

# Configuration Revolution

Why it needed 13 years and how it will be done

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*Fosdem 2018*

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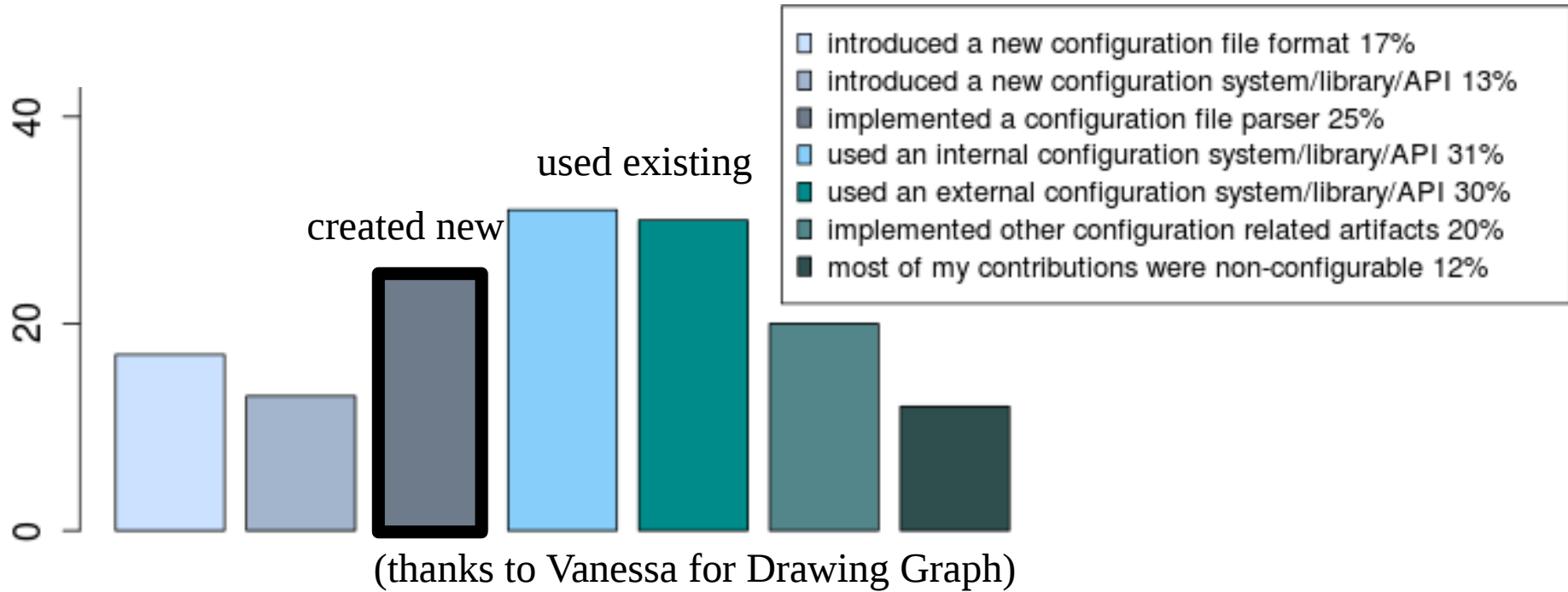
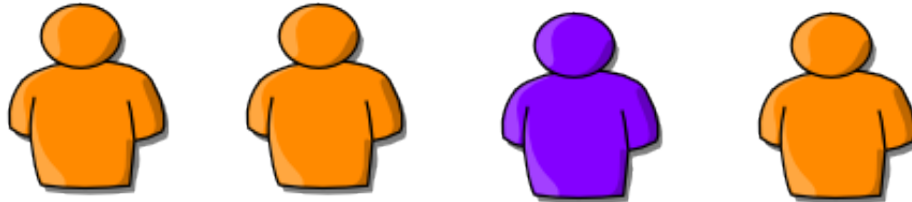
xmpp: [jabber@markus-raab.org](xmpp:jabber@markus-raab.org)

<http://www.libelektra.org>

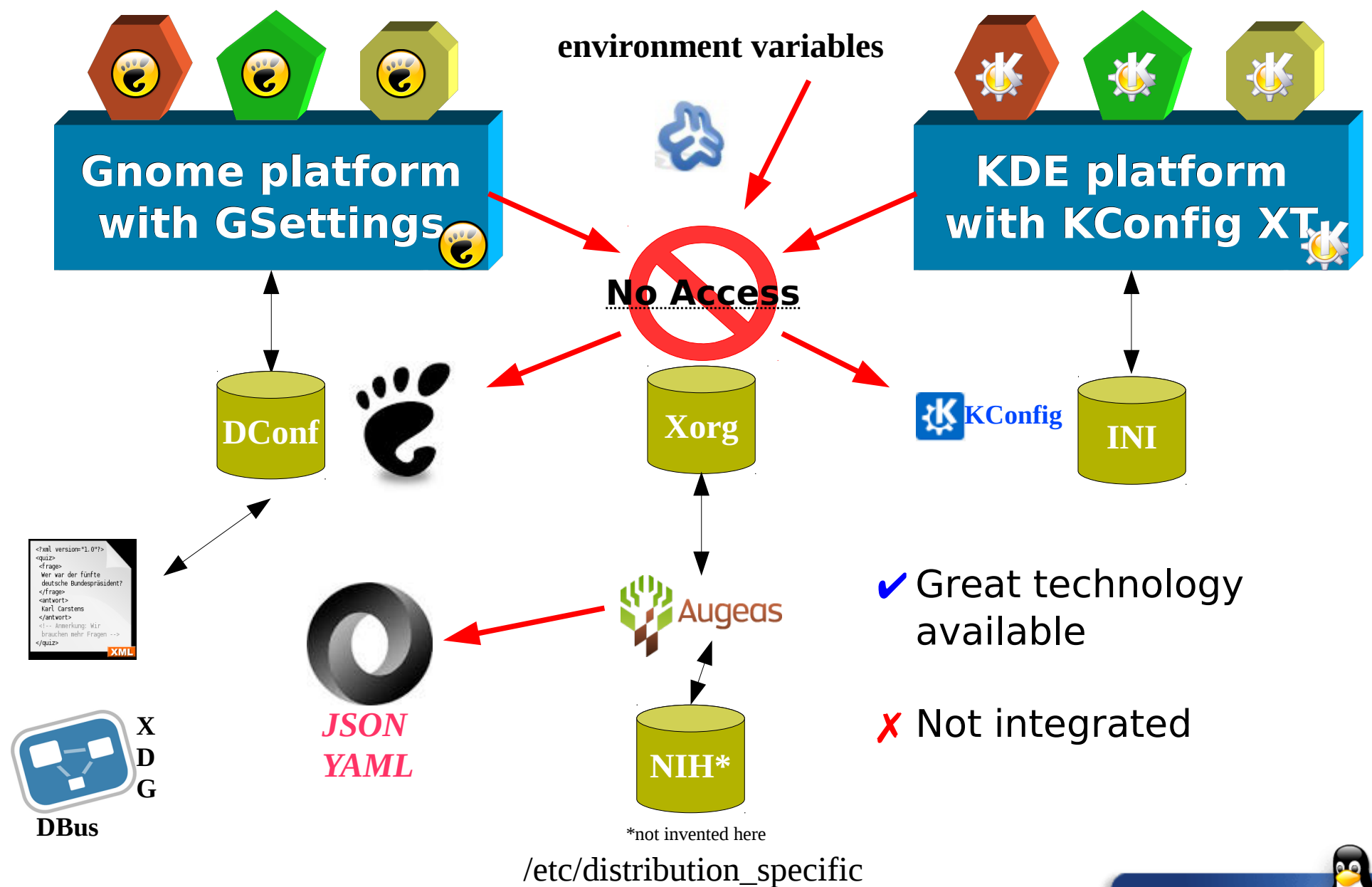


# Time is valuable

➤ 25% reinvented the same wheel (me included)



# What is wrong with Configuration?



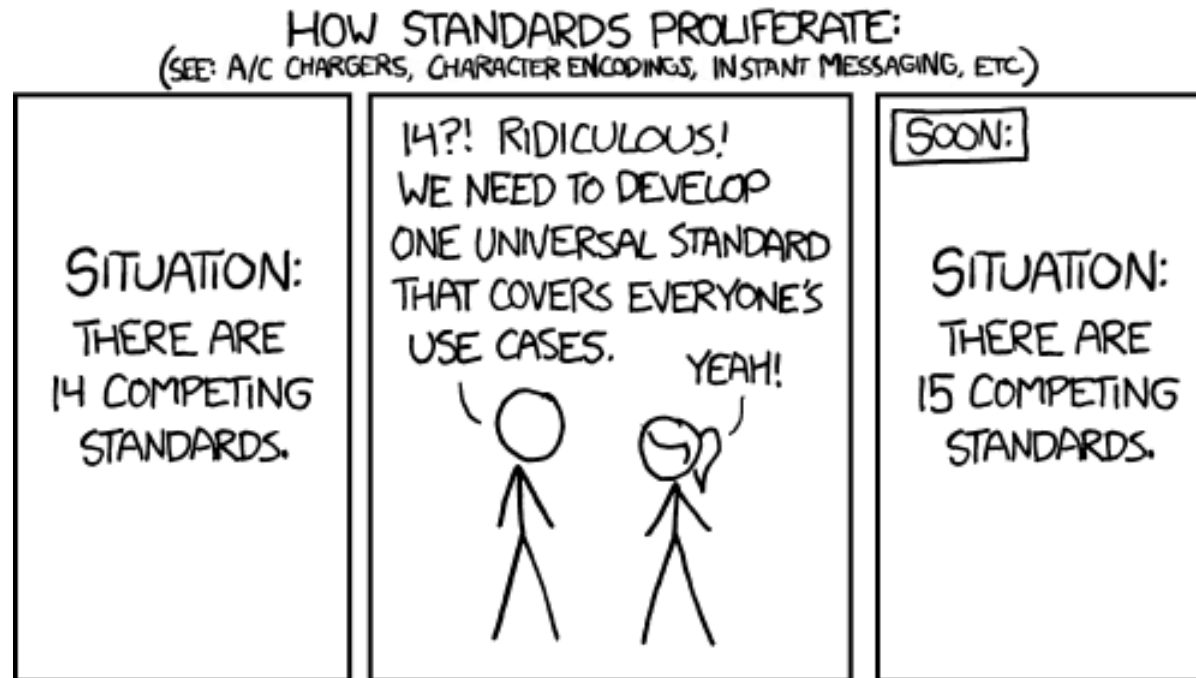
# Where are we heading?

