C2 Core - Warfighter Data Interoperability Enabler

AFCEA-GMU C4I CENTER SYMPOSIUM

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Critical Issues in C4I

Command and Control Requires Shared Understanding

Shared Operational Picture

Semantic Challenges
Critical Issues in C4I

The Challenge

Shared knowledge is embedded in translation software... very hard to get the knowledge back out for software maintenance, or for connecting with other partners.

Does not scale in a large enterprise

The \( N^2 \) problem
15 applications
210 negotiations
Total level of effort is \( O(n^2) \)
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Road to the Solution

Too much knowledge must be learned by too many people.

A top-down approach ignores the knowledge people already have.

This learning is expensive, and takes a long time.

The mission of everyone changes much faster than the vocabulary can change.

If you can’t have one universal vocabulary understood by everyone, then you must have several vocabularies, each understood by some group.

When COIs must exchange data, we must translate between vocabularies. (This by itself is an improvement: $N^2$ is not so bad when $N$ is small)
Critical Issues in C4I

Concept: Common Semantic Cores for Most Frequently Used Concepts

- **Critical Issues in C4I**
- **Concept:** Common Semantic Cores for Most Frequently Used Concepts
- **UCore & Common Cores (C2 Core)**

**Diagram:****
- **Frequency of Occurrence**
  - High Occurrence
  - Low Occurrence

- **Specificity of Concept**
  - General Concept
  - Specific Concept
  - English Language
  - Vocabulary of Domain
  - IER/Message
  - Field Descriptions
  - Overlapping COI
  - Concept Vocabulary

**Key Points:**
- **High-payoff area for vocabulary selection for domain standardization**
- **First 300 most frequently used words in English Language Account for ~66% of all communications usage**
- **66%**
- **34%**

**Area for specialized work by COIs**
C2 Core Approach to Conformance and Interoperability

- C2 Core V1.0 extends UCORE 2.0 through the structured payload approach
- C2 Core V2.0 will also extend UCORE 2.0 using the structured payload approach

Intended outcome: Provide consistent terms across applications and data exchanges – leading to greater information sharing and faster Information Exchange Specification (IES) development
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C2 Core Interoperability Framework

UCore “Base”

UCore provides the ULEX messaging framework and the UCore digest specification. This “base” may be extended by defining the contents of the structured payload.

Extended UCore ULEX Message Format

COI and IES Extensions

C2 Core Data Components

C2 Core provides a library of data component “Lego blocks”. These components are used to define the payload, which contains the whole C2 data exchange. The digest is a metadata summary of the C2 exchange that is “wrapped” around the payload.

“UCore Full” message conforming to UCore and C2 Core
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C2 Core Extension of UCore 2.0
Semantic Extension

- UCore provides the base components from which C2 Core and C2 Communities extend

  - Example
    - FacilityType is the UCore base
    - C2 Core adds FacilityName & FacilityLocation
    - COI defines FacilityCategory and FacilityEstimatedReturnToServiceDate

  - Combined together to create a single Facility object
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What’s in C2 Core?

- Content:
  - target, unit, track, plan, etc.

- Documentation and Specifications:
  - Development Concept & FAQ
  - Naming and Design Rules
  - Conformance Specification
  - Binding Specification Prototype
  - IES Specification

- Developer Tools & Support:
  - Schema Subset Generation Tool
  - Conformance Tool (ConTesA)
  - Developer’s Support Network
  - Training & IES Development Guide

- Governance Structure:
  - C2 Core is developed under the DSSC
  - C2 Core is under configuration management administered by a CCB
  - C2 Core technical support is provided by the C2 Core Working Group
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Value Proposition

- Over time, data components properly belonging to many / most COIs are designed once
- These components are used as “building blocks” in all new data exchanges
- When these new exchanges are designed, some / most of the data interoperability work is already done
- Resulting value
  - Reduced cost
  - Faster development
  - Improved agility / flexibility

Picture shows C2 Core extending UCore. This is a founding assumption of C2 Core
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PILOT C2 CORE PROJECTS UNDERWAY
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TEDS JCTD

- OM: JFCOM   TM: USMC   XM: Army
- Demo capability of sharing ADS data using web services in C2 Core message exchange format
- INC I – Army/USMC Battalion-level message exchange - POSREP
- INC II – USA, ACT/NC3A, FRA, CAN, NLD message exchanges – SIGACT, POSREP, ENESIT, OBSPOS IESs
- INC III – Navy, AF, Intel / C2 message exchange
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Coalition Battle Management Systems C2 Pilot

- CBMS has a need for a common initialization format for its participating systems.

