achelos

Compliance testing of electronic certificates

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Presentation at CA/Browser Forum Meeting

October 2020

security health mobility public IoT

SecurITy made in Germany

Agenda

1. Our motivation
2. Tool requirements for compliance testing
3. Tool design
4. Discussion

Our motivation

Where we started with certificate testing

- About achelos
  - Manufacturer-independent consulting and software development company
  - Focus: software testing and conformance testing
  - Segments: Health, Public, Mobility, IoT, Security

- The origin of certificate testing at achelos
  - German health telematics infrastructure
  - Test PKI (2015)
  - Problem: compliance of certificates to the specifications

Where we started with certificate testing

Motivation: Requests from customers from different PKI domains

→ EU regulation 910/2014
→ Payment Service Directive

Technical specifications

- ETSI EN 319 412, parts 2 to 5
- ETSI TR 119 495 (PSD2)

Tool requirements for compliance testing

Conformance test tool requirements

- Objectives of using a compliance test tool
  - Prove compliance to the standards and requirements
  - Improve interoperability

- Traceability of test results to requirements (RFC 2119)
- Auditability by means of reporting
- Validated test case implementation
- Completeness of test coverage
- Adaptability to changing standards

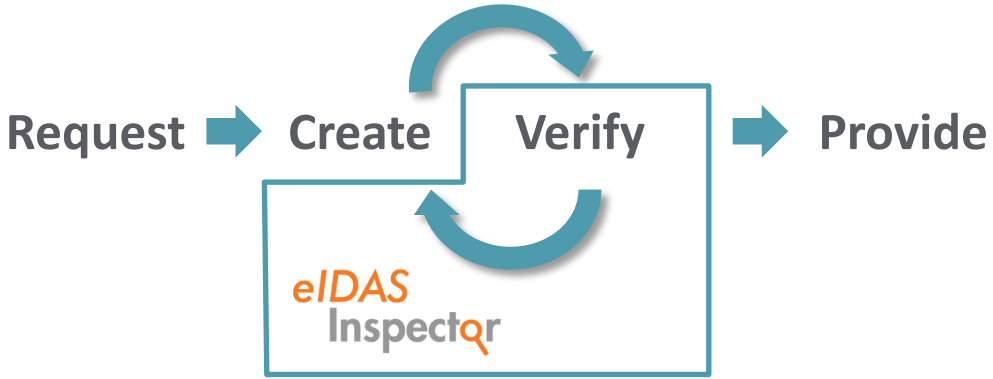
Use cases

Conformity assessment

- Check samples of certificates generated
- Adherence to standards, guidelines or specifications
- Adherence to CPS

