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User Experience: Wupperverband

The following user experience is about publishing data through a WMS service by using ArcIMS 4 with its inherent WMS Connector, and about integrating published data in an ArcIMS Web Client.

In the late 1990s, the Wupperverband – a German water body authority, operator of dams and sewage plants – started building a GIS and recording geodata. Soon it turned out that there was a need for external geodata from many other authorities and companies. Wupperverband had to deal with more than 20 communities, state and county offices and another more than 20 utilities and sewage companies within their field of responsibility – a region of over 800 square kilometers in the densely populated south of the German Ruhrgebiet. The partners used GIS products from ESRI, SICAD, Smallworld and many others, resulting in data exchange problems.

The implementation of the GIS system at the Wupperverband has been managed by CSC Ploenzke since the beginning of the year 2000. By the end of that year, Wupperverband and CSC Ploenzke had developed the idea of solving the import/export, conversion and update problems of the external data by using the new OGC WMS standard. For the last two years, a pilot project has been running in Germany trying to integrate the commercially available Internet Map Servers – ESRI ArcIMS¹ and SICAD IMS from SICAD Geomatics² using the OGC WMS Specification.

The vision was to communicate online with the partner authorities and companies to simply bypass all these problems. The first partner in this effort was rapidly found: the community of the town of Wuppertal.

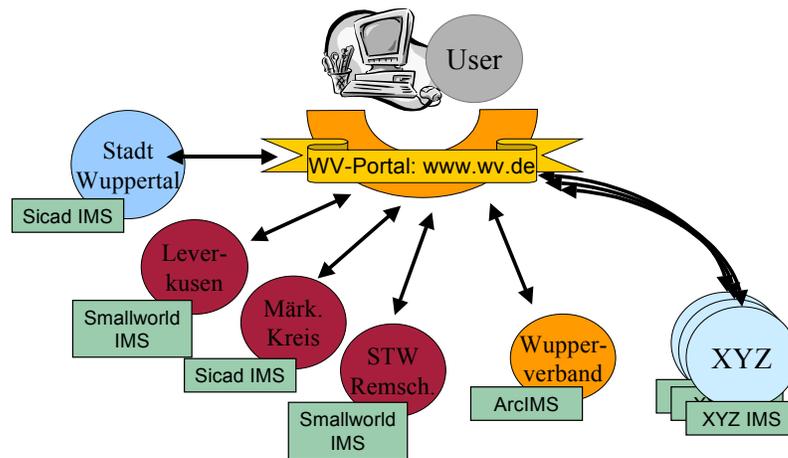


Figure 1: Wupperportal - the Vision of a WMS network in the Wupper region

They had used a SICAD based system for years and already had recorded lots of geodata. After some analysis of the content and technical aspects, a first implementation was realized in spring 2001 with a simple HTML approach. As a result, Germany's first practical WMS project went online. The financial effort for the realization was minimal, because the WMS extensions of ESRI and SICAD were provided free of charge.

The service was improved in several small steps over a period of several months. In autumn 2002, the services were migrated from ArcIMS version 3.1 to 4.0 and from SICAD Internet Suite version 4.x to 5.1. Now, the WMS extension is a built-in component of ArcIMS 4. The service was

¹ ESRI ArcIMS Product Page: <http://www.esri.com/software/arcims/index.html>

² SICAD IMS Product Page (SICAD Internet Suite) http://www.sicad.com/pages/products/technology/sicad/internet_suite/index.html

improved to become more maintainable from hard coded HTML to generic Java Servlet technology. The capability to communicate with more than one external WMS service simultaneously is being developed now. The integration of other WMS services (e.g. rasterdata from the state office in Düsseldorf, based on AED's ALK/GIAP product) were tested successively and other authorities and companies showed interest in joining the network (e.g. the Wuppertaler Stadtwerke, using a Smallworld based Utilities GIS).

