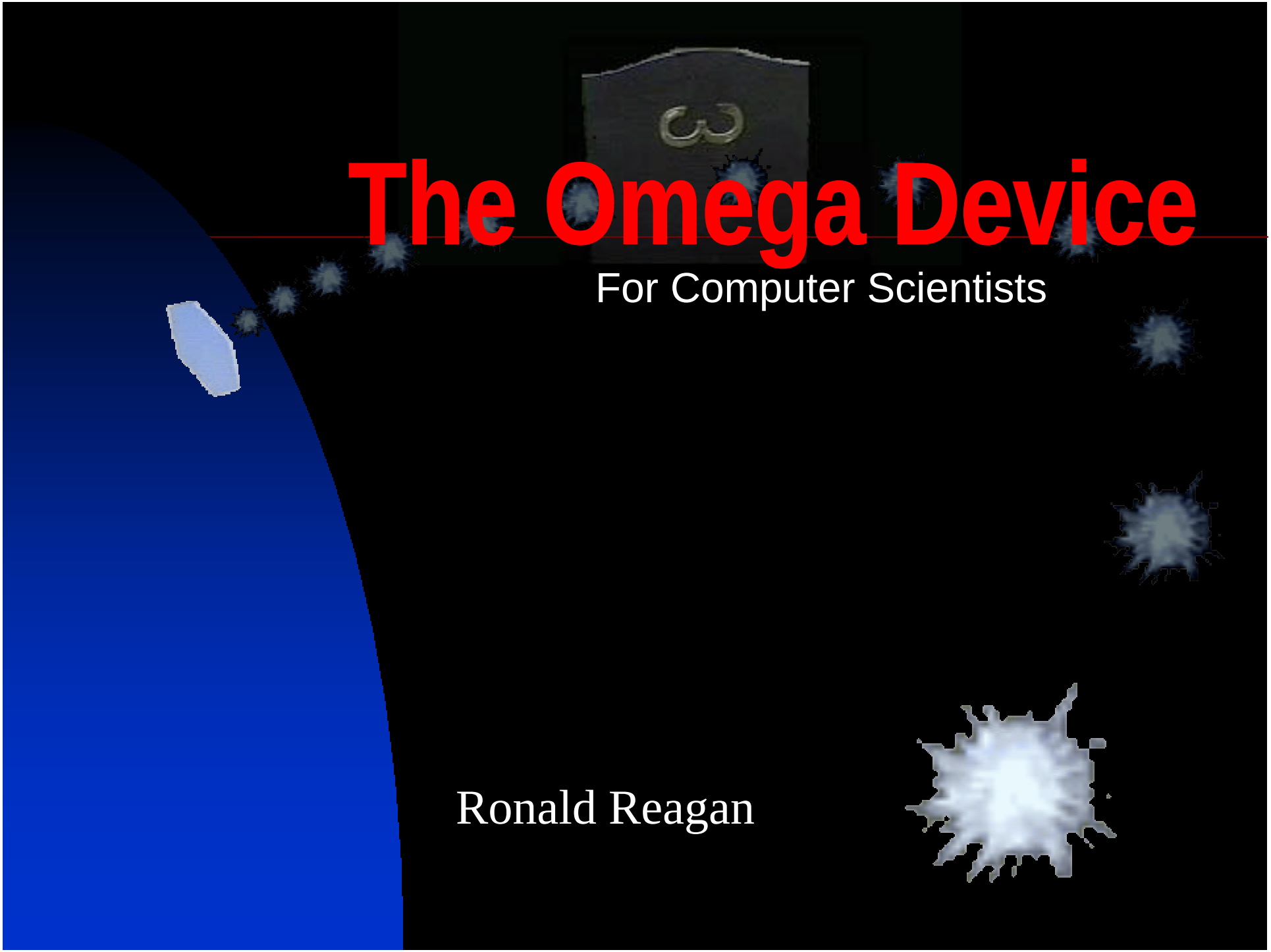

The Omega Device
For Computer Scientists
Ronald Reagan

Institute for World Domination

through the

Study of Small Molecules

"We live to use spectroscopy to determine the structure and dynamics of small molecules, thusly subverting all that is **good and rational**. We have many laser tricks. We have fearsome analysis methods. We are masters of acetylene. **Your doom is sealed**."

