Performance evaluation and enhancement of WLAN

(CMPT885 / ENSC835)

Demo Plan

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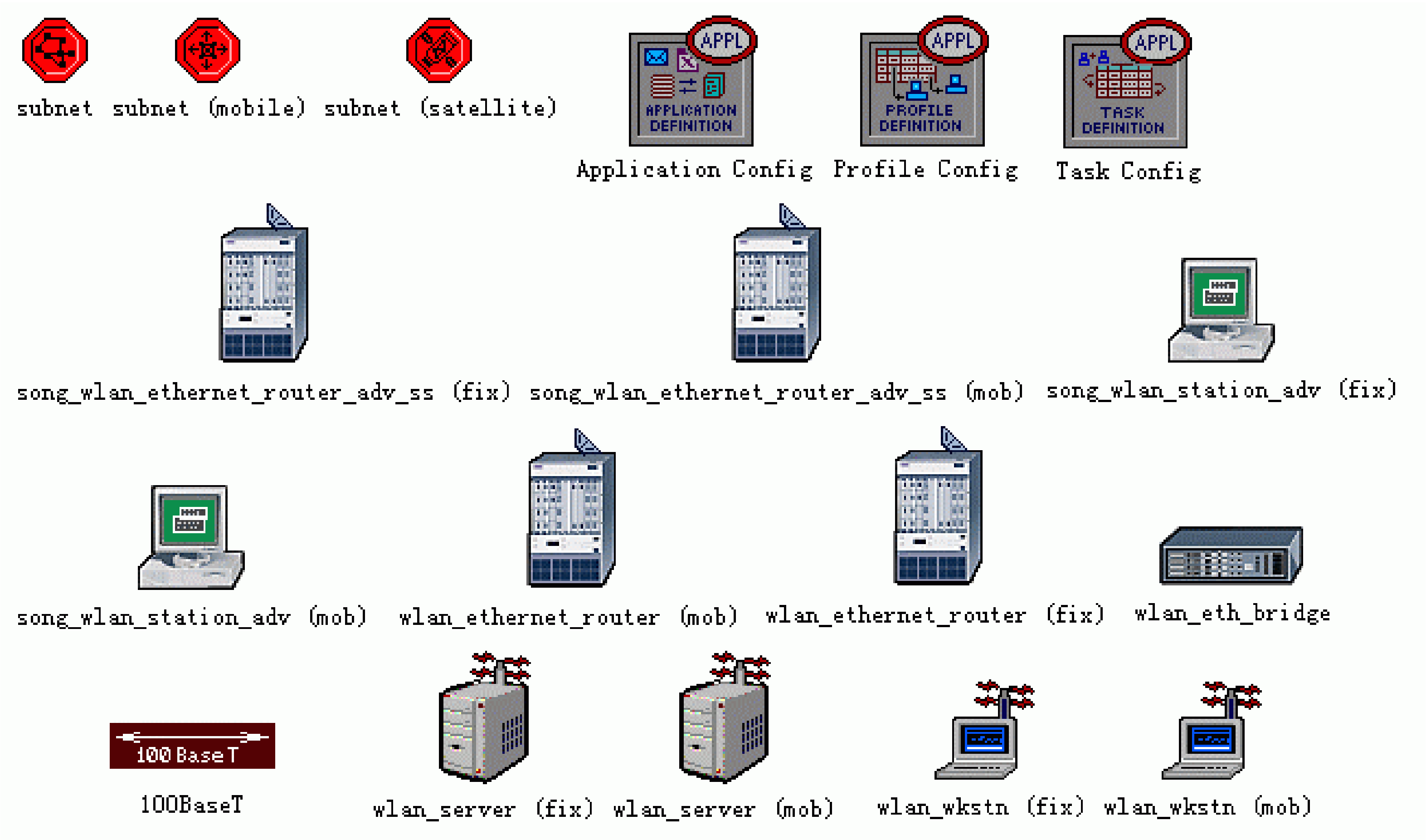
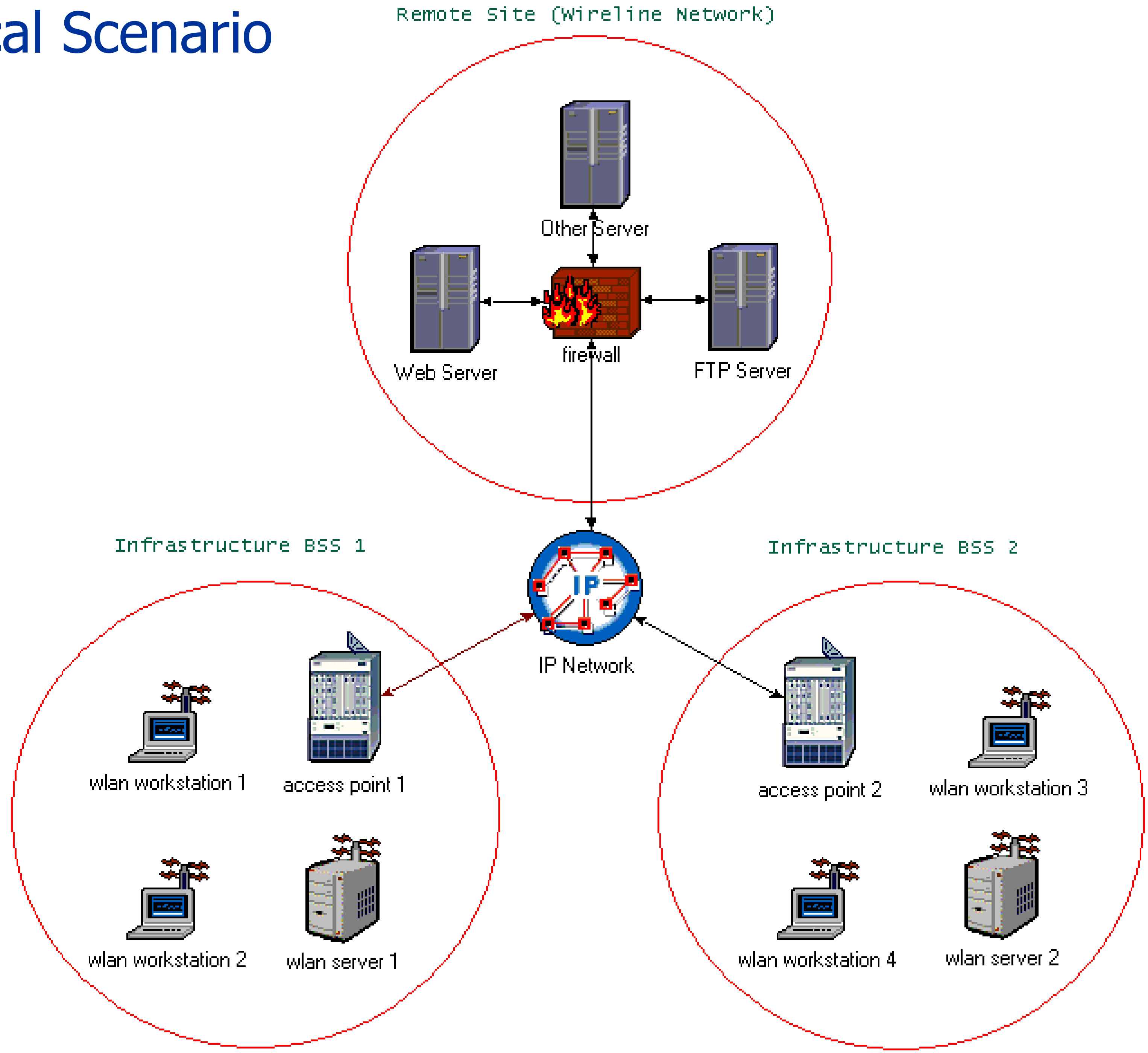
- PHY Characteristics
- WLAN Parameters
- Adaptive Backoff
- SMART Snoop*
- References

