

Chapter 2 – Investigating System Requirements

Solutions to End-of-Chapter Problems

Review Questions

1. List and briefly describe the five activities of systems analysis.

- Gather detailed information – meet with users to understand the business processes and needs
- Define requirements – document findings by building models such as use case diagram and class diagram
- Prioritize requirements – Decide which requirements (such as use cases) should be done first
- Develop user-interface dialogs – work with the users to define exactly how they will use the system and what interactions with the system are required
- Evaluate requirements with users – ensure that the requirements are complete, accurate, and prioritized correctly

2. What are three types of models?

Textual models, graphical models, and mathematical models

3. What is the difference between functional requirements and nonfunctional requirements?

Functional requirements describe the business rules that must be supported by the new system, while non-functional requirements are the system characteristics such as speed, throughput, response time, and security. Both are important.

4. Describe the steps in preparing for, conducting, and following up an interview session.

Prepare for an interview by establishing the objective, determining the users and project team members, write questions, review preliminary materials, set up the interview time and location and tell everybody.

Conduct the interview by asking questions, looking for exception conditions and probing for good details. Also take good notes, and document all the follow-up items.

Follow-up the interview by reviewing everybody's notes, building the models as necessary, document open issues, then follow-up with them. Be sure to thank contributors.

5. What are the benefits of doing vendor research during information-gathering activities?

It can inform the current team and users of new ideas and possibly more effective methods

The team can possibly find out about more current state-of-the-art solutions that vendors have created.

It may even be cheaper, faster, and more effective to purchase a solution instead of building.

6. What types of stakeholders should you include in fact finding?

Both internal and external stakeholders. Internal stakeholders would include operational people

who work with the system and executive stakeholders who may receive executive reports, or depend on the success of the system.

External stakeholders may include customers or partner organizations, who also receive information directly from the system. At the executive level, external stakeholders may be investors or regulators.

7. Describe the open-items list and then explain why it is important.

During fact finding activities, and in fact throughout all the project, some issues can be answered immediately, but others cannot be answered immediately. Some questions may not be answered because more research may need to be done, or other items may need to be decided first, or the user procedure has not be finalized, etc. Those items will need to be tracked so that they are not left out of the solution system. The open-items list provides that tracking function by noting the item, assigning a responsible person, and tracking the completion of the open item.

8. List and briefly describe the six information gathering techniques.

Information gathering techniques include

- Interview users and stakeholders – the most effective for information gathering, but the most expensive
- Distribute questionnaires – good for finding overview or summary information from many people
- Review current system documentation – good for understanding current processes
- Observe current business processes – also good for understanding the user's processes and requirements
- Research vendor solutions – good for generating new ideas and learning what already has been done
- Collect user comments – good for finding out about problems with current processes

9. What is the purpose of an activity diagram?

One purpose of an activity diagram is to document current user workflows. Activity diagrams are often called workflow diagrams. They can be used to document a user procedure as he/she interacts with the computer system.

10. Draw and explain the symbols used on an activity diagram.

See Figure 2-14.

Problems and Exercises

1. Provide an example of each of the three types of models that might apply to designing a car, a house, and an office building.

Car:

Mathematical model might be a set of calculations having to do with horse-power, torque and acceleration. Graphical model might be a set of 3 dimensional drawings of the body style. Textual model might be some written specification of the materials to be used.

House:

Mathematical model might be some calculations to determine angle of roof and types of materials needed. Graphical would be a set of blueprints. Descriptive textual model might be a description of the materials to be used.

Office building:

An office building might have all types of mathematical models of the stresses and earthquake requirements. Graphical would be blueprints or even a 3 dimensional physical model. Descriptive textual model could be of materials or steps in the construction process.

2. One of the toughest problems in investigating system requirements is to make sure they are complete and comprehensive. How would you ensure that you get all the right information during an interview session?

Answers should include the following points:

- Ensure that all stakeholders are identified and included in the requirements definition activities.
- Review every existing form and report to make sure that all information needs are understood.
- Identify and understand every business activity. Be sure that all business procedures have been discussed.
- Ensure that all exception conditions have been identified and associated processing has been defined.
- Maintain an open-items list and ensure that all items are resolved.

3. One of the problems you will encounter during your investigation is “scope creep” (i.e., user requests for additional features and functions). Scope creep happens because users sometimes have many unsolved problems and the system investigation may be the first time anybody has listened to their needs. How do you keep the system from growing and including new functions that should not be part of the system?

