

Whitepaper Online Geo Visualization

Interactive 3D Visualization on the Internet
using “BS Contact Geo”- the real-time 3D renderer of Bitmanagement

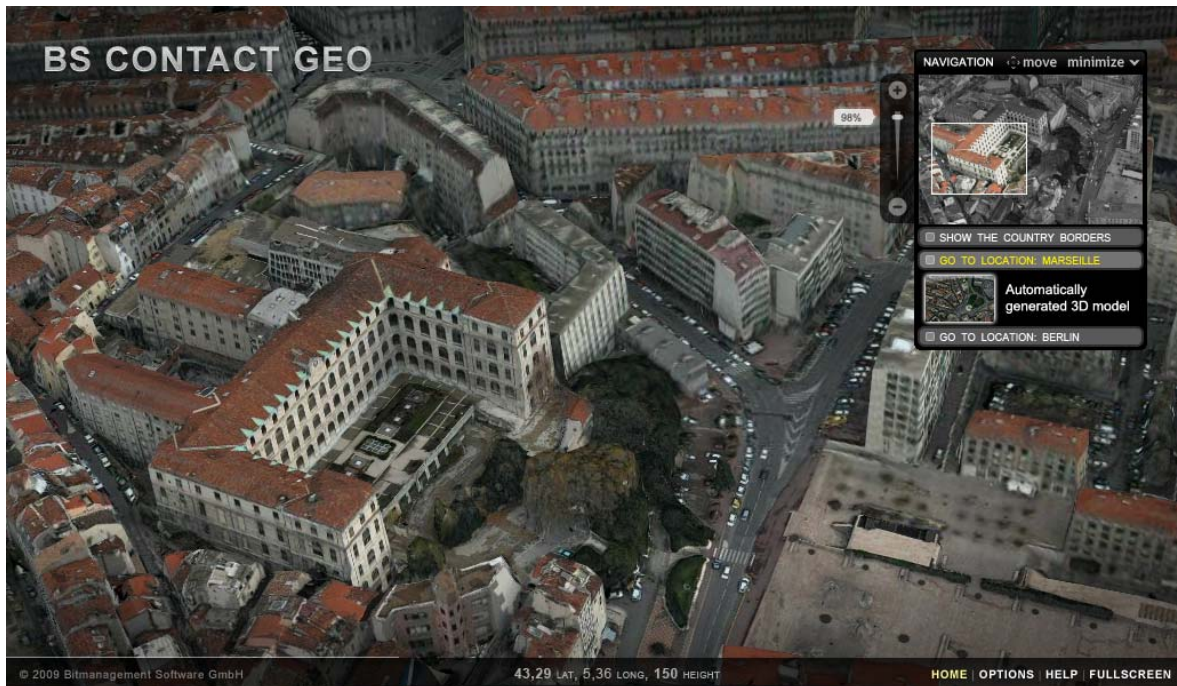


Figure 1: The real-time 3D visualization of automatically generated data covers the whole city area – cutting production time and cost significantly.

Abstract

Internet-enabled real-time visualization of large amounts of geographical data is a key technology in the "Google Earth" era of today. Bitmanagement offers the appropriate client and server software to bring the customer's own applications such as terrain, urban, architectural visualizations and even interior scenes on the Internet. The software supports level-of-detail (LOD 0-4) and the user can navigate interactively in modi like walkthrough. The standard compliance of Bitmanagement's products (e.g. OGC CityGML, MFS, WMS, ESRI Shape, ISO VRML/X3D, Collada, KMZ etc.) offers a high potential for dissemination of interactive applications (real-time viewer: **BS Contact Geo**) and thus is performant and stable. The conversion and reduction (**BS Tiler**) of conventional GIS data into online capable geo-streaming applications (**BS Geo Grid**) on the Internet is largely automated, so that integration (**API: BS SDK**) as a complement to traditional offline GIS systems will be facilitated.

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1. Visualization – one out of five current GIS Market trends

The growing usage of 3D visualizing of geospatial data is surely one of the most important trends on the market for geo information systems (GIS). About 75% of information in an advanced economy are based on geo information data (trend 1).

A multiplicity of companies already use digital GIS applications. Today, these systems need to be interactive and Internet ready. The rising acceptance of Web 2.0 in the private and business area is thereby producing optimism for providers of GIS technology.

Beyond that the software has to fulfill further requirements, arising also from other current market trends. Due to the shorter innovation cycles of basic technologies (such as computers, operation systems, networks, data banks, and multimedia terminals) suppliers of GIS technology have to gain high revenues from software packages within a much shorter period of time, with larger volumes of items and with more software licenses (trend 2).

