The Security Framework

Session 704

Dallas De Atley
Manager, Platform Security

These are confidential sessions—please refrain from streaming, blogging, or taking pictures

What You Will Learn

What You Will Learn

- Building blocks of the Security framework

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- How to store secrets in the keychain

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- How to secure communication over a network

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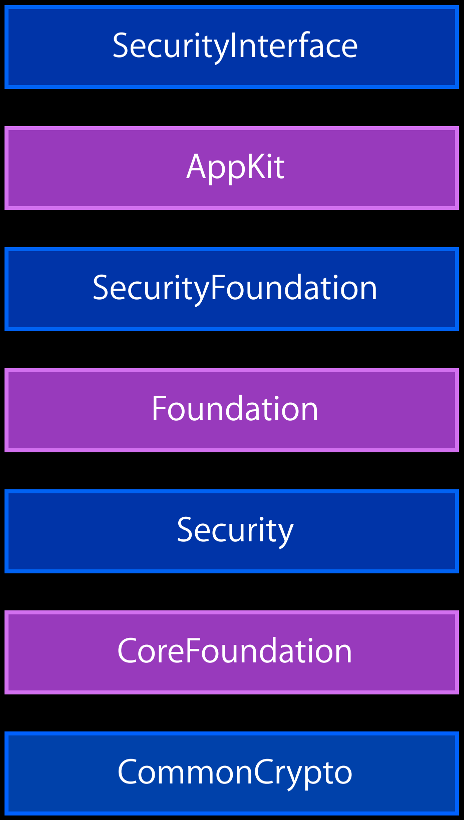
- Building blocks of the Security framework
- How to store secrets in the keychain
- How to secure communication over a network
- How to evaluate a signed object

