THE ILL WIND THAT BLEW SOME GOOD

A UNIQUE AND POWERFUL FORESTRY GIS AVAILABLE TO ALL THE FORESTERS IN SLOVAKIA RECEIVED LITTLE TAKE-UP – UNTIL A ONCE-A-DECADE STORM SHOWED THEM WHAT IT WAS CAPABLE OF DOING. MIROSLAV HOLUBEC LOOKS AT HOW IT HAPPENED

An experienced team of specialists from the state enterprise Forests of the Slovak Republic (FSR) and geospatial solution-developer YMS has created an innovative forestry GIS solution that is unique in Slovakia and the surrounding countries. It has a growing number of users, there is constant development of new functionalities and interest from other organisations, and it's won an award. But it took a storm to show users what it was truly capable of.

FSR looks after all state forests, managing almost one-fifth of the whole of Slovakia. Every year, Slovak foresters farm more than 900,000ha of forest land and harvest around 4m cubic metres of timber. FSR is, therefore, just from its area, one of the largest organisations using a GIS in the Slovak Republic.

FSR started to create its organisational GIS back in 2007. It analysed the existing systems and undertook studies into the implementation, long-term operation and gradual development of a potential new GIS. A local GIS application was launched in a test operation in Povazska Bystrica using selected data. However, the then FSR management decided to stop the project after a year.

"However, the need to work with spatial data efficiently remained acute in the whole organisation," says Jozef Samel, one of the GIS's creators and sponsors in FSR. "A few years later, the final management decision was made – to modernise the GIS from the very core and start using it throughout the whole enterprise."

FSR and YMS created a strong team of client and supplier GIS experts, and the work on the new GIS solution began.

The main concept of processing and working with forestry data was built from scratch, as there was no preceding system to work with, other than the small local GIS test. Users originally mined spatial and descriptive information by combining data from several independent applications, through online search or even by manual overlay of cadastre and forestry maps on daylighting tables. In a special desktop application (POZMAP), they worked with cadastre maps, forest area maps, and building and watercourse maps. Data about timber harvesting, forest property or forest farming records were pulled from other independent applications (WebForest, Estater or CBPC: Calculations, Budgets, Planning and Controlling).

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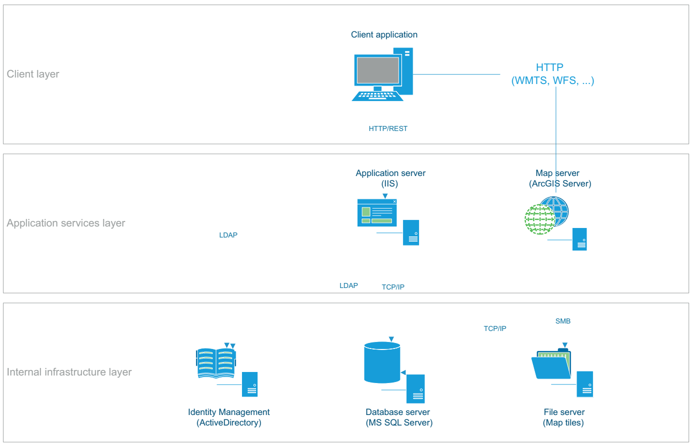
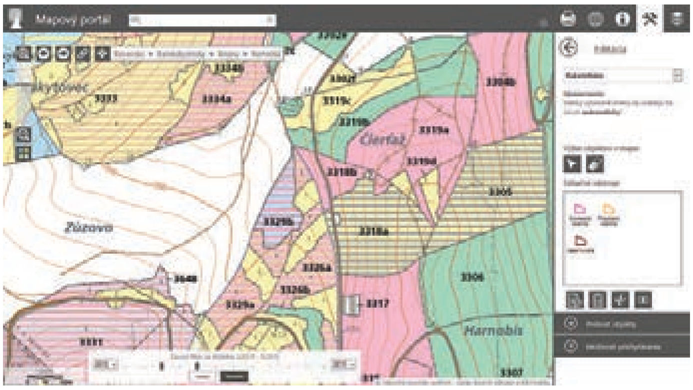
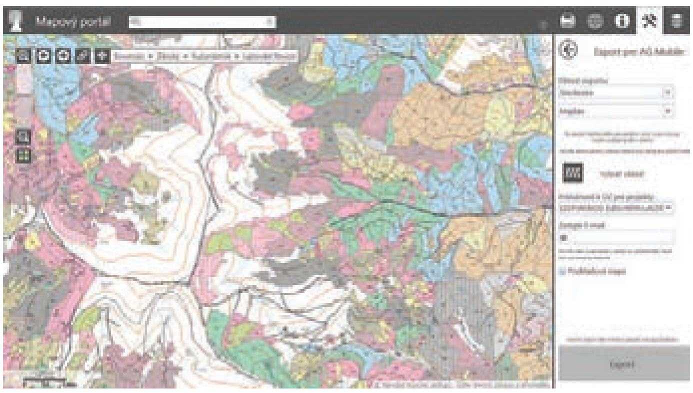
The GIS's interface



The system's architecture



Time cut – filtering geographic data in time using the GIS



Export to ArcGIS Mobile

"Centrally stored data were missing, as well as regular and complex data updates, and they weren't accessible to all the users who needed to work with them in a variety of positions," comments Ivan Pôbiš, the client-side mastermind of the new GIS. In addition, he says, "There was no modern geospatial technology and editing functions for working with the map were very limited, as was the integration of data and functions with other, independent systems."

