

# **INFT3960 – Game Production**

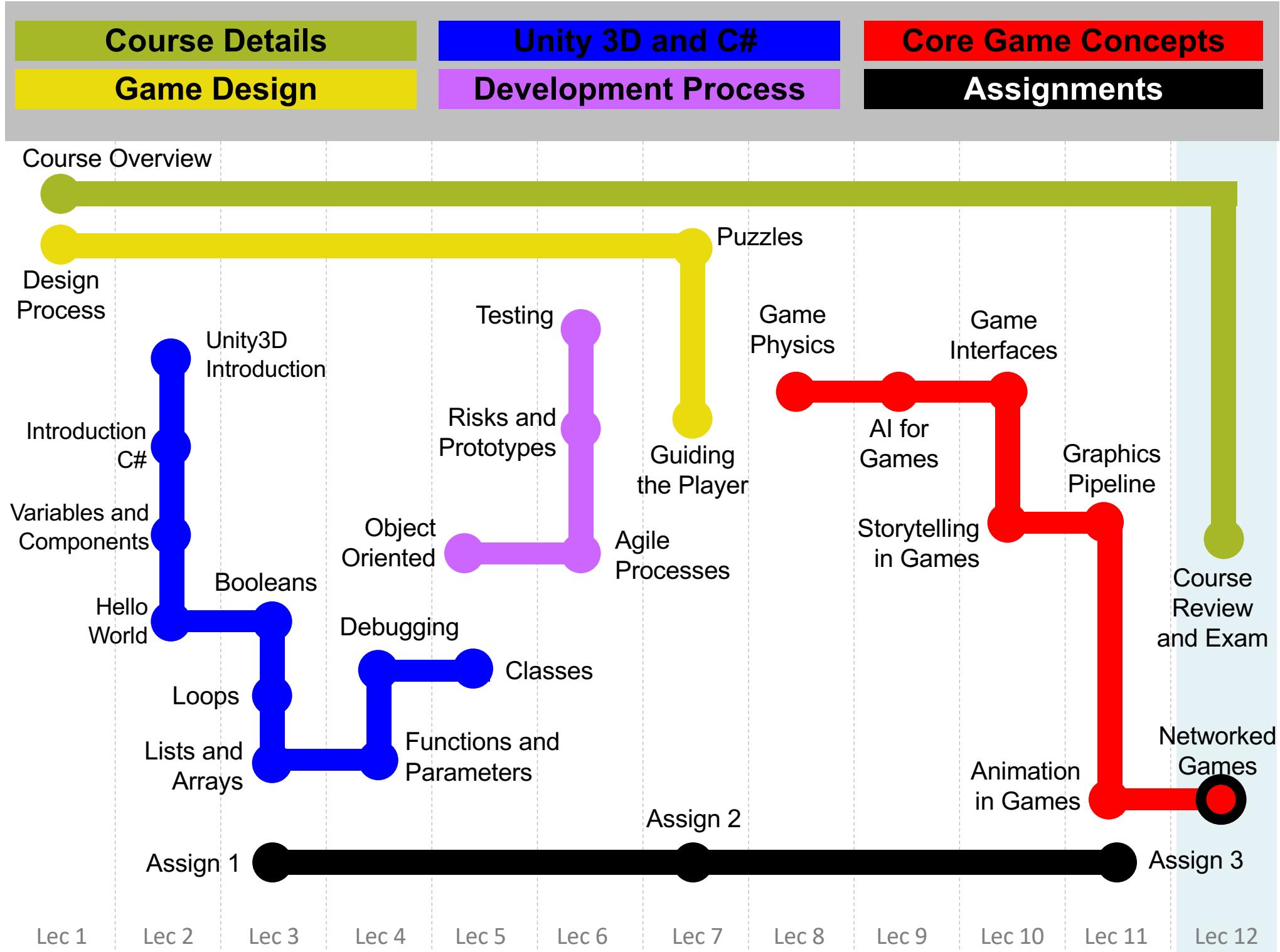
**Week 12**

**Module 12.1**

**Networked Games**

# Course Overview

<b>Lec</b>	<b>Start Week</b>	<b>Modules</b>	<b>Topics</b>	<b>Assignments</b>
1	3 Aug	Mod 1.1, 1.2	Course Overview, Design Process	
2	10 Aug	Mod 2.1, 2.2, 2.3, 2.4	Unity3D Introduction, Introduction C#, Variables and Components, Hello World	
3	17 Aug	Mod 3.1, 3.2, 3.3	Booleans, Loops, Lists and Arrays	Assign 1 21 Aug, 11:00 pm
4	24 Aug	Mod 4.1, 4.2	Functions and Parameters, Debugging	
5	31 Aug	Mod 5.1, 5.2	Classes, Object Oriented	
6	7 Sep	Mod 6.1, 6.2, 6.3	Agile Processes, Risks and Prototypes, Testing	
7	14 Sep	Mod 7.1, 7.2	Puzzles, Guiding the Player	Assign 2 18 Sep, 11:00 pm
8	21 Sep	Mod 8.1	Game Physics	
9	12 Sep	Mod 9.1	AI for Games	
10	19 Oct	Mod 10.1, 10.2	Game Interface, Storytelling in Games	
11	26 Oct	Mod 11.1, 11.2	Graphics Pipeline, Animation in Games	Assign 3 1 Nov, 11:00pm
12	2 Nov	Mod 12.1, 12.2	Networked Games, Course Review	



