





Sharing Environmental Models

An Approach using GitHub Repositories and OGC Web Processing Services

Daniel Nüst, Benjamin Pross, Christoph Stasch, <u>Simon Jirka</u> EGU General Assembly, Session ESSI2.4

Overview



- Challenge
- Web-based geoprocessing
- WPS4R
- GitHub algorithm repository
- Using GitHub for Sharing Models

Challenge

General project frame:



Building a scientific data infrastructure for sustainable land management within the GLUES (Global Assessment of Land Use Dynamics, Greenhouse Gas Emissions and Ecosystem Services) program

Challenges in this work:

- How to open analysis to others and reproduce results without the need to download all data and install tools?
- How to realize a web-based interface that allows the execution of analyses?
- How to enable interoperable access to the analysis in order to ease the integration in other applications?

Solution



- Use Geoprocessing standards (OGC Web Processing Service) for providing analysis functionality via the Web
- Utilize GitHub for managing and versioning analysis implementations
- Provide a bridge between GitHub and Web Processing Services

Web-based Geoprocessing



Basic Goals:

Being able to share processing functionality, e.g. model implementations, in a heterogeneous and distributed computing environment, as to

- Share knowledge (white box processes)
- Reuse existing implementations
- Share computing capabilities
 (e.g. from cloud and GRID environments)

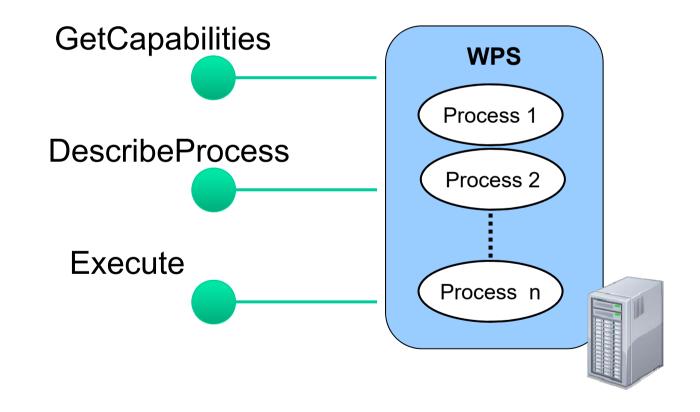
OGC Standard

- OGC Web Processing Service (WPS)
 - OGC Standard since late 2007 (Version 1.0.0), version 2.0.0 was published in 2015

http://www.opengeospatial.org/standards/wps

- Standardized service interface to publish and perform geospatial processes over the web
 - Manage processes execution
 - How to describe offered processes?
 - How to describe input/output parameters?
 - No processes are specified
- Examples of processes
 - Simple geometric calculations (e.g. intersect algorithm)
 - Complex simulation models (e.g. weather forecast)
 - Interface to legacy software (e.g. GRASS GIS)
 - ..

Operations

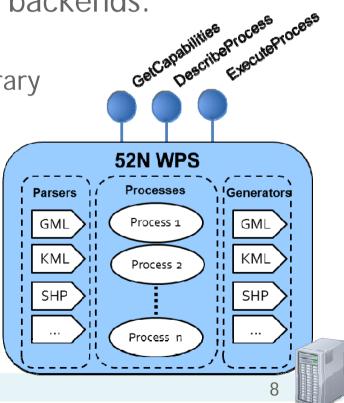


52° North WPS



- Written in Java programming language
- Available as Open Source implementation
- Synchronous and asynchronous processing
- Support for multiple processing backends:
 - GRASS GIS
 - Sextante Spatial Data Analysis Library
 - Git
 - WPS4R
 - Java Topology Suite

