KICKOFF MEETING OCTOBER 31, 2014

ANSI/NIST-ITL Update:2015

WELCOME

- Barbara Guttman
  - Director, Information Access Division

SOME OF THE NIST RESEARCH THAT SUPPORTS THE STANDARD

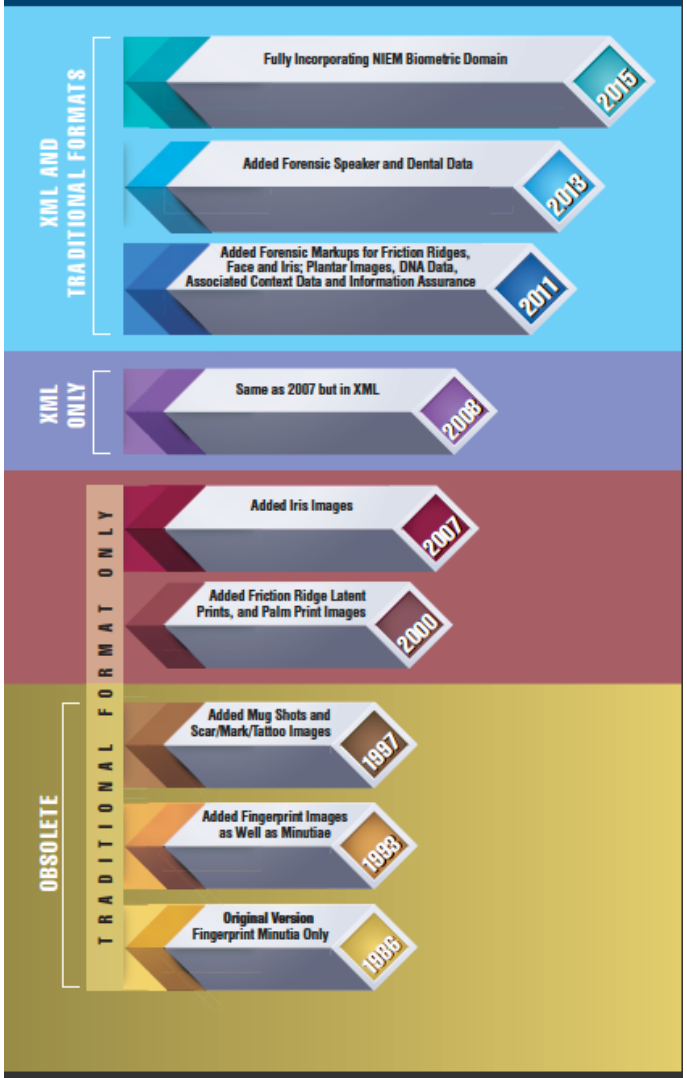
- Fingerprint
  - Compression studies
    - Guidance on converting 1000 ppi to 500 ppi
    - Use of WSQ for 500 ppi and JPEG 2000 for 1000 ppi
  - MINEX
  - ONGOING FPVTE
  - NFIQ2
  - 3D fingerprint calibration targets
- Iris
  - IREX studies
    - Compact formats
- Face
  - Face quality metrics
- Voice
  - Algorithm challenges
- Handwriting
  - Algorithm challenges
- DNA
  - RapidDNA equipment analysis
  - electropherogram ladders, etc.
- Security
  - Hashing algorithms
- Usability
  - Pictograms
- Communication Protocols
  - WS-BD

SHAHRAM ORANDI

ANSI/NIST-ITL Standard

Data Format for the Interchange of Fingerprint, Facial and Other Biometric Information

Used in over 100 nations for law enforcement, military and disaster victim identification operations



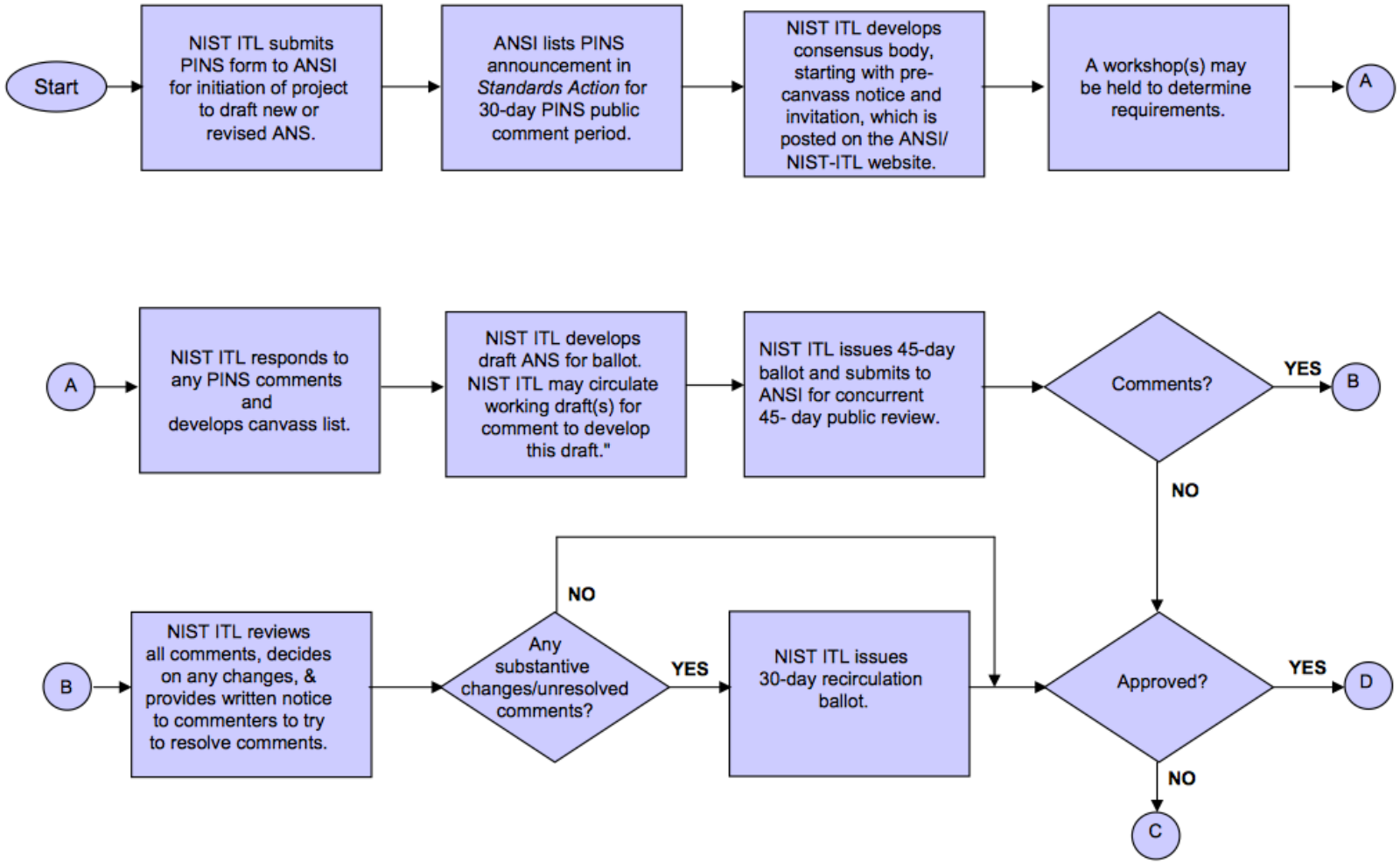
BRAD WING

PROJECT OVERVIEW

- Revise ANSI/NIST-ITL 1-2011 starting with the 2013 Update
  - Correct errors and add explanatory material where needed (particularly for lists)
  - Update references to other standards and to the Mobile ID Device BPR
  - Reflect changes to NIEM
  - Consider additional changes
    - Brief Overviews to be presented today
    - Smaller changes without separate overviews

BRAD WING

UPDATE PROCESS



BRAD WING

Delete codes 29 and 30 from Table 8 for palm (right other and left other)

- May be irrelevant with codes for grasp and carpal delta now included
- Unknown if codes have been actually used

Pro

Con

JOHN MAYER-SPLAIN

EFS TONAL REVERSAL DOES NOT INCLUDE AN 'UNKNOWN' CODE

Table 36 Tonal reversal codes

Code	Description
N	Negative – ridges are light and valleys are dark throughout the image.
P	Partial – ridges are light and valleys are dark only in portions of the image

Pro

- Field 9.314 (EFS Tonal Reversal) has only two options -- Add 'U' for Unknown for when analyst is unsure and both options should be considered

Con

- None

JOHN MAYER-SPLAIN

NIEM UPDATE (V 2.1 → V 3.0)

- Reasons for the change
- Incorporation of Biometric Domain
- Timetable for Finalization of V 3.0
- Plans for V 3.1

NIEM 2.1 Element Name	NIEM 3.0 Element Name
BinaryBase64Object	Base64BinaryObject
LocationGeographicElevation	LocationElevation
LocationTwoDemensionalGeographicCoordinate	Location2DGeospatialCoordinate
TwoDimensionalGeographicCoordinateType	Location2DGeospatialCoordinateType
Year	YearDate
YearMonth	YearMonthDate
UTMGridZoneID	MGRSGridZoneID
MeasurePointValue	MeasureDecimalValue

JUSTIN STEKERVITZ

HOW TO REFLECT NIEM UPDATES

- Update Standard to remove any element names in NIEM core
- Remove references to a NIEM version in the standard
- Maintain separate schemas and Annex G for each NIEM version for each A/N-ITL version
- Develop a conversion routine for all combination of NIEM and A/N versions

Pro

- Is in spirit of the A/N-ITL 2011 update to make the standard encoding version independent
- May cause confusion among users
- Requires funding and commitment to develop and maintain programs
- Public Outreach will be needed

Con

KAMRAN ATRI

Machine Readable Tables (MRT)

Rachel Wallner

ANSI/NIST-ITL 2015 Kickoff

October 31, 2014

noblis

For the best of reasons

RACHEL WALLNER

Agenda

I. What are the Machine Readable Tables (MRT)?

II. Purpose of MRT

III. Format of MRT

IV. Master Content Verification

V. MRT Roles

VI. MRT Lifecycle

VII. MRT in Action – Two Examples

VIII. More MRT Advantages

IX. Current Progress To Date

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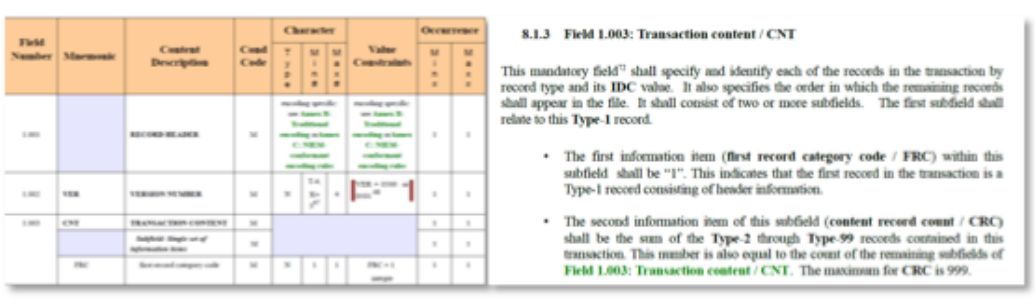
What are the Machine Readable Tables (MRT)?

- Defines machine processible attributes of transactions and fields

ANSI/NIST-ITL



Field Number	Mnemonic	Content Description	Cond Code	Character			Value Constraints	Occurrence	
1.001		RECORD HEADER	M					1	1
1.002	VER	VERSION NUMBER	M	M	TAL	4	VER = 0300	1	1
1.003	CNT	TRANSACTION CONTENT	M					1	1
			M					1	1
	IRC		M	M	1	1	IRC = 1	1	1

8.1.3 Field 1.003: Transaction content / CNT

This mandatory field[7] shall specify and identify each of the records in the transaction by record type and its **IDC** value. It also specifies the order in which the remaining records shall appear in the file. It shall consist of two or more subfields. The first subfield shall relate to this **Type-1** record.

- The first information item (**first record category code / FRC**) within this subfield shall be "1". This indicates that the first record in the transaction is a Type-1 record consisting of header information.
- The second information item of this subfield (**content record count / CRC**) shall be the sum of the **Type-2** through **Type-99** records contained in this transaction. This number is also equal to the count of the remaining subfields of **Field 1.003: Transaction content / CNT**. The maximum for **CRC** is 999.

MRT

TradXML	FieldRef	FieldID	InfoItem	InfoItemCount	InfoItemsVary	Mnemonic	Description	CondCode	XMLcondCode	DataType	MinLength	MaxLength	MinOccur	MaxOccur
X	1	01					Package Information Record (XML)	M					1	1
T	1/LEN:T	01.001:T				LEN	Record Header	M		N	2	*	1	1
X	1/XRCC:X	01.001:X				XRCC	XML Record Category Code	M		N	1	2	1	1
X	1/VER_1/ANM	01.002_01.017					Transaction (XML)	M					1	1
T	1/VER:T	01.002:T				VER	Version Number	M		N	4	4	1	1
X	1/VER:X1	01.002:X1				VER	Major Version	M		N	1	2	1	1
X	1/VER:X2	01.002:X2				VER	Minor Version	M		N	1	2	1	1
T	1/CNT:T	01.003:T	SET	2	TYPE	CNT	Transaction Content	M					1	1000
X	1/CNT:X	01.003:X	SET	2	TYPE	CNT	Transaction Content (XML)	M					1	1

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Purpose of MRT

- Make it easier for developers to implement standards and specifications
- Define framework for agencies with application profiles
- Define Machine Readable "Tables" (MRT) layers for
  - Standard Profile: e.g., ANSI/NIST-ITL
  - Application Profile: e.g., FBI EBTS
  - Tool Profile: e.g. FBI EBTS Transaction Tool
    - Defined by tool implementer

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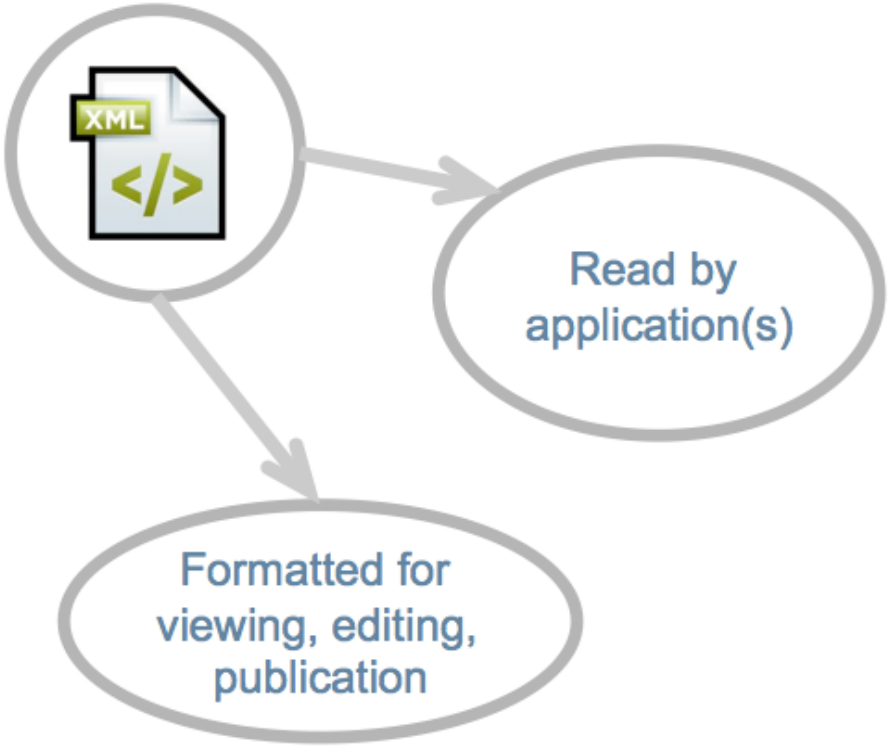
Format of MRT

- XML = Master Format




```
<FieldDef>
  <TradXML>TX</TradXML>
  <FieldRef>10/IMT</FieldRef>
  <FieldID>10.003</FieldID>
  <Mnemonic>IMT</Mnemonic>
  <Description>Image type</Description>
  <CondCode>M</CondCode>
  <DataType>AS</DataType>
  <MinLength>4</MinLength>
  <MaxLength>11</MaxLength>
  <MinOccur>1</MinOccur>
  <MaxOccur>1</MaxOccur>
  <SpecialChar>~</SpecialChar>
  <ContentType>Data</ContentType>
  <XMLPath>if [10/IMT] IN {"FACE"} then
  itl:PackageFacialAndSMTImageRecord/biom:Fac
else
  itl:PackageFacialAndSMTImageRecord/biom:Phy
endif</XMLPath>
  <CodeTable>IMT</CodeTable>
  <ValueRange>"FACE","SCAR","MARK","TATTOO"</
  <DependOther>false</DependOther>
  <InterFieldOther>false</InterFieldOther>
  <Exception>false</Exception>
  <Summary>Type of image contained in the rec
  <Example>FACE</Example>
  <Notes>See AN2011-LookupCodes MRT for Code1
```

