Future of EU Border Management: Innovation and Technologies

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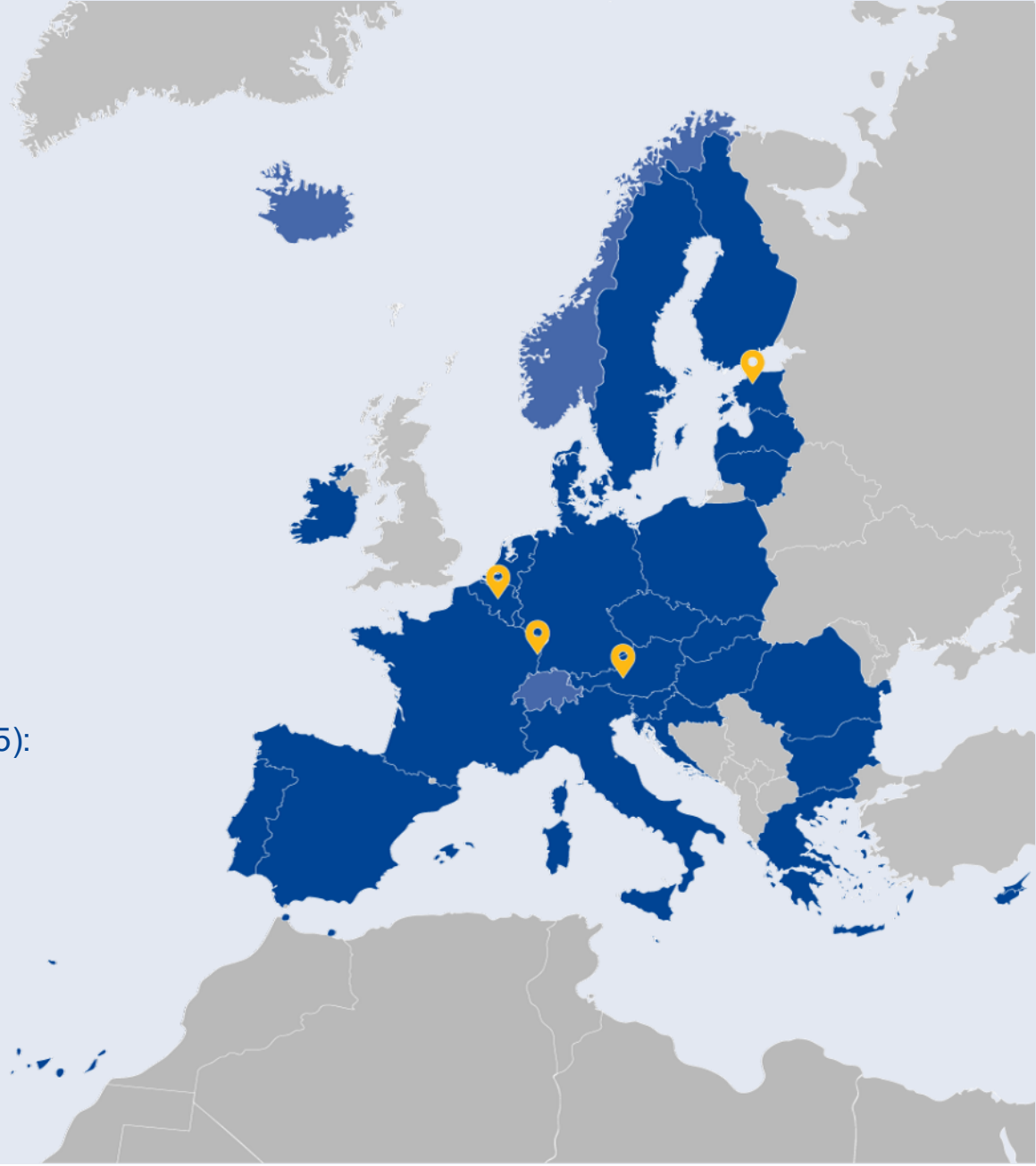
eu-LISA

Key Facts

eu-LISA is the EU Agency for the Operational Management of Large-Scale IT Systems in the Area of Freedom, Security and Justice

- eu-LISA manages large-scale IT systems to support the implementation of asylum, border management, migration, and justice policies in the EU

- Operational since: 1 December 2012
- Number of staff: 375 (as of 1 April 2025)
- Annual budget (2025): ca. EUR 315 mln



