Better QoE for Cloud-based Game Streaming

Traditional

Client

Player input

Cloud-based

Game frames

Thin Client

Cloud Servers

server

Lag can kill! (your fun)

Response time

User Input

Message: User Input

Process Input

Display World

Game World

Time

Time Warp

Δt

Opponent

Current position

Position when player acted

Player

Degrades responsiveness

Network   Client Computer

Rate

Time

Video Stream

Buffer   Video Playout

A

B

Need latency compensation!
Need buffering for smoothing jitter!

Methodology

- Build latency compensation & buffering
- Evaluate with user study experiments
  - ✓ Measure and model benefits
- Provide API for game developers
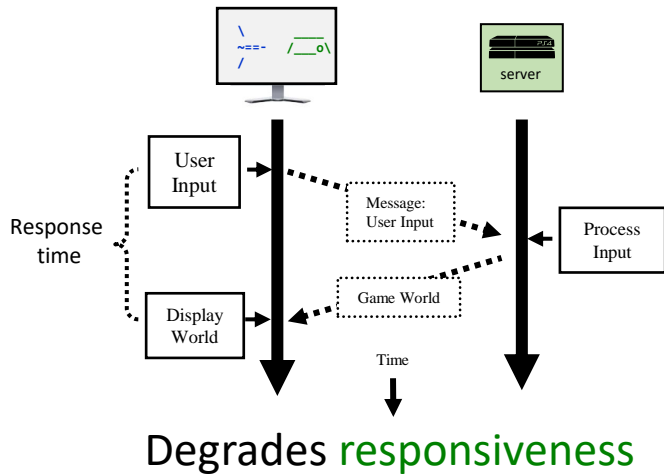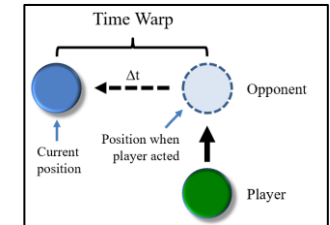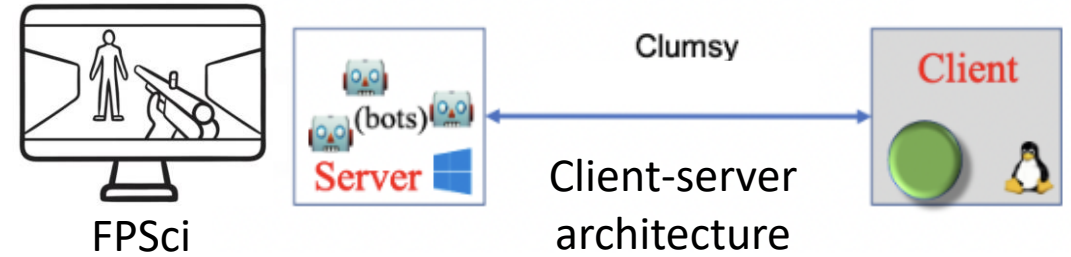- Build game to demonstrate
- Deploy to **Cloud/Testbed**

UNREAL ENGINE

unity

Thin clients

Cloud Tracker

Network Games

Mark Claypool

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First-Person Science - Exploring FPS Games and Latency

Degrades responsiveness

NVIDIA

Lag can kill! (your fun)

FPSci

Clumsy

Client

(bots)

Server

Client-server architecture

Need latency compensation!

Time Warp

Δt — Opponent

Current position — Position when player acted — Player
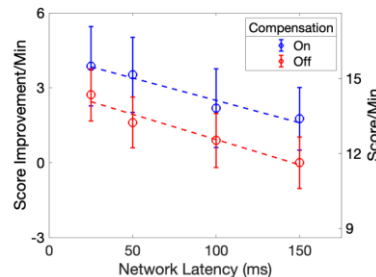
Methodology

