When the System is Down: Professional Communication During Urgent Technical Issues

Sarah Murto
University of Minnesota – Twin Cities
murto009@umn.edu

Abstract

We live in a world that expects our digital services to have 100% uptime and 24/7 service. When a technical error occurs, that technical incident must be responded to right away. Responders to a technical incident will have communication needs that arise as they try to repair the error. Previous research explored in this project has noted the occasional area of improvement in communication during a technical incident; however, these previous studies did not investigate how communication technologies influence the understanding of complex information. In order to fill a methodology gap in research, semi-structured qualitative interviews were performed with responders to technical incidents. These interviews explored how incident responders used communication technologies during an incident. Results indicate that how people use technology does not matter so much as what they use the communication technology to do. There is no clear winning communication technology, so long as the company can use technology to achieve the communication goals explained in this paper. These goals include having a central point of record that tracks the steps taken towards resolution, having communication channels that are free of distracting background noise, and having a blameless and calm working environment.

Keywords

incident response, communication effectiveness, communication technologies, software tools, response team, recovery, emergency, social, knowledge distribution

Introduction

Modern technology moves quickly. E-mails let us send messages immediately, social networking lets us instantaneously share our lives with our friends, and web applications let us do tasks at the click of a button. To keep up with these immediate demands of the users, technology also needs to move quickly. As modern software development embraces the practices of continuous integration and continuous deployment, technological changes are being implemented and made public far more rapidly than in the past (Kilamo, Leppänen, & Mikkonen, 2015). Constantly updating the technology we use on a daily basis creates a continuous cycle of improvements and progress.

Until something breaks.

No one's happy when technology isn't working as expected. We live in a world that expects 100% uptime and 24/7 service. Rapidly updating technology often means less testing of the software being deployed, which leads to a greater potential for errors (Kilamo, Leppänen, & Mikkonen, 2015). These errors can range from small, annoying bugs to show-stopping errors, and these problems will need to be repaired by a team who can fix them at any time of day (Gonzalez, 2005, p. 371).

Likely, the error is not an issue one person can solve. System administrators may need to check log files, developers may need to look into what changes have been made recently, and managers may need to contact stakeholders to let them know things are not going well (Rollason-Reese, 2003; Arychuk & Vernon, 2015). These team members will need to be in communication with one another to help resolve whatever issue has arisen as quickly as possible. The team members will be discussing highly technical topics with one another, and will need to understand these topics clearly and quickly.

Carolyn Rude, a leader in technical communication research, discusses researching the use of technologies when trying to communicate complex information in her 2009 study on research in technical communication. Researching the use of communication technologies lets us see where improvements to communication can be made. Many forms of communication can be used when trying to resolve a technical issue. Face-to-face meetings, phone calls, e-mails, chat systems, and even video conferences are commonly used methods of communication (VictorOps Inc., 2014).

Rude states that communication practices can help convey knowledge, bestow values and encourage action in a professional setting, as well as build a deeper understanding of how to work more effectively. Effective and efficient incident resolution is highly desired by users, stakeholders and the technical team. Selecting the right communication tools at the right time when discussing urgent, highly technical situations will help resolve issues more quickly. This project seeks to further investigate the effectiveness of the communication tools used by a team trying to resolve an urgent technical issue.

Previous Research

Articles specific to technical communication were difficult to find, so previous, related research came from IEEE, ACM, and other technical resources. Technology-centric publication sources provided the most relevant information. Sources cited by any articles found were also explored. Generally, previous research fell into two main categories: incident response and software developer communication.

Most research on incident response looks specifically at security incidents. However, Rollason-Reese (2003) suggests that a security incident can be thought of as "any event that may threaten or compromise the security, operation or integrity of computing resources… events [such] as network probing activities,

burst sprinkler pipes in a computer lab, email service interruptions and equipment theft" (p.98). Technical incidents may take many forms, and the definition of a technical incident shouldn't be limited to specific security threats or technical glitches. This research adheres to this broad definition of a technical incident in order to account for all that may go wrong in a technical environment.

The research on developer communication discovered for this project revolved around communicating project requirements and communicating with stakeholders during project development. Developers use communication technologies during the creation of a project, and several insights into the use of communication technologies are shown in these research studies. However, little was found involving communication during incident response after a project had been completed and was actively being used.

The following studies, presented in chronological order, discuss incident response and developer communication. While no articles found directly studied communication tools, these research papers contain brief snippets and notes about the communication tools and processes people use when working in a technical environment. It should be noted that in earlier research, the studies were more focused on the communication process. While little research was identified for the 2004-2013 decade, after this gap, research became somewhat more technology focused.

