

AN EFFICIENT APPROACH TO LOAD BALANCING OF VECTOR MAPS IN CYBERGIS CLUSTER ENVIRONMENT

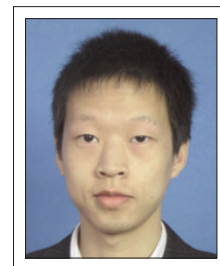
Mingqiang Guo^{a,b}, Ying Huang^b and Zhong Xie^{a,b}

^aFaculty of Information and Engineering, China University of Geosciences (Wuhan), China

^bGIS Software and Application Project Research Center of the Educational Department, Wuhan, China

The real-time visualization of vector maps is the most common function in CyberGIS, and it is time-consuming, especially as the data volume becomes larger. How to improve the efficiency of visualization of large vector maps is still a significant research direction for GIS scientists. In this research, we point out that parallel optimization is appropriate for the real-time visualization of large vector maps. The main purpose of this research is to investigate a balanced decomposition approach which can balance the load of each server node in a CyberGIS cluster environment. The load balancer analyzes the spatial characteristics of the map requests and decomposes the real-time viewshed into multiple balanced sub viewsheds, so as to balance the load of all the server nodes in the cluster environment. The test results demonstrate that the approach proposed in this research has the ability to balance the load in CyberGIS cluster environment.

La visualisation en temps réel de cartes vectorielles est la fonction la plus commune dans le domaine des cyberSIG. Elle est très coûteuse en temps, surtout lorsque le volume de données augmente. L'amélioration du rendement en visualisation de grandes cartes vectorielles demeure un axe de recherche important pour les scientifiques œuvrant dans le domaine des SIG. Dans le cadre du présent article de recherche, nous signalons que l'optimisation parallèle est convenable pour la visualisation en temps réel de grandes cartes vectorielles. Le but principal de cette recherche est de trouver une méthode de décomposition équilibrée qui peut bien répartir la charge de chaque nœud de serveur dans un environnement de « cluster » de cyberSIG. Le répartiteur de charges analyse les caractéristiques spatiales des requêtes cartographiques et décompose le cône visuel en temps réel en sous-cônes visuels multiples et équilibrés, afin d'équilibrer la charge de tous les nœuds de serveurs dans l'environnement de « cluster ». Les résultats des essais montrent que la méthode proposée dans cette recherche est capable d'équilibrer les charges dans un environnement de « cluster » de cyberSIG.



Mingqiang Guo
gmqandjxs@163.com



Ying Huang



Zhong Xie

1. Introduction

WebGIS (also known as web-based GIS and Internet GIS) is a new generation of Geographic Information System (GIS) whose client is implemented in a web browser [Yang, Wong et al. 2005]. In recent years, Wang, Yang et al. proposed CyberGIS [Wang 2010], which is based on the cyberinfrastructure. It has emerged as a new generation of GIS, representing an important research direction for both cyberinfrastructure and geographic information science. It also exhibits the following key characteristics: high-performance and scalable, open and distributed, collaborative, service-oriented, user-centric and community-driven [Wang, Anselin et al. 2013]. Many scientists have made great contributions to research the

architecture, key technologies and applications based on CyberGIS [Yang, Nebert et al. 2011; Wang, Anselin et al. 2013].

With the development of surveying, mapping and remote sensing technology, the volume of vector spatial data is increasing exponentially. The characteristics of data intensive and computing intensive tasks have gradually emerged [Yang, Goodchild et al. 2011]. The increase in the number of concurrent users brings great challenges to CyberGIS for the concurrent processing capability [Goodchild, Yuan et al. 2007; Wang 2010]. It has severely impeded the sharing and applications of large vector maps, especially within the Internet environment.