An Introduction to the Simulation Interoperability Standards Organization (SISO) and the Military Scenario Definition Language (MSDL)

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ABSTRACT

This paper is one of a coordinated set prepared for a NATO Modelling and Simulation Group Lecture Series in Command and Control – Simulation Interoperability (C2SIM). This paper provides a short history of SISO, how it is organized, the standards production process, and membership information. The second section introduces MSDL as one of the two SISO standards that provides the central technical basis for the Lecture Series.

1.0 INTRODUCTION

This paper was prepared as part of the NATO Modelling and Simulation Group Lecture Series in Command and Control – Simulation Interoperability (C2SIM). The session provides an introduction to the Simulation Interoperability Standards Organization (SISO) and the Military Scenario Definition Language (MSDL). The first part of the paper covers SISO's purpose, membership, and ongoing standards-focused activities. The second describes the Military Scenario Definition Language (MSDL) standard.

2.0 SISO

This section provides the background and an overview to the SISO organization. It includes the organization construct, its mission, and a summary of the groups and processes involved in standards development.

2.1 A Short History of SISO

SISO started as a small 2 day conference in 1989 called the "Interactive Networked Simulation for Training" with the intent of fostering rapid growth in the area of networked simulation by providing an open forum for the exchange of information. The conference took hold as an annual event and soon evolved into Distributed Interactive Simulation (DIS) Workshops. These early workshops focused on the creation of standards using the SIMNET project as an initial foundation for the now formalized DIS standard. [14]

In 1996 with the active engagement of the U.S. Department of Defense Modeling and Simulation Office (DMSO) the DIS Organization and associated workshops became the SISO organization and Simulation Interoperability Workshops (SIW). In addition to organization workshops SISO maintains a website with all of its background, papers, and standards-based activities at www.sisostds.org.

As stated on the web-site SISO's Mission is "to develop, manage, maintain, and promulgate user-driven Modeling and Simulation standards that improve the technical quality cost efficiency of M&S implementations across the world-wide M&S community."[14] The organization's identified operating principles directly support the mission and are listed below [7]:

- Open and robust communication and debate among community members;
- Responsiveness to the M&S community;
- Quality within the services and products provided;
- Disciple and rigor in the execution of SISO activities;
- Fairness across the spectrum of processes and community engagements;
- Openness to all community members and those wishing to join the community; and
- Consensus based decision making.

2.2 Organization

The SISO organization has an overall Executive Director, Mark McCall, who oversees the not-for-profit operation in a manner consistent with the SISO's legal governance documents [6]. Beyond that the working community-based organization responsibilities are delegated to the three main bodies as depicted in Figure 1.

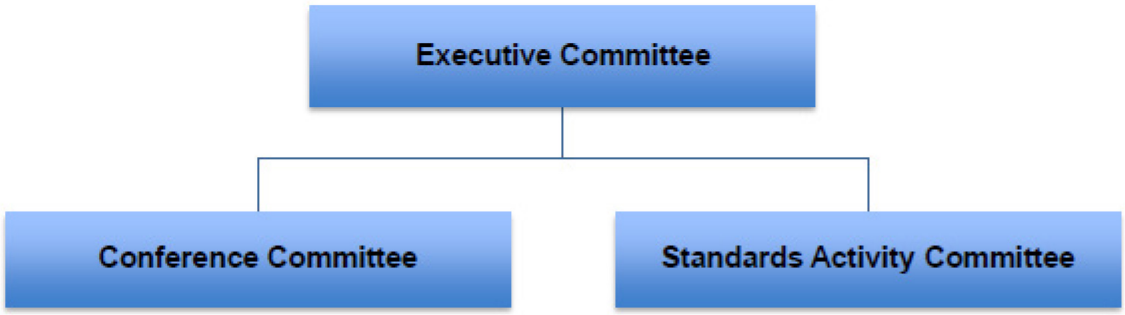

Figure 1: SISO Organization [11].