- *Many formats*
- *Weak tooling*
- *Little documentation*
- *No specification*
- *Not declarative*
- *Not transparent*
- *System administrators have no easy life*



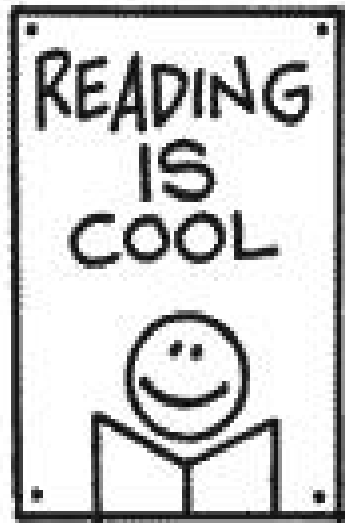


# How to (not) change the situation?

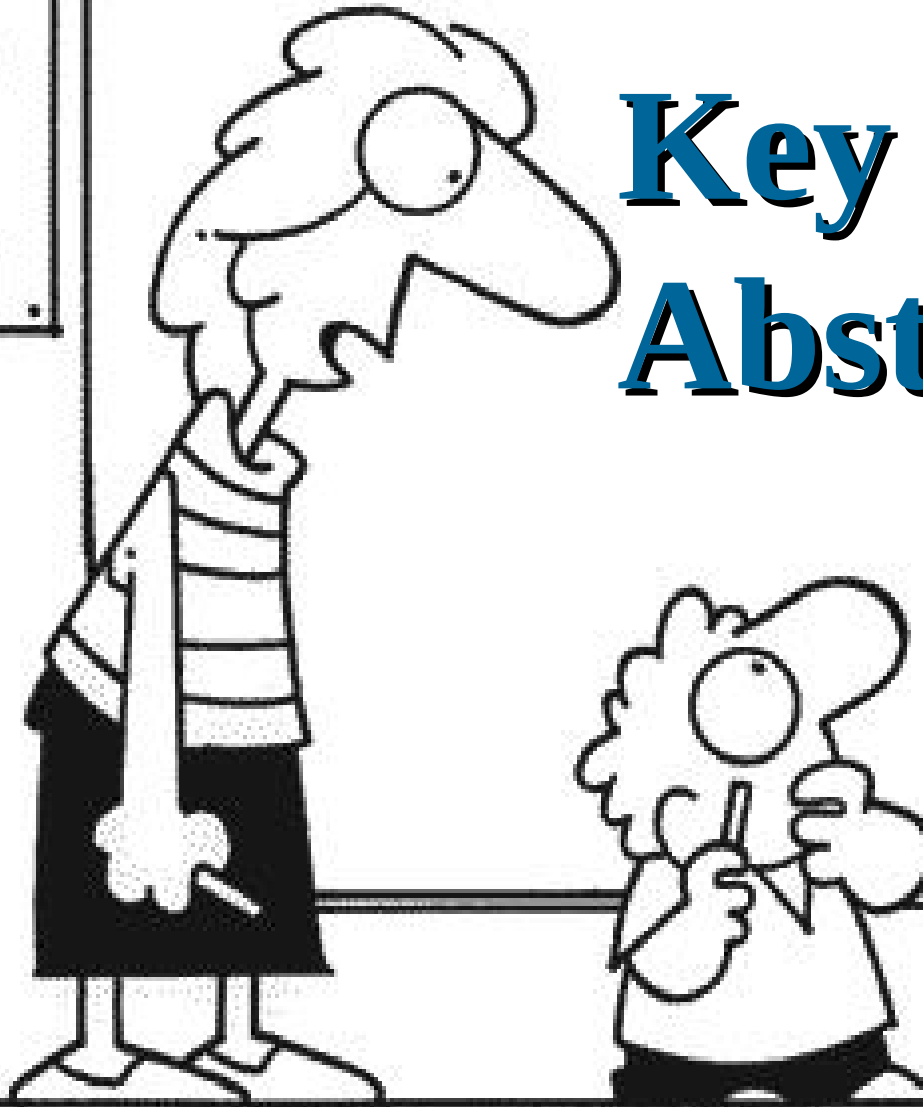


(Thanks to xkcd.com)





# Key Message: Abstraction



GLASBERGEN

**“There aren’t any icons to click. It’s a chalk board.”**

# Ladder of Abstraction



➤ *Abstract Nonsense*

➤ ...

➤ *Key/Value Spec.*

➤ *Key/Value Access*

➤ *File System*

➤ *Block Devices*

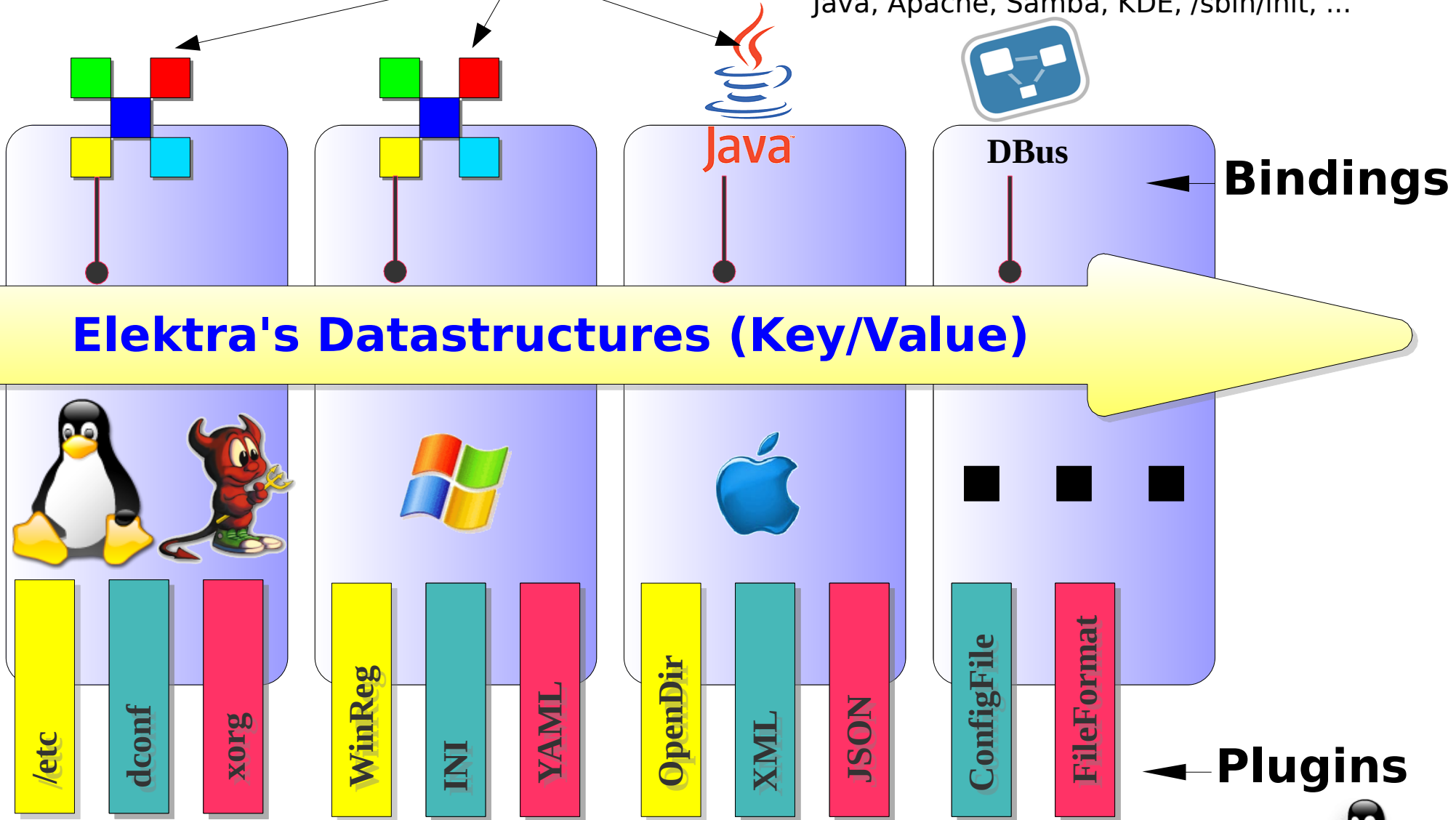
➤ *Bits on Harddisc*



# What is the Goal?

## Portable and non-portable software

Java, Apache, Samba, KDE, /sbin/init, ...

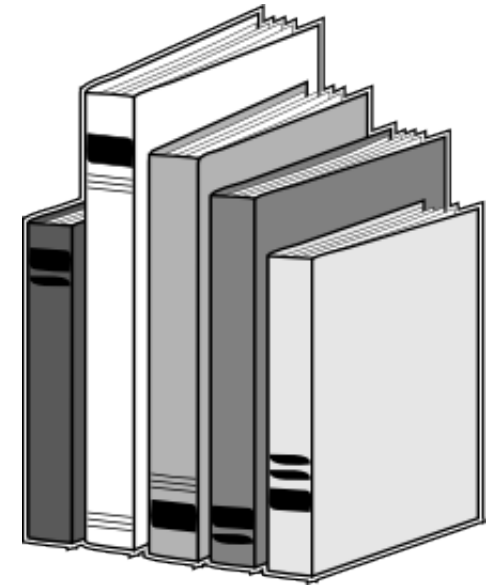


<http://www.libelektra.org>



# What we did

- *Online Questionnaire*
  - from 672 persons 286 gave answers, 162 completed
- *Source Code Analysis*
  - 50 million LOC
- *User Studies*
- *Case Studies*



<b>application</b>	<b>version</b>	<b>application</b>	<b>version</b>
Oad	0.0.17	Gimp	2.8.14
Akonadi	1.13.0	Inkscape	0.48.5
Chromium	45.0.2454.85	Ipe	7.1.4
Curl	7.38.0	Libreoffice	4.3.3
Eclipse	3.8.1	Lynx	2.8.9dev1
Evolution	3.12.9	Man	2.7.0.2
Firefox	38.3.0esr	Smplayer	14.9.0 ds0
Gcc	4.9.2	Wget	1.16

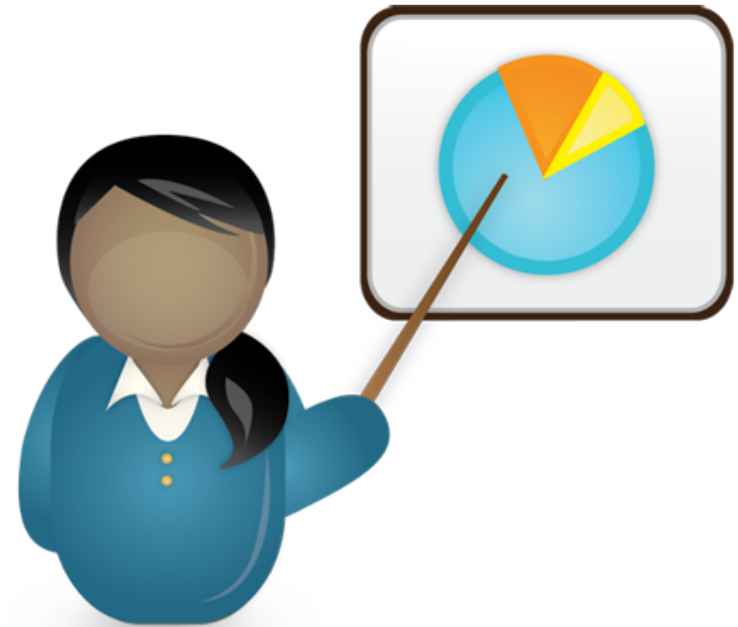




# Content for Today

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- I.** *Popular Ways for Configuration*
- II.** *Trend in Number of Configuration Options*
- III.** *Auto Detection*
- IV.** *Validation*
- V.** *Elektra*



