



Continuum : A flexible Middleware for large-scale virtual environments

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Outline

- Objectives
- Related work
- Object Model
- Platform architecture
- Conclusion, ongoing work

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Objectives (1/2)



- ➔ A middleware for large-scale virtual environments:
 - online games on the Internet
 - real-time distributed simulation (military etc.)
 - collaborative applications (design, engineering)

Objectives (2/2)



- ➔ Scalability :
 - 1000 + simulated entities
 - 100+ (geographically-distant) participants
- ➔ Persistency:
 - permanent game universe,
 - artificial life
- ➔ Adaptability
 - application semantics
 - consistency requirements etc.
- ➔ Heterogeneity

Related Work



➔ Distributed simulation

IEEE DIS protocol:

- low-level of abstraction
- application-domain specific

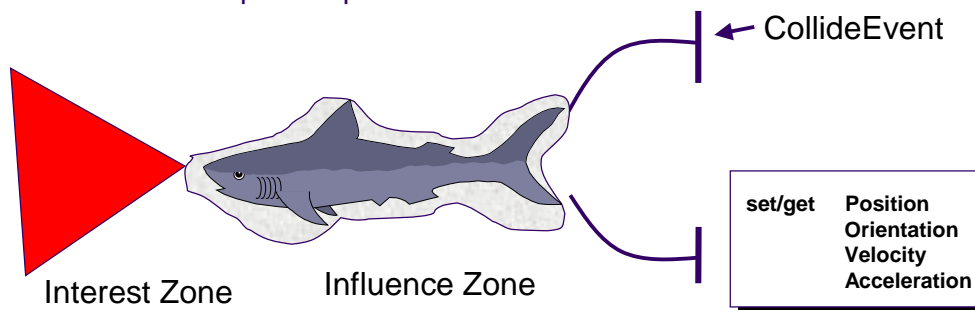
HLA/RTI simulation architecture:

- monolithic heavy-weight system
- lack of integration (simulation events outside the ORB)

Object Model (1/2)



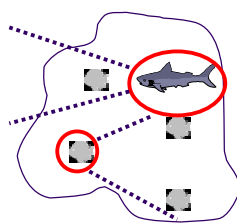
- ➔ Shared (3D) information space
- ➔ Simulation objects, situated objects
 - data interfaces
 - event interfaces
- ➔ Perception capabilities



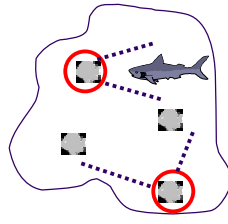
Object Model (2/2)



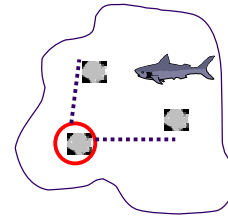
- Partial Replication based on objects' perceptions
- Logical Simulation Object \Rightarrow N replicas
 - One Master object
 - (N-1) proxies
 - arbitrary split behavior ("smart" proxie etc.)



Simulation 1



Simulation 2



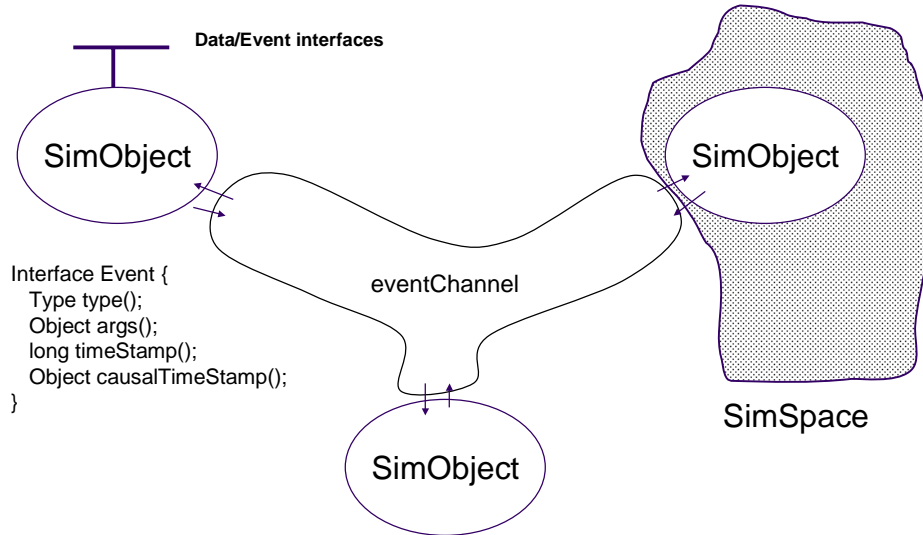
Simulation 3

Platform Architecture (1/5)