These three main bodies provide the following functions:

- The Executive Committee (EXCOM) is the policy level body of SISO that provides the overall governance and strategic planning. It is chaired by Michael O'Connor [11];
- The Conference Committee (CC) organizes the Simulation Interoperability Workshops and oversees conference Forums; it is chaired by Paul Gustavson [11]; and
- The Standards Activity Committee (SAC), which oversees the development and support of products supporting interoperability and reuse within the M&S community, is chaired by Jeff Abbott.

SISO also encourages partnership with industry and allows sponsor and member organizations to engage with the SISO organization to study or develop new products. Many within the Corporate Sponsors program, those that can make corporate donations to SISO, attend, exhibit, and demonstrate their products at the SIWs. Organizational members are those that do not want to or cannot sponsor SISO activities because of their corporate status such as US and non-US governmental agencies, National Laboratories, Federally Funded Development Centers (FFRDCs), University Affiliated Research Centers (UARCs), etc. These organizations can purchase blocks of individual membership or SIW registrations to ensure they are actively engaged is SISO activities. [6]

Additionally, the SISO EXCOM has also established a number of EXCOM non-voting member liaisons to facilitate open communication between SISO and a number of other groups to include:

- The DoD Modeling and Simulation Coordination Office (M&S CO) [6];
- NATO Modeling and Simulation Group (NMSG);
- Network Centric Operations Industry Consortium (NCOIC);
- The Institute of Electrical and Electronics Engineers (IEEE);
- International Organization for Standardization (ISO);
- National Training and Simulation Association (NTSA);
- SimSummit; and
- The Society for Computer Simulation (SCS) [11].

2.3 Products & Services

SISO provides a range of products and services not only to develop M&S standards, but also including a formalized and internationally recognized standards maintenance process; a workshop for paper and presentations; and a venue and web-site for M&S professional education and collaboration.

2.4 Working Groups

There are a number group types that provide the organization and workforce necessary to create and maintain SISO products. There are three formalized and distinct types of working groups within SISO and include: Study Groups; Product Development Groups; and Product Support Groups. Each of this will be briefly described below. [6]

Study Groups are established to consider specific M&S interoperability related issues and to provide recommendations concerning proposed courses of action to address the issues. The SISO Study Group mechanism is intended to provide a wide range of flexibility. As examples, the study groups may be formed to define key terminology; or recommend modifications to existing products; or assess areas for standardization. Normally, the life of s Study Group will not exceed one or two annual cycles. In the case that a Study Group needs more time to mature a concept or investigate a topic area at a great depth, a longer duration or Standing Study Group can be created. [6]

There are currently two active Study Groups (SG):

1. The Layered Simulation Architecture SG is exploring and developing consensus around the definition of a layered approach to enable more loosely coupled simulation applications in support of more flexibility and higher performance that current approaches provide.[6]
2. The Human Performance Markup Language (HPML) SG is exploring the maturity of the HPML as a standard way to represent generic and mission specific concepts necessary for capturing and describing human performance and behavior.[6]

Additionally, there are three active Standing SGs (SSG):

1. Economics of M&S SSG continues to support requests from the M&S community regarding data, analysis technics and results of Return On Investment (ROI) of M&S activities.[6]
2. Simulation Australia SSG is an international SSG approved in 2006 to liaise and inform SISO of Australian simulation community needs.[6]

3. Parallel and Distributed M&S SSG is conducting continuous long-term studies of vital and high-impact parallel and distributed M&S issues.[6]

Product Development Groups (PDGs) are formed as a result of an approved Product Nominations (PN) specifically created to develop or modify Balloted Products. The PDG does the work required to create the Balloted Product and resolve ballot comments. PDG's are consensus-based groups focused by the PN. The PDG may assume a dual role under another standards organization under an agreement between SISO and some other body such as ISO. [6]

A Product Support Group (PSG) is formed as a result of a completed product and an approved Terms of Reference to provide support to the product. The PSG serves as a central point for interpretations of product language, providing help desk support to the SISO community, and accepting, developing, and maintaining problem/change reports to support future product revisions. [6]

2.5 Standard Production

A fundamental objective of SISO is to produce and maintain meaningful standards to improve M&S interoperability and enhance the state of art across the M&S domain. Over the years, in collaboration with the IEEE and other organizations, SISO has produced and is sustaining a number of key M&S standards. Figure 2 provides the SISO Working Model, a high-level process flow beginning with standards identification, moving into production, and finally into product support.

