

Software Engineering Project Report



A Sample Document for Generating Consistent Professional Reports

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at the
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How to Use This Document

This document is intended as a sample template that can be copied and edited to suit a particular software engineering project. It was assembled from a combination of documents [1], [2], and [3].

Styles

This document was written in Microsoft Word, and makes heavy use of styles. The styles dialog is initially located on the menu bar under the “Home” tab in MS Word. It is recommended that the styles dialog be pulled off into a separate window when working on formatting of the document. If each paragraph is assigned a style, then modifying that particular style will affect all paragraphs in the document having the same style.

The table of contents uses the document headings and sub-headings to automatically generate table of contents information.

Tracking Changes and Multiple Authors

The “Review” tab in MS Word contains several tools that are of particular use when editing large documents, particularly when multiple authors are involved:

The “Tracking” section allows you to track the (proposed) changes to a document, and to step through each proposed change to either accept or reject the proposed changes.

The “Compare” section allows you to merge changes proposed by different authors, (which will be marked in separate colors for identification), and then to use the change tracking tools described above to accept or deny each change.

The recommended procedure is to start with each author having a copy of a base document, (possibly this template.) Then each author changes the section(s) they are responsible for, and submits their changed version to one person who acts as the overall document editor. This author merges the changes, selectively accepts or rejects each change, and then distributes a new base document to all authors for the next round of changes. It is also possible to merge the changes and then distribute the document, so that all authors can review the proposed changes. (The latter approach may be appropriate for documents such as bylaws, in which the changes must be approved by a committee or a vote before they can be accepted.)

Dealing With Material that is Unwanted (Right Now)

Much of this document includes material that is not needed for every project, and/or which may not have been written yet, and so should be removed before printing or distributing the document. There are several ways to do this, however each has their drawbacks:

1. Delete the material completely. The drawback is that now it is completely gone, and the only way to get it back is to copy it from some other document, if that is even available.
2. Change the font to "Hidden". The drawback is that this does not affect the numbering of sections, either in the text or in the table of contents. However the original style information is retained, so when the text is unhidden, individual paragraphs do not need to be restyled.
3. Change the style to "Hidden". This does cause the document to renumber properly, (because the paragraphs are no longer numbered paragraphs), but all the original style information is gone, so if it is unhidden later, then all the styles of all the unhidden paragraphs will have to be restored manually.
4. Move the text, say to the end of the document, and then do not print or distribute the material at the end of the document. If this is all that is done, then this material will continue to appear in the table of contents. However if the font is also changed to "hidden", then the material will not appear in the TOC, but all the original style information will be retained. The drawback to moving the text is that now you need to keep track of where the information was moved from, in case you ever want to move it back.

Hidden text can be made visible by selecting the backwards "P" paragraph mark on the "Home" tab.

Table of Contents

The table of contents lists the sections of the document and the page upon which each section starts. The table of contents may or may not include subsections, etc.

Microsoft Word (and many similar programs) has the ability to generate a table of contents automatically from section headings, and to update it when the document changes. The table of contents included in this template is automatically generated by MS Word, and can be updated by selecting the table and clicking on the menu that appears above the table at that time.

Note: Remove all instructional materials before finalizing and submitting this document, including this entire page and the one before it.

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List of Figures

(The title above is formatted as Heading 3, so that it appears in the table of contents, but was then modified to be centered and include a page break before the paragraph. Likewise for the List of Tables heading on the next page..) **Note: Remove this instructional paragraph.**

If a document contains a large number of figures, then it is appropriate to include a list of figures at the beginning of the document, following the table of contents. Each figure should include a title, and be numbered in a consistent logical fashion. The following list of figures was automatically generated from figure captions (see Figure 1 on page 11), and can be automatically updated by right-clicking on the table below and selecting “Update Field”. This feature is located in the “Captions” section of the “References” tab in MS Word. **Note: Remove this instructional paragraph.**

Figure 1 - Sample Image of a Survey Dive Boat 11

On a related note, the references in the paragraph above, “(see Figure 1 on page 11)” include cross-references to the Figure and page number that will adjust automatically when other Figures or pages are added or removed. This is done with the “cross-reference” button in the “Captions” section of the “References” tab in MS Word. **Note: Remove this instructional paragraph.**

List of Tables

If a document contains a large number of tables, then it is appropriate to include a list of tables at the beginning of the document, following the table of contents. Each table should include a title, and be numbered in a consistent logical fashion. The following list of tables was automatically generated from table captions (see below), and can be automatically updated by right-clicking on the table below and selecting “Update Field”. This feature is located in the “Captions” section of the “References” tab in MS Word. **Note: Remove this instructional paragraph.**

| | |
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|-----------------------------------------------------|----|

The following sample table and figure are only here to initialize the list of figures and list of tables above. They should be removed when real ones are included in the document. (I.e. delete this entire page when you can.)

| Date | Participants | Activities | Notes |
|------|--------------|------------|-------|
| | | | |
| | | | |
| | | | |

Table 1- Sample Table of Survey Dive Activity



**Figure 1 - Sample Image of a Survey Dive Boat
(photo by Tony Kiefer)**

I Project Description

1 Project Overview

A brief description of the product to be produced, before getting into details.

2 The Purpose of the Project

2a The User Business or Background of the Project Effort

Content

content, motivation, examples and Considerations

A short description of the business being done, its context, and the situation that triggered the development effort. It should also describe the work that the user intends to do with the delivered product.

Motivation

Without this statement, the project lacks justification and direction.

Considerations

You should consider whether the user problem is serious, and whether and why it needs to be solved.

2b Goals of the Project

(Note: This item and the following one together cover the " Objectives and success criteria of the project" item specified by Bruegge & DuToit.)

Content

This boils down to one sentence, or at most a few sentences, that say why we want this product. Here is where you state the real reason the product is being developed.

Motivation

There is a danger that this purpose may get lost along the way. As the development effort heats up, and as the customer and developers discover more about what is possible, the system could potentially wander away from the original goals as it undergoes construction. This is a bad thing unless there is some deliberate act by the client to change the goals. It may be necessary to appoint a person to be custodian of the goals, but it is probably sufficient to make the goals public and periodically remind the developers of them. *It should be mandatory to acknowledge the goals at every review session.*

Examples

We want to give immediate and complete response to customers who order our goods over the telephone.

We want to be able to forecast the weather.

2c Measurement

Any reasonable goal must be measurable. This is necessary if you are ever to test whether you have succeeded with the project. The measurement must quantify the *advantage* gained by the business through doing the project. If the project is worthwhile, there must be some solid business reason for doing it. For example, if the goal of the project is

We want to give immediate and complete response to customers who order our goods over the telephone.

you have to ask what advantage that goal brings to the organization. If immediate response will result in more satisfied customers, then the measurement must quantify that satisfaction. For example, you could measure the increase in repeat business (on the basis that a happy customer comes back for more), the increase in customer approval ratings from surveys, the increase in revenue from returning customers, and so on.

It is crucial to the rest of the development effort that the goal is firmly established, is reasonable, and is measured. It is usually the latter that makes the former possible.

3 The Scope of the Work

This section describes the (business) environment in which the product will be used.

3a The Current Situation

Content

This is an analysis of the existing business processes, including the manual and automated processes that might be replaced or changed by the new product. Business analysts might already have done this investigation as part of the business case analysis for the project.

Motivation

If your project intends to make changes to an existing manual or automated system, you need to understand the effect of proposed changes. The study of the current situation provides the basis for understanding the effects of proposed changes and choosing the best alternatives. Knowing what users are doing now can give insight into their views of a proposed new system.

3b The Context of the Work

Content

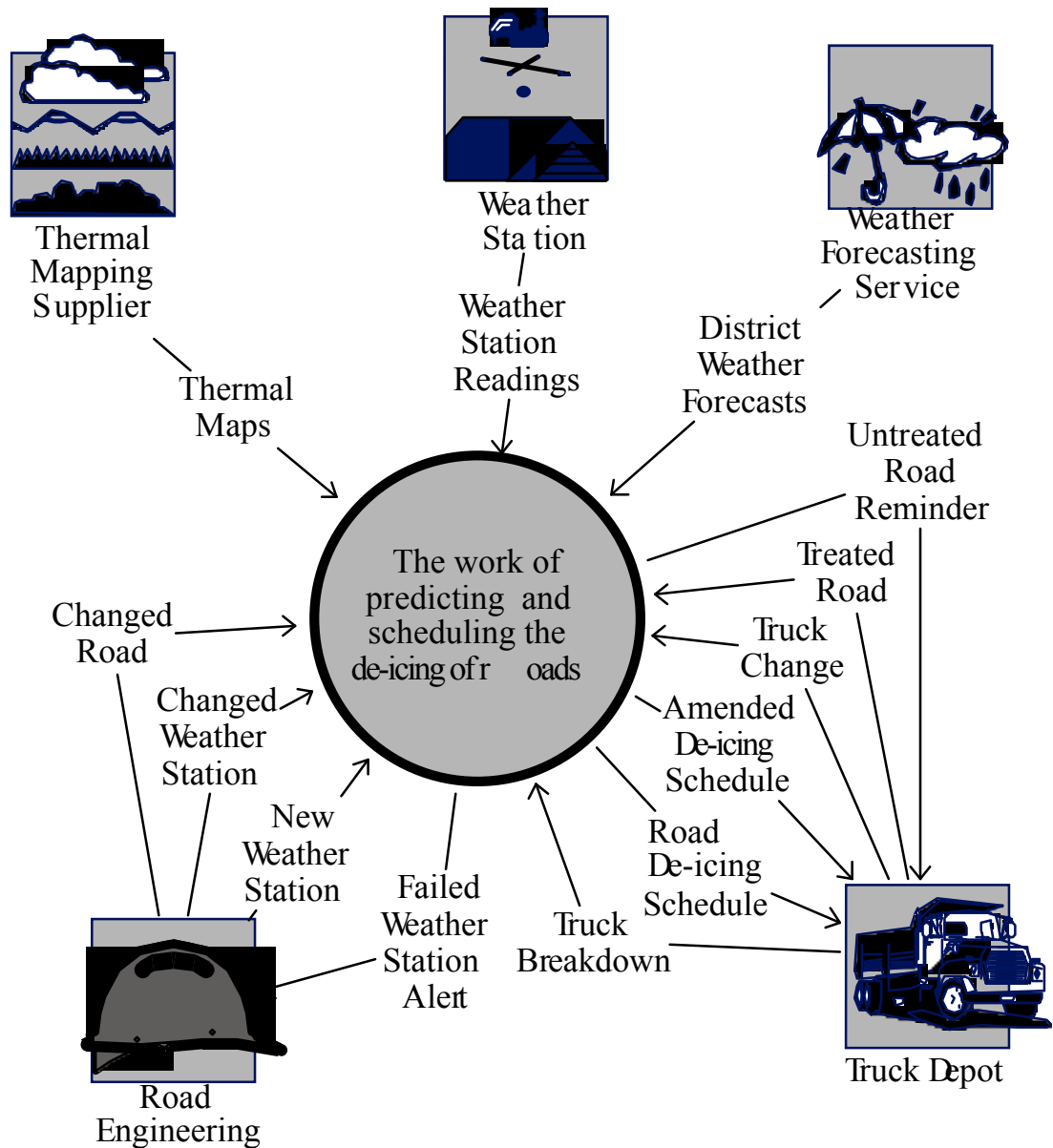
The work context diagram identifies the work that you need to investigate to be able to build the product. Note that it includes more than the intended product. Unless we understand the work that the product will support, we have little chance of building a product that will fit cleanly into its environment.

