Wireless QoS with WMM and DSCP

How to implement Quality of Service on Wireless LAN

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Andrea Grittini

- Graduated in Computer Science
- Working with wireless since 2003
- Startup of one of the first Italian WISP
- Mikrotik distributor since 2006
- Mikrotik Certified (4)
- Mikrotik Certified Trainer

Wi4Net - Totalconn

- Mikrotik Italian distributor
- Training and Consulting
- Building Certified Devices for EU market
- Power supply solutions / solar kit for stand alone solutions
- E-commerce Web site www.wi4net.it

Totalconn

- Last Mile Access solution:
  Up to 4 sectors/ ext. Ant./seria

- Point-to-Point integrated antennas
  802.11n Mimo CE Certified

- CPEs

Goals

- Understand what are the problem of the media contention in a wireless environment
- Explain the WMM protocol
- Setup a basic configuration for the prioritization steps

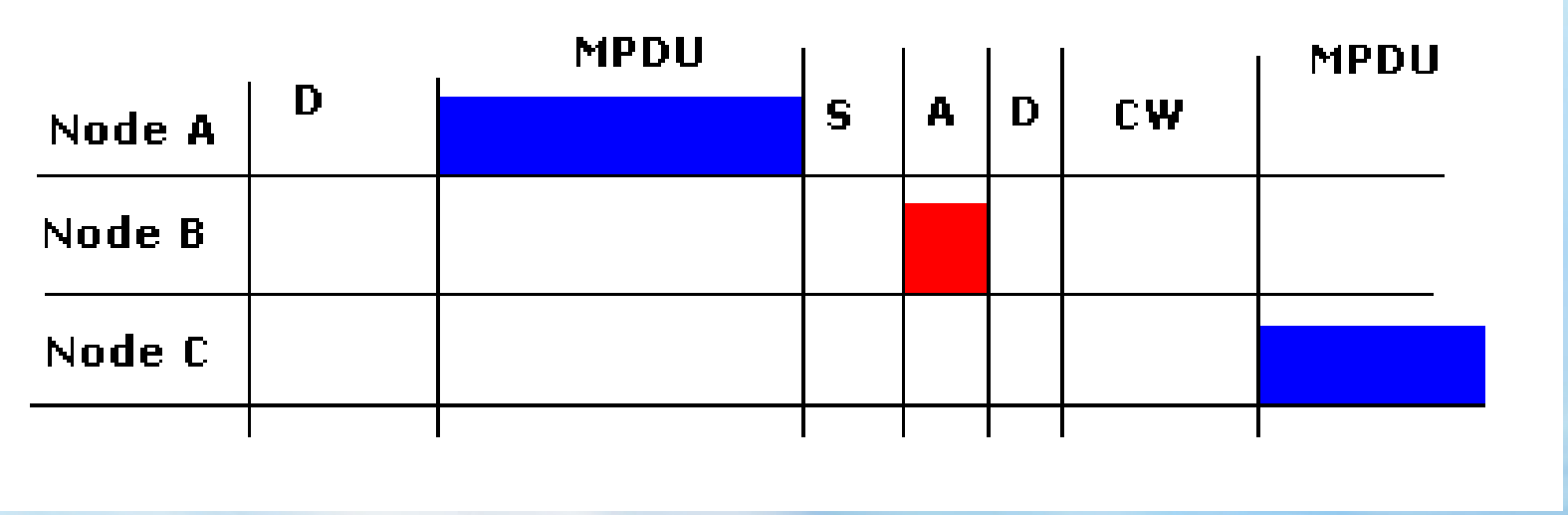
Topics

- Wireless access
- Priority and services
- ToS and DSCP
- WMM
- How WMM works
- Implementation
- Example
- Conclusion

802.11 MAC (Media Access Control)

The 802.11 family uses a MAC layer known as **CSMA/CA** (Carrier Sense Multiple Access/Collision Avoidance)

