Geography Markup Language (GML)
interactive instruments GmbH

- Founded 1985
- Providing use-case-driven solutions for information systems involving spatial information
- **Focus:** Open systems; designing, developing and integrating standards-based components
- **Services:** Consulting & Training, Integration & Implementation, Quality Assurance, Project Management
- Active in ISO/TC 211, Open GIS Consortium, CEN/TC 287, and other bodies
  - e.g.: co-author of GML 3.0 and Project Leader of ISO 19136
What is GML? – Scope

- The Geography Markup Language is
  - a modeling language for geographic information
  - an encoding for geographic information
  - designed for the web and web-based services
What is GML? – Status

- GML is an OpenGIS® Implementation Specification
  - The current version is 3.0, released January 2003
  - Previous major release was version 2.0, April 2001
- GML is also a work item of ISO/TC 211 and is on its way to be eventually published as ISO 19136
- The work is carried out by a Joint Working Team of OGC and ISO/TC 211
GML enables a vendor-neutral exchange of spatial data
What is GML? – Characteristics

GML
- is based on XML technologies (W3C)
  - XML, XML Namespaces, XML Schema, Xlinks
- implements concepts of the ISO 19100 series
- supports spatial and non-spatial properties of objects
- is open and vendor-neutral
- is extensible
- supports the definition of profiles (proper subsets) of the full GML capabilities
What is GML? – Characteristics

GML

- supports the description of geospatial *application schemas* for *information communities*
- enables the creation and maintenance of *linked* geographic application schemas and datasets
- supports the *transport and storage* of application schemas and data sets
- increases the ability of organizations to *share* geographic application schemas and the information they describe
- leaves it to implementers to decide whether application schemas and datasets are stored in native GML or whether GML is used only for schema and data transport
GML Schemas, Application Schemas and Documents

Use a schema language to model geographic information in a **GML Application Schema** and define rules for such schemas.

Define standard elements and types for use in application schemas → **GML schemas**

Capture real-world objects as data conforming to a GML Application Schema → **GML Documents**
GML Schemas

- GML Schemas are horizontal and not focused on a specific application domain
- But they can provide common constructs and concepts which may be used by all the different application domains
GML Schemas

- Base schemas, general syntax, feature model, metadata mechanisms
- Basic geometry (0d, 1d, 2d)
- Additional geometric primitives (0d, 1d, 2d, 3d)
- Geometric composites
- Geometric aggregates
- Coordinate reference systems
- Topology
- Temporal information and dynamic features
- Definitions and dictionaries
- Units, measures and values
- Directions
- Observations
- Coverages
- Default styling
GML Application Schemas

- Cadastre, Land Use
- Traffic And Transport
- Telecom
- Environment
- ...
Modelling Feature Types

Building an information community \(\rightarrow\) reaching consensus about the vocabulary (feature types and their properties)
Modelling Feature Types

```xml
<Road gml:id="o.1f75dc">
  <name>I95</name>
  <class>Interstate</class>
  <centerLine>
    <gml:Curve>...</gml:Curve>
  </centerLine>
  <maintainer>DOT xyz</maintainer>
</Road>
```
Modelling Feature Types

- Road
  - name: I95
  - class: Interstate
  - centerLine: gml:Curve
  - maintainer: auth:Authority
    - name: xyz
    - type: DOT
    - ...

GML

Modelling Feature Types

```xml
<Road gml:id="o.1f75dc">
  <name>I95</name>
  <class>Interstate</class>
  <centerLine>
    <gml:Curve>...</gml:Curve>
  </centerLine>
  <maintainer>
    <auth:Authority gml:id="o.1f32a3">
      <name>xyz</name>
      <type>DOT</type>
    </auth:Authority>
  </maintainer>
</Road>
```
Modelling Feature Types

```xml
<Road gml:id="o.1f75dc">
    <name>I95</name>
    <class>Interstate</class>
    <centerLine>
        <gml:Curve>...</gml:Curve>
    </centerLine>
    <maintainer xlink:href="urn:x-auth:o.1f32a3"/>
</Road>
```

- The object is either a child element of the property or referenced by an xlink:href attribute in the property element.
- The xlink:href attribute is interpreted in the way that the value of the property is the object referenced in the link.
- The object can be part of the same GML document or anywhere in the internet/intranet.
Linking GML Application Schemas

GML

Environment

Cadastre, Land Use

Road Infrastructure

Traffic Management

Traffic Information

GML

geometry, topology, temporal, etc.

XML Schema / Xlink

basic data types
Enabling the geospatial web

- Information Communities publish their Application Schemas (preferably in some sort of registry) so that it can be found, accessed and understood by others.
- This enables that also the features can have properties whose values are maintained by other authorities. → a web of geospatial features is created.
Learn from the HTML Web ...
... and use GML as the lingua franca of the geospatial web
Support for Application Schema designers

- Rules for Application Schemas
  - Guidelines for the usage of XML Schema
  - GML documents can be interpreted more easily by software ("GML parsers")
- Tools to map from UML or other modelling languages to GML (Open Source tools are available)
- Using a GML Profile in an Application Schema
  - A declaration of the subset of GML used by an application
  - GML itself includes a simple tool that allows to create such a GML profile automatically
Support for software developers

- XML Parsers, XSLT processors, etc. are available (including Open Source ones); as XML is popular in general many developers know how to work with and process XML documents.
- GML Parsers (i.e. GML-aware XML parsers understanding the GML model and syntax) are emerging.
- Most major GIS products have in their latest releases built-in support for GML; in addition a significant number of new products providing OGC Web Service interfaces and serving GML documents are available.
Mapping GML Data

GML is focused on content!

Web Map Server (SLD)
- Spatial DB
- GML DB
- Web Feature Server

Application / XSLT
- Web Feature Server
- GML

PNG, GIF, JPEG
SVG

GML
SVG and Web Mapping Examples

Solid Model in VRML

GML Data

SVG Views

y-plane

x-plane

z-plane

Slide from Galdos Inc.
Summary

- GML 3.0 is an adopted OpenGIS® Specification
- Most recent OpenGIS® Implementation Specifications are linked to GML
- A number of GML enabled products have been released
- Now a joint work item with ISO/TC 211 (ISO 19136)
- Provides a rich set of predefined types for Application Schemas
- Has an underlying model that makes processing GML documents easier
- Separates presentation and content
- Works well in a Web Service environment
- A building block of the Geospatial Web
Thank you for your attention!

Clemens Portele
interactive instruments GmbH

Trierer Straße 70-72
53115 Bonn
Germany

+49 228 91410 73
portele@interactive-instruments.de
http://www.interactive-instruments.de/