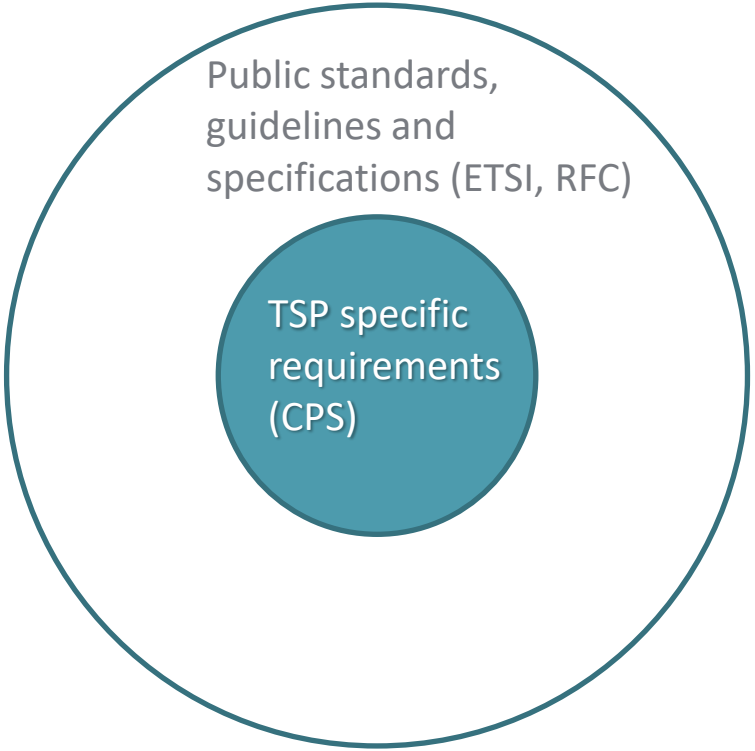
Certificate production

- In-the-loop validator
- Quality control
- Check certificates in database

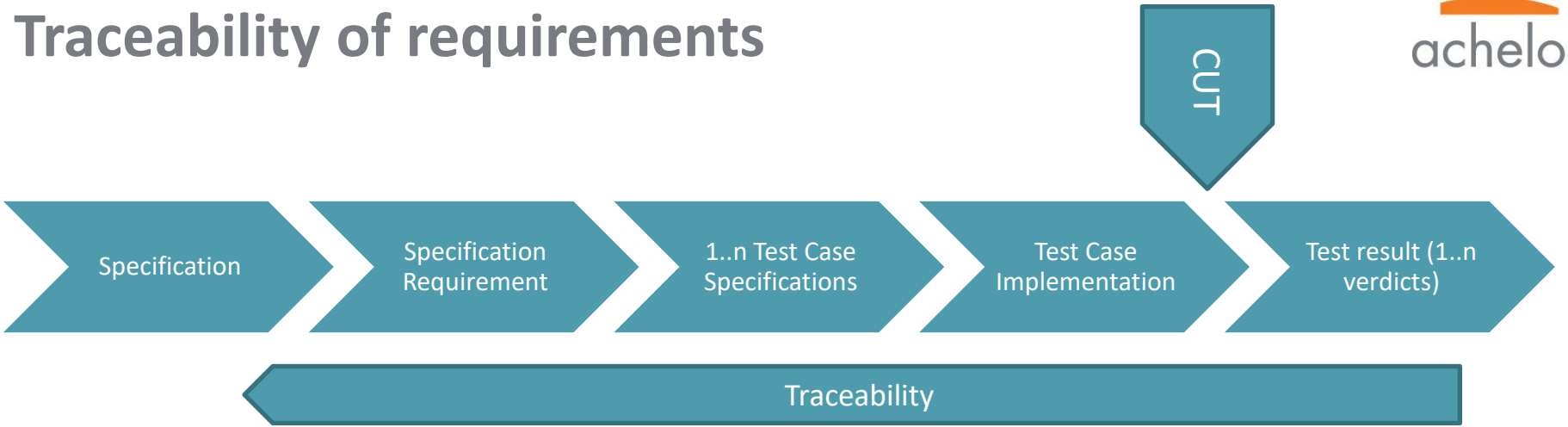


Additional requirements from QTSPs

- Assessment of Certification Practice Statement
- RFC 3647 → Certificate Profile
- Requirements described in chapter 7.1
  - Certificate extensions
  - Algorithm OIDs
  - Name forms and constraints
  - …



Traceability of requirements



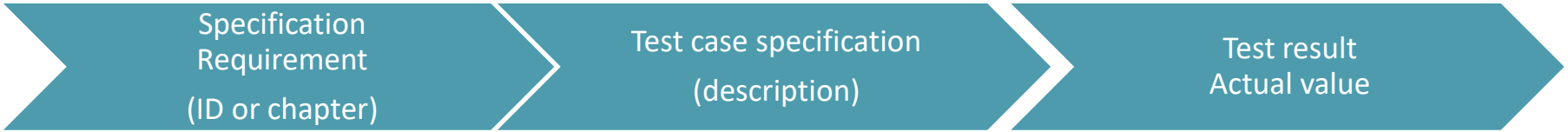
Each test results traces back to a requirement (transparency)
Each specification requirement is met (completeness)
Every test is automatically reproducable.

Test report maps every test result to a specification requirement (with an ID, e.g. chapter)

Auditability / Reporting

- Report Summary
  - Certificate under Test
  - Time/Date of test run
  - Test cases performed (passed, failed, NA, inconclusive)
  - Specification incl. **spec version**
- Report per test case

- Options
  - Report may be signed
  - Report checks if test case implementation has been unchanged (signature)



Test coverage and completeness

- Structured creation of a test specification
  - Decompose specification into single identifiable requirements
  - Create at least one testcase per requirements
  - Mapping from requirement to test

- Not all requirements can be checked by certificate linters (Organisational requirements)
- Checks by means of assessment/audits or proprietary tests (CPS)

Validation of test implementation (Correctness)

