

Propuesta de comunicación 6as Jornadas gvSIG

6th gvSIG Conference Communication proposal

Tipos de comunicación (Seleccione una o ambas) / Types of paper (Select one or both):

☐ Ponencia/Report

☐ Póster/Poster

Título / Title:

WG-Edit: nueva gvSIG-extensión para la gestión del catastro de las carreteras

**Título en inglés /
English title:**

WG-Edit: a new gvSIG extension for the street cadastre management

Persona de contacto / Contact person:

Fulvia Gambalunga

e-mail de contacto / Contact e-mail:

Fulvia.Gambalunga@provincia.bz.it

Página web de referencia (si el trabajo realizado dispone de ella) / Related web page (if the project has anyone):

**Autores de la
comunicación /
Paper authors:**

Jlic Belpoliti, Fulvia Gambalunga, Wolfgang Moser, Ivo Planoetscher, Susanne Rizzolli, Martin Zambaldi - Autonomous Province of Bolzano – Department of Statistical and Geo Informatics

Alberto Perli, Flavio Pompermaier – Sinergis (Trento)

**Ponentes (Nombre y
organización) (máx.
2 personas) /
Speakers (Name and
organization) (max. 2
persons):**

Fulvia Gambalunga - Autonomous Province of Bolzano – Department of Statistical and Geo Informatics

Flavio Pompermaier – Sinergis (Trento)

* Le informamos de que cumplimentando este formulario usted consiente expresamente que sus datos personales sean incorporados a los ficheros automatizados propiedad de la Asociación gvSIG, Plaza Don Juan de Villarrasa 14-5, 46001, Valencia (España), y serán tratados por ésta bajo su responsabilidad, con la única finalidad de gestionar la participación en las Jornadas gvSIG. Le informamos también de su derecho de acceso, rectificación, cancelación y oposición con respecto a sus datos personales pudiendo revocar su consentimiento por escrito en cualquier momento en la dirección mencionada anteriormente. (Ley 15/1999 de 13 de diciembre de Protección de Datos de Carácter Personal).

* By submitting this form you are explicitly conscious of that your personal data will be added to the automated files property of the gvSIG Association, sited in 14 Don Juan de Villarrasa Sqr., 5th, 46001, Valencia (Spain) and that they will be treated by it and under its responsibility, with the aim of managing the participation at the gvSIG Conference. We inform you about your right of



accessing, rectifying, and cancelling on the matters of your personal data. So, you can revoke your permission with a written request in any moment by sending it to the address mentionet above. (Law 15/1999 of December 13th on Personal Data Protection).

1. Summary

This article presents the WG-Edit extension for gvSIG, that allows the management of the road cadastre for the Autonomous Province of Bolzano. Until now the editing tool is based on proprietary GIS software, but following the strategic decision to use open source software for the future geodata management, the extension has been developed on gvSIG. gvSIG was chosen to substitute ArcView 3 because it is a free/open source product and a complete GIS tool with a user friendly interface. It has been chosen to remake the extension, but to add also innovative, new functionalities.

Keywords: gvSIG, editing, WebService, topology, 3D-objects

2. Introduction

The spread of ArcView3 in the last 10 years has been very extensive, due to its ease of use combined with the fact that the shapefile format has quickly become one of the main standards for GIS vector data. The development of the new environment ArcGIS Desktop by ESRI® led to the slow decline of ArcView 3, now considered old and obsolete.

Thinking of upgrading to ArcGIS all ArcView3 licenses currently in use would be impractical in terms of cost, so we made the decision to replace part of the licenses of ArcView 3 with an open source GIS-software: gvSIG. The reasons for this choice are the following:

- guarantee of continuity because it is a project started by a public institution (Generalitat Valenciana) and funded by the EU;
- JAVA as development language;
- compatibility with a large number of vector and raster file formats;
- remarkable similarity with ArcView3 in logical and functional terms.

The client application for the management of the topological network, works as an ArcView 3 extension and has been replaced by gvSIG by the development of the WG-Edit extension.

The new WG-Edit extension provides the following modules:

- module for searching roads and locations (configurable according to the data to search);
- module for the road import (complete or partial);
- module for editing (reshape, union, split, change direction, insertion variants, management of the topology);
- module for the management of attributes.

