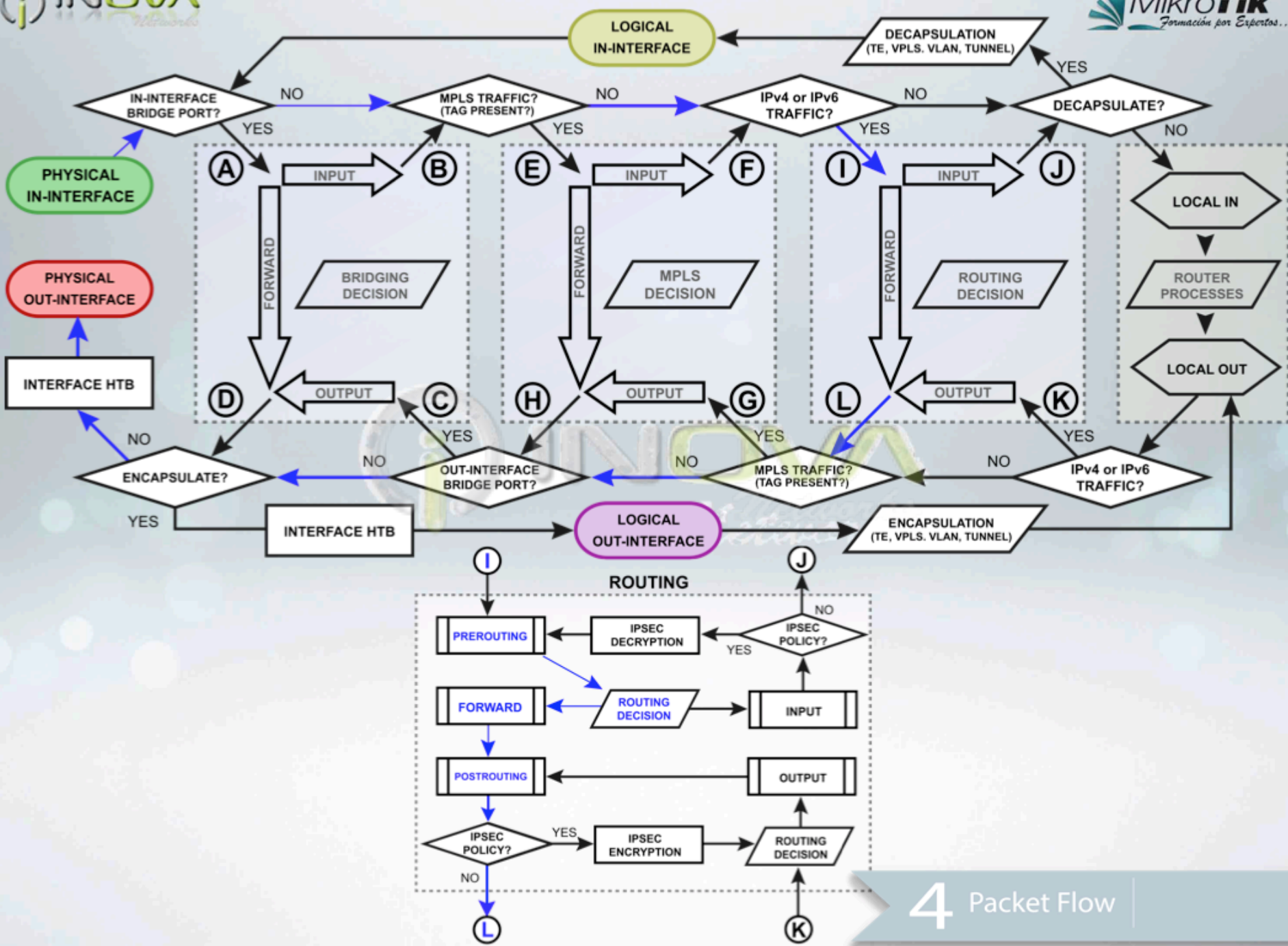
$$V_{tx} = \left( \frac{\text{Tamaño Total de Paquetes [Bytes]} \times 8 \text{ [Bits]}}{1000} \right) \times \text{Tasa de Paquetes [pps]}$$

