

Non-Functional Requirements Grades Usage Guide [Usage Manual]

April 2010

**Information-Technology Promotion Agency, Japan
Software Engineering Center**

[Usage conditions]

1. The copyright to this document is held by the Information-Technology Promotion Agency, Japan.
2. This document is protected by the Copyright Act of Japan and other international copyright protection conventions and treaties. Except for the exceptions listed in item 3, modification, public transmission, sale, publishing, translation, and adaptation of this document, in whole or in part, without the explicitly written permission of the Information-Technology Promotion Agency, Japan, is strictly prohibited, regardless of whether or not said actions are performed for purposes of profit.
3. The Information-Technology Promotion Agency, Japan grants users of this document to perform the two, and only two, actions mentioned below ((1) and (2)), provided that the following copyright notice is clearly indicated.

Copyright notice: Copyright © 2010 IPA

 - (1) Duplication of this document, in whole or in part.
 - (2) Free redistribution of duplications of this document on the condition that the parties to which the duplication is redistributed are put under the same obligations as described on this page.
4. The Information-Technology Promotion Agency, Japan makes no guarantees of this document containing no infringements of the copyrights, patent rights, or other intellectual property rights, such as utility model rights, of third parties, nor does it assume any responsibility for possible errors contained herein. The Information-Technology Promotion Agency, Japan makes no guarantees that the content of this document will conform to the legal requirements for export, technology transfer, and other national laws and regulations of any country or region.
5. Other than the exceptions specified on this page, the Information-Technology Promotion Agency, Japan does not grant any rights nor any license relating to copyrights, patent rights, or other intellectual property rights, such as utility model rights, of the Information-Technology Promotion Agency, Japan or of third parties.
6. The Information-Technology Promotion Agency, Japan shall, in any case, not be held liable for damages which may result from, but not limited to, using this document in system development, the use of the resulting developed systems, or the inability to use said systems.
7. Please contact the Information-Technology Promotion Agency, Japan's Software Engineering Center with inquiries regarding this document.

About the Non-Functional Requirements Grades Usage Guide [Usage Manual]

The Non-Functional Requirements Grades Usage Guide is, as the diagram below shows, composed of the "Usage Manual" and the "Description Manual".

Non-Functional Requirements Grades Usage Guide Structure

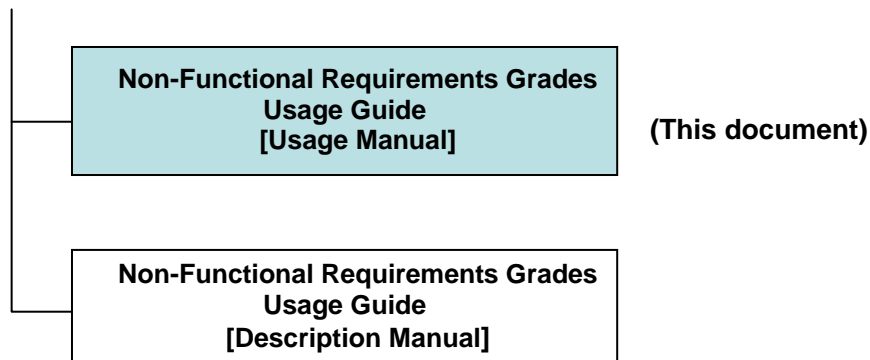


Figure: Non-Functional Requirements Grades Usage Guide [Usage Manual] positioning

The objective of this manual is to indicate how to utilize non-functional requirements grades for visualization of system infrastructure outsourcer requirements.

Please refer to the "Description Manual" for an explanation of the background behind the creation of non-functional requirements grades, details regarding individual tools, etc.

The expression "non-functional requirements grades" refers to the Non-Functional Requirements Grades Usage Guides and the following 3 tools:

- "System Infrastructure Non-Functional Requirements Related Grade Table" (hereafter referred to as the grade table)
- "System Infrastructure Non-Functional Requirements Related Item List" (hereafter referred to as the item list)
- "System Infrastructure Non-Functional Requirements Related Tree Diagrams" (hereafter referred to as the tree diagrams)

Intended audience of this document

This document is targeted primarily at persons responsible for placing or receiving orders, and who are involved in the provision, proposal, or determination of non-functional requirements during the requirement definition phase or similar phases of the development of information systems such as corporate business systems. This document refers to those placing orders as "users," and those receiving orders as "vendors".

How this document is organized

This document is organized as shown in the table below.

Table: How this Non-Functional Requirements Grades Usage Guide [Usage Manual] is organized

Chapter number	Chapter title	Overview
Chapter 1	Non-functional requirements grades overview	Provides an overview of individual non-functional requirements grades tools, and explains the intended users of those tools, etc.
Chapter 2	Relationship between the development process and non-functional requirements grades utilization	Explains the processes for which non-functional requirements grades use is envisioned, an overview of usage, etc.
Chapter 3	Basic utilization examples	Provides an explanation of typical usage of non-functional requirements grades.
Chapter 4	Further utilization examples	Provides an explanation of other examples of utilization in accordance with relevant circumstances.
Chapter 5	Points of consideration	Provides an explanation of points to consider when using non-functional requirements grades.

Table of contents

1. Non-functional requirements grades overview	1
1.1 Using non-functional requirements grades	1
2. Relationship between the development process and non-functional requirements grades utilization	5
2.1 Processes and users using non-functional requirements grades	5
2.2 Processes using non-functional requirements grades, and overview of usage	6
3. Basic utilization examples	9
3.1 Model system selection	9
3.2 Level determination of important items	14
3.3 Level determination of items other than important items	18
4. Further utilization examples	20
4.1 Example of utilization when a common infrastructure already exists	20
4.2 Example of non-functional requirements grades utilization in system expansion development	26
4.3 Example of utilization in creation of requests for information (RFI) and requests for proposals (RFP)	27
4.4 Example of utilization when information security related regulations, etc. exist	28
5. Points of consideration	32

1. Non-functional requirements grades overview

1.1 Using non-functional requirements grades

This section explains the basic concepts behind and key points of non-functional requirements grades usage.

(1) Stepwise refinement

Before we explain details of non-functional requirements grades usage in Chapter 3, the basic concept of non-functional requirements grades usage is presented below.

As Figure 1.1.1 shows, non-functional requirements grades assume stepwise refinement of requirements and agreements.

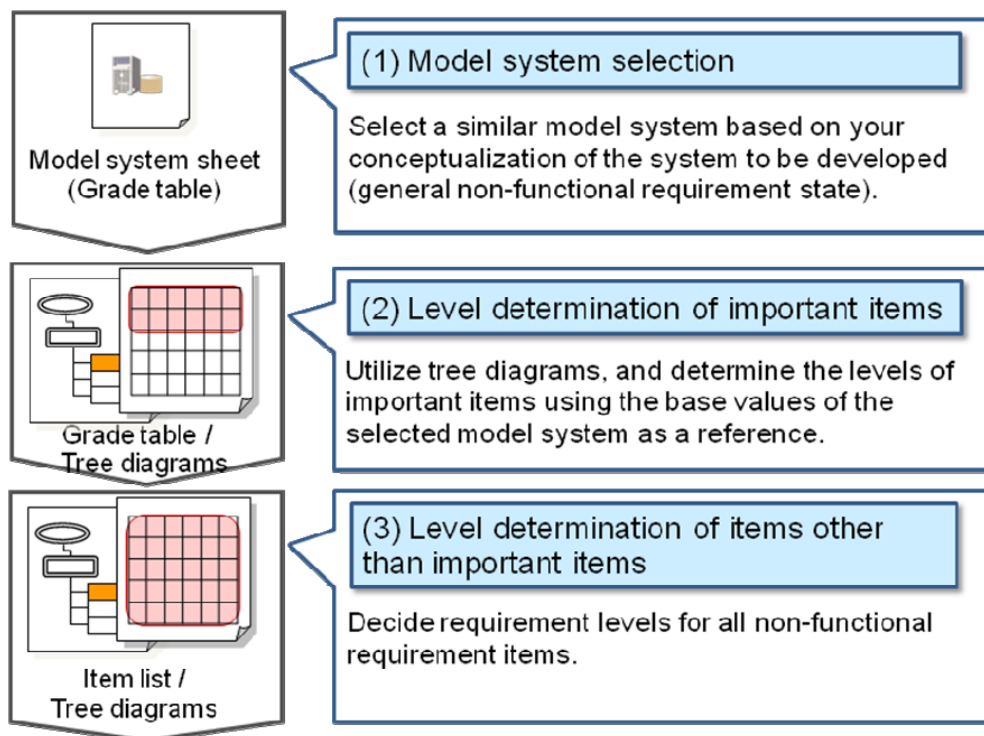


Figure 1.1.1 Stepwise utilization of non-functional requirements grades

The following information is presented to supplement the terminology used in Figure 1.1.1. Please refer to the "Description Manual" for an explanation of non-functional requirements grades and other terminology.

- Model system

Any of the three system types determined based on the Ministry of Economy, Trade and Industry information system reliability improvement related guidelines and IPA critical infrastructure information system reliability research reports, with specifically defined non-functional requirements.

- Metrics

Indices used to quantitatively express non-functional requirement minor categories. Unit of consensus for non-functional requirements.

- Important item

Item with significant impact on quality and cost during system infrastructure non-functional requirements consideration.

- Level

Value, from 0 to 6, corresponding to metrics. Specific implementation levels defined for each metric are referred to as level values, and the level values assigned as default values to the model systems contained in the grade table are referred to as base values.

There are many ways in which non-functional requirements grades may be used, and confirmed information (non-functional requirements grades input) will vary based on usage situations and timing. Non-functional requirements grades assume stepwise refinement of evaluation materials used in considering non-functional requirements depending on usage situations and timing, and provide tools which can be used in accordance with those situations.

For example, when only general non-functional requirements have been decided, as shown in the (1) "model system selection" step of Figure 1.1.1, it is best to start from selecting a model system using the model system sheet. Conversely, if non-functional requirements have been to some degree clarified, as shown in the (3) "level determination of items other than important items" step, it is possible to use the item list to decide the requirement levels of individual non-functional requirements.

