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Personal Identity Verification (PIV) of Federal Employees and Contractors

CATEGORY: INFORMATION SECURITY **SUBCATEGORY: IDENTITY**

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FOREWORD

The Federal Information Processing Standards Publication Series of the National Institute of Standards and Technology is the official series of publications relating to standards and guidelines adopted and promulgated under the provisions of the Federal Information Security Modernization Act (FISMA) of 2014.

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ABSTRACT

Authentication of an individual's identity is a fundamental component of physical and logical access control. An access control decision must be made when an individual attempts to access security-sensitive buildings, information systems, and applications. An accurate determination of an individual's identity supports making sound access control decisions.

This document establishes a standard for a Personal Identity Verification (PIV) system that meets the control and security objectives of Homeland Security Presidential Directive-12 [HSPD-12]. It is based on secure and reliable forms of identity credentials issued by the Federal Government to its employees and contractors. These credentials are used by mechanisms that authenticate individuals who require access to federally controlled facilities, information systems, and applications. This Standard addresses requirements for initial identity proofing, infrastructure to support interoperability of identity credentials, and accreditation of organizations and processes issuing PIV credentials.

Keywords: authentication, authenticator, biometrics, credential, cryptography, derived PIV credentials, digital identity, Federal Information Processing Standards (FIPS), HSPD-12, federation, identification, identity proofing, integrated circuit card, Personal Identity Verification, PIV, PIV account, public key infrastructure, verification

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November 2020

Announcing the Standard for

Personal Identity Verification (PIV) of Federal Employees and Contractors

Federal Information Processing Standards Publications (FIPS PUBS) are issued by the National Institute of Standards and Technology (NIST) after approval by the Secretary of Commerce pursuant to Section 5131 of the Information Technology Management Reform Act of 1996 (Public Law 104-106) and the Computer Security Act of 1987 (Public Law 100-235).

1. Name of Standard. Personal Identity Verification (PIV) of Federal Employees and Contractors (FIPS 201-3).

2. Category of Standard. Information Security. **Subcategory**. Identity.

3. Explanation. Homeland Security Presidential Directive-12 [HSPD-12], dated August 27, 2004, entitled "Policy for a Common Identification Standard for Federal Employees and Contractors," directs the promulgation of a federal standard for secure and reliable forms of identification for federal employees and contractors. It further specifies secure and reliable identification that

a) is issued based on sound criteria for verifying an individual employee's identity;
b) is strongly resistant to identity fraud, tampering, counterfeiting, and terrorist exploitation;
c) can be rapidly authenticated electronically; and
d) is issued only by providers whose reliability has been established by an official accreditation process.

The directive stipulates that the Standard include graduated criteria from least secure to most secure in order to ensure flexibility in selecting the appropriate level of security for each application. Executive departments and agencies are required to implement the Standard for identification issued to federal employees and contractors in gaining physical access to controlled facilities and logical access to controlled information systems.

4. Approving Authority. Secretary of Commerce.

5. Maintenance Agency. Department of Commerce, NIST, Information Technology Laboratory (ITL).

6. Applicability. This Standard is applicable to identification issued by federal departments and agencies to federal employees and contractors for gaining physical access to federally controlled facilities and logical access to federally controlled information systems, except for “national security systems” as defined by 44 U.S.C. 3542(b)(2) and [SP 800-59]. Except as provided in [HSPD-12], nothing in this Standard alters the ability of government entities to use the Standard for additional applications.

6.1 Special-Risk Security Provision. The U.S. Government has personnel, facilities, and other assets deployed and operating worldwide under a vast range of threats (e.g., terrorist, technical, intelligence), the severity of which is particularly heightened overseas. For cardholders with particularly sensitive threats while outside of the contiguous United States, the issuance, holding, and/or use of PIV credentials with full technical capabilities as described herein may result in unacceptably high risk. In such cases of risk (e.g., to facilities, individuals, operations, national interest, or national security) by the presence and/or use of full-capability PIV credentials, the head of a department or independent agency may issue a select number of maximum-security PIV credentials that do not contain (or otherwise do not fully support) the wireless and/or biometric capabilities otherwise required/referenced herein. To the greatest extent practicable, heads of departments and independent agencies should minimize the issuance of such special-risk security PIV credentials so as to support interagency interoperability and the President’s policy. Use of other risk-mitigating technical (e.g., high-assurance on/off switches for the wireless capability) and procedural mechanisms in such situations is preferable and, as such, is also explicitly permitted and encouraged. As protective security technology advances, the need for this provision will be reassessed when the Standard undergoes the normal review and update process.

7. Implementations. This Standard satisfies the control objectives, security requirements, and technical interoperability requirements of [HSPD-12]. The Standard specifies implementation and processes for binding identities to authenticators, such as integrated circuit cards and derived credentials used in the federal PIV system.

In implementing PIV systems and pursuant to Section 508 of the Rehabilitation Act of 1973 (the Act), as amended, agencies have the responsibility to accommodate federal employees and contractors with disabilities to have access to and use of information and data comparable to the access to and use of such information and data by federal employees and contractors who are not individuals with disabilities. In instances where federal agencies assert exceptions to Section 508 accessibility requirements (e.g., undue burden, national security, commercial non-availability), Sections 501 and 504 of the Act require federal agencies to provide reasonable accommodation for federal employees and contractors with disabilities whose needs are not met by the baseline accessibility provided under Section 508. While Section 508 compliance is the responsibility of federal agencies and departments, this Standard specifies several options to aid in the implementation of the requirements:

- Section 4.1.4.3 specifies Zones 21F and 22F as options for orientation markers of the PIV Card.
- Section 2.8 and Section 2.9 specify alternatives for the biometric capture device interactions required at PIV Card issuance, reissuance, and reset.
- Section 2.10 defines alternatives to smart card-based PIV credentials in the form of derived PIV credentials.
- Section 6 defines authentication mechanisms with varying characteristics for both physical and logical access (e.g., with or without PIN, over contact, contactless, or virtual contact interface).
- Section 7 defines federation as a means for a relying system to interoperate with credentials issued by other agencies.

The Office of Management and Budget (OMB) provides implementation oversight for this Standard.

PIV cards can only be issued by accredited issuers. The responsibility and authority for PIV card issuance and management rests in the departments and agencies employing federal employees and contractors regardless of whether these functions are performed in-house or outsourced to an external public or private organization. To ensure consistency in the operations of issuers, NIST provides guidelines for the accreditation of PIV Card issuers and derived PIV credential issuers in [SP 800-79]. The Standard also covers security and interoperability requirements for PIV Cards. For this purpose, NIST has established the PIV Validation Program, which tests implementations for conformance with this Standard as specified in [SP 800-73] and [SP 800-78] (see Appendix A.3).

FIPS 201 compliance of PIV components and subsystems is provided in accordance with OMB [M-19-17] through products and services from the U.S. General Services Administration's (GSA) Interoperability Test Program and Approved Products and Services List (see Appendix A.5). Implementation guidance for PIV-enabled federal facilities and information systems in accordance with OMB [M-19-17] will be outlined by [FICAM] as playbooks and best practice repositories. See also [SP 800-116] and [ISC-RISK].

8. Patents. Aspects of the implementation of this Standard may be covered by U.S. or foreign patents.

9. Effective Date. This Standard will be effective immediately upon final publication of this revision, superseding FIPS 201-2. Features of this Standard that depend upon the release of new or revised NIST Special Publications, including features that are optional, deprecated, or removed, are effective upon final publication of the supporting Special Publications.

10. Specifications. Federal Information Processing Standards (FIPS) 201 Personal Identity Verification (PIV) of Federal Employees and Contractors.

11. Qualifications. The security provided by the PIV system is dependent on many factors outside the scope of this Standard. Organizations must be aware that the overall security of the personal identification system relies on

- assurance provided by the issuer of an identity credential that the individual in possession of the credential has been correctly identified;
- protection provided to an identity credential stored within the PIV Card and transmitted between the card and the PIV issuance and relying subsystems;
- infrastructure protection provided for derived PIV credential in the binding, maintenance and use of the identity credential; and
- protection provided to the identity verification system infrastructure and components throughout the entire lifecycle.

Although it is the intent of this Standard to specify mechanisms and support systems that provide high assurance personal identity verification, conformance to this Standard does not assure that a particular implementation is secure. It is the implementer's responsibility to ensure that components, interfaces, communications, storage media, managerial processes, and services used within the identity verification system are designed and built in a secure manner.

Similarly, the use of a product that conforms to this Standard does not guarantee the security of the overall system in which the product is used. The responsible authority in each department and agency must ensure that an overall system provides the acceptable level of security.

Because a standard of this nature must be flexible enough to adapt to advancements and innovations in science and technology, NIST has a policy to review this Standard within five years to assess its adequacy.

12. Waiver Procedure. FISMA does not allow for waivers to a FIPS that is made mandatory by the Secretary of Commerce.

13. Where to Obtain Copies of the Standard. This publication is available through the internet by accessing https://csrc.nist.gov/publications/. Other computer security publications are available at the same website.

FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION 201-3

November 2020

Standard for

Personal Identity Verification (PIV) of Federal Employees and Contractors

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1. Introduction

This section is informative except where otherwise marked as normative. It provides background information for understanding the scope of this Standard.

Authentication of an individual's identity is a fundamental component of both physical and logical access control. An access control decision must be made when an individual attempts to access security-sensitive buildings, information systems, and applications. An accurate determination of an individual's identity supports making sound access control decisions.

In the past, a wide range of legacy mechanisms has been employed to authenticate an individual, utilizing various classes of identity credentials. For physical access, an individual's identity has been authenticated using paper or other non-automated, hand-carried credentials such as badges and driver's licenses. For logical access, authorization to access computers and data has been based on identities authenticated through user-selected passwords. Today, cryptographic mechanisms and biometric techniques are replacing these legacy mechanisms in physical and logical security applications. The strength of authentication that is achieved depends on the type of credential, the process used to issue the credential, and the authentication mechanism used to validate the credential.

This document establishes a standard for a Personal Identity Verification (PIV) system that meets the control and security objectives of [HSPD-12]. The Standard specifies implementation and processes for binding identities to authenticators, such as integrated circuit cards and derived credentials used in the federal PIV system. It is based on secure and reliable forms of identity credentials issued by the Federal Government to its employees and contractors. These credentials are intended to authenticate individuals who require access to federally controlled facilities, information systems, and applications. This Standard addresses requirements for initial identity proofing, infrastructure to support interoperability of identity credentials, and accreditation of organizations and processes issuing PIV credentials.

1.1 Purpose

This Standard defines reliable, government-wide identity credentials for use in applications such as access to federally controlled facilities and information systems. This Standard has been developed within the context and constraints of federal laws, regulations, and policies based on currently available and evolving information processing technology.

This Standard specifies a PIV system within which common identity credentials can be created and later used to verify a claimed identity. The Standard also identifies federal government-wide requirements for security levels that are dependent on risks to federal facilities or information being protected.

1.2 Scope

[HSPD-12], signed by President George W. Bush on August 27, 2004, established the requirements for a common identification standard for identity credentials issued by federal departments and agencies to federal employees and contractors (including contractor employees) for gaining physical access to federally controlled facilities and logical access to federally controlled information systems. HSPD-12 directs the Department of Commerce to develop a Federal Information Processing Standards (FIPS) publication to define such common identity credentials. In accordance with HSPD-12, this Standard defines the following technical requirements for these identity credentials:

- They are issued based on sound criteria for verifying an individual employee's identity.
- They are strongly resistant to identity fraud, tampering, counterfeiting, and terrorist exploitation.
- They can be rapidly authenticated electronically.
- They are issued only by providers whose reliability has been established by an official accreditation process.

Upon enrollment, a collection of records known as a PIV account is created and managed within the issuer's enterprise identity management system (IDMS). The PIV account includes the attributes of the PIV cardholder, the enrollment data, and information regarding the PIV Card and any derived PIV credentials bound to the account.

This Standard defines authentication mechanisms that offer varying degrees of security for both logical and physical access applications. Federal departments and agencies will determine the level of security and authentication mechanisms appropriate for their applications. The scope of this Standard is limited to the authentication of an individual's identity. Authorization and access control decisions are outside of the scope of this Standard. Moreover, requirements for a temporary credential used until a new or replacement PIV credential arrives are out of the scope of this Standard.

While this Standard remains predominantly focused on PIV Cards, derived PIV credentials and federation protocols also play important roles in the use of PIV accounts. Section 2.10 of this Standard defines mechanisms for derived PIV credentials associated with an active PIV account. Derived PIV credentials have authentication and lifecycle requirements that may differ from the PIV Card itself. This Standard also discusses federation protocols in Section 7 as a means of accepting PIV credentials issued by other agencies. See Section 3 for more information on components of the PIV system.

1.3 Change Management

Every revision of this Standard introduces refinements and changes that may impact existing implementations. FIPS 201 and associated normative specifications encourage implementation approaches that reduce the high cost of configuration and change management by architecting resilience to change into system processes and components. Nevertheless, changes and modifications are required over time.

This section provides change management principles and guidance to implementers of relying systems to manage newly introduced changes and modifications to the previous version of this Standard.

1.3.1 Backward Compatible Change

A backward compatible change is a change or modification to an existing feature that does not break relying systems using the feature. For example, changing the card authentication certificate from optional to mandatory does not affect the systems using the card authentication certificate for authentication (i.e., using the PKI-CAK authentication mechanism).

1.3.2 Backward Incompatible Change

A backward incompatible change is a change or modification to an existing feature such that the modified feature cannot be used with existing relying systems. For example, changing the format of the biometric data records would not be compatible with the existing system because a biometric authentication attempt with the modified format would fail. Similarly, all systems interacting with the PIV Card would need to change if the PIV Card Application Identifier (AID) changed (defined in [SP 800-73]), indicating a backward incompatible change.

1.3.3 New Features

New features are features that are added to the Standard. These features can be optional or mandatory. New features do not interfere with backward compatibility because they are not part of the existing relying systems. For example, the optional biometric on-card comparison (OCC) authentication mechanism (OCC-AUTH) was a new feature introduced in FIPS 201-2. The optional mechanism did not affect the features of existing systems. Systems had to be updated only if an agency decided to support the OCC-AUTH mechanism.

1.3.4 Deprecated and Removed Features

This subsection is normative.

When a feature is to be discontinued or is no longer needed, it is deprecated. In general, a feature that is currently in use by relying systems would only be deprecated if there were a compelling reason to do so (e.g., security). Deprecated features MAY continue to be used but SHOULD be phased out in future systems since the feature will likely be removed in the next revision of the Standard. Removed features SHALL NOT be used. For example, the CHUID authentication mechanism (Section 6.2.5) has been removed from this version of the Standard and relying systems SHALL NOT use this authentication mechanism.[1] The PIV Visual Credentials (VIS) authentication mechanism (Section 6.2.6) has been deprecated as a stand-alone authentication mechanism, but it MAY still be used in conjunction with other authentication mechanisms.

In the case of deprecated features on PIV Cards such as the magnetic stripe (Section 4.1.4.4), existing PIV Cards with the deprecated features remain valid. However, new PIV Cards SHOULD NOT include the deprecated features.

1.3.5 FIPS 201 Version Management

Subsequent revisions of this Standard may necessitate FIPS 201 version management that introduces new version numbers for FIPS 201 products. Components that may be affected by version management include but are not limited to PIV Cards, PIV middleware software, and card issuance systems.

New version numbers will be assigned in [SP 800-73], if needed, based on the nature of the change. For example, new mandatory features introduced in a revision of this Standard may necessitate a new PIV Card Application version number so that systems can quickly discover the new mandatory features. Optional features may be discoverable by an on-card discovery mechanism.

1.3.6 Section Number Stability

Section numbers have not been changed in this revision. Any deleted sections have had their contents removed and replaced with a removal notice while retaining the section header and number. New subsections have been added at the end of their respective sections with a new subsection number.

[1] The CHUID data element has not been removed and continues to be mandatory.

1.4 Document Organization

This Standard describes the minimum requirements for a federal personal identity verification system that meets the control and security objectives of [HSPD-12], including identity proofing, registration, and issuance. It provides detailed technical specifications to support the control and security objectives of [HSPD-12] as well as interoperability among federal departments and agencies. This Standard describes the policies and minimum requirements of a PIV Card and derived PIV credentials that allow interoperability of credentials for physical and logical access. It specifies the use of federation protocols as a means of accepting PIV Card credentials and derived PIV credentials issued by other agencies. The physical card characteristics, storage media, and data elements that make up identity credentials are specified in this Standard. The interfaces and card architecture for storing and retrieving identity credentials from a smart card are specified in [SP 800-73]. Similarly, the requirements for collection, formatting, and use of biometric data records are specified in [SP 800-76]. The requirements for cryptographic algorithms are specified in [SP 800-78]. The requirements for the accreditation of PIV Card issuers are specified in [SP 800-79]. The unique organizational codes for federal agencies are assigned in [SP 800-87]. The requirements for PIV Card readers are provided in [SP 800-96]. The format for encoding PIV enrollment records for import and export is specified in [SP 800-156]. The requirements for issuing derived PIV credentials are specified in [SP 800-157].

This Standard contains normative references to other documents. Should normative text in this Standard conflict with normative text in a referenced document, the normative text in this Standard prevails for this Standard.

All sections in this document indicate whether they are *normative* (i.e., provide requirements for compliance) or informative (i.e., provide information details that do not affect compliance). This document is structured as follows:

- Section 1, Introduction, provides background information for understanding the scope of this Standard. This section is *informative* unless otherwise marked as normative.
- Section 2, Common Identification, Security, and Privacy Requirements, outlines the requirements for identity proofing, registration, and issuance, by establishing the control and security objectives for compliance with [HSPD-12]. This section is *normative*.
- Section 3, PIV System Overview, provides an overview of the different components of the PIV system. This section is *informative*.
- Section 4, PIV Front-End Subsystem, provides the requirements for the components of the PIV front-end subsystem. It defines requirements for the PIV Card, logical data elements, biometric data records, cryptography, and card readers. This section is *normative*.

- Section 5, PIV Key Management Requirements, defines the processes and components required for managing a PIV Card's lifecycle. It also provides the requirements and specifications related to key management. This section is *normative*.
- Section 6, PIV Cardholder Authentication, defines a suite of authentication mechanisms that are supported by the PIV Card and their applicability in meeting the requirements of graduated levels of identity assurance. This section is *normative*.
- Section 7, Federation, defines a set of mechanisms for using federation technologies to interoperate with PIV credentials issued by other agencies. This section is *normative*.
- Appendix A, PIV Validation, Certification, and Accreditation, provides additional information regarding compliance with this document. This appendix is *normative*.
- Appendix B, PIV Object Identifiers and Certificate Extension, provides additional details for the PIV objects identified in Section 4. This appendix is *normative*.
- Appendix C, Glossary of Terms, Acronyms, and Notations, describes the vocabulary and textual representations used in the document. This appendix is *informative*.
- Appendix D, References, lists the specifications and standards referred to in this document. This appendix is *informative*.
- Appendix E, Revision History, lists changes made to this Standard from its inception. This appendix is *informative*.

2. Common Identification, Security, and Privacy Requirements

This section is normative. It addresses the fundamental control and security objectives outlined in [HSPD-12], including the identity proofing requirements for federal employees and contractors.

2.1 Control Objectives

[HSPD-12] establishes control objectives for secure and reliable identification of federal employees and contractors. These control objectives, provided in paragraph 3 of the directive, are quoted here:

> (3) “Secure and reliable forms of identification” for purposes of this directive means identification that (a) is issued based on sound criteria for verifying an individual employee’s identity; (b) is strongly resistant to identity fraud, tampering, counterfeiting, and terrorist exploitation; (c) can be rapidly authenticated electronically; and (d) is issued only by providers whose reliability has been established by an official accreditation process.

Each agency’s PIV implementation SHALL meet the four control objectives (a) through (d) listed above such that

- A credential is issued only to an individual whose identity has been verified and who has been appropriately vetted as per Section 2.2 after a proper authority has authorized issuance of the credential.
- A credential is issued only after an individual’s eligibility has been favorably adjudicated based on the prerequisite federal investigation (See Section 2.2). If there is no investigation meeting the investigative standards, the PIV credential eligibility may be approved upon favorable initiation of the prerequisite investigation[2] and once the Federal Bureau of Investigation (FBI) National Criminal History Check (NCHC) portion of the background investigation is completed and favorably adjudicated.
- An individual is issued a credential only after presenting two identity source documents, at least one of which is a Federal or State Government-issued picture ID.
- Fraudulent identity source documents are not accepted as genuine or unaltered.

[2] The initiation of a background investigation is defined as the submission of an investigative request to the Defense Counterintelligence and Security Agency or other authorized federal investigative service provider.

- A person suspected or known to the government as being a terrorist is not issued a credential.
- No substitution occurs in the identity proofing process. More specifically, the individual who appears for identity proofing and whose fingerprints are checked against databases is the person to whom the credential is issued.
- No credential is issued unless requested by the proper authority.
- A credential remains serviceable only up to its expiration date. More precisely, a revocation process exists such that expired or invalidated credentials are swiftly revoked.
- A single corrupt official in the process may not issue a credential with an incorrect identity or to a person not entitled to the credential.
- An issued credential is not duplicated or forged.
- An issued credential is not modified by an unauthorized entity.

2.2 Credentialing Requirements

Federal departments and agencies SHALL use the credentialing eligibility standards issued by the Director of the Office of Personnel Management (OPM)[3] and OMB.[4]

Federal departments and agencies must follow investigative requirements established by the Suitability and Credentialing Executive Agent and the Security Executive Agent. Departments and agencies SHALL use position designation guidance issued by the Executive Agents. The designation of the position determines the prerequisite investigative requirement. Individuals being processed for a PIV Card SHALL receive the required investigation and are subject to any applicable reinvestigation or continuous vetting requirements to maintain their PIV eligibility.

The minimum requirement for PIV Credential eligibility determination is a completed and favorably adjudicated Tier 1 investigation, formerly called a National Agency Check with Written Inquiries (NACI).[5]

Before an individual is determined eligible to be issued a PIV Card when no corresponding prior investigation exists, the appropriate required investigation SHALL be initiated with the authorized federal investigative service provider and the FBI NCHC portion of the background investigation SHALL be completed and favorably adjudicated.

Once the investigation is completed, the authorized adjudicative entity SHALL adjudicate the investigation and report the final eligibility determination to the Central Verification

[3] For example, [FCS] and the Federal Investigative Standards or subsequent standards.

[4] For example, OMB [M-05-24].

[5] NACI investigations were replaced with Tier 1 investigations upon implementation of the 2012 Federal Investigative Standards.

System (or successor). This determination SHALL be recorded in the PIV enrollment record to reflect PIV eligibility for the PIV cardholder and, if applicable, their enrollment in the Continuous Vetting Program.

For full guidance on PIV credentialing investigative and adjudicative requirements, issuers must work closely with their personnel security/suitability offices to ensure adherence to the latest federal personnel vetting guidance as provided by the Executive Agents.

2.3 Biometric Data Collection for Background Investigations

A full set of fingerprints SHALL be collected from each PIV applicant.

Biometric identification using fingerprints is the primary input to law enforcement checks. In cases where ten fingerprints are not available, then as many fingers as possible SHALL be imaged as per guidance in [SP 800-76]. In cases where no fingers are available to be imaged, agencies SHALL seek guidance from their respective investigative service provider for alternative means of performing law enforcement checks.

This collection is not necessary for applicants who have a completed and favorably adjudicated Tier 1 or higher federal background investigation on record that can be located and referenced.

Fingerprint collection SHALL conform to the procedural and technical specifications of [SP 800-76].

2.4 Biometric Data Collection for PIV Card

The following biometric data SHALL be collected from each PIV applicant:

- Two fingerprints for off-card one-to-one comparison. These fingerprints MAY be taken from the full set of fingerprints collected in Section 2.3.
- An electronic facial image.

The following biometric data MAY be collected from a PIV applicant:

- An electronic image of the left iris.
- An electronic image of the right iris.
- Two fingerprints for on-card comparison (OCC). These fingerprints MAY be taken from the full set of fingerprints collected in Section 2.3 and SHOULD be imaged from fingers not imaged for off-card one-to-one comparison.

If the identity proofing and enrollment process is performed over multiple visits, a biometric verification attempt comparing the applicant's newly captured biometric characteristics against biometric data collected during a previous visit SHALL be performed at each visit and return a positive verification decision.

If collection of biometric data as specified in this section and in Section 2.3 occur on separate occasions, a biometric comparison SHALL be performed to confirm that the two fingerprints collected for off-card one-to-one comparisons elicit a positive biometric verification decision when compared to the same two fingerprints from the original set of ten fingerprints.

Biometric data collection SHALL conform to the procedural and technical specifications of [SP 800-76]. The choice of fingers to use for mandatory fingerprint templates and optional fingerprint templates MAY vary between persons. The recommended selection and order is specified in [SP 800-76].

2.5 Biometric Data Use

The full set of fingerprints SHALL be used for biometric identification against databases of fingerprints maintained by the FBI.

The two mandatory fingerprints SHALL be used for the preparation of biometric templates to be stored on the PIV Card as described in Section 4.2.3.1. The fingerprints provide an interoperable authentication mechanism through an off-card comparison scheme (BIO or BIO-A) as described in Section 6.2.1. These fingerprints are also the primary means of authentication during PIV issuance and maintenance processes.

The optional fingerprints MAY be used for the preparation of biometric templates for OCC as described in Section 4.2.3.1. OCC MAY be used to support card activation as described in Section 4.3.1. OCC MAY also be used for cardholder authentication (OCC-AUTH) as described in Section 6.2.2.

