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Title: Performance of GRAP in Multi-Cell Wireless LANs

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Abstract

GRAP proposed as a candidate of the MAC for wireless LANs has been simulated for single and two-cell LANs with infrastructure. Different from the performance degradation of CSMA and ALOHA protocols, GRAP demonstrates better performance in multi-cell structure than that in single cell, an advantage for GRAP.

Introduction

GRAP (group randonly addressed polling) was proposed as the MAC of wireless LANs [1,2]. In [1], only RAP (randomly addressed polling) was simulated. In the following, we will show the simulated performance of GRAP in the single-cell and two-cell situations.

Simulations

(G)RAP has a feature of polling those active mobile nodes only. Under the assumption of Poisson traffic arrival for each node. There are several important parameters to summarize the results. N denotes the number of nodes in a cell; P denotes the number of random addresses that are used in (G)RAP; L is the number of stages to transmit the random address. Figure 1-4 depict GRAP's throughput and delay performance with unbacklogged nodes. Please note that GRAP only considers the active nodes rather than all nodes.

We may observe that

(1) GRAP can deliver pretty high throughput with relatively low delay.
(2) Lager P's and L's can result in better performance.
(3) As ALOHA family protocols including CSMA and its variations degrade in multi-cell structure [3], GRAP yields even better performance as GRAP is designed for multi-cell networks.
(4) Due to GRAP's inherent capability to digest congestion, GRAP has very impressed performance in heavy load.

The key component of the base station operating (G)RAP, the multiple address detector (MAD), has been designed for IR, DS-SS, and DS-FH respectively [4]. With fairly straightforward design, MAD can work well with around 20 dB dynamic range that is roughly higher than the capture range of radios, based on simulations on the SPW. The required observation time is around 70-100 symbol periods.

References:

[1] K.C. Chen, "GRAP - A Proposed Medium Access Control Protocol for Wireless LANs", *IEEE P802.11/92-131.*

[2] K.C. Chen, C.P. Tzeng, "More on the GRAP", *IEEE P802.11/93-39.*

[3] W.L. Huang, K.C. Chen, "Spatial Performance of CSMA", in preparation.

[4] K.C. Chen, C.Y. Lo, "Detection of Multiple Address in (G)RAP", in preparation.

