Machine-readable tables for ANSI/NIST-ITL and associated application profiles

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How is ANSI/NIST-ITL actually implemented?

Implementing data from field tables

Field Number	Mnemonic	Content Description	Cond code	Character			Value Constraints	Occurrence	
				Type	Min #	Max #		Min #	Max #
	CPR	**EFS CENTER POINT OF REFERENCE**	O					0	1
		Subfields: Repeating sets of information items	M⇑					1	3
	CPM	method	M⇑	AN	1	1	CMP = L or 0 or 1 or H see Table 41	1	1
9.323	PXC	X coordinate	M⇑	NS	1	5	-EHO < PXC ≤ 50,000	1	1
	PYC	Y coordinate	M⇑	NS	1	5	-EVO < PYC ≤ 50,000 integer	1	1
	CRU	radius of position uncertainty	O⇑	N	1	3	0 ≤ CRU ≤ 999	0	1
	DIS	**EFS DISTINCTIVE FEATURES**	D					0	1
		Subfields: Repeating sets of information items	M⇑					1	99
9.324	DIT	distinctive feature type	M⇑	A	4	9	entries from Table 42	1	1
	DFP	distinctive features polygon	O⇑	NS	11	1188	none	0	1
	DFC	distinctive features comment	O⇑	U	1	1000	none	0	1
9.325	NCOR	**EFS NO CORES PRESENT**	D	A	1	1	NCOR = Y	0	1
9.326	NDEL	**EFS NO DELTAS PRESENT**	D	A	1	1	NDEL = Y	0	1
9.327	NDIS	**EFS NO DISTINCTIVE FEATURES PRESENT**	D	A	1	1	NDIS = Y	0	1

Many of the field attributes can be used easily and unambiguously

But many require interpretation and individual definition of rules

➔inefficient
➔risk of typos
➔risk of misinterpretation

Implementing field codes

Tables are in different formats, and the text indicates that different fields/information items often refer to different subsets

➔inefficient
➔risk of typos
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8.4.5 Field 4.005: Image scanning resolution / ISR

The mandatory ISR field relates to the *scanning* resolution of this image. Previous versions of this standard stated that 0 in this field represents the 'minimum scanning resolution.' The minimum scanning resolution was defined in ANSI/NIST-ITL 1-2007 as "19.69 ppmm plus or minus 0.20 ppmm (500 ppi plus or minus 5 ppi)." Therefore, if the image scanning resolution corresponds to the Appendix F certification level (See **Table 14 Class resolution with defined tolerance**), a 0 shall be entered in this field.

A value of 1 is entered if the actual scanning resolution (outside of the Appendix F certification range) is specified in **Field 1.011 Native scanning resolution / NSR**.

8.8.5 Field 8.005: Image scanning resolution / ISR

This mandatory field shall contain 0 if the scanned and transmitted image resolution is within the range of 19.49 ppmm (495 ppi) to 19.89 ppmm (505 ppi). A value of 1 indicates a different, unreported, image resolution[36]. A value of 0 shall also be used if the image is vector data.

Finger position	Finger code
Unknown fingerprint	0
Right thumb	1
Right index finger	2
Right middle finger	3
Right ring finger	4
Right little finger	5
Left thumb	6
Left index finger	7
Left middle finger	8
Left ring finger	9
Left little finger	10
Plain right thumb	11
Plain left thumb	12
Plain right four fingers (may include extra digits)	13
Plain left four fingers (may include extra digits)	14
Left & right thumbs	15
Right extra digit[16]	16
Left extra digit[16]	17
Unknown friction ridge	18
EJI or tip	19
Unknown palm	20
Right full palm	21
Right writer's palm	22
Left full palm	23
Left writer's palm	24
Right lower palm	25
Right upper palm	26
Left lower palm	27
Left upper palm	28
Right other	29
Left other	30
Right interdigital	31
Right thenar	32

Latent

Tenprint card

Electronic tenprint

Palm

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Exceptions

9.138	RCI	M1 RIDGE COUNT INFORMATION	D
		Subfield: Set of information items (Note that the first subfield is in the same format as following subfields.)	M ⇑

8.14.24 Field 14.025: Alternate finger segment position(s) / ASEG

This optional field is an alternate approach to describing the locations for each of the image segments of each of the individual fingers within a flat image containing the capture of four (or more if extra digits exist on the hand) simultaneous fingers or two simultaneous thumbs. This field uses an n-vertex polygon to encompass each finger image segment, where "n" is between 3 and 99. A minimum of three points is required to describe a finger location. The order of the vertices shall be in their consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. No two vertices may occupy the same location. The polygon side defined by the last vertex and the first vertex shall complete the polygon. The polygon shall be a simple, plane figure with no sides crossing and no interior holes.