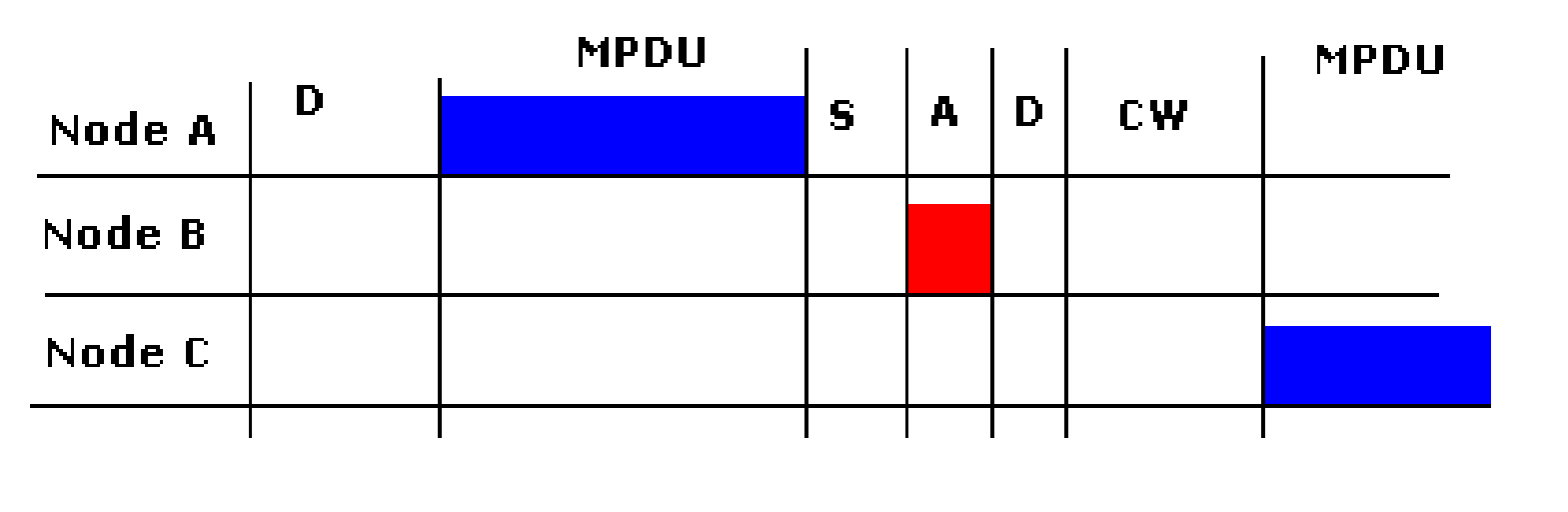
NOTE: Classic Ethernet uses CSMA/CD - collision detection). CSMA/CA is, like all Ethernet protocols, peer-to-peer (there is no requirement for a master station).



MAC sequence

- In CSMA/CA a Wireless node that wants to transmit performs the following sequence:

1. **Listen** on the desired channel.
2. If channel is **idle** (no active transmitters) it **sends** a packet.
3. If channel is **busy** (an active transmitter) node **waits** until transmission stops then a further **CONTENTION** period. (The Contention period is a random period after every transmit).
4. If the channel is still idle at the end of the **CONTENTION** period the node transmits its packet otherwise it repeats the process defined in 3 above until it gets a free channel.



QoS

- **QoS the Quality of Service**:
- Its goal is to use the available resources effectively, and improve user experience and satisfaction with your service, allowing you to run a prosperous business. QoS is what unites everything related to making routing decisions, providing reliable service with failover capabilities, utilizing most of the available network resources, respecting different application requirements.