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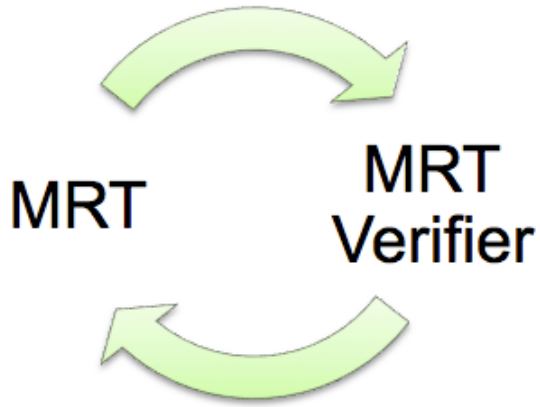
Master Content Verification



- MRT Verifier
  - Content, structure, and syntax
- MRT Continuous Integration Pipeline
  - As changes are introduced, structure and syntax are checked
  - Inadvertent errors caught and mainline is protected

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MRT Roles

- Consumers
  - Readers that view standards documents
  - Developers that read / rely on the MRT's directly
    - EBTS Compliance Tool Suite
  - Reviewers that view but do not edit tables
- Editors
  - Designated by FBI and NIST to edit / maintain content
  - Editing and maintenance is editor agnostic

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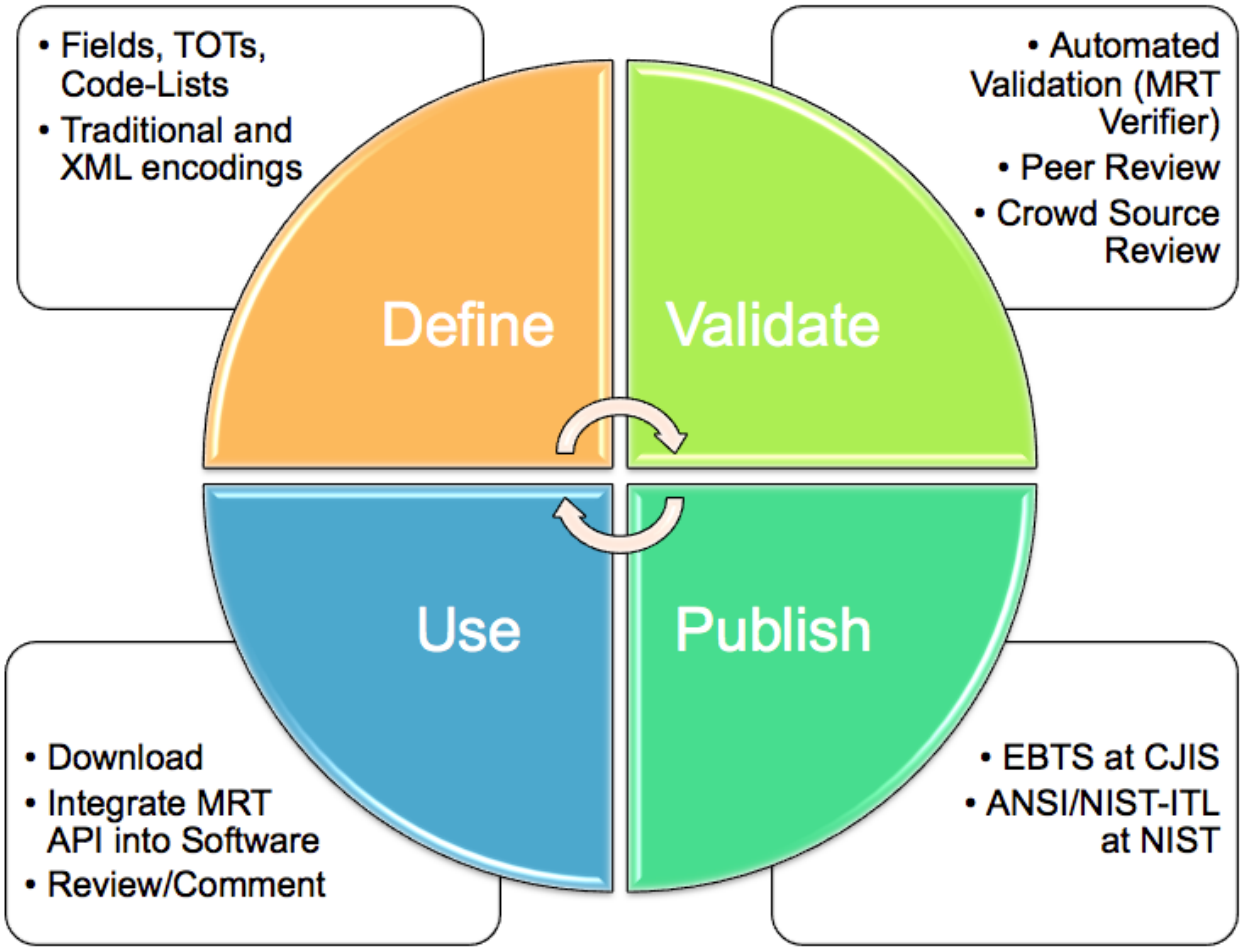
MRT Lifecycle



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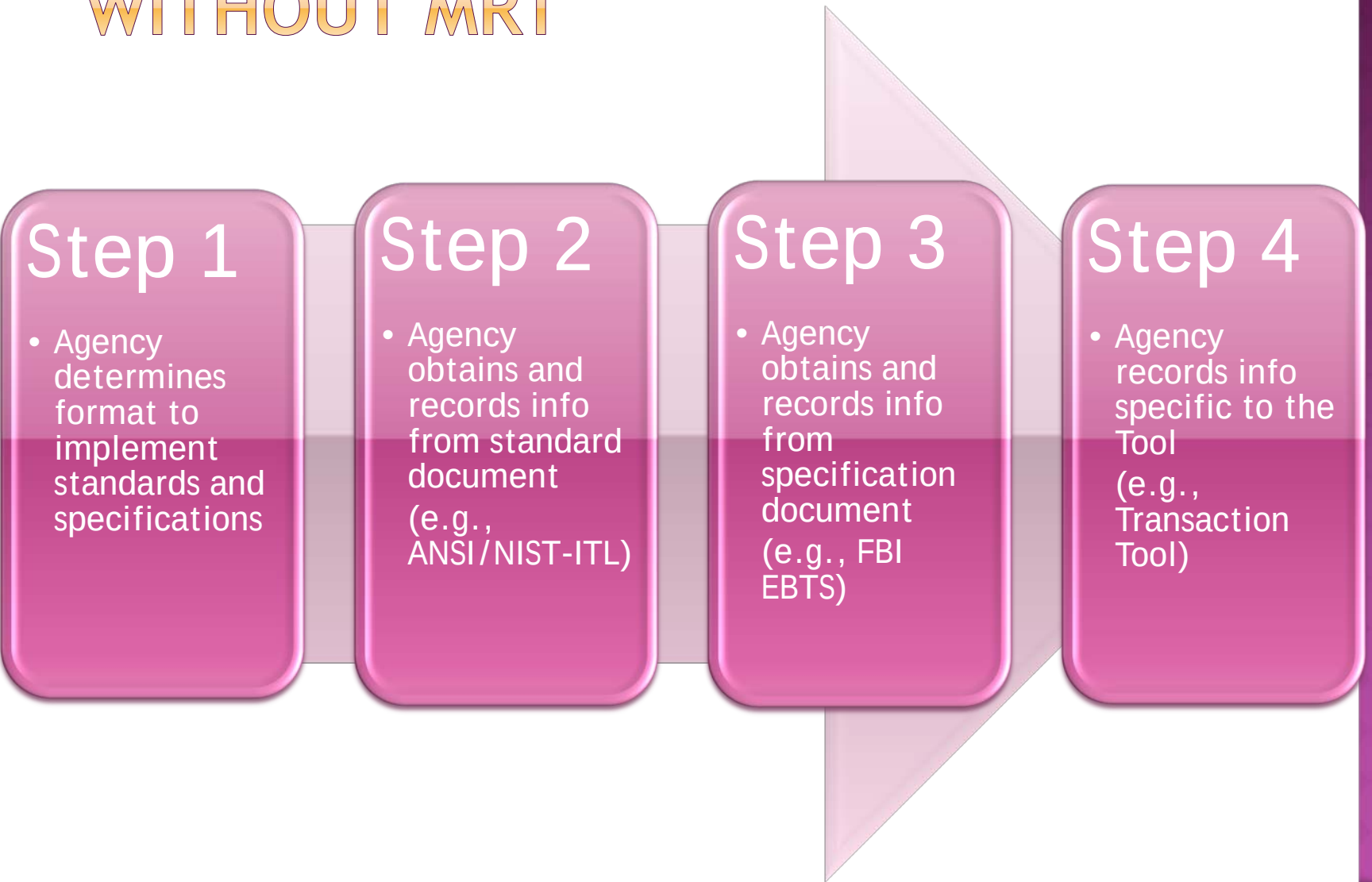
MRT IN ACTION - IMPLEMENTING STANDARDS AND SPECIFICATIONS WITHOUT MRT



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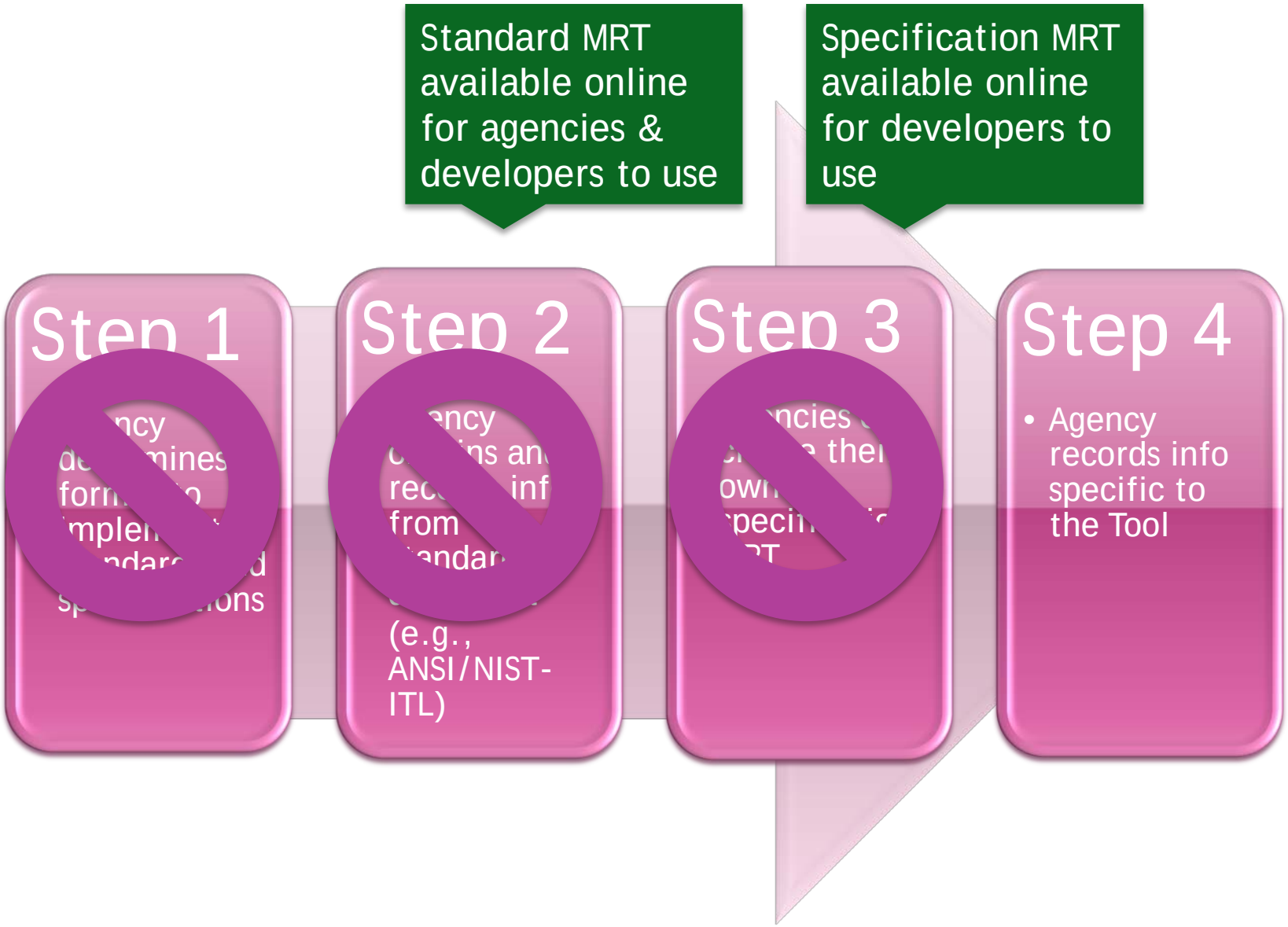
MRT IN ACTION - IMPLEMENTING STANDARDS AND SPECIFICATIONS WITH MRT



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MRT ADVANTAGES

- Quicker Implementations of Standards and Specifications

- Easier to View Standards and Specifications
  - Version Comparison

- Easier to Validate Information

- Increased Interoperability
  - Same format

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CURRENT PROGRESS TO DATE

Completed To Date	Future

• Created MRT for:
  ▪ A/N 2011
  ▪ A/N 2013
  ▪ EBTS v9.3
  ▪ EBTS v10.0.2 (including Iris Pilot)
• MRT Verifier
	• Developing MRT application programming interface (API)
	• Host A/N MRT on NIST website
	• Host EBTS MRT on CJIS website
	• Develop MRT for AN 2015 and future specifications/standards

RACHEL WALLNER

CONTACT US!

Want to know more?

Have any suggestions?

Want to keep up to date
with the MRT development?

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Brad Wing, NIST Bradford.Wing@nist.gov
Jennifer Stathakis, FBI Jennifer.Stathakis@ic.fbi.gov

RACHEL WALLNER

Thank you!

RACHEL WALLNER

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Testing of ANSI/NIST-ITL Annex G and Implementation Domain XML Schemas

Rachel Wallner

ANSI/NIST-ITL 2015 Kickoff
October 31, 2014

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For the best of reasons

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Agenda

I. Current State of XML in ANSI/NIST-ITL

II. Past and Current Issues

III. Possible Solutions

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PAST AND CURRENT ISSUES

- Discrepancies between XML schemas and Annex G

```
<xsd:element name="UpperLipCharacterizationCodeList" type="biom:LipCharacterizationCodeListType">
    <xsd:annotation>
        <xsd:documentation> An upper lip print characterization code list</xsd:documentation>
    </xsd:annotation>
</xsd:element>
    </xsd:annotation>
    <xsd:complexContent>
        <xsd:extension base="s:ComplexObjectType">
            <xsd:sequence>
                <xsd:element ref="biom:LipCharacterizationCode" minOccurs="0" maxOccurs="5"/>
            </xsd:sequence>
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
```

10.049[48]	CID	biom:CheiloscopicImageInformation	0..1
"	LPW	biom:LipPrintWidth	0..1
"	LPH	biom:LipPrintHeight	0..1
"	PHW	biom:PhiltrumWidth	0..1
"	PHH	biom:PhiltrumHeight	0..1
"	ULCL	biom:UpperLipCharacterizationCodeList	0..5
"	LLCL	biom:LowerLipCharacterizationCodeList	0..5
"	LCLD	biom:LipContactLineDescriptorCode	0..1

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PAST AND CURRENT ISSUES (CONT.)

```
<!--Changed new element to more properly represent the Audio Radio Transmission Format -->
<xsd:complexType name="SourceAcquisitionType">
    <xsd:annotation>
        <xsd:documentation>A data type for an acquisition method for the source representation</xsd:documentation>
    </xsd:annotation>
    <xsd:complexContent>
        <xsd:extension base="s:ComplexObjectType">
            <xsd:sequence>
                <xsd:element ref="biom:AcquisitionSourceCode"/>
                <xsd:element ref="biom:AcquisitionDigitalConversionDescriptionText" minOccurs="0"/>
                <xsd:element ref="biom:AcquisitionRadioTransmissionFormatDescriptionText" minOccurs="0"/>
                <xsd:element ref="biom:AcquisitionSpecialCharacteristicsText" minOccurs="0"/>
            </xsd:sequence>
        </xsd:extension>
    </xsd:complexContent>
</xsd:complexType>
<!-- Added new element to use for Radio Transmission Format-->
```

≠

Field ID	Mnemonic	XML element name	Cardinality
20.014	AQS	biom:SourceAcquisition	1..9
"	AQT	biom:AcquisitionSourceCode	1..1
"	A2D	biom:AcquisitionDigitalConversionDescriptionText	0..1
"	FDN	biom:AcquisitionFormatDescriptionText	0..1
"	AQSC	biom:AcquisitionSpecialCharacteristicsText	0..1

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POSSIBLE SOLUTIONS

- Testing
  - Entire Annex G and XML schemas need to be examined closely
  - Need several eyes on Annex G and XML schemas
  - Determine if…
    - XML elements and cardinality match in Annex G and schemas
    - All XML child elements are included within a parent
    - Consistency across XML elements for same field type
    - Indentation in Annex G is clear
- Automatically update Annex G (remove manual updates)

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Any Comments?

