Simulating and Exploiting Physical Forces in Computer Networking

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Motivation

Transpose both analyzability and self-organized phenomena from physics (instead of living systems) to computer networking.

Approach

Online simulation of physical forces in a distributed physical virtual machine.

From Forces to Networking Services

Attractive forces *(Gravity, Electrostatics)* → Routing

Attractive forces *(Gravity, Electrostatics)* → Content-centric network

Repulsive forces (*Electrostatics*) → Load balancing

Metaphor

Particle : Packet

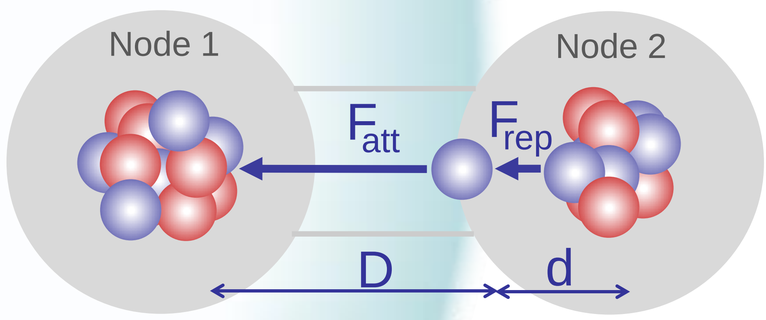
(Sub) space : Network node

Force : Execution rule

Time : Scheduled transmission event

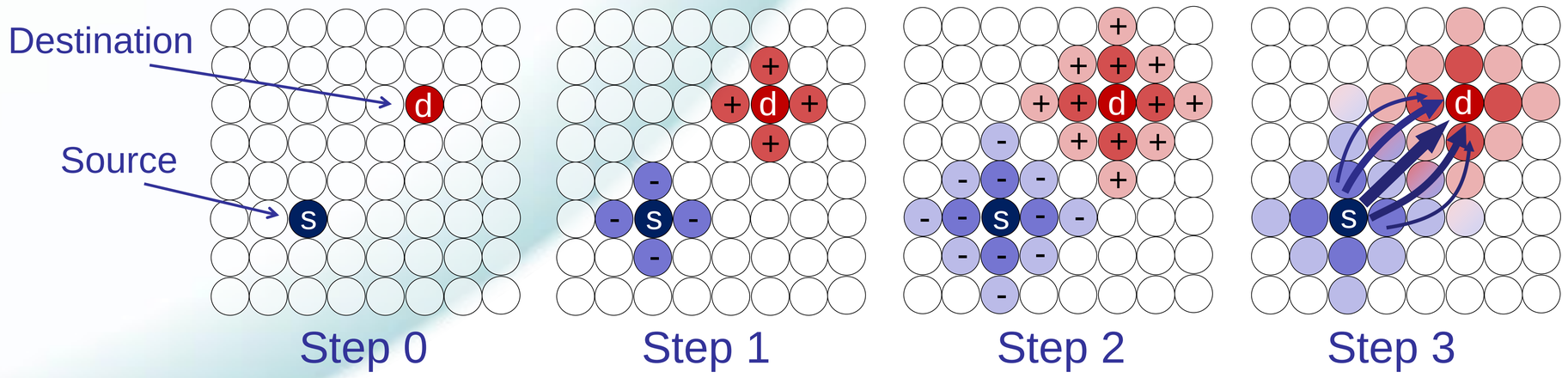
Current Implementation

Event system with stochastic transmission.
Scheduling adheres to Coulomb forces.



Routing and Load Balancing

A cloud of protons announcing the destination creates a pit.
Search electrons (packets) follow the gradient.



Our current simulation bases on a simplified Coulomb law and successfully demonstrates routing and load balancing.

Future

- Integration of energy, entropy and mass
- Extension to other types of forces
- Study of the behaviour of particles subject to competitive forces
- Design of a generic programming language for artificial physics

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FNSNF Swiss National Science Foundation

IWSOS 2011
Karlsruhe