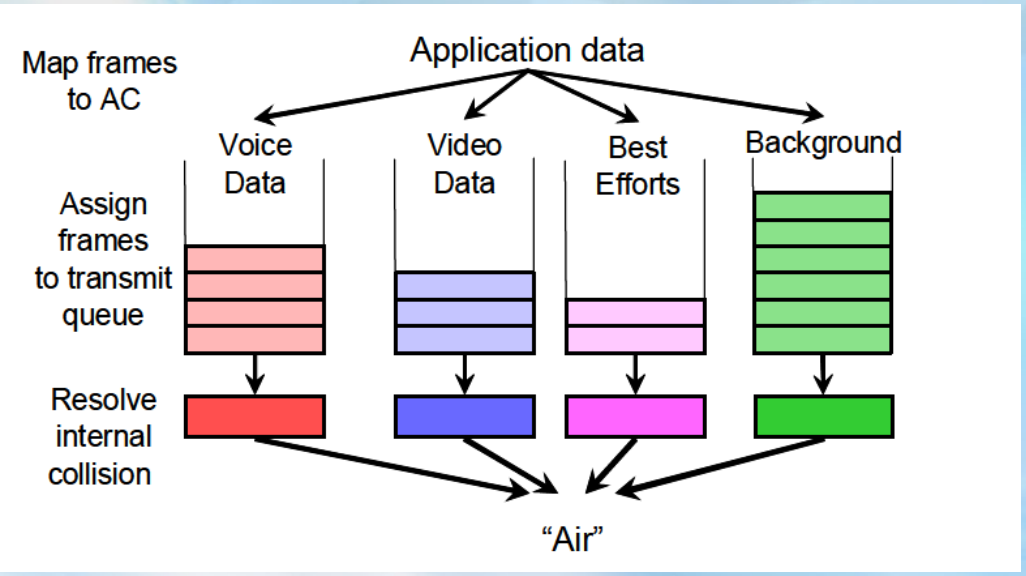
WMM and DSCP

- **WMM**: **Wi-Fi MultiMedia Quality of Service** is a set of features for Wi-Fi networks that improve the user experience for audio, video, and voice applications by prioritizing data traffic. WMM Quality of Service is based upon a subset of the IEEE 802.11e standard.

- **DSCP (ToS): Differentiated Service Code Point :** a 6 bit field in the IP packet header used to identify the level of service a packet receives in the network.

WMM

- WMM provides prioritized media access and is based on the Enhanced Distributed Channel Access (EDCA) method. It defines four priority classes (voice, video, best effort,and background) to manage traffic from different applications.



Source Wi-Fi Alliance

WMM

- In a Wi-Fi network, WMM functionality requires that **both** the access point (AP) and the clients running applications that require QoS have **WMM enabled**.
- At the same time, it is important to realize that WMM-enabled devices can take advantage of their QoS functionality **only** when using applications that support WMM and **can assign the appropriate priority level** to the traffic streams they generate
- Priority level are not assigned by default !

Access Categories

Quality of Service

QoS priority levels

Priority Level	Traffic Type
0 (lowest)	Best Effort
1	Background
2	Standard (Spare)
3	Excellent Load (Business Critical)
4	Controlled Load (Streaming Multimedia)
5	Voice and Video (Interactive Media and Voice) [Less than 100ms latency and jitter]
6	Layer 3 Network Control Reserved Traffic [Less than 10ms latency and jitter]
7 (highest)	Layer 2 Network Control Reserved Traffic [Lowest latency and jitter]

RFC 2597 and RFC 2598

Class of Service

Precedence Value	priority ToS		DSCP	WMM
routine	0	000 (0)	0 to 7	best effort
priority	1	001 (1)	8 to 15	background
immediate	2	010 (2)	16 to 23	background
flash	3	011 (3)	24 to 31	best effort
flash override	4	100 (4)	32 to 39	video
critical	5	101 (5)	40 to 47	video
internetwork	6	110 (6)	48 to 55	voice
network control	7	111 (7)	55 to 63	voice

Ref. : Rfc 2597 Rfc2598

WMM Setup

WMM Setup

- First let consider the infrastructure of our Wireless network:
- Routed Network with OSPF
- Wireless AP
- Radius authentication on wireless AP
- Bandwidth limit to customers through Radius
- CPE with internal private network 192.168.1.1/24

