In the introduction of your paper, you stated that switching systems exist for the case considered. I assume that you must have some measured data. Can you comment on the deviation, if any, between the values calculated and that measured?

Answer

Such switching systems really exist, otherwise a lot of famous authors (Cohen, Thierer, Pratt, Capetti, Kühn) have not investigated it since 1956. The assumptions for the investigations are quite usual, and have been verified by many measurements, so I suppose that for the theoretical treatment we have a usual and correct model. Unfortunately we have no measured data and so I cannot comment any deviations. Considering that some assumptions, e.g. the zero holding time of loss calls, are not justified, I believe that this kind of investigations cannot be verified by direct traffic measurements. Simulation gives no more information either, since calculation was "exact". On the other hand it would be very valuable to have some realistic measured data, and I would be very grateful if anybody could inform me about such data.

Question by I MOLNAR

I am somewhat confused about the meanings of figures 7 and 8. The way I understand it, there are the same number of traffic sources on both sides of the trunk group, and the only traffic that is generated by the participants is that they carry out with each other across the trunk group. In case of M=0 the conditions on both sides of the trunk group must be indistinguishable, the same number of sources being engaged. So why the difference between the two congestion values, which presumably would follow the Engset formula? And how come that congestion values can uniquely be established by A1, they must also depend somehow on A2?

Answer

Thank you very much for your question, you put your finger on a very serious misprint. Really the B1 and B2 congestion values must be the same for M=0. In this case, and they are the same indeed. On the Y-axis of Fig. 8, please write 10^-3 instead of 10^-1 and so on till 10^-3 instead of 10^-1. The congestion values in this case do not follow the Engset formula/see Ref. 5. Herzog and B2, Rubas, but you may get approximate values from the Engset formula with reduced number of traffic sources (Ref. 6.). The congestion depends on A2 too, this traffic was 3 erl in the case investigated.

PAPER No. 342
Author: J RUBAS

Question by L LEE

In page 3 of your paper, you stated that, in Australia, the recommended standard is that calls to PABX operator should be answered within 20 seconds with a probability not exceeding 0.05. Is the probability for a single busy hour traffic or for the average of several busy hour traffic?

Answer

The standard of service applies to time-consistent busy hour traffic load, based on a 5-day measurement during the busy season. Alternatively, in smaller P.A.B.X.'s, only a 3-day measurement is carried out and the average of the busiest hour traffic for each day is used as the traffic base for dimensioning purposes.

Question by J A BURGESS

I would like to compliment Mr. Rubas on a most interesting paper: Traffic studies on PABXs tend to take second place on those for public exchanges and it is nice to see effort being devoted to PABXs which have special traffic problems. I have two questions:

1) The PABXs subjected to measurements were presumably of standard type where operators handled all I.C. calls and the majority of O/G calls. Have you any comments on what affect direct dialling in (DDD) might have on the number of operating positions?

2) The proposed grade of service of probability 0.05 is rather excellent on busy distribution, I am in comparison with standards for switch networks but because the subscriber receives ringing tone whilst waiting for answer delay of up to 20 secs. are acceptable as similar delay would not be experienced for calls to individual lines (not PABXs). However, for outgoing calls to the public system from extensions via the PAEX operator I have doubts whether the gos would be acceptable. Would Mr. Rubas please comment on this aspect?

Answer

I thank Mr. Burgess for his interest. There is good reason for taking a greater interest in P.A.B.X.'s - they are far more numerous than the public exchanges.

1) In answer to your first question, yes, direct dialling to P.A.B.X. extensions has a marked effect on operator-position requirements. The proportion of directly in-dialled traffic varies from business to business, but the typical result is, approximately, to halve the operator traffic. Of course, other factors, such as the number of extensions barred from making outgoing calls, also have an important bearing on operator traffic and, hence, the required number of positions.

2) The choice of a service standard involves many considerations, some of which cannot be stated in numerical terms. Essentially, it must be a compromise between cost and user satisfaction. The former can be accurately determined, but the latter is not always easy to estimate; it depends to a large extent to previous experience with similar services. We choose a standard, which is intermediate between that given on local calls to manual public exchange subscribers and that given on long distance calls by trunk assistance operators. Also, let us not forget, that the standard applies to the busy season busy hour loads and the actual service is much better during the rest of the year.

Question by A FISCHER MADSEN

You consider the distribution of the service time per call as well as the distribution of pooled time per call. You mention that the distribution of the time per call is fitted best with a log-normal distribution but that the neg. exponential distribution may be used instead without committing serious error. Does this hold for the time per operation as well?

Have you investigated whether the distribution of the service times is dependent of the work load of the operators?
Answer
The distribution of operation times was obtained only from three PABX's and is therefore based on a rather small sample. There appears, however, to be no significant difference between the shape of this distribution and that of the service times per call.

