DQDB, mean access delay analysis

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Abstract: *DQDB is a medium access protocol for high-speed network in this work we present a comparison between an analytical model of DQDB [1] (INRIA research report No 1141) and results of simulation.*

DQDB,
ANALYSE EN MOYENNE DES DELAIS

Résumé: *DQDB est un protocole d'accès à haut débit. Dans ce papier nous présentons une comparaison entre un modèle analytique de DQDB (INRIA rapport de recherche No 1141 [1]) et des résultats de simulation.*

I. Introduction

A description of the analytical model which is the base of the comparison can be found in [1].A description of the DQDB protocol can be found in [2].

II. Hypothesis of the analytical model and simulations

A program of simulation has been written in C++ and uses Sphinx an event driven simulator. To be conformed to the IEEE proposal standard 802.6 and to the analytical model, the assumptions will be the following:

-The network has N stations.

-Traffic is Poisson with equal arrival rate at every station, this rate is for a given station $\frac{\lambda}{N}$ whatever the position,

-Access delays computed by the simulation program do not take into account the time in queuing. The access delay is the time interval which separates the instant when a packet goes in count down from the instant when this packet is transmitted,

-At each slot instructions run by a station are the following : the station senses the incoming slot of the writing channel, if this slot is empty the request counter is decremented.

-A station which has a pending packet and no packet in count down put the first packet of its queue in count down and initiates the count down counter.

-A station searches for a slot on the request channel to write a request bit. This research is non blocking for sending a packet, we mean that a packet can be sent unless the request of a previous packet has been sent. If the request bit is busy, the request counter is decremented.

-The stations executed instructions in the order described before, the count down counter is updated as the IEEE 802.6 proposal standard described it. In the simulation program distances between to consecutive stations are supposed to be the same and equal to an integer number r of slots. A slot duration corresponds to a time transmission of a packet. This value is a parameter of the simulation and can be selected to a given value.

III. Matching between the analytical model and results of simulation

The simulations consider $N = 200$ stations connected to the network and the first result take $r = 1$. The first thing to point out is the very good matching of analytical model and simulation for the average delay, this can be seen on figure 1. The following results concern the average delay of the station versus its position on the channel. Station 1 is the most downstream station on the writing channel as station 200 is the most upstream on this channel. Simulations confirm the fact that downstream stations have larger average delays than upstream stations. The matching between simulations and the analytical model is good except for the most downstream stations which entail in simulations larger delays than in the analytical model (See figure 2, 3, 4;the smooth curves correspond to the analytical model). We can also notice the matching is better at low load (See figure 5; the smooth curve is the analytical model).

We have also investigated the case where $r = 5$ and N is still equal to 200. For the mean access delay averaged on all the connected stations, the matching between simulations and the analytical model is still very good (See figure 6). Results found for $r = 5$ are almost the same as those for $r = 1$ (See figure 7; the smooth curve correspond to the analytical model). Other simulations have been run with a smaller number of stations. Figure 8 reports results of a simulation with $N = 50$.

IV. Conclusion

This comparison shows that [1] is a fairly good model which can work for various hypothesis and gives good values of the mean access delay except for the most downstream stations. It should be interesting to see whether repartition of stations along the bus has a great impact on characteristics of access delays. Results of simulations not shown in this paper seem to indicate that for regularly spaced stations r has not a great importance on mean access delays.

References

[1] Philippe Jacquet: "An Analytical Model For The High Speed Protocol QPSX," *Res. Rep.* INRIA, No 1141, December 1989.

[2] Draft Of Proposed Standard 802.6 Metropolitan Network (MAN) Distributed Queue Dual Bus Media Access Control January 1988.

