Proceedings of the 2019 Winter Simulation Conference
N. Mustafee, K.-H.G. Bae, S. Lazarova-Molnar, M. Rabe, C. Szabo, P. Haas, and Y.-J. Son, eds.

APPLYING MODELLING AND SIMULATION AS A SERVICE IN A MULTINATIONAL MILITARY EXERCISE

Wim Huiskamp,
Tom van den Berg

TNO Defence Research
Oude Waalsdorperweg 63
The Hague, 2597 AK, THE NETHERLANDS

Peter Lindskog

Swedish Armed Forces (SWAF) JFTC
Garnisonsvägen 1
Enköping, PL 920, SE-749 40, SWEDEN

ABSTRACT

Maintaining military readiness is more challenging than ever: missions take place in a theatre with many actors (military and civilian) while fiscal reality and available resources limit live training opportunities with coalition partners. Simulation has been recognized by NATO as a critical technology to support training and the concept of "Mission Training through Distributed Simulation" (MTDS) is currently developed by several nations under the umbrella of the NATO Modelling and Simulation Group (NMSG). However, providing MTDS solutions is also a technical and organizational challenge in itself. In addition to agreed and validated interoperability standards, NMSG is also developing a Services based approach to deliver simulation. The M&S-as-a-Service (MSaaS) concept has been investigated and tested in recent experiments and exercises. This paper introduces the MSaaS approach towards a rapid implementation of exercise environments. The VIKING-18 exercise is presented as a use-case for MSaaS and our lessons learned will be discussed.

1 INTRODUCTION

The complexity of developing an MTDS exercise is due both to technical aspects (e.g. number of different simulation assets and interfaces) as well as organizational aspects (e.g. number of actors and disciplines). An MTDS environment should be flexible and respond quickly to new training needs. A set of common agreements on the process of planning, developing, executing and analyzing the relevant MTDS training environment are required, as well as technical agreements on the implementation of the specific MTDS architecture. These agreements are currently often developed individually for each exercise. The MTDS Reference Architecture (RA) that the NMSG develops captures and structures all necessary agreements (process and technical) to provide common guidelines for implementing MTDS. The MTDS RA builds on existing NATO standards (e.g., High Level Architecture HLA) and also leverages the MSaaS approach as developed by NMSG task groups. MSaaS technology (e.g., a registry for discovering services, container technology for storing them in a repository and for service deployment) has been assessed in the VIKING-18 exercise (IITSEC18328).

2 VIKING-18 EXERCISE

VIKING-18 was conducted in April 2018 in Sweden and in several additional countries. Civilians, military and police from participating nations and organizations, including the United Nations and other international bodies, regional organizations, government agencies and non-governmental organizations (NGO) participated. VIKING-18 includes simulations, C2 systems and other supporting tools and services. Two primary groups are involved: Training Audience (TA) and Exercise Control (EXCON). The TA consisted of 1500 participants from military and other governmental organizations and NGOs. The EXCON

(including Response Cells) consisted of 500 people. Since the first VIKING exercise in 1999 it has proved itself as effective platform for multinational education and training, and practicing cooperation between civilian, military and police personnel in a comprehensive approach. The exercise is also an excellent event to advance the MTDS and MSaaS technical concepts and as such it is an opportunity for development, test and evaluation of new assets and technology.

The VIKING-18 simulation architecture is based on the NATO standard High Level Architecture (HLA) (IEEE 1516-2010 (IEEE, 2010) and NATO STANAG 4603 (NATO, 2015)). The simulation backbone is compliant with NATO Education and Training Network (NETN) Federation Architecture and FOM Design (FAFD) guidelines as recommended by STANREC 4800. The simulation environment included 'classical' assets as well as several new service-based assets:

- A VR-Forces based Vessel Traffic Generator (VRF/VTG) and an NMEA AIS TCP Server which together generate realistic civilian maritime traffic, including the transmission of AIS information which can be received and displayed by the C2 systems.
- Two Command & Control (C2) systems as the main interface for situational awareness to the TA.
- Four different simulators for generating land, air and maritime units.
- An "ORBAT service" to publish an ORBAT in the federation using MSDL.
- A "Common Simulation GUI", a generic tool for controlling simulated units.
- A MEL/MIL Service provided by the EXCON management tool "Exonaut".
- A Sensor and Report Pump Service for the automatic generation of intelligence reports.

The VIKING-18 simulation environment has been used throughout the exercise to support the Response Cells and stimulate the Training Audience.

3 LESSONS LEARNED AND WAY AHEAD

The established MTDS and MSaaS interoperability standards based on HLA have proven their value and performance as expected. The provisioning of service implementations using Docker container technology proved fairly flexible. In addition, the use of container technology also enabled a relatively easy transfer of different component versions between the TNO MSaaS Docker Registry and the VIKING-18 simulation environment. However, the introduction of new technology and the as-a-service approach increased the complexity of monitoring and controlling the individual services and simulation systems. As services can now be scaled up and down on demand (and can run anywhere), the availability of adequate and coherent service management and control functionality to oversee the execution of these simulation services becomes important. Service management and control services should be further developed and must provide sufficient insight in the internal state of individual simulation services. For example, to understand why certain simulation services respond too slow or do not respond at all. This tooling is however often lacking with current simulation systems as well and requires the development of additional APIs to query internal state data.

Several improvements on the VIKING-18 AIS-service have been implemented and tested in the recent Swedish Combined Joint Staff Exercise (CJSE) 2019. NMSG task groups continue to further develop and implement MTDS architectures, e.g. MSG-169 (Maritime domain) and MSG-165 (Air domain). The MTDS and MSaaS technology will be further integrated and evaluated in multi-national exercises such as NetOpFueEx, Spartan Warrior, the CJSE 2021 and VIKING-22.

REFERENCES

IITSEC18329. 2018. Interservice/Industry Training, Simulation and Education Conference (IITSEC). Lessons Learned from leveraging Simulation as a Service in Viking18. Nico de Reus, Tom van den Berg, Henk Janssen, Wim Huiskamp, Björn Löfstrand, Lennart Olsson, Cpt. Peter Lindskog.