A Cloud of road signs: Stochastic Path Finding in a Distributed System

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Abstract--**Inspired by matching problem, we present a model of long distance path finding in a distributed system. The experiments let the information requesters follow some stochastic paths to find information providers. Without global addresses, the experiments help to extend communication distances outside event-windows. This is a step towards a more robust distributed system.**

I. Introduction

II. Model Description

The simulation models a scaring dancing party with infinite women and men dancers. The two entrances are separated far away and each gate is reserved for only one gender. More horribly, the room is absolutely dark and silent. To increase the chances to be found and invited, women dancers are allowed to use a special perfume to indicate their positions. The goal is to let every woman dancer enjoy the party and let the left over men dance with other men.

Basic Elements

The model consists of the interactions of 3 elements:
Element_Man: Each Man dancer keeps searching for a partner. If he's lucky to bump into one woman, the pair will be teleported elsewhere. Otherwise he can smell the scent of perfume. However, he should make a decision to follow the scent or keep roaming.
Element_Woman: Each Woman dancer has to wait to be invited. But they can use a special perfume to indicate their position. Sometimes too strong scent will mislead Men dancers into wrong directions.
Element_Perfume: Perfume is the only medium that helps the matching process. Sometimes the perfumes will guide men away from women dancers. To avoid the misleading effect, perfumes should form a loose cloud surrounding the women dancers.

Path Finding

The path finding for requesters can be further broken into 2 phases: **Approaching** and **Following**.
Approaching phase:
The medium, Element_Perfume, is so simple that it doesn't have information about its own source. They just form a cloud around the sources so that to extend the visible range for the sources. This helps the requester, Element_Men, to approach the edges of possible source locations.
The requester, Element_Men, scans its event-window for any presence of Element_Perfume. If none found, he can use a memory of recently found perfume's offset as his next direction. He also counts the number of perfume atoms to avoid move into some places which have fewer perfume atoms. So hopefully, this can help the requester not to leave out of the cloud.

Following phase:
After a man has entered the cloud, he is surrounded by perfume scent. Memory of recently found perfume does not help. It's more difficult to find the right direction than when he is outside the cloud. If the density of scent forms a gradient that allows men to follow, they can have higher possibility to locate their partners. This requires the perfumes also keep a record of the number of neighboring perfumes. So that Men can estimate the chance of pairing by evaluating this number of neighboring perfumes of the next possible position.

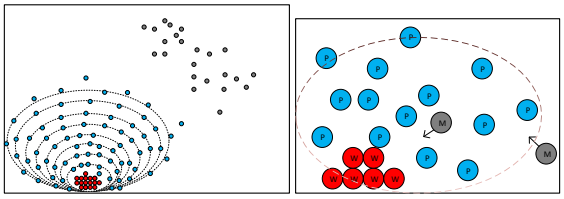

FIGURE1: approaching edge and following gradient