

An Initial Description of the C-form Organization *

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Working paper last revised April, 2002

* Authors are listed alphabetically, as both contributed equally to this article. We thank Fabiola Bertolotti, Janet Dukerich, Sanjay Gosain, Sirkka Jarvenpaa, Poonam Khanna, Hank Lucas, Ithai Stern, and Jim Westphal for helpful comments and discussions on earlier drafts of this manuscript.

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Abstract

This paper seeks to enhance organizational theory's current typology of organizational architectures to explain a flourishing modern organizational architecture that has developed utilizing the inexpensive communication paths created by technology such as the Internet and wireless networks. As communication and coordination costs have dropped, new organizing methods have emerged that are difficult to understand using the traditional organizational architectures. In this paper we introduce a new organizational architecture – the “C-form” which is categorized by (1) fluid, informal boundaries of membership, (2) a dependence on volunteer labor, (3) a strong community culture with a sense of a "higher purpose", (4) commercially viable information-based product output (5) open sharing of organizational knowledge, and (6) inexpensive and efficient communication. We explore the implications for the modern organizational world.

There has been a long history of work aimed at understanding the structure and functioning of work organizations. Building on the scientific management approach of Taylor (1911), Barnard (1938) introduced problems of cooperation, while Simon (1945) introduced bounded rationality. Both enhanced organizational theory by considering behavioral aspects of management. The behavioral theory of Cyert and March (1963) added a discussion of the political nature of work. Contingency theory (Lawrence and Lorsch 1967, Galbraith 1973) advanced the field by considering the variety of environmental conditions that true organizations face. We seek to add to this stream of advances in organization theory by describing a growing new phenomenon, which is changing the way that organizations are built and interact with their environments.

Carroll and Hannan (2000) define organizational architectures as a method of organization that can be found in many different organizational populations, as opposed to organizational forms, which have an industrial boundary based definition. Modern examples of organizational architectures include the M-form (Williamson 1975) and the “network form” (Podolny and Page 1998). While these and other existing architecture theories describe many organizations, we are now faced with an unaddressed organizational reality facilitated by advances in communication and coordination technologies. The traditional organizational architecture typology fails to adequately capture the essence of a new organizing method that has emerged which relies on a community of volunteer labor. Our goal in this paper is to present an architecture that fills this gap – the Community-form or C-form. By describing this architecture we hope to expand the tools of organizational theorists for understanding new kinds organizations emerging in the post-industrial world.

The remainder of the paper is structured as follows. First, we introduce the main characteristics of the C-form organization. We discuss one example, the organization that produces the Linux operating system, to provide a basis for examining each of the characteristics of the architecture. We then contrast the C-form with architectures in currently accepted typologies of organization theory to further demonstrate its unique aspects. Following this discussion, we review the development of several organizations that we believe are best represented by the C-form. To exemplify the architecture, we draw from both historical and modern examples of C-form organizations, including the organization that produced the Oxford English Dictionary, organizations providing educational and consumer information products on

the Internet, and several software producing C-form organizations. Finally, we summarize the characteristics of the architecture and the issues and opportunities it presents to organizational researchers.

DEFINING CHARACTERISTICS OF THE C-FORM ORGANIZATION

The key features that we propose characterize this architecture are (1) fluid, informal boundaries of membership, (2) a dependence on volunteer labor, (3) a strong community culture with a sense of a "higher purpose", (4) commercially viable information-based product output (5) open sharing of organizational knowledge, and (6) inexpensive and efficient communication. Table 1 summarizes the characteristics of the C-form. We discuss each of these characteristics below. In order to provide a concrete example to aid in that discussion, we first briefly describe one C-form organization, that which produces the Linux operating system.

[insert table 1 here]

Linux, the Open Source “Microsoft killer?” Feller and Fitzgerald (2000) developed a framework to classify open source projects, using the definition of “open source” developed by the Open Source Initiative: open source is software provided under a license that (1) allows free redistribution (2) ensures the availability of the source code (3) allows distribution of derived works under the same terms as the original code (4) disallows discrimination against any person, group, or field of endeavor (5) disallows closing the software through indirect means such as nondisclosure agreements and (6) does not place restrictions on use with regard to grouping a program with other software.¹ This definition ensures that all organizations that create open source software will fit the fifth characteristics of the C-form listed above: open sharing of knowledge. Open source software has begun to compete head-on with more traditionally-licensed products created by for-profit organizations, yet as we will explain below, the organizations that create most open source software are impossible to categorize using the current set of organizational architectures. Looking beyond the strict license-based definition of what constitutes open source code to the organizing methods used to create it, we see examples of the new C-form organizational architecture.

Linux is an open source operating system that, unlike Microsoft Windows, is made available to anyone who wants it free of charge. It is freely downloadable from the Internet. Linux is not the first software product to be created using the C-form. However it is the first to

¹ See the Open Source Initiative website at www.opensource.org for the complete definition.

receive widespread recognition from the world outside of software developers and hackers. Linux has drawn the public eye due to its positioning as a potential “Microsoft killer.” We focus our attention on Linux in this section to draw on an example that many readers may already be somewhat familiar with.

Linux was originally developed in 1991 by a Finnish student named Linus Torvalds. Over the past decade it has been maintained and developed by a loose worldwide network of thousands of individuals, demonstrating the first characteristic of the C-form listed above and the difficulty of drawing a boundary around this organization. Though some of the individuals now work for companies that have grown up around the Linux community, when the organization began they were all volunteers, and most still are (this is the second characteristic of the C-form). They work on Linux because they enjoy it. They do not “report in” to a large corporate headquarters. They instead “logon” via the Internet from wherever they are whenever they choose. The Internet provides the inexpensive, efficient communication demanded by the C-form (the sixth characteristic above). Some work occasionally on development while others work hours that managers in the traditional corporate world would consider excessive. It is entirely up to the individual how much effort he or she expends on the project. The Linux organization does not provide any financial reward for their work. Classical economics would have a difficult time explaining the phenomenon. Yet Linux has created a buzz on Wall Street.

