Abstract

Geographic Information System (GIS) is a collection of applications whose tasks include (collaborating with other systems and) gathering geographic data, store and process spatio-temporal data (geo-data) and share the derived geographic knowledge with the users and other applications. Some of the most important routine applications of GIS are spatial analysis, digital elevation model (DEM) analysis such as line of sight and slope computations, watershed and viewshed analysis, etc. GIS has became quite an important tool for geospatial sciences and has gone beyond typical tasks of mapping to performing complex spatio-temporal analysis and operations. The number of users relying upon Decision and Support Systems (DSS) built upon GIS has increased as a result of the availability of very high resolution satellite imagery and integration of spatial data and analyses with GIS packages which now satisfies the needs of many and is not just used for specialized operations. Moreover, Global Positioning Systems (GPS) in a range of mobile devices and sensors which includes updates in very short intervals has led to geo-information explosion. Parallel and Distributed Computing systems are now essential for computing over such huge amount of data and deliver faster results. The focus on development should thus be shifted from traditional GIS to Parallel and Distributed GIS
as the traditional GIS systems have become quite mature and saturated while technologies such as MPI (Message Passing Interface) and GPGPUs (General Purpose Graphics Programming Units) can be readily utilized for faster geo-data processing. The performance improved using recently developed technologies such as CUDA (Nvidia GPUs), OpenCL (ATI GPUs) and Intel's Xeon Phi co-processors could be as much as ten times if not more compared to traditional Geographic Information Systems.

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**Index Terms**

Computer Science  
Distributed Systems

**Keywords**

GIS  
GPS  
DSS  
spatio–temporal data  
spatio–temporal analysis  
Digital Elevation Model (DEM)

geospatial data

gedata

geoprocessing

OGC

Message Passing Interface (MPI)

GPU

CUDA.