The project was presented for the potential partners and the local and technical press during a workshop event on November 12, 2002. Discussion focused on integration of these local services into the wider concept of the Geodata Infrastructure initiative of North Rhine Westphalia³. The Vision of the online geodata network WUPPER (Wupperportal) portrayed in Figure 1 above got closer and the project has begun to get connected to statewide and global networks.

Publishing your Data as a WMS Service

If you want to provide your GIS data to others, independent from their GIS software product, in a read-only mode, and in a visual form that you predefine, then a WMS service is what you need. By using a WMS service, your customers/users can use your data as you provide it without the need for any data conversions. This will get rid of the need to export your data to common GIS formats like DXF or Shapefile.

One advantage of using a WMS service is that your customers will not have to worry about the data being outdated. This is because your customers will work on the most up-to-date data through the WMS service, as opposed to working with local copies or replicated geo-databases that are often outdated data.

If you are a data provider, you can use WMS services as an advertisement for your data products. Users can see them and – if you implemented it – can get attribute information, but they cannot steal your data, copy it or manipulate it for internal or commercial purposes.

Integrating Published Data in your ArcIMS Web Client

Without WMS, in general, as a user, if you need to look at external geodata for your work, you have to ask the different data providers to export this data in a compatible format. Then you have to import the data into your system and configure the visualization. This is time consuming and very challenging. In most cases, you will be faced with a loss of information during the conversion process and the received data will soon be out of date. For these reasons, you often will determine that this is inefficient and not bother with it when you can avoid it.

Having a WMS compliant client, you can access different data from different data providers dynamically with no conversion effort. You can combine GIS data from all over the world and maybe find useful sources you never thought of before.

If you want to integrate published data from other data-vendors via a WMS service into your ArcIMS installation, you are not required to install and configure the ArcIMS OGC WMS Connector. Instead, you'll have to configure your Web client.

Version 4.0 of the ArcIMS Installation CD contains a bunch of sample clients, which are free for use and which are thoughts and ideas regarding what you can do and what you might want to do with your ArcIMS. Besides samples for the different connectors, the ArcIMS CD also contains a couple of samples for the standard ServletConnector consisting of nothing more than HTML- and JavaScript-files. These samples use the standard ServletConnector and have the big advantage of requiring no additional software on the client's computer to run without the web browser (e.g. Java Runtime Environment, ArcExplorer). Also, there is no need for a big web application to run on the server (e.g. an Active Server Pages ASP-Application).

³ GDI NRW: <http://gdi.ecc-gmbh.de/>

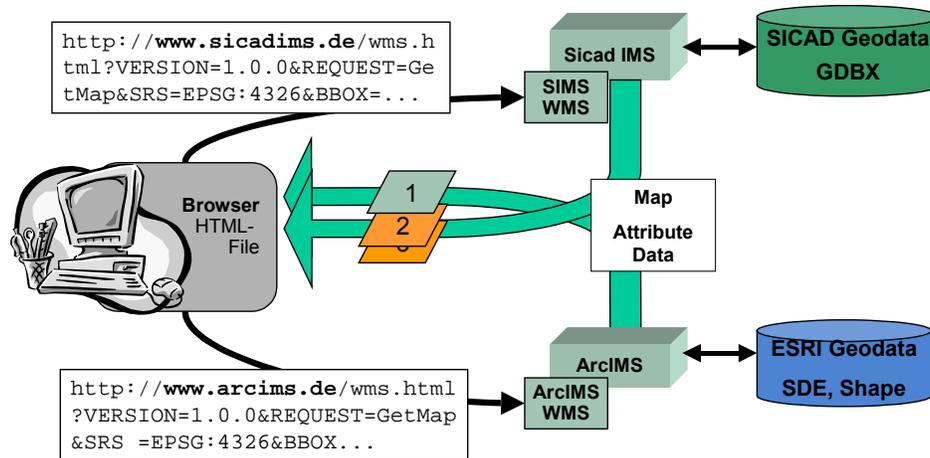


Figure 2: WMS Architecture and Data Flow in the Wuppertal project

The disadvantage is that there exists only one client demonstrating the functionality of the ArcIMS WMS connector, which was not developed to do anything except to act as the WMS connector. Also, the other samples were developed to use the proprietary interface language of ArcIMS - ArcXML (sending and receiving ArcXML requests as the communication protocol). Because of these disadvantages, CSC Ploenzke developed its own enhanced client application, described below.

