

# Developing Cadastral Web Services with Free and Open Source Geospatial Software

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# Presentation Content

- Background
- Aim
- Case Study
- Findings: Advantages and disadvantages of FOSS
- Conclusion and suggestions

## Two major dynamics of the “World order”

**1. Business Model** – highly competitive

**2. “Sustainable development”** and “dynamic and competitive business model” brings the need of

- » **Fast**
- » **High level of accuracy**
- » **Economical**

services/products/solutions...

## Instant Data Access Demand

- Emergency management
- Environmental Impact Assessment (EIA) production and evaluation
- Services for public and local management, cadastral extracts, application plans...
- Data demand in universities
- Data demand in private sector
- .....

## Spatial Data Infrastructure (SDI)

**This demand brings the need of SDI**

# INSPIRE

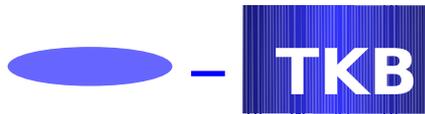
# Background



**Topographic data / services**



**Transportation data / services**



**Agriculture data / services**



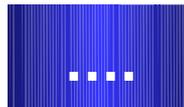
**Environmental data / services**



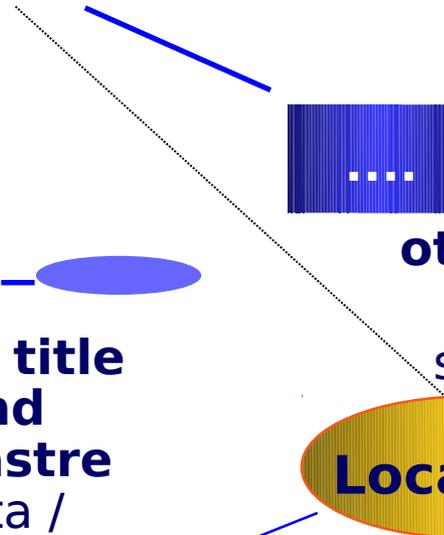
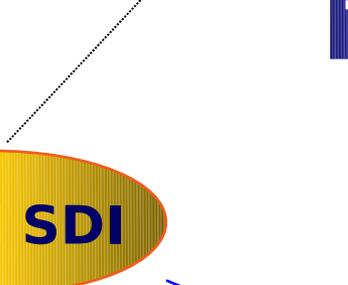
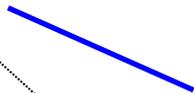
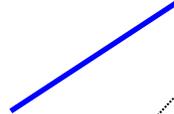
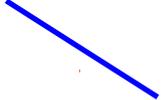
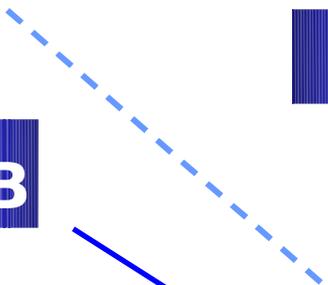
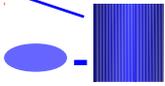
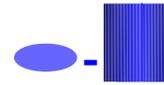
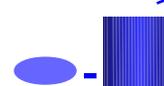
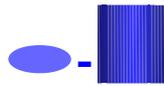
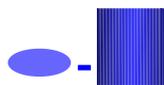
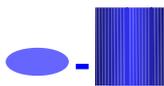
**tourism data / services**