Clear requirements

When the concept for the new solutions was being outlined, it was clear that there were two main requirements. The new GIS had to integrate and synchronise all forestry data from a variety of sources and make it available to thousands of users according to their varying competences. The geospatial technology also had to be robust enough to enable foresters to build on it in the long run, to develop it and to add new functions easily according to gradually emerging needs.

The analysis yielded a clear result: a web application accessible from internet browsers. The team of creators implemented the solution on a Windows Server using map data and services are provided by the ESRI ArcGIS for Servers technology, the data being stored in a Microsoft SQL Server database with the ESRI Spatial Database Engine upgrade.

The new system was officially titled IS WebGIS. It is composed of independent components integrated into one application. It operates on the FSR internal network and is connected to the existing central system for user identification, ActiveDirectory. Every user, after logging into the computer, automatically gains access to IS WebGIS directly, according to his or her position and based on rights assigned by ActiveDirectory.

Basic architecture

The FSR GIS solution is composed of three basic tiers: the client, the application and the internal tier. The client application communicates with the user and runs through a web browser. The application servers tier is at the core of the solution and carries the logic of the web interface for the client tier (application server), as well as working with map data (map server). The application server also contains the access point of the thin client application, which is responsible for authorising the user and the client interface.

The map server provides services with map data and compositions in two forms: as raster pictures (tiles) or as vector data. The tiles are map pictures prepared either in advance or dynamically, which puts less demand on the application. Vector data is intended for interactive selection of objects and geometry editing.

At the bottom tier, there are internal servers, which provide functionalities for application servers. The identity administrator manages the access of users to the application and is connected with overall logging of users into the FSR operating system. The database server provides the main storage of attribute and geographic data, as well as synchronises data, so that all FSR users work on the same activities with identical data in different spaces. The file server is designed to store and provide files, especially map service tiles.

Scattered data

As the FSR forestry data was scattered among several sources, one of the first project steps was to fill the central geodatabase with spatial and descriptive data from internal and external sources. "One of the most important preparatory phases was gathering all data available to FSR throughout Slovakia. The forestry team lead by Mr Pobis helped the software creator tremendously with data preparation: they gathered data, inputted them into the database, defined database structures as well as data stored in it, and cooperated expertly with YMS data specialists," explains Peter Bobal, YMS data and GIS specialist.

After populating the database, a strict schedule and process for data update was created. Internal data, such as hauling places, are updated continuously; cadastre data is imported into the central database quarterly; State Nature Protection data (protected territories) is updated twice a year, forestry data (including attributes) once a year. Data edited by authorised personnel are immediately available to all system users.

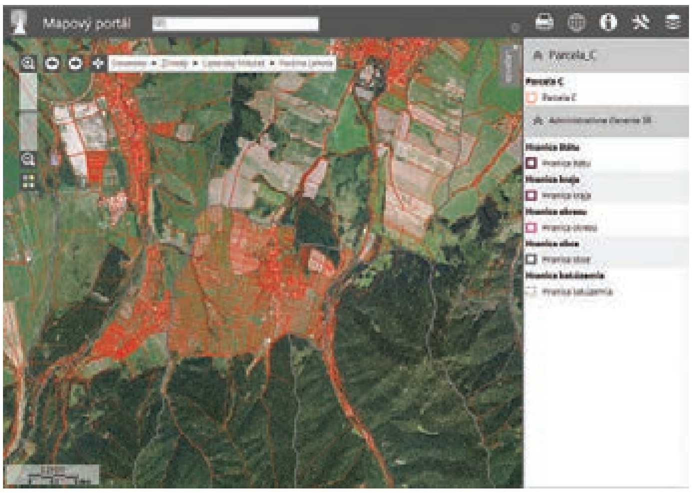
Users – all foresters

The team of GIS creators envisioned providing the GIS to all foresters. Therefore, particular attention was given to appropriate division of users and their rights. At present, the system is used by 'readers', 'editors' and 'proprietors'. Readers can use all the GIS functions that do not change data – they can read and analyse spatial and non-spatial data. Editors are more advanced users who can read, analyse and edit map data and descriptions. Proprietors work with cadastre data – they search for plots according to owners and generate title reports with plots, buildings, owners or weights.

Above all these users are 'administrators'. They can modify data directly in the database, create and publish map compositions and supporting documents, or configure the whole system.

An unexpected test

After thorough preparation of the whole solution in 2013 and a relatively slow start to its use, destiny provided an unexpected event that tested the whole system in the most extreme of conditions — the windstorm later named Zofia. The kind of storm that only comes once every 10 years, it tore through most of Slovakia for two days in May 2014.