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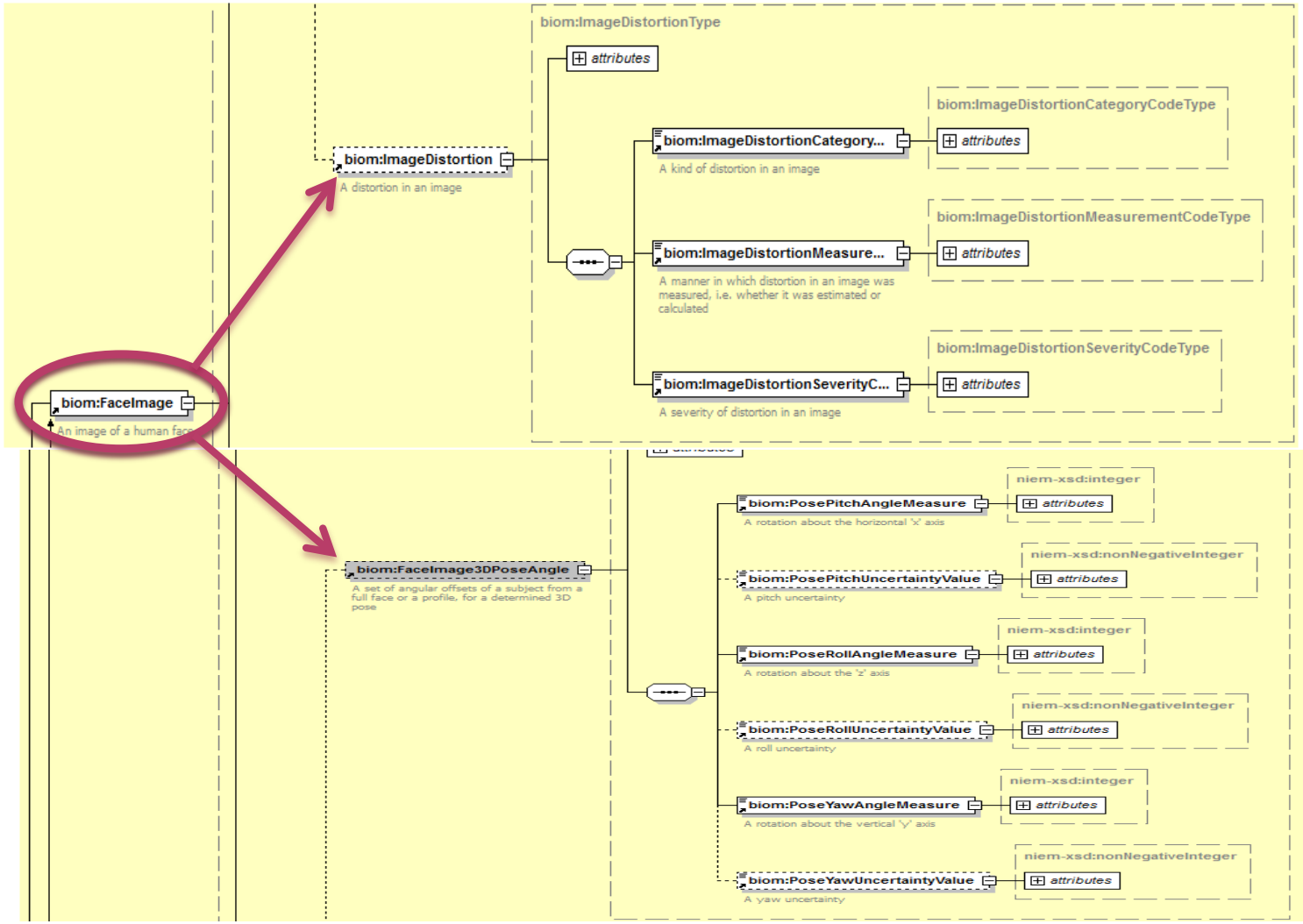
ANNEX G - CURRENT APPROACH

Field ID	Mnemonic	XML element name	Cardinality
-	-	biom:FaceImage[32]	0..1[33]
-	-	biom:PhysicalFeatureImage[34]	0..1
10.999	DATA	nc:BinaryBase64Object	1..1
-	-	biom:ImageCaptureDetail	1..1
10.998	GEO	biom:CaptureLocation	0..1
"	GRT	nc:LocationDescriptionText	0..*
"	-	nc:LocationGeographicElevation	0..1
"	ELE	nc:MeasurePointValue	1..1
"	-	biom:LocationTwoDimensionalGeographicCoordinate	0..1
"	-	nc:GeographicCoordinateLatitude	1..1
"	LTD	nc:LatitudeDegreeValue	1..1

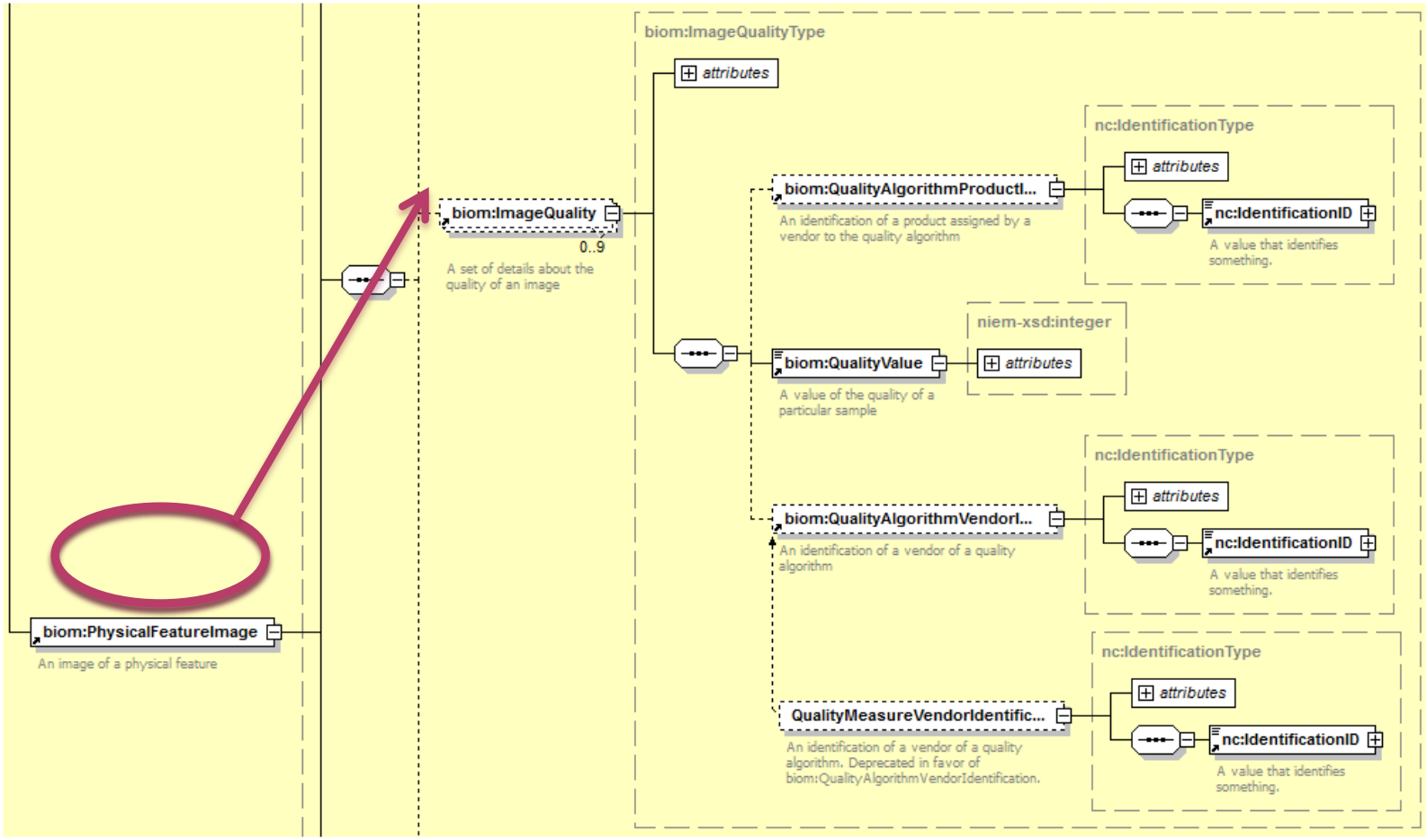
MANOJ BISHT

ANNEX G - PROPOSED APPROACH



MANOJ BISHT

ANNEX G - PROPOSED APPROACH



MANOJ BISHT

CONFORMANCE TESTING UPDATE

- Annex G difficult to keep in sync with the schema and the layout is subject to misinterpretation
- Laying out the strict conformance testing logic highlights some possible different interpretations of the standard's text
- Range value restrictions found to be different for similar elements – points out the need to treat them as separate concepts and and elements rather than keeping them the same elements with different ranges allowed.

DYLAN YAGA

BioCTS

BIOMETRIC CONFORMANCE TEST SOFTWARE

- Dylan Yaga
- Fernando Podio
- Computer Security Division
- Information Technology Laboratory
- National Institute of Standards and Technology

NIST

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NIST/ITL COMPUTER SECURITY DIVISION (CSD) BIOCTS TEAM EFFORTS

- NIST/ITL CSD supports the development of biometric conformance testing methodology standards and other conformity assessment efforts through active technical participation in the development of these standards and the development of associated conformance test architectures and test suites.
- These test tools are developed to promote adoption of these standards and to support users that require conformance to selected biometric standards, product developers and testing labs.

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NIST/ITL CSD BIOCTS TEAM CONTRIBUTIONS TO THE ANSI/NIST-ITL STANDARDS

- NIST/ITL CSD's BioCTS team developed and provided the initial set of requirements, test assertions, and supporting test assertion syntax for ANSI/NIST-ITL 1-2011 to the *NIST/ITL Conformance Testing Methodology Working Group*, chaired by Elham Tabassi from NIST/ITL Information Access Division (IAD)
- NIST/ITL CSD's BioCTS team acted as the editors for the resulting document, *NIST Special Publication 500-295, Conformance Testing Methodology for ANSI/NIST-ITL 1-2011, Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information* (NIST SP 500-295)
- The test assertions that became a part of NIST SP 500-295 were the documentation of tests that had been developed by the BioCTS team and implemented within the software titled: BioCTS for ANSI/NIST-ITL 1-2011
  - Over 100 pages, and 1,200+ test assertions were developed

Special Publication 500-295

Conformance Testing Methodology for ANSI/NIST-ITL 1-2011, Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information (Release 1.0)

NIST/ITL Conformance Testing Methodology Working Group

Fernando L. Podio
Dylan Yaga
Christofer J. McGinnis
Editors

http://dx.doi.org/10.6028/NIST.SP.500-295

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

NIST

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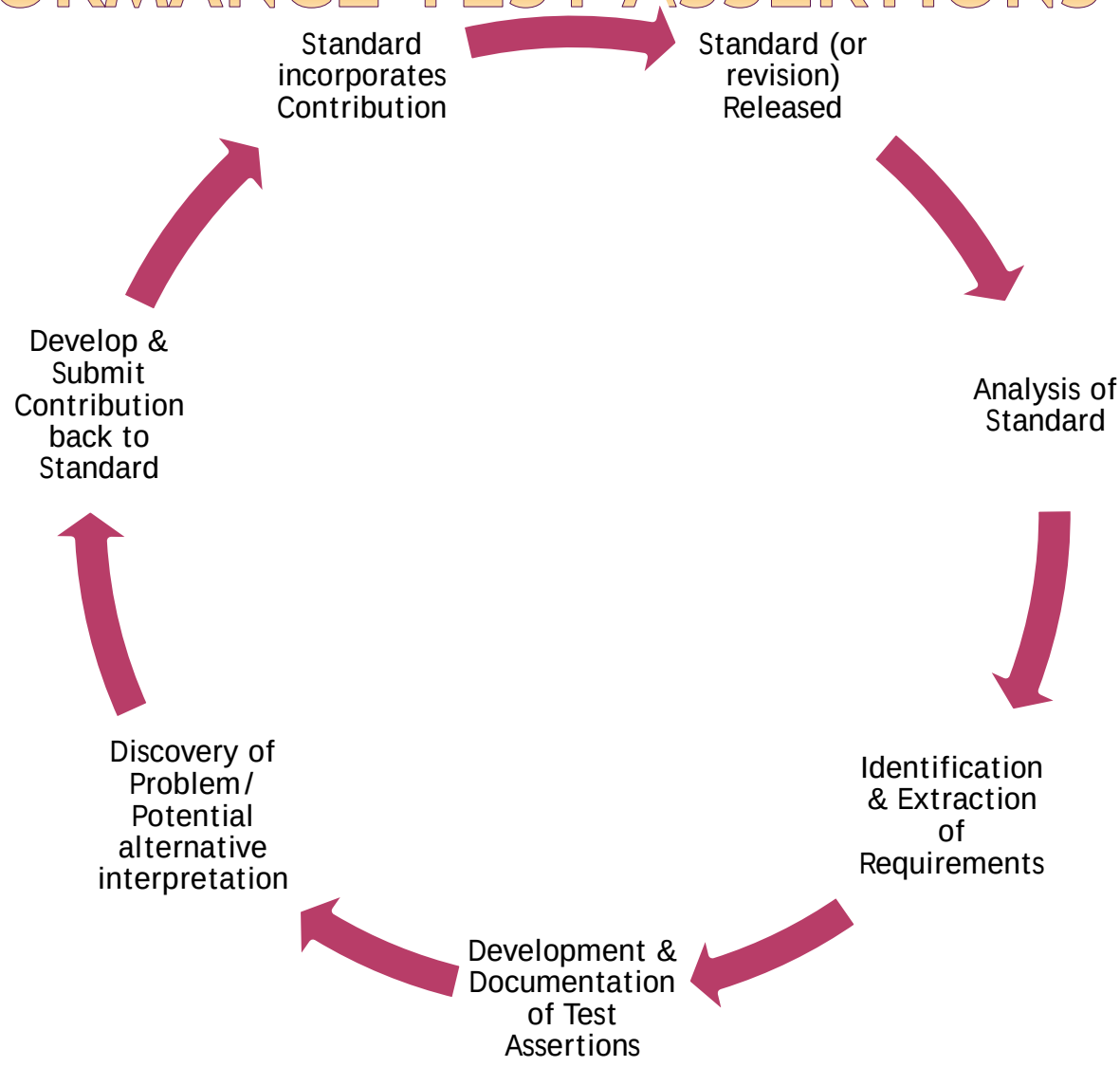
BENEFITS OF DEVELOPING CONFORMANCE TEST ASSERTIONS

- Documented and organized Requirements, extracted from all around the standard
- Development of Test Assertions that can serve as a basis for software development
- NIST/ITL CSD's BioCTS for ANSI/NIST Software
- Provides an additional critical evaluation of the base standard
- Must consider the entire range of values allowed by the standard
- Implementing the assertions often leads to asking questions, and intensive research to answer them
- May uncover multiple interpretations of requirements – and as part of feedback, can help to clarify them
- Helps to provide technical contributions back to the standard

D Y L A N Y A G A

BENEFITS OF DEVELOPING CONFORMANCE TEST ASSERTIONS



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NIST/ITL CSD'S BIOCTS FOR ANSI/NIST-ITL 1-2011

- Initial version (Beta 1.0) was released in August 2012
- Several iterations have been released over the years, adding additional features, and modifications to the Conformance Test Architecture (CTA), as well as additional tests implemented within the Conformance Test Suite (CTS)
- BioCTS for ANSI/NIST-ITL 1-2011 supports CTSs for both Traditional Encoding, as well as NIEM-XML Encoding
- Tests multiple files in a Batch Test mode, as well as provides an editor for Traditionally Encoded Transactions

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NIST/ITL CSD'S BIOCTS FOR ANSI/NIST-ITL 1-2011, CONTINUED

- The CTSs for ANSI/NIST-ITL 1-2011 provides conformance testing support* for several Record Types and tests:
  - Transaction-wide Tests
  - Type 1, Transaction Information Record
  - Type 4, High-resolution grayscale fingerprint image
  - Type 10, Facial and SMT image
  - Type 13, Variable-resolution latent image
  - Type 14, Variable-resolution fingerprint image
  - Type 15, Palm print image
  - Type 17, Iris image

- **BioCTS accepts Transactions containing any Record Type, however, only basic conformance tests are performed on Records not listed above*

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NIST/ITL CSD'S BIOCTS FOR ANSI/NIST-ITL 1-2011 AND ANSI/NIST-ITL 1-2011 UPDATE: 2013

- Beta version 1.2.5353.15785 Released September 10, 2014 is the latest version of BioCTS that supports the ANSI/NIST line of standards
- Includes updated versions of the ANSI/NIST-ITL 1-2011 CTSs
- Includes new CTSs for ANSI/NIST-ITL 1-2011 Update: 2013, which is still under development. The initial release provides conformance testing support* for several Record Types and tests (both Traditional and NIEM-XML Encodings):
  - Transaction-wide Tests
  - Record Type 1, Transaction Information Record
  - Record Type 4, High-resolution grayscale fingerprint image
  - Record Type 10, Photographic body part imagery (including face and SMT)
- Support for additional Record Types is under development

- **BioCTS accepts Transactions containing any Record Type, however, only basic conformance tests are performed on Records not listed above*

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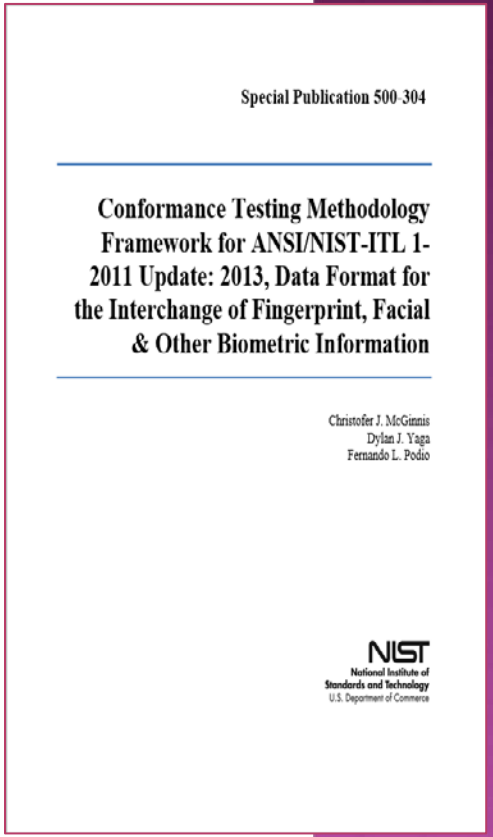
ANSI/NIST-ITL 1-2011 UPDATE: 2013 CONFORMANCE TESTING METHODOLOGY FRAMEWORK

- NIST/ITL CSD's BioCTS team has documented the set of requirements, test assertions and supporting test assertion syntax for ANSI/NIST-ITL 1-2011 Update: 2013, and is awaiting publication as NIST SP 500-304. This document contains all the tests that have been implemented within the BioCTS for ANSI/NIST-ITL 1-2011 Update: 2013 CTSs.
- NIST SP 500-304 covers:
  - Transaction Wide Test Assertions
  - Record Type 1 Test Assertions
- Additional Documents are under development and cover additional Record Type test assertions, each Record Type assertions will be an individual NIST IRs



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BIOCTS CONFORMANCE TEST SUITES: TRADITIONAL ENCODING TRANSACTION

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BIOCTS TRADITIONAL ENCODING TRANSACTION CTSS DETAILS

- The CTSs for Traditional Encoding have several phases of operation:
  - Parse – The first phase is to attempt to parse the Transaction. If the Transaction fails to parse, an error will be reported and testing does not proceed to the next phase.
  - Level 1 – The second phase is to perform Level 1 testing, which includes Value constraints, length constraints, character constraints and correct field contents (Fields, subfields and information items).
  - Level 2 – The third phase is to perform Level 2 testing, first within each Record Type individually, then at a cross Record Type level. Finally, Transaction wide tests are performed.
  - Test Log Generation – The last phase is to generate Test Logs. Both Text based, and XML based Test Log Output can be generated.

