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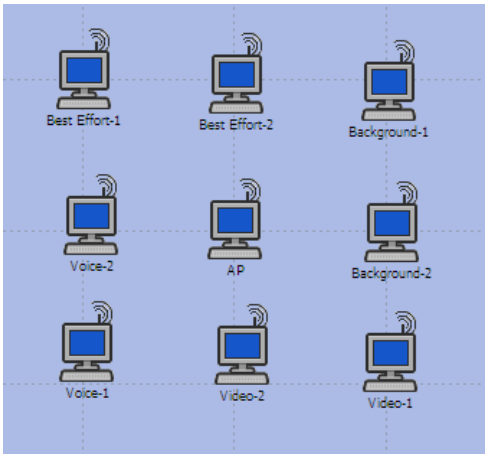
Wireless Local Area Network (WLAN) - QoS

1.Introduction

This scenario studies impact of deploying 802.11e QoS facilities on network performance, where stations generating application traffic for all QoS Types of Service (ToS) classes are present. It also highlights how an access point (AP) (11-e capable access point) can overwrite the EDCA (Enhanced Distributed Channel Access) Parameters for each Access Category (AC) to re-order their relative priorities.

2.Network scenario

The base network scenario contains one AP and eight 802.11e-enabled stations (STAs). These STAs are divided into four groups of two, such that the group members send their traffic to each other and each group's traffic is mapped to one of the EDCA ACs. For example, Voice-1 and Voice-2 generate traffic that is mapped to Voice AC at WLAN layer, and their traffic is destined to each other. Similarly Video-1 and Video-2 send traffic to each other using Video AC, and so on. The STAs are configured this way, so that by studying the end-to-end delay reported, for instance, by Voice-1, Video-1, Best Effort-1 and Background-1, we can see how the traffic of each AC is treated at the WLAN layer.



3.Objectives

The objective of this lesson is to study the impact of deploying 802.11e QoS facilities on network performance. For that, three network scenarios must be created. In the first, the AP operates as a non-802.11e device. In the second, the AP operates as a standard 802.11e-capable device. In third, the AP also operates as a 802.11e-capable device, but it uses and advertises a "reversed" set of EDCA parameter values. This means that the standard recommended values for "Voice" access category (AC) are used and advertised for "Background" AC, and vice-versa. Same "exchange" is also applied between "Video" and "Best

Effort" ACs. In summary, it reverses the relative priorities of the ACs such that Background AC is treated as the highest priority in the BSS, while Voice AC becomes the lowest priority AC.

4.Getting Started

1.Create a project (see ***Basics of OPNET*** document)

1.1. A Campus scenario

2.Create an Object Palette (see ***Basics of OPNET*** document) with the following elements:

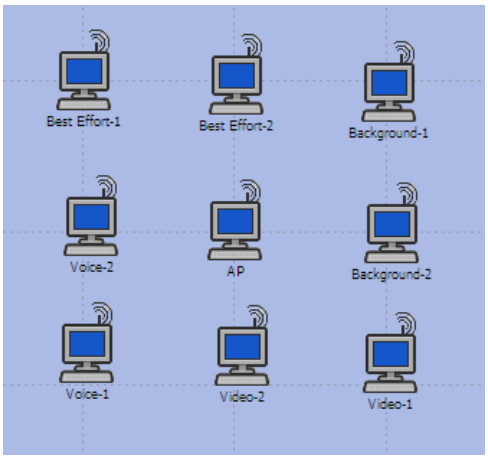
- Node models:
  - wlan_station_adv

3.Create a Network

3.1. Build a network

3.1.1. Drag the node models according to the network scenario presented in the following figure.

3.1.2. Name the objects with the names presented in the figure. Right-click on the object and select **Set Name**



3.2. To Configure the network objects Follow these steps

3.2.1. Configuring the AP.

Select the AP, right-click on it and select **Edit Attributes.**

Attribute	Parameter	Value
Wireless LAN Parameters	BSS	1
	Access point Functionality	Enabled
	Data Rate (bps)	5.5 Mbps

Then click **OK**.

3.2.2. Configuring the STAs.

Select all STAs, right-click on one of them and then select **Edit Attributes.**

Attribute	Parameter	Value
Traffic Generation parameters	Start time	constant (0.02)
	On State time	constant(3600)
	Off State Time	constant (0)
	Interarrival Time	exponential (0.125)
	Packet Size	uniform (1000,10000)
	Segmentation	no segmentation
Wireless LAN Parameters	BSS	1
	Data Rate (bps)	5.5 Mbps
	HCF Parameters	Default

Do not forget to check “Apply to selected objects” and then click **OK**.

