

TEE-based Scalable and Cheat Resistant Online Video Game Architecture

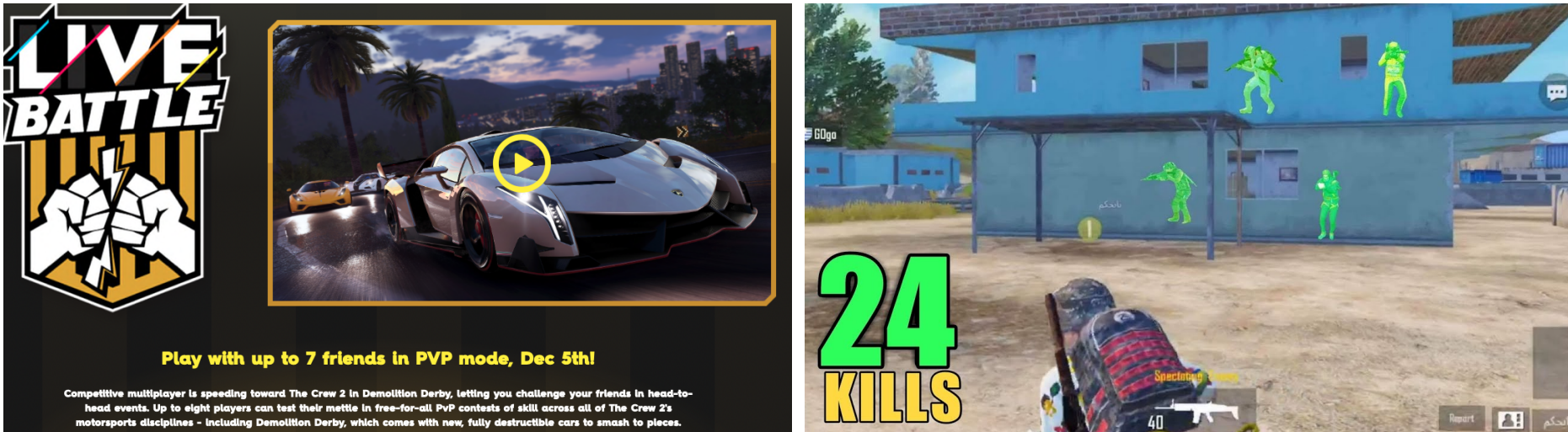


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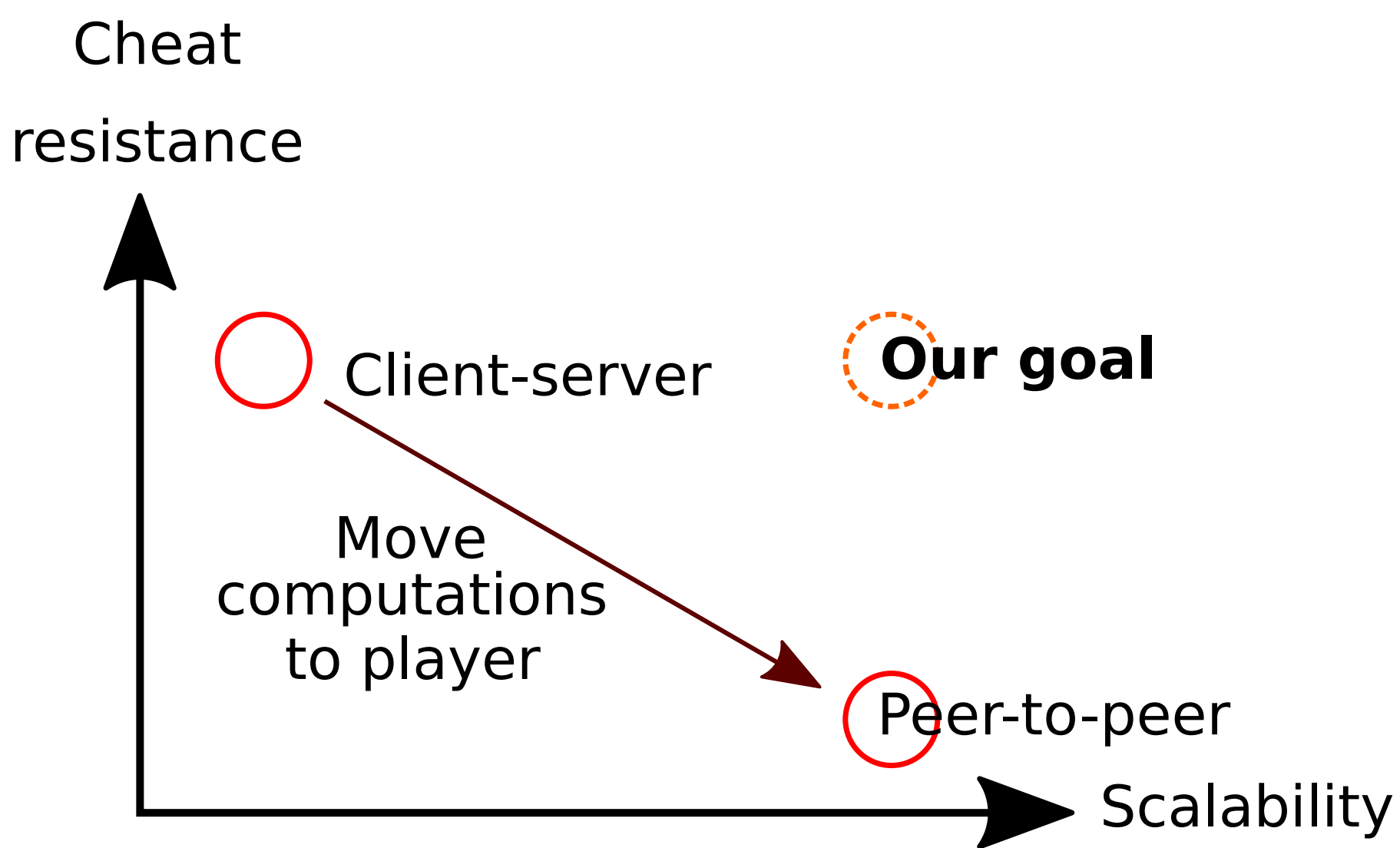


Online video games

- Game market size \$78.6 billion, 2.5 billion players
- Scalability and cheating are **important issues**

