Walkthrough of supporting ontologies

MSG-211 Technical Course, Session 2.5

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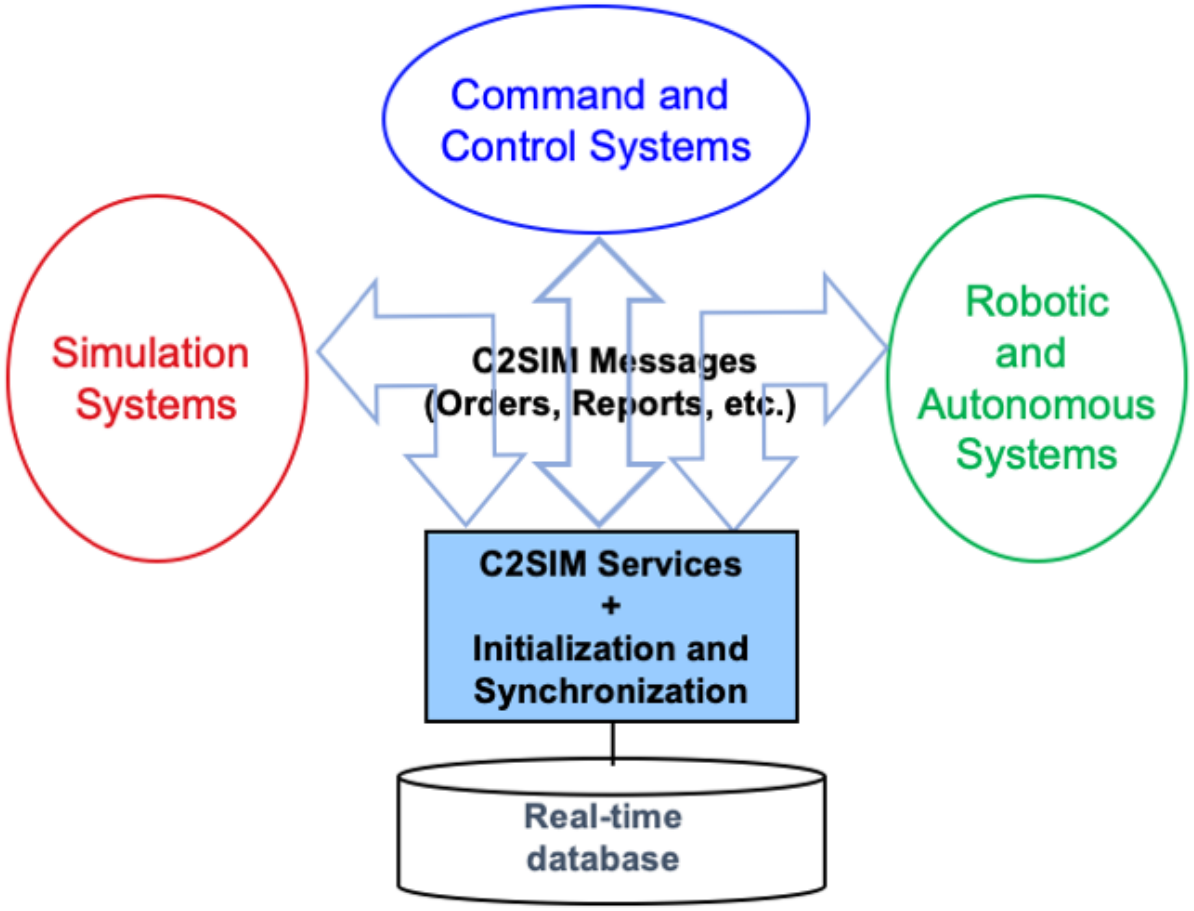
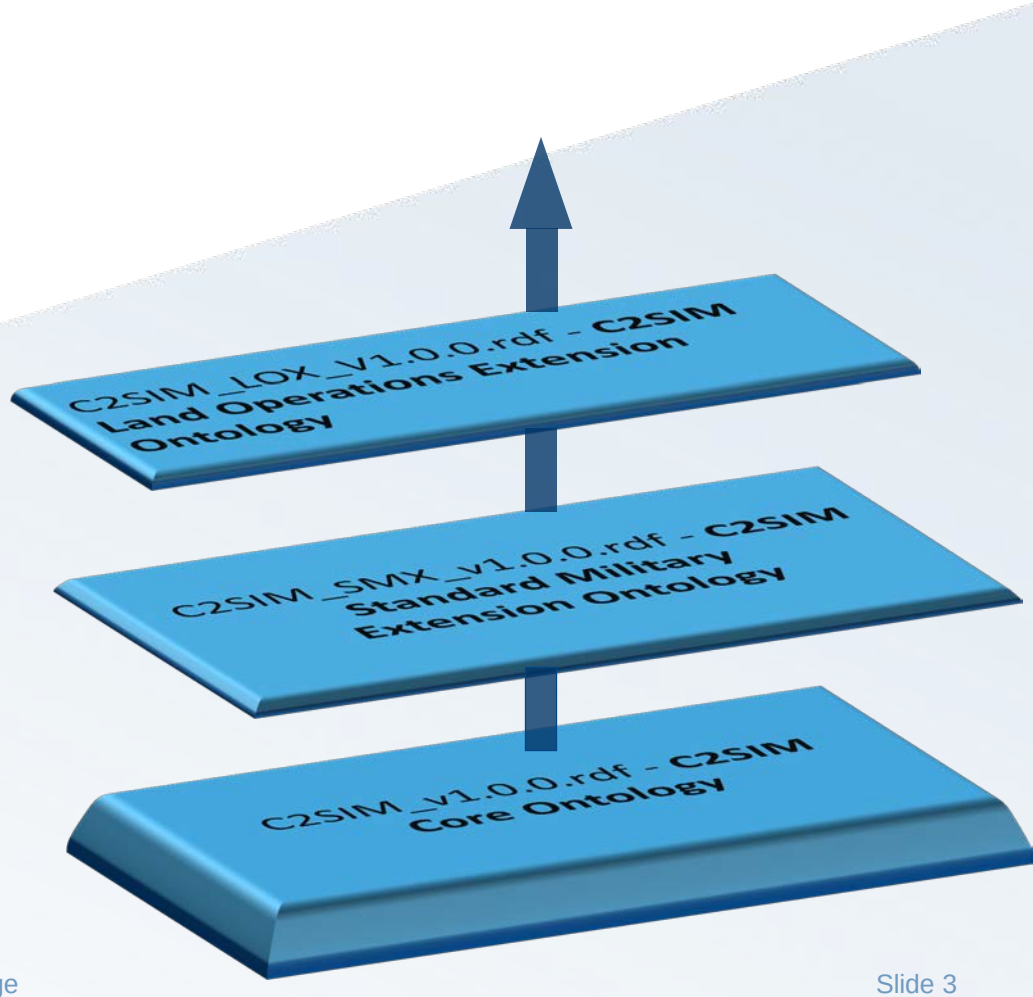
Outline

- C2SIM ontologies: Core Logical Data Model, SMX and LOX
  - Ontology Features: Taxonomy, Classes, Properties, Property Restrictions etc.
  - C2SIMContent, InitializationConcept, MessageConcept in different ontology layers
- C2SIM Extension Process using Protégé
  - Include extension into C2SIM structure
  - Model new information into ontology features
- Information Exchange with C2SIM
  - Ontology to Schema transformation
  - Schema to XML message

C2SIM Information Exchange





C2SIM Core LDM: Concept Structure

InitializationConcept

- InitializationDataFile
- ScenarioSetting
- SystemEntityList
- ObjectDefintions

MessageConcept

- C2SIMHeader
- Message
- MessageBody
- MessageCode
- ReportContent
- RequestContent

C2SIMContent

- AbstractObject
- Action
- PhysicalConcept
- Code
- Entity
- EntityType
- EntityDescriptor
- EntityState
- Relationship
- Resource

Ontology Features in Protégé

Annotation properties	Datatypes	Individuals
Classes	Object properties	Data properties

C2SIM Core LDM: C2SIMContent Entity

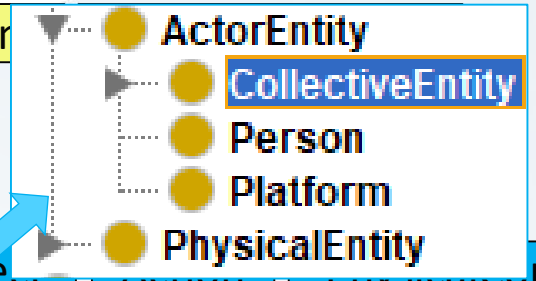
InitializationConcept

InitializationDataFile | ScenarioSetting | SystemEntityList | ObjectDefintions

MessageConcept

C2SIMHeader | Message | MessageBody | MessageCode | ReportConter

C2SIMContent

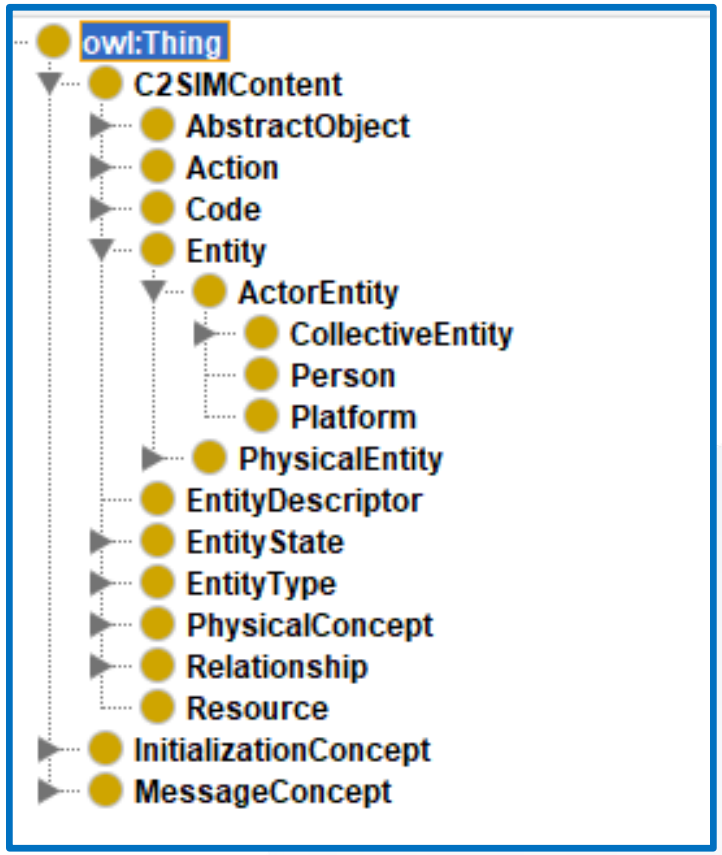


Code

Entity | EntityType | EntityDescriptor | EntityState

Relationship | Resource

Ontology Features in Protégé: Taxonomy



- Hypernymy: Superordination of classes
  - Superclass is defined by attributes
  - Transitive relation
- Hyponymy: Subordination of classes
  - „is a“ -relation
  - Subclass inherits attributes from superclass
  - Subclass specifies through additional attributes
  - Transitive relation

C2SIM Core LDM: Classes and Attributes

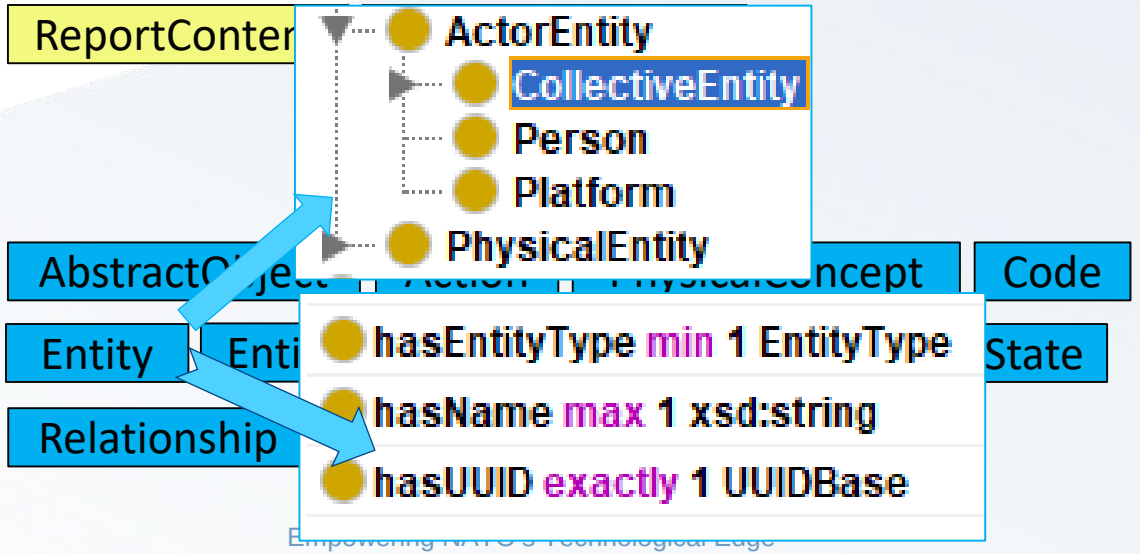
InitializationConcept

InitializationDataFile | ScenarioSetting | SystemEntityList | ObjectDefintions

MessageConcept

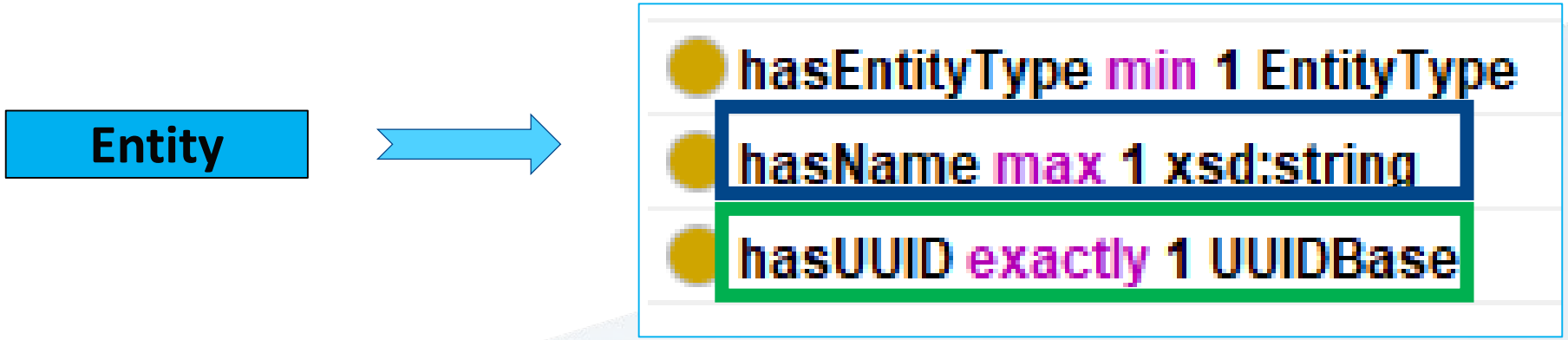
C2SIMHeader | Message | MessageBody | MessageCode | ReportConter

C2SIMContent

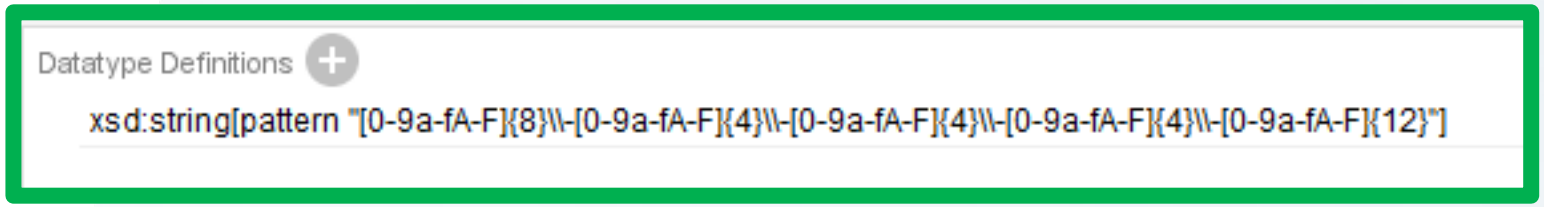


Ontology Features in Protégé: Datatype Property (Restriction)

- Datatype properties assign a property to a value type: string, int, byte, etc.