In 2003, Rollason-Reese of Eastern Connecticut State University released a summary of the lessons learned from creating and utilizing the university's incident response plan. Any incident resolution process can be broken down into five steps: becoming aware of an issue, determining the scope and severity of an issue, collecting information about the issue, recovering from the issue, and reflecting on the response to the issue in order to improve processes in the future. One of the key lessons learned was to keep everyone aware of the technical incident's current progress. Team members should stay in touch with one another, and provide the public and higher administration with updates.

In a 2004 study on knowledge sharing, Melnik and Maurer's preformed an experiment on 97 students. The researchers split the students into teams, and gave them the role of analysts, messengers, or developers. The analysts were given an abstract design. The analysts then instructed the developers to re-create the design via written directions. This experiment was then used to study how these team members communicated with one another as they tried to complete their design. The researchers discovered that students found written communication difficult to produce. Important details needed to complete the task were often left out of the document, and the instructions could not be easily adjusted for better clarity. Participants also struggled communicating about shapes they weren't familiar with, and struggled to answer questions in a timely manner. Overall, the students felt they would have communicated better if they had been allowed to speak to one another, as this would have aided in clarification. Face-to-face communication is often considered the best method of collaborative communication, and Melnik and Maurer's study aligned with this belief.

In a 2013 study by Brown, Greenspan, and Biddle, the researchers observed members of a Network Operations Center (NOC). NOCs are fully staffed workplaces where the system network is monitored constantly. NOC employees must respond immediately to any incidents that arise. Researchers performed ten interviews with staff members about their daily activities. The researchers discovered that members of a NOC were informed of incidents through monitoring tools, e-mails, chat, and system log anomalies. Team members would discuss issues with one another via face-to-face conversation. Team members also overheard collaboration between others, which alerted them to the current status and progress of an error. Chat systems and conference calls were also used; however, the study noted that there were often

multiple conference calls occurring at one time. Team members would become unsure of which conference call they were participating in, and accidentally provide information about an issue to the wrong conference call. Sharing any visualizations the team may have developed was also difficult over the phone. As a result, Brown, Greenspan, and Biddle's research called for a system with a better indication of the members and topics of a conference call, and noted a need for collaborative visualization tools.

In 2014, Paul conducted a study on NOCs. Researchers initially conducted seven interviews. These interviews provided an understanding of the mission, operations, and purpose of the NOC before the researchers started their formal NOC observations. Then, a total of 30 hours of observations took place over the course of a year. The researchers determined that all work done in a NOC is a team effort, but making sure everyone on the team is aware of what has happened and is currently happening is difficult. Face-to-face interaction was a preferred method of communication, and people in the NOC often walked up to one another to discuss an issue. However, face-to-face interaction does not leave notes or other information behind for incident responders who may need to assist with the technical issue later. This makes the NOC manager's job to keep staff aware of any current situation, even between shifts, a priority.

The newly annual *State of On-Call Report* surveys a wide variety of companies regarding after-hours incident response procedures (Arychuk & Vernon, 2015; VictorOps Inc., 2014). In order to respond to technical incidents that happen outside of working hours, many companies set up an on-call schedule of workers who are ready to respond outside of the office. Most of the time, this on-call schedule is shared between people in various job duties, such as system operations staff, developers, and support staff (Arychuk & Vernon, 2015). These on-call teams communicate via chat, direct phone calls, and conference calls the majority of the time (VictorOps Inc., 2014). While the *State of On-Call Report* does not draw any direct conclusion from its data, it does appear more companies are trying to set up incident response groups to keep their systems up-and-running.

In 2015, a team of Finnish researchers sent out a survey to Finnish companies to see how they provided feedback on their projects (Kilamo, Leppänen, & Mikkonen, 2015). The companies were asked what their main methods of communication were when allocating tasks to their teams, as well as about the methods they used to provide feedback about technical quality and the validation of features. The surveys showed that companies desired fast, non-disruptive communication so that team member's work can continue relatively uninterrupted. Subsequently, instant messaging, and e-mails are preferred to meetings and calls. Tools that allowed for highly visible communication were also preferable, such as issue-specific chat rooms and issue tickets. Staff found these tools highly useful, even when located in the same building as one another.

A Brief Research Summary

Face-to-face communication provides real-time answers to questions, as well as visual and aural communication cues that are lost in other methods of communication (Cockburn, 1993). However, when the responders to a technical incident are located remotely, face-to-face interaction is not possible. Incident responders still need to be kept in the loop. Furthermore, if it is important for work to continue uninterrupted during project development (Kilamo, Leppänen, & Mikkonen, 2015), it can then be assumed that it is important for work to be uninterrupted during a technical incident. The use of asynchronous technologies, such as chat systems, will then also be important when resolving incidents.

