PA201
Virtual Environments

Lecture 8
Online Virtual Environments

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Online Virtual Environments

Virtual Environments (VEs)

- VEs are synthetic representations of reality
  - Focused on the experience that the users of these worlds have
  - Can be used by distributed groups of large numbers of players, and are immersive and interactive
- Many types exist
  - Focus is on Online Virtual Environments
    - Sometimes called 'Collaborative Virtual Environments'

Virtual Environments Experience

- Sensory Feedback – information about the virtual world is presented to the participant's senses
  - Visual (most common)
  - Audio
  - Touch
  - Smell
- Interactivity – the virtual world responds to the user's actions
  - Computer makes this possible
  - Real-time

Walking Experiment at UNC – Chapel Hill

Online VEs

- New ways of exploring web-based applications
  - Evolution of telecommunication technologies, web-services and software engineering
- Great range of different online virtual environments
  - More than 100 different ones

Collaborative Virtual Environments

- "Collaborative Virtual Environments (CVEs) are online digital places and spaces where we can be in touch, play together and work together, even when we are, geographically speaking, worlds apart…
- In CVEs we can share the experience of worlds beyond the physical" [Churchill/Snowdon/Munro 2001]

Key Components

- Graphic engines
- Displays
  – Monitors, HMDs, etc
- Interaction devices
  – Keyboard, mouse, trackers, etc
- Processing Systems
- Data Network

Types of VEs

- High realism online virtual gaming platforms
  – Custom, more experimental prototypes
  – Online game engines
- Alternative online virtual environments
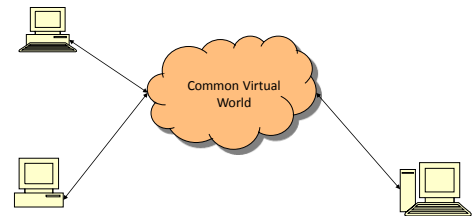 – Second Life, Active Worlds, OLIVE platform, etc

Typical Issues

- Some common research issues include:
  – What is the best virtual environment
  – What is the level of realism and interaction required
  – How best to design activities and experiences for learners

## Basic Architecture

Common Virtual World

Current Challenges

- Network Bandwidth/Latency
- Heterogeneity
- Distributed Interaction (real-time)
- Resource Management - Scalability

Networking Concepts

- Latency
  – Amount of time to transfer a bit of data from one point to another
  – Latency has a direct impact on interaction inside the virtual world
  – The designer cannot really reduce latency
    • It is possible to hide it or reduce its impact
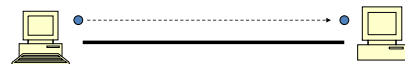
Networking Concepts .

- Latency - causes:
  – Physical limitations: speed of electromagnetic waves in the transmission material
    • Approximately 8.25 msec per time zone
  – Delays introduced by the endpoint computers
  – Delays introduced by the network itself
   • Routers

Networking Concepts ..

| TCP	Small number of users Limited data requirements Typically client-server configuration
UDP	Higher data requirements Used both in client-server and peer-to-peer configurations.
IP Broadcasting	Small peer-to-peer Net VEs with high data requirements and time sensitive delivery.
IP Multicasting	Large peer-to-peer NetVEs, be careful with routers.

Architectures

- Client-Server Systems
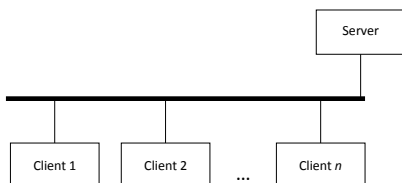 – Logical architecture
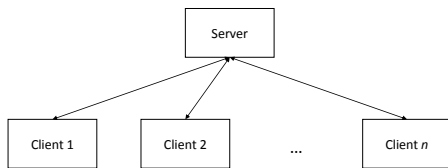
Architectures .

- Client-Server Systems
  – Physical architecture with phone lines
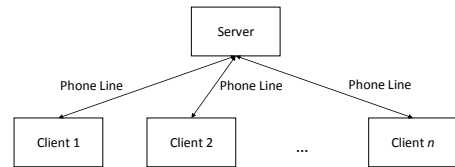
Architectures ..

- Client-Server Systems
  – Physical architecture on a LAN
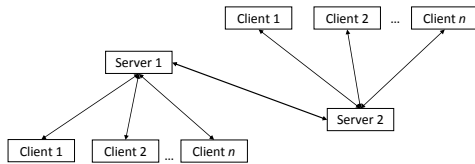

Architectures …

- Client-Server Systems
  – The Server can become a bottleneck.
  – What are the advantages? The server can decide::
    • Which clients should receive a message.
    • What protocol to use with different clients.
    • Sub-sample messages to slow users.
    • Keep statistics

Architectures ….

