Causing Mayhem on the Internet with Virtual Environments

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Motivation: Vision

“Hiro is approaching the Street. It is the Broadway, the Champs Elysees of the Metaverse. It is brilliantly lit boulevard that can be seen, miniaturized and backward, reflected in the lenses of his goggles. It does not really exist. But right now, millions of people are walking up and down it.”

“Developers can build their own small streets feeding off the main one. They can build buildings, parks, signs, as well as things that do not exist in Reality, such as vast hovering overhead light shows, special neighbourhoods where the rules of three-dimensional spacetime are ignored, and free-combat zones where people can go hunt and kill each other.”
Motivation: Virtual Environments?

- Virtual Environments are:
  - Small budgets – no cool factor
  - Genesis (2-4 years) then on-going
  - Dynamic milestones
  - Limited to few well behaved users
  - Rich variety of architectures
Motivation: Online Games?

- Online games are:
  - Virtual Environments (VE) with fat budgets
  - Built on graphic research ideas (i.e: Quake)
  - Stressed by players
  - Non-evolvable engines
  - Based on client/server architectures
Motivation: Bane of current VE

- Monolithic systems
- Functional limitation - Inflexibility
- Where is scalability?
- Network continues to be “black magic”
- Steep learning curve
- Laws of online game development
Motivation: Siggraph 2000 Panel

- Perception of components
- Re-inventing the wheel syndrome → VE developers
- Not invented here syndrome → System developers
- Position of Industry to open source
Motivation: What do we want?

Systems that support:
• Persistency ➔ cyber communities
• Runtime Extensibility ➔ System Evolution
• Interoperability ➔ content and code
• Global Infrastructure ➔ scalable
Motivation: What do we want?

Systems that support:
- Persistency ➡ cyber communities
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IT IS ALL ABOUT PEOPLE
and most prefer fishing
Motivation: Where are we?

- The birth of cyberculture
- Lots of good systems and games
- No experience exchange
- New idea \(\rightarrow\) new system
- Lots of complains
- Lots of frameworks
- NO PROGRESS!!!
Motivation: What does this mean?

- We have an understanding of issues involved
- Lack communication
- There is no “right” way
- Like reinventing the wheel
- Insufficient maturity to standardize
- Know-it-all systems
Building Blocks: Component Framework

- **VRTP Framework:**
  - Macro components – every other framework fits
  - The lower the level the more flexibility there is but the less the framework does for you
  - At the highest level, you just start the application
Building Blocks: UP Requirements

• Universal Platform
  • Independent of system resources + cross-platform
  • Retrieve resources/components
  • Some network capabilities
  • Component management
  • Global namespace for components
Building Blocks: So what is Mayhem?

- A set of well defined frameworks
- A reference implementation of the frameworks and specific extensions
- A sample application of a game that supports:
  - Heterogeneity
  - Scalability
  - Interoperability
  - Runtime extensibility
Building Blocks: Mayhem Operation

- Launch JADE with options
- Service bootstrap in XML
- Connect Server and user validation
- Capability negotiation
- Download XML description of system (ie: TW, MIM, MUD, etc)
- Enter a world
- Download the content (ie: X3D)
- Announce user
- Update and exchange content
Building Blocks: Mayhem frameworks

- So what are the Mayhem frameworks:
  - Java Adaptive Dynamic Environment (JADE)
  - TreacleWell
  - Meta Interest Management (MIM)
  - Meta Unified Datamodel (MUD)
JADE: Java Adaptive Dynamic Environment

• In a nutshell:
  • It is a low-level framework for component management
  • Reference implementation
  • Framework more important than implementation
  • Uses Java
JADE: Overview

- **Containers**: Module Managers
  - Load/Unload
  - Reload + policy
  - Find/Retrieve

- **Modules**
  - Initialize
  - Activate
  - Deactivate
  - Shutdown
JADE

- **Resource retrieval**
  - Any source
  - Any sink
  - Extensible
  - Name service (Jini, CORBA, LDAP, etc)
TreacleWell: What is it?

- The UP network Module
- Based on Application Level Framing and Micro-protocols concepts
- Unified namespace
- Abstraction to sockets and packets
- Provides component protocols (fragmentation, reliability, time synchronization, etc)
TreacleWell: The Global Picture

Application

Entity 1
Entity 2
Entity 3
Entity n

Transport

Flow 1
Flow 2
Flow n

Network

Group 1
Group n

Host 1
Host n

Naming
Mapping
Forwarding
TreacleWell: The Framework

Connectors
- Connector Adaptor 1
- Connector Adaptor 2
- Connector Adaptor ...
- Connector Adaptor n

Classifiers
- Classifier 1
- Classifier n

Flows
- Flow 1
- Flow 2
- Flow ...
- Flow n

Anchors
- Anchor 1
- Anchor n
TreacleWell: Flow Structure

Transport Application

Flow Element 1
Flow Element 2
Flow Element ...
Flow Element n

Retrieve Message

Message Buffer
TreacleWell: Slow as molasses?

**UDP Connector:**
- Send Messages: 13500 messages/s
- Receive Messages: 3825 messages/s

**Flows:**
- Flow A Send: 7745 messages/s
- Flow B Send: 13297 messages/s

Flow A = position/string/time
Flow B = string
MIM: AOIM types

- Spatial
MIM: AOIM types

- Spatial
MIM: AOIM types

- Spatial
MIM: AOIM types

- Spatial
- Locales
MIM: AOIM types

- Spatial
- Locales
MIM: AOIM types

- Spatial
- Locales
- Auras
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region

Routing Space
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region

Routing Space

A - Update
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region

Routing Space

- A - Update
- B - Update
- C - Subscribe
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region
- Filtering
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region
- Filtering
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region
- Filtering
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region
- Filtering
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region
- Filtering
- Nearest neighbors
MIM: AOIM types

- Spatial
- Auras
- Locales
- Region
- Filtering
- Nearest neighbors
MIM: Common ground

- Interest – scope information
- Wide range of policies
- Static vs Dynamic
- Client/Server vs distributed
- Poll vs Event based
MIM: Core components
MUD: Meta Unified Datamodel

- Model-View-Controller pattern and Graphs
MUD: Meta Unified Datamodel

- Model-View-Controller pattern and Graphs

Client heterogeneity
MUD: Meta Unified Datamodel
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