



Infinite Integration

The Role of Spatially Aware Middleware

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Outline



- Brief Review of Geodesy Concepts
- How do data stores treat spatial data?
- How does OpenSpirit treat spatial data?
- How do applications treat spatial data?
- Summary

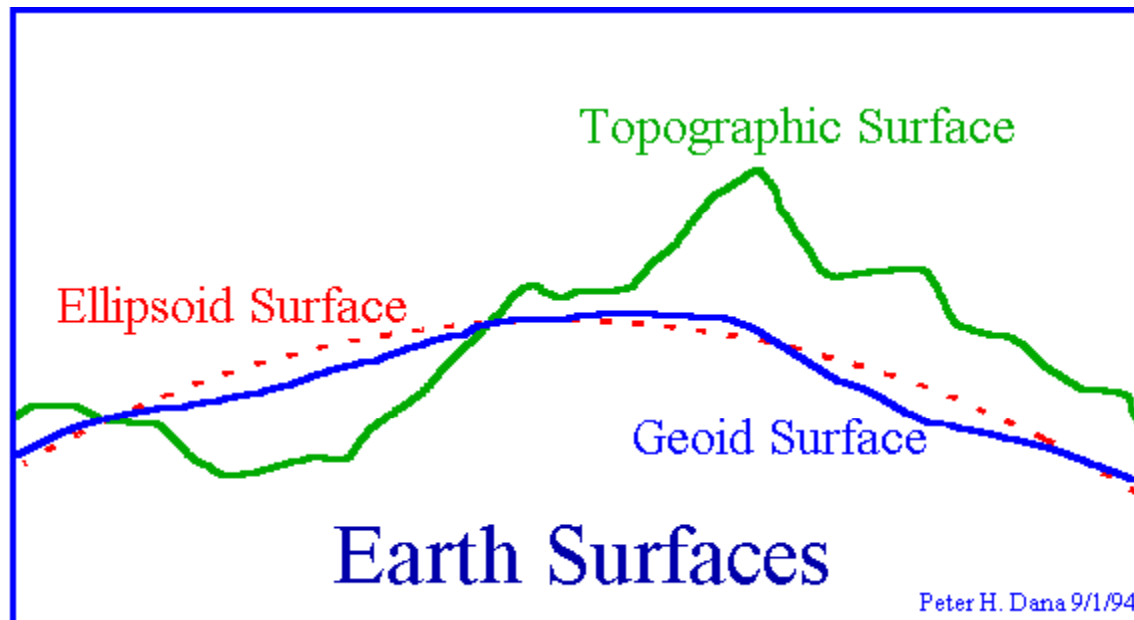


Geodesy Review

Which picture do you believe?



Earth Surfaces



Ellipsoids

Selected Reference Ellipsoids

| Ellipse | Semi-Major Axis (meters) | 1/Flattening |
|------------------------|-----------------------------|---------------|
| Airy 1830 | 6377563.396 | 299.3249646 |
| Bessel 1841 | 6377397.155 | 299.1528128 |
| Clarke 1866 | 6378206.4 | 294.9786982 |
| Clarke 1880 | 6378249.145 | 293.465 |
| Everest 1830 | 6377276.345 | 300.8017 |
| Fischer 1960 (Mercury) | 6378166.0 | 298.3 |
| Fischer 1968 | 6378150.0 | 298.3 |
| G R S 1967 | 6378160.0 | 298.247167427 |
| G R S 1975 | 6378140.0 | 298.257 |
| G R S 1980 | 6378137.0 | 298.257222101 |
| Hough 1956 | 6378270.0 | 297.0 |
| International | 6378388.0 | 297.0 |
| Krassovsky 1940 | 6378245.0 | 298.3 |
| South American 1969 | 6378160.0 | 298.25 |
| WGS 60 | 6378165.0 | 298.3 |
| WGS 66 | 6378145.0 | 298.25 |
| WGS 72 | 6378135.0 | 298.26 |
| WGS 84 | 6378137.0 | 298.257223563 |

