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Investigation into High Performance Computing Technologies for Geophysics

Tristan M. Wurst,

B.Sc

Geology and Geophysics
School of Earth and Environmental
Sciences The University of Adelaide

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Abstract

The processing of magnetotelluric (MT) data is typically carried out on a desktop computer and as a result suffers from a number of drawbacks. The time taken to process the data on the desktop computer is unacceptably long and can take approximately a month. The limited amount of random-access memory (RAM) in the desktop computer limits the length of the time series that can be used in the bounded influence remote referencing processing (BIRRP) program. Cloud computing is a new high performance computing (HPC) technology that can be accessed over the internet and has the potential to address the drawbacks presented by the desktop computer. Cloud computing reduces the cost of HPC by pooling computing resources on a large scale. Cloud computing offers on-demand resources allowing the user to use only what they need and to change the type of resources they require to suit an evolving need. To utilise the HPC capabilities of the cloud, a problem must exhibit a high degree of parallelisation. MT processing is particularly well suited to cloud computing because of its inherent ability to parallelise by the number of stations. To enable automatic utilisation of the cloud resources, workflow technology can be used in conjunction with the existing MT processing codes. This new approach to MT processing presents the opportunity to addresses other inefficiencies in the processing. As the cloud is accessible over the internet, this presents the opportunity to perform some processing in the field. The ability to process data in the field is advantageous because it allows for near instant feedback about the quality of the obtained data. This feedback can then be used by the survey team to change the survey to optimise the quality of the obtained data if required. However, to achieve this, a number of new processing techniques need to be introduced into the workflow.