



Geographic Information Systems and Cloud Computing

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Abstract

The technology of cloud computing is ushering great change in the world of Geographic Information Systems (GIS). In today's fast paced work environment, systems that can be accessed anywhere and any time have great advantages. The Cloud is answering that call as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned or released with minimal management effort or service provider interaction.

In order to study the impact of cloud computing on traditional desktop GIS, it is necessary to find out what the cloud can offer and then look into some of the options that are becoming available today. ESRI, a leader in GIS software, offers many options that include ArcGIS.com, a free to use web-based GIS software, and an ArcGIS mobile application available for smart phones and tablets. Through thorough literature review and application practice, this research provides a complete understanding of the current development of cloud computing's application in GIS.

Introduction to the Cloud

The Cloud is an idea that resources such as data storage, processing power, and applications are stored on off-site servers that can be accessed by any device that has access to the internet. The "Cloud" in this idea is network that links those devices with the off-site servers.

There are many types of Clouds that differ on the level of privacy afforded to the data stored. These types are the private Cloud, which has the most restrictive access, the public Cloud, which allows anyone with the internet to see, and the hybrid Cloud, which borrows from both types and may mimic a private Cloud that can communicate to a broader public Cloud. This versatility allows users to define how much control they have over the data being stored.

Cloud structures usually use a web-based front end user interface(Fg.1). This interface allows a user to access the applications and data stored on the off-site servers. This means that a GIS user might be able to collect, access, and begin analysis of data off a smart phone or tablet while still in the field, or work from a laptop outside the office setting.

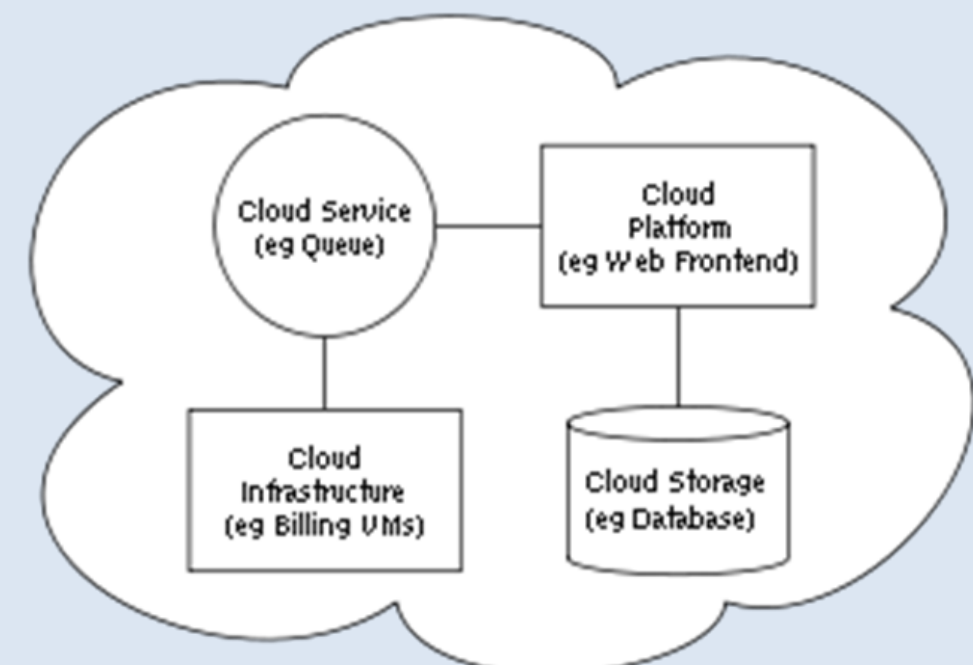


Fig.1. The structure of a Cloud

What The Cloud Can Offer

Extreme redundancy and eventual consistency give the Cloud great **Data Reliability**. Lost or corrupted data can be reconstructed through such redundancy.

