Title: A7.9-D3 Profiles for security
Title: A7.9-D3 Profiles for security
Author(s)/Organisation(s):
Marian de Vries (TUD), Dániel Kristóf (FOMI), Gabriela Szomolaiová (INGR–CZ), Jerzy Wiśniewski (INGR–CZ), Sisi Zlatanova (TUD)
Working Group:
WP7
References:
1002-a7_9-d2_profiles_for_border_security__interim_-tud-001-final
Quality Assurance:
[X] Review WP Leader (WP Leader:) [ ] Review dependent WP Leaders (Depended WP Leaders:) [ ] Review Executive Board (Executive Board Members:) [ ] Review others (Other Reviewers:)
Delivery Date:

Short Description:
This document contains the final version of the application profile for border security. The profile consists of two packages: one for the operational data, and one for the topographic and other reference data. In addition attention is paid to the procedural part of crisis response by pointing at two related data models. These models are not limited to (border) security, but deal with spatial information and process flow in all kinds of crisis situations.
Keywords:

History:

Version	*Author(s)*	*Status*	*Comment*
000	Marian de Vries	new, rfc	
001	Gabriela Szomolaiová	review	
002	Marian de Vries	update	Merged texts, added chapter 3.3. and 4, moved parts to Annex

003	Sisi Zlatanova	final	Content checked

Table of contents

1 Introduction

In the previous versions of this document the focus was on the particular use cases of the HUMBOLDT Border Security Scenario. This was needed to get a better view on information needs, and data harmonisation issues in case of cross-border cooperation between organisations in the field of security.

The use of geo-information in a (border) security related scenario is an example of multi-organisation and possibly multi-jurisdiction data sharing, where different agencies in a country or adjoining countries (on the "same side" of a border incident !) must cooperate. (To avoid misunderstanding: what is meant with cross-border cooperation is not the – unfortunately not existing – cooperation between 'enemy' countries, but the cooperation between jurisdictions in the same geo-political zone, e.g. the countries of the European Union.)

There are a number of European and international agencies that deal with border security, but their publications do not contain detailed enough information to serve as example or as some kind of standard data model. This lack of published information about border security systems and data flows is of course due to the specific nature of the border security application domain. There is an exception however: the US Department of Homeland Security has developed a „Geospatial Data Model", which is published (see Chapter 5).

In Chapter 4.3 another kind of information is considered: As example of this approach national (concept) data model in Chapter 4.3

A second remark is related to the topographic and other reference layers that will be used in the Scenario. These kind of spatial objects are for clarity reasons moved to a separate package in the conceptual data model, to have a distinction between these (static) data and the dynamic operational data described in the other package.

2 Scope of the Profile

The overall Scenario application functionality is: detection of incidents along the border of Slovakia and Hungary (border intrusion, of all kinds: illegal entry, smuggle, security endangering activities).

The following use cases have been specified in the WP9 Report:

HS01-01: Topographic Data Management

HS01-02: Human Intrusion

HS01-03: High Level Management

HS01-04: Strategic analysis

HS01-05: Strategic Planning

The first use case prepares for the other 4 uses cases: in this topographic data management use case the static datasets of the countries are harmonised with each other, in preparation of the other 4 use cases.

Use case 2 and 3 are the operational use cases (border crossing incident response), and the last two

(4 and 5) can be characterised as ‚analysis, reporting and policy preparation' tasks.

To summarize, the scope of these use cases is:

- (simulated) intruder detection
- event monitoring
- response management (organisational)
- provision of harmonised topographic and administrative data

For this final Profile for Security we added the following subject to the list:

- general risk/security management process flow (organisational)

3 Information analysis

The table below gives an overview of the information content that is needed in border security applications, and the purpose for which the specific (spatial) information is used (input) or produced (output).

Information item	**Purpose**
Location, names and types of **transport network**	Getting information on **road, street, railroad network**: ▪ Basic data set for spatial analysis and strategic planning ▪ Basic data set for defining pre-configured procedures
Location, types and names of **rivers**	Getting information on **hydrography**: ▪ Basic data set for spatial analysis and strategic planning
Land cover / Aerial images	Getting information on **open and built-up areas**: ▪ Providing information on types of land cover (forest, settlements, water, farm land …) ▪ Basic data set needed for orientation purposes
DTM	Getting information on **elevation ratio**: ▪ Detecting possible ways of intrusion and breakaway ▪ Basic data set for spatial analysis and planning
Sensor data on the border	Getting in situ information of the **crisis situation**: ▪ Data provided by digital sensors or human about the crisis situation (phone calls, images, videos etc.)