This problem is really a project management issue. The project manager should establish guidelines to control this problem.

One preventative method is to be sure that the initial scope definition is adequate and comprehensive. A partial definition during the scoping activities will exacerbate the problem of

scope creep. Even for Agile projects, the users and the project team should attempt to do a thorough job of identifying all of the functional requirements.

An effective way to control scope creep is to establish a committee that consists of both project team members and user (or client) members. All new additions to the scope of the system need to be approved by the committee. Prior to approval, an estimate should be done to determine the criticality of the request and the impact on the project schedule. The client and the users should participate in the decision so that it is a combined decision and not dictated by the project manager.

An additional technique is to begin a list of enhancements for the next version of the system. Some requests can easily be deferred to a later version.

4. What would you do if you got conflicting answers for the same procedure from two different people you interviewed? What would you do if one was a clerical person and the other was the department manager?

The first thought would be to take the opinion of the department manager as the correct answer. However, it is not uncommon for the department manager to be behind on some of the latest details of business procedures. The best solution in this case is to get the two people together and let them discuss the differences until they both agree on the correct procedure. The systems analyst should not make the decision as to which answer is correct, nor should he or she try to resolve the difference. It is the users' responsibility to do so.

5. You have been assigned to resolve several issues on the open-items list, and you are having a hard time getting policy decisions from the user contact. How can you encourage the user to finalize these policies?

Delayed policy decisions impact the project schedule. Sometimes the user does not understand the impact of delayed decisions. Thus, the first approach should be to explain the negative impact that a given decision is having on the project. If that doesn't work, then stronger measures can be taken, such as suggesting that the project steering committee review the outstanding-items list. Also, if the outstanding-items list indicates the length of time that items have been open, the analyst can assign or adjust the priority of those items that have become critical.

6. In the running case of RMO, assume that you have set up an interview with the manager of the shipping department. Your objective is to determine how shipping works and what the information requirements for the new system will be. Make a list of questions—open ended and closed ended—that you would use. Include any questions or techniques you would use to ensure you find out about the exceptions.

Three areas should be addressed in this answer: (1) closed-ended questions, (2) open-ended questions, and (3) questions related to exception conditions.

Sample closed-ended questions:

- What is the volume of shipments on an average day?
- How does the volume vary across time?
- How many employees are there in shipping?

Sample open-ended questions:

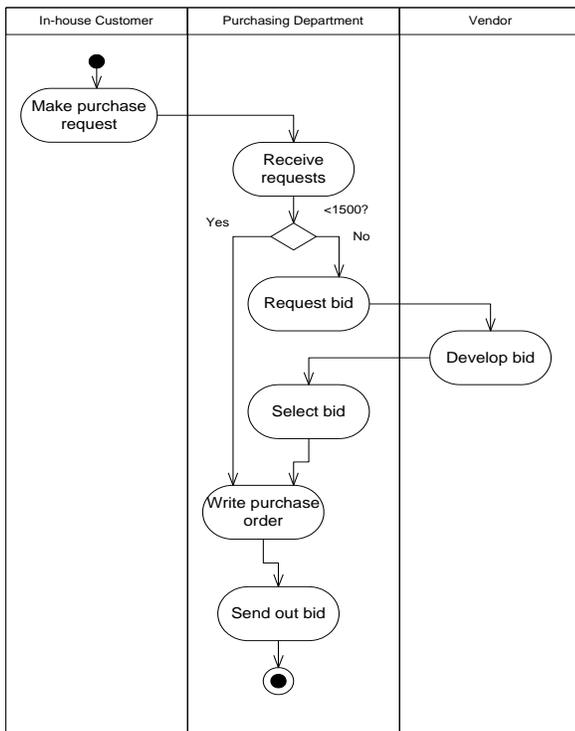
- What is the procedure for getting an order ready for shipment?
- What forms are used?
- How is the system updated when a shipment is sent?
- How are back-orders handled?
- How are returns handled?
- What information is updated when a shipment is sent?
- What reports does the system produce?
- How are employee responsibilities divided among the various procedures?

Sample exception condition questions:

- What happens when items are not in stock for an order?
- How do you handle errors in the inventory system and physical counts?
- What happens when shipments are returned due to a bad address?
- What do you do about lost shipments? How are you notified?