# Networked Games – Topics

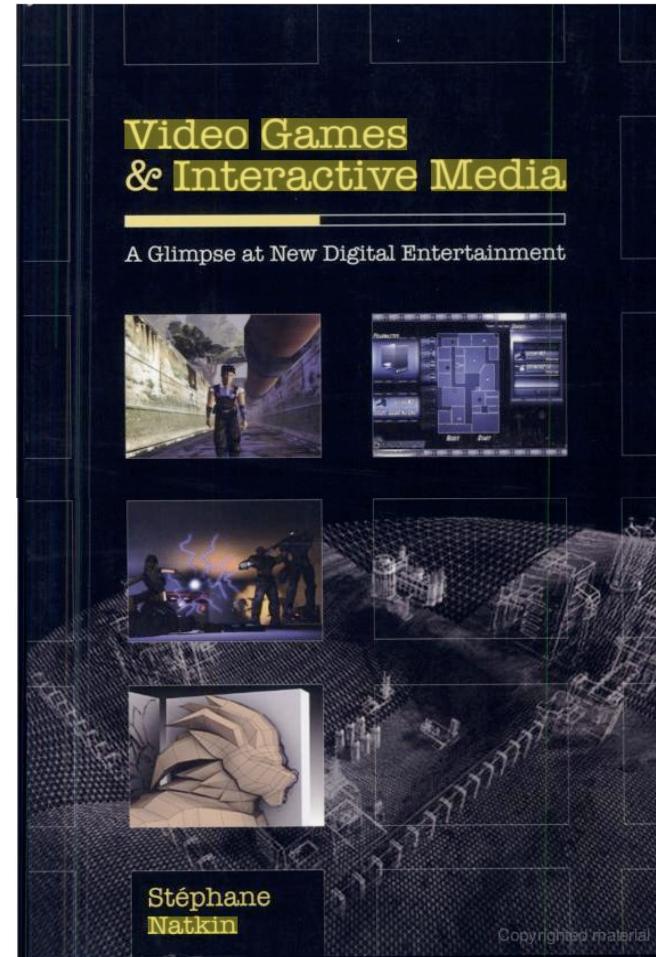
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Online Games  
Technology  
Network Architectures  
Security Issues

# Useful Reference

Stéphane Natkin  
Video Games and Interactive Media  
(2006).  
A K Peters Ltd. USA.

A bit dated but Includes a good description of the history of online games and also discusses the technology involved.



# Online Games

In the 1980's in the early days of the internet the first online games emerged.

Players typed in text commands and the world was displayed using a textual description.

These fantasy medieval worlds were a precursor to role playing games.

# Online Games

```
PAUSE INIT DONE statement executed
To resume execution, type go. Other input will terminate the job.
go
```

Execution resumes after PAUSE.

WELCOME TO ADVENTURE!! WOULD YOU LIKE INSTRUCTIONS?

y  
SOMEWHERE NEARBY IS COLOSSAL CAVE, WHERE OTHERS HAVE FOUND  
FORTUNES IN TREASURE AND GOLD, THOUGH IT IS RUMORED  
THAT SOME WHO ENTER ARE NEVER SEEN AGAIN. MAGIC IS SAID  
TO WORK IN THE CAVE. I WILL BE YOUR EYES AND HANDS. DIRECT  
ME WITH COMMANDS OF 1 OR 2 WORDS.

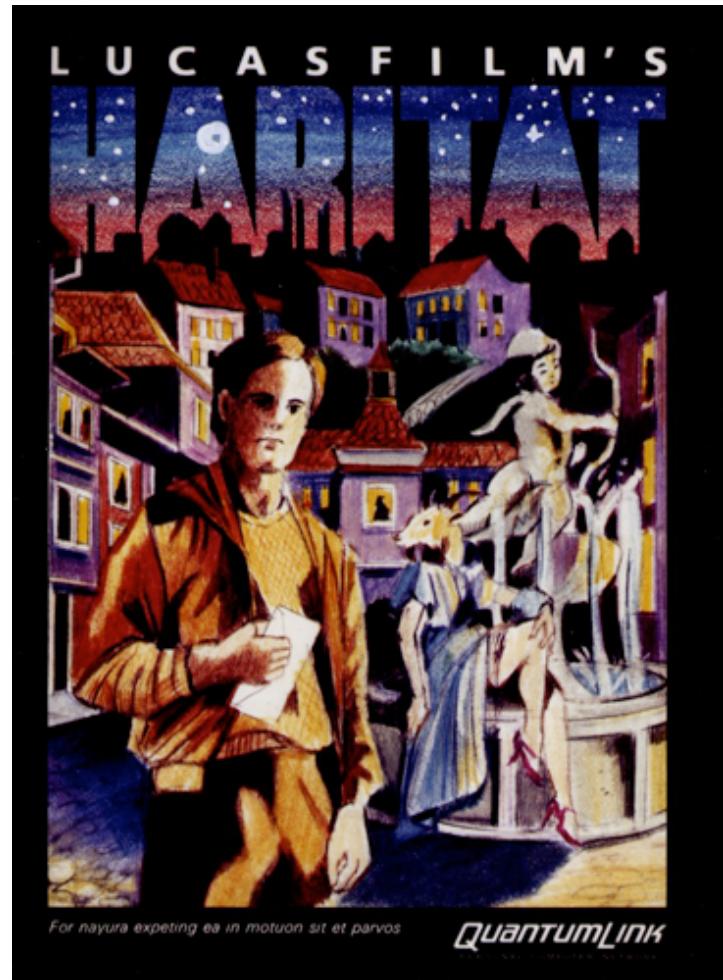
(ERRORS, SUGGESTIONS, COMPLAINTS TO CROWTHER)  
(IF STUCK TYPE HELP FOR SOME HINTS)

YOU ARE STANDING AT THE END OF A ROAD BEFORE A SMALL BRICK  
BUILDING . AROUND YOU IS A FOREST. A SMALL  
STREAM FLOWS OUT OF THE BUILDING AND DOWN A GULLY.

# MUDs

In the 1990s these early online games became multi-user.

They became known as MUDs (multi-user dungeons)



# MUDs

As players navigated the fantasy world, they could enter instructions which the game would try to respond.