Security Frameworks

OS X



SecurityInterface

AppKit

SecurityFoundation

Foundation

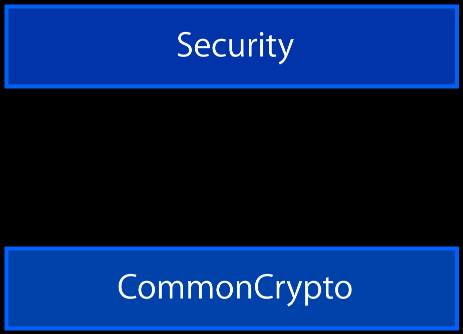
Security

CoreFoundation

CommonCrypto

Security Frameworks

OS X

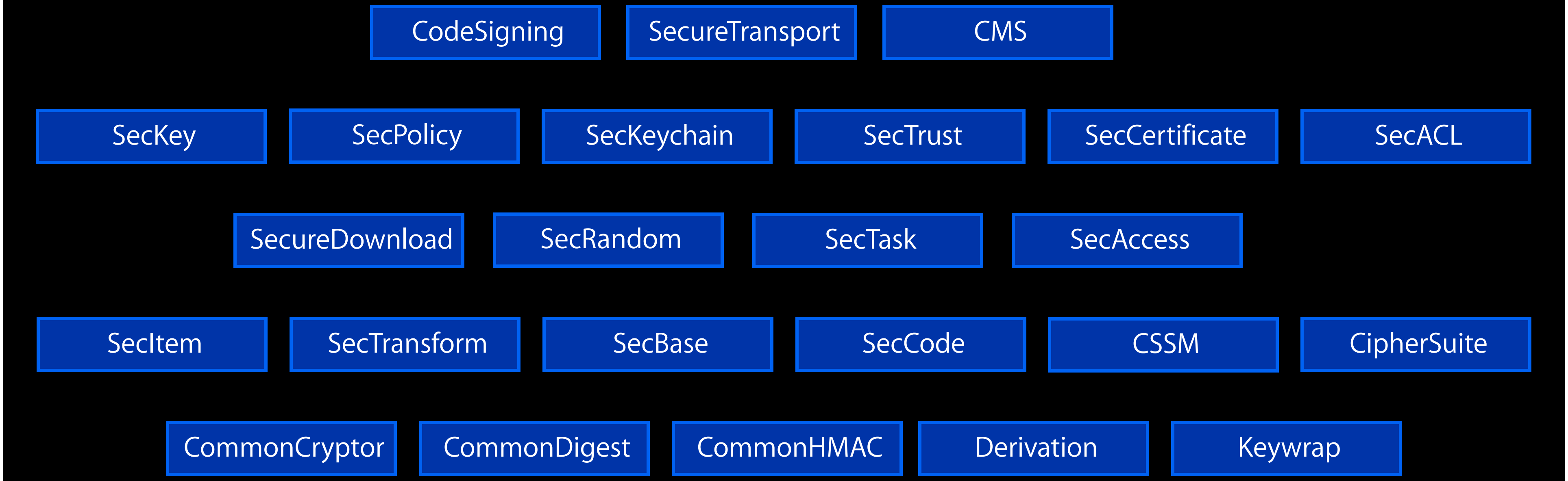


Security

CommonCrypto

Security Framework

OS X



CodeSigning SecureTransport CMS

SecKey SecPolicy SecKeychain SecTrust SecCertificate SecACL

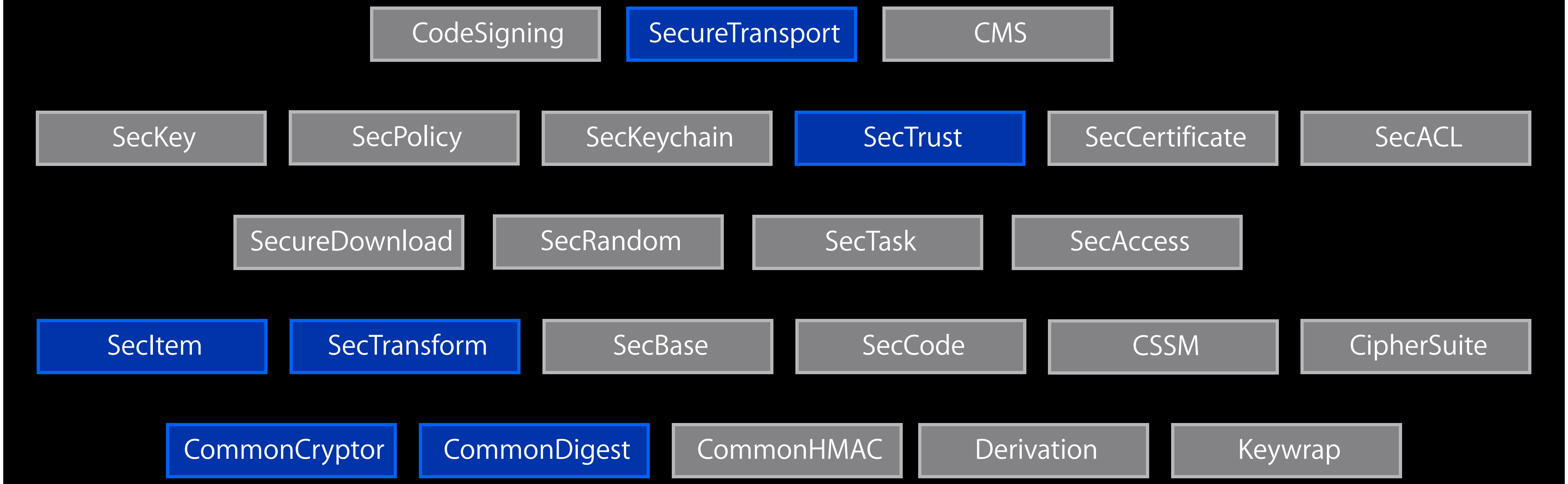
SecureDownload SecRandom SecTask SecAccess

SecItem SecTransform SecBase SecCode CSSM CipherSuite

CommonCryptor CommonDigest CommonHMAC Derivation Keywrap

Security Framework

OS X



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Technologies

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- Crypto

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- Keychain

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- Secure Transport

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- Crypto
- Keychain
- Secure Transport
- Trust Evaluation

