Latency Can Kill: Precision and Deadline in Online Games

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Is It Latency or Do You Just Suck?

Outline

• Introduction (done)
• What is latency for games? (next)
• Why does it matter?
• How much does it matter?
• Do you have evidence?

What is Network Latency?

• Latency - time to get from source to destination
  → There and back (round-trip time)

Why Does Latency Matter?

Affects responsiveness
Example of Unresponsiveness

Player is pressing left

Player is pressing up

Running back goes out of bounds! Player curses

Example of State Inconsistency

Why Does Latency Matter?

Affects consistency

Why Does Latency Matter?

Affects fairness

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How Much Does Latency Matter?

Depends upon precision of action
How Much Does Latency Matter?

Depends upon deadline of action

Game Perspectives

First Person Linear

Third Person Linear

Omnipresent

Third Person Isometric

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• Do you have evidence? (next)
  – Methodology
  – Results

Methodology (1 of 3)

• Goal:
  – Vary: precision & deadline of actions
  – Control: latency
  – Measure: performance
• Modify open source game
  – BZ Flag

Precision and Deadline

Player Performance vs. Latency

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Methodology (2 of 3)

- Varying precision – tank size
  - Larger tanks means precision
- Varying deadline – bullet speed
  - Slower bullets means looser deadline

Steps:
1. Made changes
2. Verify and validate
3. Determined game length, number of iterations
4. Ran experiments
5. Analysis

Methodology (3 of 3)

- 8 computer-controlled tanks (bots)
- 2 hour runs

<table>
<thead>
<tr>
<th>Factor</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank Size</td>
<td>0.25x, 0.50x, default, 2x, 4x</td>
</tr>
<tr>
<td>Bullet Speed</td>
<td>0.25x, 0.50x, default, 2x, 4x</td>
</tr>
<tr>
<td>Latency</td>
<td>0 ms, 100ms, 500ms, 1000ms</td>
</tr>
</tbody>
</table>

Results for Precision (Tank Size)

Generally, higher precision affected more by latency

Results for Deadline (Bullet Speed)

Generally, tighter deadline affected more by latency

Summary

- Latency can kill (your fun!)
  - Responsiveness, Consistency, Fairness
- Amount depends upon player action
  - Precision – accuracy required to complete action successfully
  - Deadline – time required to achieve the final outcome of action
- Effects grouped based on perspective
  - First-person avatar
  - Third-person avatar
  - Omnipresent

What to Do About It?

- Network improvements
  - Shift latency “left”
  - But mobile, wireless emerging!
- Server selection
  - Shift latency “left”
  - But limited selection and/or want to play with friends!
  - And want more players (1000 v 1000!)
- Latency compensation techniques - help “deal with it” (so the player doesn’t have to!)
  - Shift curves “up”
  - But often tradeoffs (e.g. consistency and responsiveness)