This field shall consist of up to five subfields: the segmentation for each finger is represented in a different subfield. The first information item (**friction ridge alternate segment position / FRAS**) is the finger number from **Table 8**. This information item is called the **friction ridge alternate segment position / FRAS** to differentiate it from **FGP.** See **Section** 7.7.12. The number of information items within each subfield depends on the number of vertices.

Some fields are exceptions, but are not indicated unambiguously

➔high risk of incorrect implementation

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Application profiles (e.g. FBI EBTS, DoD EBTS, INT-I, LITS)

ANSI/NIST-ITL is rarely used directly: most of the fields used are defined in the application profile.

Most of the implementation requirements derive from transactions, which are not addressed in ANSI/NIST-ITL.

Table formats and content differ.

➔inefficient
➔risk of typos

Table C-1 Field Edit Specifications for Type-2 Elements

Identifier	Field Name	Character	Field Size (not including Character Separators) Min	Field Size (not including Character Separators) Max	Max Occurrences	Example	Comments/Special Characters
PHT	PHOTO AVAILABLE INDICATOR	A	1	1	1	2.036:Y<GS>	
RFP	REASON FINGERPRINTED	ANS	1	75	1	2.037:CONSIDERING FOR EMPLOYMENT<GS>	Commas, blanks, dashes, hyphens, and slashes are all allowed as special characters
DPR	DATE PRINTED	N	8	8	1	2.038:19950324<GS>	
EAD	EMPLOYER AND ADDRESS	ANS	1	120	1	2.039:ACE CONSTRUCTION COMPANY,327 MAPLE AVE, BUFFALO,NY<GS>	Any printable 7-bit ASCII character is allowed.
OCP	OCCUPATION	ANS	1	50	1	2.040:PLUMBER<GS>	Any printable 7-bit ASCII character is allowed.
RES	RESIDENCE OF PERSON FINGERPRINTED	ANS	1	120	1	2.041:5021 OAK LEAF DRIVE, BUFFALO NY, USA., 14221<GS>	Any printable 7-bit ASCII character is allowed.
MIL	MILITARY CODE	A	1	1	1	2.042:M<GS>	
TSR	TYPE OF SEARCH REQUESTED	A	1	1	1	2.043:P<GS>	
GEO	GEOGRAPHICAL AREA OF SEARCH	A	2	2	5	2.044:MD<GS>	
DOA	DATE OF ARREST	N	8	8	1	2.045:19950324<GS>	

Multiple records within a transaction are separated by the "F_S" character, which signals the end of a logical record. Use of separators within the Type-1, Type-2, Type-9 through Type-99 records shall always be observed. The "U_S" separator shall separate multiple items within a field or subfield; the "R_S" separator shall separate multiple subfields, and the "G_S" separator shall separate information fields. The following is a detailed description of the separator characters

them, not what precedes them. Thus, when a tagged field includes subfields[3] (e.g., the ASL field contains subfields DOO and AOL), and another subfield is still to follow, the following one must be separated from the one preceding it by the unit separator character. If what is to follow is a

Terminology differs, most notably "subfield".

➔high risk of incorrect implementation

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XML

Field contents, length, legal characters, format often vary between XML and traditional.

Traditional			Max length	Example
2.0005	RET	Retention Code	1	Y
2.0022	DOB	Date of Birth	8	19790815

XML			Max length	Example
2.0005	RET	Retention Code	5	True
2.0022	DOB	Date of Birth	10	1979-08-15

The information necessary for compliance checking, and translation between XML and traditional is defined in multiple places and is often ambiguous.

➔inefficient
➔risk of typos
➔risk of misinterpretation
➔risk of diverging implementations

[89] The value "U" from the description of **Field 9.004: Minutiae format / FMT** maps to the value "false" in the XML, and the value "S" from the description of **field 9.004** maps to the value "true" in the XML.

[90] This element is

There is not a 1:1 correspondence between XML elements and traditional fields, often just simple separators, but sometimes complex.