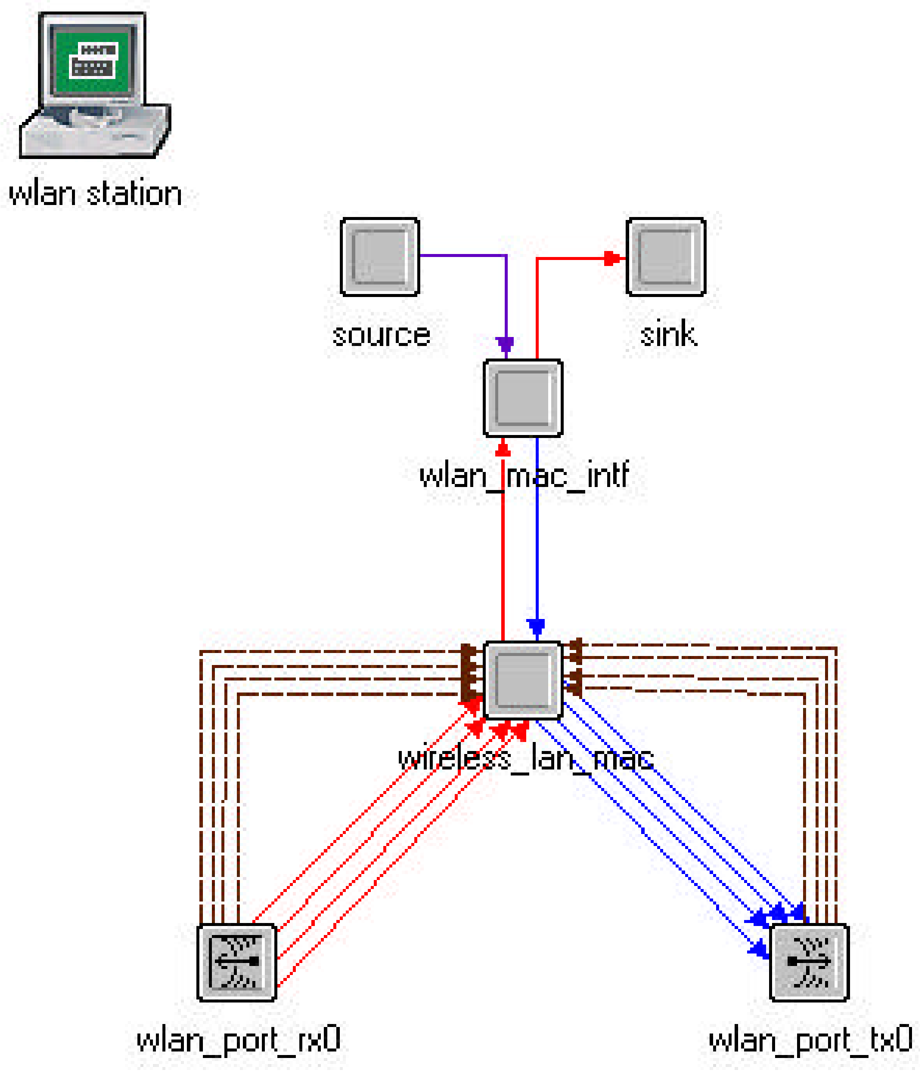
OPNET WLAN Models



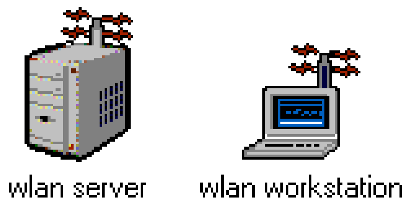
Typical Scenario

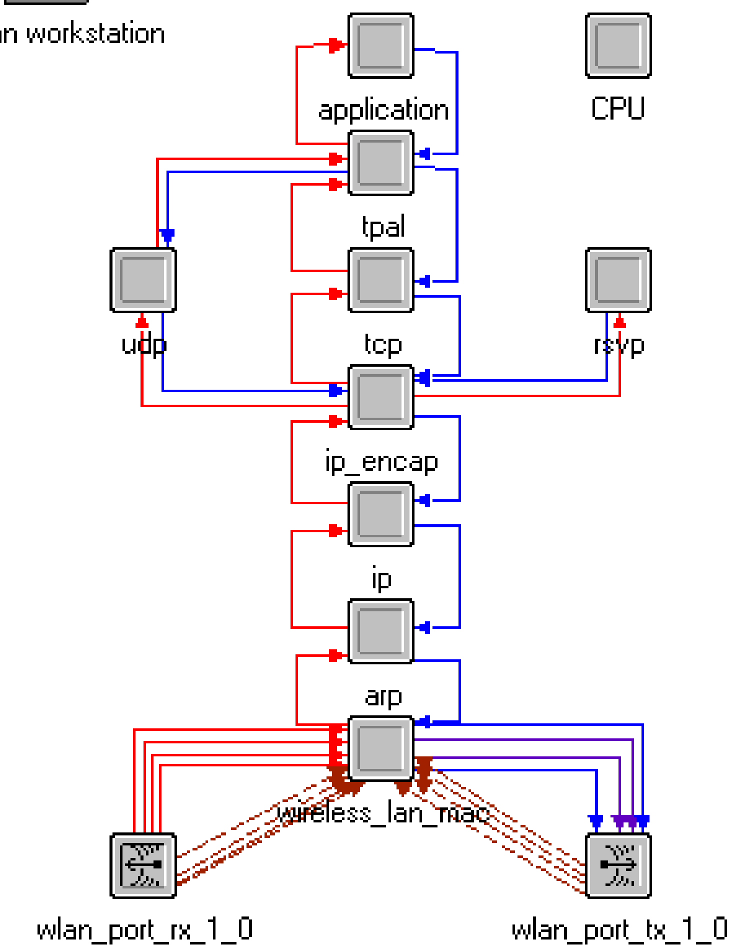


OPNET WLAN Models
- WLAN Station

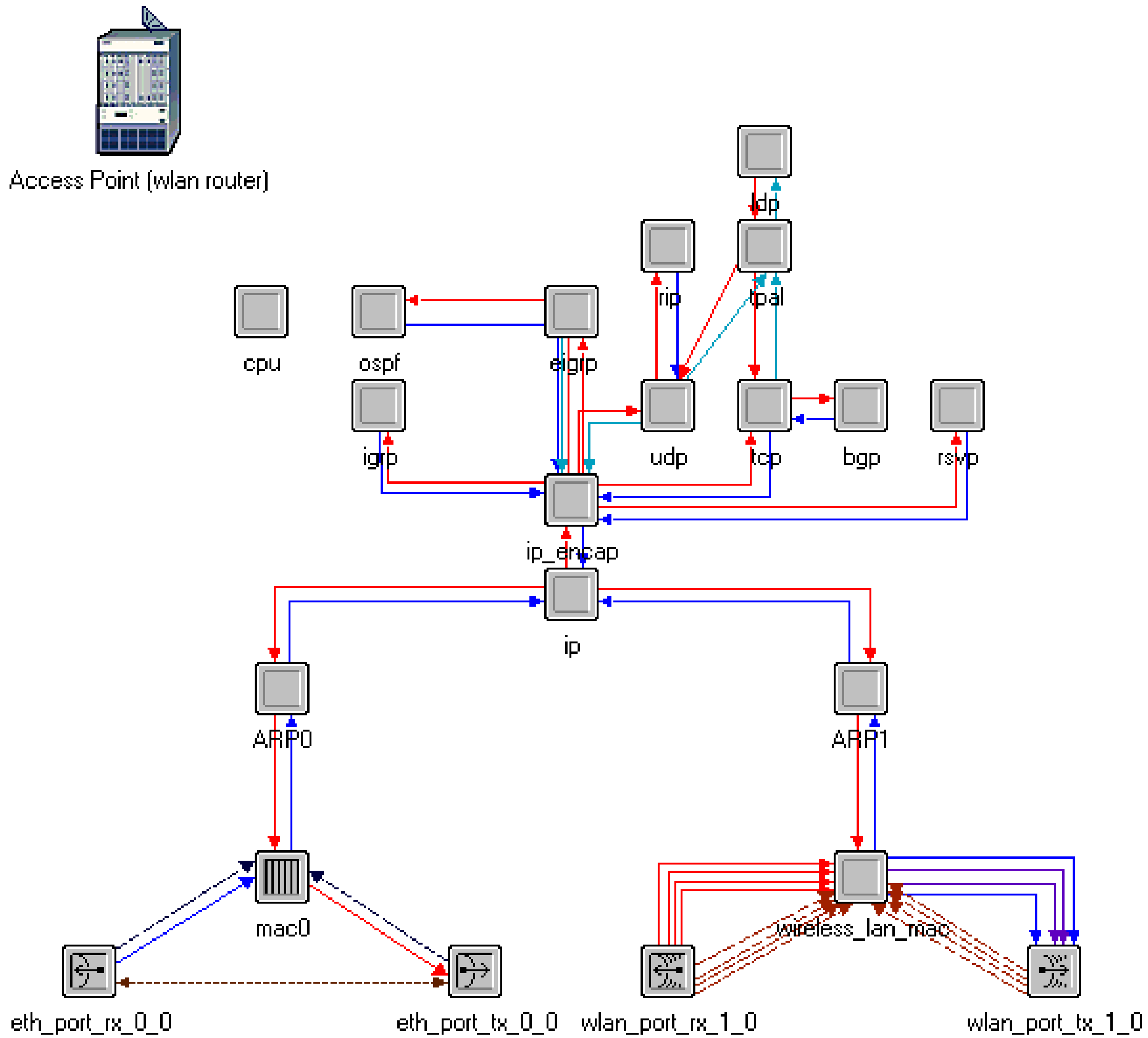


OPNET WLAN Models
- WLAN Workstation/Server





OPNET WLAN Models
- WLAN Router



Performance enhancement
- Survey of Methods

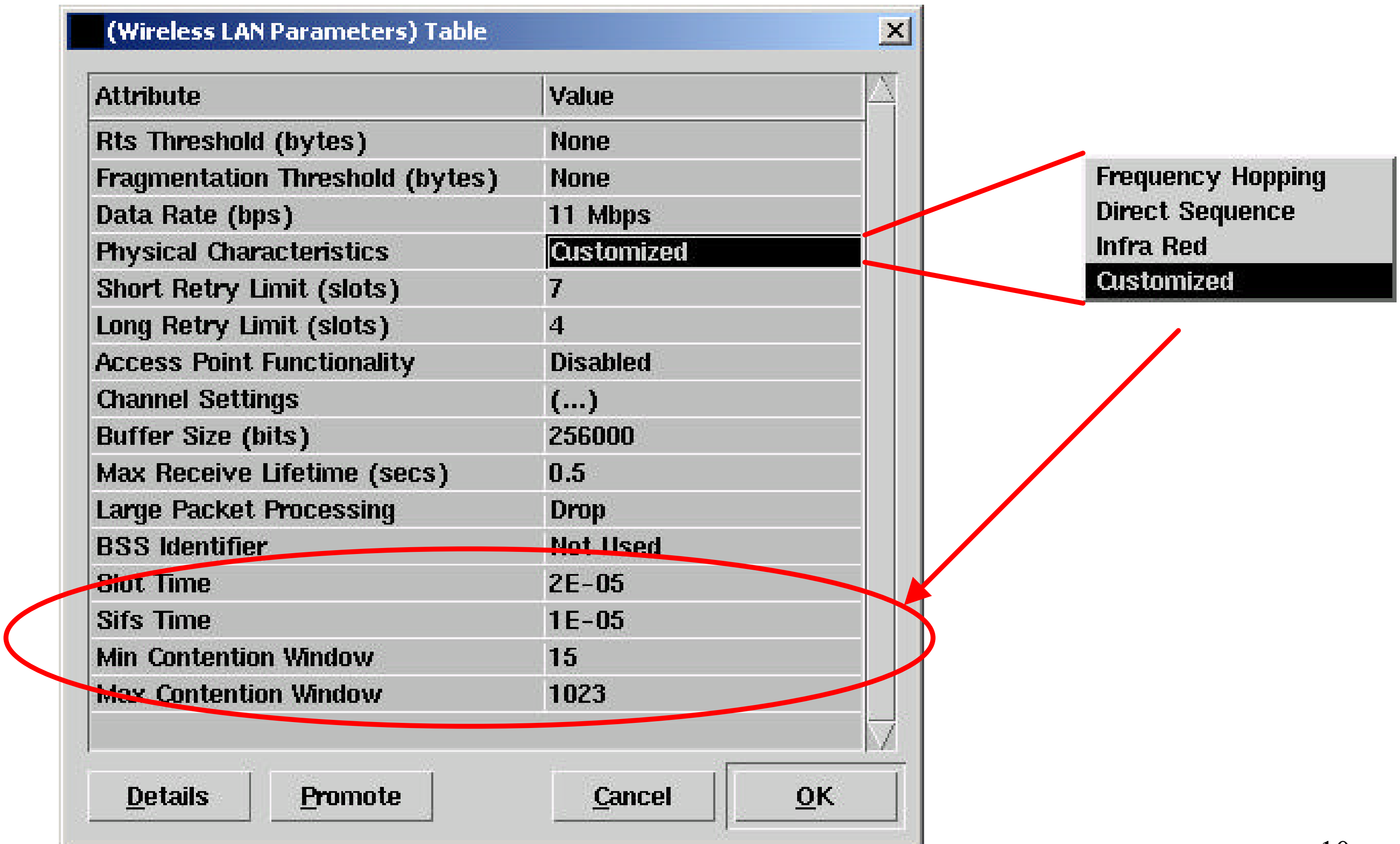
- Physical layer characteristics (slot time, SIFS)
- Tune up the WLAN parameters (Fragmentation threshold, RTS threshold, …)
- Adaptive back-off protocol on MAC layer
- Proxy approach (snoop, SMART snoop protocol)

- Reliable link-layer approach (AIRMAIL)
- Split-connection approach (I-TCP, M-TCP)

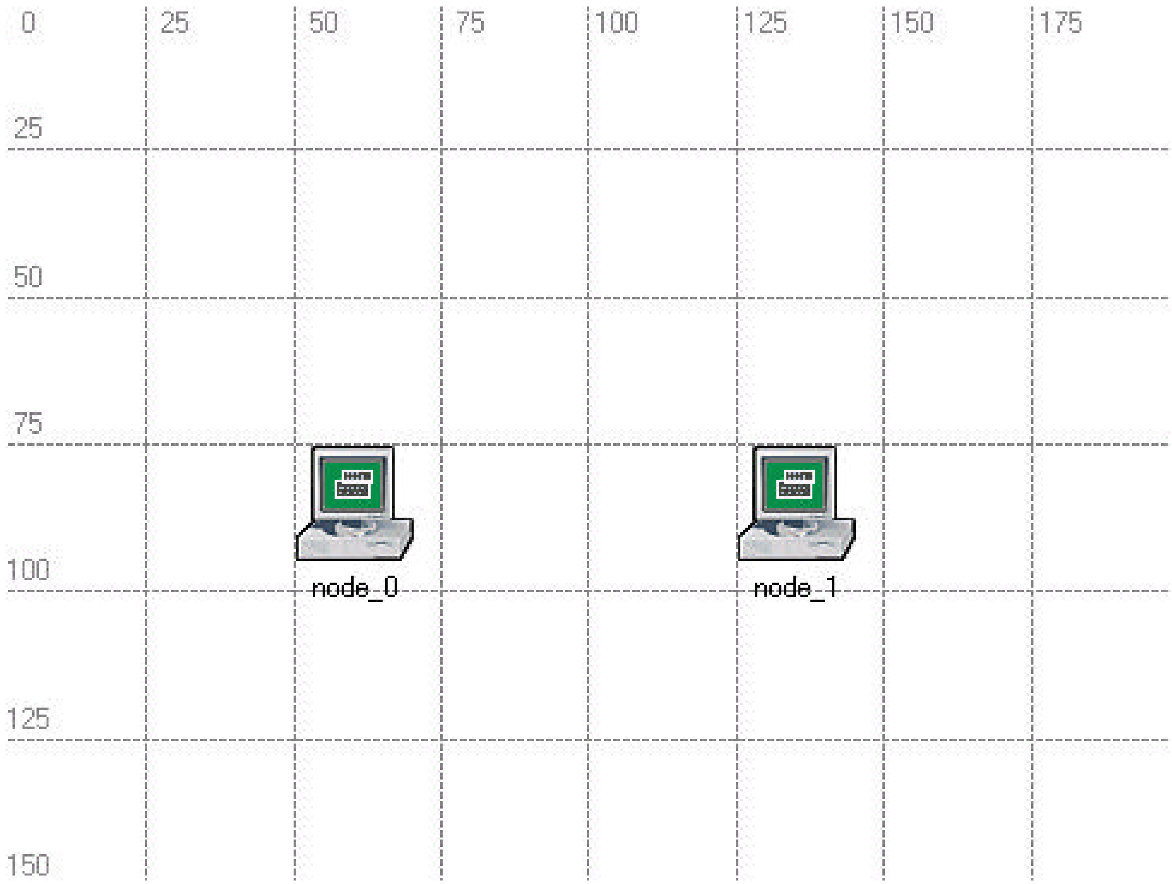
Part 1: PHY Characteristics

- Analyze the effect of PHY characteristics
- PHY characteristics provided by OPNET model: Frequency Hopping, Direct Sequence, Infra Red
- OPNET does not provide customized PHY characteristics
- Add Slot Time, Sifs Time, Minimum Contention Window, Maximum Contention Window parameters into the OPNET node model

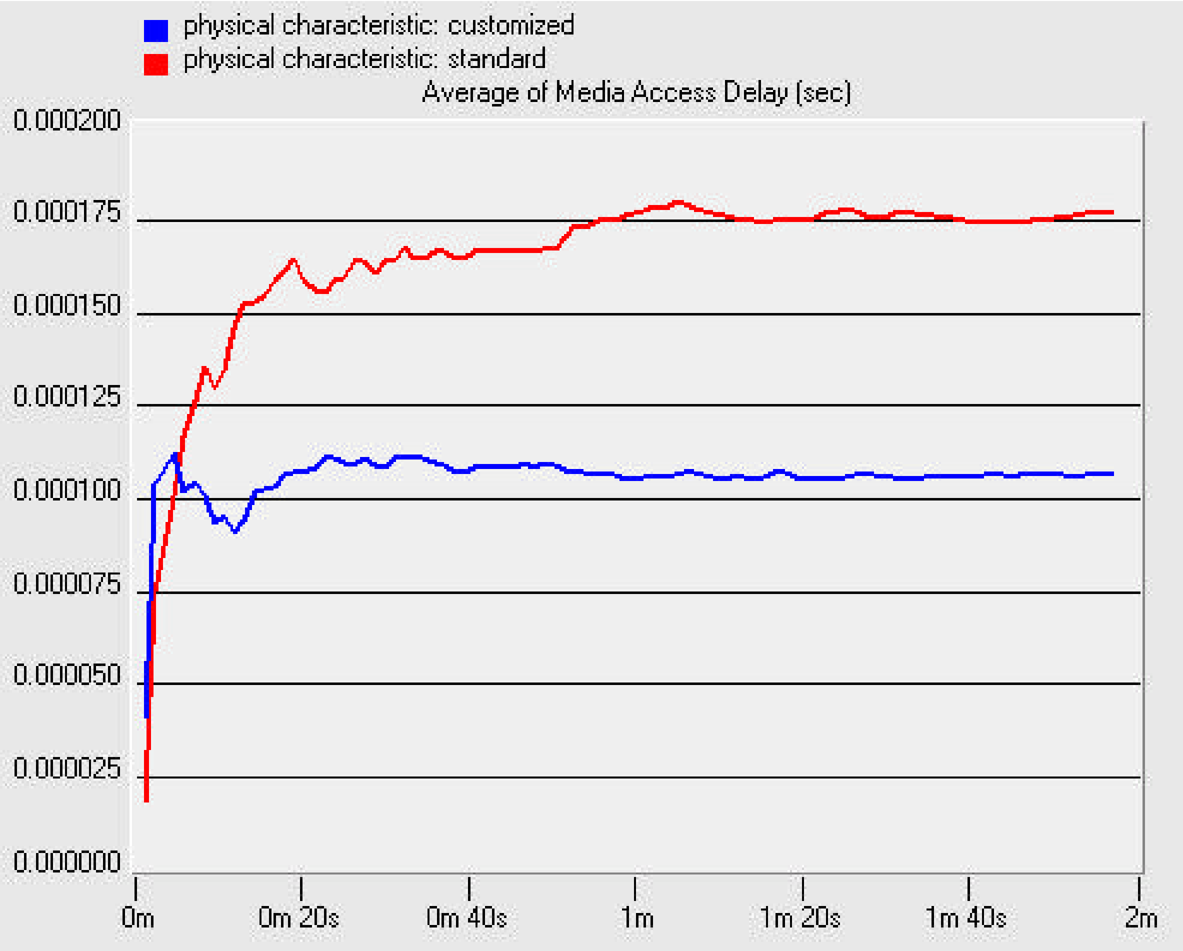
Part 1: PHY Characteristics
- Customized Settings