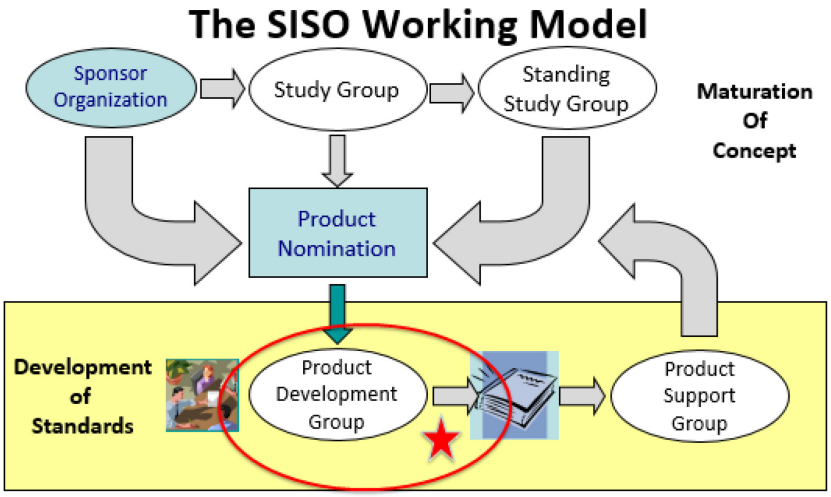

Figure 2: The SISO Working Model [2].

The process begins with a SISO community member proposing a Study Group as described within the previous section. Through its work the Study Group may identify a technology that is appropriate for standardization and create a PN. Once vetted and approved by the SISO the PDG is established and a standards-based product is developed and balloted. Once approved the product is maintained by a PSG. For technology areas that are rapidly evolving and/or are of high interest across the community a SSG may be created to assess and review the technologies within the high profile domain. [6]

Two of these standards, the Military Scenario Definition Language (MSDL) (SISO-STD-007)[10] and the Coalition-Battle Management Language (C-BML) (SISO-STD-011)[9], have a significant impact on the state of C2 to Simulation interoperability. The remainder of the discussion will focus on these standards and their impact on C2 to Simulation interoperability.

As we will discuss in detail later in the presentation, MSDL is focused on providing consistent initialization or start data for both C2 and Simulation systems participating within a system of systems environment which we will heretofore refer to as a Coalition.

Similarly C-BML is focused on representing the orders, tasks, and reports that can be sent between and among C2 systems, simulation, or robotic actor Coalitions.

The SISO membership continues to move forward in the development of new standards as well as in enhancing and updating existing standards. Both MSDL and C-BML existing standards are part of this evolution, and as was discussed during their initial development, the next step is to integrate and harmonize the language definitions into a consistent core data model that allows for easy extension [8]. The new PDG undertaking this task is called the C2SIM. More information will be provided on the evolution of MSDL and C-BML as part of the Lecture Series paper set.

As mentioned there are a variety of ways for engagement within SISO and its activities. Either as a presenter or participant in the SIWs; as a member of a one of the variety of Working Groups; or as an Officer within the SISO organization itself If you are an M&S practitioner, educator, or user SISO participation is a powerful way to stay engaged and make an impact with a diverse, world-wide M&S community. You can become a SISO member by paying an annual US$95 fee or by attending a SISO workshop.

3.0 MSDL SISO-STD-007

As mentioned earlier this section provides the background and an introduction to the MSDL standard. It includes the history, the driving design principles, and the current state of practice.

