INTRODUCTION

Aim: Maximize throughput while achieving network stability.
Goal: Select schedules in the Diamond Relay Network, towards maximizing the total network’s throughput.
Method: Rely on optimization theory tools and Lyapunov drift to obtain optimal schedules. A network controller a(t), chooses the optimal between two feasible scheduling activation sets.
Implementation: Per packet-level configuration using Click Modular Router and Ath9k driver.
Access Method: A TDMA framing over WiFi.

SYSTEM SETUP

✓ 1 Source, 2 Relays, 1 Destination.
✓ Each node maintains a backlog data queue Q(t).
✓ Channel States: S(t), Service Rates: μ(t).
✓ Lyapunov function: \( L(Q(t)) = \sum Q(r)^2 \)
✓ Drift Expression: \( \Delta(t) = E[L(Q(t+1)) - L(Q(t))] \)
✓ Slotted time, TDMA frame structure.
✓ T1 intervals for gathering Network State Information, T2 for reporting schedules and T3 for actual transmission.

SOLUTION APPROACH

Minimize a bound on the drift expression with respect to a(t)

MAX WEIGHT RULE

ALGORITHM

✓ T1 interval: Source Node gathers Network State Information from its neighbors.
✓ T2 interval: Source takes a scheduling decision.

<table>
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<tr>
<th>Access Method:</th>
<th>A TDMA framing over WiFi.</th>
<th>Red lines denote the activation of two feasible scheduling sets by controller a(t).</th>
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IMPLEMENTATION ISSUES

✓ Operating in a single frequency with CSMA prevents us from enabling parallel transmissions i.e. S→R1 and R2→D without collisions.
✓ Solution: Use of two different channels operating in each hop, in order to enable independent schedules.
✓ Scheduling decisions are taken in the IP layer rather than the MAC layer, since gathering and handling control data is more flexible with Click Modular Router.

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