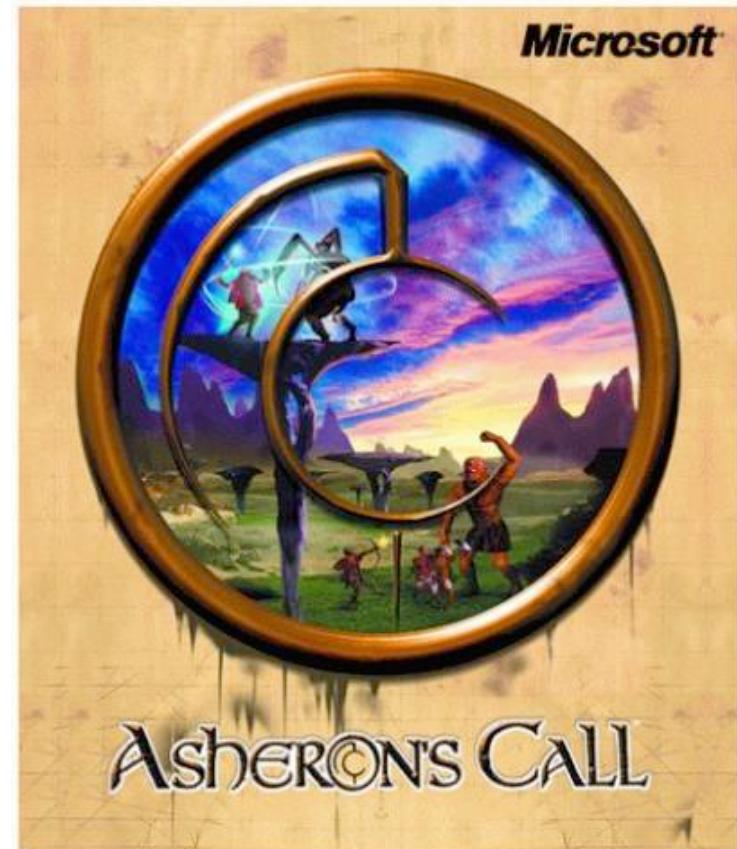
Often the text based input from the player was unrecognised and the game could not respond.

These unrecognised player inputs were stored. However later players could uncover them and provide their own responses. In this way the size of the world and the possible responses to player input grew over time.

# MMOGs

In the later 1990s, the first **massively multiplayer games** (MMOGs) appeared

- EverQuest
- Asheron's Call
- Ultima Online



# MMOGs



# Persistent Worlds

These online communities are also described as **persistent games** as the world that players inhabit persists over time although **players can act to change the shape of the world.**

The technology to support these worlds includes **advanced graphical interfaces** on fast personal computers linked and **centralised** from powerful servers.

# MMORGs

Current persistent games tend to be role playing games, and involve subscriptions of a large number of online players who share an online game world.

They are usually referred to as  
**Massively Multiplayer Online Role Playing Games (MMORPGs)**

# MMORGs

- EVE Online
- Star Wars: The Old Republic
- Final Fantasy XIV
- Guild Wars 2
- World of Warcraft (2004)

MMORPG Video Games / 2020



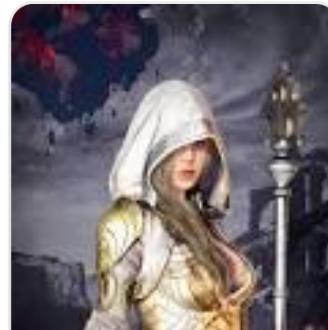
World of  
Warcraft: S...  
2020



Bless  
Unleashed  
2020



Corepunk  
2020



Shadow  
Arena  
2020



Rebirth  
Online  
2020

# MMORGs (2016)

- ArcheAge
- League of Angels 2
- TERA
- Guild Wars 2
- Elder Scrolls Online: Tamriel Unlimited
- Final Fantasy XIV: A Realm Reborn

<http://bestmmorpg2016.com/>

# MMORGs (2017)

- Crossout
- Eve Online: Ascension
- Cloud Pirates
- Revelation Online
- Riders of Icarus
- Mu Legend

<https://www.pcgamesn.com/new-mmos>

(Business Models - Free, Buy, Pay to Play)

# MMORGs (2019)

- World of Warcraft
- Elder Scrolls Online
- Runescape
- Black Desert Online
- Eve Online
- Star Wars (The Old Republic)
- Blade & Soul
- Neverwinter

<https://bestreamer.com/gaming/most-played-mmorpg-2019>

# MMORGs (2020)

- World of Warcraft
- Final Fantasy XIV
- Phantasy Star Online 2
- Runescape
- Elder Scrolls Online
- Guild Wars 2
- Black Desert Online
- Star Wars (The Old Republic)
- Eve Online
- Blade & Soul

<https://www.youtube.com/watch?v=Dx3141VWIdg>

# Network Technology

MMORPGs are one of the most complex internet software applications to build.

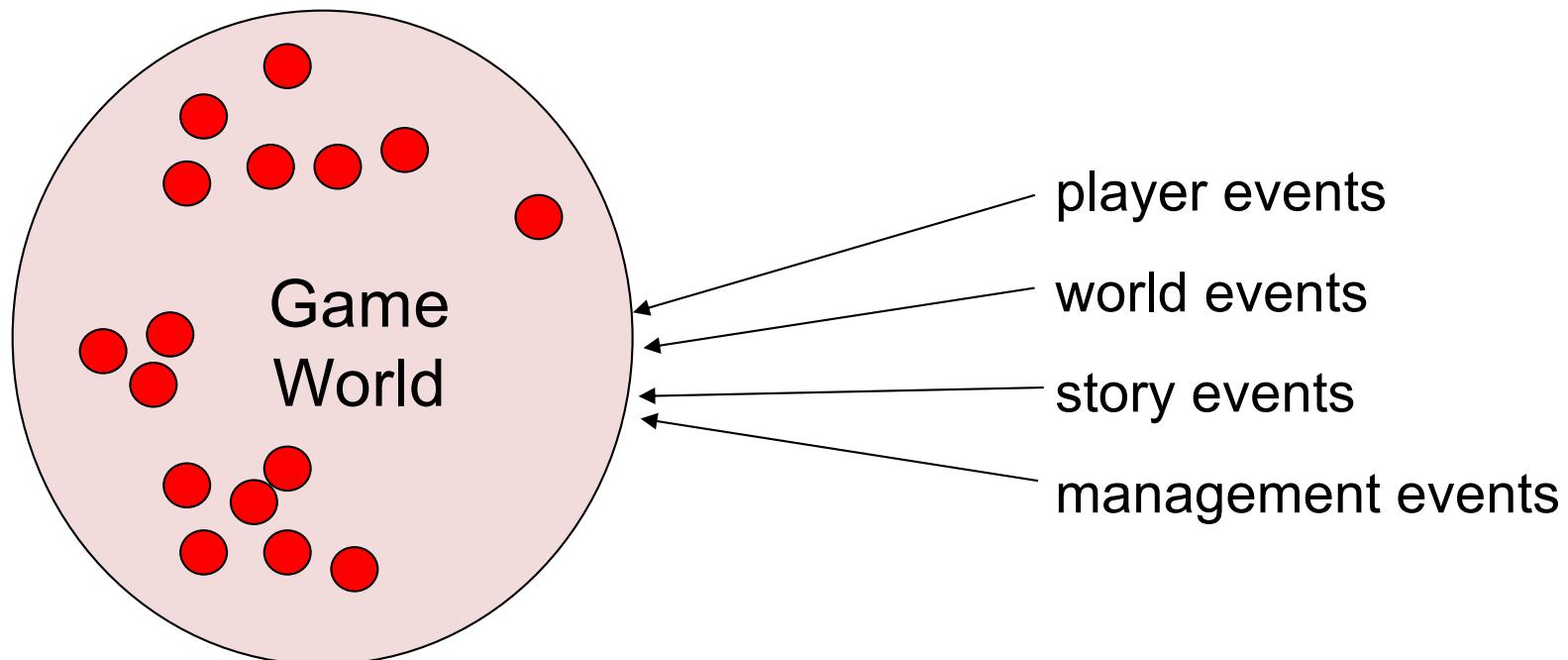
There can be over 200,000 players accessing the world at any stage.

