

Advances in GIScience Towards Web-Based Arctic GIS

Max J. Egenhofer

National Center for Geographic Information and Analysis

University of Maine

Orono, ME 04469-5711

max@spatial.maine.edu



GIS at UMaine

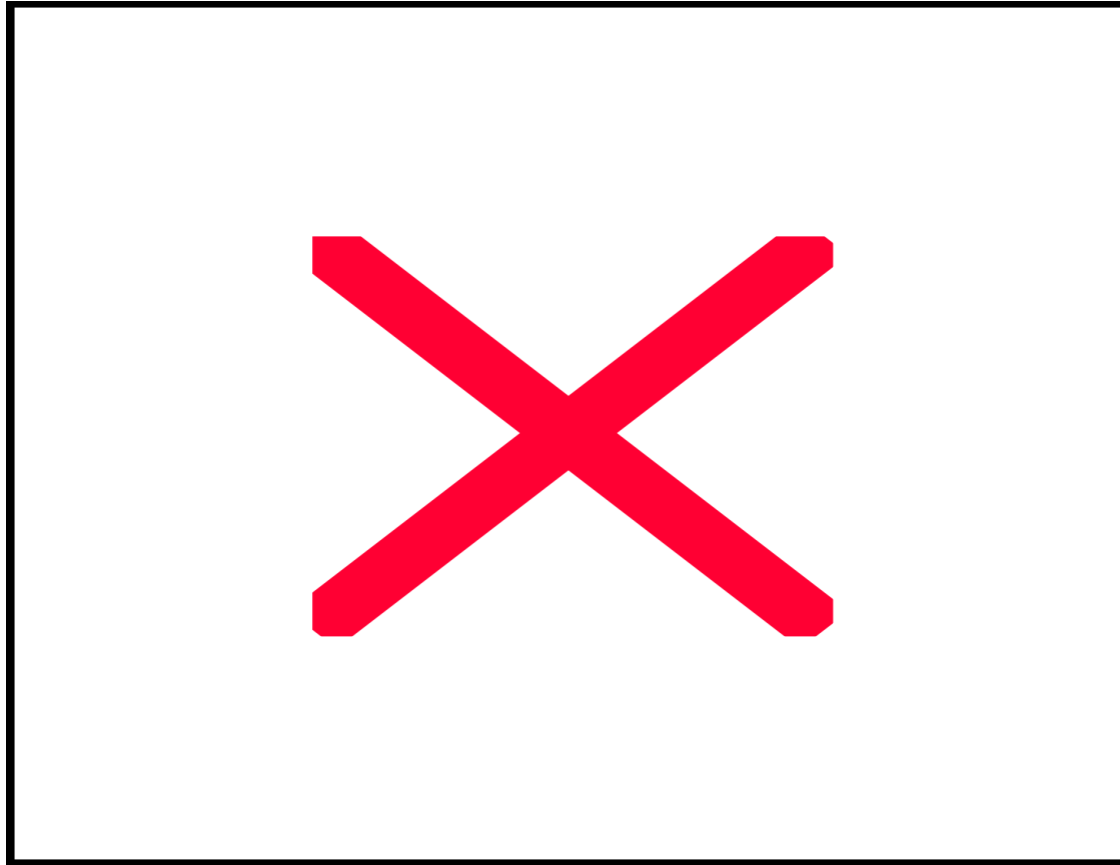
<http://www.spatial.maine.edu>

Advances in GIScience

Towards Web-Based Arctic GIS



GIS

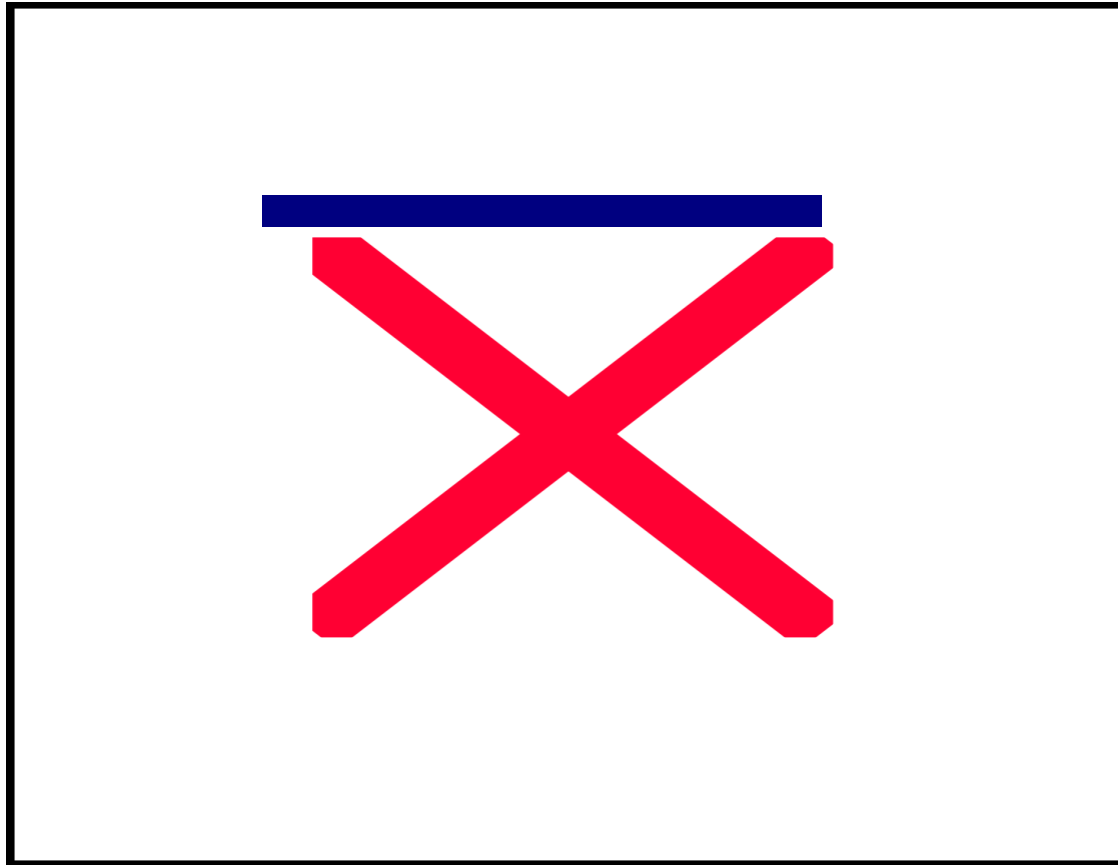


Arctic GIS

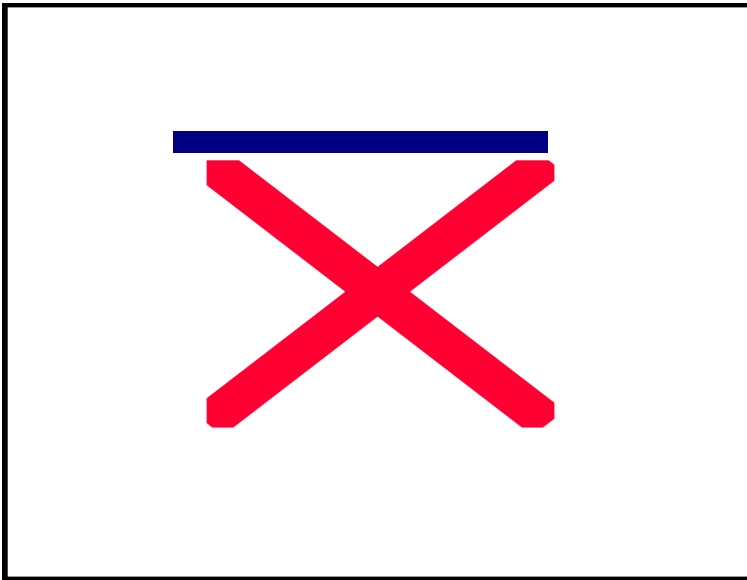
ArcView → ArcTic

?

