Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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Federal Chancellery FCh

Political Rights Section

Version 1.4, 12 April 2022

Audit concept v1.4

For examining Swiss internet voting systems

File reference: 431.0-2/5/12/16

Introduction

This document aims at defining the foundations for assessing the compliance of electronic voting systems with the draft OEV and its annex[1], as per chapter 26 of the annex of the draft OEV, and for obtaining recommendations for improvements. It describes the rules for preparing, conducting and reporting this examination. It is intended for both examiners and examinees.

Examinations of the system should be carried out at an early stage in order to allow sufficient time before the system is put into operation for non-conformities to be remedied and re-checked.

Context

Internet Voting in Switzerland

Internet voting is part of the Swiss E-Government strategic plan. The Confederation and the cantons have agreed to support internet voting and take further steps to introduce it in Switzerland. Since 2004, 15 cantons have offered internet voting to certain sections of their electorate in over 300 trials. At the beginning of 2019, internet voting was offered in ten cantons, either to registered voters living abroad and resident voters, or only to registered voters living abroad. The cantons could choose between two systems: the system offered by the canton of Geneva and the system offered by Swiss Post.

Based on its decision of November 2018, the Canton of Geneva informed in June 2019 that its system would no longer be available with immediate effect.

The Swiss Post system used in trials until February 2019 offered individual verifiability. Swiss Post aims to offer a new system that offers complete verifiability. In order to comply with federal legislation, the new system underwent a certification procedure, its source code was made accessible and, subsequently, a public intrusion test was conducted. Based on voluntary analysis of the source code and in the course of a subsequent audit mandated by the Chancellery, researchers revealed significant security flaws. In view of this, Swiss Post announced the withdrawal of its individually verifiable system and the focusing on the development of the completely verifiable system. Both systems were initially developed by the company Scytl. In 2020, Swiss Post bought the rights to the source code of the internet voting system from Scytl.

Redesign of Internet Voting Trials 2020

The Federal Council commissioned the Federal Chancellery to work with the cantons to redesign the internet voting trials. A task-force was set up to make proposals for the future of internet voting. To that end, the Federal Chancellery invited experts from academia and industry to engage in a broad dialogue on internet voting in Switzerland. After this dialog, the Federal Chancellery and the cantons published a final report on the redesign and relaunch of internet voting trials with a catalogue of measures.[2]

The Federal Council took note of the final report on 18 December 2020 and commissioned the Federal Chancellery to amend the legal bases of the Confederation. On 28 April 2021, the Federal Council opened a consultation procedure on the amendment to the legal bases, which was drafted by the Federal Chancellery.

Examinations of the systems

Before the trials can be relaunched, the amendments to the legal bases have to be made and the compliance of the system with the new legal provisions in Switzerland has to be assessed. Based on the new legal provisions, the Confederation has a stronger role and directly commissions independent experts for the assessment. The goal is a continuous improvement of internet voting in general and the

[1] The annex corresponds to the draft OEV provided with the call for offer. It corresponds to the latest candidate for entry into force.

[2] For the report and the results of the dialog see www.bk.admin.ch > Political Rights > E-Voting.

internet voting systems in particular. To that end, not only the compliance of the systems with the legal bases will be assessed but also the potential for improvement shall be identified.

Purpose

In the context of the assessment of the Swiss Post system, the experts shall answer the following questions:

- Are the system, its development and operation compliant with the legal requirements (annex II)?
- Are the measures taken to mitigate risks effective?
- Which improvements could be made for the sake of security, trust and acceptance?

The answers to these questions will be part of the basis used by the Federal Chancellery to prepare its recommendation on whether or not to grant use of the system and also for future actions on the strategic level.

Organisation

The Federal Chancellery mandates a group of experts (examiners) on the basis of the present concept. The group as a whole shall demonstrate expertise in the following areas:

- Cryptography
- E-Voting technology
- Software engineering
- Understanding and experience with IT Frameworks and market best practices, i.e. ISO 27001, COBIT[3], NIST[4] and CIS[5]
- Audit experience in the field of operational security
- Audit education, respectively certification

Experts will be assigned one or several scopes according to their competences. Each scope will be covered by at least 2 experts. They can work in groups or individually. When working in groups, one of the experts is responsible toward the Federal Chancellery. The organisation within the group is left to the members.

The Federal Chancellery supervises the work and is available to experts in the event of difficulties or questions.

When the Federal Chancellery receives a final report covering one scope, the examinees may prepare a response to the examination report prior to its publication. The report and its response can be discussed at a meeting with representatives of the Federal Chancellery, experts and examinees. The experts can then decide whether or not to amend their report.

