Coalition Battle Management Language (C-BML) and C2SIM History and Development

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C-BML Precursors

- Various ad-hoc interfaces between C2 and simulations supporting “train as you fight” concept
  - Motivated mostly by cost of human “puckster” interface
- 1995 DARPA Synthetic Theater of War (STOW) sponsored Command and Control Simulation Interface Language (CCSIL)
  - Good first step but proved complex to use
- 2003 US Army Simulation to C4I (SIMCI) sponsored Battle Management Language (BML) experiment
  - Focus on eliminating ambiguity in task description
  - Successful proof of principle
  - Simulated NATO MSG and SISO development
BML Scope

C4I

BML Order

C4I

BML Messages & Situational Awareness Information

Simulation

Robotic Forces
US Army BML Proof of Principle

BML acts as the common denominator

Multi-Source Database Augmented with BML

XML – BML Parser

CAPES

BML GUI

C4ISI

OTB
Development of C-BML

• Coalition BML (C-BML) grew out of early US and French experiments in C2-simulation interoperability
• These led to parallel interest and development in
  - NATO Modelling & Simulation Group: experimentation and validation
  - Simulation Interoperability Standards Organization (SISO): codified consensus standards
• Some of the NATO team also participated in standards process
France and US Precursors

- US Defense Modeling and Simulation Office (DMSO) sponsored research to understand Web-based M&S
  - Initiative called Extensible M&S Framework
  - GMU C4I Center teamed with Naval Postgraduate School
  - Produced XML-based BML “Extensible BML” (XBML)
  - Used a supporting Web service to link C2 and simulation
- XMSF demo at I/ITSEC 2005 drew attention of French DGA
  - France also had C2-simulation linkage (SICF-APLET)
- US and French teams decided to collaborate
- Produced interoperating C2-simulation prototype and demonstrated it for NATO MSG
US-France Demonstration Architecture

CAPES COA Definition

JSAF Simulation

BML Web services

C2IEDM+ Database

APLET COA Definition

Simulation

Push COA

Pull COA

Push COA

Pull COA
Initial Conditions (CAPES view)
Combined Plan (APLET view)
NATO MSG Exploratory Team ET-016

- France & US early work seeded interest in NATO early adopters
- Led to formation of MSG-048
  - Coalition Battle Management Language

Denmark  France (Lead)  Germany  Netherlands
Norway  Spain  UK  USA (Co-Chair)
NATO MSG-048

• ET-016 stimulated a multinational effort to show technical feasibility of Coalition BML (C-BML)
  – Canada, Denmark, Germany, the Netherlands, Norway, Spain, Turkey, UK and USA
  – Open framework to establish coherence between C2 and M&S
  – New open, system-independent, community standards and protocols.

• Work areas:
  – Establish requirements for the C-BML standard
  – Assess its usefulness and applicability of C-BML in support of coalition
  – Educate and inform the C-BML stakeholders
BML Architecture

Command and Control Systems

BML Messages
(Orders, Reports, etc.)

Simulation Systems

BML Web Services

JC3IEDM database
MSG-048 Technologies

• Server-based architecture
  – Simplifies development environment - each client can be tested individually
  – Provides a measure of fault-tolerance - does not require that all C2SIM system-of-systems are constantly available

• C2 systems
  – Battle View (Canada), SICF (France), ISIS (Netherlands), NORTaC-C2IS (Norway), ICC (UK), ABCS (USA)

• Simulation systems
  – UAV-SIM (Canada), APLET (France), SIMBAD (Spain), JSAF (UK), OneSAF (USA)

• Supporting software
  – C2LG GUI (Germany), SBMLserver (USA)
MSG-048 2009 Experimentation

MNF C2IS
- ABCS
- BattleView
- ICC
- NORTaC
- SICF

OPFOR C2IS
- ISIS
- C2LG

DIS SIM EXERCISE
- OneSAF
- UAV-Sim
- JSAF
- SIMBAD
- APLET

BML WEB SERVICES
- JC3IEDM

provided by
- ICC
- C2LG
- JSAF
Role of Grammar in C-BML

• While ET-016 was considering a possible NATO MSG Technical Activity in BML, a SISO Study Group was considering how BML might be standardized

• The SISO Study Group concluded that BML should be standardized in three phases:
  1. An XML schema for interchange of data
  2. A grammar to define syntax of a formal language
  3. An ontology to define the semantics of BML
Command and Control Lexical Grammar

- The preferred grammar, developed by Schade and Hieb, is known as *Command and Control Lexical Grammar (C2LG)*.
- Form of C2LG expressions:
  - OB → Verb Tasker Taskee (Affected|Action) Where Start-When (End-When) Why Label (Mod)*
- For example:
  - *pursue* BtI C CavB En *towards* Z at now *in order to* destroy En label_3_15;
- During development of the standard the grammar phase got folded into the other two
  - C-BML Phase 1 is an XML schema structured with C2LG.
MSG-048 Results

• Parallel activity by SISO C-BML PDG to define a standard
  – Progress made but not as smoothly
  – Slower than most stakeholder found satisfactory
  – Produced results during following phase
  – MSG-085 used schema from a US effort

