

CS 525M – Mobile and Ubiquitous Computing Seminar

Course Project Progress Report
An Extension of Rate-Adaptive MAC Protocol
For NS2 Simulator

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April 27, 2004

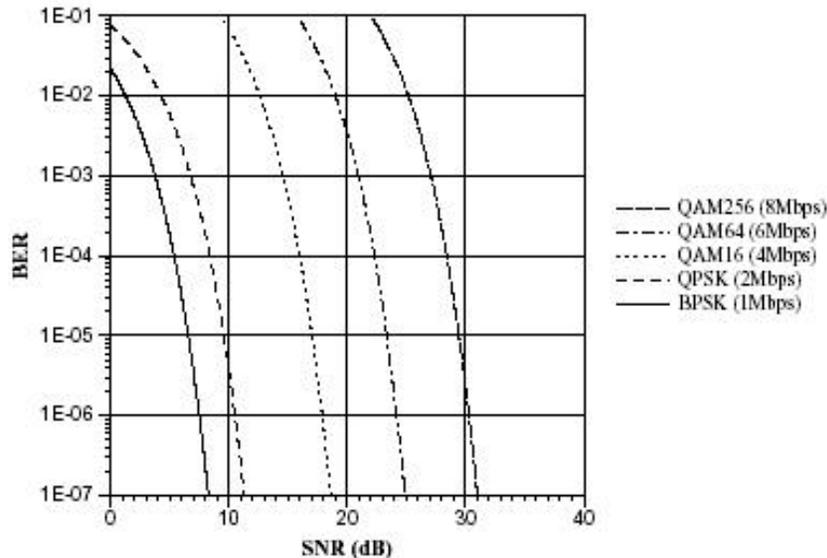
Outline

- Introduction
- Receiver Based Auto Rate
- Implementation in NS-2
- Validation and Simulation
- Summary

Introduction

- Project Introduction
 - Implement Rate-Adaptive MAC Protocol using Receiver Based Auto Rate (RBAR) algorithm in latest NS2 simulator (version 2.27).
 - Apply latest physical parameters to NS2 simulator
 - Validation the simulator by reproduce the previous simulation results
- Motivation
 - IEEE 802.11 standard supports multi-rate adaptation
 - Latest hardware supports multi-rate adaptation
 - NS2 doesn't have a build rate adaptation algorithm
 - Latest NS2 version have more features over the earlier version
 - Future research requests multi-rate MAC layer protocol, such as performance analysis, routing protocols, and etc.

Receiver Based Auto Rate



$$M_1 \quad \text{if } SNR < q_1$$
$$M_i \quad \text{if } q_i \leq SNR < q_{i+1}, i = 1, \dots, N-1$$
$$M_N \quad \text{otherwise}$$

M_i : is the modulation scheme
 q_i : is SNR threshold at which $BER(M_i) = 1E-5$

• Modulation and dataRate_

- High data rate modulation leads to higher throughput
- Also leads to higher BER when SNR is low

• RBAR

- Receiver choose the right dataRate_ based on the SNR of receiving RTS packet.
- Receiver send the dataRate_ to the sender in CTS packet.
- Sender send the DATA packet using the right dataRate_

Implementation in NS-2

- What's new in NS-2.27 related to multirate adaptation
 - PLCP (Physical Layer Convergence Protocol) transmit at a fixed rate. – PLCPDataRate_ (1Mbps)
 - Basic data for transmitting control pkts (CTS, RTS and ACK) – basicRate_ (1Mbps)
 - Can choose different data rate for transmitting DATA – dataRate_ (1-11Mbps)
- Instead of using SNR, use the receiving power – Pr
- Files modified or created:

– ./tcl/lib/ns-default.tcl	./tcl/lib/ns-packet.tcl
– ./common/packet-stamp.h	./common/packet.h
– ./mobile/prop_ricean.cc	./mobile/prop_ricean.h
– ./mac/mac-802_11.cc	./mac/mac-802_11.h
– ./mac/wireless-phy.cc	