**Land title and cadastre data / services**



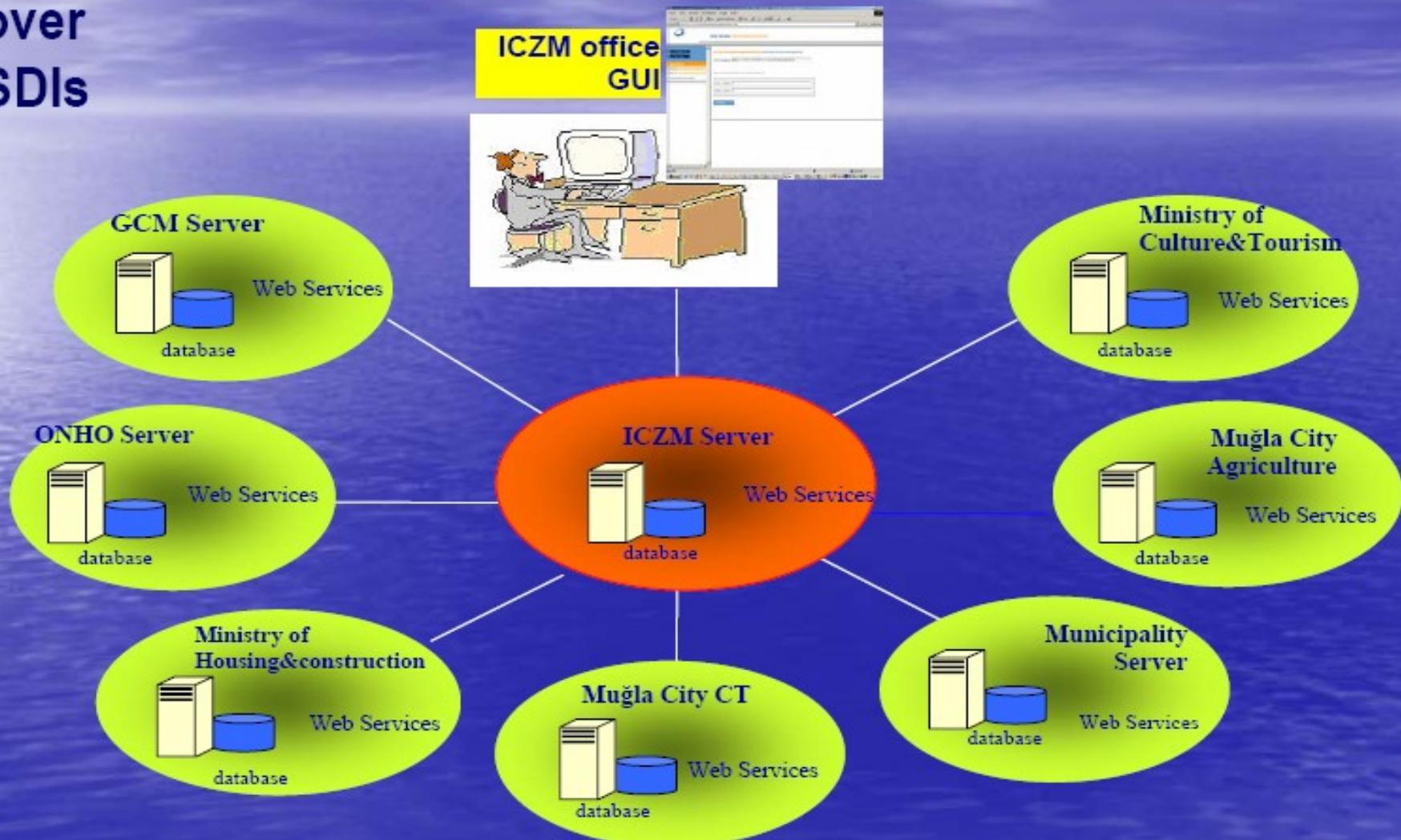
**other data / services**



## Principles of NSDI

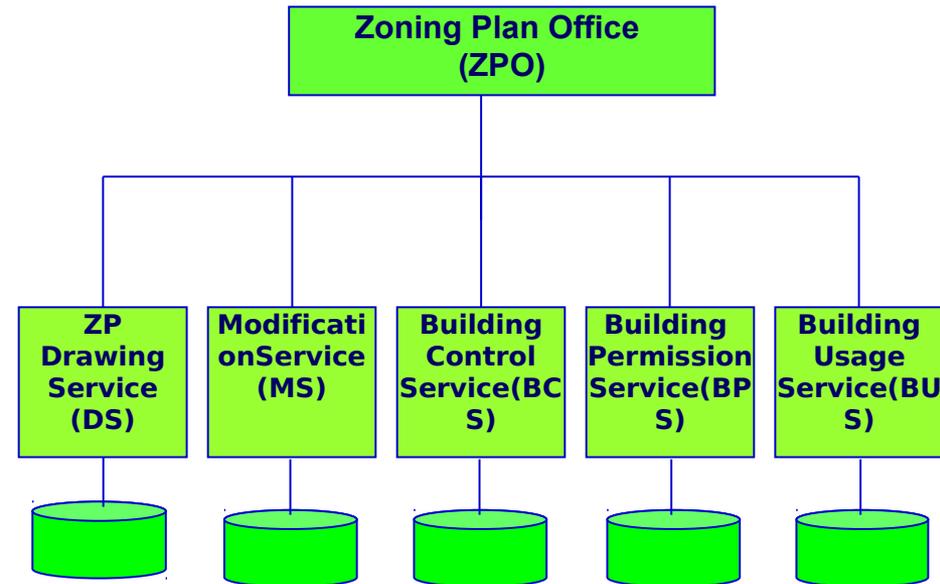
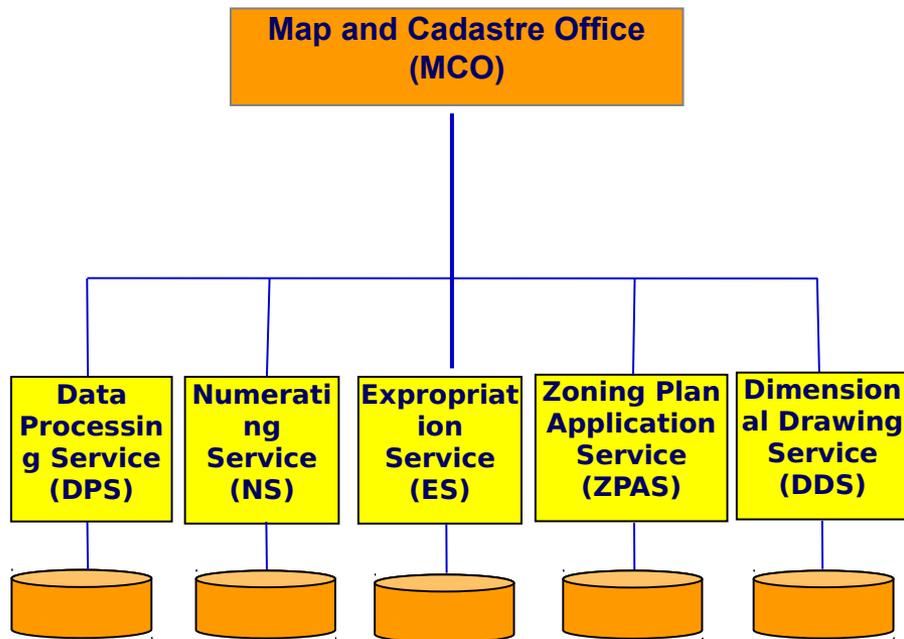
- § **The common use of data and services implemented on a NSDI server.**
- § **Each component can be **service / client****
- § **There is not a central production and distribution.**