Cryptography

Cryptography

- CommonCrypto

Cryptography

- CommonCrypto
- Designed for performance

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- Designed for performance
    - Processor specific optimizations

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- CommonCrypto
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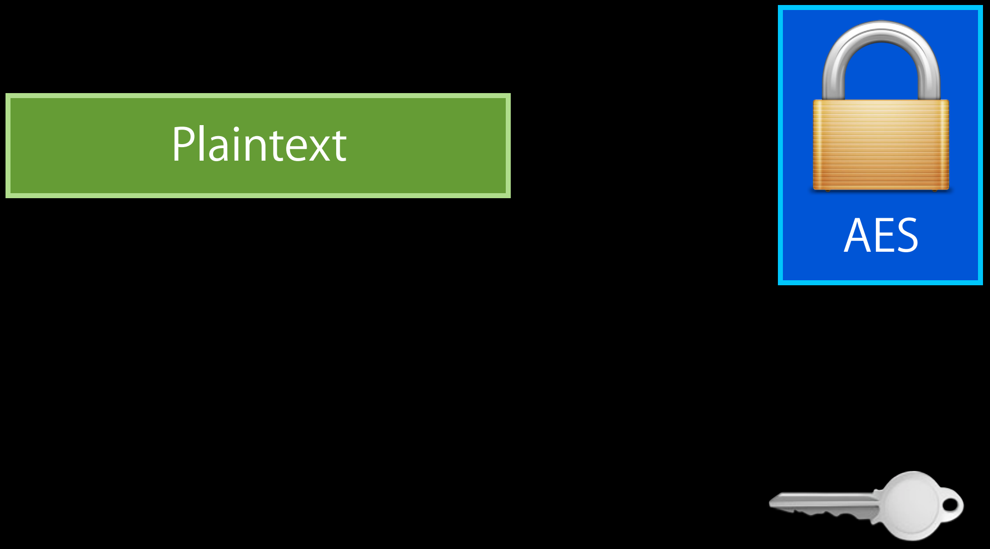
- State of the art algorithms

Cryptography

- CommonCrypto
- Designed for performance
  - Processor specific optimizations
- State of the art algorithms
  - FIPS 140-2 as defined by NIST