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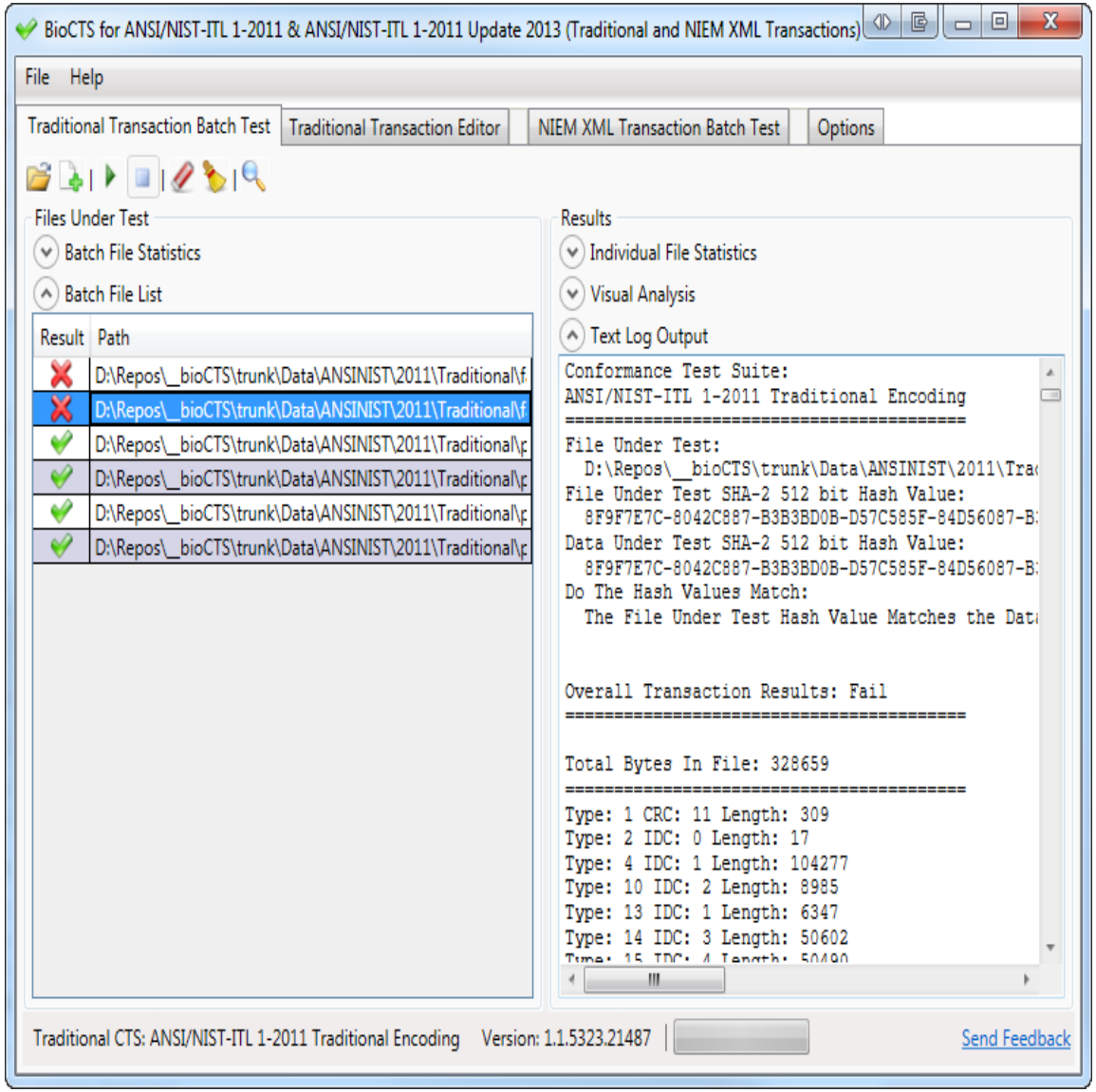
BIOCTS TRADITIONAL TRANSACTION BATCH TEST IN ACTION



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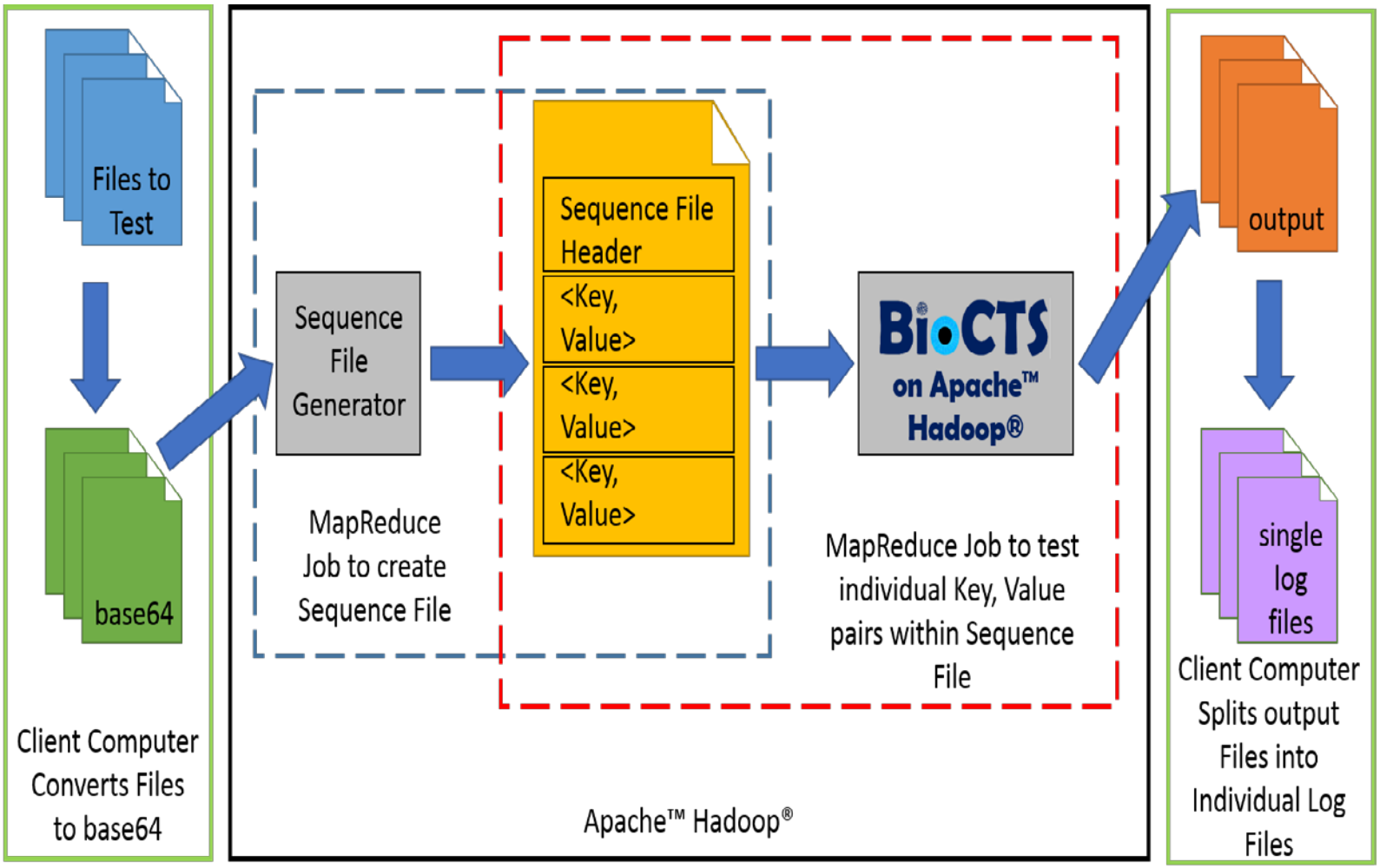
BIOCTS ON APACHE™ HADOOP® 2/3



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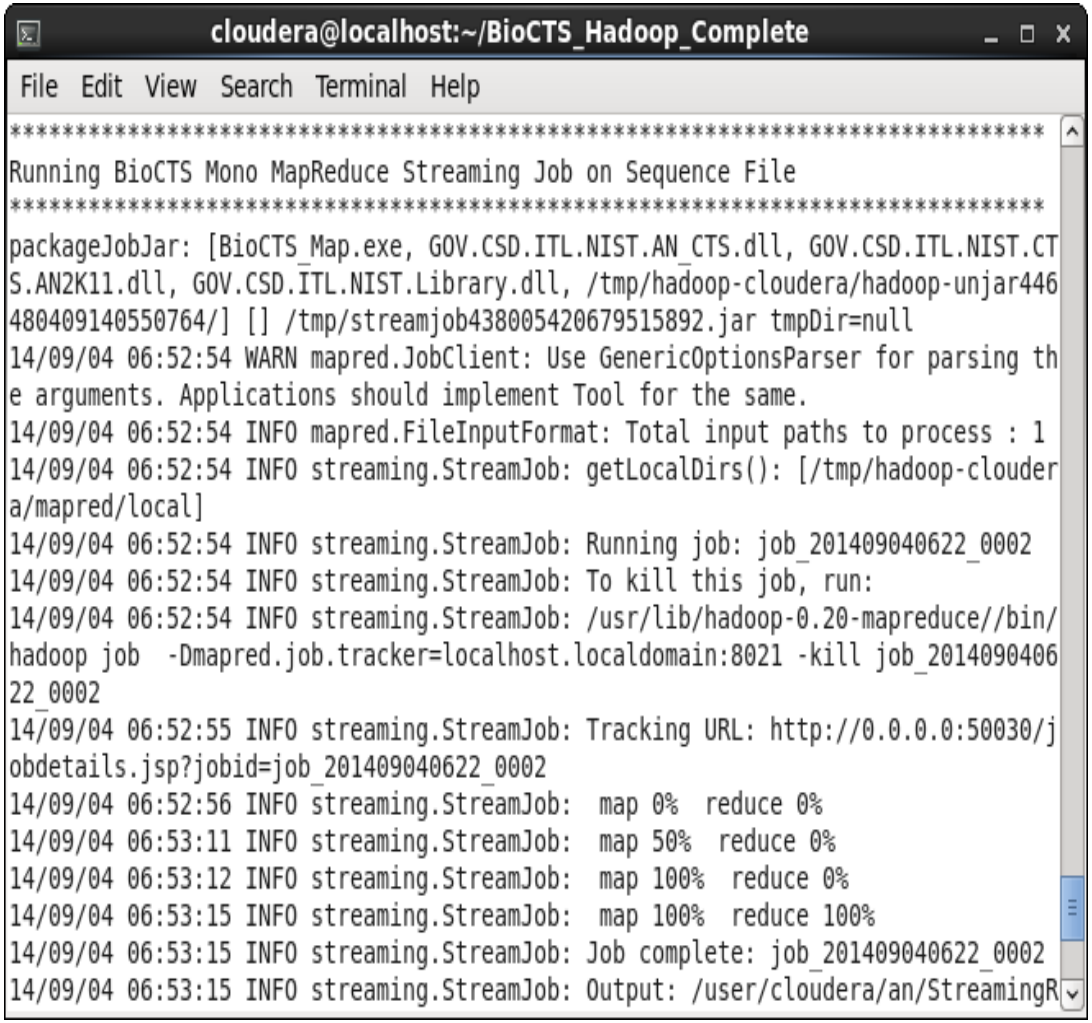
BIOCTS ON APACHE™ HADOOP® 3/3



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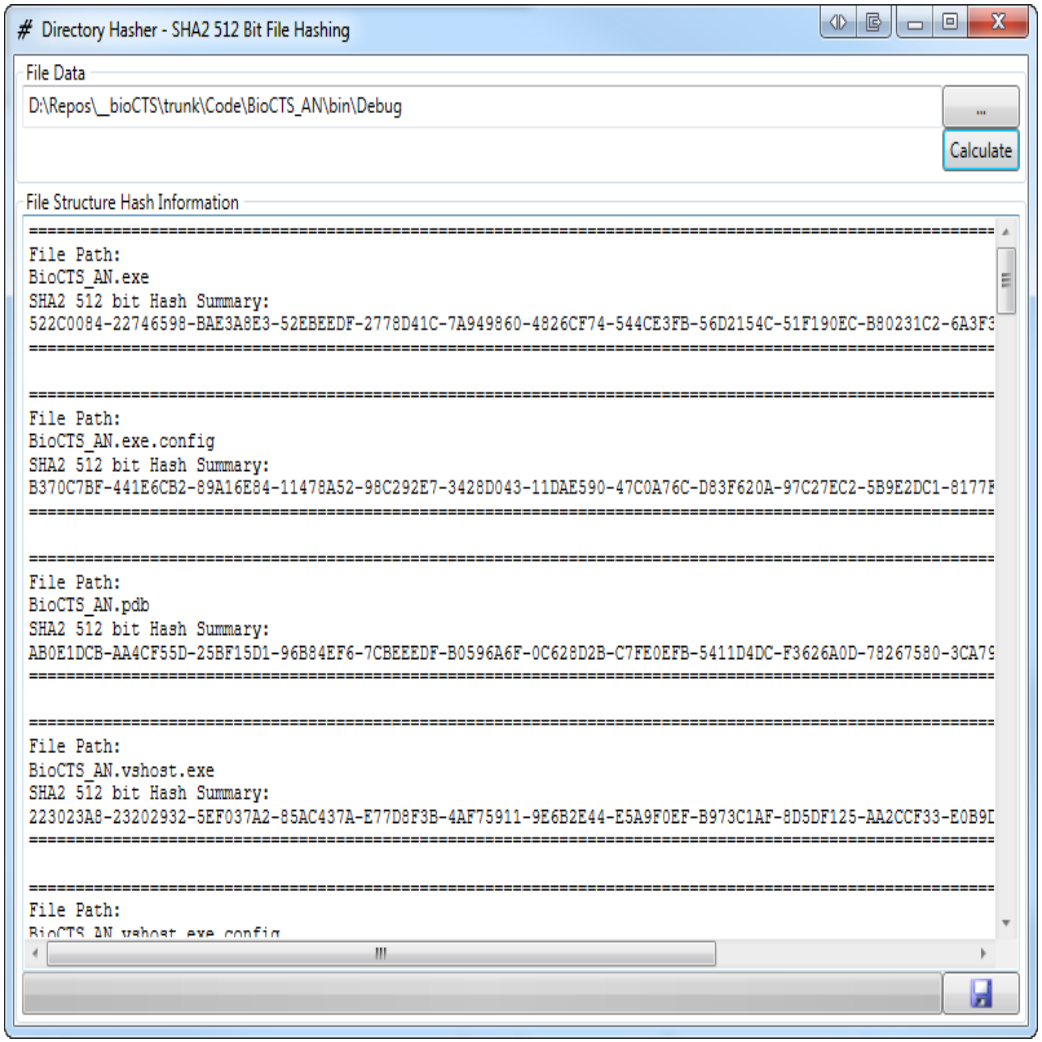
MANY OTHER TOOLS… RECURSIVE DIRECTORY HASHER

- Verify local BioCTS installs against posted Hash Summary values on the BioCTS Website



