Layer 3 Throughput Analysis for Advanced ALOHA Protocols
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Background

Medium access protocols are fundamental for an effective and efficient share of the common medium in wireless scenarios with multiple transmitters. Random access schemes are simple and effective when the nature of the channel traffic generated by the transmitters shows a bursty and unpredictable nature or when the number of transmitters is extremely high and coordination is hard to achieve.

Example scenarios are

- Machine-to-machine communication
- Satellite networks
- Underwater networks
- RFID communication systems
- Vehicular and ad-hoc networks
Motivation

• Nowadays Random Access (RA) is used for signaling or for session initialization, but

• New RA protocols have a very good throughput performance (see next slide), therefore

• They might be used also for data transmission and

• Extended performance evaluations of RA protocols in a complete protocol stack are still missing
Layer 3 Throughput Analysis

The assumptions

- We consider a population of $N_u$ users sharing the same medium where each user generates packets of layer 3 with a duration subject to the generic probability measure $f_X(x)$

- The user cannot forward the layer 3 packet to layer 2 until the previous layer 2 packet has been sent.

- The protocols operation are assumed in open-loop

- Both slotted (SA, CRDSA) and unslotted (ALOHA, CRA) are considered in the investigation
Remarks

• The analytical framework helps to evaluate the layer 3 throughput of slotted schemes without the need of numerical simulation of this layer.
• The required input are only
  1. Successful decoding probability of layer 2, $P_{succ-L2}$
  2. The probability measure $f_X(x)$ or at least the estimate of the mean value

Conclusions

• Numerical results will show that unslotted protocols outperforms slotted ones in all the scenarios
• Slotted protocols instead are more robust against variations in the probability measure of the L3 packet length