Methodology

For the examination plan to be established, the examinees provide the examiners with a table mapping the annex of the draft OEV requirements with the system and processes from the examinees. The mapping table shall describe each requirement, who takes responsibility for it and what means are used to fulfil it (function of the system, infrastructure item, process and/or documentation). The examiner can then prepare his examination plan on this basis. Should the analysis of this mapping raise questions or reveal gaps, the examiner shall contact the examinee and if necessary the Federal Chancellery.

[3] Control Objectives for Information and Related Technology

[4] National Institute of Standards and Technology

[5] Center for Internet Security

The approach for assessing the compliance shall be systematic, objective and structured. It shall be based on the above mentioned mapping, the risk assessments and the documentation provided by the examinees. Documentation that is not listed in this concept but which the examiner would consider relevant to his or her assessment must be provided by the examinees upon request. The same applies to access to tools. The examinees must designate persons who are able to support the examiner in his work and ensure their availability.

Additionally to the analysis of the documentation and tools, the examiner may conduct interviews with the relevant persons. Interviews can be carried out at the examinee's premises or remotely. If scopes foresee interviews, these must be carried out. The examiner may schedule additional interviews if he or she considers them useful for the examination.

Finally, in some cases, onsite inspections may be necessary to allow a thorough assessment. This is especially the case for infrastructure and operation and printing office. Interviews can be combined with on-site inspections for efficiency. Examinees must guarantee fully transparent access to the examiners and make competent persons available to them during the visit.

Access to the documentation should be organised by the examinees, preferably electronic for efficiency reasons.

Rights and duties

Of the examiners

- Rights
  - Get access to the documentation, tools, facilities and people needed to conduct the examination
  - Get support from the examinees and the Federal Chancellery
  - Retain the copyright on the report and the right to publish the work related to this examination and to cite analysed documents that must be published by the Cantons and/or the system provider according to Swiss law.
- Duties
  - Examining according to the specified method
  - Stay independent and objective
  - Provide an examination report in response to the purpose set out in this document, The report will be published

Of the examinees

- Rights
  - Be assessed fairly and accurately
  - Take a stand on findings
- Duties
  - Provide access and support in investigations
  - Be transparent, proactive and truthful
  - Provide requested information

Scopes

The following chapters describe the different scopes as per defined in the chapter 26 of the annex of the draft OEV. Together, they cover the entire system, its development and operation. The distribution of experts and their skills must ensure full coverage, free of gaps.

To ensure comprehensiveness and as the cryptographic protocol is the corner stone of the security of the system, experts involved in its verification must be involved in the other scopes.

In addition to the legal bases, the risk assessments of the relevant stakeholders will also be used in the examinations to ensure the effectiveness of the measures taken to mitigate the risks.

Any reports available from the examinee or other sources shall be consulted as far as it serves the purpose.

The detailed scopes presented in this documents are meant for making a first assessment of the workload. If there are reasons for a requirement not to be assessed in a particular detailed scope, this can be set out within the audit plan. The mapping table provided by the auditees serves as additional guidance within which scope the individual requirements should be examined.

Scope 1: Cryptographic protocol

Criteria

The protocol must fulfil the requirements listed in the chapter 2 of the annex of the draft OEV.

The requirements comprise:

- a list of abstract system players and a list of abstract communication channels both to be instantiated in protocol definitions;
- a set of security goals to be achieved by executing the protocol. The goals relate to verifiability, secrecy and authentication;
- for each security goal: the strongest permissible assumptions on the trustworthiness of the system players and the communication channels;
- further side-conditions setting boundaries to the definition of the protocol
- requirements on proofs that demonstrate the conformity of the protocol definition with the requirements (cryptographic and symbolic proof). The proofs may be conducted with respect to cryptographic basic components under generally accepted security assumptions (for example, "random oracle model", "decisional Diffie-Hellman assumption", "Fiat-Shamir heuristic"). The protocol should be based as far as possible on existing and proven protocols.

Examinee

System developer

Examiners

Three experts or groups of experts in cryptography.

Detailed scope

Assess the conformity of the protocol specification, highlight cases of doubt and potential for improvement. Examiners assess the protocol specification document against the requirements in chapter 2 based on their knowledge and experience with cryptographic protocols and the possible pitfalls. To that end, the argumentation in the proofs must be reviewed.