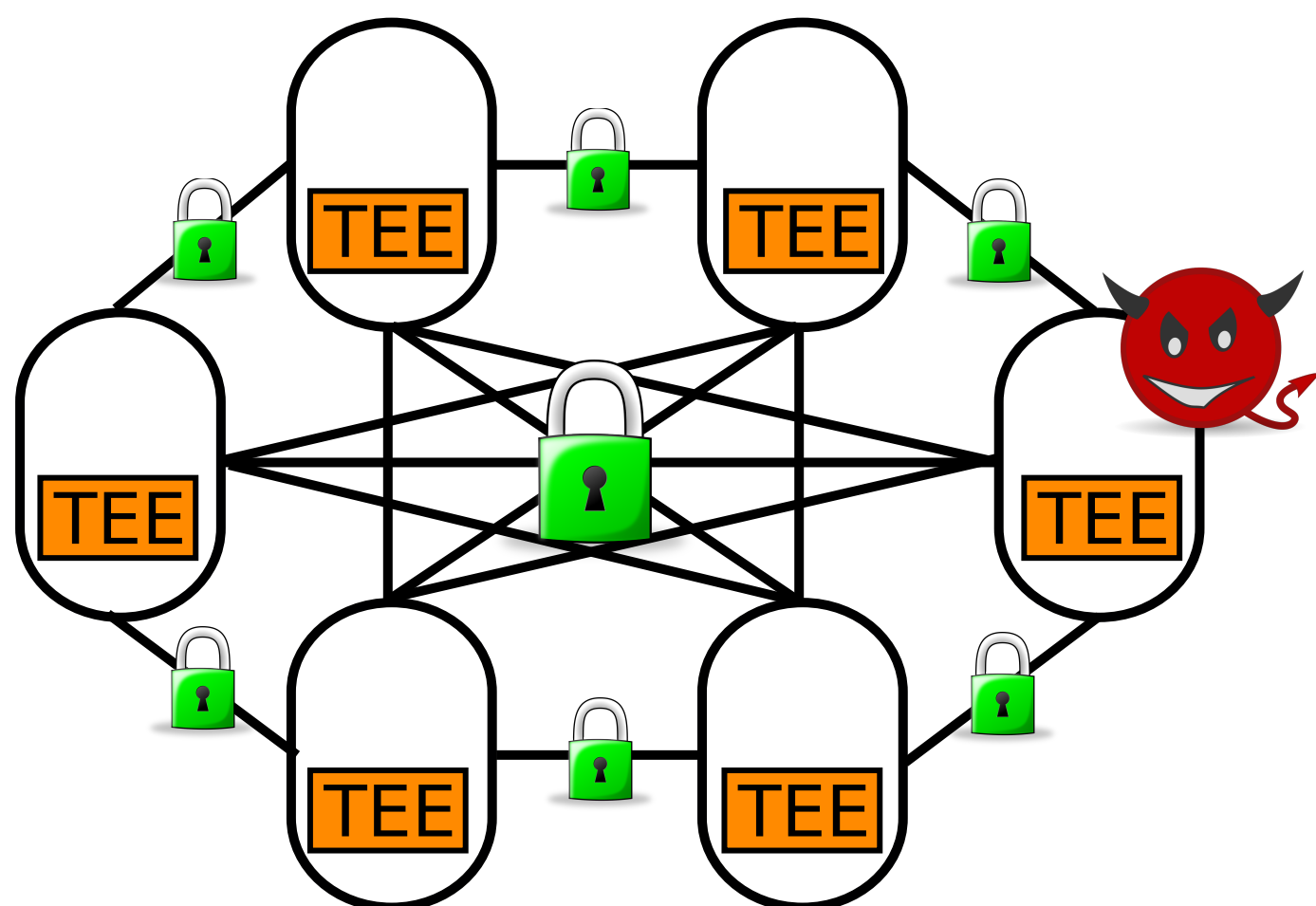


Scalability vs cheat-resistance



Scalability and cheat-resistance

- **Scalability:** Peer-to-peer architecture
- **Cheat-resistance:**
 - Trusted Execution Environment (TEE)
 - Encrypted communications

