

NIST's Development of Conformance Test Suites for Biometric Interfaces

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Overview

- Conformance Testing for Standard Biometric Interfaces
 - Conformance Test Suites for BioAPI
 - Conformance Test Suites for CBEFF

Development of Conformance Testing Tools in Support of Documentary Standards

- Conformance Testing
 - Standards based, high quality conformance testing leads to greatly increased levels of confidence in product conformance claims for developers & users.
 - It can also help ensure interoperability between standards-based products and systems.
- Conformance Test Suite (CTS) development for biometric interface standards such as BioAPI and CBEFF is a component of NIST/ITL Biometric Standards program.
- Requirements for conformance to biometric standards (e.g., interfaces, biometric data formats) are already found in Government specifications (e.g., PIV, US-VISIT).

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Definitions

- Conformance Testing
 - Captures the technical description of a specification and measures whether an implementation faithfully implements the specification. *[NIST]*
 - Conformity evaluation by means of testing. *[ISO/IEC - Guide 2]*
- Conformance Test Suite (CTS)
 - Test software used to ascertain conformance to a testing methodology described in a specification or standard.
 - While CTS implementers should have freedom designing the CTS, there may be specific requirements that have to be fulfilled.

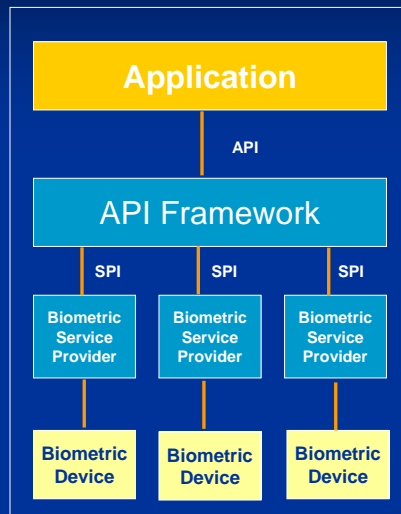
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Conformance Testing Methodology Standards for Biometric Interfaces

- Conformance Testing Methodology Standard for ANSI INCITS 358-2002, BioAPI Specification
 - Two CTS implementations conforming to this standard are publicly available:
 - NIST/ITL BioAPI CTS
www.itl.nist.gov/div893/biometrics/BioAPI_CTS/
 - DoD BTF BioAPI CTS
www.biometrics.dod.mil/Content/content.aspx?NavID=4&PageID=201
 - Test results derived from both CTS implementations were cross-validated.
- Conformance Testing Methodology Standard for Common Biometric Exchange Formats Framework (CBEFF) Data Structures
 - New project proposed to INCITS M1
 - NIST/ITL is currently developing a CBEFF Testing System for these data structures.

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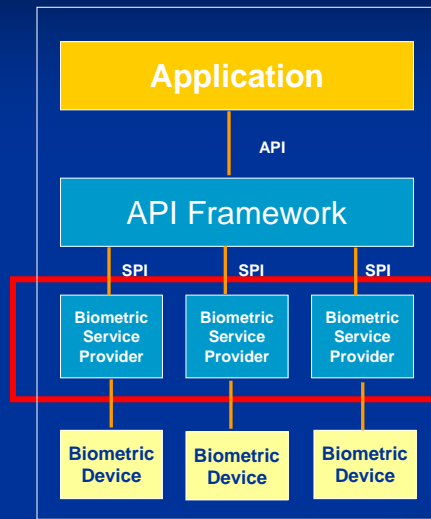
BioAPI Standards and NIST/ITL BioAPI CTS



The BioAPI Specification defines an open system standard application program interface (API) that allows software applications to communicate with a broad range of biometric technologies in a common way.

