A Framework for e-Assessment on Students' Devices: Technical Considerations

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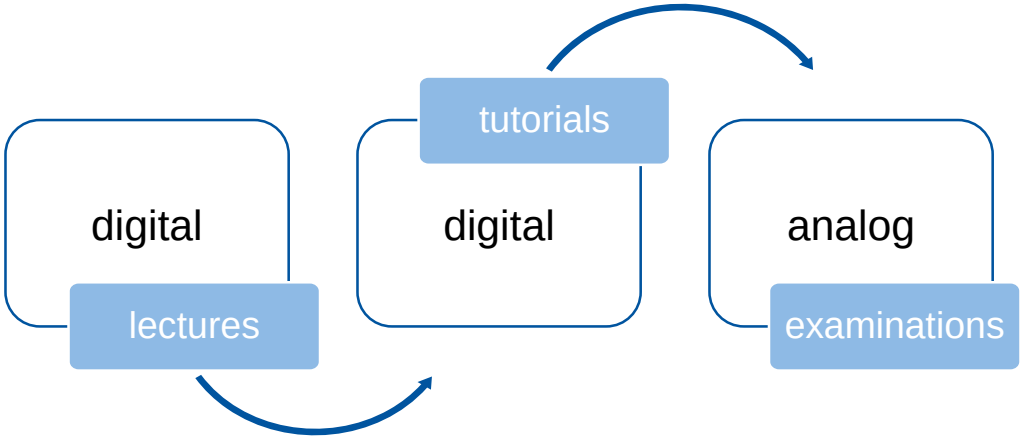
Statement of the Problem [1]

- e-Assessment is not yet well established in higher education (in Germany)
  - Reservations against e-Assessment
    - Reliability / Fairness
    - Security / Cheating
  - Financial reasons



Bring Your Own Device

- Potential solution to financial issues
- Might boost reservations against e-Assessment
- New challenges
  - Diversity of Students' Devices
  - Minimum Requirements
  - Security

→ BYOD approach has to be transparent and comprehensible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E-Assessment and Bring Your Own Device

Our Project: FLEX

FLEX (Framework for FLExible Electronic EXaminations)

Minimum Requirements

- Equality of Treatment
  - Every student has to have the same chances of succeeding as every other student
  - Even in paper-based examinations, the chances are not exactly the same
  - Conclusion: Conditions have to be similar enough to not handicap particular students
- Reliability
  - Storage of results has to be reliable
    - Results have to stay untampered after handing in
    - Results have to be retrievable for an appropriate amount of time

E-Assessment and Bring Your Own Device

Minimum Requirements – State of the Art

- Equality of Treatment
  - Web-based applications treat all users equally, since all users depend on the same server
  - Web browsers are available for every major platform
  - Security tools for e-Assessment are not available for every major platform

- Reliability
  - Many tools to prevent cheating are available
    - Camera Surveillance [2]
    - Online Proctoring using a remote desktop connection [2]
    - LockDown Software [3]
  - There are concerns
    - Effort
    - Security [4]
  - Infrastructure for reliable storage available [5, 6]

