Reviewing the Governance Structure of End-User Support in e-Science Infrastructures

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Abstract: The research into e-Science infrastructures has changed the face of traditional scientific methods. The maturity of grid technology to get the data distributed around the globe has raised possibilities to perform ground-breaking research within a specific scientific community. However, the governance and management of user support services of e-Science infrastructures yet remain an under-studied topics. Currently, there is hardly a study undertaken to see what governance approach may be suitable to enrich the user support services that an e-Science infrastructure may provide. In this paper, the governance context of the user support services of a use case of a climate e-Science infrastructures: Earth System Grid Federation (ESGF) is taken as a case study. Amongst the plethora of challenges that the user support process in ESGF face, we focus on its governance and make recommendations to improve it. The recommendations are based on an empirical study conducted to find out the current state of user support governance.

1 Introduction

The utility and importance of user-support (also known as service-desk) in any organisation cannot be underestimated. However, the resources of an organisation, especially a research institute are mostly limited. This is the case in e-Science infrastructures, where the employees, hardware and software components of multiple national or global organisations form an e-Science infrastructure. The employees of the e-Science infrastructure have a limited time and budget to answer arriving user requests [SSW10, TSM12]. In Information Technology Service Management (ITSM) terminology the user requests are also known as incidents [Jä09].

In most of the cases, it is difficult to automatically process the incoming user-requests (incidents) because the application of (intelligent) technologies to automate the process either has limitations or is too expensive to implement. Therefore, in e-Science infrastructures, the employees of organisations that constitute a particular infrastructure handle incoming incidents in addition to their core activities, mostly on voluntarily basis [CBL14, CLB14a]. As per observations in Earth System Grid Federation (ESGF), some

employees participate in user support activities more than others [CLB14b]. ESGF is a well-known climate cyber-infrastructure [Vu13, Wi12]. Normally, the employees of cyber-infrastructures, for instance in ESGF (but not limited to that), are over-whelmed by their core tasks/activities and find little time and interest to process incidents [CLB14a].

The core activities of an e-Science infrastructure employee include: Research, programming, system administration, data curation, data management and others. These core activities are necessary to advance technology, cultivate standards and maintain the operations of the infrastructure. Processing an incident is not formally part of the job description and is considered as volunteer activity by the employees. Handling incidents depends on employee's free time, interest and motivation to get indulged in supporting users[1]. It seems appropriate to recognize the user support activities as part of the job description. However, in addition to this suggestion, some changes in the current governance set-up of ESGF have been proposed and elaborated in this paper, after interviewing some stakeholders and examining ESGF documents. The new governance structure suggests to include user support services in the current governance scheme of ESGF in the form of recommendations. Furthermore, it is suggested to recognize user-support-worker's effort that may be rewarded.

This paper is organized as follows: Section 2 describes the background of e-Science infrastructures, user support, the significance of user support in e-Science infrastructures and the existing models in optimizing employee/workers activities. Section 3 discusses the contemporary user support practices in ESGF as captured from diverse sources of information and the significance to introduce some changes in the current governance. Section 4 elaborates the current user support governance recommendations to be included in ESGF overall governance, followed by its discussion and future work in section 5. Finally, conclusion is deliberated in section 6.

2 Background

The related work of this paper is divided into the four main areas given in the sub-sections:

2.1 e-Science Infrastructures

An e-Science infrastructure is collaborative, relies on grid computing technologies to share and use data to perform research in different fields including humanities and science. e-Science infrastructures are also known as e-Research, cyber-Infrastructures that are deployed to access and share the data, high performance computing (HPC) facilities and human resources to facilitate intra-disciplinary and inter-disciplinary research to harvest knowledge. An e-Science infrastructure is formed through collaboration of many organisations across national and international boundaries. It is

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[1] The word "users" can be replaced "customers". Customers pay for the services and may not necessarily be the users.

the synchronized integration of software, hardware, other technologies, as well as human expertise, required to support research in science, humanities and engineering. Networks that constitute e-Science infrastructures are complex: Users need an interface to access its resources usually data [Fr07]. The interface includes command line tools, web portals and Graphical User Interface (GUI) to access data assets; which are the main resources hosted by an infrastructure. However, during an interaction of a user with an e-Science infrastructure, a user may require help due to outages of some resources e.g. servers or any other anomaly. In addition, a user may require a particular scientific information. In order to meet these user support challenges, every e-Science infrastructure offers user support in the form of a help-desk [Ch13, CWC13, SSW10].