- Definition of specific formats of a value with regular expressions: UUIDBase



C2SIM Core LDM: Object Property (Restriction)

InitializationConcept

- InitializationDataFile
- ScenarioSetting
- SystemEntityList
- ObjectDefintions

MessageConcept

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- Message
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- RequestContent

C2SIMContent

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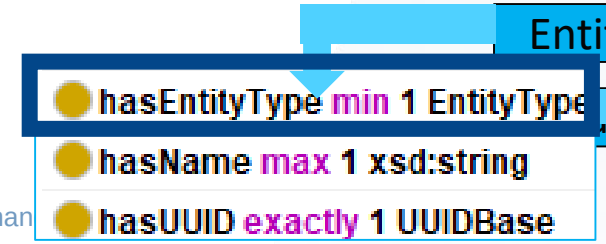
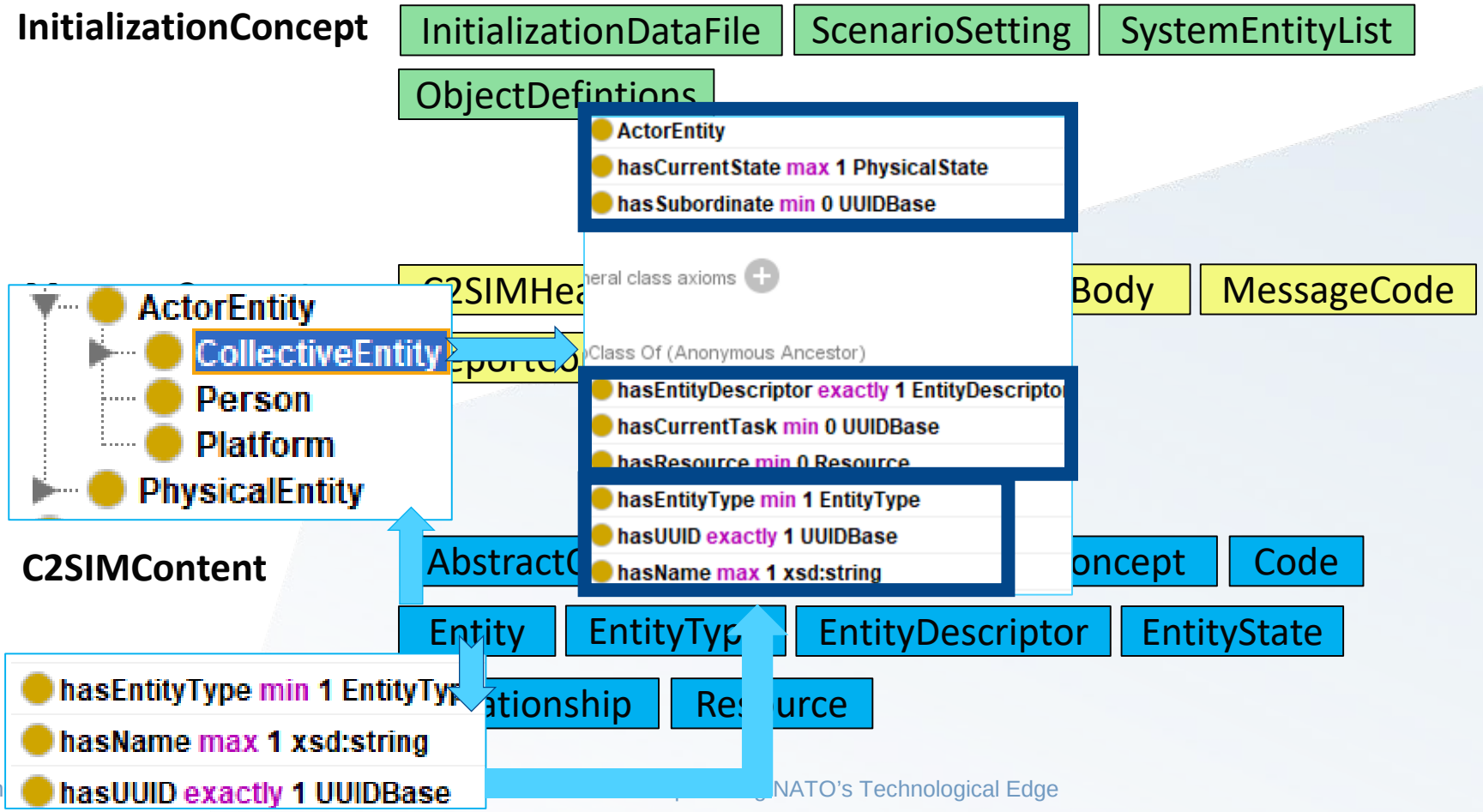
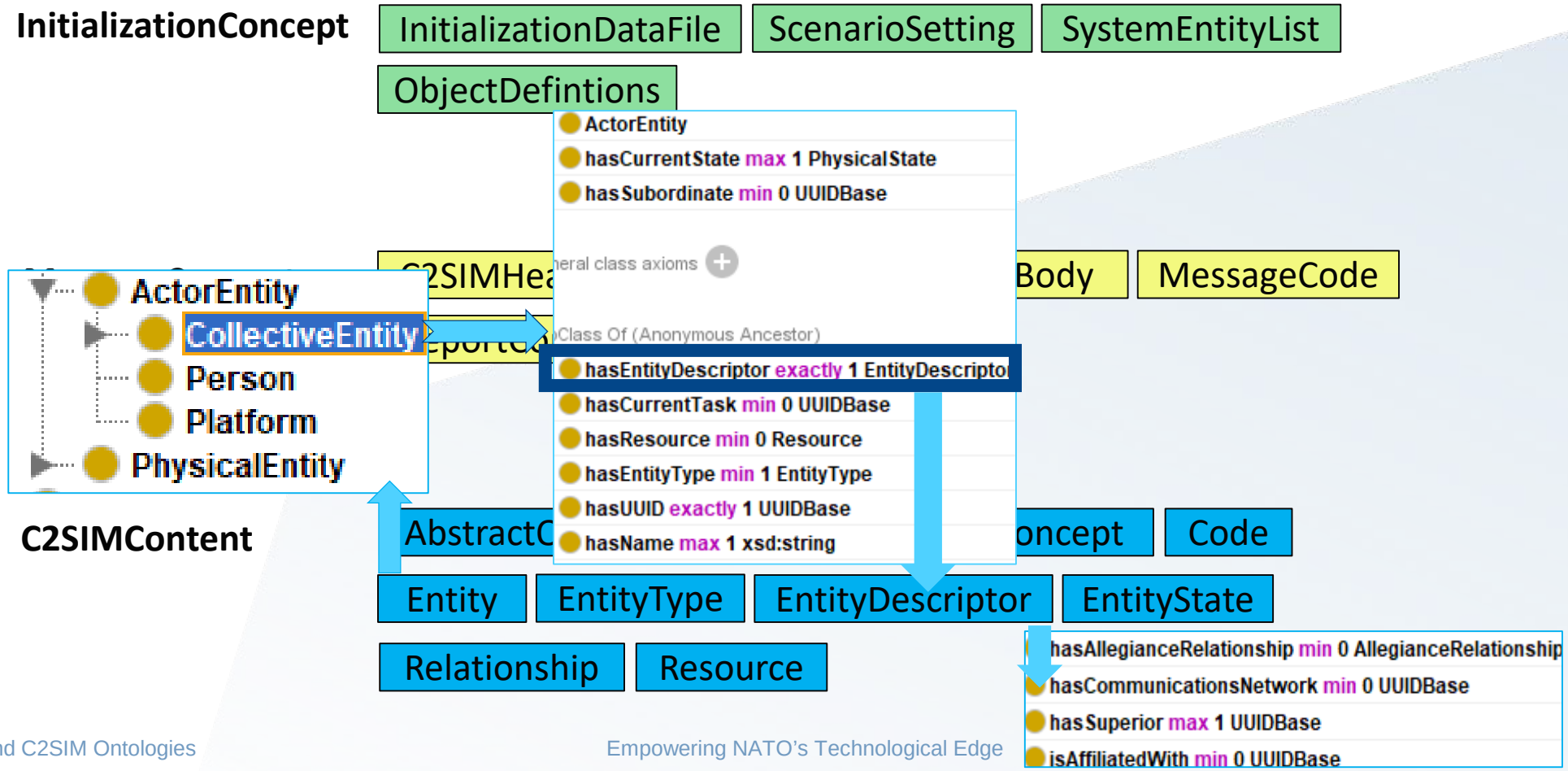


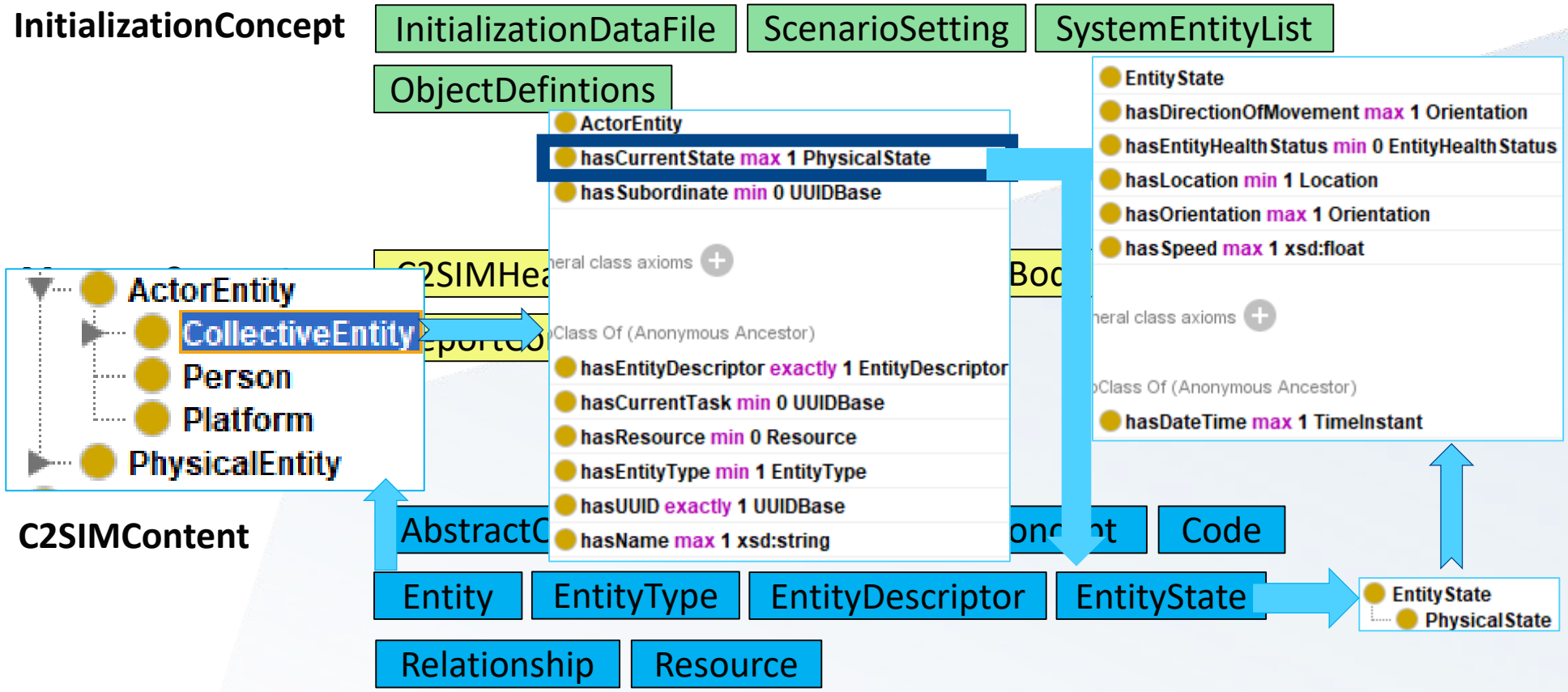
C2SIM Core LDM: Taxonomy, Property Restrictions and Inheritance



C2SIM Core LDM: Property Restrictions and extended Inheritance



C2SIM Core LDM: Property Restrictions and extended Inheritance



C2SIM Core LDM: InitializationConcept InitalizationDataFile

InitializationConcept

InitializationDataFile | ScenarioSetting | SystemEntityList

ObjectDefintions

- hasIntializationFileType max 1 xsd:string
- hasName exactly 1 xsd:string
- hasSystemName exactly 1 xsd:string

MessageConcept

C2SIMHeader | Message | MessageBody | MessageCode

ReportContent | RequestContent

C2SIMContent

AbstractObject | Action | PhysicalConcept | Code

Entity | EntityType | EntityDescriptor | EntityState

Relationship | Resource

C2SIM Core LDM: InitializationConcept ScenarioSetting

InitializationConcept

InitializationDataFile | ScenarioSetting | SystemEntityList | ObjectDefintions

- hasDateTime exactly 1 DateTime
- hasVersion exactly 1 xsd:string
- InitializationConcept

MessageConcept

C2SIMHeader | Message | MessageBody | MessageCode | ReportContent | RequestContent

C2SIMContent

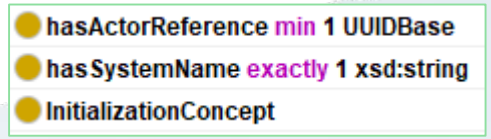
AbstractObject | Action | PhysicalConcept | Code | Entity | EntityType | EntityDescriptor | EntityState | Relationship | Resource

C2SIM Core LDM: InitializationConcept SystemEntityList

InitializationConcept

InitializationDataFile | ScenarioSetting | SystemEntityList

ObjectDefintions



MessageConcept

C2SIMHeader | Message | MessageBody | MessageCode

ReportContent | RequestContent

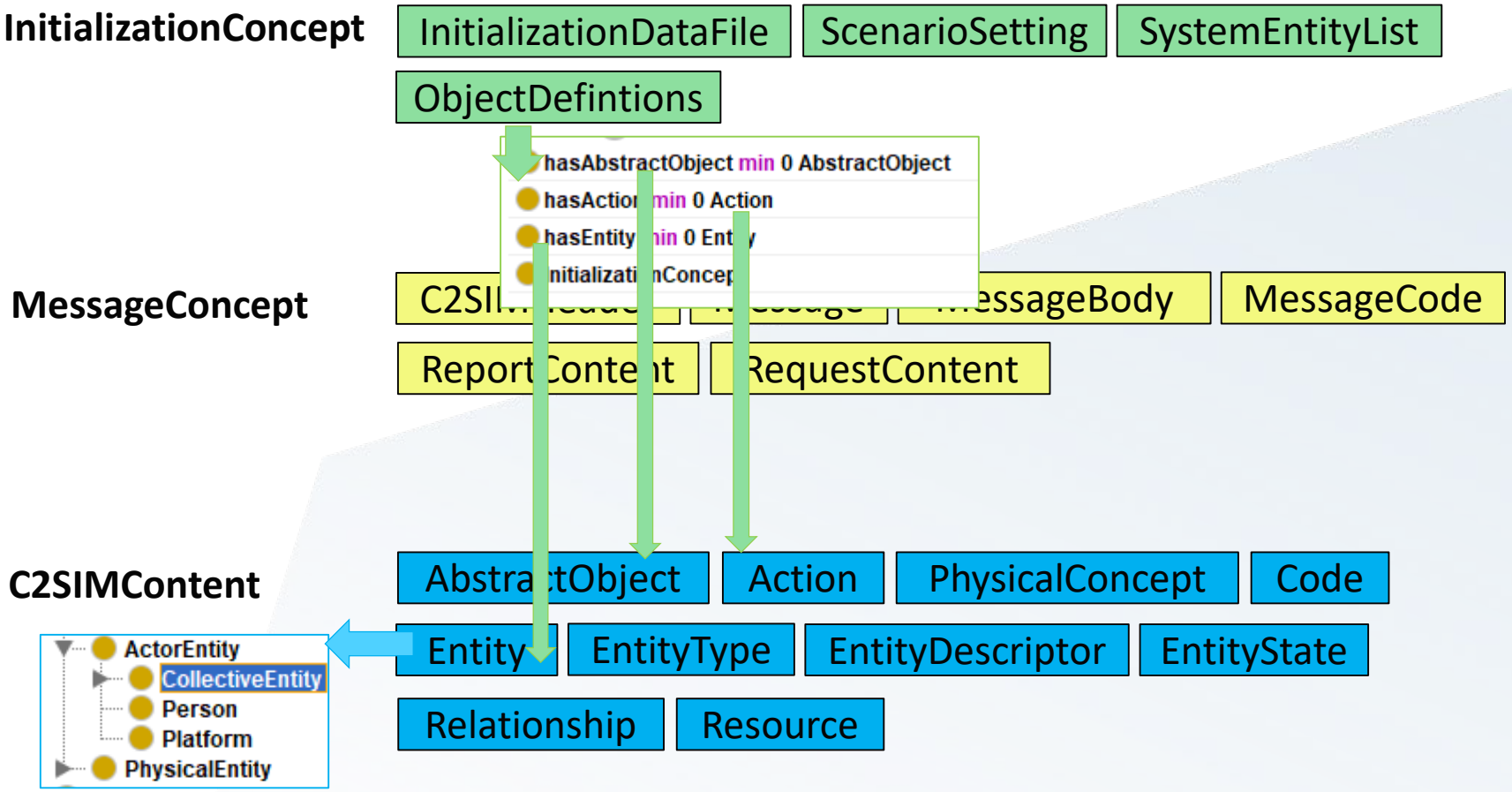
C2SIMContent

AbstractObject | Action | PhysicalConcept | Code

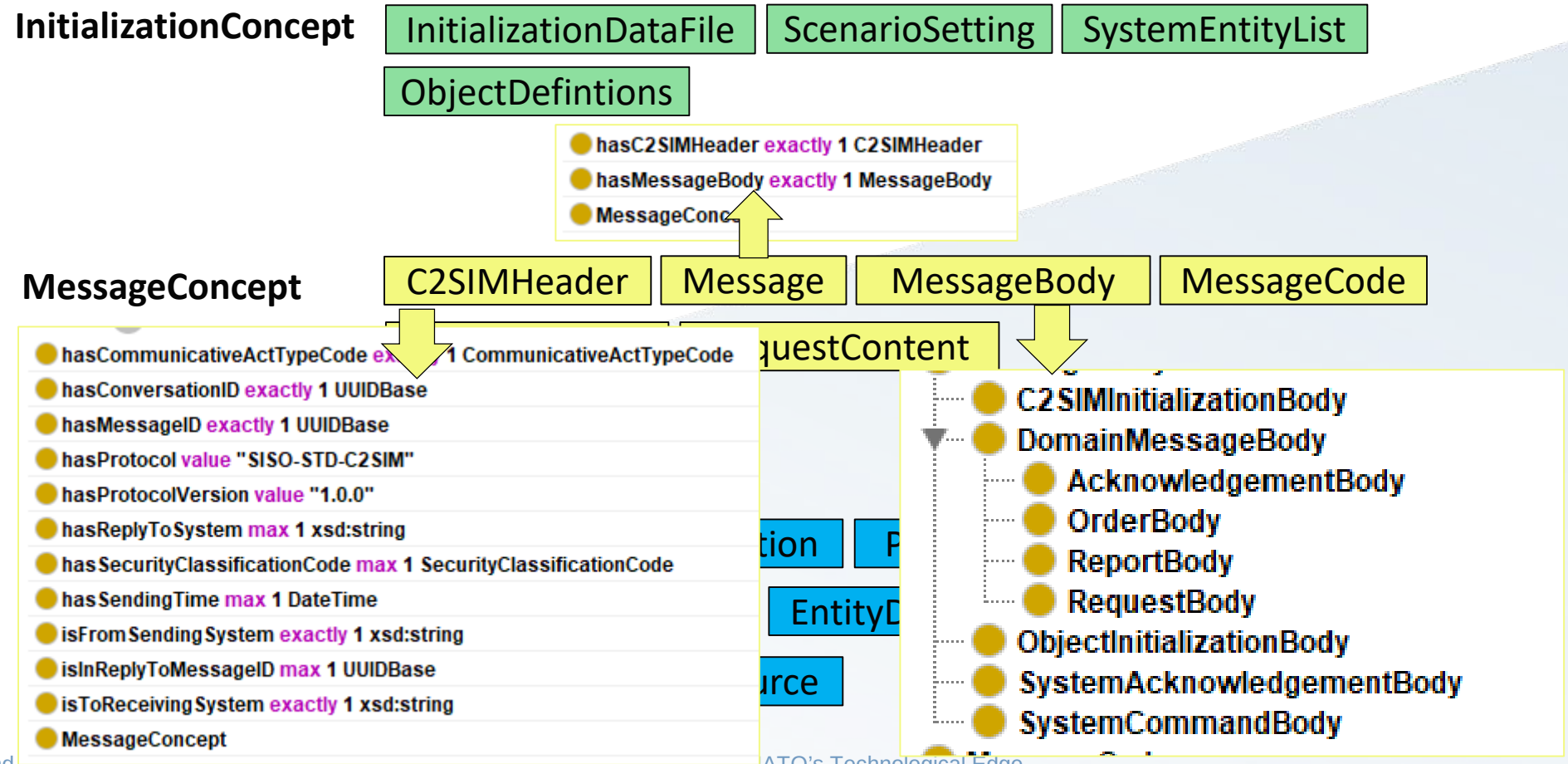
Entity | EntityType | EntityDescriptor | EntityState

