



Figure 5. Frame Allocation and max transitions vs Buffer Content Time Criticality T_2 for $(CQI_1, CQI_2, B_1, B_2, T_1) = (30, 30, 10, 10, 4)$ respectively

Table 2. Impact of variation of τ on N with $(F, \theta) = (640ms, 5\%)$ and $(CQI_2, B_1, B_2, T_1, T_2) = (15, 7, 3, 4, 7)$

$N(CQI_1)$	$\tau=2ms$	$\tau=10ms$	$\tau=20ms$
$N(1)$	51	2	1
$N(3)$	51	10	5
$N(11)$	142	28	14
$N(30)$	71	14	7

such cases, feasibility controller will decide not to apply dynamic resource sharing.

Table 2, shows impact of transition delay τ on maximum possible transition count N . As τ increases, total duration over which resources could be utilized reduces and thus N decreases. For instance, when $CQI_1=1$ varying τ from 2 ms to 20 ms, N reduces from 51 to 1.

For the sake of completeness, let us also compute the lower bound of threshold θ for which the feasibility condition satisfies. Considering fixed system parameters as $(F, \tau) = (640ms, 2ms)$ and $(CQI_1, CQI_2, B_1, B_2, T_1, T_2) = (1, 15, 7, 3, 4, 7)$, W_1 and W_2 from equations (7) and (8), gives $W_1 = 0.0816$ and $W_2 = 0.9184$ and to satisfy feasibility constraint, N must be at least set to 1. Substituting W_1, W_2 and N in (17), gives $\theta = 7.8\%$ as the upper bound. A similar computation can be done for each case, which however is omitted to maintain the readability of the paper.

6. Conclusion

In this work, we considered the fundamental problem of resource sharing, inherently associated with multi-sim single RF subsystem UE. We proposed a multi-sim architecture with a scheduling algorithm and a feasibility controller that optimizes the shared resource across the contending SIMs. We formulated an optimization problem that optimally allocates the shared resource while dynamically choosing the allocation based on various important quality of service parameters like CQI, buffer occupancy and time criticality of buffered content. Further, extensive mathematical analysis is done using KKT conditions to compute the closed form optimal frame allocation ratio. Subsequently, we incorporated the RF blackout periods involved in switching between the SIMs for a practical multi-sim architecture, to compute the maximum number of transitions possible. Subsequently, analytical results presented, emphasize the effectiveness of proposed architecture. We also tabulate the cases where feasibility conditions fail, hence render scheduling algorithm ineffective. Therefore, the proposed scheme brings significant advantage over the conventional RF resource sharing method especially in SR-DSDS and DR-DSDS architecture and hence helps to design better multi-sim capable modem.

7. Copyright statement

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7.1. Copyright

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