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Learning to Troubleshoot: A Support Process Model Case Study

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Appendices

1. Problem

A great deal of time is spent teaching new support and help desk staff members how to triage, investigate, and test new issues that they encounter, both the time of the new employee and the time of the experienced staff member asked to train them. This is especially true when each new ticket could be connected to any of the various aspects of a product; hardware, software, user interface, process, data integrity, user access. Often times, new support employees are unsure of the general steps to take in order to investigate a problem with as well as where to begin an investigation. This uncertainty results in lost time as the employee is investigating in the wrong area or spending time gathering information that may not be helpful. Uncertainty also causes the employee to repeat steps that have already been taken as those steps and observations were not recorded or the employee lacks confidence in what is discovered.

2. Solution

The focus of this capstone is to develop a protocol and workflow process which would allow for the rapid transference of knowledge gained through experience as well as teaching effective investigation habits to those new to the field of software support. A Support Process was developed which gives both an overall process for a support staff member to follow and specific tasks to complete at each phase of the troubleshooting process. The Support Process also encourages support staff members to document hypotheses and the evidence that lead to those hypotheses. This will help with tracking progress as well as minimizing the risk of another support staff member having to repeat steps that have already been taken once a ticket is escalated or if a similar issue is reported in the future.

3. Literature Review

Software support is a challenging and diverse field, especially when an individual is new to a particular product that is being supporting or new to the field of support in general. Learning a new product can be time consuming not only for the new support staff, but also for the more experienced employee who is asked to provide training. When a new product is combined with being new to the field of software support, the learning requirements can feel overwhelming. Oftentimes, the new support staff is unsure where to begin an investigation as well as what general steps to take in order to move through the troubleshooting process. This results in lost time as the new support staff repeats steps, investigates in the wrong area, or lacks confidence in discoveries or next steps.

Having a protocol and workflow process would allow for knowledge of the product as well as knowledge of the troubleshooting process to be transferred more quickly to a new support team member. The discussion that follows will outline the struggles that are encountered within software support, what changes have been suggested to address these concerns as well as the solution being put forward to incorporate these suggestions into a cohesive process, a Support Process.

Research has shown that there are various struggles that impact the ability of a support department and the support staff within that department to provide effective customer support. Some issues lie in the structure of the support department, the roles and responsibilities that are placed on each member of the support team (Kajko-Mattsson, 2004). Other issues lie in the process or lack of process that each support staff member is expected to

follow as part of their support activities (Kajko-Mattsson, 2004). Support departments also struggle with the complexity of the products being supported and the poor quality of the information that is provided on the ticket from the customer when an issue is reported (Bettenburg et al. 2008; Chilana, Grossman, and Fitzmaurice, 2011; Kajko-Mattsson, 2004).

Let's begin with the struggles that originate within the structure of the support department itself. There are two common structures that are used when designing support departments; Tiered, often called Front End/Back End, and Touch and Hold (Kajko-Mattsson, 2004; Pillai, Pundir, & Ganapathy, 2014; Tourniaire & Farrell, 1998). These models are used to organize the support team into various roles based on experience and technical skills. Both structural models work toward an efficient customer support process, but they go about this task in different ways.

Kajko-Mattsson (2004) describes several variations that could be used to establish the Front End/Back End structure either with two or three tiers of support, each tier having their own roles and responsibilities. When using a two-tiered model, support engineers fall into either front end or back end support. When using a three-tiered model, the front end support engineers are divided into two groups, which Kajko-Mattsson calls Help Desk engineers and Product Support engineers, with back-end engineers called Maintenance Execution engineers. Pillai, Pundir, and Ganapathy (2014) refer to these as Tier-1, Tier-2, and Tier-3.

Each tier has responsibilities in the support process from interfacing with customers to making corrective changes to the product that is being supported. Kajko-Mattsson (2004) and Pillai et al. (2014) give similar descriptions of the responsibilities of each of the three tiers. Tier-

1 responsibilities include, interfacing with customers, identifying what the customer is attempting to accomplish when encountering the reported issue, as well as resolving straightforward issues. Tier-2 engineers have slightly more in-depth responsibilities and tend to have more experience and knowledge of the product being supported. Tier-2 responsibilities include assisting the Tier-1 engineers, investigating issues that are escalated to them from Tier-1 by confirming what is reported, as well as providing known solutions for more complex issues. Tier-3 engineers tend to have the most experience and knowledge and are responsible for the most complex issues that are reported as well as assisting both Tier-1 and Tier-2 engineers. Tier-3 engineers are also responsible for making changes when issues are raised that require resolution within the code of the product.

The Front End/Back End model separates roles and responsibilities, creating a process that requires that issues pass from one level to another via escalation. If the issue is too complex for the engineer who is currently responsible for it, the ticket is escalated to the next tier (Kajko-Mattsson, 2004; Pillai et al., 2014).

In contrast, Tourniaire and Farrell (1998) advocates for the use of the Touch and Hold model, where an issue would remain with one engineer throughout the process, with that engineer being supported by a more experienced group of engineers if necessary. In the Touch and Hold model, Tourniaire and Farrell (1998) describe two groups of engineers, support engineers and technical advisors. The support engineers act as the customer interface and are responsible for the issue through to resolution (Tourniaire & Farrell, 1998). The technical advisors provide advice, suggest additional sources of information, and are available to work

through more difficult issues with the support engineers (Tourniaire & Farrell, 1998). Technical advisors do not have issues of their own and are able to provide assistance for support engineers when needed as well as being available to update documentation in the knowledge base (Tourniaire & Farrell, 1998).

Both of these models has difficulties in different areas of their implementation. The Front End/Back End support model is common and often comfortable for the managers as well as support staff, making it easier to implement and maintain (Tourniaire & Farrell, 1998). Some front end engineers are comfortable with the knowledge that difficult tasks can be escalated to the next tier and this gives the opportunity to ease a new staff member into the process (Tourniaire & Farrell, 1998). For others, they may become frustrated that they are unable to see issues through to resolution or that they are not able to learn additional technical skills because it is outside of their role (Tourniaire & Farrell, 1998).

The Touch and Hold model is more difficult to implement as it is less common and requires a more skilled pool of support staff (Tourniaire & Farrell, 1998). Training support staff to have the technical skills required to utilize the Touch and Hold model can be time consuming and can lead to inconsistent experiences for customers as the skill level of the support engineers will be inconsistent as they learn (Tourniaire & Farrell, 1998). The Touch and Hold model does allow support staff to be actively involved with an issue from beginning through resolution and to improve his or her skills over time, potentially improving employee retention (Tourniaire & Farrell, 1998). The Touch and Hold model also reduced the number of escalations

that occur with an issue, reducing time lost over the transition period when a ticket is moved from one tier of support to the next (Tourniaire & Farrell, 1998).

These difficulties are just part of the struggles for support departments and their staff members. Kajko-Mattsson (2004) identified that there are several additional issues that can occur within a support department related to the roles and responsibilities of the staff regardless of which structural model is used. Support departments struggle when they do not have an adequate number of competent staff members. This creates a stressful environment for staff, especially when there is the added work of training new staff and frequent staff turnover (Kajko-Mattsson, 2004; Tourniaire & Farrell, 1998). Support departments can also struggle when they are dependent upon staff members who have a particular competency who are not willing to share their knowledge with others as a means of protecting their position and status (Kajko-Mattsson, 2004; Cunningham, Knowles, & Reeves, 2001). This can become an even larger problem when staff members are unavailable or leave the company, taking their knowledge and experience with them (Kajko-Mattsson, 2004; Cunningham, Knowles, & Reeves, 2001).

Kajko-Mattsson (2004) also identified that support departments struggle with defining an effective support process and establishing that process throughout the department. This means that support staff members are not sure of the process they are supposed to follow for escalations, customer communication, or other steps within the support process (Kajko-Mattsson, 2004). This also means that the process that should be followed is not always followed consistently which leads to inconsistent interactions with customers (Kajko-Mattsson,

2004). This can cause the customer to disengage from the support process and ultimately create a poor relationship between the support department and their customers (Kajko-Mattsson, 2004).

Defining an effective support process can be challenging, especially when the products that are being supported are diverse and complex (Chilana, Grossman, and Fitzmaurice, 2011; Kajko-Mattsson, 2004). This diversity and complexity can be a significant barrier to a support department as the expertise expectations of the support staff are even higher as well as the increased level of stress that comes along with more complex and diverse issues (Chilana et al., 2011; Kajko-Mattsson, 2004). Chilana, Grossman, and Fitzmaurice (2011) also identify that not only is it a challenge that the products are diverse and complex, but the customer process and use of the product can be diverse with varying levels of complexity as well. This creates yet another level of complexity for the support department and staff members to navigate.

In addition to difficulties that arise from the structure of the support department and the complexity of the products that are being supported, the issues themselves can cause difficulties for the support staff. Chilana, Grossman, and Fitzmaurice (2011) identified that there are often gaps in the information that is included on an issue ticket making it hard to investigate. Chilana and her colleagues found that many of the tickets that were submitted were too vague and general to investigate. In addition, the tickets often lacked sufficient information to be able to determine the steps needed to reproduce the issues. Bettenburg and his colleagues (2008) also found similar difficulties with the mismatch of information that was submitted by customers and what information was needed by the individuals investigating.

Bettenburg et al. (2008) found that investigators, in that case developers, stated that the biggest struggle they encounter is the information about the issue is incomplete or incorrect, including incomplete or incorrect steps to reproduce or incomplete descriptions of the issue that was experienced. This leads investigators to spend time looking in the wrong place or not to be able to investigate at all.

Research has also been completed as to how to reduce and mitigate these difficulties that are experienced by support departments. Support departments are encouraged to have a clear process model which helps them to move through the support process effectively and efficiently (Adamonis, 2006; Betz, 2011; Grigorenko, Julin, Norton, & Pape, 2008; Pigoski, 1997; Tourniaire & Farrell, 1998). Research has also indicated which information is most meaningful to support staff and how to go about getting that information from customers (Bettenburg, Just, Schröter, Weiss, Premraj, & Zimmermann, 2008; Breu, Premraj, Sillito, & Zimmerman, 2010).

In order to address and reduce the issues with defining roles and responsibilities, support departments are encouraged to have a clear process model that support staff members follow while they move through the support process (Adamonis, 2006; Betz, 2011; Pigoski, 1997; Tourniaire & Farrell, 1998; Verghis, 2006). Adamonis (2006) discusses the importance of a process model as a means of keeping the tasks involved with user support manageable as user support is a significant determining factor in customer satisfaction. Betz (2011) discusses how having a clear process model can help to define roles and responsibilities within a support department as well as between the other departments of a company, like

change management or configuration management. This is important as issues may begin with the support department, but later be determined to be feature requests (Betz, 2011; Van Bon, Pieper, Van Der Veen, & Verheijen, 2005). How and when these issues are transferred between departments can have a significant impact on customer satisfaction (Betz, 2011). Pigoski (1997) also uses process models to discuss the various steps to move through in order to find resolutions for reported issues and implement them efficiently. Tourniaire and Farrell (1998) advocates the use of a process model to move through the steps that are required between customer and company when changes are requested.

In addition to these benefits of implementing a support process model, a support process model can also address concerns that are more directly related to the staff members themselves. A process model can reduce the cost of training new staff, reduce staff turnover, and reduce the potential for information loss when an employee leaves (Cunningham, Knowles, & Reeves, 2001; Tourniaire & Farrell, 1998). A process model can also reduce the time that it takes a support staff member to troubleshoot an issue, which leads to more effective solutions and higher customer satisfaction (Grigorenko, Julin, Norton, & Pape, 2008; Julin, 2007).

Tourniaire and Farrell (1998) point out that recruiting and training new staff is costly and it is important to hire and retain quality staff members in order to minimize these costs. Tourniaire and Farrell point out that not only is there a high cost for the early part of a new staff member's learning process, but this time period also takes resources from established staff members to train and monitor the new staff member. Tourniaire and Farrell encourage the use

of a structured process which supports staff as well as giving them opportunities to develop skills and a career as a means of retaining staff and keeping them motivated.

Grigorenko, Julin, Norton, and Pape (2008) from IBM, encourage the use of a particular approach that makes the troubleshooting process more effective. Grigorenko and his colleagues indicate that there are several pitfalls that investigators can fall into when they are first learning to investigate problems and suggest using a consistent process in order to avoid them. Grinorenko and his colleagues indicate that often times the investigator does not know where to start or what to do at each of the steps in the process, investigators might not have the information that is needed, or information may be miscommunicated to the investigator. In addition, the investigator may be dealing with more than one issue or the issue reported may be a symptom of a primary issue rather than the real issue itself (Grinorenko et al., 2008). This can cause time to be wasted while the investigator is looking in the wrong place for any of these reasons (Grinorenko et al., 2008). In addition, Julin (2007) encourages having a plan in place for what information is available for diagnostic purposes and where it can be found. Julin also encourages having diagrams that track connections between pieces of hardware and software and how information flows between various parts of the system. These pieces of information can be valuable to an investigator as well as helping to keep the process moving in a timely manner (Julin, 2007).

