

Simulation of HCF-Lite (IEEE 802.11e, QoS) with Nessi

Jérôme Vernez, Jürgen Ehrensberger, Stephan Robert [@heig-vd.ch]

Purpose

The purpose of this project is to integrate a lite version of HCF (Hybrid Coordination Function) to a network simulator developed in this school (Nessi). HCF originally from the standard IEEE 802.11e and bring new channel access methods that permit to guaranteed a Quality of Service (QoS).

IEEE 802.11e

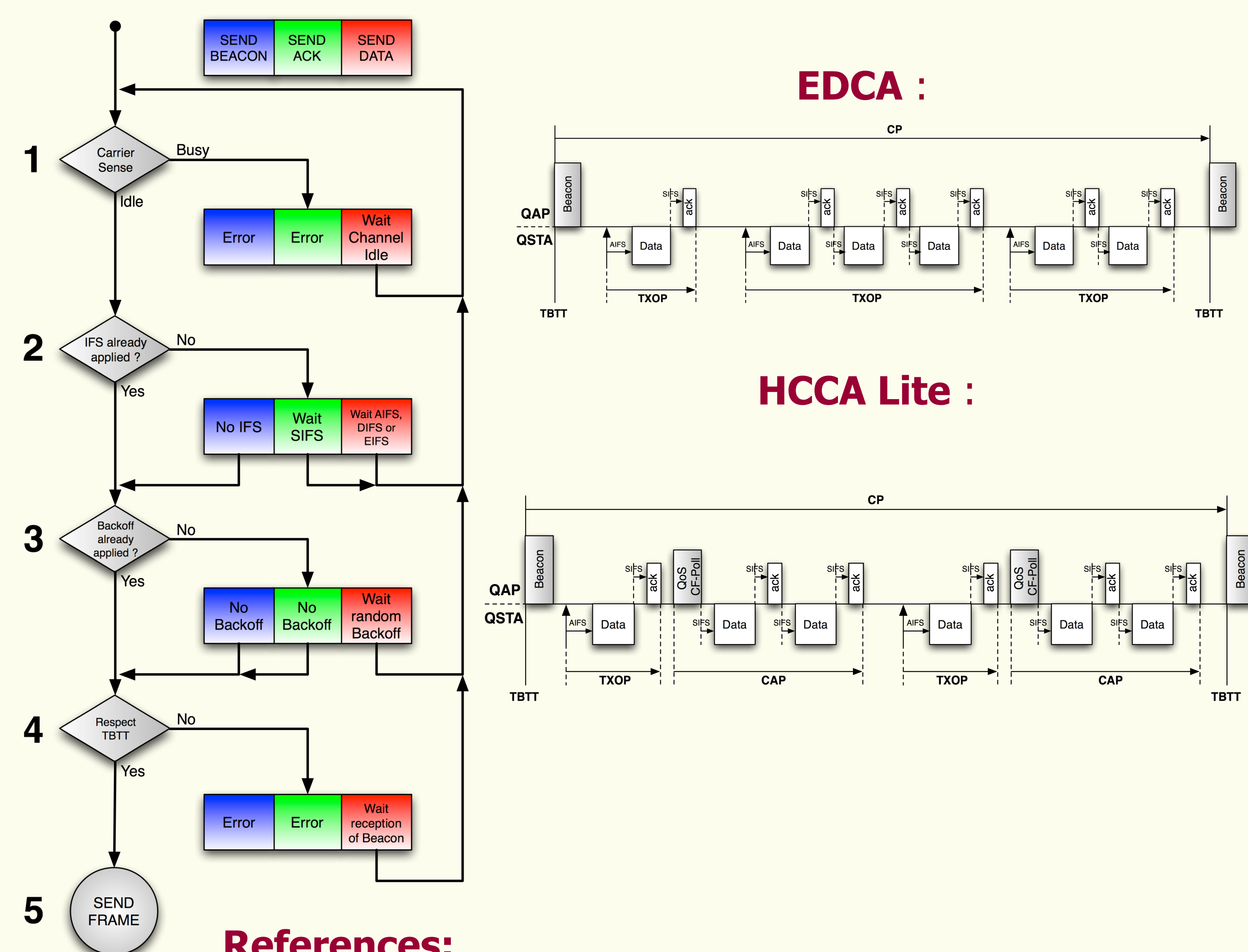
The standard IEEE 802.11 own two coordination functions; PCF (Point) and DCF (Distributed). IEEE 802.11e bring a third: HCF (Hybrid), it is a combination of PCF and DCF. HCF own two access methods:

- **EDCA** (Enhanced Distributed Channel Access)
- **HCCA** (HCF Controlled Channel Access)

EDCA is used for all contention period in HCF. The QoS of HCF is bring with the following mechanisms:

- Traffic by packet or flow
- Concept of TX opportunity (TXOP)
- Protection of Beacons
- Block Acknowledgement
- Direct Link Protocol (DLP) : reduce the channel using
- Reservation of time (CAP)

Channel Access Mechanisms

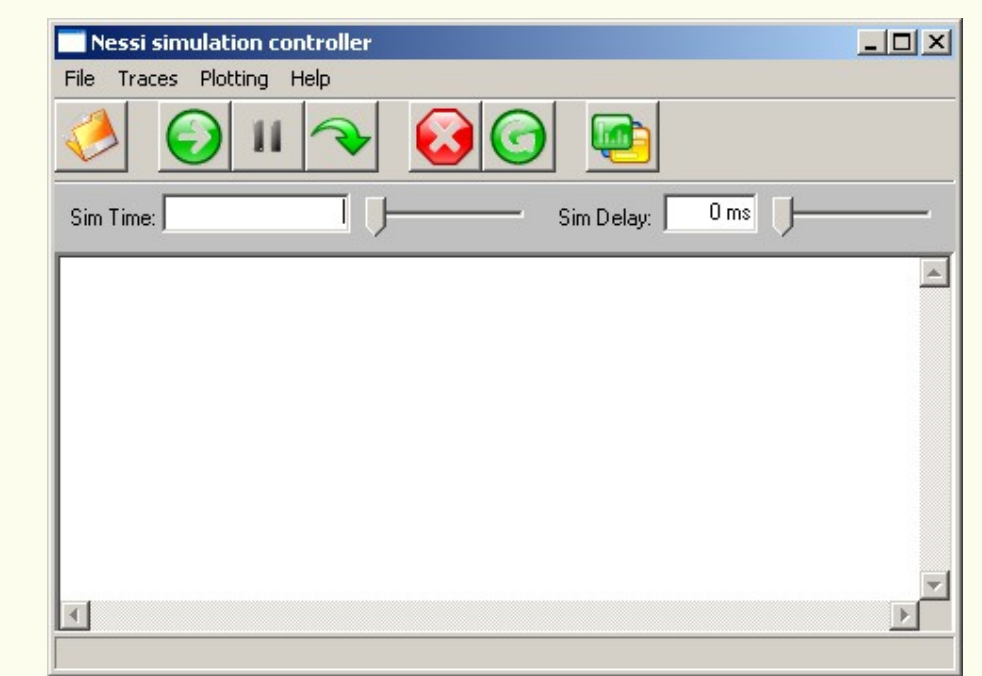


References:

- Jérôme Vernez, Jürgen Ehrensberger, Stephan Robert, « Nessi: A Python Network Simulator for Fast Protocol Development », *CAMAD*, June 8-10, 2006, Trento, Italy.
- L.Gannoune, S.Robert, « Results on Dynamic Adaptation of the Contention Window Maximum for Enhanced Service Differentiation in IEEE 802.11 Ad-Hoc Networks », *IEEE VTC*, Los Angeles, September 26-29, 2004.
- L.Gannoune, S.Robert, « Dynamic Tuning of the Contention Window Minimum (Cwmin) for Enhanced Service Differentiation in IEEE 802.11 Wireless Ad-Hoc Networks », *IEEE PIMRC*, Barcelona, Spain, September 5-8, 2004.

Nessi

- Simple Network simulator
- Python based
- Discrete event scheduler
- Network building with Script
- Development time is minimizing (reduced by a factor of -10 compared to C/C++ or Java)
- Verification and performance of new protocols
- Easy to use Graphical Interface



Integration

Physical Layer:

There are three PHY layers (DSSS, FHSS, OFDM) and these layers can be used for all access method.

Medium Access Channel Layer:

There are three MAC Layers (DCF, EDCA, HCCA-Lite).

Simulation Example

« Flux tendu »

Traffic Type	Packet Size	Interval	Rate
Data	~500 Bytes	~10 ms	=> ~400 Kbps
Video	1500 Bytes	6 ms	=> 2 Mbps
Voice	160 Bytes	20 ms	=> 64 kbps

- 24 Mbits/s (802.11g), EDCA (802.11e)
- 4 QSTAs (TX). 1 QAP (RX). Infrastructure network.
- Flux tendu (packets are deleted in the queues of QSTA)

