MBT TO TTCN-3 TOOL CHAIN: THE ONEM2M EXPERIENCE

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- IoT platform testing : Introducing MBT

- The oneM2M MBT use case

- MBT breaking its barriers in oneM2M

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IoT PLATFORM TESTING :
INTRODUCING MBT

Why are we testing the IoT ?

- It's **BIG**
  - How "BIG" is it ? (Sources : Gartner)
    - 6,4 Billion devices by 2016, 21 Billion by 2020!
    - 63 new devices connected/second (~5,5 Million devices/day)

- It's **VULNERABLE**
  - Cost of data breaches will reach **$2.1 trillion** globally by 2019 (Juniper Research, May 2015)
  - And this is "just" one example of vulnerability…

How and why are we testing IoT ?

- We use Model Based Testing (**MBT**)
  - Demonstrated in 2015 UCAAT Poster "IoT interoperability Model Based Testing": scalable & suited for IoT platforms
  - Automatic generation of executable tests
    - TTCN-3
    - Soap-UI
    - …
- Targets IoT platforms rather than devices
- Why targeting IoT Platforms ?
  - Devices are Heterogeneous → Interoperability Issues
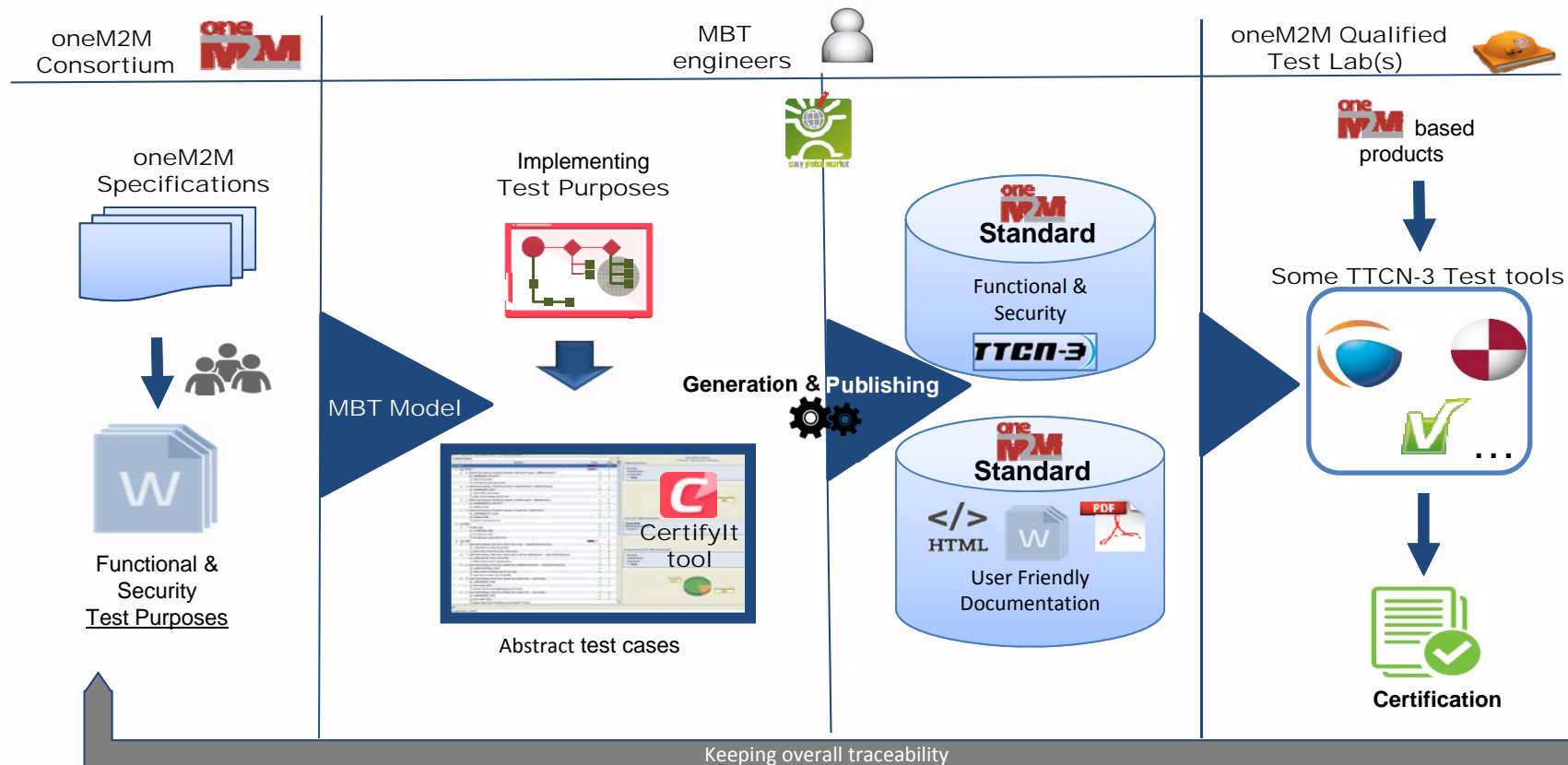 - IoT platforms tend to be standardized