The software development must pay off accordingly and the continuous updating must be ensured. Large volumes of items and a larger operating distance can be accomplished by on-line concepts and/or Internet-ready products. It becomes therefore also ever more important to ensure fast installation (roll out of systems), comfortable customer interface and simple integration of existing data and methods. These preconditions gain more importance particularly in case of consumer oriented applications (trend 3).

GIS suppliers will strengthen the cooperation with development- and distribution partners (trend 4) to master shortening of the innovation cycles and quicker selling of products.

In principle the decision in favor of or against a GIS solution does much less depend on software costs, rather than the short term and reasonably priced availability of geo data and its integration into existing EDP applications (trend 5). The underlying trend of digitization as well as the spreading of efficient PCs together with a much higher bandwidth of the Internet make it possible to develop new business models for today.

2. The market for Geo Information Systems (GIS)

Geo Information Systems rank among the key technologies for innovative service providers. Therefore importance to GIS is accomplished due to a number of new applications, for example for the ongoing reorganization of Germany's service society. International market research institutes see a mega trend in the use of geo data and geo information systems. Anyhow, the European market already showed a market volume in 2004 of 1.5 billion Euros.

Also on a long-term basis the GIS market is considered as a billion-Euro-market. The market is strongly fragmented and still one can consider only a few market figures. Therefore only rather vague growth rates can be estimated for the near future. However experts are expecting also in the coming years high to even very high growth rates.

The strongest dynamics are expected in the range of economics and public administration. This is driven above all by two facts: In 2/3 of all company processes the world-wide use of geographical or spacious data is implicit and only 20% of this market potential is tapped so far.

That might be at least one reason that there is yet to find the right momentum for development of the market. The consequence is that only a few international big companies predominate the GIS market. As far as Germany is concerned the biggest vendor of geo data is the Government. At the same time the government is also the most important power for demanding data. Though political institutions have enormous data sets, they have not yet been digitized as a consumer good. Today however municipalities increasingly start to sell their geo data to so-called „refiners“ who digitize the analog data and some times also enrich the data with additional information (e.g. moisture measurement or detailed elevation data). Generally speaking the data supply is the problem rather than the availability of state of the art software technology.

Facing Google Earth and its presence at the end user level the established GIS vendors are now under pressure and are forced to react. Geo visualization based on digitized inventory data or newly won project data increasingly are used in areas like geosciences, measurement and cadastral services as well as city and landscape planning.

3. Decision-making process: it depends on the application

The decision-making process for the use of a GIS system is not uniform. Consequently the appropriate GIS software supplier is determined by the application to develop. Up to date, some 100 GI-Systems might be available on the world-wide market. Depending on the objectives rationalization, efficiency increase, or (2) development of new markets and business fields, (3) development of municipalities in the sense of an information society having most modern IT equipment available for improvement of citizen services, one has to speak to the

respective different target groups of decision makers.

The “intergeo” fair, offering a profound overview of the GIS software provider market, is changing the locality each year.

Conclusion: The more flexible a GIS software is, the easier it can be integrated for different purposes and can be marketed to a broad extent. The GIS software using customers have to find a stable product that meets all and even specific requirements for setting up and/or adapting.

4. Client software offers conceptual advantages for GIS

Client-software represents contents of GIS applications on the PC of the end user in real-time, which means, the content is not rendered on servers. Due to the real-time ability interactive concepts can be realized in which the client himself is engaged. The content can be explored in free space by the user, e.g. with new options like navigating through content or when exploring environments. The user can leave actively even prepared paths in a presentation, as well as he can e.g. regard and handle an object ad libitum. The user’s actions activate animations putting again new interaction possibilities in operation, like buttons, sliding controls or object behaviors.

Due to the computing power at the client’s terminal the data sets for transmission on the Internet can be reduced down to partially few MB in comparison to conventional films. Thereby the natural data volume does not any longer carry weight regarding downloading or streaming in the Internet. At the same time transmitting and disseminating applications in the Internet or on CD ROM and DVD is simplified.

5. Accelerate your geo applications with BS GeoGrid Server.

Similar to video streaming, large geospatial data is sent in tiles over the Internet from the BS GeoGrid Server directly to the receiving client. The BS GeoGrid server keeps the channel to the client open in order to send the data tiles faster than from a normal web server.

Through the conversion of the geospatial data with the BS Tiler tool into fast-loading tiles and permanent intelligent streaming of data by the client software (BS Contact Geo) the visualization can be done already before the entire model has been downloaded completely. In this way, you can visualize virtually unlimited quantities of data to the user clients.