The commercial viability of Linux (the fourth C-form characteristics listed above) has become evident. Linux entered the financial spotlight when a support company called Red Hat Software had a successful IPO. This created initial interest in the investment community. Linux hardware vendor Cobalt Networks followed with the third most successful IPO in the history of the stock market, gaining 482% on the first day of trading. Eric Sink, the CEO of SourceGear (a company providing tools to support Linux) said, “...a money manager will call us and say, ‘Hey, I manage the money for so-and-so, they’re ultra-wealthy and retired, and they called and said I want my money in a Linux play because I saw what happened to Red Hat.’...It’s amazing how Red Hat’s IPO increased the visibility of Linux. Even retired people in Florida want to put their money in it.”(Rohm, 2000) Visibility for Linux increased even more with IBM and Corel’s announcements about strategic shifts to focus on Linux.

“IBM has announced an aggressive campaign to promote the Linux open source operating system...IBM will Linux-enable all of its hardware and will port applications and middleware to Linux as well. IBM also says it will collaborate with the Linux Open Source community to help develop IBM technologies.” (Penn, 2000)

“Corel Corporation today announced its Corel LINUX OS desktop will be the first Linux operating system to run Windows applications seamlessly over any connection.” (Corel, 2000)

Eric Raymond, the president of the Open Source Initiative, is a long time computer hacker who has worked in a mainframe computer environment since the 1960's. He is a public advocate of Linux and frequently appears in the media. In an interview (McMillan, 2000) Raymond described the ethos of the Linux C-form as focusing on creating the best technology – as an art form – knitted together by a social contract. When asked if the influx of investment money validated the product, he responded as any artist may, “What an awful thought. I feel kind of disgusted.” Consistent with the third characteristic of the C-form, those who work on Linux seem to have a “higher purpose,” which is freedom and defeating Microsoft. When asked if he always found Microsoft to be an ominous entity Raymond responded, “I view Microsoft much the same way in which I view government. Colossally stupid, occasionally quite evil, and to be abolished as soon as possible.” Clearly he is motivated by a “higher purpose” than seeking economic rents from a software product.

This higher purpose is echoed in Linux-related organizations' advertising campaigns. For example, “OS Empire Destroyer Game” (Linux Brothers), “Accelerating the Alternatives” (TheLinuxStore.com), “End of an empire, beginning of the revolution” (TheLinuxStore.com), “The Chronicle of the Revolution” (Linux Magazine), “The best thinking is outside the box...available at enlightened retailers everywhere” (Red Hat), “Looking for an alternative?” (Franklin Telecom), “It's time to close the windows” (Stormix Technologies), “Devious, diabolical, fascinating and brilliant minds have conspired to make public, all answers to all questions of Information Technology” (InformIT), “The only 100% independent website on the planet for the latest intelligence” (Slashdot), and perhaps the most telling “Big Brother is watching” (MacLawran Group). The advertising is indicative of the strong anti-control/anti-monopoly culture of the target audience – the members of the Linux C-form.

Linux related conferences serve the purpose of reinforcing the organization's culture. The advertising for such conferences builds on clear anti-Microsoft themes. For example, “Bridging the Revolution...Take control of your operating system...Reinvent the way technology and business function in the new millennium” (Linux World Expo), and “Linux is perched and ready to take over...close your windows” (Linux Business Expo). These are direct references to the revolutionary aspects of rebelling against the dominant player in the operating

system market – Microsoft Windows. Using Linux as an example, we now turn to a more detailed discussion of each of the defining characteristics of the C-form.

Fluid, informal membership boundaries. We define the community of workers in a C-form as consisting of all who contribute to its output. As detailed below, this may include members of inner and outer circles, where the inner circle is composed of members who are most heavily involved and have decision authority over the product. For example, for Linux, the founder developed an inner circle of “lieutenants” who helped him to screen and incorporate contributions into new releases of the software. The diagram in figure 1 depicts a hypothetical C-form.

[insert figure 1 here]

As represented in the diagram, the C-form is a permeable organization lacking formal membership boundaries. Members may come and go at will. Based on our definition of the C-form, we make the following assertion about membership: in order to be a member a person must contribute and the more a person makes high quality contributions, the more likely he or she will be in the inner circle. In other words, membership is defined in terms of participation. Given that participation determines membership, it may be difficult to determine at any given time exactly who is a member of the organization because evidence of participation (i.e. contributions) happens at discrete moments spread across time. It would be difficult to draw a boundary around the organization, as its members are spread across other organizations and across geography.

The permeability of the organization creates an interesting situation with regard to issues of coordination and control. In the absence of formal employment relationships and economic exchange, how are these maintained? In some sense the organization simply ignores issues of coordination: technology is put in place to maintain a minimum level of coordination (e.g., version control for source code, or centralized moderated discussion groups) and otherwise the organization seems to be ‘self-coordinating,’ somewhat like a market. Members make their own choices as to what they will do, when, and how. Anecdotal evidence suggests that strong community norms and charismatic leadership serve as main sources of control. With regard to the success of Linux, Raymond (1999b) says, “...[a] vital factor was the development of a leadership style and set of cooperative customs...[which] cannot be based on power relationships.” More generally, Raymond (1998: 5) observes “...the open-source culture has an

elaborate set of customs...[which] regulate who can modify software, the circumstances under which it can be modified, and (especially) who has the right to redistribute modified versions back to the community.” Given the fluid nature of the C-form organization and the lack of face-to-face contact, it may be interesting to study how these customs are instilled in new members through socialization processes.

Dependence on Volunteer Labor. The C-form does not provide its members with financial remuneration. This fact has been the subject of much discussion regarding the motivation of C-form workers. Simply put, what do they get out of it? Several prominent figures in the open source arena have discussed this question and the answers that have been put forth range from reputation (e.g., "Open source's best programmers...are involved in a reputation game." (DiBona, et al. 1999: 17)) to exhilaration (e.g., "...free software made available to him an exhilarating increase in his own creativity, of a kind not achievable in his day job..." (Moglen, 2000)) to reinforcement (Feller and Fitzgerald, 2000). Reputation benefits may lead indirectly to financial gains (e.g. by enhancing a contributor's job opportunities), and as for profit companies develop products using the output of a C-form, they may pay some of their employees to contribute work to the C-form. However, the majority of contributors are not paid, and none of them are paid by the C-form organization itself. The C-form is heavily dependent on volunteers.