[suspenseful pause] $\mathbb{W}$ *[dramatic chord]*

- A thing of apocalyptic power
- Physicists have one

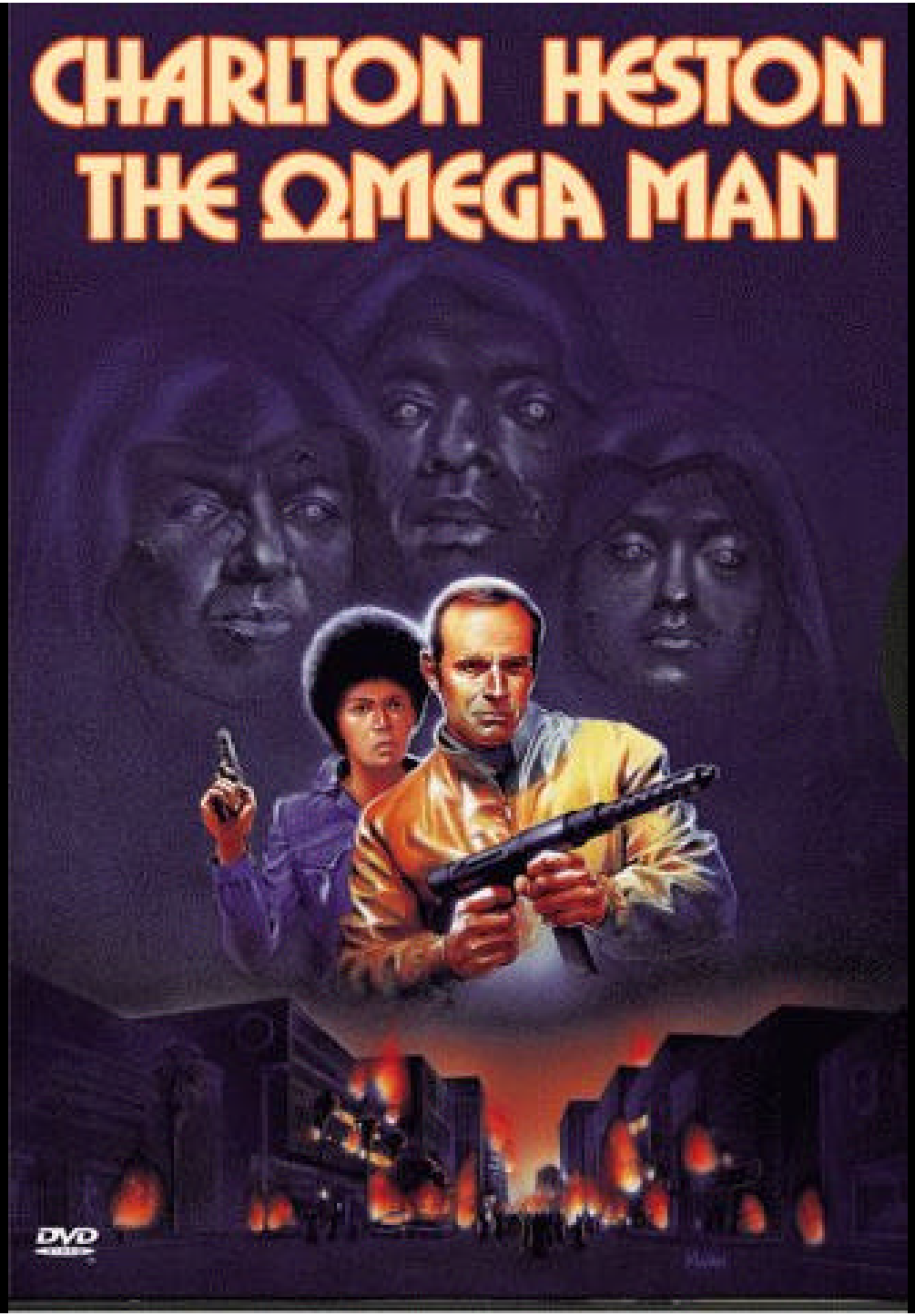
  (Tipler: The Physics of Immortality)
- Time-Lords have one

  (Doctor Who: The Hand of Omega)
- Mathematicians have one

  (Chaitin: The Unknowable)
- Even actors have one

  (Allen: Galaxy Quest)
- Don’t we deserve one too?