Relationship | Resource

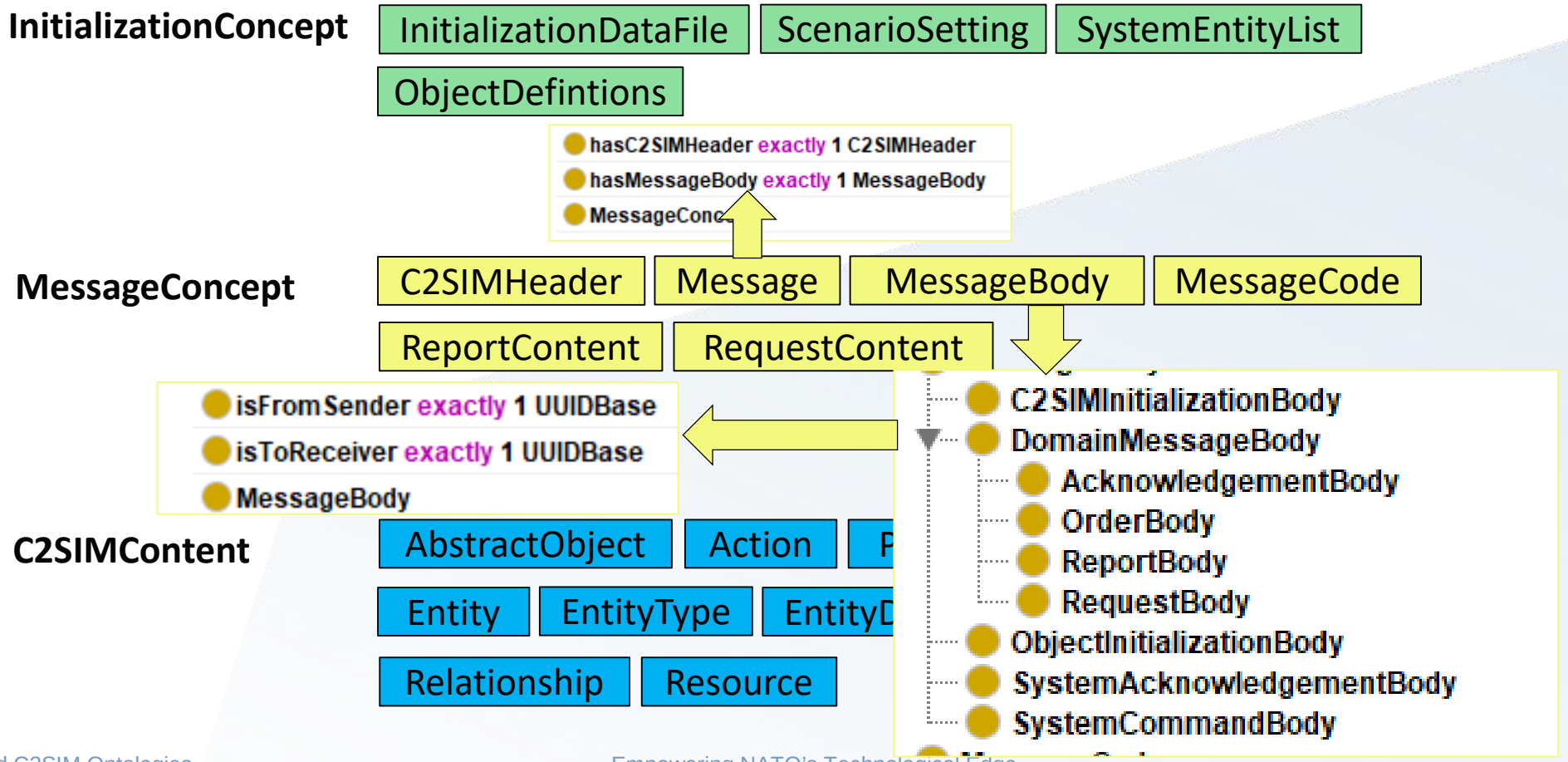
C2SIM Core LDM: InitializationConcept ObjectDefinitions



C2SIM Core LDM: MessageConcept Message, C2SIMHeader, MessageBody



C2SIM Core LDM: MessageConcept DomainMessageBody



C2SIM Core LDM: MessageConcept ReportBody

InitializationConcept

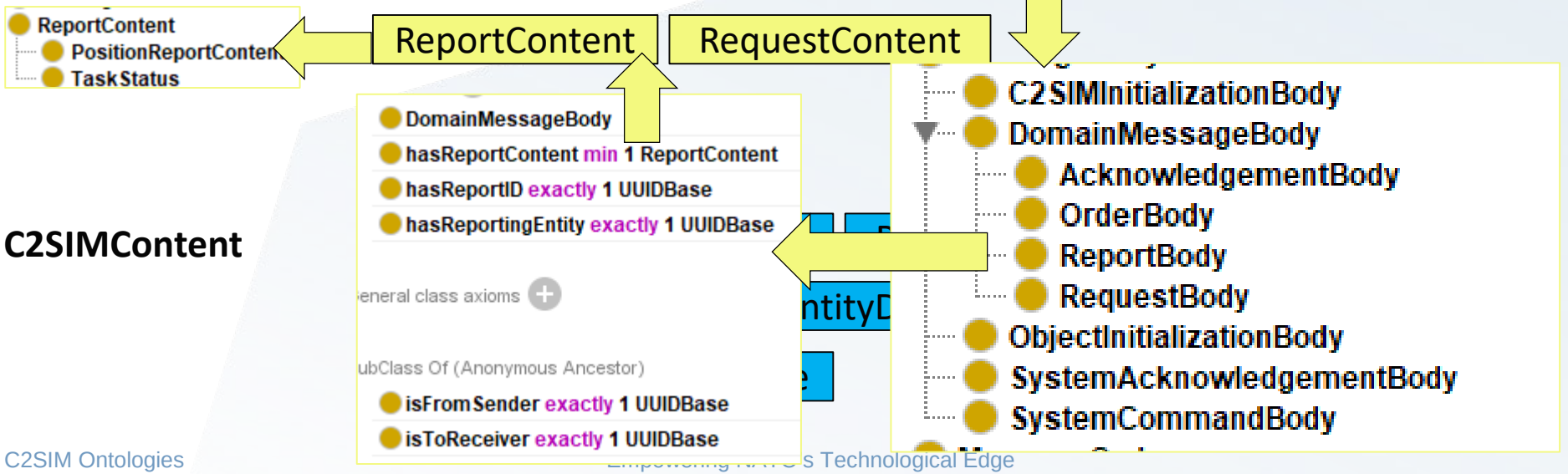
InitializationDataFile | ScenarioSetting | SystemEntityList | ObjectDefintions

MessageConcept

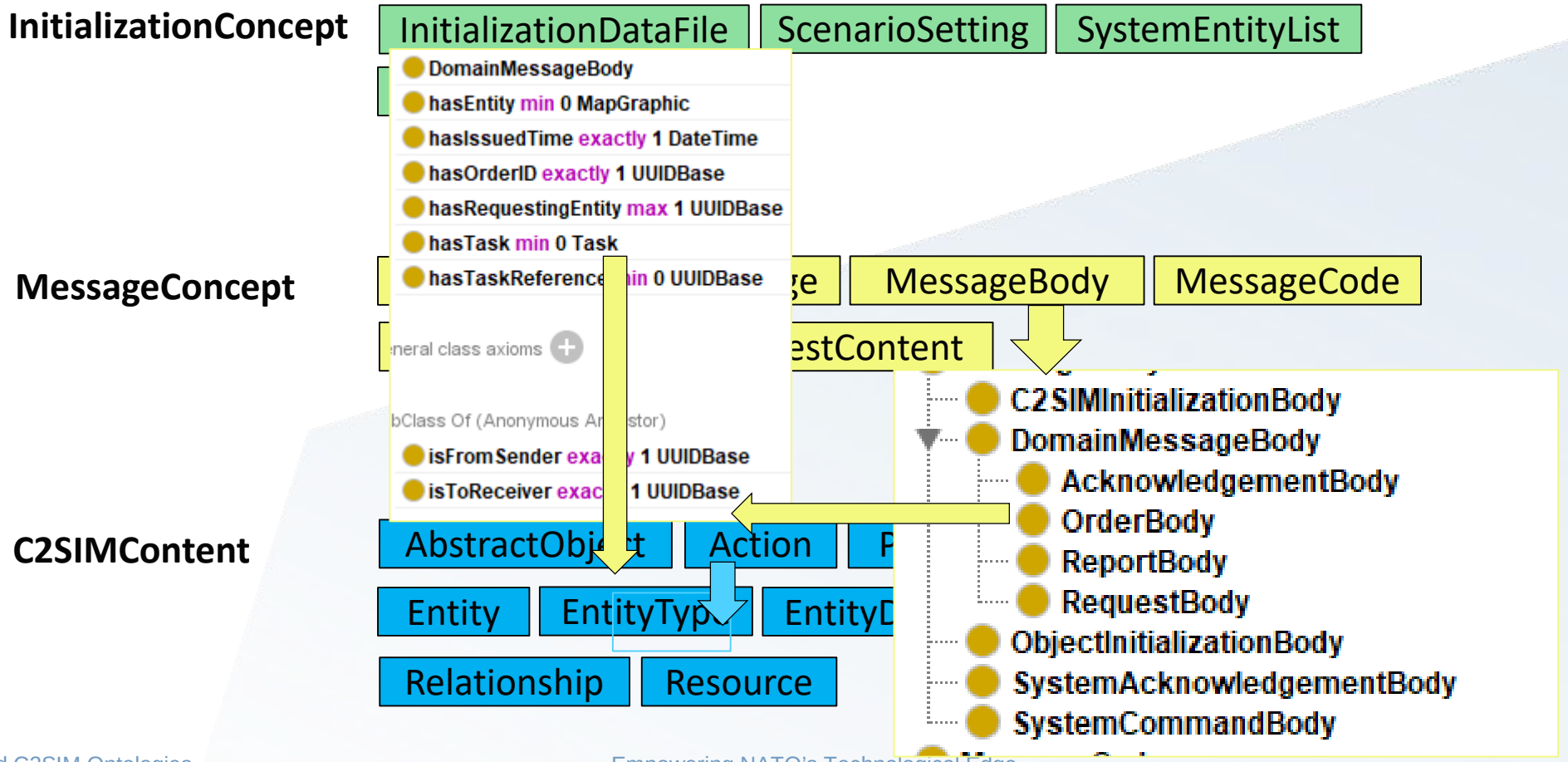
C2SIMHeader | Message | MessageBody | MessageCode

ReportContent | RequestContent

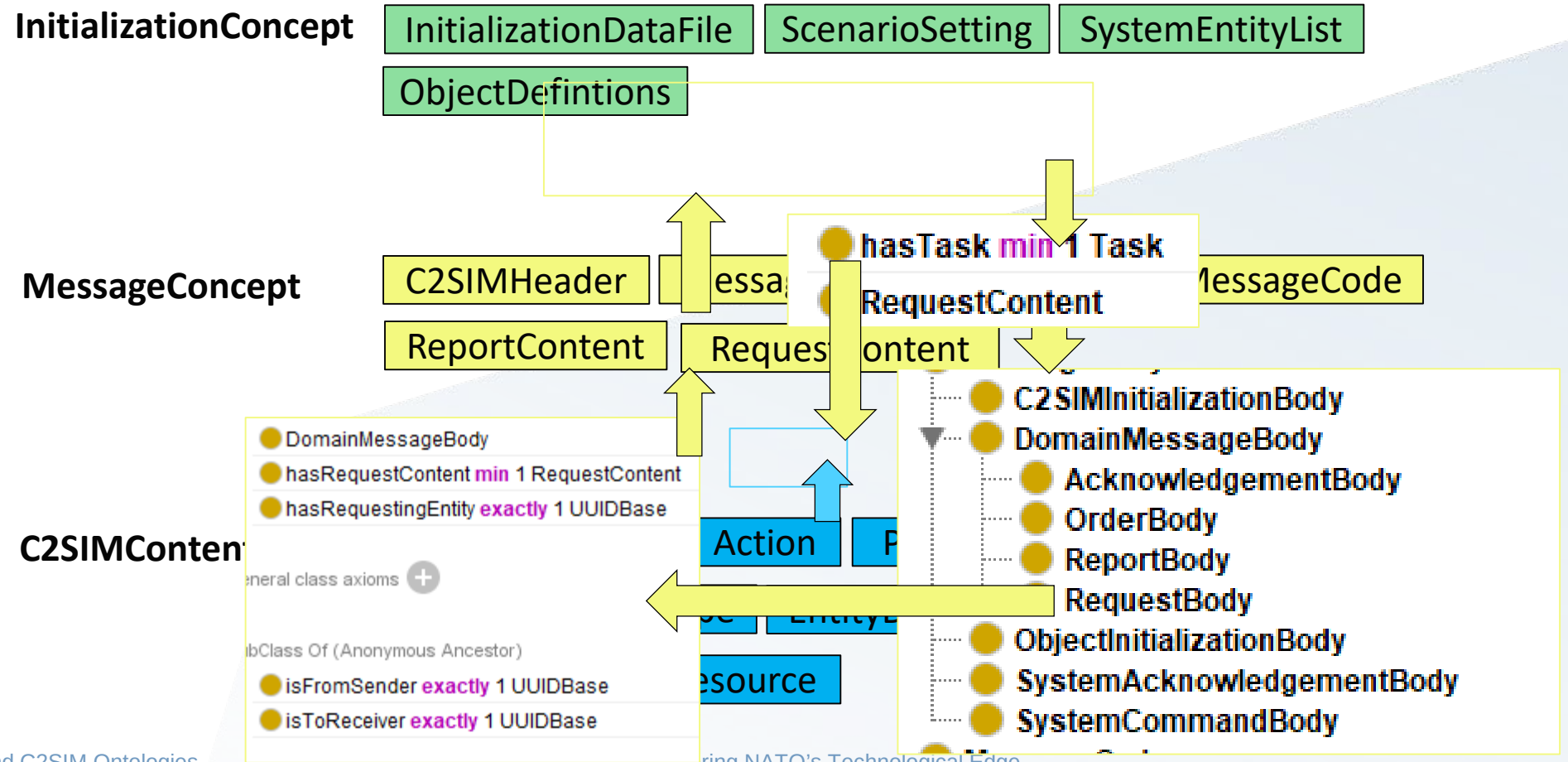
C2SIMContent



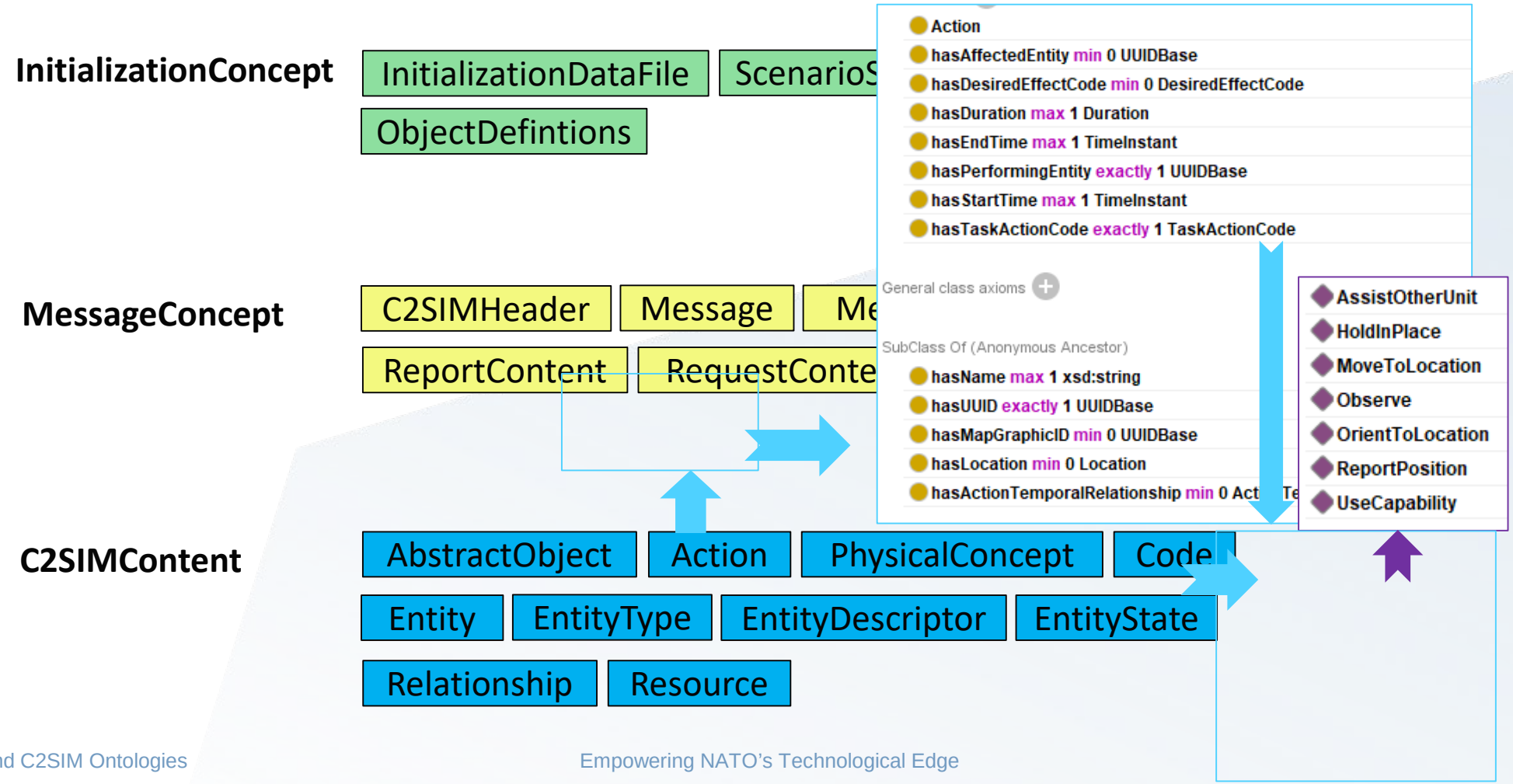
C2SIM Core LDM: MessageConcept OrderBody