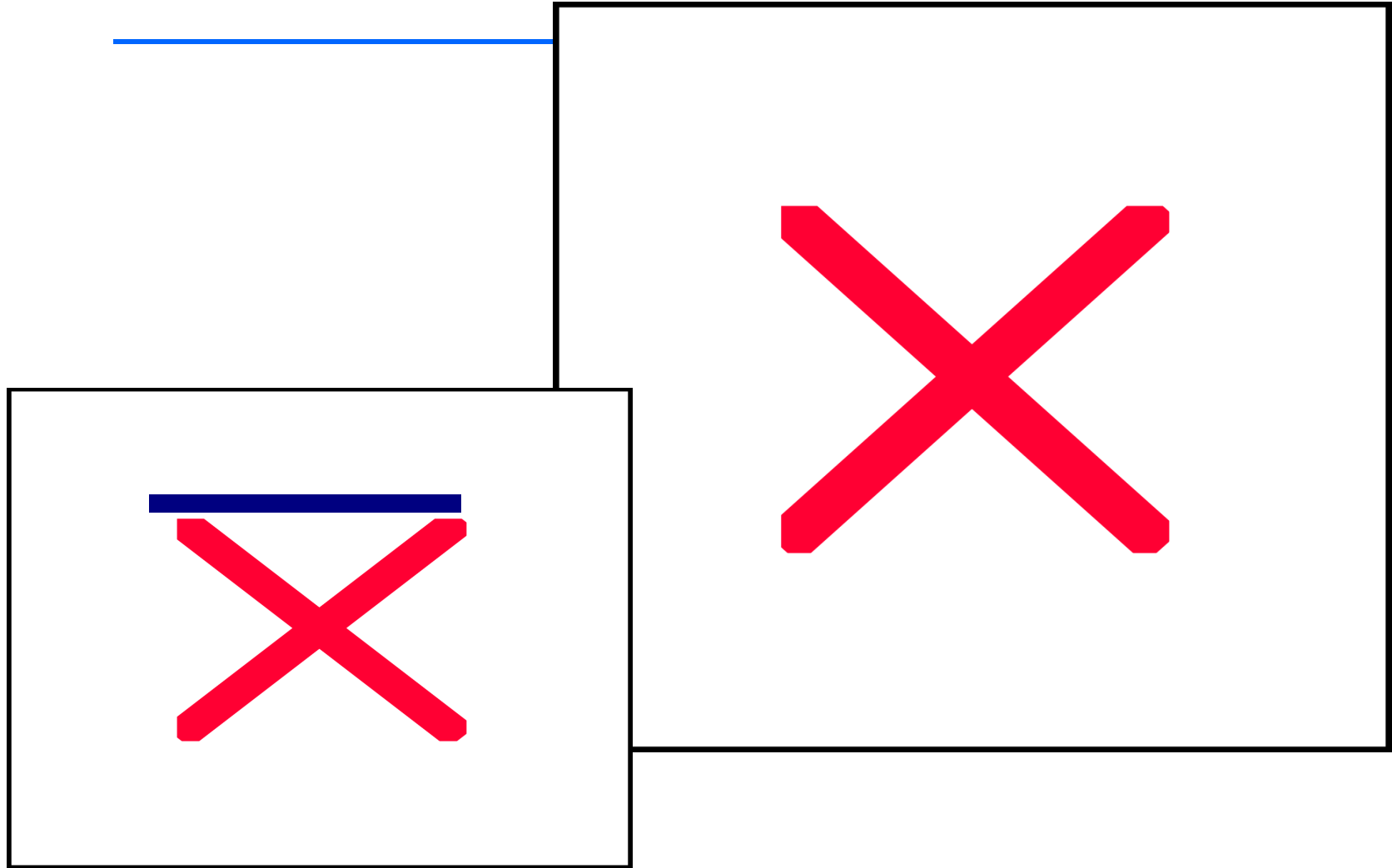
Arctic GIS



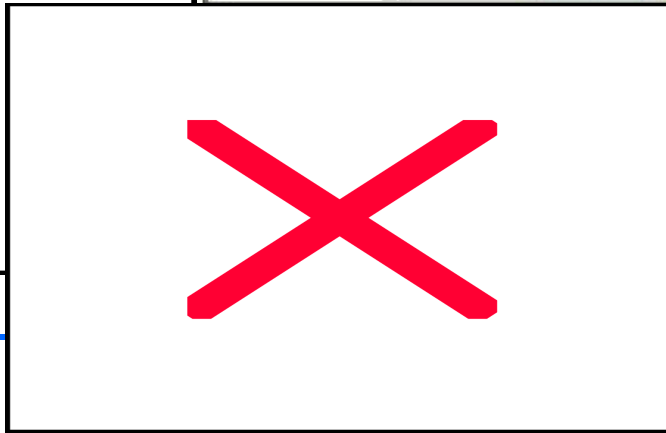
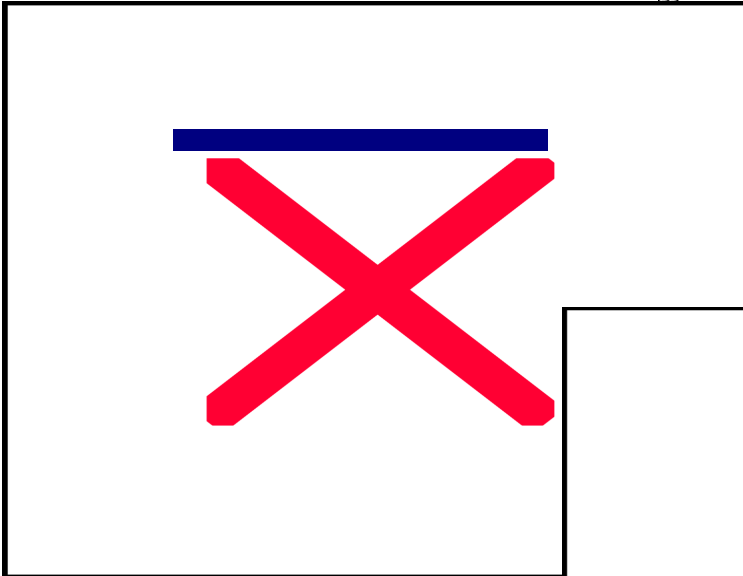
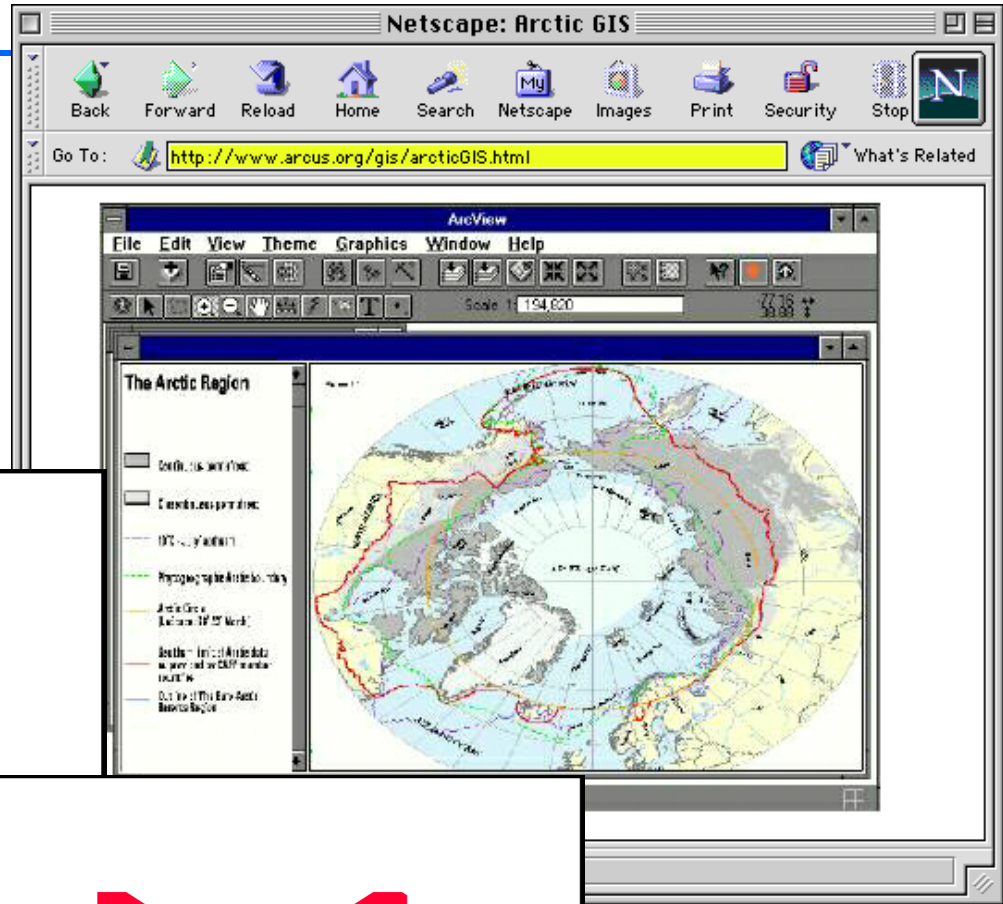
Arctic GIS



