Characterisation of Idle Period Durations in IEEE 802.11 Multihop Networks

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Me:ShortBio

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Talk:Agenda

- Context
- Contribution
- Validation
- Conclusion

About:What

802.11 Multi-hop networks

- 802.11 is a standard multi-hop technology.
- Widely used.
- Low cost, robust, ...

Performances

- To identify important parameters at layer 2.
- To use layer 2 parameters for identification, performances, ...
- To increase the performances.
- To provide Quality of Services.
- To evaluate the performances.

About:Why

Performance issues

- Performances are far from optimal.
- Quality of Service is hard to provide.
- Layer 2 seems to be a bottleneck.
- Scenario identification is not trivial.
- More and more work on channel states at layer 2.

About:Others

Busy and Free:Used

- Used at layer 2 in MadMac, SBA, IdleSense, etc.
- Used at layer 3 in ABE, RABE, etc.
- Important: Lots of use cases.

Busy and Free:Studied

- Analytical model for one-hop network.
- Simplified model for multi-hop networks.
- Important: Approximated distribution of Free and Busy periods.

About:Motivation

Beliefs

- Free and Busy periods are key parameters at Layer 2.
- Useful for performance enhancement.
- Useful (mandatory ?) for Quality of Services.
- Useful for protocol fine tuning.

Specific

- Bandwidth estimation.
- Backoff algorithm.
- Scenario identification (hidden terminal, ...)
- New performance metric at layer 2.

FreeBusy:Definition

- Only two (identifiable) states on the medium.

Free or Idle

- When nothing happens on the channel (linked to CCA).
- Specific for each node in multi-hop condition.
- Strongly related to access mechanisms.

Busy or Occupation

- When something happens on the channel (linked to CCA)
- Specific for each node in multi-hop condition.
- Strongly related to packet size.

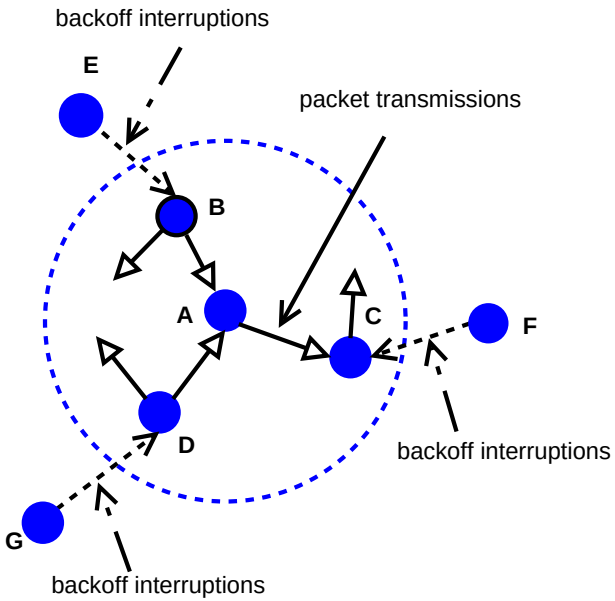
FreeBusy:Depends

Important parameters for a node are:

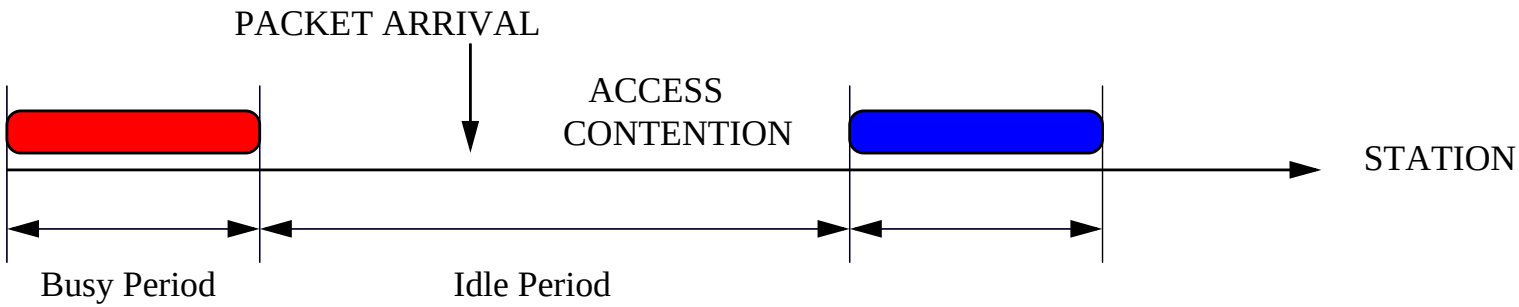
- Packet arrival rates.
- Access method / Backoff algorithm.
- Packet collisions.
- Neighbors' activity.
- ...

