

Fiscal Software Certification

An Italian Experience of Certification Against the Fiscal Legislation

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Keywords: Certification, Requirements, Legislation, Cash Register.

Abstract: This paper describes an experience of software certification in the specific fiscal software domain. The Italian Fiscal Software Certification scenario and the cash register, as specific kind of fiscal device running fiscal software, are outlined. Besides, some requirements, extracted from the current legislation, are shown. As the Italian legislation does not provide it, a Business Process Model (BPM) presenting the fiscal software certification process is illustrated. The BPM was built by means of a study of the current legislation and it constitutes the original contribution to the paper. Finally, the challenges of the further technological adjustments according to the Italian legislation are discussed.

1 INTRODUCTION

The certification of products, processes or services plays different roles according to the specific application domain. In the global market, the certification by independent and reliable bodies can be an economical and social benefit. Indeed, the assurance that a product, process or service is compliant with the requirements expressed by international standards or national legislation, can represent a real added value.

However, in specific domains the certification is mandatory before a product can be put into operation. E.g. in aviation, the new aircrafts must be certified before they are allowed to fly.

In the Italian fiscal domain, the certification of the fiscal software by a third party accredited body (an accredited University Lab or the National Research Council) is mandatory. Therefore, the fiscal software running into electronic devices suitable for storing, managing and tracing commercial transactions called *fiscal meters*, must be compliant with a set of requirements specified by the related national legislation (L. 18, 1983) and must be certified before being put on the market. To this aim, by further laws and decrees (D.M. 03/23, 1983 et seq.), the Italian national legislation established modalities and terms for the release of fiscal meters, regulating both the record of the commercial transactions and the certification

process. They shall follow to get the final approval by the Italian income revenue authority.

The software of a fiscal meter may implement also functionalities not directly related to the incomes record (the so-called fiscal functions), such software part is called "non-fiscal" software. The non-fiscal software usually carries out tasks related to goods management, accounting capabilities and so on. In this case it must not affect the correct fiscal behaviour of the remaining fiscal software and the non-fiscal software is not an object for the certification.

About the fiscal software, it is also opportune to specify that it runs on two types of fiscal meters: cash registers and automated ticketing systems. In this paper, only the first one will be considered.

Usually this certification process is carried out by accredited University Lab or the National Research Council, and it consists of inspection, evaluation and verification activities of both hardware and software components of the fiscal meter; it follows quite similar steps to be performed and differentiates mainly by the kind of the test cases applied. The final approval for the market release of a cash register is up to Italian income revenue authority, and it requires that both the certifications (the hardware one and the software one) end successfully. Nevertheless, for simplicity, this paper only addresses the steps required for the fiscal software certification.

The aims of this paper are the followings:

1) to present the Italian fiscal software certification scenario along with the involved actors and the set of requirements to be tested.

2) to describe a specific kind of fiscal device to be certified namely *cash register*.

3) to illustrate the fiscal software certification process by means of a Business Process Model (BPM, Brocke and Rosemann, 2014).

4) to highlight the challenges implied in the technological advancements according to the Italian evolution of the Italian legislation.

In the following, the fiscal software certification scenario will be described. In Sections 3 the cash register and its components will be presented. In Section 4 some cash register software requirements will be listed and in section 5 a Business Process Model for the fiscal software certification process will be illustrated. Finally, some questions on technological evolution of the cash registers will be discussed and the conclusions will be provided.

2 FISCAL SOFTWARE CERTIFICATION SCENARIO

In this section, some general concepts about certification are introduced.

Starting from the general concept of certification, one more specific kind of *software* certification is considered along with involved actors, requirements to be met and objects to be certified.

2.1 Certification Basic Concepts

A generally accepted definition of certification can be taken from ISO (ISO/IEC Guide 2, 1996): “*a procedure by which a third party gives written assurance that a product, process or service conforms to specified requirements*”.