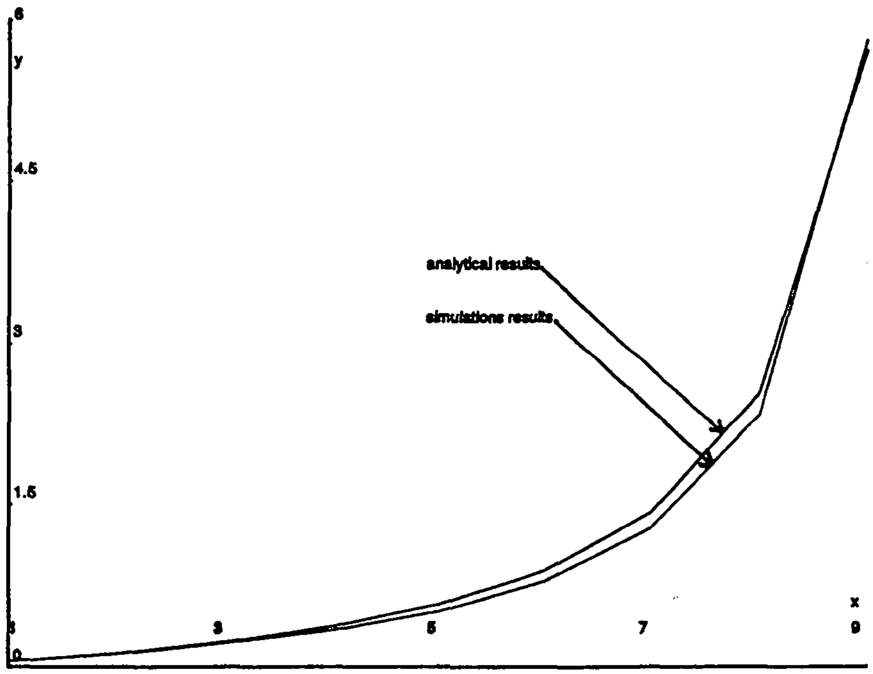

Figure 1: mean access delay *versus* input load. $r = 1$

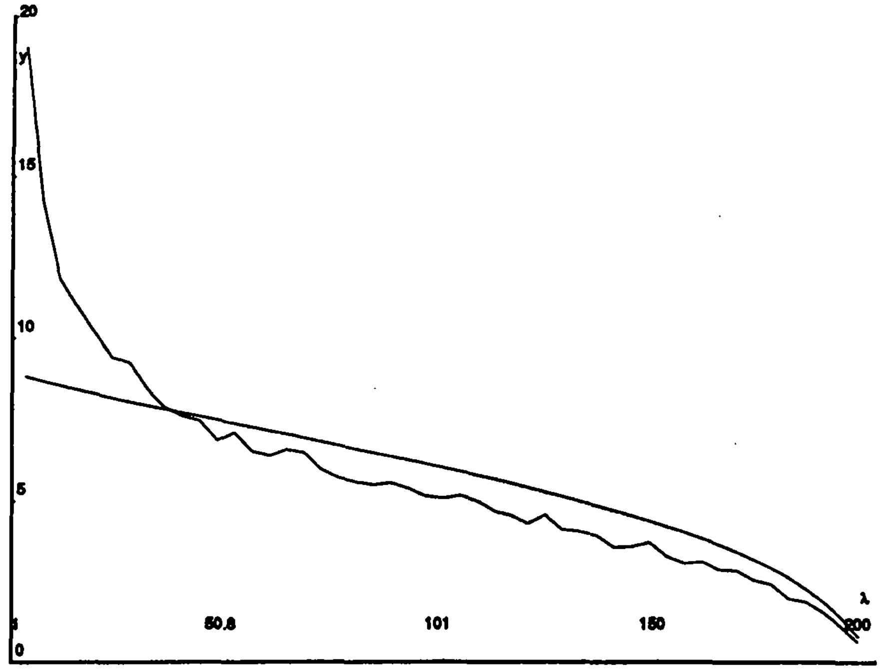

Figure 2: mean access delay *versus* position of a station. Input load $=.9, r = 1$