Agencies MAY choose to collect electronic iris images as an additional biometric characteristic. If collected, the electronic iris images SHALL be stored on the PIV Card as described in Section 4.2.3.1. The images MAY be used for cardholder authentication (BIO or BIO-A) as described in Section 6.2.1. Electronic iris images are an additional means of authentication during PIV issuance and maintenance processes when fingerprint biometric data records are unavailable.

The electronic facial image SHALL be stored on the PIV Card as described in Section 4.2.3.1. It SHALL be printed on the PIV Card according to Section 4.1.4.1. The image MAY be used for cardholder authentication (BIO or BIO-A) as described in Section 6.2.1. It MAY be retrieved and displayed on guard workstations to augment other authentication processes from Section 6.2. The electronic facial image is a secondary means of authentication during operator-attended PIV issuance and maintenance processes when fingerprint biometric data records are unavailable.

PIV background investigation, identity proofing, registration, and issuance processes MAY be performed across multiple sessions at different facilities. If multiple sessions are needed, the applicant SHALL be linked through a positive biometric verification decision by comparing biometric characteristics captured at a previous session with biometric characteristics captured during the current session. Issuers SHALL follow applicable federal laws and regulations regarding the retention and destruction of biometric data.

2.6 PIV Enrollment Records

Note: This section was formerly entitled "Chain-of-Trust".

A card issuer SHALL maintain the enrollment record for each issued PIV Card. These enrollment records are created and maintained through the methods of contemporaneous acquisition at each step of the PIV issuance process—typically including identity proofing, registration and biometric enrollment—and are generally stored as part of the cardholder's PIV account.

PIV enrollment records maintain an auditable sequence of enrollment events to facilitate binding an applicant to multiple transactions that might take place at different times and locations.[6]

PIV enrollment records SHOULD include the following data:

- A log of activities that documents who took the action, what action was taken, when and where the action took place, and what data was collected.
- An enrollment data record that contains the most recent collection of each of the biometric data collected. The enrollment data record describes the circumstances of biometric acquisition including the name and role of the acquiring agent, the office and organization, time, place, and acquisition method. The enrollment data record MAY also document unavailable biometric data or failed attempts to collect biometric data. The enrollment data record MAY contain historical biometric data records.
- The most recent unique identifiers issued to the individual, such as the Federal Agency Smart Credential Number (FASC-N) and the card Universally Unique Identifier (UUID). The record MAY contain historical unique identifiers.

[6] For example, ten fingerprints for law enforcement checks may be collected at one time and place, and two fingerprints for PIV Card templates may be collected at a later time and different place, provided that a biometric comparison confirms that the two fingerprints belong to the original set of ten fingerprints.

- Information about the authorizing entity who has approved the issuance of a credential.
- Current status of the background investigation, including the results of the investigation once completed.
- The evidence of authorization if the credential is issued under a pseudonym.
- Any data or any subsequent changes in the data about the cardholder. If the changed data is the cardholder's name, then the issuer SHOULD include the evidence of a formal name change.

The biometric data records in the PIV enrollment records SHALL be valid for a maximum of 12 years. In order to mitigate aging effects and thereby maintain operational readiness of a cardholder's PIV Card, agencies MAY require biometric enrollment more frequently than 12 years.

PIV enrollment records contain Personally Identifiable Information (PII). PII SHALL be protected in a manner that protects the individual's privacy and maintains the integrity of the records both in transit and at rest.

To facilitate interoperability between PIV issuers, systems may import and export enrollment records in the manner and representation described in [SP 800-156].

PIV enrollment records can be applied in several situations, including the following:

Extended enrollment

A PIV applicant enrolls a full set of fingerprints for background investigations at one place and time and two fingerprints for the PIV Card at another place and time. The enrollment record would contain identifiers and two enrollment data records: one with the full set of fingerprint images collected for background investigations and one with two fingerprint templates collected for the PIV Card. The two fingerprint templates would be compared to the corresponding fingers in the ten-fingerprint data set in the PIV enrollment record.

Reissuance

A PIV cardholder loses their card. Since the card issuer has biometric data records from enrollment, the cardholder can perform a biometric comparison against the biometric data stored in the PIV enrollment record. The card issuer NEED NOT repeat the identity proofing and registration process on a positive biometric verification decision. Instead, the card issuer revokes the lost card and proceeds to issue a new card as described in Section 2.9.1.

Interagency transfer

A federal employee is transferred from one agency to another. When the employee leaves the old agency, they surrender their PIV Card and it is destroyed. When the employee arrives at the new agency and is processed in, the card issuer in the new agency requests and receives the employee's PIV enrollment record from the card issuer in the old agency. The employee performs a biometric comparison against the biometric data stored in this record, and the interaction proceeds as described in Section 2.8.2.

2.7 PIV Identity Proofing and Registration Requirements

Identity proofing and registration requirements for the issuance of PIV Cards meet Identity Assurance Level (IAL) 3 since they follow a tailored process based on [SP 800-63A] IAL3 requirements. Departments and agencies SHALL follow an identity proofing and registration process that meets the requirements defined below when issuing PIV Cards.

The organization SHALL adopt and use an identity proofing and registration process that is approved in accordance with [SP 800-79].

The organization SHALL follow investigative requirements as outlined in Section 2.2.

Biometric data SHALL be captured as specified in Section 2.3 and Section 2.4.

The applicant SHALL appear in person at least once before the issuance of a PIV Card, either at the issuing facility or at a supervised remote identity proofing station (as described in Section 2.7.1).

During identity proofing, the applicant SHALL be required to provide two original forms of identity source documents.[7] These documents SHALL be validated to ensure they are genuine and authentic, not counterfeit, fake, or forgeries. Validation of physical security features SHALL be performed by trained staff. When they are available, cryptographic security features SHOULD be used to validate evidence. The identity source documents SHALL be bound to the applicant and SHALL NOT be expired or cancelled. If the two identity source documents bear different names, evidence of a formal name change SHALL be provided. At least one identity source document SHALL meet the requirements of Strong evidence as specified in [SP 800-63A] and be one of the following forms of identification:

- U.S. Passport or a U.S. Passport Card
- Permanent Resident Card or Alien Registration Receipt Card (Form I-551)
- foreign passport
- Employment Authorization Document that contains a photograph (Form I-766)

[7] Departments and agencies may choose to accept only a subset of the identity source documents listed in this section. For example, in cases where identity proofing for PIV Card issuance is performed prior to verification of employment authorization, departments and agencies may choose to require the applicant to provide identity source documents that satisfy the requirements of Form I-9, *Employment Eligibility Verification*, in addition to the requirements specified in this section.

- driver's license or ID card that is compliant with [REAL-ID] enforcement requirements pursuant to DHS regulations
- U.S. Military ID card
- U.S. Military dependent's ID card
- PIV Card

The second piece of evidence MAY be from the list above, but it SHALL NOT be of the same type as the primary identity source document.[8] The second identity source document MAY also be one of the following:

- ID card issued by a federal, state, or local government agency or entity, provided that it contains a photograph
- voter's registration card
- U.S. Coast Guard Merchant Mariner Card
- Certificate of U.S. Citizenship (Form N-560 or N-561)
- Certificate of Naturalization (Form N-550 or N-570)
- U.S. Citizen ID Card (Form I-197)
- Identification Card for Use of Resident Citizen in the United States (Form I-179)
- Certification of Birth Abroad or Certification of Report of Birth issued by the Department of State (Form FS-545 or Form DS-1350)
- Reentry Permit (Form I-327)
- Employment authorization document issued by the Department of Homeland Security (DHS)
- driver's license issued by a Canadian government entity
- Native American tribal document
- U.S. Social Security Card issued by the Social Security Administration
- original or certified copy of a birth certificate issued by a state, county, municipal authority, possession, or outlying possession of the United States bearing an official seal
- another piece of evidence that meets the requirements of Fair evidence specified in [SP 800-63A]

> Note: One piece of Strong evidence and one other piece of evidence meeting the requirements of Fair evidence in [SP 800-63A] are considered sufficient for issuance of a PIV Card because the requirement for a federal background investigation is considered a compensating control for identity proofing at IAL3.

[8] For example, if the first source document is a foreign passport (e.g., Italy), the second source document cannot be another foreign passport (e.g., France).

The PIV identity proofing, registration, issuance, and reissuance processes SHALL adhere to the principle of separation of duties to ensure that no single individual has the capability to issue a PIV Card without the cooperation of another authorized person.

The identity proofing and registration process used when verifying the identity of the applicant SHALL be accredited by the department or agency as satisfying the requirements above and approved in writing by the head or deputy (or equivalent) of the federal department or agency.

The requirements for identity proofing and registration also apply to citizens of foreign countries who are working for the Federal Government overseas. However, a process for identity proofing and registration SHALL be established using a method approved by the U.S. Department of State's Bureau of Diplomatic Security, except for employees under the command of a U.S. area military commander. These procedures vary depending on the country.

2.7.1 Supervised Remote Identity Proofing

Departments and agencies MAY use a supervised remote identity proofing process for the issuance of PIV Cards. This process involves the use of an issuer-controlled station at a remote location that is connected to a trained operator at a central location. The goal of this arrangement is to permit identity proofing of individuals in remote locations where it is not practical for them to travel to the agency for in-person identity proofing.

Supervised remote identity proofing takes advantage of improvements in sensor technology (e.g., cameras and biometric capture devices) and communications bandwidth to closely duplicate the security of in-person identity proofing. This is done through the use of specialized equipment to support an enrollment station that is under the control of either the issuer or a third party that is trusted by the issuer.

The following forms of protection SHALL be provided by either inherent capabilities of the station or staff at the station location:

- ensuring that only the applicant interacts with the station during any session;
- ensuring that the physical integrity of the station and its sensors is maintained at all times; and
- reporting any problems with the station to the issuer.

Supervised remote identity proofing SHALL meet the following requirements:

- The station SHALL be maintained in a controlled-access environment and SHALL be monitored by staff at the station location while it is being used.[9]

[9] A controlled-access environment is a location with limited egress points where staff can see the station while performing other duties.

- The issuer SHALL have a live operator participate remotely with the applicant for the entirety of the identity proofing session.
- The issuer SHALL require operators to have undergone a training program to detect potential fraud and to properly perform a supervised remote identity proofing session.
- The operator SHALL monitor the entire identity proofing session—from which the applicant SHALL NOT depart—by at least one continuous, high-resolution video transmission of the applicant.
- The operator SHALL require all actions taken by the applicant during the identity proofing session to be clearly visible to the operator.
- The operator SHALL validate the physical or cryptographic security features of primary and secondary identity source documents using scanners and sensors that are integrated into the station.
- The issuer SHALL ensure that all communications occur over a mutually authenticated protected channel.

If biometric data cannot be collected per the criteria defined in [SP 800-76] or if validation of the identity evidence is inadequate, supervised remote identity proofing SHALL NOT be used and the identity proofing and enrollment shall be performed in person at the issuer's facility. The trained operator SHALL terminate a supervised remote identity proofing session and require in-person identity proofing at an issuing facility if there is reasonable basis to believe[10] that the applicant is attempting to bypass protection capabilities of the station.

2.8 PIV Card Issuance Requirements

Departments and agencies SHALL meet the requirements defined below when issuing PIV Cards. The issuance process used when issuing PIV Cards SHALL be accredited by the department or agency as satisfying the requirements below and approved in writing by the head or deputy (or equivalent) of the federal department or agency.

- PIV Cards SHALL be issued only after the adjudicative entity has authorized issuance of the credential.
- The organization SHALL use an approved PIV credential issuance process in accordance with [SP 800-79].
- Before issuing the PIV Card, the issuer SHALL ensure that the individual receiving it has been properly processed per Section 2.1, Section 2.2, and Section 2.7.
- Biometric data used to personalize the PIV Card SHALL be those captured during the identity proofing and registration process.

[10] A reasonable basis to believe occurs when a disinterested observer with knowledge of the same facts and circumstances would reasonably reach the same conclusion.

- During the issuance process, the issuer SHALL verify that the individual to whom the PIV Card is to be issued is the same as the intended applicant/recipient as approved by the appropriate authority. Before the PIV Card is provided to the applicant, the issuer SHALL perform a one-to-one comparison of the applicant against biometric data records available on the PIV Card or in the PIV enrollment record. The one-to-one comparison requires either a comparison of fingerprints or, if unavailable, other optional biometric data records that are available. Minimum accuracy requirements for the biometric verification are specified in [SP 800-76]. On a positive biometric verification decision, the PIV Card SHALL be released to the applicant. If the biometric verification decision is negative, or if no biometric data records are available, the cardholder SHALL provide two identity source documents (as specified in Section 2.7), and an attending operator SHALL inspect these and compare the cardholder with the photograph printed on the PIV Card.
- The organization SHALL issue PIV credentials only through systems and providers whose reliability has been established by the agency and so documented and approved in writing (i.e., accredited) in accordance with [SP 800-79].
- The PIV Card SHALL be valid for no more than six years.

PIV Cards that contain topographical defects (e.g., scratches, poor color, fading, etc.) or that are not properly printed SHALL be destroyed. The PIV Card issuer is responsible for the card stock, its management, and its integrity.

2.8.1 Special Rule for Pseudonyms

In limited circumstances, federal employees and contractors are permitted to use pseudonyms during the performance of their official duties with the approval of their employing agency. If an agency determines that the use of a pseudonym is necessary[11] to protect an employee or contractor (e.g., from physical harm, severe distress, or harassment), the agency may formally authorize the issuance of a PIV Card to the employee or contractor using the agency-approved pseudonym. The issuance of a PIV Card using an authorized pseudonym SHALL follow the procedures in Section 2.8 except that the card issuer SHALL receive satisfactory evidence that the pseudonym is authorized by the agency.

2.8.2 Grace Period

In some instances, an individual's status as a federal employee or contractor will lapse for a brief time period. For example, a federal employee may leave one federal agency for

[11] An example can be seen in Section 10.5.7 of the Internal Revenue Service Manual (https://www.irs.gov/irm/part10/irm_10-005-007), which authorizes approval by an employee's supervisor of the use of a pseudonym to protect the employee's personal safety.

another federal agency and thus incur a short employment lapse period, or an individual who was under contract to a federal agency may receive a new contract from that agency shortly after the previous contract expired.[12] In these instances, the card issuer MAY issue a new PIV Card without repeating the identity proofing and registration process if the issuer can obtain the applicant's PIV enrollment record containing biometric data records from the issuer of the applicant's previous PIV Card.

When issuing a PIV Card under the grace period, the card issuer SHALL verify that PIV Card issuance has been authorized by a proper authority and that the employee or contractor's background investigation is valid. Re-investigations SHALL be performed, if required, in accordance with the federal investigative standards. At the time of issuance, the card issuer SHALL perform biometric verification of the applicant to the biometric data records in the applicant's previous PIV enrollment record. The one-to-one comparison requires either a comparison of fingerprints or, if unavailable, other optional biometric data records that are available. On a positive biometric verification decision, the new PIV Card SHALL be released to the applicant. If the biometric verification decision is negative, or if no biometric data records are available, the cardholder SHALL provide two identity source documents (as specified in Section 2.7), and an attending operator SHALL inspect these and compare the cardholder with the electronic facial image retrieved from the enrollment data record and the photograph printed on the new PIV Card.

2.9 PIV Card Maintenance Requirements

The PIV Card SHALL be maintained using processes that comply with this section.

The data and credentials held by the PIV Card may need to be updated or invalidated prior to the expiration date of the card. For example, a previously issued PIV Card needs to be invalidated when the cardholder changes their name or employment status. In this regard, procedures for PIV Card maintenance must be integrated into department and agency procedures to ensure effective card maintenance. In order to maintain operational readiness of a cardholder's PIV Card, agencies may require PIV Card update, reissuance, or biometric enrollment more frequently than the maximum PIV Card and biometric characteristic lifetimes stated in this Standard. Shorter lifetimes MAY be specified by agency policy.

2.9.1 PIV Card Reissuance Requirements

Reissuance is the process by which a new PIV Card is issued to a cardholder without the need to repeat the entire identity proofing and registration process. The reissuance process

[12] For the purposes of this section, a lapse is considered to be brief if it is not long enough to require that a new or updated background investigation be performed consistent with Executive Agents' guidance.

may be used to replace a PIV Card that is nearing expiration, in the event of an employee status or attribute change, or to replace a PIV Card that has been compromised, lost, stolen, or damaged. The cardholder may also apply for reissuance of a PIV Card if one or more logical credentials have been compromised. The identity proofing, registration, and issuance processes, as described in Section 2.7 and Section 2.8, SHALL be repeated if the issuer does not maintain a PIV enrollment record that includes biometric data records for the cardholder.

If the expiration date of the new PIV Card is later than the expiration date of the old card, or if any data about the cardholder is being changed, the card issuer SHALL ensure that an adjudicative entity has authorized the issuance of the new PIV Card. The issuer SHALL ensure that the adjudicative entity has verified that there is a PIV eligibility determination in an authoritative record, such as the agency's IDMS or the Central Verification System (or successor).

The issuer SHALL perform a biometric verification of the applicant to the biometric data records obtained from either the PIV Card or PIV enrollment record. Minimum accuracy requirements for the biometric verification are specified in [SP 800-76]. On a positive biometric verification decision, the new PIV Card SHALL be released to the applicant. If the biometric verification decision is negative, or if no biometric data records are available, the cardholder SHALL provide two identity source documents (as specified in Section 2.7), and an attending operator SHALL inspect these and compare the cardholder with the electronic facial image retrieved from the enrollment data record and the photograph printed on the new PIV Card.

The old PIV Card SHALL be revoked when the new PIV Card is issued. The revocation process SHALL include the following:

- The old PIV Card SHALL be collected and destroyed, if possible.
- Any databases maintained by the PIV Card issuer that contain FASC-N or card UUID values from the old PIV Card must be updated to reflect the change in status.
- If the old PIV Card cannot be collected and destroyed, or if the old PIV Card has been compromised or damaged, then the Certification Authority (CA) SHALL be informed and the certificates corresponding to the PIV authentication key (Section 4.2.2.1) and asymmetric card authentication key (Section 4.2.2.2) on the old PIV Card SHALL be revoked. If present, the certificates corresponding to the digital signature key (Section 4.2.2.1) and the key management key (Section 4.2.2.5) SHALL also be revoked.

In the case of a lost, stolen, or compromised card, normal revocation procedures SHALL be completed within 18 hours of notification. In certain cases, 18 hours is an unacceptable delay, and in those cases emergency procedures SHOULD be executed to disseminate the information as rapidly as possible.

If there is any data change about the cardholder, the issuer SHALL record this data change in the PIV enrollment record, if applicable. If the changed data is the cardholder's name, then the issuer SHALL meet the requirements in Section 2.9.1.1.

Previously collected biometric data MAY be reused with the new PIV Card if the expiration date of the new PIV Card is no later than 12 years after the date that the biometric data was obtained. As biometric system error rates generally increase with the time elapsed since initial collection (reference aging, [ISO 2382-37]), issuers MAY refresh biometric data in the PIV enrollment record during the re-issuance process. Even if the same biometric data is reused with the new PIV Card, the digital signature must be recomputed with the new FASC-N and UUID.

A new PIV authentication certificate and a new card authentication certificate SHALL be generated. The corresponding certificates SHALL be populated with the new FASC-N and card UUID. For cardholders who are required to have a digital signature certificate, a new digital signature certificate SHALL also be generated. Key management keys and certificates MAY be imported to the new PIV Card.

2.9.1.1 Special Rule for Name Change by Cardholder

Name changes frequently occur as a result of marriage, divorce, or as a matter of personal preference. In the event that a cardholder notifies a card issuer that their name has changed and presents the card issuer with evidence of a formal name change—such as a marriage certificate, a divorce decree, judicial recognition of a name change, or other mechanism permitted by state law or regulation—the card issuer SHALL issue the cardholder a new card following the procedures set out in Section 2.9.1 and notify the respective adjudicative entity of the name change to ensure that appropriate records are updated. If the expiration date of the new card is no later than the expiration date of the old PIV Card and no data about the cardholder other than the cardholder's name is being changed, then the new PIV Card MAY be issued without obtaining the approval of the adjudicative entity and without performing a re-investigation.

2.9.2 PIV Card Post-Issuance Update Requirements

A PIV Card post-issuance update MAY be performed without replacing the PIV Card in cases where none of the printed information on the surface of the card is changed. The post-issuance update applies to cases where one or more certificates, keys, biometric data records, or signed data objects are updated. A post-issuance update SHALL NOT modify the PIV Card expiration date, FASC-N, card UUID, or cardholder UUID.

A PIV Card post-issuance update MAY be done locally (i.e., performed with the issuer in physical custody of the PIV Card) or remotely (i.e., performed with the PIV Card at a remote location). Post-issuance updates SHALL be performed with issuer security controls equivalent to those applied during PIV Card reissuance. For remote post-issuance updates, the following SHALL apply:

- Communication between the PIV Card issuer and the PIV Card SHALL occur only over mutually authenticated secure sessions between tested and validated cryptographic modules (one being the PIV Card).
- Data transmitted between the PIV Card issuer and PIV Card SHALL be encrypted and contain data integrity checks.
- The PIV Card application SHALL communicate with no endpoint entity other than the PIV Card issuer during the remote post-issuance update.

Post-issuance updates to biometric data records, other than to the digital signature blocks within the biometric data records, SHALL satisfy the requirements for PIV Card activation reset specified in Section 2.9.3.

If the PIV authentication key (Section 4.2.2.1), asymmetric card authentication key (Section 4.2.2.2), digital signature key (Section 4.2.2.1), or key management key (Section 4.2.2.5) was compromised, the corresponding certificate SHALL be revoked.

2.9.3 PIV Card Activation Reset

The Personal Identification Number (PIN) on a PIV Card may need to be reset if the cardholder has forgotten the PIN or if PIN-based cardholder authentication has been disabled by the usage of an invalid PIN more than the allowed number of retries. A maximum of 10 consecutive PIN retries SHALL be permitted unless a lower limit is stipulated by the department or agency. Cardholders MAY change their PINs at any time by providing the current PIN and the new PIN values. PIN reset MAY be performed in person at an issuing facility, at a kiosk operated by the issuer, or remotely via a general computing platform or a supervised remote identity proofing station:

In person

When PIN reset is performed in person at the issuing facility, before providing the reset PIV Card back to the cardholder, the issuer SHALL perform a biometric verification to ensure that the cardholder's biometric characteristics elicit a positive biometric verification decision when compared to biometric data records stored either on the PIV Card or in the PIV enrollment record. In cases where a negative biometric verification decision is returned or the cardholder's biometric characteristics are not successfully acquired, the cardholder SHALL provide the PIV Card to be reset and another primary identity source document (as specified in Section 2.7). An attending operator SHALL inspect these and compare the cardholder with the electronic facial image retrieved from the enrollment data record and the photograph printed on the card.

Issuer-operated kiosk

PIN reset at an issuer-operated kiosk SHALL ensure that the PIV Card is authenticated and that the cardholder's biometric characteristics elicit a positive biometric verification decision when compared to either the stored biometric on the PIV Card through an on-card one-to-one comparison or biometric data records stored in the PIV enrollment record through an off-card one-to-one comparison. If the biometric verification decision is negative, the cardholder's biometric characteristics are not successfully acquired, or card authentication is unsuccessful, the kiosk SHALL NOT reset the PIV Card. The session SHALL be terminated and the PIN reset SHALL be performed in person at the issuing facility or at a supervised remote identity proofing station. The kiosk MAY be unattended while used for PIN reset operations.

Supervised remote identity proofing station

PIN reset at a supervised remote identity proofing station combines the assurance of an in-person reset with the convenience of a kiosk reset. All protections and requirements of Section 2.7.1 SHALL be observed during the procedure. The operator SHALL initiate a biometric verification to ensure that the cardholder's biometric characteristics captured at the station elicit a positive biometric verification decision when compared to biometric data records stored either on the PIV Card or in the PIV enrollment record. In cases where a negative biometric verification decision is returned or the cardholder's biometric characteristics are not successfully acquired, the cardholder SHALL provide the PIV Card to be reset and another primary identity source document (as specified in Section 2.7) via the scanners and sensors integrated into the station. The remote operator SHALL inspect these items and compare the video feed of the cardholder with the electronic facial image retrieved from the enrollment data record and the photograph printed on the PIV Card.

General computing platform

Remote PIN reset on a general computing platform (e.g., desktop, laptop) SHALL only be performed if all the following requirements are met:

- The cardholder initiates a PIN reset with the issuer operator.
- The operator authenticates the owner of the PIV Card through an independent procedure.
- The cardholder's biometric characteristics elicit a positive biometric verification decision when compared to the stored biometric data records on the PIV Card through OCC.

The remote PIN reset operation SHALL satisfy the requirements for remote, post-issuance updates specified in Section 2.9.2.

Regardless of the PIN reset procedure used, the chosen PIN SHALL meet the activation requirements specified in Section 4.3.1.

The PIV Card's activation methods for OCC may also be reset by the card issuer. Before the reset, the issuer SHALL perform a biometric verification of the cardholder to the biometric data records in the PIV enrollment record. If no alternative biometric data records are available, the cardholder SHALL provide the PIV Card to be reset and another primary identity source document (as specified in Section 2.7). An attending operator SHALL inspect these and compare the cardholder with the electronic facial image retrieved from the enrollment data record and the photograph printed on the PIV Card.

Departments and agencies MAY adopt more stringent procedures for PIN/OCC reset (including disallowing resets); such procedures SHALL be formally documented by each department and agency.