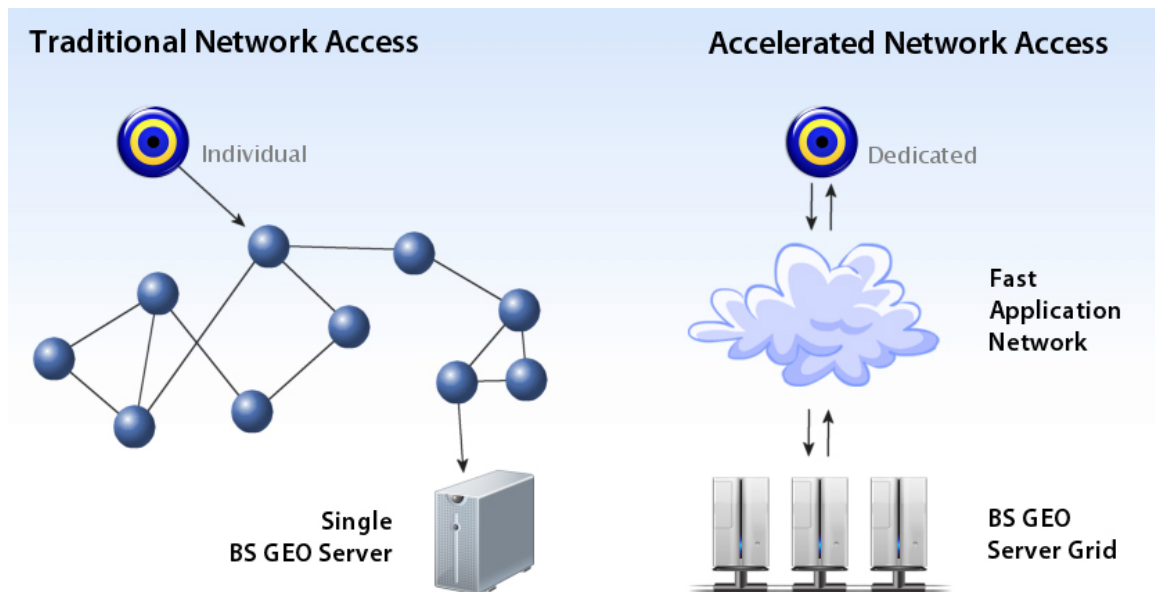


Figure 2: Fast Geo Streaming of large datasets on the Internet using BS GeoGrid Server A

A further acceleration is the use of multiple BS GeoGrid servers for the same application and the same user (eg client BS Contact Geo). The BS Geo Grid server uses a dedicated grid network of web servers to send the data to each client from multiple servers simultaneously.

Concurrent access of a large number of users can be optimized with BS GeoGrid server also, so that a web service is more stable when many users simultaneously request the same area.

6. Prepare your data automatically for the Internet

Optimization for fast rendering of elevation models, vectors, point clouds and satellite image textures. Automatic triangulation and generation of tile and LOD structures.

Preparation of the data for online streaming at runtime and unlimited walkthroughs/flyovers e.g. in landscapes. GIS layers can be imported in the application developed.

Encryption on request with customizable GUI using BS Contact Geo and usage of computer server cluster via BS Geo Grid for acceleration of the application.

Product features:

- Automatic tile building and optimization for fast rendering of data derived from point clouds, models and imagery
- Import of elevation grid data, grid textures and vectors
- Import of ESRI *.shp-files
- Triangulation and tile building
- Automatic level of detail (LOD) optimization

- Data reduction
- Tile edge optimization

Output texture formats: JPEG, JPEG 2000, PNG, TGA

Example: Through the use of BS Tiler, 120 GB of earth image data have been reduced and optimized to 4 GB for the deployment on DVD and the Internet.

The landscape models that have been optimized with the BS Tiler can also be integrated as a component within the BS Contact Geo 3D Viewer in enduser applications.

7. BS Contact Geo was developed for the GIS market

The BS Contact Geo viewer has been developed for the GIS market to support geo-specific nodes of the VRML/X3D standard as well as further geo-relevant features such as geo coding and geo-mapping of different textures.

The following description gives information about the geo-specific functionalities of the viewer (geo-features) and basic functionalities are described in the release notes.

The visualization component is used by customers for different applications. Therefore many relevant requirements of the customer can be fulfilled by BS Contact Geo as the enabling software.

Some of this functionality include

- (a) extending an application from 2D to 3D,
- (b) 3D integrating on the Internet or
- (c) 3D integration in video sequences

As a 3D GIS Viewer BS ContactGeo is offering real time interactive fly-over animations and accessible visualizations of city models showing also representations of vegetation. All these animations can be disseminated on DVD, internet, on a PC and CD/Rom. Due to the support of ISO-Standards the viewer can be simply integrated.

Its main functionalities are fast representations of large data sets by streaming technology and level of detail (LOD), geometry use in tile structures (Oct-tress, Quad-trees) and optimized memory management by pre emptive caching. Optional the stereoscopic representation can be supported as well as functions such as shaders, real time light and shade effects, live videos and augmented reality.

Further geo tools such as BS Geo Former, BS Tiler and BS Reducer support the developing workflow of a GIS application and complete the integration of Bitmanagement's software in the GIS market.

