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Unlocking the unknowns,

Cryptography essentials for Java devs

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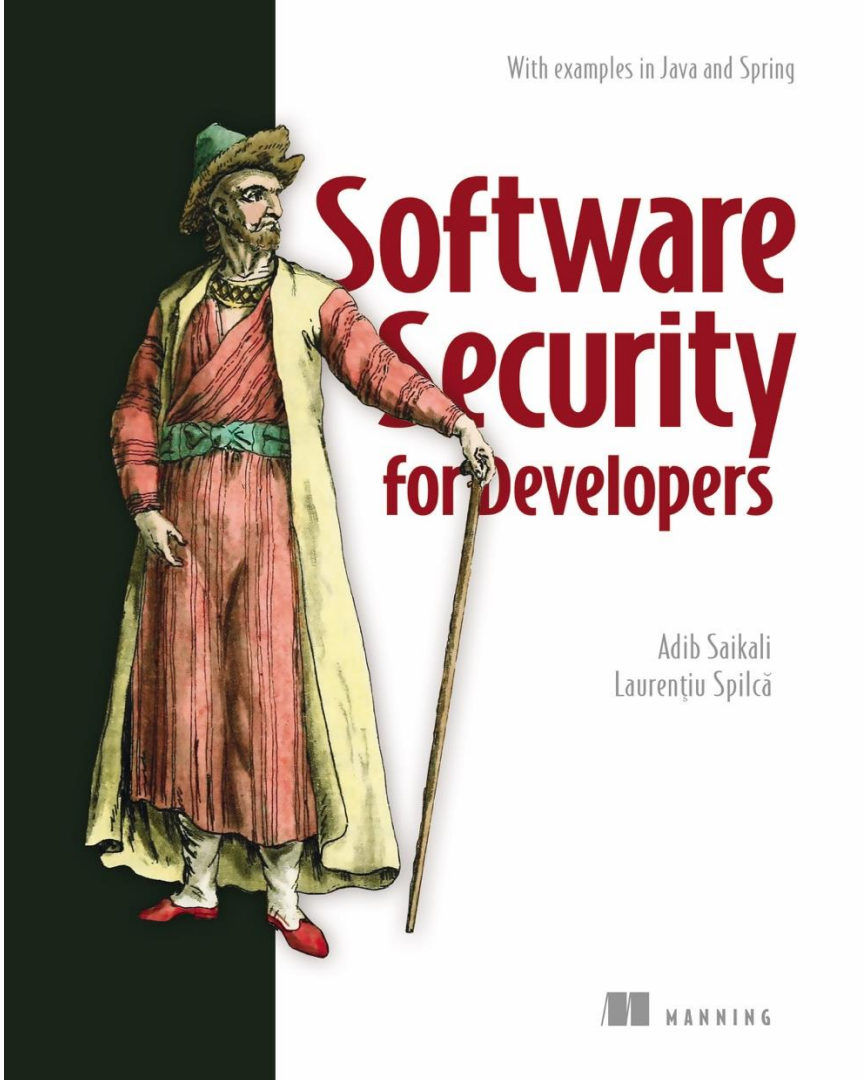
With examples in Java and Spring
Software Security for Developers
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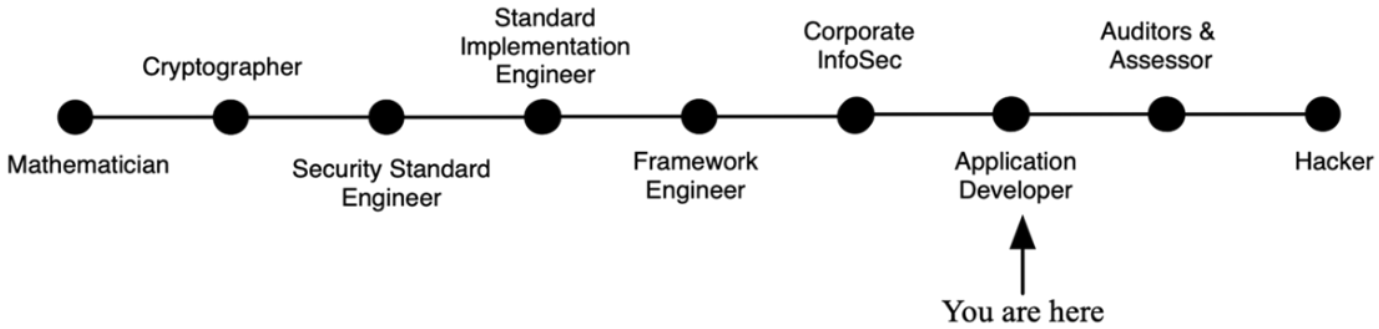

Mathematician
Cryptographer
Security Standard Engineer
Standard Implementation Engineer
Framework Engineer
Corporate InfoSec
Application Developer
Auditors & Assessor
Hacker
You are here

Integrity

Authentication

Confidentiality

Non-repudiation

Use Case 1

Acme Inc. needs to implement a ZIP file transfer capability between two services. Developers must ensure that **faulty transfers are detected and excluded** to prevent the application from processing incorrect files.

