
بسم الله الرحمن الرحيم

Evaluation of Slotted CSMA/CA of IEEE 802.15.4

Presented by:

Mr. Muzammil Behzad – g201402660

Mr. Awadalla SalahEldin – g201402500

Under the supervision of

Dr. Sameer Al-Ghadhban

King Fahd University of Petroleum & Minerals (KFUPM)

Presentation Layout

- Introduction
- Problem Statement
- Methodology
- System and Channel Model
- Simulations
- Results and Discussion
- Conclusion and Progress

Introduction

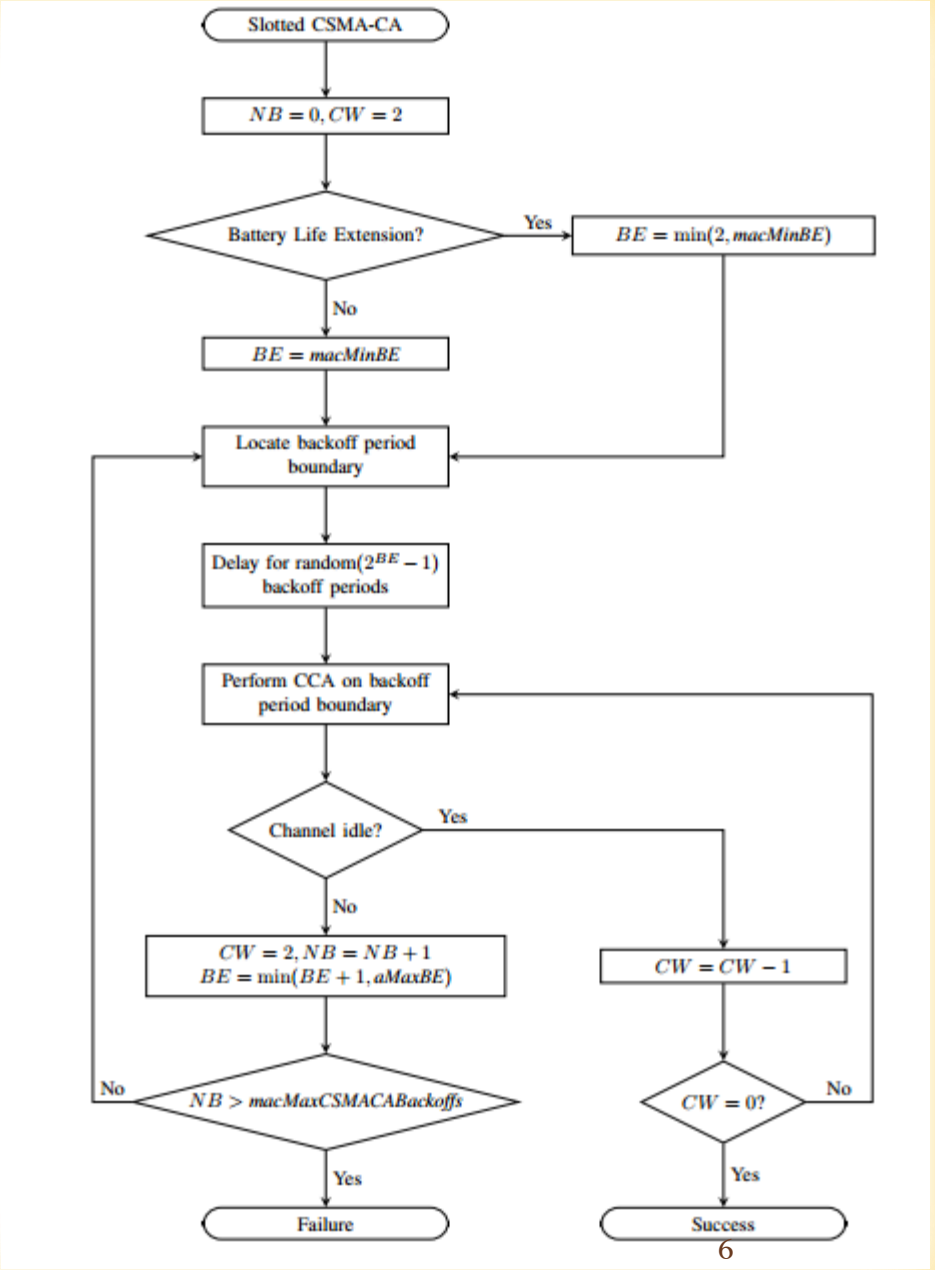
- Wireless Sensor Networks (WSNs)
  - Sensor nodes randomly deployed in a field with continuous monitoring
- IEEE Standards for wireless technologies
  - IEEE 802.11, IEEE 802.16 , IEEE 802.15.4, etc.
- IEEE 802.15.4 for Low Rate Wireless Personal Area Network (LR-WPAN)
  - 868 MHz with 20 kbps at channel 0
  - 915 MHz with 40 kbps at channel 1-10
  - 2.4 GHz with 250 kbps at channel 11-26 (Free ISM band)
- CSMA/CA: Nodes attempt to avoid collisions by transmitting when the channel is idle