Different classes of membership may be important in understanding issues around participants' motivation. Moglen (2000) describes the exhilaration felt by a first-time contributor realizing his own creative power, perhaps implying that this emotional response may explain initial and/or occasional participation in a C-form organization. DiBona, et al. (1999: 13) also imply this idea, saying that participation is "like the rush a runner feels while running a race, a true programmer will feel this same rush after writing a perfect routine or a tight piece of code." However when we consider the open source volunteers who work on projects like documentation, exhilaration as an explanation does not ring as true. Documentation is generally not considered a thrilling job. Raymond (1999b) states, "It is a hallowed given that programmers *hate* documenting." Behlendorf (1999) suggests such work is done by volunteers out of their desire to contribute to the good of the C-form. For these, perhaps motivation comes from their dedication to the higher purpose of the organization. Different kinds of contributors may have different sources of motivation, and it may be that as members move from the periphery towards

the center of the organization their motivations change. For example, the closer to the center one comes, the more prominent, and the more important reputation may be.

The C-form shares this dependence on unpaid labor to some degree with more traditional volunteer organizations. Hence one way to gain a richer understanding of membership in a C-form may be by looking at research that has focused on membership in volunteer organizations. Such research has examined determinants and correlates of the size of voluntary organizations (McPherson, 1983b), the competition among organizations for members (McPherson, 1983a; Popielarz and McPherson, 1995), the influence of intra- and inter-organizational ties on volunteer turnover (McPherson, Popielarz, and Drobic, 1992), and the recruitment and commitment of volunteers (Cress, McPherson, and Rotolo, 1997). Given the similarities between the C-form and traditional volunteer organizations, the findings from this research may generalize to help explain recruitment to the C-form.

However, the ways in which the C-form differs from traditional volunteer organizations may lead to some interesting new propositions. For example, McPherson (1983a) suggested that the physical location of organizations determines where their members come from. C-forms are hard to associate with a physical location – many are based on the Internet and their members live around the world. Compared to geographically-bound organizations and controlling for network effects (McPherson, Popielarz, and Drobic, 1992), members of C-forms might be expected to be less demographically similar to one another because of the relatively demographically anonymous means used for coordination and communication. Organizational researchers have found that workforce diversity has a positive impact on firm performance (Orlando, 2000; Zahra, Ireland, and Hitt, 2000). While the basis of higher quality that is cited in the open source movement is recruitment of only the most talented programmers and the large size of the labor pool looking for and fixing problems (Raymond, 1999b), diversity of contributors may also be a factor contributing to the relatively high performance of software C-forms as compared to traditional software producers.

Sense of higher purpose. C-forms are built around a communal sense of higher purpose. Two streams of research may be particularly useful in considering the implications of this characteristic of the C-form: organizational culture research and the research on social movements. Using the terminology of organizational culture scholars (e.g., Trice and Beyer, 1993), we might call this higher purpose ideology. Adherence to the ideology of the C-form may

be another explanation for the motivation of contributors: their belief in the cause leads them to participate. A question is raised for existing organizations that wish to develop a C-form: how can they foster an appropriate sense of higher purpose? Culture research would point us to the importance of socialization processes, and it may be interesting to see how such processes are conducted in the virtual realm of the C-form. Aside from creating and instilling an ideology, another option is to tap into a pre-existing set of beliefs in the population of potential members. This occurs when a C-form grows out of a social movement.

McCarthy and Zald (1977:1217) defined a social movement as "a set of opinions and beliefs in a population which represents preferences for changing some elements of the social structure and/or reward distribution of a society." Melucci (1980) and Touraine (1985) both argued that social movements are built on conflict. That is, in order for a movement to exist there must be some other social faction that opposes the goals of the movement. Morris (2000) considered the current state of social movement research and suggested that the basic theoretical components of social movements are the concepts of mobilizing structures, political opportunity structure, and cultural framing. Mobilization occurs through informal networks, preexisting institutional structures, and formal organizations. The political opportunities that allow a social movement to form emerge when changes in the external political environment occur. The current trend toward globalization may be an enabling force behind many C-forms. Cultural framing includes the notion of ideology and suggests that participants in a social movement must share some common culture.

Social movements tend to spawn social movement organizations. McCarthy and Zald (1977:1218) define a social movement organization (SMO) as "a complex, or formal, organization which identifies its goals with the preferences of a social movement...and attempts to implement those goals." So, for example, the National Association for the Advancement of Colored People (NAACP) is an SMO associated with the civil rights social movement. Each SMO has a declared set of target goals and some resources to be utilized toward the fulfillment of those goals. Among constituents of the SMO, there is the "cadre," those who are involved in decision making. The rest of the SMO consists of professional staff and workers.

Some C-form organizations may be based on social movements. For example, it may be consistent with the literature to view the "open source movement" as a social movement. The guiding belief is that software should be provided in a form that can be modified by the user.

The movement is enabled by the internet, and members share the ‘hacker culture.’ Unlike the typical social movement, opposition is not posed by the state or by other social movements. Instead opposition comes from profit-seeking companies such as Microsoft who stand to lose revenues if these beliefs are widely accepted. Evidence of conflict is widespread. One example of this conflict can be seen in the Halloween documents (Valloppillil and Cohen 2000). The Halloween documents are an internal Microsoft strategy memorandum detailing possible responses to the threat of the Linux community. The Microsoft authors conclude that:

Open Source Software poses a direct, short-term revenue and platform threat to Microsoft, particularly in server space. Additionally, the intrinsic parallelism and free idea exchange in Open Source Software has benefits that are not replicable with our current licensing model and therefore present a long term developer mindshare threat...commercial quality can be achieved/exceeded by Open Source Software projects...The ability of the Open Source Software process to collect and harness the collective IQ of thousands of individuals across the Internet is simply amazing. More importantly, OSS evangelization scales with the size of the Internet much faster than our own evangelization efforts appear to scale. (Valloppillil and Cohen 2000)

Raymond (2000) responds:

Bill Gates has pissed me off from day one. I don't mind that he got rich, but I do mind that he peddles himself as the ultimate hacker and God's own gift to technology when his track record suggests that he wouldn't know a decent design idea or a well-written hunk of code if it bit him in the face. He's made his billions selling elaborately sugar-coated crap that runs like a pig on Quaaludes, crashes at the drop of an electron, and has set the computing world back by at least a decade.

