

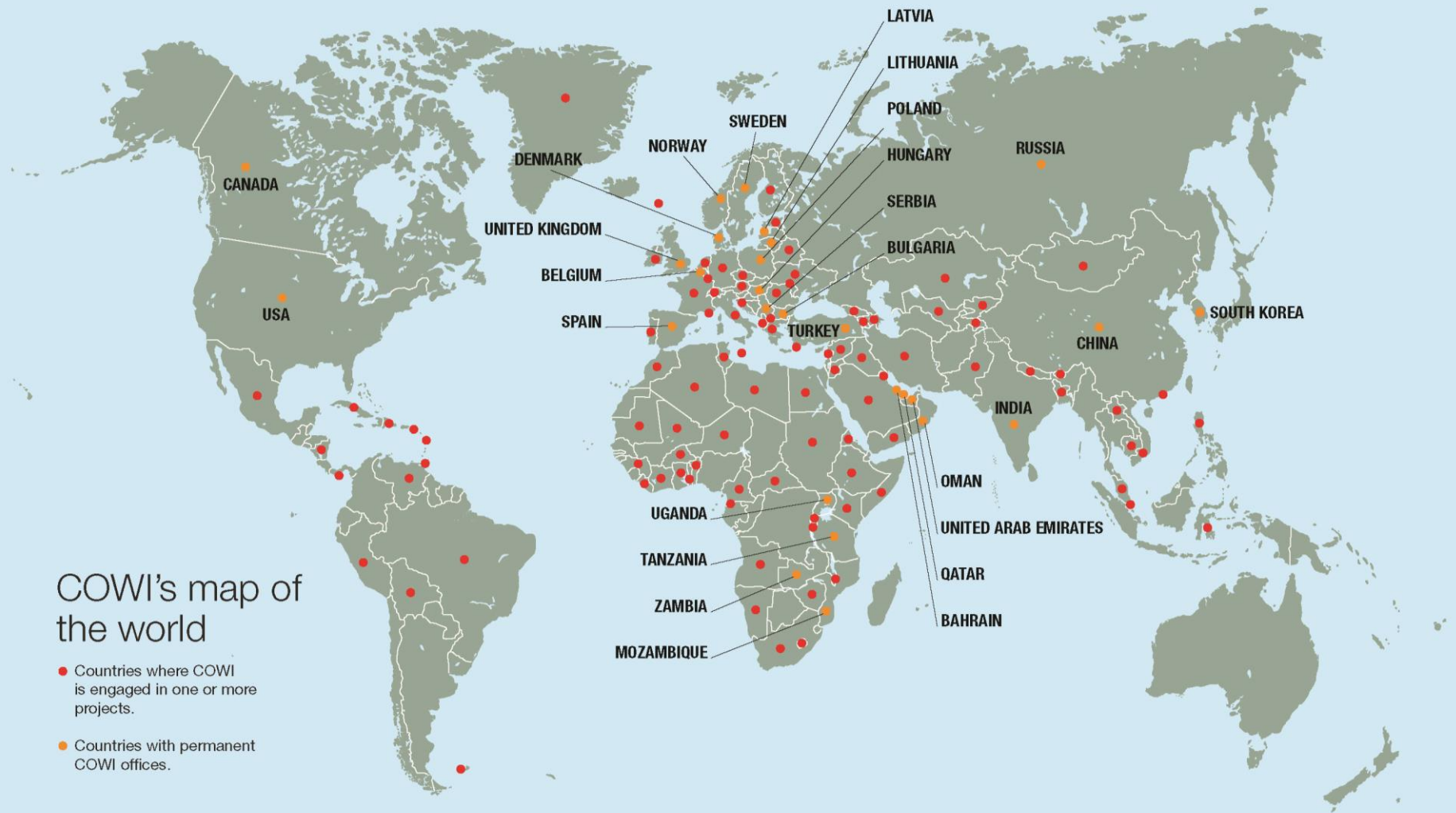
The Danish LPIS system for agricultural subsidy (IMK2)

Enterprise GIS using Open Source

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COWI's map of the world

- Countries where COWI is engaged in one or more projects.
- Countries with permanent COWI offices.