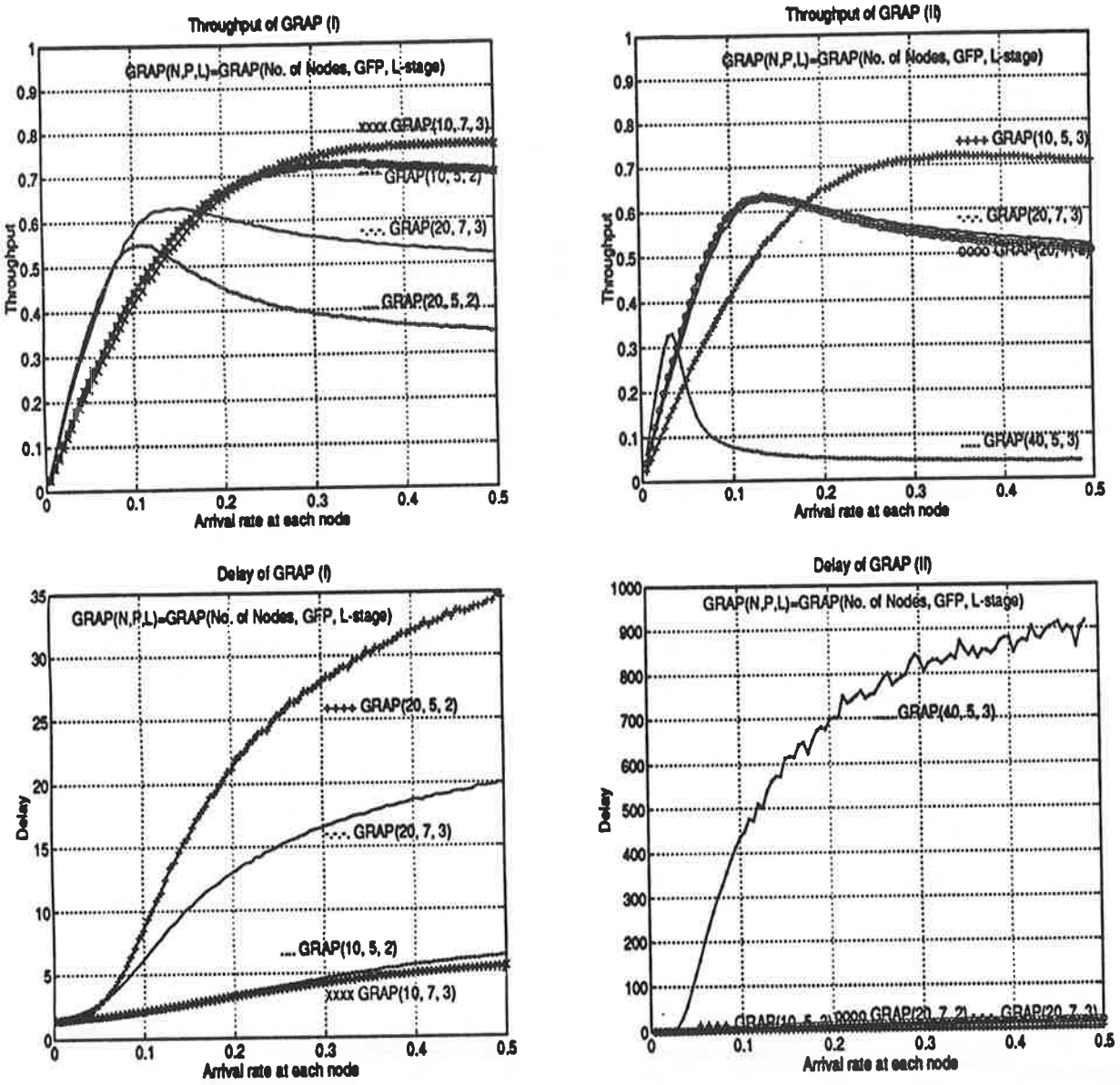

Figure 1 Performance of GRAP with P=5,7

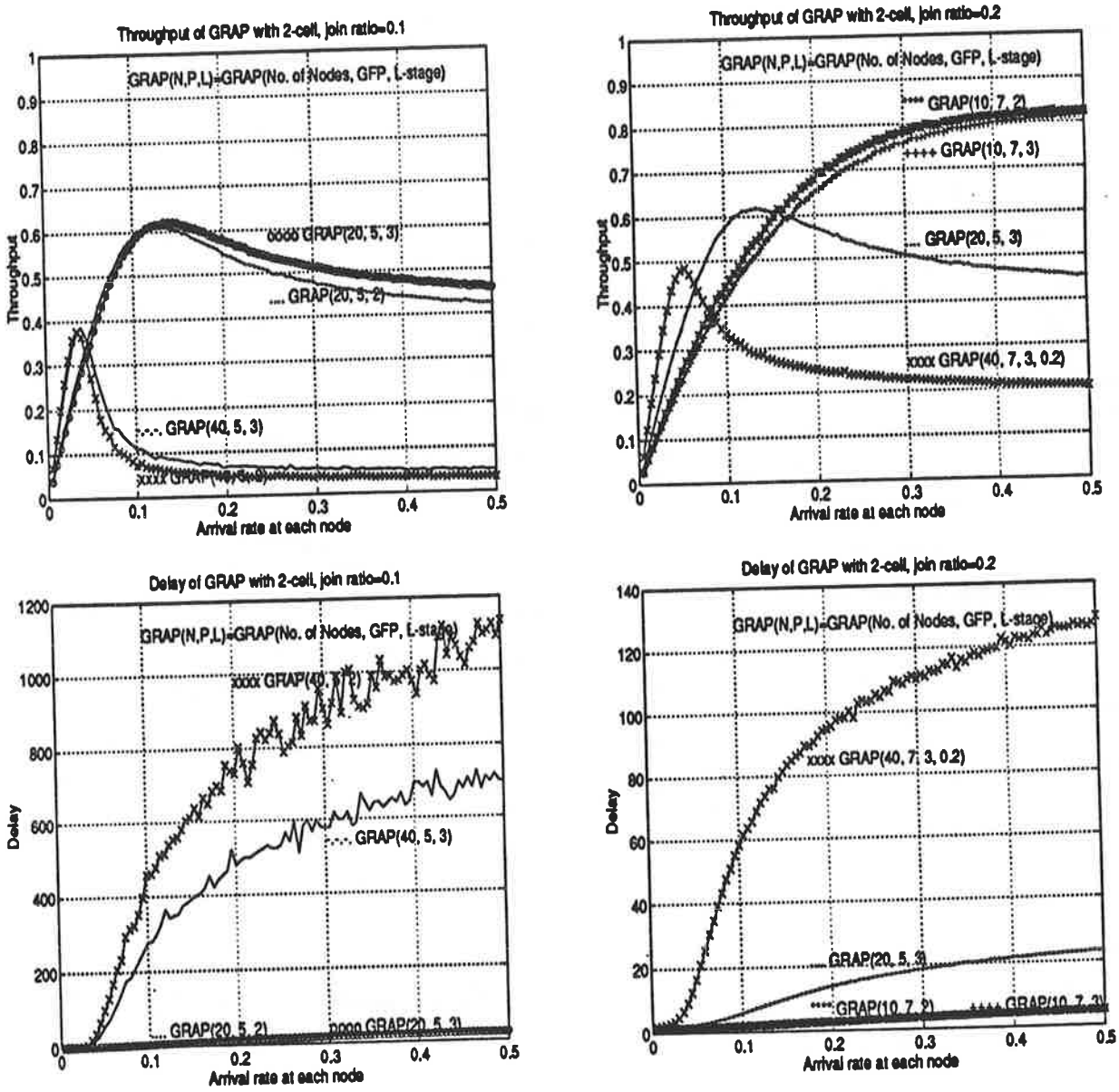