FreeBusy:Assumptions

- Packet arrival rates are known.
- Packet arrival rates can be shared
- Within a contention area there is always a packet to be sent (strong)
- Average collision probability can be computed



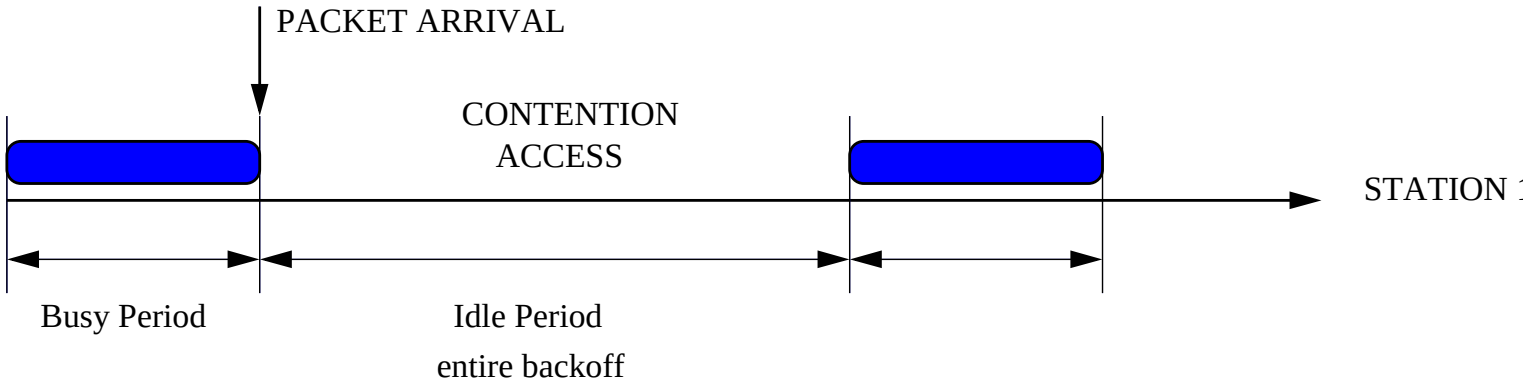
FreeBusy:Example



[Do we need 802.11 access method explanation]

FreeBusy:Split:1

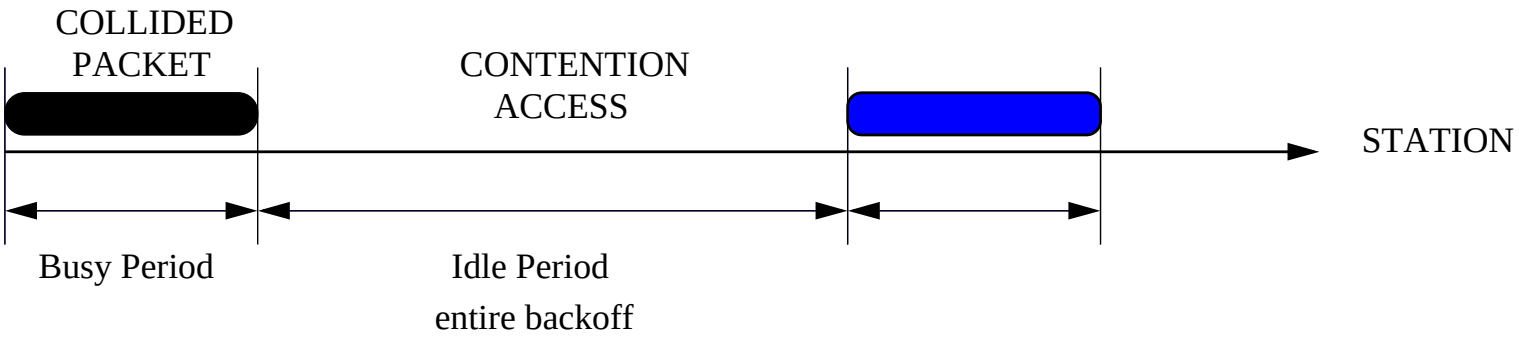
Entire backoff



- We know the backoff distribution, and it's simple.

