INTERNATIONAL PERSONNEL CERTIFICATION ASSOCIATION

“IPC Specification on Performing Online Examinations”

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CLASSIFICATION

This document is classified as an IPC Specification IPC-BD-20-001.
IPC specification lays down the standard framework which all members of IPC shall adhere to in the operation of their certification programs while performing online examinations (if applicable) and they wish to be included under the respective IPC MLA. This specification will be the primary standard against which IPC members will be assessed for membership in the IPC Multilateral Recognition Agreements (MLA) when performing online examinations (if applicable).
This IPC Certification scheme is published on the authority of the Board of Directors of IPC.

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AVAILABILITY

Copies of this document in English can be accessed on the IPC website at: www.ipcaweb.org. A printed copy of this document can be ordered by the IPC Secretariat for a minimal fee.

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PREFACE

This IPC specification document has been drafted by the IPC Technical Committee and approved by the IPC Board of Directors. It has been developed according to IPC-BD-02-020-Rev3-2014 *"IPC Procedure for Managing Projects to Develop Approved IPC Criteria Documents"*.

The preparation of this IPC specification document commenced with an initial literature search and review of existing references and guidelines on computer-based testing and internet based online testing platforms. A number of these sources were particularly influential in the development of the document:

- *ITC Guidelines on Computer-Based and Internet Delivered Testing, Jul 1, 2005, Ver. 1.0*
- *2nd International Conference on Teaching and Computational Science (ICTCS 2014), Design and Development of the Online Examination System, Hongmei Nie, 2014*
- *International Journal of Computing Academic Research (IJCAR) ISSN 2305-9184 Volume 4, Number 2(April2015), pp.62-82*
- *Design and Modeling of Web Supported Exam Automation System, Servet Günoğlu, 2008*
- *Developing Secure online exam capability, Dr Samar Zutshi, OES, 2018*
- *Guidelines on Conformity Assessment – ISO/IEC 17024:2012, The United Nations Industrial Development Organization (UNIDO)*

Introduction

Online Examinations are becoming increasingly popular and necessary. Many institutes and personnel certification bodies are giving up the traditional method of pen and paper and started to use online examinations.

An On-Line Examination System is a tool for remote assessment that measures knowledge, skills and abilities of person for candidate's evaluation or certification. However, with the introduction of this new technological approach, new concerns about security have come up. Therefore, while implementing online examination technology, it is essential to take into consideration the various security aspects and requirements.

This IPC specification document has been prepared to draw attention to the points that should be considered before an online examination application is put into service and to prepare the base for the use of a secure, reliable and consequently sustainable evaluation tool for the person's certification.

IPC MLA applicability

This IPC specification document has been drafted primarily for the use of its members and/or organizations approved by its members, that are providing online examinations. Compliance to this IPC specification document is expected from IPC MLA members that are providing online examinations under the scope of their IPC MLA.

The transition period for the implementation of this IPC specification is defined as one (1) year from the initial issue/application date.

The requirements set out in the IPC specification should be implemented, considering the requirements of ISO/IEC 17024 and other applicable IAF documents as well.

Definitions

1. Computer Based Test/Examination (CBT)

It means that the examination is performed using a computer. It means giving the examination questions in electronic environment and getting the answers in the same way on computer. In such systems, computers do not have to operate in any network mechanism. Questions are provided by using CD or pen drives and similar tools, and the given answers are transferred by using similar tools.

2. Online Test/Examination:

Online examination is a kind of test using browser or desktop application to measure the knowledge, skills and ability of the participants on a given topic. In such systems, computers must be in network mechanism through internet or VPN. Questions are forwarded to participant through internet connection by using browser or an app. Candidate gives their answer by using the same tools. With online examination candidate can take the examination online, in their own time, with their own device, regardless of where they live.

3. Back Office:

A virtual office in which the administrative work of an online examination system is carried out.

4. Remote Proctoring:

Remote proctoring is the broad ability to supervise a student taking an examination in a location of their choice by connecting to their computer, viewing what happens on their screen and monitoring their activity via a web camera. There are two broad types of services: supervision of the test-taker in real-time ("live") and review of a recording of the test-takers activities ("recorded").

i. ***Live***: A live proctor authenticates the student via a webcam and presented identification papers. The students' desktop and physical activity are monitored in real-time by a human via a webcam.

ii. ***Recorded***: The student installs software that locks down their computer and records them presenting photo-ID to the camera, video of their desktop and the feed from their webcam. The recordings are subsequently reviewed by staff (often by the service provider but sometimes by supervisors from the institution) with suspected incidents flagged for review by nominated instructional staff.