HEADQUARTERS
Tallinn, Estonia

TECHNICAL SITE
Strasbourg, France

BACK-UP SITE
St Johan im Pongau, Austria

LIAISON OFFICE
Brussels, Belgium

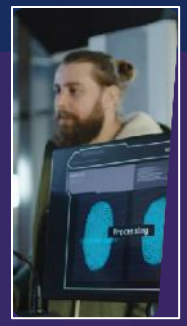
Landscape of border systems managed and developed by eu-LISA

HOME AFFAIRS & BORDER MANAGEMENT

SIS

VIS

EURODAC



EES

ETIAS

NEW EURODAC

REVISED VIS

EU-VAP

API-PNR

DTA

INTEROPERABILTY

IN OPERATION

IN DEVELOPEMENT

Competing Expectations

Enhanced security

- Cross-border crime
- Terrorism
- Illegal migration

Travel facilitation

- Increasing number of passengers
- Demand for better traveller experience
- Importance of travel and tourism industry in Europe

Challenges for border management

- Growing volume of travellers
- Increasingly complex security threats
- Higher expectations (efficiency, experience)
- Rapidly evolving regulatory framework (IO, AI Act…)

Technology as an enabler

Benefits expected

Traveller: Seamless travel to the EU

Member States: Enhanced internal security

Border guards/LE: Streamlined processes: focus on more priority tasks/ analyses

Systems managed by eu-LISA

	SIS	VIS	EURODAC
Creation	1995	2011	2003
Data stored (2024)	**93 M** alerts	**51,2 M** visa requests	**7,7 M** fingerprint sets
Operations (2024)	**15 B** searches	**259 M** operations	**1,8 M** transmitted data

SIS Schengen Information System

VIS Visa Information System

EURODAC

The future of EU border management

Evolution of the regulatory landscape

2025

EES

Electronic record of entry/exits

2026

Eurodac

Expanded scope and data

2026

ETIAS

Pre-travel authorisation for visa-exempt travellers

2028

EU-VAP

Digital platform to apply for visas online

2029

API-PNR

Connecting point for MS and air carriers for API-PNR data

2025-2028

Interoperability

Build bridges between the different systems

2030

proposal

DTA

Application to create and store digital travel credential

EES | ENTRY / EXIT SYSTEM (October 2025)

Record time and place of entry and exit from the Schengen Area by third-country nationals, both visa-exempt and visa-required

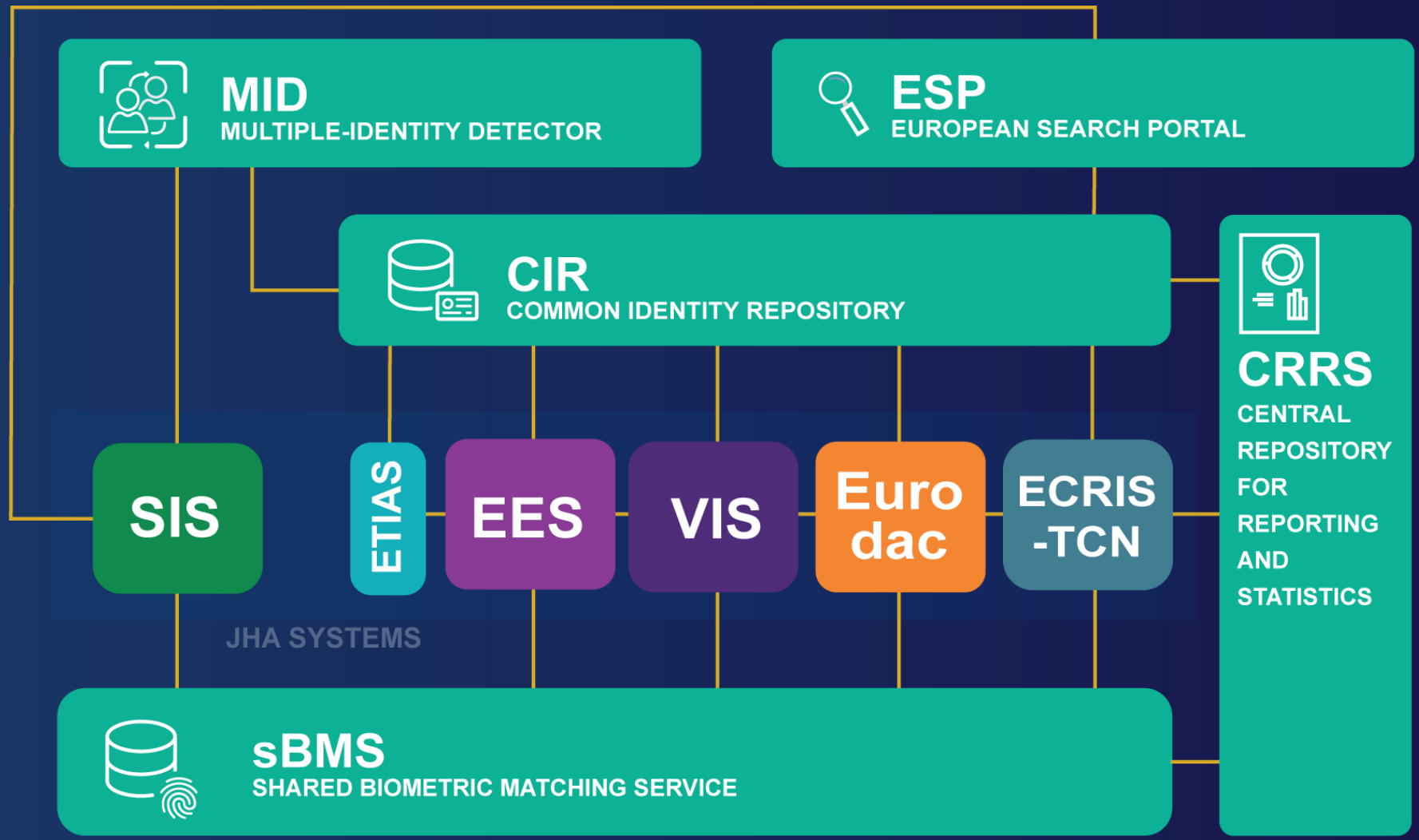
Progressive roll out period until 10 April 2026 (fully operational)

