FINNISH METEOROLOGICAL INSTITUTE

SmartMet Server
Providing MetOcean Data

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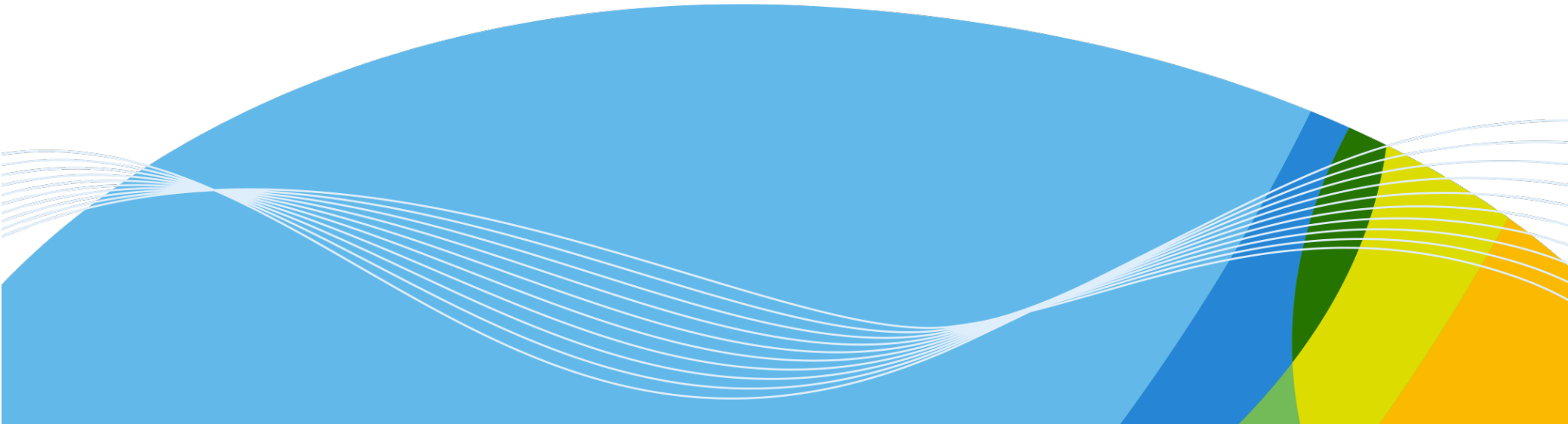
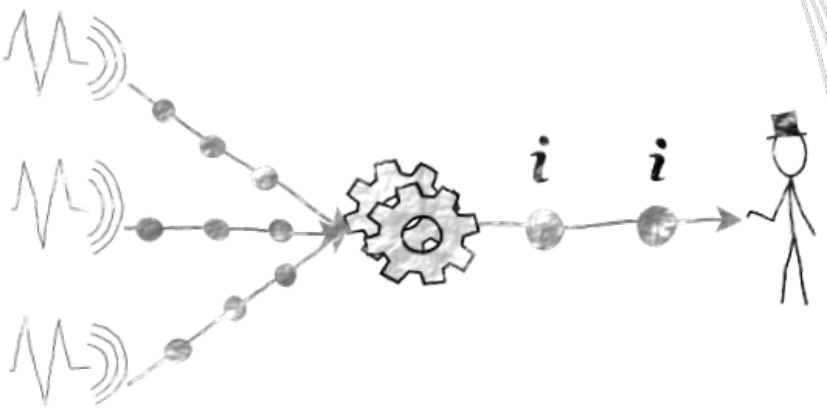


In a Nutshell

- Data and product server for MetOcean data
- High capacity & availability
  - FMI installation handles over 30 000 000 requests each day
- Data is extracted and products generated on-demand
- INSPIRE Compliant
- Operative since 2008
  - FMI client services (since 2008)
  - Finnish Meteorological Institute (FMI) Open Data Portal (since 2013)
  - Going to be used at Copernicus C3S Climate Data Store (ECMWF)
- Open source