Omega In Fiction


CHARLTON HESTON
THE OMEGA MAN
DVD

TOTAL FREEDOM What living with an uncensored Net really means
NewScientist
10 MARCH 2001 No2281 WEEKLY £2 US$3.75
THE OMEGA MAN
HE KNOWS THE NUMBER THAT WILL DESTROY ALL CERTAINTY
India's holy war on the ivory hunters
Would you pass the fairness test?

The Omega Number

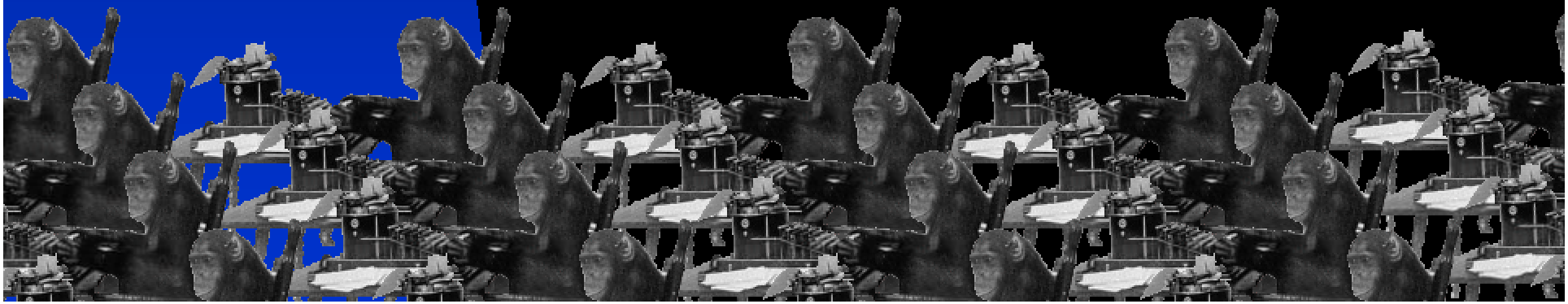
- Probability that a Turing machine run on random input will terminate
- Number of bits of Ω that can be derived limited by number of bits in axioms
- The “wisdom” number

