Integrating Simulation Devices and Systems

Rachel H. Ellaway Ph.D.[1], David Topps MBChB[1],
Kevin Lachapelle MD[2] and Jeremy Cooperstock Ph.D[2]

[1] *Northern Ontario School of Medicine, Sudbury, Ontario, Canada,*
[2] *McGill University, Montréal, Quebec, Canada*

Abstract. Simulators are typically standalone devices. The HSVO project is developing a network enabled platform control middleware and a number of integrated 'edge device' services to, among other outcomes, enable multi device and platform simulation support.

Keywords. Integration, simulation, lightpaths, middleware, edge devices, interoperability

1. Background

Simulation labs employ a number of different tools and platforms. However, so far there has been little practical integration between simulation tools and devices, which in turn means simulation sessions are typically based around discrete episodes or activities, each of which is limited in scope by the affordances of the one device. Clearly this limits the utility of such simulators.

The authors are all member of the CANARIE-funded[1] Health Services Virtual Organization (HSVO) that is bringing together experts from Canada and the US to create user controlled and interconnected remote platforms and devices as services. This affords interaction and data sharing between narrative, physionomic and mannequin based simulations, allowing them to be used in recombinant scenarios and settings. This paper describes the HSVO model for creating integrated simulation environments and some illustrative use cases.

2. Tools and Methods

The HSVO platform is based on a number of key concepts:

- Edge devices are a range of different physical, software and data services that are used during a scenario. The term edge device reflects their being on the edge of the networked platform. Examples include mannequins (the Laerdal SimMan 3G[2] is the preferred platform), virtual patients using the OpenLabyrinth[3] platform, 3D data from Stanford's Basset Collection as well as from DICOM and other sources, cameras and light arrays, clinical guidelines and physiognomic models. Some of these present their own user interfaces, others are surfaced through other device user interfaces.
- Common software control and coordination tools are required to present the various devices to the end user(s), to ensure they are started and to coordinate messaging and other forms of interaction between devices during a session. HSCO is using the Savoir platform from the NRC Institute for Information Technology in New Brunswick.

---

[1] CANARIE Inc. is Canada's advanced network organization, facilitating the development and use of its network as well as the advanced products, applications and services that run on it. The CANARIE Network serves universities, colleges, schools, government labs, research institutes, hospitals and other organizations in a wide variety of fields in both the public and private sectors. http://www.canarie.ca/

[2] see http://www.laerdal.com/SimMan3G/

[3] see http://sourceforge.net/projects/openlabyrinth/

- All of the above sit on and are connected using a network enabled platform (NEP) connecting remote and diverse devices and services. As many of the services require large amounts of bandwidth the NEP is based on dedicatable optical networks or 'lightpaths' that can be created on demand and held for the duration of the activity. HSVO is using the Argia platform from the CRC to provide this functionality[4]

The connectivity between these layers is shown in figure 1 below:

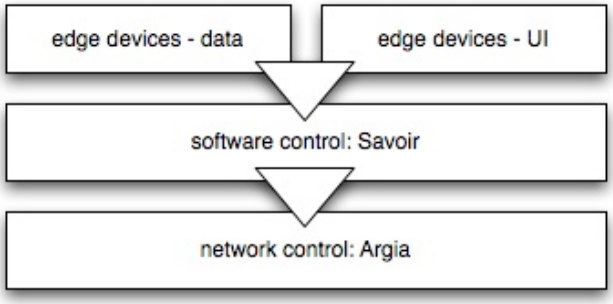

Figure 1: The HSVO systems architecture

3. Results

The HSVO model allows researchers to build new and rich forms of multimodal and integrated simulation environments. The rest of this paper will consider some of the HSVO use cases that outline the functionality and affordances of the platform.

The first example (see figure 2) sets out an activity where a virtual patient is traversed by a user and depending on their actions one or another mannequin scenario is started (using the same mannequin) with vital signs and other data passed from the virtual patient to the mannequin. The activity is made up of these branching and intermodal data exchange points.

