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Simulation, test phase for model

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Author(s)	**J. Berke, G. Hegedus, M. Csak,**
	J. Busznyak, S. Nagy, É. Szolcsányi,
	I. Sisák, S. Nedev, T.Krocan
Participant(s):	**UV, SPACECAD, DUMA**
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Abstract:

The report describes testing of the system for WP 14 The mobile and wireless technology used for information purposes in land management. Region development and landscape conservation together with countryside development and protection of the environment are connected with the re-allotment of land. Considerable devastation of the environment and also lifestyle in the country during the communist regime is a challenge for Eastern and Central The implemented method was tested. As a part of solution was implemented also ESRI product and tested interoperability among system

Keyword list:

Environment protection, Mobile services, Modelling, ArcIMS, WMS, WFS services, Interoperability

1 EXECUTIVE SUMMARY

The application of WirelessInfo results of the basic part of the project into the new land management is the main objective of the extension part that is described in this report.

However, the trials project WirelessInfo applied onto new solutions also offers new possibilities of implementation of mobile communications into every day live in rural regions. Because the WirelessInfo project is trials, the goal is to evaluate possibilities of new equipment on the field of agriculture and forestry. These new technologies are demonstrated on new practical solutions for land management. The whole project is oriented on the connection of GIS platforms with wireless communication (GSM, GPRS). Main goal of this task was to evaluate of areas in terms of understanding situation and trends of current landscape development Task includes data acquisition and pre-processing activities to get complex data sets for further analytical part of the project. The questionnaire within end-user group will be done to have detailed information on the studied areas, their strengths and weaknesses, and opportunities.

This part will consist from:

- Spatial modelling of ecologically stable units
- Terrain analysis and modelling
- Definition of different levels of environmental changes
- Quantification of special units (indices of landscape pattern)

Corresponding to the priorities defined by associated countries, following steps will be supported within workpackages

- Forms of agricultural production respecting environment and preserving cultural landscape
- Restoration and development of villages and care for country heritage
- Water reclamation and land reform
- Basic update of land register
- Country water resources management
- Forestry, including afforestation of arable land
- Technical help for processing all these steps in the form of projects, auxiliary studies for programme preparation and follow up, information and public relations
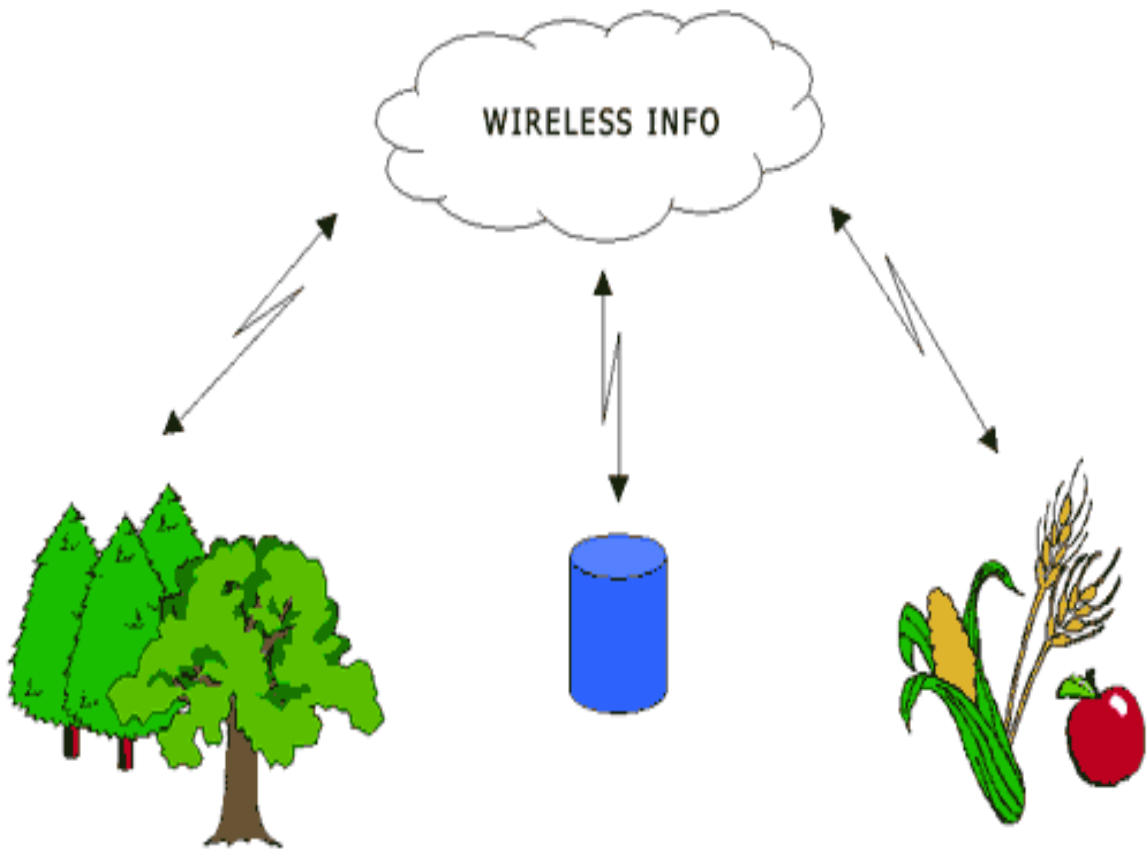
The part of solution was also implement optional ESRI systems and implemented OGC specification WMS, WFS as a test of Interoperability.

