



Dominating the Stone Age

Semester / Bachelor / Master Thesis

Networks are the fundamental underlying structure in the study of distributed computing. Due to the omnipresence of the Internet, the models used in distributed computing generally focus only on devices that are Internet-capable. The standard model in distributed computing is the so called *message passing* model, where the devices are modeled as nodes and they are connected by an edge if they can communicate with each other. In the message passing model, the nodes are allowed to send messages of unrestricted size in each round and are allowed to perform unlimited computation in each time step. In other words, each node can solve any NP-hard problem in one time unit.

Recently more and more studies on submicroprocessor devices, such as biological cells or nano-devices, have emerged. The obvious question is whether the message passing model really represents a network of such devices properly. Do tiny bio/nano devices really “compute” and/or “communicate” the same as a computer?

In a recent work, a new model of computation was introduced, where the nodes are operated by finite state machines and the communication between the nodes is restricted to a finite alphabet. This model is called the *Stone-Age* model and the aim is to take a step towards understanding the computational capabilities of networks of weak devices. The model is rather similar to a cellular network (e.g., Game of Life), but the network topology is allowed to be arbitrary.



Day 102/365 - Home made amoeba by Great Beyond
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Your task is to come up with interesting problems under this computational model and solve them. As

an example problem, it was shown that the maximal independent set (MIS) can be solved in this model in $\mathcal{O}(\log^2 n)$ time units. The drawback of this problem is that it is rather *local*, i.e., it is enough for every node to know whether they are in the MIS or not. Can one solve a global optimization problem, such as the minimum dominating set?

If you are interested in dominating the stone age model or have your own ideas on what problems to study, feel free to contact us or simply drop by for a coffee.

Requirements: Interest in theory of computer science. The student(s) should be able to work independently on this topic.

Contact

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