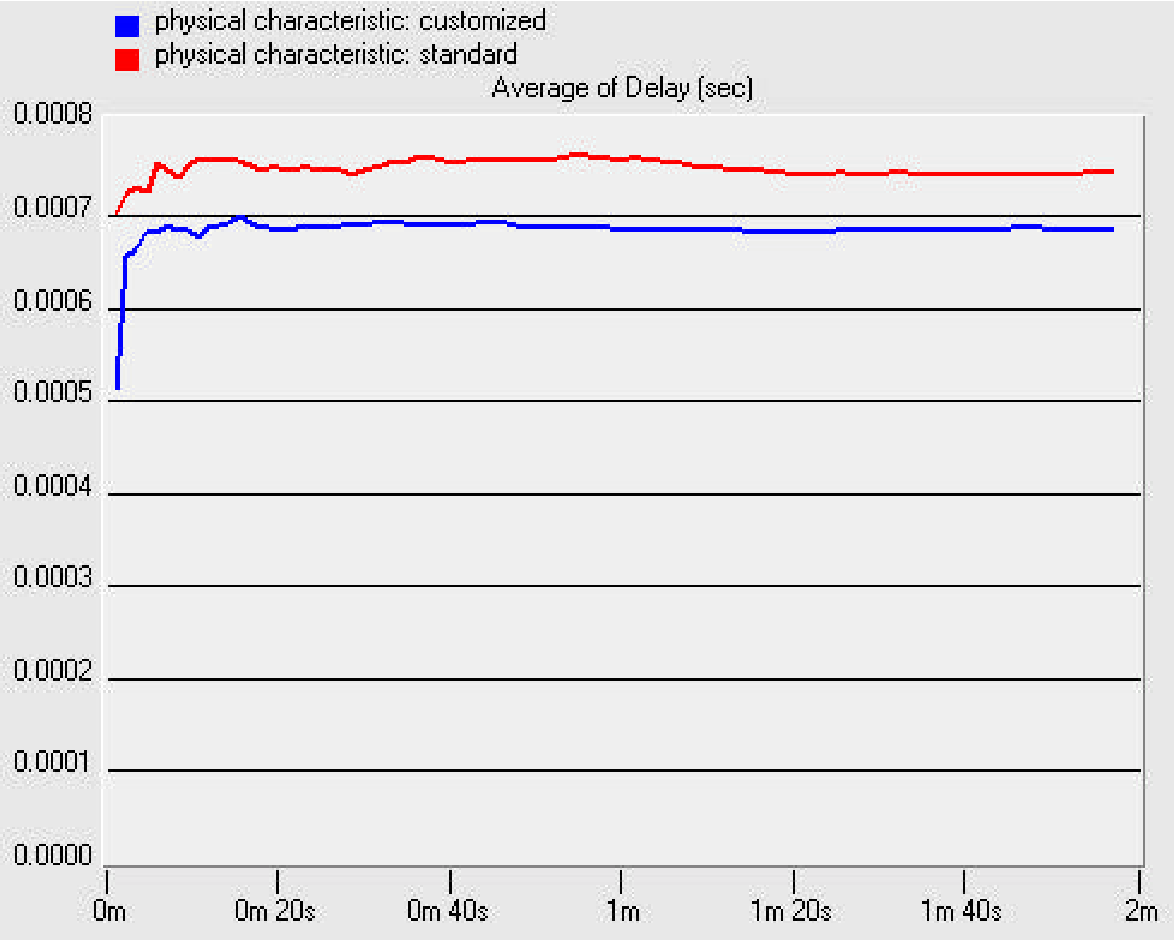
Part 1: PHY Characteristics
- Scenario



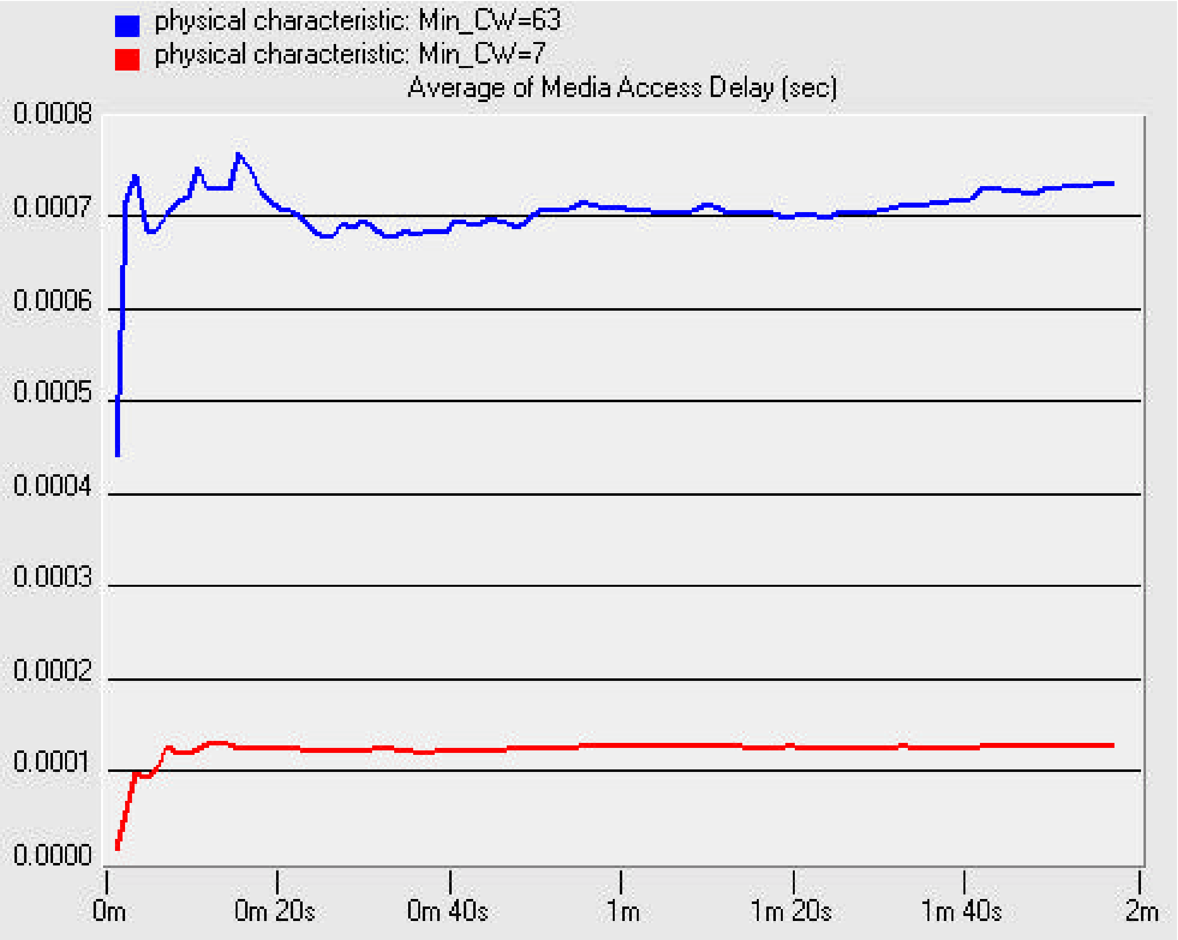
Part 1: PHY Characteristics
– Results of Customized SIFS (1)



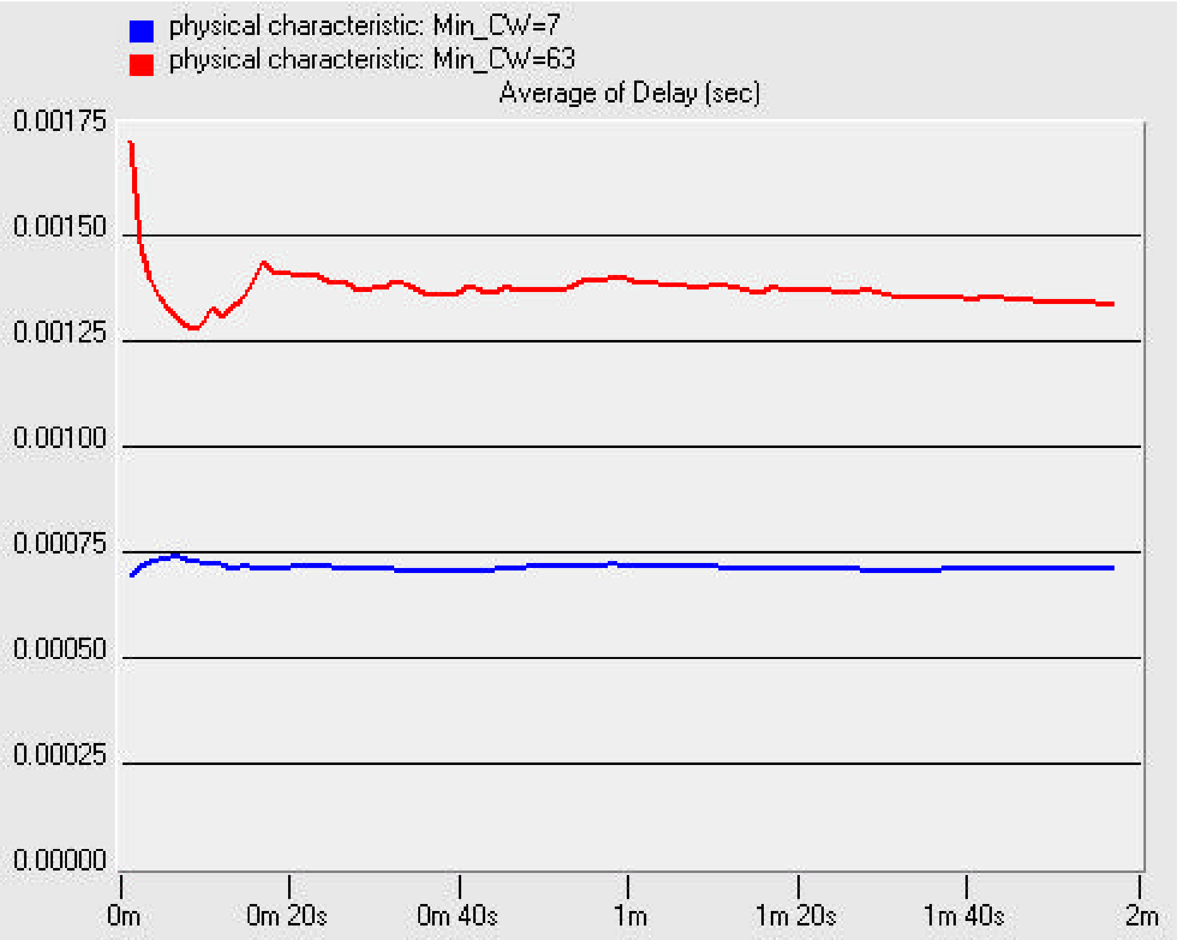
Part 1: PHY Characteristics
– Results of Customized SIFS (2)



Part 1: PHY Characteristics
– Results of Customized Min CW (1)



Part 1: PHY Characteristics
– Results of Customized Min CW (2)

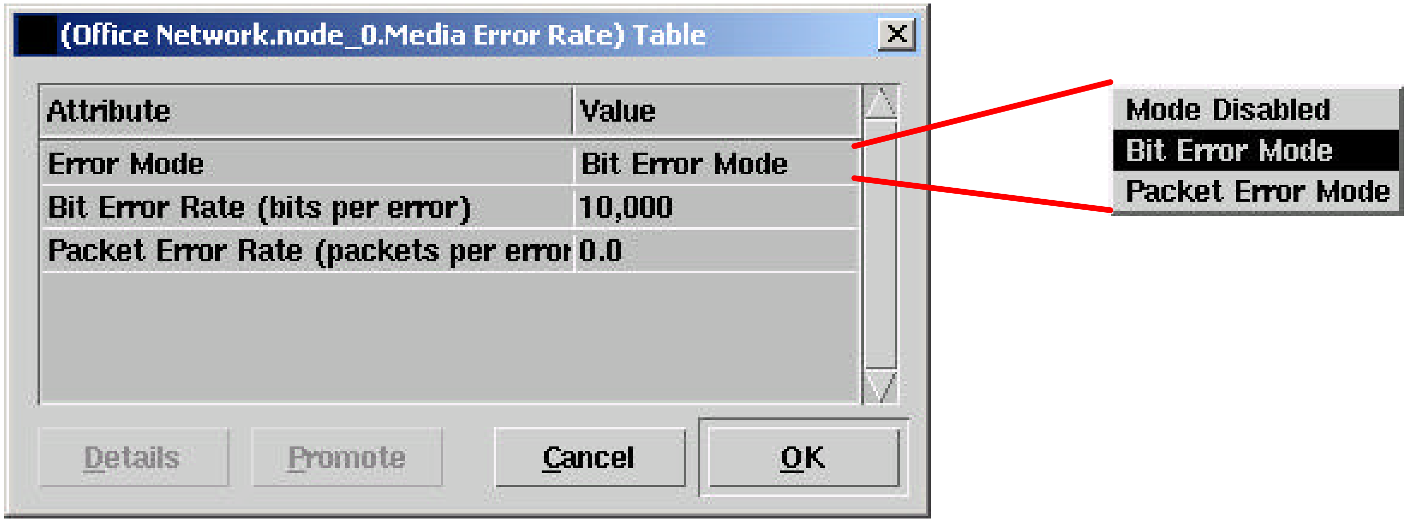


Part 2: WLAN Parameters

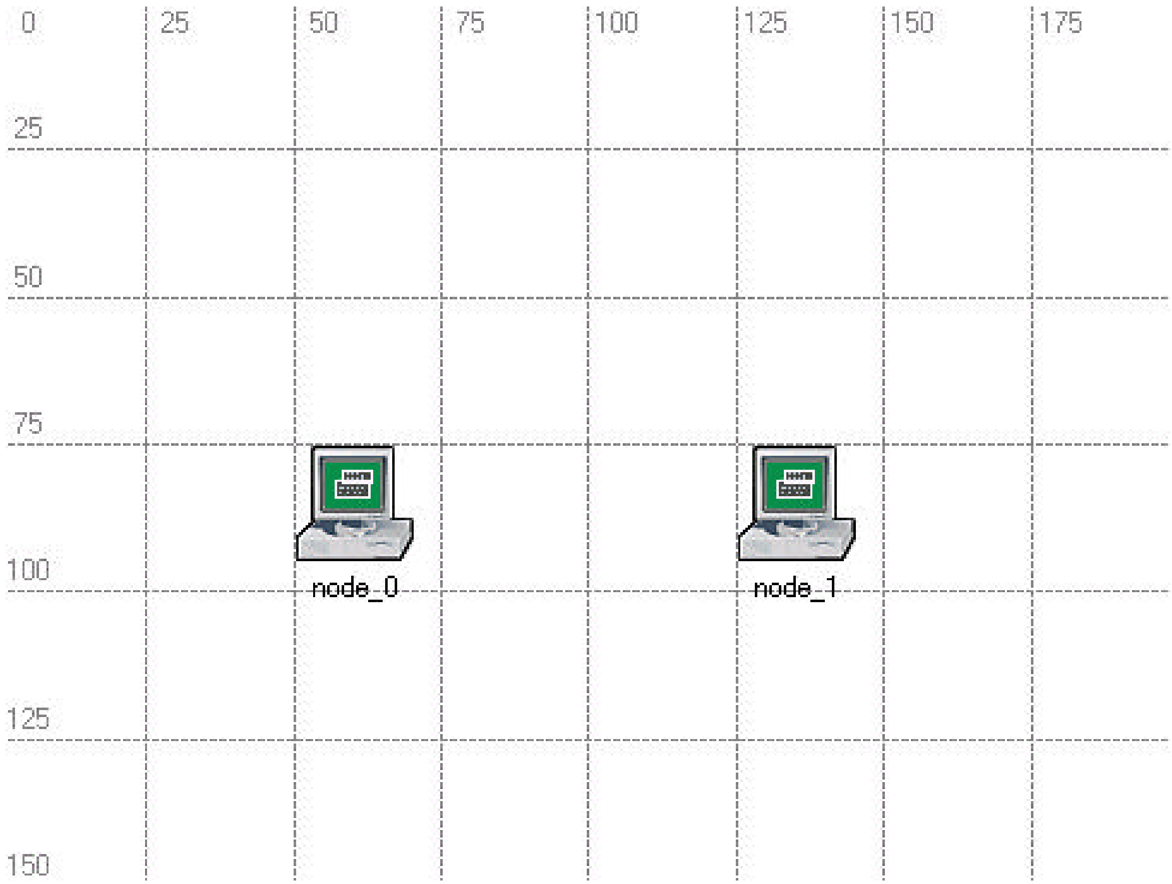
- Two important parameters: Fragmentation threshold, RTS/CTS threshold
- Proper fragmentation threshold can improve the wlan performance if the media error rate is high
- Too small fragmentation threshold will make the packet header occupy too much bandwidth