A great innovation will be the management of the elevation for the roads, meaning that a part from the coordinates X, Y and M also the coordinate Z will be managed. The extension offers functions to calculate and validate it in case it is not present in imported data, by getting it from DTM. It's also provided a form to edit manage this data graphically with the profile graph.

Other very important functions are those related to the validation of topological data management (client and server sides). They help to provide a topological correct network, which is been used as a basis for routes-calculator and the other services and functionalities within the WEGE project.

We are now under final testing of the extension, that will be operating by early 2011.

3. Objectives

The implementation of the gvSIG extension WG_EDIT is based upon the following objectives, which have been decided by the Department of Statistical and Geo Informatics:

- The database is responsible for data integrity and data security. It should not be the duty of the client or the middleware.
- A tree-tier architecture with precisely defined levels (database, application server/business logic, clients) and a standardisation of the communication interfaces within these levels (Web Service and XML/GML) is necessary.
- The visualisation of the geodata within a simple map service should be expanded to supply GIS Services e.g. making a spatial analysis by asking a Web Service using a GIS functionality.
- One objective is to create a GIS service oriented Internet platform.
- Manage the geometry as a 3D-object (X, Y, Z) considering also the M coordinate. All the functions have to take into account the 4 dimensions.
- the data access has to be implemented through the standard OGC webservices (WMS, WFS) and standard formats (GML).

The following chapters illustrates the extension WG_EDIT from the architectural, technological and the users point of view.

4. WG-Edit extension

This module allows gvSIG to interact with the “WEGE” project.

“WEGE” is a collaborative geographic information system for the road infrastructure management (road types, bridges, tunnels, etc.) and correlated elements (public transport, petrol stations, bus stops, addresses, etc.), which ensures a fine-grained definition of roles and responsibility. Furthermore, an internet platform for the communication and visualization of the collected information was created within the project as an e-government service (G2G, G2E, G2C).

The module WG_EDIT provides the functionalities to manage the road network

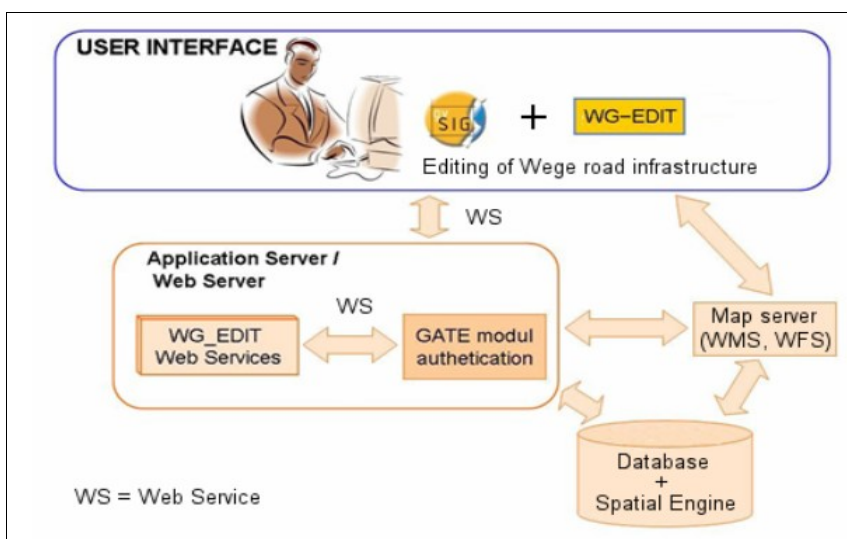


Figure 1 WG-Edit extension architecture

The extension architecture is depicted in Figure 1 and is characterized by a loose coupled approach: the interaction between GIS users (gvSIG + WG-Edit) and Wege occurs via apposite Web Services. Authentication and authorization, provided by the Gate module, are also exposed as Web

Services. Such infrastructure allow Wege to provide proper data-access policies, regardless of the specific implementation of the Gate module (actually provided by Usergate, another Sinergis product). At the same time, all operation achievable through Wege could be achieved by another road infrastructure management tool that implements the necessary Web Services. Openness of the system is a crucial objective of the WG-Edit extension: data exchange is obtained through textual messages in standard format (OGC GML for geometries and XML for everything else) and only OGC services are used for maps (WMS and WFS).

