

Certification and Legislation

An Italian Experience of Fiscal Software Certification

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Keywords: Certification, Legislation, Fiscal Meters, Cash Register.

Abstract: The paper introduces the Italian Fiscal Software Certification scenario. Some concepts about certification are illustrated. The cash registers, as specific kind of Fiscal Meter, are described and their adopted certification process based on Italian legislation requirements is presented as well. Finally, the new related technological challenges are discussed.

1 INTRODUCTION

In an increasingly competitive global market, the achievement of a certification by independent and reliable bodies could be an instrument of great economical and social benefit. The written assurance that a product, process or service is compliant with the requirements expressed by international standards or national legislation, can represent an added value expendable in the economical agreements as well as an improvement of the product, process or service quality. In some commercial environments the certification is mandatory before the product is marketed. This is the case of the fiscal meters, i.e electronic devices for storing, managing and tracing commercial transactions. Usually the available fiscal meters can be classified into two different entities: cash registers and automated ticketing systems. In this paper, only the former will be considered.

Currently many European countries are introducing specific legislations to rule the commercial transactions. Italy has been one of the first adopting a specific set of laws that regulates the fiscal transactions by means of the use of fiscal meters (L. 18, 1983), becoming a reference for the rest of the European countries. Usually the cash registers certification process involves Universities and research institutions in activities of inspection, evaluation and control of the hardware and software components in order to verify the compliance against legislation requirements. In Italy the System and Software Evaluation Centre (SSEC) of the National Research Council has been working for a

couple of decades in the 3rd party software products and processes assessment/improvement and certification. Regarding to the cash registers, the certification against the Italian fiscal legislation is provided on behalf of the Italian Finances Department.

In this context, the purposes of this paper are outlined as follows: 1) Providing an overview of the Italian experience of the fiscal software certification; 2) Describing the certification process by its activities 3) Highlighting the challenges implied by the technological evolution; 4) Presenting an early work in progress on the storage of the quantitative data about the certifications already performed.

In the following, an overview of the certification and background main concepts are provided. In Sections 3 the SSEC experience in the certification process is presented and in Section 4 some questions on technological evolution against legislation are discussed and conclusions are provided.

2 FISCAL SOFTWARE CERTIFICATION

In this section, some general concepts about certification are introduced by pointing out the key roles and the activities involved in any certification process. Subsequently, the particular case of cash register certification is shown.

2.1 Certification Scenario

About certification, the most relevant topics are

related to the terms, the involved actors, the objects to be certified and the requirements against which the objects should be certified.

2.1.1 Basic Concepts

According to the related ISO (ISO/IEC Guide 2, 1996), the certification is: “*a procedure by which a third party gives written assurance that a product, process or service conforms to specified requirements*”. Such “assurance” can be given as a result of an activity, namely “conformity assessment”, defined in the same Guide but perfected by the standard (ISO/IEC DIS 17000, 2004) as follows: “*an activity that provides demonstration that specified requirements relating to a product, process, system, person or body are fulfilled*”.

Notice that nothing such as a guarantee is desired. Usually the intended demonstration represents the “confidence” (not the “proof”) that the requirements have been fulfilled: certification cannot give a guarantee, but can only increment the confidence on the certification target objects.

2.1.2 Actors, Requirements and Objects of the Certification

The most important involved actors are the certification body and the accreditation body.

A *certification body* is an organism with internal rules, human/infrastructure resource and skill to perform certification procedures. To make the results of certification comparable and then get broad consensus about, the internal rules themselves might be required to be conformant to defined standards. In such a case, certification bodies can be “accredited” that is, declared capable of performing certification, upon periodical surveillance, by special organisms called *accreditation bodies*. This is compatible with the above definition of *conformity assessment*.

Strictly speaking, a certification body does not need to be accredited, but the accreditation is important to increase the value of the certification, and then the value of the certified object. Currently the accreditation bodies are not so many (average is one-two per country, against tens or hundreds of certification bodies, generally specialized per product category), so they can accredit each other by executing periodical conformity assessments as “peer reviews” upon their activities.

