Fig. 1: A network configuration of IEEE 802.11 Hot Spot.

Fig. 2: Throughput usage in 802.11.

the summed result of all the throughput achieved at each station in the same region. Figure 2 presents the results obtained when we use existing IEEE 802.11 MAC protocol. From the figure, we observe the followings. Firstly, IEEE 802.11 DCF cannot guarantee any service differentiation nor fairness even among stations. Specifically, we observed: (i) in the period of [0s, 40s], each region has only one station active, and DN STS at Region-1 uses 2.16 Mb/s while DN STS at Region-2 does 2.06 Mb/s; (ii) in the period of [40s, 120s] when UP STS appears at Region-1, the throughput of DN STS at Region-1 is degraded to 0.73 Mb/s while that of DN STS at Region-2 is decreased to 0.97 Mb/s, but UP STS at Region-1 gains the higher throughput of 2.76 Mb/s; (iii) in the last period of simulation, which is [120s, 160s], DN STS at Region-1 uses 2.74 Mb/s while DN STS at Region-2 does 1.64 Mb/s. Secondly, IEEE 802.11-based Network imposes unfairness on downloading stations (two DN STSs) compared to uploading station (UP STS) due to TCP-driven unfairness exaggerated with IEEE 802.11 DCF [35]–[37]; Lastly, there is no location-based service differentiation. Note that the aggregate throughput of Region-1, which is the summed throughput of two stations, is 3.49 Mb/s, but that of Region-2, which is simply the throughput of DN STS, is 0.97 Mb/s (during the period of [40s, 120s]).

4 SERVICE DIFFERENTIATION ALGORITHM BASED ON PER-LOCATION LOAD

In order to compute the portion of link capacity assignable to each location for location-based service differentiation, we introduce per-location target load. The load represents a desirable degree of traffic that a designated location imposes to the network (to the