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Marie-Christine Monget, Tomi Kelo, Jukka Koskinen

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Work towards automated vendor-neutral certification of ICT skills

Abstract

This paper describes a European project entitled *International Certificates of Excellence in Selected Areas of ICT* (InCert). The project aims to develop and test a set of international certificates focused on the hot subjects of ICT (e.g. WLANs, IEEE802.11, HIPERLAN/2, Bluetooth; mobile phone systems 3G and 4G; Internet protocols TCP-IP, VoIP and others; www technologies; signal processing in telecommunication transmitters and receivers, as well as information and network security) and connects them with labour market needs and expectations. The main features of the certificates are: vendor-neutral character and adaptation to specific needs and possibilities of regional labour markets.

This paper describes the state of the project after one year of work. The certification methodology of the InCert certification is introduced. An example of implementation in an eLearning platform is given. Securing the on-line certification software is briefly discussed. In conclusion some of the remaining tasks for the second year are described.

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Objectives of the project

There are few factors more influential and more helpful than certification as far as the opportunities of finding a job, changing a job, or moving up a career ladder are concerned. The ongoing effort of obtaining certificates pays off, because it helps to establish a person professionally as having up-to-date knowledge and skills in such difficult technical area as the communication technologies which shape the modern world. We think that the role of certification should become much greater in the European Union. The key characteristics of the InCert certification are vendor-neutrality and good matching with the regional market needs. These characteristics distinguish InCert certifications from other ICT-related certificates, and make it particularly valuable for the SMEs.

The development of an ICT certification system in the InCert project means different steps:

- defining certificate requirements (range of knowledge, skills, etc),
- describing competencies for a certificate possessor,
- developing testing procedures for ICT certification (software package for on-line testing; building the test structure, i.e. test questions, problems, answers; test administration ...),
- testing the certification procedures.

In this paper we mainly focus on the certification methodology and on a way of implementing the certificates in an on-line platform.

Partners and projects

In the InCert project [InCert], there are altogether 9 partner institutions. Majority of them are universities and research institutes. Also training and other organisations involved in the ICT sector are working for the project. Partner institutions are in charge of developing 10 on-line certificates (see annex 1).

The project has close relationship with another project entitled *Vocational Training for Certification in ICT* (Train2Cert). The projects are however realised independently due to their different theme: InCert [InCert] focuses on creating the certifications, Train2Cert [Train2Cert] focuses on certificate-oriented training.

Methodology

In this section, the methodology of InCert certifications is presented. A whole view of the procedures and methodologies involved in the InCert certificate exams is given in the diagram 1. The top part gives a colour code that distinguishes three kinds of actors, activities and data. In this document only the “green” issues are introduced. For more detailed information, please see [InCert]. In this section, the authors of InCert certificate exams are called just Authors.