2.2 User support

User support has always been seen as an extra function to the core services of corporations. It was not up until beginning of 2000s that it was realized that customer support should be enhanced. This caused application of business process frameworks to improve service quality and customer satisfaction [Ke02]. Since then, diverse support models and structures are tested to match the corporation business model of servicing customer or end-user concerns. The first help desk (HD) in the 1980's had only a desk, pen and a telephone used by human support agent [Ke02, LL07].

The traditional HD afterwards had gone through different levels of evolution with the change in the commercial organizational set-up. In order to provide customer support different techniques were employed. These techniques include Automatic Call Distributions systems (ACD) [UHG03], Interactive Voice Response (IVR) systems [Cz98], help desk management system (HDMS) along with associated reporting tools [MM96]. Moreover, help desk expert systems, knowledge-management centric help desks [GGR05] are also used. In addition to it embedding case-based reasoning (CBR) engine in help desk [AP94], [Ro04], help desks based on corpus-based analysis (CBA) mechanisms [MZ05], [ZM06], use of remote control technologies to support end-users and web based e-support techniques with and without human support agents [DR04] have been employed to improve user support process. In the case study of ESGF, user support concept covers "help-desk" or "service-desk" of a distributed, multi-organisational research-oriented, non-commercial, collaborative environment. The current user support in ESGF is being performed by human support agents i.e. employees, that include top scientists [CLB14a].

2.3 User support in e-Science Infrastructures

In the last decade, the user-support in ESGF has been evolving mainly due to the changes in ESGF architecture. For instance; looking at the development history of ESGF, the technological plus organisational changes, introduction of new data projects served by the ESGF data archive system, the number of users and their needs have been on constant rise that impacted the user support structure and the behaviour of ESGF employees to treat user requests [BBB+05, CCM+12, CWC13, Wi12]. Consequently, up until now the employees of ESGF are performing the user support by handling incidents,

on a free will basis, on top of their core infrastructure development activities/ tasks. A recent survey questionnaire and mailing list analysis conducted revealed that up to 15% of the incidents were ignored by the employees. Therefore a need to enhance ESGF user support was felt and as a part of result changes in the organisation and particularly governance structure of ESGF were suggested.

2.4 Governance and User Support

Governance is a broad concept and is being used in different domains with different connotations. In this paper, governance of e-Science infrastructure is seen as the formal and informal institutions, mechanisms, relationships, and processes between the partners or organisations. They form the strategy and underlying processes defined by the e-Science infrastructure executive board to achieve a collective benefit or a common goal. This perception of e-Science infrastructure governance is based on well-established definitions of IT Governance [Gu04].

The key elements in the Governance of e-Science infrastructure are the alignment of the service goals with the IT instruments (i.e. technological components) that must lead to the achievement of value i.e. better service for the users and stakeholders. Better e-Science governance can be achieved by setting up an e-Science infrastructure governance framework. Such a framework must encompass practices of proposing structures and processes that introduce better user-support mechanisms.

3 Research Methods Applied

In this paper, single case study method is chosen as a research method. The information about current user support governance and practices in ESGF, was captured via survey-questionnaire, participatory observation of the first author, twelve interviews with the stakeholders; mainly employees and users of ESGF and C3Grid cyber-infrastructures having different backgrounds and roles, observing relevant documents such as reports, publications and archival analysis of user and staff communication within the user's mailing list of ESGF. The triangulation of sources of information was chosen to capture different perspective to validate and to contrast the findings [Yi94], [RBP+03], [BSC12]. The current governance structure of ESGF and the recommendations made to improve the current governance of ESGF is partly based on the research methods applied.

4 Significance of the ESGF as a Case-Study

An important practical use-case in the field of climate science e-Science infrastructure is ESGF (Earth System Grid Federation) project. ESGF is the first inter-agency and international effort in the domain of Climate Science used for Earth Science Modelling (ESM) [HT05], [WBC+13], [CCM+12]. At the moment, more than twenty-seven thousand researchers are accessing climate data from ESGF distributed data-archive

worldwide that makes it a key e-Research infrastructure that supports ESM. This is the main reason to take ESGF as a use-case for this research.

Moreover, ESGF facilitates to study climate change and impact of climate change on human society and Earth's ecosystem [CCM+12]. Since physical phenomenon that govern Earth's climate are so complex and diverse, it is the most important scientific challenges of our time to undergo sophisticated model simulations that generate huge amount of data, collect observational data from various sources and share that data at a global scale. This is made possible by ESGF to discover, analyse and access the Climate data sets which are stored at multiple geographic locations across the globe [CCM+12], [Ea13], [Is13], [Vu13].