- Foundation = open-source Jonathan ORB:
 - supports different binding and interaction models;
 - multiple protocols: micro-protocol software framework
 - multi-personality (CORBA, RMI-like,...)
 - Real-time...
- (currently) 100% Java
- Continuum = a personality on top of Jonathan
 - naming, simulation object referencing
 - multi-party binding & communication object
 - mapping object model to Java

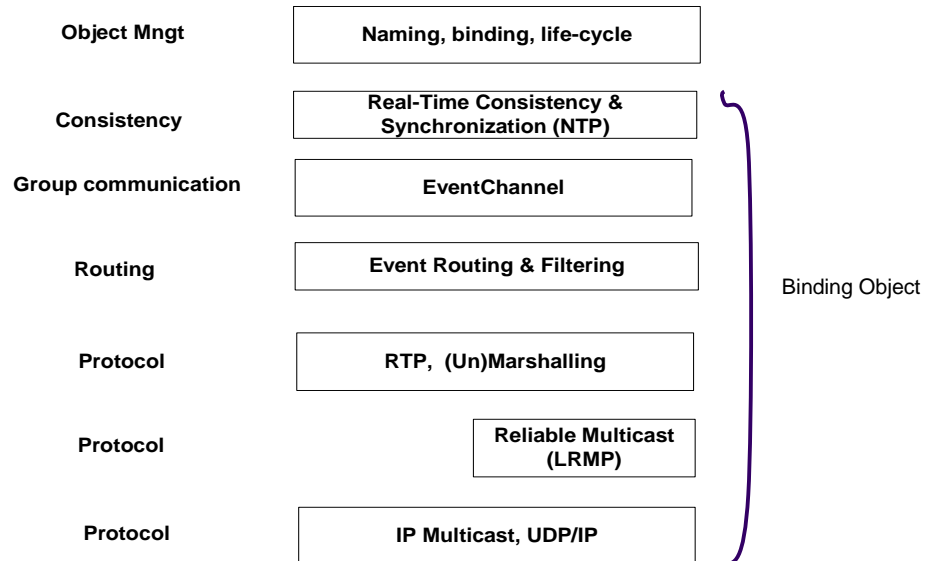
Platform Architecture (2/5)



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Platform architecture (3/5)



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Platform architecture (4/5)

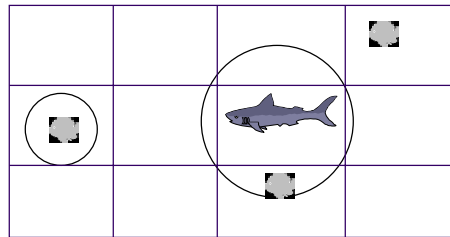


➤ Scalable Event Dissemination Architecture

publish/subscribe systems based on object location & perception capabilities

virtual environment partitioned into regions

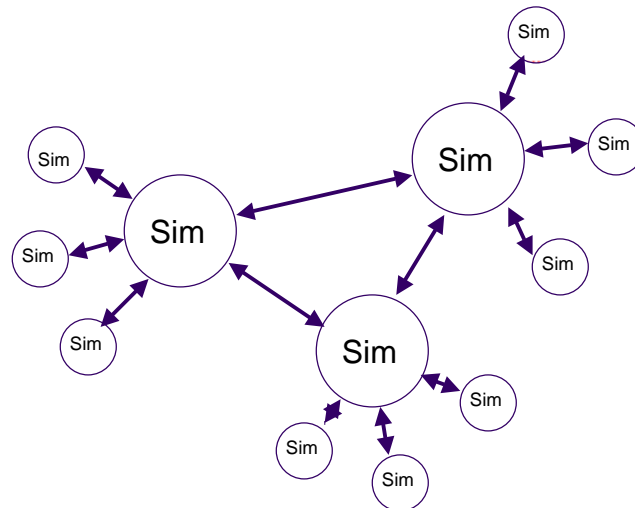
mapping regions / IP multicast addresses



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Platform Architecture (5/5)



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Conclusion



- Sharing-oriented middleware
 - high-level of abstraction
 - open platform taking into account the application semantics
 - e.g. object prefetching/caching based on object kinematic properties
 - integrated platform with multiple binding types:
 - client/server, multi-party
- In progress:
 - performance evaluation & monitoring
 - persistence / load-balancing
 - causal consistency with RT constraints
- Pointer: Jonathan open-source ORB
www.objectweb.org

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Conclusion



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