LS-141

C2 to Simulation Interoperability (C2SIM)

-

Lessons learned

Near Future: plans for operationalization

APPROVED FOR PUBLIC RELEASE

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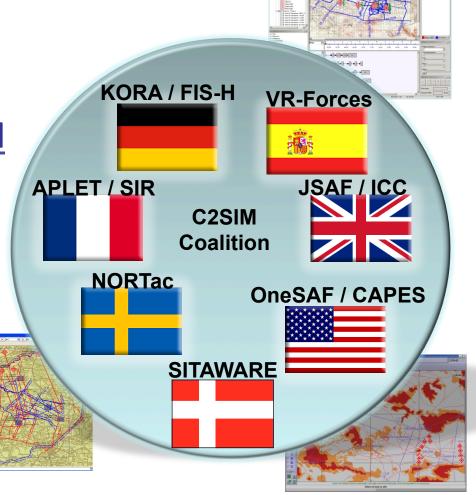**DGA/DS/CATOD**
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Agenda

1. **NATO C2SIM Technical Activities Lessons learned**

2. **Future Plans**

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VR-Forces

APLET / SIR

JSAF / ICC

C2SIM Coalition

NORTac

OneSAF / CAPES

SITAWARE

Works achieved within MSG-048 (2007 – 2010)

- **Main events**
  - NATO booth demo I/ITSEC 2007, 2008, 2009 and ITEC 2008
  - MSG-079: C-BML Workshop in February 2010, GBR
  - 20 Academic publications to SISO, ICCRTS, NMSG conference
  - Final Experimentation 2009

- **C-BML Reference Implementation**
  - GMU Open-Source communication infrastructure

- **Technical Report**
  - Approved for public release
  - Available at www.cso.nato.int

- **STO Scientific Achievement Award**

Works achieved within MSG-085 (2010 – 2014)

- **2 BML Research Symposiums**

- **2 NATO C2SIM workshops**

- **Dozen of publications at SIW, ICCRTS and NMSG Conferences**
  - ➢ Answering the question – Why a BML standard has taken so long to be established, 11F-SIW-020 (*)

  - ➢ A standard development framework for C-BML Phase 2 and beyond, 12F-SIW-045 (*)

  - ➢ Lessons Learned from NMSG-085 CIG land Operation demonstration, 13F-SIW-031 (*)

- **7 Demonstrations during ITEC and I/ITSEC**

- **3 Communication Infrastructures available (GMU, FKIE, DGA)**

- **A final Demonstration at MCBL, Fort Leavenworth**   **(*) SIWZIE AWARDS**

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C2SIM – Lessons learned

- **Variability of C2SIM Interoperation Requirements**
  - ➢ C2SIM Interoperation requirements vary across services, nations and also depend on the themes and focus areas of specific training, mission rehearsal or experimentation events
  - ➢ Develop a C2SIM interoperability standard roadmap

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C2SIM – Lessons learned

- **Combined Standard Scenario Definition, Initialisation and Execution**

  ➢ C2SIM Core : The SISO MSDL/C-BML specifications are sufficient for basic operations of manoeuvre warfare, but insufficient to meet the broader need of other military operations and support functions
    - Creating a single massive schema leads to impractical complexity

  ➢ Unified C2SIM Standard : The SISO MSDL and C-BML specifications can be made to function together but new, harmonised versions are required for most effective C2SIM interoperation

  ➢ Standardise a Core Data Model versus Schema

C2SIM – Lessons learned

- **Need to Formally Manage Standard Products**
  - ➢ Maintain Logical Data Model, Generate Derived Products
    - ▪ Don't build the model as an XML schema; build a logical data model using a Model-Driven Architecture (MDA) and generate XML schemas or equivalent derived products such as HLA-FOM modules
  - ➢ Standardisation of the Process and Production Chain
    - ▪ define a process by which stakeholder requirements can be collected, managed and effectively traced to the derived standard products

C2SIM – Lessons learned

- **C2SIM Infrastructure**
  - ➢ A C2SIM reference architecture should be defined to facilitate C2SIM federation design
  - ➢ C2SIM DSEEP Overlay as a first step to move ahead

