COMPARISON OF COMMUNICATION SERVICES WITH CONNECTION-ORIENTED AND CONNECTIONLESS DATA TRANSMISSION

Ottmar GIHR and Paul J. KUEHN

Institute of Communications Switching and Data Technics
University of Stuttgart, Fed. Rep. of Germany

ABSTRACT

During the recent years, many advances have been made in the standardization of protocols and interfaces of communications systems. Within the communications-oriented levels 1-4 of the Basic Reference Model, level-specific connections with their functions and procedures for establishment and release are of central interest. Connections play a similar role within the new standards of the ISDN basic access (D-channel protocol).

Within wide area networks (WAN), specifically however within local area networks (LAN), modifications of the fully connection-oriented data transmission have been discussed. The reasons behind this discussion originate from the repeated application of basic mechanisms within level 2 (data link), level 3 (network) and level 4 (transport) such as sequence control, error recovery, and data flow control. Especially in the case of LAN with a limited spatial network extension, low bit error probability and completely distributed control, ECMA, ISO, and IEEE provide for an alternative of connectionless data transmission.

Connection -oriented and connectionless data transmissions differ in various aspects as connection establishment and release, negotiation on service parameters, data unit relationship, acknowledgement, and addressing. Such differences influence also the performance figures of the communication services. Our study is devoted to the modelling and analysis of both types of communication services to obtain quantitative criteria additional to the qualitative criteria for the selection of services for particular applications of network types, e.g., Local Area Networks (LAN).

1. MODELLING

Our modelling approach follows the layered protocol architecture, where a model for a lower layer is aggregated and nested into the higher layer model as a submodel. In LAN's, we particular distinguish the following levels:

MAC-Submodel:
Layers 1 (Physical Media) and 2 (Media Access). This model is a multi-queue, single-server model with a specific interqueue discipline according to the Media Access Control Mechanism (as Token-Passing or CSMA/CD).

L-Connection-Submodel:
A full-duplex link-level connection with flow control, acknowledgement signalling, and MAC-submodel is modelled by a priority queuing network with two flow-controlled open chains according to Fig. 1. For each direction, a LLC-Admission

mechanism and a LLC-Priority Processor model is included. The MAC-Submodel is inserted only by its terminal behavior (delays).

LLC-Submodel:
The Network level uses the LLC-services which are modelled by connection-oriented or connectionless data unit transmissions.
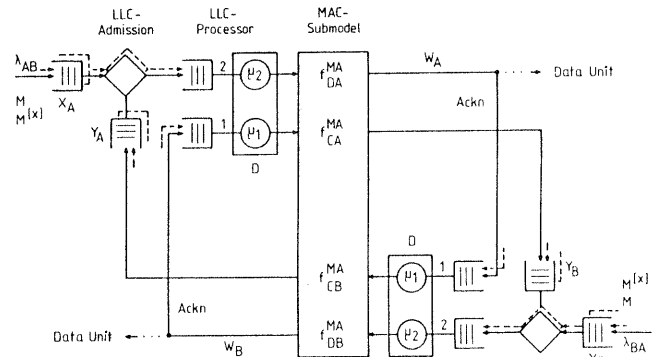

Fig.1. L-connection submodel for Local Area Networks

2. ANALYSIS

The analysis of the model follows the principles of Hierarchical Decomposition and Aggregation:

- Analysis of the MAC-Submodel for the total traffic flows from each station (control frames and data frames).

- Analysis of one FDX-LLC-connection through
  - decomposition of the two chains into two models, each for one direction only
  - aggregation of serial delays into a composite service station.

3. RESULTS

By this procedure we find typical results as end-to-end delays dependent on the LAN-parameters and window sizes. Such results can be applied for:

- selection of optimal window sizes
- delay estimations for file transfer- and inquiry/response-type traffics
- selection of the appropriate service type (connectionless/oriented).

The detailed description of the modelling method, analysis procedure, and results is included in a forthcoming paper.