DELIVERABLE

Project Acronym: **E.L.F.**

Grant Agreement number: **CIP 325140**

Project Title: **The European Location Framework**

D 2.4: E.L.F. Basemap

Revision: Final

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Project co-funded by the European Commission within the ICT Policy Support Programme		
Dissemination Level		
P	Public	P
C	Confidential, only for members of the consortium and the Commission Services	

the Competitiveness and Innovation framework Programme (CIP)
ICT Policy Support Programme (PSP) Call 6 (Grant 325140)

Revision History and Statement of Originality

Revision	Date	Author/Editor	Organisation	Description
0.1	29/10/2014	Dominique Laurent	IGNF	Baseline
0.2	31/10/2014	Anja Hopfstock	BKG	Editorial changes
0.3	14/11/2014	Dominique Laurent	IGNF	Comments from OS taken into account
0.4	14/11/2014	Anja Hopfstock	BKG	Editorial changes
0.5	19/12/2014	Dominique Laurent	IGNF	Comments from PMG taken into account
1.0	23/01/2015	Anja Hopfstock	BKG	Comment resolution and final editorial changes

Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

E.L.F. Basemap

Sub-title goes here

References

Ref.	Title/Version/Publication Date/Author
[1]	E.L.F. Annex I Description of Work
[2]	D2.9 Data Specification Regional/Global
[3]	D2.10 Data Specification Master
[4]	ELF Glossary http://www.elfproject.eu/documentation/glossary
[5]	OSGB Cartographic design principles http://www.ordnancesurvey.co.uk/resources/carto-design/carto-design-principles.html

Figures

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1 Introduction

1.1 Purpose

This document describes the concept of the ELF BaseMap service and the challenges to resolve in the multinational production effort.

1.2 Terminology

The ELF Glossary **Feil! Fant ikke referansekilden.** defines basic terms relevant for the ELF project. Beside this generic glossary, the following terms are used in this document:

Acronym	Term	Definition
AU	Administrative Units	INSPIRE/ELF theme
BU	Buildings	INSPIRE/ELF theme
CRS	Coordinate Reference System	
EBM	EuroBoundaryMap	http://www.eurogeographics.org/products-and-services/euroboundarymap
EL	Elevation	INSPIRE/ELF theme
EGM	EuroGlobalMap	http://www.eurogeographics.org/products-and-services/euroglobalmap
EPSG	European Petroleum Surveying Group	
ERM	EuroRegionalMap	http://www.eurogeographics.org/products-and-services/euroregionalmap
GML	Geographic Markup Language	http://www.opengeospatial.org/standards/gml
GN	Geographical Names	INSPIRE/ELF theme
HY	Hydrography	INSPIRE/ELF theme
LC	Land Cover	INSPIRE/ELF theme
LoD	Level of Detail	
NMCA	National Mapping and Cadastral Authorities	
TN	Transport Network	INSPIRE/ELF theme
SLD	Styled Layer Descriptor	http://www.opengeospatial.org/standards/sld
WMS	Web Map Service	http://www.opengeospatial.org/standards/wms
WMTS	Web Map Tiled Service	http://www.opengeospatial.org/standards/wmts
WP	Work Package	

2 General description

2.1 Objective

BaseMap is a pyramid of digital maps, at different zoom levels, built from the ELF harmonised data [4]. It will be available as the ELF BaseMap Service.

2.2 Expected usage of BaseMap

The main envisaged use of BaseMap is to serve as background map to enable professional users to display their data in client applications such as websites, GIS and increasingly mobile devices. It might be used also as background data for other types of applications.

BaseMap might be used also for consultation by citizens and professionals, typically as background map for Geo Locator or other ELF applications.

Users would be allowed to print BaseMap but BaseMap is not designed for printing.

2.3 Geographic extent

BaseMap aims to cover geographic Europe (oversea territories excluded).

In general, oversea territories of European states are in the scope of ELF data. However, their provision in ELF Basemap poses some technical issues (choice of CRS, additional data to provide the necessary context). Further, the availability of data for these territories in the timeframe of the project is in question. Thus, the project team decided to focus first on geographic Europe.

2.4 Content

The BaseMap content will be derived from the ELF data provided by the ELF partners (NMCAs) or by third party or obtained from EuroGeographics data (EGM, ERM, EBM, EuroDEM).

According to its level of zoom, BaseMap will mainly use data from themes AU, GN, HY, TN, EL, BU, LC, and BU.

This data will be used at different levels of detail:

- Global: around 1:1 000 000
- Regional: around 1:250 000
- Master LoD2: around 1:50 000
- Master LoD1: around 1:10 000

NOTE: The ELF data models are NMCA profile of INSPIRE.

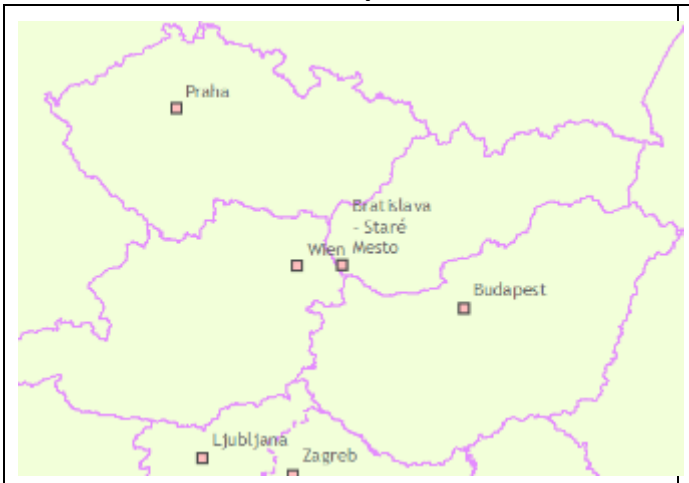
The BaseMap aims to display the current world with the best possible actuality; the features that do not exist any longer (demolished, deprecated) or who do not exist yet (in project) won't be shown on BaseMap.

