Evaluation of Run Time Infrastructure (RTI) Implementations

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ABSTRACT: *The utilization of Hardware-In-The-Loop (HWIL) processing in a Modeling and Simulation (M&S) environment introduces especially critical latency and throughput requirements. Data provided by HWIL simulations must be transmitted and processed expeditiously to reduce the risk of information loss. Of particular interest are issues related to performance – namely, latency and throughput – of the High Level Architecture (HLA) federates interacting by way of a Runtime Infrastructure (RTI). This paper presents the benchmark design, test approach, and initial results reported from the evaluation of four commonly used and readily available HLA-compliant RTI implementations. The evaluated RTIs include the: (1) RTI Next Generation (NG) 1.3v3, (2) MÄK Real-time RT 1.3.3-ngc, (3) Pitch portable RTI (pRTI)1.0r5, and the (4) Georgia Tech Parallel and Distributed Simulation (PADS) Federated Simulations Development Kit (FDK) 3.0 Detailed RTI.*

The benchmark activity was conducted under the Wide Bandwidth Information Infrastructure (WBII) Program. The benchmarks employed selected computing resources from the Federation Analysis Support Technology (FAST) Laboratory, a part of the Space and Missile Defense Battle Lab (SMDBL) located at the Advanced Research Center (ARC) in Huntsville, Alabama. The FAST Lab is a shared Ballistic Missile Defense Organization (BMDO)/SMDBL community asset that assists programs achieve their M&S goals by leveraging its available high performance computing (HPC) and High Level Architecture support (HLA) resources to encourage the wider utilization of these distributed simulation technologies.

The benchmark's experimental design evaluates the effect of twelve independent variables on throughput and latency. The independent variables evaluated include: RTI, number of federates, distribution of federates, Data Distribution Management, network transport mode, objects per federate, attributes per object, interactions per federate, parameters per interaction, attribute buffer size, interaction buffer size, and data bundling. Latency and throughput measures were then evaluated to determine if the four RTIs exhibited statistically significant performance differences. The benchmark results are intended to provide assistance to Modeling and Simulation personnel in HLA federation design and optimization.

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