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BioAPI Standard and NIST/ITL BioAPI CTS

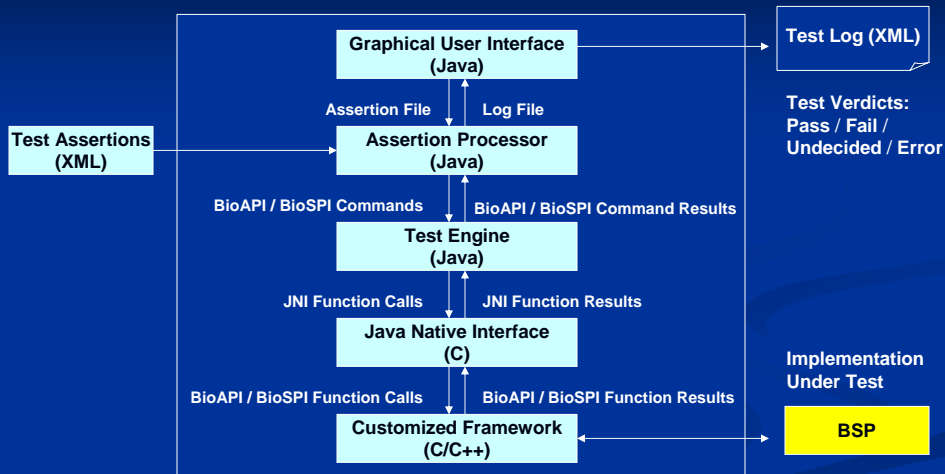


- 57 Assertions
- Uses a Customized Version of the Reference Implementation (RI) Framework
- Uses the RI Registry
- Install BSP & Test
- One XML Log per Suite of Assertions

NIST/ITL BioAPI CTS Target: Biometric Service Providers

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NIST/ITL BioAPI CTS Architecture



Currently tests BSP conformance to ANSI INCITS 358-2002, BioAPI Specification

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NIST/ITL BioAPI CTS Screenshot

The screenshot shows the BioAPI Test Environment interface. The 'Test Results' pane displays a failure for the function `BioSPI_GetHeaderFromHandle`. The error message states: "The function BioSPI_GetHeaderFromHandle has returned BioAPI_Quality is not supported by the BSP and -3 is returned." The assertion status is 'FAIL' and the test duration is 8375 milliseconds. A dialog box titled 'Error password' is overlaid on the interface, showing a password field with a single character and 'OK' and 'Cancel' buttons. In the background, a command prompt window shows the execution of `cmd.exe` and the output of the test run, including the error message and test parameters.

A number of Biometric Service Providers were used during CTS development/validation

Cross-Validation of Test Results between NIST/ITL and DoD BTF CTS

Microsoft Excel - BMO NIST Results 04-12-05-Updated.xls

		Diff		Vendor_02				
A	B	C	E	F	G	H	I	
1								
2	Line	BioAPI Function	AssertionName	V02 Diff	V02 BMO	V02 NIST 2k	V02 NIST XP	V02 NIST Runs
3	1	BioSPI_ModuleLoad	BioSPI_ModuleLoad_ValidParam		Pass	Pass	Pass	3,6
4	2	BioSPI_ModuleLoad	BioSPI_ModuleLoad_InvalidUUID		Pass	Pass	Pass	3,6
5	3	BioSPI_ModuleUnload	BioSPI_ModuleUnload_ValidParam		Pass	Pass	Pass	3,6
6	4	BioSPI_ModuleUnload	BioSPI_ModuleUnload_UnmatchedLoad		Fail	Fail	Fail	3,6
7	5	BioSPI_ModuleUnload	BioSPI_ModuleUnload_InvalidUUID		Pass	Pass	Pass	3,6
8	6	BioSPI_ModuleUnload	BioSPI_ModuleUnload_Confirm		Fail	Fail	Fail	3,6
9	7	BioSPI_ModuleAttach	BioSPI_ModuleAttach_ValidParam		Pass	Pass	Pass	3,6
10	8	BioSPI_ModuleAttach	BioSPI_ModuleAttach_InvalidModuleHandle	Diff	Pass	Fail	Fail	3,6
11	9	BioSPI_ModuleAttach	BioSPI_ModuleAttach_InvalidUUID	Diff	Pass	Fail	Fail	3,6
12	10	BioSPI_ModuleAttach	BioSPI_ModuleAttach_InvalidVersion		Pass	Pass	Pass	3,6
13	11	BioSPI_ModuleDetach	BioSPI_ModuleDetach_ValidParam		Pass	Pass	Pass	3,6
14	12	BioSPI_ModuleDetach	BioSPI_ModuleDetach_InvalidModuleHandle	Diff	Pass	Fail	Fail	3,6
15	13	BioSPI_ModuleDetach	BioSPI_ModuleDetach_Confirm		Pass	Pass	Pass	3,6
16	14	BioSPI_FreeBIRHandle	BioSPI_FreeBIRHandle_ValidParam		Pass	Pass	Pass	3,6
17	15	BioSPI_FreeBIRHandle	BioSPI_FreeBIRHandle_InvalidModuleHandle		Pass	Pass	Pass	3,6
18	16	BioSPI_FreeBIRHandle	BioSPI_FreeBIRHandle_InvalidBIRHandle		Pass	Pass	Pass	3,6

