



An Online Gaming Testbed for Peer-to-Peer Architectures

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Introduction

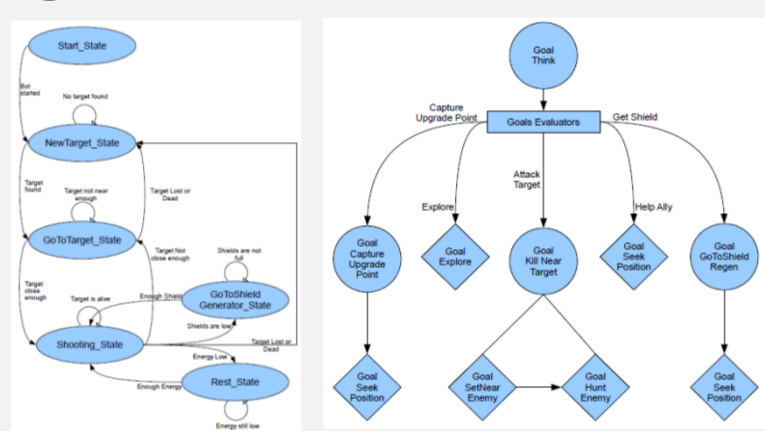
Goal: Provide a scalable testbed for P2P gaming mechanisms

Requirements:

- Gameplay representing a **real game**
- **Attractive** game to **real players**, which provide the reference behavior
- **Simple** enough for focusing on the important aspects
- Run in a **real network** as well as in a deterministic **emulated network** environment
- **Resource-efficient** for a good simulation scalability
- Well-defined and flexible **interfaces** to facilitate the replacement of network components

Bots

- Reproducible game workload generation
- Simulate human user behavior
- Implementations using finite state machines (FSM) or behavior trees (BT)

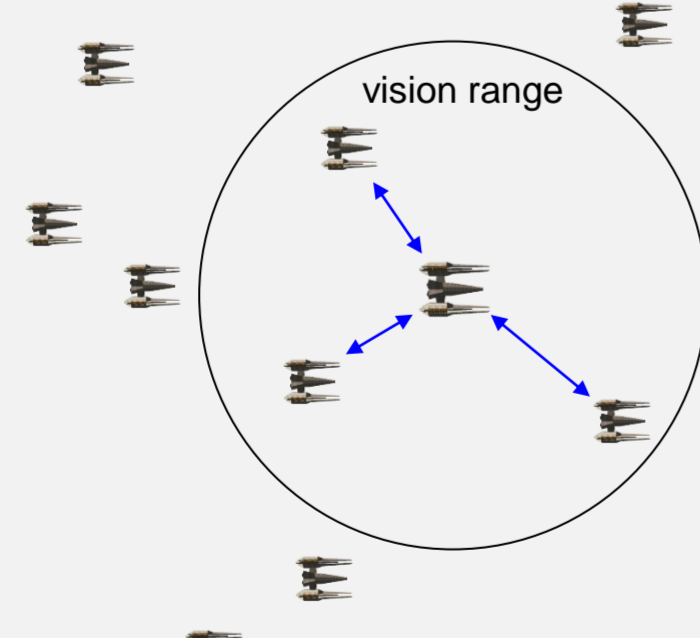


Gameplay

- Planet P14 is a prototype of a 3D real-time massively multiplayer online game
- Competing teams
- Asteroid field sets the effective game world: parametrizable, random-generated
- Points of interest (POI): bases, upgrade points
- Rewards for capturing bases

