STUDY ON THE "DIGITAL REGION" IN THE CONTEXT OF THE "GRID COMPUTING"

Qi Li   **Jian Cao**

liqi@pku.edu.cn   caojian@cybergis.org.cn
CyberGIS studio, Peking University, Beijing, 100871, China

ABSTRACT

In this paper ，Authors want to construct a "digital region" information framework based on the technology of "SIG" and its significance and application to the region sustainable development evaluation system. First, the concept of the "grid computing "and "SIG" is interpreted and discussed, then the relationship between the "grid computing and "digital region" is anysis following the framework of the "digital region" is put forward. Finally, the significance and application of "grid computing" to the "region sustainable development evaluation system" are also discussed.

KEY WORDS: grid computing   SIG (spatial information grid)   digital region

1.   INTRODUCTION

"grid" computing has emerged as an important new filed, distinguished from conventional distributed computing by its focus on large-scale resource sharing, innovative applications, and in some cases, high -performance orientation. The term "the grid" was coined in the mid1990s to denote a proposed distributed computing infrastructure for advanced science and engineering Considerable progress as since been made on the construction of such an infrastructure. The aim of the grid is to make us to use the powerful computing like using the power grid. "grid computing" which be treated as the 3G of the internet, is the direction The concept of the "SIG" (spatial information grid) which was put forward based on the grid computing, is the infrastructure and useful tool to construct the "digital region".

Region sustainable development evaluation system is the foundation of the region sustainable development and which is to complex too establish an evaluation index in the conventional way. So, it is urgent to call for an advanced method and technology to tackle this problem. The concept of "the digital region" which is put forward based on that of "the digital earth" means using the computer and networks to management the information of the region, model the region development and support the region decisions. Constructing the "digital region "using the "grid" idea and "grid" related technology will offer a common information share and interoperation platform and can play an important role in the study of the system of the region sustainable development evaluation system.

The purpose of this paper is to make the reader understanding the concept of "SIG" which based on the "grid computing" and its significance and application to the

"digital region" and "region sustainable development evaluation system.

1. "gird computing"

GRID, which is called the next generation of the internet, is an important national infrastructure which related to scientific research, economy, society and national defence. The research of "grid" has aroused the passion of the scientist in home and abroad since it was proposed in late 1990s.

The definition of the "grid" there are two definitions of the grid .one is the narrow grid and the broad one, the former is defined by Ian Foster in July 2002. "the restrict grid must meet three qualifications.(1)using the resource cooperate with each other in non centralize control environment ;(2)use the standard ,open and common portal and interface;(3)offer non-normal services.

Another definition of the gird is broad grid which is called the GGG (Great Global Grid). it not only includes the computing grid, data grid ,information grid ,knowledge grid ,but also include the network computing model such as p2p,etc.the traditional internet realize the interconnect of the hardware .the web technology realize the interconnect of the homepages and the grid try to realize the interconnection of all the resource in the internet.

There are mainly 4 kinds of application domains in terms of Ian Foster and Globus group:(1)distributing (2)supercomputing (3)distributing instrument system (4)date intensive computing and long distance immerse.

2. "SIG" (spatial information grid)

From literally, spatial information grid is a kind of grid which offers a common agent based spatial information application services for the user using the spatial information infrastructure and spatial information network portal standards. Spatial information can be disposed in distributed environment intelligently and the user can have a single access to the logical portal .all kind of the spatial information resource can be manage and used in unite by "SIG.".   The ultimate aim of the SIG is to realize the services order t of the spatial information reappearance and one request to receive service response.

The study of the framework of the spatial information grid can involved the (1) expression and release of the spatial information bottom layer of the spatial information database (2) show the use and developer how the logical structure is delaminated, implemented and integrated. (3) Function of the spatial data in middleware (related to the storage, interface and communication of the spatial data in this layer).

