

# Land Parcel Identification System: development and testing of geoinfo community data model

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# OUTLINE

- ▶ **Background**
  - CAP geo-spatial domain and Spatial Data Interest Community
- ▶ **Land Parcel Identification System (LPIS) Conceptual Model (LCM)**
  - History
  - Methodology
  - Basic classes
- ▶ **Conformance Testing**
  - CAP Quality Assurance: Data conformance issue
  - Community data models: examples and usage
  - Abstract Test Suite
  - Schema mapping
  - CAP testbed

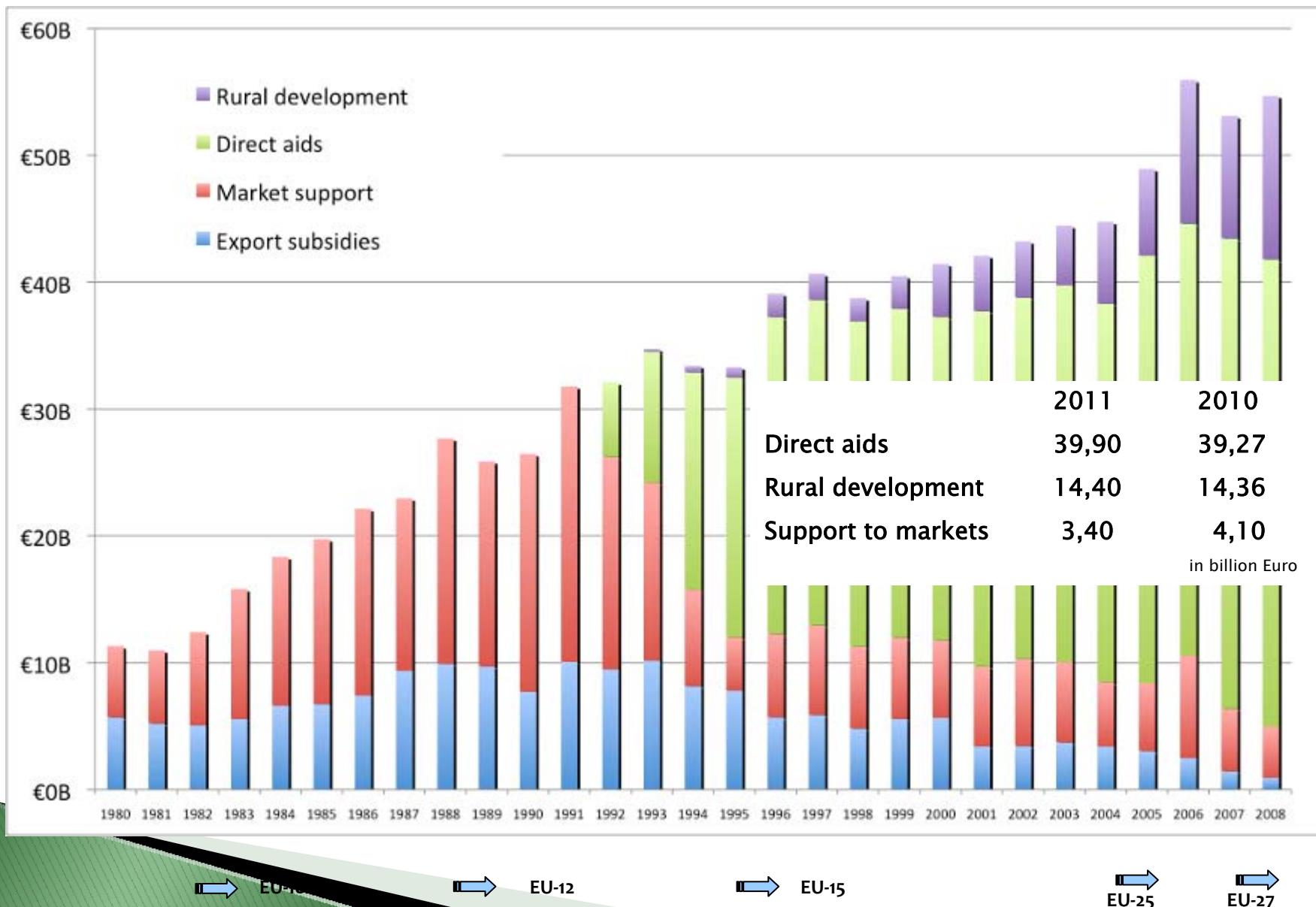
# Background: CAP today – the basics

In the past: subsidised link to production

Today:

- the majority of aid is independent of production – **Direct Payments** + payments under the **Rural Development** program
- Amount of subsidies depends on **agricultural area** cultivated and maintained
- Farmers have to respect environmental, food safety, phytosanitary and animal welfare standards – **Cross Compliance** – farmers who fail to do this will face reductions in their direct payments

# CAP expenditure, 1980–2009

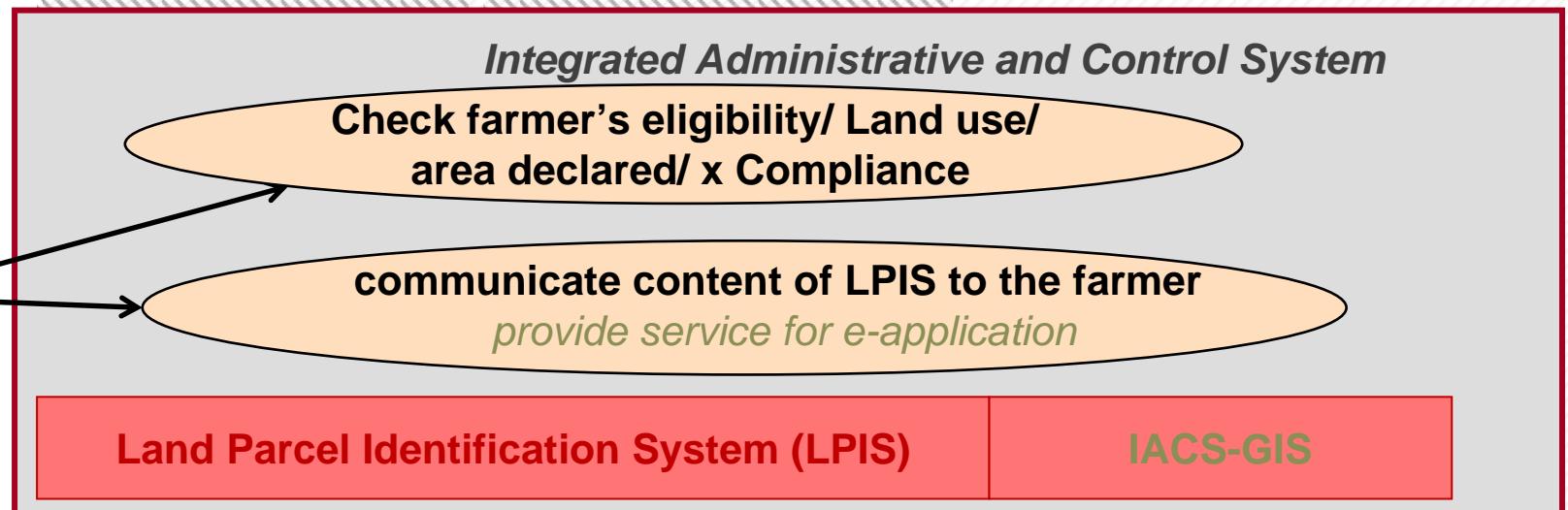


# Aid to farmers use cases

European Commission



Member State administration



Farmer



## LPIS example: Slovenia

The screenshot shows the RKG-GERK application running in Mozilla Firefox. The main window displays a map of agricultural land parcels, each outlined in pink. Overlays include green areas representing forests and yellow/orange areas representing different agricultural categories. A toolbar above the map contains various icons for zooming, panning, and selecting features. To the right of the map is a panel titled 'Nastavitev:' (Settings) which includes a search field for 'KMG MID' and several checkboxes for selecting data layers. Below the map is a table with columns for KMG\_MID and Gerk\_PID, listing numerous entries. At the bottom of the screen, there is a horizontal table with several rows of data, likely related to the selected parcels.

