Games and Frames: A Strange Tale of QoE Studies

UNIVERSITÄT DUISBURG ESSEN

Open-Minded

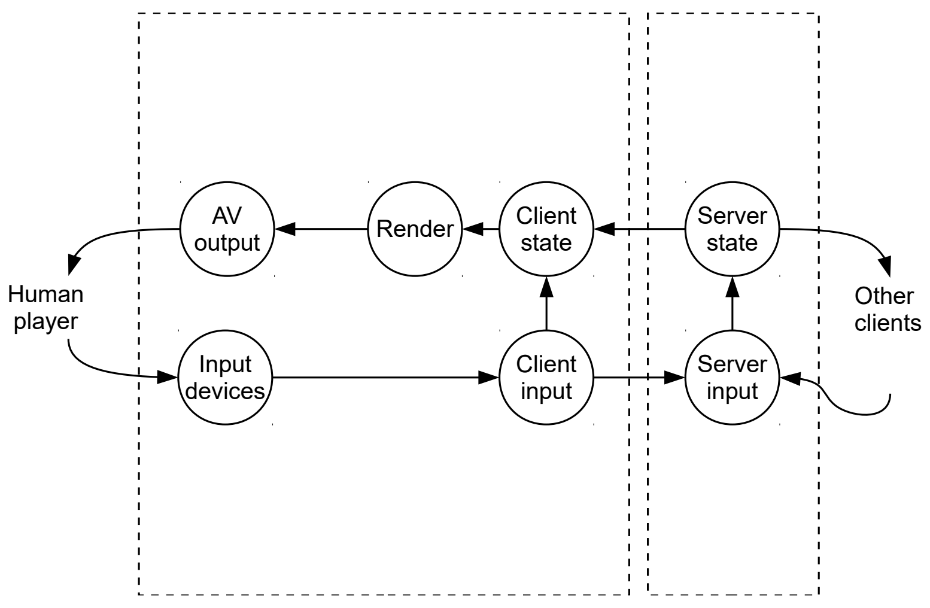
Florian Metzger*, Tobias Hoßfeld*, Albert Rafetseder†, Christian Schwartz
* Chair of Modeling of Adaptive Systems, University of Duisburg-Essen, Germany
† NYU Tandon School Of Engineering, New York, United States of America

Motivation

- Increasing research interest for video game QoS/QoE
- Past approaches treated video game QoE assessments similar to video streaming
- Networked video games have difficult-to-understand interlocked mechanics (frame and tickrates, lag, ...)
- Singular focus on network delay
- Need for a better theoretical understanding of these mechanics

Frame- and Tickrates

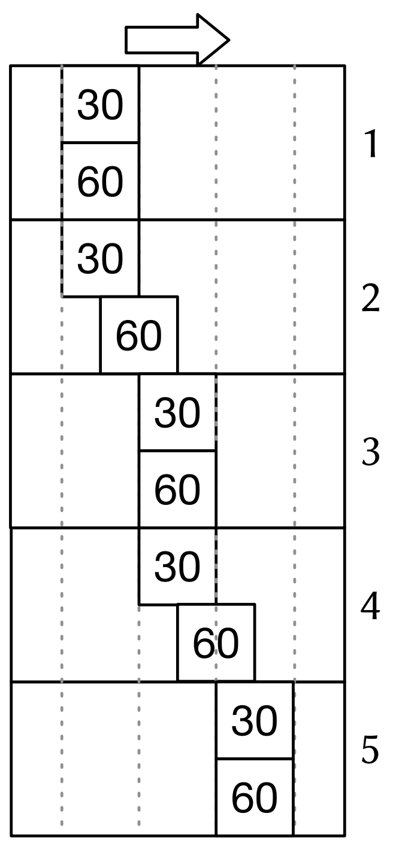
- Framerate and tickrate governings factor in input latency
- Independently clocked processes in networked games



