FINNISH METEOROLOGICAL INSTITUTE

Serving Coverage Data in FMI Open Data Portal

Finnish Meteorological Institute

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FMI Open Data

Finnish Meteorological Institute opened its data in 2013.

Basically everything that FMI has property rights was opened.

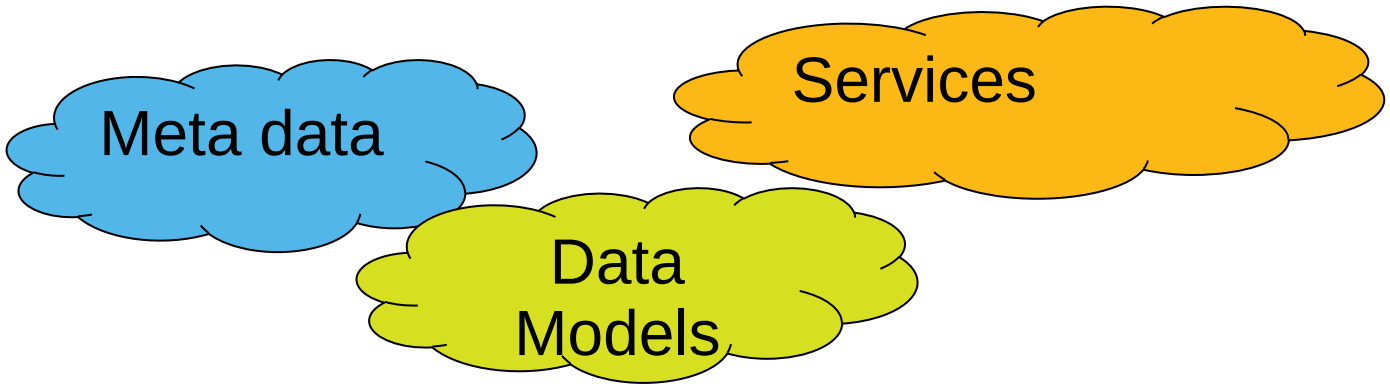
Data is provided in freely in machine readable format.

FMI OPEN DATA

https://en.ilmatieteenlaitos.fi/open-data

FMI Open Data Portal

FMI Open Data Portal follows INSPIRE requirements.



The very same data portal works as Open Data and INSPIRE portal.

Example of Data Sets

Data set	Description	Time Interval	Estimated publish date
Weather Observations	Temperature, Wind, Humidity, Ground Temperature…	10 min	Open, older data to be added
Sun Radiation	UV, Short and Long Term Radiation…	1 min	Open
Marine Observations	Waves, Sea Temperature, Sea Level…	1 h	Open
Weather Radars	**Precipitation Rate, Precipitation Amount…**	**5 min**	**Open, older data to be added**
Lightning	Thunder Strikes in Finland	5 min	Open

Example of Data Sets

Data set	Description	Time Interval	Estimated publish date
Real Time Observations	Real Time Observations from specific location(s)	AWS 2010 – Soundings 1959 – Flashes 1998 – Sea Level 1971 – Waves 2005 –	Open *older data will be added*
Climatological Observations	Dayly and monthly temperature mean and extreme values from weather stations	1959 -	Open
Climatological Observations	**Monthly temperature and precipitation rate mean values interpolated to grid**	**1961 -**	**Open**
Climatological Reference	Climatological Reference. Temperature, humidity, pressure, precipitation amount and snow depth.	Reference seasons: 1971-2000 1981-2010	Open

Example of Data Sets

Data set	Description	Time Interval	Estimated publish date
Weather forecast model HIRLAM RCR	**Point forecasts and grid data**	**Latest model run (4 times a day) 0…54 h**	**Open**
Sea forecast models	**Sea level point forecasts, Wave (WAM) and current (HBM) as grid data**	**Latest model run (4 times a day) 0...54 h**	**Open**
Environmental Monitoring Facilities	Weather observation stations, radars…		2015
Aviation Observations	METAR	30 min	open
Ground & mast observations	Special observations from ground and masts		2016 /Open