CSC's Ploenzke enhanced Client Application

The need for Web enhanced client applications comes from the lack of a Web client being able to use both:

- ArcXML as a protocol for ArcIMS MapServices revealing all the functionality ArcIMS offers (which is quite a bit more than that of the WMS interface) and
- WMS syntax to connect to every WMS service available on the Internet.

Such a Web client would incorporate the better of two worlds: the vast functionality of ArcIMS and the incredible possibilities offered by open standards allowing you to use data from everybody publishing it – no matter what software or geodata structure is used in the background.

The CSC Ploenzke evolving Web client application is an enhancement of one of the standard HTML viewers provided with ArcIMS 4.0. (This is the template of HTML- and JavaScript-files, which is generated if you are using the ArcIMS Designer application to create your MapService Website.)

After the installation of the ArcIMS CD, you will be able to use the HTML viewer "out of the box."

The CSC Ploenzke client application uses a simple Java applet that will run on most browsers (version 4 or higher) without having to install a plug-in. This applet is used for interaction with two additional Java Servlets running on the already used Servlet Engine. The Java Servlets allow the user to connect to any WMS service and to integrate their data into the client interface.

Specifically, the user will be able to:

- See a list of available WMS layers as part of the layer tree (through the `GetCapabilities` request)
- Obtain metadata for each of the provided WMS layers
- Control which WMS layer(s) are or are not to be viewed
- Draw the WMS map above or below the map generated by ArcIMS (through the `GetMap` request)

- View feature information of a certain WMS layer (through the `GetFeatureInfo` request)

As a result, the user will be able to use all of the functions provided with the standard HTML-client and use all possible functions available through the WMS interface. Both of these functions are smoothly integrated to the CSC Ploenzke interface.

The option of offering customized Web clients to different groups was taken into account, for example:

- Using the WMS functionality with one MapService and not using it with another MapService or
- Using localized versions in different languages.

You will be able to manipulate the client appropriately within minutes.

With the current CSC Ploenzke Web application, you can only work on one ArcIMS service and connect to one WMS service at a time. You can change the WMS service you are connected to within one session, but you cannot connect to two WMS services at the same time. The ability to connect to multiple WMS services as well as the ability to connect to multiple ArcIMS services at the same time is being implemented by CSC Ploenke.

Note: If you are interested in using the viewer described here, please contact Roland Stahl (see Submitting Contact Points).