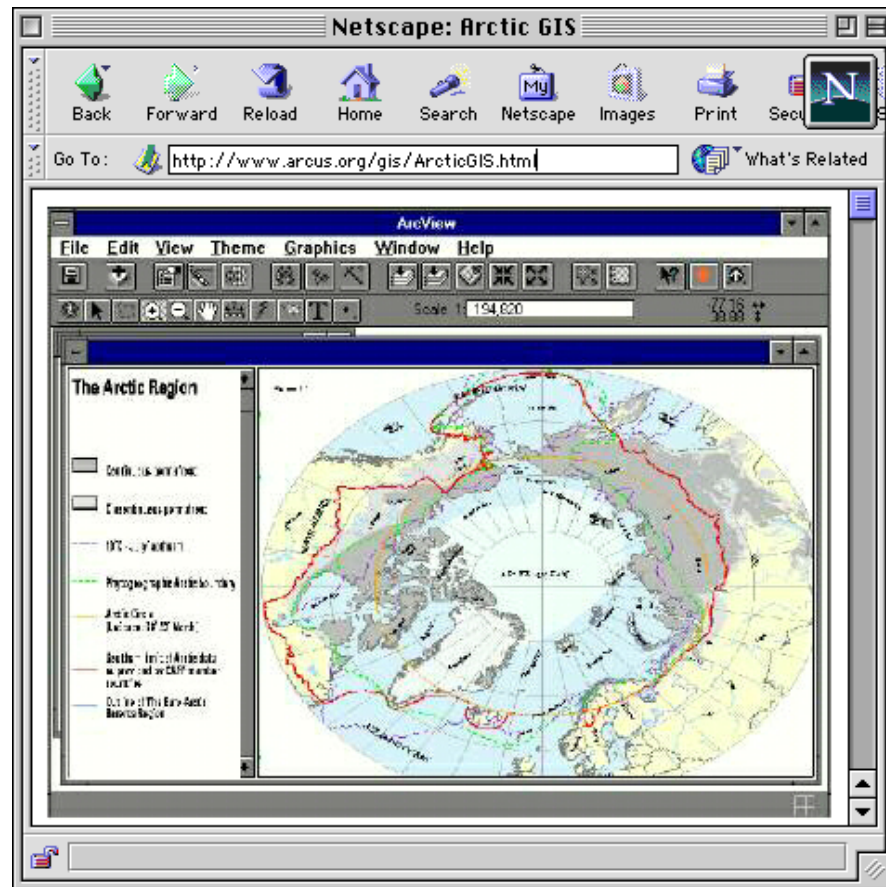
Arctic GIS + Web



Arctic GIS + Web



Web-Based Arctic GIS?



Areas for Discussing Advancement

Commercial software systems

Standard bodies

Academic research

Overview

Arctic GIS vs. other GIS

Web Access to Spatial Data

- Semantic Search
- Architecture
- Improving Performance

The Web: Today and Tomorrow

Arctic GIS

A member of the family of domain-specific GIS

***d*-GIS**

$d \in \{\text{Arctic, Tropical, Urban, Rural, Arid, Marine}\}$

$d\text{-GIS} \notin \{\text{Arc}^*, \text{Geomedia, Idrisi, Mapinfo, Smallworld}\}$

What's Special About Artic GIS?

Ontology!

Few landmarks

Little infrastructure

Uncommon feature classes

Cyclic (climatic) change

Levels of Ontologies

High-level ontologies

- Space (discrete vs. continuous), part-whole relations, time/action

Domain-specific ontologies

- Design of ontology-driven GISs
- Methods and tools for geo-ontologies
- Ontologies for Web GIS

Shift to the Web



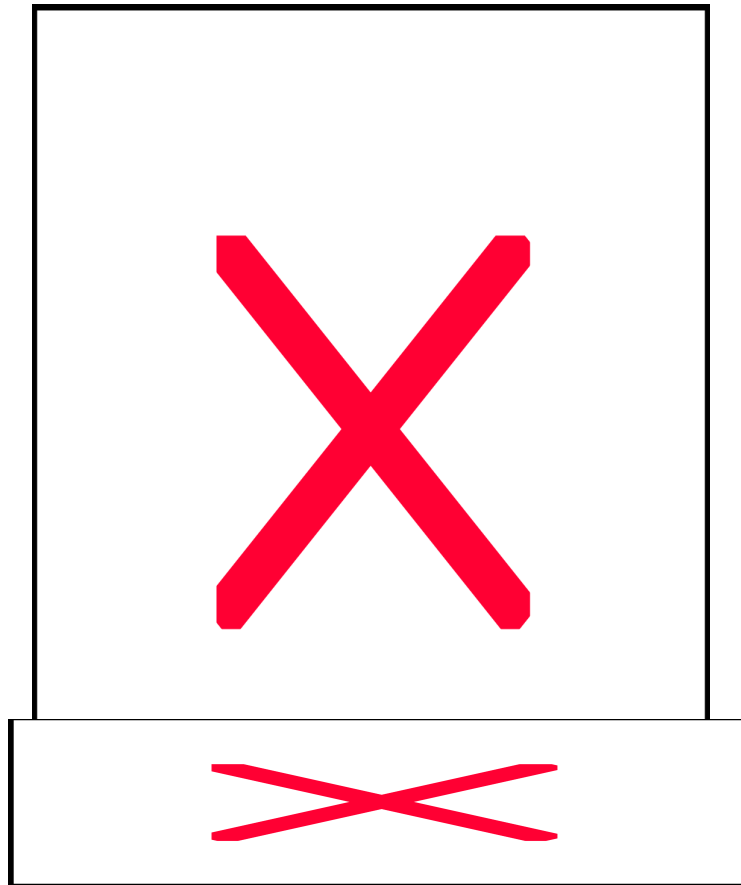
Finding the Right Data

More than keyword search

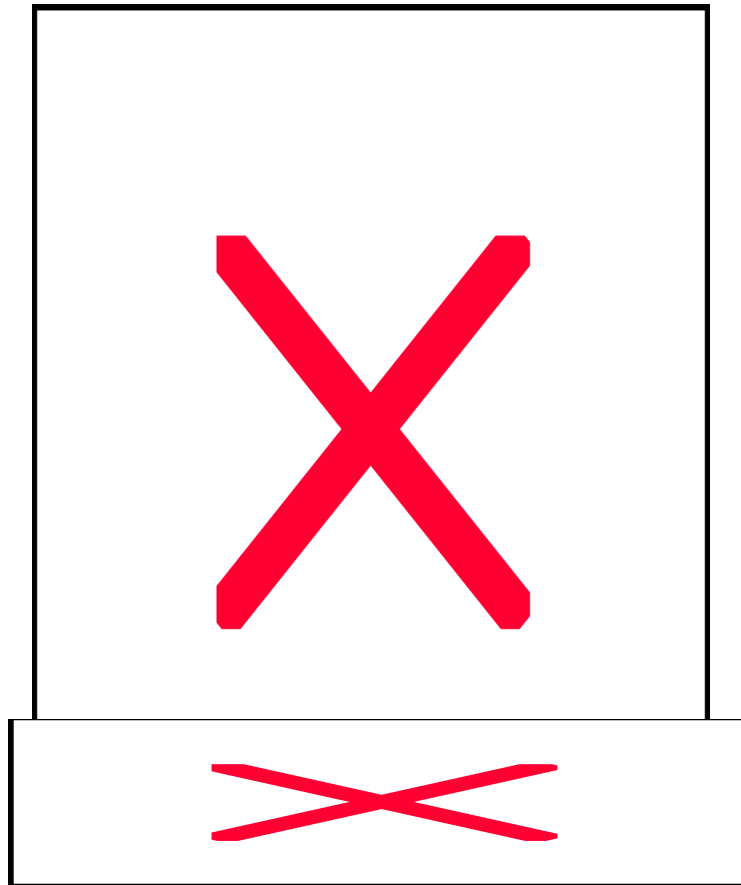
- Semantic rather than syntactic
- Use the structure of the data

