

A Longitudinal Study of the Use of a Collaboration Tool: A Breadth and Depth Analysis

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ABSTRACT

In this paper we present both a broad and deep look at the use of a collaboration tool in the intelligence community. Through an experimental program, intelligence analysts are given the opportunity to explore and use tools to determine if the tools provide sufficient value to be certified and moved into the analytic work environment. The goal of this program is to bring advanced technologies to the intelligence community through research and experimentation. New tools are evaluated using a metrics based assessment. Tools that successfully pass these evaluations are then introduced on an experimental network. Analysts employed by the experimental program work along side analysts in the intelligence community and look for opportunities where the experimental tools could be useful in current analytic processes. These uses are also evaluated to determine the value of the tools in the analytic environment.

Keywords: collaboration, evaluation, intelligence analysis, metrics

1. INTRODUCTION

As part of an experimental program in the intelligence community, Groove¹ was provided to a number of intelligence analysts starting in the spring of 2002. In this paper we look at overall use as well as examining the in-depth use of a specific application of Groove. We first discuss previous evaluation efforts for collaborative systems. The second section of the paper describes

¹ Any commercial product identified in this document is for the purpose of describing a software environment only. This identification does not imply any recommendation or endorsement by NIST, nor imply it is necessarily the best product available.

Groove and its capabilities. We then describe the study we conducted in more detail, including the metrics and the data collection we employed. The final sections contain our analysis of Groove uses from spring of 2002 to March, 2005 and our conclusions.

2. EVALUATION OF COLLABORATIVE TOOLS

Grudin [5] notes three areas of failure for computer supported cooperative work (CSCW) systems: the disparity between those who benefit from CSCW systems and those who must support them; a lack of management intuition for collaborative systems; and the difficulty of evaluating these systems. This leads Grudin to pose the following questions (among others):

- Will a collaborative system succeed if the extra work it takes is left to individual discretion?
- Can a system succeed by mandating that those who need to do additional work do so?

In addition, CSCW applications can cause evolution in the responsibilities of individuals in the workplace and workplace practices. Jobs can be created or jobs redefined. How much benefit has to be realized in a system in order for these changes and resulting disruption to be acceptable?

Evaluating collaborative systems has long been recognized as difficult. Unlike single user applications, the evaluation can not be carried out effectively in small laboratory studies. Carroll [3] advocates the use of scenario-based evaluation techniques to help ground the user experience. Pinelle and Gutwin [7] used scenarios as the basis for a cognitive walkthrough. Daminos et al.[4] proposed a number of possible scenarios illustrating different group activities that adopters of collaborative systems should consider when evaluating

different systems for the needs of their group. Haynes et al. [6] conducted a study using scenarios as an evaluation basis for a field study of collaborative work. One of the goals of their study was to use the scenarios as the basis for determining measurable benefits to the organization of the collaborative system.

Blythin et al. [1] discusses how to recognize success and failure when evaluating collaborative systems. In a three year study of an organization, they noted changes in culture, structure, and technology are often at odds with each other and, at times, incompatible goals have to be reconciled. Bowers [2] conducted a field study that focused on the procurement, implementation, and use of a collaborative system. He used interviews, observations, log files of some periods of use, and products generated by the groups using the system. As suggested by Grudin, Bowers found that there was additional overhead for using the system. He also noted awareness issues and issues with network management. Rogers [8] also conducted a field study of an organization's evolution in adapting to a collaborative system. She found that there was much procrastination in collaborative decision making and that stakeholders at times became overwhelmed with many interrelated decisions. She advocates a flexible approach rather than being tied to a set of strict procedures when making real-time decisions to support collaborative processes.

In the study description section of the paper, we will discuss how we structured our metrics based on the impact on the organization, the individuals, and the processes.

3. OVERVIEW OF GROOVE WORKSPACE

Groove [11] Workspace is a general purpose collaboration tool, designed to be used by a wide variety of organizations. Groove uses the metaphor of shared spaces to create collaborative environments. Often a space is created from a template and additional tools are added as needed. Common functionalities in all spaces are the basic collaboration mechanisms and a file sharing facility. Additional tools such as the calendar tool, sketch pad, note pad, forms tool, project planning tool, a meeting space support tool, as well as a collaborative browser, can be incorporated into a space. Most tools provided with Groove are compatible with the Microsoft Office tool suite.

Groove is a peer-to-peer application that provides its users with synchronous as well as asynchronous collaboration facilities. Basic Groove collaboration capabilities include text chat, audio chat, and an instant

messaging tool. Additional capabilities include support for threaded, text-based discussions and launching Microsoft Netmeeting from within Groove.

Groove tools support both synchronous and asynchronous modes of interacting with other members within a space. Many tools support both modes, that is, members who are in the tool space can see changes in real time, e.g., tools such as the sketch pad and note pad allow users to make changes and have others see those changes in real time as they are being made. Additionally, the resulting artifacts, i.e., sketches or notes, are persistent (unless deleted or changed by a member), and are available to other members who enter the space at a later time. Tools such as the instant messaging facility can be used in either mode, that is, in real time when all parties are on-line and active, or if all parties are not on-line at the same time, messages are delivered the next time a user becomes active in the space regardless of whether or not the sender has left the space, thereby providing asynchronous communication support.

