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Biometric System Enabler – The BioAPI Middleware

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Questions planned to be answered

- What is the BioAPI middleware?
- Why should BioAPI be used?
- How can BioAPI be used?
- Where is BioAPI already in use?
- How will BioAPI advance in the future?

Current situation on the market

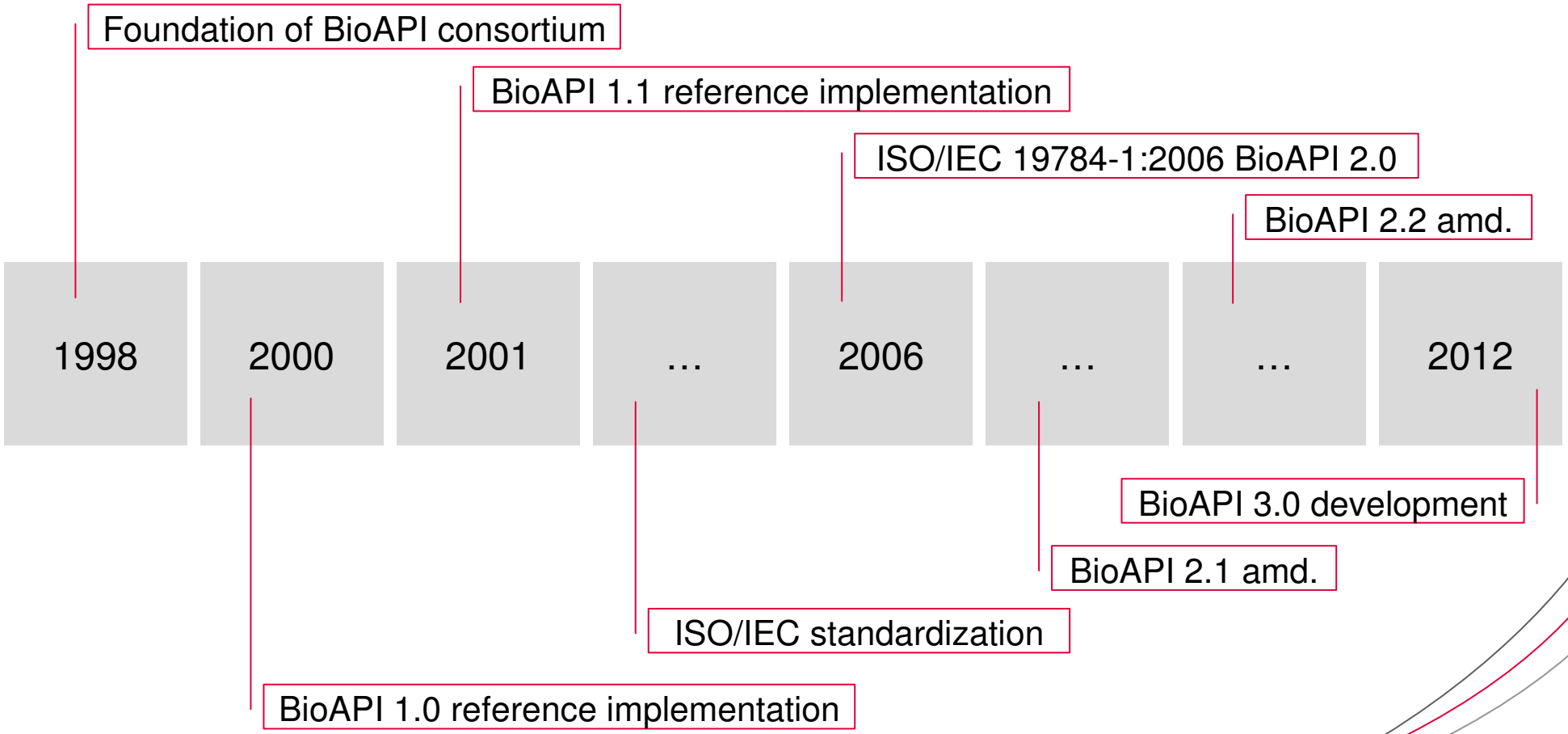
- Increasing market for biometrics, especially motivated by
  - Legal requirements (e.g. ePassports, EU-VIS)
  - Increase of security and/or convenience

- Complex system architectures
  - Proprietary, monolithic solutions
  - Missing transparency and exchangeability