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Geodetic Datum

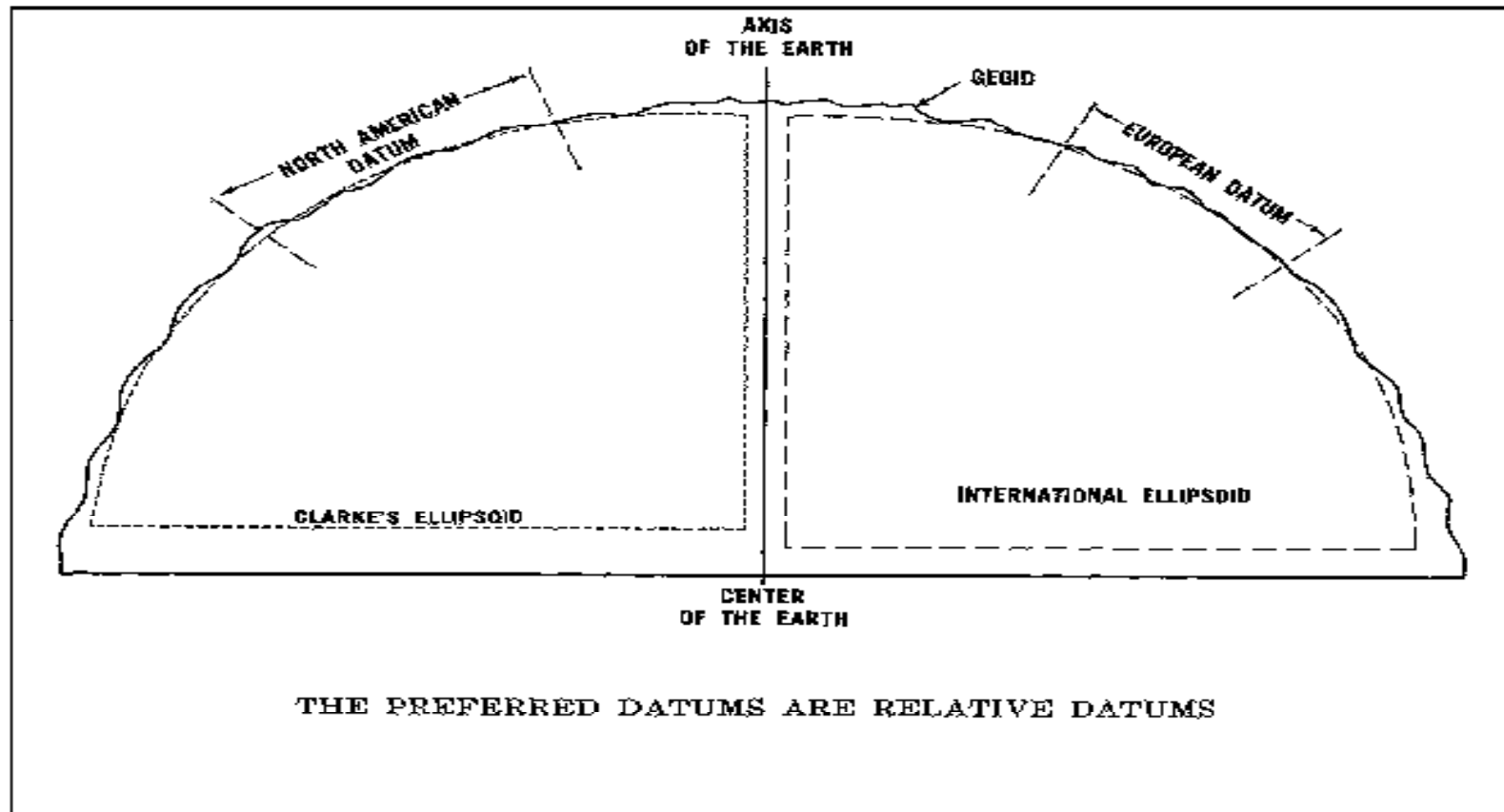


Figure 21

(from Geodesy for the Layman - Defense Mapping Agency , 1984)

Datum Shifts

- Convert from one datum to another
 - Geocentric shift (3 parameters)
 - Molodensky (5 parameters)
 - Bursa-Wolf (7 parameter - aka Coordinate Frame Rotation or Position Vector)
 - Grid Based (e.g NADCON, NTV2, ...)
- Commonly convert between datum by shifting first to WGS84