In answer to your second question, yes, I have observed dependence of the service times on the load of the operators. The work load, however, influences only the mean service time (it becomes shorter under heavier loading), not the shape of the distribution.

Question by L LEE
In the conclusions of your paper, you stated that further work has to be done in evaluating the accuracy of general dimensioning methods for PABX's with link access to operators. Will you please tell us when this information will be available and, in the meantime, what should we do for dimensioning such a case?

Answer
Some of this work has already been done and examples have been shown during the presentation of the paper. This work is continuing, and the results so far obtained are encouraging - at least for the estimates of average delay, average queue length, and the probability of delay. Provided that we confine our interest in the traffic loads on the operators and the access switch links to the values normally found in working PABX's, either the CIRBW method, or the formulae based on the geometric general model, will both give quite satisfactory estimates of the above variables. In trying to estimate the distribution of delays - particularly the tail of this distribution - we are on less certain ground. Nevertheless, good agreement with simulation has been observed at moderate traffic loads. For heavy traffic loads a modification of the formulae will be required.

Question by P KIND
Mr. Rubas, you mentioned in your paper that the method of L. Hieber, called CIRBW, for the calculation of link systems with waiting and infinite queue capacity can be modified for the case of finite queue capacity.

Did you make any investigations in this direction? As far as we know from the calculation of single stage systems with gradings and a finite queue capacity, as presented at the 6th ITC, it is no trivial problem, because of the probabilities of loss for the various finite queues in front of the subgroups.

Answer
As far as the modification of the CIRBW method to handle finite queues is concerned I have simply quoted what was stated or implied in the reference 9. Using our simulation program, I have made a number of runs with a limited number of queue places, which has resulted in a small proportion of offered calls being prevented from entering the system. Such calls were rejected and had zero holding times; their proportion varied from 0.1% to about 1%. This degree of input traffic smoothing did not have any noticeable effect on the delay variables recorded. Higher values of input blocking were not investigated, as they are not allowed by our grade of service standards for PABX's.

PAPER No. 344
Author: E WOLLNER

Question by L LEE
In your queueing model, you assume that subscribers of the same class transmit their data at the same rate. Can you comment of the reality of such an assumption?

Answer
In the analytical model described here, I consider two classes with the same calling and service rates, respectively. It would be more realistic to consider subclasses with different calling and service rates. But the state vectors of my model are already four-dimensional. A finer consideration of the subclasses leads to state vectors of still higher dimensions. But it is possible to treat such cases with my simulation model.

Question by L LEE
In your conclusions, you stated that simulation procedures have to be used because the computers available at present are not able to solve large equation systems. How long does it take to simulate one such result?

Answer
Let us consider a larger example, closer to the reality. A simulation of 104 subscribers of class 1, 23 subscribers of class 2 and 54 channels needs for 500 000 call attempts a time of half an hour by an UNIVAC-1108-Computer. But this example leads to nearly 67 000 states of the system of the analytical model. This number is, in my opinion, too large for the numerical calculation by computer; at least, the computer time would be very long.

Examples of simulation results can be found in a paper of mine, cited in the references of this paper.

PAPER No. 345
Author: W URMONEIT

Question by L LEE
What service criteria do you recommend for the design of telephone enquiry and fault clearing centres?

Answer
The following traffic parameters are typical of the system described:
- Loss B
- Mean waiting time $t_w$
- Traffic loss per server $A/N$
- Traffic offered per server $A/N$

The following interrelation is determinant for planning: Which number of waiting positions is to be assigned to a given number of servers? The answer depends on which value is chosen for the above-mentioned traffic parameters.

e.g. $B = 1\%; \frac{t_w}{g} = 0.1; \frac{A_v}{N} = 0.05; \frac{A}{N} = 0.9$

Making use of the diagram on page 345/10, one obtains for

$N \leq 11$, where $\frac{t_w}{g} = 0.1$ is the limit,

and for $N \geq 11$, $\frac{A}{N} = 0.9$ being the limit.

In this way the condition $A/N = 0.05$ (see diagram on page 345/9) is met.

PAPER No. 346
Authors: M E FAHKR EL DIN and L PERIAM

Question by L LEE
Your analytical model for the network response time may be considered as one particular form of traffic Flowgraph on GERT (See 5th ITC pp 310-317 and/or 6th ITC pp 421). I am glad to see that the simulations agree well with the analytical results at least for low traffic. If you wish to obtain approximate results only, Traffic Flowgraph may be used for including the processing time in the central computer. I wonder what leads you to study only this one particular network structure?

Answer
Thank you Dr. Lee for your comments and as an answer concerning the particular studied network structure, we would like to say that this study is guided by some practical needs.