Simulation, test phase for model

WirelessInfo

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2   CONTENT OF REPORT

3   Land management

3.1   Coordinated development of land, water management and agriculture on the catchments of Lake Balaton - Summary

Lake Balaton has international reputation as tourist area. The deterioration of water quality, first recognised in the seventies, is caused by the intake of plant nutrients, first of all phosphorus and the consequent algae bloom. The agriculture plays a more-and-more important role in the perceptual phosphorus load, since management actions have already been done to prevent the lake from external point-source loading. The agricultural nutrient loading has its diffuse sources on the whole watershed and originates mainly from land use but minor part comes from animal husbandry as well. 39 % of the catchment area belongs to arable land, vineyard, orchard or garden and only this part irresponsible for agricultural nutrient load coupled with land use. The natural conditions, which pose important boundaries of the agricultural production, were analysed in our study in order to identify major directions of the development. The climate is favourable for near-shore vineyards on the northern part of the watershed. The distribution of the precipitation is very variable, the heavy showers in the summer season may cause considerable erosion damage especially in the hilly northern catchment with great relief.
Some parts of the watershed belong to the rainiest areas of Hungary, which establish good basis for development of greenland management and grazing cattle husbandry. 48% of the arable land on the northern watershed, 20% on the southern watershed and 42% on the western watershed of the lake is exposed to water erosion due to the relief. The soils generally have low or partly medium natural fertility. Regarding soil quality it is a somewhat backward area where soil degradation processes (erosion, acidification) can hardly be overcome by farmers without support.
Land use Reliable delivery ratios of eroded nutrients in water courses hasn't been established yet. The nutrient loading depends basically on erosion and less importantly on fertilisation at some areas. Serious phosphorus accumulation in soils is not desirable but one cannot imagine an escape from the recent crisis of the agriculture without increased fertilisation. The woodland rate of the watershed is higher than at other parts of the county and still an increase is recommended on steep slopes in order to change arable farming. Row crops should be grown only on land with less than 5% slope.

3.2   Coordinated development of water management and agriculture on the catchments of Lake Balaton

The land ownership has a paramount importance from the load point of view. Competition of an agricultural land use/land ownership program is absolutely necessary in order to re-introduce regular soil conservation practices and implement already existing soil protection-melioration plans. The Balaton Development Council should initiate projects in order to establish legal framework for environmental-sound development of the agriculture on the watershed. Until that time, the Soil Protection Act (1994) must be enforced.
Based on the analysis of the conditions and circumstances, we have identified focus areas in the study, which enables to carry out a profitable agriculture of high niveau, and at the same time the protection of water quality is also achieved:

- reform of land use/land ownership
- completion of the complex soil protection plan
- completion of the integrated viticulture program
- The differential development of animal husbandry depending on watershed conditions.

4   Technology updating

4.1.1 Special Developers Environment to Info-Server

We using a special Microsoft based developing systems for the 3D based communications and simulated data exchange.

4.2   1The Mobile Internet Toolkit

The Mobile Internet Toolkit provides the technology and tools to build, deploy, and maintain sophisticated mobile applications quickly. Tight integration with Visual Studio .NET ensures that developers can leverage their existing desktop skill set and produce mobile applications. Additional device support can be added using the Mobile Internet Toolkit's extensibility features.

Over the past few years, the world has seen an explosion of new wireless devices, such as cell phones, pagers, and personal digital assistants (PDAs), which enable users to browse Web sites at any time from any location. Developing applications for these devices is challenging for the following reasons:

- Different markup languages are necessary, including HTML for PDAs, wireless markup language (WML) for wireless application protocol (WAP) cell phones, and compact HTML (cHTML) for Japanese i-mode phones.
- Devices have different form factors. For example, devices have varying numbers of display lines, horizontal or vertical screen orientation, and colour or black and white displays.
- Devices have different network connectivity, ranging from 9.6 KB cellular connections to 11 MB Wireless LANs.
- Devices have different capabilities. Some devices can display images, some can make phone calls, and some can receive notification messages.

4.3   Microsoft Mobile Internet Toolkit

The Microsoft Mobile Internet Toolkit addresses these challenges by isolating them from the details of wireless development. Thus, developers can quickly and easily build a single, mobile Web application that delivers appropriate markup for a wide variety of mobile devices.

The Mobile Internet Toolkit contains:

- Mobile Web Forms Controls that generate markup language for different devices.
- Mobile Internet Designer that works with the Visual Studio .NET integrated design environment (IDE) to provide a drag-and-drop mobile development environment.
- Browser Capabilities that is rich enough to extend ASP.NET device capabilities to mobile devices.
- QuickStart Tutorial with sample code.
- Developer Documentation.
- Device adapter code samples.

4.4   Mobile Web Forms Controls

The mobile Web Forms controls are ASP.NET server-side controls that provide user interface elements such as list, command, call, calendar, and so on. At execution time, the mobile controls generate the correct markup for the device that makes the request. As a result, you can write a mobile application once and access it from multiple devices.