Objectives:

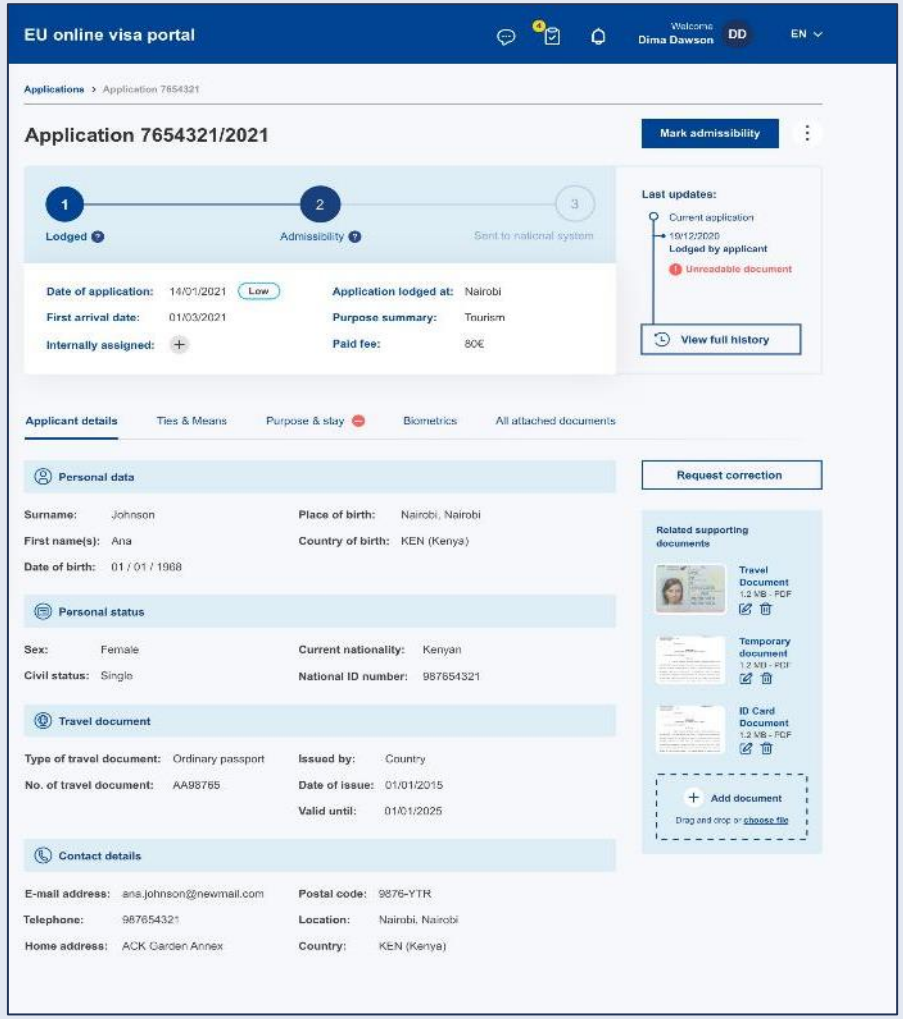
- **Support MS in dealing with increasing flows of travellers**
- **Enhance security in EU border management**
- **Prevent irregular immigration**