Validation by 3rd party

Validation with working samples

Common to many compliance programs

Defined processes for errors found in the field and error corrections

1
- Quality assurance
- Internal software testing

2
- Test validation
- Test tool report by 3rd party test lab

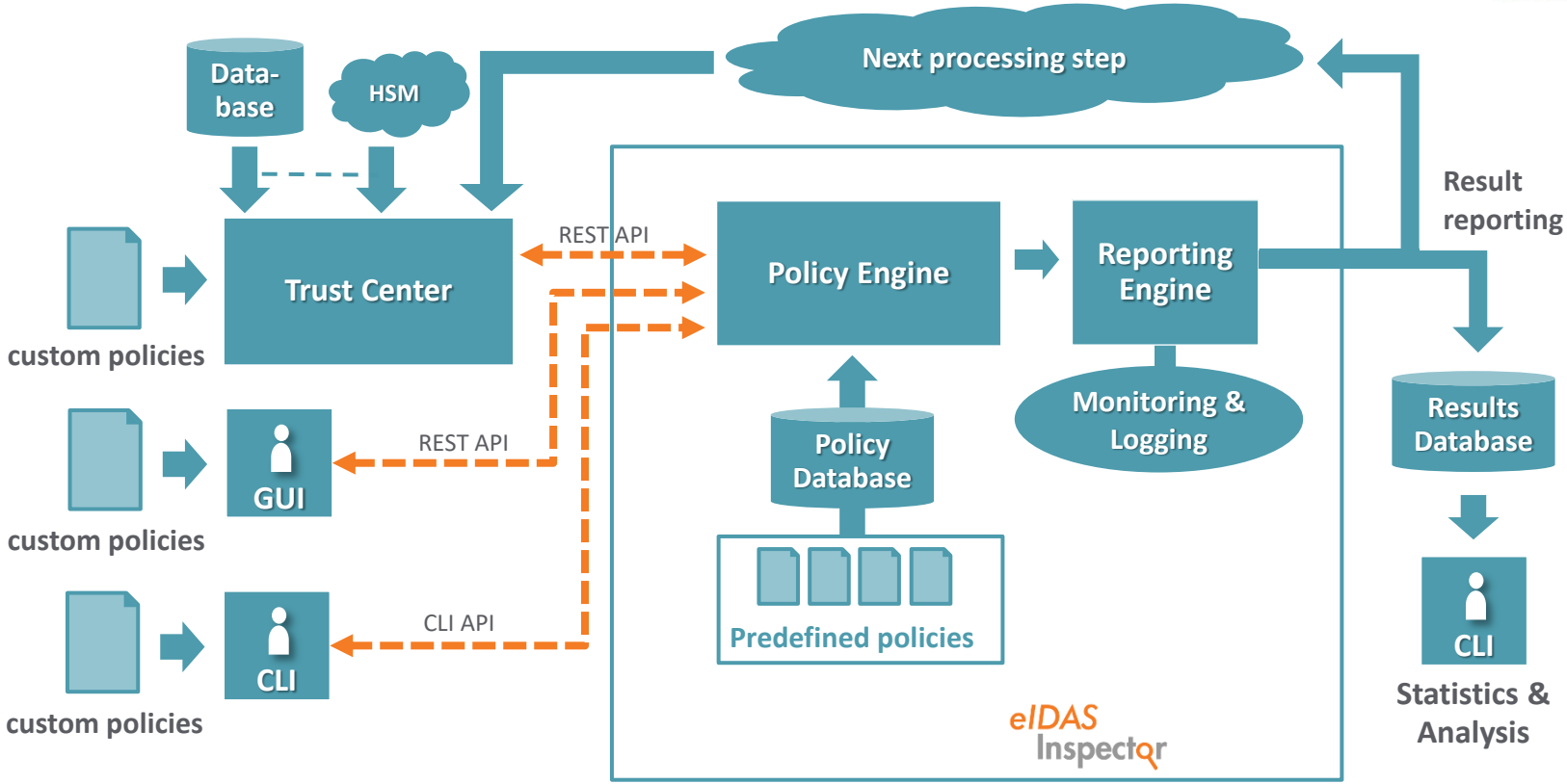
3
- Official tool qualification
- Certificate by compliance program

