Demand Priority Protocol Simulation and Evaluation

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Abstract A new network protocol (Demand Priority Protocol) environment can provide more satisfying service for different urgent transmission requests. In this paper, in order to provide guidance for the selection of environment of multimedia data transmission in Computer Supported Cooperative Work better, an object-oriented protocol specification language based on C++ is used to design a virtual environment of multiworkstation of computer cooperative work and to simulate execution of demand priority network protocol and then the performances of various transmission requests are analyzed. Finally, an evaluation of the demand priority LAN is given.

Keywords multimedia, demand priority MAC protocol, simulation, performance, evaluation.

1 Introduction

Cooperative work applications usually address distributed multimedia transactions for they are special forms of distributed transactions in deed and at the same time these transactions are always presented in multimedia data as the mixture of text, image, audio, cartoon and video. Although raw transmission technology has enough capacity to convey these new applications, traditional protocols now applied which are based on low-speed, high-error-rate links and plain applications cannot support these new emerging applications efficiently and properly. To support these applications efficiently, a 100Mb/s network is required.

An initial proposal for a 100Mb/s network was to use the CSMA/CD Protocol that is used in IEEE 802.3 and the original Ethernet. There are two reasons about why CSMA/CD is not appropriate at 100Mb/s:

1. The CSMA/CD protocol allows two sources to send simultaneously, but requires that any collision between frames be detected. This requirement limits the physical scope of the network to a few hundred meters because the minimum frame size is just 64 bytes (and much less for 802.5 frames), which has a transmission time of just 5μs at 100Mb/s. Consequently, if a 10 Base-T LAN consisting of five hubs were adapted to use 100Mb/s CSMA/CD, then several bridges would be needed to maintain the connectivity.

2. CSMA/CD is non-deterministic and does not support multiple priorities. Consequently it is impossible for a CSMA/CD network to provide bandwidth or delay guarantees to an application.

In addition, ATM and FDDI protocols also cannot be used widely because of their cost. Therefore, LAN MAN standards committee of the IEEE computer society proposed a new 100Mb/s network protocol — Demand Priority Protocol[1]. The Demand Priority Protocol has been optimized to support the hierarchical wiring structures that are widely installed. Typically, cables are run from individual desktops to a wiring closet on each office floor. These wiring closets are interconnected to another closet, which is connected to the public network. This wiring scheme provides greater flexibility and security, as well as better fault isolation capabilities than the distributed wiring of 10 Base 5 or 10 Base 2. The enormous success of the 10 Base-T version of IEEE 802.3 is attributed to its use over this wiring scheme. Therefore, the Demand Priority Protocol LAN technology is very cost competitive.
with the established LANs, such as Ethernet and Token Ring, while also providing backwards compatibility with existing network infrastructure.

Greg Watson simulated this protocol with hardware specification tool and believed that this protocol environment can provide more satisfying services for different urgent requests, especially for those as high transmission rate requests[2]. In order to provide guidance for the selection of environment of multimedia data transmission in Computer Supported Co-operative Work better, we use an object-oriented protocol specification language based on C++ to design a virtual environment of multi-workstation in computer cooperative work to simulate execution of the demand priority network protocol and then analyze the performances of various transmission requests. Finally, we give an evaluation and draw the conclusions.

2 Protocol of Demand Priority LAN

The demand priority LAN is a priority-based round-robin protocol where transmission is controlled by central network controllers called “hubs” or “repeaters”. In demand priority protocol environment, all the transmission requests are divided into two classes, one is called Normal Priority Request and the other is called High Priority Request. Normal and high priority requests are served in separate cycles. If the hub is in the process of serving a sequence of normal priority frames and a high priority request is received, then it suspends service of the normal priority traffic to serve the high. However, it does not interrupt normal priority transmission in progress. It should be noted that normal priority requests pending for more than approximate 250ms are upgraded to high priority requests (called priority promotion). With Demand Priority a station issues a request to its local hub when it has a frame to transmit. (The hub is probably located close to the wiring closet.) The hub checks for requests from its attached stations and indicates to one station that it may transmit a frame. Each hub has a number of ports and each port may be connected to a station.

A simple signaling scheme is used to control access to the network. Fig.1 shows the sequence of events that occur when a station sends a frame. The example assumes that the link from hub to station is four unshielded twisted pairs (UTP) of cables, in which case all the four pairs carry data while a frame is being transmitted, but the hub and station each uses two pairs for exchanging control signals between frames. Each thin arrow represents two pairs and each thick real arrow (frame transmitting) represents four pairs.

![Diagram](image_url)

Fig.1. The demand priority MAC protocol.

The sequence of events is as follows: initially the network is idle and so the stations send IDLE and the hub responds with IDLE.

A station sends a REQUEST to the hub, indicating that it wants to send a frame.