All WG-Edit functionality require the user authentication as preliminary step . Only once a user has logged in successfully, a new customized gvSIG View, named “WG-Edit View” is created.

This View is the starting point for all WG-Edit work session and is characterized by:

- A predefined reference system (e.g. EPSG:25832)
- An initial extent which correspond to the last saved one (that displayed before logout)
- A certain number of working layers (configurable via a dedicated administration panel)
- A preconfigured snapping tolerance and snap-to the WFS road layer in editing-mode
- Automatic refresh of WMS and WFS layers after modification of the road network
- WFS searching tool (that overcome WFS underscored attributes reading errors)
- Editing tools for a correct Z-dimension management

The peculiarities of the Wege system are:

- Historical support
- Notification of road/events changes to their owner/responsible
- Observation of bilingualism
- Respect of topological model constraints
- Openness and collaborative approach

4.1. Technological components

In the current implementation, the pieces depicted in Figure 1 has been filled with the following components:

- Database: Oracle + ArcSDE Application Server
- Application Server: JBoss, AXIS for SOAP Web Services
- Map Server: UMN Mapserver (or GeoServer)
- WG-Edit extension: on patched* gvSIG 1.9 or on gvSIG 1.10

* in order to correctly read the 4th coordinate from shapefiles we patched the fmap gvSIG library and the related patch has been integrated into gvSIG 1.10. Unfortunately, writing of the 4th dimension is still an open issue.

4.1. Some example

WG-Edit View

After the user login, the special View, named “WG-Edit View”, is automatically constructed. Moreover, also two dedicated toolbar are created:

- the first one is always displayed and is dedicated to general tasks (check-out, lock release, road import, road denomination management, proposal management, snap configuration, road searches, creation of roads and add vertex on underlying road);
- the other one is visible only in editing mode and it is basically needed to correctly manage the Z-dimension (elevation) of shapefiles.