Bitmanagement offers the download of its visualization component for testing purposes without any functional restrictions.

8. Applications

The demand for 3D based representation of Geo data is growing. The experience of Bitmanagement in many customer projects shows that with the BS Contact product family 3D projects can be additionally converted to the GIS system with existing data. The GIS is supplemented around processes, which makes it possible to realize the 3D visualization in high performance and without delimitation of the data sets. Also a coupling with the GIS is in particular possible with applications of Internet. Further highly detailed architecture models can be integrated into multimedia environments. We have arranged customer applications on the following pages related to these topics and provided these with appropriate links to the live application.

8.1 3D Earth Globes



Figure 3: 3D Earth Globe with layering of 3D geospatial data

Mirror Worlds are reflections of the real world (such as landscapes, cities, etc.), in which a user can move freely. The necessary geospatial information comes from pictures taken from outer space (satellite images) as well as from aerial photographs. This image data is superimposed on 3D digital elevation models (DEMs) in various resolutions up to street level. This allows the visualization of city models and buildings with walk through functionality. Google has prepared this market and has developed the first professional application (Google Earth). Therefore more and more end-users (consumers) require comparable 3D solutions.

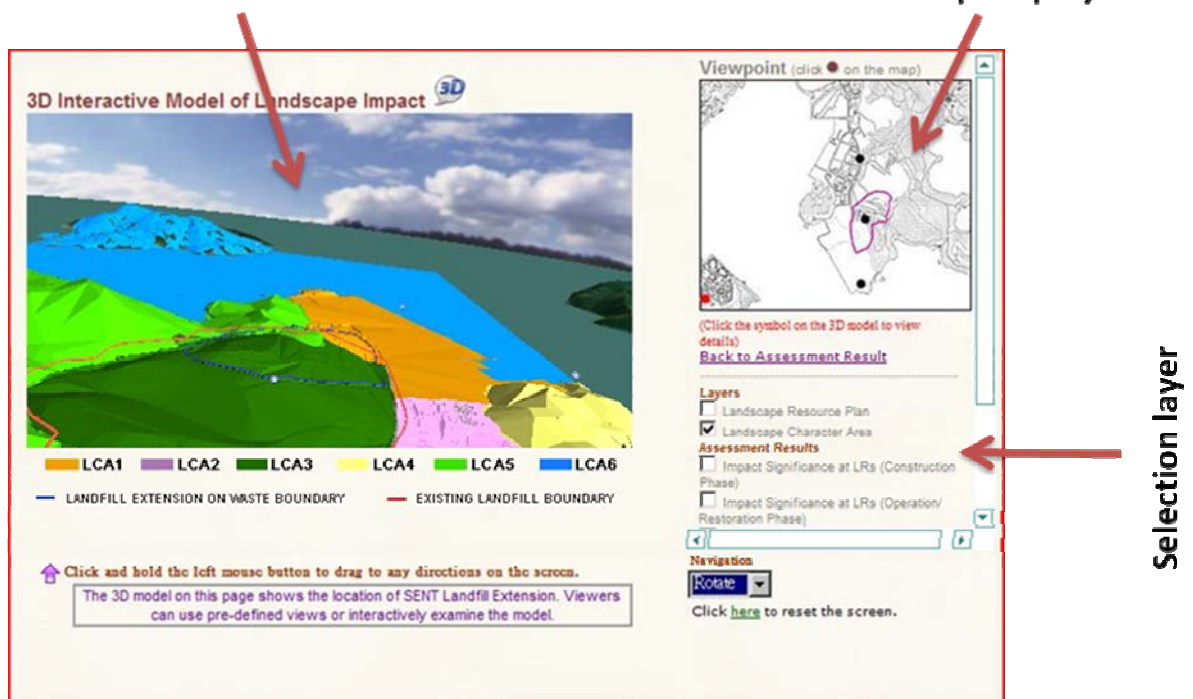
With the software for Mirror Worlds, we enable our customers to transform their existing geospatial data into new online business models. The quality depends essentially on the availability of satellite imagery or aerial photographs. Large amounts of data even complete city models and landscapes can be visualized on the Internet using intelligent data streaming. The user interface of the software product and features such as access rights or the necessary level of encryption can be determined from the business models of our customers.