- RTS/CTS is used to deal with the hidden terminal problems

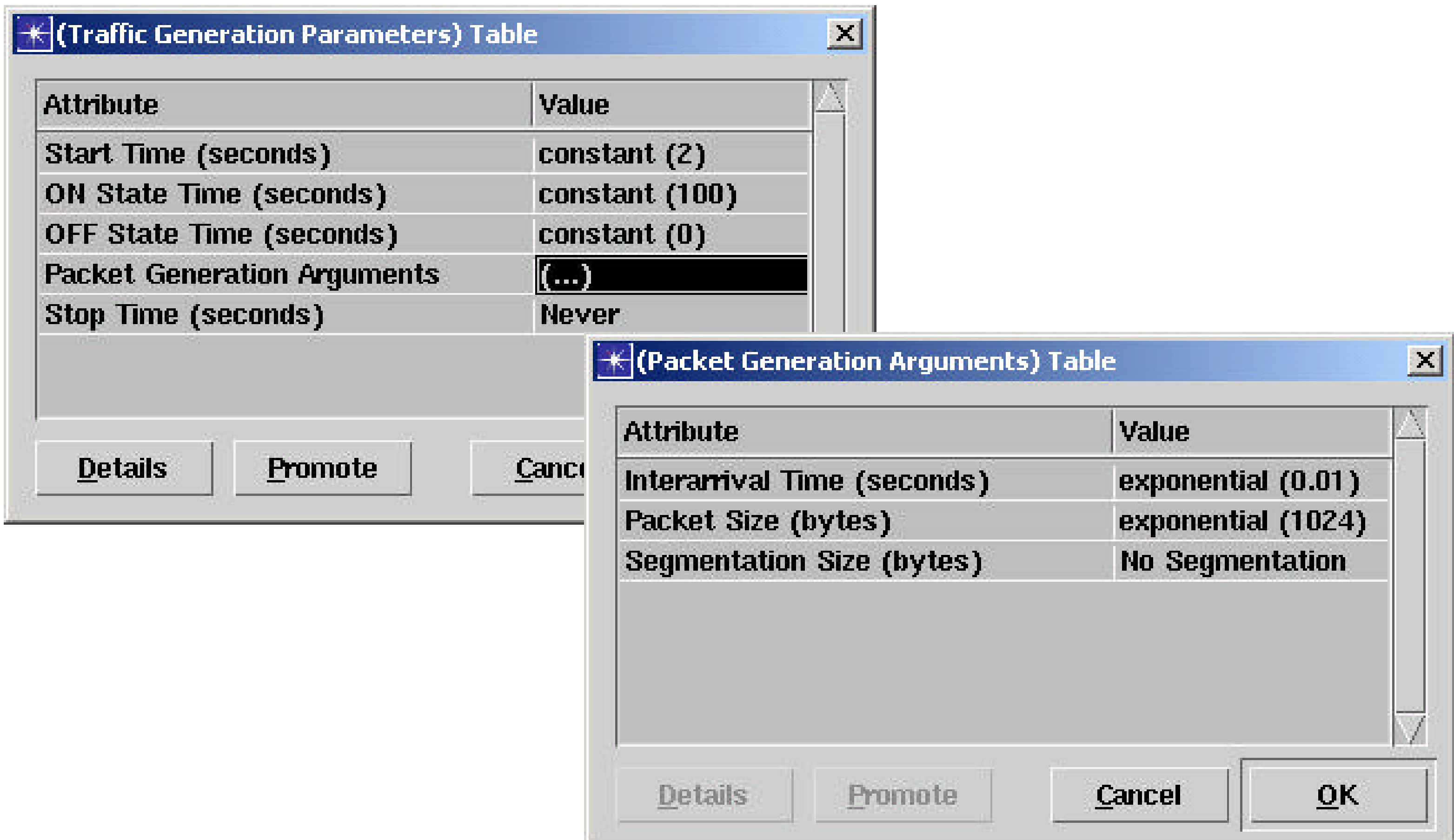
Part 2: WLAN Parameters
– Packet Error Generator



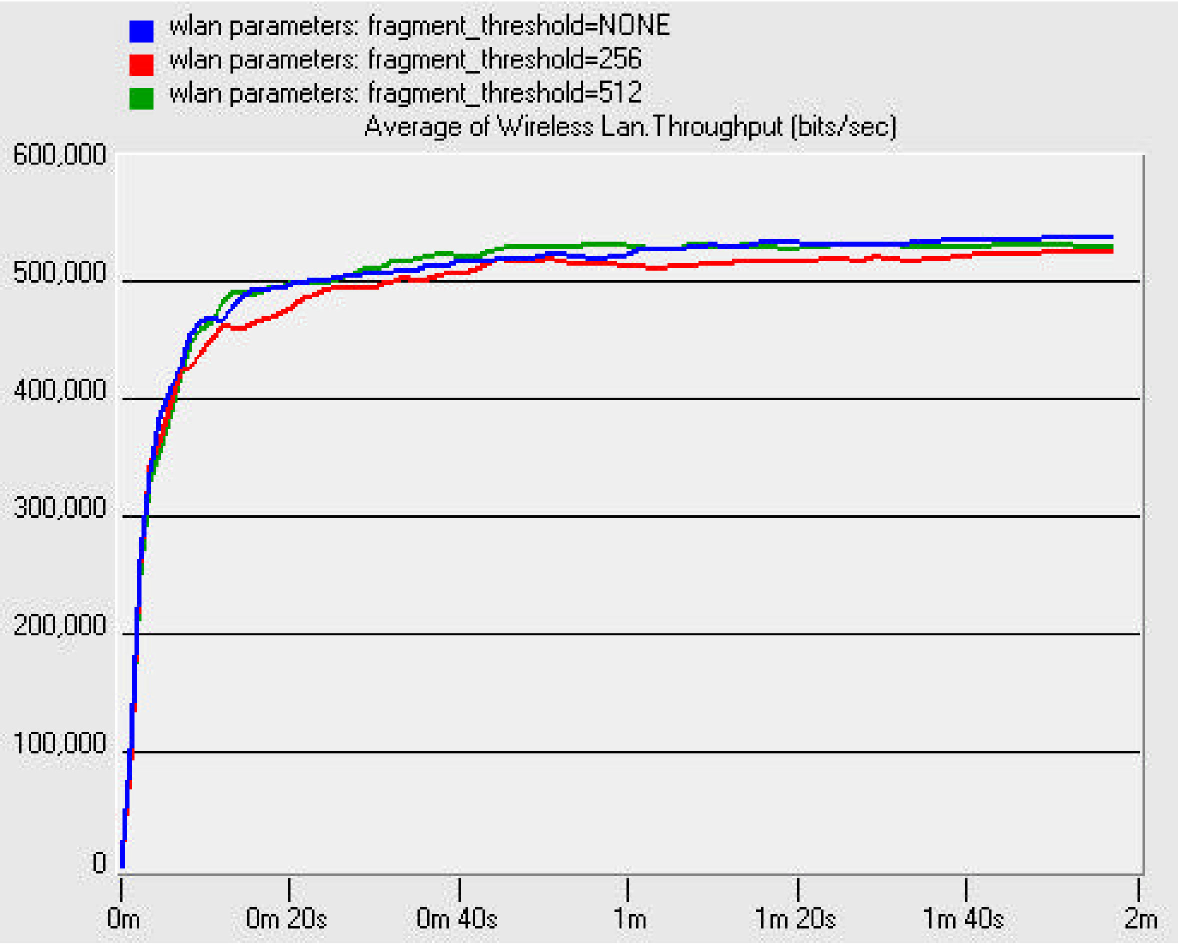
Part 2: WLAN Parameters
- Scenario



Part 2: WLAN Parameters
– Settings

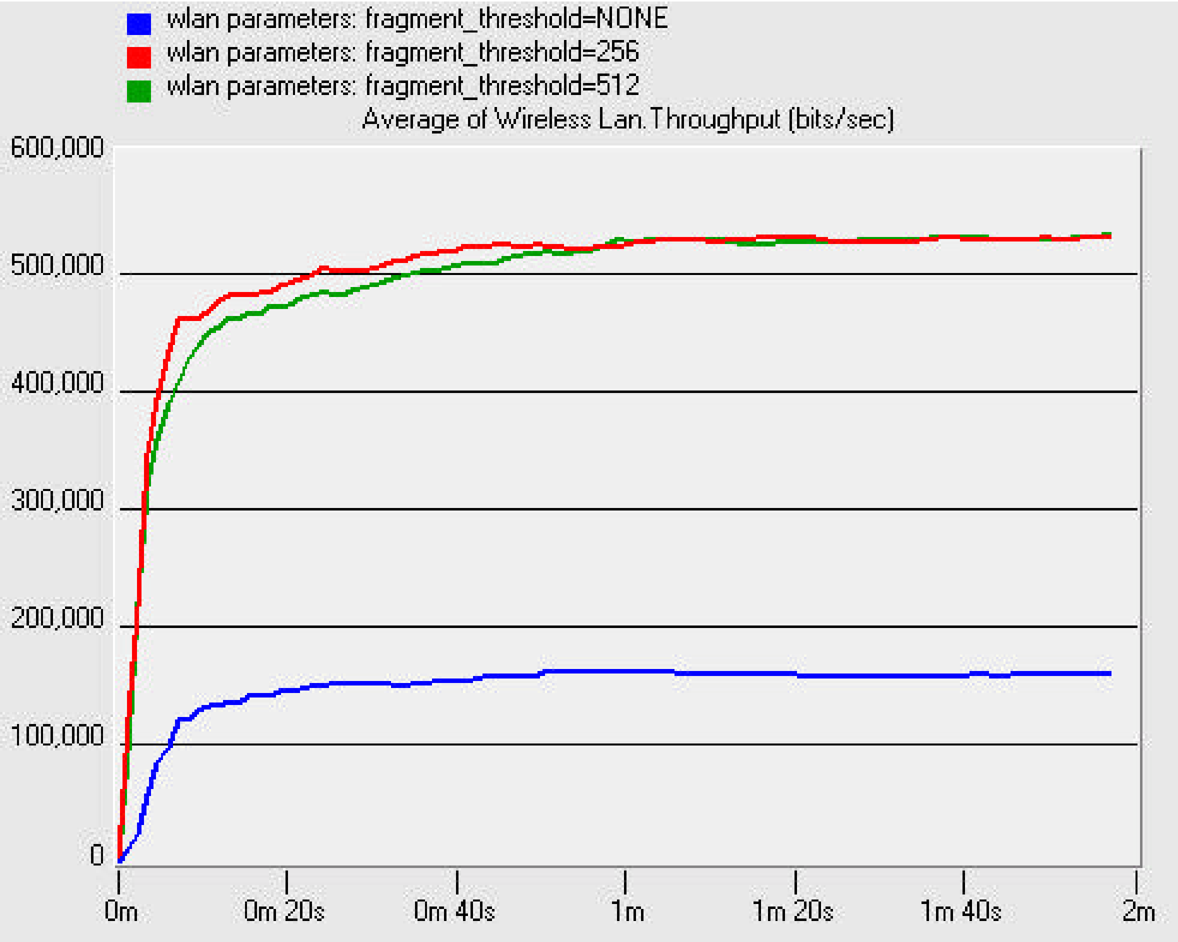


Part 2: WLAN Parameters
– Results of Fragmentation Threshold (1)



Bits Error Rate = 1/50,000

Part 2: WLAN Parameters
– Results of Fragmentation Threshold (2)

