Proceedings of the 2018 Winter Simulation Conference
M. Rabe, A.A. Juan, N. Mustafee, A. Skoogh, S. Jain, and B. Johansson, eds.

CLOUD-BASED MODELING & SIMULATION: INTRODUCING THE DISTRIBUTED SIMULATION LAYER

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ABSTRACT

Many applications including Modeling and Simulation packages require automatic resource allocation and scalability features found in most cloud infrastructures. However, this comes at a usually high cost of investment from small, medium or even large enterprises. The technology gets more complicated when demand exceeds the supply of the needed computing resources while serving end-users at the optimum quality of service (QoS) such as performance, security, reliability, and interoperability. This research proposed a new cloud architecture with Distributed Simulation Layer atop the Microservice-based Cloud Application-level Dynamic Orchestration (MiCADO) framework. It will allow geographically distributed models with access to the high-performance computing resources needed for automatic scalability. The paper also talks about the simulation model interoperability standards suitable for making the new architecture widely adaptable.

1 INTRODUCTION

In the world of technology, today, computerizing business activities and accessing them anywhere, anytime is the way forward to stay competitive which helps many to achieve the desired short and long-term business goals. Cloud computing (http://cloudcomputingnet.com/cloud-computing-architecture/) is one such driver that make workflows smooth and intuitive by allowing access to high-performance resources at reasonably affordable financial commitment. The trend now in operational research, manufacturing, health, defense, and aerospace regarding high-level decision making is carried out via simulating the real-world scenarios in various domains. Hence the need for Modeling and Simulation. Simulations are one of the most realistic ways organizations adapt by using computer models in an attempt to predict how a real-life system will behave in a given set of conditions, parameters, values, and domain-specific data (Fujimoto 2001). Researchers, open-source, and commercial developers proposed, design and deploy cloud frameworks with the aim to adding distributed facility for scalable modeling and simulation applications. One such framework is MiCADO built on container-based open source technologies (Visti et al. 2016).

2 METHODS

Simulations are best known for mimicking real-life systems and organizational processes with the aim of making improvements and efficiency. A case-study research approach will be used as an empirical inquiry that investigates a contemporary phenomenon within its real-life context (Yin 2003). I will collect processes data from real-world systems in a production assembly line, and supply chain scenarios. A prototype program fragment would be used to test-run distributed simulation with different sets of input parameters aiming to determine execution speed across multiple (distributed) cloud infrastructures. A Distributed Simulation Layer (DSL) is introduced on top of the MiCADO framework (Figure 1) to bring the High Level Architecture (HLA) to the cloud architecture for distributed models to share the same computing resources. This research will make use of Simulation Interoperability Standards Organization's (SISO) SISO-STD-006-2010 Standard for COTS Simulation Package Interoperability Reference Models (IRMs) which is designed explicitly with Operational Research/Management Science (OR/MS) in mind (Taylor 2018).

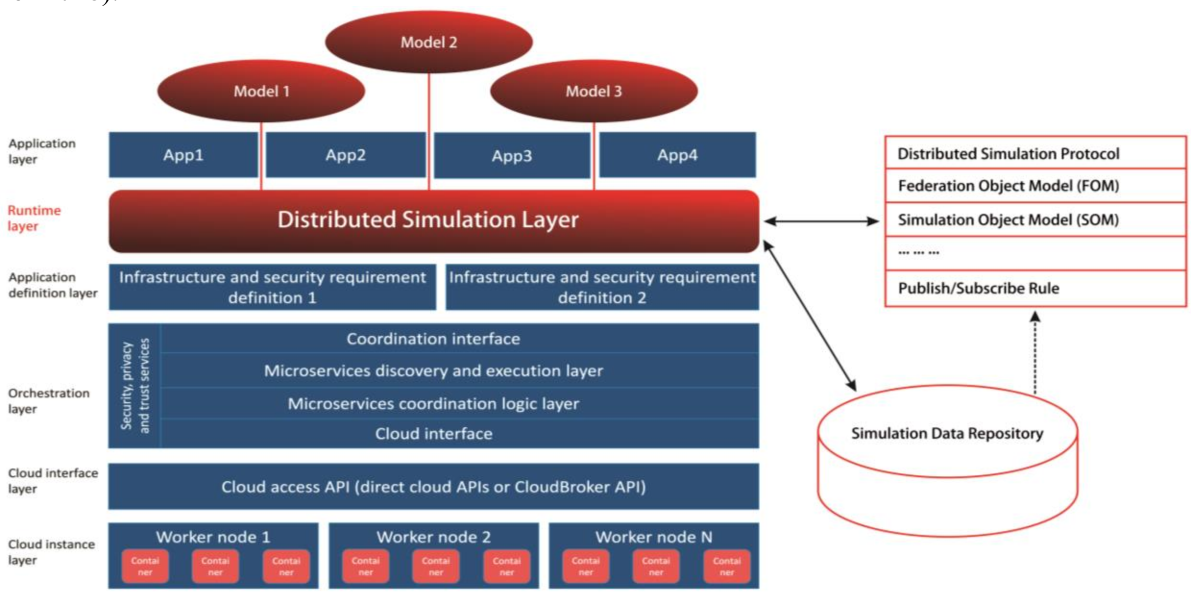

Figure 1: MiCADO Framework with Distributed Simulation Layer (DSL) for cloud-based distributed modeling and simulation.

3 CONCLUSION AND FUTURE WORK

From the theoretical perspective, distributed modeling and simulation has applications in many walks of modern life and in many areas we are just beginning to scratch the surface of what it can do. This research is focusing on developing a cloud-based architecture to connect discrete-event (geographically distributed) models to speed up simulations. The primary objective of this paper is introducing and showing work-in-progress on the Distributed Simulation Layer (DLS) which combines cloud technology with a better understanding of the fundamental operational problems to improve simulation speed.

ACKNOWLEDGEMENT

This research is funded by the Petroleum Technology Development Fund (PTDF), Nigeria.

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