Groove contains a synchronization mechanism that creates a local copy when a user opens a file and identifies when a user attempts to store a modified copy back to the file tool. Additionally, when users access a space, material that they have not previously opened is designated as new. This feature facilitates users tracking what is new or changed in a space.

Groove provides mechanisms to facilitate awareness of identity, presence, and activities of fellow Groove space users. The member list in the left-most panel gives a listing of space membership categorized by who is on-line, off-line, suspended (has not entered the space in a long time). Additionally, a small clock symbol next to a member name indicates that there has been no activity at that member's keyboard for some time. Names in the membership list also provide links to each member's "vCard", a kind of virtual business card, where participants can optionally provide their contact information. "Mousing-over" a tool button shows which uses have selected that tool as their current tool. Activity indicators include the following: a member will see a small notice pop up when another member enters the tool space they are using and, when users are engaged in a text chat, they receive an indication when another participant is typing.

Role-based access is provided via three, pre-defined access roles. A manager creates the space and can invite others to join as either participants or guests. These roles dictate the privileges one has within the shared space. Typically, participants are entitled to read, edit, and post, while guests have read-only privileges.

4. STUDY DESCRIPTION

Groove version 2.5 was made available to a number of intelligence analysts who had access to an experimental network. Besides the intelligence analysts, the experiment team also used Groove as there were a number of distributed personnel working on this project. One group, responsible for a formal request for information (RFI) process, had already decided to incorporate Groove in its process as they believed it would help to track the status of the group's work. We looked at overall usage of Groove and the use of Groove in the formal RFI process.

We were interested in identifying the impact on the organization. What changes, if any, had to be implemented in the organization? Was the tool of enough value that these changes were made? What was the impact on individuals? Did the tool create more work? For whom? And was the tool of enough value that this was acceptable?

In previous research we developed a metrics model [9,10]. Using this model, we identified four questions that should be answered to identify the impact of collaboration tools:

- Did ad-hoc collaboration increase? Would we expect this increase to be sustainable?
- Was the tool effective in supporting collaboration in the workplace?
- How did the work process change as a result of the inserted technology?
- How did the work products change as a result of the inserted technology?

Data collected consisted of:

- Groove log data over almost all of the 2 year period of time
- Interview data with users of the system
- Specific data collection of the formal and ad-hoc RFI processes concerning specifics about the number of requests, success, and time spent. This will be discussed in detail in the sections on the formal RFI process and the ad-hoc RFI process.

Specific quantitative measures obtained from Groove logs include: number of visits, number of organizations collaborating, tool use, and the number of Groove spaces. While these provide some indication of use, these measures must be interpreted carefully. Groove uses vary. Some users may log in and look quickly at a space to see if anything new is there. Others may be in a space all day long, monitoring activity in that space. Both of these uses count as a "visit." Likewise all spaces

are not created equal. Some spaces have much more activity and tool use than do other spaces. Some spaces are used only within an organization while others connect users between organizations and groups. As the users in our study move to different organizations frequently, it is difficult to analyze the use of various spaces by organization.

Groove version 2.5 logs do not provide us with all the information we would like to have including the time that people leave a space (allowing us to capture the duration of visits) and the use of the instant message or the chat tool. However, the qualitative information we have gathered through interviews with users provide insights beyond the "hard" numbers we are able to obtain through analyzing the log files.

5. OVERALL USAGE OF GROOVE

Groove has been used both by the experimental team and by other intelligence analysts who have access to the experimental network. In this section, we show the overall growth of Groove use by both groups. Groove 2.0 was installed into the experimental collaborative infrastructure starting in spring of 2002 (Figure 1). In May, 2002 a Groove session with three external organizations was initiated by the experimental team to demonstrate document sharing. By the end of 2002, we were able to access component log data from Groove to track usage. The actual data in this report is from July 2003 to March, 2005. The instrumentation allows us to view only *presence information* (who, what space, what tool). We are not able to determine what types of activities were performed in the various spaces. Additionally, we do not know when users logged out of the spaces. Because of these constraints the *number of visits* to Groove spaces was selected as a primary metric. In retrospect, this may not have been the optimal metric as some heavy users of Groove use one space, but keep it open the entire shift to monitor new information. However, in addition to the log data, we have also conducted numerous interviews with Groove users that supplement the quantitative measures and provide additional insights into the use of Groove as a collaborative tool.

5.1 Quantitative Usage Statistics

From the Groove logs we were able to view the number of users, the number of organizations, the number of spaces, and the different Groove tools that were used. In figures 2, 3, and 4 we show the number of users, the number of organizations and the number of spaces. We have also calculated an activity level for each and plotted