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oneM2M MBT use case

oneM2M IoT Standard use case

- EGM has an active contribution in oneM2M testing topics:
  - Contributor & reporters on oneM2M security tests specifications within oneM2M TC TST
  - Active member of oneM2M test tool group

- MBT for oneM2M
  - Difficulties to find correct abstraction level
  - Requires pre-configured TTCN-3 code
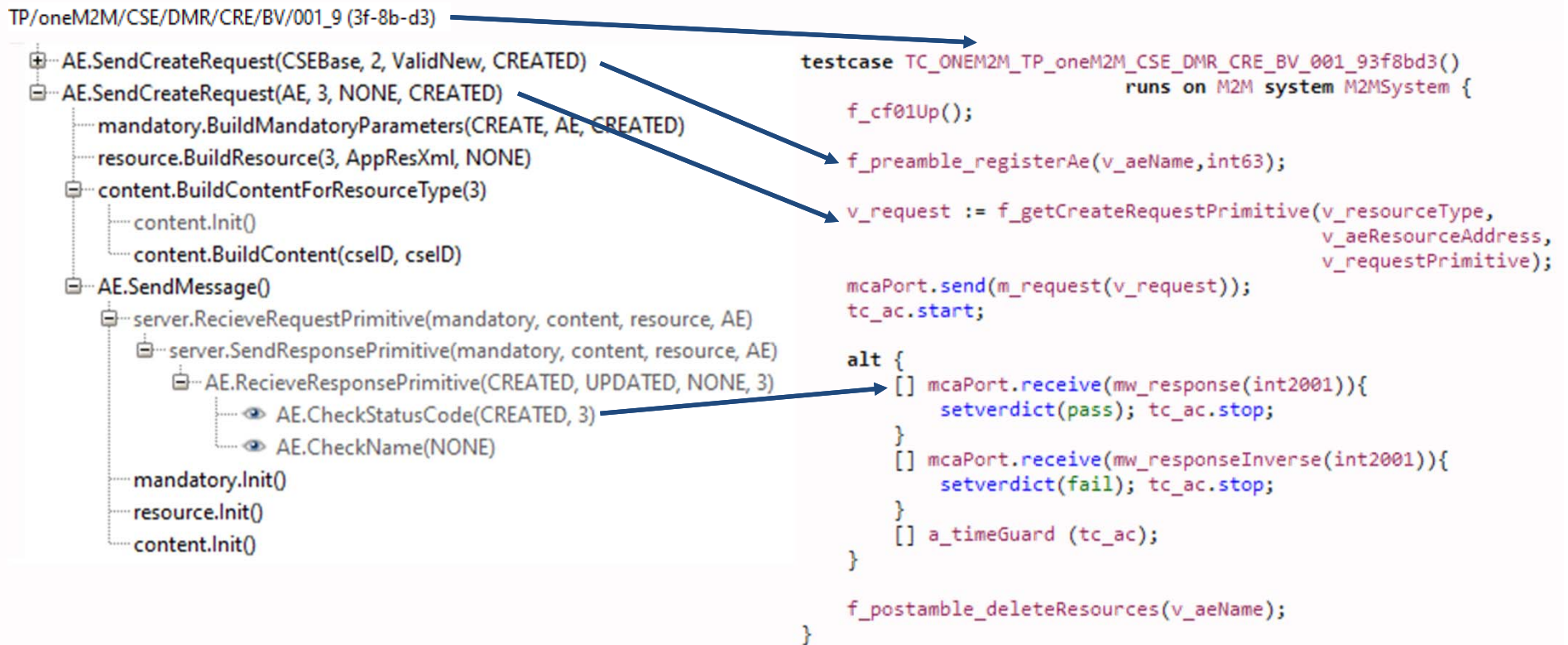 - Adaptation not user friendly on existing test environment

