



Linked Open Data in Agriculture



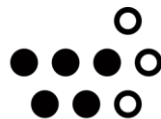
Together4Water project

Implementing an open-source database to monitor water-related SDG in Tunisia

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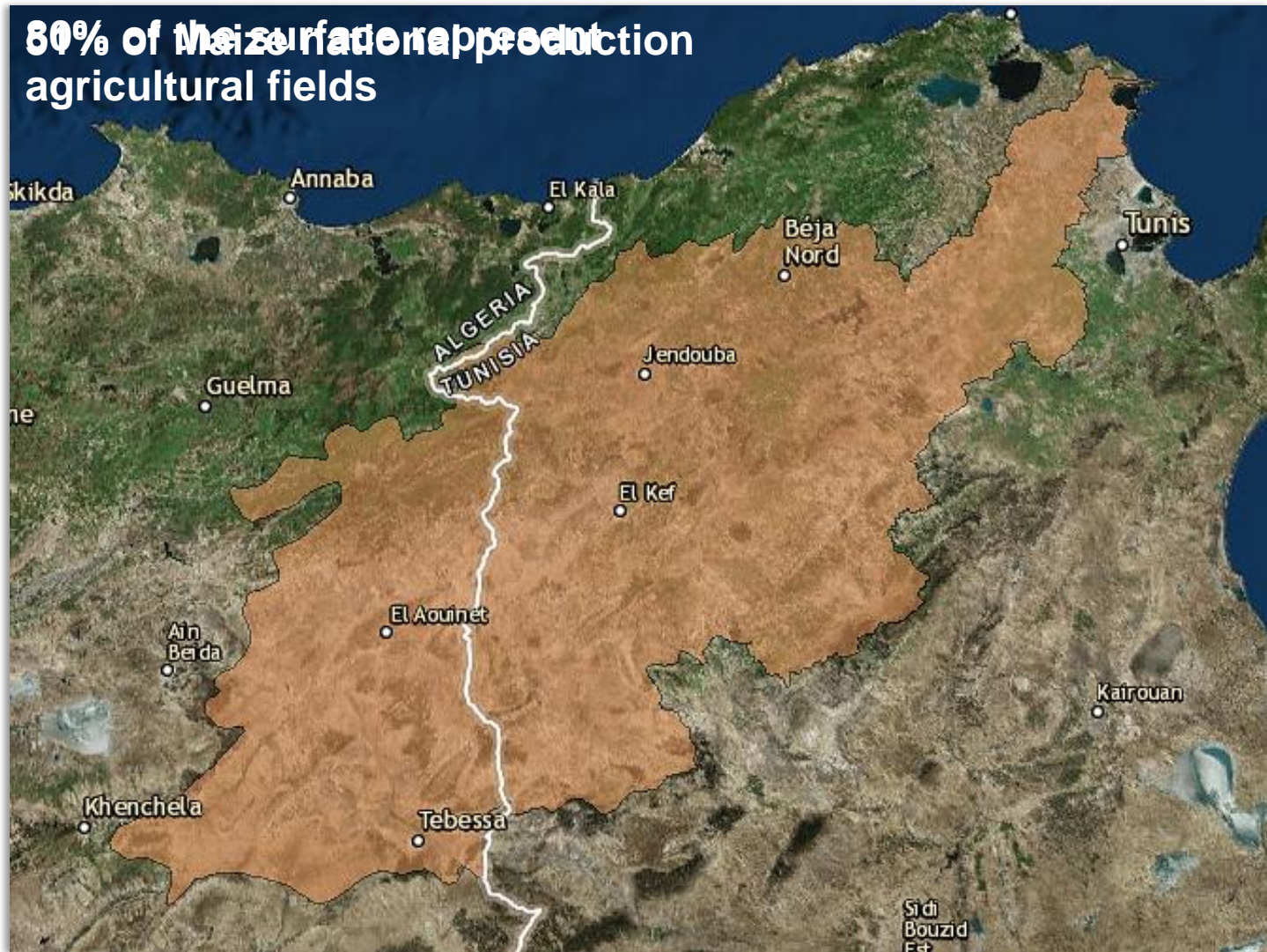
Context