	31 Dec 2025	23 Feb 2026
Individual traveller files registered	10.8 million	18.5 million
Entries	10.2 million	18.9 million
Exits	6.6 million	14.1 million
Refused entries	8 180	16 981

ARCHITECTURE AND INTEROPERABILITY COMPONENTS



EU-VAP | EU VISA APPLICATION PLATFORM



- **Fully digitalise Schengen visa procedure by 2028**
- **Online platform for visa application**
- **Replace the visa sticker**
- **42% cost reduction for applicants**

In preparation

2028
Target Entry into Operation

EU DTA | DIGITAL TRAVEL APPLICATION PROPOSAL

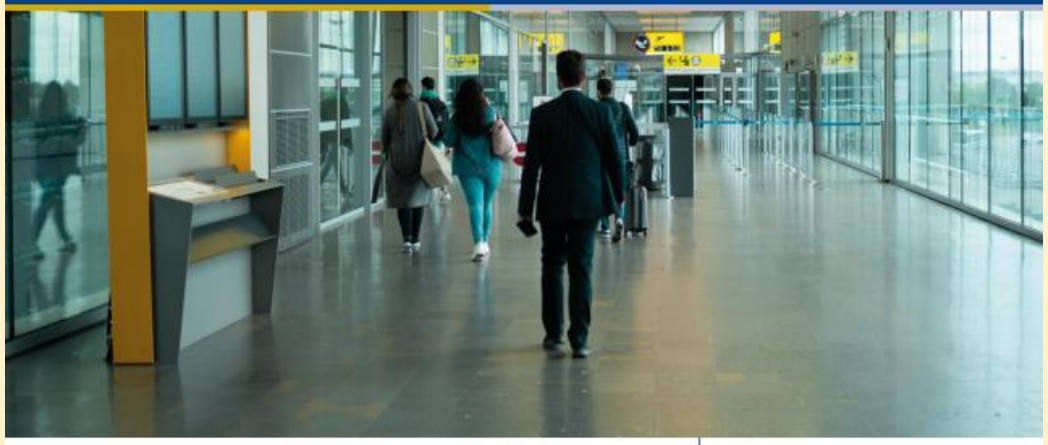
- Digital Travel Application for citizens to create and store their digital travel credential (DTC)
- Faster border check and reduced waiting time
- Increased security – checks done in advance and pre-clearance by border authorities
- Strong encryption mechanisms
- Application and system to be developed and managed by eu-LISA, integrated with other systems

