A C-BML Standard Development Framework for Phase 2 and Beyond

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C-BML Phase 2 Standard Development Framework

Motivation

• Need to Resolve Scope Conflicts
  – Formal Requirements for standard
  – Level of detail
  – Multiple domain support
  – Relevant Use-cases

• Plan for Complex C4I/Simulation Architectures

• Organize Complex Product Components

• Ensure Adequate Extensibility
  – Additional Domains, Message Sets, non-shareable information
C-BML Standard Development Framework*

C-BML Standard Products

**Product 1 (Normative)**

- **Information Exchange Structure & Content Specification**
  - Logical Data Model, XML Schemas, Grammar, Usage Rules

- **Information Exchange Mechanism Specification**
  - Definition of required & optional services for the exchange of information using C-BML

**Product 2 (Informative)**

- **Guidelines Document**
  - Examples of how to construct valid expressions and messages; how to exchange information using C-BML

- **Reference Implementation Description**
  - Example C-BML messaging service implementations that comply with the normative C-BML specifications.

A Standard Development Framework is required to build these products
The objectives of the C-BML SDF are to:

- Define a comprehensive model for requirements, domain-specific information products, information exchange interactions and service components.

- Separate normative and guidance documents.

- Provide a set of examples and usage guidance documents for technology-independent and technology-specific utilization.
Mission threads, use-cases, derived requirements from stakeholders.

Content model, Message Structure, Interaction Protocols and Services Components.

Defines: (1) Content & Structure specification; (2) Services Specification.

Examples that illustrate use of normative specifications for specific protocols.

Technology-specific examples of how standard can be implemented.

*This work is based in part on the US Joint Intelligence Community/DoD Content Discovery and Retrieval (IC/DoD CDR) Model http://metadata.dod.mil/mdr/documents/DoDMWG/2010/04/2010-04-13_CDRIPT.ppt
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Requirements

Consistent with Architecture Frameworks (AF):
- NATO AF (NAF)
- UK MoD AF (MoDAF)
- US DoD AF (DoDAF)

Operational Message is a Information Product

Information Flow exchanged in

Operational Activity

Mission Thread

Use Case

Information Exchange Requirement

Information Object satisfies Information Requirement
C-BML Standard Development Framework
C-BML relation to MoDAF/DoDAF/NAF

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Reference Architecture Overview

- Requirements
- Reference Architecture
- Normative Specifications
- Specification Guidance
- Reference Implementation

Content Model
- Vocabulary & Semantics
- Grammar & Message Structure

Interaction Protocols
- Message interaction protocol definition and examples.

Message Framework
- Service components for C-BML-based information exchange.
Represent military communications as interaction protocols using communicative acts:

- **request**
- **refuse**
- **agree**
- **inform**
- **propose**
- **accept**
- **query**
- **subscribe**
- **etc...**

**CFF** – Call For Fire
**FDC** – Fire Direction Center
**MTO** – Message To Observer
**OBS** – Forward Observer

**Reference Architecture – Interaction Protocols**

**C-BML Standard Development Framework**

**Requirements**

**Reference Architecture**

**Normative Specifications**

**Specification Guidance**

**Reference Implementation**

**Content Model**

**Message Framework**

**Interaction Protocols**

**Service Components**

**OBS**

- request (CFF)
- refuse-1 (FS Not available)
- refuse-2 (Req Not Understood)
- agree (Reads back CFF)

**FDC**

- propose (MTO)
- accepts-proposal (Reads back MTO)
- inform (corrections)
- inform (done)
- inform (damage assessment)
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Service Components

- Requirements
- Reference Architecture
- Normative Specifications
- Specification Guidance
- Reference Implementation

Core C-BML Services

- Register
- Deliver
- Persist
- Initialize
- Publish & Subscribe
- Search

Service Components

- Content Model
- Message Framework
- Interaction Protocols
- Service Components
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Normative Specifications

Requirements
Reference Architecture
Normative Specifications
Specification Guidance
Reference Implementation

Interaction Protocol

Grammar & Message Structure

Vocabulary & Semantics

Content Model

Information Exchange Structure & Content Specification

Information Exchange Mechanism Specification

Interaction protocol template.