2.9.4 PIV Card Termination Requirements

A PIV Card is terminated when the department or agency that issued the card determines that the cardholder is no longer eligible to have a PIV Card. The PIV Card SHALL be terminated under any of the following circumstances:

- A federal employee separates (voluntarily or involuntarily) from federal service.
- A contractor changes positions and no longer needs access to federal buildings or systems.
- A cardholder passes away.
- An authorized adjudicative entity determines that the cardholder is ineligible for a PIV Card after completion of a cardholder's background investigation or review of developed information (see [FCS]).
- A cardholder is determined to hold a fraudulent identity.

Similar to the situation in which the PIV Card is compromised, normal termination procedures must be in place. The PIV Card SHALL be revoked through the following procedure:

- The PIV Card SHALL be collected and destroyed, if possible.
- Per OPM guidance, the Central Verification System (or successor) SHALL be updated to reflect the change in status.
- Any databases maintained by the PIV Card issuer that indicate current valid or invalid FASC-N or card UUID values SHALL be updated to reflect the change in status.
- If the PIV Card cannot be collected and destroyed, the CA SHALL be informed and the certificates corresponding to the PIV authentication key and the asymmetric card authentication key on the PIV Card SHALL be revoked. The certificates corresponding to the digital signature and key management keys SHALL also be revoked, if present.

In addition, the PIV Card termination procedures SHALL ensure all derived PIV credentials bound to the PIV account are invalidated as specified in Section 2.10.2.

If the card cannot be collected, normal termination procedures SHALL be completed within 18 hours of notification. In certain cases, 18 hours is an unacceptable delay and in those cases emergency procedures SHOULD be executed to disseminate the information as rapidly as possible.

The PII collected from the cardholder SHALL be disposed of in accordance with the stated privacy and data retention policies of the department or agency.

2.10 Derived PIV Credentials

Derived PIV credentials are additional PIV credentials that are issued based on proof of possession and control of a PIV Card. These credentials are not embedded in the PIV Card but instead are stand-alone or integrated in a variety of devices and platforms. Derived PIV credentials play an important role for environments where use of the PIV Card is not easily supported.

2.10.1 Derived PIV Credential Issuance Requirements

Issuance of a derived PIV credential is an instance of the post-enrollment binding of an authenticator described in [SP 800-63B] and SHALL be performed in accordance with the requirements that apply to physical authenticators as well as the requirements in this section.

The binding and issuance of derived PIV credentials SHALL use valid PIV Cards to establish cardholder identity in accordance with [SP 800-157]. Derived PIV credentials MAY be created at the same Authenticator Assurance Level (AAL) as the PIV Card itself (i.e., AAL3) or MAY be created at AAL2, depending on the security characteristics of the authenticator. The issuer SHALL attempt to promptly notify the cardholder of the binding of a derived PIV credential through an independent means that would not afford an attacker an opportunity to erase the notification. More than one independent notification method MAY be used to ensure prompt receipt by the cardholder. Derived PIV credentials SHALL be bound to the cardholder's PIV account only by the organization that manages that PIV account.

2.10.2 Derived PIV Credential Invalidation Requirements

Derived PIV credentials SHALL be invalidated in any of the following circumstances:

- Upon request of the PIV cardholder as a result of loss, failure, compromise, or intent to discontinue use of a derived PIV credential

- At the determination of the issuer upon reported loss or suspected compromise of a derived PIV credential
- At the determination of the issuer upon observation of possible fraudulent activity
- When a cardholder is no longer eligible to have a PIV Card as specified in Section 2.9.4; in this situation, all derived PIV credentials associated with the PIV account SHALL be invalidated.

If the derived PIV credential to be invalidated contains a derived PIV authentication certificate and the corresponding private key cannot be securely zeroized or destroyed, the CA SHALL be informed and the certificate corresponding to the derived PIV authentication key SHALL be revoked.

A derived PIV credential SHALL NOT be accepted for authentication once the credential has been invalidated. When invalidation occurs, the issuer SHALL notify the cardholder of the change.

2.11 PIV Privacy Requirements

[HSPD-12] explicitly states that "protect[ing] personal privacy" is a requirement of the PIV system. As such, all departments and agencies SHALL implement the PIV system in accordance with the spirit and letter of all privacy controls specified in this Standard, as well as those specified in federal privacy laws and policies including but not limited to the E-Government Act of 2002 [E-Gov], the Privacy Act of 1974 [PRIVACY], and OMB [M-03-22], as applicable.

Departments and agencies may have a wide variety of uses for the PIV system and its components that were not intended or anticipated by the President in issuing [HSPD-12]. In considering whether a proposed use of the PIV system is appropriate, departments and agencies SHALL consider the aforementioned control objectives and the purpose of this Standard, namely "to enhance security, increase Government efficiency, reduce identity fraud, and protect personal privacy" as per [HSPD-12]. No department or agency SHALL implement a use of the identity credential inconsistent with these control objectives.

To ensure privacy throughout the PIV lifecycle, departments and agencies SHALL do the following:

- Assign an individual to the role of privacy official.[13] The privacy official is the individual who oversees privacy-related matters in the PIV system and is responsible for implementing the privacy requirements in the Standard. The individual serving in this role SHALL NOT assume any other operational role in the PIV system.

[13] Privacy official refers to the Senior Agency Official for Privacy (SAOP) or Chief Privacy Officer (CPO).

- Conduct a comprehensive Privacy Impact Assessment (PIA) on systems containing PII for the purpose of implementing PIV consistent with the methodology of [E-Gov] and the requirements of [M-03-22]. Consult with appropriate personnel responsible for privacy issues at the department or agency (e.g., Chief Information Officer) implementing the PIV system.
- Write, publish, and maintain a clear and comprehensive document listing the types of information that will be collected (e.g., transactional information, PII), the purpose of collection, what information may be disclosed to whom during the life of the credential, how the information will be protected, and the complete set of uses of the credential and related information at the department or agency.
- Provide PIV applicants with full disclosure of the intended uses of the information associated with the PIV Card and the related privacy implications.
- Ensure that systems that contain PII for the purpose of enabling the implementation of PIV are handled in full compliance with fair information practices, as defined in [PRIVACY].
- Maintain appeal procedures for those who are denied a credential or whose credentials are revoked.
- Ensure that only personnel with a legitimate need for access to PII in the PIV system are authorized to access the PII, including but not limited to information and databases maintained for registration and credential issuance.[14]
- Coordinate with appropriate department or agency officials to define consequences for violating privacy policies of the PIV system.
- Ensure that the technologies used in the department or agency's implementation of the PIV system allow for continuous auditing of compliance with stated privacy policies and with practices governing the collection, use, and distribution of information in the operation of the program.
- Utilize security controls described in [SP 800-53] to accomplish privacy goals, where applicable.
- Ensure that the technologies used to implement PIV sustain and do not erode privacy protections relating to the use, collection, and disclosure of PII. Agencies MAY choose to deploy PIV Cards with electromagnetically opaque holders or other technology to protect against any unauthorized contactless access to information stored on a PIV Card.

[14] Agencies may refer to [SP 800-122] for best practice guidelines on protection of PII.

3. PIV System Overview

This section is informative. It serves to provide an overview of the different components of the PIV system.

The PIV system is composed of components and processes that support a common platform for identity authentication across federal departments and agencies for access to multiple types of physical and logical access environments. The specifications for the PIV components in this Standard promote uniformity and interoperability among the various PIV system components, across departments and agencies, and across installations. The specifications for processes in this Standard are a set of minimum requirements for the various activities that need to be performed within an operational PIV system. When implemented in accordance with this Standard, PIV Cards and derived PIV credentials support a suite of authentication mechanisms that can be used consistently across departments and agencies. The authenticated identity information can then be used as a basis for access control in physical and logical access environments. The following sections briefly discuss the functional components of the PIV system and the lifecycle activities of the PIV Card.

3.1 Functional Components

An operational PIV system can be divided into three major subsystems:

PIV Front-End Subsystem

The PIV Card, card readers, biometric capture devices, and PIN input devices, as well as any derived PIV credentials used by the PIV cardholder. The PIV cardholder interacts with these components to gain physical or logical access to the desired federal resource.

PIV Issuance and Management Subsystem

The components responsible for identity proofing and registration, card and key issuance and management, and the various repositories and services required as part of the verification infrastructure, such as Public Key Infrastructure (PKI) directories and certificate status servers. This subsystem also manages the binding and termination of derived PIV credentials as described in Section 2.10.

PIV Relying Subsystem

The physical and logical access control systems, protected resources, and authorization data.

Figure 3-1 illustrates a notional model for the operational PIV system, identifying the various system components. The boundary shown in the figure is not meant to preclude FIPS 201 requirements on systems outside of these boundaries. See Section 3.3 for information about data flow and connections between components.

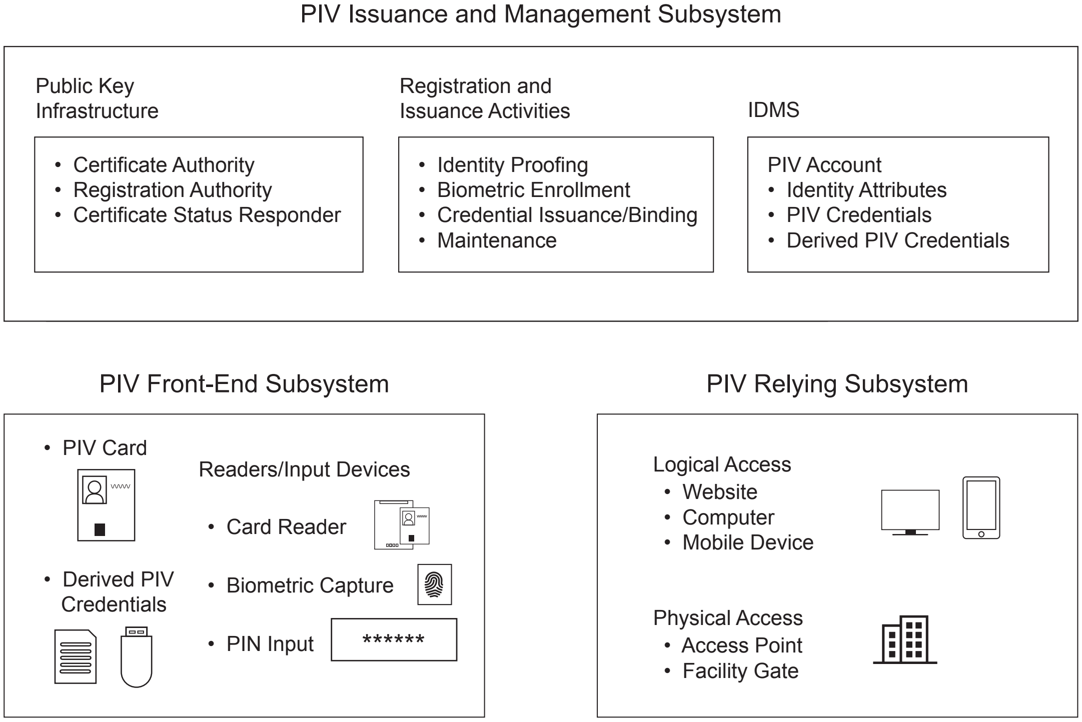


Figure 3-1. PIV System Overview

3.1.1 PIV Front-End Subsystem

The PIV Front-End Subsystem in Figure 3-1 consists of credentials and devices that are used during authentication. The PIV Card will be issued to the applicant when all identity proofing, registration, and issuance processes have been completed. Derived PIV credentials might also be registered after these processes are complete. The PIV Card takes the physical form of the [ISO 7816] ID-1 card type (i.e., traditional payment card) with one or more embedded Integrated Circuit Chips (ICC) that provide memory capacity and computational capability. The PIV Card is the primary component of the PIV system. The cardholder uses the PIV Card for authentication to access various physical and logical resources. Alternatively, derived PIV credentials increasingly play an important role as additional authenticators, especially in environments where use of the PIV Card is not easily supported. These AAL2 and AAL3 authenticators are not embedded in the PIV Card but, rather, are stand-alone or integrated in a variety of devices and platforms.

Card readers are located at access points for controlled resources to allow a cardholder to gain physical or logical access using the PIV Card. The reader communicates with a PIV Card to perform the authentication protocol and relay that information to the access control systems for granting or denying access.

Card writers, which are similar to card readers, personalize and initialize the information stored on PIV Cards. Card writers may also be used to perform remote PIV Card updates (see Section 2.9.2). The data to be stored on PIV Cards includes cardholder information, certificates, cryptographic keys, the PIN, and biometric data.

PIN input devices can be used along with card readers when a higher level of authentication assurance is required. The cardholder presenting the PIV Card types their PIN into the PIN input device. For physical access, the PIN is typically entered using a PIN pad device; a keyboard is generally used for logical access. The input of a PIN provides a "something you know"[15] authentication factor that activates[16] the PIV Card and enables access to other credentials resident on the card that provide additional factors of authentication. A cryptographic key and certificate, for example, provide an additional authentication factor of "something you have" (i.e., the card) through PKI-based authentication.

Biometric capture devices may be located at secure locations where a cardholder may want to gain access. These devices depend upon the use of the biometric data of the cardholder, stored in the memory of the card, and its comparison with a real-time captured biometric sample. The use of biometric characteristics provides an additional factor of authentication ("something you are").

3.1.2 PIV Issuance and Management Subsystem

The registration and issuance activities in Figure 3-1 start with identity proofing and registration, during which all information and documentation required for enrollment are collected, stored, and maintained. The collected information is subsequently used to personalize and issue the PIV Card, as well as to bind and issue derived PIV credentials as additional PIV authenticators.

The PIV Card issuance process focuses on the personalization of the physical (visual surface) and logical (contents of the ICC) aspects of the card at the time of issuance and maintenance thereafter. This includes printing photographs, names, and other information on the card and loading the relevant card applications, biometric data, and other data.

The PKI component provides services for PKI-based PIV credentials. This component is used throughout the lifecycle of PIV Cards and PKI-based derived PIV credentials—from generation and loading of authentication keys and PKI credentials, to usage of these keys for secure operations, to eventual reissuance or termination of the PIV Card and associated PKI-based derived PIV credentials. At the personalization phase, the PKI component issues and distributes the digital certificates for the keys generated on-card and keys generated for PKI-based derived PIV credentials. During use of the PIV

[15] For more information on the terms "something you know," "something you have," and "something you are," see [SP 800-63].

[16] Alternatively, a biometric on-card one-to-one comparison can be used to activate the PIV Card.

credentials at authentication, the PKI component provides the requesting application with the certificate status information of the PKI credentials requesting access.

The enterprise IDMS serves as the central repository for the cardholder's digital identities. It is where the relevant cardholder attributes are maintained. The IDMS creates the PIV account and associates the cardholder's PIV Card and derived PIV credentials with the account. The account is maintained throughout the cardholder's employment with the organization. Various Identity, Credential, and Access Management (ICAM)-related systems connect to the IDMS to request or update cardholder attributes. For example

- A security office may provide updated background investigative information to the IDMS.
- An HR system may relay hiring status updates.
- The IDMS may serve as the Identity Provider (IdP), authenticating the cardholder on behalf of a Relying Party (RP) and issuing assertions of attributes relating to the PIV account to the RP.

3.1.3 PIV Relying Subsystem

The PIV relying subsystem in Figure 3-1 includes components responsible for determining a particular PIV cardholder's access to a physical or logical resource.[17] A physical resource is the secured facility (e.g., building, room, parking garage) that the cardholder wishes to access. The logical resource is typically a network or a location on the network (e.g., computer workstation, folder, file, database record, software program) to which the cardholder wants to gain access.

The relying subsystem depends on authorization mechanisms that define the privileges (authorizations) possessed by entities requesting to access a particular logical or physical resource. An example of this is an Access Control List (ACL) associated with a file on a computer system.

The PIV relying subsystem becomes relevant when the PIV Card or derived PIV credential is used to authenticate a cardholder who is seeking access to a physical or logical resource. Although this Standard does not provide technical specifications for this subsystem, various mechanisms for authentication are defined in Section 6 for PIV Cards and in [SP 800-157] for derived PIV credentials to provide consistent and secure means for performing the authentication function preceding an access control decision.

The relying subsystem identifies and authenticates cardholders either by interacting with the PIV Card using mechanisms discussed in Section 6 or by communicating with an IdP through a federation protocol as discussed in Section 7. Once authenticated, authorization mechanisms that support the relying subsystem grant or deny access to resources based on the privileges assigned to the cardholder.

[17] The cardholder may authenticate with the PIV Card or a derived PIV credential.

3.2 PIV Card Lifecycle Activities

The PIV Card lifecycle consists of seven activities.[18] The activities that take place during fabrication and pre-personalization of the card at the manufacturer are not considered a part of this lifecycle model. Figure 3-2 presents these PIV activities and depicts the PIV Card request as the initial activity and PIV Card termination as the end of life activity.

The seven card lifecycle activities are as follows:

PIV Card Request
The initiation of a request for the issuance of a PIV Card to an applicant and the validation of this request.

Identity Proofing and Registration
Verification of the claimed identity of the applicant, including verification that the entire set of identity source documents presented at the time of registration is valid, capture of biometric characteristics, and creation of the PIV enrollment record.[19]

PIV Card Issuance
Personalization (physical and logical) and issuance of the card to the intended applicant.

PKI Credential Issuance
Generation of logical credentials and loading them onto the PIV Card.

PIV Card Usage
Use of the PIV Card to perform cardholder authentication for access to a physical or logical resource. Access authorization decisions are made after successful cardholder identification and authentication.

PIV Card Maintenance
Maintenance or update of the physical PIV Card and its data. Such data includes various card applications, PINs, PKI credentials, and biometric data.

PIV Card Termination
Permanent destruction or invalidation of the PIV Card and the data and keys needed for authentication so as to prevent any future use of the PIV Card for authentication.

[18] The lifecycle activities of derived PIV credentials are described in SP 800-157.

[19] In some other National Institute of Standards and Technology (NIST) documents such as [SP 800-63A], registration is referred to as *enrollment*.

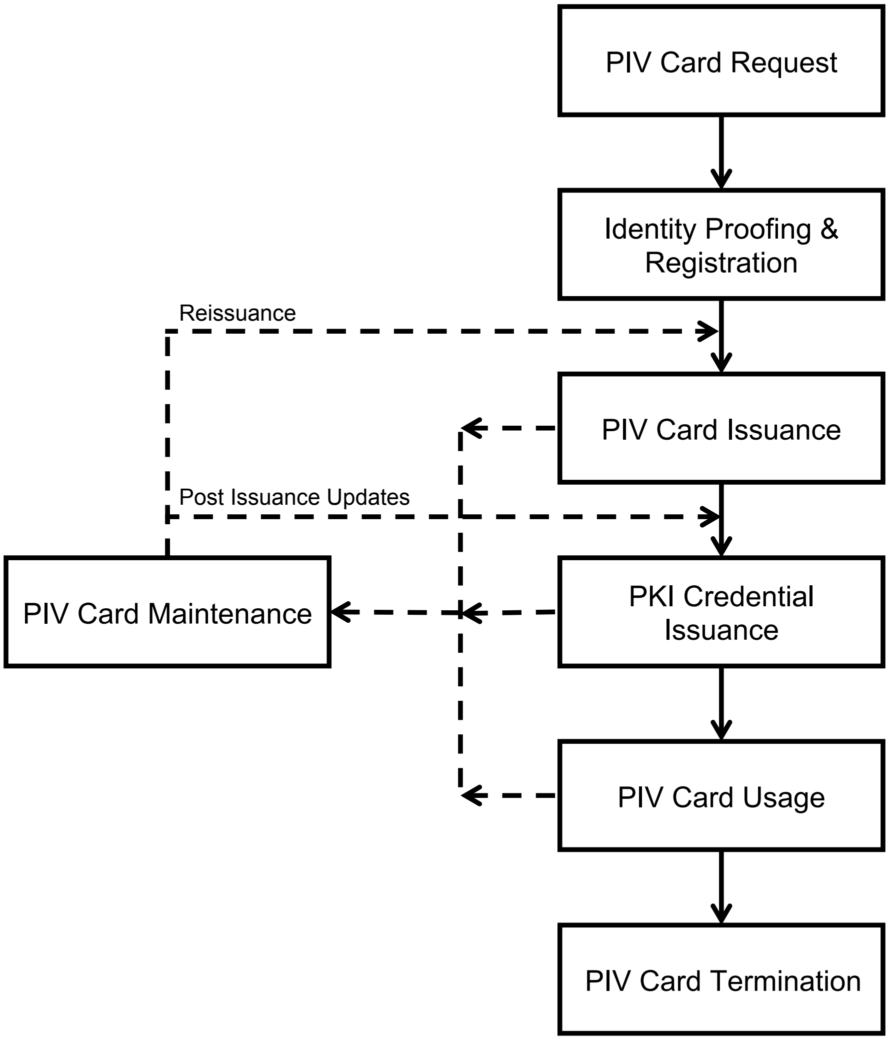


Figure 3-2. PIV Card Lifecycle Activities

3.3 Connections Between System Components

To perform authentication for logical or physical access using a PIV Card or a derived PIV credential directly, the credential is verified and attributes from the PIV account are provided to the relying subsystem. The connections and data flows between these components are shown in Figure 3-3.

While it is possible to directly accept a PIV Card issued by another agency, the recommended interoperability mechanism for most agencies is to use a federation protocol, as discussed in Section 7. In this method, the PIV cardholder authenticates to an IdP, which is part of the PIV Issuance and Management Subsystem, using their PIV Card or derived PIV credential. The IdP verifies the credential and determines the attributes associated with the PIV account. The IdP then creates an assertion that is sent to the relying subsystem. The RP validates the assertion from the IdP, but the RP never sees the credential or authentication at the IdP. The connections and data flows between these components are shown in Figure 3-4.

While this Standard makes no requirements on when to apply direct or federated authentication mechanisms, there are some natural mappings. For example, physical access systems are not usually well-suited for a federation protocol. Also, many derived PIV credentials can only be verified by their issuer and are therefore better suited for use as part of a federation protocol.

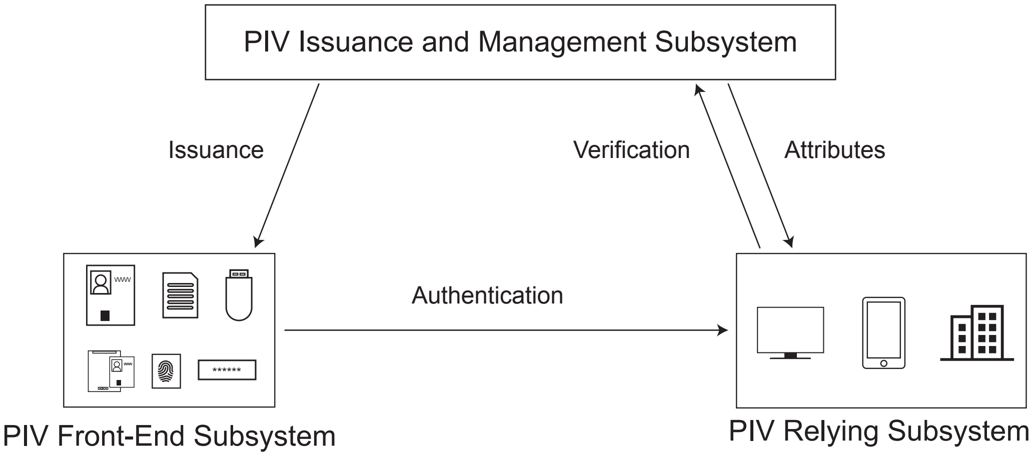


Figure 3-3. PIV System Connections

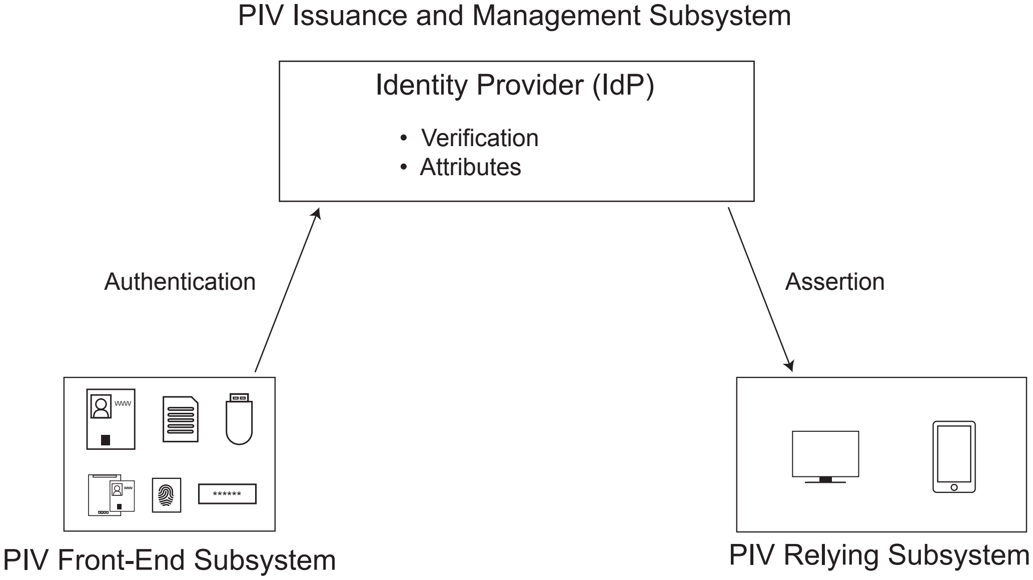


Figure 3-4. PIV System Federation Connections

4. PIV Front-End Subsystem

This section is normative. It provides the requirements for the PIV front-end subsystem components.

4.1 PIV Card Physical Characteristics

References to the PIV Card in this section pertain to its physical characteristics only. References to the front of the card apply to the side of the card that contains electronic contacts. References to the back of the card apply to the side opposite the front.

