

How To | Configure the WLAN with QoS

Introduction

This How to Note explains how to configure Quality of Service (QoS) in a wireless Local Area Network to prioritize traffic under busy conditions.

There is an example scenario provided at the end of this document, which describes the configuration for prioritizing voice traffic. This example could be extended to cover a wider installation case.

For a complete description of the commands used in this document, please refer to the following guide:

[“AT-WR4600 Series – Command Reference Guide”](#).

Trademarks

The following trademarks appear in this document:

Ethernet™ is a trademark of Xerox Corporation.
Wi-Fi®, Wi-Fi Alliance®, WMM®, Wi-Fi Protected Access® (WPA), the Wi-Fi CERTIFIED logo, the Wi-Fi logo, the Wi-Fi ZONE logo and the Wi-Fi Protected Setup logo are registered trademarks of the Wi-Fi Alliance. Wi-Fi CERTIFIED™, Wi-Fi Direct™, Wi-Fi Protected Setup™, Wi-Fi Multimedia™, WPA2™, Passpoint™, and the Wi-Fi Alliance logo are trademarks of the Wi-Fi Alliance
UPnP™ is a certification mark of the UPnP™ Implementers Corporation.
Microsoft®, MS-DOS®, Windows®, Windows NT® and Windows Vista® are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
Other brands and product names may be trademarks or registered trademarks of their respective holders. All other logos, trademarks and service marks are the property of their respective owners, where marked or not.

Which products and software version does this document apply to?

This document applies to the following Allied Telesis products:

Table 1 – Allied Telesis network products

Product	Software Version	Description and Notes
AT-WR4662n	1.1 b248 onward	High-Speed Mobility – Wireless base router IEEE 802.11a/b/g/n dual radio, 2x2 MIMO
AT-WR4652-80	1.1 b248 onward	High-Speed Mobility – Wireless mobile router IEEE 802.11a/b/g/n dual radio, 1x1 MIMO
AT-TQ00xx		Cables and accessories Note: Selection is application-dependent
AT-6101G		IEEE 802.3af Gigabit Ethernet PoE Injector Note: Use it to inter-connect AT-WR4662n

Table of contents

Introduction	1
Trademarks.....	2
Which products and software version does this document apply to?.....	2
Table of contents.....	3
Overview	4
What is Wi-Fi Multimedia (WMM)	4
Why use Wi-Fi Multimedia?	4
How Wi-Fi Multimedia works.....	5
How to configure Wi-Fi Multimedia	7
Parameter descriptions.....	7
Connecting AT-WR4600 products.....	8
Configuration example.....	10
Using QoS to prioritize voice traffic	10
Common setup	11
[Bridge0] station role: root bridge	12
[Bridge1] station role: non-root bridge [AP1] station role: root access-point.....	13
[Bridge2] station role: non-root bridge.....	14

Overview

What is Wi-Fi Multimedia (WMM)

The Wi-Fi Alliance defined WMM as a subset of the IEEE 802.11e standard to support QoS on wireless networks. WMM offers a mechanism to prioritize traffic demands from different applications and grants an adequate support to multimedia applications, thereby reducing the harmful effects caused by high latency and throughput reductions.

Why use Wi-Fi Multimedia?

Multimedia and data-centric applications typically share the same network resources, despite their conflicting requirements for data delivery. Without QoS, the network offers a best-effort service, which means that applications have equal opportunities to transfer data. WMM enables network managers to prioritize traffic based on bandwidth requirements, especially delay-sensitive applications such as Voice over Wireless LAN and streaming multimedia.

QoS policies play a key role when traffic load exceeds the capability of network resources, or when some applications, like file transfers, consume the available bandwidth. Based on services classification, WMM individually manages the traffic classes to provide low latency, reliability, and a more predictable delay to critical services.

How Wi-Fi Multimedia works

In the IEEE 802.11 standard, the wireless nodes access the medium using the “listen-before-talk” algorithm CSMA/CA-based ¹ Distributed Coordination Function (DCF). The wireless node transmits a frame once its checks indicate that the medium is free for a period of distributed inter-frame space (DIFS) and a random back-off time has elapsed. Otherwise, it defers the frame delivery. Note that contention reduces the available bandwidth, because nodes must back off before retrying to communicate.

DCF offers an efficient mechanism for transferring bursty traffic, but all nodes use the same access method, consequently a real time data source will face continuous contention with a large data transfer happening at the same time.