FreeBusy:Split:2

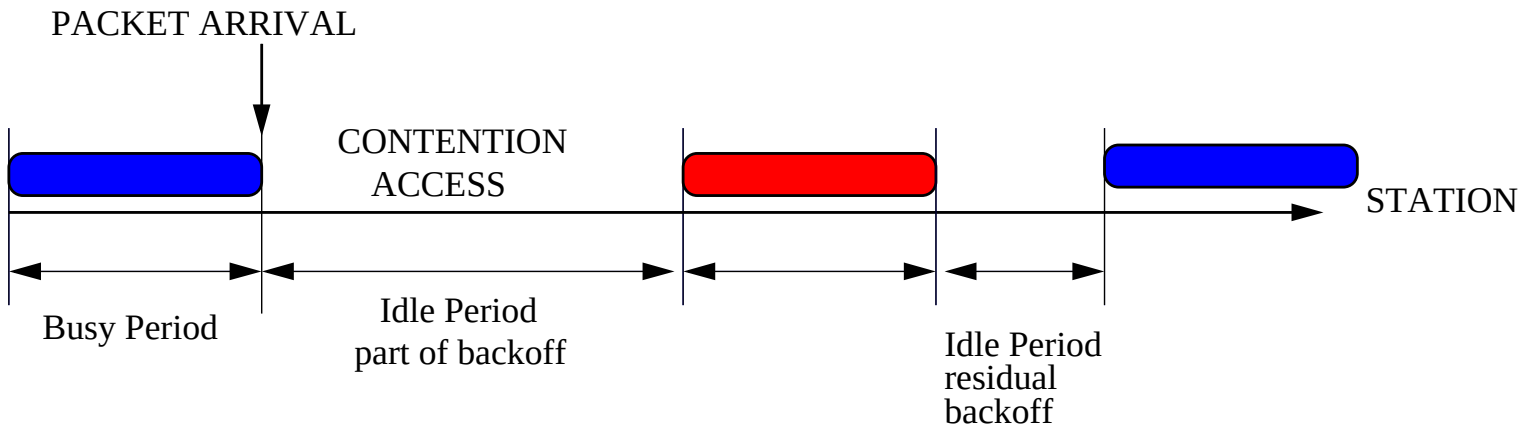
Entire backoff with collision



- We know the backoff distribution, it's a bit more complicated but tractable.

FreeBusy:Split:3

Backoff with interruptions



- We can approximate the backoff with interruption duration knowing packet arrival rates of other stations.

FreeBusy:Formula

Combination of arrival rates and interruptions

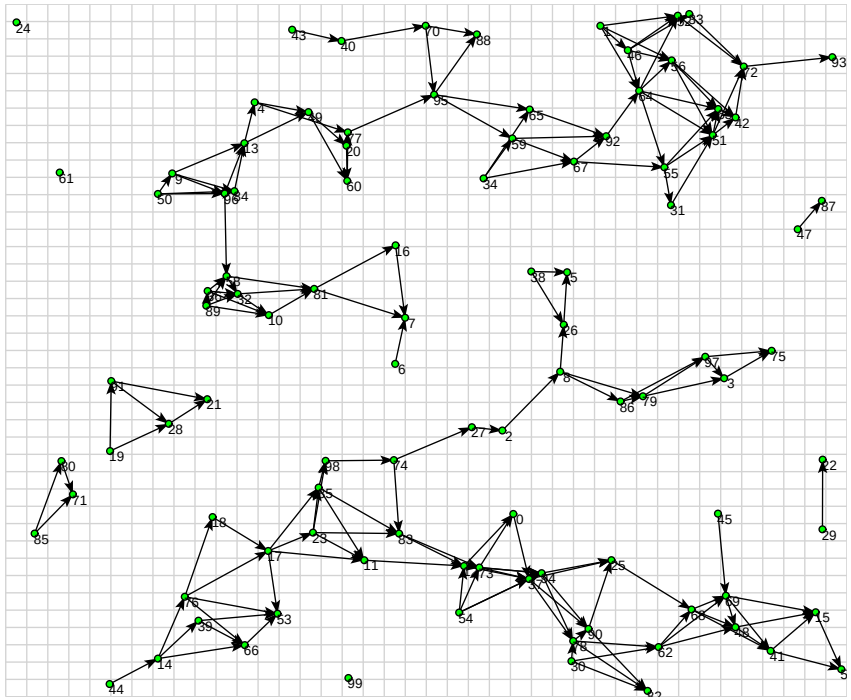
$$Pr(Idle = t) = \rho * Pr(\breve{B} = t) + (1 - \rho) * Pr(\widehat{B} = t) \qquad (1)$$

$\breve{B}$ is the distribution of interrupted backoff time (follows a gamma distribution needs mean and variance), $\widehat{B}$ is the backoff and interruption time (it includes inter-blocking probability). ρ is the offered load in the contention area.

