

XMSF TECHNICAL OPPORTUNITIES WORKSHOP

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POSITION PAPER

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Web-Based Simulation is one of the many exciting next-generation products to be expected as part of the family of Network-Centric Warfare solutions. As all of them it too is predicated on the existence of a robust INFO-STRUCTURE. The info-structure itself is dependent on sufficient levels of interoperability not just within the hardware, application, and software domains, but specially within the data domain.

This position paper addresses challenges, issues and opportunities related to data interoperability as it pertains to the development of the info-structure necessary to initiate and expand web-based simulation capabilities. Although the focus of this position paper is C2, many, if not all, the key concepts are equally applicable to other areas, such as architectures, logistics and personnel.

1. OPPORTUNITIES FOR WEB-BASED MODELING AND SIMULATION

Recent studies conducted at the Institute for Defense Analyses (IDA) for the Army have identified poor 'model alignment' issues between the classes of objects typically used in Modeling and Simulation (M&S) and the data structures used in C2 information systems.

The misalignment exists not only at the semantic level but also at the syntactical level. Semantic misalignment typically occur when (a) the concepts do not exist in both types of models, e.g., PLATFORM is a typical class in most M&S applications, but does not exist explicitly in C2 models such as Generic Hub, or Joint Common Database (JCDB); or (b) when they exist in both models they have only partial commonality—e.g., UNIT in M&S and ORGANIZATION in C2 systems do not necessarily mean the same thing.

One way out of this problematic situation is to recast C2 models in terms of OO classes and then to expand the corresponding hierarchies present in C2 so that they can be directly used by the M&S community. This would mean that, for example, a C2 hierarchy such as OBJECT-TYPE, MATERIEL-TYPE, EQUIPMENT-TYPE, SHIP-TYPE, could be extended to include specialized classes such as SUBMARINE, AIRCRAFT-CARRIER, etc., with the appropriate methods and procedures that would enable a simulation to be initialized directly out of the C2 information system, and, later on, to persist the results of the simulation in the appropriate tables of the C2 database.

The first challenge is to come up with such classes that make sense for M&S purposes, and to retain the linkage to the C2 data structures without imposing too much overhead.

The second challenge is to design the interfaces between C2 systems and M&S applications in a manner that minimizes the impact of the natural evolution of both C2 and M&S. Here, it may be worthwhile to explore the concept of XML-based 'Universal APIs' that permit the interface of any type of simulation to the data structures of a C2 database without requiring the M&S application to know all the details of the C2 implementation.

2. KEY OPEN PROBLEMS

Database to database data interoperability requires at a minimum four components:

- Common semantics and syntax
- Agreed upon Information Exchange Data Models (IEDM)
- Agreed upon Key Management to enable maintenance of referential integrity across the enterprise—use of globally unique Enterprise Identifiers (EIDs)
- Agreed upon, Web-enabled transfer mechanisms, such as XML

The major problems are in the area of policy both at the Service level, as well as at DoD level. In particular, three major policies are needed to ensure database to database data interoperability:

- Policy on authoritative data sources that can serve as Reference Data for all participating organizations. Who should control and publish all the types of ships that the US Navy has, or all the types of torpedoes, guns, ammunition, etc.
- Policy on XML, ranging from naming conventions to the use of XML technologies such as XSL/T and validation via XSD.
- Policy on Migration Strategies—when must all legacy systems begin to use approved reference data sets, implement EIDs, adopt a given IEDM for data exchanges, use XML for data transfer, publish their XML schemas, etc.

3. RECOMMENDATIONS FOR ISSUES AND CHALLENGES

- Begin a serious exploration of appropriate IEDMs such as the Generic Hub as the basis for formulating the OO classes needed in M&S
- Begin development of XML-based APIs
- Generate all XML specifications either directly out of the appropriate IEDMs, or, at a minimum provide the XSL/Ts to map to such specifications
- Adopt a key management that will permit data integration across the enterprise based on an approach like the globally unique EIDs