



# Approaches to WebGL in times of unstable or weak Internet connections

Till Adams, terrestris GmbH & Co KG

# Preface



- The talk addresses (e.g.) to decision makers but also to anyone who plans to setup a WebGIS
- This talk aims on sharing some hints based on experience regarding the setup of WebGIS
  - This applies not only to the African continent where Internet connection may be weak
  - I come from Germany, where the same applies :-)

Akamai Q1 2017 global average connection speeds rankings

Rank ↕	Country/Territory ↕	Avg. connection speed (Mb/s) <sup>[2]</sup> ↕	Relative speed ↕
1	 South Korea	28.6	<div></div>
2	 Norway	23.5	<div></div>
3	 Sweden	22.5	<div></div>
4	 Hong Kong	21.9	<div></div>
5	 Switzerland	21.7	<div></div>
6	 Finland	20.5	<div></div>
7	 Singapore	20.3	<div></div>
8	 Japan	20.2	<div></div>
9	 Denmark	20.1	<div></div>
10	 United States	18.7	<div></div>
12	 Netherlands	17.4	<div></div>
13	 Romania	17.0	<div></div>
14	 Czech Republic	16.9	<div></div>
15	 United Kingdom	16.9	<div></div>
16	 Taiwan	16.9	<div></div>
17	 Latvia	16.6	<div></div>
19	 Belgium	16.3	<div></div>
20	 Canada	16.2	<div></div>
-	World	7.2	<div></div>

# Agenda



- **Short introduction terrestris & Till Adams**
- **Some thoughts on the title of the talk**
- **Overview on the status of Internet connectivity in Africa**
- **Approaches on WebGIS**

# Short introduction terrestris & Till Adams

- 
- A photograph of three men standing together on a stage. The man on the left is wearing a purple t-shirt with a white logo and blue jeans. The man in the middle is wearing a white t-shirt and blue jeans. The man on the right is wearing a grey t-shirt with a white logo and khaki pants. They are all smiling and have their arms around each other. Behind them is a large screen displaying a presentation slide with a blue header and a white body.

# terrestris – some basic information



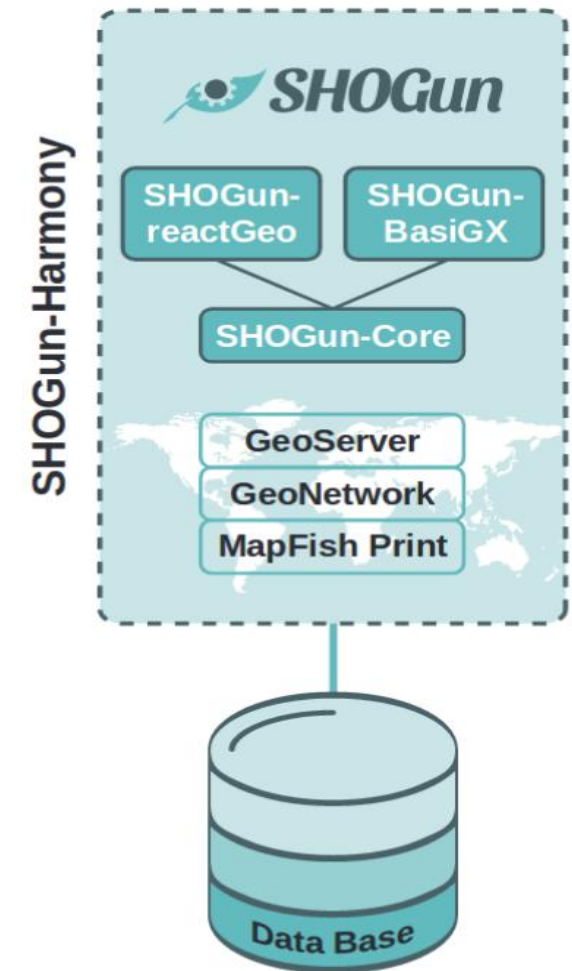
- **founded in summer 2002**
  - 16 employees
  - located in Bonn, Germany
  - customers from public and private sectors
- **In 2015, the shareholders founded the partner company mundialis**
- **terrestris is a technology service provider specialized in geoinformatics with Free Software**
  - *‘from support to the final solution’*





# SHOGun Harmony

- Ready-to-use WebGIS Suite from Open Source components
- 4 freedoms:
  - various GIS clients
  - Data base-independent
  - functionally open (plugin interface)
  - Content open (upload & publication of geodata)
- User administration or LDAP/CAS



# Thoughts on the title of the talk:

“Approaches to WebGIS in times of unstable or weak Internet connections“

What means “WebGIS“?

