Bash Coding

Security Meetup

Mittwoch, 11. Mai 2016

Überblick

1. Motivation
2. Einführung
3. Häufige Probleme
4. Best Practices / Bad Practices
5. Ausgewählte Beispiele

Motivation

- Man Pages

```
MANUAL SECTIONS
    The standard sections of the manual include:

    1      User Commands
    2      System Calls
    3      C Library Functions
    4      Devices and Special Files
    5      File Formats and Conventions
    6      Games et. Al.
    7      Miscellanea
    8      System Administration tools and Deamons

    Distributions customize the manual section to their specifics,
    which often include additional sections.
```

Motivation

- Öffentliche Server im Internet

Source	Date	Unix, Unix-like				Microsoft Windows	References
		All	Linux	FreeBSD	Unknown		
W3Techs	Feb 2015	67.8%	35.9%	0.95%	30.9%	32.3%	[97][98]
Security Space	Feb 2014	<79.3%	N/A			>20.7%	[99][100]
W3Cook	May 2015	98.3%	96.6%	1.7%	0%	1.7%	[101]

https://en.wikipedia.org/wiki/Usage_share_of_operating_systems#Public_servers_on_the_Internet, abgerufen 26.4.2016

97. ^ "Usage of operating systems for websites". W3Techs. 7 March 2015.
98. ^ "Usage of Unix for websites". W3Techs. 7 March 2015.
99. ^ "Web Server Survey". Security Space. 1 March 2014.
100. ^ "OS/Linux Distributions using Apache". Security Space. 1 March 2014.
101. ^ "OS Market Share and Usage Trends". *W3Cook.com*. Retrieved 30 June 2015.
102. ^ "Web Technologies Statistics and Trends". W3Techs. December 2013.
103. ^ "W3Cook FAQ". *W3Cook.com*. Retrieved 30 June 2015.

Einführung: Geeigneter Editor

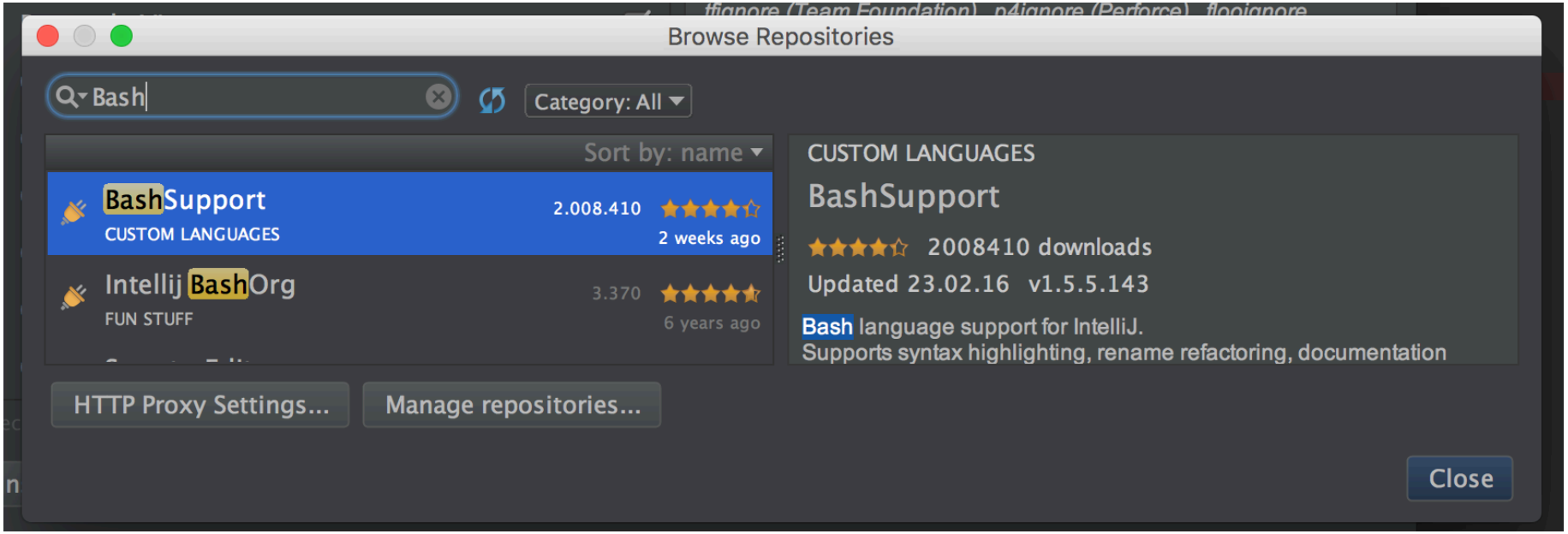
- Non-Interactive

```
➜  ~ echo "#! /bin/bash" > hi.sh
➜  ~ echo "echo \"hi\"" >> hi.sh
➜  ~ cat hi.sh
#! /bin/bash
echo "hi"
```

- Sehr verbreiteter Editor: visual improved, kurz vim
  - :set paste
  - Einstellungen über .vimrc

Einführung: Geeigneter Editor

- IntelliJ Bash Plugin
- Sublime (Syntax Shell Script (Bash))



Einführung: Hello World

- Datei erstellen:

```
touch test.sh; chmod 700 test.sh; vim test.sh
```

- Shebang

Einführung: Begriffe

- Builtins
- Expansions, unter anderem:
  - Parameter Expansion
  - Brace Expansion
  - Tilde Expansion

- Substitutions, unter anderem:
  - Command Substitution
  - Process Substitution

Einführung: Grundlegendes

- $@, $*, $#, $1,..,$9, shift vs ${10}, $?

- Compound Commands
  - Grouping

```
echo "1"; (exit 1); echo "2"
echo "1"&& (exit 1)&& echo "2"
```

?

Einführung: Debugging

- /bin/bash –xv file
- echo „command“; command; exit 0;
- Debug an/aus

```
#! /bin/bash
echo Hey
set -x
echo Hey
set +x
echo Hey
```

- Weitere Set-Parameter: set –u, set –e, set –C

Einführung: Debugging

- ShellCheck

```
➜  introduction cat shellchk.sh
#!/bin/bash
NOTUSED="notused"
➜  introduction shellcheck shellchk.sh

In shellchk.sh line 2:
NOTUSED="notused"
^-- SC2034: NOTUSED appears unused. Verify it or export it.
```

Häufige Probleme

- Variablen
  - Erstellung
  - Benennung/Namensänderung
- Zeichenabstände
- Fehlende Keywords
- Pipes und Reihenfolge stdin/out
  - Komplette Umleitung (2>&1) erst nach Schreiben in Datei
    http://stackoverflow.com/questions/4699790/cmd-21-log-vs-cmd-log-21

Häufige Probleme

- Variablen
  - Erstellung
  - Benennung/Namensänderung

- Beispiel: Einfache Parameter Expansion

```
1 #! /bin/bash
2
3 WORD="word"
4 echo "The plural of $WORD is most likely $WORDs"
```

- ?

```
6 WORD="word"
7 echo "The plural of $WORD is most likely ${WORD}s"
```

Häufige Probleme

- Quotes

```
mylist="DOG CAT BIRD HORSE"
```

```
for animal in "$mylist"; do
    echo $animal
done
```

- ?

```
for animal in $mylist; do
    echo $animal
done
```

http://www.davidpashley.com/articles/writing-robust-shell-scripts/, abgerufen 01.5.16

- $@, test Arguments
- Regel: Im Zweifel immer Double Quotes um

Häufige Probleme

- Escaping

```
#! /bin/bash
echo 'Here's the path \'
```

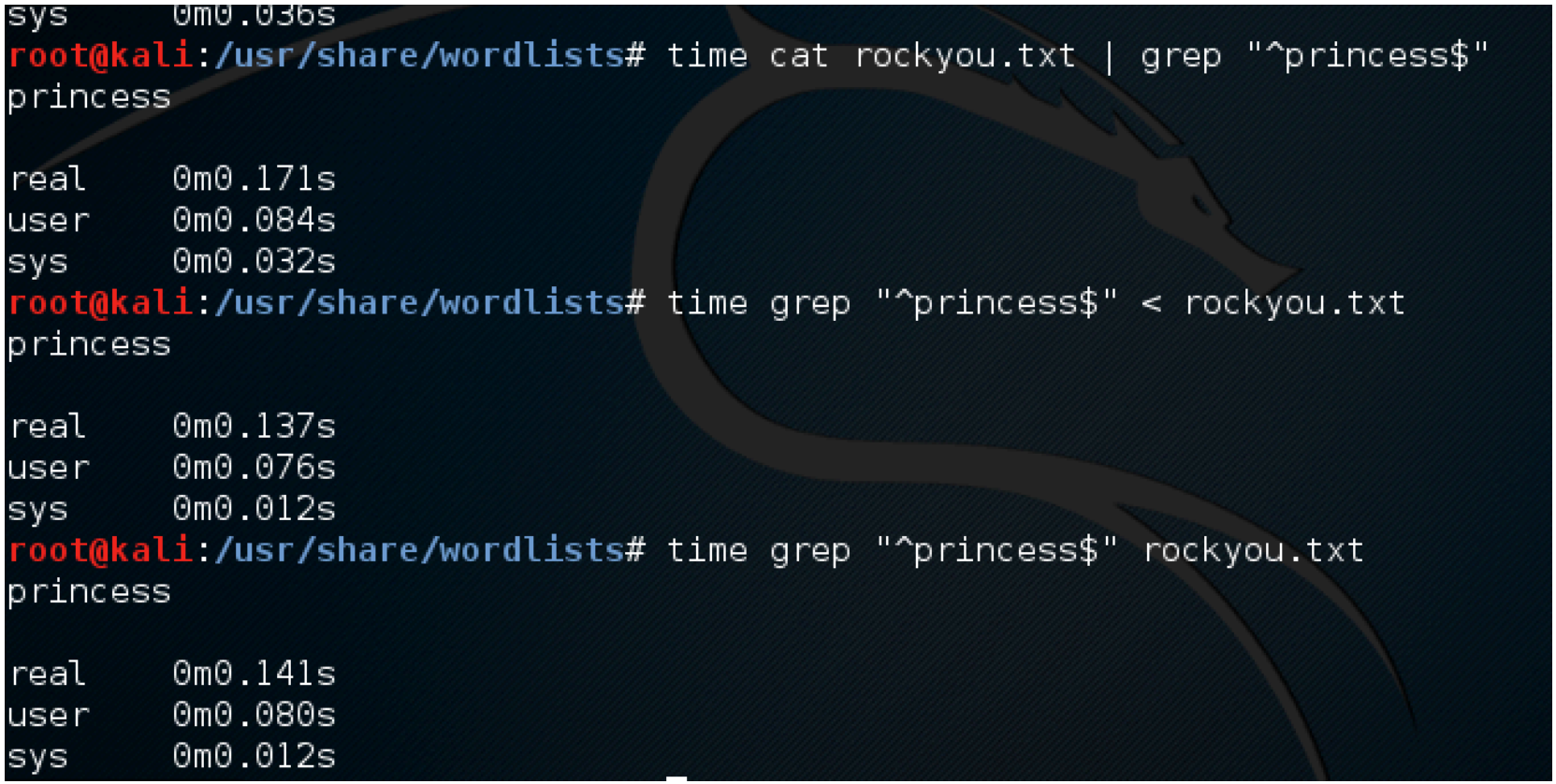
?

```
#! /bin/bash
# Strong quoting
echo 'Here'\''s the path \'
# Weak quoting
echo "Here's the path \\"
```

```
1 # Per-Character Escaping
2 echo \$HOME is set to \"$HOME\"
```

Best Practices

- Kommandos auf eigene Parameter/Stdin-Eingaben prüfen



https://wiki.ubuntuusers.de/Shell/Tipps_und_Tricks/, abgerufen 26.4.16

Best Practices

- Naming

```
➜ test ls
➜ test echo "echo Hello" > test; chmod 700 test
➜ test ls
test
➜ test test
```

- ?

```
➜ test test
➜ test ./test
Hello
➜ test which test
test: shell built-in command
```

Bad Practices

- eval

```
1 #!/usr/bin/env bash
2 { myCode=$(</dev/stdin); } <<\EOF
3 ls
4 EOF
5
6 eval "$myCode"
```

```
1 #! /bin/bash
2 # This code is evil and should never be used!
3 show() {
4     _display=$1
5     eval echo "Hello $_display"    # DANGER!
6 }
7 a="Hello"
8 show ${1:-$a}
9
```

https://wiki.ubuntuusers.de/Shell/Tipps_und_Tricks/, abgerufen 26.4.16

Ausgewählte Beispiele

- Root Password Phishing
- Performance Boost:
  - tcp connect / udp scan.sh
- Ping Sweep
- Add one wordlist to another: addtowl.sh
- Testdriven Development: test_input.sh

- Weitere Anwendungsbereiche:
  - Brute-Forcing zB Dns (Reverse) Enumeration
  - Transaktionale Programmierung

Zusammenfassung

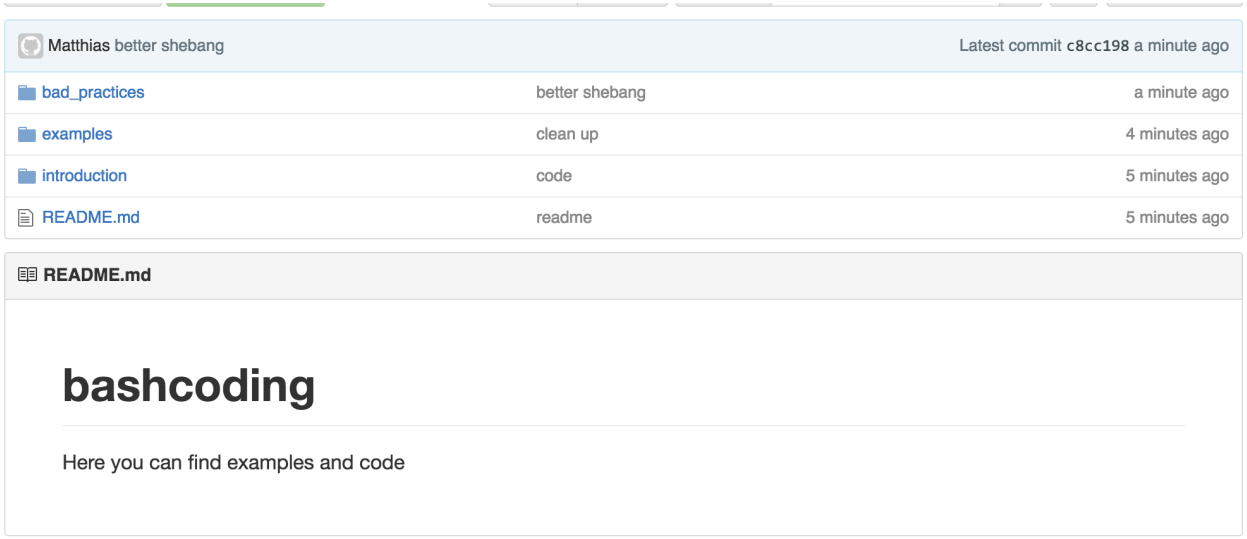
1. Motivation
2. Einführung
3. Häufige Probleme
4. Best Practices / Bad Practices
5. Ausgewählte Beispiele

Code zur Präsentation

https://github.com/mr4p/bashcoding.git

bzw

https://github.com/mr4p/bashcoding



Weitere Informationen

- **Einführung:**
  - https://en.wikibooks.org/wiki/Bash_Shell_Scripting
  - **Klammern:** http://stackoverflow.com/questions/2188199/how-to-use-double-or-single-bracket-parentheses-curly-braces
- **Fortgeschrittene:**
  - http://mywiki.wooledge.org/BashGuide
  - http://wiki.bash-hackers.org/
  - http://tldp.org/LDP/abs/html/
- **Best Practices**
  - https://wiki.ubuntuusers.de/Shell/Tipps_und_Tricks/
  - http://www.davidpashley.com/articles/writing-robust-shell-scripts/
- **Offizielle Seiten**
  - **Gnu Manual:** http://www.gnu.org/software/bash/manual/bash.html
  - **Posix Spec:** http://pubs.opengroup.org/onlinepubs/9699919799/utilities/V3_chap02.html

Vielen Dank!

Backup - Bash Coding

Security Meetup

Mittwoch, 11. Mai 2016

Matthias Altmann

Motivation

- Häufige Probleme:
  - Wiederholbare Aufgaben Kommandozeile / Aufwand

- Lösung:
  Befehle automatisierbar ablegen

- Unix: Verwendung Skriptsprache einer Shell
- Verbreiteste Shell: Bourne Again Shell (Bash)

Motivation

- Weiterer Vorteil Bash-Coding Skills
- Unix Philosophie: DOTADIW = Do One Thing And Do It Well
- Viele kleine (systemnahe) Werkzeuge
- Scriptbefehle immer auch in der Konsole anwendbar
- Produktivität auf der Konsole steigt
- Aus Security-Sicht
  - Möglichkeiten der „Macht“ über ein System steigen

Einführung: Geeigneter Editor

- Sehr verbreiteter Editor: visual improved, kurz vim
- Häufige Befehle:
  - Esc: wq!,q!
  - u
  - I, A
  - dd
  - v,y/c,p
  - gg, G
  - ^,$
  - :set number
  - :set paste

- Einstellungen über .vimrc

Einführung: Begriffe

- Functions
- Builtins
  - let
  - local

Einführung: Conditionals

- Compound Commands: Conditionals
  - Test / []

```
test 2 -gt 5; echo $?
test -e `pwd`/loops.sh; echo $?
[ -n "content" ];echo $?
```

  - (( )) Compound Command
  - [[ ]] Compound Command

Einführung

- String-Vergleiche

```
#! /bin/bash
output="not empty"
if [ ! -z "$output" ]
then
    echo "$output"
else
    echo nope
fi
```

Einführung

- File Descriptoren / Redirection

```
find . -print | grep -i bla 2> /dev/null
```

- source file
- Backticks / $()

Einführung: Process Substitution

```
1  diff <(ls dir1) <(ls dir2)
```

Einführung: [[ ]] Compound Command

- Moderne Variante des test Kommandos
- Arithmetische Operationen möglich
- Pattern Matching möglich

```
#! /bin/bash
[[ 'i=5, i+=2' -eq 3+4 ]] && echo true
VARIABLE="Let's test this string!"

# This is for regular expressions:
if [[ "$VARIABLE" =~ L*ing! ]]
then
    echo "matched"
else
    echo "nope"
fi
```

Einführung: Command Substitution

```
1  #!/bin/bash
2
3  function get_password ( )
4  # Usage:      get_password
5  # Asks the user for a password; prints it for capture by calling code.
6  # Returns a non-zero exit status if standard input is not a terminal, or if
7  # standard output *is* a terminal, or if the "read" command returns a non-zero
8  # exit status.
9  {
10   if [[ -t 0 ]] && ! [[ -t 1 ]] ; then
11     local PASSWORD
12     read -r -p 'Password:' -s PASSWORD && echo >&2
13     echo "$PASSWORD"
14   else
15     return 1
16   fi
17 }
18
19 echo "$(get_password)"
20
```

Einführung: Stringhandling / Parameter Expansion

```
1  #! /bin/bash
2  echo ${*:2}          # Echoes second and following positional parameters.
3  echo ${@:2}          # Same as above.
4  echo ${*:2:3}        # Echoes three positional parameters, starting at second.
5  stringZ=abcABC123ABCabc
6  echo ${#stringZ}                 # 15
7  echo ${stringZ:0}                              # abcABC123ABCabc
8  echo ${stringZ:1}                              # bcABC123ABCabc
9  echo ${stringZ:7}                              # 23ABCabc
10 echo ${stringZ:7:3}                            # 23A
11 echo ${stringZ:-4}                             # abcABC123ABCabc
12 echo ${stringZ:(-4)}                           # Cabc
13 echo $stringZ | tr '[:upper:]' '[:lower:]'
14 echo $stringZ | tr '[:lower:]' '[:upper:]'
15
```

Einführung: Parameter Expansion

- Substring Removal

```
 1 #! /bin/bash
 2
 3 FILENAME="test.txt"
 4 # Get name without extension
 5 echo ${FILENAME%.*}
 6 # ⇒ test
 7
 8 # Get extension
 9 echo ${FILENAME##*.}
10 # ⇒ txt
11
12 # Get directory name
13 PATHNAME="/home/bash/bash_hackers.txt"
14 echo ${PATHNAME%/*}
15 # ⇒ bash_hackers.txt
16
17 #Get filename
18 echo ${PATHNAME##*/}
19 #⇒ bash_hackers.txt
20
21
22
~
```

Häufige Probleme

- Piping und Variablen

```
1  # printf übergibt 2 Zeilen die mittels read gezählt werden
2  Zaehler=0
3  printf "%s\n" foo bar  | while read -r line
4  do
5      Zaehler=$((Zaehler+1))
6      echo "Zaehler in der Schleife: $Zaehler"
7  done
8  echo "Zaehler nach der Schleife: $Zaehler"
```

- Lösung Process Substitution

```
1  #!/bin/bash
2  Zaehler=0
3  while read -r line
4  do
5      Zaehler=$((Zaehler+1))
6      echo "Zaehler in der Schleife: $Zaehler"
7  done < <(printf "%s\n" foo bar)
8  echo "Zaehler nach der Schleife: $Zaehler"
```

Quotes und $@

```
1 #! /bin/bash
2 foo() { for i in $@; do printf "%s\n" "$i"; done };
```

?

```
3
4 foo2() { for i in "$@"; do printf "%s\n" "$i"; done };
5
```

- Im Zweifel immer Quotes bei $@ nutzen

  http://www.davidpashley.com/articles/writing-robust-shell-scripts/, abgerufen 01.5.16

- Das gleiche gilt für test conditional

Best Practices

- Verwendung von set –u

```
1 #!/bin/bash
2 set -u
3 UNUSED=$1
```

- Verwendung von set –e (rm, mkdir –p usw)

```
1 #! /bin/bash
2 # set -e
3 (exit 1)
4 if [ "$?" -ne 0 ]; then echo "command 1 failed"; fi
5
6 set -e
7 echo "Check for non-return value active"
8 if ! (exit 1); then echo "command 2 failed"; fi
9
10 set +e
11 (exit 1)
12 (exit 2)
13 echo "Multiple commands failed"
14 set -e
```

http://www.davidpashley.com/articles/writing-robust-shell-scripts/, abgerufen 01.5.16

Best Practices

- Sinnloses ls

```
1  for i in $(ls *)
2  do
3    cat $i
4  done
```

```
1  for i in *
2  do
3    cat $i
4  done
```

```
1  for i in *
2  do
3      echo "$i"  # Variable in " "
4  done
```

```
1  cat *
```

https://wiki.ubuntuusers.de/Shell/Tipps_und_Tricks/, abgerufen 26.4.16

Best Practices

- Langsames grep

```
3 grep "Tag" tosearch
4 if [ $? -ne 0 ]
5 then
6         echo "not found"
7 fi
```

- Besser

```
10 # grep -q bricht Suche beim ersten Treffer ab
11 if ! grep -q "Tag" tosearch
12 then
13         echo "not found"
14 fi
```

https://wiki.ubuntuusers.de/Shell/Tipps_und_Tricks/, abgerufen 26.4.16