The Need for Qualitative Study

Previous research on incident response has primarily depended on observation and surveys. None of the previous research discovered for this project focused on interviewing their participants about the technologies they were using to communicate. Although previous research with qualitative interviews may have used direct quotes from participants, the interview questions were about work processes and the work environment, not the technology. While previous research has hinted that certain technologies are useful, researchers only watched the users of these technologies and then drew their conclusions. Technology users have not been directly asked how they feel they work best, even though the user will know how a technology best suits their needs.

When a team is attempting to communicate during an urgent technical issue, knowing how to communicate effectively is likely going to help them as they work to resolve the issue. Subsequently, studying communication during incident resolution seems like an important topic of research. Yet, while the previous research explored in this project has noted the occasional area of improvement, previous studies did not deeply look into how these communication technologies influence the understanding of complex information. Ultimately, there is a research gap in structured, qualitative research into the use of communication technologies during a technical crisis. This study seeks to address gap.

Methodology

In order to fill a methodology gap in research, semi-structured qualitative interviews were performed with responders to technical incidents. The people interviewed worked at various companies in a variety of roles. Interviewing people with a variety of backgrounds and experiences prevented one company's culture, or one specific job role from influencing the results of the research.

Three of the interviewees were upper-level managers, two of the interviewees were mid-level managers, and two interviewees worked in other technical positions. Two of the interviewees were female, while the rest of the interviewees were male, and all participants had several years of experience in IT. Most of the interviewees knew the researcher personally, but other participants in the project suggested some of the interviewees.

The interviews took place in early 2016, and seven people participated. Interviewees were required to be involved in an incident response role within the last five years, and not be the solo responder to all incidents. Each interview took place in a private location. While there was a list of interview questions, additional questions were asked to gather more information about an interviewee's experience.

The interviewees were located in the Twin Cities metro area of Minnesota, USA. While there may be a bias stemmed from location, interviewees could reflect on experiences they had outside of their current position, which may have not occurred in the Twin Cities area.

The researcher followed concepts borrowed from Grounded Theory (Brinks & Mills, 2012) to analyze the interview data. Grounded theory does not approach a project with a hypothesis, but rather gathers and analyzes evidence from an unbiased perspective. Qualitative data, such as interviews, is gathered at the same time the data is coded and analyzed. Transcripts are of the interviews are created and coded with descriptive terms. The researcher also makes memos and notes about the interview process in order to reflect upon trends in answers and other points of interest. As data from the interviews is gathered, the researcher builds a theory.

Interview Questions

- Please state your name and occupation.
- What are some examples of urgent technical issues that you may need to help resolve?
    - For instance, a website has become inaccessible. An e-mail server's storage is full.
- How frequently would you say you are contacted about an urgent technical issue?
- Briefly describe your role(s) in helping resolve a technical issue.
    - For instance, a manager may be in charge of alerting other staff members of an issue. A server administrator may be in charge of looking through log files.
- What tools of communication do you use to communicate with your co-workers when attempting to resolve an urgent technical issue?
- What are some of the challenges you have encountered when trying to communicate about a technical issue?
- What would help you overcome these challenges?
- What do you feel are the most useful technologies when communicating with others to resolve an issue and why?
- What do you feel are the least useful technologies when communicating with others to resolve an issue and why?
- If you could make one change to the tools you and your organization use to communicate when there is a technical issue, what would it be?
- Are there any other thoughts you'd like to share?
- Is there anyone else you think would be interested in participating in this interview?

The interviews were recorded for reference. After interviews were conducted, answers were transcribed and then analyzed to determine general themes and potential future questions. Other participants would then be interviewed, with the researcher keeping previous interview answers in mind. The researcher then identified relevant themes in interviewee answers and explored these themes in the researcher's memos. There was no established hypothesis going into the research; rather, the researcher simply gathered people's thoughts and established conclusions based on unbiased evidence.

Coding

During the memoing process, potential reoccurring themes were identified and noted. When more than one interviewee brought up a topic, that topic became a theme. The researcher wrote and read all the interview transcriptions and searched for potential themes. Topics that were similar to one another were combined into one theme. Themes were then assigned a color, and quotes that fell into that theme were highlighted in that color. The color-coding process easily identified relevant quotes for reference later.

The researcher then took these themes and created an outline to summarize various subtopics within themes. During this outlining process, certain themes that had many subtopics were split apart, and other themes that were considered weak were subsequently removed. This kept the paper well organized and readable. The original coding table can be seen in *Table 1*. A sample of the color-coding process can be seen in *Figure 1*.

Timelines	Emotional Support	Everyone can View	Action visibility	Noise	Questions	Tech Comm
Winner	Passing	Coordination				

Table 1: Coding

Figure 1: Coded Transcripts

(The transcripts have been blurred to protect interviewee privacy.)