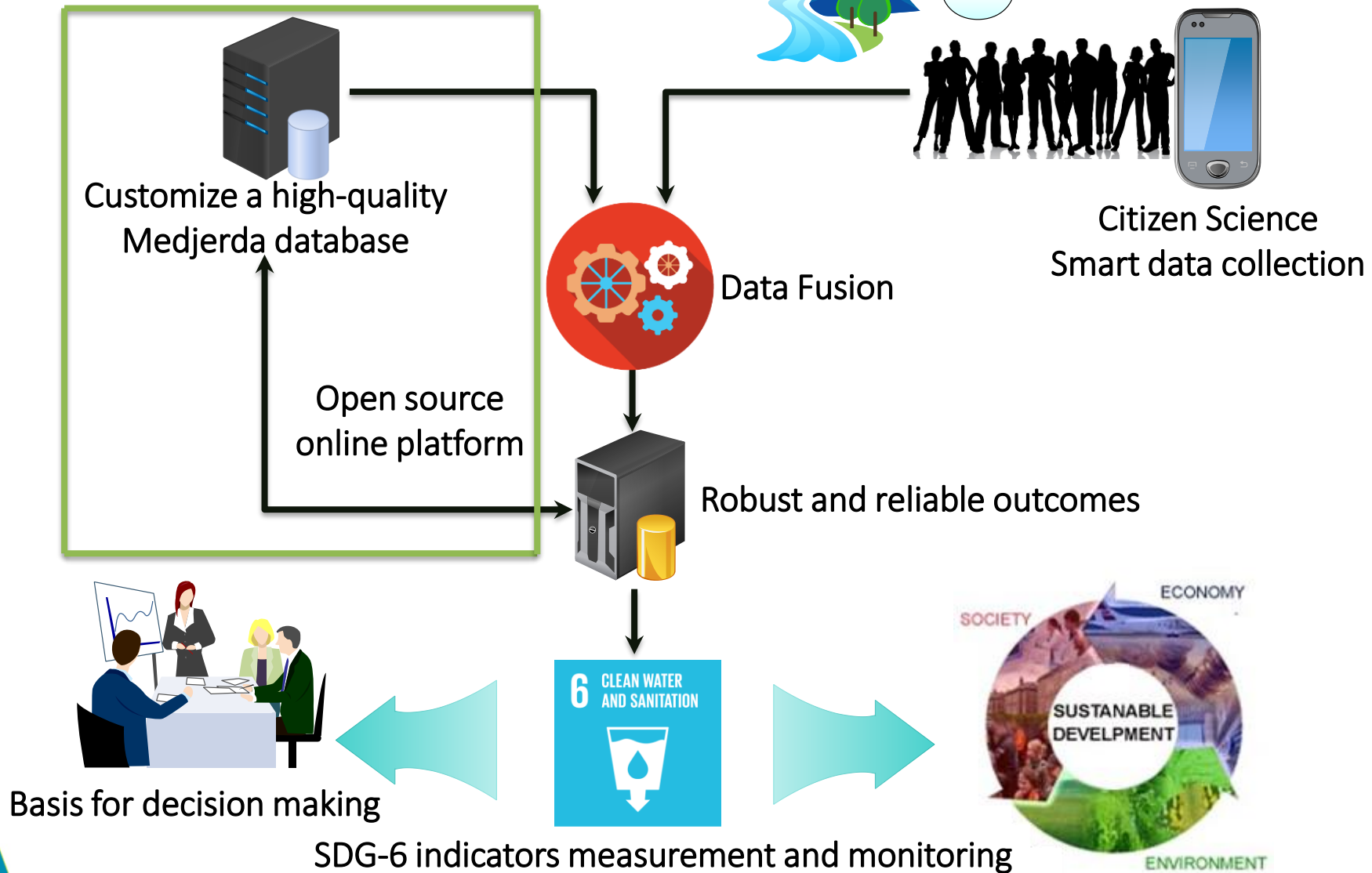
Sustainable Development Goals have been launched by the United Nations in September 2015 in the framework of the 2030 Agenda

SDG-6 aim to ensure availability and sustainable management of water and sanitation for all