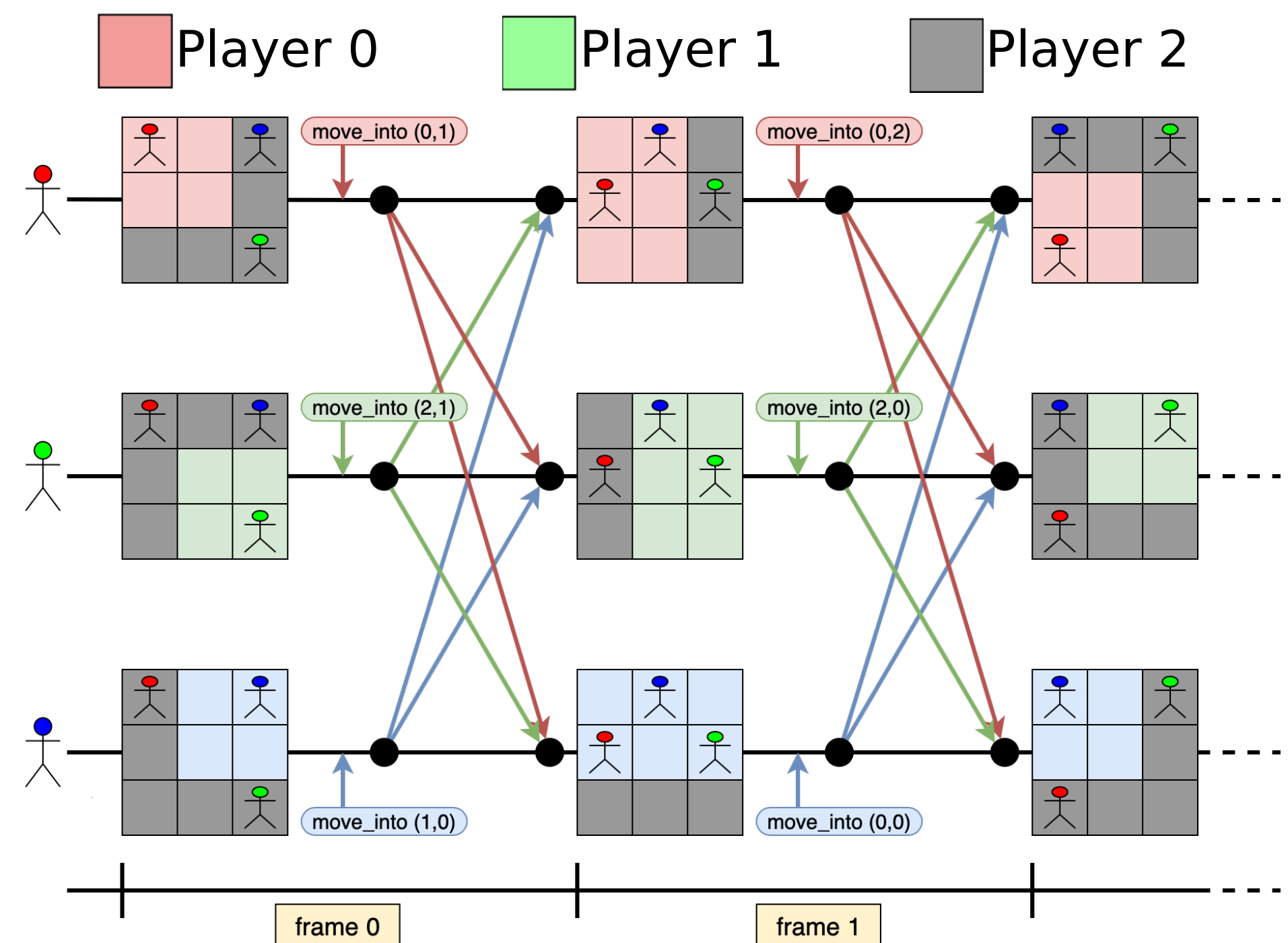


Trusted Execution Environment:

- Special execution mode
- **Protects** code and data **from strong attacker** who **controls** both **software** and **hardware**
- Specific **interface** to access TEE