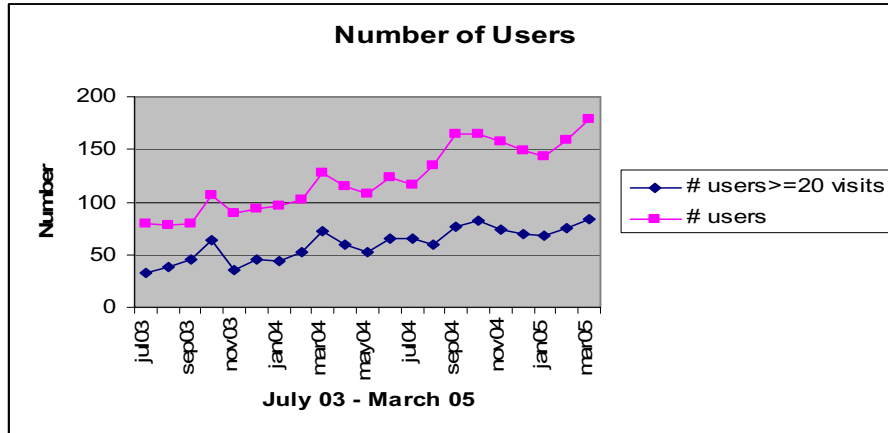


Figure 1. Number of users using Groove from July 2003 through March 2005.

that. For the number of users, we plotted only those who had more than 20 visits each month. For the number of organizations we plotted those having more than 100 visits per organization to Groove spaces. For the number of spaces, we plotted those having three or more members. Figure 1 shows that the number of users has been steadily increasing with the exception of a slight drop in the November 2003 time frame. At one point, new users were automatically being assigned Groove accounts regardless of whether they intended to use them. More importantly the number of active Groove users has been more or less increasing.

Figure 2 shows that the number of organizations has increased, although the number of active organizations shows some signs of reaching a plateau. We intend to investigate this further to determine the processes that Groove is supporting in the active organizations.

Figure 3 shows the number of spaces as well as the more active spaces. Active spaces continue to increase. The

figures above include usage statistics for both the experimental team analysts and the intelligence analysts. Figure 4 breaks out the usage for these two groups by looking at tool usage. The experiment team uses Groove to collaborate and track experiments and metrics work. The different groups within the experiment team set up Groove spaces by activity periods and used these to share documents describing activities and to assemble presentations and reports. As the quantitative usage statistics show, file sharing was the most heavily used capability for the experiment team. The discussion tool was also used. We have interview data about the use of the chat tool by both groups but we are unable to see this in the log data. Figure 4b shows tool use by the intelligence analysts. In this case, the forms tool is the major tool used. This will be discussed in the section on the formal RFI process. Figure 4b clearly shows the start of the RFI process and the use of the forms tool in the October, 2003 time frame. We also see that the use of the forms tool has fallen off since December, 2005. We will discuss this in section 6.3.

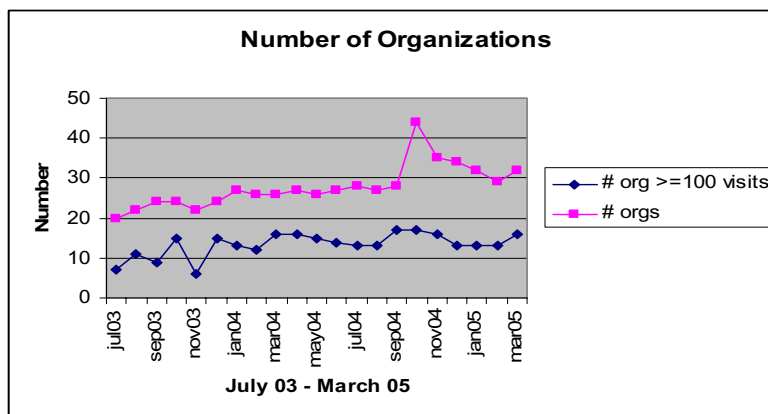


Figure 2. Number of organizations using Groove from July 2003 through March 2005.

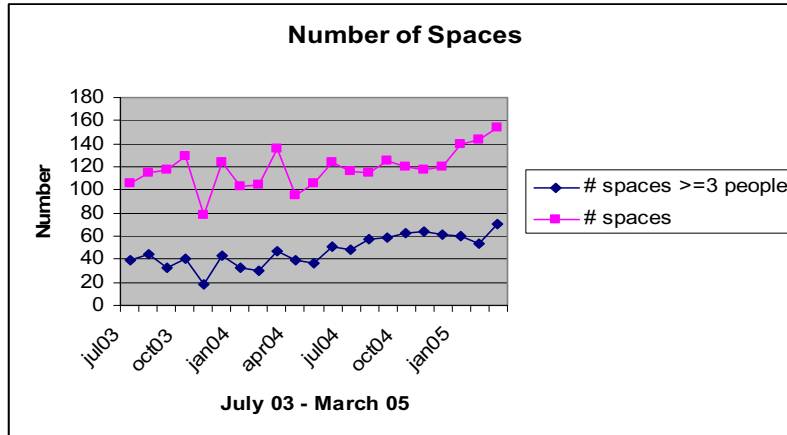


Figure 3. Number of Groove spaces from July 2003 through March 2005.