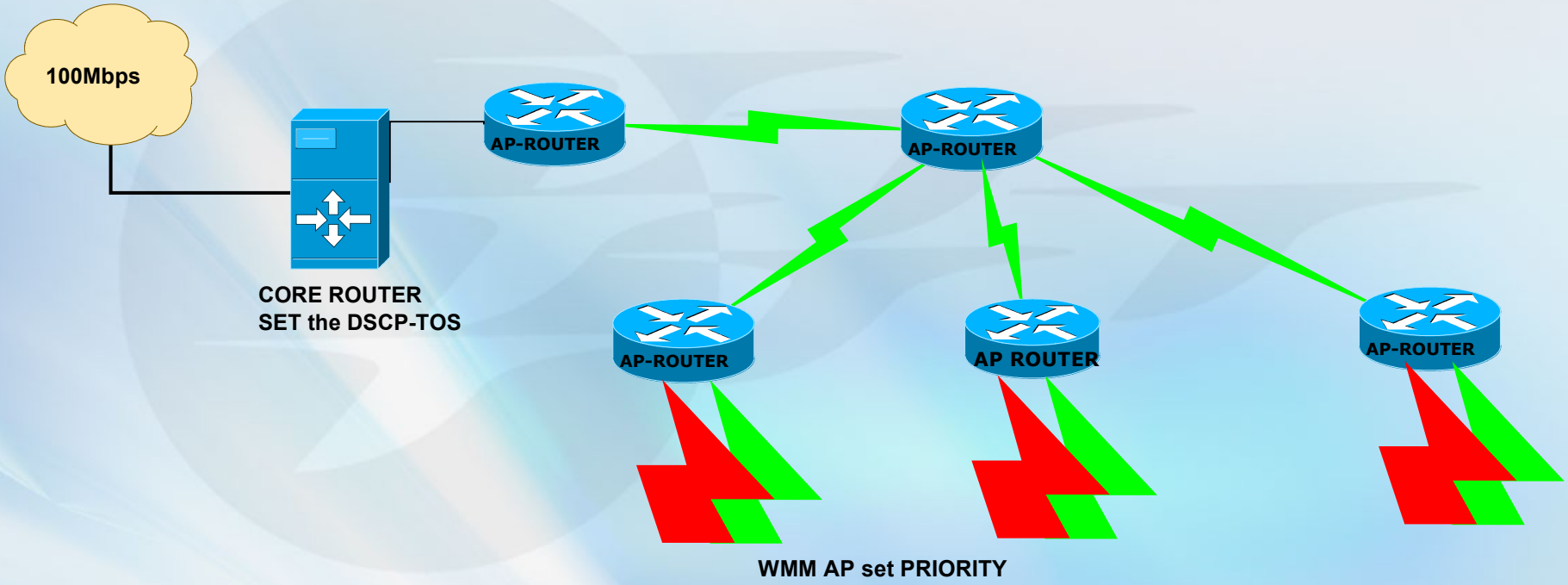
WMM setup

- DSCP (ToS) byte of IP packet is used to trasport on the network the information regarding QoS

- Advantage:
  - ✓Set it only on the core router
  - ✓Uses only 1 byte in the packet header
  - ✓Can be done on VLAN

