

Network-Centricity: Hindered by Hierarchical Anchors

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"Ah, but a man's reach should exceed his grasp ..." – Robert Browning (1812-1889)

ABSTRACT

Network-centricity is a concept under consideration as a useful paradigm for complex organizational operations, combining the strengths of bureaucracy with the innovative possibilities afforded by the ongoing explosion of information and communication technologies. Network-centric work (NCW) is that in which the activities associated with work are conducted via informal self-directed networks of people, occurring within an environment enabled by technological and organizational infrastructure. NCW cuts across boundaries within and between organizations and engages participants with more regard for their expertise and motivation than their formal roles. Network-centric organizations embrace NCW alongside bureaucracies oriented to providing the resources and articulating the vision to which the NCW is to be oriented. Network-centricity is motivated by a desire for rapid adaptation and flexibility to changing circumstances. However, in an ethnographic study of a distributed team deployed by a large corporation seeking to benefit from a network-centric approach, we found that the work of the distributed team was hindered by some team members "anchoring" to bureaucratic work practices instead of supporting network-centric practices. We identify several such anchor points and the ways in which they impeded network-centric work.

Categories and Subject Descriptors

K.6.1 [Management of Computing and Information Systems]: Project and People Management.

General Terms

Management, Human Factors.

Keywords

Network-centricity, network-centric organizations, network-centric work, distributed work, distributed team, virtual team.

1. INTRODUCTION

The notion of the networked organization is increasingly taking on new meanings in our digital age. It is commonplace now for

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much work in organizations to be conducted via electronic networks. There has been much discussion of the virtual organization (cf. [1], [8], [16]) and the flattening of hierarchies [7]. The role of informal networks in organizations are especially attracting attention by researchers ([15], [13]). However, as the organization becomes more networked, the culture also changes. Networks beget new networks. What happens when such informal networks become the primary means of coordinating work within the organization?

We are interested in understanding the emerging organizational paradigm of network-centricity. At the time of this writing, we are not aware of many instances of full-fledged network-centric organizations in practice. In 1999, the U.S. Department of Defense coined the term "*network-centric operations*" in a report to Congress [5] to characterize an approach to sharing information, improving situational awareness, and conducting warfare in ways that drew upon the experiences of large U.S. corporations in taking advantage of continually-improving information and communication technologies [1]. Since then, however, network-centric approaches have also emerged in non-military settings, such as the environmental movement (<http://www.movementasnetwork.org/001442.html>), political campaigns (Howard Dean), e-commerce (e-Bay), collaboratories [13], and large-scale online environments, such as World of Warcraft and Second Life, where participants are enabled by a formal organization to create, develop, and expire informal networks of self-directed activities to achieve collective goals.

2. THE NETWORK-CENTRIC ORGANIZATION

We refer to network-centric work (NCW) as that in which the standard practice of conducting work is through informal, self-directed networks of activity and interaction which are established by the organization's members and, importantly, which *expand* members' reach into the organization – and into other organizations – beyond their local work environment via information and communication technologies. However, it is recognized that not all organizational work is appropriate to NCW. Some aspects of organizational life are better suited to the formally-determined, hierarchically-structured roles and institutionalized rules of a Weberian bureaucracy [21], particularly those which are highly routine [18], which comprise internal governance systems (e.g., management direction, personnel policies, payroll, equal opportunity efforts, ethics policies, etc.), and those which ensure compliance with governance systems external to the organization (e.g. laws, regulations, professional "best practices," industry standards, etc.).

These hierarchically-structured systems ("hierarchies"), we contend, will continue to be a part of organizational life for the foreseeable future, no matter how "virtual" or "networked" or "post-bureaucratic" the organization becomes.

Whereas, in many organizations, bureaucracy presents a rationalized, "official" account of how work is accomplished and the informal ways of actually accomplishing work are relegated to the background, network-centric organizations (NCOs) deploy both forms in the foreground to take advantage of the stability and accountability of a bureaucracy while enabling innovative and adaptive work to occur across bureaucratic boundaries in network-centric ways. This contrasts with much organizational literature written to a theme of new technologically-enabled organizational forms transitioning to, and wholly supplanting, bureaucratic forms ([6], [11], [12]). We argue that, while such complete transformations may occur in the future, the more immediate interest is in understanding how they may work together rather than in opposition. Network-centricity is one approach to understanding the interactions between the two.