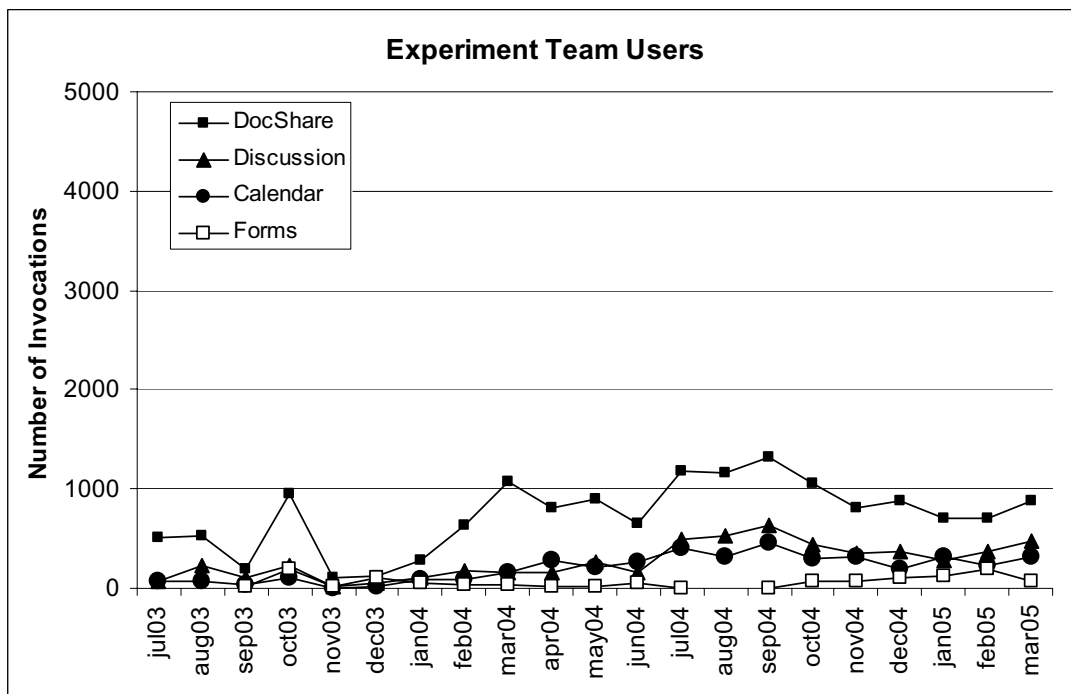


Figure 4a. Tool usage by the experiment team

5.2 Qualitative Usage

A number of participants have been interviewed about Groove usage. The results have been consistent over the time that Groove has been available. The users by and large like Groove. They find the chat facility easy to use. The message system lacks some of the features (such as carbon copy) that other popular e-mail systems have. The discussion tool does preserve the interchange but users must be in the space in order to use this tool as opposed to the chat facility which instantly pops up for

the user to see. The ability to see which users are online and active is a nice feature when users are separated by many time zones. However, the heavy weight nature of the spaces is an issue. Users need accounts on a machine to access Groove and must synchronize their spaces when they log in. Synchronization takes time when spaces are large or the user has been logged off for some time. Even so, users find Groove particularly appealing as a management tool. While users tell us that they use the lightweight chat feature, the instrumentation does not allow us to quantify this usage.

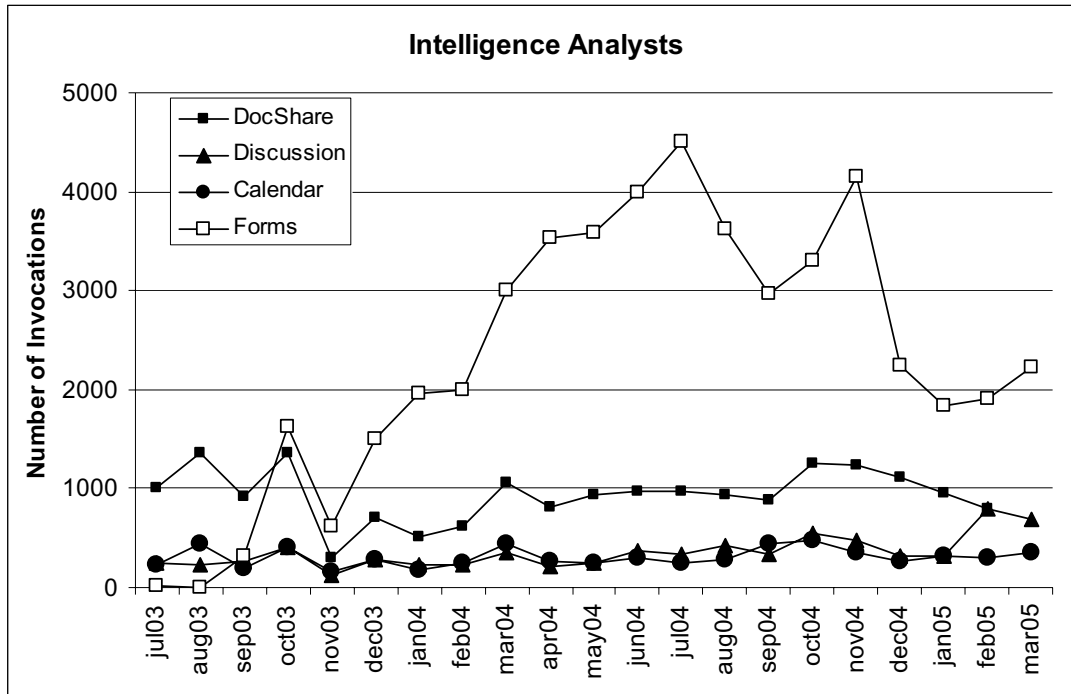


Figure 4b. Tool usage by the intelligence analysts

6. A FORMAL RFI PROCESS

The ability to rapidly and effectively respond to requests for information is vital in the military intelligence community, and the intelligence community as a whole. An agency, referred to here as Agency A, has become a central node within military intelligence because of their ability to process RFIs, and Groove has been central to that capability. They adopted Groove and incorporated it as a part of their concept of operations (CONOPS), and then continued to use the tool without involvement from the experiment organizers.

