# TERRASCOPE CLIENT: An Interactive Image Browser for an Earth Science Information System

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## Abstract

Terrascope Client is an interactive image browser designed to perform spatial exploration in conjunction with an Earth Science Information System (Terrascope Server). Using Flash MX, XML and Servlets technology it delivers satellite images with their corresponding metadata, GIS characteristics, and other outstanding information. Once an image of interest is located, users may easily search the database for images contained within this seed image (sub-images) or for images overlapping this seed image. Users may perform operations such as pan, zoom in, and zoom out over the image and display specific metadata for the image.

In this paper we present a new system that can use new technologies like Flash MX, XML and Servlets for spatial data exploration. We also present the implementation and some results that validate the architecture proposed.

**Keywords**
Geo-Spatial, image databases, Client/Server, Internet, GIS.

## 1. Introduction

The main need in the internet is to obtain information in a quick, precise and instantaneous way, without keeping in mind the geographical localization of the given information. Existing database systems and web applications have experienced an important growth in the volume of data that they process. Current applications such as Geographic Information Systems (GIS), digital libraries, search engines and multimedia impose some demands on the efficiency of query processing and the way how the data and metadata must be show to the final user. The use of distributed database systems combined with the new technologies for web development allows sharing and accessing information stored on local or remote databases in an easy and transparent way for the user.

Many research centers and universities have been making their databases available over the Internet providing effective access to databases that contain spatial data. This research emerges from the need to effectively access these large spatial databases and to know how to recover and visualize graphical/textual information from images that are stored in these sources.

*Terrascope* is an Earth Science Distributed Database Management System based on the Web, with a Peer-to-Peer

architecture where multiple data sources can be integrated in a coherent system and an interactive image browser.

Terrascope Server is a Search and Retrieval Engine (SRE)**.** With SRE we can support the execution of different queries that make it possible to gather information that is stored at each data center, with different formats or characteristics. The data can be satellite images, metadata, GIS characteristics, as well as any other type of outstanding information.

Terrascope Client (**TC**) is more than a simple image viewer, actually exists other interactive browser for accessing spatial online databases like [Chan01], [Tanin02] and the most popular TerraServer [Barclay00].

In the next section this paper describes the software architecture and system's components. In Section 3 we show the preliminary results and future work.

## 2. Implementation Issues

Terrascope Client is accessed via internet through any graphical web browser. Users can zoom and pan across a mosaic of tiles within a Terrascope scene. Terrascope Client allows to user execute many operations such as zooming or locational queries. All users queries are still evaluated on the server side and the results are downloaded onto the client for displaying.

Terrascope client was developed with Action Script and Flash MX of Macromedia and uses the XML protocol for describing the data and to communicate the server with the client. Macromedia Flash MX is the fastest way to create rich Internet content and applications with a better return on investment. Powerful video, multimedia, and application development features allow the creation of rich user interfaces.

### 2.1 Terrascope architecture

The overall architecture of the *Terrascope* project is shown in figure 1.

The *Terrascope* client receives the Geographical and spatial data from the server in a file XML, the client parsing that file and extract the results sets for the query provides by user; and the allows the interactive exploration for all the data.

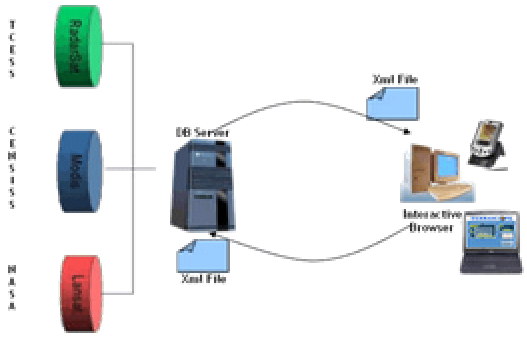


**Figure 1.** *Terrascope* Architecture

### 2.2 Image retrieval process

Terrascope Client is being developed using Flash MX and Action Script. This client has the capacity to send a query to the database server in a XML file, this file contain information such as the query type, sources, the coordinates of the area of interested, the solicited source or sources of data and one or range date to search, these information are called query parameters. This document will be send through URL to the Search and Retrieval Engine, main server.

The different parameters of the query are obtained from the interaction with the user (figure2); the user provides the sources, the dates and the coordinates interacting with ***TC.*** Once the user specifies the parameters, **TC** build a XML file and send that file to the server and wait the response.


**Figure 2.** Sample output from the Terrascope Client

The response is another XML, with the details of all information necessary for the user, just as URL where the images are stored, condition, date, time, coordinates of the image, source and other important data that will be send from the server to be checked by ***TC*** (Figure 3)..

```
<? xml version="1.0"?>
<terrascope>
  <TCESS>
     <id_swath>22787_1</id_swath>

<url>http://icarus.ece.uprm.edu/~ecoronado/images/
22787_1.jpg</url>
       <condition>Ascending</condition>
       <resolution>F1</resolution>
       <date>Mar 16 2000</date>
       <time>23:16:12</time>
       <bound>
          <longitud1>6.614653N</longitud1>
          <latitud1>75.504684W</latitud1>
          <longitud2>6.411222N</longitud2>
       </bound>
 </TCESS>
  <CENSSIS>
  <id_swath>22922_1</id_swath>
  <url>http://icarus.ece.uprm.edu/~ecoronado/images/
                    22922_1.jpg</url>
       <condition>Descending</condition>
       <resolution>F1</resolution>
       <date>Mar 16 2000</date>
</TCESS>
</terrascope>
```

**Figure 3**. Schema for the response in XML

Once the client obtains the response proceeds to analyze and parse the XML file, to obtain the data and metadata. For this task, we use the XML parsing functions provided by Flash MX then the **TC** shows the different swaths (figure 4).

After parsing the XML file, ***TC*** convert all geographical coordinates (latitude and longitude) to flash coordinates (X and Y) and outline every image in the result, creating a geo-representation of every image.

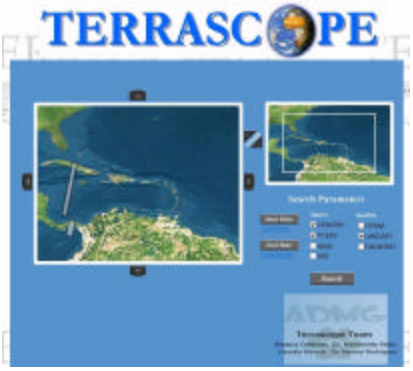


**Figure 4.** Sample output from the Terrascope Client for a query.

Once an image of interest is located, users may easily search the database for images contained within this seed image (sub-images) or for images overlapping this seed image. In other words, each browsed image provided a geospatial context from which future exploration may proceed.

## 3. Preliminary Results and Future Work

At the current state it is possible for the user to apply some queries to *Terrascope Server*, and see the set result.

Future work will concentrate in building a prototype system, similar to a GIS where several types of data are integrated into one form, and implementing more features that allow the users of this browser to interactively and visually manipulate spatial data remotely.

## References


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