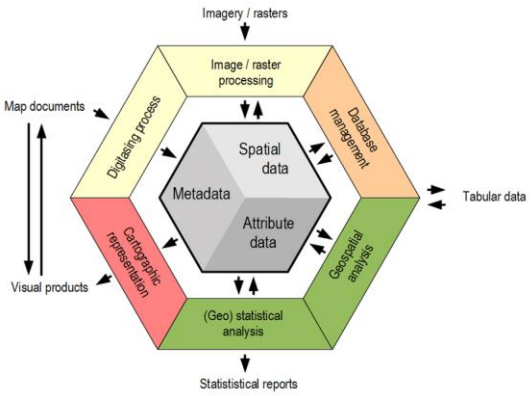
CC314 - Development of Spatial Data Infrastructure [SDE] Course

Course Duration: 10 Days
Training Fee: KSH 80,000 | USD 800
Course Registration: **Register Here>>**

1.0. Introduction



The internet and the latest Information and Communication Technologies (ICT) changed the way in which we interact with spatial information and created the premises for developing what is known today as Online GIS or Web GIS. This new GIS paradigm exposes GI content and tools over the web, contributing to GIS democratization. In this context, Spatial Data Infrastructure (SDI) provide s the foundation for geographic resources discovery and usage across networks. This module introduces the technological advances and standardization efforts that enable GI resources (vector data, raster data, tools, maps) sharing and integration across distributed platforms. Spatial data sharing and integration rely on the standards and specifications developed by the International Organization for Standardization (ISO) with its Technical Committee 211 (TC211) and Open Geospatial Consortium (OGC/OpenGIS).

1.1. Course Overview

The OpenGIS specifications will be discussed in this module including Geography Markup Language (GML) which is the standardized data encoding format used to share spatial data; Web Map Service (WMS) which specifies the interface to share georeferenced map images over the web; Web Feature Service (WFS) that allows a client to retrieve and modify Geospatial data encoded in the GML format; Metadata standards and Catalog Services standards used to store, search and discover metadata items in a standardized way; Web Coverage Service (WCS) allows a client to retrieve and modify raster data; Web Processing Service (WPS) specifies the rules for sharing spatial analysis processes over networks. The course will also focus on web mapping applications development using OpenLayers and Leaflets.

1.2. Course Objectives

This course will enable the participants to:

i. Grasp and outline the key modern technologies behind the Web GIS and distributed infrastructures.
ii. Explain the role of GIS web services in developing distributed infrastructures.
iii. List the organizations responsible for developing open standards in the GIS context and learn how to develop a Spatial Data Infrastructure.

iv. Define Spatial Data Infrastructures (SDIs) and their role in spatial data exchange and integration.
v. Develop, deploy and publish and consume web services in different applications (desktop and web clients).

1.3. Learning System

The learning and teaching strategies will follow student centered mode. The students will get practice into the main steps required to publish OpenGIS web services using both open-source and proprietary software. On completion of this module, the students will be able to develop their own applications using GI resources published as standardized web services. We focus on 80-20 approach i.e. 80% of time for practicals whilst 20% for theory.

1.4. Course Content/Outline

i. OpenGIS Standardized Geospatial Web Services:

- Spatial data and information sharing across distributed infrastructures e.g. the web.
- Key Web GIS technologies, definition of web service concept;
- The differences between Open GIS and Open Source. Why Open GIS?

ii. Standardization & Interoperability for Sharing Geospatial Resources:

- Service Oriented Architecture (SOA) together with its underlying principles, advantaged and disadvantages.
- Open Geospatial Consortium (OGC), International Organization for Standardization (ISO) with its technical committee TC211).
- (ISO/TC211) and World Wide Web Consortium (W3C); defining a simple GML schema and GML instance file.
- Encode spatial data in eXtensible Markup Language (XML) format.

iii. Introduction to GIS Web Services:

- Characteristics of Simple Object Access Protocol (SOAP) and Representational State Transfer (REST) protocol.
- The client-server interaction in distributed architectures.
- Develop a JavaScript Object Notation (JSON) file for encoding the location and the key characteristics of the capital cities of EU countries.

iv. A Spatial Data Infrastructure:

- The main components of Spatial Data Infrastructure (SDI) and benefits of creating and maintaining SDIs.
- The role of open data initiatives to develop intelligent Geospatial applications.
- Installing Tomcat and GeoServer open-source software; Loading data to GeoServer and publishing Web Map Services (WMSs) using GeoServer.
- Data visualization using Styled Layer Descriptor (SLD) specifications.
- Common goal of the existing SDI Initiatives and their importance for developing a spatially enabled society.

v. **eXtensible Markup Language (XML):**
- The role of eXtensible Markup Language (XML) to encode and transfer data over the web.
- Encode spatial data in the XML and JavaScript Object Notation (JSON)notation.
- Consuming WFS and WMS using different clients (e.g. QGIS or ArcGIS).

vi. **Metadata and Web Catalog Services:**
- The role of metadata for spatial data sharing across distributed networks over the web.
- Metadata standards on spatial datasets and services; role of Catalog Services for Spatial Data Infrastructure (SDI) initiatives.
- The concept of distributed Catalog Services together with its underlying principles.

vii. **Web Map Service (WMS/WMTS):**
- Publishing Web Feature Service (WFS) using GeoServer; Querying WFS using GET and POST requests.
- OGC Web Map Service (WMS) specification; Web Map Service (WMS) operations: GetCapabilities, GetMap, GetFeatureInfo.
- The Styled Layer Descriptor (SLD) in defining the appearance of vector and raster data.

viii. **Geography Markup Language (GML):**
- The role of the Geography Markup Language (GML) to encode and share spatial data.
- Overview of GML specifications; The differences between GML profiles and GML apps.

ix. **Web Feature Service (WFS):**
- The Web Feature Service (WFS) specification; the syntax of the WFS requests.
- The difference between READ ONLY WFS and transactional WFS.
- WFS Filter Encodings specifications; use WFS filters to select spatial data.

x. **Web Coverage Service (WCS):**
- The coverage representation model; Web Coverage Service (WCS) specifications.
- GML specifications for coverage model; the syntax of the WCS requests.

xi. **Web Processing Service (WPS):**
- Advantages and disadvantages of Web Processing Service (WPS) for processing or analyzing spatial data online.
- Web Map Tile Service (WMTS) specification.
- Description of the OGC GeoPackage format for Geospatial information.

1.5. Case Study

Developing an SDI for Buruburu Estate:
- The Requirements for developing an SDI (data, protocols, administrators, dissemination).
- Developing a web map application using OpenLayers and Leaflet.

1.6. Expected Learning Outcomes

On completion of this course, the participants are expected to:

i. Obtain solid skills and experience is application of geo-information and earth observation techniques in the development and management of an SDI.
ii. Acquire knowledge and skills needed for the collection, interpretation, and management of spatial information, using GIS to support an ideal SDI.
iii. Gain in-depth skills using Geospatial tools that help in development of realistic SDIs for spatial data sharing policy formulation and implementation.
iv. Get acquainted with GIS and other geo-techniques to provide project specific solutions in the field of Geoportals, land information & SDI development.

1.7. Training Materials (Hardware and Software)

1. A Laptop or PC;
2. Postgres SQL and PostGIS;
3. Geoserver Software;
4. ArcGIS Online;
5. Javascript, Leaflets;
6. ArcGIS & Q-GIS;

1.8. Training Style and Approach

- On-site instructor-led training;
- On-line training (optional);
- Use of PowerPoint Slides;
- Fieldwork Exercises;
- Use of Case Studies on SDI development.