OGC Web Services (WFS, WMS, WCS) & GML Visualization

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Outline

- Interoperability Issue
- GML – Introduction
- OGC Web services
  - WFS, WMS, WCS
- GML Visualization
  - GML Schema
  - Stylesheet
  - Display - SVG

State of the (non-) Union

- Tens (100s?) of billions of dollars worth of spatial data already archived at diverse sites
- Too large and expensive to move and convert
- Prohibitively inconvenient to store and manage centrally
- Operationally constraining and administratively challenging to mandate a single-technology supplier

The Solution: Interoperate

- Data remain in place
- No constraints on maintenance operations or policy
- Existing in-house tools and applications remain viable
- Only the interfaces need be well-defined among interoperating clients and servers

Interoperability

- GIS is often developed with diverse departments relying on a mix of software and information systems.
- Each department uses its individual system to increase efficiency, but sharing data and applications across the enterprise is a near impossible.

Interoperability: Requirement

- To provide interoperability among heterogeneous repositories we need
  - Converting the data in a common standard format
  - Defining a standard access mechanism and interface for accessing the data
  - Flexibility of adding a data source as needed

Open Geospatial Consortium (OGC)

- The Open Geospatial Consortium (OGC) grew out of the need among federal agencies to share data.
- Currently a collaboration of more than 230 vendors, integrators, government and private agencies, universities, and end users.
- Abstract Specification:
  - Defines basis of discourse for standards under development
  - 17 volumes.
  - A living document
- 7(+) publicly available Implementation Specs published. Many more in various stages of creation or refinement.
- Close relationship with ISO (esp. TC 211)
- Uses other standards where possible

GML: What is it ?

- OGC Endorsed “Adopted Specification” for encoding spatial information.
- A set of XML technologies for handling spatial data on the Internet.
- Emerging international standard for spatial data—endorsed by 200+ companies and agencies around the world.

Why GML ?

- A “lingua franca” for geographic information.
- GML data can be read and understood by people.
- GML can enable distributed spatial datasets that are linked together – local maintenance & development /global access
- GML data can easily be mixed with non-spatial data including text, video, and imagery.
- GML is “web-friendly” – easy to manipulate/display using current and emerging web technologies.
- GML is non-proprietary and open!
- GML enables non-proprietary web feature servers, image/map annotation, map styling and spatial analysis.

GML Overview

A standard encoding of spatial information(**content**) for encoding geographic information.

GML allows us to leverage the world of XML

- Graphical Drawing (2D and 3D)
- Querying and Element Selection
- Meta-data & Relationships (Semantics)
- Transformations (spatial and non-spatial)

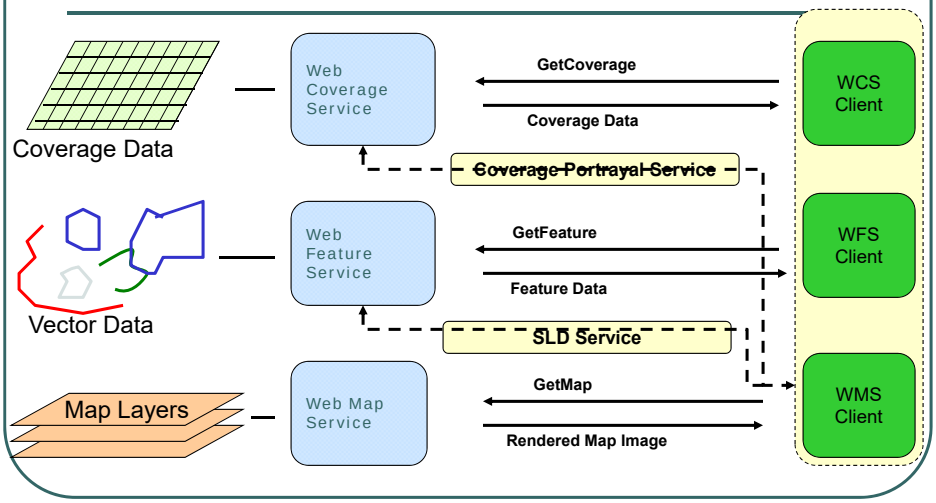
GML will enable the ubiquitous use of spatial data