Parcels in the GIS

Damage estimates were needed immediately, including the volumes of damaged and destroyed wood, types of fallen wood, and financial calculations. FSR system specialists realised immediately that the new GIS was the tool they needed for this kind of emergency mapping. They believed that damage could be identified more accurately if they did not look for cubic metres of destroyed wood, but for areas of affected territory instead.

"By drawing all affected areas in the GIS and connecting them with the existing data on trees and undergrowth, we would obtain a more accurate calculation of the fallen volume of wood than the one made by qualified visual estimations," says Ivan Pôbiš.

The GIS specialists immediately requested permission from FSR management to begin mapping the impact of the storm, and soon, one of the largest and most difficult mapping actions in the history of European forestry GIS began. For five days, more than 500 foresters throughout the whole of Slovakia were sent out to draw all the affected areas on forestry maps.

"Most of the foresters were using the GIS for the first time ever, without any training, without knowing how to input the field data into the system – they were learning right there and then," explains Ivan, who spent days and nights at the GIS during the mapping period. "We asked our colleagues to draw only borderlines, because those are much easier to edit than polygons. Several other administrators and I connected these lines into closed objects, which helped us finish the task at hand more quickly."

Despite the sudden, octuple increase in user activity, the new and untested system managed without difficulty. Seven hours later, after all the data had been inputted, GIS specialists delivered the first accurate results evaluating the area of wood damaged by Zofia. The numbers were astonishing.

"Every part of Slovakia was affected," says Jozef Samel. "More than 50,000m^3 of timber was damaged in 12 out of 23 FSR branch plants. More than 300,000m^3 were damaged in Rimavska Sobota, Benus and Revuca." Ironically, thanks to the wind storm, users realised that they had a tool that

Foresters from Forests of the Slovak Republic (FSR) conducting field work using the system

could help them with their everyday tasks. "Zofia actually trained our users. Such an event happens once in 10 years and we can easily call it a small miracle," says Jozef. "Now GIS usage continues to grow at a fast rate – daily access to the system is now generally double the numbers during the busiest days of the crisis mapping. Moreover, when system administrators are preparing documents, daily access is hundred times higher."

Successful continuation

Cheered by these successes and the positive reception from users, the GIS team used most of 2015 to complete further development.

"We widened editing tools to contain advanced functions, implemented time cuts, cadastre filters and ownership relationships reports," explains YMS project manager Stefan Hudak. "For foresters working in the field, we created extended exporting tools. We optimised printing tools and foresters now print maps fast, even in the busiest time at the end of each month."

Advanced editing functions – snapping to geometries, copying features between classes, splitting and merging features – are usually only accessible in desktop GIS systems, but are available in the web GIS. "A measuring function, for example, is part of advanced editing and allows interactive display of length and area according to each mouse movement, even before the user is finished with the drawing," explains YMS's main project business analyst Slavomír Sipina.

Foresters can switch among historic, actual and planned data very easily, just by entering the required timeframe. Cadastre data filter and ownership relationship report both provide advanced functions over cadastre data. The foresters especially use them for reviewing plot ownerships, with reports containing information about plots, types of plots, partial ownerships, buildings, weights, and pledges – complete cadastre information.

Widened exports for several types of mobile devices support fieldwork. Maps with details are exported from the live GIS to a mobile device. The forester can edit the map or use it for measurement directly in the forest, even without a data connection.

Once he or she reconnects the device, the changes are easily synchronised with the GIS.

Maps in forestry applications

Foresters are getting used to the benefits of actively working with maps. The GIS developers therefore expected the requirement to incorporate maps into specialised forestry applications that are mostly data-based, such as WebLes (Production and forest farming records) or KRPK (Calculations, budgets, planning and controlling).

"Until the end of 2015, foresters working in specialised applications had to separately start the whole GIS system, search for the relevant area and edit data directly there," explains Slavomír. "The YMS team solved this by adding a special plug-in module, the so called integration plug-in, which is a universal, fully configurable tool that can be integrated into any third party application."

The GIS won the Special Achievement in GIS Award from ESRI in summer 2015

When users of KRPK or WebLes need to prepare map documentation, the plug-in calls the map from the GIS system. The map displays directly in the forestry application and only contains those levels, data and functions that the user needs to complete his or her particular task. Editor can edit map elements using advanced editing tools or create new elements. All changes are then automatically synchronised into the main GIS system.

The plug-in is complete and ready to be launched into full use throughout the organisation at the start of 2016, unless foresters decide to speed-up the process.

A good harvest

Foresters are pleased with their GIS and do not hesitate to express their satisfaction with the system that, according to Jozef Samel, "really succeeded and meets all initial expectations." The team is currently works on further developments, during which decisions will be made about the direction that the award-winning GIS will now take and what new development will be supported.

ZOFIA ACTUALLY TRAINED OUR USERS. SUCH AN EVENT HAPPENS ONCE IN 10 YEARS AND WE CAN EASILY CALL IT A SMALL MIRACLE

Miroslav Holubec is director for research and innovation projects at YMS, Trnava (www.yms.sk)