Issues of Past Studies

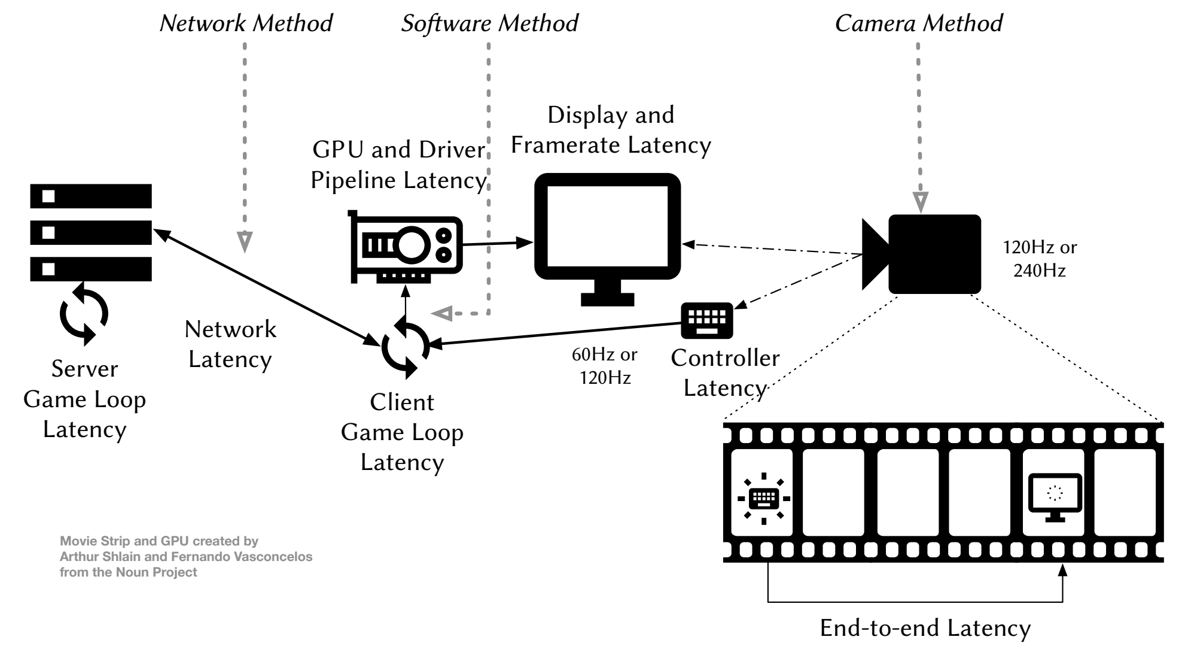
Examples of issues in past gaming QoE studies:

- Framerates insufficient for motion perception (3, 7, 15Hz), also increasing latency; but still observing acceptable quality
- Wrong choice of metrics (e.g. timescale-wise)
- Lack of training sessions and too short observation period
- No understanding of core gameplay mechanics
- Inability to generalize results from specific games