Integrity

Authentication

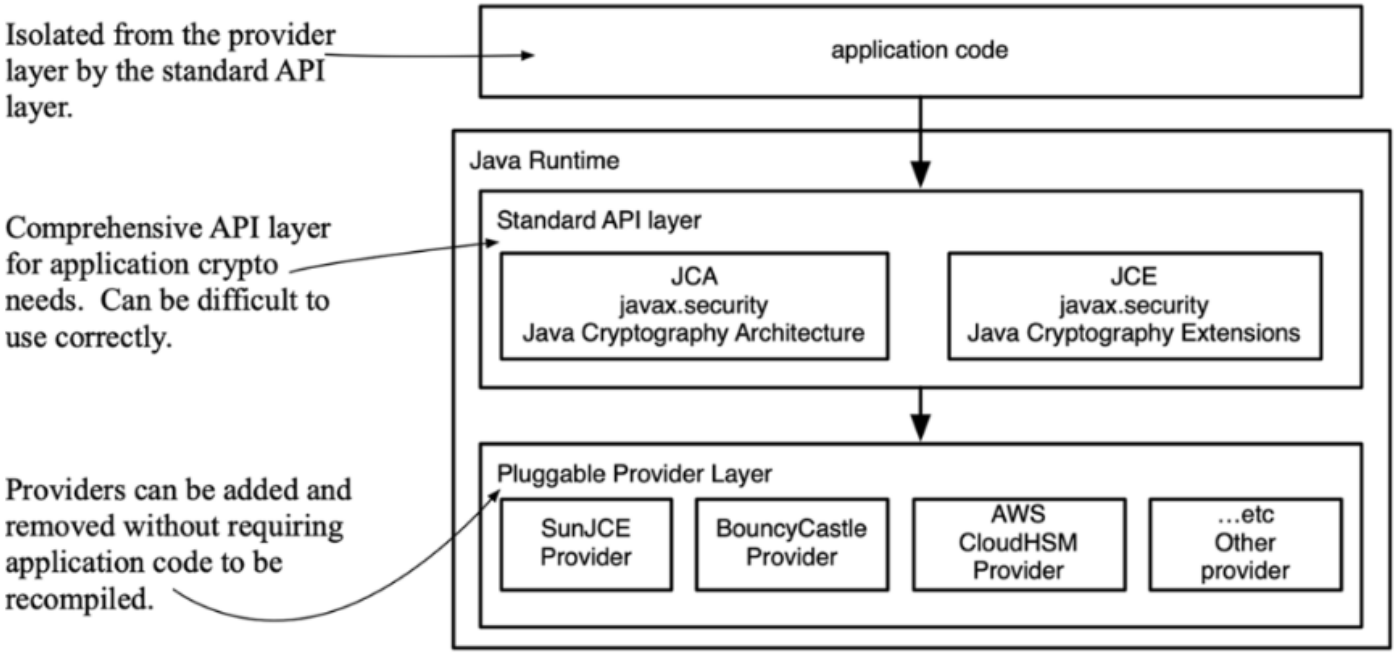
Confidentiality

Non-repudiation

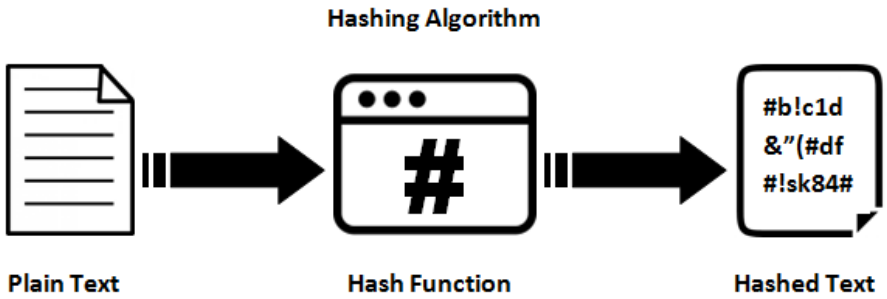
Third Parties

Google Tink
Libsodium (Kalium)
Apache Shiro

Security providers



Hash function digests



Source: [MessageHashing.java]

Use Case 2

Acme Inc. needs to **store employee passwords in hashed form in databases to ensure they cannot be viewed in plain text**. This approach will enhance security by protecting passwords from unauthorized access and ensuring that even if the database is compromised, the actual passwords remain secure.