In this section we present metrics on the use of Groove in this process, both quantitative measures and qualitative data from interviews with Groove users. In addition, we compare the current use of Groove with a concept of operations established in Oct., 2004 and discuss differences and possible explanations for those differences.

6.1. Baseline

Agency A had just started its' RFI process so we have no baseline data to use as a comparison. Initially Synchronization managers in Agency A used the forms tool in Groove to log in the various requests and to easily update and show the status of each request. The

managers of the RFI process were interested in using Groove more widely in their RFI process and a concept of operations document was developed. The CONOPS document (January, 2004) was intended to show how the intelligence community could go beyond the use of Groove as a management tool to using Groove in all six phases of the intelligence process: *Planning and Direction, Collection, Processing and Exploitation, Production, Dissemination and Integration, and Evaluation*. The document outlined the following activities for each of the phases:

- *Planning and Direction*: create a shared space to provide members of the command staff with initial intelligence templates and estimates to enhance staff planning activities.
- *Collection*: use the Groove forms Tool to build collection plans which can be viewed by members of the collection manager's shared space or disseminated as attachments to a Groove message.
- *Processing and Exploitation*: Analysts would build their own shared spaces (formally shared or informally shared) to collaborate on intelligence products.
- *Production*: Analysts could use a forms tool to make a response to the RFI.
- *Dissemination*: Fusion managers can then take these reports and move them into the shared space accessible by the intelligence community.

- *Evaluation:* Customers of the RFIs could use a forms tool to provide feedback on a request.

We are able to compare the actual evolution of Groove use to this anticipated use and discuss reasons for adherence to and divergence from the CONOPs.

6.2. Current RFI process

Figure 5 shows the RFI process at Agency A. There are many lines of communication in this process. The solid lines in the figure represent communication lines defined by the process. The dotted lines represent informal communications that optionally occur. The customers originate the RFIs, communicating either over the experimental network, e-mail on network #1 or over network #2. These are received by the Synchronization Management team which takes the RFI requests, validates them and distributes them to the appropriate analytic unit. Synchronization Management uses the forms tool in Groove to track the RFIs. The managers in the various units have access to this Groove Space. The managers are given their RFI assignments either through e-mail on network #1 or are sent an e-mail notifying them of an assignment in the Groove Space. The type of notification sent depends on which network the analytic unit spends the majority of its time. Unit #1, which gets 42% of the RFIs, is given assignments using e-mail. Unit #2 which handles 52% of the RFIs gets assignments using Groove but is sent an e-mail alert on network #1. This is necessary as the analysts must physically switch between networks for security reasons. E-mails and alerts on one network will not be viewable until they physically switch to that network.

The downward communication to the analysts is done via e-mail. The RFI managers use different methods for coordinating and tracking the RFIs assigned to their units, including shared files and hard copy notebooks. Groove is not used for tracking at this level. When the reports are completed, they are sent to Quality Control (QC) via e-mail. QC sends the approved RFIs to Synchronization Management using e-mail. Any communications back to the RFI managers by QC are via e-mail as well. Once the reports are received by Synchronization Management, they are put on the Groove Space, a spreadsheet on network #1 that mirrors the Groove space, and on a web portal to ensure that all customers have access to the intelligence products.

Informal communications among analysts and between analysts and customers use the communications network common to both. In some cases this is Groove, but in many cases this is e-mail on network #1. Analysts do use Groove for informal communications using the chat

facility, but this cannot be tracked via Groove logs so we have to rely on verbal reports of use.

6.3. Usage Statistics

Figure 6 shows the RFIs submitted since Sept., 2003. RFIs are submitted predominately using Groove and e-mail requests on network #1. The RFIs have been increasing, but the use of Groove seems to have reached a plateau for submissions. The data show a decline in the number of RFIs submitted via Groove in the first three months of 2005. This is also reflected in a decline in the use of the forms tool shown in Figure 4b. The decline in RFI submission via Groove is most probably due to the limited network access of customers to the experimental network. We also found that network accessibility in remote locations determined how RFIs were submitted and that frequently, the experimental network was more accessible. So changes in network accessibility may also account for the choice of submission medium.

We also looked at the use of the various components of Groove to determine what Groove capabilities were being used by the RFI analysts and management. Figure 7 shows this information by quarter. As seen in Figures 4a and 4b, the use of the Groove forms tool and document sharing make up most of the Groove usage. We are, however, unable to access logs of Groove e-mail and chat.

6.4. Comparison with Envisioned Concept of Operations

Currently the chief use of Groove in this environment is for management and dissemination of information requests. The dissemination is limited to distributing to customers. Analysts do not use templates in the Groove space for producing reports. Analysts do not create ad-hoc Groove spaces to use for collaboration, but do use the more informal chat features of Groove to collaborate. There are several relatively heavyweight features of Groove spaces that we identified as barriers to use for the intelligence analysts in this study. In order to keep spaces up to date, analysts need to be logged into Groove and let it synchronize as needed. Analysts do not always sit at the same desk, or if they do, they may only sit there for one shift. Other analysts use the computer during other shifts. Thus, each time the analyst logs on, the Groove spaces have to be synchronized. As spaces grow, the time to synchronize increases. If the analytic group does most of its research on another network, they have to switch back and forth between networks to look at their Groove spaces.