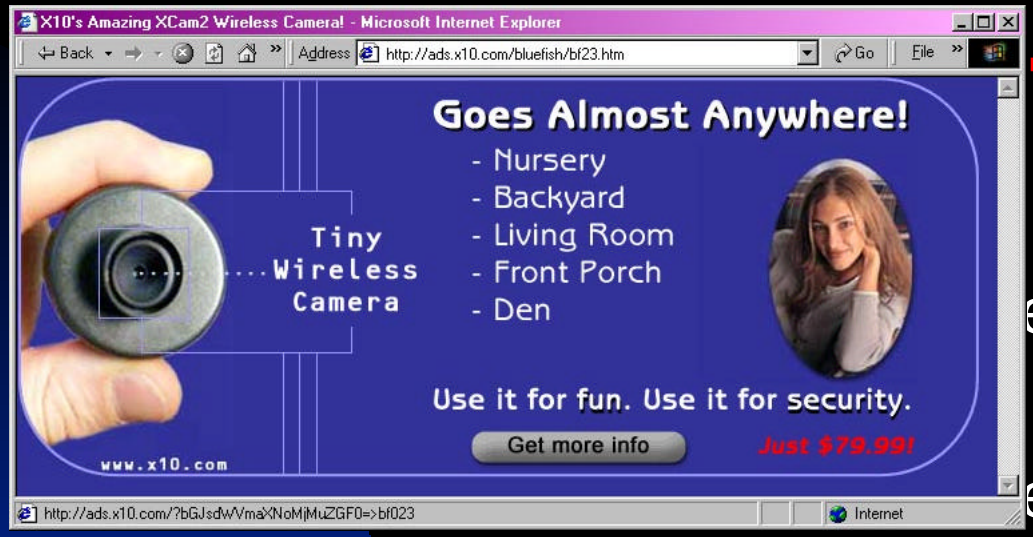
Omega for Computer Scientists

Unimaginable Power!

- Run any computation in an instant
- “Finite numbers can be very big”

  (Arthur C. Clarke, fabricated quote)
- Generate-and test vast search spaces





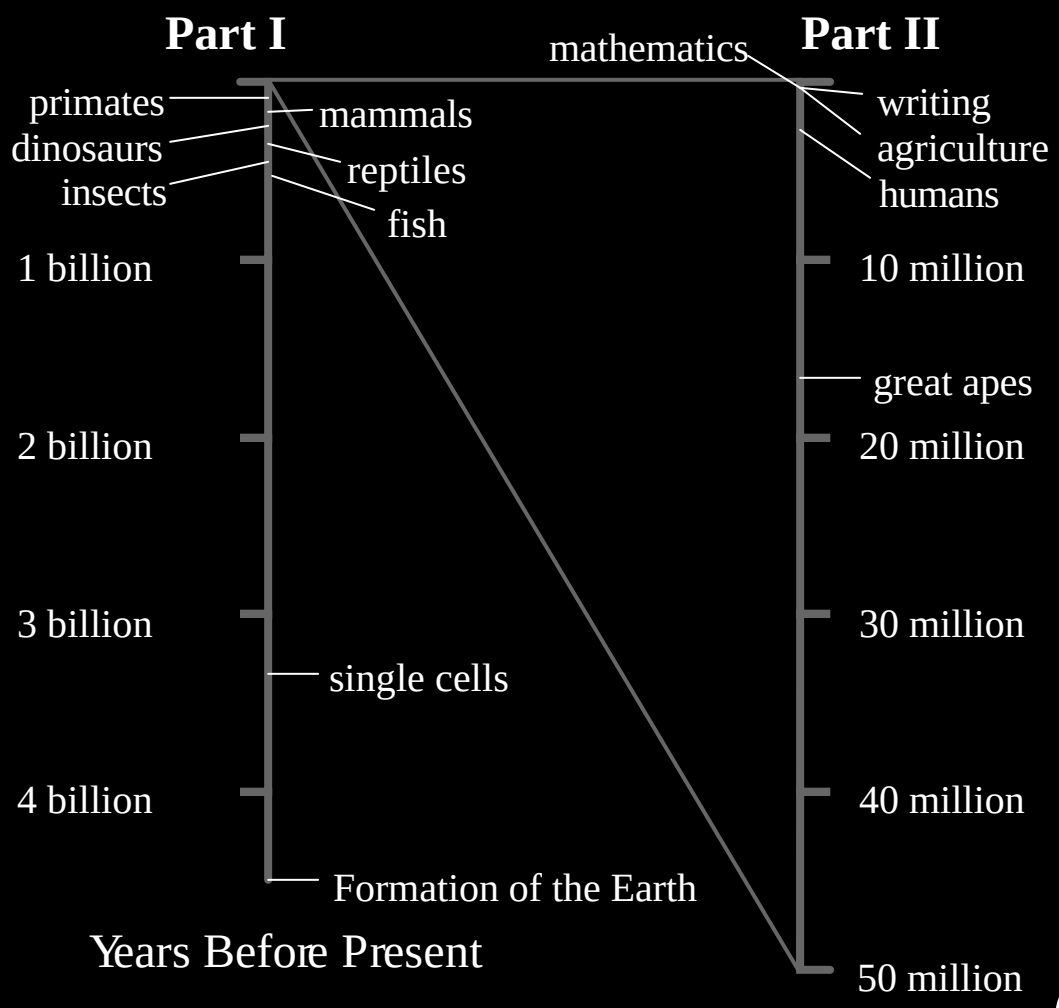
for an AI

e-and-test for an AI?

