



# Wireless QoS with WMM and DSCP

*How to implement Quality of Service on Wireless LAN*

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**Mikrotik User Meeting**

Wroclaw (PL)

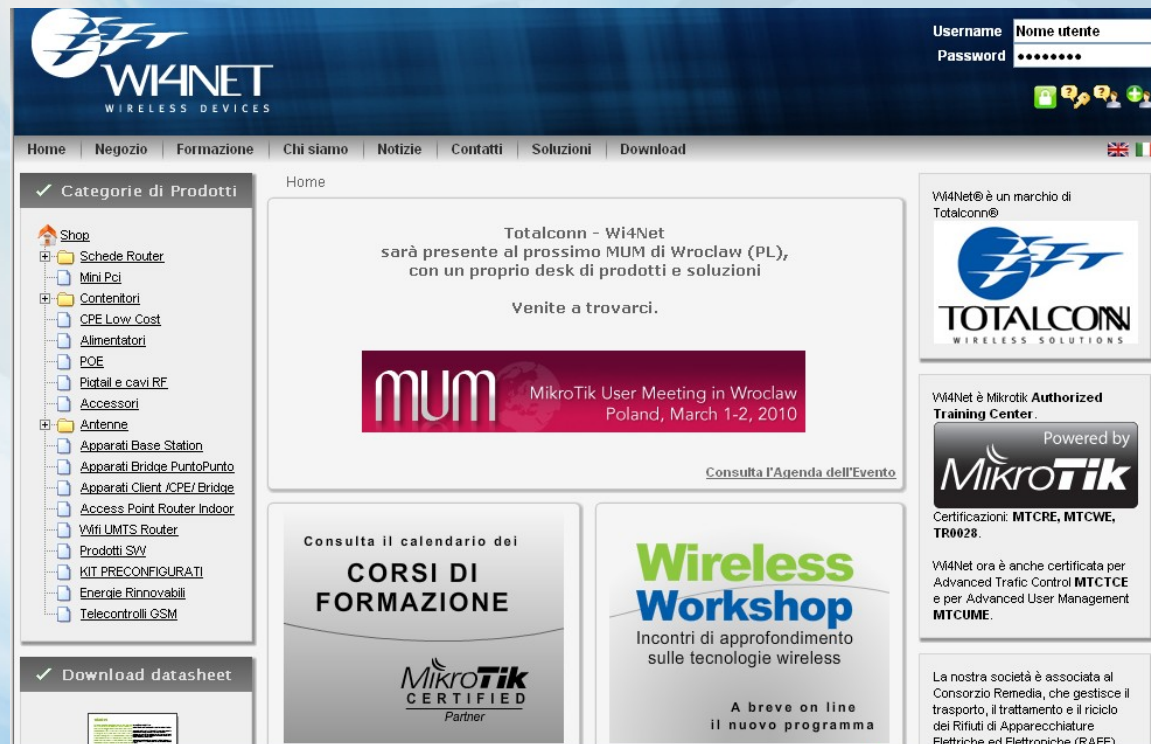
1-2 March 2010

# 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](http://www.wi4net.it)



The screenshot shows the Wi4Net website interface. At the top, there is a navigation menu with links: Home, Negozio, Formazione, Chi siamo, Notizie, Contatti, Soluzioni, and Download. The main content area features a central announcement for Totalconn - Wi4Net at the MUM (MikroTik User Meeting in Wroclaw) in Poland, March 1-2, 2010. To the left, there is a 'Categorie di Prodotti' sidebar with a tree view of product categories including Shop, Schede Router, Mini Pci, Contenitori, CPE Low Cost, Alimentatori, POE, Plottati e cavi RF, Accessori, Antenne, Apparati Base Station, Apparati Bridge PuntoPunto, Apparati Client /CPE/ Bridge, Access Point Router Indoor, Wifi UMTS Router, Prodotti SW, KIT PRECONFIGURATI, Energie Rinnovabili, and Telecontrolli GSM. Below the sidebar is a 'Download datasheet' section. On the right, there are several promotional boxes: one for Totalconn, one for MikroTik Authorized Training Center (powered by MikroTik), and one for Wireless Workshop. The bottom right corner features a 'MikroTik CERTIFIED Partner' logo and a link to 'Consulta l'Agenda dell'Evento'.