This application is available online:
<http://www.bitmanagement.com/en/demos/geo>

8.2 Integration of GIS information into a 3D application

Integrated BS-Contact Viewer

2D Map Display



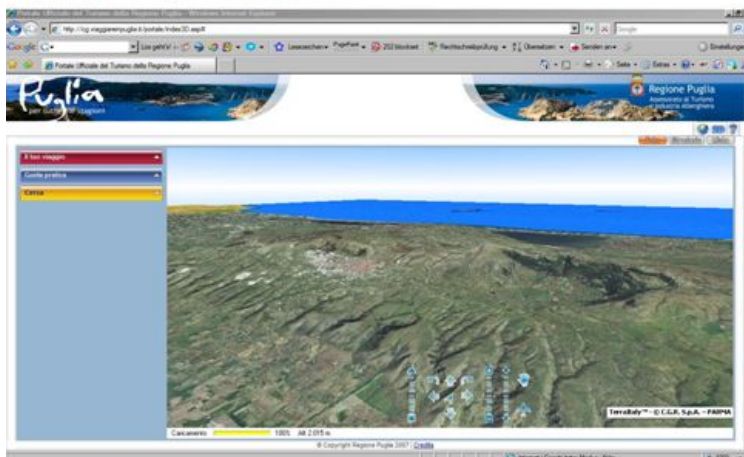
The Basis of this system is a standard GIS application, which is based on the ESRI technology for the representation of environmental influences. The results of the analysis are represented conventionally in maps. As an addition the results are three-dimensionally visualized by means of the BS Contact viewer integrated into the Website. The viewer can thus regard the results computed in the GIS interactively.

This application is available on-line:
http://202.128.236.109/pub/sent2/L&V/L&V_index.html

8.3 Coupling of 2D and 3D portals

This 2D/3D tourism portal is concerned with the classical Web – GIS application. Maps with different contents can be represented individually and can also be overlaid. Apart from the zoom the usual functions of the Web-GIS are also contained. Further search functions exist and lead to different touristic contents like restaurants and art or historical museums. The 3D application is initialized by click of a button. With the same ‚Look and Feel‘ as the 2D application, the user can move around in the 3D landscape and call up the same information as in the 2D representation. The integration of City models is possible here in LOD1-LOD4.

3D Tourism Portal In Italy



2D Tourism Portal in Italy

3D Display Button

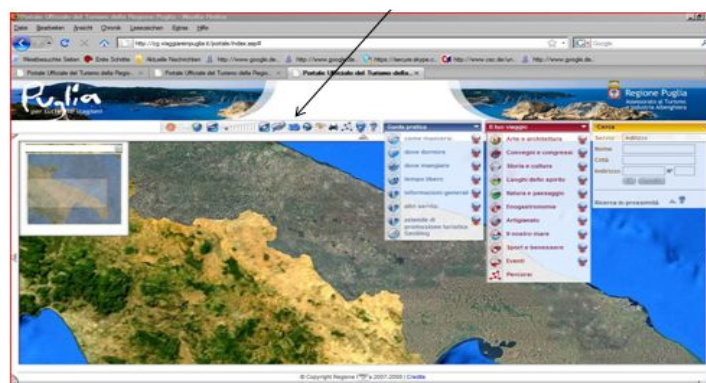


Figure 5: Interactive Tourism on the Internet.

This portal is available at: <http://cg.viaggiareinpuglia.it/portale/index.asp>

8.4 LOD 3 and LOD 4 city models with interaction and multimedia

Based on a cut of the LOD 3 - city model of the city of Prague, the city hall was modeled and integrated in LOD4. The interior of the city hall was illustrated by reconstructing the originals. The user can move freely in the city hall and has the possibility to navigate in the areas of the individual coworkers on the Internet and in Real time.

