Shell Scripting Craftsmanship

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Objectives

- Philosophical alignment
  - Context of quality
- Define quality in scripted solutions
  - What are the common elements of good scripts?

- 40 slides in 45 minutes
  - Available online after the conference

Quality cabinets

- Look at the drawers
  - Hardware
    - Attractive, inviting, practical
    - Prevent accidents (limited range)
  - Technique
    - Dovetail, staples, gum
- Expectations
  - Good enough for what it is
  - Something built to last

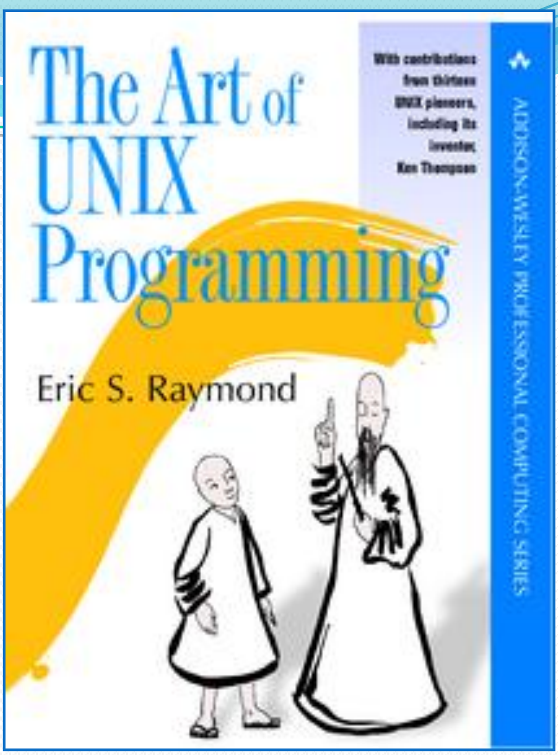
Quality

- Rule #1: **SHELL SCRIPTS MUST WORK**
  - High-visibility tasks
    - Migrations, deployments, and upgrades
  - Unforgiving tasks
    - Backups and monitoring
  - Repetitive tasks
    - Reporting and analysis

- Rule #2: **SCRIPTS MUST KEEP WORKING**
  - Harmony and joy   or . . .

Spiritual Guidance

- *The Art of Unix Programming*
  - Eric S. Raymond
  - Addison-Wesley


The Art of UNIX Programming
Eric S. Raymond
With contributions from thirteen UNIX pioneers, including its inventor, Ken Thompson
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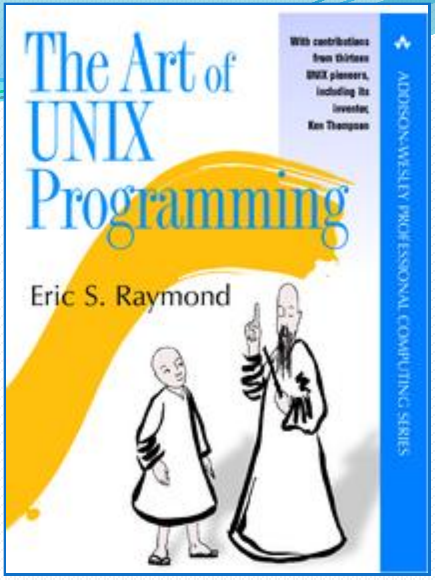
- Three decades of unwritten, hard-won software engineering wisdom from 13 Unix pioneers

- Resident anthropologist and roving ambassador of the open source movement

Quality, craftsmanship, harmony

- Dimensions of shell script quality
  - Transparency
  - Clear communication
  - Scalability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Transparency

- Rule of **Clarity**
  - Clarity is better than cleverness
- Rule of **Simplicity**
  - Design for simplicity
  - Add complexity only where you must
- Rule of **Transparency**
  - Design for visibility, inspection, and debugging

Clear Explanations

- Be generous with internal documentation
  - Particularly when being clever or ultra-efficient

```
# Find all instances of the string

find . –type f –exec fgrep –i “$mySTRING” \
/tmp/dummy {} \; 2>/dev/null
```

  - Avoid NVA interpretations

```
# List the directory content, including links

ls –lasF
```