Problem Statement

- Problems in existing methods/standards/protocols
- Energy hunger nodes
- Energy holes formation due to limited energy and wireless transmission
- IEEE 802.15.4's slotted CSMA/CA evaluated ***but not*** on:
  - All frequency bands (868 MHz, 915 MHz and 2.4 GHz)
  - Same load variations

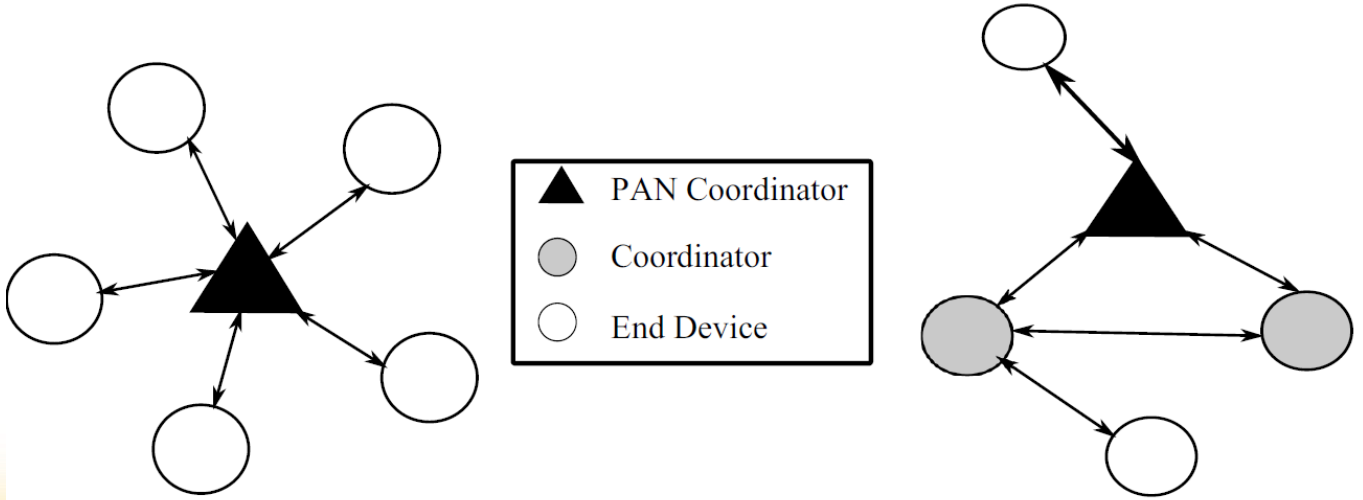
Methodology

- Slotted CSMA/CA
- Implementation with all frequency bands
- Implementation with various loads
- CCA1 (alpha) and CCA2 (beta) probability calculation using Markov chain model