What is *weak* and what is *unstable*?

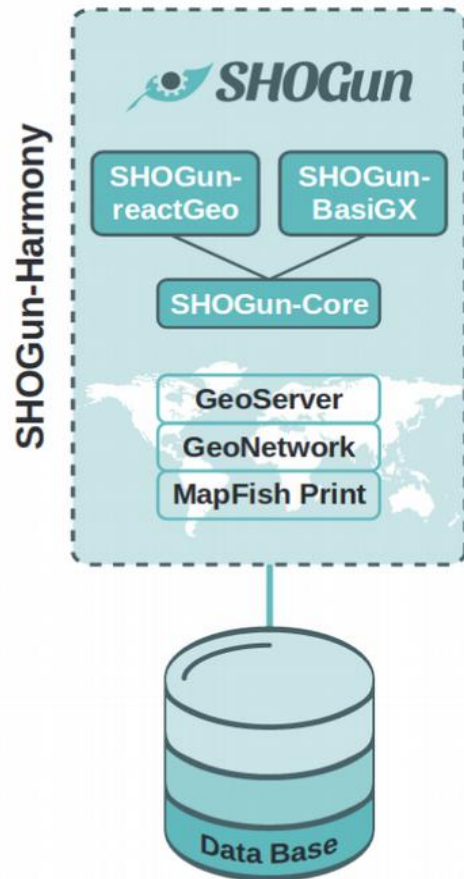
**Why is SDI important to Africa; what benefits does it hold for the continent?**

SDI is of great value to Africa, firstly because geo-information is fundamental. Whichever way you look at it, it is almost a prerequisite for development of the continent. In addition, scarcity of resources means we have to adopt approaches that will maximise the little investment that is being made. Geospatial data should be collected once and used in as many applications as possible, hence the need for SDI.

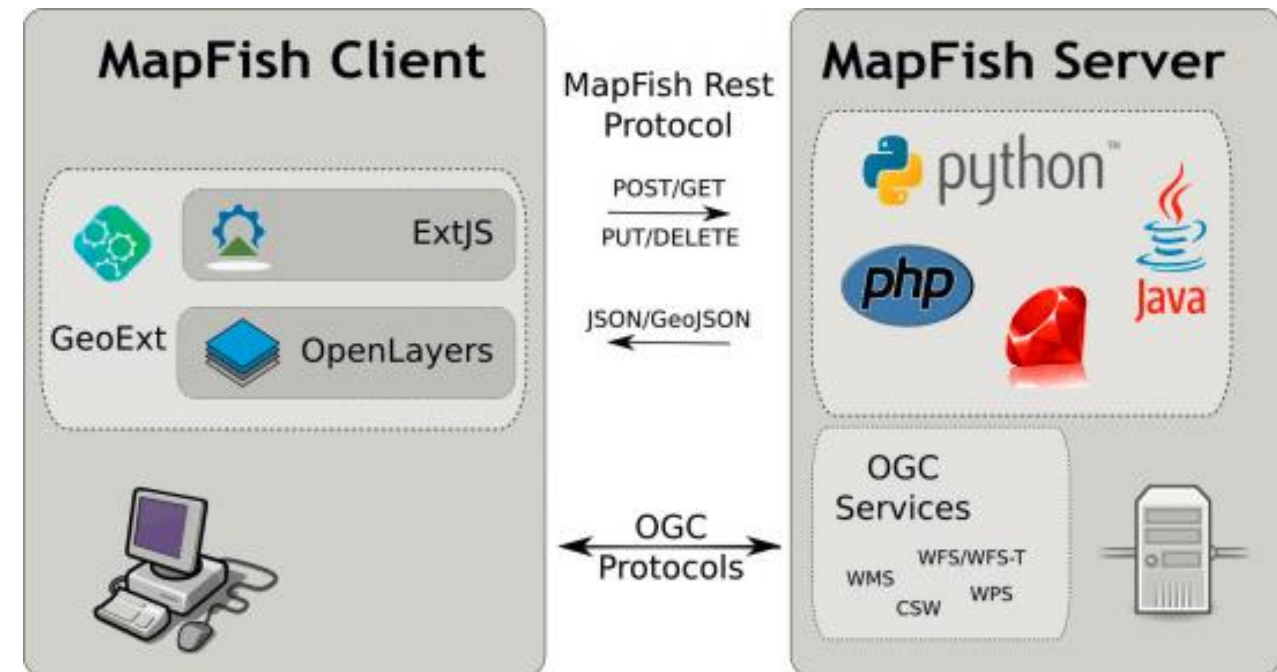
from <https://www.gim-international.com/content/article/spatial-data-for-africa>