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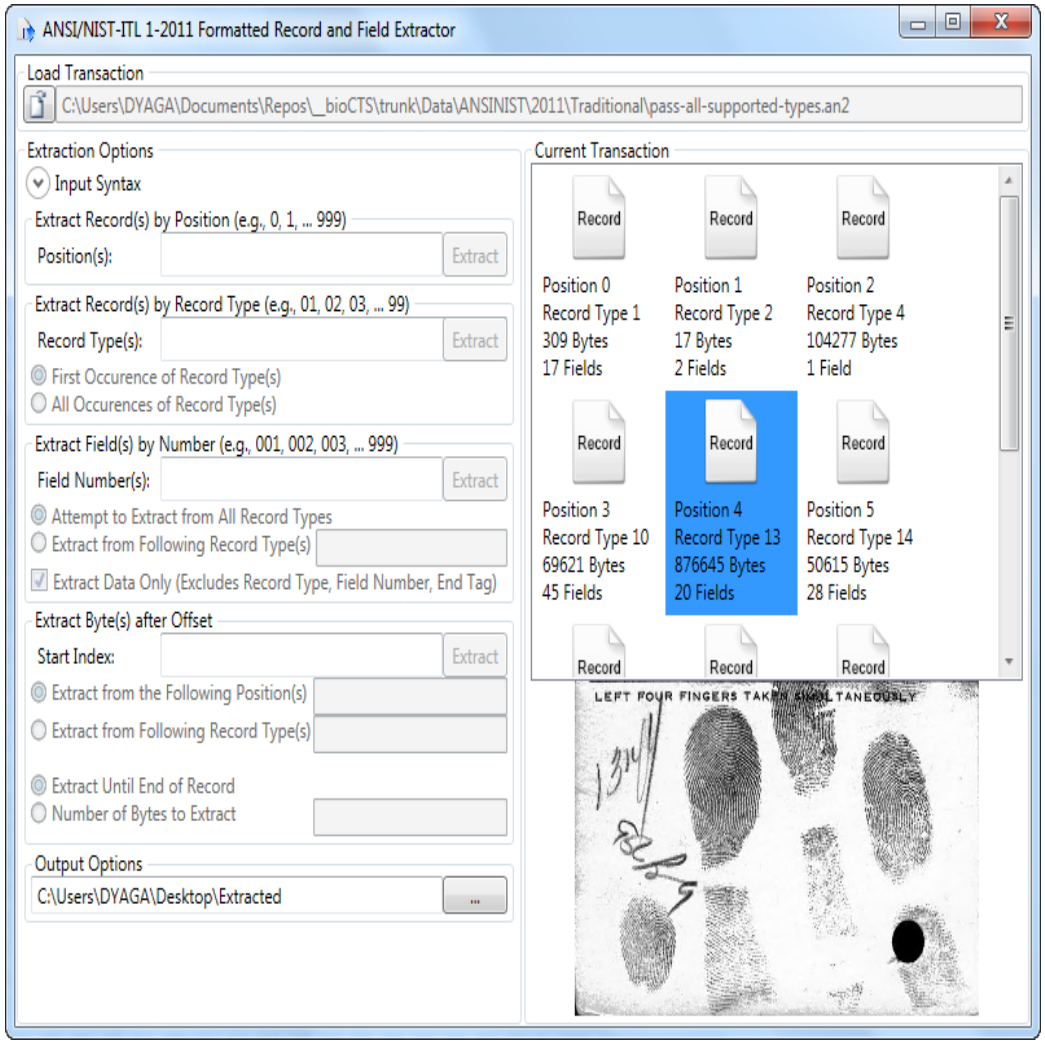
MANY OTHER TOOLS… ANSI/NIST-ITL 1-2011 FORMATTED RECORD AND FIELD EXTRACTOR

- Easily extract any data from an ANSI/NIST-ITL 1-2011 Formatted File
- E.g.,
  - All Fields xx.999 – Biometric Sample data such as Fingerprint, face, iris images
  - All Record Types 04, and 14



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AN-2015 AND BEYOND

- NIST/ITL CSD expects to…
  - Continue its efforts to develop test assertions for an updated ANSI/NIST-ITL standard
  - Continue to submit technical comments on the ANSI/NIST-ITL standard
  - Continue to develop BioCTS Conformance Test Suites to support the additions and changes made to the ANSI/NIST-ITL standard

DATE FORMATS: EXAMPLE THAT VALID RANGE IS NOT SPECIFIED

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7.7.2.3 Local date

The local date is recorded as YYYYMMDD. It may be a different date than the GMT, due to time zone differences. It is handled differently for each encoding.

Field Number	Mnemonic	Content Description	Cond Code	Character			Value Constraints	Occurrence	
				Type	Min #	Max #		Min #	Max #
1.005	DAT	DATE	M	See Section 7.7.2.3 Local date encoding specific: see Annex B: Traditional encoding or Annex C: NIEM-conformant			See Section 7.7.2.3 Local date encoding specific: see Annex B: Traditional encoding or Annex C: NIEM-conformant	1	1

8.1.5 Field 1.005: Date / DAT

This mandatory field shall contain the local date that the transaction was submitted. See Section 7.7.2.3.

DATE FORMATS: EXAMPLE THAT VALID RANGE IS SPECIFIED TO ALLOW ZEROS TO INDICATE EXACT DATE IS UNKNOWN

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7.7.2.3 Local date

The local date is recorded as YYYYMMDD. It may be a different date than the GMT, due to time zone differences. It is handled differently for each encoding.

Field Number	Mnemonic	Content Description	Cond Code	Character			Value Constraints	Occurrence	
				Type	Min #	Max #		Min #	Max #
	DPBD	subject - person birth date	O	see Section 7.7.2.3			see Section 7.7.2.3	0	1

- The fourth information item, **subject – person birth date / DPBD**, is an optional information item. See **Section** 7.7.2.3 for the format. If records are available, enter the birth date as known. In forensic examination, enter an approximate date.
- The fifth information item, **subject – range of birth date estimate / DRBD** is entered in the format $\mathbf{Y^{yy}M^{mm}D^{dd}}$. The bold letters are entered with Y indicating years, M indicating months, D indicating days. Not all levels of time need be entered – only the relevant one(s). Leading zeros need not be entered. The range is centered upon **DPBD**. Thus, for a value of **DPBD** being 19910000 (zeros being used to indicate indicate lack of knowledge of month or day), a range might be Y3, indicating plus or minus 3 years from 1991.

COMPRESSION GUIDANCE SHOULD BE CLEARER BY RECORD TYPE

Table 15 Compression codes

Code	Label	Algorithm Name	Fidelity	Standard Used
0	NONE	Uncompressed	Lossless	NA
1	WSQ20	WSQ[56] (Wavelet Scalar Quantization)	Lossy	Version 3.1:2010
2	JPEGB	JPEG (Joint Photographic Experts Group)	Lossy	*ISO/IEC 10918, JFIF 1.02:1992*
3	JPEGL	JPEG	Lossless	*ISO/IEC 10918, JFIF 1.02:1992*
4	JP2	JPEG 2000	Lossy	*ISO 15444-1:2004*
5	JP2L	JPEG 2000	Lossless	*ISO 15444-1:2004*
6	PNG	PNG (Portable Network Graphics)	Lossless	*ISO/IEC 15948:2004*

Type-4 records use the *code*[57] in **Table 15 Compression codes**. Others record types use the *label*. [<2013a]

500 ppi friction ridge imagery (not including latent imagery): The specification in *WSQ Gray-scale Fingerprint Image Compression Specification Version 3.1* shall apply. The FBI maintains a list[59] of certified WSQ implementations, based upon testing performed at NIST[60].

500 ppi latent imagery: All 500 ppi latent imagery, [2013a>] if compressed, [<2013a] shall be compressed using PNG or other some other lossless compression algorithm as defined in this section. [2013a>] Uncompressed imagery is acceptable for 500 ppi latent prints. [<2013a]

Legacy systems: Legacy systems may use JPEGB or JPEGL for compressing 500 ppi class images, but no new system shall be built using JPEGB and JPEGL .

WSQ caveats: Any certified WSQ software is able to decode images with an encoder certified for WSQ specification versions 2.0, 3.0 or 3.1. **Field 4.008: Compression algorithm / CGA** only allows the *Code* values of 0 and 1 (See **Table 15 Compression codes**) for new systems, since for such systems only uncompressed or WSQ compressed 500 ppi images may be transmitted in **Type-4** records. [<2013a]

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SUGGEST REPLACING WITH A SEPARATE TABLE FOR EACH RECORD TYPE

Type-4 Images

Type-4 images may only be used at the 500ppi transmitting resolution class, and only WSQ20 may be used for compression. JPEGB and JPEGL are allowed as legacy values. Type-4 is subject to tolerance for resolution values.

Type-4 Image Constraints

		Compression Algorithm						
		NONE (0)	WSQ20 (1)	JPEGB (2)	JPEGL (3)	JP2 (4)	JP2L (5)	PNG (6)
Transmitting Resolution	500 ppi	Valid	Valid	Legacy	Legacy	X	X	X
	Unspecified	Valid	Valid	Legacy	Legacy	X	X	X

Type-4 Resolution Constraints

Resolution	Min	Max	Tolerance
Transmitting	500 ppi	500 ppi	2%
Scanning	500 ppi	Unbounded*	2%

*Must be transmitted at 500ppi.

References:

- Only CGA values of NONE and WSQ20 (0 and 1) are valid for 500ppi as stated in 7.7.9.1.
- CGA values JPEGB and JPEGL are legacy for 500 ppi only as stated in 7.7.9.1.
- The same CGA constraints apply to unspecified resolutions because section 7.7.6 states that Record Type-4 shall not be used for anything but the 500 ppi class.
- Exemplar friction ridge images have a minimum scanning resolution of 500 ppi as stated in 7.7.6.2.1
- The transmitting resolution may only be 500 ppi as stated in 7.7.6.3.1.

Interpretations:

- The tolerance for fingerprint types is either 1% or 2% as specified in 7.7.6.1. This is dependent upon the FAP value, which is not available in Type-4 records. Therefore, 2% tolerance is assumed because it is the least restrictive.

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Type-13 Images

Type-13 compression algorithm constraints depend upon the transmitting resolution. The minimum scanning resolution is 1000ppi and the minimum transmitting resolution is 500ppi.

Type-13 Image Constraints

		Compression Algorithm						
		NONE	WSQ20	JPEGB	JPEGL	JP2	JP2L	PNG
Transmitting Resolution	500 ppi	Valid	X	X	Legacy	X	Valid	Valid
	1000 ppi	Valid	X	X	X	X	Valid	X
	>= 2000 ppi	Valid	X	X	X	X	Valid	X
	Unspecified	Valid	X	X	Legacy*	X	Valid	Valid*
*Note that these cases apply only for 500 ppi resolution.								

Type-13 Resolution Constraints

Resolution	Min	Max	Tolerance
Transmitting†	500 ppi	Scanning Resolution	None
Scanning	1000 ppi	Unbounded	None
†Increments by 100%			

References:

- CGA of WSQ20, JPEGB, and JP2 are invalid for all resolutions, because they are excluded from Table 90 "Value Constraints" for 13.011-CGA.
- Only CGA values NONE, JP2L, and PNG are valid for 500 ppi as stated in 7.7.9.1.
- CGA value JPEGL is legacy for 500 ppi only as stated in 7.7.9.1.
- Only CGA of JP2L is valid for 1000 ppi (if compressed) as stated in 7.7.9.1.
- Latent images shall have a minimum scanning resolution of 1000 ppi as stated in 7.7.6.2.2.
- The transmitting resolution has a minimum of 500 ppi and must not be greater than the scanning resolution (see 7.7.6.3.2).
- According to section 7.7.6.2.3, the transmitting resolution value for all friction ridge types (Types 4, 13, 14, 15, 19, and sometimes 16 and 20) must be a member of the resolution migration path that starts at 500ppi and increments by 100%: (i.e.: 500ppi, 1000ppi, 2000ppi, 4000ppi…). The scanning resolution does not necessarily follow the resolution migration path, but it must be scaled down or interpolated to achieve the proper value for transmission.

Interpretations:

- CGA value NONE is valid for all resolutions.
- Since no statement is made regarding resolutions greater than 1000 ppi, it is assumed that the recommendations for 1000 ppi should apply for higher resolutions.
- Since no statement is made regarding unspecified resolutions (when THPS/TVPS are aspect ratio for example), it is assumed that the values indicated in Table 90 are valid. JPEGL is treated as legacy. PNG is treated as a 500 ppi class image.
- It is assumed that tolerance does not apply to Type-13. Section 7.7.6.1 indicates that fingerprint types are subject to a 1% or 2% tolerance, but Type-13 is not necessarily a fingerprint.

DYLAN YAGA

QUESTIONS? CONTACT

- BioCTS Software
  - All Available BioCTS Software Downloads are available from:
  - http://www.nist.gov/itl/csd/biometrics/biocta_download.cfm
- BioCTS Team Email – Send feedback, comments and questions to:
  - biocts@nist.gov

- Dylan Yaga
  - dylan.yaga@nist.gov
- Fernando Podio
  - fernando.podio@nist.gov

DYLAN YAGA

NIST

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REMOVING GLASSES FOR PHOTOS

- Improve automated eye-localization & recognition accuracy
- Decrease photo rejections due to occlusions
  - Glare
  - Tint
  - Rims

- Revise standards
- Public outreach
  - Educate
    - Photographers
    - Acceptance agents
    - Customers

Pro

Con

JOHN MAYER-SPLAIN

ADDING A NEW FAP 55 CODE FOR 3.2" X 2.0" IN MOBILE PLATFORMS

Capture[1]	SAP Levels								
	5	10	20	30	40	45	50	60	55
Acquire flat images	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquire rolled images	No	No	No	No	Optional	Optional	Optional	Optional	optional
Minimum resolution	500 ppi ± 10 ppi	500 ppi ± 10 ppi	500 ppi ± 10 ppi	500 ppi ± 10 ppi	500 ppi ±10 ppi [2]	500 ppi ± 5 ppi	500 ppi ± 5 ppi	500 ppi ± 5 ppi	500 ppi ± 5 ppi
Minimum Gray levels	256	256	256	256	256	256	256	256	256
Minimum Image Dimensions (wxh)	.5" x .65"	.5" x .65"	.6 "x .8"	.8 "x 1.0"	1.6 "x 1.5"	1.6 "x 1.5"	2.5" x 1.5"	3.2" x 3"	3.2" x 2"
Minimum image area	.325 sq in	.325 sq in	.48 sq in	.8 sq in	2.4 sq in	2.4 sq in	3.75 sq in	9.6 sq in	6.4 sq. in.
Compression algorithm[3]	N/A	WSQ	WSQ	WSQ	WSQ	WSQ	WSQ	WSQ	WSQ
Maximum compression ratio	N/A	10:1	10:1	10:1	15:1	15:1	15:1	15:1	15:1
Simultaneous number of fingers	1	1	1	1	1 to 2	1 to 2	1 to 3	1 to 4	1 to 4
Sensor certification	PIV	PIV	PIV	PIV	PIV	Appendix F	Appendix F	Appendix F	Appendix F
Minutiae extractor certification	PIV	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Interchange									
Image / template	Minutiae	Image	Image	Image	Image	Image	Image	Image	Image
Standard used	INCITS 378-2004	ANSI/ NIST Type-4 or Type-14	ANSI/ NIST Type-4 or Type-14	ANSI/ NIST Type-4 or Type-14	ANSI/ NIST Type-4 or Type-14	ANSI/ NIST Type-4 or Type-14	ANSI/ NIST Type-4 or Type-14	ANSI/ NIST Type-4 or Type-14	ANSI/ NIST Type-4 or Type-14

TOM BUSS

ADDING A NEW FAP 55 CODE FOR 3.2” X 2.0” IN MOBILE PLATFORMS

- FAP45 (two finger) sensors OK for ABIS field enrollment
- FAP45 not accepted by FBI/CJIS/Police for field booking.
- Need for mobile field enrollment is growing in US and international