est program that does X

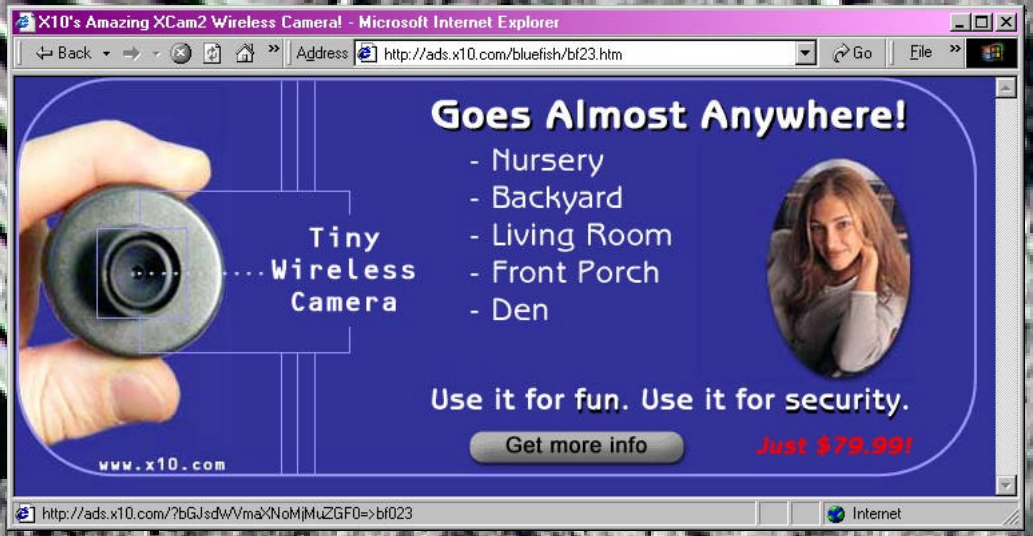
- "Search for shortest program that does X"
- Need to chose coding scheme so that:
  - The AI is easy to code, or
  - Test X is hard to code, or
  - Recursive search is hard to code

Life Works



(Brooks)

Termination Condition



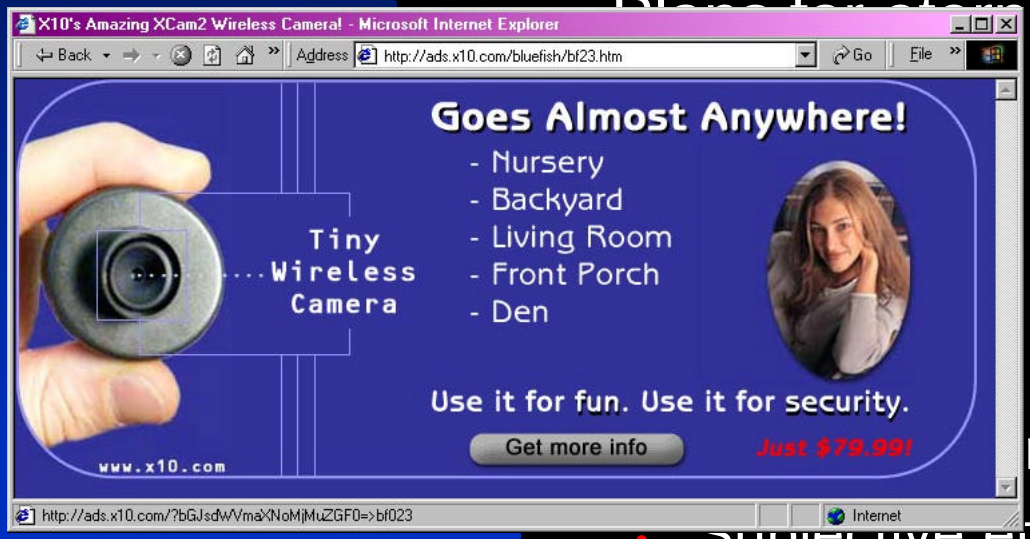
Unlimited Rice Pudding!