Tasa de Paquetes = Se mide en paquetes por segundo, depende del periodo de paquetización y del códec a utilizar

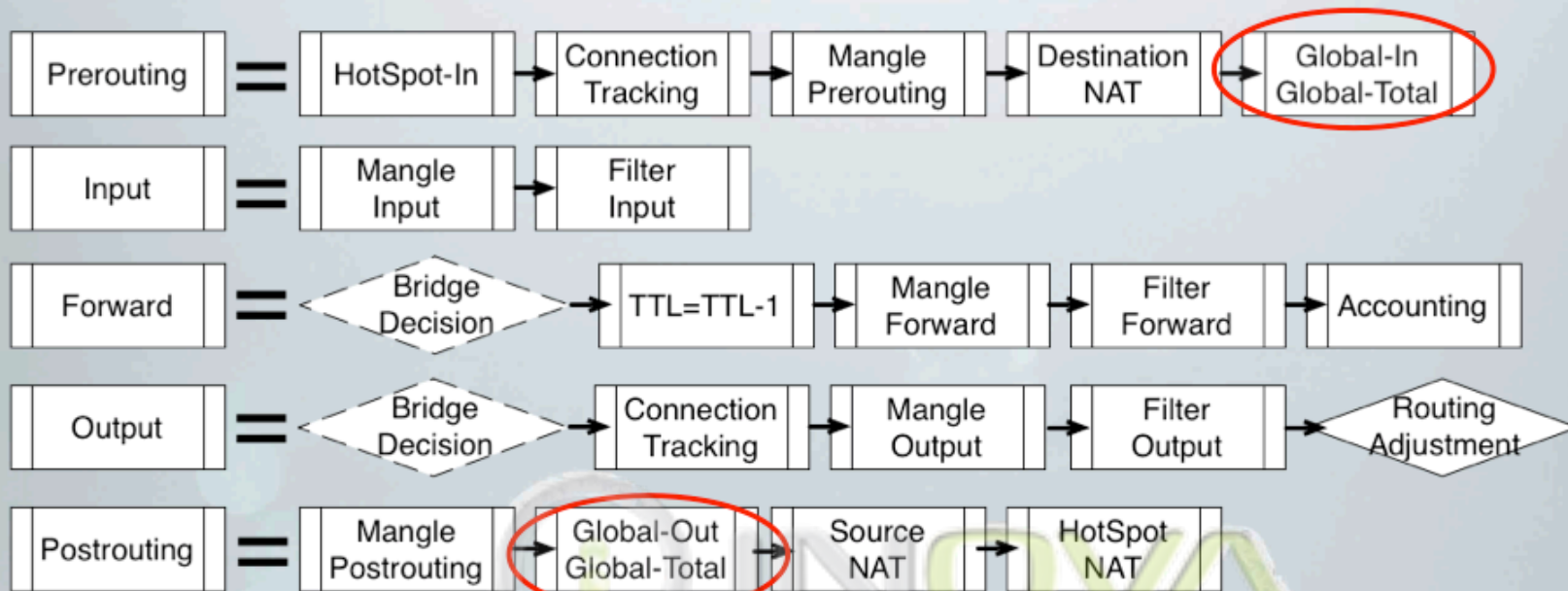
Codec	G711	G711	G729	G729
Periodo de paquetización	20ms	30ms	20ms	40ms
Nominal Bandwidth (kbps)	64	64	8	8
Packetización Size PayloadSize (bytes)	160	240	20	40
RTP Overhead (bytes)	12	12	12	12
UDP Overhead (bytes)	8	8	8	8
IP Overhead (bytes)	20	20	20	20
Ethernet Overhead (bytes)	18	18	18	18
Total Packet Size (bytes)	218	298	78	98
Packet Rate (pps)	50	33.33	50	25