(2) Non-functional requirements grades application

Requirement items are listed in the grade table and item list of the non-functional requirements grades. Not all requirement items are necessarily uniquely determined for systems when actually confirming a system's non-functional requirement items. For example, as Figure 1.1.2 shows, in a case where a system is composed of 3 sub-systems, and each sub-system has differing non-functional requirement levels, non-functional requirements grades requirement items are confirmed separately for common system-wide items, and specific sub-system items.

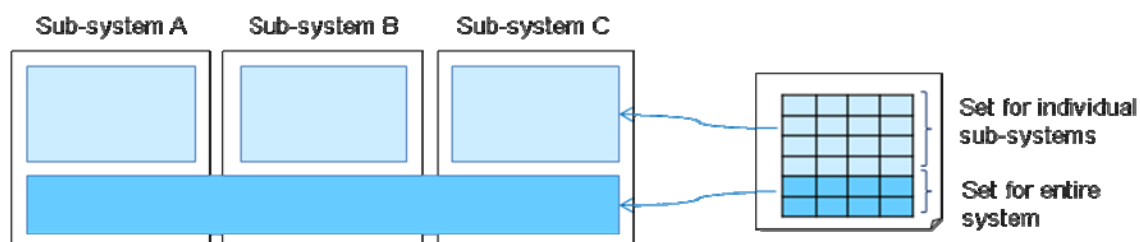


Figure 1.1.2 Non-functional requirements grades application method

As the figure shows, non-functional requirements grades must be applied for each unit with differing non-functional requirement levels, such as sub-systems, servers, and service provision functions.

(3) Non-functional requirements grades utilization sheet

A non-functional requirements grades utilization sheet is provided in spreadsheet form, unifying the grade table and item list. It is intended to be used by entering requirement item consensus results as part of the consensus formation process, and for creating unique grade tables, as explained in Section 4.1. Please refer to the usage terms and conditions listed in the non-functional requirements grades utilization sheet for specific usage terms and conditions.

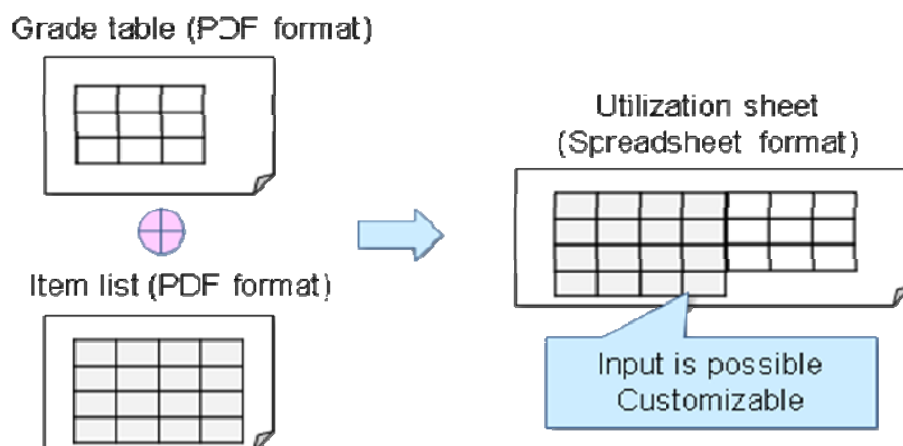


Figure 1.1.3 Non-functional requirements grades utilization sheet provision

(4) Intended users

The conceptualization of the user/vendor relationship in this "Usage Manual" is based partially on "Management Participation in Securing of Requirement Quality, Second Edition (SEC BOOKS)." The divisions and roles in "Management Participation in Securing of Requirement Quality, Second Edition (SEC BOOKS)" (in Japanese only) are as shown in Figure 1.1.4. The "Usage Manual" envisions information system divisions and vendors as users and vendors, respectively. This is not to limit who can use non-functional requirements grades, nor how they

can be used, but is used purely for convenience in Chapter 2 and onwards.

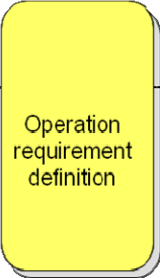

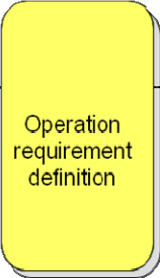

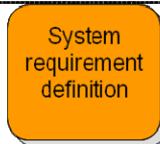
Divisions, etc., / Roles		Requirement definition contents	
Management	President		
	Officer		
Business division	Division manager		
	Business implementer		
	System implementer		
	Related companies		
Information system department	Division manager		
	System developer		
	System subsidiary		
Vendor	Prime vendor		
	Outsourcer		
	Sub-vendor		

Figure 1.1.4 User/vendor divisions and roles

(Source: "Management Participation in Securing of Requirement Quality, Second Edition")

2. Relationship between the development process and non-functional requirements grades utilization

This chapter provides an overview of envisioned non-functional requirements grades usage processes, users, and how the non-functional requirements grades are used.

2.1 Processes and users using non-functional requirements grades

Non-functional requirements grades are envisioned to be used in processes and activities which deal with non-functional requirements during the planning processes, requirement definition processes, and development processes of "Japan Common Frame 2007"¹. The upstream processes shown in the "Japan Common Frame 2007" are divided, in "Management Participation in Securing of Requirement Quality, Second Edition (SEC BOOKS)," into the processes shown in Figure 2.1.1, from the vantage of securing requirement quality.

This document uses the process examples from "Management Participation in Securing of Requirement Quality, Second Edition (SEC BOOKS)" for the processes for which non-functional requirements grades usage is envisioned, primarily from "systemization direction" to "requirement definition" (see Figure 2.1.1).

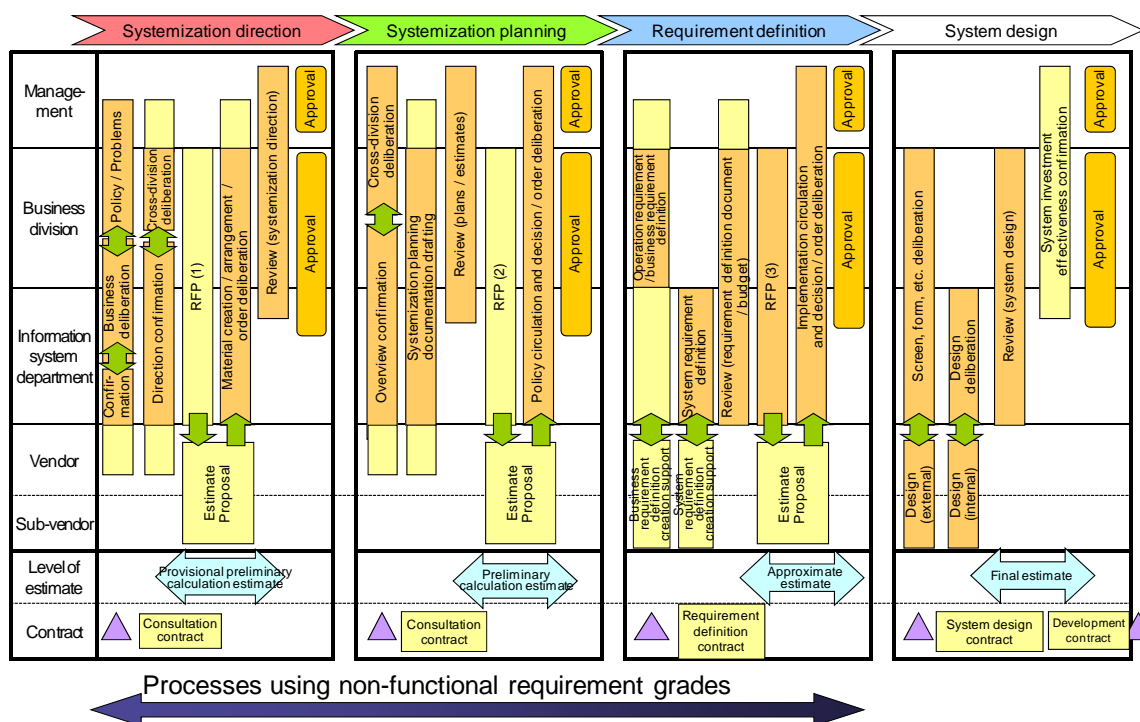


Figure 2.1.1 Processes assuming usage of non-functional requirements grades
(Based on "Management Participation in Securing of Requirement Quality, Second Edition")

¹ Please refer to "Description Manual" 5.2 for the relationship between non-functional requirements grades and the "Japan Common Frame 2007."

The objective of non-functional requirements grades is a shared recognition of non-functional requirements by users and vendors during upstream processes. Specifically, the item names, levels, and similar descriptors defined by non-functional requirements grades are envisioned as being listed in documents such as RFI (Request For Information), RFP (Request For Proposal), requirement definition documentation, and estimates, and included in agreements as part of system design contracts. Their use is primarily envisioned in upstream processes, but contents organized with non-functional requirements grades can also be used in system design and testing, so please make use of it as necessary.

The information system departments of users, and corresponding vendors, are envisioned as the users of non-functional requirements grades. User information system departments can use non-functional requirements grades to build consensus with management and business departments while coordinating user non-functional requirements, conveying the results to vendors and performing further refinement. The information system departments ultimately determine non-functional requirements. In actual use, either the user or vendor will be the primary user of non-functional requirements grades, depending on project situations, etc. Please refer to the usage examples in Chapter 3 and Chapter 4, and use non-functional requirements grades in accordance with actual circumstances.

2.2 Processes using non-functional requirements grades, and overview of usage

Generally, until the methods for actually implementing non-functional requirements are determined, they are considered in stepwise fashion as described below.

