SIMCON

A Simulation and Visualization Environment for Overlay Networks and Large-Scale Applications

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Outline

- Motivation
- Design / Features
- Architecture
- Future Work
Motivation

- 3D Internet project *HyperVerse*
  - Combining Virtual Globe with MMOG

- Global scale P2P Infrastructure
  → Simulation environment *SimCon*

Motivation

- Find suitable P2P topology for a given application scenario
- Using realistic Internet router graph
  - Quality of simulation results
  - Impact of P2P topology on the router infrastructure
  - TopGen
Design / Features

- .Net (C#)
- Independence of application and topology
  - Modular design
- Reusability
  - Communication Shims
- Extensibility
- Focus on P2P overlay topology
- Multithreaded approach

TopGen

- TopGen generates underlying router graph
- Similar to real internet graph
  - Vertex degree distribution
  - Clustering coefficient
  - Assortativity
- Provides detailed router information
  - Connectivity, Bandwidth, Latency and Router Type
**Application Module**

- Emulates the behavior of an application
- Each application instance assigned to one end host node
- Each application instance in a single thread
- Communication via Topology Modules
- Possibility to gear into a simulation asynchronously

**IApp Abstract Class**

**Methods**

- AsyncEvent
- SetSettings
- SetVertex
- Start

**Architecture**

**Simulated Applications**

- Application : IApp
  - Start Instances
- Topology Module 1 : ITopology
- Topology Module n : ITopology
  - CommunicationShim : ICoachShim
  - OverlayVertex

**Simulation Controller**

- Controller

**Simulation Evaluation**

- Recorder 1 : IRecorder
- Recorder n : IRecorder
- View : IView
**Topology Module**

- A topology module implements a P2P overlay network protocol
  - E.g. Chord
- TopologyEvents
- Reusability of Topology Modules
  - Communication Shim

**ITopology Interface**

**Methods**
- Fail
- Join
- Leave
- Lookup
- Publish
- Read
- SendBroadcast
- SendMulticast
- SendUnicast
- SetComShim
- Stabilise
- Write

**Architecture**

- Simulated Applications
  - Application
  - Topology Module 1
  - Topology Module n
  - Communication Shim
  - OverlayVertex
- Simulation Controller
  - ITopology
  - Controller
- Simulation Evaluation
  - Recorder 1
  - Recorder n
  - View

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Communication Shim

- Send and receive Messages
- Application specific Communication Shims
- SimCon Communication Shim sends and receives messages via the controller

**IComShim Abstract Class**

**Methods**
- Send

**Events**
- Received

Architecture

Simulated Applications → Simulation Controller → Simulation Evaluation

- Application
- Topology Module 1
- Topology Module n
- CommunicationShim
- OverlayVertex
- Controller

Recorder 1 : IRecorder
Recorder n : IRecorder
View : IView
Recorder

- Track a simulation
  - Topology Events
- Standard Recorder
  - Count events
- Customized Recorder
- Use TopGen graph to calculate HopCount and Latency
  - During runtime
  - Post processing

Architecture

Simulated Applications

- Application
- Topology + Module
  - Start Instances
- Communication Shim
  - Overlay Vertex

Simulation Controller

- Controller
- ITopology

Simulation Evaluation

- Recorder
  - FinalizeRecording
  - GetSettings
  - SetSettings
- View
  - IView

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View

- Visualizes a simulation
  - Topology Events
- Gear manually into a running simulation via view
  - SetAsyncHandler
  - Initiate asynchronous event via controller

User Interface

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Future Work

- Cluster support
  - Communication Shim
  - Multithreaded
- Hybrid simulations
- Performance and scalability evaluation

Thank you for your attention!!