

# LINUX CERTIFICATION CENTRE - WORKING LEVEL CERTIFICATE ASL

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## Abstract

The article shows the next stage of implementation of the international certification authority for system administrators and Linux network, which includes the elaboration of an appropriate level of certification. This involves the development of the system prior to the exams, creating a path of training and verification of the current way of teaching, allowing correction of the requirements which are subject to students.

The following article is based on experience gained while creating the courses and exams for tested by the author Academy of Linux Administration

**Key words:** certificate, exam, ASL certificate, Linux certifications

## 1 Introduction

Linux International Certification Centre is an institution, whose task is to gain the reputation of the certificates gained. It is possible in the long period of time, by the successive acquisition of the prestige of the certificates.

IT market research indicates that getting the title of the engineer is not always a sufficient argument to find a good job. Knowledge supported by the recognized certifications confirms gaining practical skills and for the employer is a factor increasing the attractiveness of a potential employee [1].

The most important element of each certificate is carrying out the verification process.

There are several ways to verify the knowledge and skills that make up the certificate:

- theoretical: the form of a theory exam,
- practical: a form of practical exam.

In addition the following, are often used:

- theoretical exam with elements of the practical test,
- two exams: a practical and theoretical verification of the student's overall knowledge [9].

An important aspect of the certificate preparation is to develop the range of materials, basing on that the verification system of the student knowledge will be created, due to that, the certificate will be associated with the acquisition of the appropriate skills by that person.

Currently existing solutions of Linux certification are based on a number of aspects that were largely reversed during the preparation of the range of materials for the created certificate International Certification Centre, and these are:

- separation from the scope of knowledge of specific solutions promoted in a given distribution,
- separation from the original environment of the system, so that acquired knowledge will not be determined by solutions prepared within the distribution,
- enabling to learn about Linux from the primary mechanisms for implementation of tasks, without introducing any initially prepared solutions [2].

The above approach for a range of material carried through by the verification process, carried out by using the created certificate has both its pros and cons.

The advantages are:

- learning the manner of operation of the system and not relying on the proven and prepared procedures,
- getting familiar with the basic mechanisms of Linux,
- promoting an approach of "how it works", then "how to run", instead of only "how to run" approach.

The disadvantages of this approach are:

- imposing a wider range of material, which can result in an increased amount of knowledge that the tested person must assimilate,
- rejection of the discussion within the scope of materials procedures or mechanisms prepared by the individual distributions, which may result in additional cost of the need to increase the level of knowledge by the person verified.

It is therefore worth noticing that promoted by the International Certification Centre Linux solutions, in some cases, complement or completely replace solutions currently existing on the market.

In the existing solutions of the certificates implemented by producers of distribution such as RedHat or Novell, the scope of knowledge to a great extent depends on the mechanisms offered by the distribution (RedHat Linux and SuSe Linux). The scope of knowledge promoted by the certification centre will therefore be a complement, describing aspects of Linux or the services and will not be completely replacing the range of material promoted by these institutions [4, 6, 8,10].

In case of other certificates, such as LPI and SAIR, the material required by these institutions to a great extent overlaps with the scope of knowledge preferred by our certification centre [3].

Another aspect, which was taken into account to establish the appropriate range of knowledge and certification process, was also the local market needs, and not, as it is done in other certification centres, the needs of the global market.

However, it should be noticed that with the current Linux development, and disparities between different distributions, as well as the approach in the verification of their practical knowledge of administration, one cannot create a single certificate, whose obtainment will imply a possibility of obtaining other certificates. Significant differences between distributions, application in them different administrative mechanisms, orientation of distribution and the specialization of the distribution to work in the field given make it practically impossible to create the scope of knowledge covering all these issues. The idea of creating a certificate under the Certification Centre was then such a preparation of the range of materials, which will be common to all solutions, and will be the preparation or complement to other current market certificates.

In the preparation of an appropriate form of the certificate, the following tasks should be performed:

- developing a range of material that is relevant to the objectives assigned to the certificate,
- determining the level of the certificate and verifying the candidate, defining the method of verification of the candidate.

## **2 The scope of Examination**

An important element of each certificate is the scope of knowledge, which it has to review and with which the material used to create courses is associated. An important aspect is the creation of relevant issues relating to the scope of knowledge. In most applications, or commercial systems, basing on that certificate paths are created, the issues are being imposed by the producer. So the way of acquiring knowledge is closely defined by him.