A number of test interactions took place until full cross-validation of test results was achieved

Common Biometric Exchange Formats Framework (CBEFF)

- Defines a structure and a common set of data elements necessary to support multiple biometric technologies. It promotes interoperability of biometric-based application programs and systems by allowing for biometric data exchange.



■ CBEFF Basic Structure

- Standard Biometric Header (SBH)
- Biometric Data Block (BDB)
- Signature/Security Block (SB)

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Common Biometric Exchange Formats Framework (CBEFF)

The CBEFF SBH provides metadata for the BDB & SB.



- BDB Format Owner
- BDB Format Type
- Creator
- BDB Product Identifier
- Security/Integrity options (e.g., encrypted/signed)
- Biometric modality
- Data type (e.g., processed data)

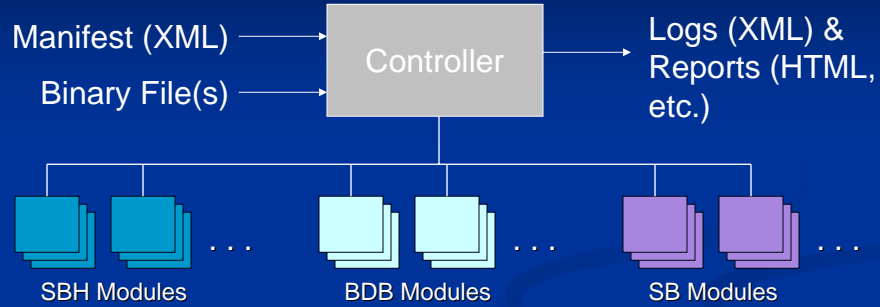
The content is specified by the owner of the type as specified in the BDB Format Owner/Type field of the SBH.

The BDB content can be a non-standard format or a data format developed or adopted by a Standards Body (e.g., INCITS M1, JTC 1 SC 37).

Contains integrity/encryption information

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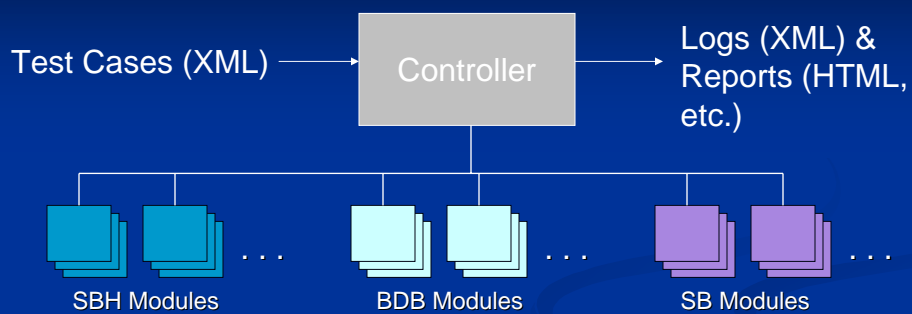
NIST/ITL CBEFF CTS Architecture



- The Controller supports Testing Modules for each of the components of a CBEFF structure.
- NIST/ITL is currently developing SBH CTS implementations for selected CBEFF Patron Formats (e.g., CBEFF Generic Patron Format based on ISO/IEC 19785-1 data elements and INCITS 398-revised Patron Format A).

