

# Game Server Selection for Multiple Players

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# Motivation (1 of 3)

- Many online games allow users to choose among multiple servers
  - Game company hosts servers
    - i.e. Blizzard's Battle.net (US East, US West ...)
  - Players host servers
    - i.e. Unreal Tournament, Quake, Doom
  - Even "centralized" services allow player "server" choice
    - i.e. Madden NFL Online
- Server configuration matters
  - Specific version may be required
  - Add-on software may be required (i.e. PunkBuster)
  - Server can become full
  - Game configuration can be important (i.e. map, spawn time, friendly fire...)



# Motivation (2 of 3)

- Even if all server conditions met, network performance matters
  - Internet latencies vary (50 ms to 1000 ms)
  - Latency impacts player performance [Armitage 2003, Beigbeder et al. 2004, Nichols et al. 2004, Pantel and Wolf 2002]
- Selection of a close, fast server important for good online game play



# Motivation (3 of 3)

- Problem compounded for geographically separated players that want to play together
  - i.e. Play from here in NYC with friend in Seattle
  - Friends and family for on-line gaming
  - Formalized teams (clans) compete against other teams
- Server in New Jersey that is good for player in NYC may be bad for player in Seattle
- Challenge find a game server that performs well for 2+ geographically players that want to play together



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# Outline

- Motivation
- State of the Art
- Server Selection
- Evaluation
- Summary

(done) (next)

### State of the Art -Server Selection for One Player

- Player chooses a game server via *server browser*
- Server browser contacts "well-known" master server (specific to each game)
  - Quake II satan.idsoftware.com
  - Half-Life half-life.west.won.net
  - Quake III master3.idsoftware.com
  - Doom 3 idnet.ua-corp.com
  - Obtains list of active, individual game servers
- Estimate latency to each active game server
  - Browsers sends application level "ping" to game server
  - Return ping packet provides info on game type
- Server browser allows player to sort
  - By number of players, game type, ping time ...
- Player selects game, then launches game



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## State of the Art -Server Selection for Multiple Players

- First, need external mechanism
  - i.e. IP phone, IM
- Each player proceeds normally as for single player
- Manually compare server lists
  - Iterative, trial and error
- Time consuming (minutes!) and error prone (good enough!)



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### Server Selection for Multiple Players

1) One player is host. Launches host program.

- Selects game options of interest
- Host then goes into listening state
- 2) Each client connects to host IP
- Server builds qstat command for clients
  - i.e. qstat -q3m,68 master3.idsoftware.com -R -P
  - i.e. qstat -q3s 216.12.96.41:27960

3) Host sends command to each client
4) Client executes qstat command
5) Client sends response data to host
6) Host parses data, filters results
7) Host selects game server (more later)

- 8) Host sends selection to each client with qstat command to launch
- 9) Clients launch game automatically



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### Selection Algorithm

1) Cull server data by removing problematic servers

- Unreachable by some clients

- Not enough free slots
- Incorrect game options (map, game type, ...)

2) Pick best performing server

- Currently, based on ping time only



### Best Server?

#### Lowest average ping

- Server A
- But bad for Player 8
- Set max ping threshold
  - i.e. 150 ms
  - Server B
- But want more "fair"
  - Server C
- We use lowest average ping
  - Future work to do other
  - e.g. could even handicap based on player skill

Player	Server A	Server B	Server C
1	24	74	95
2	17	62	89
3	41	100	92
4	35	51	88
5	18	84	96
6	27	44	87
7	30	122	93
8	272	71	94
Avg	58.0	76.0	91.8
Stdev	86.8	25.7	3.4



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(done) (done) (done) (next)



## Evaluation (Case Study)

- Quake III
- Host PC at WPI
- February 28, 2005; 14:00 (U.S. East Coast)
- 4 players (including host)

Player	Location	IP	ISP Connection
А	Hoorn, The Netherlands	82.217.15.247	Cable modem
В	Massachusetts, United States	130.215.239.33	T3
С	Kota Bharu, Malaysia	60.48.62.140	DSL
D	North Carolina, United States	67.77.3.251	DSL



### Server Ping Times for All Clients (A Big Mess)



## **Ping Distributions**



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А	Hoorn, The Netherlands	82.217.15.247	Cable modem
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### Comparison to State of the Art

- Manual best search through all servers (about 160), taking about 10 seconds
- *Manual first* lowest average among top 10
- Automatic best our approach

Method	Average Ping	Selection Time
Manual Best	$202 \mathrm{\ ms}$	6400 seconds
Manual First	$531 \mathrm{ms}$	320 seconds
Automatic Best	$202 \mathrm{\ ms}$	30 seconds



### Summary

- Server selection matters
- Current methods do not provided automated way for multiple players
- Manual selection slow and error prone
- Present an architecture for automated server selection
- Prototype shows proof of concept



### **Future Work**

- Many possible selection algorithms
  - Lowest average, fairest, thresholds ...
  - May be *per-game* or even *per-user*
  - Interact with latency compensation techniques
  - (Internet distance/coordinate maps may be relevant)
- Gather many more traces (i.e. PlanetLab)
- Care about application-to-application latency, so server load matters
- Incorporate improvements to single player server selection [Chambers et al. 2003]





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# Geographic Depiction

Political Map of the World, June 2003

