CO-327

IMPROVING WEB MAPPING WITH GENERALISATION

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Internet maps readability could be improved by using automatic map generalisation techniques (figure 1). Map generalisation is the simplification operation of map data when their representation scale decreases (figure 2). Map generalisation automation has been the topic of researches for years and nowadays, operational automated generalisation techniques exist. This article investigates the possible use of automated generalisation on the web.

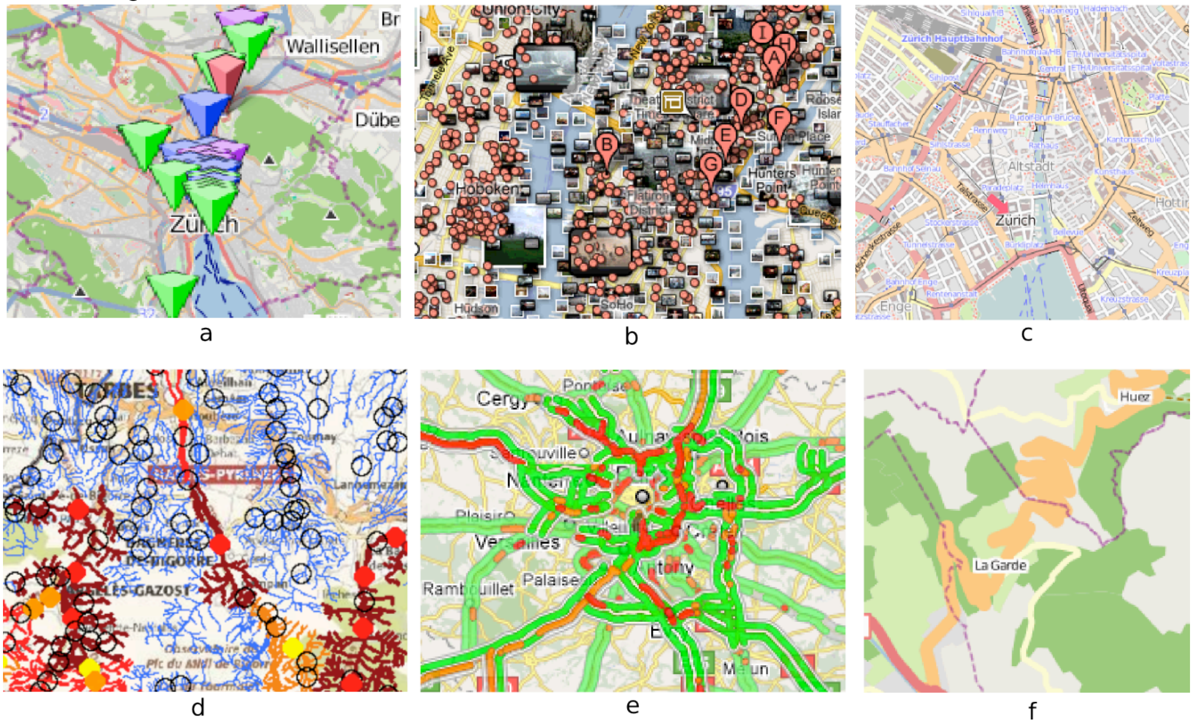

Figure 1: Examples of web maps with readability problems

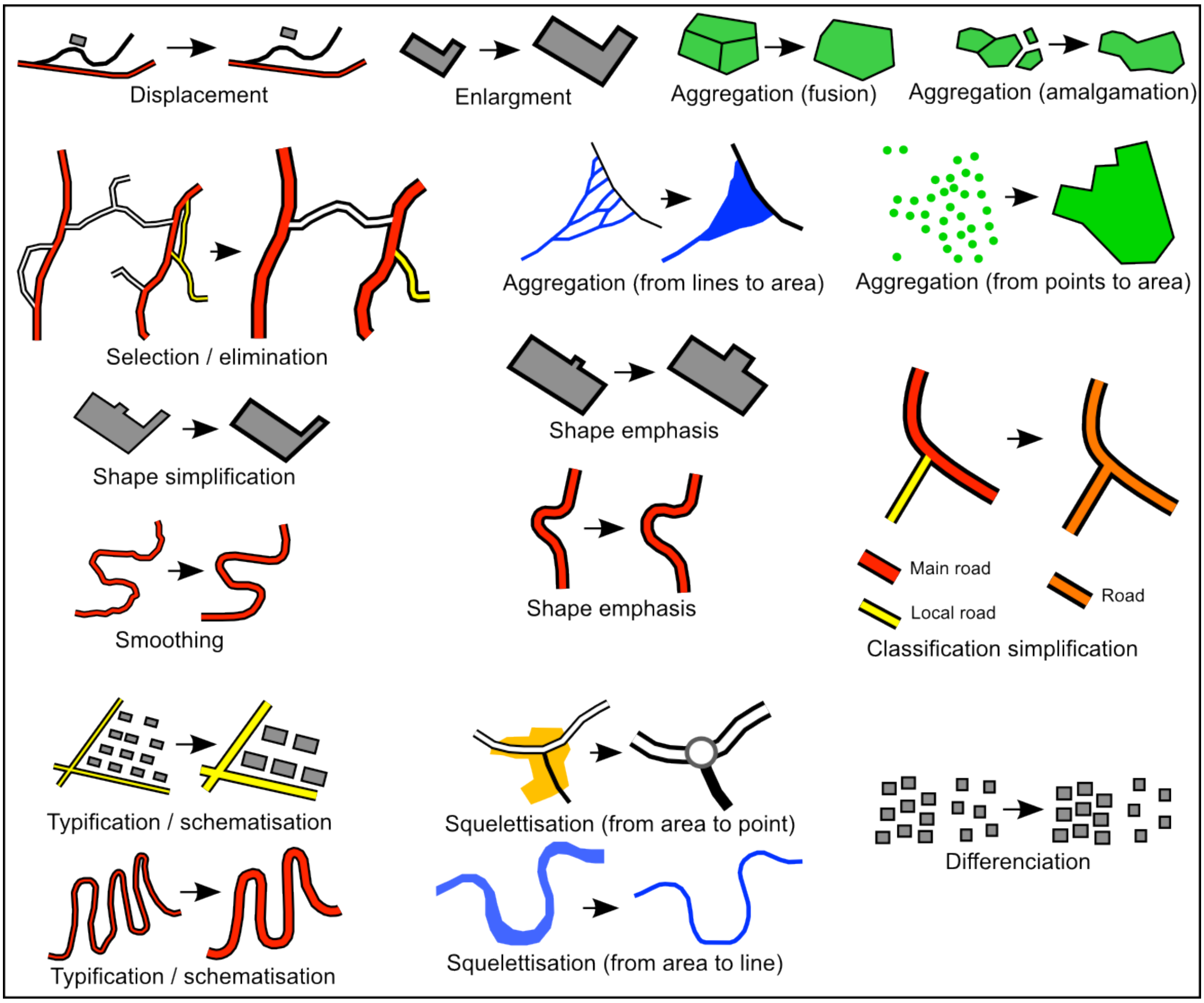

