

MUGAN: Multiplayer Games in Mobile Ad Hoc Networks

– Part II –

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Overview

Introduction

Game-related Issues

Network Challenges

Summary & Outlook



General Questions

Three Game Phases

- Pre-game phase: Discovery, Software Distribution, Set-Up
- In-game phase: Replication/Consistency, Mobility management
- Post-game phase: High scores, Chat, Organizing Follow-ups

Generic vs. Application-specific

- Which parts are game-specific? What can be done in more general way?
- Generic solution can support other kinds of applications as well
- Middleware can alleviate game development



Game Architecture

Our approach

- Centralized architectures are inappropriate for MANETs
- Distributed approach: Zone Servers
 - Multiple equal servers (selected from the group of players)
 - Each server is responsible for a distinct part of the network
- Questions:
 - How many servers? At least two. . .
 - Which node is suitable as server? (CPU, Memory, Energy, . . .)
 - Favourable network positions of the servers
 - Mobility Management / Adaptable algorithm



Game Data Replication

Distributed architectures require replication

- Consistency Problem: Have all servers the same information?
 - Recovering from wrong decisions, Fault tolerance
- Efficiency Problem: When to replicate information?
 - Data consistency vs. network load

How to replicate?

- Are generic replication primitives sufficient? (Middleware support)
- Can predictions about the network improve replication decisions?
- Use Uni-, Multi- or Broadcast? Situation-dependant?
- Don't reinvent the wheel!



Routing and Data Transportation in Ad Hoc Networks

How to get data from player to server and vice versa?

- Routing: Find a way through the network
 - Reactive/Proactive/Hybrid routing protocols
 - Single path routing vs. multipath routing
 - Repair routes fast
 - Be generic, we need non-playing nodes as relays
- Quality of Service: Keep latency and jitter low ($L \leq 150\text{ms}$)
 - Prioritise real-time network traffic / Keep queues short
 - Find good metric for routing protocol, #Hops may not be good enough
 - Be friendly to other protocols
- Can we support multicast to distribute game information?



Partitioning of Ad Hoc Networks

Splits

- Network partitioning split the game
- Splits/merges can be a transient state
- Detect splits accurately

... and Merges

- Two ad hoc clouds may reconnect
- Can games be merged? — We need support from the game.



Integration of Fixed Infrastructure Networks

Different infrastructure networks exist

- e.g. GPRS, UMTS, WLAN

Extend ad hoc networks by the use of infrastructure networks

- ...to create network shortcuts
- ...to keep split ad hoc clouds connected
- ...to store persistent information (high scores, games, etc.)
- ...to play with people from the Internet



Summary & Outlook

Summary

- Overview of the MUGAN EU proposal
- Many challenges to support multiplayer games in MANETs
- Be generic if possible, game-specific if necessary
- Interoperability with other ad hoc applications is necessary

Outlook

- Cooperation between ETHZ and TU-BS continues
- Joint Master Thesis on QoS-Routing for Games



Thank you!

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