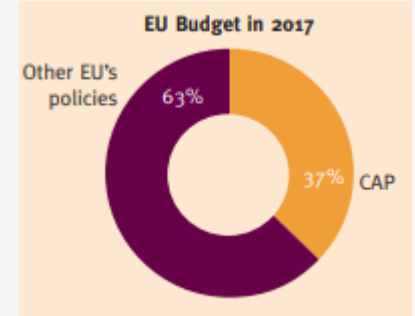


Agenda

- > What is IMK2?
- > System environment
- > Technology stack
- > Scalability
- > Mobile app development with Open Source

The domain

- > A significant part of the EU budget is spent on agricultural subsidy through the Common Agricultural Policy (CAP)
- > Each member state have one or more accredited paying agencies
 - > In Denmark there is one single paying agency - The Danish Agricultural Agency
- > Spatial location, extent and proximity are important factors when evaluating a subsidy application.
 - > IMK2 is the GIS application handling all geospatial aspects of CAP management in the Danish Agricultural Agency



The Danish IACS/LPIS organisation

- Paying Agency in Denmark:
 - The Danish Agricultural Agency
- IACS Software Provider:
 - Formpipe Software A/S
 - CGI Denmark
- LPIS Software Provider:
 - COWI A/S

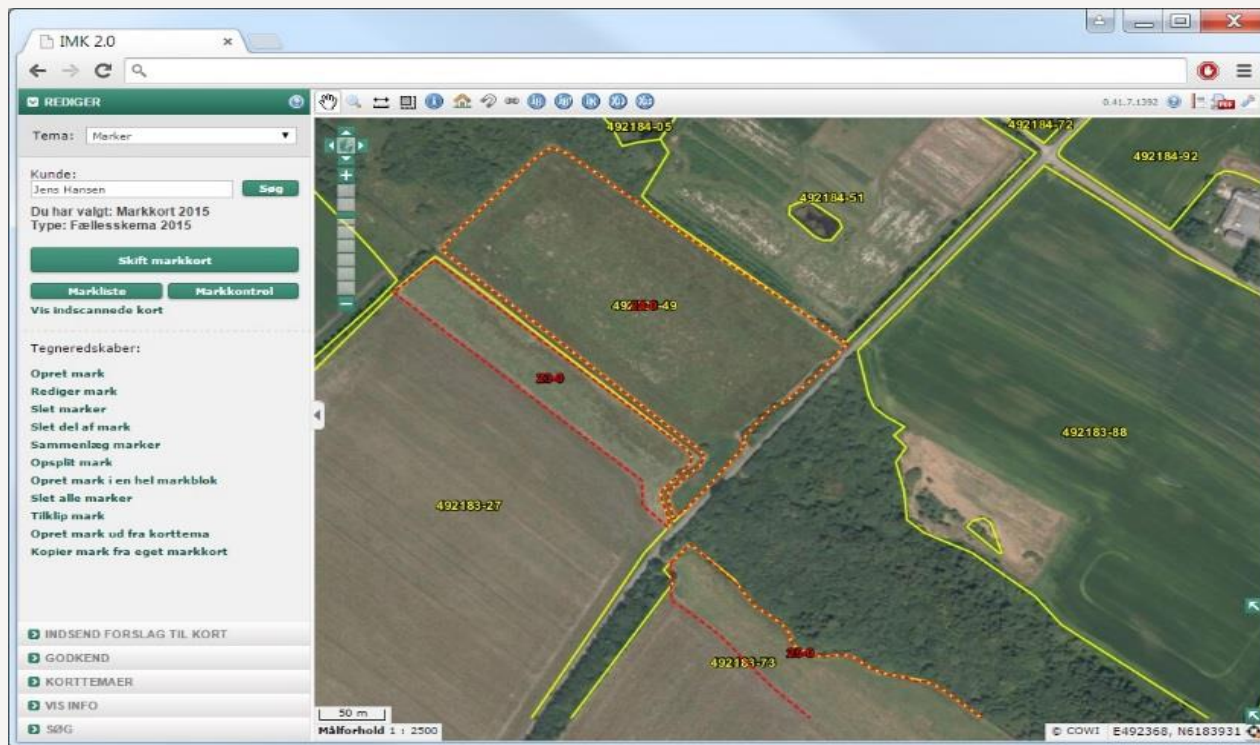


**Ministry of Environment
and Food of Denmark**
The Danish
Agricultural Agency