Because these mobile controls are based on the ASP.NET controls, you can leverage your current desktop development skill set when creating mobile applications. You can also reuse the same business logic and data access code that you use in your desktop application. Mobile and desktop Web Forms can reside in the same Visual Studio .NET project. This makes an application faster to develop and lowers your maintenance cost.

4.5   Mobile Internet Designer

The Mobile Internet Designer extends the Visual Studio .NET IDE to create mobile applications. After you install the Mobile Internet Designer, you can create and develop your mobile application in the same way that you would develop a Windows Forms or Web Forms application. The Mobile Internet Designer leverages the traditional Visual Studio design environment so that you can:

Create a mobile Web project.
- Add a mobile Web Forms page to the project.
- Drag a mobile Web Forms control onto the form.
- Double-click the control to write the logic.
- Rebuild the application.
- Run the application.

The Mobile Internet Designer makes it fast and easy to build and maintain mobile Web applications. In addition, it enables today's desktop developers to quickly learn how to create mobile applications by using Visual Studio .NET.

4.6   Device Capability Mechanism

Accurate information about the display capabilities of the target device is essential for the successful rendering of mobile controls. At a minimum, mobile controls need the following information about a device:
- Markup language (HTML, WML, cHTML)
- Browser
- Number of display lines
- Cookie support
- Screen size

The Mobile Internet Toolkit adds these mobile device capabilities to the server's machine.config file (desktop ASP.NET applications use this file to maintain device and browser information).

4.7   Advanced Features: Extensibility

In addition to adding device characteristics, the Mobile Internet Toolkit includes device adapters for a variety of mobile devices. The device capabilities information in the machine.config file allows device adapters to optimize markup for specific devices. You can create new aggregate controls from existing mobile controls. The Mobile Internet Toolkit supports device adapters for additional devices through the device capabilities mechanism.
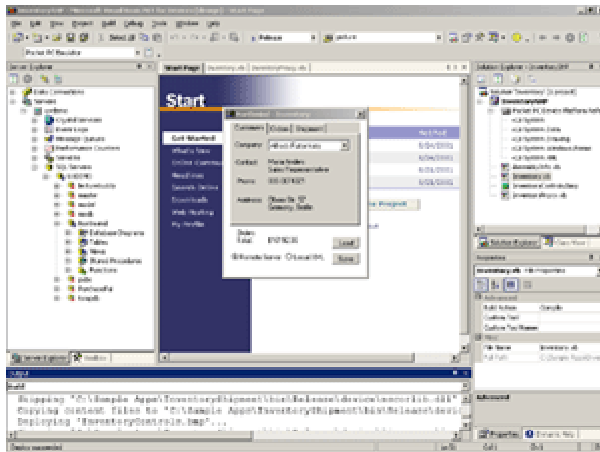
An application running in the emulator

**The same application
running on a device**

4.8   Integration to Wide Area Network

The previous solution can be very well used for developing an Internet map system, but does not yet support the Microsoft.NET technology, which we would like to use.

The softwares supplied by ESRI can be levelled better, more support can be obtained from the developers, and they are compatible with new technologies like Microsoft.NET.

With the help of ArcSDE and ArcIMS, GIS service can be provided through the network. ArcGIS softwares provide access through thick and thin clients.
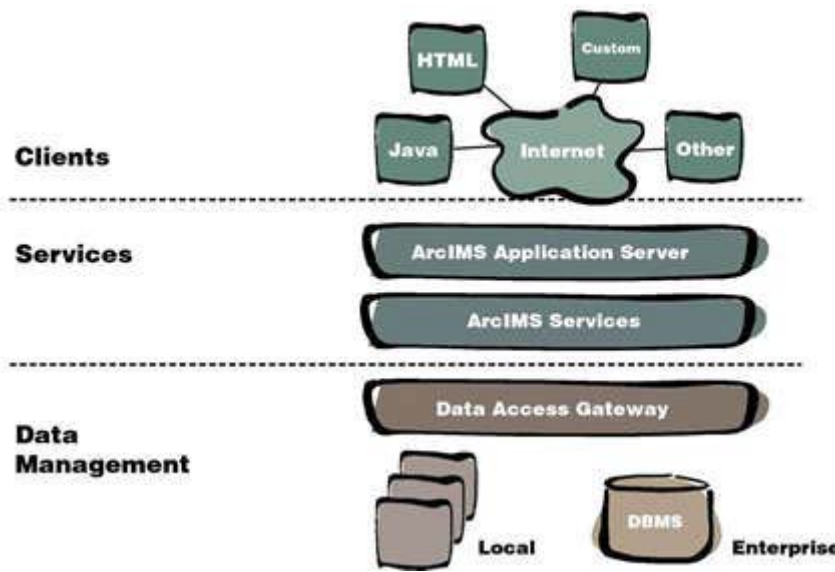
4.9   ArcIMS:

The ESRI® ArcIMS ® 4 architecture and functionality have been engineered specifically to serve geographic data and services on the Internet. The software is designed so that it is easy to create maps, develop Web pages that communicate with the maps, and administer a Web mapping site. The software is also designed to be distributed across a network and to be scalable as the demand for maps increases.

ArcIMS is a powerful, scalable, standards-based tool that lets you quickly design and manage Internet mapping services. Using the power of ArcIMS technology, governments, businesses, and organizations throughout the world are providing a wide range of location-based data and services over the Web including city and county land use information, store location maps, real-time traffic information, home buyer services, and much more.