System and Channel Model

- IEEE 802.15.4 Physical and MAC layer
- AWGN Channel
- Wireless sensor network field
- Nodes deployed randomly and compete for channel access

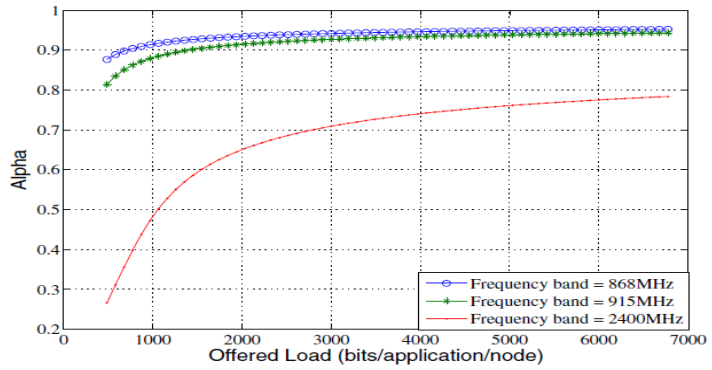
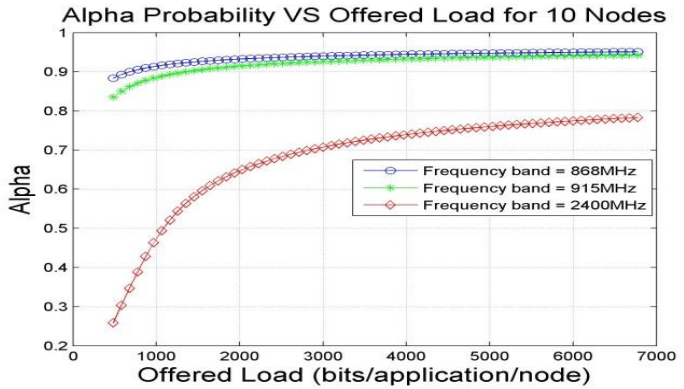
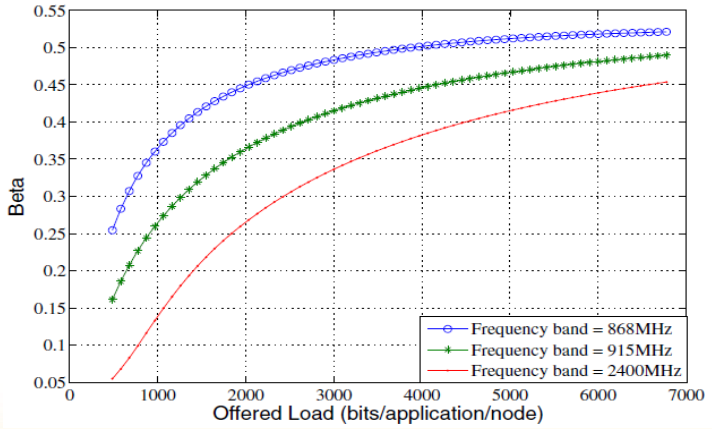
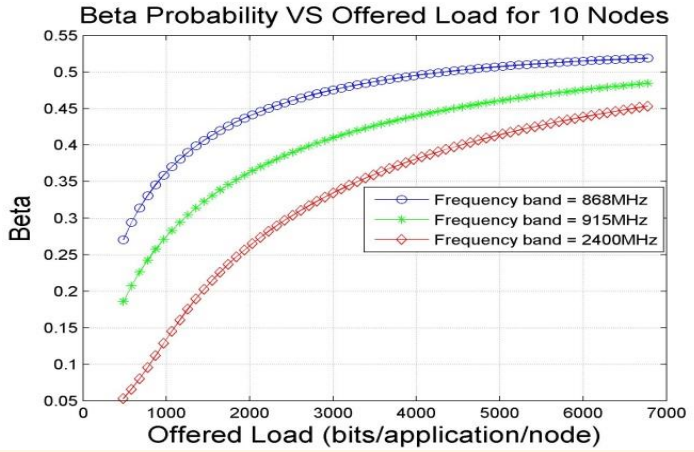