GML Applications

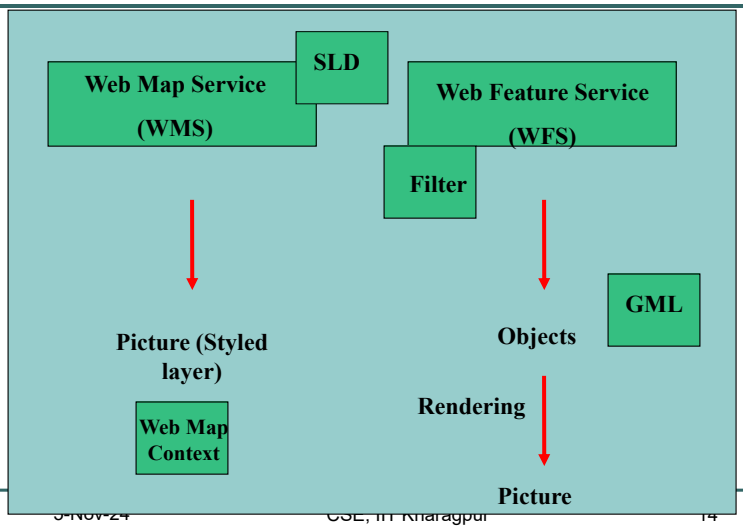
- Internet Mapping (e.g. MapQuest)
- Internet Based Situation Management
  - Disaster Management
  - Accident & Police Investigation
  - Emergency Services
- Public/Private systems for Land Titles/Leases/Permits.
- Location based services for wire & wireless users.
- Internet GIS and GIS Portals
- Private, Municipal and other Government Services ASP's

GML - Builds on W3C Standards

OGC Data Retrieval Operations



Specifications Context



Web Services

- A Web service is a software system designed to support interoperable machine-to-machine interaction over a network.
- Independent of
  - operating systems
  - programming languages
  - Organizations
- How?
  - Non-proprietary data / messaging standards
    - eXtensible Markup Language (XML)

Web Services- Benefits

- Lower software integration costs
- Maintaining legacy systems
- Using standards lowers IT costs of collaboration with external partners, vendors, clients

Web Feature Service (WFS)

Open Geospatial Consortium: Web Feature Service

- private ⇔ public boundary

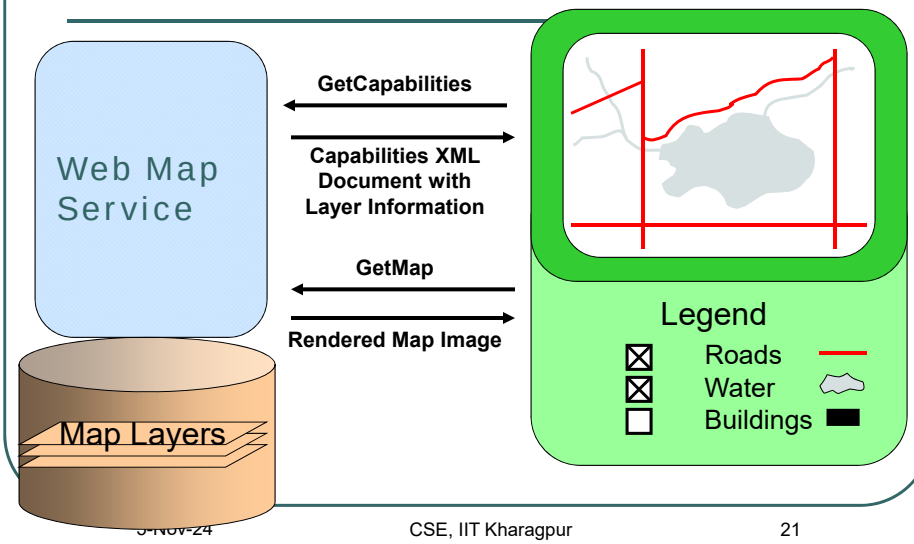
- Data-source organised for custodian's requirements
- Community-specific **GML application** language
  - TigerGML, LandGML, O&M, XMML, CGI-GML, ADX, GPML, CSML, MarineXML etc

OGC Web Feature Server *Interfaces*

- OGC WFS Interfaces
  - GetCapabilites
  - DescribeFeatureType
  - GetFeature
  - Transaction
  - LockFeature/GetFeatureWithLock
- Response to GetFeature request is formatted using GML

Web Map Service (WMS)

