Cellular Automata

Life on a Grid

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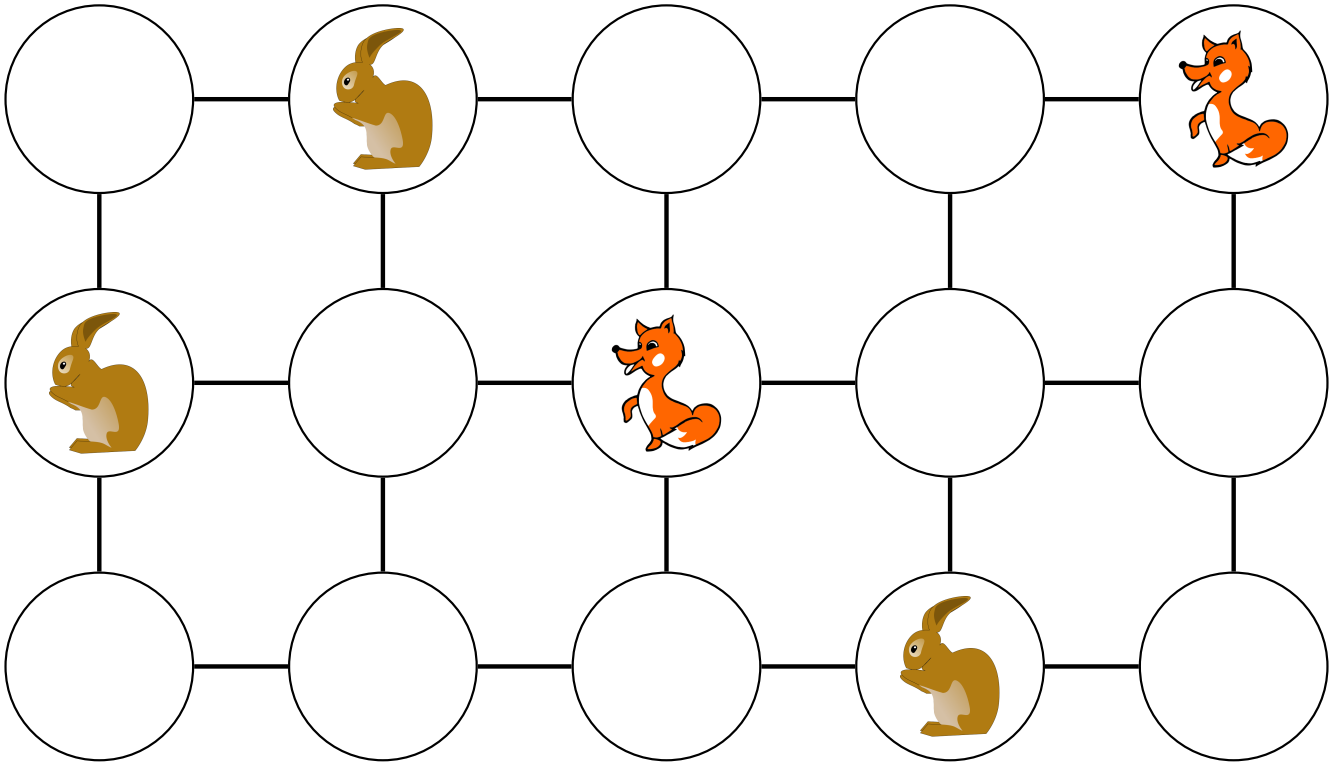
27th January 2014

The world is a grid



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The Cellular Automaton

- Each cell is active
- The cell has a state
- In a simple predator-prey scenario, we could have
  1. Occupied by prey
  2. Occupied by predator
  3. Empty
- We do not model the occupant separately
- The cell decides its own state transitions

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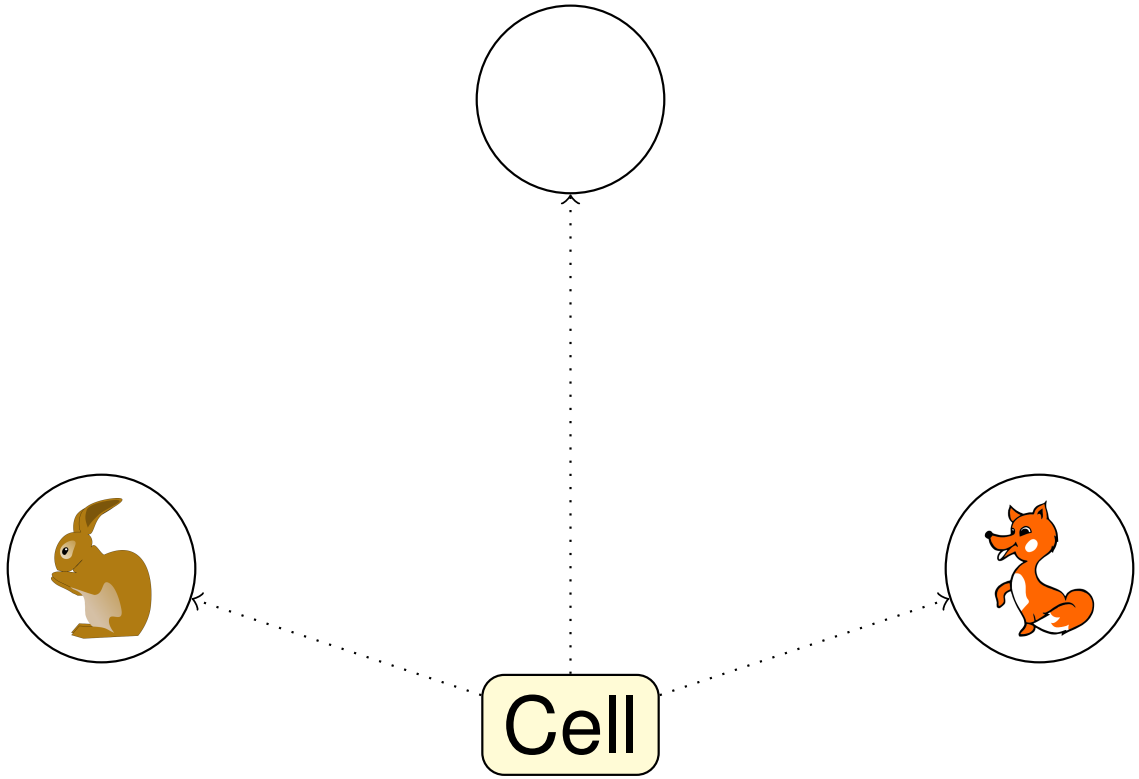
Cell States



Automata

An automaton is a state machine.

Definition

A state machine is a directed graph. The nodes are called states, and the edges are called transitions. Each transition is labelled with a condition indicating when and how the system should change from one state to another.

The system is in exactly one state at any one time.

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Cell State Transitions

Cells can observe neighbour cells as a basis for transitions.

1. Empty cell with two neighbour rabbits
   → birth → new rabbit
2. Fox with with adjacent rabbit
   → fox moves and dines → empty cell
3. Rabbit with adjacent fox and adjancent empty cell
   → rabbit flees → empty cell
4. Rabbit reaches age limit
   → dies → empty cell

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Summary

- Two ways to model on a grid world
  - Active agents — agent-based models
  - Active cells — cellular automaton
- Cellular automaton
  - each cell is modelled as a state machine
  - the cell monitors its state transition conditions

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