

rmAgro

*Linked Open Data in Agriculture,
September 27-28th 2017, Berlin, Germany.*

Daan Goense. (daan@pragmaas.com)



PRAGMAAS



WAGENINGEN UNIVERSITY
WAGENINGEN **UR**



AgroConnect



FarmDigital



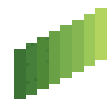
Daan Goense

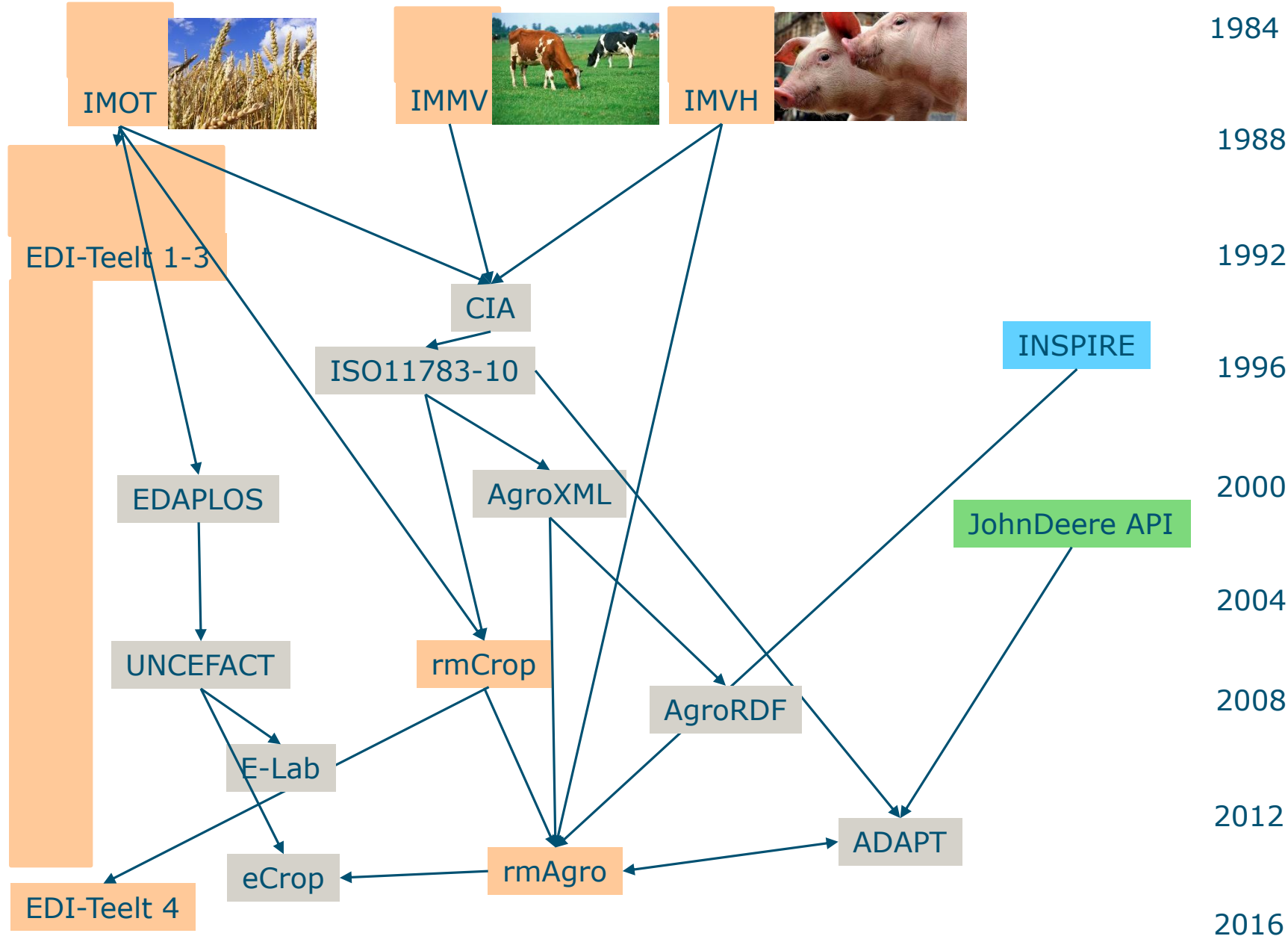
- Retired from Wageningen University & Research (WUR)
- Research in Farm Machinery Management, Precision Agriculture and ICT in Agriculture.
- Consultant under the name Pragmaas.
- Hired by WUR to maintain the reference model for agriculture