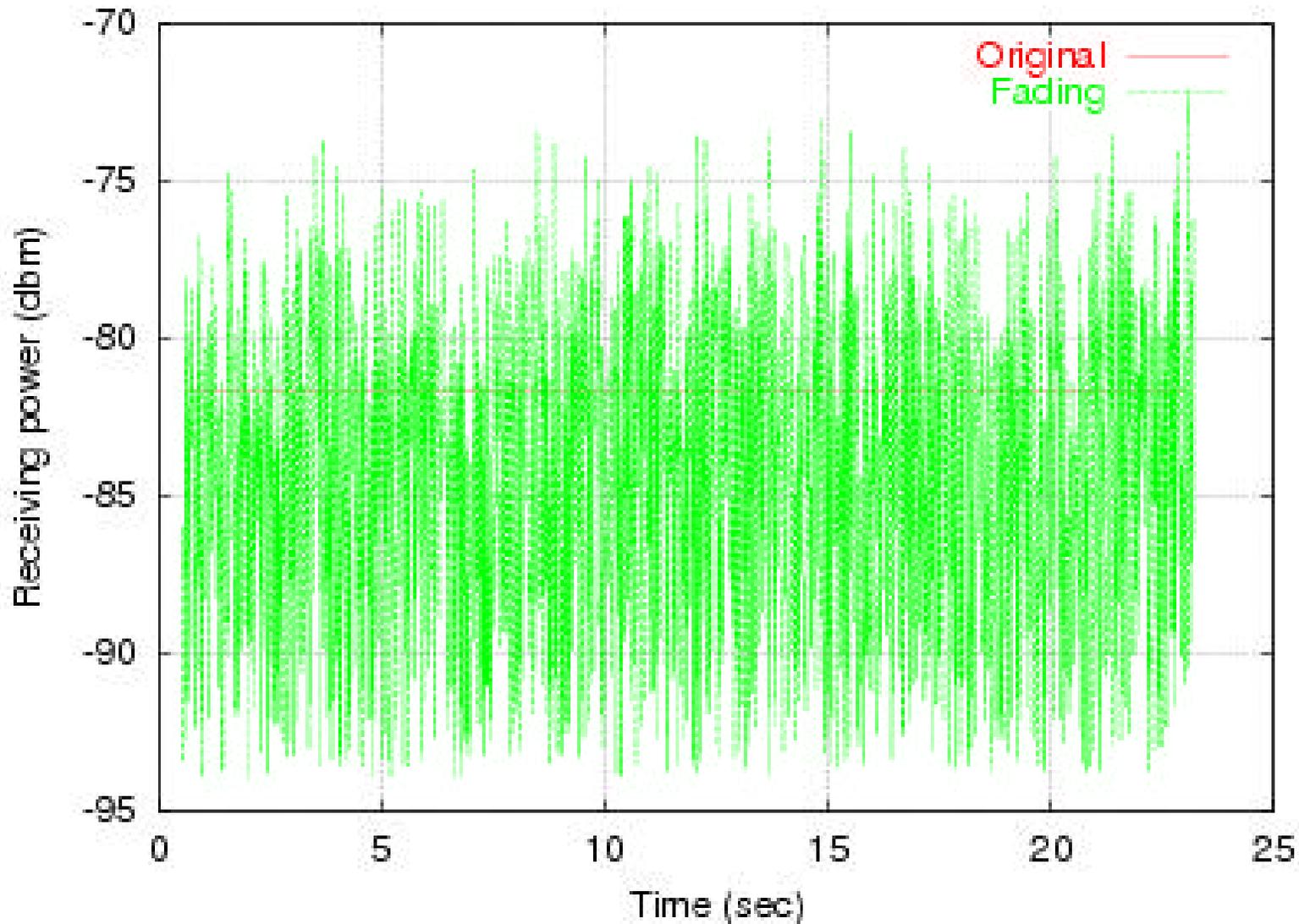
Physical Layer parameter

Parameter	Dexcription	
Frequency range	2400MHz to 2484MHz	
Transmitter Power	15 dbm \pm 2db	
11 Mbps (CCK) Sensitivity	-82 dbm	6.310e-12 mw
5.5 Mbps (CCK) Sensitivity	-87 dbm	1.995e-12 mw
2 Mbps (DQPSK) Sensitivity	-91 dbm	7.943e-13 mw
1 Mbps (DBPSK) Sensitivity	-94 dbm	3.981e-13 mw
Carrier Sense Threshold	-108 dbm	1.585e-14 mw
Capture Threshold	10	
System Loss	0 dbm	