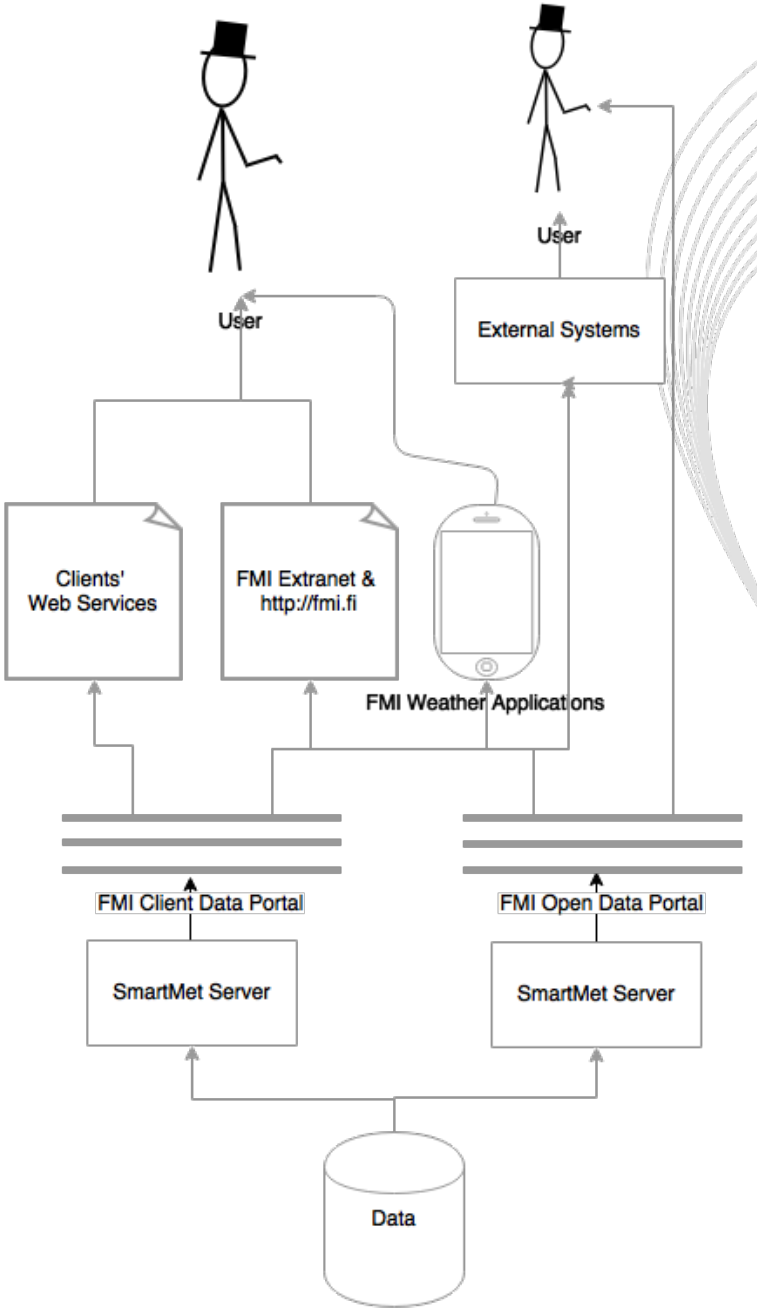
In a Nutshell

- Several input sources
  - GRIB-, NetCDF-, etc. files (multi-dimensional grid data)
  - PostGIS database (vectors)
  - Point database (point observations)
- Several output interfaces and formats
  - WMS, WFS 2.0
  - JSON, XML, ASCII, HTML, SERIAL
  - GRIB1, GRIB2, NetCDF



