

Online Gaming and Ad hoc Networking

Datakom II Seminar Lecture 2005 Erik Nordström

Multiplayer Computer Games (MCG) - Background

- In the beginning there was **MUD** (Multi-User Dungeon)
- First adventure game to support multiple users (University of Essex)
- Came to be popularly known as “Multi-Undergrad Destroyer”

zMUD 6.10

File Edit View Settings Actions Layout Windows Plugins Help

Chars Settings Classes Aliases Variables Paths Triggers Macros Buttons Prefs Map DB Quit

realms Tell Group

Tell Group

Zugg tells you 'Hello there'
 Darker tells you 'How's it going?'
 Chiara tells you 'Hi'

Map for realms (Zugg-Realms of Despair)

File Edit View Zone Actions Config Help

Level 0

City

Forest

Darkhaven Square

Queue: <empty>

realms (Zugg-Realms of Despair)

Exits: north south.
 The corpse of Irixs is lying here. (2)
 A shoppe bag lies discarded nearby. (2)
 Renkeron the Pincher is hovering here.
 (Hide) Mixro is very poor...{IT-T} is standing here.

<634hp 135m 159mv 1332478 Exp(648) E> Darkhaven Square
 You are standing within the expanse of the famous Darkhaven Square.
 An immense stone statue of Duke Luther sits in the center of the square,
 surrounded by fountains of shimmering crystal water. Gardens and shrubbery
 enhance the air of serenity and peace here in the center of the great city.
 A plaque set into the base of the fountain attracts your eye. Cobblestone
 roads lead away in the four cardinal directions, while to the northeast
 and northwest are forested paths. The cathedral spires of Notre Dame
 de Sioux rise with majesty above the treetops to the northwest.
 Exits: north east south west up northeast northwest.
 Stone fountains containing crystal clear water surround the Duke's statue.
 The corpse of Galdahan fills the air with a foul stench.
 A pack mule lumbers about, carrying its master's belongings.
 A pack mule wanders in a dazed, zombie-like state.
 Betholos: The Casino is OPEN! 3 west, south, up from here! is standing here.
 Lea Darkbane [Bloodletter] is hovering here.
 Vok Vok Vikok! is standing here.

<634hp 135m 157mv 1332478 Exp(648) E>
 Vok unsuccessfully attempts to mount a pack mule.

<634hp 135m 157mv 1332478 Exp(648) E>

hp: 911 mana 130 mv 507 0:01:06 8:57 p

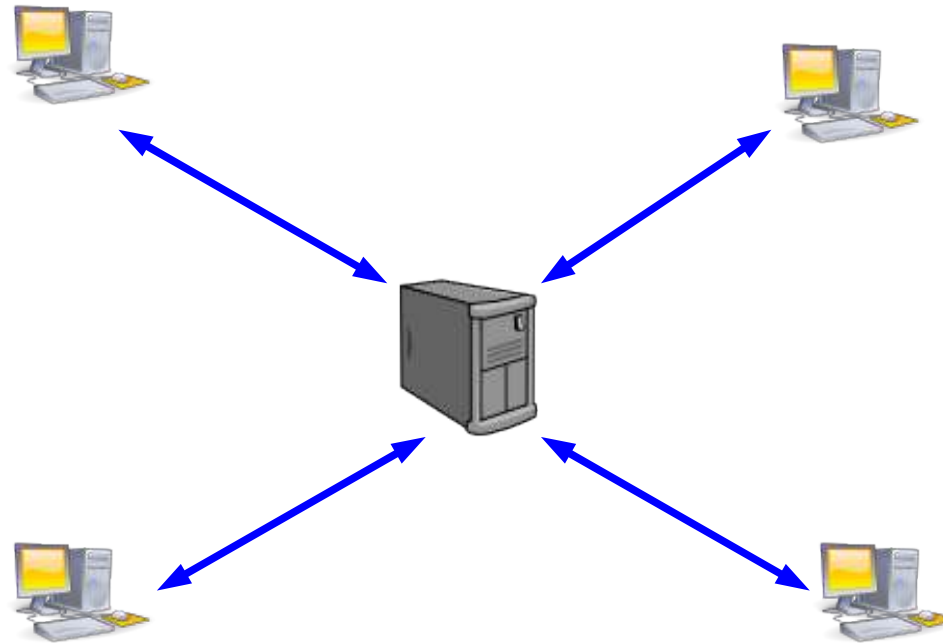
Computer Game Types

- **FPS** – First Person Shooter. *Doom, Quake, Unreal, etc.*
- **RTS** – Real Time Strategy. *Command and Conqueror, Warcraft, Starcraft...*
- **RPG** – Role Playing Game. *Baldur's Gate, Fallout...*
- **MMORPG** – Massively Multiplayer Online Role Playing Game. *Everquest, Neverwinter Nights...*