2.5 BaseMap versions

There will be potentially 2 versions of BaseMap:

- Administrative BaseMap (will be tested, alternatively it will be integrated to the Topographic Basemap) : the content will come from the theme AdministrativeUnits
- Topographic BaseMap : main content will come from themes TN, HY, GN, LC, EL, LC and BU

Table 1 ELF BaseMap versions

	
Potential Administrative BaseMap (5,7 M)	Potential Topographic BaseMap (500K)

NOTE: the Administrative BaseMap has 2 main purposes:

- *External: some users will likely be interested by an administrative background (to display user content geocoded using AU data).*
- *Internal:*
  - *the design of BaseMap raises several issues (cf next chapters). The administrative BaseMap with its limited content, aims to fix the methodology*
  - *in addition, the objective is to offer at least a BaseMap by February 2015 (for the ELF platform). The administrative BaseMap may hopefully be ready at this date whereas the topographic BaseMap that is quite more complex is now scheduled by end of June 2015.*

2.6 Coordinate Reference System

BaseMap will be provided in:

- Web Mercator (WGS / Pseudo Mercator ; EPSG : 3857)
- Lambert Azimuthal Equal area (ETRS89 / LAEA Europe **;** EPSG : 3035)

Same CRS will be used for cascaded view services; this will enable users to use together the ELF BaseMap and the various ELF layers with their associated symbols (designed by the ELF "visualisation" activity).

2.7 Levels of zoom

The standard for zoom levels has been chosen by ELF PMG (Project Management Group). There were several candidates, according to the potential CRS: the zoom levels used by Web Mercator, by LAEA, by EPSG: 3034, by EPSG: 4258 and by INSPIRE-CRS84-QUAD.

The zoom levels used for ELF BaseMap are a subset of the zoom levels defined for Bing Maps Tile System.

Level of Detail	Map Width and Height (pixels)	Ground Resolution (meters / pixel)	Map Scale (at 96 dpi)
4	4,096	9,783.9396	1 : 36,978,669.43
5	8,192	4,891.9698	1 : 18,489,334.72
6	16,384	2,445.9849	1 : 9,244,667.36
7	32,768	1,222.9925	1 : 4,622,333.68
8	65,536	611.4962	1 : 2,311,166.84
9	131,072	305.7481	1 : 1,155,583.42
10	262,144	152.8741	1 : 577,791.71
11	524,288	76.4370	1 : 288,895.85
12	1,048,576	38.2185	1 : 144,447.93
13	2,097,152	19.1093	1 : 72,223.96
14	4,194,304	9.5546	1 : 36,111.98
15	8,388,608	4.7773	1 : 18,055.99
16	16,777,216	2.3887	1 : 9,028.00
17	33,554,432	1.1943	1 : 4,514.00
18	67,108,864	0.5972	1 : 2,257.00
19	134,217,728	0.2986	1 : 1,128.50
20	268,435,456	0.1493	1 : 564.25
21	536,870,912	0.0746	1 : 282.12
22	1,073,741,824	0.0373	1 : 141.06
23	2,147,483,648	0.0187	1 : 70.53

Table 2 potential ELF zoom levels

The least detailed zoom level necessary to cover geographic Europe is effectively around 40 M.

The most detailed zoom level for BaseMap has to be decided after prototyping BaseMap:

- Administrative BaseMap: the most detailed zoom level will likely be restricted to Master LoD1 (around 10K)
- Topographic BaseMap: the objective is to display streets. Likely the most detailed zoom level will be around 1K or 500 (to be confirmed by prototyping)

2.8 Different visualisations of the BaseMap

It is currently envisaged to propose several types of legend for BaseMap (both for the administrative and the topographic ones): as result of the project there will be at least one visualisation provided. Other visualizations will be considered if there are resources available.

- "full colour " if BaseMap is used alone for consultation and "pastel" or "well-balanced" or "greyscale" if Basemap is used as background data,
- with or without geographical names

Table 3 Examples of different types of legend

			
Full colour	Well-balanced	Pastel	Greyscale

NOTE: it might be possible to derive a pastel legend from the full-colour one by applying transparency

The idea of a map without labels aims to solve the issue of multilingual names:

- a user might use BaseMap without any label (a "silent" map)
- ELF WP2 (visualisation) might offer layers for labels in different languages
- The user could then display (or not) these various layers with labels.

However, these ideas will have to be tested during the prototyping of BaseMap

3 BaseMap challenges

The content will be based on the "harmonised" ELF data at different levels of detail (Global, Regional, Master LoD2, Master LoD1 and possibly Master LoD0).

This potential input for BaseMap raises several major issues:

- The content is in the complex structure inherited from the INSPIRE schemas ; the complexity of this data is not suitable for portrayal purposes
- The content (though in common ELF schema and reference system) is still heterogeneous and not always fit for cartographic purposes

3.1 Issues due to ELF data model and format

The production process for BaseMap (described in next chapter) is based on WMS services using common portrayal rules (provided as SLD files) and applied on the ELF data that are in a common data model and format (initially GML).

3.1.1 GML format

A key issue is that WMS services can't take GML data as input but they can only serve data coming from a Data Base Management System.

Another issue comes from the volume of data: data in rich INSPIRE/ELF data models and in GML may result in huge volumes of data, that may be difficult to handle both when prototyping and when producing BaseMap.

3.1.2 Complexity of data model

The ELF schemas inherit from the hierarchical and complex structure (data types, multiple cardinality) of INSPIRE models that is not well integrated in and handled by current GIS. This would be an issue when prototyping BaseMap.

In addition, the ELF schemas may have too rich content for BaseMap; for instance, they accommodate temporal aspects whereas BaseMap will display only valid features; this would impose to define several filters for each feature type.

The key issue is that some ELF objects (aggregate features, properties of TN theme) can't be used with SLD standard.

- The TN properties are modelled in INSPIRE as feature types and not as direct attributes carried by the roads, road links, railway links,etc. So, they can't be used to portray transport objects (for instance, making distinction between different categories according to their importance)
- aggregate features are features that don't have a direct geometry as they are defined as a set or sequence of other features ; therefore, it is impossible to apply directly a legend to them, using SLD standard

The road network are key information for a topographic map, this implies that the ELF data has to be restructured for BaseMap.

3.1.3 Proposed solution

The proposed solution is to prepare the data by transforming it into a simpler and flattened data model.