Internal secured data	Getting information on **patrol units**: ▪ In situ data - position, equipment of the patrol units, number of unit members etc. ▪ Information on transport equipment
Pre-defined procedures according to specific constraints of the event	Getting information on **process** to handle the crisis situation: ▪ Processes are pre-defined in the system according to specific constrains ▪ On basis of the procedures C&C centers are able to handle the crisis situation quickly and effectively
Output: Maps and tables in reports using harmonised terminology and graphical representation	To have comparable statistics and maps about border intrusion and other security related incidents

4 Profile for border security

For the geo-information that is needed in (border) security applications a distinction can be made between the data about incidents (both dynamic sensor data and historical data in reports) on the one hand, and topographic reference layers and information about administrative regions and responsible agencies on the other hand.

Therefore the data model for border security developed in HUMBOLDT consists of two packages, one for the operational data (Section 4.1) and another one for the topographic and other reference data (Section 4.2).

There is also a third kind of information needed: who does what in which specific situation (procedures and responsibilities), where the „who" says something about „which agency or organisation" and about the specific user roles in those organisations. This procedural part of operational (crisis) situations can also be subject of data and process modeling. This is shortly discussed in Section 4.3.

Finally there is a strong link with real-time, sensor data management. For the sensor management part of the information flow one of the issues is how to combine data streams from different sensors controlled by different agencies in real-time.

4.1 Incident detection

The ‚intrusion detection and reporting' package specifies the dynamic data: the captured events, and the reports and continuous updating of the location of the ‚actors' (intruder, patrol unit) (red lining).

This part of the model could not be verified against possibly existing standards in this application domain (in Europe or international). Therefore, in reality, the data and information flows will certainly differ from the model developed here.

The UML model in Figure 1 gives the main components of this package. As can be seen, the package also contains a class as placeholder for a document system or database with procedures and specific tasks for each type of incident (i.e. the IncidentSpecificProcedure class).

For the crisis response part also “procedure harmonisation” is necessary, plus digital storage of and access to the tailored procedures and tasks per type of event and level of urgency.

When deciding on the scope of the Profile the issue was raised whether or not internal data (of the agencies involved) needed to be included in the conceptual data model. In the use case descriptions in the Border Security Scenario there is also data/information mentioned as ‚internal secured’. The question is whether this data needs to be harmonised (and can be harmonised). Can it remain as it is (because it is not exchanged between the border security organisations?). Or is it necessary to also look at this internal data because of the strategic analysis.

