PA193 - Secure coding principles and practices

Team project: bip39 mnemonic phrase generator (and verifier)

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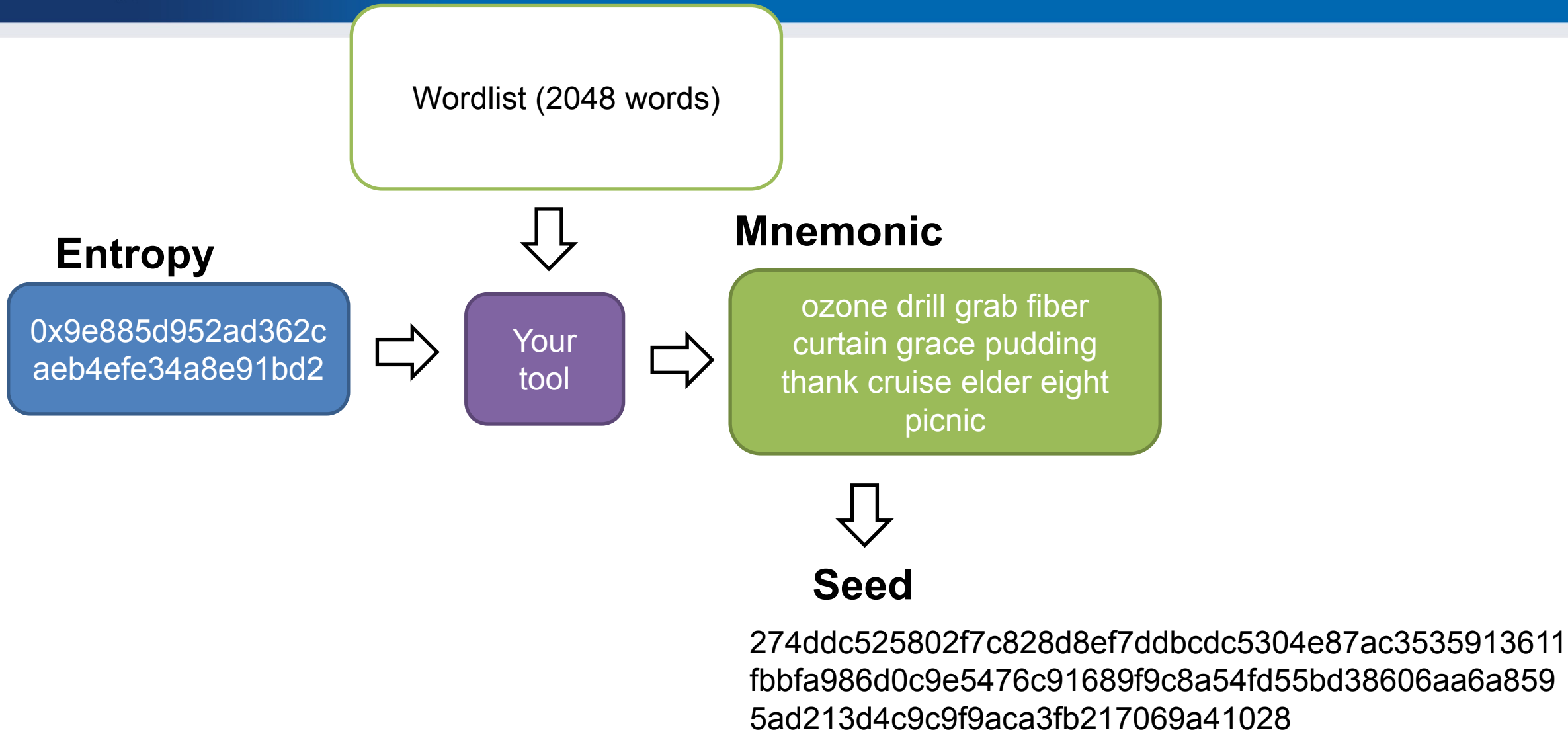
Project idea

1. Write (securely) generator and verifier of bip39 mnemonic phrases
2. Write code as library code with proper API + demonstration usage
3. Analyze own implementation with static and dynamic analysis tools
4. Use GitHub + TravisCI integration for automatic tests, test vectors
5. Review code of other team generator
6. Create patch for selected flaws and open pull request