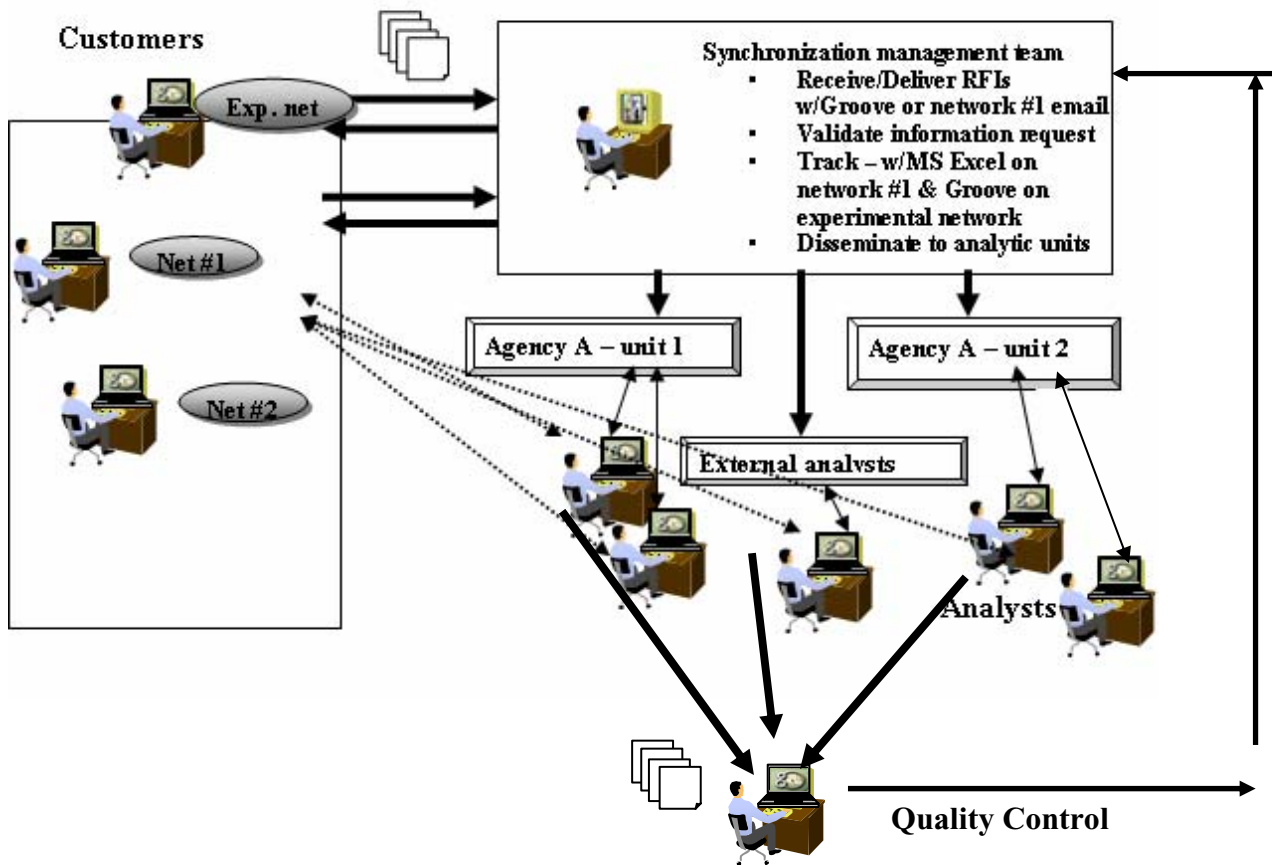


Figure 5. The RFI Process in Agency A

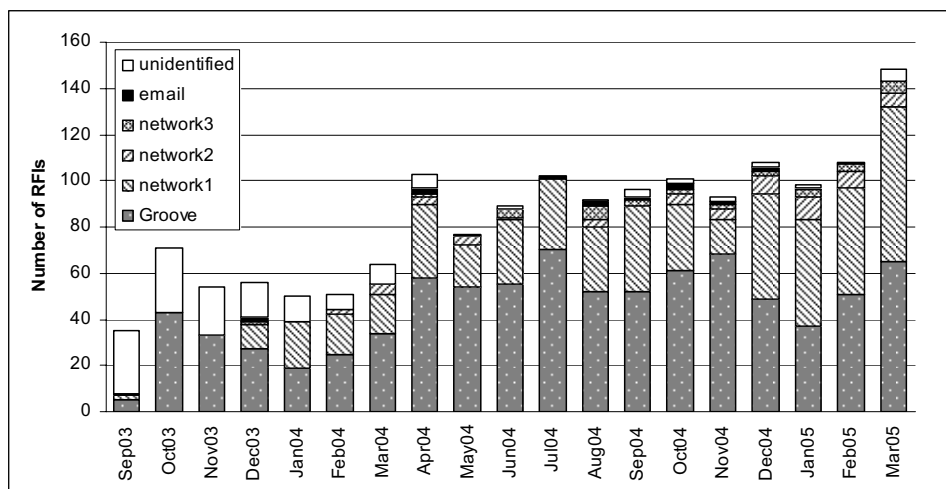


Figure 6. RFIs submitted since Sept, 2003.

