Multi-player Interactive Games over Wide-area Networks

Kai Shen
Dept. of Computer Science, University of Rochester

Some basics:
- A virtual 2/3-dimensional gaming space with many objects
- Player-initiated actions: moving your objects, attacking some other objects, etc.

Main challenges:
- Multi-player: may need to support a large number of players
- Interactive: real-time constraint in synchronizing the actions and their impact on the gaming space
- Wide-area network: limited network resources

Know your application!

What it is done right now? (my guess)
- A server and multiple client (each for a player); the server itself can also host a player
- All player-initiated actions get to the server and its impact is propagated to all players (with bounded delay, how much?)
- Actions can be aggregated when too many come too quickly

Any other ideas about how it works?
Scalability

- What are the potential problems when the number of players scales up?
- Network bandwidth connecting the server is the main problem
  - incoming or outgoing bandwidth?
- How to solve this?
  - multicast
  - distribute the server

Multicast the Outgoing Updates

- Difficulties:
  - real-time
  - consistency
  - Selective subset multicast

No native multicastsupport on the Internet at large now

Distribute the Server

How does each player know which server(s) to connect to?

Distribute the Server (cont.)

What if too many players move into a single region?

- dynamic load balancing, how?
Summary

- Main challenges:
  - Scalability to support a large number of players
  - Real-time interactivity
  - Limited network resources in wide-area networks
- Approaches:
  - Multicast the updates
  - Distribute the server: locating your server, dynamic load balancing
- If you propose a server distribution approach, what is the focus of performance evaluation?
- What we need for performance measurements (using simulation)?
  - We need network topology and link properties
  - We need workload - know your application, traces?