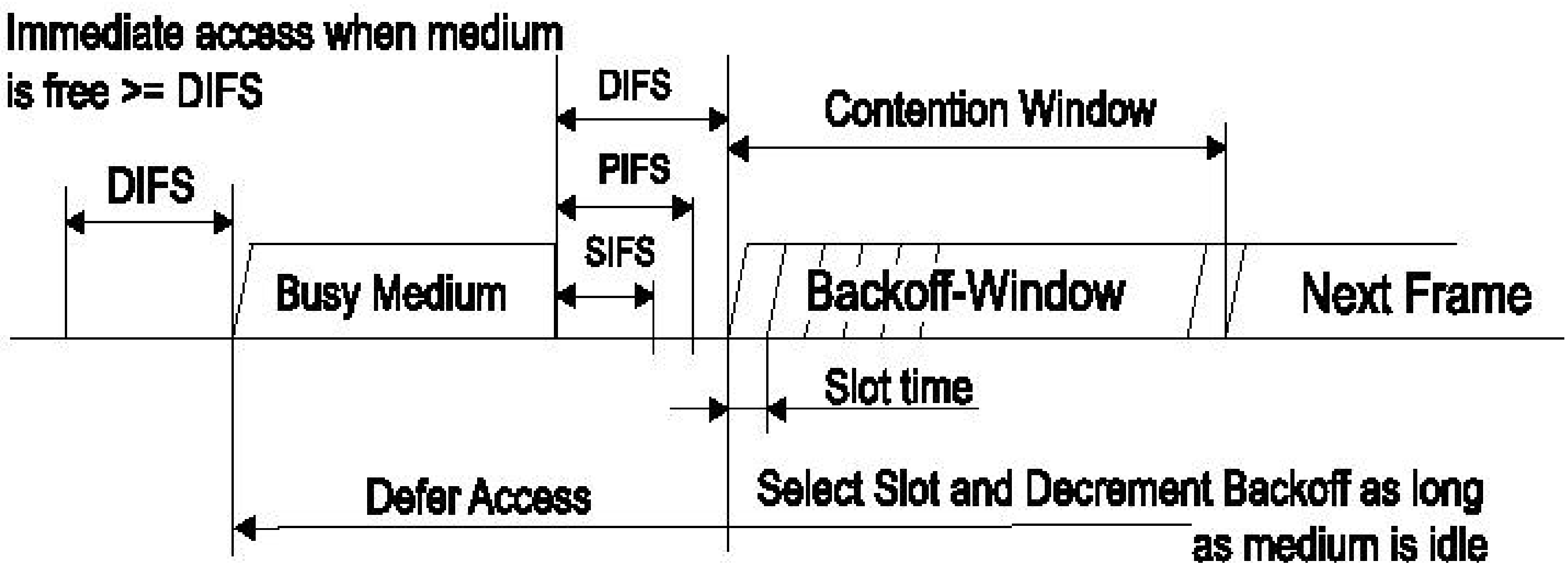


Bits Error Rate = 1/10,000

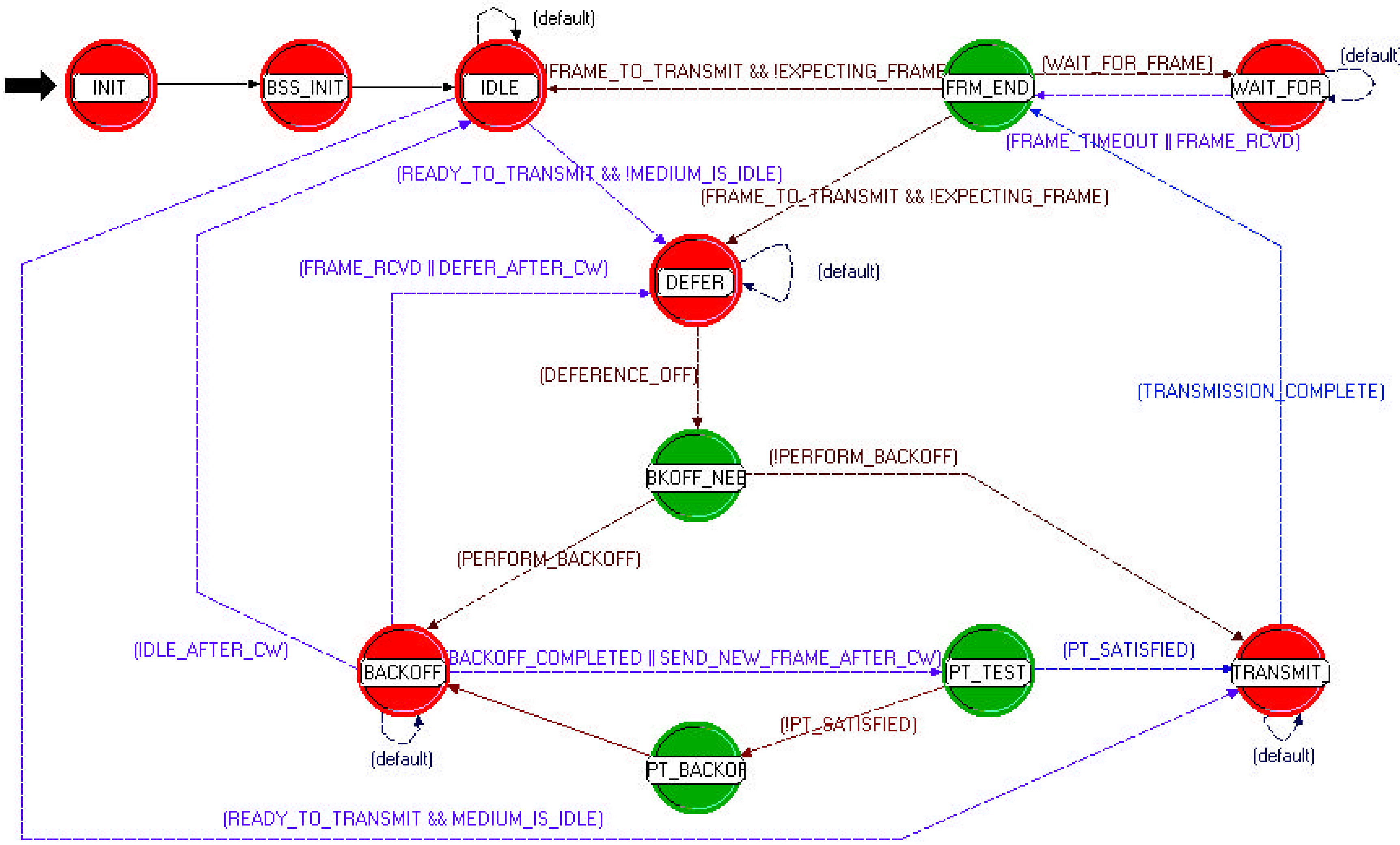
Part 3: Adaptive Backoff

- Named Distributed Contention Control (DCC)
- Can be executed on the top of pre-existent access scheduling protocol (DCF)
- For the adaptive reduction of contention in WLAN networks
- Estimate the channel's congestion level from the slots utilization rate
- High congestion level → Trigger the virtual congestion procedure → Do the Backoff without the cost of a collision

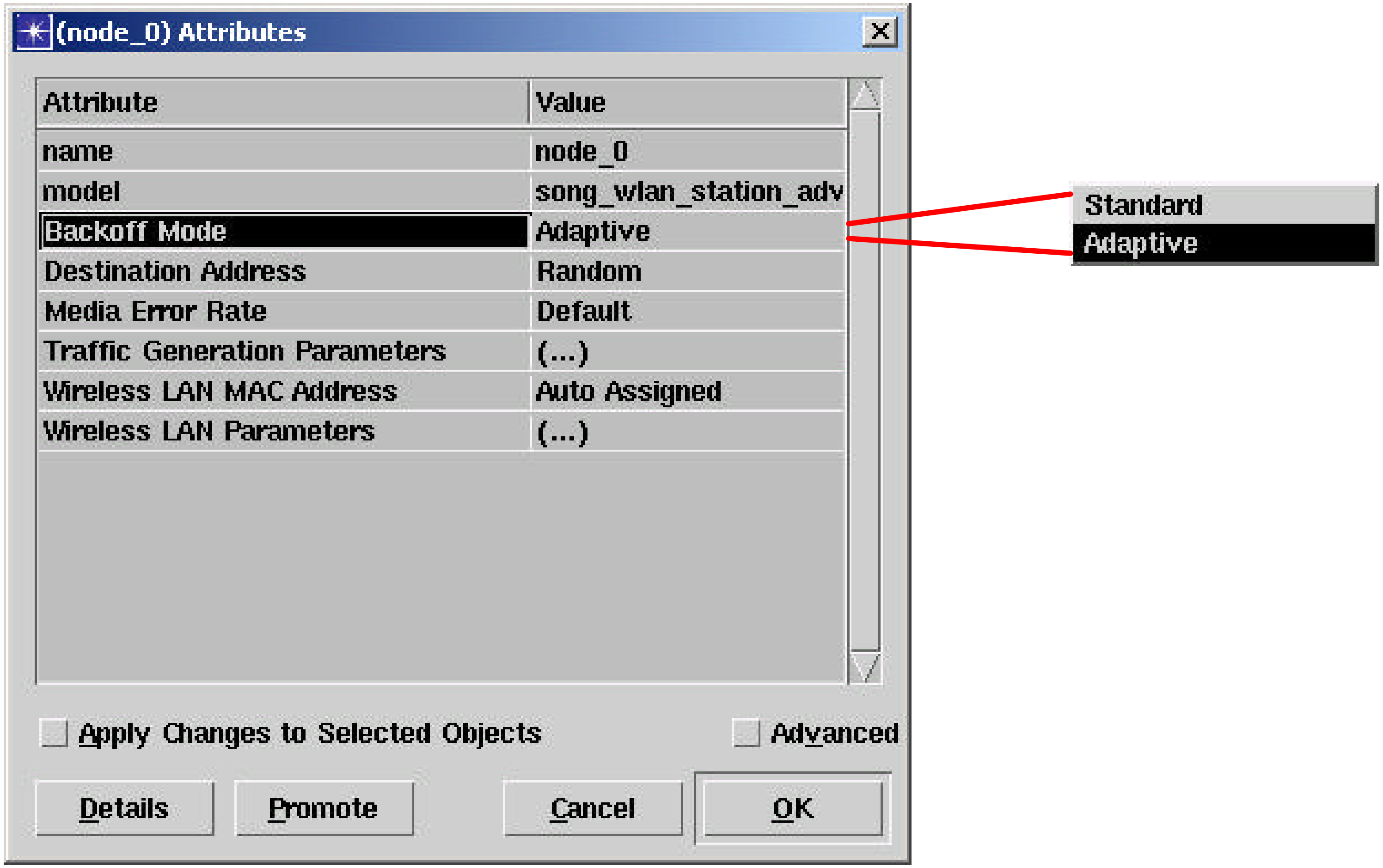
Part 3: Adaptive Backoff



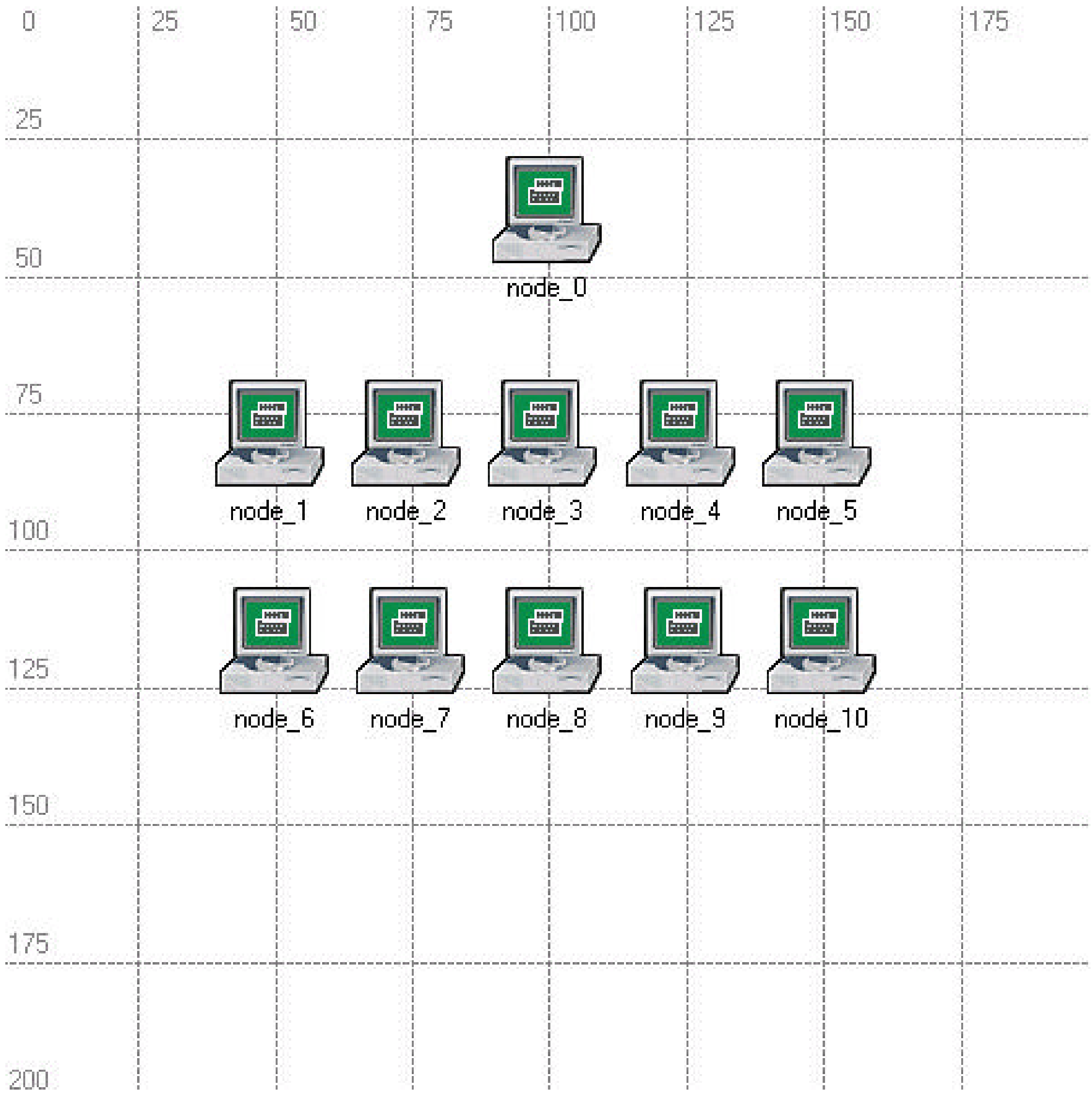
Part 3: Adaptive Backoff
– Modified Model