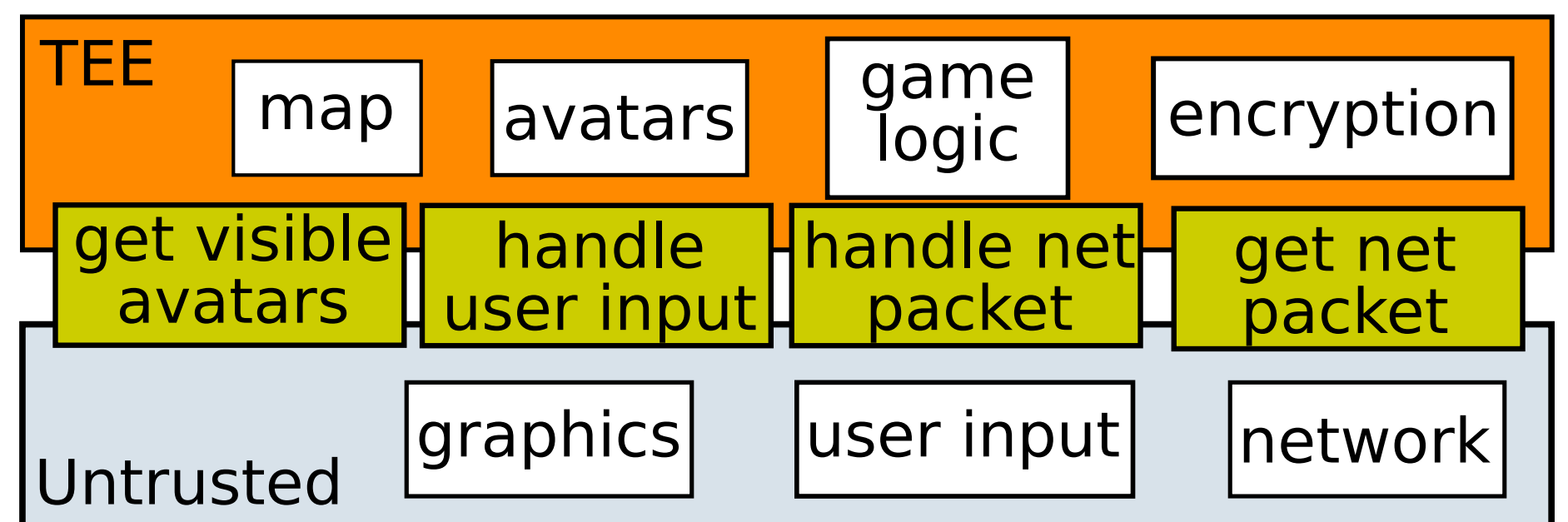
Game prototype

- Difficult to find an open-source P2P game
- Game prototype: **players move on a map**
- **Network** communication **synchronous**
- Players exchange move command
- **Cheating** player **knows all positions**



