Practical Security for Electronic Examinations on Students' Devices

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Our Project: FLEX

FLEX (Framework for FLExible Electronic EXaminations)

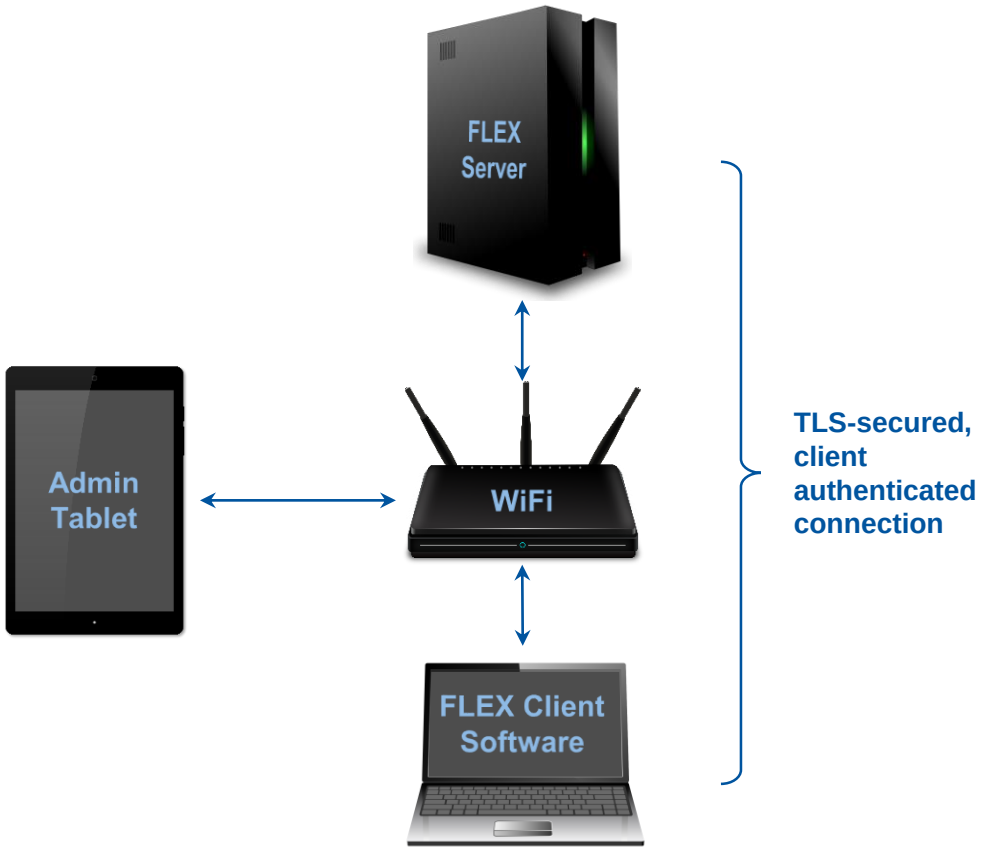
Motivation

- e-Assessment is a rather new, but actively developed topic for German Institutes of Higher Education [1]
- **FLEX** aims to enable German IHEs to conduct e-Assessment on Student Owned Devices (→ BYOD)
- However, BYOD introduces (security) concerns as the devices are not fully controlled by the examining institution, including …
  - Equality of Treatment [2]
  - Student Identification / Authorship Attribution *
  - Cheating Prevention *

Approach

- The **FLEX** client software monitors itself and its communication channels to prevent cheating
  - The students’ devices are *untrusted devices*
  - Lockdown does not work reliably in a BYOD setting [3]
- Students are identified using certificates and public key cryptography
  - The private part of the certificate can be used to verify authorship of results
  - The public part of the certificate has to be stored reliably [4]
- There are still invigilators in the room, therefore **FLEX** does not have to handle everything in software, but can inform an invigilator in the exam room