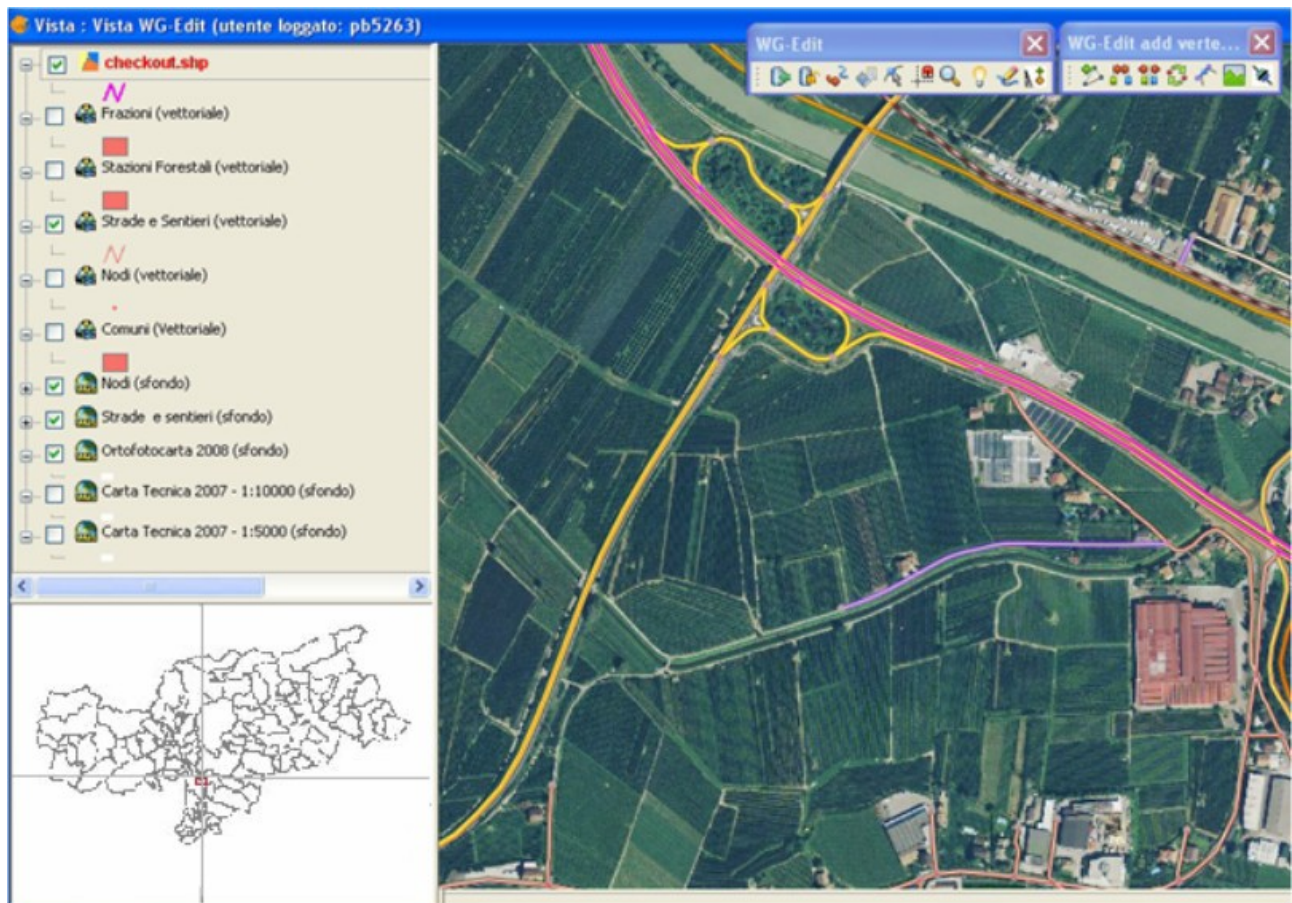


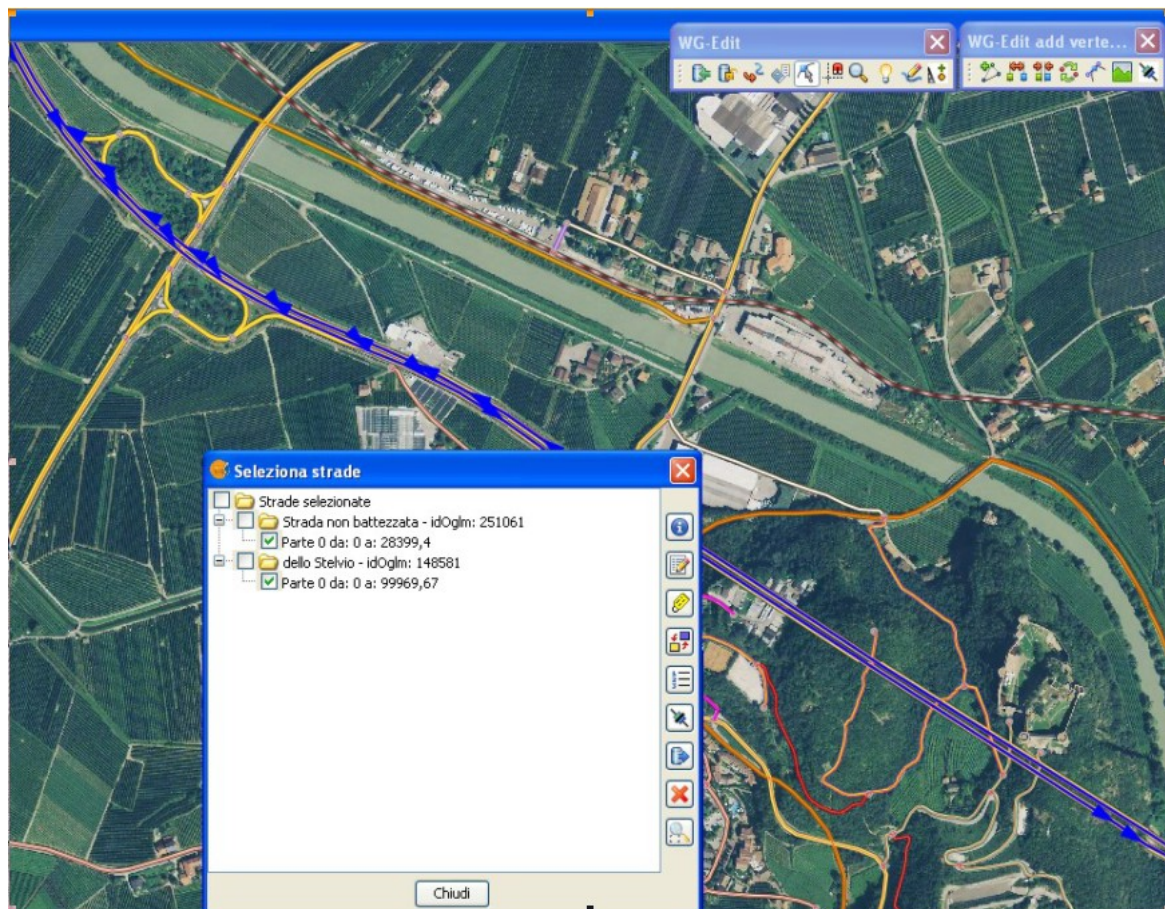
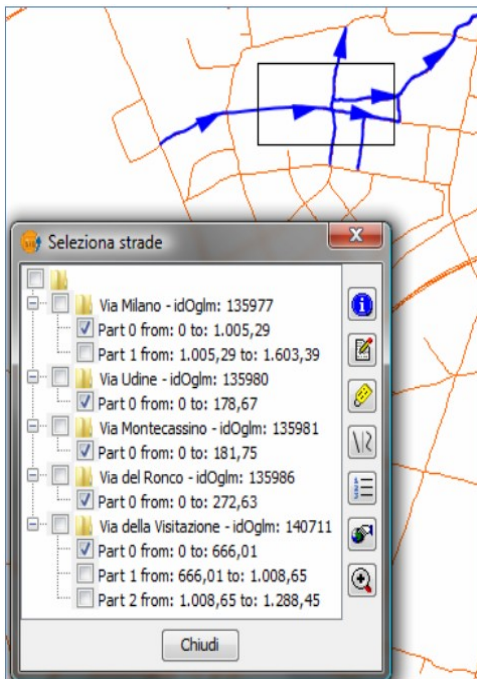
Figure 2: WG-Edit View, an example

With respect to the basic WG-Edit View, the one depicted in Figure 2 contains the editable version of the check-out layer. The concept of *locking* is crucial in this new extension: thanks to this mechanism, multiple users can work on the same road geometry (although on different parts of it). When a user needs to modify the geometry of a road, it performs a **check-out** and locks the needed parts. When the user finish its work, it “commits” the modification **checking-in** the locked parts.

Road selection

In order to improve the usability of the WG-Edit extension, many of the WG-Edit functionality have been collected into one central point: the road selection dialog. This panel is opened after a rectangular selection on the map and it shows to the user all roads within it. The concept is similar to a selection on a WFS layer but, since a lot of additional data is required, the selection operation is performed directly on the spatial layer.

The user is now able to detect which street it has selected and perform a lot of operation on it, directly from the street selection panel. Such operations are: identify, denomination editing, baptize (association of a denomination to a street geometry), change of typology (e.g. secondary road -> freeway), parts management (reorder, reverse, Z-management), connections test, check-out, road removing (with historical support) and zoom-to.



Z-dimension management

One of the most innovative and complex feature of the WG-Edit extension is the correct management of the Z-coordinate (elevation). Unfortunately, gvSIG does not properly handle the writing of shapefiles with both Z and M dimensions so, many of the common editing operations of gvSIG has required a dedicated button on the WG-Edit toolbar. Moreover, operations such as point addition requires additional constraints such as automatic Z valorization.