Tool design

Some tool design decisions

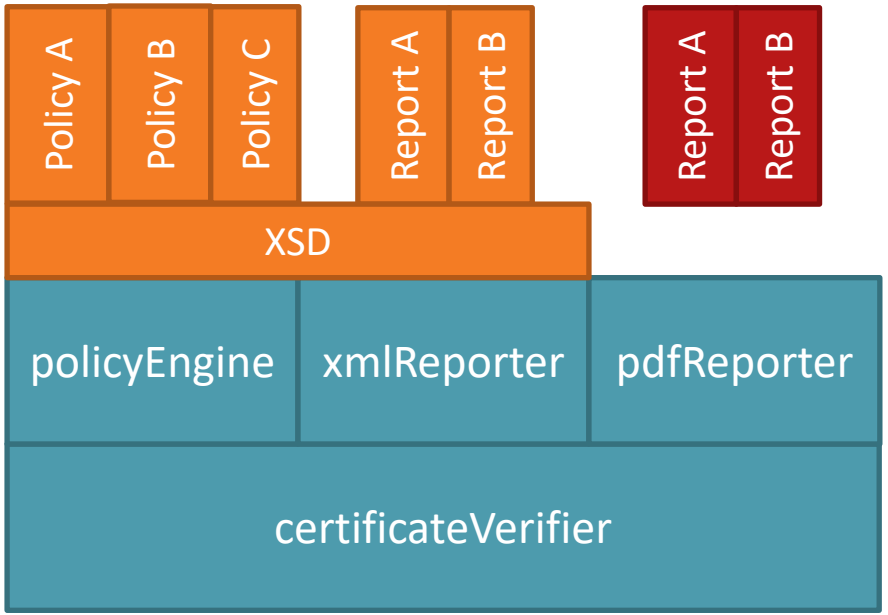
- Extensibility
  - Create custom test cases (e.g. to implement CPS, chapter 7.1)
  - Modify standard test cases
- Modularity
  - Tool -> performance, reporting, robustness, test case mgmt
  - Test case (policy) -> certificate compliance
- Versioning of tests
- Easy to integrate into automated processes
  - Service (REST)
  - Scriptable (CLI)
  - Light weight
- Independent of a platform
  - Java
  - XML

System Integration



Modularity

- Separation of tool and test cases (policy)
  - XML based language to specify requirements and test cases
  - XML: human and software readable
  - Generation of reports as PDF files for archiving



XML based test case (report) implementation

4.1.1.2			PASSED	
4.1.1.2_(1.1)_sigAlg_present	SignatureAlgorithm	SignatureAlgorithm parameter MUST be provided.	PASSED	
isPresent			PASSED	SHA256WITHRSA
4.1.1.2_(1.2)_sigAlg_equals_signature	SignatureAlgorithm	Signature algorithm identifier value MUST be the same as the value int the signature field.	PASSED	
listContainsElements			PASSED	[1.2.840.113549.1.1.11]
4.1.1.3			PASSED	


```
- <t:testStep expandable="true" uuid="4a2b2e77-514c-487d-8398-29d1ccf6ec1d" verdict="PASSED" expected="SignatureAlgorithm parameter MUST be provided." target="SignatureAlgorithm" ref="4.1.1.2_(1.1)_sigAlg_present">
  - <c:isPresent expandable="false" uuid="1eaf2e0f-8a57-4621-b255-a4b8b5f93e1b" result="PASSED">
      <ac:signatureAlgorithm value="SHA256WITHRSA" parsable="true"/>
    </c:isPresent>
</t:testStep>
- <t:testStep expandable="true" uuid="2031e6d9-35c1-464a-bd1d-72eba2d06021" verdict="PASSED" expected="Signature algorithm identifier value MUST be the same as the value int the signature field." target="SignatureAlgorithm" ref="4.1.1.2_(1.2)_sigAlg_equals_signature">
  - <c:listContainsElements expandable="true" uuid="2ea98a4c-401f-484a-b295-04e7b0eb1feb" result="PASSED" noOfMinElements="1" noOfMaxElements="-1" allowDuplicates="false" exclusive="true">
      <ac:signature value="[1.2.840.113549.1.1.11]" parsable="true"/>
    - <expectedElements>
        <ac:signatureAlgorithm value="SHA256WITHRSA" parsable="true"/>
      </expectedElements>
    </c:listContainsElements>
</t:testStep>
```