Results and Discussion

There were several themes found among the interview participant's comments and answers. Rather than focusing on the technologies themselves, most of the interviewees focused on the process of communication itself. These processes of communication can be aided or hindered by certain technologies, but there is not one ultimate communication tool for successful communication. Successful communication will happen as long as team can meet their communication needs. These needs that should be accomplished during incident response communication can be viewed as goals. Communication goals include tracking of what steps towards resolution have been done, making sure the team members are doing what is needed, and keeping the team solving the issue from getting distracted or discouraged. Each of the major communication goals discovered in this research are discussed below.

Emergency Technical Communication

We have groups of people that speak that same language, but one person is on one side of technology and one person is on the other side of technology. And they still don't understand each other. It's no longer a language barrier: it's a technical language barrier.

Communication during technical incidents will involve conveying complex to both team members who need to understand the underlying technology well and other interested parties who will need more clarification. Not everyone with an interest in the resolution of the technical issue will need the same level of technical detail, so it is important to keep the audience in mind.

Certain responders to a technical incident may get lost in technical details. One interviewee noted that he often communicates during a technical issue in both a high-level format and a low-level format. When explaining an ongoing issue in an e-mail he tries to provide the short explanation of the issue at the start of the e-mail. A longer, well-identified and detailed version of the explanation is included later in the e-mail, should someone need that level of detail.

A lack of general technical understanding is not the only impediment to communication, however. Sometimes, someone simply has a different technical background. Database administrators may not have the same background knowledge as a server administrator, who in turn may not have the same background knowledge as a programmer. One interviewee, working at a company with staff in several different countries, has to work with several groups of people whose first language is not English. He stated that he usually does not have problems communicating with these teams because of a native language barrier, but because of a technical language barrier. It can be important to keep in mind that even members of the same technical team may encounter a technical language barrier between their areas of expertise.

Gathering the Team

Many different types of teams may need to be involved in the resolution of the issue. One interviewee from a large company often had to pass incidents to other teams via their ticketing system. These teams would then protest that the issue was not their problem, and try to hand the problem to another team. The interviewee referred to this process as playing hot potato: "It's not our issue…[But], we can't pass tickets back and forth." He went on to say this tends to happen when a change made elsewhere affected another team's work. When the cause of the issue is not easily deduced, assumptions about who caused the problem can be an issue.

Finding the right people to contact during an issue can be very important, even if they cannot directly fix the issue. One manager mentioned that he liked to have a list of 2-3 people who would have the skills to resolve the issue, and if those people are not available, he will call the most senior engineer he can contact. Another manager has contacted people, even if they were on vacation, to get the help he needed to fix the issue. He noted that, ideally, the staffing will be there to help fix the issue, and a company should always have a level of backup.

Knowing who is available to help resolve the issue can be important. Interviewees noted that they have struggled when trying to contact someone and have not received a response. Even when a certain person is supposed to be available, they may be away from their desk for a small period of time and be unable to be contacted. To get around this, some communication technologies have the ability to show a person's availability. One business has an instant messaging service that allows users to mark their status as being out sick, at lunch, or in a meeting. When a technical incident occurs, it is immediately clear that who is not immediately available, and someone else may be better to contact to help resolve the issue.

It may seem useful to get many members of the team working on the issue; however, there is risk in contacting too many people. In order to prevent employees from rapidly reassigning tickets between teams, one company decided that every team must be represented during severe issues, even if they have little relation to the issue. Although the incident could be resolved with less people, many more people than necessary are present. One interviewee noted that this is especially grating when the technical issue happens outside of work hours, and there is little involvement from her team. It ends up wasting her time. In order to save team member's time, it can be vital to track the actions of each team member at any given time.

Coordinating Teams

There may be a race condition of two people trying to solve an issue at the same time. People need to explicitly state what steps they are taking…. You don't want to destroy evidence or step on someone else's work.

It is not only important that others are aware of what a technical team is doing when resolving an issue. The technical team must also be aware of what the other members of the team are doing. Many of the managers who were interviewed emphasized the importance of coordinating teams during a technical incident.

The available members of the team should be coordinated so that individual team members are not attempting to handle too many pieces of the issue at once. When talking about the company's ticketing system, an interviewee elaborated on the concept of tasks. While his team may be in charge of ultimately resolving the issue, he is able to assign tasks to other employees, whether they are outside or inside his team. One individual can then work on a specific task related to the larger issue, while other team members could focus on different tasks. This assignment process allows for better teamwork when resolving an issue.

Coordination also helps ensure one team member's work will not affect someone else's work. While teamwork is important, it is also important that team members avoid undoing other's work. When assigning work, one manager tells his team the tasks everyone will perform when resolving an incident. For instance, the database repair team may need to complete a task or two before the testers can get started. After an incident occurs, the manager notifies testers that they will have a task coming soon, but that they need to wait until the database team says they are ready.

