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Pregledni znanstveni članak

Open Geospatial Consortium Web Services in Complex Distribution Systems

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ABSTRACT. The short review of the Open Geospatial Consortium (OGC) web service with regard to Web Map Service (WMS) and Web Feature Service (WFS) has been given in this work from the perspective of server and client applications. The problems of the exchange of spatial data in the complex systems as municipal service have been described. Based on analysis of data exchange between employees in the same company and exchange between municipal services the existing condition has been schematically shown. Having this in mind, the proposal of measures has been given to improve communication by implementing distribution OGC web service with assumption that improvement of communication initiates the progress of overall system as well. Suggested solution is based on open source WMS/WFS servers and clients, but with remark that large number of commercial desktop GIS systems has inbuilt support for OGC web service. In the end it has been pointed out to some possible specialized client's requests in regard to data safety and control of data access, as well as some extended types of data such as topological structures, surfaces and alike. Described model of distribution exchange can be applied to all complex systems, but within smaller systems such as companies which consist of more sectors.

Keywords: OGC web services, WMS, WFS, complex distribution system, spatial data.

1. Introduction

Since the very beginning of organized life, people settled certain areas in groups. Increasing number of people, construction of great number of buildings, cities have founded companies whose aim is to deal with business of general interest. Next to companies dealing with administrative works, public companies which deal with town planning, design and construction of suitable infrastructure have also been founded.

Please refer to Appendix A for a list of acronyms used in this paper.

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Public, that is, municipal companies such as water supply and sewerage, electrical companies, telecommunications, gas and oil companies, heating plants set and maintain the installations, but they are also obliged to keep the information on them and their spatial position. On the other side companies such as Institute of Urbanism and all other companies which in its line of business use spatial information are potential users of spatial information. Supervision, quality control, handover of spatial data is defined by laws and rules of procedures and it differs from country to country.

In some countries these functions are performed by cadastral offices which deal with spatial data of municipal installations, while municipal services are users of these data and they are legally obliged to carry out the spatial registration of newly placed installations and to submit them to cadastral offices.

Second example of keeping the spatial records is such that municipal services have their specialized departments which deal with collecting and management of spatial data on installations from its line of business, and they are obliged to submit data to cadastral offices. In both examples the cadastral office has the role of distribution centre.

Although the second example is more flexible than the first, both cases face the problems when there is an issue of formats of data exchange and mediums by which data is exchanged. Municipal companies use the data which are maintained, but the problem of designing installation requires the use of information on other installation. Municipal services mostly use analog or scanned maps, digital CAD drawings or different Desktop GIS solutions.

The most frequent example of bad management of spatial information within the organization and interpersonal communication between such organizations has been shown on the picture

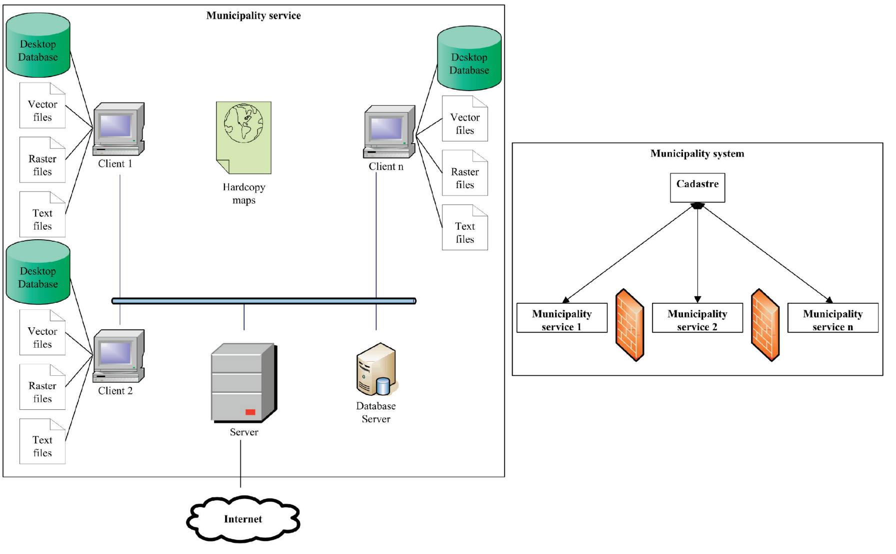

Fig. 1. *Prototype of bad management of spatial information.*

Clients use spatial data from local resources in different vector and raster formats. The exchange is mostly carried out through local computer networks. Problems of interoperability are solved by use of import/export functions. The use of hardcopy maps additionally makes the combination of information difficult.

