Advances in Systems and Technologies
Toward Interoperating Operational
Military C2 and Simulation Systems

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Presentation Overview

• Introduction: the need for C2SIM
• Early prototypes
• NATO MSG-048
• NATO MSG-085
• Future work
• Conclusions

NOTE: This is about capabilities, not experiments.
Introduction: The Need for C2SIM
Vision

• We are working toward a day when the members of a coalition interconnect their networks, command and control (C2) systems, and simulations simply by turning everything on and authenticating, in a standards-based environment.

• This will be major step forward in C2 for coalition agility.
BML Purpose and Operation

• Facilitates C2-Simulation interoperation
  – Exchange of Orders and reports in standard format

• Current architecture uses a repository service to hold state submitted by client C2 and Simulation systems
  – Web service with XML input – Network Centric
  – Real-time database enables schema translation

• Now using SISO Coalition BML (C-BML) Phase 1 standard

• Mechanism for shared initialization of all systems required
Evolving BML Architecture

Command and Control Systems

BML Messages (Orders, Reports, etc.)

BML Web Services + Initialization and Synchronization

real-time database

Simulation Systems

ICCRTS’14-047
Roots of C-BML

USA

• “Train as you fight” requires using operational C2 systems as interface to simulations
  – Implemented with human “puckster” or “stove pipe” computer interface

• US Army SIMCI conducted a successful experiment to remove ambiguity at the C2SIM interface by replacing the free text of military orders and reports with a standardized vocabulary

• US Defense M&S Office supported a broad effort in Web technologies for interoperation
  – Including C2SIM based on MIP C2IEDM (now JC3IEDM)
Scope of SIMCI Experimental BML

Figure 1: Scope of SIMCI Experimental BML in 2003
Roots of C-BML
Multinational

• France DGA developed C2SIM capability using
  – APLET simulation for mission planning
    • faster than real time
  – SICF C2 system

• NATO ET-016: France and USA
  – Interoperation of national prototypes stimulated NMSG interest

• SISO
  – Convened a Study Group to consider standardizing BML
Proof of Principle: MSG-048
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
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 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
MSG-048 Example: French COA

COA 1: Conduct one slate to clear the area. Blower but safer.
Proof of Concept: MSG-085
NATO MSG-085

• Chartered near end of MSG-048 due to high promise
  – 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
MSG-085 and SISO

- 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 4 different schemas implemented
MSG-085 activities and events

Phase 1
POW DEVELOPMENT

Phase 2
REQUIREMENTS ANALYSIS
- OCD Planning
- OCD Training
- Tech Req. Spec.

Phase 3
RECOMMENDATIONS & GUIDANCE

2010
POW

2011
IITEC 2011

2012
IITEC 2012

2013
IITEC 2013

2014
IITEC 2014

COMMUNICATION, WORKSHOPS & SYMPOSIUMS
- SISO BML Symposium
- SISO BML Symposium
- ICCRTS C2SIM TRACK
- NATO C2SIM Workshop I
- NATO C2SIM Workshop II

DEMONSTRATION EXPERIMENTATION & EVALUATION
- ICTRTS C2SIM TRACK

FINAL DEMO

Final Report

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Multiple Server Implementations

• MSG-048 Scripted BML (SBML) server from GMU had added features:
  • integrating multiple MSDL scenario files
  • translating among various semantically-equivalent schema
  • web-based coordination
• VMASC developed high-throughput CBMS document-based server
• FKIE implemented document-based server independently
• Commercially based WISE-SBML server builds on SBML (10x or better performance)
• FKIE and WISE-SBML servers interoperate to distribute communications and load
Linked Server Architecture
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: MSG-048 was chaotic; MSG-085 “just worked”
  – Audience impression: MSG-085 worked very well
• Proved the concept that C2SIM in the form of MSDL and C-BML is ready to be tested in real coalition operations.
MSG-085 Final Demonstration Architecture
Conclusions / Way Forward

• C2SIM concept has made steady progress over the last decade

• Both NATO and SISO have continued progress toward the day when military coalitions will be able to “plug in” their C2 and simulation systems to interoperate

• However, much remains to be accomplished:
  – Engage the operational military community as users
  – Expand the compatibility and scope of MSDL and C-BML