

# NONFUNCTIONAL REQUIREMENT EXAMPLES

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## OPERATION GROUP

Describes the user needs for using the functionality. The user perceives the system as an electronic tool that helps to automate what would otherwise be done manually. From this point of view, the user is concerned with how well the system operates.

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## ACCESS SECURITY

The extent to which the system is safeguarded against deliberate and intrusive faults from internal and external sources.

### Examples

- a. Employees shall be forced to change their password the next time they log in if they have not changed it within the length of time established as “password expiration duration.”
- b. Users must change the initially assigned login authentication information (password) immediately after the first successful login. The initial password may never be reused.
- c. The payroll system shall ensure that the employee salary data can be accessed only by authorized users. The payroll system shall distinguish between authorized and non-authorized users.
- d. Employees shall not be allowed to update their own salary information, and any such attempt shall be reported to the security administrator.
- e. Only holders of current security clearance can enter the national headquarters building.
- f. The access permissions for system data may only be changed by the system’s data administrator.
- g. Passwords shall never be viewable at the point of entry or at any other time.
- h. Each unsuccessful attempt by a user to access an item of data shall be recorded on an audit trail.
- i. Users shall receive notification of profile changes via preferred communication method of record when profile information is modified.

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## ACCESSIBILITY

The extent to which the software system can be used by people with the widest range of capabilities to achieve a specified goal in a specified context of use.

### Examples

- a. The system shall be accessible to people with disabilities in accordance with the Americans with Disabilities Act of 1990.
- b. The system shall be accessible by people with specific vision needs, to the extent that a user shall be able to:
  - a. Display the whole user interface in a large font without truncating displayed text or other values.
  - b. Use a screen magnifier to magnify a selected part of the screen.
  - c. Use a screen reader to read aloud information displayed.

(An estimated 27% of working age adults has a vision difficulty or impairment.)

- c. The system shall be accessible by people who are color blind, to the extent that they shall be able to discern all text and other information displayed by the system as easily as a person without color blindness. Any meaning conveyed through the use of color shall also be conveyed by other means discernable by a color blind person.

(An estimated 9% of men and 0.5% of women are color blind.)

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## AVAILABILITY

The degree to which users can depend on the system to be up (able to function) during “normal operating times”.

### Examples

- a. The Online Payment System shall be available for use between the hours of 6:00 a.m. and 11:00 p.m. CST.
- b. The Online Payment System shall achieve 100 hours MTBF (mean time between failure).
- c. The CIF system shall achieve 99.5% up time.
- d. The mortgage amortization schedule shall be available to the customer within 15 seconds for 95% of the times that it is requested. The remaining times it will be available within 20 seconds.
- e. The Automated Teller Machine shall be at least 99.0 percent available on weekdays between 6:00 a.m. and 11:00 p.m. local time. The machine shall be at least 99.95 percent available on weekdays between 4:00 p.m. and 6:00 p.m. local time.
- f. Unless the system is non-operational, the system shall present a user with notification informing them that the system is unavailable.
- g. A new installation of the system shall be available for first-time use within 24 hours of the start of the install.
- h. The online registration system shall permit backing up of the registration database while other registration activities are going on. (It is estimated that this requirement reduces duration for which the online registration system would be unavailable to students for maintenance by 15 minutes each calendar day.)

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## CONFIDENTIALITY

The degree to which the software system protects sensitive data and allows only authorized access to the data.

### Examples

- a. Taxpayer Social Security Number shall never be viewable at the point of entry or at any other time. Only the last four digits of a SSN will be displayed on printable electronic documents.
- b. The Medical System shall transmit patient records only when the patient has provided a written, signed release form authorizing the transmission.
- c. Only Claims Adjusters with authorized clearance may view employee claims against self-insured employers.
- d. The system shall protect the privacy of all protected health information in compliance with the privacy rule of the U.S. Health Insurance Portability and Accountability Act (HIPAA). Protected health information is any information about an individual that concerns their health, the provision of health care to them, or payment for health care.

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## EFFICIENCY

The extent to which the software system handles capacity, throughput, and response time.

### Examples

- e. At least 20 percent of the processor capacity and storage space available to the system shall be unused at peak load seasonal periods.
- f. The system restart cycle must execute completely in less than 60 seconds.
- g. System shall be able to process a notification in 1 second or less, and up to and including 100 notifications in 15 seconds or less.
- h. The initial system shall be able to handle the entry of orders by customers at a minimum rate of 10 per second.
- i. The system must accommodate 300 simultaneous users or less within the peak load period from 9:00 a.m. to 11:00 a.m. Maximum simultaneous user capacity loading at non-peak periods will be 150.
- j. Any interface between a user and the automated system shall have a maximum response time of two seconds.
- k. Complete report summaries of the current business day's trading shall be available one minute after the end-of-day close of trading.
- l. Routine maintenance that is executed while users are active shall not cause a perceptible increase in response time for any function of more than 5% over the response time when no maintenance process is executing.
- m. The system shall produce a storage capacity warning notification when the 65% capacity threshold is crossed with additional notifications issued thereafter at 5% threshold increments.