Applied to the *software* area, the software certification is a procedure by which a third party gives written assurance that a *software* product, process or service conforms to specified *software* requirements.

The “assurance” can be given as a result of an activity, the “conformity assessment”, defined in the same Guide but refined by the standard (ISO/IEC DIS 17000, 2004) as “*an activity that provides demonstration that specified requirements relating to a product, process, system, person or body are fulfilled*”.

Nothing such as a “guarantee” is wanted. The “demonstration” should be perceived as

“confidence” instead of “proof”. The “confidence” is something one can try to achieve and in many cases can never be achieved.

In the software certification context, the purpose of this activity is to increment the confidence about the conformance of software products, processes or services towards some defined requirements.

Finally, the third-party certification should be meant as an independent assessment asserting that specified requirements pertaining to a product, person, process or management system have been met.

2.2 Actors, Requirements and Objects of the Fiscal Software Certification

The *actors* involved in the certification process can be divided in two groups, *who want to give confidence on the object of certification* (certification and accreditation bodies, suppliers, sellers, standard makers...) and *who want to get confidence on the object of certification* (customers, users, end users, government...).

Among the first group, the most important subjects are the *certification body* and the *accreditation body*.

A *certification body* is an organism with internal rules, human/infrastructure resources and specific skills apt to perform certification procedures. In some cases, the internal rules themselves might be required to be compliant to defined standards. In such a case, the certification bodies should be “accredited”, that is declared capable of performing certification activities, upon periodical surveillance, by special organisms called *accreditation bodies*.

The accreditation increases the value of the product, process or service to be certified. The accreditation bodies are specialized per product category, and, since even the accreditation bodies need the accreditation, they can accredit each other by executing periodical conformity assessments with a “peer reviews” mechanism.

The *certification body* referred here is the System and Software Evaluation Centre (SSEC) of the National Research Council, and the *accreditation body* is the Minister of Finances. The SSEC has been working for a couple of decades in the 3rd party software products and processes assessment, improvement and certification.

In the Italian fiscal software certification scenario, the certification process is approved by the Minister of Finances, and on its behalf the certification against the Italian fiscal legislation is provided. The Minister of Finances appoints the

certification bodies and performs a sort of control on their certification activities.

Generally speaking, the certification *requirements* are substantially standards or legislation. The standards should meet the criteria of suitability. Therefore, they should be easy to understand and to use, grounded on scientific bases, cost effective, able to capture user needs and to support evolving techniques. In the case of the fiscal software certification, the Italian Fiscal Legislation is the reference as requirements collection. The above cited suitability criteria are not always satisfied since in many cases the legislation (as it will be reported in the Sec.6) is obsolete and not completely able to support evolving techniques. This is a challenge that the legislation should handle as soon as possible.

About the *objects* of certification, they are usually *processes, products, services* or *organizations*, and the certification concerns properties or attributes of the objects. In the case here considered, the object to be certified is the fiscal software of a cash register.

The graphic representation of the Certification and Accreditation scenario for the cash registers is depicted in Fig. 1.

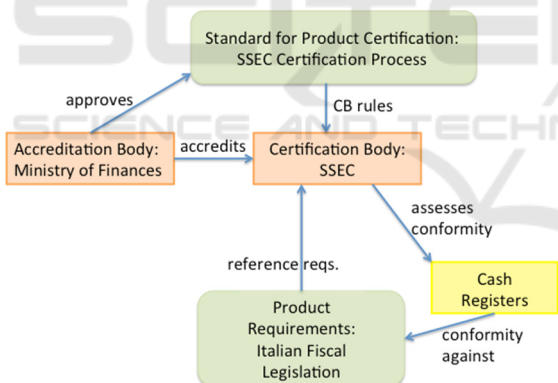


Figure 1: SSEC Certification and Accreditation Scenario.

3 CASH REGISTERS

First of all, it is opportune to define what a cash register is.