The PIV Card's physical appearance and other characteristics should balance the need to have the PIV Card commonly recognized as a federal identification card while providing the flexibility to support individual department and agency requirements. Having a common look for PIV Cards is important in meeting the objectives of improved security and interoperability. In support of these objectives, consistent placement of printed components and technology is necessary.

The PIV Card SHALL comply with the physical characteristics described in [ISO 7810], [ISO 10373], and [ISO 7816] for contact cards in addition to [ISO 14443] for contactless cards.

4.1.1 Printed Material

The printed material SHALL NOT rub off during the life of the PIV Card. The printing process SHALL NOT deposit debris on the printer rollers during printing and laminating. Printed material SHALL NOT interfere with the ICCs or related components, nor SHALL it obstruct access to machine-readable information.

4.1.2 Tamper-proofing and Resistance

To combat counterfeiting and alterations, the PIV Card SHALL contain security features outlined in the American Association of Motor Vehicle Association's (AAMVA) Drivers License/Identification Card (DL/ID) Card Design Standard [CDS]. The Card Design Standard classifies security features into three categories, depending on the inspection level required for verification:

Inspection Level 1

Security features that can be examined without tools or aids and include easily identifiable visual or tactile features for rapid inspection at point of usage. Examples include an embossed surface pattern, an optically variable device (such as a hologram), or color-shifting inks.

Inspection Level 2

Security features that require the use of a tool or instrument (e.g., UV light, magnifying glass, or scanner) to discern. Examples include microtext, UV-fluorescent images, IR-fluorescent ink, nano and micro images, and chemical taggants.

Inspection Level 3

Security features inspected by forensic specialists to conduct in-depth examination that may require special equipment to provide true certification.

A PIV Card SHALL incorporate at least one security feature at inspection level 1 or inspection level 2. Federal departments and agencies SHOULD incorporate additional security features and include all three inspection levels.

Incorporation of security features SHALL

- be in accordance with durability requirements;
- be free of defects, such as fading and discoloration;
- not obscure printed information; and
- not impede access to machine-readable information.

All security features SHOULD maintain their function for the life of the card. As a generally accepted security procedure, federal departments and agencies SHOULD periodically review the viability, effectiveness, and currency of employed tamper resistance and anti-counterfeiting methods.

4.1.3 Physical Characteristics and Durability

This section describes the physical requirements for the PIV Card.

The PIV Card SHALL contain a contact and a contactless ICC interface.

The card body SHALL be white in accordance with color representation in Section 4.1.5. Only security features, as described in Section 4.1.2, may modify the perceived color slightly. Presence of security features SHALL NOT prevent the recognition of white as the principal card body color by a person with normal vision (corrected or uncorrected) at a working distance of 50 cm to 200 cm.

The card body structure SHALL consist of card materials that satisfy the card characteristics in [ISO 7810] and test methods in [ANSI 322]. Although the [ANSI 322] test methods do not currently specify compliance requirements, the tests SHALL be used to evaluate card material durability and performance. These tests SHALL include card flexure, static stress, plasticizer exposure, impact resistance, card structural integrity, surface abrasion, temperature and humidity-induced dye migration, ultraviolet light exposure, and laundry test. Cards SHALL NOT malfunction or delaminate after hand cleaning with a mild soap and water mixture.

The card SHALL be subjected to sunlight exposure in accordance with Section 5.12 of [ISO 10373] or to ultraviolet and daylight fading exposure in accordance with [ANSI 322]. Sunlight exposure in accordance with [ISO 10373] SHALL be in the form of actual, concentrated, or artificial sunlight that appropriately reflect 2 000 hours of southwestern United States' sunlight. Concentrated sunlight exposure SHALL be performed in accordance with [G90-17] and accelerated exposure in accordance with [G155-2013]. The card SHALL be subjected to the [ISO 10373] dynamic bending test and SHALL have no visible cracks or failures after the [ISO 10373] or [ANSI 322] exposure.

There are methods by which proper card orientation can be indicated. Section 4.1.4.3, for example, defines Zones 21F and 22F, where card orientation features MAY be applied.[20] Note: If an agency determines that tactilely discernible markers for PIV Cards impose an undue burden, the agency SHALL implement policies and procedures to accommodate employees and contractors with disabilities in accordance with Sections 501 and 504 of the Rehabilitation Act.

The card SHALL be 27 mil to 33 mil (0.68 mm to 0.84 mm) thick before lamination, in accordance with [ISO 7810].

The PIV Card SHALL NOT be embossed other than for security and accessibility features.

Decals SHALL NOT be adhered to the card.

Departments and agencies MAY choose to punch an opening in the card body to enable the card to be oriented by touch or to be worn on a lanyard. Departments and agencies should ensure such alterations are closely coordinated with the card vendor and manufacturer to ensure the card material integrity and printing process are not adversely impacted. Departments and agencies SHOULD ensure such alterations do not

- compromise card body durability requirements and characteristics;
- invalidate card manufacturer warranties or other product claims;
- alter or interfere with printed information, including the photograph; or
- damage or interfere with machine-readable technology, such as the embedded antenna.

The card material SHALL withstand the effects of temperatures required by the application of a polyester laminate on one or both sides of the card by commercial off-the-shelf (COTS) equipment. The thickness added due to a laminate layer SHALL NOT interfere with the smart card reader operation. The card material SHALL allow production of a flat card in accordance with [ISO 7810] after lamination of one or both sides of the card.

The PIV Card MAY be subjected to additional testing.

[20] For some individuals, the contact surface for the ICC may be sufficient for determining the orientation of the card.

4.1.4 Visual Card Topography

The information on a PIV Card SHALL be in visual printed and electronic form. This section covers the placement of visual and printed information. It does not cover information stored in electronic form, such as stored data elements or other possible machine-readable technologies. Logically stored data elements are discussed in Section 4.2.

As noted in Section 4.1.3, the PIV Card SHALL contain a contact and a contactless ICC interface. This Standard does not specify the number of chips used to support the mandated contact and contactless interfaces.

To achieve a common PIV Card appearance and provide departments and agencies with the flexibility to augment the card with department- or agency-specific requirements, the card SHALL contain printed information and machine-readable technologies. Mandated and optional items SHALL be placed as described and depicted. Printed data SHALL NOT interfere with machine-readable technology.

Areas that are marked as reserved SHOULD NOT be used for printing. The reason for the recommended reserved areas is that placement of the embedded contactless ICC module may vary between manufacturers, and there are constraints that prohibit printing over the embedded contactless module. The PIV Card topography provides flexibility for placement of the embedded module, either in the upper right corner or in the lower portion. Printing restrictions apply only to the area where the embedded module is located.

Unless otherwise specified, all data labels SHALL be printed in 5 pt Arial with the corresponding data in 6 pt Arial Bold. Unless otherwise specified, all text SHALL be printed in black.

4.1.4.1 Mandatory Items on the Front of the PIV Card

Zone 1F: Photograph

The photograph SHALL be placed in the upper left corner, as depicted in Figure 4-1, and be a frontal pose from top of the head to shoulder. A minimum of 300 dots per inch (DPI) resolution SHALL be used. The background SHALL follow recommendations set forth in [SP 800-76].

Zone 2F: Name

The full name[21] SHALL be printed directly under the photograph in capital letters from the American Standard Code for Information Interchange (ASCII) character set specified in [RFC 20]. The full name SHALL be composed of a primary identifier

[21] Alternatively, an authorized pseudonym as provided under the law as discussed in Section 2.8.1.

(i.e., surnames or family names) and a secondary identifier (i.e., pre-names or given names). The printed name SHALL match the name on the identity source documents provided during identity proofing and registration to the extent possible. The full name SHALL be printed in the PRIMARY IDENTIFIER, SECONDARY IDENTIFIER format. The entire full name SHOULD be printed on available lines of Zone 2F and either identifier MAY be wrapped. The wrapped identifier SHALL be indicated with the ">" character at the end of the line. The identifiers MAY be printed on separate lines if each fits on one line. Departments and agencies SHALL use the largest font in the range of 7 pt to 10 pt Arial Bold that allows the full name to be printed. Using 7 pt Arial Bold allows space for three lines and SHALL only be used if the full name does not fit on two lines in 8 pt Arial Bold. Table 4-1 provides examples of separate primary and secondary identifier lines, single line with identifiers, wrapped full names, and full name in three lines. Note that the truncation SHOULD only occur if the full name cannot be printed in 7 pt Arial Bold.

Names in the primary identifier and the first name in the secondary identifier SHALL NOT be abbreviated. Other names and conventional prefixes and suffixes, which SHALL be included in the secondary identifier, MAY be abbreviated. The special character "." (period) SHALL indicate such abbreviations, as shown in Figure 4-2. Other uses of special symbols (e.g., the apostrophe in "O'BRIEN") are at the discretion of the issuer.

Zone 7F: Contact Area

The electronic contact interface for the card as defined by [ISO 7816]. Printed items SHALL NOT cover the contact surface. The total size of the contact surface can vary between manufacturers. The area shown in Figure 4-1 roughly represents the minimal possible size.

Zone 8F: Employee Affiliation

An employee affiliation SHALL be printed on the card as depicted in Figure 4-1. Examples of employee affiliation include "Employee," "Contractor," "Active Duty," and "Civilian."

Zone 10F: Agency, Department, or Organization

The organizational affiliation SHALL be printed as depicted in Figure 4-1.

Zone 14F: Card Expiration Date

The card expiration date SHALL be printed on the card as depicted in Figure 4-1. The card expiration date SHALL be in a YYYYMMMDD format. The YYYY characters represent the four-digit year; the DD characters represent the two-digit day of the month; and the MMM characters represent the three-letter month abbreviation as follows: JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, and DEC. The Zone 14F expiration date SHALL be printed in 6 pt to 9 pt Arial Bold.

Table 4-1. Name Examples

Name	Characteristics	Example
John Doe	Simple full name of individual who does not have a middle name, two lines sufficient at 10 pt.	
Anna Maria Eriksson	Simple full name, two lines sufficient at 10 pt.	
Anna Maria Eriksson	Simple full name with abbreviated middle name, two lines sufficient at 10 pt.	
Anna Maria Eriksson	Simple full name, one line sufficient for full name at 10 pt.	
Susie Margaret Smith-Jones	Longer full name in two lines, sufficient space at 10 pt.	
Susie Margaret Smith-Jones	Longer full name wrapped, two lines sufficient at 10 pt.	
Chayapa Dejthamrong Krusuang Nilavadhananananda	Longer full name wrapped, two lines not sufficient at 10 pt. Reduce to 8 pt.	
Vaasa Silvaan Beenelong Wooloomooloo Warrandyte Warwarnambool	Longer full name, two lines not sufficient at 8 pt, 7 pt allows sufficient space for three lines in Zone 2F.	
Vaasa Silvaan Beenelong Wooloomooloo Warrandyte Warwarnambool	Same as previous but full name is wrapped.	
Dingo Pontooroomooloo Vaasa Silvaan Beenelong Wooloomooloo Warrandyte Warwarnambool	Truncated full name, three lines at 7 pt not sufficient.	

BEENELONG WOOLOOMOOLOO W>
ARRANDYTE WARWARNAMBOOL, D> G
INGO PONTOOROOMOOLOO VAASA

Zone 15F: Color-Coding for Employee Affiliation

Color-coding SHALL be used for additional identification of employee affiliation as a background color for Zone 2F (name) as depicted in Figure 4-1, Figure 4-3, and Figure 4-4. The following color scheme SHALL be used:

- blue: foreign national,
- white: government employee, or
- green: contractor.

Foreign national color-coding has precedence over government employee and contractor color-coding. These colors SHALL be reserved and SHALL NOT be employed for other purposes. These colors SHALL be printed in accordance with the color specifications provided in Section 4.1.5. Zone 15F MAY be a solid or patterned line at the department or agency's discretion.

Zone 18F: Color Code for Employee Affiliation

The affiliation color codes "B" for blue, "W" for white, and "G" for green SHALL be printed in a white circle on the right side of Zone 15F, as depicted in Figure 4-1. The diameter of the circle SHALL NOT be more than 5 mm. The lettering SHALL correspond to the printed color in Zone 15F.

Zone 19F: Card Expiration Date

The card expiration date SHALL be printed in a MMMYYYY format in the upper right-hand corner as depicted in Figure 4-1. The YYYY characters represent the four-digit year and the MMM characters represent the three-letter month abbreviation as follows: JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, and DEC. The Zone 19F expiration date SHALL be printed in 12 pt Arial Bold.

4.1.4.2 Mandatory Items on the Back of the PIV Card

Zone 1B: Agency Card Serial Number

This item SHALL be printed on the back of the card and contain the unique serial number from the issuing department or agency. The format SHALL be at the discretion of the issuing department or agency. The preferred placement is as depicted in Figure 4-6, but variable placement along the outer edge is allowed in accordance with other FIPS 201 requirements, as shown in Figure 4-8.

Zone 2B: Issuer Identification Number

This item SHALL be printed as depicted in Figure 4-6 and consist of six characters for the department code, four characters for the agency code, and a five-digit number that uniquely identifies the issuing facility within the department or agency.

4.1.4.3 Optional Items on the Front of the PIV Card

This section contains a description of the optional information and machine-readable technologies that may be used as well as their respective placement. The storage capacity of all optional technologies is as prescribed by individual departments and agencies and is not addressed in this Standard. Although the items discussed in this section are optional, if used, they SHALL be placed on the card as designated in the examples provided and as noted.

Zone 3F: Signature

If used, the department or agency SHALL place the cardholder signature below the photograph and cardholder name, as depicted in Figure 4-3. The space for the signature SHALL NOT interfere with the placement of the ICCs and related components. Because of card surface space constraints, placement of a signature may limit the size of the optional two-dimensional bar code.

Zone 4F: Agency-Specific Text Area

If used, this area can be used for printing agency-specific requirements, such as employee status, as shown in Figure 4-2. Note that this zone overlaps with an area that some card manufacturers might not allow to be used for printing.

Zone 5F: Rank

If used, the cardholder's rank SHALL be printed in the area, as illustrated in Figure 4-2. Data format is at the department or agency's discretion.

Zone 6F: Portable Data File (PDF) 417 Two-Dimensional Bar Code (Deprecated)

This bar code is deprecated in this version of the Standard. In a future version of this Standard, the bar code may be removed. If used, the PDF bar code SHALL be placed in the general area depicted in Figure 4-4 (i.e., left side of the card). If Zone 3F (a cardholder signature) is used, the size of the PDF bar code may be affected. The card issuer SHALL confirm that a PDF used in conjunction with a PIV Card containing a cardholder signature will satisfy the anticipated PDF data storage requirements. Note that this zone overlaps with an area that some card manufacturers might not allow to be used for printing.

Zone 9F: Header

If used, the text "United States Government" SHALL be placed as depicted in Figure 4-3, Figure 4-4, and Figure 4-5. Departments and agencies MAY instead use this zone for other department or agency-specific information, such as identifying a federal emergency responder role, as depicted in Figure 4-2. Some examples of official roles are "Law Enforcement," "Fire Fighter," and "Emergency Response Team (ERT)."

Zone 11F: Agency Seal

If used, the seal selected by the issuing department, agency, or organization SHALL be printed in the area depicted. It SHALL be printed using the guidelines provided in Figure 4-2 to ensure that information printed on the seal is legible and clearly visible.

Zone 12F: Footer

If used as the federal emergency response official identification label, a department or agency SHALL print "Federal Emergency Response Official" as depicted in Figure 4-2. The label SHOULD be in white lettering on a red background. Additional information regarding the federal emergency responder role MAY be included in Zone 9F, as depicted in Figure 4-2.

When Zone 15F indicates foreign national affiliation and the department or agency does not need to highlight emergency response official status, Zone 12F MAY be used to denote the country or countries of citizenship. If so used, the department or agency SHALL print the country name or the three-letter country abbreviation (alpha-3 format) in accordance with [ISO 3166]. Figure 4-4 illustrates an example of using country abbreviations for a card issued to a foreign national.

Note that this zone overlaps with an area that some card manufacturers might not allow to be used for printing.

Zone 13F: Issue Date

If used, the card issuance date SHALL be printed above the Zone 14F expiration date in YYYYMMMDD format, as depicted in Figure 4-3. The YYYY characters represent the four-digit year; the DD characters represent the two-digit day of the month; and the MMM characters represent the three-letter month abbreviation as follows: JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, and DEC.

Zone 16F: Photograph Border

A border MAY be used with the photograph to further identify employee affiliation, as depicted in Figure 4-3. This border MAY be used in conjunction with Zone 15F to enable departments and agencies to develop various employee categories. The photograph border SHALL NOT obscure the photograph. The border MAY be a solid or patterned line. For solid and patterned lines, red SHALL be reserved for emergency response officials, blue for foreign nationals, and green for contractors. All other colors MAY be used at the department or agency's discretion.

Zone 17F: Agency-Specific Data

In cases where other defined optional elements are not used, Zone 17F MAY be used for other department or agency-specific information, as depicted in Figure 4-5.

Zone 20F: Organizational Affiliation Abbreviation

The organizational affiliation abbreviation MAY be printed in the upper right-hand corner below the Zone 19F expiration date as shown in Figure 4-2. If printed, the organizational affiliation abbreviation SHALL be printed in 12 pt Arial Bold.

Zone 21F: Edge Ridging or Notched Corner Tactile Marker

If used, this area SHALL incorporate edge ridging or a notched corner to indicate card orientation, as depicted in Figure 4-4. Departments and agencies SHOULD closely coordinate such alterations with the card vendor and manufacturer to ensure that the card material integrity and printing process are not adversely impacted.

Zone 22F: Laser Engraving Tactile Marker

If used, tactilely discernible marks SHALL be created using laser engraving to indicate card orientation, as depicted in Figure 4-4. There SHALL be an opening in the lamination foil where laser engraving is performed. Departments and agencies SHOULD closely coordinate such alterations with the card vendor and manufacturer to ensure that the card material integrity and printing process are not adversely impacted.

4.1.4.4 Optional Items on the Back of the PIV Card

Zone 3B: Magnetic Stripe (Deprecated)

The magnetic stripe is deprecated in this version of the Standard. In a future version of this Standard, the magnetic stripe may be removed and the space may be allocated for agency-specific data to be printed. If used, the magnetic stripe SHALL be high coercivity and placed in accordance with [ISO 7811], as illustrated in Figure 4-8.

Zone 4B: Return Address

If used, the “return if lost” language SHALL be placed on the back of the card in the general area depicted in Figure 4-7.

Zone 5B: Physical Characteristics of Cardholder

If used, the cardholder physical characteristics (e.g., height, eye color, hair color) SHALL be printed in the general area illustrated in Figure 4-7.

Zone 6B: Additional Language for Emergency Response Officials

Departments and agencies MAY choose to provide additional information to identify emergency response officials or to better identify the cardholder’s authorized access. If used, this additional text SHALL be in the general area depicted in Figure 4-7 and SHALL NOT interfere with other printed text or machine-readable components. An example of a printed statement is provided in Figure 4-7.

Zone 7B: Section 499, Title 18 Language

If used, standard Section 499, Title 18, language warning against counterfeiting, altering, or misusing the card SHALL be printed in the general area depicted in Figure 4-7.

Zone 8B: Linear 3 of 9 Bar Code (Deprecated)

The bar code is deprecated in this version of the Standard. In a future version of this Standard, the bar code may be removed. If used, a linear 3 of 9 bar code SHALL be placed in the area depicted in Figure 4-8. It SHALL be in accordance with Association for Automatic Identification and Mobility (AIM) standards. Beginning and end points of the bar code will depend on the embedded contactless module selected. Departments and agencies are encouraged to coordinate placement of the bar code with the card vendor and manufacturer.

Zone 9B and Zone 10B: Agency-Specific Text

In cases in which other defined optional elements are not used, these zones MAY be used for other department or agency-specific information, as depicted in Figure 4-8. Departments and agencies SHOULD minimize printed text to that which is absolutely necessary.

In the case of the Department of Defense, the back of the card will have a distinct appearance as depicted in Figure 4-8. This is necessary to display information required by the Geneva Accord and to facilitate legislatively mandated medical entitlements.

4.1.5 Color Representation

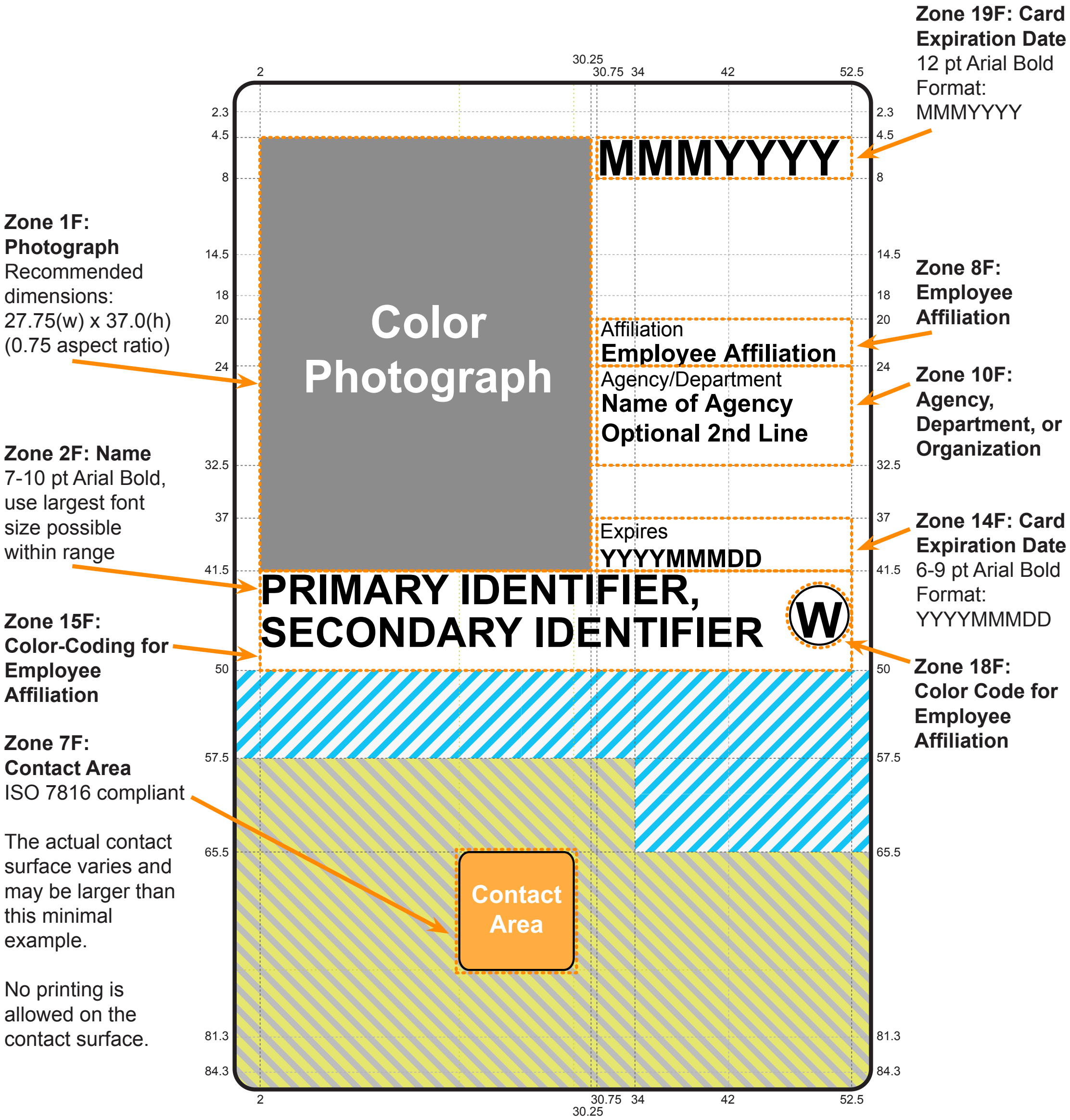
Table 4-2 provides quantitative specifications for colors in four different color systems: sRGB Tristimulus [IEC 61966], sRGB [IEC 61966], CMYK (Cyan, Magenta, Yellow, and Key or ‘blacK’), and PANTONE®. Note the PANTONE® color cue mapping is approximate and will not produce an exact match. An agency or department MAY use the PANTONE® mappings in cases where the exact color scales are not available. Since the card body is white, the white color-coding is achieved by the absence of printing. Note that presence of security features, which MAY overlap colored or printed regions, may modify the perceived color. In the case of colored regions, the effect of overlap SHALL NOT prevent the recognition of the principal color by a person with normal vision (corrected or uncorrected) at a working distance of 50 cm to 200 cm.

Table 4-2. Color Representation

Color	Zone	sRGB Tristimulus	sRGB	CMYK	PANTONE®
White	15F	255, 255, 255	255, 255, 255	0, 0, 0, 0	
Green	15F	153, 255, 153	203, 255, 203	40, 0, 40, 0	359 C
Blue	15F	0, 255, 255	0, 255, 255	100, 0, 0, 0	630 C
Red	12F	253, 27, 20	254, 92, 79	0, 90, 86, 0	032 C

All listed measurements are in millimeters originating from the top left corner.

Unless otherwise specified, data labels are printed in 5 pt Arial with the corresponding data printed in 6 pt Arial Bold.



Zone 19F: Card Expiration Date
12 pt Arial Bold
Format:
MMMYYYY

Zone 1F: Photograph
Recommended dimensions:
27.75(w) x 37.0(h)
(0.75 aspect ratio)

Zone 8F: Employee Affiliation

Zone 10F: Agency, Department, or Organization

Zone 2F: Name
7-10 pt Arial Bold, use largest font size possible within range

Zone 14F: Card Expiration Date
6-9 pt Arial Bold
Format:
YYYYMMMDD

Zone 15F: Color-Coding for Employee Affiliation

Zone 18F: Color Code for Employee Affiliation

Zone 7F: Contact Area
ISO 7816 compliant

The actual contact surface varies and may be larger than this minimal example.

