

APPENDIX E
PROCESSOR CONTENTION

One of the advantages of multi-control in telephone systems is that the capacity of the exchange can be increased step by step, by the addition of processors. To see what the effect of the delays as a result of processor contention may be, we consider the following sketchy model.

Assume, that we have a system of N processors. One may think that by increasing N one can decrease the traffic load per processor and thus increase the system's capacity irrespective of the value of N . This is however not necessarily so. Assume, that the synchronization of any combination of two processors in the system delays both by $d\%$. The effective capacity of a system of N processors would then amount to:

$$N \cdot (1 - d/100)^{N-1}.$$

The effect of the addition of one additional processor is:

$$(N + 1) \cdot (1 - d/100)^N - N \cdot (1 - d/100)^{N-1}.$$

The effect is zero or negative if:

$$(N + 1) \cdot (1 - d/100)^N \leq N \cdot (1 - d/100)^{N-1},$$

which implies:

$$N \geq 100/d - 1.$$

If $d = 2\%$, the maximal system capacity would then be reached for 49 processors.