The adjacent systems on the context diagram (e.g., Weather Forecasting Service) indicate other subject matter domains (systems, people, and organizations) that need to be understood. The interfaces between the adjacent systems and the work context indicate why we are interested in the adjacent system. In the case of Weather Forecasting Service, we can say that we are interested in the details of when, how, where, who, what, and why it produces the District Weather Forecasts information.

Motivation

To clearly define the boundaries for the study of the work and requirements effort. Without this definition, we have little chance of building a product that will fit seamlessly into its environment.

Examples



Considerations

The names used on the context diagram should be consistent with the naming conventions and data dictionary definitions presented in section 5. Without these definitions, the context model lacks the required rigor, and it may be misunderstood. Relevant stakeholders must agree to the definitions of the interfaces shown on the context model.

3c Work Partitioning

Note: Volere talks of dividing up the work according to the different *business events* to which the business must respond. However each response to a business event is effectively a use-case, so Volere's list of business events is effectively the same as a use-case diagram and a descriptive list of the associated use-cases.

Content

A list showing all business events to which the work responds. Business events are happenings in the real world that affect the work. They also happen because it is time for the work to do something—for example, produce weekly reports, remind nonpaying customers, check the status of a device, and so on. The response to each event is called a business use case; it represents a discrete partition of work that contributes to the total functionality of the work.

The event list includes the following elements:

- Event name
- Input from adjacent systems (identical with name on context diagram)
- Output to adjacent systems (identical with name on context diagram)
- Brief summary of the business use case (This is optional, but we have found it is a very useful first step in defining the requirements for the business use case—you can think of it as a mini-scenario.)

Motivation

To identify logical chunks of the system that can be used as the basis for discovering detailed requirements. These business events also provide the subsystems that can be used as the basis for managing detailed analysis and design.

Example

Business Event List

| Event Name | Input and Output | Summary |
|--------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1. Weather Station transmits reading | Weather Station Readings (in) | Record the readings as belonging to the weather station. |
| 2. Weather Service forecasts weather | District Weather Forecast (in) | Record the forecast. |
| 3. Road engineers advise changed roads | Changed Road (in) | Record the new or changed road. Check that all appropriate weather stations are attached. |
| 4. Road Engineering installs new Weather Station | New Weather Station (in) | Record the weather station and attach it to the appropriate roads. |
| 5. Road Engineering changes Weather Station | Changed Weather Station (in) | Record the changes to the weather station. |
| 6. Time to test Weather Stations | Failed Weather Station Alert (out) | Determine if any weather stations have not transmitted for two hours, and inform Road Engineering of any failures. |
| 7. Truck Depot changes a truck | Truck Change (in) | Record the changes to the truck. |
| 8. Time to detect icy roads | Road De-icing Schedule (out) | Predict the ice situation for the next two hours. Assign a truck to any roads that will freeze. Issue the schedule. |
| 9. Truck treats a road | Treated Road (in) | Record the road as being in a safe condition for the next three hours. |
| 10. Truck Depot reports problem with truck | Truck Breakdown (in) Amended Gritting Schedule (out) | Reassign available trucks to the previously assigned roads. |
| 11. Time to monitor road treatment | Untreated Road Reminder (out) | Check that all scheduled roads have been treated in the assigned time, and issue reminders for any untreated roads. |

Considerations

Attempting to list the business events is a way of testing the work context. This activity uncovers uncertainties and misunderstandings about the project and facilitates

precise communications. When you do an event analysis, it will usually prompt you to make some changes to your work context diagram.

We suggest you gather requirements for discrete sections of the work. This requires you to partition the work, and we have found business events to be the most convenient, consistent, and natural way to break the work into manageable units.

3d Competing Products

Content

Other alternatives that already exist can be described here. Why should we go to all the trouble of creating a new product? What flaws or deficiencies do the existing products have that justify the creation of something new?

Motivation

Knowing what other choices the customer has to choose from can help us judge whether or not our project is even worth doing, and if so, what we need to do different to be better than the available alternatives.

Considerations

Note the subtle difference between this item and the “Off the Shelf” solutions documented in sections 6d or 35 below. The latter refers to software that we can buy and incorporate into our solution.

4 Product Scenarios

Scenarios are somewhat informal stories describing how the end users would use the product once it is completed. They take the form of narratives and may involve specific individuals and examples.

4a Product Scenario List

The product scenario list is quite simply a list of the product scenarios that will appear in the next section. It is a good idea to either number or name each scenario for later reference, and it can also be a good idea to organize the list so that related scenarios appear together. (Depending on the naming / numbering scheme, they can be grouped into sections and subsections, etc.)

4b Individual Product Scenarios

Product scenarios are written in a natural narrative fashion, easily understood by clients and other non-technical stakeholders. Each one tells a story of how the end users are expected to eventually use the finished product. For example:

Monthly Reports: At the end of every month Mary has to generate the monthly reports, and distribute copies to all the managers and sub-managers. The first

thing she has to do is to make sure that all the end-of-the-month tests have been run, and that everyone else is logged off of the system. Then she selects the date range and the specific information she wants included in her reports, selects either the long or short format, and selects a printer. Depending on how busy the month has been, it may take as long as fifteen minutes, during which time no one else can use the system. She only prints one copy on the computer, and then makes all the rest of the copies she needs on the copy machine.

5 Stakeholders

5a The Client

Content

This item gives the name of the client. It is permissible to have several names, but having more than three negates the point.

Motivation

The client has the final say on acceptance of the product, and thus must be satisfied with the product as delivered. You can think of the client as the person who makes the investment in the product. Where the product is being developed for in-house consumption, the roles of the client and the customer are often filled by the same person. If you cannot find a name for your client, then perhaps you should not be building the product.

Considerations

Sometimes, when building a package or a product for external users, the client is the marketing department. In this case, a person from the marketing department must be named as the client.

5b The Customer

Content

The person intended to buy the product. In the case of in-house development, the client and the customer are often the same person. In the case of development of a mass-market product, this section contains a description of the kind of person who is likely to buy the product.

Motivation

The customer is ultimately responsible for deciding whether to buy the product from the client. The correct requirements can be gathered only if you understand the customer and his aspirations when it comes to using your product.

5c Hands-On Users of the Product

Content

A list of a special type of stakeholder—the potential users of the product. For each category of user, provide the following information:

- User name/category: Most likely the name of a user group, such as schoolchildren, road engineers, or project managers.
- User role: Summarizes the users' responsibilities.
- Subject matter experience: Summarizes the users' knowledge of the business. Rate as novice, journeyman, or master.
- Technological experience: Describes the users' experience with relevant technology. Rate as novice, journeyman, or master.
- Other user characteristics: Describe any characteristics of the users that have an effect on the requirements and eventual design of the product. For example:

Physical abilities/disabilities

Intellectual abilities/disabilities

Attitude toward job

Attitude toward technology

Education

Linguistic skills

Age group

Gender

Motivation

Users are human beings who interface with the product in some way. Use the characteristics of the users to define the usability requirements for the product. Users are also known as actors.

Examples

Users can come from wide variety of (sometimes unexpected) sources. Consider the possibility of your users being clerical staff, shop workers, managers, highly trained operators, the general public, casual users, passers-by, illiterate people, tradesmen, students, test engineers, foreigners, children, lawyers, remote users, people using the system over the telephone or an Internet connection, emergency workers, and so on.

5d Priorities Assigned to Users

Content

Attach a priority to each category of user. This gives the importance and precedence of the user. Prioritize the users as follows:

- Key users: They are critical to the continued success of the product. Give greater importance to requirements generated by this category of user.
- Secondary users: They will use the product, but their opinion of it has no effect on its long-term success. Where there is a conflict between secondary users' requirements and those of key users, the key users take precedence.
- Unimportant users: This category of user is given the lowest priority. It includes infrequent, unauthorized, and unskilled users, as well as people who misuse the product.

The percentage of the type of user is intended to assess the amount of consideration given to each category of user.

Motivation

If some users are considered to be more important to the product or to the organization, then this preference should be stated because it should affect the way that you design the product. For instance, you need to know if there is a large customer group who has specifically asked for the product, and for which, if they do not get what they want, the results could be a significant loss of business.

Some users may be listed as having no impact on the product. These users will make use of the product, but have no vested interest in it. In other words, these users will not complain, nor will they contribute. Any special requirements from these users will have a lower design priority.

5e User Participation

Content

Where appropriate, attach to the category of user a statement of the participation that you think will be necessary for those users to provide the requirements. Describe the contribution that you expect these users to provide—for example, business knowledge, interface prototyping, or usability requirements. If possible, assess the minimum amount of time that these users must spend for you to be able to determine the complete requirements.

Motivation

Many projects fail through lack of user participation, sometimes because the required degree of participation was not made clear. When people have to make a choice

between getting their everyday work done and working on a new project, the everyday work usually takes priority. This requirement makes it clear, from the outset, that specified user resources must be allocated to the project.

5f Maintenance Users and Service Technicians

Content

Maintenance users are a special type of hands-on users who have requirements that are specific to maintaining and changing the product.

Motivation

Many of these requirements will be discovered by considering the various types of maintenance requirements detailed in section 14. However, if we define the characteristics of the people who maintain the product, it will help to trigger requirements that might otherwise be missed.

5g Other Stakeholders

Content

The roles and (if possible) names of other people and organizations who are affected by the product, or whose input is needed to build the product.

Examples of stakeholders:

- Sponsor
- Testers
- Business analysts
- Technology experts
- System designers
- Marketing experts
- Legal experts
- Domain experts
- Usability experts
- Representatives of external associations

For a complete checklist, download the stakeholder analysis template at www.volere.co.uk.

For each type of stakeholder, provide the following information:

- Stakeholder identification (some combination of role/job title, person name, and organization name)
- Knowledge needed by the project
- The degree of involvement necessary for that stakeholder/knowledge combination
- The degree of influence for that stakeholder/knowledge combination
- Agreement on how to address conflicts between stakeholders who have an interest in the same knowledge

Motivation

Failure to recognize stakeholders results in missing requirements.