WMS Interface: Operation



OGC Web Map Service Interfaces

- GetCapabilites
- GetMap
- GetFeatureInfo

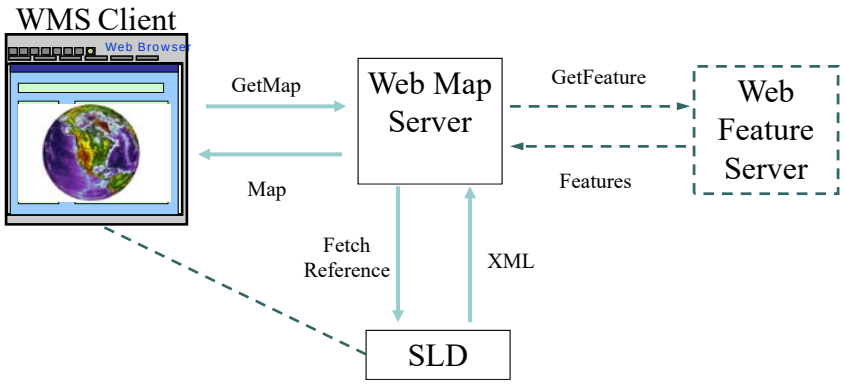
GetCapabilities Interface

- Provides information about what a server can do, what data layers it can serve, formats available, etc.
- *http://www.server.org/wmt/mapserver.asp?WMTVER=1.1.1&REQUEST=capabilities*
- Response is encoded in XML

GetFeatureInfo Interface

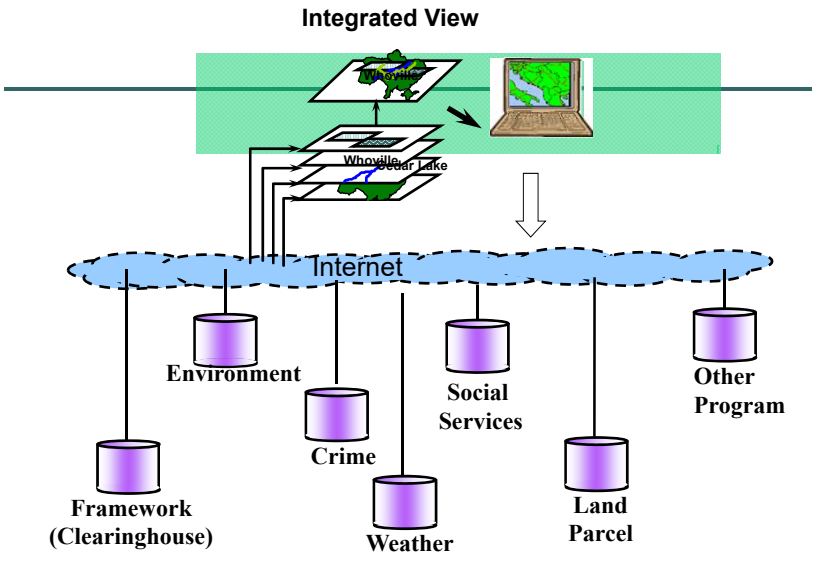
- Optional interface
- Asks for information about features display in the map
- Response is free form html

OGC WMS



Interoperability

- A client can access data from multiple data repositories independent of platform or vendor!
- Even in the simple “picture case” there are hard issues:
  - Coordinate Systems
  - Bounding box and aspect ratio of a request
  - Transparency



GML Scope

Spatial Data Interchange

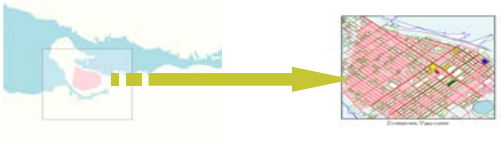
Building/querying complex distributed spatial datasets

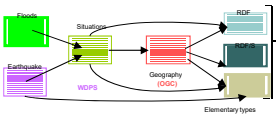
Facilitating open standards for Map Styling & Symbology

Foundation for a comprehensive distributed spatial infrastructure based on XML and related Web technologies.

GML Scope

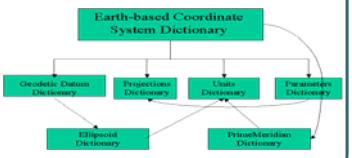
Facilitating open standards for spatial querying and analysis





Laying the foundations for a spatial semantic-web

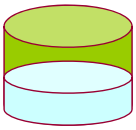
Providing a framework for open spatial reference system dictionaries & coordinate transformation services