Bill Gates pretends to defend “innovation”, and if he did I'd love him for it. But there's very little evidence that Microsoft even knows what the word means. Buying or outright stealing key technologies rather than innovating has been a Microsoft trait from the beginning... And the worst -- the absolute worst - is that he's conditioned computer users to expect and even love derivative, shoddily-implemented crap. Millions of people think that it's right, it's normal to have an operating system so fragile that it hangs or crashes three or four times a week and has to be rebooted every time you change anything deeper than the wallpaper. Dammit, we knew how to do better than that in 1975!

If you're not an engineer, maybe you can't understand how deeply offensive most techies find this kind of thing. It gives me actual pain to see what Microsoft has done to the computing world, to the expectations of users, to the craft of programming that I love. But most of all, it disgusts me to the point of rage and nausea to contemplate living in the Microsoft-only future Gates has planned for everybody.

Linus Torvalds jokes about world domination, but Bill Gates means it. What Microsoft has done in the past is very bad, but I would not have gone to war with them over the past. The real issue is that they won't leave me and my friends any safe place. They want to hijack the Internet we built with brains and sweat and blood; they want top-to-bottom control of computing everywhere; they're determined to have it all, forever and ever, amen. That is the deepest subtext of the Halloween memoranda. And that, ultimately, is why I must be Bill Gates's enemy.

If open source is a social movement, the Linux C-form can be seen as an SMO associated with it. The cadre is represented by the inner circle of the C-form. In the case of Linux, this would be Linus Torvalds and his “lieutenants,” those who share decision authority with regard to incorporating changes and additions into new releases. The resources are essentially the brainpower of the contributors and the goal is to create an operating system to beat out Microsoft.

Though parallels may be drawn, there are several factors that distinguish a typical SMO from a C-form organization. For example, social movement organizations generally focus on changing something, while C-forms focus on creating something, a specific output, which may bring the C-form into direct competition with profit seeking organizations (this is the fourth distinguishing characteristic of C-forms). Additionally C-forms need not be based on a social movement. While the example of Linux we employ in this section may be based on a social movement, the example of the Oxford English Dictionary, which we describe below, was not. While a social movement can spawn a C-form, being based upon a social movement is not a prerequisite of a C-form organization. Another difference can be seen in the organization of members. McCarthy and Zald (1977) note a unique type of constituent in an SMO, the "isolated constituent" who does not come into face-to-face contact with others. Because the primary means of communication for many C-forms is distributed, the majority of members are isolated rather than the minority.

Commercially viable information-based product output. The C-form is characterized by the production of an information-based product. In the case of Linux, this is an operating system. It would be impractical to produce hard goods using a C-form as the costs of coordination and transportation would be excessive. Information-based products are suited to C-form production because the cost of duplication of the final product is trivial. This enables a free sharing of the product without damage or cost to those that create it. The lack of a formal organization in the C-form leaves room for peripheral services such as customer support to be filled by support organizations, and profit-seeking companies may emerge to provide physical goods and services associated with the information product of the C-form. As an example, hundreds of for-profit organizations have sprung up dealing with various aspects of supporting or enabling Linux. These range from companies that provide 24 hour user support services to organizations that will do corporate installations of Linux for those without the technical skills to do so.

The community nature of the C-form leads these related support organizations to interact with the C-form members differently than traditional organizations. Advertising campaigns for major Linux related companies frequently include statements regarding community membership such "An active member of the Linux community" (VA Linux Systems), "At the center of Linux" (Linuxcare), "There is a bonafide internet conspiracy" (InformIT), and "Taps the

collective consciousness of the entire Linux/Open Source development community” (Slashdot). The organizations attempt to claim membership in the C-form to gain social acceptance and subsequent usage of their products and services by C-form members.

Open knowledge sharing. The C-form is built around an open sharing of ideas and knowledge both within the organization and outside of it. There is no attempt to contain organization-specific knowledge or hide it from competitors. This represents a radical departure from most other kinds of organizations. Imagine the Coca-Cola Company taking this attitude and opening the formula for Coke up to suggested improvements by interested parties. Work on knowledge sharing has focused on the issue of how to encourage employees to share their knowledge effectively with others. C-forms do not have that problem; sharing is a prerequisite to membership. By definition, all members share. Are there lessons to be learned here for non C-form organizations interested in leveraging their employees’ knowledge? Moglen (2000) suggests part of the motivation for sharing in open source projects is that participants are assured under the licensing arrangements that their contributions will always remain free and no one else can turn them into proprietary products. In this sense, no one else can take credit for them. We return here to reputation as a motivation for sharing.

Inexpensive and efficient communication. The existence of a C-form depends on inexpensive and efficient communication. This is critical for allowing the participation of many widely dispersed individuals. Such communication has recently become available via the Internet and wireless networks. These communication networks provide efficiency. Each member is responsible for his or her own communication costs, making communication essentially free for the organization. C-forms represent truly virtual organizations (as defined by DeSanctis and Monge, 1999). As such they may be interesting contexts in which to study questions in the literature on virtual organizing. For instance, DeSanctis and Poole (1999) suggest that using electronic communication may pose difficulties for organizations in maintaining a coherent identity and avoiding information overload. These are issues that seem to be managed well in organizations such as Linux. Studying C-forms may provide insights on how to manage these issues in non-C-form organizations.

THE C-FORM IN CONTRAST TO OTHER ORGANIZATIONAL ARCHITECTURES

Above, we described six key characteristics that define the C-form. As described, the typical C-form doesn't seem to fit any traditional theoretical organizational architecture very

well. Common models of organizational architecture such as M-form, U-form, matrix, clan and network forms each share some similarities with the C-form, but none fully capture the organizational system surrounding C-forms. U-form firms are organized in functional divisions such as R&D, sales, and engineering. This clearly is not the case with C-forms in which members choose to work on whatever interests them and freely move between projects. M-form firms are multidivisional and tend to be organized around geographical or product categories, which contain functional divisions. For a worker to transfer from one division to another requires significant bureaucratic activity. Again, this is not the case: the C-forms we have described have no geographical boundaries and allow transfer from project to project with no bureaucracy. Matrix firms combine both vertical and horizontal chains of command, which also does not apply. In a C-form there are generally no chains of command. With regard to open source projects, Alan Cox, a leader in the Linux community, says, "There's no 'official' anything... There's this continuous army of people looking and cross-checking for stuff... the willingness to give up control is a basic principle of open source development... the development community is in charge." (McMillan, 1999: 40) Clans generally rely on long-term, sometimes lifetime employment (Scott, 1992), which is impractical given the fluid and informal membership boundaries of the C-form.