Ontology-based information retrieval

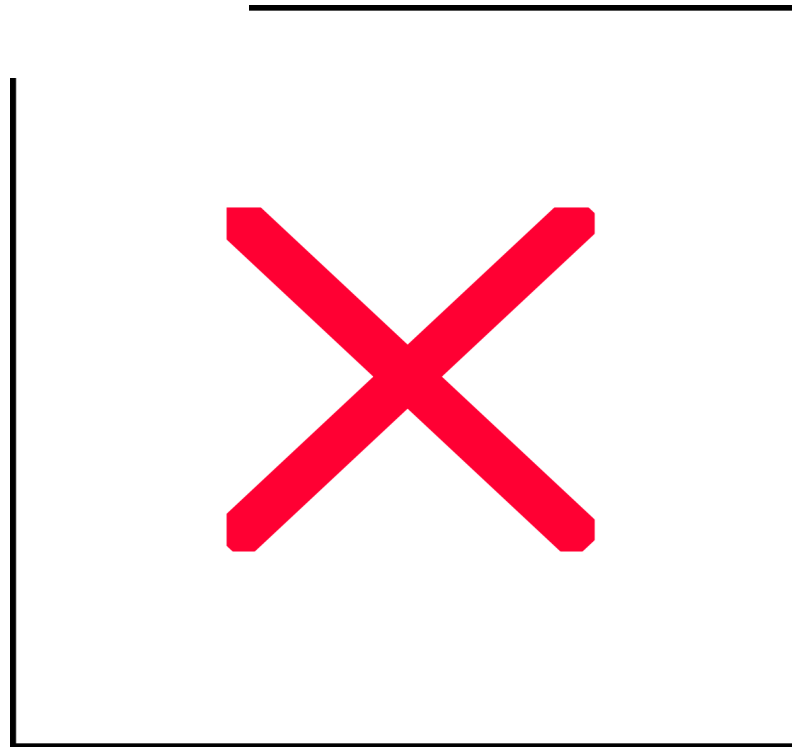
Ontology-Based Information Retrieval



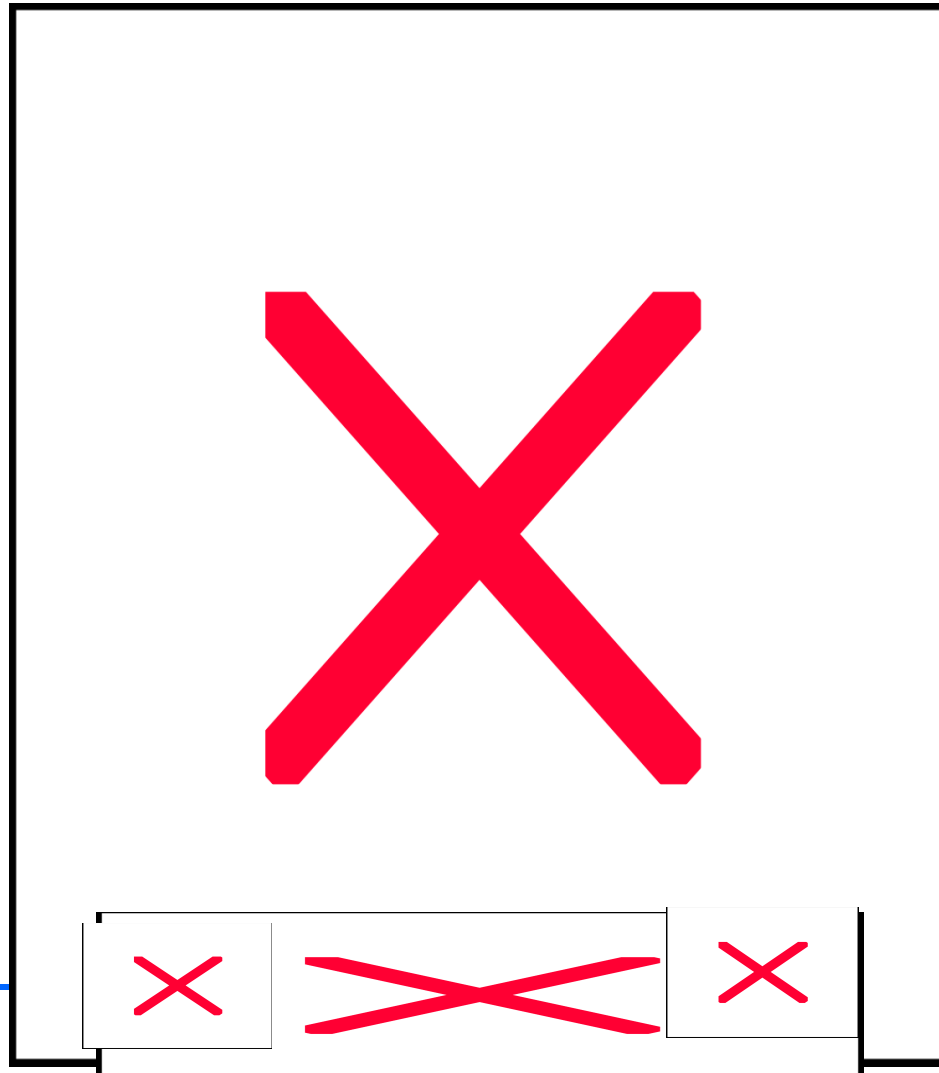
“Find Datasets with Roads”