Multiplayer Computer Game Timeline

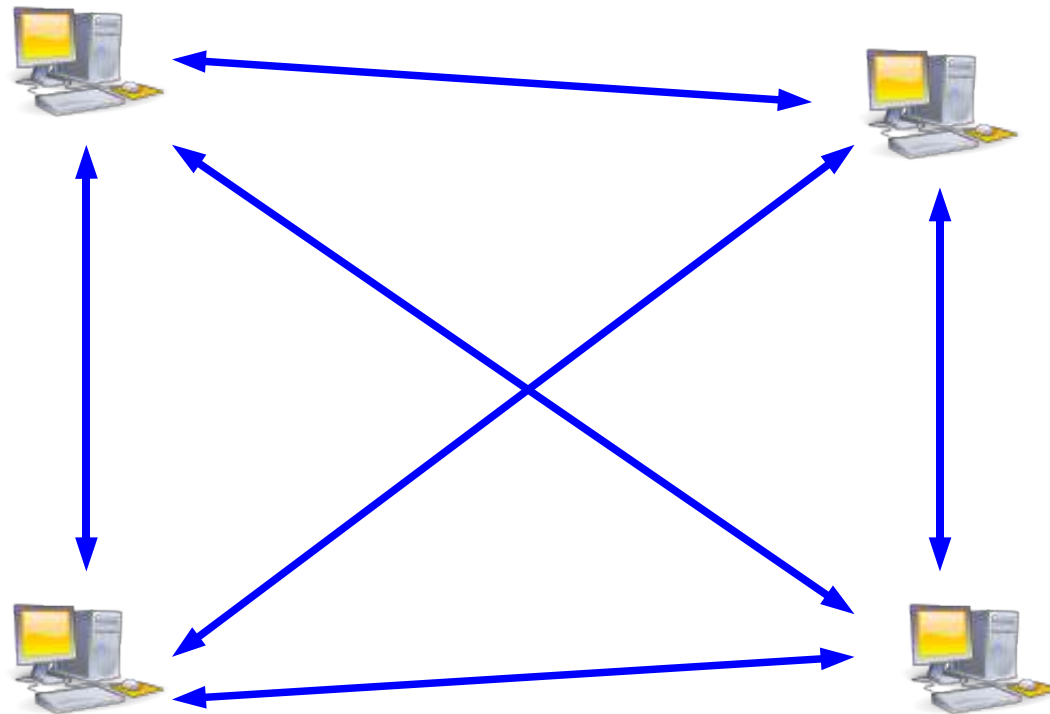
- 1979 – MUD
- 1993 – DOOM (first popular networked game)
- 1995 – CivNet (one of the first massive MMORPGs)
- 1996 – Quake (first popular client/server game)
- 1999 – Quake III Arena, Unreal Tournament

