12F-SIW-009
Improvement of simulation interoperability by introducing the CBML benefits into the HLA world

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Context

• Information system as a support to military activities:
  - *Simulation provides a realistic and secure environment to support military operations,*
  - *Military works are done using C2 systems:*
    - ✓ Need of interoperability between C2 system and simulation,
  - *Models are not included in a single simulation system:*
    - ✓ Need of interoperability between simulations.

• Benefits of interoperability standards:
  - To provide information exchange support between systems,
  - To avoid specific link between systems.
Interoperability standards

• Simulation-Simulation interoperability:
  - Different standards available (DIS, HLA...),
  - Case of HLA:
    - IEEE standard HLA 1516-2010 (called HLA evolved),
    - Reference data exchange models: RPR FOM, NETN FOM...

• Simulation-C2 interoperability:
  - Standard C-BML still in production (SISO PDG):
    - Language (vocabulary and grammar) to define messages,
    - XML schemas for data initialization (MSDL) and exchange (C-BML),
    - Server implementations to support information transport.

DIS: Distributed Interactive Simulation - HLA: High Level Architecture – FOM: Federation Object Model
MSDL: Military Scenario Description Language - C-BML: Coalition-Battle Management Language
Implementation of C2 – Simulation links

C2 System
  - CBML Interface

CBML Server
  - CBML Interface

CBML-HLA Gateway
  - CBML Interface

Distributed Simulations (HLA)
  - CBML FOM module
    - Federate
    - Federate
  - Simulation Runtime Infrastructure

Simulation
  - Distribution Support (HLA, DIS, TENA...)

Distributed Simulation
  - Distributed Simulation
NATO NETN FOM

- NETN FOM is a modular reference FOM designed by the NATO MSG-068 (actually improved by NATO MSG-106),
- C-BML information introduced as an additional FOM module.
C-BML FOM module

• Several approaches actually studied to design the C-BML FOM module:
  – Encapsulation of C-BML message in an HLA common interaction and/or object class:
    ✓ Gateway independent from the C-BML schemas,
    ✓ FOM module simple and stable,
    ✓ Simulation depending on C-BML schema.
  – Decomposition of C-BML message into specific HLA object classes (one object class for every kind of military task):
    ✓ Gateway depending on the C-BML schemas,
    ✓ FOM module complex to set up,
    ✓ Simulation independent from C-BML schemas.

• French experimentation done on the first approach.
# French C-BML FOM module

<table>
<thead>
<tr>
<th>Module H-BML</th>
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<tbody>
<tr>
<td>MessageBML (S)</td>
<td>OrderBML (PS)</td>
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<td></td>
<td>ReportBML (PS)</td>
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<table>
<thead>
<tr>
<th>MessageBML - attributes</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>OpsHeader</td>
<td>Military header describes the active actors in BML exchange</td>
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<tr>
<td>BMLContent</td>
<td>BML Content</td>
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<th>OrderBML - attributes</th>
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<td>MetaData</td>
<td>Summary data (MetaDataOrderList) for filter information</td>
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<td>MetaData</td>
<td>Summary data (MetaDataReportList) for filter information</td>
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French C-BML-HLA experimentation

C-BML World
- SICF (Joint C2 system)
- CBMS (C-BML Server)
- C-BML/HLA Gateway
- CBML – initialization (ODB...)
- CBML – conduct (order / report)
- HLA (interactions order / report)

HLA Federation
- ORQUE (maritime)
- WAGRAM (land)
- pRTI 1516-2000 - FOM ASI V1
- pRTI 1516-2010 - FOM ASI V2 (based on NETN FOM)
- ALLIGATOR (gateway)
- pRTI 1516-2010 - FOM ASI V2 (based on NETN FOM)
CBMS and Stimulation tool

**CBMS:**
- USA implementation of C-BML server,
- Based on RESTful (REpresentational State Transfer) Web technology,
- C-BML data repository (XML database), structured by topics and including search function.

**STIMULUS:**
- French technical tool designed to put on and get data from CBMS topics,
- Provide capacity to import files using MSDL and C-BML XML schemas.
C-BML-HLA gateway

- **GATE:**
  - French technical tool to manage exchange between C-BML world and HLA federation,
  - Connection status and log display,
  - Automatic **order** transfer from C-BML server to HLA federation,
  - Automatic **report** transfer from HLA federation to C-BML server,
  - Provide capacity to **filter** data transfer (automatic block or manual allow) according to the message content (C-BML metadata and HLA attributes).
French Land simulation

- WAGRAM:
  - French simulation system to manage land activities (battalion aggregated units),
  - Simulation of all combat and logistics activities, including civilian modeling,
  - Compliant with the NETN FOM (attrition, logistics...),
  - Import of MSDL files,
  - Automatic process of C-BML orders (attack, observation, move, reconnaissance, withdraw and special operation),
  - Generation of C-BML reports (own and enemy force situations).
French maritime simulation

- ORQUE:
  - French simulation system to manage maritime activities (platform units),
  - Simulation of surface, submarine and air activities, including customized behavior modeling.
  - Compliant with the NETN FOM (attrition, logistics...),
  - Import and export of MSDL files,
  - Automatic process of C-BML orders (attack, patrol and observation / detection),
  - Generation of C-BML reports (own and enemy force situations).
CBML interface for C2 system

• SICF:
  – French C2 system to manage Joint and Army information,
  – Military information services (mail, workflow, repository...),
  – Tactical situation display using layers (tactical spreadsheet with a XML format).

• C-BML plug-in:
  – French technical tool to manage exchange between C-BML server and SICF tactical spreadsheets,
  – Import/Export of unit and orders,
  – Import/Export MSDL files.
Scenario and experimentation

• Small scenario including a battalion with three companies deployed in mountainous and seaside terrain,

• Execution of the experimentation (one week) :
  – One day for the setting of all components,
  – One day of experimentation,
  – One day of improvement of some components,
  – One day of experimentation,
  – One day of analysis and results.

• The improvements of component done during the experimentation were about:
  – Improvement of graphical interface,
  – Update of the CBML interfaces due to minor evolution of the XML schemas of the CBML,
  – Minor update in simulation models to improve the automatic process of the orders.
Lesson learnt and way ahead

• The first lesson learnt indicates that the draft C-BML FOM module needs to be improved by:
  – Replacing interaction by object for the ORDER in aim of persistency (suitable for federate which joins the federation after the order sending),
  – Adding communication elements such as Request and Acknowledge.

• Difficulty to represent maritime information using MSDL,

• The management of CBML in HLA is still studied in NATO MSG-106 is aim to improve the representation of message (object or interaction, encapsulated order or explicit task message...),

• The both HLA and CBML standards will be used more and more in military context (military exhibition, military school, training center...).
Brigade C2

CBML Interface

Operations Planning Simulation

Land Aggregate Simulation

Maritime Simulation

CBML Server

HLA-BML Gateway

HLA Federation

Vehicle Simulation

Land Platform Simulation

UAV

MELMIL
Questions

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