# I. Popular Ways for Configuration

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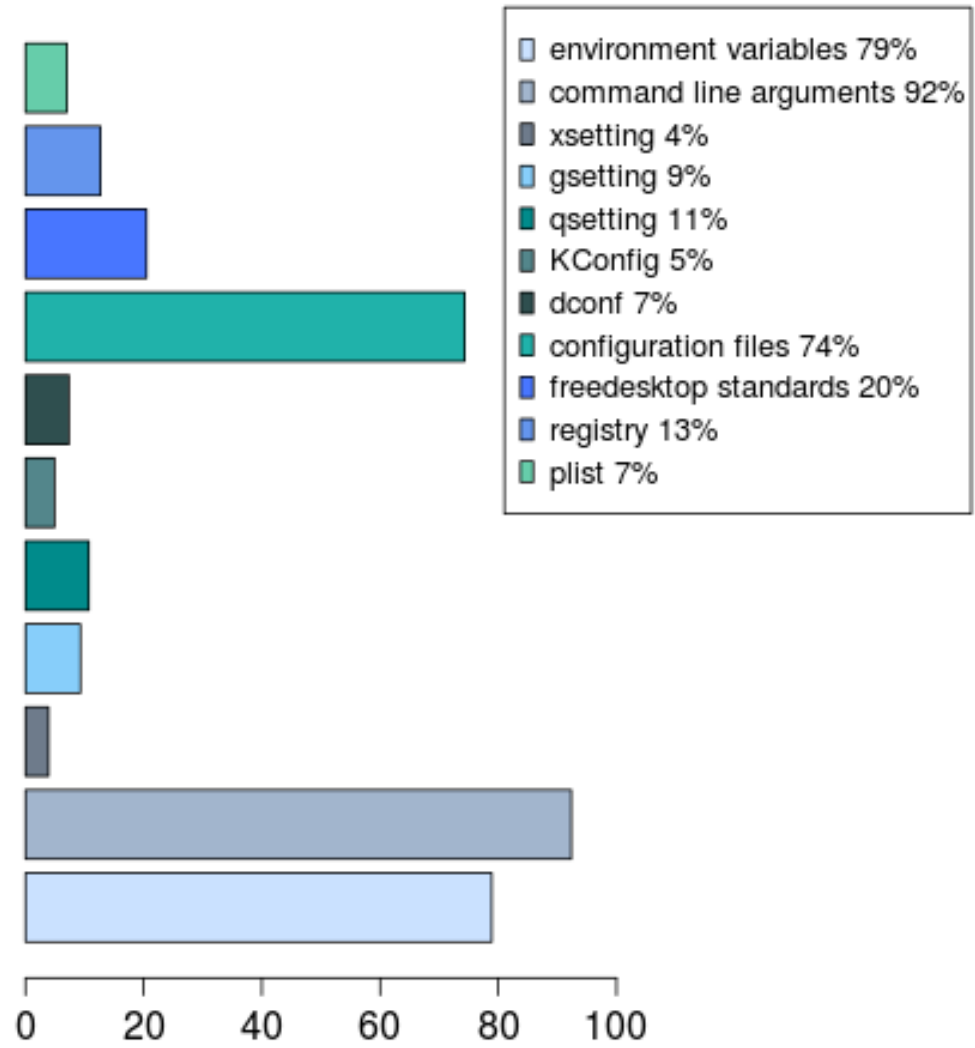
Markus Raab <elektra@markus-raab.org>

<http://www.libelektra.org>



# And the Winners are...

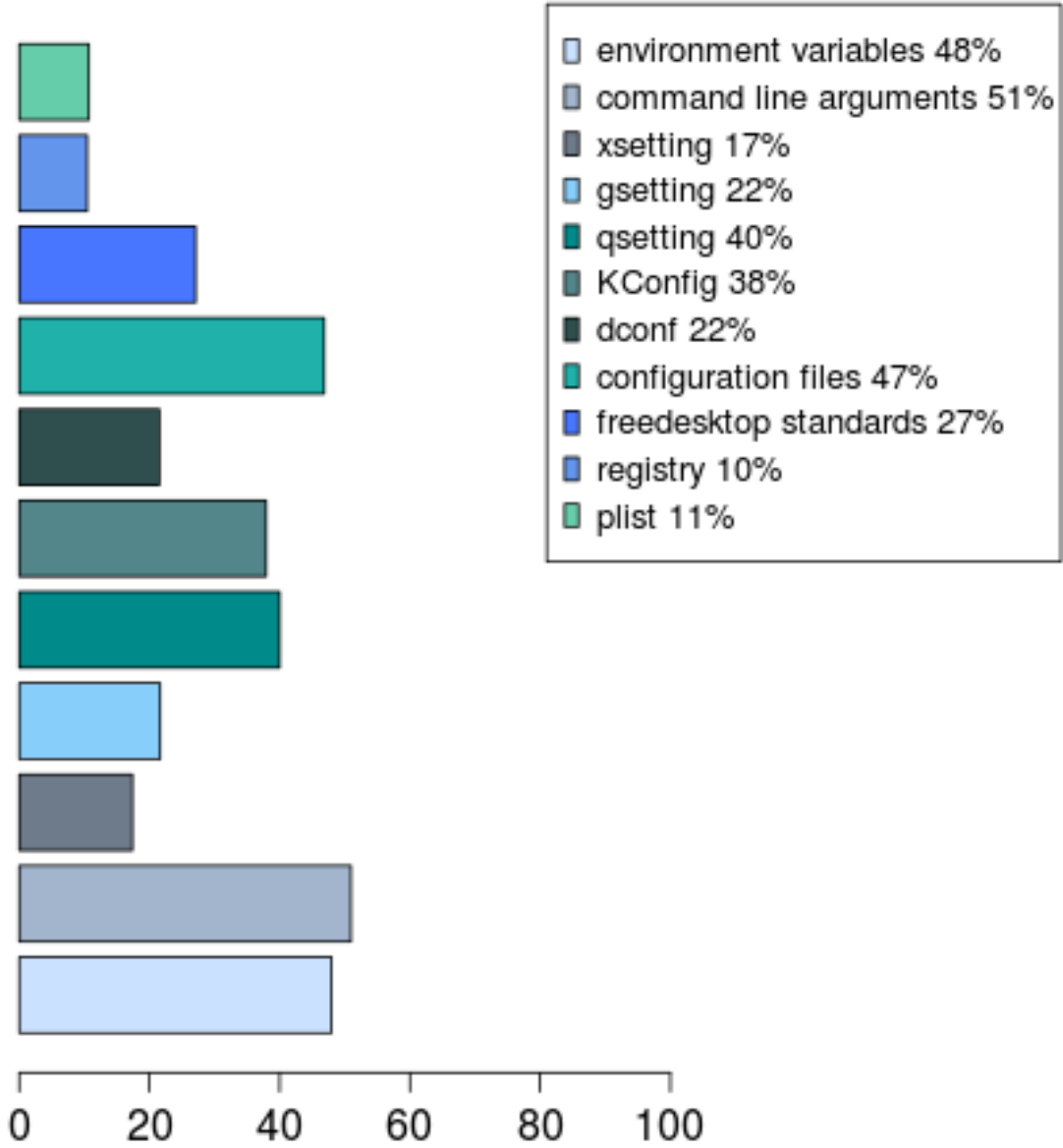
- *command-line arguments*
- *environment variables*
- *configuration files*



# Satisfaction



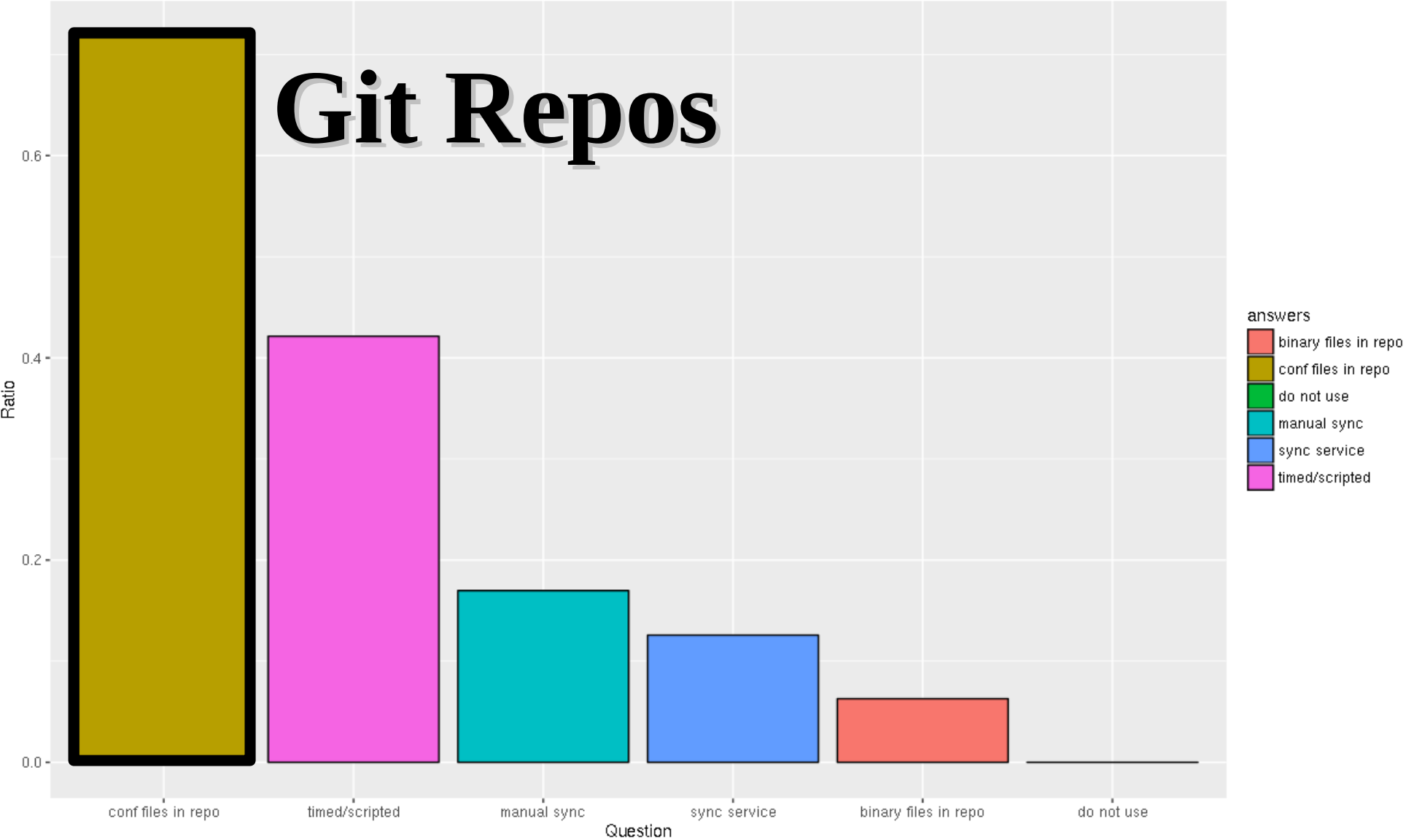
➤ *similar to popularity*



# How to backup?

What is your preferred way to backup, sync or share configurations?

