Biometric Use Case Models for Personal Identity Verification

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FIPS 201 Biometric Requirements

- Ten fingerprint images are captured at enrollment
  - Sent to FBI for criminal history records check
  - Fingerprint capture device must comply with FBI standards
  - Strict image quality guidelines must be met for enrolled images
  - Images are used to generate templates for PIV card
- Biometric templates stored on PIV card are required for interoperability of PIV authentication between agencies
  - Mandatory storage of minutiae templates from two index fingerprints
  - Alternative fingers are allowed if index fingers cannot be imaged
  - Templates generated by segmenting images from 10-print enrollment

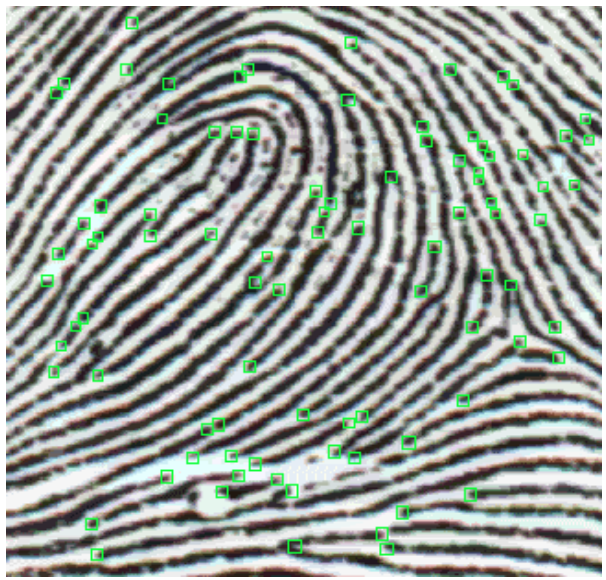
Discussion will focus on operational use of biometric for authentication

Biometrics in FIPS 201

- FIPS 201-1 – *Standard for Federal Personal Identity Verification (PIV)*
- SP 800-73-1 - *Technical Specification and Interfaces for PIV Card*
- **SP 800-76 - *Biometric Data Specification***
- SP 800-78 - *Cryptographic Algorithms and Key Sizes*
- SP 800-79 - *Guidelines for Certification and Accreditation of PIV Card Issuing Organizations*
- SP 800-85 - *Guidelines for Conformance Testing of PIV Middleware and PIV Card Application*
- SP 800-87 - *Codes for Federal and Federally-Assisted organizations*

Fingerprint Minutiae Template

- Maps the points where ridges start/stop or branch
- NIST standard data format based on ANSI/INCITS 378 Fingerprint Minutiae Data Interchange Standard
  - Defines specific format option called “MIN A”
- Fraction of the size of compressed images (<1K)



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SP 800-76

Sec. 1.2 states: …..for both logical and physical access applications, and for applications using biometric data stored either on or off the PIV Card, this document neither requires nor precludes the use of:

1. The PIV Card fingerprint templates;
2. Specific authentication paradigms such as match-on-card;
3. Data from other biometric modalities (e.g., hand geometry, iris, etc.);
4. Data formatted according to other standards;
5. Data whose format is proprietary or otherwise undisclosed.

SP 800-76 (cont.)

- Alternative biometric modalities and/or paradigms may be used for ***intra-agency*** authentication under FIPS 201
  - Such implementations may not be interoperable with other agencies
- Alternative biometric modalities could include fingerprint, hand geometry, iris, face, etc.
- Alternative biometric paradigms could include
  - Store biometric template off card
  - Store biometric template on card in agency-specific container
  - Match on card
  - Etc.