In a network-centric organization, the role of management is less about hierarchical "command-and-control" between subordinates and superiors than about establishing a vision for the organization's goals to which organizational members can self-direct their efforts, and about the provision of resources by which network-centric work can be accomplished. We refer to a key set of such resources as a "net-enabled environment." The "net" in this term has a dual meaning. First, it refers to a technological infrastructure comprised of networks of information and communication technologies and services: e.g. telephone/voice-over-IP, e-mail, web, text/instant messaging, data exchange, audio/video-conferencing, etc. Second, it refers to the social and professional networks of organizational members, as well as the organizational infrastructure to enable them to work together, with minimal regard for physical or organizational propinquity, and to be recognized and rewarded for such work.

The rules of organizing in a network-centric environment are different than those in a traditional hierarchy. In addition to waiting for and relying upon management direction and coordination, in principle anyone in a network-centric organization can form and coordinate projects, as well as share information and expertise. Norms are different. Information in a NCO is treated as a public good, within the informal networks, as opposed to a private good; information is freely shared rather than being strategically managed.

Though NCW is initiated and self-directed by organizational members, rather than being assigned by management, it may nevertheless emerge into a persistent pattern of work activity and may develop a unique identity towards which management of the formal bureaucracy may provide resources and support. We refer to such persistent networks of NCW as "network-centric teams" (NCTs). While a network-centric team may persist over time, the network comprising the NCT can change, adding/removing people and tasks as deemed appropriate to the changing situational context. Though it is argued that traditional hierarchical organizations are also in constant transformation [14], the inscribed patterns and codified relationships in hierarchies make change slow to happen. NCTs, in contrast, are encouraged to change and adapt as frequently as necessary.

Network-centric workers are encouraged not only to seek out and engage expertise and resources from outside their local work environment but also to respond to others approaching them (who may be either internal or external to their local site or formal organizational division). Those who are effective in achieving network-centricity, in practice, can benefit themselves by establishing themselves as brokers of information and relationships across "structural holes" [3] in these organizational networks of tasks and people. They can also benefit the organizational work by facilitating new relationships between strangers in the organization [17] and they can benefit the NCO by establishing "weak ties" [10] for information flow between areas of NCW and between NCTs.

Boundaries between the hierarchical organization and network-centric organization may be hard to decipher. Scott [20] maintains that all forms of collective units, such as groups, organizations, and communities, possess boundaries though they may be hard to distinguish. Traditional hierarchies have boundaries, for example, between different business units or company divisions. If we add that people also act within an additional (network-centric) structure, then the task of defining boundaries between these different structures truly becomes formidable. One of the defining features of a network-centric organization is that the boundaries are highly permeable. But in contrast to Scott's (1998) notion of porous boundaries for information, network-centric organizational members are empowered and encouraged to transcend organizational boundaries in their collaborations. People can cluster together, in their NCW, to collaborate across business units, across organizational divisions, across geographic distance, and even between organizations themselves.

The relationship between organizational forms and the extent to which such forms are net-enabled is illustrated in Table 1. We do not claim network-centricity as an "ideal type" about which we theorize, but as an observable pragmatic adaptation of existing organizational structures to the possibilities afforded by new technologies. We propose that organizations are located along a continuum, according to the degree to which they are "net-enabled" and to the degree that work is conducted through network, rather than hierarchical, relations. Peer-to-peer technologies, collaborative workspaces, and cyberinfrastructure are examples of technology systems that make an organization highly net-enabled. Facilitating the use of personal or collegial networks to form teams, share information, develop innovative ideas, or consult expertise are examples of how organizations can encourage their members to work in network-centric ways. We expect that, as an organization increases its network-centricity, it would continue to interact with necessary elements of formal hierarchical structures, though perhaps to a lesser degree.

Finally, we build upon this latter point to argue that the technological and organizational infrastructures comprising the net-enabled environment must also provide a functional bridge (or "interface") between the practices of NCW and the practices of the external hierarchical systems with which network-centric workers must continually negotiate. Such organizational interfaces are important mechanisms by which the formal organization can be apprised of NCW activity and by which feedback (about the congruence of the activity to organizational goals), not command and control, can be returned. This provides some degree of mutual awareness for both the formal and

informal parts of the NCO, as well as a means by which the NCW can be rewarded.

Network-centric activities occur across the formal organizational boundaries which typically manage reward systems (e.g. payroll, bonuses, merit reviews, promotions, etc.), so it is important to provide alternative mechanisms for NCW to be rewarded. Inherent in such mechanisms is the need to support the establishment, maintenance, and capacity to discover reputations grounded in NCW. Everyone seeks to maintain a good reputation with their managers and their peers, which make it difficult for people in other parts of the organization to engage them in NCW, though such engagement might be optimal for the organization. This difficulty is an example of how practices grounded in external hierarchies can unnecessarily constrain NCW. As we will show, an over-reliance on practices grounded in external hierarchies can impede network-centric work.