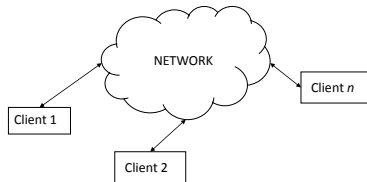- Multiple-Server Architectures

Architectures …..

- Multiple-Server Architectures
  - Several servers have the following advantages:
    - System scales better
    - Communication between clients attached to different servers takes longer
    - Key issue: how to assign clients to servers?

Architectures …..

- Peer-to-peer

Architectures ……

- Peer-to-peer
  - "Network" will be:
    - Broadcast
    - One or multiple multicast groups
  - In the case of multicast groups:
    - Area of Interest Management: assign different users to different multicast groups, based on some criteria
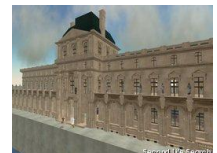
Technology Comparison

Technology	Speed (Kbps)	Min # players	Max # players
Modem	56	1	6
DSL	1500	39	163
T-1	1500	39	163
10BT	10,000	263	1085
100BT	100,000	2630	10851

Second Life – An example

- A typical illustration of online virtual environments is Second Life
  - 13 million registered accounts worldwide
- An open source approach exists
  - OpenSim

Tours in Virtual Reality

- See examples:
  - http://www.virtualfreesites.com/museums.reality.html

Second Life Video

Virtual Learning Environment

Virtual Learning Environment

- A virtual learning environment (VLE) in educational technology is a Web-based platform for the digital aspects of courses of study
  - Usually within educational institutions
- VLEs typically
  - Allow participants to be organized into cohorts, groups and roles
  - Present resources, activities and interactions within a course structure
  - Provide for the different stages of assessment report on participation
  - Have some level of integration with other institutional systems

VLEs Components

- VLE learning platforms commonly allow:
  - Content management
    - Creation, storage, access to and use of learning resources
  - Curriculum mapping and planning
    - Lesson planning, assessment and personalisation of the learning experience
  - Learner engagement and administration
    - Managed access to learner information and resources and tracking of progress and achievement
  - Communication and collaboration
    - Emails, notices, chat, wikis, blogs

VLEs Components .

- A VLE is normally not designed for a specific course or subject
  - Capable of supporting multiple courses over the full range of the academic program
  - Consistent interface within the institution
- VLEs support an exchange of information between a user and the learning institute through digital mediums
  - i.e. e-mail, chat rooms, web 2.0 sites or a forum thereby helping convey information to any part of the world with just a single click

Justification for VLEs

- Economize on the time of teaching staff, and the cost of instruction
- Facilitate the presentation of online learning by instructors without web authoring experience
- Provide instruction to students in a flexible manner to students with varying time and location constraints
- Provide instruction in a manner familiar to the current web-oriented generation of students
- Facilitate the networking of instruction between different campuses or even colleges
- Provide for the reuse of common material among different courses
- Provide automatic integration of the results of student learning into campus information systems

https://en.wikipedia.org/wiki/Virtual_learning_environment

VLEs Controversy

- VLEs are supposed to support many 21st century skills, including:
  – Cultural and global awareness: Students have access to a wide network of people and information. Students are able to learn and work with people from all over the world
  – Self-direction: Students are able to work at their own pace
  – Information and communication technology literacy: Students use technology to obtain and present information
  – Problem solving skills: Students are required to demonstrate their knowledge and skills in order to be assessed, and they often participate in group thinking and discussion
  – Time management: Students are required to meet deadlines

https://en.wikipedia.org/wiki/Virtual_learning_environment

VLE Systems

- Prominent open source VLEs are used by schools, businesses, and training organizations and include:
  – Moodle, eFront, OLAT, Sakai, ILIAS, ATutor, Fedena, openelms, Claroline, and Dokeos
- Commercial VLEs include:
  – Blackboard, Rukuku, Lotus Workplace, COSE, My Learning UK, and WebCT

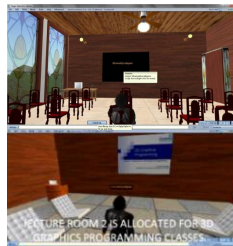https://en.wikipedia.org/wiki/Virtual_learning_environment

# Case Studies

OpenSim Case Study

- Online Virtual Learning Environment
  – OpenSim
    • Open source
    • Creates dynamic online VEs
    • Allows customisation
    • Supports different database systems
- Aim:
  – Teach computer graphics University UG students