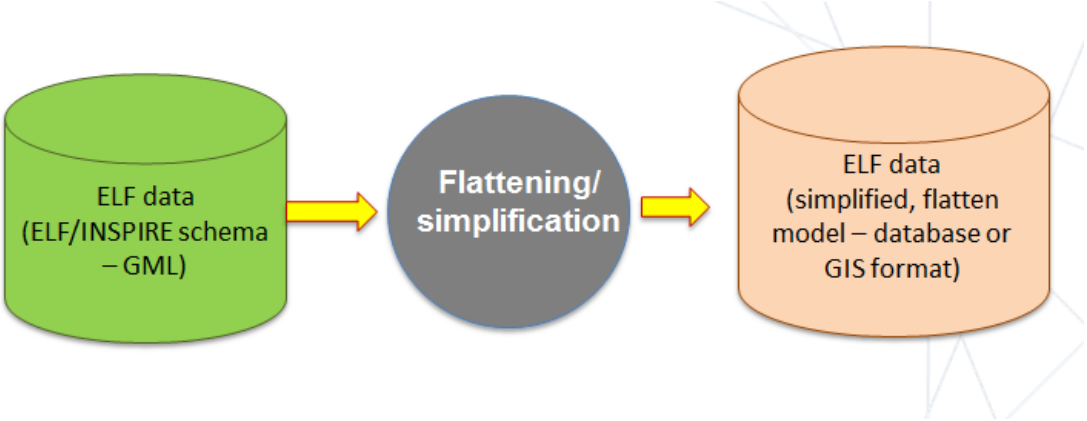


Figure 1 Proposed transformation

NOTE : the flatten model and the transformation rules from GML data to the flatten and simplified model are part of BaseMap specifications and will be provided in annex documents.

3.2 Issues due to heterogeneous content

There are 2 main causes of heterogeneous content:

- The way the model is populated:
    - The INSPIRE/ELF model are very flexible as most of attributes are explicitly voidable and as all feature types are implicitly voidable (INSPIRE being based on existing data). Consequently, lot of information may be present in the ELF data model but absent in some or even most of existing data.
    - The INSPIRE/ELF model is also flexible regarding the cardinality of some attributes ; this is especially true regarding geographical names (in theme GN but also in other themes)
- The level of detail, i.e. the density of information: the ELF data should be provided under 5 levels of detail (Global / Regional / Master LoD2 / Master LoD1/ Master LoD0) but national data won't always be provided at all relevant Master levels. In addition, even with a well-defined level of detail, data may remain relatively heterogeneous, e.g. it is still the case for ERM despite of around 10 years of harmonisation work.

3.2.1 Population of data model

Some feature types are completely missing: no possible action from specification work (WP2), it is up to WP6 (Third party content) to struggle to find alternative data provider.

The attributes required for nice portrayal may be missing. Most INSPIRE attributes are voidable and so, there may be attributes that are useful for portrayal that are present in some countries and not in other ones. This case would occur mainly for Master level data (as ELF Regional and Global are based respectively on ERM and EGM where core attributes are mandatory).

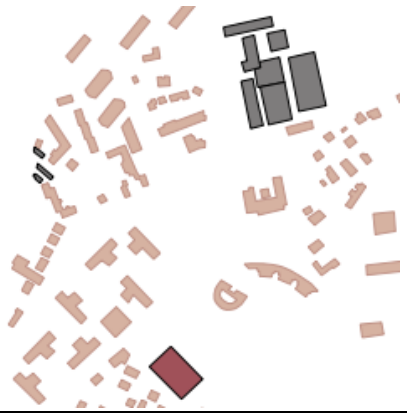
Case 1:

For a given feature type, nice portrayal would be achieved applying different symbols according to the various values of an attribute, e.g. the currentUse of a Building. This attribute is populated in some NMCAs but not in all of them.

The idea would be to design 2 legends:

- The recommended one using the different values of the attribute: this legend will have to be applied now by NMCAs having the information. NMCAs not having this information should be encouraged to capture it in future
- The default one using one single symbol for all the instances of the feature type to be used (at least as provisory solution) by the NMCAS not having populated the attribute.

Table 4 Handling heterogeneous data content

	
Recommended legend: the attribute currentUse on feature type Buildings allows to make distinction between: • Industrial buildings: grey • Commercial buildings: red • Ordinary (other) buildings: pink	**Default legend**: The attribute currentUse is missing on feature type Buildings. All the buildings are represented using same symbology.

NOTE: in the illustration above, the default legend consist to apply the symbol of ordinary buildings (most frequent case) to all buildings and this may be misleading: users may think there are neither industrial nor commercial buildings; but this solution would ensure some cross-border homogeneity. On the opposite, choosing for the default legend a symbol not used by the nice recommended legend would provide more heterogeneous impression but might be cleaner solution.

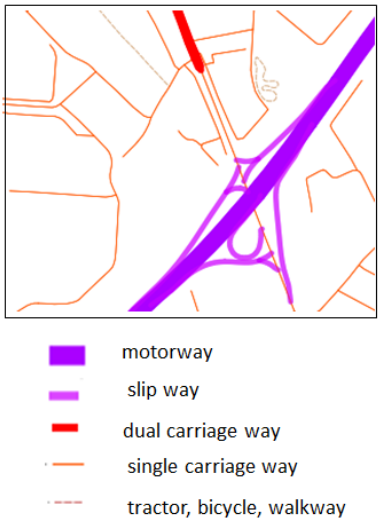
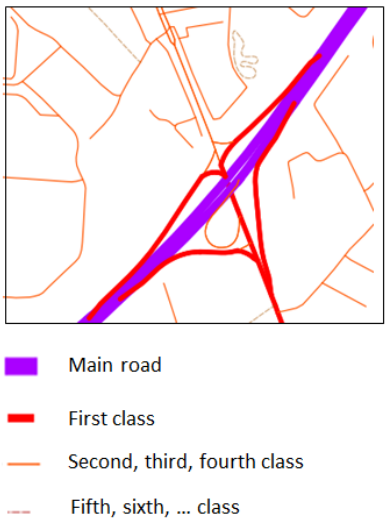
Case 2:

For a given feature type, nice portrayal would be achieved applying different symbols according to the "importance" of the feature. Several attributes may be used to assess this importance. These various attributes of course may be not all populated by all NMCAs.

The idea would be to design 2 (or more) legends:

- The nice one using the different values of the attribute considered as the best one: this legend will have to be applied now by NMCAs having the information. NMCAs not having this information should be encouraged to capture it in future
- Alternative one(s) using one the different values of alternative attributes to be used (at least as provisory solution) by the NMCAS not having populated the best attribute.