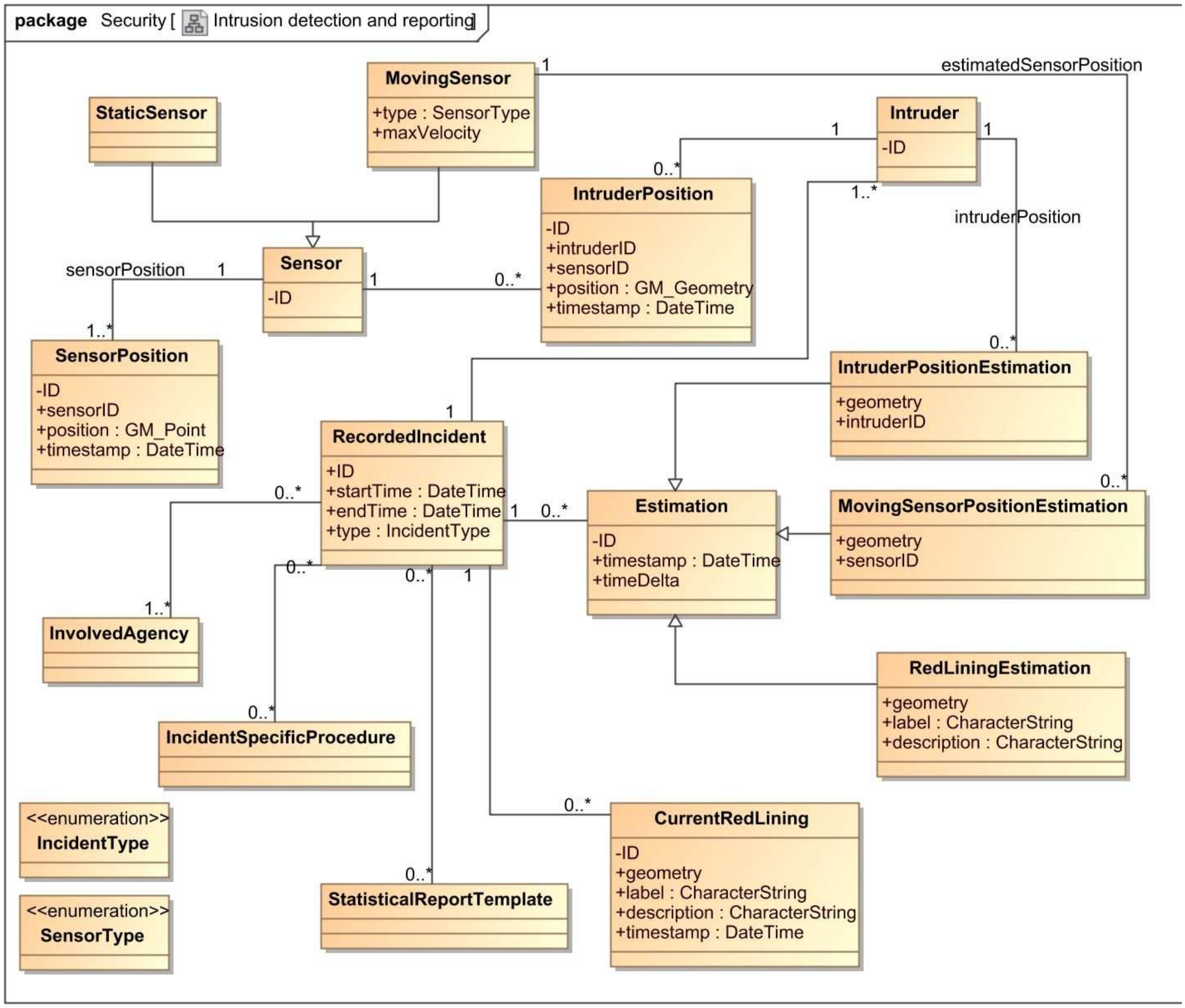


Figure 1 Data model, intrusion detection and reporting package

and reporting use cases. For the construction of the Profile it was however decided to leave the internal information flow out of the data model.

4.2 Topographic and other reference data

The second package defines the topographic and other reference data, see Figure 2.

This kind of geo-information is needed as detailed background layer for orientation and navigation. It is also used later for spatial analysis of physical border conditions, and for creating maps and statistical overviews in the reporting phase.