- https://github.com/bitcoin/bips/blob/master/bip-0039.mediawiki


Wordlist (2048 words)
Entropy
0x9e885d952ad362caeb4efe34a8e91bd2
Your tool
Mnemonic
ozone drill grab fiber curtain grace pudding thank cruise elder eight picnic
Seed
274ddc525802f7c828d8ef7ddbcdc5304e87ac3535913611fbbfa986d0c9e5476c91689f9c8a54fd55bd38606aa6a8595ad213d4c9c9f9aca3fb217069a41028

Required functionality: entropy → seed and phrase

- Input:
  - entropy (binary or hexadecimal string), “9e885d952ad362caeb4efe34a8e91bd2”
- Output:
  - text mnemonic phrase: “ozone drill grab fiber curtain grace pudding thank cruise elder eight picnic”
  - seed: “274ddc525802f7c828d8ef7ddbcdc5304e87ac3535913611fbbfa986d0c9e5476c91689f9c8a54fd55bd38606aa6a8595ad213d4c9c9f9aca3fb217069a41028”

Required functionality: phrase → entropy and seed

- Input: mnemonic phrase
- Output: seed and initial entropy as hexadecimal strings

Required functionality: phrase & seed → OK/NOK

- Input: mnemonic phrase and expected seed
- Output: OK if provided phrase generates expected seed, NOK otherwise

Required functionality: library code with API

- Create core functionality as library code
  - => easy to use in other projects
- Create program “main()” providing command line interface (CLI)
  - cmd-line arguments, std input, read from files…
- Create demonstration of required functionality
- Document usage properly (README.md)

Required functionality

- Implement required in selected language (must be agreed with PetrS)
  - Any language, but:
    - 2 different tools for static analysis must be available
    - 2 different tools for dynamic analysis
    - No repetition of language within the same seminar group
- You must write code yourself, no use of external code or libraries is allowed
  - Exception: SHA2-512, SHA2-256
- Use defensive programming: only valid inputs are accepted, invalid rejected
- Implement tests, cover also following test vectors
  - https://github.com/trezor/python-mnemonic/blob/master/vectors.json

Teams

- 3 people per team
  - Assigned today (within group)
- Teams must use GitHub for cooperation
  - Distribute work load between all members
  - Contribution from all team members must be visible in commits (git commits from the member)
  - Your evaluation will be partially based on your participation
- Start working early, especially with implementation

Immediate next steps (seminar 3.10.2019)

- Form groups, exchange emails, get together, select your language, find required static and dynamic analysis tooling, book with me now
- Setup repo at GitHub '*PA193_mnemonic_XXX*' where XXX is name of your team
  - Create README.md
- Setup GitHub and TrevisCI integration (first test is code compilation)
- Start writing mnemonic generator implementation (use small commits)

Projects - timeline

1. Write code (GitHub): max. **10 points** (**31.10.2019**)
   - Complete implementation + presentation [31.10.2019, your seminar group]

2. Review, attack, present and patch implementations: max. **10 points** (**16.12.2019**)
   - Initial kickoff together with implementation team [31.10.2019]
   - Write patch for a selected bug, open pull request
   - Report + presentations [16.12.2019, Monday 16:00 – all teams together]

- At least 10 points (total) from project are required

TEAMS

- Team BugsBunny (language C):
  - https://github.com/xx/PA193_mnemonic_xxx
  - Member1 <456271@mail.muni.cz>
  - Member2 <456443@mail.muni.cz>
  - Member3 <394097@mail.muni.cz>
- Team SIGSEGVBoys (language C++):
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- Team Hypershell (language Python):
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  - Yorick Kupczyk
- Team BigBugs (language Java):
  - https://gitlab.fi.muni.cz/xdlhopol/PA193_mnemonic_bigbugs
  - Martin Horáček
  - Daniel Dlhopolček
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- Team Bernard's Star (language C++):
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- Team lazy beancounters (language Rust):
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  - Daniel Filakovsky<445605@mail.muni.cz>
  - Antonin Dufka <445281@mail.muni.cz>

- Cyber Warriors (language C):
  - https://github.com/xx/PA193_mnemonic_xxx
  - Ankur
  - Nomit
  - Amal
- Team Slytherin (language Python):
  - https://github.com/xx/PA193_mnemonic_xxx
  - Martin Vondracek
  - Solodkova Elena
  - Samuel Obuch