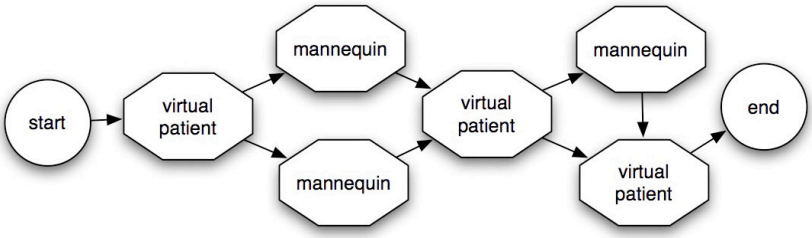

Figure 2: sequential multimodal simulation scenario

The next example (figure 3) adds aspects of synchronous communication to the mix with some participants working in the presence of the mannequin and others working remotely. Both groups have access to the simulated patient's vital signs and other shared data flows. The activity passes to and from a virtual patient depending on user actions.

[4] see http://www.inocybe.ca/19;jsessionid=7F45E1433D1DC757E2C6CA68CF9C0E1C

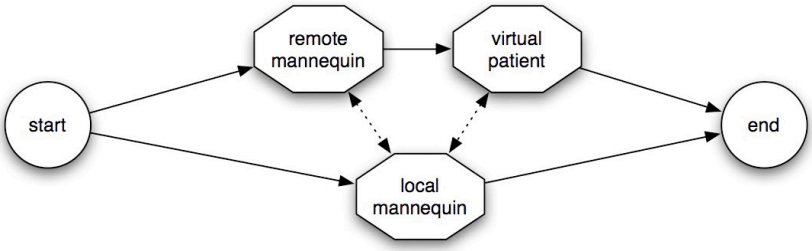

Figure 3: synchronous multimodal simulation scenario

The third example (figure 4) changes the model to one where the tutor is remote from the learners yet is able to interact with them through their control of virtual patients, mannequins and other devices.

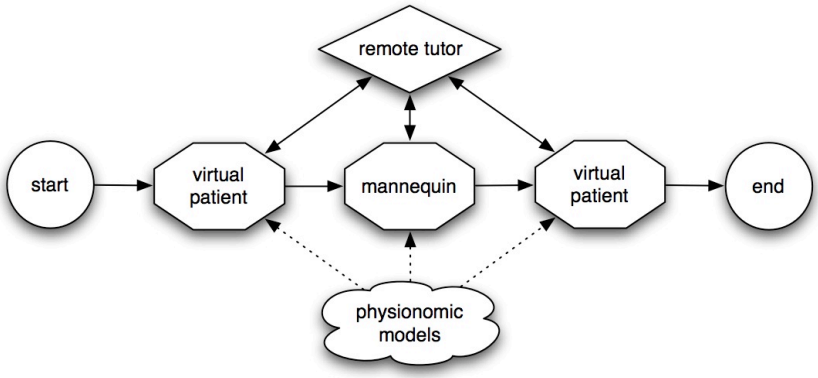

Figure 4: remote control of a multimodal simulation scenario

4. Discussion

HSVO is integrating tools such as commercial mannequins, screen-based simulations and physionomic algorithms and models that share data, thereby enabling more fluid and innovative use of simulation in many different settings. The end result is to create an environment that can:

- Provide common data standards and APIs for different simulation devices and tools to interact with each other.
- Drive an open standards and open access agenda, particularly in encouraging and enabling commercial, open source and local developments to interact.
- Support more fluid, well-aligned and innovative uses of simulations tools and technologies.
- Stimulate research and development into existing and emergent patterns of simulation use in different settings.
- Stimulate broader research into clinical and educational practice and environments.

From a practical perspective the HSVO plan is to improve the education and training of health practitioners in distributed and remote settings by enabling rich multimodal simulation environments that can be connected to other devices, services and participants and configured to reflect shared data methods for all of the devices and services concerned, thereby breaking down the intrinsic silos around simulation devices and modalities. Once this fluid and open model is established it is likely that simulation practice will be able to move into new and uncharted territories.