Source: [PasswordHashing.java]

Use Case 3

Acme Inc. needs to implement a ZIP file transfer capability between two services. Developers must ensure that **faulty transfers are detected and excluded, maintaining data integrity** throughout the process. Although the data is not confidential, preserving its accuracy and completeness is essential.

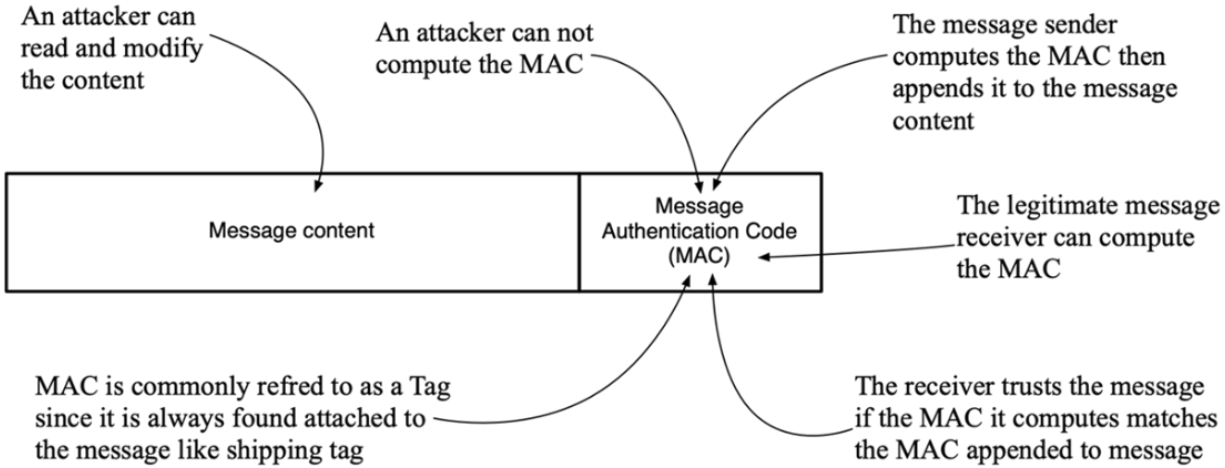
Integrity

Authentication

Confidentiality

Non-repudiation

Message Authentication Code (MAC)



Source: [HmacMessageAuthenticator.java]

Goal	SHA-2	SHA-3	HMAC
Integrity	✅	✅	✅
Authentication	❌	❌	✅
Confidentiality	❌	❌	❌
Non-repudiation	❌	❌	❌

Use Case 4

Acme Inc. needs to implement a ZIP file transfer capability between two services. Developers must ensure that the **data remains confidential and cannot be accessed by unauthorized parties during transit or at rest**. Additionally, **faulty transfers should be detected and excluded to maintain data integrity**.