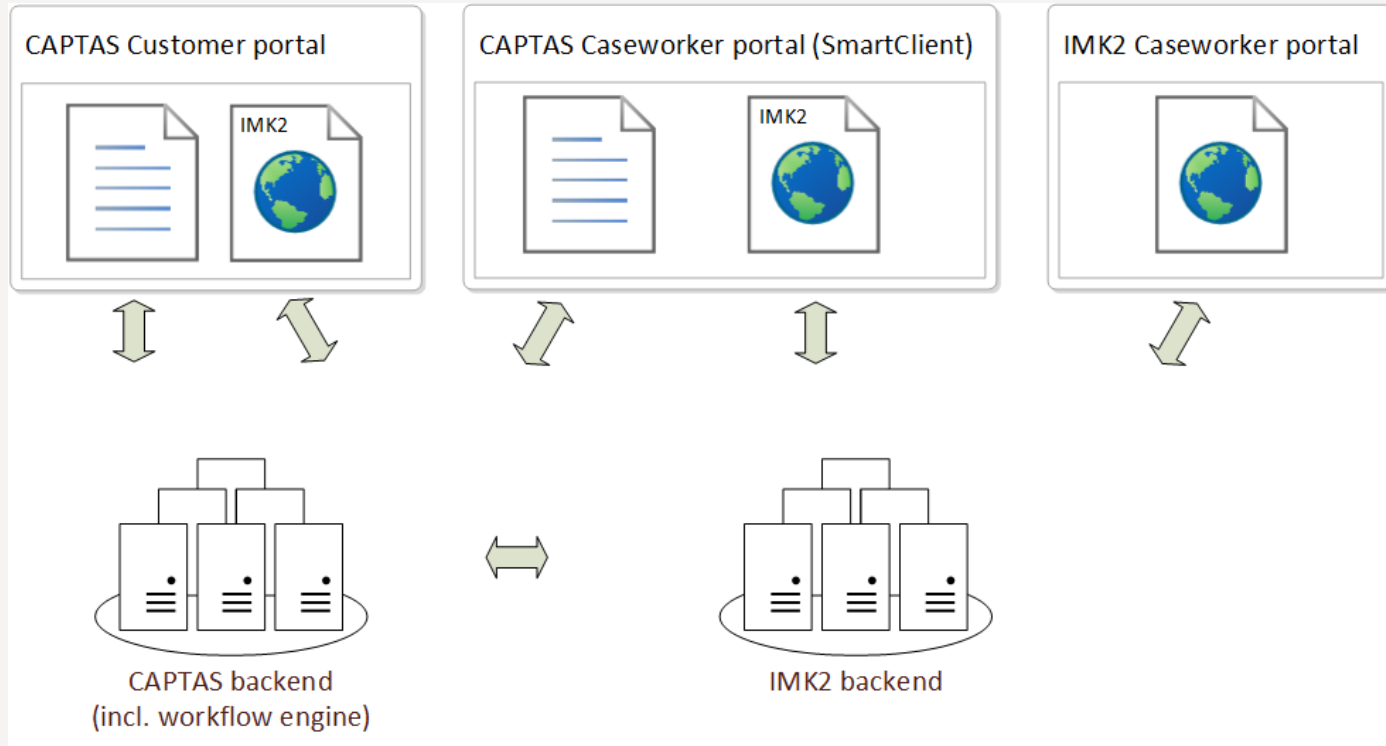


Danish Agriculture Agency - LPIS/IMK2

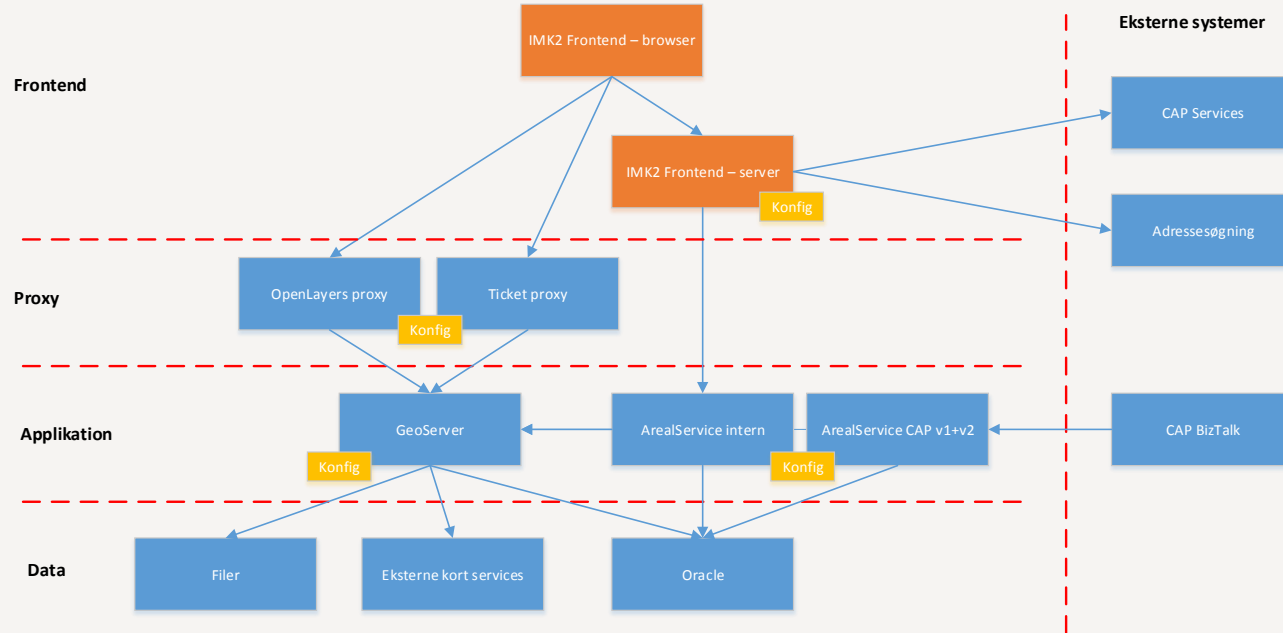
- IMK2 (LPIS) handles the geographical part of the farmers application, the agency's case processing, control and payments related to EU agricultural subsidies.
- With some 40,000 applications a year and highly complex GIS calculations based on some 200 map layers, the system makes extremely high demands on system performance and reliability.
- Application of satellite data in relation to future EU CAP reform.
(E.g. MOIST, crop identification etc.)



IACS and LPIS interaction



High level architecture



Technology – the front-end tier

> Front-end tier

> Client:

- > HTML/CSS/JavaScript
- > OpenLayers
- > AngularJS
- > jqWidgets

> Server: .NET WebAPI



Technology – the application service tier

- Application service tier

- WCF Web Services
- NetTopologySuite (NTS)
- Entity Framework with direct support for NTS
- NTS is the spatial engine of all IMK2 algorithms
- The application service tier is multi-threaded and scaled out on a cluster of web servers.



Technology – the geodata service tier

- > Geodata service tier

- > GeoServer with these extensions:

- > Oracle data access
 - > Control Flow
 - > Improved control of concurrent request
 - > Scripting Extension – Python
 - > Hooking up custom functionality



- > The geodata service tier is scaled out on a cluster of web servers

Technology – the data tier

- > Data tier
 - > Oracle Spatial
- > Object Relational Mapping – Entity Framework
- > Oracle driver – DevArt dotConnect
- > Oracle spatial is only used for 'simple' spatial queries.

The Oracle Spatial logo consists of the word "ORACLE" in red, uppercase, sans-serif font, followed by a horizontal line, and then the word "SPATIAL" in black, uppercase, sans-serif font.The Entity Framework logo features a stylized white "N" shape on a purple background, followed by a horizontal line, and then the text "Entity Framework" in white, sans-serif font.