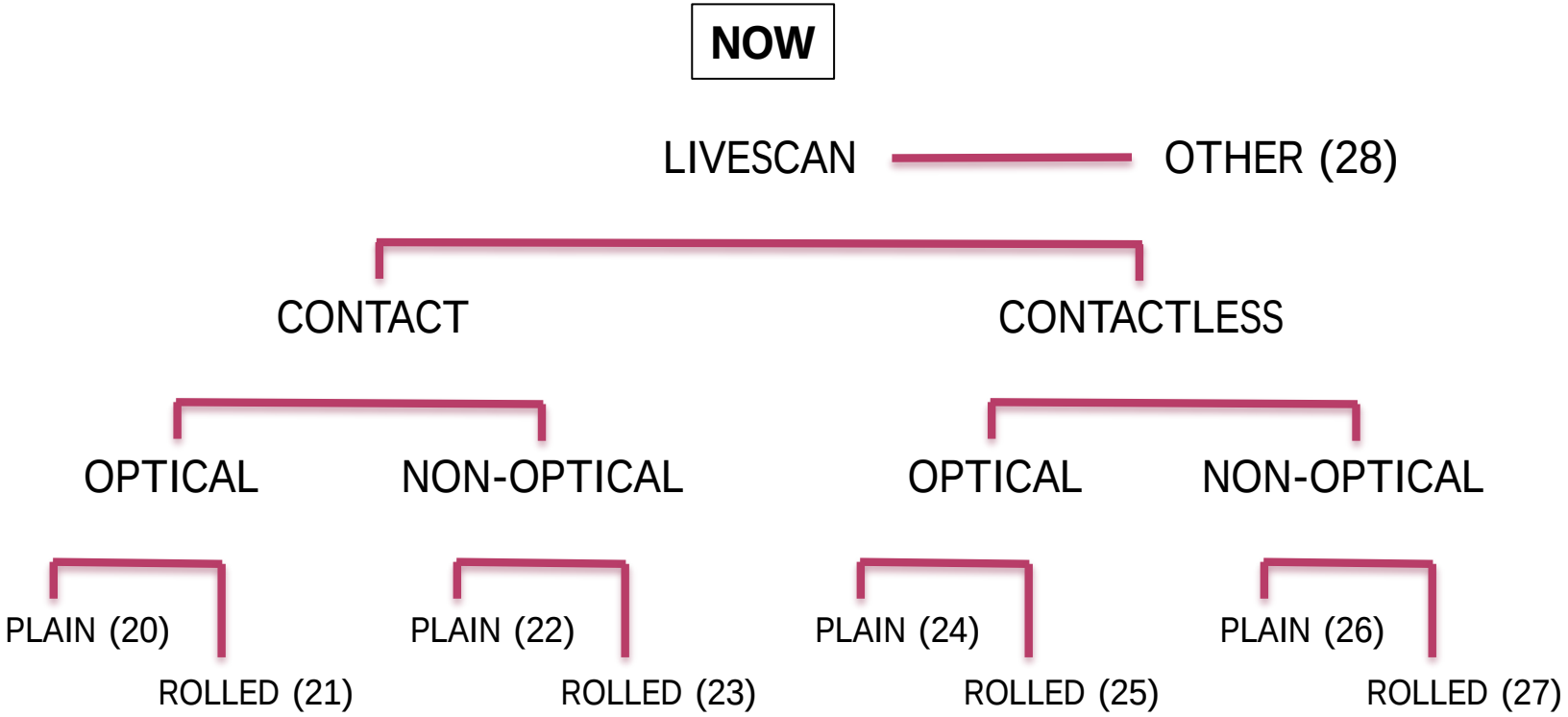
Current situation

- LES (film/TFT based) FAP55 sensor can take shape compatible with cell phone size and thickness goals.
- FAP55 (3.2” x 2”) size meets “type 4” enrollment standard suitable for field booking (10print rolls)

Reasons for adding FAP55

TOM BUSS

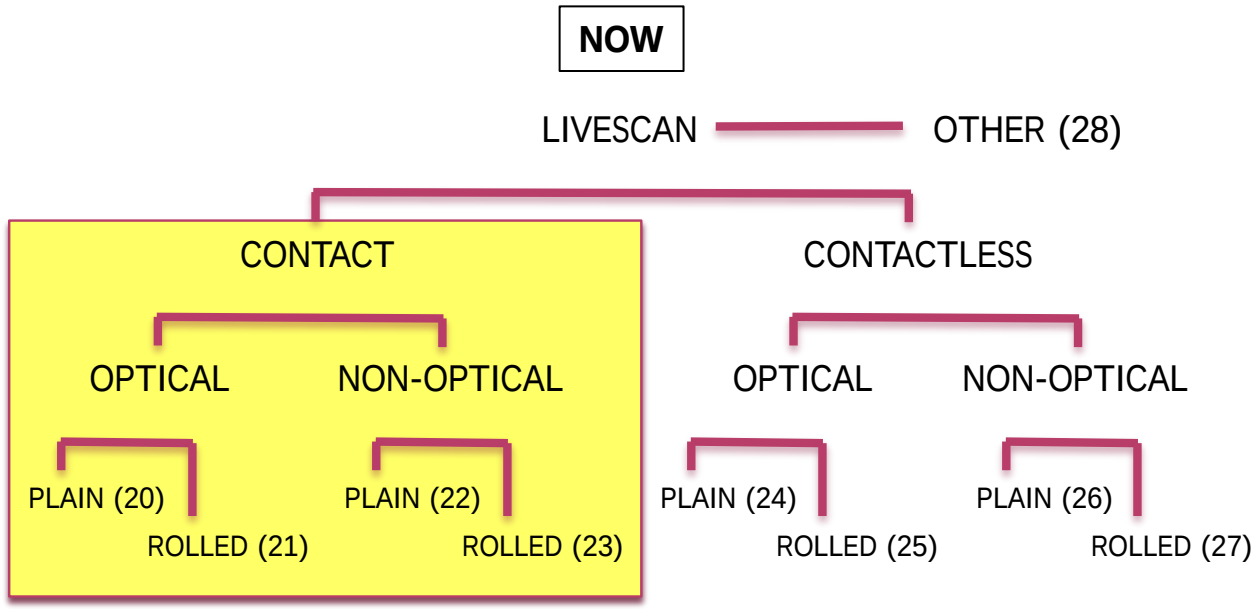
REVISION OF TABLE 7 TO HANDLE: MULTISPECTRAL, CONTACTLESS, AND OTHER TYPES



- Impression Types are "flat" coded [0..39]
- Table 7 *hierarchy* can be revised w/o changes to existing codes

MIKE GARRIS

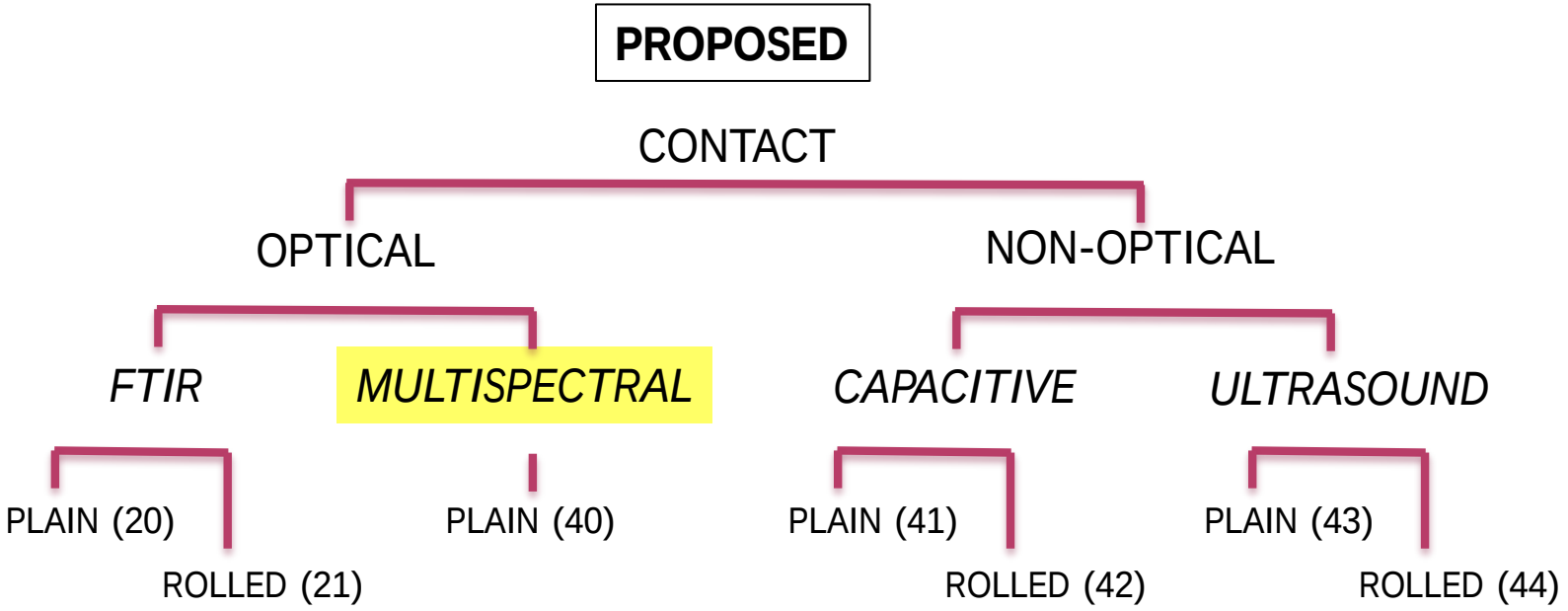
REVISION OF TABLE 7 TO HANDLE: MULTISPECTRAL, CONTACTLESS, AND OTHER TYPES



- Multispectral
  - International Users – requested by Swedish Police
  - Where does it fit?
  - Contact/Optical but different from FTIR (legacy)
  - "OTHER(28)" – not useful

MIKE GARRIS

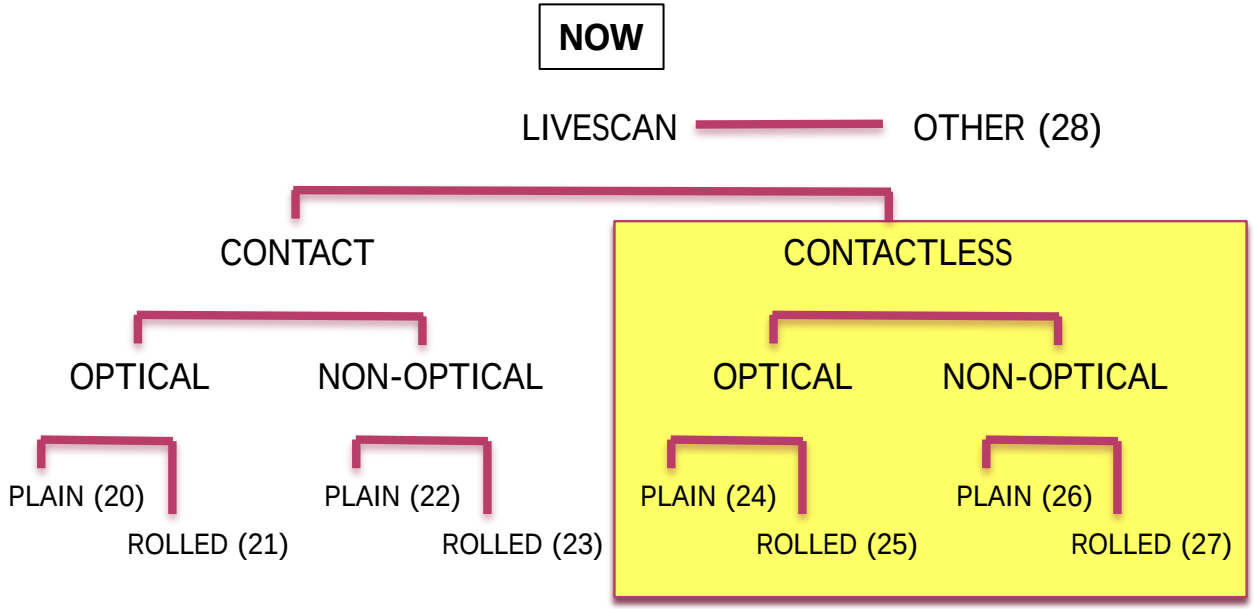
REVISION OF TABLE 7 TO HANDLE: MULTISPECTRAL, CONTACTLESS, AND OTHER TYPES



1. Break down Optical into FTIR (legacy) and Multispectral
   - Existing codes 20 and 21 are unchanged
2. Should Non-Optical also be broken down?
   - Existing codes 22 and 23 deprecated/made legacy?
3. Need to draft guidance on use between Non-Optical and OTHER(28)

MIKE GARRIS

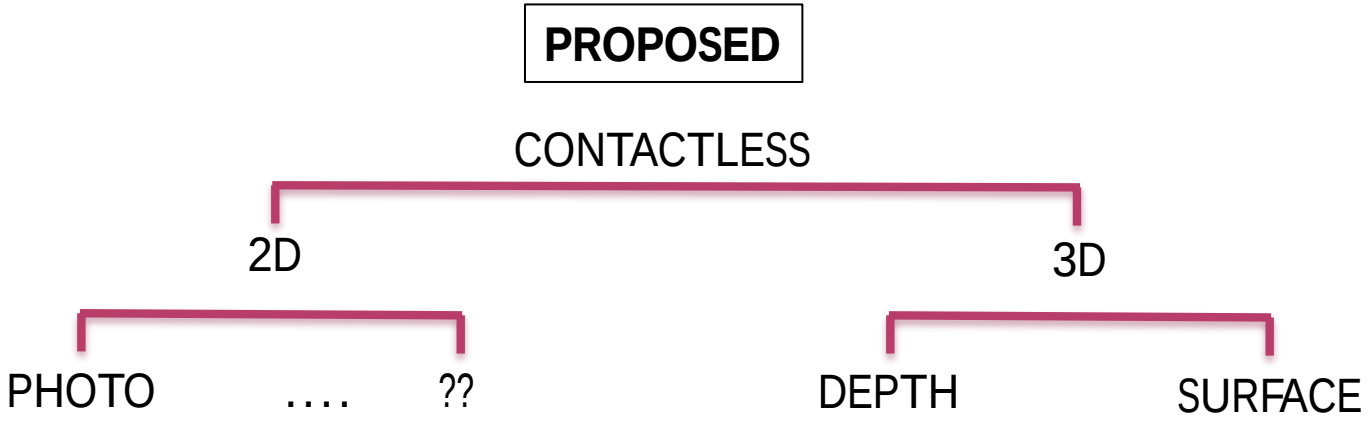
REVISION OF TABLE 7 TO HANDLE: MULTISPECTRAL, CONTACTLESS, AND OTHER TYPES



- Contactless
  - Optical vs. Non-Optical does not apply
  - Plain & Rolled are *Contact*-based terms – do not apply

MIKE GARRIS

REVISION OF TABLE 7 TO HANDLE: MULTISPECTRAL, CONTACTLESS, AND OTHER TYPES



1. Break down Contactless into 2D and 3D
   - 2D has arrived, no 3D (yet!)
2. Is 3D ready to be addressed in this update?
   - Type 14,15,19 – exclude 3D, include 3D-to-2D under OTHER(28)
   - Type 22 for images "not standard 2D photography"
   - Depth = Sensors producing point cloud
   - Surface = Sensors producing triangular mesh

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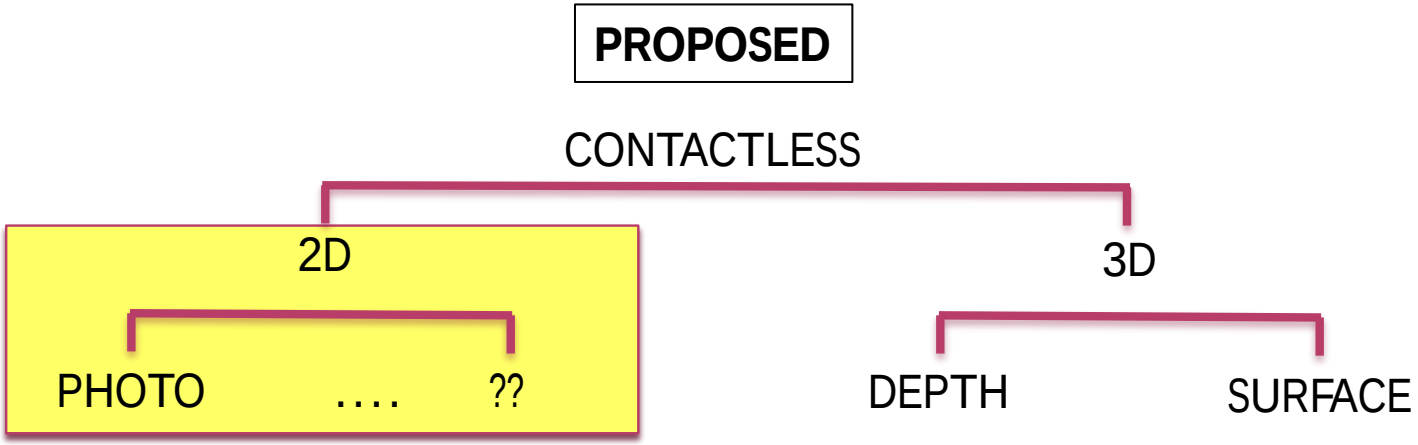
REVISION OF TABLE 7 TO HANDLE: MULTISPECTRAL, CONTACTLESS, AND OTHER TYPES



1. Break down Contactless into 2D and 3D
   - 2D has arrived, no 3D (yet!)
2. Is 3D ready to be addressed in this update?
   - Type 14,15,19 – now exclude 3D,
     now include 3D-to-2D under OTHER(28)
   - Type 22 for images "not standard 2D photography"
   - Depth = Sensors producing point cloud
   - Surface = Sensors producing triangular mesh