Keeping Common Ground

Waiting for other team members to finish their work can be a difficult task if it is not clear how work is progressing. Many interviewees have experienced complications from being unable to see of what other team members are doing. One interviewee's co-workers were not properly using the company's ticketing system. Instead of using the easily visible ticketing system, the co-workers had worked on the issue via private e-mails. When it was the interviewee's turn to help with the issue, he could not see what the other team members had tried. He felt he spent a significant amount of time redoing steps someone else had done, since he had no way of knowing what his co-workers had already tried. As he phrased it, "If it's not in the ticket, it didn't happen…. If it's not noted, we're going to do it again." It will take more time to resolve an issue if steps are being repeated because they are not documented in an accessible format. When most issues need to be resolved as quickly as possible, this can become an extreme burden.

Team members should be aware of what other team members are working on. One benefit of this is bringing visibility to potential problems. An interviewee was reading the team's incident chat when another team member said they were going to delete a certain file. This file was crucial for their team's computer system. The team manager was not aware of how crucial this file was, and gave the team member permission to delete the file. The interviewee was not able to prevent the deletion; but, they could explain how the deletion was an issue and start to repair the mistake. The incorrect assumption could be correctly quickly because the actions being taken were visible to all team members.

People make many assumptions when communicating. These assumptions can cause problems when people assume others have information they do not. People may also assume they know everything there is to know about a situation. When people do have the same knowledge as other members of their team, they share a common ground. However, when team members make assumptions that they are sharing common ground, it can lead to nasty surprises when the team discovers they were wrong (Bradshaw et al. 2004). In the above scenario, the manager assumed that a file was not necessary, when other members of the team knew it was very necessary. The manager and employees assumed they shared the same knowledge, and ended up damaging their computer systems. Having too many assumptions can make an incident resolution take longer, as this leads to miscommunication and discoordination that get in the way of progress.

Advanced Data

Chat systems and ticketing tools also have a primary advantage: they are not limited to communication through words. Several interviewees mentioned that it is easier to communicate certain ideas with images and other visual resources. One interviewee mentioned that he often shares data with the team from server monitoring software, such as diagrams of server states. As a server administrator, he has access to this data, while other team members may not have permission to directly view this data.

Another interviewee noted that a web programmer might find it useful to see a diagram of server behavior right after an update to a website was released. The person working on the server may not understand the code update, and the programmer may not fully understand how the server works. However, the programmer can look at a graph of server's behavior and better understand what their code may have done. The diagram can help both of them establish a common ground understanding between an expert on servers and an expert on programing.

Communicating with visuals is impossible over a traditional phone call, and can even be difficult over e-mail. When an image is sent as an e-mail attachment, it may not continue to be attached as the e-mail is replied to and forwarded. A chat system will retain any of the images posted to it without someone ensuring the image was still being sent to anyone who needed to be updated.

Information for All

Information gets put out in real time and anyone can see it and contribute information here or there. They'll be able to say 'there is where we're at, this is where we're not at.' You can quickly jump [in] and see 'hey, this is a conversation that I've missed.'

It is important to send out a status update that includes what the technical team has done, what the team is working on now, what the team has left to do and approximately how long that action will take. In addition to this status update, there should also be a clearly stated time when there will be another update on the status of the incident. Setting expectations about the frequency of updates keeps staff from wondering if the issue is resolved yet, or how long they should wait for more information.

Many people will need to read updates on the status of the incident. The status update can be provided to a selection of people, or it can be provided in an open format, so that anyone can access it. Letting information be accessed by whoever needs it is very important. Most interviewees saw the need for open access to any information regarding a technical incident.

Traditionally, a team may have sent out updates about a technical issue via e-mail. However, an e-mail is only visible to its recipients. One interviewee pointed out that they need to be extremely cautious that they include all of the necessary people when they are sending out an e-mail, or the person they forget will be left out. Another interviewee noted, "Usually with e-mail, a piece of context will go missing, or someone… [doesn't] get the history up until that point. With [a group chat system], they can see that history right away and get caught up on the issue." To avoid issues like these, many companies are choosing forms of communication that let people join the conversation at their own will, and see any information they need to see in one location.

Group chat systems and detailed ticketing systems tend to be a good tools for central, accessible communication. Chat and ticketing systems leave a history of any comments made, and anyone can see what the team has done and is currently doing. These tools can also be used as a central point of record for all notes that need to be made about the incident. All of the interviewees found it necessary to have a central point of record. By creating a central point of record, the team can see logs of exactly what was happening at what time. These logs can record all actions made by the team members.