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NIST/ITL CBEFF CTS Architecture



- Test Cases help verify the Controller and Test Modules are working properly.
- Test Case Types – more testing with fewer test case files.
 - Full
 - Structure Only
 - Data Only
 - Partial Structure & Data

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NIST/ITL CBEFF CTS Sample Test Case

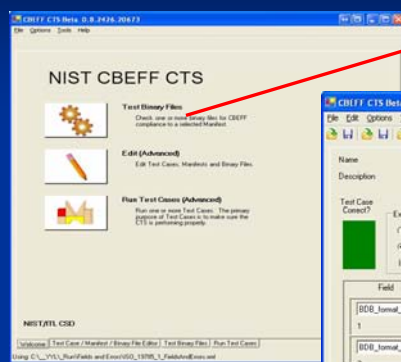
```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <TestCase xmlns:noNamespaceSchemaLocation="TestCaseSchema_Q3.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
3   <Name>m_0_8_Not_Defined_Mandatory_Field_Fail</Name>
4   <Description>All mandatory fields must be defined in this record</Description>
5   <ExpectedResult>Fail</ExpectedResult>
6   <ExpectedError BytePos="0" FieldName=""_GLOBAL_ ErrorName="CBEFF_ERR_MANDATORY_FIELD_NOT_DEFINED"/>
7   <NumberOfFields>25</NumberOfFields>
8   <Field Sequence="1" Name="BDB_FORMAT_OWNER_FIELD" DefinedLength="2" ActualLength="2" BytesBase64="AgE=" />
9   <Field Sequence="2" Name="PRODUCT_FORMAT_OWNER_FIELD" DefinedLength="2" ActualLength="2" BytesBase64="AAA=" />
10  <Field Sequence="3" Name="SBH_OPTIONAL_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="BA=" />
11  <Field Sequence="4" Name="PRODUCT_FORMAT_OWNER_FIELD" DefinedLength="2" ActualLength="2" BytesBase64="AAA=" />
12  <Field Sequence="5" Name="PRODUCT_FORMAT_TYPE_FIELD" DefinedLength="2" ActualLength="2" BytesBase64="AAA=" />
13  <Field Sequence="6" Name="PATRON_FORMAT_OWNER_FIELD" DefinedLength="2" ActualLength="2" BytesBase64="AAA=" />
14  <Field Sequence="7" Name="PATRON_FORMAT_TYPE_FIELD" DefinedLength="2" ActualLength="2" BytesBase64="AAA=" />
15  <Field Sequence="8" Name="INDEX_FIELD" DefinedLength="4" ActualLength="4" BytesBase64="AAAAAA=" />
16  <Field Sequence="9" Name="BIOMETRIC_CREATION_DATE_FIELD" DefinedLength="8" ActualLength="8" BytesBase64="*
FAUMD;EjHoUBwPESQwWg=" />
17  <Field Sequence="10" Name="VALIDITY_PERIOD_FIELD" DefinedLength="18" ActualLength="18" BytesBase64="
FAUMD;EjHoUBwPESQwWg=" />
18  <Field Sequence="11" Name="BIOMETRIC_TYPE_FIELD" DefinedLength="3" ActualLength="3" BytesBase64="AAA" />
19  <Field Sequence="12" Name="BIOMETRIC_SUBTYPE_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="AQ=" />
20  <Field Sequence="13" Name="CBEFF_HEADER_VERSION_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="EQ=" />
21  <Field Sequence="14" Name="PATRON_HEADER_VERSION_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="EQ=" />
22  <Field Sequence="15" Name="BDB_PURPOSE_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="AA=" />
23  <Field Sequence="16" Name="BIOMETRIC_DATA_TYPE_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="A=" />
24  <Field Sequence="17" Name="BIOMETRIC_DATA_QUALITY_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="g=" />
25  <Field Sequence="18" Name="CREATOR_LENGTH_FIELD" DefinedLength="4" ActualLength="4" BytesBase64="AAAAQ=" />
26  <Field Sequence="19" Name="CREATOR_CONTENT_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="AA=" />
27  <Field Sequence="20" Name="CHALLENGE_RESPONSE_LENGTH_FIELD" DefinedLength="4" ActualLength="4" BytesBase64="
AAAAAQ=" />
28  <Field Sequence="21" Name="CHALLENGE_RESPONSE_CONTENT_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="
AA=" />
29  <Field Sequence="22" Name="PAYLOAD_LENGTH_FIELD" DefinedLength="4" ActualLength="4" BytesBase64="AAAAQ=" />
30  <Field Sequence="23" Name="PAYLOAD_CONTENT_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="AA=" />
31  <Field Sequence="24" Name="BIOMETRIC_DATA_BLOCK_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="AA=" />
32  <Field Sequence="25" Name="SIGNATURE_FIELD" DefinedLength="1" ActualLength="1" BytesBase64="AA=" />
33 </TestCase>