http://52north.org/wps

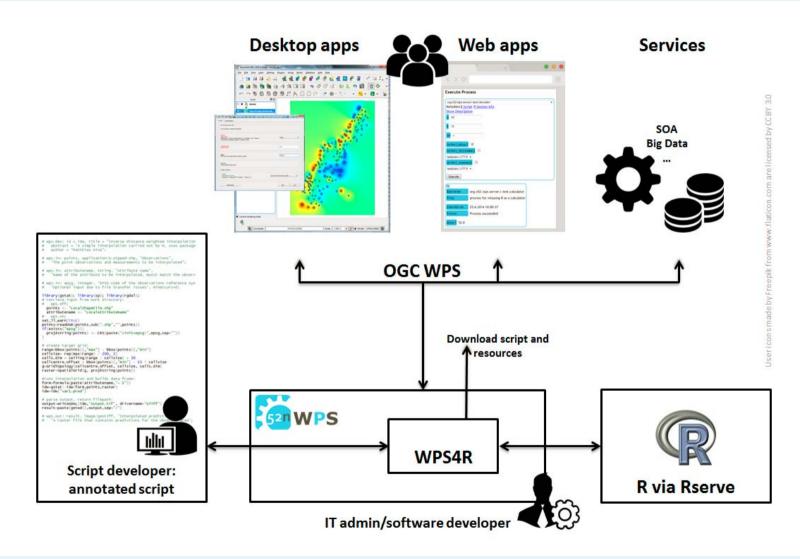


WPS4R



- Create WPS processes from R scripts
- Annotations in script comments
 - Script can still be run offline
- Script upload via WPS admin console
- Script execution on local or remote Rserve instance

WPS4R

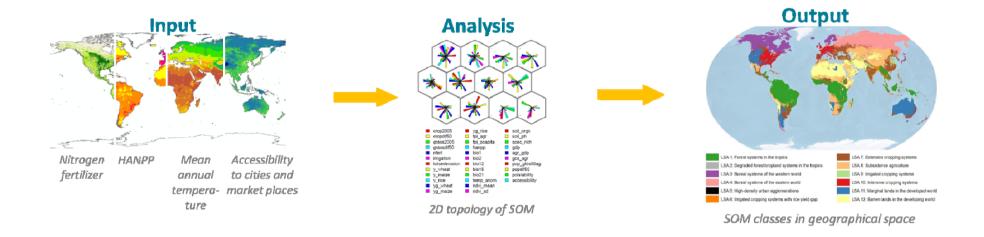


Workflow



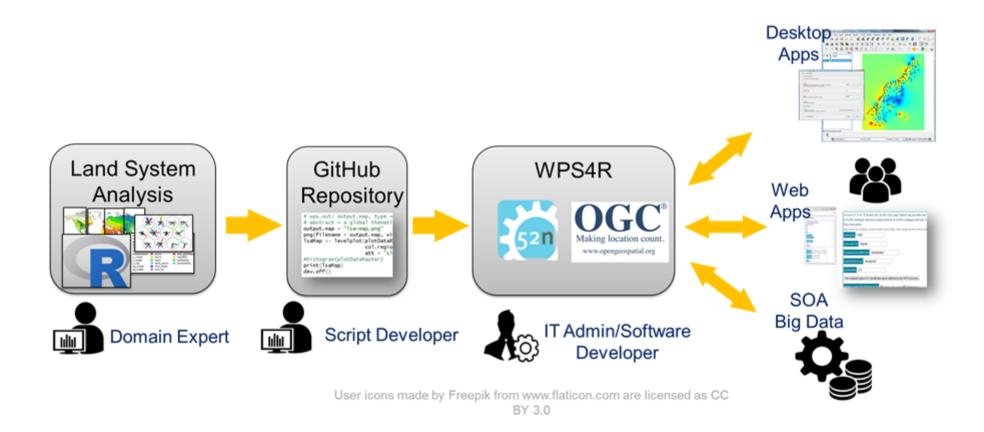
- The existing R script is published through an interoperable OGC Web Processing Service using the 52N WPS4R framework
- Input parameters can be modified and the process can be started in a web form
- The calculations are performed (e.g. plots are created) and the results are displayed in the browser
- Data can be downloaded for further inspection

Land System Analysis



Vaclavik, T., Lautenbach, S., Kuemmerle, T., Seppelt, R. (2013): Mapping global land system archetypes. Global Environmental Change 23(6): 1637-1647. DOI: 10.1016/j.gloenvcha.2013.09.004.

Using GitHub for Sharing Models 52n



Results

- The web process allows interested users to experiment with selected input parameters and to inspect detailed results as well as the data to create further analysis, plots, maps, etc. offline
- There is no need for users to download software or data → parameters of processes can be adjusted when starting the execution, e.g.
 - Sample size (number of points on the globe)
 - Sampling strategy (e.g. random, regular)
 - Input normalization method

Lessons learned



- Web publication works, but complex analyses lead to complex interfaces and require guidance
- The original R script needed considerable work
 - Documentation as well as some pre-processing steps were missing
 - Code craftsmanship can help from the start







Thanks for your attention! Questions? Comments?

s.jirka@52north.org or c.stasch@52north.org

http://52north.org/wps