SA: Simulating MAC Protocols

The first MAC protocol designed for wireless networks was Aloha. As opposed to prior point-to-
point computer communications, Aloha used a shared medium for transmission. Because of its
very simple mechanism, where each node just sends data with probability $p$, Aloha is widely
studied and serves as a basis for many of the MAC protocols being deployed nowadays in wired
and wireless networks, such as Ethernet and IEEE 802.11. Keeping the random access spirit of
Aloha, a variety of MAC layer protocols have been proposed for wireless ad-hoc networks. Many
of these protocols use some variation of CSMA (Carrier Sense Multiple Access), which improves
the utilization of the channel by allowing nodes to first “listen” to the medium and then decide
whether to transmit or not. The main challenge of all these protocols is to deal with the *hidden
terminal* problem, which makes it tricky to take preventive measures against collisions, since two
sending nodes may not be within mutual reach of each other and therefore not be able to sense
that the other is transmitting to the same receiver, for example.

In this thesis you will compare, through simulations, the performances of two or more MAC
protocols for wireless ad-hoc networks in the SINR (Signal-to-Interference-plus-Noise-Ratio)
model. In the SINR model, the energy of a signal fades with the distance to the power of the
path-loss exponent $\alpha$. If the signal strength received by a device divided by the interfering
strength of competitor transmitters is above some threshold $\beta$, the receiver can decode the
message, otherwise it cannot.

Your first task will be to find (or implement) a simulator that captures the notions of signal
propagation, interference and collisions in the SINR model. Furthermore, you will have to
generate different network scenarios, tuning parameters such as transmission power level, path-
loss exponent, network connectivity, density, and other factors that influence the topology of the
network. Afterwards, you will have to simulate the behavior of two or more MAC protocols and
find out what are their strengths and weaknesses. The main part of the thesis will be to build
interesting network topologies that represent the best and the worst-case behavior of each
protocol.

Interested? Please contact us for further details!

**Kind of work:** Mostly practical

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