3.1 The History of MSDL

From 1997-2001, as the concepts for the Army's next generation entity-level simulation, the One Semi-Automated Forces (OneSAF), were initiated and matured, the concept of reusing scenarios within and between simulations was discussed as having the potential to provide meaningful cost and time savings. As shown in Figure 3 a standard formatted scenario file could be populated and used and re-used by many simulation clients with savings found across the a number of uses, such as:

- Using the same scenario across a number of different simulations with different fidelity levels for analytical purposes;
- Sharing the same scenario in a consistent manner across a number of simulations in a training federation; and
- Providing a way to leverage different scenario development tools and viewers to develop and manipulate reusable authoritative scenarios.

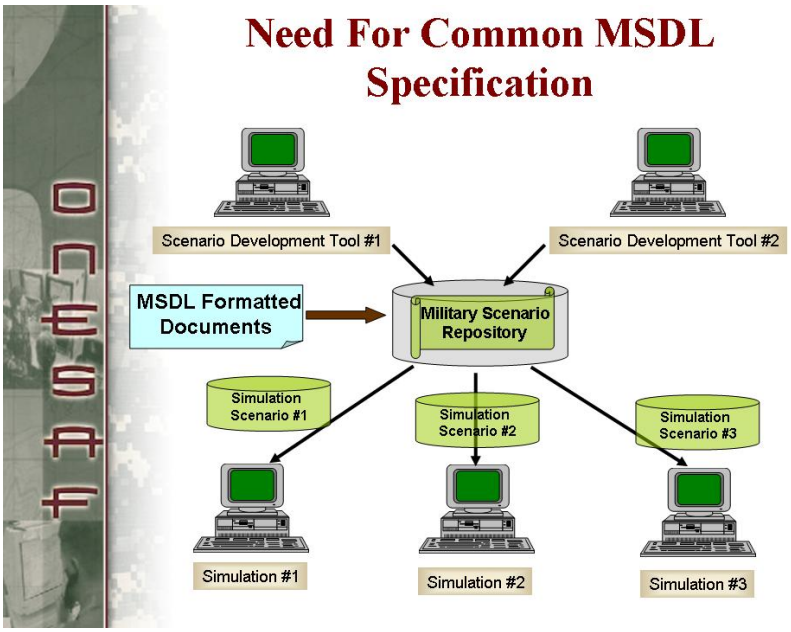

Figure 3: The Need for a Common Scenario Specification.

During this period there was also a special interest from top levels of Army DoD leadership in developing Army and DoD-wide modeling and simulation standards to promote cost savings and reuse. This culminated in specific guidance provided by Mr. Walt Hollis, Deputy Under-Secretary Army for Operational Analysis (DUSA-OR), to the OneSAF Program Management to prioritize development of specifications, formats, process, and tools that could be matured into industry wide standards.

MSDL is one such standard that matured through the SISO standards process as a result of this prioritization.

3.2 MSDL Design Goals

To realize the scenario development time and cost reduction goals it was critical to identify and assess not only how to develop appropriate scenario development tools but how to specify an interface to the scenario data that would maximize reuse across the M&S community with low introductory costs.

During the common scenario capability design process four design characteristics were considered fundamental to meet the goals:

1. Application independence to allow the MSDL format and native simulation initialization format to evolve independently;
2. Separation of data from code to allow users to access the data as appropriate for their application;
3. Separation of concerns to ease understanding of the data, reduce maintenance costs, and to reduce complexity; and
4. Use commercial and industry standards to allow open, non-proprietary access to reusable scenario data.

3.3 MSDL Study Group Activity

Early MSDL Study Group efforts concentrated on defining the extents of simulation start data to be included within the data model. As shown in Figure 4 the group was initiated in the Spring of 2005 with over 100

participants from 5 Nations including representation from industry, academia, and government. Members of the C-BML Study Group, newly created at the same time, also actively participated. Six face-to-face meetings were held with a successful PN approved by the SAC on 8 March 2006.

