5. System model

The characteristics of the wireless medium make wireless networks fundamentally different from wired networks. Specifically:
the wireless medium has neither absolute nor readily observable boundaries outside of which stations are known to be unable to receive network frames:

- the channel is unprotected from outside signals;
- the wireless medium is significantly less reliable than wired media;
- the channel has time varying and asymmetric propagation properties;

In this section we investigate , by a set of experimental measurements , the relationship between the transmission and carrier sensing range through 4-station experiments .
In particular it is useful to make a distinction between transmission range and carrier sensing range :

- *the transmission range* (*TX_range)* is the range (with respect to the transmitting station) within which a transmitted frame can be successfully received. The transmission range is mainly determined by the transmission power and the radio propagation properties
- *the Physical Carrier Sensing Range* (*CS_range*) is the range (with respect to the transmitting station) within which the other stations detect a transmission. It mainly depends on the sensitivity of the receiver (the received threshold) and the radio propagation properties

Other tests show that physical carrier sensing range is almost the same for different transmission rates. Indeed the physical carrier sensing mainly depends only on two parameters: the stations' transmitting power and the distance between transmitting stations. The rate at which data are transmitted have no significant effect on these parameters.

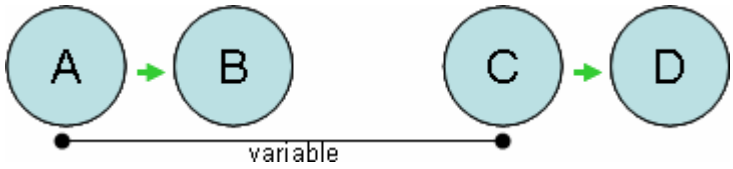

Figure 5-1

We also have measured the throughput achieved varying the distance d(A,C) (refer to the configuration of Figure 5-1) but with MAC delay set by MAC layer (Figure 5-2).

In this case both couples communicate but throughput depends on their distance.

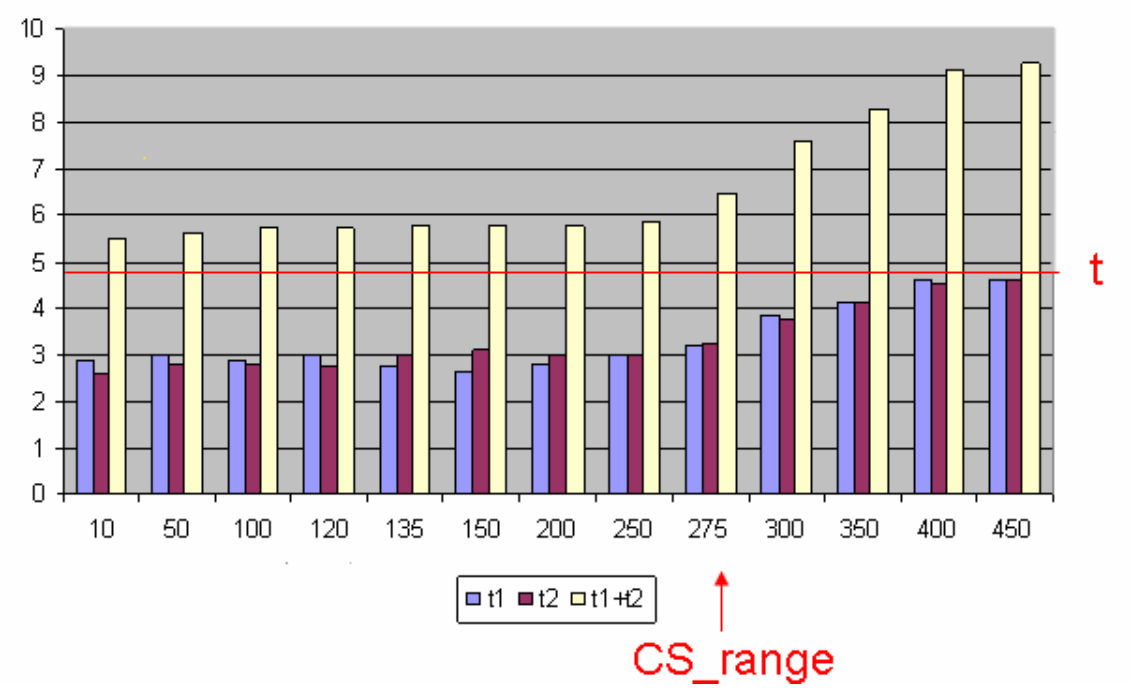

Figure 5-2

As it clearly appears from the figure there are two steps in the aggregate throughput (`t1+t2`) and in the individual throughput (`t1`,`t2`) : one until *CS_range* and the other after *CS_range*.

This behavior can be explained as follows.

Taken a session as reference , the presence of the other session may have two possible effects on the performance of the reference session :

- if the two sessions are within the same physical carrier sensing range they share the same physical channel. Individual throughput are minor than average measured throughput in 2-station configuration that is t=4.6 kbps (see 4.4 for

details). Aggregate throughput increases a little with distance due to the minor interferences between the couples.

- if they are outside the physical carrier sensing range the radiated energy from one session may still affect the quality of the channel observed by the other session. As the radiated energy may travel over unlimited distances, this effect completely disappears only for very large distances (about d(1,3)=450 m). Individual throughputs speed up and trend to average measured throughput in 2-station configuration (`t`).