Already 30 years efforts to standardise data communication in agriculture

- 1984: A project to stimulate information technology in the Netherlands.
- 1987: Ad hoc Arbeitsgruppe Busch-Schnittstelle
- 1991; ISO/TC23/SC19
- 2000: AgroXML (D), EDAPLOS (F)
-
- Now:
 - AgroConnect (NL)
 - UNCEFACT (International)
 - AgGateway (USA → International)





Technologies vary during time

- IMOT: *relational database & process*
- EDI-Teelt 1-3: *ADIS – Edifact - XML*
- CIA: *Object Orientation*
- ISO11783-part10: *(ADIS) - XML*
- AgroXML: *XML*
- EDAPLOS → UNCEFACT: *XML*
- EDI-Teelt 4: *XML*
- drmCrop → EDI_Teelt4: *domain (Object Orientation) → XML*
- AgroXML -> AgroRDF *XML → RDF*
- ADAPT: *API / Plugin in C#*

What triggered rmCrop?

- Change in technologies over time. (ADIS, (EDIFACT), XML, JSON, API, RDF)
 - → Domain reference model should be independent from implementations.
- Additional scopes in crop production.
 - Precision Agriculture, Guidance, Tracking and tracing, etc.
- → **One common basis that defines the whole Crop Production Domain.**

Why change to rmAgro?

- Other branches of agriculture share objects with crop production.
- Share applications like tracking and tracing.
- There are mixed farm enterprises (Crop production and animal production) where resources are shared.
- → **rmCrop** → **rmAgro**
 - Include Greenhouse production, Animal husbandry
 - **rmAgro is a project in progress**
 - Identify common classes
 - Add classes from other branches of agriculture
 - Nieuwe inzichten