WMM provides two features that resolve contention and enable QoS:

- Enhanced Distributed Channel Access (EDCA)
- Hybrid Controlled Channel Access (HCCA)²

EDCA gives precedence to higher-priority traffic by means of a shorter arbitration interframe space (AIFS) and contention windows (CW). The back off time is the sum of predefined AIFS and a random value from 0 to CW, which is doubled at each collision till the limit (CW_{max}) is reached. Figure 1 depicts the timing. In addition, transmit opportunity (TXOP) bounds the time allocated to the node for data delivery.

HCCA is a centralized access control facility coordinated by the access point, which acts as point coordinator (PC). The PC collects the status of registered stations (via polling) and provides them the permission for channel occupancy and assigns, for example, the TXOP, the transmit start time and duration.

¹ Carrier Sense Multiple Access with Collision Avoidance.

² HCCA facility is not delivered by current software release.

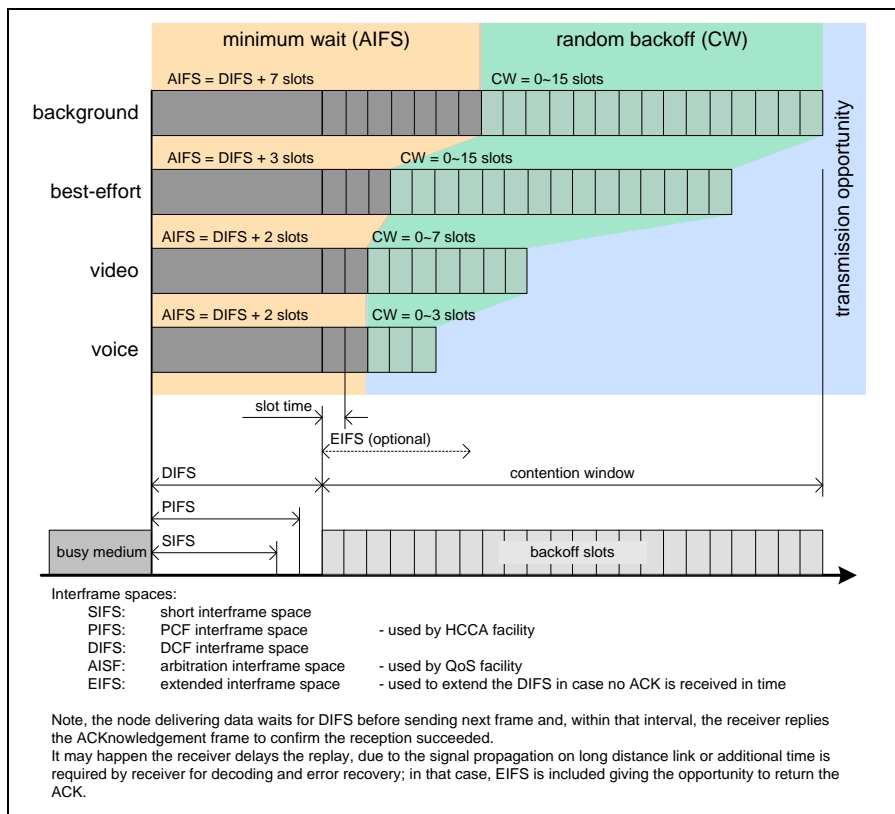


Figure 1 – WMM access timing

WMM requires that the clients running multimedia applications assign the appropriate priority level to the generated data traffic and that network infrastructure consistently applies QoS policies.

WMM derives four Access Categories from IEEE 802.1D Class of Service (CoS) as depicted by Table 2.

Within the wireless node, the WMM manages four independent transmit queues, one per access category, and dispatches to them incoming packets depending on the assigned Layer 3 differentiated service field (TOS/DSCP). Packet forwarding will happen basing on transmit opportunities.

Table 2 - WMM Access Categories and IEEE 802.1d tag mapping

Access Category	Priority	Description	IEEE 802.1D Traffic Types
Voice	Highest	Low-latency and toll voice quality	6, 7
Video	Highest -1	SDTV and HDTV streaming	4, 5
Best-effort	Lower + 1	Traffic less sensitive of latency, but affected by delays	0, 3
Background	Lower	Low priority traffic without throughput constraint (i.e. file transfer)	1, 2

How to configure Wi-Fi Multimedia

Use the command: **traffic-class** to set the EDCA back off criteria for the required WMM access category:

```
traffic-class [background|best-effort|video|voice]
             cw-min <0-10> cw-max <0-10> fixed-slot <2-20>
no traffic-class [background|best-effort|video|voice]
```

On collisions, WMM sets the back off time within the CWmin range and uses a persistence factor (PF) as the coefficient that multiplies the contention window size in successive retransmission attempts following a collision.

Note: WMM setup may only be entered on a wireless node with an access point role. It will distribute the QoS policies to “slave” nodes, for example, non-root bridge, workgroup-bridge, etc.