6 Mandated Constraints

This section describes constraints on the eventual design of the product. They are the same as other requirements except that constraints are mandated, usually at the beginning of the project. Constraints have a description, rationale, and fit criterion, and generally are written in the same format as functional and nonfunctional requirements.

6a Solution Constraints

Content

This specifies constraints on the way that the problem must be solved. Describe the mandated technology or solution. Include any appropriate version numbers. You should also explain the reason for using the technology.

Motivation

To identify constraints that guide the final product. Your client, customer, or user may have design preferences, or only certain solutions may be acceptable. If these constraints are not met, your solution is not acceptable.

Examples

Constraints are written using the same form as other atomic requirements (refer to the requirements shell for the attributes). It is important for each constraint to have a rationale and a fit criterion, as they help to expose false constraints (solutions

masquerading as constraints). Also, you will usually find that a constraint affects the entire product rather than one or more product use cases.

Description: The product shall use the current two-way radio system to communicate with the drivers in their trucks.

Rationale: The client will not pay for a new radio system, nor are any other means of communication available to the drivers.

Fit criterion: All signals generated by the product shall be audible and understandable by all drivers via their two-way radio system.

Description: The product shall operate using Windows XP.

Rationale: The client uses XP and does not wish to change.

Fit criterion: The product shall be approved as XP compliant by the MS testing group.

Description: The product shall be a hand-held device.

Rationale: The product is to be marketed to hikers and mountain climbers.

Fit criterion: The product shall weigh no more than 300 grams, no dimension shall be more than 15 centimeters, and there shall be no external power source.

Considerations

We want to define the boundaries within which we can solve the problem. Be careful, because anyone who has experience with or exposure to a piece of technology tends to see requirements in terms of that technology. This tendency leads people to impose solution constraints for the wrong reason, making it very easy for false constraints to creep into a specification. The solution constraints should only be those that are absolutely non-negotiable. In other words, however you solve this problem, you must use this particular technology. Any other solution would be unacceptable.

6b Implementation Environment of the Current System

Content

This describes the technological and physical environment in which the product is to be installed. It includes automated, mechanical, organizational, and other devices, along with the nonhuman adjacent systems.

Motivation

To describe the technological environment into which the product must fit. The environment places design constraints on the product. This part of the specification provides enough information about the environment for the designers to make the product successfully interact with its surrounding technology.

The operational requirements are derived from this description.

Examples

Examples can be shown as a diagram, with some kind of icon to represent each separate device or person (processor). Draw arrows to identify the interfaces between the processors, and annotate them with their form and content.

Considerations

All component parts of the current system, regardless of their type, should be included in the description of the implementation environment.

If the product is to affect, or be important to, the current organization, then include an organization chart.

6c Partner or Collaborative Applications

Content

This describes applications that are not part of the product but with which the product will collaborate. They can be external applications, commercial packages, or preexisting in-house applications.

Motivation

To provide information about design constraints caused by using partner applications. By describing or modeling these partner applications, you discover and highlight potential problems of integration.

Examples

This section can be completed by including written descriptions, models, or references to other specifications. The descriptions must include a full specification of all interfaces that have an effect on the product.

Considerations

Examine the work context model to determine whether any of the adjacent systems should be treated as partner applications. It might also be necessary to examine some of the details of the work to discover relevant partner applications.

6d Off-the-Shelf Software

Content

This describes commercial, open source, or any other off-the-shelf software (OTS) that must be used to implement some of the requirements for the product. It could also apply to nonsoftware OTS components such as hardware or any other commercial product that is intended as part of the solution.

Motivation

To identify and describe existing commercial, free, open source, or other products to be incorporated into the eventual product. The characteristics, behavior, and interfaces of the package are design constraints.

Examples

This section can be completed by including written descriptions, models, or references to supplier's specifications.

Considerations

When gathering requirements, you may discover requirements that conflict with the behavior and characteristics of the OTS software. Keep in mind that the use of OTS software was mandated before the full extent of the requirements became known. In light of your discoveries, you must consider whether the OTS product is a viable choice. If the use of the OTS software is not negotiable, then the conflicting requirements must be discarded.

Note that your strategy for discovering requirements is affected by the decision to use OTS software. In this situation you investigate the work context in parallel with making comparisons with the capabilities of the OTS product. Depending on the comprehensibility of the OTS software, you might be able to discover the matches or mismatches without having to write each of the business requirements in atomic detail. The mismatches are the requirements that you will need to specify so that you can decide whether to satisfy them by either modifying the OTS software or modifying the business requirements.

Given the spate of lawsuits in the software arena, you should consider whether any legal implications might arise from your use of OTS. You can cover this in the section on Legal Requirements.

Note the subtle difference between this section and section 35 below. This section documents OTS solutions that **must be** included in the final solution, and the latter offers suggestions for OTS that could be included.

6e Anticipated Workplace Environment

Content

This describes the workplace in which the users are to work and use the product. It should describe any features of the workplace that could have an effect on the design of the product, and the social and culture of the workplace.

Motivation

To identify characteristics of the workplace so that the product is designed to compensate for any difficulties.

Examples

The printer is a considerable distance from the user's desk. This constraint suggests that printed output should be deemphasized.

The workplace is noisy, so audible signals might not work.

The workplace is outside, so the product must be weather resistant, have displays that are visible in sunlight, and allow for the effect of wind on any paper output.

The product is to be used in a library; it must be extra quiet.

The product is a photocopier to be used by an environmentally conscious organization; it must work with recycled paper.

The user will be standing up or working in positions where he must hold the product. This suggests a hand-held product, but only a careful study of the users' work and workplace will provide the necessary input to identifying the operational requirements.

Considerations

The physical work environment constrains the way that work is done. The product should overcome whatever difficulties exist; however, you might consider a redesign of the workplace as an alternative to having the product compensate for it.

6f Schedule Constraints

Content

Any known deadlines, or windows of opportunity, should be stated here.

Motivation

To identify critical times and dates that have an effect on product requirements. If the deadline is short, then the requirements must be kept to whatever can be built within the time allowed.

Examples

To meet scheduled software releases.

There may be other parts of the business or other software products that are dependent on this product.

Windows of marketing opportunity.

Scheduled changes to the business that will use your product. For example, the organization may be starting up a new factory and your product is needed before production can commence.

Considerations

State deadline limitations by giving the date and describing why it is critical. Also, identify prior dates where parts of your product need to be available for testing.

You should also ask questions about the impact of not meeting the deadline:

- What happens if we don't build the product by the end of the calendar year?
- What is the financial impact of not having the product by the beginning of the Christmas buying season?

6g Budget Constraints

Content

The budget for the project, expressed in money or available resources.

Motivation

The requirements must not exceed the budget. This limitation may constrain the number of requirements that can be included in the product.

The intention of this question is to determine whether the product is really wanted.

Considerations

Is it realistic to build a product within this budget? If the answer to this question is no, then either the client is not really committed to building the product or the client does not place enough value on the product. In either case you should consider whether it is worthwhile continuing.

7 Naming Conventions and Definitions

7a Definitions of Key Terms

All Terms, Including Acronyms and Abbreviations, Used in the Project must be defined at some point. List the most important ones here, and refer the reader to the glossary on page 77 for a complete list. (Note: that page number is a cross-reference, and will automatically be updated whenever the glossary moves.)

Content

A glossary containing the meanings of all names, acronyms, and abbreviations used within the requirements specification. Select names carefully to avoid giving a different, unintended meaning.

This glossary reflects the terminology in current use within the work area. You might also build on the standard names used within your industry.

For each term, write a succinct definition. The appropriate stakeholders must agree on this definition.

Avoid abbreviations, as they introduce ambiguity, require additional translations, and could potentially lead to misinterpretation in the mind of anyone who is trying to understand your requirements. Ask your requirements analysts to replace all abbreviations with the correct term. This is easily done with word processors.

Acronyms are acceptable if they are completely explained by a definition.

Motivation

Names are very important. They invoke meanings that, if carefully defined, can save hours of explanations. Attention to names at this stage of the project helps to highlight misunderstandings.

The glossary produced during requirements is used and extended throughout the project.

Examples

Truck: A vehicle used for spreading de-icing material on roads. “Truck” is not used to refer to goods-carrying vehicles.

BIS: Business Intelligence Service. The department run by Steven Peters to supply business intelligence for the rest of the organization.

Considerations

Make use of existing references and data dictionaries. Obviously, it is best to avoid renaming existing items unless they are so ambiguous that they cause confusion.

From the beginning of the project, emphasize the need to avoid homonyms and synonyms. Explain how they increase the cost of the project.

7b UML and Other Notation Used in This Document

Content

This section should describe the specific meaning of any symbols, punctuation, subscripts, superscripts, etc. used commonly throughout the document. If following published or common standards, then it is acceptable to reference those standards, and list any exceptions.

Motivation

If the distinction between a hollow arrow and a solid arrow is significant, for example, then everyone must know exactly what the distinctions and meanings are.

Considerations

If a particular notation is only used in one place, say on a single diagram or in a single section, then it may be more appropriate to document it in that specific location.

Example

This document generally follows the Version 2.0 OMG UML standard, as described by Fowler in [4]. Any exceptions are noted where used.

7c Data Dictionary for Any Included Models

Content

Dictionary definitions of all information flows and stores used in models. Particular consideration should be given to defining the data attributes of all flows shown the context models (see sections 7 and 8).

This section should also contain any technical specifications for interfaces shown on the context models.

Motivation

The context diagram provides an accurate definition of the scope of the work being studied or the scope of the product to be built. This definition can be completely accurate only if the information flows bordering the scope have their attributes defined.

Examples

Road de-icing schedule = issue number + {road section identifier + treatment start time + critical start time + truck identifier} + depot identifier

As you progress through the requirements specification, define each of the elementary terms in detail.

Considerations

The dictionary provides a link between the requirements analysts and the implementers. The implementers add implementation details to the terms in the dictionary, defining how the data will be implemented. Also, implementers add terms that are present because of the chosen technology and that are independent of the business requirements.

8 Relevant Facts and Assumptions

8a Facts

Content

Factors that have an effect on the product, but are not mandated requirements constraints. They could be business rules, organizational systems, or any other activities that have an effect on this product. Facts are things you want the reader of the specification to know.

Motivation

Relevant facts provide background information to the specification readers, and might contribute to requirements. They will have an effect on the eventual design of the product.

Examples

One ton of de-icing material will treat three miles of single-lane roadway.

The existing application is 10,000 lines of C code.

8b Assumptions

Content

A list of the assumptions that the developers are making. These assumptions might be about the intended operational environment, but can be about anything that has an effect on the product. As part of managing expectations, assumptions also contain statements about what the product will *not* do.

Motivation

To make people declare the assumptions that they are making. Also, to make everyone on the project aware of assumptions that have already been made.