# Images provided by the European Commission: budget for 2010 – 6 million €

http://139.191.1.73 - MARS ImageBrowser - Microsoft Internet Explorer fornito da Libero

## THE MARS IMAGE BROWSER The MARS PAC Image Archive

The screenshot shows the MARS Image Browser interface. On the left is a large satellite image of a forested area with red and green colors. To the right is a map of Europe with a grid of blue diamond icons representing image acquisition points. A legend on the right lists various geographical features like Countries, Settlements, Rivers, Lakes, Corine Landcover, and DEM (IGDC). Below the map is a table of image metadata:

No.	Image	Acquisition Date	Satellite	Sensor	Country	Site	Orbit
1	Show	2003-03-27	SPOT	Panoramic	CH FR	SUPT	-
2	Show	2003-04-01	SPOT	Multispectral	CH FR	SUPT	-
3	Show	2003-09-04	SPOT	Multispectral	CH FR	SUPT	-
4	Show	2003-07-14	SPOT	Multispectral	CH FR	SUPT	-

Buttons at the bottom include "Copy Path" and "Download...".

Large Search Map window size Search for Internet

# LPIS geospatial community

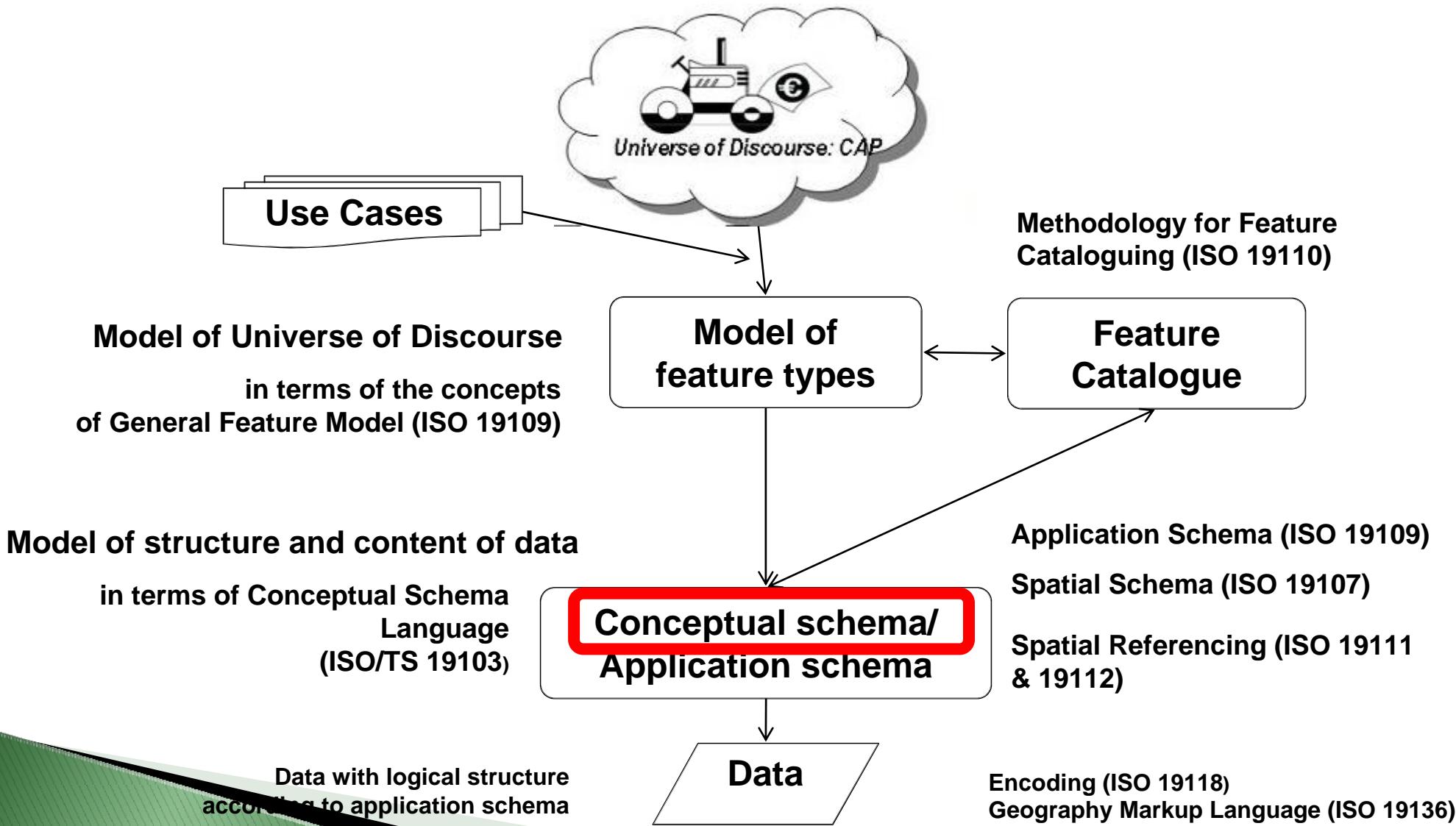
- ▶ Annual MARS conference  
(Monitoring of Agricultural Resources)
- ▶ Annual LPIS workshop since 2006
  - Ispra, Italy, 2006
  - Ispra, Italy, 2007
  - Sofia, Bulgaria, 2008
  - Tallinn, Estonia, 2009
  - Copenhagen, Denmark, 2010
- ▶ WikiCAP  
[http://marswiki.jrc.ec.europa.eu/wikicap/index.php/Main\\_Page](http://marswiki.jrc.ec.europa.eu/wikicap/index.php/Main_Page)
- ▶ INSPIRE CAP IACS–SDIC  
(Spatial Data Interest Community)

# **LPIS Conceptual Model, LCM**

The objective of the study :

- ▶ to bring in the concepts of GI quality elements and quality assurance in the assessment of the compliance of the LPIS systems with the EU regulations; to develop efficient, transparent procedures for conformance testing;
- ▶ to introduce the framework of conceptual modelling ISO 19100 and methodological approaches for standardisation into the agricultural sector domain;
- ▶ to study the possibility of collaboration/integration between the LCM and informatics model for land administration;
- ▶ to investigate the interoperability issues with environmental data from different domains such as of INSPIRE Annexes themes.

# Conceptual models



# Conceptual models: examples

- ▶ INTERLIS (Swiss Cadastre)
- ▶ CCDM – Core Cadastral Domain Model, EULIS
- ▶ LADM – Land Administration Domain Model (Dutch Cadastre)
- ▶ Agricultural Data Model Project, (ESRI)
- ▶ STDM – Social Tenure Domain Model (UN-HABITAT)
- ▶ INSPIRE themes data specification (CP- cadastral parcel, in total 34 common data specifications)

# Conceptual models: usage

- ▶ a new derived implementation
- ▶ foster interoperability between data and applications;
- ▶ data harmonisation and standardisation
- ▶ data interoperability
- ▶ assessing quality of databases

# LPIS Conceptual Model (LCM):

- ▶ First-cut version January, 2008. Discussion via wikiCAP
- ▶ FIG conference paper, Stockholm, 2008
- ▶ Version 1.0, May 2009
- ▶ Testing of LPIS implementations in 5 MS (ATS), 2009
- ▶ LCM ja ATS Version 1.1, June 2010
- ▶ co-operation with Land Administration Domain Model for annex to ISO standard 19152, 2008–2010, DIS