Client/Server Multiplayer Architecture



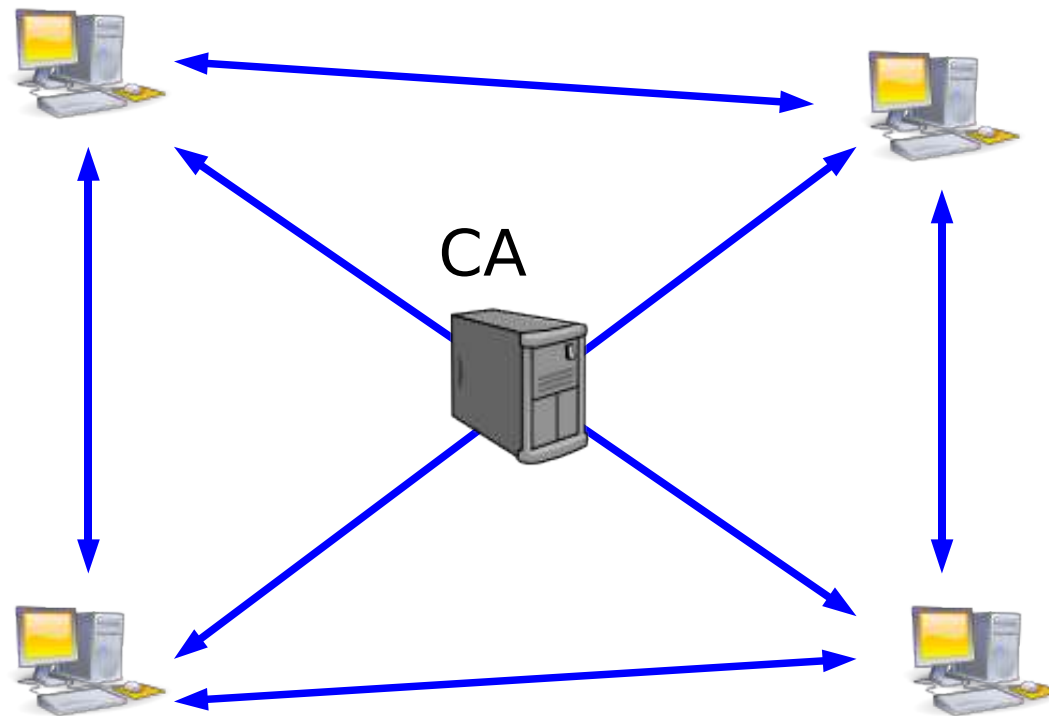
- Game state managed by server, updates sent to clients
- Single point of failure
- High bandwidth requirements at server, fast processing
- Typical for FPS and RPG games

Peer-to-Peer Multiplayer Architecture



- Game state at each client
- Robust, scalable, but state consistency difficult
- Cheating easier
- High bandwidth at clients, growing with connected peers
- Some RTS games

Hybrid Multiplayer Architecture



- Game state at each client
- Central Arbitrator (CA) to detect inconsistencies

Multiplayer Game Throughput Requirements

- Top 10 games sold in the UK (15/05-02)¹

Sales Rank	Game	Throughput Requirement
1	The Sims: On Holiday	28.8 kbps
2	Star Wars: Jedi Knight II	56 kbps
3	Medal of Honor	33.6 kbps
4	Dungeon Siege	56 kbps
5	FIFA 2002 World Cup	56 kbps
6	The Sims	28.8 kbps
7	The Sims: Hot Date	28.8 kbps
8	Championship Manager	LAN
9	Half-Life: Generations	28.8 kbps
10	Zoo Tycon	N/A

¹. Source: PhD thesis, Tristan Henderson

Challenges in MCGs

- Two attributes for good player experience:
- **Consistency:**
 - Distributed processes tightly coupled...
 - High bandwidth, low latency
- **Responsiveness:**
 - Fast response to data queries
 - Fast, efficient computation
- Having both is hard/impossible. Trade-offs required

Improving Performance in MCGs

- Message compression and aggregation
- Interest management – only exchange necessary data
- Dead reckoning – predicting change in data (i.e., velocity, directional vector)
 - Trades consistency for reduced effect of high latency

Quality of Service (QoS) in Group Multimedia Applications

- **Throughput** – minimum data rate
- **Delay/Latency** – elapsed time between data being emitted from sender and consumed by receiver
- **Jitter** – maximum allowed variation in delay
- **Error rate** – ratio of incorrect/lost data to sent data
- **Degree of reliability** – minimum number of group members that must receive each item of data

QoS Requirements

- Accepted delay for MCG typically 100-1000 ms
- FPS ~ 100 ms
- RTS ~ 500 ms and low jitter

Security and Cheating in MCGs

- Two types of concerns:
 - Protection of sensitive information (e.g., credit card numbers, personal/private data)
 - Fair play

