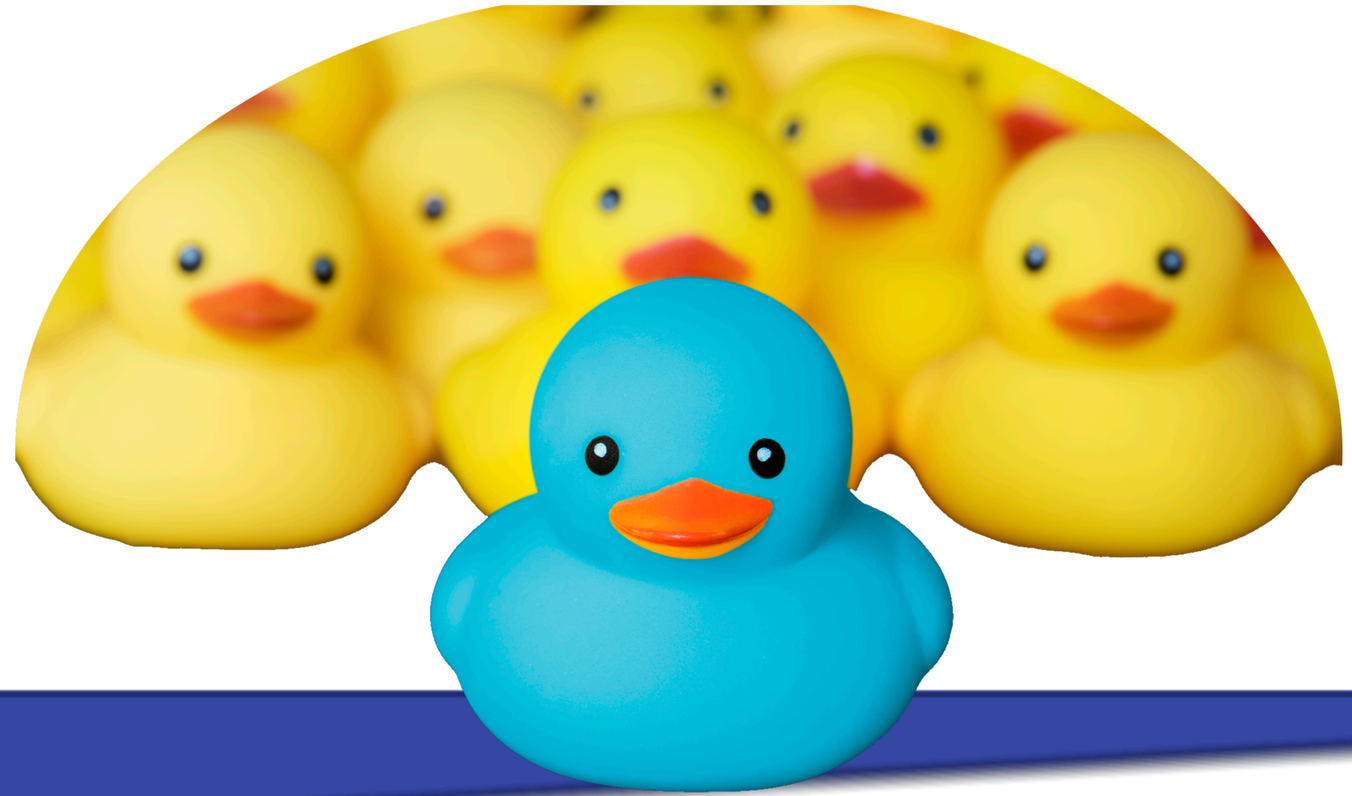
Tests that (Almost) Write Themselves

Hints for Golden Master Testing in Python



Stefan Baerisch, stefan@stbaer.com, 2020-07-20

image: freepik.com premium, by rawpixel

About

Stefan Baerisch

stbaer.com (German only, sorry)

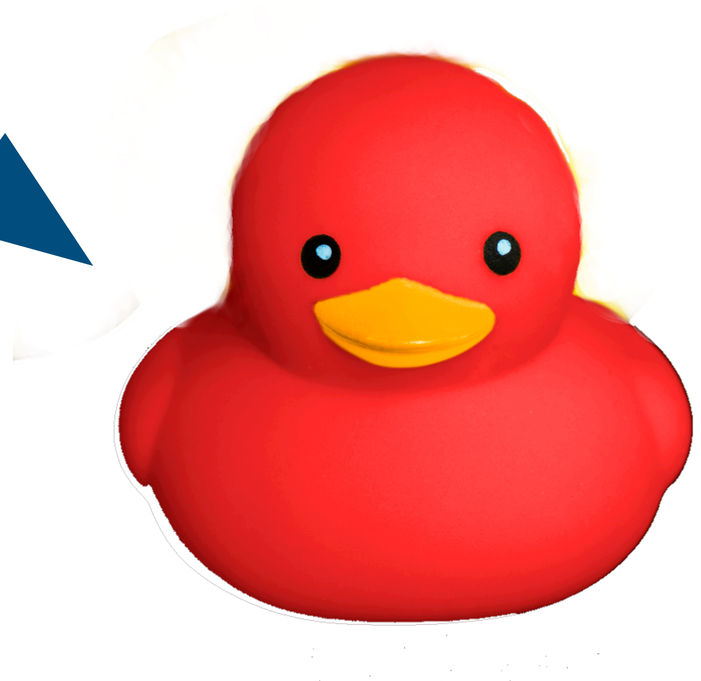
Software since 2005

Python since 2006

Project mangement / Test Management since 2010

Some Background on Golden Master Tests

Good Duck?



How would you describe an ‘acceptable’ rubber duck ?

Do you know it when you see it?

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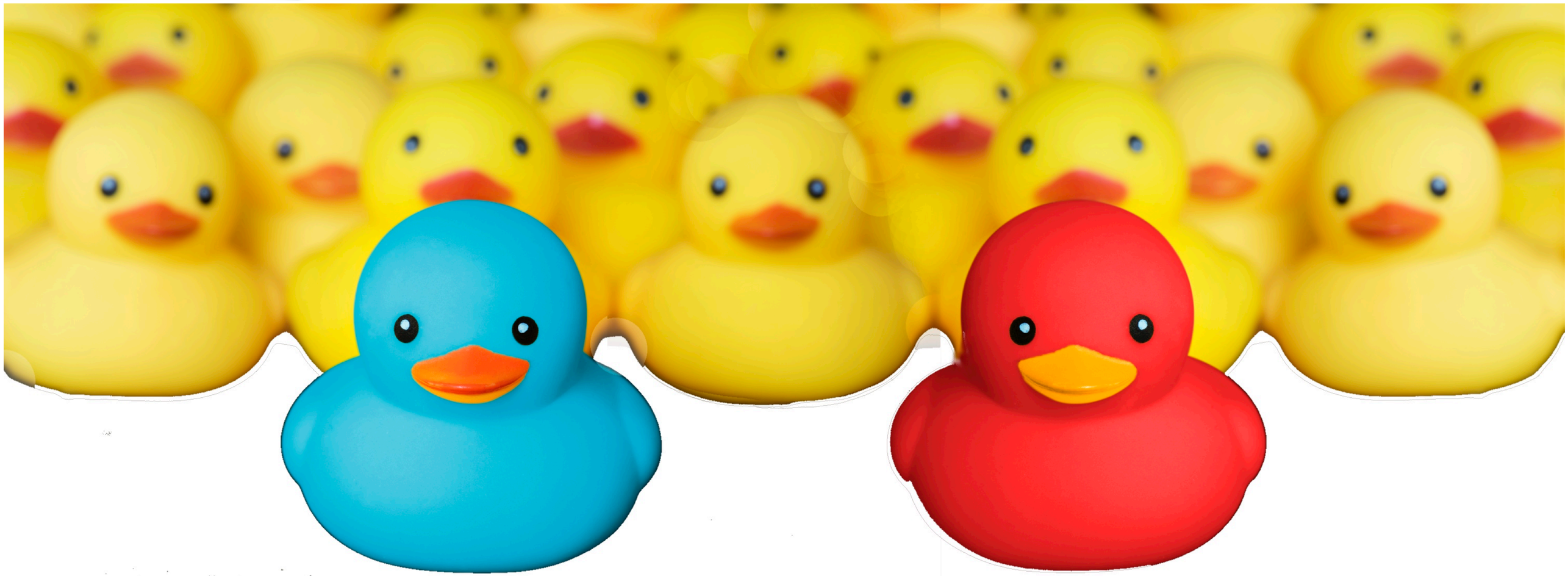
Testing Ducks



How would you describe an ‘acceptable’ rubber duck ?

Do you know it when you see it?

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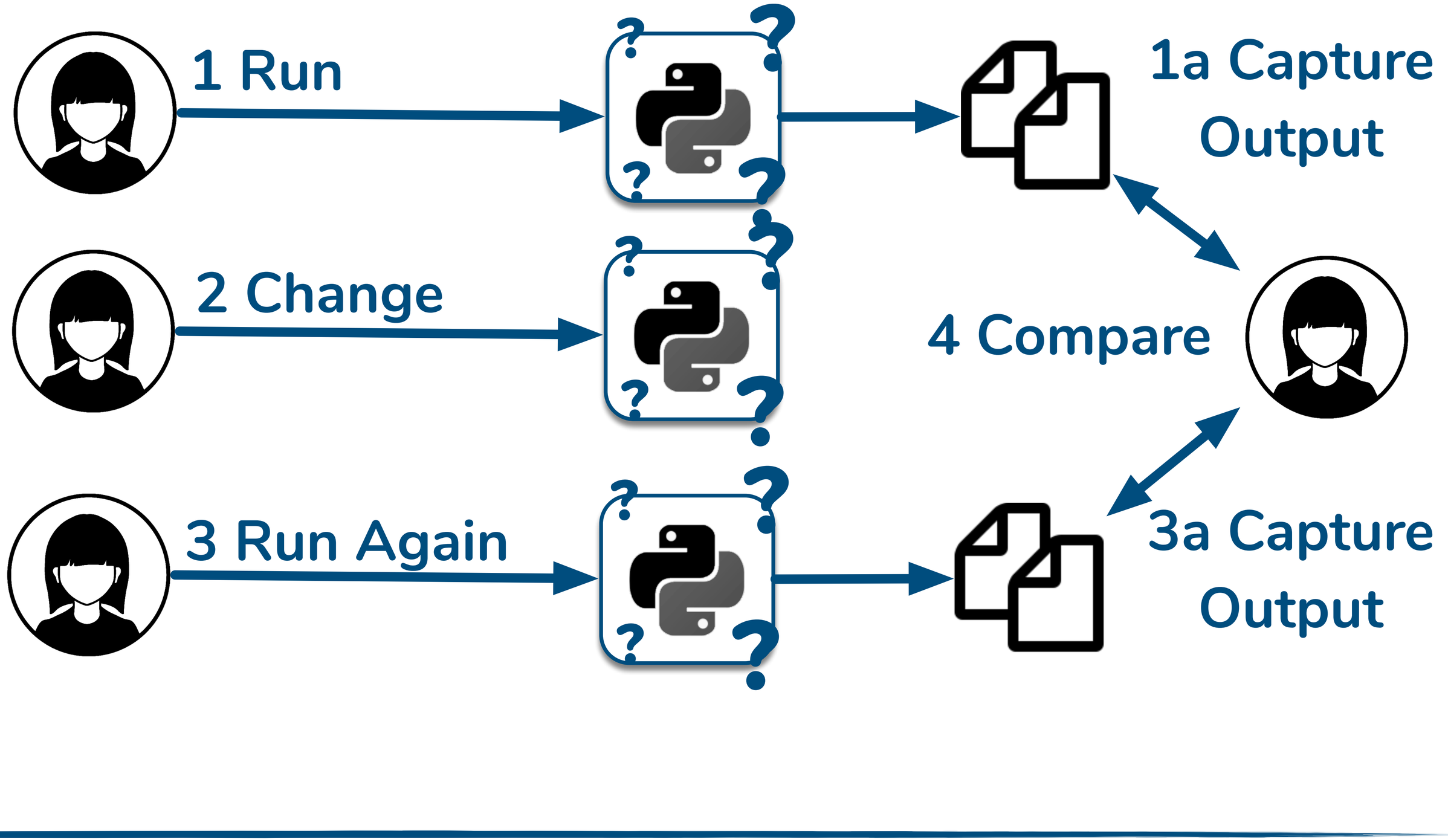
The Idea behind Golden Master Testing


```
debug3: sign_and_send_pubkey: signing using rsa-sha2-512
debug3: send packet: type 50
debug3: receive packet: type 52
debug1: Authentication succeeded (publickey).
Authenticated to eviact.com ([142.93.108.97]:22).
debug1: channel 0: new [client-session]
debug3: ssh_session2_open: channel_new: 0
debug2: channel 0: send open
debug3: send packet: type 90
debug1: Requesting no-more-sessions@openssh.com
debug3: send packet: type 80
```

How to implement test if data is unknown or too complex for an assert() ?

```
debug1: Sending environment.
debug3: Ignored env NVM_INC
debug3: Ignored env TERM_PROGRAM
debug3: Ignored env NVM_CD_FLAGS
debug3: Ignored env DOTNET_CLI_TELEMETRY_OPTOUT
debug3: Ignored env SHELL
debug3: Ignored env TERM
debug3: Ignored env CLICOLOR
debug3: Ignored env TMPDIR
debug3: Ignored env Apple_PubSub_Socket_Render
debug3: Ignored env TERM_PROGRAM_VERSION
debug3: Ignored env TERM_SESSION_ID
```

What is Golden Master Testing



How does this help?

Scenario	Action
Testing a legacy system	Ensure that changes are visable
Testing complex data	Identify and review changes
Testing complex data with some changes	Select or filter data used for tests

Golden Master Testing - An Overview

Golden Master Tests are also known as:

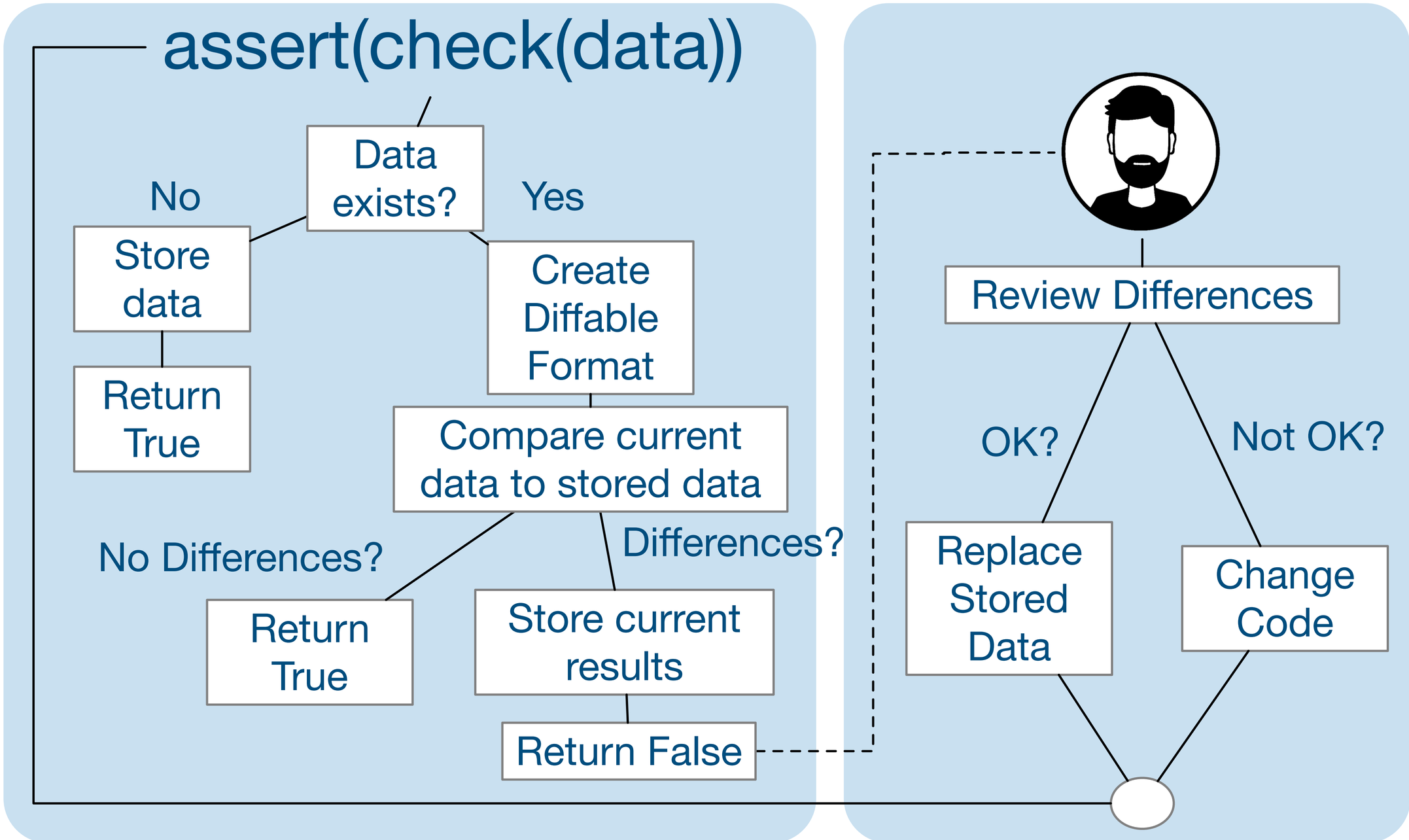
- **Characterization Tests**
- **Approval Tests**
- **Snapshot Tests**

Because changes to the data are ‘approved’

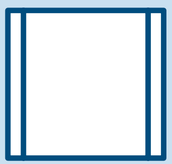
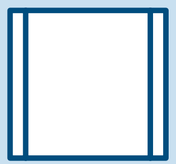
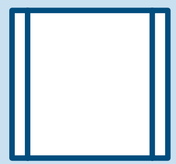
In the Javascript World, especially Jest

Implementing Golden Master Tests

The Process

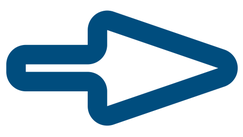

assert(check(data))
Data exists?
No
Yes
Store data
Return True
Create Diffable Format
Compare current data to stored data
No Differences?
Differences?
Return True
Store current results
Return False
Review Differences
OK?
Not OK?
Replace Stored Data
Change Code
Automatic Test Process
Manual Approval Process

Design Decisions

Test Target	State 	Log 	Output 
Test Size	Few Large 	Many Small 	
Storage Formats	Text 	Json/XML 	Custom 
Diff Approach	CLI $… 	Lib 	Custom 
What to Ignore	Key Order	Dates	Random Values

Test Target

Text / Logfiles	→	Use as is, with Filtering
Databases	→	Select and Store as DDL
JSON	→	import json
		custom implementation or…
Objects	→	`import jsonpickle` or…
		`import deepdiff`
Images	→	pillow
Dataframes	→	json



Keep it simple. Python makes it quite easy to get a text presentation of data

What to Ignore

What to ignore?

Dates / timestamps
Key order for non-ordered dicts
Random data (object ids / sequence ids)
Non-relevant data (non significant floating point data)

Needs some pre-processing, depending on use case

Test Size

Large Tests ⟺ Small Tests

easy, fast setup

will notice most changes

frequent reviews

likely more work cleaning up data

will need to break up / select data

may miss changes

less frequent reviews / shorter reviews

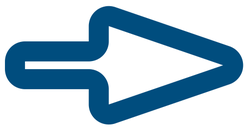
Less work cleaning up data

Storage Formats

How do you store results from past runs?

The format should be:

- Easy to store in VCSs
- Diffable in Python and External Tools
- Supported by Editors / Views
- Should be structured to support working with Python



If possible, use normalized JSON with linebreaks

An Example Implementation

Design Goals

Keep things simple

Compare Python Objects, no extentions — `jsonpickle`

Simple comparision — `difflib.unified_diff`

Simple storage — store files with tests, explicit naming of tests

Simple operations —

`check()` - store or compare data

`list()` - show stored data and conflicts

`review`(name) - show differences

`approve`(name) - mark the current version as ok

Our Sample Class

```
class MyTestClass:
    def __init__(self):
        self.a = "Hello"
        self.b = 1
        self.c = 2.33433
        self.d = [1, 2.3333, 3.3332]
        self.e = "2020-05-12"

test_data = MyTestClass()
changed_test_data = MyTestClass()
changed_test_data.d.pop()
changed_test_data.c += 0.5
```

Overview

```
checker = checker.Checker(os.path.dirname(__file__))
```
← Set storage location

```
assert checker.check(test_data, "name1")
assert checker.check(test_data, "name1")
```
Save
Compare
← Success

```
assert checker.check(test_data, "name2")
assert checker.check(changed_test_data, "name2")
```
Save
Compare
← Failure

```
checker.list()
```
← Show state of tests / stored data

```
checker.review("name2")
```
← Show diff of “name2” test

```
checker.approve("name2")
```
← Accept the lastest version

Overview Results

```
checker.list()
```

```
Name: name1 Conflict: False
Name: name2 Conflict: True
@@ -1,10 +1,11 @@
```

```
checker.review("name2")
```

```
 {
      "a": "Hello",
      "b": 1,
-     "c": 2.83433,
+     "c": 2.33433,
      "d": [
          1,
-         2.3333
+         2.3333,
+         3.3332
      ],
      "e": "2020-05-12"
 }
```

```
checker.approve("name2")
```

```
name2.now ⇒ name2.last
```

Implementation - Check

```
def check(self, obj, name):
    jsonpickle.set_preferred_backend('json')
    jsonpickle.set_encoder_options('json', sort_keys=True, indent=4)
    now_text = jsonpickle.encode(obj, unpicklable=False)

    last_filename = self._get_filename(name, LAST)
    if os.path.exists(last_filename):
        last_text = open(last_filename, mode="r", encoding="utf-8").read()
        diff = difflib.unified_diff(now_text.split("\n"), last_text.split("\n"))
        if len(list(diff)) != 0:
            now_filename = self._get_filename(name, NOW)
            self._write_file(now_filename, now_text)
            return False
        else:
            return True
    else:
        self._write_file(last_filename, now_text)
        return True
```

Implementation - List Status

```
def list(self):
    for val in self._get_list():
        print(f"Name: {val['name']} Conflict: {val['conflict']}")

def _get_list(self):
    result = []
    cands = glob.glob(os.path.join(self.path, "*.last"))
    for cand in cands:
        name = os.path.basename(cand).replace(".last", "").lower()
        conflict = os.path.exists(cand.replace(".last", ".now"))
        result.append({"name": name, "conflict": conflict, "filepath": cand})
return result
```

Implementation - Store

```
def review(self, name=None):
    read = lambda fn: open(fn, mode="r", encoding="utf-8").read().split("\n")
    for cand in self._get_entries(name, True):
        last_name = cand['filepath']
        last_cont = read(last_name)
        now_name = cand['filepath'].replace(".last", ".now")
        now_cont = read(now_name)
        diff = list(difflib.unified_diff(last_cont, now_cont,
                                         tofile=now_name, fromfile=last_name))
        print("\n".join(diff[2:]))

def _get_entries(self, name, only_conflict=False):
    cands = self._get_list()
    if name is not None:
        cands = [c for c in cands if c['name'] == name.lower()
                 and (not only_conflict or c['conflict'])]
    return cands
```

Implementation - Diff

```
def approve(self, name=None):
    for cand in self._get_entries(name, True):
        last = cand['filepath']
        now = last.replace(".last", ".now")
        print(f"{os.path.basename(now)} ⇒ {os.path.basename(last)}")
        shutil.move(now, last)
```

Other Existing Libraries

`github.com/syrusakbary/snapshottest`

Inspired by Javascript's Jess. Nice Integration with unittest/nose/pytest

`github.com/approvals/ApprovalTests.Python`

Python implementation of approval testing,

Summary

Why

Golden Master Tests work by **capturing & comparing** results of program executions. It helps with complex data, especially wen we want to monitor for changes.

How

We store results and compare between run. On differences, we **review & approve** the results

Python

Python has many modules to help us.
Some existing implementations exist if we don’t want to implement it ourselves

Thank you!

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