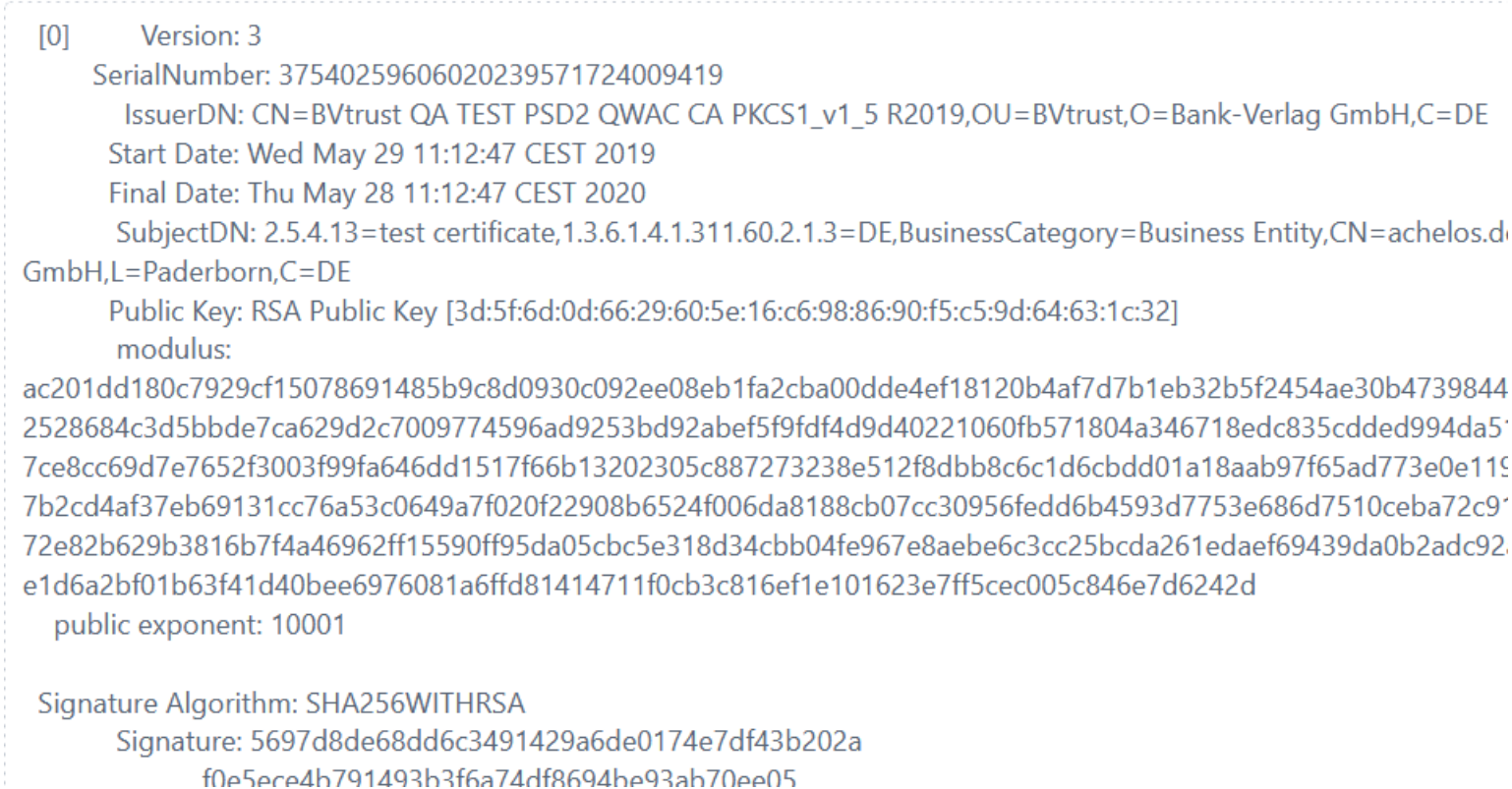
Reporting – test information

Test information:

Subject: 2.5.4.13=test certificate,1.3.6.1.4.1.311.60.2.1.3=DE,BusinessCategory=Business Entity,CN=achelos.de,SERIALNUMBER=f263cf73-b090-
GmbH,L=Paderborn,C=DE
Issuer: CN=BVtrust QA TEST PSD2 QWAC CA PKCS1_v1_5 R2019,OU=BVtrust,O=Bank-Verlag GmbH,C=DE

