INFORMATION SYSTEMS, WEB AND PERVASIVE COMPUTING SERIES

Systems and Network Infrastructure Integration

Design, Implementation, Safety and Supervision

Saida Helali

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Contents

Preface

This book, a true independent learning tool intended principally for students of network and systems sectors, is a guide to understanding the various facets of a network and systems integration project by learning the underlying concepts and acquiring the skills necessary to implement such projects. It is aimed at helping students acquire technical skills stemming from the analysis of needs, the specification of infrastructure characteristics, the definition of the equipment and components of the resulting networks, and their incorporation into the construction of a complete high-performance infrastructure that will satisfy the needs of a client company. Moreover, the methodological and organizational skills needed to oversee this type of project in terms of various considerations such as cost and deadline are also necessary and will be furnished by this book. This book also addresses the concept of Green IT, in order to raise students' awareness of environmental issues before they begin their professional lives, so that they will take these issues into account during the deployment of IT infrastructures.

The ultimate objective of this book is to enable students to learn how to design and develop network infrastructures for medium-sized and large businesses, and, more specifically, how to analyze needs and subsequently translate them into the design of the topology of a network that is fit for purpose. How do we define need in terms of interconnection equipment? How do we put an optimized addressing scheme in place? How do we determine the technologies, tools and manufacturers best suited to create a high-quality, high-performance network that is highly secure and accessible while being eco-friendly and state-of-the-art at the same time?

This book is made up of nine chapters, set out in two complementary sections adapted for IT network technicians; specifically:

– A methodological and organizational section that will enable students to understand, from the first chapter, the concept of specifications, and how to decipher them and to acquire the knowledge needed to manage an IT project, that is, the corresponding approaches, methods and tools. Indeed, it is vital to plan every stage of the implementation of an IT solution, to be familiar with its principal actors, and to know how to develop an efficient communication plan with regard to deliverables requested, milestone dates, etc.

This section will also provide an overview of the basic concepts of simulation in Chapter 2, and will more specifically introduce the GNS3 tool for the prototyping and testing of IT infrastructures before their on-site deployment. The use of this type of software protects an IT infrastructure integration project team for disrupting the operation of the production network. In addition, GNS3 is highly prized for teaching purposes, particularly in the absence of network hardware.

This section will also present the aspects of the environmental impact of IT infrastructures, or Green IT, with the aim of introducing students to and increasing their awareness of this reduced energy consumption approach in all network infrastructure implementation projects.

– A technological section that will address the purely technical aspects of network infrastructures in an organically laid-out sequence based on the actual process of setup and implementation.

Chapter 4, which begins this section, gives a concise introduction to the main network services generally provided by IT infrastructures.

The design of these infrastructures is a vital stage in the process of their implementation, which is discussed in Chapter 5.

Chapter 6 is dedicated to the theme of security. Any infrastructure integration project must be sure to implement certain security mechanisms depending on the needs of the client company.

Chapter 7 focuses on virtualization and cloud computing, two interdependent paradigms that are omnipresent in every network infrastructure today.

Concepts dealing with the quality of service (QoS) and high availability increasingly demanded by modern IT infrastructures, in which the types of applications are extremely diverse and performance is more and more of a priority, are discussed in Chapter 8.

The final chapter is dedicated to the supervision of a network infrastructure and its various tools, with the objective of monitoring the infrastructure installed in order to mitigate and possibly prevent technical failures.

Each chapter ends with a mental map in the form of a visual summary of the main points of information discussed, in order to better structure them and facilitate their memorization.

Saida HELALI
June 2020

1

Introduction to Project Management

"A little impatience can ruin a great project."

Confucius

– Understanding the basic principles of project management.

– Learning the principal methods and tools of project management.

– Understanding the usefulness of specifications and how to interpret them.

1.1. Introduction

Managing an IT project is similar to managing any type of project in general. According to Wysocki, a project is a sequence of unique, non-repetitive, complex and connected activities intended to achieve an objective. This must be done within both a specific time frame and a budget, and in compliance with a set of specifications.

