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Crisis – What crisis? How MSaaS could benefit Crisis Management Training Exercises

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Abstract – This paper discusses how the concept of providing Modelling & simulation as a Service (MSaaS) can support the development and execution of crisis management exercises such as performed by the Swedish Armed Forces (e.g. Viking 18). It draws upon the approach to MSaaS developed by the AIMS research project in the UK and describes how tools that are emerging to implement MSaaS can support crisis management.

1 Introduction

Modelling & Simulation as a Service (MSaaS) offers a different approach to providing simulation capability by exploiting Service Oriented Architecture (SOA) and cloud-based infrastructures. The scientific branch of the UK MOD (Dstl) funded the Architectures, Interoperability & Management of Simulations (AIMS) project to research MSaaS as it can potentially provide many benefits to simulation users as described in [1].

Although the simulation industry has made great strides in developing the MSaaS concept over the last few years, it is still very much work in progress. This is particularly true with respect to its scope and terminology, which is still evolving. The AIMS approach to MSaaS is described in [2] and the NATO Modelling & Simulation Group (MSG-136) approach to MSaaS in [3].

The development of MSaaS is currently being driven by military needs but can be applied to many different uses cases as described in [4]. The Viking 18 Crisis Management Exercise was used to evaluate service based implementations of simulation elements as described in [5]. This paper illustrates how MSaaS can be used to support Crisis Management exercises and outlines the potential benefits.

2 Modelling & Simulation as a Service

There is no universally accepted definition for MSaaS and different people and organisations have a different interpretation of what is meant by the term. However, it is generally accepted that MSaaS is more than just running simulations in the cloud using virtualisation and container technologies. The AIMS definition of MSaaS is [2]:

An Enterprise-level architecture that promotes modularity, loose coupling, agility and reusability of Modelling & Simulation resources from different suppliers by making them available on-demand to a large number of disparate users in order to reduce the cost and time for implementing Modelling & Simulation capability to improve operational effectiveness. A more complete understanding of MSaaS is obtained by decomposing the AIMS definition into the four MSaaS principles:

- An on-demand fully transparent and integrated method of moving from an operational requirement to an executable simulation that can deliver that requirement;
- A (semi-)automated composition of simulations reusing existing capability where possible and integrating new if required;
- Deployment and execution of simulations decoupled from specific hardware and infrastructure to enable flexible and scalable use;
- Sharing of acquired capability, including hardware, software, services and infrastructure.



Figure 1. MSaaS Ecosystem

Figure 1 shows the AIMS MSaaS ecosystem and the stakeholders that use it. The ecosystem comprises;

- Modelling & Simulation (M&S) Resources: comprises M&S Assets, M&S Services and M&S Blueprints¹;
- Registry: a structured, searchable database containing information about M&S Resources (analogous to an electronic, searchable catalogue);
- Repository: a store for reusable resources such as M&S Services and M&S Blueprints;

¹ An M&S Blueprint captures all the information about a simulation including requirements, design and deployment.

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- Process: defines how services are Discovered, Composed, Deployed and Executed²;
- Infrastructure: comprises the computing and network elements for executing the Simulation Environment;
- Portal & Tools: the Portal provides a single point of entry for accessing the toolset that supports the MSaaS process.

The long-term vision for MSaaS is to be able to go from a requirement for producing a simulation capability to delivering the capability with minimal human involvement.

A key tenet of the AIMS approach to MSaaS is the use of a registry/repository that could be used to catalogue and store simulation resources. A common registry (or federated registries) can be used by different organisations and nations to share the simulation resources they own. Metadata held by the registry not only captures what the simulation resources provide and states how to obtain it but also any licence conditions for using the resource.

A key output of the AIMS research was the concept of the 'Blueprint', which captures all aspects of the design and deployment of an exercise. The 'Blueprint' comprises separate data objects and include requirements, scenario, composition (what services are required), deployment (where services are to be executed on the infrastructure) and the event itself (date, locations, responsibilities, etc.). Each of these data objects are discoverable and can be reused. One of the benefits of the 'Blueprint' is it enables previously constructed exercises to be rerun without the need for operators requiring a high-level of technical knowledge

3 MSaaS applied to Crisis management

Crisis management exercises typically require complex distributed simulation environments to support the many organisations/agencies involved e.g. military, police, Red Cross, etc. The number of participants in a crisis management exercise can be in the hundreds or thousands and can be geographically separated. Simulation is used to stimulate real equipment so that participants are able to operate the systems they would normally use in the event of a crisis.