# Totalconn

- Last Mile Access solution:  
Up to 4 sectors/ ext. Ant./series
- Point-to-Point integrated antennas  
802.11n MIMO CE Certified

- CPEs



WMM QoS

# 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

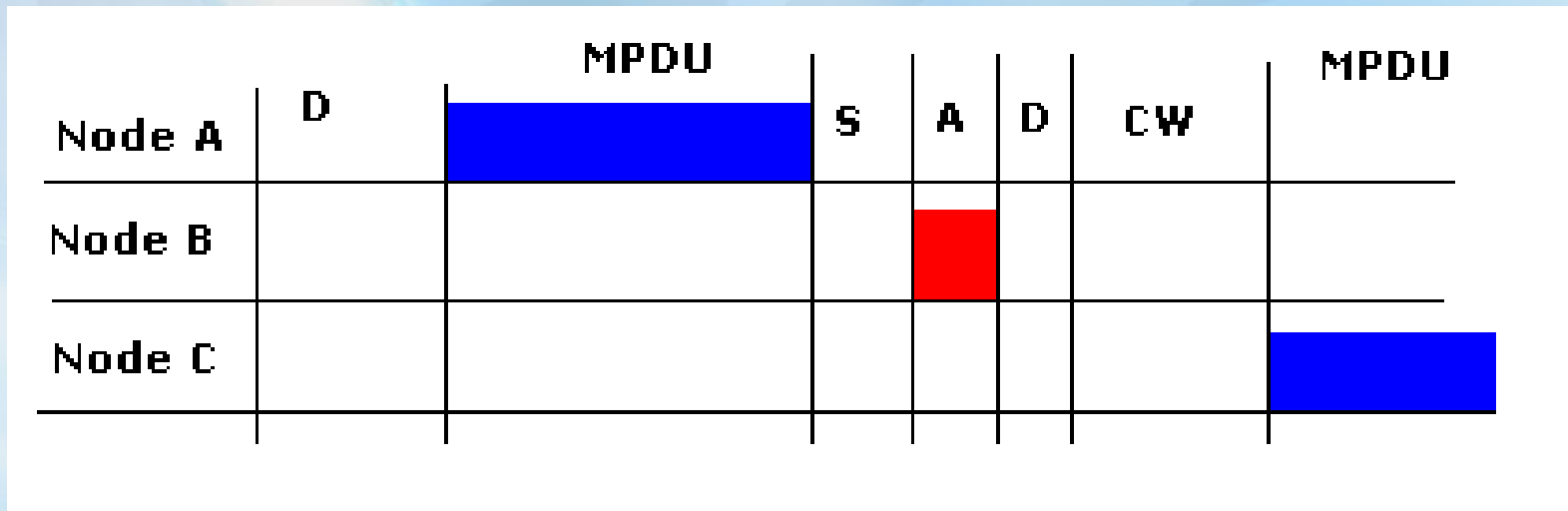
# Topics

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

# 802.11 MAC (Media Access Control)

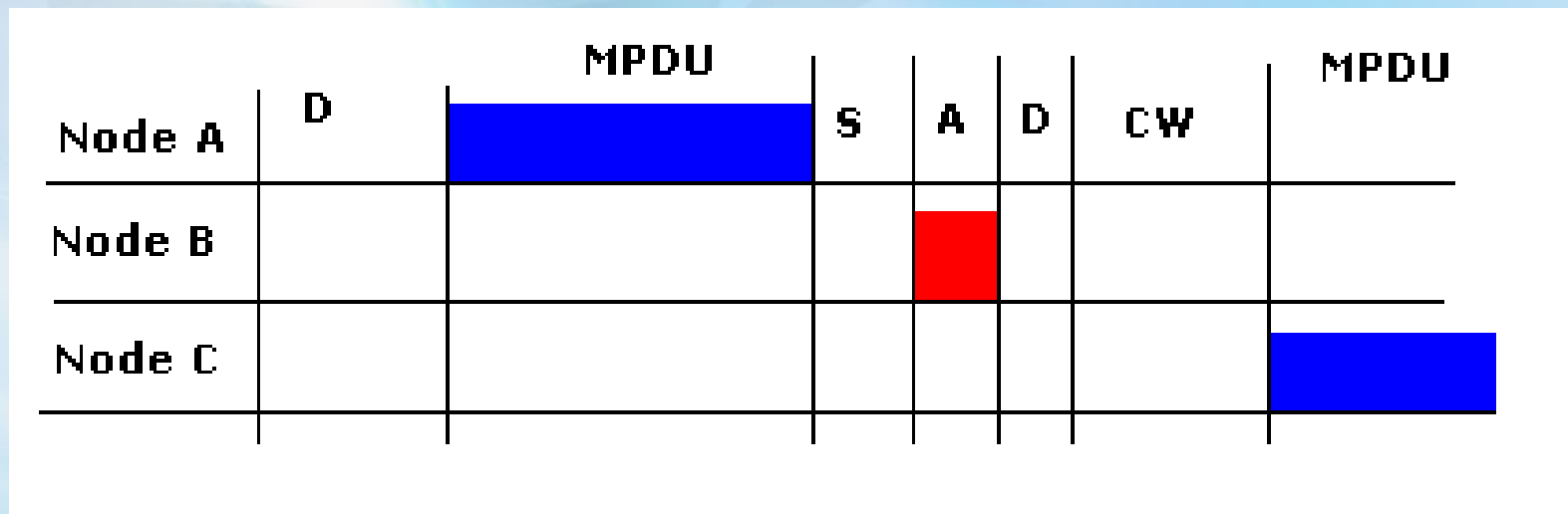
The 802.11 family uses a MAC layer known as **CSMA/CA** (Carrier Sense Multiple Access/Collision Avoidance)

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.