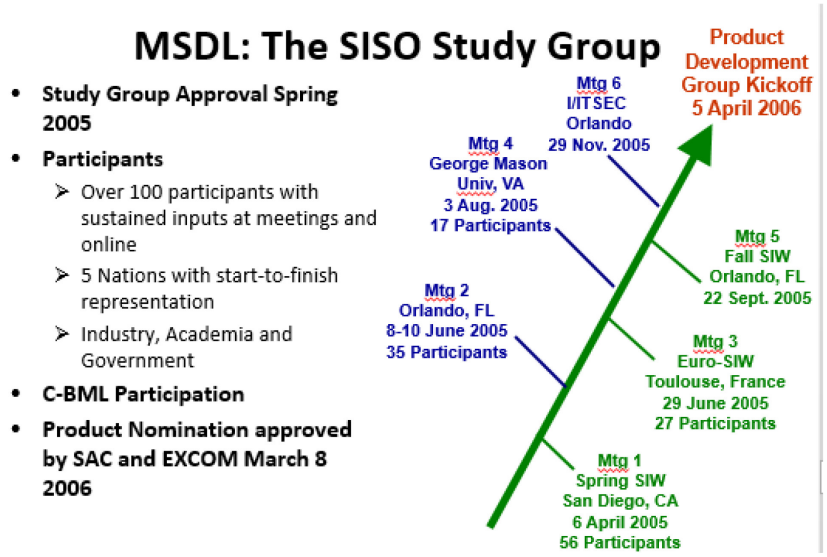

Figure 4: MSDL The SISO Study Group.

The resulting definition set included three types of model and simulation initialization data sets:

- The first is the Model-based initialization level that focuses on the types of data necessary to drive specific models of the environment, land and air platforms, and individual combatants and other life-forms, and the organizations to which the individuals belong [12];
- The second is the Scenario-based initial conditions which is the specific focus of MSDL and will be explored in greater detail throughout this lecture series [12]; and
- The third is Federation-based initialization considers consistent initial conditions across all of the data types mentioned in the previous sections for simulations that will be joined and run as a federation of systems [12].

For the purposes of this discussion there is also a special case of federation-based initialization that occurs in many simulation assisted exercises that accommodates exchange of information between the simulations and real-world Mission Command systems.

Historically, the interface between the two systems is handled via translations between simulation formats and real-world message formats such Joint Variable Message Format (JVMF), United States Message Text Format (USMTF) and more recently Publish and Subscribe Service (PASS) and Data Distribution Service (DDS) topics.

In general there is a much richer set of data sent from the simulation to the Mission Command devices providing message-based and graphical situational awareness than orders generated by the Commanders and their Staff on Mission Command systems to the simulations. In some limited cases, such as for indirect fire control, there is an interface allowing commands to be input from the real-world devices. By and large in this setting the simulations and Mission Command devices are initialized independently with somewhat consistent organizational and environmental data sets.

3.4 MSDL and C-BML Collaboration

This work included collaboration with the newly formed C-BML group and how to coordinate initialization data model development activities with Battle Management Language activities.

Although many of the finer details associated with the originally coordinated planned product delivery schedules between MSDL and C-BML were modified based on the realities of standards development the underlying theme of continue coordination and harmonization and integration as part of the phase II product delivery remained intact.

The C2SIM Product Development Group introduced within the SISO section is a key step in the realization of the single integrated data model goal.

3.5 The Road to Balloting

The road to balloting the standard began with products drafted by the initial MSDL Study Group (SG). The PDG took the initial drafts and then focused on identifying and aligning with lessons learned from on-going use of MSDL like data models and other related standards, including SISO's base object model (BOM) and the JC3IEDM.[1]

Four concepts within the draft specification provided by the Study Group were not include in the final balloted version. These items are listed along with the rational for not including them in the final balloted standard:

- A Plan element contained large free text fields to hold a 5 paragraph operations order associated with the scenario. The Plan element was not included in the final MSDL specification to reduce the issues with automated unambiguous import. Additionally, there is a reference field provided within the MSDL specification to link to documents order information[1];
- A Complex Course Of Action element contained a number of sub-elements to define a parse-able mission. This element overlapped with the objectives of the C-BML PDG and was provided as input and consideration within the C-BML activity [1].;
- A Threats element was another free text field describing the threat situation and was not included as it could be handled as a reference [1]; and
- A set of enumerations specific to OneSAF units and equipment was not included as the information was specific to a single simulation [1].

