
**Software engineering — Mock up and
prototype — A categorization of software
mock up and prototype models and their
use**

*Ingénierie du logiciel — Maquette et prototype — Un classement des
maquettes et prototype logiciels et leur utilisation*

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Foreword

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In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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ISO/IEC TR 14759 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software engineering*.

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Introduction

Mock up and prototypes are commonly confused. This stems from the English word "prototype" which covers the two French terms "maquette" (mock up) and "prototype" (prototype). An examination of the meaning given to the two words mock up and prototype in the aeronautical industry reveals that the first stipulates a version of the plane which cannot be piloted and the second a version which can be piloted. Using this analogy, a software mock up is defined as a provisional product that cannot be piloted by users, is not intended to evolve into a fully operational product and may be thrown away once its objective has been achieved. A software "prototype" is defined as something that can be piloted, is developed as a part of the target product and may evolve into an operational product.

Besides this first distinction between mock up and prototype, two additional distinctions have been introduced to address specific features of software issues:

- "illustrative" (related to realistic graphic representation, as in HCl's) versus "functional" (capable of performing computations) address the objective of the mock up and prototype development.
- "demonstrative" (serving to prove the relevance of a solution) versus "operational" (fit for proper functioning in real conditions of operations) address the level of refinement of the deliverable.

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Software engineering — Mock up and prototype — A categorization of software mock up and prototype models and their use

1 Scope

This Technical Report applies to any project which uses evolutionary development.

This Technical Report sets out the concepts associated with the production of mock ups and prototypes by identifying and describing the various deliveries which result.

The Technical Report is written for user representatives, developers, managers, quality assurance practitioners of systems and software products and services.

1.1 Purpose

The purpose of this Technical Report is to define the boundaries of mock up and prototype oriented projects.

The purpose of this Technical Report is to reduce risk in critical projects.

1.2 Field of Application

The purpose of this Technical Report does not provide the reader with a normative definition of a specific software life cycle model.

The Technical Report applies to any project which involves uncertain conditions, e.g. safety critical software, user interfaces, new algorithms.

2 References

This Technical Report includes references to other publications. The latest edition of the publication referred to applies.

ISO/IEC 9126:1991, *Information technology — Software product evaluation — Quality characteristics and guidelines for their use*.

ISO/IEC 12207:1995, *Information technology — Software life cycle processes*.

3 Abbreviation and definitions

3.1 Abbreviation

HCI Human-computer interface.

3.2 Definitions

a) Demonstrative

A demonstrative product is a product which proves the relevance of a solution.

b) Functional

A functional product is a product capable of performing computations.

c) Illustrative

An illustrative product is a non functional product.

d) Mock up

A mock up is a throw-away product. Note that it can be retained e.g. for verification, training and as a record.

e) Operational

An operational product is a product which functions in real conditions of operations.

f) Prototype

A prototype is a preliminary type, form, or instance of a system that serves as a model for later stages or for the final, complete version of the system. A prototype is a usable product.

NOTE Refer to clause 4 and Figure 1 for further information about these definitions.

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4 Categorization of mock up and prototype models

Mock up and prototype combine the following possible attributes: illustrative, functional, demonstrative and operational, as shown in Figure 1.

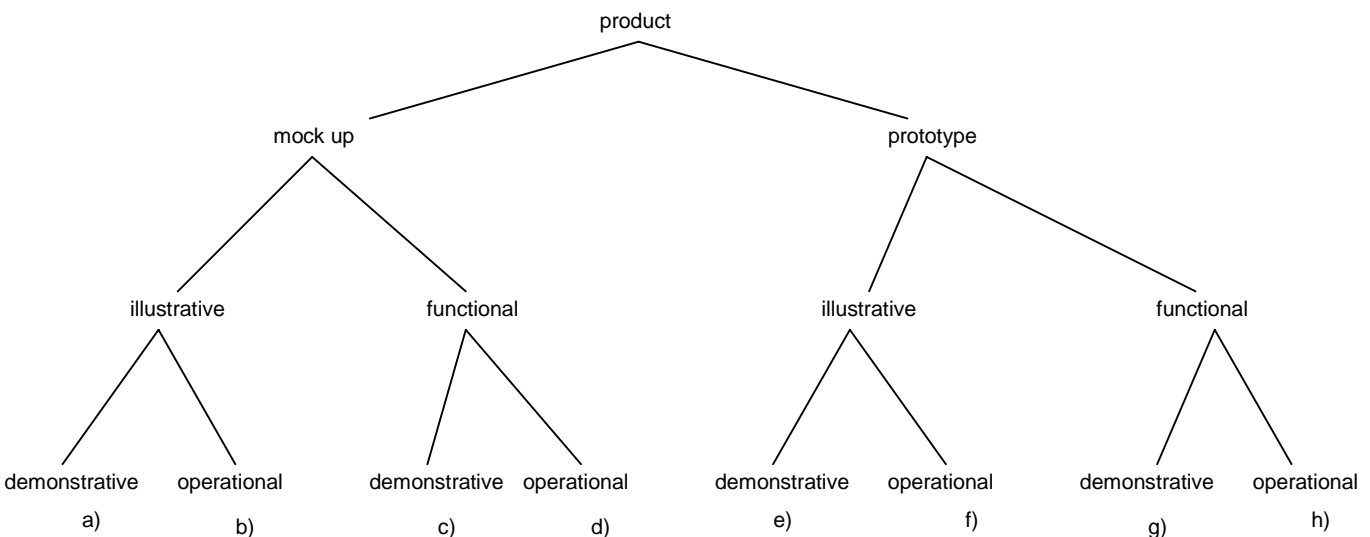


Figure 1 — Three pairs of terms, leading to eight possible types of products

The eight possible types of products identified in Figure 1 are described as follows:

- a) A **demonstrative illustrative mock up** is a throw-away product representing the behaviour of the system, running in the development environment.

