

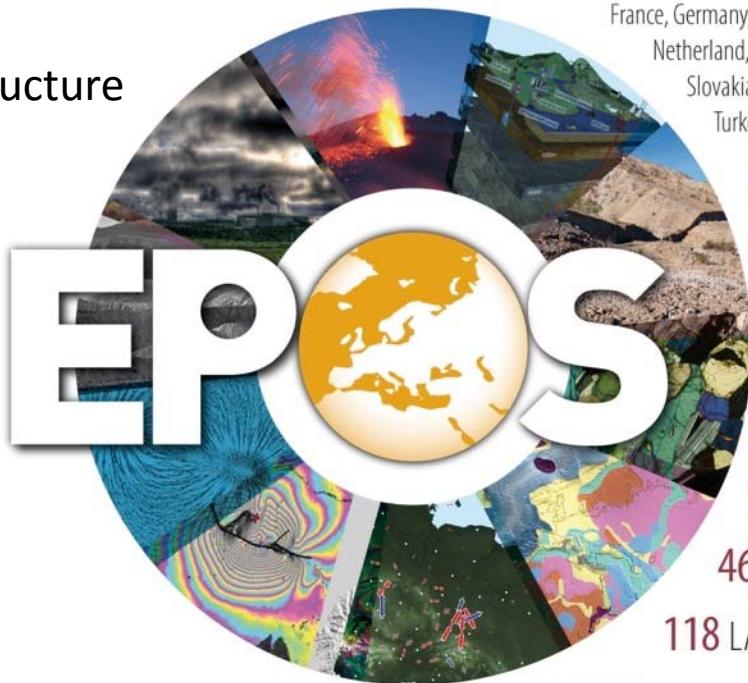
# A unique Index to serve all INSPIRE data associated to a Borehole

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# EPOS in a nutshell

- European Plate Observing System
  - [www.epos-eu.org](http://www.epos-eu.org)
  - European research infrastructure on solid earth science
  - Integrates the existing and future advanced European facilities into a single, distributed, sustainable infrastructure



## 25 COUNTRIES

Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Netherland, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom

## 4 INTERNATIONAL ORGANIZATIONS

Orfeus, Emsc, Euref, Intermagnet

## 256 NATIONAL RESEARCH INFRASTRUCTURES

## 4939 SEISMIC STATIONS

## 2272 GPS RECEIVERS

## 464 TB SEISMIC DATA

## 118 LABORATORIES

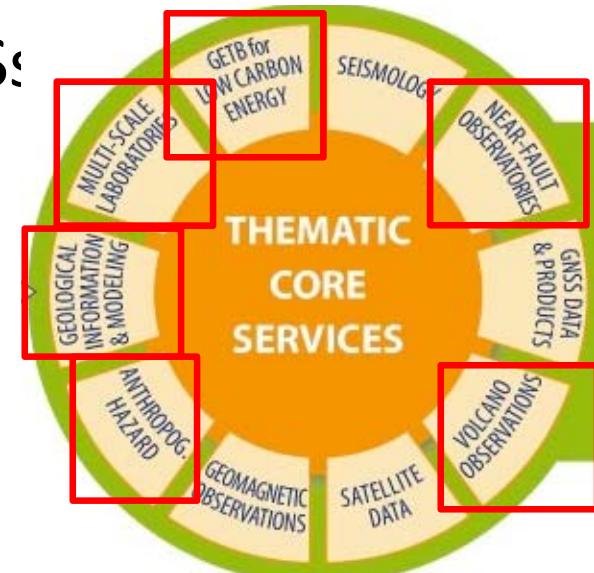
## 828 INSTRUMENTS

Several PetaBytes of solid Earth Science data will be available

Several thousands of users expected to access the infrastructure

# Borehole in EPOS

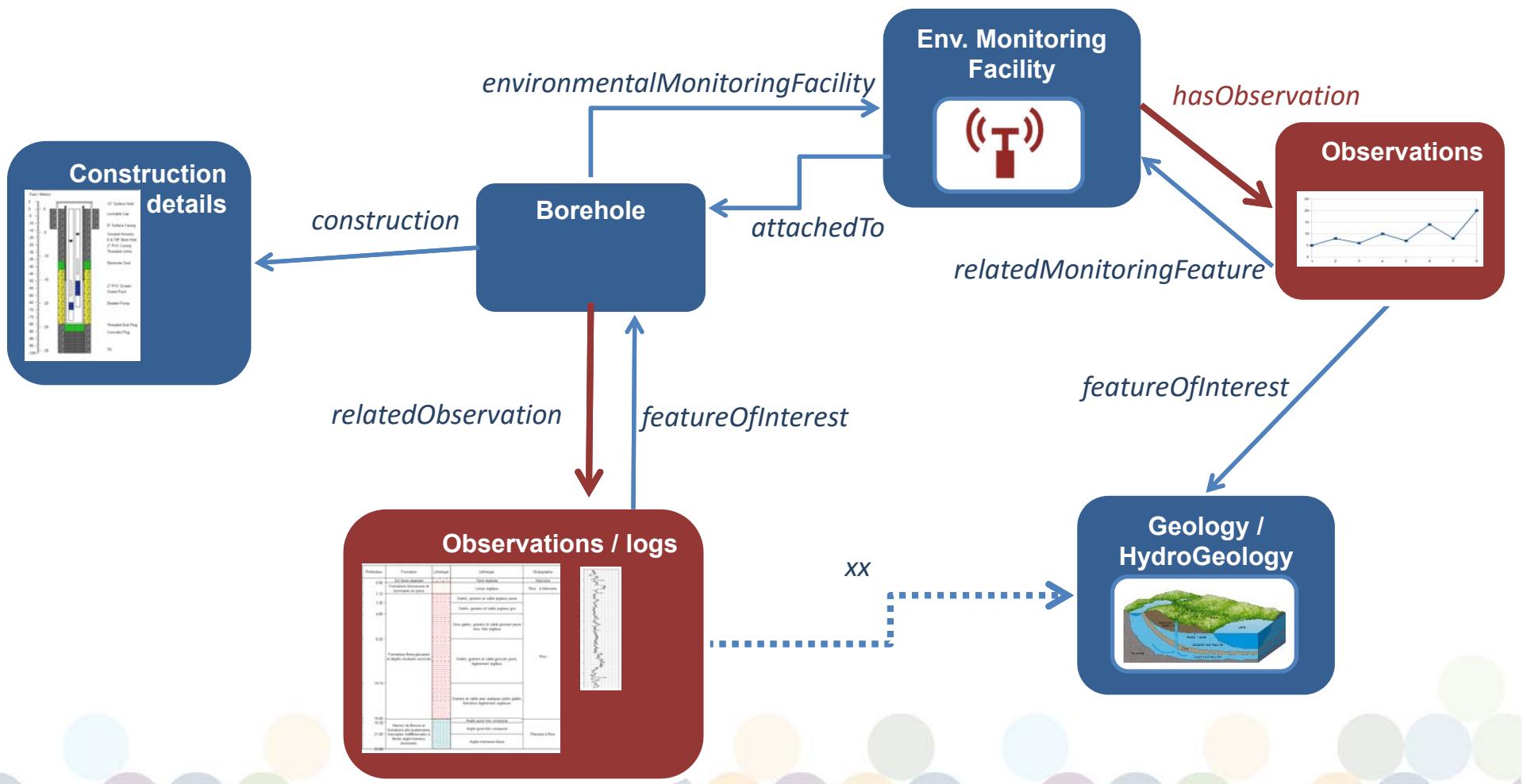
- Core notion for Thematic Core Service ‘Geological information and modelling’
- But also of interest for other TCS:
  - Near fault observatories,
  - Volcano observation,
  - Anthropogenic Hazards,
  - Multiscale Laboratories,
  - Geo-Energy,
  - ...