Simulations

Simulation:Setup

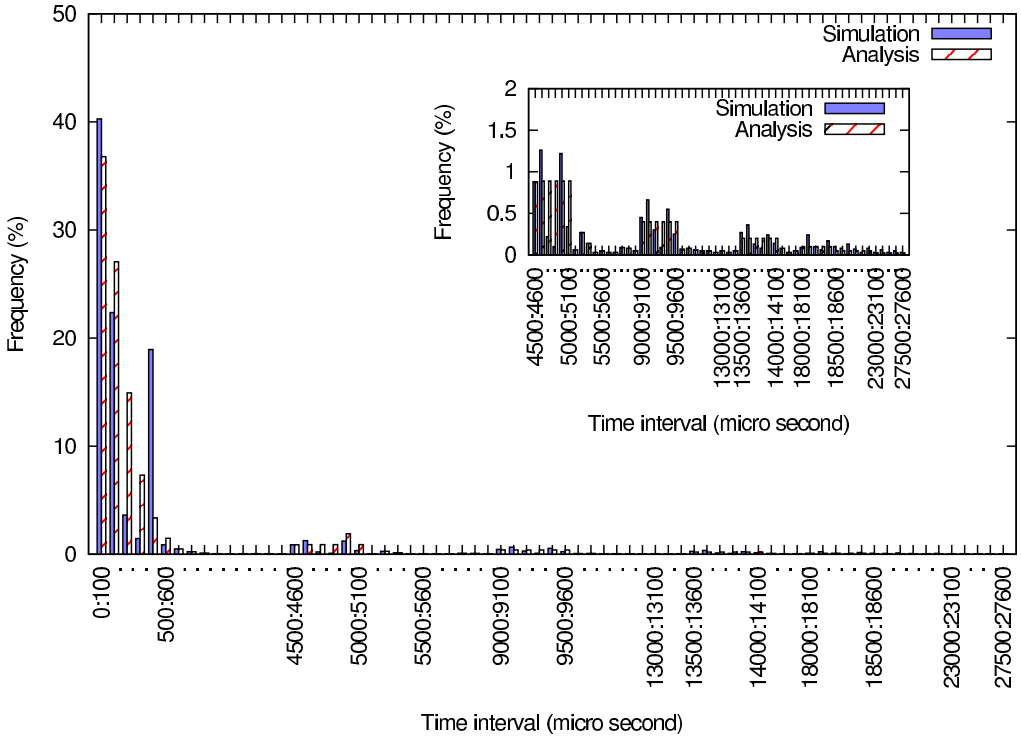
- NS-2.33.
- Random topologies.