To obtain Z value of a certain 2D point there are three basically different ways:

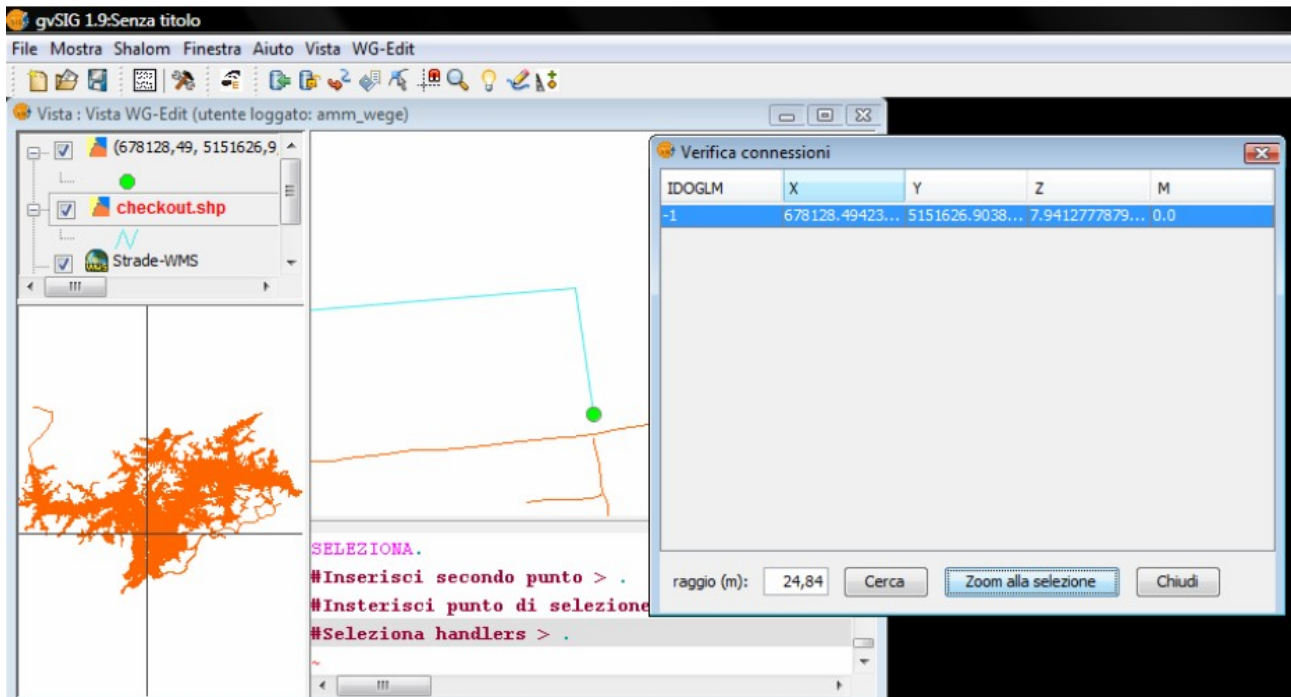
- **Client-side computation** (through Sextante profile): the Z coordinate, intrinsically contained within a DEM (Digital Elevation Model), is retrieved from its RGB representation. The precision of the computed values depends on the resolution of the underlying image. Unfortunately, this approach has shown its limitation in a real work scenario due to the exceeding download time for high-resolution images (exposed via WCS);
- **Server-side computation**: similarly to the just described approach but much faster because the DEM is already located on the local file-system (no download time to wait for). Unfortunately, also this solution presents its side of the coin: the Z computation is a rather expensive operation from a computational point of view and, thus, processing resources could be affected;
- **Manual editing**: sometimes, Z coordinate gets corrupted. Errors could be inherited from DEM or can be generated after an upgrade of the database. At this purpose, a dedicated framework, named Plot Editor, has been developed and integrated within the WG-Edit extension (see Figure 3).



Figure 3 Plot editor developed for Z editing

Connections test

Such a feature aims to help the users in ensuring the correctness of road intersections, easing the detection of “possible open connections”. In other words, all end points of selected parts are examined: if within their neighborhood (defined by a search radius) there are vertices of other roads, they gets marked as “possibly open” and displayed in a dedicated dialog (see Figure 4).