Simulations

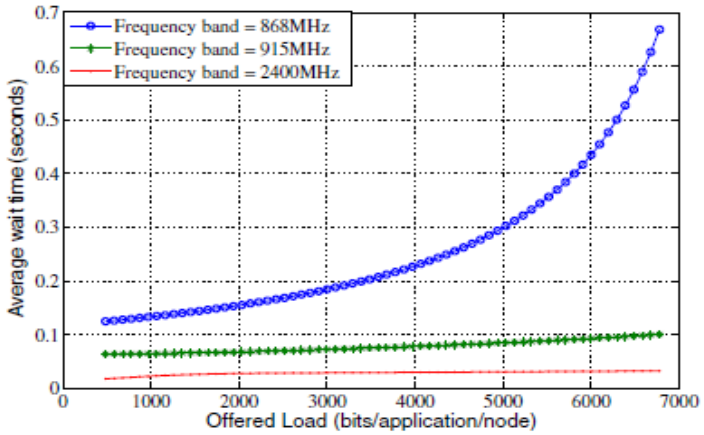
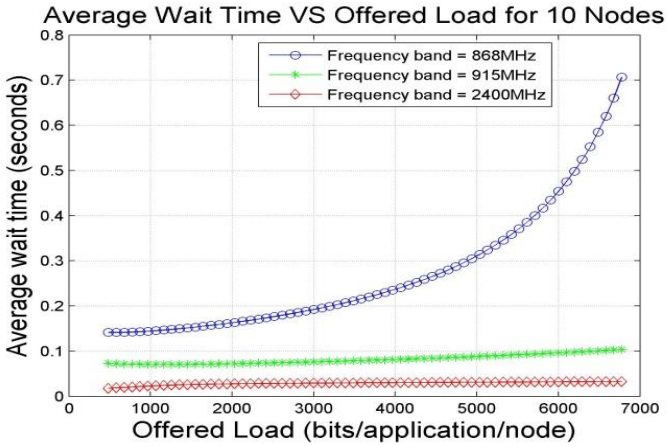
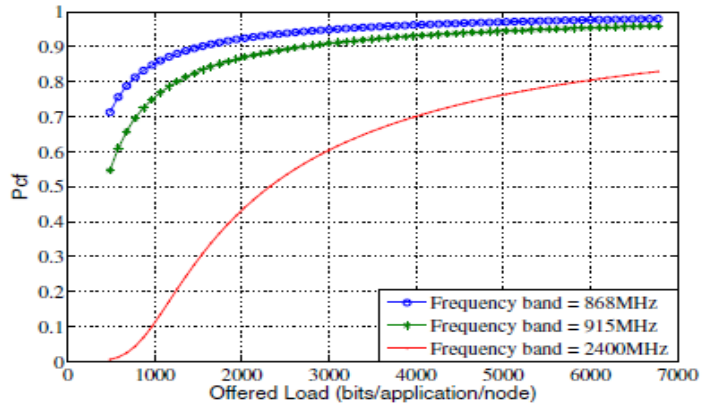
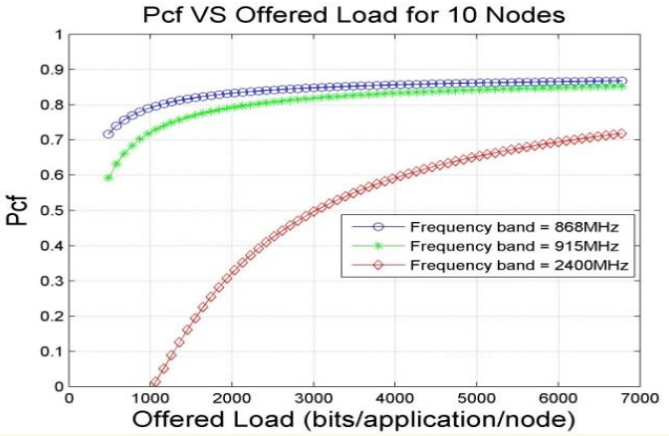
- Simulations in MATLAB
- Performance Metrics:
  - Reliability
  - Throughput
  - Transmission failure probability
  - Average time wait
  - Alpha (CCA1) and beta (CCA2) probabilities
  - Pcf and Pcr