Simulations

Simulation:Results:1

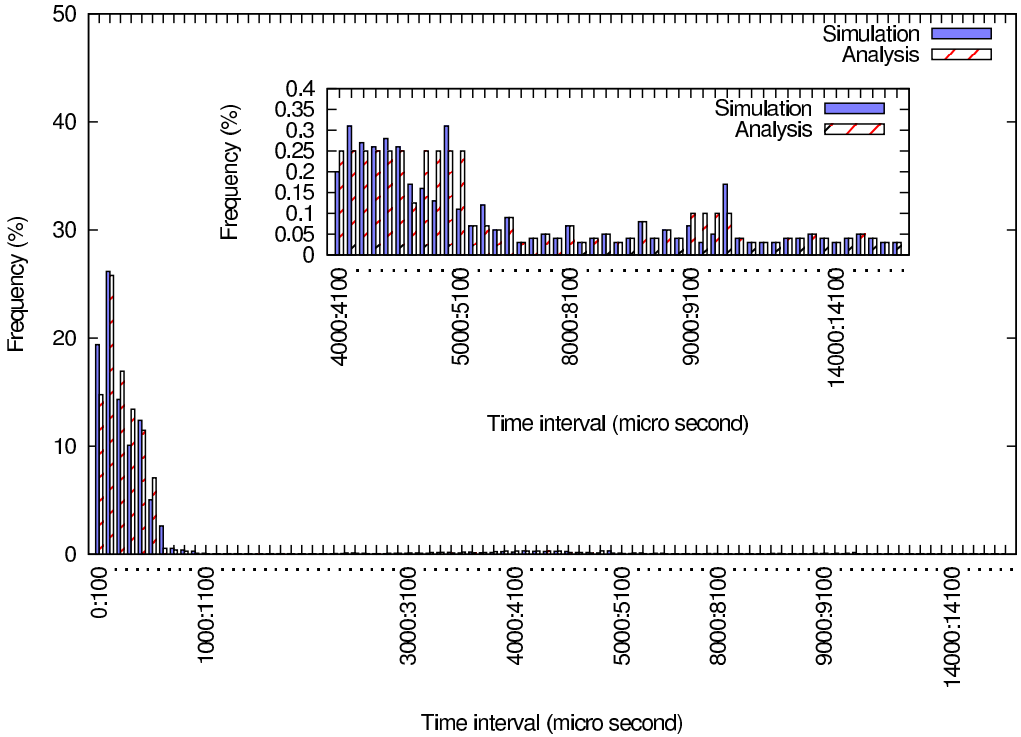
- Distribution for a random node



Simulations

Simulation:Results:2

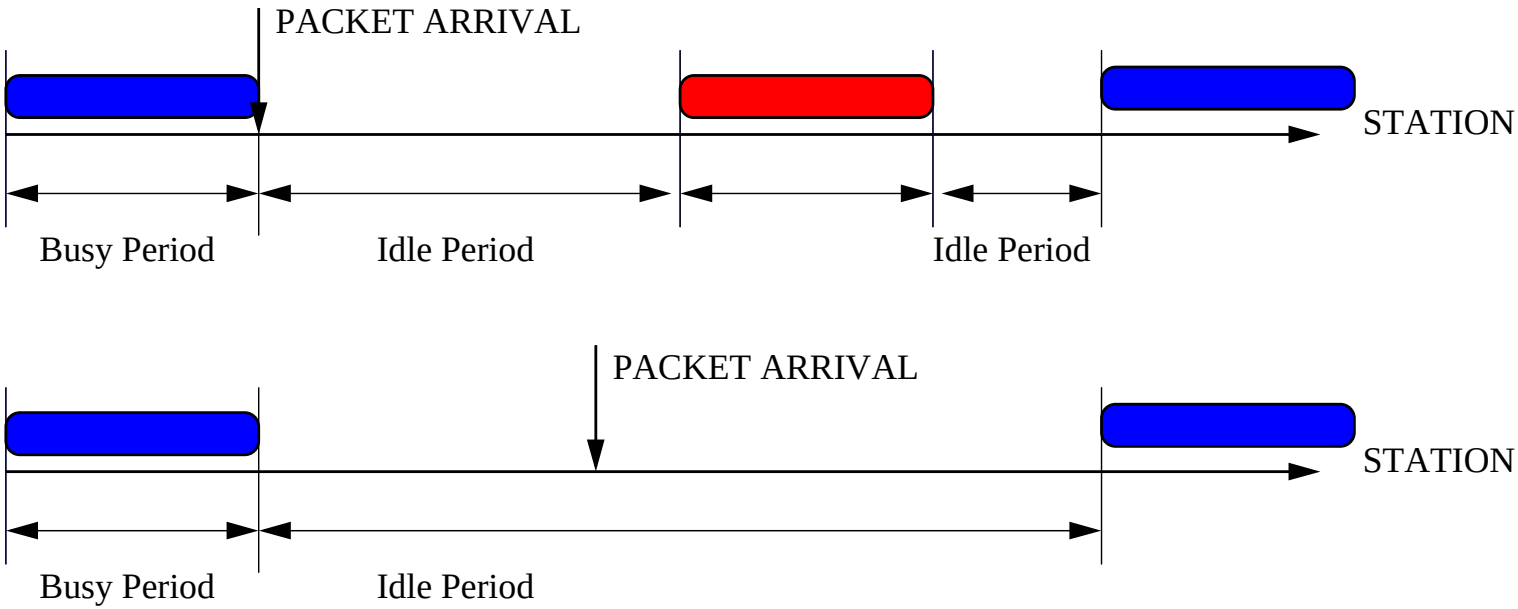
- Distribution for a random node



NextStep:1

- Exchange distribution for bandwidth reservation.
- Fine tune MAC layer for performance enhancements.

NextStep:2


PACKET ARRIVAL
STATION
Busy Period
Idle Period
Idle Period
PACKET ARRIVAL
STATION
Busy Period
Idle Period

MERCI

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