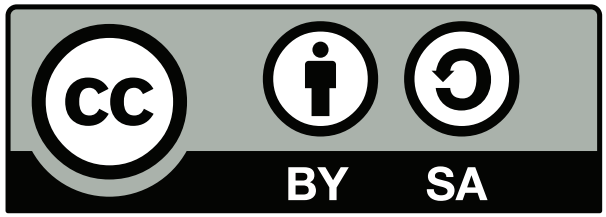
L03 Configuration Integration

Markus Raab

Institute of Information Systems Engineering, TU Wien

24.03.2021



Configuration Libraries

Configuration Access APIs

An ***application programming interface (API)*** defines boundaries on source code level. Better APIs make the execution environment easier and more uniformly accessible.

Configuration access is the part of every software system concerned with fetching and storing configuration settings from and to the execution environment. There are many ways to access configuration [1, 2, 4]. ***Configuration access APIs*** are APIs that enable configuration access.

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- `long pathconf (const char *path, int name)`
- `long sysconf (int name)`
- `size_t confstr (int name, char *buf, size_t len)`

Configuration Access Points

Within the source code the ***configuration access points*** are configuration access API invocations that return configuration values.

```
1 int main()
2 {
3     getenv ("PATH");
4 }
```

Configuration Libraries

Configuration libraries provide implementations for a configuration access API.
Trends:

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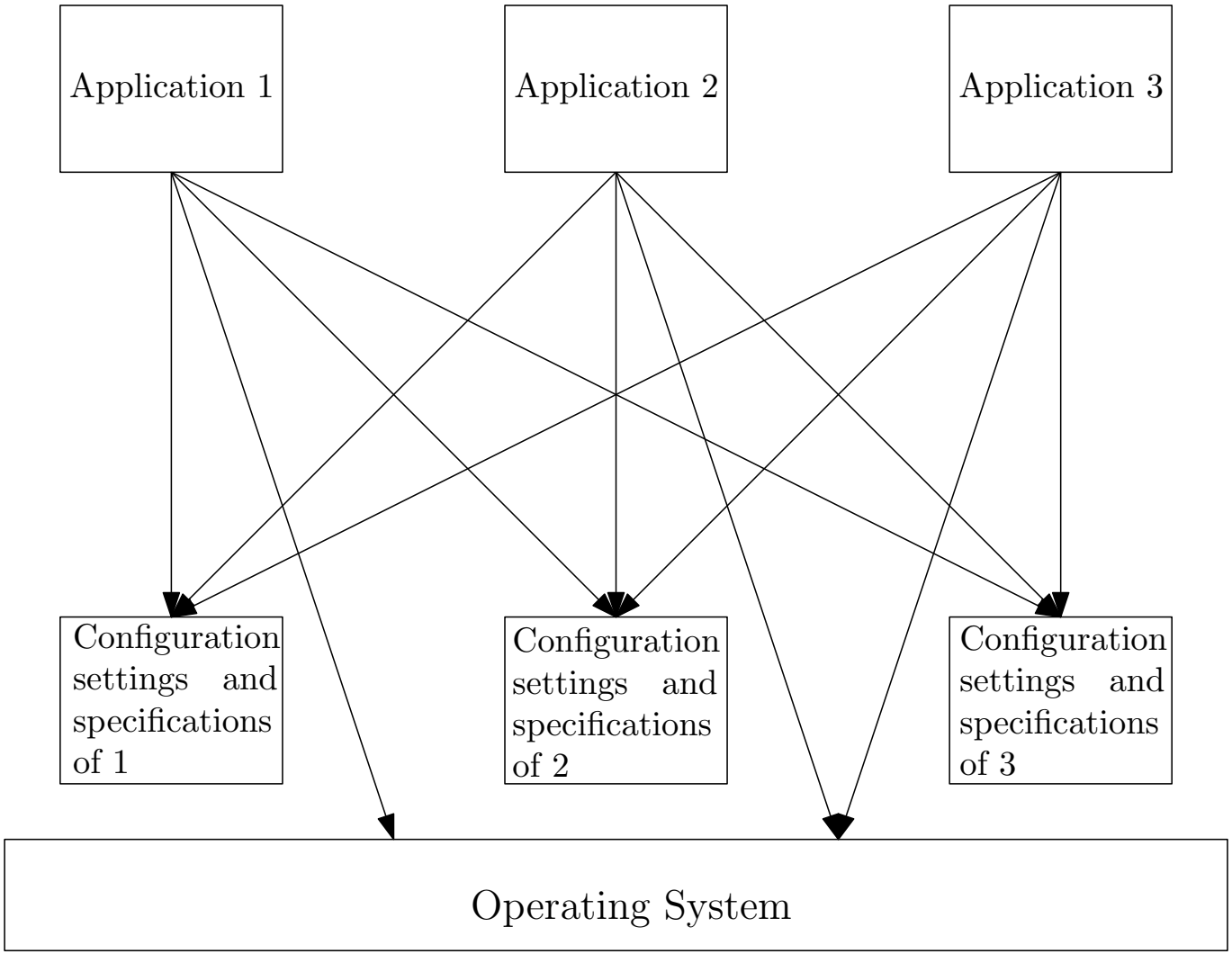
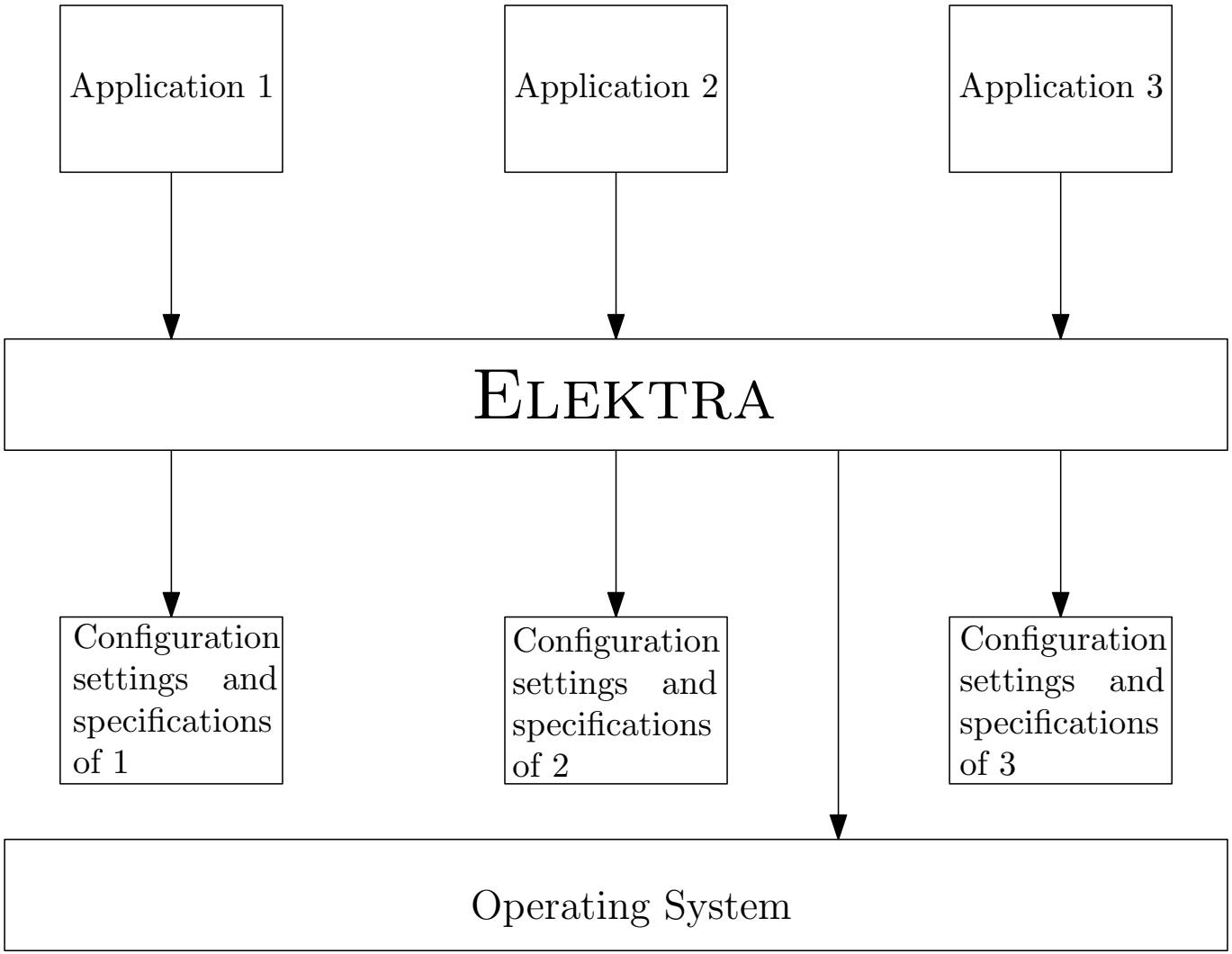
- configuration integration (UCI, Augeas, Elektra)

Current Situation



Wanted Situation



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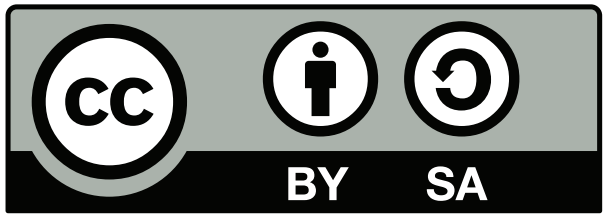

Lightweight to Strong Integration

Lightweight Integration

Specify already-existing configuration files:

```
1 [ntp]
2   mountpoint:=ntp.conf
3   infos/plugins:=ntp
```

Works well for configuration management tools.