City Model (excerpt) in LOD 3

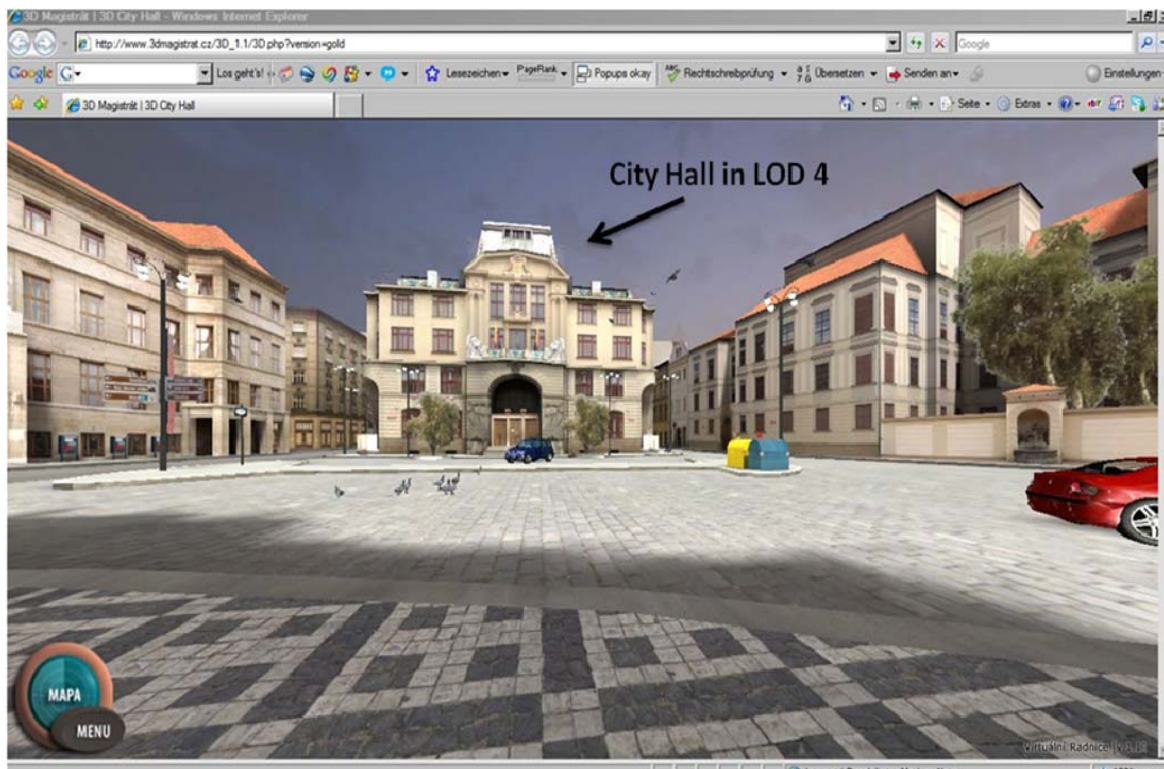
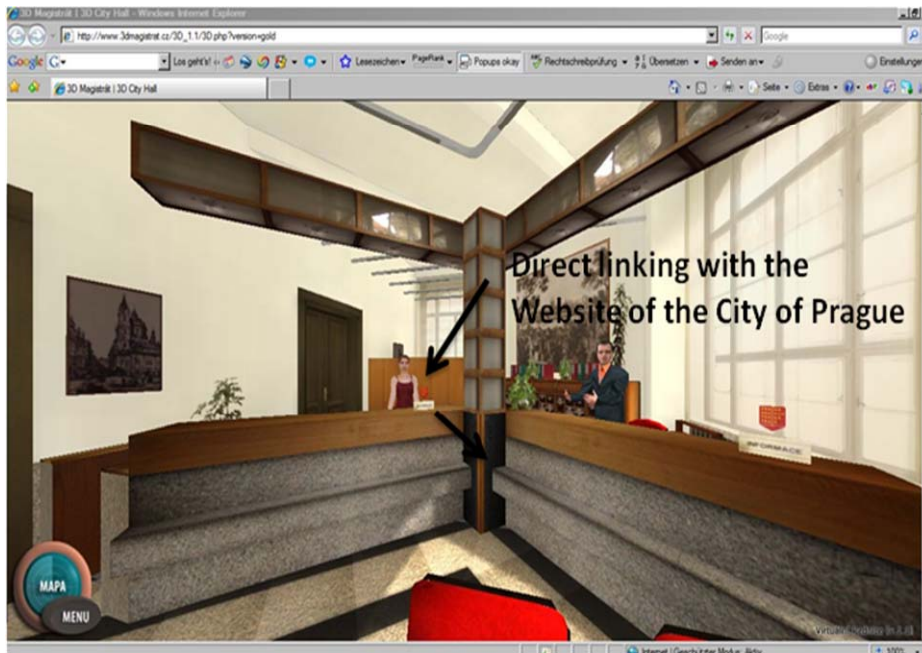


Figure 6: Highly detailed city visualization in LOD 3 and LOD 4

The Application demonstrates the almost unlimited possibility of the interaction and Linkage with multimedia contents. From the entrance hall one arrives directly to the e-Government platform of the city. The user can himself move either freely through the model and find the office or view the online represented office of a coworker.