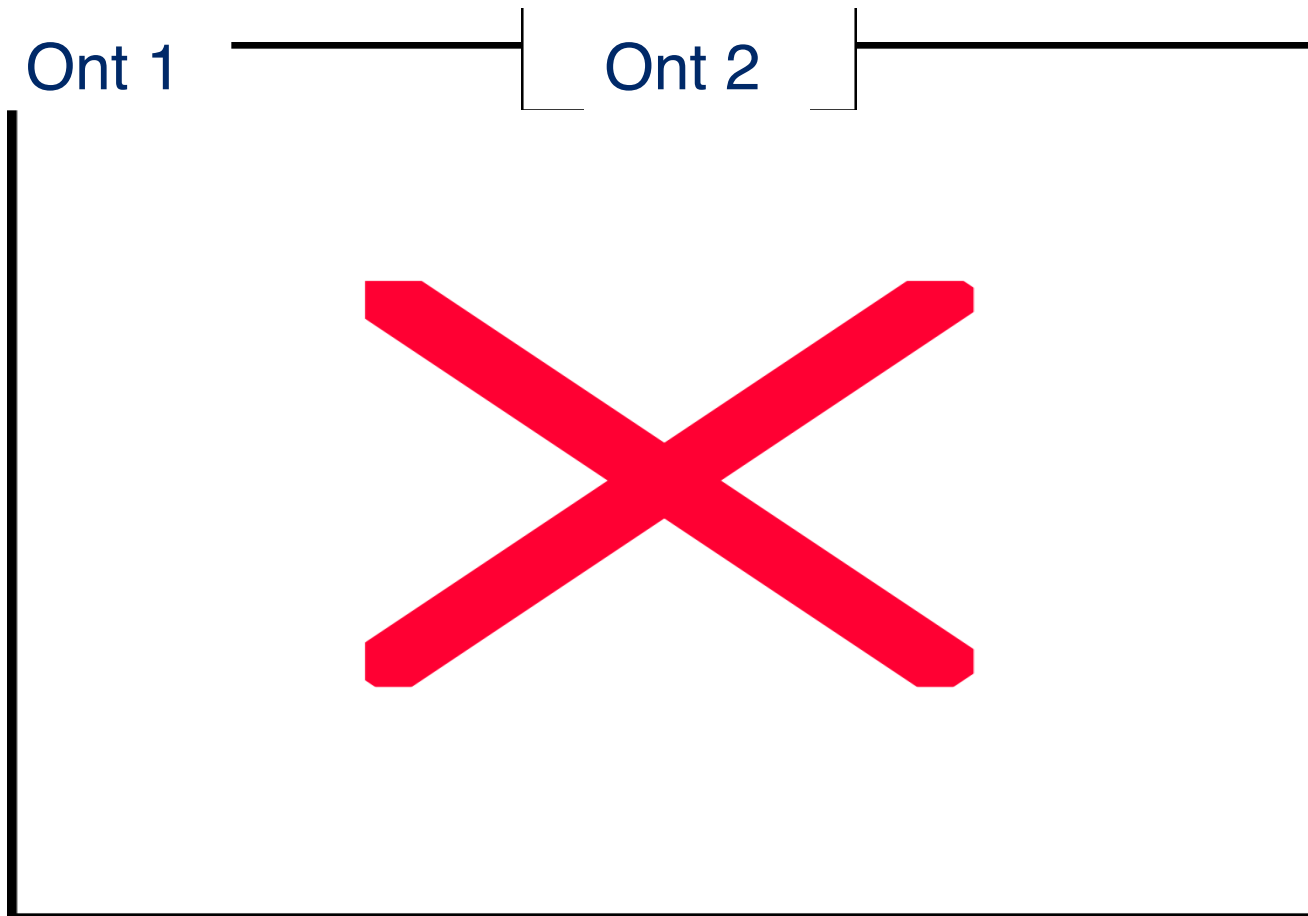
Usual Query Results



Similarity-Based Retrieval



Query Results

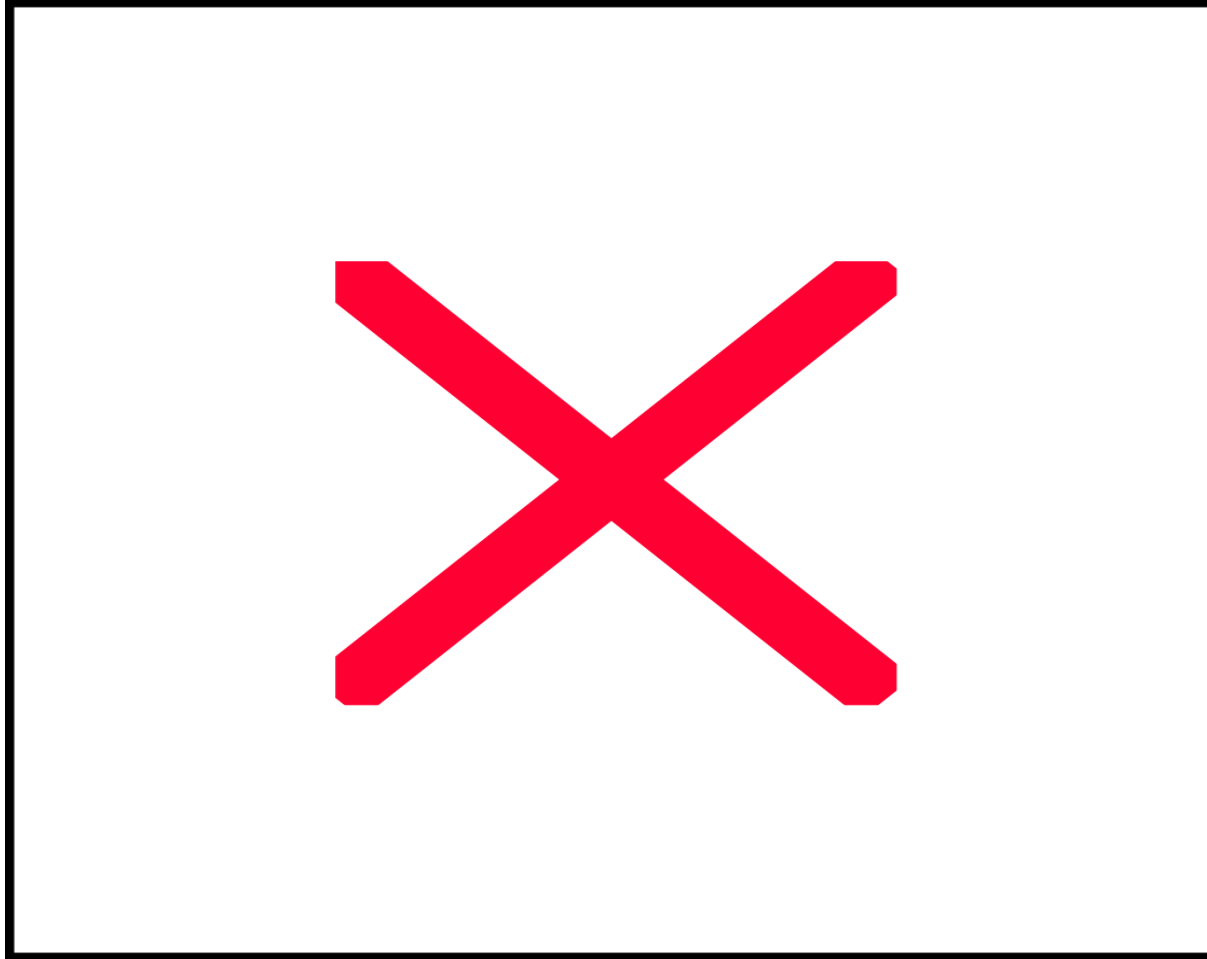


Downloading GIS Datasets

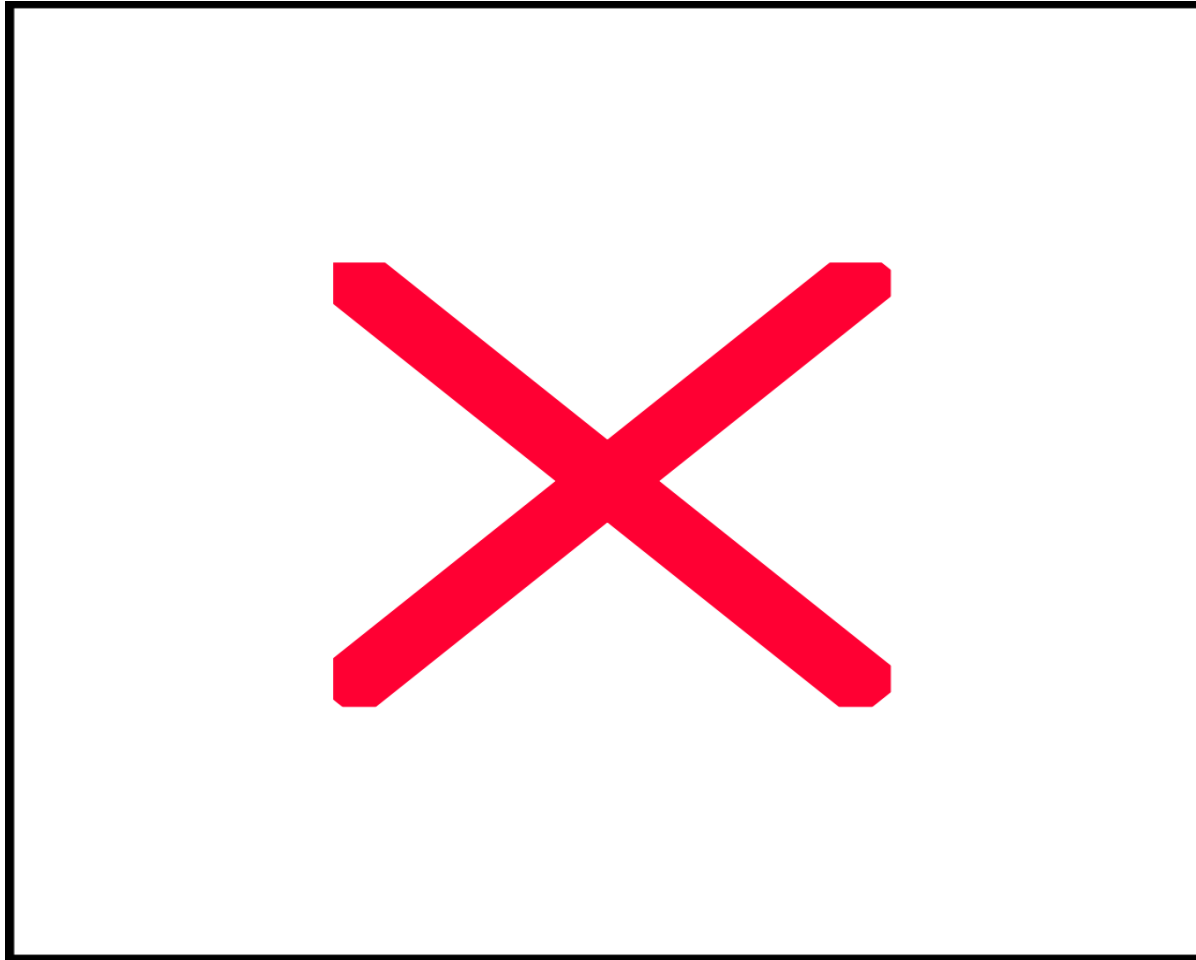
