
Networked games: a QoS-sensitive application for QoS-insensitive users?

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Introduction

Why do we care about QoS?

- Apparently QoS is a requirement for next-gen networks
- There are lots of applications that require QoS

What are these applications?

- Multimedia conferencing?
 - ▶ Not that popular... (but Apple, AOL?)
- VOIP?
 - ▶ Reasonably popular...
- Networked games?
 - ▶ Very popular
 - ▶ But where's the QoS?

Outline

- Games —QoS requirements
- Our experiments —methodology
- Results
- What next?
- Discussion

Games

- Ever popular — *Spacewar* (1969) was networked
- Some market research (don't forget the salt):
 - ▶ \$1.5bn revenue / year (total games market = \$11bn)
 - ▶ 114 million players by 2006
 - ▶ 55 million “casual” players
- Three main genres:
 - ▶ FPS — *Half-Life, Quake, Doom*
 - ▶ MMORPG — *Everquest, Star Wars: Galaxies*
 - ▶ RTS — *Civilization, Age of Empires*
- Typically client-server, UDP
- Delay is most important QoS parameter

Requirements for games

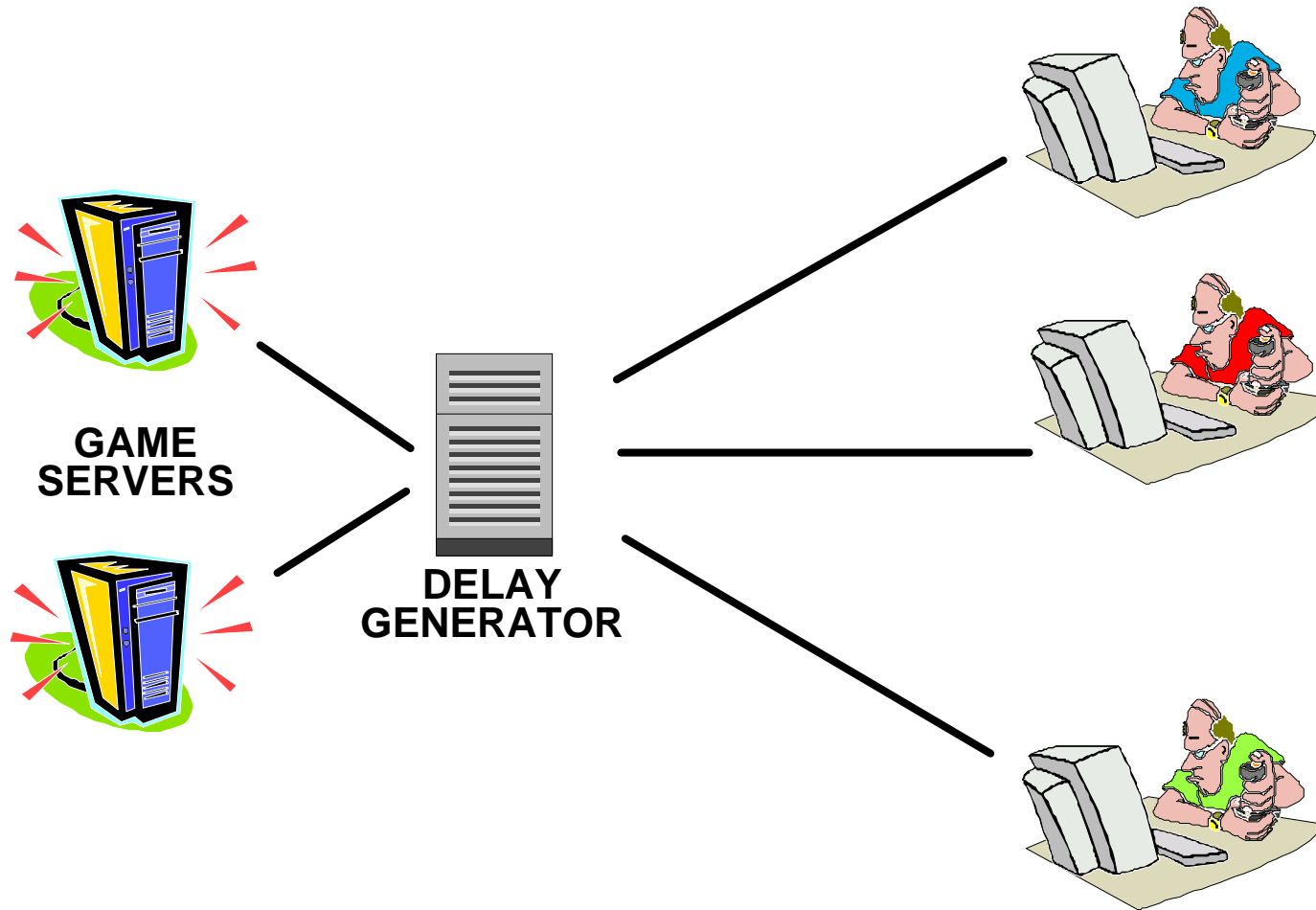
Delay is most important QoS parameter:

- Human factors
 - ▶ 200ms requirement for interaction
- DIS
 - ▶ 100-300ms for simulations
- VR studies
 - ▶ interaction difficult ≥ 225 ms
- Game studies
 - ▶ 100ms for racing games
 - ▶ around 150-250ms for FPS
 - ▶ 150ms for MiMaze

Experiments

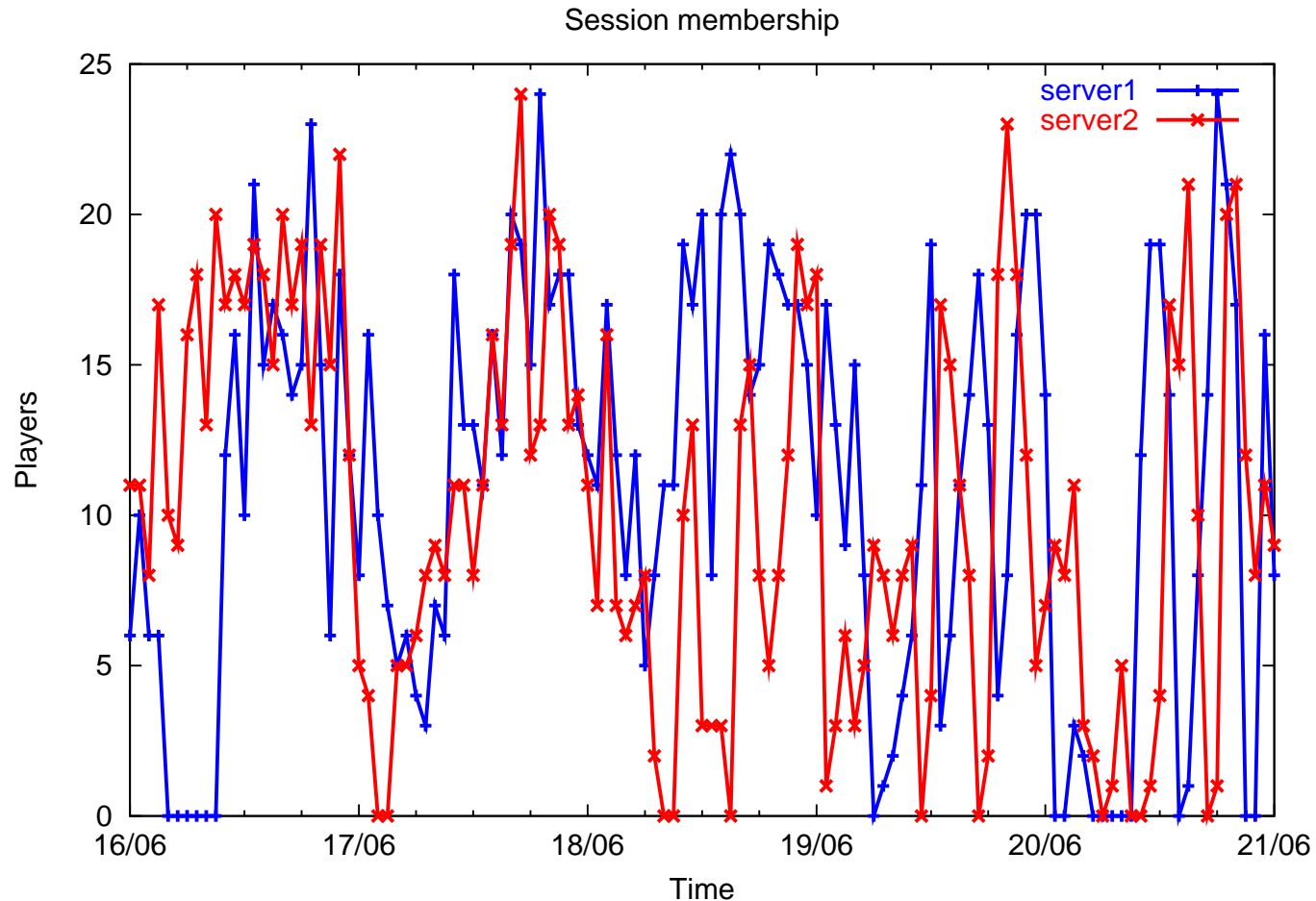
- Do players care about QoS?
- Can they notice?
- We can find out. . .
 - ▶ Set up some public game servers
 - ▶ Alter the QoS (delay)
 - ▶ See what happens
- How does delay affect:
 - ▶ Joining a server —are players dissuaded?
 - ▶ Leaving a server —are players annoyed enough to leave?

