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DROSOPHILA NERVOUS SYSTEM PAVES WAY TO ENHANCE DISTRIBUTED SYSTEM ENVIRONMENT

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Abstract: *A Distributive system is a collection of autonomous system connected by communication networks and equipped with software systems designed to produce an integrated and consistent computing environment. Distributive system is to find a small set of processors that can be used to rapidly communicate with the rest of the processors in the network by using maximal independent set (MIS) technique. Numbers of connected systems in distributed environment is very large and require more message exchanges because they have to know the location of the system to which they are communicating, so this will create extra traffic over the network that will increase the communication overhead. A similar arrangement occurs in the Drosophila Melanogaster, which uses tiny bristles to sense the outside world, each bristle develops from a nerve cell, called a sensory organ precursor (SOP), which connects to adjoining nerve cells, but does not connect with other SOPs. In the Drosophila Melanogaster nervous system, however, the cells have no information about how they are connected to each other. The method does not require advance knowledge of how the cells are arranged. This paper proposes the concept of Drosophila Melanogaster nervous system that can be applied to distributed systems in order to improve the communication overhead which in turn enhances the distributed system environment.*

Keywords*-MIS (Maximal Independent Set); SOP (sensory organ precursor).*

1. INTRODUCTION

Distributed system is one in which hardware or software components located at networked computers communicate and coordinate their actions only by passing messages [3]. In the computing world, one step toward creating this distributive system is to find a small set of processors that can be used to rapidly communicate with the rest of the processors in the network which is called a maximal independent set (MIS). Maximal independent set (MIS) selection is a fundamental distributed computing procedure that seeks to elect a set of local leaders in a network. Every processor in such a network is either a leader (a member of the MIS) or is connected to a leader, but the leaders are not interconnected. There are many methods of choosing the leaders out of which one is the probabilistic method which is similar to rolling dice in which some processors identify themselves as leaders, based in part on how many connections they have with other processors. Processors connected to these self-selected leaders take themselves out of the running and, in subsequent rounds, additional processors self-select themselves and the processors connected to them take themselves out of the running, that is it on the next consecutive round the next leader will be selected and at each round, the chances of any processor joining the MIS (becoming a leader) increases as a function of the number of its connections.

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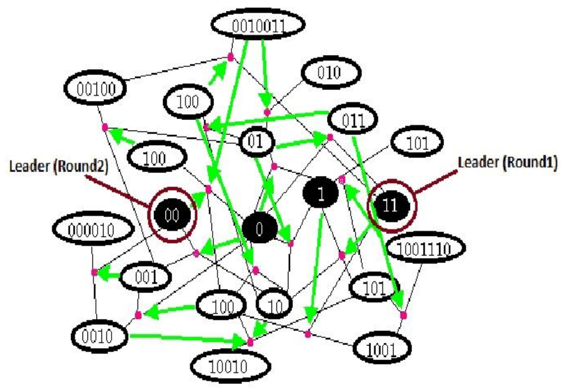

Figure 1

Problems with MIS: This selection process of MIS is rapid, but it entails lots of complicated messages being sent back and forth across the network, and it requires that all of the processors need to know that in what manner the nodes and its neighboring nodes are connected in the network for the communication to take place. This in turn increases the communication overhead in the network.

2. DROSOPHILA MELANOGASTER NERVOUS SYSTEM

The problems associated with MIS can be solved by help of Drosophila Melanogaster nervous system. There are mechosensory bristles on the body surface of the adult Drosophila Melanogaster that constitute the majority of the adult peripheral nervous system. The development of these organs takes place during late larval and early pupal stage and involves a well studied sequence of events. A sensory organ precursor cell produces (SOP)[2], via a fixed lineage, the four cells that make up the mature bristle organ.

During the larval and pupal stages of a Drosophila Melanogaster's development, the nervous system also uses a probabilistic method to select the cells that will become SOPs. In the Drosophila Melanogaster nervous system, however, the cells have no information about how they are connected to each other. As various cells self-select themselves as SOPs(Fig-1), they send out chemical signals to neighboring cells that inhibit those cells from also becoming SOPs[4]. This process continues for three hours, until all of the cells are either SOPs or are neighbors to an SOP, and the Drosophila Melanogaster emerges from the pupal stage.