Example of Data Sets

Data set	Description	Time Interval	Estimated publish date
Air Quality Observations	Air Quality Observations	1h	2015-2016
Silam Model	**Dispersion Model for Air Quality, Forest Fire and Pollen**	**Latest model run (once a day) 0…96h**	**2015**
HELMI Ice Model	**Ice forecast model**	**Latest model run (4 times a day) 0...54 h**	**open**
Soundings	Temperature, Humidity, Pressure, Wind from ground to 25 km height	2 times a day	2015
Road Weather Observations (LIVI)	Road Weather Observations	10 min	open

View Service (WMS)

- Based on GeoServer
- Only the most common layers published

Catalog Service (CSW)

- Based on GeoNetwork

Download Service (WFS 2.0)

- Web Feature Service (WFS) 2.0 Simple Profile
- Based on stored queries
  - Predefined data sets with possibility for additional parameters (i.e. time and area)
- In-house production

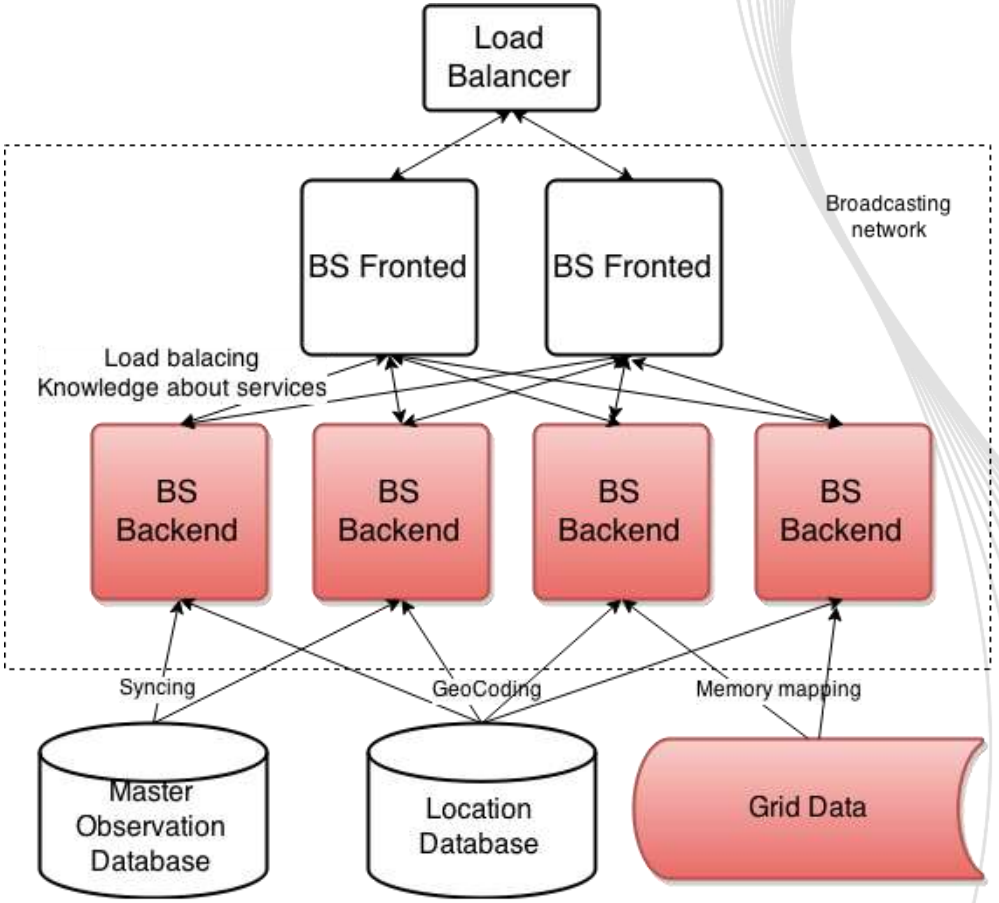
Data Models

- Observations and point forecasts as GML
  - The same data is published in:
    - MultiPointCoverage
    - MeasurementTimeSeries
    - SimpleFeature
- Gridded data is provided in appropriate binary format (Grib, NetCDF, GeoTiff…)
  - WFS members contains the metadata ‘envelope’ with a link to a actual data

Download Service

Data Services

- Supported data formats:
  querydata (FMI internal)
    - Ready tools for converting other formats (grib, netcdf, hdf…) to querydata
- Memory-maps the data from NFS
- Serves both point data grid data
    - Supports both spatial and temporal
      interpolation and nearest point selection