Do all users need the entire, detailed dataset?

- Samples, summaries, footprints

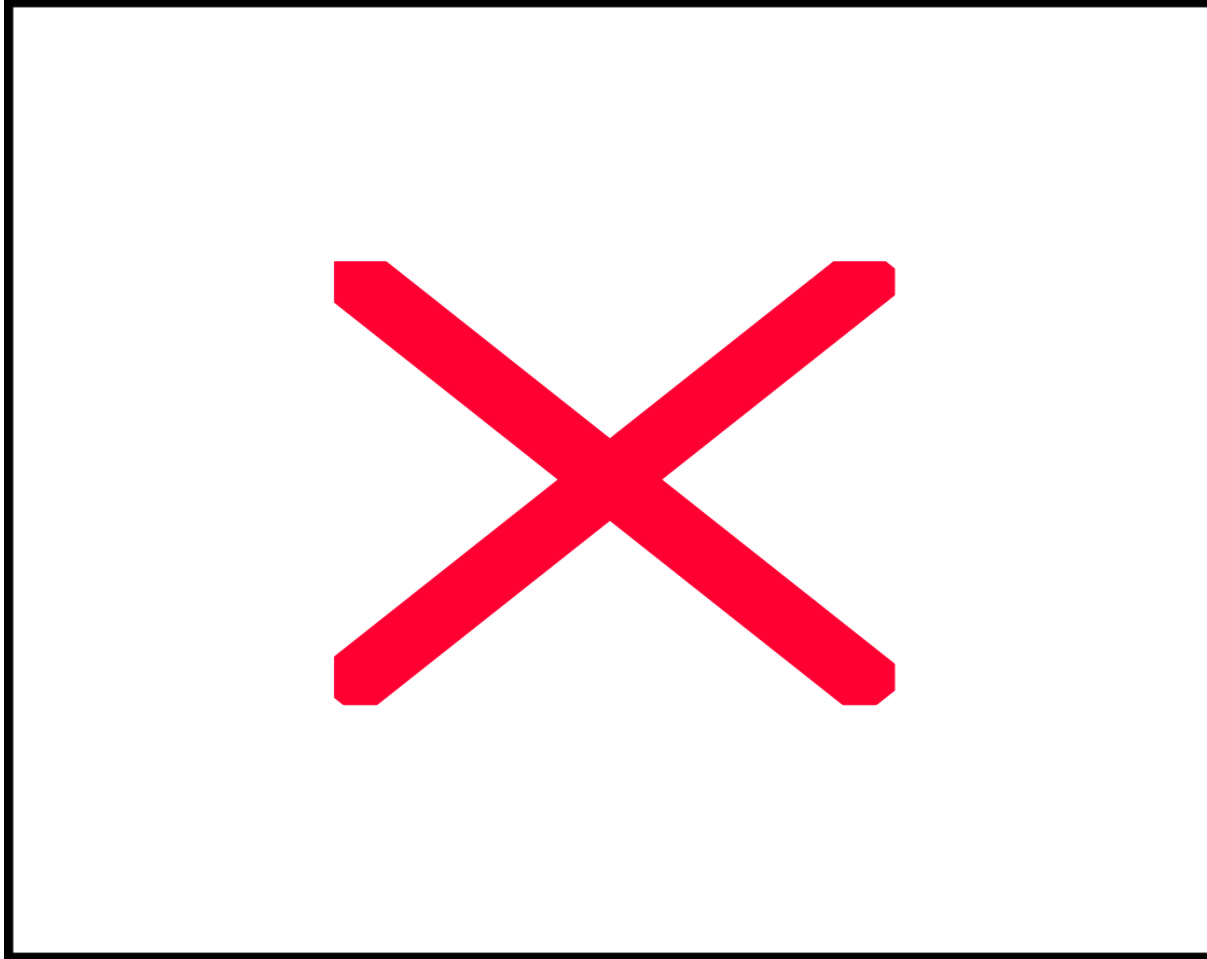
Access to Large GIS Datasets



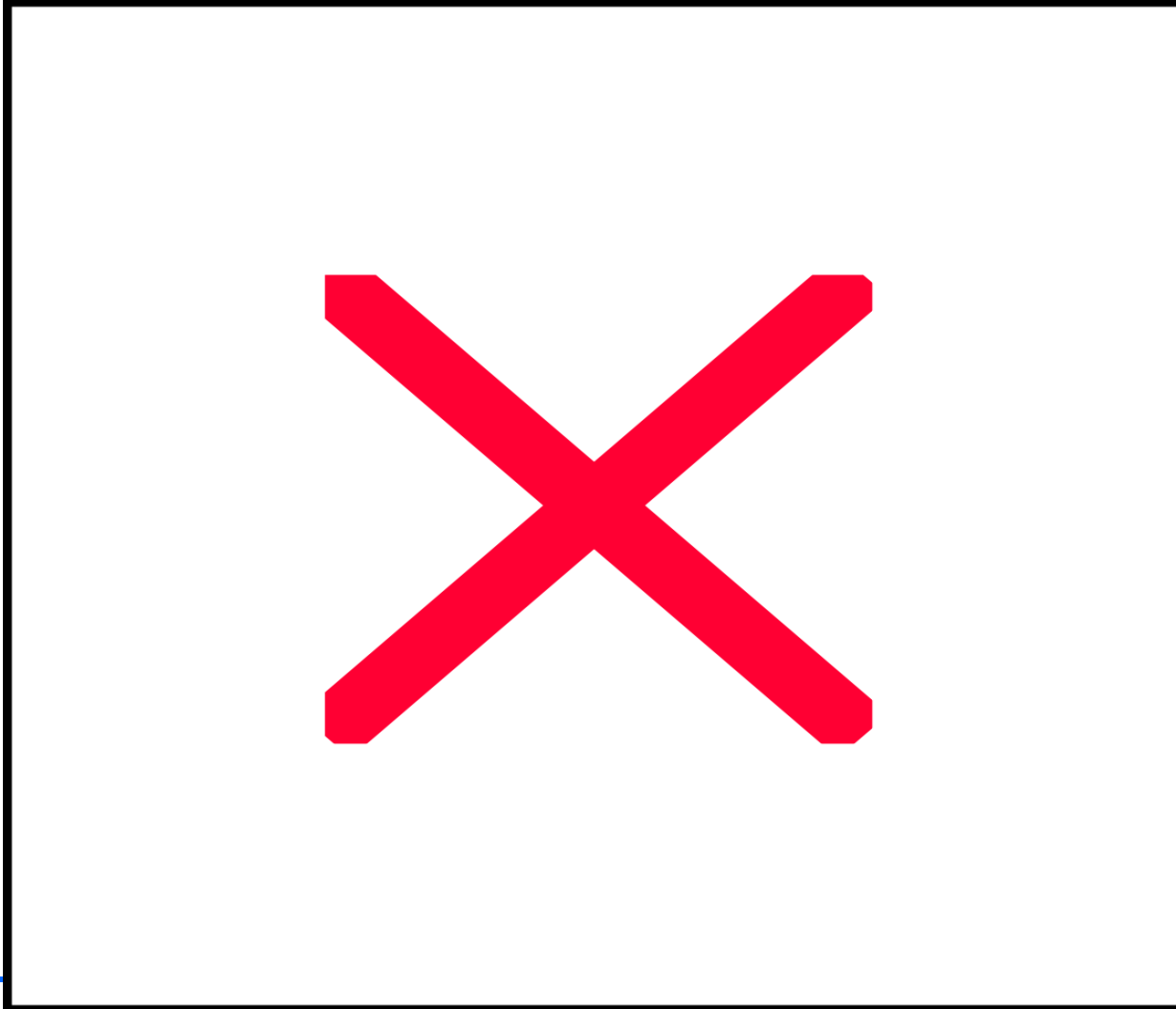
Access with Metadata to Large GIS Datasets