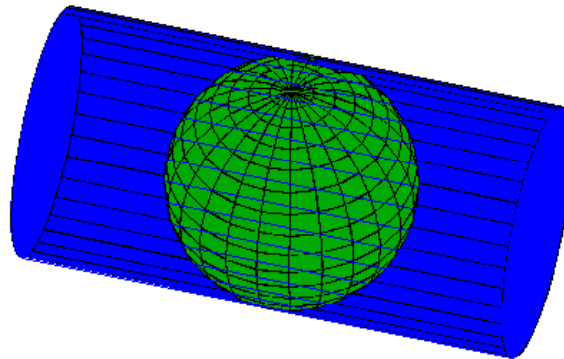
List of datums : <http://www.colorado.edu/geography/gcraft/notes/datum/edlist.html>



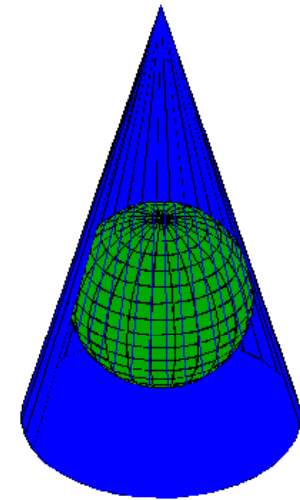
Map Projections

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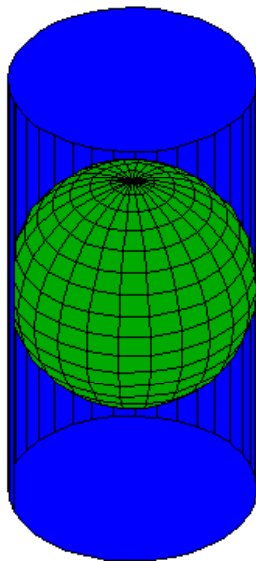
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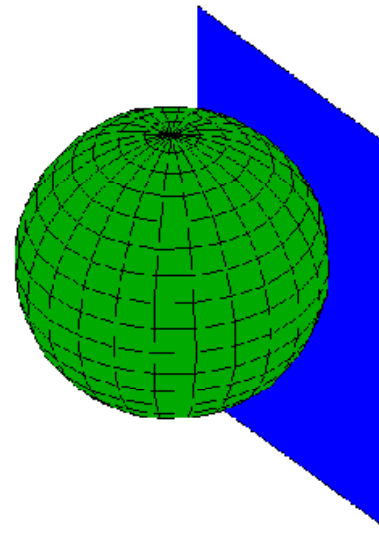
**Transverse Cylindrical
Projection Surface**



Conical Projection Surface



Cylindrical Projection Surface



Planar Projection Surface

Location Definition

- Specify latitude, longitude **plus** the datum (includes reference ellipsoid)