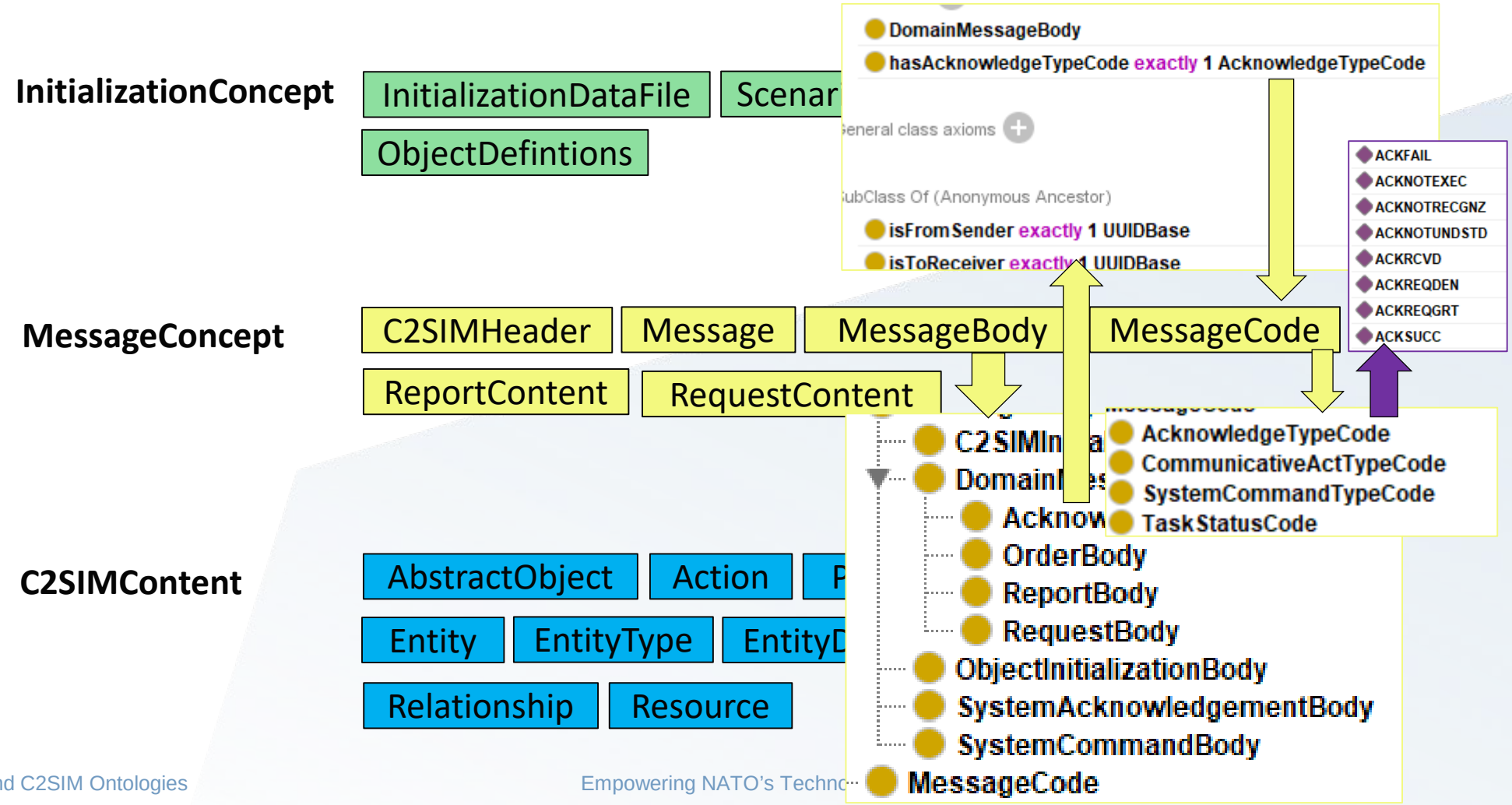
C2SIM Core LDM: MessageConcept RequestBody



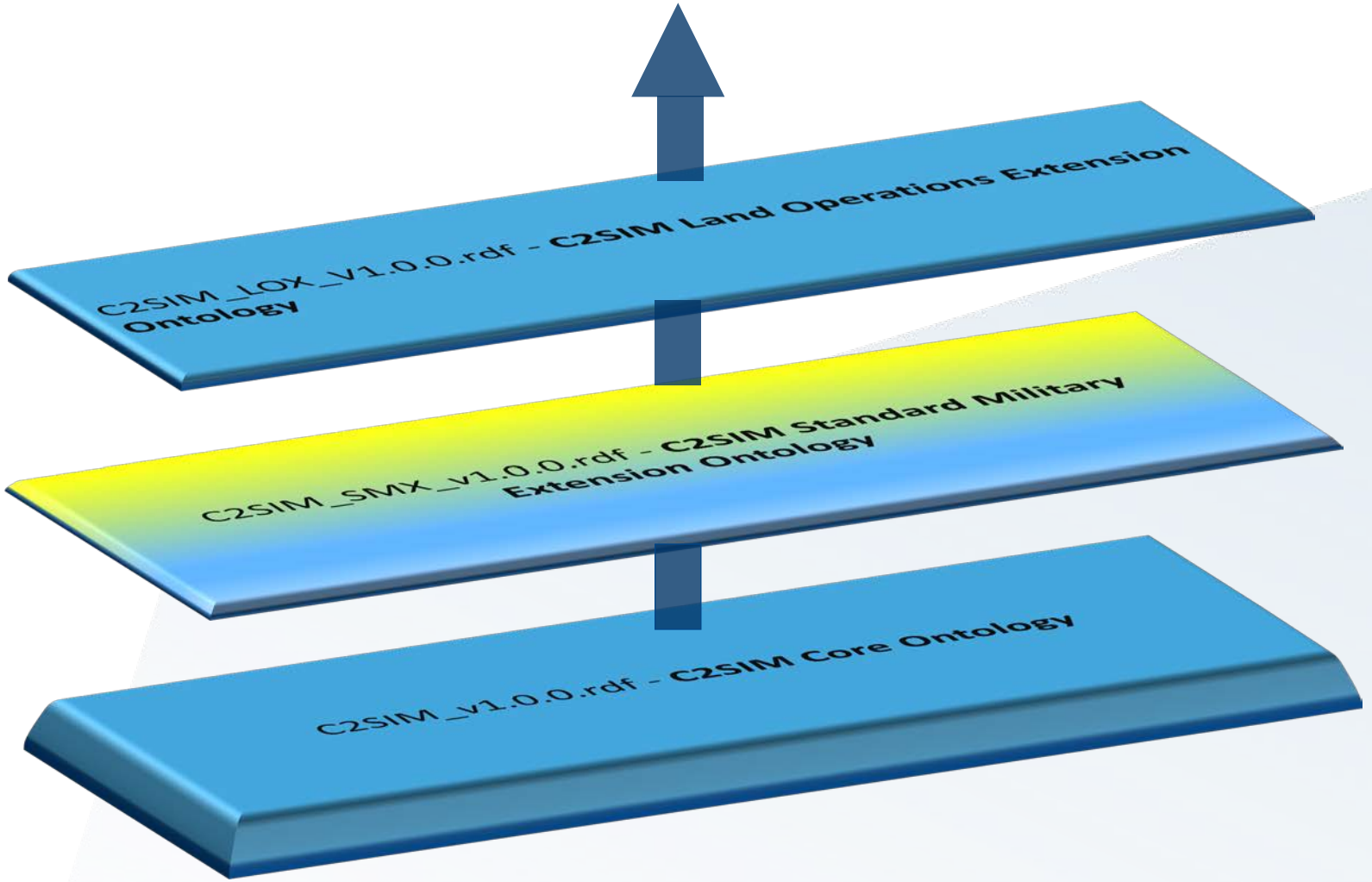
C2SIM Core LDM: C2SIMContent Task



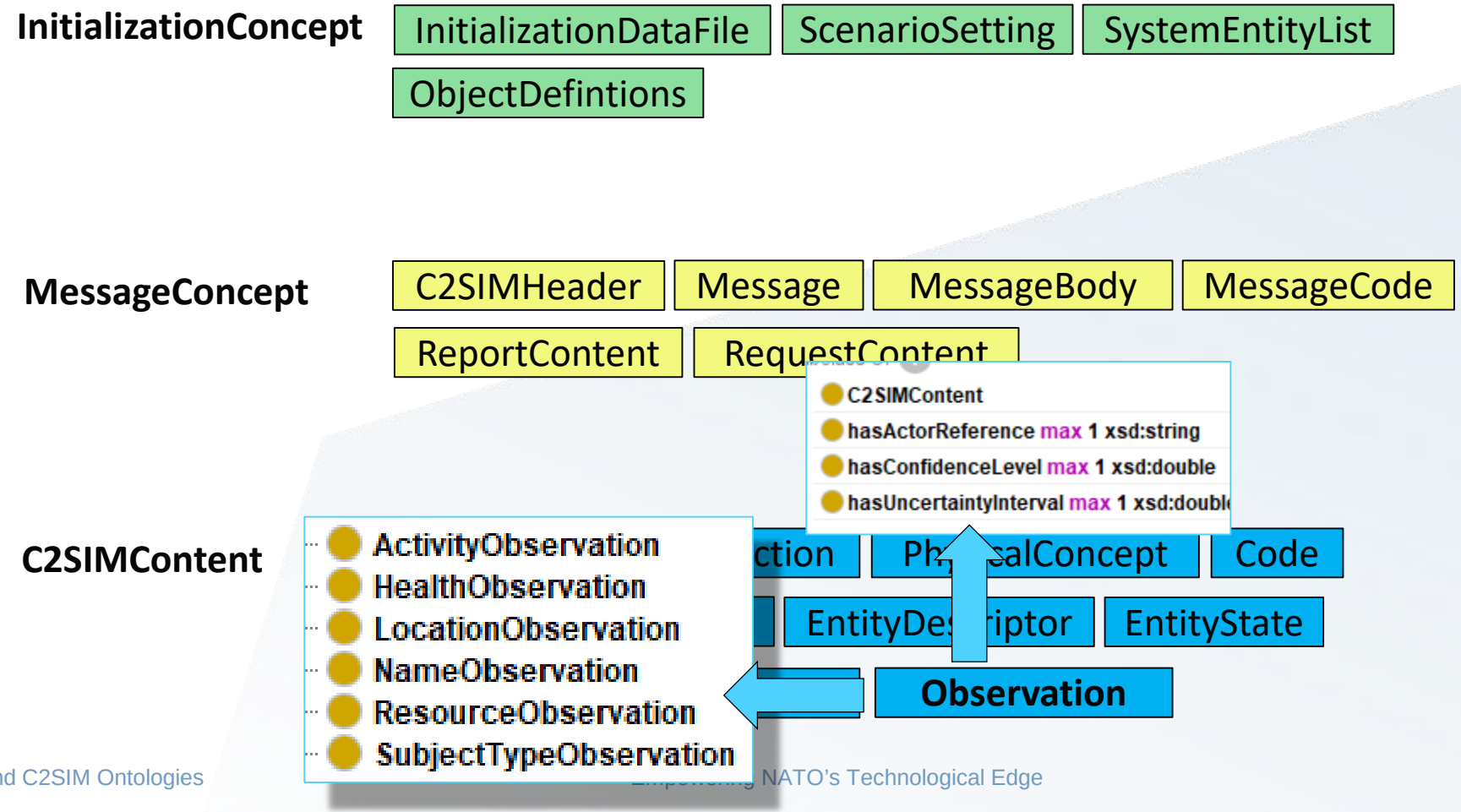
C2SIM Core LDM: MessageConcept AcknowledgementBody