Table 1. Organizational forms differ by structure and the penetration of technology into work practices.

		TECHNOLOGICAL & ORGANIZATIONAL INFRASTRUCTURE	
		Low net-enabled	High net-enabled
ORGANIZATIONAL STRUCTURE	Hierarchical	Formal relations, determined by organizational hierarchy e.g. collocation within same business unit	Technology used in hierarchical relations, e.g. firewalls, access control lists, etc.
	Networked	Network relations have low dependence on technology, e.g. face-to-face encounters in an open-office environment; travel to meetings	Network-centric organization , e.g. peer-to-peer technologies, cyberinfrastructure

The purpose of this paper is to present the challenges that face an organization as it tries to take advantage of the possibilities afforded by new technologies. To our knowledge, there is no research that has addressed these issues, especially how people negotiate between the different approaches to accomplishing work within the same organization. We present results of field research conducted at an organization as it tries to develop a more network-centric operational structure.

2.1 Related Concepts

The concept most related to network-centricity is that of the "virtual organization." Davidow and Malone (1992) characterize the virtual organizational form as "an ever-varying cluster of common activities in the midst of a vast fabric of relationships" (p. 7). DiSanctis and Monge (1999) define the virtual organization as having components that are geographically dispersed, "functionally or culturally diverse" (p. 694), and connected laterally via technology. Though both notions share the concept that the organization conducts distributed work, and implicitly is dependent upon IT, network-centricity depends much more on the concept of the organization as a dynamic network of communication and coordination; it emphasizes the capacity to expand networks of people and tasks in response to changing environments.

In a related concept, focusing on organization without consideration of its technological infrastructure, Heckscher posits that the "post-bureaucratic" organization would continue to have hierarchical structures, but under the control of the network-centric structures ([11], [41]). In contrast, we maintain that hierarchies exist alongside, or *external to*, network-centric structures and practices in each must continually negotiate with practices in the other to accomplish organizational goals.

Virtual organizations may formally reproduce the hierarchies found in the entities comprising them, though it's been observed that much of the actual work of the organization occurs through the personal or informal networks ([13], [15]) which are key to NCW. However, such observations have focused more on the networks themselves and define less clearly how they are integrated and function together within the organization.

In this paper, we present an ethnographic case study of a distributed team in a corporation striving to develop benefits from NCW while maintaining existing hierarchies. We will present aspects of that team's interaction to illustrate network-centric activity and interaction. In contrast, we will also identify hierarchical practices which impeded network-centricity in the distributed team and which contributed to its failure to achieve its goals.

3. BACKGROUND

This ethnographic study of a distributed team was conducted at a large corporation with facilities distributed throughout the United States. The corporation had historically been organized along strongly hierarchical lines, yet had somewhat recently determined that a more flexible and adaptable network-centric approach was needed to take advantage of state-of-the-art technology to leverage its diverse, widely-distributed workforce. Somewhat in parallel to this organizational direction, the corporation developed an extensive information and communication infrastructure to develop, test, and demonstrate network-centric technology systems to potential customers. To demonstrate these products, a Division within the corporation constructed multiple Demonstration Facilities (DFs) to provide the real-time, networked resources to demonstrate the products. These DFs – one on the east coast of the U.S. (DF-E), one on the west coast (DF-W), and one in the center of the country (DF-C) – plugged into this distributed infrastructure to draw upon various information and communication resources, in real-time, to deliver a comprehensive view of widely-distributed, simulated activity and interaction between simulated customer entities.

The DFs drew upon the same network infrastructure and information systems, so coordination between facilities – to determine which facility had priority access to network-based resources at any particular time – was tedious and time-consuming. Each maintained its own set of calendars (8 were eventually identified) and specific individuals were required to coordinate with other sites and to manually update local calendars. In mid-May, a distributed Task Team (TT) was convened, nominally to develop a common, shared calendaring system to facilitate this operational coordination as much as possible. This team was selected for this study because it would need to integrate input from people at multiple sites and organizational divisions. It needed to accomplish its task quickly and with minimal management oversight. As such, it was considered a good

candidate for the NCW model the corporation wanted to develop for itself.

Antecedent to the TT were two relevant activities that greatly influenced the TT. In the first activity, 6+ months before the TT was established, an employee of the Division funded the development of a prototype system ("PROTO") to accomplish much of this scheduling and coordination. However, this effort did not solicit input from users and stakeholders of the anticipated system. In the second antecedent activity the Division was determined to expand the input into the design of the system by establishing a Process Team (PT), approximately 2.5 months before the TT convened. The PT was to develop a plan whereby the TT could accomplish its goal. In this way, by expanding participation in the development of the proposed system to include users at multiple sites, as well as by drawing upon technological and organizational expertise located at multiple sites, the Division attempted to enable a network-centric, collective effort to develop the system.