Cunningham, Knowles, and Reeves (2001) discuss the importance of knowledge gathering processes, both reviewing documentation as well as learning from colleagues as documentation often becomes outdated quickly. Cunningham, Knowles, and Reeves note that

there is the practice of “secrecy” which can take place. This is when a staff member may not document specific portions of information in order to give themselves additional power as being the sole knowledge base on a particular topic. Cunningham, Knowles, and Reeves note that while this does happen, it is more likely that staff members are weighing the time it takes to document findings against the need to investigate and resolve the next issue that they are presented with. Either situation results in the possibility that when a staff member leaves, knowledge and experience leaves with them if that information is not passed along to others in one way or another (Cunningham, Knowles, & Reeves, 2001).

In addition to the need for a process model, research has been conducted to determine what types of information are desired by investigators compared with the types of information provided by reporters. Bettenburg and his colleagues (2008) found that investigators indicated that the most important pieces of information that are needed in order to investigate a reported issue are steps to reproduce, stack traces to investigate errors, and test cases which lay out the specific information about what the customer is trying to accomplish. Bettenburg et al. also found that steps to reproduce, observed behavior, and expected behavior are the three pieces of information that are most often provided by customers, but that there are often errors in this information. Chilana et al. (2011) had similar findings; that investigators are looking for accurate information about how to reproduce the issue and that it is often lacking.

Breu, Premraj, Sillito, and Zimmerman (2010) take the findings of what information is required in order to resolve issue tickets and make suggestions on how to gather this information. Breu et al. discusses the importance of keeping reporters involved in the

resolution process and how to go about this. Breu et al. suggests asking questions early on in the lifecycle of the ticket as most questions that get answered occur in the first half of the life of the ticket. Quicker response times, from both the investigator and the reporter, lead to a more timely resolution of a ticket (Breu et al, 2010). Breu et al. also found that tickets are not able to be resolved if the reporter is not engaged in the resolution process. Reporters tend to be more invested early on in the life of the ticket and that is the best time to gather the additional information needed to resolve the ticket (Breu et al, 2010). Updating the reporter often as to the progress of the ticket also keeps them more engaged over the life of the ticket (Breu et al, 2010).

4. Connection between Problem and Literature

The solution that is being put forward here, takes the suggestions that have been discussed and incorporates the research showing what information is the most helpful to investigators as well as how to best gather than information from reporters and keep them engaged in the process. This solution uses a process model to establish the structure and process for the support department. This reduces the cost of training a new employee, reduces the time to troubleshoot, increases confidence, reduces employee turnover, and reduces the impact of employees moving on and taking their knowledge with them. Incorporating these benefits with the findings on what information is most important to be able to resolve a ticket and the process for maintaining reporter engagement, serves as the foundation for the Support Process.

The proposed Support Process incorporates the suggestions expressed by Kajko-Mattsson (2004) and Pillai, Pundir, and Ganapathy (2014) of a three tiered support department with the Touch and Hold model advocated for by Tourniaire and Farrell (1998). The Support Process attempts to integrate the positives of both models, while minimizing the negatives. The Support Process allows for a support team member to escalate an issue ticket after completing the Gather Information phase, if they wish, but also allows them to continue to investigate that issue if they would like to learn more advanced topics that push the boundaries of their role. The Support Process also includes structure and direction to allow an investigator the opportunity to progress and learn on their own or to ask for assistance from another team member without having to hand-off the ticket if that is the desire of the individual. Particular restrictions on how long a support staff member could take to investigate would depend on the urgency of the ticket and the requirements of the department.

The structure and direction within the Support Process was developed from incorporating the general processes that were advocated by Adamonis (2006) and Grigorenko, Julin, Norton, and Pape (2008) with the more specific troubleshooting processes that are outlined by General Troubleshooting Theory (2005) and Technology Transfer Services (n.d.). Adamonis outlines the steps that a support staff member would work through in order to resolve a help desk ticket, but does not give a great deal of detail about how to go about those steps. Grigorenko and his colleagues give detailed information about questions to ask when a report is made as well as the importance of documenting findings, but again does not give a great deal of detail about the steps in the investigation process. The process that is detailed in General Troubleshooting Theory in intended to be used specifically with Apple products, but

the general process steps were used as the basis of the steps of the Support Process that is being advocated for here. The steps suggested in General Troubleshooting Theory was combined with the steps suggested by Technology Transfer Services (n.d.). Technology Transfer Services (n.d.) puts forward the idea that having a clear process to work through can help to reduce the impact of less experience and lays out steps that an investigator can follow in order to determine where a problem exists within a system. In the case of Technology Transfer Services (n.d.), they are troubleshooting physical systems, plumbing and electrical systems, but the steps that are followed are applicable non-the-less.

The Support Process also incorporates the findings that were made by Bettenburg and his colleagues (2008) which indicates what information is needed to successfully resolve the issues that are reported as well as the findings made by Breu and her colleagues (2010) which encourage investigators to ask questions early on in the process and to have frequent contact with the customer in order to maintain customer involvement. Fleischer and Read (2002) also advocate that it is important for Tier-1 staff members, who are usually the first point of contact for a customer, to be able to ask good questions in order to build and maintain a positive relationship with their customers. These findings were incorporated by including numerous questions that should be asked of the customer early on in the process so that the investigator, regardless of how many investigators have touched the ticket, has the information that they need to be able to investigate and resolve the ticket.

5. Proposed Process Model

The solution being described here, the Support Process, takes the form of a process model which describes the general troubleshooting process (See Appendix B: 12.1.1 and 12.1.2) and allows the support staff member using it to drill down into each of the process phases for even greater detail on the steps to take as part of that phase. The general troubleshooting process, adapted from General Troubleshooting Theory (2005) and Technology Transfer Services (n.d.), has six phases to move through in order to complete the troubleshooting process; Gather Information, Verify the Issue, Brainstorm Possible Causes, Investigate Cause/Solution, Resolve and Re-test, and Report to Customer (See Appendix B). There are some product specific aspects of this Support Process, specifically the Quick Fixes and the Problem Spaces. These areas of investigation are specific to this writer's position providing support for a logistics software product, which utilizes a handset to track movements of people and goods as well as a web interface to support route construction and monitoring. A glossary is provided in Appendix A in order to define context specific terminology.

5.1 Gather Information Phase

The Support Process begins when an issue ticket is submitted by a customer (See Appendix C: 13 for a sample ticket). The first phase that a support staff member enters after being assigned a ticket is the Gather Information phase (See Appendix B: 12.2.1 and 12.2.2). The purpose of the Gather Information phase is to outline the questions that are needed to troubleshoot the reported issue. Quick information gathering early on in the life of the ticket is important to successful closure. When the support staff member enters the Gather Information phase, the process model describes the five areas where information about the

issue can be gathered from; what happened, where did it happen, who did it happen to, when did it happen, and why did it happen here and now (General Troubleshooting Theory, 2005; Grigorenko, Julin, Norton, & Pape 2008; Technology Transfer Services, n.d.). Not all of these questions need to be asked for each ticket, but each question should be considered in the context of each specific ticket in order to gain a clear picture of the issue as well as what steps the user took to encounter the issue.

The final steps of the Gather Information phase covers the importance of summarizing back to the reporter the information that they conveyed to the support staff member to make sure that there are no misunderstandings. As pointed out previously, Breu and her colleagues (2010) advocate that questions be asked early on in an investigation when the reporter is engaged with the reporting process. After there is agreement between the support staff member and the reporter about the issue, the support staff member must document the information that has been provided by the customer (See Appendix C: 13.1). This will help details remain clear as well as assist with escalation if the need should arise later in the lifecycle of the ticket.

After the Gather Information phase is complete, the support staff member returns to the Support Process to review where to move to next. The support staff is asked “Can you attempt to reproduce the issue?” Selecting “No” indicates that the support staff member is choosing to escalate the ticket rather than continue to investigate. Selecting “Yes” indicates that the support staff member has the skill to move on to the next phase; Verify the Issue. This choice to continue is just one opportunity of many that the support staff member will have to

either push forward and learn new skills or pass the ticket along to the next tier in the support department structure.

5.2 Escalate

If the support staff member decides to escalate the issue to the next tier, this means that the support staff member is handing the ticket off to a higher tier in the support department or out of the support department if the ticket needs to be addressed by project management or development. When a ticket is escalated, it is important that the support staff member escalating the ticket reviews what has already been documented and adds any additional information that may have been gathered as part of the investigation (See Appendix B: 12.8). This helps to make the transition between support staff members as smooth as possible, reducing the likelihood that the receiving staff member will have to backtrack in order to be able to move forward with the investigation. The escalating support staff member should also document why the issue is being escalated, communicate with the customer as well as with the staff member taking over the ticket that the ticket is being escalated, and update the ticket to reflect the escalation and new staff assignment (See Appendix C: 13.7). This will further help to keep all parties clear on the status of the ticket and maintain customer engagement.

5.3 Verify the Issue Phase

If the support staff member opts to continue on with the investigation, the next phase is to Verify the Issue (See Appendix B: 12.3). This phase begins with the support staff member taking the information that was gathered from the customer in the previous phase and beginning to document the steps that the customer reported occurred which produced the

issue (See Appendix C: 13.2). The support staff member then moves through the process of reproducing the issue in an environment that is the same or similar to that of the customer in order verify that the reported issue is a problem and is continuing to occur (General Troubleshooting Theory, 2005). This process will also help the support staff member to determine if the issue is only occurring for the reported user or if other users are affected as well.

Through the Verify the Issue process model, the support staff member can access the Quick Fix document (See Appendix B: 12.9). Quick fixes are possible solutions to common issues that can be investigated quickly. Not all quick fixes are applicable in all cases, nor will each ticket have an applicable quick fix, but taking a look at the Quick Fix document may help to resolve a common issue and help the investigator avoid spending additional time investigating a known issue (General Troubleshooting Theory, 2005; Technology Transfer Services, n.d.). If the support staff member is able to find a solution in the Quick Fix document, the support staff member is instructed to move on to Report to Customer. If a Quick Fix is not found, whether the support staff member is able to reproduce the issue of not, the support staff member is instructed to document the steps that were taken and the outcome of those steps (See Appendix C: 13.2).

When the support staff member completes the Verify the Issue Phase and returns to the Support Process model (See Appendix B: 12.1.1 and 12.1.2), he/she asked if the issue was reproduced. If the issue was not reproduced, Investigator is asked if there is enough information and directed back to Gather Information Phase if more information is needed. If

there is enough information or if the support staff member was able to reproduce the issue, the question is asked “Can you continue to investigate?” Here again is an opportunity for the industrious support staff member to progress in his or her skills, even just to test the water, knowing that the ticket can still be escalated. If the support staff member elects to move forward, the next phase in the Support Process is to brainstorm possible causes.

5.4 Brainstorm Possible Causes Phase

The purpose of this phase is to determine possible problem spaces where the issue may have originated from and where to look for a resolution (See Appendix B: 12.4.1 and 12.4.2). A problem space is a general area of a product which group together issues to attempt to determine an area to investigate. The secondary purpose of the brainstorming phase is to determine if the problem that is being reported is a primary issue or a secondary issue. An issue is considered to be primary if it is the source of a problem where an issue is considered to be secondary if it is a symptom or side-effect of another problem. If a reported issue is determined to be secondary, then the reported issue is a symptom rather than the issue itself. This determination can change the principal problem space for investigation.

The Brainstorm Possible Causes phase is made up of two parts; the process model for the brainstorming process (Appendix B: 12.4.1) and the Problem Space map (Appendix B: 12.4.2). The Problem Space map shows connections between common symptoms that are reported and the area where an investigation should take place. The support staff member is asked to find the issue that is reported in the ticket on the Problem Space map, then follow the connections until the most likely problem space has been determined. Some connections lead to different problem spaces than what was originally reported.

Considering the example problem spaces provided in 12.4.2, issues are often reported stating “information in the report is incorrect”. This appears to be an issue with reports, but when the support staff member looks for “reports” on the Problem Space map, he/she finds that this may be an issue with the user process rather than with reports. If there were errors in the user process, this may have placed unexpected data in the database, which then appears as incorrect on a report. In this case, the report appearing incorrect is a secondary issue to the user process errors that created unexpected outcomes. These user errors then become the primary issue and are further investigated, rather than investigating the report itself.

