C2 AND SIMULATION SYSTEMS WHICH HAVE BEEN IMPLEMENTED

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Example Systems

- **SAFIR**
  - C2: SIR, SICF, BCIP 5.4
  - M&S: APLET, SWORD, JSAF

- **COMELEC FRA-DEU**
  - C2: SICF, FIS-H
  - M&S: SWORD, KORA

- **MSG Experimentation**
  - C2: SICF, ICC, 9LANDBMS, SITAWARE, ESRI COP Viewer, JADOCS, ISIS, CAPES, C2PC, JCHAT, TALOS
  - M&S: APLET, JSAF, OneSAF, VBS2
Architectural Framework Model
Specific Examples

- ICC – JSAF
  - ICC
  - JSAF
- System overview for each of the chosen systems
- System interface
- Specifics for C2Sim, e.g. bolt-on translator, i/f to WS, message sets, etc
- Video
UML View

ICC & NIRIS
Message Processing and Middleware
JSAF Simulation
Air Operations Messaging Capability

JSF BML INTERFACE 2.0 ARCHITECTURE

SYSTEM TO BML TASKING
- SysTaskReceiver
- Bml2SysTaskTranslator
- BmlMsgSender
- BmlMsgReceiver
- BmlServer

BML TO SYSTEM TASKING
- BmlParser
- BmlSysTaskTranslator
- SysTasker
- SysReportReceiver
- SysTask2BmlTranslator

BML TO SYSTEM REPORTING
- BmlParser
- BmlMsgSender
- BmlMsgReceiver
- Bml2SysReportTranslator

SYSTEM TO BML REPORTING
- BmlParser
- BmlMsgSender
- SysReportDispatcher
- SysReport2BmlTranslator
- SysReportReceiver

Green components are common to all C-BML servers

Can connect to SBML or CBMS Server

Yellow components are templates for message translators and wrappers

Red components are system specific
Air Operations Messaging Capability

JSAF BML INTERFACE 2.0 ARCHITECTURE

**TASKING**

- **BML Server**
- **BmlServerIF**
- **Bml2SysTaskTranslator**
- **SysTaskReceiver**
- **SysTask2BmlTranslator**
- **BmlParser**
- **BmlMsgSender**
- **BmlMsgReceiver**
- **SysTasker**
- **SysReportDispatcher**

**REPORTING**

- **Bml2SysReportTranslator**
- **SysReportDispatcher**
- **SysReportReceiver**
- **SysReport2BmlTranslator**
- **BmlParser**
- **BmlMsgSender**
- **BmlMsgReceiver**

**Can connect to SBML or CBMS Server**

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Specific Systems – ICC

- ICC – NATO Integrated Command and Control – software for air operations
  - This is an Air Campaign planning tool widely used in NATO
  - It can generate ACOs, ATOs and ACMREQs
  - It can be integrated with a targeting tool (JTS/FAST)
  - It can be used to display a Recognised Air Picture and Common Operational Picture from operational feeds
  - It can integrate with ISTAR assets, e.g. using the CSD

- ACO – Airspace Control Order
- ATO – Air Tasking Order
- ACMREQ – Airspace Control Measure Request
- JTS – Joint Targeting System
- FAST – Flexible Advanced C2 Services for Time-Sensitive Targeting
- CSD – Coalition Shared Database
ICC – The User Interface

- TaskOrg
- ACMs
- Mission Editor
- Resources
- 2D Map
- Mission Tote & ATO
ICC Tasking (C-BML Order) Translator

- ICC
  - Load ACO, ATO
  - Parse ACO, ATO
  - Create & Publish C-BML Orders

- ICC DB
  - or
  - ACO & ATO

- Develop ACO, ATO

- C2Sim WS

- Parse ACO, ATO

- Create & Publish C-BML Orders
Specific Systems – JSAF

- JSAF – Joint Semi-Automated Force simulation
  - This can be modified for C2-Sim because:
    - It can be initialised with structured data
    - It has behavioural models for Units, Entities and Equipment
    - There is an accessible dynamic tasking interface *(not scripted)*
  - ‘Front-end/Back-end’ MVC distributed architecture *(not Server/Client)*
  - HLA FOM already includes:
    - Tasking Interactions:
      - Tasking State
      - Tasking Parameters
      - Background Parameters
      - Behaviour Status
JSAF – The User Interface

