

Network Game Design:

Hints and Implications of

Player Interaction

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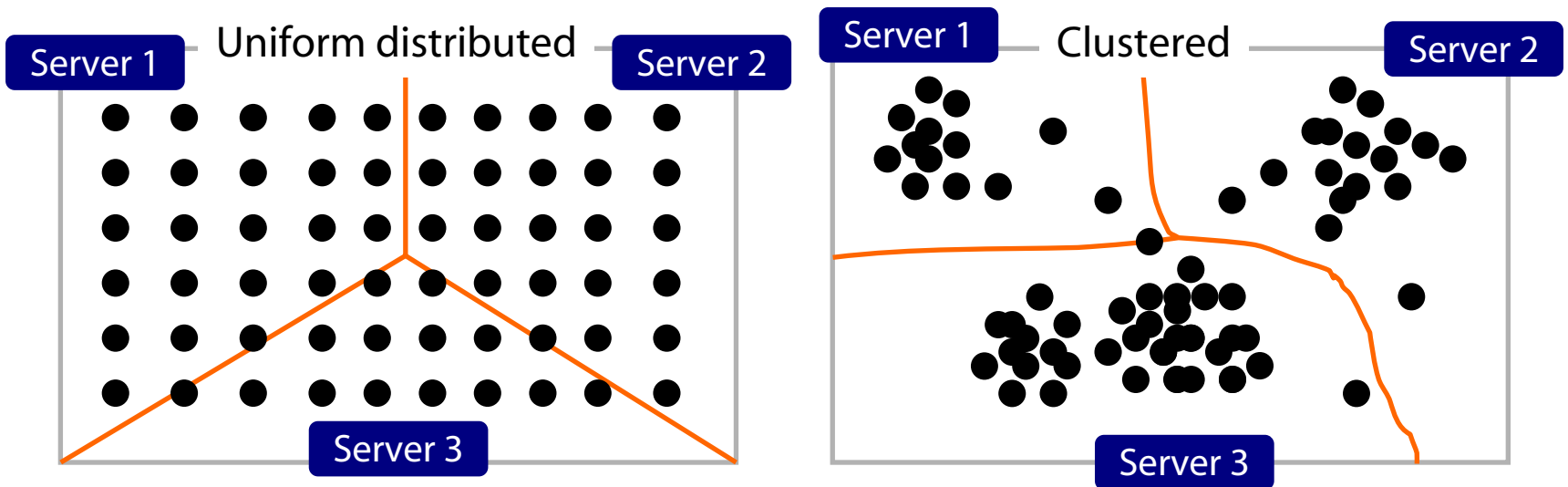
Chin-Laung Lei, National Taiwan University



Observation

User behavior is a key factor of how well a network system performs (and how should a system be designed)

Example: **Virtual World Partitioning Problem**



If game players tend to be **clustered** in the game world

⇒ **dynamic and adaptive** partitioning of the game world would be required.

Motivation

Drawing Design Implications

from Players' Interaction

for Designing More Responsive &

Scalable Online Games

What We've Done

1. **Collecting** game traces (packet-level)
2. **Inferring** user interaction from game traces
 - Who are interacting?
 - Where are the players?
 - How do they interact? (stay together or team up)
3. Studying the **implications** of user interaction on game design