PUBLIC

Enabling Seamless Travel to the European Union

Research Monitoring Report

December 2022

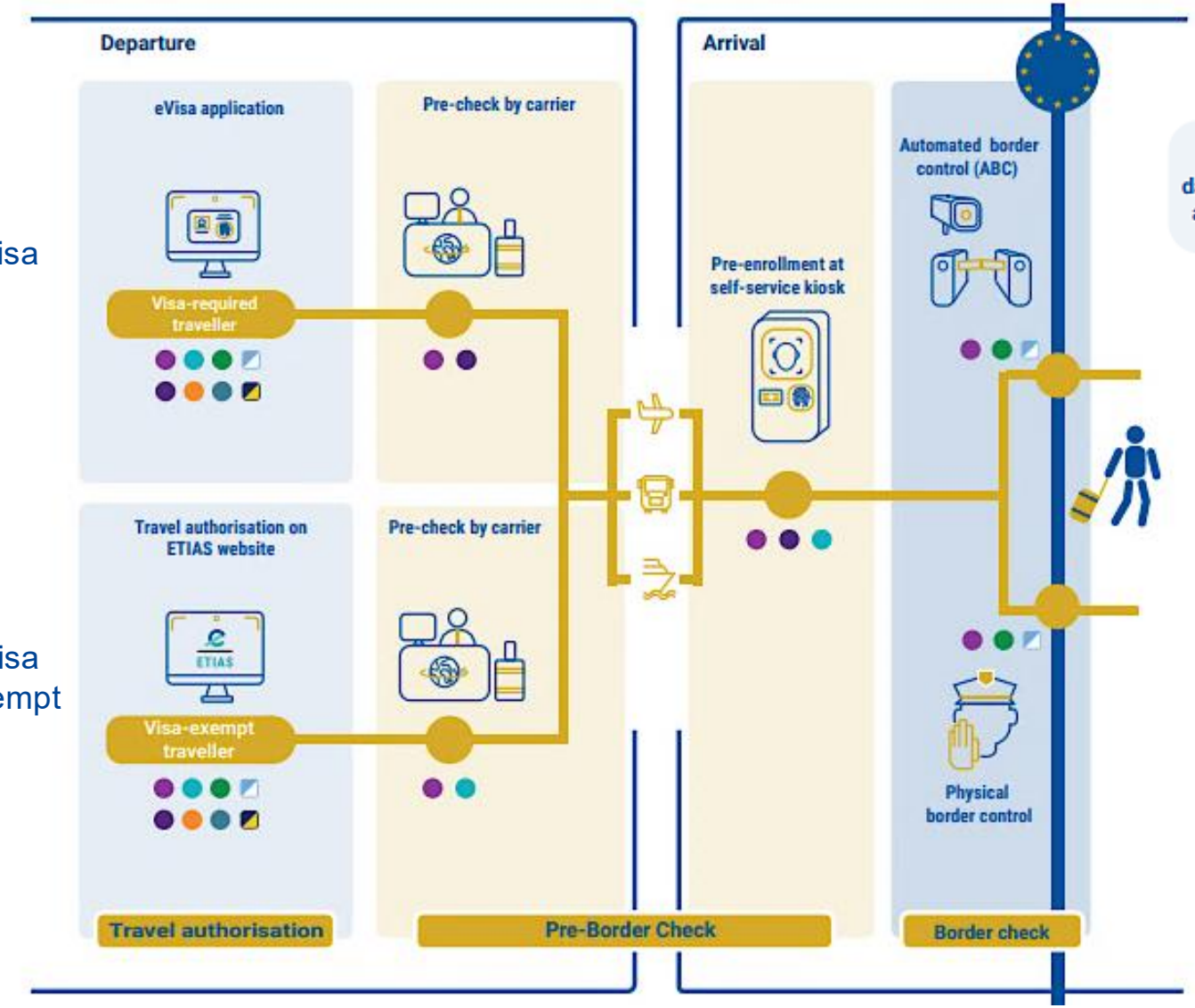


European Union Agency for the Operational Management of Large-Scale IT Systems in the Area of Freedom, Security and Justice

www.eulisa.europa.eu

eu-LISA

The Traveller Continuum



Visa

Visa exempt

Systems and databases checked at different steps

EES ETIAS SIS Interpol databases

VIS Eurodac ECRIS-TCN Europol database

Main Initiatives and technologies to facilitate seamless travel

Digital Visa

The EU is set to fully digitalise the **Schengen visa procedure** by 2025, introducing an online platform for visa applications, and replacing the visa sticker with a digital visa.

ETIAS and EES

The **European Travel Information and Authorisation System (ETIAS)** is a pre-travel authorisation system for visa-exempt third-country nationals planning to travel to the Schengen Area.

The **Entry/Exit System (EES)** will record the time and place of entry and exit from the Schengen Area of all third-country nationals, both visa-required and visa-exempt.

Automated Border Control

Automated border control (ABC) systems, such as e-gates, facilitate travel without undermining the integrity of border checks. Their next evolution – **biometric corridors** – will enable on-the-move verification of travellers.

Carrier Interface

This web interface will **allow international carriers to query the EU's relevant information systems** to make informed decisions prior to boarding, while also reducing uncertainty for travellers.

Digital Travel Credentials

Digital travel credential (DTC) is an **electronic identity document**, which can temporarily or permanently substitute a conventional passport and result in reduced waiting times at border crossing and more efficient traveller processing.