Usage

- Basis of most FMI product generation



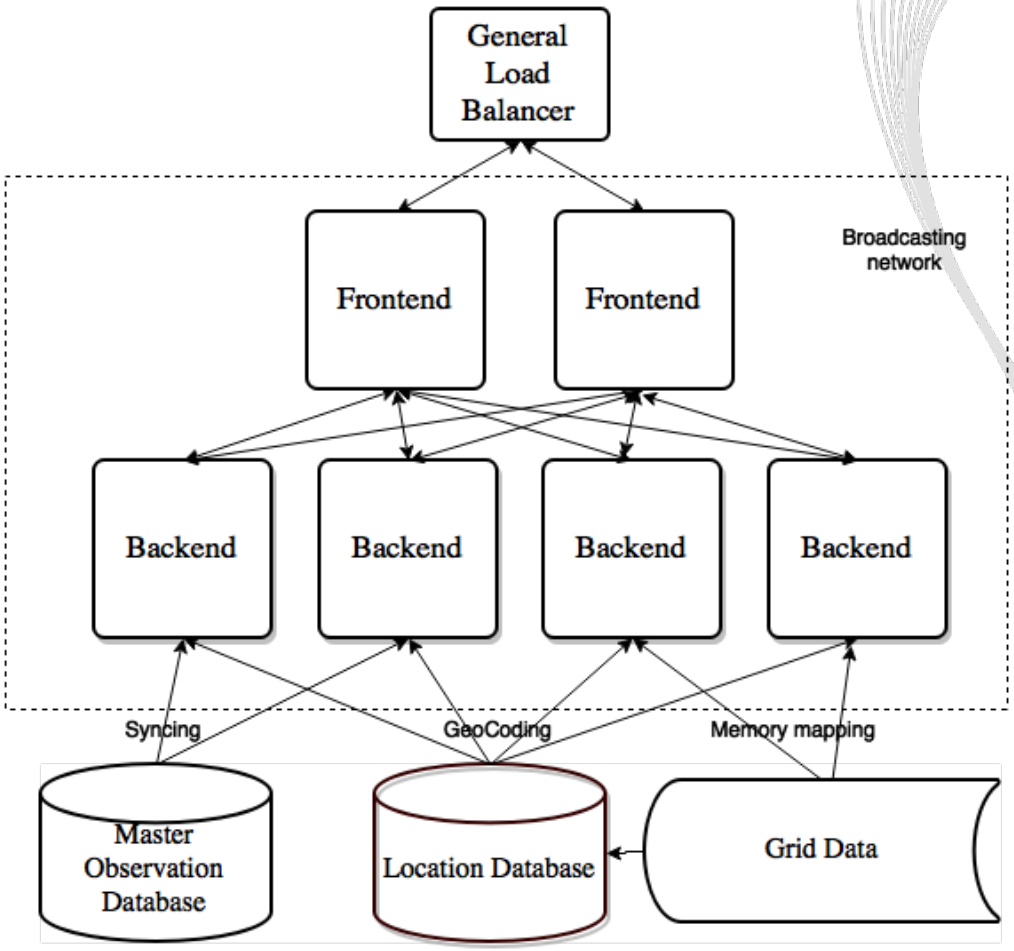
Open Source

- Published in 2016 in GitHub
  - https://github.com/fmidev/smartmet-server
- MIT Licence
- Documentation in GitHub

- FMI will host the development
  - Small contributions with pull requests
  - In larger contributions, implementation plan is recommended (in GitHub wiki)
  - CLA (Contributor Licence Agreement) will be required

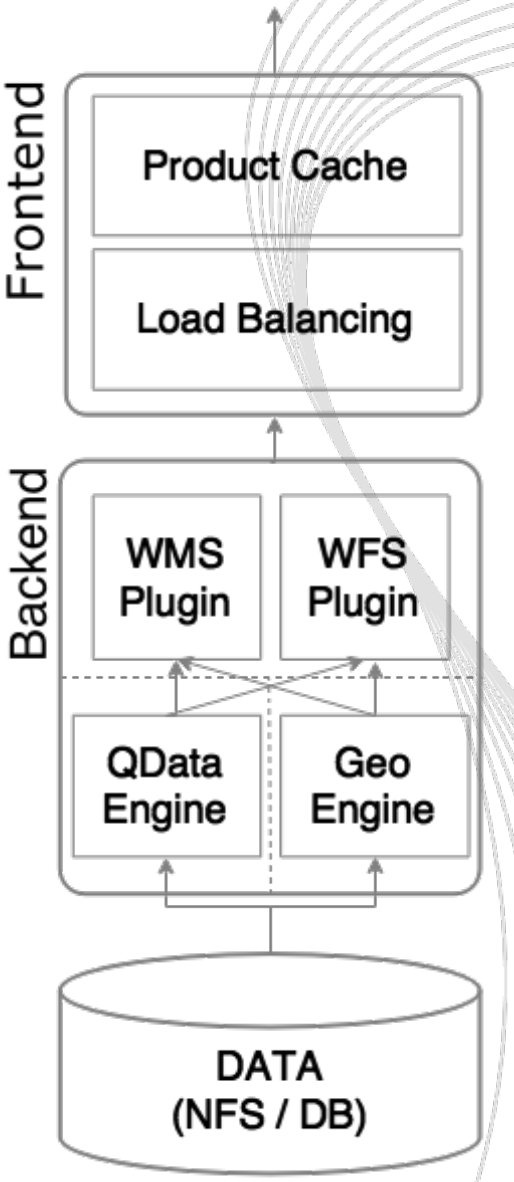
Architecture

- Frontend
  - Load balancer
  - Knowledge about backend services
- Backend
  - Different backends may contain different services
- Plugin-based architecture
  - *Engines* provide shared access to the data
  - *Plugins* provide services (APIs) built upon engines