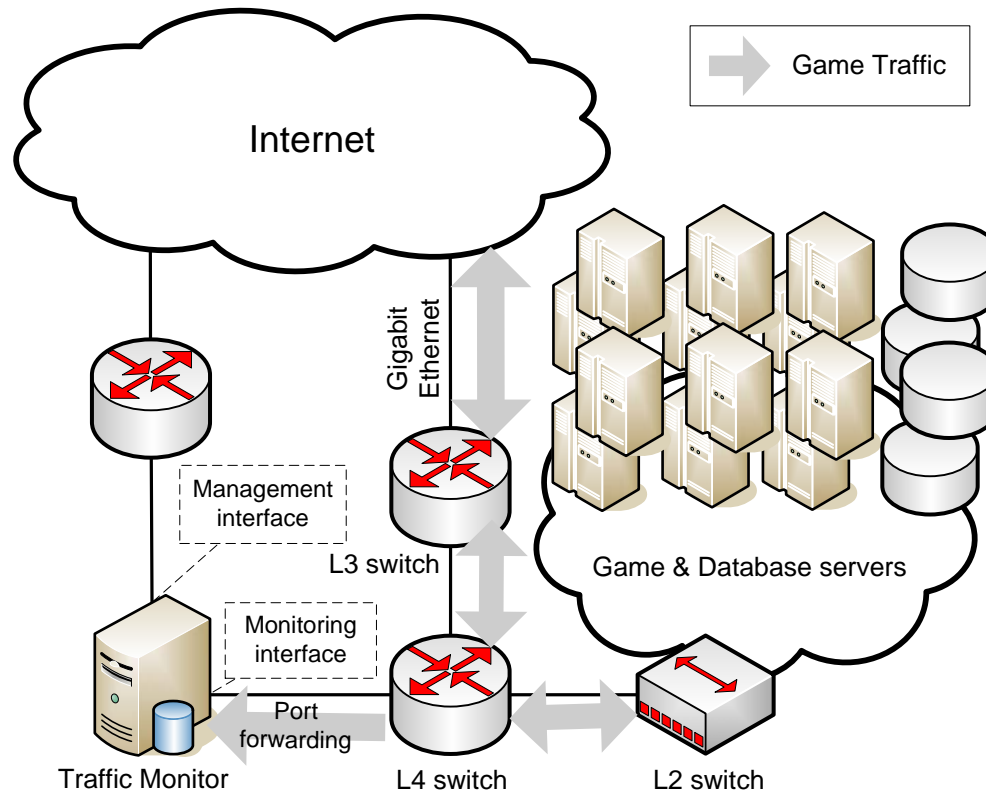
Talk Outline

- The question
- ➔ ■ Trace collection
- Deriving user interaction
- Analysis of user interaction (and its implications)
- Conclusion

Game Studied -- ShenZhou Online



Game Trace Collection



trace	conn. #	packets (in/out/both)	bytes (in/out/both)
N1	57,945	342M / 353M / 695M	4.7TB / 27.3TB / 32.0TB
N2	54,424	325M / 336M / 661M	4.7TB / 21.7TB / 26.5TB

Why We Use Packet-Level Traces?

Packet-level traces are **much easier** to obtain

- no modification to game servers is required
- recording packet traces does not increase the workload of game servers

Player behavior inferred naturally connects to **network-level factors**, e.g., IP addresses and network latency

Extraction of Player Interaction

We would like to know ...

- whether any two players are **at the same place**
- whether any two players are **teammates**

For each player (game session), we have ...

