Thinking On Sharing 3D GIS Data By Web Service Following OGC Standard

Wu Lvewei
Nanjing Urban Planning & Research Center, Nanjing, Jiangsu, China

ABSTRACT

Sharing based on web service is a well-understood method in GIS. This paper mainly study on how to share 3D GIS data in this way. Based on the analysis of current situation, this paper concludes the existing problem and put forward the idea of sharing 3D by web service following OGC standard. Besides , feasibility and practicality of the idea are verified by relevant experimental evidence. In the end, a framework conforming to the idea above is present, providing reference to the sharing 3D GIS based on web service.

Keywords: OGC, web service, 3D, share

1. 1. INTRODUCTION

By the development of 3D technology, 3D GIS is widely used in various fields. When massive 3D data are acquired by data collection tools increasingly rich, it becomes a realistic issue to be considered that how to share so as to meet the application requirement. Undoubtedly, directly data copy is the most common way of sharing, but there are also obvious drawbacks. In recent years, sharing based on web service is becoming the most popular way because of its efficient, security and reusable.

Comparing with traditional 2D GIS, 3D GIS is still backward in data sharing based on web service. There are many reasons for this backward: On the one hand, 3D technology itself requires more powerful graphic display performance and higher bandwidth capacity, on the other hand, the development of OGC standard about 3D web service is far behind 2D and there is still not formal version released. All the above make it hard to solve the problem existing in the process of sharing 3D geodata based on web service fundamentally.

Analysing current situation of sharing 3D geodata based on web service, this paper concludes existing problem, and pays more attention to verify practicability of the idea that sharing 3D geodata by web service following OGC standard as well as corresponding implementation framework, providing foundation for the effective application of 3D GIS.

2. 2. STATUS ANALYZING

Most popular GIS platforms support 3D web service, as shown in Table 1:

Table1. Status of popular GIS platform supporting 3D web service

Company	GIS Platform	Service	3D Support
ESRI	ArcGIS server	Globe Service	Yes
Skyline	Skyline Globle	SFS	Yes
SuperMap	SuperMap iServer	REST-real space service	Yes
Gvitech	CityMaker Server	featureService& terrainService	Yes

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According to the table above, all the platforms support 3D web service although their architectures are not the very same. Sharing 3D geodata based on web service, so to speak, is not a challenge from a technology perspective. However, from an application perspective, 3D web service still exists many shortages. For example, comparing with 2D web service, 3D web service is less effective. Other shortages of 3D web service mainly include:

Firstly, sharing is restricted to platform. At present, 3D web service from different GIS platforms cannot access each other, so is the geodata delivery by the web services. It cause that 3D web service is tied to the GIS platform. When geodata to be shared is published by a GIS platform different from the demander's one, sharing cannot be realized.

Secondly, sharing is inflexible. The type of existing 3D web service is single and almost all the 3D web services are designed without considering various application demand as well as composite application of the web services, focusing solely on delivering 3D geodata in respect platform from server side to client side.

Thirdly, architecture optimization is ignored. Most existing 3D web service adopt the thick-client architecture when design, asking client to do a lot of works like 3D rendering or calculating. Under this architecture, client needs to have more powerful graphic display performance and higher bandwidth capacity because the size of 3D geodata is huger compared to 2D. If the client performance is poor, there would not be a great sharing effect.

The same problems have ever troubled 2D geodata sharing. Realizing and supporting web service following OGC standards (WMS, WFS, WMTS) solve the problems to a great extent. But in the 3D technology field, there is still not formal version of OGC standard released. Currently, OGC has developed some standards on 3D web service, but only draft paper released. There still are obstacles to share 3D geodata by web service because the feasibility and practicality of OGC 3D web service need to be tested further.

3. SHARE 3D GIS DATA BASED ON WEB SERVICE FOLLOWING OGC STANDARD

Although the OGC standards on 3D web service are not released formally, we have to rely on them if we want to solve the problems mentioned in part 2 well. There are a couple of reasons. First, OGC standards are accepted by public, making systematic definition and classification on 3D web service, what is essential to realize sharing; second, the OGC standards on 3D web service can elegantly solve the problem that 3D data delivering by web service from different platforms cannot interoperate and overlay with each other, and if web services from various platforms followed uniform OGC standard, data accessing should not be difficult; third, seeing from the draft paper of 3D OGC standards, the shortages about architecture and efficiency have been considered during the progress of standard developing, making it possible for sharing efficiently and thin-client based. What is more, 2D OGC standards have solved the problems existing in sharing 2D geodata by web service, and refer to the experience, 3D can do so, too.

Therefore, the OGC standards on 3D web service are further discussed in this part and the feasibility and practicality verified are focused on. As long as the OGC 3D standards are feasible and practical, the problems existing in sharing 3D geodata based on web service will be solved simply.