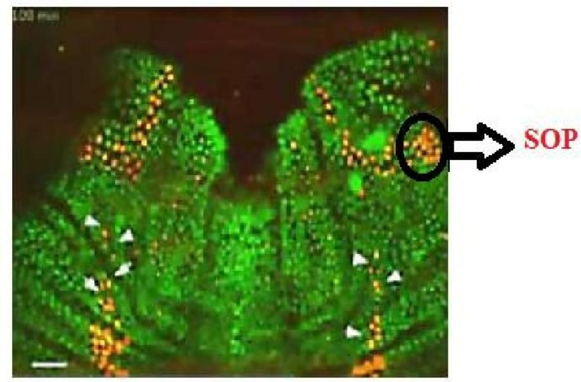

Figure 2[1]: In this confocal microscope image of the pupal stage of Drosophila Melanogaster development, nerve cells that self-select to become sensory organ precursors (SOPs) are identified by arrows. These cells send chemical signals to neighboring cells, blocking them from becoming SOPs and causing them to fluoresce red in the image.

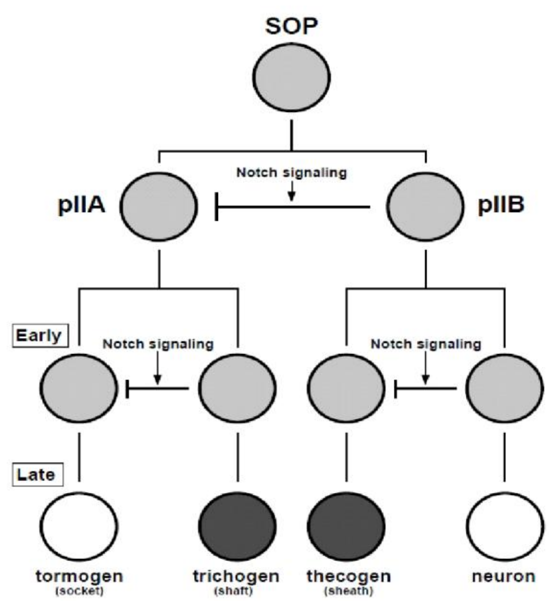

Figure-3[2] Schematic representation of the adult mechosensory bristle lineage and of the role of N signaling in bristle cell fate specification.

Schematic representation of the adult mechosensory bristle lineage and of the role of N signaling in bristle cell fate specification. At each division, the cell fate asymmetry of the daughter cells require the activity of the N signaling pathway, such that the cells on the left in each pair is prevented by their signal from adopting the same fate as its sister's cell on the right.

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The signal itself is bidirectional, with each cell both sending and receiving. The pIIA secondary precursor, the tormogen, and the thecogen are responsive to the N-mediated signals sent by their sister cells, but pIIB, thetrichogen, and the neuron are made resistant to the reciprocal signal by N pathway antagonists.

3. COMPARISON BETWEEN THE MIS & SOP

The probability that any cell will self-select increases not as a function of connections, as in the typical MIS algorithm for computer networks, but as a function of time in biological approach using sensory organ precursor of the Drosophila Melanogaster. The biological approach of Drosophila Melanogaster does not require advance knowledge of how the cells are arranged in its network due to this the communication between them can be very feasible and simple. Drosophila Melanogaster have large no of neurons through which they make communication between them so that Drosophila Melanogaster nervous system technique can be applied on the large networks [2] where we do not need to know the exact location of the nodes.

4. CONCLUSION & FUTURE WORK

This paper has presented a brief overview of implementing SOP over maximal independent set concept of distributed system. By using Drosophila Melanogaster nervous system technique that is SOP, we can have a better run time than the current approaches which are been used in Distributed Systems. And a major factor which contributes for this is that we can considerably reduce the communication overhead which occurs in MIS because it requires prior knowledge of the location of the nodes which in turn increases the traffic over the network.

5. FUTURE WORK

a) The implementation part of Drosophila Melanogaster nervous system using SOP concept in areas such as environmental monitoring using remote sensing .
b) To make it more efficient, so that we can have two SOP leaders getting interconnected with each other and can communicate their messages over the network. If we accept such a premise we can start trying to find ways to take advantage of that general trend for the betterment of everyone.

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