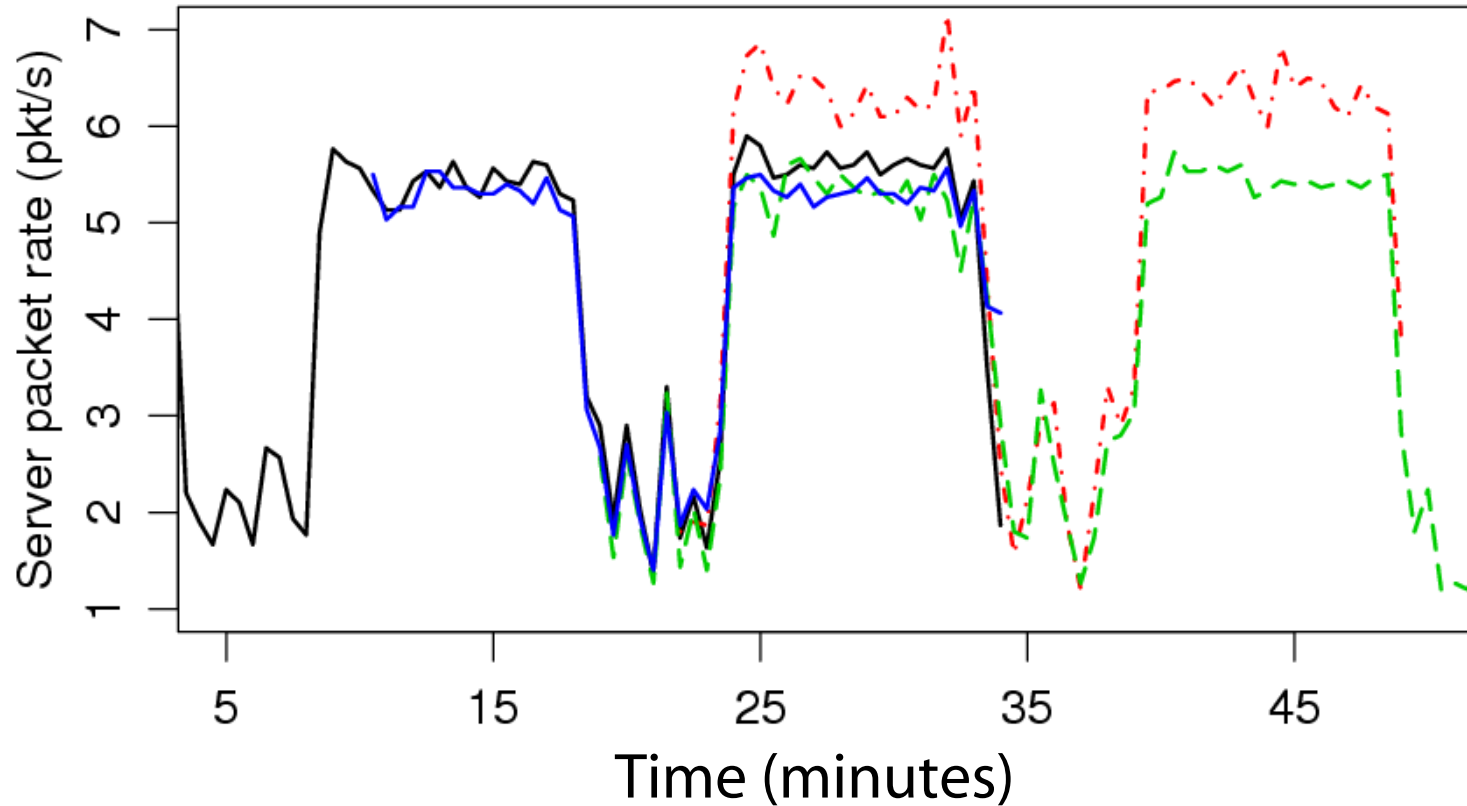
- a client packet arrival process
- a server packet arrival process