- Disadvantage:
  - ✓Cannot changed on encapsulated packets

Network Diagram



WMM Setup: Where

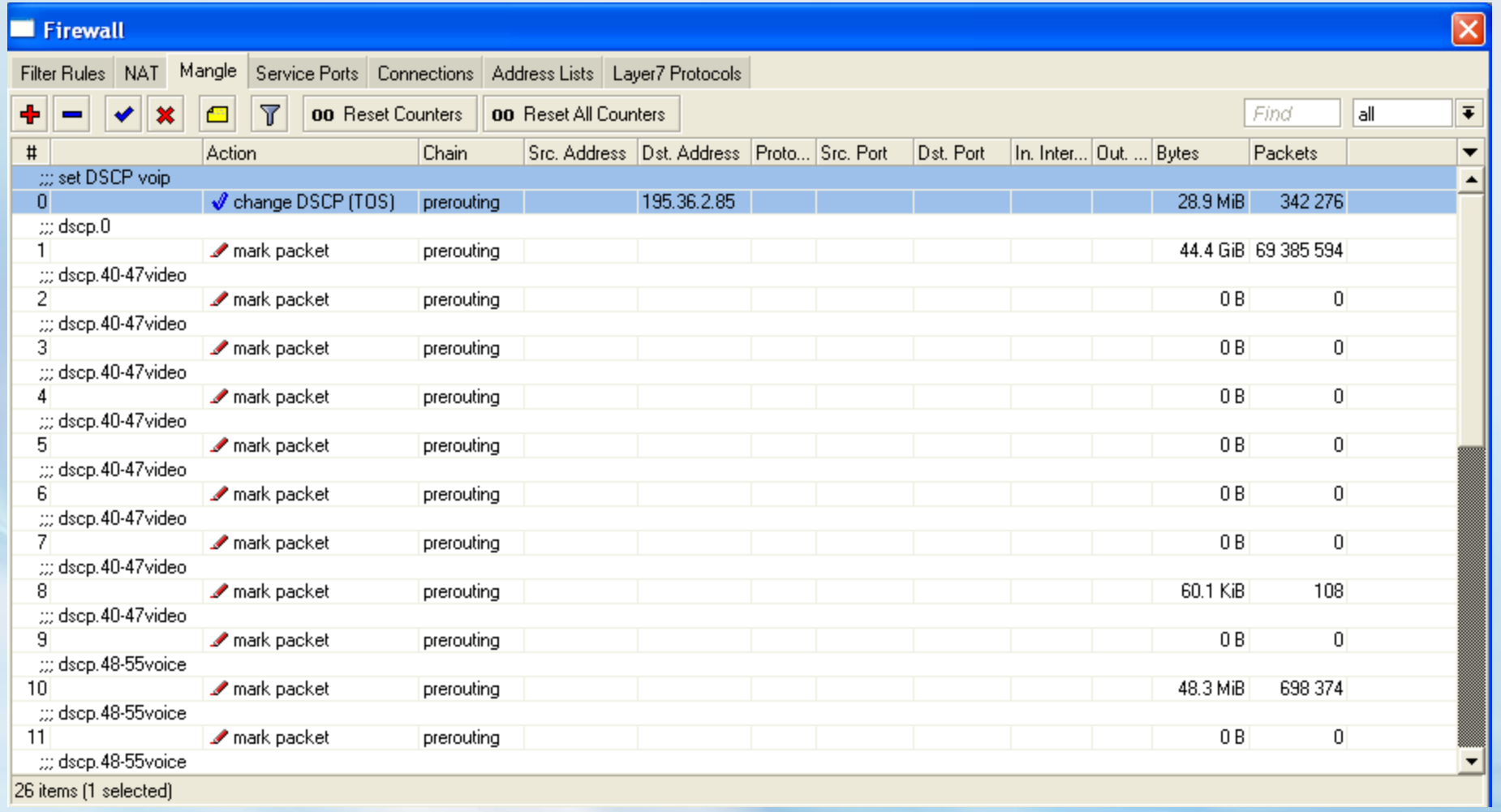
1. On the Gateway Router
2. On the AP
3. On the CPE client device

Core Router

- DSCP ToS are applied by creating MANGLE rules on prerouting chain

```
/ip firewall mangle
add action=change-dscp chain=prerouting comment="ssh" disabled=no
   dst-port=22 new-dscp=4 protocol=tcp
add action=change-dscp chain=prerouting comment="http" disabled=no
   dst-port=80 new-dscp=4 protocol=tcp
add action=change-dscp chain=prerouting comment="Voip Server"
   disabled=no dst-address=172.16.1.1 new-dscp=6
```