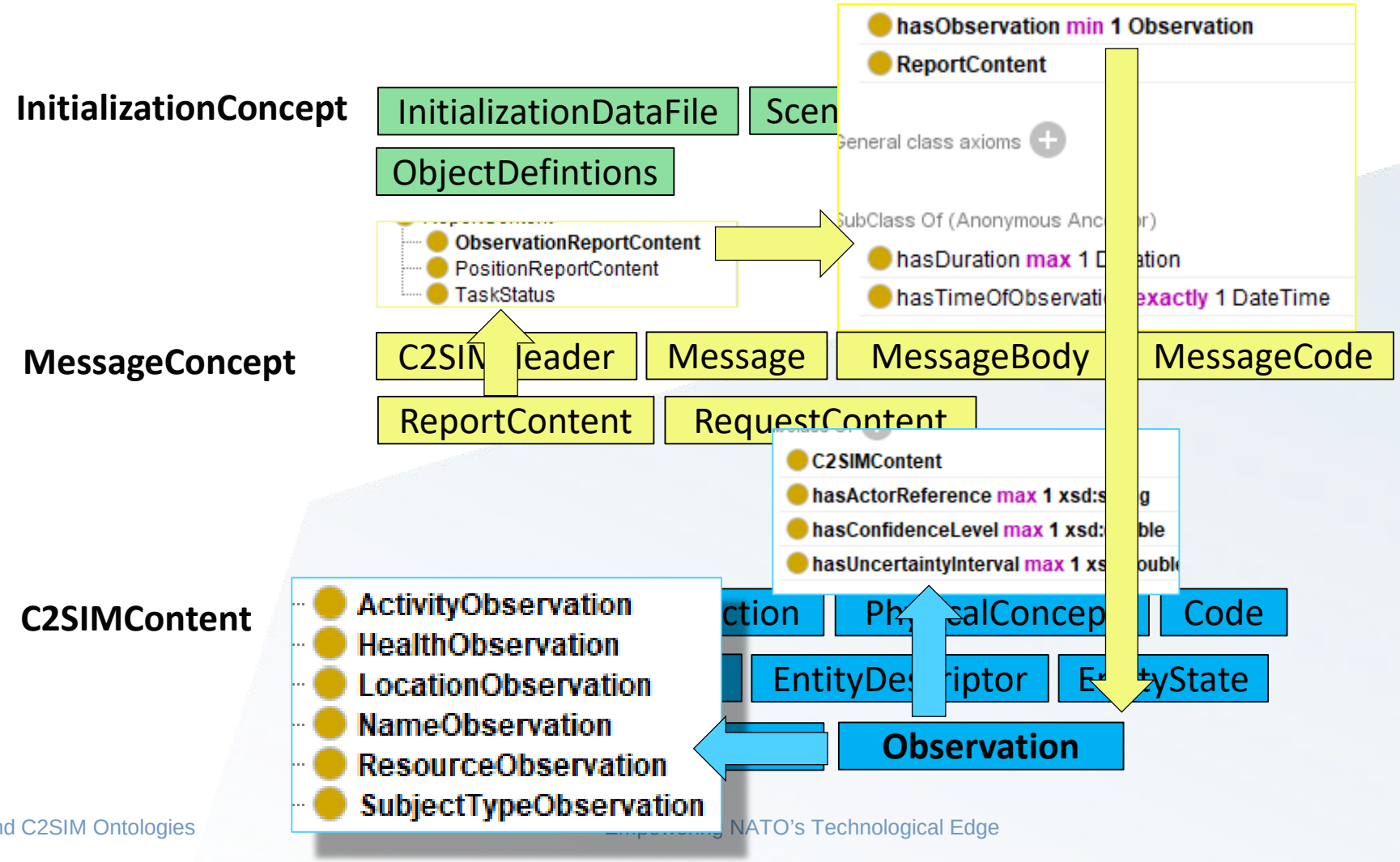
C2SIM Standard Military Extension



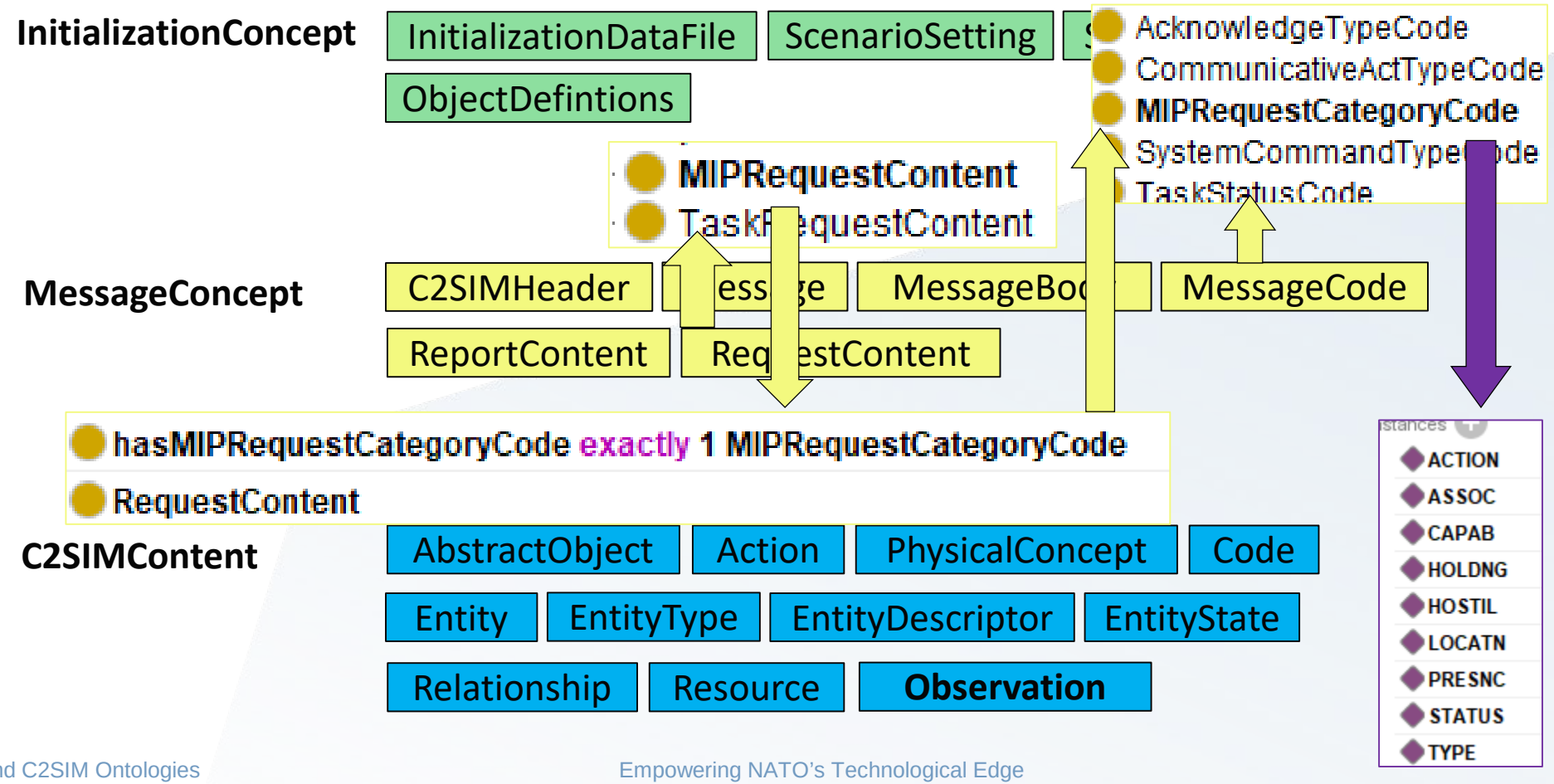
C2SIM SMX: C2SIMContent Observation



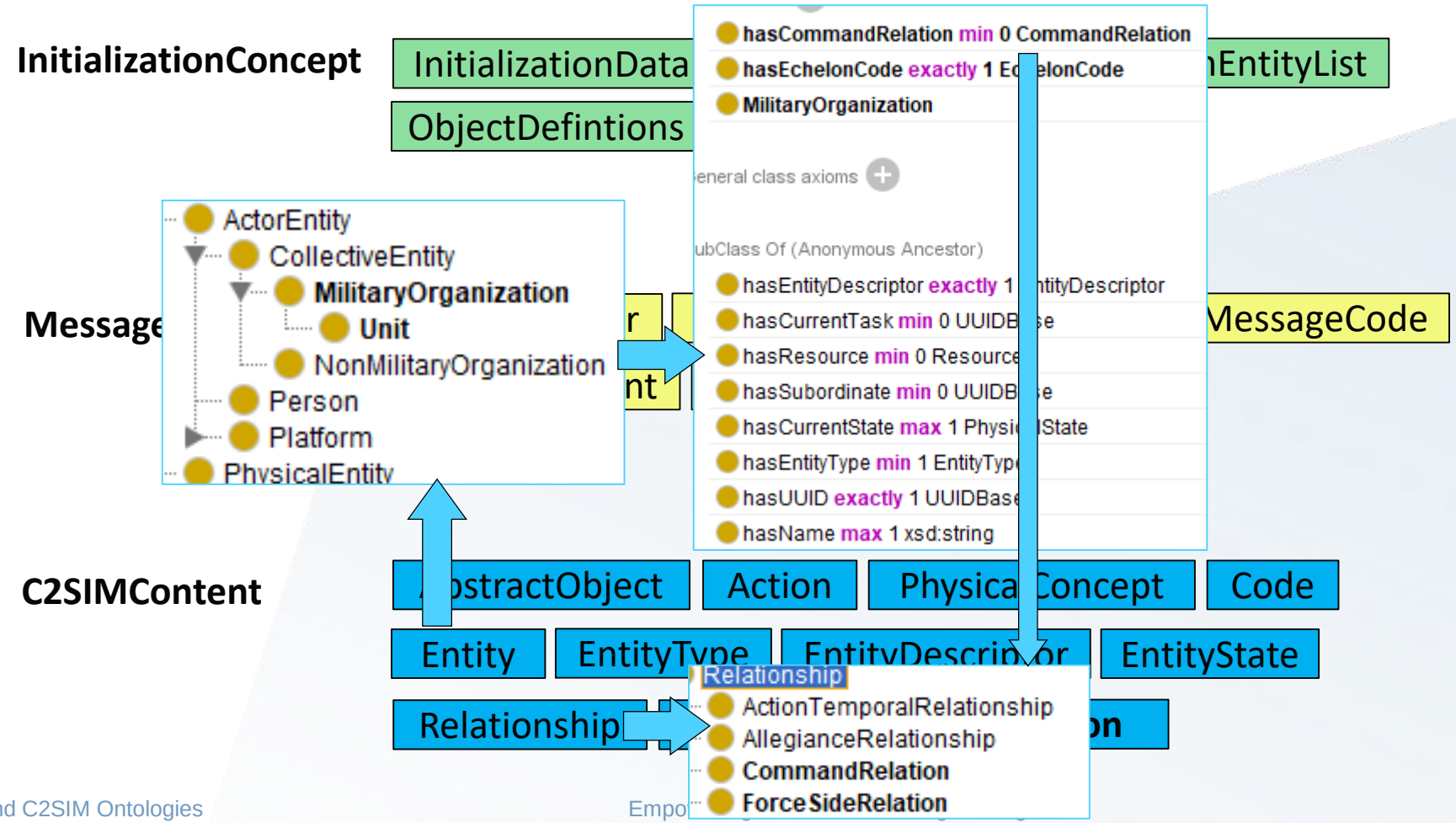
C2SIM SMX: MessageConcept ReportContent and Observation



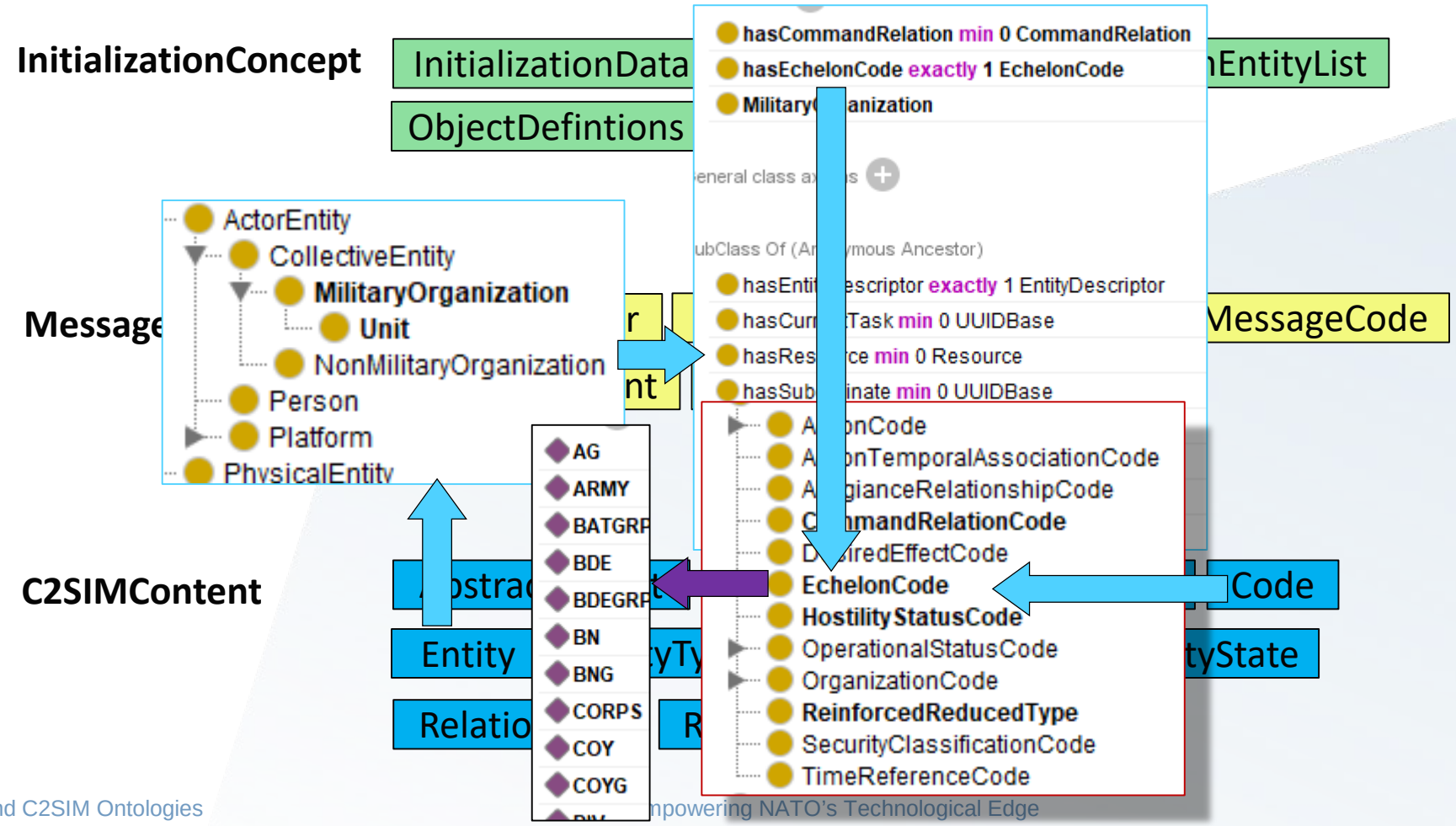
C2SIM SMX: MessageConcept RequestContent and MIPCategoryCode



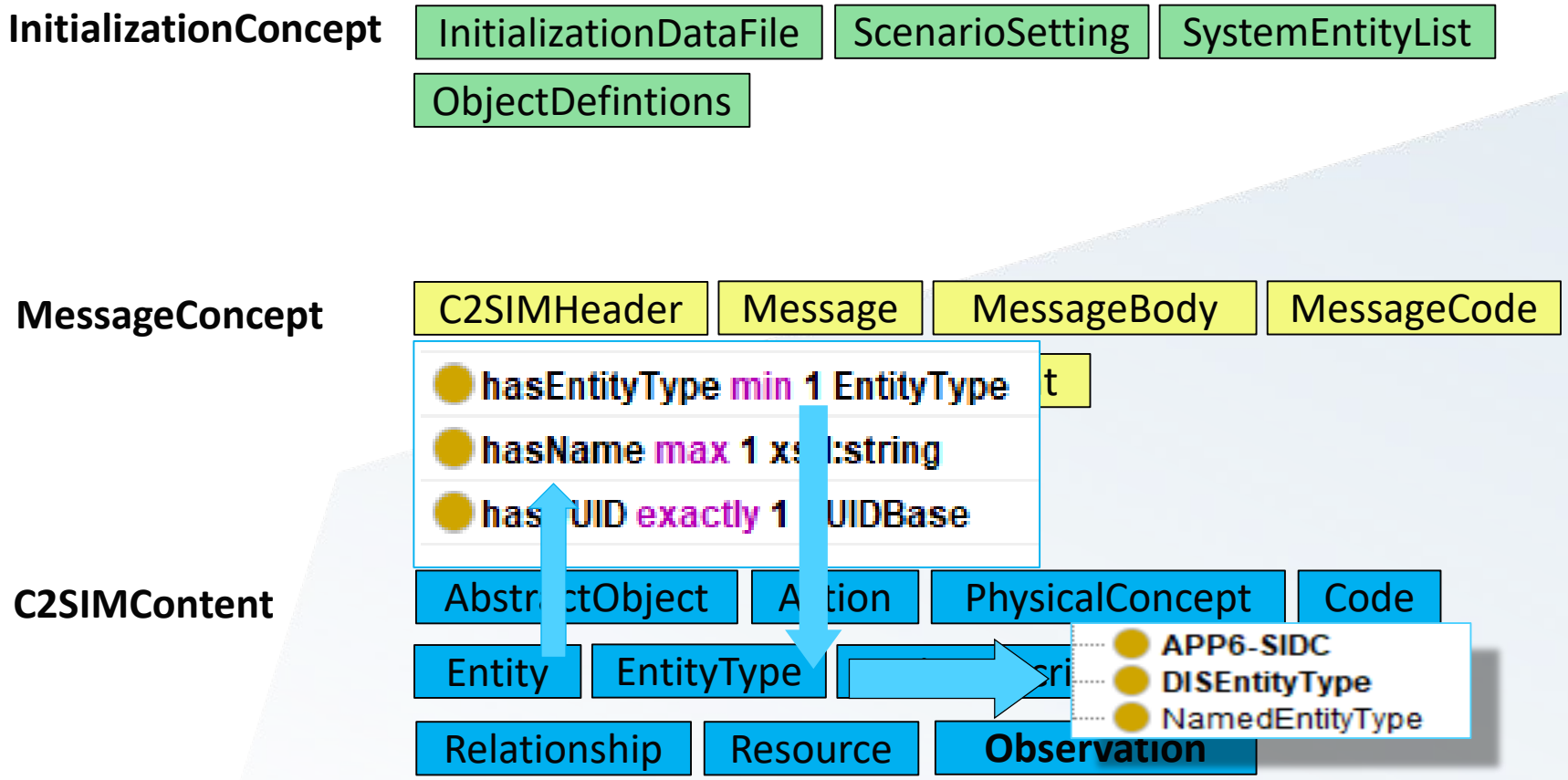
C2SIM SMX: C2SIMContent Entity and CommandRelation



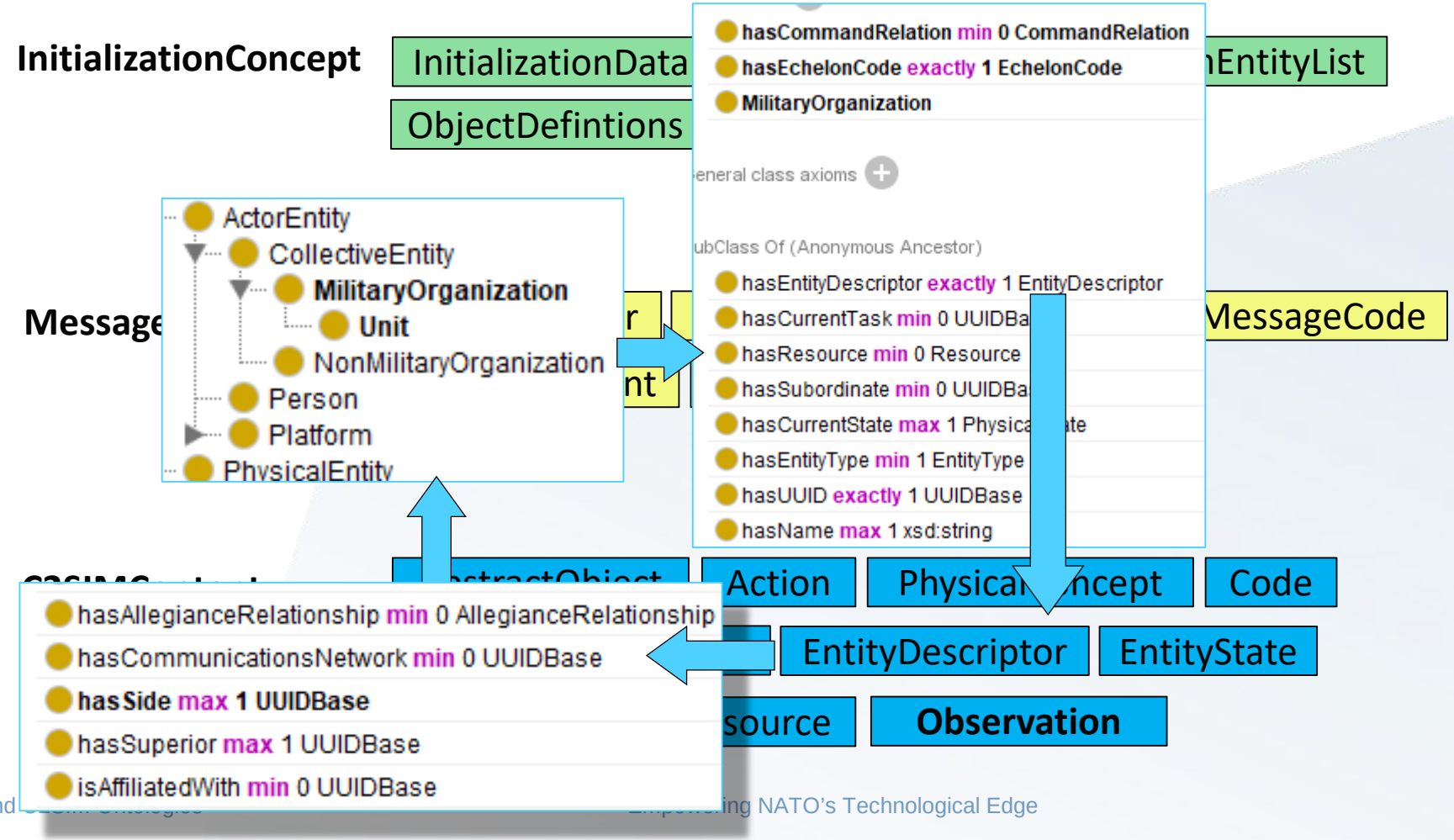
C2SIM SMX: C2SIMContent Entity and EchelonCode



C2SIM SMX: C2SIMContent Entity and EntityType



C2SIM SMX: C2SIMContent Entity and EntityDescriptor



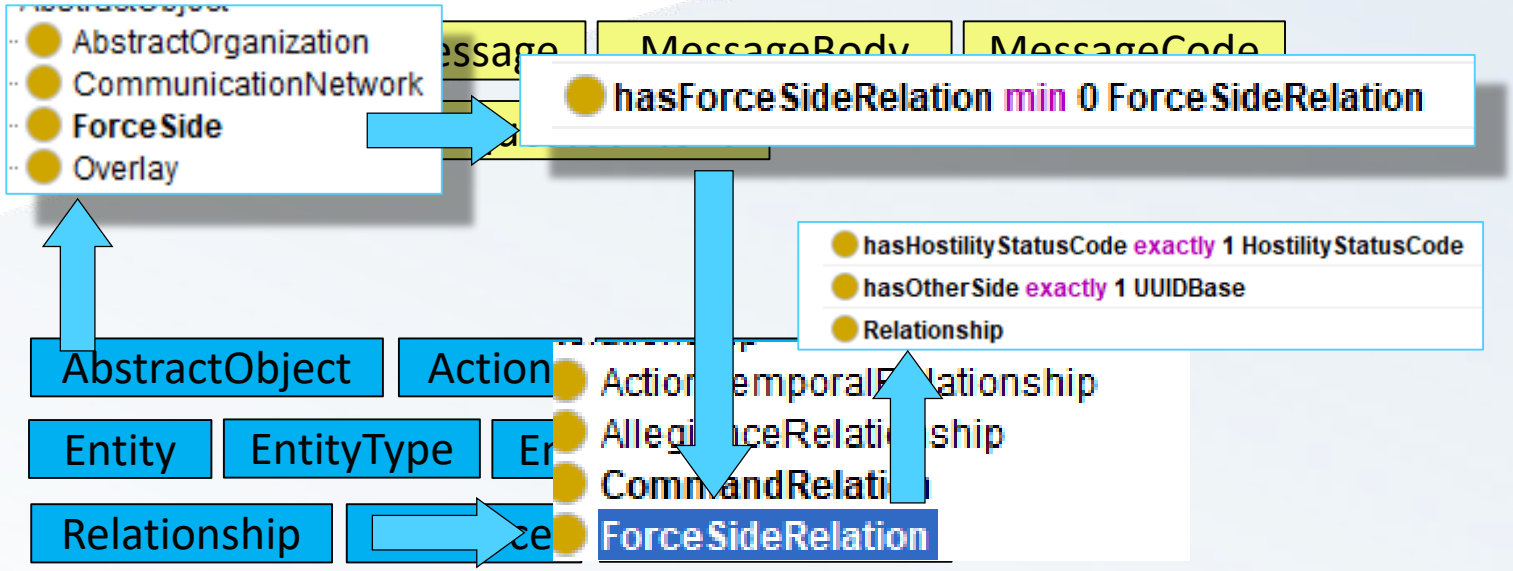
C2SIM SMX: C2SIMContent AbstractObject and ForceSide