This way of keeping records helped by data exchange with other municipal companies, using CDs, DVDs or by e-mail causes the following:

- Difficult data up-dating
- Reduced use of data
- Incapacitated data analyses
- Multiple data retorting
- Disturbed data integrity
- Communication problems.

Due to all these reasons the efficiency of running cities is being reduced, and on the other side increasing number of population in cities results in expanding the municipal infrastructure by which the pressure on municipal services is increasing. The only answer to these problems is using internet as medium for data exchange and introduction of distribution GIS which shall implement (URL 4):

- Service invocation standards: Definition of interface which allows different systems to function together.
- Information transfer standards: Definition of contents, structures and formats of spatial information for transfer between different processing systems.

Using OpenGIS specifications and implementing certain services such as WMS and WFS, the arrangement of system can be significantly increased, communication between users of spatial information is improved, and per se the general progress and improving of quality level of services.

2. Open Geospatial Consortium Web Services

Open Geospatial Consortium (OGC) is an international volunteer organization for standardization which helps the development and implementation of standards for spatial contents and services, GIS data processing and exchange (URL 12).

OGC is also an international consortium which consists of 346 companies, government agencies and universities (URL 1).

Open GIS Abstract Specification is the result of OC Technical Committee (TC) work and its primary goal is to support the spatial technology and interoperability of data and securing referential frame for development of OpenGIS Implementation Specification.

OpenGIS Abstract Specifications are technical documents which in detail specify the interface or encodings. Software developers use these documents for the support building for interface or encodings in its own products and services.

Within OpenGIS Specifications there are several documents which explain the spatial web services among which the most significant are WMS and WFS.

2.1. Web Map Service

WMS is a service which dynamically at the request produces the maps from spatial data base using HTTP as the distributed computing platform. Map in this sense is not data but digital georeferenced image suitable for display and transfer through the web. At each request of WMS client, WMS server renders the reply in shape of the map in image format such as PNG, GIF, JPG or vector/based graphics such as SVG. WMS server and WMS client imply server and client application which implements WMS. Client can address more requests to one or more WMS servers, combining their answers. By this approach WMS enables creating network of distributed map servers from which a client requests maps and by combining them with their own data it builds maps according to their own wish. Besides maps request, WMS client can address the request in the shape of question for metadata and attributes of certain map elements.

WMS defines (URL 5):

- How to request and secure the information on services which map server provides – GetCapabilities
- How to request and secure the maps as image (raster or vector) – GetMap
- (Optional) How to request and secure the information on map contents – GetFeatureInfo.

Having in mind that OGC has a tight cooperation with ISO/TC 211, OGC abstract specification is in accordance with ISO 19100 therefore WMS is adopted as ISO standard (URL 6).

2.2. Web Feature Service

Unlike WMS service which supplies clients with georeferenced images, OGC WFS service secures the interface for access and sending of spatial data using Geography Markup Lenguage (GML) which is based on XML using HTTP as the distributed computing platform too. Advantage of WFS in regard to WMS is that editing of spatial entities and setting up of queries based on attributes or space (spatial or non-spatial query) have been enabled. As with WMS, WFS enables requests for spatial data from more different WFS servers where system of m clients and n servers can be seen as distributed.

Basic WFS enables research of spatial data and placing queries. Extended WFS gives additional possibility for creating, deleting and updating of spatial data.

Next to some concepts which have been taken over from WMS and which form the basic WFS such as GetCapabilities, GetFeature and DescribeFeatureType, WFS also defines (URL 3) options of transactions such as

- Create a new feature instance
- Delete a feature instance
- Update a feature instance
- Lock a feature instance
- Get or query features based on spatial and non-spatial constraints.

2.3. Server side

Increasing of internet flow and appearance of serious client – server applications led to development of web GIS concept. A few GIS servers dominate on the market today. When we talk about commercial ones, it is worth mentioning ESRI ArcIMS, AutoDesk MapGuide, Integraph GeoMedia, GoogleEarth... Amongst leading open source there are UMN MapServer and GeoServer.

With appearance of OGC standards, some of the above mentioned servers implement WMS and WFS. Commercial servers have mainly maintained its formats and protocols, but in their client applications they inbuilt the support for OGC services. One of the examples of GIS web servers of great performance is UMN MapServer, which implements the OGC standards.

