Chapter 1
Defining Minimum Requirements of Inter-Collaborated Nodes by Measuring the Weight of Node Interactions

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ABSTRACT

This paper focuses on defining the minimum requirements to support the inter-cooperation between various scales, dynamically evolved Virtual Organizations (VOs). This proposed method is able to assign a weighted value to each pair-wise path that each member (node) can select in order to locate neighbouring nodes according to their preferences. The method also takes into account the communication overhead between each node interaction. The weight of each path is to be measured by the analysis of prerequisites in order to achieve a mutually agreed interaction between nodes. Requirements are defined as the least parameters or conditions that a node needs to achieve in order to determine its accessibility factor. The motivation behind this work is the vision of the Critical Friends Community model, which is a suitable topology for interoperable grid environments. The topology suggests that capturing inter-cooperated nodes interactions that can be publicly available could lead to knowledge of neighbouring VO members which, in turn, could be used for facilitating a more effective resource discovery and selection decision.

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INTRODUCTION

The vision of this work is to pose a new approach to extend current VO node inter-cooperation practices as originally introduced and explained by Bessis in Huang et al. (2009). Our research leverages grid technology as a framework which emphasizes an open environment of self-motivated and acting members. For achieving this endeavour, we employ graph theory as the method to represent the interconnection of nodes and aiming at defining weighted paths that nodes can choose for future job assignments as we illustrated in Sotiriadis et al. (2010). Within a typical grid VO it is common that the number of the nodes and their communication is previously acknowledged and are connected in random topologies composing cliques of members. A widely accepted vision, initially stated by Foster et al. (2001), is that grid is about resource sharing and problem solving in multi-institutional VOs. These multi-tenancy environments of nodes may have interconnections with other VOs participants by composing an extended and scalable environment. Bessis in Huang et al. (2009) call these neighbouring of nodes as Critical Friends Community (CFC) and each specific member as a Self-led Critical Friend (SCF) which plays the role of mediator in the communication by reflecting inter-connections to any trusted node. On a similar vein, Huang et al. (2010) addressed a notable case namely how a SCF topology should be the means to realize interoperability and clarifies that a grid community can communicate within their VOs, thus they can form and manage their own perceptions about neighbouring nodes based on previous interactions, such as communication and delegation records. In other words, by using SCF, the discovery of nodes is based on a nodes internal knowledge independent of its VO domain. In this paper, we aim to utilize the fact that each VO is a specific neighbourhood of nodes composing a clique of vertices. By defining each path weight we aim to identify several paths between pairs of nodes. Eventually, the measured weight of path edges will be supportive to the resource discovery method. The model appreciates that by assigning a value to each path we may then calculate the best job assignment selection based on the minimum requirements that a node should achieve. The effect of these is extracted from a node’s necessities in order to achieve a job delegation, including the following:

- Policy management control, as the mean communication authorization.
- Knowledge coupling for delegating a specific job.
- Physical resources data stored within an announcement profile.
- Execution time constraints as history data from previous jobs delegations.

In a rational way, node communication is achieved firstly by attaining policies, followed by pairing knowledge background, and finally by physical resource and time information coupling. Data gathered from minimum requirements analysis is stored in a public profile of each node called a metadata snapshot profile. Finally, nodes will be able to decide the weight of each edge and make use of the weight at a later stage of resource selection.

There have been various attempts for realizing communication within such uncertain distributed environments. In general grids are categorised in centralized management VOs and open environments of self-motivated and acted members. This distinction is a key to understand the novel challenges posed by the inter-cooperated self-led members. Centralized management grids have received considerable attention in academia in recent years. Ma et al. (2008) suggest that efforts within the Grid community that address centralized or hierarchical models such MDS in Globus and MatchMaker in Condor have high efficiency and reduce the response time. In contrast, Czajkowski et al. (2001) propose that when the system extends to a large scale the performance...