Reception in City Hall LOD 4 Model with interaction



Office staff for personal interaction with the website

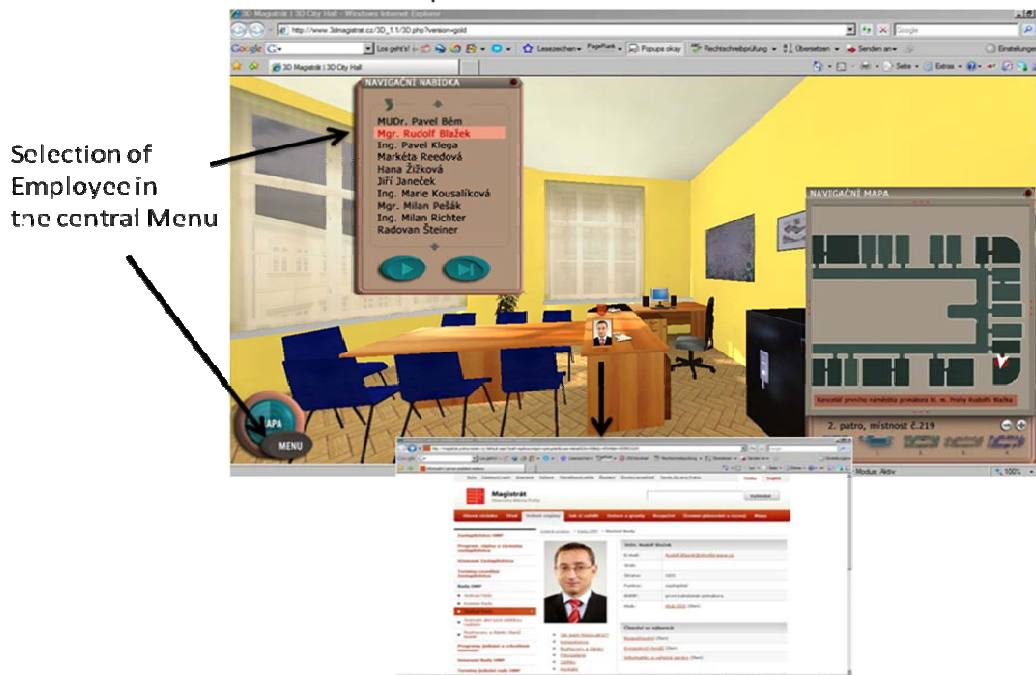


Figure 7: E-Government application for more support of the citizen.

This example is available at: <http://www.3dmagistrat.cz/en/enter.php>

8.5 Visualization of historic cities

Here on the basis of data which was collected from the excavation place in Spain , the first Roman Settlement outside of Rome was reconstructed. The viewer can also commit partially out-modeled buildings and enter them on the Internet.

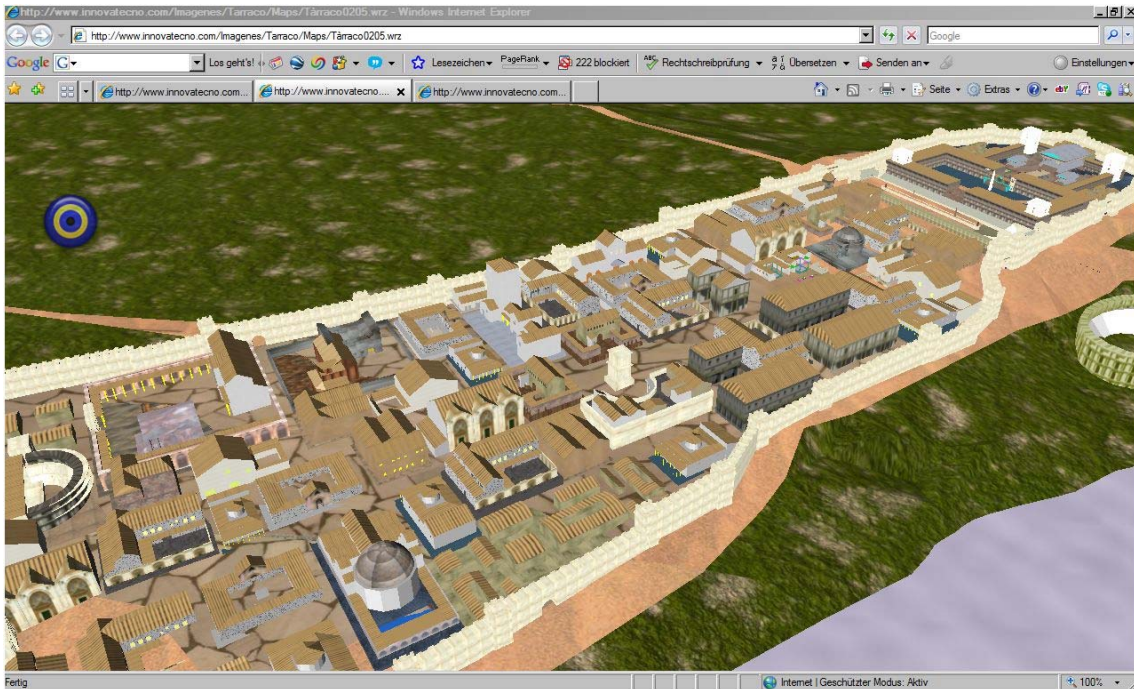


Figure 7: Visualization of historic cities – Ancient Tarraco online:
<http://www.innovatecno.com/Tarraco3DEng.php>

