Transmit And Reserve (TAR): a Coordinated Channel Access for IEEE 802.11 Networks

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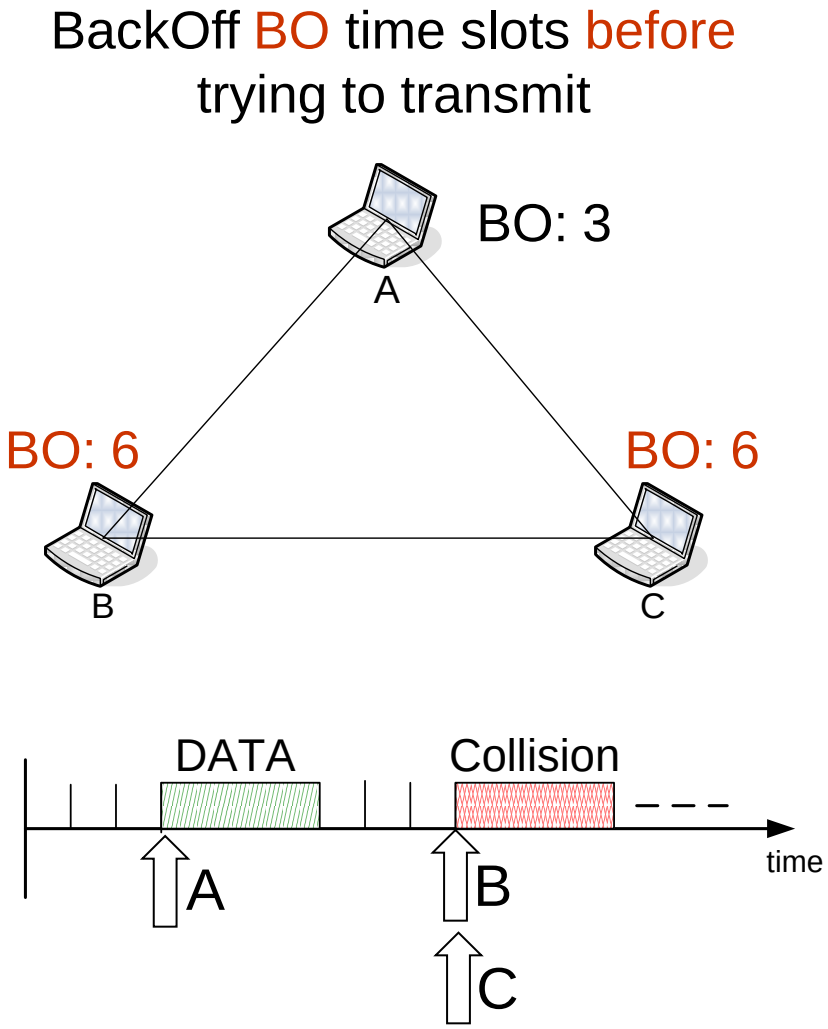
Outline

- Why TAR
- Objectives
- Description
- Evaluation results
  - Throughput & Collision rate
  - Short term fairness
- Conclusions & future perspectives

Why Transmit And Reserve (TAR)?



- 802.11 MAC
  - Contention based
  - Random access
  - Exponential BackOff
- Limitations
  - Collisions
  - Bandwidth waste
  - Short term unfairness