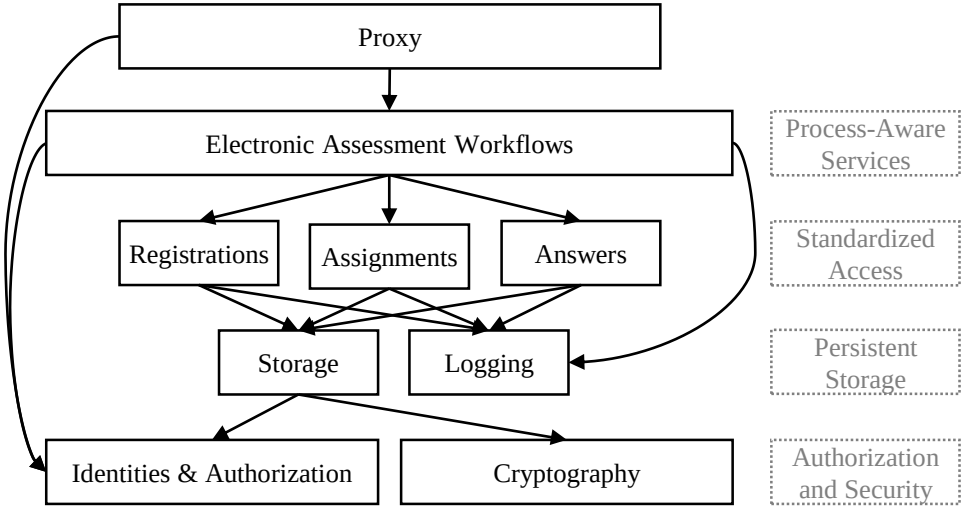
Basic Architecture



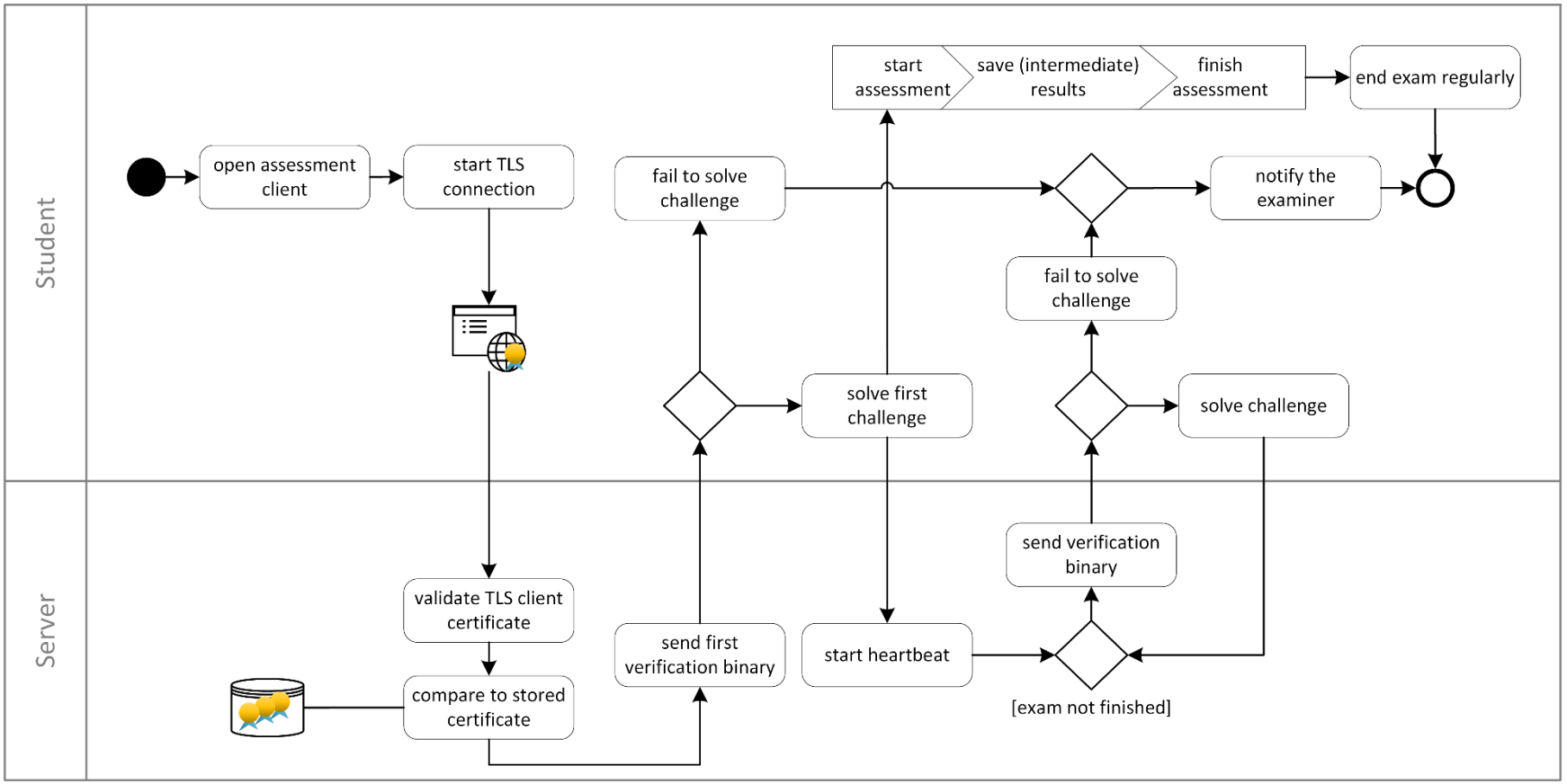
FLEX

- Client Software
  - The software is tested for unauthorized modifications by Remote Attestation [5]