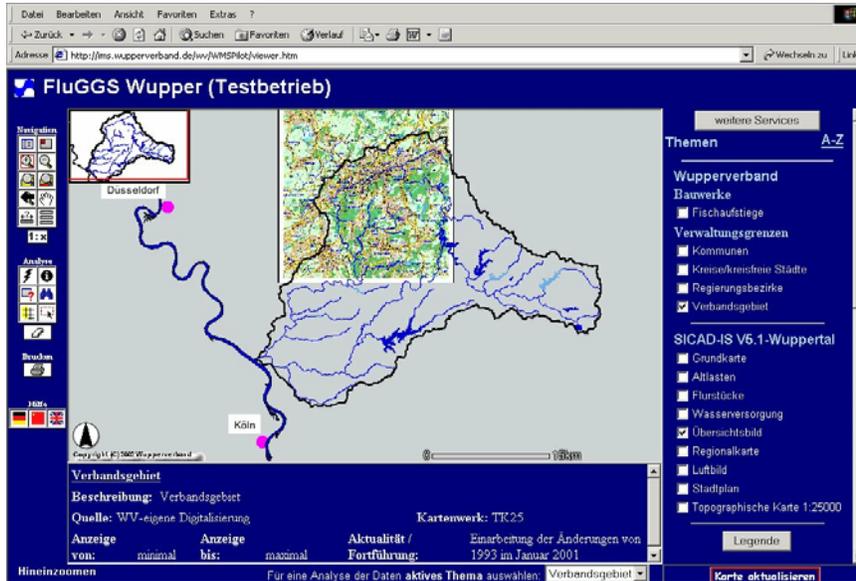


Figure 3: WMS Service example screenshot of combined geodata from SICAD and ESRI Internet Map Servers through the WMS interface using the enhanced ESRI HTML

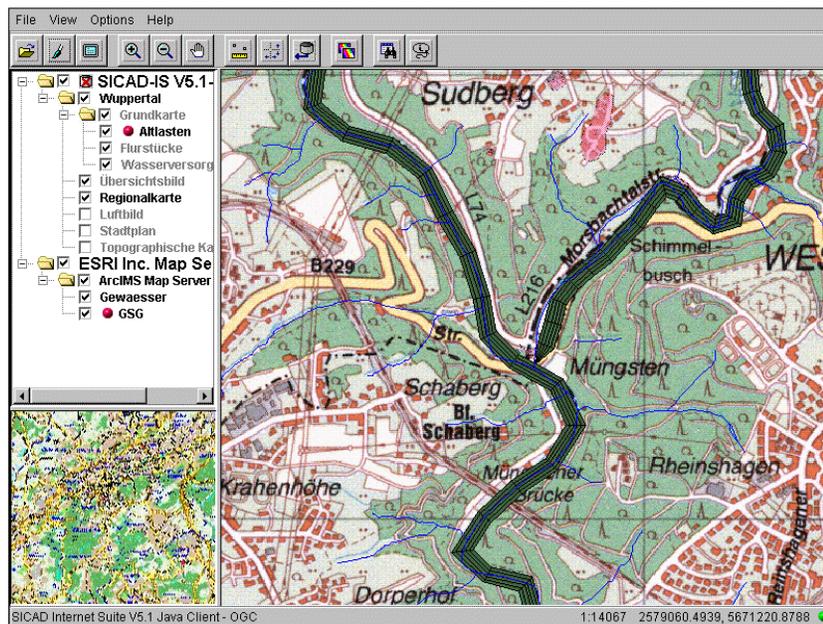


Figure 4: WMS Service example screenshot of combined geodata from SICAD and ESRI Internet Map Servers

ArcIMS Tuning Recommendations

The `GetCapabilities` document is generated by default by the ArcIMS WMS connector as long as you do not have an xml-file stored under your capabilities directory using the name of the

requested MapService as the filename. For example, if you have the MapService "SanFrancisco" running and you have a XML-file named SanFrancisco.xml stored at

```
c:/ArcIMS/capabilities/
```

The WMS connector will provide this file as a result of a GetCapabilities request. If the WMS connector does not find such a file, it will create one from scratch.

It is up to the user to decide if he/she wants to provide a manipulated, but more detailed and exact, GetCapabilities document with the disadvantage of having to manually manipulate that file every time the underlying MapService is changed.

If you want to create your own GetCapabilities document, it is recommended just to save the file in the capabilities directory provided by ArcIMS and to edit it manually using a text editor (e.g., Notepad). Here is a list of parameters (xml-tags) you might want to check/change in the GetCapabilities document to better offer your MapService to the public.