- 1) Grasp the general sense of scale and the objectives during consideration phase of the business which will undergo systematization
- 2) Clarify the service levels required by business services, and basic quality approach
- 3) Establish consensus with regard to the non-functional requirement level based on specific non-functional requirement definitions

Non-functional requirements grades are based on the assumption of this stepwise refinement deliberation approach. Specifically, for individual upstream processes, non-functional requirements grades can be repeatedly used to perform refinement, until, in the end, all non-functional requirements are decided. Figure 2.2.1 and Table 2.2.1 show examples of using non-functional requirements grades in requirement definition processes.

This diagram references a diagram in "Management Participation in Securing of Requirement Quality, Second Edition (SEC BOOKS)," adding the following 3 phases of implementation items and non-functional requirements grades relationships as the basic usage concept of non-functional requirements grades.

- (1) Model system selection
- (2) Level determination of important items
- (3) Level determination of items other than important items

The implementation items for these three phases are not performed exclusively during "requirement definition," but may also be performed during "systemization direction" and "systemization planning." As non-functional requirements become incrementally clearer, the tools used also become more detailed, moving from model system sheet to grade table, and from grade table on to item list.

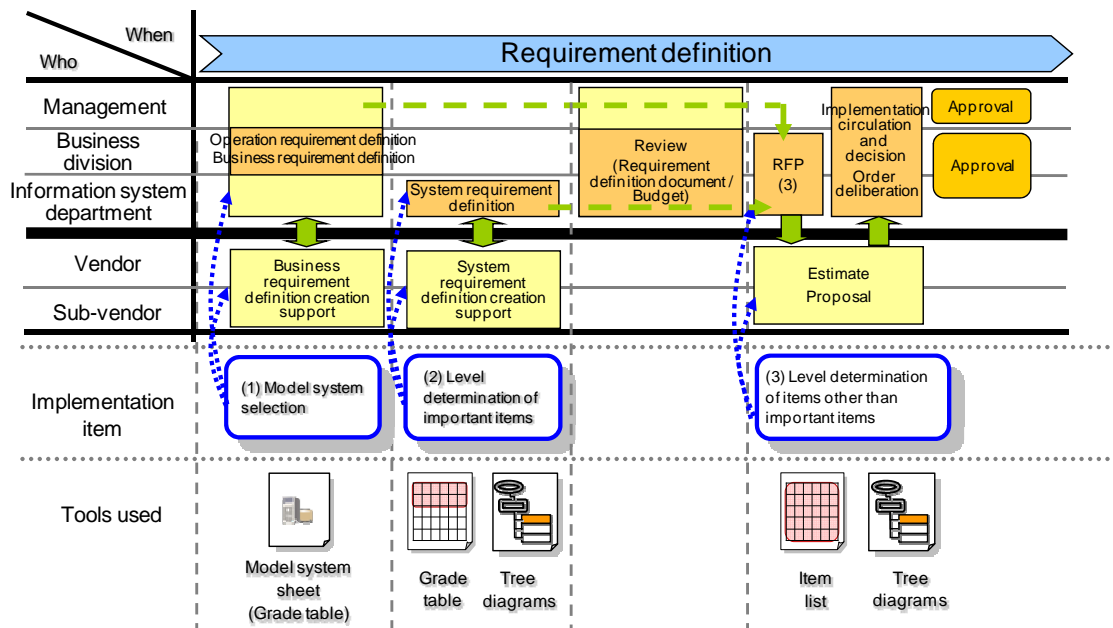


Figure 2.2.1 Overview of usage of non-functional requirements grades during requirement definition process
(Based on "Management Participation in Securing of Requirement Quality, Second Edition")

Table 2.2.1 Non-functional requirement related requirement definition process and overview of usage

Task performed	Non-functional requirement related requirement definition process	Overview of usage
(1) Model system selection	During business requirement definition phase, clarify basic policy related to service levels and quality required by business services, and extract information necessary for establishing assumptions of the system.	Using the model system sheet, select a model system closest to the system to be developed.
(2) Level determination of important items	During system requirement definition phase, decide levels for the most critical non-functional requirement items.	Use tree diagrams to gain an overview of overall non-functional requirements (important items are shaded). Use grade table to determine the specific levels of important items, using the selected levels displayed for each model system selected in phase (1) as a reference.
(3) Level determination of items other than important items	Crystallize non-functional requirement items not determined in (2), and determine requirement levels.	Use item list to reach user/vendor consensus regarding all item list items, including items other than important items. In the event that there are items which cannot be decided upon due to the need to decide design specifics, reach a consensus regarding when and how the decision will be made.

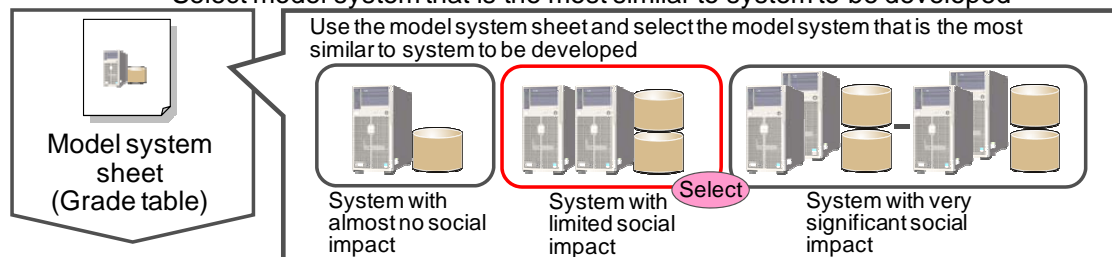
3. Basic utilization examples

This chapter provides detailed explanations of basic usage examples for each of the three phases shown in Table 2.2.1. Figure 3.1 shows an overview of non-functional requirements grades usage.

3 Basic Phases of Non-Functional Requirement Confirmation

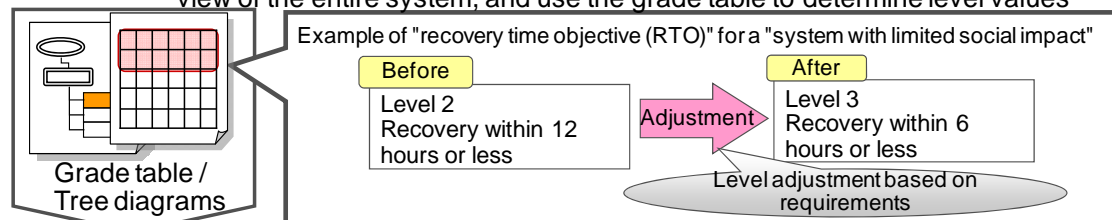
Phase (1) Model system selection:

Select model system that is the most similar to system to be developed



Phase (2) Level determination of important items:

Use tree diagrams to gain a bird's eye view of the entire system, and use the grade table to determine level values



Phase (3) Level determination of items other than important items:

Determine requirement levels for non-functional requirements using item list

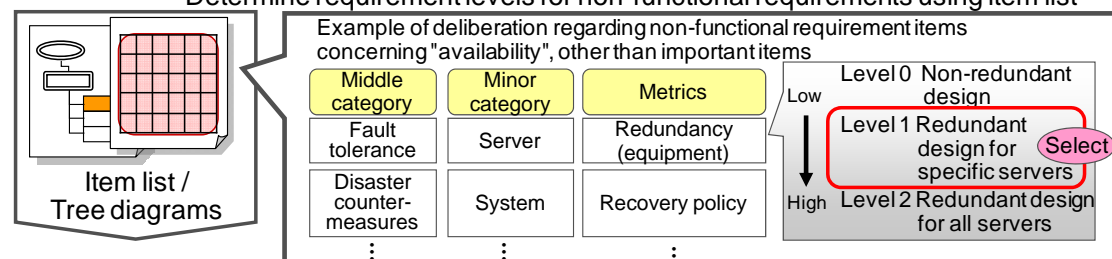


Figure 3.1 Overview of non-functional requirements grades usage

In reality, there are a variety of methods for carrying out system development, so please consider usage methods that fit ones individual system development approach, using the basic usage examples for reference. Chapter 4 introduces further utilization examples.

3.1 Model system selection

During model system selection, use the model system sheet and select the model system closest to system to be developed. Figure 3.1.1 shows an illustration of the model system sheet. There are three model systems: "Systems with almost no social impact," "Systems with limited social impact," and "Systems with very significant social impact" (please refer to [Description Manual] 2.1.1).

Non-Functional Requirements Grades Usage Guide [Usage Manual]