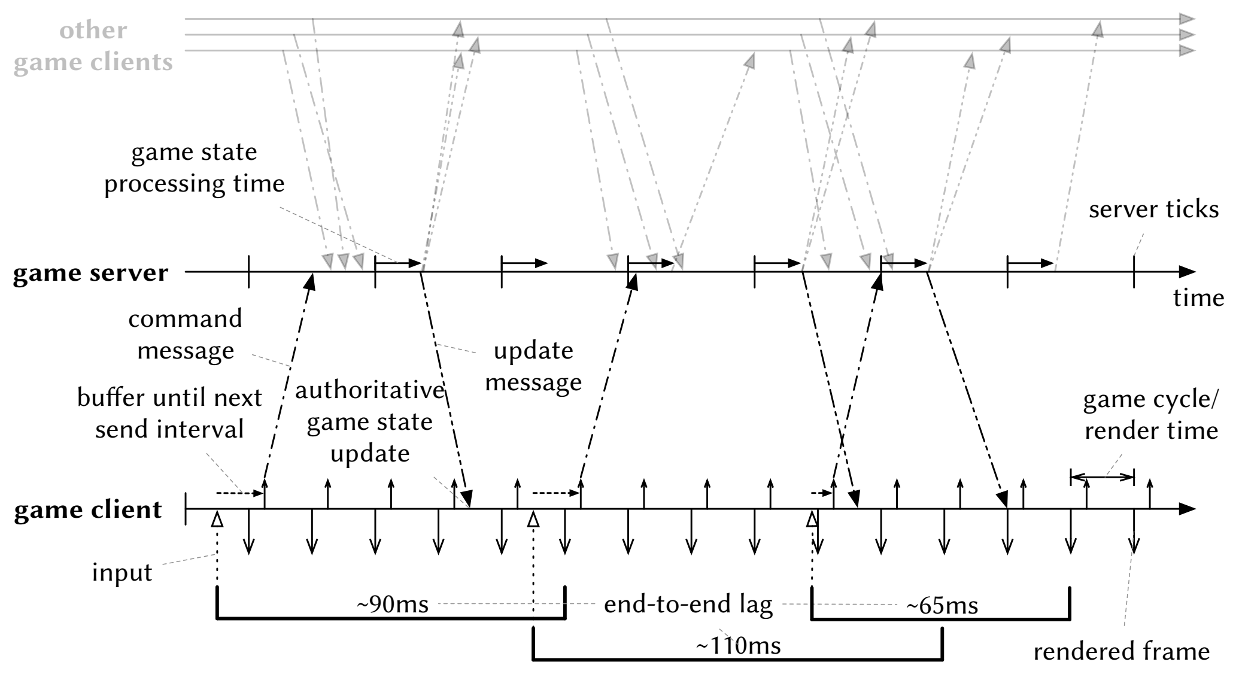
- Motion percption in video follows the concept of "apparent motion", kicking in at ~16Hz

Sources of Lag

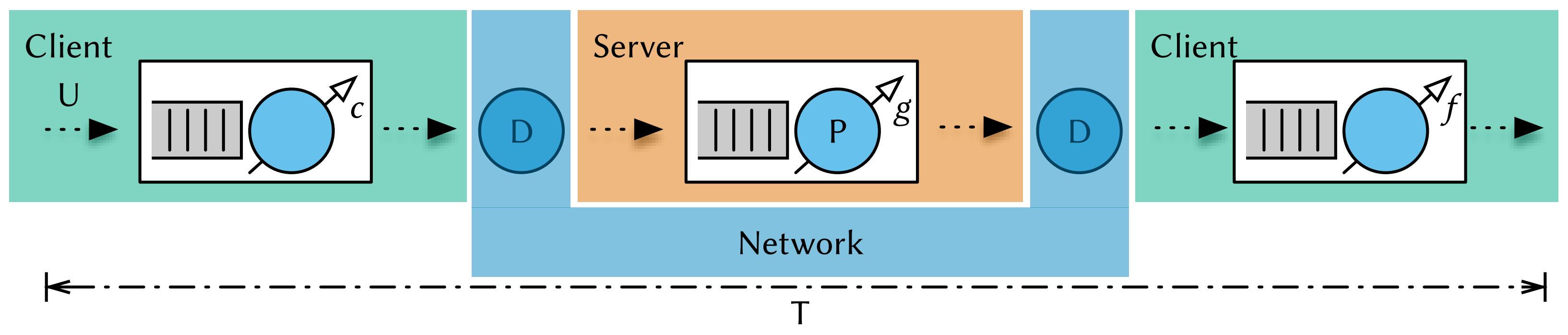


Movie Strip and GPU created by Arthur Shlain and Fernando Vasconcelos from the Noun Project

- Every game is influenced differently by lag and its sources
- Lag has different effects on gameplay
- Lag distribution through inter-arrival time distributions and clocked processes
- Different vantage points to observe lag



