

Business System Analysis Series

On Business Requirements and Technical Specifications:

A Requirements Taxonomy

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**On Business Requirements and Technical Specifications:
A Requirements Taxonomy**

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On Business Requirements and Technical Specifications: A Requirements Taxonomy

The Need for Requirements

Business systems involve a complex set of interaction between various human and mechanical components. Each component has many different dimensions or attributes. The successful functioning of the business system depends upon all of these components interacting in a predictable and desirable manner. Changes to the business system require an appropriate level of detailed understanding of each attribute at the point in time when business and technical developers make decisions regarding that particular dimension.

Various types or categories of requirements may be needed to define the acceptable future state(s) of each attribute. If you are defining any specific type of requirement, test scenarios need to be designed to prove that the defined attribute of the specified component can only be in an acceptable state at any time.

It is important to note here that whereas we are introducing a significant number of different requirement categories in this paper, no single project is every likely to require every type of requirement that we will be describing. Each project is unique and it is important for the business analyst to determine which particular types of requirements are needed for their specific project based on the parameters of the project as well as organizational considerations.

Business Requirements and System (or technical) Specifications

Requirements are commonly divided into business requirements and system (or technical) specifications based on who has the authority and knowledge to make decisions in that dimension. Our definition of a business requirement is “A simple, complete sentence that defines a feature, function, fact, or behavior that a *future* system will (or will NOT) enable, execute, enforce, or exhibit”. A technical specification (sometimes called, “system requirement”) “expresses at the appropriate level of detail how an automated component of the system will behave or what it will produce in order for the system to deliver what the business system needs”. To achieve the appropriate level of detail and to enable a semblance of complete coverage of each area, we further divide both business and system requirements into categories.

Whereas these definitions might appear to be quite clear (to the authors), extensive experience in defining business requirements and system specifications indicates that the clearer a concept is to the author, the less likely it is to be understood as intended by the target audience. Numerous studies in the field of information technology projects underscore this experience. As a result, we feel it imperative to promote a common understanding of differences between business requirements and system specifications. In that vein, this document presents our perspective on the various categories of business and system requirements. For each specific category, we will offer definitions, examples, and clarifications in an attempt to express their meaning.

Categories of Requirements

Many organizations separate requirements into two categories, “Functional” requirements (things the system has to do and the data needed to do it) and “Non-functional” (anything else). We have issues with this terminology. First off, although there is a strong link between the functions of the system and the data that these functions consume or create, splitting the two separates the structure of the data (which is relatively stable) from the day-to-day functions (which are relatively volatile). Secondly, the term “Non-Functional” could be interpreted to mean “does not work” whereas what this category of requirements define is how the system has to *behave* or what *limits* are imposed by the environment on the solution. In addition, there are too many fundamentally diverse types of requirements into the “Non-Functional” category.

In our approach, we start off by defining *four* fundamental categories (perspectives) of the solution that requirements have to address: Functional, Informational, Behavioral, and Environmental. Each of these four perspectives needs to be definable in both business requirements and system specifications. Note that we are not suggesting that every IT project will of necessity need requirements from every perspective. We are, however, recommending that the business and systems analysts need to at least consider each perspective before declaring the process of gathering requirements complete, (besides we know that they are never complete).-

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FUNCTIONAL Requirements

Functional requirements define what the solution has to do. From the business perspective, a functional requirement identifies business processes or procedures that may be independent of technology (i.e., process order, package shipment). In the technology domain, functional specifications define specific programs, modules or routines that accomplish a specific output based solely on input provided and the programmed logic. Functional requirements are relatively concrete and easy to objectively define. However, when the automated modules are named the same as the business procedure they support, they often cause miscommunication.

Functional Business Requirements		Functional Technical Specifications	
Category	Definitions / Clarifications / Examples	Category	Definitions / Clarifications / Examples
01 Processes / Procedures (Manual) ¹	<p>A series of actions, changes, or functions that when completed create a desired result:</p> <p><i>The series of actions done to create a marketing campaign. A set of established forms or methods for conducting the affairs of a business.</i></p> <p><i>The system has to accurately calculate the Harmonized Sales Tax (HST) for all transactions originating in the Maritime provinces.</i></p>	51 Modules / Programs (Automated)	<p>These technical specifications describe what each module or program will do.</p> <p><i>In the object world, this category specifies assemblies, classes, applications, etc.</i></p> <p><i>HST01 will calculate HST for a single toll call and round it to the nearest cent.</i></p>

¹ Please note that the numbers used in these tables are to identify the requirements category only. They are not meant to convey meaning beyond that.