The current Italian legislation specifies what is a cash register, why it was introduced, which are its components, what kind of documents it must issue, and the specific normative requirements that each issued document should satisfy.

What it is: The cash register is a fiscal device designed to record and process numerical data

entered by the keyboard or other suitable functional unit of information acquisition, equipped with the device to print on special supports the same data, and their total (D.M. 03/23 all. A, 1983).

Why it was Introduced: in 1972 Italy has adjusted its tax policies to the other countries tax policies introducing the value added tax (V.A.T.) (D.P.R. 633, 1972). By V.A.T. introduction, a supplier of goods or services must charge to the customer the payment of a tribute, and in turn the supplier must pay that tribute to the Government. Subsequently to the V.A.T. introduction, the phenomenon of the tax evasion quickly increased. It was necessary to monitor the revenues of the commercial activities in order to check the regularity of their transactions in terms of data integrity and security. In this context, the fiscal receipt was considered the instrument to oppose the tax evasion since it allowed to keep trace of the payments and to monitor the revenues of the commercial activities. As result of this exigency, the law (L. 18, 1983) established the duty for the cash register of issuing a fiscal receipt, at the time of the payment, for the sale of goods, not being subject to the emission of an invoice and occurring in shops or open public places.

Consequently, the cash register must satisfy some requirements of security and, in particular, of integrity in order to prevent “unauthorized access to, or modification of, computer programs or data” (ISO/IEC 25010, 2011).

Its Components: The cash register is composed of indicating devices (typically *screens*), a printing device, a fiscal memory and the casing. Each component must satisfy specific normative requirements. In particular, the *indicating devices* must be two and must be placed on the two opposite sides of the cash register in order to allow to the purchaser an easy reading of the displayed amounts. The displayed characters must be at least seven millimetres high.

The *printing device* provides for the release of the fiscal receipt, daily fiscal closing report and of the electronic transactions register. Printed characters must be at least twenty-five millimetres high and must present appropriate requirements of clarity and easy readability.

The *fiscal memory* is an immovable affixed memory that contains fiscal data. It must record and store the fiscal logotype, the serial number, the progressive accumulation of the amount, etc. In order to guarantee the integrity of its data, the fiscal memory must allow, without the possibility of cancellation, only progressive increasing

accumulations and the preservation of their contents over time.

Finally, the *casing* must foresee a unique fiscal seal by means of a single screw that ensures the inaccessibility of all hardware components involved in the fiscal functionalities of the cash register, except for the paper management. Also, onto the casing, must be applied in a well visible place on the front toward the buyer, a slab with reported data as mark of the manufacturer, machine serial number, data of the model approval document and the service centre.

What Kind of Documents it Must Issue: The cash registers have to be able to print a fiscal receipt, a daily fiscal closing report, and an electronic transactions register. Each document must contain mandatory information specified for single indentation, for instance: company name, owner name and surname, V.A.T. percentage and company address, accounting data, date and time of the fiscal receipt issue, the fiscal logotype, the total amount of the payments of the day, the cumulative total of the amounts of the daily payments, etc.

The Italian legislation provides a detailed refinement of this generic descriptions providing hardware and software requirements that better characterize the structure and functionalities of a valid cash register (D.M. 03/23 all. A, 1983). In particular, the legislation requires two separate certification processes: one for the hardware components and one for the software layer. The two processes are quite similar in the steps to be performed and differentiate mainly by the kind of the test cases to be applied. Only for aims of clarifying, the hardware components testing requires, for instance, water tightness or battery capacity, and evaluations of HW reliability, measured by Mean Time Between Failure (MTBF).

For the software components, black-box tests are performed, according to the software requirements required by legislation and below reported.

The certification of a cash register needs that both the processes terminate with successful results. For aim of simplicity this paper only details the steps required for the fiscal software certification.

