Depicting the 3 WLANs line scenario in Komondor

Sergio Barrachina-Muñoz

October 4, 2017

1 The scenario

Network system composed of three WLANs located in a line. APs are separated by a distance d_{AP}. The separation between the AP and the STA of a same WLAN is determined by d_{STA}. In Figure 1, it is shown the schematic of this scenario.

The configuration parameters considered in this document are shown in the box inside Figure 3. This scenario must serve to validate the Komondor simulator performance for non fully overlapping scenarios. To that aim, results are compared with the Spatial-Flexible Continuous Time Markov Networks (SFCTMN) framework.

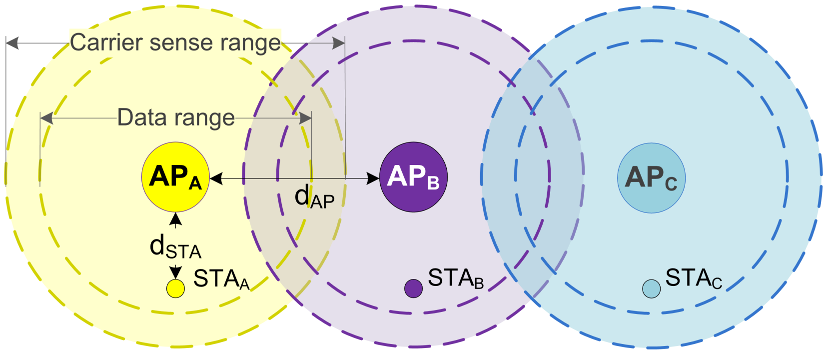

Figure 1: Scenario considered: line network composed of 3 WLANs that share a single-channel.

2 Results

As shown in Figure 3, 6 regions can be defined regarding the throughput experienced by the WLANs in the scenario of Figure 1.

R1 **Full overlapping (low SINR)**: collisions occur in a full-overlapping scenario where WLANs are close enough to cause high interferences at the receiver STAs. In this region, for very small d_{AP} (e.g. 2 m), any pair of WLANs finishing the backoff at the same time will suffer a collision due to SINR < CE, where SINR is the signal-to-noise-plus-interference ratio and CE is the capture effect. For slightly larger distances, only the pairs A,B and B,C cause collisions. That is why the throughput of A and C is slightly larger in this region.

R2 **Full overlapping (high SINR)**: for $d_{\mathrm{AP}} > 10$ m the capture effect condition is accomplished. Therefore, collisions will not cause packet losses. That is why the throughput captured by Komondor is larger than the one estimated by SFCTMN, which, in this fully-overlapping case, does not allow any state when more than one WLAN transmits. The reason is that the power sensed by each AP (P_{rx}) is larger than the CCA threshold when some WLAN is transmitting.

R3 **Neighbor overlapping**: the pairs A,B and B,C overlap. Therefore, B has almost no opportunities for transmitting. This is a clear example of the hidden node effect.

R4 **Potential overlapping at edges**: when any pair of WLANs is transmitting, the other one freezes its backoff counter. Again, the throughput in Komondor is higher due to the collisions that do not cause losses because the CE is accomplished. This case is strange but it is worth it to be detected. Also, CTS/RTS packets cannot be decoded, preventing WLANs to enter in NAV when so.

R5 **Potential overlapping at B**: when both A and C transmit, the power sensed by B in the primary channel is higher than the CCA threshold. Why B's throughput is higher in R5 than in R4? It seems that more collisions happen in R5 as more transmissions are allowed due to the fact that A and C operate like in isolation. These collisions do not cause packet losses at B, while allow it to transmit fewer more times than in R4 in state ABC.

In SFCTMN, in R4 B is transmitting the 0.6648 of the time. In Komondor it is 0.7033. This seems to be caused by the BO collisions that do not imply packet losses.

In R5, SFCTMN estimates that B is transmitting just the 0.5009. This makes sense because as A and C operate like in isolation most of the time are transmitting causing backoff freezing at B. However, in Komondor B is transmitting 0.7502 of the time. The only reason that I can guess is that the number of backoff collisions in the system increases with respect to R4.

