Errata

Publication IV

- The first sentence of the caption of Figure 2 should read:
  Plot of the optimal rate pair \((r_1^*, r_2^*)\) against the distance parameter \(k\) for asymmetrical arrival rates \((\lambda_{11} = 10, \lambda_{12} = 1, \lambda_{21} = 19, \lambda_{22} = 1, c_0 = 50, c_1 = 30)\).

- In Section V, the maximum service rates are \(c_0 = 50, c_1 = 30\), for all cases.

Publication V

- The last sentence of the caption of Figure 3 should read:
  The legend in panel (a) shows the dynamic policies involved in Scenario 2 and the legend in panel (c) shows the different dynamic policies involved in Scenario 3.

Publication VI

- Equation (1) is valid only when the modes change very slowly compared to the rate at which the time slots to the flows are allocated. In any dynamic operating mode, this time-scale separation assumption is valid,
and thus (1) is strictly applicable only in the dynamic modes.

- Equation (7) gives the service rates of the different queues in a static mode. In a static policy the operating modes are probabilistically chosen in each time slot. As the modes change very quickly compared to the flow-level dynamics, these flows receive an average service rate that depends on the probability distribution of the different modes. Since there are two possible modes that serve the downlink queues, the expressions presented in (7) are approximations of the actual downlink service rate in this case. The actual expression of the downlink service rates $\phi^{d}_i$ are as follows\(^1\)

\[
\frac{1}{\phi^{d}_1} = E[B^d_i] E \left[ \frac{1}{p^{dl}c^{dd}_1(R_1) + p^{lu}c^{du}_1(R_1)} \right],
\]

\[
\frac{1}{\phi^{d}_2} = E[B^d_i] E \left[ \frac{1}{p^{dl}c^{dd}_2(R_2) + p^{lu}c^{du}_2(R_2)} \right].
\]

However, since the uplink queues are served by only one mode, the expressions for the uplink service rates $\phi^{u}_i$ are the same as presented in (7).

When these actual service rates of the physical model are used, the resulting capacity region seems to be larger than when the approximate values are used. This can be observed from an example in Figure 5.1.

The physical model optimal static service rate values can be obtained by conducting a local search around the approximated values. For the scenarios considered in the paper, the approximated values tend to underestimate the service rates of the queues, and therefore the average queue lengths are smaller when the physical model service rates are used. The approximation error tends to grow with increasing load values and appears to be very small when the fraction of the arrival rate that can be stabilized is small.

Figure 5.1. The capacity region from the physical model and the same obtained from (3.14) when $\mu = 0.5$ for Scenario 3 described in Section 8.5. Note that the difference is discernible only in the magnified picture (seen in the right panel). We can also see that the capacity region obtained from the physical model is clearly a superset of the one approximated by (7).

Publication IX

- In p. 60 the left side of the third equation from last should read:

$$c_1 + (1 - q_i)(\nu - p_i r_{i,1} \Delta_i(\nu)) + q_i (\nu - p_i r_{i,2} \Delta_i(\nu))$$