

## **Client Meeting Notes Summary – 05 Mar 20**

### **General Notes:**

LVC – live virtual & constructive; a simulation term (live = in real life, virtual = simulation on a computer, constructive = adding non-real entities to an ongoing virtual simulation that has real actors in to too).

- Main use of LVC Integration:
  - o E.g. P3D Flight Models used in VBS simulator
  - o Link a virtual environment (that isn't perfect) to link a specialist system

DIS (Distributed Interactive Simulation) – standard networking protocol for exchanging information among simulation applications

HLA (High Level Architecture) – another simulations standard (US Military Standard), not utilised for this project

Open Source Libraries:

- OpenDis – Java, C#, C++
- KDIS

Pattern of Life – important term. Need to simulate both a terrain and entities to simulate life (focussing on entities ONLY in this initial project).

Unity – used to inject pattern of life into simulation (e.g. create a “crowd”, “flock” etc.)

- Geometric objects moving around
- Injected into VBS
- Match traffic into real entities

Simulators – both VBS and Titan 3D Virtual simulators - just a visualisation platform

### **Topics:**

Entities

- Unity creates “flock” of entities to inject into middleware -> interpreted/mapped to objects in connected simulator(s)
- Focus on simple animation and entity content (as they can be mapped to various entities in simulator)
- Each entity should have state information/attributes including but not limited to position, velocity (speed with orientation/direction), latitude, longitude and altitude.

Algorithms for Pattern of Life:

- Boids: 3 simple rules to simulate flock behaviour
- Other options include...
  - o Look at simulating human behaviour e.g. conversations\

### **Other:**

Tools & Concepts

- ‘Data reckoning’ to avoid having to send a large number of packets or not sending enough packets and causing entities to behave unrealistically (e.g. jumping between positions rather than smooth animation or sudden changes in direction).
  - o Involves sending each entity’s position and velocity (via packets to the middleware) initially and ONLY sending updates if velocity changes (direction or speed)
  - o Can include a threshold (e.g. if change is above ‘x’ send an update).

- Note: VBS interface should know how many packets are being sent to it
- Right Hand Coordination System (a standard)
  - Focuses on entity state PDUs and parameters
- DIS Protocol
  - Have to configure both the IP and Port ourselves
  - Suggested tool – Wireshark to see the packets being sent from Unity to middleware
    - Ensures we can monitor the amount of traffic in network

## Resources

- Open Source Implementation of DIS – KDIS, Portico, OpenDIS
- DIS Spec - [https://standards.ieee.org/standard/1278\\_1-2012.html](https://standards.ieee.org/standard/1278_1-2012.html)
- Entity State PDU Summary - <http://faculty.nps.edu/brutzman/vrtp/mil/navy/nps/disEnumerations/JdbeHtmlFiles/pdu/29.htm>
- Crowd Behaviour Algorithms: Boids (Bird behavior)

## Outcomes:

Goal: to create “pattern of life” behaviour that is injected into one or more connected, distinct simulators via middleware.

## Tasks:

- Work in Unity to create pattern of life behaviour
- Integrate with middleware utilising DIS libraries
- Display changes in real time in VBS

Show results on at least 2 distinct connected VBS instances.

## Bigger picture:

- Connecting 2 or more simulators up together can create an even better (i.e. higher fidelity) simulation
- Want to display how one can use a high fidelity crowd behaviour model to populate simulators.

## Key Guidelines:

- Expected meeting once a week – confirmed for every Thursday at 1230 at client location.
- Email preferred method of communication.
- Establish deliverables ourselves, with something presentable every week – for example:
  - Unity Scenario established
    - which algorithms we pick to generate behaviours - finalise behaviour model
  - Two separate VBS instances connected via DIS

## Future Opportunities:

- Possibility of being involved with the writing of a paper to be included in upcoming simulations conference