Parameter descriptions

cw-min (Contention Window minimum)

That is the random wait time before retrying the transmission; the initial size of the contention window is within $0 \sim CW_{\min}$ back off slots.

The value specifies the number of back off slots as a power of $2^n - 1$; in example,

`cw-min 3` means $2^3 - 1 = 7$ back off slots.

`cw-min 0` means $2^0 - 1 = 0$ back off slots.

cw-max (Contention Window maximum)

That is the maximum size of the contention window.

The value specifies the number of back off slots as a power of $2^n - 1$.

fixed-slot (Arbitrary Inter-Frame Space)

That is the predefined idle time that the station waits before starting the contention window (CW).

The value specifies the number of back off slots.

Note: Refer to “AT-WR4600 – Command Reference Guide”, for default settings and recommended configuration for the different WLAN topologies (access point, bridging, etc.).

Connecting AT-WR4600 products

There are two options for accessing the Command Line Interface of the devices:

- SSH remote shell, using any text-mode SSH client software.
- RS-232 Line Driver/Receiver that provides a standard DTE console interface; note, this is optional and is not always available.

Accessing the device via SSH

The Secure Shell (SSH) is an encrypted networking protocol, allowing the user to configure the device through an Ethernet network. Microsoft does not supply SSH tool. You can use an alternative program such as *Tera Term Pro*, which is licensed under GPL2. The device is factory configured with the static IP address 192.168.1.1. If the device is receiving an address from a DHCP server, please check the assigned IP address.

Accessing the device via RS-232

To access the device, you can use either the build-in Microsoft HyperTerminal (note it was removed from Windows Vista and later versions) or an alternative program such as *Tera Term Pro*.

The settings of the serial terminal are as follows.

Transmission rate	115200bps
Data length	8 bit
Stop bit	1bit
Parity	None
Flow control	None

Accessing the CLI

Enter the login and password via the terminal console (SSH or RS-232). Note, by default, the login name is **manager** and the password is **friend**.

```
AT-WR4600 login: manager
Password:
Feb  9 10:35:07 AT-WR4600 auth.info login[6898]: root login on 'ttyS0'

      AA TTTTTTTTTTTTTTTTTT  ooooo
     AAAAA TTTTTTTTTTTTTTTT  ooooooooo
    AAAAAAA TTTTTTTT   I  oooooo
   AAAAAAAAAA TTTTTTT  IIIIIIIII
  AAAAAAA  AAAAA  TTTT   IIIIIIIII
 AAAAAAA   AAAAA  T   IIIIIIIII

Copyright (C) 2012 Allied Telesis International
All rights reserved.
AT-WR4600> enable
Password:
AT-WR4600#
```

Configuration example

This configuration example starts with the Command Line Interface already set to Global configuration mode:

```
AT-WR4600#configure terminal
AT-WR4600 (config) #
```

On setup completion, run the command **show running-config** to verify the applied configuration.

Note:

All of the examples in this document provide the minimum set of commands useful for configuring the WMM, regardless of other services like bridging, and security etc.

Using QoS to prioritize voice traffic

This example applies the QoS policy to support voice traffic.

Wireless nodes belong to a Wireless Distribution System working in 5GHz bands, while the access to a wireless LAN is offered in 2GHz bands.