Download Service

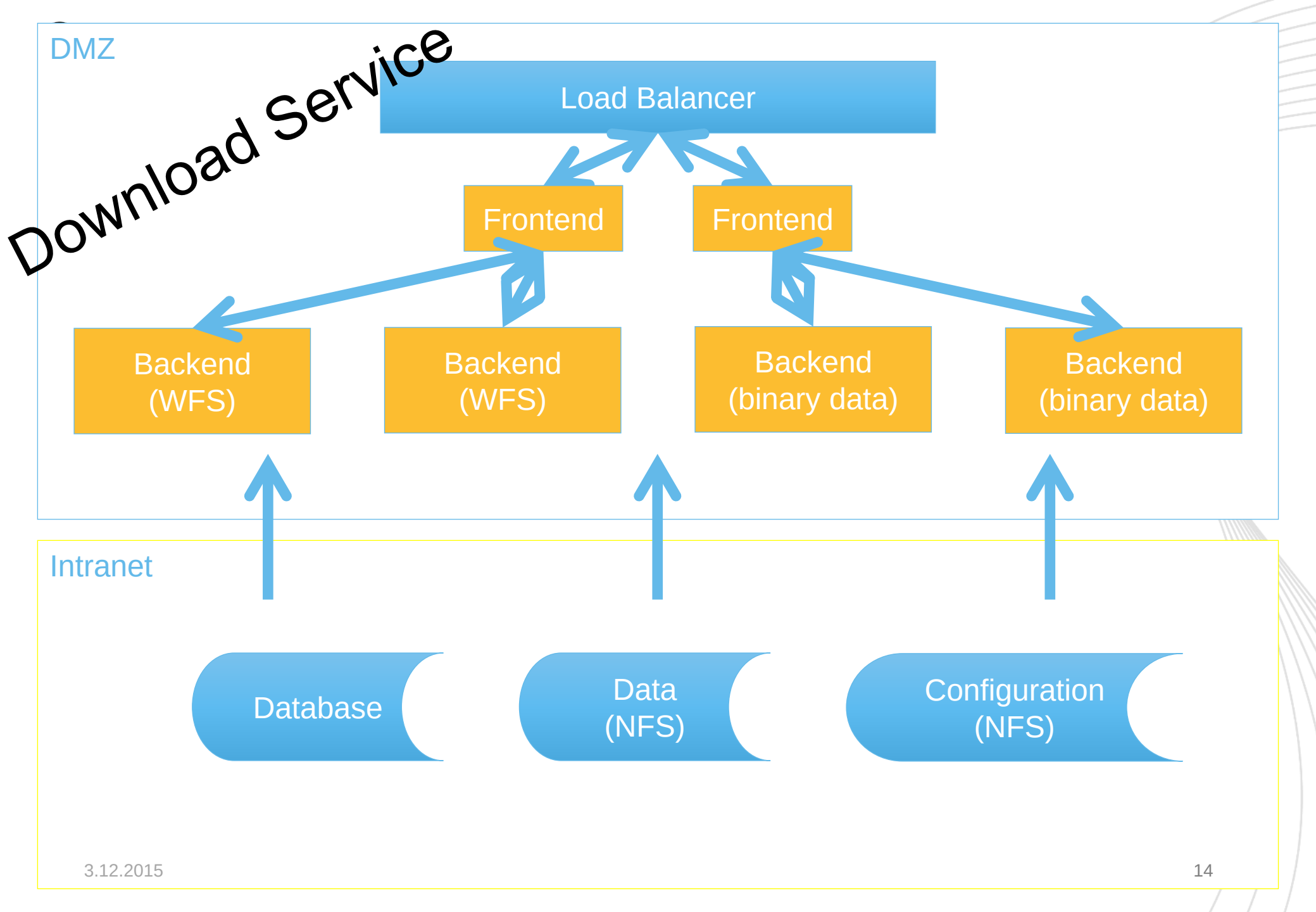
Download Plugin (WCS-like)

- Provides grid data as binary data
- Supported output formats: *GRIB1*, *GRIB2*, *NetCDF* and Querydata,
- Supports all proj.4 projections (depends on output format support)
- Supports slicing by
  - area (bbox)
  - elevation (pressure and/or model level)
  - time (start time, end time and origin time)
- Possibility to define grid resolution by
  - selecting every Nth grid point to x and y direction
  - grid size → data is interpolated to new grid points