ArcIMS features

- Integration with ESRI's ArcGIS Desktop products including the ability to publish ArcMap and ArcPublisher documents on the Internet

- Ability to combine data from multiple sources

- Secure access to map services

- Wide range of GIS capabilities

- Highly scalable architecture

- Standards-based communication

- Support for a wide range of clients

- Useful metadata services for indexing and sharing geographic information

ArcIMS establishes a common platform for the exchange of Web-enabled GIS data and services. ArcIMS is more than just an Internet mapping solution—it's a framework for distributing GIS capabilities over the Internet. As a publishing technology, ArcIMS features unique capabilities for supporting a wide variety of ESRI clients. As a serving technology, ArcIMS includes a wide variety of ESRI serverside technologies and provides unique opportunities for data integration.

Specifically built to serve GIS on the Internet, ArcIMS is designed to make it easy to create map services, develop Web pages for communicating with the map services, and administer sites. ArcIMS operates in a distributed environment that consists of both clientside and serverside components. Typically, the client requests information from an Internet or Intranet server. Then the server processes the request and sends the information back to the client viewer.
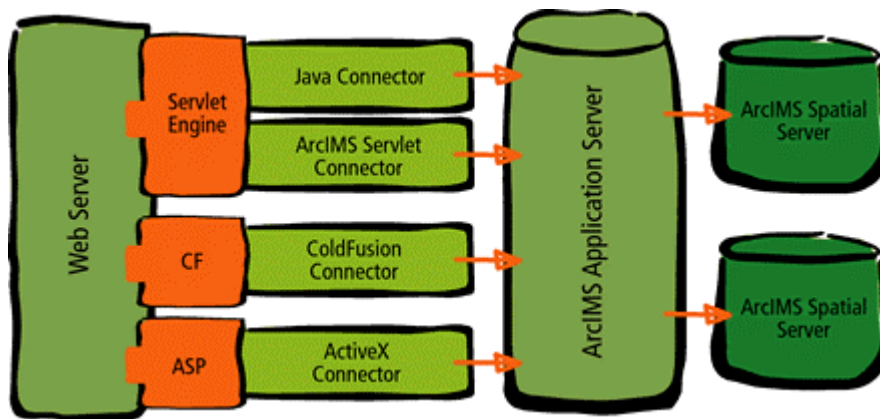
The ArcIMS server technology is part of a multitier architecture. The ArcIMS framework consists of clients, services, and data management. The wide variety of supported clients and the server potential are what set ArcIMS apart from other Internet GIS competitors.
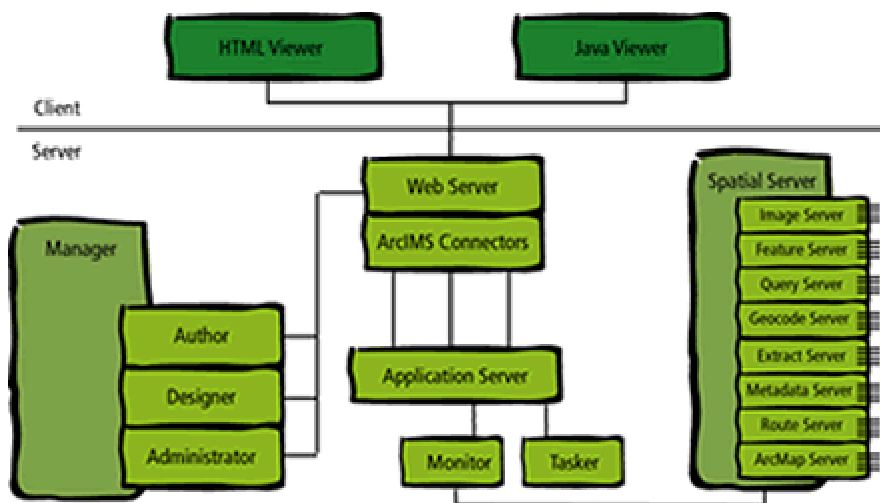
Within a simple browser interface, you can access, display, and interact with data generated from professional GIS solutions throughout the world. Integrate geographic data from multiple sources for localized query and analysis. ArcIMS brings you a world of information by simultaneously accessing Web data, local shapefiles and coverage's, ArcSDE layers, and images.

System Requirements

Product	ArcIMS 4.0.1
Platform	PC-Intel
Operating System	Windows 2000, Professional, Server, and Advanced Server
OS Service Pack/Patch	SP 2 or SP 3
OS Support Level	Fully supported
Swap Space	300 MB minimum Utilizing Windows Terminal Server technologies may require additional MB, depending on the number of clients accessing the server.

Disk Space Requirements:

A Typical ArcIMS installation requires approximately 478 MB of NTFS (505 MB of FAT) disk space for program files and system files. If installing to a drive other than your system drive, 123 MB of this total of NTFS space (127 MB of FAT) will be required on your system drive for system files.

A Complete installation of ArcIMS requires approximately 827 MB of NTFS (864 MB of FAT) disk space. If installing to a drive other than your system drive, 224 MB of this total of NTFS space (231 MB of FAT) will be required on your system drive for system files.

For the disk space requirements for each ArcIMS component, see the ArcIMS installation program on the CD.