## Git Repos



(thanks to Marvin for Drawing Graph)

<http://www.libelektra.org>





# Abstraction I: Key/Value



➤ *INI*



➤ *XMLTool*

➤ *Augeas:*

➤ *Hosts*

➤ *Fstab*

➤ *INI*

➤ *JSON*

➤ *TCL*

➤ *Line*

➤ *CSV*

➤ *Hosts*

➤ ...

```
[env]
ls = ls -FH
vnc = vncserver
```

```
<?xml version="1.0"
encoding="UTF-8"?>
<keyset xmlns=""
xsi:schemaLocation=""
parent="user/env/alias">
<key basename="ls"
type="string"
value="ls -Fh"
<comment></comment>
</key>
<key basename="vnc"
type="string">
<value>vncserver
</value>
<comment></comment>
</key>
</keyset>
```



# Abstraction I: Data Structure

```
aviram@sampa:~/src/elektra - Shell - Konsole
Session Edit View Bookmarks Settings Help
$ EDITOR=kate kdb editor system/filesystems xmltool

kdbeditNv8vm6 [modified] - Kate
File Edit Document View Bookmarks Tools Sessions Settings Window Help

<?xml| version="1.0" encoding="UTF-8"?>
<!-- Generated by Elektra API. Total of 66 keys. -->
<keyset xmlns="http://www.libelektra.org"
  parent="system/filesystems">
  <key basename="mediacdrecorder/mpoint"
    type="string" uid="root" gid="root" mode="0644">
    <value>/media/cdrecorder</value>
    <comment>Mount point</comment>
  </key>
  <key basename="mediacdrecorder/options"
    type="string" uid="root" gid="root" mode="0644">
    <value>pamconsole, fscontext=system_u:object_r:removable_t, exec,noauto,me
    <comment>Filesystem specific options. See mount(8)</comment>
  </key>
  <key basename="mediacdrecorder/device"
    type="string" uid="root" gid="root" mode="0644"
    value="/dev/hdc">
    <comment>Device or Label</comment>
  </key>
```

- any syntax mappable to key/value
- any API
- any language
- edit any configuration file format in any editor



# Abstraction I: Namespaces

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- ◆ [/sw/org/myapp/#0/current](#) uses all of below
- ◆ [system](#) namespace is stored below [/etc/config/](#)
- ◆ [user](#) namespace is stored below [~/.config/](#)
- ◆ [dir](#) like .git or .htaccess
- ◆ [proc](#) namespace is for the current process (**cmdline+env**)



## II Trend in Number of Configuration Options

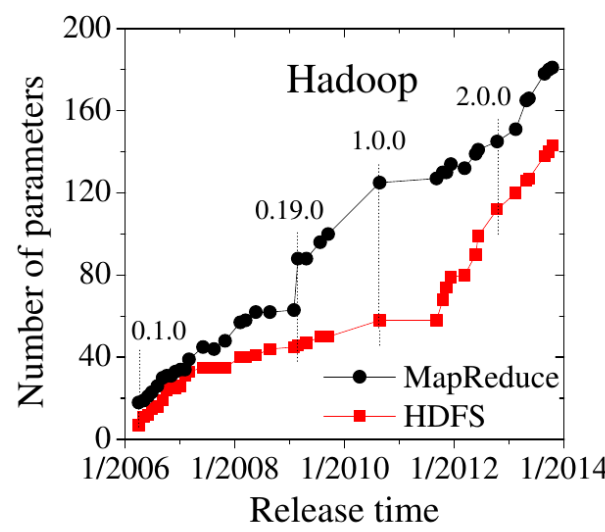
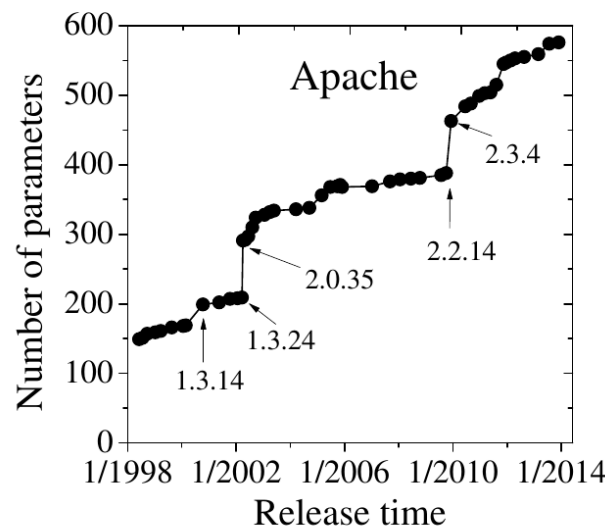
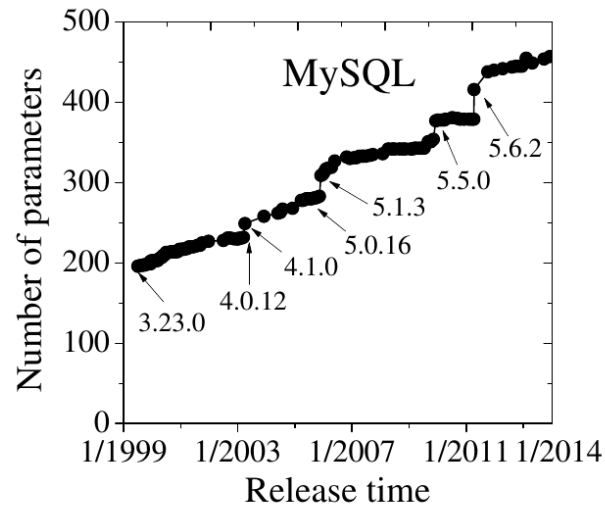
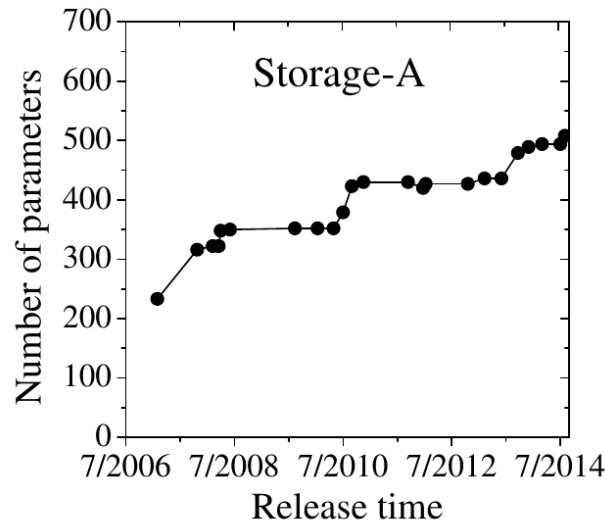
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# Trend (1)



(thanks to Xu for Graph)

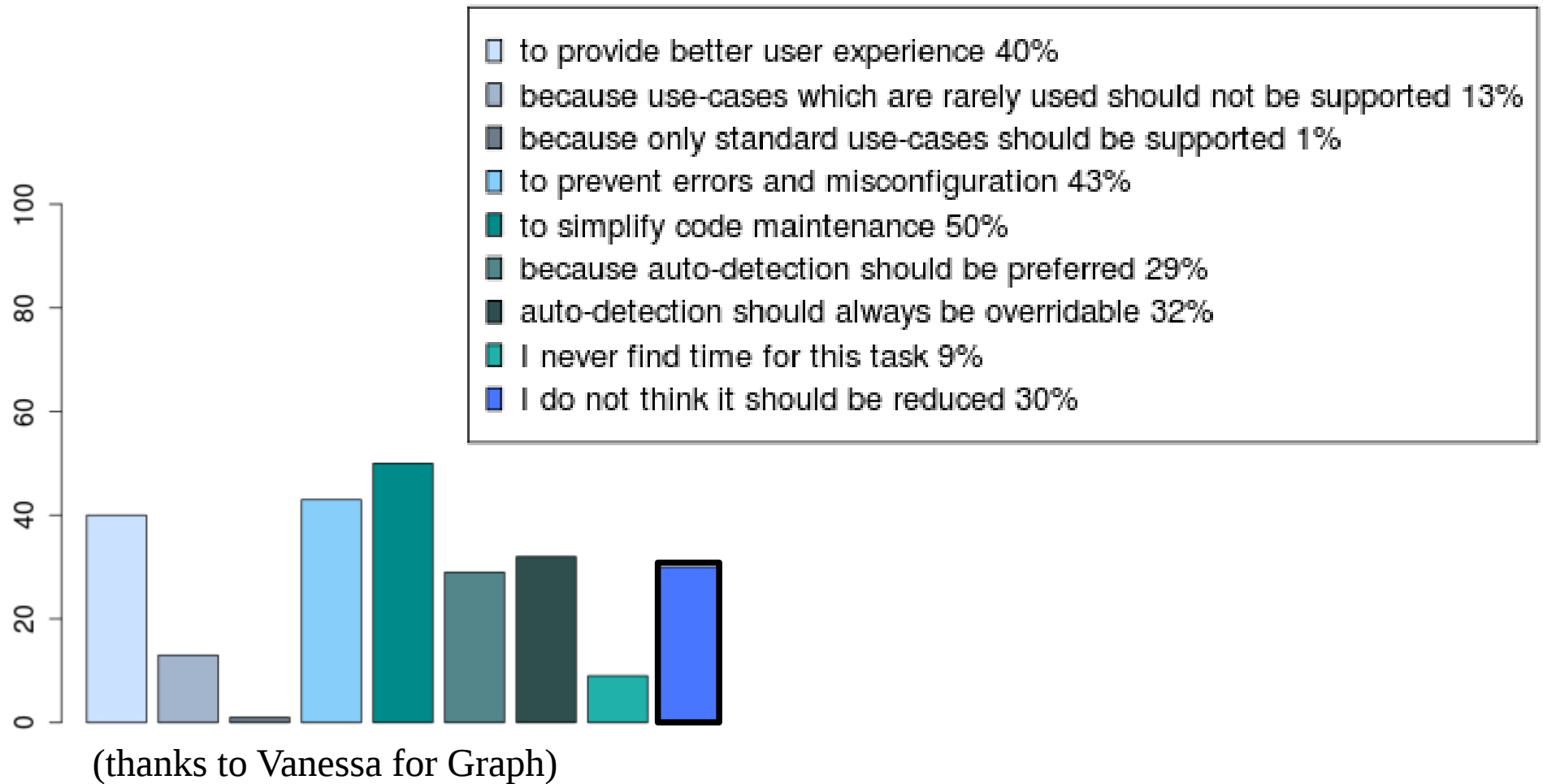
➤ 52% of configuration options could be removed