Table 5 Handling heterogeneous data content

	
Nice (recommended) legend: roads are displayed with different symbols according to the values of attribute formOfWay (considered as the best one)	**Alternative legend**: if formOfWay is not available, the functionalRoadClass might be used as alternative solution. The purpose would then be to choose a legend giving as much as possible similar results as the nice (recommended one)=> to be checked at international boundaries;

NOTE 1: this illustration is given just as example; it is not yet decided what will be the best attribute or best attribute combination to assess the "importance" of a road: formOfWay, functionalroadClass, numberOfLanes, width, etc.

NOTE 2: the attribute functionalRoadClass is good candidate but it is poorly harmonised as the number of values is not defined; it may vary from 5 (or even less) to 10 according to the country. If used (either in the recommended or in the alternative legend), the legend might be different from one country to another and so, probably will have to be customised by each NMCA.

Case 3: multiple cardinality

This case occurs mainly for geographical names as any feature may generally have several names, themselves allowed to have several spellings.

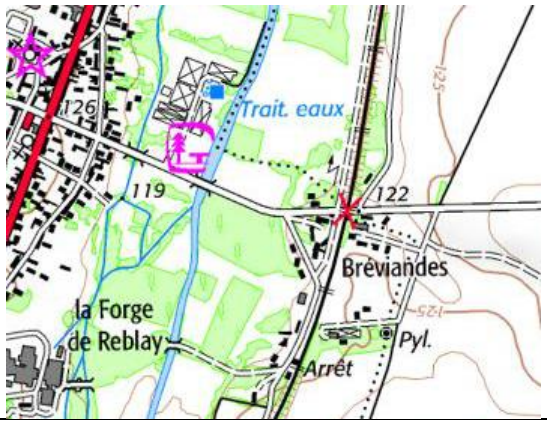
However, the issue of spelling is limited to the countries that do not use the latin alphabet, such as Greece (using greek alphabet) and as Bulgaria (using cyrillic alphabet). A reasonable solution might be to display latin spellings for BaseMap at smaller scale (when the map shows whole Europe or at least several countries) and to use national alphabet for BaseMap at the other scales [to be checked if this information is available in EGM/ERM]. The limit between use of latin or national alphabet would have to be decided during the prototyping phase.

In addition, the font specified in the legend/stylesheet would need to be one which contains the Greek and Cyrillic characters (some don't).

The issue regarding the number of names to be displayed on BaseMap is more difficult to solve:

- The INSPIRE/ELF data model allows cardinality [1…*] or [0…*]
- In existing data, the situation may vary quite a lot according to LoD and to countries
  - For Global/Regional levels, the cardinality is limited to 2
  - For Master levels, the cardinality is not really known but whereas some countries have only one name, some others may have up to 4 names (or more?)
- The requirements for BaseMap may also vary according to countries, generally because of multilingualism situation. For instance, national law may impose to display several names.

Table 6 Map labels and multilingualism

	
France: only one name for a given feature	Finland: up to 3 names for a given feature
Existing topographic digital maps	

The issue comes that not all available names shall be displayed on the map; for a given feature, the general rule should be to display only the name(s) considered as necessary as too many names will decrease the readability of the map.

Therefore, there are two decisions to be taken (for a given feature):

- How many names should be displayed on BaseMap?
- How to select them?

Regarding the second question, the INSPIRE model does not offer so much to make the selection, only the “status” attribute (official/standardised/other/historic) looks relevant. The possibility to use an extended model in ELF in order to have some classification of the importance of a name was evoked but, as this proposal has not been yet adopted, it doesn’t look feasible to have data with this additional information during the timetable of ELF project.

A potential solution would be the following:

- For Global/Regional levels, the names available in ELF (Master LoD0, 1 or 2) are displayed on BaseMap

- For Master levels, it is up to each NMCA to decide and the number of names to be displayed and on the filter criteria to be applied to select these names.
    - BaseMap would impose the style to be applied to name labels for a given feature type and would propose a default location for following cases:
        - one name
        - two names
        - three names
    - Each NMCA would decide on the number of names to be displayed and if necessary, on the rules to select the names that shall be shown.

NOTE: this issue about multiple cardinalities may also occur for other attributes. The nice solution would be to take the "main" value but it is unsure if there will be a way to select this main value (e.g. ordered list or attribute consisting of a data type with some information about the importance of the value). For instance, if BaseMap uses the attribute currentUse [0…*] of Building that is a data type composed of the use itself and of the percentage, the selection, in case of multiple values, might be done on the percentage (if filled). The default solution if no possible selection criteria would be to take just the first value in the list.

3.2.2 Level of detail

The ELF data should be provided under 5 levels of detail (Global / Regional / Master LoD2 / Master LoD1/ Master LoD0) but national data won't always be provided at all relevant Master levels.

The objective of BaseMap is, for a given zoom level, to have a relevant density of information (to make the map readable but not too poor) and to have - more or less - the same density of information (to make the map look homogeneous), in all European countries what may be quite challenging.

NOTE: of course, the density of information may vary (for a given level of zoom) according to real world conditions; for instance, the density of road network is not the same in urban or rural areas and the administrative pyramid may vary significantly from one country to another.

Two issues may occur:

- Data is not detailed enough for a given level of zoom; this might be typically the case if data is missing for Master LoD1 and/or Master LoD0. There is nothing that may be done at specification level (i.e. by WP2): BaseMap will be designed using available data of "upper" level, e.g. Master LoD2 or even Regional data , if most detailed LoDs are missing (unless of course WP6 succeeds to find other data providers)
- Data is too detailed for a given level of zoom; the issue may be solved using generalisation. Generalisation may imply selection of features to be displayed and/or simplification of geometries.