MCG Cheating

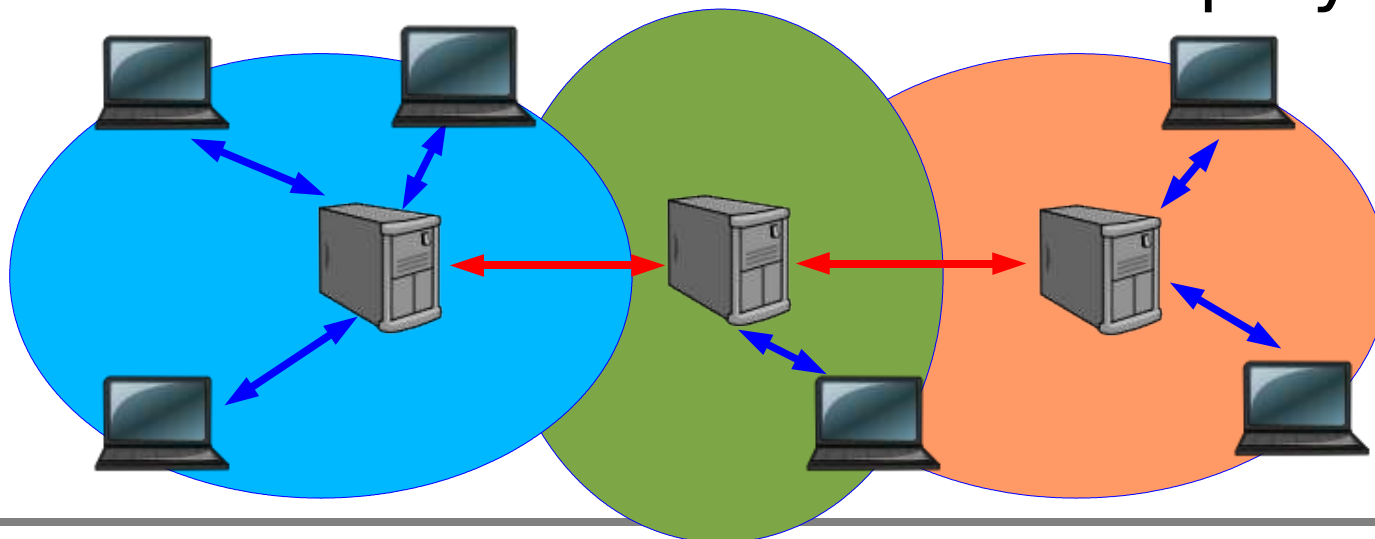
- Packet tampering:
 - Reflex augmentation – aiming proxy
 - Packet interception
 - Packet replay (repeated firing)
- Information exposure:
 - Passive – cracked clients accessing extra information (fog of war, see through walls)
- Design defects:
 - Loopholes, tampered clients

Challenges for MCGs in Ad hoc Networks

- Intermittent connectivity
- Long delays (reactive routing)
- Bandwidth
- No centralized server?
- Cheating:
 - Opponents forwarding your packets
 - Authentication
- Can games be designed with this in mind?

Possible Solutions for Ad hoc Networks

- Zone servers (Riera et. al 2003)
 - Some players are elected as zone servers
 - Zone servers in charge of small group of players
 - Zone servers distribute all messages to all other zone servers and in the end players



MCGs in Ad hoc Network **Research**

- Mobility models for simulating ad hoc networks are in general poor:
 - Random walk
 - Random waypoint
- Using Quake II Multiplayer to generate mobility traces (Fitzek et. al 2003)
 - Movements in virtual environment similar to real world
 - Modified server tracks player movements

Mobile Gaming

- Predicted to be worth \$1.2 billion by 2006 in U.S. alone (*Wireless News Factor*)
- Phones already have built in gaming
 - Multiplayer via bluetooth
 - Dating
 - Treasure hunting (GPS required)
- New generation of hand held game devices (Sony, Nintendo)

Mobile Gaming - Contd.

- Paul-Jon McNealy, Consumer and Gaming Software analyst for American Technology Research in San Francisco:
- Mainly two types of games
 - Head-to-head
 - Two players. Short sessions
 - Multiplayer
 - Larger groups, but not as in PC online gaming. ; Long sessions (RPG type)
- Games like Poker spur online multiplayer growth rather than traditional videogames

Mobile Gaming – Real Tournament

- Real Tournament (Mitchell et. al 2003)
 - Augmented reality multiplayer game
 - Teams compete in capturing monsters
 - Handheld PDAs (6PAQ) with GPS, Compass, Push-2-talki



New Generation Mobile **Gaming Devices**

- Previous generation power in today's hand-held devices
- Built in wireless connectivity
 - Enables multiplayer gaming anywhere

Nokia N-Gage QD



- Built in phone
- Bluetooth for head-to-head games
- Online multiplayer (N-Gage Arena)

Nintendo DS (Dual Screen)



- Built in WiFi
- Dual Screens (one touch sensitive)

Sony PlayStation Portable **(PSP)**



- Built in WiFi
- Watch movies

Seminar – Paper presentation and discussion

- Select a scientific paper from conference or Journal
- Read and prepare presentation
- Relate to issues, problems, difficulties when applying to ad hoc networks
- Netgames (ACM Conference)
- Proceedings at www.acm.org - digital library
- Seminar – May 17, 13:15, Room 1211