- Now we can solve informal problems
- How can we build a better proxy?
- What should I write in this card to grandpa?
- Can we reverse entropy?
- How can I tell if she likes me?

abdefghij abdefghij
VUTSRQPOQ VUTSRQPOQ
ghijabdef ghijabdef

Hacking Subjective Time

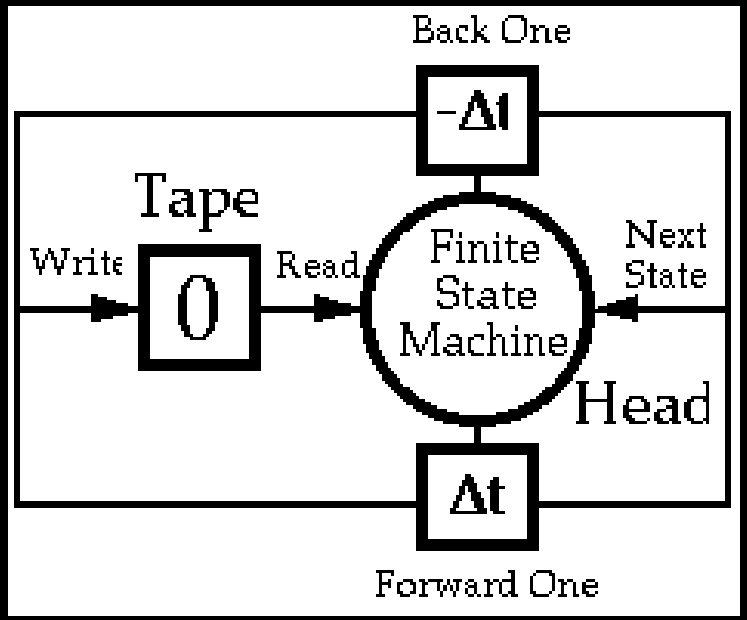
- What is ultimate fate of universe?
- Plans for eternal life