If the reported issue does not appear on the Problem Space map, the support staff member is asked questions to further narrow the possible areas that could be causing the issue. If the support staff member determines that the issue in not part of the Problem Space map, the support staff member is prompted to consider adding the area to the Problem Space map at the end of the investigation. The support staff member is then directed to document hypotheses of what is causing the issue and the evidence that supports those hypotheses (See Appendix C: 13.3).

Upon returning to the Support Process, if the support staff member is not able to narrow down the problem space to one or two areas, the support staff member is given the opportunity to escalate the issue or choose to continue to investigate. Continuing to investigate will bring the support staff member to the Investigate Cause/Solution phase of the Support Process.

5.5 Investigate Cause/Solution

The purpose of this phase is to determine the cause of the issue that was reported so that a resolution can be provided to the customer (See Appendix B: 12.5). There are two paths for the support staff member to choose from in the Investigate Cause/Solution phase. If the issue that was reported is a primary issue and the steps to reproduce the problem are clear, the investigation begins directly. The support staff member reviews the knowledge base, compares the issue with a "known good" example for differences, and can consult other team members for their thoughts on the issue in order to determine a cause. These activities give the support staff member the opportunity to learn from the experience of others while still respecting the time responsibilities of other staff members. These activities encourage the support staff member to attempt to find answers independently first and gives options for how to accomplish this, but also allows for the support staff member to seek information from other team members without having to escalate the issue.

If the issue reported is not the primary issue or if the steps to be able to reproduce the primary issue are not clear, the first task of the investigation phase is to determine the steps that the user took to produce the primary issue. The support staff member begins by gathering evidence of the issue. Then the support staff member attempts to reproduce those pieces of evidence in a development environment. This often requires trial and error in order to match all of the pieces of evidence from the reported issue with the outcomes gathered by the support staff member. The support staff member may have to attempt the steps to reproduce several times in order to find the correct sequence of events to fully match the evidence gathered from the reported issue.

Once the steps to reproduce the primary issue have been established and the results match the secondary symptoms that were reported, the investigation continues through the investigation steps of reviewing the knowledge base, comparing the issue with a "known good" example for differences, and consulting other team members for their thoughts on the issue in order to determine a cause. After completing all of these steps, whether a cause was determined or not, the support staff member is prompted to document what has been found (See Appendix C: 13.4). This will help with further investigation on the issue and can become part of the knowledge base to assist with the investigation of future tickets.

Upon returning to the Support Process (See Appendix B: 12.1.1 and 12.1.2), if a cause was not found, the support staff member is redirected back to either Brainstorm Possible Causes, if the staff member is unsure where else to investigate, or back to the beginning of the Investigate Cause/Solution phase in order to explore a different cause. If the support staff member continues to struggle, he/she can escalate the ticket to the next tier in the support department structure and follow the steps for escalation.

If a cause is determined, the support staff member is asked to determine if an application change is required in order to address the issue that was reported. In some cases, the issue that is reported is a user process error and does not require a change to the product. In those cases, the support staff member would continue on to the Report to Customer phase and document that no resolution was necessary (See Appendix C: 13.5).

If a change is required, either in configuration or in the code of the product, the investigator is asked "Can you make the change?" If the investigator cannot, the ticket can be

escalated to another member of the team who is responsible for making the change or to project management or development if the change is outside of the responsibilities of the support department. If the support staff member can make the change, the investigator enters the Resolve and Re-Test phase of the Support Process (See Appendix B: 12.6).

5.6 Resolve and Re-Test Phase

The purpose of this phase is to resolve the issue by making changes to the application and then re-testing to make sure the issue is no longer occurring (See Appendix B: 12.6). The support staff member making the change may have to attempt several resolutions in order to resolve the issue correctly. The support staff member should make changes in a development environment until a solution is determined to be effective. After the support staff member makes the change, he/she then re-tests with the steps to reproduce both the primary and secondary issues in order to verify that the problem is no longer occurring. If the steps to reproduce no longer produce the same outcome that was reported, then the issue has been resolved. If the issue has not been resolved, the Resolution phase also outlines the process to follow in order to work back through the steps of resolution as well as investigation, if necessary, to determine a resolution for the reported issue.

After a resolution has been found and implemented correctly within a development environment, the support staff member communicates with the customer in order to deploy the changes to the customer's test environment and gain verification from the customer that the issue was resolved before deploying the resolution to the customer's production environment. The support staff member then returns to the Support Process model to move into the final phase, Report to Customer (See Appendix B: 12.1.1 and 12.1.2).

5.7 Report to Customer Phase

The final phase of the Support Process is the Report to Customer phase. This phase many occur after the Investigation phase or after the Resolution phase (See Appendix B: 12.7). The purpose of the Report to Customer Phase is to communicate the findings of the investigation with the customer as well as to document the resolution on the ticket and to add information to the knowledge base or problem space map if necessary (See Appendix C:13.6).

This phase is important as it brings closure for the customer on the issue as well as adding to the experience and knowledge of others who may encounter a similar issue in the future. Making these steps part of the Support Process encourages staff members to take the time to complete these tasks prior to taking on the next ticket. This phase also gives the customer the opportunity to ask additional questions in order to avoid the issue in the future or to understand any additional steps that may be required.

5.8 Example Issue Ticket

An example of an issue ticket which this writer encountered as part of her work as a Tier-3 support engineer, is included here to help further clarify this process (See Appendix C). This ticket began as an email from a customer stating that users were experiencing issues where handsets, Windows Mobile Phones, were freezing at a particular point in their application process and asked for the issue to be investigated. The ticket begins with the Ticket Overview page (See Appendix C: 13.0). This page includes information about the ticket, the customer, and the assigned support staff member. The Ticket Overview also includes the tasks that were completed as well as the status updates that were made to the issue ticket. As tasks

are completed, they are added to the task overview and the ticket status is updated (See Appendix D).

The first task to complete with this ticket is to request additional information from the customer as the information provided is not enough to investigate this issue effectively (See Appendix B: 12.2.1 and 12.2.2). In order to gather additional information, an email was sent requesting specific information about what happened, where in the process the issue is encountered, if all users have been effected or just some, when the issues began, and if anything had changed recently (See Appendix C: 13.1). The customer's response indicated that after the user is asked "Is your task complete?" and the user selects "yes" the handset screen turns white and makes a strange noise. The customer also indicated that this is not happening to all users, but is happening consistently with users who are given a job code ending in "S". The customer also indicated that the use of job codes ending in "S" was recent and that the issue with the handset freezing started around the same time. This information is used to fill in the questions on the Gather Information page of the ticket (See Appendix C: 13.1).

The next step is to verify the issue that was reported (See Appendix B: 12.3). Using a test environment, steps were taken to reproduce the steps that the customer reported (See Appendix C: 13.2). When the question "Is your task complete?" appeared and "yes" was selected, the screen turned white and the handset made a buzzer-like sound, confirming the issue that was reported by the customer. Even though the issue was reproduced, taking a look at the Quick Fixes (See Appendix B: 12.9) indicates that an incorrect application version could

be a cause, but since the issue was reproduced on the correct application version, the next step is to move to the Brainstorming phase (See Appendix B: 12.4.1).

Reviewing the Problem Space map (See Appendix B: 12.4.2), issues with the handset are broken into three areas, unexpected results of scans, error messages, and issues with freezing. Since the issue concerns the handset freezing, the problem space map indicates that there may be an issue with the workflow that the customer is using. In this case, a workflow is a graphical representation of the process options available in a particular application and what occurs when particular options are selected.

On the Brainstorming page of the ticket, it is documented that the issue appears to be in the workflow as the freezing event occurs in a particular place in the workflow process (See Appendix C: 13.3). This is supported by the customer report as well as the verification that a job code ending in "S" results in a freezing event. It is documented in the ticket as well that since the issue was reproduced using the correct application version on the handset, the quick fix that could be applicable of the customer not using the correct application version on their handsets, can be eliminated.

Since the possible causes were narrowed to one, the workflow, the next step is to move into the investigation phase (See Appendix B: 12.5). In reviewing the workflow document, which is part of the knowledge base available to the support department, a search was completed for the question, "Is your task complete?" (See Appendix C: 13.4). The portion of the workflow after the answer "yes" splits into two paths, job codes ending in "P" or job codes ending in "H". There is not an option for a job code ending in "S". This finding is then

documented on the Investigate page of the ticket, including a snippet of the workflow as evidence of the findings. As this is a change to the product, rather than an error or bug in the workflow, this would be considered a feature enhancement.

Upon returning to the Support Process (See Appendix B: 12.1.1 and 12.1.2), since the cause was determined, the next question that is asked is if an application change is required. The answer to this question is yes, which then leads to the question "Can you make the change?" In this case, this change needs to be made through Project Management as this change would be a feature enhancement. Since this is beyond the responsibility of the support department, this issue will be escalated to Project Management. The Resolve and Re-test page in the ticket is completed to document that the issue was escalated to Project Management (See Appendix C: 13.5).

As part of the escalation process in this case, the customer is updated with the findings of the investigation. The customer is informed that there is a need for a feature change to accommodate the change to using job codes ending in "S" (See Appendix C: 13.6). If the customer decides to move forward with the change, as the customer did in this case, an escalation form is completed and forwarded to Project Management outlining the outcome of the investigation and the change that is being requested by the customer (See Appendix C: 13.7). This marks the end of the lifecycle of the support issue ticket and the Ticket Overview is updated to reflect that the ticket has been escalated out of the support department and closed (See Appendix C: 13.0).

6. Plan and Methodology for Evaluating the Process Model

In order to begin evaluating the Support Process model that has been developed, the process model was shared with a support staff member at each of the lower levels within the same software logistics company where this writer is a Tier-3 Support engineer. The process model was also shared with an IT Operations manager who is responsible for training help desk staff at a large supply company. Each reviewer was asked to evaluate the process model and use it over a period of a week for their troubleshooting tasks. Each reviewer was then asked to complete a short survey about their experience level working within software support/help desk as well as their thoughts on the process model; if they think it would be helpful to support/help desk staff, if it was helpful to the reviewer over the time period they used it, as well as if there was anything they would change to make the process model more effective (See Appendix E).

7. Evaluation Results

Reviewers reported that they have between six and ten years of support or help desk experience, ranging from working directly with customers as a Tier-1 support engineer through training new support and help desk staff.

Reviewers expressed that they found the Support Process model to be very helpful for themselves and hypothesized several other benefits and uses. One reviewer, who trains new help desk staff stated, “I think this process model would be ideal for training new help desk personnel and would also serve as a valuable reference for any help desk staff. I have found for me that one of the most difficult parts of hiring new help desk techs is getting them up to speed

in our environment. I could use this model and integrate our company's proprietary software and procedures into it. This would make training the new hires much faster and they would be able to start taking help desk calls on their own much sooner."

Another reviewer commented on the department wide benefits of using the Support Process model stating, "I think a lot of solutions are often overlooked because of the assumptions or skipping/overlooking key steps in the investigation or information gathering stages. I think a documented and accurate workflow will help all involved and ultimately lead to improved customer satisfaction, faster turnaround on ticket processing time, and less un-necessary back & forth with customers and colleagues."

Reviewers responded that they found the Support Process model easy to follow, clear, and comprehensive. Reviewers were able to identify ways to customize the Support Process model to fit the product and environment being supporting. The observation was made that updates would have to be made with regularity to keep the process up to date for long-term use and suggestions were made to link the available knowledge bases directly to the Support Process model so that users have even easier access.

Although it was a small sample of reviews, the responses indicate that further research into the use of the Support Process would be constructive as the Support Process model appears to add value to support and help desk departments as a means to improve efficiency, training, and consistency. Consistent use of the Support Process model may improve investigation skills, customer satisfaction, staff retention, and staff confidence.

8. Suggestions for Continuing Research

To gain a better understanding of whether or not this process model has a meaningful impact on the training speed and skill of new support staff members as well as whether or not there is an improvement in the effectiveness of the support department overall, there needs to be additional evaluation of the Support Process model. Further evaluation with a larger pool of reviewers, over a longer period of time would bolster support for additional research methods.

Deploying the Support Process model to a portion of a support team, while the other portion of the support team is not exposed would create a situation where the impact of the Support Process model could be measured based on speed of resolution and accuracy of resolution as well as speed and accuracy of escalation as these tend to be areas where support staff struggle. Deploying the Support Process model to new employees would also allow for an important measure of the learning speed of new staff who are exposed to the Support Process model compared with those that were not.