5 Current Governance Structure of ESGF

ESGF consortium is an international body of collaborating institutions, with every institute having its own norms, culture, community, specialization, components (hardware/software), human resources, standards, standing (reputation), goals and expectations. Therefore, ESGF has its own governance scheme and policy based on the principles of "governance" developed over years. Every participating institute influences it. The user support in ESGF needs an explicit governance strategy. This governance structure is comparable to general principles of governance or the "constitution" found in arena of Political Science, adhering to the principles of: Critical ideas of fairness, transparency, measurability, responsibility, accountability and performance. ESGF governance structure is composed of the following constituents, see Fig. 1 on the next page.

ESGF has a review board known as "the ESGF Review Board (ERB)" which closely coordinates and monitors the three committees: Executive Committee (EC), Steering Committee (SC) and the Technical Committee (TC), see Fig. 1. The main functions of all governance units namely ERB, EC, SC and TC are depicted in the ovals near them in the same colour. The ESGF organization and the governance is focussed on the ESGF data archive software development primarily and does not include user support process strategy making and a general support services strategy explicitly. Since the ESGF infrastructure has become mature to leverage its services to users, therefore it is important to make policy that satisfies user concerns and makes ESGF service delivery efficient and ultimately lowers the costs.

6 Proposed Changes in the Governance Scheme of ESGF

The ESSC comprises of three task-forces namely: ESGF Developers Task Force (DTF) to cater the needs of developers of ESGF, User-support Services Task Force (USTF) to cater the needs of users of ESGF and finally ESGF Data Management and Publishing Task Force (DMPTF) to cater the requirements of ESGF data managers, as shown in Fig. 2. In order to address user support concerns in the current ESGF governance scheme,

user support committee or task force (USTF) is needed to be created, consisting primarily of the user support process owner (USPO), user support coordinators (USC), members of executive committee (EC) as well as technical committee (TC). In addition, USC for scientific data modelling projects can also take part in USTF.
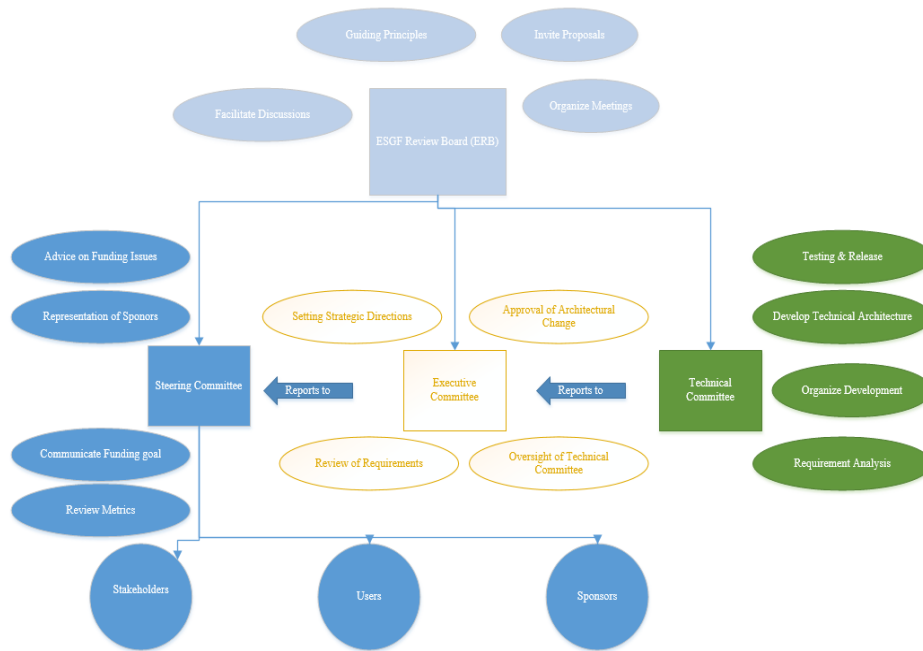

Fig. 1: The figure shows the current governance scheme of ESGF e-Science infrastructure. The squares depict the governing committees and the ovals are the main functions of each committee.

USTF is a special committee which is formed to serve the interests of users, attract new users for more usage and improve the usability (ease of use) of the ESGF. USTF interacts closely with the data publishing and management support (DPMS) and the ESGF software team. In the long run, USTF aims to have a comprehensive user support platform that covers the complete user support process, automatizing it whereever useful for the ESGF user community.