Documentation

The examinee shall provide at least:

- Cryptographic protocol specification
- Cryptographic proof
- Symbolic proof

Interviews

None

Scope 2: Software

Criteria

The software of the system including the auditor's technical aid must fulfil the requirements listed in chapters 2 to 25 of the annex of the draft OEV and adequately support the protocol (chapter 2 of the annex of the draft OEV). The mapping between a requirement in those paragraphs and the place (functionality in the system, organisational procedure, element of infrastructure, etc.) where it is fulfilled shall be provided by the examinees before the examination. If the mapping table indicates that a requirement is covered in another scope than the one specified here, the examiner shall verify this claim. Functions whose trustworthiness is decisive for the effectiveness of verifiability as per draft OEV, must be examined in detail on the basis of the source code and the cryptographic protocol.

Moreover, a sample of the functional tests documented and executed by the developer are to be executed by the examiners to validate their results. The sample shall be selected by the examiners on the basis of its coverage of security functions and the contribution of these functions to risk mitigation.

Examinees

System developer and provider

Examiners

Three experts or groups of experts with the support of experts in cryptography who examined the scope 1. The competences of the experts and/or groups taken as a whole should cover the fields of software engineering and secure development process.

Detailed scope

	Requirements of the draft OEV
a) Assess the development process	8.13, 17.1, 17.2, 17.3, 24.1.1, 24.1.2, 24.1.3, 24.1.4, 24.1.14, 24.1.15, 24.1.16, 24.1.17, 24.1.18, 24.1.19, 24.1.20, 24.4.1, 24.4.2, 24.5, 25.13.3, 25.13.4
b) Assess the code quality and security	3.2, 14.1, 14.2, 14.4, 14.5, 14.6, 15.2, 15.3, 15.4, 24.1.5, 24.1.6, 24.1.10, 24.1.12, 25.8.2, 25.8.3, 25.8.4, 25.8.5, 25.9.2, 25.9.3, 25.9.4, 25.10.5, 25.10.6, 25.10.7, 25.10.8, 25.11.2, 25.11.3, 25.11.4, 25.12.2, 25.12.3, 25.12.4, 25.13.2, 25.13.5
c) Asses the documentation quality	24.1.5, 24.1.6, 24.1.7, 24.1.8, 24.1.9, 24.1.12, 24.1.13, 25.2.2, 25.2.3, 25.2.4, 25.2.5, 25.2.6, 25.2.7, 25.2.8, 25.3.2, 25.3.3, 25.3.4, 25.3.5, 25.3.6, 25.4.2, 25.4.3, 25.5.2, 25.5.3, 25.5.4, 25.10.2, 25.10.3, 25.10.4
d) Assess the alignment between software development products	24.1.9, 24.1.11, 25.1.3, 25.2.8
e) Assess the implementation of the protocol	2.5, 2.6, 2.12.1, 2.12.2, 2.12.3, 2.12.4, 2.12.5, 2.12.6, 2.12.7, 2.12.8, 2.12.9, 2.12.10, 2.12.11, 2.13.1, 2.13.2, 3.17, 25.1.2
f) Assess the functionalities	3.13, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 5.1, 8.11, 9, 10, 11.1, 11.5, 11.6, 25.7.2, 25.7.3

Documentation

The examinees shall provide at least:

- Risk assessment
- Mapping between relevant requirements and way of implementation
- Cryptographic protocol
- Specification and design documentation
- Source code
- Development process documentation
- Configuration management documentation
- Tests documentation
- Build and deployment process documentation
- Quality assurance documentation including audit reports
- Usability concept

Whenever tools are used to support the processes (e.g. Jira, SonarQube, etc.), access to them shall be provided.

A running version of the system with test data shall be available.

Interviews

Interviews shall include at least people from:

- Project management
- Development team
- Test team

Scope 3: Infrastructure and operation

Criteria

The system and its operation must fulfil the requirements listed in chapters 2 to 25 of the annex of the draft OEV and adequately support the specified objectives. The mapping between a requirement in those paragraphs and the place (functionality in the system, organisational procedure, element of infrastructure, etc.) where it is fulfilled shall be provided by the examinees before the examination. If the mapping table indicates that a requirement is covered in another scope than the one specified here, the examiner shall verify this claim. The core system must be operated in a currently valid ISO 27001 certified infrastructure. Basic components, such as software that serves the secure and independent use of control components, the operating systems used or the servers used must be proven to meet the best standards.

Examinees

System provider, canton and printing office

Examiners

Two experts or groups of experts with the support of experts in cryptography who examined the scope 1. The competences of the experts or groups should cover the field of operational security.