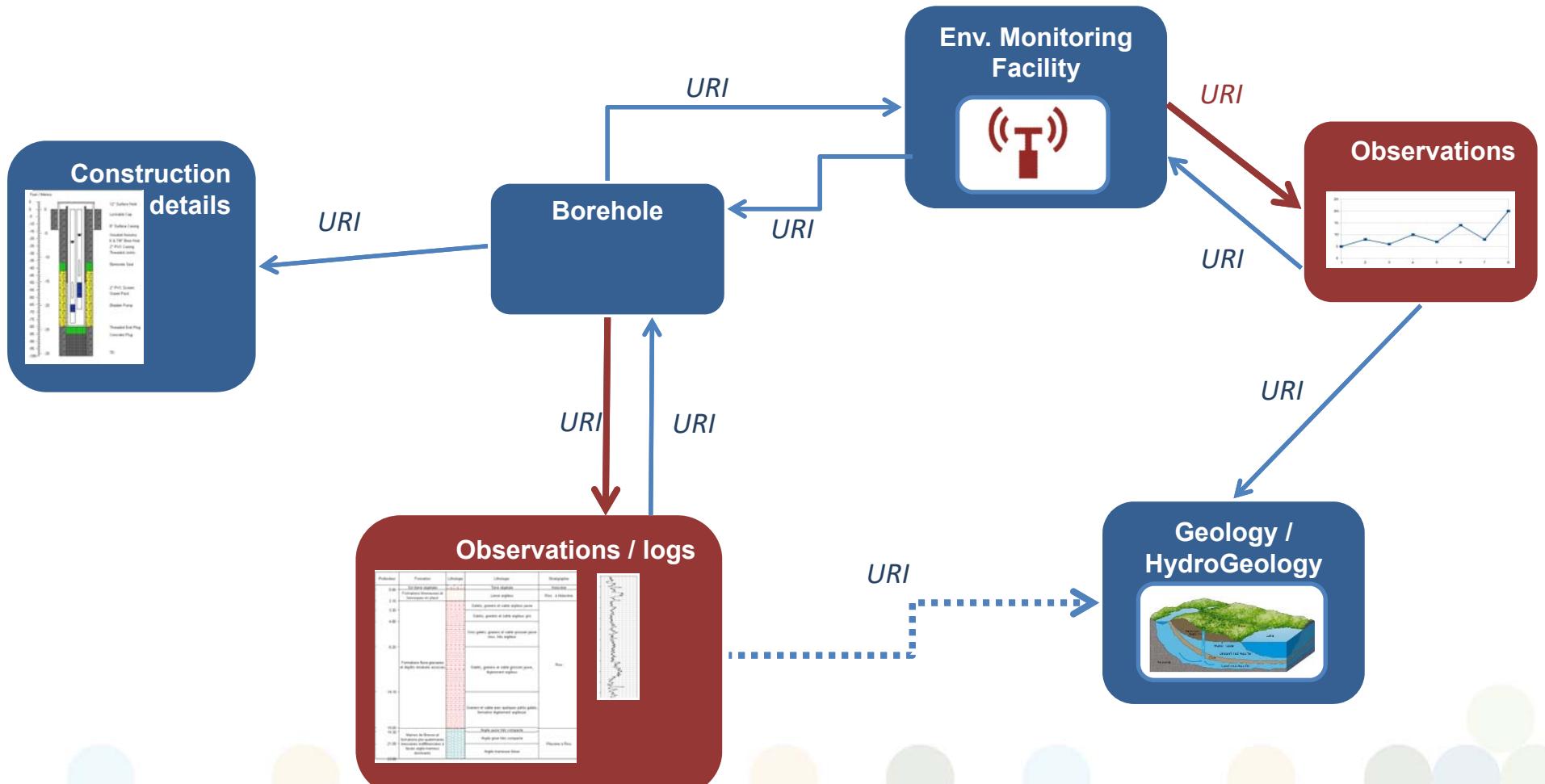
# Borehole in EPOS

- Objective: to provide a unique EU access point to search for Boreholes
  - Using “Summary borehole information”
  - and providing link to richer structured information flows
- IT approach
  - Not re-invent the wheel, try to re-use / extend pre-existing initiatives..
  - GeoSciML 4.1 Borehole View was extended with couple fields (still is Simple Feature SF-0)