Cryptography

Symmetric Encryption

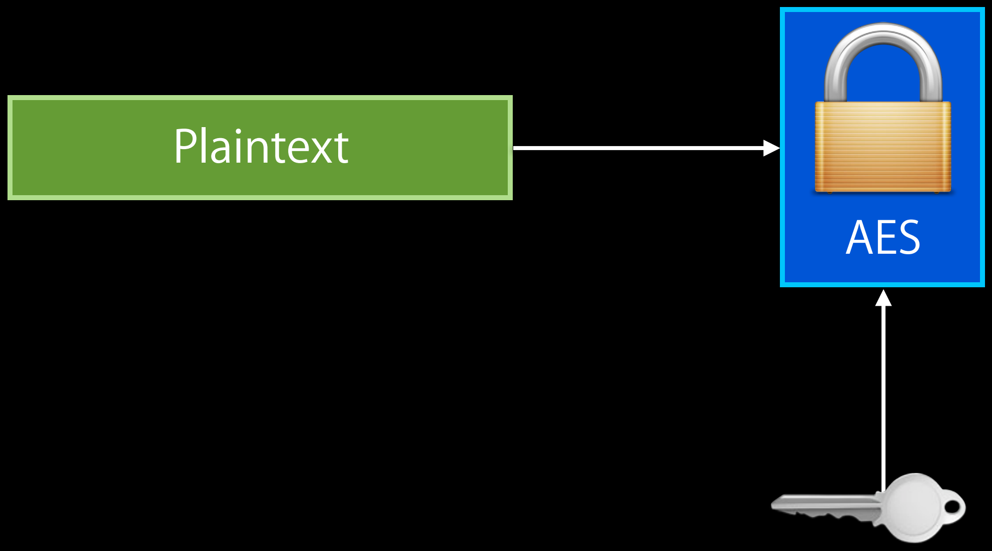


Plaintext

AES

Cryptography

Symmetric Encryption



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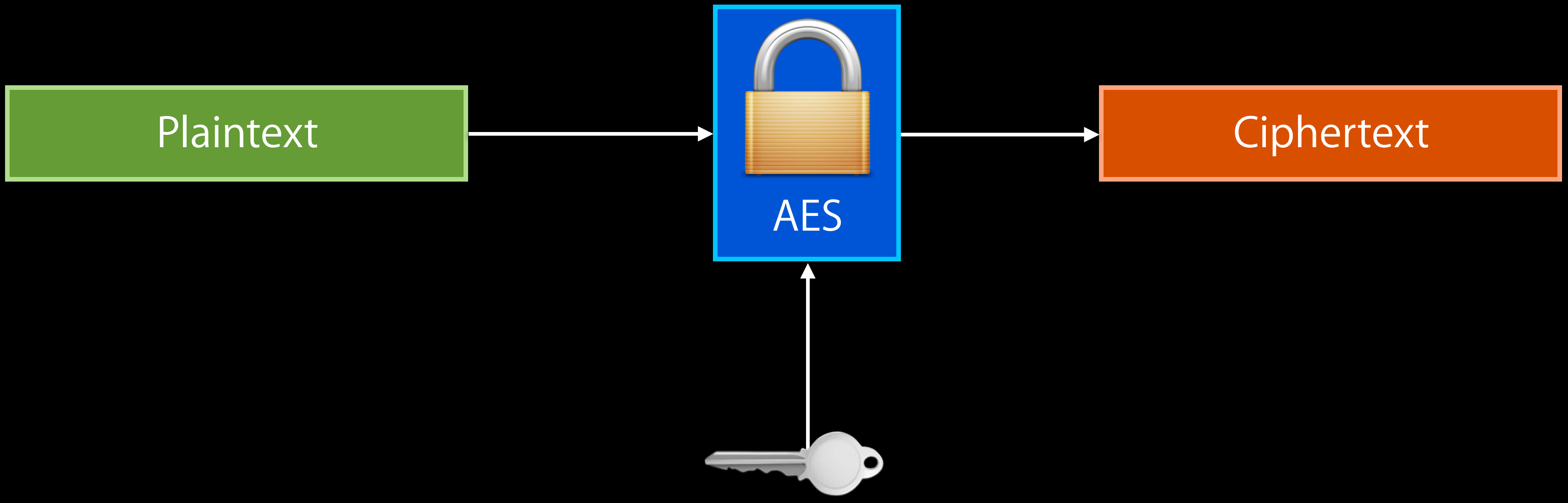