Access to Standard Template is Restricted Under FIPS 201

- Interoperable fingerprint templates can ***only*** be read through the ***contact*** interface following ***entry*** of a ***PIN***
- However, the card holder unique ID (CHUID) ***can*** be read from the ***contactless*** interface and ***without*** a ***PIN***
- Use of contact readers and PIN entry may not be appropriate for some physical access control systems (PACS) due to throughput requirements
- Use of contact readers in environments exposed to the weather may not be practical

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Biometric Use Case Models for Physical Access

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Match Off Card to Standard Fingerprint Template Stored On Card

- Insert card in contact reader
- Enter 6-digit PIN
- Scan fingerprint of cardholder
- Read templates from PIV card
- Match template off card to template stored on card
  - Matching takes place in reader, panel or server

Plus: Any PIV card will work
No need for biometric network or external database

Minus: Slower throughput
Card wear & exposure to dust, moisture, etc.
Limited to fingerprint biometrics using standard template format

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Match Off Card to Alternative Biometric Template Stored Off Card

- Read CHUID through contactless interface
- Scan biometric of cardholder (could be any biometric)
- Match live template off card to template stored off card
  - CHUID is index pointer to stored template
  - Templates stored in reader, panel or server
  - Matching takes place in reader, panel or server

Plus: Faster throughput
Choice of biometric modalities & template formats
Any PIV card will work
Contactless reader eliminates wear & environment issues

Minus: Requires network and external database
Requires separate biometric enrollment to external database

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Match Off Card to Alternative Biometric Template Stored On Card

- Read biometric on card through contactless interface
  - Template stored in agency-specific container on PIV card
- Scan biometric of cardholder (could be any biometric)
- Match live template off card to template stored on card
  - Matching takes place in reader, panel or server

Plus: Faster throughput
Contactless reader reduces wear & weather concerns
No need for biometric network and external data base

Minus: Requires separate biometric enrollment on PIV card
Issue of writing biometric to card issued by other agencies

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Match On Card to Alternative Biometric Template Stored On Card

- Insert card in contact reader or present card to contactless reader
- Scan biometric of cardholder (could be any biometric)
- Match live template on card to template stored on card
  - Template stored in agency-specific container on PIV card
  - Matching takes place within logic of smart card

Plus: No PIN entry required
No need for biometric network and external data base
Enrollment template never leaves PIV card

Minus: Requires separate biometric enrollment on PIV card
Issue of writing biometric to card issued by other agencies
MOC currently limited to proprietary templates

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Biometrics for Logical Access

Network Authentication

- FIPS 201 defines PKI as the required authentication method for logical access
- PKI requires contact interface and PIN entry to exercise private key for cardholder authentication
- Biometrics could be an additional authentication factor for very high security environments
  - 3-factor authentication – PIV Card, PIN and biometric

Network Authentication (Cont.)

- Biometrics as an additional authentication mechanism for logical access could be implemented in any paradigm or modality
  - Finger, face, iris, hand, etc.
  - Match on card, Match off card
  - Store on card, store off card
- Since PKI is mandated for logical access, the only advantage to using biometrics is additional security
  - No convenience or throughput benefits

IBIA Recommendations to NIST

For Physical Access Control Applications:

- Remove PIN requirement for reading interoperable fingerprint templates on PIV card
- Allow access to interoperable fingerprint templates through the contactless interface

If recommendations adopted, would further encourage the operational use of interoperable biometrics to meet HSPD-12 objectives for interoperability, security and rapid authentication

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Rationale for Recommendations

- Physical access control not well suited for contact cards due to environmental and throughput issues
- NIST removed PIN requirement for access to certificate in SP 800-73-1
  - Rationale: Privacy issues no longer considered significant
- A similar privacy rationale exists for fingerprint templates
  - Minutiae templates cannot be used to reconstruct the original image
  - Are fingerprints “secrets” anyway?
- Compromised enrollment template is of little use
  - No practical way to introduce the template back into the system
  - Physical finger must be in contact with the reader for authentication
  - Enrollment templates are digitally signed with a “type” designation
  - Attempting to send an enrollment template as a verification template would be rejected as an invalid data object

Conclusions

- FIPS 201 allows a lot of flexibility in implementing biometric authentication for intra-agency access control
- Given restrictions on use, interoperable templates may only be practical for use at visitor control centers to bind a visiting agency employee to the PIV card
- Consider the use of alternative biometrics – particularly for physical access control systems

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