Context – Study area



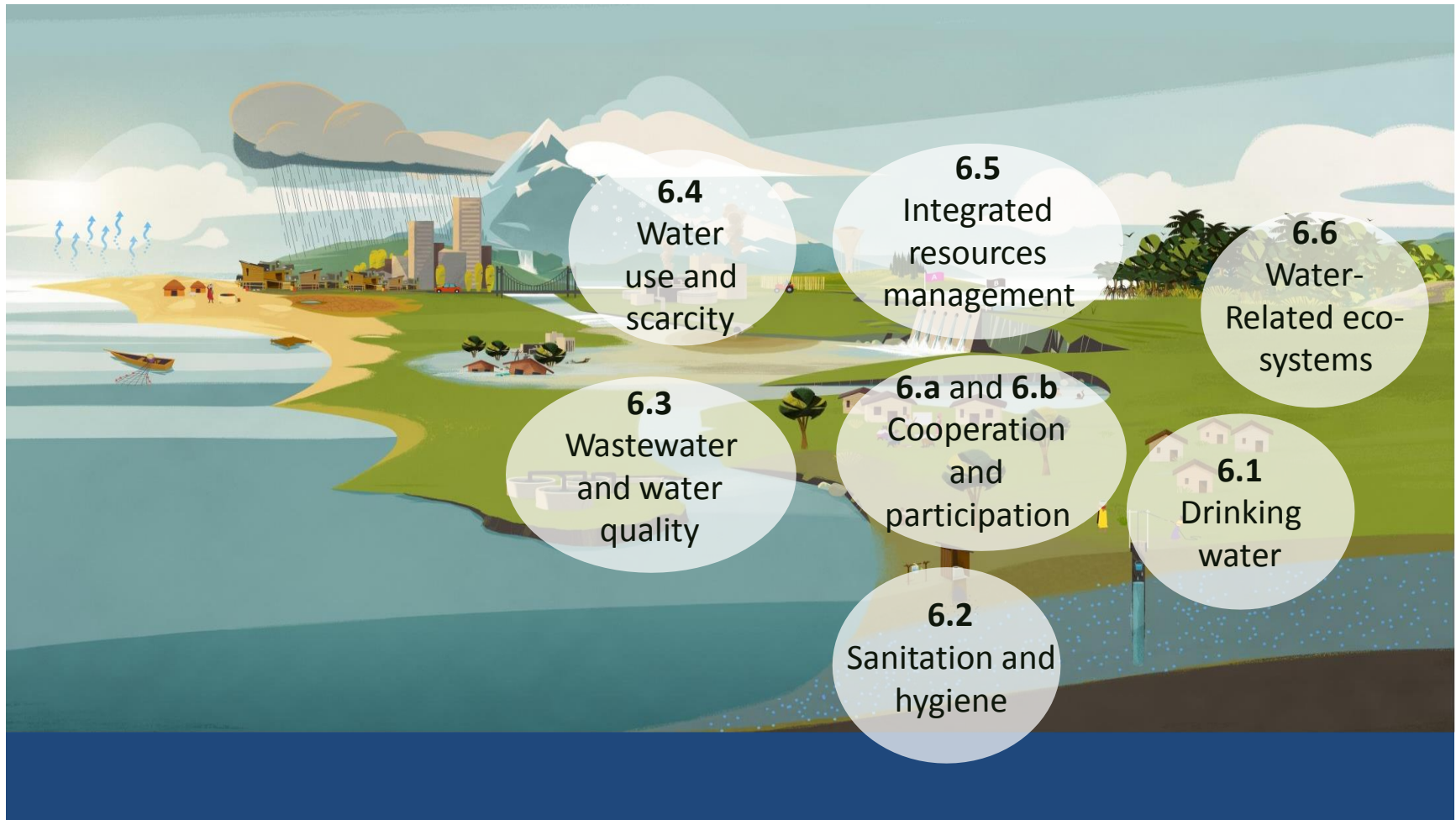
Approach



SDG-6 global indicators (short titles)

6.1.1	Proportion of population using safely managed drinking water services
6.2.1	Proportion of population using safely managed sanitation and hygiene services
6.3.1	Proportion of Wastewater safely treated
6.3.2	Proportion of bodies of water with good ambient water quality
6.4.1	Change in water use efficiency
6.4.2	Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
6.5.1	Integrated water resources management
6.5.2	Transboundary basin area with an operational arrangement for water cooperation
6.6.1	Change in the extent of water-related ecosystems over time
6.a.1	Amount of water- and sanitation-related official development assistance that is part of a government coordinated spending plan
6.b.1	Participation of local communities in water and sanitation management

High quality data to meet SDG-6



Data acquisition and analysis

Different data sources



- **Difficult to collect**
- **Different quality levels**
- **Different Metadata standards**

Drinking Water and
Sanitation
Water Quality
Wastewater reuse

Ministry of
Environment

Ministry of
Agriculture

Surface and
groundwater
Irrigation
...

Regional
Water-
Related
Institutions
(10)

Precipitation
River flow
...