MEMORY REQUIREMENTS

Web server/Manager: 256 MB of RAM recommended
ArcIMS Application Server: 256 MB of RAM recommended
ArcIMS Spatial Server: 256 MB of RAM recommended per CPU
HTML Viewers: 64 MB of RAM recommended
Java Viewers and ArcExplorer-Java Edition: 128 MB of RAM recommended
All components: 256 MB of RAM recommended per CPU

4.10 ArcSDE

ArcSDE® software is part of the ESRI® ArcGIS™ family of software products that integrates geographic information query, mapping, spatial analysis, and editing within a multi-user enterprise DBMS environment. ArcSDE enables organizations to move from a traditional approach—managing a separate collection of geographic data files—to a new, integrated environment in which spatial data is managed as a continuous database that is accessible to the entire organisation and easily published on the Web.

This change enables the integration of GIS technology with an organisation's standard information technology infrastructure. As a core component of the information infrastructure, spatial data is finally available to every member of an organisation for fundamental business activities such as mapping customer locations, selecting sites, routing and logistics, managing and designing facilities, market research, customer services and customer care, territory planning, and spatial-based data mining.

ArcSDE is an application server that facilitates storing and managing spatial data (raster, vector, and survey) in a DBMS and makes the data available to many kinds of applications. ArcSDE allows you to manage spatial data in one of four commercial databases (IBM® DB2®, Informix®, Microsoft® SQL Server™, and Oracle®). ArcSDE serves data to the ArcGIS Desktop products (ArcView®, ArcEditor™, and ArcInfo™) and through ArcIMS® and is a key component in managing a multi-user GIS.

Key Benefits of ArcSDE

Database Portability ArcSDE provides a common model for spatial data. Using ArcSDE data import and export utilities; you can move data from one DBMS to another without loss of information. This portability safeguards your data investment and is especially important in a heterogeneous database environment. This capability allows the most advanced geodata-base designs to be moved. Application Portability ArcSDE defines a single logical model for spatial data that is independent of the physical data representation in the DBMS. Because how the data is stored is transparent to the end application, applications developed with ArcObjects™ or ArcSDE C or Java™ application programming interface (API) will run with little or no modification regardless of the underlying DBMS spatial data schema. ESRI's Data ModelsGIS users need common standards to build and share data. ArcSDE supplies both a simple relational model of points, lines, and polygons and a sophisticated object model with support for intelligent features, rules, and relationships—the geodatabase. The geodatabase can be combined with the ArcGIS data models, templates for implementing GIS projects for specific industries and applications. Data models enhance implementation of GIS solutions by streamlining data migration. Data IntegrityArcSDE manages the integrity of the point, line, and polygon information added to the database and will not allow ill-formed feature geometry to be inserted. In addition, you can use ArcSDE with ESRI's ArcEditor and ArcInfo client software to implement real-world behaviours for features that would not be practical to implement in the DBMS itself (e.g., connectivity rules for utility networks). Long Transactions and VersionsAlthough a DBMS can provide multi-user read and write access on tables, editing GIS data in a multi-user environment requires managing concurrent access to data—access that can span hours, days, or weeks. ArcSDE supports long transaction editing as well as modelling "what if" scenarios by creating versions. Versioning lets users create multiple, persistent representations of the database without making copies of the data. More than one user can modify the same data. At the end of an editing session, edited features are merged into a target version and conflicts are reconciled.

4.10.1 Open, Scalable Environments

ArcSDE works with commercial DBMSs from leading vendors including IBM, Microsoft, and Oracle. ArcSDE supports popular server hardware/operating system environments including Microsoft Windows NT® and 2000 and leading UNIX® platforms including HP–UX®, HP® Tru64™ UNIX, IBM AIX®, Red Hat® Linux®, SGI™ IRIX™, and Sun™ Solaris™. ArcSDE operates over any local area, wide area, or wireless Transmission Control Protocol/Internet Protocol (TCP/IP) network and can connect concurrently to multiple databases. It also allows access to the databases on the desktop, Web, and mobile clients.
Standards-Based

ESRI has been actively participating in the definition of spatial standards for interoperability and data sharing by working with organizations such as the U.S. Federal Geographic Data Committee (FGDC), the Open GIS Consortium (OGC), and the International Standards (OGC), and the International Standards Organization (ISO), particularly the SQL/MM Multimedia (Spatial) Committee and ISO TC 211, two of the primary ISO technical committees involved in spatial standards. ESRI supported the development of the National Spatial Data Infrastructure (NSDI) and the OpenGIS® Simple Features Specification.

ESRI was the first GIS vendor to successfully complete OGC's conformance testing and become certified with products that conform to the OpenGIS Simple Features for SQL Specification (see OGC's Conforming Products Web page for more details at www.opengis.org/testing/product). The ArcSDE binary schema—the default schema used for ArcSDE for Oracle and SQL Server—is not only fully compliant with the OpenGIS Simple Features for SQL Specification's Binary Geometry but provides additional GIS data types such as z values, measures, annotation, and support for raster and survey data that extend beyond the OGC specification.