All these players may be running different types of hardware and have various internet speeds.

Yet the game world state must remain consistent for all the players.

# Global Events

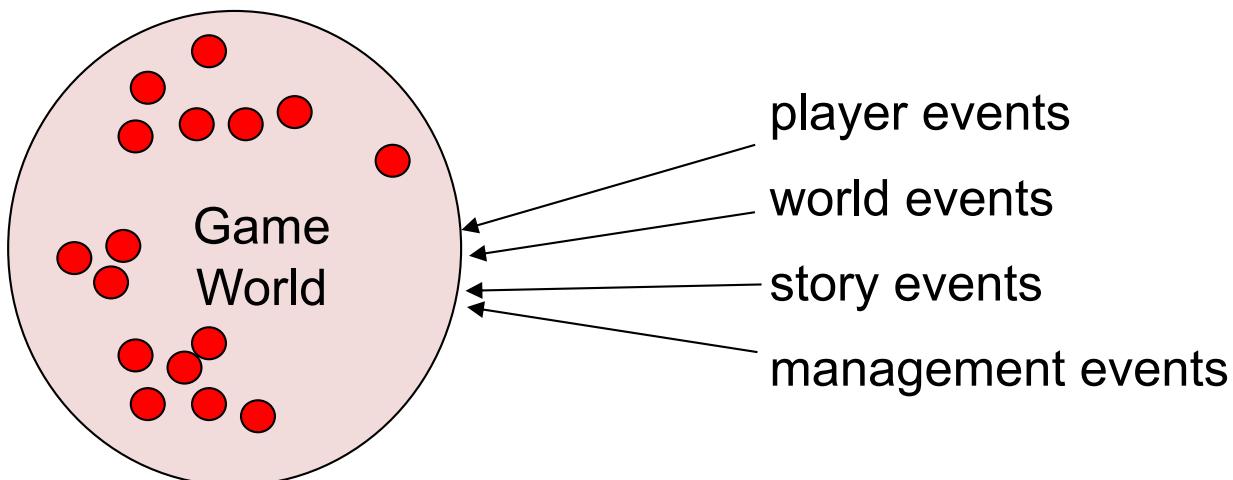
All events in a MMORPG (player events, world events, story events, management events) need to update the game world for the players involved.



# Global Events

Some events such as centralised changes to the world state may need to be synchronised, and occur simultaneously for all players.

Other updates can occur at different rates for different players - perhaps taking effect at the next log on.



# Local Events

Player generated events may be strategy-driven and these events do not necessarily have to update in real time.

However action-driven events need to take effect immediately.

Although these action-events may only have a localised effect on a few players in one area of the world.

# Evolving World

Most MMORPGs allow the players to contribute to the growth of the game world.

In this way the game world is constantly being changed by the players.

This generative nature of these game worlds is very different from the predetermined journey a player takes through other types of games.

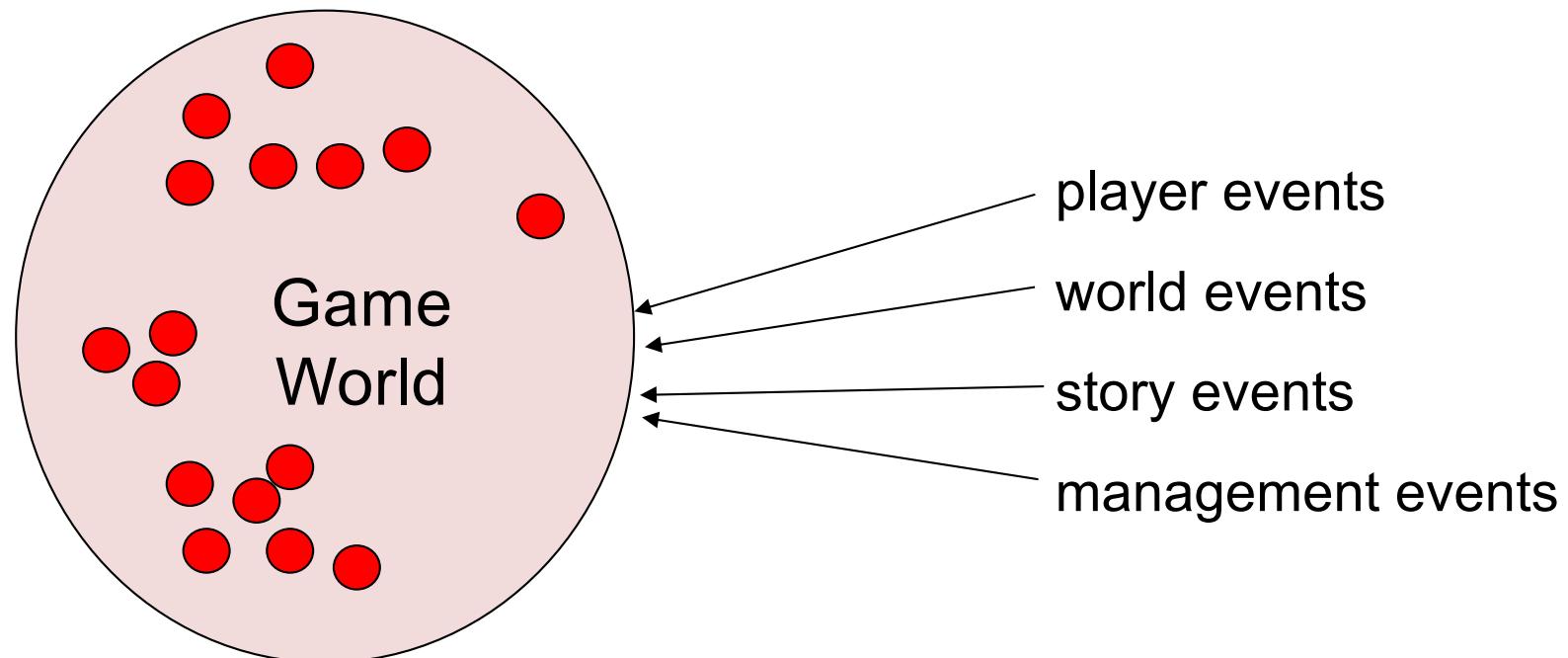
# Evolving World

This introduces many technical challenges in designing, implementing and maintaining these online worlds.