EXAMPLE A slide-show, usually thrown away, unless it is used for training or marketing the product.

- b) An **operational illustrative mock up** is a throw-away product representing the behaviour of the system, running in the operational environment.

EXAMPLE A mock up of a HCI, tested in operational conditions, a situation which is frequently encountered in military contexts. When an operational illustrative mock up is tested, the interface is realistic and usable, but the functional environment is simulated.

- c) A **demonstrative functional mock up** is a throw-away product showing the functional organization of the system, running in the development environment.

EXAMPLE The first draft of a real-time algorithm, demonstrating a set of functions.

- d) An **operational functional mock up** is a throw-away product showing the functional organization of the system, running in the operational environment.

EXAMPLE The mock up of an algorithm, tested in operational conditions, to validate the reliability of a solution.

- e) A **demonstrative illustrative prototype** is a usable product representing the behaviour of the system, running in the development environment.

EXAMPLE A prototype of a HCI, tested in development conditions.

- f) An **operational illustrative prototype** is a usable product representing the behaviour of the system, running in the operational environment.

EXAMPLE A prototype of a HCI, tested by target users in operational conditions.

- g) A **demonstrative functional prototype** is a usable product showing the functional organization of the system, running in the development environment.

EXAMPLE The prototype of real-time software, still tested in development conditions.

- h) An **operational functional prototype** is a usable product showing the functional organization of the system, running in the operational environment.

EXAMPLE The prototype of real-time software, tested by target users in operational conditions.

5 Use of mock up and prototype models

Both mock up and prototype are helpful to analyse user's software quality requirements and to investigate possible risks on software quality characteristics, although they have differences and should be distinguished.

These software characteristics are, for example, interoperability of functionality, fault tolerant of reliability, operability of usability or time behaviour or efficiency and so on, which may be found in ISO/IEC 9126.

5.1 Mock up versus prototype

The mock up does not provide a real version but a realistic version of the target product. The purpose of a mock up is to give users a representative image of the target deliverable, enabling them to detect and correct deficiencies at a time when the cost of such modifications is still quite low. Later, the software supporting the mock up is discarded; the design of the mock up is terminated but its specification may be reused in any further development.

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The software supporting the mock up may also be kept along with the design as a quality record and for use in subsequent verification and validation.

The mock up is characterized by the following statements:

- a) Not all features of the target product need be represented;
- b) The development environment (machine, language, and tools) need not be that of the target product but it must be representative of the target product;
- c) The operating environment technical components need not be those of the target product but they must be representative of the target product;
- d) It is acceptable to use a subset of the documentation normally used to document the full development life cycle.

The prototype provides a simplified but usable version of the target product. The purpose of a prototype is to assess the interactions between the target operating environment and the target deliverable. Later, the software supporting the prototype should be improved and should remain as a part of the target product.

The prototype is characterized by the following statements:

- a) Not all features of the target product need be represented;
- b) The development environment (machine, language, and tools) is that of the target product;
- c) The operating environment technical components are those of the target product;
- d) Document the full development life cycle as if it were the final product.

The following is an example of usage of mock up and prototype throughout the software life cycle.

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Table 1 — Mock up or prototype cross-reference to ISO/IEC 12207¹⁾

	Mock up	Prototype
Development Process		
environment	operational or demonstrative	operational or demonstrative
machine	mock up machine	target
language, tools	mock up language and tools	target
operating env. tech. components	mock up components	target
operating env. constraints	operational or demonstrative	operational or demonstrative
functions	illustrative or functional	illustrative or functional
data	operational or demonstrative	operational or demonstrative
Quality assurance Process		
output	operational or demonstrative	operational or demonstrative
reliability	operational or demonstrative	operational or demonstrative
Validation Process		
users	operational or demonstrative	operational or demonstrative
conditions of use	operational or demonstrative	operational or demonstrative
Documentation Process		
phase management doc.	specification only	normal
technical production doc.	reduced	normal
manuals	reduced	normal

5.2 Illustrative versus functional

The aim of an illustrative deliverable is to assess the components of the software which are related to representation. An illustrative deliverable provides a realistic preview of the target behaviour of the system.

The illustrative deliverable is characterized by its ability to illustrate HCIs without providing the functionality of these HCIs. For example, the screens are provided and can be activated, but no output is computed. Tools used for these representations can produce computer output responses to verify user interaction with the system.

The aim of a functional deliverable is to assess relevance of the solution. The functional deliverable is characterized by its ability to implement all functions which are supposed to be within the scope of the prototype.

The following is an example of usage of mock up and prototype throughout the software life cycle from illustrative and functional viewpoints.

1) The features used in Table 1 are:

target - present in the target environment;
reduced - simplified from the target environment; and
normal - conforming with the standards.