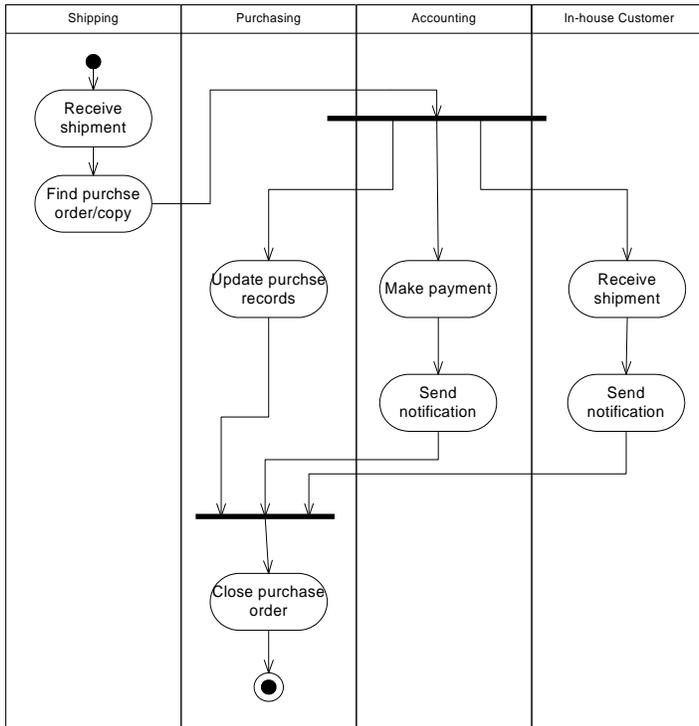
7. Develop an activity diagram based on the following narrative. Note any ambiguities or questions that you have as you develop the model. If you need to make assumptions, also note them.

The purchasing department handles purchase requests from other departments in the company. People in the company who initiate the original purchase request are the “customers” of the purchasing department. A case worker within the purchasing department receives the request and monitors it until it is ordered and received. Case workers process requests for the purchase of products under \$1,500, write a purchase order, and then send it to the approved vendor. Purchase requests over \$1,500 must first be sent out for bid from the vendor that supplies the product. When the bids return, the case worker selects one bid and then writes a purchase order and sends it to the vendor.



8. Develop an activity diagram based on the following narrative. Note any ambiguities or questions that you have as you develop the model. If you need to make assumptions, also note them.

The shipping department receives all shipments on outstanding purchase orders. When the clerk in the shipping department receives a shipment, he or she finds the outstanding purchase order for those items. The clerk then sends multiple copies of the shipment packing slip. One copy goes to Purchasing, and the department updates its records to indicate that the purchase order has been fulfilled. Another copy goes to Accounting so a payment can be made. A third copy goes to the requesting in-ouse customer so he or she can receive the shipment. After payment is made, the accounting department sends a notification to Purchasing. After the customer receives and accepts the goods, he or she sends notification to Purchasing. When Purchasing receives these other verifications, it closes the purchase order as fulfilled and paid.



9. Conduct a fact-finding interview with someone involved in a procedure that is used in a business or organization. This person could be someone at the university, in a small business in your neighborhood, in the student volunteer office at the university, in a doctor's or dentist's office, or in a volunteer organization. Identify a process that is done, such as keeping student records, customer records, or member records. Make a list of questions and then conduct the interview. Remember, your objective is to understand that procedure thoroughly (i.e., to become an expert on that single procedure).

Responses will vary. Answers should include both closed-ended questions and open-ended questions. Answers might also include some questions to address exception conditions. Answers to the questions can be written in text form or presented in an activity diagram.

10. Using RMO and the CSMS as your guide, develop a list of all the procedures that may need to be researched. You may want to think about the exercise in the context of your experience with such retailers as L.L. Bean, Lands' End, or Amazon.com. Check out the Internet marketing done on the retailers' Web sites and then think about the underlying business procedures that are required to support those sales activities. List the procedures and then describe your understanding of each.

Answers will vary, but a good set of procedures might include all of the use cases identified in Figure 3-11 of the next chapter. Figure 3-11 has five subsystems, each with several use cases.

Solutions to End-of-Chapter Cases

Case Study: Jacob and Jacob, Inc. On-Line Trading System

1. What is the best method for Edward to involve the brokers (users) in development of the new online trading system? Should he use a questionnaire? Should he interview the brokers in each of the company's 30 offices, or would one or two brokers representing the entire group be better? How can Edward ensure that the information about requirements is complete, yet not lose too much time doing so?

This situation is a viable candidate for a questionnaire. The users are dispersed and probably diverse. The questionnaire should focus on needs and preferences and can also help to establish which topics need further refinement.