# What means “WebGIS” ?



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from: <https://www.camptocamp.com/de/solution/web-mapping/>

# What means “WebGIS” ?



- **Desktop GIS moved to the Browser?**
  - Example: Geodata-infrastructure for Water Authority in Germany
    - WebGIS replaced Desktop-GIS
      - upload of Feature Types
      - digitize in Browser
      - huge Print Module
      - [...]
- **WebGIS is a medium that is capable to spread geo-related information to a (un)controlled mass of people**
  - Example: RESIMAO 2006 “Market Price Information System”
    - Geographical Information was requested and sent via SMS

# WebGIS features



- **webbased GIS allow web-clients to access geospatial data and functions**
- **no expert-knowledge for usage is required**
  - if the system's design takes the user into account, so **Decision Makers** can be involved and make use of Geospatial Data
- **Users access centralized (up-to-date) database**

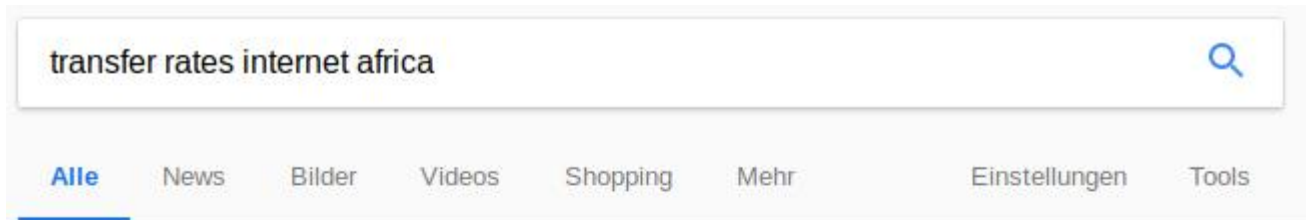
# What is *weak* and what is *unstable*?



- **Weak** means that transfer rates are low
  - strong local/regional variations
- **Unstable** means, that internet access may break down temporarily
  - also adressable to regions with no internet access at all

# Let's have a look on the status of Internet connectivity in Africa

# Africa's Internet Connection Speed



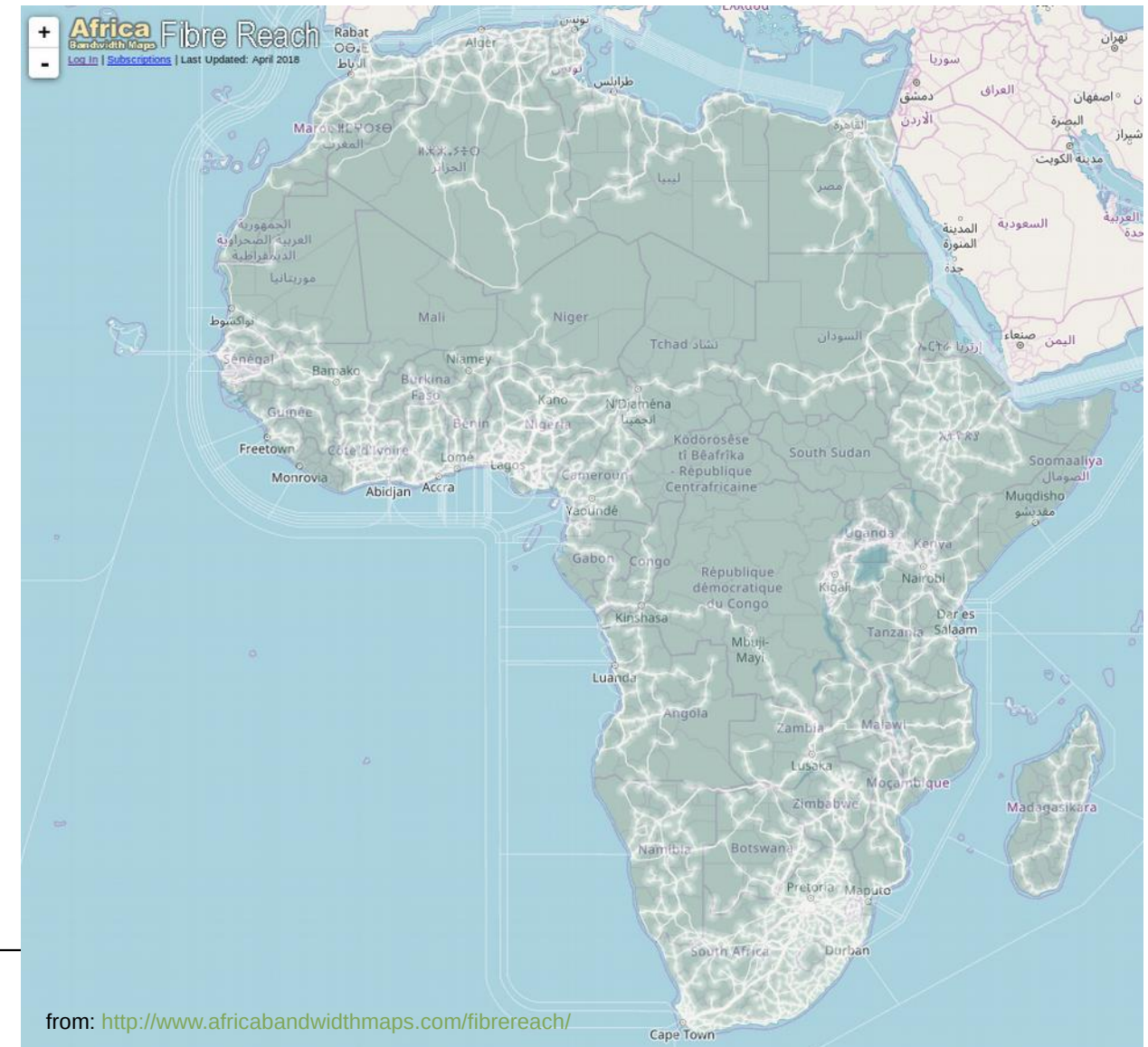
Ungefähr 37.600.000 Ergebnisse (0,52 Sekunden)