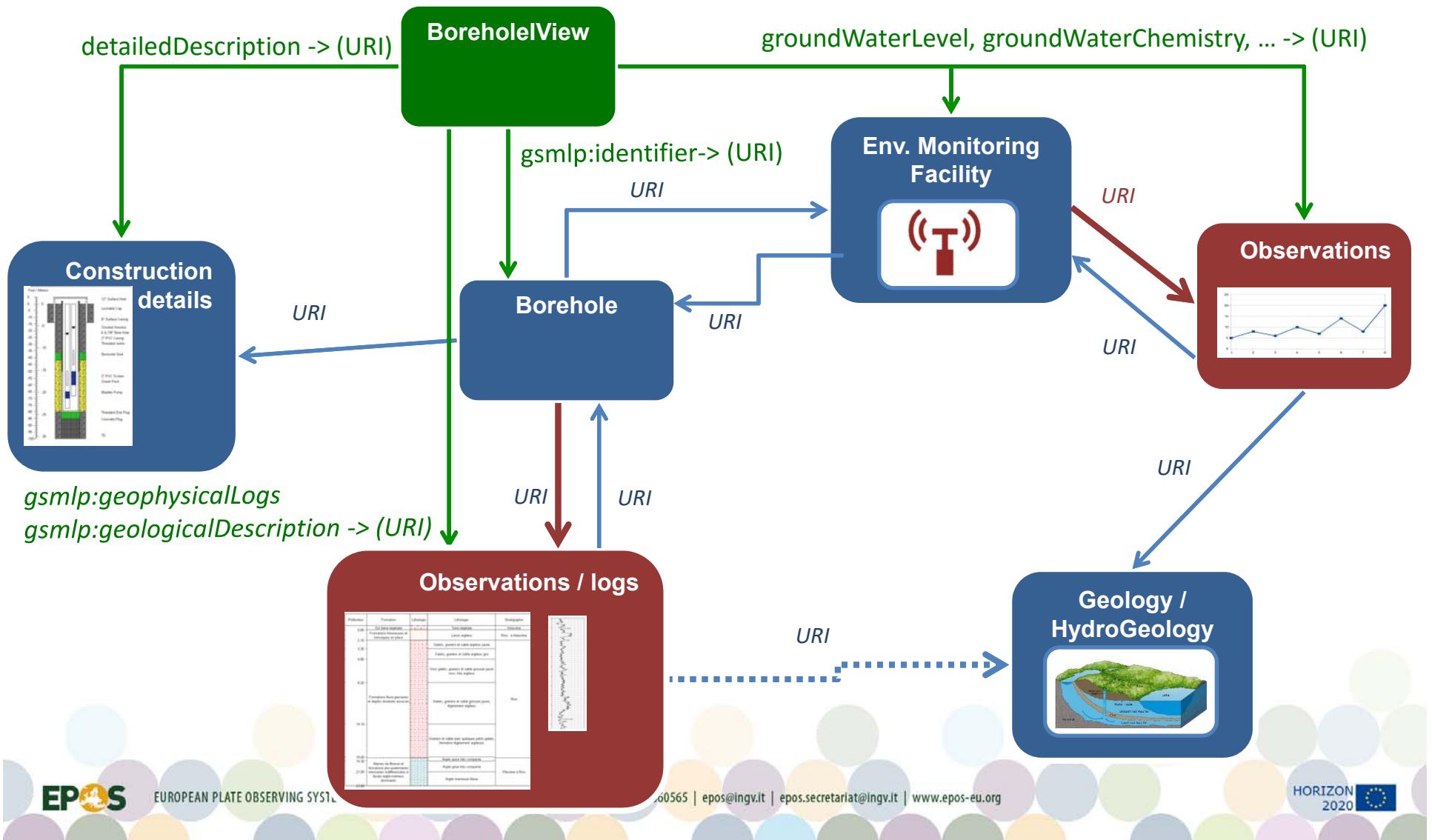
# Borehole in EPOS – Model View



# Borehole in EPOS – Resource View



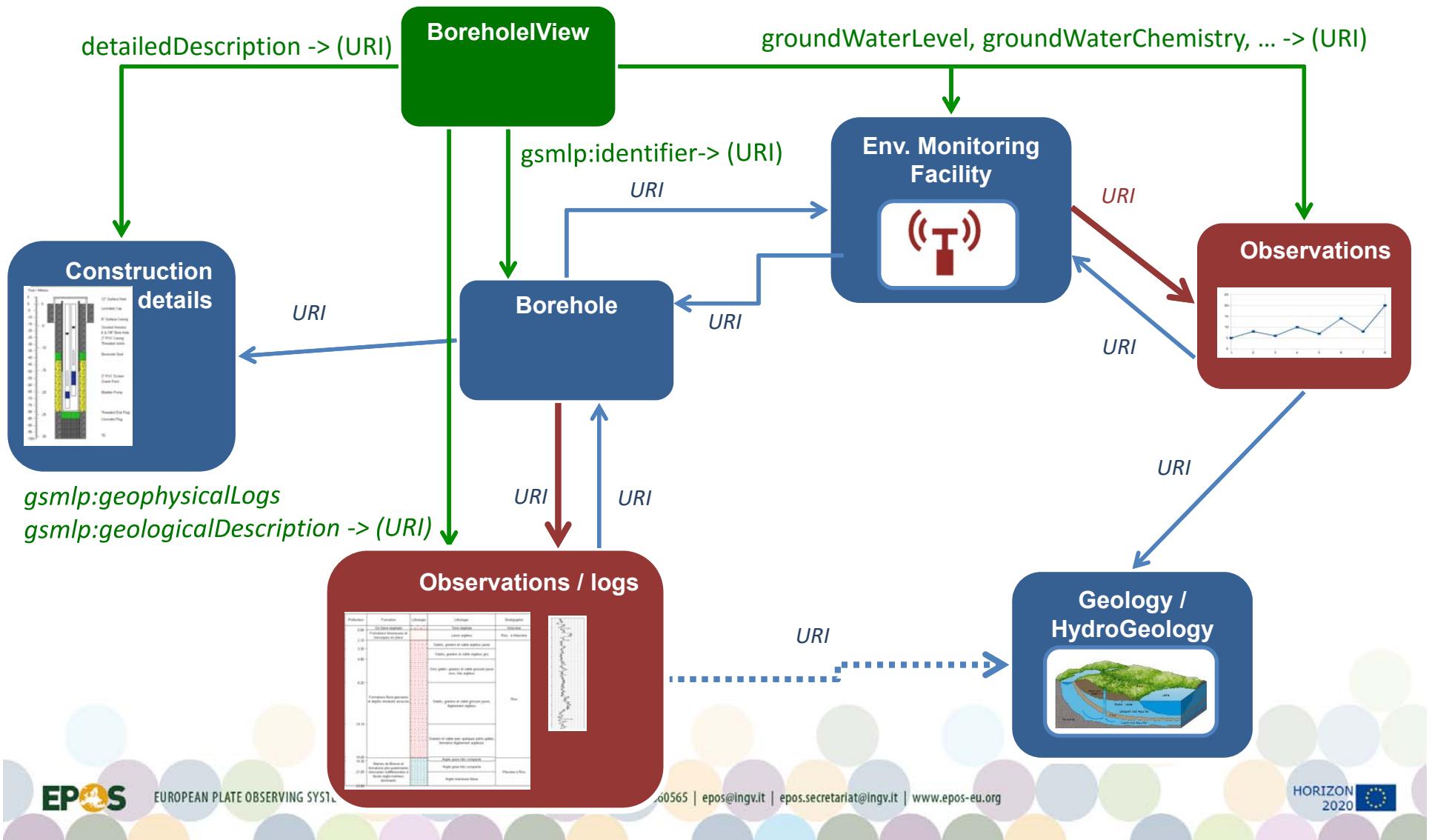
# Using the index as a quick look-up and shortcut to data flows



