A Case Study of Stochastic Path in a Distributed System

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The area: Density check and Gradient check in Path Finding

Distributed System

Fault Tolerant
Scalable
Lifelike

Path Finding

Automata Agent Behavior
Forward Pointer
Broadcasting

The problem is interesting

Micro World

Axon Growth
Percolation
Pheromone

Living World

Ant Colony Algorithm
Swarm Intelligence
Human Society

Cosmological World

Astrophysical

The problem is hard

Synchronizing

The Order of events

Difficult to form a cloud

Make prediction of real world

The problem is doable

Abstract of the real world

Simplify Agent Behavior

The framework of MFM

The model: interactions between automata agents

Request Element:

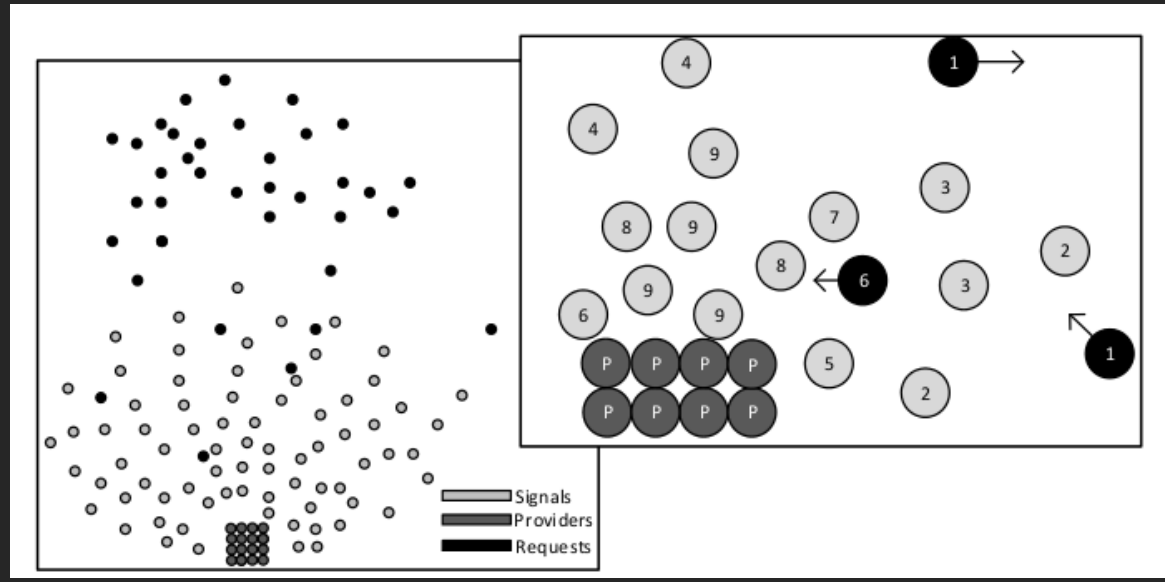
Search for service Providers.
Detect signals and move towards higher density.

Signal Element:

Works like pheromone.
Evaporation rate.
Form a cloud around sources

Provider Element:

Like an Ant nest.
Emit signals to indicate their locations.



Features

Simple(broadcasting)