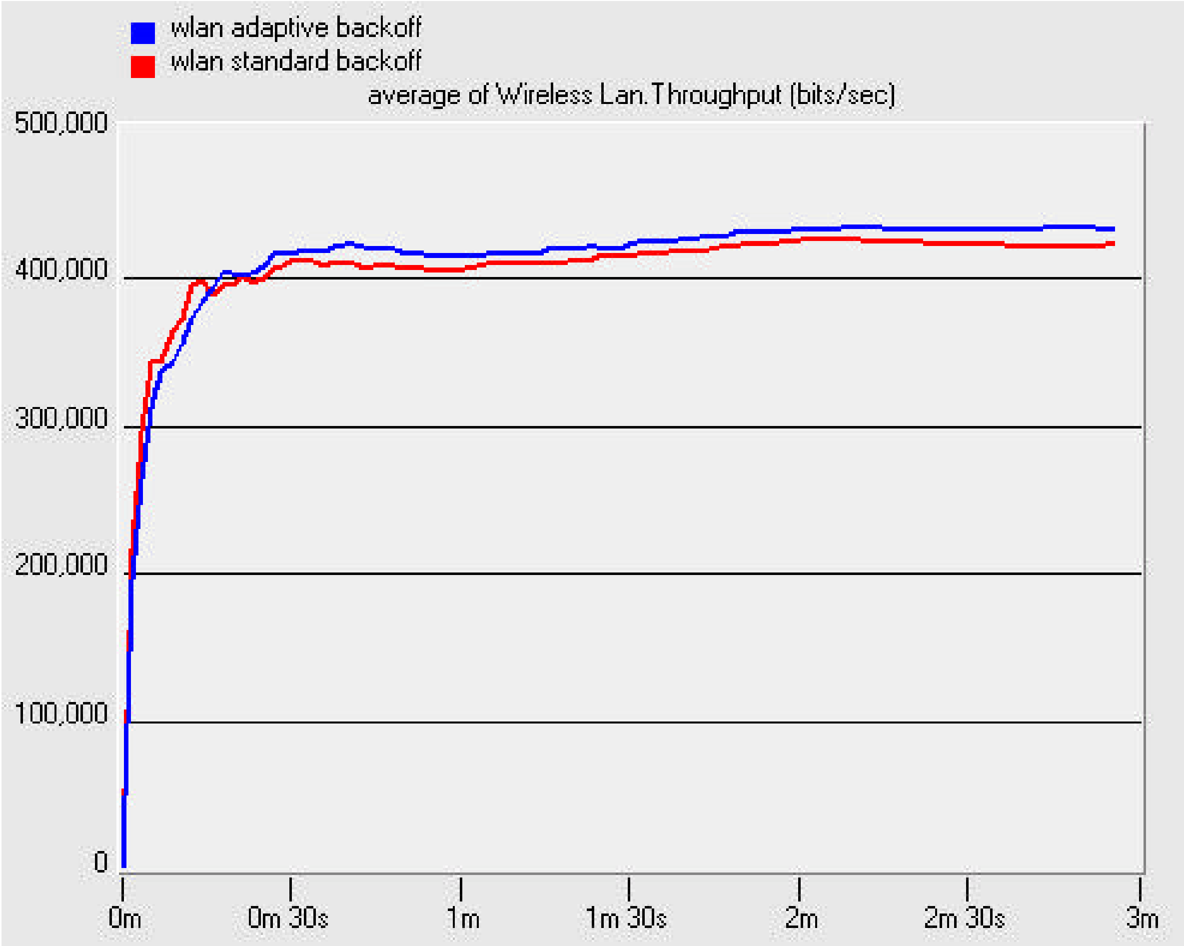
Part 3: Adaptive Backoff
- Settings



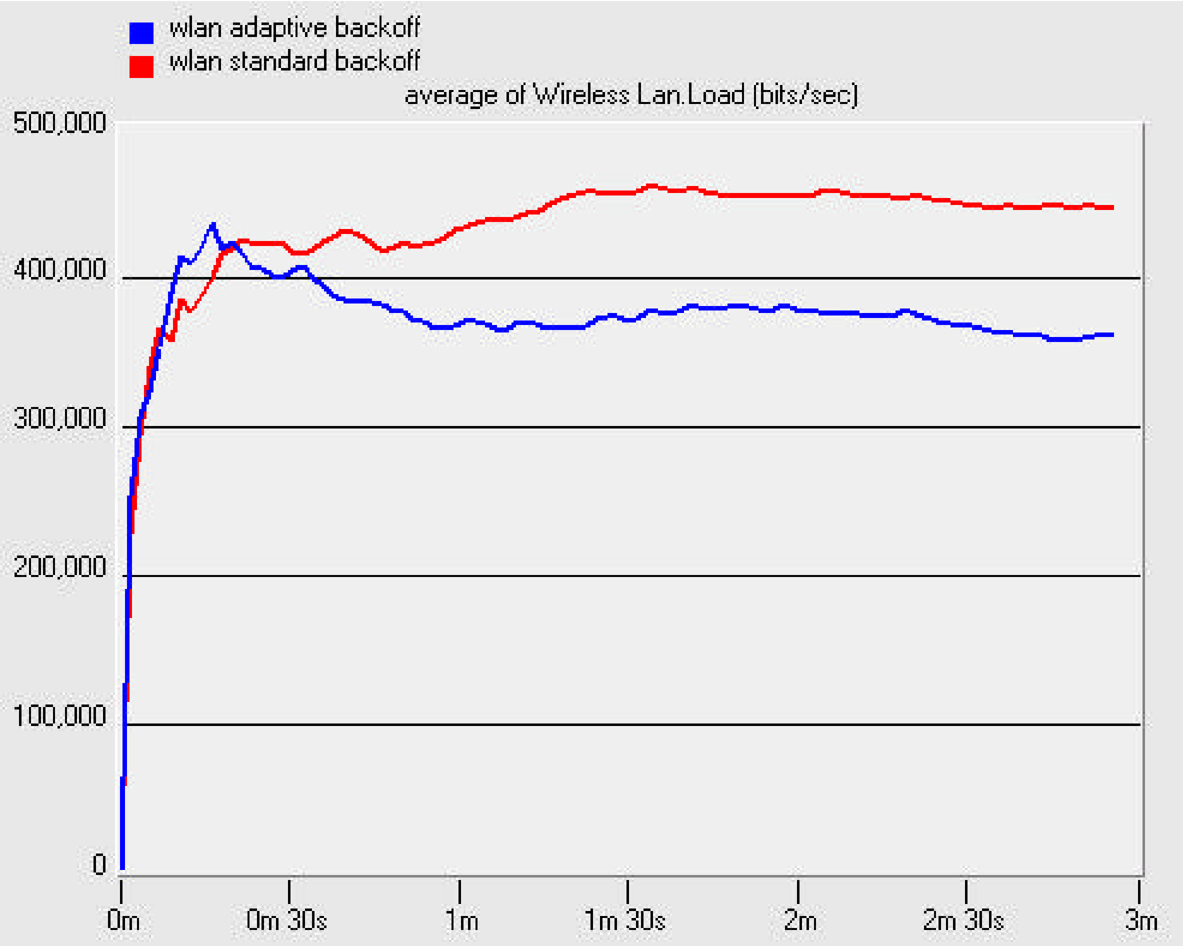
Part 3: Adaptive Backoff
- Scenario with 11 Stations



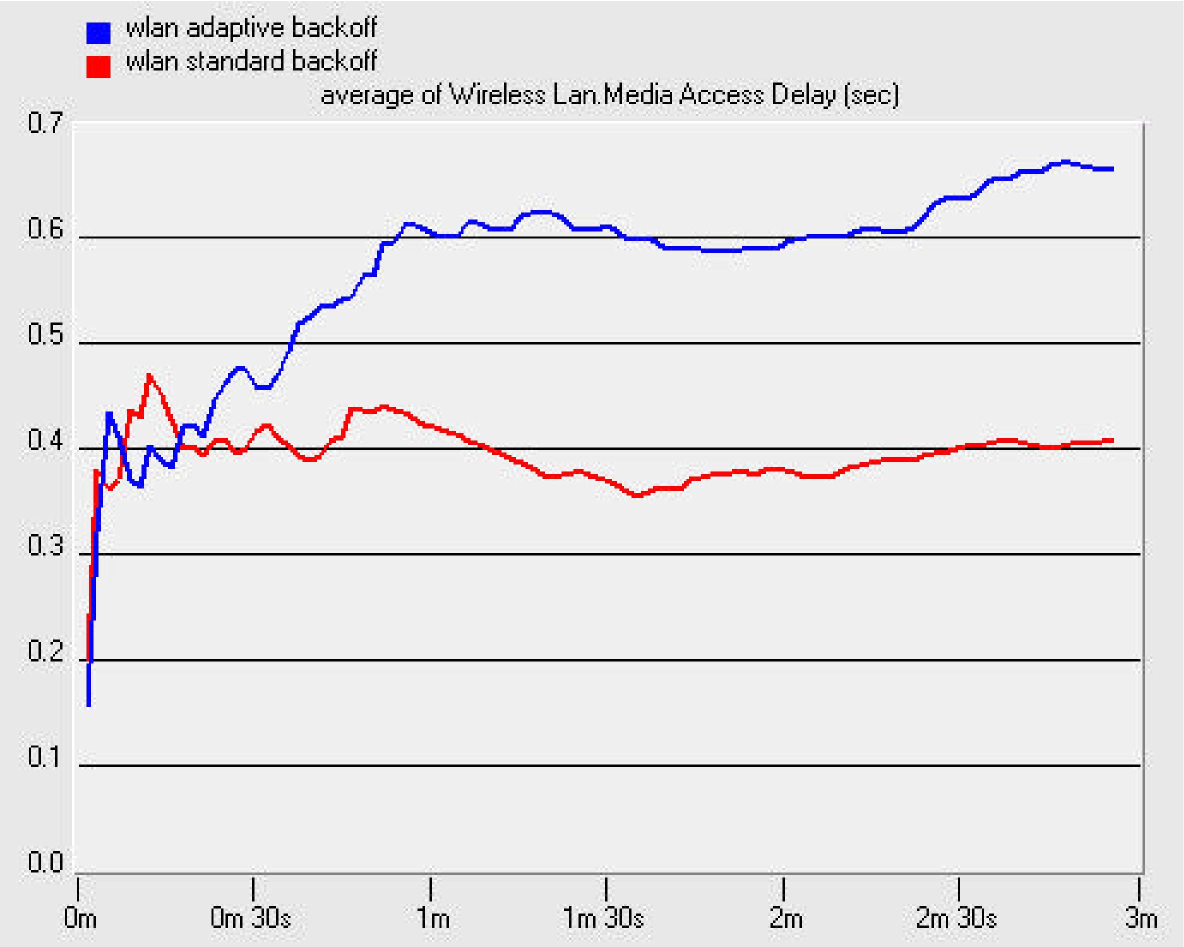
Part 3: Adaptive Backoff
– Results of 11 Stations (1)



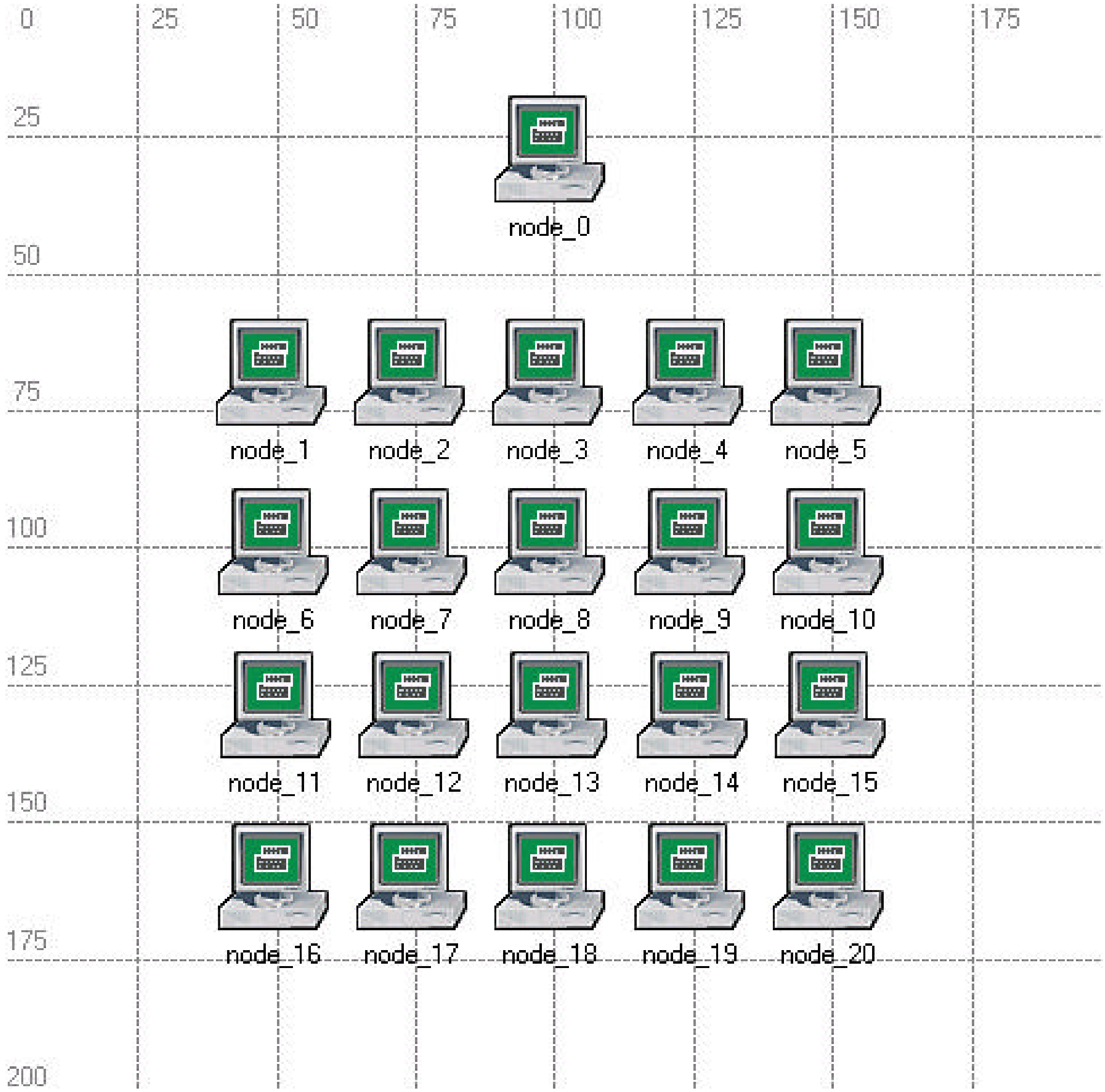
Part 3: Adaptive Backoff
– Results of 11 Stations (2)