Safe Exam Browser

Respondus
Assessment Tools for Learning Systems

Questionmark

git

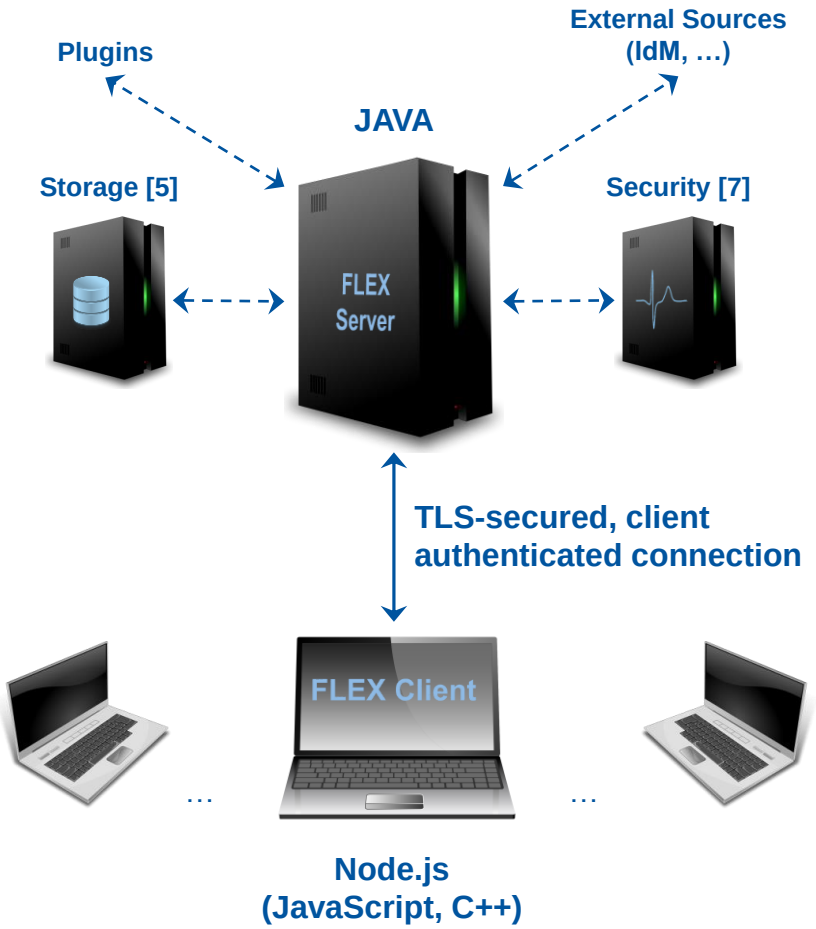
[P1, P2, P3, P4]

Additional Requirements

- Identification of Students
  - Checking the ID (paper-based Examination, e-Assessment)
- Relation between Results and Students
  - Handwriting (paper-based Examination)
  - Digital Signature (e-Assessment)
    - Public part of signature has to be stored reliably
    - Signature also used to establish secure connection to server
- No administrative privileges
  - Software deployment should be as easy as possible
  - Portable Solution preferred