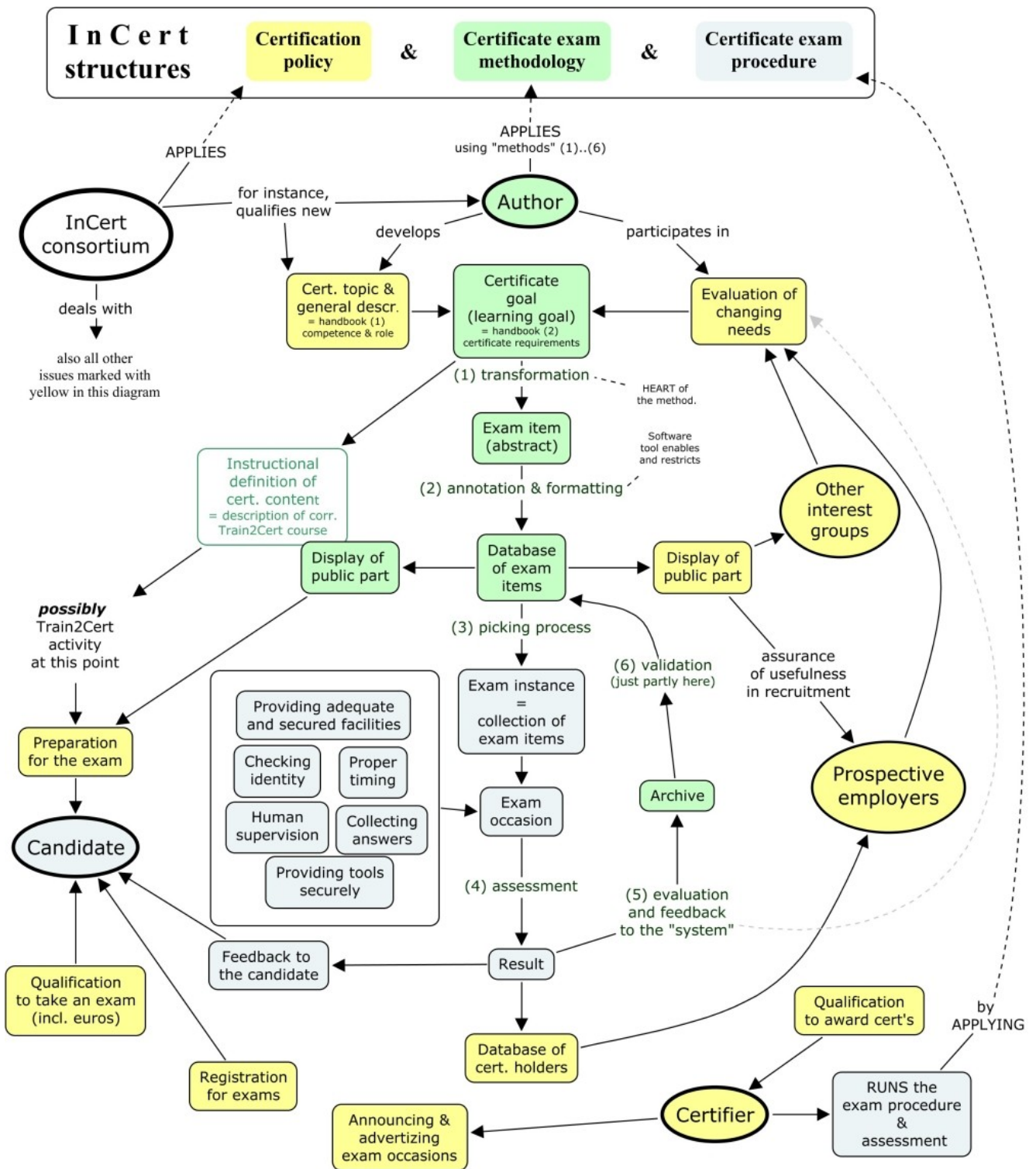


Diagram 1. Procedures and methodologies involved in the InCert certificate exams.

As it is shown in the diagram, Author has some responsibility to interact with those parties that could employ certificate holders or otherwise represent industries where the certified knowledge and skills are required. This interaction was needed for motivating and defining the certificate in the first place and later on to keep it up-to-date. In the InCert project we assumed, however, that the certificate goal had been defined already.

One of the first tasks for Author was to extract and edit from the goal a description that helps the candidates to appreciate the learning goal they face if they want to pass the certificate exam. This description will be accompanied by a representative set of exam items that the candidates can view using a module of the exam software. Further preparation of the candidate falls within the scope of the Train2Cert project [Train2Cert], the sister project of InCert.

The exam software is just briefly mentioned in the diagram, but it will be an essential tool for Authors. Actually for the computerized part of the exam the software will define the limits of what can be achieved with the exam, and it will guide the author to input all necessary attributes for each item. It will also accept the general parameters for a certificate exam, like number of items and timing.

The main task of Author is to *transform* the certificate, or learning, goals to exam items. For this purpose *experience* is an essential tool, and a good start towards it can be obtained by familiarizing with the philosophy, or at least pedagogy, of multiple choice questions, the MCQ's. In the InCert project, a recommendation for this transformation has been created. The recommendation uses *best practices approach* and is supported by qualified references. The recommendation also defines annotation and formatting of exam items, rules for the picking process & production of the exam instance, assessment of InCert certification exams, evaluation and adjustments guidelines, and naturally practices for validation.

Example of implementation in the Moodle platform

In the InCert project one of the possibilities was to use an existing on-line platform to set up the certificates. For the project the Moodle [Moodle] platform was chosen, partly due to its open source background. In this section, we will first describe how to design a certificate in the Moodle platform and then show a method to import/export metadata related to certificate exam items, MCQs in practice, from/to other platforms.

In order to build a certificate, an author must list the related knowledge and know which competencies are targeted for the candidate. After that, the author can build a cross-table of knowledge/competence to be shown to the candidate before enrolment to the exam test. As it is normally advised, we use the way of showing the contents as chapters composed of sections and built a set of MCQs for each section.

Preview Validation Chapter 2

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1

Which are the differences between ethernet and token ring ?