  - If channel is **idle** (no active transmitters) it **sends** a packet.
  - 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).
  - 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

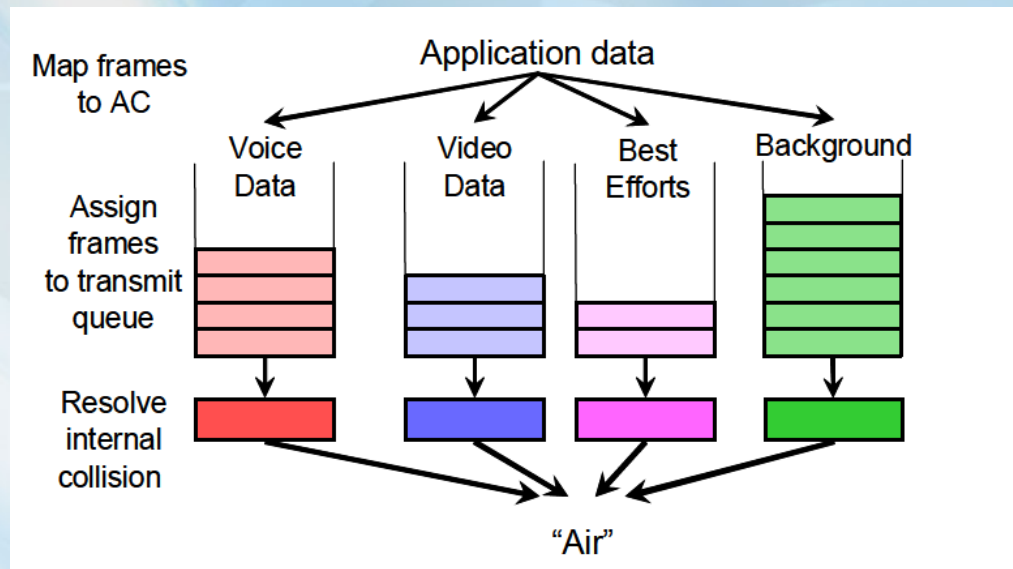
- **QoS the Quality of Service:**
- Its goal is to use the available resources effectively, and improve user experience and satisfaction with your service, allowing you to run a prosperous business. QoS is what unites everything related to making routing decisions, providing reliable service with failover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