Map Server is an open source development surrounding for the development of GIS-WEB applications (URL 9). It was developed at the University of Minnesota in cooperation with NASA and Institute for natural resources in Minnesota. It has the support for more platforms: Linux, Windows, Mac, Solaris etc.

MapServer is the Common Gateway Interface (CGI) program which operates in the background of Web server. When the MapServer is dispatched the request, it uses the information forwarded through URL address and also from configuration map data base for generating raster map. The requests for auxiliary cartographic contents such as legend, scale and other values forwarded to CGI as variable can be sent. Web applications made with the use of MapServer is interactive, functional and platform independent solution from the perspective of server and also from the perspective of client.

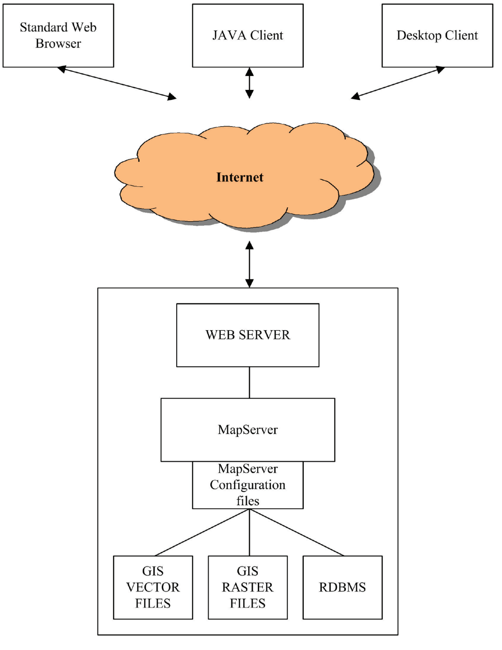

Fig. 2. *Architecture of Map Server.*

Simple MapServer Application consists of following elements (URL 8):

- Map data file – structured textual configuration datafile which is used by the application. Map datafile defines the area of the map, saves trajectories to vector raster data, information on projection and layers etc.
- Geographical data – MapServer can use more types of geographical data such as ESRI shapefile, PostGIS, OGR…
- HTML page – represents interface between users and MapServer. It is common to be found on the Web root directory. The map which MapServer creates is found on the HTML page. To secure the interactivity, MapServer to each request responds to generating new map. The request is sent through either URL address using attribute GET, or through hidden variables using attribute POST.
- MapServer CGI – Binary or executive data file which responds to the request of Web server by creating raster map. It is common for it to be found on CGI-BIN or script directory on http server. Web server needs to have executive rights in the directory where MapServer is found and due to security reasons it should not be on the web root directory.
- HTTP server – it receives the requests obtained from client browser and it responds to them by returning html page.

How does the MapServer implement the OGC web service? WMS and WFS servers communicate with clients through HTTP protocol. In most cases WMS and WFS servers is the CGI program, but there are other solutions such as servlets. Concretely MapServer is the CGI program: In case of WFS server it is necessary for Map Server to compile with following libraries:

- PROJ4 – library for reprojection
- GDAL/OGR – library which supports I/O different vector and raster formats.

If these conditions are met, it is only necessary to properly adjust MapServer configuration file. Correct adjustment of configuration file implies securing of all necessary parameters.

Necessary parameters of the configuration file in the case of WMS server (URL 11):

On the map level

- Map NAME
- Map PROJECTION
- Map Metadata (in the WEB Object):
  - wms_title
  - wms_onlineresource
  - wms_srs (unless PROJECTION object is defined using “init=epsg:...”)

On the layer level

- Layer NAME
- Layer PROJECTION
- Layer METADATA
  - wms_title
  - wms_srs (optional since the layers inherit the map’s SRS value)

- Layer STATUS
  - Layers set to STATUS DEFAULT will always be sent to the client.
  - Layers set to STATUS ON or STATUS OFF can be requested by the client.
- Layer TEMPLATE (required for GetFeatureInfo requests)
- Layer DUMP TRUE (only required for GetFeatureInfo GML requests)

Necessary parameters of the configuration file in case of WFS server (URL 10):

- Data source is of vector type (Shapefile, OGR, PostGIS, SDE, SDO, …)
- LAYER NAME must be set. Layer names must start with a letter when setting up a WFS server (layer names should not start with a digit or have spaces in them).
- LAYER TYPE is one of: LINE, POINT, POLYGON
- LAYER DUMP parameter set to TRUE
- The "wfs_onlineresource" metadata is strongly recommended.