# LPIS Core conceptual Model (LCM): methodology

*Step 1: Requirements  
and basic concepts  
from EU Regulations*

*Step 3: LCM - UML model,  
GML-Conceptual schema  
and Feature catalogue*

*Step 5: Test-bed  
XML/GML scheme*

*Step 2: Analysis of MS  
implementations*

*Step 4: ATS –  
abstract test suite*



# Step 1. Analysis of the requirements concepts

## Article 15

### Elements of the integrated system

1. The integrated system shall comprise the following elements:
  - (a) a computerised database;
  - (b) an identification system for agricultural parcels;



#### Regulatory

- + REG01FUN: Identification of agricultural parcels
- + REG02FUN: Determination of the area
- + REG03FUN: Furnishing of farmer's application (Art. 12.3)
- + REG04FUN: Calculation of entitlements: verification of entitlements and crosschecks with the LPIS
- + REG05FUN: Automated administrative crosschecks
- + REG06FUN: Administrative checks: Furnishing on-the-spot check
- + REG07FUN: Administrative checks: Checks in respect to cross-compliance
- + REG08FUN: Aid application process: Farmer indicates the location of each agricultural parcel (inside reference parcel)
- + REG09FUN: No aid (agricultural parcel) can be claimed in excess of reference parcel
- + REG10TEC: Implemented as GIS, provide GIS functionality
- + REG11TEC: Use of cartographic references (or DOP)
- + REG12TEC: Use of aerial orthoimagery as reference
- + REG13TEC: Scale of details 1:10000
- + REG14TEC: use of national geodetic system
- + REG15TEC: pre-printed form indicates the RP (ID-number, area, geometry)
- + REG17TEC: LPIS area unit is reference parcel
- + REG19TEC: Farmer's application basic unit is agricultural parcel
- + REG20TEC: LPIS update
- + REG21TEC: 75%/90% rule

#### Quality

- + PR1: 75%/90% role
- + QR1: Content corresponds to the accuracy at least 1:10000 (Art. 20.1)
- + QR2: Content corresponds to cartographic reference not older than 5 years

#### Extensibility

- + ER1: Should support data interoperability
- + ER2: Should support application interoperability
- + ER3: Support services

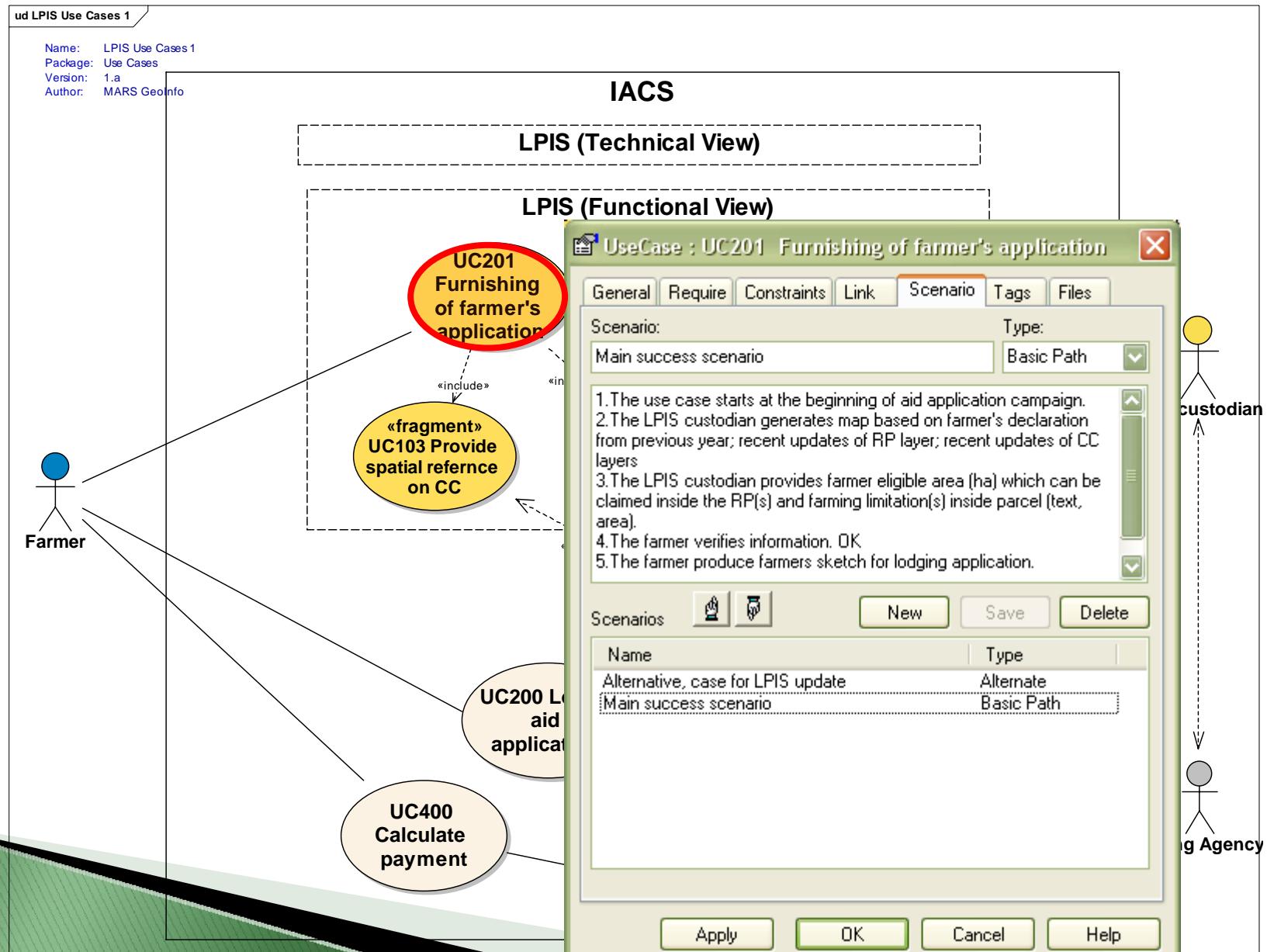
#### Implementation

- + IR1: Shall be implemented as GIS

#### Standards

- + SR4: Conformance with ISO19100 standards

# Use Case model

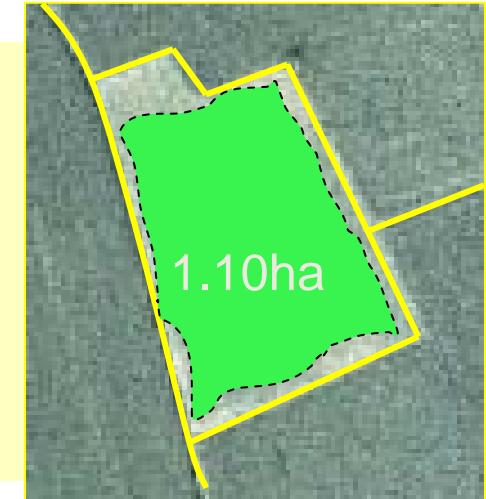


# Key spatial concepts

Commission Regulation (EC) No 73/2009 Art 2

## (1a) Agricultural parcel

shall mean a continuous area of land on which a single crop group is cultivated by a single farmer. However, where a separate declaration of the use of an area is required in the context of this Regulation that specific use shall further limit the agricultural parcel;



## (26) Reference parcel

shall mean a geographically delimited area retaining a unique identification as registered in the GIS in the Member State's identification system referred to in Article 18 of Regulation (EC) No 1782/2003;

Art 6(1) CR 796/2004

the identification system for agricultural parcels .... shall operate at **reference parcel** level such as cadastral parcel, or production block which shall ensure unique identification each of reference parcel



