Four steps for selecting the right FBI fingerprint category

INTRODUCTION

Livescan, ID Flats, FAP levels, single finger, mobile vs. stationary applications, Appendix F... - selecting the correct image quality certification category can be difficult. Many parameters need to be considered in order to specify the appropriate fingerprint scanner for the intended use case. This guide provides some background information on the fingerprint scanner certification and defines four steps for finding the way through the jungle of terms and relations between scanner type and certification categories.

IMAGE QUALITY STANDARDS

For specifying fingerprint scanners used in high security applications, government agencies and police forces around the globe refer to the official FBI specifications for image quality, officially

Electronic Biometric Transmission Specification (EBTS)[1].

By following the requirements defined in EBTS it is ensured that these products meet the interoperability, work with Automated Fingerprint Identification Systems and provide highest image quality for supporting all phases of identification.

Although the EBTS originally has been developed for exchanging fingerprint data between various agencies in the U.S., today it is used by governments and agencies worldwide.

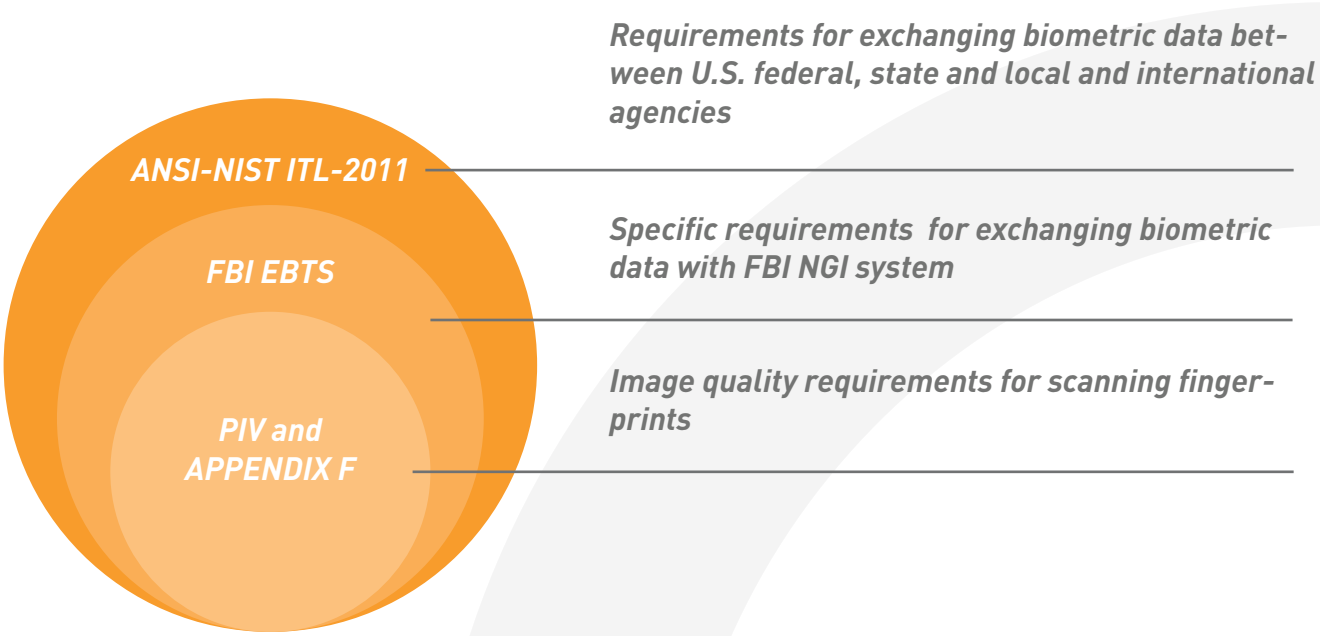

Figure 1: The certifcation ecosystem

1 https://www.fbibiospecs.cjis.gov/EBTS/Approved

IMAGE QUALITY REQUIREMENTS

The EBTS distinguishes between two technical performance levels for image quality:

PIV-071006
The lower performance level PIV was introduced in 2006 for the Personal Identify Verification program of the U.S. government (PIV) and is to be used for scanners supporting one-to-one fingerprint verification.

Appendix F
The image quality according to Appendix F of EBTS has stringent image quality requirements focusing on the human fingerprint comparisons and facilitating large scale machine many-to-many operations.

Depending on the use case and selected image capture size, scanners are certified either according PIV or Appendix F requirements.