Parameters	868MHz	915MHz	2.4GHz
Number of Nodes	10	10	10
Data Rate	20Kbps	40Kbps	250Kbps
Bits/Backoff Slot	20	20	80
Offered Load	484 to 6776 bits	484 to 6776 bits	484 to 6776 bits
aunitBackoffPeriod	20*50*e-6	20*25*e-6	20*16*e-6
Turnaround time	12*50*e-6	12*25*e-6	12*16*e-6
macAckWaitDuration	120*50*e-6	120*25*e-6	120*16*e-6
Sensing Time	8*50*e-6	8*25*e-6	8*16*e-6
LIFS	40*50*e-6	40*25*e-6	40*16*e-6
SIFS	12*50*e-6	12*25*e-6	12*16*e-6
macMinBE	3	3	3
macMaxBE	5	5	5
MaxCSMABackoff	4	4	4
macMaxFrame re-tries	3	3	3

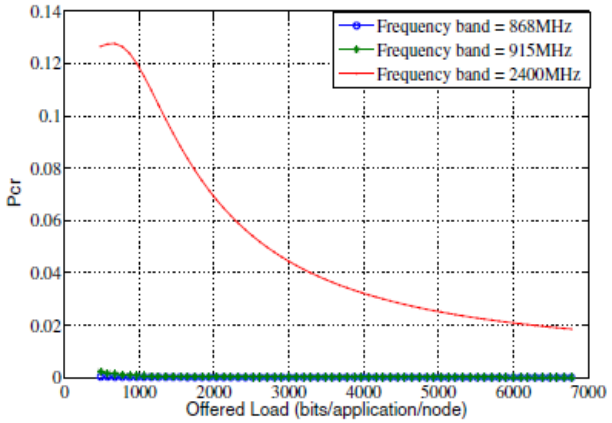
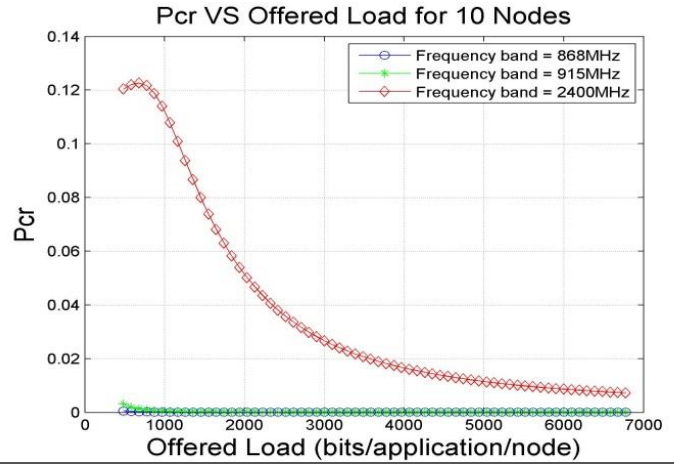
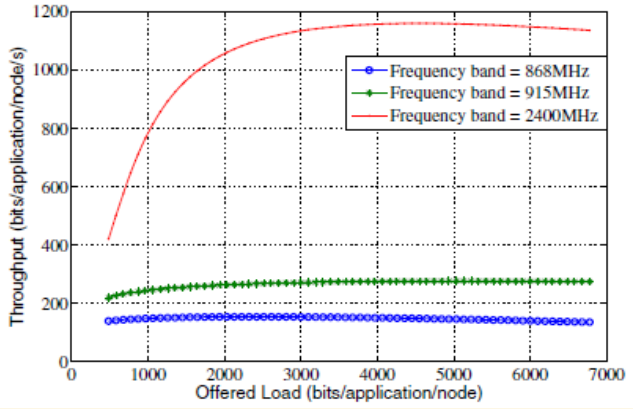
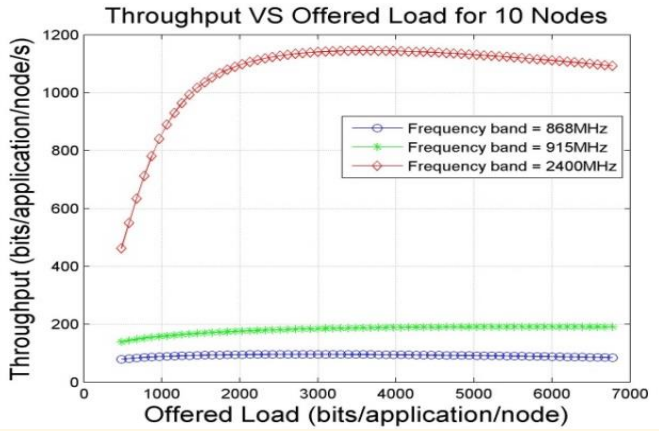
Results and Discussions (1/5)

