DISCUSSION RECORD

Session No. 62 – NETWORK MANAGEMENT

PAPER No. 621
Author: W B MACURDY

Question by Å KNUTSSON
Mr. Macurdy, I have the impression that the approach to Network Management is so far a rather pragmatic one. One scientific approach on the other hand would be to apply methods developed in modern stochastic control theory.

Control theoretical methods have proved to be very powerful for controlling various industrial processes and complex dynamic systems whose inputs are stochastic processes.

Control theoretical methods applicable to optimal real time control of the traffic-flow in a network would for instance be state estimation techniques as Kalman-filtering and various prediction methods.

Mr. Macurdy, am I unfair in characterizing the existing Network Management approach as pragmatic, and what is your opinion about an approach applying control theoretical methods?

Answer
I think there is no doubt that existing network management methods have evolved more from practise than from theory. Although I believe the situation is now changing a bit. The problem of applying theoretical methods appears to be in the difficulties of modeling the transient interactions of the many switching machines involved. I certainly agree that there is a need to consider new techniques such as the methods of modern control theory. Our attempts to use control theory directly have so far not been particularly fruitful. We have, however, recently obtained analytic results on the problem of network optimization by other techniques. Results will hopefully appear in the Bell System Technical Journal this coming year. They support the approach being undertaken in 4ESS as discussed in the paper.

Question by W PERNAU
The amount of long distance traffic that is handled by operators decreases in the run of time. At the end of a certain period you will have fully automatically direct dialling service in the whole country. Then instructions to the operators are no longer possible. At that time you have only network management possibilities, which are performed automatically, that is by the switching system itself. This is especially true for immediate reaction to a sudden irregularity, e.g. overload. And now to be effective with traffic management actions your whole trunk network must not be filled with traffic completely at this time; that means you must have a certain amount of spare capacity (circuits).

My question is, in what way will you take into account this fact; will you overdimension the trunk network to a certain degree in order to meet network management requirements?

Answer
The proportion of DDD traffic in the US network is already substantially greater than that of operator traffic. It is certainly true that as the operator proportion decreases, operator controls, such as limit-to-one-attempt, will have declining significance. Why the operator traffic decrease will cause the "whole network" to increase in fullness is not clear to me. In any event such "fullness" would only prevent use of expansive controls. Protective controls to handle overloads would still be effective. I know of no plans to change the dimensioning rules for the reason you suggest.

PAPER No. 623
Authors: K RAHKO and T ERKE

Question by D G HAENSCHKE
Adaptive routing which is based on measurements of the percent of time x_o or more trunks are occupied simultaneously in a trunk group can respond only to overloads that result in high trunk group occupancy. It cannot respond to severe switching overload conditions since under these conditions circuit group occupancy declines as short ineffective attempts replace normal holding time messages. I would like to ask the authors if they have considered the problems created by short ineffective attempts during overloads when trying to infer true traffic demand from integrated peak trunk group occupancy measurements?

Answer
This depends of course on the switching system and the strategy of routing of the network. If there are used common control equipments, these should be provided with a control system of same kind, too. For example, when having 4 markers, the control limit is chosen x_o is 3, and so on.

Question by D G HAENSCHKE
What is the length of the measuring period necessary for establishing route blocking probabilities from integrated peak occupancy measurements required for reliability?

Answer
This depends on the route in question, duration of blocking on the route, total probability of blocking and the routing strategy. In small routes the time may be from 15 to 60 minutes and big routes from 3 to 15 minutes. This must be studied on the basis of simulation of the whole network.

Question by P LE GALL
Dr. Rahko has referred the CCITT recommendation, relating to the overall grade of service, which can be admitted in an automatic world-wide call. Relating to the grade of service of 1 % which is required for each national link, Dr. Rahko considers it as being related to the time congestion. This may be true when the link is uniquely made of a fully available trunk group, but when the link is composed moreover of a final route, it is no more true. In this case, the loss probability of 1 % applies to the final route only. It is a call congestion, generally higher than the time congestion.

It must be mentioned that, in this CCITT recommendation, only the call failures due to congestion in the speech network are considered. The case of the admissible amount of unsuccesses, due to the other types of failures, has not been yet considered, especially the case of failures due to time out relays, after protracted waitings of signals in the signalling system.

Answer
According to our studies is call congestion about twice as high as time congestion. I interpret the CCITT recommendation for final choice routes as 0.5 % time congestion.

PAPER No. 624
Author: O WEAN

Question by D G HAENSCHKE
Your simulation results confirm the effectiveness of protective overload controls that limit switching delays. Trunk reservation controls in a trunk limited hierarchical network are found to equalize service but are found to provide little additional network efficiency when there is no switching congestion, a result which is in good agreement with simulation studies performed recently at Bell Telephone Laboratories. Have you made an evaluation of the effectiveness of trunk reservation control in inhibiting switching machine congestion caused by register shortages?

Answer
The simulation results which are shown in this paper are done very short time ago, and may be considered as only preliminary results. As you have seen from the paper the simulations with trunk reservation were carried out on a trunk limited network. In this case it had no substantial influence on the traffic performance. It has also been carried out simulations with trunk reservation in the case with switching congestion. All blocking in the network was then due to time-outs. In this case the priority reservation controls did not operate at all, due to the fact that the trunks became idle as a result of the smaller holding times on the trunks. These two examples were steady state simulations of the network. To make an evaluation of the effectiveness of trunk reservation in inhibiting switching congestion it is necessary to simulate the transient operation of the network between these two states and then take into account the effect of repeated call attempts. This is one of those things we have planned to do in the further work. Mr. Macurdy showed in his presentation what result we can expect i.e. that trunk reservation will operate effective in the range between the pure trunk limited network and the time when time-outs occur.