For Linux and distributions based on it, creating problems is carried out against specific foundations, such as:

- implementation of the learning process based on a single distribution,
- implementation of the learning process based on individual applications,
- implementation of the learning process based on the common elements of the Linux system [2,7].

The specificity of Linux system, does not enable, in the creation of learning paths, to build upon the common elements (such as the operating system kernel, bash, or set of applications). In some cases, the way of describing these issues differs, by discussing the basics of the mechanism, the basis for specific for each distribution applications (graphical configurators), or a detailed description of principles of the operation. As mentioned above, the last approach involves the transfer of bigger amount of materials, which increases the time that the student must devote to studying and getting familiar with various issues. An example of such a solution is the Yast system, which occurs only in OpenSuSe and Suse distributions. Describing the manner of the operation, and the system configuration, using this tool replaces a detailed discussion of different configuration mechanisms. The student becomes familiar with one way of answering a given question, without knowing the technical aspects of its operation. In the process of learning it allows to minimize the time, but at the expense of detailed knowledge. Such an approach is therefore solely attributed to the given distribution, where the given tools are used [6].

An additional element of specificity of each distribution is its destiny, which implies the choice of materials carried out to the creation of the learning process. Examples are distributions developed as a user-friendly desktop systems, such as the Ubuntu distribution. The purpose of the given distribution causes that during the training, the range of material covered by the certificate will focus exclusively on the aspects of using the system as a workstation, apart from the question of the system administration or the configuration services [11].

The approach followed by the International Certification System of Linux is to produce the range of materials, allowing the verification of issues related to the administration of all Linux systems, without focusing on the individual distributions. This means that during the training various aspects of popular distributions such as Debian (Ubuntu), RedHat (Fedora), Suse (OpenSuse), Slackware and Mandriva must be discussed. Certainly, the course is also to discuss other existing distribution, however, without much emphasis on the differences in detail [9].

Additionally, in the preparation of the range of materials for the certification centre, aspects of business administration at the scale of Middle-Range and Enterprise were brought into focus, which resulted in minimizing the

description of the use of the system itself, to describe the practical techniques used in the administration of such environments.

Analyzing the existing materials available for individual certificates (RedHat, Novell, LPI and Sair) and basing on gathered knowledge and experience of instructors, the common part has been designated that allows the creation of the learning process by which it would be faster to prepare for the certificates available on the market.

The second aspect which was taken into account, was preparing a training path for the administrators within the practical issues encountered in Polish companies. The material was prepared by previous experiences and consultations with the administrators of existing information systems, using Linux.

The scope of the learning material has been divided into four parts, forming separate courses:

- basic information about system management, including work with the covering and process management,
- advanced mechanism for operating the system, creating scripts,
- network services,
- advanced mechanisms to operate Linux [9].

The division of the above ranges largely overlap with the scope of knowledge required for existing certificates.

### **3 Developing Certificate Level**

Developing one's own path of certification involves the preparation of the system prior to exams. Only obtaining the adequate result by the candidate will allow him to enter the appropriate certificate.

Implementing the certifications path in the academic environment will ensure the high level of competency of obtained certificates [9].

In order to develop an adequate level of knowledge acquisition by students, the following aspects of the learning process should be considered:

- time spent on the acquisition of knowledge within existing courses,
- whether the student has to spend extra time for exploring the knowledge beyond the possible courses,
- if there would be an opportunity to approach the certificate without preparatory courses, but only by providing materials,
- whether the acquired knowledge is to be the knowledge with an emphasis on practical or theoretical aspects of the scope of learning.

The above aspects must therefore describe the following elements of the teaching process:

- scope of knowledge,
- method of verification,
- method of motivation.

The first item has already been thoroughly described (in [9]) and is connected with summary time that the average student must spend in order to assimilate it. Please note that in some cases the process of learning may be slower or faster, therefore the procedure of the education process should enable more engaging of the above-average students and adequately motivate or encourage below-average students.

One of the most important elements of the whole process of teaching is the way of verification and related with it the manner of motivation. In case of the verification, it is performed as the most frequent, however not intrusive to the student, exams.

In the proposed by the Centre Certification Linux solution, additional tests have been introduced, to verify the understanding of the given issue during the learning process. In addition, a further examination has been added at the end of each course. After completing the course and successfully passing all the exams, the student may proceed with the certification of ASL.

The division of the exams under the Certification Centre:

- partial exams,
- end of course exams,
- ASL certificate.

