

Modeling Geometry and Reference Systems on the Web of Data

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Coordinate Reference Systems (CRS)

- **A representation of the locations of geographic features within a common geographic framework**
- **Each CRS is defined by its measurement framework**
 - Geographic: spherical coordinates (unit: decimal degrees)
 - Planimetric: 2D planar surface (unit: meters) + a map projection
 - Additional measurement properties: ellipsoid, datum, standard parallels, central meridians, etc.
- **Situation:**
 - Several hundred Geographical Coordinate Systems (WGS84, ETRS89, etc.)
 - Several thousands Projected Coordinate Systems (UTM, Lambert93, etc.),
<http://resources.esri.com/help/9.3/arcgisserver/apis/rest/pcs.html>

Current Tooling

- **Circé: A Converter Software from IGN**

- Allows conversion between some France CRSs to WGS84
- Closed Source, No open service

The screenshot shows the 'Circé France' application window with the 'Transformation grille' tab selected. The 'Système de départ' (Starting System) is configured with 'WGS84' as the system, 'Géographiques' as the type, and 'Lambert OACI-DECCA (GRS)' as the projection. The 'Système d'arrivée' (Destination System) is configured with 'WGS84' as the system, 'Planes' as the type, and 'UTM Nord fuseau 31 (GRS8)' as the projection. The 'Calcul des coordonnées planes du système d'arrivée en mètres' button is located at the bottom of the window.

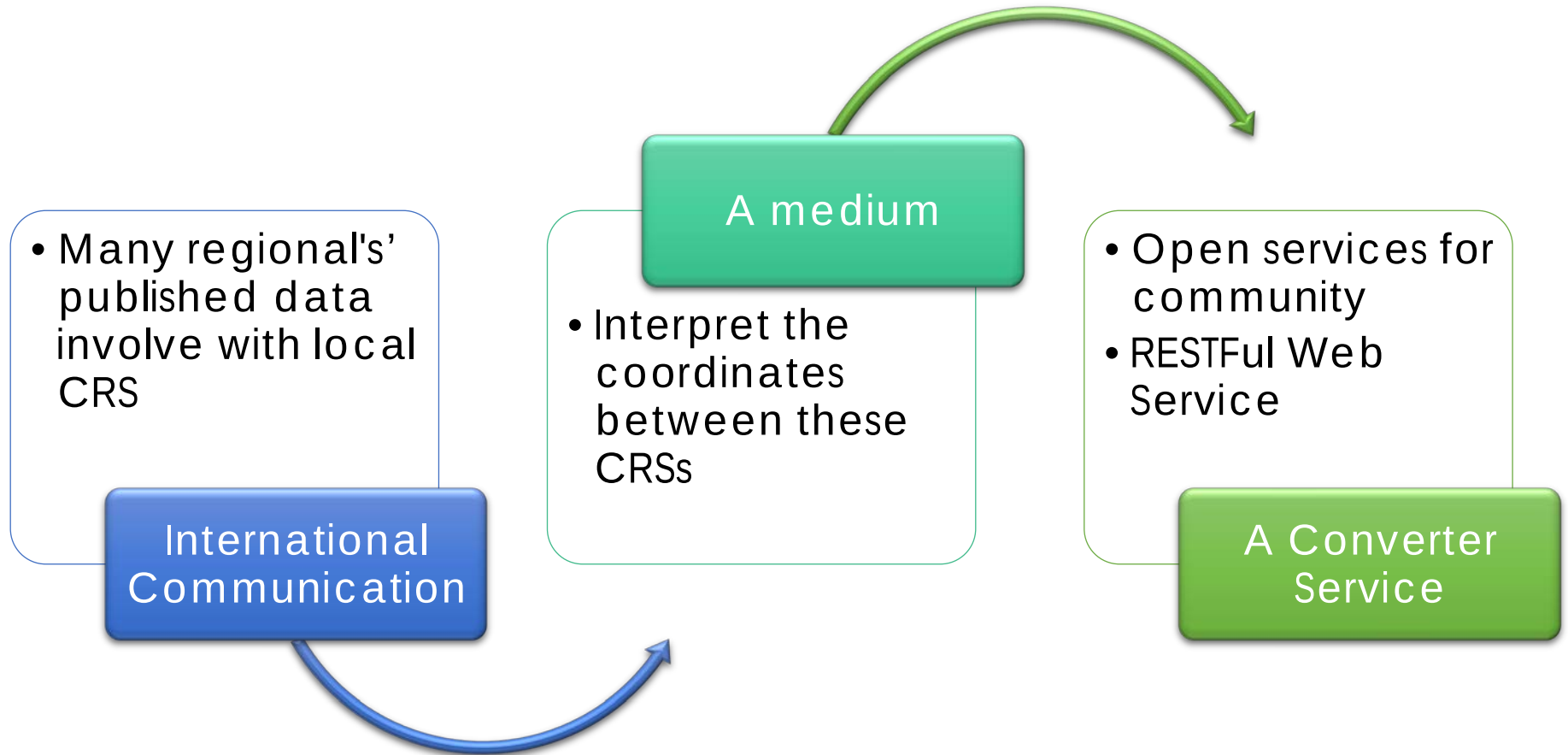
The screenshot shows the 'Circé France' application window with the 'Transformation grille' tab selected. The 'Système de départ' (Starting System) is configured with 'NTF (Paris)' as the system, 'Géographiques' as the type, and 'Lambert 1 Nord' as the projection. The 'Système d'arrivée' (Destination System) is also configured with 'NTF (Paris)' as the system, 'Géographiques' as the type, and 'Lambert 1 Nord' as the projection. The 'Calcul des coordonnées géographiques du système d'arrivée' button is located at the bottom of the window.