Robust

Limitations

Works well only on small grid

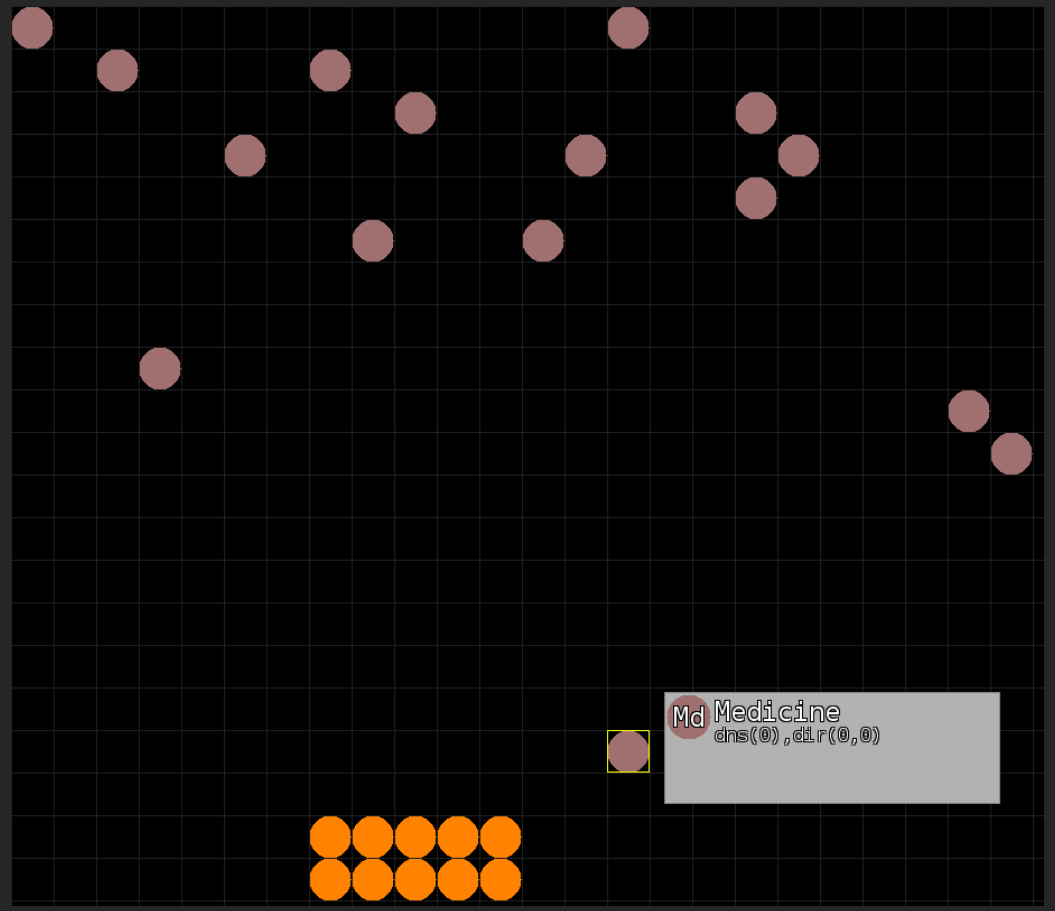
Cloudlike Shape is hard to achieve

Simplifications

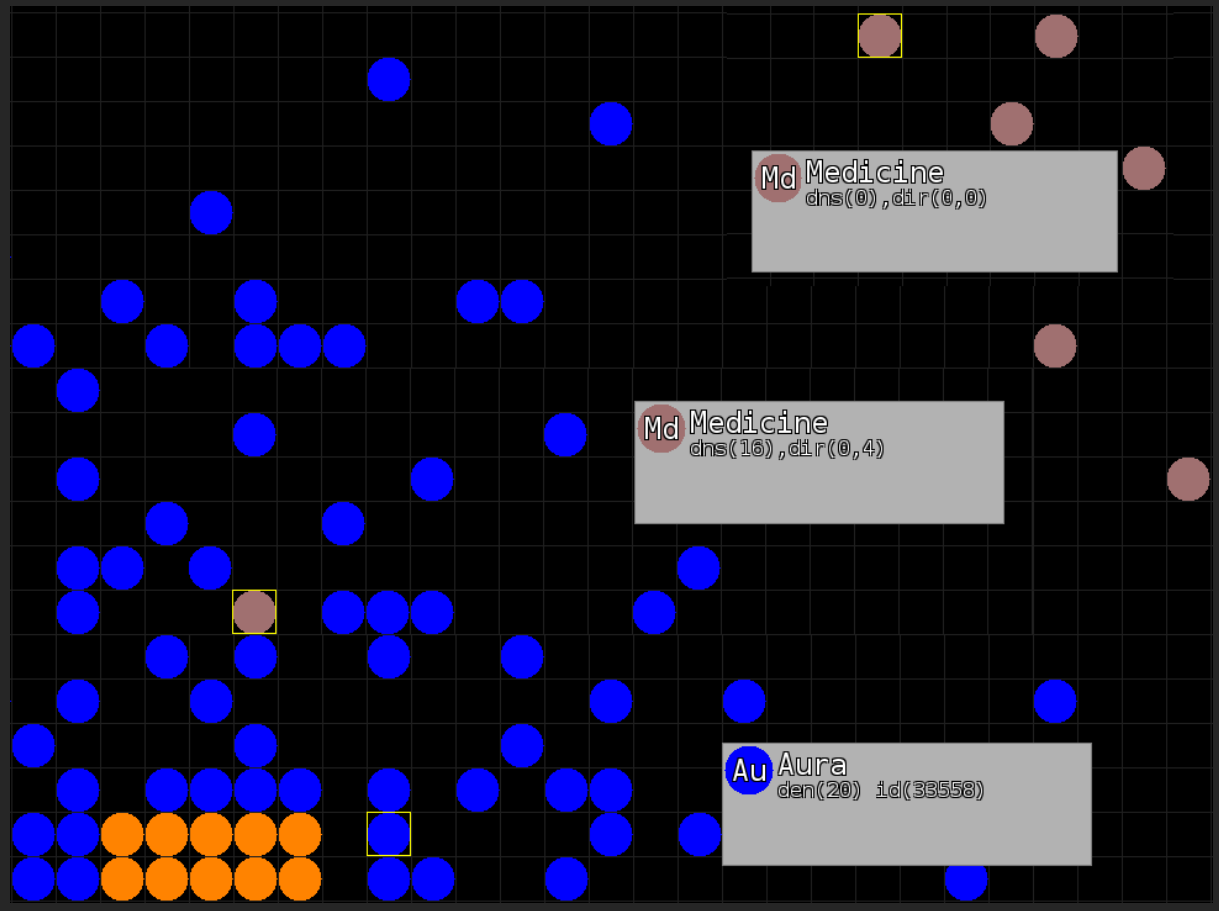
Density instead of Gradient

Experiment 1

Setup Baseline: Compare requests satisfied percentage