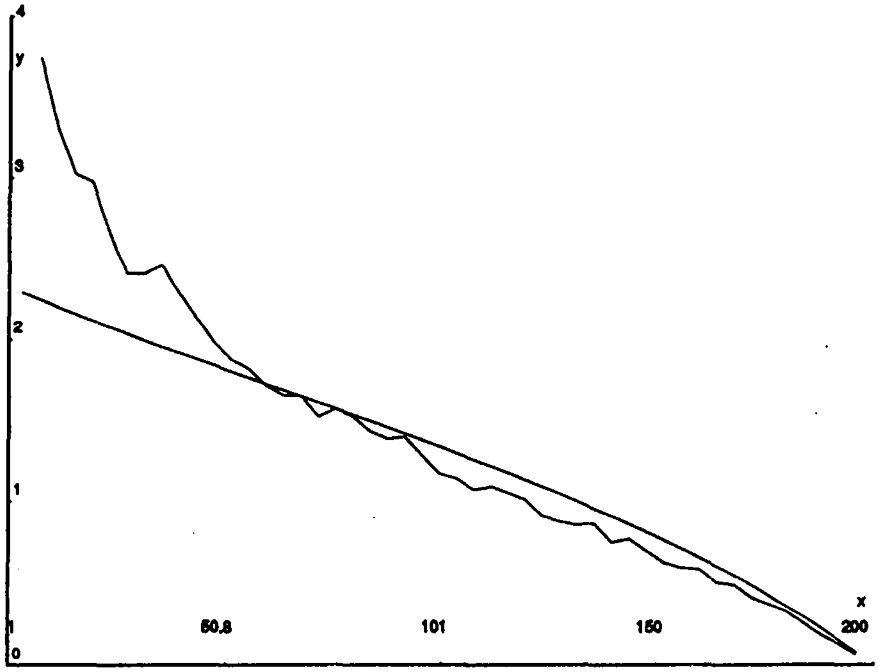

Figure 3: mean access delay *versus* position of a station. Input load $=.7, r = 1$

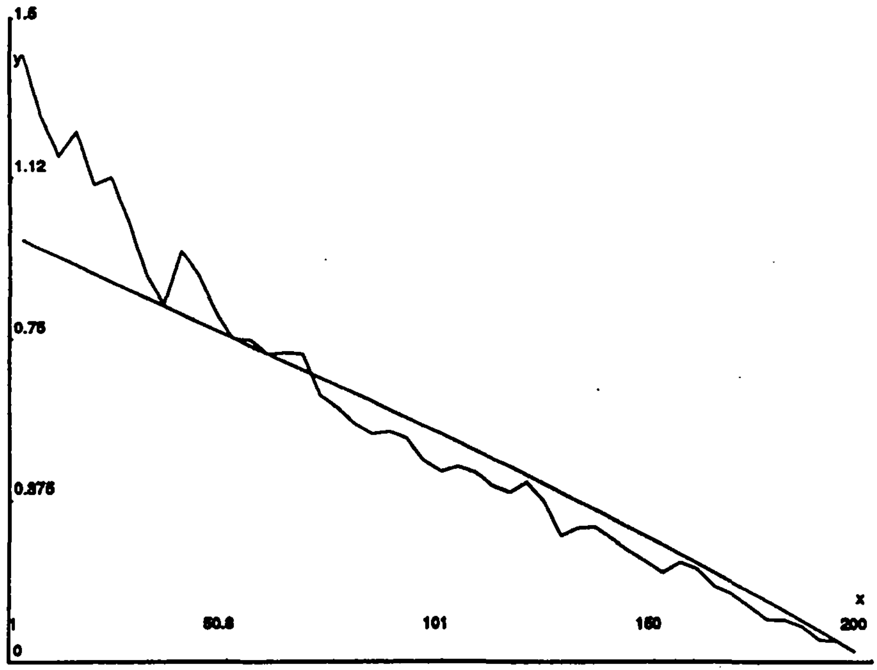

Figure 4: mean access delay *versus* position of a station. Input load $=.5, r = 1$