2.4. Client side

Implementation of OGC WMS client has been mainly brought down to formatting requests and forwarding of necessary and optional parameters. The simplest WMS client is any web browser, where in URL address the requests are forwarded such as GetCapabilities, GetMap or GetFeatureInfo. These requests forwarded to WMS MapServer look something like this:

GetCapabilities:

http://www.geoservis.ftn.ns.ac.yu/cgi-bin/mapserv?map=damaturu.map&SERVICE=WMS&VERSION=1.1.1&REQUEST=getcapabilities

GetMap:

http://www.geoservis.ftn.ns.ac.yu/cgi-bin/mapserv?map=damaturu.map&SERVICE=WMS&VERSION=1.1.1&REQUEST=GetMap&LAYERS=damaturu

Second option for the implementation of WMS in web browser is to use some of the script languages such as JavaScript. By encapsulating request within functions of the script, using services of WMS server is transparent for the user, i.e., user does not have to worry about formatting the request. By interactive choice of tools and manipulation, the user indirectly forwards the request, and script takes care of formatting the User's request and forwards it to server in a way understandable to the server.

The most popular way among most of users is the implementation of WMS service inside Desktop applications. Such application can also implement its own tools for adding and manipulation of data from local resources, enabling creation of custom maps. It is most often the case of Desktop GIS software which have inbuilt support for OGC web services. As most operations connected to manipulation of spatial data happen on the Client's side, Desktop applications with support for OGC services are fat-clients.

It is unnecessary to count all commercial Desktop applications which implement OGC services because all leading producers of Desktop GIS applications build in the support for WMS services and somewhat smaller number for WFS as well. I would point out to some of the biggest: ESRI ArcGIS, Integraph GeoMedia, Bentley MicroStation, Audesk, MapInfo, PCI GeoMatics, Oracle, GoogleEarth. Some of these commercial applications have free viewers such as ESRI ArcExplorer or GoogleEarth Free (URL 2).

When we talk about open source Desktop GIS applications with support for OGC service I would point out Dig and QGIS. Not going too much into the functionality of QGIS as Desktop GIS tool, it can be noticed that QGIS is a user – friendly program and as open source project according to its performance it represents the alternative to ESRI ArcMap (if these two things can compare at all).

QGIS as WMS client can communicate with WMS 1.1, 1.1.1 and 1.3 servers. QGIS receives map as an answer in the form of raster image PNG or JPG format (URL 7).

Communication between QGIS as the client and WMS goes through following phases:

a) Creating connection towards the server. Local name of the connection and URL address to WMS server are defined as parameters.

b) Connection to server. As a result the server responds to the request of GetCapabilities. The User chooses the layer which he wishes to use and available coordination referential system where spatial data are shown. Besides that the User chooses the format of raster where he receives the answer (jpeg/png).

c) Adding maps into the project. Response to GetMap request.

d) After adding the map the user completely transparently manipulates the map as it has been read from the local resource, where each operation type zoom in/out, pan or identity sends new GetMap or GetFeatureInfo (in case of Identity operations) requests to server for rendering new map, that is, for Feature information.

QGIS as WFS client communicates with WFS servers using version 1.0.0. Interface for sending requests is identical as with communication with WMS servers. Some advanced functions such as selection under different criteria, table overview and alike are the advantage in regard to WMS.

3. Using OGC Web Services in Municipality Information Systems

One of the systems to which exchange and updating of spatial data influences significantly on overall progress is the system of municipal services. Technological progress of single services conditions the upgrading of services quality level which they provide, but the system of more connected services in great extent depends on interpersonal communication and data exchange. For the city the upgrading of overall system is more significant than its single components, because the system is strong as much as its weakest component.

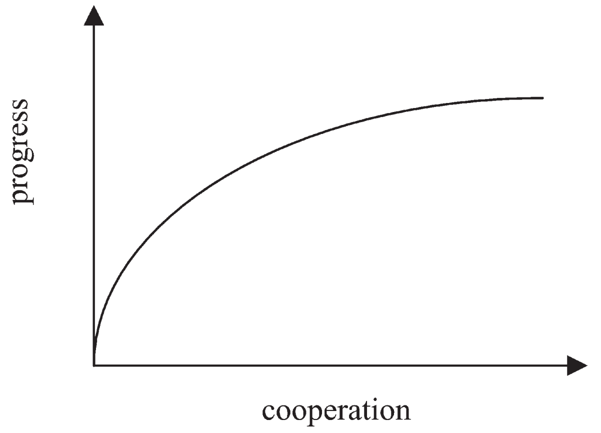

Fig. 3. *The Influence of cooperation on overall progress.*

For establishing interpersonal cooperation between municipal services, the precondition is that each service within its competencies collects and structures its data according to suitable data model. Depending on the extent, format and structure of data, some services are forced to collect data by digitalization existing analog maps, while other simply need to structure them according to given data model. The worst case is with the services which have not been updating data for many years or they do not have the spatial data on its installation. This is at the same time the most expensive scenario but this is usually the price for services with poor archive.

