

NVE Technologies and Challenges



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Lecture Overview

- About Networked Virtual Environments
 - definition, applications, requirements
- NVE Technologies Overview
 - graphics engines
 - control & communications
 - processing systems
 - network
- NVE design/development challenges
 - network capacity
 - heterogeneity
 - distributed interaction
 - real-time aspects
 - failure management
 - scalability
 - deployment/configuration

NVE Definition and Applications

- Definition:
 - a software system in which multiple users interact with each other in real time, regardless of location

- Applications:
 - military training/rehearsal
 - design evaluations
 - e-commerce
 - games

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 Technologies Overview

Graphics Engines

- without this we have only networked computers
- but is now available in PCs with graphics cards
- better displays provide a surround experience:
 - head mounted display
 - cave: room with projection on 3 or more surfaces

NVE Technologies Overview

Control & communications

- keyboard & mouse
- joystick/spaceball
- data glove
- motion detectors
- tethered position sensor

NVE Technologies Overview

Processing systems

- behavior
- rendering
- communications & control

NVE Technologies Overview

Network

- throughput, latency, errors (QOS)
- previously required special facilities
 - (e.g. Defense Simulation Internet)
- now practical on lightly loaded Internet
- standards essential to interoperate
- standards also now include 3D display

NVE design/development challenges

Software issues

- distributed operation
- graphical interface
- interactive behavior
- existing services:
 - database
 - authentication
 - logging
- involves trade-offs

NVE design/development challenges

Network capacity ("bandwidth")

- aggregate of users increases demands
 - usual assumption that burst traffic is independent does not hold up
- selective delivery conserves capacity
 - easy to say; can be hard to do!

NVE design/development challenges

Heterogeneity

- variety of network connections
 - ranges from dial-up to high-performance
- variety of displays and computers
 - graphics and processor performance not uniform
 - don't always work well together
- making interactions "fair"
 - what does "fair" mean, anyhow?

NVE design/development challenges

Distributed interaction

- create illusion of locality
- deal with latency
- deal with interactions, e.g. collisions

Real-time aspects

- fast, prioritized response
 - requires multithreaded systems
- design for contention (locks etc)

NVE design/development challenges

Failure management

- system stop (local or global)
 - quits working
- system lockout (closure)
 - won't accept any new participants
 - worst case, won't accept new inputs
- system degradation (hindrance)
 - doesn't work up to design specification
- fault-tolerance (system continuance)
 - ideal capability

NVE design/development challenges

Scalability

- generally: the ability to increase size of a system using resources that are linear with respect to size
- depends on network capacity, processor capability, rendering speeds, overall architecture
- size parameters:
 - number of simultaneous entities
 - number of simultaneous hosts
 - allowable physical distance
 - partition interaction to improve scalability

NVE design/development challenges

Deployment and configuration

- easiest on dedicated systems with configuration control
- on the Internet
 - provide for download
 - accept security bounds
 - deal with multiple-browser display issues
- provide for system configuration
 - virtually every parameter
- web standards/services are making this better