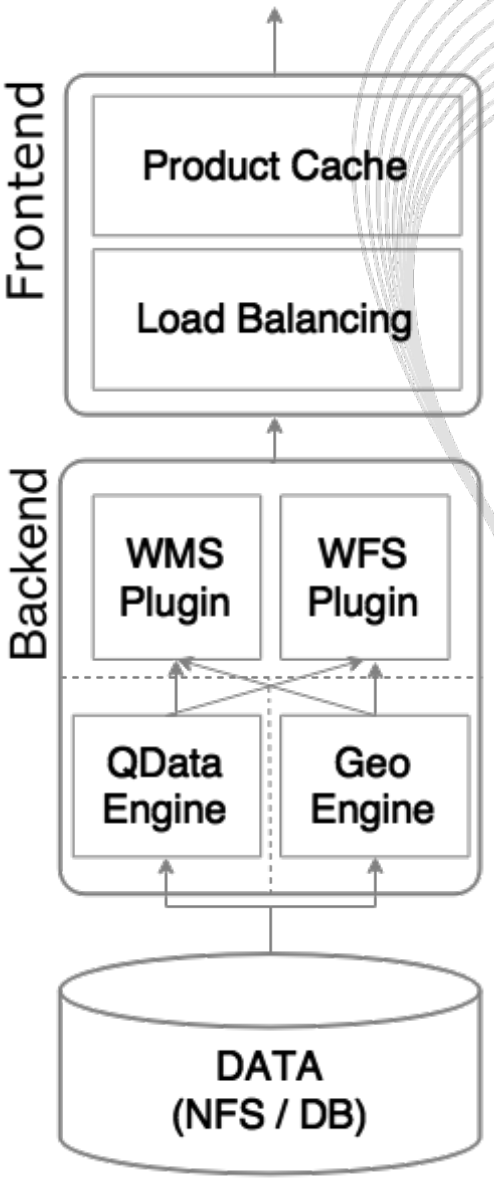
Most Important Components

- Frontend
  - Provides HTTP 1.1 server
  - Monitors status of backend services and provides load balancing
  - Provides LRU product cache
- Data Engines (providing C++ API)
  - Querydata engine provides access to the grid data
  - Observation engine provide access to the point data in database
  - Geonames and gis engines provide geolocation information



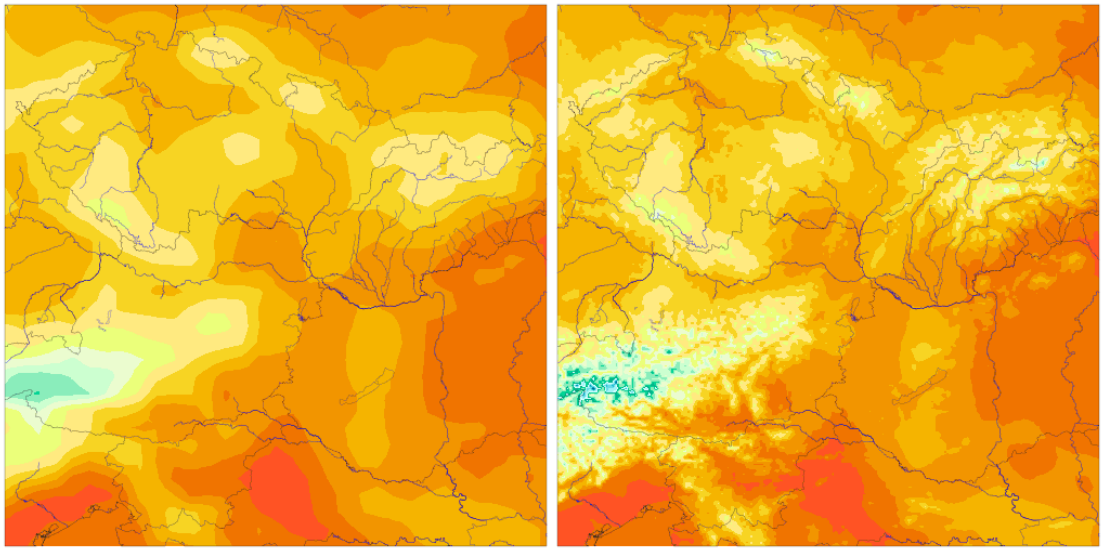
Most Important Components

- Plugins (providing HTTP API)
  - **WMS**: Generates SVG images from grid data on-demand, which are rendered to requested raster format
  - **WFS**: Point data output for grid data and observations
  - **Timeseries:** Custom point data interface with support for aggregate values over time and area
  - **Download / WCS:** Grid data output