Figure2: Some generalisation operations

Generalisation and web mapping: state of play

1. Generalisation systems architecture

Map generalisation requires two kinds of transformations: Model and graphic generalisation.

Model generalisation is the transformation from detailed concepts to generalised concepts. When the representation scale decreases, some concepts aggregates into other more generalised (Figure 3).

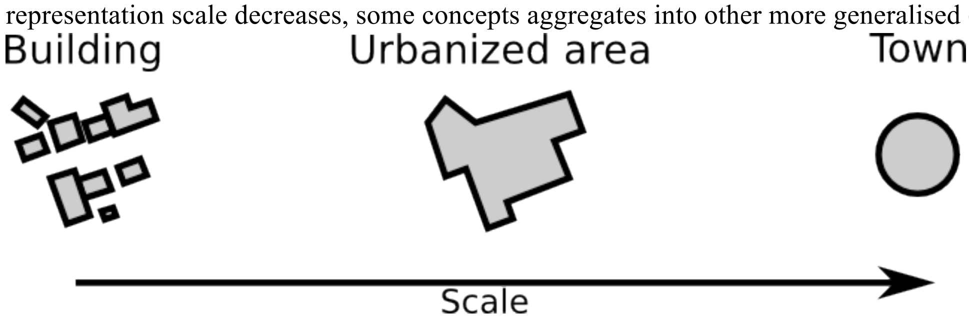

Figure3: Model generalisation: buildings, urbanized areas, and towns

Graphic generalisation is the transformation of map symbols to make them readable: too small symbols are enlarged, overlapping or too closed objects are displaced, etc. (Figure 4).