3.1 OGC 3D web service

Although formal version is not released, OGC has been developing its 3D web service standards for years and have released several discussion papers. By now, the newest 3D web services of OGC public known are W3DS and WVS:

(1) W3DS (Web 3D Service)

Being similar to 2D web service WMS, W3DS does not delivery original data to user by the service interface, but the 3D scenes that are comprised of display elements. In contrast to the WMS, the output of a W3DS is not images, but scene graphs consisting of a tree like structure of nodes, groups, transforms, shapes, materials, and geometries. Since attributes are not part of the scene graph, they must be accessed by additional service operations. W3DS is optimized for efficient real time rendering at high frame rates and can be interactively displayed and explored by internet browsers with 3D plug-ins, or loaded into virtual globe applications. The newest version of W3DS is 0.4.0.

(2) WVS (Web View Service)

WVS is a portrayal service developed from WTS(Web Terrain Service) and WPVS(Web Perspective View Service).WVS mainly provides 2D image representing a 3D view on a scene. Users can get access to complex 3D geodata without having to provide and maintain specific 3D graphics hardware because only standard images are transferred. WVS is thin client architecture and thus visual representations of complex 3D scenes can be easily integrated

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into various workflows, applications, or systems. WVS is suitable to the situation that clients do not provide powerful 3D graphics capabilities for processing 3D graphics data such as mobile phones. The newest version of W3DS is 0.3.0.

3.2 Feasibility validation

Feasibility is primary to share based on OGC 3D service. OGC had published a public engineering report called OGC 3D Portrayal Interoperability Experiment (3DPIE for short) which test and demonstrate different approaches for service-based 3D portrayal based on Web 3D Service (W3DS) and Web View Service (WVS). The 3DPIE includes three different phases: data integration, service integration, and service delivery. As shown in Figure 1:

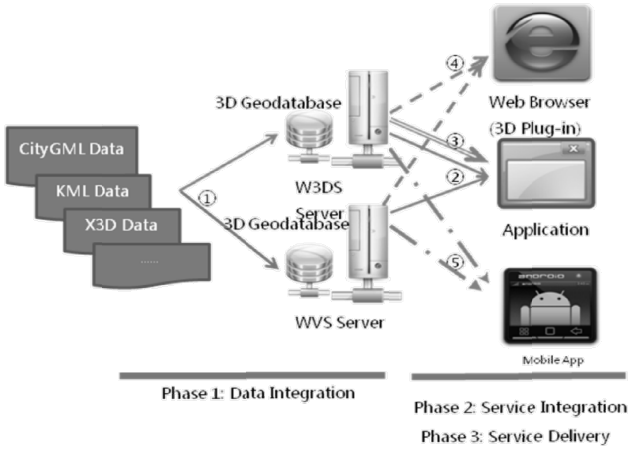

Figure 1. Phases of 3DPIE

In Figure 1, experiment ② tests the interoperability between W3DS and WVS on the interface and application level by integrating WVS images in a W3DS client; experiment ③ test basic W3DS interface capabilities that are necessary to merge multiple data sets; experiment ④ test the ease of including 3D geospatial content in web pages as multimedia component; experiment ⑤ test the applicability of the 3D portrayal approach for the visualization of and interaction with large 3D worlds on thin clients such as smart phones and tablets.

The experiment validates the feasibility of sharing based on OGC 3D service, and conclusion made from the experiment is as follow:

(1)W3DS and WVS published by the same platform are interoperable.

(2)Some W3DS services published by different platforms are interoperable.

(3)W3DS and WVS are applicable to various clients include web browser, application and mobile app.

3.3 Thinking on share 3D geodata based on W3DS and WVS

The feasibility has been verified in section 3.2, establishing the foundation for sharing based on OGC 3D web services. But there still are some issues that need to be considered. For examples, in practical sharing applications, a 3D scene is comprised of not only 3D geodata but also 2D geodata like vector, image and so on, then how to meet the need for 2D geodata in 3D application and realize synergetic displaying of 2D and 3D as well as the operations like querying, analysing? Nearly all the platforms having private 3D web services itself, should OGC 3D web service or private 3D web service be used in sharing? The 3D web services talked about above are Portrayal Service, and how about Processing Service of 3D? Therefore, a technical framework is needed to guide the sharing. The goal of the framework is to make clear the position and function of OGC 2D web service and private 3D web service, and to clarify the relationship among OGC 2D web service, OGC 3D web service, private 3D web service and 3D processing service. Finally, a feasible and practical technical framework is presented.

The framework that fitted the description above is shown in Figure 2. In core of OGC 3D web service, this framework satisfies practical application and provides reference to the sharing 3D geodata based on web service.