No printing is allowed on the contact surface.

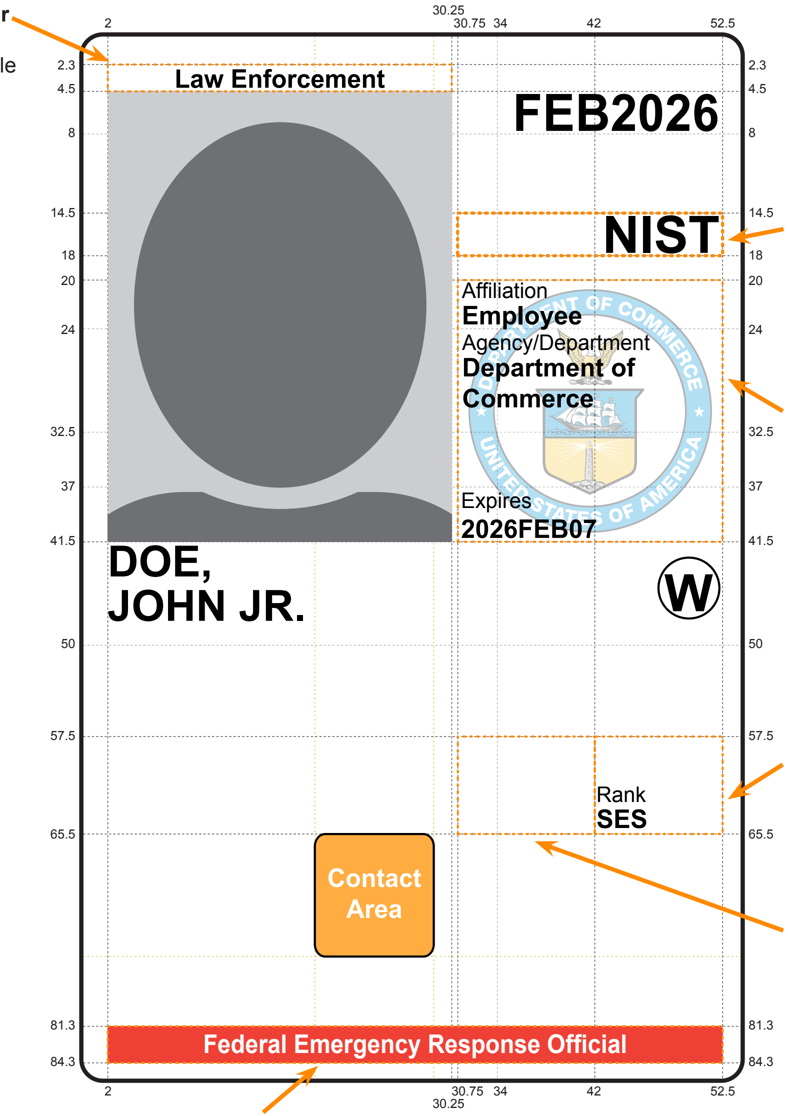
▨ Optional data area. Agency-specific data may be printed in this area. See examples for required placement of optional data elements.

▨ Optional data area likely to be needed by card manufacturer. Optional data may be printed in this area but will likely be subject to restrictions imposed by card and/or printer manufacturers.

Figure 4-1. Card Front: Printable Areas and Required Data

All listed measurements are in millimeters originating from the top left corner.

Unless otherwise specified, data labels are printed in 5 pt Arial with the corresponding data printed in 6 pt Arial Bold.



Zone 9F: Header
Emergency response example shown

Zone 20F: Organizational Affiliation Abbreviation
12 pt Arial Bold

Zone 11F: Agency Seal
20 x 20

Must not impair readability of text.

Start with 65% brightness and 25% contrast.

Zone 5F: Rank

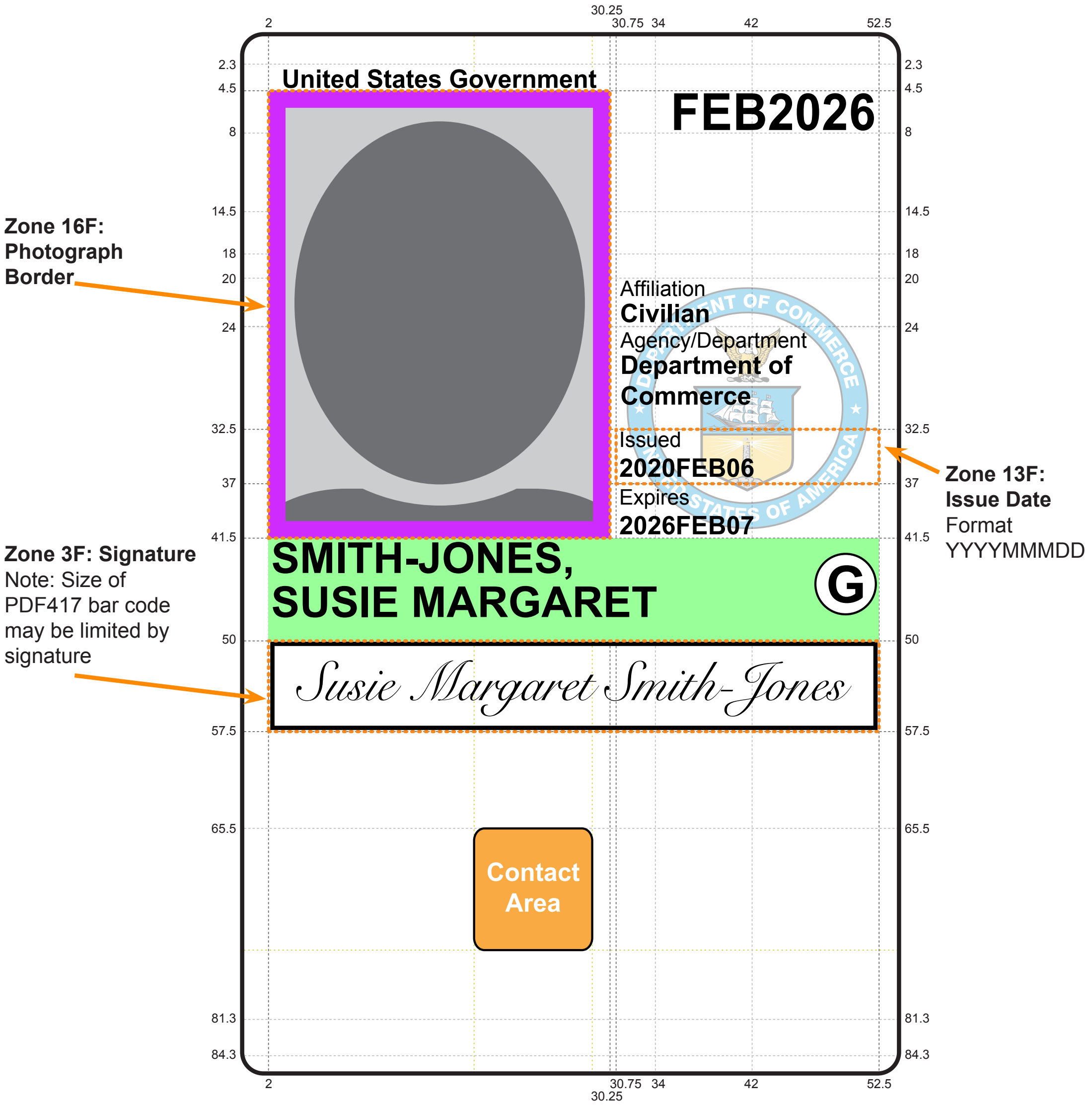
Zone 4F: Agency-Specific Text Area

Zone 12F: Footer
Emergency response example shown

Figure 4-2. Card Front: Optional Data Placement (Example 1)

All listed measurements are in millimeters originating from the top left corner.

Unless otherwise specified, data labels are printed in 5 pt Arial with the corresponding data printed in 6 pt Arial Bold.



Zone 16F: Photograph Border

Zone 3F: Signature
Note: Size of PDF417 bar code may be limited by signature

Zone 13F: Issue Date
Format YYYYMMMDD

Figure 4-3. Card Front: Optional Data Placement (Example 2)

All listed measurements are in millimeters originating from the top left corner.

Unless otherwise specified, data labels are printed in 5 pt Arial with the corresponding data printed in 6 pt Arial Bold.

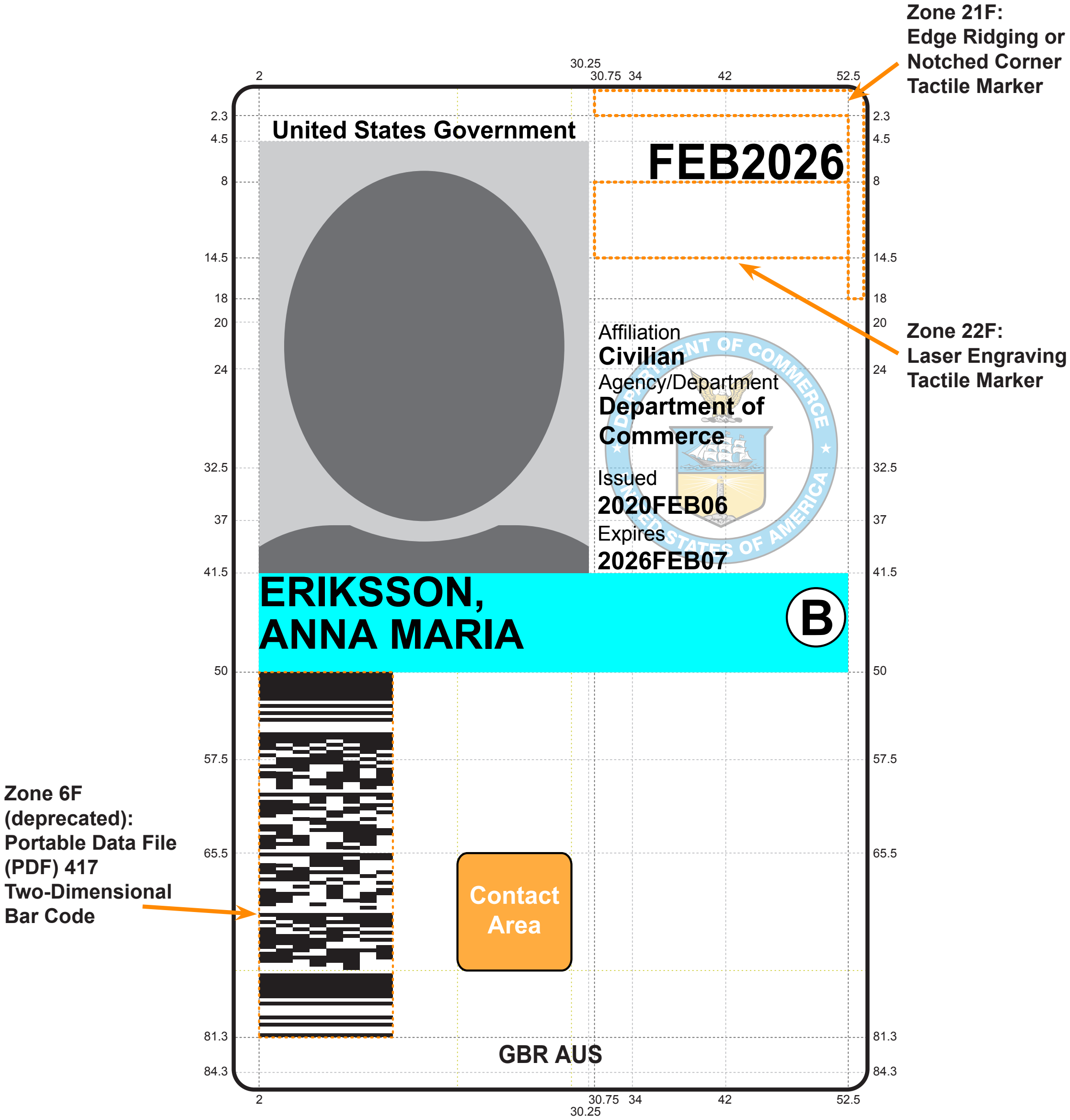


Figure 4-4. Card Front: Optional Data Placement (Example 3)

All listed measurements are in millimeters originating from the top left corner.

Unless otherwise specified, data labels are printed in 5 pt Arial with the corresponding data printed in 6 pt Arial Bold.

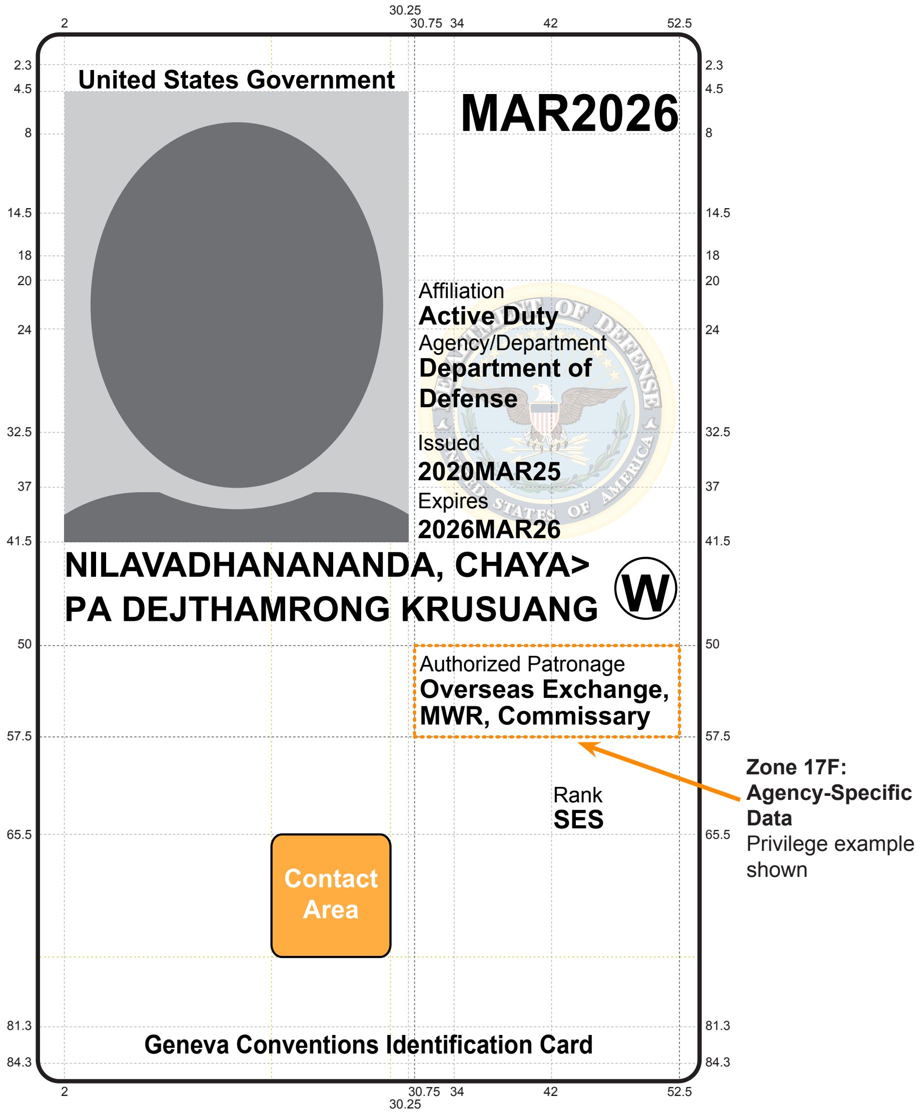


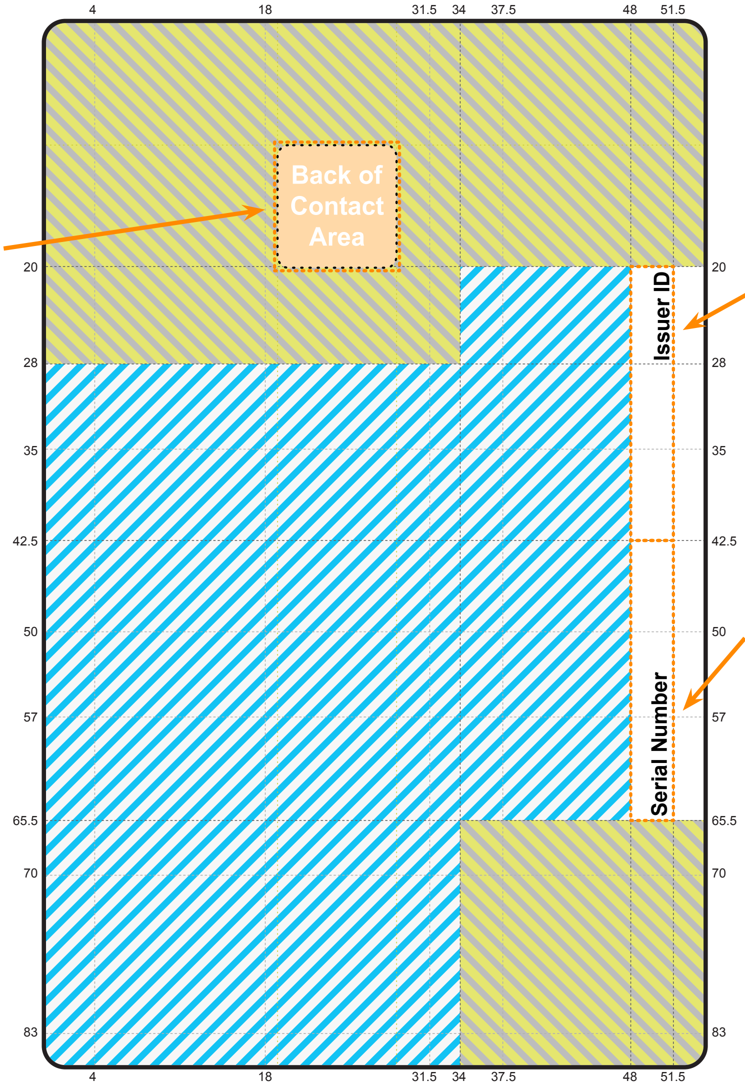
Figure 4-5. Card Front: Optional Data Placement (Example 4)

All listed measurements are in millimeters originating from the top left corner.

Unless otherwise specified, data labels are printed in 5 pt Arial with the corresponding data printed in 6 pt Arial Bold.

Back of Contact Area
The contacts are located on the front of the card opposite this area.

Note: The contacts are not exposed on the back of the card, and information may be printed in this area, subject to card manufacturer restrictions.



Zone 2B: Issuer Identification Number
6 pt Arial Bold
Right justified

Zone 1B: Agency Card Serial Number
6 pt Arial Bold
Left justified

Variable placement along the outer edge is allowed in accordance with other FIPS 201 requirements; this figure provides an example of possible placement.

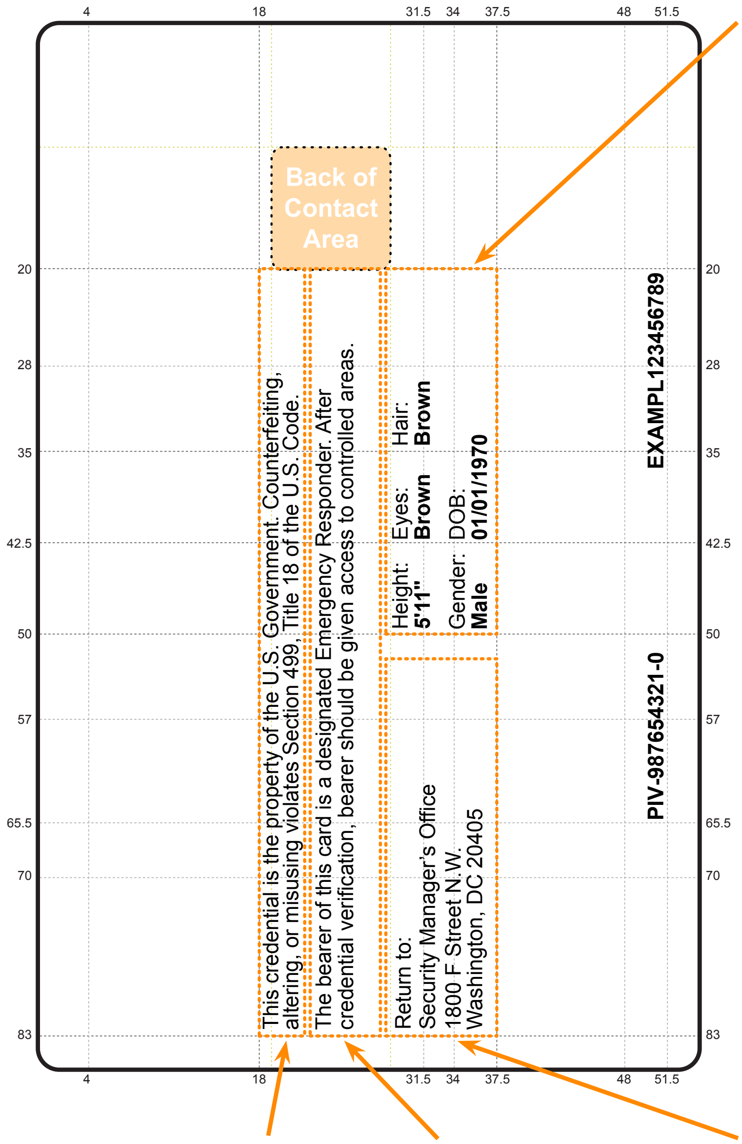
▨ Optional data area. Agency-specific data may be printed in this area. See examples for required placement of optional data elements.

▨ Optional data area likely to be needed by card manufacturer. Optional data may be printed in this area but will likely be subject to restrictions imposed by card and/or printer manufacturers.

Figure 4-6. Card Back: Printable Areas and Required Data

All listed measurements are in millimeters originating from the top left corner.

Unless otherwise specified, data labels are printed in 5 pt Arial with the corresponding data printed in 6 pt Arial Bold.


4
18
31.5
34
37.5
48
51.5
20
28
35
42.5
50
57
65.5
70
83
Back of Contact Area
This credential is the property of the U.S. Government. Counterfeiting, altering, or misusing violates Section 499, Title 18 of the U.S. Code.
The bearer of this card is a designated Emergency Responder. After credential verification, bearer should be given access to controlled areas.
Hair: Brown
Eyes: Brown
Height: 5'11"
DOB: 01/01/1970
Gender: Male
Return to:
Security Manager's Office
1800 F Street N.W.
Washington, DC 20405
EXAMPL123456789
PIV-987654321-0

Zone 5B: Physical Characteristics of Cardholder
5 pt Arial Bold
Limit use of abbreviations

Use imperial units.

Zone 7B: Section 499, Title 18 Language
5 pt Arial

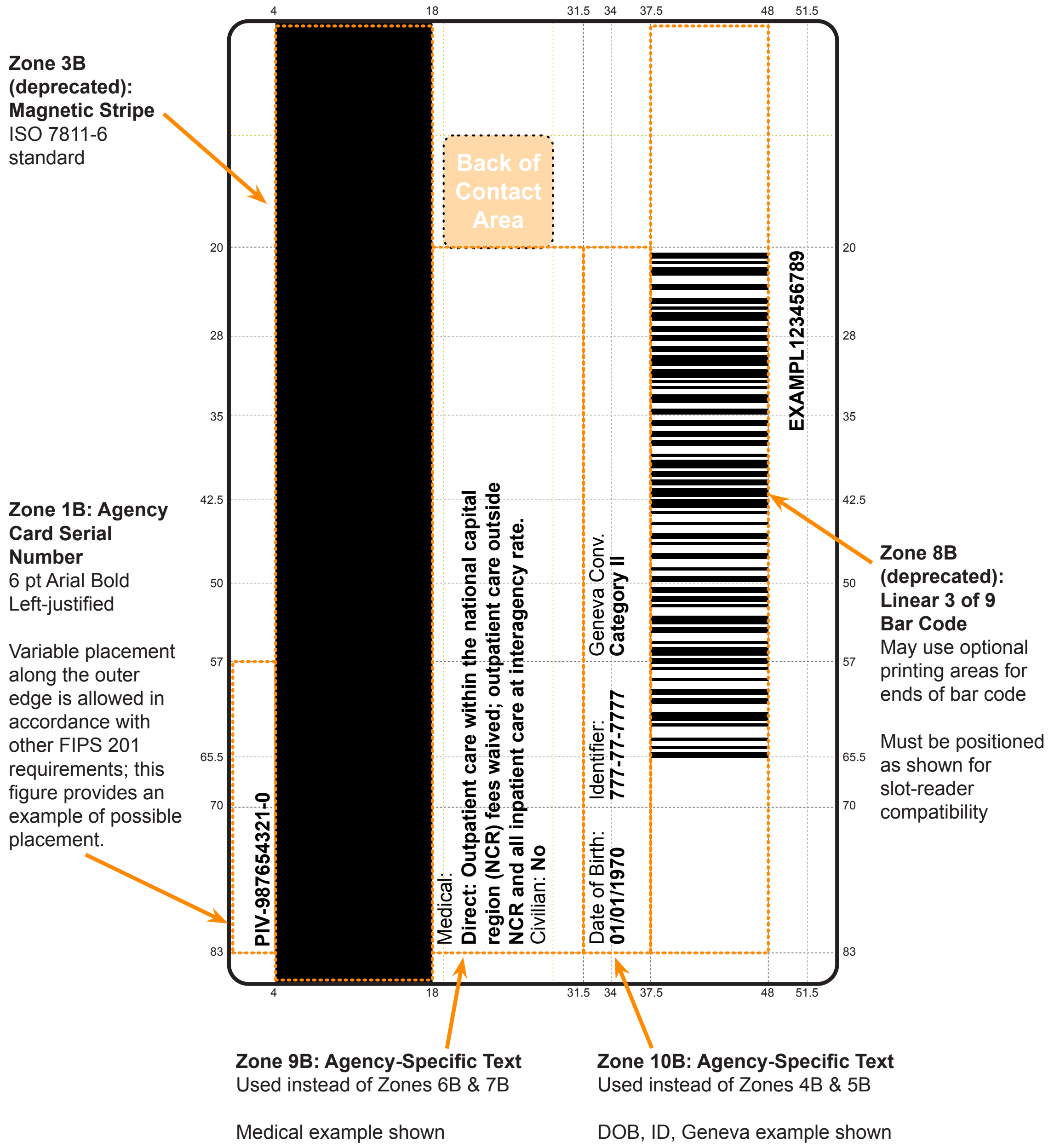
Zone 6B: Additional Language for Emergency Response Officials
5 pt Arial

Zone 4B: Return Address
5 pt Arial

Figure 4-7. Card Back: Optional Data Placement (Example 1)

All listed measurements are in millimeters originating from the top left corner.