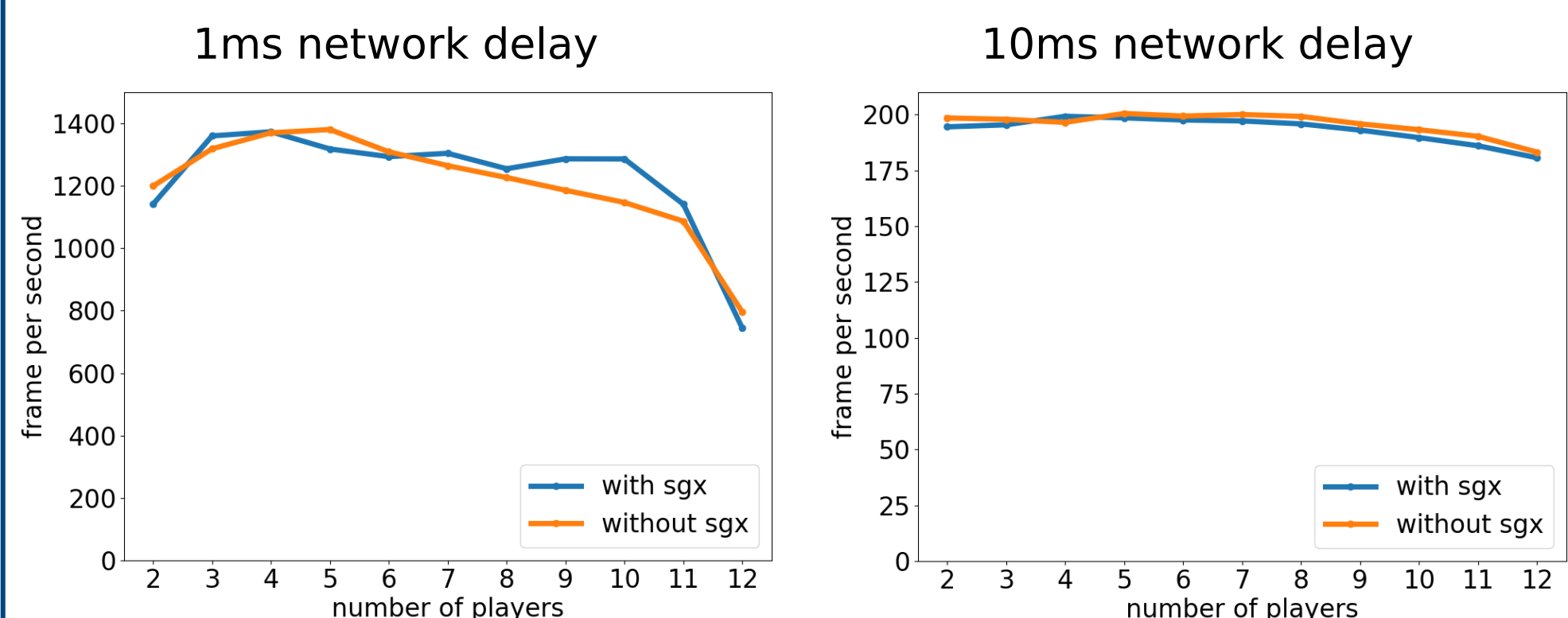
Implementation

- **TEE:** Intel **SGX** (80% gaming PCs have Intel CPU)
- 3500 lines of code
- **Small** well-defined **interface:** 4 calls



Performance results

- Two SGX-capable 6 cores machines, 1Gbps LAN



- **1.6%** performance **overhead**