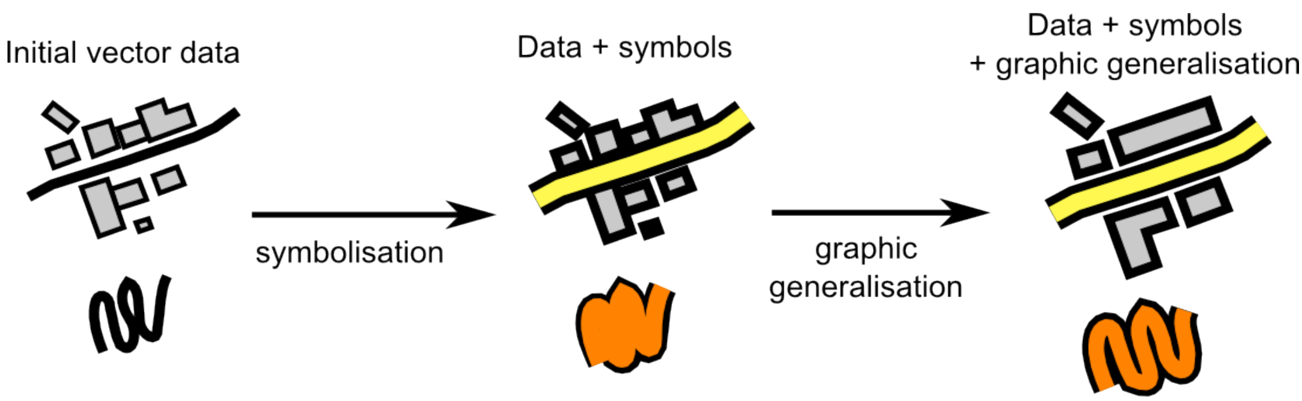

Figure 4: Two examples of graphic generalisation

Many automatic methods have been developed to automate both. Typical generalisation systems architecture is presented on figure 5. A generalisation system produces generalised data and maps from input vector data. A multi-scale database is produced from a master database using model generalisation. Then, cartographic databases and maps are produced after graphic generalisation.

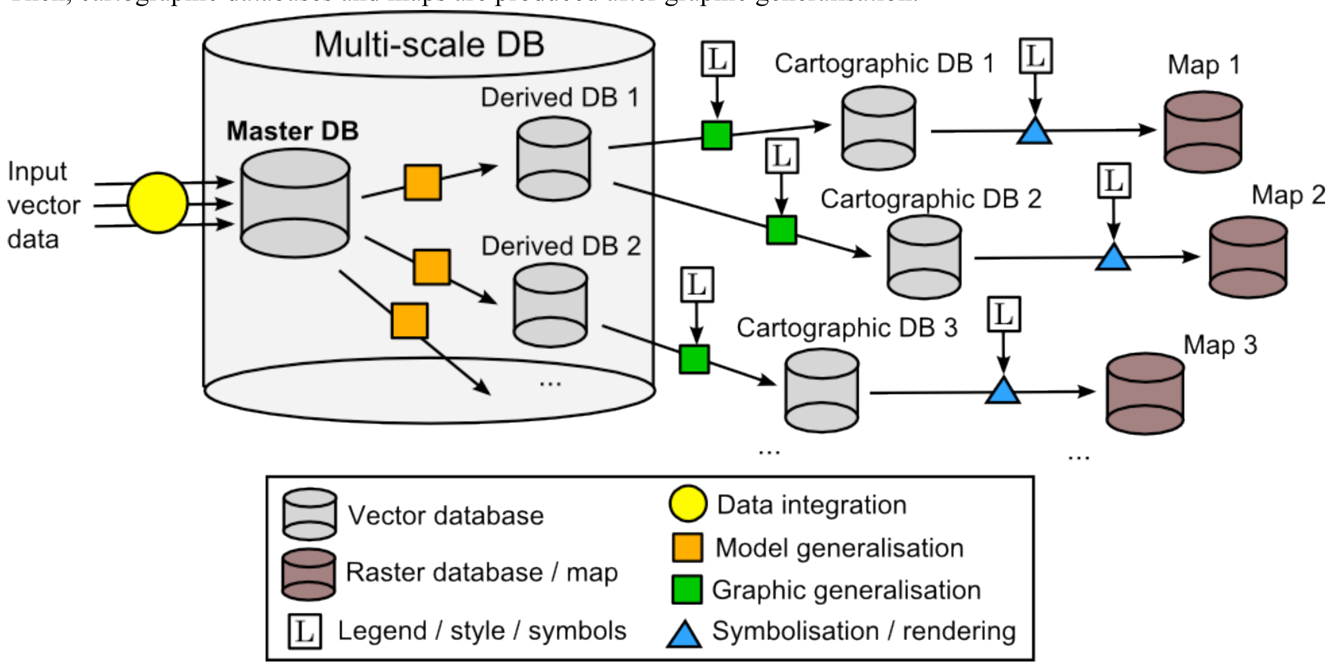

Figure 5

2. Web mapping systems architecture

Web mapping systems (figure 6) are composed of web mapping server and web mapping client components.