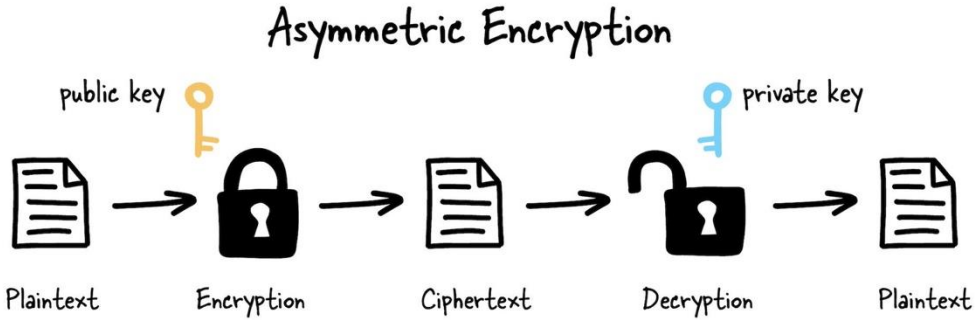
Integrity

Authentication

Confidentiality

Non-repudiation

Asymmetric Key Encryption



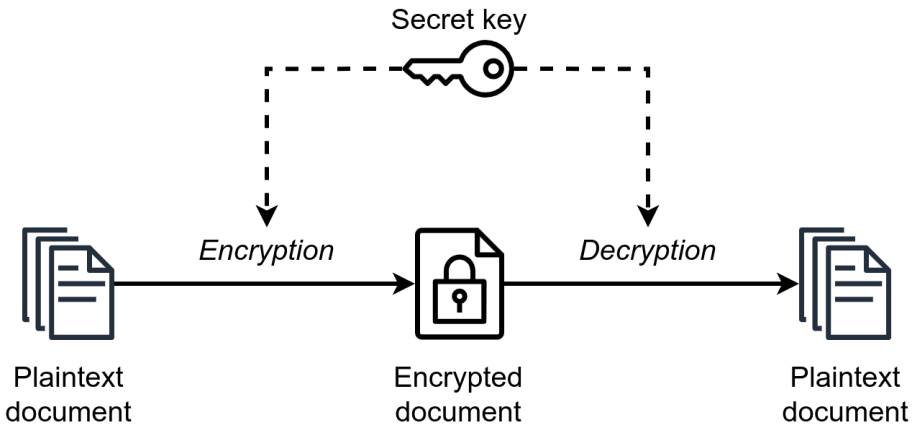
RSA (Rivest-Shamir-Adleman): Widely used for secure data transmission, RSA is notable for its use in digital signatures and secure key exchange.

ECC (Elliptic Curve Cryptography): Offers higher security with smaller key sizes compared to RSA, making it efficient for mobile devices and smart cards.

DSA (Digital Signature Algorithm): Primarily used for digital signatures, ensuring the authenticity and integrity of a message.

Diffie-Hellman: A method for secure key exchange, allowing two parties to establish a shared secret over an insecure channel.

Symmetric Key Encryption



Use symmetric key encryption for:


Encrypting files


Encrypting databases


Encrypting disk partitions

Use asymmetric key encryption for:


Key exchange


Digital signatures


Digital certificates

Source: [MessageEncryptDecrypt.java]

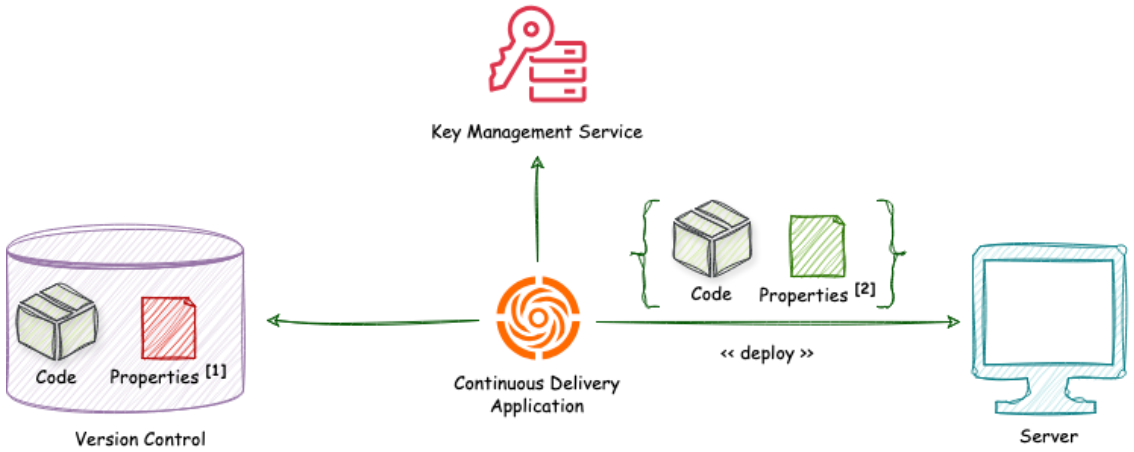
Sources:

[FileEncryption.java]

[FileDecryption.java]

Use Case 5

Acme Inc. needs to ensure the secure management of sensitive information to mitigate critical security risks. Developers must **avoid storing secrets unencrypted or in plain text within the source code.** Instead, they should utilize secrets management services and environment variables to protect sensitive data effectively.