It will probably cost too much to interview the brokers in all of the offices. One way to select offices is to develop a set of characteristics that distinguish the various offices, and then to select a representative office from each set of similar offices. If the answers to questions are very similar as interviews progress, it may be possible to abbreviate or shorten later visits to offices. If there is a wide variation between needs and procedures, then additional interviews can be scheduled.

2. Concerning customer input for the new system, how can Edward involve customers in the process? How can he interest them in participating? What are some ways that Edward can be sure that the customers he does involve are representative of Jacob and Jacob's entire customer group?

This may also be a viable candidate for a questionnaire. Statistically, sampling can guarantee that a large enough group can be studied, at least for the questionnaire. The questionnaire should focus on the types of services and reports (statements) that the customer receives from the system. If interviews are needed, some distinguishing characteristics should first be identified. Then, representative samples of customers could be interviewed. The cost of interviewing can also be controlled through the use of telephone interviews.

3. As Edward considers what other stakeholders he should include, what are some criteria he should use? Develop some guidelines to help him build a list of people to include.

Guidelines include:

- Look at all the existing reports and destinations. All of the destination persons will have an interest in the information provided by the system.
- Look at all the different departments in the company to see if they currently receive or need to receive information from the new system.
- Consider senior management to see if strategic information needs to be maintained and reported.

Running Cases: Community Board of Realtors

1. Who are the stakeholders for the issues related to real estate in your community, and what are their main interests?

Answers will vary. Usually for each state/county there are such organizations as:

- A Division of Real Estate for the state. Often in a state's department of commerce
- A state Association of Realtors
- A state Multiple Listing Service
- Local Realtor Boards and Associations
- Real Estate Offices and Agents

2. What types of information does the board collect and make available to its members and to the community?

Answers will vary.

- Real Estate Offices:
 - Collects information about offices
 - Collects information about agents and brokers
 - Provides search and display of offices, agents, and brokers with addresses
 - Provides services to real estate offices, such as advertising, training, banking information, lender information etc.
- Real Estate Listings:
 - Collects Information about property listings
 - Collects Information about sales of property
 - Provides search and display about listed properties
 - Provides maps of listed properties

3. Research the real estate industry in at least two countries other than the United States. For each of these countries, what are some of the cultural and legal issues that differ from those in the United States? If you were working on support for an international real estate cooperative system, in what ways would the information collection activity process be complicated?

Answers will vary.

Running Cases: The Spring Breaks 'R' Us Travel Service

1. Who are the stakeholders for SBRU? For each type of stakeholder, what aspects of the SBRU booking system are of particular interest?

- Students – Student booking, Social Networking, Accounting and Finance
- Resorts – Resort relations, Student Booking, Social Networking, Accounting and Finance

2. What are the main functional requirements for the major subsystem areas (i.e., resort relations, student booking, accounting and finance, and social networking)?

- ***Resort Relations:***
 - Sign up with SBRU (get an account)
 - Edit account information
 - Create/enter resort information for SBRU website
 - Post availability and prices of rooms/facilities
 - View/edit room availability
 - Retrieve completed reservations (View, report, or system interface)
 - Submit damage report
- ***Student Booking:***
 - Join SBRU/enter personal and financial information
 - View resort information and availability of rooms/facilities
 - Make a reservation (book a room/facility)
 - Make a payment for reservation
 - Cancel a reservation
- ***Accounting and Finance:***
 - Process student payments
 - Make refunds/correct payment errors
 - Process payouts to resorts
 - Edit/update/correct payouts
- ***Social Networking:***
 - Set personal privacy settings (viewable by friends only, resort users, resort employees, etc.)
 - Link up with “friends”
 - Chat with friends
 - Post comments on personal page
 - Upload pictures to personal page
 - Post comments on resort page
 - Upload pictures to resort page

3. Describe some usability requirements for students, booking interactions, and social networking interactions.

Students will be using all types of laptops, tablets (iPads), smartphones (iPhones) to make reservations, check status, and especially social networking. Displays must be adaptable for all these types of computing devices. Internet access will also be through ethernet, Wifi, and telephone access, with the varying speeds associated with each. Hence images and text should be combined judiciously.

4. Assuming that social networking at the resorts will require wireless communication and connection to the Internet, what are some reliability requirements that resorts might be asked to maintain? What are some performance requirements? Is this a bigger issue because resorts are in international locations?

Social networking capabilities can be provided two ways, either through SBRU's central servers or locally through the resort's server.