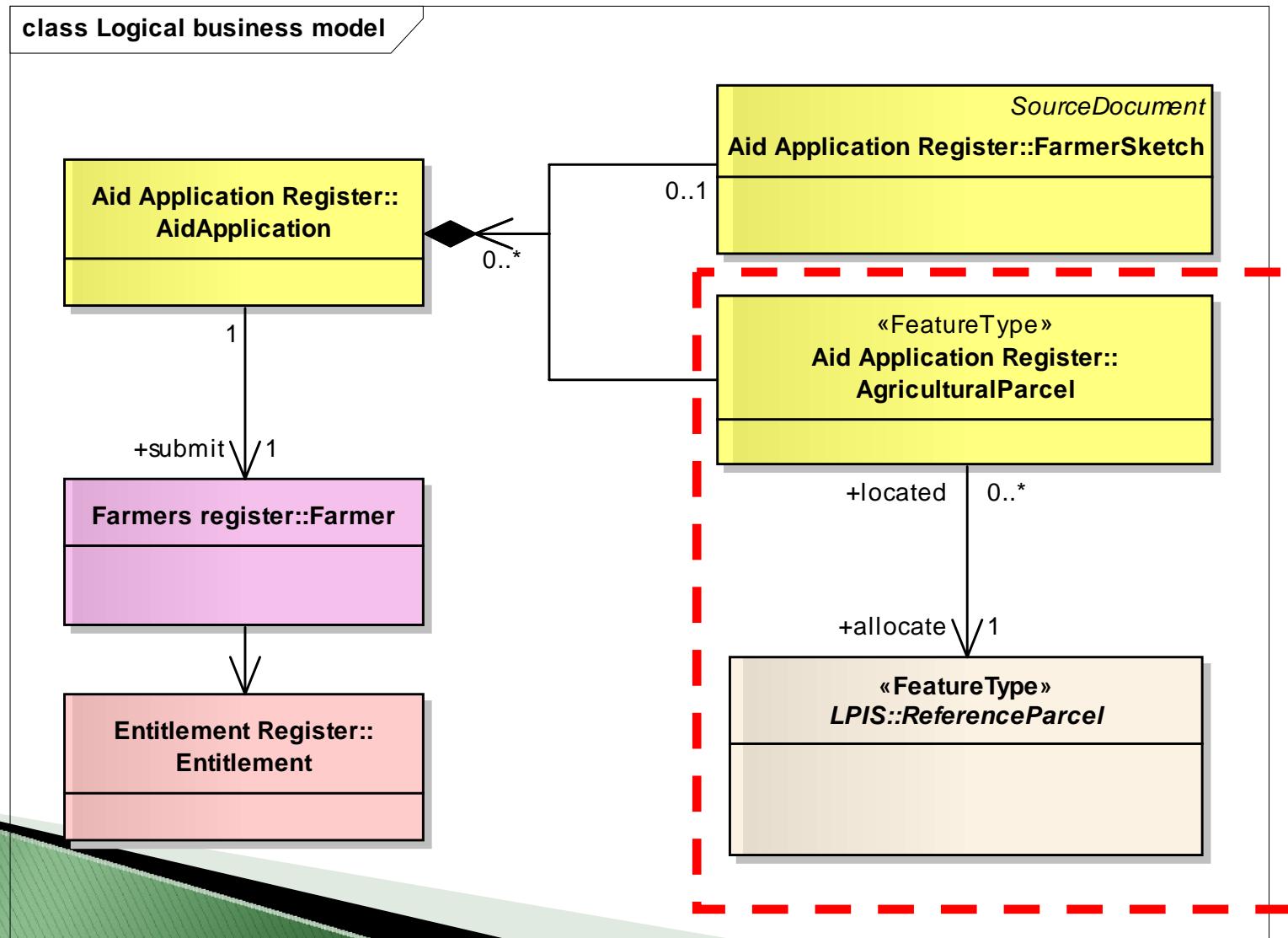
## Step 2. analysis of LPIS implementations in MS

How to deal with 27+ implementations based on .....  
.....5\* types of Reference Parcel?

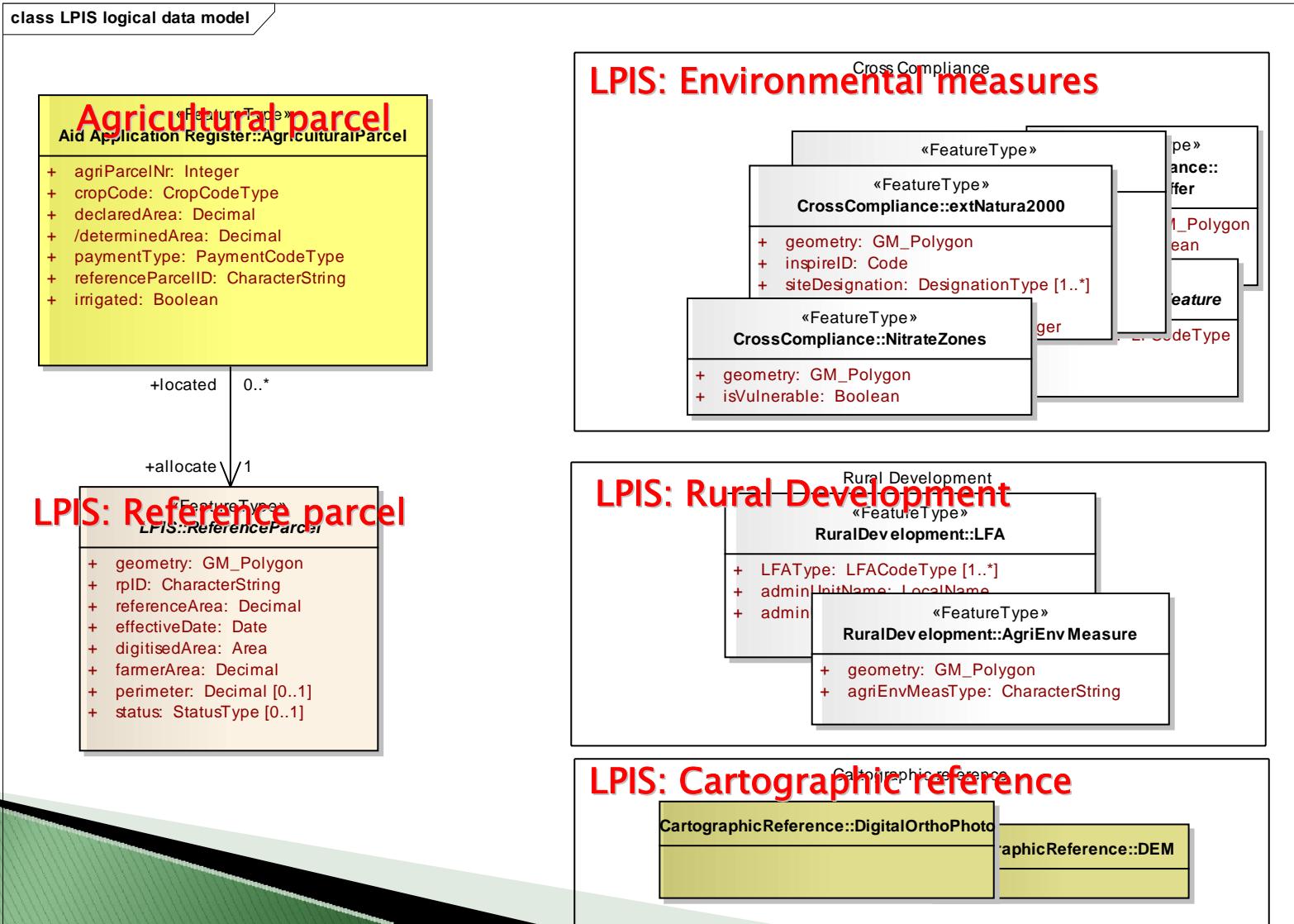


	= Agricultural parcel (spatial)	< Farmer block/ilot	< Physical block	Cadastral parcel
content / coverage	one single crop group	one or several crop groups	one or several crop groups	do not match agricultural pattern
applicants	single farmer	single farmer	one or several farmers	one or several farmers
temporal aspect	annual	multi-annual	semi-permanent	n/a