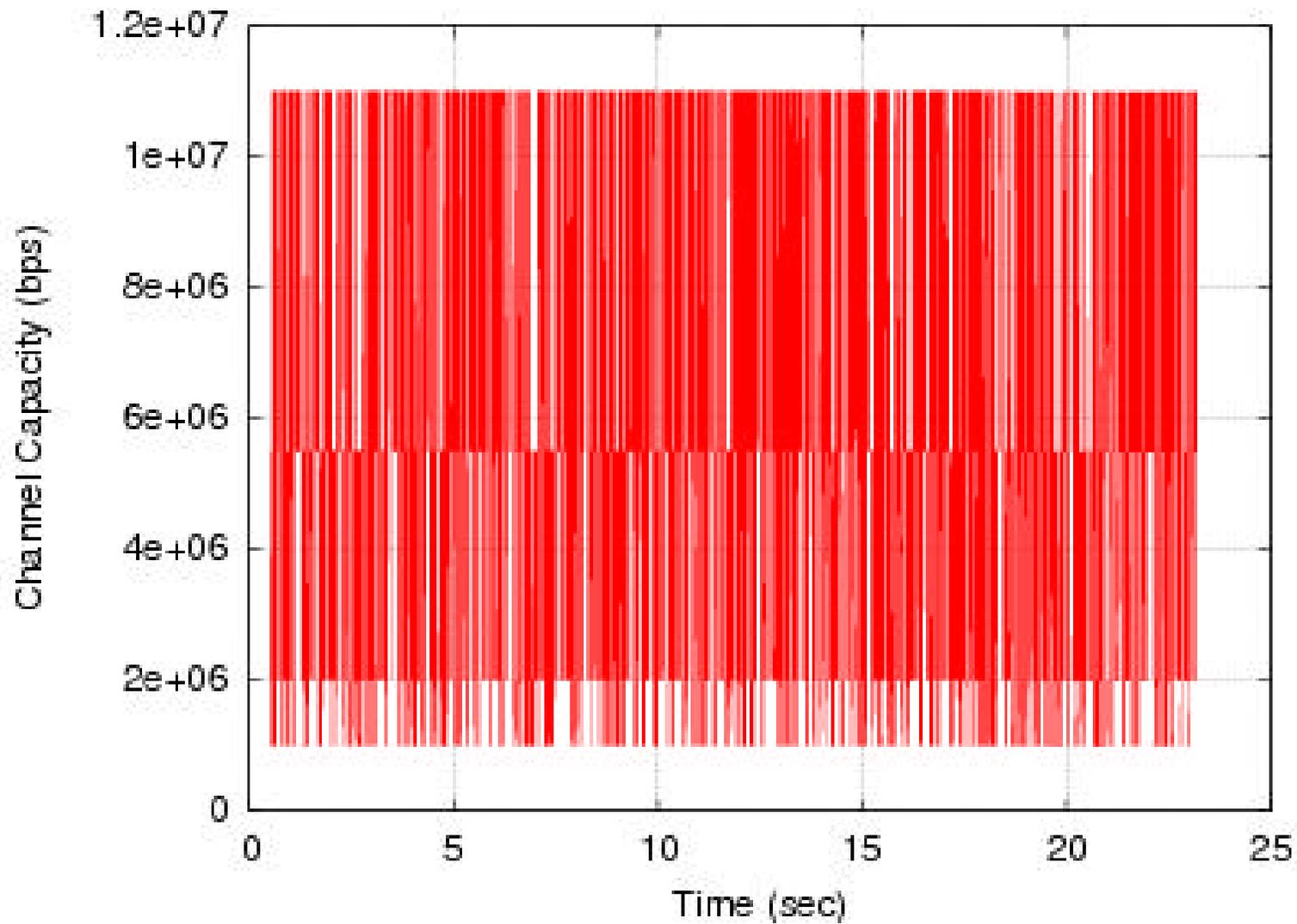
Validation and Simulation

- Fading
 - Creating fading: Ricean Fading Model
 - Distance between two nodes: 390 m
 - Simulation time: 24s
 - Compare throughput with single rate MAC layer at 1, 2, 5.5, and 11 Mbps
- Mobility
 - Node 2 move away from Node 1 at 20m/s
 - Simulation time: 50s (1000m)
 - Compare throughput with single rate MAC layer at 1, 2, 5.5, and 11 Mbps