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ETSI World Class Standards

oneM2M use case previously demonstrated in oneM2M second interop event (South Korea May 2016)

oneM2M Consortium

oneM2M Specifications

Functional & Security Test Purposes

MBT engineers

Implementing **Test Purposes**

MBT Model

Abstract test cases

CertifyIt tool

Generation & Publishing

Standard Functional & Security **TTCN-3**

Standard User Friendly Documentation HTML PDF

oneM2M Qualified Test Lab(s)

oneM2M based products

Some TTCN-3 Test tools

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Certification

Keeping overall traceability

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Publishing & Executing TTCN-3

- MBT tool offers publishing abstract test cases in many different formats such as XML, HTML, JUnit and others

- We created with the help of the MBT tool API a custom TTCN-3 Abstract Test Suite (ATS) publisher

- Automated TTCN-3 code generation implies a lower maintenance cost

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TTCN-3 Test example

TP/oneM2M/CSE/DMR/CRE/BV/001_9 (3f-8b-d3)

- ⊞ AE.SendCreateRequest(CSEBase, 2, ValidNew, CREATED)
- ⊟ AE.SendCreateRequest(AE, 3, NONE, CREATED)
  - mandatory.BuildMandatoryParameters(CREATE, AE, CREATED)
  - resource.BuildResource(3, AppResXml, NONE)
  - ⊟ content.BuildContentForResourceType(3)
    - content.Init()
    - content.BuildContent(cselD, cselD)
  - ⊟ AE.SendMessage()
    - ⊟ server.RecieveRequestPrimitive(mandatory, content, resource, AE)
      - ⊟ server.SendResponsePrimitive(mandatory, content, resource, AE)
        - ⊟ AE.RecieveResponsePrimitive(CREATED, UPDATED, NONE, 3)
          - 👁 AE.CheckStatusCode(CREATED, 3)
          - 👁 AE.CheckName(NONE)
  - mandatory.Init()
  - resource.Init()
  - content.Init()

```
testcase TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_001_93f8bd3()
                          runs on M2M system M2MSystem {
    f_cf01Up();

    f_preamble_registerAe(v_aeName,int63);

    v_request := f_getCreateRequestPrimitive(v_resourceType,
                                             v_aeResourceAddress,
                                             v_requestPrimitive);
    mcaPort.send(m_request(v_request));
    tc_ac.start;

    alt {
    [] mcaPort.receive(mw_response(int2001)){
          setverdict(pass); tc_ac.stop;
       }
    [] mcaPort.receive(mw_responseInverse(int2001)){
          setverdict(fail); tc_ac.stop;
       }
    [] a_timeGuard (tc_ac);
    }

    f_postamble_deleteResources(v_aeName);
}
```

