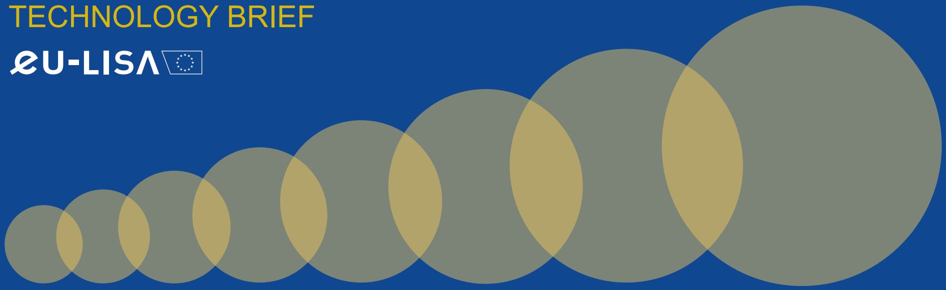
TECHNOLOGY BRIEF

eu-LISA



BIOMETRIC TECHNOLOGY ····· PART 2

WHAT ADDED VALUE DOES eu-LISA BRING THROUGH BIOMETRICS?

> *"The greatest danger in times of turbulence is not the turbulence itself, but to act with yesterday's logic. Biometrics offer a modern approach to security and law enforcement, providing a level of accuracy and reliability unmatched by traditional methods."*
>
> **Peter Drucker (Management Consultant, Educator, and Author)**

This second part of the technology brief focused on biometric recognition technology addresses, from a high-level perspective, how biometrics is being employed by eu-LISA[1]. For a general overview of biometric recognition systems, we refer the interested reader to Part 1 of the technology brief.

WHY ARE BIOMETRICS IMPORTANT FOR eu-LISA?

In 1995, seven EU countries abolished their internal borders, as a consequence of the initial signing of the Schengen Agreement 10 years earlier. The number progressively increased as over additional countries joining the Schengen area. This change made it necessary to strengthen the external Schengen borders through a series of compensatory measures, notably:

- A common visa policy;
- Control mechanisms for people at the Schengen area's external borders.

These new measures are currently instrumented through a set of integrated large-scale IT systems, that are the result of the evolution of border management at the EU level which, for almost a decade now, has been marked by an acceleration of digitalisation and the adoption of technologies that serve two simultaneous objectives:

To enable stronger security and more safety within the Schengen space

To make border crossings to the Schengen area simpler, smoother and faster for travellers, carriers and border guards.

In summary, the EU is working on the ambitious goal of implementing **one of the world's most advanced border management ecosystems in the world**, to significantly step up the facilitation of seamless and safe international travels from and to the EU.

To fulfill its mandate, since 2012 eu-LISA is in charge of the operation and evolution of three systems: the Schengen Information System **(SIS),** the Visa Information Systems **(VIS),** and the European Dactyloscopy Database **(EURODAC).**

Three more systems are currently being developed by eu-LISA: the Entry/Exit System **(EES),** European Travel Authorisation System **(ETIAS),** **a**nd the European Criminal Records - Third Country Nationals **(ECRIS-TCR).** Once released they will further streamline border management processes and facilitate travel, enhance law enforcement cooperation and strengthen security in the Schengen Area.

In addition to the operational management and development of these systems (see figure 1), eu-LISA also plays a crucial role in the technical implementation and development of the **interoperability (IO) framework**[2] that allows the systems to communicate with each other by sharing information whenever required and allowed by the legal framework, in full respect of data protection safeguards (see figure 2 for an overview of the IO framework).

[1] EU Agency for the Operational Management of Large-Scale IT Systems in the Area of Freedom, Security and Justice (eu-LISA) eu-LISA

[2] EU IT Systems Interoperability framework

Systems interoperability ensures information availability, improves the effectiveness of service delivery and provides a better identity management, across the IT systems. As a result, interoperability is a key feature in order to guarantee that the information provided by EU IT systems to border and law enforcement authorities is not only complete, accurate and reliable, but also seamlessly available.