Methodology



- Two popular public *Half-Life* game servers
- One Linux gateway for adding delay

Joining a server



- With no additional delay, both servers are similar...

Leaving a server

- Add random amount of delay to all players on server
 - ▶ Add up to 250ms, i.e. $2 \times$ “tolerable” amount
- Players who leave tend to have higher delay
- Delay affects performance of players (kills/min)
- Amount of extra delay (as a %) has no significant effect
- Regular players no less likely to leave
- Duration has an effect —players who have played longer less likely to leave

Leaving a server (2)

- Does “relative delay” (player’s delay relative to others) have an effect?
 - ▶ Add delay to a subset of players on the server
- Seems to have little effect
 - ▶ Even though relative differences in delay have an effect on performance
 - ▶ Time again has an effect —players who didn’t leave in event of additional delay had been playing longer

"Conclusions"

- How important is QoS for game players?
 - ▶ Controlled experiments indicate players can notice 150ms and don't like 250ms
 - ▶ It appears they tolerate much more in the "real world"
- Might QoS requirements change over time?
 - ▶ Utility of application is not static over time
 - ▶ Can ISPs exploit this?
- Pricing/charging for QoS
 - ▶ Surveys indicate players unwilling to pay for QoS
 - ▶ If can't notice QoS, they will be even less willing to pay. . .

Future work

- Further experiments
 - ▶ Other QoS parameters
 - ▶ Other strategies for annoying players
- Different games
 - ▶ driving, MMORPG etc.
- Different environments
 - ▶ Mobile
- Modelling time-variant QoS
 - ▶ Cooperative users versus non-cooperative ISPs

Discussion

- What applications require end-user QoS?
 - ▶ Is choosing a QoS level an appropriate end-user decision?
- Will we ever see end-user QoS pricing?
 - ▶ What will it look like?
- Are users too accustomed to a free best-effort service?
 - ▶ Napster → no-one is paying for music
 - ▶ Console users, MMORPGs
- Should ISPs fool customers?
- Is dynamic QoS desirable/feasible?
 - ▶ Will users pay for it?