5. Online testing systems potential stakeholders:

i. ***Test Takers***: Individuals who are personally attending and completing a test or are being evaluated in other ways.

ii. ***Test Developers***: Individuals or organizations that are responsible for the design and creation of the test or assessment. These may be part of a service provided by others.

iii. ***Test Administration Service Providers***: These organizations have technology and distribution channels (e.g., testing centers / online examination system owners) to make sure that a published test is available at times and locations convenient for the Test Takers.

iv. ***Technology Service Providers***: These organizations provide various services to other stakeholders, including but not limited to database services, item banking technology, and storage support.

v. ***Test Publishers or Owners***: These organizations or persons own the content of a test and authorize its use for specific purposes (e.g. industry associations, institutes, personnel certification bodies). They also may contract with service providers as needed.

vi. ***Test Users***: The test users are stakeholders who make use of test information, including scores of test takers to decide their competency, knowledge, skills and abilities for various purpose. (e.g. personnel certification bodies, universities, human resources)

REQUIREMENTS

1. Online Examination System - Architecture

The Online Examination System is an electronic application which requires a server, server-side software, data base, firewall, wi-fi or ethernet connection, active internet connection, and client device. A web-based (server-side) online examination application at fundamental level includes at least the following components:

a. Back office, developing, examination preparation and examination administration module.
b. Website (public information about online examinations and online examination terms and conditions).
c. Online examination module for test-takers.

Some online examination systems may require a small app to be downloaded and installed to the desktop as a 4th module due to high security requirements.

CBTs cannot be considered online examination system. Such systems are mostly being preferred to be used by examination centers and corporations for internal usage.

2. Online Examination System - Security

Security is the most important issue in online examination systems. Effective measures must be taken against potential threats, such as stealing examination questions and changing examination results. Threats to test security are considered all the potential threats to validity of the entire examination which is used for the assessment of the competence of a person.

The core of protection is a test security plan. The first phase of it, is to evaluate the current test security status of the examination provider. There are four major steps in basic protection and security model to be evaluated:

a. Threats to test security that are relevant to online examination system.
b. Possible frequency and impact of each threat.
c. Relevant deterrents or preventative measures for each threat.
d. A plan for how to deal with issues, like when a candidate is found cheating.

ISO/IEC 17024 accredited Personnel Certification Bodies should define and evaluate the risks regarding security and ensure that it takes necessary action against the threats. The required processes to be placed in place in order to safeguard the reliability and security of the examination system must be defined. Such processes are expected to include, but are not limited, to the following:

2.1 Connection and Access

The following processes must be identified and implemented:

2.1.1. Unique username and password should be defined for each user and test-taker.

2.1.2. Access authorization should be created for each user. (e.g. superuser, back office coordinator, proctor, invigilator, examiner, reviewer, test-taker)

2.1.3. The user activation should be performed by e-mail, text message or phone call for the newly registered user.

2.1.4. Access log should be kept for the users online in the system.

2.1.5. The browser or app that is left open for a long time without any action being taken should not be allowed to be reused. (e.g. requesting password again)

2.1.6. When the Internet connection is broken, the data is stored offline and synchronized when the connection is restored.

2.1.7. The system users or test-takers should connect to the system via https: // (hypertext transfer protocol secure) or a secure VPN (virtual private network).

2.1.8. The user should be prevented from connecting by using multiple devices simultaneously.

2.1.9. The IP address and geographical location of users and test takers accessing the system should be logged.

2.2 Security of examination information displayed on the candidate screen

The following processes must be identified and implemented:

2.2.1. During the online examination the user should not be allowed to use any other digital media than the secure browser or app.

2.2.2 The online examination system should block dual monitors, virtual machines, copy / paste, and any other applications other than the online examination application.

2.3 Server / Cloud Server

The following processes must be identified and implemented:

2.3.1 Access authorization to the server should be restricted.

2.3.2 Confidentiality agreement should be made with the hosting provider in case of hosting the online examination system and data using a rental server.

2.3.3 If the server connection is interrupted or server halted for technical reasons during the online examination, re-commissioning protocol should be defined.