We've proposed an algorithm

- based on the **correlations** between the **packet arrival processes**

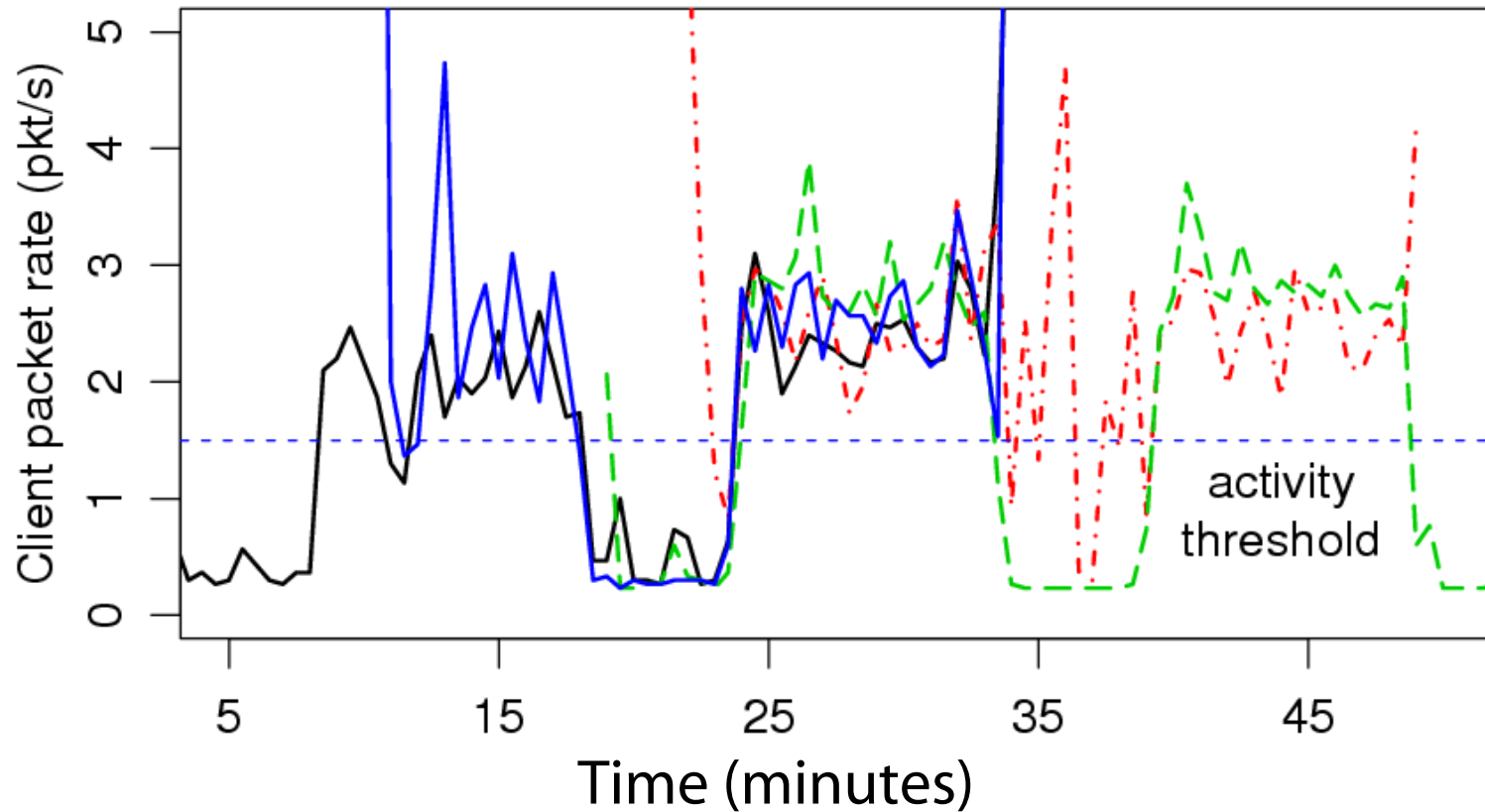


Example: Four Neighbors



- Server packet rates imply the **degree of PC/NPC activities** around the avatar

Example: Four Teammates



- Client packet rates imply the **degree of game play activities** of the avatar

Talk Progress

- The question
- Trace collection
- Deriving user interaction
- ➔ ■ Analysis of user interaction (and its implications)
 - player dispersion
 - network proximity
 - social interaction
- Conclusion

Dispersion of Players

The dispersion of players in the game world:

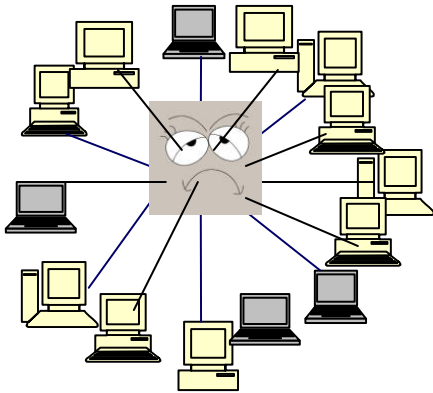
- well modeled by **Zipf** distributions
- 30% of players gather in the top 1% of places

Implications:

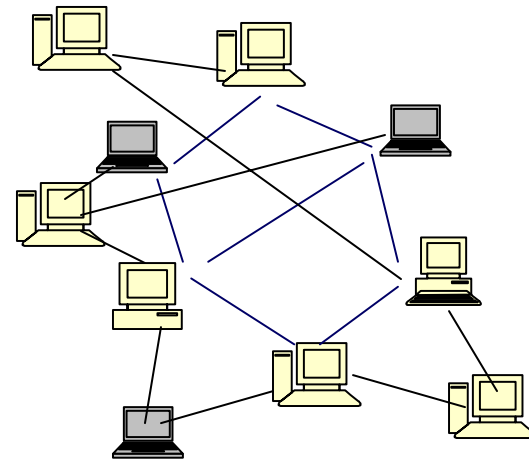
- static and fixed-size partitioning of the game world might be insufficient
- **dynamic and adaptive** partitioning algorithms should be used