What are sources for rmAgro

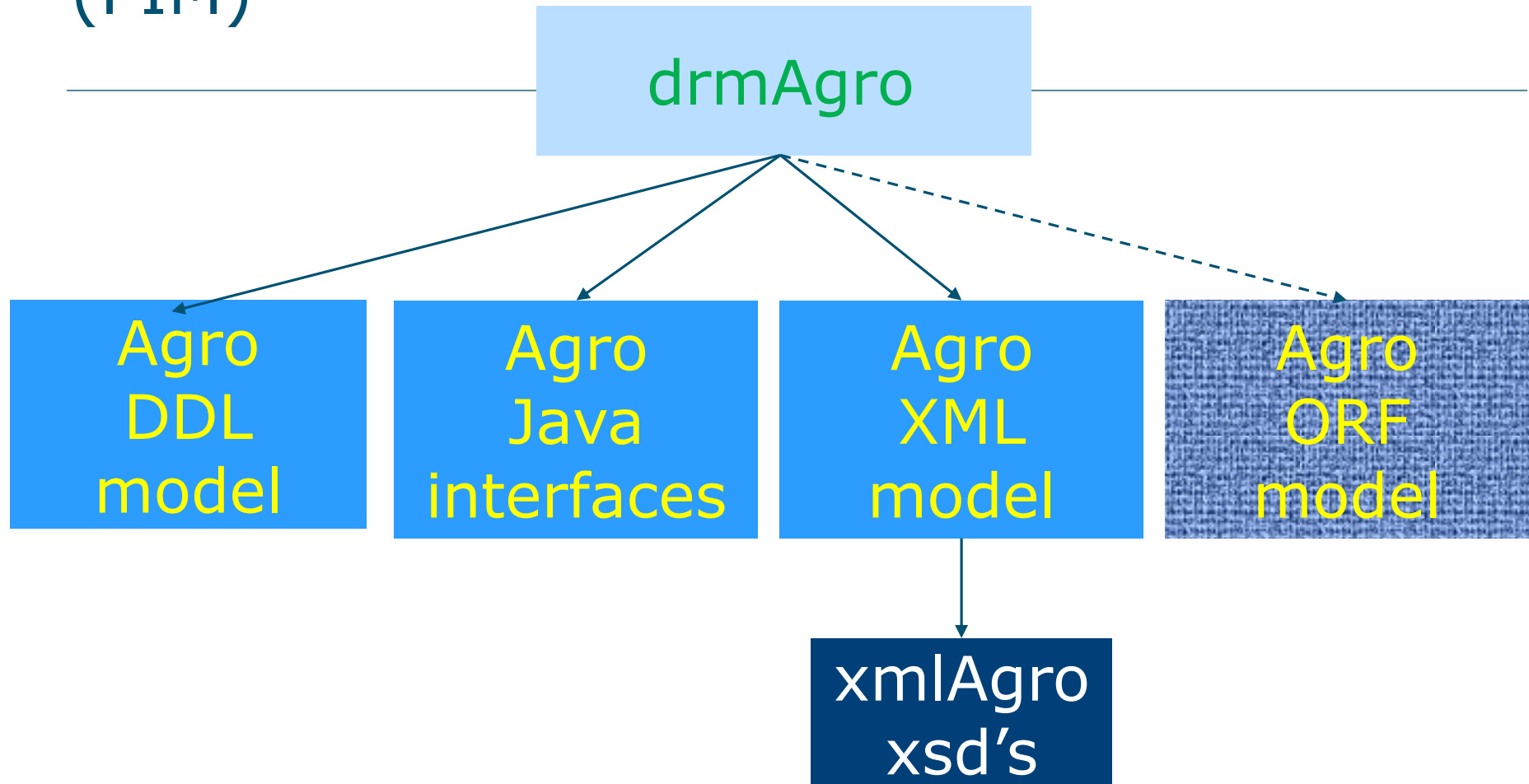
- Informatie model open teelten.
- ISO11783-10
- AgroXML
- Edaplos
- Data dictionary for plant protection products
- Dutch class model for fertilizers
- Frugicom (Horticulture)
- INSPIRE
- **Dutch software houses and users of data**
- Research projects from Wageningen UR
 - Crop growth models, scheduling of farm operations
- *and recently ADAPT*
- *we think we might cover quite some requirements*



rmAgro; a model suite in EA

- *Business Process Model (**BPMN**), mainly for FISpace*
- **Use case** model, mainly for ISO/TC23/SC19WG5
- Domain Reference Model (**drmAgro**)
- *Dynamic view (**sequence diagrams** for Fispace and Edi-Teelt)*
- **DDL model** (transformed from drmAgro)
- *External models (ISO19107, Fertilizer, Crop Protection)*
- *External Informative XSD's (ISO11783, AgroXML)*
- External Used XSD's (XSD,GML,GMLCOV,SWE,UDT/UNCEFACT)
- **Java Model** (interface model & *implementation model* transformed from drmAgro)
- *Mapping (drmAgro/drmCrop to other models)*
- **WSDL** (defines messages for FISpace and Edi-Teelt)
- **XSD model** (transformed from drmAgro)
- **ORF model** (In development, transformed from drmAgro)