4. METHOD

At the outset of the TT activity, a researcher traveled to DF-E to observe and interview team members there for the first three TT audio-teleconferences ("telecons", referenced as TC-1, TC-2, etc.), occurring within the same work week. Security restrictions prevented video recording of team members as they sat alone during the telecons, but audio recordings of the telecons were allowed. In addition, for TCs 1-3, Paul¹ and Opal recorded the activity at DF-W with two digital audio/video recorders and two digital audio recorders placed along their conference table to capture local discussions. For the fourth TT telecon (TC-4), occurring six days after TC-3, the researcher "observed" and recorded (via telephone and Webex) the telecon while traveling back to the DF-W area. On the day before the last meeting, the researcher observed and audio/video recorded a 95-minute meeting involving only four members of the TT at DF-W (Pete, Paul, Otis, Opal) to unilaterally develop a plan to present during the last telecon. For the fifth and last telecon (TC-5) of the distributed TT, occurring 16 days after TC-1, the researcher observed and audio/video recorded from the DF-W site. The telecons typically lasted around 50 minutes, though TC-3 lasted 86 minutes and TC-5 lasted 29 minutes.

In addition to the 4.3 hours of audio and video recordings of team telecons, almost 11 hours of interviews were audio-recorded among ten TT members (two members declined to be interviewed). Fifty percent of the team members were interviewed before the distributed TT was formally disbanded the day after TC-5; the remainder were interviewed within six business days afterwards (and two early interviewees were re-interviewed at this time). Field notes were recorded by the researcher, particularly to identify what information was being shared via Webex at what time; these notes were subsequently reconciled with electronic copies of PowerPoint files used to organize and display the information. One key PowerPoint presentation (referenced later as "Lessons"), used by a corporate researcher reporting on the "lessons learned" to senior Division management in two months after disbanding the distributed TT, and based on a separate set of interviews, was captured. Electronic documents being shared via a

SharePoint collaboration workspace, established for the TT, were also captured. Finally, team members were requested to share all email and instant message exchanges with the researcher. Over 340 copies of messages were received and 142 unique messages were identified. No instant message exchanges were received before the distributed TT was disbanded.

5. THE DISTRIBUTED TEAM

5.1 The Task Team

The PT met in January-February, led by Gus at DF-E. The PT consisted of a total of five people at four sites: Bev (DF-E), Toni (DF-W), Blake (DF-C), and Ty (DF-N). The PT developed a plan for the TT, including a scope for the task to be accomplished and a team membership they felt could accomplish this task. This plan called for three team members from each of the main DFs (DF-E: Gus, Bev, Pam; DF-W: Pete, Paul, and Toni) and one member each from two less-integrated sites (DF-C: Blake; and DF-N: Ty).

When the Team Lead (Pete) was assigned for the TT, in early May, he indicated that the PT-recommended team members were not the ones he would have chosen and he invited five people from his own site (DF-W: Otis, Paul, Bart, Vera, Toni), two different people from DF-E (Sue, Eva), and two from DF-C (Jason, Blake). The six DF-W people had considerable prior experience in working together and Pete felt that resulting cohesion would be necessary to deliver the product by the deadline. This deadline was imposed by Division management after the PT concluded and before the TT began.

The two DF-E team members invited (Sue, Eva) declined to participate and two more-junior employees (Bev, Pam) were assigned to represent DF-E on the team. Opal (DF-W) and Gus (DF-E; the PT Lead) invited themselves onto the team. Blake was the sole representative of DF-C, though the sole programmer/developer (Jason) invited to participate was a virtual worker (telecommuter) based out of DF-C. Jason's participation, from the outset, in the TT had unintended consequences (discussed below). This mixture of formal invitations, declines & replacements, and informal self-invitations are reflective of a network-centric group operating in a hierarchical organization. The TT membership was not completely specified by management, but allowed to grow/shrink as people directed their own activities regarding it.

The team met via telephone audioconference, using a Webex display of documents and applications as a common visual focus. The DF-W team consistently gathered together to participate, while the rest of the TT sat alone (either in their work offices or dialed in from home). While gathered together, the DF-W team could – and did – mute their audioconferencing microphone to discuss items and strategize collectively in real time. The team members not at DF-W had access to technologies (instant messaging, email) similarly to communicate interactively with other team members, but these team members reported not using them during these audioconferences.