The effort resulted in changes, additions, deletions, and removal (reduction in scope) of the draft version 1 schema. The technical document was then brought up to date with the schema.

In addition to the standards review milestones within the standards development process a style guide, per industry best practices, for XML Schema production was also generated.

The last mile in the road processes included balloting, voting, interactive comment resolution, and SISO acceptance of the final product as shown in Figure 5.

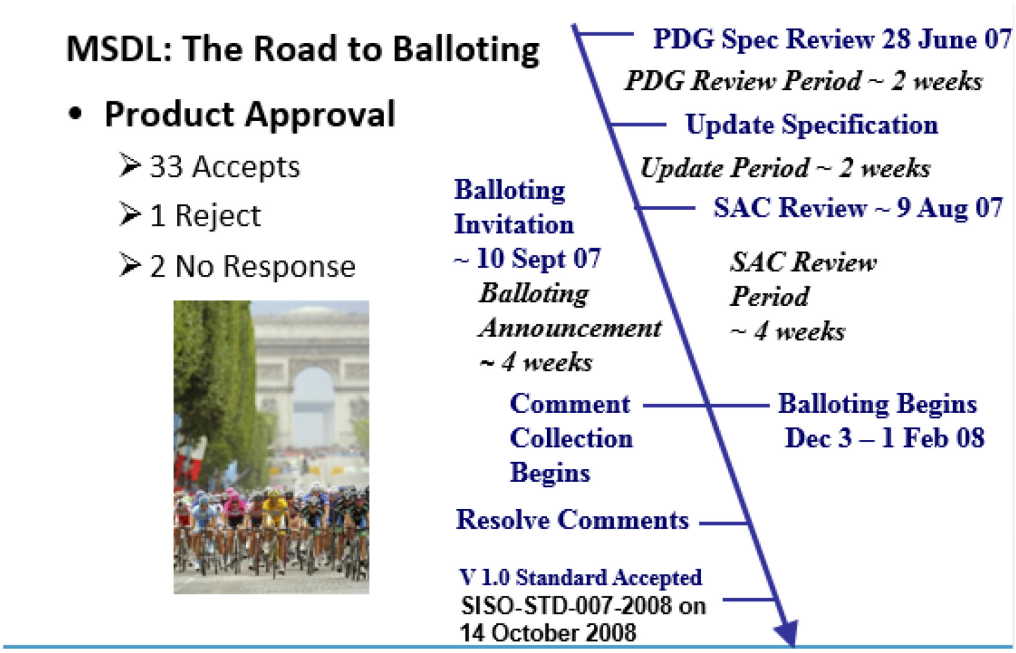

Figure 5: MSDL: The Road to Balloting.

3.6 The MSDL Data Model

The MSDL data model holds nine primary elements. These elements describe a military scenario according to the MSDL PDG's military scenario definition:

"A specific description of the situation and COA at a moment in time for each element in the scenario. The description of the scenario conveys reality (what is true about the situation, such as the forces identified as participants in the situation) and perceived reality…"

The nine primary data elements include [10]:

- Scenario ID– Describes meta data regarding the scenario;
- Options – Describes the parameters to be applied across the scenario;
- Environment – Describes scenario time, extents of the geographic area, and the weather, meteorological and oceanographic conditions;
- ForceSides – Describes Sides and Forces relationships for a scenario;
- Organization – Describes the organizations within a scenario;
- Overlays – Describes collections of tactical graphics and associates them with a particular unit or entity owners;
- Installation – Describes the installations as they stand at scenario start time for the forces, sides, or units;
- Tactical Graphics – Describes the tactical action-based information; and
- MOOTW Graphics – Describes the Military Operations Other Than War action-based information for a scenario.