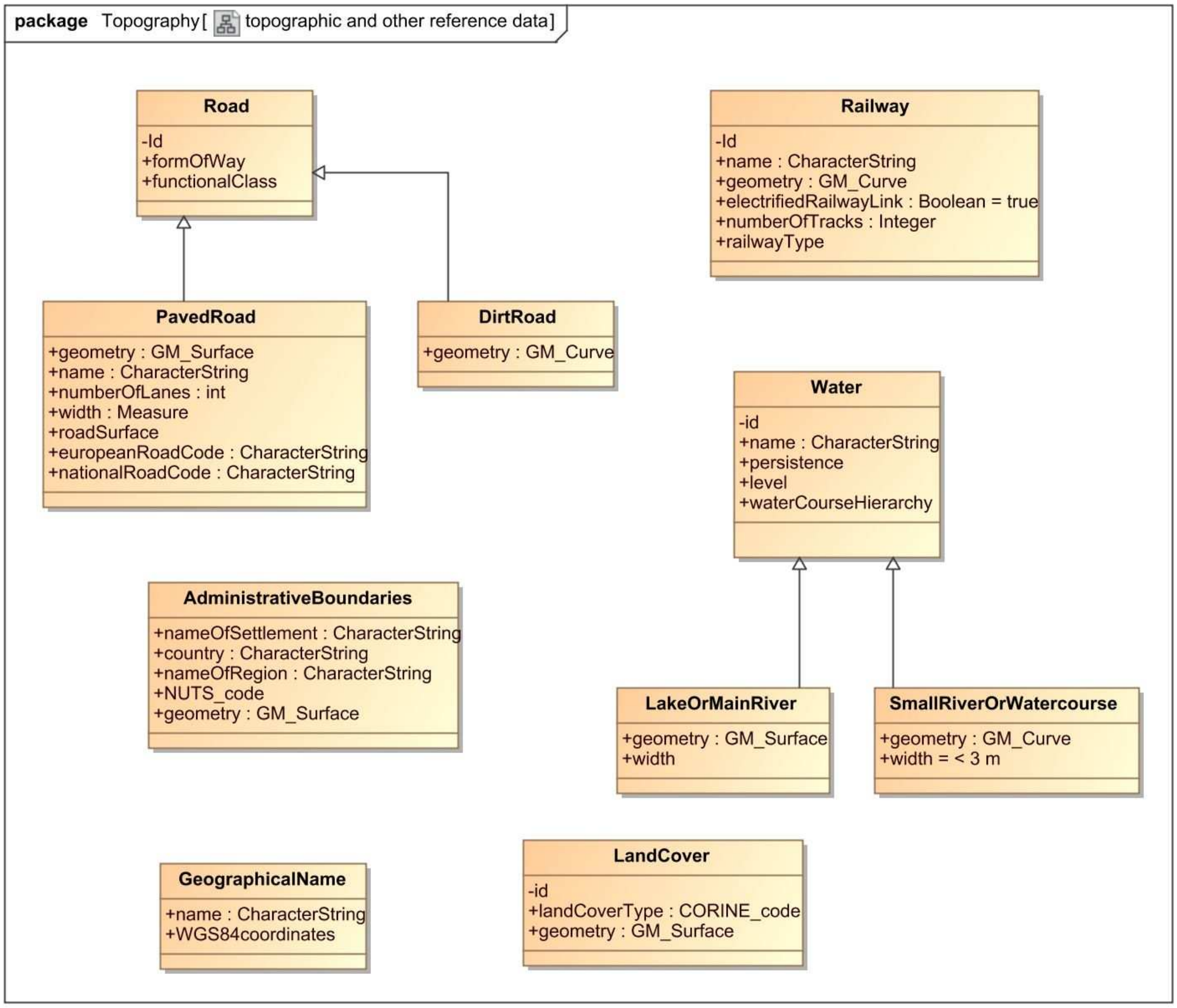


Figure 2 Data model, topographic and other reference data

For this ‚topography and other’ package a number of INSPIRE Annex I theme data models are relevant, that is: Hydrography, Transport Networks, Administrative Units and Geographical Names.

A number of attributes of the classes in the package are re-used from these Annex I data specifications, but complete INSPIRE spatial object types have not been re-used in their entirety, because of lack of corresponding data items in the available data sources (also see Annex B.).

4.3 Incident response: tasks and decisions

Border security applications can be seen as a special case of crisis response systems. In crisis response apart from the information flow, there is also the “chain of command” issue, and more in general the question who does what and when, depending on the type of crisis and on the specific phase in the crisis (Dilo and Zlatanova, 2008).