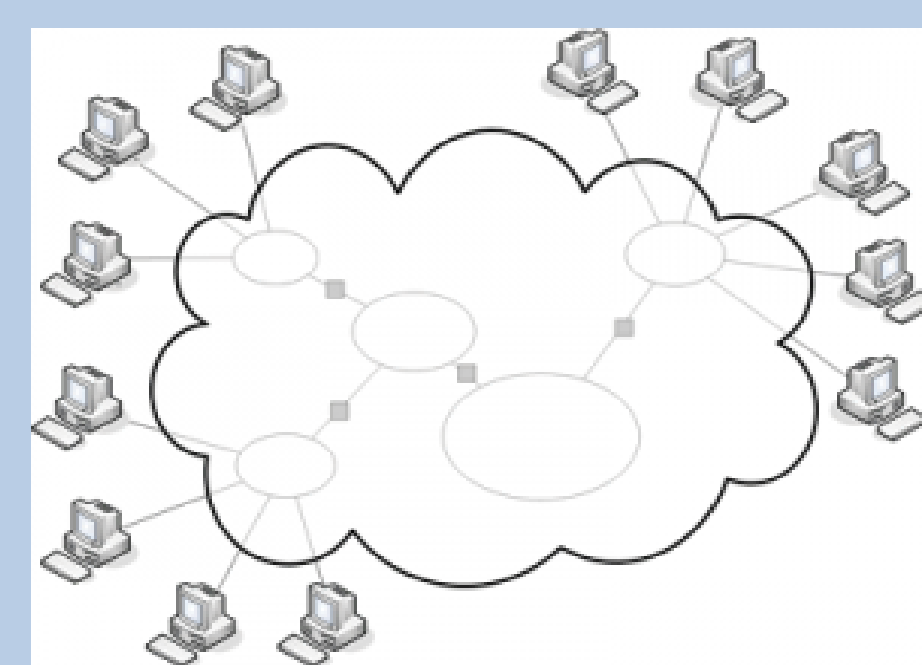
Location Independence is a key benefit of cloud computing. Users can access data servers from anywhere that they have internet, which is virtually everywhere one the globe with satellite technology



The Cloud

Scalability means that processing power and data storage are on demand: the more that is needed, the more that is available.

Database Structure allows multiple users to access and analyze shared data from separate devices



Pros and Cons of Cloud GIS Applications

When comparing Cloud GIS applications to the traditional desktop environments, it becomes apparent quite quickly how useful it could become. Though it seems simple at first glance, ArcGIS.com (Fig.2) and its derivative mobile applications provide enough tools to create maps from data collected or made available by ESRI. Creating data on the smart phone mobile application was as simple as walking around and adding points (Fig.3a). These points can then be uploaded to ArcGIS.com to be analyzed(Fg.3b). This could be highly advantageous to technicians analyzing data in the field, as the user does not need to be back at the office in order to see the results of the day's mapping.

A major disadvantage of the Cloud GIS applications, however, is found when compared to the desktop platform. While ArcGIS.com does offer some tools to make maps, it pales in comparison to the sheer number of analysis tools available to the standard ArcGIS(Fg.4). A second disadvantage stems from the risk of hacking to uploaded private data the cloud, which could be remedied with more stringent data security.

