ABSTRACT

In telecommunication systems and computer networks, it would be uneconomical if exclusive resources like switching and transmission facilities were dedicated to each customer. So a pool of facilities is generally provided to customers, and thus situations may occur in which a customer is rejected or has to wait for connection, because of shortage of common resources. This is a common experience for those who surf internet using dialup facility. Hence it is required to evaluate such grades of services quantitatively, and between the grades of services and the amount and configuration of communication facilities.

The teletraffic theory started by A.K. Erlang, a Danish mathematician, at the beginning of 20th century has been found to be very important paradigm using the tools of which such communication problems could be solved.

The teletraffic theory has been developed incorporating recent advances in operations research and queuing theory. Markovian teletraffic models with interarrival and service time both exponentially distributed have been studied for a long time as i) Markovian loss systems, ii) Markovian Delay systems and iii) Extended Markovian Models. Alternately Non-Markovian teletraffic models have also been studied as i)Renewal Processes ii) Poison input General Service time models iii) Poison input constant service time models iv) Renewal input Exponential server models and v)Renewal input single server models. In addition, Integrated Services Digital Network (ISDN) and Local Area Network (LAN) have been studied as Multi-Class input models like i) Batch Arrival Model, ii) Priority Queue Model, iii) Multi-Dimensional Model, iv) Mixed Loss and Delay Model v) Multi-Queue Models.
This thesis work is concerned with the formulation of a constructive theory for modeling a three dimensional computer network communication using the concepts of Cellular Automata and Algorithms related to Genomes. The central idea on which the work carried out in the thesis is that the network of computers is treated as 2D and 3D lattices of cellular automata and the communication protocols as genetic algorithmic linking.

The work has been carried out in the following manner, i) Study of traditional models, ii) Study of cellular automata and genetic algorithms, iii) Study of Genomics, (iv) Problem formulation and conceptual development of tools and algorithms, v) Case studies and program development and validation.

The central point on which the work reported here in this research is that a complex computer network is modeled as a cellular automaton lattice of nodes consisting of active and dummy nodes and their connectivity and performance as a nonlinear dynamical system behavior. Thus the network performance could be studied as extended genetic algorithmic fixing of network paths in between desired nodes. The research has been catered to the needs of reorganizing communication protocols for a very complex system like internet, rather a stack of internets.