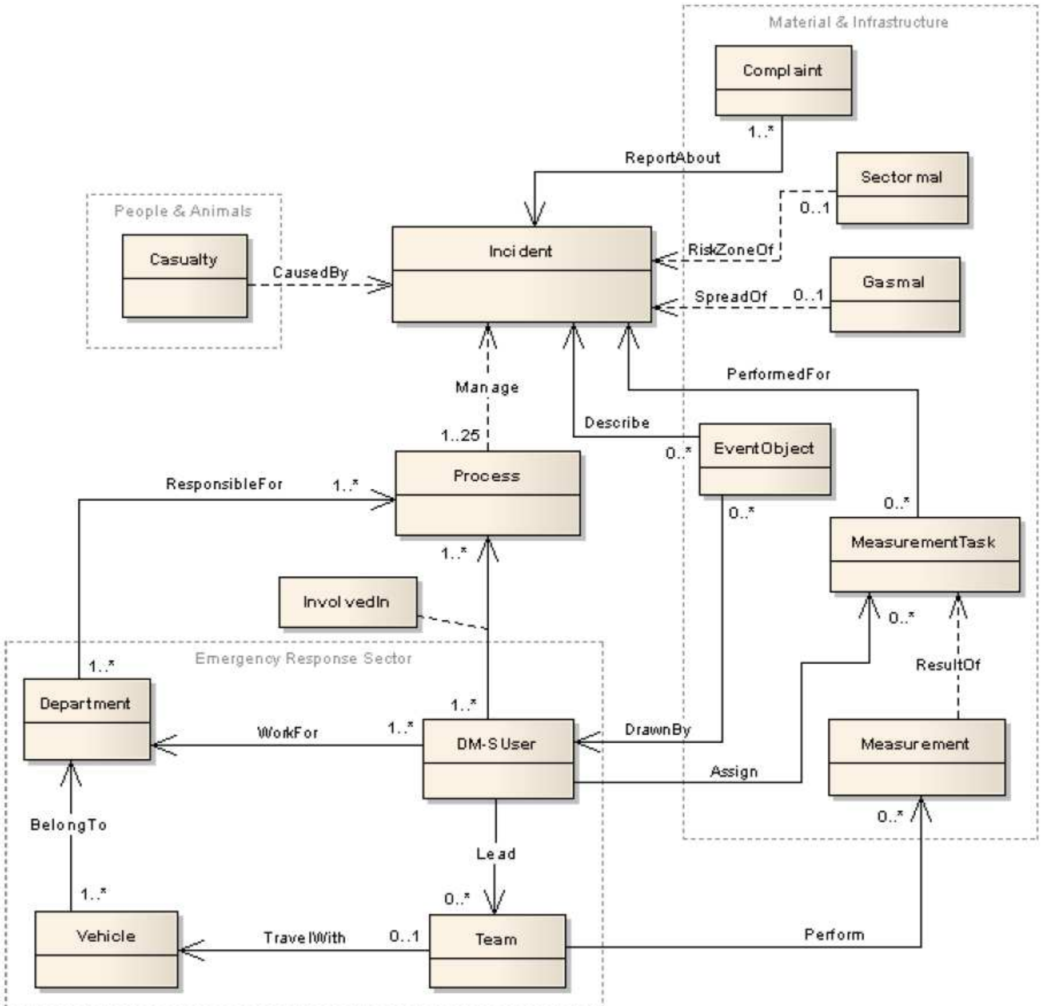


Figure 3: Observed events, processes and user roles (source: Dilo and Zlatanova, 2008)

The data model shown in Figure 3 is an example of a national profile for crisis response, in this cases developed in the Netherlands. In this model the central role of ‚Incident' and of ‚Process" is clearly visible.

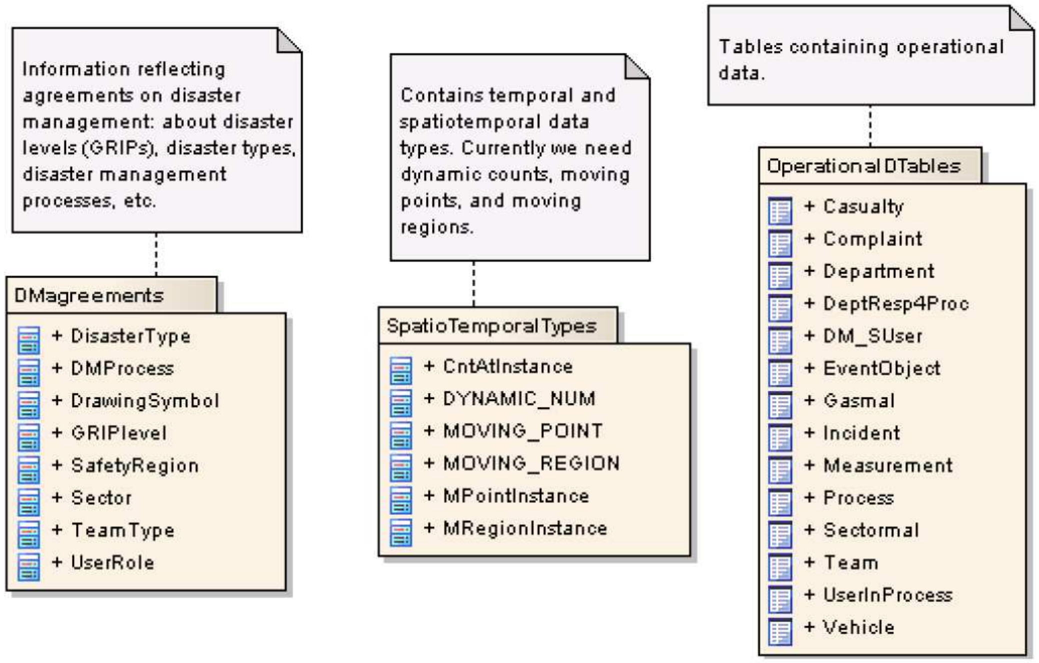


Figure 4: Components of crisis management data model (source: Dilo and Zlatanova, 2008)