Base is a Platform Independent Model (PIM)



rmAgro; a model suite in EA

- *Business Process Model (**BPMN**), mainly for FISpace*
- ***Use case model**, mainly for ISO/TC23/SC19WG5*
- *Domain Reference Model (**drmAgro**)*
- *Dynamic view (~~sequence diagrams~~ for Fispace and Edi-Teelt)*
- ***DDL model** (transformed from drmAgro)*
- *External models (ISO19107, Fertilizer, Crop Protection)*
- *External Informative XSD's (ISO11783, AgroXML)*
- *External Used XSD's (XSD,GML,GMLCOV,SWE,UDT/UNCEFACT)*
- ***Java Model** (interface model & implementation model transformed from drmAgro)*
- *Mapping (drmAgro/drmCrop to other models)*
- ***WSDL** (defines messages for FISpace and Edi-Teelt)*
- ***XSD model** (transformed from drmAgro)*
- ***ORF model** (In development, transformed from drmAgro)*

Modelling conventions for the domain model drmAgro

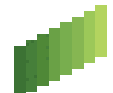
- It is a platform (computation) independent model !
- No id's or keys, except for global identifiers as attributes.
- No foreign keys.
- Generic datatypes (*no language specific datatypes*)
- Many to many relations stay as they are, no association class (*except when it has attributes*)

Naming conventions used in drmAgro

- Camel based names for classes (i.e. **CropField**) and attributes (**CropYear**)
-**Type** is only used for data types !
 - Not for classification of objects !
 - *Use Classification or Category or Group, etc.*
- Designator in stead of Name. (from ISO11783)

Starting points

- Use existing standards when appropriate
 - ISO19107 and GML
 - SensorML
 - GMLCOV
 - UNCEFACT Unqualified Data Types
 - CodeType
 - IdentifierType



Some aspects that require(d) attention (1)

■ A **class** $\leftrightarrow$ **data type**.

- When the object can be identified by the value of its attributes and needs no identifier, it is a data-type)

■ **Enumerations** $\Leftrightarrow$ **Coding tables**

- Be aware that a change in an enumeration list requires recompiling of code.

■ **CodingList** $\leftarrow \rightarrow$ **IdentifierList**

- UNCEFACT differentiates between them, but when to use what is not always clear.



Some aspects that require attention (2)

■ Identifiers

- Initially only a Global Unique Identifier based on ISO15459 in the Netherlands
- → generic Identifier based on UNCEFACT

■ Level of abstraction

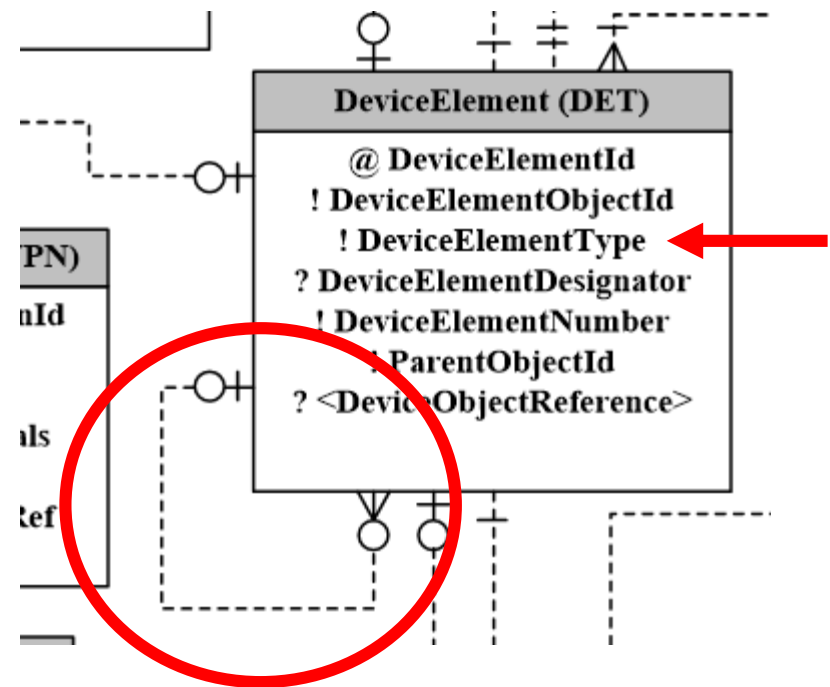
- When to use a subclass ?

Example of a too abstract class

- **DeviceElement** in ISO11783 stands for all functional components of an implement.

