Session 4: Spectrum of Applications

Elaine Barker. et al.
Goal: To provide a basis for all current and future applications and environments requiring key management for the Federal government.

- Browsers
- Email
- Mobile applications, e.g., laptops, tablets, smart phones, etc.
- Cloud
- Key and metadata storage
- Key establishment
Email Application
Email Application

- Entities will need to be in the same FCKMS or Security Domain to establish keys.
Mobile Applications

Lily Chen, NIST
Key management in mobile devices

• The keys in a mobile device belong to different stack holders
  • Device specific keys - usually installed by mobile manufactures
  • Communication service authentication keys - in the smartcard - service providers
  • Wireless link protection keys - established with the network (3G, LTE, etc.) - service providers
  • Application specific keys - for different applications such as TLS, DRM, etc. - applications
  • User specific keys - to protect user data - user can lock and unlock using password
  • Enterprise/government keys - in BYOD environment
The mobile devices and service are COTS products

FCKMS depends on other CKMSs
  - FR:3.4 The CKMS design shall specify the COTS products used in the CKMS
  - FR:3.5 The CKMS design shall specify which security functions are performed by COTS products.
  - FR:3.6 The CKMS design shall specify how COTS products are configured and augmented to meet the CKMS goal.

The areas and standards to look into
  - Trusted platform (hardware root of trust, Draft NIST SP 800-164)
  - Telecommunication standards (3GPP, LTS, IEEE 802.11, etc.)
  - Application standards (TLS, IKE, DRM, OASIS, etc.)
  - Configurations
Mobile challenges

• Different CKMSs may have different policies and different goals
• Manufactures may not release the key management details for device keys
• Service authentication keys are provider specific
• New applications are introduced frequently and so are key management issues
Cloud Security

Michaela Iorga, NIST
* Key and Metadata Storage

Elaine Barker, NIST
Key and Metadata Storage

• Local, backup or archive storage outside a cryptographic module.
• Could be accessed by multiple entities.
• Section 6.1.2 (Key Protections):
  o **Shall** physically or cryptographically protect all symmetric and private keys from unauthorized disclosure, use, and modification (PR: 6.2).
  o **Shall** support the protection of keys at a level that is commensurate with the impact level of the data to be protected by the keys (PR: 6.3).
  o **Should** cryptographically protect all keys against unauthorized disclosure and modification when outside a cryptographic module (PA: 6.1).
Key and Metadata Storage

• Section 6.4.14 Store Operational Key and Metadata):
  o **Shall** cryptographically or physically protect the integrity of all stored keys and metadata, and the confidentiality of stored private keys, secret keys, and their sensitive metadata. (PR: 6.35). Similar to PR: 6.2.
• Sections 6.4.19 and 6.4.20
  (Cryptomodule entry and output):
    o **Shall** enter/output keys used to protect information at the Moderate or High impact levels into a cryptographic module as split components or in encrypted form (PR: 6.43 & PR: 6.47). I.e., store the keys in encrypted form or as split components for Moderate and High systems.
    
    o **Shall** enter the sensitive metadata associated with keys used to protect information at the Moderate or High impact levels into a cryptographic module in encrypted form (PR: 6.44). I.e., store the metadata in encrypted form for Moderate and High systems.
• Sections 6.4.19 and 6.4.20 (contd.):
  o **Shall** assure that keys and their metadata are protected against replacement, modification, and unauthorized disclosure during entry/output into/from a cryptographic module (PR: 6.46 & PR: 6.48).
  o **Should** enter/output keys used to protect information at the Low impact level into a cryptographic module as split components or in encrypted form (PA: 6.16 & PA: 6.18). *I.e.*, should store the keys in encrypted form or as split components for Low systems.
• Sections 6.4.19 and 6.4.20 (contd.):
  o **Should** enter the sensitive metadata associated with keys used to protect information at the Low impact level into a cryptographic module in encrypted form (PA: 6.17). *I.e., should store the metadata in encrypted form for Low systems.*
*Key and Metadata Storage*

- **Section 6.4.15 (Backup a Key and its Metadata):**
  - **Shall** backup keys and metadata with the same integrity and confidentiality protections as the operational copies of the keys and metadata and at the same or a higher security strength. (PR: 6.36).
  - **Should** backup long-term keys and metadata on a medium that is separate from that used for the operational storage of the keys and metadata PA: 6.13).
Section 6.4.16 (Archive a Key and/or Metadata):

- **Shall** archive with the same integrity and confidentiality protections as the operational copies of the keys and metadata and at the same or a higher security strength. (PR: 6.37).