3.2.3. Configuring traffic flows.

Select each STA individually, right-click on it and select **Edit Attributes.**

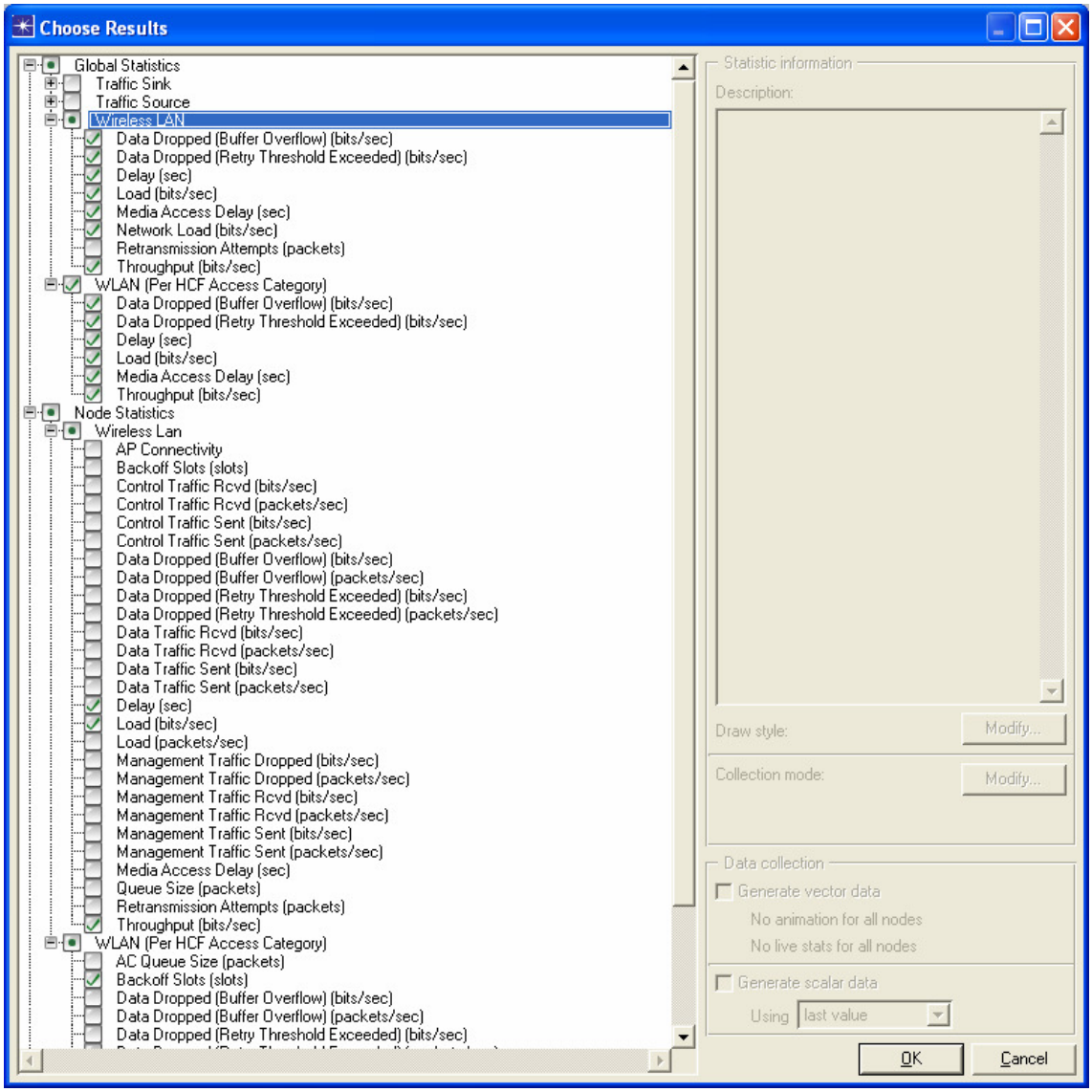
STA	Attribute	Parameter	Value
Background-1	Destination Address		2
	Traffic Type Service		Background(1)
	Wireless LAN	Wireless LAN MAC Address	1
Background-2	Destination Address		1
	Traffic Type Service		Background(1)
	Wireless LAN	Wireless LAN MAC Address	2
Best Effort-1	Destination Address		4
	Traffic Type Service		Best Effort (1)
	Wireless LAN	Wireless LAN MAC Address	3
Best Effort-2	Destination Address		3
	Traffic Type Service		Best Effort (1)
	Wireless LAN	Wireless LAN MAC Address	4
Video-1	Destination Address		6
	Traffic Type Service		Interactive multimedia(5)
	Wireless LAN	Wireless LAN MAC Address	5
Video-2	Destination Address		5
	Traffic Type Service		Interactive multimedia(5)
	Wireless LAN	Wireless LAN MAC Address	6
Voice-1	Destination Address		8
	Traffic Type Service		Interactive voice(6)
	Wireless LAN	Wireless LAN MAC Address	7
Voice-2	Destination Address		7
	Traffic Type Service		Interactive voice(6)
	Wireless LAN	Wireless LAN MAC Address	8

4.Collecting Statistics

4.1. Global Statistics

4.1.1. Right-click in the workspace (but not on an object) and select **Choose Individual DES Statistics** from the Workspace pop-up menu.