Change notification

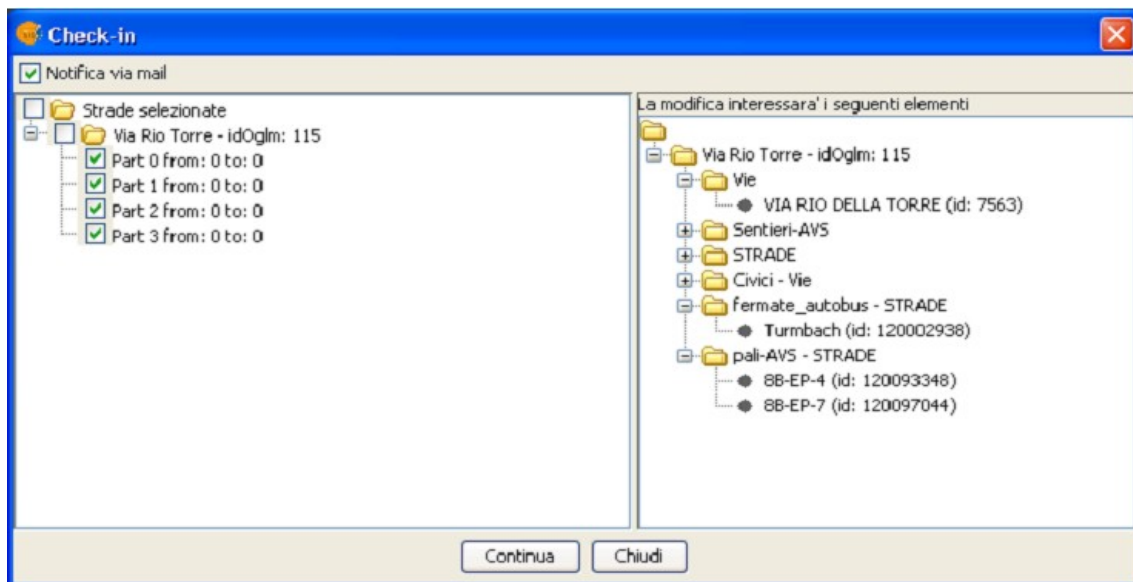
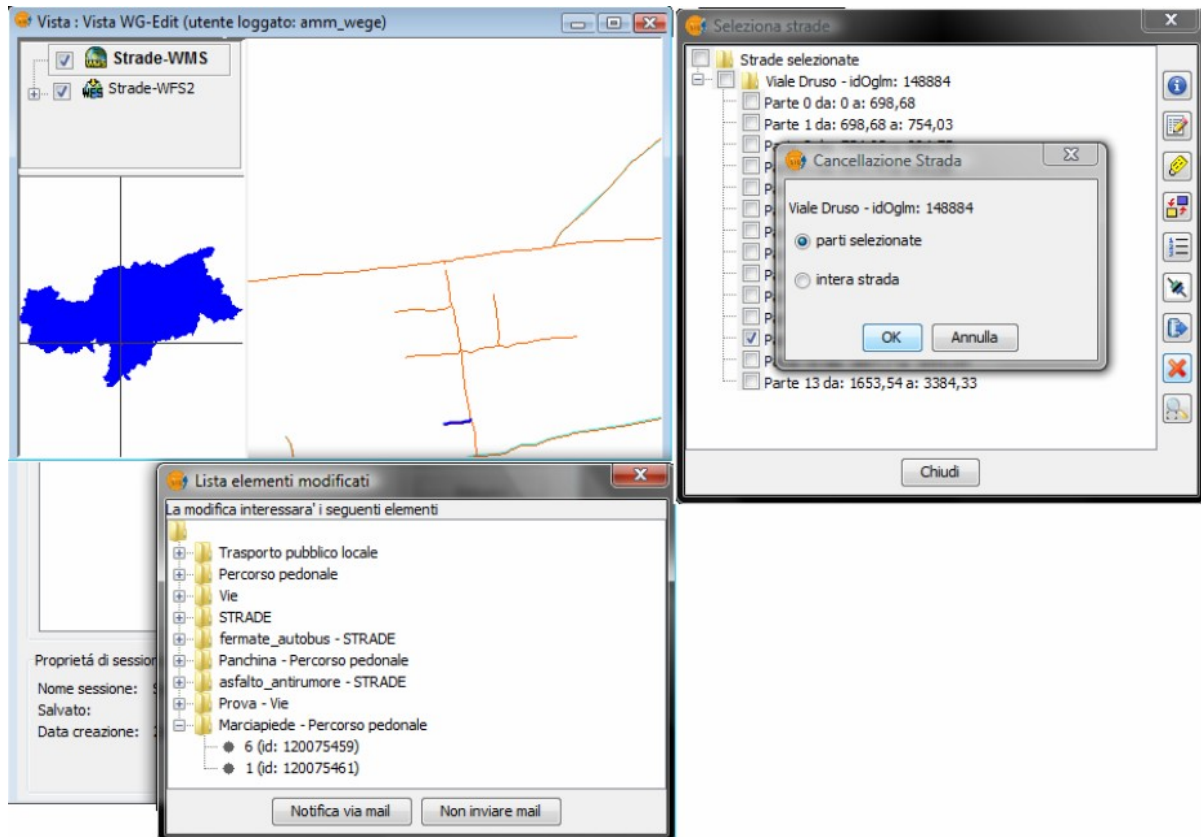
As mentioned during the introduction of the Wege project, the road network is just the base layer. Upon it, users can build multiple OGLM layers[1] and, upon them, one or more Event layers[2] can also be built. In case of modification to the underlying infrastructure, person in charge for OGLM/Events must be informed about the change, in order to verify if their position is still valid or not (see).