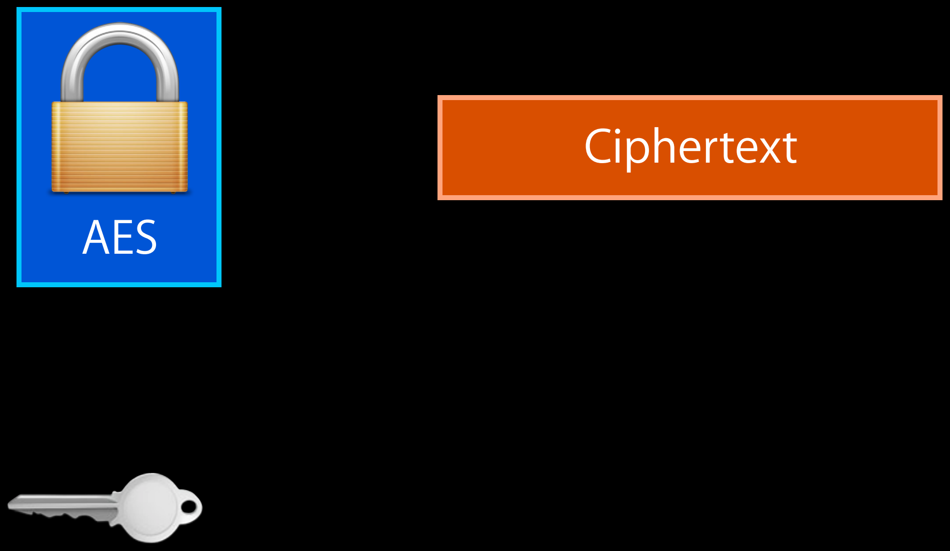
Plaintext

AES

Ciphertext

Cryptography

Symmetric Decryption



AES

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Cryptography

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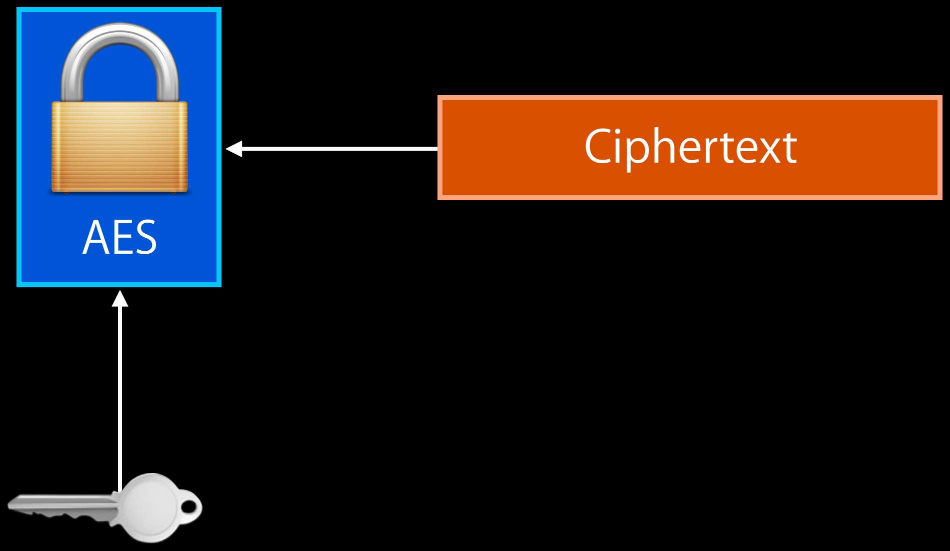