InitializationConcept

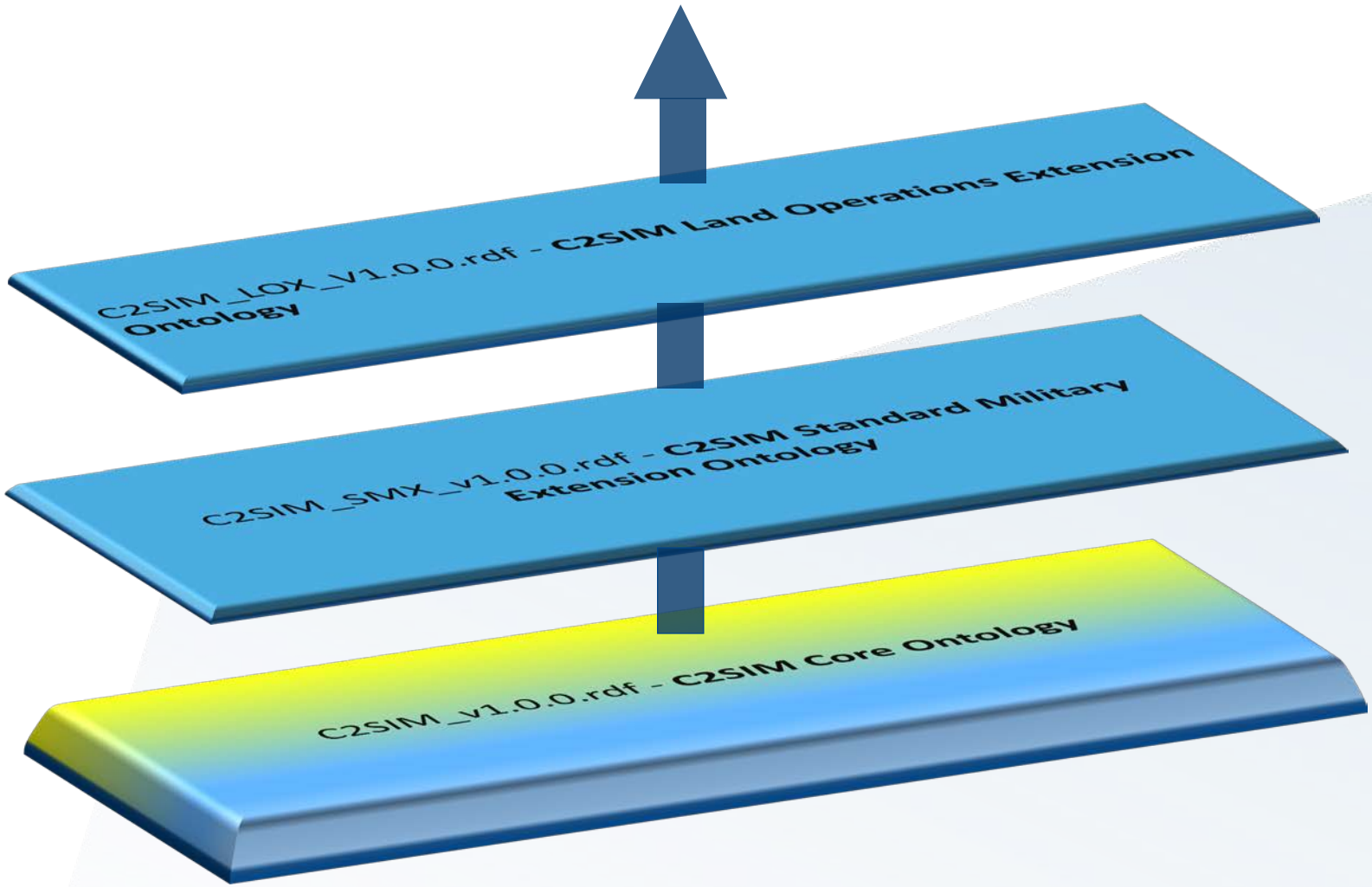
InitializationDataFile | ScenarioSetting | SystemEntityList | ObjectDefintions

MessageConcept

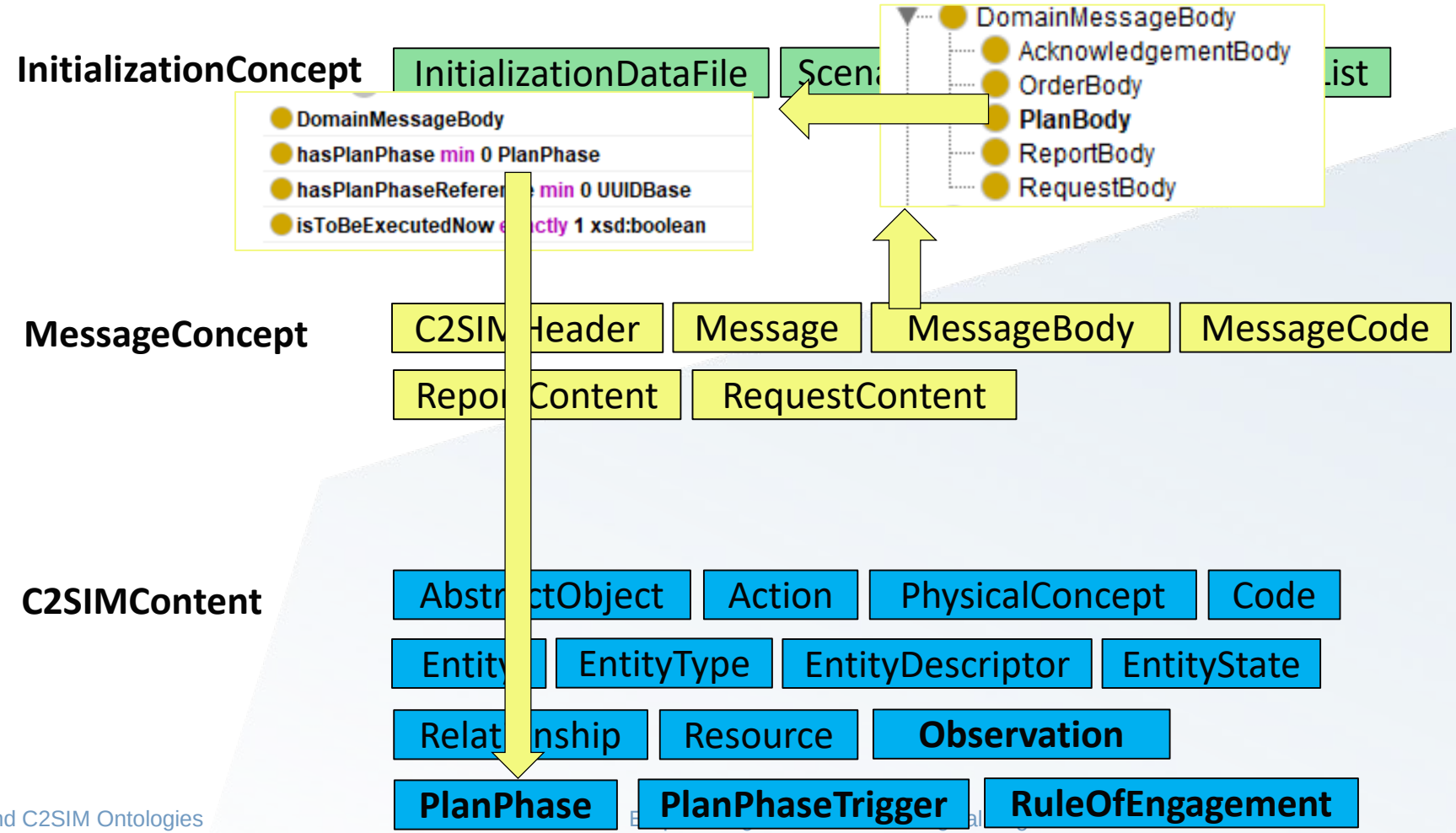
C2SIMContent



Land Operation Extension (LOX)



C2SIM SMX: MessageBody PlanBody



C2SIM SMX: C2SIMContent PlanPhase and PlanPhaseTrigger

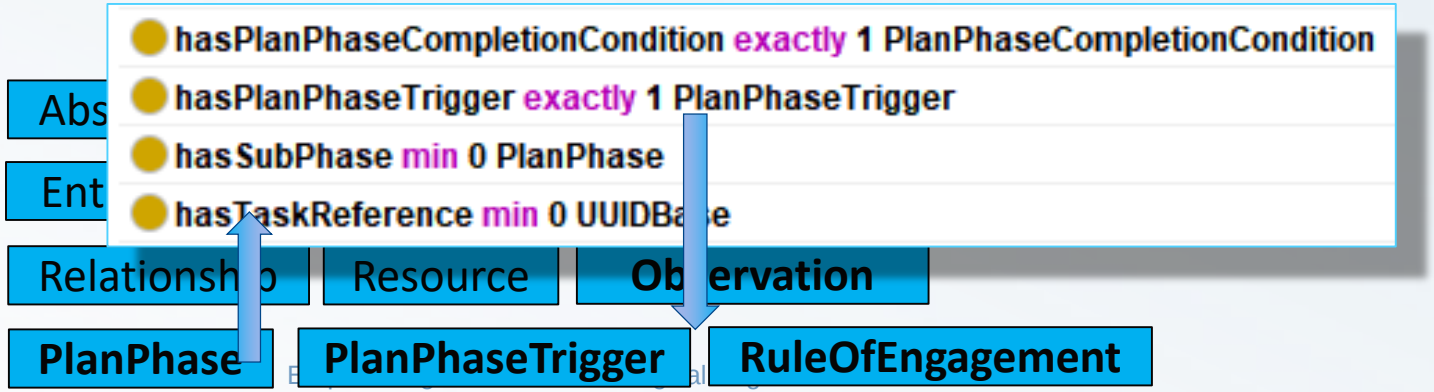
InitializationConcept

InitializationDataFile | ScenarioSetting | SystemEntityList | ObjectDefintions

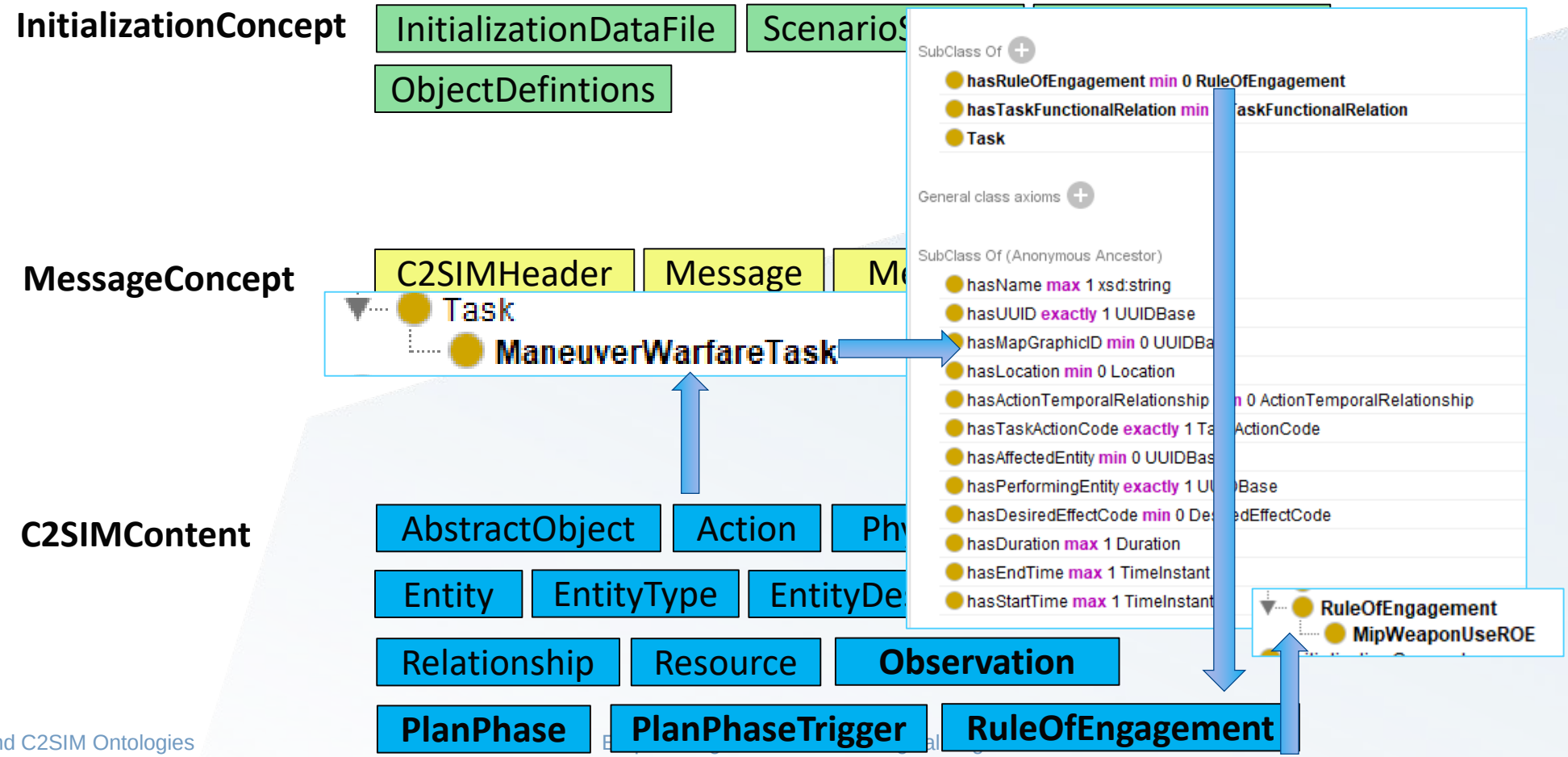
MessageConcept

C2SIMHeader | Message | MessageBody | MessageCode | ReportContent | RequestContent