Peer-to-Peer Games

- Reducing server load \Rightarrow more scalable
- Faster response time
- Audio/video communications

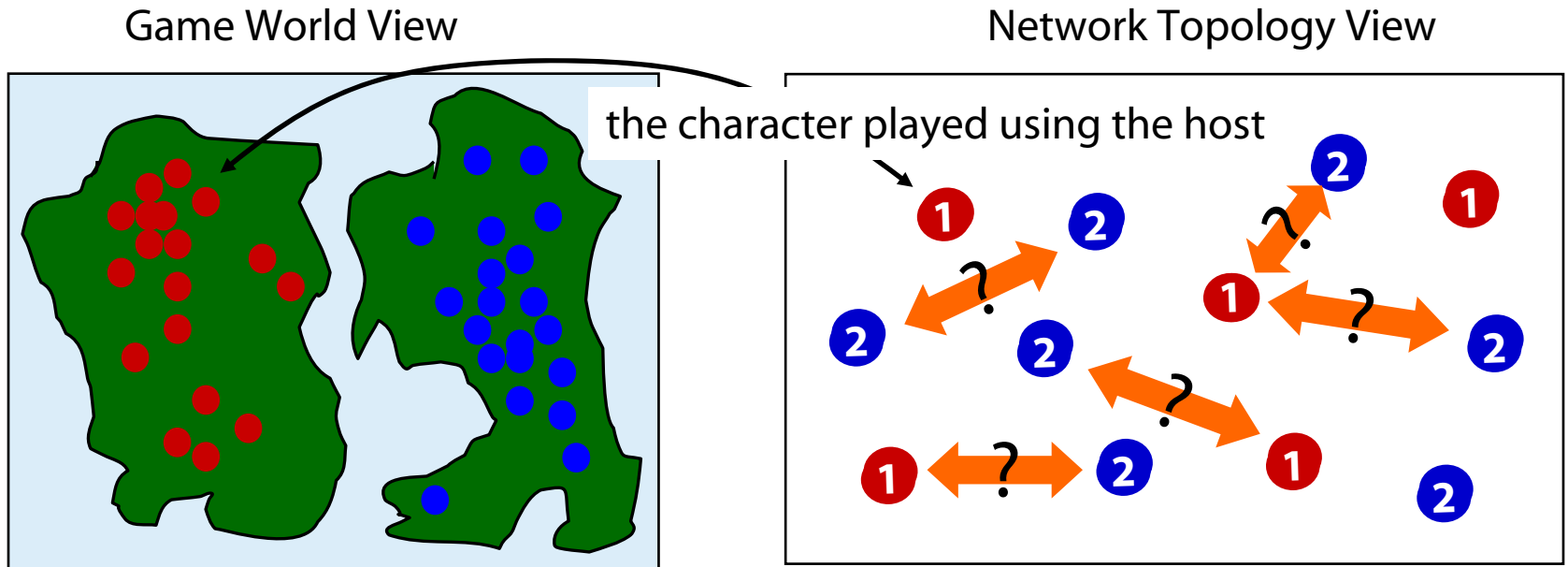


Client-server architecture



Peer-to-peer architecture

Overlay Construction

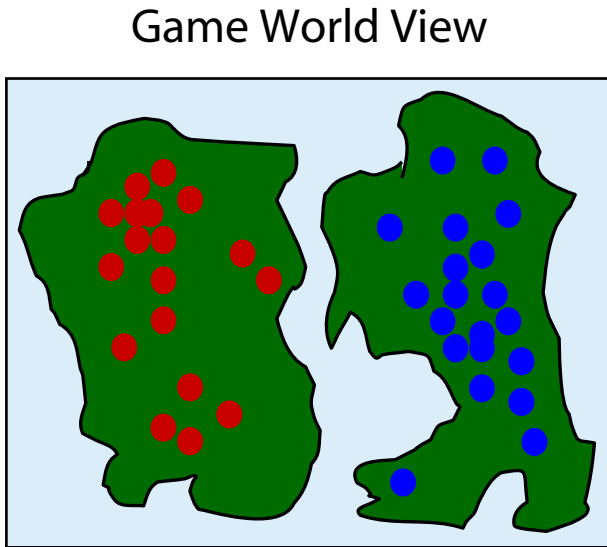


How to construct overlay networks?