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Ciphertext

Cryptography

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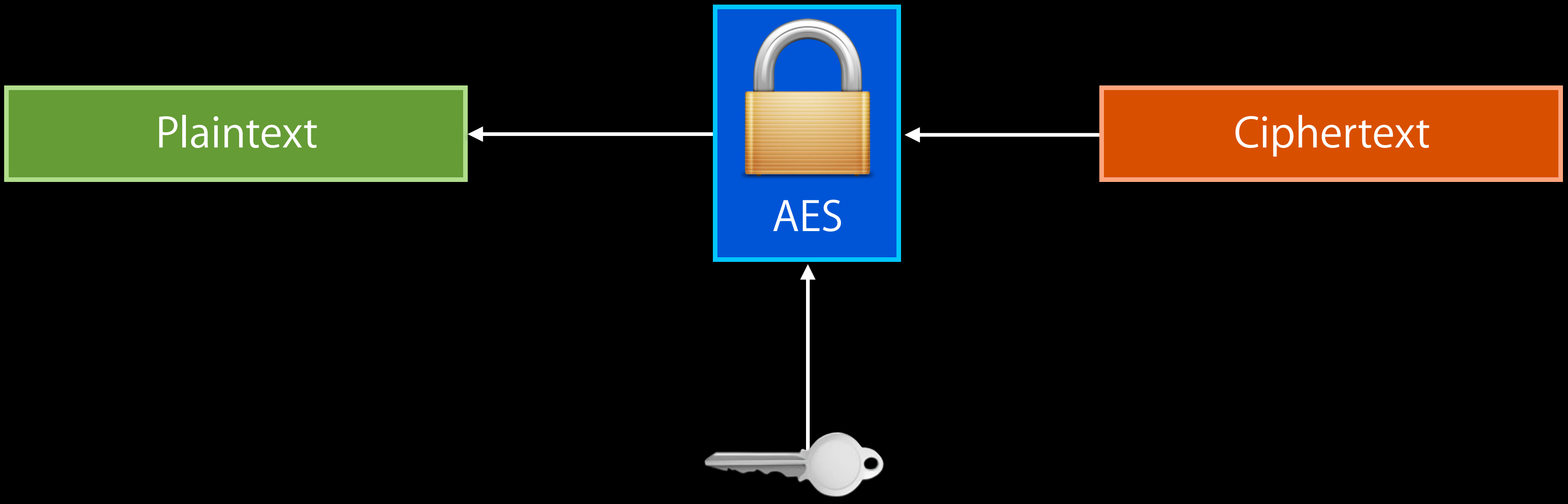
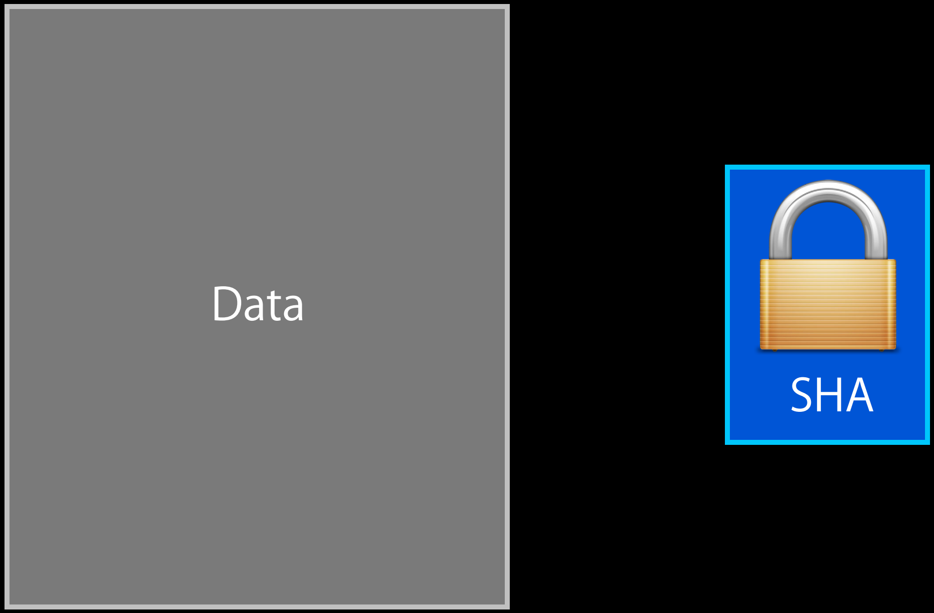