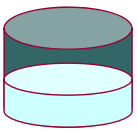
Common Geometry Model

By adopting GML

We get a Common Geometry Model

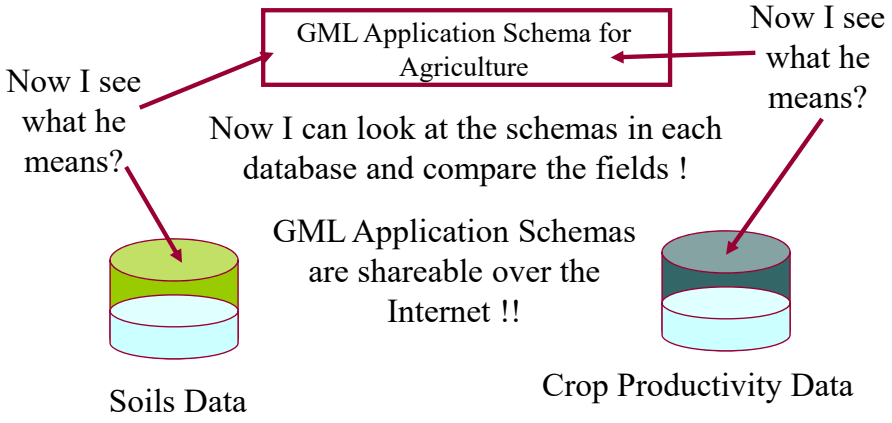


Soils Data

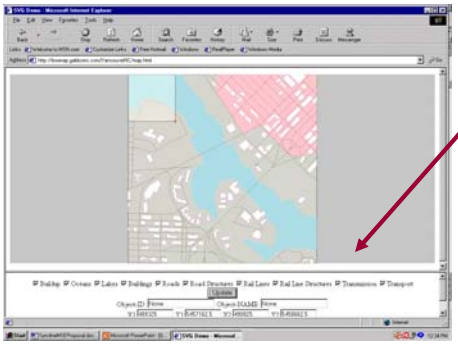


Crop Productivity Data

GML provides a Common Schema language



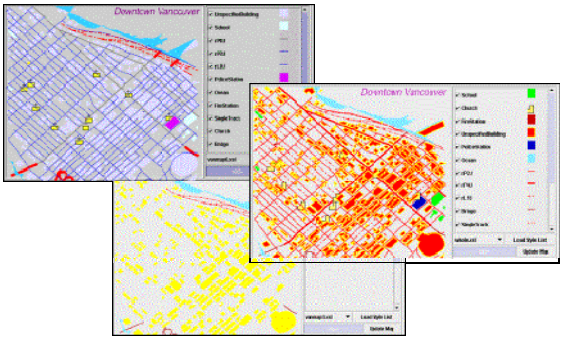
GML Focuses on Content



Maps display in a standard browser web page!

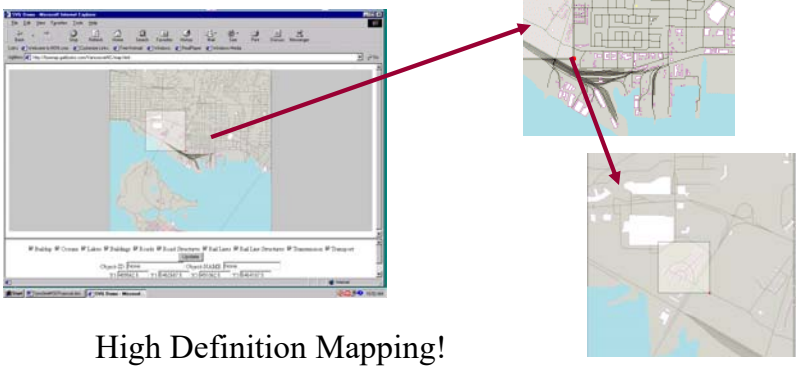
GML Separates Content & Presentation !

GML Mapping Examples



Same spatial data – many different styles !

GML Mapping Examples



High Definition Mapping!

Data Sharing Summary

- GML Provides common shareable geometry structures.
- GML Provides a common schema language. GML Application Schemas can be shared on the Internet.
- GML Application Schemas facilitate schema mapping (shared semantics) – we need a GML Application Schema for Agriculture !
- GML Facilitates Coordinate Transformation – XML data is easily transformed. GML Provides schemas for Coordinate Reference System Dictionaries and supporting elements including Prime Meridians, Datums and Ellipsoids.

XML, GML, and UML

- XML – Extensible Markup Language, a way to structure information for exchange
- GML – Geography Markup Language (vector data expressed in XML)
- UML – Unified Modeling Language, a design and diagramming environment to model your information

GML Advantages

- GML is **easily transformed** – coordinate conversion, schema conversion, presentation conversion
- GML is **non-proprietary** and open! Any client can talk to any server!
- GML enables **non-proprietary** web feature servers, image/map annotation, map styling and spatial analysis.

Display GML data

- Use Scalable Vector Graphic (SVG).
- A W3C standard format.
- Works directly with the Web browser.
- Requires a SVG plug-in (free from Adobe or other vendors).

Finally .....

GML Geography Markup Language: open standard developed by Open Geospatial Consortium, provides framework (geometry and feature schema)

XSLT eXtensible Stylesheet Language for Transformation: tool for converting XML documents and thus - tool for converting GML documents

SVG Scalable Vector Graphics: language for describing two dimensional vector graphics

Thank you .....