During the last meeting of the distributed TT (TC-5), Paul declared that an impasse had been reached and offered a plan: "*I don't get a sense of forward progress right now, so here's my offering to the group: let Pete and I go back up to (the Division Boss) and explain, in detail, all the concerns ... and let him make an executive decision on how to proceed.*" The next day, after this

¹ Pseudonyms are used.

meeting, Pete announced that the distributed TT had been disbanded. The task was handed over to the collocated team members at DF-W. This collocated team delivered a presentation to the Division Boss, per the deadline, and according to the direction they wanted to take (see Section 5.2.1), but no system had yet been deployed in operation as this paper was being written (six months after the deadline).

5.2 The Team Divided

The team was net-enabled, with a technological infrastructure supporting facile communication across geographic and organizational boundaries and an organizational culture encouraging the free exchange of information and expertise relevant to the task at hand. Team members routinely worked in this technology environment and reported a high degree of comfort with it. They were well-motivated to develop a system to make their day-to-day work easier (e.g., from the Lessons presentation: *"Team really wanted to make the project a success as coordination is now an onerous process for everyone"*) and they had access to collaboration technologies (e.g. shared workspaces, document repositories, and instant messaging) for working together across distance.

In spite of this net-enabled environment, the TT quickly polarized into two "camps" (within the first 10 minutes of TC-1) by very different understandings of the primary goal the TT was expected to achieve, how the TT was to achieve that goal, and who the TT was supposed to satisfy through that achievement. We describe these camps² in this section and, in the next section, how this polarization was sustained by "anchoring" their TT contributions to different hierarchical practices of the organization in which they were embedded, rather than using these differential understandings as a basis from which to negotiate a collectively acceptable solution.

5.2.1 The Bottom-Up Camp

The "Bottom-Up" camp, articulated by Otis and supported by Pete and Paul (all at DF-W) from the outset, wanted to begin with the specific data fields in existing calendars and work up to an implementation of these fields designed to present a view of the information to satisfy The Division Boss. The Bottom-Up camp here felt the primary goal of the TT was to deliver a system by the imposed deadline and they often emphasized this from the outset: *"(We) also need to realize the deadline is (date), per The Division Boss' Boss and The Division Boss"* (Pete TC-1); *"No, it was direction from The Division Boss, we have to have a finished baseline product by (the deadline)"* (Otis TC-1 37:08); *"Yes, we will have a common calendar by (the deadline)"* (Pete TC-2).

To achieve this primary goal, this camp felt the best approach was for the TT to start by aggregating all the fields common to existing calendars at the three sites represented on the TT. Prior to TC-1, Pete requested TT members to send him the field names of the calendars they used, reflecting this initial approach. Only two TT members (Otis and Bart, both from DF-W) submitted field

names and these names formed the basis for discussion at the outset of TC-1.

By this approach, the Bottom-Up camp sought to satisfy The Division Boss and, through him, his Boss: *"what I'm doing is reflecting what The Division Boss wants to see in a joint calendar"* (Paul TC-1); *"... because I've been to The Division Boss' Boss' staff meetings and they look for the same things; The Division Boss' staff meetings (too)."* (Paul TC-1); *"The Division Boss likes to view information in a certain way"* (Paul TC-3).

5.2.2 The Top-Down Camp

The "Top-Down" camp wanted to deliver a system that was the best one they could achieve: *"I think one of the key things is for us to provide the right products for the job"* (Bev TC-2); *"(we are) to build a good synchronization of distributed operations, which is our overall goal"* (Bev TC-3). This was more important to them than meeting the imposed deadline: *"I think that, to be able to deliver this by (the deadline) and to actually integrate several of our existing calendars together, is a very aggressive timeline"* (Bev TC-1); *"I agree with you, Bev, as an IT expert, to have a deadline thrust on us, without even knowing what the requirements are, is literally insane"* (Jason TC-3).

To achieve their goal, this camp felt the best approach was to survey users of existing calendars to identify abstract, top-level requirements: *"I was on travel (when Pete requested field names from us) so ... one of the things I really wanted to do (now, at the start) was to ... go back to my staff and have a chance to interview them (to) see what's going on with the calendars now, if they are meeting their needs ... and I really haven't had a chance to do that because I was on travel"* (Bev TC-1); *"... part of the process that (the PT) wrote down was that (the TT) would go back and do some type of site survey and that would include going back and asking more than just a few people what they think should be on here (for the deliverable)"* (Gus TC-1). With requirements determined, a technology platform for the deliverable would then be chosen to meet those requirements, and then the TT would work down to the specific details of data field names and workflow to be implemented in the system.

By this approach, the Top-Down camp sought to satisfy the anticipated end-users of the system, rather than the management responsible for the collective work at all three sites, as well as to deliver a system which was reflective of existing workflows at each site and which was more integrated than a simple aggregation of data fields from existing calendars.