Just as mentioned before, the concept of he "grid" coined after the power grid. The ultimate of the grid is make the user use the computing power easy like using the power .The ultimate of "SIG" is to make the users of spatial information use the uniform spatial information easily regardless of its store location. In a word, SIG offer a universal spatial information services for the end user regardless of the detail

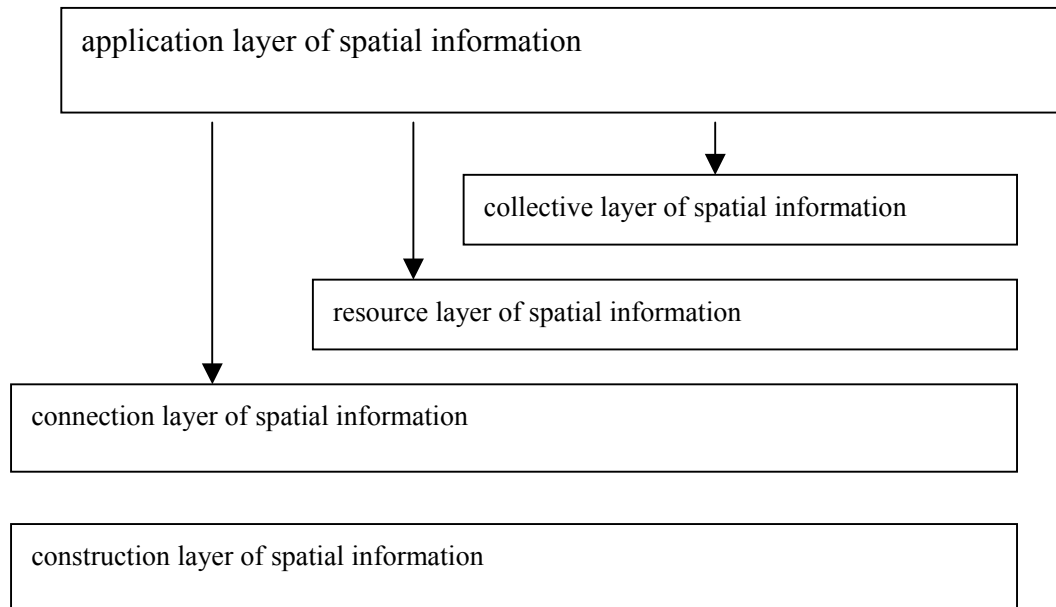computing installations and geographical location of the storage and computing of spatial information.

```
·  ┌─────────────────────────────────────────────────────────┐
   │  application layer of spatial information               │
   └─────────────────────────────────────────────────────────┘
          │            │                    │
          │            │            ┌──────────────────────────────────┐
          │            │            │ collective layer of spatial information │
          │            │            └──────────────────────────────────┘
          │            ▼
          │   ┌──────────────────────────────────────────┐
          │   │ resource layer of spatial information     │
          │   └──────────────────────────────────────────┘
          ▼
   ┌─────────────────────────────────────────────────────────┐
   │  connection layer of spatial information                │
   └─────────────────────────────────────────────────────────┘

   ┌─────────────────────────────────────────────────────────┐
   │  construction layer of spatial information              │
   └─────────────────────────────────────────────────────────┘
```

Figure 1 the framework of the SIG

The crude framework of the spatial information grid, illustrated in figure1, is make up of following layers:

The application layer of spatial information
The construction layer of spatial information:
The connection layer of spatial information
The resource layer of spatial information
The collective layer of spatial information

3.   the relationship between the digital region and the grid computing

The concept of the digital region is come from that of "digital earth" which is developed into a stratagem for the country and region gradually since it put forward by Gell in 1998. "Digital region" is application of the "digital earth" region environment. The concept of "digital region" is a evolved one and is the concept of managing information resource, establish the related application and offer the related services by using the network and computer technologies. It is affected and evolved by the computing and network technologies. With the development of the networks, the technology support the "digital region" will evolve form the distributing computing to the GRID one.

We can use the idea and gird computing technology to construct a "digital region", the "digital region "can be treated as the representative application of "grid "and "grid computing" ,but they just a tool to implement the "digital region" and can not be treated as the whole part of the constructing of "digital region".