Q3 (WPS-like)

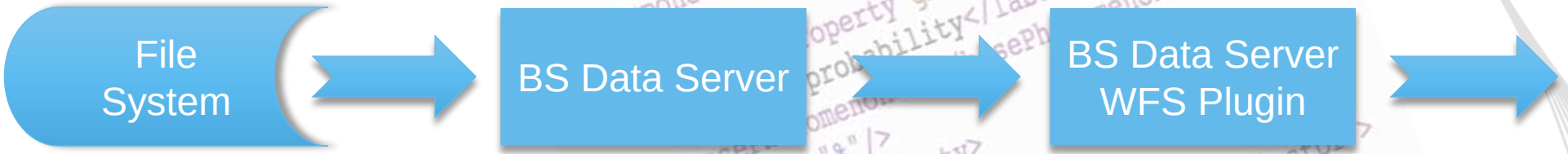
- Provides service to process the data and return output as data or image
- Input: LUA scripts
- Output formats
  - Matrix as text
  - Matrix as binary (querydata)
  - JSON
  - Contoured images: *svg*, *png, jpeg, pdf*

```
local param= T
local limit= 0

local r,err= HIR{ hybrid=true, params={param,Z,P} }
assert(r,err)

-- Iterate levels from down to up
-- Store height and pressure when >= 'limit' (last will remain)

local m_Z= matrix()  -- heights collected; originally all 'nan'
local m_P= matrix()  -- pressures collected
local m_v= matrix()  -- value at such positions (not needed)

for g in grids_by_level(r) do
  for pos,v in points(g[param]) do
    if v>=limit then
      m_Z[pos]= g.Z[pos]
      m_P[pos]= g.P[pos]
      m_v[pos]= v
    end
  end
end
return m_Z, m_P, m_v
```


DMZ
Download Service
Load Balancer
Frontend
Frontend
Backend (WFS)
Backend (WFS)
Backend (binary data)
Backend (binary data)
Intranet
Database
Data (NFS)
Configuration (NFS)

Producing INSPIRE Data Products

Point Forecasts



Forecast model data

Memory mapped data. Server provides logic for interpolation the data for requested area and time.

On-the-fly formatting (based on template)

INSPIRE compliant XML response

Producing INSPIRE Data Products

Grid Forecasts 1/2

Forecast model data

Server provides relevant meta data to fetch the data content

On-the-fly formatting (based on templates)

INSPIRE compliant XML response containing meta data and link to binary data

Producing INSPIRE Data Products

Grid Forecasts 2/2

Forecast model data

Memory mapped data. Server provides logic for interpolation the data for requested area and time.

Format the data to requested format and projection.

Binary data

Producing INSPIRE Data Products

Radar Images 1/2

GeoServer Image Mosaic plugin database

Server provides relevant meta data to fetch the data content

On-the-fly formatting (based on templates)

