Overcoming Throughput Degradation in Multi-Radio Cognitive Radio Networks

Tanvir Ahmed Khan

Supervised by:
Dr. A. B. M. Alim Al Islam
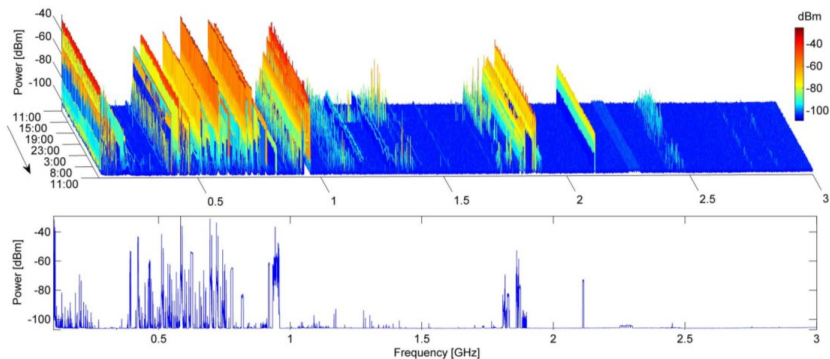Assistant Professor,
Dept. of Computer Science and Engineering,
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Dhaka, Bangladesh.
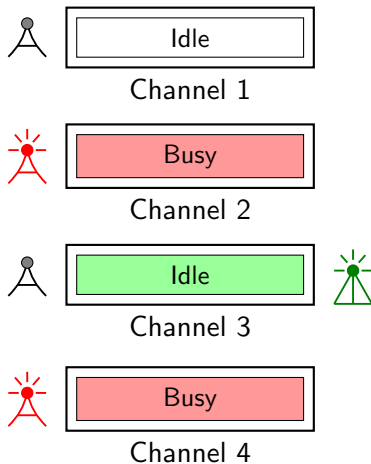
M.Sc. Thesis Proposal

Preliminaries

Cognitive Radio Networks (CRNs)

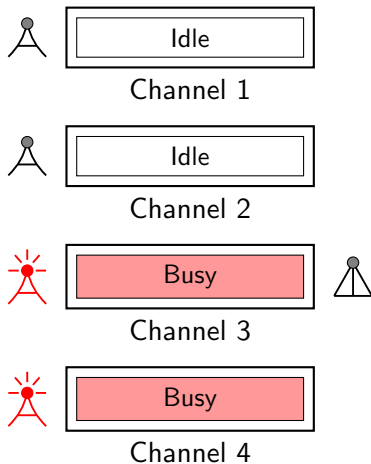Licensed frequency spectrums are mostly under-utilized! [7]
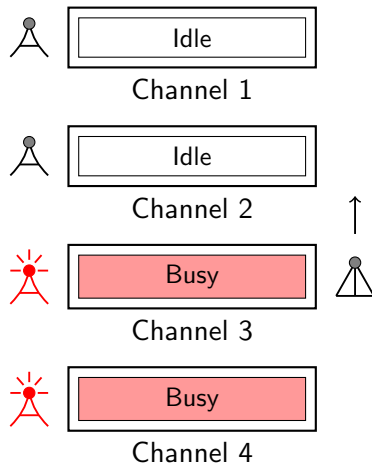
Preliminaries

