ARTIFICIAL INTELLIGENCE LABORATORY

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

PHYSICS OF COMPUTATION SEMINAR

Date: Thursday, May 13, 1999
Time: Refreshments at 3:45pm
Talk at **4:00pm**
Place: NE43, 8th-floor AI Playroom

Reversibility *et al:* Future, Present and Past

Edward Fredkin

The concept of *reversibility* has evolved from noticing that a few natural processes have that property (eg. the motions of the planets) into a desirable attribute of certain kinds of artificial mechanisms. We want to build reversible digital devices such as computers. The necessity of continual miniaturization as the path to progress in computational efficiency forces one to find circuitry of lower and lower power dissipation. We have good reason to believe that reversibility will become a necessary part of future computers if the progress implied by Moore's law is to continue. Unfortunately reversibility, while absolutely necessary, is not sufficient.

We will review some of the history as to how we got to where we are, what needs to be done in addition to getting rid of irreversibility, and finally, at least some ways of solving a few of the more obvious other sources of dissipation; the spoilers of efficiency.

As an example, we will show how to efficiently compute the evolution of a PDE hydrodynamics style model of computation, eliminating as many of the heat generating mechanisms as we can imagine.

We are encouraged by wonderful examples from nature (such as an isolated box containing a gas), where reversibility, quantization, conservation laws and other properties of physics make things keep on trucking instead of allowing things to wind down and come to a stop.

Host: Norm Margolus

This talk is part of a seminar series on adapting computers and computations to the constraints of, and opportunities afforded by, microphysics; and on the development and application of the physical theory of computation and information. If you would like to receive electronic notice of these seminars, send email to "poc@mit.edu."

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