- Interoperability required
  - Dynamic market (vendors, products)
  - Short production cycles due to fast research progress and performance increase
  - New approaches and technologies

- **Standards are needed ➔ BioAPI**
  - **Platform-, device- and vendor-independent provision of biometric functionality**

BioAPI history



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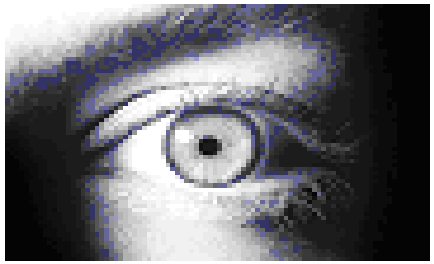
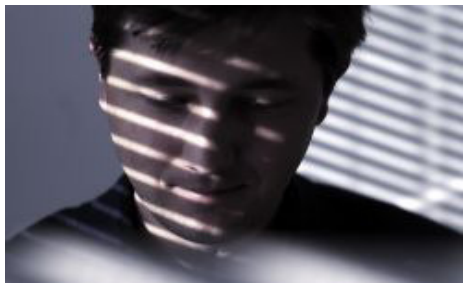
Basic principles of BioAPI 2.0

- Specification of overall architecture of biometric systems
  - High-level C programming interfaces
  - Modular design for biometric components
- Connectivity to
  - Biometric hardware (sensors, devices, …)
  - Biometric software (algorithms for template generation and comparison)
  - Reference systems (databases, smartcards, …)
- Applicable for all biometric modalities





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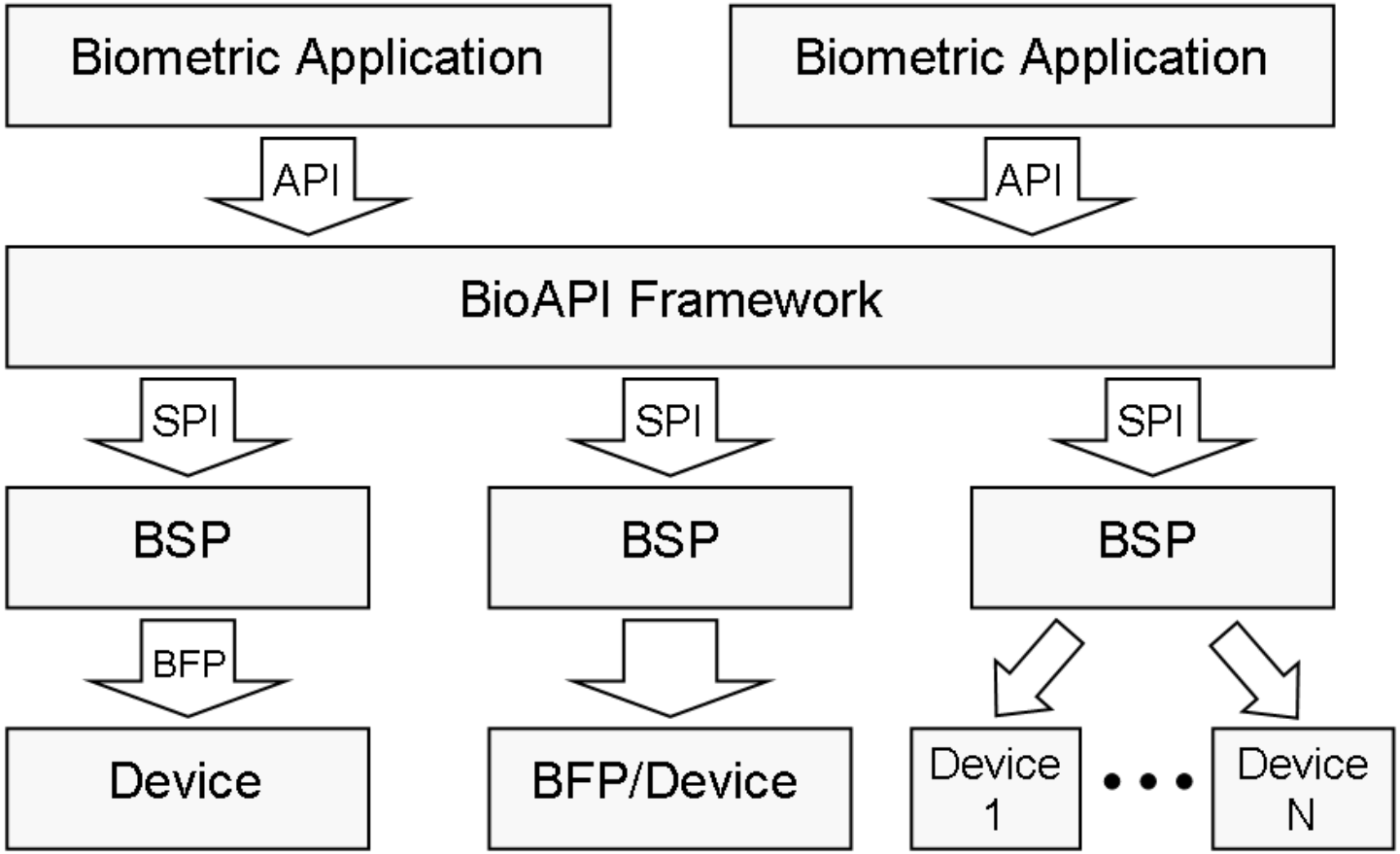
BioAPI 2.0 architecture