From the student's point of view, the knowledge acquired during the course enables:

- passing prepared by the Certification Centre Certificate Linux ASL certificate,
- preparation for the majority of the LPI certification (range of issues in 80% overlap with the scope realized by this certificate),
- preparation for the Comptia Linux + exam (a range of issues in 90% overlap with the scope realized by this certificate),
- preparation for the certification of Oracle: Oracle Enterprise Linux Administrator Certified Associate or Oracle Enterprise Linux Certified Implementation Specialist (range of issues in the 80% overlap with the scope realized by this certificate),
- preparation for RedHat or Novell certifications after additional training.

It is important to remember, however, that in case of the approach to additional examinations carried out for example, by RedHat, it is required to complete the appropriate course, indicated by the given company.

The training conducted by the Centre Linux Certification has been prepared in the following way:

- dividing of teaching material into 4 courses,
- each course has been divided into 5 parts,
- after each part the participant must pass the relevant partial examination of the material covered by every sub-part,
- after each course the participant has to pass the relevant end of the course exam,
- after the course there is a possibility to approach the whole training cycle certification exam.

### **3.1 Partial Exams**

One of the methods of verifying the work within the course is the completion of the partial examinations, based on the progress of work achieved during the training. Every student has the opportunity to approach each exam as a form of improvement. The number of amendments is not limited, however, is supervised by the trainer. The student has the opportunity to approach the sub-test during the whole course.

The sub-test exams consist of the two types of exams:

- group exams - performed to verify the whole training group,
- amendment exams - performed by individual students.

The realization of exams required the creation of an appropriate examination platform.

Another additional element created by the partial exams, besides the verification, is the element of motivation. Motivation in this case involves the imposition of the in-training model of acquiring knowledge, by defining to people being trained adequate terms, in which the knowledge they gained could be verified.

The described above assumptions to the partial examination result from various models of acquiring knowledge by the student.

Characteristics of partial exams:

- number of questions: 30,
- exam time: 40 minutes,
- kind of questions:
  - test questions with multiple choice without information on the number of correct answers,
- type of questions:
  - general questions about Linux, and various issues,

- detailed questions about the commands,
- technical questions.

### **3.2 End of the course exams**

The end of each of the four courses was a final exam, verifying acquisition of knowledge from each course or 5 sub-modules. The approach to the examination was possible only after passing various partial exams. In addition, unlike the partial exams, the possibility of providing partial information about the number of correct answers in the form: one answer correct, two correct answers, three or more answers correct was introduced, and questions connected with entering the text of a response from the keyboard were added.

Characteristics of the end of course exams:

- number of questions: 40,
- exam time: 60 minutes,
- kinds of questions:
  - test questions, with multiple choice, with information on the number of correct answers,
  - questions about entering the correct command or command structure,
  - questions about entering the expression / word related with the technical questions,
- type of questions:
  - general questions about Linux, and various issues,
  - specific questions about the commands,
  - technical questions.

This approach to the final examination of the course allowed to verify the knowledge the students have acquired. From the conclusions submitted by individuals passing results, although the examination verified the greater range of knowledge, it was easier than the individual partial exams. In addition, a better rate of passing the exam is confirmed by the statistics discussed later in this article, which shows that the rate of passing the examination at the first attempt was about 8% higher than the various partial exams.

#### 4 Analysis of the rate of passing the exams

In 2123 exams were carried out within the examination platform, including exams passed and failed.

Summing up, each student had 24 exams to pass (20 partial exams, and 4 end of the course exams ). In total, all the students had to pass 1968 exams. There were 1661 passed exams and 307 were failed.

Information on the samples of the tests

- **exams:** 1968,
- **exams passed:** 1661,
- **exams failed:** 307,
- **all attempts:** 2123rd.

Information on partial exams:

- **all the exams:** 1421,
- **all attempts:** 1793,
- **attempts at partial exams 1:** 1106 (percentage of total 77.83%),
- **attempts at partial exams 2:** 264 (percentage of total 18.57%),
- **attempts at partial exams 3:** 45 (percentage of total 3.16%)
- **attempts at partial exams 4:** 6 (0.42%).

Information on the end of the course examinations:

- **all final exams:** 284,
- **all attempts to pass the final exam:** 330,
- **attempts at final examinations 1:** 242 (85.21 percent of the total%),
- **attempts at final examinations 2:** 38 (13.38 percent of the total%)
- **attempts at final examinations 3:** 4 (percentage of total 1.40%).

