INTERNATIONAL STANDARD

ISO/IEC/IEEE 41062

First edition
2019-02

Software engineering — Recommended practice for software acquisition

Ingénierie du logiciel — Pratique recommandée pour l'acquisition des logiciels

Reference number
ISO/IEC/IEEE 41062:2019(E)

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(Revision of
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Approved 5 December 2015

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Abstract: A set of useful quality considerations that can be selected and applied during one or more steps in a software acquisition process is described in this recommended practice. The recommended practices can be applied to software that runs on any computer system regardless of the size, complexity, or criticality of the software. The software supply chain may include integration of off-the-shelf (OTS), custom, or free and open source software (FOSS). Each organization or individual using this recommended practice will need to identify the specific quality and activities that need to be included within its acquisition process.

Keywords: acquirer, custom developed, end user, FOSS, IEEE 1062™, off-the-shelf, OTS, SaaS, software acquisition process, software as a service, supplier

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PDF: ISBN 978-1-5044-0085-5 STD20506
Print: ISBN 978-1-5044-0086-2 STDPD20506

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Introduction

This introduction is not part of IEEE Std 1062-2015, IEEE Recommended Practice for Software Acquisition.

This introduction provides some background on the rationale used to develop this recommended practice. This information is meant to aid in the understanding and usage of this recommended practice.

This recommended practice describes the management and execution of software acquisition activities. It is intended for the following:

- Individuals or organizations that acquire software from suppliers
- Individuals or organizations that acquire software from a developer for resale to other individuals or organizations
- Individuals or organizations that influence how software is acquired from suppliers
- Suppliers interested in providing high-quality software to acquirers

This recommended practice is designed to help organizations and individuals

- Incorporate quality considerations during the definition, evaluation, selection, and acceptance of supplier software for operational use
- Determine how supplier software should be evaluated, tested, and accepted for delivery to end users

This recommended practice is intended to satisfy the following objectives:

- Promote consistency within organizations in acquiring third-party software from software suppliers
- Provide useful practices on including quality considerations during software acquisition planning
- Provide useful practices on evaluating and qualifying supplier capabilities to meet user software requirements
- Provide useful practices on evaluating and qualifying supplier software
- Assist individuals or organizations judging the quality of supplier software for referral to end users

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1. Overview

This recommended practice is divided into six clauses. Clause 1 provides the scope of this recommended practice. Clause 2 lists references to other standards that are essential in applying this recommended practice. Clause 3 provides definitions that are either not found in other standards, or have been modified for use with this recommended practice. Clause 4 describes the options for acquiring software. Clause 5 describes the eight steps in a software acquisition process and the related quality practices that apply to acquiring software. Clause 6 describes how quality assurance can be applied to software acquisition.

This recommended practice also contains five annexes. Annex A provides a set of checklists that individuals or organizations may elect to adapt to their specific needs, Annex B provides software acquisition guidelines with respect to Software Safety Assurance and Software Information Security Assurance, Annex C provides guidelines with respect to rights in technical data software usage, Annex D provides acquisition plan guidelines, and Annex E is the bibliography.

1.1 Scope

This recommended practice describes a set of useful quality considerations that can be selected and applied during one or more steps in a software acquisition process. The recommended practices can be applied to software that runs on any computer system regardless of the size, complexity, or criticality of the software. The software supply chain may include integration of commercial-off-the-shelf (COTS), custom, or free and open source software (FOSS). Each organization or individual using this recommended practice will need to identify the specific quality and activities that need to be included within the organization's acquisition process. Security will be included as a quality attribute considered during the acquisition.

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1.2 Purpose

This recommended practice is designed to help organizations and individuals incorporate quality, including security considerations during the definition, evaluation, selection, and acceptance of supplier software for operational use. It will also help determine how supplier software should be evaluated, tested, and accepted for delivery to end users. This recommended practice is intended to satisfy the following objectives:

- Promote consistency within organizations in acquiring software from software suppliers.
- Provide useful practices on including quality, security, safety and data rights considerations during acquisition planning.
- Provide useful practices on evaluating and qualifying supplier capabilities to meet user requirements.
- Provide useful practices on evaluating and qualifying supplier software.
- Assist individuals or organizations judging the quality of supplier software for referral to end users.
- Assist suppliers in understanding how the software will be evaluated, tested, and accepted for delivery to end users.

Success in acquiring high-quality software products and services from software suppliers can be achieved by doing the following things:

a) Identifying quality characteristics necessary to achieve the acquirer's objectives
b) Selecting suppliers most capable of meeting the acquisition objectives
c) Including quality considerations in the planning, evaluation, and acceptance activities
d) Developing an organizational strategy for acquiring software
e) Establishing a software acquisition process using the eight steps stated in 5.2 as a starting point
f) Putting the defined process into practice

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 1228™, IEEE Standard for Software Safety Plans.[1, 2]

ISO/IEC/IEEE Std 12207, Systems and software engineering—Software life cycle processes.