XXX

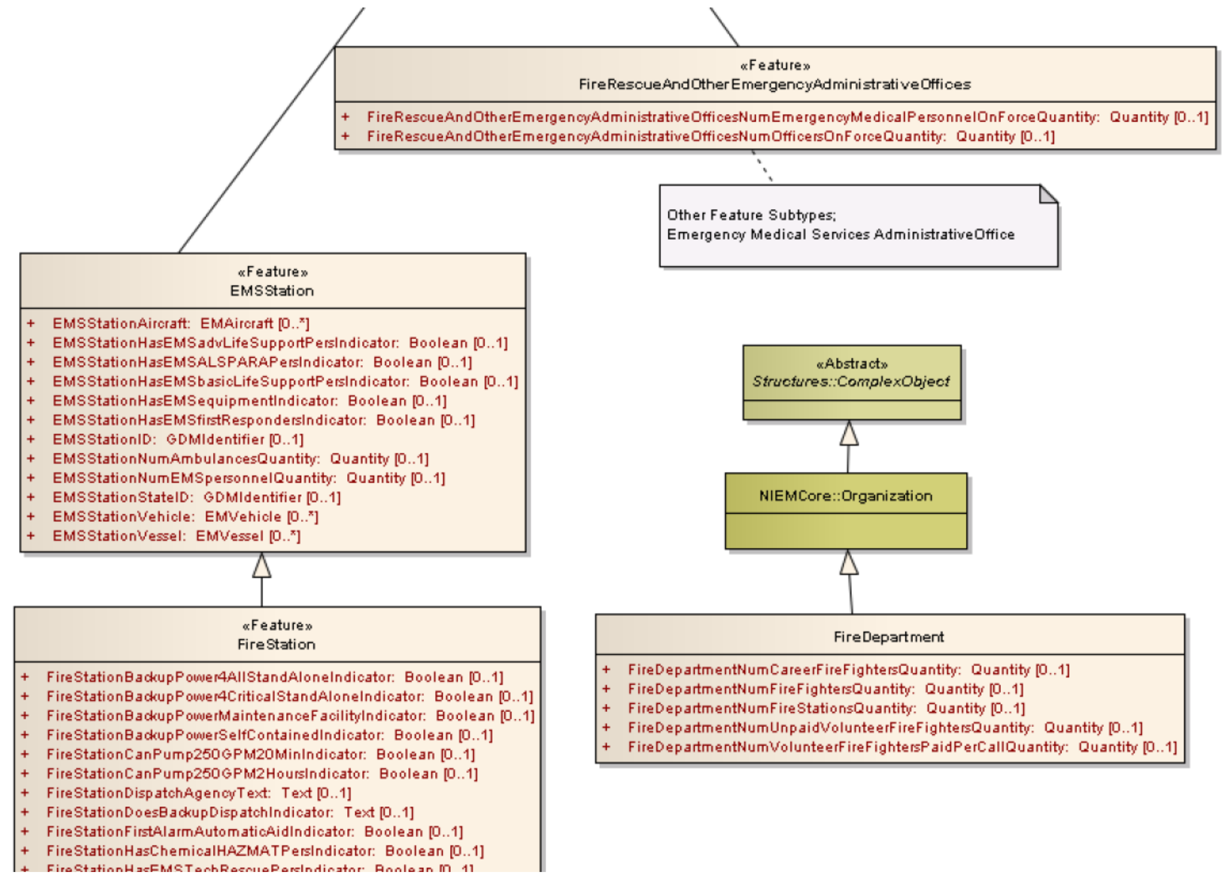
The application domains of crisis management and disaster management have evolved the last 10 years into research areas with high public interest. An initiative that in the future can be an additional source for data models for crisis response is the Information Systems for Crisis Response and Management (ISCRAM) discussion and research community, see http://www.iscram.org

5 Related data models

5.1 DHS Geospatial Data Model

In the US the Department of Homeland Security has developed an extensive „Geospatial Data Model“ that covers a broad range of security-related incidents and crises. In Figure 5 a small part of the model is shown (source: DHS 2010, UML model, version 2.5).

It depicts an EmergencyServiceFacility, in this case a fire station. Note the distinction between the operational unit (the fire station itself) and the administrative side (the fire department). Also for other Emergency Services this distinction is made.



The „Geospatial Data Model“ is very extensive, which makes it complex to re-use only parts of it in a data profile for border security. On the other hand, since most attributes are optional, this does not have to be a serious problem. Nevertheless it is probably better to look for data modeling ideas and patterns that can be borrowed from this model, and not for concrete classes and associations.