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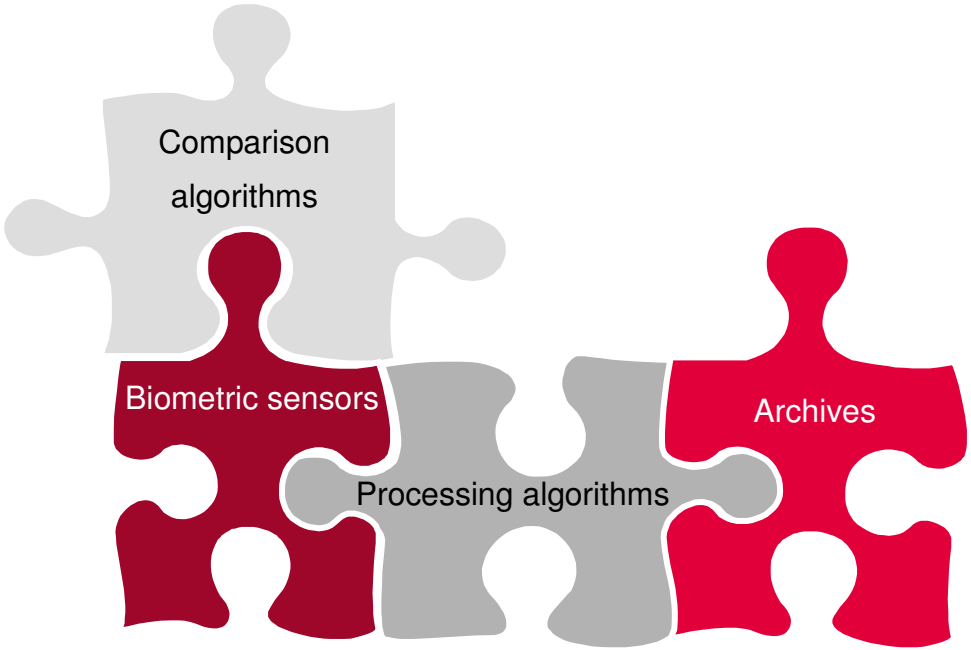
Biometric Service Provider

- Modular encapsulation of biometric functionality
  - Capture BSP
    Acquisition of biometric raw data by accessing biometric devices (e.g. fingerprint sensor, iris camera)
  - Verification Engine / BSP
    Template extraction and biometric 1:1 comparison
  - Identification Engine / BSP
    Template extraction and biometric 1:N comparison
- Management of BSPs done by BioAPI Framework
  - Component registry manages modules
  - Dynamic loading of BSPs via Framework

High flexibility through modules

- Easy exchange of BSPs which contain biometric basic functionality
  - Change of BSP while application is running
  - Biometric functionality is transparent to the application
    e.g. same GUI for different technologies
  - Multiple BSPs can be used for the same task
    e.g. acquisition of fingerprints and facial image for ePassport production
  - Free combination of BSPs
    e.g. acquisition using device of vendor X and biometric comparison using algorithm of vendor Y



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Code example: Enrollment and 1:1 verification I

- **Initialization of framework**
  `BioAPI_Init()`

Acquisition process using Capture BSP

- **Loading of BSP**
  `BioAPI_BSPLoad(CaptureBSP_Vendor_X)`
- **Attaching of sensor unit**
  `BioAPI_BSPAttach(CaptureBSP_Vendor_X, SensorUnit_1)`
- **Acquisition of reference fingerprint image**

```
BioAPI_Capture(Purpose_Enroll, Right_Indexfinger, WSQ,
      CapturedReferenceFpData)
```

