More on Latency and Game Playability

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Typical Latencies

- Latencies differ over different networks and the type of last mile access a user has can add a significant amount to the overall delay of data transmission.
- LAN latencies are low - typically 10ms or less
- Dial up modems - hundreds of msecs
- Cable and DSL - typically tens of msecs but can vary to 100msecs
- Backbone latencies within a continent are around 50msecs and cross continent can easily reach hundreds of msecs.
Impact of Latency

- Depends very much on the “game type”

- Player interactions can be very sensitive to latency - e.g., shooting an enemy with a rifle.

- Some game scenarios, such as amassing an army or moving troops over a terrain will not be affected as much by latency.

- Some latencies can be visually masked - e.g., large explosions, multiple shots/strikes (e.g., machine gun), a lot of activity such as a group attack on a monster.
Categorizing Player Actions

- Precision
- Deadline

The precision and deadline requirements for a player action determine the effects of latency on that action.
Precision

- Precision is the **accuracy** required to complete an action successfully.
- Precision is the **size** of a distant opponent and the player’s weapon/tool and its **target range**.
- E.g., sniper carrying a rifle shooting at a distant player vs a machine gun and an attack on a tank.
Deadline

- Deadline is the **time** required to **achieve** the final outcome of the action such as a lap in a race.

- Deadline is the **time** to **target** an opponent with a weapon or spell before the opponent moves out of range.
Further understanding of requirements

- The precision and deadline requirements are determined not only by the action itself but also
  - By the game’s *interaction model*, and
  - By the player’s *game perspective*. 
Interaction Model

The interaction model defines how a player interacts with the game world and is typically classified as either:

- the *avatar* model
- the *omnipresent* model
Interaction Models contd.

- In the **avatar model**, the player interacts with the game through a single representative character, and player actions are defined in terms of commanding it.
  - The avatar exists at a particular location in the virtual world and can influence only the immediate locality.
  - First-person shooter games, role-playing games, action games, sports games, and racing games are all examples of game genres with an avatar-interaction model.

- In the **omnipresent model**, players view and simultaneously influence the entire set of resources under their control. Real-time strategy games such as Rise of Nations and construction and simulation games are genres of this model.
Game Perspective

- Defines how a player views the game world on a screen.

- Games with the avatar interaction model typically have either a first-person perspective where the player sees through the eyes of the avatar or a third-person perspective where the player follows an avatar in the virtual world.

- The perspective used by games with the omnipresent-interaction model is often variable, giving players an aerial perspective or bird’s-eye view of the virtual world while also allowing them to zoom in to a third-person or even a first-person perspective for finer granularity of control over individual resources.
Precision - Deadline Game Requirements

- AVATAR, THIRD PERSON
  - Running
  - Casting Area Spell
  - Shooting Grenades
  - Combat
  - Drinking Health Potion

- AVATAR, FIRST PERSON
  - Shooting Machine Gun
  - Racing
  - Shooting Sniper
  - Combat

- Omnipresent
  - Exploring
  - Fighting
  - Moving
  - Building

Axes:
- Higher-Precision vs. Higher Deadline
- Lower Precision vs. Lower Deadline
Playability vs Latency for Different Interaction Models

Unreal Tournament 2003

Avatar, First-Person

Latency (in msec) vs Hit Fraction

Avatar, Third-Person

Latency (in msec) vs Combat Time

Car Racing

Madden NFL 2004

Avatar, First-Person

Latency (in msec) vs Time per Lap (in seconds)

Avatar, Third-Person

Latency (in msec) vs Yards Per Carry

Everquest 2, complete a fight

Warcraft III, build technology tree

OmniPresent

Latency (in msec) vs Build Time (in seconds)

OmniPresent

Latency (in msec) vs Unit Score Difference

Age of Mythology
Performance vs latency for different classes of online games

- **Omnipresent** (ex: RTS)
- **Third-Person Avatar** (ex: Sports, RPG)
- **First Person Avatar** (ex: FPS, Racing)
<table>
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Why do we need numbers??

For:

- **Game designers.** So they know the latency tolerances of different player actions, helping them apply latency compensation techniques, as needed

- **Network designers.** So they are able to create infrastructures providing quality of service (QoS) for online games and other interactive applications

- **Game players.** So they are able to make informed choices about their Internet connections and QoS purchases affecting latency and hence gameplay.
Reference