"Grid computing" is the key technology and network platform in constructing the "digital region". Some aim of the "grid computing" such as the share of the information, SOD (services on demand) can meet the need of the "digital grid". We

can say that the "digital region" supported by the "grid" and "grid computing" is a group of grid which support the spatial attribute.

Its ultimately aim is to support the region sustainable development decision

It can realize the share of the region information especially the spatial information because which can be seen as the basic part and can integrated the related attributed information by it and can model the region development.

The GGC (global grid computing) can be seen as a part of the "digital earth" to some extent. "Digital region" is the one important part of the digital earth nerve network which make up by at least 2 parts of the nerve cell and related linkage.

4. digital region based on the grid computing

The framework of the "digital region" is constructed by the grid computing technology and grid idea which is illustrated in the figure2
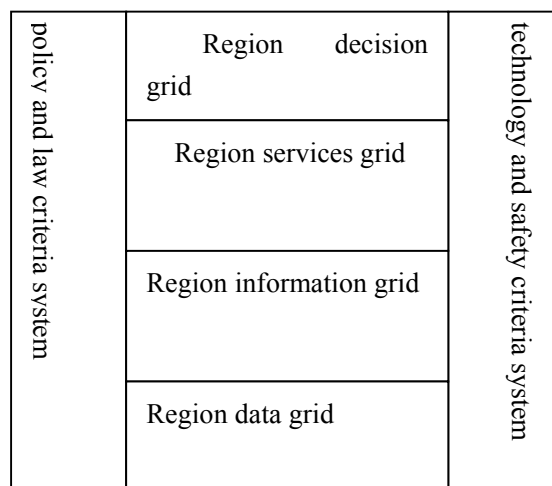
policy and law criteria system	Region decision grid	technology and safety criteria system
	Region services grid	
	Region information grid	
	Region data grid	

Figure2 framework of the "digital region" based on the "grid"

5. digital region and the region sustainable development evolution system

The land of our country is the broad one and the development of the region is imbalance which led to the "region development problem". The region sustainable development is the key to the region development problem. region sustainable development evolution indexes system is make up by a group of evaluation index which is interrelated each other and is established in order to realize the aim of the region sustainable development .the region sustainable development system is a huge complex system which make up by resource ,environment, economic and social subsystems. The index of the region sustainable development should completely reflect the characteristic of indexes and their combination.

In the past few years, many meaningful attempts have been made by research institutes and scholars and various sustainable development evolution indexes are establish in differently ways.

The selection of evolution indexes must based on the analysis of a lot of region sustainable development information

The characteristic of region sustainable development information is regional,

distributing and integration, so it is hard to realize the share and interoperability needlessly to say the cooperation of the related organization and this is a big obstacle to establish the region sustainable development index system.

We hold the view that the region sustainable development evolution indexes system which is based on the anysis of a lot of sustainable development data and case study is developed and perfect gradually. A unite index system is established gradually with the development of in practice and experience of the region .constructing the "digital region" play an important role in establishing the region sustainable development evolution indexes system.

Firstly, we can have a unite access to the region sustainable development information from this platform which is established on the grid computing.

Secondly, we can monitor the region on the "digital region "platform and offer the real and useful data for the establishing of the region sustainable development evolution indexes system.

Thirdly ,we can constructing the region dynamics model to model the region development and help to put up the simulation system of the region .such as "region disaster weather simulation, region flood simulation model ,region economic environment simulation and so on to offer the study case and experience data for the establishing of the region sustainable development index system.

The framework of "digital region" support the region decision and region sustainable development index system is illustrated in figure 3.

| Region sustainable development decision grid |
| Region sustainable development evaluation system grid |
| Region sustainable development services grid |

| Region Resource System Grid | Region Economic System Grid | Region Social System Grid | Region Environment System Grid |

