How Mapping, Cadastral and Land Registry organizations in developing countries can cost-effectively assure the quality and reliability of their Spatial Data Infrastructure (SDI)

Methodologies and tools to assure quality and reliability of spatial web services in a cost-effective way for organizations responsible for SDIs in developing countries.

The volume of spatial data collected keeps increasing rapidly with ever more powerful and more detailed ways for observing and simulating our environment and the human behavior. Continuously available Spatial Data Infrastructures (SDIs) are required to create usable information from the vast amount of data by effectively querying and using it from a site possibly located on the other side of the world. A good SDI makes it possible to discover, filter, acquire and interact with spatial data required for a particular use in a reliable, efficient and easy-to-use manner.

National Mapping, Cadastre and Land Registry Agencies and their SDIs are good example of technical environments, where up-to-date spatial data need to be reliably available all the time. For these organisations, high quality spatial information such as topographic maps, satellite images and road information, for an effective and precise land registration, and specially in crisis situations when systems need instant information accurately. In addition to that, nowadays inhabitants are using more and more mobile applications that include spatial information to make their life easier and for better quality. Those applications often also require real time updated data readily available, as well as a fast response from services for the users requesting the information.

Not rarely National Mapping, Cadastre and Land Registry Agencies host hundreds of services, making the task of managing the performance and the utilization of those extremely challenging. Especially when taking into account that some services will be part of a set or group called critical, both in the sense of availability as in the sense of "popularity", which at the end of day, it may affect the performance. Many times, IT departments are keen and quick to develop simple solutions for at least a rough estimate of the availability. However, they quite often suffer when it comes to analyse the usage of the spatial elements of the services. This is usually not part of their core expertise and may take quite a long and expensive process until a satisfactory solution may be established, if so. And when we consider the scenario of frequently limited budget for these tasks, this may actually never be achieved.

Technical standards (by Open Geospatial Consortium, e.g.) aiming at increased interoperability of spatial data, services, and applications created, form a solid base for well-functioning Spatial Data Infrastructures. However, the technical capabilities of the particular software and hardware components alone is not enough to guarantee a fully functional and reliable distributed spatial data infrastructure. Even the most interoperable and advanced SDI components can be configured and connected sub-optimally, making their use difficult, inefficient and unreliable as parts of an SDI. As within any computer system, the SDI components and the networks connecting them also occasionally suffer from technical failures, which temporarily renders them unusable or unreachable for all or some of the users. The field of Quality of Service deals with estimating, reporting and improving the experienced quality of communication between the components of distributed systems to inform users leveraging their capabilities to solve real-world problems.

To establish a reliable SDI, measuring, improving and communicating information about Quality of Service criteria is one of the key success factors. These criteria include availability, performance and capacity of the individual SDI components. Tools for measuring and analysing the Quality of Service do exist, but there is little to no support for a standardised way of communicating the benefits and the impact of an improved Quality of Service level of the spatial services to the end users.

When adopting a more comprehensive monitoring and analytical solution specific for spatial web services, new information can be revealed regarding the users and the level of usage of the services, which shed some light on the challenges and issues faced by the users of those spatial services. Here we list some of the aspects and benefits harvested with the use of a specialized tool. The methodologies and solutions exhibited here* aim to solve the issues above by:

- Testing the capacity of services by generating realistic & relevant loads, so that services meet capacity requirements related to their assigned level of usage;
- Keeping track of uptime and identifying trends affecting service level and availability;
- Establishing thresholds for indicators and setting up alerts and warnings to assure performance levels;
- Analysing the usage level and their trends for services and data sets. By comparing the number of users and the number of requests at the latest month/year with the number of users and requests from the

previous months/years, National Mapping Agencies can identify trends in the utilization and better understand to what extent the spatial information offered is being utilized by public and private users for further developments;

- Identifying the most popular services and data sets (layer or feature type) among all services, these organisations can easily prioritize the attention to those services/data sets as well as perceive which type of information is calling the attention of users instantly, seasonal, or on a consecutive, more continuous basis. Thus, the organisation can drive its resources to increase the robustness of the infrastructure for a specific service on a permanent or temporary basis, according to the outcome of those analyses, making the investments in the infrastructure more effective;
- Showing the actual economic impact of the improvements in the service performance to users.

*This presentation will show a real case study about the benefits and the impact of analysing the quality and usage of spatial web services in a cost-effective way.