TAR: Coordinated Channel Access

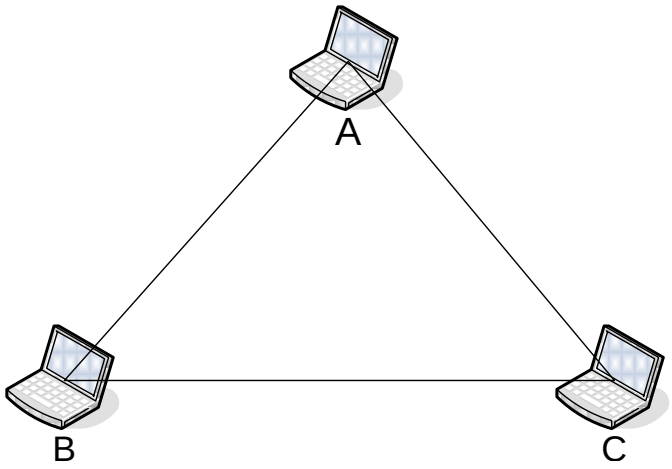
- Objectives:
  - Avoid the randomness in 802.11 channel access (when possible)
  - Improve the global throughput and short term fairness and reduce the collisions in highly connected networks
- How?
  - Coordinate the channel access between the sender nodes in a distributed manner
  - Provide a means for sender nodes to avoid selecting already selected BackOff values

TAR: Coordinated Channel Access

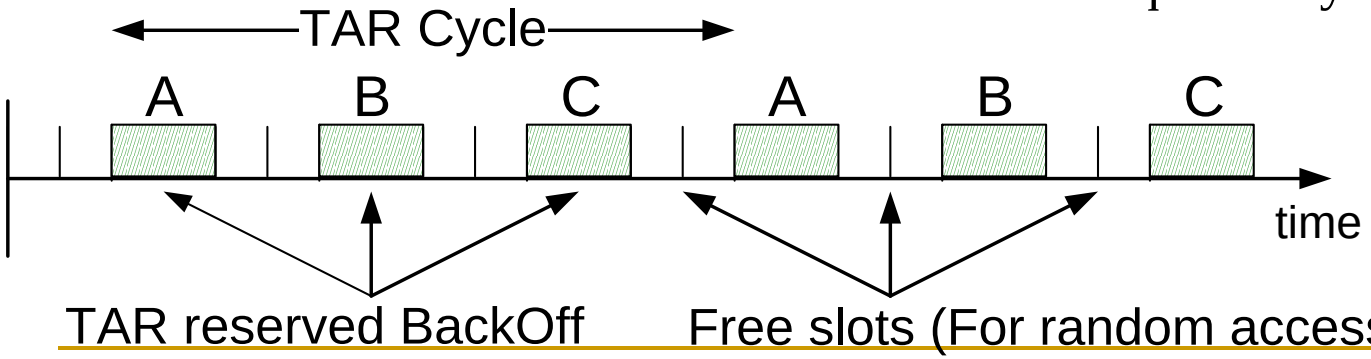
- Main idea of TAR
  - At the moment of transmitting a packet, Reserve a BackOff value for the next transmission.
- Description of TAR
  - Select a BackOff value for the next transmission
  - Advertise the selected BackOff in the current transmitted message
  - Maintain a Reserved BackOff counter and update it with every received advertised BackOff

TAR: Coordinated Channel Access

Nodes avoid selecting already selected BackOff values



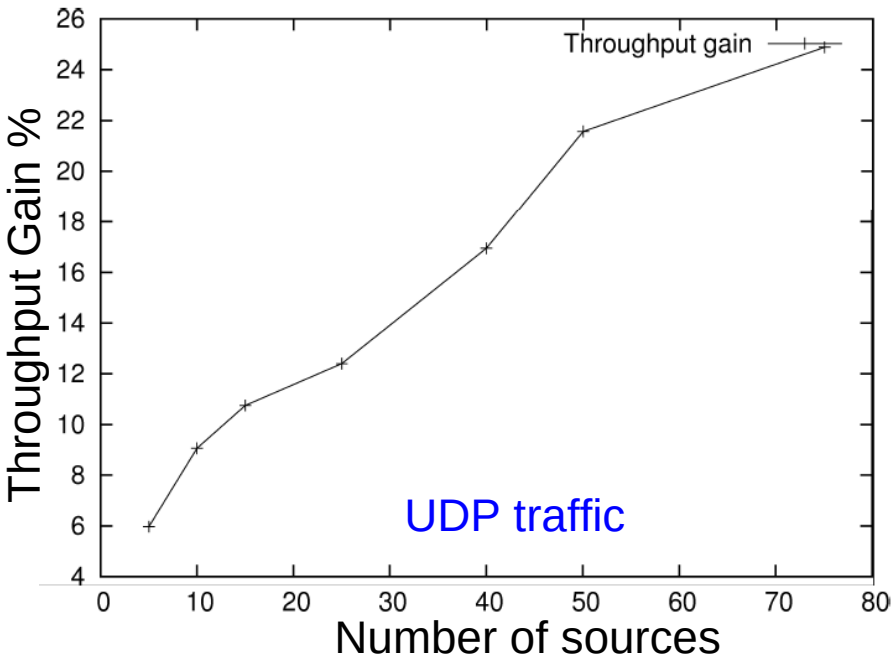
- Each node maintains:
  - RBO: Reserved BackOff
  - BO: BackOff
- RBO: advertised in transmitted messages
- Nodes synchronize to the received RBO
- Next Backoff Selection:
  - BO := RBO + Constant
- A TAR cycle is thus created where active nodes access sequentially to the channel