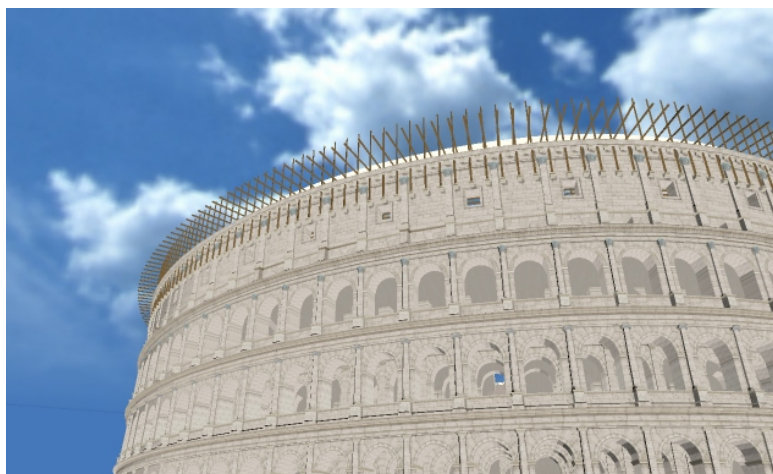
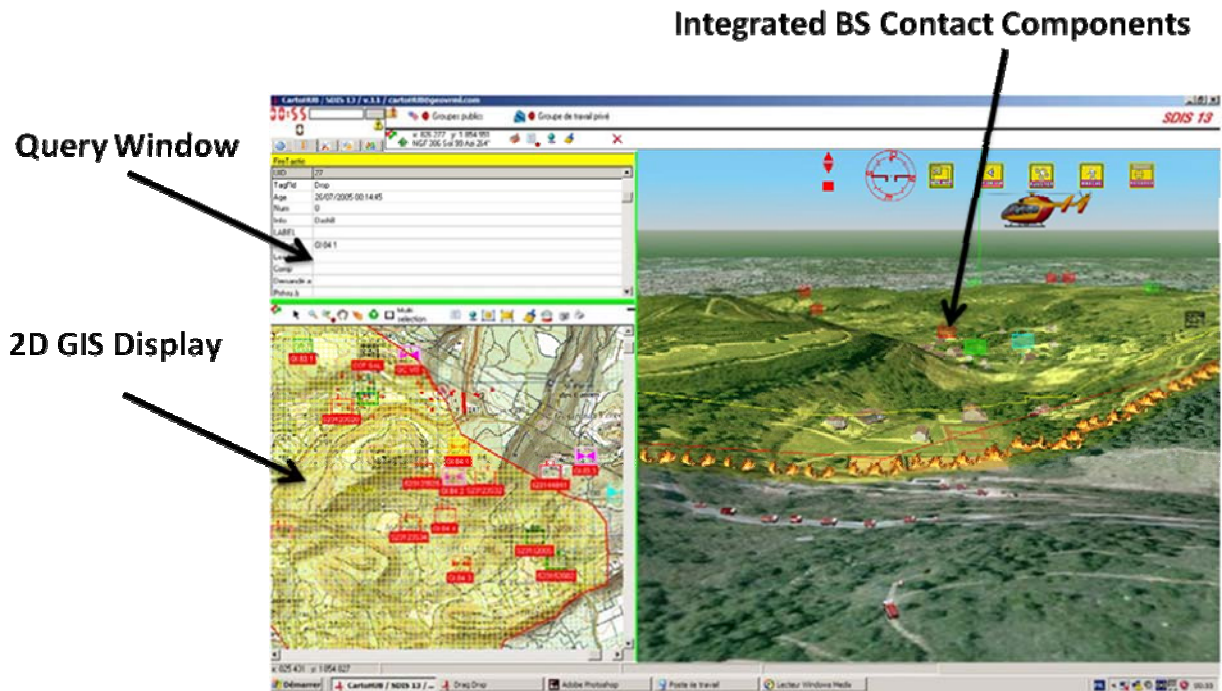


Figure 8: Rome Reborn Project – the Colloseum online:
<http://www.pastperfectproductions.com/>

8.6 Safety applications



This application is a solution for those fire fighting measures in which monitoring and training are used. Here a Geo Information System in 2D was coupled directly to a 3D visualization component. In the 2D GIS inquiries can be started and switched off depending on the application Layer. In the 3D visualization these data are then represented additionally coupled to the area elevation data and aerial photographs. The symbols come in addition to it. Decision making in the emergency cases becomes thereby simpler and more effective.

8.7 Navigation in Cars - Online

Modern navigation equipment has Internet access to various applications in addition to Navigation. For example a database binding for useful information to cities, regions, and objects of interest is included. Navigation is supported with 3D maps and area representations on the display. Thus the driver is led by close to reality house row alignments and streets.



9. Contact

Please find our product portfolio, demos and test-download of our software at:

Bitmanagement Software GmbH
Oberlandstrasse 26
82333 Berg near Munich
Germany

www.bitmanagement.com
info@bitmanagement.com

Telefon: ++49 (0)8151-971708
Telefax: ++49 (0)8151-971709

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