Web mapping servers store and diffuse:

- raster/image data. These images have often been pro-computed from vector data.
- vector data. These vector data are symbolised according to a given legend.

Web mapping clients load and display data from web mapping servers depending on a location, a zoom level, and data layers selected by the user.

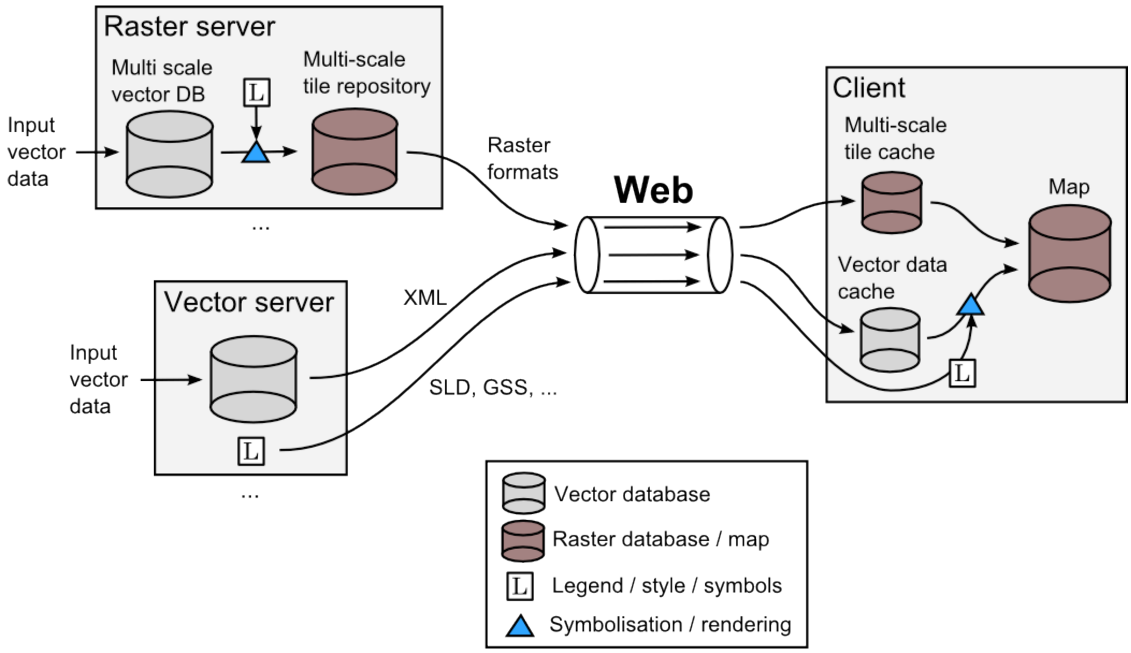

Figure 6

Generalisation in web mapping

Because web mapping enables interactive navigation across scales, the use of generalisation techniques becomes important. The task of merging both kinds of systems is not straightforward. This section gives some recommendations to solve blocking issues of web generalisation.

Preference for vector web mapping servers: Generalisation is possible only on vector data. Vector data transfer, storage, and symbolisation may be heavy, but this issue can be solved if a sufficient part of the generalisation process is done on the server: generalised data are lighter.

Model generalisation on the server – graphic generalisation on the client: Generalisation must be shared between the server and the client. A good balance is to compute model generalisation on the server and to store the result in a multi scale database. The client queries multi scale servers to retrieve the relevant objects for its visualisation scale, and to computes graphic generalisation.

Progressive loading and generalisation of the data: Many web clients display vector data progressively when they are loaded. The same progressive display can be applied for during the generalisation process.

Progressive loading of generalisation libraries: Generalisation requires several heavy software components (like algorithms) that are not used for all generalisation cases. Loading of some generalisation components could be dynamic, depending on the need.

The architecture presented on figure 7 respects most of the previously given recommendations. It integrates the architectures of generalisation and web mapping systems shown on figures 5 and 6.