Figure 1. Overview of the systems managed by eu-LISA

The graphic includes links to the official regulation of each of the systems

1995 **SIS**
Including an Automated Fingerprint Identification System (AFIS) from 2018. It allows law enforcement and border control authorities to exchange alerts, conduct automated searches on wanted or missing people or objects, in fights against cross-border crime and terrorism

2003 **EURODAC**
Is a database of fingerprints used to manage asylum applications and determine relative Member States responsibilities in the asylum procedure

2011 **VIS**
Supports the implementation of the common EU visa policy and the provision of visas to third-country nationals travelling to the Schengen area.

2024 **EES**
Will replace passport manual stamps for travellers at the Schengen borders, by automated recording of the date and location of entry and exit, with the aim to strengthen security and detect overstayers

2025 **ETIAS**
Will be an online pre-authorisation system for visa-exempt travellers to the Schengen space

2025 **ECRIS-TCN**
Will allow the exchange of convictions for third country nationals between Member States

To sum up, **eu-LISA's core mission is the development and operation of EU's large scale IT systems for identity management in the domains of Justice and Home Affairs (JHA)**.

As laid out in Part 1 of the present technology brief, biometrics is one of the key existing solutions for identity management, and one that provides answers and capabilities very difficult to achieve, if at all possible, using any other of the existing traditional approaches, such as detection of duplicated identities, negative recognition to detect cases of stolen ID documents, or searches for missing persons.

Consequently, biometric recognition technology is inherently linked to eu-LISA's main mission and present at the very core of all its systems.

WHAT ADDED VALUE DOES eu-LISA BRING TO THE CITIZENS TRHOUGH BIOMETRICS?

Through biometrics, the interoperability of the systems managed by eu-LISA is expected to deliver several improved services and values to its users, in support of the **dual goal of enhancing security while facilitating freedom of movement** within the Schengen space and travel:

For travellers coming to Schengen, it will improve their travel experience by making border crossings faster and more seamless, through the use of biometric-enabled equipment such as self-service kiosks (SSK) and Automated Border Control (ABC) gates, as well as providing the possibility of remote pre-enrolment to the systems[3].

For citizens, the inclusion of biometric recognition across the systems will facilitate identification and support bona fide citizens, increasing internal security by combating identity fraud, illegal migration and trafficking of human beings, at the same that it enhances fight against serious crime and terrorism.

For border guards and law enforcers, it will help streamline manual processes and enable them to focus on their most critical tasks and risk analysis.

WHAT BIOMETRIC CHARACTERISTICS ARE USED IN EU's IT SYSTEMS?

Biometrics are an integral part of the EU IT systems managed by eu-LISA.

Today, EURODAC and VIS store fingerprints for identification, while their respective evolutions, foresees as well the storage of facial images for identification purposes.

[3] For further information on the use of SSK and ABC gates we refer the reader to eu-LISA Research Monitoring Report "Enabling seamless travel to the European Union".

Since 2018, it is possible to store in SIS **fingerprints** and **facial images** for identification purposes. SIS also allows the storage of **finger-marks, palm-prints and DNA** for the investigation of serious crimes and cases of missing persons. When it enters into operation, in Q4 of 2024, EES will store both fingerprints and face images for identification purposes, while ECRIS-TCN will use fingerprints for identification and facial images for confirming identity.

In addition, the interoperability components, that bridge the different systems, will also make extensive use of biometric technologies.

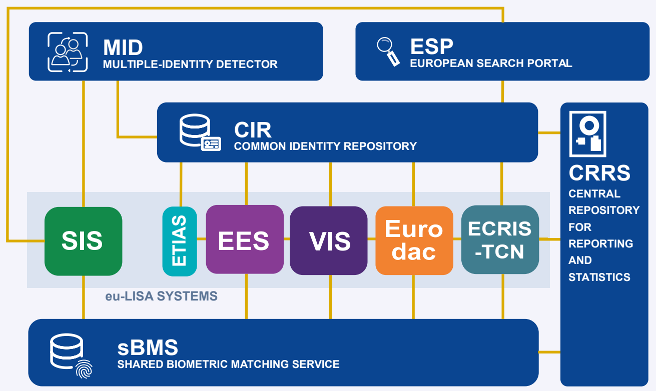
The Shared Biometric Matching Service (sBMS), is the common biometric recognition module that will process biometric samples, store biometric templates[4] and perform biometric-based searches in all systems, based on fingerprints and/or face, when allowed by the legal framework. In particular:

The Common Identity Repository (CIR) will store biometric samples for the different systems.