WMM QoS

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	W M M
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

# WMM Setup



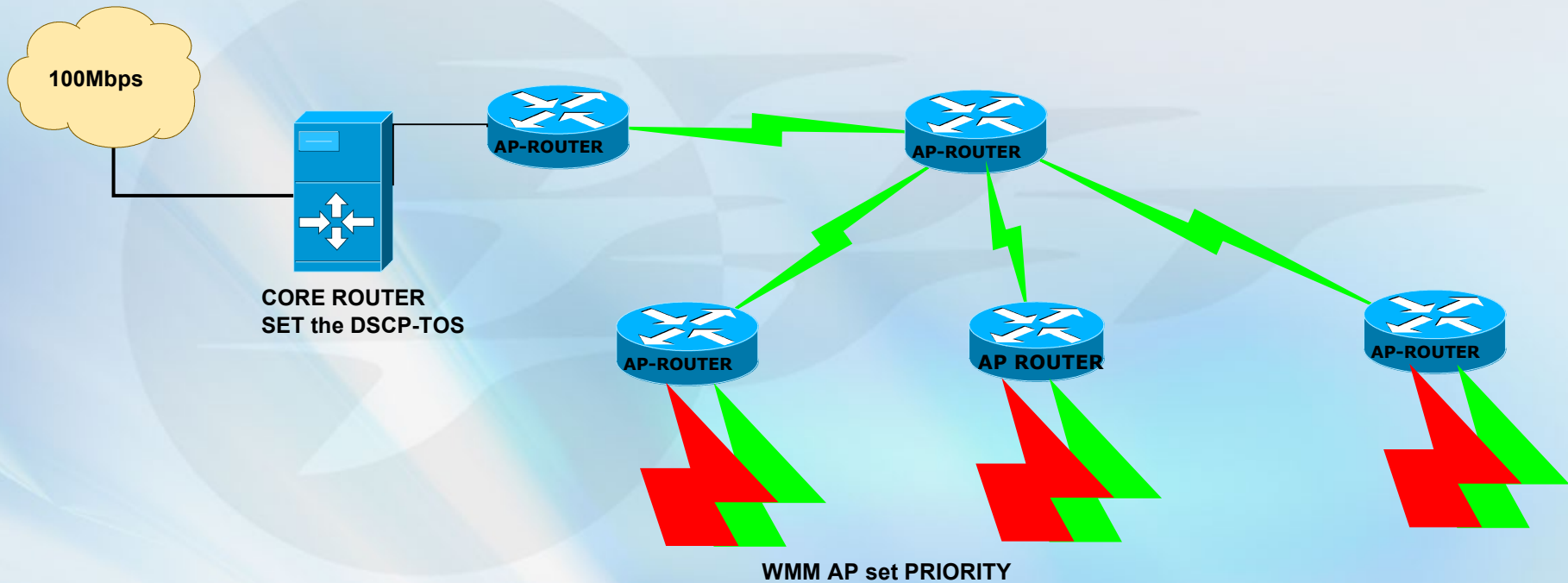
# WMM Setup

- 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 transport 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 be 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