Examples

Assumptions about new laws or political decisions.

Assumptions about what your developers expect to be ready in time for them to use—for example, other parts of your products, the completion of other projects, software tools, or software components.

Assumptions about the technological environment in which the product will operate. These assumptions should highlight areas of expected compatibility.

The software components that will be available to the developers.

Other products being developed at the same time as this one.

The availability and capability of bought-in components.

Dependencies on computer systems or people external to this project

The requirements that will specifically *not* be carried out by the product.

Considerations

We often make unconscious assumptions. It is necessary to talk to the members of the project team to discover any unconscious assumptions that they have made. Ask stakeholders (both technical and business-related) questions such as these:

- What software tools are you expecting to be available?
- Will there be any new software products?
- Are you expecting to use a current product in a new way?
- Are there any business changes you are assuming we will be able to deal with?

It is important to state these assumptions up front. You might also consider the probability of whether the assumption is correct and, where relevant, a list of alternatives if something that is assumed does not happen.

The assumptions are intended to be transient. That is, they should all be cleared by the time the specification is released—the assumption should have become either a requirement or a constraint. For example, if the assumption related to the capability of a product that is intended to be a partner product to yours, then the capability should have been proven satisfactory, and it becomes a constraint to use it. Conversely, if the bought-in product is not suitable, then it becomes a requirement for the project team to construct the needed capability.

II Requirements

9 Product Use Cases

This section begins to describe in more specific and precise detail exactly what steps the system takes in the course of its performance. Use cases serve not only to more specifically define the system (and its boundaries), but also to identify functional requirements, to identify initial objects / classes, and to organize the work.

9a Use Case Diagrams

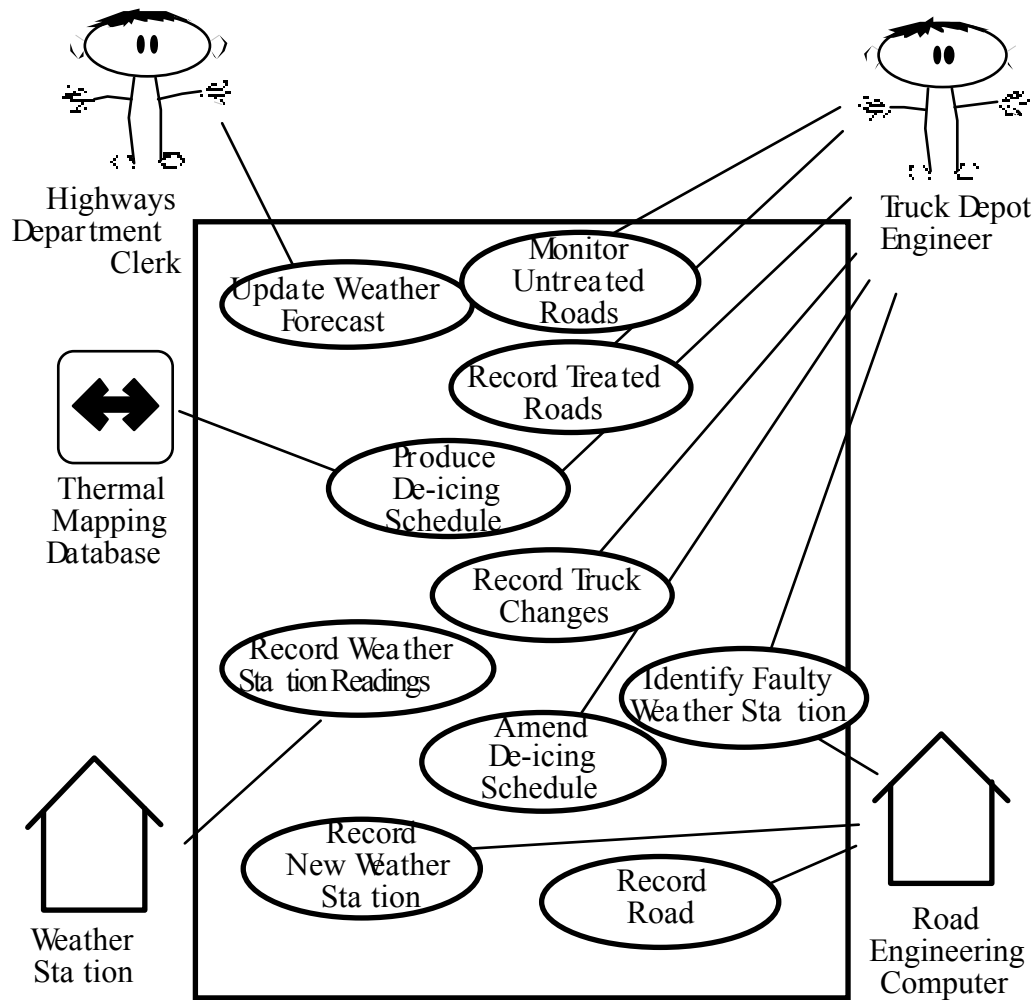
Use Case diagrams serve two purposes: As a form of graphical table of contents listing the individual use-cases, and also to define the boundary of what is included as part of the proposed system and what is not included.

A use case diagram identifies the boundaries between the users (actors) and the product. You arrive at the product boundary by inspecting each business use case and determining, in conjunction with the appropriate stakeholders, which part of the business use case should be automated (or satisfied by some sort of product) and what part should be done by the user. This task must take into account the abilities of the actors (section 3), the constraints (section 4), the goals of the project (section 1), and your knowledge of both the work and the technology that can make the best contribution to the work.

The use case diagram shows the actors outside the product boundary (the rectangle). The product use cases are the ellipses inside the boundary. The lines denote usage. Note that actors can be either automated or human.

Depending on the complexity of the product it may be necessary to use more than one diagram to list all of the use cases. When more than one diagram is required the use-cases can be divided up several ways: Normal operations versus exceptional cases, or daily tasks versus monthly tasks, or user tasks versus administration tasks, etc.

Example



Derive the product use cases by deciding where the product boundary should be for each business use case. These decisions are based on your knowledge of the work and the requirements constraints.

9b Product Use Case List

The use case diagram is a graphical way of summarizing the product use cases relevant to the product. If you have a large number of product use cases (we find 15–20 is a good limit), then it is better to make a list of the product use cases and model or describe each one individually.

9c Individual Product Use Cases

Use cases are similar to scenarios, in that both tell the story of how the system interacts with the user(s) in response to some business event or while conducting some business task. The difference is that use-cases are much more formal, with certain pre-determined sections for each use-case, and that use-cases indicate clearly what action the system takes in response to what actions taken by the user.

For example, here is Figure 4.7 from "Object Oriented Software Engineering" by Bruegge and DuToit:

| | |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Use case name</i> | ReportEmergency |
| <i>Participating actors</i> | Initiated by FieldOfficer Communicates with Dispatcher |
| <i>Flow of events</i> | <ol style="list-style-type: none">1. The FieldOfficer activates the "Report Emergency" function of her terminal.2. FRIEND responds by presenting a form to the FieldOfficer.3. The FieldOfficer completes the form by selecting the emergency level, type, location, and brief description of the situation. The FieldOfficer also describes possible responses to the emergency situation. Once the form is completed, the FieldOfficer submits the form.4. FRIEND receives the form and notifies the Dispatcher.5. The Dispatcher reviews the submitted information and creates an Incident in the database by invoking the OpenIncident use case. The Dispatcher selects a response and acknowledges the report.6. FRIEND displays the acknowledgment and the selected response to the FieldOfficer. |
| <i>Entry condition</i> | <ul style="list-style-type: none">• The FieldOfficer is logged into FRIEND. |
| <i>Exit conditions</i> | <ul style="list-style-type: none">• The FieldOfficer has received an acknowledgment and the selected response from the Dispatcher, OR• The FieldOfficer has received an explanation indicating why the transaction could not be processed. |
| <i>Quality requirements</i> | <ul style="list-style-type: none">• The FieldOfficer's report is acknowledged within 30 seconds.• The selected response arrives no later than 30 seconds after it is sent by the Dispatcher. |

Figure 4-7 An example of a use case, ReportEmergency. Under ReportEmergency, the left column denotes actor actions, and the right column denotes system responses.

10 Functional Requirements

Content


A specification for each functional requirement. As with all types of requirements, use the requirements shell. A full explanation is included in this template's introductory material.

Motivation

To specify the detailed functional requirements for the activity of the product.

Examples

| | | | | | |
|------------------------|---------------------------------------------------------------------------------------------|---------------------------|------------|-------------------|------|
| Requirement #: | 75 | Requirement Type: | 9 | Event/use case #: | 7, 9 |
| Description: | The products shall record all the roads that have been treated | | | | |
| Rationale: | To be able to schedule untreated roads and highlight potential danger | | | | |
| Originator: | Arnold Snow - Chief Engineer | | | | |
| Fit Criterion: | The recorded treated and untreated roads shall agree with the drivers' road treatment logs. | | | | |
| Customer Satisfaction: | 3 | Customer Dissatisfaction: | 5 | | |
| Priority: | | | Conflicts: | | |
| Supporting Materials: | | | | | |
| History: | Created February 29, 2006 | | | | |


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Fit Criterion

Each functional requirement should have a fit criterion or a test case. In any event, the fit criterion is the benchmark to allow the tester to determine whether the implemented product has met the requirement.

Considerations

If you have produced an event/use case list (see sections 7b and 8a), then you can use it to help you trigger the functional requirements for each event/use case. If you have not produced an event/use case list, give each functional requirement a unique number and, to help with traceability, partition these requirements into event/use case-related groups later in the development process.

11 Data Requirements

Content

A specification of the essential subject matter, business objects, entities, and classes that are germane to the product. It might take the form of a first-cut class model, an

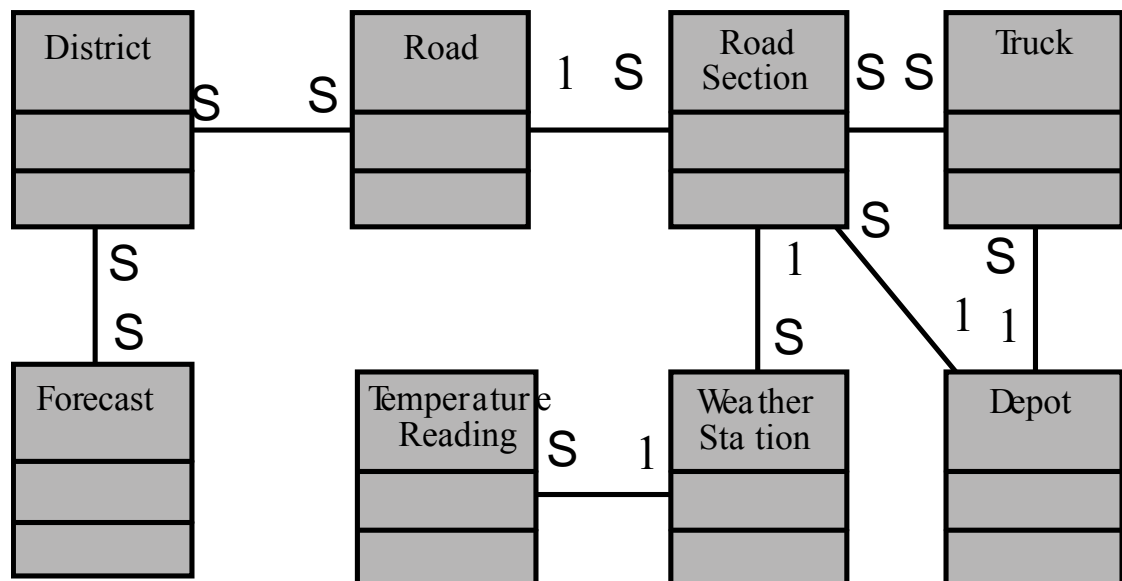
object model, or a domain model. Alternatively, these requirements might be described by defining the terms in the dictionary described in section 5.