Many of the technology demands made by today's online games are addressed by the network architecture.

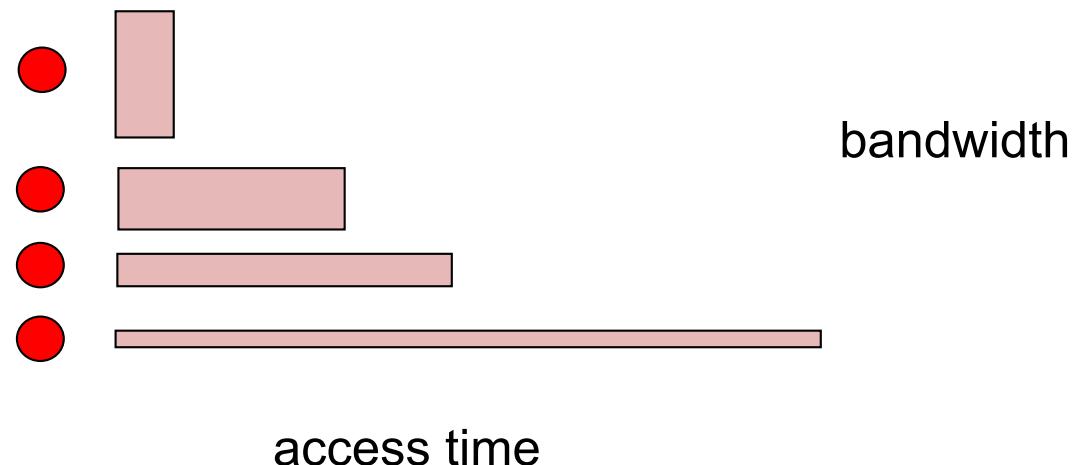
# Network Architecture

An online game world must respond to events fast enough to keep the world coherent and to make sure the player's response time is acceptable.



# Network Architecture

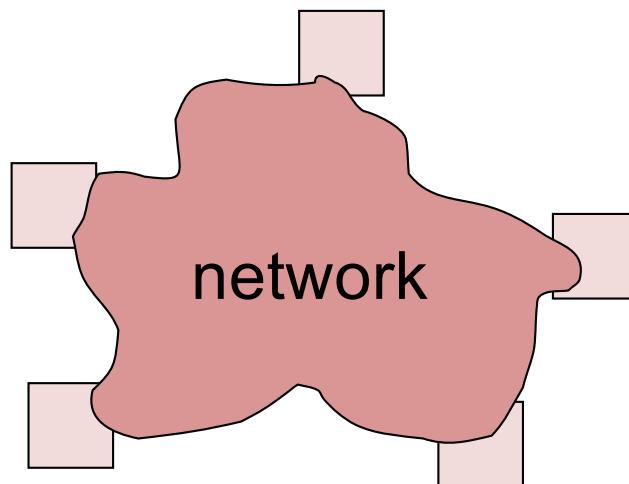
The bandwidth of the network is one critical constraint in the design of any networked game.



# Network Architecture

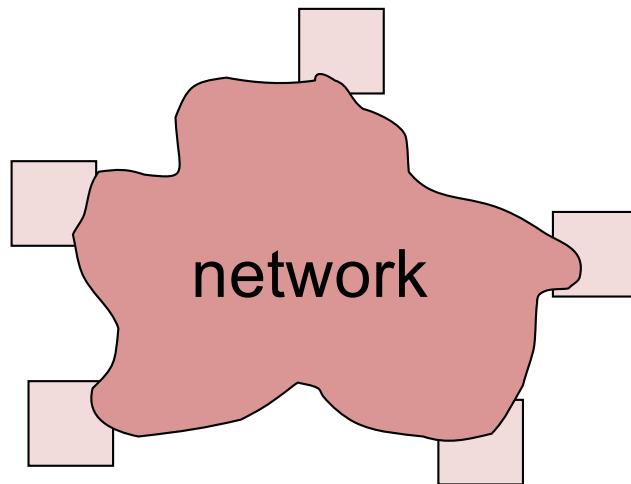
Online games are implemented as a *distributed computer system*.

A collection of machines that communicate by exchanging events (messages) across a network.



# Network Architecture

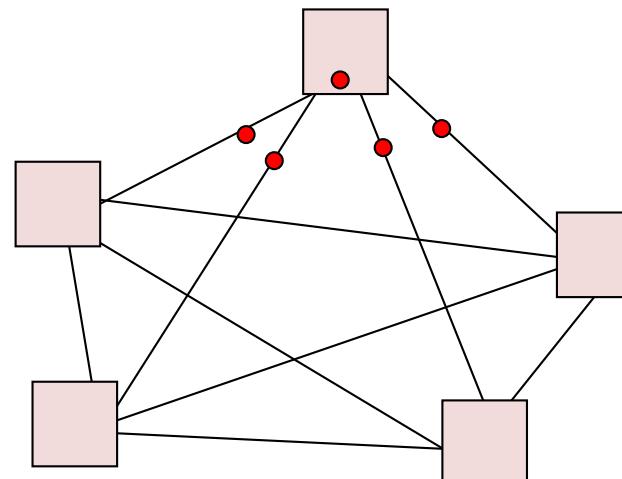
However there are a number of different configurations that can be used to implement a distributed system (types of network)



# Peer-to-Peer

Local high-bandwidth networks (usually in a single location) allows events to be broadcast simultaneously to all computers in the network.