Marks: 1

Choose at least one answer.

- a. Collisions are possible in both.
- b. Only ethernet permits random access.
- c. Only token ring is deterministic.
- d. Token ring uses an active monitor.

2

Destination address starts the ethernet frame header in order to

Marks: 1

Choose at least one answer.

- a. allow ethernet boards to filter frames easily.
- b. help understand frames.
- c. manage multicast frames.
- d. calculate more easily CRC.

Diagram 2. Example of questions for a section implemented in the Moodle platform.

For an author, one way of importing MCQs to a database is to write the questions and answers to a special form existing in the Moodle platform. We wanted however to enhance the import process by enabling the import of already existing data. To accomplish this goal, we decided to build an XML file specially structured to fit MCQs for our chapters and sections as a structured course in the Moodle platform. Part of a sample XML file is presented in a diagram 3. A teacher (author) can use this alternative procedure to fill the data base more efficiently. After building and filling the XML file, the file can be imported into the Moodle platform.

```

<?xml version="1.0" encoding="utf-8" ?>
<!DOCTYPE quiz SYSTEM "xmlmoodle.dtd">
<quiz>
<!-- CATEGORY -->
<question type="category">
  <category>2_1_internal_network_organization</category>
</question>
-----
<question type="multichoice">
<name>
  <text>switch_router_server 6</text>
</name>
<questiontext format="html">
  <text>How to minimize the number of gone through equipments?</text>
</questiontext>
<image />
<generalfeedback>
  <text>see chapter 2 for more information</text>
</generalfeedback>
<defaultgrade>1</defaultgrade>
<penalty>0</penalty>
<hidden>0</hidden>
<shuffleanswers>0</shuffleanswers>
...
<answer fraction="33">
  <!-- 0 or 100 as the answer is good or not -->
  <text>Token ring uses an active monitor.</text>
  <feedback>
    <text>good answer, but there is another one.</text>
  </feedback>
</answer>
<answer fraction="33">
  <text>Token ring uses an active monitor.</text>
  <feedback>
    <text>good answer, but there is another one.</text>
  </feedback>
</answer>
<answer fraction="34">
  <text>Only token ring is deterministic.</text>
  <feedback>
    <text>good answer, but there is another one.</text>
  </feedback>
</answer>
<answer fraction="0">
  <text>Collisions are possible in both.</text>
  <feedback>
    <text>Of course not!</text>
  </feedback>
</answer></question></quiz>

```

Diagram 3. Part of an XML file to illustrate the selected format.

About security of the exams contents

The development of the software package will consist of several tools: a MCQ data base, a client program (editor) for easy input/collecting of the content of the data base, an Internet application to deliver the exams and collect the results according to rules defined in the methodology, and an administrative tool to manage the certificate exams.

Due to using an existing platform, some functions were already implemented. The data base, one of the most critical part of the certification system, requires however extra attention. An independent security layer has to be designed and implemented to protect the confidentiality and integrity of the database.

Future work for the project

For the second year of the InCert project, we have to implement the whole exam system on-line. Due to platform selection, we have to secure the database and develop an administrative layer in order to manage the candidates and the exam tests.

All authors have to generate exam items of corresponding certificates and to offer them for a cross-evaluation between partners. Authors also have to test the items with their students and provide some evaluation.

The development of the ICT certification system in the InCert project will lead us to establish an international (European) organisation, the InCert consortium, which consist of the project partners and organisations from outside the project. The role of the consortium is to promote the proposed certificates, watch over their quality, as well as to manage the certification procedures worked out in the project after its completion.

References

[InCert] <http://incert.eu/>

[Train2Cert] <http://train2cert.eu/>

[Moodle] <http://moodle.org/>

Annex 1. Partners and certificate topics

Partner	Certificate topics
Poznan University of Technology, Poland	1. Wireless LAN802.11a/b/g/e 2. Teletraffic engineering 3. Signalling system No 7 4. Digital television – DVB system
École Nationale Supérieure des Télécommunications de Bretagne, France	5. IPv6 (Next generation Internet Protocol)
Tampere University of Technology, Finland	6. Network security
Polytechnic of Milan, Italy	7. Optical networks
Institut National des Télécommunications, France	8. Internet/Intranet technology
Society for Lifelong Learning, Slovakia	9. NGN Protocol Platforms 10. Information security

Other organisations working in the project: PCKU, Poland; Noema-CMI, Finland; PT Inovação, Portugal.