

Internetworked Infrastructure Requirements for Virtual Environments

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Article Outline

1. Overview
2. Existing Infrastructure Technologies
3. Software Infrastructure Needs.
4. Hardware Infrastructure Needs.
5. Applications
6. Projections
7. Conclusions

Overview

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1. Overview

Connecting every one to everything

Scope : VE development is so broad that it can be seen as an inclusive superset of all other global information infrastructure applications.

Global information infrastructure (GII) :

The totality of worldwide infrastructure elements that combine the three industry sectors:

- (a) telecommunications
- (b) computer (information) technology
- (c) consumer electronics to extend the capabilities

[After ISO /IEC N1957]

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2. Existing Infrastructure Technologies

- Layered models:
OSI and IP, TCP & UDP
- Internet Protocol IP:
Lower layers, Middle transport-related layers.
- Distributed Interactive Simulation (DIS):
PDU (Entity state , Message).
- World Wide Web .
- Multicast :
FDDI, Mbone.

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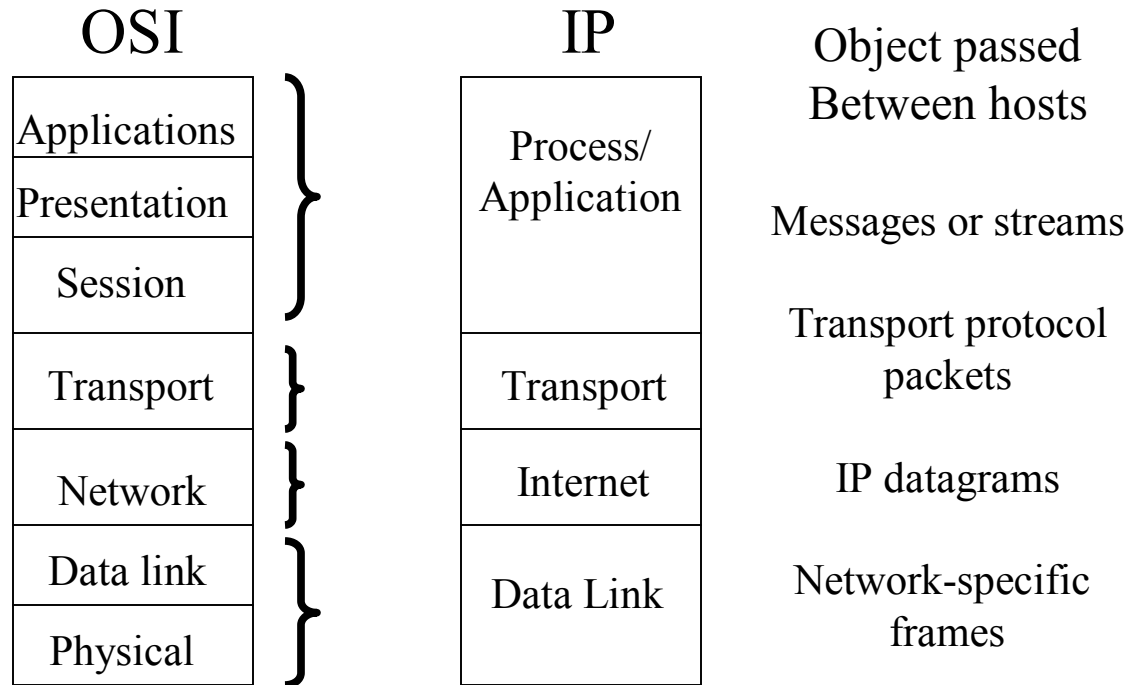


Figure 1. Correspondence between OSI and IP protocol layer model, and objects passed between corresponding host layers.

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3. Software Infrastructure Needs

- Four key communication methods
 - Light-weight Interactions.
Messages that contain state, event and control information.
 - Network Pointers.
Pointers that contain reference to an object
 - Heavy-weight.
Large data objects.
 - Real-time streams.
Video , Audio , 3D graphics

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- Application layer interactivity
 - DIS is insufficiently broad.
 - Money spent on NVE for military applications. Other implementations are in (poorly) networked games !
- Next-generation DIS
 - Awkward extensibility , requiring nontrivial computations to decipher bit patterns.
 - Next generation “dial-a-protocol” capability.

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- Other interaction models
 - Rule-based agents.
 - Common Gateway Interface scripts (cgi).
 - Linda project “tuples”
 - MUDDS and MOO.
 - Tcl , Java.
- Virtual Reality Modeling Language (VRML).
 - next VRML 2.0 : peer-to-peer.
 - Virtual Reality Transfer Protocol (vrtp)

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- Vertical interoperability
Applications that work on all mediums is needed in VE , supercomputers to workstations.

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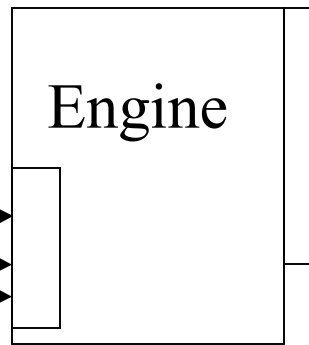
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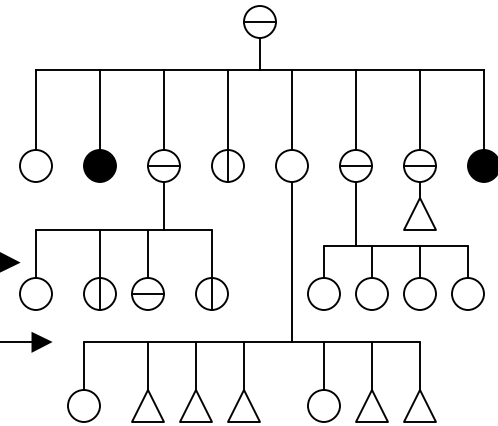
Conclusions

Engine outputs Stimulate scene graph

Engines are default
behavior interface,
constrained to act
only upon scene graph.



robot.vrml



Example behavior stimuli

- Sensors and algorithms (Open Inventor)
- Scripted actions (embedded or live via network)
- Open extensions mechanism (e.g http)
- Distributed Interactive Simulation (DIS).

Behaviors are
engine drivers

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4. Hardware Infrastructure Needs

- Research testbed.
 - National Research Council report : Designated VE networks.
 - Wide-Area Year (I-WAY) project.
- Other problems.
 - Avoid vender-specific hardware (e.g VTC)
 - Effective throughput is often less than bit rate.
 - Latency performance rarely tested.
 - Network costs are often hidden or ignored.

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5. Applications

Drive progress not protocol

- Sports : live 3D stadium with instrumented players.
- Military: 100,000 player problem.
- Science: Virtual worlds as experimental laboratories for robots and people.
- Interaction : Multiple CAVEs using ATM and VRML.

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6. Projections

- VE becoming world archive in an interaction by humans, robots and software.
- VE will add order to context.
- Internet becoming a small computer.

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7. Conclusions

- Virtual reality implications was not discussed.
- Discussions of the WWW is weak , nothing motioned about extensions of Markup Languages.
- Some sections tend to be more of science fiction rather than problem oriented solutions.

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Questions ?