- Bin
- Section
- Nozzle
- Valve
- Etc.....

- *When is the reciprocal relation valid?*



Level of abstraction

- When to use a subclass ?
 - As soon as one has to specify for which types of a class a relation to another class is valid, the class is too abstract.



Geografic information

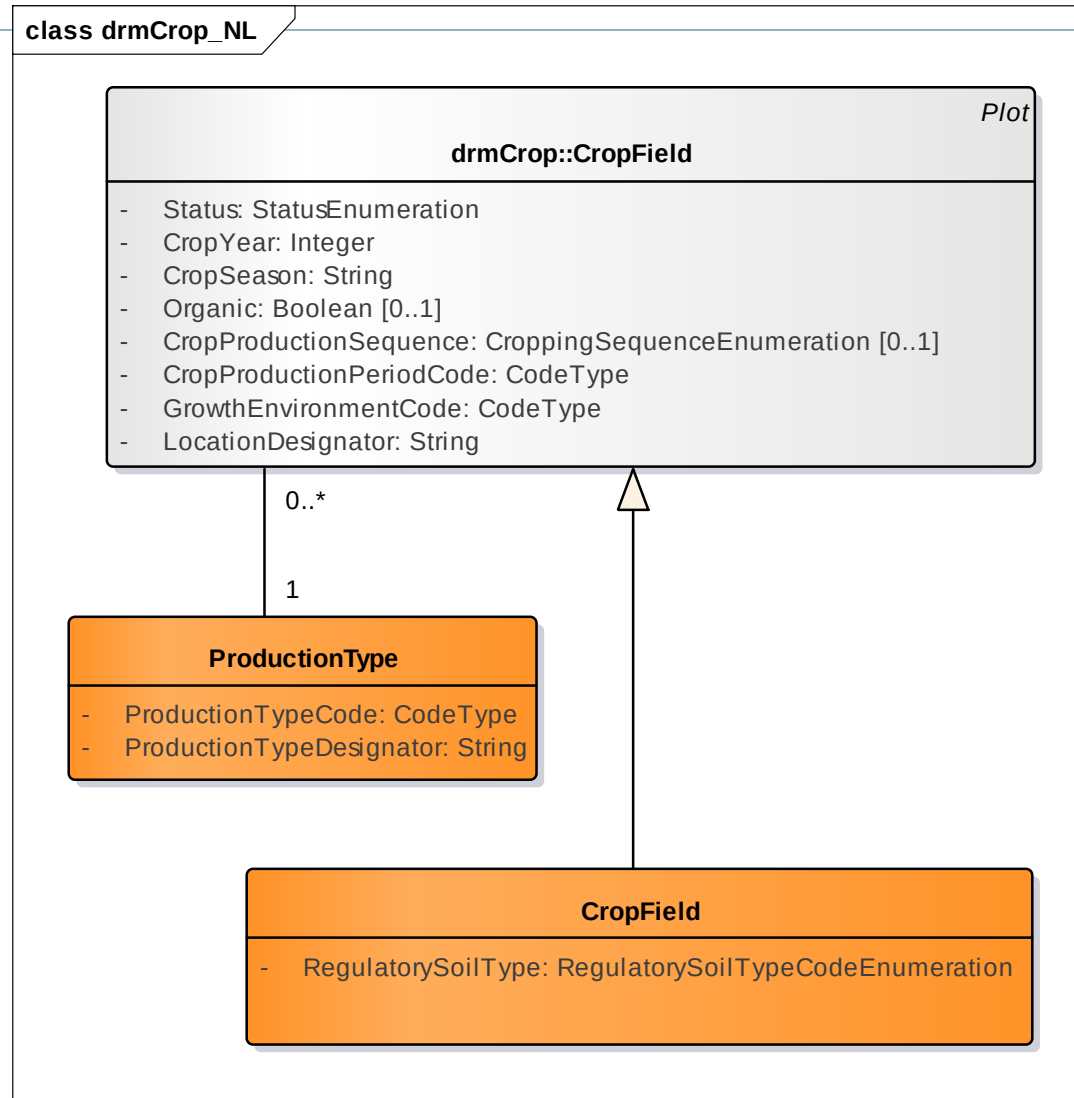
- ISO19107 and GML
 - ISO19107 is an interface model
 - GML is an XML model based on ISO19107
 - There is no common, platform independent, model !
 - GML deviates sometimes from ISO19107
 - *Polygon has boundary in ISO, not in GLM*
 - Gridpoint does not exist in GLM
- ➔ Geometries in the reference model are not transformed. For the XML model use GML. For the (Java) Interface Model use ISO19107.