Motivation

To clarify the system's subject matter, thereby triggering recognition of requirements not yet considered.

Example

This is a model of the system's business subject matter using the Unified Modeling Language (UML) class model notation.



You can use any type of data or object model to capture this knowledge. The issue is to capture the meaning of the business subject matter and the connections between the individual parts, and to show that you are consistent within your project. If you have an established company standard notation, use that, as it will help you to reuse knowledge between projects.

Considerations

Are there any data or object models for similar or overlapping systems that might be a useful starting point? Is there a domain model for the subject matter dealt with by this system?

12 Performance Requirements

12a Speed and Latency Requirements

Content

Specifies the amount of time available to complete specified tasks. These requirements often refer to response times. They can also refer to the product's ability to operate at a speed suitable for the intended environment.

Motivation

Some products—usually real-time products—must be able to perform some of their functionality within a given time slot. Failure to do so may mean catastrophic failure (e.g., a ground-sensing radar in an airplane fails to detect an upcoming mountain) or the product will not cope with the required volume of use (e.g., an automated ticket-selling machine).

Examples

Any interface between a user and the automated system shall have a maximum response time of 2 seconds.

The response shall be fast enough to avoid interrupting the user's flow of thought.

The product shall poll the sensor every 10 seconds.

The product shall download the new status parameters within 5 minutes of a change.

Fit Criterion

Fit criteria are needed when the description of the requirement is not quantified. However, we find that most performance requirements are stated in quantified terms. The exception is the second requirement shown above, for which the suggested fit criterion is

The product shall respond in less than 1 second for 90 percent of the interrogations. No response shall take longer than 2.5 seconds.

Considerations

There is a wide variation in the importance of different types of speed requirements. If you are working on a missile guidance system, then speed is extremely important. By contrast, an inventory control report that is run once every six months has very little need for a lightning-fast response time.

Customize this section of the template to give examples of the speed requirements that are important within your environment.

12b Precision or Accuracy Requirements

Content

Quantification of the desired accuracy of the results produced by the product.

Motivation

To set the client's and users' expectations for the precision of the product.

Examples

All monetary amounts shall be accurate to two decimal places.

Accuracy of road temperature readings shall be within $\pm 2^{\circ}\text{C}$.

Considerations

If you have done any detailed work on definitions, then some precision requirements might be adequately defined by definitions in section 5.

You might consider which units the product is intended to use. Readers will recall the spacecraft that crashed on Mars when coordinates were sent as metric data rather than imperial data.

The product might also need to keep accurate time, be synchronized with a time server, or work in UTC.

Also, be aware that some currencies have no decimal places, such as the Japanese yen.

12c Capacity Requirements

Content

This section specifies the volumes that the product must be able to deal with and the amount of data stored by the product.

Motivation

To ensure that the product is capable of processing the expected volumes.

Examples

The product shall cater for 300 simultaneous users within the period from 9:00 A.M. to 11:00 A.M. Maximum loading at other periods will be 150 simultaneous users.

During a launch period, the product shall cater for a maximum of 20 people to be in the inner chamber.

Fit Criterion

In this case, the requirement description is quantified, and thus can be tested.

13 Dependability Requirements

13a Reliability Requirements

Content

This section quantifies the necessary reliability of the product. The reliability is usually expressed as the allowable time between failures, or the total allowable failure rate.

Motivation

It is critical for some products not to fail too often. This section allows you to explore the possibility of failure and to specify realistic levels of service. It also gives you the opportunity to set the client's and users' expectations about the expected frequency and significance of potential failures.

Examples

The product shall not fail more than once per day.

No data shall be lost or damaged in the event of a failure. (This is an example of a *fail-safe* requirement, which states that the product is allowed to fail, but it must do so safely.)

Considerations

Consider carefully whether the real requirement for your product is that it is available for use or that it does not fail at any time.

Consider also the cost of reliability and availability, and whether it is justified for your product.

13b Availability Requirements

Content

This section quantifies the necessary availability of the product. The availability is usually expressed as the fraction of total time that the system is up and available for use.

Availability is a function of the mean time between failures, the mean time required to bring the system back up after a failure, and the mean time the system is expected to be down for routine maintenance.

Motivation

There is a subtle distinction between how often a system goes down (reliability) and how much total time it spends being down (availability). This section allows you to specify realistic expectations about the amount of time that the product will be available for use.

Examples

The product shall be available for use 24 hours per day, 365 days per year.

The product shall be available for use between the hours of 8:00 A.M. and 5:30 P.M.

The escalator shall run from 6 A.M. until 10 P.M. or the last flight arrives.

The product shall achieve 99 percent uptime.

Considerations

Consider carefully whether the real requirement for your product is that it is available for use or that it does not fail at any time.

Consider also the cost of reliability and availability, and whether it is justified for your product.

The sections on reliability and availability can sometimes be combined.

13c Robustness or Fault-Tolerance Requirements

Content

Robustness specifies the ability of the product to continue to function under abnormal circumstances.

Motivation

To ensure that the product is able to provide some or all of its services after or during some abnormal happening in its environment.

Examples

The product shall continue to operate in local mode whenever it loses its link to the central server.

The product shall provide 10 minutes of emergency operation should it become disconnected from the electricity source.

Considerations

Abnormal happenings can almost be considered normal. Today's products are so large and complex that there is a good chance that at any given time, one component will not be functioning correctly. Robustness requirements are intended to prevent total failure of the product.

You could also consider disaster recovery in this section. This plan describes the ability of the product to reestablish acceptable performance after faults or abnormal happenings.

13d Safety-Critical Requirements

Content

Quantification of the perceived risk of damage to people, property, and environment. Different countries have different standards, so the fit criteria must specify precisely which standards the product must meet.

Motivation

To understand and highlight the damage that could potentially occur when using the product within the expected operational environment.

Examples

The product shall not emit noxious gases that damage people's health.

The heat exchanger shall be shielded from human contact.

Fit Criterion

The product shall be certified to comply with the Health Department's standard E110-98. It is to be certified by qualified testing engineers.

No member of a test panel of [specified size] shall be able to touch the heat exchanger. The heat exchanger must also comply with safety standard [specify which one].

Considerations

The example requirements given here apply to some, but not all, products. It is not possible to give examples of every variation of safety-critical requirement. To make the template work in your environment, you should customize it by adding examples that are specific to your products.

Also, be aware that different countries have different safety standards and laws relating to safety. If you plan to sell your product internationally, you must be aware

of these laws. A colleague has suggested that for electrical products, if you follow the German standards, the largest number of countries will be supported.

If you are building safety-critical systems, then the relevant safety-critical standards are already well specified. You will likely have safety experts on your staff. These experts are the best source of the relevant safety-critical requirements for your type of product. They will almost certainly have copious information that you can use.

Consult your legal department. Members of this department will be aware of the kinds of lawsuits that have resulted from product safety failure. This is probably the best starting place for generating relevant safety requirements.

14 Maintainability and Supportability Requirements

14a Maintenance Requirements

Content

A quantification of the time necessary to make specified changes to the product.

Motivation

To make everyone aware of the maintenance needs of the product.

Examples

New MIS reports must be available within one working week of the date when the requirements are agreed upon.

A new weather station must be able to be added to the system overnight.

Considerations

There may be special requirements for maintainability, such as that the product must be able to be maintained by its end users or by developers who are not the original developers. These requirements have an effect on the way that the product is developed. In addition, there may be requirements for documentation or training.

You might also consider writing testability requirements in this section.

14b Supportability Requirements

Content

This specifies the level of support that the product requires. Support is often provided via a help desk. If people will provide support for the product, that service is considered part of the product: Are there any requirements for that support? You might also build support into the product itself, in which case this section is the place to write those requirements.

Motivation

To ensure that the support aspect of the product is adequately specified.

Considerations

Consider the anticipated level of support, and what forms it might take. For example, a constraint might state that there is to be no printed manual. Alternatively, the product might need to be entirely self-supporting.

14c Adaptability Requirements

Content

Description of other platforms or environments to which the product must be ported.

Motivation

To quantify the client's and users' expectations about the platforms on which the product will be able to run.

Examples

The product is expected to run under Windows XP and Linux.

The product might eventually be sold in the Japanese market.

The product is designed to run in offices, but we intend to have a version running in restaurant kitchens.

Fit Criterion

Specification of system software on which the product must operate.

Specification of future environments in which the product is expected to operate.

Time allowed to make the transition.

Considerations

Question your marketing department to discover unstated assumptions that have been made about the portability of the product.

14d Scalability or Extensibility Requirements

Content

This specifies the expected increases in size that the product must be able to handle. As a business grows (or is expected to grow), our software products must increase their capacities to cope with the new volumes.

Motivation

To ensure that the designers allow for future capacities.

Examples

The product shall be capable of processing the existing 100,000 customers. This number is expected to grow to 500,000 customers within three years.

The product shall be able to process 50,000 transactions per hour within two years of its launch.

14e Longevity Requirements

Content

This specifies the expected lifetime of the product.

Motivation

To ensure that the product is built based on an understanding of expected return on investment.

Examples

The product shall be expected to operate within the maximum maintenance budget for a minimum of five years.

15 Security Requirements

15a Access Requirements

Content

Specification of who has authorized access to the product (both functionality and data), under what circumstances that access is granted, and to which parts of the product access is allowed.

Motivation

To understand the expectations for confidentiality aspects of the system.

Examples

Only direct managers can see the personnel records of their staff.

Only holders of current security clearance can enter the building.

Fit Criterion

System function name or system data name.

User roles and/or names of people who have clearance.