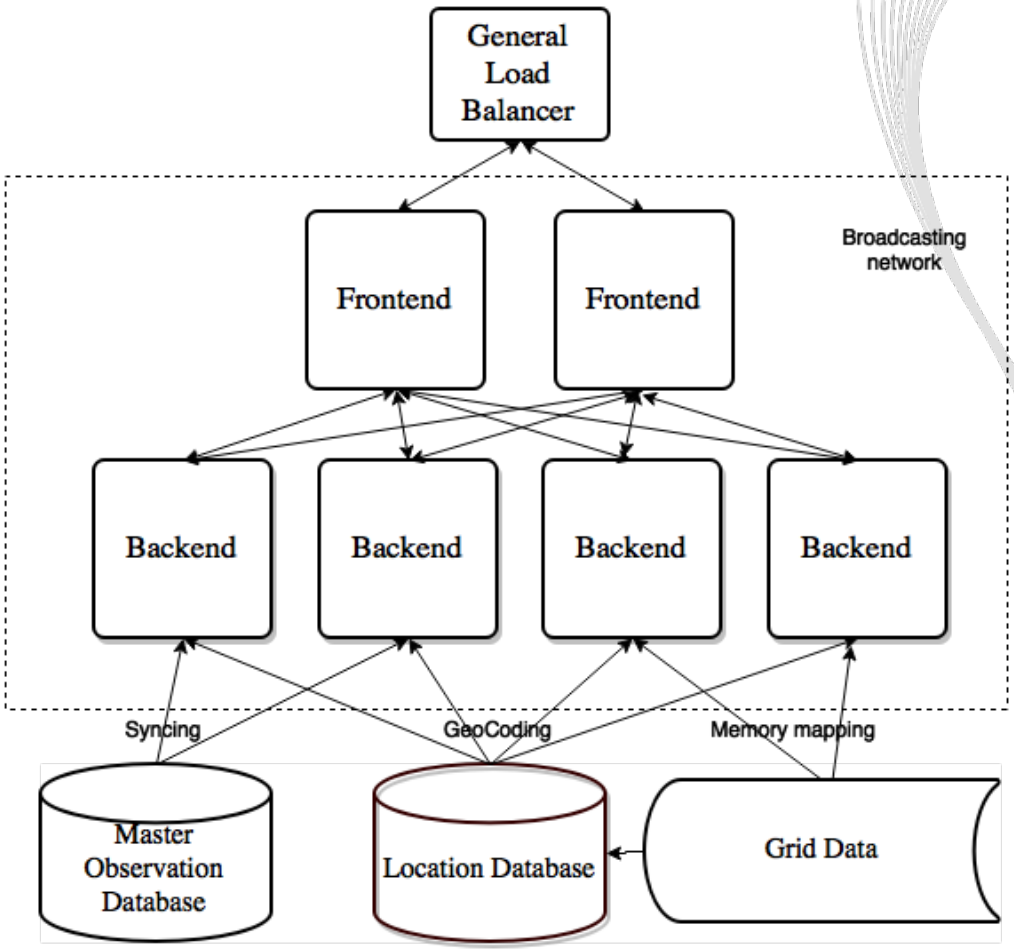
Post-Processing Capabilities

- Corrects the data based on accurate DEM (up to 30 meter resolution) and land/water information
- Calculates derivative parameters
- Support for aggregate values over time and area



FMI Setup
In 2016

- 2 frontends
  - RAM: 256G
  - CPU: 24x 2.10GHz
  - OS: RHEL7
- 5 backends
  - RAM: 12G
  - CPU: 24x2.50GHz
  - OS: RHEL7
- Load Balancer
  - F5 BIG IP 11