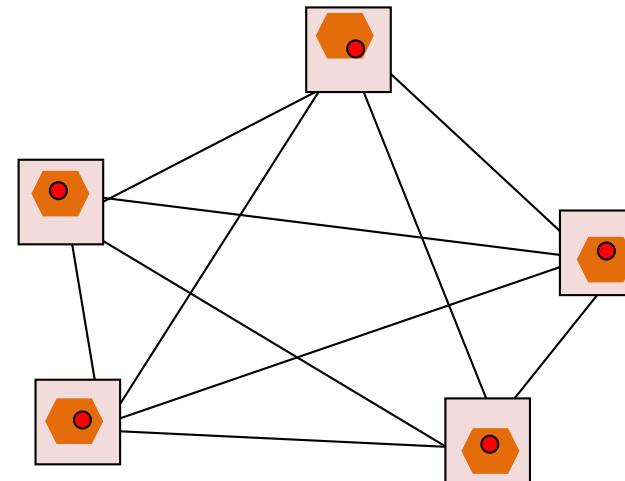
This is described as a peer-to-peer network.



# Peer-to-Peer

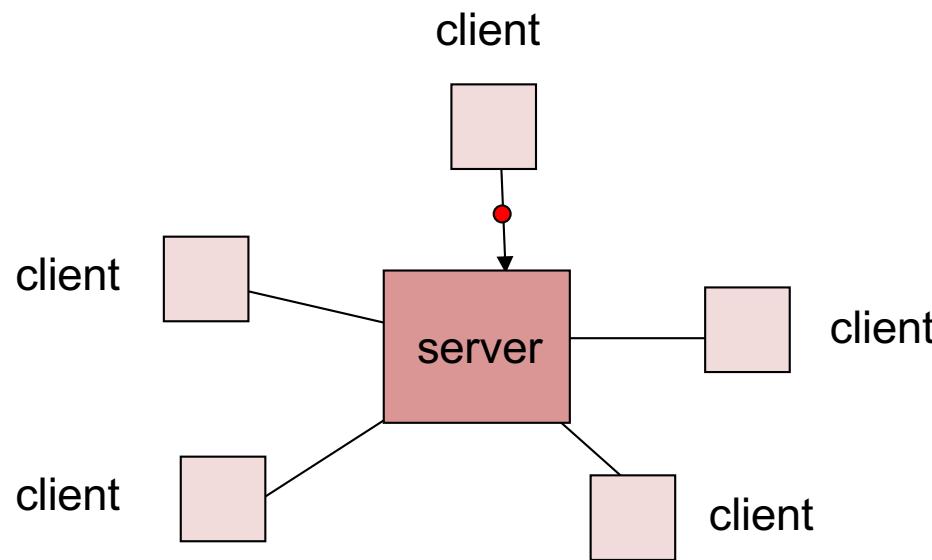
Each computer maintains its own copy of the game world and updates the state based on the messages received.

Since all computers receive all events at the same time the game world remains consistent for all players.



# Client Server

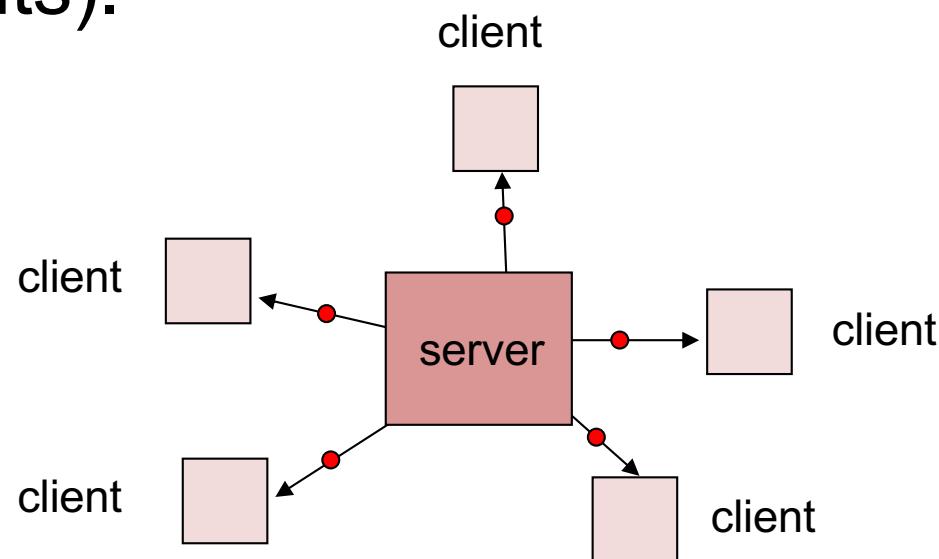
The architecture used in internet connected games is called a client-server model.



# Client Server

The game world runs on a single centralised machine.

This central machine (the server) receives (and sends) all the messages from the player's machines (the clients).