## Kenya's mobile internet beats the United States for speed - Quartz

<https://qz.com/.../kenya-has-faster-mobile-internet-speeds-than-th...> ▼ Diese Seite übersetzen  
Kenya has the world's 14th-fastest mobile **internet speed**, according to a report from the content delivery ... At 13.7 megabits per second, Kenya's average **data connection speed** in the first quarter of 2017 was ... June 08, 2017 Quartz africa.

## African countries have the slowest internet speeds, says a new ...

<https://qz.com/.../african-countries-have-the-slowest-internet-spee...> ▼ Diese Seite übersetzen  
14.08.2017 - It turns out most of those countries are in **Africa**, data from a global broadband **speed** league shows. The **speed** gaps between various countries ...





# Tanzania's Internet Connection Speed

- Desktop – use: <https://www.bandwidthplace.com/location/{tanzania}/>



## Tanzania

In 2012, Internet users in Tanzania represented 4.0% of the country's population, growing 118.8% over the prior 5 years. Speed test results show an average of 2.21 Mbps download and 1.81 Mbps upload speeds across all mobile, tablet, and desktop devices tested. Take a look at the charts below for an at-a-glance view of speed test results by device. Tanzania Telecommunications, Zanzibar Telecom, Cats-Net Ltd. and Africa Online are among the many Internet Service Providers (ISPs) delivering broadband to Tanzania.

Device Type

☒ Desktop ☐ Tablet ☐ Mobile

Sort By

☐ Total Tests Taken ☒ Download Speed

BandwidthPlace is the only Internet speed test site where you can analyze mobile, desktop, and tablet results - all on the same chart. Compare real time and historic speed test results customized for Tanzania on this page.