ISO/IEC/IEEE Std 15288, Systems and software engineering—System life cycle processes.

ISO/IEC/IEEE Std 15289, Content of life-cycle information products.

ISO/IEC/IEEE Std 24765, Systems and Software Engineering—Vocabulary.

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3. Definitions and terms

For the purposes of this document, the following terms and definitions apply. The *International Standard ISO/IEC/IEEE 24765: Systems and Software Engineering—Vocabulary* should be referenced for terms not defined in this clause.[3]

3.1 Definitions

acquisition: Process of obtaining a system, product, or service.

commercial-off-the-shelf (COTS): A product available for purchase and use without the need to conduct development activities [ISO/IEC/IEEE 15289:2011].

modified-off-the-shelf (MOTS): Software product that is already developed and available, usable either "as is" or with modification, and provided by the supplier, acquirer, or a third party.

off-the-shelf (OTS): Product or system already developed and available [ISO/IEC/IEEE 15289:2011].

software-intensive system: A system for which software is a major technical challenge and is perhaps the major factor that affects system schedule, cost, and risk [IEEE Std 1362-1998 (Reaff 2007)] and [ISO/IEC/IEEE 24765:2010].

NOTE—In the most general case, a software-intensive system is comprised of hardware, software, people, and manual procedures.[4]

3.2 Use of should, may, and can

In this document, the word *should* is used to indicate a recommendation. The word *may* is used to indicate a permissible action. The word *can* is used for statements of possibility and capability.

4. Software acquisition alternatives

4.1 Introduction

Software can be acquired in three different ways or a combination of the three. It is acknowledged that any combination of these three alternatives will make the overall software project more complex and likely to be different from each other. This document does not attempt to address the combinations of these three basics software acquisition options. The software acquisition alternatives include contracting custom-developed software, obtaining the right to use off-the-shelf (OTS) software and renting software as a service (SaaS). The advantages and disadvantages of each option are summarized in Table 1.

[3]*The International Standard ISO/IEC/IEEE 24765: Systems and Software Engineering—Vocabulary* is available at www.computer.org/sevocab.

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4.2 Custom-developed software

Reaching an agreement, often a formal contract for the custom development is an acquisition approach where the solution to an acquirer's need is provided via hiring a supplier (outsourcing) or using an internal team to custom develop a software solution that is built to a specification or set of requirements. Following software development standards and known methods, the acquirer oversees the development, test activities, and products performed by the supplier. At acceptance, the acquirer takes ownership of the solution and possibly some of the supporting tools/methods in order to support ops/maintenance of the solution. This option includes software built from scratch and/or integrated from other existing components (e.g., reuse, modified FOSS).

4.2.1 Advantages of custom-developed software

The advantages of custom-developed software are as follows:

- The solution should match the need exactly, no more or no less.
- The acquirer can require that flexibility and maintainability be supported by the solution and by the supplier of the solution.
- The acquirer can monitor and influence the course of development/test in case changes are deemed appropriate.
- The acquirer can control and influence the related topics to the executable software solution (e.g., size, performance, information protection, authorization security, capacity) and the software development environment (language, tools, etc.).
- If a problem is reported, the acquirer can determine if the problem legitimately violates the specifications and if it does, the supplier should be responsible for fixing that problem, typically at no additional cost to the acquirer.
- Changes after acceptance are typically still under control of the acquirer via an ops/maintenance agreement with a possibly different ops/maintenance supplier.

4.2.2 Disadvantages of custom-developed software

The disadvantages of custom-developed software are as follows:

- Typically costs more than the other options.
- Typically takes more time (sometimes much more) than the other options.

4.3 Off-the-shelf (OTS) software

This is an acquisition approach where the solution to an acquirer's need is provided via purchasing and taking possession of an already built solution from a software supplier. The acquirer agrees to the seller's license agreement to use the "executable" version of the solution but typically does not have access to the source code or other information about the solution or the processes used to produce that product. In addition, the acquirer typically takes possession of the software solution and installs in on assets owned by the acquirer. In addition, the solution is typically acquired in "as is" condition, unless the supplier offers built-in tailoring of the product (and this more common than not). This option includes commercial off-the-shelf (COTS), free and open source software (FOSS) products acquired in "as is" condition, and other non-developmental items (NDI).

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4.3.1 Advantages of OTS

The advantages of OTS are as follows:

— Cost is less than the custom-developed option but similar to the SaaS option.