Considerations

Is there any data that management considers to be sensitive? Is there any data that low-level users do not want management to have access to? Are there any processes that might cause damage or might be used for personal gain? Are there any people who should not have access to the system?

Avoid stating how you will design a solution to the security requirements. For instance, don't "design a password system." Your aim here is to identify the security requirement; the design will then come from this description.

Consider asking for help. Computer security is a highly specialized field, and one where improperly qualified people have no business. If your product has need of more than average security, we advise you to make use of a security consultant. Such consultants are not cheap, but the results of inadequate security can be even more expensive.

15b Integrity Requirements

Content

Specification of the required integrity of databases and other files, and of the product itself.

Motivation

To understand the expectations for the integrity of the product's data. To specify what the product will do to ensure its integrity in the case of an unwanted happening such as attack from the outside or unintentional misuse by an authorized user.

Examples

The product shall prevent incorrect data from being introduced.

The product shall protect itself from intentional abuse.

Considerations

Organizations are relying more and more on their stored data. If this data should be come corrupt or incorrect—or disappear—then it could be a fatal blow to the organization. For example, almost half of small businesses go bankrupt after a fire destroys their computer systems. Integrity requirements are aimed at preventing complete loss, as well as corruption, of data and processes.

15c Privacy Requirements

Content

Specification of what the product has to do to ensure the privacy of individuals about whom it stores information. The product must also ensure that all laws related to privacy of an individual's data are observed.

Motivation

To ensure that the product complies with the law, and to protect the individual privacy of your customers. Few people today look kindly on organizations that do not observe their privacy.

Examples

The product shall make its users aware of its information practices before collecting data from them.

The product shall notify customers of changes to its information policy.

The product shall reveal private information only in compliance with the organization's information policy.

The product shall protect private information in accordance with the relevant privacy laws and the organization's information policy.

Considerations

Privacy issues may well have legal implications, and you are advised to consult with your organization's legal department about the requirements to be written in this section.

Consider what notices you must issue to your customers before collecting their personal information. A notice might go so far as to warn customers that you intend to put a cookie in their computer. Also, do you have to do anything to keep customers aware that you hold their personal information?

Customers must always be in a position to give or withhold consent when their private data is collected or stored. Similarly, customers should be able to view any private data and, where appropriate, ask for correction of the data.

Also consider the integrity and security of private data—for example, when you are storing credit card information.

15d Audit Requirements

Content

Specification of what the product has to do (usually retain records) to permit the required audit checks.

Motivation

To build a system that complies with the appropriate audit rules.

Considerations

This section may have legal implications. You are advised to seek the approval of your organization's auditors regarding what you write here.

You should also consider whether the product should retain information on who has used it. The intention is to provide security such that a user may not later deny having used the product or participated in some form of transaction using the product.

15e Immunity Requirements

Content

The requirements for what the product has to do to protect itself from infection by unauthorized or undesirable software programs, such as viruses, worms, and Trojan horses, among others.

Motivation

To build a product that is as secure as possible from malicious interference.

Considerations

Each day brings more malevolence from the unknown, outside world. People buying software, or any other kind of product, expect that it can protect itself from outside interference.

16 Usability and Humanity Requirements

This section is concerned with requirements that make the product usable and ergonomically acceptable to its hands-on users.

16a Ease of Use Requirements

Content

This section describes your client's aspirations for how easy it is for the intended users of the product to operate it. The product's usability is derived from the abilities of the expected users of the product and the complexity of its functionality.

The usability requirements should cover properties such as these:

- Efficiency of use: How quickly or accurately the user can use the product.
- Ease of remembering: How much the casual user is expected to remember about using the product.
- Error rates: For some products it is crucial that the user commits very few, or no, errors.
- Overall satisfaction in using the product: This is especially important for commercial, interactive products that face a lot of competition. Web sites are a good example.
- Feedback: How much feedback the user needs to feel confident that the product is actually accurately doing what the user expects. The necessary degree of feedback will be higher for some products (e.g., safety-critical products) than for others.

Motivation

To guide the product's designers toward building a product that meets the expectations of its eventual users.

Examples

The product shall be easy for 11-year-old children to use.

The product shall help the user to avoid making mistakes.

The product shall make the users want to use it.

The product shall be used by people with no training, and possibly no understanding of English.

Fit Criterion

These examples may seem simplistic, but they do express the intention of the client. To completely specify what is meant by the requirement, you must add a measurement against which it can be tested—that is, a fit criterion. Here are the fit criteria for the preceding examples:

Eighty percent of a test panel of 11-year-old children shall be able to successfully complete [list of tasks] within [specified time].

One month's use of the product shall result in a total error rate of less than 1 percent.

An anonymous survey shall show that 75 percent of the intended users are regularly using the product after a three-week familiarization period.

Considerations

Refer to section 3, Users of the Product, to ensure that you have considered the usability requirements from the perspective of all the different types of users.

It may be necessary to have special consulting sessions with your users and your client to determine whether any special usability considerations must be built into the product.

You could also consider consulting a usability laboratory experienced in testing the usability of products that have a project situation (sections 1–7 of this template) similar to yours.

16b Personalization and Internationalization Requirements

Content

This section describes the way in which the product can be altered or configured to take into account the user's personal preferences or choice of language.

The personalization requirements should cover issues such as the following:

- Languages, spelling preferences, and language idioms
- Currencies, including the symbols and decimal conventions
- Personal configuration options

Motivation

To ensure that the product's users do not have to struggle with, or meekly accept, the builder's cultural conventions.

Examples

The product shall retain the buyer's buying preferences.

The product shall allow the user to select a chosen language.

Considerations

Consider the country and culture of the potential customers and users of your product. Any out-of-country users will welcome the opportunity to convert to their home spelling and expressions.

By allowing users to customize the way in which they use the product, you give them the opportunity to participate more closely with your organization as well as enjoy their own personal user experience.

You might also consider the configurability of the product. Configurability allows different users to have different functional variations of the product.

16c Learning Requirements

Content

Requirements specifying how easy it should be to learn to use the product. This learning curve ranges from zero time for products intended for placement in the public domain (e.g., a parking meter or a web site) to a considerable amount of time for complex, highly technical products. (We know of one product where it was necessary for graduate engineers to spend 18 months in a training program before being qualified to use the product.)

Motivation

To quantify the amount of time that your client feels is allowable before a user can successfully use the product. This requirement guides designers to understand how users will learn the product. For example, designers may build elaborate interactive help facilities into the product, or the product may be packaged with a tutorial. Alternatively, the product may have to be constructed so that all of its functionality is apparent upon first encountering it.

Examples

The product shall be easy for an engineer to learn.

A clerk shall be able to be productive within a short time.

The product shall be able to be used by members of the public who will receive no training before using it.

The product shall be used by engineers who will attend five weeks of training before using the product.

Fit Criterion

An engineer shall produce a [specified result] within [specified time] of beginning to use the product, without needing to use the manual.

After receiving [number of hours] training a clerk shall be able to produce [quantity of specified outputs] per [unit of time].

[Agreed percentage] of a test panel shall successfully complete [specified task] within [specified time limit].

The engineers shall achieve [agreed percentage] pass rate from the final examination of the training.

Considerations

Refer to section 3, Users of the Product, to ensure that you have considered the ease of learning requirements from the perspective of all the different types of users.

16d Understandability and Politeness Requirements

This section is concerned with discovering requirements related to concepts and metaphors that are familiar to the intended end users.

Content

This specifies the requirement for the product to be understood by its users. While “usability” refers to ease of use, efficiency, and similar characteristics, “understandability” determines whether the users instinctively know what the product will do for them and how it fits into their view of the world. You can think of understandability as the product being polite to its users and not expecting them to know or learn things that have nothing to do with their business problem.

Motivation

To avoid forcing users to learn terms and concepts that are part of the product’s internal construction and are not relevant to the users’ world. To make the product more comprehensible and thus more likely to be adopted by its intended users.

Examples

The product shall use symbols and words that are naturally understandable by the user community.

The product shall hide the details of its construction from the user.

Considerations

Refer to section 3, Users of the Product, and consider the world from the point of view of each of the different types of users.

16e Accessibility Requirements

Content

The requirements for how easy it should be for people with common disabilities to access the product. These disabilities might be related to physical disability or visual, hearing, cognitive, or other abilities.

Motivation

In many countries it is required that some products be made available to the disabled. In any event, it is self-defeating to exclude this sizable community of potential customers.

Examples

The product shall be usable by partially sighted users.

The product shall conform to the Americans with Disabilities Act.

Considerations

Some users have disabilities other than the commonly described ones. In addition, some partial disabilities are fairly common. A simple, and not very consequential, example is that approximately 20 percent of males are red-green colorblind.

16f User Documentation Requirements

Content

List of the user documentation to be supplied as part of the product.

Motivation

To set expectations for the documentation and to identify who will be responsible for creating it.

Examples

Technical specifications to accompany the product.

User manuals.

Service manuals (if not covered by the technical specification).

Emergency procedure manuals (e.g., the card found in airplanes).

Installation manuals.

Considerations

Which documents do you need to deliver, and to whom? Bear in mind that the answer to this questions depends on your organizational procedures and roles.

For each document, consider these issues:

- The purpose of the document
- The people who will use the document
- Maintenance of the document

What level of documentation is expected? Will the users be involved in the production of the documentation? Who will be responsible for keeping the documentation up-to-date? What form will the documentation take?

16g Training Requirements

Content

A description of the training needed by users of the product.

Motivation

To set expectations for the training. To identify who is responsible for creating and providing that training.

Considerations

What training will be necessary? Who will design the training? Who will provide the training?

17 Look and Feel Requirements

17a Appearance Requirements

Content

The section contains requirements relating to the spirit of the product. Your client may have made particular demands for the product, such as corporate branding, colors to be used, and so on. This section captures the requirements for the appearance. Do not attempt to design it until the appearance requirements are known.

Motivation

To ensure that the appearance of the product conforms to the organization's expectations.

Examples

The product shall be attractive to a teenage audience.

The product shall comply with corporate branding standards.

Fit Criterion

A sampling of representative teenagers shall, without prompting or enticement, start using the product within four minutes of their first encounter with it.

The office of branding shall certify the product complies with the current standards.

Considerations

Even if you are using prototypes, it is important to understand the requirements for the appearance. The prototype is used to help elicit requirements; it should not be thought of as a substitute for the requirements.

17b Style Requirements

Content

Requirements that specify the mood, style, or feeling of the product, which influences the way a potential customer will see the product. Also, the stakeholders' intentions for the amount of interaction the user is to have with the product.

In this section, you would also describe the appearance of the package if this is to be a manufactured product. The package may have some requirements as to its size, style, and consistency with other packages put out by your organization. Keep in mind the European laws on packaging, which require that the package not be significantly larger than the product it encloses.

The style requirements that you record here will guide the designers to create a product as envisioned by your client.