Current Tooling

- **The World Coordinate Converter:** <http://twcc.free.fr>
 - Conversion between numerous CRSs from International to Regional
 - Closed Source, No open service



Developing an REST converter service



Use Case: CRS used in France

- France Metropolitan Projection System: RGF93/Lambert 93
- Other region's Projection System: UTM

REGION	GEO COORDINATE SYSTEM	ELLIPSOID	PROJECTION SYSTEM	ALTIMETRY SYSTEM
FRANCE METROPOLITAN	RGF93	IAG-GRS 1980	Lambert 93 and CC 9 Zones	
MAYOTTE	RGM04 (ITRF2000)	IAG-GRS 1980	UTM 38 South	SHOM 1953
GUYANE	RGFG95	IAG-GRS 1980	UTM 21 22 North	
MARTINIQUE	WGS84	IAG-GRS 1980	UTM 20 North	
GUADELOUPE	WGS84	IAG-GRS 1980	UTM 20 North	
LA RÉUNION	RGR92	IAG-GRS 1980	UTM 40 South	GGR 99
NOUVELLE-CALÉDONIE	ITRF90	IAG-GRS 1980		
POLYNÉSIE	RGPF	IAG-GRS 1980	UTM 5, 6, 7 and 8 South	Tahiti IGN 1966
WALLIS ET FUTUNA	MOP87	International 1924		
SAINT-PIERRE ET MIQUELON	RGM01 (ITRF2000)	IAG-GRS 1980	UTM 21 North	Danger 1950
ILE CLIPPERTON	Marine 1967	International	UTM 12 South	

Source: <http://geodesie.ign.fr/>

Implementation

- **WGS84 - Lambert93**

- From WGS84 to Lambert93: Isometric Latitude calculation algorithm
- From Lambert93 to WGS84: reverse Isometric Latitude calculation

- **WGS84 - UTM**

- UTM: http://en.wikipedia.org/wiki/Universal_Transverse_Mercator_coordinate_system
- RGF 93 and WGS 84 using the same ellipsoid (GRS 80)

- **REST service being deployed**

- **Source code: <https://github.com/vienlam/Geo>**

Application: Interlinking Geo Datasets

- Use case: schools described as geographical objects in Dbpedia (WGS84) and in data.gouv.fr (Lambert93)
- LINES (Link discovery framework for MEtric Spaces) interlinking tool: <https://github.com/aksw/limes>

Test Cases			
	Test 1	Test 2	Test 3
Aggregate function	trigrams	trigrams	trigrams
Weight of Title	0.3	0.3	0.3
Coordinate function	euclidean	euclidean	euclidean
Weight of Coordinate	0.7	0.7	0.7
Matched Threshold	0.95	0.9	0.93
Review Threshold	0.9	0.8	0.88
No. Duplicates	8	37	29
No. Review Duplicates	29	900	40
1-n Results from Duplicate	No	Yes	No
1-n Results from Review	Yes	Yes	Yes
Correct matches	36	>36	63

Vocabularies

- **A vocabulary for describing CRS:**
<http://data.ign.fr/ontologies/ignf#>
 - close to ISO 19111 schema for CRS description
 - RDF: <http://www.eurecom.fr/~atemezin/datalift/ign-onto/ignfV4.rdf>
- **A vocabulary for describing Geometries:**
 - gsp: <http://www.opengis.net/ont/geosparql#>
 - sf: <http://www.opengis.net/ont/sf#>
- **What is missing: integration of CRS:**
 - geom: <http://data.ign.fr/ontologies/geom#>
 - RDF: <http://www.eurecom.fr/~atemezin/datalift/ign-onto/GeometryV8.ttl>