Chapter X
Implementation and QoS for High-Performance GIServices in Spatial Information Grid
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ABSTRACT

With the development of grid technology, the spatial information grid researches are also in progress. In China, the spatial information grid platform (abbreviation to SIG) not only can provide geo-spatial data services (GDS) for handling terabytes of geospatial data, but also can present processing functionality services (PFS) encapsulated from several Remote Sensing (RS) software to solve RS computing problems remotely. In particular, the spatial user can utilize some provided high-performance PFS to achieve those computing intensive tasks that lacking of the high-performance computing facility such as cluster or Condor platform. Unfortunately, the existing SIG paid litter attention to Geographic Information Science (GIS) field, as a result, the constitution of PFS related to GIS, especially the high-performance GIServices (HP-GIServices), are becoming the main issues for SIG’s next research. Lacking of GIServices mainly resulted from the limitations of SIG architecture, difficulty of extracting parallel GIS functionalities modules, as well as the complexity for services implementation and encapsulation. Based on existing SIG platform, this chapter proposes the improved architecture for SIG, upon which the constituted GIS nodes can provide GIServices. Within the new architecture, some parallel GRASS GIS (Geographic Resources Analysis Support System) algorithms programs, which are built by different parallelization patterns and can run in cluster with better efficiency, are encapsulated to high-performance GIServices.
guiding by certain generic mode. Lastly, the QoS (quality of services) indexes are proposed to evaluate the quality of the constituted HP-GIServices in SIG. From the tentative experiments and analyses, the facts demonstrate that this approach can reach our aims. In all, the chapter firstly gives an overview of existing SIG platform. Facing to the problem of lacking of HP-GIServices, the improved architecture, various parallelization patterns to extract parallel GIS algorithms based on GRASS GIS are proposed. Furthermore, the encapsulation guidance and QoS for evaluating HP-GIServices are also discussed.

SIG AND THE IMPORTANCE OF HP-GISERVICES

Grid can provide resources for sharing and collaboration through different administrative domains. Those resources can include hardware, software, data, and even frameworks (Expert Group, 2004). Virtual organization (VO) is the key concept in grid applications, and is defined as a temporal or permanent set of entities, groups or organizations that provide or use those resources (Foster and Kesselman, 1998). With the development of grid, the use of grid computing is continuously increasing and is being introduced into application fields such as biocomputing, finance and image processing, as well as consolidation in more traditional areas such as high-energy physics and geosciences (Blanquer et al., 2005). In particular, spatial information research plans such as DATA GRID in Europe, Earth System Grid in the US, and the Spatial Information Grid of China are in progress.

Generally speaking, spatial information grid is a fundamental infrastructure that can collect and share all types of geospatial information rapidly and effectively, with powerful capabilities for service on demand, geospatial data management and information processing. SIG is an innovational framework that provides end users with approaches for querying, accessing, manipulating and analyzing the information available. In addition, SIG is a distributed environment that combines resources such as geospatial data and computing, story and processing tools to supply services to geospatial applications. (Jin, J.J., 2004).

Status Quo of SIG

SIG platform, one part of the whole spatial information grid in China, is constituted by 3 types of nodes, namely, data grid services node (DGS-Node), computing grid services node (CGS-Node) and management grid services node (MGS-Node), supplied by 4 different research units that located in different areas geographically. DGS-Nodes have several types’ geo-data and various formats. CGS-Nodes mainly point to the computing platform including Cluster and Condor. Upon CGS-Nodes, some software as Titan (one type of commercial software for RS image processing), PIPS (one parallel RS image processing software in cluster developed by CEDOE, CAS), are integrated into. MGS-Node can manage different types of nodes and the main communications and controlling issues related to the whole platform.

The various types of grid nodes are constructed based on basic grid middleware, SIG CONTAINER, which is a middleware combination of several grid tools selectively that is quite suitable for using grid technology in the geospatial field. When CONTAINER is installed in different Nodes, the basic protocol between different Nodes is achieved, as well as some tools or packages for Web Services encapsulation are also provided. Additional, it not only supports several OS (Operation System) such as Windows, Linux, but also has the capability of updating and version identification etc. (Huang, Z.C. et al., 2007)