Region specific attributes

- Ackerzahl in Germany
- Regulatory soil type in the Netherlands
- EPA number in the USA

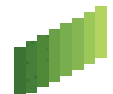
- A country specific package where country specific classes are a sub-class from the class in the main package

Example of Region specific attribute



Structure of the domain model (1)

- drmAgro
 - DataTypes
 - Enumerations
 - Geometries (→ GML and GMLCOV or →
ISO19107)
 - SWE types (→ SWE)
 - DataArrayType
 - XSD types (→ XMLSchema)
 - token, ncName, anyURI
 -



Structure of the domain model (2)

■ drmAgro

-
- *All common classes* (i.e. Party, Organization, .)
-
-
- drmCrop
- drmAnimal
- drmGreenHouse
- drmInfrastructure (yards, trees, roads, etc)
- drmPostharvest
- (*drmStyleGuide*)

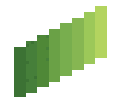
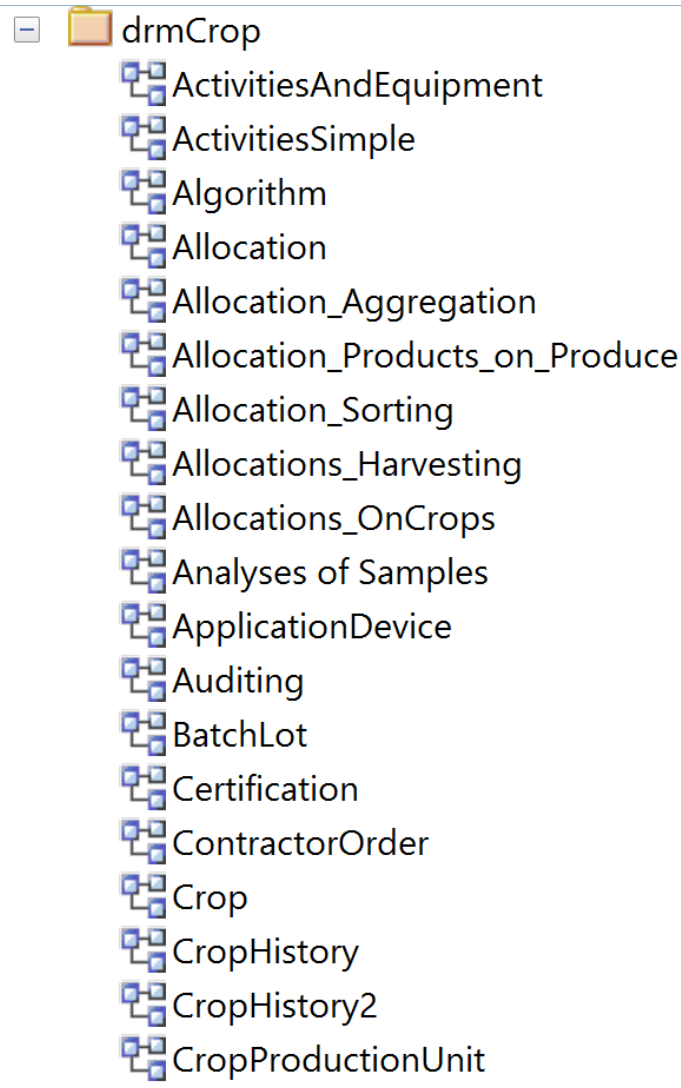