BaseMap will be carried out using:

- Data at different levels of zoom (e.g. Global, Regional, Master LoD2, Master LoD1)
- Automatic cartographic generalisation to populate the various levels of zoom; this automatic generalisation will be driven using the ScaleMaster methodology, i.e. using an Excel file that provides for each level of zoom :
    - The feature types to be displayed or not
    - The selection criteria (if any) and the recommended geometric generalisation operations
    - Possibly the chosen symbology

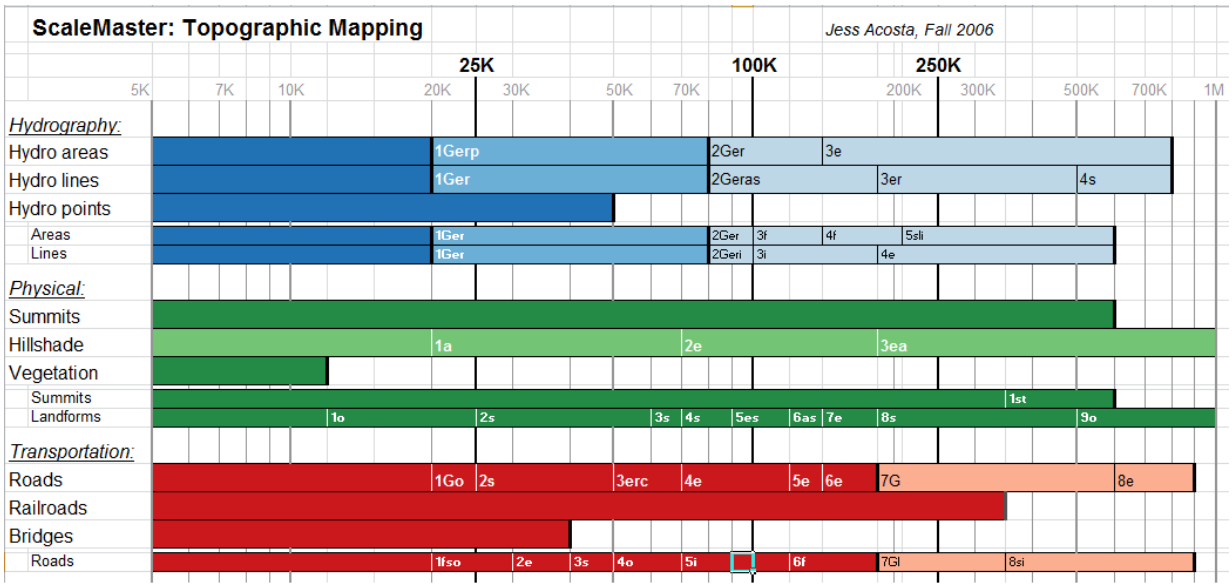


Figure 2 Initial, simple ScaleMaster excel table

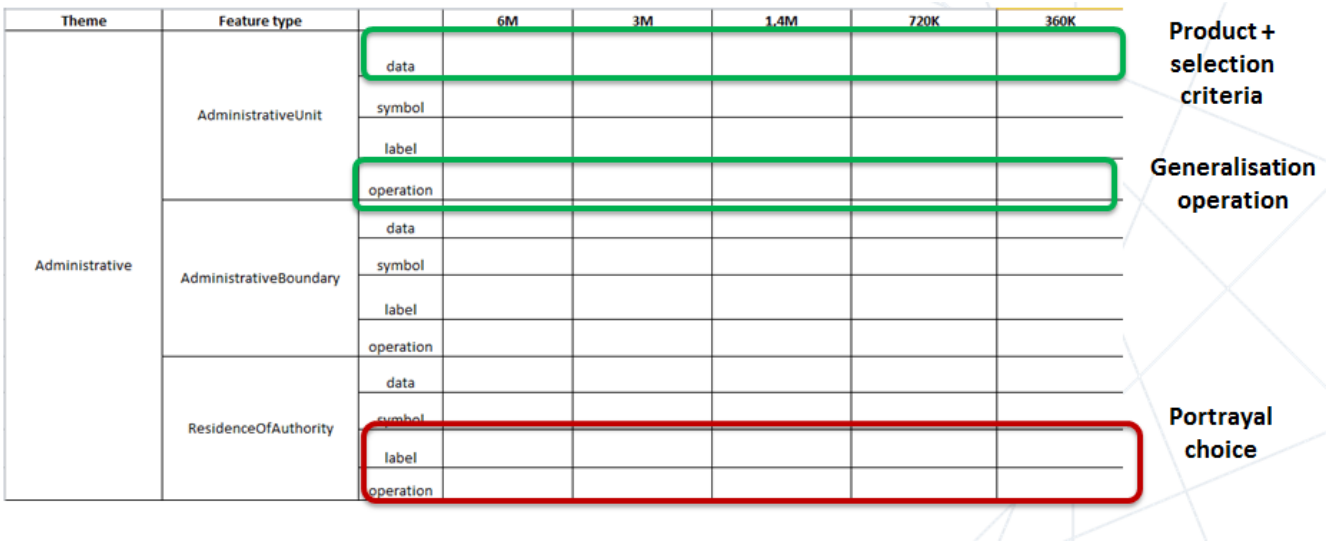


Figure 3 Exhaustive ScaleMaster excel table (adapted for BaseMap)

NOTE: the ScaleMaster table provides a human-readable documentation of portrayal choices whereas the SLD files provide a machine-readable documentation. Both are part of BaseMap specifications and will be provided in annex documents.

3.2.3 Other risks

The following issues have already been identified:

- The data model may not include the relevant information for cartographic purposes. This is mainly true for the data type GeographicalName that does not offer a dedicated attribute to select the most relevant name(s) for a given feature
- The data model is fine but source data is too poor; typically, the attribute "population" would be very useful to select relevant instances of NamedPlace to be displayed for a given level of zoom. This attribute is present in ELF data model and is available for Regional level; unfortunately, it is quite unsure that it will be available for all Master data.
- The data model and source data may be fine but the transformation process is not suitable:
    - The transformation process is not accurate enough: for instance, the attributes least/mostDetailedViewingResolution of theme GN are just filled with default value for all features of a given data set instead of being filled for each instance
    - The transformation process might be incomplete, especially for complex themes, such as TN; for instance, handling NetworkReference that ensures the link between geometry and semantics is a key point but is far from obvious.

Other issues might also be discovered when prototyping BaseMap; on one hand, BaseMap will serve as part of validation process for ELF data (positive aspect); on the other hand, in case the issues are not solved on time, the BaseMap results may be relatively poor (negative aspects).

4 Production process

4.1 Recommended process

The recommended process is to carry out BaseMap by applying common portrayal rules on data in a common model.

4.1.1 Transformation into ELF data model

Source data is composed of the heterogeneous data coming from NMCAs for Master LoD1 and LoD2 and from already harmonised European products, namely EBM, ERM, EBM and EuroDEM, for Global and Regional levels.