# Tanzania's Internet Connection Speed

## - Mobile -



### Tanzania

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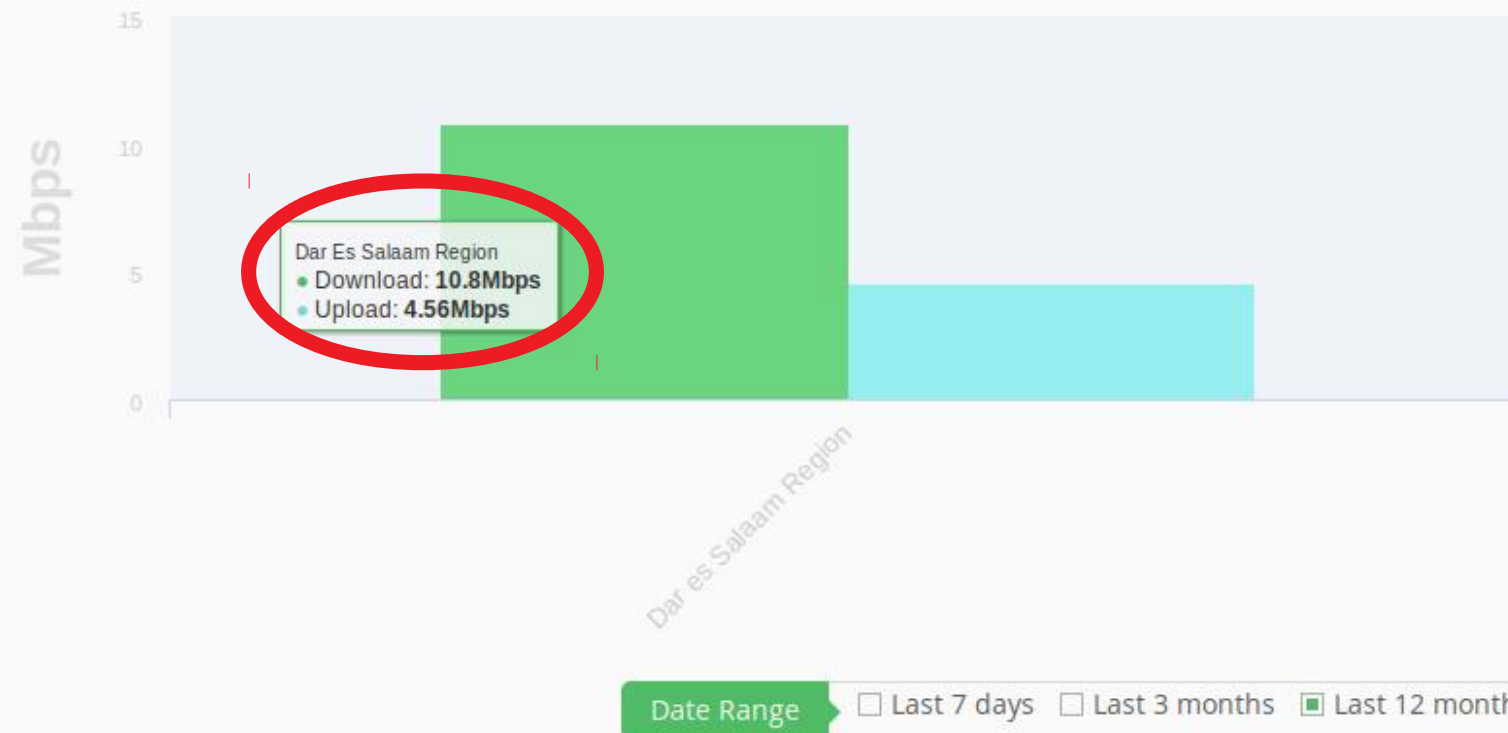
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Sort By

☒ Total Tests Taken ☐ Download Speed

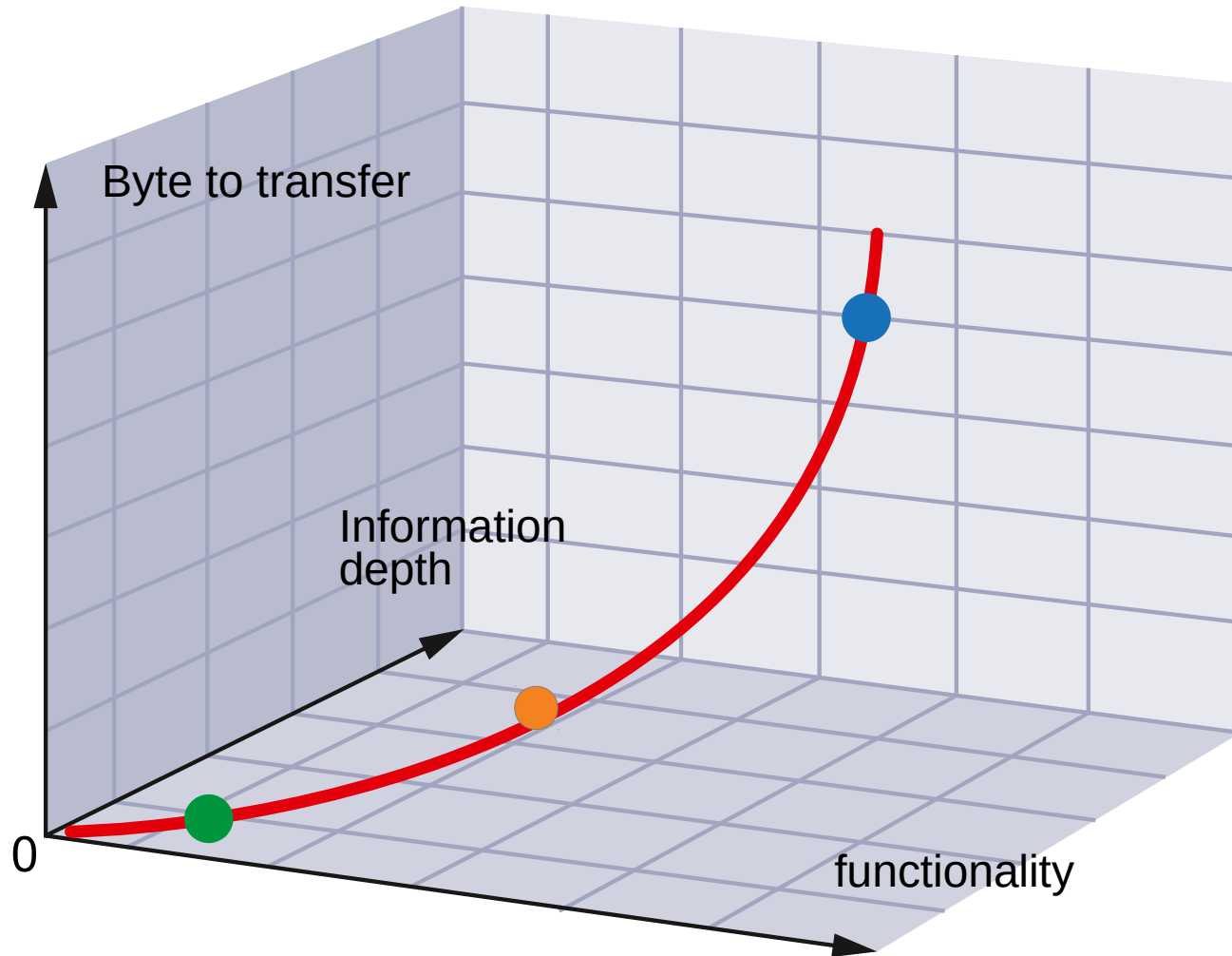
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# Approaches on WebGIS

