COMMON CRITERIA AND BIOMETRIC PERFORMANCE TESTING

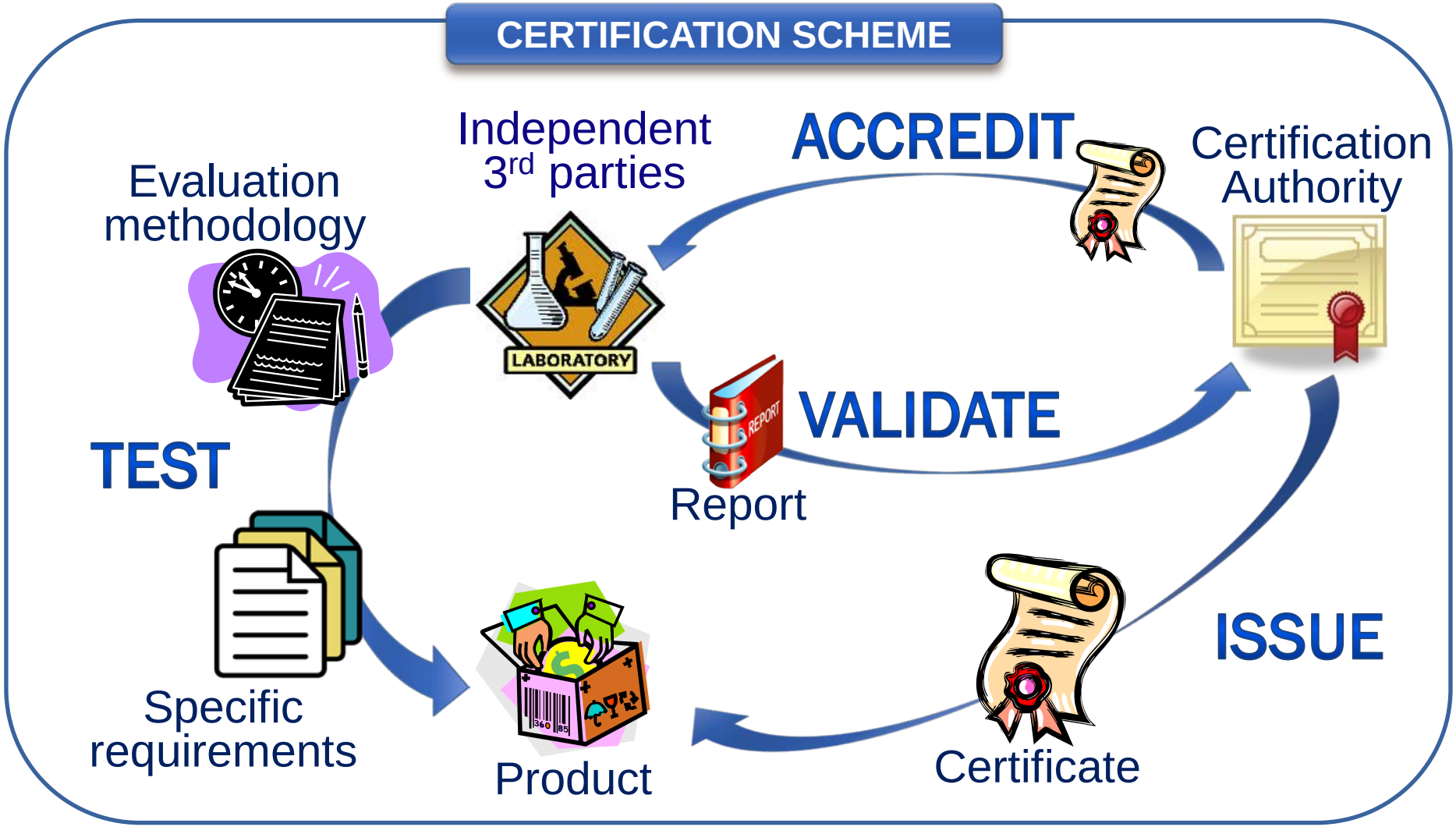
Belen Fernandez-Saavedra, Raul Sanchez-Reillo,
Judith Liu-Jimenez, Inmaculada Tomeo-Reyes

iDTestingLab – CARLOS III UNIVERSITY OF MADRID

OUTLINE

- General evaluation process
- Biometric system evaluation process
  - Approaches for testing biometric systems
- Common Criteria & CEM
- Specific guidelines
  - Interpretation of a general biometric schema
  - CC testing activities involved in biometric performance testing
- Conclusions

GENERAL EVALUATION PROCESS



BIOMETRIC SYSTEMS EVALUATION PROCESS

- A global certification scheme does not exist yet
  - First step towards a global scheme: NVLAP in US
- Importance of testing biometric systems
  - Biometric systems are conceived for:
    - Operating at critical scenarios: border control, banking, …
    - Handle sensitive information
- Two approaches for testing biometric systems