Firewall												
Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols												
#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Inter...	Out. ...	Bytes	Packets	
::: set DSCP voip												
0	✓ change DSCP (TOS)	prerouting		195.36.2.85						28.9 MiB	342 276	
::: dscp.0												
1	✗ mark packet	prerouting								44.4 GiB	69 385 594	
::: dscp.40-47video												
2	✗ mark packet	prerouting								0 B	0	
::: dscp.40-47video												
3	✗ mark packet	prerouting								0 B	0	
::: dscp.40-47video												
4	✗ mark packet	prerouting								0 B	0	
::: dscp.40-47video												
5	✗ mark packet	prerouting								0 B	0	
::: dscp.40-47video												
6	✗ mark packet	prerouting								0 B	0	
::: dscp.40-47video												
7	✗ mark packet	prerouting								0 B	0	
::: dscp.40-47video												
8	✗ mark packet	prerouting								60.1 KiB	108	
::: dscp.40-47video												
9	✗ mark packet	prerouting								0 B	0	
::: dscp.48-55voice												
10	✗ mark packet	prerouting								48.3 MiB	698 374	
::: dscp.48-55voice												
11	✗ mark packet	prerouting								0 B	0	
::: dscp.48-55voice												

26 items (1 selected)

# 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
```

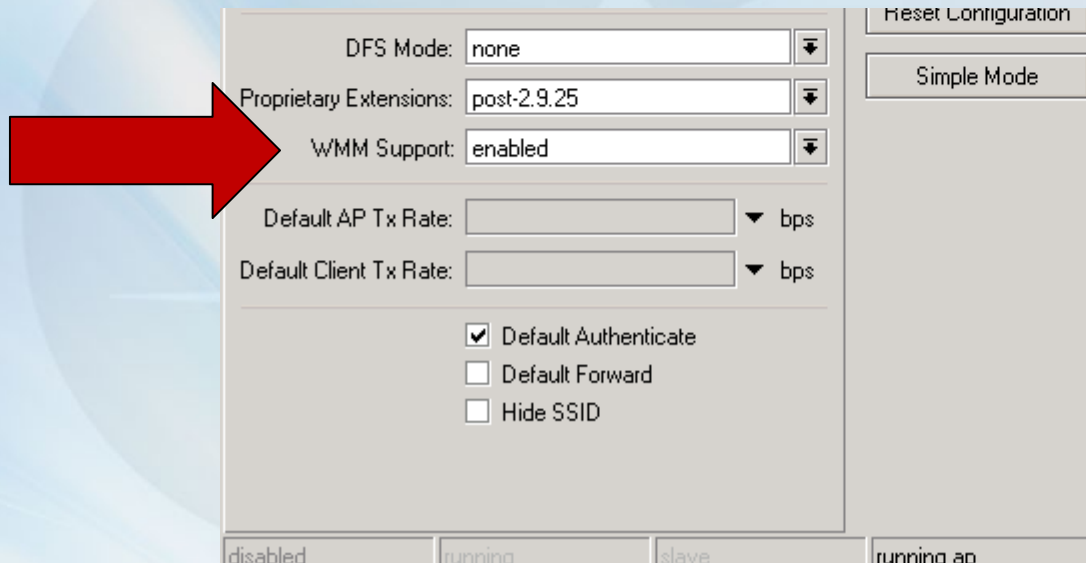
- Or by matching dscp value and change the priority