In this paper, only USTF is discussed in detail. USTF is composed of USPOs, USCs, EC members as well as TC members. All members of USTF, especially USPO, user support coordinators, first level support staff (FLS) get together at-least once a month and discuss the short-term and long-term activities for future and the progress achieved so far. USPO may liaise with other user support strategy developers in other e-Science infrastructures of other domains as well as industry.
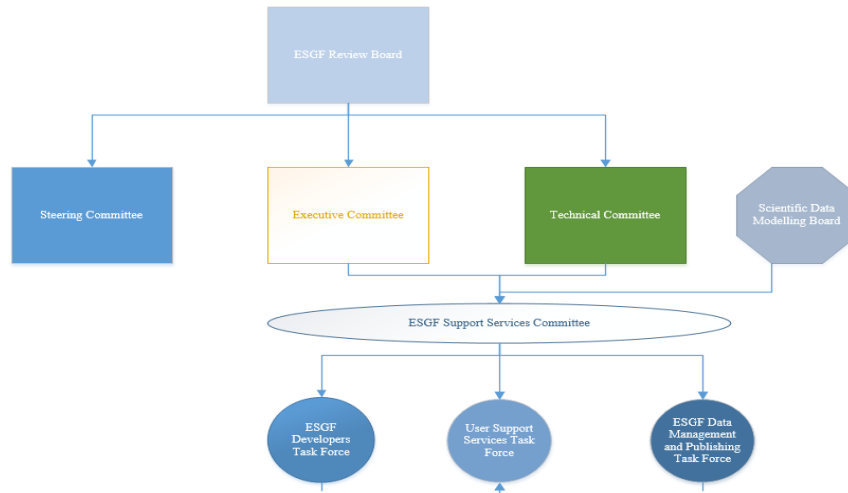
Fig. 2: The figure shows the new governance scheme where ESGF Support Services Committee (ESSC) has formed to address concerns of users of ESGF.

The USTF is a monitoring body that monitors the strategy of user support services and its implementation at the local administrative bodies or the institutes participating in ESGF consortium. Furthermore, USTF adapts the user support services to the changing needs of the e-Science infrastructure. The manifesto of USTF includes defining norms and standards in the form of SLA's[2] and OLA's[3] to make process reliable and monitoring these agreements at regular intervals. USTF must also look for adequate funding from the sponsors and set budget for user support services. The funding must be then invested in an efficient manner. In addition, USTF must investigate the need of providing automation in the user support process necessary.

Categories of user issues must be sorted out by unanimously agreeing on the categorization standards. All known and unknown problems must be documented. If possible a data-base can be created. These problems and their corresponding categories can then be shared with other e-Science infrastructures as well. It is useful to present a list of all problems that users encounter and the list can discussed in the meetings. Finally, a strategy can be made to reduce the user issues by solving the underlying root causes. The global user support directory (USD) must be maintained and updated at regular intervals. The USD will include all the FLS staffs, SLS staffs along with their components for which they are responsible and accountable.

It is vital to invite and encourage users to provide feedback on the ESGF operations and services. These suggestions may lead to inclusion of new features i.e. user driven development and enhancement of ESGF as well as its user support. In addition, short survey to capture user and support staffs satisfaction level must be conducted at regular

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[2] Service Level Agreement (SLA) is an agreement between users who use the service and the service providers.
[3] Operation Level Agreement (OLA) is an agreement between different service providers within an organisation who provide operational services under the same organisation.

intervals. The users can be involved in training sessions, workshop, meetings, conferences and teleconferences at local as well as global levels. If researchers and open-source contributors are attracted to the investigation and development of user support process of ESGF, usability and scalability of ESGF can be improved drastically. Furthermore, data modelling centers can be contacted to provide more data as well as data support in the ESGF data archive system.

Possible incentives to the users and the support staffs may be introduced in order to improve the user support process. Responsibility and accountability must be allocated to staffs. To make the user support process interesting, gamification techniques can be applied. Similarly, self-help can be promoted by disseminating understandable task-oriented support information to the users via ESGF web-pages, wikis, in the form of documents and online tutorials. Moreover, user statistics must be collected and communicated to interested stakeholders of ESGF. Eye-tracking technologies can be applied to evaluate and enhance UI components of ESGF. must be proposed in the ESGF system. Commercial access may be granted to the commercial users with some fees. For instance insurance companies can use climate data. Finally, appropriate metrics to measure the quality of user support must be introduced.

7 Conclusion and Future Work

In this paper, the need to introduce improved user support process strategies in e-Science infrastructures are highlighted. These policies may vary from one e-Science infrastructure to another depending on their scientific domain and architecture. But these policies must be implemented in the governing scheme of e-Science infrastructures to enhance user support process; thus ultimately improving service desk function within e-Science infrastructures. More work is needed to be done to introduce a stable user support for the users of e-Science infrastructure. There is a need to understand importance of user support process and its inclusion in the overall governance in e-Research. This shall bring value to over-all productivity of the e-Science infrastructures and their stakeholders, particularly users.

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