Interactive visualisation and fluent animation of meteorological data in an operational web application based on WMS

Marc Müller

ask – Innovative Visualisierungslösungen GmbH

What this presentation is about

- METFROG
  The weather visualisation system at the air traffic control in Germany: Deutsche Flugsicherung (DFS)

- Challenges and best practices handling web-based WMS clients with large amounts of data

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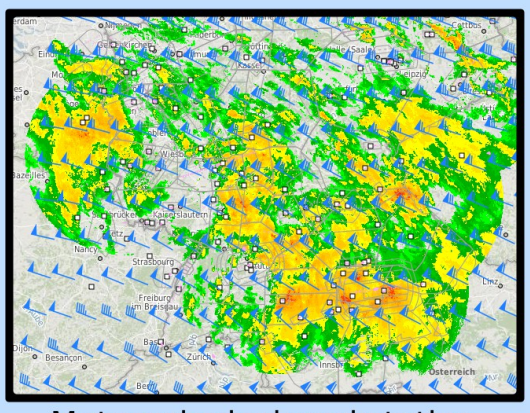
- IT solutions und services since 1995
- Core-Area
  - Visualisation of weather related data in 2D/3D
  - Broadcast Computer Graphic
  - Automated document generation
  - Meteorological workstations
  - Processing of meteorological and geographical data

Requirements for the development of METFROG

- Interactive, multi-layered meteorological workstation
- Browser-based application
- Smooth animation of meteorological data
- Based on open standards
- Completely configurable and extendable within browser
- Handling has to be very simple