1ST APPROACH

- According to national or international standards
  - ISO/IEC JTC1
    - SC37: Biometric standards
      - ISO/IEC 19795 Biometric performance testing and reporting
    - SC27: Security standards
      - ISO/IEC 19792 Security evaluation for biometrics

- Disadvantages
  - Only specific requirements which are included in the standard are assessed

2ND APPROACH

- According to other certification schemes
  - Common Criteria for Information Technology Security Evaluation (CC)
    - Certificates internationally recognized
    - Overall evaluation process
    - Common Evaluation Methodology (CEM)
- Disadvantages
  - General evaluation framework and testing methodology
    - Not totally adapted to biometric products

COMMON CRITERIA & CEM

- More exhaustive evaluation: 2nd approach
- Specific guidelines for biometric systems are necessary
  - This problem is not recent:
    - 2001: Biometric Technology Security Evaluation under CC (BTSE)
    - 2002: Biometric Evaluation Methodology Supplement (BEM)
    - 2009: ISO/IEC 19792
  - BTSE and BEM documents need to be:
    - Updated to the current version of CC
    - Expanded for covering ISO/IEC 19795 requirements
  - ISO/IEC 19792:
    - Does not provide a fully detailed methodology (Requirements of ISO/IEC 19795-2 are not addressed)
    - Does not provide a relation between the defined requirements and CEM

NEW GUIDELINES

- New guidelines for applying CC to biometric products
  - Based on previous works: BTSE, BEM and ISO/IEC 19792
  - Consider current versions of CC and ISO/IEC 19795
  - Provide a relation between additional biometric testing requirements and CEM working units
  - Only cover biometric performance testing and the analysis of those threats that are counteracted by it (i.e. impersonation and disguise)
    - For covering the analysis of the rest of vulnerabilities it is necessary a formal methodology which has not been specified yet

- Contents
  - Interpretation of a general biometric system
    - Functional specification
    - TOE Design
  - CC testing activities involved in biometric performance testing
    - Guidance documents (AGD)
    - Tests (ATE)

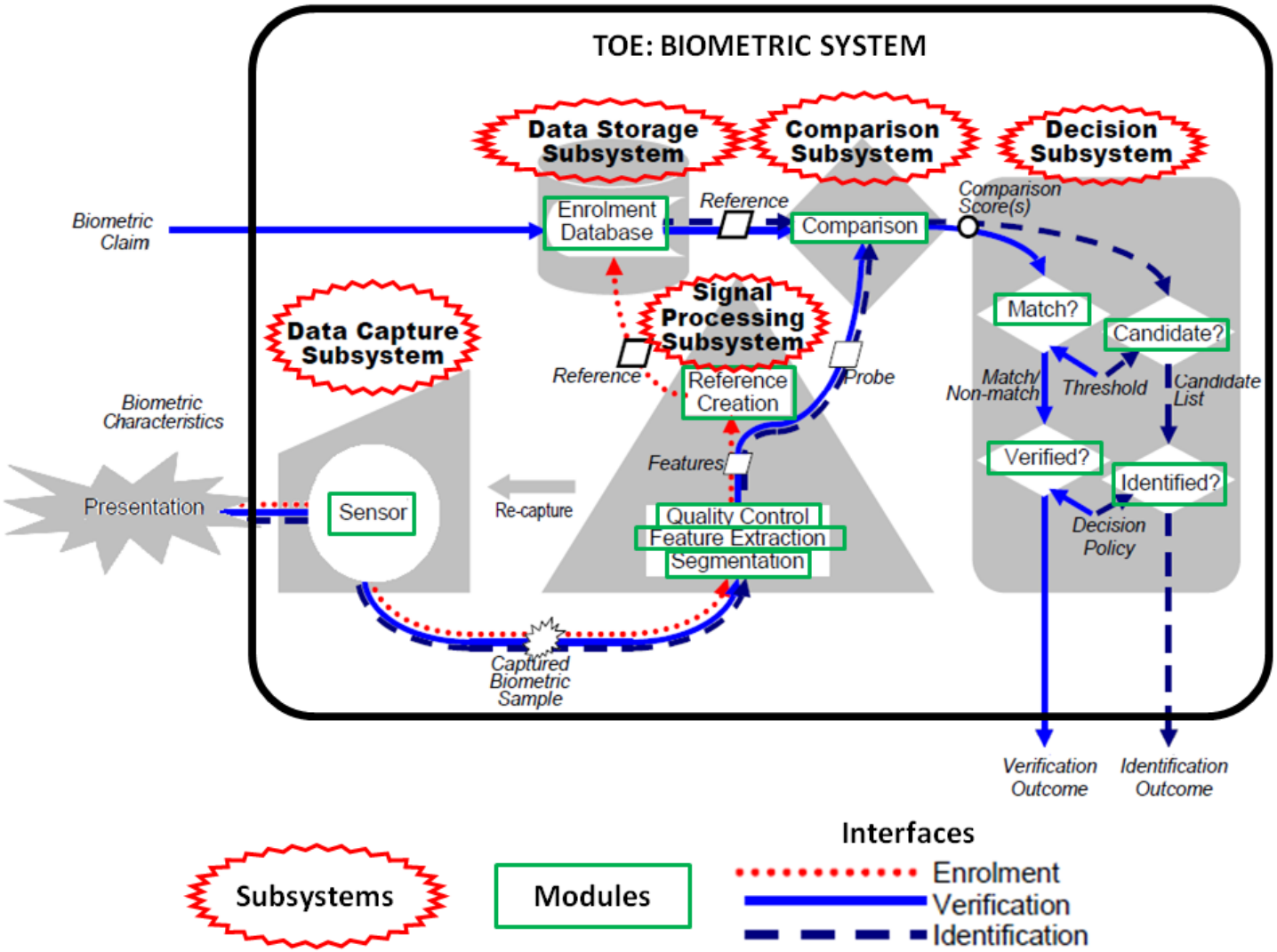
INTERPRETATION OF A GENERAL BIOMETRIC SYSTEM