Motivation

Given the state of today's market and people's expectations, we cannot afford to build products that have the wrong style. Once the functional requirements are satisfied, it is often the appearance and style of products that determine whether they are successful. Your task in this section is to determine precisely how the product shall appear to its intended consumer.

Example

The product shall appear authoritative.

Fit Criterion

After their first encounter with the product, 70 percent of representative potential customers shall agree they feel they can trust the product.

Considerations

The look and feel requirements specify your client's vision of the product's appearance. The requirements may at first seem to be rather vague (e.g., "conservative and professional appearance"), but these will be quantified by their fit criteria. The fit criteria give you the opportunity to extract from your client precisely what is meant, and give the designer precise instructions on what he is to accomplish.

18 Operational and Environmental Requirements

18a Expected Physical Environment

Content

This section specifies the physical environment in which the product will operate.

Motivation

To highlight conditions that might need special requirements, preparations, or training. These requirements ensure that the product is fit to be used in its intended environment.

Examples

The product shall be used by a worker, standing up, outside in cold, rainy conditions.

The product shall be used in noisy conditions with a lot of dust.

The product shall be able to fit in a pocket or purse.

The product shall be usable in dim light.

The product shall not be louder than the existing noise level in the environment.

Considerations

The work environment: Is the product to operate in some unusual environment? Does this lead to special requirements? Also see section 11, Usability and Humanity Requirements.

18b Requirements for Interfacing with Adjacent Systems

Content

This section describes the requirements to interface with partner applications and/or devices that the product needs to successfully operate.

Motivation

Requirements for the interfaces to other applications often remain undiscovered until implementation time. Avoid a high degree of rework by discovering these requirements early.

Examples

The products shall work on the last four releases of the five most popular browsers.

The new version of the spreadsheet must be able to access data from the previous two versions.

Our product must interface with the applications that run on the remote weather stations.

Fit Criterion

For each inter-application interface, specify the following elements:

- The data content
- The physical material content
- The medium that carries the interface
- The frequency
- The volume

18c Productization Requirements

Content

Any requirements that are necessary to make the product into a distributable or salable item. It is also appropriate to describe here the operations needed to install a software product successfully.

Motivation

To ensure that if work must be done to get the product out the door, then that work becomes part of the requirements. Also, to quantify the client's and users' expectations about the amount of time, money, and resources they will need to allocate to install the product.

Examples

The product shall be distributed as a ZIP file.

The product shall be able to be installed by an untrained user without recourse to separately printed instructions.

The product shall be of a size such that it can fit on one CD.

Considerations

Some products have special needs to turn them into a salable or usable product. You might consider that the product has to be protected such that only paid-up customers can access it.

Ask questions of your marketing department to discover unstated assumptions that have been made about the specified environment and the customers' expectations of how long installation will take and how much it will cost.

Most commercial products have some needs in this area.

18d Release Requirements

Content

Specification of the intended release cycle for the product and the form that the release shall take.

Motivation

To make everyone aware of how often you intend to produce new releases of the product.

Examples

The maintenance releases will be offered to end users once a year.

Each release shall not cause previous features to fail.

Fit Criterion

Description of the type of maintenance plus the amount of effort budgeted for it.

Considerations

Do you have any existing contractual commitments or maintenance agreements that might be affected by the new product?

19 Cultural and Political Requirements

19a Cultural Requirements

Content

This section contains requirements that are specific to the sociological factors that affect the acceptability of the product. If you are developing a product for foreign markets, then these requirements are particularly relevant.

Motivation

To bring out in the open requirements that are difficult to discover because they are outside the cultural experience of the developers.

Examples

The product shall not be offensive to religious or ethnic groups.

The product shall be able to distinguish between French, Italian, and British road-numbering systems.

The product shall keep a record of public holidays for all countries in the European Union and for all states in the United States.

Considerations

Question whether the product is intended for a culture other than the one with which you are familiar. Ask whether people in other countries or in other types of organizations will use the product. Do these people have different habits, holidays, superstitions, or cultural norms that do not apply to your own culture? Are there colors, icons, or words that have different meanings in another cultural environment?

19b Political Requirements

Content

This section contains requirements that are specific to the political factors that affect the acceptability of the product.

Motivation

To understand requirements that sometimes appear irrational.

Examples

The product shall be installed using only American-made components.

The product shall make all functionality available to the CEO.

Considerations

Did you intend to develop the product on a Macintosh, when the office manager has laid down an edict that only Windows machines are permitted?

Is a director also on the board of a company that manufactures products similar to the one that you intend to build?

Whether you agree with these political requirements has little bearing on the outcome. The reality is that the system has to comply with political requirements even if you can find a better, more efficient, or more economical solution. A few probing questions here may save some heartache later.

The political requirements might be purely concerned with the politics inside your organization. However, in other situations you may need to consider the politics inside your customers' organizations or the national politics of the country.

20 Legal Requirements

20a Compliance Requirements

Content

A statement specifying the legal requirements for this system.

Motivation

To comply with the law so as to avoid later delays, lawsuits, and legal fees.

Examples

Personal information shall be implemented so as to comply with the Data Protection Act.

Fit Criterion

Lawyers' opinion that the product does not break any laws.

Considerations

Consider consulting lawyers to help identify the legal requirements.

Are there any copyrights or other intellectual property that must be protected? Conversely, do any competitors have copyrights on which you might be in danger of infringing?

Is it a requirement that developers have not seen competitors' code or even have worked for competitors?

The Sarbanes-Oxley (SOX) Act, the Health Insurance Portability and Accountability Act (HIPAA) and the Gramm-Leach-Bliley Act may have implications for you. Check with your company lawyer.

Might any pending legislation affect the development of this system?

Are there any aspects of criminal law you should consider?

Have you considered the tax laws that affect your product?

Are there any labor laws (e.g., working hours) relevant to your product?

20b Standards Requirements

Content

A statement specifying applicable standards and referencing detailed standards descriptions. This does not refer to the law of the land—think of it as an internal law imposed by your company.

Motivation

To comply with standards so as to avoid later delays.

Example

The product shall comply with MilSpec standards.

The product shall comply with insurance industry standards.

The product shall be developed according to SSADM standard development steps.

Fit Criterion

The appropriate standard-keeper certifies that the standard has been adhered to.

Considerations

It is not always apparent that there are applicable standards because their existence is often taken for granted. Consider the following:

- Do any industry bodies have applicable standards?
- Does the industry have a code of practice, watchdog, or ombudsman?
- Are there any special development steps for this type of product?

III Design

21 System Design

21a Design goals

Content

Design goals are important properties of the system to be optimized, and which may affect the overall design of the system. For example computer games place a higher priority on speed than accuracy, and so the physics engine for a computer game may make some rough approximations and assumptions that allow it to run as fast as possible while sacrificing accuracy, whereas the physics calculations performed by NASA must be much more rigorously correct, even at the expense of speed.

Note an important difference between design goals and requirements: Requirements include specific values that must be met in order for the product to be acceptable to the client, whereas design goals are properties that the designers strive to make "as good as possible", without specific criteria for acceptability. (Note also that the same property may appear in both a requirement and a design goal, so a design goal may be to make the system run as fast as possible, with a requirement that says any speed below a certain specified threshold is unacceptable.)

Motivation

Considerations

Example

22 Current Software Architecture

Content

Motivation

Considerations

Example

23 Proposed Software Architecture

23a Overview

Content

Motivation

Considerations

Example

23b Class Diagrams

Content

Motivation

Considerations

Example

23c Dynamic Model

Content

Motivation

Considerations

Example

23d Subsystem Decomposition

Content

Motivation

Considerations

Example

23e Hardware / software mapping

Content

Motivation

Considerations

Example

23f Data Dictionary

Content

Motivation

Considerations

Example

23g Persistent Data management

Content

Motivation

Considerations

Example

23h Access control and security

Content

Motivation

Considerations

Example

23i Global software control

Content

Motivation

Considerations

Example

23j Boundary conditions

Content

Motivation

Considerations

Example

24 Subsystem services

Content

Motivation

Considerations

Example

25 User Interface

Content

Motivation

Considerations

Example

26 Object Design

26a Object Design trade-offs

Content

Motivation

Considerations

Example

26b Interface Documentation guidelines

Content

Motivation

Considerations

Example

26c Packages

Content

Motivation

Considerations

Example

26d Class Interfaces

Content

Motivation

Considerations

Example

IV Test Plans

27 Features to be tested / not to be tested

Content

Motivation

Considerations

Example

28 Pass/Fail Criteria

Content

Motivation

Considerations

Example

29 Approach

Content

Motivation

Considerations

Example

30 Suspension and resumption

Content

Motivation

Considerations

Example

31 Testing materials (hardware / software requirements)

Content

Motivation

Considerations

Example

32 Test cases

Content

Motivation

Considerations

Example

33 Testing schedule

Content

Motivation

Considerations

Example

V Project Issues

34 Open Issues

Issues that have been raised and do not yet have a conclusion.

Content

A statement of factors that are uncertain and might make significant difference to the product.

Motivation

To bring uncertainty out in the open and provide objective input to risk analysis.

Examples

Our investigation into whether the new version of the processor will be suitable for our application is not yet complete.

The government is planning to change the rules about who is responsible for gritting the motorways, but we do not know what those changes might be.

Considerations

Are there any issues that have come up from the requirements gathering that have not yet been resolved? Have you heard of any changes that might occur in the other organizations or systems on your context diagram? Are there any legislative changes that might affect your system? Are there any rumors about your hardware or software suppliers that might have an impact?

35 Off-the-Shelf Solutions

35a Ready-Made Products

Content

List of existing products that should be investigated as potential solutions. Reference any surveys that have been done on these products.

Motivation

To give consideration to whether a solution can be bought.

Considerations

Could you buy something that already exists or is about to become available? It may not be possible at this stage to make this determination with a lot of confidence, but any likely products should be listed here.

Also consider whether some products must not be used.

35b Reusable Components

Content

Description of the candidate components, either bought from outside or built by your company, that could be used by this project. List libraries that could be a source of components.

Motivation

Reuse rather than reinvention.

35c Products That Can Be Copied

Content

List of other similar products or parts of products that you can legally copy or easily modify.

Motivation

Reuse rather than reinvention.

Examples

Another electricity company has built a customer service system. Its hardware is different from ours, but we could buy its specification and cut our analysis effort by approximately 60 percent.

Considerations

While a ready-made solution may not exist, perhaps something, in its essence, is similar enough that you could copy, and possibly modify, it to better effect than starting from scratch. This approach is potentially dangerous because it relies on the base system being of good quality.

This question should always be answered. The act of answering it will force you to look at other existing solutions to similar problems.

36 New Problems

36a Effects on the Current Environment

Content

A description of how the new product will affect the current implementation environment. This section should also cover things that the new product should *not* do.