Geographic
Coordinate
System

-or –

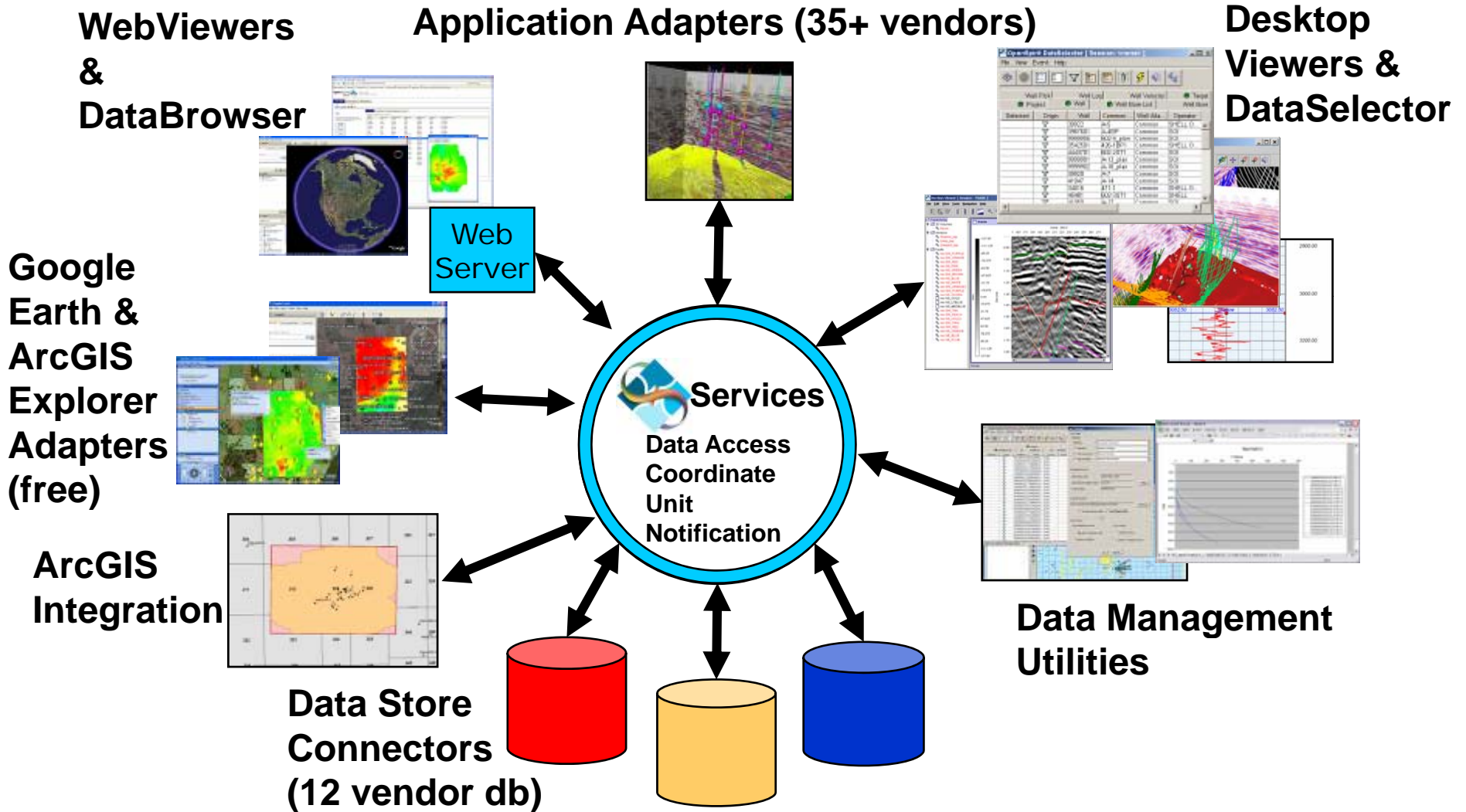
- Specify x, y (Easting, Northing) **plus** the projection method (and parameters) **plus** the datum

Map
Coordinate
System

- Then if you need to shift to a different datum you must also know what datum shift method (and parameters) to use

