



An Investigation of Communication Techniques Between Internal and External Groups within Cyberinfrastructure

Chye Shoong Chin and Kerk F. Kee

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Introduction

Cyberinfrastructure (CI), otherwise known as e-science, is defined as, “a complex system, involving a diverse network of interdependent technologies, remote instruments, big datasets, dispersed experts, diverse institutions, etc.” (Kee et al., 2016). Advancements in communication technologies have allowed geographically dispersed experts in the sciences and engineering to collaborate on big data projects to solve real world problems (Lee, Dourish & Mark, 2006). However, Getwaltig and Cannon (2014) argue that it is a project’s personnel that is responsible for producing valuable results, rather than the software and technologies used. Productive communication is built on interactions, which are essential for project collaboration and/or community building. In CI projects, communication is one of the key challenges within the community. Geographical dispersion among interdisciplinary members across the nation makes project collaborations and community building challenging. This challenge compromises CI projects’ potential to generate revolutionary discoveries and solutions.

Literature Review

Prior social science research (e.g., Hackett et al., 2008; Yuhjung & Kyojik, 2011) suggests that face-to-face (FTF) communication creates group solidarity and social cohesion in group members. Furthermore, computer-mediated communication (CMC) promotes symbiotic relationships between remote parties, impacting the group’s productivity (Sooryamoorthy & Shrum, 2007). FTF communication shows that in-person meetings maintain unity of a collaborative project (Walsh & Mahoney, 2007), while CMC has shown to make an impact on an individual’s behavior by transmitting values and norms (Kelly et al., 2003). Furthermore, CMC also overcomes geographical and time barriers, increases participation, and connects experts across different disciplines (Godar & Ferris, 2004). These two forms of communication are fundamental in project collaborations as well as building the cyberinfrastructure community. Given this background, this poster investigates the research question (RQ): *What communication techniques are effective for organizing (such as project collaboration and community building) for cyberinfrastructure?*

Methodology

This poster employed the grounded theory approach (Corbin & Strauss, 1990) and analyzed 60 interviews with domain scientists (eg. bioinformatics, computational chemistry, theoretical physics) and computational technologists. Participants for this study were cyberinfrastructure personnel stationed across the United States (US). Interviews were conducted either through telephone calls or in-person interviews at conferences. Following the interview guided by an established protocol, the co-authors performed multiple iterations of data analysis and literature integration, yielding preliminary findings in this poster.

Findings

	Project Collaboration	Community Building
Computer Mediated Communication (CMC)	<p>“[It’s] important to have a collaborative technology...from a phone call and share your PDF or a Slack channel or various other video - Zoom or what have you... I don’t think we could function without it.” (Pure User, NE)</p> <p>“I think that publications by the people who use the facility are obviously extremely important as a way for others in the community to become aware of the CI tool.” (Administrator, UT)</p> <p>“I think they’re both important...we’ve seen a lot of surprising growth from the organic spread...it’s because they’ve heard it...they’ve heard about us and they want to use us.” (Administrator, AZ)</p>	<p>Right. I, for instance, GitHub would be something that would be interesting to add to this. I think it kind of hits all five of the - we try to convince people to use that or whatever variant for version control and other issues. (Administrator, NE)</p> <p>“We actually hired somebody specifically to do external communication for us because we realized it was so important...that really helped our public image as well as our image with our funding agency.... We reach out to different communities.” (Administrator, AZ)</p> <p>“When we were talking about external communications, the success of all the projects... has basically come down to others in the community seeing success...and presenting their success in some very publicly, visible way.” (Administrator, UT)</p>
Face-to-Face Communication (FTF)	<p>“So for me as a center director to go and give a presentation at a department and explain the capabilities we provide and then having a faculty member come up to me afterwards and say, ‘I didn’t really think that your center would be right for me but I have this problem.’” (Administrator, OH)</p> <p>“Design and construction...became the adaptive organizing necessary, which was done by calling all of the research faculty into one room and asking them if this were to be designed.” (Liaison, NA)</p> <p>“I start to really talk to other people and they recommend other...we actually combine the research and the operation together.” (Liaison, IN)</p>	<p>“You gotta get out there like a sales person and go visit faculty and researchers and talk to them about joining a campus condo or joining a proposal to get an MRI system or what have you.” (Administrator, CA)</p> <p>“We enable the students to develop in the workforce environment...I collaborate with some faculty to teach them in their class to incorporate the material in there.” (Liaison, IN)</p> <p>“We are sending students from non-computing majors to supercomputing...Send[ing] them to conferences...lower[ing] barrier of entrance.” (Administrator, CO)</p>

Conclusion

Through the use of grounded theory, this project highlights the communication strategies that help organize project collaboration and community building for CI. We argue that a hybrid approach combining FTF and CMC is the norm for CI organizing. It will be beneficial for practitioners not to over-emphasize one mode over another within PC and CB as illustrated by our 2x2 matrix, unless a specific goal is better supported by a particular mode. Second, to elaborate on the caveat of specific goals, CMC is best chosen for exchanging data and information, and FTF is best for introducing CI practices. Third, over the long-term of PC and CB, we recommend considering how the less obvious mode may serve to at least supplement the primary mode for the same communication goal, such that one does not either continue over-relying on one mode or consciously abandon an existing mode in practice. For example, travelling across the country for project collaboration instead of conducting phone calls or video conferences.

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