# Step 3. Basic concepts of the Integrated Administrative and Control System



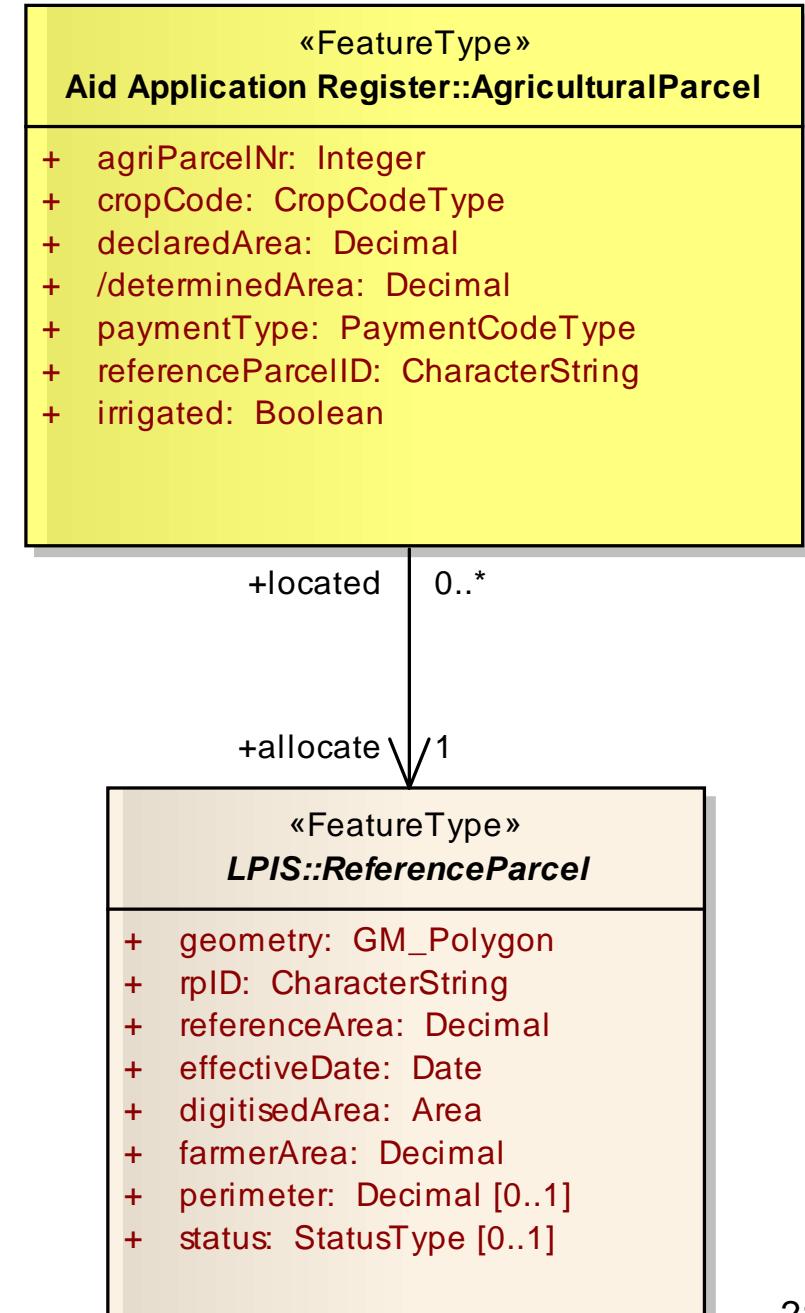
# Land Parcel Identification System data model.



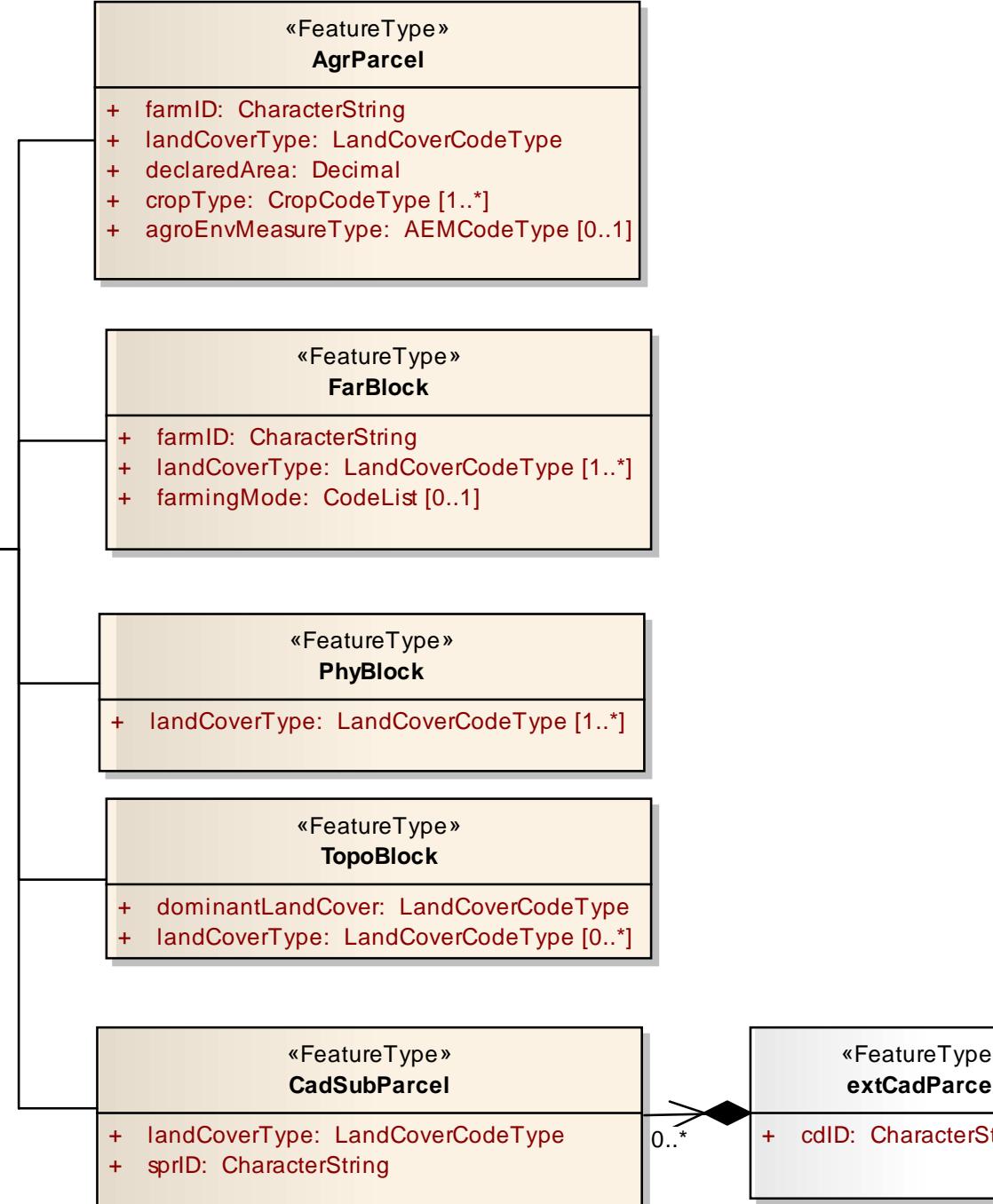
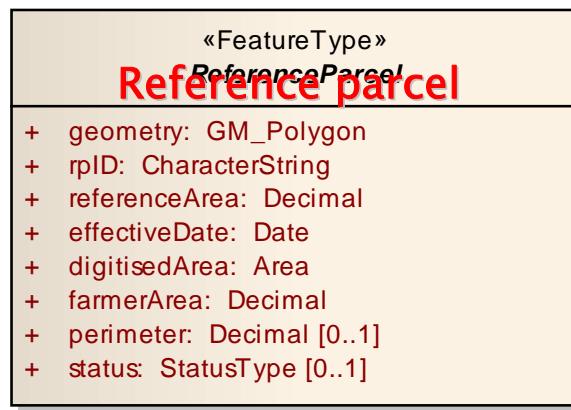
# Reference parcel vs agricultural parcel