Very Fast Access to Large GIS Datasets



Access through Summaries to Large GIS Datasets



Downloading GIS Datasets

Do all users need the entire, detailed dataset?

- Samples, summaries, footprints

Progressive transmission familiar from raster data

Progressive Raster Transmission



Something Similar for Vector Data

Incremental download

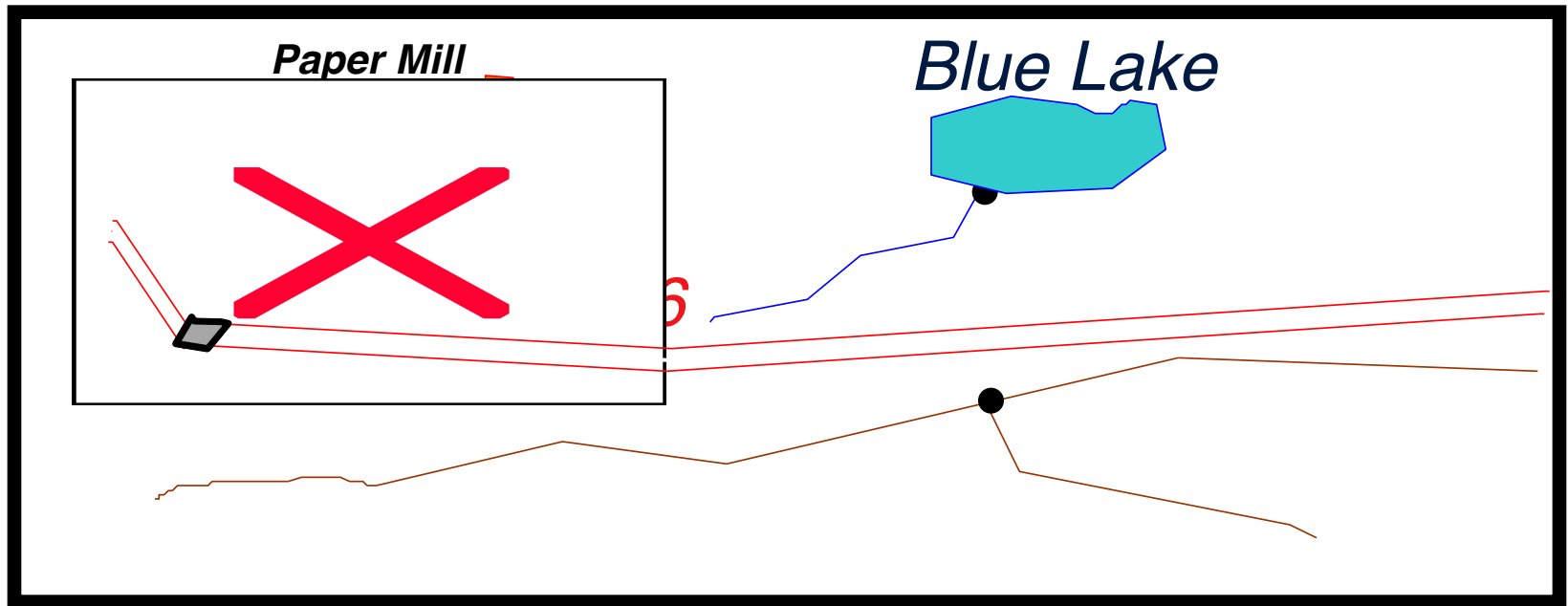
More than visual inspection

Enable analysis on coarse data sets

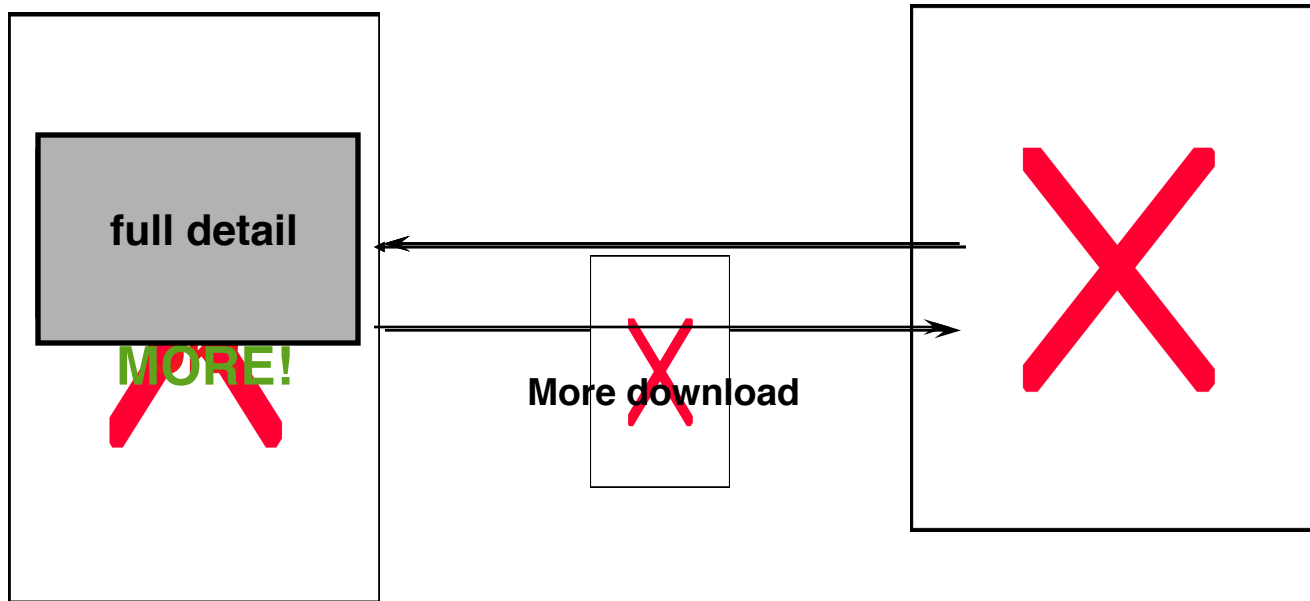
Detail on demand



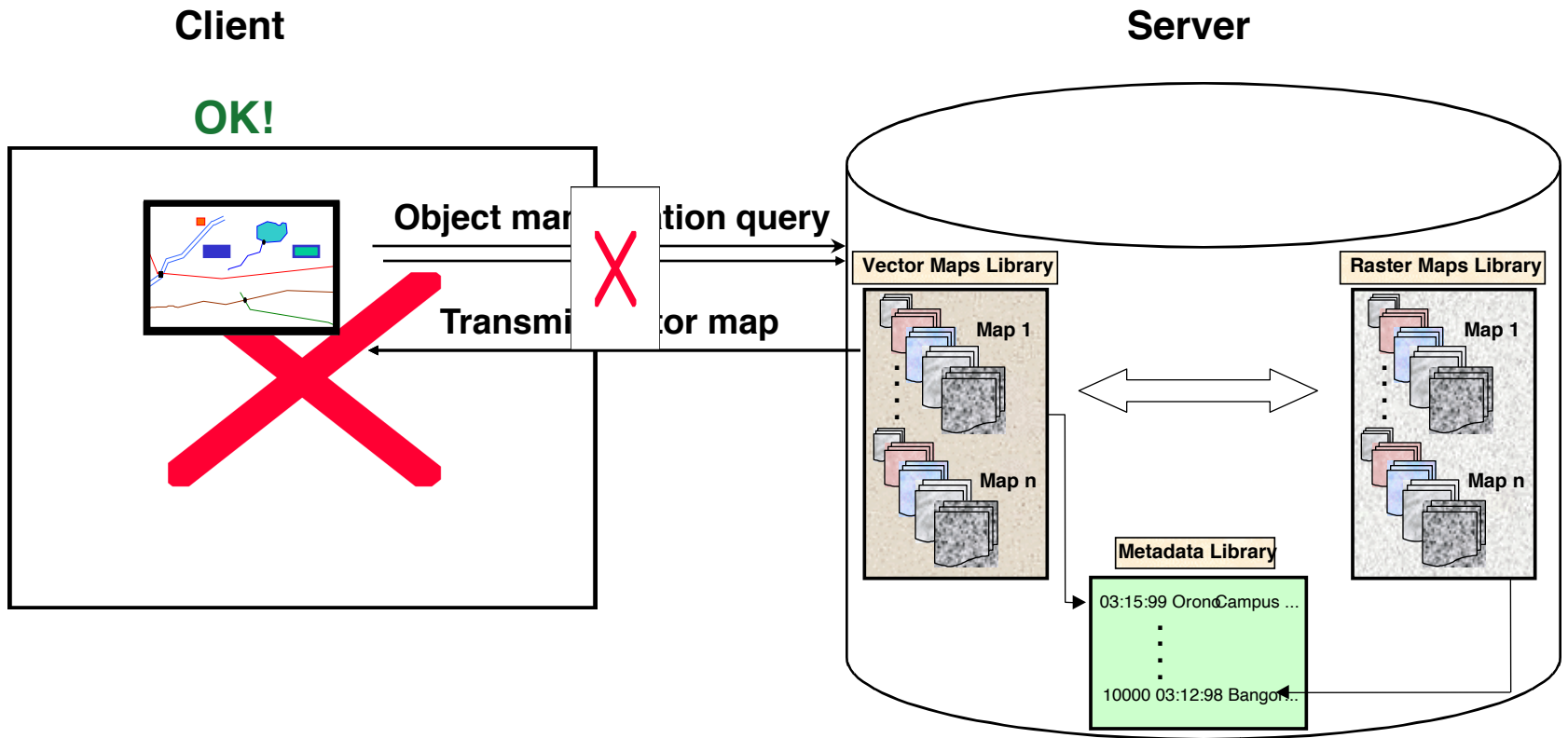
Progressive Vector Transmission



Detail on Demand



Web-Based GIS



Current Web Environment

Access of files

Updating files

Text based

Graphics as visuals

Physical identifiers

Keyword search

Future Web Environment

Access of files

Updating files

Text based

Graphics as visuals

Physical identifiers

Keyword search

Access to databases

Transactions

Multimedia

Geometry for analysis

Logical identifiers

Content-based retrieval

A Vision Beyond Today's GISs