2.3.4 If the server connection is interrupted or server halted for technical reasons during the online examination, the maximum waiting time of test-taker to be able to continue the examination should be defined. (e.g. after 5 minutes, examination should be cancelled and renewed even if the system is back)

2.3.5 Measures should be taken to prevent any server connection interruption due to unexpected power (electricity) cut (e.g. continuous power supply, generator).

2.3.6 The system should periodically be backed up. This backup frequency should be defined according to the risk analysis of the examination provider to prevent data loss.

2.3.7 The security precautions of the backups taken should be defined and the access to these backups should be limited.

2.3.8 Records related to the online examination system should be protected from loss, destruction, falsification, unauthorized access.

2.3.9 When operating platforms are changed, critical processes should be reviewed and tested to ensure there is no adverse impact on online examination system operations or security.

2.4 General Data Protection

The following processes must be identified and implemented:

2.4.1 Security of personal data of online examination system users and test-takers should be provided.

2.4.2 Unauthorized access to test-taker's examination results should be prevented.

2.4.3 Unauthorized access to the taken screenshot, picture or video of the test-taker through the online examination system by proctor for the security should be prevented.

2.4.4 Privacy and protection of personally identifiable information should be ensured as required in relevant legislation and regulation where applicable.

2.5 Question Bank

The following processes must be identified and implemented:

2.5.1 Access to the question bank should be restricted except for authorized users.

2.5.2 Control and confirmation of questions added or deleted in the question bank should be provided.

2.5.3 Copy of the questions that are deprecated or revised should be retained. Revision history of the questions should be saved.

2.5.4 Even if a question has been deleted or changed from the question bank, the version that has been used at the test-taker's examination should be kept at least the retention time of examination results.

2.6 Examination Security

The following processes must be identified and implemented:

2.6.1 Test taker's ID with picture should be authenticated by the proctor prior to examination start. Proctor shall ask the applicant to show his/her identity document to the webcam during this process. The valid ID may be a driver's license, passport or national identification card.

2.6.2 To prevent test-taker of getting help and perform any kind of cheating, during the online examination, appropriate measures should be taken by the examination provider, including continuous monitoring of the examination process. Usage of webcam and

microphone are mandatory and if a candidate does not consent to allow usage of those, he/she cannot be allowed to take the online exam.

2.6.3 Before the test is started, the test taker shall demonstrate the workplace surroundings by web camera.

2.6.4 The procedure to be applied if the internet connection is interrupted during the examination or if the candidate closes the connection on one side should be defined.

2.6.5 Appropriately trained Proctor/Invigilator/Examiner should be appointed before the online examination.

2.6.6 Appropriately trained Proctor/Invigilator/Examiner must be present, at remote location, during the online examination.

2.6.7 Arrangements should be made for the Proctor/Invigilator/Examiner to observe the test-taker during the online examination.

2.6.8 The appropriate method for the Proctor/Invigilator/Examiner to monitor the surrounding environment of the candidate should be determined.

2.6.9 Technical capacity to stop or cancel the examination if necessary, should be provided to the Proctor/Invigilator/Examiner.

2.6.10 Conditions to stop or cancel the examination, should be defined and communicated to both Proctor/Invigilator/Examiner and individuals taking the examination.

2.6.11 A method to trace back the performed examination should be implemented in the case of test-taker's objection, complaint or appeal.

2.6.12 If the on-line examination includes an oral examination session, examiners and test-taker's dialogs and images should be recorded. Usage of webcam and microphone, or equivalent technology, is mandatory and if a candidate does not consent to allow these, he/she cannot be allowed to take the online oral examination. The candidate must consent to the video recording. Examination provider shall ensure that consent is received from the examiner if the examiner is included in the video recording. The retention time of the captured video should not be kept longer than the purpose of storage.

2.7 Other

The following processes must be identified and implemented:

2.7.1 If the candidate fails in his first attempt and takes the examination for the second time, re-use of the previous examination paper or re-use of some of the previous examination questions should be prevented.

2.7.2 Measures should be taken to prevent test-takers from getting help from each other or perform any type of cheating in the event that many staff members of an institution take the test remotely at the same time or/and at the same venue.

2.7.3 Measures should be taken to prevent changes to the examination results.

2.7.4 When necessary, access to the test-takers answer sheet should be provided and access authorization should be defined.