6 Related projects

EuroBoundaryMap, http://www.eurogeographics.org/products-and-services/euroboundarymap

European Border Surveillance System (EUROSUR)

FRONTEX, http://www.frontex.europa.eu/

Havlik D., Bleier T., Schimak G. Sharing Sensor Data with SensorSA and Cascading Sensor Observation Service. *Sensors*. 2009; 9(7):5493-5502

ISCRAM (Information Systems for Crisis Response and Management), http://www.iscram.org/

LIMES (Land and Sea Monitoring for Environment and Security), http://www.fp6-limes.eu/

OGC Sensor Web Enablement WG, http://www.opengeospatial.org/projects/groups/sensorweb

SANY Sensor Anywhere - IST FP6 Integrated Project, http://sany-ip.eu/about_sany

SeBoCom (Secure and Interoperable Border Communications)

7 References

DHS 2010. DHS (US Department of Homeland Security) Geospatial Data Model, http://www.fgdc.gov/fgdc-news/geo-data-model-v25

Dilo, A. and S. Zlatanova (2008). Spatiotemporal Data Modeling for Disaster Management in the Netherlands. Proceedings of the Joint ISCRAM-CHINA and GI4DM Conference, Harbin, China.

INSPIRE data specifications (for roads, rivers, and administrative units): http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2

OGC (2007a). OpenGIS® Sensor Model Language (SensorML) Implementation Specification, Version: 1.0.0. OGC® 07-000

OGC (2007b). Sensor Observation Service, Version: 1.0. OGC 06-009r6

OGC (2007c). OpenGIS® Transducer Markup Language (TML) Implementation Specification, Version: 1.0.0. OGC 06-010r6

Usländer, T., RM-OA - Reference Model for the ORCHESTRA Architecture Version 2 (Rev. 2.1). OGC Best Practices Document 07-097

Annex A: Data harmonisation requirements

The specification of the Profile for Security that is presented in this document took place in the context of the development of use cases in the HUMBOLD Border Security Scenario. As part of the information analysis phase also the main data harmonisation issues in the Scenario were identified. For documentation purposes this list is included in this Annex A.

1 Data format

The commonly used data formats can already be read directly by GIS client systems, others need to be converted first.

This topic should be solved by harmonisation in the HUMBOLDT framework, where an expert user would be able to choose what the output data format is.

Harmonisation of the data format can be achieved via standardised web services (WMS, WFS).

2 Spatial and temporal reference systems

2.1 Spatial reference system

The spatial reference systems differ between Slovakia and Hungary:

Slovakia has: S-JTSK (Systém – Jednotné Trigonometrické Sítě Katastrální = System – Uniform Trigonometrical Cadastral Network), which is EPSG: 2065

For the Slovakian DTM dataset the vertical datum used is: BpV (Balt po vyrovnaní = Baltic Vertical Datum-after Adjustment).

Hungary has: HD72 / EOV (Egységes Országos vetület = Uniform National Projection), which is EPSG:23700.

Current solution:

The differences in spatial reference systems are partly solved in the GIS client, which manage the coordinate transformation process internally (if the coordinate systems are known, and defined in the system).

Approach in the Scenario:

Relevant for the Scenario are the following SRS systems: EPSG 102067, 2493, 2494, 28403, 28404, 32633, 32634 and 4326.

Coordinate transformation between these systems should be supported by the software used in the Scenario, either in the GIS clients, or in the WMS/WFS services, or with a separate transformation service.

3 Conceptual data model

Yes, the conceptual data models for the basic geographic reference information differ between

Slovakia and Hungary. Adding more countries will increase the differences in data models.

Current solution:

The differences in data models are solved manually or with semi-automated tools for model harmonisation. These solutions can only be used by expert users, which is a disadvantage.

3.1 Geometry types

The ‘intrusion detection and reporting’ package holds the sensor data and has to deal with moving objects. A flexible way to construct tracks from point measurements is needed. But otherwise there are no complex geometry issues, because only the point, polygon, and line geometry types will be used.

3.2 Importance of time / Dynamic data

For the sensor data this is of course very important. It is necessary to harmonise the way time and date are specified, and how history of the (filtered) sensor data is kept. There are examples in international standards, which will be followed in the Scenario where possible.

4 Classification

Yes, the classification scheme issue is relevant, for example for the distinction between crisis levels (severity of the incident) because of the cross-border communication. And also for the static data, such as the land cover classification.

Harmonisation of classifications is partly dealt with through the specifiation of the common data model, which will include common code lists, and partly by constructing additional terminology listings or thesauri.

5 Terminology

Yes, the differences in used terminology/vocabulary are a relevant issue for the cross-border information exchange and cooperation in the field in responding to indicents along the border.

Approach in HUMBOLDT:

Implementing catalogues dealing with used terminology from all involved countries.