Field ID	Mnemonic	XML element name	Cardinality
"	-	biom:PositionPolygonVertex	..99
"	[illegible]	[illegible]	1..1
"	VPO	biom:PositionVerticalCoordinateValue	1..1
-	-	biom:PhysicalFeatureDescriptionDetail	0..9
10.043	COL	biom:PhysicalFeatureColorDetail	0..1
"	[illegible]	biom:PhysicalFeaturePrimaryColorCode	1..1
"	TC2, TC3, TC4, TC5, TC6	biom:PhysicalFeatureSecondaryColorCode[105]	0..5
10.042	[illegible]		
"	SMI	biom:PhysicalFeatureCategoryCode	1..1
"	TAC	biom:PhysicalFeatureClassCode	0..1
"	TDS	biom:PhysicalFeatureDescriptionText	0..1
"	TSC	biom:PhysicalFeatureSubClassCode	0..1

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Summary of issues in implementing ANSI/NIST-ITL

- Errors introduced by typos, and inefficiencies / wasted effort in reentering by hand tables that cannot be read by machine
- Inefficiencies and misunderstandings due to different formats and contents between ANSI/NIST tables and EBTS, as well as between different application profiles
- Requirements defined only in the text of the specification
- Exceptions and special cases are not clearly indicated
- No efficient way of knowing exactly what changed between two versions of a specification

- **It is important to make sure that a standard is unambiguous and straightforward to implement**

Recommended solution

Overview

- Immediate need
  - Tables for various FBI-sponsored software (ULW, UFW, FBI compliance checker)
  - Machine-readable data tables incorporating
    - field requirements from AN2011 *and* FBI EBTS
    - transaction requirements from FBI EBTS
- Designed to be applicable to a broad range of use cases
  - Compliance
  - Processing
  - Creation/editing/viewing
  - Translation: between application profiles, between traditional and XML
  - Precise differences between versions of a standard
- Proposed formats are mostly complete
- Requesting working group to finalize formats and review details
- NIST has agreed to host the AN2011 tables on its website
- FBI can host the EBTS tables on its website
- Requesting other agencies with application profiles (DoD, Interpol, national standards agencies) to consider adopting tables in these formats

Goals

- Expand the existing AN2011 and EBTS tables
- Useful for a variety of tools for a variety of purposes (e.g. creating, displaying, processing, and checking transactions)
- Include both XML and traditional formats
- Explicitly flag fields that are exceptions to general cases
- Master tables are maintained as spreadsheets, but designed for trivial conversion to multiple formats to ease implementation (e.g. delimited text, XML, YAML, JSON)
- Format will allow precise detailing of revisions between versions
- A common format means that conformance/compliance checkers can work across multiple application profiles (e.g. FBI EBTS and INT-I) merely by changing tables

Tables

- ANSI/NIST tables
  - Field definition
  - Lookup codes
- Application profile tables
  - (Designed to layer on top of ANSI/NIST tables)
  - Field definition
  - Lookup codes
  - Transaction record and field definitions

FieldDefinition table

- Each entry represents one field, information item, and/or XML element

- Existing attributes
  - Record/field number
  - Mnemonic
  - Description
  - Condition code (expanded)
  - Data/character type (expanded)
  - Min/Max length
  - Min/Max # of occurrences

- New attributes
  - explicit listing of special characters
  - XML element, full Xpath
  - XML exception (defined relation between traditional and XML)
  - CodeTable reference
  - Value range
  - Regular expression
  - Inter-field dependencies
    - presence
    - values
  - Summary

- App profile only
  - AN field revised in app profile

LookupCode table

- Explicitly lists every field code with definition
- Can be used in combination with the value range in the FieldDefinition table to accommodate varying ranges of frequently-used tables (e.g. finger/palm/plantar position)

Transaction tables

- TOTrecords
  - Defines record set requirements
- TOTfields
  - Defines field requirements
  - Inter-field dependencies
    - presence
    - occurrences
    - values

Takeaway

- We are developing machine-readable data tables
- Currently covering AN2011 and EBTS94
- Immediate need is for ULW, UFW, and the EBTS compliance checker
  - but designed to apply to as many use cases as possible
- When complete
  - NIST has agreed to host the AN2011 tables on its website
  - FBI can host the EBTS tables on its website

- Requests:
  - Requesting **working group** to finalize formats and review details
  - Requesting **other agencies with application profiles** (DoD, Interpol, national standards agencies) to consider adopting tables in these formats