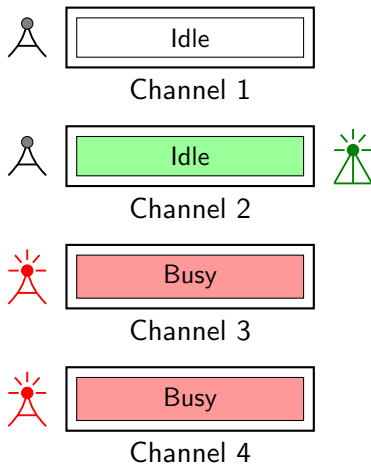Cognitive Radio Networks

Preliminaries
Cognitive Radio Networks

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Cognitive Radio Networks

Preliminaries
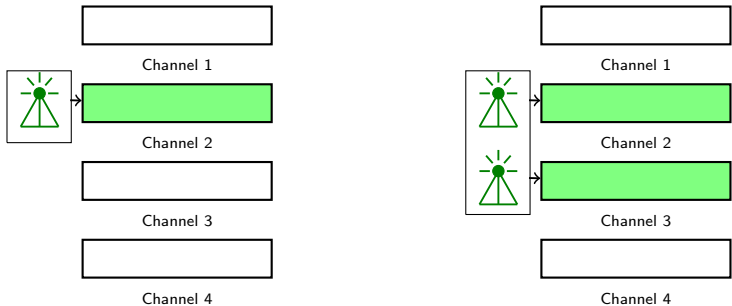
Cognitive Radio Networks

Preliminaries

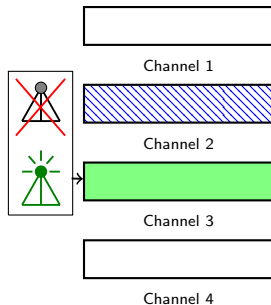Improves network capacity [2, 3]

Preliminaries

Enhances transmission reliability [4]

Preliminaries

Multi-radio Networks

Channel 1

Channel 2

Channel 3

Channel 4

Channel 5
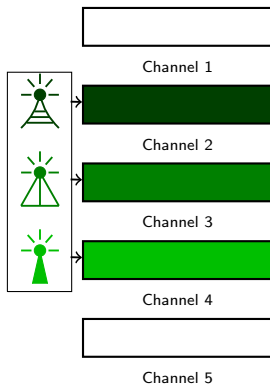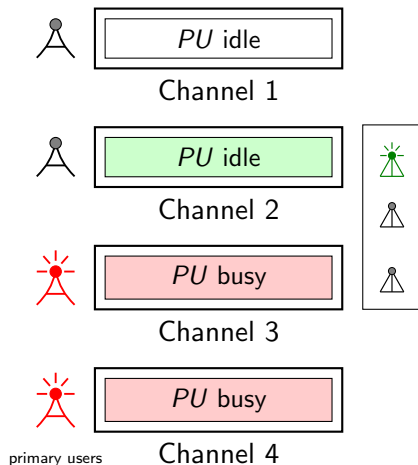
Enables heterogeneous wireless access [6]

Preliminaries
Multi-radio Cognitive Radio Networks

primary users
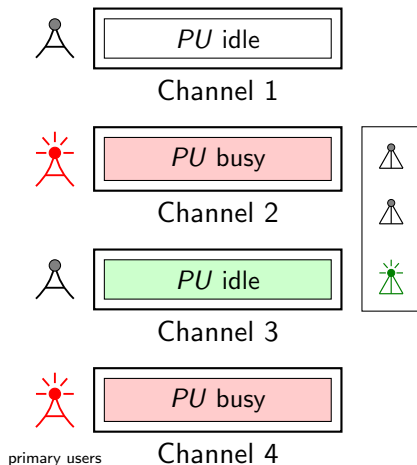
Preliminaries

Throughput Degradation in Multi-radio CRNs
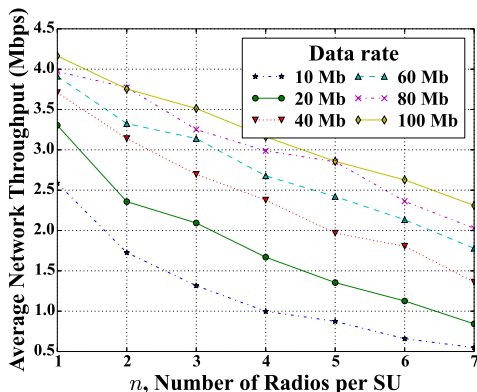
Throughput degrades with an increase in number of radios per SU

Preliminaries

Throughput Degradation in Multi-radio CRNs
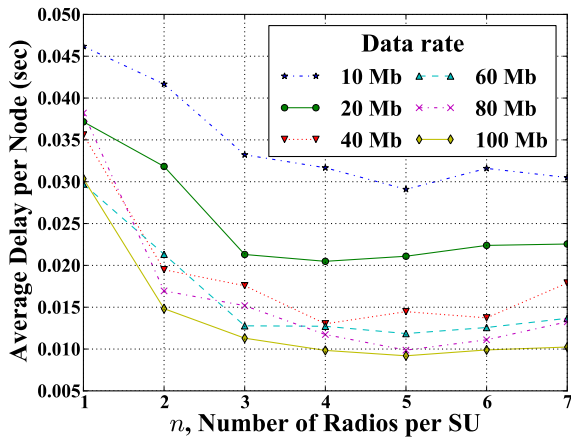
Delay improves up to a certain point, and then start to degrade