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INFORMATIONAL Requirements

Informational requirements represent knowledge or data that has to be processed, created, tracked, and/or presented in some usable manner. From the business side, informational requirements specify data that the business user needs to know to perform a business function and data that is produced as a result of their actions. At the technology level, informational specifications define input data, output data, stored data, and the metadata for each. Whereas much of this data is directly related to the business requirements, some data is technology-dependent and should be transparent to the business user.

Informational Business Requirements		Informational Technical Specifications	
Category	Definitions / Clarifications / Examples	Category	Definitions / Clarifications / Examples
11 Knowledge	<p>Information and/or skills applied to a specific situation. This is the human (subjective) need that drives all IT applications.</p> <p><i>How to change a tire.</i></p> <p><i>I want to know when to reorder training material from our vendor.</i></p>	61 Data structures	<p>Data structure specifications describe the groupings of the information that may be needed by people or by applications.</p> <p><i>A data structure can be a flat file, a table, an array, a property or set of properties (for a class), or any other collection of basic raw data that is structured in a manner to be usable by an application.</i></p> <p><i>The CustOrder file contains CustID, CustName, OrdDate, OrdQty, and OrdPrice elements.</i></p>
12 Information	<p>A collection of <u>related</u> facts or related data that is greater value than the individual datum.</p> <p><i>Statistical information, customer profiles.</i></p> <p><i>Our website ranks # 2 in worldwide access when searching for the term "Business Requirements Gathering".</i></p>	62 Databases, Data Warehouses, and Data Marts	<p>Database specifications determine the technology that will be used to maintain the groupings of data structures.</p> <p><i>A database is a structured group of tables, relationships, data values, dated a script since, and other information that describes its structure and contents.</i></p> <p><i>The Cash Forecasting database will be developed in Oracle 8i.</i></p>
13 Business Rules	<p>A definition of natural data structures defined by the business community.</p> <p><i>Business rules define entities, relationships, attribute, and behaviors from the business perspective.</i></p> <p><i>An ORDER can be shipped in one or more SHIPMENTS. A "Customer" can have one or more ORDERS.</i></p>	63 Access Paths	<p>Access paths specifications describe primary keys and relationships that determine how data can be accessed by programs or modules.</p> <p><i>Stored data can only be accessed once an access path has been defined.</i></p> <p><i>The CustomerID, ZipCode, LastOrderDate will be used to access the most current credit ratings for a customer.</i></p>

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Informational Business Requirements		Informational Technical Specifications	
14 Business Data Entities	<p>The objects or classes about which the technology will store and manipulate data.</p> <p><i>Business data entities are the things the business community is concerned with on a daily basis.</i></p> <p><i>A customer is an individual or organization that has purchased products or services from us in the past 2 years.</i></p>	64 Tables (Files)	<p>Data is normalized in the computer to avoid redundant data. Normalized data is stored in tables (or flat files).</p> <p><i>Data specifications have to include the expected volume of data (how much) and the expected volatility (how often it might change).</i></p> <p><i>The system should support the five major shippers that service our customer area.</i></p>
15 Business Data Elements	<p>The properties or characteristics of an element of data.</p> <p><i>Individual data elements describe something about a business data entity or its relationship with other entities.</i></p> <p><i>The customer-id is a unique, 15-digit, positive, real number that identifies a single customer.</i></p>	65 Data Fields	<p>Data element descriptions distinguish between base and derivable data.</p> <p><i>Base data elements cannot be calculated, they must be stored. For each derivable data element, a formula is required.</i></p> <p><i>The Ship-Cost will be calculated based on the selected Shipper, the weight of the shipment, and the Ship-To zip code.</i></p>
16 Help Facilities	<p>Context specific information about how to perform a function, action or process of a system.</p> <p><i>The user has to be able to see the corporate standard definition of every element on a data entry screen.</i></p> <p><i>The system date can be set to these formats: mm/dd/yyyy, dd-Month Name-yyyy.</i></p>	66 User Views	<p>User view specifications described collections of information structured and presented in a manner that is people friendly.</p> <p><i>Typically, there are two levels to user views, the data level and the presentation level. Both levels need to be defined independent of each other.</i></p> <p><i>See the AddBook screen prototype.</i></p>
17 Data Constraints	<p>Externally mandated limits on the storage and availability of data elements.</p> <p><i>Legal, organizational, operational, or other needs defining the life expectancy of data.</i></p> <p><i>Results of a medical trial must be kept electronically available for fourteen years after the trial is completed.</i></p>	67 Data Properties	<p>Data properties specifications encompass any information that is needed to describe the length, content type, constraints, ownership, or any other dimension of the information that is being manipulated.</p> <p><i>Data properties are commonly referred to as metadata.</i></p> <p><i>CustType: Numeric - 1=Public, 2=Corporate, 3=Individual</i></p>