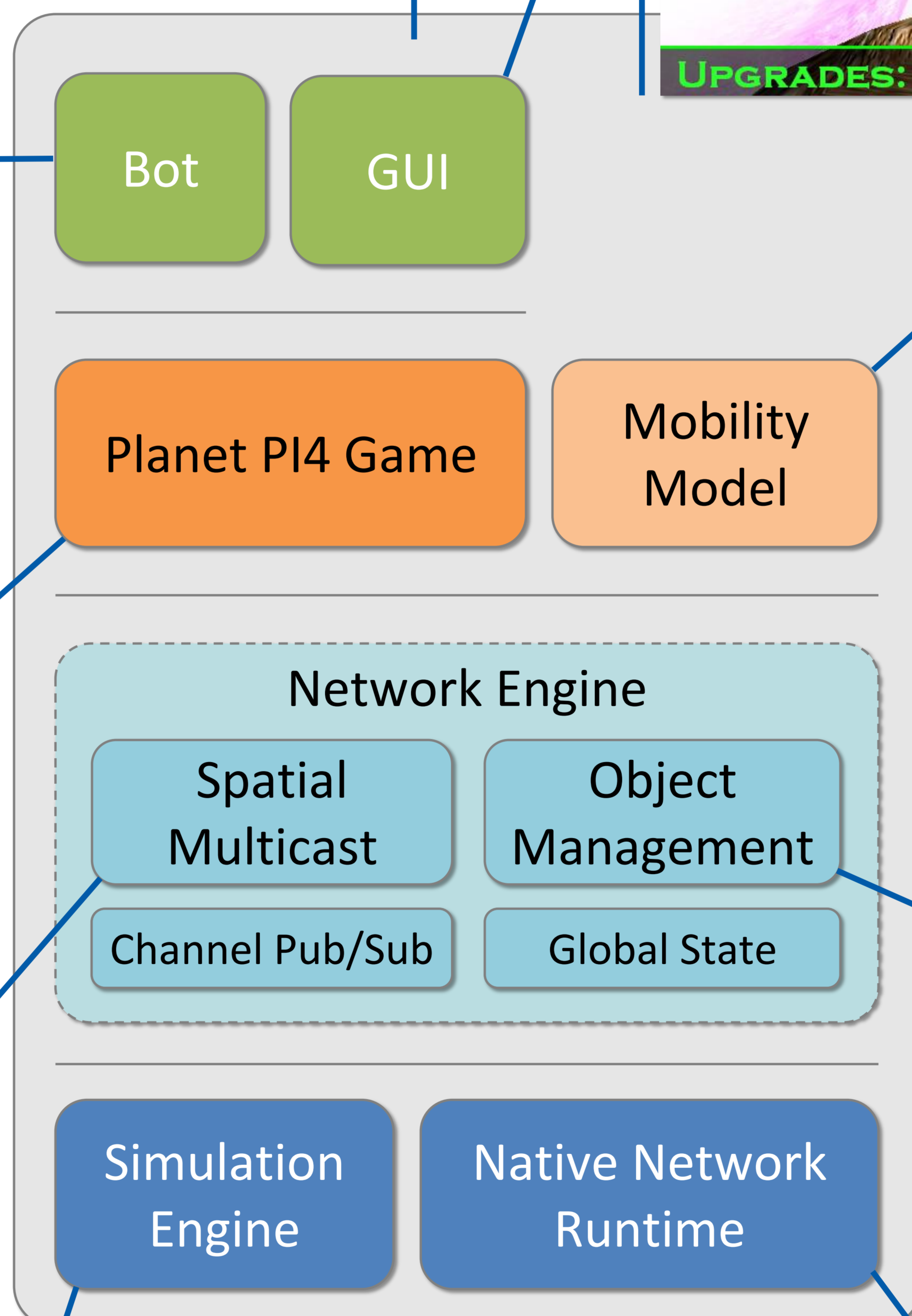
Network: Spatial Multicast

- Dissemination of game events in a spatial context
- Interest management and multicast
- Instances: VON [1], pSense [2], pSense-3D, client/server