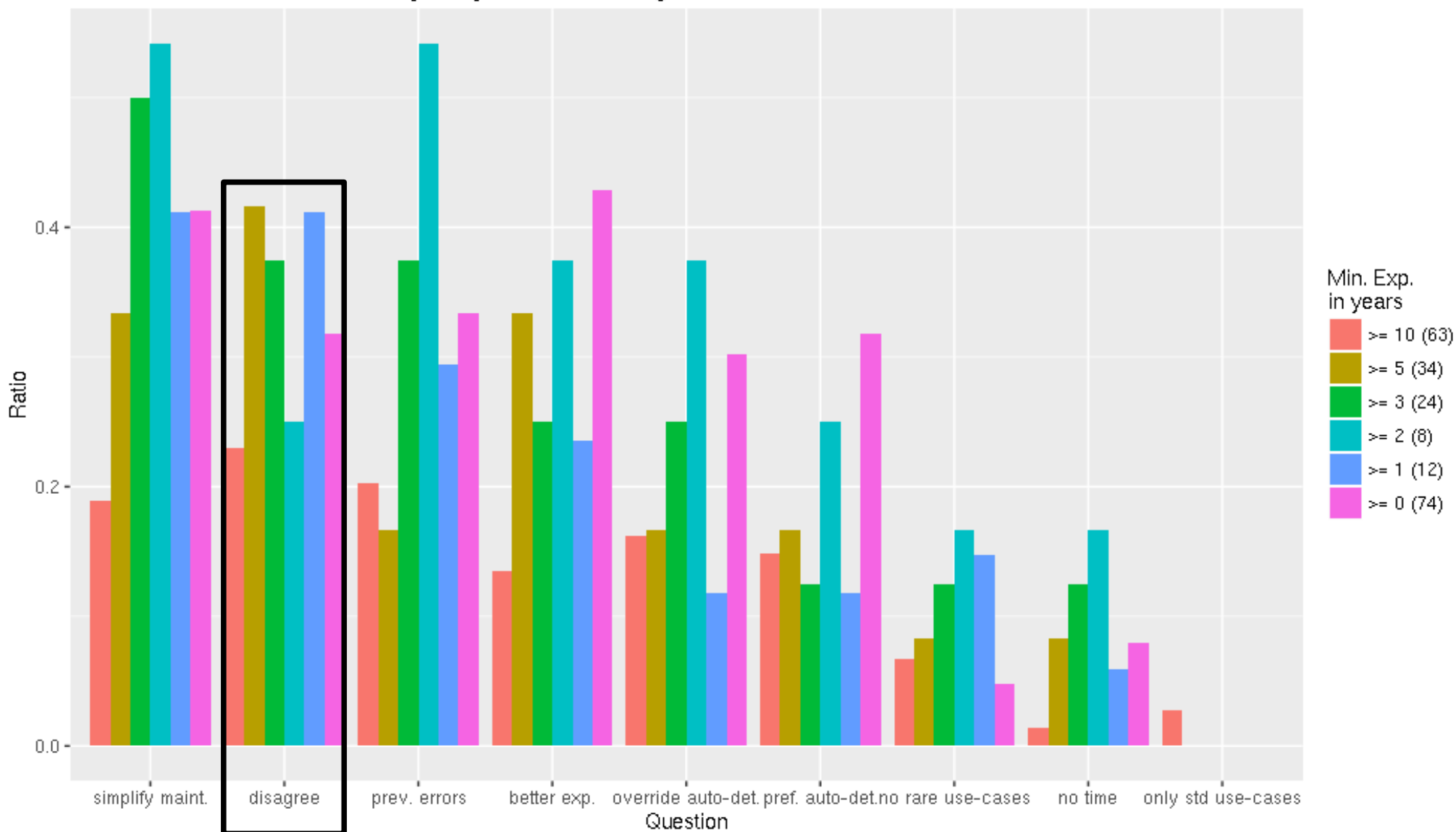
# Then let us reduce

➤ *But 30% of developers think it should **not** be reduced*



# Really?

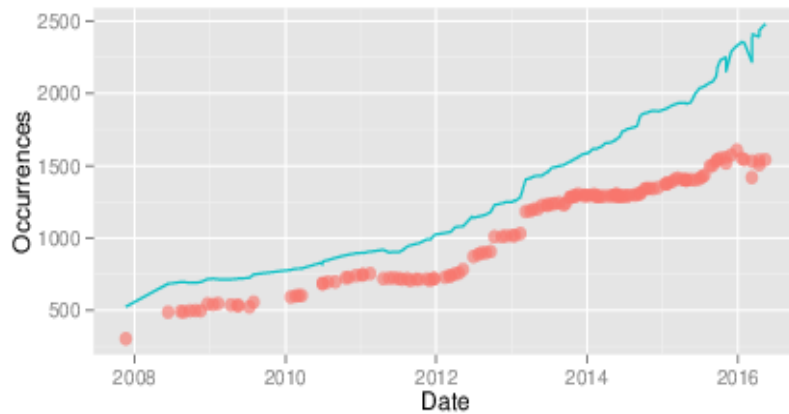
Why do you think configuration should be reduced?



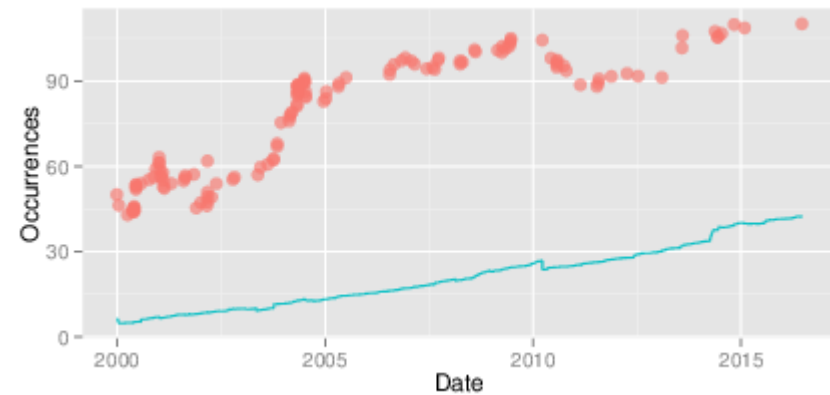
# Trend (2)

➤ For environment vars/`getenv` we have a similar trend

## Firefox



## Curl

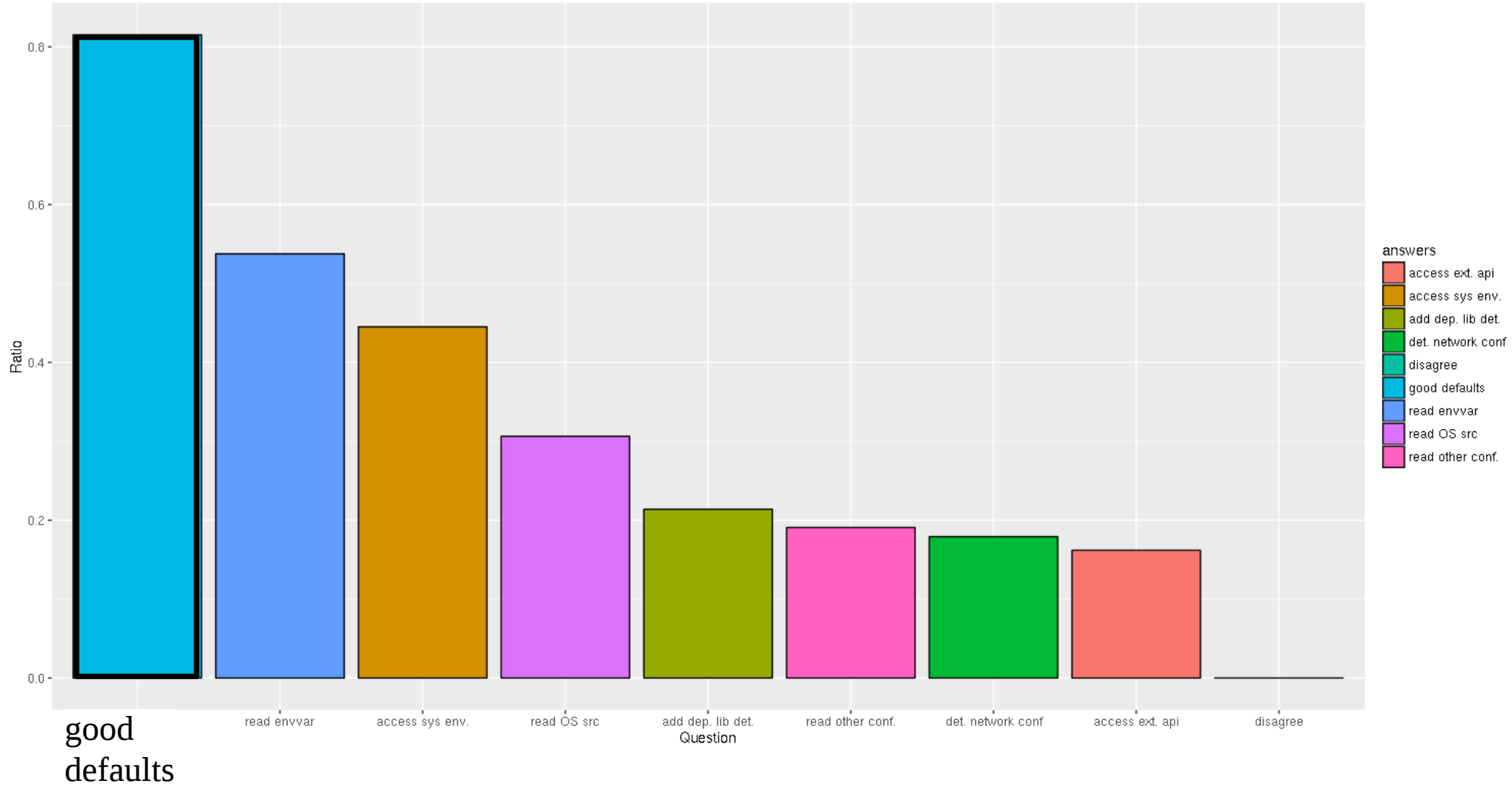


# Current Situation



# Good Defaults

Which effort do you think is worthwhile for providing better configuration experience?





# Namespaces (again)

---

- ◆ */sw/org/myapp/#0/current* uses all of below
- ◆ *system* namespace is stored below */etc/config/*
- ◆ *user* namespace is stored below *~/.config/*
- ◆ *dir* like *.git* or *.htaccess*
- ◆ *proc* namespace is for the current process (**cmdline+env**)
- ◆ *spec* namespace allows you to specify **defaults+visibility (via metadata)**





# Abstraction II: Namespaces + Defaults + Visibility







## III Auto detection

---

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***<http://www.libelektra.org>***

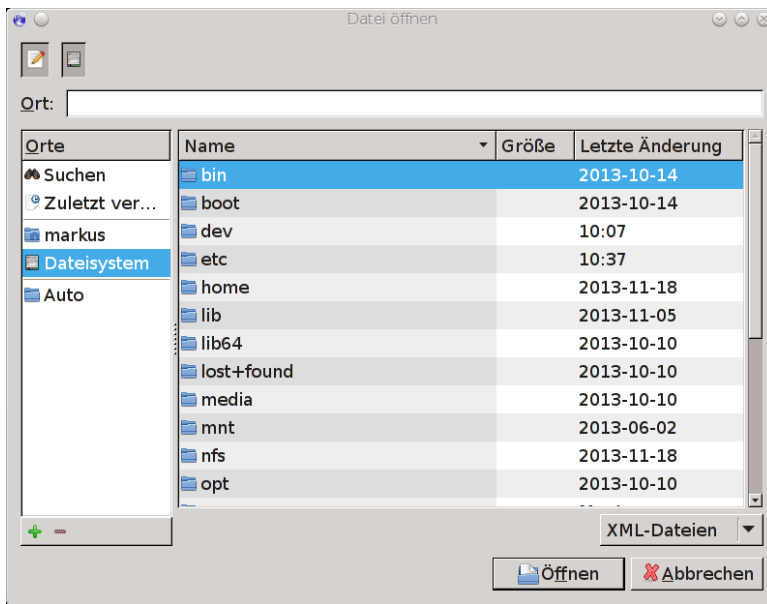
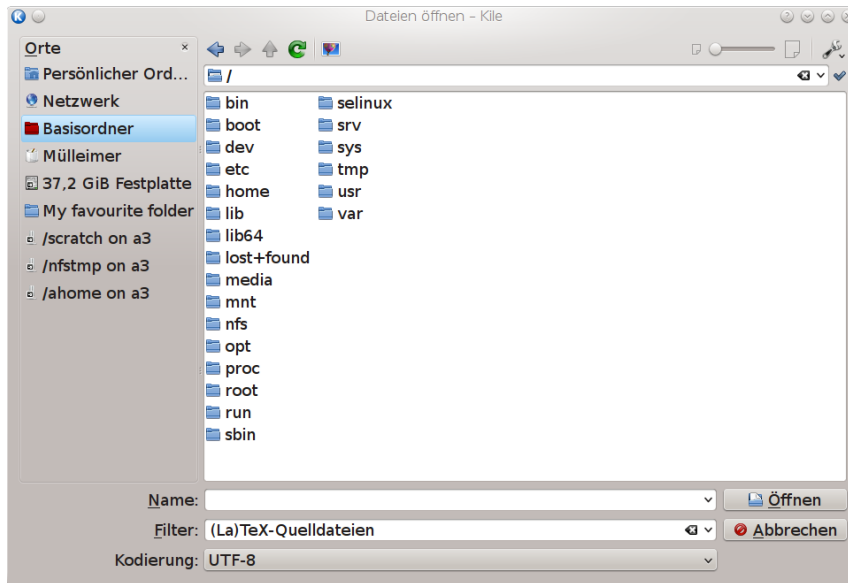




XServer  
GPSd

...