- **C2SIM Communication Infrastructure**
  - ➢ Standard enables the building of expressions
  - ➢ But it is also required that a set of services to ease C2SIM usability and to enable effective use

Communication Infrastructure - Lessons learned

- **Experienced high reporting rates during scenarios**
  - ➤ Created load on BML infrastructure (e.g. Server)
  - ➤ Contribute to information overload of
    - ▪ BML clients & infrastructure
  - ➤ High throughput rates must be assumed

- **Made judicious use of Publish & Subscribe**
  - ➤ Previous experimentation used only client-server architecture
  - ➤ Subsequent polling led to information bottlenecks
  - ➤ Combined Web Service/Publish & Subscribe greatly improved information flow

Communication Infrastructure - Lessons learned

- **Validation**
  - ➤ C-BML expression correctness
  - ➤ Transaction success

- **Persistence functionality required for:**
  - ➤ Record & Playback
  - ➤ Continuation of an exercise

Communication Infrastructure - Lessons learned

- **Scenario Initialization Needs (C2 & simulation systems)**
  - ➢ Need to coordinate the start-up sequence

- **Run-time Scenario Management Needs**
  - ➢ Late joiners
  - ➢ Re-joiners (e.g. following system failure, communication disruption)
  - ➢ Pause, Start, Re-start, Stop, Record & Playback

Communication Infrastructure - Lessons learned

- **Information overload**
  - Higher levels of automation and increased digitization of military information are factors that can contribute to the generalized situation of information overload at:
    - Network level
    - System level
    - Operator level

- **Addressing information overload will likely require**
  - Further development of interest management mechanisms, (e.g. more "smart-push")
  - Further work on automated information processing technologies
    - e.g. Intelligent agents, Intelligent Adaptive Interfaces

Communication Infrastructure - Lessons learned

- **Characteristic Time Scales (e.g. publishing, processing)**
  - ➤ C2 & Simulation Systems do not always have same characteristic time-scale
    - Simulations vary ~ from 10^{-2} to 1 S
    - C2IS ~ 1 S to minutes
- **Some simulation systems run faster than real-time**
  - ➤ May need to process reports before sending to C2IS
  - ➤ Simulation result can be used differently by C2IS
    - Common Operational Picture
    - COA evaluation

Can create a data producer/consumer issue!
Need to control the simulation reporting rates.

Communication Infrastructure - Lessons learned

- **Information assurance of BML expressions is required**
  - ➢ Validation
  - ➢ Acknowledgment
  - ➢ Error-handling

Other considerations - Lessons learned

- **BML Gateways/Translators are necessary – for now**
  - ➤ External or non-intrusive interfacing to C2IS has significant advantages (e.g. Using actual C2IS as-is)

- **In order to fully exploit BML-enabled capabilities C2 and simulation systems will have to evolve**
  - ➤ Integrate BML constructs into the applications

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ET-038

Definition of NATO activities to operationalize C2-Simulation interoperability

Team Leader(s): Lionel Khimeche (France-DGA)
Kevin Galvin (Great Britain-THALES)

Contributing NATO: Denmark, France, Germany, Great-Britain, Norway, The Netherlands, United-States of America

Start-End: January 2015 – December 2015

Related activity: Follow on MSG-085 "C2 Simulation Interoperations" initiated in 2010 and concluded in 2014

Objective(s): Define the future technical works NATO needs to execute in order to operationalize C2SIM interoperability

Themes/topics: To consider for future TA

- Assist SISO in providing a consistent C-BML and MSDL next generation C2SIM standard via experimentation, in reviewing draft products and in providing guidance
- Collaborate with standards bodies to propose the C2SIM next generation to a STANAG
- Expand SISO C2SIM core Data Model
- Define a process by which stakeholder requirements can be collected, managed and effectively traced to the derived standard products
- Expand understanding for better education

Output and Deliverables:
- Summary Report, including recommendations for a TA
- TAP and TOR for a future TA
- Draft POW (optional)