The Multiple Identity Detector (MID) will use biometric data to detect multiple identities for one same individual and establish links for the same identity across the different systems. It will also contribute to ensuring the identification of bona fide persons and combat identity fraud. This new module will be key to prevent cases such as the one that took place in the 2016 Berlin Christmas market attack, where the terrorist was holding over 14 different alphanumeric identities[5].

The following diagram shows the different interoperability components and their connection with eu-LISA large-scale IT systems in operation and in development.

Figure 2. Overview of the Interoperability framework developed by eu-LISA


MID
MULTIPLE-IDENTITY DETECTOR
ESP
EUROPEAN SEARCH PORTAL
CIR
COMMON IDENTITY REPOSITORY
CRRS
CENTRAL REPOSITORY FOR REPORTING AND STATISTICS
SIS
ETIAS
EES
VIS
Euro dac
ECRIS -TCN
eu-LISA SYSTEMS
sBMS
SHARED BIOMETRIC MATCHING SERVICE

WHAT IS UNIQUE ABOUT BIOMETRICS AND eu-LISA?

It is not an overstatement to say that eu-LISA is developing one of the most-complex ecosystems of biometrics enabled Large-Scale IT Systems in the world. Several characteristics make the EU's interoperable architecture unique with respect to biometrics in particular:

Size of the biometric databases and number of queries.

At the moment, VIS stores 47 million fingerprint sets and 51 million face sets. In SIS, in 2023, 4 million finger-based searches for persons were performed (equivalent to over 11,000 searches per day on average). In the future, it is estimated by Frontex that the EES will be used for 180 million third country nationals traveller visits in 2025[6].

Multiple business areas

The systems will serve law enforcement authorities, border management, EU consular offices across the world, migration, and justice. This means that a complexity of different players in the field will access biometric data, with different types of needs to be served and different tolerance to risk and data accuracy

Multiple access points and stakeholders

Authorities from 31 European countries, in addition to relevant EU agencies (e.g., EUROPOL), will have access to the central systems through their own national systems, and be able to carry out biometric-based searches. Travellers will interact with the systems via dedicated websites and mobile apps and will be able to communicate their biometric data. Autonomous devices at Border Crossing Points (BCPs) such as self-service kiosks and Automated Border Control (ABC) gates will also communicate with the systems and exchange biometric related data. In addition, carriers will also have access to part of the EES and ETIAS non-biometric data.

WHAT ARE THE SPECIFIC CHALLENGES THAT eu-LISA FACES IN THE USE OF BIOMETRICS?

While much is expected and can be gained from the use of biometrics, the unique context in which eu-LISA operates also brings several challenges that still need to be further addressed to provide a better service to the users and citizens, and to increase the added value that it brings to society. These challenges could shape current and future research in biometrics, and help bridge the gap between research under laboratory conditions and deployment in operational conditions.

[4] For the definition of the terms "biometric samples" and "biometric templates" we refer the reader to the harmonised biometric vocabulary that can be consulted in the "ISO/IEC 2382-37:2022 Information Technology – Vocabulary. Part 37: Biometrics"

[5] Fourth progress report towards an effective and genuine Security Union

[6] FRONTEX, "Technical guide for border checks on Entry Exit System (EES) related equipment"

Biometric interoperability and standardisation

Public authorities that control ID management systems use biometric tools developed by specialised private vendors. As a result, standardisation is essential to avoid vendor-lock in situations and ensure seamless communication of biometric data (from different vendors) between the national systems and the central systems. In this regard, the work of the ISO SC37 committee for the standardisation of biometric technology is of great value. As an illustrative example, in the field of biometric quality estimation, the committee is carrying out, in close cooperation with eu-LISA, the development of different open-source software tools for the assessment of fingerprint quality (NFIQ2[7] tool), facial image quality (OFIQ[8] tool) and finger-mark (on-going project). The current plan is to eventually fully integrate all these vendor-agnostic software tools in the systems managed by the Agency in order to improve the interoperability and overall performance of the systems.