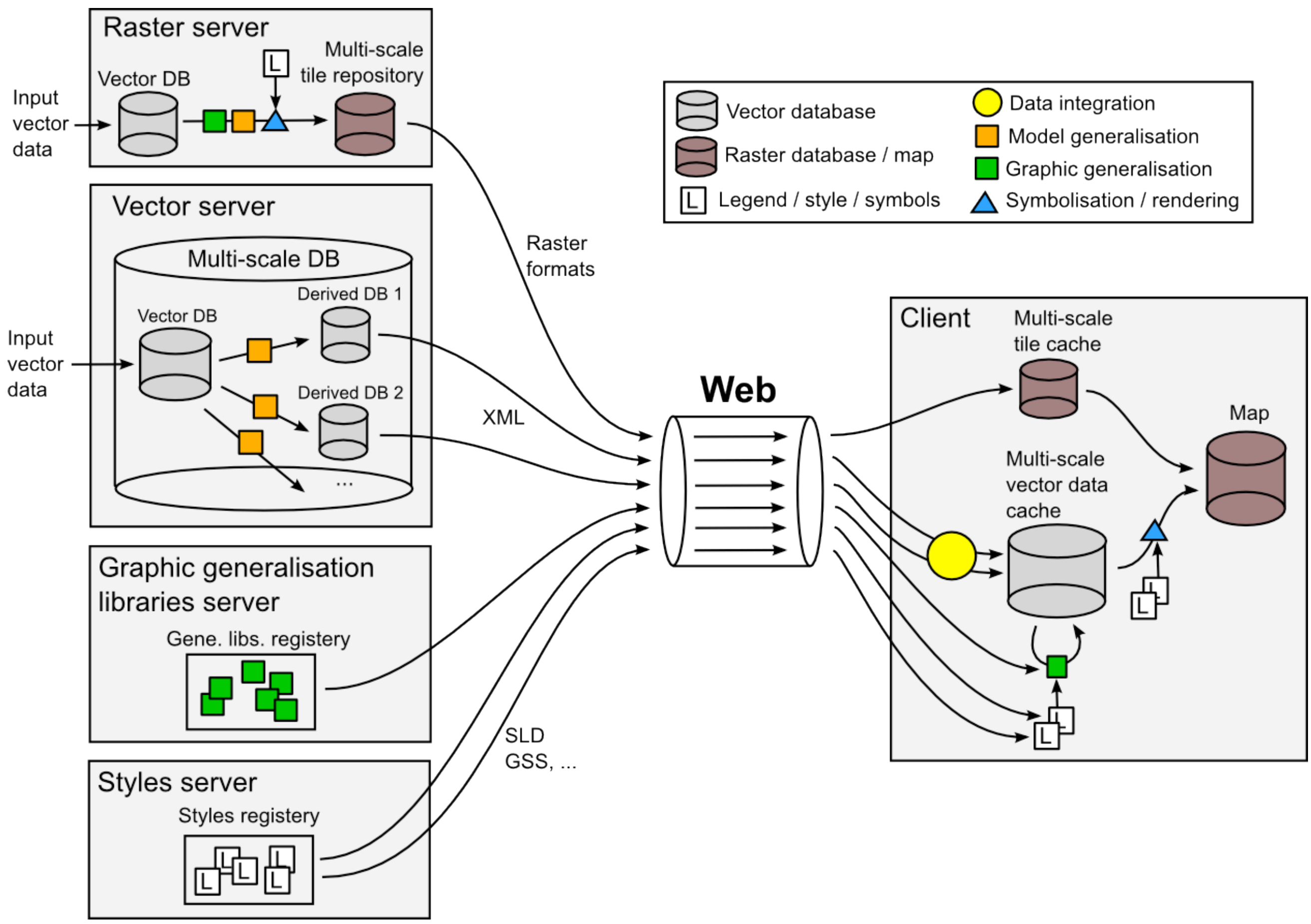

Figure 7

Such web mapping system is composed of four types of web mapping servers:

Raster web mapping servers enhanced with model and graphic generalisation techniques.

Vector web mapping servers diffuse vector data from a multi-scale database built using model generalisation techniques.

Graphic generalisation libraries servers diffuse graphic generalisation libraries to be loaded dynamically by the clients depending on their generalisation needs.

Legend web mapping servers provide cartographic styles for vector data.

Finally, the cartographic client loads vector data from different multi-scale servers according to the visualisation scale. The client computes graphic generalisation, taking into account some specified styles. The data are displayed progressively: the objects appear when they are loaded from the server, and their progressive generalisation is displayed.