行政院國家科學委員會專題研究計畫　期中進度報告

多個具相關性的 M/M/n/n, M/G/n/n 與 G/G/n/n 過程之研究與應用(1/2)

計畫類別：個別型計畫
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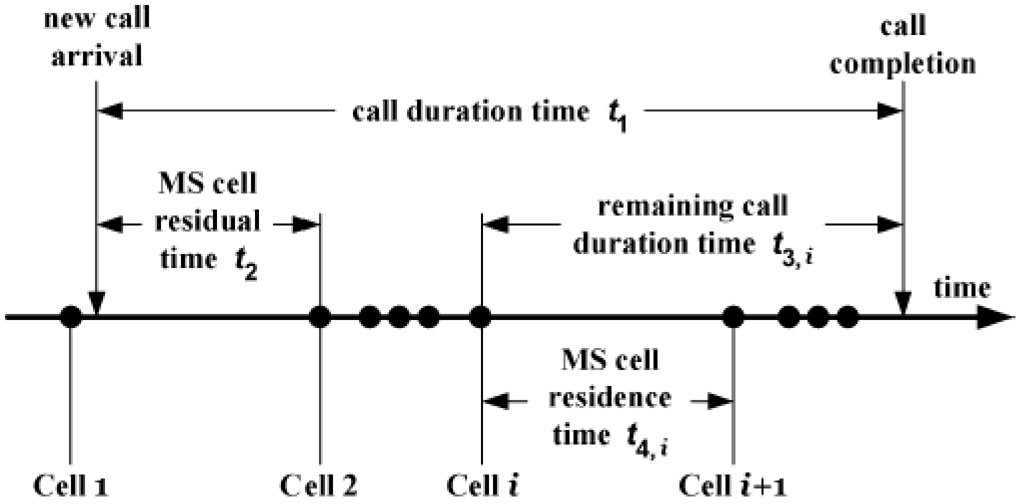
Consider the timing diagram in the figure 1. In this figure, a call arrives when the people resides in cell 1. The call duration time is t_1 . The MS cell residual time at cell 1 (i.e., the interval between when the call arrives and when the people moves out of cell 1) is .

FIGURE 1

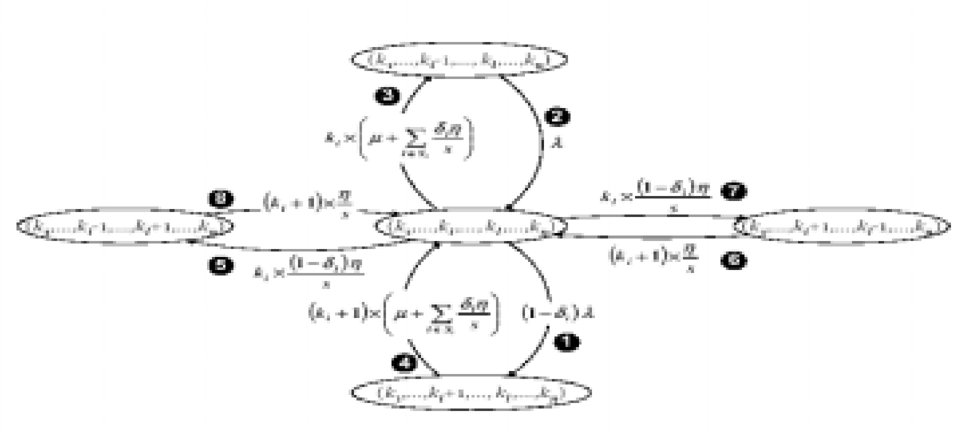


If the call is successfully handed over to cell i, then the remaining call duration time is $t_{3,i,}$.

The MS cell residence time at cell i (i.e., the interval between when the people enters cell i and when it moves out of cell i) is $t_{4,i}$. In our first step, the call duration times are assumed to be exponentially distributed, and have the same exponential distribution.

Consider a system with n cell sub-system. For $i \le 1 \le n$, let S_i be the index set of sub-system i's neighbors. That is sub-system j is a neighbor of sub-system i if $j \in S_i$. Let $|S_i|$ be the number of sub-system i's neighbors. In this first year, we consider a homogeneous system conforming to the following requirements: (1) each sub-system has c positions (2) the routing probabilities to the neighboring sub-systems are the same (3) the residence times distribution on the system are the same for all customs (4) the residence times distribution on the sub-system are the same for all customs (5) behavior of different customs are independent.

For solving our problem, we plan to consider the random variables N_i, which are the number of busy positions in i^{th} sub-system. Also, we consider the following events: (1) the event of moving to i^{th} sub-system (2) the event of moving from i^{th} sub-system (3) the event of moving from i^{th} sub-system to j^{th} sub-system. Then we will consider the Markov chain with state $(N_1,N_2,\ldots,N_n)$ as following figure



where different numbers mean different kind of transition. Using theorems about Markov chain, we already get the limiting distribution. Finally, we also find some relation between the limiting distribution and the probabilities we are interested in.

We consider the following input parameters in our model, (1) : The new call arrival rate to a cell. The new call arrivals are assumed to be a Poisson stream (2) : The mean call duration time. (3) The mean cell residence time. The cell residence times are independent and identically distributed (i.i.d.). This year we assume exponential MS cell residence times. In the next year, we will consider general MS cell residence time distributions. We assume that the call duration time and the peopel cell residence time are independent of each other.. The following output measures are evaluated in our study. (1) the new call blocking probability: The number of new call blockings divided by the number of new calls. Since the system is homogeneous, the new call blocking probability for all cells are the same and for a cell, this probability can be expressed as P(A new call is blocked | this new call occurs at cell i)= P(N_i is full) (2) the forced termination probability: The number of forced terminations divided by the number of handovers. (3) the call incompletion probability; i.e., the probability that a call is either blocked or forced to terminate: The sum of the numbers of new call blockings and forced terminations divided by the number of new calls.

To derive the new call blocking probability, we first define five events. (1) A_i: A call is handed over into cell i. (2) B_k . A call is handed over out of a cell with k busy channels. (3) C: A handover occurs in the cellular system. (4) $D_.$ A call is handed over out of cell m. (5) $E_{j,k}$ A call is handed over out of a specific cell j with k busy channels. We know that to compute the new call blocking probability, we need to consider how the flow-in handover traffic behaves. For example, there is no flow-in handover traffic into cell i if k=0 for all cell*i*'s neighbors. Also we find the routing probability that a call is handed over from cell i with k busy channels to cell j, given that the call is handed over from a cell with k busy channels to cell j. Since we consider homogeneous topology and routing pattern, the people can only move into cell I from any one of cell*i*'s neighbors with probability 1/s. Using above result, we can derive the analytic solution for the new call blocking probability. For the forced termination probability, we use the same method as deriving the new call blocking probability, we can easily derive the probability. The final probability we want to derive is the call incompletion probability. We find that this call incompletion probability is a function of new call blocking probability and call incompletion probability. Therefore, the call incompletion probability can be easily derived the analytic formulation of new call blocking probability and call incompletion probability

For the next year, we will concentrate on approximation model for general cell residence times. The idea we want to try first is to adjust the exact analytic solution developed in this year. Specifically, we will approximate the general cell residence time by an exponential distribution with some adjusted rate. In this case, even the Markov properties are not available any more. we still try to add time variable into our Markov state. Hope this will help us to figure out some interesting tool to solve this problem. If we could not find the exact solution, we plan to approximate our process by some exponential process, then use our results in this year to get some approximate answer.