# Other customization

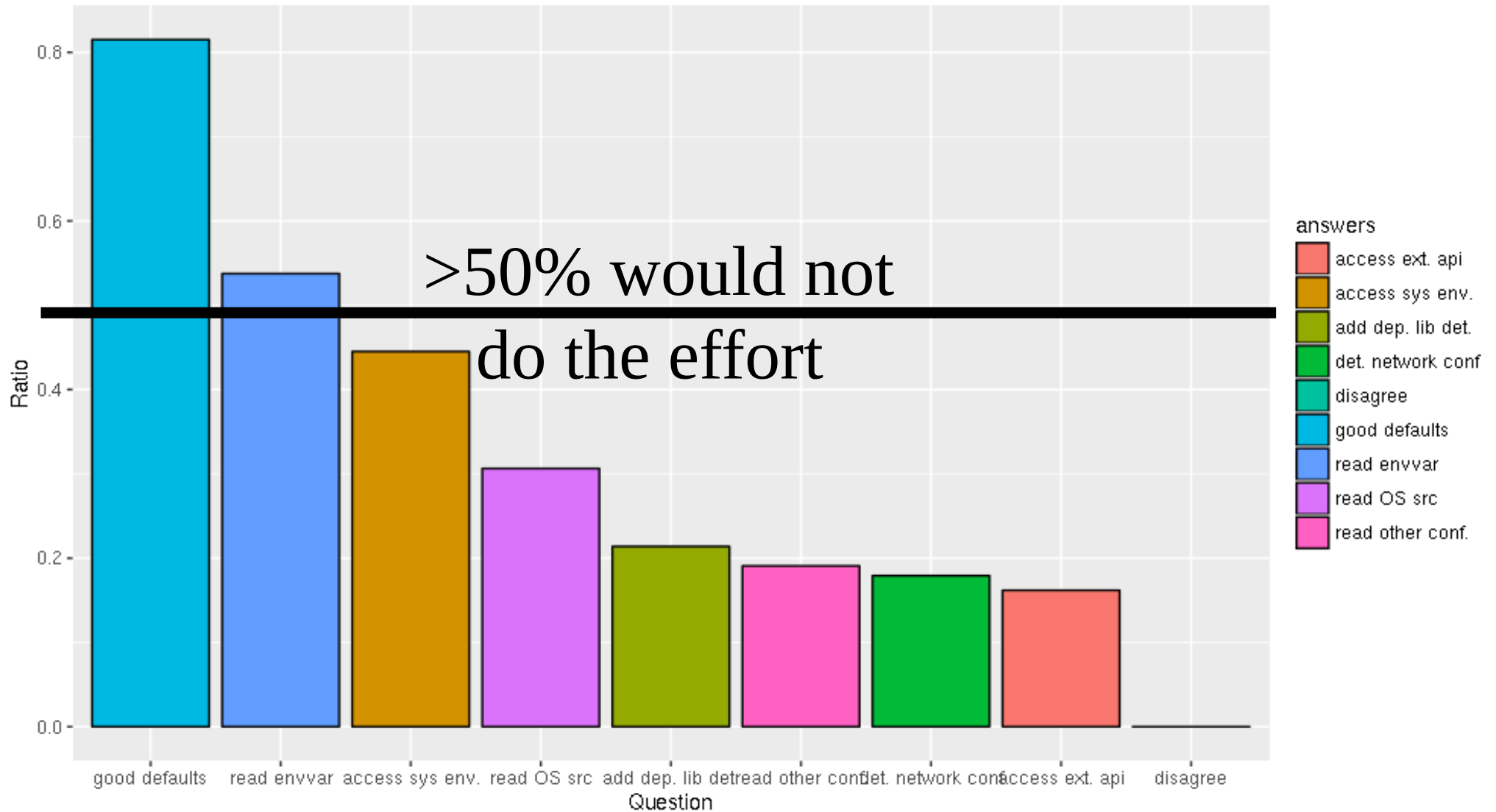


- *Shortcuts*
- *Look&Feel*
- *Favourite Places*
- *Language*
- *Sorting Criteria*
- *Hidden files*
- *Size of Icons*
- *Proxy Settings*
- ...



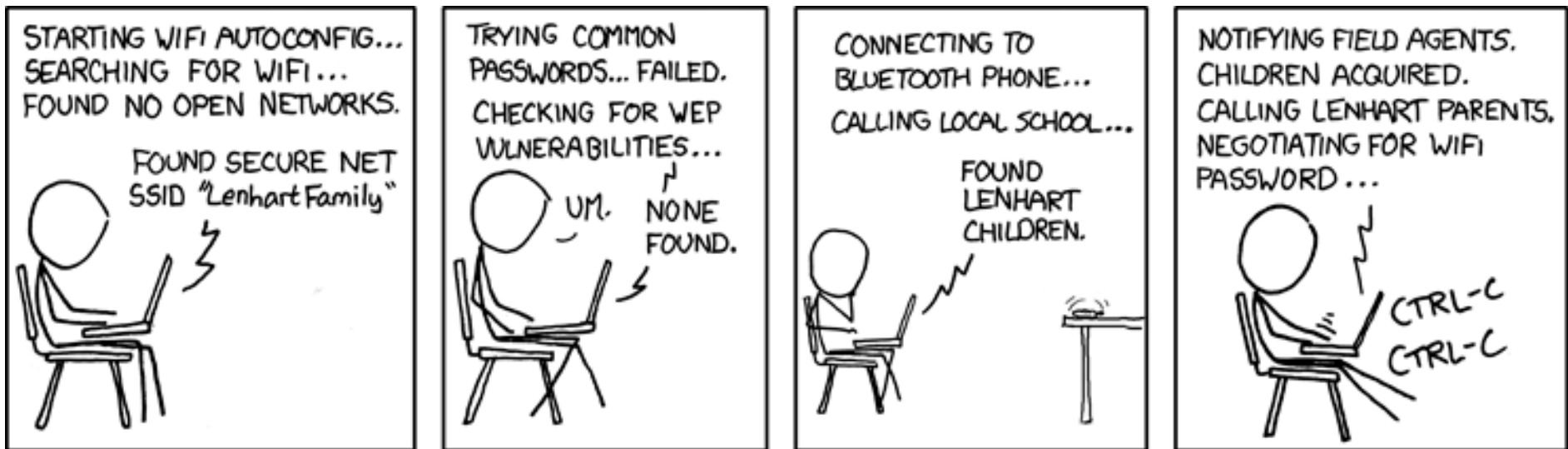
# Detection of other sources

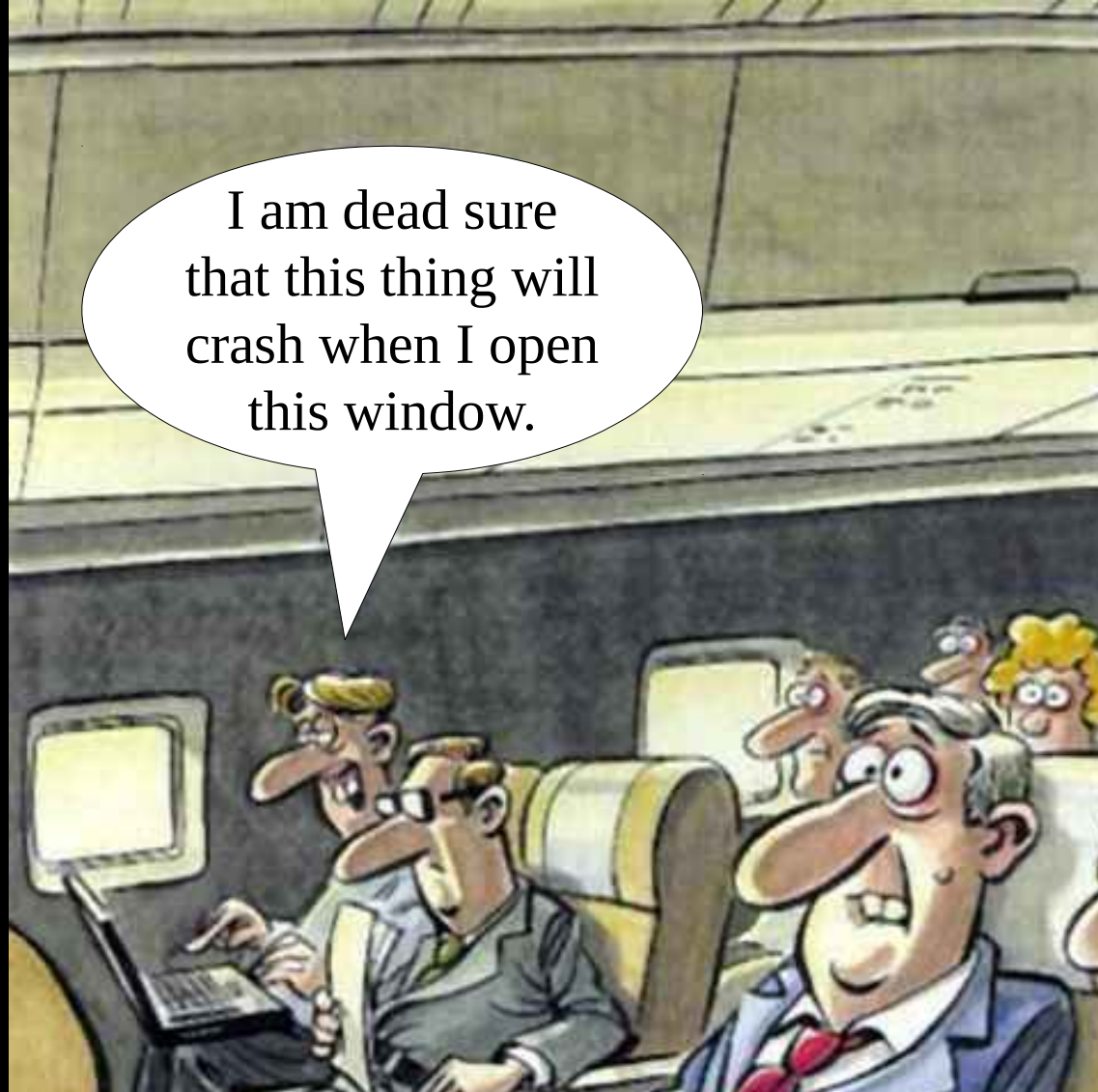
Which effort do you think is worthwhile for providing better configuration experience?