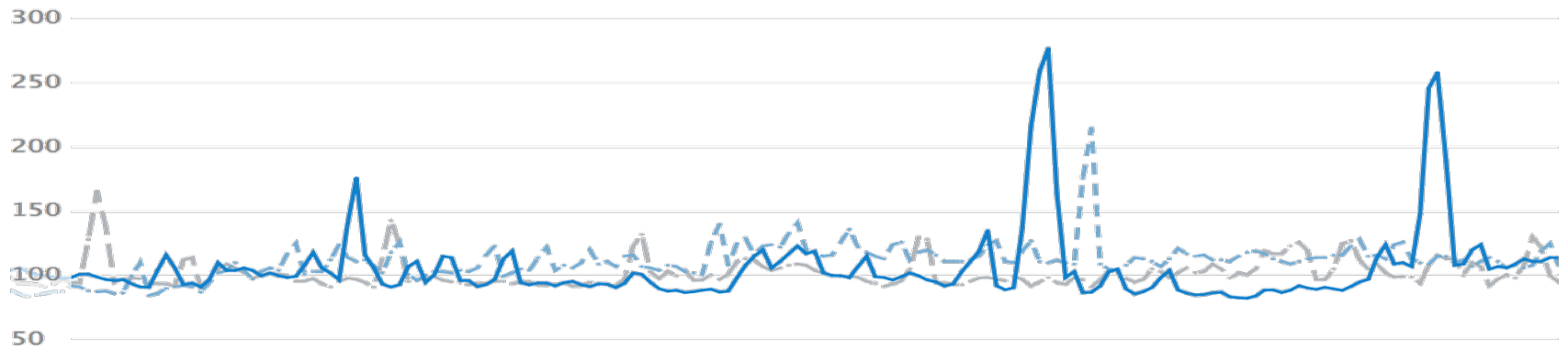
Performance
Production (FMI Setup)

Typical load

- > 30 000 000 req/day
- Baseline 200 req/s
- Peaks over 650 req/s

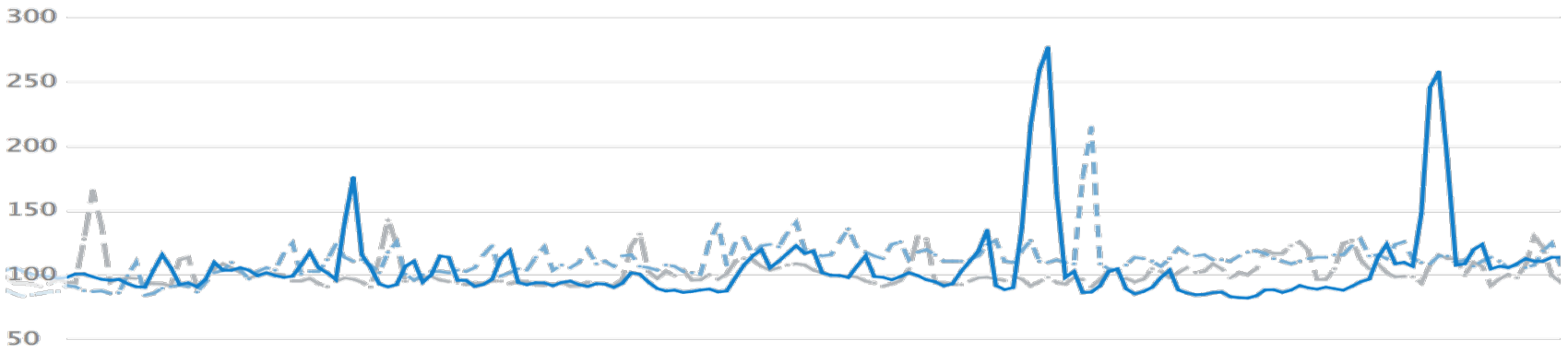
Average response times

WFS	140 ms/req
WMS	130 ms/req
Timeseries	30 ms/req
Autocomplete	4 ms/req



Performance
Load Tests (Production Setup)

- Scenario based on operative use at FMI
- Peaks over 4300 req/s
- Avg 173 ms, 95% of responses in 244 ms, median 54 ms
- Possibly heavy data requests require QoS management
    - Independent queues for slow and fast queries



Roadmap

Native GRIB and NetCDF support for input data

Support for GRIB and NetCDF data as input data without converting data to internal data format

Clustering support over Internet

Possibility to provide data from it's original source via single API (*bring users to data*)

WCS support

Implement WCS interface for download plugin

https://github.com/fmidev
https://en.ilmatieteenlaitos.fi/open-data

http://roopetervo.com
http://www.slideshare.net/tervo

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