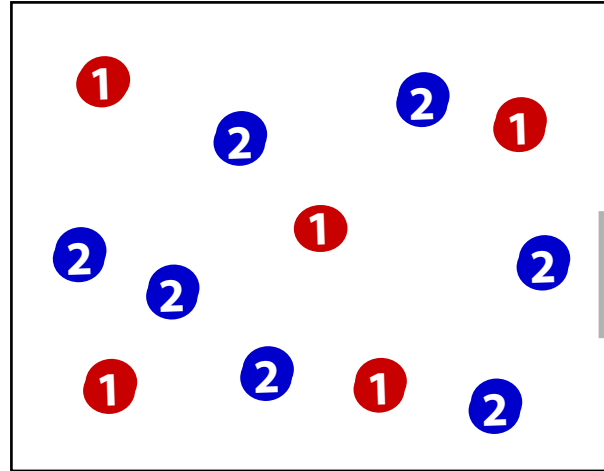
Goal: to optimize the overall transmission latency

i.e., how to pass information between the peer nodes?

Similarity between The Two Approaches?

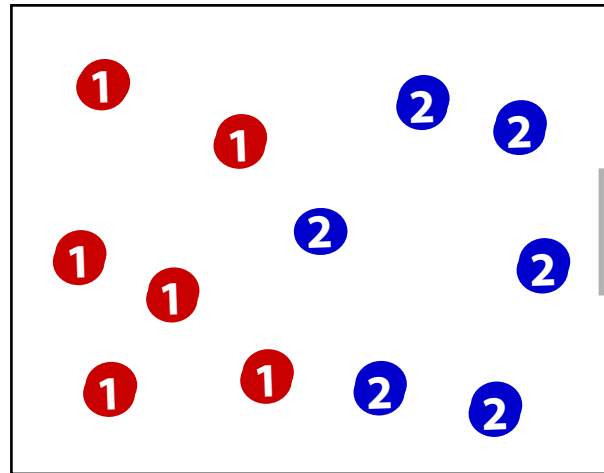


Network Topology View



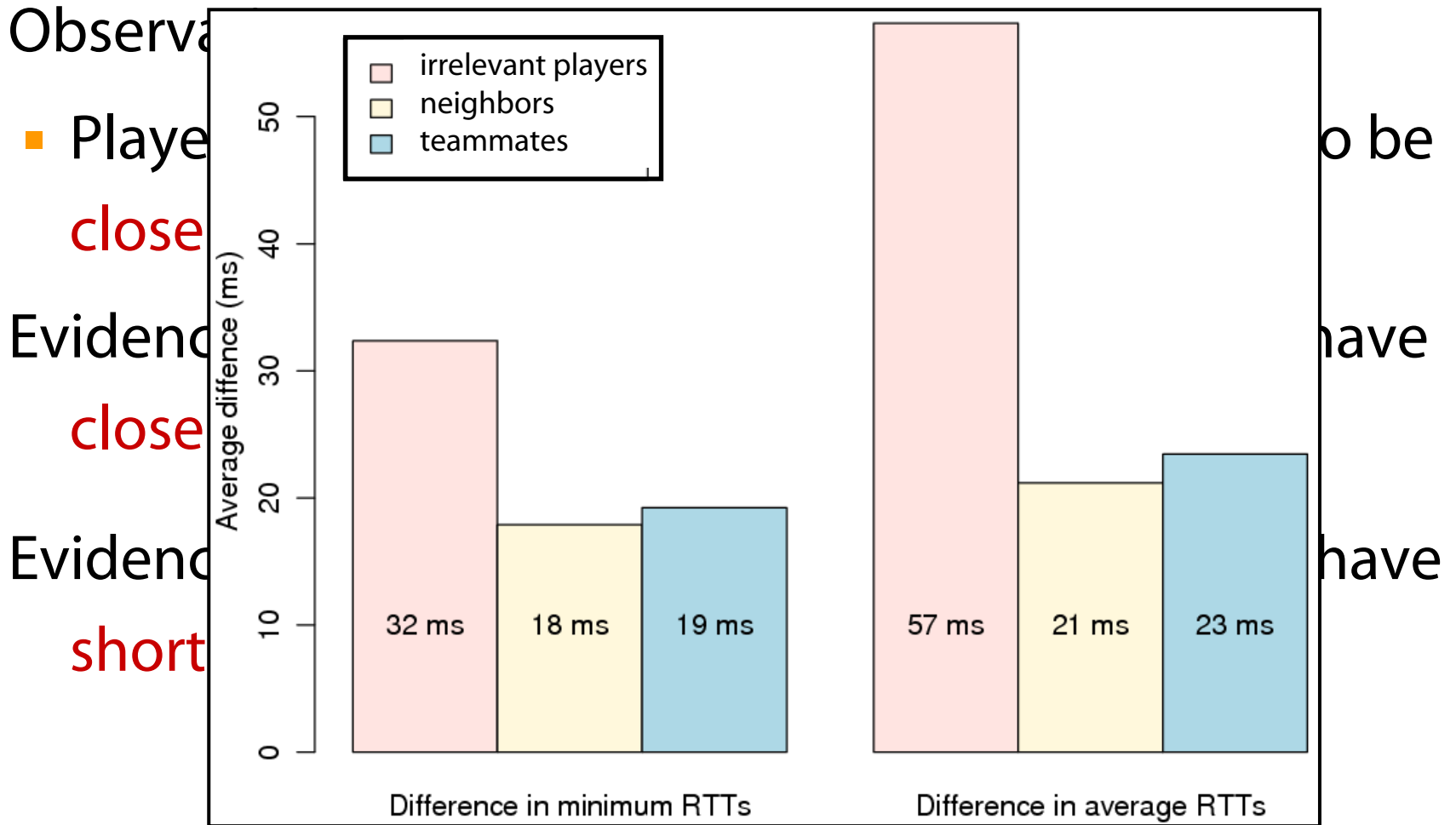
two approaches
lead to **different**
overlays

