Implementing a mobility scenario using SDN and Ryu Framework

Iulisloi Zacarias
Prof. Dr. Luciano Paschoal Gaspary

Instituto de Informática
Universidade Federal do Rio Grande do Sul (UFRGS)

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Outline

Scenario Caracterization

- Proposed mobility scenario
- A stream video server
- Clients play the video streamed by the server
- Hosts can disconnect and connect from switches / access points

Scenario Diagram

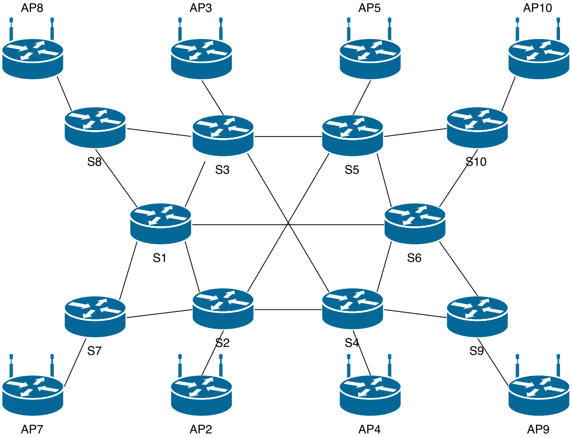


Figure: Overview of proposed scenario

Basic principles (1/2)

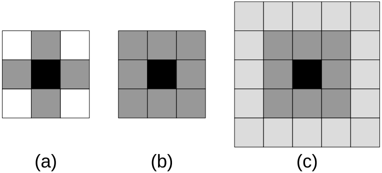
- Spatial structure is the *first* most important principle (e.g.: a matrix or a vector)
- Each cell is a location representing an individual
- These set of positions is called "world" or "celular world"
- Can represent, for example, a model of how people live in the city

Basic principles (2/2)

- Each automaton has neighbors on sides
- The social self-organization concept arises from local interactions among individuals (neighborhood)
- In cellular automaton models, we can give precise meaning to what we mean of local interaction
- Local interaction is the *second* important principle of a cellular automaton
- An individual can only interact with others in specified distance around

Types of neighborhoods

- There are many different types of neighborhoods
- The most common are:
  - Von Neumann Neighborhood (a)
  - Moore Neighborhood (b)
- Moore neighborhood can be customized, for example, a 5x5 Moore neighborhood (c)



Neighborhood and interaction

- Different kind of neighborhood models distinct individuals interactions
- Taking the example of spread a rumor, in the Moore neighborhood the rumor will spread faster than in Von Neumann neighborhood
- The way you model the neighborhood express how local or global the interaction is

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Modeling the interaction

How can we model the interaction?

R: Once more, two basic principles

First Principle: The cell state

- The agents in the cells have a state
- The states can represent the opinion, ethnicity
- Typically, the states are modeled as a number (e.g. 1, 2, 3) or a binary value (e.g. "On" of "Off")

Second Principle: The rules

- Agents can change their states
- How they update their “states” depends on both, the own state and the states of their neighbors

How state changes are modeled?

- Time is discrete in cellular automaton models
- All agents can change their states every step (tick) at the same time
  - They take their own state and the state of neighbors in previous time, and they all change to a new state
- One agent at the time can change its state (e.g.: a randomly selected agent will change its state)

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State change dynamics

- Influence dynamics
  - Agents do not change their location but change their state
- Migration dynamics
  - Agent may move to another place in the world, depending on the current state of the neighborhood

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How many automaton rules are there?

- There are many rules (really?!)
  - How many rules we can create with a one-dimension world, two states, and a neighborhood or three cells
  - Number of Rules $= S^N = 2^3 = 8$
  - There are two possible ending for each rule $(S = 2)$, thus:

$$S^{S^N} = 2^{2^3} = 256 \; rules$$

  - If you spent 1 minute examining each rule, you will work for 4:15h

From chaos emerge organization

- Random start states can produce similar patterns

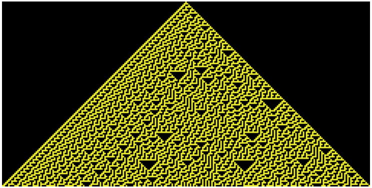

Figure: Single point start state

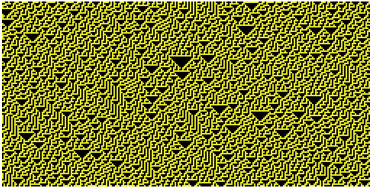

Figure: Random start state

The Game of Life

- Undoubtedly, the best-known cellular automata model is "Game of Life"
- It was proposed by John Conway
- Game of life can form different, interesting, patterns

Interesting, but where we can use that?

- Computer processors
- Cryptography (Rule 30)
- Random number generation
- Error correction coding (hardware based)
- Fluid dynamics
- Social interaction
- Eletric power systems

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