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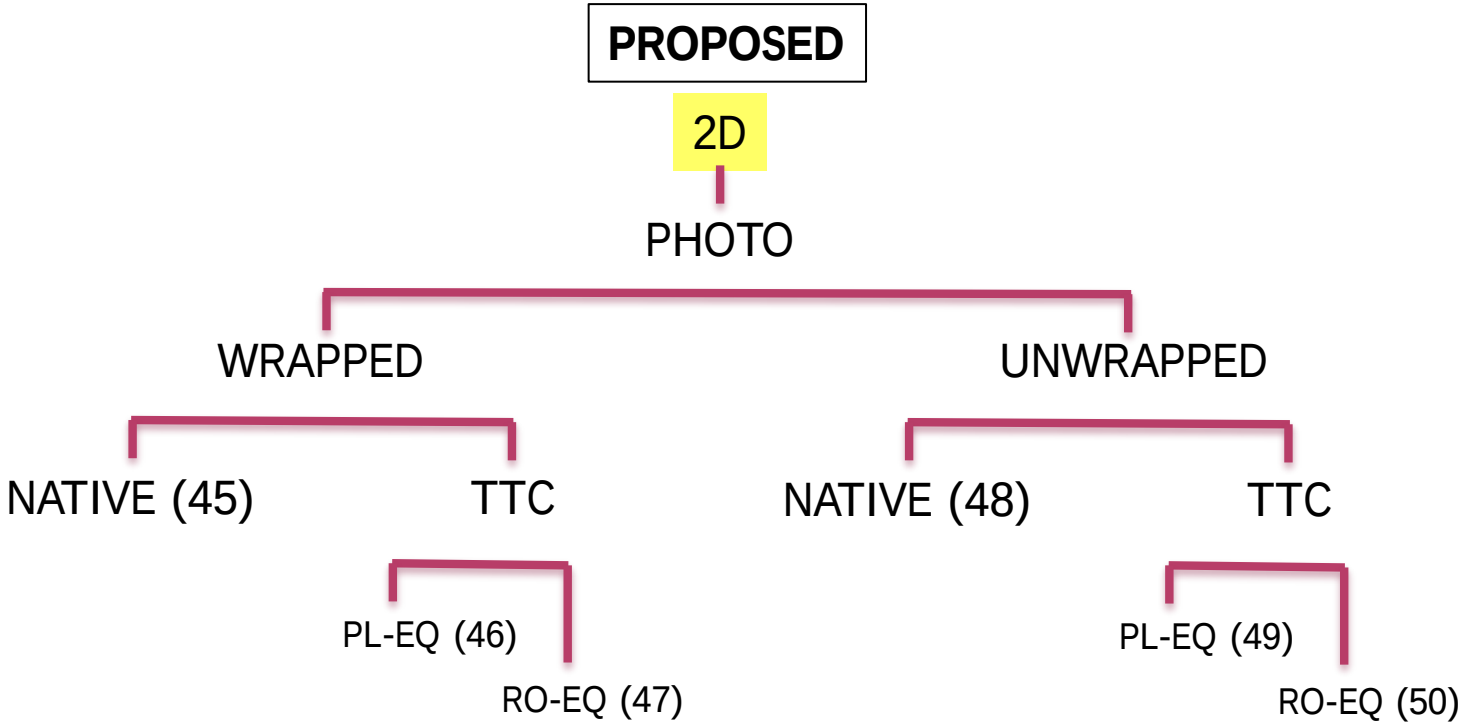
REVISION OF TABLE 7 TO HANDLE: MULTISPECTRAL, CONTACTLESS, AND OTHER TYPES



- Break down 2D/PHOTO into Wrapped and Unwrapped
- Native = image data as sensed
- TTC = Transformed To Contact (made to look like FTIR/legacy)
- PL-EQ = Plain Equivalent; RO-EQ = Rolled Equivalent
  - These are coded OTHER(28) right now

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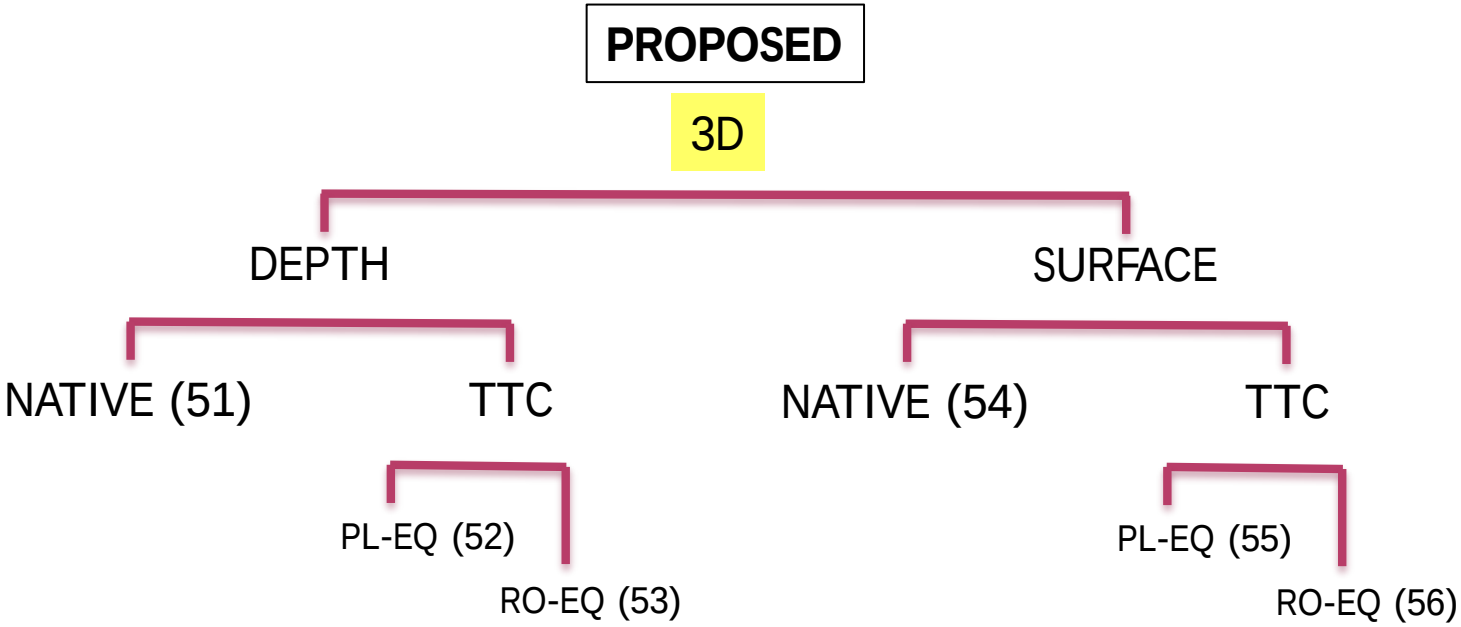
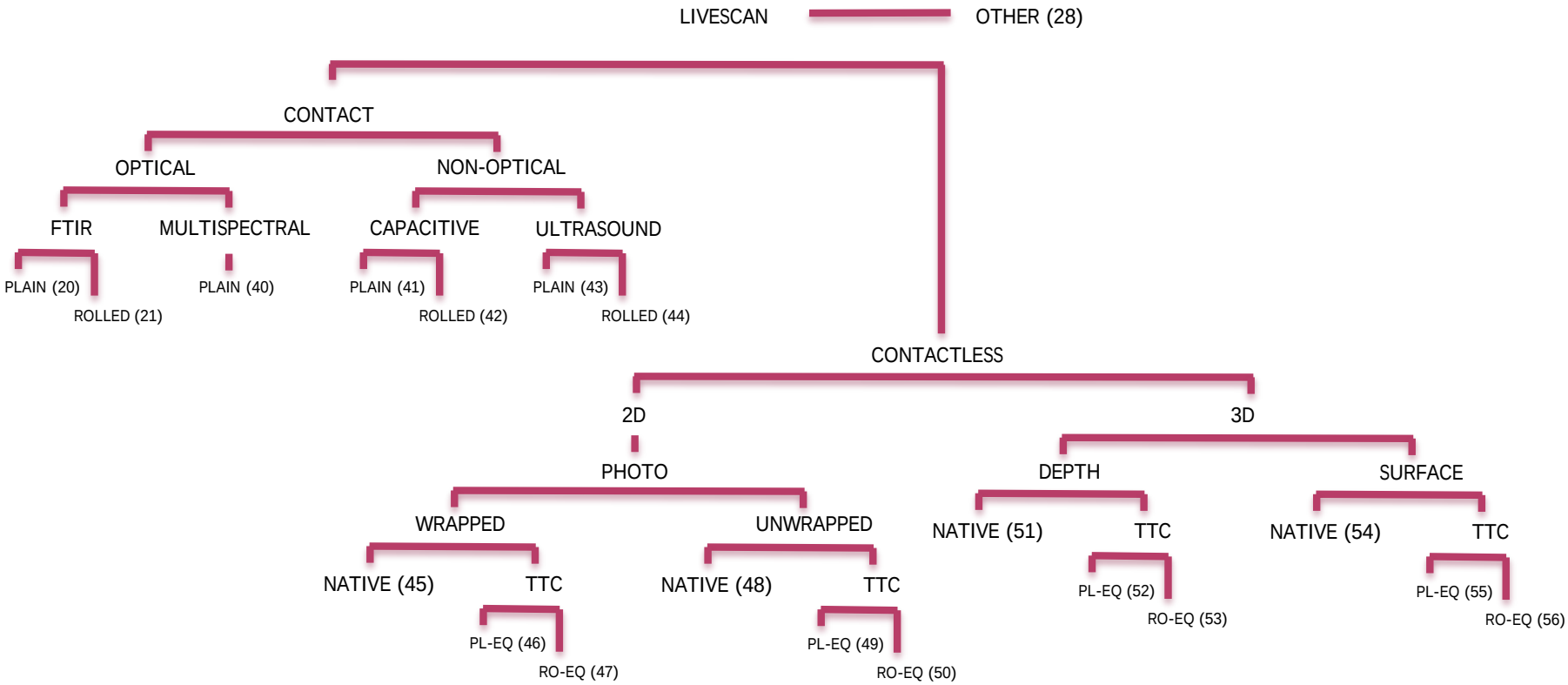
REVISION OF TABLE 7 TO HANDLE: MULTISPECTRAL, CONTACTLESS, AND OTHER TYPES

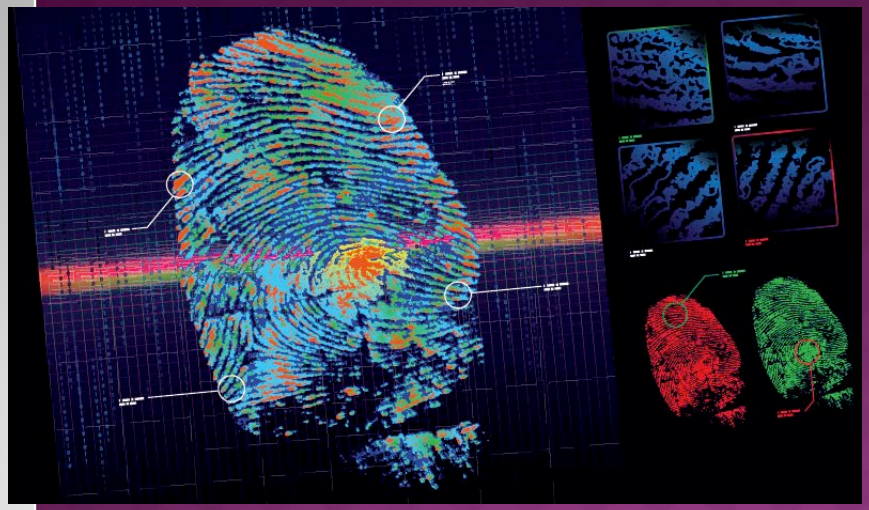


- PL-EQ & RO-EQ now coded OTHER(28)
  - Update should at least address these codes
- Full 3D in this update will require:
  - New Section: Terminology, Concepts, Formats, Compression
  - New 3D Image Record Type?

MIKE GARRIS

PROPOSED


LIVESCAN
OTHER (28)
CONTACT
OPTICAL
NON-OPTICAL
FTIR
MULTISPECTRAL
CAPACITIVE
ULTRASOUND
PLAIN (20)
ROLLED (21)
PLAIN (40)
PLAIN (41)
ROLLED (42)
PLAIN (43)
ROLLED (44)
CONTACTLESS
2D
3D
PHOTO
DEPTH
SURFACE
WRAPPED
UNWRAPPED
NATIVE (51)
TTC
NATIVE (54)
TTC
NATIVE (45)
TTC
NATIVE (48)
TTC
PL-EQ (52)
RO-EQ (53)
PL-EQ (55)
RO-EQ (56)
PL-EQ (46)
RO-EQ (47)
PL-EQ (49)
RO-EQ (50)



BIOMETRIC QUALITY STANDARDIZATION

elham.tabassi@nist.gov

http://www.nist.gov/itl/iad/ig/development_nfiq_2.cfm

October 31, 2014

ANSI/NIST Workshop

QUALITY ASSESSMENT FOR ERROR SUPPRESSION

Quality problem: “The Last 1%”

Or maybe “The Last 0.1% or 10%”

» Fraction of samples that should not be sent to the matcher

- Core algorithmic capability of current matchers are reaching their asymptote. Performance improvements should be and could be achieved by improving data quality and integrity.
- Quality assessment should be done based on only one instance most of the times (representation).
- Providing constructive feedback only possible if cause of poor quality is known

character

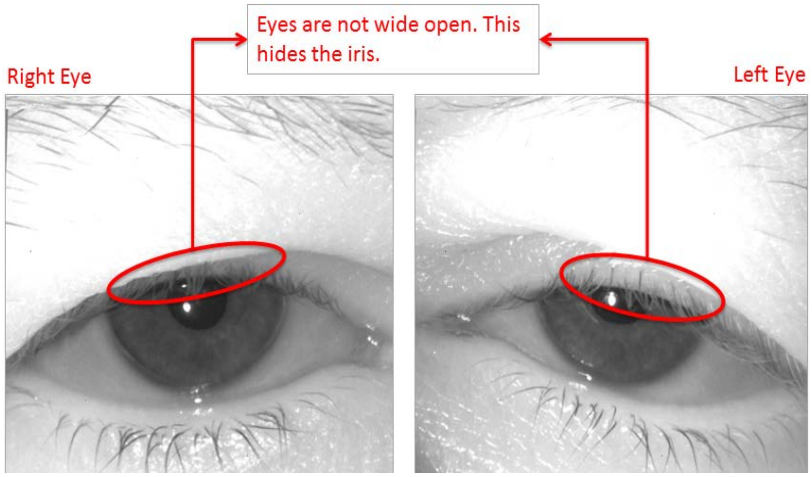
behavior

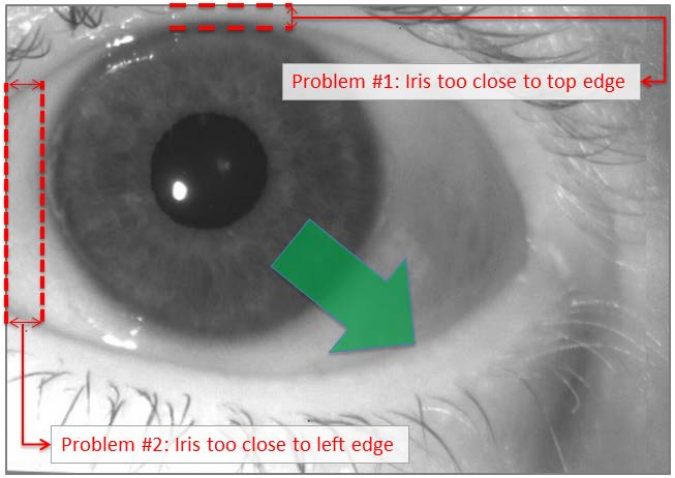
environment

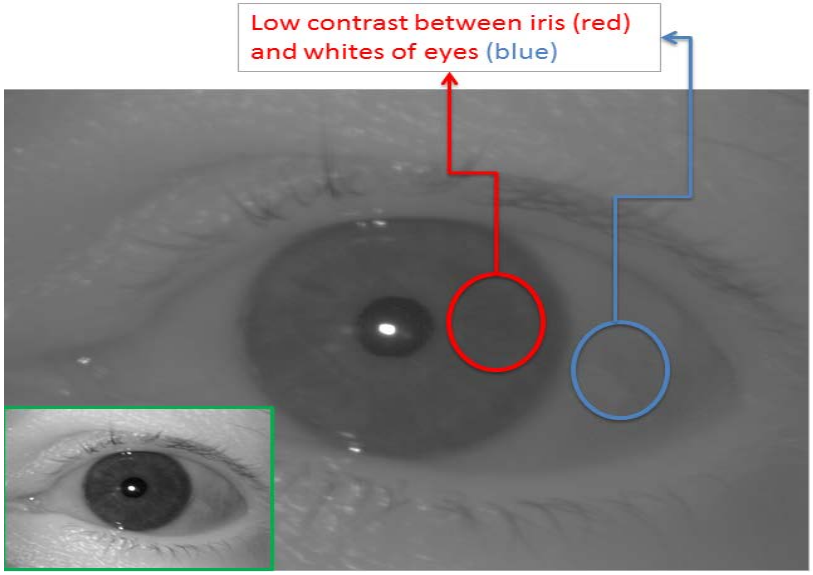
Imaging/system

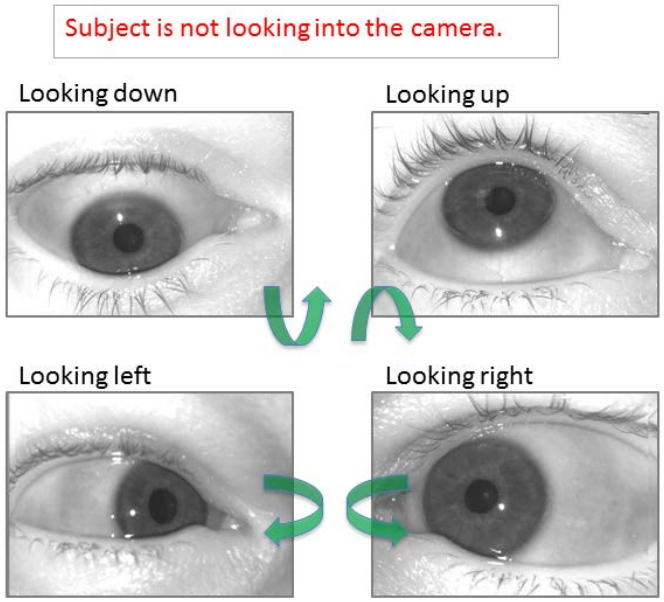
ELHAM TABASSI

PREVENT GIGO









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NIST FINGERPRINT IMAGE QUALITY