Model system sheet




No.	Major category	Property	System with almost no social impact	System with limited social impact	System with very significant social impact
Illustration of the model system					
General description of the model system			This type of system is used within a specific department of a company to a relatively limited extent. When its functions become degraded or unavailable, the specific department will be significantly affected while others will not. The system assumed here is a very small scale system that is open to the Internet.	This type of system provides the infrastructure for corporate activities. When its functions become degraded or unavailable, such corporate activities as well as external users including suppliers and customers will be significantly affected. The system assumed here is a mission-critical system that is restricted to a corporate network.	This type of system provides the infrastructure for people's lives and socioeconomic activities. When its functions become degraded or unavailable, both of these will be significantly affected. The system assumed here is an infrastructure that is used by the general public.
1	Availability	Uptime ratio	• Downtime of up to several days per year is accepted (99% uptime ratio).	• Downtime of up to approximately an hour per year is accepted (99.99% uptime ratio).	• Downtime of up to several minutes per year is accepted (99.999% uptime ratio).
2		Recovery objective	• Restoration of data from a weekly backup will be the recovery objective when restoring data upon system recovery.	• Restoration of data within one business day will be the recovery objective when restoring data upon system recovery.	• Restoration of data to the point of outage within several hours will be the recovery objective when restoring data upon system recovery.
3		Large-scale disaster	• The system is expected to be rebuilt in the event of a large-scale disaster.	• The target recovery time is within a week in the event of a large-scale disaster.	• Business continuity is required at a DR (Disaster Recovery) site in the event of a large-scale disaster. • A backup center is established in anticipation of a large-scale disaster.
4		Performance objective	• A general performance objective is set, but is less important than other requirements.	• A performance service level is specified.	• A performance service level is specified.
5		Scalability	• Scalability is not considered.	• An expansion plan for the system is established.	• An expansion plan for the system is established.
6		Operating hours	• Service is provided during work hours only, and the system is not in operation during the nighttime.	• A system outage window is secured between the completion of the nighttime batch process and the beginning of business operation.	• The system operates 24/7 to provide non-interrupted service.
7		Backups	• The administrator of the department manually backs up only necessary data.	• A daily backup of the entire system is performed automatically.	• A backup site (DR site) with all data synchronized with the operation site is established.
8		Operation monitoring	• Active monitoring is performed using various types of hardware and software logs.	• Each business function of the application is monitored to see whether they are operating normally.	• Performance and resource usage is monitored to detect indications of failure.
9		Manuals	• Manuals are created independently by the administrator of the department.	• A maintenance manual is prepared along with the operation manual since a service desk is established to carry out maintenance work.	• The operation manual is customized in accordance with the operation rules of the data center.
10		Maintenance	• Maintenance work is possible whenever necessary.	• Shutting down the system for maintenance work is possible as long as operation during work hours is not affected.	• All maintenance work is performed while the system is online.
11		Migration scheme specification	• There are no rules for migration schemes (an agreement is reached based on the scheme proposed by the vendor).	• Applications are proactively integrated and modified to streamline business operation. • System cutover is performed all at once.	• The system is migrated in phases to reduce risks.
12		Migration schedule	• A sufficient number of days for migration is secured.	• System outages due to migration are possible.	• System outages due to migration shall be at minimum.
13		Equipment and data	• Equipment and data are newly developed.	• Equipment and data will have modifications.	• There is migration of equipment and data. However, in order to maintain data consistency and compatibility with other systems, changes to the database structure are limited.
14	Security	Disclosure scope of critical assets	• There are no critical assets that require security measures. (Critical assets refer to information assets that require high security, such as personal information, sensitive information, information with high negotiability, etc.)	• There are critical assets that require security measures, but connections are limited to specific parties.	• There are critical assets that require security measures, and service is provided to an unspecified number of persons.
15	System environment and ecology	Restrictions scope of critical assets	• There are no legal or regulatory restrictions, etc.	• There are some legal and/or regulatory restrictions, etc.	• There are legal and/or regulatory restrictions, etc.
16		Earthquake resistance	• A minimum level of earthquake resistance is necessary.	• A regular level of earthquake resistance is necessary.	• A high level of earthquake resistance is necessary.

Figure 3.1.1 Illustration of model system sheet

Model system selection is performed with the two steps shown in Table 3.1.1.

Table 3.1.1 Model system selection steps

No.	Model system selection step	Selection method
1	Select model system	Use the model system sheet to select a model system based on system roles and the magnitude of impact that would be caused by reduced system functionality or system outage.
2	Confirm differences between selected model system and system to be developed	Use the model system sheet to compare the non-functional requirements of the selected model system and the system to be developed and determine requirement differences, in order to confirm the validity of the selection.

[Step 1 Select model system]

In the model system selection step, one selects a model system based on the roles of the system being developed, and the amount of impact that would be caused by reduced system functionality or system outage. The model system sheet provided by the grade table is used when selecting a model system. Compare the overviews of the model systems described in the model system sheet with the development project and select a corresponding model system.

For example, if the system to be developed is an order receipt system for receiving orders from specific clients (hereafter called the "example order reception system"), it is assumed that if the example order reception system becomes unusable, there would be a significant impact both within ones company and to the clients.

Comparing the example order reception system's overview with the model systems on the model system sheet, one sees that the example order reception system is a system used in corporate activities, and that if the system became unusable, such corporate activities, as well as external users including suppliers and customers would be significantly affected.

Figure 3.1.2 shows an illustration of the model systems indicated in the model system sheet.




No.	Major category	Property	System with almost no social impact	System with limited social impact	System with very significant social impact
		Illustration of the model system			
		General description of the model system	This type of system is used within a specific department of a company to a relatively limited extent. When its functions become degraded or unavailable, the specific department will be significantly affected while others will not. The system assumed here is a very small scale system that is open to the Internet.	This type of system provides the infrastructure for corporate activities. When its functions become degraded or unavailable, such corporate activities as well as external users including suppliers and customers will be significantly affected. The system assumed here is a mission-critical system that is restricted to a corporate network.	This type of system provides the infrastructure for people's lives and social/economical activities. When its functions become degraded or unavailable, both of these will be significantly affected. The system assumed here is an infrastructure that is used by the general public.

Figure 3.1.2 Model system overview

The "system with limited social impact" model system is one which serves as the infrastructure of corporate activities, and whose corporate activities as well as external users including suppliers and customers would be significantly affected if the system's functionality degraded or the system became unavailable, and is envisioned as a mission-critical system that is restricted to a corporate network. Based on the above, the "system with limited social impact" model system is the closest match, so it is selected as the model system.

[Step 2 Confirm differences between selected model system and system to be developed]

In the step where the non-functional requirements of the selected model system are compared to those of the system to be developed, the 16 properties listed in the model system sheet for the selected model system are compared with the non-functional requirements of the system to be developed, in order to confirm the validity of the selection. Non-functional requirement differences are also confirmed. Adjustment of these differences is performed during the next phase.

Table 3.1.2 shows a theoretical non-functional requirement overview for the example order reception system.

Table 3.1.2 Example order reception system non-functional requirement overview

No.	Major category	Requirement overview
1	Availability	<p>The system is powered up 24 hours a day.</p> <p>There are no orders received between late night and early morning. These hours may be used for batch processing, backups, system maintenance, etc.</p> <p>If a system outage occurs during business hours, the system should be recovered within 5 to 6 hours when at all possible, and all processing completed within the same day.</p> <p>It should be possible to recover the system after a large-scale disaster in approximately 1 week.</p>
2	Performance and scalability	<p>Considering the possibility of future growth, the system should be able to accommodate the number of clients doubling over the next 5 years.</p> <p>In order for order reception entry to be handled smoothly, 95% or more of order reception processing should have a response time of 3 seconds or less.</p>
3	Operability and maintainability	<p>The system should be monitored, and, in the event that the system stops, the operation department should be notified immediately.</p> <p>Backups should be performed automatically at night.</p>
4	Migratability	<p>The client and product master data used in order reception will be migrated. Clients should be notified of the migration, and the migration should be performed on a non-business day.</p>
5	Security	<p>Only connections to specific clients should be permitted, and data such as client and product master data should be protected.</p>
6	System environment and ecology	<p>A regular level of earthquake resistance is sufficient.</p>

The example order reception system non-functional requirement overview shown in Table 3.1.2 is compared with the properties of the "system with limited social impact" listed in the model system sheet. Table 3.1.3 shows the results of availability comparison.

Table 3.1.3 Comparison of model system and example order reception system non-functional requirements related to availability

No.	Major category	Property	System with limited social impact	Example order reception system
1	Availability	Uptime ratio	Downtime of up to approximately an hour per year is accepted (99.99% uptime ratio).	There is no established uptime ratio.
2		Recovery objective	Restoration of data within one business day will be the recovery objective when restoring data upon system recovery.	The recovery objective is 5 or 6 hours.
3		Large-scale disaster	The target recovery time is within a week in the event of a large-scale disaster.	It should be possible to recover the system after a large-scale disaster in approximately 1 week.

The above comparison is also performed for each performance and scalability, operability and maintainability, migratability, security, and system environment and ecology item, and the differences between the non-functional requirements of the model system and the example order reception system are confirmed. Table 3.1.4 shows the comparison results.

Please note that the goal of model system selection is not to select a model which perfectly matches the system to be developed, but to narrow the amount of grade table adjustment by selecting the model system that comes closest to the system to be developed.

Table 3.1.4 Comparison of model system properties and example order reception system non-functional requirement overview

No.	Major category	Property	System with limited social impact	Example order reception system
1	Availability	Uptime ratio	• Downtime of up to approximately an hour per year is accepted (99.99% uptime ratio).	• There is no established uptime ratio.
2		Recovery objective	• Restoration of data within one business day will be the recovery objective when restoring data upon system recovery.	• The recovery objective is 5 or 6 hours.
3		Large-scale disaster	• The target recovery time is within a week in the event of a large-scale disaster.	• It should be possible to recover the system after a large-scale disaster in approximately 1 week.
4	Performance and scalability	Performance objective	• A performance service level is specified.	• 95% or more of order reception processing should have a response time of 3 seconds or less.
5		Scalability	• An expansion plan for the system is established.	• The system should be able to accommodate the number of clients doubling over the next 5 years.
6	Operability and maintainability	Operating hours	• A system outage window is secured between the completion of the nighttime batch process and the beginning of business operation.	• There are no established operating hours.
7		Backups	• A daily backup of the entire system is performed automatically.	• Backups should be performed automatically at night.
8		Operation monitoring	• Each business function of the application is monitored to see whether they are operating normally.	• The system should be monitored, and, in the event that the system stops, the operation department should be notified immediately.
9		Manuals	• A maintenance manual is prepared along with the operation manual since a service desk is established to carry out maintenance work.	• There is no established manual.
10		Maintenance	• Shutting down the system for maintenance work is possible as long as operation during work hours is not affected.	• The hours between late night and early morning may be used for system maintenance.
11	Migratability	Migration scheme specification	• Applications are proactively integrated and modified to streamline business operation. • System cutover is performed all at once.	• There is no established migration scheme.
12		Migration schedule	• System outages due to migration are possible.	• Clients should be notified of the migration, and the migration should be performed on a non-business day.
13		Equipment and data	• Equipment and data will have modifications.	• Client and product master data used in order reception will be migrated.
14	Security	Disclosure scope of critical assets	• There are critical assets that require security measures, but connections are limited to specific parties.	• Only connections to specific clients should be permitted. • Data such as client and product master data should be protected.
15	System environment and ecology	Restrictions	• There are some legal and/or regulatory restrictions, etc.	• There is no established restrictions.
16		Earthquake resistance	• A regular level of earthquake resistance is necessary.	• A regular level of earthquake resistance is sufficient.

