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A data management system to enable urgent natural disaster computing

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Civil protection, in particular natural disaster management, is very important to most nations and civilians in the world. When disasters like flash floods, earthquakes and tsunamis are expected or have taken place, it is of utmost importance to make timely decisions for managing the affected areas and reduce casualties. Computer simulations can generate information and provide predictions to facilitate this decision making process. Getting the data to the required resources is a critical requirement to enable the timely computation of the predictions.

An urgent data management system to support natural disaster computing is thus necessary to effectively carry out data activities within a stipulated deadline. Since the trigger of a natural disaster is usually unpredictable, it is not always possible to prepare required resources well in advance. As such, an urgent data management system for natural disaster computing has to be able to work with any type of resources. Additional requirements include the need to manage deadlines and huge volume of data, fault tolerance, reliable, flexibility to changes, ease of usage, etc.

The proposed data management platform includes a service manager to provide a uniform and extensible interface for the supported data protocols, a configuration manager to check and retrieve configurations of available resources, a scheduler manager to ensure that the deadlines can be met, a fault tolerance manager to increase the reliability of the platform and a data manager to initiate and perform the data activities. These managers will enable the selection of the most appropriate resource, transfer protocol, etc. such that the hard deadline of an urgent computation can be met for a particular urgent activity, e.g. data staging or computation. We associated 2 types of deadlines [2] with an urgent computing system.

1. Soft-hard deadline: Missing a soft-firm deadline will render the computation less useful resulting in a cost that can have severe consequences
2. Hard deadline: Missing a hard deadline renders the computation useless and results in full catastrophic consequences.

A prototype of this system has a REST-based service manager. The REST-based implementation provides a uniform interface that is easy to use. New and upcoming file transfer protocols can easily be extended and accessed via the service manager. The service manager interacts with the other four managers to coordinate the data activities so that the fundamental natural disaster urgent computing requirement, i.e. deadline, can be fulfilled in a reliable manner. A data activity can include data storing, data archiving and data storing. Reliability is ensured by the choice of a network of managers organisation model[1] the configuration manager and the fault tolerance manager. With this proposed design, an easy to use, resource-independent data management system that can support and fulfill the computation of a natural disaster prediction within stipulated deadlines can thus be realised.

References

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