THE MIP INFORMATION MODEL

A Platform-Independent Reference Data Model for a Future Interoperability Solution

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OUTLINE

- Multilateral Interoperability Programme (MIP)
- Introducing the MIP Information Model
- Restructuring the Model
- Additional Transformations
- Summary and Outlook
The aim of the Multilateral Interoperability Programme (MIP) is to achieve international interoperability of Command and Control Information Systems (C2IS) at all levels from corps to battalion, or lowest appropriate level, in order to support multinational (including NATO), combined and joint operations and the advancement of digitization in the international arena.
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History of the MIP Information Model

Generic Hub 4

ATCCIS

LC2IEDM 2.2

View Models

MIP Block 1

NCDM RM

NATO

C2IEDM 6.15

MIP Block 2

MIP/NDAG-Merger
MOA 2004-02-04

JC3IEDM

MIP Block 3

MIM

No baseline released yet
The MIM

Core Elements

- Extensive hierarchy of battle space objects (147 subclasses)
  - Classification
  - Status
The MIM
Core Elements

- Location hierarchy
- 2D and 3D geometry
- Including relative and absolute coordinate systems
The MIM
Core Elements
The MIM
Core Elements

The MIM Core Elements
The MIM
Core Elements

- Line
- Point
- Surface
- GeometricVolume

- Location
- Capability
- GroupAccount
- Object
- Comment
- Action
- ActionObjective
- ActionEffect
- ActionResource
- Event
- Task

- Organisation
- Materiel
- Person
- Facility
- Feature
The MIM
Core Elements
The MIM
Core Elements
The MIM
Core Elements

- **ActionObjective**
  - +focuses 0..*
  - +observedResults 0..*
- **ActionEffect**
  - +observedResults 0..*
- **ActionResource**
  - +requirements 0..*
- **Action**
  - 1
- **Location**
  - 0..1
- **Capability**
  - 0..1
- **Affiliation**
  - 0..*
- **Address**
  - 0..*
- **Object**
  - 0..1
- **Comment**
  - 0..1
- **GroupAccount**
  - 0..1
- **Event**
  - 0..1
- **Task**
  - 0..1
- **Organisation**
  - 0..1
- **Materiel**
  - 0..1
- **Person**
  - 0..1
- **Facility**
  - 0..1
- **Feature**
  - 0..1
- **CandidateTargetList**
  - 0..1
- **RuleOfEngagement**
  - 0..1
- **OrganisationStructure**
  - 0..1
- **PlanOrder**
  - 0..*
- **PlanOrderComponent**
  - +topic 0..1
- **Holding**
  - 0..1
- **ObjectTypeEstablishment**
  - 0..1

The MIM Core Elements
### MIM by Numbers

<table>
<thead>
<tr>
<th>Comparison</th>
<th>JC3IEDM 3.0.2 ER Model</th>
<th>MIM 1.0 UML Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Rules</td>
<td>14,764 MIRD DB Records</td>
<td>310 OCL Constraints</td>
</tr>
<tr>
<td>Entities / Classes</td>
<td>273</td>
<td>326</td>
</tr>
<tr>
<td>Attributes</td>
<td>898 (1472 incl. key attributes)</td>
<td>873</td>
</tr>
<tr>
<td>Associations (incl. subtyping)</td>
<td>397</td>
<td>394</td>
</tr>
<tr>
<td>Code Types</td>
<td>470</td>
<td>400</td>
</tr>
</tbody>
</table>

-98%*  
+19%  
-3% (-41%)  
-1%  
-15%

*some OCL constraints map to multiple MIRD DB records
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Aligning Hierarchies
Making the Model Timeless and Sourceless

Maximum one status at a given time provided by a single reporter

Only one classification at a given time provided by a single reporter
Merging Hierarchies

Object

- «name»
  - name

Organisation

- «code, status»
  + availabilityCode [0..1]
  + cbnDressStateCode [0..1]
  + commandAndControlRoleCode [0..1]
  + fireModeCode [0..1]
  + operationalStatusCode
  + operationalStatusQualifierCode [0..1]
  + readinessCode [0..1]
  + reinforcementCode [0..1]
  + trainingCode [0..1]

- «indicator, status»
  + isCommittedIndicator [0..1]
  + isInReserveIndicator [0..1]
  + isInActionIndicator [0..1]

- «quantity, status»
  + radiationDoseQuantity [0..1]

- «duration, status»
  + readinessDuration [0..1]

MilitaryOrganisation

- «code, type»
  + serviceCode

TaskFormation

MilitaryConvoy

- «rate»
  + daySpeedRate [0..1]
  + nightSpeedRate [0..1]