4 FISCAL REQUIREMENTS FOR CASH REGISTER SOFTWARE

The cash register industrial life-cycle includes different situations like regular functioning, exhausted fiscal memory, disconnected devices, etc.

From the ministerial decree (D.M. 03/23, 1983) on, the Italian legislation has disciplined these different situations imposing precise technological constraints with a subtle level of detail.

The complete list of requirements that the cash register must satisfy can be extracted from the legislation, even though it is sometimes obscure and misunderstood. Anyway the legislation remains the reference point for fiscal software developers and certifiers.

In the following some extracted requirements will be introduced. These are organized according to the specific situations of the cash registers life-cycle.

During the Regular Fiscal Functioning (that is with a fiscal memory that records and storages accounting data), a cash register must issue:

- a *fiscal receipt* with some of the following information specified for single indentation: company, company name, name and surname of owner, V.A.T. number and site of the company, accounting data, date, time of issuing of the fiscal receipt, fiscal logotype (compliant with the model that the legislation requires) etc.
- a *daily fiscal closing report* with some of the following information specified for single indentation: V.A.T. number and site of the company, eventual amounts of sales, number of issued fiscal receipts, number of issued non-fiscal receipts, date and time of issuing of the fiscal receipt, number of the fiscal resets, fiscal logotype (compliant with the model that the legislation requires).
- an *electronic transactions register* with some of the following information specified for single indentation: accounting data, date, time of issuing of the fiscal receipt, number of issued non-fiscal receipts, etc. The transactions *electronic* register was introduced by the (P.M. 31/05, 2002). Before this date, the transaction register was papery.

During the Data Input, it must not be possible:

- To change time in impossible formats (for instance: 26:44).
- To change date in impossible formats (for instance: 31/09/2012).
- To issue the fiscal receipt with a series of articles whose sum is greater than fixed max value per total of receipt (MAXSF).

Fiscal Memory Close to the Exhaustion (possible only from 2 to 5 closures to the exhaustion):

- In the daily fiscal closing report must appear the message “memory close to the point of exhaustion”.
- In the last daily fiscal closing report must appear the message “memory exhausted”.

With Exhausted Fiscal Memory:

- The command of issuing a fiscal receipt must not be executed.

After an Interruption of the Electricity:

- The fiscal receipt must be compliant to the legislation. Therefore, it must be report all information cited above.
- The last daily fiscal closing report must be compliant to the legislation. Therefore, it must report all information cited above.

If the Printing Device is Disconnected:

- Any issuing of fiscal documents by the cash register must be inhibited.
- Congruent warnings must be reported.

If the Indicating Device is Disconnected:

- Any issuing of fiscal documents by the cash register must be inhibited.
- Congruent warnings must be reported.

If the Fiscal Memory is Disconnected:

- Any issuing of fiscal documents by the cash register must be inhibited.
- Congruent warnings must be reported.

As mentioned above, these are only an extract of a broader collection of cash register software requirements that the legislation requests. They have been reported in order to underline the level of detail that the Italian legislation has identified in this matter.

The global collection constitutes a Requirements Repository that the SSEC keeps continuously updated and aligned to the continuous modifications in the legislation imposed by the designate authorities.

To each requirement collected in the requirements repository a set of specific test cases and responses is associated and executed during the test phase.

5 A BUSINESS PROCESS MODEL FOR THE CASH REGISTERS CERTIFICATION

In this section, a Business Process Model of the fiscal software certification process is presented.

For clarity purposes, it is important to specify that the BPM is not provided by the Italian

legislation but it is an original contribution of this paper and is based on the analysis of the legislation itself.

The certification process of the fiscal software involves three important stakeholders: the *enterprise*, the *certification centre*, the *income revenue authority*.

- The enterprise develops the target cash register software and applies for its validation to both the certification centre and the validation authority. The developed software has to be already in-house tested.
- The certification centre performs the legislation compliance check by means of ad-hoc generated software testing suites. The results of the testing phase are summarized in a testing report.
- The income revenue authority executes additional test cases mainly targeting special cases and exceptions and provides the final approval.