FBI EBTS CERTIFICATION CATEGORIES

Whereas PIV and Appendix F are purely technical requirements, the EBTS also differentiates between the use cases of the scanners. For fingerprint scanners there are currently four categories defined:

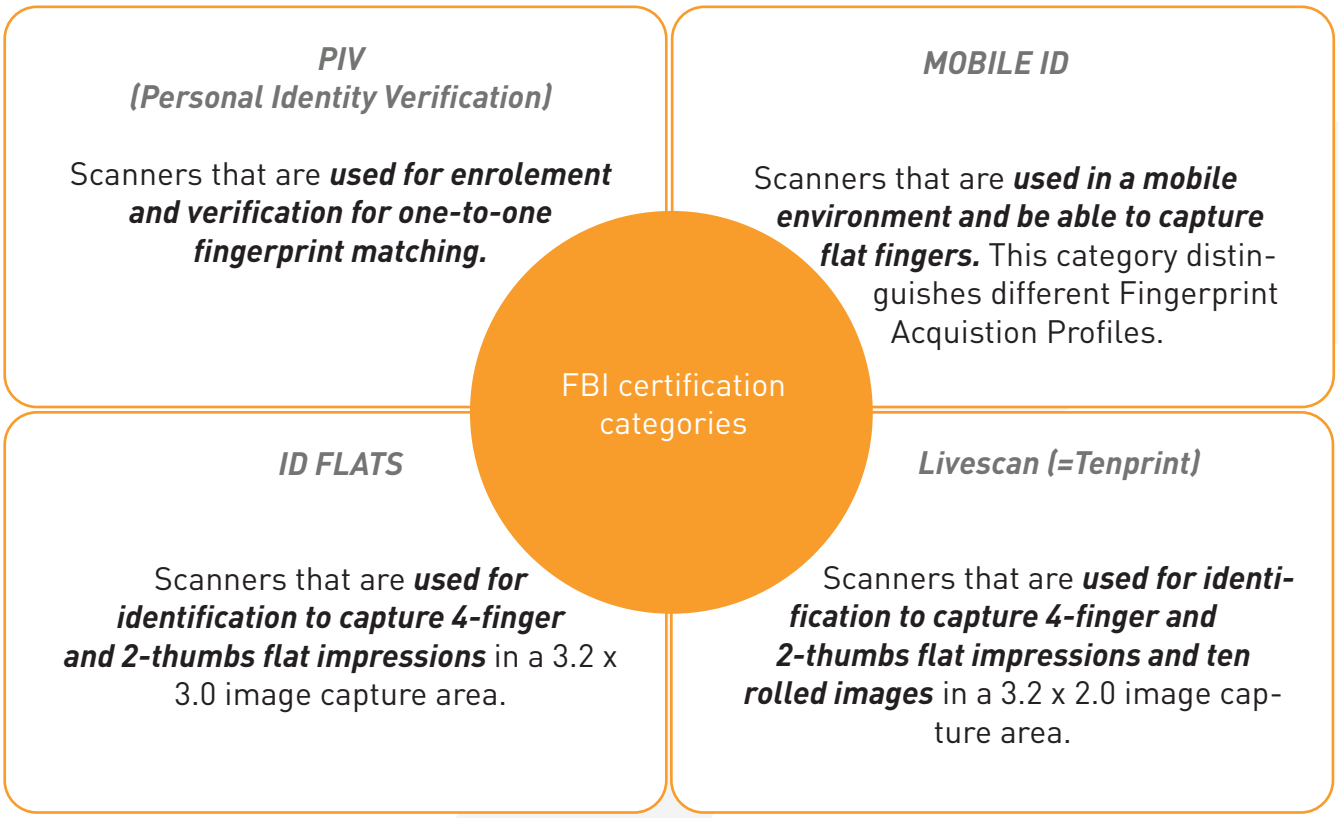

Figure 2: FBI certification categories

The "Mobile ID" category furthermore distinguishes different Fingerprint Acquisition Profiles (FAP levels) that help to select the correct fingerprint capture size for mobile applications.