Services Specification

Definition of services.

Service Components

Message Framework

Specification

Information Exchange

Mechanism Specification

Service

Components

SISO
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Information Exchange Structure & Content Specification

MESSAGE CONTENT
- Assertive Expressions
- Commissive Expressions
- Directive Expressions

Constituents
- Thing
  - Entity
  - Facility
  - GeospatialFeature
  - GroupOfThings
  - LivingThing
  - Animal
  - Person
  - Material
  - Equipment
  - Organization
- Event
  - Action
  - CommunicationAct
- Property
  - Capability
  - PhysicalProperty
  - Role
- SpatialRegion
  - GeospatialRegion
  - GeospatialBoundary
  - GeospatialLocation
- Temporal Region
- Temporal Boundary
- Temporal Instant
- Temporal Interval

Report/Task Primitives
- CommunicationAct
  - Acknowledgement
  - Assertive
  - Report
    - EventReport
    - StatusReport
    - TaskReport
  - Commissive
    - RequestReply
    - AcceptRequest
    - DeclineRequest
  - Directive
    - Order
    - Request
    - RequestAction
    - RequestInformation

SISO
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Information Exchange Structure & Content Specification

*Example adapted from C2LG - [http://www.bastianhaarmann.de/download/c2lg_specification.pdf](http://www.bastianhaarmann.de/download/c2lg_specification.pdf)
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Information Exchange Structure & Content Specification

Abstract Syntax Tree → Concrete Syntax(es)
Semantically equivalent; Derived from abstract syntax

XML Schema

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema>
  <xs:element name="Order">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="CommandIntent" minOccurs="0">
          ...
        </xs:element>
        <xs:element name="OrderBody">
          ...
        </xs:element>
        <xs:element name="SpatialConstraint">
          ...
        </xs:element>
        <xs:element name="TemporalConstraint">
          ...
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
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Information Exchange Mechanism Specification

**TRANSPORT MESSAGE**

- **Transport Envelope**
  - **Header**
  - **C-BML Message**
    - **Metadata**
    - **C-BML Content**

**Messaging**
- JMS
- AMQP
- OMG-DDS

**Email**
- SMTP
- MIME

**WS**
- WSDL
- SOAP

**WS**
- HTTP
- XML

**HLA Object**
- HLA 1516

**Requirements**

**Reference Architecture**

**Normative Specifications**

**Specification Guidance**

**Reference Implementation**
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Relationship between Normative & Guidance Specifications

**NORMATIVE SPECIFICATIONS**

- Content Model
- Message Framework
- Interaction Protocol Definition Rules
- Service Specifications

**APPLICATION OF NORMATIVE SPECIFICATIONS**

- Extensions
- Message Catalog
- Interaction Protocol Definitions
- Service Implementations

Based on national doctrine and service specific procedures.

Based on specific standard transport protocols.

Relationships:
- Requirements
- Reference Architecture
- Normative Specifications
- Specification Guidance
- Reference Implementation
DEFINITION:
A reference implementation is an implementation of a standard that is by definition conformant to that standard. Such an implementation provides a proof of concept of the standard and also provides a tool for the developers of the conformance test suite (by generating expected values, testing the test suite, etc.) A reference implementation has maximum value in the early stages of a conformance program.

http://www.nist.gov/itl/ssd/is/conformancetesting.cfm

A reference implementation is, in general, an implementation of a specification to be used as a definitive interpretation for that specification.
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UML Tool Implementation
Conclusions

We have proposed a Standard Development Framework for C-BML Phase 2 based on lessons learned from Phase 1 Drafting Activity.

The C-BML Phase 2 SDF defines a Reference Architecture and separates C-BML areas of concern for: Requirements, Vocabulary, Grammar, Message Structure, Message Exchange, Interactions and Services.

The SDF organizes the C-BML specification and frames future drafting discussions.

It poses C-BML in terms of enterprise architecture, including the Architecture Framework initiatives of NATO, US DoD, UK MoD.

We have implemented framework as a UML model.

Working with MIP Products and tools to generate C-BML Standard Products such as XML schemas and ontology modules using an automated process.

SDF allows the acceleration of Phase 2 and can support a recommendation to merge Phases 2 and 3.