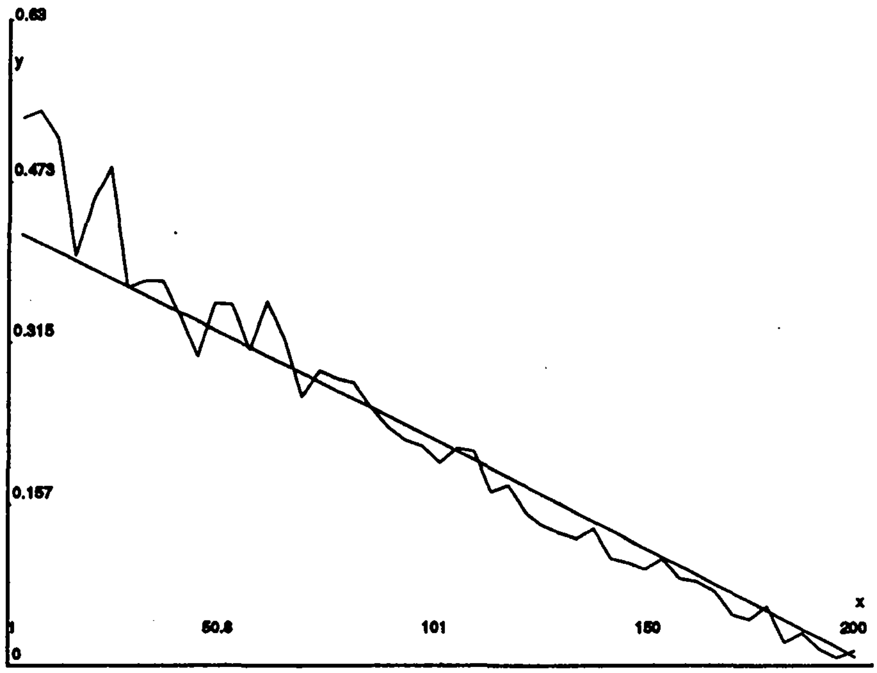

Figure 5: mean access delay *versus* position of a station. Input load $=.3, r = 1$

