Interoperability and Conformance Testing

Dr. John Campbell, President,
Bion Biometrics Inc.

Biometrics Consortium Conference 2005

Tuesday, September 20, 2005
Outline of Presentation

- Why use Biometric Standards?
- Conformance and Interoperability – What do they really mean?
- ILO SID and ISO 19794-2
- INCITS 378-2004
Why use Biometric Standards?

- Standards help improve quality, safety, reliability, efficiency and interchangeability
- Standards help reduce cost
- Standards prevent vendor lock-in
- Standards help systems work together
- Standards simplify system design
- Standards simplify support of multiple technologies
- **Standards allow interoperability**
Why use Biometric Standards?

- Biometric samples from many locations submitted for central processing
  - FBI IAFIS
  - US VISIT
  - US State Department Visa programs
- Biometric ID created in one nation must be verified in other nations (ISO standards)
  - ICAO E-passport
  - ILO SID
- System has distributed ownership
  - TWIC
Conformance and Interoperability

The applications just mentioned require conformance and interoperability to work

- Conformity Assessment (a.k.a. Conformance Testing) – “activity that provides demonstration that specified requirements relating to a product, process, system, person or body are fulfilled” (SC 37 Standing Document 7)

- Interoperability – “the ability of different information technology systems and software applications to communicate, to exchange data accurately, effectively, and consistently, and to use the information that has been exchanged”
Conformance and Interoperability

- Fingerprint Products A and B both claim conformance to INCITS 378-2004
  - A and B should each create INCITS 378-2004 template during enrollment
  - A and B should each be able to read a INCITS 378-2004 template during verification

If INCITS 378-2004 is perfect and both products conform perfectly then
  - Enroll on A, Verify on B should work
  - Enroll on B, Verify on A should work

In reality, conformance enhances the chance of interoperability but definitely doesn’t guarantee it
Conformance and Interoperability

- Now assume Products A and B also conform to INCITS 358-2002 (BioAPI)
- Also assume each product on separate PC as part of different application
- If both A and B conform perfectly to BioAPI, then we now also get
  - Interchangability of products from one computer and application to the other
- But, how do we know A and B are conformant to 378 or 358
- Conformance Testing Methodology Standards Required (1749-D, 1703-D)
Conformance and Interoperability Case Study – ILO SID

- International Labour Organization
- Specialised agency of the United Nations with 176 Member States
- Tripartite Structure (Governments, Employers and Workers with equal rights)

ILO developed a new Seafarers’ Identity Document (SID) Convention to define a professional ID for seafarers, who are internationally mobile workers

SID uses 2 fingerprint templates in a 2D barcode
ILO SID Case Study

Biometric data could be used for identification in issuing country (prevent duplicate identities, do background checks, etc.)

In receiving countries, biometric data only used to verify that seafarer was person to whom SID was originally issued

Each national system used for identification could be isolated, but the biometric data on the card had to be interoperable among all countries issuing SIDs and receiving seafarers

ILO turned to ISO for help with standards
ILO SID Case Study

- ILO produced technical document SID-0002 that referenced latest versions of multiple SC 37 biometrics standards, including 19794-2, which defines fingerprint minutiae template.
- Many biometrics vendors wanted to be part of ILO SID market and claimed they could support ILO requirements.
- ILO recognized the need for third party testing for conformance, performance and interoperability.
- Thus far, one online scenario test and one offline technology test (using images gathered in scenario test) have taken place.
ILO SID Case Study

Conformance Testing

- Of 10 products tested, only 1 was initially conformant to the standards specified in SID-0002
- Later, 7 products were brought into basic conformance by interactions between test lab and the vendors

Performance Testing

- Data gathered on a ship with real seafarers enrolled once and then verified three times over a six week period.
- Match scores and match results returned immediately for scenario test and images stored for later use in technology (off-line) testing
- Standard false accept rate (FAR) and false reject rate (FRR) data was computed
Interoperability Testing

- Each seafarer enrolled 2 fingers on all 7 products
- Each seafarer verified 70 times in each of the 3 visits, so that on each product they could attempt to verify against:
  - their own templates for that product (2)
  - another seafarers’ templates for that product (2)
  - their own templates from three randomly selected other products (6)
- After scenario test only 2 products were interoperable at the ILO required performance threshold of 1% FAR and FRR
- After much work reviewing the standard and the various templates, further guidance was issued to the vendors, and after the technology test a third product was declared interoperable
## Results From ILO SID Case Study