- Interpretation of a general biometric schema from a CC point of view
  - TOE (Target of evaluation)
    - General biometric system established by ISO/IEC SC37 in the Standing Document SD11
  - Security objectives:
    - Authenticate/Identify users correctly
    - Fulfil specific error rates
  - TSF (TOE Security Functionality)
    - Combination of hardware and software that are involved in the enrolment and verification/identification functions

FUNTIONAL SPECIFICATION: TSFIs

- Physical Interfaces:
  - TSFI. Biometric_characteristic: obtains a signal that contains the biometric characteristic of the user
- Logical Interfaces:
  - TSFI.Enrol: invokes the enrol function
  - TSFI.Verify / TSFI.Identify: invokes the verification/identification function
  - TSFI.Configure: invokes the configuration function

TOE DESIGN


TOE: BIOMETRIC SYSTEM
Data Storage Subsystem
Comparison Subsystem
Decision Subsystem
Biometric Claim
Enrolment Database
Reference
Comparison
Comparison Score(s)
Data Capture Subsystem
Signal Processing Subsystem
Reference
Reference Creation
Probe
Match?
Candidate?
Match/ Non-match
Threshold
Candidate List
Biometric Characteristics
Features
Verified?
Identified?
Presentation
Sensor
Re-capture
Quality Control
Feature Extraction
Segmentation
Decision Policy
Captured Biometric Sample
Verification Outcome
Identification Outcome
Subsystems
Modules
Interfaces
Enrolment
Verification
Identification

CC TESTING ACTIVITIES

- AGD: Guidance Documents
  - AGD_PRE: Preparative procedures
  - AGD_OPE: Operational user guidance
- ATE: Tests
  - ATE_COV: Coverage
  - ATE_DPT: Depth
  - ATE_FUN: Functional tests
  - ATE_IND: Independent testing

AGD_PRE: PREPARATIVE PROCEDURES

- BTSE, BEM and ISO/IEC 19792
  - Include information about the influence of the environmental factors and the ways to minimize it
- New guidelines to AGD_PRE.1-2 should also address the inclusion of the following information:
  - Description of biometric system location
    - Height and orientation
    - Considering multiple locations: wall, turnstile, etc. (if necessary)
  - Description of user's interactions
    - Specific workspace
  - Description of certain functions to adjust biometric capture sensor to the existing environmental factors
    - E.g.: function to calibrate the illumination level

AGD_OPE: OPERATIONAL USER GUIDANCE (I)

- Two roles: Administrator and user
- User guides:
  - BTSE, BEM and ISO/IEC 19792
    - Include guidance on the capture and enrolment processes and aspects such as privacy
  - New guidelines should also address the inclusion of the following information:
    - Physical interface
      - Influential factors at the capture process such as physical elements, behavioural aspects, etc. (AGD_OPE.1-2, 1-3 and 1-6)
      - Feedback to users (AGD_OPE.1-2 and 1-4)
      - Template adaptation (AGD_OPE.1-4)
    - Logical interfaces
      - Instructions to use the interfaces (AGD_OPE.1-1 and 1-2)
      - Number of attempts, time limit, feedback (AGD_OPE.1-3 and 1-4)
      - Enrolment process: Personal data and their handling (AGD_OPE.1-6)

AGD_OPE: OPERATIONAL USER GUIDANCE (II)