Certification Category		Specification FBI EBTS	Image capture area (WxH inches)	Types of fingerprints collected
Live-Scan (Tenprint) System		Appendix F	1.6 x 1.5 roll 3.2 x 2.0 flat	Rolls, plain & 4-finger
Identification Flats		Appendix F	3.2 x 3.0	4-4-2 flats
PIV Single Finger		PIV-071006	0.5 x 0.65	1 finger flat
Mobile ID	FAP 10	PIV-071006	0.5 x 0.65	1 flat
	FAP 20	PIV-071006	0.6 x 0.8	1 flat
	FAP 30	PIV-071006	0.8 x 1.0	1 flat
	FAP 40	PIV-071006	1.6 x 1.5	1-2 flat
	FAP 45	Appendix F	1.6 x 1.5	1-2 flat
	FAP 50	Appendix F	3.2 x 2.0	1-4 flat
	FAP 60	Appendix F	3.2 x 3.0	1-4 flat

Table 1: Certification categories for image quality requirements of the FBI EBTS

MOBILE ID CATEGORY AND THEIR FAP LEVELS

The six different FAP levels in the Mobile ID category are determined by the scanner's capture dimension, the number of fingers to be acquired and the level of the image specification.

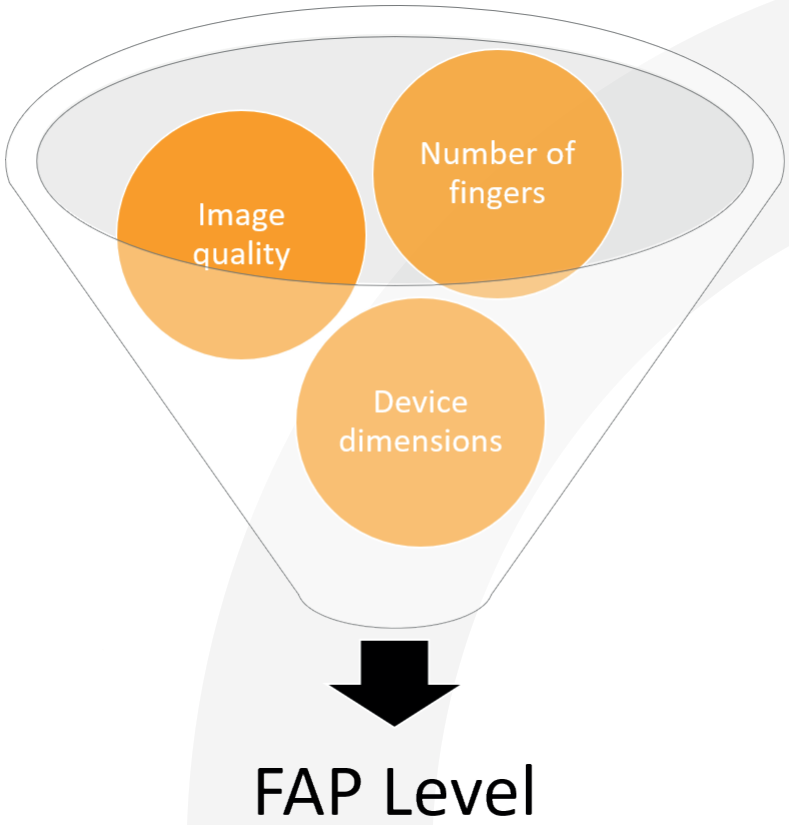

Figure 3: Parameters that determine FAP Levels

The higher the FAP level, the larger the capture area and the more fingers can be captured simultaneously, the more stringent the image quality certification is.

MOBILE ID FAP LEVELS 10 - 40

FAP levels 10-30 are used for single finger scanners for one-to-one verifications. The difference between the FAP level 10, 20 and 30 is basically the image capture surface.