5.3 Anchor Points

As noted earlier, the scope of work activities in contemporary organizations is constrained by the need to conform to externally-specified laws and regulations, "best practices," management policies, technical standards, organizational resources, etc. These constraints don't specify how work is to occur, at the micro level of individual and group practice, but shape the environment in which such collaborative efforts can be accomplished.

Within group-level interactions, however, individuals and subsets of the group may "anchor" their contributions to the NCW in the practices of these external hierarchies as a source of legitimization and validation rather than a point of collective sensemaking and negotiation. Such "anchor points" hinder NCW and, as illustrated here, can impede the effectiveness of teams attempting to

² The names for each camp were chosen only as references descriptive of the differing approach to their collective work and no claim is implied that either approach is inherently hierarchical or network-centric.

accomplish organizational work. For example, in forming a network-centric group, the initiator will select members based on their reputations, as Pete did by primarily drawing upon people with whom he routinely worked, mostly from his own local organization. Without a means to know reputations outside one's informal network, this is reasonable. However, such in-groups can become "anchored" to local ways of working, reinforcing in-group biases, and thereby limiting the creativity of the group and the scope of its reach across the organization.

Within this TT, as described in Section 5.1, we identified four types of "anchor points" which contributed to the failure of the TT to accomplish the goal for which it had formed: external authorities, technological advocacy, asymmetric communication style, and work commitments external to the TT.

5.3.1 External Authorities

In a hierarchical organization, work is legitimized by authorities external to those doing the work. The team may be tasked with making decisions, but the team's result must always be validated by an external authority before transforming the result into organizational action. In a network-centric organization, work is legitimized collectively by those doing the work and by expanding the network of active participants, as necessary, to provide such validation.

As described in Section 5.2.1, the Bottom-Up camp continually attempted to validate its stance by references to the external hierarchy: the Division Boss, his Boss, and the mandated deadline. This camp did not try to engage the external authorities themselves in the TT's deliberations. In contrast, the Top-Down camp sought to actively involve end-users in understanding the nature of the task and the abstract requirements. This camp also suggested expanding the TT participation to include the Division Boss, during TC-5, after Paul declared an impasse: *"is there a reason we don't have a collective meeting with (the Division Boss)?"* (Bev TC-5). Jason also expanded participation in the TT, in reaction to concerns he had, by getting his manager involved in the discussion at the outset of TC-5, which immediately preceded the declaration of an impasse.

In this way, Pete and Paul tried to broker between the Division Boss and the TT to maintain their control of access to the former and, in so doing, they conformed to typical hierarchically-oriented practices. The Top-Down camp, in contrast, sought to expand the network of contributing participants to the TT rather than to control access to them. This latter approach is more reflective of NCW than the other camp's approach.

5.3.2 Technological Advocacy

All sites preferred to deploy a system affording them the same capabilities as they had individually developed. The fundamental polarization with regard to the technology environment for the deliverable system boiled down to a contest between Microsoft's SharePoint and Adobe's ColdFusion. SharePoint was the corporate standard and was used by team members at all sites. Gus took the initiative to establish a SharePoint collaboration site for the TT to use, though few TT members used it initially: *"(This) team should be using the SharePoint space to share (information)."* (Bev TC-2).

The end-users at DF-E were accustomed to using their SharePoint-based coordination system, which not only included

calendar services for scheduling demonstration events, but incorporated collaborative workspaces for each event wherein documents and discussions, specific to a single event, could be found. The end-users at DF-C similarly were accustomed to their SharePoint-based system, which enabled a key requirement for them: the capability to track facilities, rooms, and equipment as well as people relevant to the event being coordinated: *"There's only one thing we really need and that's object management. We know we can do it in SharePoint ... we were waiting to see what this team came up with"* (Blake TC-4); *"I don't think I can (meet our needs) with your (ColdFusion-based) tool. It's pretty much SharePoint or nothing"* (Blake TC-5). Both Blake and Bev identified a requirement for the deliverable system to be able to present scheduling information via Microsoft's Exchange server/Outlook client applications. Jason, a ColdFusion developer, identified a related issue, in that the IT policy for the company would prevent ColdFusion from providing this capability: *"Going back to the original conversation (on TC-2) about Outlook, no, we cannot gain access to Exchange servers via ColdFusion or any other technology that's not built by Microsoft. This is why SharePoint has the leg up"* (Jason TC-5).