## Decision making over SDIs



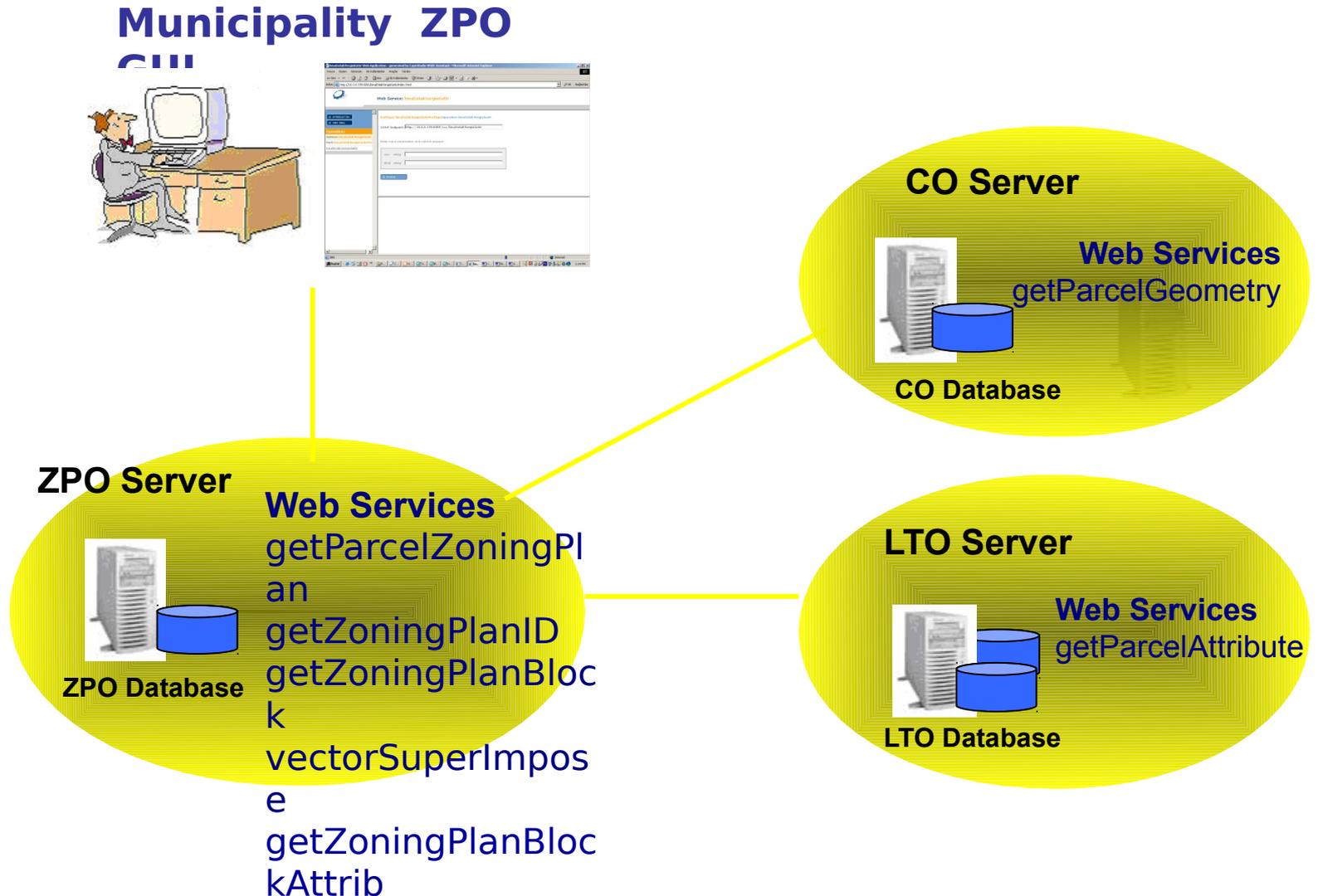
# Background

Earlier work (2003)– designing web services for Trabzon Municipality



# Background

## Generating a zoning plan from via Web services



## Generating a zoning plan from via Web services

Microsoft Internet Explorer window showing a zoning plan visualization. The address bar indicates the file path: C:\Documents and Settings\Halil AKINCI\Belgelerim\SVG Samples 08.04.2004\IDF\IDF\_HTML.html.

The main content area displays a map with various zones and boundaries. A tooltip shows the Point Coordinates: x = 30873.65, y = 28799.55. A blue arrow points to the SVG toolbox, which includes tools for zooming, panning, and editing.

The map shows several zones: "Belediye Hizmet Alanı" (Municipal Service Area), "İlköğretim Alanı" (Primary Education Area), and "39" (Parcel 39). A road width of 12.00 is indicated. A blue circle highlights a value of 35.00.

MER'İ İMAR PLANI				Kat Adedi	4	İnşaat Nizamı	Ayrık
İmar Plan No	20L-IIIb		Bina Yüksekliği	13	TAKS (%)	0.30	
İmar AdaID	121		Bina Derinliği	10	KAKS (%)	1.20	
Tasdik Tarihi	20.05.1997		Ön Bahçe Mesafesi	5	Kot Alınacak Nokta: 19		
Mahallesi	Esentepe		Yan Bahçe Mesafesi	4			
Sokağı	Sahil		Arka Bahçe Mesafesi	6.5			
Kadastro	Pafta 20L-IIIb	Ada	Parsel	Yüzölçümü	a-İskan Sahasındadır		
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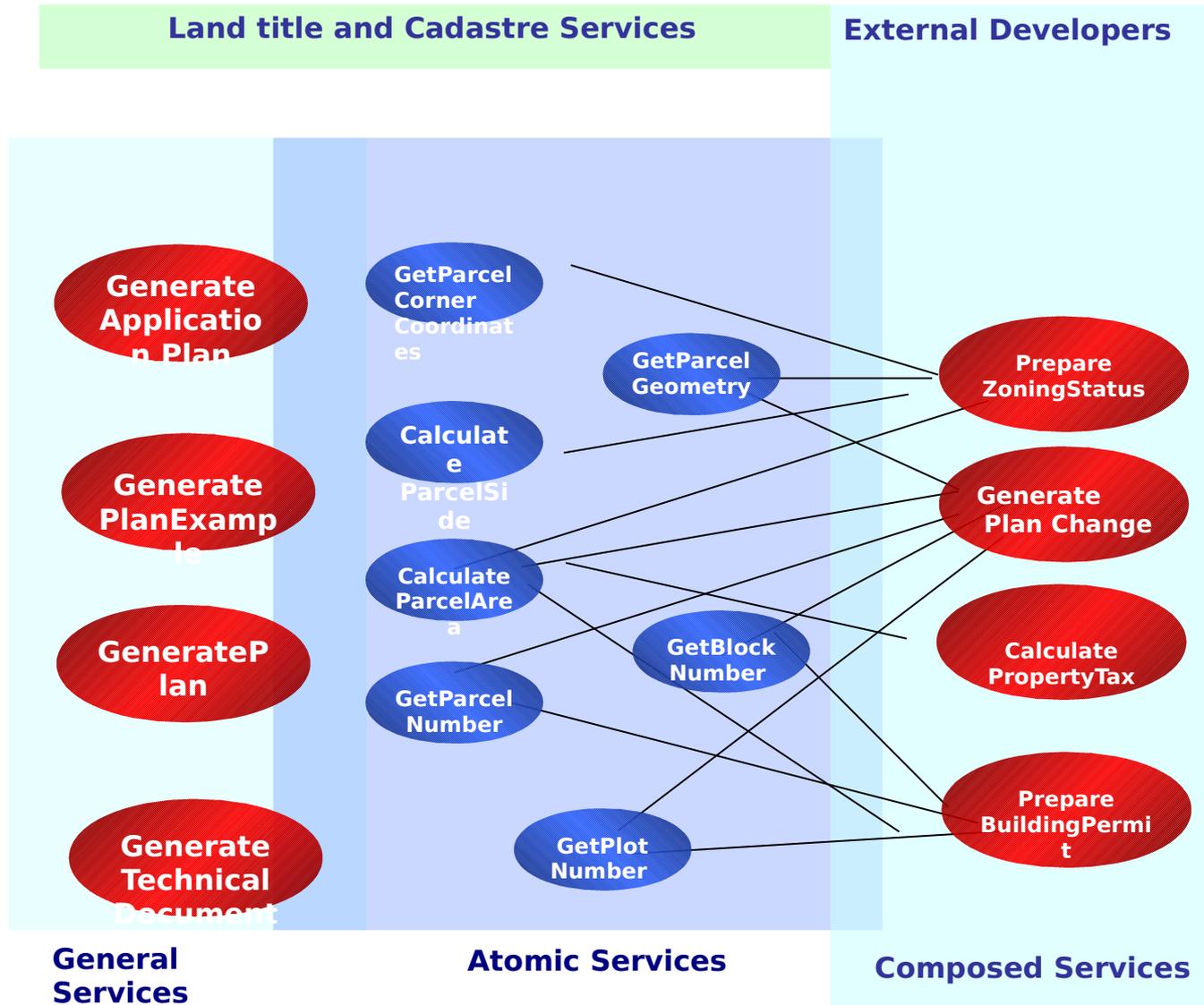
bad CSS property or descriptor declaration

