



UNIVERSITÀ DI PISA

Computer Engineering

Distributed Systems and Middleware Technologies

Slotted random-access wireless network

Group Project Report

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1 — Introduction

1.1 Problem Description

From the group project assignment:

*In a **slotted random-access network**, N couples transmitter-receiver share the same communication medium, which consists of C separate channels. Multiple attempts to use the same channel in the same slot by different transmissions will lead to collision, hence no receiver listening on that channel will be able to decode the message. Assume that each of the N transmitters generate packets according to an **exponential inter-arrival distribution**, and picks its channel at random on every new transmission. Before sending a packet, it keeps extracting a value from a **Bernoullian RV with success probability p** on every slot, until it achieves success. Then it transmits the packet and starts over. If a collision occurs, then the transmitter backs off for a random number of slots (see later), and then starts over the whole Bernoullian experiment. The number of back-off slots is extracted as $U(1, 2^{x+1})$, where x is the number of collisions experienced by the packet being transmitted.*

1.2 Objectives

The aim of the project report is the *Assessment of the Effectiveness of the Slotted Random-Access Network Protocol* described in the latter paragraph.

1.3 Performance Indexes

In order to define a metric of performance of the objective, the following Performance Indexes are defined:

- **Throughput:** let Tp be the Throughput to be measured, N_p the number of packets successfully sent to the corresponding receiver, N_t the number of time-slot considered in the count of N_p , T_{slot} the period (in seconds) of a time slot, the Throughput(per slot) can be measured as:

$$Tp(slot) = \frac{N_p}{N_t} \quad [packets/slot]$$

During all the documentation the latter will be used because more meaningful w.r.t. the scenario that will be defined. We can also convert this performance metric in a more standard form, dealing with packets per second:

$$Tp = \frac{Tp(slot)}{T_{slot}} \quad [packets/s]$$

- **Response Time:** defined as the time that occurs from the first appearance of one packet at the Transmitter up to the reception of the packet at the Receiver.