

# Following the Grid Path

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## ABSTRACT

My dissertation study examines the social mechanisms that shape the paths of an open technological field. The primary focus is on internal and external transformations. I study internal changes to the technology as it is adopted by diverse institutional actors—across different scientific communities and national boundaries, and from academic to the business sector. External transformations are examined by analyzing the relationship between developments in related technological domains with path setting of the studied field. Grid computing—a largely open technological field, key to the Cyberinfrastructure and eScience paradigm and to some of the largest scientific collaborations to date—is used as a case study. Multiple methods including participant observations, interviews, content analysis and examination of a dynamic participation network over time, are used to investigate the impact of different levels of socio-technical dynamics on the studied technology.

## Keywords

Grid computing, innovation, science and technology, Cyberinfrastructure and eScience

## 1. RESEARCH OBJECTIVE

A common understanding of emergent technological fields perceives Technology C as competing against Technology D in market M. After a few rounds a winner is declared, and the course of the field is set. This bloody tale, commonly known as “standard wars” [7], has dominated formulations of technological innovations and has been applied to dozens of diverse cases of “closed” technologies such as videocassettes [4], automobiles [5], and the computer keyboard [3]. Contrast this understanding with an increasingly prevalent “open” alternative. Innovation O is launched into the public domain, both for use and for further development. Participants from around the world embrace it. Some implement it as Technology O', others update it to become Technology ~O, still others decide that their old technology is a part of the Technology O# family. Examining the impact of institutional regimes of stakeholder communities on the trajectories of these more “open” technologies [2], dominant in open source communities [8], for example, is the main objective of the study.

This research query is particularly relevant to the scholarship of technological innovation, to studies of science and technology, and, more generally, to institutional theory, in at least four interrelated ways: (1) It will illuminate the social dynamics among the various stakeholders across institutional settings in considering adoption at various stages of technological development; (2) It will offer insights regarding the relationship between the socio-technical environment and social action, such the decision to participate in a technological community and adopters' leverage on shaping the technological field; and (3) It will add to the understanding of the relationship between technological developments and scientific institutions. Additional contributions to research methodologies of distributed communities are expected.

## 2. THE CASE STUDY

In order to address the research question I investigate the case of Grid computing. There are a number of reasons that make this technology an exceptionally suitable case study. Grid computing is considered a high-impact technological field, and yet while it has been developed for over ten years, it is far from closure and stabilization. A decade of development offers a useful historical horizon to examine actors involved, participation trends, and technological transformations, but it is not too distant of a period, insofar as events are still quite fresh in the memory of participants. In addition, from the genesis of the field most of the core software components were “open,” not only making them available to users free of charge, but also allowing Grid computing to be molded by stakeholders in the environment. As many other fields of information technology, related technologies emerge and demise, new paths are constantly proposed, and user habits may change every few years. These features allow examining the potential effect of the external technological environment on the technological trajectory.

Dozens of associations, particularly of scientists, have organized around Grid computing over the years. This study focuses on the activities at the Open Grid Forum (OGF). Comprised of a global community of scientists, as well as commercial users and business firms, this organization is presently the central standardization body of Grid computing. As the standardization activities require

“rough consensus” [6] among the various stakeholders about the path and the meaning of Grid computing, the OGF is a particularly useful site for the purposes of this project. Other advantages to studying the activities of the OGF include its open participation model, with virtually no barriers of entry, and the high quality of interaction data over the years among participants.

### 3. STUDY DESIGN

As the examined case is broad in scope and the stakeholder communities are vast and globally dispersed, it is not feasible to capture every, or even most, activities that relate to Grid computing. To gain a broader understanding of the processes in the technological field from its inception I rely on multiple data collection methods; each illuminating different dimensions of the studied case. I extensively utilize secondary data and archival materials—policy documents of various countries (e.g. [1]), meeting minutes in scientific communities and working groups within the Open Grid Forum, presentations, publicly available email exchanges, analyst reports, organizational documents, and scientific publications. These data are used to analyze a dynamic social network of participants in Grid computing, emergence of schools of thought over time, and social mobilization around the varied conceptions. Computerized content analysis is anticipated to be employed to investigate responses of particular groups to changes in the larger technological environment—such as policy initiatives in other countries, or alternative emergent technologies. The qualitative component of the study focuses on the Open Grid Forum. It includes participant observations of selected working groups from this organization. As the community interacts in various fora—meeting face-to-face, participating in telephone conferences, and exchanging emails and documents—the study involves a novel type of ethnography that transcends traditional fixed notions of a “field.” Semi-structured interviews of a selected sample of 40+ members from Grid computing stakeholders supplement both the ethnographic and the quantitative components.

### 4. RESEARCH PROGRESS

To date, the preliminary data collection stage has been completed. In this phase, I received the informal endorsement of the community leadership (and more formally from the OGF’s board), selected groups to follow from the OGF, documented about 65 hours of interaction among participants, examined major policy documents that relate to Grid computing, and identified primary communities that nucleated around Grid computing. During this stage I also honed an interview guide by conducting six interviews. Pilot instruments were developed for coding archival and secondary data. I am currently in the midst of the second data collection phase; the major data gathering effort in the project. Data elements include notes from continuous participant observations, interviews with over 35 members of the Grid community, completion of a participation database (i.e., by organization, organization type, country), coding of major

events in the studied field from its inception, coding archival material and secondary data for examining emergence and transformations of schools of thought, and collecting publications for a prospective computerized content analysis, which would enable investigation of adjustments to related development in the broader technological environment, as well as to changes in understanding and utilization of the studied technology. This stage is expected to be completed by the end of Winter 2008. A brief additional phase of data preparation includes setting data for analysis, such as transcribing interviews, and the organization of the participation and events datasets. Data collection stages are to be followed by analysis and write up, which are anticipated to be finalized by 2009.

### 5. CONCLUSION

The study of Grid computing offers a unique opportunity for examining the increasingly prevalent impact of institutional regimes of stakeholder communities on setting the trajectory of open technologies. Results from the study are expected to directly contribute to theories of technological innovation, studies of science and technology, and institutional theory, with a particular contribution to the understanding of adoption dynamics and trajectories of Cyberinfrastructure and eScience.

### 6. REFERENCES

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