Figure 2 Performance of GRAP in 2-cell

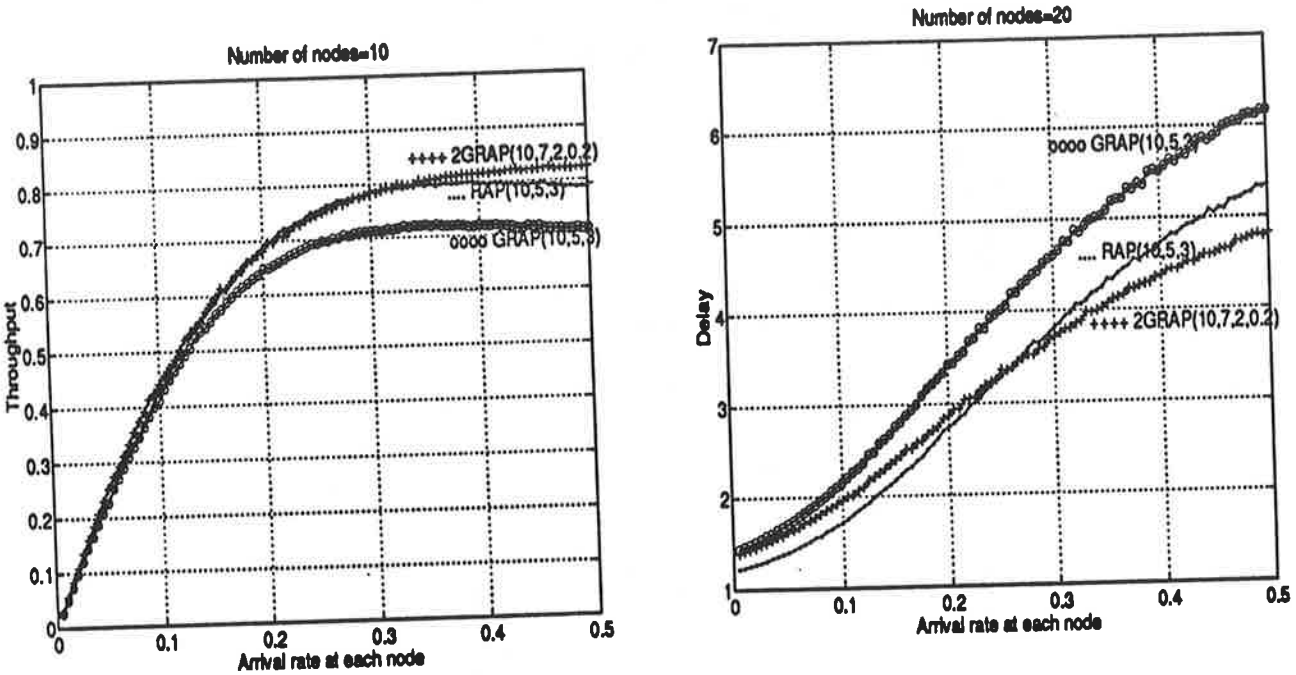

Figure 3 Comparison of RAP, GRAP in Single- and 2-Cell with 10 Nodes