NFIQ1.0 → quality number =5

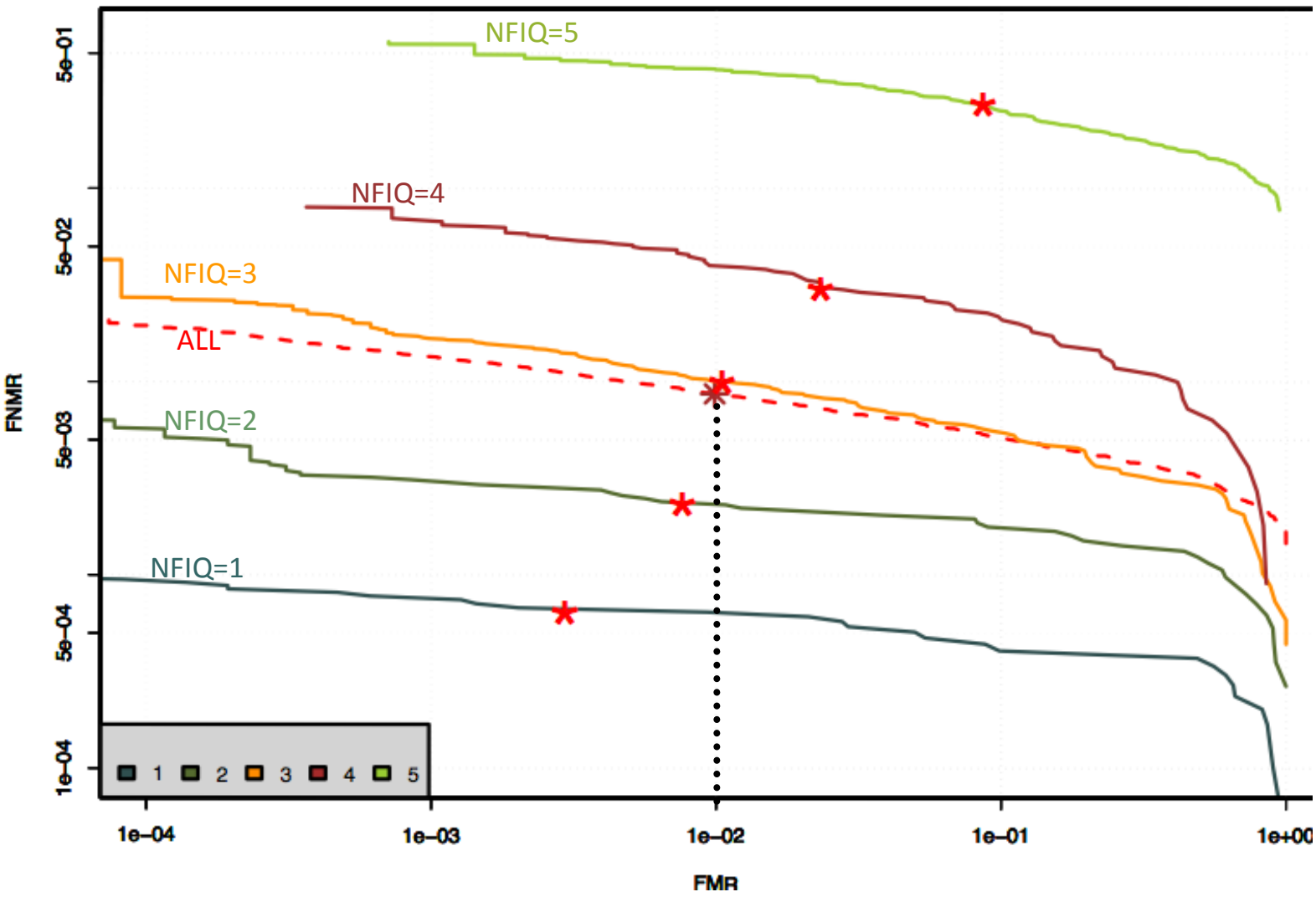
NFIQ's 5 levels of quality are intended to be predictive of the relative performance of a minutia based fingerprint matching system.

NFIQ=1 indicates high quality samples, so lower FRR and/or FAR is expected.

NFIQ=5 indicates poor quality samples, so higher FRR and/or FAR is expected.

ELHAM TABASSI

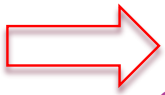
NFIQ – RANK STATISTIC FOR PERFORMANCE

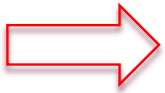


ELHAM TABASSI

CHALLENGES IN DEVELOPMENT A BIOMETRIC QUALITY ASSESSMENT ALGORITHM

- Agnostic to comparison algorithm
  - Capability to predict performance of different comparison algorithms
- Sufficient resolution
  - How many levels are too many?
- Pairwise quality
  - $Q_1 = F(image_1)$; $Q_2 = F(image_2)$;
  - $Q_{12} = G(F(image_1), F(image_2))$
- Calibration
  - What FNMR is expected for each quality level/score?
- Quality of quality
  - Performance measures





- Get a good representation of the current (state-of-the-art) comparison algorithm for training
  - Include as many as possible
    - Requires building community
- We really don't know.
- Robust method for labeling training data + ultimately visual inspection
- Devise + revise metrics and visualization techniques

Technical

Way forward

ELHAM TABASSI

CHALLENGES IN DEVELOPMENT A BIOMETRIC QUALITY ASSESSMENT ALGORITHM

- Data + Data sharing issues
  - training (particularly low quality)
  - testing (Images with specific defects)
- Agnostic to application scenario
  - `sufficient quality' is different for enrolment vs. verification
  - Ditto 1:1 and 1:N.
- Meet unknown System requirements
  - Timing, hardware, etc.
- Robust
  - Zero failure to compute rate

- Data cannot leave a site, but an open source algorithm can be ran on the data and Results can then be shared
- Go for the best recommended by the community
- Develop technical guidance and best practice
  - In collaboration with end users of the particular application
- Good coding practice

Technical, etc.	Way forward

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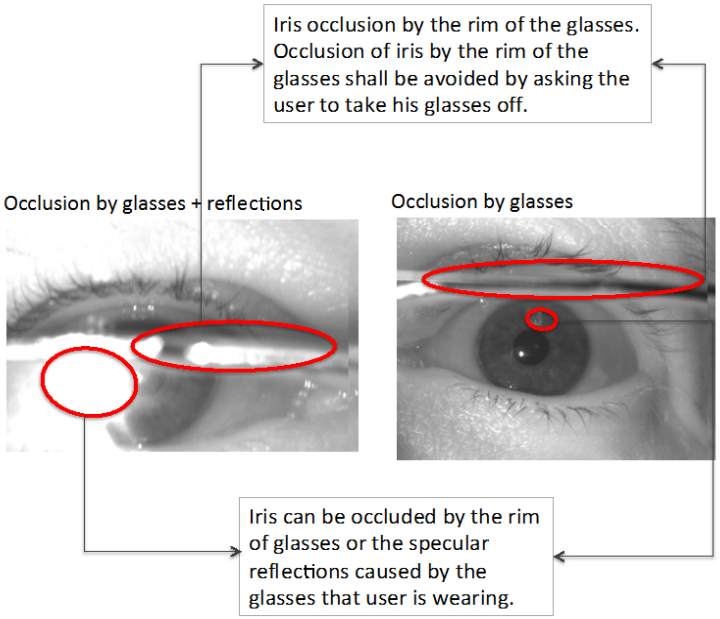
ACTIONABLE QUALITY FEED BACK TO USER/OPERATOR

- Empty / Uniform / no minutiae
- Wet / dry
  - High/low pressure
- Centeredness
  - Singularity detection
- Incompleteness
  - Entropy of orientation flow
- Ghost images

- occlusion
- non-frontal gaze
- Low contrast
- Non-centered



ISO/IEC 29794

ANSI/NIST-ITL

STANDARDIZATION :: TOWARDS A VECTOR OF QUALITY COMPONENTS

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STANDARDISATION - THEN

- Information technology - Biometrics sample quality Part 1: Framework
- Definitions
  - quality: "the degree to which a biometric sample fulfils specified requirements for a targeted application"
  - quality score: "a quantitative expression of quality"
  - utility: "the observed performance of a biometric sample or set of samples in one or more biometric systems"
- Quality score from 0 to 100

description		size	valid values	notes
Number of Quality Blocks		1 byte	[0,255]	This field is followed by the number of 5-byte Quality Blocks reflected by its value (see **Fehler! Verweisquelle konnte nicht gefunden werden.**). A value of zero (0) means that no attempt was made to assign a quality score. In this case, no Quality Blocks are present.
Quality Block	Quality Score	1 byte	[0,100] 255	0: lowest 100: highest 255: failed attempt to assign a quality score
	Quality Algorithm Vendor ID	2 bytes	[1,65535]	Quality Algorithm Vendor ID shall be registered with IBIA as a CBEFF biometric organization. Refer to CBEFF vendor ID registry procedures in ISO/IEC 19785-2.
	Quality Algorithm ID	2 bytes	[1,65535]	Quality Algorithm ID may be optionally registered with IBIA as a CBEFF Product Code. Refer to CBEFF product registry

ISO/IEC IS 29794-1:2009

5-byte Quality Block

ISO STANDARDIZATION OF IRIS IMAGE QUALITY

- Defines and quantifies iris image quality components.
  - for a single image
  - for two images being compared
  - for acquisition device.
- Considers subject, environment and device covariates.
- For each quality component, it specifies
  - description, computation method, units, and valid values/threshold.
- **FDIS Ballot**

- Required
  1. Usable iris area [70,100]
  2. Iris-sclera contrast [5,100]
  3. Iris pupil contrast [30,100]
  4. Pupil boundary circularity
  5. Grey scale utilisation [6,20]
  6. Iris radius [80,253]
  7. Pupil dilation [20,70]
  8. Iris pupil concentricity [90,100]
  9. Margin adequacy [80,100]
  10. Sharpness
- Recommended
  11. Frontal gaze-elevation
  12. Frontal gaze-azimuth
  13. Motion blur

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NFIQ 2.0

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NFIQ 2.0

Promises, promises	So far, we have achieved
Improved feature	Many features, somehow improved
More level (0-100)	More level (0-100)
Faster, lighter	Faster, lighter
Actionable feedback	Actionable feedback
NFIQ 2.0 mobile	Towards NFIQ Mobile
Slap	In progress – need FpVTE
Better performance	Better performance
Modular design	Plug and play
Calibration	Mapping to FNMR
Conformance testing	Underway
	Standard features

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AT A GLANCE

- 5 levels.
  - 1(highest) to 5(lowest)
- 11 features
- Comparison scores of 3 algorithms used for training
- 3400 training images
- ~300 msec per image

NFIQ 1.0

- 100 levels
  - 0(lowest) to 100(highest)
- 15 features
- Comparison scores of 7 algorithms used for training
- ~5000 training images
- ~ 100 msec per image
- Actionable quality
  - Flags for blank image, low contrast
- Design for NFIQ Mobile

NFIQ 2.0

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NIST Biometric Quality Program

Push Towards Zero Error Biometrics

Strengthening Science	Advancing metrology	Developing Standards	Developing Tool Box	Best Practice Guidance	Enumerative Bibliography	Coordination+ Collaborations
Failure Analysis	Performance Evaluation	Requirements Specifications	Open source Public domain	Instructional + Guidance	Technical Literature	
Identifying the likely causes of recognition error, quantifying their effect and ways to mitigate them.	Quantitative means of assessing performance of quality assessment algorithms (IREX II IQCE)	On image properties affecting performance, and on capture device	Reference implementations of quality assessment algorithm, iris segmentation	Materials for quality score summarization + Best capture practice + example images of various quality	Reports, white papers, publications relevant to biometric quality and iris image quality in particular	Workshops, Conferences Grants (WVU, NYU Poly)
Research	Evaluation	Standard	Software	Report	Webpage	
NIST IR 7155 ICIP 2005 NIST IR 7820	NIST IR 7820 PAMI 2007 ICPR 2010	ISO/IEC 29794 ISO/IEC 19794	NFIQ 1.0 NFIQ 2.0 NIIQ 1.0	NIST IR 7422 NIST IR 8XXX	www.nist.gov/itl/iad/ig/bio_quality.cfm	BQW 2006, 07 IBPC 2010, 12 NFIQ 2010,12

THANK YOU.

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ADDITION OF A SPECIFIC FIELD FOR NFIQ2 RESULTS

Pro

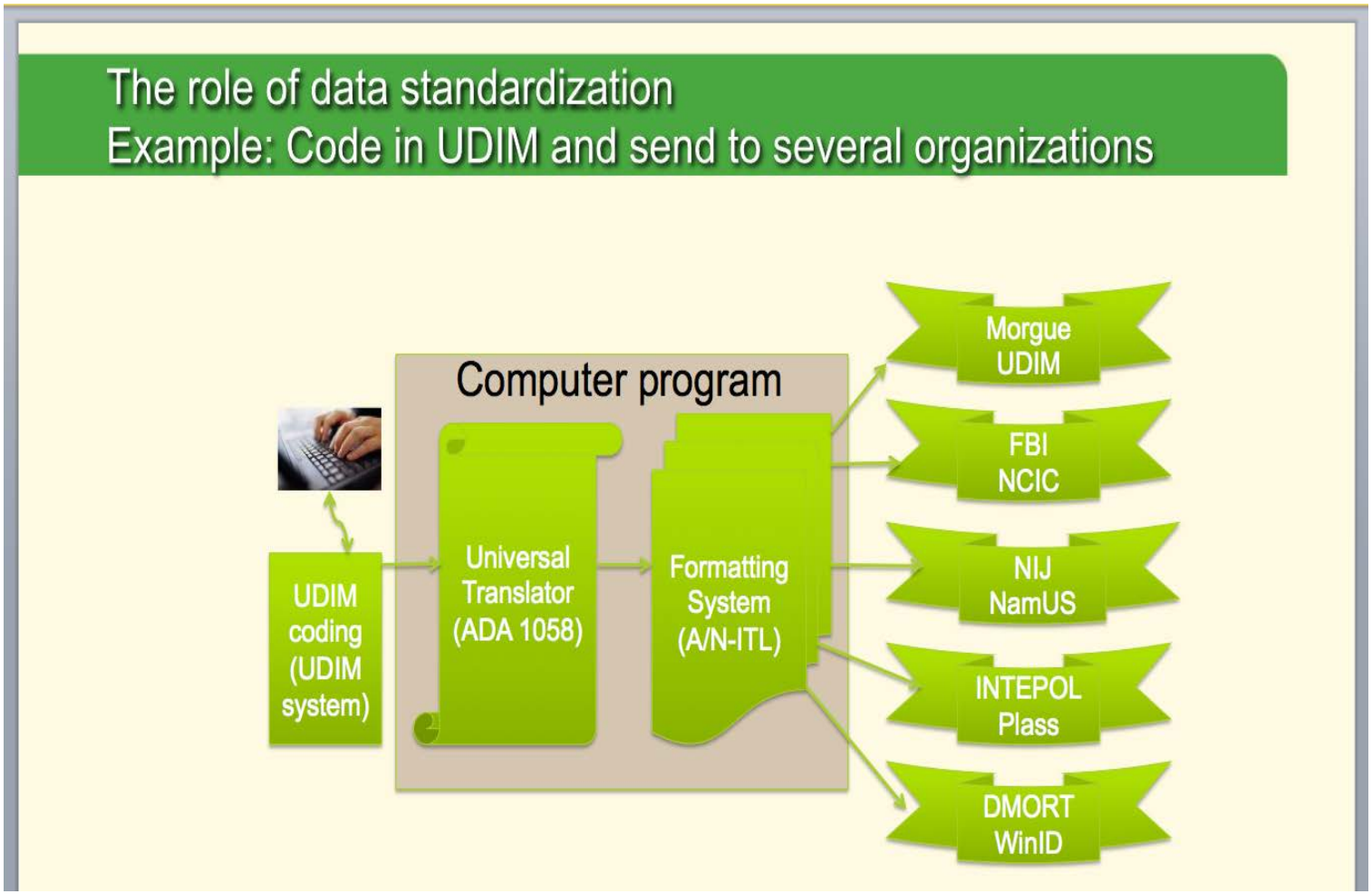
- NFIQ (version 1) has its own field (14.022) Users may want a separate field to clearly indicate and distinguish NFIQ2 from any other metric.

Con

- Field 14.024 already exists (Fingerprint quality metric) for metrics that use a scale of 1 to 100. It could be confusing to have a separate field for just NIFQ2. All that is needed is to specify that the algorithm is NFIQ2.

BRAD WING

DENTAL CODING TRANSLATOR



BRUCE BANDINI

OPEN DISCUSSION

- Additional topics to be considered
- Develop working groups
  - Select chairs
  - Solicit volunteers
- Develop a Timetable

BRAD WING