Given the atomized nature of the C-form organization as displayed in figure 1, the temptation may arise to question whether it should be viewed as an organization at all and perhaps instead as a hybrid of market and hierarchy, a clan, or a network. Along these lines, Raymond (1999b) refers to open source development as a bazaar. In organization theory terms, his bazaar might be referred to as a market of ideas. Powell (1990) provides a review of the key distinctions among markets, hierarchies, and networks. The first three columns of table 2 are borrowed from Powell (1990). We have added column four to describe clans and column five to show the ways in which we believe the C-form is similar to and distinct from each of these modes of economic activity.

[insert table 2 here]

As can be seen in table 2, C-forms are distinct from markets and hierarchies in their normative basis (in open-source communities, for example, code is given away and property rights are often purposely foregone), their means of communication (communication is many-to-many, and the actions of contributing to a project and/or using its output is a strong signal as to

the value of the project), their methods of conflict resolution (C-forms tend to have fiat without supervision), their tone (open competition of ideas in which the best solutions win), and actor preferences (they are both independent in the sense that they are largely uncoordinated and interdependent in that the independent actions must be assembled into a final product. Also, as discussed below, there is a sense of altruism). A main feature distinguishing a C-form from a clan is that the latter rely heavily on long term employment relationships whereas the C-form has no formal employment relationships.

Given that they depend on the actions of loosely connected actors, the C-form may seem most similar to a network form. Podolny and Page (1998) define the network form as "any collection of actors ($N \geq 2$) that pursue repeated, enduring exchange relations with one another and, at the same time, lack a legitimate organizational authority to arbitrate and resolve disputes that may arise during exchange." The network form is created through repeated economic exchange. The network form relies upon the assumption of economically motivated self-interested network actors. "Exchange" among the actors in a C-form is difficult to identify. They share ideas freely in order to improve a single information-based output. In most cases, even the companies that have developed around the C-form donate their tangible improvements to the product. The C-form is a loosely organized social network (that crosses traditional organizational networks) in which every tangible contribution by any member is given freely to all without reciprocal economic exchange.

EXAMPLES OF THE C-FORM

Our discussion above focused on a single example of a C-form organization in order to demonstrate each of the characteristics of the architecture and help differentiate it from other architectures. In this section we discuss some of the many other examples of organizations which we believe are best represented by the C-form. While C-form organizations have been gaining popularity and wide notice recently, the architecture actually first began to appear at least 140 years ago. The earliest example we have been able to find is the organization that developed around the creation of the Oxford English Dictionary (OED). This organization is described by Winchester (1998). The OED project began in 1857 when Archbishop Richard Chenevix Trench spoke out at a meeting of the London Philological Society suggesting the need to address deficiencies in then-current dictionaries. He argued that a truly comprehensive dictionary was needed, one that included *all* English words, present and past. In addition, the

dictionary would include the history of each word, documenting how its use had developed and changed over time. To create such a dictionary would obviously be a monumental undertaking. To accomplish it:

"Trench presented an idea - an idea that ...was potentially dangerous, and even revolutionary. But it was the idea that in the end made the whole venture possible.

The undertaking of the scheme, he said, was beyond the ability of any one man...[it] must be instead the 'combined action of many.' It would be necessary to recruit a team - moreover, a huge team, one probably comprising hundreds and hundreds of unpaid amateurs, all of them working *as volunteers*." (Winchester, 1998: 93, italics in original)

The Society accepted the idea formally in 1858, and Herbert Coleridge became the first editor. Over the next 70 years, thousands of volunteers participated. Volunteers selected the period of history that interested them and in large part determined themselves what they would contribute. At first they sent their contributions directly to the editor for review. However, within a few years a new editor, Frederick Furnivall, created a team of assistants to act as intermediaries, screening the volunteers' contributions. Members bore many of their own costs of communication, thereby relieving the organizational entity of those costs. The dictionary was published and sold in volumes. This early example of a C-form demonstrates all of the features listed above. It lacked formal boundaries of membership, depended on volunteer labor, had a higher sense of purpose, produced a commercially viable information-based product, had open sharing of knowledge, and relied on relatively inexpensive communication.

As the OED was being published in the early 1900's, the groundwork was being laid for the next generation of C-form organizations. Major events propelling the development and dispersion of the current software producing C-forms began with the advent of computing in the 1940's, the birth of the hacker culture in the early 1960's, and the creation of the ARPAnet in 1969 (Raymond, 1999a). Concurrent with these events, C-form organizations began to flourish and develop into the state in which we see them now. We have already discussed in some detail what we believe is probably the best-known software producing C-form organization, Linux. We now provide a more generalized description of how the C-form develops in the software industry and a brief summary (in table 3) of other successful software-producing C-forms.

A Summary Description of the C-form in Software Development. As described above, open source software is often developed by informal worldwide electronically linked networks of individual developers. In most open source software projects, labor works on a voluntary basis and the product it creates is provided without charge to anyone who wants it. Coordination for open source efforts is generally achieved electronically, using the Internet, with

each volunteer member responsible for his or her own connection. Hence project coordination is handled with virtually no cost to the organization. While Linux has been in the spotlight, it by no means stands alone as a successful software C-form. One online meeting place for the open source community, www.sourceforge.net, lists several thousand open source projects in various stages of development. Each of these represents a potential C-form organization. Other examples of widely known open source C-forms include Sendmail, GNU, Samba, Perl, and Apache. These are described briefly in table 3. These software C-forms are the backbone of a large portion of the modern Internet.