Figure 2 Example Crisis Management Exercise

Different exercises can be produced to enable participants to train for scenarios they may encounter for real. The development of large crisis management exercise is very complex typically involving many simulation and other specialists from several nations. Also, the integration of the simulation environment with disparate operational systems is very challenging as they are likely to be distributed across many sites.

Crisis management exercises benefit from running the simulation software in a cloud environment. This enables the capability to be accessed anywhere/anytime. It also means that the hardware is only required during the preparation and execution of crisis management exercises and can be reused for other purposes when not required.

As the use of cloud computing becomes more ubiquitous, more applications are having their user interface accessed from a browser. This means that the client computers do not require any software to be installed on them. The use of the https protocol provides a level of security. If additional security is required the local computers can be connected to the cloud via a virtual private network (VPN).

The reuse of M&S resources speeds-up the development of crisis management exercises by enabling developers to 'discover' simulation resources that support their requirements, which they might not have been aware of. However, this can only occur when organisations start publicising the existence of their validated simulation assets. For crisis management, these could include;

- Scenario generation services;
- C2 stimulation services;
- Population migration (refuge) services;
- Pattern of life (POL) services;
- Traffic services;
- Pseudo live data feed services e.g. Automatic Identification System (AIS), Automatic dependent surveillance – broadcast (ADS-B);
- Logistics services e.g. equipment, food;
- Medical services;
- Weather services;

² NATO MSG-136 has produced an MSaaS overlay for the IEEE Distributed Simulation Engineering & Execution Process (MSG-136, MSaaS Vol.3 Reference Engineering Process, 2018)

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- Simulation visualisation services e.g. 2D map, 3D stealth view;
- Simulation control services.

To further expedite the development of exercises, AIMS has introduced the concept of sub-compositions, which are groups of services that perform a particular function. As an example, a crisis management exercise may make use of a pattern-of-life (POL) sub-composition to improve the realism of the exercise by representing realistic numbers of people and vehicles. Other sub-compositions may provide visualisation, exercise control tools and live data feeds with minimum developer effort. Once a simulation environment has been designed, it can be stored in a registry/repository and easily deployed to the infrastructure if the exercise is to be rerun.

MSaaS tool support

As the MSaaS concept is maturing, organisations are producing tools to discover and compose simulation assets and to deploy and execute them in a cloud environment. The Thales NUADA tool has demonstrated the ability for non-technical personnel to construct and deploy complex simulation environments from a library of simulation assets. This includes the ability to automatically integrate physical simulators with common back-end services executing in the cloud.

MSaaS Benefits to crisis management

The benefits of MSaaS to crisis management include;

- Efficient use of Simulation Resources buy/develop once, use many times;
- Saves time creating and deploying simulations by reusing simulation resources that already exist;
- Reduces technical expertise required for creating/deploying simulations By capturing the information in a previously constructed 'Blueprint';
- Capitalises on the benefits of recent IT developments - By making use of cloud computing;
- Collaborative working by providing a shared development environment;
- Different Business models Pay As You Go.

Conclusions

The concept and technologies of providing MSaaS provides several benefits throughout the lifecycle of a crisis management exercise. In particular, the use of previously validated exercises or sub-compositions can provide a good starting point for generating new exercises, which can significantly reduce the development time.

Tools are becoming available to deploy complex simulation environments to cloud infrastructures so that

these benefits should start to be realisable in the short term. It is envisaged that the sharing of simulation assets between nations and organisations will occur in the medium term as it will take time to identify and catalogue available simulation assets.

In order to reap the benefits of MSaaS more work is required to increase the range of services available for crisis management exercises and to make them compliant with cloud infrastructures.

To help promote the use of MSaaS, Dstl is standing-up a follow-on to the AIMS research programme that will address some of the current limitations of implementing an MSaaS capability e.g. automated composition. The outputs from this and other initiatives, such as MSG-164, will help simplify the generation and execution of crisis management exercises.

Biographies

Ben Doyle – Ben is a Product Line Manager at Thales Training & Simulation. With 26 years' experience in the simulation industry he has had engineering roles working in research and on the development of many different training systems. His current role focuses on the development of simulation product strategy.

Keith Ford - Keith has worked in the simulation industry for 38 years and has recently been leading the development of the concept for providing Modelling & Simulation as a Service. He is currently the R&T Manager at Thales Training & Simulation and is responsible for all internally and externally funded R&T projects.

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