An XML representation produced by the XMLSpy graphical editing tool is shown below in Figure 6.

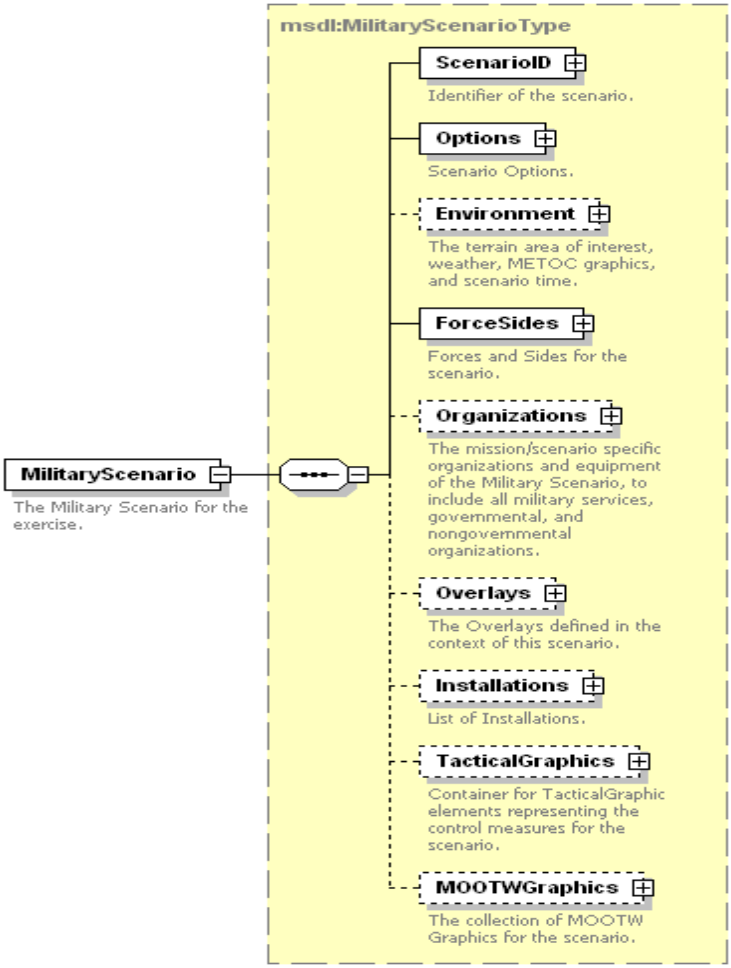

Figure 6: MSDL Primary Elements in XML Graphical Notation [10].

The contents of the specification are expected to grow and extend over time to support other types of information such as equipment loading information, unit orders and individual soldier tasking and individual platform readiness or damage state.

3.7 MSDL in Operation

As we see in Figure 7, the evolving Coalition-Battle Management Language (C-BML) is recommended to be used to supply order and task information.in MSDL format. As a standard XML data model MSDL allows both simulation and C2 systems to easily create, export, and ingest standards-based scenarios. The MSDL files can be imported into simulations for direct execution, included within a larger federation of simulations, or used for consistent initialization within a Coalition of simulations and C2 systems.