# Asynchronous Update

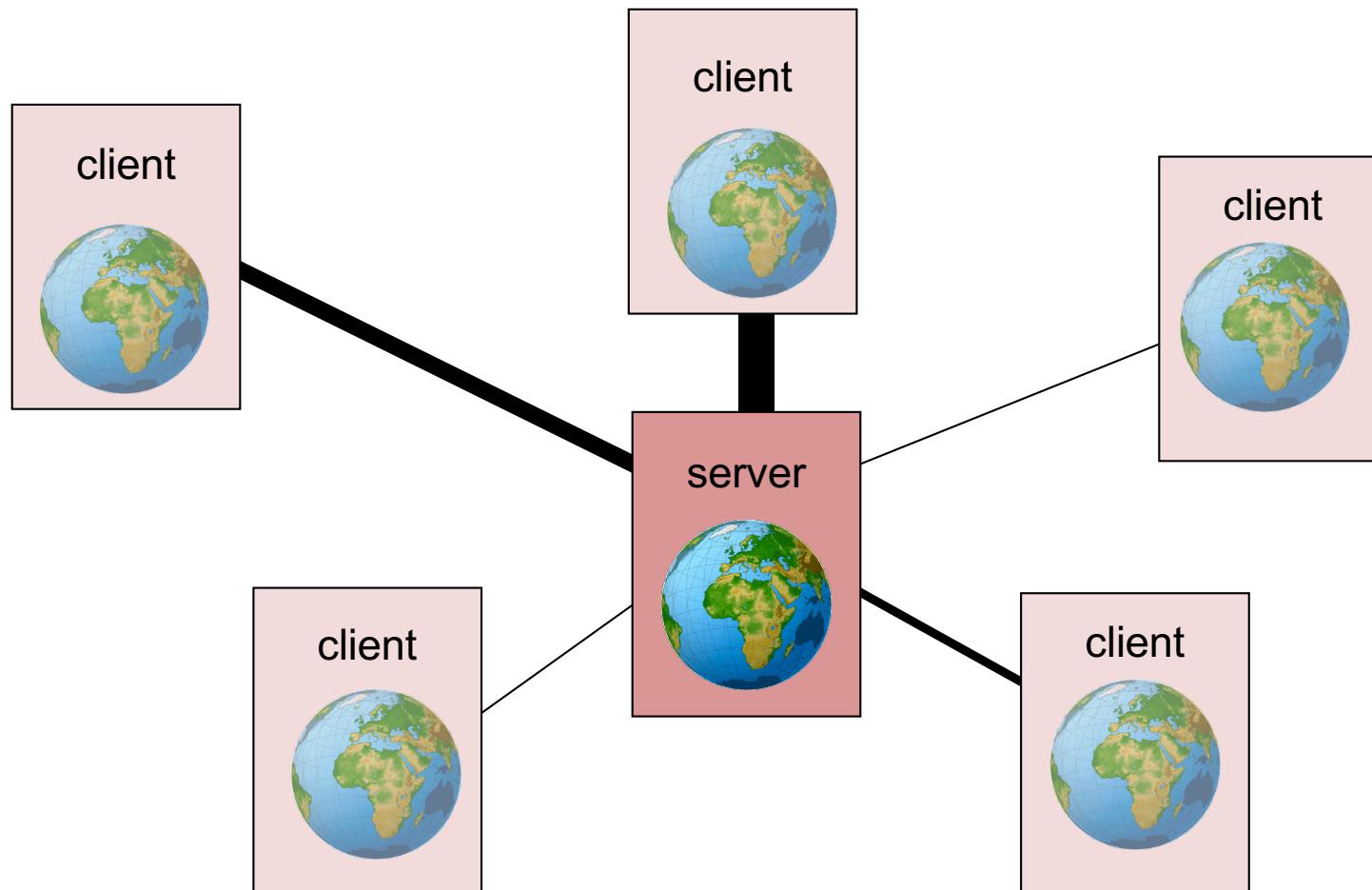
These networks have a variety of bandwidths between each computer.

There is also a variety of distances and branches between each player in the network.

So consistent updates of the game world is not possible for client-server games

# Client Server

This type of architecture does makes it easier to control the single centralised game world.



# Client Server

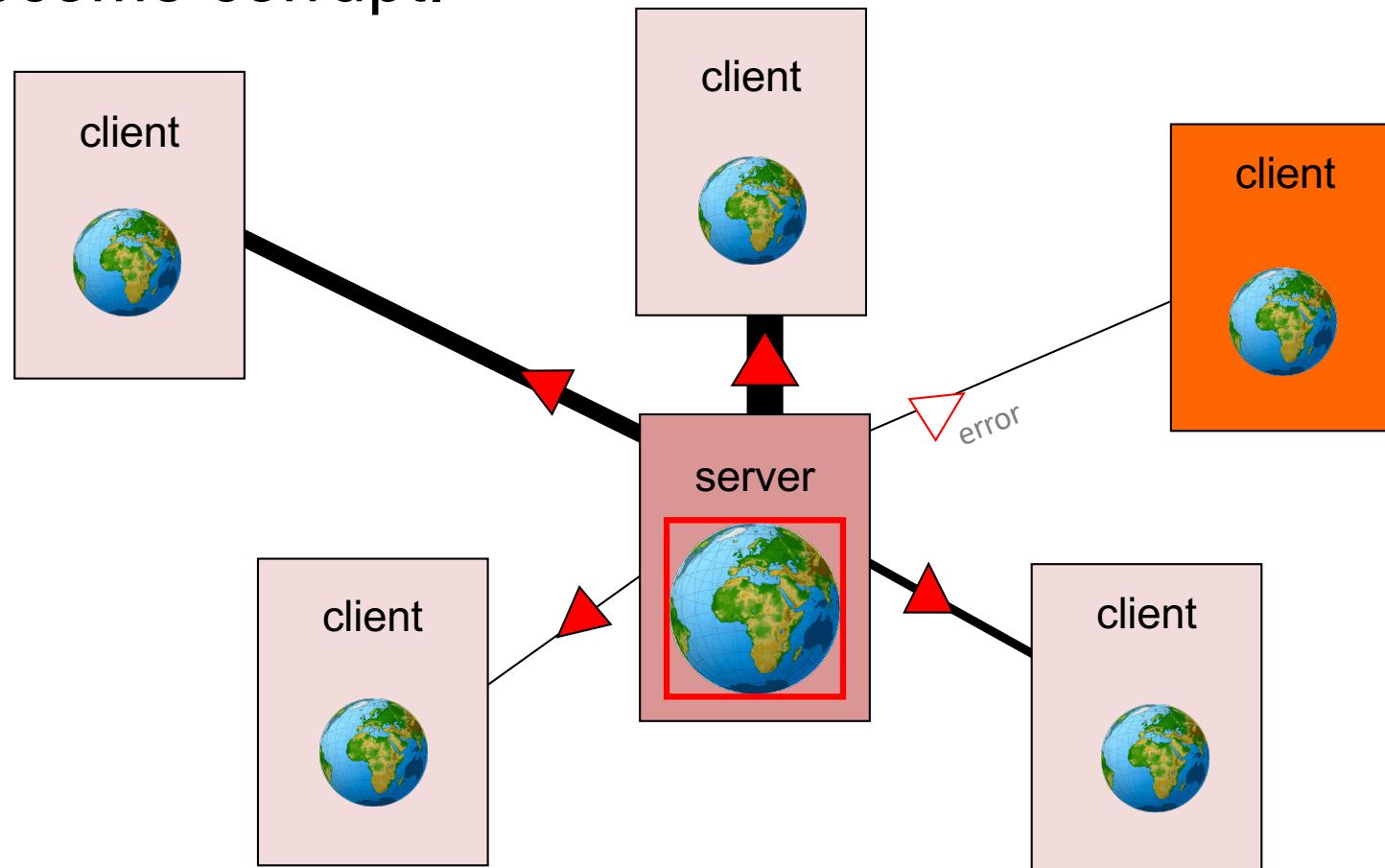
However, each message from the server needs to be sent to every client.