Enrolment of Biometric Data

Recent innovations include **personal/commercial mobile devices** for biometrics enrolment and identity verification, and the implementation of techniques to foil presentation and morphing attacks.

eu-LISA TRAINING ACTIVITIES OVERVIEW

117

TRAINING MATERIAL AVAILABLE ON eu-LISA PLATFORM

22

NEW TRAINING ACTIVITIES DELIVERED IN 2025

HORIZONTAL TRAINING

1 ONLINE COURSE
7 ONLINE MODULES
6 WEBINARS

6 | 14

SIS

11 ONLINE COURSE
10 WEBINARS

5 | 21

VIS

7 ONLINE COURSES
1 ONLINE MODULE
6 WEBINARS

2 | 14

EURODAC

3 ONLINE COURSES
3 WEBINARS

1 | 6

EES

14 ONLINE COURSES
6 ONLINE MODULES
5 WEBINARS

1 | 25

ETIAS

6 ONLINE COURSES
7 WEBINARS

1 | 13

ECRIS

1 ONLINE COURSE
8 WEBINARS

3 | 9

e-CODEX

2 WEBINARS

2 | 2

INTER-OPERABILITY

7 ONLINE COURSES
1 ONLINE MODULE
5 WEBINARS

1 | 13

JITs CP

FIRST WEBINAR PLANNED FOR Q4 2025

The **Training plan** is based on the **training needs analysis** performed in July – October 2024. As per the practice, MS National Contact Points will be asked about **emerging needs** during the year, and if needed, **additional activities will be planned**.

Technologies and challenges

Mapping of technologies relevant for the Agency

eu-LISA

IDENTITY MANAGEMENT

- Digital identity (DTC)
- Identity fraud
- Biometrics in identity management

ARTIFICIAL INTELLIGENCE

- AI in IT operations
- Natural language proc.
- AI in risk assessment

BIOMETRICS

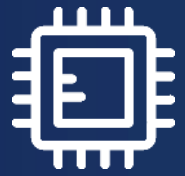
- Biometric data quality
- Performance of biometric recognition systems

COMPUTING INFRASTRUCTURE

- Cloud technologies
- EU Security data space for innovation

CYBERSECURITY / INFORMATION SECURITY

- AI in cyber security
- Encryption



SOFTWARE ENGINEERING

- Agile, DevSecOp
- Software factory
- Blockchain

Artificial intelligence

Usages in eu-LISA

Shared Biometric Matching Service

- Increased accuracy
- Faster matching

ETIAS and VISA chatbots

- Gen AI to reply to general questions
- Alleviate work of consular posts
- Reduce cost & focus on tasks of higher value
- Available 24/7

CRRS

- Analyse huge amount of data
- Make sense of undetected trends

Support to operations

- Enhanced cybersecurity
- Support service desk
- Review of coding

Support to administration

- Optimisation of tasks
- Efficiency gains

Biometrics

Benefits of biometrics

For travellers coming to Schengen

- Faster and more seamless border crossing

For Member States and citizens

- Increase internal security (identity frauds, illegal migrations, serious crime and terrorism)