For smaller resorts using SBRU servers – provide high-bandwidth access to the Internet. Service level should be close to 100% availability with very wide bandwidth.

For those resorts with high usage of SBRU clients, they may want to provide local connectivity services. This would require the same support as the smaller resorts, but also allow local chatting and communication ability.

For international resorts sometimes there are problems of connectivity, bandwidth, and reliability. Resorts that want to join SBRU will require a minimum service level guarantee.

5. What are some security requirements? Is there any reason why students in Europe, Asia, or other locations could not book rooms through SBRU? What issues might be anticipated?

There are many security issues that must be addressed.

1. Resorts have accounts with resort availability, reservations, accounts, and payments. Different levels of security, data transmittal, and authorization is required. Resort information only requires protection from hacking and defacing. Reservations contain personal information and use HTTPS sites with TLS. Consideration should be given to encryption. Account and payment information most definitely requires TLS and encryption.

2. Student information is also personal and private. It will include payment and credit card information. All financial information requires TLS and encryption.

3. Social networking capabilities require protection of personal information and “friend” information. It

SBRU should be able to support students from throughout the world. However, supporting international students may require web pages to be translated into other languages. It will also require establishing relationships with international bank clearing houses to handle different

currency systems.

6. To collect information on functional requirements for the social networking subsystem, what are some techniques that might be used? Be specific and include some sample questions you might ask by using various techniques.

Assuming SBRU has an existing system, with existing student customers and desires to add social networking (thus an existing customer base does exist).

The social networking system should be heavily driven by student desires and requests. Some possible ways to determine the functional requirements are:

1. Review other social networking sites to see how they work.
2. Send out questionnaires to existing customers on the desirability and possible use of social networking.
3. On selected customers conduct telephone interviews to elaborate student desires.
4. After a social networking capability has been added, then use ongoing evaluation questionnaires to refine the usability and functional effectiveness of the system. (For example after a vacation give an incentive to collect student feedback on the resort, the booking system, and the social networking system)

Running Cases: On the Spot Courier Services

1. Who are the stakeholders for On the Spot? How involved should On the Spot's customers be in system definition? As the business grows, who else might be potential stakeholders and interested in system functions?

Stakeholders include:

- Bill Wiley – owner
- Customers, usually businesses
- Delivery persons
- Warehouse staff

Since Bill was the visionary for the business and the system, he will understand the needs of the system. However, since he is letting business customers use the system to schedule packages, it would be a good idea to form a focus group of users who would be willing to help in requirements definition.

Both the delivery persons and the warehouse staff will have suggestions on how to make their jobs easier. They should be involved in requirements definition.

Bill's accountant should be involved to ensure that the system has sufficient financial information and controls.

2. If you were commissioned to build a system for Bill, how would you determine the requirements? Be specific in your answer. Make a list of the questions you need answered.

Since this is a small start-up company, the work procedures are very probably not efficient and probably are not scaleable. Therefore, care should be taken not to build the system to only support these small scale work procedures.

Either of two approaches can be taken. If Bill has a good vision of how he wants his business to function as it expands and grows, then interviewing Bill is a good starting place. However, if Bill is still focusing on the current procedures, it may be a good idea to start by researching commercial solutions from vendors. The courier business is well established with many players and several commercial systems available. Researching commercial solutions can expand the vision and view of how On The Spot can provide expanded services. After researching commercial solutions, Bill should be interviewed to discuss the exact requirements for On The Spot.

Other stakeholders, as identified in Answer 1, should also be interviewed.

Kinds of questions that need answers.

- Services offered by On The Spot: Same-day delivery, Overnight delivery, Package pickup, sizes and rates
- Customers: Cash only customers, account customers, new customers, billing
- Scheduling of pickup: What is allowed, phone, web page, fax
- Payment: Cash only, on web page, monthly account

- Routes: How to organize, pickup and delivery, standard routes, ad hoc routes, multiple per day
- Warehouse: Windows of processing, equipment required, what information is tracked
- Package delivery: routes, tracking of packages,

3. What technology and communication requirements do you see? What are the hardware requirements, and what kind of equipment will provide viable options to the system? What would you recommend to Bill?

There appear to be four locations that will require interaction with the system.

1. Customer Web pages where customers can list packages for pickup and also make payment. Regular customers may also print out their own labels.
2. A work station where a clerk can handle phone requests for pickup.
3. The warehouse where sorting occurs and tracking information is entered.
4. The delivery trucks where pickups are noted, payments are accepted, labels are printed, deliveries are noted. These delivery trucks are mobile, and should have real time interaction with the home server.