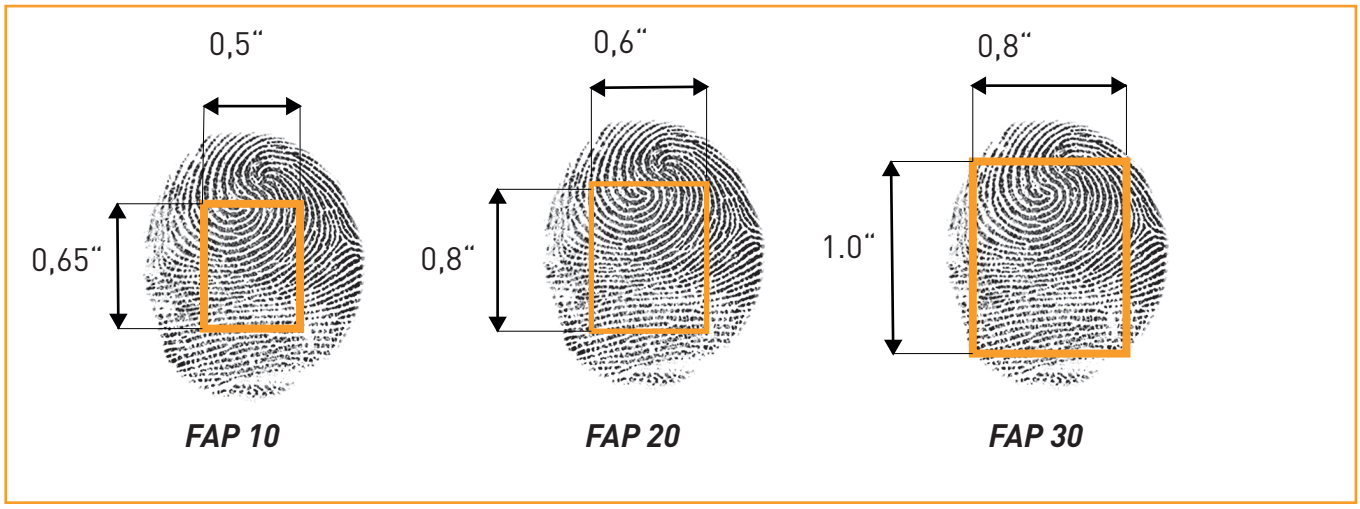

Figure 4: Comparison of image capture areas FAP 10 – FAP 30

As the capture size determines significantly the matching performance[2], the FBI for example recommends using FAP 30 level when single fingers are to be used for AFIS search capability.

FAP levels 40 and 45 are utilized for capturing two fingers simultaneously. That way potential sequence errors are reduced. As FAP level 45 requires the more stringent image quality level "Appendix F" it can also be used to capture rolled fingerprints.

MOBILE ID FAP LEVEL 50 AND 60

Scanners certified for FAP level 50 and 60 can be used to capture 4 flat fingers and rolled fingers simultaneously. However there are important differences between these two FAP levels.

The capture area of FAP level 50 is one third smaller compared to FAP 60 scanners. The smaller capture has historical reasons. Originally, the FBI only accepted rolled fingerprint impressions for identification purposes. Those fingerprints were taken with ink-and-paper on the so called "tenprint card". Digital fingerprint scanners that are able to capture ten rolled and four flat fingersare therefore also called "tenprint scanners".

2 Examination of the Impact of Fingerprint Spatial Area Loss on Matcher Performance in Various Mobile Identification Scenarios NIST, 2014, https://nvlpubs.nist.gov/nistpubs/ir/2014/NIST.IR.7950.pdf

For enabling one-to-many identifications by flat fingers only, in 2005 the certification category „Identification Flats“ (also called „ID Flats“, „slaps“) was introduced (EBTS version 7.1). With an image capture size of 3.2 inches x 3.0 inches cutting of fingers is avoided and a post-processing rotation of the flat fingers is not required. Today, „Identification Flats“ is the most used capture category worldwide for 1:N identifications at border control, visa enrollments or civil background checks. For mobile applications this image format became FAP level 60.

Capture size for FAP 50 level

Capture size for FAP 60 level

Figure 5: Comparison of dimensions and placement between FAP 50 and FAP 60

Identifications based on four flat fingers require scanners certified for ID Flats or FAP level 60.

FOUR STEPS FOR SELECTING THE CORRECT CERTIFICATION CATEGORIES

When selecting the correct fingerprint scanner certification category these four steps provide guidance for selecting the correct image quality level and certification category:

1. DETERMINE YOUR USE CASE

What are you going to collect fingerprints for? There are many and very different applications possible (border control, voter registration, background checks, visa applications, national registry, point of sales etc.), but finally all applications result in one (or more) of these three categories: Enrolment, Verification or Identification.

Depending on various factors like the number of individuals in your database, the combination of fingerprint checks with another token, the level of the required biometrics performance, the fingerprint collection environment and many other, will determine the second step:

2. DETERMINE THE NUMBER AND TYPE OF FINGERS THAT ARE TO BE CAPTURED

The number of fingers to be collected from each individual mainly determines the type of fingerprint scanner to be used and thus, the certification category.

In addition, the decision if flat and/or rolled fingerprints are required, results in different certification categories. Thereby the number of required fingers is a decision between the use case (see (1)), the regulatory requirements, budget and practical aspects.

It is certainly possible to collect ten flat fingers of an individual with a single finger scanner for example. However, the risk of sequence errors and the time it needs might justify the selection of a scanner with a larger capture area in order to collect multiple fingers in one step. As rule of thumb, the larger the scanner's capture area and the more fingers captured in parallel, the better the matching performance.

3. DETERMINE THE IMAGE QUALITY LEVEL

Once the numbers of fingers is selected and the decision if flat and/or rolled fingers need to be captured is made, the image quality level is given. There are only two options, PIV or Appendix F certified scanners.