The first phase will be to transform the various source data into the common, INSPIRE-based and so, complex ELF data model [2],[3]. This process will be done by each NMCA for Master data and centrally for European products. Data will be served by WFS (or other download service such as ATOM feeds) in GML format.

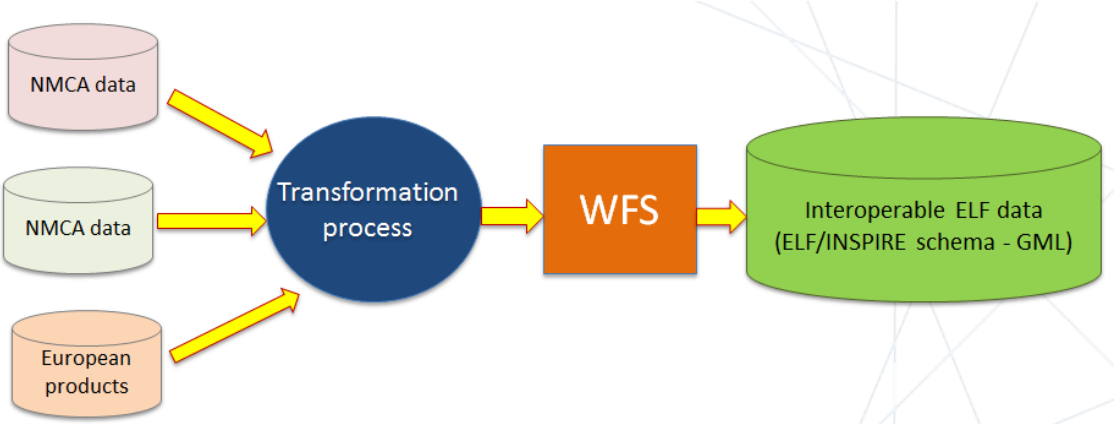


Figure 4 Transformation of source data into ELF data

4.1.2 ELF data enhancement

The ELF data that are now in a common data model will be checked by running the quality validation tool and, if necessary, they will be edge-matched at international boundaries. These two processes will be executed more or less automatically by the geo-tools developed by the ELF WP4.

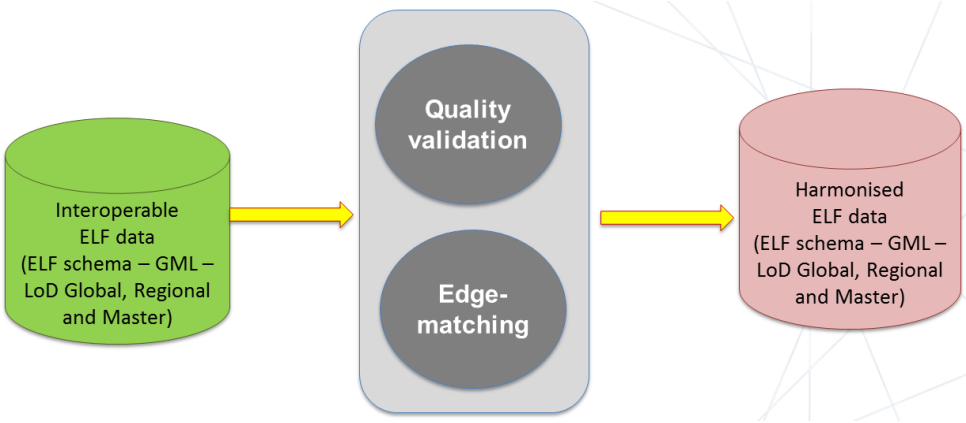


Figure 5 ELF data enhancement

As previous phase, these two processes will have to be performed by NMCAs for Master level and centrally for Global and Regional levels.

4.1.3 ELF data simplification

The ELF data that is now validated and edge-matched should be transformed in the simplified and flatten model that is suitable for BaseMap. This process is also in charge of NMCAs for Master level and of ELF project globally for Global and Regional levels.

In order to make this flattening/simplification easier, a common tool enabling automatic transformation might be provided by the ELF project. The matching tables documenting the transformation rules from GML data to the flattened and simplified BaseMap model could be used as terms of reference for the development of such tool.

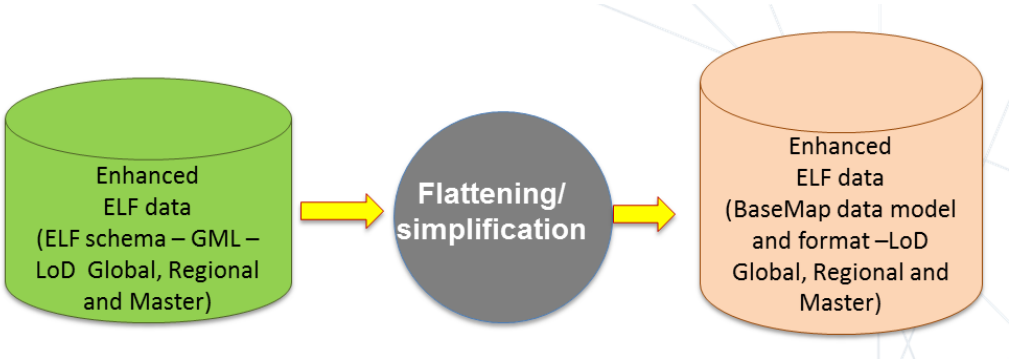


Figure 6 ELF data simplification

4.1.4 Cartographic Generalisation

The ELF data that is now in a simple and flat data model may be generalised, using automatic geo-processing services. These geo-processing services are centrally provided (by Kadaster).

This phase enables to get, for each BaseMap level of zoom, a set of feature types containing data at the relevant level of generalisation.