Unless otherwise specified, data labels are printed in 5 pt Arial with the corresponding data printed in 6 pt Arial Bold.



Zone 3B (deprecated): Magnetic Stripe
ISO 7811-6 standard

Zone 1B: Agency Card Serial Number
6 pt Arial Bold
Left-justified

Variable placement along the outer edge is allowed in accordance with other FIPS 201 requirements; this figure provides an example of possible placement.

Zone 8B (deprecated): Linear 3 of 9 Bar Code
May use optional printing areas for ends of bar code

Must be positioned as shown for slot-reader compatibility

Zone 9B: Agency-Specific Text
Used instead of Zones 6B & 7B

Medical example shown

Zone 10B: Agency-Specific Text
Used instead of Zones 4B & 5B

DOB, ID, Geneva example shown

Figure 4-8. Card Back: Optional Data Placement (Example 2)

4.2 PIV Card Logical Characteristics

This section defines the PIV Card's logical identity credentials and the requirements for use of these credentials.

To support a variety of authentication mechanisms, the PIV Card SHALL contain multiple data elements for the purpose of verifying the cardholder's identity at graduated assurance levels. The following mandatory data elements are part of the data model for PIV Card logical credentials that support authentication mechanisms interoperable across agencies:

- a PIN,
- a Cardholder Unique Identifier (CHUID)[22],
- PIV authentication data (one asymmetric private key and corresponding certificate),
- two fingerprint biometric templates,
- an electronic facial image, and
- card authentication data (one asymmetric private key and corresponding certificate).

This Standard also defines two data elements for the PIV Card data model that are mandatory if the cardholder has a government-issued email account at the time of PIV Card issuance. These data elements are

- an asymmetric private key and corresponding certificate for digital signatures, and
- an asymmetric private key and corresponding certificate for key management.

This Standard also defines optional data elements for the PIV Card data model. These optional data elements include

- an electronic image of the left iris,
- an electronic image of the right iris,
- one or two fingerprint biometric templates for OCC,
- a symmetric card authentication key for supporting[23] physical access applications,
- an asymmetric key to establish secure messaging and authenticate the PIV Card in support of physical access applications, and
- a symmetric PIV Card application administration key associated with the card management system.

[22] The CHUID as an authentication mechanism in Section 6.2.5 has been removed from this version of the Standard. The CHUID data element itself, however, has not been removed and continues to be mandatory as it supports other PIV authentication mechanisms.

[23] The symmetric card authentication key has been deprecated in this version of the Standard. Both the symmetric card authentication key and associated SYM-CAK authentication mechanism may be removed in a future revision of the Standard.

Additional data elements are specified in [SP 800-73].

PIV Card logical credentials fall into the following three categories:

Cardholder-to-Card (CTC) authentication

Credential elements used to prove the identity of the cardholder to the card, also known as card activation. Examples include the PIN and the fingerprint biometric templates for OCC.

Card-Management-to-Card (CMTC) authentication

Credential elements used to prove the identity of the card management system to the card. Examples include the PIV Card application administration key.

Cardholder-to-External (CTE) authentication

Credential elements used by the card to prove the identity of the cardholder to an external entity, such as a host computer system. Examples include the biometric data records for BIO and BIO-A, symmetric keys, asymmetric keys, and the fingerprint biometric templates for OCC-AUTH.

4.2.1 Cardholder Unique Identifier (CHUID)

Note: The CHUID authentication mechanims (Section 6.2.5) has been removed from this version of the Standard. The CHUID data element itself, however, has not been removed and continues to be mandatory as it supports other PIV authentication mechanisms. For example, the BIO, BIO-A, and SYM-CAK authentication mechanisms use the CHUID data element as a source for the card's expiration date. The CHUID data element also provides the content signing certificate for some authentication mechanisms and unique identifiers for PACS ACLs.

The PIV Card SHALL include the CHUID, as defined in [SP 800-73]. The CHUID SHALL include two card identifiers: the Federal Agency Smart Credential Number (FASC-N) and the card UUID in the Global Unique Identification Number (GUID) data element of the CHUID. Each identifier uniquely identifies each card as specified in [SP 800-73]. The value of the card UUID SHALL be a 16 byte binary representation of a valid UUID as specified in [RFC 4122]. The CHUID SHALL also include an expiration date data element in machine-readable format that specifies when the card expires. The expiration date format and encoding rules are as specified in [SP 800-73].

A CHUID MAY also include a Cardholder UUID that represents a persistent identifier of the cardholder, as specified in [SP 800-73]. The value of the cardholder UUID SHALL be a 16 byte binary representation of valid UUID, as specified in [RFC 4122].

The CHUID SHALL be accessible from both the contact and contactless interfaces of the PIV Card without card activation.

The FASC-N, card UUID, and expiration date SHALL NOT be modified post-issuance.

This Standard requires inclusion of the asymmetric signature field in the CHUID container. The asymmetric signature data element of the CHUID SHALL be encoded as a Cryptographic Message Syntax (CMS) external digital signature, as specified in [SP 800-73]. Algorithm and key size requirements for the asymmetric signature and digest algorithm are detailed in [SP 800-78].

The public key required to verify the digital signature SHALL be contained in a content signing certificate, which SHALL be issued under the `id-fpki-common-piv-contentSigning` policy of [COMMON]. The content signing certificate SHALL also include an extended key usage (`extKeyUsage`) extension asserting `id-PIV-content-signing`. The public key SHALL be included in the `certificates` field of the CMS external digital signature in a content signing certificate. Additional descriptions for the PIV object identifiers are provided in Appendix B. The content signing certificate SHALL NOT expire before the expiration of the card authentication certificate.

4.2.2 Cryptographic Specifications

The PIV Card SHALL implement the cryptographic operations and support functions defined in [SP 800-78] and [SP 800-73].

The PIV Card has both mandatory and optional keys:

PIV authentication key
A mandatory asymmetric private key that supports card and cardholder authentication for an interoperable environment. See Section 4.2.2.1.

Asymmetric card authentication key
A mandatory private key that supports card authentication for an interoperable environment. See Section 4.2.2.2.

Symmetric card authentication key (deprecated)
Supports card authentication for physical access and is optional. See Section 4.2.2.3.

Digital signature key
An asymmetric private key that supports document signing, and it is mandatory if the cardholder has a government-issued email account at the time of PIV Card issuance. See Section 4.2.2.4.

Key management key
An asymmetric private key that supports key establishment and transport, and it is mandatory if the cardholder has a government-issued email account at the time of PIV Card issuance. Optionally, up to 20 retired key management keys may also be stored on the PIV Card. See Section 4.2.2.5.

PIV Card application administration key

An optional symmetric key used for personalization and post-issuance activities. See Section 4.2.2.6. PIV secure messaging key

An optional asymmetric private key that supports key establishment for secure messaging and card authentication for physical access.

The PIV Card SHALL store private keys and corresponding public key certificates and SHALL perform cryptographic operations using the asymmetric private keys. At a minimum, the PIV Card SHALL store the PIV authentication key, the asymmetric card authentication key, and the corresponding public key certificates. The PIV Card SHALL also store a digital signature key, a key management key, and the corresponding public key certificates unless the cardholder does not have a government-issued email account at the time of PIV Card issuance.

With the exception of the card authentication key and keys used to establish secure messaging, cryptographic private key operations SHALL be performed only through the contact interface or the virtual contact interface. Any operation that MAY be performed over the contact interface of the PIV Card MAY also be performed over the virtual contact interface. Requirements for the virtual contact interface are specified in [SP 800-73].

All PIV cryptographic keys SHALL be generated within a cryptographic module with overall validation at [FIPS 140] Level 2 or above. In addition to an overall validation of Level 2, the PIV Card SHALL provide Level 3 physical security to protect the PIV private keys in storage. The scope of the validation for the PIV Card SHALL include all cryptographic operations performed over both the contact and contactless interfaces

- by the PIV Card application;
- as part of secure messaging, as specified in this section; and
- as part of remote post issuance updates, as specified in Section 2.9.2.

Specific algorithm testing requirements for the cryptographic operations performed by the PIV Card application are specified in [SP 800-78].

Requirements specific to storage and access for each key are detailed in the following sections. Where applicable, key management requirements are also specified.

4.2.2.1 PIV Authentication Key

This key SHALL be generated on the PIV Card. The PIV Card SHALL NOT permit exportation of the PIV authentication key. The cryptographic operations that use the PIV authentication key SHALL be available only through the contact and virtual contact interfaces of the PIV Card. Private key operations MAY be performed using an activated PIV Card without explicit user action (e.g., the PIN need not be supplied for each operation).

The PIV Card SHALL store a corresponding X.509 certificate to support validation of the public key. The X.509 certificate SHALL include the FASC-N in the Subject Alternative Name (SAN) extension using the `pivFASC-N` attribute to support physical access procedures. The X.509 certificate SHALL also include the card UUID value from the GUID data element of the CHUID in the SAN extension. The card UUID SHALL be encoded as a Uniform Resource Name (URN), as specified in Section 3 of [RFC 4122]. The expiration date of the certificate SHALL be no later than the expiration date of the PIV Card. The PIV authentication certificate MAY include a PIV background investigation indicator (previously known as the NACI indicator) extension (see Appendix B.2). This non-critical extension indicates the status of the cardholder's background investigation at the time of card issuance. Section 5 of this document specifies the certificate format and the key management infrastructure for the PIV authentication key.

4.2.2.2 Asymmetric Card Authentication Key

The asymmetric card authentication key MAY be generated on the PIV Card or imported to the card. The PIV Card SHALL NOT permit exportation of the card authentication key. Cryptographic operations that use the card authentication key SHALL be available through the contact and contactless interfaces of the PIV Card. Private key operations MAY be performed using this key without card activation (e.g., the PIN need not be supplied for operations with this key).

The PIV Card SHALL store a corresponding X.509 certificate to support validation of the public key. The X.509 certificate SHALL include the FASC-N in the SAN extension using the `pivFASC-N` attribute to support physical access procedures. The X.509 certificate SHALL also include the card UUID value from the GUID data element of the CHUID in the SAN extension. The card UUID SHALL be encoded as a URN, as specified in Section 3 of [RFC 4122]. The expiration date of the certificate SHALL be no later than the expiration date of the PIV Card. Section 5 of this document specifies the certificate format and the key management infrastructure for asymmetric card authentication keys.

4.2.2.3 Symmetric Card Authentication Key (Deprecated)

The symmetric card authentication key is deprecated in this version of the Standard. Both the symmetric card authentication key and the associated SYM-CAK authentication mechanism may be removed in a future revision of the Standard.

If used, the symmetric card authentication key MAY be imported onto the card by the issuer or be generated on the card. If present, the symmetric card authentication key SHALL be unique for each PIV Card and SHALL meet the algorithm and key size requirements stated in [SP 800-78]. If present, cryptographic operations using this key MAY be performed without card activation (e.g., the PIN need not be supplied for operations with this key). The cryptographic operations that use the card authentication key SHALL be available through the contact and contactless interfaces of the PIV Card. This Standard does not specify key management protocols or infrastructure requirements.

4.2.2.4 Digital Signature Key

The PIV digital signature key SHALL be generated on the PIV Card. The PIV Card SHALL NOT permit exportation of the digital signature key. If this key is present, cryptographic operations using the digital signature key SHALL be performed using the contact and virtual contact interfaces of the PIV Card. Private key operations SHALL NOT be performed without explicit user action, as this Standard requires the cardholder to authenticate to the PIV Card each time it performs a private key computation with the digital signature key.[24]

The PIV Card SHALL store a corresponding X.509 certificate to support validation of the public key. The expiration date of the certificate SHALL be no later than the expiration date of the PIV Card. Section 5 of this document specifies the certificate format and the key management infrastructure for PIV digital signature keys.

4.2.2.5 Key Management Key

This key MAY be generated on the PIV Card or imported to the card. If present, the cryptographic operations that use the key management key SHALL only be accessible using the contact and virtual contact interfaces of the PIV Card. Private key operations MAY be performed using an activated PIV Card without explicit user action (e.g., the PIN need not be supplied for each operation).

The PIV Card SHALL store a corresponding X.509 certificate to support validation of the public key. Section 5 of this document specifies the certificate format and the key management infrastructure for key management keys.

4.2.2.6 PIV Card Application Administration Key

If present, the PIV Card application administration key SHALL be imported onto the card by the issuer. If present, the cryptographic operations that use the PIV Card application administration key SHALL only be accessible using the contact interface of the PIV Card.

[24] NIST [IR 7863] addresses the appropriate use of PIN caching related to digital signatures.

4.2.2.7 PIV Secure Messaging Key

The PIV secure messaging key supports the establishment of secure messaging and authentication using the SM-AUTH authentication mechanism. If present, the key SHALL be generated on the PIV Card and SHALL NOT be exported. The cryptographic operations that use the PIV secure messaging key SHALL be available through the contact and contactless interfaces of the PIV Card. Private key operations[25] can be performed without access control restrictions. The PIV Card SHALL store a corresponding secure messaging card verifiable certificate (CVC) to support validation of the public key by the relying party. The use of the PIV secure messaging key and the CVC is further specified in [SP 800-73] and [SP 800-78].

When the key is used to establish secure messaging, it enables data and commands transmitted between the card and an external entity to be both integrity-protected and encrypted. Secure messaging MAY be used, for example, to enable the use of on-card biometric comparison. Once secure messaging has been established, a virtual contact interface MAY be established.

4.2.3 Biometric Data Specifications

The PIV front-end subsystem employs biometric verification to automate the recognition of cardholders based on their biological characteristics. The PIV Card can digitally store fingerprint, face, and iris biometric characteristics. Techniques for storage, protection, and access of these biometric data records are outlined in the following sections and explained in depth in [SP 800-76].

4.2.3.1 Biometric Data Representation

The following biometric data SHALL be stored on the PIV Card:

- Two fingerprint biometric templates. If no fingerprint images meet the quality criteria of [SP 800-76], the PIV Card SHALL nevertheless be populated with fingerprint biometric templates, as specified in [SP 800-76].
- An electronic facial image.

The following biometric data MAY also be stored on the PIV Card:

- electronic image of the left iris,
- electronic image of the right iris, and

[25] Private key operation with the PIV secure messaging key is defined as the use of the key to establish session keys for secure messaging or the use of key for SM-AUTH card authentication.

- fingerprint biometric templates for OCC.[26]

All biometric data SHALL be stored in the data elements referenced by [SP 800-73] and in conformance with the preparation and formatting specifications of [SP 800-76].

4.2.3.2 Biometric Data Record Protection

The integrity of all biometric data records, except for fingerprint biometric templates for OCC, SHALL be protected using digital signatures. The records SHALL be prepended with a Common Biometric Exchange Formats Framework (CBEFF) header and appended with the CBEFF signature block [IR 6529-A].

The format for a CBEFF header is specified in [SP 800-76].

The CBEFF signature block contains the digital signature of the biometric data record and facilitates the verification of integrity of the biometric data record. The CBEFF signature block SHALL be encoded as a CMS external digital signature as specified in [SP 800-76]. The algorithm and key size requirements for the digital signature and digest algorithm are detailed in [SP 800-78].

The public key required to verify the digital signature SHALL be contained in a content signing certificate, which SHALL be issued under the `id-fpki-common-piv-contentSigning` policy of [COMMON]. The content signing certificate SHALL also include an extended key usage (`extKeyUsage`) extension asserting `id-PIV-content-signing`. If the signature on the biometric data record was generated with a different key than the signature on the CHUID, the `certificates` field of the CMS external digital signature SHALL include the content signing certificate required to verify the signature on the biometric data record. Otherwise, the `certificates` field SHALL be omitted. Additional descriptions for the PIV object identifiers are provided in Appendix B. The content signing certificate SHALL NOT expire before the expiration of the card authentication certificate.

4.2.3.3 Biometric Data Record Access

The biometric data records, except for fingerprint biometric templates for OCC, that are stored on the card

- SHALL be readable through the contact interface only after the presentation of a valid PIN; and

[26] The on-card and off-card fingerprint biometric data records are stored separately and, as conformant instances of different formal fingerprint template standards, are syntactically different. This is described more fully in [SP 800-76].

- MAY optionally be readable through the virtual contact interface only after the presentation of a valid PIN.

OCC MAY be performed over the contact and contactless interfaces of the PIV Card to support card activation (Section 4.3.1) and cardholder authentication (Section 6.2.2). The fingerprint biometric templates for OCC SHALL NOT be exportable. If implemented, OCC SHALL be implemented and used in accordance with [SP 800-73] and [SP 800-76].

4.2.4 PIV Unique Identifiers

A cardholder is authenticated using the mechanisms described in Section 6. The authenticated identity MAY then be used as the basis for making authorization decisions. Unique identifiers for both authentication and authorization are provided in this Standard in order to uniquely identify the cardholder. The two types of identifiers that serve as identification (of the cardholder) for authentication and authorization purposes are as follows:

Card identifiers

Each PIV Card contains a card UUID and a FASC-N that uniquely identify the card and, by correspondence, the cardholder. These two card identifiers are represented in all of the authentication data elements for the purpose of binding the PIV data elements to the same PIV Card. For example, the card UUID is represented in the GUID data element of the CHUID, in the `entryUUID` attribute of CMS-signed biometric data records and in the `subjectAltName` extension of PIV authentication certificates. Similarly, the FASC-N is represented in the CHUID, in the `pivFASC-N` attribute of CMS-signed biometric data records, and in the `subjectAltName` extension of PIV authentication certificates.

Cardholder identifiers

Other identifiers MAY be present in credentials on the PIV Card that identify the cardholder rather than the card. Examples include the cardholder UUID that may appear in the CHUID or the subject names that may appear in the `subjectAltName` extension in the PIV authentication certificate.

4.3 PIV Card Activation

The PIV Card SHALL be activated[27] to perform privileged[28] operations such as using the PIV authentication key, digital signature key, and key management key. The PIV Card SHALL be activated for privileged operations only after authenticating the cardholder

[27] Activation in this context refers to the unlocking of the PIV Card application so that privileged operations can be performed.

[28] A read of a CHUID or use of the card authentication key is not considered a privileged operation.

or the appropriate card management system. Cardholder activation is described in Section 4.3.1 and card management system activation is described in Section 4.3.2.

4.3.1 Activation by Cardholder

PIV Cards SHALL implement user-based cardholder activation to allow privileged operations using PIV credentials held by the card. At a minimum, the PIV Card SHALL implement PIN-based cardholder activation in support of interoperability across departments and agencies. Other card activation mechanisms as specified in [SP 800-73] (e.g., OCC card activation) MAY be implemented and SHALL be discoverable. For PIN-based cardholder activation, the cardholder SHALL supply a numeric PIN. The PIN SHALL be transmitted to the PIV Card and checked by the card. If the PIN check is successful, the PIV Card is activated. The PIV Card SHALL include mechanisms to block activation of the card after a number of consecutive failed activation attempts. A maximum of 10 consecutive PIN retries SHALL be permitted unless a lower limit is imposed by the department or agency.

The PIN should not be easily guessable or otherwise individually identifiable in nature (e.g., part of a Social Security Number or phone number). The PIN SHALL be a minimum of six digits in length. The PIV Card SHALL compare the chosen PIN against a list of at least 10 commonly-chosen values (e.g., 000000, 123456) and require the choice of a different value if one of those is selected by the cardholder.

4.3.2 Activation by Card Management System

PIV Cards MAY support card activation by the card management system to support card personalization and post-issuance card update. To activate the card for personalization or update, the card management system SHALL perform a challenge response protocol using cryptographic keys stored on the card in accordance with [SP 800-73]. When cards are personalized, each PIV Card SHALL contain a unique PIV Card application administration key specific to that PIV Card. PIV Card application administration keys SHALL meet the algorithm and key size requirements stated in [SP 800-78].

4.4 Card Reader Requirements

This section provides minimum requirements for contact and contactless card readers. This section also provides requirements for PIN input devices. Further card reader requirements are specified in [SP 800-96].

4.4.1 Contact Reader Requirements

Contact card readers SHALL conform to [ISO 7816] for the card-to-reader interface. These readers SHALL conform to the Personal Computer/Smart Card (PC/SC) Specification [PCSC] for the reader-to-host system interface in general-purpose desktop computing systems and SHALL conform to the requirements specified in [SP 800-96]. In systems where the readers are not connected to general-purpose desktop computing systems, the reader-to-host system interface is not specified in this Standard.

4.4.2 Contactless Reader Requirements

Contactless card readers SHALL conform to [ISO 14443] for the card-to-reader interface and data transmitted over the [ISO 14443] link SHALL conform to [ISO 7816]. In cases where these readers are connected to general-purpose desktop computing systems, they SHALL conform to [PCSC] for the reader-to-host system interface and SHALL conform to the requirements specified in [SP 800-96]. In systems where the readers are not connected to general-purpose desktop computing systems, the reader-to-host system interface is not specified in this Standard.

4.4.3 Reader Interoperability (Removed)

> Note: This section was formerly entitled “Reader Resilience and Flexibility.”

The content of this section has been removed since the PIV middleware specified in [SP 800-73] adequately covers reader interoperability, resilience, and flexibility for different PIV systems.

4.4.4 Card Activation Device Requirements

When the PIV Card is used with a PIN or OCC data for physical access, the input device SHALL be integrated with the PIV Card reader. When the PIV Card is used with a PIN or OCC data for logical access (e.g., to authenticate to a website or other server), the input device is not required to be integrated with the PIV Card reader. If the input device is not integrated with the PIV Card reader, the PIN or OCC data SHALL be transmitted securely and directly to the PIV Card for card activation.

The specifications for fingerprint biometric capture devices for OCC are given in [SP 800-76].

Malicious code could be introduced into PIN capture and biometric capture devices for the purpose of compromising or otherwise exploiting the PIV Card. General good practice to mitigate malicious code threats is outside of the scope of this document (see [SP 800-53]).

5. PIV Key Management Requirements

This section is normative. It defines the processes and components required for managing a PIV Card's lifecycle and provides the requirements and specifications related to key management.

PIV Cards consistent with this specification SHALL have two or more asymmetric private keys. To manage the public keys associated with the asymmetric private keys, departments and agencies SHALL issue and manage X.509 public key certificates as specified in this section.

5.1 Architecture

CAs that issue certificates to support PIV private keys SHALL participate in the hierarchical PKI for the Common Policy managed by the Federal PKI.

CA certificates SHALL conform to [PROF].

5.2 PKI Certificate

All certificates issued to support PIV private keys (i.e., PIV authentication, card authentication, digital signature, and key management certificates) SHALL be issued in accordance with [COMMON]. CAs and registration authorities can either be operated by departments and agencies or be outsourced to PKI service providers. For a list of PKI service providers that have been approved to operate under [COMMON], see https://www.idmanagement.gov.

Details of the cryptographic properties of PIV keys are found in Section 4.2.2 and its subsections.

5.2.1 X.509 Certificate Contents

The required contents of X.509 certificates associated with PIV private keys are based on [PROF]. The relationship is described below:

- Certificates that contain the public key associated with a PIV authentication private key SHALL conform to the *PIV Authentication Certificate Profile* in [PROF] and SHALL specify the `id-fpki-common-authentication` policy of [COMMON] in the certificate policies extension (Section 4.2.2.1).

- Certificates that contain the public key associated with an asymmetric card authentication private key SHALL conform to the *Card Authentication Certificate Profile* in [PROF] and SHALL specify the `id-fpki-common-cardAuth` policy of [COMMON] in the certificate policies extension (Section 4.2.2.2).
- Certificates that contain the public key associated with a digital signature private key SHALL conform to the *End Entity Signature Certificate Profile* in [PROF] and SHALL specify the `id-fpki-common-hardware` policy of [COMMON] in the certificate policies extension (Section 4.2.2.4).
- Certificates containing the public key associated with a key management private key SHALL conform to *Key Management Certificate Profile* in [PROF] and SHALL specify the `id-fpki-common-policy` or `id-fpki-common-hardware` policy of [COMMON] in the certificate policies extension (Section 4.2.2.5).
- Requirements for algorithms and key sizes for each type of PIV asymmetric key are given in [SP 800-78].

The expiration date of the PIV authentication and card authentication certificates SHALL NOT be after the expiration date of the PIV Card. If the card is revoked, the PIV authentication and card authentication certificates SHALL be revoked in cases where the card cannot be collected and destroyed. However, a PIV authentication or card authentication certificate MAY be revoked and subsequently replaced without revoking the PIV Card. The presence of a valid, unexpired, and unrevoked authentication certificate on a card is sufficient proof that the card was issued and is not revoked.