Data acquisition and analysis

Google Earth Engine: Cloud-based open remote sensing analysis

The screenshot displays the Google Earth Engine web interface. The top navigation bar includes the Google Earth Engine logo, a search bar, and user controls. The main interface is divided into three panels: Scripts, Assets, and Inspector. The Scripts panel shows a script for creating a task to export an NDVI image to Google Drive. The Assets panel shows a list of scripts, including 'Final Product NDVI Landsat + MODIS *'. The Inspector panel shows the console output, which includes a message about using print(...) to write to the console and two JSON responses for FeatureCollections.

Scripts Docs Assets

Filter scripts...

▼ Private

- Another view to NDWI
- Change in water bodies
- Final Product NDVI Landsat + ...
- IST Medjerda

Final Product NDVI Landsat + MODIS * Get Link Save Run Reset

```
657
658 // Create a task that you can launch from the Tasks tab.
659 Export.image.toDrive({
660   image: visualization,
661   description: 'NDVI_Medjerda',
662   region: basin,
663   maxPixels: 281310230,
664 }
```

Inspector Console Tasks

Use print(...) to write to this console.

- FeatureCollection (124 elements, 0 columns) JSON
- <https://earthengine.googleapis.com/api/table?...> JSON
- FeatureCollection (124 elements, 0 columns) JSON