# Using the index as a quick look-up and shortcut to data flows

```
<wfs:FeatureCollection numberMatched="unknown" numberReturned="1" timeStamp="2017-09-05T07:42:27.003Z" xsi:schemaLocation="http://www.opengis.net/gml/3.2 http://schemas.opengis.net/gml/3.2.1/gml.xsd http://www.opengis.net/wfs/2.0/wfs.xsd https://forge.brgm.fr/svnrepository/epos/trunk/schemas https://forge.brgm.fr/svnrepository/epos/trunk/schemas/epos-lite.xsd">
  - <wfs:member>
    - <gsmlp:BoreholeView gml:id="BSS001REWW">
      <gml:description>Borehole description</gml:description>
      - <gml:identifier codeSpace="http://www.ietf.org/rfc/rfc2616">
          http://ressource.brgm-rec.fr/data/BoreholeView/BSS001REWW
        </gml:identifier>
      <gml:name>Forage BSS001REWW</gml:name>
      - <gsmlp:identifier>
          http://ressource.brgm-rec.fr/data/Borehole/BSS001REWW
        </gsmlp:identifier>
      <gsmlp:purpose xlink:href="http://inspire.ec.europa.eu/codelist/BoreholePurposeValue/hydrogeologicalSurvey" xlink:title="levé hydrogéologique, gestion de l'eau"/>
      <gsmlp:status xlink:href="http://resource.europe-geology.eu/vocabs/BoreholeStatus/drillingCompleted" xlink:title="drilling completed"/>
      <gsmlp:drillingMethod xlink:href="http://resource.europe-geology.eu/vocabs/DrillingMethod/hydraulic_rotary_drilling" xlink:title="hydraulic rotary drilling"/>
      <gsmlp:operator>BRGM (PIEZOMETRIE)</gsmlp:operator>
      <gsmlp:driller>INTRAFOR-COFOR</gsmlp:driller>
      <gsmlp:drillEndDate>1974-11-30Z</gsmlp:drillEndDate>
      <gsmlp:startPoint xlink:href="http://resource.europe-geology.eu/vocabs/BoreholeStartPoint/naturalLandSurface" xlink:title="natural land surface"/>
      <gsmlp:inclinationType xlink:href="http://resource.europe-geology.eu/vocabs/BoreholeInclinationType/vertical" xlink:title="vertical"/>
      <gsmlp:boreholeMaterialCustodian>unknown</gsmlp:boreholeMaterialCustodian>
      <gsmlp:boreholeLength_m uom="http://qudt.org/vocab/unit/M">23.0</gsmlp:boreholeLength_m>
      <gsmlp:elevation_m uom="http://qudt.org/vocab/unit/M">223.87</gsmlp:elevation_m>
      <gsmlp:elevation_srs>http://www.opengis.net/def/crs/EPSG/0/5720</gsmlp:elevation_srs>
      - <gsmlp:source>
          http://ficheinfoterre.brgm.fr/InfoterreFiche/ficheBss.action?id=06512X0037/STREMY
        </gsmlp:source>
      - <gsmlp:metadata_uri>
          http://www.geocatalogue.fr/Detail.do?fileIdentifier=BR_BSS_BAA
        </gsmlp:metadata_uri>
      <gsmlp:genericSymbolizer>Not provided</gsmlp:genericSymbolizer>
      + <gsmlp:shape></gsmlp:shape>
      <gsmlp:cored>false</gsmlp:cored>
      <gsmlp:accessToPhysicalDrillCore>false</gsmlp:accessToPhysicalDrillCore>
      <gsmlp:boreholeUse xlink:href="http://inspire.ec.europa.eu/codelist/BoreholePurposeValue/groundwaterLevelMonitoring" xlink:title="surveillance du niveau de la nappe phréatique"/>
      <gsmlp:detailedDescription xlink:href="http://www.opengis.net/def/nil/OGC/0/template" xlink:title="template "/>
      + <!-->
      <gsmlp:geophysicalLogs xlink:href="http://www.opengis.net/def/nil/OGC/0/unknown" xlink:title="unknown"/>
      <gsmlp:geologicalDescription xlink:href="http://ressource.brgm-rec.fr/obs/RawGeologicLogs/BSS001REWW" xlink:title="Borehole BSS001REWW geologic log available."/>
      <gsmlp:groundWaterLevel xlink:href="http://ressource.brgm-rec.fr/data/Piezometre/06512X0037/STREMY.2" xlink:title="Description of Piezometer attached to BSS001REWW. Provides link to SensorObservationService offering"/>
      <gsmlp:groundWaterChemistry xlink:href="http://www.opengis.net/def/nil/OGC/0/unknown" xlink:title="unknown"/>
      <gsmlp:rockGeochemistry xlink:href="http://www.opengis.net/def/nil/OGC/0/unknown" xlink:title="unknown"/>
      <gsmlp:poreGasChemistry xlink:href="http://www.opengis.net/def/nil/OGC/0/inapplicable" xlink:title="inapplicable"/>
      <gsmlp:geoTechnicalInfo xlink:href="http://www.opengis.net/def/nil/OGC/0/unknown" xlink:title="unknown"/>
      </gsmlp:BoreholeView>
    </wfs:member>
  </wfs:FeatureCollection>
```