Calculo ancho de banda G711 con periodo de paquetización de 20ms

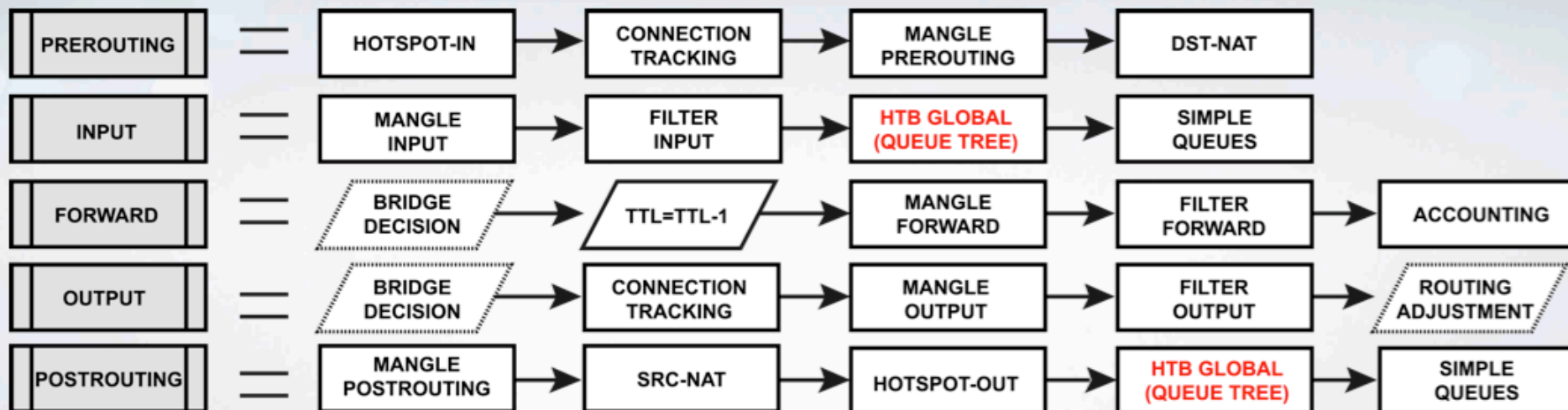
$$V_{tx} = \left( \frac{(160+12+8+20+18) \times 8 \text{ [Bits]}}{1000} \right) \times 50 \text{ [pps]} = 87.2 \text{ Kbps}$$