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## INTEGRITY

The degree to which the data maintained by the software system are accurate, authentic, and without corruption.

### Examples

- a. All monetary amounts must be accurate to two decimal places.
- b. Accuracy of warehouse temperature readings will be within plus or minus two degrees Celsius.
- c. Whenever a change is made to information stored in Microsoft Word, the fact of the change shall be recorded in a database or equivalent technology that is routinely backed up. This is intended to identify changed documents in the event of the loss of a disk.
- d. The loan origination system shall perform all calculations with rounding to five (5) decimal places before rounding for presentation to two decimal places (dollars and cents).
- e. The integrity of the system data area must be checked by the internal audit system twice per second; if inconsistencies in the data are detected, the system operation should be disabled.
- f. The precision of calculations with derived data shall be at the same degree of precision as the originating source data.
- g. Derived totals and sub-totals shall be considered transient data and never committed to permanent storage.
- h. Tallies and totals shall acknowledge the source of record when presented without supporting detail.
- i. Presentation of earned premium shall be relative to presentation date, policy renewal date, and payment posted date calculated to a whole day.

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## RELIABILITY

The extent to which the software system consistently performs the specified functions without failure.

### Examples

- a. The Automated Teller Machine (ATM) probability of failure on demand (POFOD) shall be 0.001 (1 out of 1000) when reading the magnetic stripe data on an undamaged card.
- b. The rate of failure occurrence (ROCOF) per ATM shall be 1/1000 (1 occurrence in 1000 days). Failure means the ATM fails to operate with any card inserted, and the software must be restarted to correct the failure.
- c. The mean time to failure (MTTF) of the ATM timing out due to user inactivity shall be 1/1000 (1 occurrence in 1000 transactions). Failure means the ATM must cancel the transaction, and must allow the user to start over.
- d. The account update process shall roll back all related updates when any update fails to commit.
- e. The authorization transaction match process shall require a 100-percent match to post a transaction.
- f. The data transmission process shall confirm the receiving terminal is in a ready state prior to the start of transmission.
- g. The point-of-sale terminal shall have an MTTF of 1/10,000 transactions in an ROCOF of 1/30 days. Failure is defined as an invalid transaction presented for processing.

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## SAFETY

The degree to which a software system prevents harm to people or damage to the environment in the intended context of use.

### Examples

- a. The Radiation System shall not permit operation unless the Operator Guard is in Operate position.
- b. The Medication Monitoring System shall not dispense doses of medication that are greater than maximum amount prescribed by the physician.
- c. The Food Vending Machine shall not dispense a snack if the temperature of a cold food item goes above 41°F.

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## SURVIVABILITY

The extent to which the software system continues to function and recovers in the presence of a system failure.

### Examples

- a. If the audit trail function fails before the user saves updates to the contract, the system shall be able to recover all changes made in the contract being updated up to one minute prior to the failure.
- b. When an update failure is detected all updates performed during the failed session shall be rolled back to restore the data to pre-session condition.
- c. All data recovered in a roll-back condition shall be recorded for use in forward recovery under user control.
- d. When operating after a failure the user shall be informed the application is operating in a “safe mode” and all data is available for review without update.
- e. The system shall prevent access to failed functions while providing access to all currently operational functions.
- f. All transactions shall pass three-way hash routine validation before committing transaction update.
- g. All hardware components of the assembly operation shall be replicated, such that failure of any one hardware component shall not render the assembly operation unavailable to end-users. It is acceptable for system performance to be poorer than normal for up to 3 business days following the failure and replacement of a piece of hardware.

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## USABILITY

The ease with which the user is able to learn, operate, prepare inputs, and interpret outputs through interaction with a system.

### Examples

- a. The new product shall be easy to use by adult members (age 18 to 80) of the public who may only have one hand free.
- b. The vending product shall be able to be used by adult members of the public without training. A panel representative of at least 95 percent of the general public shall successfully purchase a product from the vending product on their first encounter.
- c. The product shall be self-explanatory and intuitive such that a service agent shall be able to produce a price quote within 10 minutes of encountering the product for the first time.
- d. The new policy management system shall be evaluated by 90 percent of the user community to be at least as easy to use as the existing system.
- e. A trained order-entry clerk shall have the ability to submit a complete order for a product chosen from a supplier catalog in a maximum of 7 minutes, with an average order entry time of 4 minutes.
- f. People with no training and no understanding of English shall be able to use the product.
- g. A new warehouse clerk shall be able to enter a customer order on the system within a typical 8-hour business day.
- h. The system shall be useable by program developers after five weeks of training.