AgriculturalParcel:  
declaredArea  
determinedArea

ReferenceParcel:  
digitizedArea  
referenceArea  
farmedArea



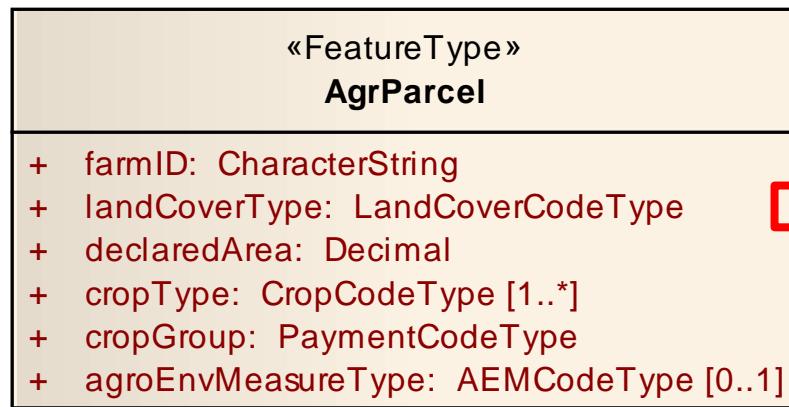
# Reference Parcel



# LandCover and LandUse



«CodeList»	LandCoverCodeType
arableLand	
grassland	
naturalGrassland	
greenhouse	
permanentTreesCrop	
permanentScrubCrop	
permanentHerbaceousCrop	
shortRotationCoppice	
irrigatedRice	
kitchenGarden	
nonAgricultural	



«CodeList»	Entitlement Register:: PaymentCodeType
SPS	
durumWheat	
proteinCrops	
rice	
nuts	
energyCrops	
arableAreaPayment	
arableRegPayment	
hop	
cotton	

«CodeList»	CropCodeType
no-crop	
wheat	
rye	
barley	
oats	
linseeds	
...	

## Reference parcel

+hasIntersection

0..\*

### «DataType» LPIS::Intersect

- + resultBoolean: Boolean [0..1]
- + resultArea: Decimal [0..1]
- + resultPercentage: Integer [0..1]

+intersectWith /1

### «DataType» LPIS::FarmingLimitation

- + FarmLimitationType: CharacterString

0..\*

## NitrateZone

+limitedBy

### «FeatureType» extNatura2000

- + geometry: GM\_Polygon
- + inspireID: Code
- + siteDesignation: DesignationType [1..\*]
- + siteName: LocalName [0..\*]
- + siteProtectionClassification: Integer

### «FeatureType» NitrateZones

- + geometry: GM\_Polygon
- + isVulnerable: Boolean

### «FeatureType» StreamBuffer

- + geometry: GM\_Polygon
- + isBuffer: Boolean
- + bufferWidth: Decimal

# Cross Compliance

## Intersect

## FarmingLimitation

### «FeatureType» LandscapeFeature

- + landscapeFeatureType: LFCODEType

+contain /0..\*

### «CodeList» DesignationType

- + SPA
- + SAC

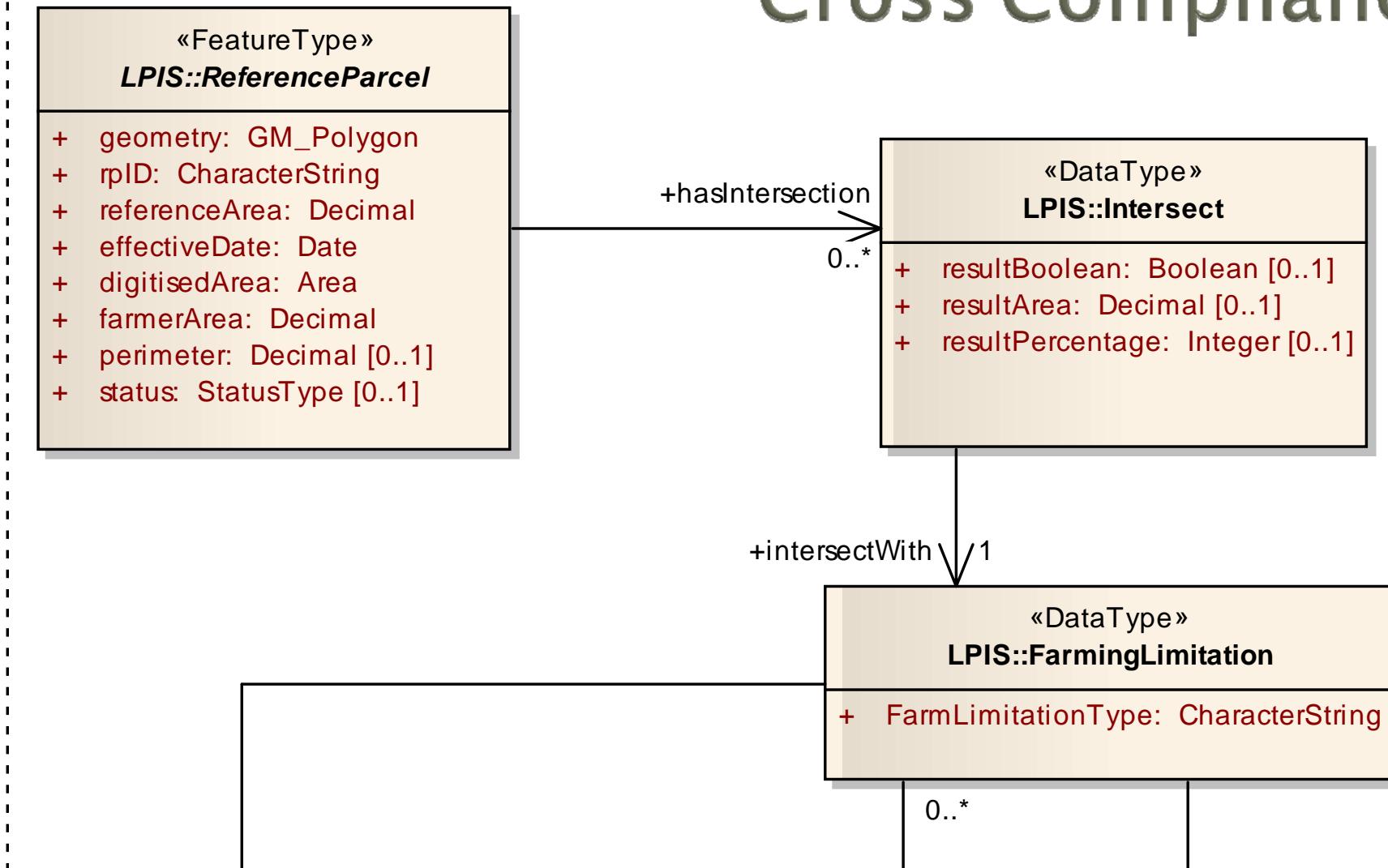
### «FeatureType» AnimalFarm

- + farmLocation: GM\_Point
- + farmRegistryCode: Code
- + farmBldCode: Code
- + farmAddress: CharacterString
- + animalType: Code [1..\*]
- + productionType: Code [1..\*]

### «CodeList» LFCODEType

- + hedges: CharacterString
- + ponds: CharacterString
- + ditches: CharacterString
- + treesInLine: CharacterString
- + treesInGroup: CharacterString
- + trees: CharacterString
- + fieldMargining: CharacterString