Visual Simplicity

- Be kind to yourself and others

- Layouts and formatting

  USE WHITESPACE

  Break up long lines with \
  back-slash \

- It is okay to use the TAB key

Visual Flow

```
for thisHOST in `cat ${HOSTLIST}`; do
if [ ${#thisHOST} -gt 5 ]; then
echo "BIG: ${thisHOST} is ${#thisHOST} characters"
else
if [ ${#thisHOST} -lt 3 ]; then
echo "LITTLE: ${thisHOST} is ${#thisHOST} characters"
fi
fi
done
```

Visual Flow

```
for thisHOST in `cat ${HOSTLIST}`; do
if [ ${#thisHOST} -gt 5 ]; then
echo "BIG: ${thisHOST} is ${#thisHOST} characters"
else
if [ ${#thisHOST} -lt 3 ]; then
echo "LITTLE: ${thisHOST} is ${#thisHOST} characters"
fi
fi
done

for thisHOST in `cat ${HOSTLIST}`; do
    if [ ${#thisHOST} -gt 5 ]; then
           echo "BIG: ${thisHOST} name is long"
    else
           if [ ${#thisHOST} -lt 3 ]; then
                  echo "LITTLE: ${thisHOST} name is short"
           fi
    fi
done
```

Harmonious style and content

This works:

```
mySID=`zenity --list --text "Select the database instance"
   --column "SID" --column "Description" "NICKEL" "Five
   Cent Database" "URANIUM"  "Not-For-Export Database"
   "CUSTOM"   "User defined instance" `
```

So does this:

```
mySID=`zenity --list \
              --text "Select the database instance" \
              --column "SID" --column "Description" \
                "NICKEL"   "Five Cent Database" \
                "URANIUM"  "Not-For-Export Database" \
                "CUSTOM"   "User defined instance" `
```

Which would you rather update?

Visual Consistency

- Make ${VARIABLES} stand out in your code

- Variable naming conventions
  - **ALL_CAPS** for variable names
  - **CamelCase** for function names
  - **thisVARIABLE** or **myVARIABLE** for looped variables

- Be internally consistent
  - Make a rule and follow it

Outstanding Variables

```
for thishost in `cat $hostlist`; do
  if [ $#thishost -gt 5 ]; then
         longmessage
  else
         if [ $#thishost -lt 3 ]; then
                shortmessage
         fi
  fi
done
```

Outstanding Variables

```
for thishost in `cat $hostlist`; do
  if [ $#thishost -gt 5 ]; then
         longmessage
  else
         if [ $#thishost -lt 3 ]; then
                shortmessage
         fi
  fi
done

for thisHOST in `cat ${HOSTLIST}`; do
  if [ ${#thisHOST} -gt 5 ]; then
         LongMessage
  else
         if [ ${#thisHOST} -lt 3 ]; then
                ShortMessage
         fi
  fi
done
```

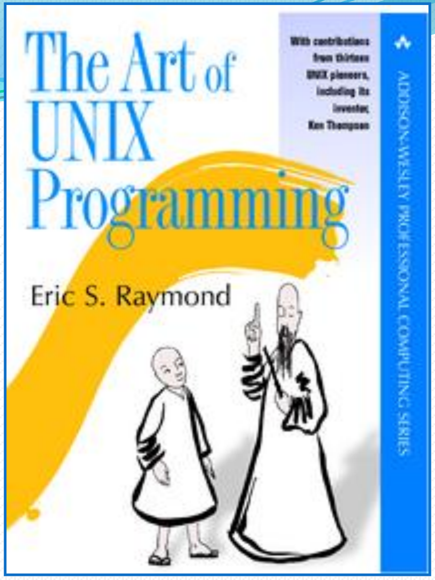
The Penny Wise Quiz

a. Shorter variable names =
Less typing =
Less work

b. Obscure variable names =
Reduced transparency =
Poor quality

- Save your cycles for deciphering the logic
  - Not the variable names

Transparency II



- Rule of **Modularity**
  - Write simple parts connected by clean interfaces
- Rule of **Robustness**
  - Robustness is the child of transparency and simplicity

Efficiency

- Use shell script **functions**
  - Simple syntax

```
function GiveDirectoryContent {
echo "\nThis directory contains:"
ls -lasF
}

> GiveDirectoryContent
```

- Modularize *all* repeated code statements

Predictability

- Layout in sections
  - ***Header*** with file name, purpose, command-line inputs
  - ***Independent variables*** – edited w/ every installation
    - “Nothing to change below this line”
  - ***Dependent variables*** – never require edits
  - ***Functions*** section
  - ***Runtime*** block

- Think “On call” when laying out a script

Predictable Layout

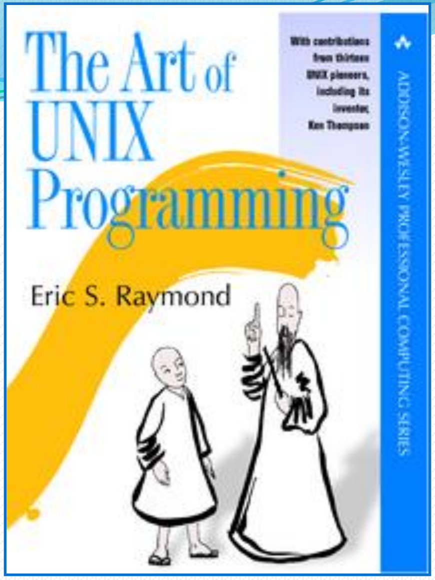
```
#!/bin/bash
#############################################################
# File              : sample_script.sh
# Input values      : Database name (optional)
# Purpose           : Amaze others
#############################################################

# ===========================================================
# Independent variables
# ===========================================================
export BASEDIR=/usr/lbin/orascripts

# ===========================================================
# Dependent variables
# Nothing to change below this line
# ===========================================================
LOGDIR=$BASEDIR/logs
WORKFILE=$LOGDIR/workfile.lst
```

Transparency Zen

- Rule of **Diversity**
  - Distrust all claims of "one true way"
  - Including your own

- Collaboration + humility = the cost of quality
  - Design reviews expose opportunties
  - Code reviews expose failure modes

Steal, adapt, improve, repeat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If it ain't broke . . .

- Don't ignore it
  - Particularly for older scripts

- Tune it up
  - Apply new techniques and tools
    - Gzip for compress

  - Verify old programs' assumptions
    - Unreliable hardware

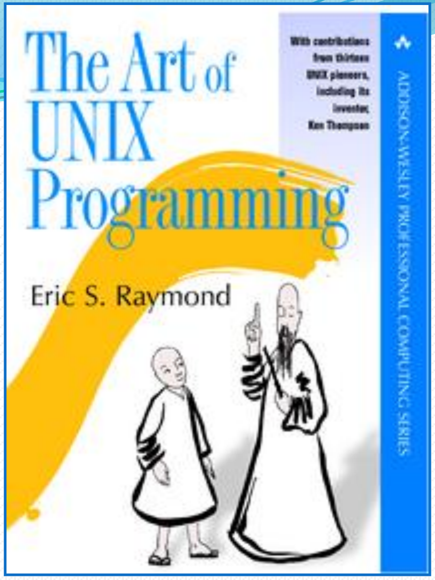
Transparency Wrap-up

Well-crafted shell scripts:

- Written with maintenance and on-call in mind
- Provide useful guidance and instructions
- Reflect visual simplicity and clear layout

Comments or questions

User Communication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- Rule of **Silence**
  - Communicate clearly when necessary
- Rule of **Repair**
  - When you must fail, fail noisily and as soon as possible
- Rule of **Least Surprise**
  - In interface design, do the least surprising thing
  - Do the most expected thing

Work *with* the user

- Verify scripted actions

```
echo “These files will be backed up:”
cat ${FILELIST}
```

- Keep the user informed
  - Share status and decisions

```
echo “You asked to delete everything in /etc”

read -p "Is this correct? [Y|N]" myVal
case $myVal in . . .
```

Graciousness

- Handle errors with grace
  - Explain the situation
  - Lead the user to a solution

```
if [ ${#1} -eq 0 ];then
   echo "The required value for database name"
   echo "was not passed in the command line"
   read -p "Enter the database name:  " myVal
   export thisSID=$myVal
fi
```

Signs of Life

- Same script should work in cron or interactive
    - Test for tty (terminal id)

```
if tty -s
then
   echo “Oh good, this is interactive”
   echo “Hello $USER”
else
   date +“Script $0 started %T” >> $LOGFILE
fi
```

Communicating Failure

- Cryptic feedback is neither welcome nor helpful

```
>
> FATAL ERROR: bckpinit_strt error 12
>
```

- Terminal output is free, use it if you need it

```
>
> File not found: bckpinit_strt.conf
>
> Corrective action required:
>     Verify bckpinit_strt.conf exists at ABC
>     and readable by user xyz

> Email notification has been sent
```

Artist and Psychologist

- Break the output into usable blocks
  - Use \n and \t liberally
    - If it makes it easier for user to understand

- Particularly important for interactive scripts
  - Push the read statement into their attention

- Direct their eyes with breaks and groups
  - Apply the same practices to log files and reports

Electronic Communication

- Be complete, be clear
  - Which host
  - Which process / job
  - What happened (in prose)
  - How to troubleshoot / resolve the problem
- Start communicating in the subject line
- Cryptic feedback in email is useless

Relevance

Subject: servtest1: oradb arch_move completed WITH WARNINGS

```
servtest1: oradb arch_move completed WITH WARNINGS on 07/21/08
Total number of warnings = 1 .
Please review warning log,
/oradb_orabase/local/logs/oradb.arch_move.wlog

***** BOF /oradb_orabase/local/logs/oradb.arch_move.wlog *****
 13:03:47 STG 3:Warning : NO Archives to move
***** EOF /oradb_orabase/local/logs/oradb.arch_move.wlog *****
```

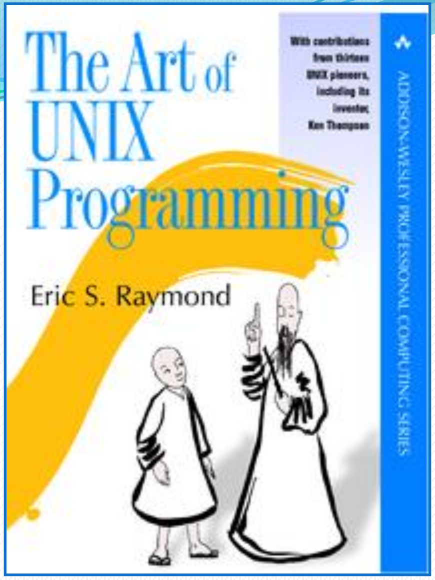
Communication Wrap-up

Well-crafted shell scripts:

- Work *with* the user
- Are generous with visual guidance and produce attractive, useful log files and reports
- Provide clear and complete feedback

Comments or questions

Scalability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- Rule of **Extensibility**
  - Design for the future
  - It will be here before you know it
- Rule of **Economy**
  - Use machine resources instead of people power
- Mindset
  - Awareness
  - Thoughtfulness

Scalability

- Scalability goal #1: Never customize a script

- Hard and fast rules
  - Overuse variables
  - Never hardcode
    - Passwords
    - Host or database names
    - Paths
  - Use command-line input, ‘read’, or parameter files

Stability and Predictability

- Consistency
  - Use the same code across your entire enterprise
- Security
  - Limit editing permissions
    - 'Them' and you, too
- Revision control
  - Keep a gold copy out there

Make the Machine do the Work

- Create everything you need, every time
  - Fix permissions too

```
export thisDIR=/usr/lbin/orascripts

if [ ! -d $thisDIR ]; then
   mkdir $thisDIR
fi
chmod 775 $thisDIR
```

- If you would manually check it . . .

Resourcefulness

- Single-point maintenance
  - Host and database name lists
  - Central repository
- Use existing files
  - /etc/passwd, var/opt/oracle/oratab
- Use a function library
  - 'Sourced' whenever needed
  - Edit once for every use

Function library contents

- Suggestions
  - Report headings
  - Common format inserts
  - Email distribution lists or policies
  - Email privacy notices
  - Error handling

- Watch for opportunities

Scalability Wrap-up

Well-crafted shell scripts:

- Never require editing for a new host / installation
- Handle expected problems from the start
- Use existing resources whenever possible

Comments or questions

You are a Unix Programmer

"To do the Unix philosophy right, you have to be loyal to excellence. You have to believe that ***software design is a craft*** worth all the intelligence, creativity, and passion you can muster."

-- Eric S. Raymond

MY BOSS SAYS WE NEED SOME EUNUCH PROGRAMMERS.
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