Information on all forms of exams:

- **all the exams:** 1705,
- **all attempts:** 2123,
- **attempts at exams 1:** 1348 (percentage of total 79.06%),
- **attempts at exams 2:** 302 (17.71 percent of the total%),
- **attempts at exams 3:** 49 (percentage of total 2.29%),
- **attempts at exams 4:** 6 (percentage of total 0.35%).

Information on the time of passing the exams:

In the following statements two aspects must be taken into account :

- time when the exams were carried out,
- time of the usage of the examination platform (logging in to the platform).

While analyzing these data, it should be taken into account, that the courses (and at the same time, some examinations) were conducted on Saturday and Sunday, so the quantitative parameters showing the rate of passing the exams in those two days may be overstated because of this.

Ability to pass amendment exams did not depend on the days when courses were held. The distributions below show both passing the partial exams and end of the course exams.

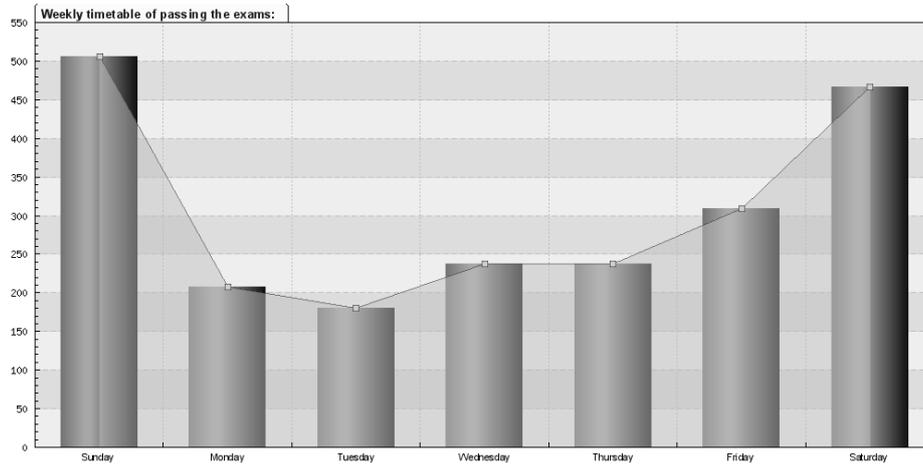


Figure 6. Weekly timetable of passing the exams

Results of the analysis of the time, when the exams were carried out:

- **number of examinations carried out over the weekend (Sunday and Saturday) - 973,**
- **number of examinations carried out on Monday - 206,**
- **number of examinations carried out on Tuesday - 180,**
- **number of examinations carried out on Wednesday - 237,**
- **number of examinations carried out on Thursday - 238,**
- **number of examinations carried out on Friday - 308,**
- **the total number of examinations carried out during the week – 1169.**

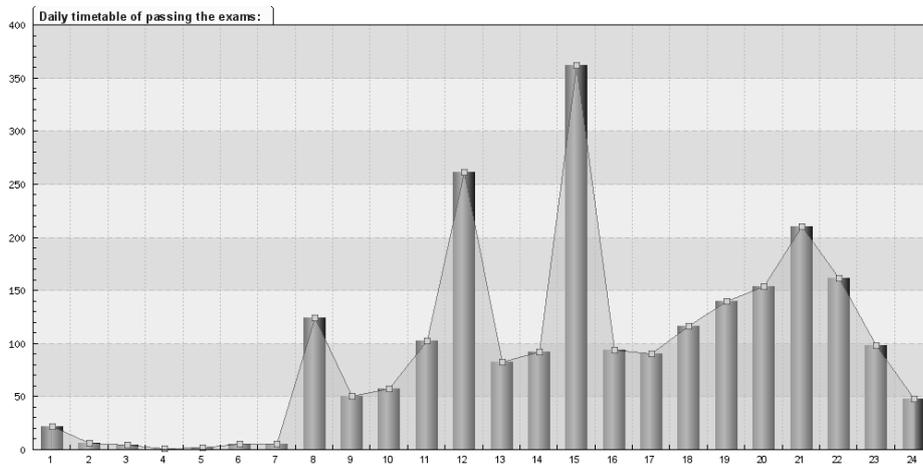


Figure 7. Daily timetable of passing the exams

Another element that was taken into account was the time of logging in to the examination system, including the passing of the exam. After analyzing the data from the logging system, percent characteristics is similar to the shown above timetable of passing exams.