# Limits of Auto Configuration

- *broken devices*
- *wrong detections*
- *you sometimes have different preferences...*





# Abstraction III: Specifications to avoid misunderstandings





## IV Global Validation

---

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***<http://www.libelektra.org>***





IPv4, 5  
CSI has it

# State of the Art



## Use the source

```
1563 case CFG_LTHREADS:
1564 >-----{ int mask = 0;
1565 >-----/* use a power of two */
1566 >-----while (c->value_uint > 1) {
1567 >----->-----c->value_uint >>= 1;
1568 >----->-----mask <<= 1;
1569 >----->-----mask |= 1;
1570 >-----}
```

<http://www.libelektra.org>





# Tool

# Spec



**Needed Info**

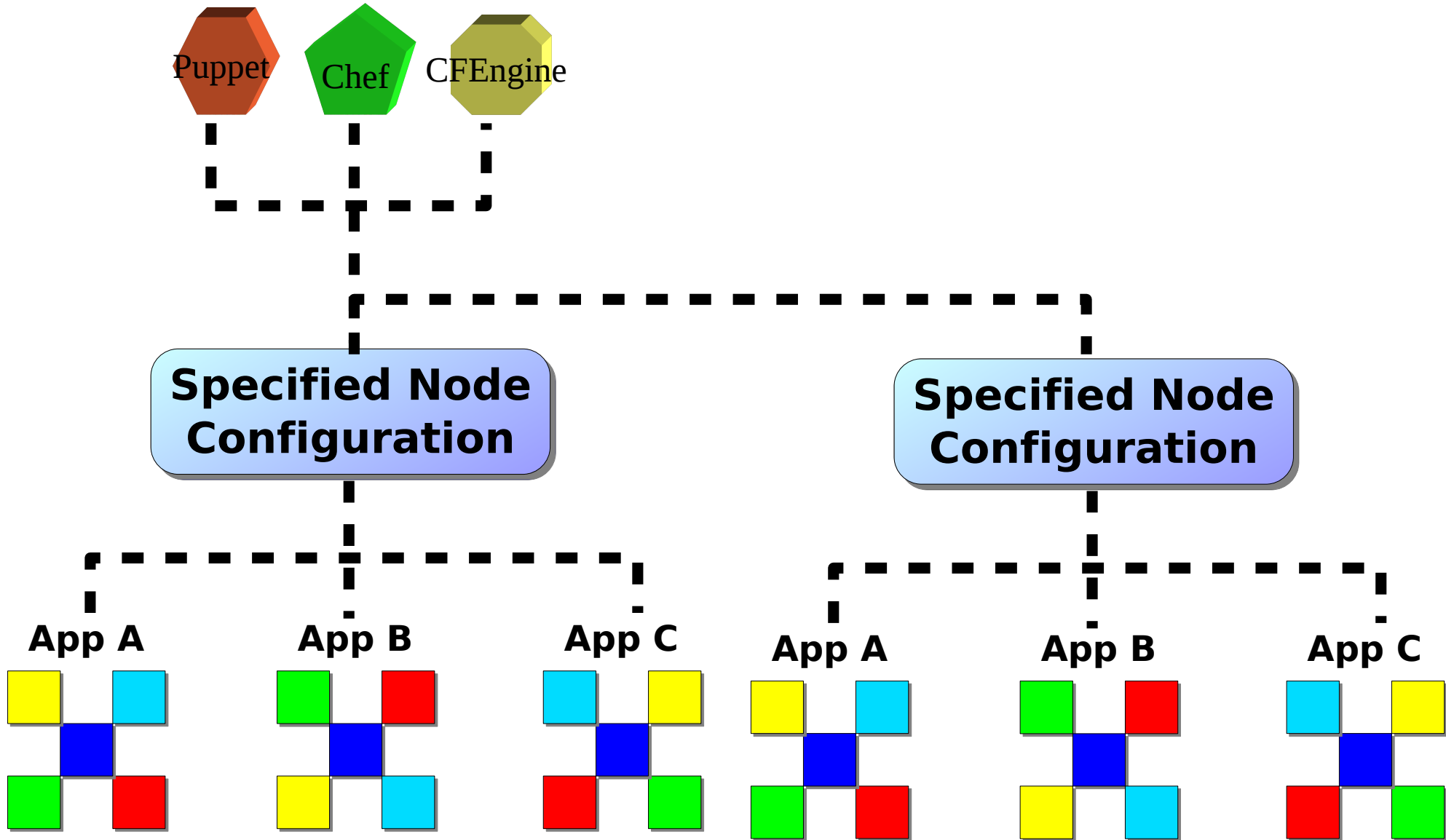
# Wanted (Specification)

```
1 [/sw/openldap/slapd/#0/current/listener-threads]
2 check/range:=1,2,4,8
3 check/condition:=(../info/threads/available) ? (.) : (!)
4 check/condition/message:=Thread support is not available
5 default:=next-range(/info/system/cpu/number / '16')
6 description:=One thread is adequate for up to 16 CPU cores.
7 type:=long
```

- ***Introspection***
- ***Documented***
- ***Safe (Enforced when settings change)***



# Configuration Management





# V. Elektra

---

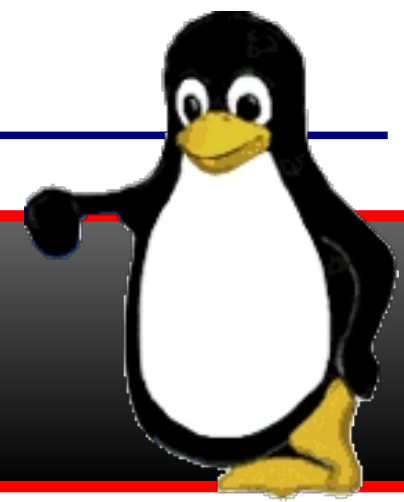
**Markus Raab <elektra@markus-raab.org>**

***<http://www.libelektra.org>***





# What is libelektra?



```
sh$ ldd /lib/libelektra.so
libc.so.6 => /lib/tls/libc.so.6
/lib/ld-linux.so.2 => /lib/ld-linux.so.2
```

- ✓ *Technology-neutral datastructures which allow access to global configuration storage*
- ✓ *Portable (ANSI C)*
- ✓ *For embedded systems (small, can be static)*
- ✓ *No daemon, Security by OS*

<http://www.libelektra.org>





# Bindings

---

## ➤ Available

- ✓ C/C++
- ✓ Shell
- ✓ Lua
- ✓ Python
- ✓ Java
- ✓ Ruby
- ✓ Haskell

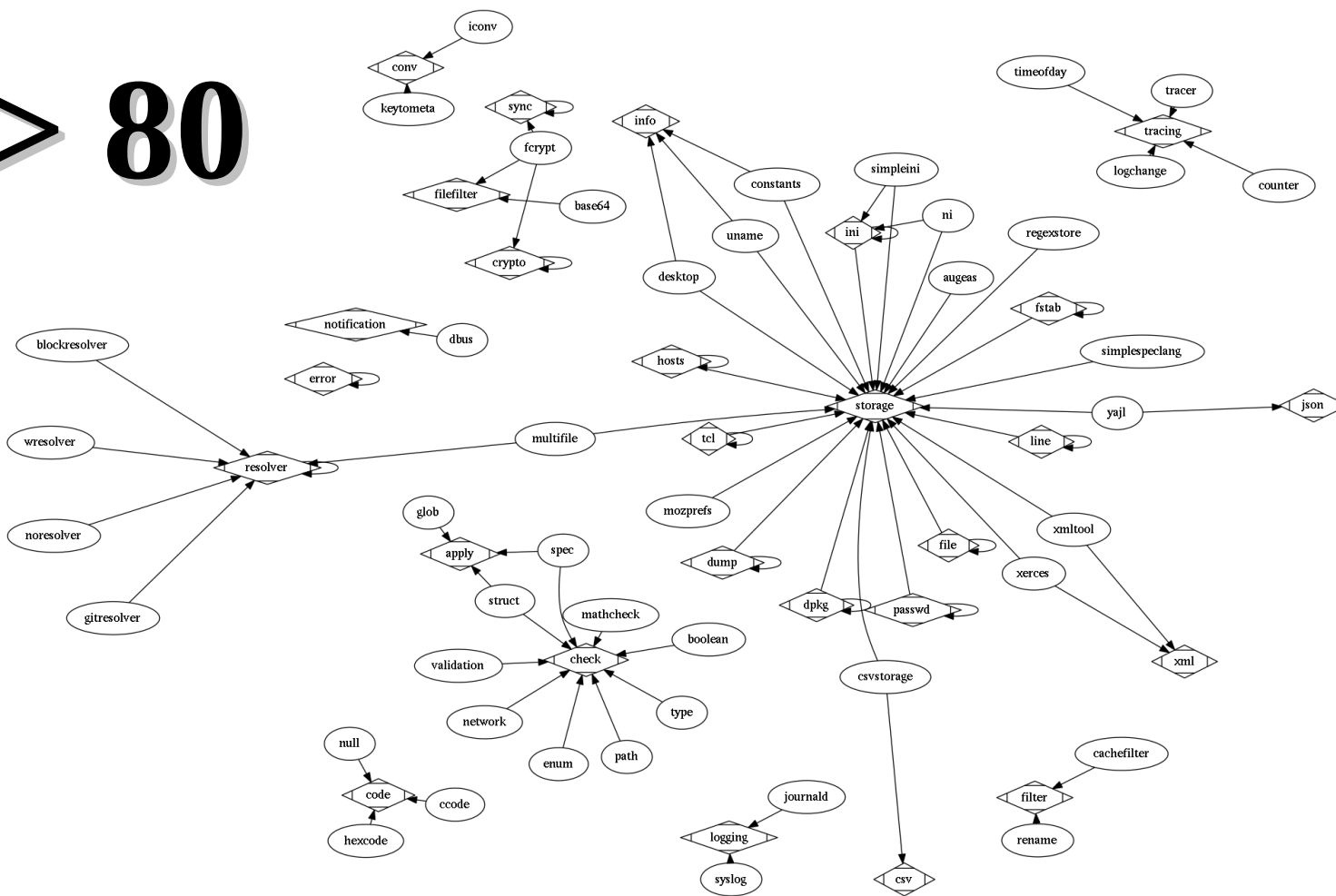


## ➤ Interception

- ✓ GSettings
- ✓ Getenv
- ✓ Filesystem

# Plugins

> 80



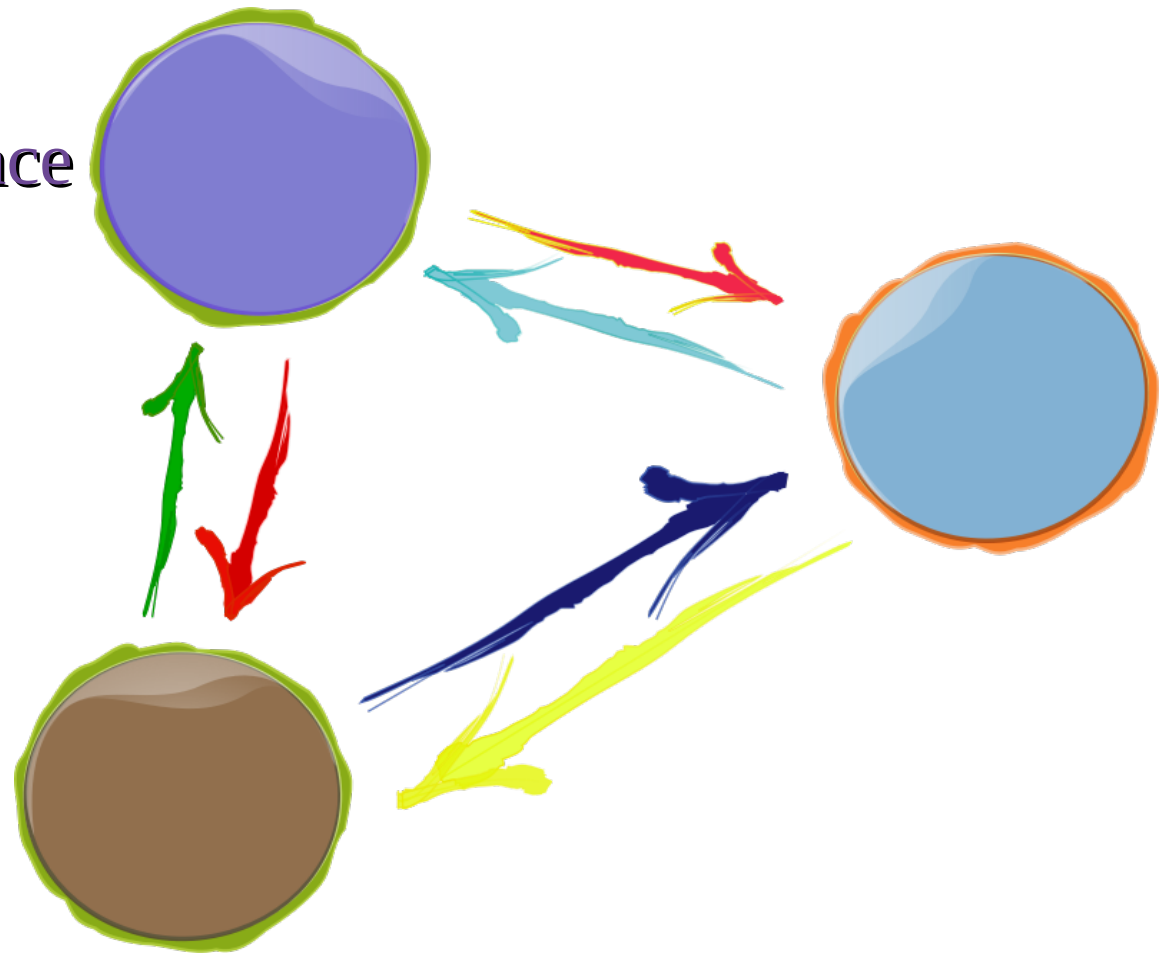
Recently added:

- ✓ XML
- ✓ YAML
- ✓ Multifile
- ✓ Date
- ✓ Range
- ✓ ...