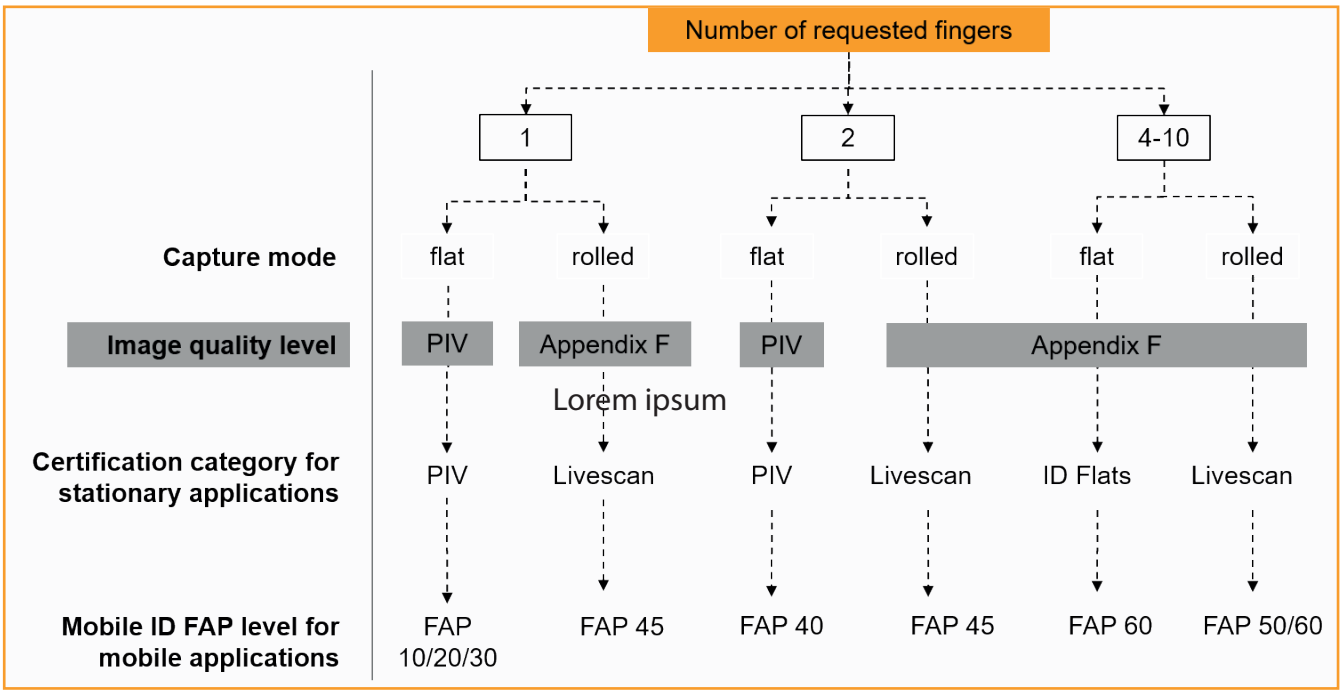

Figure 6: Scheme for selecting image quality level and certification category

4. DETERMINE IF FINGERS ARE TO BE CAPTURED WITH A STATIONARY OR MOBILE SCENARIO

The FBI EBTS defines the mobile identification category "... A mobile identification device is a live scanner viewed in the context of a portable biometric acquisition station..."[3]. There is no clear line between scanners for mobile and non-mobile use cases. In fact, some scanners are certified for both, stationary use and mobile applications. As an example, scanners, certified for ID Flats, that are both light and compact are also certified in the Mobile ID category FAP 60 as they can be used as portable devices.

Within stationary categories it is distinguished between PIV (flat fingers for a maximum of two fingers simultaneously) or ID Flats for identification based on 4 flat fingers or livescan for rolled fingerprints.

Within the mobile category the numbers of fingers and the scanner's capture area determine the FAP level to be selected.

SUMMARY

Selecting the correct image quality certification category can be confusing not only because of the many categories existing but also by the various terms that are used in the identity field.

Besides all technical considerations it is of utmost importance to determine first the use case, the level of security and last but not least practical aspects when it comes to the fingerprint capture process itself. Once these aspects are defined properly, the selection of the appropriate certification category and scanner type along the 4-step-approach should be the easier part.

3 FBI EBTS, Appendix F, F-20 (https://www.fbibiospecs.cjis.gov/EBTS/Approved)