4.1.2. Select the data collection according to the following figure.



5.Run Simulation

1.Run a simulation

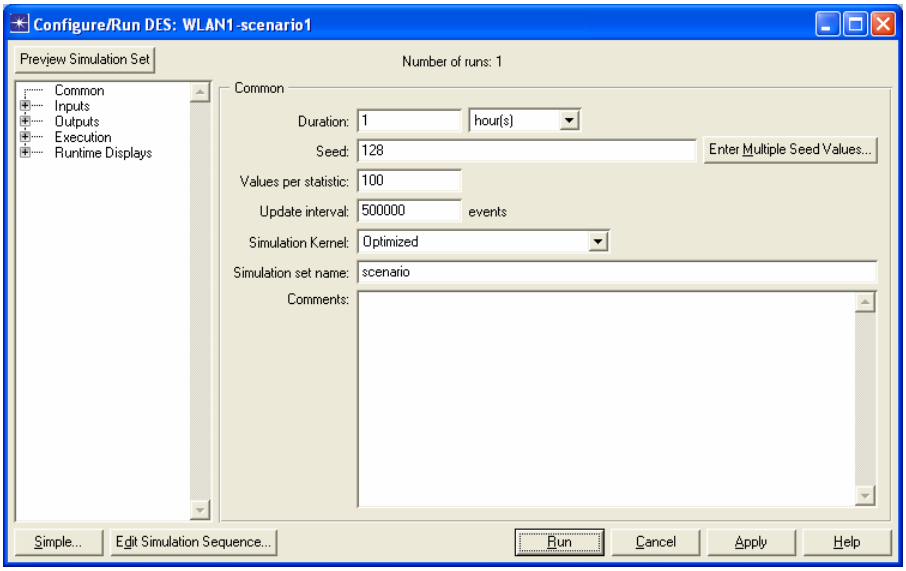
1.1. Select DES > Configure/Run Discrete Event Simulation….

1.2. Type **1** in the **Duration:** field to simulate 1 hour of network activity.

1.3. Type **10000** (events) in the **Update interval:** field to specify how often the simulation calculates events/second data. In this case, the simulation calculates and displays events/second data at 10,000-event intervals. The default setting for this is 500,000 for larger network simulations.

1.4. Set the Simulation Kernel to **Optimized**. You can use one of two types of kernels to run your simulation. The development kernel collects simulation data you can use to debug your models, but the optimized kernel runs faster.

1.5. Click the **Run** button to begin the simulation. While the simulation runs, a dialog box appears showing the simulation's progress.

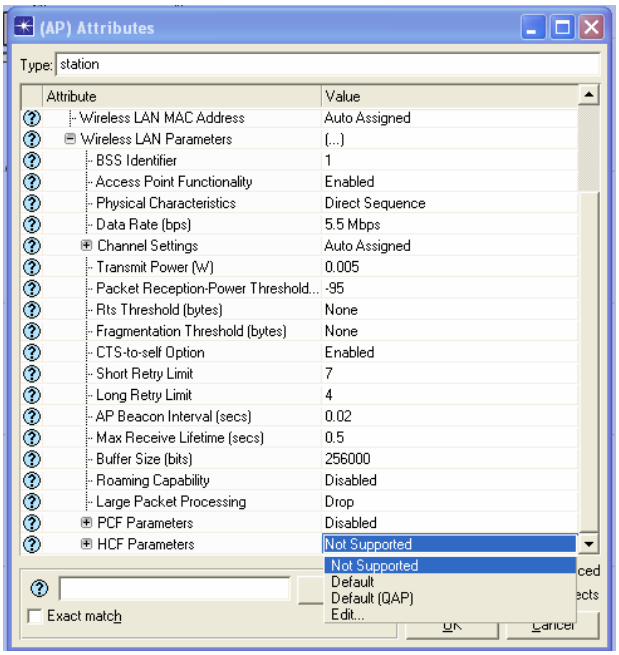


6.Setting 802.11e-capable AP

1.Configuring an 802.11e-capable AP

1.1. Select the AP, right-click on it and select **Edit Attributes.**

1.1.1. Set **HCF Parameters** equal to Default (QAP)



2.Configuring a “reversed” 802.11e-capable AP.

2.1. Select the AP, right-click on it and select **Edit Attributes.**

2.1.1. Set **Wireless LAN Parameters -> HCF Parameters -> AP Specific Parameters -> Parameters Advertised in BSS** according to the following table.

Attribute	Parameters		Value
EDCA Parameter Set Distribution			enabled
EDCA Parameter Set	Voice	CWmin	15
		CWmax	1023
		AIFSN	7
		DS-CCK	3264
		Extended Rate…	One MSDU
		FHSS…	One MSDU
	Video	CWmin	15
		CWmax	1023
		AIFSN	3
		DS-CCK	6016
		Extended Rate…	One MSDU
		FHS…	One MSDU
	Best Effort	CWmin	7
		CWmax	15
		AIFSN	2
		DS-CCK	One MSDU
		Extended Rate…	3008
		FHS…	One MSDU
	Background	CWmin	3
		CWmax	7
		AIFSN	2
		DS-CCK	One MSDU
		Extended Rate…	1504
		FHSS…	One MSDU