- C2 Core and Military Scenario Definition Language (MSDL) seem to be good candidates to serve as the basis for the development of such a format.

- In this pilot, we will evaluate how well C2 Core aligns with the initialization standard for simulations (MSDL).
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Navy C2 Rapid Prototype Continuum

- Analytical Study Effort
- Assess C2 Core for sharing C2 Situational Awareness and Planning/Tasking data
- Disseminate data up/down Navy/ Cross-Service/Joint C2 architectures
- Measure semantic understanding across communities
- Establish extensions to C2 Core with receiving system understanding them
- Constrain message size & estimate computing and bandwidth loading
Proposed Layered Understandability using C2 Core

- Space Mission Category
- Space Mission Scheduled Time
- Space Mission Priority

- Air Mission Category
- Air Mission Scheduled Time

- Ground Mission Task
- Ground Mission Missile Path

ES = Exchange Schema
IES = Information Exchange Specification
Critical Issues in C4I

Air Force Request Manager Pilot

Proposed Approach

• Provide a method for the communities to extend the exchange schemas with community-specific information

• Have all C2 communities agree upon exchange schemas for core C2 concepts

• Have the communities agree upon a common vocabulary for shared data

ES = Exchange Schema
IES = Information Exchange Specification
Army BML Pilot Overview

- The purpose is to implement operationally significant C2CORE based information exchanges between Simulations and Battle Command systems.

- C2 Core Battle Management Language Pilot utilizes doctrinally correct information as implemented in US Army Battle Command and Simulation systems. It will demonstrate the ability to interoperate between an Army/Coalition Data structure and a C2 Core data structure while maintaining doctrinal correctness.

- It will include Common Ground and NATO MSG components
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BML Demo Use Cases

Demo Use Case 1 Steps

- C2Core Schemas are pre-validated
- CG NODE is pre-populated with a CG Digital OPORD
- The information is extracted and converted into a C2Core compliant output file

Demo Use Case 2 Steps

- The C2Core file is entered in the BML GUI and used as input into a NATO MSG SBML database using a C2CORE C-BML compliant script
- The information is extracted through the SBML WS and the BML is viewed with a BML GUI
Army C2 Data Sharing Pilot (DSP)
Project Overview – Purpose

- Help mature C2 Core & facilitate C2 Core version 2.0
- Determine if C2 Core is mature enough to extend into Civil Information Management (CIM), specifically Key Leader Engagement (KLE) reports
- Use CIM to assess operational/technical insights & the expertise needed to mature C2 Core
- Use C2 Core to exchange KLE data with US and Coalition forces
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C2 DSP Architecture

- TiGR
- Androi
- CPoF

Laptop #1

Laptop #2

Laptop #3

Surrogate Coalition Client

Semantic Browser

C2 DSP Demo Control Software

C2Core/JC3IED Mediation (DSL-A)

C2 Core

C2Core WS

C2Core/PASS Mediation

PASS

MIP WS

MIP DEM

JC3IED M

MIP DEM

JC3IED M

KLE Data
Overarching Findings

C2 Core demonstrated sufficiently mature to implement and support system connectivity and information exchange.

C2 Core demonstrated sufficiently mature to use as a foundation for development.

Pilot provided a new capability to send complex Key Leader Engagement (KLE) data from a fielded US system to a coalition partner without requiring coalition code changes.

Pilot demonstrated C2 Core ability to connect previously unconnected systems (TiGR, JC3IEMD, CPoF)
C2 Core Information Sources

• Software Forge: https://software.forge.mil/sf/projects/c2_core

• Defense Knowledge Online: https://www.us.army.mil/suite/files/17758027

• DoD MetaData Registry: https://metadata.dod.mil

• Developer’s Support Network: http://c2core.gtri.org
Thank you for your attention!

QUESTIONS?