Medium Integration

Having frontends that implement existing **APIs** decouple applications from each other. These applications continue to use their specific configuration accesses, but ELEKTRA redirects their configuration accesses to the shared key database.
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Also needs application-specific specifications.

Strong Integration

Change the application so that it directly uses Elektra.
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Advantages:

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- more type safety
- administrators can choose configuration file formats
- notification and logging
- only one parser involved
- no specification for binding needed
- no built-in defaults: everything is introspectable

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Different implementations strategies:

- have some application-specific API which uses `KeySet`
- use one of KeySet's language bindings
- use Elektra's high-level API (currently only C)
- use code generation

Strong Integration

Examples:

- LCDproc
- Oyranos
- for GNOME: `gsettings`
- for KDE: `kconfig`

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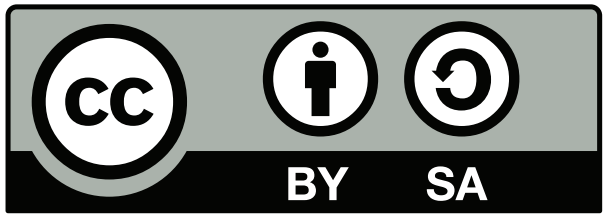

Sharing Configuration

- idea: make default values better
- generalization of sharing configuration values
- examples: language settings, default printer, ...

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Can be derived from:

- other configuration settings (override/fallback)
- context [3]
- hardware/system (problem with dependences)

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Can be derived from:

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- context [3]
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- XServer vs. gpsd

Examples

Context:

```
1 [slapd/threads/listener]
2 context :=/slapd/threads/%cpu%/listener
```

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```
1 [slapd/threads/listener]
2 context:=/slapd/threads/%cpu%/listener
```

Calculation with conditionals plugin
(e.g., switch off GPS if battery low):

```
1 [gps/status]
2 assign:=(battery > 'low') ? ('on') : ('off')
```

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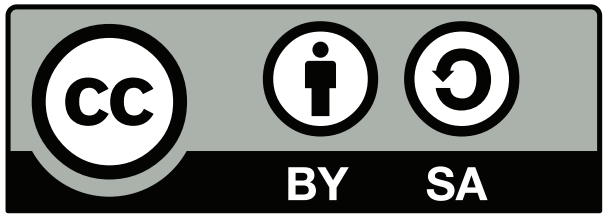

Meeting

Task

Do you have any questions?

Task

Which configuration access APIs do you know?
What are the differences between these APIs?

Question

How can we make applications to honor the configuration specification?

Question

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Answer

Elektrify: Make the application use a configuration library that has support for configuration specifications.

Question

Which forms of configuration integration exist?

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Answer

- Lightweight Integration: Mount existing configuration files for configuration management tools
- Medium Integration: Specify how to access via existing APIs
- Strong Integration: Modify the application.

Question

After we integrated some application, how can we share configuration settings?

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Answer

- Override/fallback links.
- Calculate/transform values.
- Mount context/hardware/system information.

Task

Explain mounting.

Develop with Elektra

Task

Can you already compile software using Elektra?

Teams

Task

All teams formed?

Issues

Task

Did you find suitable issues?

Reformatting

Task

Can you reformat the code?

Running Tests

Task

Can you run all the tests?

Feedback

- Videos?
- More or less materials?
- Do you use semester schedule?
- Any suggestions for improvements?

L04: Sources of Configuration

- Configuration file formats
- Environment variables
- Command-line arguments

[1] Dongpu Jin, Xiao Qu, Myra B. Cohen, and Brian Robinson. Configurations everywhere: Implications for testing and debugging in practice. In *Companion Proceedings of the 36th International Conference on Software Engineering*, ICSE Companion 2014, pages 215–224, New York, NY, USA, 2014. ACM. ISBN 978-1-4503-2768-8. doi: 10.1145/2591062.2591191. URL `http://dx.doi.org/10.1145/2591062.2591191`.

[2] Emre Kiciman and Yi-Min Wang. Discovering correctness constraints for self-management of system configuration. In *International Conference on Autonomic Computing, 2004. Proceedings.*, pages 28–35. IEEE, May 2004. doi: 10.1109/ICAC.2004.1301344.

[3] Markus Raab and Gergö Barany. Introducing context awareness in unmodified, context-unaware software. In *Proceedings of the 12th International Conference on Evaluation of Novel Approaches to Software Engineering - Volume 1: ENASE,*, pages 218–225. INSTICC, ScitePress, 2017. ISBN 978-989-758-250-9. doi: 10.5220/0006326602180225.

[4] Tianyin Xu, Jiaqi Zhang, Peng Huang, Jing Zheng, Tianwei Sheng, Ding Yuan, Yuanyuan Zhou, and Shankar Pasupathy. Do not blame users for misconfigurations. In *Proceedings of the Twenty-Fourth ACM Symposium on Operating Systems Principles*, pages 244–259. ACM, 2013.