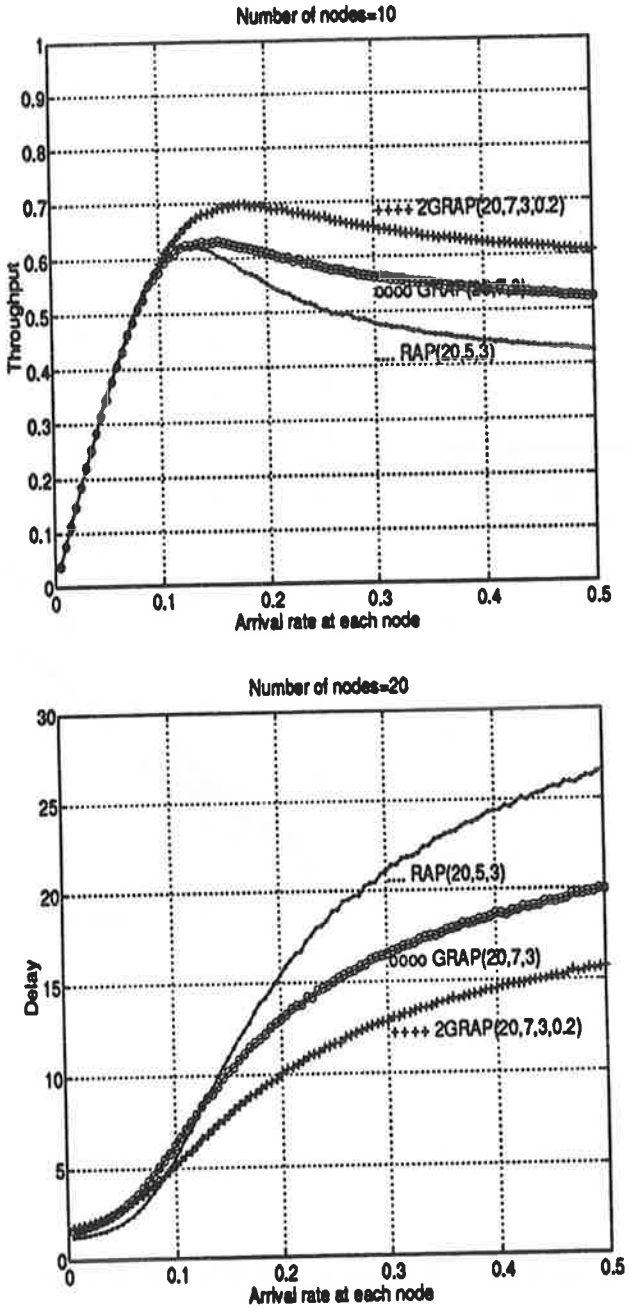

Figure 4 Performance of RAP and GRAP in Single- and 2-Cell with 20 Nodes