- User Tools
- Environment
- Units
- Overlays, Graphics
- Unit Status
- Tasking Matrix
- Detailed O/P
JSADF Tasking (C-BML Order) Translator

C2Sim WS → Subscribe (Filter if necessary) → Parse C-BML → Create & Publish Overlays and Tactical Graphics → Populate, Schedule and Publish Tasking Interaction → JSADF

Internal format with permanent or transient storage
Reporting

- Simulation provides *Ground Truth*
- Reports to C2 provide *Perceived Truth*
  - Latency, sampling frequency, sensor errors, identification errors, etc increase inaccuracy
- C-BML reports:
  - Positions, Tracks, Event locations – Should be displayed graphically on a map display
  - Other status, e.g. Logistics, Mission reports, Acknowledgements – Better displayed in a written list
- A C2 display, say of a COP, is merely an extension of the operator’s memory
Reporting (cont)

- Need to get symbology correct, MSDL is helpful here as it can include 2525D symbol codes for units/equipment
- Mapping to operational message sets is important, not all use 2525D codes, e.g. OTH-Gold
- Overloading C2 systems and middleware with reports is a potential difficulty:
  - May need to throttle, filter or sieve reports
  - May need to be controlled on both or either side of server
- Timestamping of reports is a challenge
Supporting Approaches

- DSEEP Overlay for C2Sim
- SISO Guide to Scenario Development
- M&S and C2Sim as Services
C2Sim DSEEP Overlay

• Distributed Simulation Engineering and Execution Process
• Developed by MSG-085 to help capture the systems engineering processes required to support a C2Sim federation, particularly the System Design Agreements
• Recommendation of MSG-085 is to use a C2Sim DSEEP Overlay when developing complex federations
• Lends itself very well to Agile development methods
A C2Sim DSEEP Overlay

1. Define C2-SIM FEDERATION Environment Objectives
2. Perform Conceptual Analysis
3. Design C2-SIM FEDERATION Environment
4. Develop C2-SIM FEDERATION Environment
5. Integrate and Test C2-SIM FEDERATION Environment
6. Execute C2-SIM FEDERATION
7. Analyse Data and Evaluate Results

Extensions required

XML Schema Extensions

C2SIM XML Schema

Scenario Documentation

C2SIM Federation Requirements

C2-SIMULATION FEDERATION DSEEP OVERLAY
Guideline on Scenario Development

- SISO Guide (currently in draft, Aug 2015)
- C-BML identified as having a role in formal scenario specification for Operational and Executable scenarios
- Refinement processes may require extra data definitions over and above what C2Sim supplies
M&S as a Service

- NATO MSG-136 research programme is investigating cloud-based computing systems to support M&S as a Service
  - Clients access Services, Platforms and Infrastructure ‘in a cloud environment’
- What is required to extend this to include C2Sim as a Service?
C2Sim as a Service

- C2Sim Interoperability Services are needed to support:
  - Initialisation, development, validation, storing, merging and distribution
  - Exchange of C2Sim messages – push/pull, pub/sub, unicast, multicast, broadcast
    - Addressing, Routing, Acknowledgement, Error-handling
  - Logging, replay and analysis of C2Sim messages
  - Augmentation of C2Sim messages, e.g. adding common metadata
  - Modification of C2Sim messages, e.g. timestamp shifting
  - Translation of C2Sim messages, e.g. between different ‘dialects’
  - Exercise Management
    - Coordination/monitoring of participants – which sites/players are joined, their capabilities, status, etc
    - Coordination/monitoring of applications – which applications are joined, etc
    - Security – which data is it possible to exchange and with whom?
    - Time management
    - Federation agreements

- Need to provide service profile meta-data to permit registration, discovery and execution
Questions