Source: [https://ionutbalosin.com/2025/03/core-application-security-for-java-developers]

Source: [application.properties]

Symmetric Key Encryption

AES/CBC/PKCS5Padding

AES/CFB/NoPadding

AES/OFB/NoPadding

AES/GCM/NoPadding

AES/CTR/NoPadding

Goal	SHA-2	SHA-3	HMAC	AES/CBC
Integrity	✅	✅	✅	❌
Authentication	❌	❌	✅	❌
Confidentiality	❌	❌	❌	✅
Non-repudiation	❌	❌	❌	❌

Use Case 6

Acme Inc. needs to implement a ZIP file transfer capability between two services. Developers must ensure that **each transfer is verifiable, preventing senders from denying their actions.** Additionally, **faulty transfers should be excluded to maintain data integrity and reliability.**

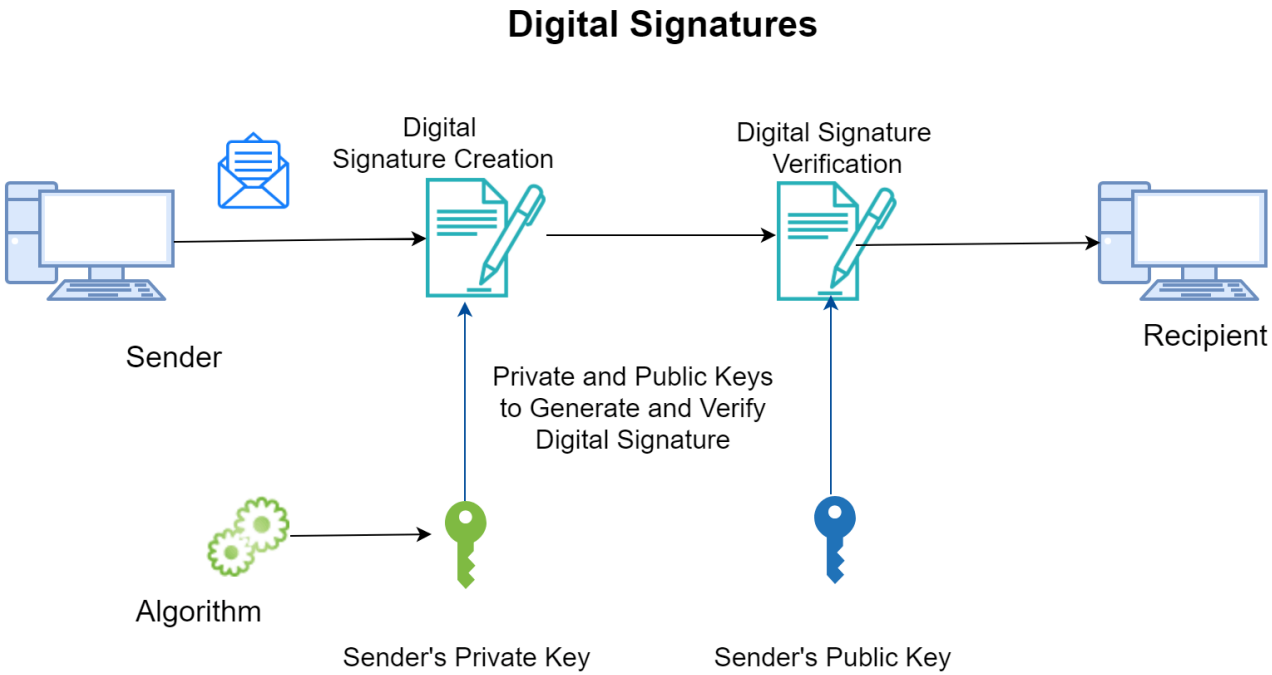
Integrity

Authentication

Confidentiality

Non-repudiation

Generating and Verifying Signatures



Source: [DigitalSignatureVerifier.java]

Thank You

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Conference figures: 40+ sessions | 15+ countries

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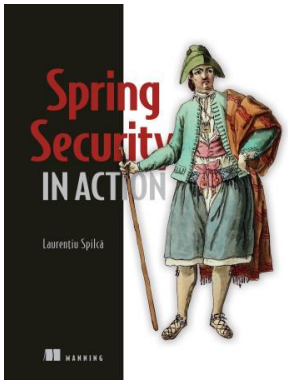

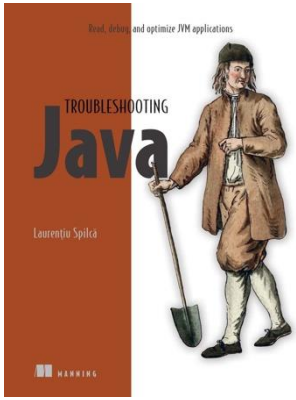

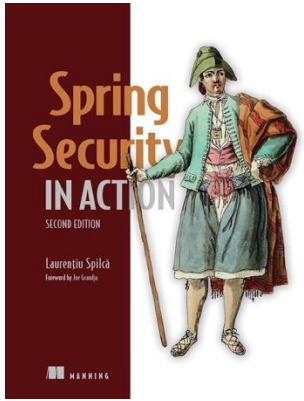

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