E-Assessment and Bring Your Own Device

Architecture



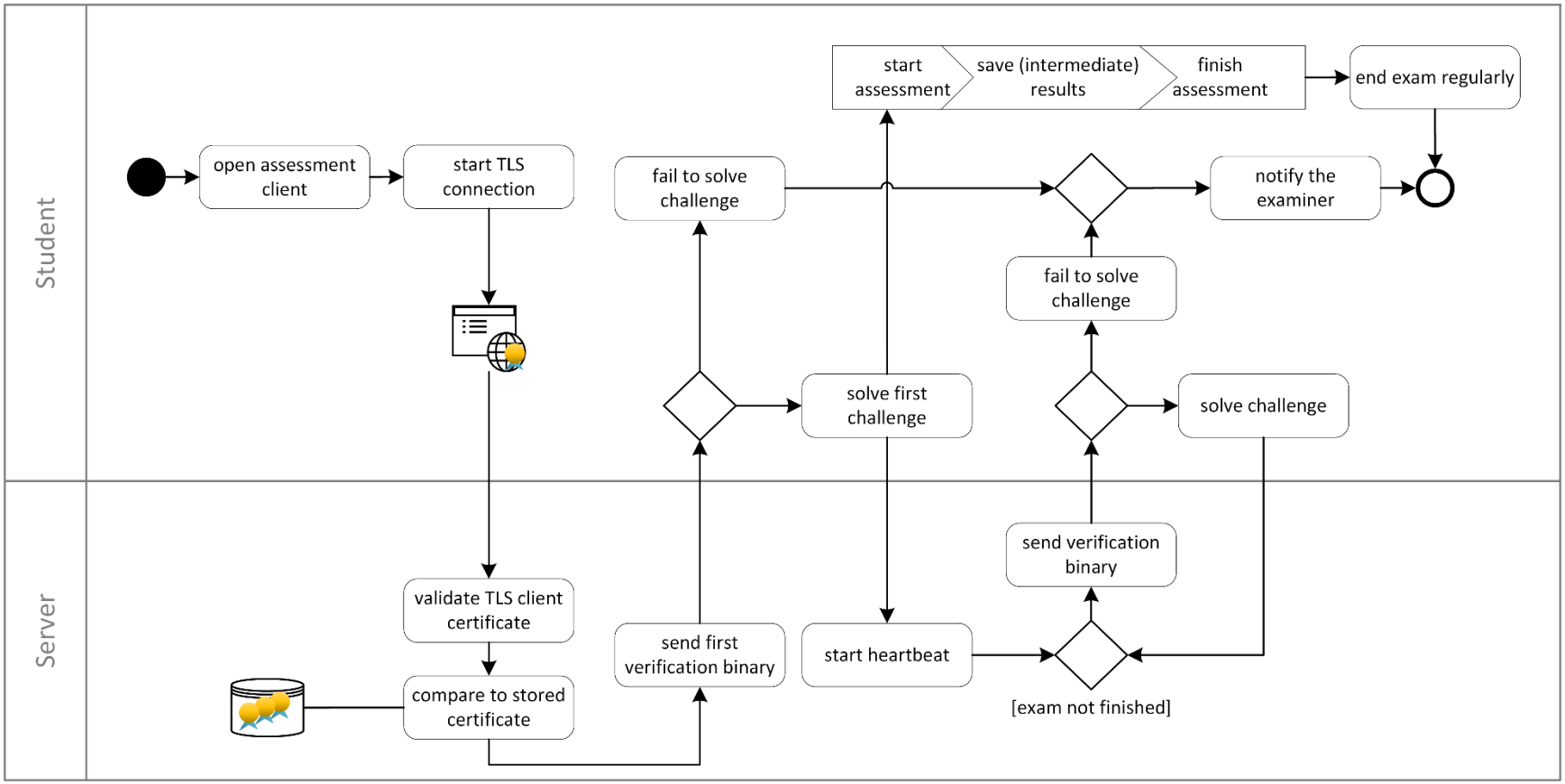
Architecture

- FLEX Client
  - Electron Framework and NodeJS
    - Web-based application
    - Cross-platform
  - Security features as native plugins
  - Modular organization

- FLEX Server
  - JAVA and Linux
  - Three different purposes
    - Identification of students
    - Distribution of assignments
    - Collection of results
  - Implementation as micro service architecture [8]

[P5, P6]

Architecture – Security



[P5, P6]