INSPIRE compliant XML response containing meta data and link to binary data

Producing INSPIRE Data Products

Radar Images 2/2

GeoServer
Image Mosaic plugin
database

GeoServer WMS

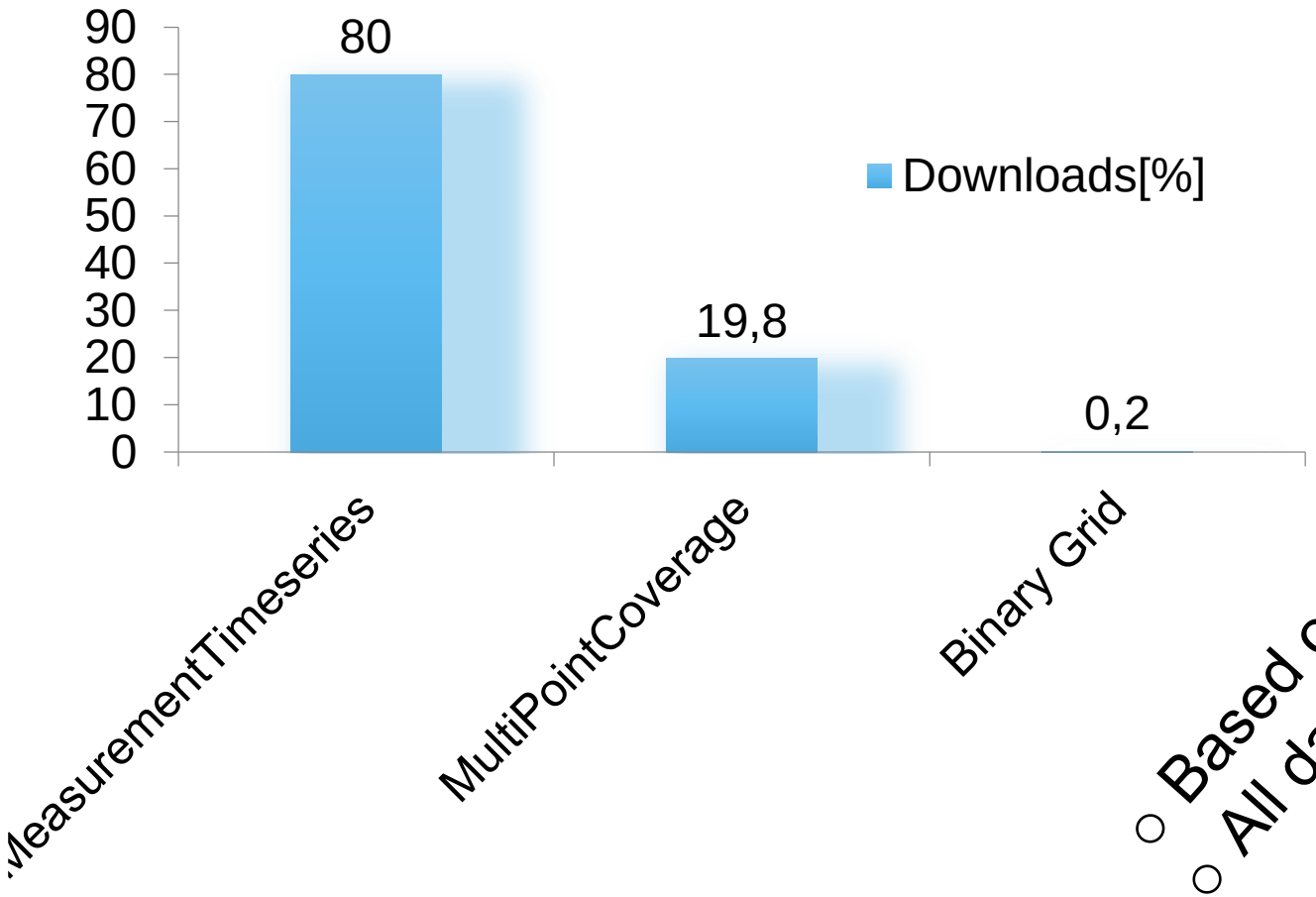
Raw black and white
GeoTiff images so that
there's no information lost.
(User may still request
images as colored png)

Some Experiences

At the moment about 7200 registered users

And a little over 430 000 data downloads per day (5 req/s)

Data Models Popularity Comparison



- Based on one month data (04/2014)
- All data sets combined

Some Experiences

Although standards are followed, there's a gap between provided data model and clients' capabilities

INSPIRE is a long project. Better to look forward than backward

Hard Parts

Multiple data formats are required

Converting everything to one data format is complicated, time consuming and expensive.

Hard Parts

Handling parameters is one of the hardest parts.

Names, units, levels, time intervals…

Hard Parts

Multidimensional data is hard to handle

- Data is often 5 dimensional with irregular grid and time intervals

Hard Parts

Data need to be transferred in chunked encoding (requires HTTP 1.1)

There's no always support for HTTP 1.1. (in clients, proxies, load balancers…)

Lessons learned

Supporting several projections for the data is vital.

For example many weather models are calculated in rotated lat-lon. Grids are often irregular

Lessons learned

There have to be some way for client to check if new data exists

Data is updated often but not regurarly

Lessons learned

It might be good idea to require some pub/sub functionalities in INSPIRE contexts

New standard but quite simple to implement

http://www.slideshare.net/tervo/
https://en.ilmatieteenlaitos.fi/open-data

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www.fmi.fi