Our Research Problem
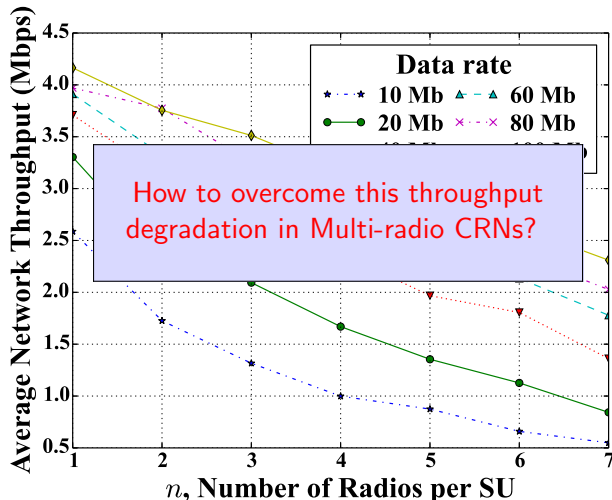
Our Research Problem

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Our Research Problem

Also, we want to make sure that delay does not get worse while attempting to increase the throughput.
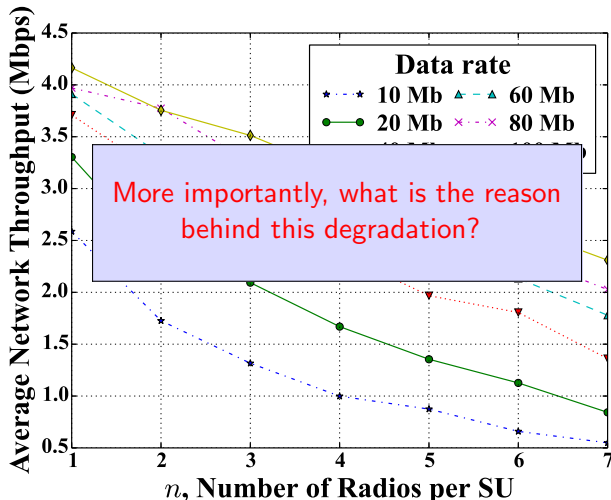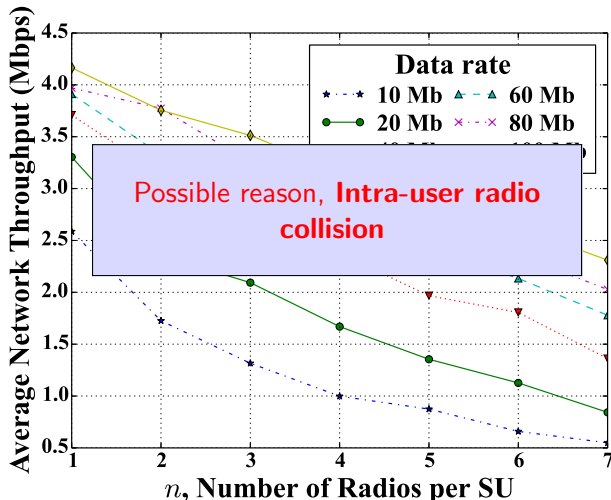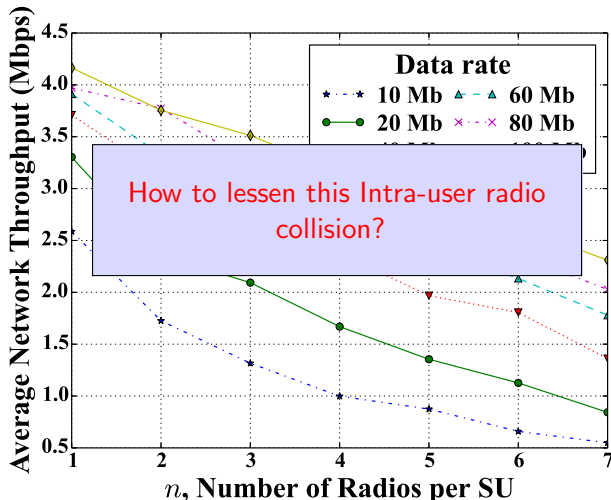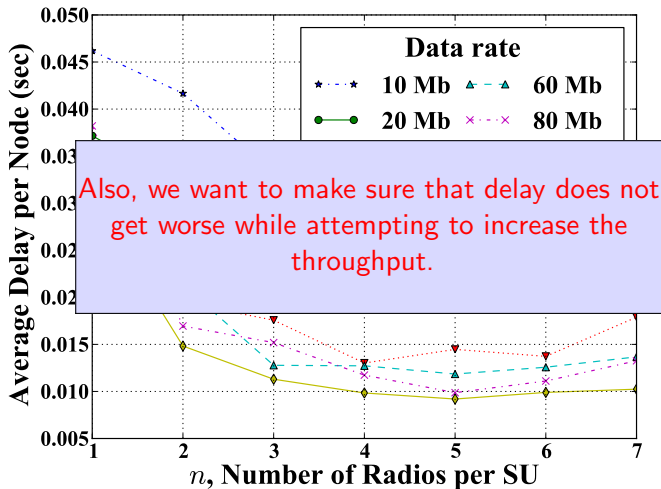
Our System Model