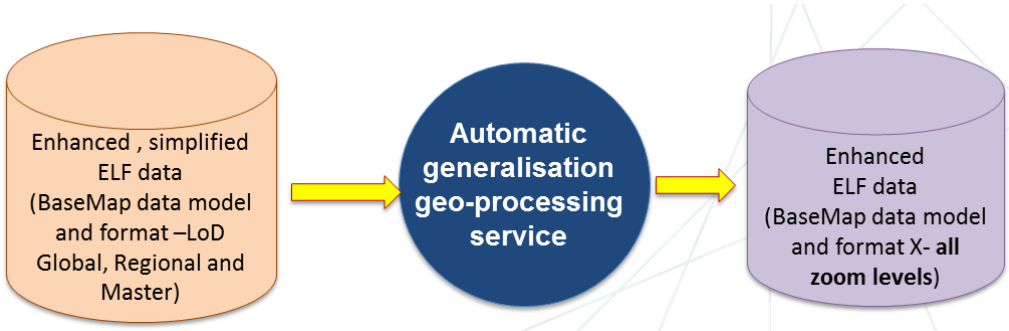


Figure 7 Cartographic generalization

4.1.5 Setting up the BaseMap services

The portrayal choices defined by the BaseMap specifications and provided as SLD files may now be used to set up WMS view services. Once again, this operation has to be done by NMCAs for Master level and centrally for Global and Regional levels.

In order to offer convenient performances to users, BaseMap will be provided as WMTS; this implies to compute the various tiles.

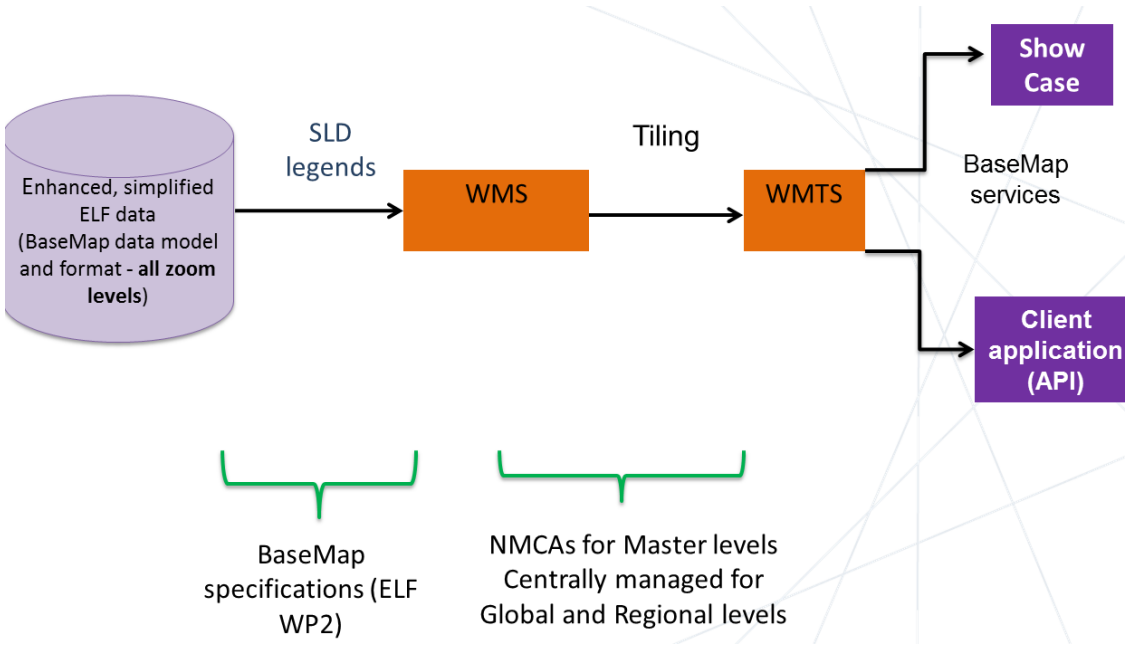


Figure 8 Setting up ELF BaseMap services

4.2 Alternative process

The alternative process would consist is to carry out BaseMap by applying common portrayal rules on existing data, i.e. on data in heterogeneous data models.

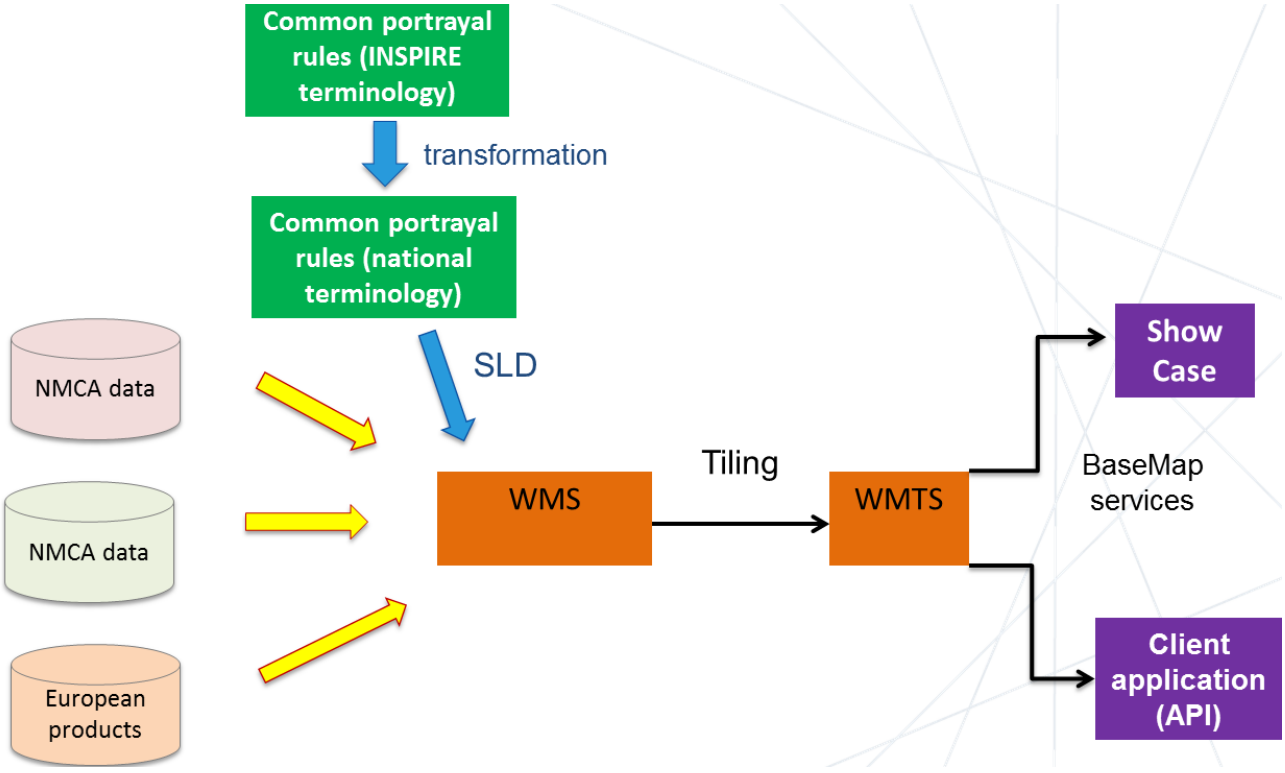


Figure 9 Alternative production process

In this case, common portrayal rules would be provided by BaseMap specifications, using the common ELF/INSPIRE terminology. Then, it would be up to each NMCA to translate these portrayal rules into the terminology used for their existing data (to be done within the SLD files) and to set up WMS services based on their existing data and on the adapted, translated SLD files.