- **Shall** archive in accordance with applicable laws, regulations, and policies (PR: 6.38).

- When archived keys and metadata are moved to a new medium, copies of keys and metadata on the old storage medium **shall** be destroyed (PR: 6.39).

- **Should** archive long-term keys and metadata in accordance with SP 800-57, Part 1 (PA: 6.14).

- **Should** move archived keys and metadata to an alternate readable storage medium before the old medium is replaced or becomes unreadable (PA: 6.15).
Section 6.4.13 (List Key Metadata):
  o **Shall** list only specific requested and authorized metadata elements for authorized entities (PR: 6.34).
• Section 6.4.17 (Recover Key and/or Metadata):
  o **Shall** support recovering keys and/or metadata that have been backed up or archived, following the FCKMS rules for recovery (PR: 6.40). *Make sure the FCKMS Security Policy addresses recovery.*
  o **Shall** protect the integrity and (if appropriate) the confidentiality of keys and metadata during recovery (PR: 6.41).
**Key and Metadata Storage**

**Section 6.5:**

- Before keys and metadata are stored, a Federal CKMS **shall** authenticate the identity and verify the authorization of the entity submitting keys and/or metadata for storage, and verify the integrity of the keys and metadata (PR: 6.58).

- Only authorized entities **shall** be allowed access to stored keys and metadata in a Federal CKMS (PR: 6.59).
*Key Establishment*

Elaine Barker, NIST
Key Establishment

- Establish keys and metadata for use by one or more entities.
- Section 6.4.18 (Establish a Key):
  - When secure interoperability is required, a Federal CKMS shall support establishing a key and associated metadata between entities (PR: 6.42).
• Obtaining Assurances:
  • Section 6.4.21 (Validate Domain Parameters)
    ✓ Shall validate domain parameters (PR: 6.49).
    o Section 6.4.22 (Validate Public Key)
      ✓ Shall validate using approved methods (PR: 6.50).
    o Section 6.4.23 (Validate Public Key Certification Path)
      ✓ Shall validate the certification path prior to using the public key in the certificate (PR: 6.51).
• Obtaining Assurances (contd.):
  o Section 6.4.24 (Validate Symmetric Key)
    ✓ **Shall** validate before initial use (PR: 6.52).
  o Section 6.4.25 (Validate Private Key (or Key Pair))
    ✓ **Shall** validate before its first use. (PR: 6.53).
  o Section 6.4.26 (Validate the Possession of a Private Key)
    ✓ **Shall** possession using approved methods (PR: 6.54).
Key Establishment

• Section 6.4.28 (Manage the trust anchor Store)
  o **Shall** use only trust anchors that merit trust (PR: 6.56).
  o Only authorized additions, modifications, and deletions **shall** be made to trust anchors (PR: 6.57).
  o **Should** use trust anchor formats as specified in [RFC 5914] (PA: 6.19).
  o **Should** perform source authentication, usage authorization, and integrity checks before trust anchors are initially used (PA: 6.20).
• Key-establishment process:
  o PR: 2.1 requires support of NIST-approved cryptographic algorithms, schemes and modes of operation. Doesn’t require use; should it?
  o Section 6.6.1 (Key Transport)
    ✓ Shall verify the identity and authorization of the source, the integrity of the received data and that confidentiality has been provided (PR: 6.60).
  Section 6.6.2 (Key Agreement)
    ✓ Shall obtain assurance of the identity of each party involved in the transaction. (PR: 6.61).
Key Establishment

• Key-establishment process (contd.):
  o Section 6.6.3 (Key Confirmation)
    ✓ **Should** support key confirmation for all key-establishment transactions (PA: 6.21).
  o Section 6.6.4 (Key-establish Protocols)
    ✓ **Shall** support one or more approved key-establishment protocols (PA: 6.22). **Note:** Change to a PR.
*Questions and Comments?