Making the Support Process model into an interactive piece of software, integrated with a ticket tracking system and knowledge base could potentially also improve the usability of the process and encourage more consistent use from support staff members. Including prompts for documentation of the various steps in the investigation process would also improve consistency of use as well as create an ever growing knowledge base for future investigations.

9. Lessons Learned

Through completing this capstone project, this writer has learned a great deal about the support process and how to efficiently and effectively move through the troubleshooting

process. This writer had little experience in software support prior to beginning this project and had only held the Tier-3 support position or any support position for 3 months prior to beginning this project. Working through this capstone process allowed this writer to learn a great deal and allowed her to put together a process document that she wished she had been given when starting her new position.

It was also surprising to this writer that there was not more research about the support process and the specific tasks associated with the support process. There was research on organizational and management issues associated with support departments, research on organizing repositories of information in order for it to be helpful to support departments, and research completed on what information is needed to resolve issue tickets, but little research on the support process and the process of troubleshooting (Chilana, Grossman, and Fitzmaurice, 2011). This project illuminated to this writer that even though Information Technology is a field that is always changing and progressing, it is still a fairly young field, which leaves room for new and interesting research opportunities.

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11. Appendix A – Glossary

Area – Grouping of topics within a product which are connected logically

Escalate – Process of moving a ticket to a higher level of technical skill either within the support team or moving a ticket outside of the support team depending on the requirements of the ticket.

Handset – Ruggedized cell phone, running Windows Mobile or Android OS, with built in scanner functionality used to scan barcodes and track items

Harvester – Software application which replicates data in one database and moves it into another. Precursor to integration

Image capture – A picture can be taken on the handset screen from another device if a screenshot cannot be taken on the handset experiencing the issue

Integration – Interface between customer and product databases where information is transmitted, various types, i.e. FTP. Advanced version of a harvester

Knowledge base – repository of information gathered together and used to answer questions about a particular product or process.

License Key – Numerical value entered on the handset to allow handset to access specific customer service

Log files – Files that document the events and errors that occurred on a piece of hardware; i.e. handset, a server, or a harvester

Next line – Next tier of staff, support staff, developer, or management with increasing technical skill or responsibility in the area in question

Primary issue – the problem or situation that is at the basis of the issue

Problem spaces – general areas where issues may occur within a particular product which help to determine where to begin to investigate an issue

Quick fixes – steps that can be taken quickly which may or may not address the issue in question, but do not take much to check.

Screenshot – An image of the user's computer screen or handset screen which can show what the user has encountered

Secondary issue – the symptom of the primary issue, a manifestation of the primary issue

Service – A customer specific environment where the product is utilized

Steps to reproduce – the steps that need to be followed in order to reproduce an issue consistently in a test environment

Ticket – Submission from customer reporting an issue that needs resolved; includes company, contact person, and details concerning the issue that occurred. May be submitted in the form of an email from the customer or as a record of a phone call with the customer.

Workflow – A diagram or diagrams which are used to generate the mobile application which runs on the handsets. Can be customer specific and dictates the options for how handset application looks, which screens are shown, and how input is processed.

12.0 Appendix B - Support Process

Description

The purpose of the Support Process workflow is to assist new support staff to learn the troubleshooting process, to pass information and experience between support staff, and to create a consistent, efficient process to investigate and resolve support tickets.

Following the process phases and questions will allow the support staff member to move through the support process, learn additional information, and feel confident about making the decision to escalate a ticket to the next level of support in a timely fashion.

Simply follow the arrows from one process step to the next, answering the questions provided, in order to determine the best path of investigation.

Objectives for process phases:

Gather information – The purpose of the Gather Information phase is to outline the questions that are needed to troubleshoot the reported issue. Quick information gathering early on in the life of the ticket is important to successful closure. Not all questions need to be asked for each ticket, but all should be considered in the context of each specific ticket.

Verify the issue – The purpose of the Verify phase is to verify that the issue that was reported is an issue, is continuing to occur, and to determine and document the steps that are taken in order to reproduce the issue. Quick fixes can be accessed through the Verify phase. Quick fixes are possible solutions to common issues that can be implemented quickly. Not all quick fixes are applicable in all cases, nor will each ticket have an applicable quick fix.

Brainstorm possible causes – The purpose of the Brainstorming phase is to determine possible problem spaces where the issue may have originated from and where to look for a resolution. A problem space is a general area of a product which group together issues to attempt to determine an area to investigate. The secondary purpose of the brainstorming phase is to determine if the problem that is being reported is a primary issue or a secondary issue, meaning that it is a symptom of the issue rather than the issue itself. This determination can change the principal problem space for investigation.

Investigate cause/solution – The purpose of the Investigation phase is to determine the cause of the issue that was reported so that a resolution can be provided to the customer. If the issue that was reported is a primary issue and the steps to reproduce the issue are clear, the investigation begins directly, reviewing the knowledge base, comparing the issue with a “known good” example for differences, and consulting other team members for their thoughts on the issue in order to determine a cause. If the issue reported is a secondary issue or the steps to be able to reproduce the issue are not clear, the first step of the investigation phase is to determine the steps that the user took to produce the primary issue. Once the steps to reproduce the primary issue have been established and the results match the secondary

symptoms that were reported, the investigation continues through the investigation steps of reviewing the knowledge base, comparing the issue with a "known good" example for differences, and consulting other team members for their thoughts on the issue in order to determine a cause.

Once a cause has been determined, there are two possible paths depending on whether or not an application change is required. If an application change is required, the next phase in the process is Resolve and re-test. If an application change is not required, the next phase is Report to customer.

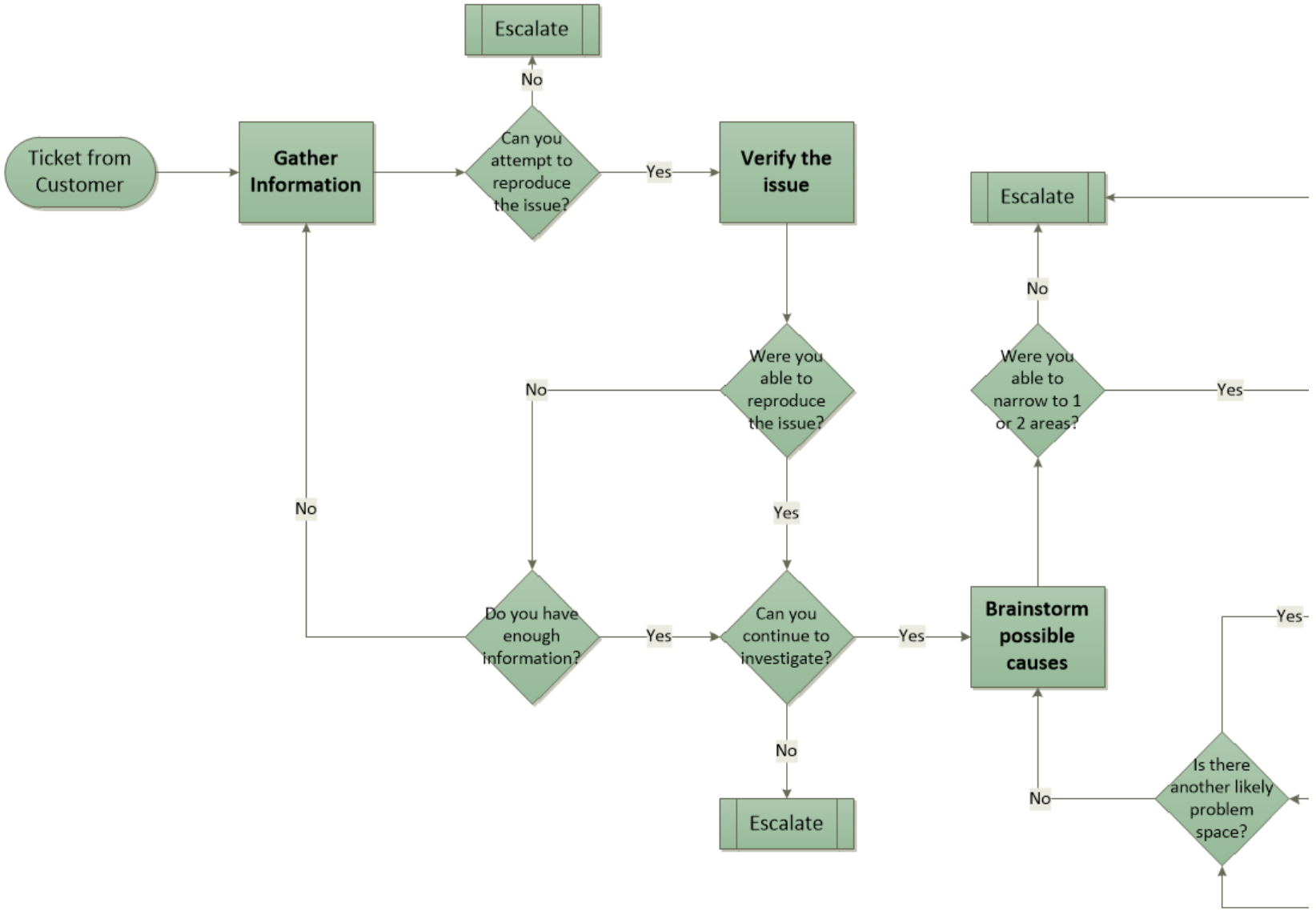
Resolve and re-test – The purpose of the Resolution phase is to make changes in order to resolve the issue and then to re-test that the issue is no longer occurring by following the steps that were used previously to reproduce the issue, both primary and secondary. The Resolution phase also outlines the process to follow if the changes do not result in the elimination of the reported issues as well as the steps to follow to communicate with the customer in order to deploy the changes that were made and gain verification from the customer that they have observed that the issue was resolved.

Report to customer – The Report phase is the final phase of the Support Process, whether this phase occurs after the Investigation phase or after the Resolution phase, depending on whether or not an application change was required. The purpose of the Report phase is to communicate the findings of the investigation with the customer as well as to document the resolution on the ticket and to add information to the knowledge base or problem spaces if necessary.

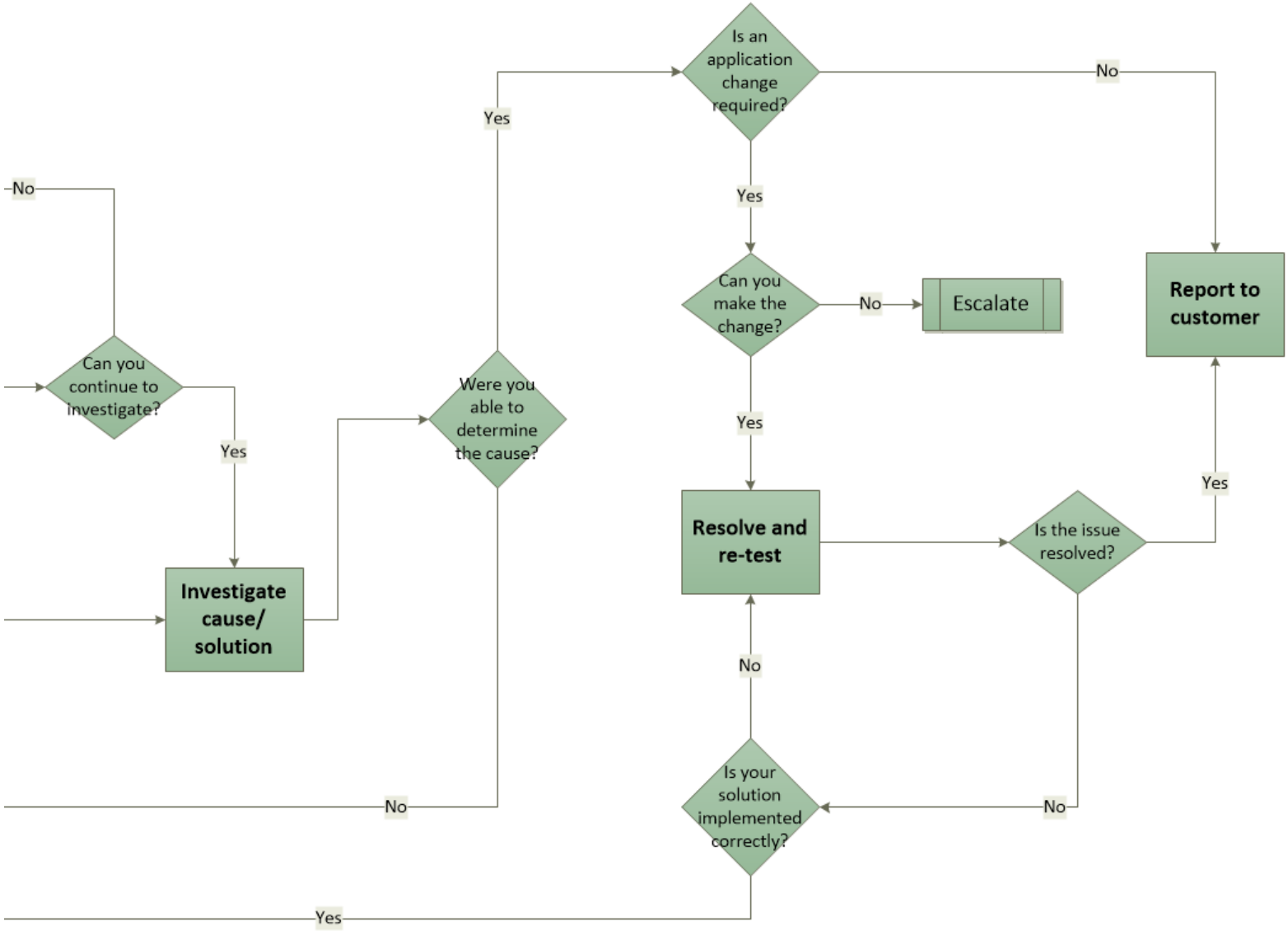
Documentation – Documentation is a significant aspect of each of the phases of the Support Process. Documentation should take place throughout each of the phases of the process so that information can be passed between support staff when necessary as well as making additions to the knowledge base or problem spaces as accurate and meaningful as possible. Consistent documentation also makes moving through the Support Process more efficient as small details of steps taken can be forgotten if they are not documented requiring additional time to repeat steps in order to find the missing information.

