Protocol Description and Platform in Massively Multi-agent Simulation

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Motivation

- Social information system for people in a city
  - Mobile terminals enable to provide individual information.
- Our goal is verifying social information system using large-scale multi agent simulation.
Simulation Example:
Simulation of Large-Scale Evacuation Navigation System

Evacuation Navigation

All Info of Disaster Area

Controller

Navigation System

Virtual Disaster Area

Location

Navigation

Guiding Agents

Evacuee Agent

- The Evacuee Agent acts for human evacuee who is user of navigation system.
- An guiding agent instructs the corresponding evacuee.
- Controller gives evacuation navigation to guiding agents and observes situation caused by it.
Evacuee
Controller
Demo: Simulation of Large-Scale Evacuation Navigation System
Platform for simulation of dweller in city

- Requirements of Platform
  - Scalability
    - To perform simulations of virtual user on a city, simulation systems have to control a large number of agents that model human behaviors.
  - Describe Agent Scenario easily
    - Experts of application domain can easily describe agent scenario that reflect human behaviors.
Caribbean/$Q$: Massively multi-agent platform

$Q$ Language

Describe agent behavior as scenario

Caribbean

Large scale Agent sever

- Control agents with $Q$ scenario
  - $Q$ scenario describes how an agent should interact with its environment including humans and other agents.

- Caribbean/$Q$ has enough scalability to perform simulations of virtual user on a city,
Describe scenario in $Q$ Language

- Agent is defined by a scenario that specifies what the agent is to do.
- A scenario is used for describing state transitions.
- Cues and Actions
  - Cues are used to request agents to observe their environment.
  - Actions are used to request agents to change their environment.

![Diagram showing a scenario flowchart with states for Start, Goal is Undecided, Navigation, No Navigation, Unknown road, Move, Arrive at Goal, and End.](image-url)
Caribbean/Q successfully managed 1,000,000 agents

Q processing system is imported as Caribbean object and it is managed by Caribbean thread scheduler.
Evaluation

- **Cace1: Simulation of Evacuation Navigation System**
  - About ten thousands agents can execute 1 action per 1 second.

- **Cace2: Using Simple Action**
  - Caribbean/Q successfully managed 1,000,000 agents.
  - The increase in the number of agents does not affect the time to process an action.
Conclusion and Future Work

Conclusion
- We have realized massively Multi-agent simulation platform using Caribbean and $Q$.
- Caribbean/Q can manage 1,000,000 agents.

Future work
- User interface for large scale simulation system
- Apply other domain
  - Traffic control system
  - Navigation system in an amusement park
Thank you!!
Agents give personalized navigation to evacuees.
- e.g.) Agents navigate corresponding evacuee to hospital when the evacuee is injured. Otherwise agents navigate to near shelter.

Agents negotiate rescue with other agents.
- e.g.) Agents negotiate rescue with neighbor agents when the corresponding person can’t evade.