• Final Experimentation 2009
  – Work with operational military SMEs acting as brigade staff
  – Intensive preparation over Internet (new approach at the time)
  – Integration events in Portsmouth, UK and Paris, France
  – Counter-insurgency scenario with Canadian, French, Norwegian, UK, USA simulated units

• Succeeded as Proof of Principle despite difficulties
• Won NATO Scientific Achievement Award 2013
NATO MSG-085

- Follow-on TA chartered near end of MSG-048
  - To support standardization and show operational relevance
  - Added participating nations: Belgium and Sweden (also interest by Italy and Australia)
  - Also added operational military expertise
- Organized into Technical and Operational Subgroups
  - Also, orthogonally, Common Interest Groups:
    - Autonomous/Air, Land, and Maritime Operations;
      Joint Mission Planning, and Infrastructure
- Recognized need to add MSDL to C-BML
  - In first year (2010), participants implemented MSDL
  - Which in turn showed MSDL/C-BML incompatibility
Evolving BML Architecture

Command and Control Systems

BML Web Services
+ Initialization and Synchronization
real-time database

Simulation Systems

BML Messages
(Orders, Reports, etc.)
SISO C-BML Standard

• MSDL standard was approved in 2009
• In 2012 SISO completed balloting C-BML Phase 1
• Two versions approved:
  • “full” intended to address very wide range that can be represented by the JC3IEDM
  • “light” facilitates rapid implementation
• Standard approved May 2014
• Delays in approval resulted in MSG-085 nations having 3 different schemas implemented
MSG-085 Final Demonstration
System of Systems

Ft. Leavenworth, USA

SIMULATIONS
- APLET
- SWORD
- JSAF
- OneSAF

FKIE and WISE-SBML C2SIM servers

BN HQs
- SICF
- SITAWARE
- C2LG
- 9LANDBMS
- 41 FRA
- 42 DEN
- 43 DEU
- 44 USA

MOC
- C2LG

BDE HQ
- SICF
- JCHAT
- ARTY LO

BN HQs
- SICF
- 41 FRA

BN HQs
- SICF
- 41 FRA

= Role Player

FDC
- ICC
- JADOC

AOC
- JADOC

Farnborough, UK

Madrid, ESP

JCHAT
- 4 ESP

TALOS

LS-141 - C2 to Simulation Interoperability (C2SIM)
MSG-085 Final Demonstration

- Conducted at Fort Leavenworth Kansas
  - In collaboration with Mission Command Battle Lab
- Featured Joint and Combined Mission Planning
- Complexity similar to MSG-048 but with major differences:
  - Network sophistication: two linked servers; three schemata; two sites participated via Internet
  - Setup process: where MSG-048 was chaotic; MSG-085 “just worked”
  - Audience impression: MSG-085 worked very well
- Proved concept: C2SIM in the form of MSDL and C-BML ready to be tested in real coalition operations.
Path to STANAG: 2\textsuperscript{nd} Gen SISO C2-Simulation

- MSG-085 showed that MSDL and C-BML could work together effectively, but with some difficulty
  - They should be converged/harmonized
- Experience with C-BML “Full” schema indicates it is cumbersome to use
  - Yet it only covers maneuver warfare – not all types of operations
- MSG-085 technical work indicated that the approach taken by Multilateral Interoperability Programme (MIP) is more useful
  - Define data to be exchanged as data model, expressed as UML (not XML schema)
  - Extend data model to new domains as needed
  - Derive XML schema from the data model
SISO C2SIM

• SISO MSDL and C-BML Product Development Groups agreed to merge, forming C2SIM
  ➢ A single Product Development Group with multiple Drafting Groups
  ➢ And a Product Support Group to maintain MSDL and C-BML
  ➢ Reduced administrative overhead

• New approach in SISO: PDG and PSG form a lifecycle product group empowered over the product lifecycle to develop and support products.
  ➢ Membership common to both PDG and PSG
C2SIM Officers

- **Co-Chairs (two) provide overall leadership**
  - Ensure PDG products form an integrated whole
  - No specific role in drafting; contribute like others

- **Vice-Chairs associated with specific functions**
  - Logical Data Model
  - Initialization
  - Tasking-Reporting

- **Lead Editor**
  - Ensure documents form adequate, coherent suite
  - Not responsible to develop technical concepts (but must understand)

- **Secretary**
  - Manages information necessary for PDG process (not product)

- **C2SIM PSG Co-chairs**
  - work closely with the PDG Co-chairs to maintain effectiveness of previously released standards
  - Ensure that PDG products take transition into account
Combining MSDL and C-BML

• C2SIM-LDM (Logical Data Model)
  – Core set of data elements
  – Standard way of extending the core

• C2SIM-Initialize
  – Intended to supersede MSDL version 1
  – Defines startup and checkpoint information

• C2SIM-TaskingReporting
  – Intended to supersede C-BML phase 1
  – Major issue: be able to expand to new domains without being cumbersome
  – Derived from extended LDM
C2SIM Products

- C2SIM Logical Data Model (C2SIM-LDM)*
- C2SIM Initialization XML Representation* (C2SIM-Initialize)
- C2SIM Tasking and Reporting XML Representation (C2SIM-TaskingReporting)*
- Guideline for C2SIM-Initialize Implementation
- Guideline for C2SIM-Tasking Reporting Implementation

* standards document