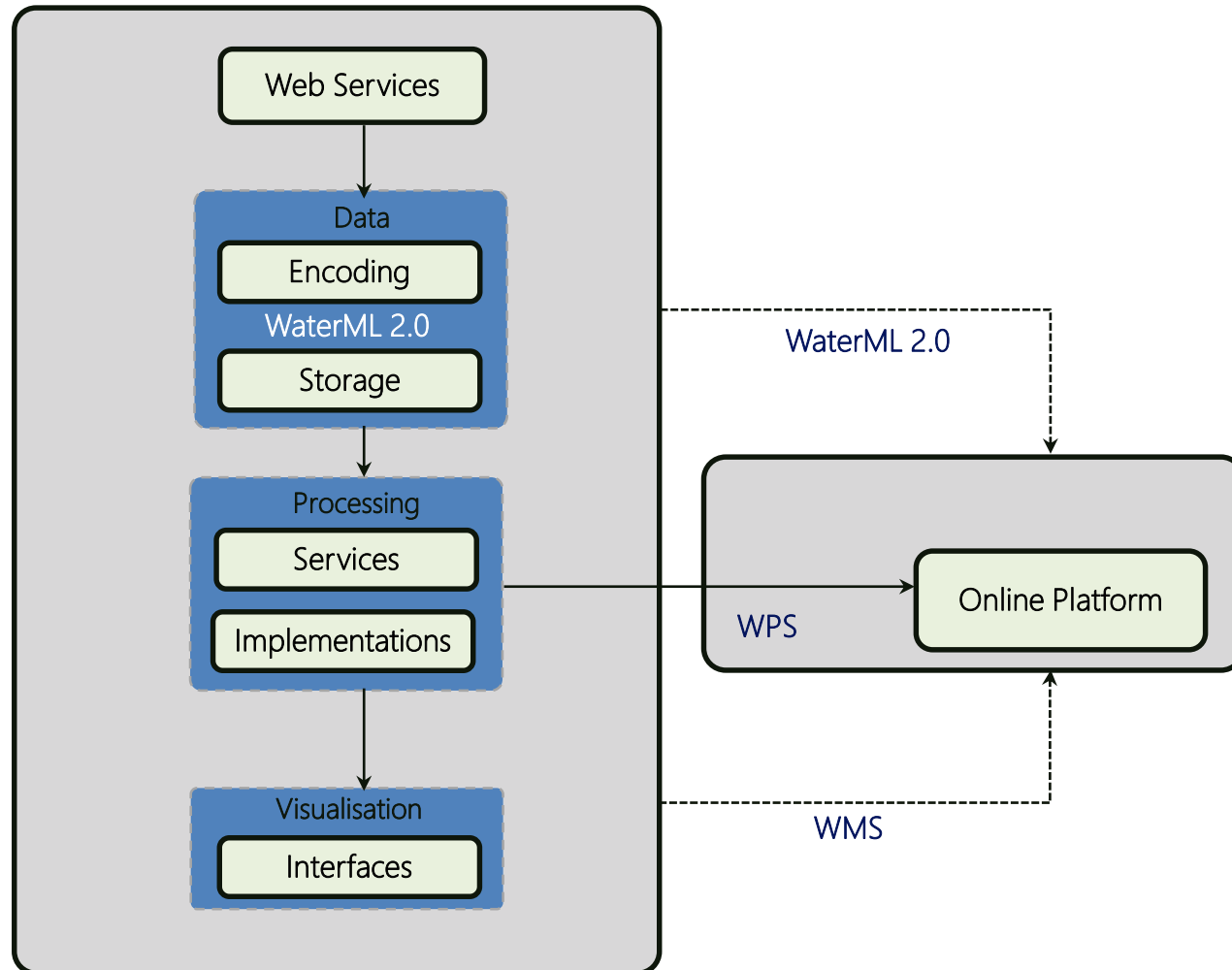
Layers Plan Satellite

Google Earth Engine map showing Tunisia with a green NDVI overlay. The map includes labels for various cities and regions, such as Annaba, Sidi Amar, Guelma, Constantine, and Tunis. The NDVI overlay is a green-shaded area representing vegetation density.

Data acquisition and analysis

Data	Raw data status	Improved data status
Drinking water & Sanitation	<ul style="list-style-type: none"> • Metadata issues • No geodatabase 	<ul style="list-style-type: none"> • Reinforced metadata • Creation of geodatabase
Wastewater Quality	<ul style="list-style-type: none"> • Metadata issues • No geodatabase • Data gaps • Short Temporal Resolution 	<ul style="list-style-type: none"> • Reinforced metadata • Creation of geodatabase • No data gaps • Standardized TR
Wastewater reuse	<ul style="list-style-type: none"> • No geodatabase • Data gaps 	<ul style="list-style-type: none"> • Creation of geodatabase • No data gaps
Weather data	<ul style="list-style-type: none"> • Metadata issues • Data gaps 	<ul style="list-style-type: none"> • Reinforced metadata • No data gaps
Remote sensed data	<ul style="list-style-type: none"> • Missed data 	<ul style="list-style-type: none"> • Available data • Reinforced metadata • Full Spatial Distribution

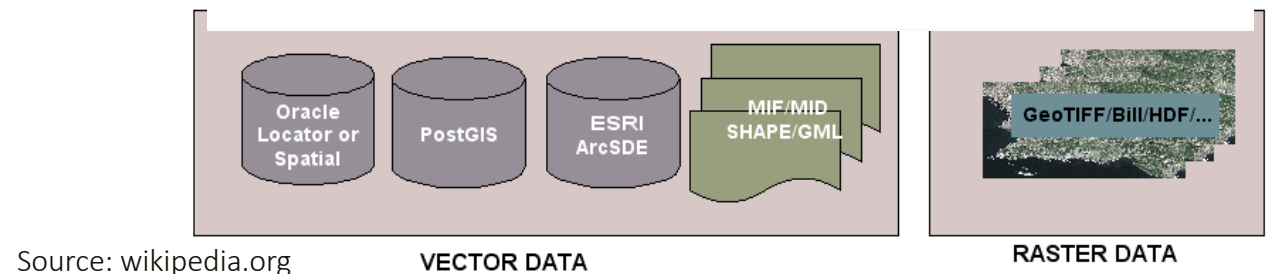
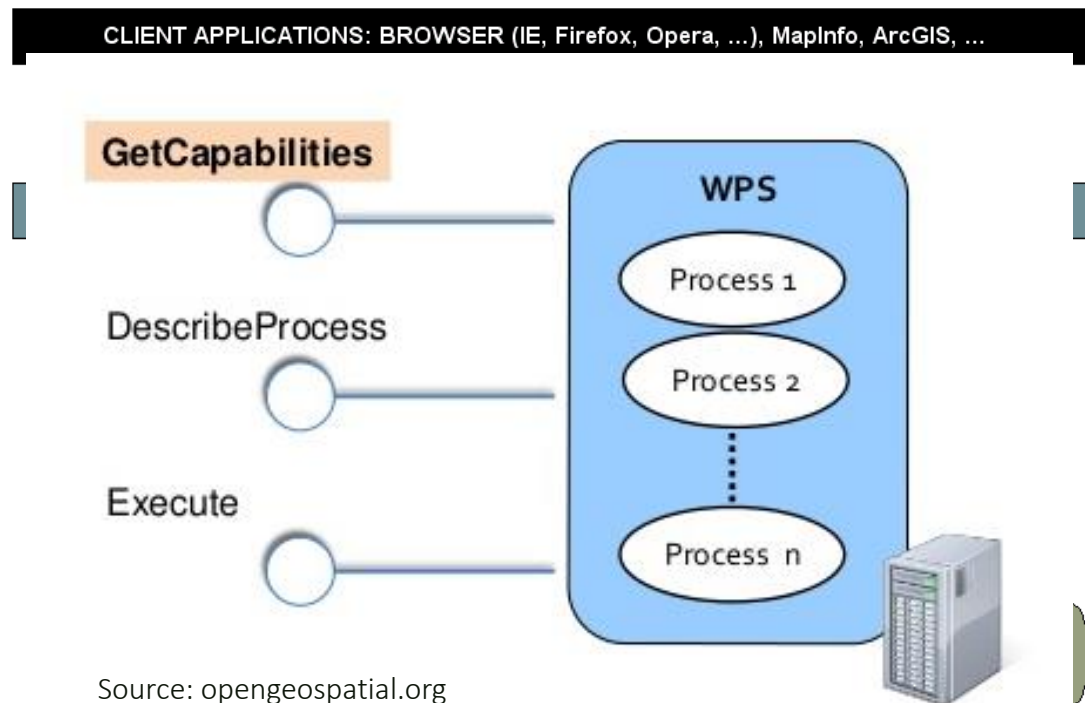
Together4Water Database architecture