- **Acquisition of probe fingerprint image**

```
BioAPI_Capture(Purpose_Verify, Right_Indexfinger, WSQ,
      CapturedProbeFpData)
```

- **Detaching of BSP**
  `BioAPI_BSPDetach(CaptureBSP_Vendor_X)`
- **Unloading of BSP**
  `BioAPI_BSPUnload(CaptureBSP_Vendor_X)`

Code example: Enrollment and 1:1 verification II

Processing and verification using Verification Engine BSP

- **Loading of BSP**
  ```
  BioAPI_BSPLoad(VerificationEngineBSP_Vendor_Y)
  ```
- **Attaching of processing and matching unit**
  ```
  BioAPI_BSPAttach(VerificationEngineBSP_Vendor_Y,
       ProcessingUnit_1, MatchingUnit_1)
  ```
- **Reference fingerprint template creation**
  ```
  BioAPI_CreateTemplate(CapturedReferenceFpData, ISO19794-2,
       FpTemplate)
  ```
- **Probe fingerprint processing**
  ```
  BioAPI_Process(CapturedProbeFpData, ISO19794-2, FpProcessed)
  ```
- **1:1 verification**
  ```
  BioAPI_VerifyMatch(FpTemplate, FpProcessed, Threshold, Result, Score)
  ```
- **Detaching of BSP**
  ```
  BioAPI_BSPDetach(VerificationEngineBSP_Vendor_Y)
  ```
- **Unloading of BSP**
  ```
  BioAPI_BSPUnload(VerificationEngineBSP_Vendor_Y)
  ```
- **Termination of framework**
  ```
  BioAPI_Terminate()
  ```

What BioAPI 2.0 does not offer …

- Functions for quality assurance
  - Very important for enrollment
- Support for multi-biometrics
  - Support of several modalities
  - But no support of biometric fusion
- Integration into distributed systems
  - Service oriented architectures (SOA)
- Applications are not technology-independent

➔ **Solution:** secunet(biomiddle

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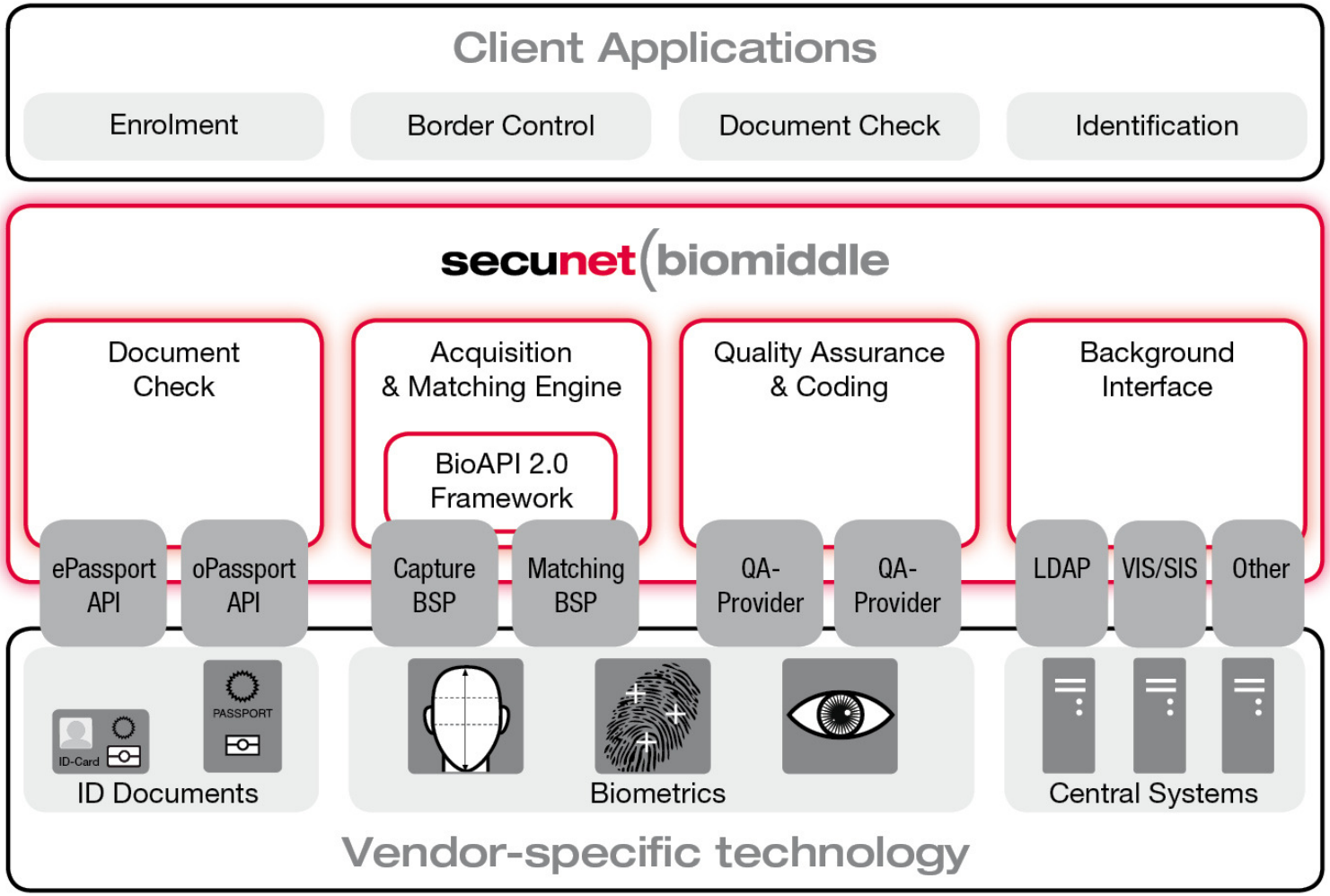