This whole process is slower than a peer-to-peer architecture and requires a greater amount of information to be sent across the network.

(Although improving technology, faster higher bandwidth networks and compression algorithms makes this less of a problem)

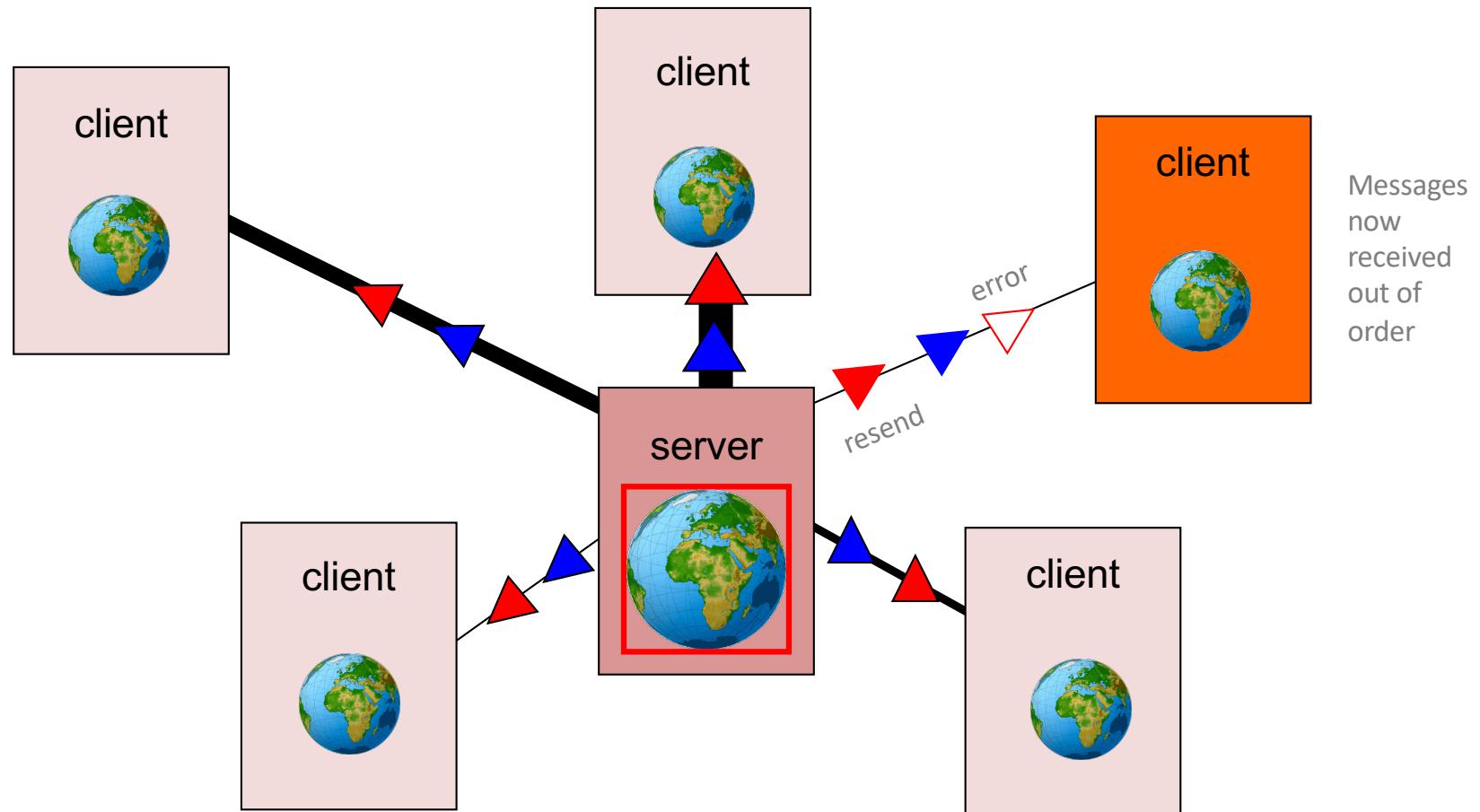
# Consistent State

There is also the problem that some messages may not be received by some clients (network error) or may become corrupt.



# Transmission Errors

Message order 2 1  
▶ ▶



# Scalable Networks

Current MMORPGs may have hundreds of thousands of players at anytime.

This requires the network architecture to be "scalable".

As new players enter the game the support network may need to grow to ensure response times are maintained.

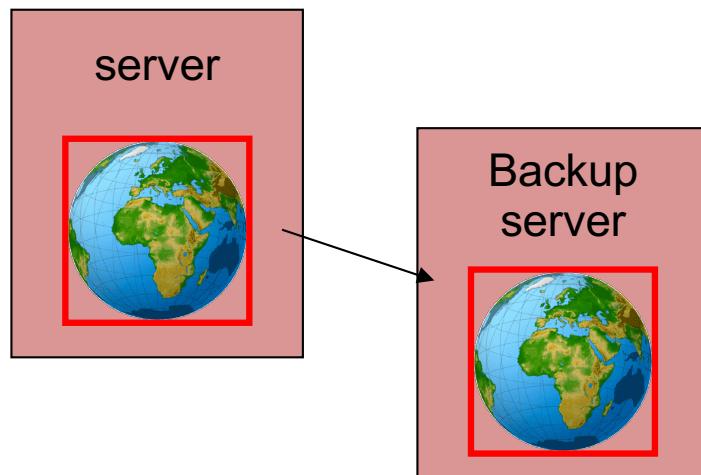
# Fault Tolerance

A key element of successful online games is that the game is always operational.

To achieve this strategies need to be in place if faults occur in the server. This usually involves redundancy of the server hardware and software.

# Fault Tolerance

It requires keeping a second updated game world on a second machine which can be seamlessly switched if a fault occurs.



# Security

Security, as with most networked systems is a critical component of online games. It needs to consider:

- Player authentication
- Protection of player confidentiality
- Data Integrity
- Enforcing the rules of the game world
- Protecting against willful disruption of the game
- Copyright protection