In the following, the Business Process Model of the cash registers certification is illustrated (Fig. 2) and the tasks executed by the different stakeholders during the certification process are shown.

5.1 The Business Process Model

As shown in Fig. 2, the process starts with the Cash Register Software Development task in which the target enterprise develops and provides to the certification centre the fiscal software to be certified.

In particular, during this phase the enterprise provides to the certification centre the following materials:

- 1) the software documentation:
 - the architectural model that contains the description of the hardware and software components of the cash register
 - the functional model that contains the specification of functionalities implemented in the source code
 - the end user manual with the description of the interface and the functionalities available to the final user
 - the maintenance procedures necessary during the cycle life of cash register;
- 2) the source code of the cash register completed with the libraries that could be used during the on-line testing activity;
- 3) any additional information that can be requested as completion of the mandatory documentation.

These data are used by the certification centre to refine the collection of test cases and the

corresponding correct results to be executed in order to verify the compliance against the current legislation. Indeed, on the bases of the architectural and functional models, subsets of software requirements are identified and, for each of them, specific test objectives are selected.

In particular, the SSEC considers five different test objectives corresponding to different cash register behaviours: *initialization*, i.e. the fiscal memory of the cash register is not recording data (fiscal memory is not yet active); *fiscal functioning*, i.e. the fiscal memory is activated; *abnormal conditions*, i.e. possible anomalous behaviour due to misinterpretation or incorrect time and data input; *boundary condition*, i.e. boundary values for the fiscal memory use are considered, for example close to the exhaustion or exhausted; *malfunctioning*, i.e. accidental and malicious situations are considered.

According to the selected test objectives, a customized test plan is built and therefore it can be executed.

During this phase, the test environment is set up and it will be reported in the final product of the certification process, that is a compliance certificate.

By the test plan execution, the selected test cases are executed and the test results are collected and compared with the correct results associated to each of the executed test cases. If the expected result is the same of that obtained by the cash register, then the test case is considered as *pass*, otherwise the test case is classified as *fail*. The set of verdicts (pass or fail) is organized in a *Test Report*.

In cases of non-compliance of some of the cash register features or behaviours, the certification centre notifies to the enterprise the discovered issues. For these errors of non-compliance a modification of the source code is requested to the cash register developers and an optional phase of regression testing (Pezze` and Young, 2008) is considered.

In case of total compliance to the Italian legislation, a *Compliance Certificate* is issued and sent to the income revenue authority for further investigations.

The *Compliance Certificate* is the final product of the certification process. It is the collection of the provided documentation, test report and eventual remarks and comments of the certification centre. This certificate can be only successful.

In case of a failed testing session, a report of detected issues is drawn up in order to lead the enterprise during its software improvement. After this, the stakeholder may apply again to a new testing session.

In the second phase of this process, the income revenue authority analyses the Compliance Certificate provided from the certification centre, and decides if additional test cases could be necessary or not. Finally, it releases the official approval for the cash register certification and its relative commercialization.

6 DISCUSSION

The paper reports an Italian experience of fiscal software certification inferring from the background knowledge collected over several decades of activity. In this long experience many exceptions with respect the normal process execution have been experienced. They highlighted some important challenges that deserve to be reported.

The first challenge concerns the legislation. Although it plays a central role in the certification process, often it is still too generic to cover all the possible exceptions and issues. Such a vagueness and incompleteness of the requirements determines misunderstandings, and may cause troubles in software development and errors in the final product.