- rity
- Subjective eternity

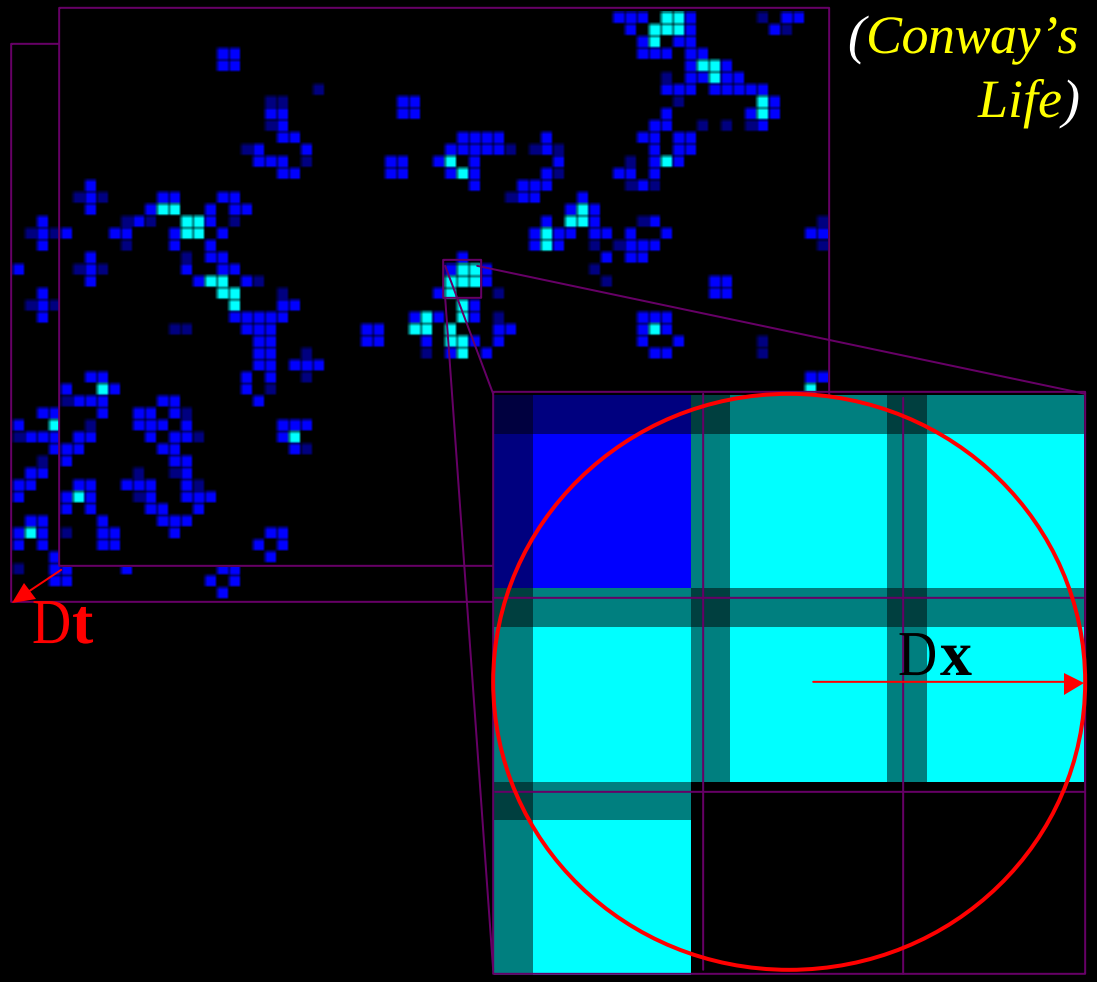
Hacking Real Time

- Many “time travel” mechanisms
- Inevitably introduce causal loops
- Okay if loop is logically consistent?



(Moravec: Time Travel and Computing 1991)