4.11 GIS data management

GIS Data in the DBMSA spatial data management solution should be engineered to take advantage of the most advanced offerings from each DBMS vendor. ArcSDE manages the physical storage of spatial features using the standard data types provided by the DBMS. If the DBMS provides for native spatial types, ArcSDE will use them. The table below lists the data formats supported in each DBMS. For example, ArcSDE can read and write data using Oracle Spatial, the IBM Spatial Extender for DB2 Universal Database, and the Informix Spatial DataBlade® Dynamic Server.

DBMS	Geometry Storage
Oracle	ArcSDE compressed binary
	Oracle8i and 9i Spatial and 9i Loca
Microsoft SQL Server	ArcSDE compressed binary
Informix	Informix Spatial DataBlade
IBM DB2	DB2 Spatial Extender
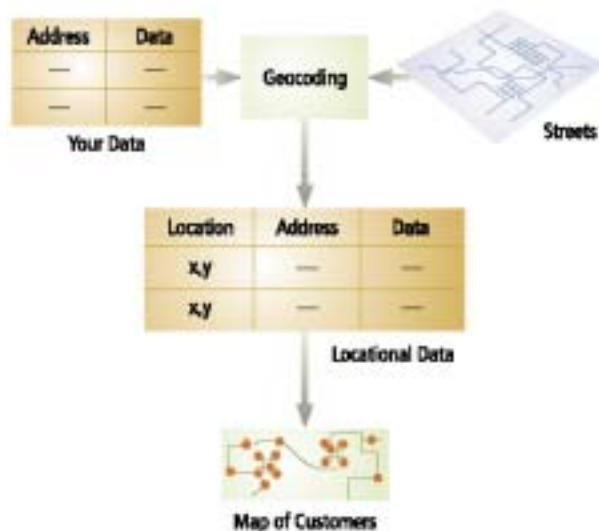
Leverage Your GIS With DBMS-Based Data Management
Managers and users of geographic data have long recognised that inter-organization collaboration requires that people share spatial information. Centralised storage and management of

spatial data can provide cost-effective data management by reducing data duplication and enhancing accuracy. ArcSDE meets the key goal of managing spatial data in a DBMS by allowing you to enter the data once while enabling access to the data by many users. ArcSDE, operating in the client/server and distributed computing environments, provides a scalable, multi-user solution that uses a single data model to store vector, raster, and survey data. In addition, ArcSDE maintains a continuous database (i.e., not tiled) that can model features and real-world behaviours and supports long transactions and versioning.

ArcSDE works with ESRI's ArcGIS Desktop clients (ArcView, ArcEditor, and ArcInfo) and ArcIMS, ESRI's technology for Internet mapping and distributed GIS, to provide a single, integrated, scalable, secure, standards-based family of solutions. ArcSDE works with the ArcPublisher extension, providing dynamically updated, high-quality maps that can be read by anyone with ArcReader, a free map viewer. This comprehensive framework lets organizations of all sizes effectively create, manage, and share spatial information over private Intranets or the Internet.ArcSDE and ArcIMS provide the foundation for e-government and e-commerce based portals. This architecture has proven ability to handle the hit rates of large commercial Web sites and is the basis for ESRI's own Geography NetworkSM. ArcIMS supports ArcGIS Desktop, Web browser clients, and the free ArcExplorer data viewer.

4.11.1 Integrated With the Enterprise

Spatially enabled data stored in a DBMS benefits businesses by allowing spatial query, aggregation, and display of information in tabular databases (i.e., geometric searches on records that have spatial coordinate association). Adding location information to existing business applications reveals patterns and trends in the data that might otherwise have been missed. Linking location to information (or bringing "the where" to bear on "the what") is a process that applies to many aspects of business such as choosing a site, targeting a market, drawing up sales territories, or allocating resources.

ArcSDE allows users to query, analyze, and view various geographic layers using different client software programs. ArcSDE is also critical to applications in the telecommunications market where operators and network managers need to provide location services in association with other telecommunication or Internet services and in transportation and logistics for the optimization of the flow of goods and services across a geographic network.

Flexible Architecture

N-tier environment support provided by ArcSDE allows connection to the host DBMS through an application server (three-tier architecture) or through a connect driver where the client application is connected directly to the DBMS (two-tier architecture).

Two- and three-tier configurations can work separately or together providing maximum flexibility in system design. A database administrator can choose between centralized management or distributed processing load. ArcSDE can also easily be combined with ArcIMS for applications requiring stateless Web deployment of Web-based mapping and distributed GIS.

4.12 Developer Opportunities

ESRI provides developers with many options for creating new applications or adding ArcSDE support to existing applications. Developers can use ArcObjects, the ArcGIS C++ Object

Component API. Developers can also use MapObjects and MapObjects—Java Standard Edition to build custom applications or add spatial functionality to existing applications using advanced development environments such as Visual Basic®, Visual C++®, PowerBuilder®, or Delphi™. In addition, ArcSDE provides organizations with open, high-level C and Java APIs for querying and processing spatial data and GIS functions.

5   Interoperability

For interoperability among platforms Web Mapping Services were implemented.

WMS solution

The WMS is a Web Map Service (specifically an OGC Web Map Service). A WMS is capable of producing maps drawn into a standard image format (PNG, JPEG, etc) based on a standard set of input parameters. The resulting map can contain "transparent" pixels where there is no information and thus several independently drawn maps can be laid on top of each other to produce an overall map. This is possible even when the maps come from different Web Map Servers.