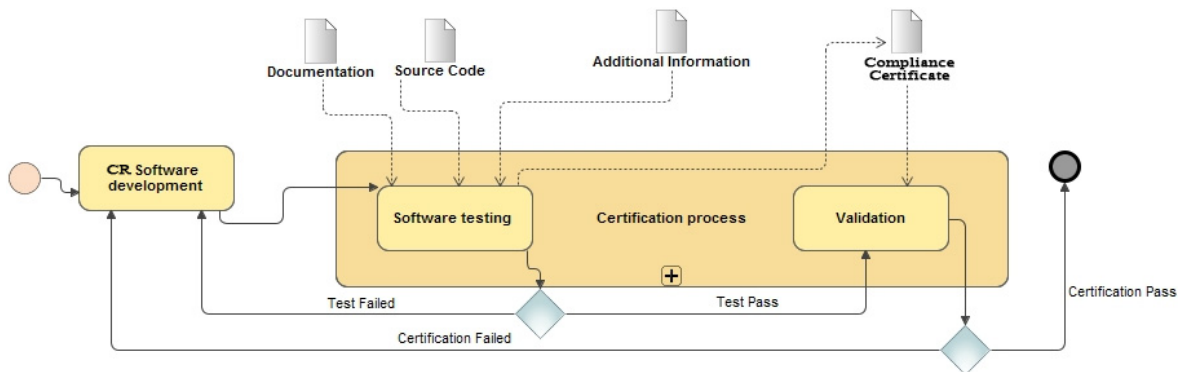


Figure 2: Cash Registers Certification Business Process Model.

In order to reduce this risk, the SSEC tries to keep updated and aligned with the norms a proprietary Requirements Repository, that is the collection of cash register normative requirements, both from the hardware and software point of view, so to keep track of any possible non-compliance against the legislation. Besides, the SSEC collects and updates a set of *practices* provided by the designate authorities to avoid additional errors.

The second challenge concerns the documentation provided by the producers. Many times it is not thus complete and accurate so to allow that specific subsets of software requirements are identified and, for each of them, specific test objectives are selected. In these cases, the SSEC is forced to ask for important integrations to well know the software to be certified and build up a customized test plan to be executed.

The third challenge concerns the error handling discovered during the test plan execution. Although there are the above cited interventions to limit eventual misunderstandings, possible problems may arise during the testing session. In case of non-compliances, the correction of the source code is required to the cash register developers. This intervention has a rather high cost, in terms of time and effort, spent by both the certification body and the producer. stakeholders. In more severe cases, it could be necessary the execution of an additional phase of regression testing in order to verify that the source code corrections do not invalidate the already tested functionalities. For these problems, the SSEC has adopted the *compartmentation of the source*, i.e. wherever possible, by the analysis of the available documentations as well as code inspection, source code is sliced into separate components so that only the test cases related to a specific part are selected and re-executed. However, this approach for test case selection and prioritization cannot be easily adopted because most of times the source code is implemented as firmware or middleware. Therefore, strengthening the actions in the previous directions (updating of the legislation and integration of the missing documentation) can further limit new problems during the testing session.

Beyond these issues on the current fiscal software certification process, it is important to report that the Italian legislators are trying to strengthen the transactions traceability as strategy to improve the effectiveness of the fight against tax evasion. From this point of view, the abolition of the fiscal receipt and the adoption of tools for the electronic invoice and the telematic transmission of the incomes are considered an effective solution.

These changes require technological advancement and normative adjustments for the stakeholders involved in the certification process. The developers must adapt the fiscal software of their cash registers to the new normative issues, and the certification bodies must reorganize their certification process for the legislation compliance check. These new challenges advise that the fiscal receipt is more and more becoming the symbol of a historic moment destined already to the quick end (Prokin and Prokin, 2013).

7 CONCLUSION

In the paper the Italian fiscal software certification scenario has been illustrated. After having considered the main concepts of the software certification, its actors and its requirements, the cash register, as object to be certified, has been introduced and some its software requirements have been presented. Subsequently, a Business Process Model for the cash registers certification has been shown, and a discussion about the most current challenges on this specific kind of software certification closes the paper.

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