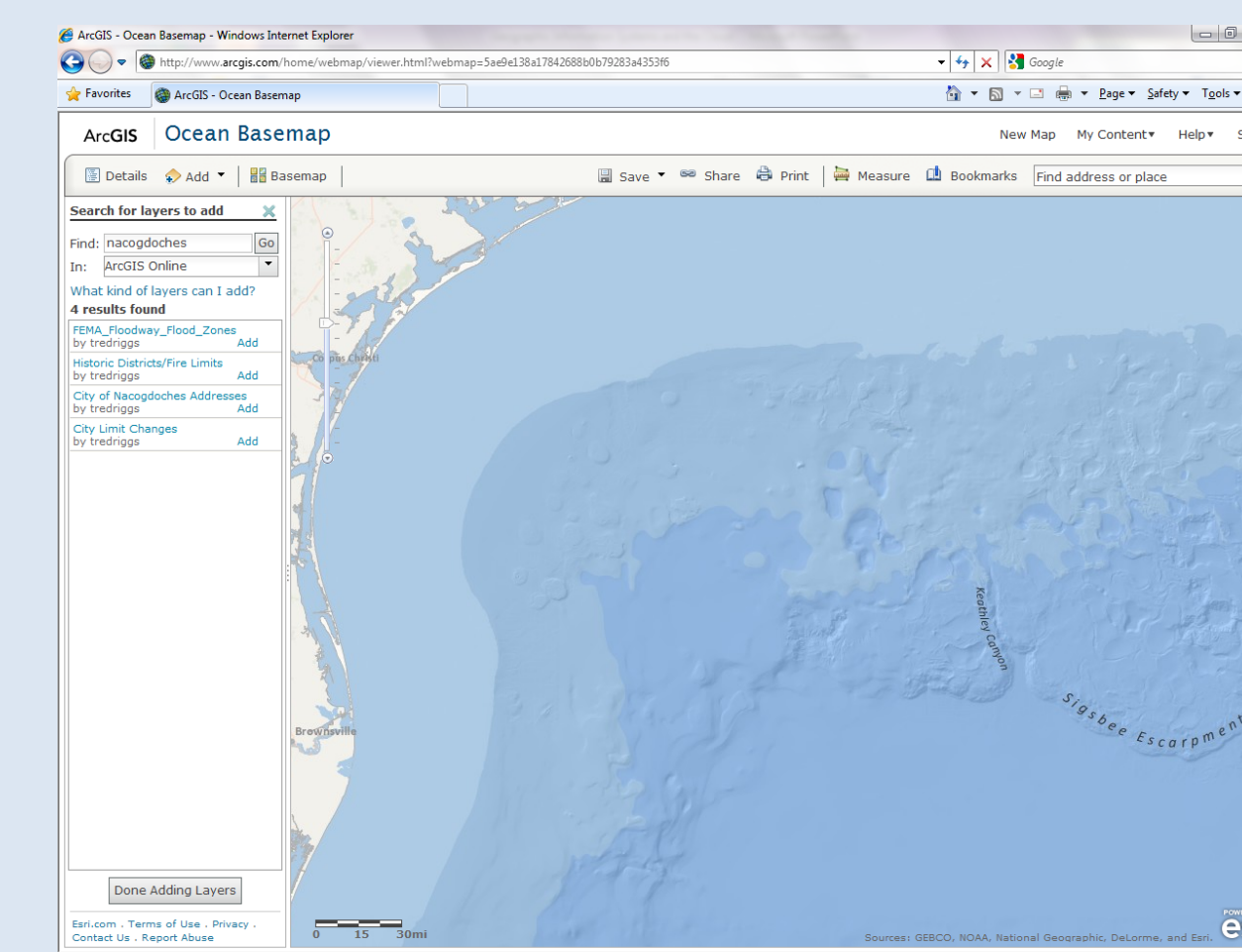


Fig.2. ESRI's ArcGIS.com platform, its entry into Cloud GIS

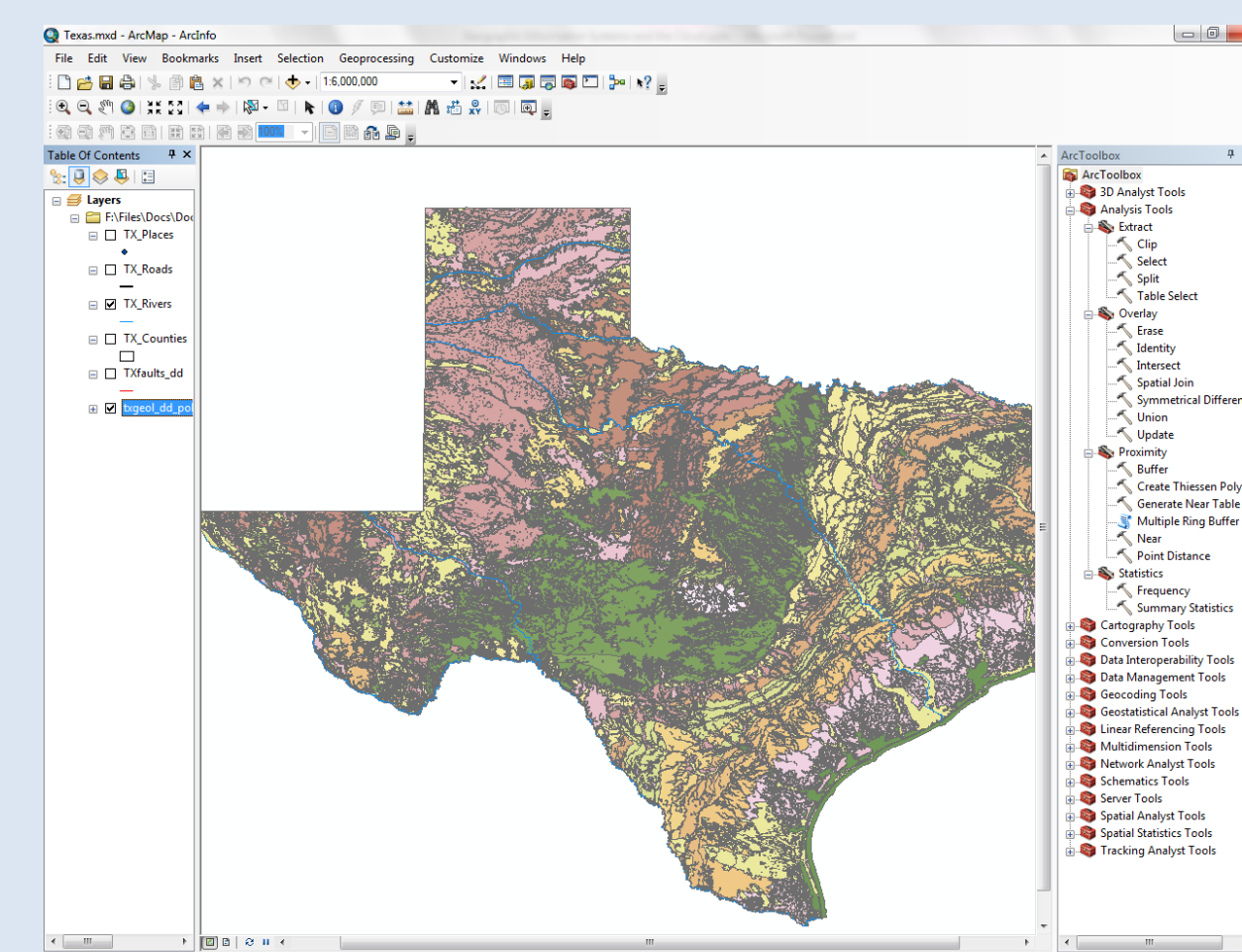


Fig.4. ESRI's ArcGIS desktop platform, the traditional GIS application, with the extensive toolbox shown on the right



Fig.3a. Collecting points on the mobile platform

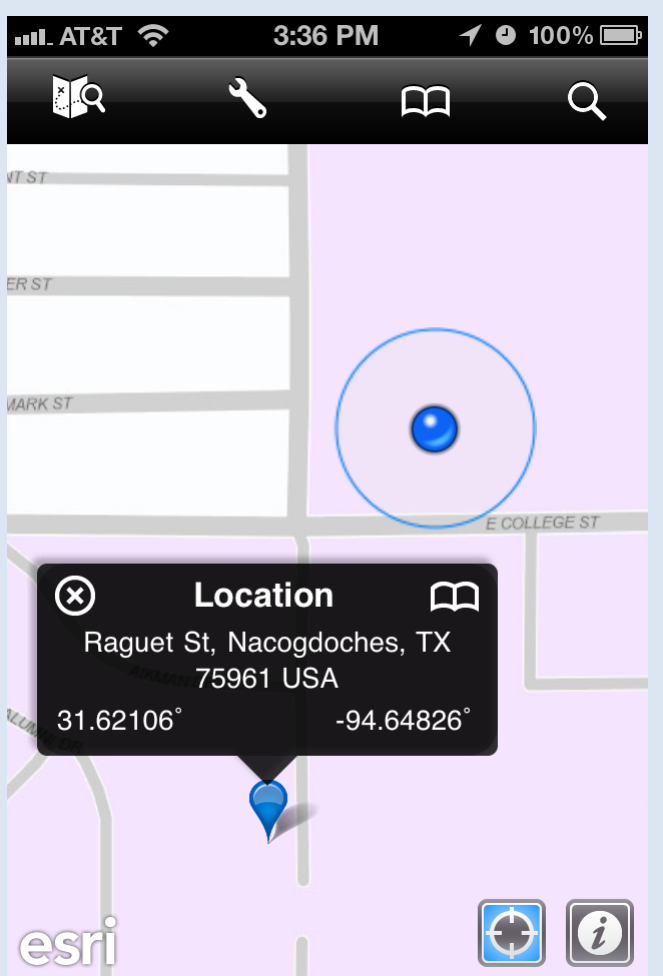


Fig.3b. A second point is added on the smart phone mobile application

Conclusions

Use of the cloud for GIS applications will need to jump a few hurdles in order for future acceptance. First, complexity generally translates into less user friendly with computer applications, but Cloud GIS platforms need to be able to better compete with the analysis tools of traditional desktop platforms. Without many of the more in depth tools, the Cloud GIS platform becomes utility of amateur users, and will not gain traction with GIS professionals. Second, the security issues with putting private data onto a cloud should be addressed more carefully. If one cannot trust that his data is safe, he won't have a reason to upload it and use cloud computing.

The advantages of this technology, however, are greatly compelling. The Cloud would unshackle users from their traditional posts, and allow greater productivity due to this independence from the 4 walls of the office. The data management in terms of reliability and scalability are leaps and bounds better than a traditional setting, and the ability to share data across a very wide group of users would make long distance collaboration quite simple.

With a little bit of time and polishing, the Cloud could very well become the standard platform by which all GIS work is done. It will be interesting to see how this technology becomes widely used among professionals in the future.