Escalation – Escalation is a central component of the Support Process as it is not expected that one support staff member be able to complete all of the steps in the Support Process independently. It is expected that support staff members will pass a ticket between several members of the team depending on the requirements of the ticket, the technical skills of the staff member, and the desire of the staff member to learn additional skills. The timely decision to escalate a ticket as well as the accurate documentation of the staff member's steps prior to the escalation are vital to the successful closure of the ticket.

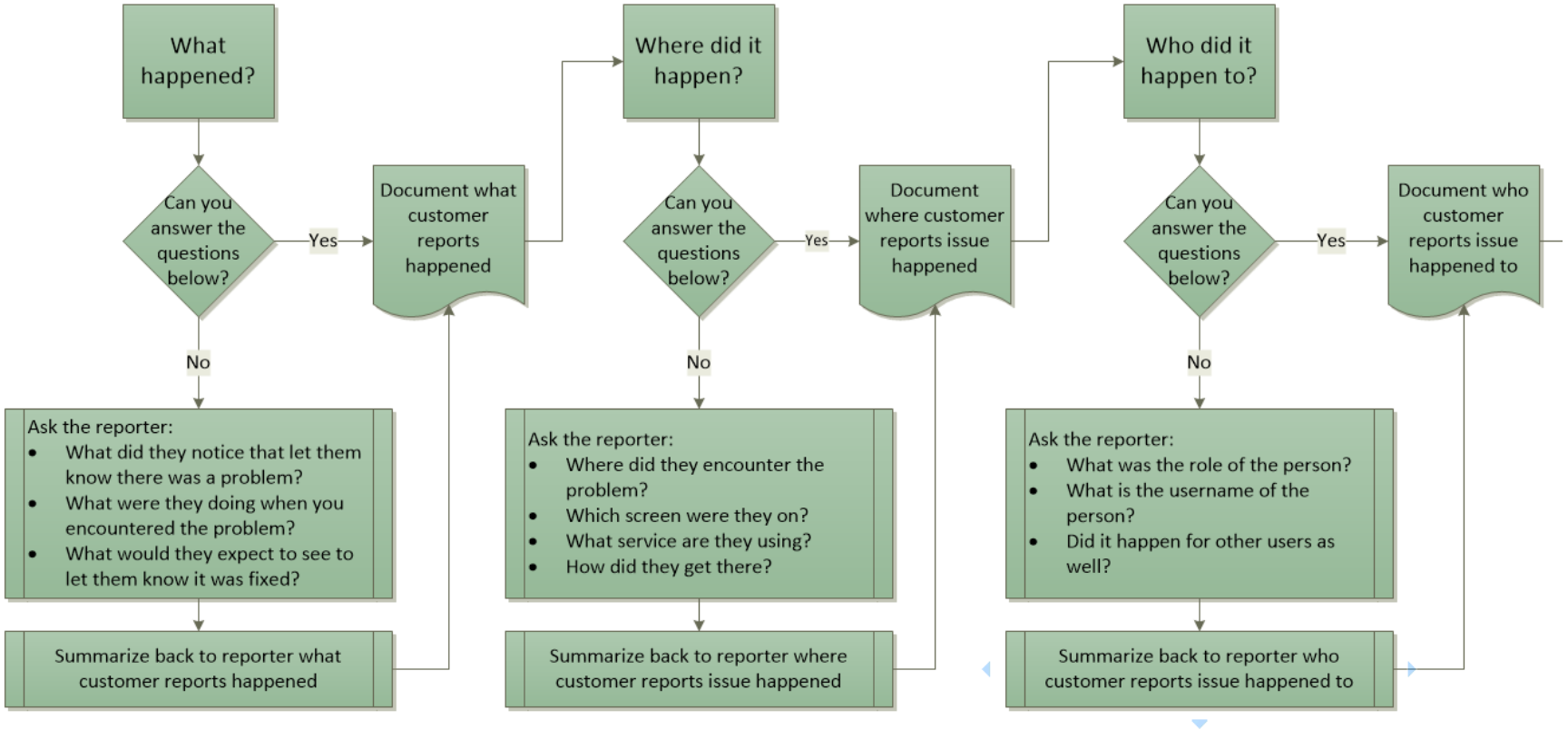
12.1.1 Support Process



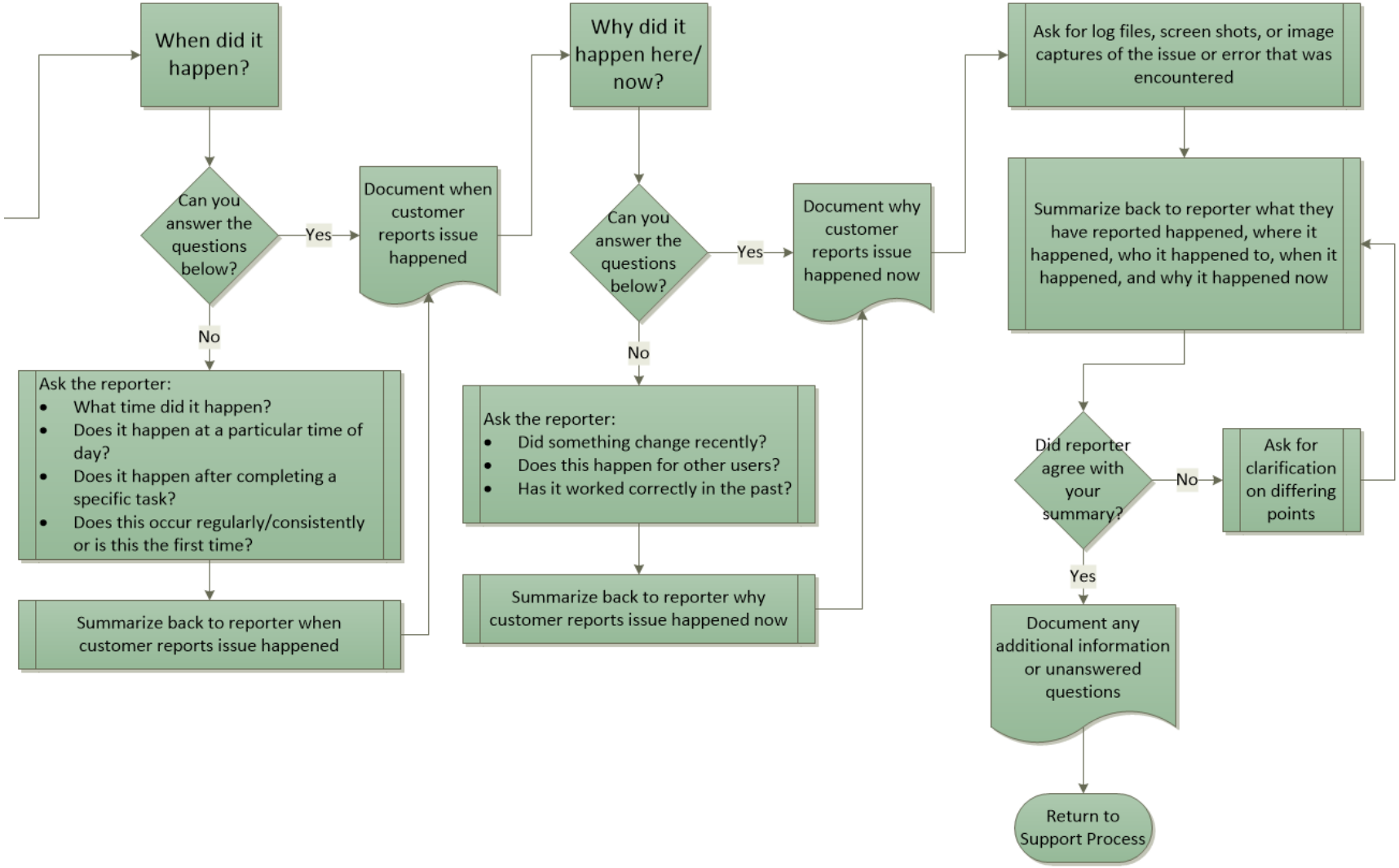
12.1.2 Support Process



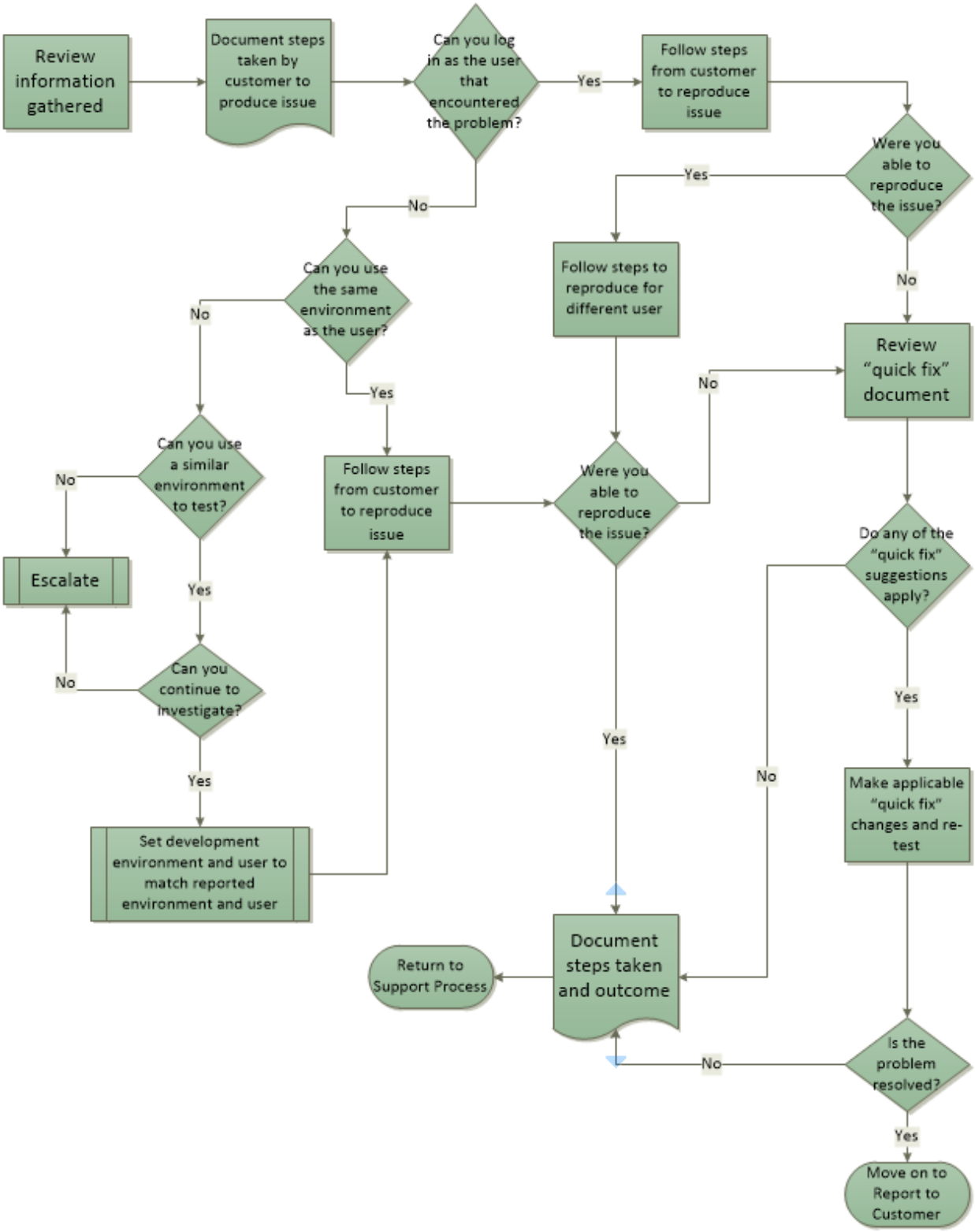
12.2.1 Gather Information



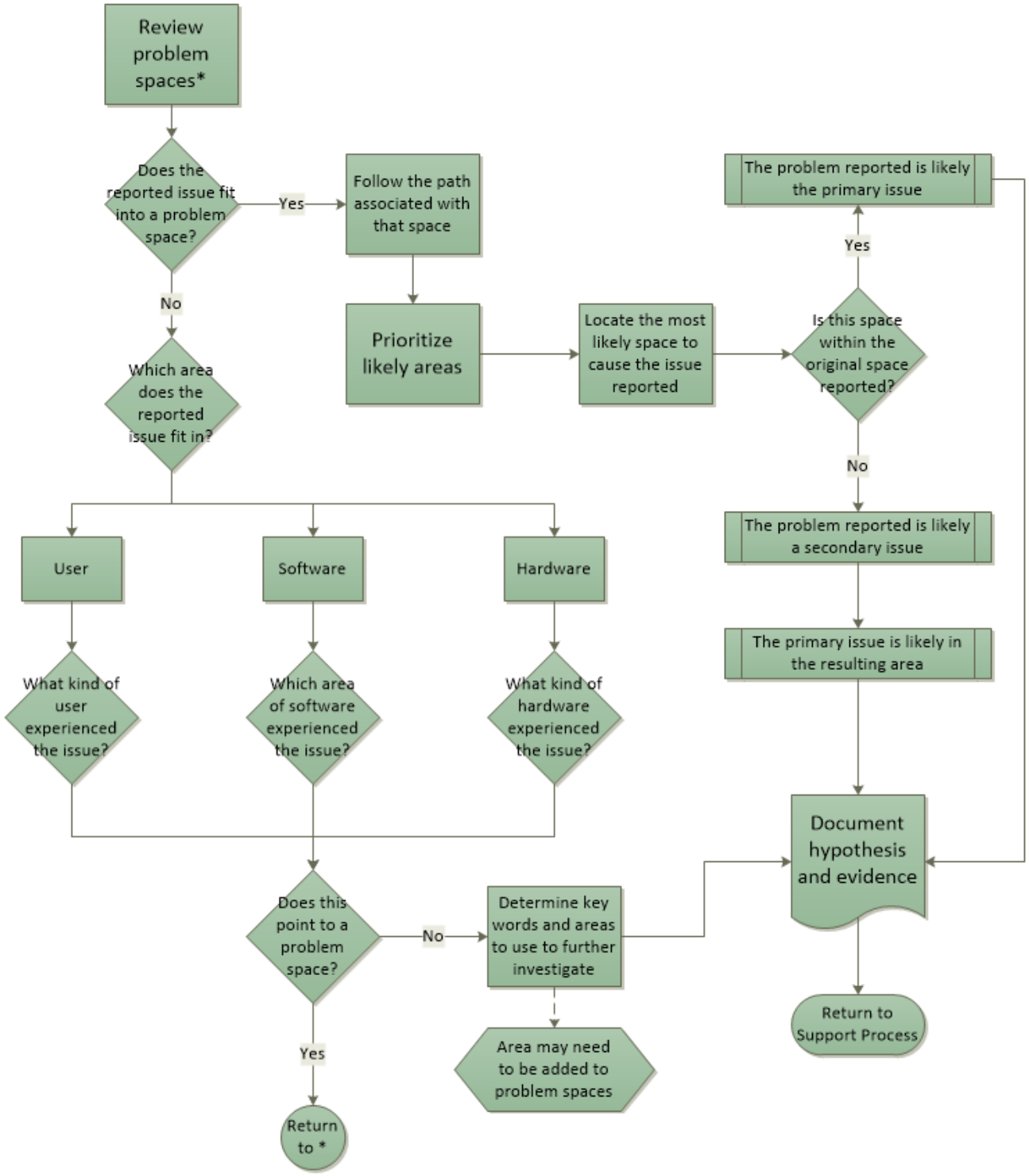
12.2.2 Gather Information



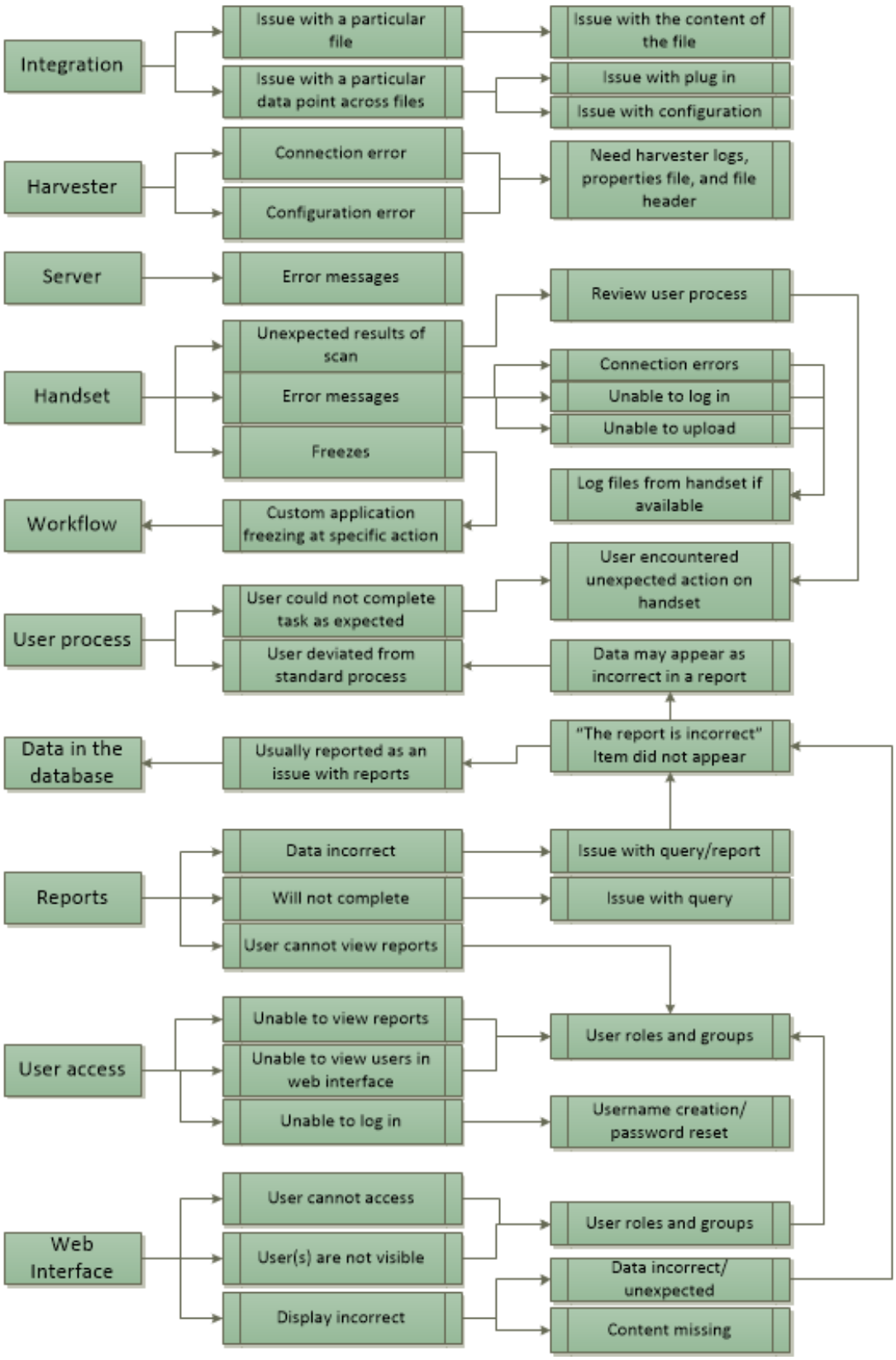
12.3 Verify the Issue



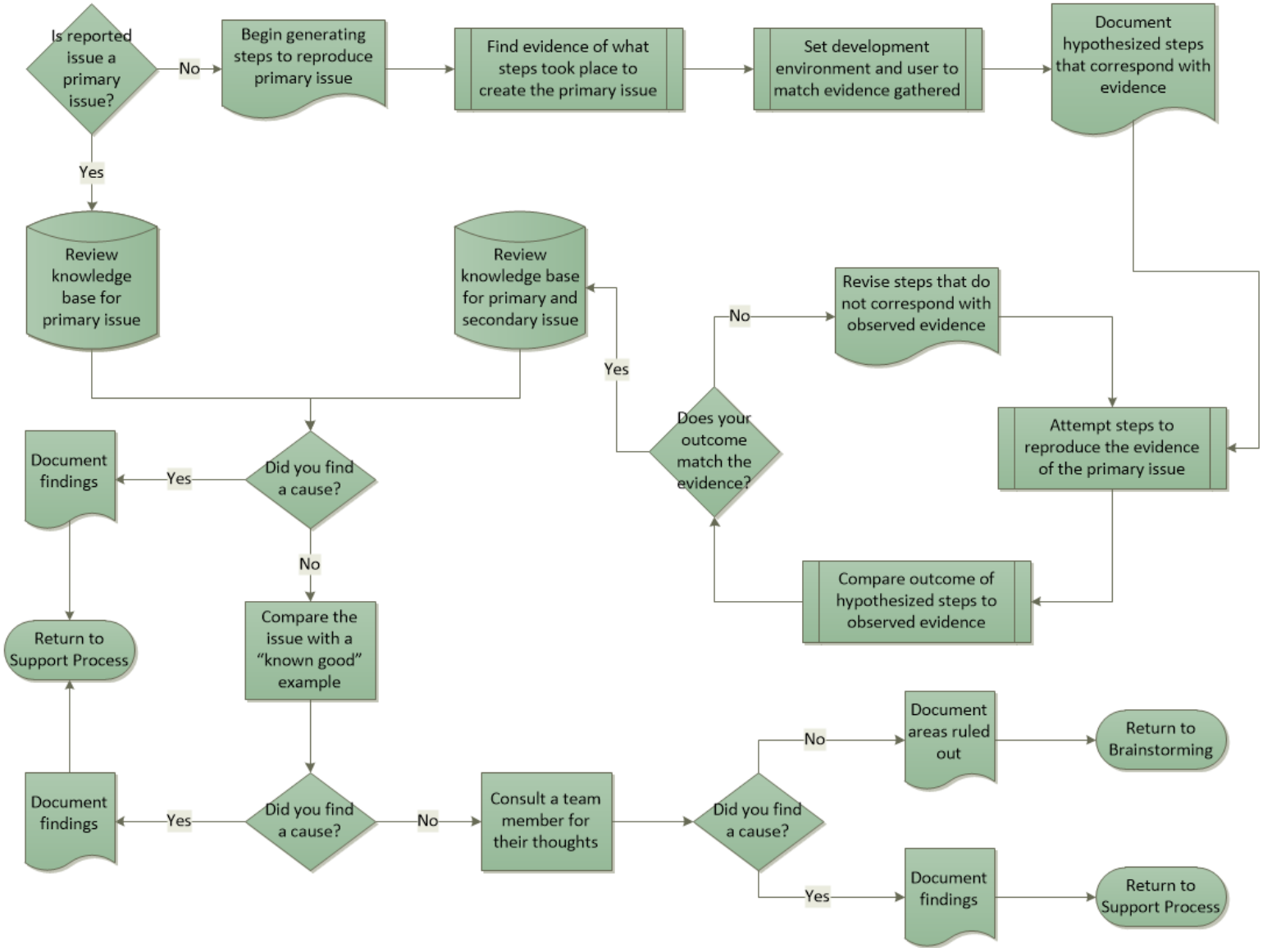
12.4.1 Brainstorm Possible Causes



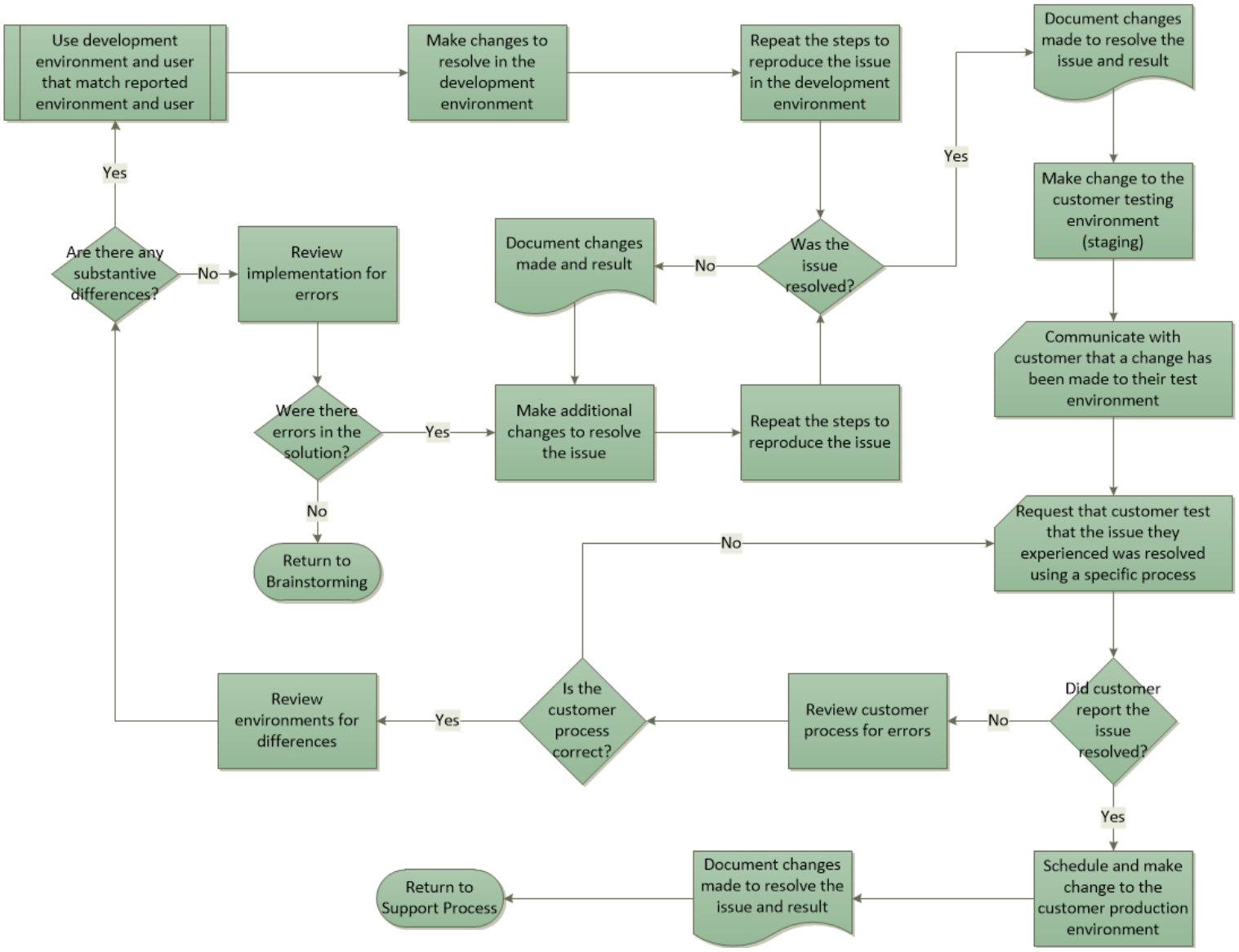
12.4.2 Brainstorm Possible Causes – Problem Space Map