Equipment to support these functions might be:

- A central server for the Web pages and for clerk entered pickup requests
- Warehouse equipment, such as scanners, to note tracking information.
- Mobile devices for the trucks. Probably tablet computers Internet access and with scanning wand. Also a mobile printer in the truck. (If rates are by size, then they can be measured. If rates are by weight, then set of scales is also needed.) The mobile devices will need Internet access to communicate with the home office. This can be provided either with cell phone technology and support, or with wide-area Wi-fi that is available in some cities. Cell phone access to the Internet is more widespread.

4. What are the primary functional requirements for the system as described so far in the case?

Functional requirements can be listed as use cases.

- Add/update a customer
- Request a pickup
- Pickup a package
- Deliver a package
- Enter package tracking information
- Track a package
- Sort packages by route
- Display a route (print, view) (list of pickups/deliveries)
- Update a route (add pickups or deliveries real time)
- Print monthly bills (print, electronic)
- Accept payment

Running Cases: Sandia Medical Devices

1. Who are RTGM's stakeholders? Should NMHS's patients be included in defining the system requirements? Why or why not? Should RTGM interact with medical professionals other than physicians? Why or why not?

Stakeholders include:

- Patients (users of the monitoring device and of the phone application)
- Doctors (users of the information transmitted)
- Other medical staff (those who enter patient medical information on phone app)
- Medical equipment engineers (developers of the mobile monitoring equipment)
- Technical staff (developers of the central server system, and the database)
- Project team members (developers of the phone app)

Patients should be included in defining system requirements for those areas that impact their use. This would include the medical device (comfort, wearability, maintenance), and the phone app (installing, executing, user interface screen).

Other medical professionals other than physicians may need to be involved. This would include medical staff that are involved in the design of the device (is it sensitive enough to read glucose levels, etc.). Other medical professionals may want to research results for medical studies. As such they will dictate what data should be captured.

2. If you were the lead analyst for RTGM, how would you determine the requirements? Be specific in your answer. List several questions you need answered.

Assuming we are limiting the fact finding and requirements definition to the smartphone app.

Questions for the medical equipment engineers would include: What are the specifications for the device – range, transmit parameters, data formats, occurrence of transmittal, ranges of values for normal, abnormal, and dangerous? What “test” capabilities does it have and how is it enabled?

Questions for the patient would be about the user interface for the phone app – how readable, how understandable, signalling for normal and abnormal conditions, message format? How usable are the screens for entering data, reading information, “testing” the equipment?

Questions for the medical professionals include information about the data formats to be sent, how often data should be sent, how to notify the system about abnormal, emergency situations, what other patient information needs to be captured?

3. What are the primary functional requirements for the system as described so far in the case?

- Enter user (patient) information
- Test monitoring device
- Receive monitor-device data
- Send monitoring data to server
- Receive data from server
- Alert patient (user) of abnormal situation

4. Are the parameters for alerting patients and medical personnel the same for every patient? Can they vary over time for the same patient? What are the implications for the system's functional requirements?

The case does not describe medical parameter variation by patient, but it may be assumed that depending on severity of illness, or weight of the patient, or sex may impact the acceptable and dangerous levels. Hence entering patient may need to be done by trained medical personnel, or it needs to be accessed from the central server.

The case does not address if alerts can change over time. But assuming that severity of illness will cause the parameters to change, patient information should be updated as appropriate.

The functional requirements may need to change to maintain or access from the server, history information to automatically update alert levels.

5. Briefly describe some possible nonfunctional requirements for RTGM.

Usability – Patients may be completely non-technical, may also be ill, may be disabled. Usability needs to be assessed very carefully.

Reliability – Both the monitoring device and the phone app must be error free. In addition, some type of fail safe capability should be built in. For example if the monitoring device fails to communicate, the phone app should sound an alert. The phone app should have a “normal operation” icon showing at all times (maybe a green light).

Performance – Probably not a problem for the phone app. Performance, e.g. throughput will need to be evaluated for the central server and the telephone connectivity.

Security – all medical information must conform to HIPAA requirements. Transmittal of data over phone lines should be encrypted. Care should taken so that multiple devices that are located near to each other do not interfere.

The “+” requirements should also be address. How easy is it to install the phone app? How much memory does it require? What kinds of devices is it compatible with? How does it interface with the server application?