  - It has to be ensured that the execution environment is not a virtual machine [6]

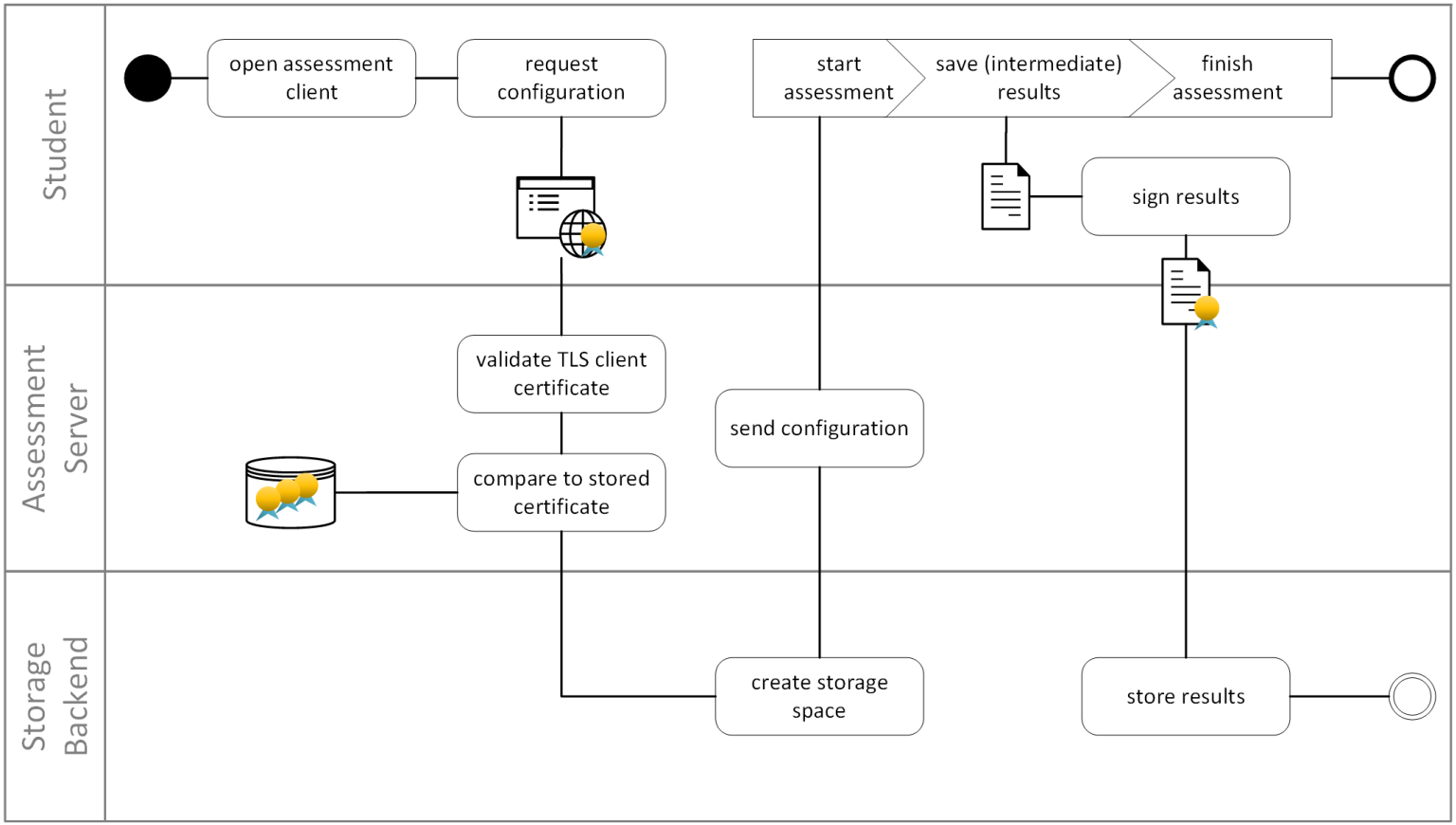
- Server Software
  - The server uses a micro services pattern [7] to reduce the dependencies between different modules of the server architecture