# Cross Compliance

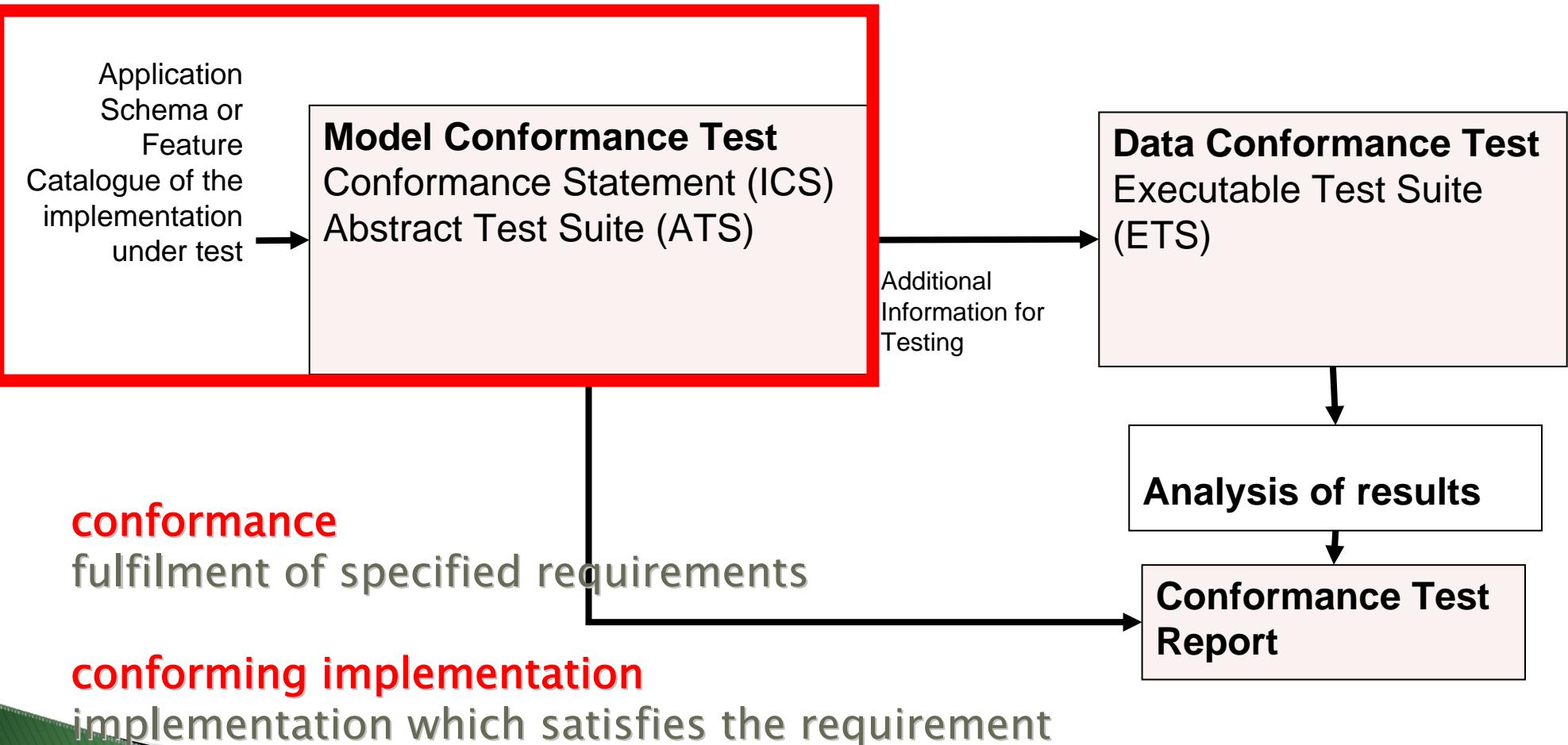


# Conformance Testing

of conceptual (logical) consistency  
is a mapping between common model and data  
model of implemented system under test

- ▶ data specifications
  - or
- ▶ between conceptual and application schema

# ISO 19105 Conformance and testing



# **Conceptual (logical) consistency**

- ▶ Common conceptual model → Conceptual schema  
(UML, data specification or Feature Catalogue → GML schema )
- ▶ Data model of implementation under test → Application Schema  
(data specification or Feature Catalogue → GML application schema)
- ▶ Mapping between common model and data model of implemented system under test  
(Via 1) data specifications or 2) between conceptual and application schema)

# ATS structure

Module A\_11

Module A\_12

Module A\_13

A\_131

A\_132

A\_133

Definition of reference parcel

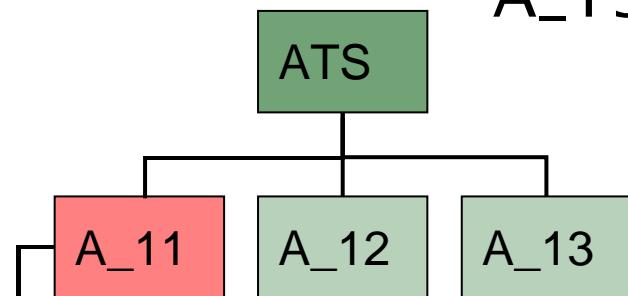
Eligible Land CoverType of  
reference parcel (land cover)

