Background

- **Coalition Secure Management and Operations System (COSMOS)**
  - Multilateral Interoperability Programme (MIP)
    - Command and Control Information Exchange Data Model (C2IEDM)
    - Data Exchange Mechanism (DEM)
  - Constrained Information Exchange Based on Role
    - Information Exchange Requirements (IER)
    - Constraint Model for Concise IER Definition and Assessment
COSMOS Primary Objectives

- To provide an acceptable level of security to the MIP data exchange environment
- To reduce the volume of data that currently flows through MIP nodes
- To allow Information Management Officers to tailor the data exchange at a finer level of granularity
- To explore the potential capabilities and limitations of agent technology at higher levels of security control
MIP Exchange

Nation 1
- Friendly
- Neutral
- Org

Contracts on FRDNEU

Nation 2

Nation 3
- Correlated
- Enemy

Contract on CORENU
Enabling Technologies

- **Knowledge Management Framework**
  - Service Oriented Architecture
  - Collaborative decision-support (agents and users)
  - High-level information representation (ontology)
  - Common services (distributable software modules/reuse)

- **Distributed Information Management**
  - Modular service and de-coupled applications allow flexibility in system deployment (platform independence)
  - Information location transparency

- **System Interoperability**
  - Access any information domain using structured data format
  - Information mapping to alternative views
Foundational Concepts

- **Ontology** – High level information representation defining structural hierarchy, characteristics, and relationships (object model) as well as inherent behavior and semantics (logic).

- **Agent** – Software entity capturing domain logic/expertise (behavior and semantics). Provides feedback in response to satisfaction of logical conditions enabling collaborative decision support.

- **Information Exchange Requirement (IER)** – Basic definition of a specific kind of information required to perform a particular activity or function. The requirement specification may be associated with one or more conditions that when satisfied trigger an appropriate information exchange action.

- **Role** – Activity or function assumed by an operational unit. May be used to establish an entity fulfilling a particular role with its basic set of information requirements.
Key Processes

• Define Role/Task Information Requirements
  – Select IER criteria based on pre-defined/similar roles or tasks
  – Define/modify IER criteria composed of information value constraints (patterns)

• Assess Information Exchange Requirements
  – Evaluate national C2 information against coalition exchange requirements
  – Recommend exchange of information satisfying IER criteria through inclusion in relevant Information Group

• Monitor Information Exchange
  – Provide reports on node/contract/group activity
  – Validate incoming information against exchange requirements
System Architecture

- User Interface
- Agent Engine
- Exchange Control Agents
- Interoperability Bridge
- C2
- EC
- DMZ
- DEM
- Notification Service
- DSL
- C2IEDM
- IMT
- Connector

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COSMOS
Information Management Framework:
• Provides collaborative, distributed, information services infrastructure
Interoperability Bridge:

- Provides information mapping service with connections to DEM and DSL service interfaces
Agent Engine:
- Provides agent inference environment

System Architecture

Agent Engine

User Interface

Interoperability Bridge

Connector

DMZ

DEM

Notification Service

C2IEDM

DSL
User Interface:
- Provides IMO interaction functionality
DSL C2IEDM Object Service:
- Connects to IMT via the Interoperability Bridge
- Provides C2 operational information to IMT
DEM Interface:
- Connects to IMT through Interoperability Bridge
- Provides DEM management information to IMT
System Architecture

Notification Server Interface:
• Provides asynchronous notification of changes to C2 database
Physical Architecture
Exchange Control Domain
Derived Features

- referenceId  ->  refObjectItem.referenceId
- location     ->  getLocation(refObjectItem...LongitudeCoordinate, refObjectItem...LatitudeCoordinate)
- country      ->  getCountry(refObjectItem...GeopoliticalCode)
- affiliation  ->  getAffiliation(refObjectItem...HostilityStatusCode)
- symbol       ->  getSymbolCode(self.affiliation, self.country)
**Unit Capability Agent** – Based on detected changes in *unit capability*, the agent responds by adjusting the **Area of Influence** for the unit. The Area of Influence is, in turn, utilized by the Exchange Control Agent to affect information group assignment.

**Condition**: Unit information (e.g., location, type, holdings, etc.), capability assignment (e.g., max fire range) to unit, unit type, or holdings.

**Response**: Area of Influence associated to a unit, unit type, and holdings aggregated based on interrelationships.
IER Agent – Based on detected changes to a unit’s tasking, the agent responds by recommending definition of Information Exchange Requirement (IER) criteria reflecting task information requirements.

**Condition**: Unit information (e.g., location, type, holdings, etc.), and task assignment to unit, task-action required capabilities (e.g., secure-area task requires mobility capability).

**Response**: Recommended IER definition and assignment based on task information requirements.
Agents

**Exchange Control Agent** – Based on detected changes in *unit* operational characteristics (e.g., *area of influence*), the agent responds by checking against *information exchange requirements* to determine possible COSMOS Information Group (CIG) membership modification.

**Condition**: Unit characteristics and assigned task Information Exchange Requirements (IER).

**Response**: Based on satisfaction of IER criteria may produce a change (addition or removal) in unit CIG membership.
IMO Tool
Conclusion

• **Knowledge Representation**
  – Standard C2 Information Exchange Model
  – Exchange Control Model Incorporating Specialized Information Perspective and Information Exchange Constraint

• **Ontology Driven Framework**
  – Generated Information Management Framework
  – Collaborative Agents and User Interface

• **Service Oriented Architecture**
  – Information Management Services (Persistence, Subscription, Life-Cycle Management)
  – Distributed Software Modules