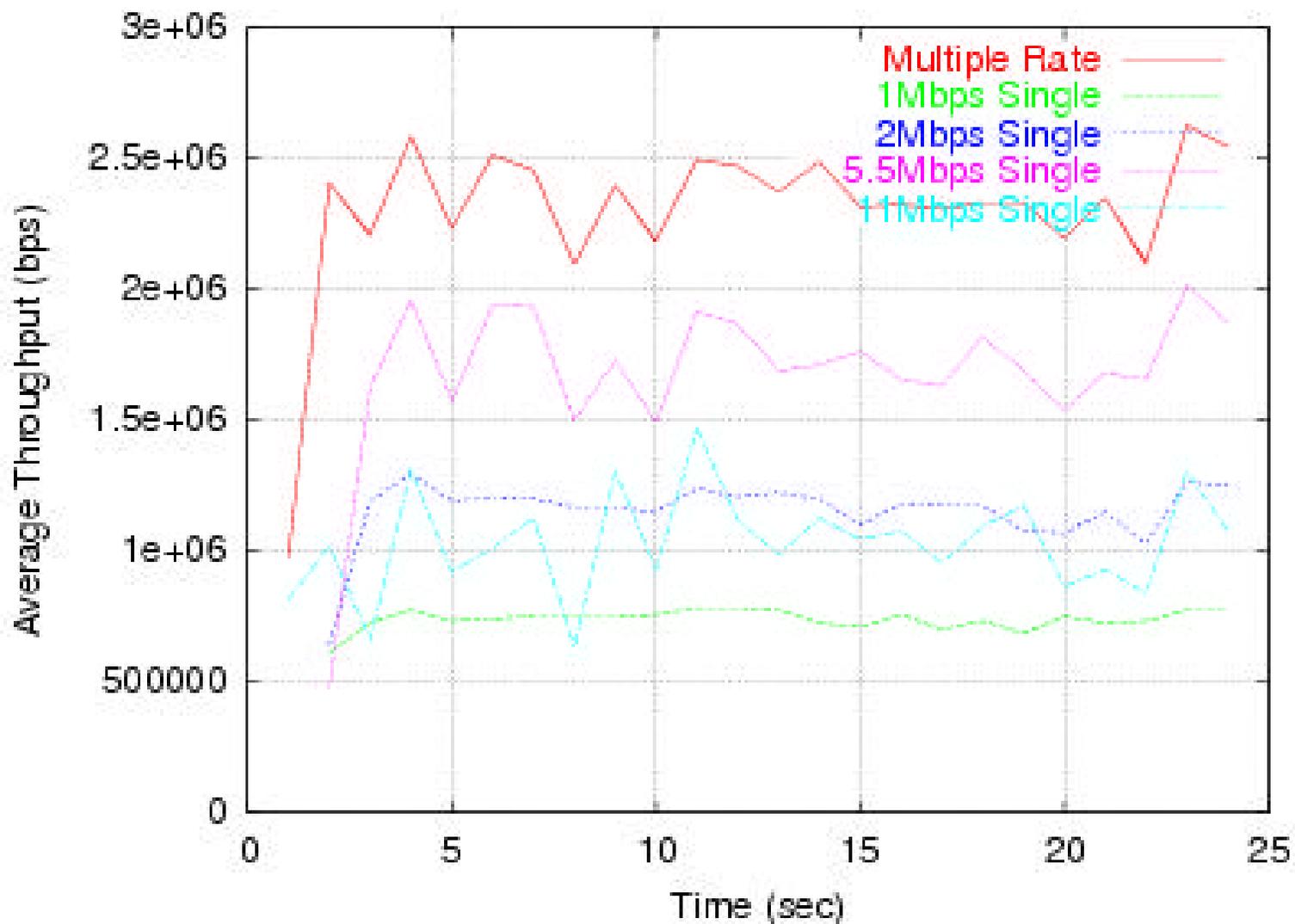
Fading – receiving power



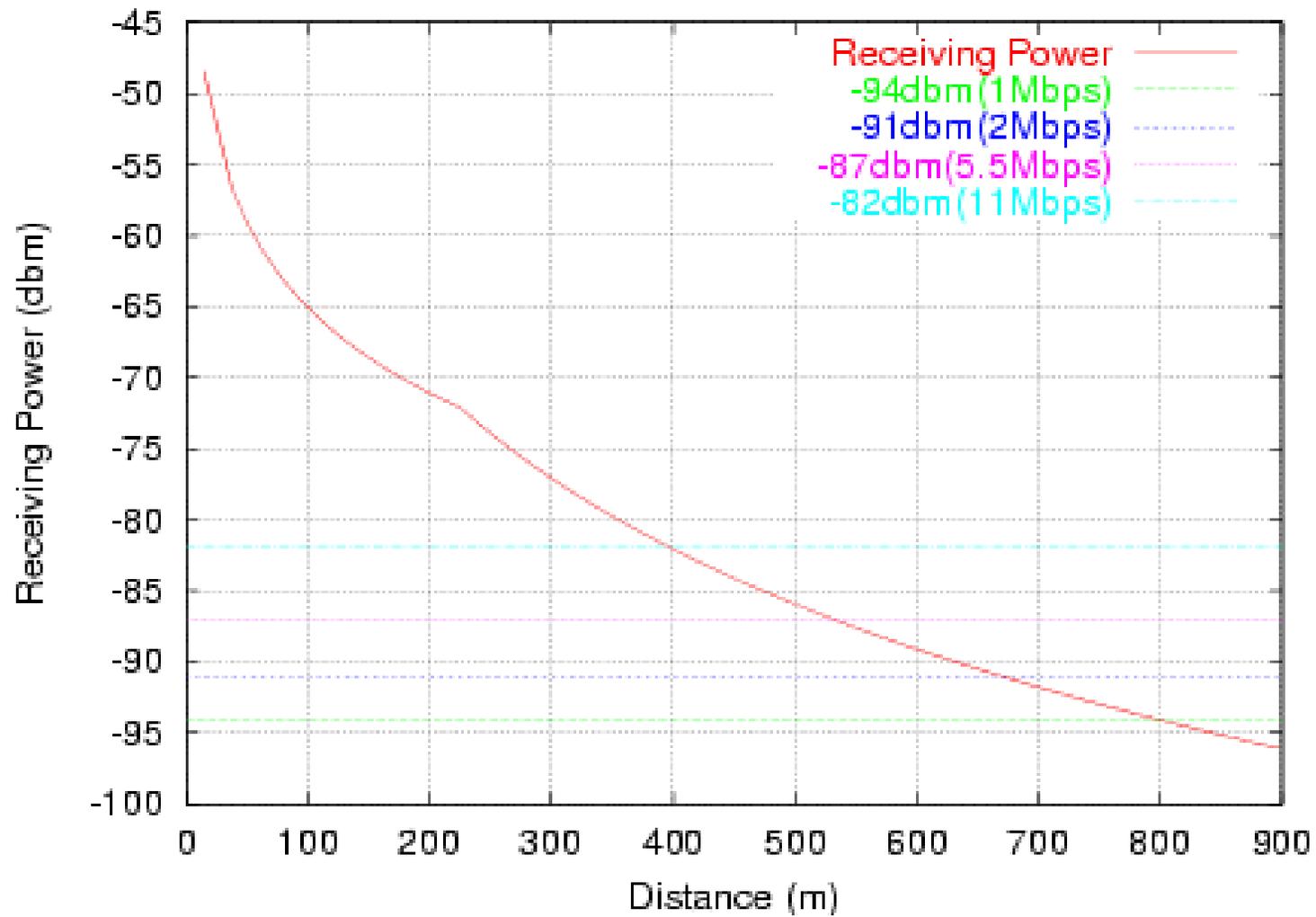
Fading – rate adaptation



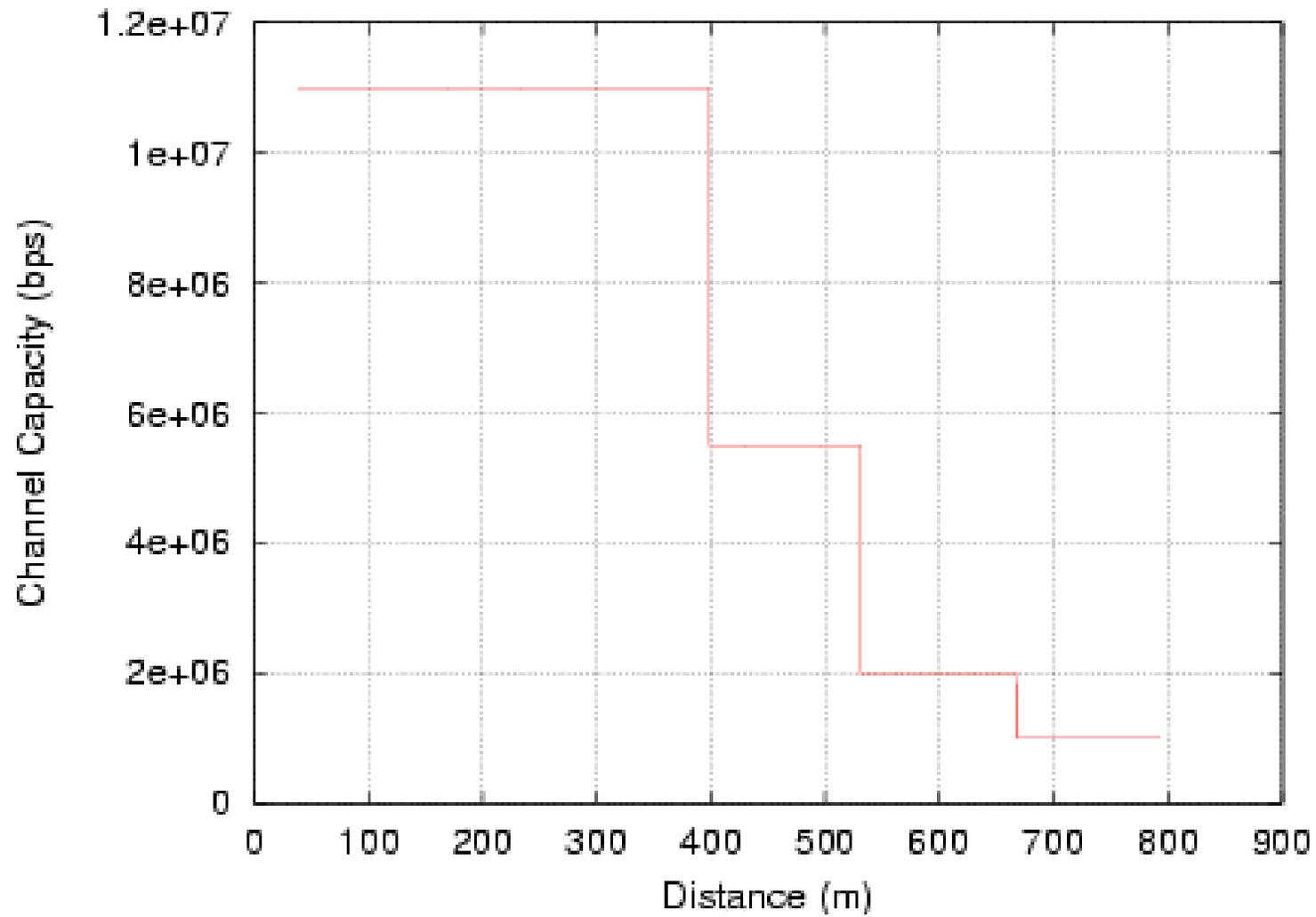