[insert table 3 here]

To summarize the examples described above, the typical open source software success story goes like this. One (or a few) bright hacker(s) encounter a problem with a piece of software (often developer oriented software such as an operating system or utility). It does something the hacker does not like, or it does not do something he wants it to do (DiBona, Ockman, and Stone, 1999). The hacker starts working on a solution to the problem. He makes progress and in the process becomes engrossed in the project, coming up with ideas for other ways it can and should be built upon and improved. At some relatively early stage in the development of the software, the hacker posts his code on the Internet with a call for other interested parties to help him work on it. Others who have an interest in the present and potential functionality of the software start making improvements to the code. If there is no interest at all the project dies. This serves as an early market research test. If there is interest, proposed changes are posted on the Internet. The changes are evaluated and commented upon by other developers. After open discussion the originator of the project decides whether or not to implement the changes and to release a new "official" version of the code updated with the contributors' improvements. No money is exchanged. The process is similar to the traditional peer review academic model of paper development, but sped up due to the public nature of the commenting process.

Just as OED developed a small group of assistants to the editor, a heavily involved "inner circle" develops around the project originator. These are the people who make the greatest number of contributions and who evolve into more influential roles as the project develops, often coming to share the gatekeeper role of the originator. A much larger, more casually involved "outer circle" develops around the project. Both of these circles are permeable, with individuals

moving between them, joining, and leaving. Together, these circles make up the "contributors." These contributors may be dispersed throughout the world, and they use the Internet for the majority of their communication and coordination. Most never meet face-to-face. Most gain no direct financial rewards from their efforts.

Due to the input of hundreds, thousands, or in cases like Linux, tens of thousands of talented and interested developers, the software undergoes rapid improvement. Bugs are found (and often simultaneously fixed) at speeds an order of magnitude above what occurs in a closed source development organization such as Microsoft. The market literally determines what features are incorporated into the software, since the heaviest users also act as the developers. This creates very useful software, which often gains a high percentage of the market. For instance, the product of the Sendmail C-form is responsible for 75% of the mail exchanged on the internet (Williams 1999). In addition to the software being available to the group that created and fine tuned it, it continues to be freely provided to anyone who wants it, whether they contributed to it or not.

Such development communities can form in at least two ways. In the "classical" way an individual or small group starts a software project and puts out an open call for help as we have just described. This manner of developing C-forms is supported by meeting places on the Internet where would-be C-form originators advertise their projects and would-be contributors can find projects that interest them (e.g., www.sourceforge.net and www.freshmeat.org). More recently a second method has developed in which a pre-existing organization creates a product and then makes it available for free and opens it to non-members for input and development. One of the most famous examples of this occurred when Netscape Corporation released the source code for its Netscape Navigator Internet Browser.

In both of these cases, the boundaries of the organization are difficult to define. There is an inner and an outer circle of contributors. There may or may not be legally-established for-profit and/or non-profit entities that distribute the software, provide documentation for it, and/or provide support for it. Members of the inner and outer circles of contributors may or may not be legally connected to (e.g., employed by) these organizations. Users of the software may or may not also act as contributors. Thus legal boundaries and distinctions are not likely to provide a good basis for defining the system of organization that develops in an open source community.

Non-software C-forms. As shown by the early example of the OED, C-forms are not limited to open source software. The advent of the Internet led to the flourishing of open source software quite naturally as the original users of the Internet were computer savvy programmers. However, the C-form can be seen in other realms as well. Von Hippel (2001) points out the similarities between open source communities and communities of sports enthusiasts who share their efforts in developing innovations in sporting equipment. In both cases, individuals develop new designs (for software or equipment) that are better suited to their own needs, then share those designs with others who help to improve upon them. For profit companies that produce sporting equipment may develop commercial products utilizing the information product (equipment designs) of the enthusiasts.

In March of 1999 the Open Book Internet Initiative (OBII) was launched by Pearson Education. The OBII is composed of educators, independent authors, parents, students, content experts, and independent fact checkers. It focuses on improvements to textbooks targeted for elementary and secondary schools. Corrections and updates are posted to a central Internet clearinghouse for immediate distribution and comment by all involved. As in the case of Sendmail and Sendmail, Inc. (see table 3) the OBII has a close working relationship with Pearson Education.

Similarly on the consumer watch front, A Bell Tolls (ABT) was established as a hobby by three friends in 1997. It is a clearinghouse of long distance rate information for the domestic U.S. market (Steele 2001). Over the years ABT has grown into a large force in the long distance industry providing data to many government regulatory authorities and consumer protection agencies (Washington State House of Representatives 2000). The data provided is a competitive threat to commercial database providers such as Tariffs.com and Salestar. The membership of the community is composed of consumer advocates, state and federal regulators, telecommunications pricing specialists, telecommunications consultants, bill auditors, accountants, sales representatives, reporters, and consumers. ABT focuses on keeping a watch on long distance rate changes through the creation of a comprehensive database. Corrections and updates are provided via e-mail by over 12,000 members and distributed via e-mail and the Web free of charge to interested parties. Top media outlets such as the New York Times, LA Times, Washington Post, Wall Street Journal, ABC, NBC, CBS, etc. also disseminate warnings from ABT when a major consumer issue is discovered (A Bell Tolls 2002) further intensifying the

impact of the C-form's information product on the long distance industry. Also as is the case with Sendmail and Sendmail, Inc., ABT has spawned a for-profit entity named A Bell Tolls, LLC which provides customer service to consumers wishing to switch long distance providers based upon the ABT database. Similar to the Linux example discussed above, if consumer activism is a social movement, the ABT C-form can be seen as an SMO. The three original founders serve as the cadre. The resources are the collective information contributed by the members and the goal is to combat misleading advertising by major telecom players designed to confuse consumers. The possibilities for future C-forms affiliated with more traditional organizations are extensive. In an Industry Standard article (2000) Don Tapscott and David Ticoll discuss potential future organizations which are in fact C-forms:

General Motors could use the process [open source development] to help design cars using 3D visual prototypes distributed via the Web. Participants could include style-conscious customers, fleet buyers, knowledgeable service technicians, supply-chain partners, dealers, car buffs, and industrial designers...Customers would be motivated to give advice because they love cars, enjoy interacting with other enthusiasts and gain pleasure from influencing the design of a car. When GM adopts an idea, it publicizes the news to the community, enhancing the contributor's reputation...GM would profit from a rich flow of networked human capital that it exploits but does not own. Companies ignore the collaborative and inclusive powers of the Net at their peril...their customers could also collaborate without them.

