

Networking Virtual Environments

Naval Postgraduate School

Spring 2003



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Course Concept

- This course is a networking-heavy variation on Dr. Michael Zyda's MV4474, *Networked Virtual Environments (NVE)*.
 - Text: Singhal & Zyda, *Networked Virtual Environments*, ACM Press, 1999
 - Reference: Pullen, *Understanding Internet Protocols*, Wiley, 2000
 - Use of material from Dr. Zyda's slides is gratefully acknowledged.
 - Slides will be available the day before class (the URL will be announced today or tomorrow by email).
- This course is project-based: individual and group projects will cover the major aspects of NVE.
 - Students who already have a background in NVE will be offered more demanding networking projects.

MV4924 Instructor

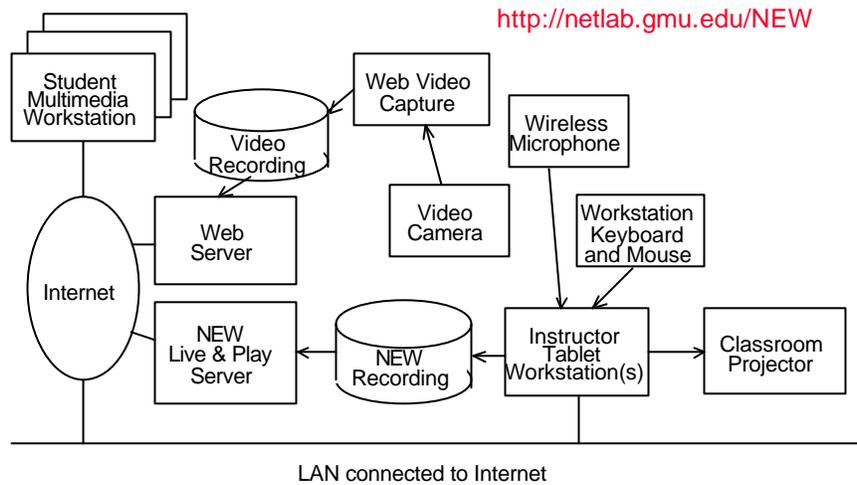


- Dr. Mark Pullen
- Office/Hours: SP-242/ Mon,Tue,Wed,Thu 0900-1100
- Communications: e-mail <mpullen@gmu.edu>
- Background: <http://netlab.gmu.edu>

Distance Education Desktop Delivery

- In-class delivery uses a system developed at GMU called Network EducationWare (NEW)
 - enables multiple home/office desktops on Internet to receive coordinated graphic presentation
 - includes voice, annotations, slide flipping
 - questions by voice or text
 - entire process recorded for later playback
- Students can use this system at home or office, if they have:
 - P300 or better PC running Windows 98/ME, NT/2000/XP
 - Java enabled
 - Standard sound card
 - good Internet service to NPS (56K modem OK)
 - to try it out see <http://netlab.gmu.edu/disted>
- it is possible to take all classes this way
 - including project presentation

Distance Education via Network EducationWare



Grading

- Course is project-based
 - four individual projects
 - one group project: teams of one or two
 - each project counts 1/5 of overall grade

Course Outline (1)

1. networked virtual environment overview (sessions 1-3)
 - a. forms of distributed interaction
 - b. examples of NVEs and related systems
 - c. graphics/display
 - d. supporting software
 - e. networks
2. networking review (sessions 4-8)
 - a. host-to-network technologies
 - b. internetting
 - c. multicasting
 - d. transport layer
 - e. application protocols
 - f. communication architectures

Course Outline (2)

3. networked multimedia (sessions 9-15)
 - a. sound
 - b. graphics
 - c. video
 - d. priority, rate control, flow control
 - e. middleware
4. virtual simulation (sessions 15-20)
 - a. managing shared state
 - b. stream networking
 - c. psychological issues: event resolution
 - d. DoD architectures: DIS and HLA
 - e. visualization

Course Outline (3)

5. efficiency/performance issues (sessions 21-27)
 - a. approximating reality: dead reckoning
 - b. threads
 - c. real-time rendering
 - d. collision detection
 - e. compression and aggregation
 - f. area-of-interest management
 - g. server architectures

6. online conferencing/teaching (sessions 28-33)
 - a. system requirements & subtle issues
 - b. floor control
 - c. recording
 - d. integrated graphics
 - e. network performance issues

7. exam week: team project presentation/demonstration

MV4924-01 SPRING 03

4/5/03

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MV4924 Projects

1. (week 3) send DIS PDUs to NPSnet to make a simple object (ball?) follow a simple trajectory (straight line or ballistic)
2. (week 5) stream a sound file to an audio player
3. (week 7) create an X3D visualization that produces the same output as project #1 by creating X3D and streaming it to a viewer
4. (week 8) read DIS PDUs from UDP stream for a simple object and display them with a second-order DR taken from the DIS protocol
5. (weeks 9-11) group project: UDP-based overlay multicast (five modules interchange with instructor-written code)

Students who have already done projects similar to 1 thru 4 may substitute a different project, in consultation with the instructor.

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Meeting Dates

- April 7, 8, 9, 10, 14, 15, 16, 17, 21, 22, 23, 24, 28, 29, 30
- May 1, 5, 6, 7, 8, 12, 13, 14, 21, 22
- Jun 2, 3, 4, 5, 9, 10, 11, 12
- Project presentations: Jun 23, 24, 25, 26

Networked Virtual Environment Overview

Lecture Overview

NVE promises & challenges

- definition/description
- NVE requirements

NVE Definition

A software system in which multiple users can interact with each other in real time, regardless of location

NVE Requirements

- shared sense of space (same place)
- shared sense of presence (able to interact)
 - virtual persona: avatar
- shared sense of time (modulo human perception time)
- means to communicate: means to share interactions with each other and the NVE

NVE Requirements - Summary

- An NVE provides the ability to interact, share information, and manipulate the NVE via immersive graphics.