5.3 X.509 Certificate Revocation List (CRL) Contents

CAs that issue certificates corresponding to PIV private keys SHALL issue CRLs as specified in [COMMON]. The contents of X.509 CRLs SHALL conform to *CRL Profile* in [PROF].

5.4 Legacy PKIs (Removed)

The content of this section has been removed since [COMMON] provides the requirements for department and agency CAs that might be issuing cross-certified PIV authentication certificates and card authentication certificates.

5.5 PKI Repository and Online Certificate Status Protocol (OCSP) Responders

CAs that issue certificates corresponding to PIV private keys (i.e., PIV authentication, card authentication, digital signature, or key management certificates) SHALL

- maintain a Hypertext Transfer Protocol (HTTP) accessible service that publishes the CRLs for the PIV certificates that it issues, as specified in [PROF];
- maintain an HTTP-accessible service that publishes any CA certificates issued to it, as specified in [PROF]; and
- operate Online Certificate Status Protocol (OCSP, specified in [RFC 6960]) services for the PIV certificates that it issues, as specified in [PROF].

PIV authentication, card authentication, digital signature, and key management certificates SHALL

- contain the `crlDistributionPoints` extension needed to locate CRLs, and
- contain the `authorityInfoAccess` extension needed to locate the authoritative OCSP responder.

Departments and agencies SHALL notify CAs when certificates need to be revoked.

5.5.1 Certificate and CRL Distribution

This Standard requires the distribution of CA certificates and CRLs using HTTP. Specific requirements are found in [PROF].

Certificates that contain the FASC-N or card UUID in the SAN extension, such as PIV authentication certificates and card authentication certificates, SHALL NOT be distributed publicly (e.g., via HTTP accessible from the public internet). Individual departments and agencies can decide whether digital signature and key management certificates can be distributed publicly by the CA.

5.5.2 OCSP Status Responders

OCSP status responders SHALL be implemented as a certificate status mechanism. The OCSP status responders SHALL be updated at least as frequently as CRLs are issued.

6. PIV Cardholder Authentication

This section is normative. It defines a suite of authentication mechanisms that are supported by all PIV Cards as well as the applicability of these mechanisms in meeting the requirements for a set of graduated assurance levels. This section also defines some authentication mechanisms that make use of credential elements that MAY optionally be included on PIV Cards. Specific implementation details of authentication mechanisms identified in this section are provided in [SP 800-73]. Graduated authenticator assurance levels are also applicable to derived PIV credentials used in accordance with [SP 800-157].

While this section identifies a wide range of authentication mechanisms, departments and agencies may adopt additional mechanisms that use the identity credentials on the PIV Card. In the context of the PIV Card application, authentication is defined as the process of establishing confidence in the identity of the cardholder presenting a PIV Card. The authenticated identity can then be used to determine the permissions or authorizations granted to that identity for access to various physical and logical resources.

The authentication mechanisms in this section describe how to authenticate using the PIV Card directly. The authenticated identity can also be used to create an identity assertion as part of a federation protocol, as described in Section 7.

6.1 PIV Assurance Levels

This Standard defines multiple levels of assurance for logical and physical access. Each assurance level establishes a degree of confidence that the presenter of the PIV Card is the person referred to by the PIV credential. The entity performing the authentication further establishes confidence that the person referred to by the PIV credential is a specific person identified through the rigor of the identity proofing process conducted prior to issuance of the PIV Card and the security of the PIV Card issuance and maintenance processes specified in Section 2. The PIV identity proofing, registration, issuance, and maintenance processes meet or exceed the requirements for IAL3, as defined in [SP 800-63A].

The PIV Card contains a number of logical credentials that are used by the authentication mechanisms specified in Section 6.2. PIV assurance levels may vary depending on the PIV authentication mechanism used. The assurance levels for physical and logical access are specified in Section 6.3.1 and Section 6.3.2, respectively.

Parties responsible for controlling access to federal resources (both physical and logical) SHALL determine the appropriate assurance levels required for access based on the harm and impact to individuals and organizations that could occur as a result of errors in the authentication of the PIV cardholder. Once the required assurance level has been determined, one of the authentication mechanisms specified in Section 6.2 SHALL be applied to achieve that assurance level.

6.1.1 Relationship to Federal Identity Policy (Removed)

> Note: This section was formerly entitled "Relationship to OMB's E-Authentication Guidance."

The content of this section has been removed since OMB [M-04-04] has been rescinded by OMB [M-19-17], which recognizes the IALs defined in NIST [SP 800-63] as the framework for managing digital identity risks within the Federal Government. A mapping between PIV authentication mechanisms and SP 800-63 assurance levels can be found in Section 6.3.2.

6.2 PIV Card Authentication Mechanisms

The following subsections define the basic types of authentication mechanisms that are supported by the credential set hosted by the PIV Card application. PIV Cards can be used for authentication in environments that are equipped with contact or contactless card readers. The usage environment affects the PIV authentication mechanisms that may be applied to a particular situation.

6.2.1 Authentication Using Off-Card Biometric One-to-One Comparison

The PIV Card application hosts the fingerprint biometric templates, electronic facial image, and optional electronic iris images. These biometric data records can be read from the card following CTC authentication using a PIN supplied by the cardholder. The biometric data records are designed to support the CTE authentication mechanism through an off-card biometric one-to-one comparison scheme. The following subsections define two authentication mechanisms that make use of biometric data records.[29]

Some characteristics of the authentication mechanisms using biometric data are as follows:

- strong resistance to use of the PIV Card by a non-owner since both PIN entry and cardholder biometric characteristics are required
- digital signature on biometric data records, which is checked to further strengthen the mechanism
- slower since it requires multiple interactions with the cardholder for presentation of the PIN and acquisition of a biometric sample

[29] As noted in Section 4.2.3.1, fingerprint biometric templates are not guaranteed to contain biometric characteristic data since it may not be possible to collect fingerprints from some cardholders. Additionally, electronic iris images are not guaranteed to be present on a PIV Card since iris biometric capture is optional. When biometric verification cannot be performed, PKI-AUTH is the recommended alternate authentication mechanism.

- does not provide protection against use of a revoked card
- usable with both contact card readers and contactless card readers that support the virtual contact interface

6.2.1.1 Unattended Authentication Using Biometric Data (BIO)

The following steps SHALL be performed for unattended authentication using biometric data:

- The CHUID or another data element[30] is read from the card. The signature of the CHUID or another data element is verified to ensure that the card has not expired and that the card comes from a trusted source.
- The cardholder is prompted to enter a PIN, activating the PIV Card.
- The biometric data record is read from the card.
- The signature on the biometric data record is verified to ensure that the biometric data record is intact and comes from a trusted source. Note that the signature verification may require retrieval of the content signing certificate from the CHUID if the signature on the biometric data record was generated with the same key as the signature on the CHUID.
- The cardholder is prompted to capture a new biometric sample.
- If the new biometric sample elicits a positive biometric verification decision, the cardholder is authenticated as the owner of the card.
- The FASC-N or the card UUID in the CHUID or other data element is compared with the corresponding element in the signed attributes field of the external digital signature in the biometric data record.
- A unique identifier within the CHUID or other data element is used as input to the authorization check to determine whether the cardholder should be granted access.

6.2.1.2 Attended Authentication Using Biometric Data (BIO-A)

In this higher assurance variant of BIO, an attendant (e.g., security guard) supervises the submission of the new biometric sample by the cardholder. Otherwise, the steps for this authentication mechanism are the same as in Section 6.2.1.1.

[30] The PIV authentication certificate or card authentication certificate may be leveraged instead of the CHUID to verify that the card is not expired.

6.2.2 Authentication Using On-Card Biometric One-to-One Comparison (OCC-AUTH)

The PIV Card application MAY host an optional OCC algorithm. In this case, OCC data is stored on the card, which cannot be read but could be used for biometric verification. A fingerprint biometric template is supplied to the card to perform CTC authentication, and the card responds with a positive or negative biometric verification decision. The response includes information that allows the reader to authenticate the card. The cardholder PIN is not required for this operation. The PIV Card SHALL include a mechanism to block this authentication mechanism after a number of consecutive failed authentication attempts as stipulated by the department or agency. As with BIO and BIO-A, if agencies choose to implement OCC, it SHALL be implemented as defined in [SP 800-73] and [SP 800-76].

Some of the characteristics of OCC-AUTH are as follows:

- highly resistant to credential forgery
- strong resistance to use of unaltered card by non-owner
- usable with contact and contactless card readers

6.2.3 Authentication Using PIV Asymmetric Cryptography

The PIV Card contains two mandatory asymmetric authentication private keys and corresponding certificates to support CTE authentication, as described in Section 4. The following subsections describe how to perform authentication using the authentication keys.

6.2.3.1 Authentication with the PIV Authentication Certificate Credential (PKI-AUTH)

The following steps SHALL be performed for PKI-AUTH:

- The PIV authentication certificate is read from the PIV Card application.
- The relying system validates the PIV authentication certificate from the PIV Card application using certificate path validation specified in [RFC 5280] to ensure that it is neither expired nor revoked and that it is from a trusted source. Path validation SHOULD be configured to specify which policy OIDs are trusted.[31]
- The cardholder is prompted to enter a PIN, which is used to activate the card. If implemented, other card activation mechanisms, as specified in [SP 800-73], MAY be used to activate the card.
- The relying system issues a challenge string to the card and requests an asymmetric operation in response.

[31] The policy OID for the PIV authentication certificate is `id-fpki-common-authentication`.

- The card responds to the previously issued challenge by signing it using the PIV authentication private key.
- The relying system verifies the signature using the public key in the PIV authentication certificate.
- A unique identifier from the PIV authentication certificate is extracted and passed as input to the authorization check to determine whether the cardholder should be granted access.

Some of the characteristics of the PKI-based authentication mechanism are as follows:

- requires the use of certificate status checking infrastructure
- highly resistant to credential forgery
- strong resistance to the use of an unaltered card by a non-owner since card activation is required
- protection against the use of a revoked card
- usable with both contact card readers and contactless card readers that support the virtual contact interface

6.2.3.2 Authentication with the Card Authentication Certificate Credential (PKI-CAK)

The following steps SHALL be performed for PKI-CAK:

- The card authentication certificate is read from the PIV Card application.
- The relying system validates the card authentication certificate from the PIV Card application using certificate path validation specified in [RFC 5280] to ensure that it is neither expired nor revoked and that it is from a trusted source. Path validation SHOULD be configured to specify which policy OIDs are trusted.[32]
- The relying system issues a challenge string to the card and requests an asymmetric operation in response.
- The card responds to the previously issued challenge by signing it using the card authentication private key.
- The relying system verifies the signature using the public key in the card authentication certificate.
- A unique identifier from the card authentication certificate is extracted and passed as input to the authorization check to determine whether the cardholder should be granted access.

Some of the characteristics of the PKI-CAK authentication mechanism are as follows:

- requires the use of certificate status checking infrastructure,

[32] The policy OID for the card authentication certificate is `id-fpki-common-cardAuth`.

- highly resistant to credential forgery,
- low resistance to use of unaltered card by non-owner, and
- usable with contact and contactless readers.

6.2.3.3 Authentication Using Secure Messaging Key (SM-AUTH)

The PIV Card MAY include a secure messaging key and corresponding CVC to establish symmetric keys for use with secure messaging. The same key, CVC, and key establishment protocol can also be used for authentication, since the PIV Card is authenticated in the process of establishing secure messaging. Details of the SM-AUTH authentication mechanism are specified in [SP 800-73] and [SP 800-78].

Some of the characteristics of the secure messaging authentication mechanism are as follows:

- resistant to credential forgery,
- does not provide protection against use of a revoked card,
- low resistance to the use of an unaltered card by a non-owner, and
- usable with contact and contactless readers.

6.2.4 Authentication Using the Symmetric Card Authentication Key (SYM-CAK) (Deprecated)

The symmetric card authentication key and associated SYM-CAK authentication mechanism are deprecated in this version of the Standard. Both the key and the authentication mechanism may be removed in a future version of this Standard.

If the symmetric card authentication key is present, it SHALL be used for PIV cardholder authentication using the following steps:

- The CHUID, PIV authentication certificate, or card authentication certificate data element is read from the PIV Card and is checked to ensure that the card has not expired.
- The digital signature on the data element is checked to ensure that it was signed by a trusted source and is unaltered.
- The reader issues a challenge string to the card and requests a response.
- The card responds to the previously issued challenge by encrypting the challenge using the symmetric card authentication key.
- The relying system decrypts the card's response with its symmetric key and verifies that it matches the challenge string sent to the card.

- A unique identifier within the data element is used as input to the authorization check to determine whether the cardholder should be granted access.

Some of the characteristics of the symmetric card authentication key authentication mechanism are as follows:

- resistant to credential forgery,
- does not provide protection against use of a revoked card,
- low resistance to the use of an unaltered card by a non-owner, and
- usable with contact and contactless readers.

6.2.5 Authentication Using the CHUID (Removed)

The content of this section has been removed since the CHUID authentication mechanism is no longer allowed under FIPS-201.

The BIO, BIO-A, and the deprecated SYM-CAK authentication mechanisms use the CHUID data element as a source for the card's expiration date. The CHUID data element also provides the content signing certificate for some authentication mechanisms and unique identifiers for PACS ACLs. Therefore, the CHUID data element remains a required on-card data element, as described in Section 4.2.1.

6.2.6 Authentication Using PIV Visual Credentials (VIS) (Deprecated)

Visual authentication of a PIV cardholder as a stand-alone authentication mechanism has been deprecated in this version of the Standard. The mechanism provides little or no assurance of the cardholder's identity and SHOULD NOT be used. It is expected that the stand-alone use of visual authentication will be removed from this Standard in a future revision.

The PIV Card has several mandatory features on the front (see Section 4.1.4.1) and back (see Section 4.1.4.2) that support visual identification and authentication:

Zone 1F
Photograph

Zone 2F
Name

Zone 8F
Employee Affiliation

Zone 10F
Agency, Department, or Organization

Zones 14F and 19F
Card Expiration Date

Zone 15F
Color-Coding for Employee Affiliation

Zone 1B
Agency Card Serial Number

Zone 2B
Issuer Identification Number

In addition, any available security features described in Section 4.1.2 SHOULD be checked in a visual inspection to provide additional assurance that the PIV Card is genuine and unaltered.

The PIV Card may also have several optional components on the front (see Section 4.1.4.3) and back (see Section 4.1.4.4) that support visual identification and authentication, such as:

Zone 3F
Signature

Zone 11F
Agency Seal

Zone 5B
Physical Characteristics of Cardholder

When a cardholder attempts to pass through an access control point for a federally controlled facility, a human guard SHALL perform visual identity verification of the cardholder and SHALL determine whether the identified individual should be allowed through the control point. The following steps SHALL be applied in the visual authentication process:

- The guard at the access control entry point determines whether the PIV Card appears to be genuine and has not been altered in any way.
- The guard compares the cardholder's facial features with the photograph on the card to ensure that they match.
- The guard checks the expiration date on the card to ensure that the card has not expired.
- The guard compares the cardholder's physical characteristic descriptions to those of the cardholder. (Optional)
- The guard collects the cardholder's signature and compares it with the signature on the card. (Optional)

- One or more of the other data elements on the card (e.g., name, employee affiliation, agency card serial number, issuer identification, agency name) are used to determine whether the cardholder should be granted access.

Some characteristics of the visual authentication mechanism include the following:

- human inspection of the card,
- not amenable for rapid or high-volume access control,
- susceptible to human error,
- some resistance to the use of an unaltered card by a non-owner,
- low resistance to tampering and forgery, and
- does not provide protection against the use of a revoked card.

6.3 PIV Support of Graduated Authenticator Assurance Levels

The PIV Card supports a set of authentication mechanisms that can be used to implement graduated assurance levels. The assurance levels used within this Standard are closely aligned with NIST [SP 800-63], which specifies a digital identity risk management process that is cited by OMB [M-19-17].

The following subsections specify which PIV authentication mechanisms CAN be used to support the various authenticator assurance levels described in this section. Two or more authentication mechanisms MAY be applied in unison to achieve additional assurance of the identity of the PIV cardholder. For example, PKI-AUTH and BIO may be applied in unison to achieve additional assurance of cardholder identity.

Adequately designed and implemented relying systems can achieve the PIV Card assurance levels stated in Table 6-1 for physical access and Table 6-2 for logical access. Relying systems that are inadequately designed or implemented may only achieve lower assurance levels. The design of the components of relying systems—including card readers, biometric capture devices, cryptographic modules, and key management systems—involves many factors not fully specified by FIPS 201, such as correctness of the functional mechanism, physical protection of the mechanism, and environmental conditions at the authentication point. Additional standards and best practice guidelines (e.g., [SP 800-53], [FIPS 140], and [SP 800-116]) apply to the design and implementation of relying systems.

6.3.1 Physical Access

The PIV Card can be used to authenticate the cardholder in a physical access control environment.

The three levels of authentication assurance for physical access, referred to as the Physical Assurance Level (PAL), are defined as:

PAL1
Formerly SOME confidence in the asserted identity's validity (weakest).

PAL2
Formerly HIGH confidence in the asserted identity's validity.

PAL3
Formerly VERY HIGH confidence in the asserted identity's validity (strongest).

Selection of the PAL SHALL be made in accordance with the applicable policies for a facility's security level [RISK-MGMT-FACILITIES]. Additional guidelines for the selection and use of PIV authentication mechanisms for facility access can be found in NIST [SP 800-116].

The PIV-supported authentication mechanisms for physical access control systems are summarized in Table 6-1. An authentication mechanism that is suitable for a higher assurance level can also be applied to meet the requirements for a lower assurance level. Moreover, the authentication mechanisms in Table 6-1 can be combined to achieve higher assurance levels.[33]

Table 6-1. Applicable PIV Authentication Mechanisms for Physical Access

Physical Assurance Level	Applicable PIV Authentication Mechanisms
PAL1	PKI-CAK, SYM-CAK
PAL2	BIO
PAL3	BIO-A, OCC-AUTH, PKI-AUTH

[33] Combinations of authentication mechanisms are specified in [SP 800-116].

6.3.2 Logical Access

The PIV Card can be used to authenticate the cardholder in support of decisions regarding access to logical information resources. For example, a cardholder may log in to their department or agency network using the PIV Card; the identity established through this authentication process can be used to determine access to information systems and applications available on the network.

Selection of required AAL SHALL be made using the risk management process specified in [SP 800-63].

Table 6-2 describes the authentication mechanisms defined for this Standard to support logical access control. An authentication mechanism that is suitable for a higher assurance level can also be applied to meet the requirements for a lower assurance level.

Table 6-2. Applicable PIV Authentication Mechanisms for Logical Access

Required Authenticator Assurance Level	Local Workstation Environment	Remote/Network System Environment
AAL1	PKI-CAK	PKI-CAK
AAL2	BIO	
AAL3	BIO-A, OCC-AUTH, PKI-AUTH	PKI-AUTH

7. Federation Considerations for PIV

This section is normative. It defines a set of mechanisms for using federation technologies to interoperate with PIV and derived PIV credentials issued by other agencies.

Federation protocols allow a trusted IdP to assert a cardholder's identity to an RP across a network in a secure and verifiable fashion, even if the PIV Card or derived PIV credential has been issued by another agency. The processes and requirements for federation systems are discussed in depth in [SP 800-63C].

7.1 Connecting PIV to Federation

When using a federation protocol, the PIV Card or derived PIV credential is not directly presented to the relying subsystem. Instead, the PIV Card or derived PIV credential SHALL be used to authenticate the PIV cardholder to the IdP of a federation system.[34] The IdP SHALL associate this login with the PIV account of the cardholder and SHALL create an assertion representing the cardholder to be sent to the RP, including attributes of the cardholder stored in the PIV account. Upon receipt, the RP SHALL validate the assertion and use the attributes provided in the assertion to match the cardholder information to the information on record, as discussed in Section 3.1.3. The connections and components of a federated protocol are shown in Figure 3-4.

Note that processing the PIV Card's PKI-based certificate directly is not a form of federation as defined by [SP 800-63C], since the certificates on the PIV Card do not meet the requirements of an assertion. In particular, while an assertion is a short-lived message created specifically for a federation transaction, the certificate is long-lived and intended to be presented to many different RPs over time.

7.2 Federation Assurance Level (FAL)

[SP 800-63] defines three dimensions of assurance: IAL, AAL, and FAL. The use of a PIV credential or a derived PIV credential for authentication in a federation transaction will determine the IAL and AAL of that transaction, but the FAL is determined independently of the credential itself. As with all credentials, the PIV credential MAY be used with any FAL, regardless of the IAL and AAL that the credential represents. Guidance for determining the correct FAL for a given application is available in [SP 800-63].

The IAL, AAL, and FAL SHALL be known to the RP during the federation transaction. This information MAY be pre-established or the IdP MAY communicate this at runtime in the assertion. For example, the information can be presented using technologies defined in [RFC 8485] or [SAML-AC].

[34] The IdP is usually operated by the issuer of the PIV Card or derived PIV credential.

7.3 Benefits of Federation

While it is possible to directly process a PIV credential that belongs to a different agency, federation is the recommended way for an agency to accept and process PIV credentials from other agencies.

Benefits of using a federation protocol to present a PIV credential include the following:

Federation attributes

The assertion attributes are more dynamic in nature than the fixed attributes in PIV credentials. They can be adapted to the needs of the RP and further tailored (e.g., selective disclosure of attributes per-provider to preserve privacy).

Stable identifier

The identifier in the assertion IdP is stable across multiple certificates over time and can be associated with all of the cardholder's authenticators.

Simplicity

Processing of a federation protocol is simpler for the RP since credential validation and management are tasked to the credential issuer/IdP. This is further exemplified by the use of federation technologies to provide authentication and authorization to mobile applications, smart devices, and other non-traditional applications.

Appendix A. PIV Validation, Certification, and Accreditation

This appendix is normative. It provides compliance requirements for PIV validation, certification, and accreditation.

A.1 Accreditation of PIV Card Issuers (PCI) and Derived PIV Credential Issuers (DPCI)

[HSPD-12] requires that PIV credentials be issued by providers whose reliability has been established by an official accreditation process. Consistent assessment guidelines are established for PIV Card Issuers (PCI) and Derived PIV Credential Issuers (DPCI) in [SP 800-79], which SHALL be followed by all credential issuers in order to achieve accreditation.

The entire spectrum of activities in the PCI and DPCI accreditation methodology is divided into the following four phases:

- initiation,
- assessment,
- accreditation, and
- monitoring.

The initiation phase involves communicating the goals of the assessment/accreditation to the key personnel of the PCI and DPCI organization and the review of documents, such as the PCI and DPCI operations plan. In the assessment phase, the appropriate assessment methods stipulated in the methodology for each PCI/DPCI and control are carried out and the individual results recorded. The accreditation phase involves aggregating the results of assessment, arriving at an accreditation decision, and issuing the appropriate notification—the Authorization to Operate (ATO) or the Denial of Authorization to Operate (DATO)—that is consistent with the accreditation decision.

A.2 Application of Risk Management Framework to IT Systems Supporting PCI

The accreditation of the capability and reliability of a PCI and DPCI using the methodology outlined in [SP 800-79] depends on adequate security for the information systems that are used for PCI and DPCI functions. The assurance that such a security exists in a PCI and DPCI is obtained through evidence of the application of the Risk Management Framework guidelines specified in [SP 800-37]. The methodology in [SP 800-37]was, in turn, created pursuant to a mandate in Appendix III of Office of Management and Budget (OMB) Circular [A-130]. An information system authorization decision, together with evidence of security control monitoring compliant with [SP 800-37] guidelines, signifies that a PCI/DPCI organization's official accepts responsibility for the security (in terms of confidentiality, integrity, and availability of information) of the information systems that will be involved in carrying out the PCI/DPCI functions. Hence, evidence of successful application of the Risk Management Framework consistent with [SP 800-37] guidelines is mandatory for issuing PCI/DPCI accreditation using [SP 800-79].

A.3 Conformance Testing of PIV Card Application and Middleware

Assurance of conformance of the PIV Card application interface to this Standard and its associated technical specifications is needed in order to meet the security and interoperability goals of [HSPD-12]. To facilitate this, NIST has established the NIST Personal Identity Verification Program (NPIVP). Under this program, NIST has developed test procedures in [SP 800-85A] and an associated toolkit for conformance testing of PIV Card applications. NPIVP conformance testing also includes PIV middleware, but conformance testing may be discontinued at a future time since computer operating systems increasingly provide built-in support for smart cards.

Commercial products under these two categories are tested by the set of test laboratories accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) program using the NIST-supplied test procedures and toolkit. The outcomes of the test results are validated by NIST, which then issues validation certificates. Information about NPIVP is available at https://csrc.nist.gov/projects/nist-s-personal-identity-verification-program.

A.4 Cryptographic Testing and Validation

All on-card cryptographic modules that host the PIV Card application and cryptographic modules of card issuance and maintenance systems SHALL be validated to [FIPS 140] with an overall Security Level 2 (or higher). The facilities for [FIPS 140] testing are the Cryptographic and Security Testing Laboratories accredited by the NVLAP program of NIST. Vendors who want to supply cryptographic modules can select any of the accredited laboratories. The tests that these laboratories conduct for all vendor submissions are validated, and a validation certificate for each vendor module is issued by the Cryptographic Module Validation Program (CMVP), a joint program run by NIST and the Communications Security Establishment (CSE) of the Government of Canada. The details of the CMVP and NVLAP programs and the list of testing laboratories can be found at the CMVP website, https://csrc.nist.gov/projects/cryptographic-module-validation-program.