Detailed scope

	Requirements of the draft OEV
a) Assess the certification(s) of the system provider	ISO 27001:2013 certificate + SoA

b) Assess the infrastructure and organisational measures of the system provider	2.5, 2.6, 2.9.1.2, 2.9.2.2, 2.9.3.2, 2.9.4.2. 2.13.3, 3.5, 3.6, 3.7, 3.8, 3.9, 3.11, 3.12, 3.14, 3.15, 3.16, 3.17, 3.19, 3.20, 8.13, 11.1, 11.4, 12.1, 12.2, 12.8, 13, 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.8, 14.9, 14.10, 15.1, 15.2, 15.3, 15.4, 16.1, 16.2, 18.1, 18.2, 18.3, 19.1, 19.2, 19.3, 19.4, 20.1, 20.2, 20.3, 21.1, 21.2, 21.3, 21.4, 22.1, 22.2, 22.3, 22.4, 22.5, 23.1, 23.2, 23.3, 23.4, 23.5, 24.2.1, 24.2.2, 24.2.3, 24.3.1, 24.3.2, 24.3.3, 24.3.4, 24.3.5, 24.3.6, 24.4.1, 24.4.2, 24.4.3, 25.6.2, 25.6.3, 25.6.4
c) Assess the infrastructure and organisational measures of the canton	Art. 14, 2.5, 2.6, 2.9.1.2, 2.9.2.2, 2.9.3.2, 2.13.3, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16, 3.17, 3.18, 3.19, 3.20, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 6.1, 6.2, 6.3, 7.1, 7.2, 7.3, 7.8, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.11, 8.12, 8.13, 8.14, 9, 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8, 11.9, 11.10, 11.11, 11.12, 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 13, 14.1, 14.2, 14.3, 14.4, 14.7, 14.8, 14.9, 14.10, 15.1, 15.2, 15.3, 15.4, 16.1, 16.2, 18.1, 18.2, 18.3, 19.1, 19.2, 19.3, 19.4, 20.1, 20.2, 20.3, 21.1, 21.2, 21.3, 21.4, 22.1, 22.2, 22.3, 22.4, 22.5, 23.1, 23.2, 23.3, 23.4, 23.5, 24.3.5, 24.3.6, 24.4.1, 25.6.2, 25.6.3, 25.6.4
d) Assess the infrastructure and organisational measures of the print office	2.9.1.2, 2.9.3.2, 2.9.4.2, 2.13.3, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.17, 3.19, 3.20, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 14.9, 18.1, 18.2, 18.3, 19.1, 19.2, 19.3, 19.4, 20.1, 20.2, 20.3, 21.1, 21.2, 21.3, 21.4, 22.1, 22.2, 22.3, 22.4, 22.5

Documentation

The examinees shall provide at least:

- Relevant organisational process descriptions

Additionally, the system provider shall provide at least:

- Risk assessment
- Mapping between relevant requirements and way of implementation
- Training records
- Current valid ISO 27001 certificate and Statement of Applicability
- Operational documentation
- Network schemas
- Logging and monitoring concept

Additionally, the canton shall provide at least:

- Risk assessment
- Mapping between relevant requirements and way of implementation
- Training records
- Tests documentation

Additionally, the printing office shall provide at least:

- Risk assessment (if not already part of the canton's risk assessment)
- Network schemas

Interviews

Interviews shall include at least:

- Operation team
- Incident response team
- Cantonal responsible

Scope 4: Penetration test

Criteria

Competent attackers from the Internet must not be able to penetrate the infrastructure in order to gain access to important data or to take control of important functions. A penetration test is to be run to assess the effectiveness of the security measures taken to prevent such cases. The tests are carried out on the basis of potential vulnerabilities discovered after a methodical analysis of publicly available documentation, in particular that in Art. 7 of the draft OEV.

Examinee

System provider

Examiners

Two experts or groups of experts with the support of experts in cryptography who examined the scope 1. The competences of the experts or groups should cover the field of penetration testing.

Detailed scope

a) Search public domain sources to identify potential vulnerabilities
b) Conduct a methodical vulnerability analysis of the system based on its guidelines, functional specifications, architecture description and source code to identify potential vulnerabilities
c) Conduct a penetration test based on the identified potential vulnerabilities to determine whether the system is resistant to attack by an attacker with a moderate attack potential

Documentation

The examinee shall provide at least:

- Architecture documentation
- Data flows
- Description of used technologies
- Documentation provided for the public scrutiny of the source code and bug bounty

Interviews

None

Reports

The reports are to be published and shall be written with this objective in mind. In particular, they should be as comprehensive and easy to understand as possible. One report with a consolidated view among members of a same team shall be provided when working in a group. The reports are also to be written in a way allowing to make references to the statements easily (e.g. identifier per findings or indexing of the paragraphs).