# Goals

- **Out-of-the-box experience**  
simplify!  
sensored or calculated  
(X-server)
- **Sharable**  
across applications  
robustness!
- **Tooling**  
make system  
administration sane



# The *kdb* Command

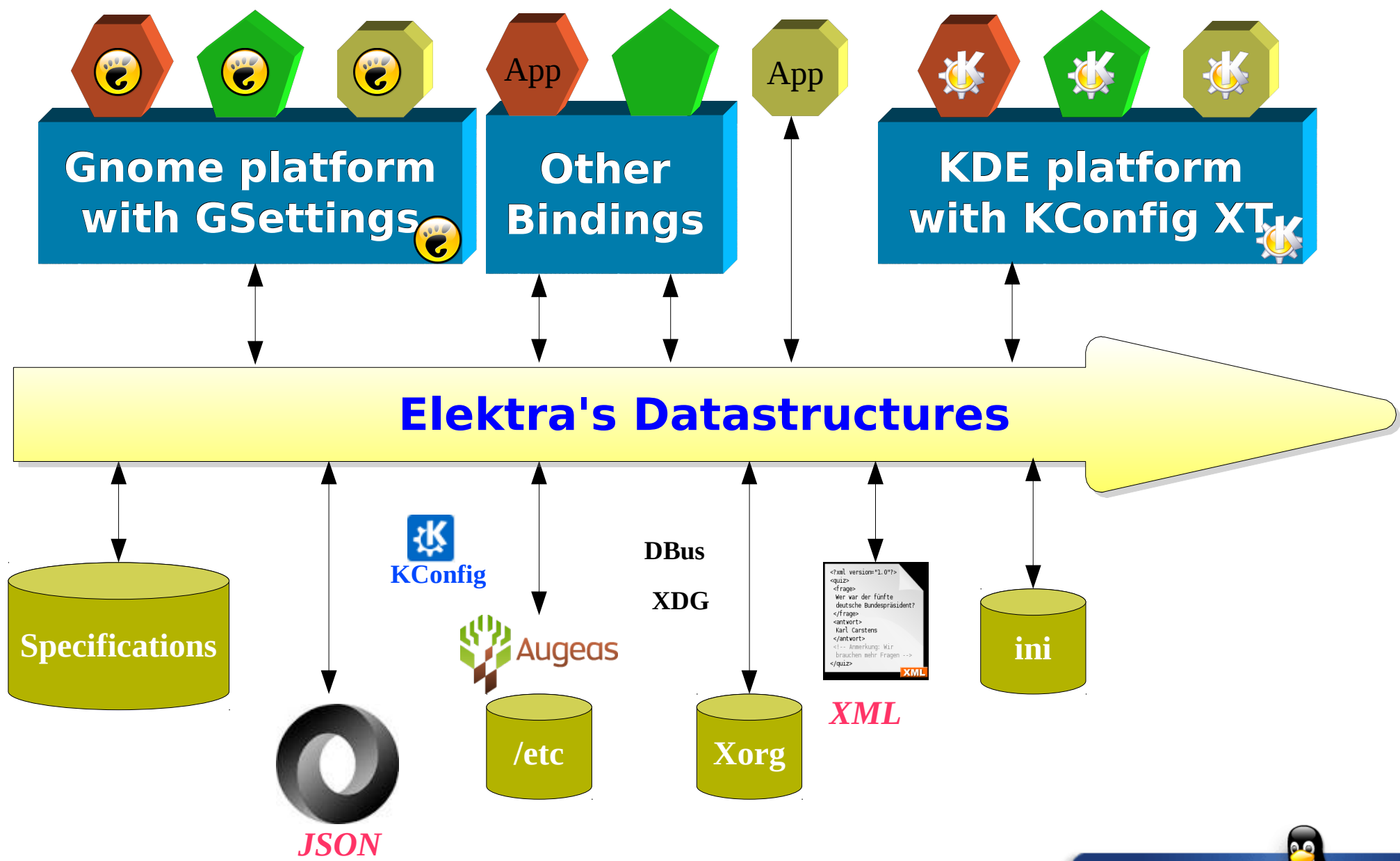
---

```
$ kdb get /filesystems/boot/mpoint  
  
# kdb set /sw/xorg/Screen/Display/Modes 1280x1024  
  
$ kdb ls /sw/myapp  
  
$ kdb rm /env/alias/vnc
```

- Perfect for scripts: administrative work+package install
- Easy to write tools like this
- Also for **Specifications!** It has **tab completion!**



# Technology Integration



# Who uses Elektra? What are the targets?

## ✓ *Embedded Systems*



cameras

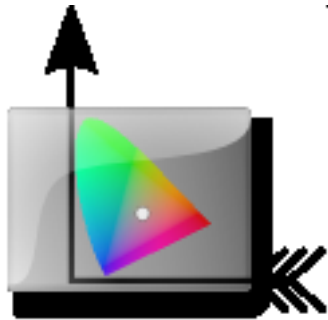


universities



weighing scales

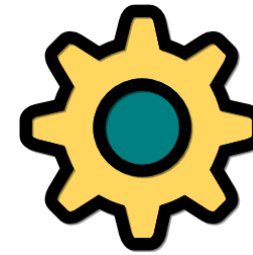
## ✓ *shared configuration in FLOSS (Desktop)*



oupanos



(in progress)



➤ Your project?

## ✓ *Administrators (Servers)*

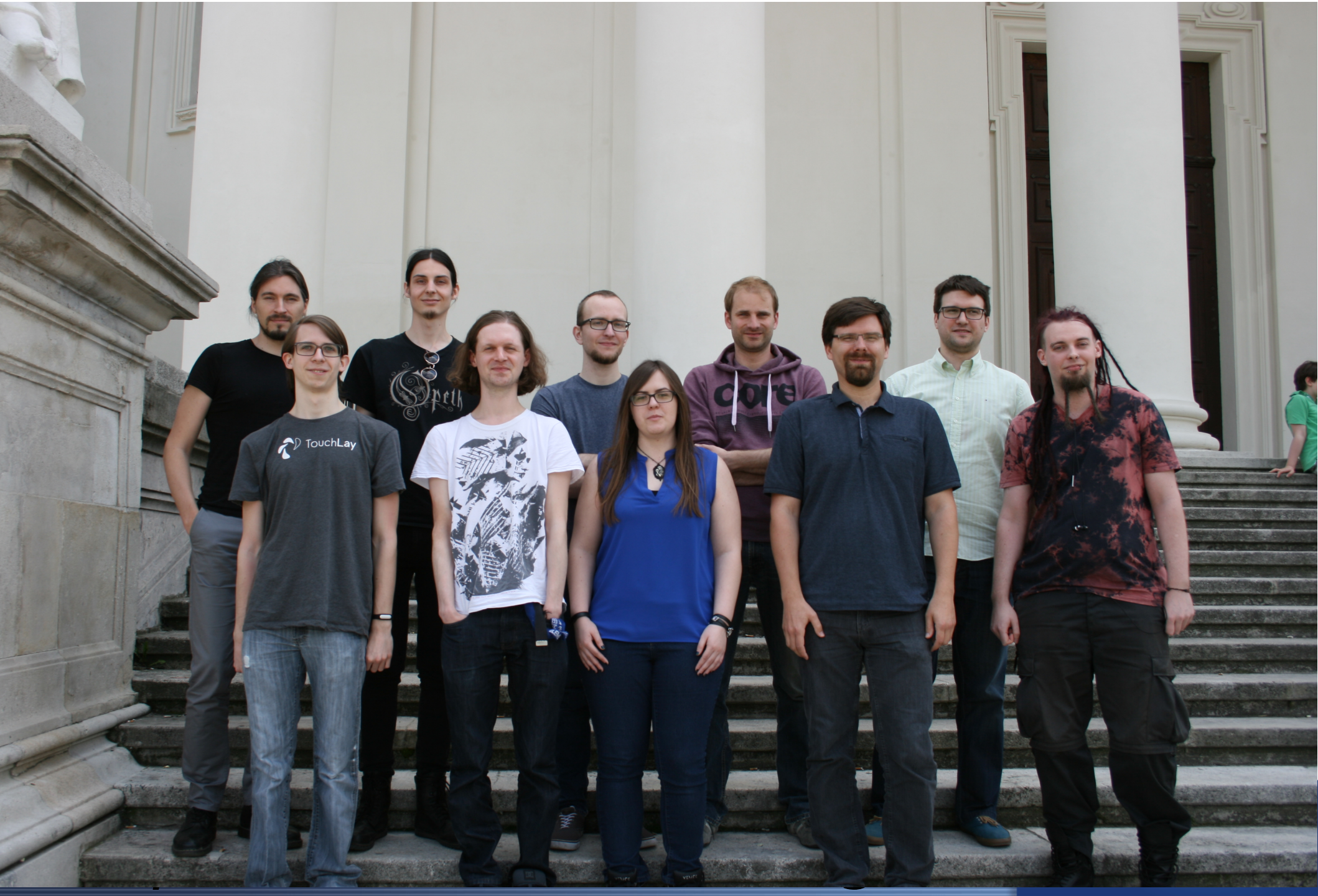


<http://www.libelektra.org>





# Who is working on Elektra?





# Who is working on it?

- Armin Wurzinger: *Type Interference*
- Bernhard Denner: **Puppet Module**
- Daniel Bugl: *WebUI*
- Dominik Hofer: the **high-level API**
- Kurt Micheli: *Order Preserving Minimal Hash Map*
- Ulrike Schaefer: **Code Completion**
- Michael Zehender: *Quality Improvements*
- Mihael Pranjić: *mmap plugin*
- Peter Nirschl: *crypto plugin*
- René Schwaiger: **YAML plugin**
- Sebastian Bachmann: *Shell Completion*
- Thomas Waht: *Notification*
- Thomas Waser: **Validation** and Transformations of Configuration
- Vanessa Kos: *Misconfiguration Bug Database*



1.0 this year



➤ You: *Fun Parts?*



# Resources

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*Thank you for your attention!*

*Drop us an email or open a issue!*

*Questions?*

- *Homepage: <https://www.libelektra.org>*
- *Open Data: <https://rawdata.libelektra.org>*
- *Build Server: <https://build.libelektra.org/>*

**Markus Raab <[elektra@markus-raab.org](mailto:elektra@markus-raab.org)>**

<http://www.libelektra.org>