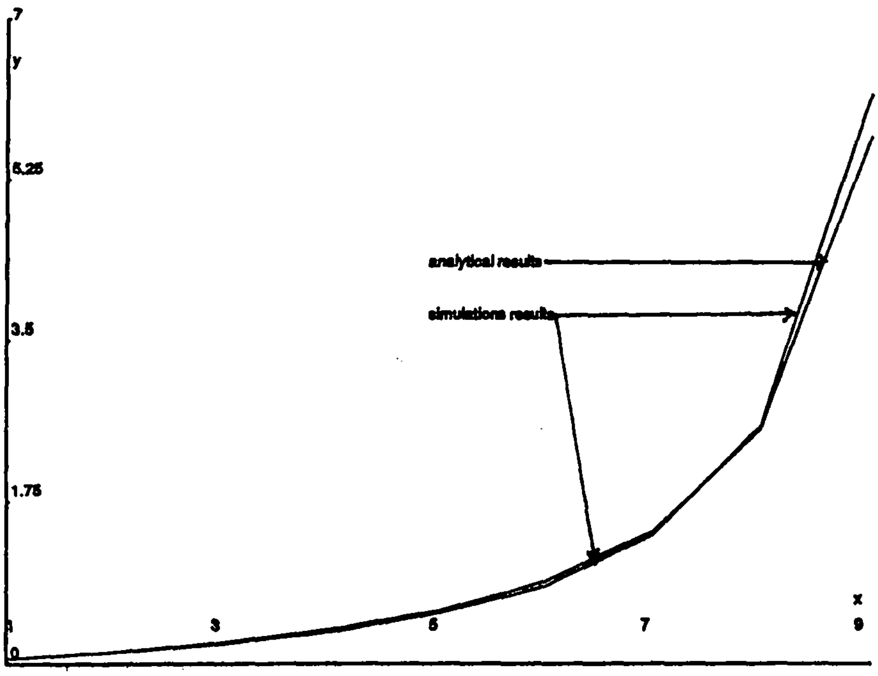

Figure 6: mean access delay *versus* input load. $r = 5$

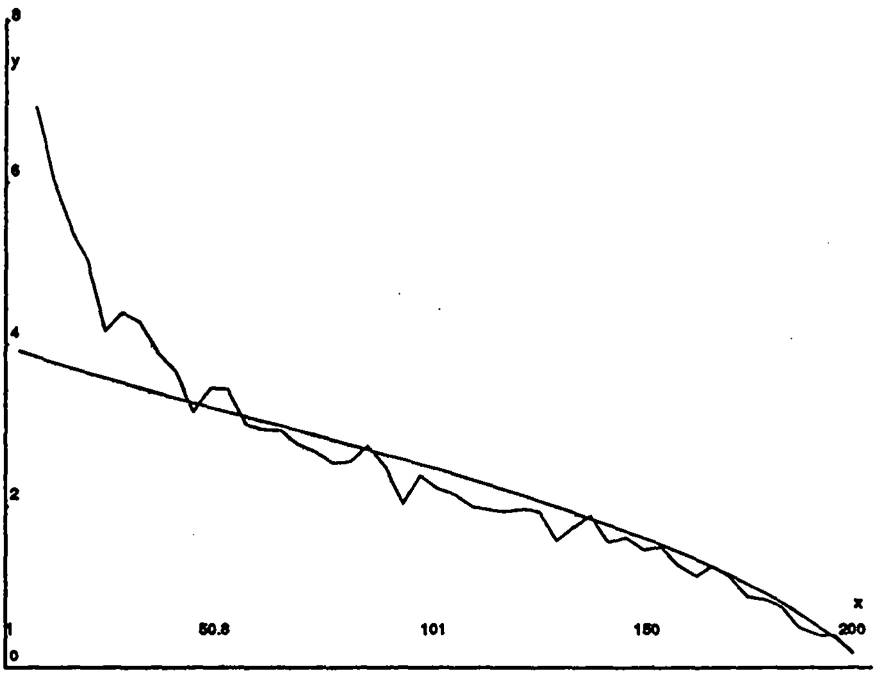

Figure 7: mean access delay *versus* position of a station. Input load =.8, $r = 5$

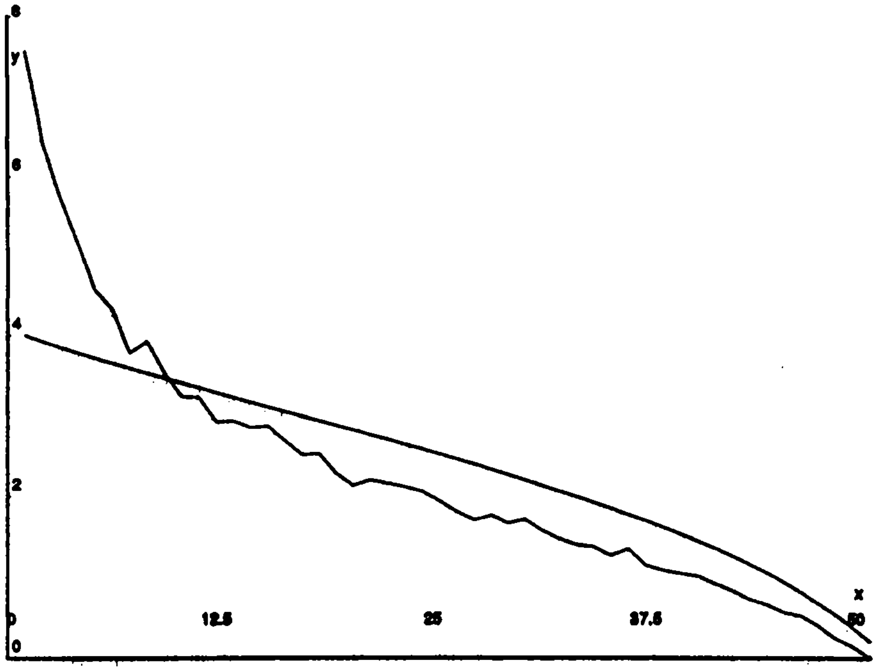

Figure 8: mean access delay *versus* position of a station. Input load =.8, $r = 5$ with only $N = 50$

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