An IT project (ITP) requires technical skills (programming, security, networks, architecture, etc.), as well as organizational and communication skills. The objective is to design a reliable, viable and satisfactory IT solution for a client, particularly in terms of agreeing upon deadlines, cost and quality. There are multiple aspects to a project:

– functional: responds to a need;

– technical: complies with clearly defined specifications and limitations;

– organizational: adheres to a predetermined mode of operation (roles, culture, function, resistance to change, etc.);

– temporal: complies with deadlines;

– economic: adheres to a budget.

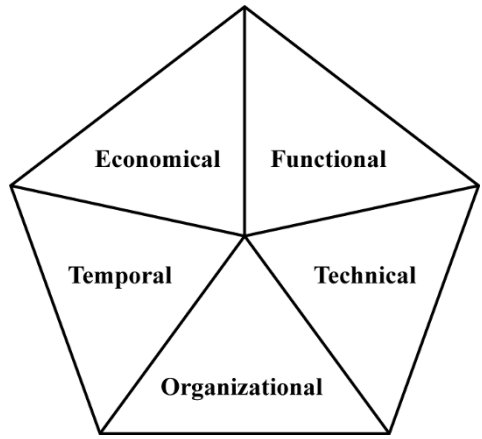

Figure 1.1. *Facets of a project*

1.2. Project management

Project management is an approach based on the application of knowledge, skills, tools, and techniques to project activities aimed at fulfilling the expectations of the parties involved in the project.

Every project can be broken down into phases. Each phase can be further broken down into stages, and these stages into tasks. The main phases of a project are shown in Figure 1.2.

Figure 1.2. *The main phases of a project*

– The initiation phase consists of defining the work to be carried out. It recalls its genesis, usefulness and end goal in answering “why” and “what”

questions. The expected completion date can be set during this phase, and an overall budget can be estimated. A set of specifications must be drawn up at this point.

– The design phase involves the actual definition of the project; it structures, organizes and plans it. Its objective is to prepare and organize the implementation of the elements laid out during the initiation phase.

– The execution phase represents the realization or implementation of the project. Each of the points laid out in the action plan is worked on during this phase, according to the set of specifications.

– The closure phase involves building on recent experience with the goal of ongoing improvement through assessment reports and rigorous documentation.

1.3. Project management methods and tools

Project management methodologies enable a project to succeed and comply with the deadlines, budget and resources provided. They help each stage of the project to be completed, from planning to implementation, in the interests of efficiency and profitability.

Principal methodologies include:

a. Classic methods: these methods are most often used in project management. They are referred to as “cascading” because each stage must end by moving on to the next. The major disadvantage of this approach lies in its lack of flexibility with regard to changes.

b. Agile methods: these methods are gaining more and more popularity. They offer more flexibility and control in project management and better fulfill client expectations. Client needs are the cornerstone of agile methods. The client is involved throughout the entire project, which is executed according to an iterative, incremental process. Scrum, the agile method most often used, introduces the concept of sprints, which represent the different stages of the project. Throughout the project, existing functionalities will be continuously improved. It is also possible to add new functionalities if needed. Scrum is based on three roles:

– the product owner, who sets the technical requirements for the product,

– the development team, which develops the project according to the needs specified by the product owner and the scrum master,

– the scrum master, who oversees the realization of these objectives and is responsible for management within the project team. Successful communication with the product owner and the development team lies within the remit of the scrum master.

c. Adaptive methods: these methods adjust themselves to fit variations in projects, especially those that are complex and difficult to manage with a classic approach.

d. Critical path method: this method corresponds to the full set of tasks that must be accomplished in order to complete the project by a predetermined date. These critical tasks must not be subjected to any delay, otherwise the project will fall behind schedule.

e. The PERT method: this method is used to manage sequencing in a project. It involves representing the project in the form of a graph, a network of tasks whose sequencing will enable the achievement of preset objectives.

All of the tasks necessary for the execution of the project are listed and put in a specific order, with their dependence on one another established.