n Primary users

Our System Model
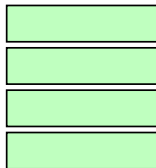
n Spectrum channels

Our System Model
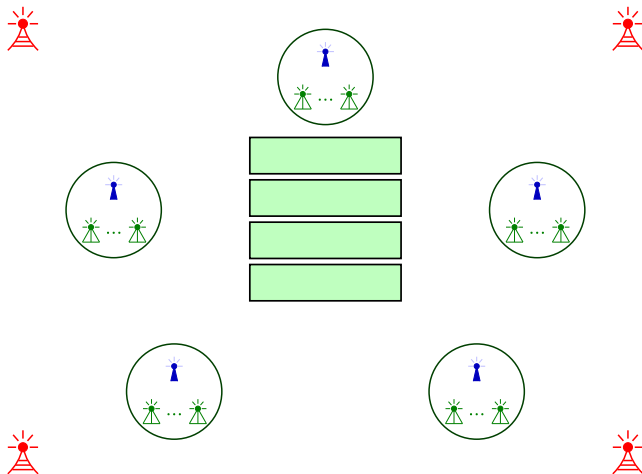
m Secondary users, each with at-least two radios

Our System Model
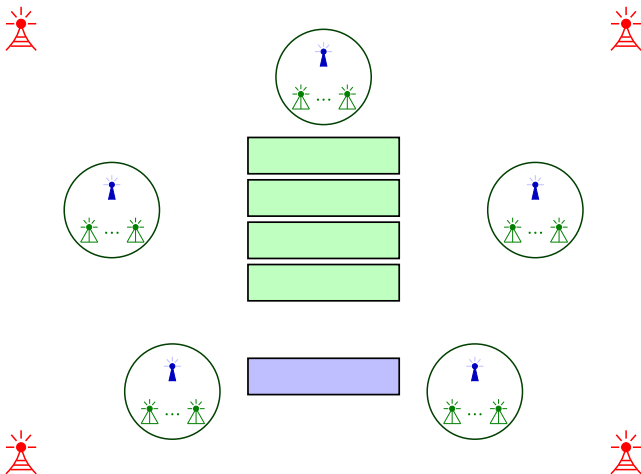
Dedicated control channel using a dedicated radio

How to Lessen Intra-user Radio Collision?

Radio-Channel Assignment with Collision Avoidance

Channel 1

Channel 2

Channel 3

Channel 4

Thoughput=?
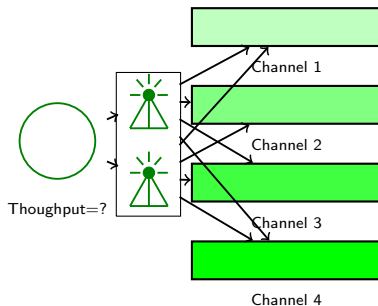
How to Lessen Intra-user Radio Collision?

Radio-Channel Assignment with Collision Avoidance

How to Lessen Intra-user Radio Collision?

Radio-Channel Assignment with Collision Avoidance

Channel 1

should reduce contention probability

Thoughput=?