A.5 FIPS 201 Evaluation Program

In order to evaluate the conformance of specialized products that support the PIV functionality to this Standard and its associated technical specifications, GSA established the FIPS 201 Evaluation Program. The product families may include the card products tested under the PIV Validation Program, physical access control systems, or other products as needed. Products evaluated and approved under this process are placed on the FIPS 201 Approved Products List to promote the procurement of conformant products by implementing agencies. The details of the program are available at https://www.idmanagement.gov/.

Appendix B. PIV Object Identifiers and Certificate Extension

This appendix is normative. It provides additional details for the PIV objects identified in Section 4.

B.1 PIV Object Identifiers

Table B-1, Table B-2, and Table B-3 list details for PIV object identifiers.

Table B-1. PIV Object Identifiers for PIV eContent Types

ID	Object Identifier	Description
`id-PIV-CHUIDSecurityObject`	2.16.840.1.101.3.6.1	The associated content is the concatenated contents of the CHUID, excluding the asymmetric signature field.
`id-PIV-biometricObject`	2.16.840.1.101.3.6.2	The associated content is the concatenated `CBEFF_HEADER` + `STD_BIOMETRIC_RECORD`.

Table B-2. PIV Object Identifiers for PIV Attributes

ID	Object Identifier	Description
`pivCardholder-Name`	2.16.840.1.101.3.6.3	The attribute value is of type DirectoryString and specifies the PIV cardholder's name.
`pivCardholder-DN`	2.16.840.1.101.3.6.4	The attribute value is an X.501 type Name and specifies the DN associated with the PIV cardholder in the PIV certificates.
`pivSigner-DN`	2.16.840.1.101.3.6.5	The attribute value is an X.501 type Name and specifies the subject name that appears in the PKI certificate for the entity that signed the biometric data record or CHUID.
`pivFASC-N`	2.16.840.1.101.3.6.6	The `pivFASC-N` OID MAY appear as an X.501 type Name in the `otherName` field of the Subject Alternative Name extension of X.509 certificates or a signed attribute in CMS external signatures. Where used as an X.501 type Name, the syntax is OCTET STRING. Where used as an attribute, the attribute value is of type OCTET STRING. In each case, the value specifies the FASC-N of the PIV Card.

Table B-3. PIV Object Identifiers for PIV Extended Key Usage

ID	Object Identifier	Description
`id-PIV-content-signing`	2.16.840.1.101.3.6.7	This specifies that the public key MAY be used to verify signatures on CHUIDs and biometric data records.
`id-PIV-cardAuth`	2.16.840.1.101.3.6.8	This specifies that the public key is used to authenticate the PIV Card rather than the PIV cardholder.

The OIDs for certificate policies are specified in [COMMON].

B.2 PIV Background Investigation Indicator Certificate Extension (Deprecated)

The PIV background investigation indicator (previously known as the NACI indicator) is deprecated under this version of the Standard, and it is expected that the indicator will be removed from a future revision. Instead of the on-card indicator, background investigative status is commonly maintained in each agency IDMS and personnel security system as well as in the Central Verification System (or successor). Status of the investigation can be communicated as needed using federation protocols.

If used, the PIV background investigation indicator extension indicates to the issuer whether the subject's background investigation was incomplete at the time of credential issuance. The PIV background investigation indicator extension is always non-critical. The value of this extension is asserted as follows:

- TRUE if, at the time of credential issuance, (1) the FBI National Criminal History Fingerprint Check has completed, and (2) a background investigation has been initiated but has not completed.
- FALSE if, at the time of credential issuance, the subject's background investigation has been completed and successfully adjudicated.

The PIV background investigation indicator extension is identified by the id-piv-NACI object identifier. The syntax for this extension is defined by the following ASN.1 module:

```
PIV-Cert-Extensions { 2 16 840 1 101 3 6 10 1 }
DEFINITIONS EXPLICIT TAGS ::=
BEGIN
-- EXPORTS ALL --
-- IMPORTS NONE --
id-piv-NACI OBJECT IDENTIFIER ::= { 2 16 840 1 101 3 6 9 1 }
NACI-indicator ::= BOOLEAN
END
```

Appendix C. Glossary of Terms, Acronyms, and Notations

This appendix is informative. It describes the vocabulary and textual representations used in the document.

C.1 Glossary of Terms

The following terms are used throughout this Standard.

Access Control

The process of granting or denying specific requests to 1) obtain and use information and related information processing services and 2) enter specific physical facilities (e.g., federal buildings, military establishments, border crossing entrances).

Applicant

An individual applying for a *PIV Card* or *derived PIV credential*. The applicant may be a current or prospective federal hire, a federal employee, or a contractor.

Application

A hardware/software system implemented to satisfy a particular set of requirements. In this context, an application incorporates a system used to satisfy a subset of requirements related to the verification or identification of an end user's *identity* so that the end user's *identifier* can be used to facilitate the end user's interaction with the system.

Architecture

A highly structured specification of an acceptable approach within a framework for solving a specific problem. An architecture contains descriptions of all the *components* of a selected, acceptable solution while allowing certain details of specific *components* to be variable to satisfy related constraints (e.g., costs, local environment, user acceptability).

Assertion

A verifiable statement from an IdP to an RP that contains information about an end user. Assertions may also contain information about the end user's *authentication* event at the IdP.

Asymmetric Keys

Two related *keys*—a *public key* and a *private key*—that are used to perform complementary operations, such as encryption and decryption or signature generation and signature verification.

Authentication

The process of establishing confidence of authenticity; in this case, the validity of a person's *identity* and an authenticator (e.g., *PIV Card* or *derived PIV credential*).

Authenticator Assurance Level (AAL)

A measure of the strength of an *authentication* mechanism and, therefore, the confidence in it, as defined in [SP 800-63] in terms of three levels:

AAL1

SOME confidence

AAL2

HIGH confidence

AAL3

VERY HIGH confidence

Biometric Authentication (BIO, BIO-A)

A form of *authentication* in which authenticity is established by *biometric verification* of a new *biometric sample* from a *cardholder* to a *biometric data record* read from the *cardholder*'s activated *PIV Card*. In *BIO*, the biometric sample may be captured from the *cardholder* in isolation, while in *BIO-A*, an attendant must oversee the process of biometric *capture*.

Biometric Capture Device

Device that collects a signal from a *biometric characteristic* and converts it to a captured biometric sample. [ISO 2382-37]

Biometric Characteristic

Biological attribute of an individual from which distinctive and repeatable values can be extracted for the purpose of automated recognition. Fingerprint ridge structure and face topography are examples of biometric characteristics [ISO 2382-37].

Biometric Data

Biometric sample or aggregation of biometric samples at any stage of processing [ISO 2382-37].

Biometric Data Record

Electronic data record containing biometric data. This information can be in terms of raw or compressed pixels or in terms of some *biometric characteristic* (e.g., patterns) [ISO 2382-37].

Biometric On-Card Comparison (OCC)

A one-to-one *comparison* of fingerprint *biometric data records* transmitted to the *PIV Card* with a biometric reference previously stored on the *PIV Card*. In this Standard, OCC is used as a means of performing card activation and as part of OCC-AUTH.

Biometric Verification

Process of confirming a biometric claim through biometric *comparison*.

Biometric Verification Decision

A determination of whether biometric probe(s) and biometric reference(s) have the same biometric source based on *comparison* score(s) during a *biometric verification* transaction [ISO 2382-37].

Capture

Series of actions undertaken to obtain and record, in a retrievable form, signals of *biometric characteristics* directly from individuals [ISO 2382-37].

Cardholder

An individual who possesses an issued *PIV Card*.

Card Management System

The card management system manages the lifecycle of a *PIV Card* application.

Central Verification System

A system operated by the Office of Personnel Management that contains information on security clearances, investigations, suitability, fitness determinations, [HSPD-12] decisions, PIV credentials, and polygraph data.

Certificate Revocation List

A list of revoked *public key* certificates created and digitally signed by a *certification authority* [RFC 5280] [RFC 6818].

Certification

The process of verifying the correctness of a statement or claim and issuing a certificate as to its correctness.

Certification Authority

A trusted entity that issues and revokes *public key* certificates.

Chain of trust

An interoperable data format for *PIV enrollment records* that facilitates the import and export of records between *PIV Card issuers*.

Card Verifiable Certificate

A certificate stored on the *PIV card* that includes a public key, the signature of a *certification authority*, and further information needed to verify the certificate.

Comparison

Estimation, calculation, or measurement of similarity or dissimilarity between biometric probe(s) and biometric reference(s) [ISO 2382-37]. See also *Identification*.

Component

An element of a large system—such as an *identity* card, *issuer*, card reader, or *identity verification* support—within the PIV system.

Conformance Testing

A process established by NIST within its responsibilities of developing, promulgating, and supporting FIPS for testing specific characteristics of *components*, products, services, people, and organizations for compliance with a FIPS.

Credential

Evidence attesting to one's right to credit or authority. In this Standard, it is the *PIV Card* or *derived PIV credential* associated with an individual that authoritatively binds an *identity* (and, optionally, additional attributes) to that individual.

Cryptographic Key (Key)

A parameter used in conjunction with a cryptographic algorithm that determines the specific operation of that algorithm.

Derived PIV Credential

A *credential* issued based on proof of possession and control of a *PIV Card*. Derived PIV credentials are typically used in situations that do not easily accommodate a *PIV Card*, such as in conjunction with mobile devices.

Enrollment

See *Identity Registration*.

Enrollment Data Set

A record that includes information about a biometric enrollment (i.e., name and role of the acquiring agent, office and organization, time, place, and acquisition method).

Federal Agency Smart Credential Number (FASC-N)

One of the primary *identifiers* on the *PIV Card* for physical *access control*, as required by FIPS 201. The FASC-N is a fixed length (25 byte) data object that is specified in [SP 800-73], and included in several data objects on a *PIV Card*.

Federal Information Processing Standards (FIPS)

A standard for adoption and use by federal departments and agencies that has been developed within the Information Technology Laboratory and published by NIST, a part of the U.S. Department of Commerce. A FIPS covers some topic in information technology to achieve a common level of quality or some level of interoperability.

Federation

A process that allows for the conveyance of *identity* and *authentication* information across a set of networked systems.

Federation Assurance Level (FAL)

A category that describes the *federation* protocol used to communicate an *assertion* containing *authentication* and attribute information (if applicable) to an RP, as defined in [SP 800-63] in terms of three levels:

FAL1

SOME confidence

FAL2

HIGH confidence

FAL3

VERY HIGH confidence

Hash Function

A function that maps a bit string of arbitrary length to a fixed length bit string. Secure hash functions [FIPS 180] satisfy the following properties:

One-Way

It is computationally infeasible to find any input that maps to any pre-specified output.

Collision Resistant

It is computationally infeasible to find any two distinct inputs that map to the same output.

Identification

The process of discovering the *identity* (i.e., origin or initial history) of a person or item from the entire collection of similar persons or items.

Identifier

Unique data used to represent a person's *identity* and associated attributes. A name or a card number are examples of identifiers.

Identity

The set of physical and behavioral characteristics by which an individual is uniquely recognizable.

Identity Assurance Level (IAL)

A category that conveys the degree of confidence that the end user's claimed *identity* is their real *identity*, as defined in [SP 800-63] in terms of three levels:

IAL1

SOME confidence

IAL2

HIGH confidence

IAL3

VERY HIGH confidence

Identity Proofing

The process of providing sufficient information (e.g., *identity* history, *credentials*, documents) to establish an *identity*.

Identity Management System (IDMS)

One or more systems or *applications* that manage the *identity proofing*, *registration*, and issuance processes.

Identity Registration

The process of making a person's *identity* known to the PIV system, associating a unique *identifier* with that *identity*, and collecting and recording the person's relevant attributes into the system. In some other NIST documents, such as [SP 800-63A], identity registration is referred to as *enrollment*.

Identity Verification

The process of confirming or denying that a claimed *identity* is correct by comparing the *credentials* of a person requesting access with those previously proven and associated with the *PIV Card* or a *derived PIV credential* associated with the *identity* being claimed.

Issuer

The organization that is issuing the *PIV Card* to an *applicant*. Typically this is an organization for which the *applicant* is working.

Issuing Facility

A physical site or location—including all equipment, staff, and documentation—that is responsible for carrying out one or more of the following PIV functions:

- *identity proofing* and *registration*;
- card and token production;
- activation and issuance;
- post-issuance binding of *derived PIV credential*; and
- maintenance.

Key

See *Cryptographic Key*.

Match

Comparison decision stating that the biometric probe(s) and the biometric reference are from the same source. Match is a possible result of a *Comparison*. The opposite of a match is a non-match [ISO 2382-37].

Model

A detailed description or scaled representation of one *component* of a larger system that can be created, operated, and analyzed to predict actual operational characteristics of the final produced *component*.

Off-Card

Refers to data that is not stored within the *PIV Card* or to a computation that is not performed by the integrated circuit chip (ICC) of the *PIV Card*.

On-Card

Refers to data that is stored within the *PIV Card* or to a computation that is performed by the integrated circuit chip (ICC) of the *PIV Card*.

Online Certificate Status Protocol (OCSP)

An online protocol used to determine the status of a *public key* certificate [RFC 6960].

Path Validation

The process of verifying the binding between the subject *identifier* and subject *public key* in a certificate, based on the *public key* of a trust anchor, through the validation of a chain of certificates that begins with a certificate issued by the trust anchor and ends with the target certificate. Successful path validation provides strong evidence that the information in the target certificate is trustworthy.

Personally Identifiable Information (PII)

Information that can be used to distinguish or trace an individual's *identity*—such as name, social security number, *biometric data records*—alone, or when combined with other personal or identifying information that is linked or linkable to a specific individual (e.g., date and place of birth, mother's maiden name, etc.) [M-17-12].

Personal Identification Number (PIN)

A numeric secret that a *cardholder* memorizes and uses as part of authenticating their *identity*.

Personal Identity Verification (PIV) Account

The logical record containing credentialing information for a given PIV *cardholder*. This is stored within the *issuer's identity management system* and includes PIV enrollment data, *cardholder identity* attributes, and information regarding the *cardholder*'s *PIV Card* and any *derived PIV credentials* bound to the account.

Personal Identity Verification (PIV) Card

A physical artifact (e.g., *identity* card, "smart" card) issued to an individual that contains a PIV Card application which stores *identity credentials* (e.g., photograph, *cryptographic keys*, digitized fingerprint representation) so that the claimed *identity* of the *cardholder* can be verified against the stored *credentials*.

PIV Enrollment Record

A sequence of related *enrollment data sets* that is created and maintained by *PIV Card issuers*. The PIV enrollment record typically contains data collected at each step of the PIV *identity proofing*, *registration*, and issuance processes.

Private Key

The secret part of an *asymmetric key* pair that is typically used to digitally sign or decrypt data.

Pseudonym

A name assigned through a formal process by a federal department or agency to a federal employee for the purpose of the employee's protection (i.e., the employee might be placed at risk if their actual name were known) or for other purposes.

Public Key

The public part of an *asymmetric key* pair that is typically used to verify signatures or encrypt data.

Public Key Infrastructure (PKI)
A support service to the PIV system that provides the *cryptographic keys* needed to perform digital signature-based *identity verification* and to protect communications and the storage of sensitive verification system data within *identity* cards and the verification system.

PKI-Card Authentication (PKI-CAK)
A PIV *authentication* mechanism that is implemented by an *asymmetric key* challenge/response protocol using the card *authentication key* of the *PIV Card* and a contact or contactless reader.

PKI-PIV Authentication (PKI-AUTH)
A PIV *authentication* mechanism that is implemented by an *asymmetric key* challenge/response protocol using the PIV *authentication key* of the *PIV Card* and a contact reader or a contactless card reader that supports the virtual contact interface.

Recommendation
A special publication of the ITL that stipulates specific characteristics of the technology to use or the procedures to follow to achieve a common level of quality or level of interoperability.

Registration
See *Identity Registration*.

Symmetric Key
A *cryptographic key* that is used to perform both the cryptographic operation and its inverse (e.g., to encrypt, decrypt, or create a message *authentication* code and verify it).

Security Executive Agent
Individual responsible for the development, implementation, and oversight of effective, efficient, and uniform policies and procedures that govern the conduct of investigations and adjudications for eligibility to access classified information and eligibility to hold a sensitive position in the Federal Government. In accordance with Executive Order 13467 (as amended), this individual is the Director of National Intelligence (DNI).

Suitability and Credentialing Executive Agent

Individual responsible for prescribing suitability standards and minimum standards of fitness for employment. With the issuance of Executive Order 13467, as amended, the Suitability and Credentialing Executive Agent is responsible for the development, implementation, and oversight of effective, efficient, and uniform policies and procedures governing the conduct of investigations and adjudications for Suitability, Fitness, and Credentialing determinations in the Federal Government. Pursuant to sections 1103 and 1104 of title 5, United States Code, and the Civil Service Rules, the director of the Office of Personnel Management (OPM) is the Suitability and Credentialing Executive Agent.

C.2 Acronyms and Abbreviations

The following acronyms and abbreviations are used throughout this Standard:

AAL

Authenticator Assurance Level

AAMVA

American Association of Motor Vehicle Association

ACL

Access Control List

AES

Advanced Encryption Standard

AID

Application Identifier

AIM

Association for Automatic Identification and Mobility

ANSI

American National Standards Institute

ASN.1

Abstract Syntax Notation One

ASTM

American Society for Testing and Materials

ATO

Authorization to Operate

CA

Certification Authority

CAK

Card Authentication Key

CBEFF

Common Biometric Exchange Formats Framework

CDS

Card Design Standard

CHUID

Cardholder Unique Identifier

cm

Centimeter

CMS

Cryptographic Message Syntax

CMTC

Card Management System to Card

CMVP

Cryptographic Module Validation Program

CMYK

Cyan, Magenta, Yellow, and Key (or blacK)

COTS

Commercial Off-the-Shelf

CRL

Certificate Revocation List

CSE

Communications Security Establishment

CTC

Cardholder to Card

CTE

Cardholder to External System

CVC
Card Verifiable Certificate

DATO
Denial of Authorization to Operate

DHS
Department of Homeland Security

DN
Distinguished Name

DOB
Date of Birth

dpi
Dots Per Inch

ERT
Emergency Response Team

FAL
Federation Assurance Level

FASC-N
Federal Agency Smart Credential Number

FBI
Federal Bureau of Investigation

FICAM
Federal Identity, Credential, and Access Management

FIPS
Federal Information Processing Standards

FIPS
PUB FIPS Publication

GSA
U.S. General Services Administration

GUID
Global Unique Identification number

HR

Human Resources

HSPD

Homeland Security Presidential Directive

HTTP

Hypertext Transfer Protocol

HTTPS

Hypertext Transfer Protocol Secure

IAL

Identity Assurance Level

ICAMSC

Identity, Credential, and Access Management Subcommittee

ICC

Integrated Circuit Chip

ID

Identification

IDMS

Identity Management System

IdP

Identity Provider

IEC

International Electrotechnical Commission

IETF

Internet Engineering Task Force

INCITS

International Committee for Information Technology Standards

IR

Infrared

ISO

International Organization for Standardization

IT

Information Technology

ITL

Information Technology Laboratory

mil

Thousandth of an inch

mm

Millimeter

MWR

Morale, Welfare, and Recreation

NACI

National Agency Check with Written Inquiries

NCHC

National Criminal History Check

NIST

National Institute of Standards and Technology

NISTIR

National Institute of Standards and Technology Interagency Report

NPIVP

NIST Personal Identity Verification Program

NVLAP

National Voluntary Laboratory Accreditation Program

OCC

On-Card Biometric One-to-One Comparison

OCSP

Online Certificate Status Protocol

OID

Object Identifier

OMB

Office of Management and Budget

OPM
Office of Personnel Management

PAL
Physical Assurance Level

PCI
PIV Card Issuer

PC/SC
Personal Computer/Smart Card

PDF
Portable Data File

PIA
Privacy Impact Assessment

PII
Personally Identifiable Information

PIN
Personal Identification Number

PIV
Personal Identity Verification

PKI
Public Key Infrastructure

pt
Point (unit of measurement)

RFC
Request for Comments

RP
Relying Party

SAML
Security Assertion Markup Language

SAN
Subject Alternative Name

SP
Special Publication

sRGB
Standard Red Green Blue

SSP
Shared Service Provider

URN
Uniform Resource Name

U.S.C.
United States Code

UUID
Universally Unique Identifier

UV
Ultraviolet

C.3 Notations

This Standard uses the following typographical conventions in text:

- ASN.1 data types are represented in a `monospaced font`. For example, `SignedData` and `SignerInfo` are data types defined for digital signatures.
- Specific terms in CAPITALS represent normative requirements. When these same terms are not in CAPITALS, the term does not represent a normative requirement.
  - The terms “SHALL” and “SHALL NOT” indicate requirements to be followed strictly in order to conform to the publication and from which no deviation is permitted.
  - The terms “SHOULD” and “SHOULD NOT” indicate that among several possibilities, one is recommended as particularly suitable without mentioning or excluding others, that a certain course of action is preferred but not necessarily required, or that (in the negative form) a certain possibility or course of action is discouraged but not prohibited.
  - The terms “MAY” and “NEED NOT” indicate a course of action permissible within the limits of the publication.
  - The terms “CAN” and “CANNOT” indicate a possibility and capability—whether material, physical, or causal—or, in the negative, the absence of that possibility or capability.

Appendix D. References

This appendix is informative. It lists the specifications and standards referred to in this document.

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Appendix E. Revision History

This appendix is informative. It provides an overview of the changes to FIPS 201 since its initial release.

Version	Release Date	Updates	Location
FIPS 201	February 2005	Initial Release	
FIPS 201-1	March 2006	Added the requirement for electronically distinguishable from identity credentials issued to individuals who have a completed investigation (NACI Indictor).	
FIPS 201-1 Change Notice 1	March 2006	Added clarification for variable placement of Agency Card Serial Number along the outer edge of the back of the PIV Card is allowed.	
		Also, updated ASN.1 encoding for NACI Indicator (background investigation indicator).	
FIPS 201-2	August 2013	This version represents the 5-year review of FIPS 201 and change request inputs received from agencies. Following are the highlights of changes made in this version.	
		Modified the requirement for accreditation of PIV Card issuer to include an independent review.	
		Incorporated references to credentialing guidance and requirements issued by OPM and OMB.	
		Made the facial image data element on the PIV Card mandatory.	
		Added the option to collect and store iris biometric data on the PIV Card.	
		Added option to use electronic facial image for authentication in operator-attended environments.	
		Incorporated the content from Form I-9 that is relevant to FIPS 201.	
		Introduced the concept of a “chain-of-trust” optionally maintained by a PIV Card issuer.	
		Changed the maximum life of PIV Card from 5 years to 6 years.	

		Added requirements for issuing a PIV Card to an individual under a pseudonymous identity.	
		Added requirements for issuing a PIV Card to an individual within grace period.	
		Added requirements for post-issuance updates.	
		Added option to allow for remote PIN resets.	
		Introduced the ability to issue derived PIV credentials.	
		The employee affiliation color-coding and the large expiration date in the upper right-hand corner of the card are now mandatory.	
		Made all four asymmetric keys and certificates mandatory.	
		Introduced the concept of a virtual contact interface over which all functionality of the PIV Card is accessible.	
		Added a mandatory UUID as a unique identifier for the PIV Card in addition to the FASC-N.	
		Added optional on-card biometric comparison as a means of performing card activation and as a PIV authentication mechanism.	
		Removed direct requirement to distribute certificates and CRLs via LDAP.	
		Updated authentication mechanisms to enable variations in implementations.	
		Require signature verification and certification path validation in the CHUID, BIO, and BIO-A authentication mechanisms.	
		The VIS and CHUID authentication mechanisms have been downgraded to indicate that they provide LITTLE or NO assurance in the identity of the cardholder.	

		Deprecated the use of the CHUID authentication mechanism. The CHUID data element has not been deprecated and continues to be mandatory.	
FIPS 201-3	November 2020	This version represents the 5-year review of FIPS 201 and change request inputs received from agencies. Following are the highlights of changes made in this version.	
		Alignment with SP 800-63-3 language and terms.	
		Used explicit normative language terms SHALL/SHOULD/MAY/CAN.	
		Updated process for binding and termination of derived PIV credentials with PIV account.	§2
		Updated credentialing requirements for issuance of PIV Cards based on OPM guidance.	§2
		Added requirements for supervised remote identity proofing and PIV Card maintenance.	§2
		Modified identity proofing requirements to reflect updated list of accepted documents.	§2
		Deprecated PIV NACI indicator (background investigation indicator).	§2
		Updated guidance on collection of biometric data for credentialing.	§2
		Clarified multi-session proofing and enrollment.	§2
		Provided clarification on grace periods.	§2
		Clarified biometric modalities for proofing and authentication.	§2, §6
		Updated system description and associated diagrams.	§3
		Generalized chain of trust records to enrollment records and made them required.	§3
		Deprecated the use of magnetic stripes on PIV Card.	§4
		Deprecated the use of bar codes on PIV Card.	§4

		Updated example PIV Card diagrams.	§4
		Linked expiration of content signing certificate with card authentication certificate.	§4
		Revised PIN requirements based on SP 800-63B guidelines.	§4
		Deprecated symmetric card authentication key.	§4
		Removed requirement for support of Legacy PKIs.	§5
		Removed references to OMB M-04-04 that was rescinded by OMB M-19-17.	§6
		Expressed assurance levels in terms of PAL and AAL.	§6
		Removed previously deprecated CHUID authentication mechanisms. The CHUID data element has not been deprecated and continues to be mandatory.	§6
		Deprecated VIS authentication mechanism.	§6
		Deprecated SYM-CAK authentication mechanism.	§6
		Added SM-AUTH as optional authentication mechanism.	§6
		Added section discussing federation in relationship to PIV credentials.	§7