Mangle on core Router



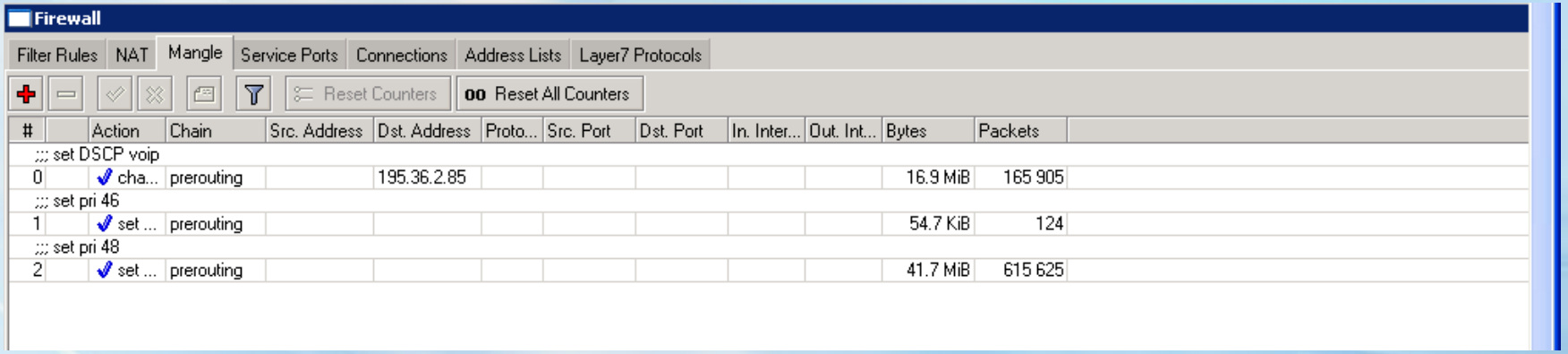
Setup on AP

- In two mode, assigning priority from DSCP:

```
/ip firewall mangle
add action=set-priority chain=postrouting comment="Translate DSCP
   Values into WMM priorities" new-priority=from-dscp
   passthrough=yes
```

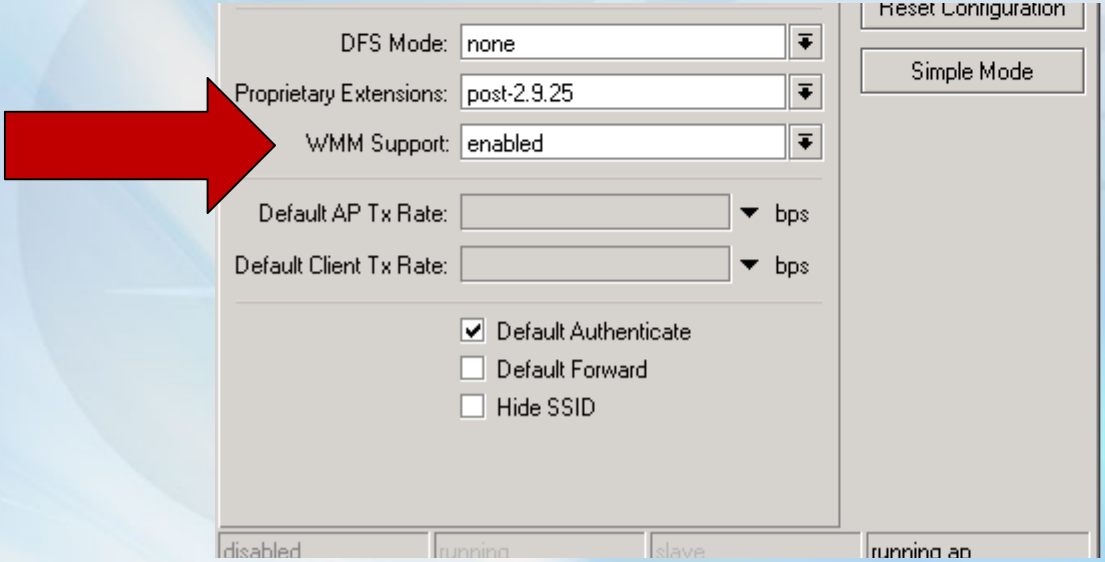
- Or by matching dscp value and change the priority

```
add action=set-priority chain=postrouting comment="Translate DSCP
   Values into WMM priorities" dscp=46 new-priority=7
   passthrough=yes
```