3.2 Level determination of important items

For level determination of important items, tree diagrams are used to get a bird's eye view of overall non-functional requirements, and specific requirement levels are determined, using the selected levels shown for the model system selected with the grade table.

Tree diagrams show requirement items for each major category on a separate page for improved readability, and indicate important items with shading. It provides an overview of the position within the overall metrics of important items displayed in the grade table. Deliberation priority is also checked (please refer to "Description Manual" 2.1.3 regarding tree diagrams).

The grade table shows selected levels and selection conditions for each model system. Figure 3.2.1 shows an illustration of the grade table (please refer to "Description Manual" 2.1.1 regarding grade tables). Specific requirement levels are determined, using the selected levels and selection conditions shown for the model system selected with the grade table.

In the case of the example order reception system, a "system with limited social impact" was selected as the model system. Figure 3.2.1 shows part of the availability section of the grade table.

The outlined area contains the selected levels and selection conditions for the "system with limited social impact".

No.	Major category	Middle category	Minor category	Minor category description	Overlapping item	Metric	Level						Impact on operation costs	
							0	1	2	3	4	5		
A.1.1.1	Availability	Continuity	Operation schedule	Information regarding system operating hours and operation outage.	X	Operating hours (normal)	Not specified	During business hours (9:00 to 17:00)	Outage only at night (9:00 to 21:00)	Possible outage for approximately 1 hour (9:00 to 8:00 the next day)	Possible outage for a brief period (9:00 to 8:55 the next day)	Uninterrupted 24 hours	[Overlapping C.1.1.1. "Of deliberating "availability [Metric] "Operativ [Level] The time	
A.1.1.2						Operating hours (specific days)	Not specified	During business hours (9:00 to 17:00)	Outage only at night (9:00 to 21:00)	Possible outage for approximately 1 hour (9:00 to 8:00 the next day)	Possible outage for a brief period (9:00 to 8:55 the next day)	Uninterrupted 24 hours		
A.1.1.3						Existence of planned system shutdown	Possible planned system shutdown (operation schedule can be changed)	Possible planned system shutdown (operation schedule cannot be changed)	No planned system shutdown					

Grade of "system with limited social impact"

	System with almost no social impact		System with limited social impact		System with very significant social impact	
	Selected level	Selection conditions	Selected level	Selection conditions	Selected level	Selection conditions
em) rating es the l of ability, m which nsidered rating ability and sity-related ng item) Operating icates the level of availability, n item which a considered deliberating operability and ainability related pment costs eration costs lapping item] 1.1. "Existence of ned system tdown" indicates ossible level of stem availability, d is an item which ust be considered hen deliberating bout operability and maintainability related development costs	2	Outage only at night (9:00 to 21:00) [-] Business is performed during a more limited amount of operating hours. [+] When considering uninterrupted 24 hour operation or only short interruptions for reboot processing, etc.	4	Possible outage for a brief period (9:00 to 8:55 the next day) Uninterrupted 24 hour operation is not necessary, but continual operation to the extent as possible is desired. [-] Long periods of operation outage, such as not permitting access at night [+] Uninterrupted 24 hour operation	5	Uninterrupted 24 hours There are no time periods during which the system can be shut down. [-] There is a regular period during each day when operation can be shut down.
	0	Not specified There are no specific days with operating hours that differ from normal days. [+] There are specific days with operating hours that differ from normal days, such as backup operations performed on weekends/holidays.	2	Outage only at night (9:00 to 21:00) During weekends, only backup operations are performed, so the system is shut down at night. [-] There are no weekend backups or batch processing, etc., and operation is stopped on weekends/holidays. [+] The system is used for business by employees who come in on weekends/holidays, so the system operates on weekends/holidays as well.	5	Uninterrupted 24 hours There are no time periods during which the system can be shut down. [-] There are regularly scheduled days when operation is stopped.
	0	Possible planned system shutdown (operation schedule can be changed) System shutdown is possible if consensus is gained in advance. [+] When it is sufficient with only outages during non-operating hours	1	Possible planned system shutdown (operation schedule cannot be changed) Uninterrupted 24 hour operation is not necessary. There are hours during which outage is possible, and planned outages are possible. [-] There are no times within the operation schedule during which outages are possible, but outages possible if coordinated in advance. [+] When uninterrupted 24 hour operation is required	2	No planned system shutdown There are no time periods during which the system can be shut down. [-] There are times within the operation schedule during which outages are possible, and there is a need for planned system shutdowns.

Figure 3.2.1 Grade table

During model system selection, the model system's properties and example order reception system non-functional requirement overview are compared, and the differences between them confirmed. Table 3.1.3 will be used in an explanation of grade table adjustment.

First will be an explanation of the differing recovery objectives (RO). The selected level for "A.1.3.2 Recovery time objective (RTO)" for a "system with limited social impact" in the grade table

is, as shown in Figure 3.2.2, "2" - "Within 12 hours".

System with limited social impact		
Selected level		Selection conditions
2	Within 12 hours	Determine based on system scale, taking the recovery point objective into consideration. [-] The impact of business outage is small. [+] The impact of business outage is large.

Figure 3.2.2 "A.1.3.2 Recovery time objective (RTO)" selected level and selection conditions

There is a description of [-] and [+] items in the selection condition area. The recovery time objective of the example order reception system is 5 to 6 hours. When the impact of recovery within 12 hours for selected level 2 is great, the grade table level is referenced, and the selected level is adjusted to 3. Figure 3.2.3 shows the levels for "A.1.3.2 Recovery time objective (RTO)" shown in the grade table.

Level					
0	1	2	3	4	5
1 business day or more	Within 1 business day	Within 12 hours	Within 6 hours	Within 2 hours	

 Level adjustment

Figure 3.2.3 Levels for "A.1.3.2 Recovery time objective (RTO)" shown in the grade table

As Figure 3.2.4 shows, the adjusted results are for level 3, within 6 hours.

Selected level	
2	Within 12 hours
3	Within 6 hours

Figure 3.2.4 "A.1.3.2 Recovery time objective (RTO)" selected level adjusted result example

Next will follow an explanation regarding the undetermined uptime ratio. As Figure 3.2.5 shows,

for a "system with limited social impact," "A.1.5.1 Uptime ratio" has a selected level of "4," "99.99%," and the selection conditions indicate that approximately 1 hour of outage per year is tolerated. The level explanation in the notes area indicates that for a system operating 24 hours a day, 365 days a year, an uptime ratio of 99.99% works out to 52.6 minutes of down time per year.

Notes	System with limited social impact	
	Selected level	Selection conditions
<p>[Level]</p> <p>For 24/365 operation, annual business outage totals are shown below for each level.</p> <p>95% 18.3 days</p> <p>99% 87.6 hours</p> <p>99.9% 8.76 hours</p> <p>99.99% 52.6 minutes</p> <p>99.999% 5.26 minutes</p> <p>For a system which operates 8 hours a day, 5 days a week, the relationship between service switchover time and uptime ratio is as shown below.</p> <p>1 hour per week 97.5%</p> <p>1 hour per month 99.4%</p> <p>1 hour per year 99.95%</p>	4	99.99%
		Downtime of approximately 1 hour per year is acceptable.

Figure 3.2.5 "A.1.5.1 Uptime ratio" notes and "system with limited social impact" contents

The example order reception system operating hours is not yet set, so "A.1.5.1 Uptime ratio" cannot be set, but if it is assumed that the system will operate 24 hours a day, 365 days a year, and will stop once per year, then, as the previously discussed "A.1.3.2 Recovery time objective (RTO)" is within 6 hours, the amount of time that business is interrupted must be that or lower. Taking this into consideration, for "A.1.5.1 Uptime ratio" the selected level's numbers will be retained, with the understanding that they may be revised when the operating hours are decided. In order to determine the uptime ratio, the operating hours must first be specified.

Lastly, for "A.1.4.1 Recovery objective (In event of large-scale disaster)," the model system's selected level and the example order reception system's non-functional requirement contents are largely the same, so the selected level will be left as-is.

Next, let's look at a different major category, "performance and scalability." One of the example order reception system's performance and scalability requirements is that "95% or more of order reception processing should have a response time of 3 seconds or less" (Table 3.1.4 item 4). "B.2.1.1 Adherence rate of response during normal operation" is used for this requirement. For the "system with limited social impact" model system, the "B.2.1.1 Adherence rate of response during normal operation" selected level is "3" - "90%." In the case of the example order reception system, an adherence rate of 95% or greater is required, so the "B.2.1.1 Adherence rate of response during normal operation" selected level is raised to 4, and a target adherence rate of response of 95% is set.

As illustrated above, specific requirement levels are set for all important items, using selected levels and selection criteria shown for model systems in the grade table as reference.

3.3 Level determination of items other than important items

During this phase, the item list is used to decide requirement levels for all non-functional requirement items. Specifically, for item list metrics other than those for important items, system requirement contents are confirmed, and an appropriate level is selected and decided from a maximum of 6 levels for each metric (please refer to "Description Manual" 2.1.2 regarding the item list). Along with level selection results, the specific contents must be confirmed.

For the example order reception system, if "A.1.5.1 Uptime ratio" is set to 99.99% during important item level assignment, system redundancy design will have to be considered as part of the system's fault tolerance (please refer to "Description Manual" 2.2.1). For servers, "A.2.1.1 Redundancy (equipment)" and "A.2.1.2 Redundancy (components)" must be decided. Redundancy must also be considered for storage and the network. For example, Figure 3.3.1 shows metrics "A.2.1.1 Redundancy (equipment)" and "A.2.1.2 Redundancy (components)" for the item list's minor category "Server" under "Fault tolerance."