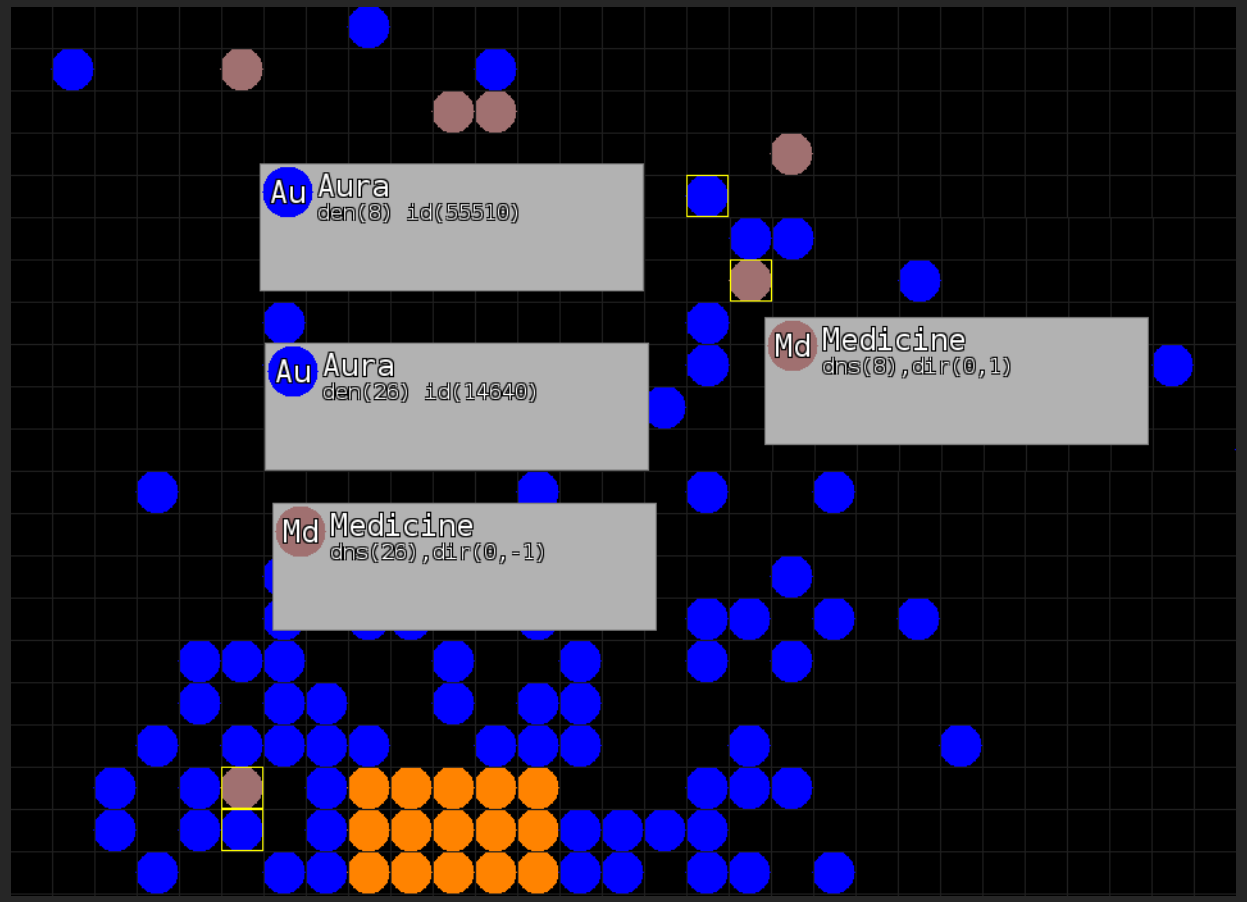
no signal



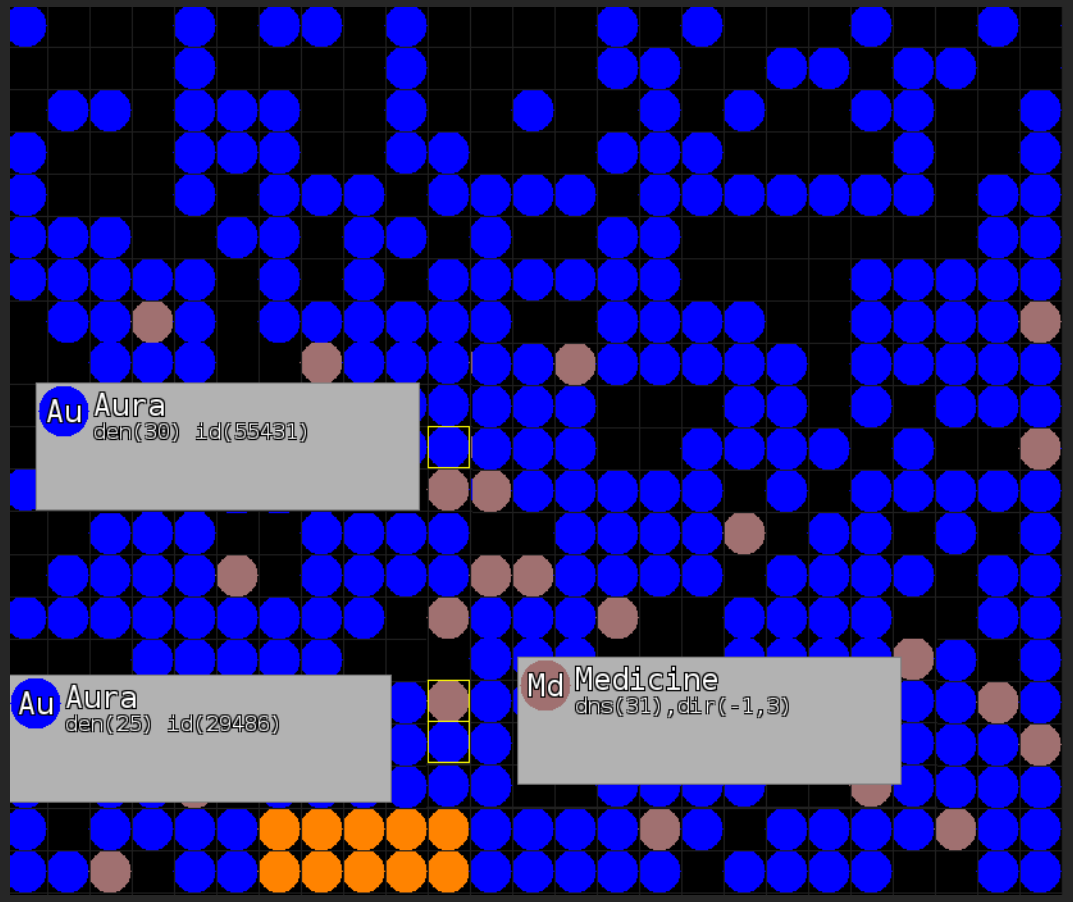
3% signal density

Experiment 2

Check requests satisfied percentage under various signal density

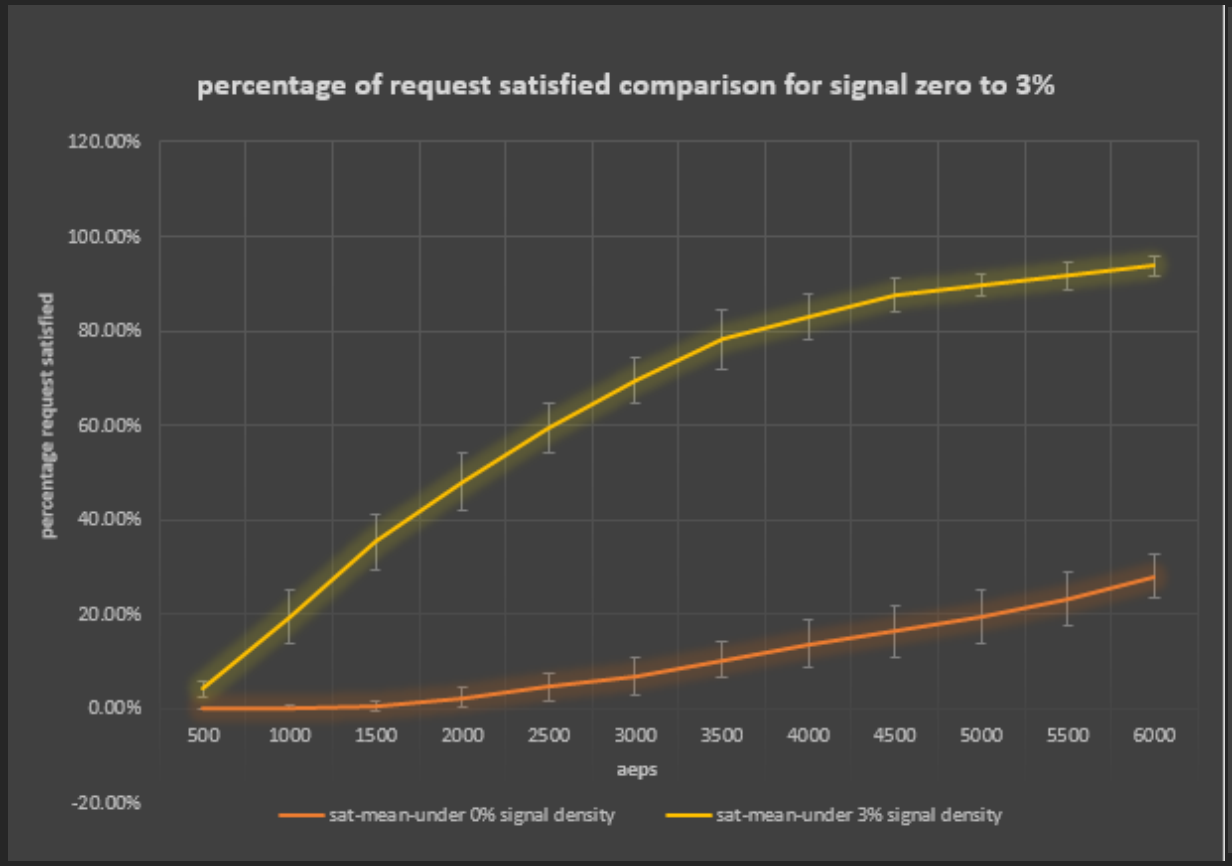