Network Topology View



two approaches
lead to **similar**
overlays
→ either approach
is OK

Correspondence between Network Distance and Virtual World Distance



Implications of Network Proximity

For client-server architecture

- improves the **fairness** of game playing, as interacting players tend to have similar latencies to their servers

For peer-to-peer architecture

- message delivery between the hosts of interacting players is **faster**
- opportunities for **optimizing** network latency between interacting players

Effect of Network/Physical Distance

Observation (for a group of players):

- network distance ↓ team play time ↑

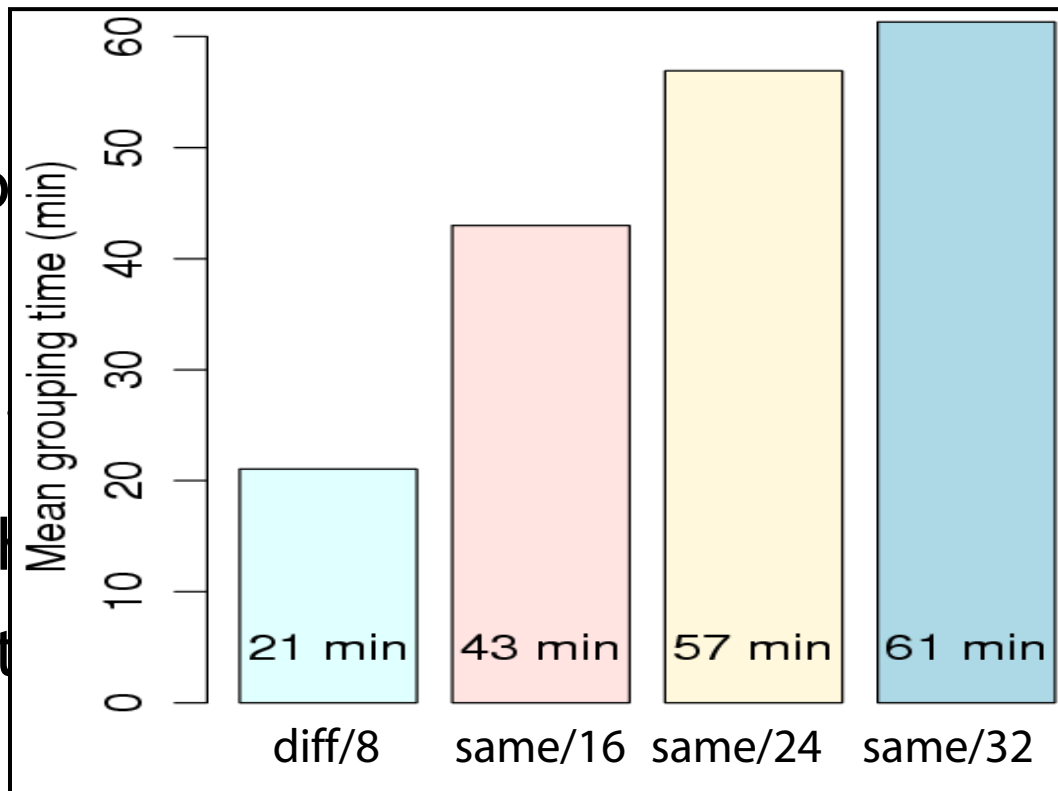
Explanation

- real-life

- real-life

⇒ enrich

players t