Other actors involved in certification are those *who want to give confidence on the object of certification*

(over certification and accreditation bodies also suppliers, sellers, standard makers...) and *who want to get confidence on the object of certification* (customers, users, end users, government...). Therefore entities and relationships among different actors can vary depending on wanted consensus about their acts and on other opportunities.

Requirements, as mentioned in the definitions given for certification, may be expressed in terms of standards or legislation. Again, this is aimed at increasing confidence on certification, since standards are designed to be commonly accepted reference models, allowing certification bodies to express comparable and repeatable results. This in turn facilitates, at least in principle, circulation of goods, and fosters commercial co-operations with mutual acceptance of the results of certification in the international trading framework.

The objects of certification are usually *processes, products, people or organizations*. To be more precise, as a measure is a statement of an *attribute* of an object, certification often refers to properties or attributes of objects: so, there is certification of attributes (e.g. electrical properties) of a product, of attributes (e.g. capability) of a process, of skill of professionals, of quality systems of organizations.

In order to assess conformity in a repeatable and documented way, a certification body must follow a defined process, and it is important that all the certification bodies follow the same rules for the same object types. Again, widely recognized standards for the assessing process would give such a confidence.

With respect to the general certification scenario discussed above, the activities performed at the SSEC has got some peculiarities:

- The role of *Accreditation Body* in the case of the Fiscal Meters certification is played by the Ministry of Finances. It appoints the certification bodies and performs a sort of control on their certification activities. No standards for the accreditation are used. In addition the Ministry of Finances doesn't ask nor provide any mutual accreditation/recognition with respect other peer accreditation bodies.
- A certification centre, here identified by the SSEC, plays the role of Certification Body. The SSEC certification process is approved by the Accreditation Body (Ministry of Finances) and the Italian Fiscal Legislation plays the role of Standard for Product Requirements. The resulting Certification and Accreditation scenario for the Fiscal Meters Certification is represented in Fig. 1.

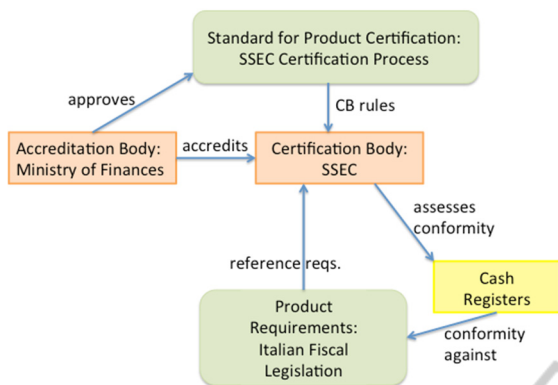


Figure 1: SSEC Certification and Accreditation scenario.

2.2 Cash Register Certification

In order to simplify the tax relations between European Community member countries, 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, 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. The phenomenon of the tax evasion quickly increased, and the fiscal receipt was considered the instrument to oppose the tax evasion. Therefore 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 subject to the emission of an invoice and occurring in shops or open public places.

The cash register must be compliant with the model and the characteristics defined by the Ministry of Finances (D.M. 03/23, 1983) and its certification is mandatory before the cash register is marketed. To this aim, by further laws and decrees (D.M. 19/06, 1984), (D.M. 14/01, 1985), (D.L. 326, 1987), (D.M. 4/04, 1990), (D.M. 30/03, 1992), (D.M. 04/03, 2002), (P.M. 31/05, 2002), (P.M. 28/07, 2003), (P.M. 16/05, 2005) the Ministry of Finances established modalities and terms for the release of cash registers. According to the current Italian legislation the cash register definition includes:

What It Is: The cash registers are devices 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: As reported above, the cash registers were introduced for the release of the fiscal receipt that was considered the instrument for checking the regularity of the economic transactions. By the fiscal receipt it is possible to keep trace of the payments and therefore to monitor the revenues of the commercial activities. 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 the displayed characters must be at least seven millimeters high. The devices 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 *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 millimeters high.

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 center.