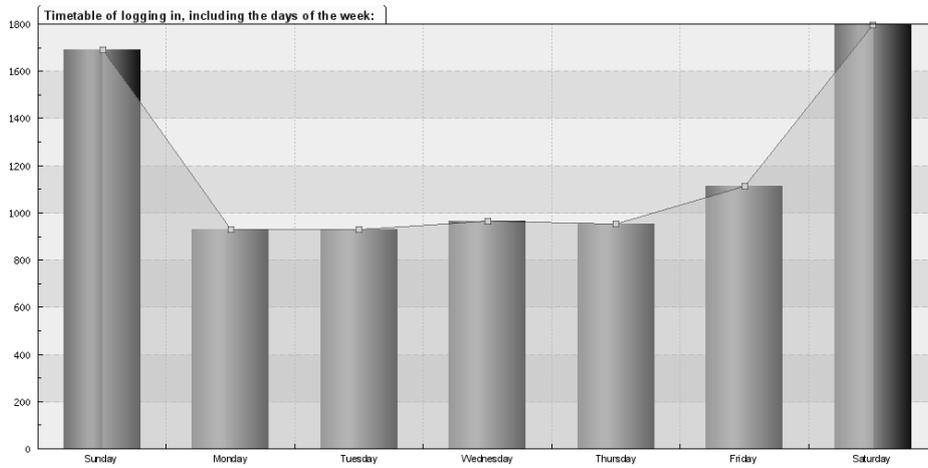


Figure 8. Timetable of logging in, including the days of the week

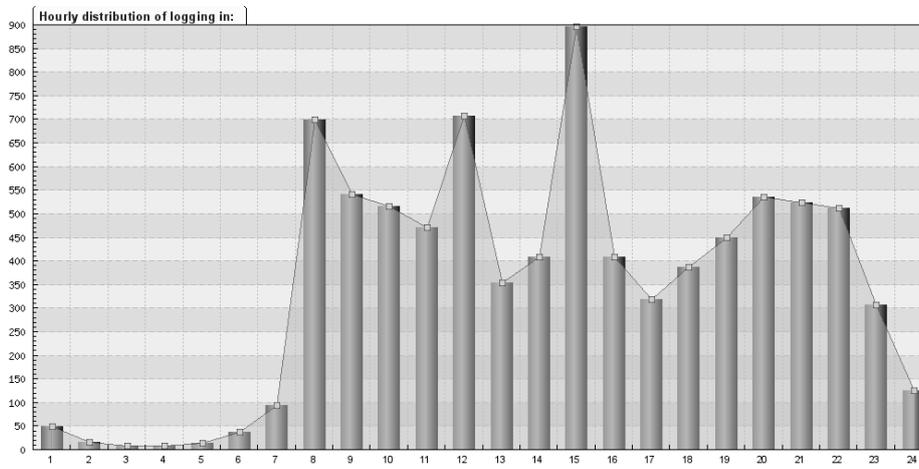


Figure 9. Hourly distribution of logging in

While analyzing the reports given above one comes to the following conclusions:

- most of the examinations were passed at the first attempt

In case of partial exams, the rate of passing at the first attempt was realized in 77.83%, while in case of the final exams it was at 85.21%. The conclusion from this result is the fact of a better preparation for the end of the course exam, although it included a wider range of material. A student approached the final exams three times maximum, in case of the partial examinations fourfold exam situations took place.

- during the realization of the course, students preferred the possibility of taking exams beyond the time of the course than in time imposed during the course

The cause of the above conclusion was mainly a bigger comfort of passing the exam, without the additional stress associated with the course. The possibility of using additional materials should also be taken into account, which in case of an examination held during the course was impossible. While creating a scheme of realizing the examination path this problem was taken into account, however considering the fact that during the exam a student obtains additional knowledge. The opportunity of a wide exploitation of additional materials was, however, offset by the reduction of the passing time to 30 minutes in case of partial examinations, and 60 minutes for the end of the course exams. The response time for each question was therefore one minute in the first case and 1,5 minutes in the second case.

- for taking the exam evening hours, between 6 and 11 PM, were often chosen

The students were working people and that range of hours allowed them to take the exams.

## 5 Conclusions

The purpose realised by the Certification Centre of Linux is to bring in to the market IT training with high quality ASL certificate, which will educate and verify the Linux system administrators, regardless of the distribution. The high level of examination can be obtained by verifying the knowledge of students after all stages of completed training.

The suggested verification system of the partial and the end of the course exams shows an increase in the rate of passing at the various stages of examining. This system will allow faster access to the ASL certificate for students with a high rate of passing and provides a higher level of examining.

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