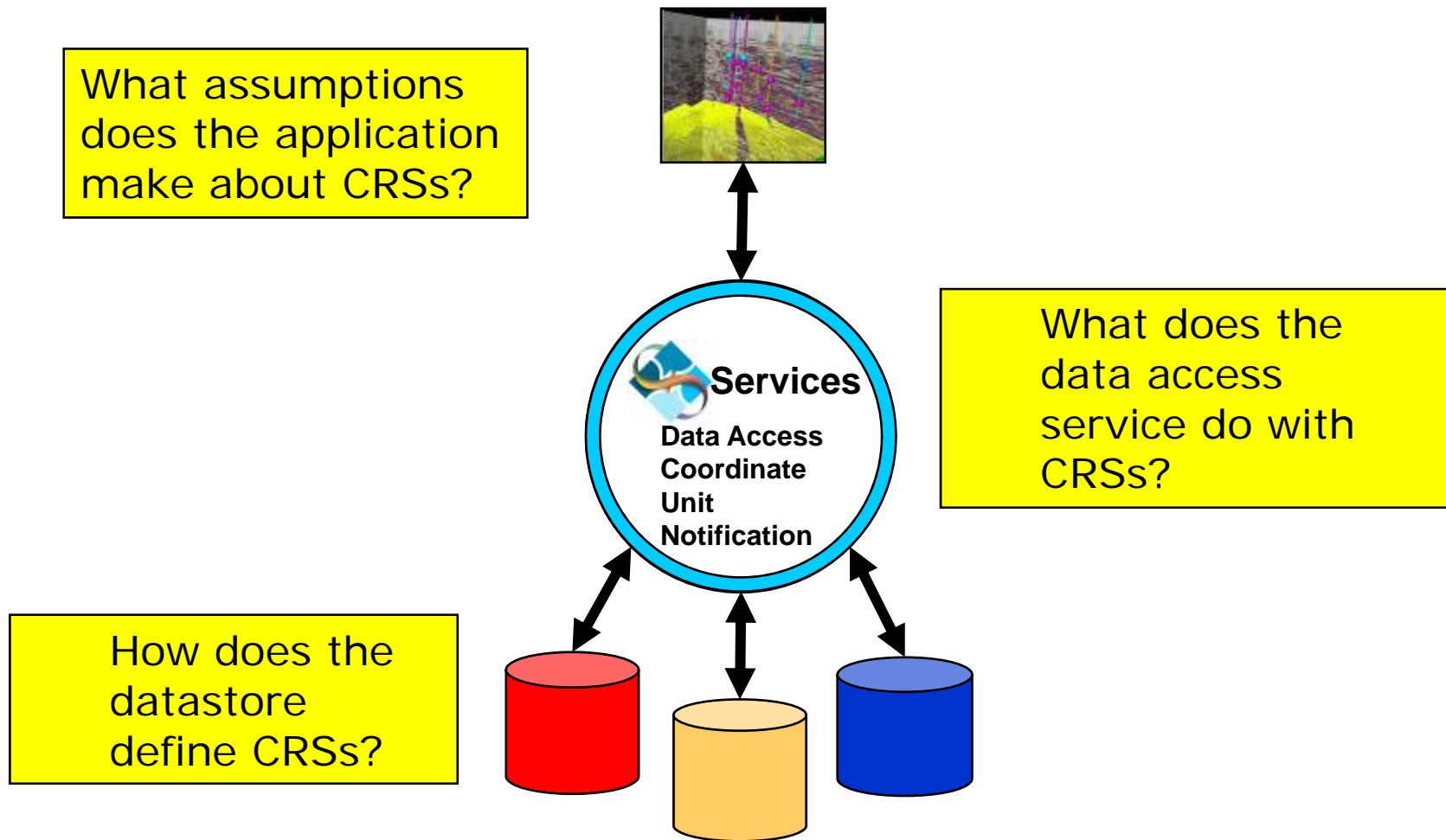


OpenSpirit Integration



Treatment of Spatial Data

Application Adapters (35+ vendors)



Datastores – Spatial Data



| Cases | Examples | How OpenSpirit Data Connector treats spatial data |
|---|--|--|
| 1. Well defined CRS and datum shift to WGS84 defined | OpenWorks, GeoFrame, Kingdom, Petra, ... | Translate vendor specific projection methods & parameters, datum / ellipsoid parameters and datum shift method and parameters to EPSG standard nomenclature and construct equivalent CRS and datum shift transformation (using ESRI projection engine library) |
| 2. Well defined CRS– no datum shift defined | PPDM, SDE, ... | When datastore is registered with OpenSpirit add metadata to define datum shift for every GCS referenced then use as in 1 |
| 3. No or incomplete definition of project CRS | Gocad, Petra (earlier version), ... | When project is made available in OSP catalog adds metadata that defines project CRS and datum shift then use as in 1 |



Applications – Spatial Data



| Cases | Examples | How OpenSpirit Data Connector treats data |
|--|------------------------|--|
| 1. Application defines CRS and datum shift to WGS84 | RMS, Petrel 2007.1,... | Application translates OSP (EPSG) terminology into its own and either <ul style="list-style-type: none">• queries for OSP data specifying the desired CRS (and supplying datum shift) – OSP does any required transformation (Petrel 2007.1)• queries for data in datastore CRS and then , if needed, does transformation itself into application CRS (RMS) |
| 2. Application assumes all data in consistent (undefined) CRS | Gocad, Petrel 2005,... | Application requests data in the preferred CRS (and datum shift) set on OpenSpirit session (selected from datastores project) |

Summary



- A well designed datastore should fully specify the CRS (map projection plus datum) that any spatial data is stored in (and optionally the datum shift to WGS84)
- OpenSpirit data connectors translate the vendor specific CRS definition to an EPSG CRS
- Applications that access data via OpenSpirit may get the spatial data in the datastore's CRS or may request it in any desired CRS and OpenSpirit will transform it on the fly (if possible)
- Applications that have no knowledge of CRS should use the OpenSpirit session's preferred CRS
- Applications should tag their local data with the CRS (name and OpenSpirit key)
- By leveraging the OpenSpirit spatially aware middleware applications can access spatial data coming from diverse sources in a consistent coordinate system using a common set of transformations based on EPSG standards