Not going into methods of data collection and the data model itself, generally as a result the spatial data base is obtained. Initial importing of all available data from relevant sources into spatial data base, it does not have to be that they completely respond to the conditions in reality, but it represents well structured image of the existing archive. Data base with these initial data make the starting position. Having in mind that spatial data are not statical and unchangeable during time as a consequence of numerous works on municipal installations, digging and placing new ones, changing or removal of the old ones, it is necessary to procure the mechanisms for spatial registering and updating on the existing data base. For system maintenance it is necessary to bring set of rules and standards which could enable the data base updating under executed changes.

Modern trends of using and maintenance of spatial data impose the need for distribution to wide number of users. To this purpose the useful resource is the Internet or when it' s a word about municipal, state, local and city services suitable local networks.

Distribution of data through computer network and executing transactions i.e. data updating requires the thorough analysis and making of suitable solution. As distribution of data is of cyclic character, OGC web services as WMS and WFS enable the creating of distribution system with respect of the data integrity and minimum redundancies.

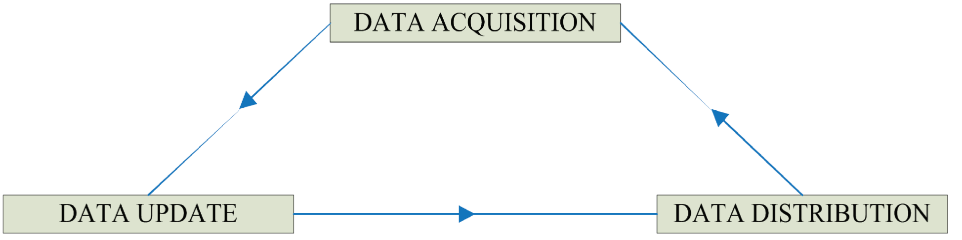

Fig. 4. *Cyclic process of spatial data maintenance.*

Next to spatial data which they own, municipal services can join the forces for collecting data which are of general character such as ortophoto plans, digital terrain models, information such as name of the streets and house numbers and alike. By this approach these joined resources are used rationally and with minor investments the possibility is created for their periodic procurement in the aim of control of changes (procurement of ortophoto image once a year). The significance of ortophoto plan of the municipality is useful in the case of settlement analysis and connections. In this way it is easy to collect the information on illegal connections to the network of communal installations.

How to improve the system with the help of OGC web service? Firstly each organization can increase the arrangement of their system.

All spatial data are common resources. Data are structured and centralized. Data access is defined depending on the user's group to which the client belongs.

Creating the group of accounts, the data users are divided into:

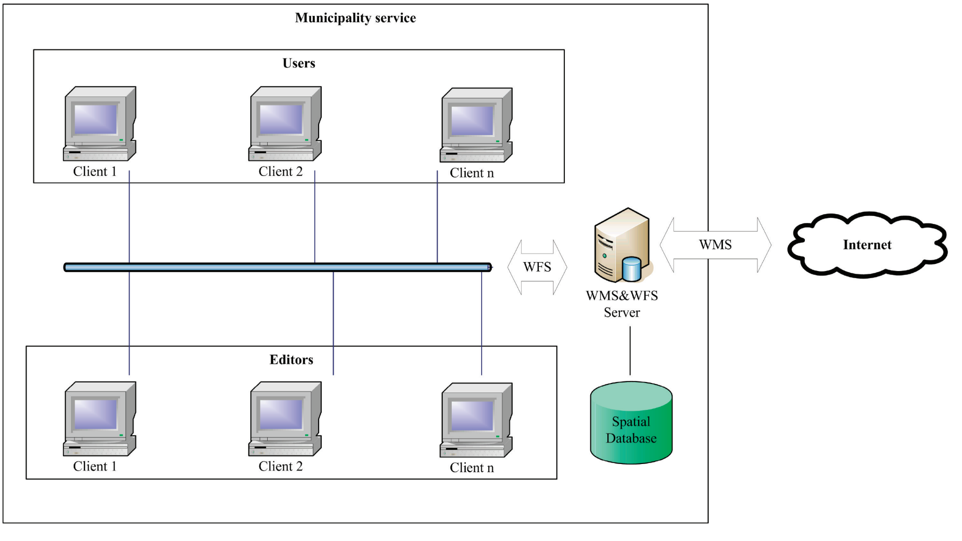

Fig. 5. *The prototype of spatial information management with the use of OGC web services within the company.*

- Read – only users
- Data editors
- Administrators.