Fading – throughput



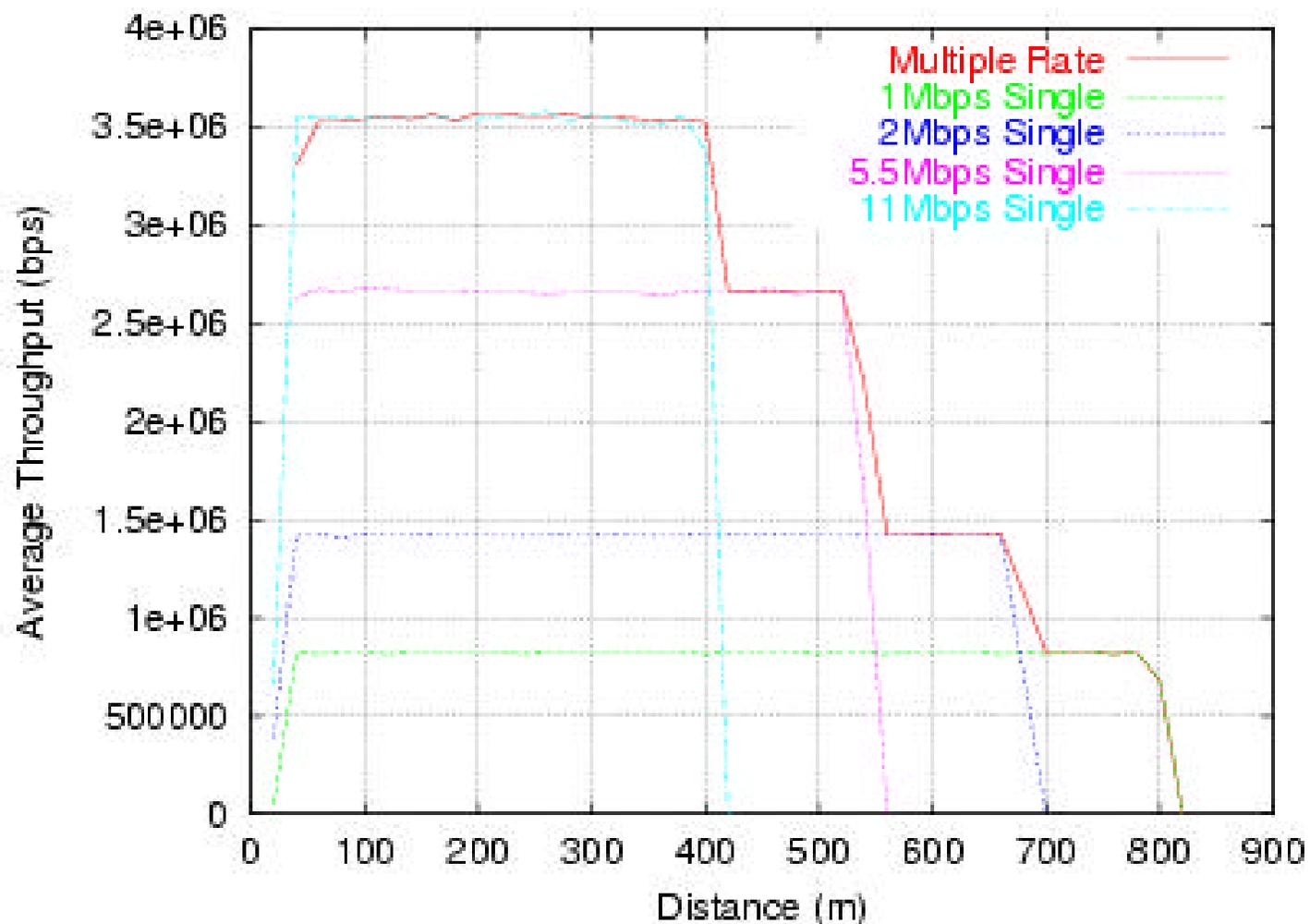
Mobility – receiving power



Mobility – rate adaptation



Mobility – throughput



Summary

- Implement Rate-Adaptive MAC Protocol using Receiver Based Auto Rate (RBAR) algorithm in latest NS2 simulator (version 2.27).
- Apply latest physical parameters to NS2 simulator
- Validation the simulator by reproduce the previous simulation results.
- Will be available online soon.

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