**Results from First ILO Performance and Interoperability Test**


<table>
<thead>
<tr>
<th>Template</th>
<th>A</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>Mean</th>
<th>Aggregate Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.0%</td>
<td>3.6%</td>
<td>19.8%</td>
<td>52.0%</td>
<td>1.6%</td>
<td>40.6%</td>
<td>19.6%</td>
<td>11.1%</td>
</tr>
<tr>
<td>C</td>
<td>0.0%</td>
<td>1.7%</td>
<td>40.2%</td>
<td>5.5%</td>
<td>59.4%</td>
<td>3.0%</td>
<td>18.3%</td>
<td>17.7%</td>
</tr>
<tr>
<td>D</td>
<td>9.4%</td>
<td>40.4%</td>
<td>21.1%</td>
<td>49.7%</td>
<td>22.2%</td>
<td>37.0%</td>
<td>30.0%</td>
<td>38.8%</td>
</tr>
<tr>
<td>E</td>
<td>1.9%</td>
<td>6.3%</td>
<td>72.7%</td>
<td>4.9%</td>
<td>1.8%</td>
<td>3.6%</td>
<td>15.2%</td>
<td>20.9%</td>
</tr>
<tr>
<td>F</td>
<td>0.0%</td>
<td>4.9%</td>
<td>65.0%</td>
<td>41.9%</td>
<td>0.0%</td>
<td>27.3%</td>
<td>23.2%</td>
<td>20.1%</td>
</tr>
<tr>
<td>G</td>
<td>4.3%</td>
<td>46.6%</td>
<td>66.6%</td>
<td>6.3%</td>
<td>17.0%</td>
<td>1.6%</td>
<td>23.7%</td>
<td>21.3%</td>
</tr>
<tr>
<td>Mean</td>
<td>2.6%</td>
<td>17.2%</td>
<td>47.6%</td>
<td>26.7%</td>
<td>17.0%</td>
<td>18.9%</td>
<td>21.7%</td>
<td></td>
</tr>
</tbody>
</table>

*Product B removed since unable to produce FAR of 1%*
### Results From ILO SID Case Study

Results from Second ILO Performance and Interoperability Test


Table 7. Enhanced Test: Dual-Finger FRR+FTA at 1% FAR for Key Visit

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.0%</td>
<td>4.3%</td>
<td>0.9%</td>
<td>3.5%</td>
<td>0.0%</td>
<td>2.6%</td>
</tr>
<tr>
<td>B</td>
<td>2.7%</td>
<td>2.7%</td>
<td>2.7%</td>
<td>3.5%</td>
<td>1.8%</td>
<td>2.7%</td>
</tr>
<tr>
<td>C</td>
<td>0.0%</td>
<td>2.6%</td>
<td>1.2%</td>
<td>3.5%</td>
<td>0.9%</td>
<td>1.8%</td>
</tr>
<tr>
<td>E</td>
<td>1.0%</td>
<td>1.9%</td>
<td>1.0%</td>
<td>2.9%</td>
<td>1.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>F</td>
<td>0.9%</td>
<td>5.2%</td>
<td>1.6%</td>
<td>3.3%</td>
<td>0.0%</td>
<td>3.5%</td>
</tr>
<tr>
<td>G</td>
<td>0.9%</td>
<td>2.7%</td>
<td>2.7%</td>
<td>2.7%</td>
<td>0.9%</td>
<td>2.7%</td>
</tr>
</tbody>
</table>
ILO SID – Lessons Learned

- ILO required standards. This was a good start.
- If ILO had not required conformance testing, there could have been 10 products, none of which would have been interoperable.
- If ILO had not required interoperability testing, there could have been 7 products, only 2 of which were interoperable.
- Now there are 3 interoperable products and all SID systems must use one of them.
- Conformance and Interoperability testing are not synonymous and both are important.
Conformance and Interoperability Case Study – INCITS 378-2004

- US fingerprint minutiae standard
- Published last year. Already lots of interest.
  - NIST MINEX 04
  - DHS TSA TWIC
  - Multiple vendors announced support for 378
- So far, no real world experience of conformance or interoperability
- That changes at Biometrics Consortium Conference 2005 !!
INCITS 378-2004 Case Study

- Four fingerprint vendors involved in standards, all claim conformance to 378
- Bion Biometrics used its multi-standard conformance testing toolkit to evaluate conformance for each vendor
- After a little work, all 4 are conformant
INCITS 378-2004 Case Study

- Visit any participating vendor’s booth in exhibition
- Get fingerprint enrolled using 378 template generated by that vendor
- Template encrypted on to smart card
- Take template to any other vendor
- They will attempt to read it and verify your finger with their matching algorithm
- Different sensors, different algorithms, different vendors, standardized template
- Will there be interoperability?
Biometric Standards - Resources

- SC 37 Web Site (Most docs protected)
  - [http://isotc.iso.org/livelink/livelink?func=ll&objId=2262372&objAction=browse&sort=name](http://isotc.iso.org/livelink/livelink?func=ll&objId=2262372&objAction=browse&sort=name)
  - Need to allow pop-ups

- US M1 Web Site (Many docs are open)
  - [http://www.incits.org/tc_home/m1.htm](http://www.incits.org/tc_home/m1.htm)

- National Biometric Security Project
  - [https://db.nationalbiometric.net/fmi/iwp/res/iwp_home.html](https://db.nationalbiometric.net/fmi/iwp/res/iwp_home.html)
  - Need to allow pop-ups