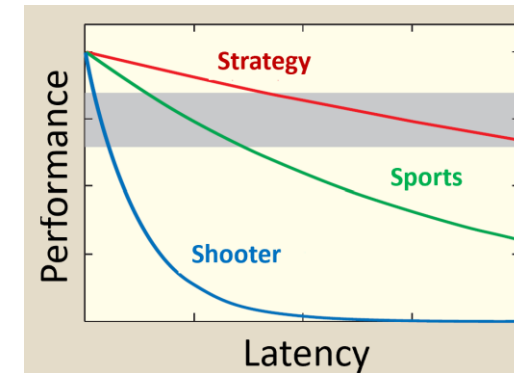**UNREAL ENGINE**

C++

g3d

unity

- Build network game
- Add latency compensation
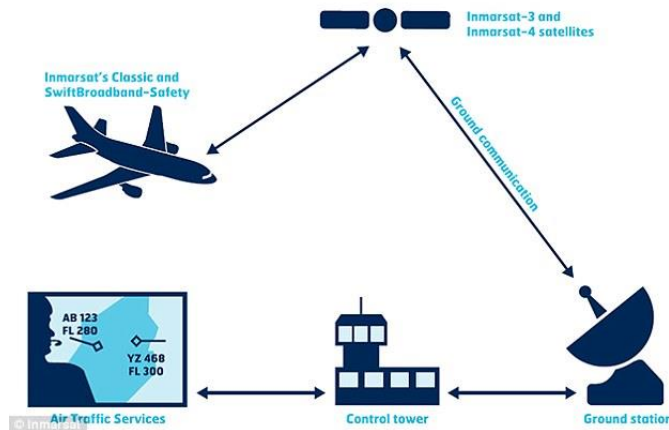- Evaluate with user study
- Analyze
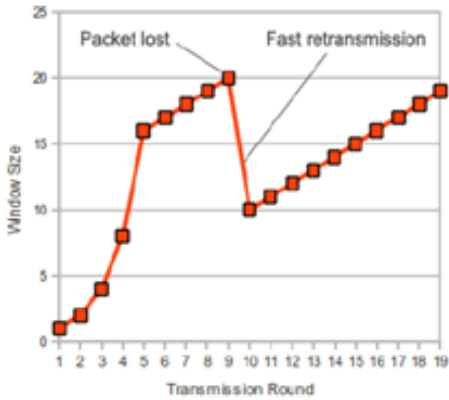
Lag Can Kill

Latency and Games Research

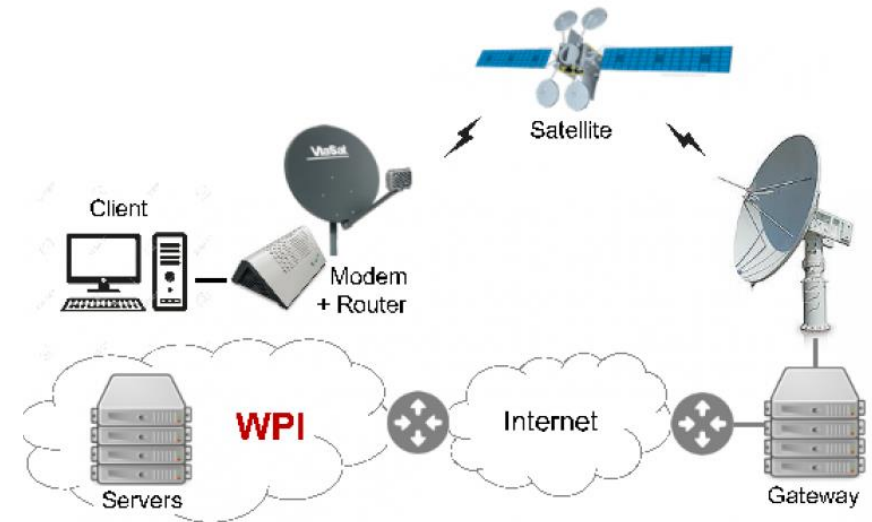## Mark Claypool

claypool@cs.wpi.edu
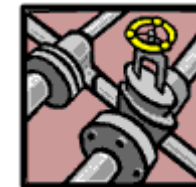
TCP/QUIC Performance

Suffers when high round-trip time → **Satellite Internet**!

Satellite Testbed

Methodology

1. Read and discuss research papers on networking
2. Design and run experiments (programs sending network traffic)
3. Analyze the data (stats and drawing graphs)
4. Improve congestion control algorithms
5. Repeat 2-4, as needed → publish!

Congestion Control Research Group

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