Keeping the Speed Limit



The Omega Protocol

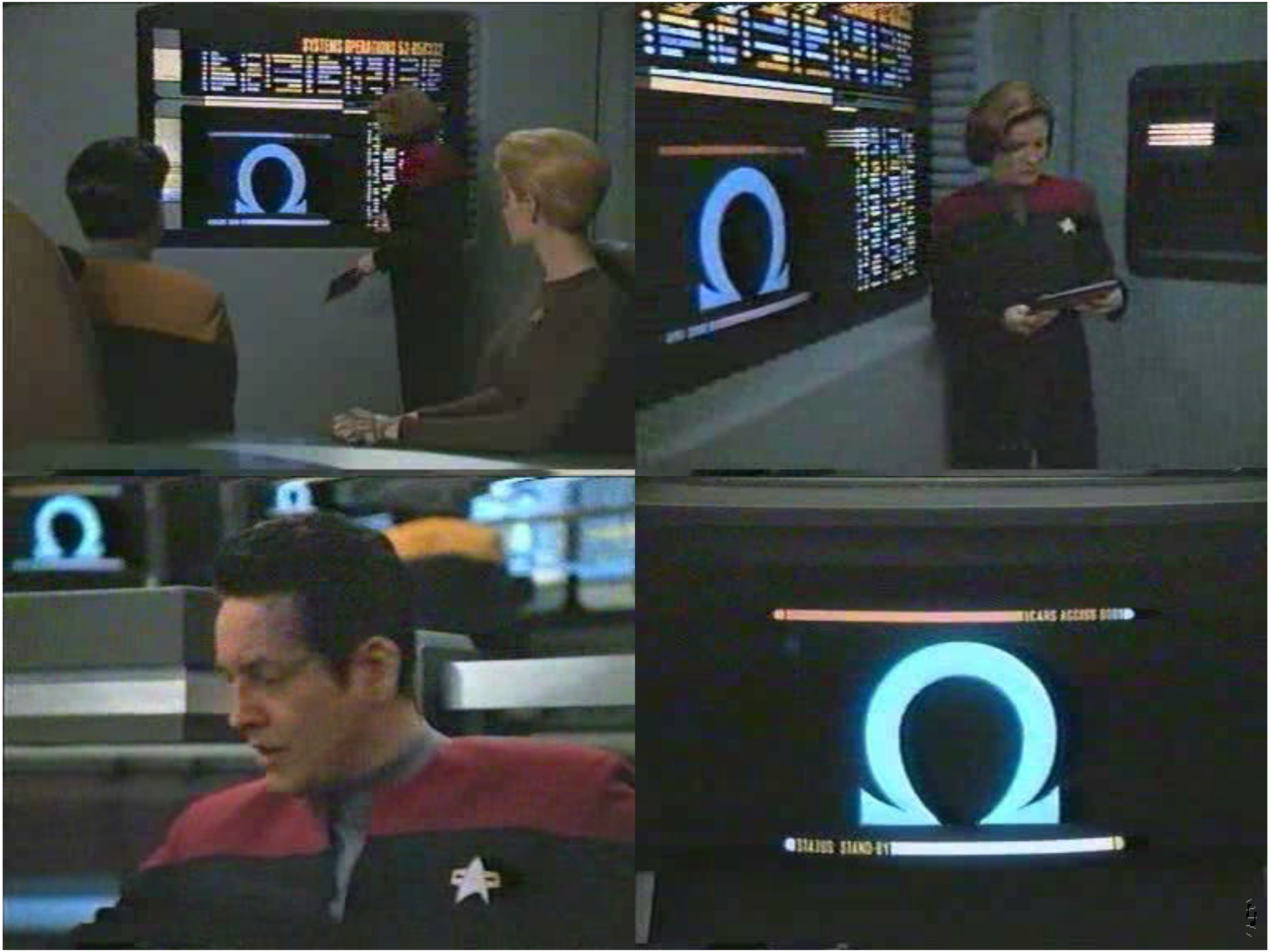
1. Set up initial state on Life board
2. Entangle the board
3. Send synchronization pulse
4. Cells update based on neighbors
5. Cells transmit state back by Δt
6. Collapse entanglement
7. Read out fixed point solution

The Importance of being Finite

- Ω number is computably enumerable
- Implies possibility of having axioms that are consistent for all finite processes, but are inconsistent for infinite processes
- If nature relies on finiteness for consistency, we inherit that limit

[suspenseful pause] Ω [dramatic chord]

"[Ω] embodies an enormous amount of wisdom in a very small space ... inasmuch as its first few thousand digits, which could be written on a small piece of paper, contain the answers to more mathematical questions than could be written down in the entire universe. Throughout history mystics and philosophers have sought a compact key to universal wisdom, a finite formula or text which, when known and understood, would provide the answer to every question. [...] Such sources of universal wisdom are traditionally protected from casual use by being hard to find, hard to understand when found, and dangerous to use, tending to answer more questions and deeper ones than the searcher wishes to ask. The esoteric book is, like God, simple yet undescribable. It is omniscient, and transforms all who know it. Omega is in many senses a cabalistic number. It can be known of, but not known, through human reason. To know it in detail, one would have to accept its uncomputable digit sequence on faith, like words of a sacred text." *(C. H. Bennett)*


STATUS: STAND-BY

Is P ^{1} NP ?

- Tell proxy all about complexity theory
- Generate all possible strings up to size N
- Arrange in binary tree
- Starting at leaves, have proxy prune less convincing branch
- Return single most convincing string

Test Procedure

- False starts:
  - Lots of ad-hoc math puzzles
  - Challenge/response
  - Recording human “transfer function”
- Key: change the coding scheme
  - Make tests harder to compress
  - Make AI relatively simpler to code
- Use simulated probabilistic physics

Is W Device Possible?

- Does fast computation let us do anything obviously impossible?
- Need to be careful with boundary to avoid speed limit violations
- Finiteness is crucial – introduces contradictions into formal systems not seen otherwise