7% signal density

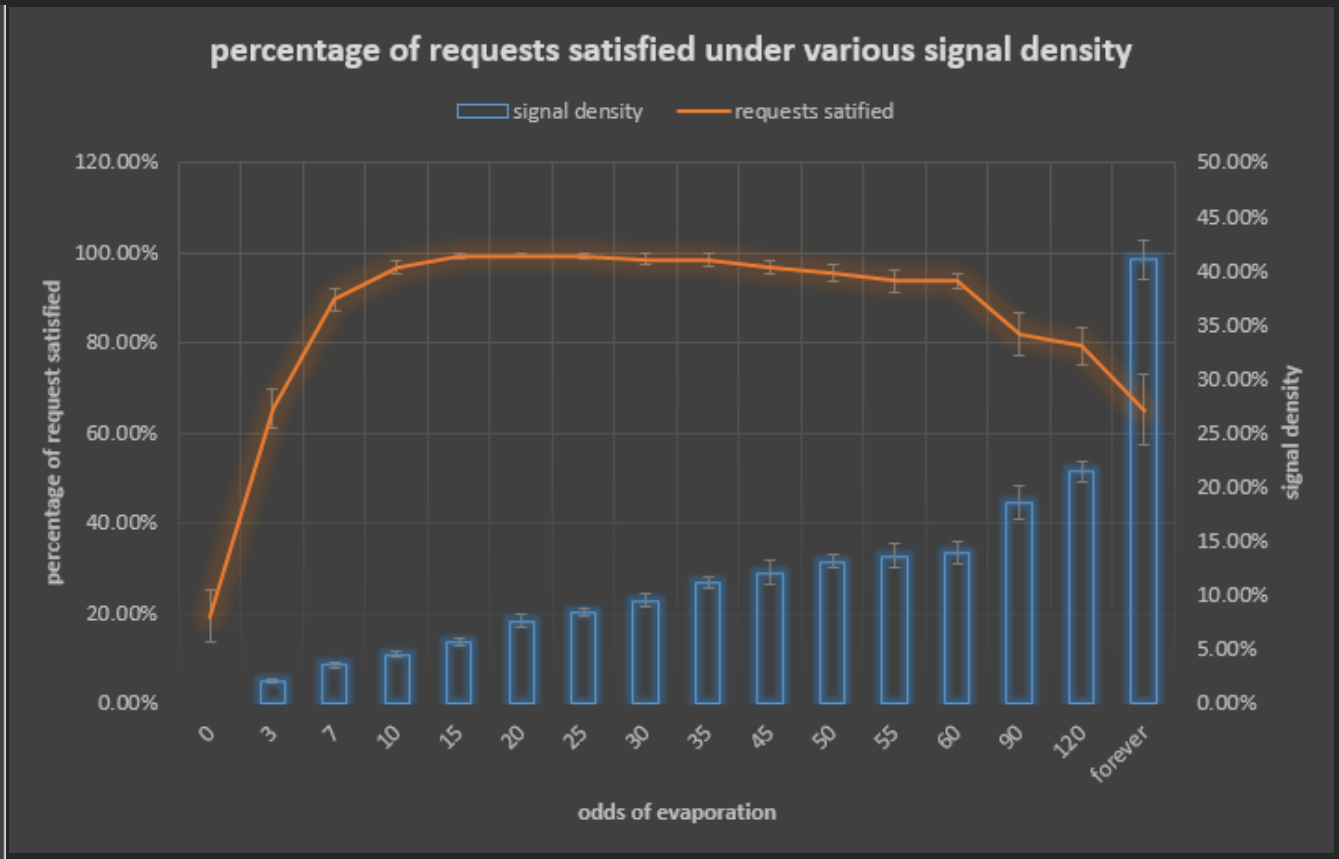


40% signal density

Result1



Result2



Recap what we have done

In this case study, we use a broadcasting idea to form stochastic paths in a distributed system

We observed the effects of different signal density on path finding for requests

By this case study, we get more understand about Artificial Life researches.

Conclusion

Path Finding in Distributed Systems can be implemented by the behaviors of automata agents without addresses or names.

Using density checks to form paths has some robustness.

Future Work

Tune element behavior to be scalable

Allow Providers to move

Some case studies on multiple Providers

Replace density checks with gradient checks

Thank you and have a nice Holiday!