Bilgisayarm

# Background

## "Developing A Service Oriented Analysis And Design Methodology In The Example Of

**Cadastral Web Services"** *Hasan Tahsin Bostancı Ph.D.Thesis, 2010*



# Aim of Study

We try to find out

- Can spatial processes be executed without using any GIS (Geographic Information System)?
- Can spatial web services be developed with Free and Open Source Software (FOSS)

# CASE STUDY

## Why choose FOSS?

- **Source code is open**
- **For *time* and *financial* efficiency**



## Steps

- **Determine the needed web services,**
- **Determine the FOSS that will be used to develop web services,**
- **Deploy and run the web services on the web application server**

# The needed web services \*

## Case Study

Hasan Tahsin Bostancı Ph.D.Thesis. 2010

<b>Web Service</b>	<b>Explanation</b>	<b>Input</b>	<b>Output</b>
<b>GetParcelGeometry</b>	Returns the geometry of parcel (boundaries).	<b>Parcel_ID</b>	Parcel Geometry
<b>CalculateParcelArea</b>	Returns the calculated area	<b>Parcel_ID</b>	Calculated area of parcel
<b>GetBuildingGeometry</b>	Returns the geometry of building/buildings if necessary (boundaries)	<b>Parcel_ID</b>	Building Geometry
<b>GetParcelCornerCoordinates</b>	Returns the corner coordinates of parcel	<b>Parcel_ID</b>	Corner coordinates of parcel
<b>GetBuildingCornerCoordinates</b>	Return the corner coordinates of the parcel if there are building/buildings on the parcel	<b>Parcel_ID</b>	Corner coordinates of building
<b>CalculateParcelSide</b>	Calculate the side lengths of the parcel	<b>Parcel_ID</b>	Lengths of parcel side
<b>GetPolygonCoordinates</b>	Returns the coordinates of polygons which are inside the buffer area as a result of buffer analysis to the parcel	<b>Parcel_ID</b>	Polygons and polygon coordinates
<b>DrawNeighbourParcelBorder</b>	Returns the border of neighbor parcels which are inside the buffer area as a result of buffer analysis to the parcel	<b>Parcel_ID</b>	Neighbor parcel boundaries

**Search for**  
***“getParcelGeometry”*** routine in  
**FOSS**

# Determining the FOSS That Will Be Used To Develop Web Services

## Pre-Selection:

- » Literature Review
- » Research related projects
- » Web search over available FOSS

## Final Selection

- » Generate criteria

# Literature Review

Hall and Leahy, 2008



**MapGuide**

**No criteria to select a suitable  
FOSS**

# Ramsey, 2007

## Criteria:

Desktop FOSS

software

Programming language used in coding the

Whether the software is an application or library

Web Projects

Toolkits

Frameworks

Servers

**There are over thirty  
software**

# Steiniger, 2008

- **Criteria:**

- » Application Focus
- » User Level
- » Supported operating system
- » Development platform
- » Developed by
- » Software license



**Kosmo**



**ILWIS**

**MAPWINDOW**



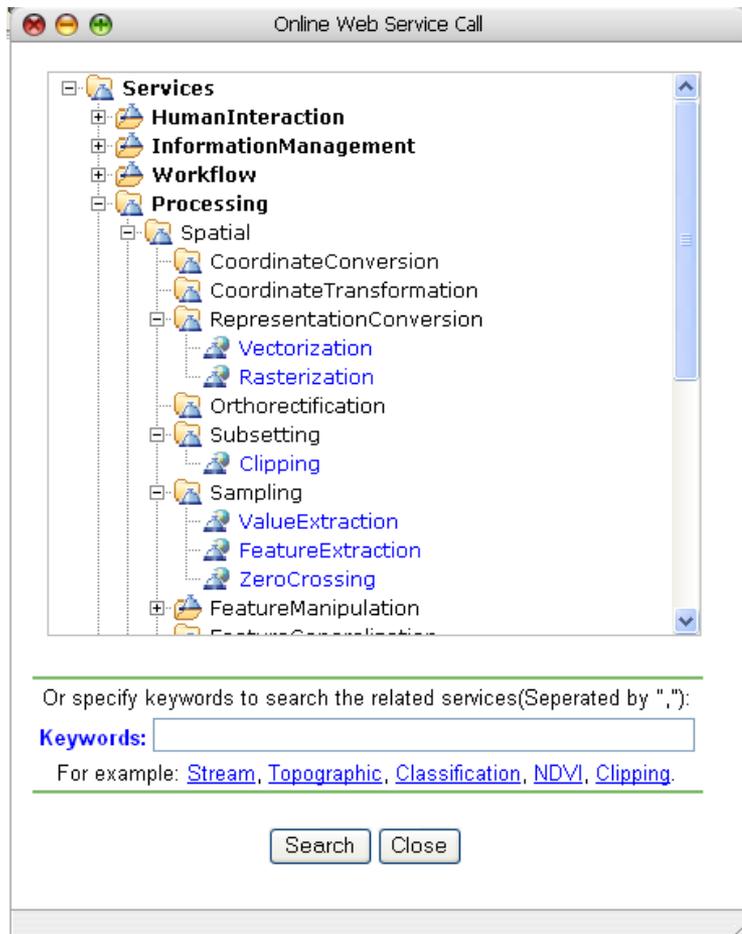
# Related projects

## GeOnAs (GeoBrain Online Analysis System



### *GRASS Based Web Services*

### *Vector and raster analysis*



## User interface of GeOnAs



NASA EOS Higher-Education Alliance (NEHEA) -- GeoBrain

Mobilization of NASA EOS Data and Information through Web Services and Knowledge Management Technologies for Higher-Education Teaching and Research