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BEHAVIORAL Requirements

Behavioral requirements determine how the solution has to act. Behavior can be defined in *quantitative or qualitative* measures. Quantitative measures are expressed in or easily translated into numbers. They are relatively easy to measure. Qualitative measures are expressed in terms that are typically subjective and for which some mode of measurement becomes necessary. Translating qualitative measures into quantitative measures is referred to as quantification.

Specifying Quantitative Behaviors

Quantitative behavioral requirements are needed to define how long it can take to do something, how often things have to be done, how much data is involved whenever we do something, and how accurate that data has to be from the business perspective. In the world of technology, quantitative specifications are needed to define the amount of data that needs to be created, consumed or stored, the precision at which that data has to be maintained, how long it can take to execute segments of code. These are often referred to as **Performance Requirements**.

Quantitative Business Requirements		Quantitative Technical Specifications	
Category	Definitions / Clarifications / Examples	Category	Definitions / Clarifications / Examples
21 Urgency	<p>How long a person can wait on a response from the automated system before their ability to do their job becomes impaired.</p> <p><i>The desired time lapse for the next event to occur after a specific event occurs.</i></p> <p>Customer service reps have to know the credit status of a caller within 5 seconds.</p>	71 Update Time	<p>Input urgency specifies how quickly a component needs input before it is incapable of completing its mission.</p> <p><i>Typically, sub-second input urgency implies the need for a real time application whereas in interactive applications it is often measured in minutes.</i></p> <p>The reactor shut-off module will shut the system down if it does not receive an override within 3 seconds after issuing a temperature exceeded warning.</p>
22 Frequency	<p>The number of instances an event or process occurs in a specific interval of time.</p> <p><i>Transactions/functions per unit of time</i></p> <p>Payroll will be processed every two weeks.</p>	72 Response Time	<p>Response time specifications mandate how quickly the automated system has to respond to a user request.</p> <p><i>Low response time specifications indicate the need for interactive systems.</i></p> <p>Peak response time for credit rating will not exceed 1.5 seconds.</p>
23 Volume	<p>The amount of data (information) stored, transmitted, presented, and/or used by a process.</p> <p><i>Number of occurrences of records or items on a report</i></p> <p>We anticipate an active customer base of 10,000 by the end of 2006.</p>	73 Size	<p>Size specifications are quantitative measures that can refer to the size of the database (number of all records of each type) or the size of an application (how many MB or GB the distributed application requires).</p> <p>The recorded seminar presentation will not exceed the capacity of a CD-Rom (720 MB)</p>

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Quantitative Business Requirements		Quantitative Technical Specifications	
24 Accuracy	<p>The acceptable deviation from a defined standard or target.</p> <p><i>Tolerance for errors from the business community</i></p> <p>The on-hand inventory file values must be within +/- 2% of the actual physical count.</p>	74 Precision	<p>Precision is specified as a measure of accuracy as it applies to informational content or the results of calculations.</p> <p><i>This is typically expressed in terms of a number of digits behind the decimal point.</i></p> <p>HST will be rounded to the nearest cent.</p>

Specifying Qualitative Behaviors

Qualitative behavioral business attributes are often perceived of as a problem from the information technology side because they are by definition difficult to measure. They are essential, however, to define how easily an end user will be able to use the solution to do their job, how quickly a new user has to be trained to use the solution, and how easily the solution has to adapt to changing needs. The technology dimension defines how quickly the software has to be able to be modified, how trustworthy the results of the solution need to be, how easy it must be to transport the solution onto a different hardware/software platform, and how easily the solution will adapt to variations in workload. These are sometimes called **Subjective Requirements**.