Depending on the end-users of your ArcIMS MapService you will probably want to offer the file in another encoding, in addition to the UTF-8 encoding:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
```

You probably want to offer your Capabilities file from your server and to make it available independent of the digitalearth server. Download the DTD-file to your file system, store it in the capabilities directory and write down the appropriate path to the XML-file, replacing the "http://www.digitalearth.gov...":

```
<!DOCTYPE WMT_MS_Capabilities SYSTEM  
"http://www.digitalearth.gov/wmt/xml/capabilities_1_1_0.dtd">
```

You can change the entries of the following tags to better describe the MapService you are offering:

```
<Service>  
<Name>OGC:WMS</Name>  
<Title>ArcIMS WMS 1.1.0 Map Server</Title>  
<Abstract> </Abstract>
```

Make sure that the value of the xlink:href attribute in the <OnlineResource> tag points to the exact MapService. If the link ends with a question mark (com.esri.wms.Esrimap?), it will point to the MapService you have defined as defaultService in the file "WMSEsrimap_prop". If you use more than one MapService, make sure the link ends with the specific name of your MapService:

```
com.esri.wms.Esrimap?ServiceName=<MapServiceName>
```

You should make sure that the only file format which is listed here is the format your MapService is using. The format can be found and changed using ArcIMS Administrator.

```
<Capability><Request><GetMap>  
<Format>image/png</Format>
```

If you check the layers offered by your MapService, you will see that none of them is offering to be queryable, meaning no GetFeatureInfo capability on your layers. If you are trying to make such a request by hand (typing a get Feature request as a URL into your browser), you will see that you can successfully do such a request. If you want to let people know that they can make GetFeatureInfo requests, add the attribute queryable to each layer-tag that is describing data:

```
<Layer queryable="1">
```

You will probably have specified a minimum or maximum extent for layers in your MapService to provide the valuable information at which scale it should be available and drawn onto a map. This

information gets lost when the `GetCapabilities` document is generated automatically by default. To pass this information to the public, add the following tag to each layer you want:

```
<ScaleHint min="xxx" max="xxx" />
```

To create appropriate min and max values, you can at first use the rough rule of thumb to convert the minimum and maximum values you specified in the MapService's axl-file (the map configuration file). Open the file in an (xml- or text) editor and find the minimum and maximum values for each layer. Use this formula to get the values to write in the `ScaleHint`-tag:
`axl_minimum / 3846.15 = scalehint_min`

For example, if your minimum value in the axl-file is 1:20.000, you will divide it by 3846.15 resulting approximately in 5.2, which will be the value for min in the `ScaleHint`. The same will be required for the maximum value.

This solution is not meant to be geodetically precise, but it does the job in most cases.

```
<Capability><Layer><Layer>  
<SRS> and <LatLonBoundingBox>
```

There are some remarks to add regarding coordinate information of layers available through the WMS interface:

- Although ArcIMS provides the possibility of Map projections on the fly, it is not supported with the WMS interface, that is if you request a layer, the only transformation you will get is that which you have defined in the axl-file of your MapService (if you have not defined one, the default one will be taken). If you want to provide your data in more than one coordinate space, you will have to create a MapService for each coordinate system you want to use. In addition, you will have to create a `GetCapabilities` document for each of these MapServices with the different coordinate systems.
- As long as your MapService is in EPSG:4326, the values in tag `LatLonBoundingBox` are correct. If you change your MapService to another coordinate system, the values are updated but are not correct. The WMS Specification states that the values provided with the tag `LatLonBoundingBox` indicate the edges of the enclosing rectangle in latitude/longitude decimal degrees as in SRS EPSG:4326 [WGS1984 lat/lon]. That is why you should change the values back to lat/lon degrees.
- It is recommended that you add the tag `BoundingBox` to every layer which is to be used for a specific SRS:

```
<BoundingBox SRS="EPSG:your_epsg_number" minx="xxx"  
miny="xxx" maxx="xxx" maxy="xxx" />
```

Troubleshooting

Check the WMS log-file "WMSEsrimap.log" located under:

```
c:\ArcIMS\workingdir
```

If you have problems getting the `GetCapabilities` document, try using the tool "wget"⁴.

⁴ wget tool: <http://wget.sunsite.dk/>