Taking an e-Assessment / Remote Attestation



Taking an e-Assessment / Authorship Attribution



Summary / Outlook

- The **FLEX** project aims to provide Institutes of Higher Education with a software framework that enables them to carry out e-Assessment reliably in a BYOD setting

- Different challenges are tackled
  - Student Identification / Authorship Attribution
  - Cheating Prevention
  - Equality of Treatment [2]

- **FLEX** is still in development, next steps will be alpha- and beta testing

- It is planned to release a first version of **FLEX** around mid of 2019

Thanks for your attention! ☺

Are there any questions or comments?

Sources

[1] Hochschulforum Digitalisierung: The Digital Turn: Hochschulbildung im digitalen Zeitalter (2016) https://hochschulforumdigitalisierung.de/sites/default/files/dateien/Abschlussbericht.pdf

[2] B. Küppers, R. Zameitat, U. Schroeder: e-Assessment: Ensuring Equality of Treatment in a BYOD-Setting, EUNIS 2018, Book of Proceedings (2018) http://www.eunis.org/eunis2018/papers/

[3] Søgaard, T. M.: Mitigation of Cheating Threats in Digital BYOD exams, Master's Thesis (2016) https://brage.bibsys.no/xmlui/handle/11250/2410735

[4] Küppers, B.; Politze, M.; Schroeder, U.: Reliable e-Assessment with git: practical considerations and implementation, EUNIS 2017, Book of Proceedings (2017) http://dx.doi.org/10.17879/21299722960

[5] Garay, J. A. and Huelsbergen, L.: Software Integrity Protection Using Timed Executable Agents, Proceedings of the 2006 ACM Symposium on Information, Computer and Communications Security, pp. 189-200 (2006)

[6] Hoffman, N.: VM Checking and Detecting (2014) http://securitykitten.github.io/vm-checking-and-detecting/

[7] Namiot, D.; Sneps-Sneppe, M.: On Micro-services Architecture, International Journal of Open Information Technologies (2014)