ISO/TC 211 – Short introduction to Spatial Schema

Presentation at the workshop on GIS/BIM during ISO/TC 211 meeting in Stockholm, Sweden
Introduction – ISO 19107 DIS version

This International Standard provides conceptual schemas for describing, representing and manipulating the spatial characteristics of geographic entities. Standardization in this area is the cornerstone for other geographic information design, specification and standardization.

"Vector" data consists of geometric primitives used to construct expressions of the spatial characteristics of geographic features. "Raster" data is based on the division of the extent covered into small units according to a tessellation of the space. This International Standard deals only with vector data.

The content of the new 19107 is approximately the same intent as the old, but with clearer and more accurate descriptions on needed algorithms. The only additions to the content:

- simplicial topology (the basis for TIN and TEN structures), which will only affect those interested in the techniques for mostly numeric/spatial distribution of attributes
- edge for coverages -- essentially polyhedral meshes of any dimension based on baricentric coordinates.
Levels of abstraction
Geometry

There is a hierarchy of complexity in the "geometry" of the underlying object used in various coordinate systems. These may use:

- reference planes (map geometry – Euclidean)
- reference spheres (spherical geometry — using spherical trigonometry)
- reference ellipsoids (ellipsoidal geometry using Gaussian or Riemannian metrics)
- or more complex surfaces (usually using numeric approximations for calculation).

The coordinates of a point locate it on, or in relation to, the reference geometry. With the exception of the "map geometry," the usual Euclidean formulae for distance and area do not apply directly in the coordinate system.
Geometric reference surface

- **Interface**: GeometricReferenceSurface
  - id: URI {readOnly}
  - metadata: URI [1..*] {readOnly, ordered}
  - /datum: Datum

- **Interface**: PlaneMap

- **Interface**: Sphere
  - radius: Distance {readOnly}

- **Interface**: Ellipsoid
  - inverseFlattening: Real
  - semiMajorAxis: Distance
  - semiMinorAxis: Distance

- **Interface**: Geoid

- **Codelist**: GeometricSurfacesType
Topology expressions provide qualitative descriptions of the spatial relations between geometry objects. Topology deals with the characteristics of geometric figures that remain invariant if the space is deformed elastically. Topological properties do not change when information is transformed from one coordinate system to another, usually including the coordinate function that map from $\mathbb{R}^2$ or $\mathbb{R}^3$ to the reference geometry. Topological properties in the domain of the coordinate system will be identical to those on the geographic surface; but the metric properties may change significantly (e.g. distance, area, direction).
Spatial operators

Spatial operators are functions and procedures that use, query, create, modify or delete spatial objects. This International Standard defines the taxonomy of some of the more important operators, their definitions and implementations. The goals are to:

- Define spatial operators unambiguously, so that different implementations will yield comparable results within the limitations of accuracy and resolution.
- Use these definitions to define a set of standard operations that will form the basis of compliant systems and thus act as a test-bed for implementers and a benchmark set for validation of compliance.
- Define an operator algebra that will allow combinations of the base operators to be used predictably in the query and manipulation of geographic feature data.
Questions
[I will do my best]