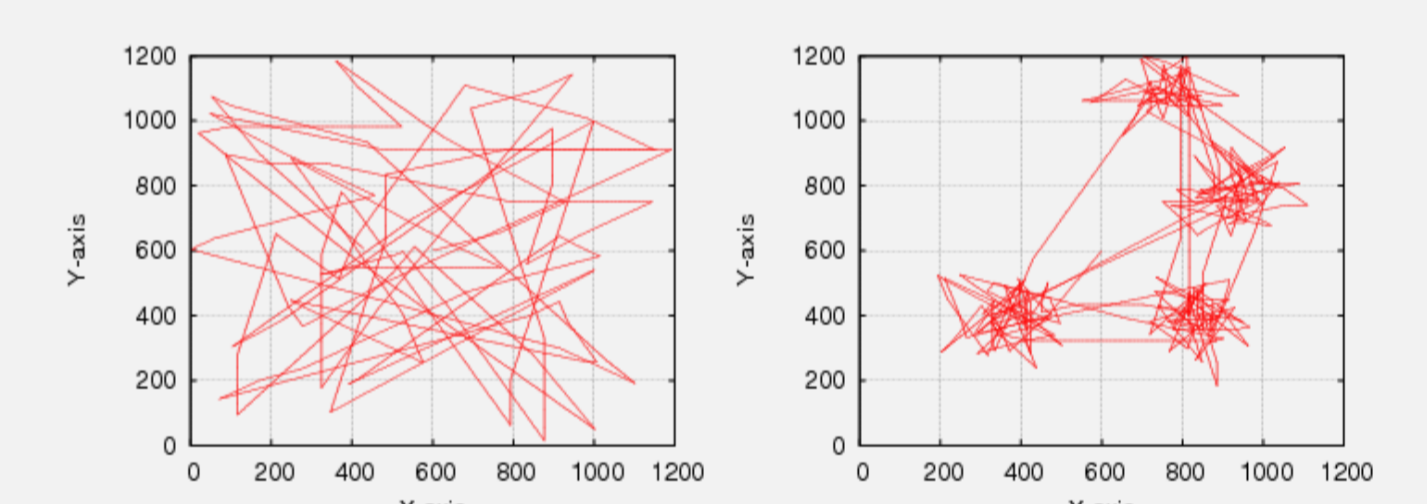
Simulation Engine [3]

- Discrete-event simulation
- Packet level network interface (UDP)
- Custom overlay simulator, alternatively ns-3
- Statistics interface, live plotting from SQLite database using gnuplot



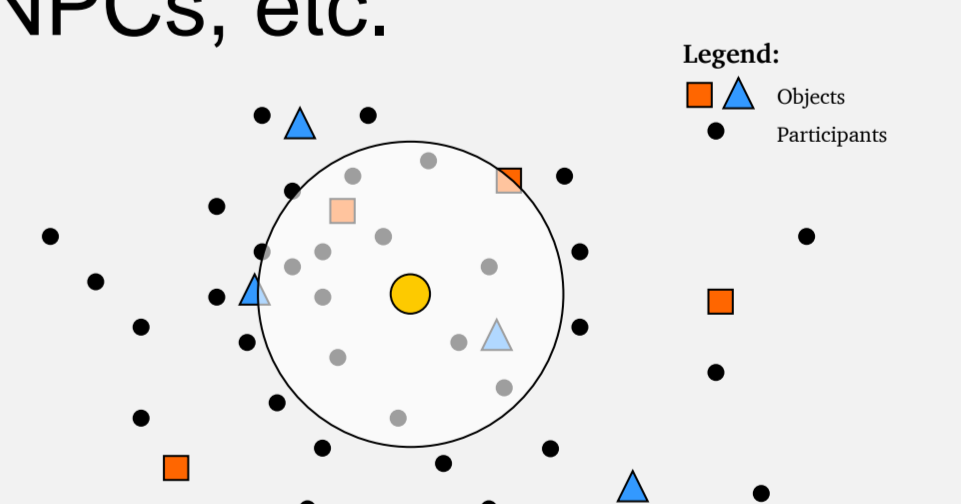
Simple Mobility Model

- Simple & lightweight
- Not simulating whole gameplay → higher scale, faster simulation
- Simple extensibility
- E.g. random waypoint model, special movement patterns, traces (other games)



Network: Object Management

- Persistent storage
- Object lookup
- Concurrent modification / synchronization
- Enables bases, NPCs, etc.
- Instances: Colyseus [4], VSM [5]



Native Runtime

- Real-time, real network
- For human players
- User studies: generate traces, calibrate bot behavior

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1. Hu S-Y, Chen J-F, Chen T-H. VON: a scalable peer-to-peer network for virtual environments. IEEE Network. 2006;20(4):22-31.
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3. Leng C, Lehn M, Rehner R, Buchmann A. Designing a Testbed for Large-scale Distributed Systems. In: SIGCOMM'11: Proceedings of the 2011 conference on Applications, technologies, architectures, and protocols for computer communications. 2011.
4. Bharambe A, Pang J, Seshan S. Colyseus: A Distributed Architecture for Online Multiplayer Games. In: Proceedings of the 3rd conference on Networked Systems Design & Implementation (NSDI'06). Berkeley, CA, USA: USENIX Association; 2006.
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