Qualitative Business Requirements		Qualitative Technical Specifications	
Category	Definitions / Clarifications / Examples	Category	Definitions / Clarifications / Examples
31 Usability	<p>A measure of how easy (intuitive) it is to use the system. Often referred to as user-friendliness.</p> <p><i>Subjective dimension that usually requires prototyping or visual representation to clarify</i></p> <p>The graphical interface will not depend upon color alone to convey mission-critical information.</p>	81 Maintainability	<p>Maintainability specifications express how easy it has to be to modify the behavior of an application once it has been deployed.</p> <p><i>Concepts such as cohesion and coupling are measures of maintainability.</i></p> <p>It has to be possible to add new loan rate calculation modes to the system with less than 1 developer day of effort.</p>
32 Trainability	<p>A measure of how easy it is to learn how to use the system.</p> <p><i>Desired length of training time to achieve a specific goal.</i></p> <p>After three hours of web based training and one hour of practice, the user will be able to correctly process 8 out of 10 map requests in less than 2 hours.</p>	82 Reliability	<p>Reliability specifications are an expression of how errors that the application makes affect the outside world.</p> <p><i>Common measures of reliability are mean time between failures (MTBF), mean time to repair (MTTR), etc.</i></p> <p>The patient monitoring system down time will not exceed 1 cadaver between failures.</p>

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Qualitative Business Requirements		Qualitative Technical Specifications	
33 Flexibility	<p>A measure of how easy it is to add new functionality or change existing functionality</p> <p><i>Length of time expected to accomplish maintenance task</i></p> <p><i>A support programmer with 1 year of experience supporting this system should be able to create a new two page (screens) user view in less than two hours.</i></p>	83 Scalability	<p>Scalability specifications are needed to define acceptable criteria for an application to grow over time in reaction to growing business events or volumes of data.</p> <p><i>Missing scalability requirements lead to solutions that quickly become unable to respond to changing business volumes.</i></p> <p><i>The system has to accommodate a 500% annual increase in sales.</i></p>
34 Availability	<p>A measure of the planned up time during which the system can be used. It is usually expressed as a percentage of duration.</p> <p><i>Mean time between failures and accumulated down time during failures</i></p> <p><i>During peak time (10am to 2pm) the system should be operational 99.5% of the time.</i></p> <p><i>The nuclear power plant radiation level monitor function has to be available 24/7/365.</i></p>	84 Portability	<p>Portability specifications are necessary for applications that will be installed on multiple operating systems.</p> <p><i>This measure can be critical for applications that are used in n-tiered architectures and/or on the internet/intranets.</i></p> <p><i>The application will function without modifications on Windows, Linux, Apache and Apple operating systems.</i></p>

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ENVIRONMENTAL Requirements

Environmental requirements define the context within which the solution has to operate. Business attributes are needed to define who will interact with the future business solution, where each component of the solution is physically located, who has the authority to do what to each component, governmental and regulatory mandates, language and customs of the business users, as so forth. On the technology side, environmental factors that need to be defined include hardware, software, network architecture, operating systems, and data base technology, data exchanges with other solutions, allowable programming language, architectural structure, methods, documentation, etc. Since requirements in this category often constrain the design of a successful solution, they are often referred to as “Constraints”.