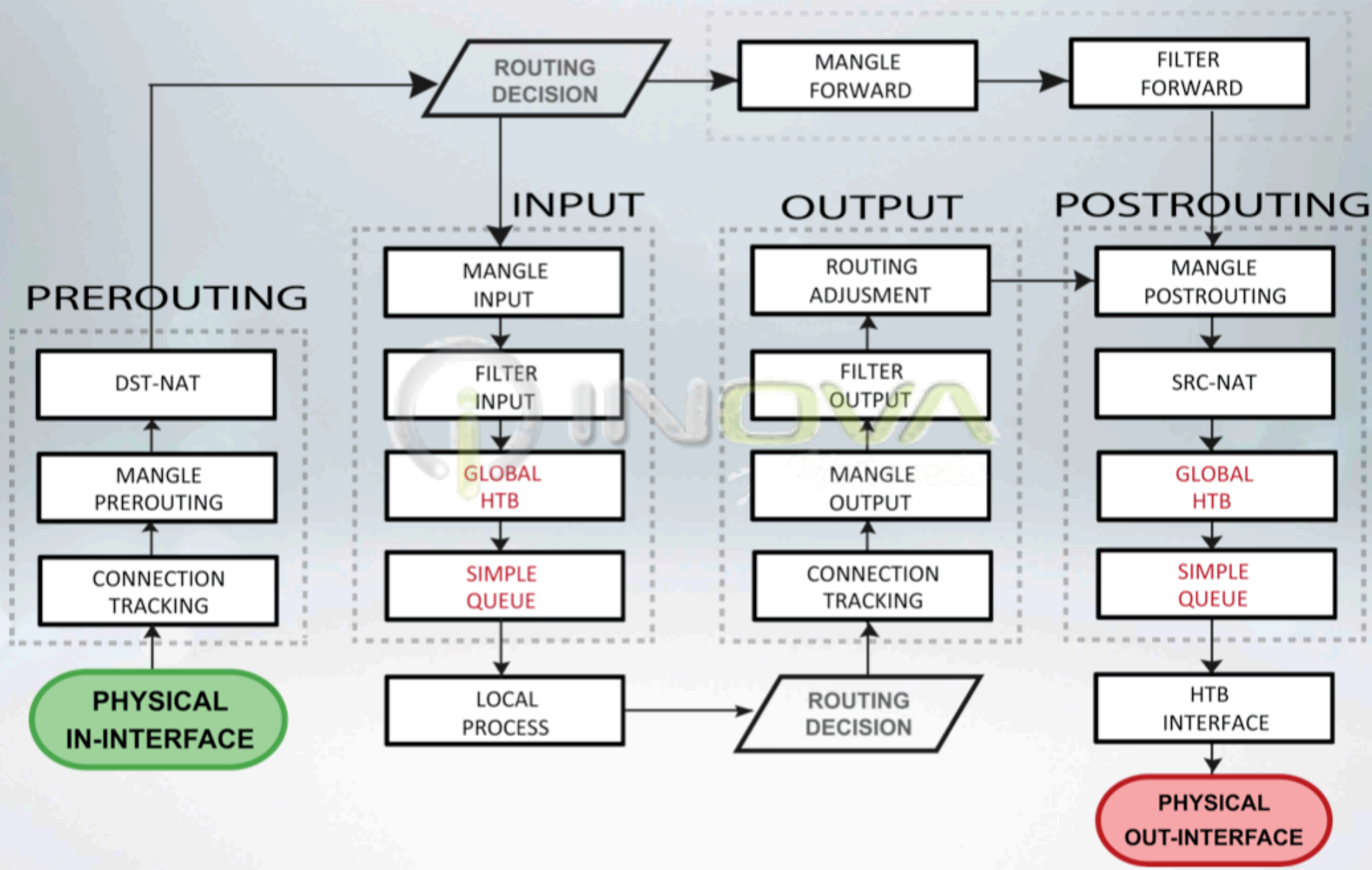




## Cambios en RouterOS V6



# FORWARD



# Caso - 1



# Caso - 2





- |                                                                                          |                                                                                           |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
|  Rtp  |  Http  |
|  Sip  |  Https |
|  Icmp |  Resto |

```
/ip firewall mangle
```

```
add action=mark-connection chain=forward comment=RTP dst-port=10000-20000 new-connection-mark=Con_RTP protocol=udp
add action=mark-packet chain=forward connection-mark=Con_RTP new-packet-mark=Pkt_RTP passthrough=no
add action=mark-connection chain=forward comment=SIP dst-port=5060-5061 new-connection-mark=Con_Sip protocol=udp
add action=mark-packet chain=forward connection-mark=Con_Sip new-packet-mark=Pkt_Sip passthrough=no
add action=mark-packet chain=forward comment=ICMP new-packet-mark=Pkt_ICMP passthrough=no protocol=icmp
add action=mark-connection chain=forward comment=Http dst-port=80 new-connection-mark=Con_Http protocol=tcp
add action=mark-packet chain=forward connection-mark=Con_Http new-packet-mark=Pkt_Http passthrough=no
add action=mark-connection chain=forward comment=Https dst-port=443 new-connection-mark=Con_Https protocol=tcp
add action=mark-packet chain=forward connection-mark=Con_Https new-packet-mark=Pkt_Https passthrough=no
add action=mark-connection chain=forward comment=Resto new-connection-mark=Con_Resto
add action=mark-packet chain=forward connection-mark=Con_Resto new-packet-mark=Pkt_Resto
```