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 indention, for instance: company name, owner name and surname, V.A.T. percentage and company address, accounting data, etc. The Italian legislation details these generic descriptions providing

hardware and software requirements that better characterize 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 on the kind of test cases to be applied. For instance for the hardware components tests for water tightness or battery capacity as well as HW reliability are required, while for the software components black-box tests defined on the basis of legislation requirements are executed.

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.

2.3 Cash Register Software Requirements

From the ministerial decree (D.M. 03/23, 1983) on, the Italian legislation disciplined different moments of the cash register industrial life-cycle and imposed precise technological constraints. In order to highlights the level of detail adopted for the requirements specification in the Italian legislation in this section some examples are provided. The complete requirements list can be extracted from the legislation.

During the Data Input, it must Not be Possible:

- 1) To change time in wrong formats (e.g. 26:44).
- 2) To change date in wrong formats (e.g. 31/09/2012).

With exhausted Fiscal Memory:

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

If the Printing Device is disconnected:

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

3 SSEC EXPERIENCE

The SSEC of the National Research Council performs third-party evaluations and certifications of software processes and products, according to national legislation and international Standards to meet the needs of users, suppliers and public administration.

In detail, for the cash registers, the SSEC activities are: software and hardware certification according to

Italian fiscal legislation on behalf of the Italian Ministry of Finances, and systems evaluation (Reliability prediction, Safety, MTBF of context-dependent systems, Compliance against standards).

In particular the certification process adopted inside the SSEC is divided into two separate phases (Pezzè and Young, 2008): the *off-line testing activity* preparation and the *on-line testing* session.

In the context of the fiscal software certification, the SSEC has also set an activity of building up a database of data collected by the certifications already performed in order to set up and conduct empirical research studies. These data could be of interest for other certification bodies or involved actors. Collected data are focused on software characteristics like *maintainability* and *reliability* of the fiscal software or *security* of the fiscal data, etc. The collected data are, for instance, Mean Time Between Failure (MTBF) or fault patterns and redundancy as reliability measures, or also number of provided authentication methods and number of data corruption instances actually occurring as security measures.

The data collection is an important and continuous work in progress of the SSEC due to the numerous normative updates and technological innovations that have deeply modified the product to be certified over the years. Continuous changes in the database inputs raise problems of data uniformity and make difficult having long terms statistical analysis. Nevertheless the database promotes an approach of improvement and building up of best practices for the fiscal software certification.

3.1 Off-line Testing Activity

During the off-line testing activity the collection of the different information relative to the development process of the cash register is performed. In particular five kind of sources are considered:

1) Documentation, that is the collection of documents provided by the cash register developers. It mainly consists in: an *architectural model*, i.e. the description of the hardware and software components of the cash register; a *functional model*, i.e. the specification of functionalities implemented in the source code; an *end user manuals*: the description of the interface and the functionalities available to the final user. The documentation includes the maintenance procedures necessary during the cycle life of cash register;

2) Additional Information, or extra data that can be requested as completion of the mandatory documentation.

3) Source Code, i.e. the source code of the cash register completed with the libraries that could be used during the on-line testing activity.

4) Requirements Repository, i.e. the collection of cash register requirements, both from the hardware and software point of view, as required by the Italian legislation.

5) Test Case Database, that is the collection of test cases and corresponding correct results useful for the evaluating of the cash register during the on-line testing session. In particular a set of specific test cases and responses is associated to each of the requirements collected in the requirements lists.

3.2 On-line Testing Activity

During the on-line testing activity the documentation collected in the off-line activity is exploited for the conformity assessment of the cash register. In particular inside the SSEC group the activities can be divided into the following steps (Pezzè and Young, 2008):

1. Documentation Analysis: the information contained into the “Documentations and Additional Information” folders are analyzed in order to identify characteristics and functionalities implemented into the cash register under certification.

2. Requirements Selection: on the bases of the architectural and functional models, the subsets of hardware and software requirements are identified from the complete list of requirements available into the “Requirements Repository”.