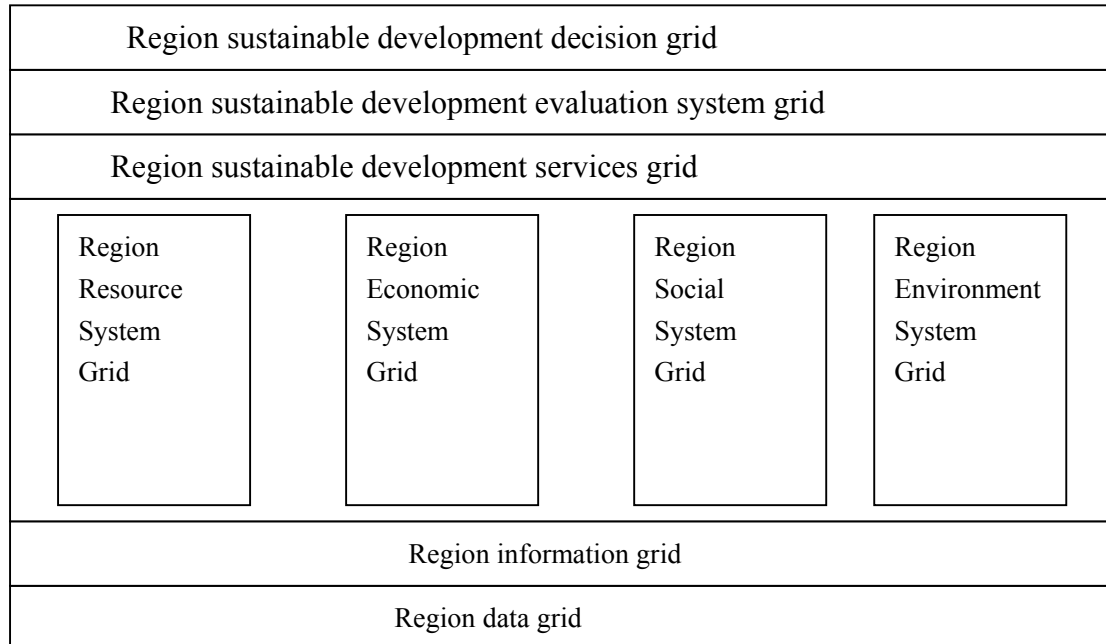| Region information grid |
| Region data grid |

Figure 3 "digital region" support the region decision and region sustainable development index system

6.   Conclusion and further work

In this paper, we try to use the idea of "grid "and "grid computing "to construct the "digital region". We drawn the conclusion that grid and grid computing is very useful

to construct the "digital region" and which can help to establish of the region sustainable development index system. these framework is not mature and need further deep study ,the next of our work is

(1) Perfect the framework of the "SIG" and study how to establish it with the current grid technology.
(2) Perfect the framework of the "digital region" and "region sustainable development index system"
(3) Choose representative region such as the "digital JING JIN TANG area which refer to the Beijing ,Tianjin and tangshan to and implemented.

REFERENCES

http://www.gridhome.com

Dou .Z.H(2002) *grid computing* (in chinese) ,Tsinghua university press 2002 137-173page

Cheng.J.C (2001)*Introduction to the region sustainable development in the context of information society*, Shangwu press 2001 (in Chinese)

Cheng.J.C(2003). D*igital city-theory, technology and method* (in Chinese) science press 2003.1 Beijing

GoreA (1998).*Digital Earth.Understanding Our Planet in the 21st century* http://www.digitalearth.gov/speech/html.1998

Zeng.L (1999) *constructing the "digital region environment, accelerate the sustainable development of the yangzi industry area* . Chinese graphic and imagine special on "digital earth "1999 supplement

Li.Q (2002) *research on the technical framework of the "digital city technology* trasaction of the wuhan university 4 2002

Li.Q (1999) Wu .S.Y *digital earth –the third leap for mankind to understand the earth in 21st century*

Ian Foster(2002) ,*grid services for distributed system integration* 2002 IEEE

IAN FOSTER(2000) "*Internet Computing and the Emerging Grid*" Nature Web Matters, 7 December 2000 http://www.nature.com/nature/webmatters/grid/grid.html

Wang.F.F (2002) *some assume and classify of the sustainable development index system* soft science research 2002

Liu.L.L(2002) *research on the region sustainable development index* (in Chinese) soft science 2002