Firewall

Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols

Reset Counters 00 Reset All Counters Find all

#	Action	Chain	Src. Address	Dst. Address	Protocol	Src. Port	Dst. Port	In. Int...	Out. I...	Bytes	Packets
0	ma...	forward			17 (udp)		10000-20000			6.1 MiB	31 970
1	ma...	forward								6.1 MiB	32 017

Mangle Rule <10000-20000>

General Advanced Extra Action Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol:  17 (udp)

Src. Port:

Dst. Port:  10000-20000

Mangle Rule <10000-20000>

General Advanced Extra Action Statistics

Action: mark connection

Log

Log Prefix:

New Connection Mark: **Con\_RTP**

Passthrough

Mangle Rule <>

General Advanced Extra Action Statistics

Chain: forward

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface:

Out. Interface:

Packet Mark:

Connection Mark:  **Con\_RTP**

Mangle Rule <>

General Advanced Extra Action Statistics

Action: mark packet

Log

Log Prefix:

New Packet Mark: Pkt\_RTP

Passthrough

Firewall

Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols

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#	Action	Chain	Src. Address	Dst. Address	Protocol	Src. Port	Dst. Port	In. Int...	Out. I...	Bytes	Packets
;;; RTP											
0	ma...	forward			17 (udp)		10000-20000			6.1 MiB	31 970
1	ma...	forward								6.1 MiB	32 017
;;; SIP											
2	ma...	forward			17 (udp)		5060-5061			40.2 KiB	323
3	ma...	forward								40.2 KiB	323
;;; ICMP											
4	ma...	forward			1 (icmp)					161.0 KiB	1 970
;;; Http											
5	ma...	forward			6 (tcp)		80			97.4 KiB	1 483
6	ma...	forward								881.0 KiB	2 119
;;; Https											
7	ma...	forward			6 (tcp)		443			518.2 KiB	3 674
8	ma...	forward								1520.4 KiB	6 224
;;; Resto											
9	ma...	forward								15.8 MiB	24 037
10	ma...	forward								15.7 MiB	23 876

11 items

# Estructura HTB

Max-limit=256k

Download  
Parent=LAN

CIR=**Limit-at** (Ancho de banda mínimo garantizado)

MIR=**Max-Limit** (Máximo Ancho de banda)