→ specify your needs

# Functionality and Information depth relate Bytes



- full-featured WebGIS-client + (WMS-)maps - up to several Mb  
vector tiles loads ~200Kb/vectortile\*

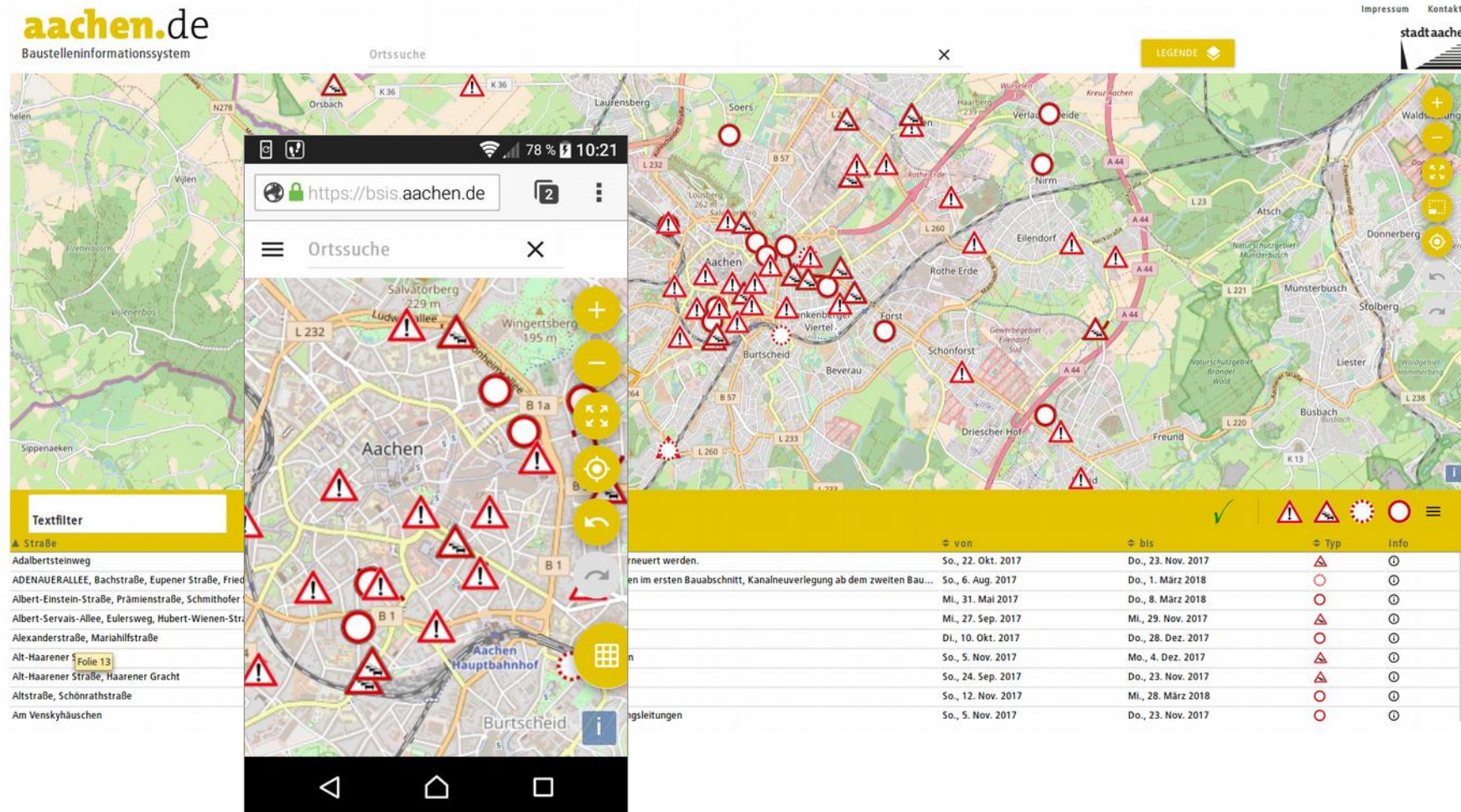
\* example: <https://ows.terrestris.de/osmvectortiles/index.html>