The production process may look simpler but it likely won't provide such good results as the recommended one:

- The "translation" of portrayal rules may be quite difficult and imperfect if the source existing data has a data model that is significantly different from the INSPIRE one
- The existing data can't benefit from the geo-tools that are designed to run on common ELF data.

This alternative process should be envisaged only as spare solution, for instance, for themes raising strong issues, such as theme TN if the flattening phase is not enough to ensure relevant data for mapping purposes (dealing with linear referencing of properties will be challenging) or for data producers that are exaggeratedly late in transforming their data into ELF model.

5 Administrative BaseMap

Administrative BaseMap aims to represent the main content of theme AU, namely the following feature types:

- Administrative units and their name(s)
- Administrative boundaries represented according their nationalLevel and, for international boundaries, according to their legal status
- Residence of authority and their name(s)

The administrative BaseMap is carried out using data from EBM (in ELF model) for the small scale levels of zoom and Master level for the large scale levels of zoom. The use of EBM has been preferred to the use of ERM and EGM because EBM has richer semantics.

The administrative units in Europe are quite various by their size and numbers, according to countries; consequently, it is impossible to design portrayal rules ensuring homogeneous rendering of administrative data.

However, to avoid too much heterogeneity, the display of administrative units of national levels 2, 3, … will vary according to the country : for instance the level 2 administrative units of Luxembourg or Malta won't be displayed at same levels of zoom as the Länder (level 2 administrative units) of Germany.

Therefore, the selection criteria of administrative units and related features are country-dependant.

The annex documents defining Administrative BaseMap will be provided on ProjectPlace (https://service.projectplace.com/pp/pp.cgi/0/942805217) :

- Flattening principles – flatten model

- Matching rules between ELF GML data and BaseMap model
- ScaleMaster
- SLD file

6 Topographic BaseMap

Specifications of Topographic BaseMap to be provided by End of April 2015.

7 ANNEX: Cartographic design principles

The following 8 good cartographic design principles come from Ordnance Survey experience [5]

This annex explains how BaseMap will try to conform to these quality rules.

Understanding of user requirements This is absolutely vital to the success of any map! An effectively designed map is one in which the intended message is clearly communicated to the map user. This is only possible by fully understanding what that message is and how the map is intended to be used.	Two main identified user requirements for BaseMap: • To be used alone for consultation => full colour legend • To be used as background => pastel legend
Consideration of display format To achieve maximum clarity a map should be designed from the very beginning with its final display medium in mind. There are numerous output formats for maps and various types of media on which they can be disseminated. Each has its own merits and its own limitations so there needs to be sound consideration and a valid reason for the choice that is made.	BaseMap will be designed (and tested) mainly for display on desktop or laptop computers. If the designed content and legends are good enough for mobile devices, this display medium will be added to the potential uses of BaseMap. Paper maps are out scope of BaseMap.
A clear visual hierarchy The aim here is to draw attention to certain elements of the map and push those of less importance further down the visual plane - although certain features are less important they may still be required, if not then they should be removed. This helps the user differentiate between map features and helps them comprehend the map's message effectively.	There will be 2 versions of BaseMap: - administrative - topographic A clear visual hierarchy for topographic BaseMap will be a (challenging) objective.
Simplicity Cartography aims to portray spatial information in an appropriate way in order to transform information into knowledge. The inclusion of unnecessary information makes this process less effective and one should always assess that information's value to the	Simplicity may be rather challenging to achieve as there are many feature types in ELF/INSPIRE. Potential solutions would be : • Do not display feature types that are present only in very few NMCAs • Use legend as simple as possible ; do not

user against map clutter and confusion.	use too many symbols
Legibility All map elements need to be legible, meaning that they are readable, understandable and recognisable. All need to be large enough and clear enough relative to the viewing scale and the media on which the final map will be displayed.	This should be ensured : • By choosing symbols large enough • By adapting the content for each zoom level Typically, ELF Regional and Master levels should be used at equal or larger scales than their nominal, official scale. Cartographic generalisation will be used ; it might be required especially for Global level (as EGM data will have to be used at smaller scales than nominal scale 1M)
Consistency Consistency provides a map with balance. It enables features to be perceived as being organised into groups and it allows maps themselves to belong to a family of products through a shared identity.	BaseMap consistency should be ensured: • by a well-chosen legend for a given level of zoom • by legends that are similar for the different levels of zoom • by consistent content across the different levels of zoom ⇨ BaseMap will be designed and prototyped by a core team, located in same NMCA Consistency should also be ensured regarding BaseMap content in regard to real world.
Accessibility Making maps and making geographic data and accompanying stylesheets easily obtainable and usable is imperative to successful use. Accessibility factors to consider in the design process include distribution formats, user disabilities, cost and intuitiveness in use	Distribution formats : WMTS in order to ensure good performances User disabilities: legend that is suitable for red-green blind persons might be designed if time available during ELF duration Cost: BaseMap is supposed to be free of charge (but possible exceptions) Intuitiveness: the legend should be simple and obvious enough (anyway, the legend will be published)
Good composition Composition concerns the arrangement of all the different visual elements, from the map's title to the scale bar. It is both how the map is structured and positioned, and how the map	BaseMap should be displayed in the ELF showcase. Style and location of additional information (title, scale, legend, etc.) to be discussed with WP3

works alongside any additional information. All elements of the map should work together to provide a clear and complete understanding to the user. Their style should also be harmonious or complementary.	