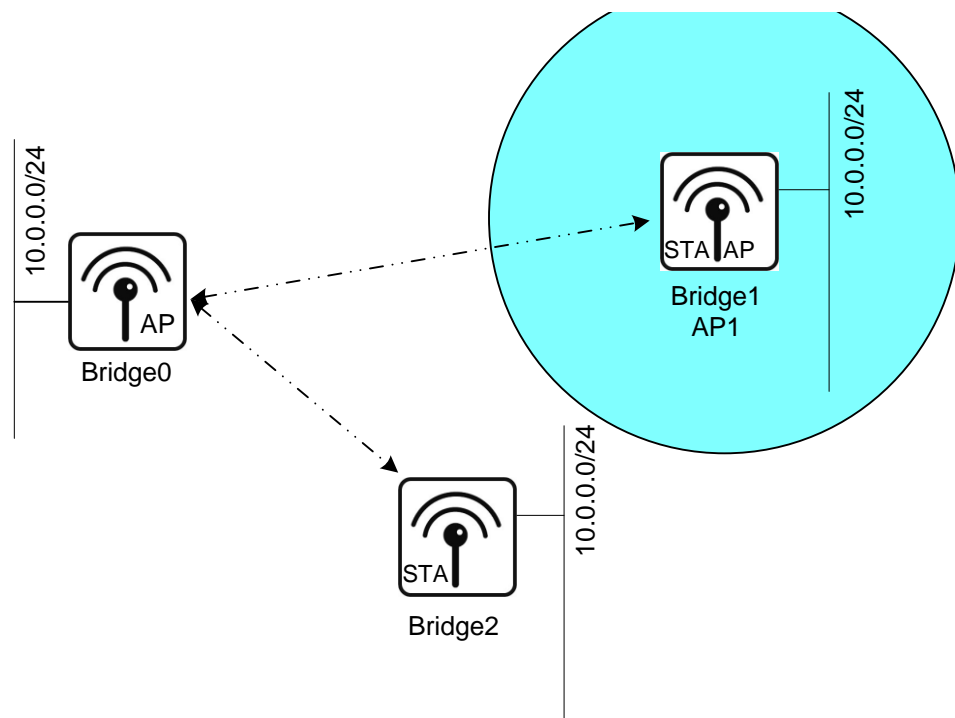


Figure 2 – QoS giving preference to voice traffic

Common setup

To restore the factory configuration on any device, enter the following commands:

```
AT-WR4600#copy nvram:/factory-config-bridged startup-config
AT-WR4600#reload
```

Configure the common SSID for open authentication:

```
AT-WR4600 (config) #dot11 ssid ATiopen
AT-WR4600 (config-ssid) #authentication open
AT-WR4600 (config-ssid) #guest-mode
AT-WR4600 (config-ssid) #exit
```

[Bridge0] station role: root bridge

Assign the static IP address:

```
AT-WR4600 (config) #interface vlan1.1
AT-WR4600 (config-if) #no ip address dhcp
AT-WR4600 (config-if) #ip address 10.0.0.100/24
AT-WR4600 (config-if) #exit
```

Configure the station role, the SSID and WMM to the radio interface 0 for bridging:

```
AT-WR4600 (config) #interface dot11radio 0
AT-WR4600 (config-if) #protocol-family an
AT-WR4600 (config-if) #station-role root bridge
AT-WR4600 (config-if) #ssid ATiOpen
AT-WR4600 (config-if) #bridge-group 1
AT-WR4600 (config-if) #traffic-class voice cw-min 2 cw-max 4
fixed-slot 2
AT-WR4600 (config-if) #traffic-class best-effort cw-min 4 cw-max 10
fixed-slot 3
AT-WR4600 (config-if) #no shutdown
AT-WR4600 (config-if) #end
```

[Bridge1] station role: non-root bridge
[AP1] station role: root access-point

Assign the static IP address:

```
AT-WR4600 (config) #interface vlan1.1
AT-WR4600 (config-if) #no ip address dhcp
AT-WR4600 (config-if) #ip address 10.0.0.1/24
AT-WR4600 (config-if) #exit
```

Configure the station role and the SSID to the radio interface 0 for bridging:

```
AT-WR4600 (config) #interface dot11radio 0
AT-WR4600 (config-if) #protocol-family an
AT-WR4600 (config-if) #station-role non-root bridge
AT-WR4600 (config-if) #ssid ATIOpen
AT-WR4600 (config-if) #bridge-group 1
AT-WR4600 (config-if) #no shutdown
AT-WR4600 (config-if) #exit
```

Configure the station role, the SSID and WMM to the radio interface 1 for access:

```
AT-WR4600 (config) #interface dot11radio 1
AT-WR4600 (config-if) #protocol-family bg
AT-WR4600 (config-if) #station-role root access-point
AT-WR4600 (config-if) #ssid ATIOpen
AT-WR4600 (config-if) #bridge-group 1
AT-WR4600 (config-if) #traffic-class voice cw-min 2 cw-max 4
fixed-slot 2
AT-WR4600 (config-if) #traffic-class best-effort cw-min 4 cw-max 10
fixed-slot 3
AT-WR4600 (config-if) #no shutdown
AT-WR4600 (config-if) #end
```

[Bridge2] station role: non-root bridge

Assign the static IP address:

```
AT-WR4600 (config) #interface vlan1.1
AT-WR4600 (config-if) #no ip address dhcp
AT-WR4600 (config-if) #ip address 10.0.0.2/24
AT-WR4600 (config-if) #exit
```

Configure the station role and the SSID to the radio interface for bridging:

```
AT-WR4600 (config) #interface dot11radio 0
AT-WR4600 (config-if) #protocol-family an
AT-WR4600 (config-if) #station-role non-root bridge
AT-WR4600 (config-if) #ssid ATiopen
AT-WR4600 (config-if) #bridge-group 1
AT-WR4600 (config-if) #no shutdown
AT-WR4600 (config-if) #end
```