Results from paper	Re-simulated results
	
	

Results and Discussions (2/5)

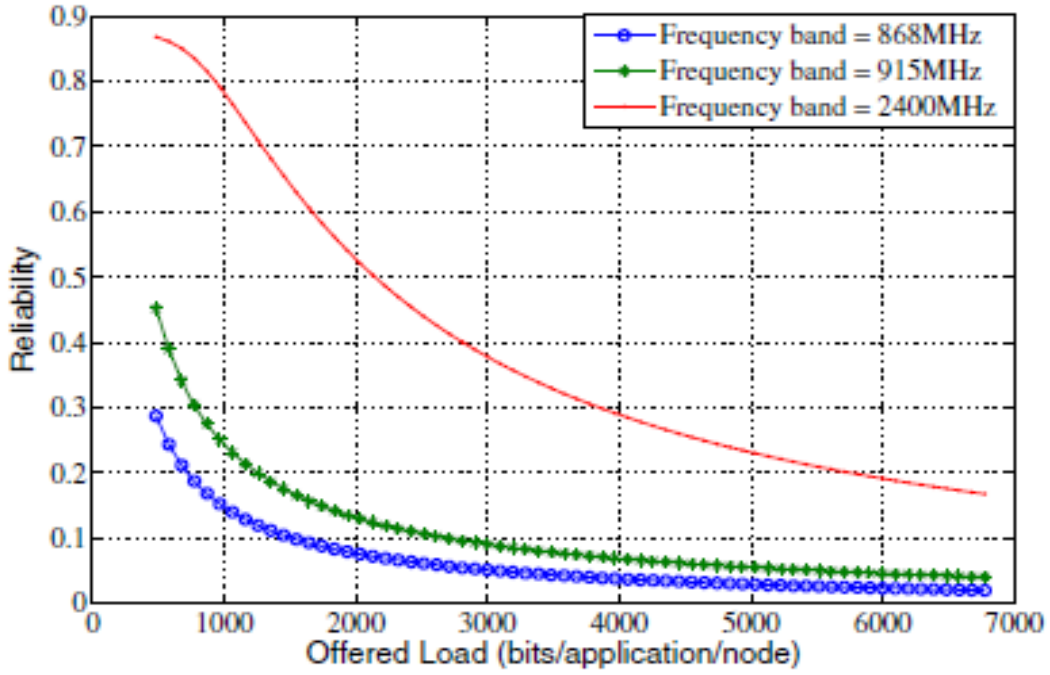
Results from paper	Re-simulated results
	
	