## **AWARE (A tool for monitoring and forecasting available water resource in mountain environments)**

Spatial web services in hydrology

Sextante, GeoTools, JFreeChart integrated on 52NWPS

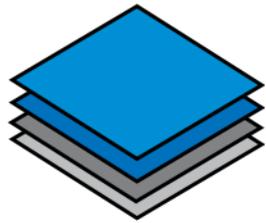
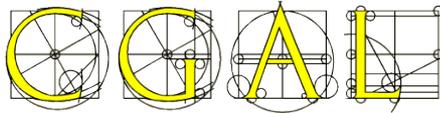
**Major Web Sites listing Geospatial Open Source Software only**

<b><a href="http://www.osgeo.org/">http://www.osgeo.org/</a></b>	<b><a href="http://www.freegis.org">http://www.freegis.org</a></b>
<b><a href="http://www.maptools.org/">http://www.maptools.org/</a></b>	<b><a href="http://opensourcegis.org/">http://opensourcegis.org/</a></b>

**Major Web Sites listing General Open Source Software**

<b><a href="http://directory.fsf.org">http://directory.fsf.org</a></b>	<b><a href="http://sourceforge.net/">http://sourceforge.net/</a></b>
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# WHICH SOFTWARE?



# Final Selection:

- **Functional content:** How comprehensive is the **FOSS**? Does the FOSS contain “specific routines” (e.g. getParcelGeometry)?
- **Operating System (OS):** Is the **FOSS** compatible with the required **OS** which is Windows XP in our case.
- **Code Maturity:** Is the code mature enough? Less `bugs` in the source code.
- **Licence:** **GPL.**
- **Programming Language:** **Java.**

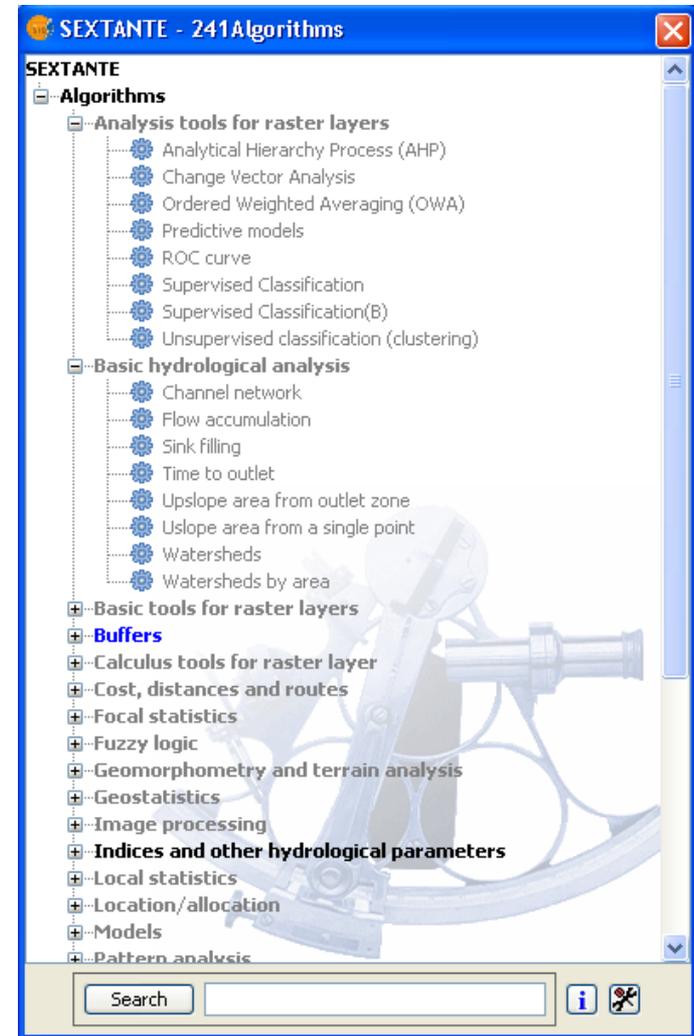
# Software Researched in Scope of Case Study

## Sextante

- ü “A set of free geospatial analysis tools”\*
- ü Java based geospatial routine library.
- ü Very high ‘Functional content’; offers many routines for raster and vector data.
- ü Windows 32 systems compatible.