WMS is based on transfer of georeferenced maps i.e. images or eventually drawings, which are generated on request. In some cases exist demand on transfer not maps but geofeatures. This possibility belongs to communication among geodata sources. Such type of the service is covered by another OGC specification WFS – Web Feature Service. This specification defines formal request over WWW, which returns OGC simple features in GML format. GML is an XML dialect for geographic features. Specification consist from two requests:

From WirelessInfo point of view is important ability of 1.1.0 WMS servers to establish so called cascade servers. Cascade servers play role of hubs of WMS networks and offer possibility to create gateway for mobile devices, which use different sources of geographic information. For mobile systems, there exist two-principle solution:

DHTML/CSS mobile client
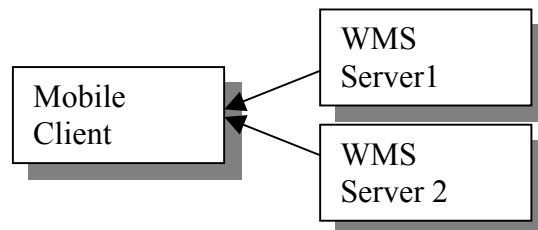
Advantages:
- Servers work parallel, there is faster response from the server's side.

Disadvantage:
- The CSS explorer is necessary on the side of terminal; many currents mobile terminals do not have this functionality. Higher request on side of client
- It is necessary to obtain information from all server in the some coordinate system
- There is transferred large amount of data, which could be very important using GPRS technology

Cascading using Mapserver
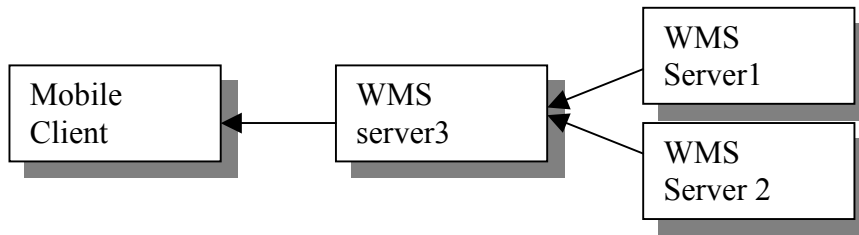
Advantage:
- Low request on the client side (HTML is enough)
- Solution support Java clients
- It is possible to use data from the servers, which use different coordinate systems, Coordinate WEB Services are realised on server
-

Disadvantage:
- It is necessary to have one more server

From the practical comparison of both solution was demonstrate, that for mobile thin client only second solution is possible to use. Second solution seems to be possible use only for thick clients.

WFS

The Web Feature Service Implementation Specification describes feature database operations (e.g., points, lines, and polygons) making it possible for client and server applications to interoperate across the web. The request is typically generated on the client and posted to a WFS server. The WFS server reads and executes the request, returning the result in Geography Markup Language (GML) encoding. The GML document, used in conjunction with an XML Schema, can then be parsed by any client application for further use.

The Filter Encoding Implementation Specification adds the capability to constrain feature requests to WFS enabled server by using a filter expression within a request. A filter expression described in XML, can for example, limit selection to just those features that lie within a geographic area, or include a spatial operation (trees must be within 20 feet of an electric line) with a property constraint (must be a maple tree). The neutral XML filter encoding allows easy parsing and validation by a WFS server before being transformed into the targeted language of a required data store.

The Style Layer Descriptor Implementation Specification defines the encoding for symbology, styling and rules for map display. SLD, expressed in an XML document, can be used or referenced by a Web mapping client application when formulating a map request to any SLD enabled map server. Using this approach, Web maps can be generated dynamically using a number of independent map services accessing a number of remote data sources. Performance and efficiency is achieved since only the resulting maps need to be transported to the client as opposed to the data itself.

The WFS solution could be principally used also in the form of cascading, with final output in WMS for thin client or as direct WFS services for thick client. Direct using of WFS services for mobile client could be dangerous, there could be transferred large amount of data.