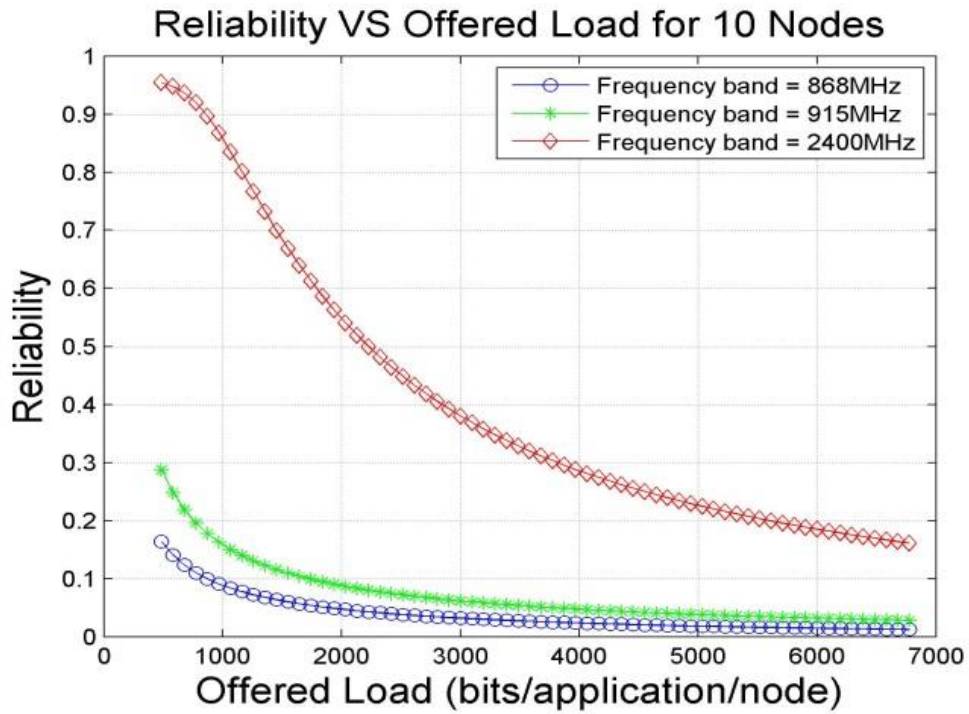
Results and Discussions (3/5)

Results from paper	Re-simulated results
	
	

Results and Discussions (4/5)