Channel 3

Channel 4

How to Lessen Intra-user Radio Collision?
Radio-Channel Assignment with Collision Avoidance

Channel 1

should also reduce switching delay

Thoughput=?
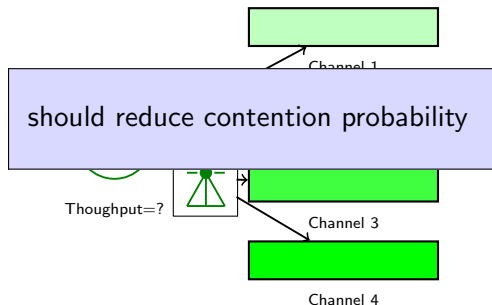
Channel 3

Channel 4
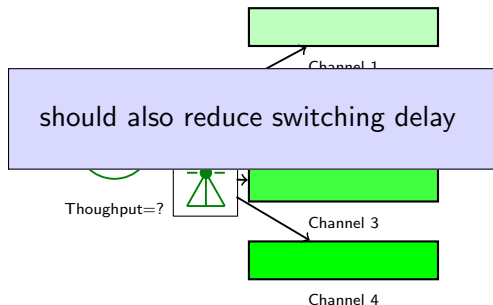
Feedback-based Multi-radio Exploitation

send data through someone who is reliable
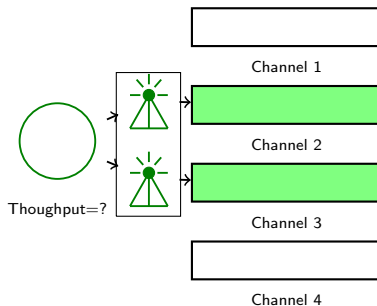
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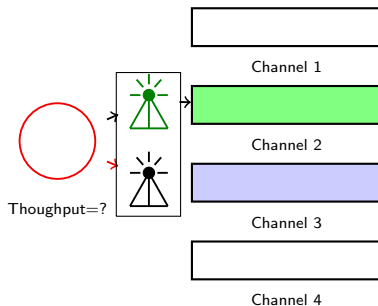
Feedback-based Multi-radio Exploitation

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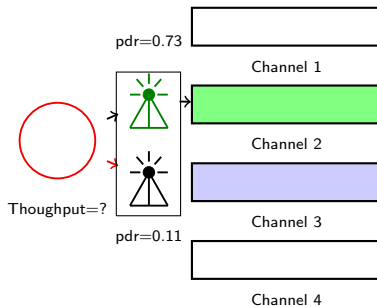
measurements of packet delivery ratio for each radio

Feedback-based Multi-radio Exploitation

send data through someone who is reliable
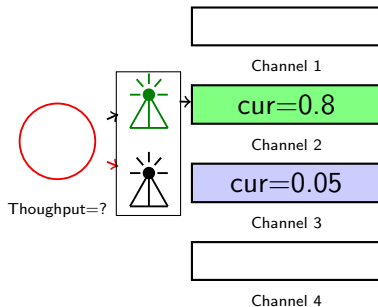
measurements of channel utilization ratio for each channel

Feedback-based Multi-radio Exploitation

send data through someone who is reliable
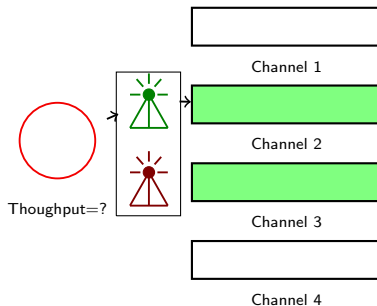
cutoff based on **pdr** and cur

Feedback-based Multi-radio Exploitation

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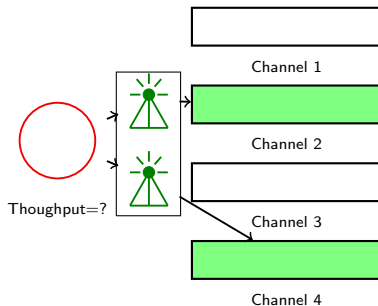
cutoff based on pdr and **cur**

Performance Analysis through Simulation

Simulation Platform

- ns-3 simulator [5]
  - Using CRE extension [1]
  - Perform modifications in the simulator to implement our approach

Conclusion

- We will simulate multi-radio CRNs using our developed module and investigate the performance of the network.
  - Here, we will vary operational parameters of our proposed approach and evaluate sensitivity of changing the parameters' values over performance of the network.

Conclusion

- ▶ Then, we will compare the following network performance metrics obtained through our proposed approach against that of the existing approaches.
  - ▶ Average network throughput,
  - ▶ Per packet average end-to-end delay,
  - ▶ Per node average throughput,
  - ▶ Average packet loss.

Conclusion

- ▶ Finally, we will investigate various properties of our proposed approach, discuss findings of our study, and highlight open issues of the study as future directions.

Thanks for your attention! Any questions?

References

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