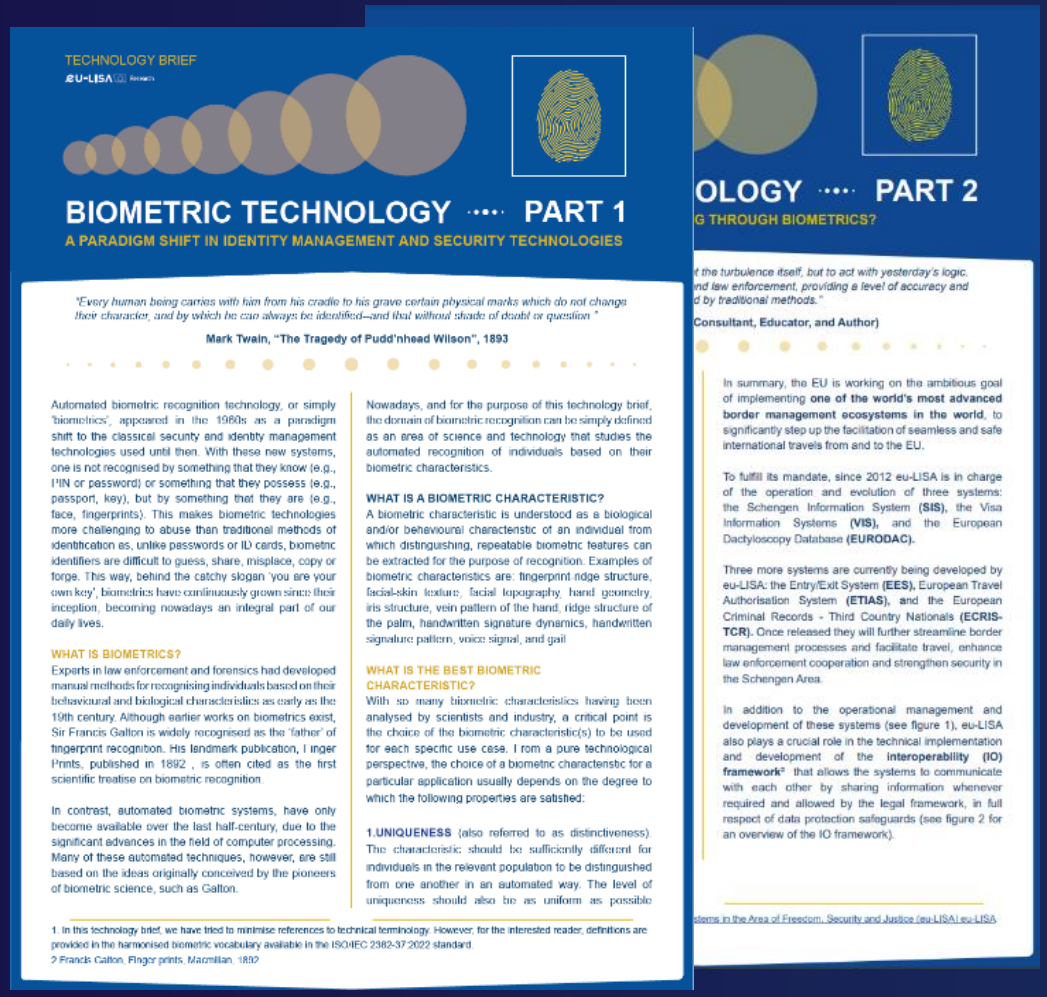
For border guards and law enforcement

- Streamline and speed up verification to focus on most critical tasks and risk analysis

Challenges

- Quality of the biometric data
- Performance at scale
- Accuracy across different populations (avoid bias)
- Robustness against attacks
- Transparency & explainability
- Training for users

eu-LISA reports on biometrics and identity management


TECHNOLOGY BRIEF

eu-LISA Research

BIOMETRIC TECHNOLOGY ····· PART 1

A PARADIGM SHIFT IN IDENTITY MANAGEMENT AND SECURITY TECHNOLOGIES

"Every human being carries with him from his cradle to his grave certain physical marks which do not change their character, and by which he can always be identified—and that without shade of doubt or question."

Mark Twain, "The Tragedy of Pudd'nhead Wilson", 1893

Automated biometric recognition technology, or simply 'biometrics', appeared in the 1960s as a paradigm shift to the classical security and identity management technologies used until then. With these new systems, one is not recognised by something that they know (e.g., PIN or password) or something that they possess (e.g., passport, key), but by something that they are (e.g., face, fingerprints). This makes biometric technologies more challenging to abuse than traditional methods of identification as, unlike passwords or ID cards, biometric identifiers are difficult to guess, share, misplace, copy or forge. This way, behind the catchy slogan 'you are your own key', biometrics have continuously grown since their inception, becoming nowadays an integral part of our daily lives.

WHAT IS BIOMETRICS?

Experts in law enforcement and forensics had developed manual methods for recognising individuals based on their behavioural and biological characteristics as early as the 19th century. Although earlier works on biometrics exist, Sir Francis Galton is widely recognised as the 'father' of fingerprint recognition. His landmark publication, Finger Prints, published in 1892 , is often cited as the first scientific treatise on biometric recognition.

In contrast, automated biometric systems, have only become available over the last half-century, due to the significant advances in the field of computer processing. Many of these automated techniques, however, are still based on the ideas originally conceived by the pioneers of biometric science, such as Galton.

Nowadays, and for the purpose of this technology brief, the domain of biometric recognition can be simply defined as an area of science and technology that studies the automated recognition of individuals based on their biometric characteristics.

WHAT IS A BIOMETRIC CHARACTERISTIC?

A biometric characteristic is understood as a biological and/or behavioural characteristic of an individual from which distinguishing, repeatable biometric features can be extracted for the purpose of recognition. Examples of biometric characteristics are: fingerprint ridge structure, facial-skin texture, facial topography, hand geometry, iris structure, vein pattern of the hand, ridge structure of the palm, handwritten signature dynamics, handwritten signature pattern, voice signal, and gait

WHAT IS THE BEST BIOMETRIC CHARACTERISTIC?