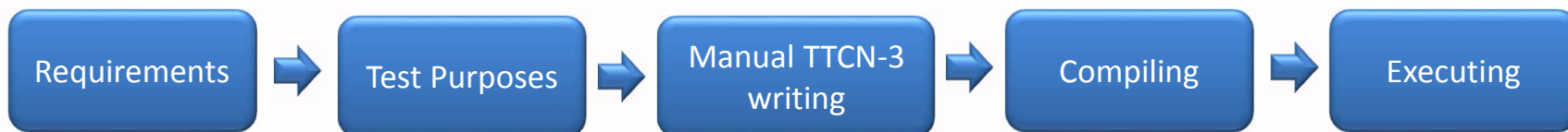MBT Abstract Test   Published TTCN-3 Test
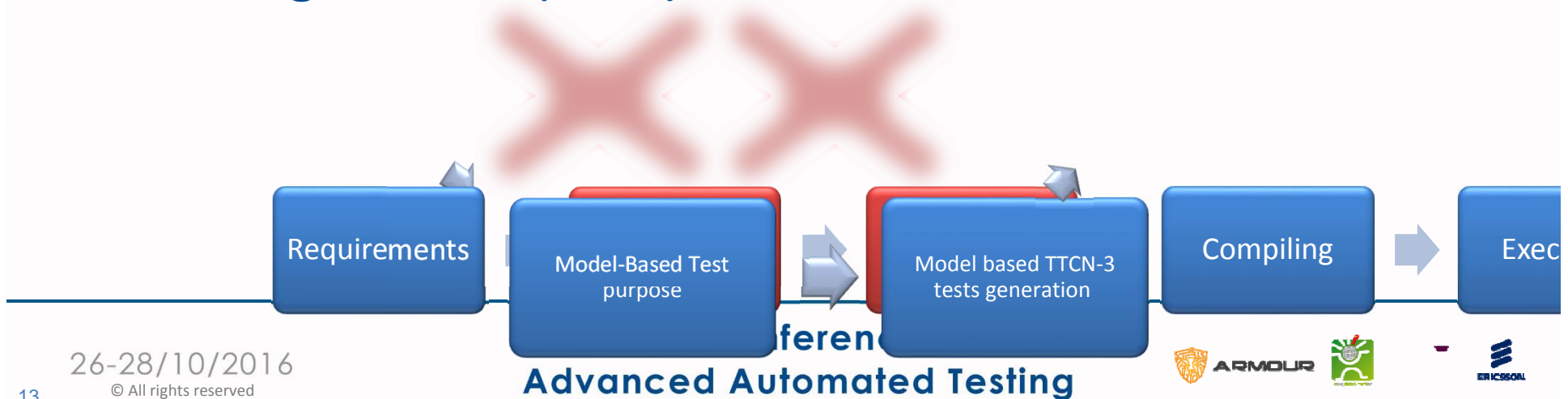
MBT breaking its barriers in oneM2M

Curent status & Common Issues

- Complex oneM2M organization: Steering Committee, Technical Plenaries, 6 Working Groups,…

- Long and expensive manual work: test purposes production and TTCN-3 writing

- High maintainability cost

- Expensive quality control (manual traceability of tests against standard requirements)

- Overall huge resources investments

Requirements → Test Purposes → Manual TTCN-3 writing → Compiling → Executing

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The MBT process

- MBT is an automated and cost efficient test generation process and provides high quality test suites

- Easy maintenance: modification ripple through the entire automated TTCN-3 code generation

- MBT enables the **TRACEABILITY** of requirement coverage : tests quality control achieved at low cost

| Requirements | Model-Based Test purpose | Model based TTCN-3 tests generation | Compiling | Exec |

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Results

oneM2M Second interop Results (South Korea May 2016)