2.7.5 At the end of the test period defined for the online examination, the test-taker's test should be automatically terminated.

2.7.6 During the examination, the test-taker should be able to start with the question he/she wishes, to reach the question he/she wishes and to change his/her answer.

2.7.7 Before starting the examination, the test-taker must ensure that he/she understands the rules of the examination and acknowledges the instructions for the examination. Regarding this subject, it should be ensured that the necessary arrangements have been made.

2.7.8 It should be defined whether the candidate can interrupt the exam, how long he/she can leave the test machine for urgent needs or not.

2.7.9 Information security requirements for mitigating the risks associated with any supplier’s (or other third party) access to the online examination system should be agreed with the supplier (or other third party) and documented.

2.7.10 Appropriate procedures should be implemented to ensure compliance with legislative, regulatory and contractual requirements related to intellectual property rights and use of online examination products and tests.

2.7.11 Online examination system should allow the export of statistical data for data (psychometric) analysis.

2.7.12 The online examination provider must make the system public and provide an online tool for the candidate to try and test the system before creating an exam profile to take the exam. The examination provider should ensure that the questions from the approved question banks are not used during this trial.

ANNEX I - Informative Section

This informative session describes some of the techniques that can be used in order to enhance the security of the online examination system.

a. Secure Browser

Secure Browser Technology prevents users from opening any other window while the online examination process is going on. The user is allowed to access only the examination window. For more information you can access the following web site: https://safeexambrowser.org/

b. Online Proctored Examination/Test

A proctored online examination process involves the role of an 'E-Proctor' – a supervisor or a person who monitors exam-takers during the examination process.

Virtual proctoring space is also important in online examination technology. Online video proctoring facilitates monitoring the test-takers online during the test duration using a webcam, a microphone, and access to the screen of the test-takers. It can be possible from remote locations and proceeds in three possible ways:

a. Live Online Proctoring – by using an audio-video and screen share feeds in real-time.
b. Recorded Proctoring – by recording audio-video and screen share feeds of the test -takers.
c. Advanced Automated Proctoring – by monitoring the feeds for any suspicious activity using advanced video and audio analytics.

c. Data Encryption

Data encryption plays an important role in preventing unauthorized access to question banks. It also helps to avoid result manipulation without valid credentials. It is a vital feature to make sure the security of the examination. The entire communication between server and examination client is also encrypted with a secure mode of communication. This ensures the confidentiality of the question papers being exchanged between the server and the client.

d. Audit Logging

By the audit logging function all the activities like Login, Logout, Examination Access, Question Navigation, Answer Responses, etc. are recorded in the system. The system also may records details of activities like Question Navigation, Section Changes, and Internet Speed. Using techniques like geotagging it is possible to track the exact location of the user during online examination activity.

e. IP based Authentication & Authorization

The concept of IP based Authorization and Authentication means that the access and operating of the examination program is restricted or limited to a certain specified number of IP addresses. In the case of Admin login, it is possible to have IP based Authentication so that users trying to log in from specific IP are allowed to access the system. This enables access only for certain specific IP addresses and ensures complete safety for the examination.

ANNEX II – Fundamental Types of Questions Used in Online Examinations

The fundamental question types used in examinations are not limited to, but can be of the following formats:

- Multiple-choice,
- Open-End,
- Closed-End, and
- Fill-In type questions.

a. **Multiple-choice Question:** Fundamental test questions which provides respondents with multiple answer options. Multiple choice questions can have single select or multi select answer options**.**

i. **Single Choice:** It's more like the MCQ type, here multiple answers are given for the question but only one is correct.

ii. **Multiple Choice:** It is used when your question might have more than one possible answer.

b. **Open-Ended/Essay:** An open-ended question is a question that cannot be answered with a "yes" or "no" response, or with a static response. Open-ended questions are phrased as a statement which requires a response. The response can be compared to information that is already known to the questioner. This question type best fits when you need to take feedback from the candidate.

c. **Short Answer:** It's more like the same as open-ended type, the difference is here the character limit is 200 ideally.

d. **Close-Ended Questions:** Closed-ended questions are those which can be answered (but not always) by a simple "yes" or "no," "true" or "false".

e. **Fill in the Gaps:** As the name suggests, candidates need to type in a word or two in the blank field. It needs to define the correct response while creating the question.