Hexagonal Architecture & UMF$^3$
For Interoperability

WCC presentation
9 October 2019
HEXAGONAL ARCHITECTURE & UMF³ FOR INTEROPERABILITY

Agenda

1. POLE: Landscape, Example, Challenges
2. POLE and UMF³
3. Hexagonal Architecture for Interoperability
4. Implementation & Transition
5. Single Search Interface for Member States
THE POLE LANDSCAPE
PERSONS, OBJECTS, LOCATIONS, EVENTS

AIRPORT
- Semi-public
- Passport system
- API/PNR system
- Visa system
- Residency system
- Video analytics
- Surveillance face recognition

LAW ENFORCEMENT
- Criminal AFIS
- Forensic face recognition
- License plate recognition
- DNA

EUROPEAN SYSTEMS
- EU-VIS
- SISII
- EURODAC
- EES
- ECRIS-TCN
- ETIAS

BANK
- Private
- Civil ID system
- Driver’s license system
- Video analytics
- Surveillance face recognition

STADIUM
- Semi-public
- Video analytics
- Surveillance face recognition

STATION
- Public
- Video analytics
- Surveillance face recognition

CITIZENS

TCNs (VISITORS)

TCNs (RESIDENTS)

ASYLUM SEEKERS

CITIZENS

EUROPEAN SYSTEMS

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STADIUM INCIDENT
VICTIM (CURRENT SITUATION)

Reported homicide during football match in Helsinki

Victim: non-live fingerprint

Criminal AFIS
EU-VIS AFIS
Residents System

No Hits
Hit
No Hits

No Hits

Forensic Face Recognition

Biographics
Ramses el Masry
5/4/1985
Male
Egyptian
Short Stay Visa

Biographics
Vananta Airport
Entry: 18/12/2018
23 kg bag
Tel: +201066112
E-mail: rmasry@t.eg
STADIUM INCIDENT
SUSPECT (CURRENT SITUATION)

Suspect fled, knife found

Latent fingerprint extraction & enhancement

Fingerprint expert

Candidate list

Criminal AFIS

No Hits

EU-VIS AFIS

No Hits

SISII AFIS

Hit

Residents System

Biographies
Sergei Ivanov
12/10/1975
Male
Moscow
Resident

Biographies
No Hits

API / PNR

Hit

Vehicles

No Hits

Biographies
Sergei Ivanov
12/10/1975
Jeep
A6
Red
Helsinki
LDZ-562

Biographies
No Hits

Hit

Forensic Face Recognition

Hit

Ivanov Sergei
10/12/1975
Male
Drug Smuggler
Free: 1/11/2018

Biographies
No Hits

API / PNR

No Hits
STADIUM INCIDENT
CHALLENGES

• Many systems to be queried separately, consuming time
• Databases process personal & sensitive data, restricting access
• Databases and interfaces were developed by different vendors, creating compatibility issues
• Different types of data: biometric, biographic, and metadata, cannot be covered in a single query
• Different encounters of the same person are not linked, causing officers to miss connections
• Surveillance cameras create huge amounts of metadata, making searching difficult
ACHIEVING INTEROPERABILITY
WHY HEXAGONAL ARCHITECTURE?

• Separating applications, business domain, and infrastructure (e.g. databases)

• Dependencies move from applications and infrastructure to the business domain

• Each of the applications, infrastructure, and the business domain can be independently modified

• The architecture is data-agnostic

• The architecture is vendor-agnostic

• Hexagonal architecture can achieve interoperability and a Single Search Interface
HEXAGONAL ARCHITECTURE & UMF³
FOR INTEROPERABILITY

- UMF e.g. fingerprint
- Interface
  - port
  - adapter
- NoSQL databases (big data)
- Business Domain
  - UMF fingerprint
    - #562 Filan Filany
    - #352 Amr el Rahwan
    - #718 Filany Filan
- APIs
  - e.g. biometric vendors, API / PNR
- Matching Platform
  - e.g. WCC ELISE
- NIST conversion
- NFIQ 2.0 quality check
  - #562 Filan Filany
  - #352 Amr el Rahwan
  - #718 Filany Filan
ELISE ID PLATFORM
BIOMETRICS (VENDOR INDEPENDENT)

ELISE ID Platform

Standard Interface

Biometric Image

Enrollment Server

Biometric Template

ELISE Store

Biographic
Face Vendor 1
Face Vendor N
Finger Vendor 1
Finger Vendor N
Iris Vendor 1
Iris Vendor N
Voice Vendor 1
Voice Vendor N
HEXAGONAL ARCHITECTURE IMPLEMENTATION
AS-IS ARCHITECTURE

Interface

Business Domain

APIs:
EURODAC
SISII
EU VIS
EES
ECRIS

Queries
1:1 or 1:N

port
adapter
HEXAGONAL ARCHITECTURE IMPLEMENTATION
INTEGRATION ARCHITECTURE

- Interface
- API:
  - Business Domain
    - Queries: 1:1 or 1:N

APIS:
- EURODAC
- SISII
- EU VIS
- EES
- ECRIS

Port
Adapter
HEXAGONAL ARCHITECTURE IMPLEMENTATION
UNIFICATION ARCHITECTURE

Interface

NoSQL databases (big data)

Business Domain
Queries 1:1 or 1:N
Enrolment
Access Rules
MID

APIs
e.g. biometric vendors, API / PNR

Matching Platform
e.g. WCC ELISE

NIST conversion
NIFIQ 2.0 quality check

port
adapter

SISII EUVIS EURO DAC EES ETIAS ECRIS CIR
HEXAGONAL ARCHITECTURE – MEMBER STATES
SSI & INTEROPERABILITY

European Interface

NoSQL databases (big data)

Business Domain
EU

APIs

e.g. biometric vendors, API / PNR

Matching Platform

e.g. WCC ELISE

NIST conversion

NIFIQ 2.0 quality check

Business Domain
Member State

APIs:

AFIS
Face Rec.
DNA
API / PNR

Single Search Interface

DBs:

Vehicle Reg.
Criminal Rec.
Case Mngt.
Passports
Civil ID

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