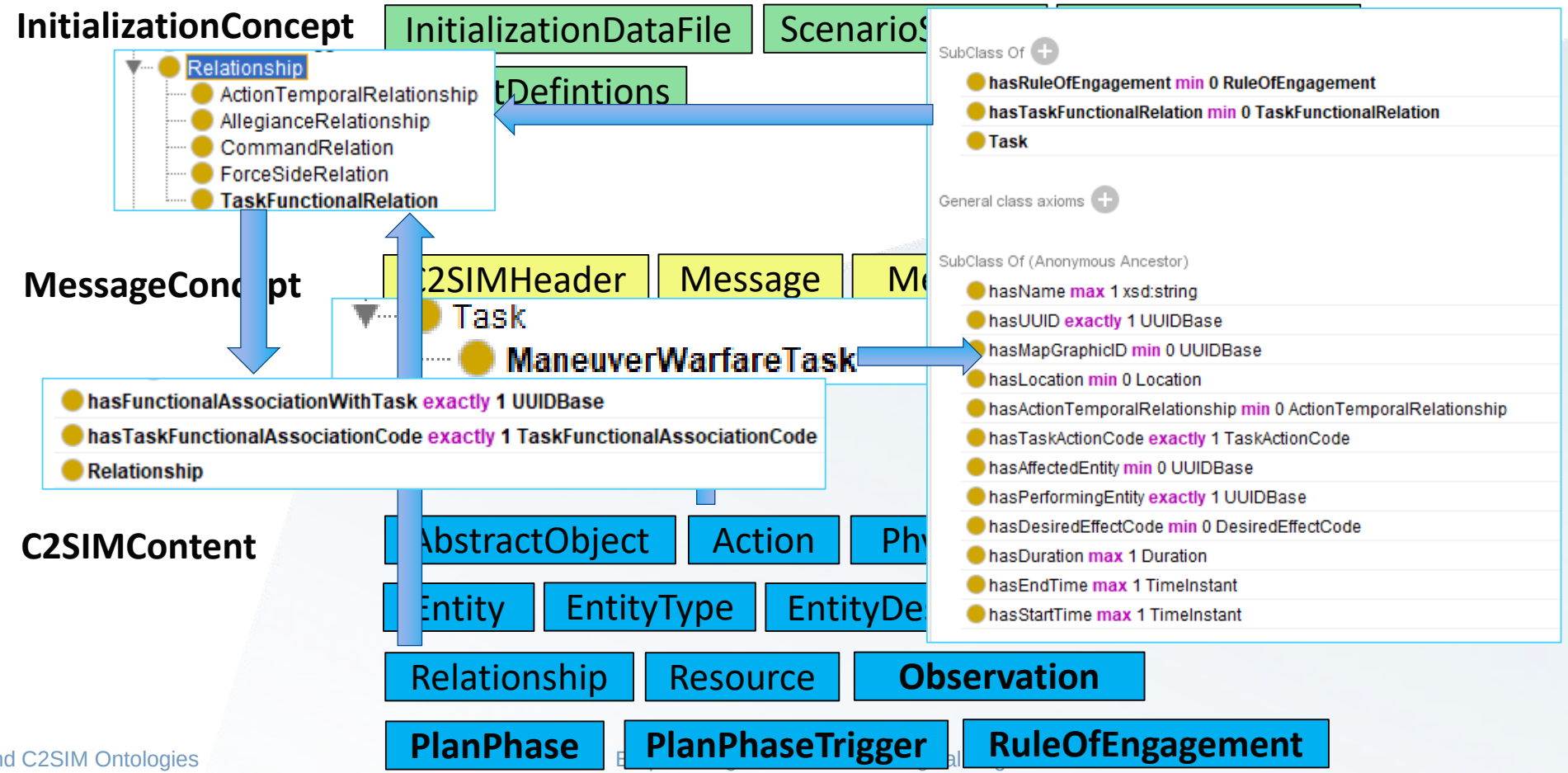
C2SIMContent



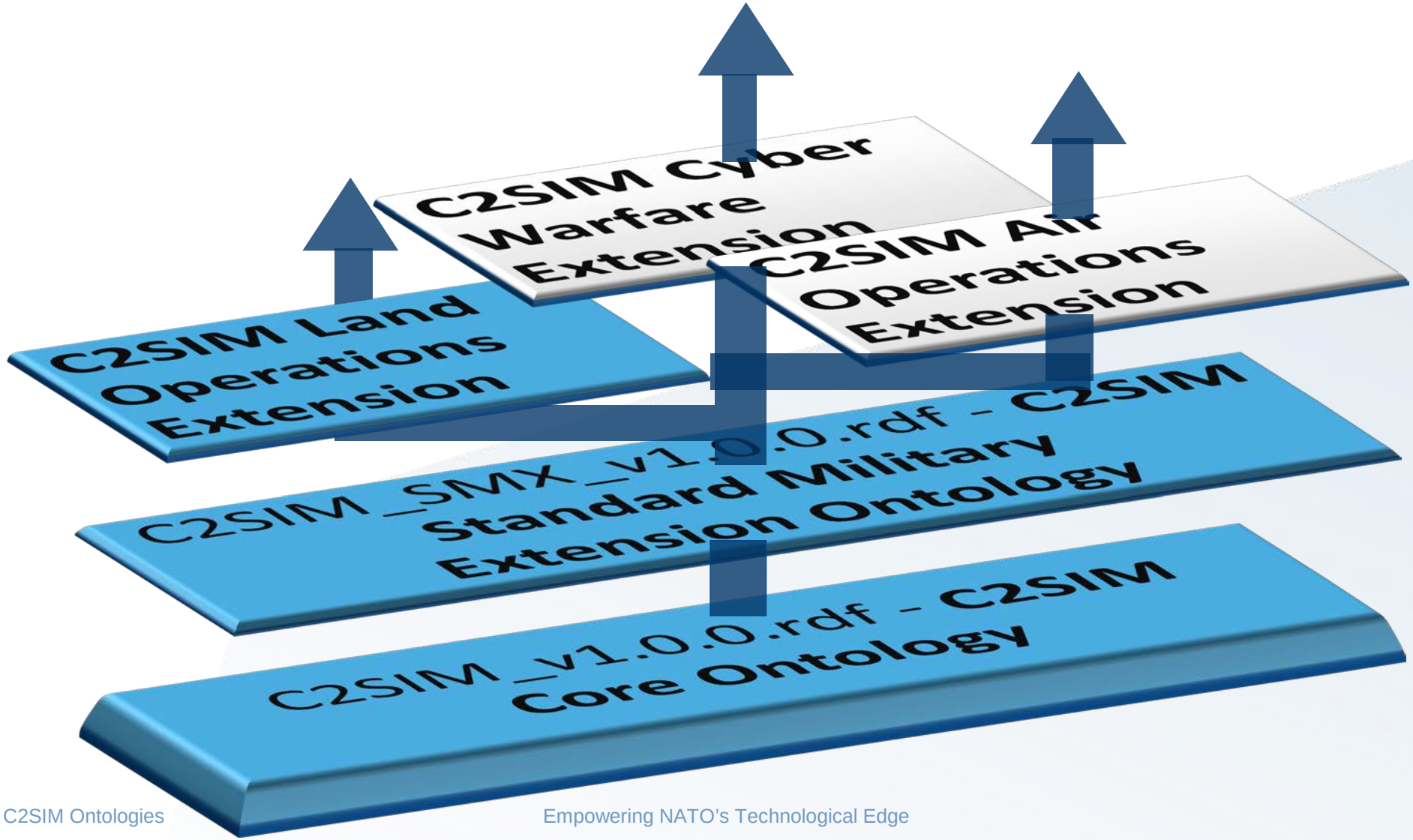
C2SIM SMX: C2SIMContent Task and ManeuverWarfareTask



C2SIM SMX: C2SIMContent Task and ManeuverWarfareTask



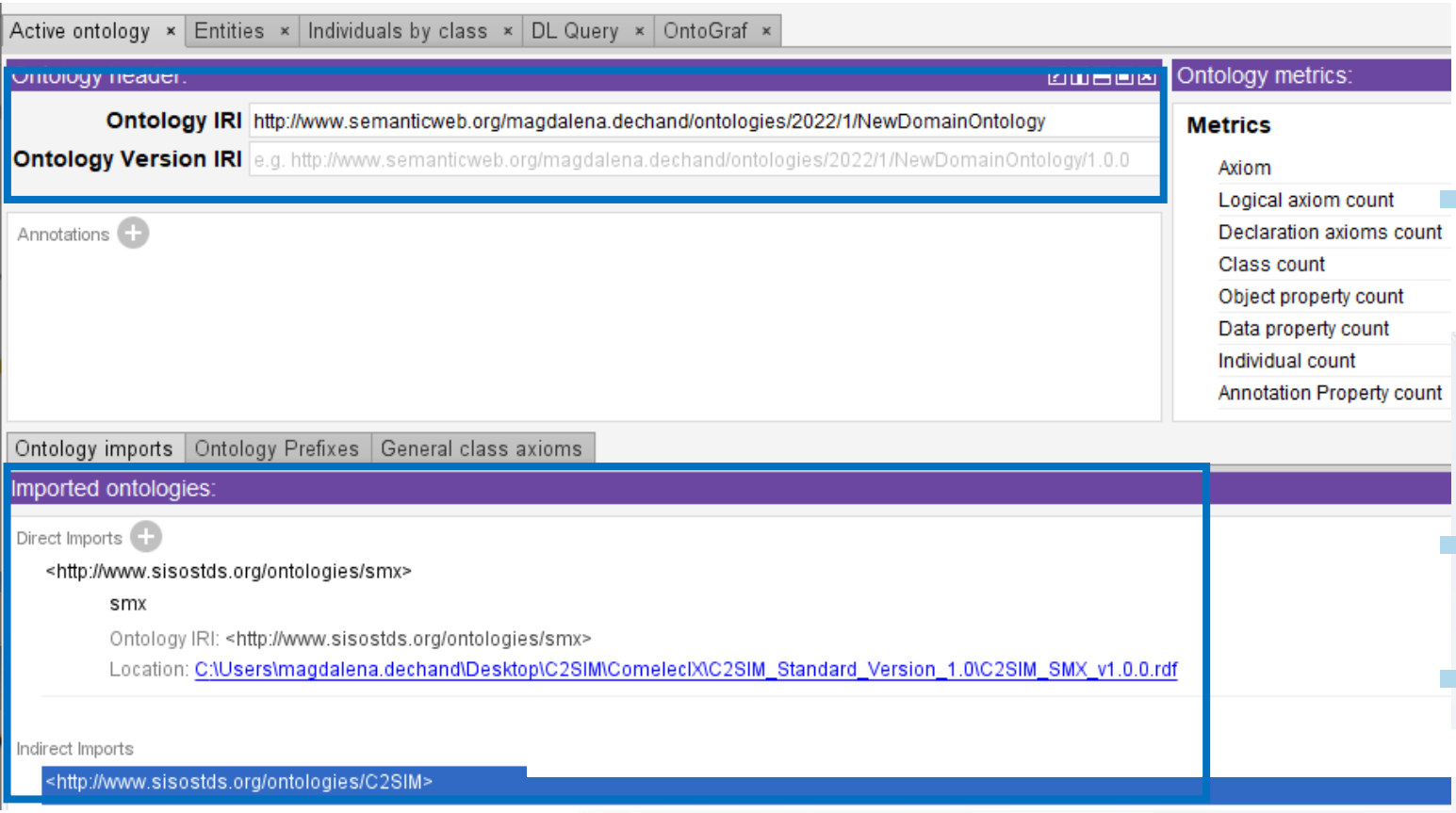
C2SIM Extension Process



C2SIM Extension Process Support

- Scenario driven vs. incorporating different standards to C2SIM
- Enable information exchange for initialization or for tasking and reporting
- Add or change concepts and properties to existing C2SIM ontologies
  - Problem Reports
  - Change Requests
- Create new domain extension
  - Join working group
  - Submit your extension to community

C2SIM Structure NameSpace and Imports

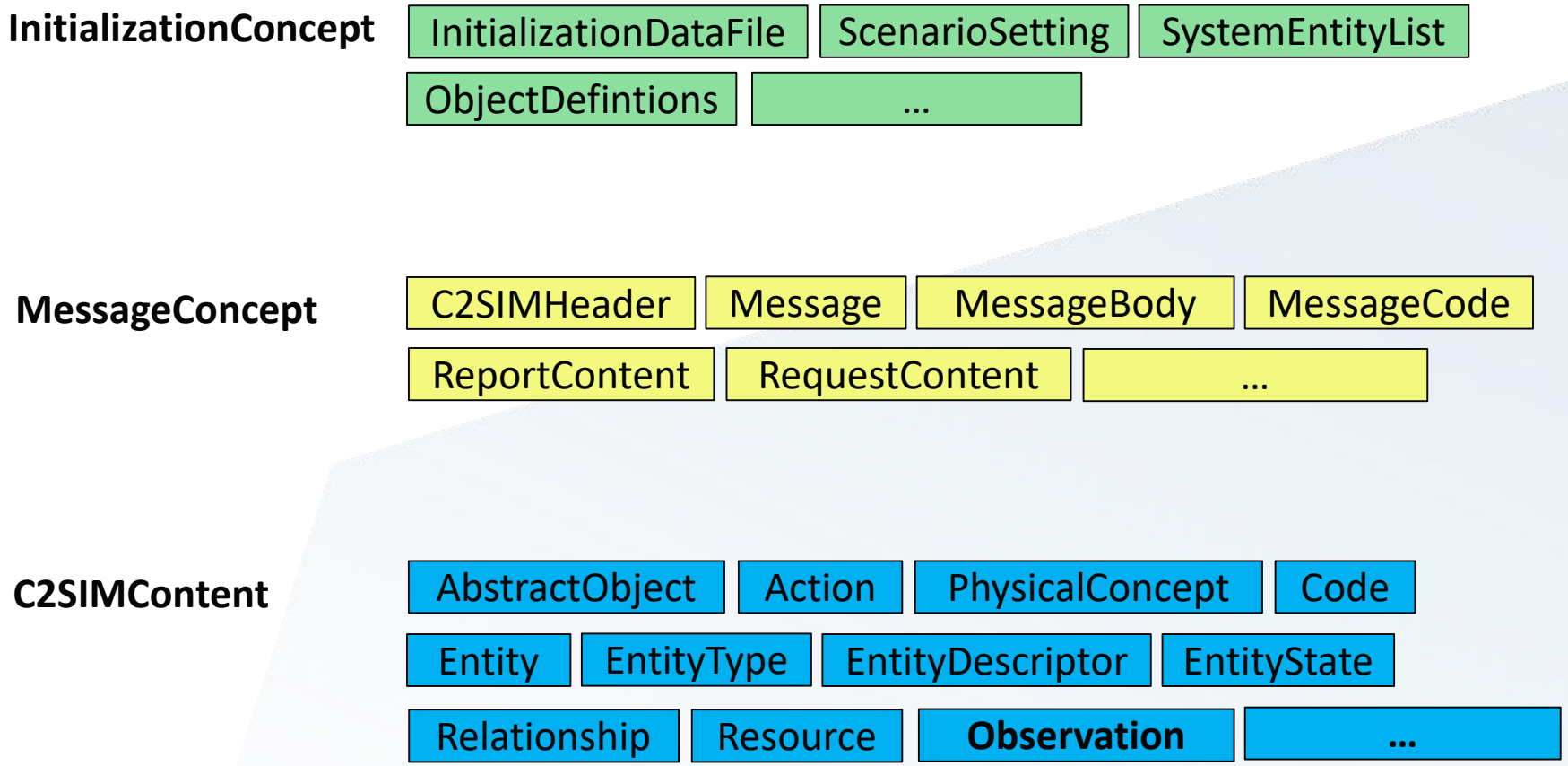


- NameSpace ensures that all newly modelled information will be stored in the extension layer
- Import of ontology layers
- SMX automatically imports Core

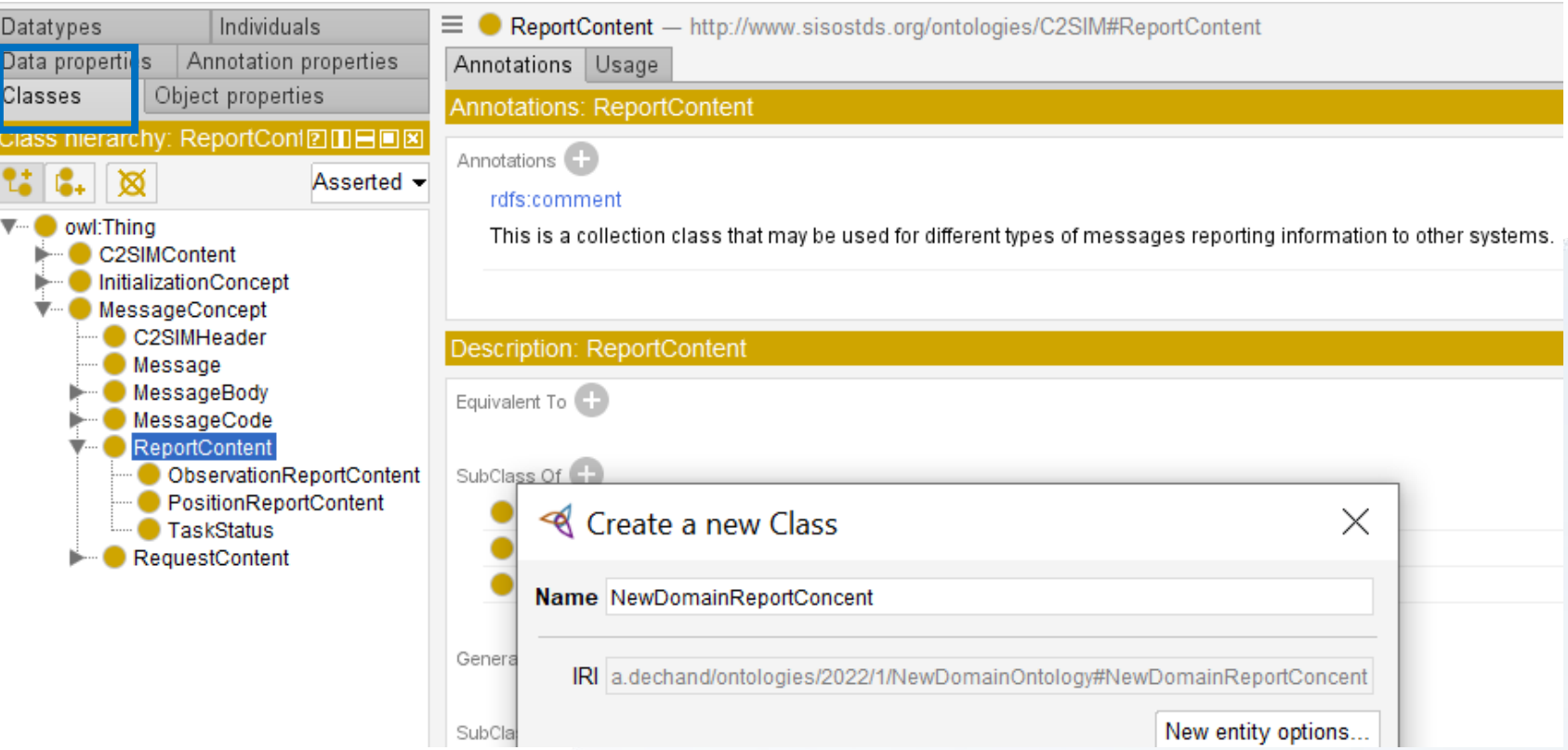
C2SIM Extension Ontology Features

- Add new concepts
  - Subclasses
    - Inherits property restrictions of superclass
    - Specify adding property restrictions
  - Create new individuals/instances as member of a class
- Add property restrictions to already existing classes
- Add data properties to use as restrictions
- Add new datatypes to use for datatype properties
- Add object properties to use as restrictions