Anytime-anywhere spatial computing

More than pretty looking maps

Task-oriented geospatial services

A foundation for geospatial knowledge discovery

Driven by Technological Changes

Mobile computing

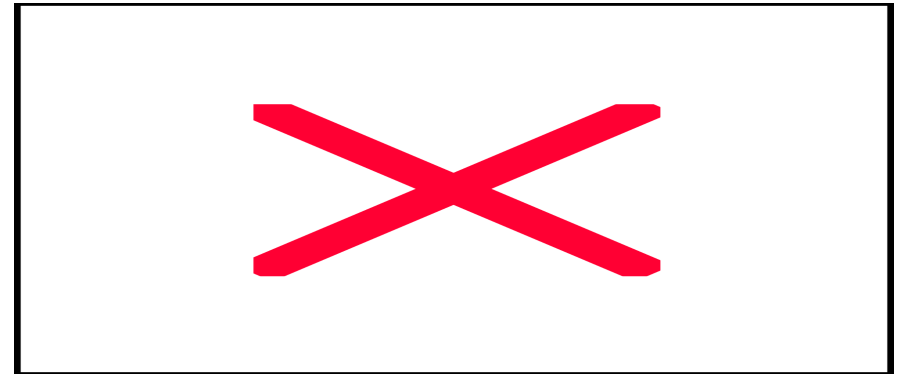
Wireless communication

Real-time updates

Chem-bio sensors

Spatial Information Technologies

**Global Positioning
Systems (GPS)**



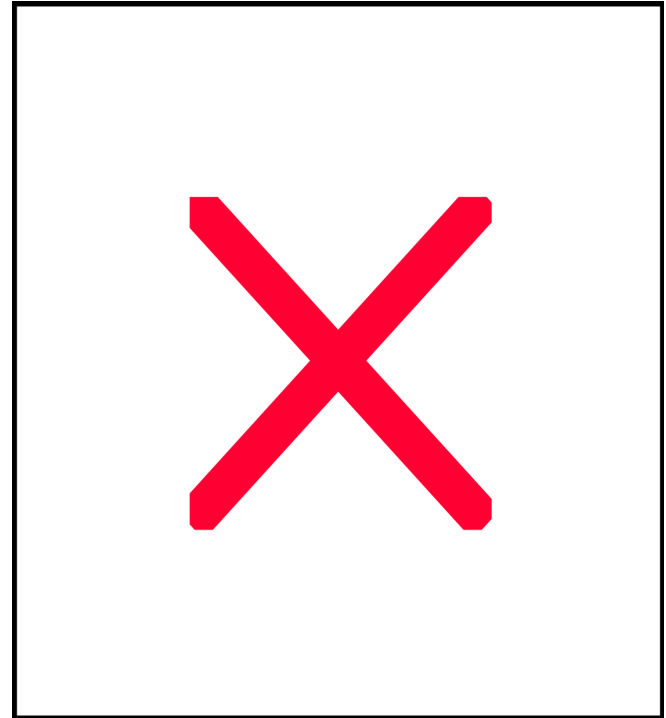
Spatial Information Technologies

Cellular phones



Spatial Information Technologies

**Portable computing
devices**



Spatial Information Technologies

Digital (video) cameras



Spatial Information Technologies

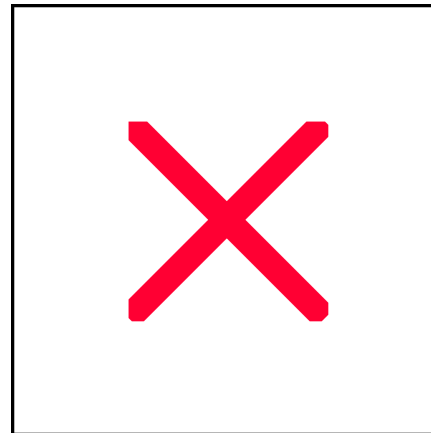
Miniaturization of Location Devices

- GPS receivers
- Gyroscopes



Spatial Information Technologies

Microsensors



Geospatial Confetti

Real-time (environmental) **monitoring**

Each confetti piece with
an array of **microsensors** (chemical, bio)
a **location device**
wireless transmission

Feeds into **temporal field models**



Geospatial Confetti

