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Defining Volunteer Computing: a Formal Approach

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The International Desktop Grid Federation supports the operation, integration, and exploitation of various flavors of CPU scavenging distributed research infrastructures starting from private Desktop Grids (e.g. operated by University of Westminster), through to so-called City Grids such as AlmereGrid, and ending with large-scale public volunteer computing project including EDGeS@home.

Desktop grids and volunteer computing utilize the idle computing cycles of desktop computers to solve embarrassingly parallel type of compute-intensive problems, such as Monte Carlo simulations or Master-Worker type applications. Publicly operated ones using mostly volunteer resources are referred as volunteer computing, or recently as "crowd computing". Contrary, private desktop grids are operated within an organization (university or company) using their computing resources and applying their local policies. Volunteer computing resembles private desktop grids whereas desktop grids are not fully equivalent to volunteer computing.

There are several attempts to distinguish and categorize them using informal and formal methods. However, most formal approaches model a particular middleware and do not focus on the general notion of volunteer or desktop grid computing.

This paper makes an attempt to describe some best practices (examples) and also to formalize their characteristics and relationship. To this end formal modeling is applied that tries to grasp the semantic of their functionalities –as opposed to comparisons based on properties, features, etc. We apply this modeling to formalize the BOINC volunteer computing system. The result of this work is a formal model of BOINC that aims at serving as a foundation for formalizing other volunteer computing systems and helps categorizing existing middleware. The model is developed using the abstract state machines (ASMs) framework and builds on a model that formalized (service) Grid Computing in general.

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