Read-only users use WFS services for data access. They use these data in wide range of their activities, they explore, create custom maps, do the analysis and alike.

Data editors are by rule less numerous than read-only users. Their task is to do the data updating within the service. For this they can use Transactional Web Feature Service (WFS – T) or simply copy the spatial data on server with new version (creating back up of old version is desirable) once a day, once a week or once a month.

Administrators take care of regular system functioning, assigning suitable privileges and all other problems which system administrators deal with.

As interface with external clients the clients are enabled outside the company access to data through WMS service.

Secondly by connecting in this way organized components into one larger whole one powerful distribution system is obtained with all benefits which these systems have.

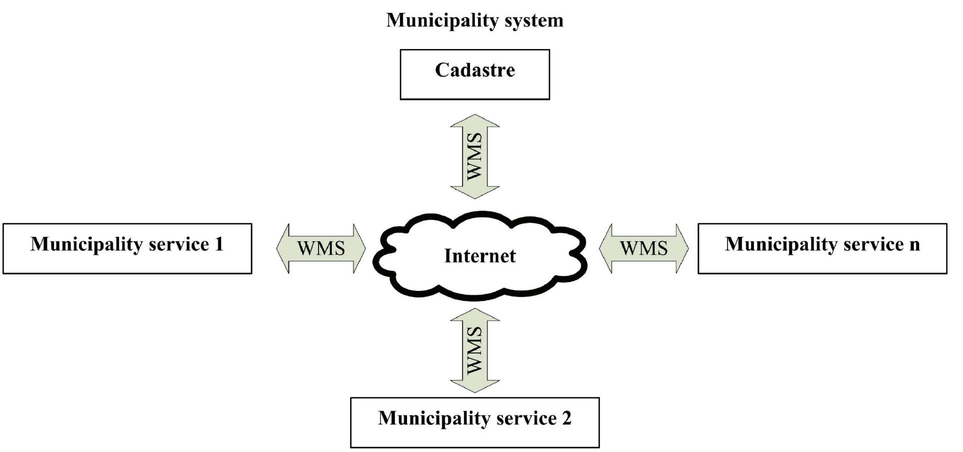

Fig. 6. *The prototype of spatial information management with the use of OGC web services within complex system of more companies.*

Services make available public data to all other services which have interest to use these data. On the other hand services have insight into someone else's updated data. For some service to use spatial data, it does not necessarily have to emit its data. Planners, urban planners, ecologists, biologists, as well as other professions using information which are connected to geometrical entities show great interests in follow up of the spatial changes in some time period. Some of the examples are follow up of the building construction in town in regard to municipal infrastructure, follow up of the dynamics, watching the vegetation changes in different seasons.

The openness of GIS is also shown in connection with other data bases which can be on local or distance computers. By combining data found in GIS base, the patterns which do not have to be visible at first can be noticed.

4. Consideration of Some Technical Problems

During implementation of OGC web services it is necessary to pay attention to some details such as coordinate system and projections and also to some optional details which are connected to versions GML and data security. Optional details can be requested by clients who have specific requests.

4.1. Coordinate systems and projections

One of the main properties of GIS data is their spatial position. Spatial position refers to physical area of the Earth.

Mathematical area which represents the best approximation of the Earth is rotational ellipsoid. Rotational ellipsoid which is used as referential ellipsoid is defined as WGS84 with its half axis and parameter of flatness. WGS84 is also a global coordinate system defined in the following way. Coordinate start is found in the mass centre of the Earth, axis Z passes through middle pole; axis X passes through the point of equator section and zero meridian, and axis Y complements the system of right orientation. The position on the ellipsoid can be defined by rectangular (X, Y, Z) or geodetic curvilinear (φ, λ, h) coordinates (Blagojević 1994).

Some countries have defined their own local referenced ellipsoids. Unlike global ellipsoids, it is the best approximation of the Earth surface for the territory of their administrative border.