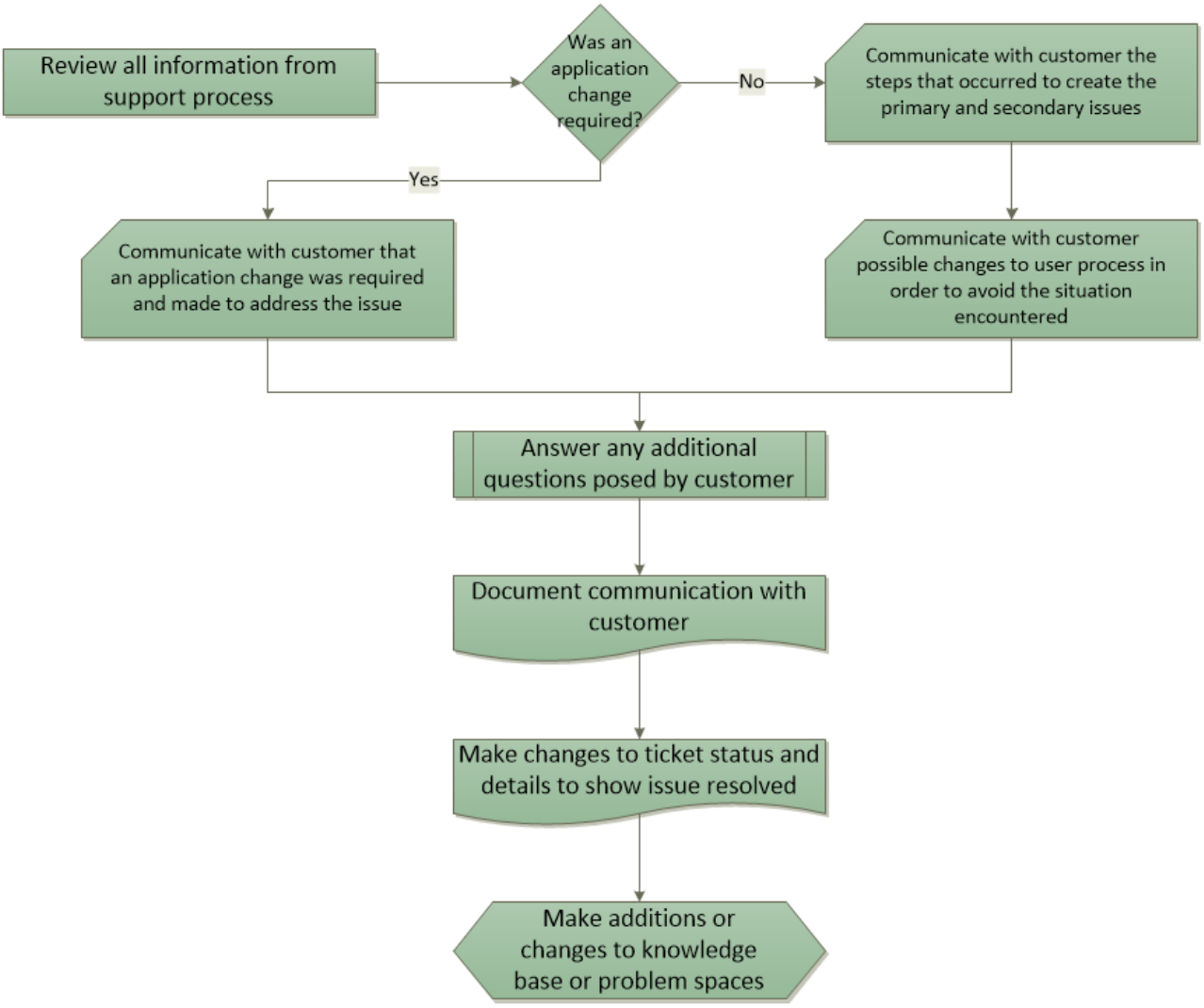
12.5 Investigate Cause/Solution



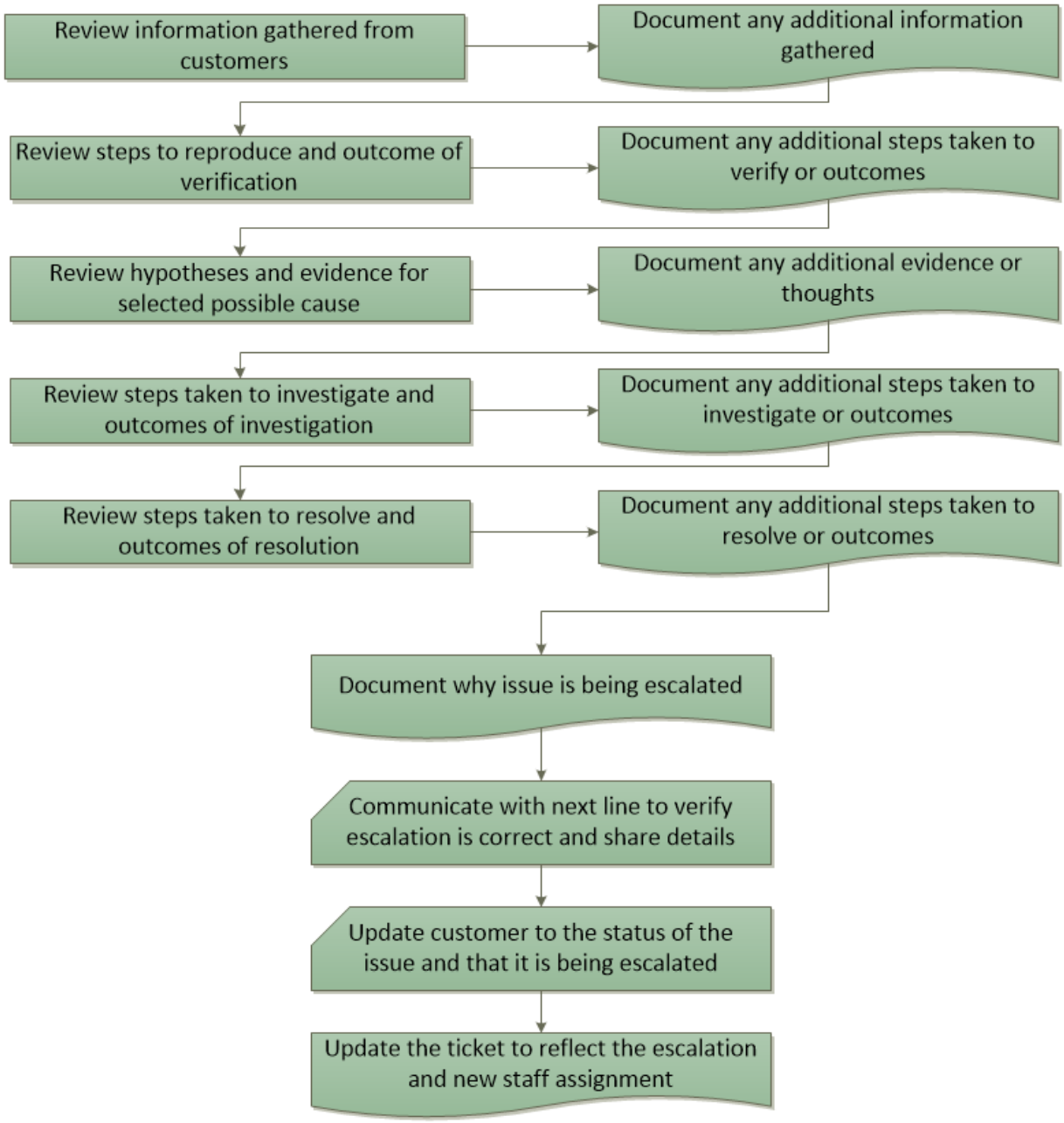
12.6 Resolve and Re-Test



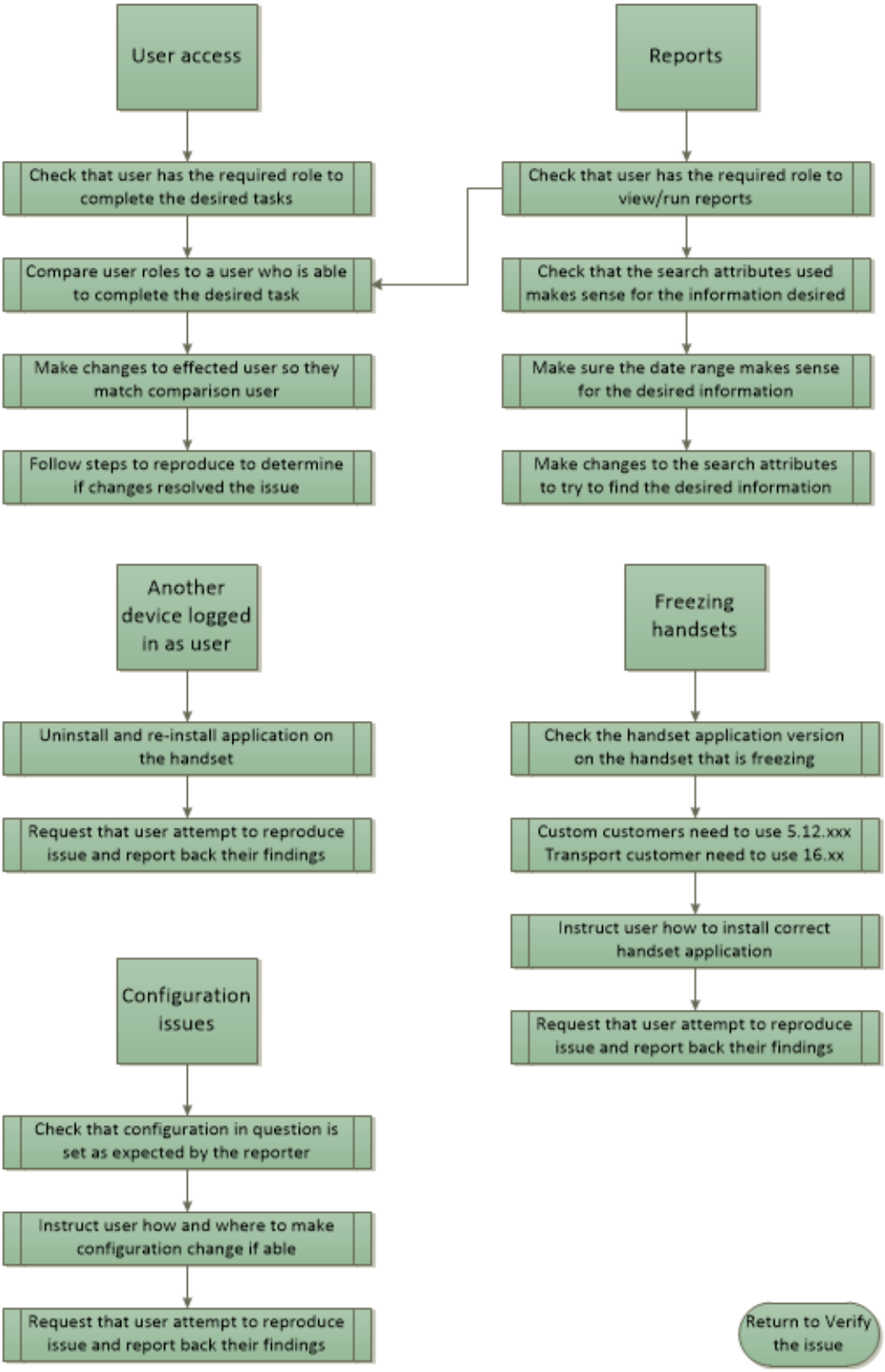
12.7 Report to Customer



12.8 Escalate



12.9 Quick Fixes



13.0 Appendix C – Example Support Ticket

Ticket Overview

Ticket Number: 50001	Employee Responsible: Rachelle Solt
Customer: John's Plumbing	
URL: www.johnsplumbing.custom.com	
License Key: 916452841	
Username: John1	
Description:	
Dear Support, We have several handsets over the last few weeks that are freezing at a particular point in our workflow when the user is marking their task as complete and then is not able to move forward. Please investigate. Thanks, John	

Task Overview	**Ticket Status**
03-15-16 – Email received from customer	In Process
03-15-16 – Email to customer to gather additional information	Pending Customer Action
03-16-16 – Email received from customer	In Process
03-16-16 – Verified Issue	In Process
03-16-16 – Brainstorm causes	In Process
03-16-16 – Investigate workflow	In Process
03-16-16 – Email customer outcome of investigation	Pending Customer Action
03-17-16 – Email received from customer	Escalated to Project Management
03-17-16 – Email sent to Project Management; Escalation form included	Escalated to Project Management
03-17-16 – Email customer about escalation	Escalated and Closed

13.1 Gather Information

03-15-16 Email to customer Good afternoon John, Can you please provide us some additional information to assist with our investigation? Is there a particular screen that is displayed prior to the handset freezing? Is this occurring for all of your users or just some? When did your users start to experience this issue? Has anything changed recently? Thank you for your help, Rachelle Software Support
03-16-16 Response from customer Rachelle, The handsets are freezing after the user answers the question “Is your task complete?” After the user enters “yes” the handset makes a strange noise and displays a white screen. This is not happening to all of the users, just the users with a job code ending with an “S”. We recently started using job codes that end with an “S” and that is around when we started to experience this issue. Thanks, John
What happened?
The handset screen turns white and the handset makes a strange noise.
Where did it happen?
This happens after the user answers “yes” to the question, “Is your task complete?”
Who did it happen to?
This happens to users who are completing a task with a job code that ends with the letter “S”.
When did it happen?
This started to occur “a few” weeks ago.
Why did it happen here/now?
A change was made to add job codes that ended in the letter “S”.

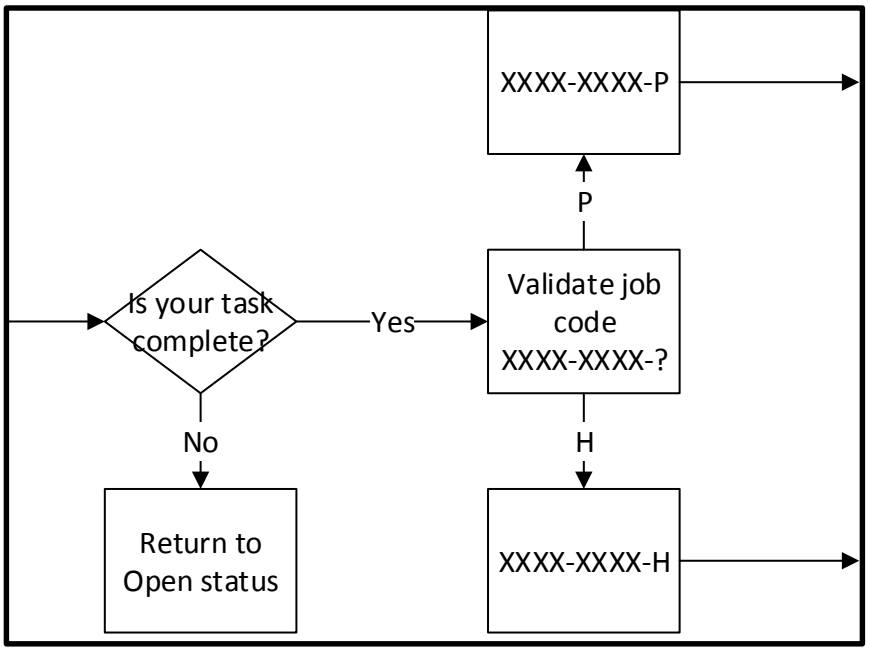
13.2 Verify the issue

Steps to reproduce:
Enter License Key: 916452841 Enter user name: John1 Enter job code: 1648-48-S Select “Begin Task” Select “Task Complete” Select “Yes” when asked “Is your task complete?”
Outcome of verification process:
Handset screen turned white Handset made a buzzer-like sound

13.3 Brainstorm possible causes

Hypothesis of cause:
In review of the problem spaces, an issue where the handset is freezing could be linked to the workflow.
Support:
The handset is freezing after a particular question is answered when the job code ends in the letter “S”. It is possible that the workflow does not account for this change that the customer made to start using a new job code.
Hypotheses ruled out:
The version of the handset application could be incorrect and this could be causing the issue, but given the specific point that the handset is encountering the issue as well as the recent change made, it is less likely.
Support:
Issue was reproduced using a handset that was using the correct application version.

13.4 Investigate cause/solution

Steps taken to investigate:
Reviewed workflow – searched for question “Is your task complete?”
Outcome of investigation:
After question is asked, the workflow splits into two branches, job codes ending in H and job codes ending in P. There is no logic to handle the job code that ends in S. This change would be a feature enhancement if customer decided to move forward.


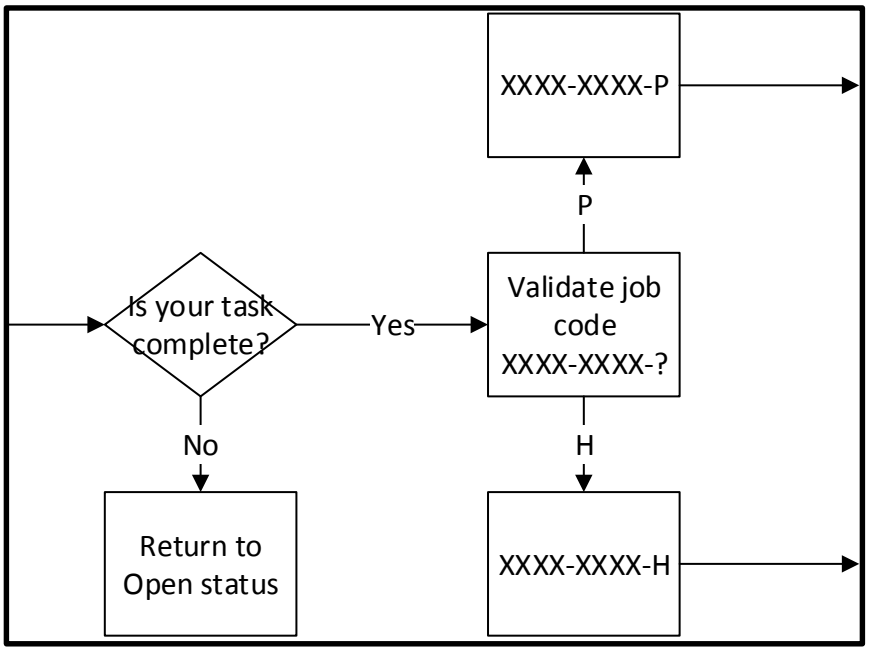
13.5 Resolve and Re-test

Steps to resolve:
Ticket escalated to Project Management for resolution.
Outcome of resolution:

13.6 Report to Customer

Information reported to customer:
03-16-16 – Email to Customer Good afternoon John, The workflow that you are currently using does not have any logic to support the new job codes that you have started using. The workflow is designed only for job codes ending in P or H. A change to support job codes that end in S would be a feature enhancement and would have to go through project management. Please let us know if you would like to move forward with that process. Rachelle Software Support
03-17-16 – Email from Customer Rachelle, We would like to move forward with that change. Can you have someone get in touch with me? Thanks, John
03-17-16 – Email to Customer Good morning John, I have escalated your request to project management. Someone will be in touch with you shortly to discuss this change further. Rachelle

13.7 Escalation Form

Ticket Number: 50001
Customer: John's Plumbing
URL: www.johnsplumbing.custom.com
License Key: 916452841
Username: John1
Description of request:
Customer requests additional logic added to workflow to account for an additional job code, which ends in "S".
Reason for Escalation:
Currently handset freezes after question "Is your task complete?" is answered "yes". After question is asked, the workflow splits into two branches, job codes ending in H and job codes ending in P. There is no logic to handle the job code that ends in S.
Customer has been informed of the need for a feature enhancement and has agreed to move forward with the change. They have requested contact from Project Management to begin the process.


14. Appendix D – Ticket Statuses

Closed without Feedback – The ticket has been closed due to inactivity of the customer; either not responding to questions posed by the support staff member making it impossible to move forward on the ticket (30 days) or not responding with confirmation that they accept the resolution or explanation provided (10 days).

Escalated – The issue reported cannot be addressed by the assigned support staff member and that staff member has requested an escalation of that ticket. This status remains until the support staff member receiving the ticket changes the status.

Escalated to Development – The issue reported in the ticket is a bug in the software code which cannot be addressed by a support staff member.

Escalated to Project Management – The issue reported in the ticket requires a feature enhancement which cannot be completed by a support staff member.

Escalated and Closed – The issue reported in the ticket was escalated to another department outside support and the support ticket was closed.

In Process – The ticket is actively being worked on by a support staff member.

Pending Customer Action – The support staff member is waiting for input from the customer in order to move forward in the support process.

Pending Customer Closure – The support staff member is waiting for confirmation from the customer that they accept the resolution or explanation provided.

Pending Third Party – The support staff member is waiting for input from a third party outside of the support team or the customer.

Resolved and Closed – A resolution or explanation for the issue reported was provided and accepted by the customer and the ticket was closed.

15. Appendix E – Survey

1. How long have you been working in the field of customer support/help desk and in what capacity?

2. Do you think that this process model would be helpful for customer support/help desk staff? How so?

3. Was this process model helpful to you in your current position? How so?

4. Is there anything that you would change to help make this document clearer or more user-friendly?

5. Do you have any other comments or thoughts about this process model?