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Configuration Management

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Language

- Slides are in English
- Papers are in English
- Book is in English

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Language of the Talk?

Task

Hands up if you prefer German.

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Misconfiguration

- *misconfigurations* [1, 8, 10, 11] are a major cause of system failures [4, 5, 9]
- much time needed to fix misconfigurations [3, 4, 7, 11]
- configuration is a user interface for both developers and system administrators

No-Futz

- Holland et al. [2] defined *futzing* to denote *"tinkering or fiddling experimentally with something."*
- With **no-futz computing** Holland et al. [2] mean *"that futzing should be allowed, but should never be required."*
- currently configuration is error-prone and under-specified, *futzing* is often required

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Examples

Not every misconfiguration involves big companies, cloud, and huge amounts of money:

- No internet access because resolv.conf symlink broken.
- KDE crash because of ulimit setting.
- Out-of-service of computers during exam.

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First Assignment

- Have you already experienced misconfiguration?
- Did you read about misconfiguration in the news?

Task
Discuss with your neighbor and tell us the best stories.

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Content Overview

1. Motivation

2. Content Overview
   - Terminology
   - Requirements
   - Topics

3. Organisation
   - Preliminaries
   - Grades
   - Assignments

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Terminology

Terminology

Definition

A *configuration setting*, or *setting* in short, fulfills these properties:

1. It is provided by the execution environment.

2. It is *consumed* by an application.

3. It consists of a key, a configuration value, and potentially *metadata*. The *configuration value*, or *value* in short, influences the application's behavior.

4. It can be *produced* by the maintainer, user, or system administrator of the software.

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Requirements

Requirement

A configuration library must be able to integrate (legacy) systems and must fully support (legacy) configuration files.

Requirement

Validation of configuration settings must happen systematically before the application is even started.

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Requirements

Requirements

Task

Discuss about requirements a configuration framework should fulfil.

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Topics

Topic: *sources of configuration*

- semi-structured data
- configuration file formats
- command-line arguments
- environment variables

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Topics

Topic: *design and architecture of configuration and configuration access*

- architectural decisions
- introspection
- code generation
- variability

Topic: *reduction of misconfiguration and configuration duplicates*
Misconfiguration obviously needs configuration. We will discuss the ideas of:

- complexity reduction
- when configuration is needed (decisions, user interface)
- configuration-less systems (auto-detection)
- how duplication can be avoided (generation of artifacts)
- testability (generation of test cases)

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Topics

Further topics:

- *context-awareness* (context-oriented programming)
- *avoidance of dependences*
- *cascading configuration*
- *strategies for validation and modularization*
- *documentation of configuration*

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Topics

Task

Break.

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Topics

Topic: *sound, complete and early detection of misconfiguration*

- points in time for configuration access and validation
- validation techniques
- constraints

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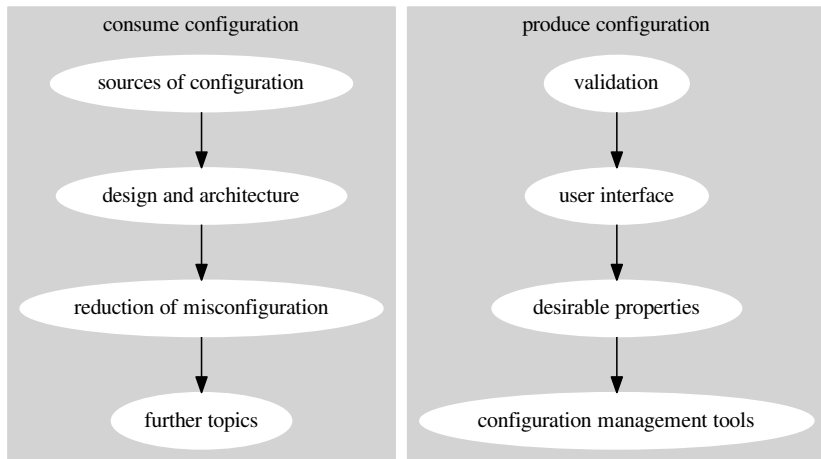0000000000000000

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Topics

Topic: *configuration as user interface*

- How system administrators work.
- Which user interfaces exist.
- How to specify configuration.

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Topics

Topic: *desirable properties of configuration*

- self-description
- changeability
- idempotence
- round-tripping

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Topics

Topic: *configuration management tools*

- Puppet
- Chef
- Ansible
- CfEngine
- Nix
- many others...