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

Firewall											
Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 Protocols											
#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Inter...	Out. Int...	Bytes	Packets
::: set DSCP voip											
0	✓ cha...	prerouting		195.36.2.85						16.9 MiB	165 905
::: set pri 46											
1	✓ set ...	prerouting								54.7 KiB	124
::: set pri 48											
2	✓ set ...	prerouting								41.7 MiB	615 625

# WLAN wireless settings

- On the AP and on the CPE:

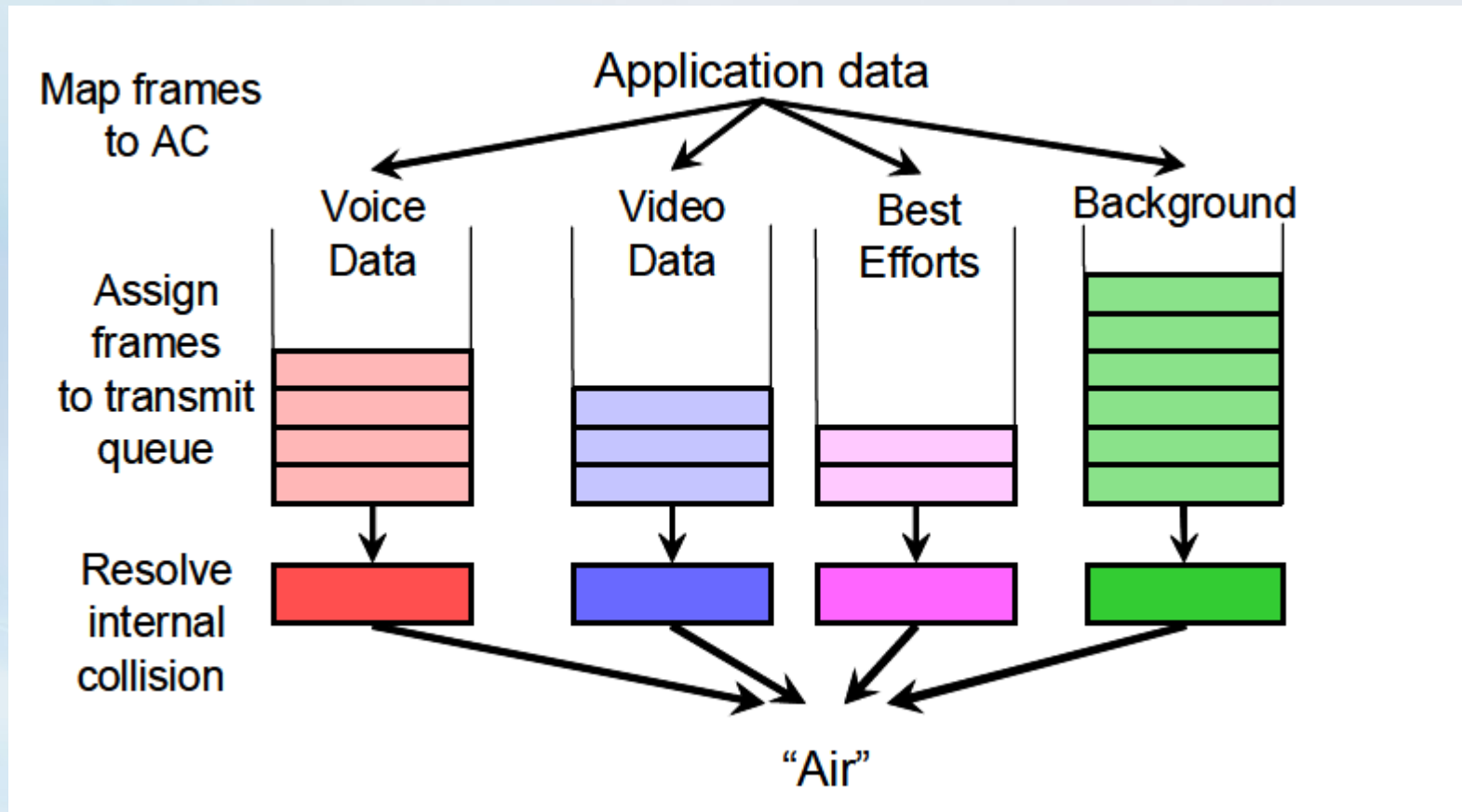


The screenshot shows a configuration window for WLAN wireless settings. A red arrow points to the 'WMM Support' dropdown menu, which is currently set to 'enabled'. Other settings include 'DFS Mode' (none), 'Proprietary Extensions' (post-2.9.25), 'Default AP Tx Rate' (empty), 'Default Client Tx Rate' (empty), and checkboxes for 'Default Authenticate' (checked), 'Default Forward' (unchecked), and 'Hide SSID' (unchecked). A 'Reset Configuration' button and a 'Simple Mode' button are also visible.

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



# WMM action



# 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 !

Visit our stand Wi4Net – Totalconn

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