- Small WebGIS for special purpose

- SMS ~ 140 Bytes



# Construction site information system Aachen



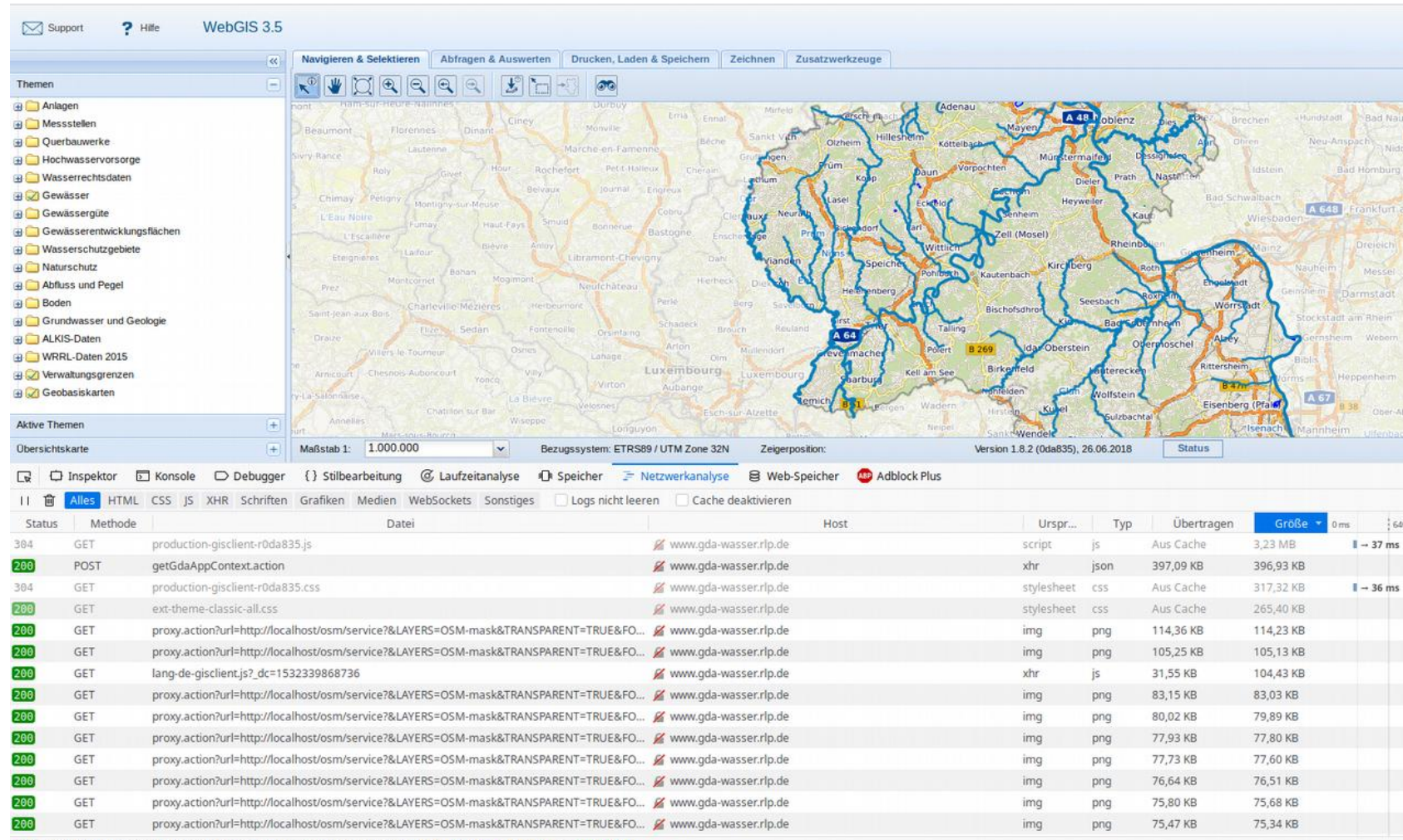
Typ	Übertragen	Größe	0 ms
html	757 B	797 B	→ 27 ms
js	23,31 KB	73,49 KB	→ 48 ms
js	506 B	164 B	→ 37 ms
js	58,16 KB	175,72 KB	→ 85 ms
js	323,49 KB	1,35 MB	→ 178 ms
css	1,94 KB	1,66 KB	→ 27 ms