- Administrator guides:
  - BTSE, BEM and ISO/IEC 19792
    - Include information about the environmental controls
    - Address considerations of decision thresholds
    - Consider user behaviour and the need for users to be monitored or supervised
  - New guidelines should address the inclusion of similar information to user guides in addition to the following information:
    - Physical interface
      - Procedures for training users to present their biometric characteristics (AGD_OPE.1-2)
      - Quality requirements to determine correct/incorrect presentations (AGD_OPE.1-3)
    - Logical interfaces
      - TSFI.Enrol:
        - Quality requirements to accept/reject acquired samples, if this decision is not automatically made (AGD_OPE.1-3)
        - How to manage personal and biometric data (AGD_OPE.1-6)
      - TSFI.Verify/TSFI.Identify:
        - Procedures for training users to use these functions (AGD_OPE.1-2)
      - TSFI.Configure:
        - How to manage security settings such as quality thresholds, maximum number of attempts, etc., considering also different operation modes (AGD_OPE.1-3 and 1-5)

ATE_COV: COVERAGE

- ISO/IEC 19792
  - Appropriate testing methodology ISO/IEC 19795 - 1
- New guidelines should also address the following:
  - Testing TSFIs previously mentioned (ATE_COV.2-1)
  - Testing several TSFIs at the same time (ATE_COV.2-2)
    - Technology evaluations: TOE does not include the capture sensor
    - Scenario evaluation: TOE includes the capture sensor
  - Testing procedures: test pre-requisites, test steps and expected results (ATE_COV.1-3)
    - Data size or test crew size and user characteristics
    - Environment similar to the operational environment
    - Genuine and impostor attempts for testing TSFI.Verify and TSFI.Identify
    - Testing order: e.g. TFSI.Enrol before TSFI.Verify/TSFI.Identify
    - and all requirements specified at ISO/IEC 19795 Part 1 and Part 2

ATE_DPT: DEPTH

- Highly dependent of the TOE design and its architecture
- Additional guidelines should address that:
  - Technology evaluations are appropriate to analyse all the subsequent parts of a biometric system after the human-sensor interface (ISO/IEC 19795-2)

ATE_FUN: FUNCTIONAL TEST

- BTSE, BEM and ISO/IEC 19792
  - Carry out performance testing and obtain FNMR and FMR
  - Use proper and statistically representative data
  - Take care of collection procedures and environment
- New guidelines should address that evaluators must:
  - Check the following:
    - If test documentation includes the mandatory information defined at ISO/IEC 19795 Part 1 and 2 for reporting (ATE_FUN.1-1)
    - If test documentation specifies the type of performance evaluation and procedures for conducting it (ATE_FUN.1-2)
    - Proper test configuration: biometric system settings and operational environment (ATE_FUN.1-3)
    - If test procedures and the execution sequence are appropriate to obtain error rates (ATE_FUN.1-4)
    - If test documentation includes the claimed error rates (ATE_FUN.1-5)
    - The obtained error rates are consistent with the claimed error rates and the application of statistical methods to calculate them (ATE_FUN.1-6)
  - Report the testing effort including the type of performance evaluation, obtained performance metrics and most relevant details (ATE_FUN.1-7)

ATE_IND: INDEPENDENT TESTING

- BTSE, BEM and ISO/IEC 19792
  - Similar recommendations to functional test
- Join functional and independent testing activities in one biometric performance evaluation to reduce cost
  - e.g. PalmSecure SDK Version 24 Premium Fujitsu Limited
- New guidelines should address that evaluators must:
  - Check the following:
    - Correct configuration, installation and operation of the biometric system (ATE_ID.1-1,1-2, 2-1 and 2-2)
    - Correct application of the test plan by developers and consistent results (ATE_IND.2-3 to 2-5)
  - Plan and execute some tests in accordance to ISO/IEC 19795 (ATE_IND.1-3 to1-5 and 2-6 to 2-8)
    - Equivalent database/test crew
  - Record and report results and testing effort and check if the obtained error rates are consistent (ATE_IND.1-6 to1-8 and 2-9 to 2-11)

CONCLUSIONS

- A global certification scheme for biometric systems does not exist yet
- Biometric systems can be tested using CC and CEM
- Specific guidelines to apply CC & CEM evaluation activities have been proposed
- These guidelines need to be completed
  - including particular procedures to analyse biometric vulnerabilities (Class AVA)
  - including other recommendations to apply CC evaluation activities (ADV and ALC) to biometric systems (if necessary)

THANK YOU
FOR YOUR ATTENTION

B. Fernandez-Saavedra, R. Sanchez-Reillo,
J. Liu-Jimenez, I. Tomeo-Reyes

{mbfernan, rsreillo, jliu, itomeo}@ing.uc3m.es