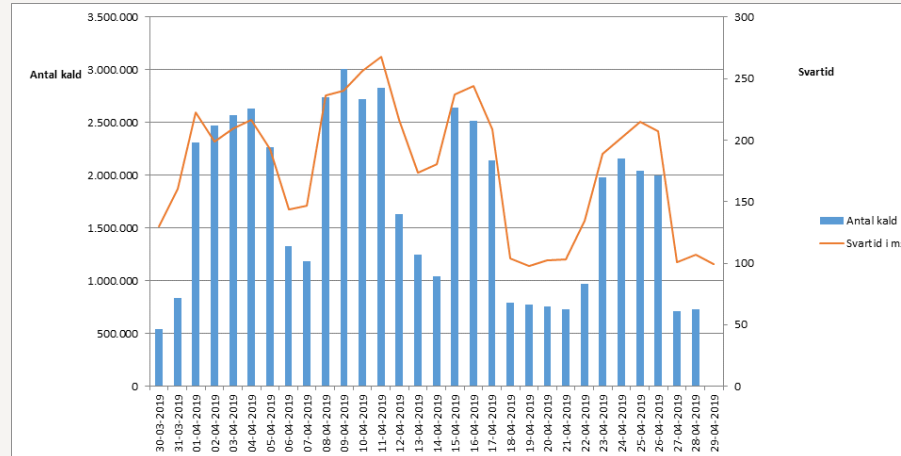
Technology - overview

- > Front-end tier
 - > Client: HTML/CSS/JavaScript and OpenLayers, AngularJS
 - > Server: ASP.NET WebAPI
- > Application service tier
 - > WCF WebService and NetTopologySuite
- > Geodata service tier
 - > GeoServer
- > Data tier
 - > Oracle



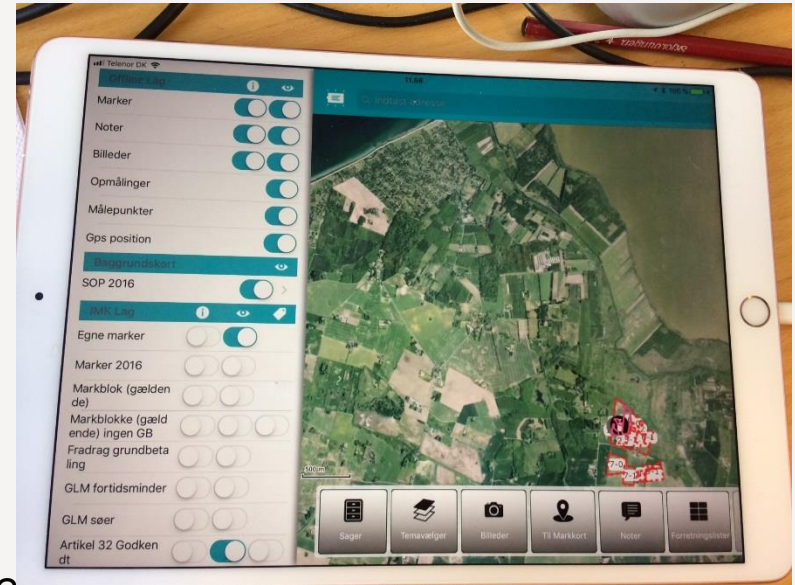
Scalability and Load

- Approx. 40.000 Danish farmers apply for subsidy on-line
- Peak load on GeoData Service Tier: more than 350.000 map views pr. hour. (~100 maps/s)
- All tiers (except data tier) are scaled out on load-balanced clusters.



CASE: iOS app for OTSC

- Introduced for the 2018 inspection campaign
- Integrated with Trimble high precision GNSS hardware (50 cm)
- All relevant application-data are available to the inspector in the app
- All measurements and observations are recorded in the app and directly transferred to IMK2
- All operations are available in off-line mode using a cached version of the case data



Technology – mobile devices

- > iOS
- > Xamarin
- > Mapsui – Map component for Xamarin
- > Sqlite – off-line cache
- > Trimble GNSS API