6   Soil Erosion Modeling in Watershed of Lake Balaton

- Soil erosion changes by 3D simulation model in Keszthely-hill, Hungary

- Case area selection, case study monitoring design, preparation and station building, system testing.
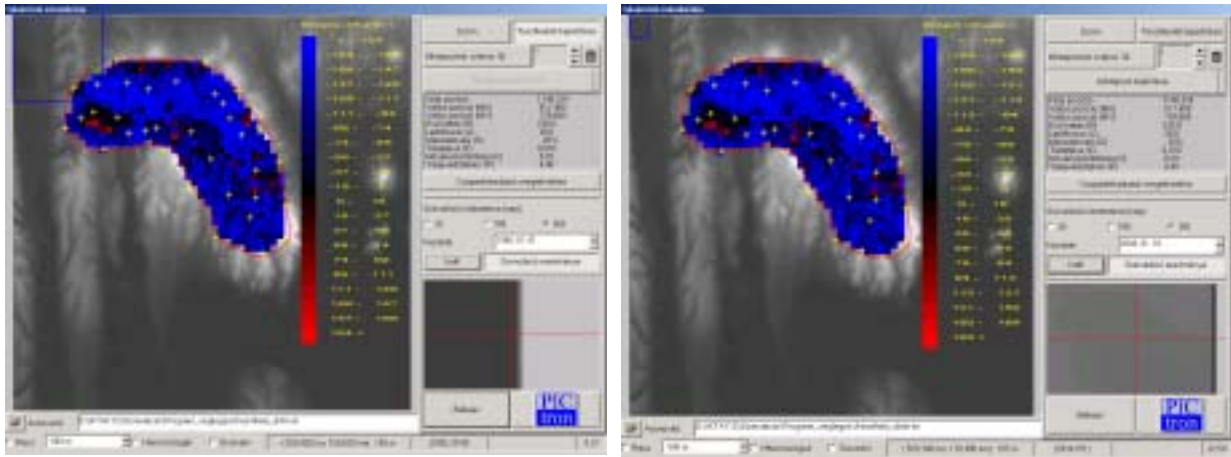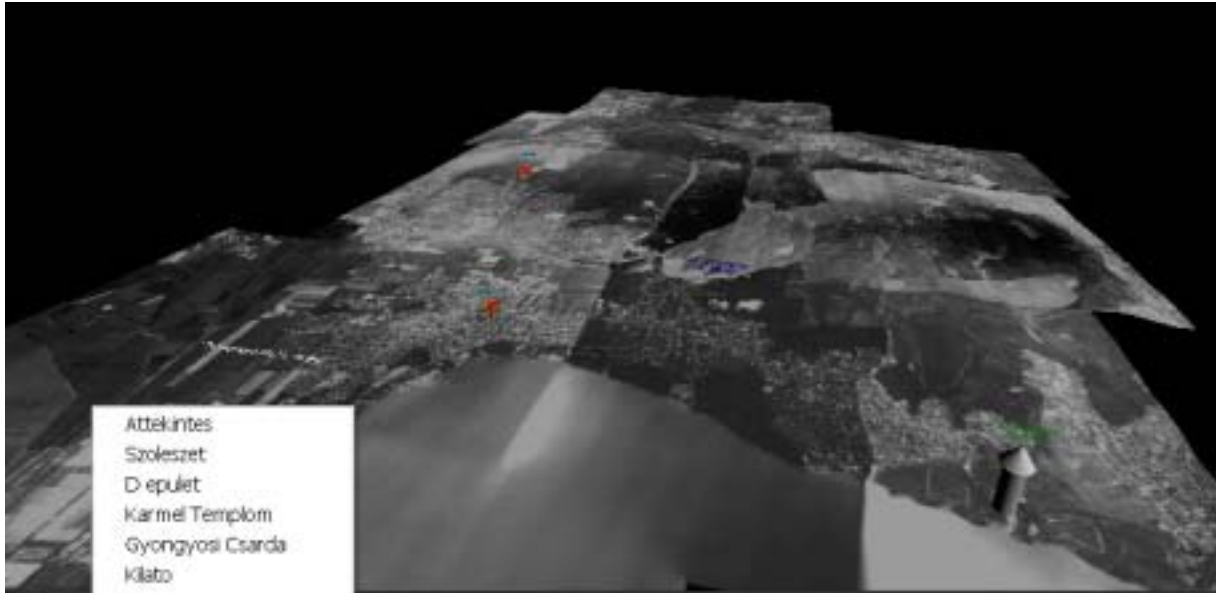

(1980 – left, 2002 - right)

Original (left) and the classified (right) aircraft images for the monitoring and testing

6.1 Test 3D model

The 3D model we testing some terrain local (well-known) measuring points.

The 3D model we precisely by GPS and topographical measured data.

	Main ponits of GPS	Terrain	Measuring	in Keszthely-hill		
Reference	Baltic altitude	Measured altitude	North EOV latitude	Measured north latitude	East EOV latitude	Measured east latitude
32-2126	106,26-105,60	150 -2	514251,74	46 48' 01,362	159623,64	17 16' 12,360
42-4075	135,79-135,12	178 -2	514812,27	46 46' 47,400	161035,08	17 16' 37,188
42-4339	138,66	190 -2	510419,47	46 46' 19,164	160266,15	17 13' 10,992
42-4016/a	150,61-151,91	207 -2	510657	46 46' 48,672	161171,51	17 13' 21,186
32-2131	131,62	181 -1	510635,39	46 45' 41,262	159085,75	17 13' 22,560
32-2104	124,43	171	510594,04	46 44' 55,842	157685,02	17 13' 22,128
32-2108	121,89-121-29	172	510876,94	46 44' 17,298	156486,31	17 13' 36,780
42-4068/1b	131,92	190	511878,38	46 46' 11,800	160106,31	17 14' 20,556
42-4068/1a		186	511879,12	46 46' 15,120	160101,44	17 14' 19,944

Reference	SOG	DPOP	Number of satelite	Time
32-2126	0-0,3	2,1	5	13,16
42-4075	0-0,3	2,2	6	13,28
42-4339	0,1-0,2-0,3	4,2	6	14,25
42-4016/a	0,1-0,5	4 - 5,2	6 7	14,11
32-2131	0-0,3	3,1	9	17,22
32-2104	0,2-1,0	3,7 - 8,2	4 fekete+ 2 kék	16,25
32-2108	0,2-0,8	10,2	7	16,56
42-4068/1b	7	0-11,6	4 fekete	15,26
42-4068/1a	0,1-0,9	2-10,5	4 fekete	15,25

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