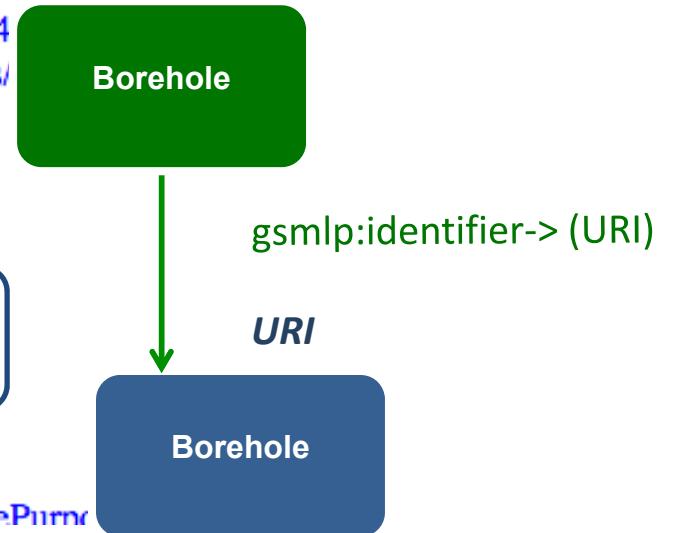
# Using the index as a quick look-up and shortcut to data flows



# Using the index as a quick look-up and shortcut to data flows

```
<wfs:FeatureCollection numberMatched="unknown" numberReturned="1084  
http://localhost:8080/epos/schemas/gml/3.2.1/gml.xsd http://www.opengis.net/wfs/  
https://forge.brgm.fr/svnrepository/epos/trunk/schemas/epos-lite.xsd">
```

```
- <wfs:member>  
  - <gsmlp:BoreholeView gml:id="ISPRA_rm_DBH_1">  
    <gml:description>GELA</gml:description>  
    - <gml:identifier codeSpace="http://www.ietf.org/rfc/rfc2616">  
      http://sgi2.isprambiente.it/eposLite/BoreholeView/ISPRA_rm_DBH_1  
    </gml:identifier>  
    <gml:name>ACATE 1 DIR</gml:name>  
  + <gsmlp:identifier></gsmlp:identifier>  
    <osmln:purpose xlink:href="http://inspire.ec.europa.eu/codelist/BoreholePurpo
```



**BoreholeIndex** has unique direct access to feature information

# Using the index as a quick look-up and shortcut to data flows

```
- <gsmlp:identifier>  
  http://sgi2.isprambiente.it/epos/Borehole/ISPRA_rm_DBH_1  
</gsmlp:identifier>
```