While the GM example is purely speculation, the realm of possibilities is clear. Volunteer labor pools can be organized in a C-form to produce commercially viable products. The commercial viability of such products is already apparent from the success of companies such as Red Hat, which packages and sells open source software, sport equipment manufacturers who mass produce products based on the innovations freely shared by communities of sport enthusiasts, and A Bell Tolls, LLC which services the needs of long distance users based upon the database created by the ABT C-form.

DISCUSSION

The C-form organizational architecture that we have described is characterized by informal boundaries, volunteer labor, strong common goals and beliefs, a focus on information-based output, open sharing of knowledge, and the use of inexpensive communication. We have discussed the ways in which we see this architecture as similar to and distinct from those already present in the lexicon of organizational theory, and raised many research issues regarding the structure and internal workings of organizations that employ the C-form. We now turn our attention to a discussion of the manner in which the C-form may transform industries.

Research Issues at the Industry Level of Analysis. What will the world look like ten years from now? We believe the appearance of the C-form has the potential to alter the organizational landscape in drastic ways. What are the characteristics of industries well suited to the C-form and how will those industries be altered if the architecture spreads? More specifically, what are the economic and social factors that foster the creation of C-form organizations in an industry? Under what conditions are C-form organizations likely to be more successful than other organizations in the same industry?

One way to begin addressing these questions is to look to the literature on post-industrial organizations. Heydebrand (1989) suggests six variables that serve to differentiate post-bureaucratic from bureaucratic organizations: informalism vs. formalism, universalism vs. particularism, weak vs. strong classifications and framing of options, loose vs. tight coupling among subunits, propagation of trust and loyalty. Heydebrand offers a simplified profile of the typical postindustrial organization. It would be small or located in small subunits of larger organizations. Its object is service or information. Its technology is computerized. Its division of labor is informal and flexible, with a decentralized managerial structure that is eclectic, participative, and overlapping with nonmanagerial functions. The C-form matches this broad description of a post-industrial form quite well, with the possible exception of the size criteria.

Perhaps the factors that create and define post-industrial society may be the factors that foster development of the C-form. Given the global dispersion of members, the C-form would not be possible on such a wide basis without the drastic reduction in communication costs that has recently occurred. Additional pressure to develop this architecture may have come from the constantly reducing cycle times involved in information products. The C-form allows product changes to be made virtually as the demand for them arises rather than having to go through a time-consuming bureaucratic process. It also allows for a virtually unlimited amount of highly skilled labor to focus on the most pressing problems. With new technologies and new demands constantly emerging, the bureaucracy involved in the response of more traditional organizational architectures does not allow enough speed to react. In the C-form the consumers who need new products or features create them, whereas in more traditional models a company that has sold a product is less able and less motivated to respond quickly. This contrast parallels the contrasts between a free market (the C-Form) and a centrally controlled economy (traditional hierarchical organization). Using the Linux-Microsoft comparison, demand is determined in the Linux C-

form based upon the individual needs of the broader market. On the other hand, Microsoft needs to create a long term strategic plan, allocate production capacity to specific projects, and predict future needs.

With regard to diffusion outside the software industry, other information products could be candidates for production by C-form. Advice and consulting services may lend themselves well to the C-form. In fact we are now seeing numerous Internet communities, such as ABT, sprout up that are utilizing the C-form. These range from counseling services to industry specific consumer watch groups. These C-form communities all have permeable boundaries, unique cultures, inner and outer circles, operate using public information disclosure, do not focus on economic exchange as currency, and take on new projects based upon the interests of the members. Thus we suggest that C-forms are likely to arise when the key resources in production are human resources (e.g., domain specific ability and knowledge).

Raymond (1999c) suggests several interesting ideas related to the question of diffusion of the C-form in the software industry. He points out that software programs generally provide value through their use. In order to retain value to the user, the software must be serviced and maintained over time. This is where the vast majority of programmer time is spent. In the software producing C-form, value and rents are closely aligned in that the initial installation of the software is free, and rents are often captured in the provision of documentation and support (this is how Red Hat and Caldera and other Linux-related for-profit companies make money). In addition to aligning interests of rent-seekers and consumers, this architecture produces high quality software through the direct participation of the users in development and through the competition engendered by making all improvements publicly available. In order to maintain an edge, rent seekers must offer continuous improvements and valuable services such as support and documentation. Thus we expect that the C-form will spread in areas of software development in which the bulk of usage value derives from continuing service (this might exclude programs that perform very specific, static tasks). In addition to support and documentation, continuing service may include services such as providing information through the software--i.e. open source financial analysis programs could be created and related for-profit companies could sell subscriptions to financial data service. Also, the C-form may spread in areas of software development in which reliability, stability, and quality are especially crucial (i.e. in mission critical applications such as operating systems and server software) because the

C-form allows peer review and leads to a higher quality end product (Feller and Fitzgerald, 2000).

Clearly the C-form is not ideally suited for all contingencies. A set of environmental conditions can still exist that favor other architectures. So, under what conditions might we expect C-form organizations to out-perform rivals? The unlimited number of people working on problems that are the most relevant to the market, combined with the fluid communication between all of the C-form members leads us to expect that C-forms are more efficient than other organizations in getting market feedback. Given the speed with which they get feedback and the large number of minds that may be immediately applied to a problem, C-forms are able to respond more quickly than other architectures to changing conditions and environmental shocks. For these reasons, C-forms should be more successful than other architectures in very high-speed environments.

An additional factor bolstering the success of C-form organizations may be the development of other profit seeking organizations around them. Because these organizations help to support the people who are working in the C-form for free and lend the C-form product greater credibility in the eyes of the public, they increase its viability.

CONCLUSION

This paper has introduced a new organizational architecture -- the C-form -- and discussed the issues this architecture raises for researchers. This is a method of organizing based on the voluntary work of persons interested in creating a product to be made available for public consumption. Its recent growth relies on the non-economic motivations of members and the drastic reduction in coordination and communication costs made possible by the Internet and wireless networks.

The structure of the economy is rapidly changing, and new kinds of organizations are emerging as the initial assumptions that led to the creation of traditional organizational architectures are violated. The C-form, as characterized in this paper, expands the tools of organizational theorists to understand these new architectures of organization, and promises to be an important subject for research. We hope that the research questions presented here stimulate researchers to grapple with these issues which current organizational theories of traditional architectures are unable to address.