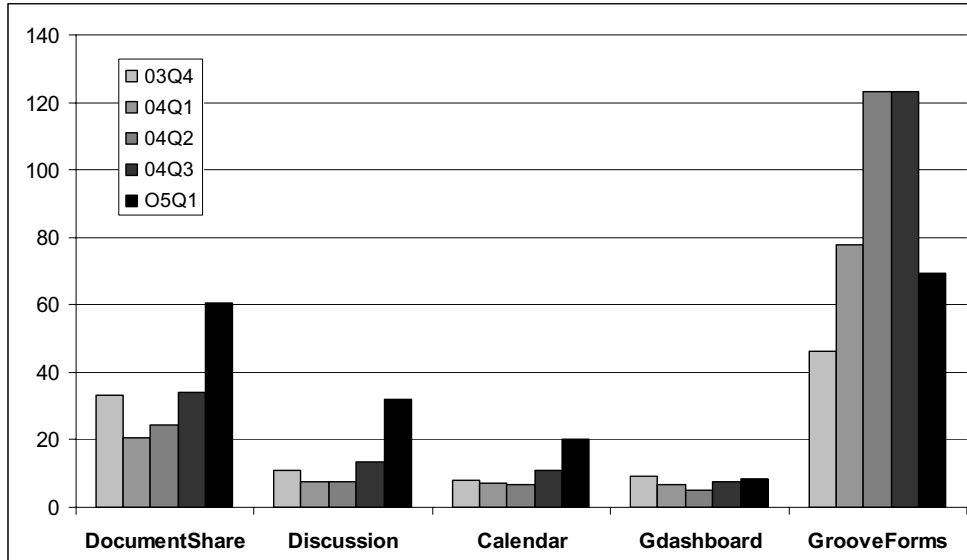


Figure 7. Tool usage in Groove by quarter for RFI analysts

The Synchronization Management group values Groove for its organization capabilities and finds no difficulty in posting RFI reports to Groove and to another network to serve customers who do not have access to the experimental network. They do, however, periodically open new Groove spaces as the size of the current space gets too large to manage effectively and safely.

6.5. Qualitative Analysis

One analyst who served as the manager of RFIs in another location told us that he had duplicated the Synchronization Management scheme there. He tracked the RFIs that were performed locally and those that were sent back to Agency A. Many times Groove was used as the communication means back to Agency A as it proved to be more reliable than other communication networks. Furthermore, the ability to see who is online was valuable to those separated by miles and time zones.

In general, analysts like Groove. They like the e-mail and chat facility and find those tools easy to use. They do not like the time needed for synchronizing spaces. At times analysts at Agency A operate on a 24/7 basis and therefore, analysts share computing resources. Each analyst must have his own Groove account and needs to synchronize his spaces each time he logs in. If analysts use multiple machines, they will need Groove accounts on each machine in order to access their spaces. However, the organization has been willing to adjust scheduling procedures to ensure that analysts are able to sit at the same computer each day. Analysts may, however, need to share this computer with others on different shifts.

Analysts also noted that maintaining accounts and spaces was an issue when being transferred from one duty station to another. Typically, these transfers take over 30 days. Thus analysts are often suspended from their spaces and have to request access again. They also noted that their e-mails did not transfer.

A small number of analysts at Agency A used the “explorer” add-on. The tool is valuable as it allows them to search the previously completed RFIs to determine if a particular name has been investigated earlier. However, Synchronization Management is cautious about using this feature as it might lead to dependence on earlier and perhaps, out of date, reports. There is also the issue of the latency in bringing up the explorer application.

Another problem mentioned by analysts was the invitation process in Groove. Some spaces have many folks who are invited. Some analysts said they were reluctant to participate when they didn’t know exactly who all the invited folks were. Analysts are also continually being switched between duties and would like to be able to know what other spaces are available. Currently, analysts are not aware of the existence of spaces that they are not invited to.

The three largest barriers to the use of Groove are its availability only on an experimental network, the need for Groove to use space on local computers, necessitating time and space for synchronization, and the time needed for training. Currently, the training is long and analysts are frequently unable to obtain accounts on Groove until weeks after they received their training.

7. CONCLUSIONS

Our quantitative data shows a steady increase in number of users, organizations, and number of Groove spaces. The number of active organizations seems to be approaching a plateau. We will need to investigate more closely the use of Groove in the various processes in these organizations to determine if the plateau is due to the tool or to organizational issues. When we look at the different usage patterns of experiment team users and agency intelligence analysts, we see that the forms tool is the most heavily used capability for the agency intelligence analysts, while the experiment team users concentrate more on document sharing features.

We return to the four questions posed in the introduction:

Did ad-hoc collaboration increase? We found evidence to support this. Our interviews with analysts in the formal RFI process provided data about analyst to analyst collaboration as well as analyst to customer collaboration. We expect the collaboration in the formal RFI process to continue and to potentially increase as more customers and analysts obtain access to Groove and the experimental network.