No.	Major category	Middle category	Minor category	Minor category description	Overlapping item	Important item	Metric	Level						Impact on operation costs	Notes
								0	1	2	3	4	5		
A.2.1.1	Availability	Fault tolerance	Server	Requirements to maintain the requested service when a failure occurs on a server.			Redundancy (equipment)	Non-redundant design	Redundant design for specific servers	Redundant design for all servers					[Metric] Equipment and components in "Redundancy" indicate the units of redundancy. Equipment redundancy refers to providing multiple units of equipment; component redundancy refers to providing multiple components which make up a unit (disks, power supplies, fans, network cards, etc.). By applying virtualization technologies, multiple server functions can be aggregated in a single piece of hardware, resulting in a decreased amount of hardware necessary for redundancy. Either way, equipment redundancy must be considered in order to fulfill hardware business continuity requirements. [Level 1] "Redundant design for specific servers" refers to using different redundancy approaches for different types of servers which are used in a system (DB servers, AP servers, monitoring servers, etc.). When requirements are not for individual servers, but redundancy for business or functions, set levels based on the servers which is assumed will handle these business or functions.
A.2.1.2							Redundancy (components)	Non-redundant design	Redundant design for specific components only	Redundant design for all components					[Level 1] This assumes redundancy for the components which make up a server (internal disks, power supplies, fans, etc.) as needed (for example, mirroring of internal disks, dual network interface cards, etc.).

Figure 3.3.1 Metrics and contents for item list minor category "Server"

If level 2, "Redundant design for all servers" is selected for A.2.1.1 server redundancy in order to increase reliability, multiple servers must be prepared for all servers. As seen, redundant design relates to system cost.

If the cost does not fall within the budget, or the system design is excessively complex in comparison to "Continuity" requirements, the redundancy level value must be reconsidered. In the case of the example order reception system, level 1, "Redundant design for specific servers," is chosen for A.2.1.1 server redundancy, and consideration is given to whether or not redundancy can be implemented in specific servers, such as servers for client entry, database servers, and the like. During these considerations, attention should also be paid to the contents of the notes area, which says "By applying virtualization technologies, multiple server functions can be aggregated in a

single piece of hardware, resulting in a decreased amount of hardware necessary for redundancy".

For the example order reception system, let us assume that it was decided, after deliberation, that the processing of input from clients would be distributed over the network among multiple servers, and that the remaining servers could take over in the event that one server suffered a malfunction. This decision relates to the performance and scalability metric "B.2.1.3 Adherence rate of response during degraded operation." This metric relates to performance, in systems in which processing is distributed among multiple servers, when one of those servers fails. Please note that there are related metrics which will require consideration when level values and implementation methods for this metric have been decided on.

As described above, in this phase, the item list is used in the deliberation and determination of non-functional requirements of the system to be developed. Even after they are decided, they may be affected by other metrics, requiring review and revision. This process is repeated until all metrics are decided.

Optimally, all item list requirement contents are checked and decided during the requirement definition process. However, there are times when requirement levels cannot be decided even when given due consideration. If it is not possible to decide requirement contents, it is important to clarify when and how the metrics will be determined, and to carry this over into the next process. Attention must be given to the fact that failure to decide items may affect costs.

4. Further utilization examples

This chapter provides the following 4 non-functional requirements grades utilization examples.

- Example of utilization when a common infrastructure already exists
- Example of non-functional requirements grades utilization in system expansion development
- Example of utilization in creation of requests for information (RFI) and requests for proposals (RFP)
- Example of utilization when information security related regulations, etc. exist

4.1 Example of utilization when a common infrastructure already exists

When there are already facilities within a user's organization or company which can be shared, such as backbone networks or data centers, it is efficient to separate non-functional requirements when constructing a new system into "items which have already been decided system-wide" and "items which are adjusted individually for separate systems," and to decide on them separately. That is, items such as infrastructure specifications, for which levels are not separately decided for individual systems, are defined in advance using the item list.

For some users, there may be individual companies' own system category definitions (often referred to as "importance rankings" or the like) which resemble the model systems. When this is the case, the companies' level sets can be created instead of using the model system sheet and grade table provided by the non-functional requirements grade, to be used as an internal grade table.

This section provides an example where the 3 hierarchical categories shown in Figure 4.1.1 below are used to redefine overall items. In this example, we have chosen to call these categories "common infrastructure," "internal grades," and "individually adjusted items".

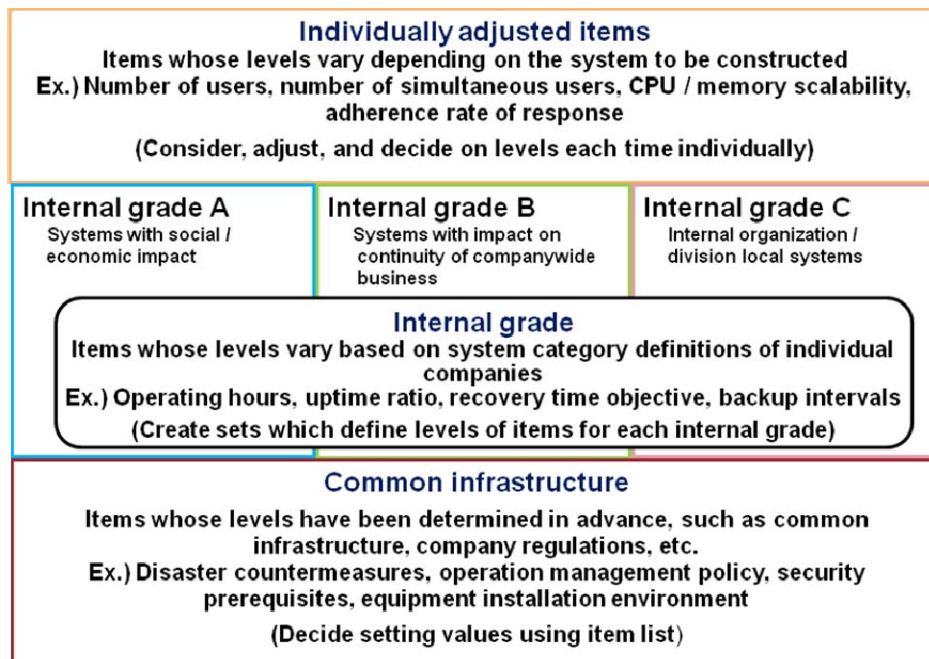


Figure 4.1.1 Hierarchical overview of division of items into 3 categories

By defining items with these categories, one increases the number of common items decided in advance, making more efficient non-functional requirement deliberation possible.

Specific examples are shown below. This example assumes the following type of company.

- A company with its own data centers, and an established backbone network
- A company with internal regulations and guidelines about security and operation for information system
- A company which considers server equipment specifications separately for each new project
- A company with system category rank definitions equivalent to grades

When actually applying this example, add or remove items in accordance with the actual conditions of individual companies. (A non-functional requirements grades utilization sheet can be used to simplify application.)

(1) Common infrastructure

Common infrastructures contain items defined by company regulations and industry guidelines, as well as items whose requirements have been made clear by data center specifications and existing network facility specifications. Common infrastructure related items do not depend on individual system specifications, so setting values for corresponding items should be confirmed in advance, and a table created.

In terms of major categories, system environment related items which pertain to the "system environment and ecology" major category, and items conformant with company regulations and policies which correspond to the "availability," "operability and maintainability," and "security" major categories may exist.

Table 4.1.1 shows an example. For common infrastructure items, it is not sufficient to merely assign levels; instead, specific internal conditions, such as guideline names, must also be set. For example, in Table 4.1.1, as shown in minor categories such as "information security related compliance" and "configuration management," multiple items, such as related internal regulation and guideline names, can be set as setting values. As minor categories such as "network" and "planned system shutdown" show, it may be desirable to use organization and internal company terminology when describing system infrastructure specifications, so in order to improve column readability, setting values are entered for each minor category. When actually applying grades, it is important to refer to the item list and be aware of the metrics included in each minor category when entering setting values.

Table 4.1.1 Example of common infrastructure items and setting values

Major category	Middle category	Minor category	Setting value example
Availability	Fault tolerance	Network	According to company backbone network specifications, all network paths have redundancy. (Line redundancy is only used when path redundancy is not possible)
	Disaster countermeasures	System	Large-scale disaster countermeasures are not implemented. (Reconstruct at a later date under a separate contract)
		Externally archived data	Backups are stored on media in a separate center in case of large-scale disaster.
		Ancillary facilities	Data center provides earthquake / fire / power loss countermeasures.
Operability and maintainability	Normal operation	Time synchronization	Servers inside network synchronize times with external standard time server.
	Maintenance operation	Planned system shutdown	Planned system shutdowns are scheduled on an annual basis, and can be performed given 1 month of advance notice as long as they do not affect service provision hours.
		Patch application policy	Validated patches are applied regularly.
		Scheduled maintenance frequency	Scheduled maintenance is performed once every six months for servers installed within the data center.
	Other operation management policies	Internal control support	Internal control support is performed in accordance with company regulations.
		Service desk	The existing company service desk is used.
		Configuration management	Performed in accordance with common work procedures (XX standards).
Security	Prerequisites / restrictions	Information security related compliance	Performed in accordance with company information security policy and industry XXXX guideline.
	Network measures	Network control	Transmission control is implemented in order to shut down unauthorized transmissions.
		Denial of service (DoS) attack avoidance	Measures are implemented to handle network congestion attacks.
	Malware countermeasures	Malware countermeasures	Antivirus software is used, and real-time scanning and weekly full scans are performed.
System environment and ecology	Conformity standards	Product safety standards	Not specified (no standard required)
		Electromagnetic interference	Not specified (no standard required)
	Conditions of equipment installation environment	Earthquake resistance / seismic isolation	Support of earthquakes with intensity equivalent to 6-upper (data center specifications)
		Space	19 inch rack mounted (installed in data center)
		Weight	1,500Kg/m ² (data center specifications)

		Compatibilities with electric facilities	Sufficient electrical capacity has been set aside, and there are no particular limitations. Power loss countermeasures have been implemented. (data center specifications)
		Temperature (range)	20 - 28 deg C (data center specifications)
		Humidity (range)	30 - 70% (data center specifications)
		Air conditioning capacity	There is sufficient available capacity, and no particular limitations (data center specifications)
	Environmental management	Energy consumption efficiency	Not specified
		Amount of CO ₂ emissions	Not specified

(2) Internal grade

In the event that one company has system categorization definitions equivalent to grades, for items which do not correspond to the common infrastructure items in (1), one should identify corresponding non-functional requirement items based on internal definitions, and create an internal grade.