**! Code maturity problems.**

\* <http://forge.osor.eu/plugins/wiki/index.php?id=13&type=g>

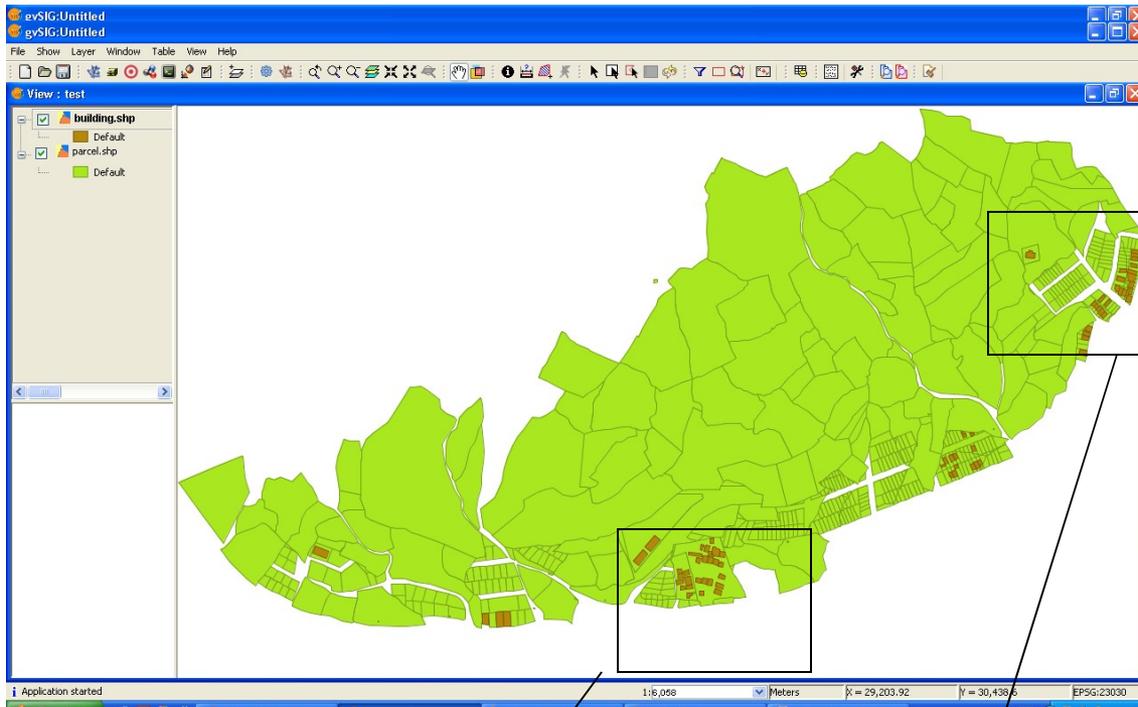


Sextante Toolbox

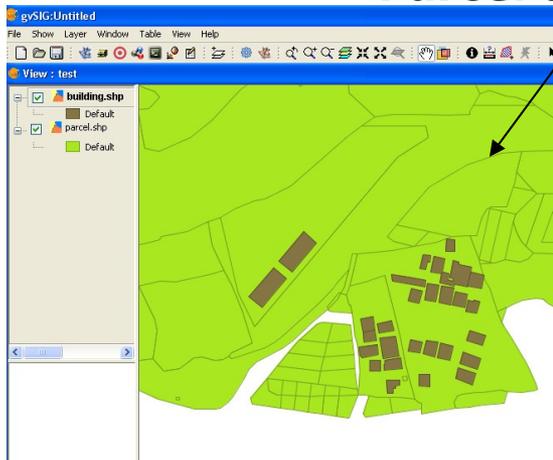
# Test for “clip” routine of Sextante

## Why?

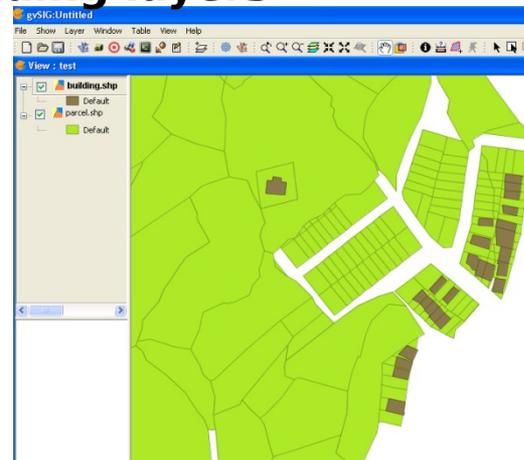
- “clip” routine in Sextante could be used for the function of “getBuildingGeometry” web service.
- We integrate Sextante to gvSIG and try “clip” routine both in Sextante and gvSIG.



**Parcel and building layers**

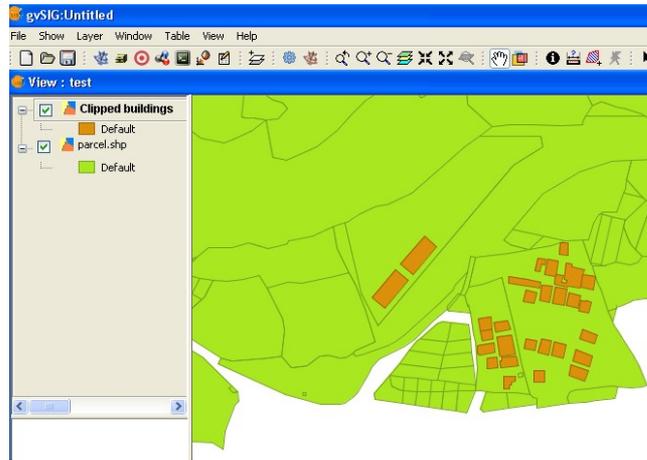


1. Region

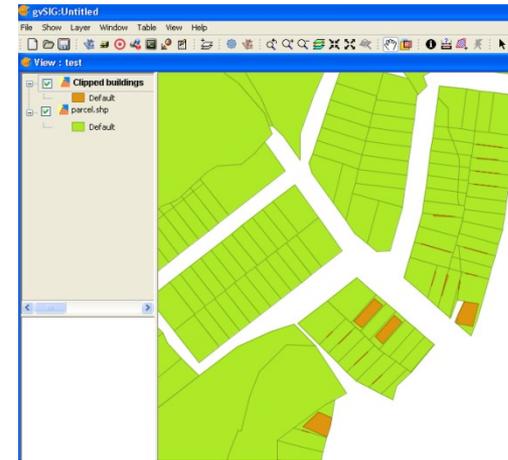


2. Region

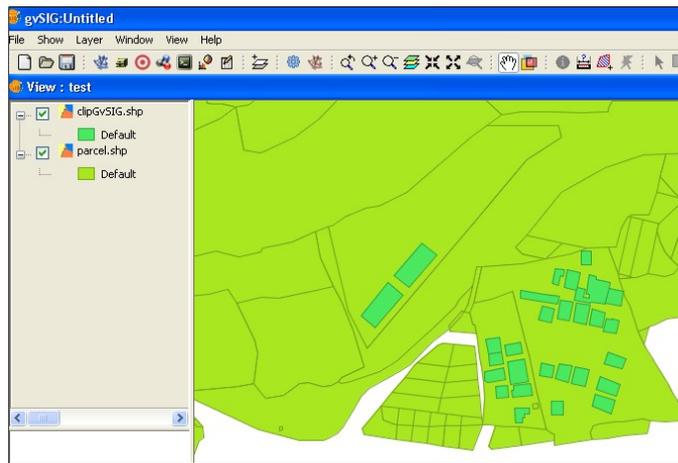
# Results of “clip” routine



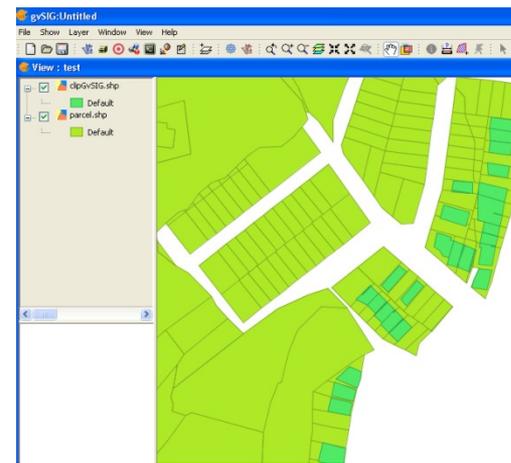
Sextante “clip” result (1. region)