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## REVISION GROUP

Describes the user needs for changing the source code or data that drive the system. The user perceives the system as a set of programmed language statements. These statements are treated as a problem that must be solved. The system must be analyzed, modified, tested, and implemented as problems arise, or the business changes the way it operates.

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## FLEXIBILITY

The ease with which the software can be modified to adapt to different environments, configurations, and user expectations.

### Examples

- a. Provisions shall be made for the future usage of multiple languages. Provision shall include at least the following: 1) The structure of the data store shall be such that multi-lingual support shall not necessitate additional components or the need to replace current components, and 2) A user shall be able to nominate their preferred language when entering their personal information.

- b. No piece of text that might be displayed to a user shall reside in program source code. Every piece of text that a user might see must be modifiable without changing source code. That is, no user-visible text will be “hard-coded.”
- c. The billing system shall be able to process invoices and payments in multiple different currencies. (Currency conversion calculations are to be detailed in business rules and enforced by functional requirements.)
- d. The course curriculum management system shall allow multiple independent courses to be offered with multiple scheduled offerings. Information about courses shall be rigorously separated from each other, and no user shall be able to view or otherwise access information about a course with which they are not connected.
- e. The employee benefits system shall be suitable for use by any ABC Corporation office in any country in which ABC Corporation operates. (It is assumed that all users of the system speak a common language so translation into multiple languages for user interfaces, reports, documentation, and other business materials is not necessary.)
- f. The system shall have the ability to add a new user notification method by developing and “plugging in” the software necessary to support the new method. A new user notification method shall not require changes to the core software of the system to allow its introduction.

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## MAINTAINABILITY

The ease with which faults in a software system can be found and fixed.

### Examples

- a. The customer service call center shall analyze 95% of the problem reports within 2 hours. Items classified as “urgent” shall be repaired within 3 business days in 98% of the reported cases.
- b. The application development process must have a regression test procedure that allows complete re-testing within 2 business days.
- c. A maintenance developer shall be able to modify existing statements to conform to revised regulations from the federal government with 24 labor hours or less of development and testing effort.
- d. A new consumer type code must be able to be added to the product within 12 business hours.
- e. The system must maintain a service log and, on system start-up, must check if system service is due. If a scheduled service session has not been carried out within 5 calendar days of the scheduled date, the system should discontinue operation.
- f. A development programmer who has at least one year of experience supporting this software application shall be able to add a new product feature, including source code modifications and testing, with no more than one week of labor.
- g. The system shall not be shut down for maintenance more than once in a 24-hour period.

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## MODIFIABILITY

The degree to which changes to a software system can be developed and deployed efficiently and cost effectively.

### Examples

- a. No piece of text that might be displayed to a user shall reside in source code. That is, every piece of text that a user might see must be modifiable without changing source code.
- b. A development programmer who has at least one year of experience supporting this software application shall be able to add a new product feature, including source code modifications and testing, with no more than one week of labor.
- c. Function calls shall not be nested more than two levels deep.

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## SCALABILITY

The degree to which the system is able to expand its processing capabilities upward and outward to support business growth.

### Examples

- a. The elapsed duration of time required to produce any statement or report showing information about transactions shall be based upon how much data is presented rather than the total quantity of stored data.

- b. The effort needed to administer the payroll system (as measured in hours per month of system administrators' time) shall not increase with an increase in the number of employees. If there is a significant increase in system operation work, it shall be proportionately less than an increase in the number of employees.
- c. The payroll system shall be scalable to support unlimited growth in the number of employees.
- d. The business rules repository shall be scalable to manage an unrestricted number of additional rules.
- e. The travel reservation system shall be scalable to accommodate its use by an unlimited number of agency offices worldwide.
- f. The claims system shall support all assigned adjustors following any catastrophic event.
- g. The account management system shall support unlimited customer, account, and transaction relationships.
- h. The transaction authorization system shall scale to potential hourly spikes of 1,000% in authorization requests during peak holiday shopping.

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## VERIFIABILITY

The extent to which tests, analysis, and demonstrations are needed to prove that the system will function as intended.

### Examples

- a. No member of a test panel of 500 children (aged 8) shall incur an injury while playing with the product. The product must comply with product safety regulations as defined by (specify).
- b. The maximum number of test cases to cover testing of any particular source code module shall be 20.
- c. The Customer Information System shall be implemented using Release 5 of Library 4B.
- d. The system and supporting infrastructure for the automatic shut-down sequence must be validated to the highest reasonable commercial reliability standards.
- e. The design of the Payroll System shall include software that tests the operating system and the communication links, memory devices, and peripheral devices.
- f. It shall be possible for the All-in-One Printer software to be installed by a typical customer who has no special expertise. The installation process shall be convenient and involve the entry of little information by the user.
- g. When a new version of the payroll system is released, it shall be possible to upgrade to it from any previous version.
- h. Software testing will require the use of a test database with data extracted from the production database. This test database will be deleted after successful implementation of the software system.
- i. At the time of conversion the customer demographic information shall have a 99.5% match rate after data scrubbing.
- j. All developers on the project shall have identical development environment configurations, and all testers shall have identical quality assurance environment configurations.