In this example, let us assume that a company (Company A) has defined "reliability ranks." Table 4.1.2 shows a sample internal grade created primarily from the perspective of reliability. Optimally, one should make effective use of non-functional requirements grades to create a table such as this which corresponds with the grade table.

Table 4.1.2 Example of internal grade established from perspective of reliability

Major category	Middle category	Minor category	Metrics	Company A reliability rank		
				Rank A (high reliability)	Rank B (medium reliability)	Rank C (low reliability)
				Selected level	Selected level	Selected level
Availability	Continuity	Operation schedule	Operating hours	5 Uninterrupted 24 hours	4 Possible outage for a brief period (9:00 to 8:55 the next day)	2 Outage only at nighttime (9:00 to 21:00)
		Business continuity	Affected business scope	4 External online businesses	3 External batch related businesses	2 All internal businesses
		Recovery objective (When business outage occurs)	Recovery point objective (RPO)	3 Up until the point at which failure occurred (Recovery from daily backup + archive)	2 Up until 1 business day prior to outage (Recovery from daily backup)	1 Up until 5 business days prior to outage (Recovery from weekly backup)
			Recovery time objective (RTO)	4 Within 2 hours	2 Within 12 hours	1 Within 1 business day
		Uptime ratio	Uptime ratio	5 99.999%	4 99.99%	2 99.00%
	Fault tolerance	Server	Redundancy (equipment)	2 Redundant design for all servers	1 Redundant design for specific servers	0 Non-redundant design
		Storage	Redundancy (disks)	2 Redundancy with RAID1	1 Redundancy with RAID5	0 Non-redundant design
Operability and maintainability	Normal operation	Backups	Data recovery scope	2 Recover all system data	2 Recover all system data	1 Recover necessary data only
			Backup interval	5 Synchronous backups	4 Daily backups	1 Random backups performed in situation such as system configuration changes, etc.
	Operation to ensure business continuity	System fault detection handling	On-site arrival time	5 Maintenance staff stationed on-site	3 Maintenance staff arrive before start of next user business day after fault is detected	1 Maintenance staff arrive within days of fault detection
	Operating environment	Establishment of development environment	Presence of development environment	2 Establish development environment identical to operating environment	1 Establish development environment limited to part of operating environment	0 No system development environment established
	Support structure	Lifecycle period	Lifecycle period	3 10 years or longer	2 7 years	0 3 years
Security	Fraud tracking / monitoring	Fraud monitoring	Fraud monitoring scope	2 Entire system	1 Scope which includes highly important assets, and external connection related areas	1 Scope which includes highly important assets, and external connection related areas
			:	:		
			:	:		
			:	:		

(3) Individually adjusted items

Individually adjusted items cannot be defined by the common infrastructure or with internal grades, and their levels must be individually adjusted in accordance with the system to be created.

The major categories of individually adjusted items generally correspond with performance and scalability and migratability, and consist of items whose values must be defined for each system, such as number of users, number of clients, performance objectives, and the like, or which span different levels based on their position within a single system.

When considering individually adjusted items, the method of using the item list to determine non-functional requirement levels is the same, but, as common infrastructure and internal grade

items have already been decided, the number of items to be considered for each project is greatly reduced. Table 4.1.3 shows an example.

Table 4.1.3 Example of individually adjusted items and setting values

Major category	Middle category	Minor category	Metrics	Level						Level setting value (specific values also acceptable)
				0	1	2	3	4	5	
Performance and scalability	Business processing volume	Business volume during normal operation	Number of users	Specific users only	Upper limit is fixed	Usable by unspecified number of users				Level 2
			Number of simultaneous users	Access limited to specified users only	Limited number of simultaneous users	Access by unspecified number of users				Level 1 (Up to 500 simultaneous users (license limitation))
			Number of business functions	Business functions are organized	A list of confirmed business functions has been created	There is a list of business functions, but have yet to be confirmed				Level 1
			Number of batch processes	Number of processes is defined for individual processing units	Number of processes is defined for primary processes					Level 1
		Business volume expansion	Expansion rate of data volume	1-fold	1.2-fold	1.5-fold	2-fold	3-fold	10-fold or greater	Level 3
		Retention period	Retention period	6 months	1 year	3 years	5 years	10 years or longer	Permanent retention	Level 3
	Performance objective	Online response	Adherence rate of response during normal operation	No defined adherence rate	60%	80%	90%	95%	99% or greater	Level 5
	Resource scalability	CPU scalability	CPU utilization	80% or greater	Between 50% and 80%	Between 20% and 50%	Less than 20%			Level 3
		Memory scalability	Memory addition capacity	No addition capacity	1 open slot	2 open slots	3 open slots	4 or more open slots		Level 2
Operability and maintainability	Operating environment	External system connection	Existence of external system connections	No connections with external systems	Connected to external systems inside the company	Connected to external systems outside the company				Level 2
	Support structure	Maintenance contract	Maintenance contract scope	No maintenance contract	Maintenance contract with each vendor for its own products	Multivendor support contract (some exceptions allowed)	Multivendor support contract (extending to all products which make up system)			Level 1
Migratability	Migration scheme	System deployment scheme	Number of steps for site deployment	No regulations, as there is only 1 site	Simultaneous deployment	Less than 5 steps	Less than 10 steps	Less than 20 steps	20 steps or more	Level 1
	Migration scope (equipment)	Equipment to be replaced	Equipment / device migration contents	Nothing in migration scope	Hardware replacement of equipment / devices in migration scope	Hardware, OS, and middleware replacement of equipment / devices in migration scope	Total system replacement of equipment / devices in migration scope	Total system replacement and integration of equipment / devices in migration scope		Level 0
	Migration scope (data)	Migration data volume	Migration data format	Nothing in migration scope	Same format as migration destination	Different format than migration destination				Level 0
Security	Access / usage restrictions	Authentication function	Authentication of agents with administrative rights	Not implemented	1 time	Authentication performed multiple times	Authentication performed multiple times using different authentication methods			Level 2 (Authentication must be performed twice for administrators)
		Usage restrictions	Operation limitations placed by system measures	None	Only minimum necessary amount of program execution, command operation, and file access is permitted					Level 1
	Data confidentiality	Data encryption	Encryption of stored data	None	Only authentication information is encrypted	Important information is encrypted				Level 1
System environment and ecology	System characteristics	Number of clients	Number of clients	Specified clients only	Upper limit is specified	Usable by unspecified number of clients				Level 2
		Geographical spread	Geographical spread	Inside site	Within 1 city	Within 1 prefectural area	Within 1 region	Domestic	International	Level 4
		Multi-language support	Number of languages	Only handles numbers, etc.	1	2	5	10	100	Level 1 (National language)

4.2 Example of non-functional requirements grades utilization in system expansion development

When performing system expansion development for an existing system, the existing system's non-functional requirements must be carried over. Deliberation regarding non-functional requirements related to system expansion development is performed by first confirming existing system non-functional requirements, and then considering the non-functional requirements of the segments of the system for which expansion development will be performed. In the end, both are taken into consideration, parts of the existing system which can be shared are used, and non-functional requirements needed by the segment(s) being developed are finalized.

- 1) Confirm the existing system's non-functional requirements.
- 2) Deliberate regarding the non-functional requirements of the segments of the system for which expansion development will be performed.
- 3) Decide on the non-functional requirements of the segments of the system for which expansion development will be performed.

During the first step, confirming existing system non-functional requirements, sometimes existing system non-functional requirements are clearly defined, while sometimes they have been implemented based on implicit knowledge. In the case of the former, confirm the defined existing system non-functional requirements. In the case of the latter, the item list must be used to confirm existing system non-functional requirements.

Next, deliberate regarding the non-functional requirements of the segments of the system for which expansion development will be performed. Use the aforementioned item list, check existing non-functional requirements, and clarify the non-functional requirements of the segments of the system for which expansion development will be performed. For example, if the objectives are improved availability and performance, the requirements related to availability and to performance will differ. There are already requirement levels for the existing system's non-functional requirements, so make sure that the non-functional requirements of the expansion development segment do not conflict with the requirement levels of the existing system.

Lastly, take both the existing non-functional requirements and the developed segment non-functional requirements into consideration, use the sections of the existing system that can be used in common, and determine non-functional requirements for the developed segment. For example, when network and networking equipment are shared, security and availability can partially use already implemented levels.

4.3 Example of utilization in creation of requests for information (RFI) and requests for proposals (RFP)

Item lists can be appended to requests for information (hereafter referred to as "RFI") and requests for proposals (hereafter referred to as "RFP"), with non-functional requirements listed therein. The information and proposals provided in response to RFIs and RFPs can be used to adjust deficiencies or excesses in level values set in the item list in order to complete non-functional requirements.

For example, if a non-functional requirements grades is used, when a model system is selected as described in Chapter 3, selected levels will be displayed within the grade table. Those levels can be adjusted to clarify non-functional requirements. Also, levels for non-functional requirements other than important items can be selected for each metric in the item list, and requirement contents clarified. The item list can then be appended to an RFI or RFP. The non-functional requirements shown in the item list will be further deliberated on with the information or proposals supplied in response to the RFI or RFP.

Next, an overall view is required of non-functional requirements being considered. A tree diagram is used for this. In the tree diagram, metrics for each major category are shown on one page, and important items are shaded for easier identification. Depending on the tree diagram, you can gain an overall understanding of non-functional requirements, the position of non-functional requirements specified in RFI or RFP, as-yet undecided non-functional requirements, and the like.

Again, non-functional requirements tend to undergo stepwise refinement, so it is important that non-functional requirements be presented from an early stage. By presenting them from an early stage, you can receive appropriate proposals from an early stage, resulting, ultimately, in improved system quality. If you use the basic utilization examples in Chapter 3, and the further examples in 4.1, you can present non-functional requirements from an early stage.