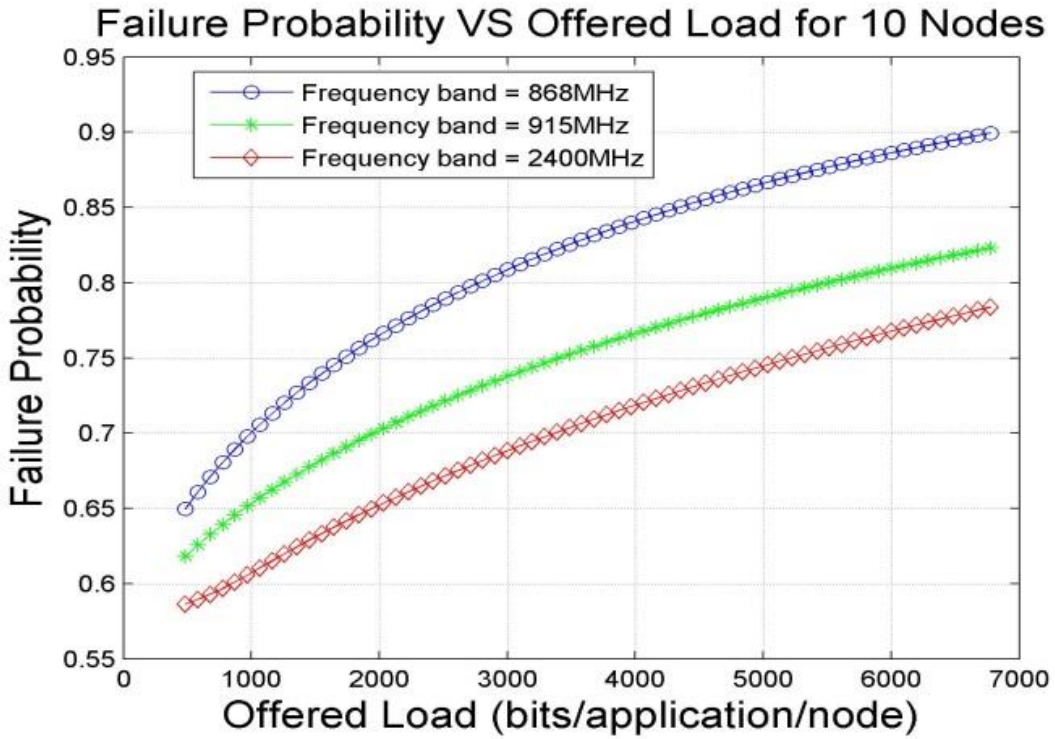
Results from paper	Re-simulated results

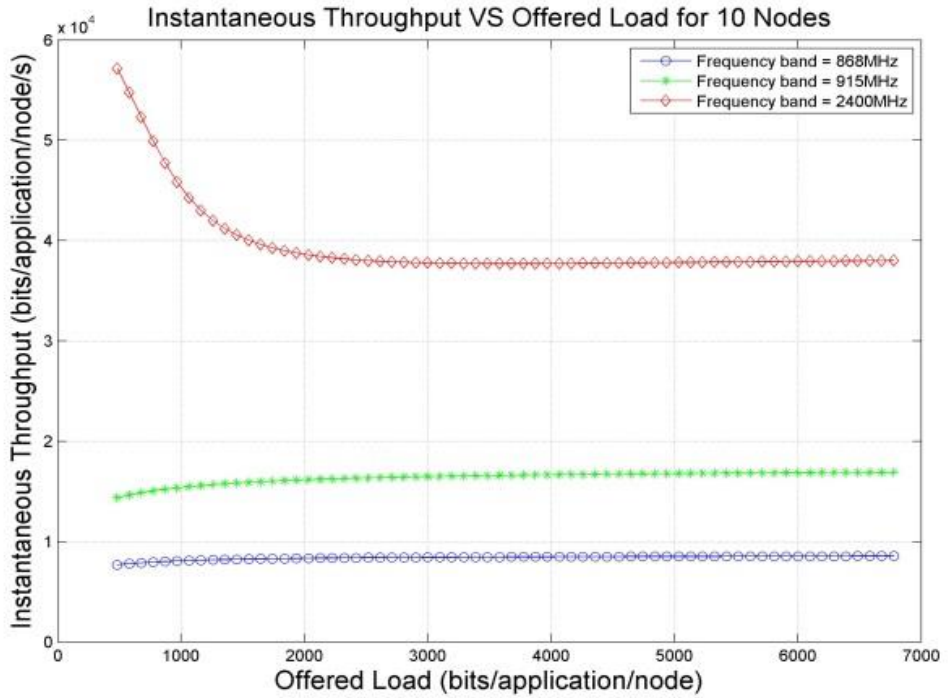




Results and Discussions (5/5)

Self Generated Results (not in the paper)





Conclusion

- Performance during 2.4 GHz band is considerably better than other two frequency bands, i.e. 868 MHz and 915 MHz
- Increasing load severely effects the reliability
- Re-simulation done completely with all results reproduced plus some more results as shown.


thanks!