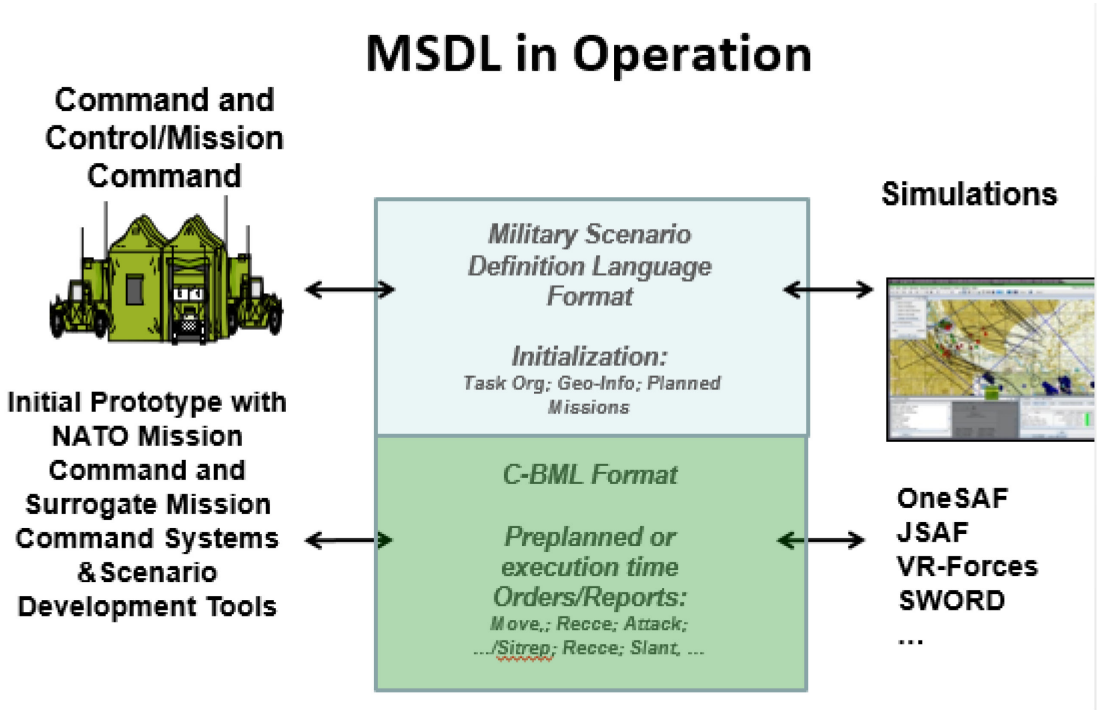

Figure 7: MSDL in Operation [13, 9].

It should be note that in addition to the MSDL specification a formalized coordination process between all participants is recommended to ensure common and consistent interpretation and import of the initialization data. The formality and coordination of the initialization process depends on the size and complexity of the exercise.

For a simple single simulation exercise without external connectivity to other simulations or Mission Command devices the process can and should be defined within the simulation's documentation.

For larger more complex simulation-based events involving single or multiple real-world Mission Command devices as well as multiple simulation federates, a well-defined rigorous system of systems initialization process is necessary. This section does not intend to provide a one size fits all initialization process, but instead identifies the high risk areas that need to be addressed with the initialization process to support reduced costs and enhanced federation stability as the following:

- Agreement on environmental representation consistency and correlation boundaries;
- Agreement on unit, platform, and life-form enumeration definitions and the enumeration mapping and tracking process;
- Agreement on pre-runtime scenario change management and control. Scenario here includes order of battle, positions, health status, graphics overlays, environmental representation, actor ownership, Mission Command device interaction, etc.; and
- Steps and magnitudes of change (for example, is it allowable for one federate to change the order of battle and then reflect this change during simulation runtime or is does this change need to be made a disseminated to all or some subset of the federates prior to runtime) for orderly pre-runtime changes within the scenario.

The focus here is on the orderly and consistent progression from pre-runtime to runtime across the federation to include simulation, Mission Command devices, and other federates.

With appropriate processes in place it has been demonstrated that there are a number of existing use cases that benefit from the standard and reusable scenarios that MSDL supports across training, mission planning, mission rehearsal, testing, or experimentation event.

Finally it has also been shown that, when combined with the C-BML formatted orders, tasks, and reports, a much richer set of initial conditions, plans, and perceptions can be created [3,4]. As we will see in the upcoming sections there is real promise to reduce the time to construct, enhance, and run a consistent holistic scenario with a combination of MSDL and C-BML enabled technologies.

4.0 CONCLUSION

In conclusion this paper has provided an introduction and overview of the SISO organization and the MSDL standard. It provides a launching point for the remainder of the standards-based technologies and technical discussions to be presented as part of the C2SIM Lecture Series.

5.0 REFERENCES

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