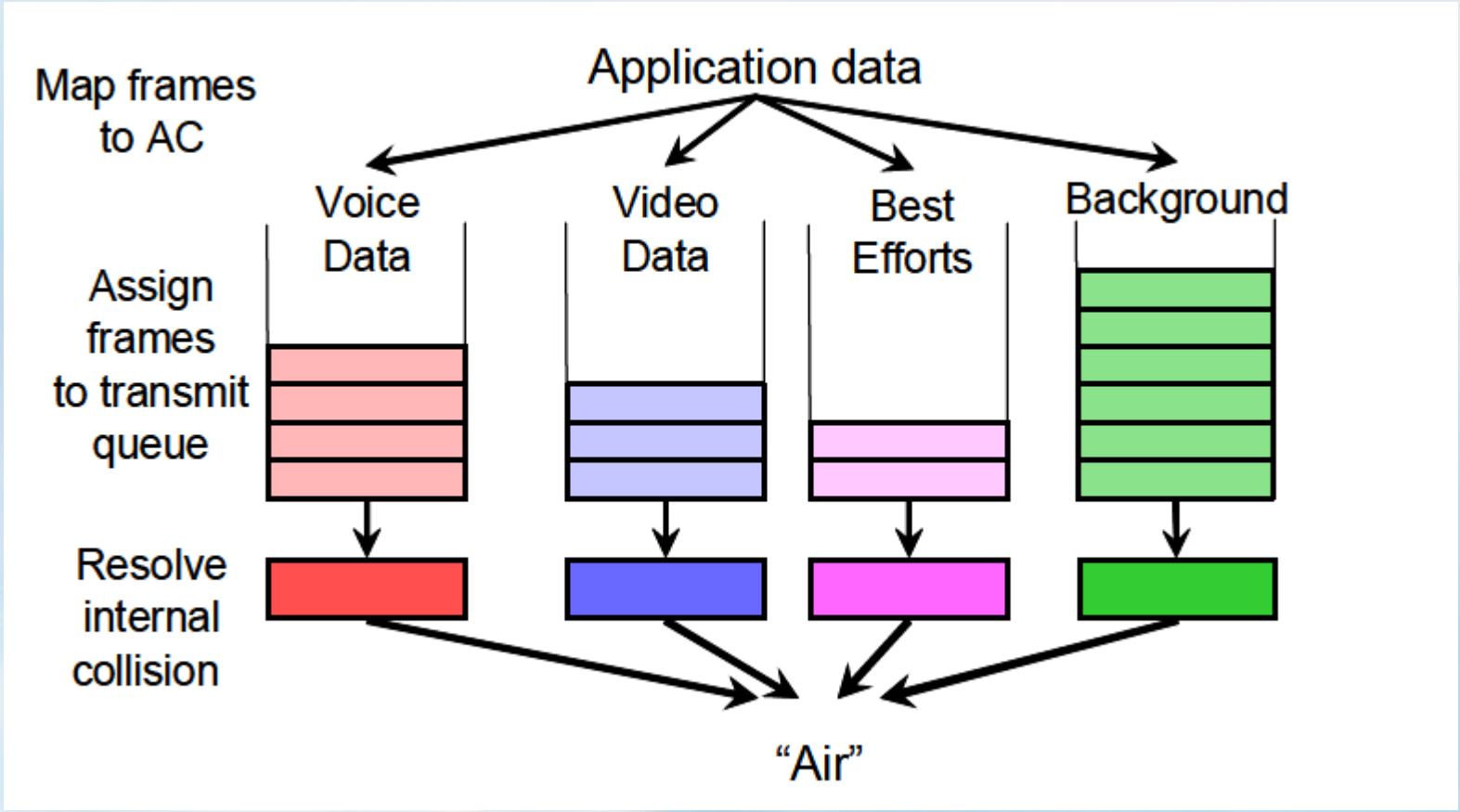
WLAN wireless settings

- On the AP and on the CPE:



- `/interface wireless set wlan1 wmm-support=enable`

WMM action


Map frames to AC
Application data
Voice Data
Video Data
Best Efforts
Background
Assign frames to transmit queue
Resolve internal collision
"Air"

Conclusion

- WMM is a simple mode to implement quality of service on the Wireless Media
- Helps providers to resolve the problem of the Media Access Contents in congestion case
- WMM is not consuming high resources on the Access Point in order to be applied

Thanks for your attention !

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