If the issue occurs again in the future, team members will be able to look back at the central point of record and see how an issue was resolved previously. As one interviewee noted, "If you have a similar issues come up in the future, you can more quickly resolve it." If a similar incident occurs in the future, incident responders should not need to start from the beginning of the debugging process. Team members should be able to access what the solution was before. Keeping track of solutions and processes in post-mortem reports and communication logs is a clear way to make that information accessible.

As an interviewee pointed out, having an openly available central point of record means everyone can see it, even employees outside of the technical team. There should be no issues with having all of the technical information out for others in the company to see. A central point of record was seen by

interviewees as necessary not only to help members of the technical team keep track of what had been tried and accomplished, but also to answer the questions of those curious about the issue. However, with all this information visible, it is often necessary to make sure others have a way to ask any questions that may arise.

Fielding and Shielding Questions

When a technical issue arises, there are likely to be many questions from people not directly working on the issue. Answering these questions is essential for keeping people informed about an ongoing issue; however, the team resolving the issue should not be constantly interrupted by having to answer questions. The team should instead be allowed to focus on completing the task at hand. As one interviewee phrased it, "Every minute they're explaining is a moment they're not fixing the issue."

One person can be dedicated to shielding the technical team from having to answer questions. This person can gather information from the technical team and pass that information onto anyone with questions. Usually, if a team has this role, it will be the role of a manager. Questions may be coming from a Vice President, Chief Financial Officer or Provost, who may not understand the technology behind the issue. They may also have questions about how many people are affected, the financial implications of the issue, or they may be questioning the severity of the issue. These are questions that may be better suited for a manager to answer than technical staff.

The person answering questions may use a different format than status updates. If a status update is sent out via e-mail, for instance, phone calls or video chats may be a better format for answering questions. In general, interviewees agreed it is better to answer questions from high-level staff members with direct, vocal communication. Direct communication allows the answer to be targeted to its recipient.

According to research by Cockburn (1993), people do best when communicating with real-time question and answer. "Questions reveal the ambiguity in the speaker's explanation, or the way in which the explanation misses the listener's background" (1993). Instantaneously correcting misinterpretations can be important, especially in an urgent situation. Communication also tends to become less effective when there are missing visual and aural cues (such as gestures and vocal inflection). By using a phone or video chat system, some of these cues are reestablished, which can lead to better communication with important stakeholders.

Similarly, Media Richness Theory states that various media differs in how many social cues they are able to convey, the timeliness of feedback, and how natural the communication feels (Weimann et al. 2013). Phone communication may feel more natural than typing, as most people talk to others on a daily basis. Chat systems may receive an instantaneous response, while someone asking questions in a ticketing system will likely receive a delayed response. These differences in communication can cause some technologies to be better suited for certain tasks than other technologies.

While making individual contact with a handful of upper-level executives may be possible, it is difficult to contact all interested parties. Although direct contact with important stakeholders was consistent in interviewee experience, each interviewee had a different experience answering questions for a wider group of people. One large company would establish a conference call with everyone, and even set up video calls when people were located in different parts of the world. This let people discuss the issue and hear everything anyone may have to say.

Another company would establish a group chat where people could come to ask questions. Establishing a non-intrusive way to answer questions can keep team members from being too distracted by intrusive and noisy communication.

Avoiding Noise

It worked to just say 'no off topic chatter' while we're troubleshooting. Then people wouldn't chime in with their cat jokes.

Noise refers to anything that distracts or detracts from communicating about the issue at hand. Noise can come in many forms. In a face-to-face conversation, noise can literally be too many people talking at once. On a phone call, it may be distracting background noises, such as a dog barking. On a conference call, it can be the phone system constantly introducing that 'X Has Entered the Conversation.'

Sound is not a necessary component of noise, however. In a chat room, it can be off-topic conversation, such as gossip, that detracts from making notes on an actual issue. Even business processes can be noise. One interviewee noted that taking the time to follow extremely time-consuming and tedious procedures takes away from the time the team will spend actually solving the issue.

Almost every interviewee mentioned problems with noise of one form or another. Noise should be reduced as much as possible for successful communication. Several of the interviewees mentioned that reserve chat rooms for discussion of the incident, which would minimize any gossip. Another person noted that they could hide certain parts of a previous conversation (such as comments made by a customer) if they needed to concentrate only on what members of his team had said. Taking steps to reduce noise can help keep a technical team focused on resolving the incident when they are communicating.

Keeping Alert

Noise can also come in the form of alert fatigue. Alert fatigue happens when the system a company has in place to alert staff that there is a technical issue is repeatedly triggered without purpose. An automated alert system may send out alerts too frequently if it is set to monitor statistics too sensitively. Alert fatigue can also develop if the system being abused. For instance, one interviewee complained that people would contact him via the emergency phone line for help with their personal, non-work computers.