However, the Division Boss's calendar needs were more basic and staff at DF-W had long been meeting this need by manually creating and updating a Microsoft Excel spreadsheet with the desired information. As such, a commitment to SharePoint was not as desirable as at the other two sites. The Bottom-Up camp was anchored to a preference for a ColdFusion-based system. This was reflected by Pete's inaugural invitation only to a ColdFusion developer (Jason: *"I'm not a SharePoint expert"* TC-2) to participate in the TT and was recognized as such by others during the first meeting: *"... how have we defined that we're using the proper back-end for our calendar system? ... I feel like a whole lot of decision-making has occurred prior to today's meeting we weren't involved in"* (Bev TC-1).

The Bottom-Up camp felt that choosing ColdFusion would enable the TT to start with the work that had already been put into developing Proto and could enable them to meet the Division Boss' needs by the deadline: *"(PROTO) is a great start, Jason, we can add on to this and we can use this"* (Paul TC-2); *"for this time frame, I think (PROTO) is the solution which can meet the deadline"* (Otis TC-2); *"I suggest we begin using (PROTO) and add on to it"* (Pete TC-4).

Although team members in both camps anchored themselves to a particular technology platform during these five telecons, the reported actions antecedent to TC-1 demonstrate that the Top-Down camp intended for the TT to operate in a network-centric manner, but the Bottom-Up camp's anchoring to their preferred technology required the Top-Down camp to adopt a similar attachment to their own preferred technology in response. Most of the Top-Down camp's members (Gus, Bev, Blake) had participated in the earlier PT and had recommended experts in both SharePoint and ColdFusion for the TT. This set the stage for the TT to have been capable of negotiating the appropriate technology platform in a network-centric manner: i.e. by expanding the participation to include relevant expertise. Pete, however, ignored these recommendations and invited only a ColdFusion expert. In effect, he tried to unilaterally pre-impose a particular technology solution on the TT, a very hierarchical approach.

5.3.3 *Asymmetric Communication Style*

In a hierarchical organization, communication is constrained to flow only along authorized channels. In a network-centric organization, communication should ideally involve all those relevant to, or affected by, a particular task. There is a balance to be achieved between providing enough relevant information to everyone and providing too much irrelevant information. The key to this balance is responsive, or symmetric, communication styles. People must feel free to ask questions and to respond with "I don't know" or to decline to answer; moreover, such responses must be considered as acceptable responses by the team. People must be able to expect, and rely upon, others' responsiveness.

The day before the final telecon (TC-5), Pete unilaterally informed the team that he was making the decision to deploy a ColdFusion-based system: "I had a meeting with the Division Boss on Friday and he stated that if we didn't come up with something he would. Therefore, I have made a decision to go with ColdFusion." At TC-4, the team had collectively determined an agenda for TC-5, one item of which had been a requirements-based comparison of the SharePoint and ColdFusion technology platforms for the deliverable. By pre-empting this collective decision with a unilateral one, Pete was interacting with the team very asymmetrically and in a very hierarchical manner.

TT members in both camps also reported that Pete was very unresponsive to email-based queries and requests, thereby unilaterally limiting the scope of participation and work-related activity. In contrast, when trying to identify requirements, Bev gathered responses to an email survey from multiple sites, thereby expanding the participation (i.e. a network-centric activity) in the TT work: "*Not all my stakeholders have responded yet with their requirements. I haven't yet heard from (the other) sites (for the survey I sent out. I've had about 30% participation at my site, so I'm not done with my requirements gathering phase*" (Bev TC-3).

Hierarchically-anchored, formally-assigned team leaders can also impede network-centric efforts to accomplish work, as illustrated by this email exchange between Bev and Pete on the day before TC-5:

(Bev) "*I confess to being a bit frustrated that you spoke to Opal, without ever talking to me, and asked her not to go ahead with a meeting (between Bev and Opal) that you and I agreed would be beneficial last week.*"

(Pete, in response) "*After my conversation with the Division Boss on Friday and today please be patient. I will (inform) the team momentarily (with the decision for ColdFusion).*"

Though Bev and Opal tried to show some initiative to work together across different sites and different parts of the corporation on one aspect of the TT work, Pete unilaterally aborted the attempt and legitimized it by reference to the Division Boss. This contrast between peer-to-peer and authoritarian communication styles illustrates how network-centricity can be impeded by hierarchy.

5.3.4 *Formal Work Commitments*

One aspect of organizational work inherent in network-centricity is that, as people activate their informal networks to accomplish work, they are continuously participating in other networks of activity, both formal and informal, which González and Mark [9] characterize as different "working spheres" managed by each

individual. In hierarchical organizations, the organizational structure is used by management to constrain employee activity to specific working spheres while, in a network-centric organization, workers have both increased opportunity to develop and contribute to different networks of activity and increased discretion whether to participate or not. When anchored to the requirements of formal working spheres, the spontaneity and informality implicit in network-centric work can be impeded.