Reference parcel attributes

Obligatory attributes

Attributes for cross-compliance

Specific attributes of Reference Parcel  
types



All together 9 basic & 21 capability tests

# ATS Structure

## Module A\_131

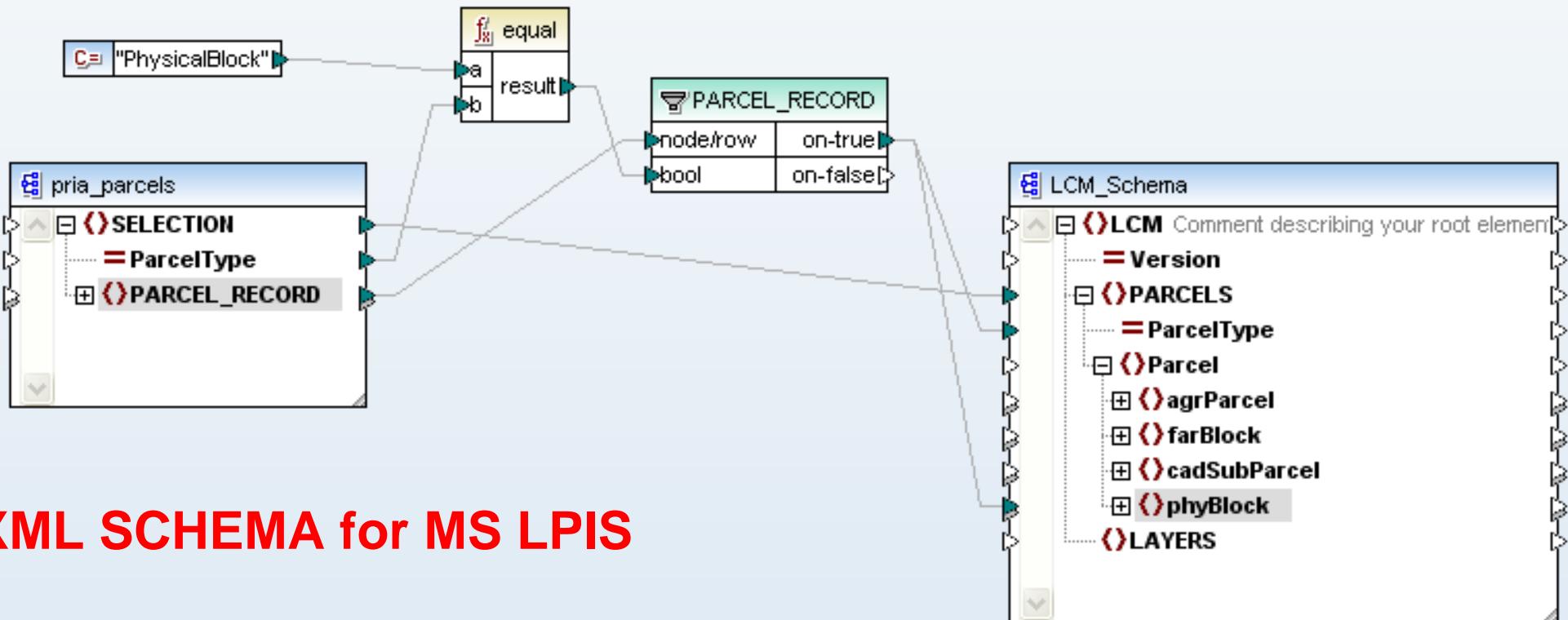
Test ID	Test purpose:	Test method:	dataset/ table	datalayer	attribute	format	value	definition (eng.)
A_1311 [capability test]	verify if there is an attribute to store: the <u>unique identifier</u> of the Reference Parcel	verify dataset, datalayer, attribute name, format, range, valid values; compliance to the requirements	<dataset/table>	<layer>	<attribute>	<format>	<value>	<definition (eng.)>
A_1312 [capability test]	verify if there is an attribute to store: <u>referenceArea</u> (maximum eligible area);	verify dataset, datalayer, attribute name, format, range, valid values; compliance to the requirements	<dataset/table>	<layer>	<attribute>	<format>	<value>	<definition (eng.)>
A_1313 [capability test]	verify if there is an attribute to store: <u>effectiveDate</u> (date when current version of the parcel became valid)	verify dataset, datalayer, attribute name, format, range, valid values; compliance to the requirements	<dataset/table>	<layer>	<attribute>	<format>	<value>	<definition (eng.)>
A_1314 [capability test]	verify if there is an attribute to store:: <u>digitizedArea</u> ; (GIS-area)	verify dataset, datalayer, attribute name, format, range, valid values; compliance to the requirements	<dataset/table>	<layer>	<attribute>	<format>	<value>	<definition (eng.)>
A_1315 [capability test]	verify if there is an attribute to store: <u>farmedArea</u> ;	verify dataset, datalayer, attribute name, format, range, valid values; compliance to the requirements	<dataset/table>	<layer>	<attribute>	<format>	<value>	<definition (eng.)>
A_1316 [capability test]	verify if there is an attribute to store: <u>validityStatus</u>	verify dataset, datalayer, attribute name, format, range, valid values; compliance to the requirements	<dataset/table>	<layer>	<attribute>	<format>	<value>	<definition (eng.)>

# ATS trial, 2009

- ▶ 5 member states participated
- ▶ 5 different reference parcel types
- ▶ Practical exercise:
  - Preparation
  - Testing
  - Reporting
- ▶ From 2010 part of CAP Quality Assurance Framework, obligatory to report by the February, 2011

# Schema mapping exercise

transformation testing assume software-aided mapping, which can be applied offline or online through the web services



**XML SCHEMA for MS LPIS**

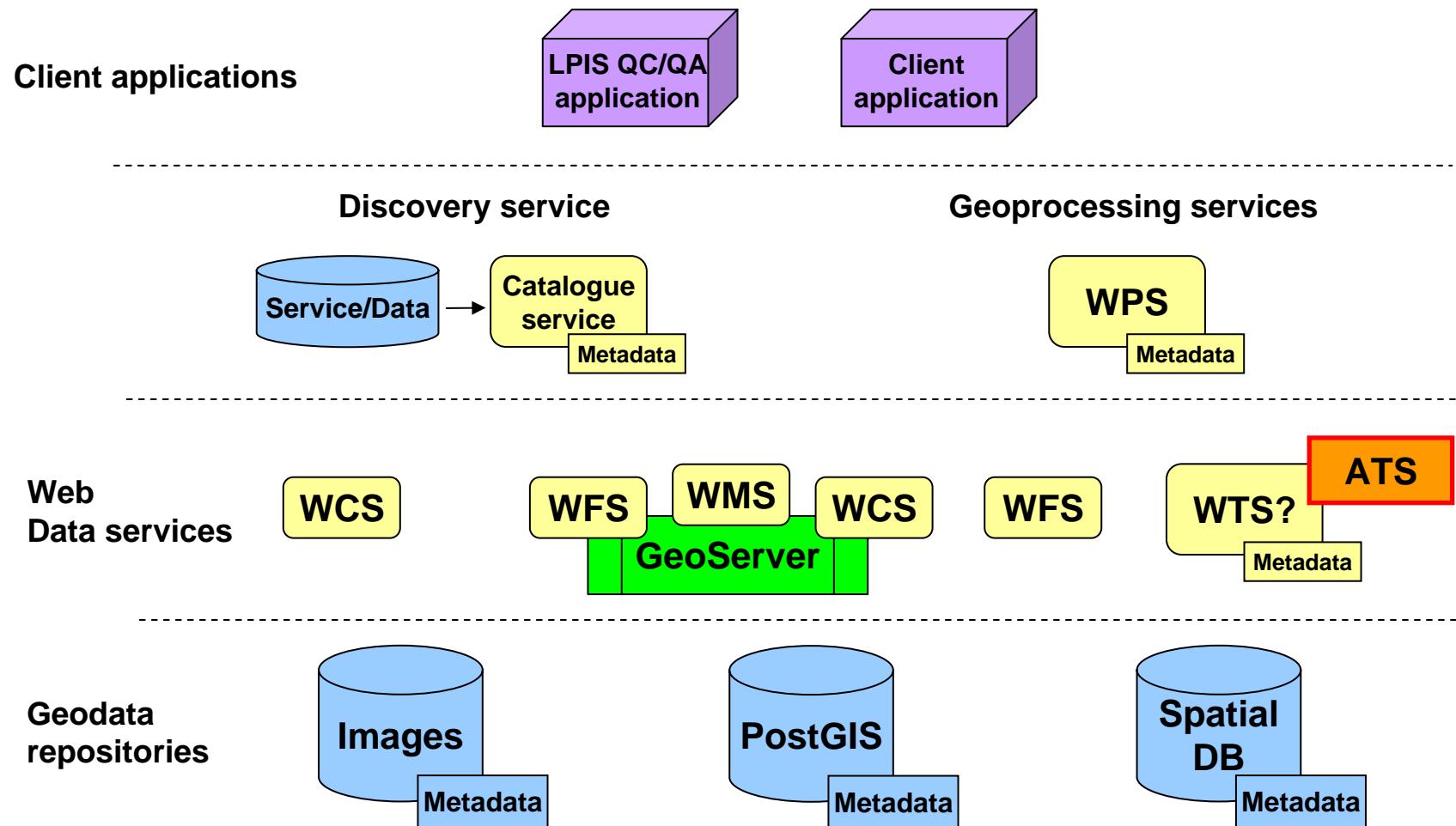
**XML SCHEMA  
LCM model**

# Transformation testing, Challenges

- ▶ the lack of a standard meta-language for model mappings.  
The XSLT – Extensible Stylesheet Language Transformation – can be used to transform XML encoded datasets, but it is reported to have weak performance when it comes to processing large GML files.
- ▶ There are several commercial and research transformation tools available,
  - Feature Manipulation Engine (FME) (Safe Software),
  - GoPublisher (Snowflake Software)
  - Radius Studio (1Spatial).

use different languages; mapping rules expressed in one software environment cannot be easily used in or imported into another.

# CAP TESTBED environment



# Conclusions

- ▶ the LCM, provides a ‘translation’ from legal text into the language of geoinformatics;
- ▶ the ATS trail proved its practicality and helped to fine-tune both the model and the test suite;
- ▶ countries participating in the trail had the possibility to assess how well their data sets are aligned with the legislation;
- ▶ the methodology allows for the repetition of the testing after major or redesign in order to prove an improvement in logical consistency.





Thank you for your attention!