Sextante “clip” result (2. region)



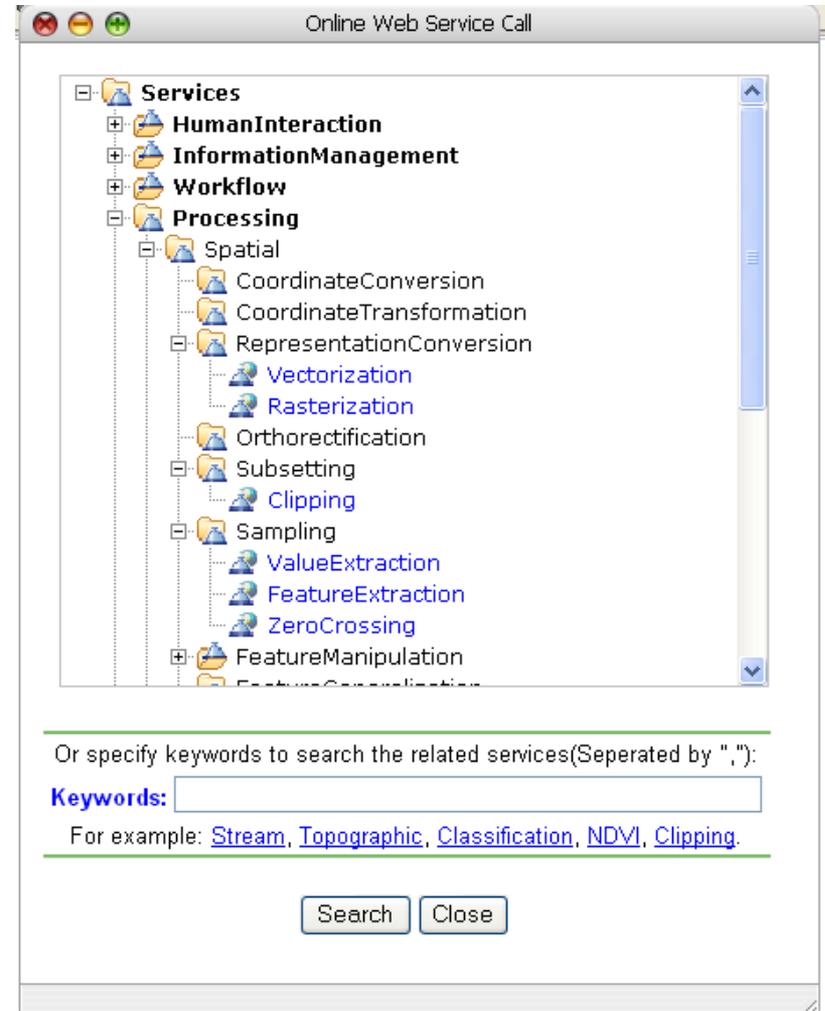
gvSIG “clip” result (1. region)



gvSIG “clip” result (2. region)

# GeOnAs GRASS Based Web Services

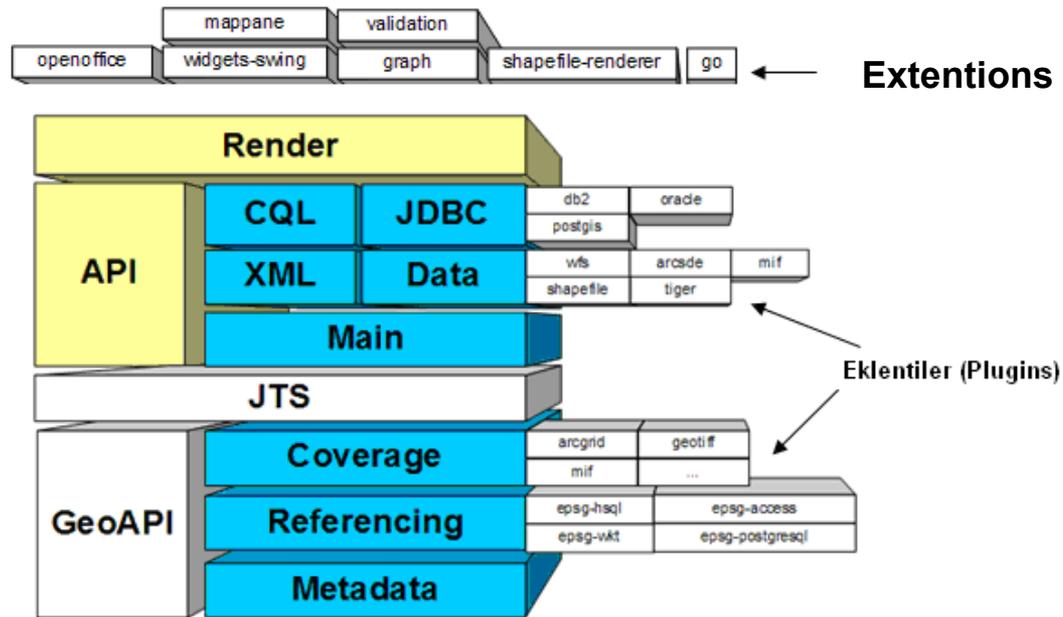
- ü Geospatial web services in GeOnAs project are developed using GRASS functions
- ü Programming language, axis web services
- ! Web services are only compatible with LINUX OS.



**GeOnAs online web services user interface**



# GeoTools



- ü “GeoTools is an open source library that provides tools for geospatial data”\*. **Java**
- ü It is built up on robust libraries like JTS and GeoAPI, it has classes to make **general analysis**, not much specific routines as in Sextante.
- ü **LGPL licence**.
- ü **Windows XP** compatible.
- ü It is more code mature than Sextante.

\* <http://GeoTools.org/>

## The final selection result

- GeoTools is the only one that satisfies the criteria.

