

Seminar Software Qualität

Auftaktveranstaltung

Maximilian Junker

Technische Universität München

Informatik IV: Software & Systems Engineering

Prof. Dr. Dr. h.c. Manfred Broy

Organisatorisches

Termin für das Seminar

Optionen: 22. Januar – 2. Februar

Bitte in Doodle eintragen:

<https://doodle.com/poll/wn8ci39d88xq5uug>

Termine

- Version 1.0 Seminararbeit: 2 Wochen vor Vortrag
- Probevortrag (verpflichtend): 2 Wochen vor Vortrag
- Finale Abgabe Seminararbeit: 1 Woche nach Vortrag

Agenda

1. Organisatorisches
- 2. Software Qualität – Eine Motivation**
3. Effektiv Präsentieren
4. Literaturrecherche

Software Qualität

Eine Motivation

Maximilian Junker

**(mit Folien von Benedikt Hauptmann, Henning Femmer, und
Florian Deissenböck)**

Technische Universität München

Informatik IV: Software & Systems Engineering

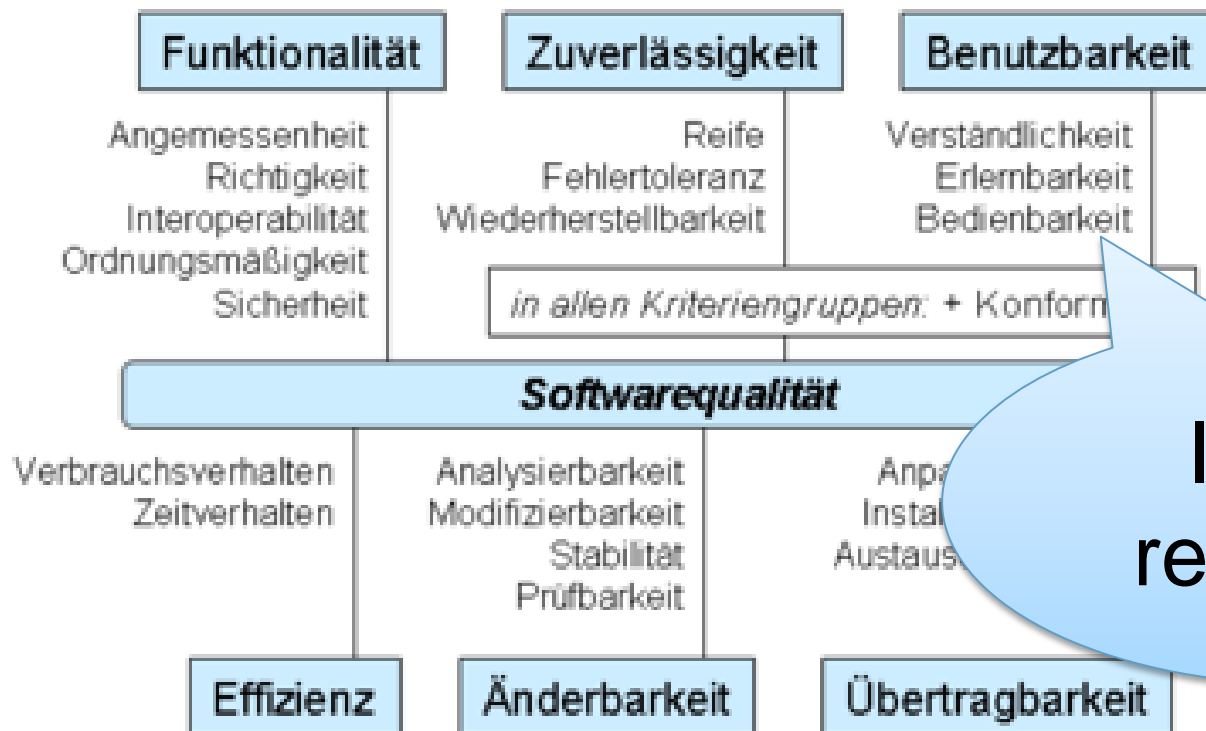
Prof. Dr. Dr. h.c. Manfred Broy

Agenda

1. Software Qualität?
2. Qualität von Sourcecode
3. Qualität von Anforderungen
4. Qualität von Tests
5. Tools für die Qualitätssicherung

Software Qualität fassen – Qualitätsmodelle

Qualitätsmerkmale von Softwaresystemen (ISO 9126)



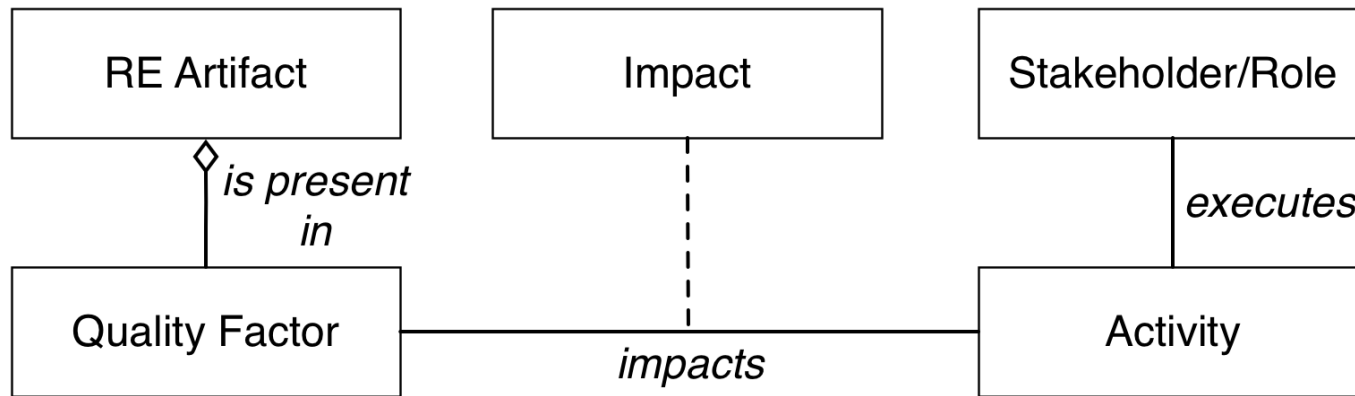
Immer
relevant?

Unterschiedliche Qualitätsmodelle – Was nun?

| Set of Reqs. / Reqs. Document | (Individual) Requirements | Requirements Language Criteria |
|--|------------------------------|---------------------------------------|
| Consistent | Unambiguous | Superlatives |
| Complete | Necessary | Subjective Language |
| Affordable | Consistent | Vague Pronouns |
| Bounded | Complete | Ambiguous Adverbs and Adjectives |
| Unambiguity | Traceable | Open-ended, non- verifiable. Terms |
| Clear Structure | Verifiable | Comparatives |
| Modifiability and Extensibility | Feasible | Loopholes |
| Traceability | Implementation Free | Incomplete References |
| | Singular | Negatives Statements |
| | Agreed | Short Sentences and Paragraphs |
| | Understandable | One Req. per Sentence |
| Key: <div> <div>ISO 29148 & IREB Characteristics</div> <div>ISO 29148 Characteristic</div> <div>IREB Characteristics</div> </div> | | |

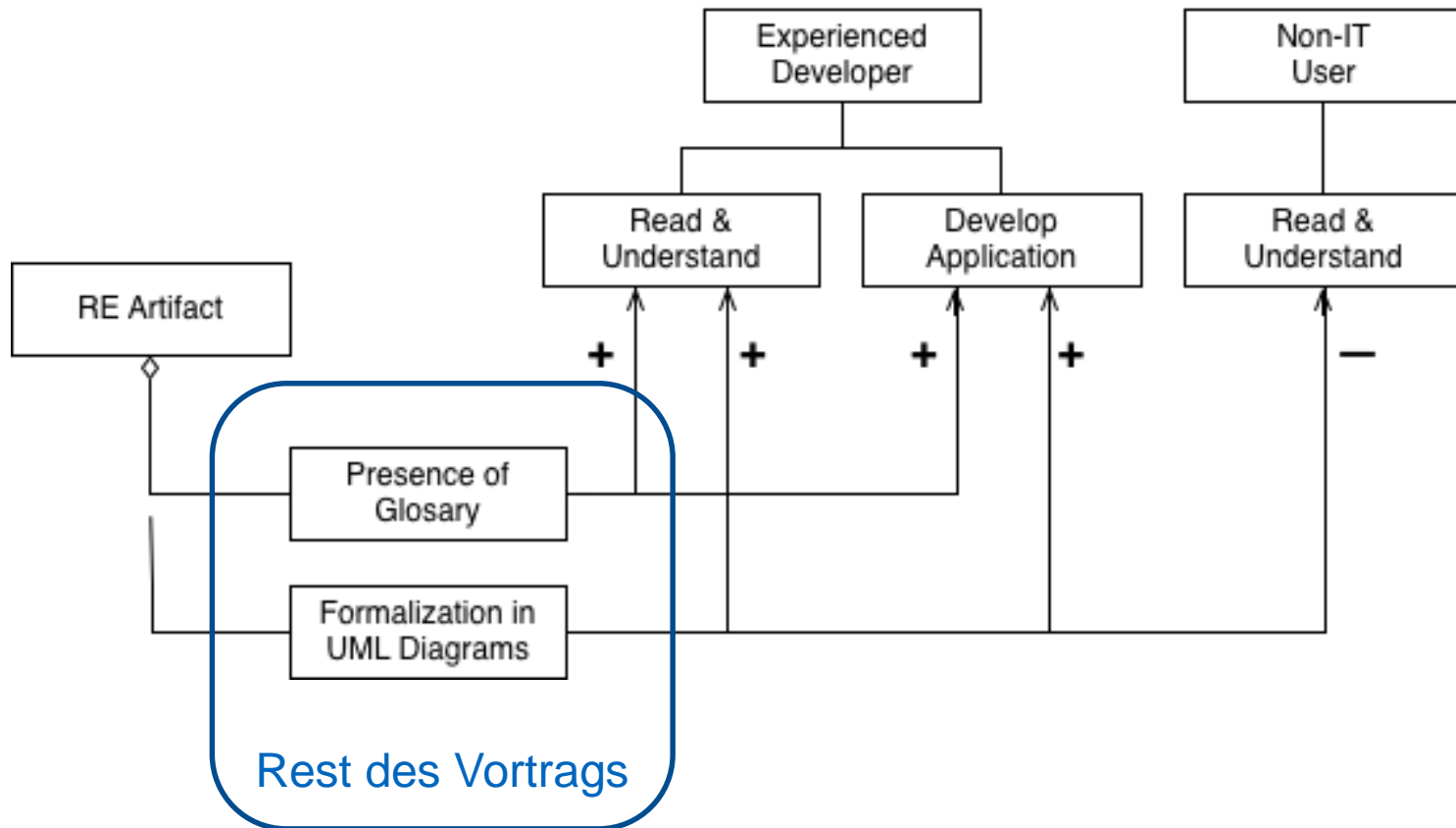
Aktivitätsorientierte Qualitätsmodelle

Beispiel Requirements Engineering



Aktivitätsorientierte Qualitätsmodelle



Beispiel Requirements Engineering




```
... socket.error, (errno, strerror):  
    print "ncfiles: Socket error (%s) for host %s (%s)" % (errno,  
ncfiles: Urllib2 error (%s)" % msg  
output")  
  
for h3 in page.findAll("h3"):  
    value = (h3.contents[0])  
    if value != "Afdeling":  
        print >> txt, value  
        import codecs  
        f = codecs.open("alle.txt", "r", encoding="utf-8")  
        text = f.read()  
        f.close()  
        # open the file again for writing  
        f = codecs.open("alle.txt", "w", encoding="utf-8")  
        f.write(value+"\n")  
        # write the original contents
```

Potentielle Bugs

```
46- protected static Properties getPreferences() {  
47-     if (fPreferences == null) {  
48-         fPreferences = new Properties();  
49-         fPreferences.put("loading", "true");  
50-         fPreferences.put("filterstack", "true");  
51-         readPreferences();  
52-     }  
53-     return fPreferences;  
54- }
```

 Bug Info 

BaseTestRunner.java: 47

 Navigation

Incorrect lazy initialization and update of static field junit.runner.BaseTestRunner.fPreferences in junit.runner.BaseTestRunner.getPreferences()
On field junit.runner.BaseTestRunner.fPreferences

Bug: Incorrect lazy initialization and update of static field junit.runner.BaseTestRunner.fPreferences in junit.runner.BaseTestRunner.getPreferences()

This method contains an unsynchronized lazy initialization of a static field. After the field is set, the object stored into that location is further updated or accessed. The setting of the field is visible to other threads as soon as it is set. If the further accesses in the method that set the field serve to initialize the object, then you have a *very serious* multithreading bug, unless something else prevents any other thread from accessing the stored object until it is fully initialized.

Even if you feel confident that the method is never called by multiple threads, it might be better to not set the static field until the value you are setting it to is fully populated/initialized.

Rank: Scary (6), **confidence:** High
Pattern: LI LAZY_INIT_UPDATE_STATIC

Formatierung



```

        hashOut.data = hashes + SSL_MD5_DIGEST_LEN;
hashOut.length = SSL_SHA1_DIGEST_LEN;
if ((err = SSLFreeBuffer(&hashCtx)) != 0)
    goto fail;

if ((err = ReadyHash(&SSLHashSHA1, &hashCtx)) != 0)
    goto fail;
if ((err = SSLHashSHA1.update(&hashCtx, &clientRandom)) != 0)
    goto fail;
if ((err = SSLHashSHA1.update(&hashCtx, &serverRandom)) != 0)
    goto fail;
if ((err = SSLHashSHA1.update(&hashCtx, &signedParams)) != 0)
    goto fail;
    goto fail;
if ((err = SSLHashSHA1.final(&hashCtx, &hashOut)) != 0)
    goto fail;

err = sslRawVerify(ctx,
                   ctx->peerPubKey,
                   dataToSign,
                   dataToSignLen,
                   signature,
                   signatureLen);
/* plaintext */
/* plaintext length */

if(err) {
    sslErrorLog("SSLDecodeSignedServerKeyExchange: sslRawVerify "
               "returned %d\n", (int)err);
    goto fail;
}

fail:
SSLFreeBuffer(&signedHashes);
SSLFreeBuffer(&hashCtx);
return err;

```

Schachtelungstiefe

```
for (const_iterator<Permission> permission =  
    permissions.begin();  
    permission != permissions.end(); ++permission) {  
    if (!permission->isInternal()) {  
        if (user->hasPermission (permission)) {  
            cout << " " << permission << endl;  
        }  
    }  
}  
}  
}  
}  
} /* bezieht sich auf if in Zeile 172 */  
}
```

Klone

```

public String format(String field) {
    int i;
    field = field.replaceAll("&\\\\\\\\\\\\\\\\&", "&amp;").replaceAll("[\\n](1,)*", "<p>");

    StringBuffer sb = new StringBuffer();
    StringBuffer currentCommand = null;

    char c;
    boolean escaped = false, incommand = false;

    for (i = 0; i < field.length(); i++) {
        c = field.charAt(i);
        if (escaped && (c == '\\')) {
            sb.append('\\');
            escaped = false;
        } else if (c == '\\') {
            if (incommand) {
                /* Close Command */
                String command = currentCommand.toString();
                Object result = CHARS.get(command);
                if (result != null) {
                    sb.append((String) result);
                } else {
                    sb.append(command);
                }
            }
            escaped = true;
            incommand = true;
            currentCommand = new StringBuffer();
        } else if ((incommand && (c == '{' || c == '}')) {
            // Swallow the brace.
        } else if (Character.isLetter(c) || (c == '%')) {
            if ((Globals.SPECIAL_COMMAND_CHARS.indexOf(String.valueOf(c)) >
                escaped = false;

            if (incommand)
                sb.append(c);
            // Else we are in a command, and should not keep the letter.
        } else {
            currentCommand.append(c);
            testCharCom: if ((currentCommand.length() == 1)
                && (Globals.SPECIAL_COMMAND_CHARS.indexOf(currentComm

```

```

public String format(String field) {
    int i;
    field = field.replaceAll("&\\\\\\\\\\\\\\\\&", "&amp;").replaceAll("[\\n](1,)*", "<p>");

    StringBuffer sb = new StringBuffer();
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    char c;
    boolean escaped = false, incommand = false;

    for (i = 0; i < field.length(); i++) {
        c = field.charAt(i);
        if (escaped && (c == '\\')) {
            sb.append('\\');
            escaped = false;
        } else if (c == '\\') {
            if (incommand) {
                /* Close Command */
                String command = currentCommand.toString();
                Object result = Globals.HTML_CHARS.get(command);
                if (result != null) {
                    sb.append((String) result);
                } else {
                    sb.append(command);
                }
            }
            escaped = true;
            incommand = true;
            currentCommand = new StringBuffer();
        } else if ((incommand && (c == '{' || c == '}')) {
            // Swallow the brace.
        } else if (Character.isLetter(c) || (c == '%')) {
            if ((Globals.SPECIAL_COMMAND_CHARS.indexOf(String.valueOf(c)) >
                escaped = false;

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                sb.append(c);
            // Else we are in a command, and should not keep the letter.
        } else {
            currentCommand.append(c);
            testCharCom: if ((currentCommand.length() == 1)
                && (Globals.SPECIAL_COMMAND_CHARS.indexOf(currentComm

```

Anforderungsqualität



The system generates relations to other files, based on attribute values.

The controls shall be illuminated where appropriate.

The device shall allow the user to request recommendations in as few steps as possible.

Undefinierte Akronyme

| | |
|------------|------------------------|
| ERTMS/ETCS | The ETCS part of ERTMS |
| MA | Movement Authority |
| RBC | Radio Block Centre |

The ERTMS/ETCS on-board equipment shall send an MA request to the RBC and wait. If an SR authorisation is received from RBC, the process shall go to S24.



Unvollständige Anforderungen

Platzhalter und

Standardtexte

*[This section contains the
preconditions of the use case.]*

tbd.

Klone

Copy & Paste Reuse (*Cloning*) führt zu

1. Höheren Wartungsaufwänden
2. Inkonsistenzen

[REQ101]

Component A must receive data and confirmation.

[REQ201]

Component B must receive data and confirmation.

...

[REQ801]

Component C must receive data and confirmation.

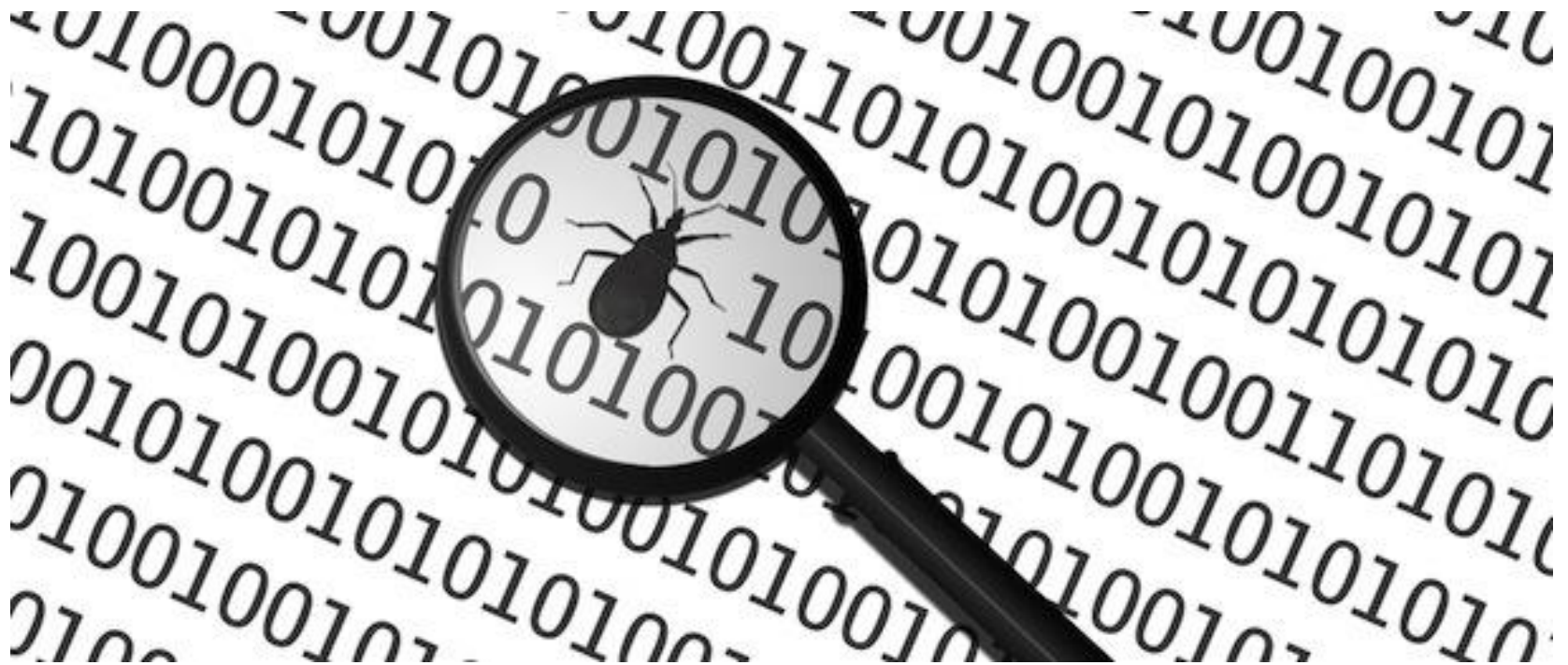
[REQ401]

The component D must receive data and confirmation.

[REQ501]

Component E must receive **sender name** , data, and confirmation.

Testqualität



Fragile Tests

RECORD

RUN

Login

+ Add New Action

✂

📄

✕

↶

↷

⬆

⬇

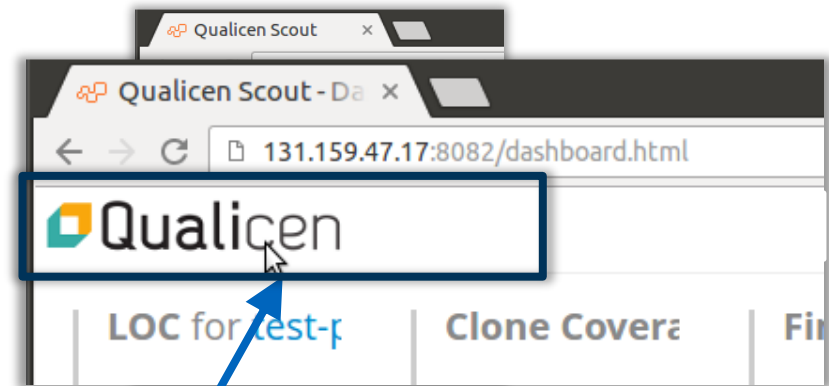
⬇

⬆

Turbo Mode

Screenshot

| # | Action | | | | |
|---|--------------|--------|------|----------|-------------------------|
| 1 | Mouse | Click | Left | Relative | ↔ UsernameField |
| 2 | Key Sequence | admin | | | ↔ UsernameField |
| 3 | Mouse | Click | Left | Relative | ↔ PasswordField |
| 4 | Key Sequence | admin | | | ↔ PasswordField |
| 5 | Mouse | Click | Left | Relative | ↔ LoginButton |
| 6 | Validate | Exists | | | ↔ QualicenLogoDashboard |



| <div> <div>+</div> Add New Item <div>🔍</div> Track... <div>✂</div> <div>📄</div> <div>✕</div> <div>↶</div> <div>↷</div> <div>🖨</div> <div>TestScoutRepository</div> <div>Variables...</div> <div>Cleanup</div> </div> | |
|--|---|
| Item | Path |
| <div> <div>📁</div> <div>Login Dialog</div> </div> <div> <div>↔</div> UsernameField <div>↔</div> PasswordField <div>↔</div> LoginButton </div> | <div>Base: /dom[@caption='Qualicen Scout' and @page='login.html' and @path='/login.html' and @browsername='Mozilla']</div> <div>./input[#'username-field']</div> <div>./input[#'password-field']</div> <div>./button[#'login-button']</div> |
| <div> <div>📁</div> <div>Main Windows</div> </div> <div> <div>↔</div> AccountPopupButton <div>↔</div> Logout <div>↔</div> QualicenLogoDashboard </div> | <div>Base: /dom[1]</div> <div>./img[#'account-popup-button']</div> <div>./div[#'1']/div[@innertext='Logout']</div> <div>body/div[10]/img[@src='http://131.159.47.17:8082/images/teamscale']</div> |



Ineffektive Tests

176832_SecurityTrimmingIsAppliedToSearchResults

[CONTENT]

Validation Ratio



Valid

Name

Just 17 out of 125 step(s) of this test are validating steps. (13.60%)

Setup

TearDown: ---

Step 01: LoginToApplicationAndValidateLoggedInUsername

Step 02: NavigateToDocumentsListPageFromHomePage

Step 03: SetAnyUserWhoCanReadItemsInDraftItemSecuritySetting

Step 04: UploadDocumentToDocumentsLibrary

Step 05: NavigateToHomePageFromEditPage

Step 06: CreateNewSharePointSiteAtHomePage

Step 07: EditNewSharePointSiteAndFillMandatoryFieldsInMetadataPane

Step 08: AddDocumentModuleToExistingNewsSite

Keine oder schlechte Struktur in Tests

| RECORD RUN Add Entry | | | | | |
|----------------------|--------------------|------------------------|-------|----------|-------------------|
| Add New Action | | | | | |
| # | Action | | | | |
| 1 | Run Application | C:\KeePass\KeePass.exe | | | |
| 2 | Mouse | Click | Left | Relative | MasterPassword |
| 3 | Key Sequence | rx | | | MasterPassword |
| 4 | Mouse | Click | Left | Relative | BtOK |
| 5 | Mouse | Click | Left | Relative | Edit |
| 6 | Mouse | Click | Left | Relative | AddEntry |
| 7 | Mouse | Click | Left | Relative | Title |
| 8 | Key Sequence | \$varTitle | | | Title |
| 9 | Mouse | Click | Left | Relative | MBtnIcon |
| 10 | Invoke Action | Select () | | | LI_Icon |
| 11 | Mouse | Click | Left | Relative | ButtonClose |
| 12 | Mouse | Click | Left | Relative | UserName |
| 13 | Key Sequence | \$varUsername | | | UserName |
| 14 | Mouse | Click | Left | Relative | Password |
| 15 | Mouse | Click | Right | Relative | Password |
| 16 | Mouse | Click | Left | Relative | SelectAll |
| 17 | Key Sequence | \$varPassword | | | Password |
| 18 | Mouse | Click | Left | Relative | Repeat |
| 19 | Mouse | Click | Right | Relative | Repeat |
| 20 | Mouse | Click | Left | Relative | SelectAll |
| 21 | Key Sequence | \$varPassword | | | Repeat |
| 22 | Mouse | Click | Left | Relative | URL |
| 23 | Key Sequence | \$varURL | | | URL |
| 24 | Mouse | Click | Left | Relative | MBtnStandardEx... |
| 25 | Mouse | Click | Left | Relative | MI_Expires |
| 26 | Mouse | Click | Left | Relative | ButtonOK |
| 27 | Mouse | Click | Left | Relative | Entry |
| 28 | Mouse | Click | Right | Relative | Entry |
| 29 | Mouse | Click | Left | Relative | DeleteEntry |
| 30 | Mouse | Click | Left | Relative | Save |
| 31 | Close Applicati... | CloseWindow | 0ms | | MainForm |

Neuen
Eintrag
anlegen

Eintrag löschen

Speichern und schließen

Tools für die Qualitätssicherung

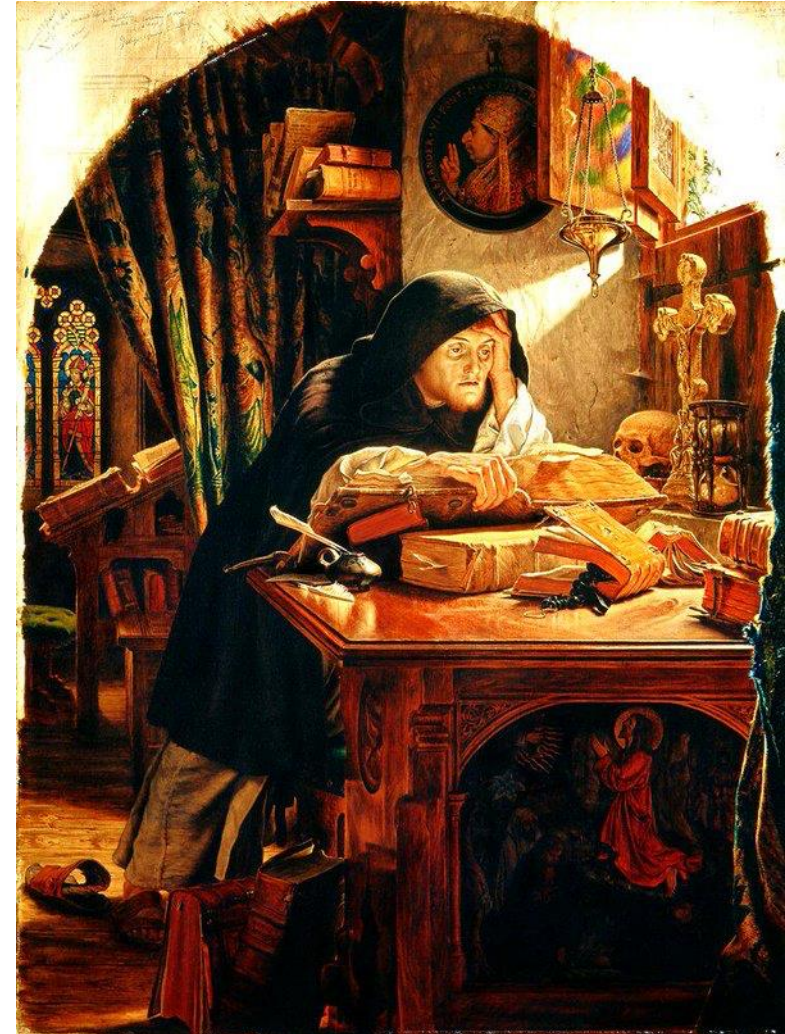


Effektiv:

- Genaue inhaltliche Prüfung möglich
- Prüfen schwer automatisch messbare subjektive Verständlichkeit
- Wissensvermittlung

Aber:

- Aufwendig und teuer.
- Lange Feedback-Schleifen.
- Inkonsistent.



Automatisierte Qualitätsanalyse

Teamscale und Scout



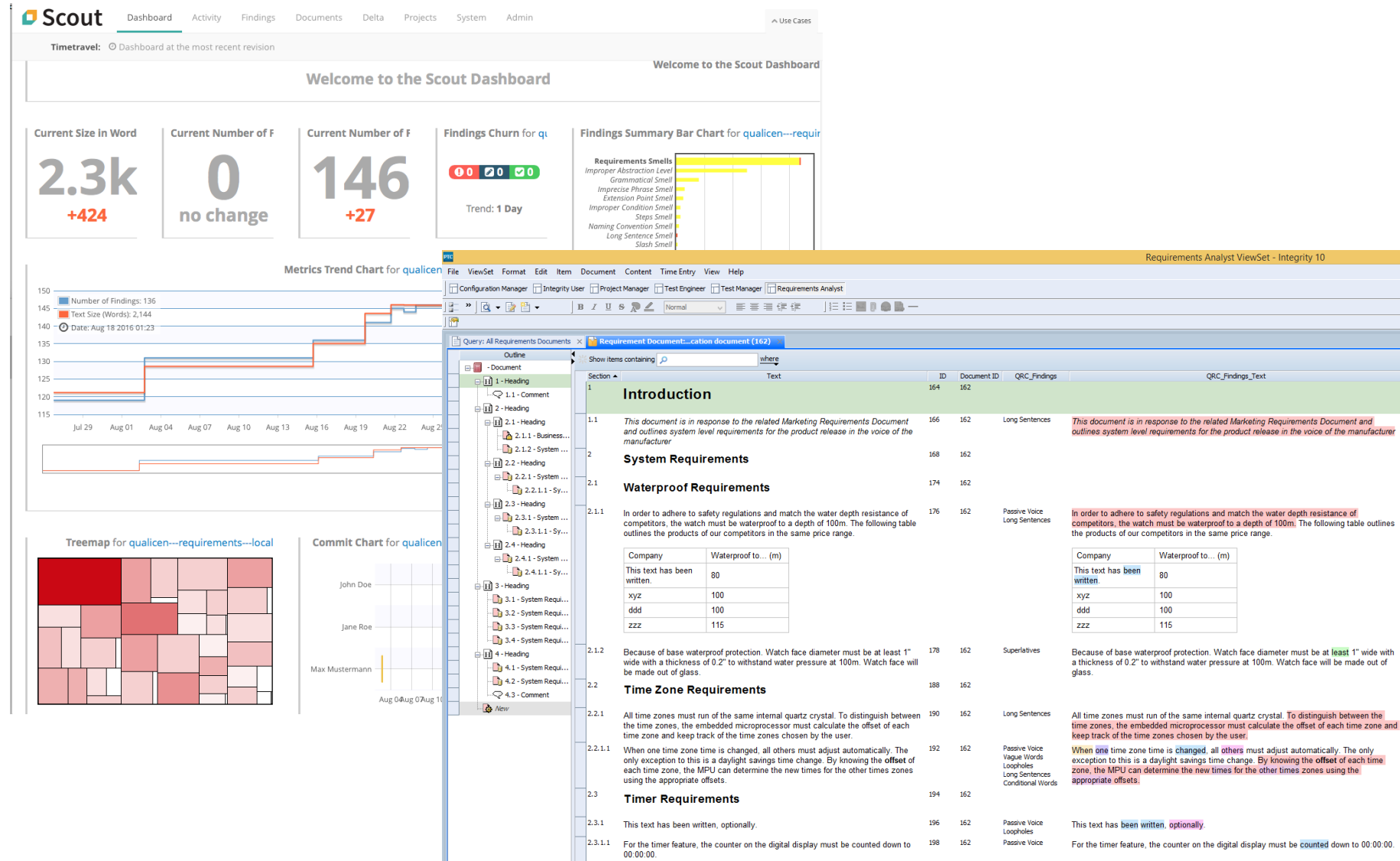
Scout Dashboard Documents More

Project: Daimler-Evaluation-Test Timetravel: Documents at the most recent revision

Evaluation-test / atm.csv / PAPER / ATM_RANDOM_BAD_PIN More

| Step | Action | Check |
|------|----------------------------------|--|
| 1 | Put ATM card in card-reader | ATM asks for the PIN. |
| 2 | Enter <u>some</u> bad PIN. | ATM responds that the PIN you entered is wrong and that you have only two <u>more</u> attempts left. |
| 3 | <u>Enter the same PIN again.</u> | ATM responds that the PIN you entered is the same wrong PIN again and that you have only one attempt left. |
| 4 | Put ATM card in card-reader | ATM asks for the PIN. |
| 5 | Enter a random PIN. | The result differs <u>depending</u> on <u>whether</u> the PIN is correct. |

Automatische Qualitätsanalyse – Zwei Perspektiven



Automatische oder manuelle Qualitätssicherung?

- **Viele relevante Qualitätseigenschaften sind nicht automatisch analysierbar**
 - Kommentare
 - sinnvolle Verwendung von Datenstrukturen und Algorithmen
 - Inhalte von Anforderungen
 - logische Redundanz
- **Diese Eigenschaften bedürfen der manuellen Analyse**
- **Manuelle Analysen sollten soweit möglich durch automatische Analysen unterstützt werden**