Policyname: RFC5280SubscriberPolicy_v05.2008
StartingTime: 2020-10-21T15:30:16.907113Z
Test-duration: 1414ms
Number of tests passed: 98
Number of tests failed: 0
Number of warnings: 3
Number of tests inconclusive: 45

Reporting – certificate information



[0] Version: 3
SerialNumber: 375402596060202395717240094l9
IssuerDN: CN=BVtrust QA TEST PSD2 QWAC CA PKCS1_v1_5 R2019,OU=BVtrust,O=Bank-Verlag GmbH,C=DE
Start Date: Wed May 29 11:12:47 CEST 2019
Final Date: Thu May 28 11:12:47 CEST 2020
SubjectDN: 2.5.4.13=test certificate,1.3.6.1.4.1.311.60.2.1.3=DE,BusinessCategory=Business Entity,CN=achelos.d
GmbH,L=Paderborn,C=DE
Public Key: RSA Public Key [3d:5f:6d:0d:66:29:60:5e:16:c6:98:86:90:f5:c5:9d:64:63:1c:32]
modulus:
ac201dd180c7929cf15078691485b9c8d0930c092ee08eb1fa2cba00dde4ef18120b4af7d7b1eb32b5f2454ae30b4739844
2528684c3d5bbde7ca629d2c7009774596ad9253bd92abef5f9fdf4d9d40221060fb571804a346718edc835cdded994da5
7ce8cc69d7e7652f3003f99fa646dd1517f66b13202305c887273238e512f8dbb8c6c1d6cbdd01a18aab97f65ad773e0e11
7b2cd4af37eb69131cc76a53c0649a7f020f22908b6524f006da8188cb07cc30956fedd6b4593d7753e686d7510ceba72c9
72e82b629b3816b7f4a46962ff15590ff95da05cbc5e318d34cbb04fe967e8aebe6c3cc25bcda261edaef69439da0b2adc92
e1d6a2bf01b63f41d40bee6976081a6ffd81414711f0cb3c816ef1e101623e7ff5cec005c846e7d6242d
public exponent: 10001

Signature Algorithm: SHA256WITHRSA
Signature: 5697d8de68dd6c3491429a6de0174e7df43b202a
f0e5ece4b791493b3f6a74df8694be93ab70ee05

Reporting – report by test case

name	target	description	status	value
RFC5280SubscriberPolicy_v05.2008			PASSED: 98, FAILED: 0, WARNING: 3, INCONCLUSIVE: 45	2.5.4.13=test certificate,1.3.6.1.4.1.311.60.2.1.3=Entity,CN=achelos.de,SERIALNUM a5d2-4d36fbafa680,2.5.4.97=PSD GmbH,L=Paderborn,C=DE
4.1.1.2			PASSED	
4.1.1.2_(1.1)_sigAlg_present	SignatureAlgorithm	SignatureAlgorithm parameter MUST be provided.	PASSED	
isPresent			PASSED	SHA256WITHRSA
4.1.1.2_(1.2)_sigAlg_equals_signature	SignatureAlgorithm	Signature algorithm identifier value MUST be the same as the value int the signature field.	PASSED	
listContainsElements			PASSED	[1.2.840.113549.1.1.11]
4.1.1.3			PASSED	
4.1.1.3_(1.1)_sig_value_present	SignatureValue	Certificates MUST provide a signatureValue parameter	PASSED	
isPresent			PASSED	5697D8DE68DD6C3491429A6DE(
4.1.1.3_(1.2)_sig_algid_equals_sigalg	SignatureValue	Signature algorithm identifier MUST be the same as in the algorithm identifier field	PASSED	
isValidSigned			PASSED	

Versioning

Traceability

Completeness

Quality Assurance

- QA during build process (500+ Tests incl corrupted certificates)

- Validation of test case implementation
  - Through customer projects with respect to eIDAS
  - Based on Zlint test certificates for BR and EV Guideline
  - Comparison of Zlint and eIDAS Inspector results

- Automatic generation of test specifications for each policy
  - Can be used by 3rd party for tool validation

Discussion

Discussion

- Validation of test case implementations
- Use of the eIDAS Inspector for CA/Browser Forum guidelines
- Open Source of the certificateVerifier for the Forum

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Vielen Dank | Thank you

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