- Small WebGIS for special purpose:

initial load: ~400Kb



# Geodata-Architecture Water



Typ	Übertragen	Größe	ms
s	Aus Cache	3,23 MB	→ 37 ms
son	397,09 KB	396,93 KB	
css	Aus Cache	317,32 KB	→ 36 ms
css	Aus Cache	265,40 KB	
png	114,36 KB	114,23 KB	

- Full featured WebGIS client:

initial load: ~1.2Mb  
+ Cache



## → specify your needs



- Check for functionality / data you really need!
- Think about the user groups
  - which background do they have?
- Let your user decide – don't open too much information when startup
- Detect the net-connection in regions, where your users are!
  - Based on that, decide on client-server interactions
- If possible, run your project in an agile mode
  - Scrum and/or Kanban related project management

# Approaches on WebGIS

→ optimize your webApp

## → optimize your Web-App



- Check the used libraries and compile only functions, that are really needed!
- Create a production build of your application. Use suitable tools for minification and concatenation.
  - e.g. “UglifyJS” - removes comments, whitespace, simplifies variables & functions
  - e.g. „size-limit“ - prevents JS-Libraries to bloat ([github.com/ai/size-limit](https://github.com/ai/size-limit))
- This build should be delivered via a web server that uses GZip compression
- => Leads to a reduction of up to 50% of the transferred size!

## → optimize your Web-App



- **Check your code! Harmless seeming functions may lead to high CPU or RAM load**
- **Search for appropriate browser addons (e.g. React DevTools).**
  - Chrome offers some possibilities to analyze the loading behavior of the application and to find problems (tab "Performance" in the developer console)
  - <http://yslow.org/> is a good tool with Plugins for many browsers

# Approaches on WebGIS

→ optimize your services

## → optimize your Services



- **Optimize your data source!**
  - Use GDAL to produce pyramids and overviews for Raster-Data
  - for vector data from a database, unnecessary data should be removed and columns relevant to the query indexed
  - Database views can also be used to query subsets of a data record, which can further improve performance
  - For geographical data, a generalization of the objects for certain zoom levels should be considered (in e.g. PostGIS: ST\_Simplify)



## → optimize your Services



- **Store data on a SSD-Harddrive if possible**
- **The image format for the output of WMS services should be well chosen.**
  - JPEG is often the best performing, but PNG with the appropriate palette can also be a good choice, depending on the data set.
- **With WMS/WFS or even Vector-Tiles services use suitable scale limits.**
- **Cache the tiles (e.g. GeoWebCache, MapProxy)**
  - Cached tiles should be delivered to the client via the server with the corresponding header ("Cache-Control", Expires"), so that they are requested only once

# Approaches on WebGIS

→ go Offline!



- **Use Service Workers (local caching of your application)**
  - <https://caniuse.com/#feat=serviceworkers>
  - Service workers is a method that enables bootstrapping of webapplications when they are Offline
    - Control your network events and cache local resources
  - Then make your application Offline ready
    - Implement Offline-Functionality
    - Sync Data (if data changes, e.g. Editing) when back on Net!






- **Use Vector Tiles!**
  - Transfer the vector data to the client (where it is cached)
  - Use browser-cached styling methods
- **Vector Tile Engines:**
  - TileServerGL (tileserver.org)
  - Maptiler (maptiler.com)
  - Overview: [https://wiki.openstreetmap.org/wiki/Vector\\_tiles](https://wiki.openstreetmap.org/wiki/Vector_tiles)
- **One example:** <https://robertomlsoares.github.io/leaflet-offline/>



# Conclusions

## → optimize your WebGIS

- 
- Open Source Geospatial tools offer all you need! Make use of them.
  - Specify your needs, user-groups and general conditions first
  - use the knowledge of the Open Source Community! Get involved.





# Thank you for your attention!



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## Questions ?