Modeling and Simulating Lag

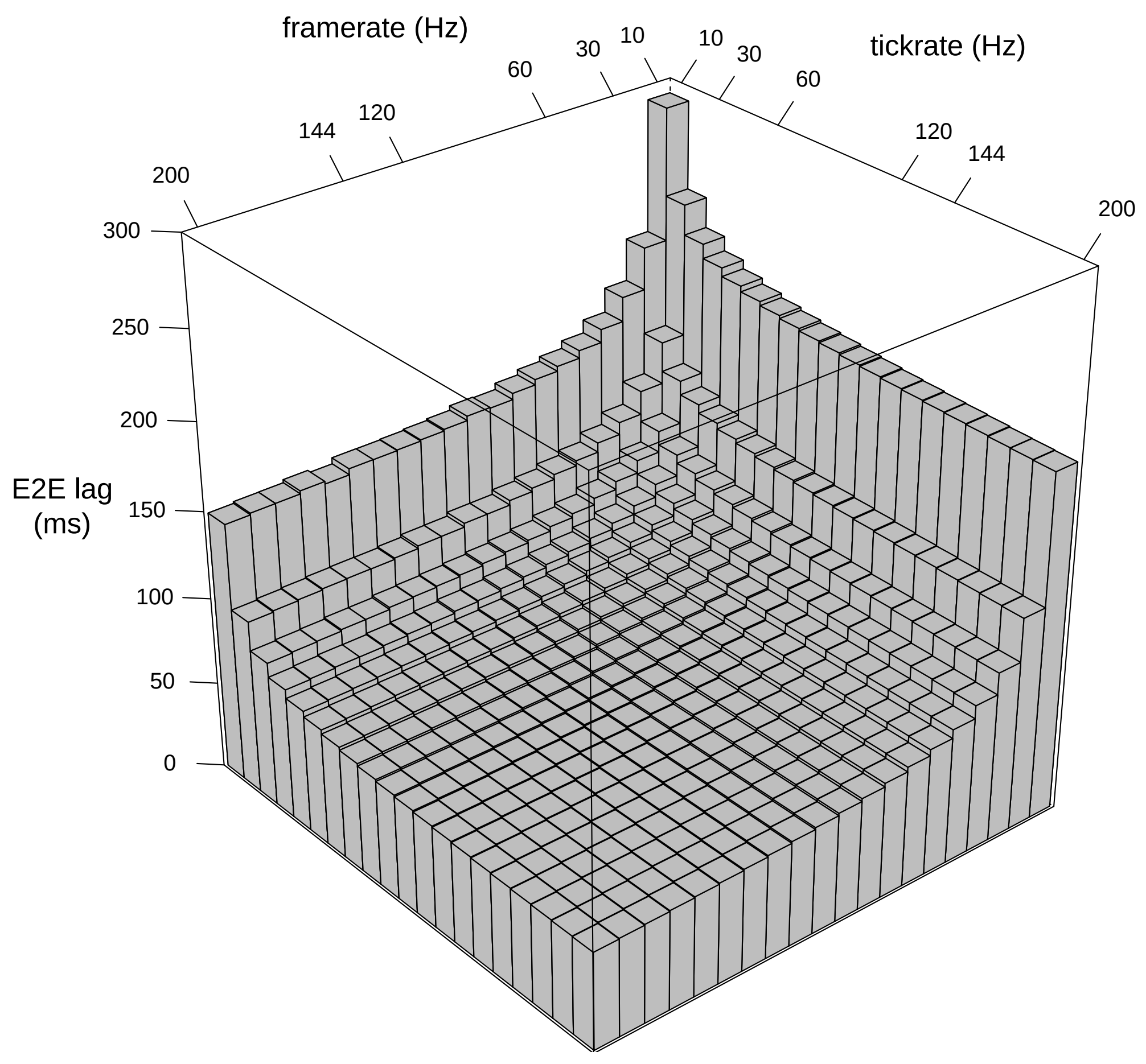


We model the End-to-End Lag from the various messages and rates intrinsic to the game. The E2E lag, highlighted at the bottom of figure, is the time elapsed between a user input event and the display of the event's results on the screen.

Using the online game event flow as a basis, we arrive at a queueing model for the end-to-end lag T that represents client input events U, the command rate c, a symmetric network delay D, server processing time P, server tickrate g, and the client framerate f.

This generic model allows mapping the above game types by adding or removing delay components. For instance, a local game requires no network and server-side processing, whereas a cloud game would model encoding and decoding delays.
The figure above represents a locally-running game (with no NW influence etc.).

Results



Further information, the full paper, all data as well as source code can be found at `https://github.com/mas-ude/onlinegame-lag-sim`, contact `florian.metzger@uni-due.de`, or just scan the QR-code.

References and Acknowledgements: