

Automatisiertes Software Testing



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Präsentation zum Praxisprojekt



M A
L I G H T I N G



Die Beteiligten

Vorgeschichte meines Projekts





Die GrandMA2

Die Veranstaltungstechnik Steuerung DMX

Tests für die grandMA2

Screen 4

Plugin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Macro	1.21	Masters
LUA	ShowfileInit	Tests Cancel	Run Tests	Agenda Store	Agenda Agenda	Agenda Assign	Agenda Copy	Agenda Delete	Channel Delete	Channel Assign	Channel At	Channel Clone	Channel Full				
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	1.	1.22	Extern 1
Channel Highlight	Channel Off	Channel On	Channel Park	Channel Release	Channel Remove	Channel SelFix	Channel Unpark	Cue Store	Cue Delete	Cue Assign	DMX Delete	DMX Assign	DMX At	DMX Full			
30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	2	1.23	Extern 2
DMX Off	DMX On	DMX Park	DMX SelFix	DMX Unpark	DMXS Store	DMXS Delete	DMXS Copy	DMXS Insert	DMXS Move	DMXS Update	DMXU Delete	DMXU Move	DMXU Off	DMXU On			

Command Line Feedback

```
17h51m48.177s : Macro : Label DmxSnapshot 778 "TOZERO_GROUP STEP 1"
17h51m48.178s : Verification Process...
17h51m48.190s : Macro : Label Group 48 "TOF_GRP_1"
17h51m48.191s : Macro : Label DmxSnapshot 278 "TOF_GRP_1"
17h51m48.215s : Macro : Off Page Thru
17h51m48.217s : TOZERO_GROUP STEP 1 PASSED (778)
17h51m48.217s : All test done.
17h51m48.217s :
17h51m48.217s : Duration: 1 min 52 sec
17h51m48.217s :
All Scripts in the Testmatrix succeed. No Error
17h51m48.217s :
Destructive tests had been skiped.
17h51m48.228s :
8 of 136 Scripts were ignored:
17h51m48.228s : ASSIGN_DMX
17h51m48.228s : DELETE_CHANNEL (destructive)
```

System Monitor

```
17h51m45.866s : Store on CUE 2
17h51m45.867s : Store on CUE 3
17h51m45.868s : ASSIGNING CMD_SEQUENCE 127 TO EXECUTOR 31
17h51m45.870s : Updating Exec Cache
17h51m46.508s : Stored DMX snapshot with 131072->149 bytes
17h51m46.580s : COPY 1 -> 1 (0 exist)
17h51m46.581s : Copying DMXSnapshot 193 to DMXSnapshot 693
17h51m46.700s : SUBMASTER EXECUTE
17h51m46.729s : Store on CUE 1
17h51m46.730s : Updating Exec Cache
17h51m46.730s : ASSIGNING CMD_SEQUENCE 117 TO EXECUTOR 11
17h51m46.731s : Updating Exec Cache
17h51m47.287s : Stored DMX snapshot with 131072->149 bytes
17h51m47.394s : COPY 1 -> 1 (0 exist)
17h51m47.394s : Copying DMXSnapshot 194 to DMXSnapshot 694
17h51m47.498s : SUBMASTER EXECUTE
17h51m48.119s : Stored DMX snapshot with 131072->149 bytes
17h51m48.176s : COPY 1 -> 1 (0 exist)
17h51m48.177s : Copying DMXSnapshot 278 to DMXSnapshot 778
17h51m48.231s : SUBMASTER EXECUTE
```

Fader 1 (1 .. 15)

1 LT 95 ASS_EXEC	2	3	4	5	6 LT 99 AT_EXEC	7 LT 100 BLK_EXEC	8 LT 101 CAL_EXEC	9 LT 102 CPY_EXEC	10 LT 102 CPY_EXEC	11 LT 117 TOZE_EXEC	12 LT 102 CPY_EXEC	13 LT 123 SEL_EXEC	14 LAS 12 PAU_EXEC	15 LT 122 PAU_EXEC
1 Cue				1 Cue	1 Cue	1 Cue	1 Cue	1 Cue	1 Cue	1 Cue	1 Cue	2 Cue	60.0 BPM	60.0 BPM
LTP 100 Off				LTP 100 Off	LTP 100 Off	LTP 100 Off	LTP 100 Off	LTP 100 Off	LTP 100 Off	LTP 100 Off	LTP 100 Off	0.0 s	0.0 %	
On				On	On	On	On	On	On	On	On	Mstr 100 Off	Mstr 100 Off	
Toggle				Go	Go	Go	Go	Go	Go	Go	Go	On	On	

Button 1 (101 .. 115)

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Command Overlay

- CMD (Scr)
- Shortcut (Ins)

```

1 <?xml version="1.0" encoding="utf-8"?>
2 <MA xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://schemas.malighti
3   <Info datetime="2012-03-26T11:48:43" showfile="lua_test" />
4
5   <Plugin index="0" luofile="test_init_fixtures.lua"      name="ShowfileInit"/>
6
7   <Plugin index="1" luofile="test_cancel.lua"              name="Tests|Cancel"/>
8   <Plugin index="2" luofile="test_main_matrix.lua"         name="Run|Tests"/>
9
10  <Plugin index="3"    luofile="test_channel_delete.lua"   name="Channel|Delete" />
11  <Plugin index="4"    luofile="test_channel_assign.lua"   name="Channel|Assign"/>
12  <Plugin index="5"    luofile="test_channel_at.lua"       name="Channel|At"/>
13  <Plugin index="6"    luofile="test_channel_clone.lua"   name="Channel|Clone"/>
14  <Plugin index="7"    luofile="test_channel_highlight.lua" name="Channel|Highlight" />
15
16  <Plugin index="8"    luofile="test_cue_store.lua"        name="Cue|Store"/>
17  <Plugin index="9"    luofile="test_cue_delete.lua"       name="Cue|Delete"/>
18  <Plugin index="10"   luofile="test_cue_at.lua"          name="Cue|At"/>
19  <Plugin index="11"   luofile="test_cue_call.lua"         name="Cue|Call"/>
20  <Plugin index="12"   luofile="test_cue_copy.lua"        name="Cue|Copy"/>
21  <Plugin index="13"   luofile="test_cue_edit.lua"        name="Cue|Edit"/>
22  <!--Plugin index="14" luofile="test_cue_part.lua"        name="CuePart|Store"/>
23  <Plugin index="15"   luofile="test_cue_part_delete.lua"  name="CuePart|Delete"/>
24  <Plugin index="16"   luofile="test_cue_part_at.lua"     name="CuePart|At"/>
25  <Plugin index="17"   luofile="test_cue_part_call.lua"   name="CuePart|Call"/>
26
27  <Plugin index="18"   luofile="test_dmxs_store.lua"       name="DMXS|Store"/>
28  <Plugin index="19"   luofile="test_dmxs_delete.lua"      name="DMXS|Delete"/>
29  <Plugin index="20"   luofile="test_dmxs_copy.lua"        name="DMXS|Copy"/>
30
31  <Plugin index="21"   luofile="test_fixture_update.lua"  name="Fixture|Update"/>
32  <Plugin index="22"   luofile="test_fixture_assign.lua"   name="Fixture|Assign"/>
33  <Plugin index="23"   luofile="test_fixture_at.lua"       name="Fixture|At"/>
34  <Plugin index="24"   luofile="test_fixture_clone.lua"   name="Fixture|Clone"/>
35
36  <Plugin index="25"   luofile="test_fixture_highlight.lua" name="Fixture|Highlight"/>
37
38
39

```

test_main_matrix.xml

Plugin Pool

1	2	3	4	5	6	7	8	9
LUA	ShowfileInit	Tests Cancel	Run Tests	Channel Delete	Channel Assign	Channel At	Channel Clone	Channel Highlight
Plugin								
10	11	12	13	14	15	16	17	18
Cue Store	Cue Delete	Cue At	Cue Call	Cue Copy	Cue Edit	Cue Move	Cue SelFix	Cue Update
20	21	22	23	24	25	26	27	28
CuePart Delete	CuePart At	CuePart Call	CuePart Copy	CuePart Edit	CuePart Move	CuePart SelFix	CuePart Update	DMX Assign
30	31	32	33	34	35	36	37	38
DMXS Store	DMXS Delete	DMXS Copy	DMXS Move	DMXS Update	Fixture Delete	Fixture Assign	Fixture At	Fixture Clone
39								Fixture Highlight

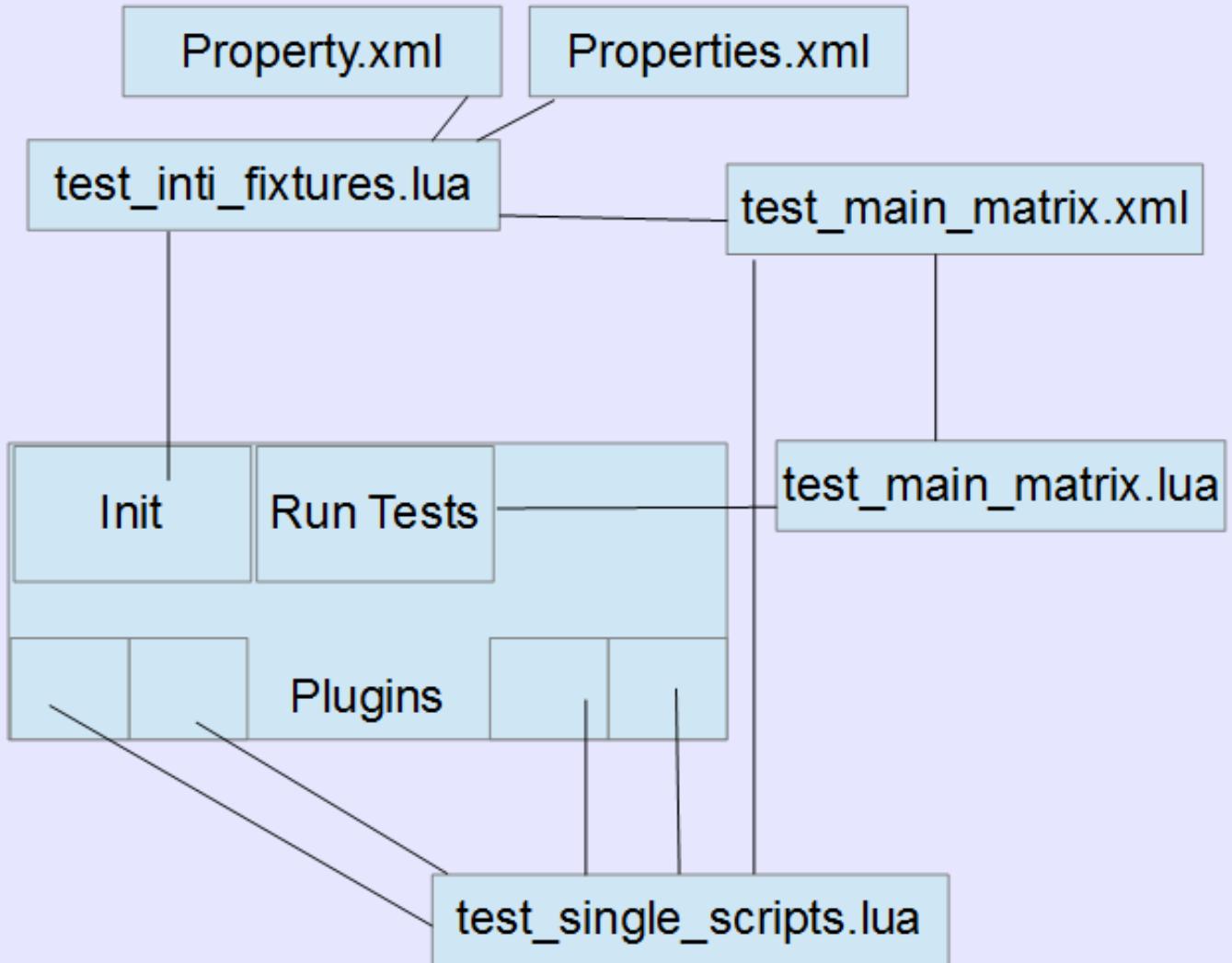
```

1  -----
2  -- This script tests to release a fixture
3  -- Seq 131, Executor 40, DMXsnap 258
4  -----
5
6 local fixturecount = get_prop_fixturecount();
7
8 local test=
9 {
10   method_name      = "RELEASE";
11   object_name      = "Fixture";
12   pre              = 'ClearAll; Delete Sequence 131 /nc; delete DMXsnapshot 258 /nc; delete Executor 40 /nc';
13
14   steps =
15   {
16     {
17       pre  = 'Fixture 1 thru '.. fixturecount[2] ..' at 0 thru 100; Store sequence 131 cue 1 /nc; assign sequence 131 at Executor 40';
18       cmd  = 'Release Fixture 1; Fixture 1 thru '.. fixturecount[2] ..' at 50; store sequence 131 cue 2; clearall; go executor 40';
19       post = 'label sequence 131 "REL_FIX_1"; label executor 40 "REL_FIX_1"; label DMXsnapshot 258 "REL_FIX_1"';
20       cleanup = 'off executor thru; Off sequence thru; off channel thru; off fixture thru';
21       test_dmx=true;
22       test = 258;
23       gold = 758;
24     }
25   };
26 };
27
28 RegisterTestScript(test);
29
30 -----
31 -- module entry point
32 -----
33
34 local function StartThisTest()
35   StartSingleTestScript(test);
36 end
37
38 return StartThisTest;

```

Plugin	1	2	3	4	5	6	7
10	11	12	13	14	15	16	17
Cue Store	Cue Delete	Cue At	Cue Call	Cue Copy	Cue Edit	Cue Move	Cue SelFix
20	21	22	23	24	25	26	27
CuePart Delete	CuePart At	CuePart Call	CuePart Copy	CuePart Edit	CuePart Move	CuePart SelFix	CuePart Update
30	31	32	33	34	35	36	37
DMXS Store	DMXS Delete	DMXS Copy	DMXS Move	DMXS Update	Fixture Delete	Fixture Assign	Fixture At

Innerhalb
der
Applikation





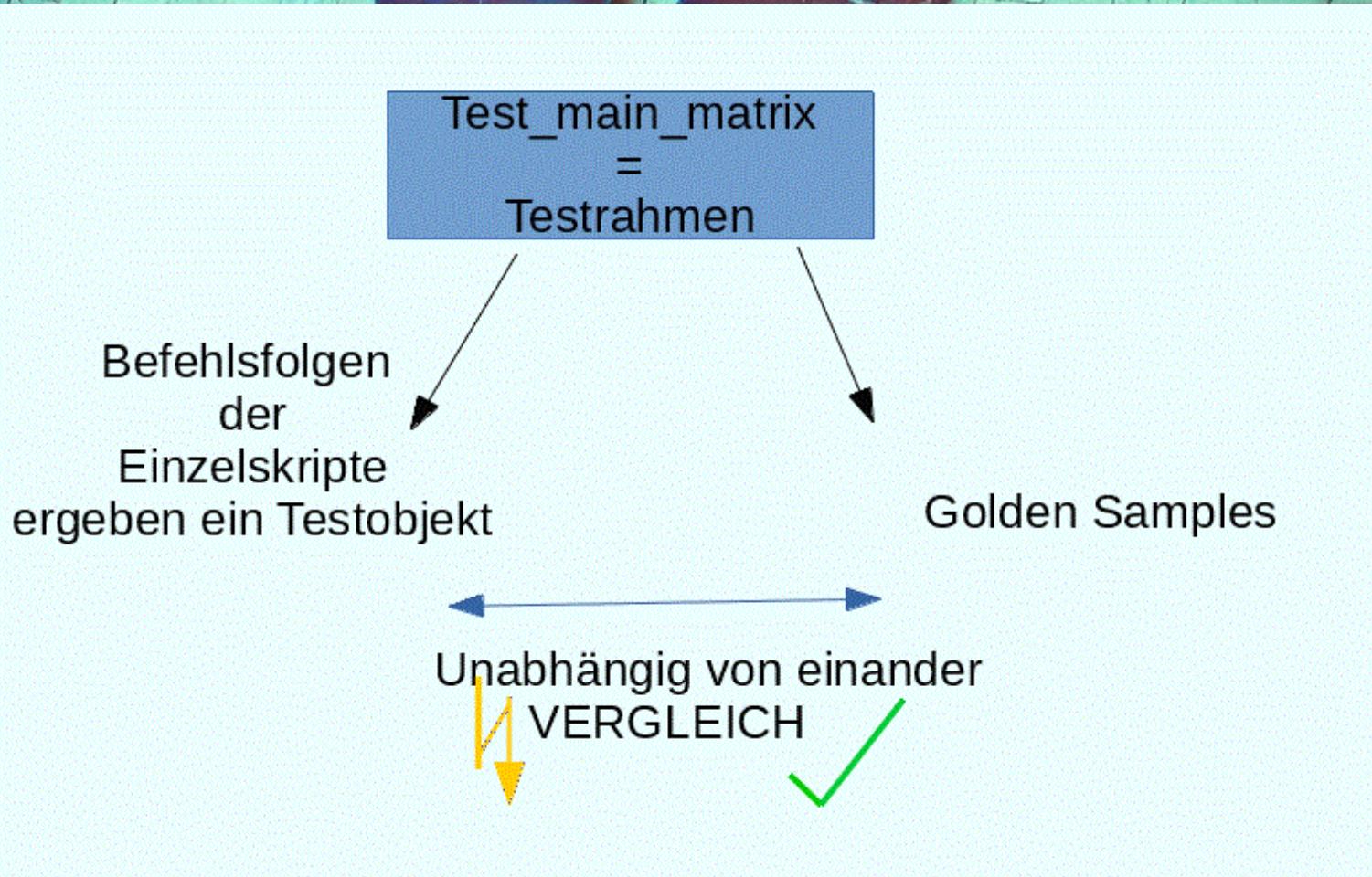
DMXoutput

DMXsnapshot

Verifizierung



Das Testorakel



```

local handle = G.handle(ON .. "..test_index); -----handle of the test object -- Referenz auf test objekt, Handle des Testobjekts
local golden_handle = nil;

if(tonumber(verify_param.gold) > 0) then                                --if golden handle is available
    if dev then
        if(ON2) then
            F("Handle-Request:" .. ON2 .. "...verify_param.gold);
        else
            F("Handle-Request:" .. ON .. "...verify_param.gold);
        end
    end
    if(ON2) then-----object name for Cueparts
        golden_handle = G.handle(ON2 .. "...verify_param.gold);--concat object with golden handle
    else
        golden_handle = G.handle(ON .. "...verify_param.gold); --objects which are no Cueparts -- Referenz auf GoldenSample, Handle des Gs
    end
else                                         --no golden handle, comparision with empty position
    golden_handle = nil;
    F('Verification Process to an empty object... ');
    if(G.compare(handle,golden_handle) == self.blacktest) then
        if(self.blacktest) then
            return "black comparison with an empty object";
        else
            return "golden comparison with an empty object";
        end
    end
end

```

Nicht-Determiniertheit

Logging

handles

```

10h40m46.699s : Duration: 4 min 0 sec
10h40m46.699s :
10h40m46.699s : Summary: 7 of 267 Scripts in the Testmatrix failed!
10h40m46.699s :   EXPORT_MACRO STEP 2 VERIFY ERROR (105): golden comparison failed
10h40m46.699s :   EXPORT_PRESET STEP 2 VERIFY ERROR (1.110): golden comparison failed
10h40m46.699s :   EXPORT_WORLD STEP 2 VERIFY ERROR (107): golden comparison failed
10h40m46.699s :   IMPORT_EFFECT STEP 1 VERIFY ERROR (107): golden comparison failed
10h40m46.699s :   IMPORT_PRESET STEP 1 VERIFY ERROR (1.111): golden comparison failed
10h40m46.699s :   IMPORT_SEQUENCE STEP 1 VERIFY ERROR (211): golden comparison failed
10h40m46.699s :   IMPORT_WORLD STEP 1 VERIFY ERROR (108): golden comparison failed
10h40m46.699s :
10h40m46.699s :     Destructive tests had been skiped.
10h40m46.699s :
10h40m46.699s : 9 of 267 Scripts were ignored:
10h40m46.699s :   DELETE_CHANNEL (destructive)
10h40m46.699s :   DELETE_DMX (destructive)
10h40m46.699s :   DELETE_DMXUNIVERSE (destructive)
10h40m46.699s :   DELETE_FIXTURE (destructive)
10h40m46.699s :   DELETE_SELECTION (destructive)
10h40m46.699s :   ASSIGN_DMX (destructive)
10h40m46.699s :   EXPORT_PLUGIN
10h40m46.699s :   IMPORT_PLUGIN
10h40m46.699s :   MOVE_DMXUNIVERSE (destructive)
10h40m46.699s :
10h40m46.699s : 10h23m28.222s : Also the following 8 Step10h23m28.222s : Summary: 26 of 267 Scripts in the Testmatrix failed!
10h40m46.699s :   STORE_EXECUTOR: Version10h23m28.222s : STORE_AGENDA STEP 1 VERIFY ERROR (2): golden comparison failed
10h40m46.699s :   DELETE_PRESET STEP 410h23m28.222s : STORE_CUE STEP 2 VERIFY ERROR (105.1): golden comparison failed
10h40m46.699s :   EDIT_EFFECT: Version10h23m28.222s : STORE_MACRO_SCRIPT_PREPARE_ERROR : OBJECT DOES NOT EXIST
10h40m46.699s :   MOVE_CUE STEP 2: Ver10h23m28.223s : STORE_VIEW_SCRIPT_PREPARE_ERROR : OBJECT DOES NOT EXIST
10h40m46.699s :   MOVE_CUE STEP 4: Ver10h23m28.223s : STORE_WORLD STEP 1 VERIFY ERROR (115): golden comparison failed
10h40m46.699s :   MOVE_CUEPART STEP 3:10h23m28.223s : DELETE_AGENDA STEP 1 VERIFY ERROR (-1): golden comparison with an empty object
10h40m46.699s :   MOVE_CUEPART STEP 4:10h23m28.223s : DELETE_CUE STEP 3 TEST ERROR : CMD-Error: OBJECT DOES NOT EXIST
10h40m46.699s :   MOVE_DMXSNAPSHOT STEP10h23m28.223s : DELETE_MACRO_SCRIPT_PREPARE_ERROR : OBJECT DOES NOT EXIST
10h40m46.699s :   MOVE_DMXSNAPSHOT STE10h23m28.223s : DELETE_VIEW_SCRIPT_PREPARE_ERROR : OBJECT DOES NOT EXIST
10h40m46.699s :   ASSIGN_AGENDA STEP 1 VERIFY ERROR (5): golden comparison failed
10h23m28.223s :   COPY_AGENDA STEP 1 PREPARE_ERROR : CMD-Error: RESIZE FORBIDDEN
10h23m28.223s :   COPY_CUE STEP 6 VERIFY ERROR (106.1): golden comparison failed
10h23m28.223s :   COPY_MACRO_SCRIPT_PREPARE_ERROR : OBJECT DOES NOT EXIST
10h23m28.223s :   COPY_VIEW_SCRIPT_PREPARE_ERROR : OBJECT DOES NOT EXIST
10h23m28.223s :   COPY_WORLD STEP 1 VERIFY ERROR (101): golden comparison failed
10h23m28.223s :   EDIT_WORLD STEP 1 VERIFY ERROR (105): golden comparison failed
10h23m28.223s :   EXPORT_MACRO STEP 2 VERIFY ERROR (105): golden comparison failed
10h23m28.223s :   EXPORT_PRESET STEP 2 VERIFY ERROR (1.110): golden comparison failed
10h23m28.223s :   EXPORT_WORLD STEP 2 VERIFY ERROR (107): golden comparison failed
10h23m28.224s :   IMPORT_EFFECT STEP 1 VERIFY ERROR (107): golden comparison failed
10h23m28.224s :   IMPORT_PRESET STEP 1 VERIFY ERROR (1.111): golden comparison failed
10h23m28.224s :   IMPORT_SEQUENCE STEP 1 VERIFY ERROR (211): golden comparison failed
10h23m28.224s :   IMPORT_WORLD STEP 1 VERIFY ERROR (108): golden comparison failed
10h23m28.224s :   MOVE_WORLD STEP 1 VERIFY ERROR (113): golden comparison failed
10h23m28.224s :   UPDATE_WORLD STEP 1 VERIFY ERROR (119): golden comparison failed
10h23m28.234s :   INSERT_WORLD STEP 1 VERIFY ERROR (109): golden comparison failed
10h23m28.234s :
10h23m28.234s :     Destructive tests had been skiped.
10h23m28.234s :
10h23m28.234s : 10h23m28.234s : 9 of 267 Scripts were ignored:

```



Test-Debugging



```
Address: 0x000000002929BBF0 Columns: 
0x000000002929BBF0 78 9c ed ce 21 0e 00 20 0c 03 40 9e de 9f 8f xœi!... .@ŽPÝ.
0x000000002929BBFF 20 30 80 43 80 b8 ab da 9a 2c 6b 6d 97 e4 b0 0€C€,«Úš,km-ä°
0x000000002929BC0E bd 90 91 f5 66 aa 4a f5 ae 9a c3 17 df e4 51 ..'öf=Jö@šÄ.BäQ
0x000000002929BC1D 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... .
0x000000002929BC2C 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... .
0x000000002929BC3B 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... .
0x000000002929BC4A 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... 
```

```
Address: 0x00000000292EE910 Columns: Auto
0x00000000292EE910 78 9c ed ce 21 12 00 20 08 04 40 9f ce cf 71 xœi!... .@ŽÍiq
0x00000000292EE91F 74 c6 82 36 83 86 5d 12 77 01 5a db 65 e6 21 tÆ.6f.].w.ZÛeæ!
0x00000000292EE92E bd 10 63 a2 86 f3 8c ea 55 b5 96 2f be 89 47 ..c¢.ó€êUµ-/..G
0x00000000292EE93D 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... .
0x00000000292EE94C 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... .
0x00000000292EE95B 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... .
0x00000000292EE96A 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... 
```

12h07m50.907s : Performing test FULL_FIXTURE
 12h07m50.907s : ****
 12h07m50.955s : Macro : ClearAll
 12h07m50.958s : Macro : Delete DmxSnapshot 246 /nc
 12h07m50.960s : Macro : Fixture 1 At 50
 12h07m51.522s : Macro : Store DmxSnapshot 246
 12h07m51.530s : Verification Process...
 12h07m51.573s : Macro : Label DmxSnapshot 246 "FUL_FIX_1"
 12h07m51.574s : FULL_FIXTURE STEP 1 PASSED (746)
 12h08m13.605s : Executing : Backup
 12h08m20.096s : Executing : SaveShow "comparisioncheck3"
 12h08m20.213s : Show successfully saved as "comparisioncheck3".
 12h09m50.822s : Executing : Edit Plugin 152

DEVELOPER_TOOLS_ENABLED is d							
1	LT 95	ASS_EXECUTOR	3 Cue	3	LT 96	ASS_EXEC	1 Cue
			1 Cue				
	LTP 100	Off	Toggle		LTP 100	Off	Toggle
	Black	E	Temp		Black	E	Temp
	Flash	Go			Flash	Go	
101	LT 95	ASS_EXECUTOR	3 Cue	103	LT 96	ASS_EXEC	104
							105
106				107			



... Test-Debugging

test_main_matrix.xml

test_feature_on.lua

● test_fixture_on.lua

1/82

783

do_test = function (self)

local errMsg = nil;

if(self.cmd) then

errMsg = C(self.cmd);

end

789

if(self.cmd_func) then

self.cmd_func();

end

793

if(errMsg) then

errMsg = "CMD-Error: " .. errMsg;

if(dev) then

E(errMsg);

end

return errMsg;

end

801

if(self.test_dmx) then -----if the DMXsnapshot is selected for the comparision

G.verify(G.handle("SELECTION")); -- handle object name SELECTION

G.verify(G.handle("PROGRAMMER")); --object name PROGRAMMER

gma.sleep(0.5);

C("STORE DMXSNAPSHOT "..self.test); ---command for saving the DMXSnapshot at the position for compar

end

808

if(self.smoketest) then

gma.feedback("THIS IS A SMOKE TEST!");

end

end;

813

814

```

11h38m38.723s : ****
11h38m38.740s : Macro : ClearAll
11h38m38.742s : Macro : Delete DmxSnapshot 246 /nc
11h38m38.743s : Macro : Fixture 1 Full
11h38m38.288s : Macro : Store DmxSnapshot 246
11h38m39.296s : THIS IS A SMOKE TEST!
11h38m39.307s : Got my Handles. Testobject: 169869314.0
11h38m39.307s : Testindex: 246
11h38m39.307s : Golden Sample: 203423746.0
11h38m39.307s : Verification Process...
11h38m39.307s : Macro : Label DmxSnapshot 246 "FUL_FIX_1"
11h38m39.331s : Macro : Off Channel Thru
11h38m39.335s : Macro : Off Fixture Thru
11h38m39.338s : FULL FIXTURE STEP 1 PASSED (746)
11h39m23.869s : Executing : Delete Plugin Thru
11h39m26.907s : Executing : Edit Plugin 2
11h39m30.330s : Executing : Import "test_main_ma
11h39m30.381s : 98 object(s) from "test_main_ma
11h39m41.474s : Executing : Plugin 65
11h39m41.495s : Macro : Fixture Thru
11h39m41.500s : Macro : Channel Thru
11h39m41.505s : Patched devices: 80
11h39m41.516s : Debug: false
11h39m41.516s : ****
11h39m41.516s : Performing test FULL FIXTURE
11h39m41.516s : ****
11h39m41.522s : Macro : ClearAll
11h39m41.524s : Macro : Delete DmxSnapshot 246 /nc
11h39m41.536s : Macro : Fixture 1 Full
11h39m41.539s : THIS IS A SMOKE TEST!
11h39m41.540s : Macro : Label DmxSnapshot 246 "FUL_FIX_1"
11h39m41.541s : WARNING, NO OBJECTS FOUND FOR LABEL
11h39m41.542s : Macro : Off Channel Thru
11h39m41.545s : Macro : Off Fixture Thru
11h39m41.548s : FULL FIXTURE STEP 1 PASSED

```

To do:
Besseres Beispiel für
Smoketest einfügen

Smoketest



„Testautomatisierung
ist die Durchführung von
ansonsten manuellen Testtätigkeiten
durch Automaten.“

[BTa15-1]



Manueller Test Vs Automatisierter Test



Heutiger Stand

Ausblick

A composite image featuring a woman with short brown hair, wearing a light green, ruffled, off-the-shoulder dress, sitting on a black and white checkered piano keyboard. She is looking directly at the camera with a neutral expression. To her right is a large, ornate, gold-colored gramophone. The background consists of vertical, glowing yellow lines against a dark background.

Fazit

Quellen:

Präsentation zum Praxisprojekt von Katharina Ziegler,
Matrikel Nummer 791521, Korbinianstraße 18, 82515 Wolfratshausen, Tel 017623494763, lichttechnik.ziegler@web.de
Beuth Hochschule für Technik Berlin, Studiengang Medieninformatik Bachelor online, WS 2016/17

[BTa15-1] Thomas Bucsics, Manfred Baumgartner, Richard Seidl, Stefan Gwihs:
Basiswissen Testautomatisierung, Konzepte, Methoden und Techniken, dpunkt.verlag 2015 Heidelberg,
ISBN 978-3-86490-194-2, Seite 7

Abbildungen:

- [MA-1] http://www.malighting.com/de/news-referenzen/news/news-details/375_hoechstleistung.html
Olympische Spiele (letzter Stand 20.01.2017)
- [MA-2] <http://www.malighting.com/en/news-references/references.html>
The One Grand Show, Copyright Friedrichstadt Palast Berlin, Sven Darmer (letzter Stand 20.01.2017)
- [MA-3] <http://www.malighting.com/en/products/control.html> (letzter Stand 20.01.2017)
- [MA-4] Screenshot der Applikation grandMA2 onPC von MA Lighting Technology GmbH
- [MA-5] Screenshots der Datei test_main_matrix.xml und der Applikation grandMA2 onPC von MA Lighting Technology GmbH
- [MA-6] Screenshots der Datei test_fixture_release.lua und der Applikation grandMA2 onPC von MA Lighting Technology GmbH
- [MA-7] Screenshot der Applikation grandMA2 onPC von MA Lighting Technology GmbH
- [MA-8] Screenshot der Datei test_main_martix.lua
- [MA-9] Screenshot der Applikation grandMA2 onPC von MA Lighting Technology GmbH
- [MA-10] Screenshot der Applikation grandMA2 onPC von MA Lighting Technology GmbH und Bitdarstellung der Vergleichsobjekte
- [MA-11] Screenshots der Datei test_main_matrix.lua und der Applikation grandMA2 onPC von MA Lighting Technology GmbH

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