Series of parameters by which the form, size and orientation of ellipsoids have been defined in regard to Earth is called geodetic datum. Relation between local ellipsoid and referential ellipsoid (WGS84), i.e. their coordinate system is defined with datum transformation.

Curvilinear coordinates are not advantageous for creating of maps, but they more often project to geometrical solids such as conus, cylinder or plain.

For spatial data to be spatially defined next to coordinate values the datum and projection with all necessary parameters must be known. OGP Surveying and Positioning Committee through its sub-committee manage and publish all these information necessary for spatial referencing under the name European Petroleum Survey Group (EPSG) Geodetic Parameter Dataset. This dataset contains data on majority of the national coordinate systems and unique identification for spatial referencing is EPSG number. For Serbia EPSG=31277, and for WGS84 coordinate system EPSG=4326.

For implementation of WMS and WFS parameters EPSG number for each set of data is necessary because only referential data can be combined with data from other WMS servers which cannot be in the same coordinate systems, but knowing their relation to referential coordinate systems this can be shown in any known projection.

4.2. Web Feature Service and Geography Markup Language versions

GML as dialect of XML has a significant part when there is a word on communication between client and server. WFS client and WFS server communicate using GML. It is important to point out to some of the differences between GML versions. Version 1.0.0 WFS uses GML 2.1.2, while WFS 1.1.0. uses GML 3.1.1.

GML 2.1.contains encoding support for basic geometrical types of data such as point, line, polygon, while GML 3.1.1 contains encoding support for some additional types such as topological structure, curves, surfaces, multi – dimensions (time, elevation, multi-band imagery).

Basic WFS does not implement the transactions. For editing spatial entities it is necessary to implement WFS – T on server and also on client side. The example of usage which is mentioned in this paper uses UMN MapServer which does not implement and probably it will never implement WFS-T. Spatial data on municipal installations in cities are changeable, but the dynamics of changes does not run too fast. Alternative, but very efficient method of updating of spatial data could run with updating on the local computer, and updating of data on the server to be done once a day, week or month (with backup of previous version). If data on the server are stored in some database, it is possible to update through specialized clients using query languages. Although UMN MapServer supports the requests for GML 2 and for GML 3, the only possible vector type of the data is point, line and polygon.

During implementation of WFS service within some company you should be aware of all these restrictions of UMN MapServer. If user's requests overcome these possibilities, there are some solutions such as GeoServer which implements WFS-T. Not going into the comparison of GeoServer and UMN MapServer, it should be emphasized that both have their advantages and disadvantages and simply the implementation of one or other depends on user's request. By specification and analysis of user's request several municipal services in Novi Sad, I came to the conclusion that implementation of WFS-T service is not necessary and that the use of raster and basic vector data mostly satisfies their needs, but this does not have to be the rule in other environments.

4.3. Data access control

The system such as the city which comprises of municipal services which exchange data on spatial entities can be closed. Simply, they exchange data freely, but they do not want their data to be public and available on the global network. Even when they exchange them mutually, not all data are available to all of them. Each service makes decisions which data to whom it would distribute. Depending on the data confidentiality different security access can be undertaken. Security can be achieved on more levels. The system made of WMS or WFS servers can exist within LAN or VPN network. Security protection can be defined also within the firewall. Regarding authentication this can be defined through HTTP. Each user has its name and access code. If the name and code are not matching, the server will not respond to Client's requests. Coding of the data either with symmetric keys or asymmetric keys can slow down the communication because beside the time you need for sending and receiving of the data, the time is spent on coding and decoding of data. Cryptography of the data violates the comfort in the work of clients, i.e. it creates the impression that spatial data take longer to read. If this is not about strictly confidential data, the decoding of data would definitely be avoided, and on the other side a bit slower data reading is the price which has to be paid for this kind of protection. All in all, each service which distributes and uses data must perceive the character of its data and bring the estimate to what extent it wants to protect its data from unauthorized use. Most probably some of data would be available to certain clients. Introducing control over approach to data the possibility is opened to commercial data distribution, i.e. for modernization of business of certain services. From this commercial distribution of data, services like cadastral offices have most benefits, having in mind that their primary business operation is commercial distribution of data.

