SensorWeb Disaster Architecture Framework:
Lessons Learned

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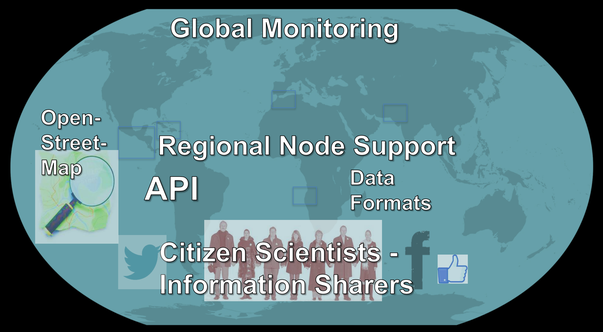
Context

A Big Data Problem

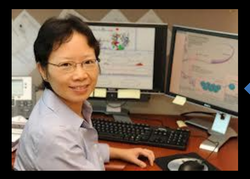
- Disaster Support requires access to a lot of instrument data from many sources
- Scientists and data providers need to have a global view of "data" (Raw/Level0/Level1/Indices)
- But users need localized information products that are easy to access/use
- Local/regional users need an ability to update/change the local inputs used for derived product generation

Disaster Architecture Framework



Approach: Leverage OpenStreetMap for Crowd-sourcing (*a la* Wikipedia) to support citizen scientists and allow them to share information

Who is the Customer / User?



Struggle

Scientist – Global Needs
For Centralized Serving of Level0 / Level1 / Indices

End User – Local Needs
For Input of Regional/Local Knowledge

- Are we building a system for scientists or end-users? Scientists / data providers want to control their data.
- Are we allowing users to have full access to the data and even change it? Global data would benefit from Local/Regional knowledge
- Are we designing interfaces and standards for computer scientists or neo-geographers?
- The composite of all local/regional systems is a valid global view for derived disaster data products.

Ingredients

OpenStreetMap Tools

Leverage Existing Infrastructure
- Protocols, Database Schemas, Code…

Support Crowd-Sourcing
- Citizen Science
- Field Reports, Product Validation/Verification

Community-Based Data Stewardship
- Wikipedia…

OpenStreetMap and Wikipedia are centralized global databases that have involved local communities:

We Need A Distributed Version To Enforce That A Local/Regional Node Can Only Change Local Data

Distributed Framework

Let's not build another centralized system to try and cover every disaster in the world.

Must involve regional/local nodes:
- Leverage regional capacity building efforts: e.g., SERVIR, PDC, World Bank / USAID
- Global centralized system requires too many assumptions about regional/local conditions
- Regional/local nodes are likely to be more accurate about their regional/local conditions
- They can reach/involve/train the local community

We need to support connectivity
- Need API
- Need common formats compatible with digital maps

Data Formats

Users expect more than PNGs or PDFs.

GEOTIFFs and NetCDF/HDF files are OK, but too large for most end user bandwidth.

[MB]Tiles are better
- Web Map Tiling Service is better than older Web Map Service

Vectors are even better
- Topojson (x100 less storage)
- GeoJSON

And vector tiles are coming…
- MapBox

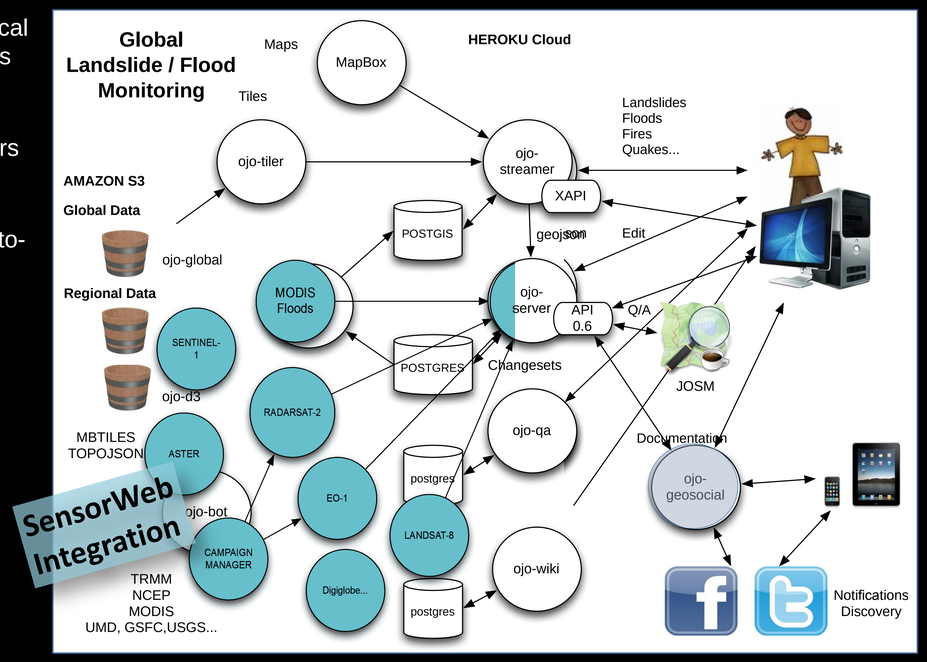
A higher level API

Story Telling, Information Sharing, and Discovery

- OGC server interfaces are critical to providers and high-end users for serving global data
- But they are not at the local / regional user level – these users only want local information
- And regional node visitors will increasingly become machine-to-machine level interfaces

Regional node requirements

- Publish potential products (objects)
- Publish behaviors (Javascript) to generate those products in proper format
- Generate activity streams
- Integrate with social networks



Example User API

- Must be goal driven
  - I want [verb] [object] [target]
    - *example: I want a current water_extent of Haiti*
- User-Agent queries available nodes and returns behaviors to follow to obtain needed products
- User decides behavior to follow and executes those activities on the servers
- Products generated dynamically and returned to user
- Activity streams pushed to social networks

Lessons learned

- Involve users (crowd sourcing)
- Leverage openstreetmap tools and wikipedia approach (citizen science)
- Enable distributed nodes to provide composite global view
- Centralized global systems are OK for data providers, but need to avoid building a centralized system to serve derived disaster products
- Create stories to propagate quickly via social networks
  - Publish stories not products
    - *User + Verb + Object*
  - Enable user tags over formal semantics
- Develop API at user level (mashups)
  - Think about behaviors

How can ESIP help?

- Help us write better stories
- About more needed products
- That can be discovered and generated on the fly via an easy to use API
- And get regionally involved!

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