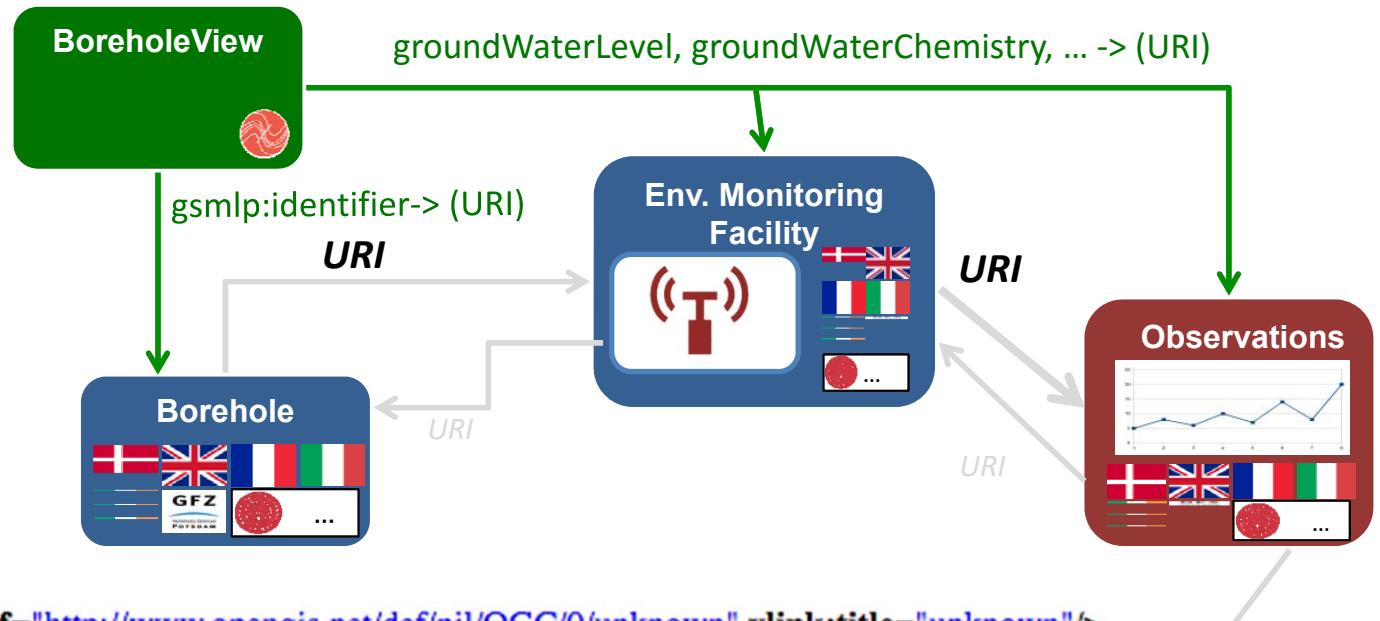
Borehole

**BoreholeIndex** has unique direct access to detail feature information

gsmlp:identifier-> (URI)

```
<wfs:FeatureCollection numberMatched="unknown" numberReturned="1084" timeStamp="2017-08-28T07:00:28.749Z" xsi:schemaLocation="http://www.opengis.net/gml/3.2  
http://localhost:8080/epos/schemas/gml/3.2.1/gml.xsd http://www.opengis.net/wfs/2.0 http://localhost:8080/epos/schemas/wfs/2.0/wfs.xsd https://forge.brgrm.fr/svnrepository/epos/trunk/schemas  
https://forge.brgrm.fr/svnrepository/epos/trunk/schemas/epos-lite.xsd">  
- <wfs:member>  
  - <gsmlp:BoreholeView gml:id="ISPRA_rm_DBH_1">  
    <gml:description>GELA</gml:description>  
    + <gml:identifier codeSpace="http://www.ietf.org/rfc/rfc2616"></gml:identifier>  
    <gml:name>ACATE 1 DIR</gml:name>  
    - <gsmlp:identifier>  
      http://sgi2.isprambiente.it/epos/Borehole/ISPRA_rm_DBH_1  
    </gsmlp:identifier>  
    <gsmlp:purpose xlink:href="http://inspire.ec.europa.eu/codelist/BoreholePurposeValue/hydrocarbonExploration" xlink:title="hydrocarbon exploration"/>  
    <gsmlp:status xlink:href="http://resource.europe-geology.eu/vocabs/BoreholeStatus/drillingCompleted" xlink:title="Drilling completed"/>  
    <gsmlp:drillingMethod xlink:href="http://resource.europe-geology.eu/vocabs/DrillingMethod/hydraulic_rotary_drilling" xlink:title="Hydraulic rotary drilling"/>  
    <gsmlp:operator>AGIP MINERARIA</gsmlp:operator>  
    <gsmlp:driller>AGIP MINERARIA</gsmlp:driller>  
    <gsmlp:startPoint xlink:href="http://resource.europe-geology.eu/vocabs/BoreholeStartPoint/seaFloor" xlink:title="seaFloor"/>  
    <gsmlp:inclinationType xlink:href="http://resource.europe-geology.eu/vocabs/BoreholeInclinationType/vertical" xlink:title="Vertical"/>  
    <gsmlp:boreholeMaterialCustodian>unknow</gsmlp:boreholeMaterialCustodian>  
    <gsmlp:boreholeLength_m uom="http://qudt.org/vocab/unit/M">3388.0</gsmlp:boreholeLength_m>  
    <gsmlp:elevation_m uom="http://qudt.org/vocab/unit/M">-3.0</gsmlp:elevation_m>  
    <gsmlp:elevation_srs>http://www.opengis.net/def/crs/EPSG/0/4326</gsmlp:elevation_srs>  
    <gsmlp:positionalAccuracy>unknow</gsmlp:positionalAccuracy>  
  + <gsmlp:source></gsmlp:source>  
    <gsmlp:metadata_uri>http://sgi.isprambiente.it/geoportal</gsmlp:metadata_uri>  
  + <gsmlp:genericSymbolizer></gsmlp:genericSymbolizer>  
  + <gsmlp:shape></gsmlp:shape>  
    <gsmlp:cored>false</gsmlp:cored>  
    <gsmlp:accessToPhysicalDrillCore>false</gsmlp:accessToPhysicalDrillCore>  
    <gsmlp:boreholeUse xlink:href="http://inspire.ec.europa.eu/codelist/BoreholePurposeValue/hydrocarbonExploration" xlink:title="hydrocarbon exploration"/>  
    <gsmlp:detailedDescription xlink:href="http://www.opengis.net/def/nil/OGC/0/template" xlink:title="template"/>
```