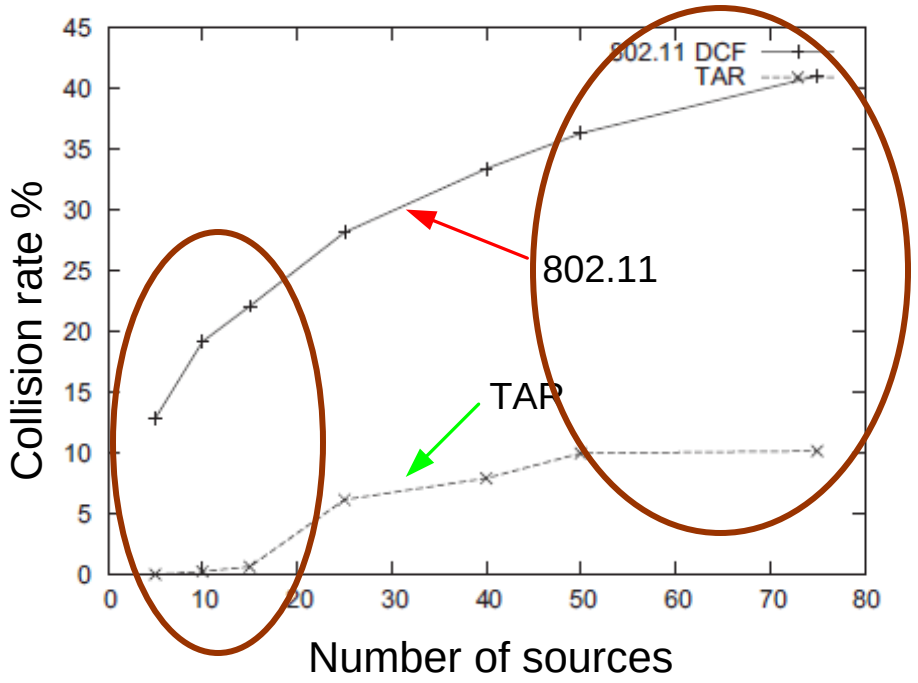


TAR: Evaluation

- Comparison with 802.11
- Simulation in NS2:
  - Different nb of nodes
  - Constant bit-rate
  - Saturation condition
- Evaluation criteria
  - Throughput
  - Collisions
  - Fairness and inter-transmissions delay