— Time to initial operations is less than the custom-developed option and can be greater than the SaaS option.

— Since the acquirer takes possession of the solution, the control over data and access is greater than the SaaS option and about the same as the custom-developed option.

4.3.2 Disadvantages of OTS

The disadvantages of OTS are as follows:

— The terms of the generally non-negotiable license agreement constrain how the solution may be used by the acquirer, possibly to the acquirer's detriment. The solution typically includes features that attempt to enforce specific agreement terms, adding cost and complexity to the solution.

— The solution may not satisfy all of the acquirer's needs (sometimes called gaps) and it may also provide features/capabilities that are not required, not desired or even tolerable to the acquirer. The acquirer may need additional solutions, or modifications to the acquired solution, to fill these gaps. In addition, the acquirer may also need to identify and deactivate or prevent the extraneous code from activating itself.

— Sometimes, the User Interface to the solution is different from the way an acquirer is currently offering a User Interface to their current users. This can sometimes/often be solved via product tailoring.

— Typically, there will be a need to obtain support from the supplier for installation, activation, and maintenance.

— Problem reporting can be an issue, depending on the supplier's capability to accept and react to problem reports. In addition, the supplier may not even agree that because an acquirer alleges a problem exists that a legitimate problem actually does exist.

— Product changes, both fixes and upgrades, are controlled mostly by the supplier and determined by marketplace needs. Such changes may not be consistent with the acquirer's ongoing needs or timeframe.

— It is possible for the vendor to go out of business resulting in a possible loss of data.

4.4 Software as a service (SaaS)

Software as a service (SaaS) is an acquisition approach where the solution to an acquirer's need is provided via an agreement with a supplier for access to a software product for a fixed amount of time and to use that software product remotely, via connection (wired, wireless, etc.) to the supplier's assets. Inputs to the remote software product are transmitted to the supplier and outcomes/results/products from using the software product are transmitted back to the acquirer. This acquisition option is part of the Cloud Computing approach (NIST Special Publication 800-145 [B12]) to software (aka renting access to products, services, infrastructure, etc.) and is frequently referred to as software as a service (SaaS).

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4.4.1 Advantages of SaaS

The advantages of SaaS are as follows:

— Rapid access to products and services via Service Level Agreement (SLA) and ready to use solutions, more so than custom-developed or OTS.

— No need to provide internal computing assets to support "building or buying" the equivalent products or services, thus reducing costs and time in prep for using solution, as compared to both custom-developed and OTS.

— Typically is cheaper than custom-developed option and can be cheaper than the OTS option.

— No need to take permanent ownership of the software solution, thus reducing impacts associated with such ownership (e.g., sustainment, hardware to host solution), as in the custom-developed and OTS options.

4.4.2 Disadvantages of SaaS

The disadvantages of SaaS are as follows:

— The terms of the generally non-negotiable license agreement constrain how the solution may be used by the acquirer, possibly to the acquirer's detriment. The solution typically includes features that attempt to enforce specific agreement terms, adding cost and complexity to the solution.

— The solution may not satisfy all of the acquirer's needs (sometimes called gaps) and it may also provide features/capabilities that are not required, not desired or even tolerable to the acquirer. The acquirer may need additional solutions, or modifications to the acquired solution, to fill these gaps. In addition, the acquirer may also need to identify and deactivate or prevent the extraneous code from activating itself.

— The location of where the data is stored is not controlled by the acquirer; therefore the data (personal data, sensitive data, etc.) could be subject to the rules and regulations of the locality of the supplier.

— In the event the supplier is no longer a case of e.g., bankruptcy of supplier, potentially the acquirer's data could be lost.

— The user interface to the solution may be different from the way an acquirer is currently offering a user interface to their current users. This can sometimes/often be solved via product tailoring.

— Protection of data, being transmitted in both directions due to dependency on supplier's capabilities. This may require internal protections or legal agreements if this protection should ever fail or be compromised.

— Problem reporting and problem correction of a solution, if it does not work as desired: Supplier may not agree with nature of the problem or may not be able to fix in a timely manner. Similar to OTS and more problematic than custom-developed.

— Assured access to solution due to dependency on external assets. Again, backup/alternative paths to supplier's assets may be required or legal recourse in case of loss of access. This is typically a bigger risk than for custom-developed or OTS options.

— Recovery from loss of access to or other failures of the solution may be dependent on the supplier's abilities and sometimes out of the control of the acquirer.

— Product changes, both fixes and upgrades, are controlled mostly by the supplier and determined by marketplace needs. Such changes may not be consistent with the acquirer's ongoing needs or timeframe.