4.4 Example of utilization when information security related regulations, etc. exist

Corporate information security policies, "Standards for Information Security Measures for the Central Government Computer Systems," "FISC Computer System Safety Measure Standards for Banking and Related Financial Institutions," "PCI DSS," and similar industry-defined standards, guidelines, and regulations contain information security-related requirements. As such, in order to create conformant information systems, non-functional requirements related to security must be established such that regulations, etc. are satisfied.

This section provides examples of utilization when there are regulations, etc., containing information security related requirements.

(1) Process of utilization when information security related regulations, etc. exist

The basic utilization steps are the same as the steps shown in Chapter 3, but when there are regulations related to information security, etc., when setting security item levels, the items shown in Table 4.4.1 must be performed.

Table 4.4.1 Utilization steps when information security related regulations, etc. exist

No.	Step name	Step contents
1	Confirmation of security requirements put forth in security related regulations, etc.	Confirm security related requirements defined in information security related regulations, etc., such as information security policies.
2	Confirmation and setting of items which correspond to requirements of regulations, etc.	Confirm which of the grade table and item list security items correspond to the requirements confirmed in step 1. For items whose levels have been clearly indicated in security related regulations, etc., set levels which correspond with those requirements.

Some regulations clearly separate "requirements which absolutely must be implemented" from "other requests," using expressions such as "essential," "recommended," and "voluntary." When there are "requirements which absolutely must be implemented," when adjusting levels, special caution must be taken to avoid contradicting those regulations, etc. Appropriate level adjustment, taking into consideration services to be implemented, and other requirements, must be performed for "other requests."

(2) Detailed utilization step example

The "Standards for Information Security Measures for the Central Government Computer Systems (Fourth Edition)" will be used as a specific example for steps 1 and 2 listed in (1) above.

[Step 1 Confirmation of security requirements put forth in security related regulations, etc.]

Requirements are identified in order to satisfy security requirements defined by security related regulations, etc. Sometimes, conformance is required with more than 1 regulation, etc. When that is the case, confirmation must be performed for all regulations, etc.

For example, when the requirements in "Standards for Information Security Measures for the Central Government Computer Systems (Fourth Edition)" are confirmed, the following items corresponding to non-functional requirements grades requirement items can be identified.

- Measures based on information security requirement clarification
 - Information security related functions (agent authentication function, access control function, authority management function, activity trail management functions, etc.)
- Information security related threats
 - Security hole countermeasures, malicious program countermeasures, denial of service attack countermeasures, etc.

[Step 2 Confirmation and setting of items which correspond to requirements of regulations, etc.]

Check which of the security related requirements confirmed in step 1 correspond to item list requirement items. We will use the "agent authentication function" as an example. Figure 4.4.1 shows an excerpt of the "Authentication Functions" section of the "Standards for Information Security Measures for the Central Government Computer Systems (Fourth Edition)."

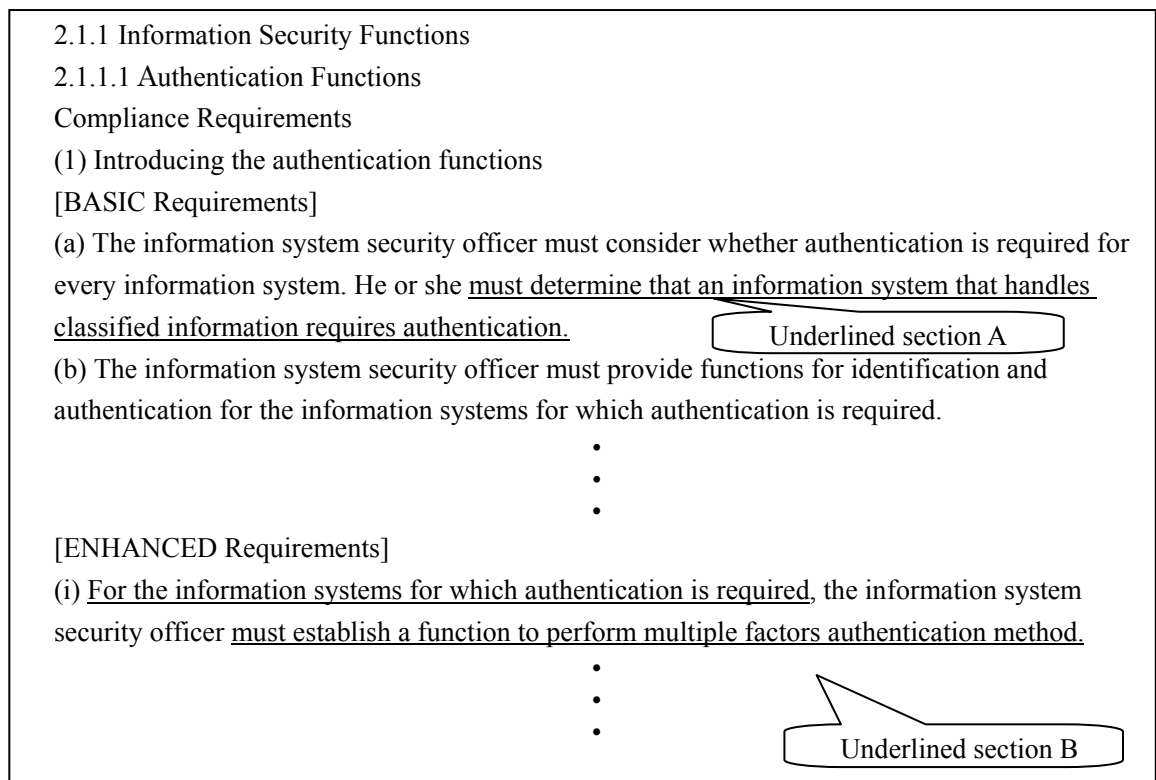
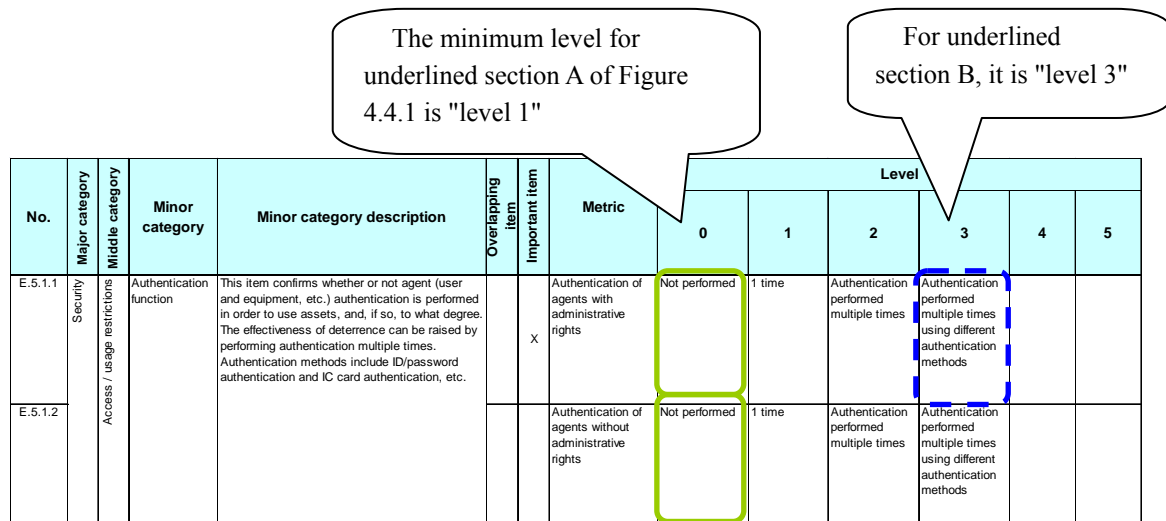


Figure 4.4.1 Excerpt from the "Standards for Information Security Measures for the Central Government Computer Systems (Fourth Edition)."

Underlined sections A and B in the figure above correspond to the item list's "E.5.1.1 Authentication of agents with administrative rights" and "E.5.1.2 Authentication of agents without administrative rights."

As such, one would confirm whether information requiring protection is handled, and, if so, set appropriate levels for "E.5.1.1 Authentication of agents with administrative rights" and "E.5.1.2 Authentication of agents without administrative rights" in order that agent authentication can be performed.

Figure 4.4.2 shows an example of level setting.



No.	Major category	Middle category	Minor category	Minor category description	Overlapping item	Important item	Metric	Level					
								0	1	2	3	4	5
E.5.1.1	Security	Access / usage restrictions	Authentication function	This item confirms whether or not agent (user and equipment, etc.) authentication is performed in order to use assets, and, if so, to what degree. The effectiveness of deterrence can be raised by performing authentication multiple times. Authentication methods include ID/password authentication and IC card authentication, etc.		X	Authentication of agents with administrative rights	Not performed	1 time	Authentication performed multiple times	Authentication performed multiple times using different authentication methods		
E.5.1.2							Authentication of agents without administrative rights	Not performed	1 time	Authentication performed multiple times	Authentication performed multiple times using different authentication methods		

Figure 4.4.2 Setting requirement item levels

For example, since systems which handle information that require protection must at least conform with basic requirements (underlined section A), as Figure 4.4.2 shows, a level where agent authentication is performed, level 1 or higher, must be selected. When conformance with enhanced requirements (underlined section B) is required of sections relating to agent authentication, level 3 is selected, as multiple agent authentication elements are required.

5. Points of consideration

This chapter provides an explanation of the points to consider when using non-functional requirements grades, shown in Table 5.1.

Table 5.1 Points of consideration

No.	Item	Points of consideration
1	When there are non-functional requirements that do not exist in the item list	Universal and level-assignable metrics have been selected for the non-functional requirements grade. As such, there may be specific and particular requirements for specific projects. When this occurs, it is recommended to organize the non-functional requirements that are not in the item list as individual requirements, and use them together with the non-functional requirements grade.
2	When using with a project that does not correspond to a model system	There may be cases where the non-functional requirements grades are used for a system that does not match the three model systems defined by the non-functional requirements grade. Even in this situation, the non-functional requirements grades may be used to directly specify non-functional requirements.