Enhancing HPC for Scheduling and Deploying Game-based Simulation Training on the Cloud

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INTRODUCTION

The University of Central Florida's Institute for Simulation and Training (IST), in collaboration with the U.S. Army, is **extending High Performance Computing (HPC) to a cloud-based service over the next year**.

The cloud service will:

- Support game-based simulations (*GBS*).
- Automate job load balancing.
- Optimize resource allocation.
- Improve job scheduling efficacy.

Figure 1: IST's Stokes HPC

RESEARCH GOAL

- Determine practicality of HPC resources for GBS.
- Analyze HPC scheduling techniques.
- Measure HPC performance with containers and virtual machines (VM).
- Feasibility study of shared/federated:
  - Resources.
  - Scheduling Methods.

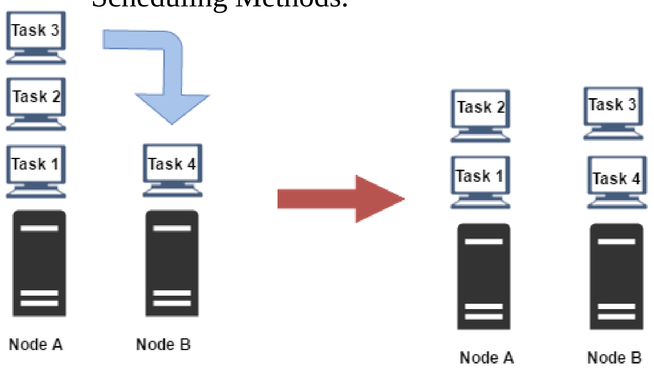

Figure 2: Load balancing

METHODOLOGY

A series of progressive experiments are designed to schedule a GBS:

- With a job scheduler.
- With multiple executing jobs.
- Through a container and VM.
- Across a cluster federation.

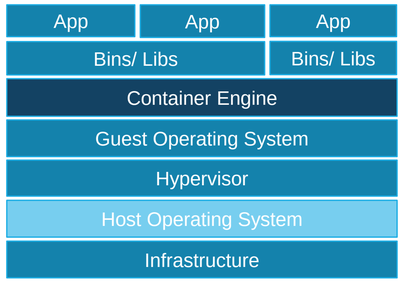

Figure 3: Containers inside VMs

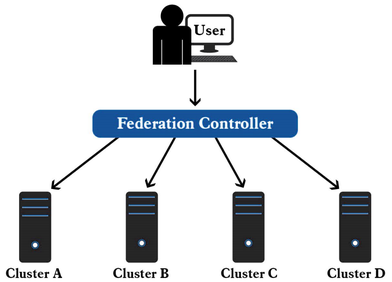

Figure 4: Federated Clusters

ONGOING AND FUTURE EXPERIMENTS

Ongoing research successes:

- Scheduled a GBS: Microsoft Flight Simulator 10 (FSX).
- Deployed GBS with the Windows emulator WINE.
- Gathered preliminary performance data.

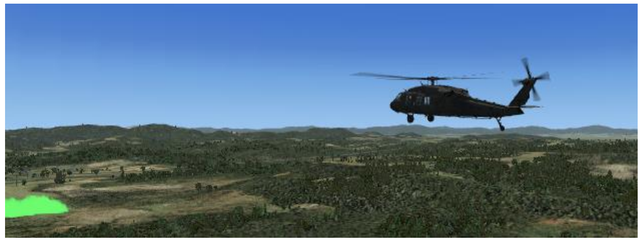

Figure 5: Microsoft Flight Sim X

Upcoming research will schedule a GBS:

- Natively.
- Inside a VM (Virtual Box, VMWare, KVM).
- Using containers (e.g. Docker, Singularity).
- In a container on a VM.
- Across federated clusters.

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METRICS

- CPU Usage Percentage across all Cores.
- Memory Usage in Bytes.
- Job Time in queue (ms).
- Job Execution-time (ms).
- Frame Rate: Frames per Second (fps).

PROCEDURES

1. Schedule GBS with one of the Methodology criteria.
2. Operator executes mission in GBS.
3. Collect HPC performance metrics.
4. Compare performance data for all criterion.

PRELIMINARY RESULTS

Below are preliminary results of performance evaluation when running a GBS (FSX) natively in our test environment.