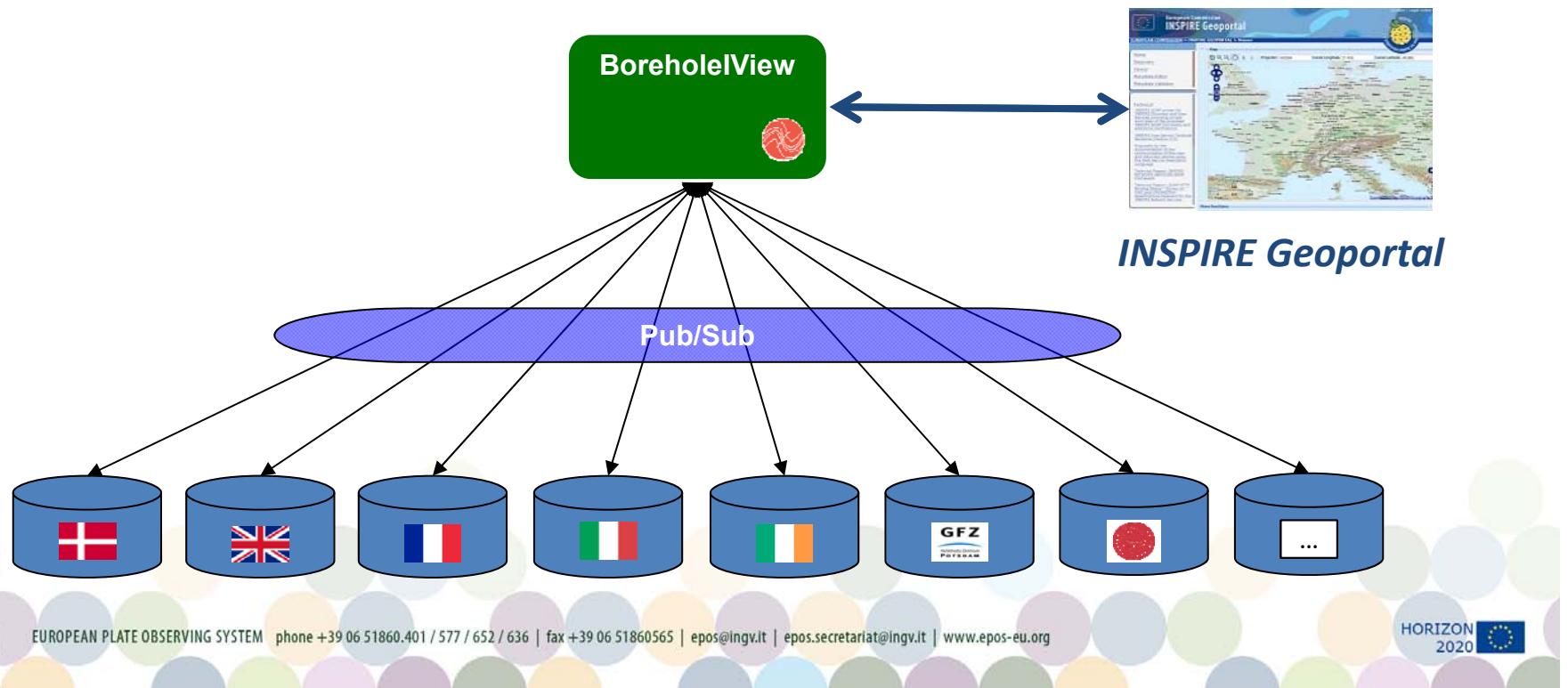
# Using the index as a quick look-up and shortcut to data flows



```
<gsmlp:geophysicalLogs xlink:href="http://www.opengis.net/def/nil/OGC/0/unknown" xlink:title="unknown"/>
<gsmlp:geologicalDescription xlink:href="http://ressource.brgm-rec.fr/obs/RawGeologicLogs/BSS001REWW" xlink:title="RawGeologicLogs/BSS001REWW"/>
<gsmlp:groundWaterLevel xlink:href="http://ressource.brgm-rec.fr/data/Piezometre/06512X0037/STREMY.2" xlink:title="Piezometre/06512X0037/STREMY.2"/>
```

# How do we feed the index ?

- Each institution maintains its Borehole summary info service
- Only those summary info are harvested at EU level
- The index is up-to-date thanks to a pub/sub approach



# Conclusions

- Exposing summary Information (simpleFeature) is easier/faster than complex Feature
  - Allows to add more data providers
- Harvesting simpleFeature is more reasonable than complex Feature
  - WFS on complexFeature is not meant/suited to synchronize millions of instances !
  - Harvesting a ‘Borehole vCard’ just for discovery makes more sense
- The Borehole index in turns points to National data flows
  - With respect to INSPIRE semantics
  - Just here to support discovery

# Perspectives

- ***Data provider***
  - Add more EU geological surveys and research partners
- ***IT***
  - EU Borehole Index entries now around 3 Million (this will grow)  
⇒ Need for faster WFS : Studying connexion of GeoServer app-schema with Sol'R index
- ***Having the index indexed by search engines***
  - => Exposing its content in (Geo)JSON-LD

# Thank you

