Introduction

With the increase in virtual organizations for computational tool development in the 21st century, it has become important to investigate the factors that shape the products of these projects for distribution and world-wide computational tool usage in big data sciences. This poster looks at the macro conditions of funding policy, organizational structure and motivations of virtual organizations that could be improved for the computational movement.

Literature Review

Funding is the source for computational tools, virtual organizations, and cyberinfrastructure in big data sciences. Furthermore, Kee and E. C. Browning (2010) state how the different factors involved in cyberinfrastructure, such as the institutions, individuals, and ideologies need to be coordinated as the basis for projects that create computational tools. For individuals, there is no immediate financial compensation for pursuing technological advancement and thus are forced to choose between unrewarded service to the cyberinfrastructure community or building their tenure case via publications for more funding and academic prestige.

The organizational structure of virtual organizations lends to processes and workflow unprecedented in collaborative projects. Namely as DeSanctis & Monge (1998) explain how the virtual format of these organizations allow for reconfigurable and blurring of boundaries within the organization itself. Thus, switching and refining tasks, roles and work assignments are enhanced, which allows for "combinatorial freedom" (DeSanctis & Monge, 1998, p. 2) or the "ability to dynamically allocate work across people or subgroups depending on workload demands" (DeSanctis & Monge, 1998, p. 2). This is one of the advantages of virtual organizations as not only can you have people working from different parts of the globe but the allocation and distribution of workflow can be managed more efficiently and quickly.

The problems and limitations of the scientific environment was well documented such as in a study conducted by Casey (2010) on developing trust in virtual organizations/teams. Besides encouraging the usage of communication media options available, Casey (2010) emphasized the value of evaluating the virtual organization/team as a whole (compared to geographically dependent variables) because all team members were united toward a common goal which in turn incentivized trust and cooperation, therefore increasing the effectiveness of a team.

Research Question:

What are the improvements that can be made in the macro conditions of the scientific environment that could better facilitate virtual tools adaptation and diffusion?

Methodology

This poster employed the grounded theory approach (Corbin & Strauss, 1990) and analyzed 25 interviews conducted with domain scientists (in bioinformatics, computational chemistry, theoretical physics, etc.) and computational technologists. Interview participants came from across the US (including CA, IL, IN, SC, MI, TX, etc.) and three from the UK (specifically Scotland). Interviews range from 16 minutes to 2:25 hours, with 10 conducted in person at the Supercomputing 2013 conference in Denver, and 15 over the phone, between Nov 2013 and April 2014. Guided by the stated research question, the co-authors performed multiple iterations of data analysis and literature integration, yielding preliminary findings presented in this poster.

Findings

Funding Policies

National policies shape the development of the big data and computational movement in different countries. For example, US policies encourage internal competition among US researchers to get funding from the same few funding agencies, and discourage collaboration with international partners. Whereas in Europe, collaboration among EU countries is necessary for bigger funding at the EU level, due to smaller gold pools and less resources to work with within smaller EU countries. However cooperation outside of EU is restricted. Furthermore, the funding timeline orientation also differ internationally.

"For example as a US researcher it is often extremely difficult to collaborate with international partners because there are few international opportunities for funding that require US participation. For example in Europe that is not the case, the European tend not to be outside of that either."

(Theoretical Particle Physicist, Chicago, 3/19/2014)

"So if you develop a tool in Europe, the main challenge is after—say you've been working for five years—the main challenge is after your money runs out after those five years, who's going to look after it? There's no… there won't be any core funding for this kind of stuff, which is something that here [i.e., the US as compared to EU] exists much more. So somebody can invest fifteen years into developing a tool because there's going to be staff to work on it." (Project Manager, UK, 11/18/2013)

Organizational Structures

Hierarchical structure of organizations are thought to be necessary, wherein team tasks are delegated and divided with section leaders interact on daily basis to ensure time track. The members of virtual organizational teams are hindered by the various responsibilities they need to manage. This includes those from their university or institution which keep track of the amount of publications and citations versus the work needed to be done on the virtual organization project itself along with the progress evaluations by funders. Indeed, members are pulled apart from different directions and they don't have the time to efficiently work on both their tenure-track research responsibilities and their project technology development responsibilities.

"It's been, in fact, a problem more recently because there is now more top-down direction, and that means that a lot of what you're doing is more short-term, even when they're all talking about it being... if you're going to do that, you're going to say, okay, well we need milestones and we need this sort of progress reports and what not, and if you're trying to do open-ending thinking, it's kind of hard to do that with milestones..."

(Computational Technologist, Illinois, 3/2/2014)

"So there'd be a review every couple of years, make sure that the laboratory is doing... is making good progress, producing good papers that are well-cited and so forth. There wasn't a lot of micro-management of how the money was allocated to projects. So that allowed you do to longer-term thinking." (Computational Technologist, Illinois, 3/2/2014)

Conclusion

From the data gathered, the research team highlighted the various macro conditions in the scientific environment that shape the big data and computational movement which include, funding tensions, organizational structure, and motivations of virtual organization teams. To improve on the scientific macro-conditions for better science-tool development and diffusion there are several solutions that could be feasible in the funding policies, organizational structures, and team coordination of funding structures a possible solution is the idea of an international funding organization backed by an international trust fund to be based on a railway track analogy recorded below. In terms of interdisciplinary projects, another researcher remarked how communication between domains is "terrifyingly bad" and proffered increased interdisciplinary conferences as a solution to this problem.

"So I mean the big one there is the interdisciplinary communication... Um... which is terrifyingly bad. Um so cause there's this idolization of researchers in their own... in their own sub-field in the US..."

(Communications Manager, UK, 11/19/2013)

"Like laying a railway track... This building is building this side of the track, ...but what happens is there's like this track comes this way, because there is an offset of like what..."

[Interviewer]: "So you are saying that railway track um actually don't align up..."

[They don't line up.]

(Research Systems Architect, Indiana, 11/18/2013)

References


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