Limit-at=200k  
Max-limit=256k

Limit-at=56k  
Max-limit=256k

Critico  
Parent=Download

Resto  
Parent=Download

Limit-at=180k  
Max-limit=256k  
Priority=1

Limit-at=10k  
Max-limit=256k  
Priority=1

Limit-at=10k  
Max-limit=256k  
Priority=2

Limit-at=20k  
Max-limit=256k  
Priority=8

Limit-at=20k  
Max-limit=256k  
Priority=8

Limit-at=16k  
Max-limit=256k  
Priority=8

RTP  
Parent=Critico

SIP  
Parent=Critico

ICMP  
Parent=Critico

HTTP  
Parent=Resto

HTTPS  
Parent=Resto

RESTO  
Parent=Resto

- Rtp
- Http
- Sip
- Https
- Icmp
- Resto



- Prioridad = 1 Trafico Critico
- Prioridad = 1 Trafico Critico
- Prioridad = 2 Trafico Critico
- Prioridad = 8 Trafico Resto

```

/queue tree
add max-limit=256k name=Download parent=LAN queue=default
add max-limit=256k name=Upload parent=WAN queue=default
add limit-at=200k max-limit=256k name=Critico_Down parent=Download queue=default
add limit-at=56k max-limit=256k name=Rest_Down parent=Download queue=default
add limit-at=10k max-limit=256k name=ICMP_Down packet-mark=Pkt_ICMP parent=Critico_Down priority=2 queue=default
add limit-at=200k max-limit=256k name=Critico_UP parent=Upload queue=default
add limit-at=56k max-limit=256k name=Rest_UP parent=Upload queue=default
add limit-at=10k max-limit=256k name=ICMP_Up packet-mark=Pkt_ICMP parent=Critico_UP priority=2 queue=default
add limit-at=20k max-limit=256k name=Http_Down packet-mark=Pkt_Http parent=Rest_Down queue=default
add limit-at=20k max-limit=256k name=Https_Down packet-mark=Pkt_Https parent=Rest_Down queue=default
add limit-at=16k max-limit=256k name=Resto_Down packet-mark=Pkt_Resto parent=Rest_Down queue=default
add limit-at=20k max-limit=256k name=Http_Up packet-mark=Pkt_Http parent=Rest_UP queue=default
add limit-at=20k max-limit=256k name=Https_Up packet-mark=Pkt_Https parent=Rest_UP queue=default
add limit-at=16k max-limit=256k name=Resto_Up packet-mark=Pkt_Resto parent=Rest_UP queue=pcq-upload-default
add limit-at=180k max-limit=256k name=RTP_Down packet-mark=Pkt_RTP parent=Critico_Down priority=1 queue=default
add limit-at=180k max-limit=256k name=RTP_Up packet-mark=Pkt_RTP parent=Critico_UP priority=1 queue=default
add limit-at=10k max-limit=256k name=SIP_Down packet-mark=Pkt_Sip parent=Critico_Down priority=1 queue=default
add limit-at=10k max-limit=256k name=SIP_Up packet-mark=Pkt_Sip parent=Critico_UP priority=1 queue=default
    
```



Queue List

Simple Queues Interface Queues Queue Tree Queue Types

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Find

Name	Parent	Packet Marks	Priority	Limit At (...)	Max Limit (bits/s)	Avg. Rate	Queued Bytes	Bytes	Packets
Download	LAN		8		256k	259.6 kbps	0 B	31.0 MiB	52 769
Critico_Down	Download		8	200k	256k	155.4 kbps	0 B	4266....	21 869
RTP_Down	Critico_Down	Pkt_RTP	1	180k	256k	150.8 kbps	0 B	3757....	18 049
SIP_Down	Critico_Down	Pkt_Sip	1	10k	256k	3.8 kbps	0 B	158.8 KiB	261
ICMP_Down	Critico_Down	Pkt_ICMP	2	10k	256k	784 bps	0 B	331.0 KiB	3 465
Rest_Down	Download		8	56k	256k	104.1 kbps	0 B	26.8 MiB	30 900
Http_Down	Rest_Down	Pkt_Http	8	20k	256k	0 bps	0 B	1593....	1 842
Https_Down	Rest_Down	Pkt_Https	8	20k	256k	26.8 kbps	29.8 KiB	18.5 MiB	15 887
Resto_Down	Rest_Down	Pkt_Resto	8	16k	256k	34.3 kbps	20.1 KiB	6.9 MiB	13 250
Upload	WAN		8		256k	164.2 kbps	0 B	9.5 MiB	69 147
Critico_UP	Uploa		8		256k	155.2 kbps	0 B	4817....	24 396
RTP_UP	Critico		8		256k	148.9 kbps	0 B	4378....	21 039
SIP_UP	Critico		8		256k	5.5 kbps	0 B	197.3 KiB	705
ICMP_UP	Critico		8		256k	784 bps	0 B	241.5 KiB	2 652
Rest_UP	Uploa		8		256k	8.9 kbps	0 B	4.8 MiB	44 751
Http_UP	Rest.		8		256k	0 bps	0 B	256.3 KiB	1 964
Https_UP	Rest.		8		256k	5.7 kbps	0 B	2909....	25 074
Resto_UP	Rest.		8		256k	3.2 kbps	0 B	1729....	17 713

Queue <RTP\_Down>

General Statistics

Name: RTP\_Down

Parent: Critico\_Down

Packet Marks: Pkt\_RTP

Queue Type: default

Priority: 1

Limit At: 90k bits/s

Max Limit: 256k bits/s

Burst Limit: bits/s

Burst Threshold: bits/s

Burst Time: s

Buttons: OK, Cancel, Apply, Disable, Comment, Copy, Remove, Reset Counters, Reset All Counters

18 items (1 selected)

# Certificación Oficial MTCNA



## Contactos

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# Gracias...!