When alert fatigue sets in, people stop listening. They may not answer calls, or they may not take the issue seriously. Several interviewees mentioned that they hardly read e-mails, since they are typically not relevant to them. The e-mail system had been abused to the point that reading e-mails felt like more of a waste of time than a useful form of communication. These interviewees had reached fatigue with the technology.

Chat systems and other asynchronous technologies can help reduce alert fatigue. The chat system allows the team member to view it on their own schedule. If they are working on debugging an issue, they can choose to focus on the work they are doing rather than constantly keeping track of the conversation. They will still need to participate in the conversation; however, responding to a chat message demands much less immediate attention than the need to answer a phone call. A phone call would force the team member to drop everything they were doing in order to answer the phone. If the team member has received too many phone calls about irrelevant topics, they may not answer: it is not worth the dedicated time.

Not everyone will follow the policies in place to reduce noise and alert fatigue. People may not care about the rules, especially if they are having an emotional outburst. One interviewee noted that on conference calls, a participant would sometimes start losing their temper, and begin screaming into their phone. This type of behavior is not only noisy; it is also upsetting. People can also be distracted by the emotional mood of the environment they are working in.

From Technical Support to Emotional Support

The thing I learned at the beginning is that emotion comes in quickly and catches you by surprise. I tried to keep a calm demeanor, and when I didn't, I'd catch other people freaking out.

Technical incidents are stressful situations, making managing emotions a necessary part of successful communication. There can be a lot on the line when a technical incident happens, such as loss of important data or the loss of company income. Team members who have accidentally caused the issue may be worried about losing their jobs, while other team members may not feel capable of fixing the issue and panic under pressure.

Most of the managers interviewed noted the importance of keeping team members calm and productive. One manager noted that it could be difficult to read his team member's emotions over a chat system, due to a lack of social and audial cues. He stated that when using a chat system, "Sometimes, I'll make a phone call to make sure so-and-so is not panicked about [the issue], or unsure about [it]. You might not be able to tell this [in a chat system] unless someone explicitly types 'I am unsure about this.'"

Another interviewee commented, "There's some calming that happens when you talk to someone in person." The interviewee further noted that a team member cannot misinterpret the tone of your message as easily when they are hearing your voice. As shown Cockburn's 1993 research, enabling audial and social cues is sometimes necessary to keep employees calm. Hearing someone's voice can add some humanity into the situation. Making a phone call or starting a video chat may be the best way to comfort someone, as audial and social cues are kept intact; however, it is also important for the right social cues to be the ones that the team members are receiving.

In order to keep team members calm, it is important that the manager also remains calm. One manager noted that it was important for him to keep his voice and pacing calm. This manager said, "The state that I created would be reflected back at me by other people…. I just need to calm down and deal with the situation. I am in the room with you and keeping it calm…. My stakeholders knew that if [I] was calm, [I] probably got it under control."

Management and stakeholders also need to ensure they do not put too much pressure on employees to resolve the issue immediately. While it is certainly important that the issue is resolved in a timely manner, the employees should be trusted enough to be doing their best. The employee should not feel like they will be blamed and punished for an issue occurring. Several interviewees highlighted the importance of a trusting, blameless work environment. One interviewee recalled several times where being in a blameless environment lead to team members admitting when they messed up something. That honesty lead to a quicker resolution of the issue, as the team member confessed what the cause of the issue was, and felt free to do so in the safety of their work environment.

Timelines and Post-Mortem Processes

Once the incident is resolved, it is important to look at how the team handled the incident resolution. Most companies have a post-mortem process. Post-mortem processes usually analyze the technical issue that occurred, discuss how staff members handled the issue, and create a plan to keep the issue from happening in the future. In order to properly analyze the issue, a timeline of the incident is created. Many interviewees feel the incident timeline is best constructed with the aid of timestamped communication tools.

Timestamped communication tools can come in many formats. Some companies use chat tools, where each individual post is timestamped; team members will record the actions they are doing into the chat system. Other companies focus on their ticketing systems, where they note the steps taken towards the incident resolution in the ticket. Another company used their automated issue alerting system to track when system alerts were sent out; from there, they added additional comments to track the actions performed to resolve the issue. Each of these technologies records the actions that were taken, and the time they happened, in a central location. These timestamped tools naturally work as a central point of record.

Many interviewees found having a detailed timeline was necessary for creating post-mortem reports. This timeline can be used during post-mortem interviews with team members. Post-mortem interviews record what each member of the team did and experienced during the incident. One interviewee pointed out that asking people what happened during the incident without a timeline does not always lead to accurate answers. "Eyewitness reports get muddled…," she pointed out, continuing to say that having a timeline to reference can help that person's narrative match reality more accurately.

The choice of tool used to create a timeline does not matter: the tool just needs to have a timestamp, team-wide accessibility, and the ability to write in the actions that are being taken to resolve the issue. As long as the timestamp tool can meet these needs, the team should select whatever tool they feel the most comfortable using.