In drmCrop

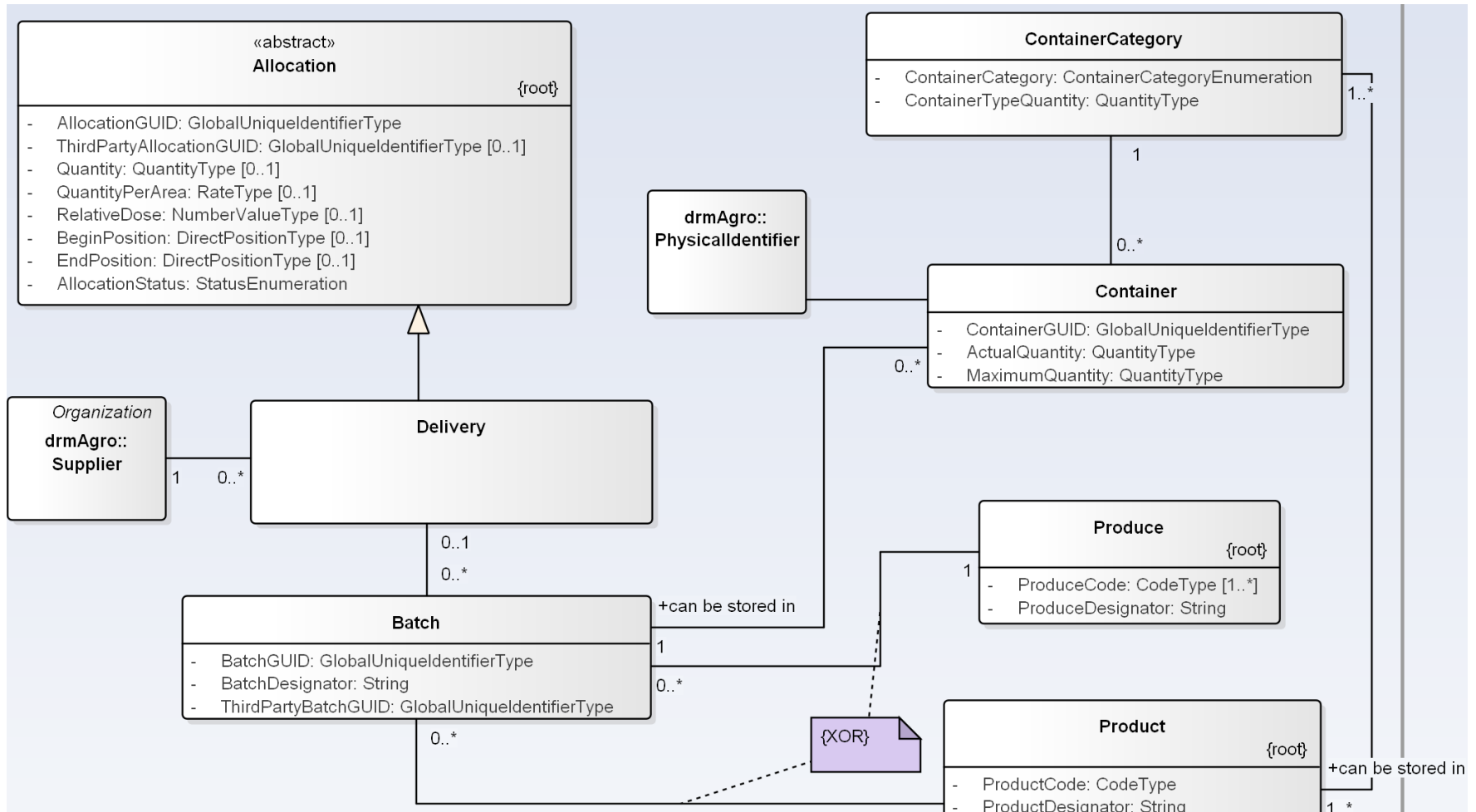
- drmCrop_NL
- ISO11783
 - DeviceClass
 - DeviceElement
 - ECU
 - ImplementECU
 - TaskController



Diagrams for different scopes of the model



Example for Batch



All classes have definitions, evt. remarks and examples

 Class : CropField

Properties

General

Templates

Rules

Requirements

Constraints

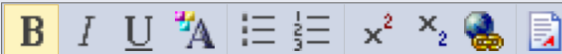
Scenarios

Related

Files

Links

CropField



Definition.
CropField describes the continuous surface of land which is used during a period of time by a certain CropProductionUnit.