Exploitation:
Enable a broader range of military activities and meet the needs of the coalition nations and the definition of the technologies to develop, validate and mature future C2SIM approach leading the next generation of C2SIM standards

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Future NATO Technical Activity

Operationalization of standardized

C2-Simulation Interoperability

2016 - 2018

Future NATO Technical Activity - Objectives

- **Develop extensions to the unified C2SIM (MSDL/C-BML) core Data Model for specific functional areas**

- **Encourage nations to use the standards and motivate suppliers to develop products**

- **Exploit C2SIM in use cases through an operational, conceptual and executable scenario development process**

- **Inform the standards development process**

- **Make recommendations for a STANAG based on the C2SIM standard**

- **Educate the community of practice on C2SIM technology employment**

Future NATO Technical Activity - Topics

- **Outreach to military stakeholders**

- **Use case extensions and a minimum set of information exchange**

- **Development process, products and tools for implementation**

- **NATO Architecture Framework (NAF) and other methods to describe scenarios and interoperability requirements**

- **Automation of M&S initialization**

- **Experimentation and validation of the standard**

- **Services to enable persistent C2SIM interoperability**

- **STANAG development**

- **Progress demonstrations and workshops**

- **Tutorials**

Future NATO Technical Activity – 2016 Road Map

- **Define operational use of C2SIM standard through applying a robust process**
  - ➢ using NAF as an approach to understand user requirements for C2SIM interoperability
  - ➢ Exploiting operational, conceptual and executable scenario development guide
  - ➢ defining the mechanism and resulting products to translate operational information exchange requirements into conceptual requirements necessary to support military domains
  - ➢ defining a methodology by which stakeholder requirements can be collected, managed and effectively traced to the derived standard products

- **Define, enable and operate a persistent environment based on C2SIM standard**
  - ➢ For stakeholders to learn and gain experiences how to use the standard
  - ➢ Based on available products

- **Collect from community of practice relevant use cases**
  - ➢ to identify areas to expand the C2SIM core Data Model in 2017
  - ➢ to identify opportunities to participate during an event in use case validation to obtain acceptance

- **Execute a demonstration of the work accomplished**

Future NATO Technical Activity – 2017 Road Map

- **Create extensions to the C2SIM core Data Model**
  - ➤ Execute the process (collect and trace SME exchange requirements and generate C2SIM ad-hoc format)
  - ➤ Experiment the extension
  - ➤ Provide feedback to SISO C2SIM PDG

- **Define, enable and operate a persistent environment based on C2SIM standard**
  - ➤ Add the capabilities about the extension of the Core Data Model

- **Start the STANAG process**
  - ➤ Provide the recommendations

- **Participate in use case validation to obtain acceptance**
  - ➤ Shadow an exercise, part of an event, other operational activity

- **Execute a demonstration of the work accomplished**
  - ➤ I/ITSEC, ITEC, C2 event (e.g. CAX Forum), CWIX, Network Integration Event (US)

Future NATO Technical Activity – 2018 Road Map

- **Continue to create extensions to the C2SIM core Data Model**
  - ➢ Execute the process (collect and trace SME exchange requirements and generate C2SIM ad-hoc format)
  - ➢ Experiment the extension
  - ➢ Provide feedback to SISO C2SIM PDG

- **Continue to define, enable and operate a persistent environment based on C2SIM standard**
  - ➢ Add the capabilities about the extension of the Core Data Model

- **Continue the STANAG process**
  - ➢ Provide the draft STANAG

- **Participate in use case validation to obtain acceptance**
  - ➢ Exercise, event, other operational activity

- **Execute a demonstration of the work accomplished**
  - ➢ I/ITSEC, ITEC, C2 event (e.g. CAX Forum), CWIX, Network Integration Event (US)

- **Organize an outreach event and Workshop**

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Future NATO Technical Activity – Deliverables

- **Extension to core C2SIM Data Model**

- **Standardized C2SIM deployment process**

- **Recommended C2SIM STANAG**

QUESTIONS