In the distributed TT, there were continuous references by the most active TT members to their other work commitments: "*I haven't had a chance to (use the SharePoint workspace set up for the TT by Gus, because) I've been in meetings*" (Pete TC-2); "*With my current workload, it's not likely (that I can modify and deploy PROTO...)*" (Jason TC-2); "*I literally gave (my users) 24 hours to respond and I'm pushing back on that there wasn't adequate time to get them on board*" (Bev TC-3); "*Are we done for now? ... We (DF-W) have a meeting (to attend)*" (Pete TC-3); "*I personally do not have time for this*" (Paul TC-3). "*... not to mention that we are all incredibly busy*" (Paul TC-5).

In this team, members used references to other commitments to justify an inability to perform this work as needed. Implicitly, such references signal a lack of organizational commitment to the collective team work. As an organization seeks to optimize the utilization of its workforce, formal work commitments are likely always to compete with NCW. However, following González and Mark, a constant effort for an individual to manage her/his own working spheres implies constant effort to collectively coordinate other commitments and the need to be able to seek relief from the formal hierarchy when other commitments are impeding the network-centric work.

6. DISCUSSION

At the outset, this distributed Task Team seemed poised to succeed in its goals and likely to provide examples of collective network-centric work activity. Within the company management, it was felt that this TT was fully empowered to accomplish the task as they saw fit and the company committed significant resources to that accomplishment. The TT members were comfortable in their net-enabled environment and motivated to make their work lives easier by delivering a useful system. Even though it had a significant impact, the ramifications of the imposed deadline were not appreciated until after the distributed TT was disbanded.

We initially observed that "networks beget new networks," meaning that working together on projects with different others establishes a basis for networking again on future endeavors. However, it seems also to be true that "anchors beget anchors." The Division Boss anchored to the deadline he imposed which caused the Team Lead to anchor to a particular set of choices regarding team membership and the technology platform for the deliverable system. These anchors, in turn, motivated other team members to establish their own anchors: Blake declared "*it's SharePoint or nothing*" (technological advocacy) and Jason had to bring in his manager to validate his concerns (external authorities)

This chain of anchor points mired the nominally "empowered" Task Team members in the hierarchical practices of the local organization in which they worked. It sustained the early polarization in the distributed Task Team and impeded the ability of the team to work in a network-centric manner. By anchoring

themselves, one camp may have "won" (in the sense that the task work continued in the direction they chose) but the Division "lost" by not being able to deploy a system to facilitate critical coordination between different sites.

Network-centricity is about "expansiveness" or, to rephrase Browning, to expand one's reach (for understanding to accomplish work) to exceed one's immediate grasp (of the situation). Browning wrote this, more metaphorically, about aspiration and ambition and we (among others) believe organizations should aspire to network-centricity as a pragmatic operational paradigm. However, network-centricity is more than a one-way reaching across boundaries to retrieve or capture information for local consumption/utilization (e.g. knowledge management [4], information foraging [19], etc.) Network-centricity is more than establishing a list of names as a social network one can contact for one's own benefit. When the flow of information and benefits is one-way, the organization is acting hierarchically. Network-centricity is about mutual or reciprocal benefits accruing from work-oriented interaction and the inculcation of a work environment where organizational members working across boundaries not only ask "what's in it for us?" but also "what's in it for them?"

The essential reciprocity of network-centricity is similar to the notion of "heedful interrelating" described by Weick and Roberts [22] in characterizing the development of a collective mind on an aircraft carrier flight deck. Heedful interrelating is based not only on all team members' contributions to constituting a collective mind, but also on *expanding* the representation of those external to the team into the team activity and *expanding* consideration through partially subordinating local interests to collective interests – similar to Wenger's [23] (p. 262) notion of "mutual alignment" as negotiated understanding between the local and the collective.

As we've argued here, network-centricity co-exists with some external, hierarchically-grounded constraints and there must also be heedful-interrelating between NCW and hierarchically-structured work. Effective network-centric organizations will be those which invest in both technological and organizational infrastructures to facilitate such interrelationships across boundaries of organization and distance, while discouraging inappropriate anchoring to hierarchically-based practices to achieve local goals at the expense of collective goals. The distributed Task Team reported here failed to achieve network-centricity in pursuit of its collective goals because their interactions were anchored to external authorities, technological advocacies, asymmetric communication styles, and formal work commitments resulting in a failure to inter-relate heedfully.

We expect that organizations can move along a continuum to become more network-centric as necessary in their dynamic environments, i.e. where their members can more skillfully negotiate the boundaries between the hierarchical and network-centric work practices. Learning to think and act network-centrally involves a paradigm shift where information and effort are viewed as bringing value not solely to the individual but to other organizational members and to the organization as a whole.

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