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TABLE 1
RESEARCH ISSUES RELATED TO THE C-FORM

Defining Characteristic	Contrast to other types of organizations	C-form Research Issues
Informal membership boundaries	Somewhat similar to volunteer organizations, but more extreme because permeability extends to the inner circle and because the C-form organization typically lacks a physical base.	How is coordination and control managed? How does the organization retain knowledge when members leave?
Dependence on volunteer labor	Similar to volunteer organizations, however (a) more extreme because even the inner circle is not paid and (b) the c-form may compete with for-profit organizations	How are different classes of contributors motivated? How are members recruited and retained?
Strong community culture/higher purpose	Other organizations may have these characteristics, but usually not as the normative basis of the organization (i.e., in others it is combined with employment relationships)	How can traditional organizations wishing to create a C-form (e.g., Netscape) engender a strong culture?
Commercially viable information-based product output	Unlike other organizations, C-forms cannot practically produce physical goods.	Are there standard categories of peripheral goods and services that can be provided by non C-form organizations based upon the output of the C-form? What strategic threats and opportunities do C-forms provide?
Open knowledge sharing	Unlike other organizations, C-forms rely on complete transparency of all information. There are no proprietary rights.	What are the performance implications of open knowledge sharing vs. closed systems? What enforcement mechanisms exist to avoid economic theft and shirking?
Inexpensive and efficient communication	Because communication is handled through public channels and each member is responsible for his/her own costs, communication is free to the organization. This is not true for other organizations because while they can take advantage of the efficiency of the Internet, they generally must pay for members' equipment and connections.	How is coherent identity maintained using electronic communication? How is information overload avoided? What can other kinds of virtual organizations learn from C-forms?

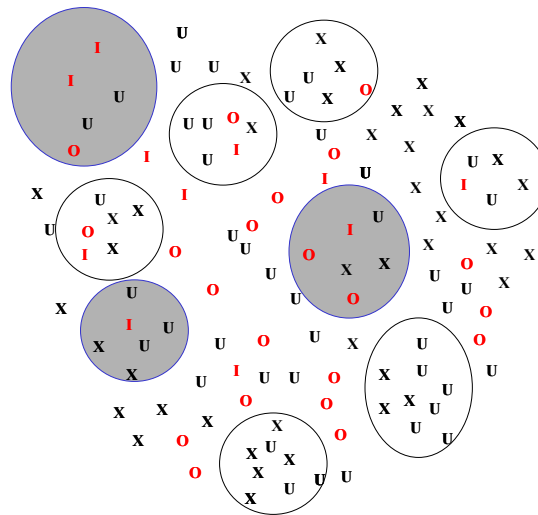
TABLE 2 THE C-FORM VERSUS OTHER METHODS OF ORGANIZING

	Market	Hierarchy	Network	Clan	C-form
Normative Basis	Contract-property rights	Employment relationship	Complementary strengths and long term contract relationship	Long-term employment relationship, common goals	Common goals, open sharing and volunteer philosophy
Means of Communication	Prices	Routines	Relational contracting	Routines, common culture	Many-to-many, action, common culture
Methods of Conflict Resolution	Haggling-resort to courts/enforcement	Fiat/ supervision	Norm of reciprocity/reputational concerns	Informal interpersonal controls, solidarity, fiat is available	Inner circle act as gatekeepers, some fiat, not much supervision
Degree of Flexibility	High	Low	Medium	Medium	High
Amount of Commitment Among Parties	Low	Medium to high	Medium to high	High	High in inner circle, low to medium otherwise
Tone or Climate	Precision and/or suspicion	Formal/bureaucratic	Open-ended, mutual benefits	Common goals, solidarity	Meritocracy, common values, higher purpose
Actor Preferences or Choices	Independent	Dependent	Interdependent	Dependent	Independent (choices to contribute/use), Interdependent (outcomes depend on coordination of independent choices)

TABLE 3 SOFTWARE PRODUCING C-FORMS

Sendmail (www.sendmail.org)	Sendmail is an open source program that handles electronic mail messages. It was originated in 1979 by Eric Allman, and it is currently used by over 75% of the Internet's mail servers (Williams, 1999). It is maintained by the worldwide community of volunteers known as the Sendmail Consortium. In 1997 Allman formed Sendmail, Inc. to provide a closed source, supported business version. Sendmail, Inc. has a close relationship with the open source version of Sendmail, providing many resources to support it.
GNU (www.gnu.org)	GNU was begun in 1983 by Richard Stallman. His purpose was to build a Unix-compatible operating system and provide it free to everyone. Stallman later founded the Free Software Foundation to head creation of GNU. GNU is supported by a wide range of volunteers. Stallman has been more widely involved in the open source (or as he prefers, "free software") movement, notably with the creation of the GNU General Public License (GPL), which is widely used to define the terms of distribution of open source software.
Samba (www.samba.org)	Andrew Tridgell created this software, used for communication between operating systems, in 1991. He now supports it with help from the samba team, a group consisting of about 20 people, and several hundred volunteers around the world. Samba is freely available under the GNU General Public License.
Perl (www.perl.org)	Larry Wall created Perl, an all purpose programming language that helped create many of the Internet's top sites, in 1986. It is now distributed under the GNU General Public License and maintained and improved by programmers worldwide. Perl received acclaim when in 1996 Yahoo co-founder David Filo wrote to Wall that Yahoo could never have started without Perl.
Apache (www.apache.org)	Apache was begun in 1995 by a small group of webmasters who wanted to coordinate their improvements to a preexisting web server implementation. There is a small group (~10) of frequent contributors who control the project, and several hundred who contribute to it. New members are admitted to the inner circle via nomination by a current member and approval of the rest. Apache is now the most frequently used server software on the Internet.

FIGURE 1
A HYPOTHETICAL C-FORM ORGANIZATION



I's represent members of the inner circle. O's represent members of the outer circle. U's represent individual consumers of the C-form product. X's represent individuals who are not consumers. Shaded circles demarcate membership in an organization that seeks rents from the product of the C-form. Unshaded circles represent membership in organizations that utilize the C-form product but are not designed specifically around the C-form. All I's and O's signify members of the C-form.