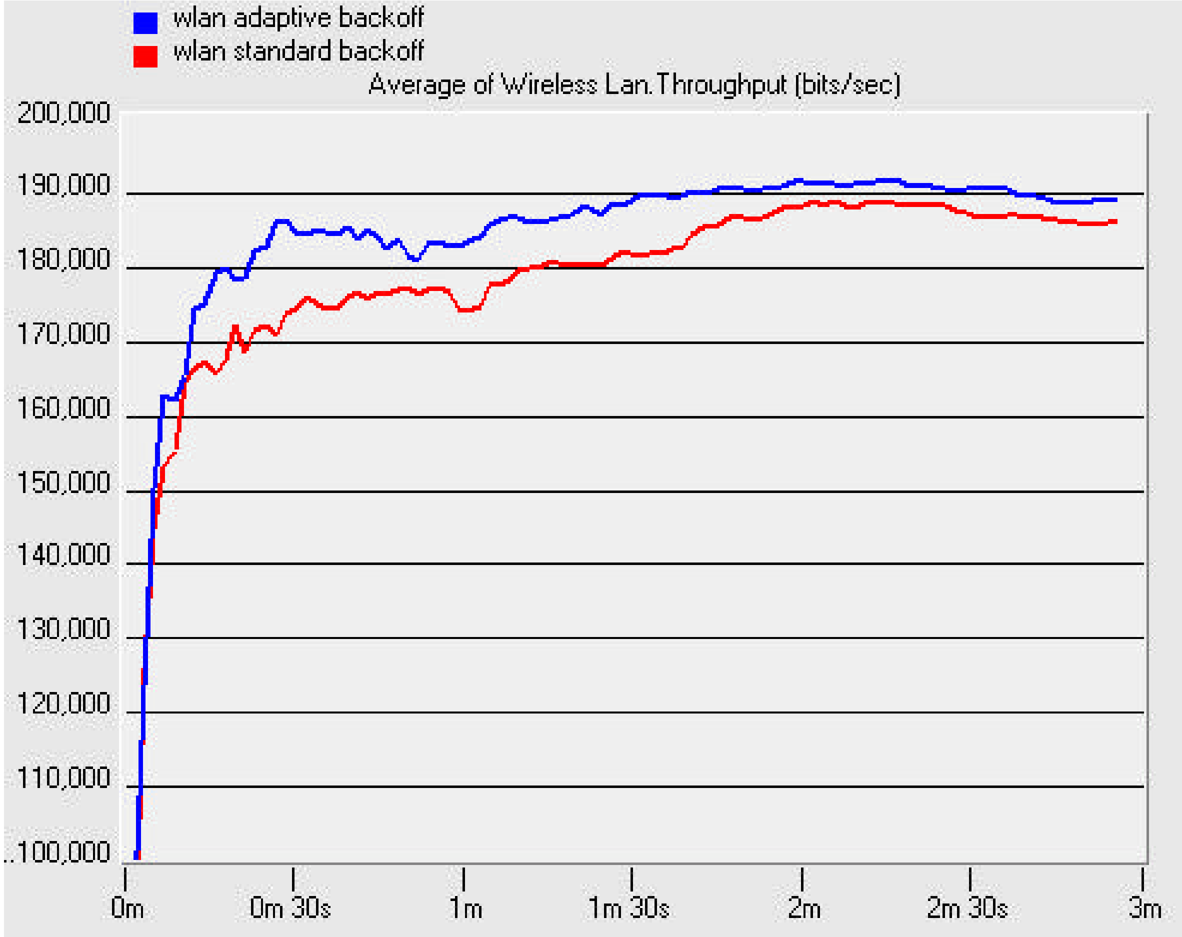
Part 3: Adaptive Backoff
– Results of 11 Stations (3)



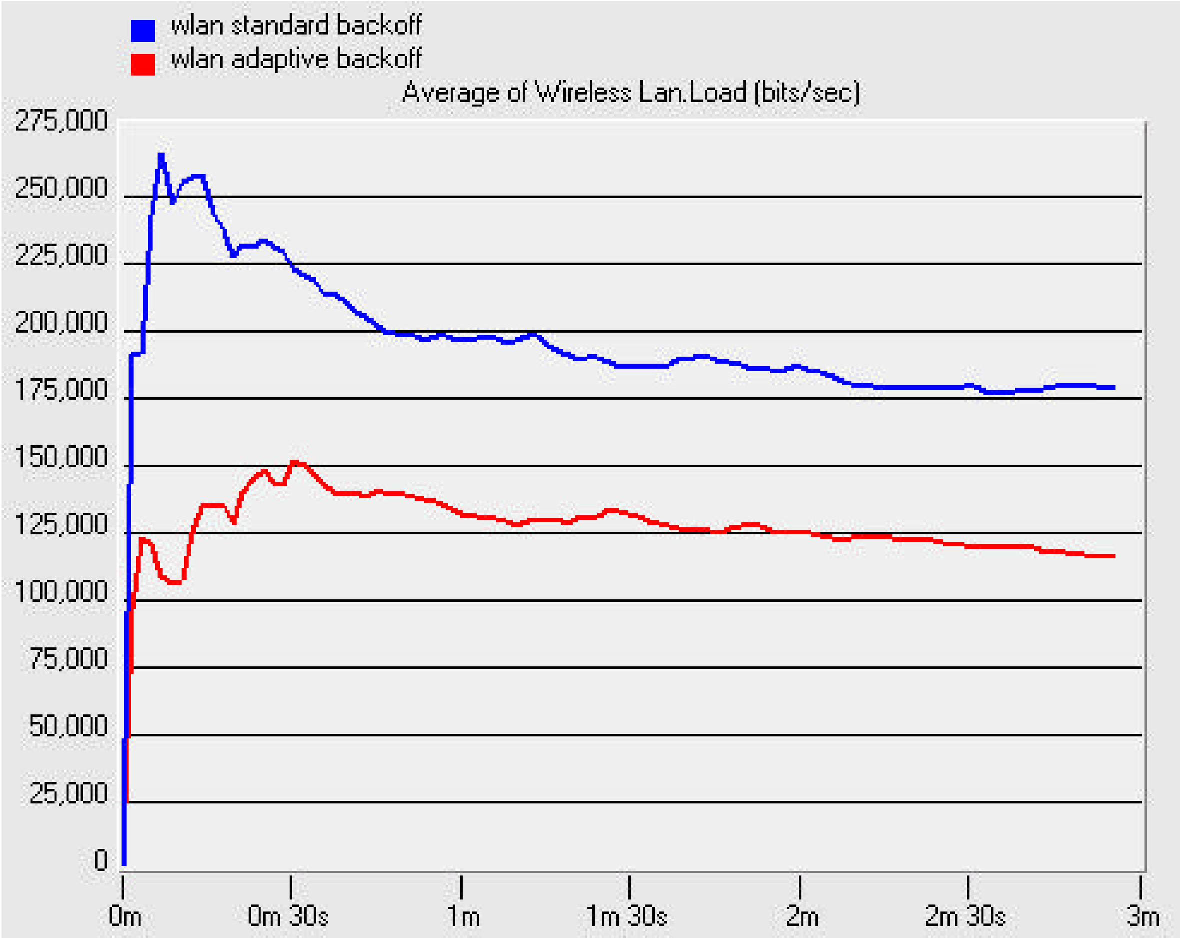
Part 3: Adaptive Backoff
- Scenario with 21 Stations



Part 3: Adaptive Backoff
- Results of 21 Stations (1)

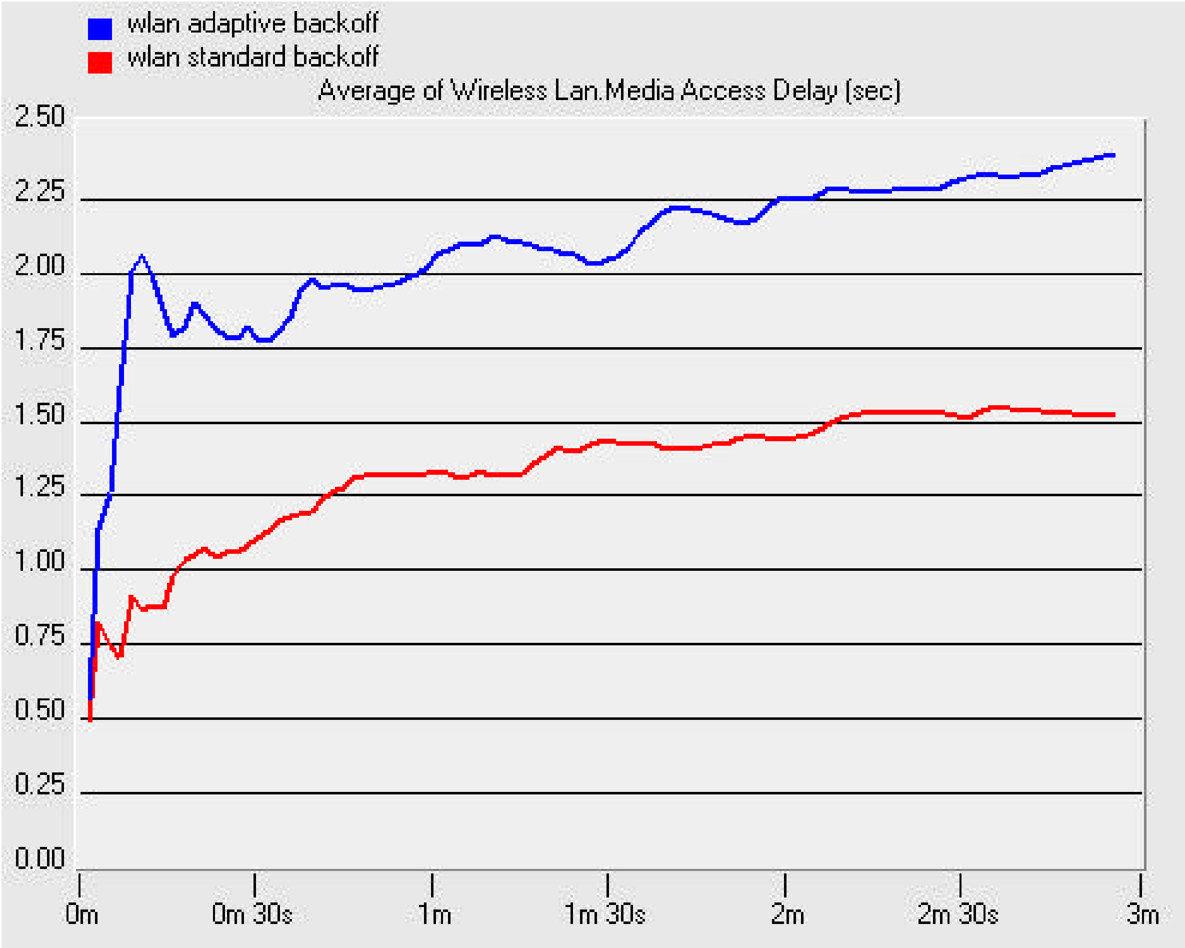


Part 3: Adaptive Backoff
- Results of 21 Stations (2)

