

Deployment of A-globe Multi-Agent Platform

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ABSTRACT

A-globe [2, 1] is a freeware, simulation-oriented multi-agent platform featuring agent migration, communication inaccessibility simulation and high scalability with moderate hardware requirements. Using dedicated simulation messaging together with 2D and 3D visualization support, large agent systems can be engineered, tested and visualized on a single machine. **A-globe** agents are fully-fledged JAVA agents, each with its own independent thread, that can autonomously migrate between platforms running on different hosts. Thanks to the separation of simulation and agent code, deployment of agents to embedded devices is straightforward. The platform is not natively FIPA-compliant, as the inter-operability was sacrificed to offer superior scalability and efficiency.

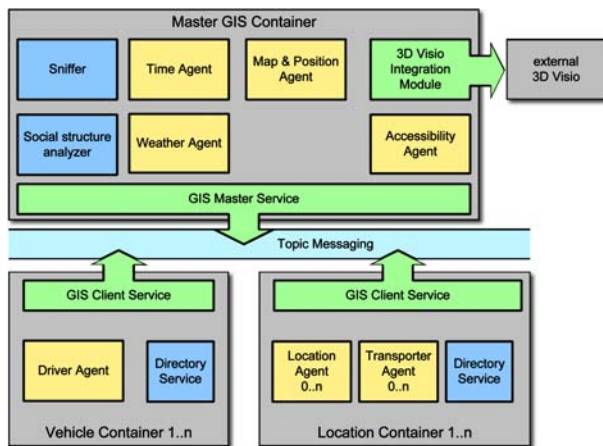


Figure 1: A-globe based simulation.

Categories and Subject Descriptors

I.2.11 [Distributed Artificial Intelligence]: Multiagent systems;
I.6.3 [Simulation and Modeling]: Applications

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General Terms

Performance, Design, Experimentation

Keywords

Multi-Agent Platform, Simulation, Visualization



Figure 2: ACROSS scenario visualization.

1. A-GLOBE SIMULATION SUPPORT

A-globe includes a special infrastructure for environmental simulation. Besides the *actor agents* that play roles in the simulated world, *environment simulation agents* (ES) are located in a dedicated master container. Instead of using messages, they communicate with actor agents by *topic messaging*, container-to-container messaging specifically reserved for environmental simulation, as shown in Fig. 1. Topic messaging is managed by GIS Service – a special **A-globe** service to which the actor agents subscribe to receive various topics. If such a topic is received by the container, it is distributed to all subscribed agents. Note that all agents in the container receive the same data, because the environment perception shall be identical for all collocated agents. In addition, the agents who wish to act on the environment can submit topics to the GIS service. These topics are then sent to all ES agents in the master container subscribed to receive the topic. ES agent can be responsible for nearly any simulation layer. However, *accessibility agents*, who control the existence of communication links between agent containers, occupy a privileged place between ES agents. **A-globe** message layer uses this information to actually prevent messaging between inaccessible nodes. Simulated accessibility can depend on many factors, typically including the distance.

2. ACROSS DEMONSTRATION

To illustrate the concepts of the platform design we will present the ACROSS scenario – Agent Complex Reasoning Simulation System that uses the *A-globe* features to create a relatively rich world where diverse types of agents can interact. A simplified economy on an island based on Java (Indonesia) geography is simulated, see Fig. 2 and 3. Currently, we use this scenario as a common base for multiple research targets, where we need to investigate interactions between a relatively high number of fully-fledged agents. In the scenario we solve a logistics problem in a non-collaborative environment with self-interested agents. Agents that are part of the scenario have no common goals and their cooperation is typically financially motivated.



Figure 3: Representation of physical cargo in the ACROSS scenario.

3. ATC DEMONSTRATION

Our second demonstration illustrates how agents can be used for the negotiation-based de-confliction in the Air-Traffic Control (ATC), Fig. 4 and 5. The agents are responsible for aircraft simulation and airways planning. The core of the system consists of (1) the server component – that simulates positions of aircraft and other objects in the simulated world, aircraft hardware, weather conditions, communication ranges; and (2) the plane component – agents simulating aircraft behavior. One of them – a *pilot agent* is the main control unit of the simulated aircraft handling negotiation-based de-confliction. It processes radar data and communicates with the respective pilot agent. Each plane has its own flight mission which can be time constrained.

The system has been integrated with three external geographical and tactical data sources available online: NASA, U.S. Geological Survey (USGS) and Geographic Names Information System (GNIS) database. The system also provides real-time 2D/3D visualization: either locally and/or via a remote web client running inside any compliant internet browser.

4. CONCLUSION

Both demonstrated systems illustrate unique *A-globe* features: superior scalability and efficiency, that allows us to define complex agent societies on restricted resources and advanced simulation support that clearly separates simulation and visualization from agent decision-making.

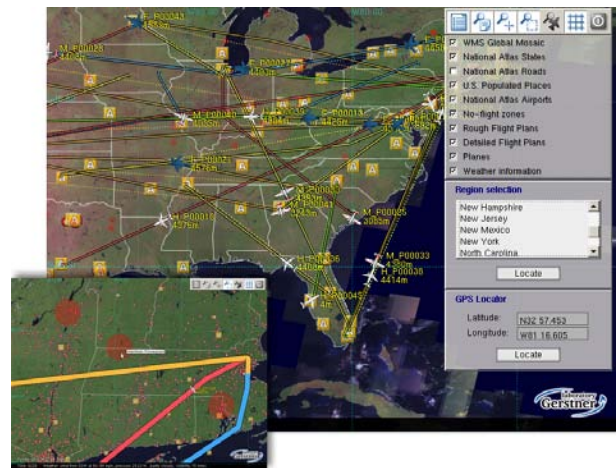


Figure 4: ATC system integrates several external data sources.

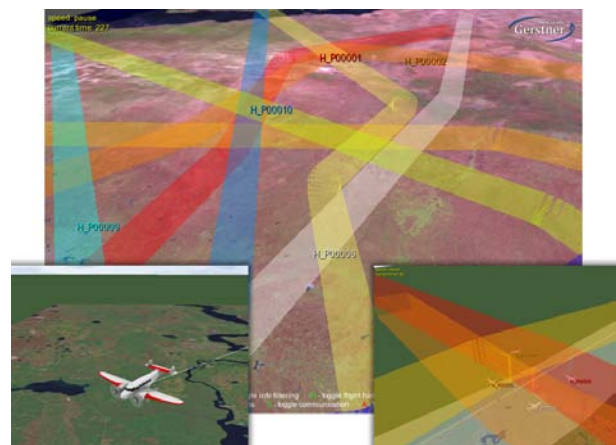


Figure 5: De-conflicted air-traffic control among several autonomous aerial vehicles.

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5. REFERENCES

- [1] A-globe. A-globe Agent Platform. <http://agents.felk.cvut.cz/aglobe>, 2006.
- [2] D. Šišlák, M. Rehák, M. Pěchouček, M. Rollo, and D. Pavlíček. *A-globe: Agent development platform with inaccessibility and mobility support*. In R. Unland, M. Klusch, and M. Calisti, editors, *Software Agent-Based Applications, Platforms and Development Kits*, pages 21–46, Berlin, 2005. Birkhauser Verlag.

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