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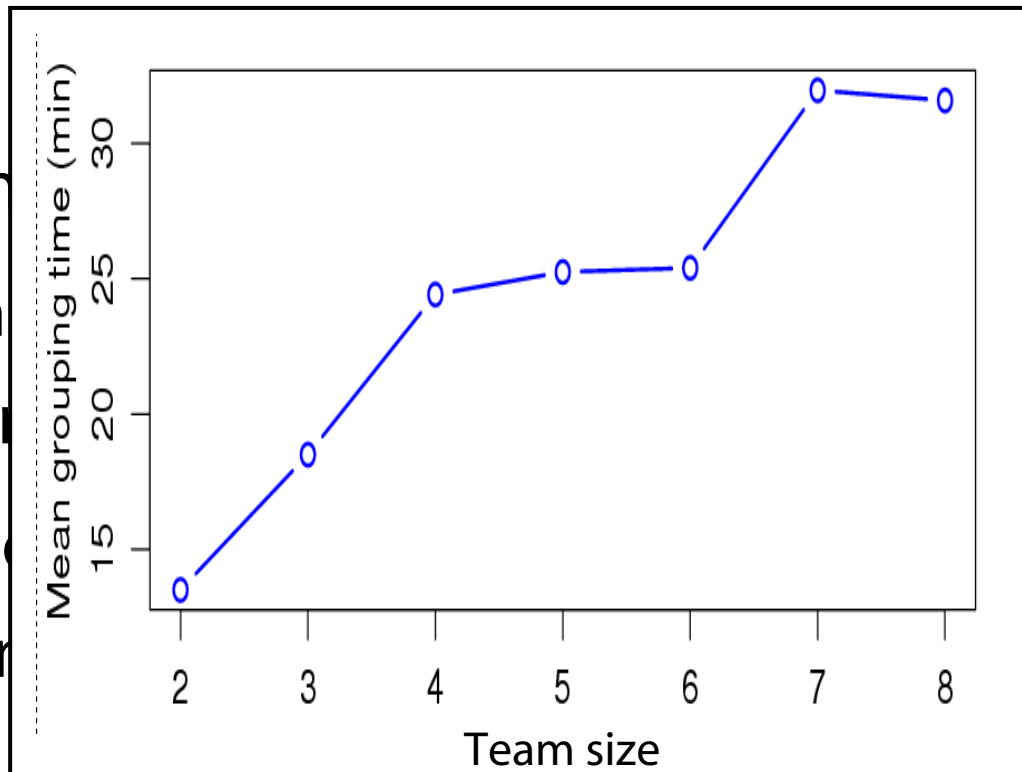
Effect of Social Interaction

Observation:

- degree of social interaction ↑ game play time ↑
- team size ↑ team play time ↑

Explanation

- due to the social bonding and communication during the game
- a game context provides a natural environment for social interaction and learning



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Conclusion

Packet-level traces

- easier to obtain
- feasible to extract user interaction

Findings summarized

- partitioning of the virtual world should be **dynamic**
- **network proximity** of interacting game players
- games could be made more sticky by supporting **in-game communication** and **encouraging team playing**

Thank You!

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