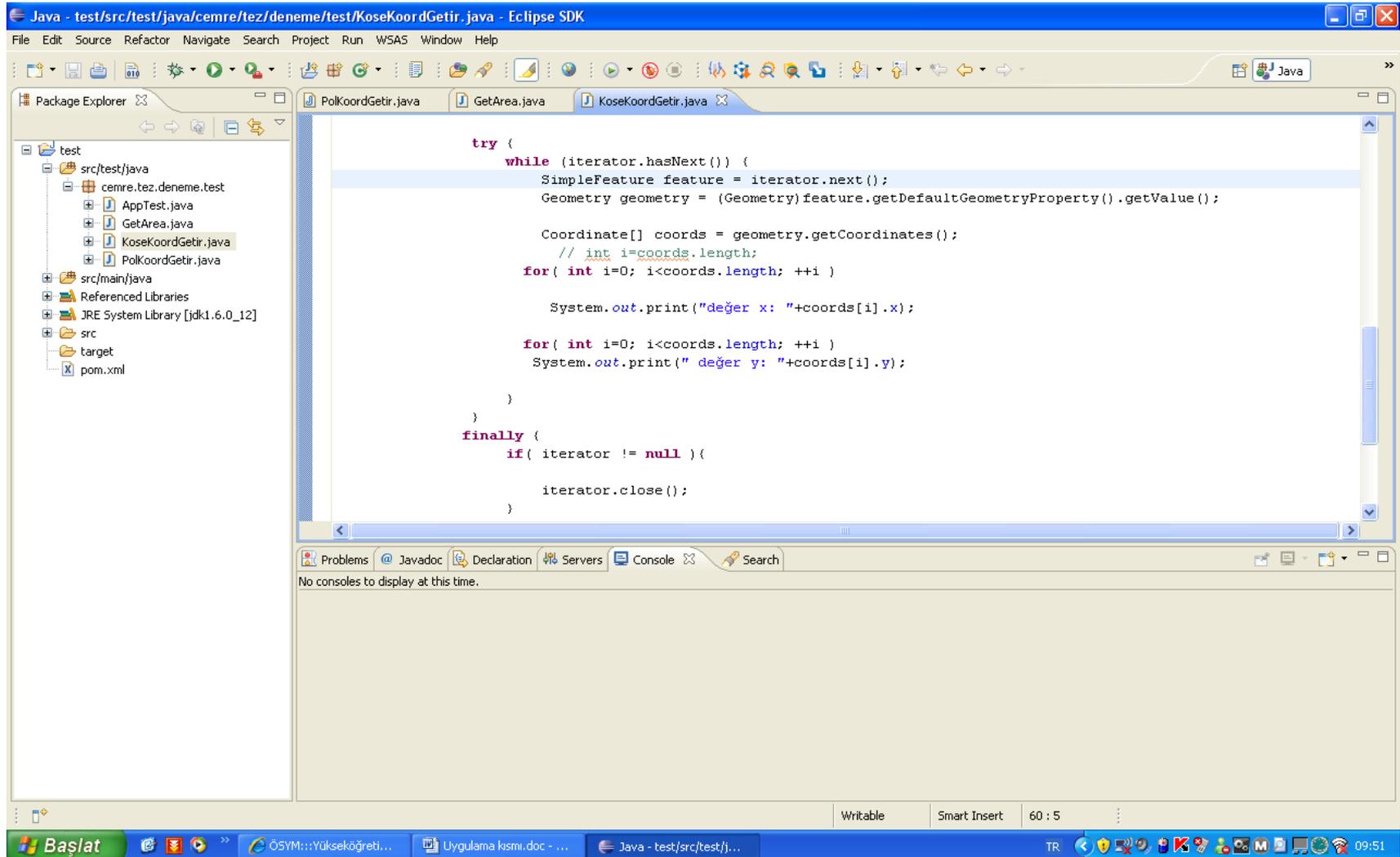


# Deploy and run the web services on the web application server

## Software used

- **J2SDK (Java Software Development Kit) – GeoTools is Java based library.**
- **GeoTools**
- **Eclipse as Java IDE**
- **Apache Maven - GeoTools recommends.**
- **WSO2 Web Services Application Server (WSAS) to deploy web services.**

# Eclipse Java IDE user interface



# WSAS User Interface

The screenshot displays the WSAS Management Console in a Microsoft Internet Explorer browser window. The browser title is "WSO2 Web Services Application Server v2.3 Management Console - Microsoft Internet Explorer". The address bar shows "https://localhost:9443/#\_\_divTryit". The page header includes the WSAS logo and "Management Console" with a "Signed in as admin" status and links for "About", "Docs", and "Sign Out".

The main content area is titled "Services > GetArea > Try Web Service". It features a "Choose endpoint..." dropdown menu with "getParseAlan" selected. Below this, a parameter field "param0 (0..1)" contains the value "160". A "getParseAlan >>" button is highlighted with a green box, and the resulting output "6933.935851371847" is displayed below it.

The left sidebar contains a navigation menu with the following items: Home, Manage, Services (highlighted), Modules, Security, Transports, Keystores, Logging, Shutdown/Restart, Monitor, System, Statistics, Logs, Tracer, Flows, Tools, and WSDL2Code.

The Windows taskbar at the bottom shows the "Başlat" button, several open applications including "bin", "Web services applicat...", and "WSO2 Web Services ...", and the system tray with the date "08:45" and "TR".

# Advantages and disadvantages of FOSS,

## Advantages Our findings Disadvantages

- ü Being usually free of charge, otherwise available for a small fee
- ü Having active discussion forums for users and developers
- ü Being Open Source
- ü No implementation warranty
- ü Published before being checked thoroughly enough for bugs; For instance, although “clip” routine in **Sextante** does not give correct results, it is published.
- ü Insufficient documentation; **GeoTools** is a geospatial FOSS library which is often updated. The manuals are neither sufficient nor up-to-date.

# Conclusion and Suggestion

- We find **GeoTools library** to be the most suitable geospatial software to be used in developing web services. GeoTools library is the only FOSS among the ones we researched that satisfies the criteria we determined.
- The part of the work with the most difficulties has been to see whether a web service routine is already implemented in any existing FOSS. Currently, we have to carefully examine all the source codes or research many manuals. Given the huge number of FOSS available, this is a highly impractical solution to the problem. Additionally, to make better use of FOSS being open source, there should be a **syntactic or semantic search facility** for routines.

Questions?