3. Test Objective Selection: For each of the selected requirement subsets, the test objectives are identified. In particular the SSEC considers five different testing conditions corresponding to different cash register behaviors: *Initialization*, i.e. the fiscal memory of the cash register is not recording data (fiscal memory not yet active); *Fiscal Functioning*, i.e. the fiscal memory is activated; *Abnormal Conditions*, i.e. possible anomalous behavior 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.

4. Test Plan Definition: According to the detected test objectives for any requirement subsets, one or more test cases are selected among those available into the Test Cases Database. In case of the test cases are missing the proper ones are ad-hoc generated and the Test Case Database enriched accordingly. In this way a customized test plan is

obtained.

5. Test Plan Execution: The required test environment is set up and the selected test cases are executed. During this phase the test results are collected and compared with the correct results associated to each of the executed test case. 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*. At the end of the testing session, the set of verdicts (pass or fail) are collected into a *Test Report*. In case of error discovered during the test execution a modification of the source code is requested to the cash register developers and an optional phase of regression (Pezze and Young, 2008) testing is considered.

6. Certification Results: The final product of the certification process is the *Compliance Certificate*, that is the collection of the provided documentation, by the test report and by the certification center possible remarks and comments. It is to be noticed that the certificate can be only successful. In case the testing step has failed, a report of any spotted issues is drawn up both to lead the stakeholder during its software improvement and to update the certification centre activity historical recording. After the stakeholder may apply again to a new testing session.

4 DISCUSSION AND CONCLUSIONS

In the previous sections the overall certification process adopted inside the SSEC has been presented and the off-line and on-line testing activities, performed during the process, have been detailed.

However, due to the peculiarities of each cash register, to the company that develops it and to the Italian legislation, many exceptions to the presented process have been encountered over the years. In the following a not exhaustive list of the main challenges derived by the everyday experience is discussed. The first one is represented by the Italian legislation. It tends to be too verbose and too generic to cover all the possible exceptions and issues. This can cause misunderstanding and errors during the assessment of the requirements satisfaction. The automation of the conformance assessment process would be a desirable goal, but a too generic and continuously modified legislation is a strong limit to this automation, and the human intervention is thus always necessary. Besides, the SSEC keeps continuously updated and aligned the Requirements

Repository to the continuous modifications in the legislation imposed by the designate authorities. However these modifications heavily influence also the historical data collection, its uniformity and analysis. An additional challenge of the SSEC activity is therefore to adopt specific procedures to manage, verify and update the normative corpus so promptly react and integrate the legislation modifications, the official clarifications or interpretations provided by the designate authorities. During the on-line testing activity one of the main problem encountered by the SSEC has been the management of the documentations provided by the stakeholders that in many cases did not reach the sufficient level of detail. Indeed, due to time-to-market constraints, either the architectural model or the functional model could not be fully complete and documentation integration could be necessary. An additional critical issue of the on-line testing activity is the management of the errors discovered during the test plan execution. Indeed, in case of faults or non-compliances, corrections of the source code are necessary. This increases the prize, in terms of time and effort, of the certification and development activities. In particular, an important delay in the test certification release could be caused by the necessity to the execution of an additional phase of regression testing. This is important to verify that the source code corrections do not invalidate the already tested functionalities. To speed up this part of the process, the solution adopted inside the SSEC is the *compartmentation of the source code*, i.e. wherever possible, by the analysis of the documentation available, the source code is sliced into separate components so that only the test cases related to a specific part are selected and re-executed.

In order to identify the best strategy to improve the effectiveness of the fight against tax evasion, currently the Italian legislators are trying to strengthen the transactions traceability. To this aim, the abolition of the fiscal receipt is being considered as well as the adoption of tools for the electronic invoice and the telematic transmission of the payments. By means of these actions, an important process of cultural change is becoming established in the country. This apparent simplification of the transactions traceability imposes new challenges of technological advancement and adjustments in respect of the legislation for the cash register developers, suppliers and vendors. A reorganization of the certification process in the legislation compliance check is needed as well. These challenges advise that the fiscal receipt is more and

more becoming the symbol of a historic moment destined already to a quick end (Prokin and Prokin, 2013).

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