C2SIM Extension Process
Add Classes

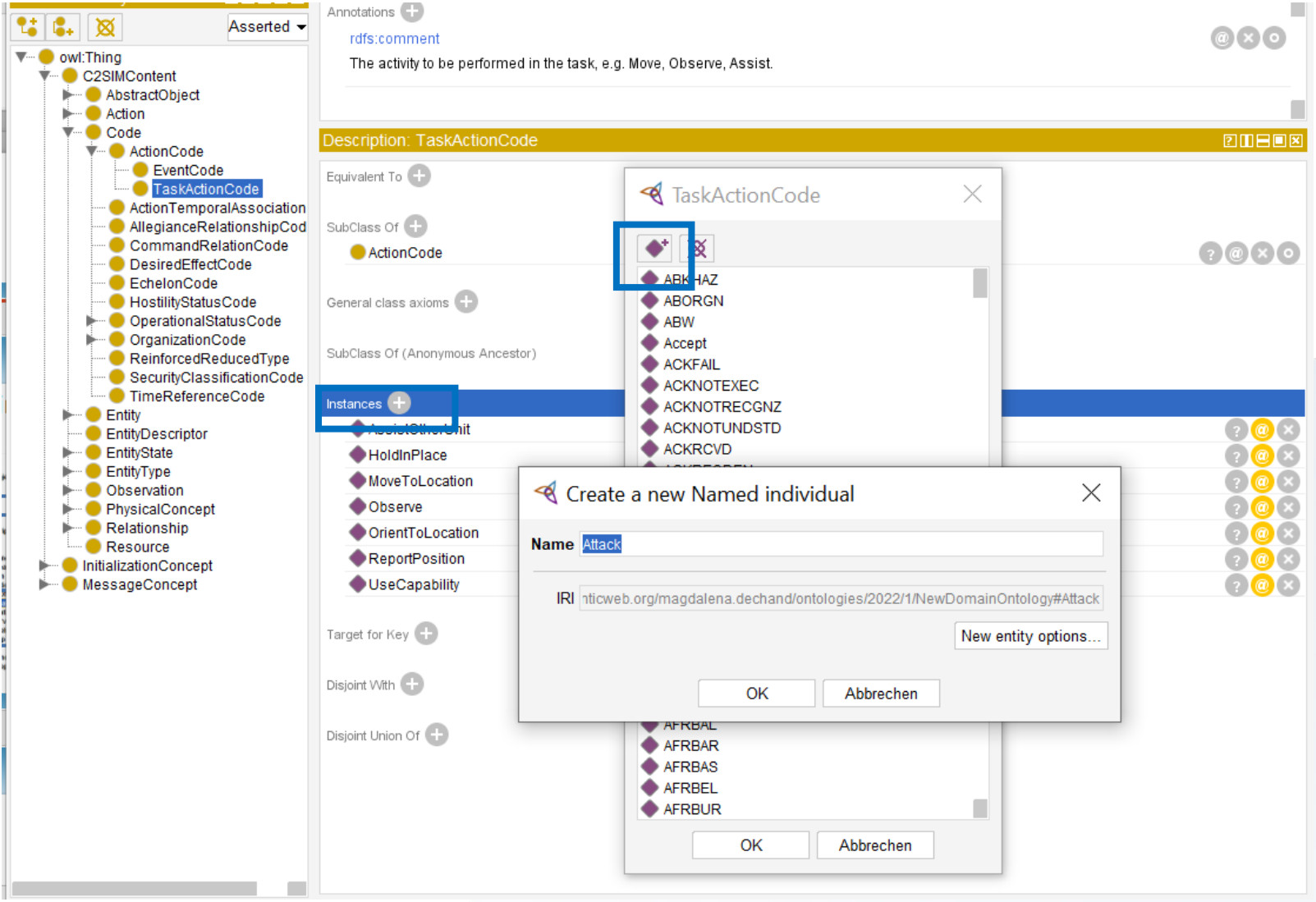


C2SIM Extension Process Add Classes in Protégé



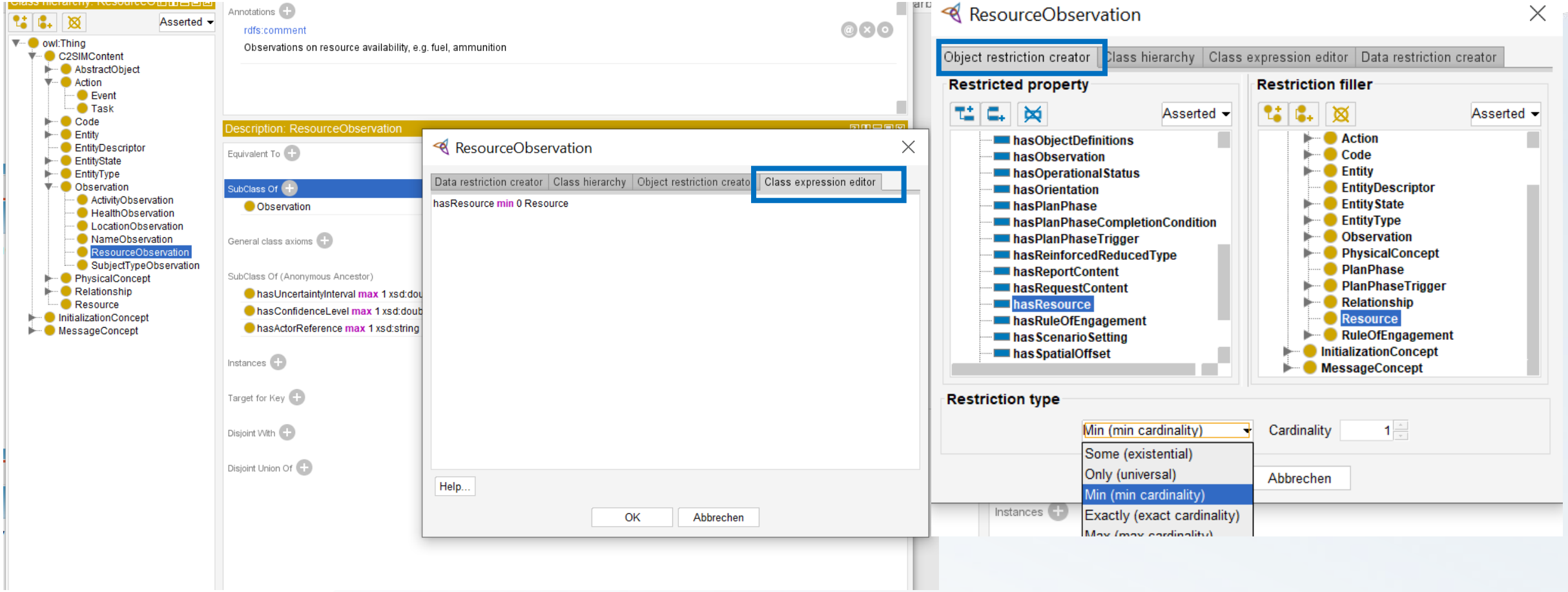
- Choose class Level to add subclass
- Choose name for subclass
- Create subclass

C2SIM Extension Process
Add Instances

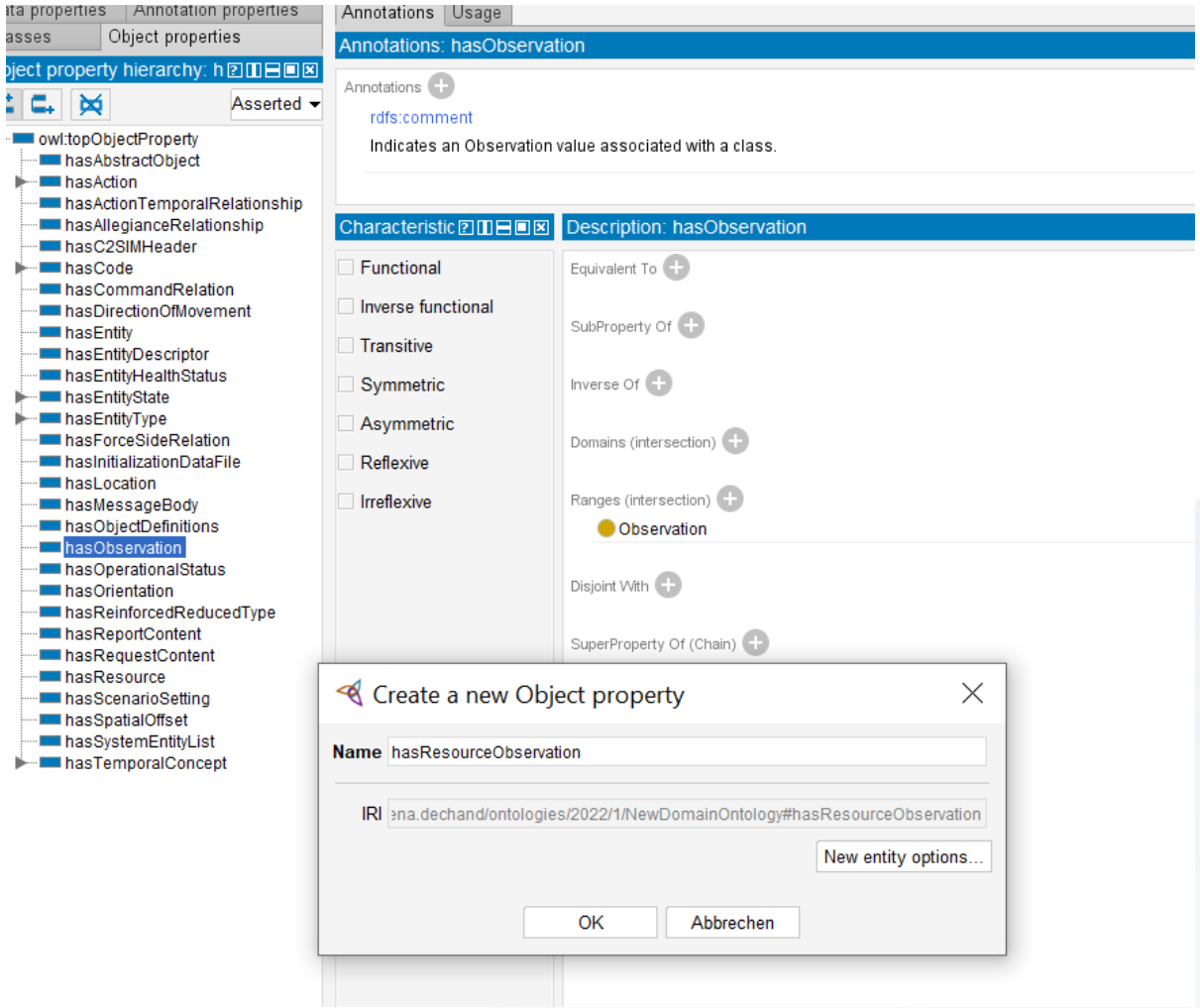


- Assign to a class
  - Use predefined list
- Create new Instance

C2SIM Extension Process
Add Property Restriction

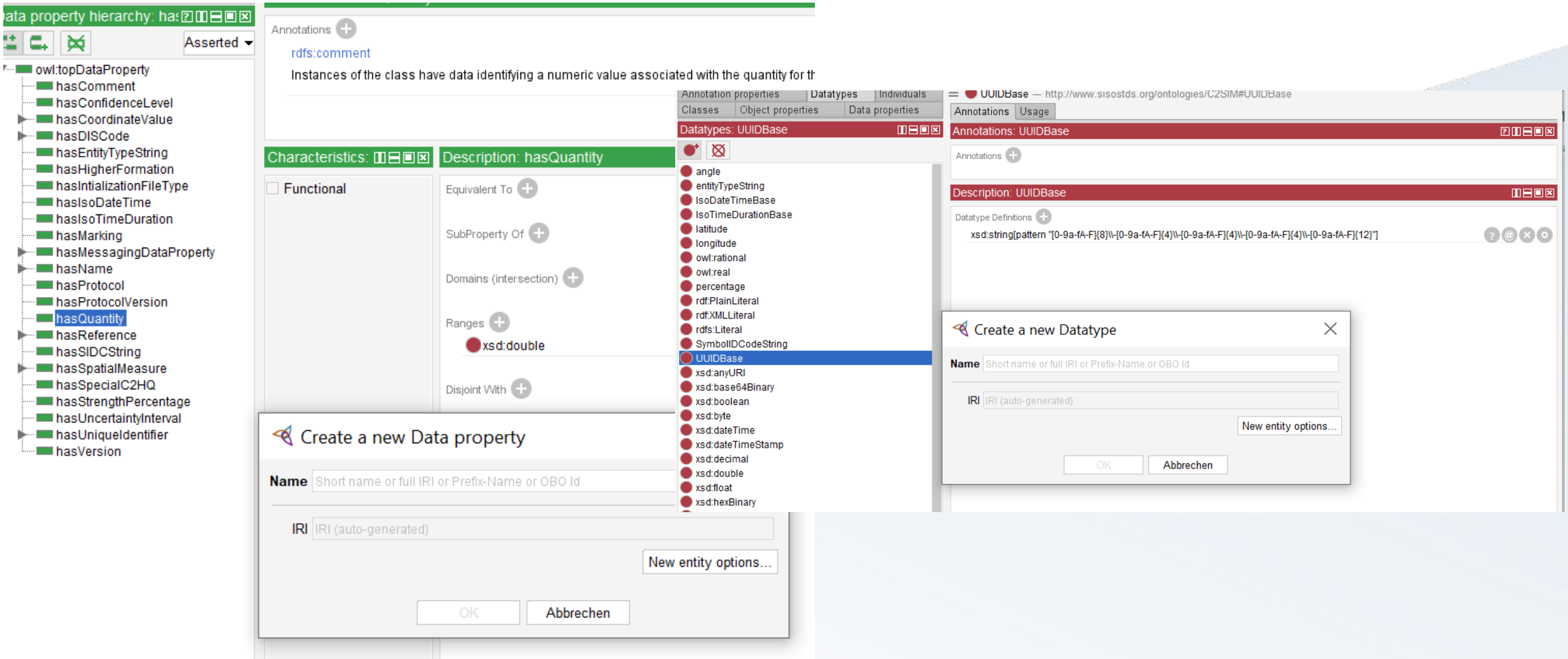


C2SIM Extension Process
Create Object Property

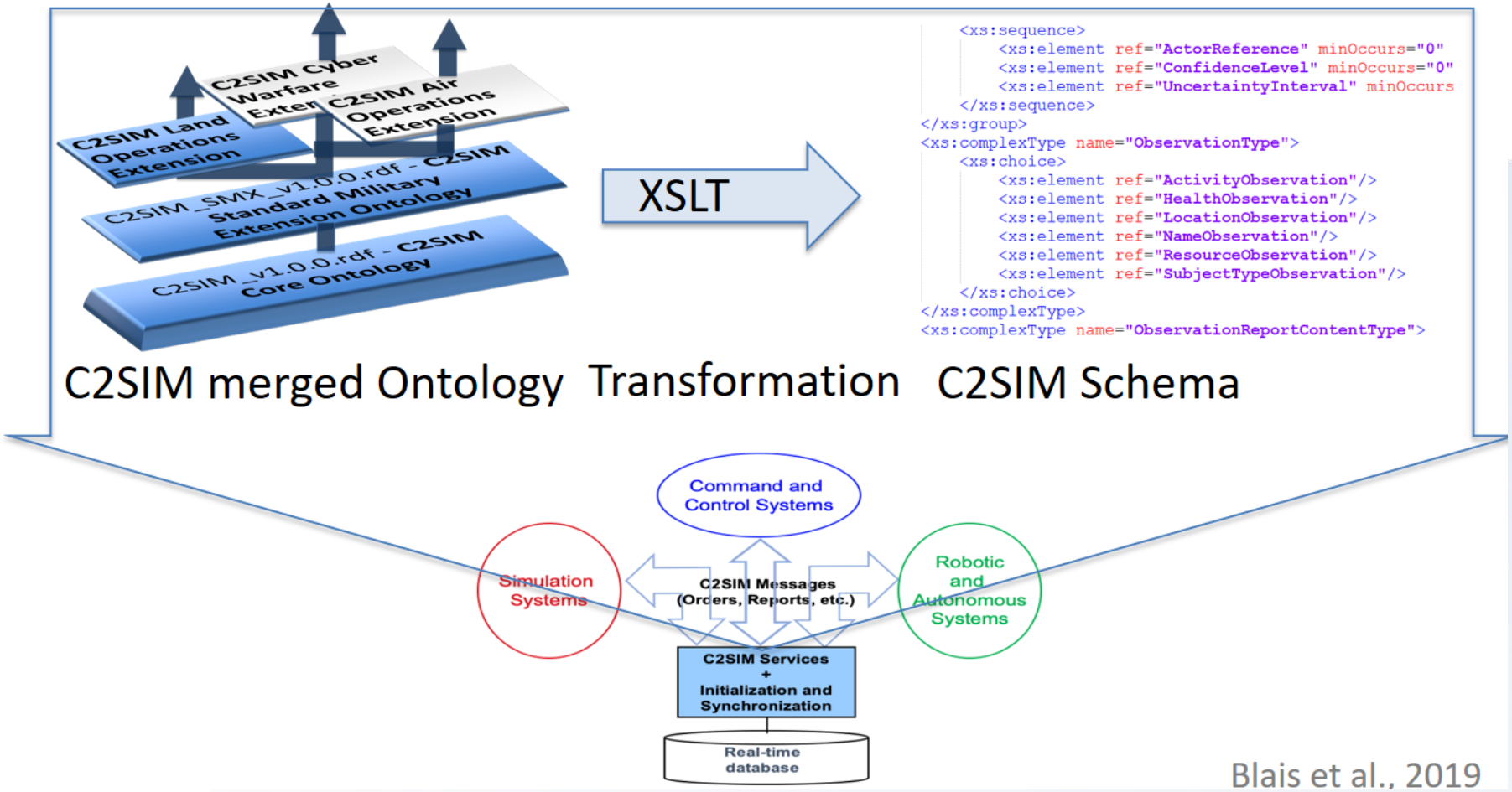


- Properties organized in taxonomy
- Characteristics not used in C2SIM
- Range needed for schema transformation

C2SIM Extension Process
Create Data Property and Datatype



C2SIM Transformatin Process for Information Exchange



C2SIM_SMX_LOX_v1.0.0.xsd Schema

```
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    <xs:group name="ObservationGroup">
        <xs:annotation>
            <xs:documentation>This is an observation of the state of something in the world; generally an actor, but possibly anything that is a
The subclasses defined here are sufficient to create a report with Size, Activity, Location, Unit Identification, Time, and Equipment, or some s
            <xs:documentation>http://www.sisostds.org/ontologies/smx#Observation</xs:documentation>
        </xs:annotation>
        <xs:sequence>
            <xs:element ref="ActorReference" minOccurs="0" maxOccurs="1"/>
            <xs:element ref="ConfidenceLevel" minOccurs="0" maxOccurs="1"/>
            <xs:element ref="UncertaintyInterval" minOccurs="0" maxOccurs="1"/>
        </xs:sequence>
    </xs:group>
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            <xs:element ref="ActivityObservation"/>
            <xs:element ref="HealthObservation"/>
            <xs:element ref="LocationObservation"/>
            <xs:element ref="NameObservation"/>
            <xs:element ref="ResourceObservation"/>
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        <xs:annotation>
            <xs:documentation>This report contains an observation of some aspect of a subject--not necessarily including the location, health, o
Multiple observations all refer to the same observed actor.</xs:documentation>
            <xs:documentation>http://www.sisostds.org/ontologies/smx#ObservationReportContent</xs:documentation>
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        <xs:sequence>
            <xs:group ref="ReportContentGroup"/>
            <xs:element ref="Observation" minOccurs="1" maxOccurs="unbounded"/>
```

XML Messages according to C2SIM Schema

```
<MessageBody>
    <DomainMessageBody>
        <OrderBody>
            <FromSender>00000000-0001-0037-0000-000000000000</FromSender>
            <ToReceiver>00000000-0001-0342-0000-000000000000</ToReceiver>
            <IssuedTime>
                <IsoDateTime>2020-12-08T09:26:31Z</IsoDateTime>
            </IssuedTime>
            <OrderID>311dd7fc-73af-4d1a-8351-7bf012cb7f27</OrderID>
            <Task>
                <ManeuverWarfareTask>
                    <Location>
                        <GeodeticCoordinate>
                            <Latitude>50.99114</Latitude>
                            <Longitude>11.98973</Longitude>
                        </GeodeticCoordinate>
                    </Location>
                    <Location>
                        <GeodeticCoordinate>
                            <Latitude>51.058514</Latitude>
                            <Longitude>12.143538</Longitude>
                        </GeodeticCoordinate>
                    </Location>
                    <UUID>6418304f-c239-4ed2-ab24-30127180befb</UUID>
                    <PerformingEntity>00000000-0001-0342-0000-000000000000</Perfor
                    <TaskActionCode>ATTACK</TaskActionCode>
                </ManeuverWarfareTask>
            </Task>
        </OrderBody>
    </DomainMessageBody>
```

C2SIM- Core

LOX

C2SIM- Core

```
<ReportContent>
    <ObservationReportContent>
        <TimeOfObservation>
            <DateTime>
                <IsoDateTime>2020-09-11T08:00:00Z</IsoDateTime
            </DateTime>
        </TimeOfObservation>
        <Observation>
            <LocationObservation>
                <Location>
                    <GeodeticCoordinate>
                        <AltitudeAGL>0.0</AltitudeAGL>
                        <Latitude>50.869267</Latitude>
                        <Longitude>11.890426</Longitude>
                    </GeodeticCoordinate>
                </Location>
            </LocationObservation>
        </Observation>
    </ObservationReportContent>
```

C2SIM Core

SMX

SMX

C2SIM Core

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- Protégé Ontology Tool: https://protege.stanford.edu/
- C2SIM Products: https://www.sisostds.org/Default.aspx?tabid=105&EntryId=51847

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