In this method, the stages of a project are represented graphically in a PERT diagram, which establishes the critical path that determines the minimum duration of the project.

f. The PRINCE2 (PRojects IN Controlled Environments, version 2) method: this method is a structured, pragmatic and adaptable project management methodology that can be used for any type of project. It guarantees that projects will be delivered on time, within budget and ensuring risk, advantage and quality management.

g. The Lean Management method: this method is used to provide high-quality work with minimal money, resources and time.

A wide range of tools is available for the management of a project. These are used to increase productivity and efficiency. Thus, it is necessary to know which ones to choose depending on our needs.

Table 1.1 recaps the main tools available for each phase of a project.

	Initiation (pre-project)	**Design**	**Execution**	**Closure**
Examples of tools	Objective tree RACI matrix Specifications	Pareto WBS Gantt diagram Communication plan Risk management	Collaborative work tools Brainstorming Problem-solving tools Control panel	Project review

Table 1.1. *Main tools for project management*

1.3.1. *Gantt diagram*

This is an effective and practical tool for project management created by Henry Gantt in 1917, which remains the most widely used representation tool. It consists of a graphic diagram useful for project planning and gives information and time frames for a project's phases, activities, tasks and resources.

Tasks are put in rows and durations (days, weeks or months) in columns. They are represented by bars whose length is proportional to the estimated duration. These can take place sequentially or partially or entirely simultaneously.

1.3.2. *RACI (Responsible, Accountable, Consulted, Informed) matrix*

The success of a project relies on the clear and precise definition of the roles and responsibilities of each actor involved. To do this, a RACI matrix is used. In this matrix, activities are laid out in rows and roles in columns. In each cell of the table, the role's responsibility for the activity is indicated, using the letters R, A, C or I.

	Role 1	**Role 2**	**…**	**Role m**
Activity 1	R	A	I	C
Activity 2	I	R	I	A
…	A	R	C	I
Activity n	C	R	C	I

Table 1.2. *Example of a RACI matrix*

It can be used to set out responsibilities in a project or within a company or business.

1.3.3. *The concept of specifications*

This is a contractual document describing what is expected from the project manager by the contracting authority. It is generally developed by the client and contains the following main sections: context, objectives, vocabulary or terminology, scope, schedule, etc.

The contracting authority is the party responsible for the expression of needs; they are the entity that places the order. The project manager is responsible for making these needs a reality.

The specifications must set out needs in a functional manner, independent of any technical solution with the exception of specifying the technical environment into which the solution requested must be inserted.

According to norm NF X 50-150 developed by the AFNOR, a functional specification document (FSD) is the document by means of which the requesting party expresses its needs in terms of service features and limitations. For each function and limitation, assessment criteria and their levels are defined.

NOTE.– The FSD is concerned with the service features of a product and their corresponding limitations, and does not contain any technical ideas or impose any solutions. Its objective is to propose the product best suited to provide the service(s) requested under the conditions specified and at minimal cost.

Knowing how to read and correctly interpret a set of specifications is very important for the success of the associated project. The project team must analyze needs, including understanding the expectations of the final users (the WHAT), and know how to put them into practice (the HOW). The team must gain a perfect understanding of the associated issue by asking itself the following questions:

– Who is requesting this solution?

– Who will use the proposed solution? With what benefits?

– What will be the solution's environment?

– What are the limitations and problems that may be encountered?

The ultimate goal always remains the satisfaction of the end-users' and clients' needs. These needs can be explicit or clearly stated, implicit or unstated but necessary. In this context, we can speak about functional specifications, pertaining to the functionalities expected of the project, and non-functional specifications, which represent the secondary characteristics to be offered.

Interpreting a set of specifications consists of:

– describing the project, including the context of work, motivations and objectives that will be evaluated at the end of the project, the challenges or difficulties to be overcome, and the criteria for success, or how to evaluate the project in relation to objectives;

– subsequently defining the phases of implementation of the project and the links between these phases using a Gantt diagram, for example. In addition, milestone targets and deliverables corresponding to each phase must be set, and a clear idea of the procedures has to be followed for the management and follow-up of the project.