Biometric data quality

Quality metrics are key, not only for interoperability, but also as a self-auditing tool to ensure the necessary recognition accuracy across systems. For instance, in centralised systems such as the ones managed by eu-LISA, with multiple data providers and data sources, the quality assessment tools mentioned above can help to identify the data sources that consistently submit samples of lower quality, in order to take the necessary measures to correct the situation. Quality monitoring in the central databases is also a process of great importance to set recognition thresholds (both within a system and across different systems) to ensure the overall accuracy requirements for the interoperable architecture. In summary, ensuring higher quality data translates into higher accuracy and, as a result, in enhanced security at the border with fewer bona-fide travellers being wrongly stopped.

Data protection

Security of the data hosted by eu-LISA is amongst the highest priorities for the Agency and for the EU. This is particularly relevant for biometric data, which constitute sensitive personal data and which, as explained in Part 1 of this technology brief, presents limitations in terms of renewability and linkability. Continuing research and development in the field of Biometric Template Protection (BTP) schemes, that allow to produce different unlinkable templates from one unique biometric sample, is therefore critical in order to reach a level of maturity that allows for their deployment in real operational conditions, without impacting recognition accuracy, and where processing speed and computational efficiency are key factors.

Algorithmic fairness

The systems managed by eu-LISA process data from all segments of society coming from all over the globe. In compliance with human fundamental rights, one of the key values at the very centre of eu-LISA's mission is to offer the same level of service to all travellers and citizens, independently of their demographic features (e.g., sex, ethnicity, age…). In this regard, it is critical for the Agency that the technologies deployed in its systems are as un-biased as possible, with respect to different demographic groups. As an example, it would not be acceptable if, due to biases in the biometric recognition algorithms, elders get stopped and checked at borders at a double rate than young travellers.

Vulnerability protection

The Agency is transitioning from a tightly controlled, closed-communication environment with limited access for selected stakeholders, to a more open communication platform. This new approach will enable data access for additional parties, including ultimately the travellers through unsupervised mobile apps and self-service kiosks. This change to a more uncontrolled environment introduces new potential opportunities for ill-intentioned users to try to exploit biometric-based threats such as presentation attacks or morphing attacks[9]. Consequently, there is a need to promote research to detect next-generation biometric vulnerabilities and develop frameworks to evaluate the risks that these threats pose.

Operational testing

The EU recognises the need to build a strong capability to properly test new solutions for biometrics, in all of the key areas previously-mentioned, and in conditions as close as possible to the final operational environment where systems are deployed. In this regard, the work carried out by the US NIST is outstanding and clearly worth of being highlighted. eu-LISA would welcome the opportunity of benefiting from similar capabilities within the EU and strengthen our ability to

[7] NIST Fingerprint Image Quality - NFIQ2

[8] Open Source Facial Image Quality - OFIQ

[9] See part 1 of this technology brief

conduct proper testing under operational conditions so as to deploy the best possible technological solutions. Very much related to the development and strengthening of this testing capacity, is the availability of data. In this field, eu-LISA supports and encourages the use of new technological options, such as generative AI algorithms, for the production of synthetic biometric data that could provide a viable solution for the training of models and for the initial estimation of performance (that should, in any case, eventually be confirmed on real operational data)

CONCLUSION

Biometrics constitutes a real paradigm shift in identity management technologies, bringing some unique capabilities to the fields of border management and law enforcement, such as the detection of identity fraud, the possibility to detect multiple alphanumeric identities of the same person within a database or across databases, and support for investigations dealing with missing persons or crime-scene analysis.

While biometrics is of great added value to complement traditional identity management approaches, research still needs to address some limitations mainly related to biometrics renewability, its high level of linkability across applications, and data and privacy concerns.

Thanks to the major advancements seen in the last decade in computational processing and, especially, in the fields of data science and artificial intelligence, there is no doubt that biometric technology will continue to take strides forward, bridging the existing gaps and appropriately addressing the challenges faced today in real-life scenarios such as those in which eu-LISA operates.

There is an unquestionable commitment by all parties benefiting from biometrics (the scientific community, industry, regulators and end users) to continue making large investment in developing this technology.

As such, we can only predict that the key role that biometric recognition plays today in supporting fulfilling eu-LISA's mission will continue to increase and become more preponderant, allowing the Agency to improve its high-quality identity management service in the Schengen area to benefit of the Member States, law enforcement agencies and ultimately EU citizens and third-country nationals visiting the EU.

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Neither eu-LISA nor any person acting on behalf of eu-LISA is responsible for the use that might be made of the following information.

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