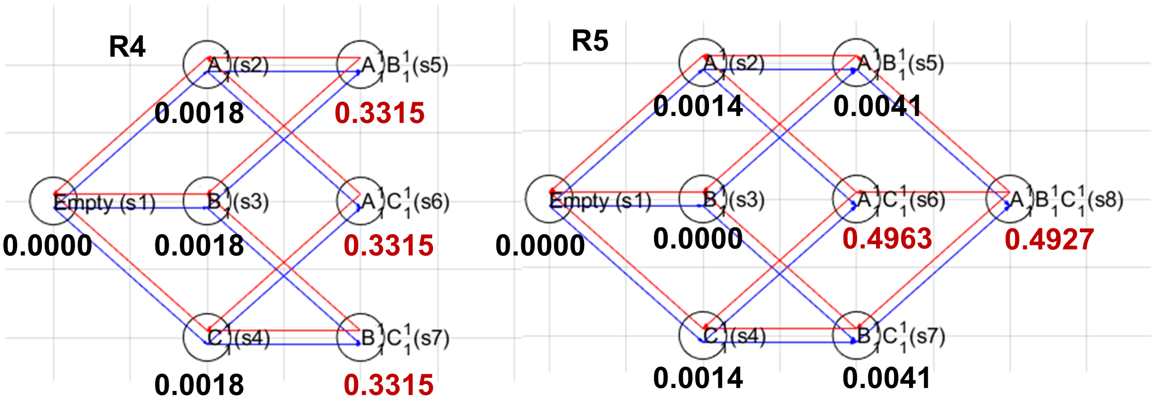

Figure 2: CTMNs of R4 and R5.

R6 **No overlapping**: each WLAN transmits in isolation, therefore the number of successful transmission depends only on the contention window.

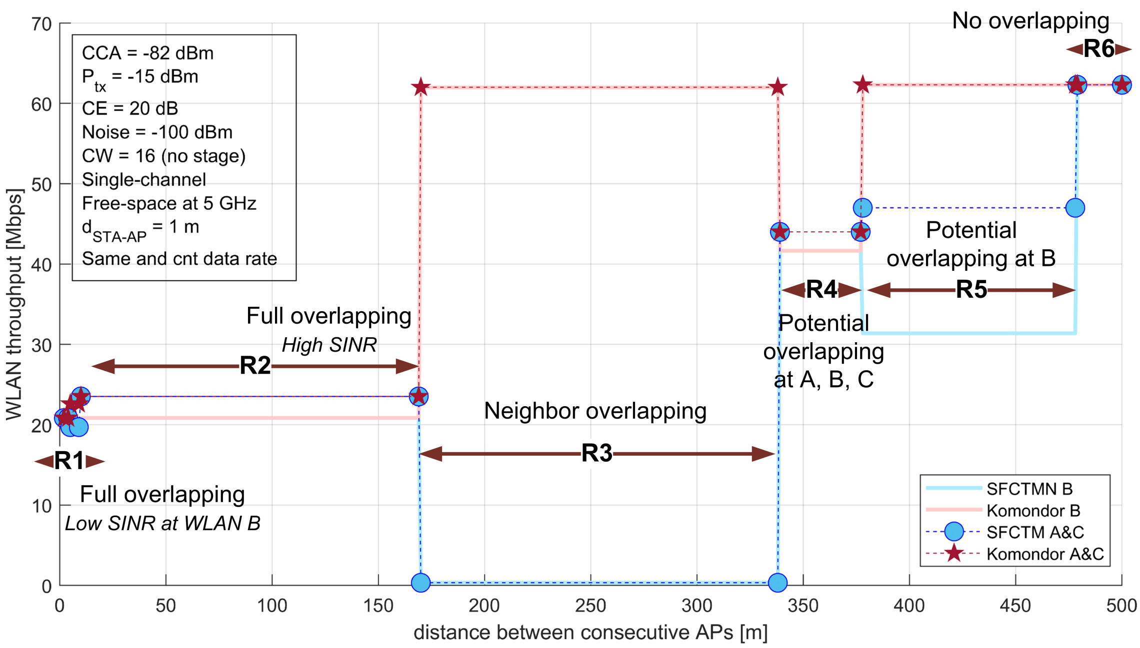

Figure 3: Throughput.