Context

C2 System

- CBML Interface

C2 System

- CBML Interface

C2 System

- CBML Interface

CBML Server

- CBML Interface

- CBML Interface

- CBML Interface

- CBML-HLA Gateway

Simulation

Distributed Simulation

Distributed Simulation

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

Distributed Simulations (HLA)

- C-BML FOM module(s)

- Federate

- Federate

- Simulation Runtime Infrastructure
NATO MSG-106 “SPHINX”

- NATO Modeling and Simulation Group about the enhanced CAX architecture, design and methodology (2012-2014),
- Activities divided into Operational, Technical and Governance subgroups,
- Technical subgroup in charge of research on simulation interoperability (initialization of scenario, interoperability Simulation-C2, modeling responsibility...),
  - Production of a reference NETN FOM,
  - Production of a Federation Architecture and FOM Design document,
  - Distributed experimentation about “Initialization of Order of Battle” and “Simulation-C2” (France, Netherlands, Norway and Sweden).

CAX: Computer Assisted Exercise       NETN: NATO Education and Training Network
The concept of coupling MSDL, BML and HLA standards

TWO COMPLEMENTARY SIM-C2 FOM MODULES:

1. High level object and interaction part with encapsulated BML data
2. Low level interaction part with translated BML data
Improvements of MSDL

- Extension of MSDL XML schema:
  - Initial allocation of modeling responsibilities,
  - Unit and equipment type identification for simulation,
  - Representation of holdings,
  - Extended description of humans,
  - Embarkment status.
NETN reference FOM

• Modular FOM (HLA 1516 evolved):
  – Based on RPR-FOM 2,
  – Provider Consumer Protocol,
  – Modules about L16, Logistics, Aggregate, Transfer of modeling responsibility, C-BML, CBRN...
C-BML for High Level simulation

- NETN FOM module used by High Level simulations (modeling at aggregate level),
- C-BML data encapsulated without any translation,
- Need of a gateway between C-BML server and HLA RTI,
- C-BML orders and requests as HLA object in aim of persistent data,
- C-BML reports and acknowledges as HLA interaction (included task, situation and logistics reports).
BML for Low Level simulation

- NETN FOM module used by Low Level simulations (modeling at platform level),
- BML data detailed at task level,
- Need of a translation federate between the BML FOM modules (High Level and Low Level),
- BML task and report as HLA interaction (included task, situation and logistics reports).
C2 Agent federate

• Low-level BML focuses on tasks and reports with a much finer granularity than C-BML orders and reports,
  – C2 Agent includes compact low-level tasks and commands that easily can be interpreted and executed by CGF (Computer Generated Force) tools,
  – C2 Agent reflects the capabilities commonly found in COTS (Commercial Off-The-Shelf) CGF tools,
  – C2 Agent is independent of any specific doctrine or tactics,

• Additional use: "Command & Control" concept between simulations (for example during disaggregation process).
Experimentation architecture

FKIE CBML Server

Stimulus

SICF

BML-HLA Gateway

HLA Evolved RTI

WAGRAM

SWORD

ORQUE

C2 Agent Federate

High Level Simulations

Low Level Simulations

PITCH ACTORS

VR FORCES

1 C-BML FOM module

2 Low level BML FOM module

2013 Fall SIW
Distributed federation
Testing support

- **Integration and Verification System (setup phase):**
  - Self-test system used for conducting tests with prepared stimulating and responding federates,
  - Tests for Connectivity, Scalability, NETN Logistics, Behavior (Spatial, Dead Reckoning), TMR (Transfer of Modeling Responsibility) and Low BML commands and reports,
  - Adapted to RPR2 and NETN2 but is today not a FOM agile system.

- **Pitch Actors (conduct phase):**
  - CGF mainly used in testing as a federate to stimulate other federates and for demonstration purpose,
  - Designed for the RPR FOM but is now adapted to NETN2 to manage NETN Logistics, TMR, and low level BML orders and reports,
  - Entities can be given a sequence of actions to conduct in a script.
  - Entities react to warfare interactions.
MSDL results

• Scenario used consisting of four countries and two thousand units,
• DIS entity types within the MSDL file allows the simulations to automatically match the units of the scenario to their model templates,
• Allocation of units among the simulations done on aggregated units managed by high level simulation (additional test required for low level simulation),
• Scenario merge done manually and step by step (common tool to perform this merge may be helpful),
• Data transfer by file (additional test required for central server distribution).
BML-C2 results

• **FKIE BML Server:**
  – Automatic process
  – JMS interface faster than Web Service interface especially for MSDL data,
  – No customized topics to sort C-BML messages,
  – No Graphical User Interface, need to plug an additional technical tool.

• **SICF (C2) - CBML interface:**
  – Manual process,
  – Limited exchange of messages.

• **HLA – CBML gateway:**
  – Automatic process,
  – Possibility to set filters to limit dataflow.
High level simulation results

• Tests done:
  – Orders from C2 systems to simulations,
  – Reports from simulations to C2 systems.

• Simulations feed back:
  – Automatic process of order only for assigned units.
  – Land orders tested: move, attack, reconnaissance, observe, withdraw and Special Forces operations,
  – Maritime order tested: attack, patrol and observe,
  – Automatic acknowledges and Reports (task and situation) sent by simulations.
Low level simulation results

- **Tests done:**
  - Orders from C2 systems to simulations,
  - Reports from simulations to C2 systems,
  - Translation of order for a battalion into sequences of lower level tasks for platoons (done by C2 Agent federate).

- **Simulations feed back:**
  - Automatic process of task only for assigned units,
  - Automatic generation of reports (situation).
Lesson learnt and way ahead

• The results of the NATO MSG-106 experimentation demonstrate the feasibility of the combination of the MSDL, C-BML, HLA standards for system interoperability (C2-Simulations).

• New C2-Simulation experimentations are planned during the second half of 2013 and all the year 2013:
  – Study on exchange between C2systems and CBML,
  – Study on exchange between High Level and Low Level BML modules (for example introduction of TMR (Transfer of Models Responsibility, i.e. enhancement of HLA transfer of ownership) in aim to link the “high level” and “low level” simulations.
Questions

José RUIZ
DGA/DS/CATOD
jose.ruiz@dga.defense.gouv.fr