— It is possible for the vendor to go out of business resulting in a possible loss of data.

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Table 1—Software acquisition options

	Advantages	Disadvantages
Custom-developed software	1. The solution should match the need exactly, no more or no less. 2. The acquirer can require that flexibility and maintainability be supported by the solution and by the supplier of the solution. 3. The acquirer can monitor and influence the course of development and test in case changes are needed. 4. The acquirer can control and influence the related topics to the executable software solution (e.g., size, performance, information protection, authorization security, capacity) and the software development environment (language, tools, etc.). 5. If a problem is reported, the acquirer can determine if the problem legitimately violates the specifications and if it does, the supplier should be responsible for fixing that problem, typically at no additional cost to the acquirer. 6. Changes after acceptance are typically still under control of the acquirer via an operations/maintenance agreement with a possibly different operations/maintenance supplier.	1. Typically costs more than the other options. 2. Typically takes more time than the other options.
Off-the-shelf (OTS) software	1. Cost is less than custom-developed option but similar to the SaaS option. 2. Time to initial operations is less than the custom-developed option but greater than the SaaS option. 3. Since the acquirer takes possession of the solution, the control over data and access is greater than the SaaS option and about the same as the custom-developed option.	1. The terms of the generally non-negotiable license agreement constrain how the solution may be used by the acquirer, possibly to the acquirer's detriment. The solution typically includes features that attempt to enforce specific agreement terms, adding cost and complexity to the solution. 2. The solution may not satisfy all of the acquirer's needs (sometimes called "gaps") and it may also provide features/capabilities that are not required, not desired or even tolerable to the acquirer. The acquirer may need additional solutions, or modifications to the acquired solution, to fill these gaps. In addition, the acquirer may need to identify and deactivate or prevent the extraneous code from activating itself. 3. Sometimes the user interface to the solution is different from the way an acquirer is currently offering a user interface to their current users. This can sometimes/often be solved via product tailoring. 4. Typically, there will be a need to obtain support from the supplier for installation, activation and maintenance. 5. Problem reporting can be an issue, depending on the supplier's capability to accept and react to problem reports. In addition, the supplier may not even agree that because an acquirer alleges a problem exists that a legitimate problem actually does exist. 6. Product changes, both fixes and upgrades, are controlled mostly by the supplier and determined by marketplace needs. Such changes may not be consistent with the acquirer's ongoing needs or timeframe. 7. It is possible for the vendor to go out of business resulting in a possible loss of data.

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	Advantages	Disadvantages
Software as a service (SaaS)	1. Rapid access to products and services via Service Level Agreement (SLA) and ready-to-use solutions, more so than custom-developed or OTS. 2. No need to provide internal computing assets to support 'building or buying' the equivalent products or services, thus reducing costs and time in preparation for using solution, as compared to both custom-developed and OTS. 3. Typically is cheaper than custom-developed option and can be cheaper than the OTS option. 4. No need to take permanent ownership of the software solution, thus reducing impacts associated with such ownership (e.g., sustainment, hardware to host solution), as in the custom-developed and OTS options.	1. The terms of the generally non-negotiable license agreement constrain how the solution may be used by the acquirer, possibly to the acquirer's detriment. The solution typically includes features that attempt to enforce specific agreement terms, adding cost and complexity to the solution. 2. The solution may not satisfy all of the acquirer's needs (sometimes called gaps) and it may also provide features/capabilities that are not required, not desired or even tolerable to the acquirer. The acquirer may also need to identify and deactivate or prevent the extraneous code from activating itself. 3. Sometimes the user interface to the solution is different from the way an acquirer is currently offering a user interface to their current users. This can sometime/often be solved via product tailoring. 4. Typically, there will be a need to obtain support from the supplier for installation, activation, and maintenance. 5. Problem reporting and problem correction of a solution, if it does not work as desired. 6. Recovery from loss of access to or other failures of the solution may be dependent on the supplier's abilities and sometimes out of the control of the acquirer. 7. Product changes, both fixes and upgrades, are controlled mostly by the supplier and determined by marketplace needs. Such changes may not be consistent with the acquirer's ongoing needs or timeframe. 8. It is possible for the vendor to go out of business resulting in a possible loss of data.

5. Software acquisition process

5.1 Purpose

The purpose of the acquisition process is to obtain a product or service in accordance with the acquirer's requirements.

5.1.1 Outcomes

As a result of the successful implementation of the acquisition process:

a) A request for supply is prepared.

b) One or more suppliers are selected.

c) An agreement is established between the acquirer and supplier.

d) A product or service complying with the agreement is accepted.

e) Acquirer obligations defined in the agreement are satisfied.

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