Data visualization to understand



OpenGIS® Web Map Service
Interface (WMS)



Data standardization to share



WaterML 2.0:

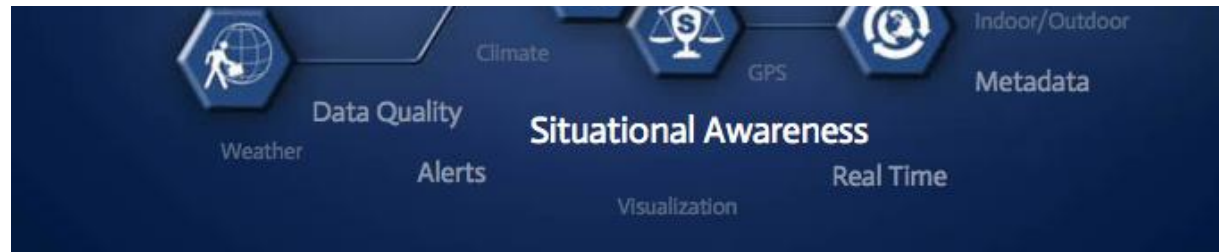
The importance of
Metadata, Exchanging,
and Open-source

```
<wml2:MeasurementTimeseries gml:id="xsd-measurement-timeseries-tvp.example">

  <gml:description>Example timeseries for XML encoding
  http://www.opengis.net/spec/waterml/2.0/req/xsd-timeseries-time-value-pair</gml:description>

  <wml2:metadata>
    <wml2:MeasurementTimeseriesMetadata>
      <wml2:temporalExtent>
        <gml:TimePeriod gml:id="time-period.1">
          <gml:beginPosition>2011-11-21T12:27:00+10:00</gml:beginPosition>
          <gml:endPosition>2011-11-21T12:30:00+10:00</gml:endPosition>
        </gml:TimePeriod>
      </wml2:temporalExtent>
      <wml2:baseTime>2011-11-21T12:27:00+10:00</wml2:baseTime>
      <wml2:spacing>PT1M</wml2:spacing>
    </wml2:MeasurementTimeseriesMetadata>
  </wml2:metadata>

  <wml2:defaultPointMetadata>
    <wml2:DefaultTVPMeasurementMetadata>
      <wml2:uom code="m"/>
      <wml2:interpolationType>
        xlink:href="http://www.opengis.net/def/waterml/2.0/interpolationType/Continuous"
        xlink:title="Instantaneous"/>
      </wml2:DefaultTVPMeasurementMetadata>
    </wml2:defaultPointMetadata>
```



Conclusions

- The Medjerda database moved from raw, scarce, and low quality data to robust and consistent information.
- Data quality is critical to meet the SDGs, in particular, SDG-6:
 - ✓ Efficient assessment
 - ✓ Accurate reporting
 - ✓ Reliable outcomes
- Data visualization and standardization are key elements to deliver high quality data, and to foster exchange of open-source information

What's next ...

2018 – Launch of the Citizen Science campaign in Tunisia to reinforce data availability in the near future ...

We involve : school students, NGO and a company (farmers and stakeholders).





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