Motivation

The intention is to discover early any potential conflicts that might otherwise not be realized until implementation time.

Examples

Any change to the scheduling system will affect the work of the engineers in the divisions and the truck drivers.

Considerations

Is it possible that the new system might damage some existing system? Can people be displaced or otherwise affected by the new system?

These issues require a study of the current environment. A model highlighting the effects of the change is a good way to make this information widely understandable.

36b Effects on the Installed Systems

Content

Specification of the interfaces between new and existing systems.

Motivation

Very rarely is a new development intended to stand completely alone. Usually the new system must coexist with some older system. This question forces you to look carefully at the existing system, examining it for potential conflicts with the new development.

36c Potential User Problems

Content

Details of any adverse reaction that might be suffered by existing users.

Motivation

Sometimes existing users are using a product in such a way that they will suffer ill effects from the new system or feature. Identify any likely adverse user reactions, and determine whether we care about those reactions and what precautions we will take.

36d Limitations in the Anticipated Implementation Environment That May Inhibit the New Product

Content

Statement of any potential problems with the new automated technology or new ways of structuring the organization.

Motivation

The intention is to make early discovery of any potential conflicts that might otherwise not be realized until implementation time.

Examples

The planned new server is not powerful enough to cope with our projected growth pattern.

The size and weight of the new product do not fit into the physical environment.

The power capabilities will not satisfy the new product's projected consumption.

Considerations

This requires a study of the intended implementation environment.

36e Follow-Up Problems

Content

Identification of situations that we might not be able to cope with.

Motivation

To guard against situations where the product might fail.

Considerations

Will we create a demand for our product that we are not able to service? Will the new system cause us to run afoul of laws that do not currently apply? Will the existing hardware cope?

There are potentially hundreds of unwanted effects. It pays to answer this question very carefully.

37 Tasks

37a Project Planning

Content

Details of the life cycle and approach that will be used to deliver the product. A high-level process diagram showing the tasks and the interfaces between them is a good way to communicate this information.

Motivation

To specify the approach that will be taken to deliver the product so that everyone has the same expectations.

Considerations

Depending on the maturity level of your process, the new product will be developed using your standard approach. However, some circumstances are unique to a particular product and will necessitate changes to your life cycle. While these considerations are not product requirements, they are needed if the product is to be successfully developed.

If possible, attach an estimate of the time and resources needed for each task based on the requirements that you have specified. Attach your estimates to the events, use cases, and/or functions that you specified in sections 8 and 9.

Do not forget issues related to data conversion, user training, and cutover. These needs are usually ignored when projects set implementation dates.

37b Planning of the Development Phases

Content

Specification of each phase of development and the components in the operating environment.

Motivation

To identify the phases necessary to implement the operating environment for the new system so that the implementation can be managed.

Fit Criterion

Name of the phase.

Required operational date.

Operating environment components included.

Functional requirements included.

Nonfunctional requirements included.

Considerations

Identify which hardware and other devices are necessary for each phase of the new system. This list may not be known at the time of the requirements process, as these devices may be decided at design time.

38 Migration to the New Product

38a Requirements for Migration to the New Product

Content

A list of the conversion activities. Timetable for implementation.

Motivation

To identify conversion tasks as input to the project planning process.

Considerations

Will you use a phased implementation to install the new system? If so, describe which requirements will be implemented by each of the major phases.

What kind of data conversion is necessary? Must special programs be written to transport data from an existing system to the new one? If so, describe the requirements for these programs here.

What kind of manual backup is needed while the new system is installed?

When are each of the major components to be put in place? When are the phases of the implementation to be released?

Is there a need to run the new product in parallel with the existing product?

Will we need additional or different staff?

Is any special effort needed to decommission the old product?

This section is the timetable for implementation of the new system.

38b Data That Has to Be Modified or Translated for the New System

Content

List of data translation tasks.

Motivation

To discover missing tasks that will affect the size and boundaries of the project.

Fit Criterion

Description of the current technology that holds the data.

Description of the new technology that will hold the data.

Description of the data translation tasks.

Foreseeable problems.

Considerations

Every time you make an addition to your dictionary (see section 5), ask this question: Where is this data currently held, and will the new system affect that implementation?

39 Risks

All projects involve risk—namely, the risk that something will go wrong. Risk is not necessarily a bad thing, as no progress is made without taking some risk. However, there is a difference between unmanaged risk—say, shooting dice at a craps table—and managed risk, where the probabilities are well understood and contingency plans are made. Risk is only a bad thing if the risks are ignored and they become problems. Risk management entails assessing which risks are most likely to apply to the project, deciding a course of action if they become problems, and monitoring projects to give early warnings of risks becoming problems.

This section of your specification should contain a list of the most likely risks and the most serious risks for your project. For each risk, include the probability of that risk becoming a problem. Capers Jones's *Assessment and Control of Software Risks* (Prentice-Hall, Englewood Cliffs, N.J., 1994) gives comprehensive lists of risks and their probabilities; you can use these lists as a starting point. For example, Jones cites the following risks as being the most serious:

- Inaccurate metrics
- Inadequate measurement
- Excessive schedule pressure
- Management malpractice
- Inaccurate cost estimating
- Silver bullet syndrome
- Creeping user requirements
- Low quality
- Low productivity
- Cancelled projects

Use your knowledge of the requirements as input to discover which risks are most relevant to your project.

It is also useful input to project management if you include the impact on the schedule, or the cost, if the risk does become a problem.

40 Costs

For details on how to estimate requirements effort and costs, refer to Appendix C Function Point Counting: A Simplified Introduction

The other cost of requirements is the amount of money or effort that you have to spend building them into a product. Once the requirements specification is complete, you can use one of the estimating methods to assess the cost, expressing the result as a monetary amount or time to build.

There is no best method to use when estimating. Keep in mind, however, that your estimates should be based on some tangible, countable artifact. If you are using this template, then, as a result of doing the work of requirements specification, you are producing many measurable deliverables. For example:

- Number of input and output flows on the work context
- Number of business events
- Number of product use cases
- Number of functional requirements
- Number of nonfunctional requirements
- Number of requirements constraints
- Number of function points

The more detailed the work you do on your requirements, the more accurate your deliverables will be. Your cost estimate is the amount of resources you estimate each type of deliverable will take to produce within your environment. You can create some very early cost estimates based on the work context. At that stage, your knowledge of the work will be general, and you should reflect this vagueness by making the cost estimate a range rather than a single figure.

As you increase your knowledge of the requirements, we suggest you try using function point counting—not because it is an inherently superior method, but because it is so widely accepted. So much is known about function point counting that it is possible to make easy comparisons with other products and other installations' productivity.

It is important that your client be told at this stage what the product is likely to cost. You usually express this amount as the total cost to complete the product, but you may also find it advantageous to point out the cost of the requirements effort, or the costs of individual requirements.

Whatever you do, do not leave the costs in the lap of hysterical optimism. Make sure that this section includes meaningful numbers based on tangible deliverables.

41 Waiting Room

Requirements that will not be part of the next release. These requirements might be included in future releases of the product.

Content

Any type of requirement.

Motivation

To allow requirements to be gathered, even though they cannot be part of the current development. To ensure that good ideas are not lost.

Considerations

The requirements-gathering process often throws up requirements that are beyond the sophistication of, or time allowed for, the current release of the product. This section holds these requirements in waiting. The intention is to avoid stifling the creativity of your users and clients, by using a repository to retain future requirements. You are also managing expectations by making it clear that you take these requirements seriously, although they will not be part of the agreed-upon product.

Many people use the waiting room as a way of planning future versions of the product. Each requirement in the waiting room is tagged with its intended version number. As a requirement progresses closer to implementation, then you can spend more time on it and add details such as the cost and benefit attached to that requirement.

You might also prioritize the contents of your waiting room. “Low-hanging fruit”—requirements that provide a high benefit at a low cost of implementation—are the highest-ranking candidates for the next release. You would also give a high waiting room rank to requirements for which there is a pent-up demand.

42 Ideas for Solutions

When you gather requirements, you focus on finding out what the real requirements are and try to avoid coming up with solutions. However, when creative people start to think about a problem, they always generate ideas about potential solutions. This section of the template is a place to put those ideas so that you do not forget them and so that you can separate them from the real business requirements.

Content

Any idea for a solution that you think is worth keeping for future consideration. This can take the form of rough notes, sketches, pointers to other documents, pointers to

people, pointers to existing products, and so on. The aim is to capture, with the least amount of effort, an idea that you can return to later.

Motivation

To make sure that good ideas are not lost. To help you separate requirements from solutions.

Considerations

While you are gathering requirements, you will inevitably have solution ideas; this section offers a way to capture them. Bear in mind that this section will not necessarily be included in every document that you publish.

43 Project Retrospective

Content

At the end of every project you should reflect upon what methods were used that worked out well and should be repeated in the future, and also what methods did not work out well and should be avoided. Any recommendations, suggestions, or ideas for how to do things better in the future should also be documented

Motivation

To learn from experience, and to continually strive for process improvement.

Considerations

When things don't go well, it is important to distinguish whether the methods themselves were poor, or simply poorly implemented in this particular case, or whether they just weren't right for this particular project / group of engineers.

VI Glossary

The glossary defines terms that may not be familiar to all readers. This is especially important if the document is expected to reach a wide and varied audience, such as school children. The glossary may be placed at either the beginning or the end of the document.

Flotsam: Any part of a ship or its cargo found floating on the water, whether it was deliberately or accidentally lost by its original owners.

Jetsam: Any part of a ship or its cargo that is deliberately cast off (jettisoned) by its original owners, generally in order to lighten the ship, whether it floats or sinks.

VII References / Bibliography

This section describes the documents and other sources from which information was gathered. This sample bibliography was generated using the “Insert Citation” and “Bibliography” buttons in the “Citations & Bibliography” section under the “References” tab of MS Word. Creating new citations will not update this list unless you click on it and select “Update Field”. You may need to reset the style for this paragraph to “normal” after updating.

- [1] Robertson and Robertson, Mastering the Requirements Process.
- [2] A. Silberschatz, P. B. Galvin and G. Gagne, Operating System Concepts, Ninth ed., Wiley, 2013.
- [3] J. Bell, "Underwater Archaeological Survey Report Template: A Sample Document for Generating Consistent Professional Reports," Underwater Archaeological Society of Chicago, Chicago, 2012.
- [4] M. Fowler, UML Distilled, Third Edition, Boston: Pearson Education, 2004.

VIII Index

This section provides an index to the report. The sample below was generated using the “Mark Entry” and “Insert Index” items from the “Index” section on the “References” tab, and can be automatically updated by right clicking on the table below and selecting “Update Field”. To remove marked entries from the document, toggle the display of hidden paragraph marks (the paragraph button on the “Home” tab), and remove the tags shown with XE in { curly braces. }

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