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Operational examples of BioAPI 2.0 usage I

project example

- EasyPASS: Self-service border control at Frankfurt airport
  - 4 eGates with face recognition
  - Evaluation phase
    - 3 different vendors for face recognition used
    - Same application, only exchange of Verification Engine BSPs

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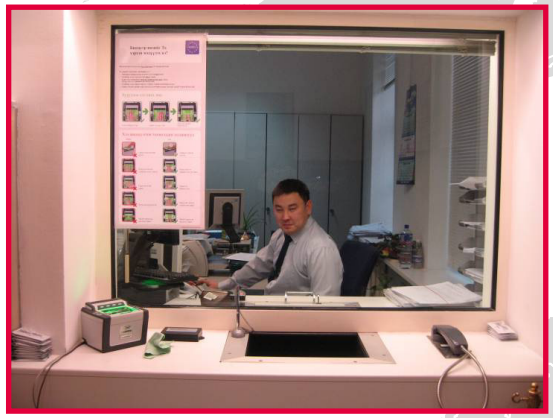
Operational examples of BioAPI 2.0 usage II

project example

- Visa application and border control in Germany and Austria
  - Acquisition of data for enrollment and verifications/searches against EU-VIS
  - Usage of different Capture BSPs for acquisition



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What BioAPI 3.0 (and related standards) will offer …

What BioAPI 2.0 does not offer …

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  - Very important for enrollment
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  - Support of several modalities
  - But no support of biometric fusion
- Integration into distributed systems
  - Service oriented architectures (SOA)

- Support for quality assurance
  - BioAPI_CheckQuality
- Support for multi-biometric fusion
  - BioAPI_Fuse
  - BioAPI_Decide
- Support for BioAPI Interworking Protocol (BIP)
  - ISO/IEC 24708:2008

- Further features of BioAPI 3.0
  - Suspicious Presentation Detection (a.k.a. Liveness Detection, Artefact Detection, …)
  - Logging
  - Configuration of BSPs

- ISO/IEC WD 30106: BioAPI for object oriented programming languages
  - Part 1: Architecture
  - Part 2: Java implementation
  - Part 3: C# implementation

Questions (hopefully) answered

What is the BioAPI middleware?	Standardized interface for device- and vendor-independent provision of biometric functionality
Why should BioAPI be used?	Avoid vendor lock-in, high flexibility through modular design, lower maintenance
How can BioAPI be used?	Easy development of BioAPI applications, Framework implementations available
Where is BioAPI already in use?	Self-service eGates at Frankfurt airport, MoI and MoFA Austria, MoFA and Federal Police Germany
How will BioAPI advance in the future?	BioAPI 3.0 development in progress, Further functionality will be added

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Thank you!

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