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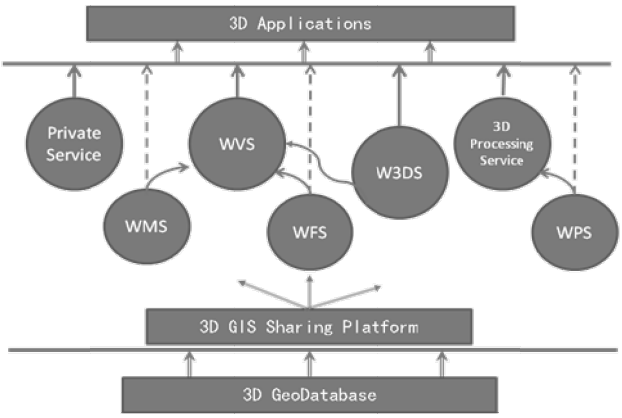

Figure 2. Technical framework of sharing 3D geodata based on web service

At the bottom is the basic supporting of the framework-3D geodatabase, which is used to storage the 3D geodata to be shared; In the middle, a 3D sharing platform is construct to publish all the web services include 2D and 3D, delivering geodata to various applications; on the top, 3D applications get geodata by web service interface and take advantage of them. Among the web services in the framework, private web service is the 3D web service defined by GIS platform, with the characteristic of high efficiency within platform and poor interoperability between platforms, being used to providing data to the application running in inner network; OGC standard W3DS and WVS are the core of 3D sharing and used to sharing data between platforms or applications running in inner network or Internet because of their great interoperability; 2D OGC standards WMS and WFS are used as data source of WVS, and meet the 2D data requirement in 3D application to some extent; 3D processing service is a to be defined but indispensible web service which publishes and shares geoprocessing that only belong to 3D, and used to do the spatial analysis in inner network or Internet; OGC standard WPS is 2D processing service and used to provide necessary supporting to 3D processing service and 3D applications.

3.4 W3DS implementation

The implementation process of 3D OGC web services is very import to put the framework into use. The brief introduction about how to implementation W3DS is given here.

(1) The class diagram of W3DS implementation

W3DS includes 5 interfaces: GetScene, GetCapbilities, GetFeatureInfo, GetLayerInfo, GetTile. Figure 3 is the class diagram of implementing interfaces GetScene, GetFeatureInfo and GetTile.

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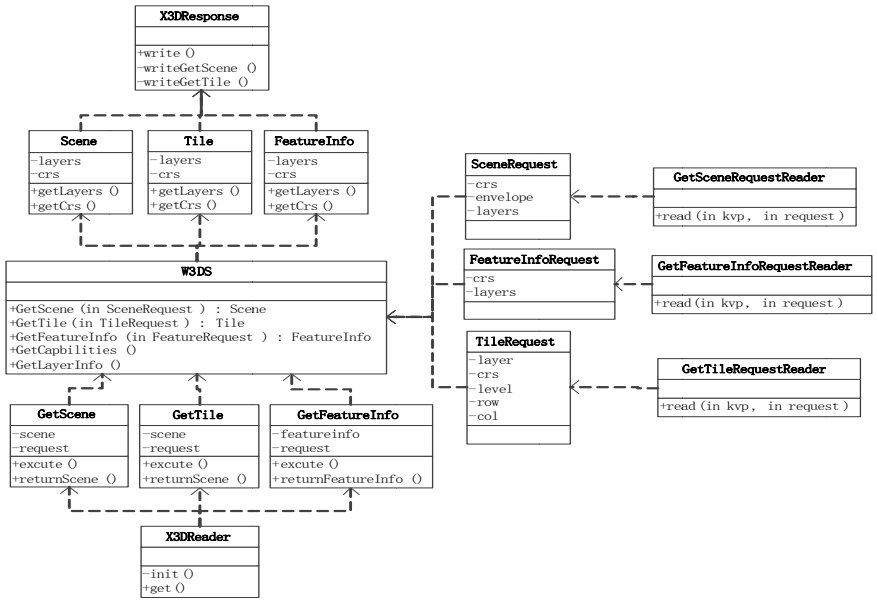

Figure 3. Class diagram of W3DS implementation

(2)The achieving result of W3DS

Some open source software has implemented W3DS. Figure 4 is the display effect of an open source client.

Figure 4. Display effect of W3DS

4. CONCLUSION

Sharing 3D GIS based on web service following OGC standard can not only reduce the cost and difficulty of constructing 3D GIS system and resolve the problem of isolated information in 3D field but also avoid the disadvantage of current 3D sharing. By analysing the current situation of popular platforms, this paper explores the feasibility of sharing 3D geodata based on web service and present an idea that share in core of OGC 3D web service, providing reference to the corresponding sharing.

With the deeper development of platform for geoinformation common services, the shortage of existing 3D sharing will be found in practical application. The demand for sharing following OGC standard will increase, too. This paper preliminarily gives the answer to how to share 3D geodata by web service following OGC standard and provides supporting to the construction of platform for geoinformation common services. Therefore, this paper has important meaning of improving the foundation surveying and mapping production's share and wide application.

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