- «dimension»
  + dayVehicleGapDimension [0..1]
  + nightVehicleGapDimension [0..1]
  + packetGapDimension [0..1]

- «duration»
  + haltDuration [0..1]

- «quantity»
  + packetSizeQuantity [0..1]

GovernmentOrganisation

- «code, type»
  + mainActivityCode [0..1]
Eliminating Business Rules (1)

Valid combinations of Domain Values for BiologicalMateriel

<table>
<thead>
<tr>
<th>BiologicalMateriel.categoryCode</th>
<th>BiologicalMateriel.subcategoryCode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial</td>
<td>Chlamydia</td>
</tr>
<tr>
<td></td>
<td>Rickettsiae</td>
</tr>
<tr>
<td></td>
<td>[NULL]</td>
</tr>
<tr>
<td>Toxic Industrial Material</td>
<td>[NULL]</td>
</tr>
<tr>
<td>Toxin</td>
<td>[NULL]</td>
</tr>
<tr>
<td>Viral</td>
<td>[NULL]</td>
</tr>
</tbody>
</table>
Eliminating Business Rules (2)
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MDA Transformation Tool Chain

- MIM as a starting point

Step 1:
- Create a subview

Step 2:
- Re-introduce versioning if required
- Re-introduce ObjectType hierarchy if required

Step 3:
- Perform additional transformations if required
Step 1: Create Conformant Subview

- A conformant subview does not violate constraints of the MIM
  - (i.e. follows Liskov substitution principle)
- Business Rules
  - May be dropped if they result in a constant expression
- Mandatory Attributes
  - May be set to read-only with a given default value
- Mandatory Associations
  - Have to be included
- Optional Attributes / Associations
  - May be ignored
Step 2: Re-introduce versioning and ObjectType (1)

- If the exchange of history is required, versioning needs to be modeled
  - Entities vs. value objects
  - A generic superstructure will enable versioning of entities by allowing multiple instances per identifier

- If the exchange of type information is required, Object and ObjectType will be split again
  - All <<type>> attributes will be moved to the ObjectType hierarchy
  - All <<typerole>> association ends will be moved to the ObjectType hierarchy
Step 2: Re-introduce versioning and ObjectType (2)

Split Object and ObjectType

Object

- status, code
- boobyTrapPresenceCode [0..1]
- emissionControlCode [0..1]
- code, status
- hostilityStatusCode [0..1]
- indicator, type
- isDecoyIndicator
- name
- name
- type, name
- typeName

Materiel

- status, code
- bodyColourCode [0..1]
- demolitionStatusCode [0..1]
- markingCode [0..1]
- markingColourCode [0..1]
- operationalStatusCode
- operationalStatusModeCode [0..1]
- operationalStatusQualifierCode [0..1]
- usageStatusCode [0..1]
- indicator, status
- isInReserveIndicator [0..1]
- dimension, type
- issuingHeightDimension [0..1]
- issuingLengthDimension [0..1]
- issuingWidthDimension [0..1]
- identifier
- lotIdentifier [0..1]
- serialNumberIdentifier [0..1]
- type, identifier
- reportableItemIdentifier [0..1]
- stockNumberIdentifier [0..1]
- code, type
- supplyClassCode [0..1]

MaterielType

- dimension, type
- issuingHeightDimension [0..1]
- issuingLengthDimension [0..1]
- issuingWidthDimension [0..1]
- type, identifier
- reportableItemIdentifier [0..1]
- stockNumberIdentifier [0..1]
Step 3: Additional Transformations (Example)

- ChangeDiscriminatorCodesToSubtypes
  - Changes all categoryCode attributes to subclasses
  - Would add 3300 new subclasses throughout the model
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Summary and Outlook (1)

- MIP Information Model Version 1.0
  - UML Class Model, operational content of JC3IEMD 3.0.2
  - Timeless, sourceless
  - Attributes stereotyped according to UN/CEFACT’s Core Components Data Type Catalogue
  - Metadata and Grouping split from core elements
  - Available at http://mipcee-svn.lsec.dnd.ca/DEV/SVN/PIM/tags/Releases/MIM%201.0

- MIP Information Model Version 1.1
  - Work in progress
  - Will include all changes from JC3IEMD 3.1.4 (MIP Block 3.1)
Summary and Outlook (2)

- MDA Tools
  - Java based tools to perform additional transformations on the MIM
  - Documentation of tools and best practices still missing
  - Available at http://mipcee-svn.lsec.dnd.ca/DEV/SVN/SRC/trunk/CPProcessor

- Further investigation into different transformations ongoing
Questions?
Comments?

Thank you very much for your attention

We would like to thank all active participants of MIP