Conclusion

This research project was inspired by a curiosity about how people use technology while communicating during a technological crisis. It turns out that how people use technology does not matter so much as what they use the communication technology to do. There is no clear winning technology, so long as the communication goals can be achieved.

What communication tools can do, however, is create limitations. If there is concern about how one team member is feeling about an issue, an instant message may not make the same emotional connection that a brief phone call may make. Similarly, an e-mail may not be accessed by as many people when compared to the number of participants in a chat room. These limitations can be overcome by using another piece of technology when the situation calls for it.

Future research may evaluate how each communication tool meets the communication goals discussed in this paper. While qualitative interviews provided insight into the needs of incident responders, most people were not reflective on whether a technology met their needs or not. Interviewees tended to only consider the technologies they had available in their workplace, rather than wonder about potential improvements or alternative technologies. Experiments that encourage teams to use different communication technologies would gather more information on which technologies actually work best in which situations.

Nevertheless, incident response communication relies heavily on excellent technical communication. Technical communication is not just limited to writing formal documentation; it also comes up in real-time verbal and asynchronous communication. Technical communicators may want to focus on improving the post-mortem writing process, training fellow staff members in clear communication, and ensuring companies have policies and programs in place that are supportive of effective communication.

Ultimately, there is not one winning tool for communication, and there does not need to be. An advanced ticketing system, conference calls, a group chat system, or a combination of all three may work best for a team. What matters is that clear, accessible, timely communication can happen and that the incident response team can meet the communication goals noted by this research. It is best to look at these communication goals and find a way to achieve them; which communication technologies work best to achieve these goals will depend on each team.

Citations

Arychuk, S., & Vernon, T. (2015). The State of On-Call Report 2015: Is it "really" working? Retrieved from http://newrelic.com/resources/webinar/20160112-State-of-On-Call-Report-2015 accessed January 26, 2016.

Birks, Melanie, and Jane Mills (2011). Grounded Theory: A Practical Guide. Los Angeles, CA: Sage.

Bradshaw, J. M., Feltovich, P. J., Klein, G., & Woods, D. D. (2004). Common Ground and Coordination in Joint Activity. Organizational Simulation., 1–48.

Brown, J. M., Greenspan, S., & Biddle, R. (2013). Complex activities in an operations center: A case study and model for engineering interaction. EICS 2013 - Proceedings of the ACM SIGCHI Symposium on Engineering Interactive Computing Systems, 265–274. http://doi.org/10.1145/2480296.2480310

Cockburn, A. A. (1993). Characterizing people as non-linear, first-order components in software development. HaT Technical Report. Retrieved February 07, 2016, from http://alistair.cockburn.us/Characterizing people as non-linear, first-order components in software development/v/slim

Gonzalez, J. J. (2005). Towards a Cyber Security Reporting System – A Quality Improvement Process. Lecture Notes in Computer Science Computer Safety, Reliability, and Security, 368-380. Retrieved February 4, 2016, from http://link.springer.com/chapter/10.1007/11563228_28

Kilamo, T., Leppänen, M., & Mikkonen, T. (2015). The social developer: now, then, and tomorrow. Proceedings of the 7th International Workshop on Social Software Engineering - SSE 2015, 41–48. doi:10.1145/2804381.2804388

Melnik, G., & Maurer, F. (2004). Direct verbal communication as a catalyst of agile knowledge sharing BT - Proceedings of the Agile Development Conference, ADC 2004, June 22, 2004 - June 26, 2004, 21–769522483. http://doi.org/10.1109/ADEVC.2004.12

Paul, C. (2014). Human-Centered Study of a Network Operations Center: Experience Report and Lessons Learned. Proceedings of the ACM Workshop on Security Information Workers, 39–42. http://doi.org/10.1145/2663887.2663899

Rollason-Reese, R. L. (2003). Incident Handling: An Orderly Response to Unexpected Events. Proceedings of the 31st Annual ACM SIGUCCS Fall Conference, 97–102. http://doi.org/10.1145/947469.947496

Rude, C. D. (2009). Mapping the Research Questions in Technical Communication. Journal of Business and Technical Communication, 23(2), 174–215.

VictorOps Inc. (2014). The State of On-Call. Retrieved from https://victorops.com/wp-content/uploads/2014/12/State-of-On-Call-Report-2014-VictorOps.pdf accessed January 25, 2016.

Weimann, P., Pollock, M., Scott, E., & Brown, I. (2013). Enhancing team performance through tool use: How critical technology-related issues influence the performance of virtual project teams. IEEE Transactions on Professional Communication, 56(4), 332–353. http://doi.org/10.1109/TPC.2013.2287571