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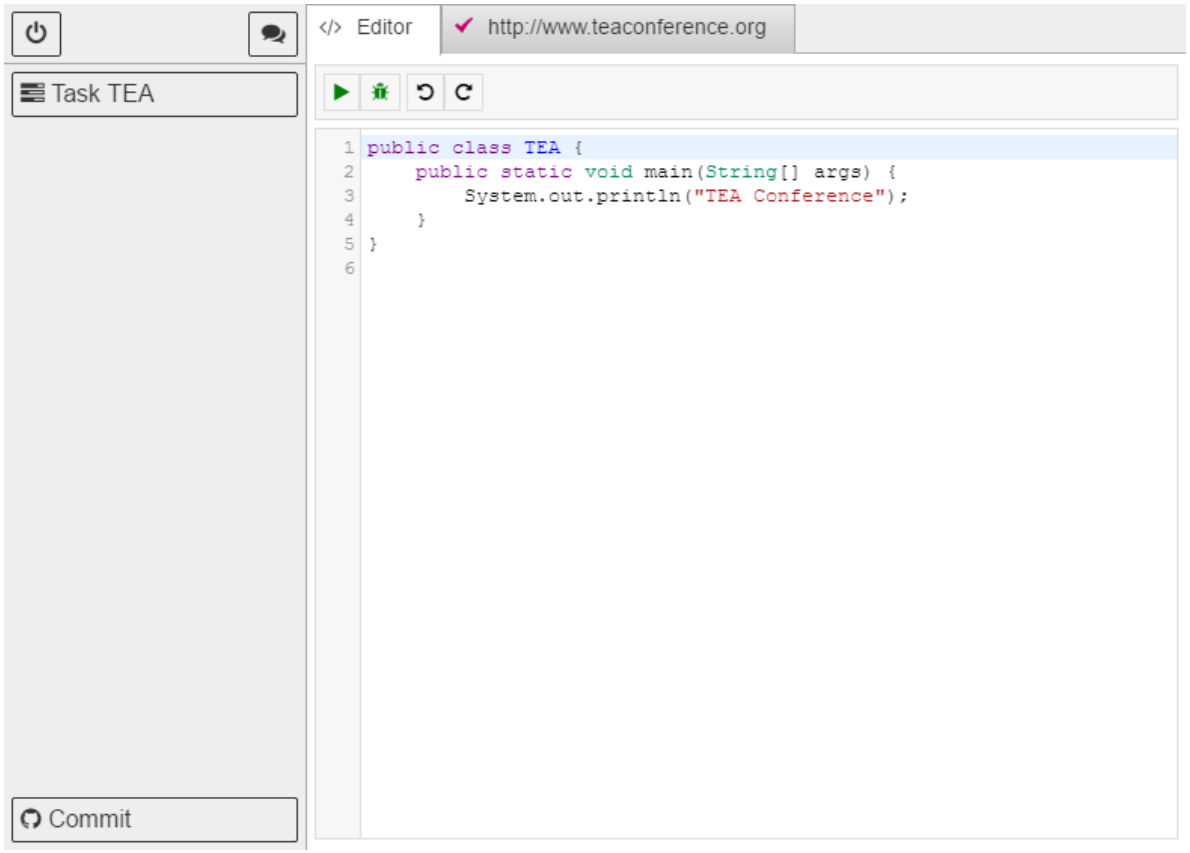
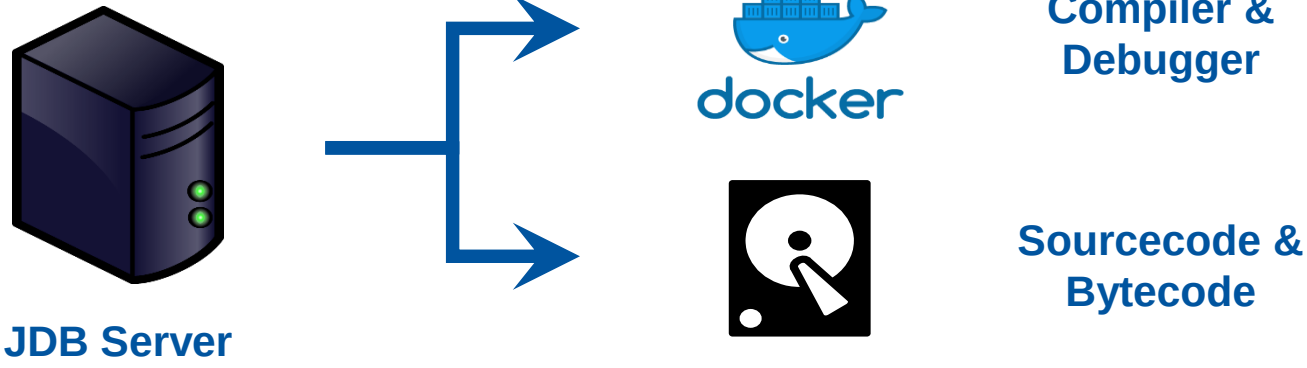
FLEX Client: Programming Assignment



[P5, P6]

FLEX Server: Programming Assignment [9]



[P5, P6]

Summary and Outlook

- FLEX is a framework for e-Assessment on students' devices
- FLEX is in a prototypical state
- More work regarding security and usability has to be carried out

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References

Pictures

[P1] http://safeexambrowser.org/news_en.html
[P2] http://www.respondus.com/products/lockdown-browser/
[P3] https://www.questionmark.com/content/questionmark-secure
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