```

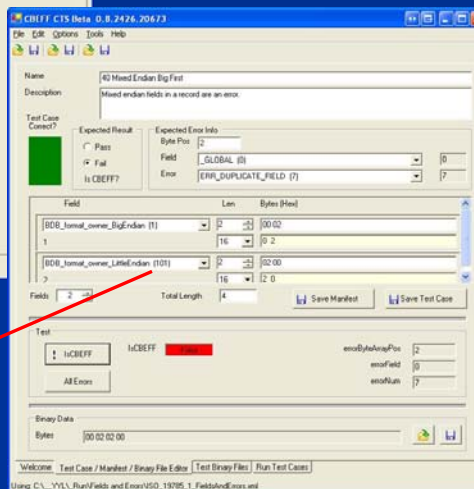
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NIST/ITL CBEFF Controller/SBH Screenshots



Tests Binary Files for Conformance to a CBEFF Patron Format

Manifest (input to CTS) & Test Case editor



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NIST/ITL CBEFF Controller/SBH Screenshots

The image shows two overlapping screenshots from a Microsoft Internet Explorer browser. The left screenshot displays the 'CBEFF CTS Test Results' page. It shows a test suite named 'Multiple Errors' with a 'Result: Fail'. The test was run on 8/9/2006 at 4:53:54 PM UTC. The test suite contains 5 tests, with 4 passed and 1 failed. A table lists the failed tests:

Seq	Field Name	Exp. Len.	Len.
1	BDB_format_owner_BigEndian	2	2
2	BDB_format_owner_BigEndian	2	2
3	Version	1	1
4	Version	1	1

The right screenshot shows the 'CBEFF CTS Beta, 0.8.2476.20673' application window. It displays a list of test cases, each with a status icon (green for pass, red for fail). The failed cases include:

- Multiple Errors and
- No Data and
- FailOwner and
- FailType and
- Encaps Opt and
- EDB Integrity Opt and
- Subtype and
- Biometric Type and
- Challenge Resp and
- Creation Date ASCII and
- LE BDB Index and
- Processed Level and
- LE BDB Product Owner and
- EDB Purpose and
- Quality and
- Valid Period ASCII Bad End and
- Valid Period ASCII Bad Order and
- Valid Period ASCII Bad Seq and
- Valid Period ASCII Bad Seq2 and
- Valid Period ASCII Bad Start and
- Valid Period ASCII Oh and
- BIR Creation Date ASCII and
- BIR Palton Format Owner Type and
- BIR Valid Period ASCII Bad End and
- BIR Valid Period ASCII Bad Order and
- BIR Valid Period ASCII Bad Seq and
- BIR Valid Period ASCII Bad Seq2 and
- BIR Valid Period ASCII Bad Start and

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INCITS M1: http://www.incits.org/tc_home/m1.htm
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 JTC 1 SC 37: <http://www.itc1.org> (select SC37)
 ISO: <http://www.iso.org>