With so many biometric characteristics having been analysed by scientists and industry, a critical point is the choice of the biometric characteristic(s) to be used for each specific use case. From a pure technological perspective, the choice of a biometric characteristic for a particular application usually depends on the degree to which the following properties are satisfied:

1.UNIQUENESS (also referred to as distinctiveness). The characteristic should be sufficiently different for individuals in the relevant population to be distinguished from one another in an automated way. The level of uniqueness should also be as uniform as possible

1. In this technology brief, we have tried to minimise references to technical terminology. However, for the interested reader, definitions are provided in the harmonised biometric vocabulary available in the ISO/IEC 2382-37:2022 standard.

2 Francis Galton, Finger prints, Macmillan, 1892

OLOGY ····· PART 2

G THROUGH BIOMETRICS?

t the turbulence itself, but to act with yesterday's logic. nd law enforcement, providing a level of accuracy and d by traditional methods."

Consultant, Educator, and Author)

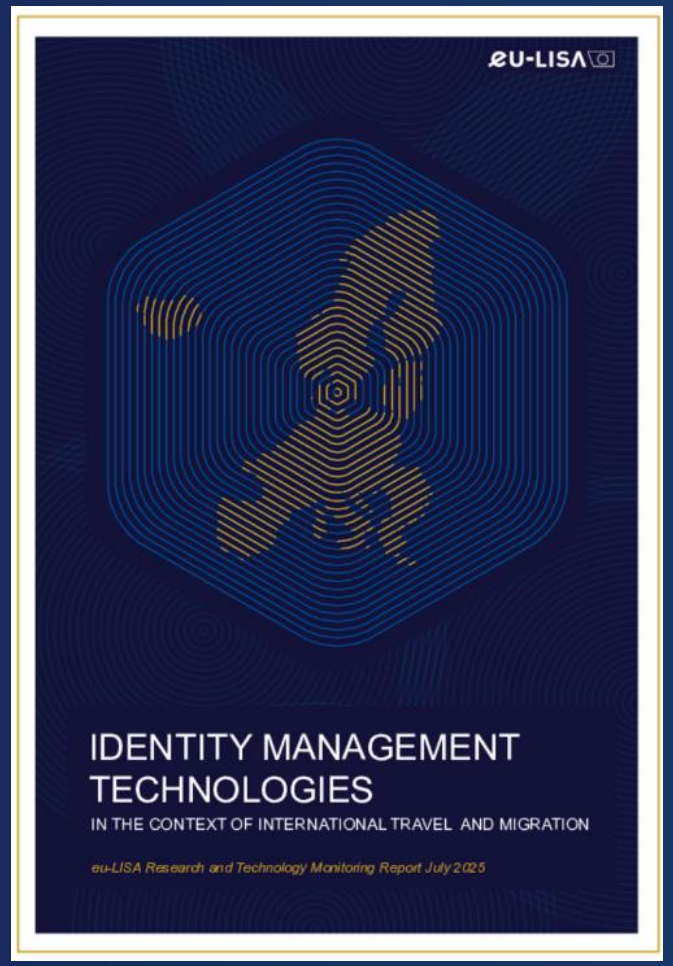
In summary, the EU is working on the ambitious goal of implementing **one of the world's most advanced border management ecosystems in the world**, to significantly step up the facilitation of seamless and safe international travels from and to the EU.

To fulfil 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)**, and 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).

stems in the Area of Freedom, Security and Justice (eu-LISA) eu-LISA



EU INNOVATION HUB

HUB CLUSTERS

- Foresight and Key Enabling Technologies
- Artificial Intelligence
- Biometric Recognition Systems: data quality, evaluation and standardisation
- Encryption
- Unmanned Aerial Systems

EU INNOVATION HUB

EU INNOVATION HUB FOR INTERNAL SECURITY

Policy Brief

Independent evaluation of biometric recognition technology in the EU: state of play and future options

Table of Contents

Considerations for innovation in border management

Operational reliability & resilience

- EU border systems are mission critical
- Availability, performance, business continuity are key
- Cybersecurity and resilience: not optional

Human factor

- High impact for individuals
- Privacy, proportionality, accountability by design
- Public trust is a public asset that need to be protected
- Contribute to efficient borders that remain human and lawful

Key priorities for digital innovation in border management

Interoperability

Trustworthy AI

Data quality
across systems

Invest in skills

Cyber-resilience

Cloud readiness

Thank you!

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