Environmental Business Requirements		Environmental Technical Specifications	
Category	Definitions / Clarifications / <i>Examples</i>	Category	Definitions / Clarifications / <i>Examples</i>
41 Distribution (Organization)	<p>The roles and responsibilities of the users of the system.</p> <p><i>Who can do what or gets what information</i></p> <p><i>A clerk will be able to determine inventory from any of the floor access terminals.</i></p>	91 Interfaces (Interaction)	<p>Interfaces/interaction specifications of the boundary between the users and automation or between applications that need to communicate with each other.</p> <p><i>One major dimension of interface specifications has to do with the end-user interface which is often defined in terms of a universally accepted standard.</i></p> <p><i>The payroll system has to communicate with the HR system using EDI format 8II6B.</i></p>
42 Location	<p>The physical site of the components of the system (including people).</p> <p><i>Geographic or structure of hardware, software, resources</i></p> <p><i>The application will be accessible from any city in Florida.</i></p>	92 Standards	<p>Standards specifications determine which corporate, industry-wide, best practice or other limits will be imposed on the structure, content or context of the evolving solution.</p> <p><i>Standards often also apply to “91 Interfaces”, above.</i></p> <p><i>Dates will be represented as dd-MonthName-yyyy (02-September-2066.</i></p>
43 Security	<p>A description of the characteristics of those people who are allowed to use the system and the means by which they gain access to the system.</p> <p><i>Use of secret codes and/or biometric identifiers</i></p> <p><i>Only E8 level and above personal can view the Andromeda files based on retinal scan and fingerprint id.</i></p>	93 Infrastructure	<p>Infrastructure specifications describe the hardware/software configuration that is needed for the project to be successful.</p> <p><i>This can also include system software, middleware, and other necessities.</i></p> <p><i>The disk drives of the system will be shadowed at each regional center and the global center.</i></p>

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Environmental Business Requirements		Environmental Technical Specifications	
44 Legal	<p>Specific laws or regulations with which the system must comply.</p> <p><i>Externally mandated constraints</i></p> <p><i>Personal health data will not be stored with personal identity data.</i></p>	94 Methodology	<p>Methodology specifications identify the approach that the project will follow and why.</p> <p><i>Methodologies should be a project-level decisions since the selected approach has a significant impact on project success or failure.</i></p> <p><i>THE Guide Project Management and System Development methodology will be used for this project.</i></p>
45 Cultural	<p>Human factors that must be consider in the design of the system. It usually denotes a personal quality resulting from the development of intellect, manners, and aesthetic appreciation.</p> <p><i>Localization considerations</i></p> <p><i>The system cannot use any red fonts.</i></p> <p><i>Information on the order entry interface has to have the same meaning in English, German, French and Italian.</i></p>	95 Technology Architecture	<p>Technology constraints limit the project teams' ability to make decisions regarding hardware / software platforms for their particular application.</p> <p><i>Architectural specifications are often the domain of the "System Architect" role.</i></p> <p><i>The application has to run on the existing hardware/software platform.</i></p>

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Hyperlinked Table of Requirement Categories

Since the number of different dimensions is fairly mind-boggling, we would like to offer an overview table to place each of the requirement categories. Following the overview table, we will offer the definitions, examples and clarifications of each requirement type. The names of each requirement type are linked to their definitions, so clicking on the name will get you directly to the definition.

		Business Requirements	Technical Specifications
Functional (Doing)		01 Processes / Procedures (Manual)	51 Modules / Programs (Automated)
Informational (Knowing)		11 Knowledge 12 Information 13 Business Rules 14 Business Data Entities 15 Data Elements 16 Help facilities 17 Data Constraints	61 Data structures 62 Data bases, Data Warehouses, and Data Marts 63 Access Paths 64 Tables (Files) 65 Data Fields 66 User Views 67 Data Properties
Behavioral (Performing)	Quantitative (Objective)	21 Urgency 22 Frequency 23 Volumes 24 Accuracy	71 Size 72 Precision 73 Response Time 74 Update Time
	Qualitative (Subjective)	31 Usability 32 Trainability 33 Flexibility 34 Availability	81 Maintainability 82 Reliability 83 Portability 84 Scalability
Environmental (Constraining)		41 Distribution (Organization) 42 Location 43 Security 44 Legal 45 Cultural	91 Interfaces (Interaction) 92 Standards 93 Infrastructure 94 Methodology 95 Technology

As a final disclaimer, we would like to note that this list is not necessarily complete. Just like the requirements that they strive to delineate, the list is subject to change as this volatile industry continues to evolve. That notwithstanding, this list should serve as a reasonable baseline for future evolution.

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On Business Requirements and Technical Specifications is one of a series of white papers published by the Requirements Solutions Group, LLC. This white paper is intended to complement our training in business system analysis and delivery. For more information concerning this training, our methodology, or our consulting services, contact:

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