For example, suppose that there's a bridge upon a road. If the geometry of such a road gets modified, the bridge could be affected and, thus, is marked by Wege as invalid. The person in charge for bridges will have to go and check if the bridge coordinates are still valid or they must be modified.

This mechanism ensures the proper alignment between physical (road network) and logical layers (OGLM and Events).

[1] OGLM: **O**ggetto **G**eometrico **L**ineare **M**isurato (english: linear measured geometric object). Linear objects correlated to the road network (information based on the road network) e.g. public transport routes, bicycle routes, hiking routes

[2] Event: elements correlated to the road network,. They can be one in of these three formats: *points on the road*, a *double point* (relative position of the element on the road and real position of the element) e.g. bus stops, petrol station, and *linear elements as part of the road* e.g. bridges, tunnels, pavement.



4.1. Solved problems and open issues

- GML parsing: in order to encode/decode 4D geometries with GML, a customization of the Geotools library has been necessary.
- Reading of 4D shapefile has been fixed and the related patch has been released to the community. Such a patch is now natively included in gvSIG 1.10. Writing instead is still an open issue, since there is a remarkable impact on the source code and we need the support/opinion of the gvSIG team before patching that part;
- CAD tools have been partially replicated in order to correctly manage Z coordinate and add some extra functionality (such as automatic Z valorization on point creation). A solution to hide specific buttons of gvSIG editing toolbars is required
- Reading of oracle tables with Java 1.6 and pagination mechanism . Opened tickets:
 - [#14397: Oracle tables creation fails with java 1.6](#)
 - [#14396: Big Oracle tables hangs](#)
- Reading of attribute WFS values
 - [#14395: WFS: underscored attributes reading](#)
- Editing tool issues in gvSIG 1.10:
 - [JOIN: Z value gets damaged](#)
 - [SPLIT: not feasible. The split button remains disabled with 4D geometries](#)
 - [EXPLODE: feature gets removed from the layer](#)

1. Conclusions

We explained in this paper our effort to bring up a new interface based on gvsig for our users. In order to ensure this aim and make gvSIG fit to our needs, we had to enhance and adapt it. Indeed, we invested a lot in the gvSIG platform implementing new functionalities and improving existing ones. We strongly believe in the spirit of open SW and will therefore donate all those intense work, functionalities and improvements to the community.

On the other side, we expect that the gvSIG association is also prepared and interested in taking over such extensions and incorporate it in future versions of the software. This, from our point of view, is a must in order to guarantee the competitiveness of the Association. Only this approach will allow us to further invest in gvSIG and continue with our work on our GIS-platform based on gvSIG- solutions. Investing significant resources in new implementations without the warranty of their compatibility with future versions of gvSIG would be for us a not viable road.