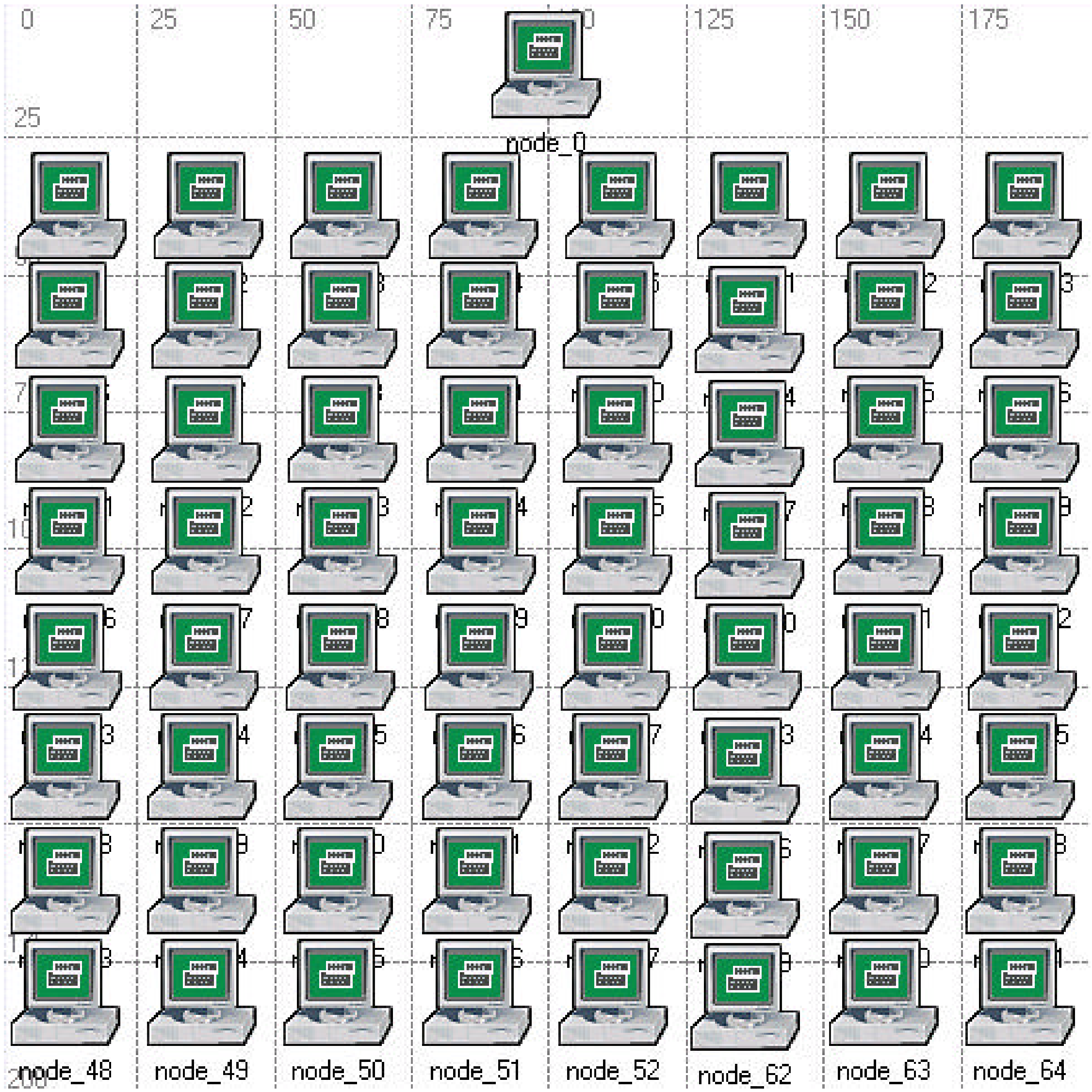


Part 3: Adaptive Backoff

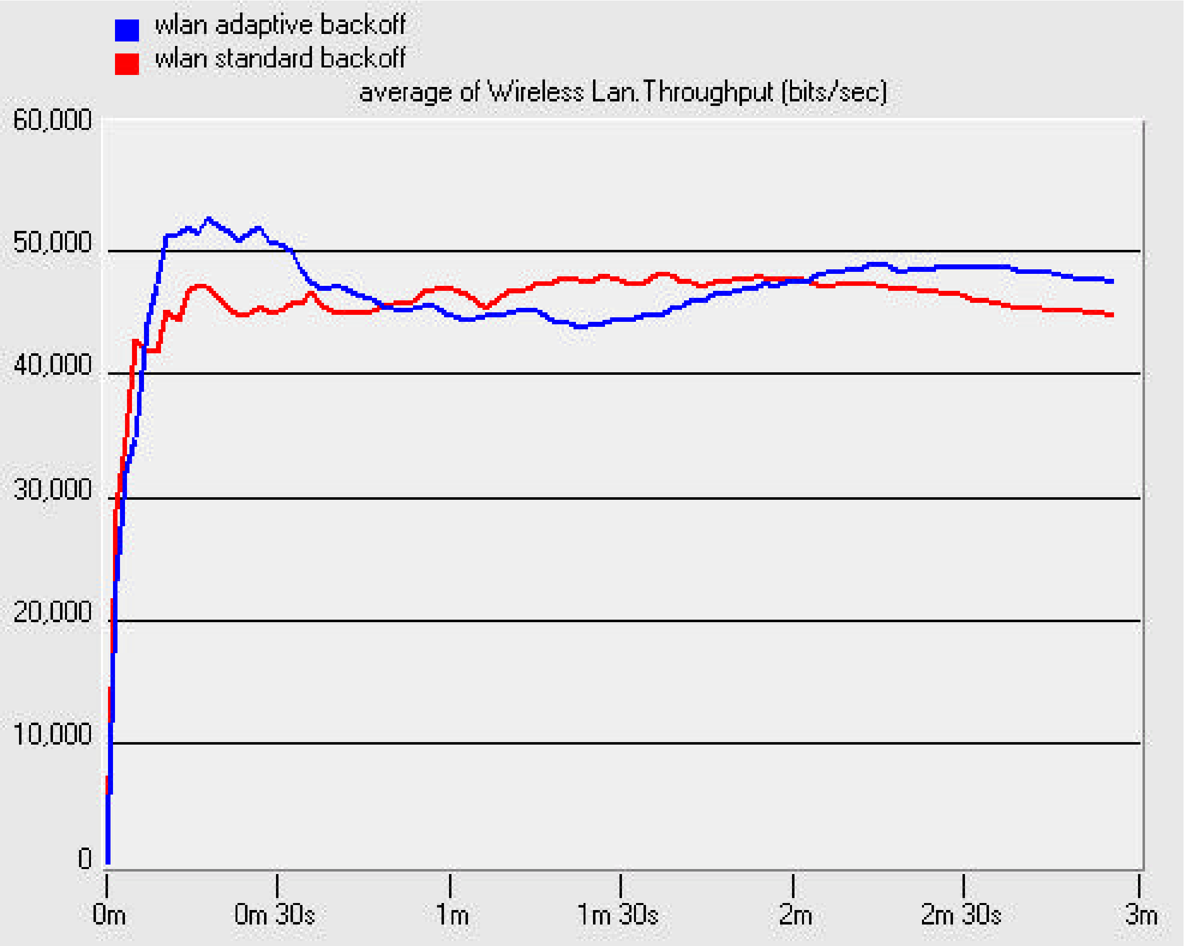
- Results of 21 Stations (3)



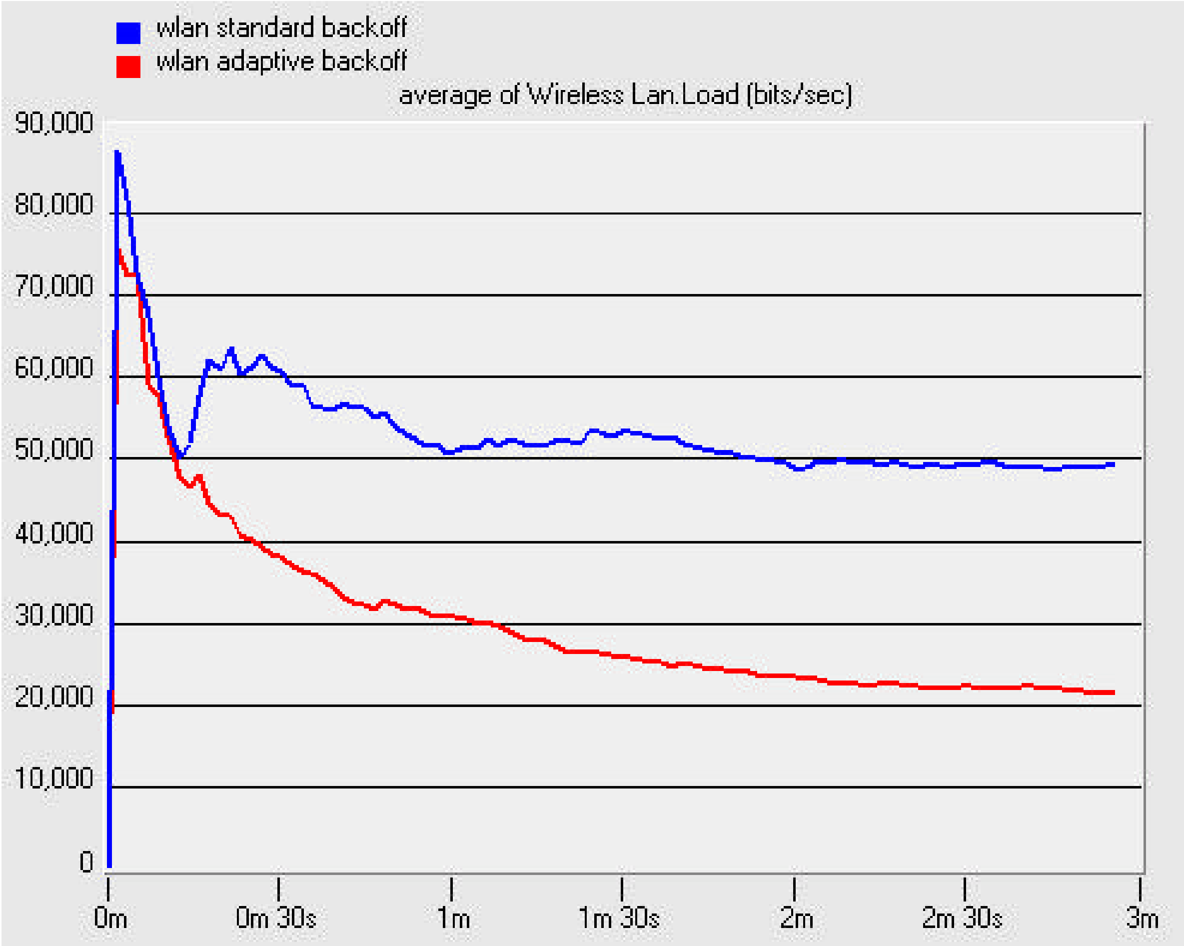
Part 3: Adaptive Backoff
- Scenario with 65 Stations



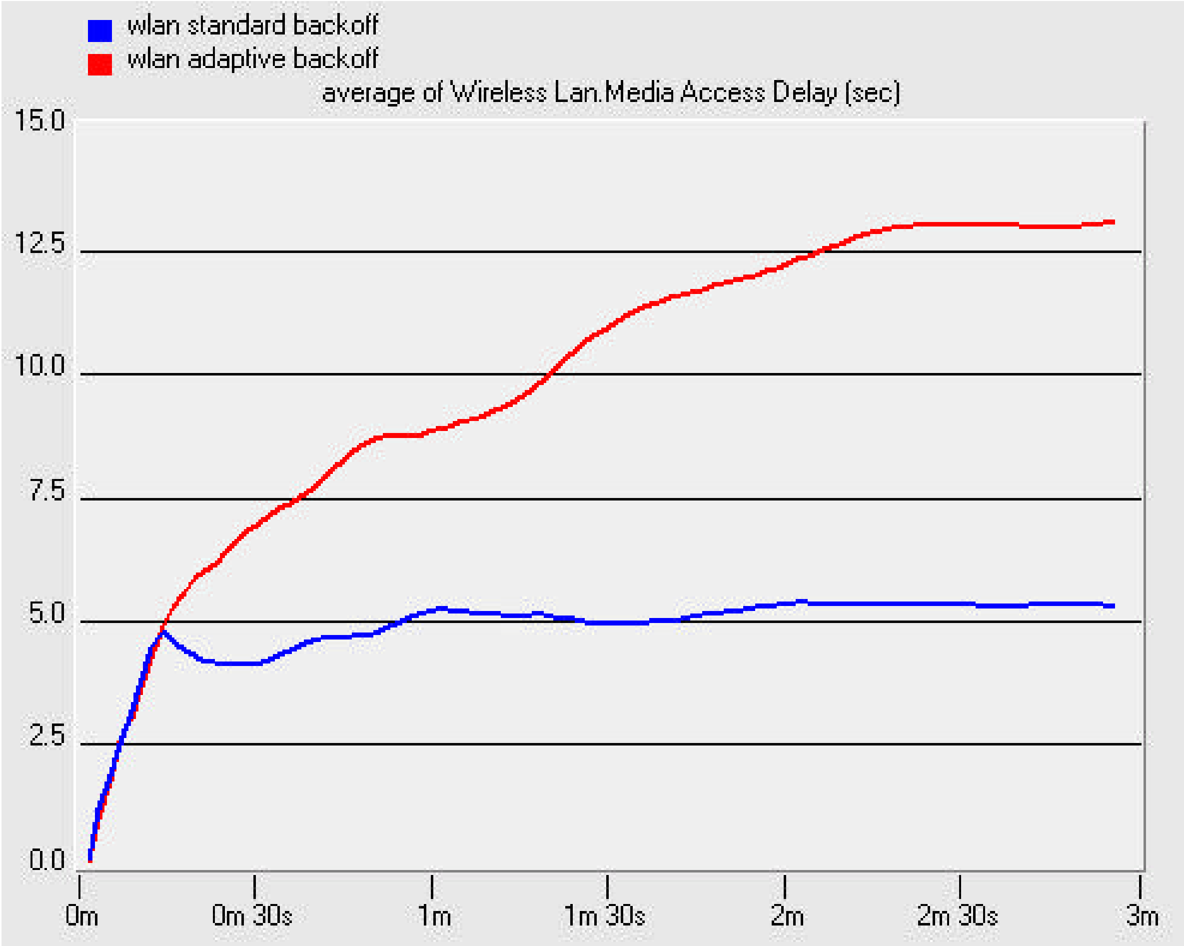
Part 3: Adaptive Backoff
– Results of 65 Stations (1)



Part 3: Adaptive Backoff
- Results of 65 Stations (2)



Part 3: Adaptive Backoff
- Results of 65 Stations (3)

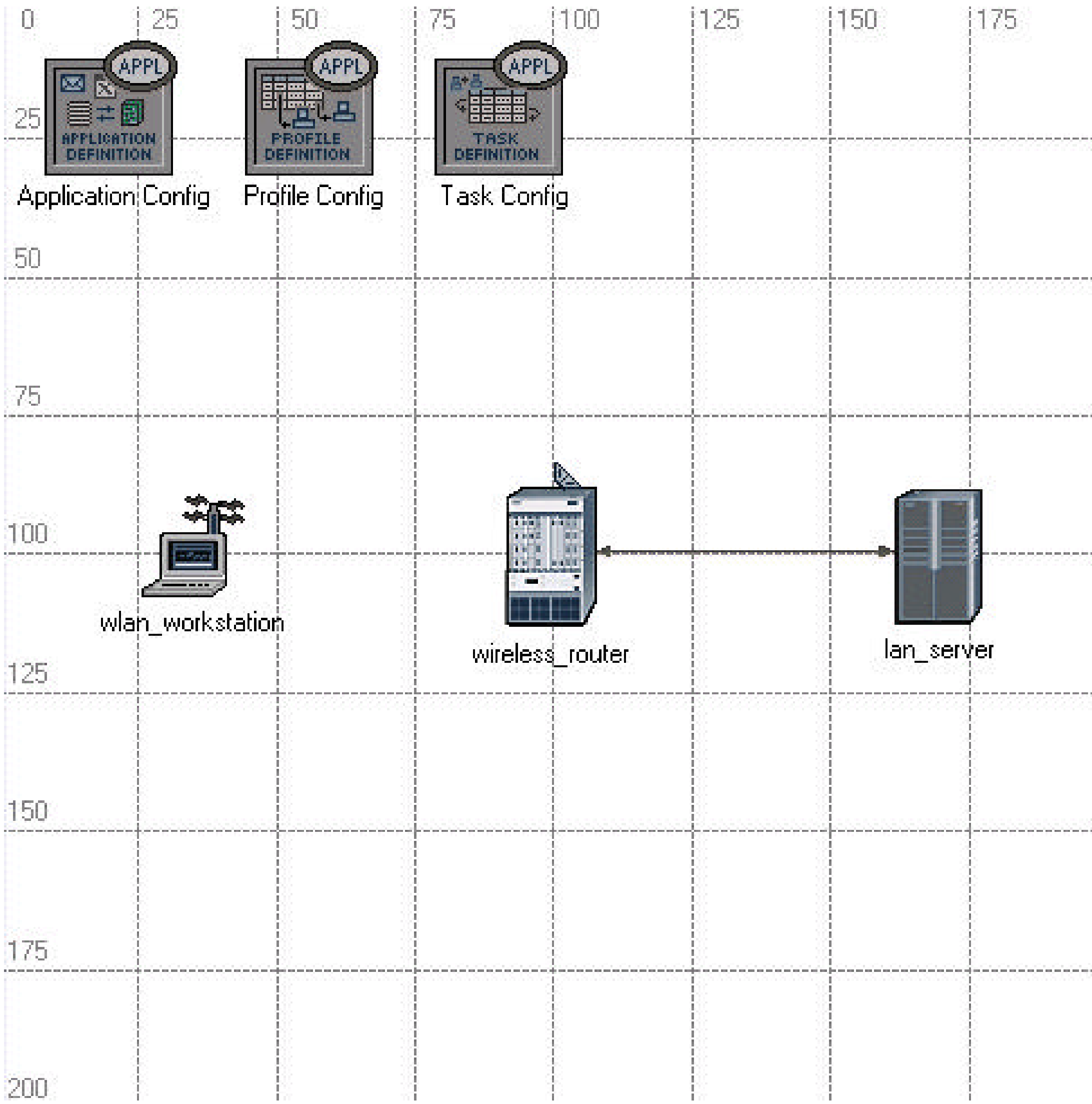


Part 4: SMART Snoop*

- TCP-aware link-layer scheme
- Makes the lossy link appear as a higher quality link with a reduced effective bandwidth
- Based on the Snoop protocol
- Use SMART strategy(Simple Method to Aid Retransmissions, it combines the best feature of Go-Back-N and Selective-Ack)
- SMART Snoop agency is in the Access Point

Part 4: SMART Snoop*

- Scenario



Part 4: SMART Snoop*

Notes:

- TCP issues are not included in IEEE802.11
- Part 1-3 already forms a completed project
- Part 4 requires too much work
- I choose to work on Part 4 because I want to take this valuable opportunity to learn something more about the networks

- Part 4 is still in progress …

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Thanks!

(April 9, 2002)