Jaligama. V, Liarokapis, F. An Online Virtual Learning Environment for Higher Education, Proc. of the 3rd International Conference in Games and Virtual Worlds for Serious Applications (VS-Games'11), IEEE Computer Society, Athens, Greece, 4-6 May, 207-214, 2011. (ISBN: 978-0-7695-4419-9)
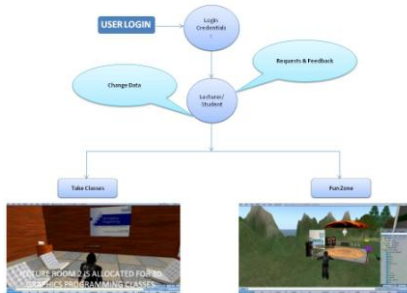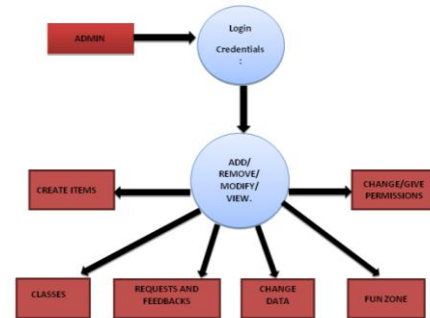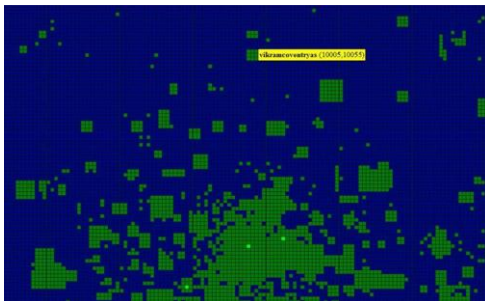
Virtual Learning Environment
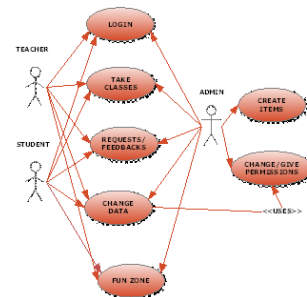
User-System Interaction

Administrator Privileges

Online VE Location

Modelling

Virtual Fun Zone

Online Teaching

- A 2nd year computer science undergraduate module has been ported into our online virtual learning environment
  - Called '3D Graphics Programming' and introduces 3D computer games graphic programming fundamentals to the students
- The theoretical part covers issues such as textures, global illumination and the simulation of physical phenomena

Online Virtual Classroom

User Evaluation

- Two-stage evaluation with 20 participants was performed and qualitative and quantitative feedback was recorded
  - Participants ranged from students to business professionals
  - Evaluation lasted for approximately 1 hour per participant
- All end-users had some experience with computer games, console games or online virtual environments
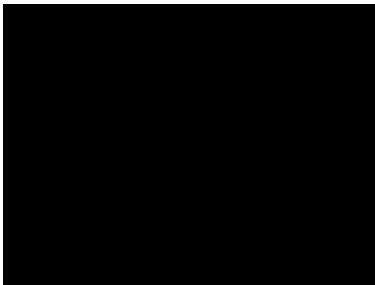
Qualitative Evaluation

- On the positive side, most participants noted that the platform is quite enjoyable and has a lot of potential for remote learning
- On the negative side, some participants did not like the idea of spending some time to familiarise with the platform
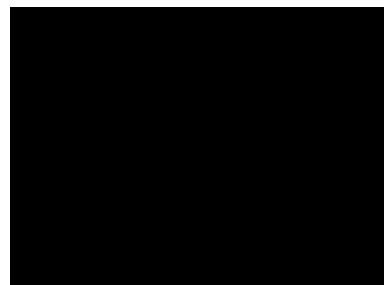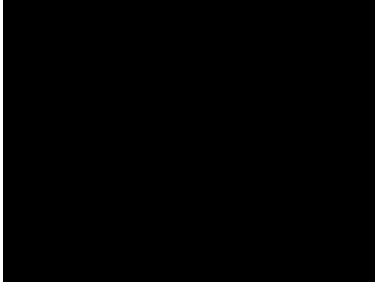
Feedback

Virtual Learning Experience

Audio-Visual Effectiveness

Other Virtual Activities

Distance Learning Experience

Video 1

Video 2

Video 3

Videos

- http://www.youtube.com/watch?v=rZ5vzsNugVQ&feature=mfu_in_order&playnext=1&videos=_6TNubnT0To
- http://www.youtube.com/watch?v=HI7nrORinrg&feature=mfu_in_order&list=UL
- http://www.youtube.com/watch?v=NGf9BTGsAB8
- http://www.youtube.com/watch?v=a5itQRi7Sog&feature=mfu_in_order&list=UL

VS-Games Conferences

- VS-Games 2009, Coventry, UK
  - http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=5116537
- VS-Games 2010, Braga, Portugal
  - http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=5458389
- VS-Games 2011, Athens, Greece
  - http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?reload=true&punumber=5962074

IEEE VS-Games 2017

- Dates:
  - Submission: 30th April 2017
  - Conference: 6-8 September 2017
- Location:
  - Athens, Greece
- Website:
  - http://vsgames.org/2017/

Conclusions

- Online VR is becoming more and more popular
  - Expected to get serious profits in the digital industry
- More research is required in many areas
  - HCI, personalisation and pedagogy

Questions