Once this is done, also the legends and symbols of the maps and the terminology used in the reports can be harmonised, using the correct vocabulary and graphical representation, also see: Portrayal.

6 Metadata

Metadata in HUMBOLDT should be in compliance with INSPIRE and ISO. For the Scenario it is in addition important that the metadata is shown to end-users in a "human readable" format.

7 Scale, aggregation

Detailed reference maps are needed to accurately position the border security events. Therefore

1:10,000 maps (vector and raster) are a minimum condition, having a larger scale would even be better.

It would be good to have the same map scale on both sides of the border. If this is not the case, automated map generalisation, could help. However, for the operational phase, automated generalisation of (vector) maps does not have a high priority. Also aerial photos or satellite images can be used for navigation and orientation.

For the reporting phase, thematic (and geographic) aggregation will be useful: number of incidents can be collected per small region, but also at the provincial level, or for the country as a whole. This can however be handled by the normal existing GIS tools.

8 Portrayal

Every user/organisation uses its own style and legend for visualisation. Currently the differences are solved manually by defining a certain portrayal style.

In HUMBOLDT, in the Border Security Scenario, users solving crisis situations should have the ability to choose from pre-defined portrayal styles that are then applied to the datasets of the different countries that have the same thematic content. This interoperability will make the communication easier, e.g. between different local Command centres.

The common portrayal style should also include the map legends. These legends should anyhow be clear for non-expert users. Language translation / localisation is an option for the legends (see 10: Multi-linguality).

9 Processing functions

Not in the strict sense of algorithms and parameters, but in the sense of having the same thresholds and warning levels. And secondly in having agreed-upon procedures how to respond to certain incidents: the crisis response organisational aspect. Specifying these common procedures is out of scope for the Scenario, but a database or document system with procedures and tasks specific to certain situations is an element in the common data model (see Chapter 3).

10 Multi-linguality

Yes, this is an issue, because the Border Security agencies in Slovakia and Hungary use their systems in different languages. Translation of important terms in incident response is needed. Implementing international catalogues for the used terminology (dictionaries) could help. But in an operational situation (in the field, or in a Comand centre) it is too slow when someone has to first manually look up the relevant terms in the agreed-upon common language. Automated language translation is then an option: the application software should be able to execute language transformation of the used terminology in different languages to the target language.

A reverse strategy is that translation is sometimes warranted the other way around: from common language (English?) to the local language, which could be of benefit in case of non-expert users of for example land use maps.

11 Spatial, temporal and thematic consistency of data

11.1 Spatial consistency

This is an important data harmonisation aspect for Border Security. Data from adjoining regions, with potentially overlapping areas, must form a consistent layer (data set), to avoid misunderstanding. Having software and best practices for edge matching is therefore very relevant.

12 Priorities

Both levels of harmonisation (the general, data model and complete data set, level, and the individual spatial object instance level) are important in this Scenario.

High priority is given to: common terminology and portrayal, language translation (multi-linguality aspect), and to spatial and thematic consistency (seamless and consistent map layers using edge matching techniques).

All of these are important preconditions for fast and consistent decision making in operational situations. For the reporting phase again terminology and portrayal is important, and in addition having the possibility of thematic and geographic aggregation into statistical results at different aggregation levels.

Annex B: Example data sources

This list is an example of the type of data sources that contain the information needed in border security applications. The data sets in the list are for Hungary, unless indicated otherwise. For a complete overview, with more details per data source, see document: 920-hs_border_security_data_specifications-fomi-001-new.

Information item	**Data sets**
Location, names and types of **transport network**	Paved roads: topo_10k_polygon Dirt roads: topo_10k_line Railways: topo_10k_line (all vector)
Location, types and names of **rivers**	Lakes and main rivers: topo_10k_polygon Small rivers and watercourses: topo_10k_line (all vector)
Land cover	CLC50_HU (vector)
Topographic map	Topo_10k_ras_HU (raster)
Aerial images	Orto50cm_2005_HU (orthophotos)
DTM, elevation	DDM5_HU (raster)
Administrative boundaries	For Hungary: admin_bdrs_HU (vector) For Slowakia there is a WMS service with administrative boundaries at: http://www.geonet.sk/main_en.htm
Geographical names	FNT (Gazetteer of Hungary) (MS Access database)
Sensor data on the border	No ‚real' data available, possibility is to create simulated sensor data
Internal secured data	Same as above
Pre-defined procedures according to specific constraints of the event	Textual format or queryable database