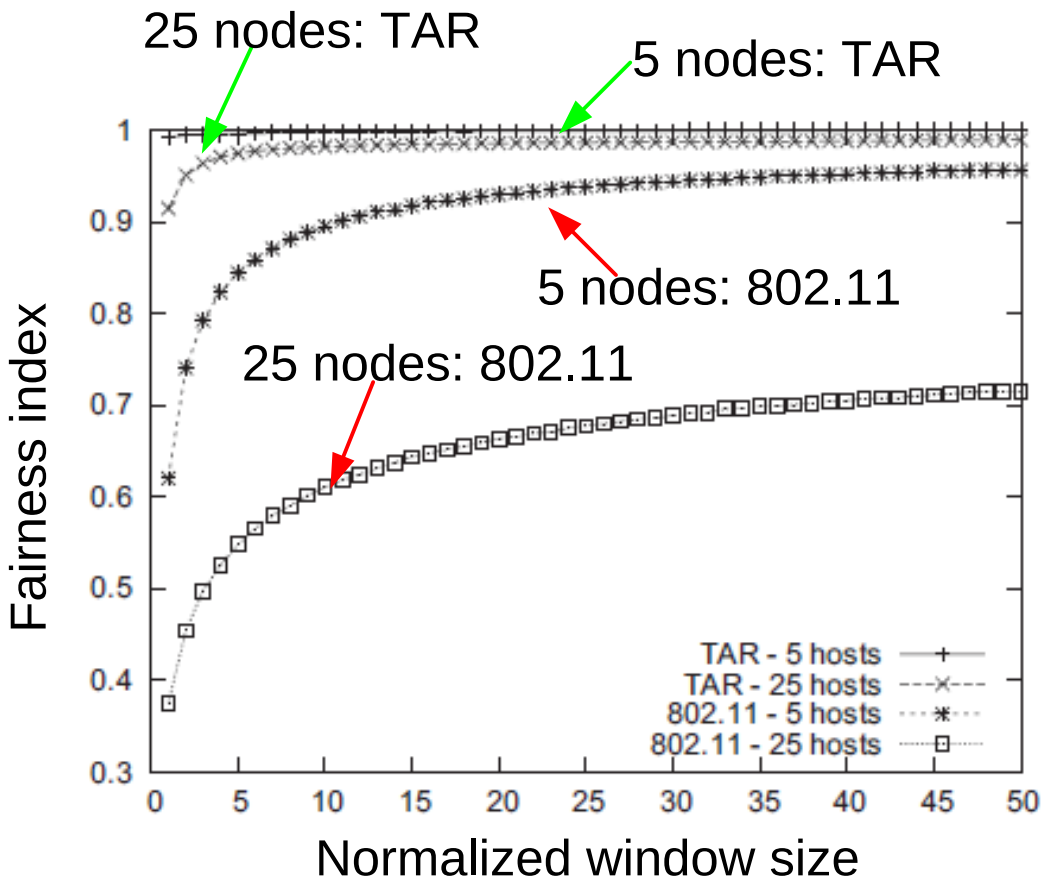
TAR: Throughput / Collision Rate





- UDP traffic
  - High throughput increase
  - Increases with the number of nodes
- Collision Rate
  - Avoided for low to medium density
  - Highly avoided for high density

TAR: Short Term Fairness



- TAR short term fairness
  - Based on Jain fairness index (index used to measure the fairness: i.e. bandwidth partitioning)
  - TAR is almost not sensitive to the number of sources
  - TAR: Very high short term fairness (closer to 1 is better)

TAR: Short Term Fairness

Nb nodes	802.11		TAR	
	mean	stdv	mean	stdv
5	14.716	17.737	13.707	0.415
10	31.718	61.691	27.470	1.972
25	95.640	241.732	71.087	12.616
50	239.462	579.847	147.407	33.468

Inter-transmissions delay in (ms)

- Inter-transmissions delay
  - Low deviation with respect to the average of the inter-transmission delay
  - Better suited for multimedia application

Contributions & Future Perspectives

- Contributions
  - Conception of a distributed mechanism for coordinating channel access.
  - Improve the global throughput of the network.
  - Provide close to perfect short term fairness among network nodes.
  - Attractive for multimedia applications.
- Future Perspectives
  - Better adaptation for multihop environments.
  - Reserving “time vectors” instead of BackOff values.
  - Coexistence with 802.11e (QoS).

For questions

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