CloudButton

A serverless approach for fast calculation of irrigation needs

Agriculture is one of the first activities initiated by humanity. As technology develops, the agricultural sector does too. Currently, the concept of Smart Agriculture, also called Third Green Revolution is acquiring great interest. Given that agriculture is the main source of food and the backbone of the world economy, investing in this area will improve performance without doubt and, consequently the well-being of the people around the world.

Answare is an innovative Spanish SME specialized in software development for strategic IT areas: eHealth, mobility, 3D/VR, GIS. Smart agriculture is one of the sectors we also work in. Our objective is to provide software tools to improve the efficiency of the agricultural technician.

Estimating irrigation needs is a computationally expensive process that combines many data from different sources

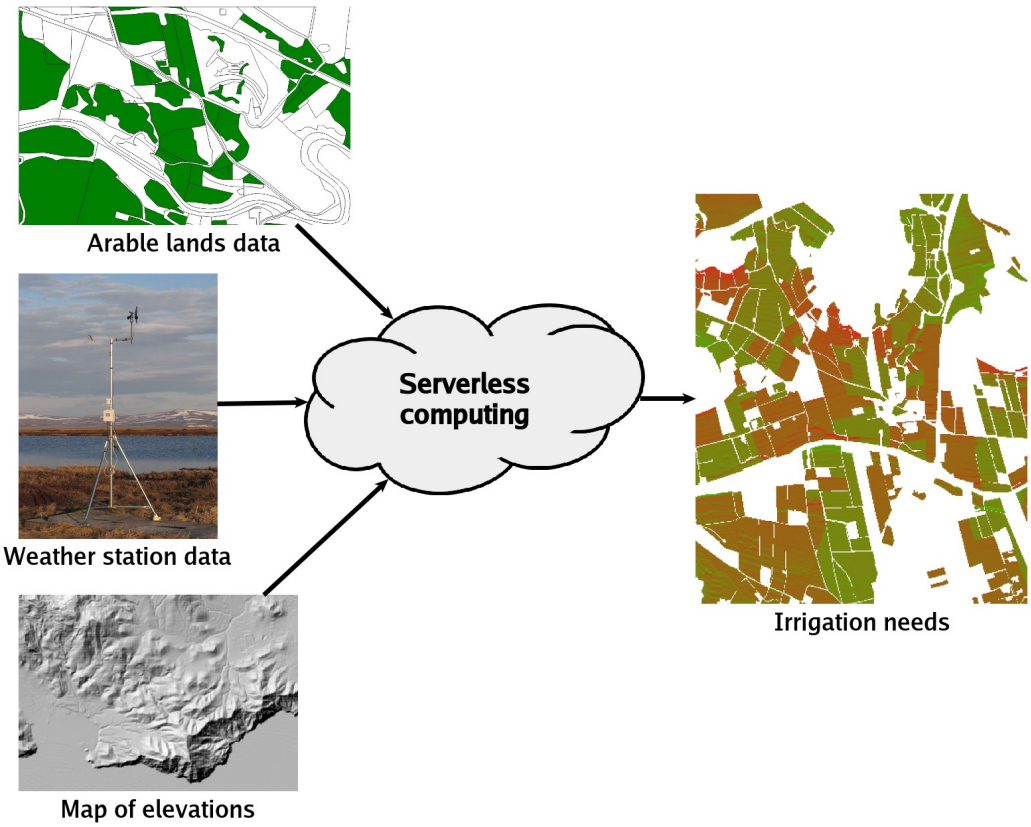
Imagine an agricultural technician responsible for planning the irrigation of several arable lands. Thanks to geospatial processing, they can obtain the irrigation needs of their crop, a process for which there are different estimations.

However, the implementation of these estimations is a computationally expensive process which requires to combine many data from different sources (meteorological information, land orography, agricultural land use data, ...). When the technician tries to apply this process to large areas of land or with a high level of detail, she will be restricted to the capacity of their computer, which has limited resources. The computer may lack the resources necessary to carry out the process or it will spend a large amount of time executing the tasks.

Our technician could buy a better computer, or even do these calculations remotely, on a specialized high-performance server. However, both alternatives present serious drawbacks. For an SME like Answare, a high-end computer is difficult to amortize, and accessing a high-performance server is not straightforward. Also, neither solution is viable as the number of technicians or the land extension to compute increases.

In the context of the H2020 CloudButton project, we set our sights on cloud technologies. This project, coordinated by the CLOUDLAB group at Universitat Rovira i Virgili, is focused on creating a serverless data analytics platform. At Answare, our goal is to give this technician access to the virtually infinite computation resources existing in the cloud. Doing so is not an easy task, since the resources used by each machine when deploying serverless processes are resource-constrained, so we decided to follow a divide and conquer approach. Our application will split the calculation of irrigation needs into small and manageable land extensions which will be parallely processed by multiple computers in the cloud. Our technician will be able to control the number of splits and the range of surrounding areas that location-sensitive processes take into account.

As we use small subdivisions of the original land, the computational requirements of each execution and also the time taken will be very small. The technician can execute processes – which previously last hours – in only a few minutes using a solution which scales with the extent of the monitored land and the number of technicians which do the calculations simultaneously. For example, given an input elevation map located in the Region of Murcia with an extension of 57,200 hectares, our developed serverless estimation process is more than 5 times faster than the previous version. This difference will greatly increase as the number of input maps does. In addition, we leverage the pay-per-use serverless model to reduce the computing costs, paying only for the time actually used for computation.



Our tool, thanks to serverless computing, is an elastic and economic solution for large problems involving arbitrary geospatial data. The system does not require provisioning of resources by expert engineers because it auto-scales on demand depending on the size of the data. Our users can access a cloud supercomputer without any complex engineering skills, and thus democratizing access to Big Data.

Thanks to the cloud, we can know the irrigation needs of a country in a matter of minutes

Thanks to the tools developed in the CloudButton project, we made a swift transition to serverless technologies. The technician will use the same tools she previously used, namely Python notebooks, but the computations are transparently transferred to the cloud. Ultimately, he is able to do his work more efficiently and profitably.