- 20 participating oneM2M standard implementers
- 12 sessions with 11 oneM2M implementations tested
- 22 MBT generated Test Cases provided
- Our experience at Seoul:
  - Showed the feasibility of the MBT process
  - We confirmed that the MBT approach provided a level of service better or identical to manual testers
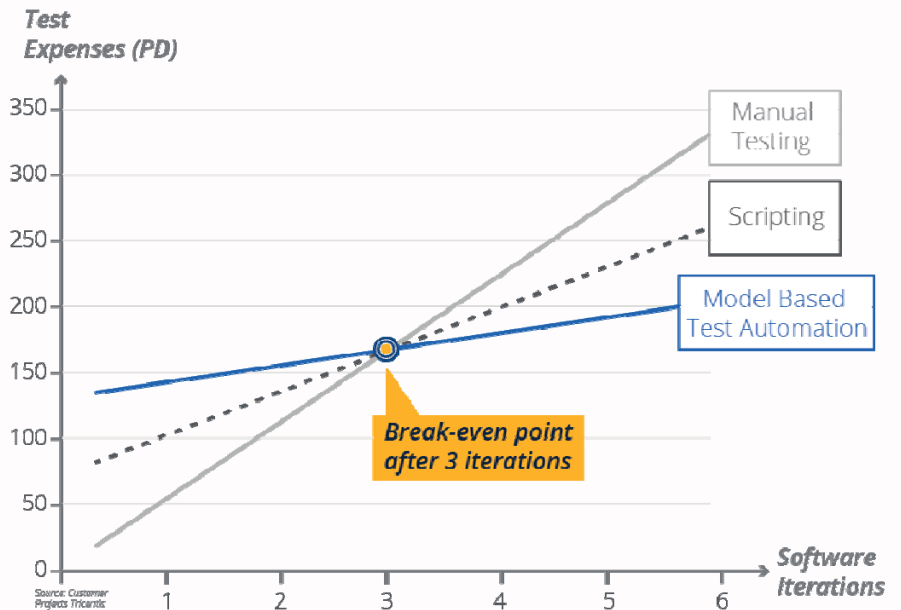
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TTCN-3 test tool execution results overview

timestamp	testcase	verdict	reason
2016-05-11 16:27:32.510000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_003_13f44d3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:33.947000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_003_33f24d3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:34.791000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_003_43fbfd3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:35.508000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_002_53f05d3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:36.058000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_002_73f06d3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:36.846000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_002_83fdbd3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:37.393000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_001_93f8bd3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:37.964000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_001_113fc8d3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:38.661000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_001_123f2dd3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:39.610000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BV_001_173f99d3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:40.077000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BV_001_193f14d3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:41.070000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BV_001_203ffad3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:41.761000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BO_002_213ffbd3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:42.217000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BV_004_263fc6d3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:42.917000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BV_004_283f0cd3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:43.771000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BV_004_293f4ad3	pass	f_createAccessControlPolicy: Resource type 1 created successfuly
2016-05-11 16:27:44.864000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_004_133ff3d3	inconc	"f_createResource: Error while creating resource type 3"
2016-05-11 16:27:47.547000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_004_153f4fd3	inconc	"f_createResource: Error while creating resource type 1"
2016-05-11 16:27:47.904000	TC_ONEM2M_TP_oneM2M_CSE_DMR_CRE_BV_004_163f90d3	inconc	"f_createResource: Error while creating resource type 23"
2016-05-11 16:27:48.543000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BO_003_223f91d3	fail	
2016-05-11 16:27:49.094000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BO_003_243f1ed3	fail	
2016-05-11 16:27:49.620000	TC_ONEM2M_TP_oneM2M_CSE_DMR_RET_BO_003_253f35d3	fail	

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Conclusion

Conclusion

- MBT is suited for IoT Platforms testing

- Increased quality & traceability of generated tests

- High initial cost compared to manual testing

- Mid term return on Investment

Thank YOU

Questions and comments?

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