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Running Parameter Sweep Applications on Everest Cloud Platform

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Parameter sweep applications are a very important class of applications, which is typically defined as a set of computational experiments over a set of input parameters, each of which is executed with its own parameter combination. These computations are becoming extremely important in science and engineering. As an example, one can explore the behavior of the airfoil by running its model multiple times, depending on its properties, such as speed, angle attack, shape and so on. Parameter sweep applications may require enormous amount of processor time. Therefore, this class of applications is an ideal class for distributed computing. The report presents a generic Parameter Sweep web service that runs such applications in distributed computing environment.

The web service is built on Everest, which is a cloud platform that supports publication, sharing and reuse of scientific applications as web services. Its underlying approach is based on a uniform representation of computational web services and its implementation using REST architectural style. In contrast to traditional service development tools, Everest follows the Platform as a Service cloud delivery model by providing all its functionality via remote interfaces. A single instance of the platform can be accessed by many users in order to create, run and share services with each other without the need to install additional software on users' computers. Another distinct feature of Everest is the ability to connect services with external computing resources. That means that service developer can provide computing resource for running service jobs. A service user can also override the default resource by providing another resource for running her jobs.

In order to initiate the parametric computation, the user needs to submit necessary files, describing the experiment, through the web browser. These parametric computations require some input set of the experiment's parameters and the computational model of the experiment, depending on these parameters. The presented web service generates computational tasks for each unique combination of the input parameters (typically their cartesian product, however the user could describe what these combinations need to be). If the computation succeeds, the result the user can download from the server is the archive with all of the tasks' results.

Also discussed are the possible scheduling strategies for all of the computational tasks, generated by the Parameter Sweep service. Each computing resource, provided by some user, has numerous characteristics like maximum number of computational tasks, allowed to run at the same time, total number of tasks, assigned to this resource, number of currently running tasks and others. Everest takes all of these stats into account when applying different scheduling strategies.

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