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Topics

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Topics

Elektra

- Elektra improves configuration management.
- Configuration management tools can use Elektra.
- Elektra implements what we discuss in this lecture.
- Elektra allows applications to fulfil the requirements we will discuss.
- Obviously you will also be able to apply the knowledge from this LVA without Elektra.
- Developed at TU Wien (https://libelektra.org).

In which topics are you interested?

Task (1)

Choose a partner for this task.

Task (2)

Go to stations and discuss topic with your partner.

Task (3)

Write down the most interesting topics. (Can be topics of stations or new topics.)

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   - Assignments

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Preliminaries

Communication:

- TISS (forum and news)
  https://tiss.tuwien.ac.at/course/courseDetails.
  xhtml?courseNr=194030&semester=2019S
- GitHub (private and public repository)
  https://git.libelektra.org
- EMail markus.raab@complang.tuwien.ac.at
- before/after/during lectures

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Preliminaries

Task

Create a pull request to the Elektra Repository. The pull request description should contain "CM". With the account you used, you will get access to a private repository.

Deadline: 13.03.2019 23:59

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Preliminaries

Previous Knowledge

- Obviously *no* prior knowledge about Configuration or Configuration Management necessary.
- If you already have experience, you can use it in your talk and assignments.
- Knowledge about large-scale software construction is beneficially.
- You should have some understanding of software engineering and software requirements.
- Programming skills is a must.

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Preliminaries

Programming Languages

Elektra supports following programming languages:

- C
- C++
- Java
- Haskell
- Ruby
- Python
- Lua

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Grades

You will get a grade once you submitted a PR with "CM" in the description.

To get a positive grade:

- All parts must be done.
- All parts must be positive.

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Grades

Grade is calculated from:

    30 %: homework

    30 %: team exercise

    10 %: talk

    30 %: test

      +: extrapoints

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Assignments

Talk

about anything related to configuration management.

- The duration must be 20 minutes.
- It must be about your experience.
  - E.g., about the homework you did.
  - I.e., not only about study of literature.
  - If you extensively use some tool before, please share your experience.

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Assignments

Homework

The homework consists of three parts:

1. Play around with Elektra, create a PR with anything you find.
   For example:
   - Improve a tutorial or write a new one (if none exists).
   - Write new examples.
   - Write new tests.
   - Fix documentation.

2. Fix five bugs (from the pool of issues, or assigned by me based on your skills)

3. Implement a non-trivial feature, for example:
   - Make a configuration management tool use Elektra.
   - Write a validation plugin.
   - Write support for a new configuration file format (with an existing parser).

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Assignments

Task

Think about a talk and homework till next week. Write it down in the private repository (first come, first served).

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Assignments

Team Exercise

You can select your team (2 people) and your task related to *improve* configuration management. Every team member has a different task:

1. Elektrify some application.
2. Configure the application using Configuration Management.

And then swap roles and start again with different task.

If possible, you should use the parts developed in the homework.

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Assignments

Task

Talk with someone who is not necessarily your neighbor about a potential collaboration in the team exercise.

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Assignments

Lecture is every week Wednesday 09:00 - 11:00.

06.03.2019: topic, teams

13.03.2019: registration, initial PR

20.03.2019: Guest Lecture

27.03.2019: (HS?)

03.04.2019:

08.05.2019: (HS?)

10.04.2019: mid-term submission of exercises

15.05.2019:

22.05.2019:

29.05.2019:

05.06.2019: final submission of exercises

12.06.2019:

19.06.2019: last corrections of exercises

26.06.2019: exam

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Assignments

Guest Lecture?

Title: Formal Foundations of Configuration Management for Program Analysis

Name: Jürgen Cito, MIT

Date/Time: 20.03.2019, 09:00 (c.t.)

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Assignments

Questions?

Task

Please register for the course and start playing with Elektra.

Task

Any questions?

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     applications (cmu-pdl-05-109). *Parallel Data Laboratory*,
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[10] Tianyin Xu and Yuanyuan Zhou. Systems approaches to tackling configuration errors: A survey. *ACM Comput. Surv.*, 47(4):70:1–70:41, July 2015. ISSN 0360-0300. doi: $10.1145/2791577$. URL http://dx.doi.org/10.1145/2791577.

[11] Zuoning Yin, Xiao Ma, Jing Zheng, Yuanyuan Zhou, Lakshmi N. Bairavasundaram, and Shankar Pasupathy. An empirical study on configuration errors in commercial and open source systems. In *Proceedings of the Twenty-Third ACM Symposium on Operating Systems Principles*, SOSP '11, pages 159–172, New York, NY, USA, 2011. ACM. ISBN 978-1-4503-0977-6. doi: $10.1145/2043556.2043572$.