Was the tool effective in supporting collaboration in the workplace? We can answer this positively. The use of Groove as a management tool for RFIs was viewed so positively that similar processes were setup in other smaller organizations. And, the use in Agency A has grown as the RFI process there has increased.

How did the work process change as a result of the inserted technology? The use of the forms tool helped to create a better tracking vehicle. As the RFI process was new, it is difficult to assess change. However, we did compare an envisioned process with the actual process. In doing so, we found deviations that can be attributed to issues with Groove. Although it was envisioned that individual analysts could setup ad-hoc Groove spaces to collaborate on products, this did not happen. Analysts also have access to shared folders they can use and many of them are in direct contact (sitting side by side). In addition, much of the work they do has to be completed very quickly. Thus the overhead of setting up a space, inviting others to it, and posting and monitoring work is much more heavyweight than needed for the fast-paced work they do.

How did the work products change due to technology insertion? As the RFI process was new, we were unable to judge a difference in quality. However, the fact that the RFI process grew significantly suggests that customers found the products to be of a good quality.

Looking at the impacts on organizations, individuals, and processes, what were the results? We found in the RFI process that there was an issue with analysts who had to sit at different desks due to 24/7 operations and the need to have Groove local on their machine. The agency found the tool to be so useful that they organized the work schedules and seating arrangements so that an analyst would always have the same desk at which to sit. This means that someone else sits at the computer during other shifts. So there is still the need for synchronization when an analyst logs in again but there is not a need for analysts to have their accounts on multiple computers.

Groove has both advantages and disadvantages as a collaboration tool. The advantages are the wide range of functionality available as well as the ability for independent developers to create tools that work on top of the Groove collaborative platform. The disadvantage of Groove is its heavyweight nature. The time needed to synchronize spaces and the requirements for users to have an account on each computer they use for Groove are serious impediments to use. Training time and the time needed to obtain Groove accounts are also drawbacks. Currently, the biggest issue is that Groove is available only on the experimental network. This is a temporary problem that will be solved if the software is adopted and put on the main network. Nonetheless, users like Groove and organizations have even made changes to accommodate Groove use. Groove is mainly used for sharing files, using the form tool, and the lightweight chat (instant message) capability. We are able to quantify the first two uses but we are unable to track the use of instant message other than through interviews with Groove users. Analysts view the use of Groove for managing for the RFI process as a success. In fact, they do not mind duplicating the information in the Groove space on different networks using different tools. In our study the value of the collaboration tools was due to increased quality of products and better management capabilities.

In summary, the impediments to adoption of Groove for collaboration could be classified as technology issues, policy issues, and management issues. Technology issues such as the time needed for synchronization needs to be solved by software developers. Policy issues such as having to switch between different networks on one computer need to be resolved by the organizations. Management needs to resolve issues of just-in-time training. It is important to identify and address these types of issues for the organization to make an informed decision about whether to adopt collaborative software.

Our objective in this study was to identify both the negative and positive aspects of collaborative technologies in a process in the intelligence community. Based on this analysis the community has several options.

They can consider changes to policy and management needed to make this particular collaboration tool work, assuming the technology issues can be resolved. Or they can use the results from this research to develop requirements for collaborative software that more closely fit within current policy and management constraints.

8. References

- [1] Blythin, S., Hughes, J., Kristoffersen, S., Rodden, T., and Rouncefield, M. "Recognising "success" and "failure": evaluating groupware in a commercial context". *Proceedings of the International ACM SIGGROUP Conference on Supporting Group Work: The Integration Challenge*. 1997, pp. 39-46.
- [2] Bowers, J. "The work to make a network work: studying CSCW in action". *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work*. 1994, pp. 287-298.
- [3] Carroll, J. MAKING USE OF SCENARIO-BASED DESIGN OF HUMAN-COMPUTER INTERACTIONS. 2000. MIT Press: Cambridge, MA.
- [4] Damianos, L., Hirschman, L., Kozierok, R., Kurtz, J., Greenberg, A., Walls, K., Laskowski, S., and Scholtz, J. "Evaluation for collaborative systems". *ACM Computing Surveys (CSUR)* . Volume, 31, Issues 2es (June 1999), Article No. 15.
- [5] Grudin, J. "Why CSCW Applications Fail: Problems in the Design and Evaluation of Organizational Interfaces", *Proceedings of the 1988 ACM Conference on Computer Supported Cooperative Work*", 1988, pp. 85-93.
- [6] Haynes, S., Puro, S., and Skattebo, A. "Evaluation methods: Situating Evaluation in scenarios of use." *Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work*", 2004. pp. 92-101.
- [7] Pinelle, D. and Gutwin, C. "Design Methods: Groupware walkthrough: adding context to groupware usability evaluation" *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Changing Our World Changing Ourselves*. 2002. pp. 455-462.
- [8] Rogers, Y. "Exploring obstacles: integrating CSCW in evolving organizations". *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work*, 1994, pp. 67-77.
- [9] Steves, M. and Scholtz, J. "A Framework for Real World Software System Evaluations." *Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work*. 2004. pp. 600-603.
- [10] Steves, M. and Scholtz, J. "A Framework for Evaluating Collaborative Systems in the Real World." 2005. *Hawaii International Conference on System Science (HICSS 38)*.
- [11] www.groove.net, accessed June 28, 2005