5. Conclusion

The design of communication between services in cities can be approached in more ways, but it is optimal to create such a complex system where these data would be independent from the system which uses it. This implies the introduction of corresponding convention, i.e. bringing the suitable standard of the data format. When we talk about the spatial data OGC web services proscribe these standards and they are open for the implementation. More and more software clients have the support for use of these services and beside basic possibilities which these services render, upgrading is also possible in order to respond to some specific requests of clients. By agreement of more business units which by their nature of business communicate and exchange the spatial data one complex system based on OGC web services can be built. This system is primarily modern, regulated clients needs oriented. By exchange of data between one spatial server and several clients some advantages client-server architecture are already accomplished, and what is going on with exchange of data between one side of several spatial servers and on the other side thousands of clients? Having in mind that the users of this information can use them in work with the knowledge that they work with updated data which are always available, the overall progress of complex system which in this way improves the services which are provided to end users i.e. citizens has been achieved.

In this paper the view with accent to municipal services of the cities has been given, but the model is applicable to all other complex systems within which the spatial data are exchanged, whether we talk about companies or sectors within one company.

One great advantage when we talk about distribution systems is that clients are supplied with information such as satellite images of high resolution or raster maps which depending on the resolution and size of the area which they show in this primary form can be more than 1 GB size. Even strong Desktop computers with software which are optimized for the work with big rasters have difficulties when reading these data. This is where spatial servers come whose role is to generate the maps at the request of clients for certain area and in certain scale in the format suitable for sending through the web.

More and more popular e-business is now possible to apply also in domain of spatial data. By introducing e-business in distribution of spatial data, numerous benefits are accomplished starting from increase of efficiency up to reduced number of engaged human resources and reduced delivery period of data to clients. Client does not get data in the format which requires certain transformation, formatting and process, but they can be used immediately.

One great idea such as OGC web service can now raise many issues regarding their use. It is necessary to invest time for presenting this technology in the cities or other environment which exchange spatial data, introduce the decision making management with benefits and with first implementation as domino effect many cities shall express the need for introducing this technology. I believe that the results would be impressive and that after short period they will accomplish the progress which could be unbelievable.

Appendix A

acronym	description
CAD	Computer Aided Design
CD	Compact Disk
CGI	Common Gateway Interface
DVD	Digital Video Disc
EPSG	European Petroleum Survey Group
GDAL	library for reading and writing raster geospatial data formats
GIF	Graphics Interchange Format
GIS	Geographic Information System
GML	Geography Markup Language
HTTP	Hyper Text Transfer Protocol
ISO	International Standard Organization
JPG, JPEG	Joint Photographic Experts Group
LAN	Local Area Network
OGC	Open Geospatial Consortium
OGP	The International Association of Oil & Gas producers
OGR	library for reading and writing vector geospatial data formats
PNG	Portable Network Graphic
PROJ4	library for spatial reprojection
QGIS	Quantum Geographic Information System
SVG	Scalable Vector Graphic
TC	Technical Committee
UMN	University of Minnesota

URL	Unified Resource Locator
VPN	Virtual Private Network
WFS	Web Feature Service
WFS-T	Transactional Web Feature Service
WGS84	World Geodetic System
WMS	Web Map Service
XML	Extensible Markup Language

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Web servis Otvorenoga geoprostornog konzorcija u složenim sustavima distribucije

SAŽETAK. Rad prikazuje kratki pregled web servisa Otvorenog geoprostornog konzorcija (OGC) u odnosu na Web Map Service (WMS) i Web Feature Service (WFS) iz perspektive aplikacija servera i korisnika. Opisani su problemi razmjene prostornih podataka u složenom sustavu kao zajedničkom servisu. Na temelju analize razmjene podataka između zaposlenika u istoj tvrtki i razmjene između servisa zajednice shematski je prikazano postojeće stanje. Imajući to na umu dan je prijedlog mjera za poboljšanje komunikacije koristeći raspodjelu OGC web servisa pod pretpostavkom da poboljšanje komunikacije pokreće također i razvitak cjelokupnog sustava. Predloženo rješenje temelji se na serverima i klijentima otvorenog servisa WMS/WFS, uz napomenu da veliki broj komercijalnih desktop GIS sustava ima ugrađenu podršku za OGC web servis. Na kraju je ukazano na neke moguće zahtjeve klijenata u vezi sa sigurnošću podataka i kontrolom pristupa podacima, kao i nekim proširenim tipovima podataka kao što su topografske strukture, površine i slično. Opisani model razmjene može se primijeniti na sve složene sustave, ali unutar manjih sustava kao što su tvrtke koje se sastoje od više sektora.

Ključne riječi: OGC web servis, WMS, WFS, složeni sustav raspodjele, prostorni podaci.

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