Remark.
The surface of the CropField is always within the borders of a Field.

As a CropProductionUnit applies to only one CropType, a CropField is grown by one CropType.

It is the farmer who decides when to split up to different CropFields. That can be a different **Variety**, a different purpose for which the crop is grown, a different class in seed production, the need to keep it separate for tracking and tracing purposes etc.

Stereotype:

Status:

Alias:

Keywords:

Author:

Complexity:

Language:

Version:

Phase:

Package:

Background information

- rmAgroGuideline.docx (on the ftp server)
- Describes
 - Structure of the model suite
 - Modelling and naming conventions
 - Issues
 - Design patterns



Scopes covered by drmAgro

■ *Parties*

- Party, Organization, Person, Department, Farm, etc.

■ *Fields*

- Plot, Field, CropField, ActivityField, KadastralField

■ *Activities on the farm*

- Job, Task, Operation

■ *Data processing*

- DataSet, DataAggregation, Algorithm, DataProcess



Scopes covered by drmAgro (2)

- *Handling of products and produce*
 - ProductAllocation, Product, Batch, TreatmentZone
- *Sampling and analyses*
 - Sample, Analyses, PropertyValue, Laboratory, Container, VerticalLayer
- *CropRecording*
 - CropProductionUnit, CropField, Operation, AbsoluteTiming, CulturalPractise, OperationTechnique, SpatialDataset, ProductAllocation, TreatmentZone, Batch, etc.



Scopes covered by drmAgro (3)

- *Farm machinery*

- Equipment, Implement, Tractor, ManMachineSystem

- *Ordering*

- Order, OrderItem, Delivery, Invoice, Customer, Supplier

- *Product composition*

- Product, ProductAllocation, Batch, ProductElement

Availability of the model

- rmAgro snapshot:
ftp://pragmaas.com/rmCrop/rmAgro_SNAPSHOT/
- *(Fails sometimes for dubious reasons)* 
 - Enterprise Architect model
 - description of background as word document.
 - Read only version of Enterprise Architect



Use of drmAgro/drmCrop as reference for

- EDI_Teelt messages (SOAP – XML based web services)
 - CropField data to the Dutch government
 - CropField data to advisors
 - Recommendations from advisors to FMIS
 - Orders from farmers to contractors
 - CropField records to processors
- UNCEFACT messages
 - ➔ *Conversion to UNCEFACT naming conventions.*
 - Crop and produce data to processors (Greenhouse)
 - Sample data to laboratories
 - Laboratory results



Coding tables

- CropClasses (3x)
- OperationTechniques
- CulturalPractises
- Products
 - CropProtectionProducts
 - Nutrients
- Produce
- Weather variables
-
- **Between 50 and 100 coding lists**

Coding tables & Identifier lists

- Leave that **as much as possible** to the authorities who can be made responsible for that.
- CropClasses (3x) → **???? Breeders ?????**
- OperationTechniques **AEF ???**
- CulturalPractises **????**
- Products
 - CropProtectionProducts → **Legislative Authorities**
 - Nutrients → **??? Fertilizer industry ???**
- Produce → **GS1**
- Weather variables → **WMO**
- Physical and Chemical soil variables → **Soil science society**

Is it ready ?

- **No !** And it never will be !
- There are several loose ends
- One is only sure when it is successfully implemented
 - Some parts are !
- There are issues to solve
 - When generating the XML model, Choice/SelectionOff is not separated as element yet.