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## TRANSITION GROUP

Describes the user needs for managing the upkeep of the system. From this point of view, the system carries similar characteristics as hardware. The user is concerned with aspects such as packaging, transport, and compatibility with other systems.

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## INSTALLABILITY

The ease with which a software system can be installed, uninstalled, or reinstalled into a target environment.

### Examples

- a. It shall be possible for the Web Shop client application to be installed by a typical customer who has no special expertise. The installation process shall be convenient and involve the entry of little information by the user. The client application shall be downloaded from the service's Web site.
- b. It shall be possible for the system's main server software to be installed by a competent system administrator who has no previous knowledge of the system or of the third-party products it uses, but who is familiar with the operating system of the machines on which it is to be installed. The software shall be installed from a popular portable medium.
- c. When a new version of the main system is released, it shall be possible to upgrade to it from any previous version.



- d. Installing an upgrade shall not modify existing configuration values. An exception is made for any values that the new version uses in different ways from the previous version. The motivation for this requirement is to avoid wasting the time of users who have spent considerable time configuring the system to suit themselves.

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## INTEROPERABILITY

The extent to which the software system is able to couple or facilitate the interface with other systems.

### Examples

- a. The system must be able to interface with any HTML (HyperText Markup Language) browser.
- b. The baselined version 2 of the spreadsheet must be able to access information from the previous baselined version.
- c. The Automated Teller Machine (ATM) must interface with the Automated Clearing House (ACH) in order to complete withdrawal transactions.
- d. The product shall not use picture icons that could be considered offensive in any country where the product is marketed.
- e. The common language used in the incoming mail department shall be English to increase communication effectiveness and reduce processing errors.
- f. Any change or upgrade to the interface between the Order Entry System and the Inventory Warehouse system shall be installed simultaneously by both systems.
- g. Local communications for each SmartMeter system can be used within the premises to link to local devices through utilization of standard protocols. There will be no reliance or operational mandate upon a Supplier to organize a site visit in order to install and/or maintain operation of any local device out of the SmartMeter system.
- h. Physical communications will be guaranteed as interoperable through the use of an agreed minimum national service standard (to be defined) for prioritized exchanges of data. Any such service standards would be expressed in the time taken to complete the data exchange, for example, 15 minutes, 2 hours, 1 day. It will not be prescriptive about the number of retries required or delivery performance – all exchanges of data will complete.
- i. All SmartMeter systems will provide a standard interface that can be used by meter operators for installation and maintenance purposes without disturbing any meter seals and reinstating any tamper detection covers.
- j. To be interoperable with the SmartMeter energy system, any local device must support the chosen local communications, data interface, protocol and security solutions.

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## PORTABILITY

The ease with which a software system can be transferred from its current hardware or software environment to another.

### Examples

- a. All timestamps recorded by the transaction processing system shall be in UTC (Universal Time Coordinated) when placed into permanent storage.
- b. The time zone shall be obvious to the user whenever a time element is displayed.
- c. The product is targeted for sale next year in the European market.
- d. The product is designed to run in business offices, but the intent is to have a version which will run in manufacturing assembly plants.
- e. The system shall be developed for Microsoft Vista and Macintosh operating system platforms.
- f. The HomeAccounting software may be ported to any personal computer or workstation environment supporting at least 16-bit color on a 15 inch display monitor, achieving a SPECfp95 benchmark rating of at least 5.0, and having a data storage capacity of at least 8 MB.

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## REUSABILITY

The extent to which a portion of the software system can be converted for use in another system.

### Examples

- a. The payment subsystem design is based on the payment module from the ALPHA product line. The ePAYZ system should not be modified unless absolutely necessary.
- b. Development of functionality to support the Electronic Funds Transfer (EFT) payment option shall be modularized such that it can be reused by other departments of the organization.
- c. Web applications shall be developed to adhere to HyperText Markup Language (HTML) guidelines and standards.
- d. All software that runs on a client device shall be written in a prevalent programming language such that the software can be run on a personal computer without having to download a supporting environment.
- e. The hard-copy materials in the Library of Congress shall be converted to an electronic form such that the existing knowledge can be flexibly presented in different formats for use in different contexts. (Note that this involves more than just putting the materials into computer repositories and accessing the knowledge through information retrieval systems. Accessibility must also comply with copyright laws.)

