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 $\geq 225$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...
Joining a server (2)

Add some delay and people go away...
- 50ms seems to be enough to deter
Leaving a server

- Add random amount of delay to all players on server
  - Add up to 250ms, i.e. $2 \times \text{“tolerable” amount}$
- 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?