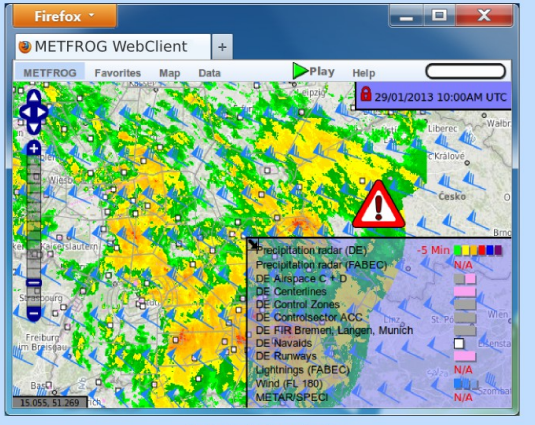


Meteorological workstation

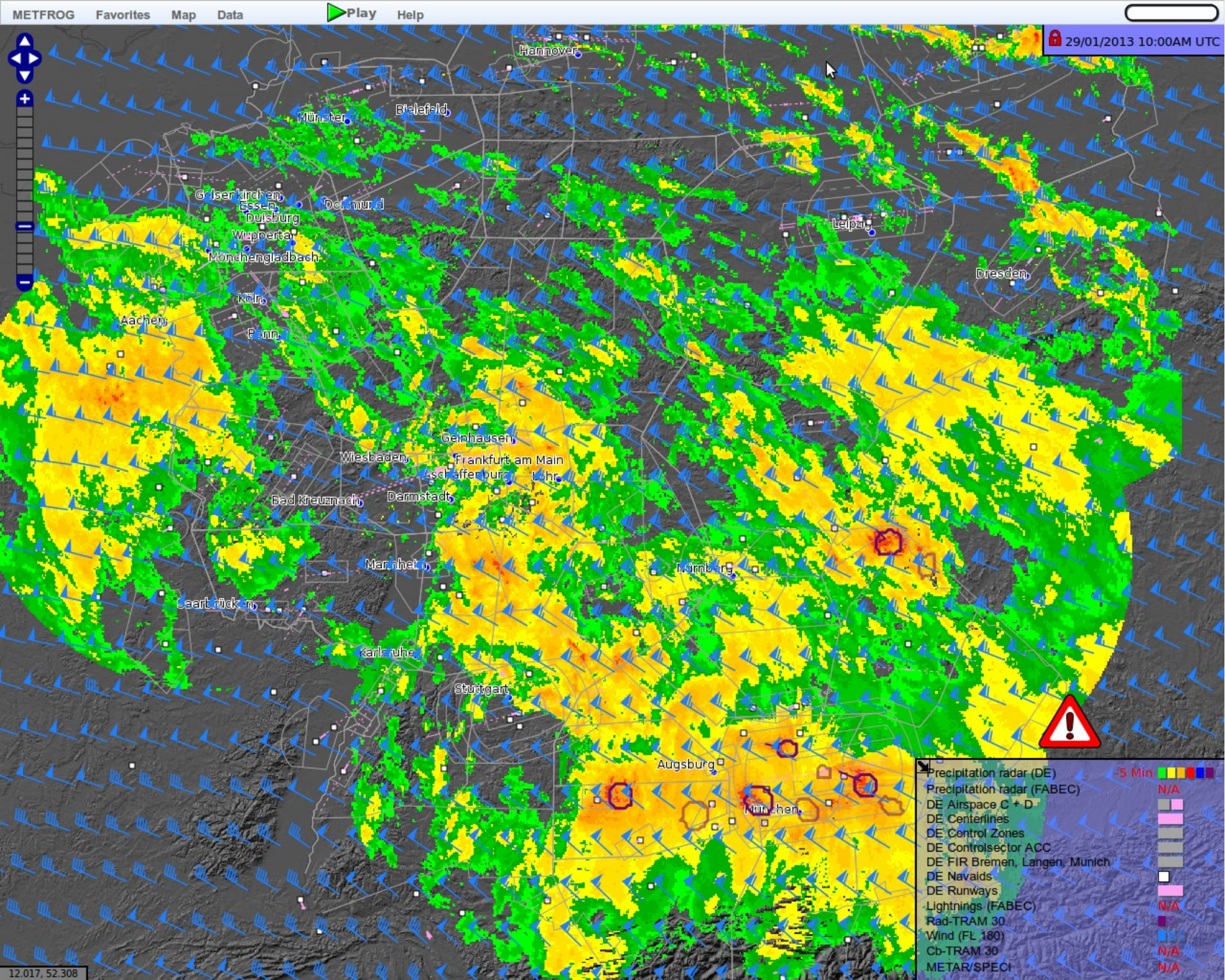
+

Browser

=



METFROG


METFROG
Favorites
Map
Data
Play
Help
29/01/2013 10:00AM UTC
Hannover
Bielefeld
Münster
Gelsenkirchen
Essen
Duisburg
Dortmund
Wuppertal
Mönchengladbach
Köln
Aachen
Bonn
Leipzig
Dresden
Gelnhausen
Wiesbaden
Frankfurt am Main
Aschaffenburg
Lohr
Darmstadt
Bad Kreuznach
Mannheim
Nürnberg
Saarbrücken
Karlsruhe
Stuttgart
Augsburg
München
Precipitation radar (DE) -5 Min
Precipitation radar (FABEC) N/A
DE Airspace C + D
DE Centerlines
DE Control Zones
DE Controlsector ACC
DE FIR Bremen, Langen, Munich
DE Navaids
DE Runways
Lightnings (FABEC) N/A
Rad-TRAM 30
Wind (FL 180)
Cb-TRAM 30 N/A
METAR/SPECI N/A
12.017, 52.308

Challenges in design and implementation

- Handling large amounts of data
- Handling time-variant, resolution dependant and multi-source data
- Achieving a high performance despite many seperate layers
- Fluid animation of multiple WMS layers

Available data in METFROG [1/2]

- Geographical data
  - Air control zones

    approach sectors, control sectors, etc.
  - Airport

    runways, airport locations, etc.
  - Background images
    - height map, HR satellite images, OpenStreetMap, etc
  - Ground-data
    - streets, city names, borders, rivers, etc.
  - Etc.

Available data in METFROG [2/2]

- Time-variant meteorological data:
  - Raster based data

    radar images
  - Modell output

    wind: [resolution dependant, multi-source]
  - Vector based data
    - storm cell tracking and prediction
  - Point data
    - lightning, METAR: [resolution dependant]
  - Etc.

Challenges in visualising large amounts of data in a browser [1/3]

- METFROG provides ~80 WMS-Layers thereof ~20 time variant
- A typical map in METFROG consists of 10 to 20 WMS layers, visible at the same time

Challenges in visualising large amounts of data in a browser [2/3]

- Trade off between high server-load (single-tile) vs high client-load (tiled)
- One layer sends between 6 and 30 WMS requests for an update, depending on screen resolution and tile-size

- Typical amount of requests in METFROG...
  - … for a map @ 1280x1024:
    ~100 tiles (each 1024x1024px)
  - … for an animated frame @ 1280x1024:
    ~30 tiles (each 1024x1024px)

Challenges in visualising large amounts of data in a browser [3/3]

- Common pitfalls
  - Images in the browser cache are not instantly available
  - Many parallel requests to a server do not scale well

Approaches to optimise handling and animation

- Intensive use of caching
- Efficient request management and layer handling
- Using HTML5 features can vastly improve performance and memory footprint

Experiences using WMS for animating meteorological data

- Without optimisation an animation takes 1-5 seconds per frame
  - **Animation is not usable at all**

- With optimisation an animation can display up to 20 frames per second, even on low-end hardware
  - **Animation runs very smooth**

Demo

Thank you for your attention

For further Information please visit our website at
http://www.askvisual.de
or contact me via mail:

marc.mueller@askvisual.de