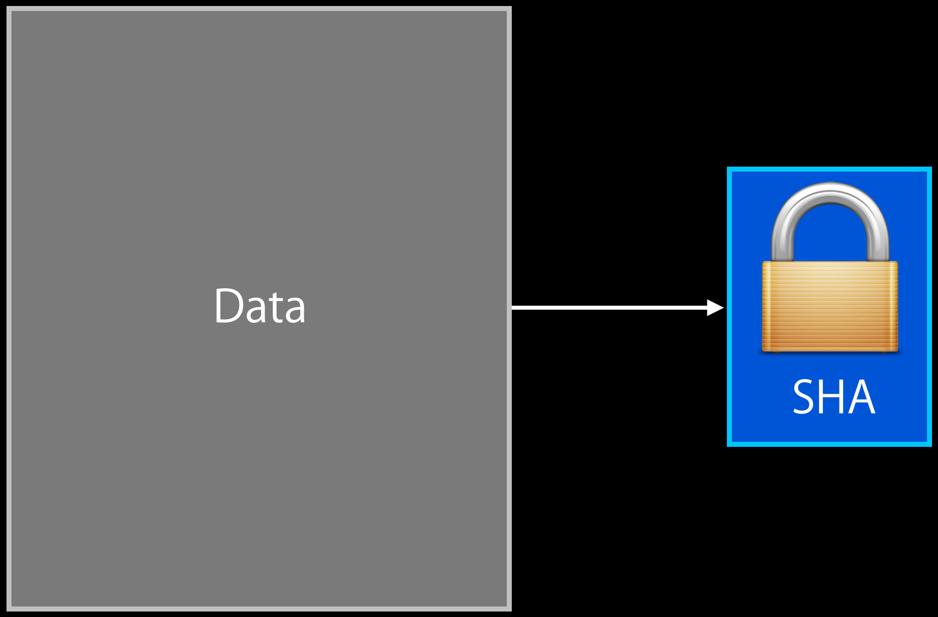
Cryptography

Message Digest



Cryptography

Message Digest

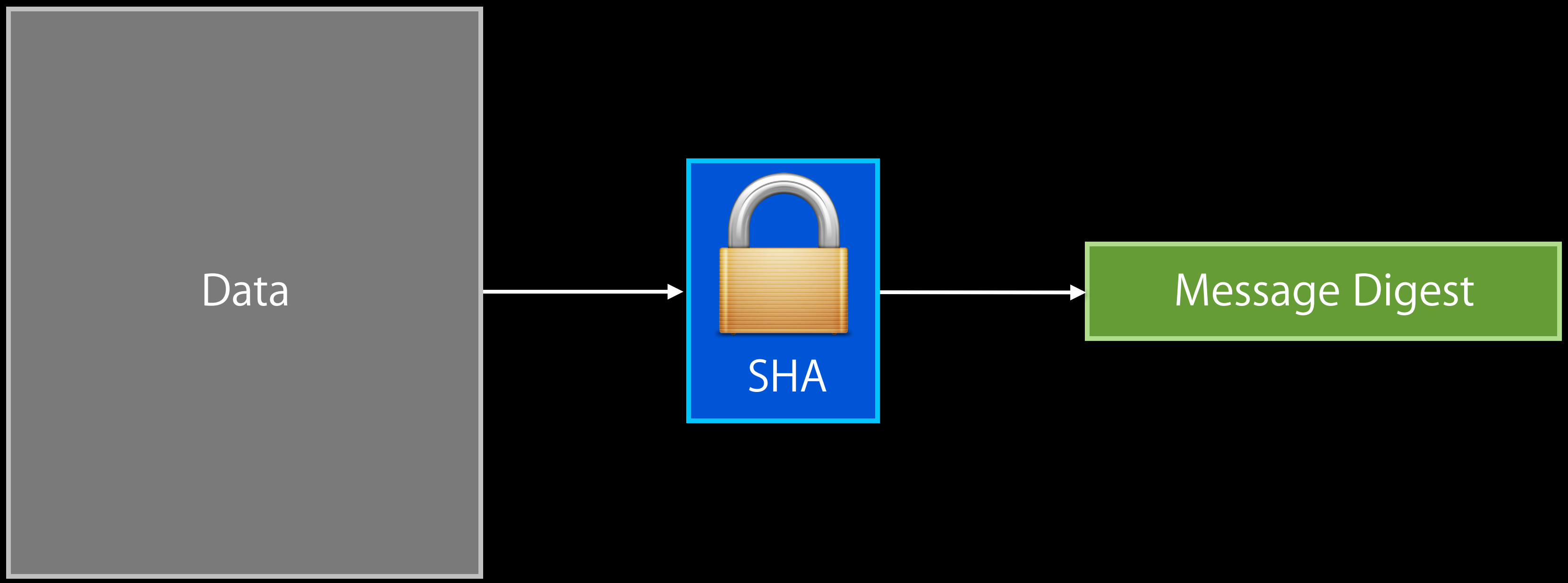


Data

SHA

Cryptography

Message Digest



Data

SHA

Message Digest

Cryptography

Message Digest

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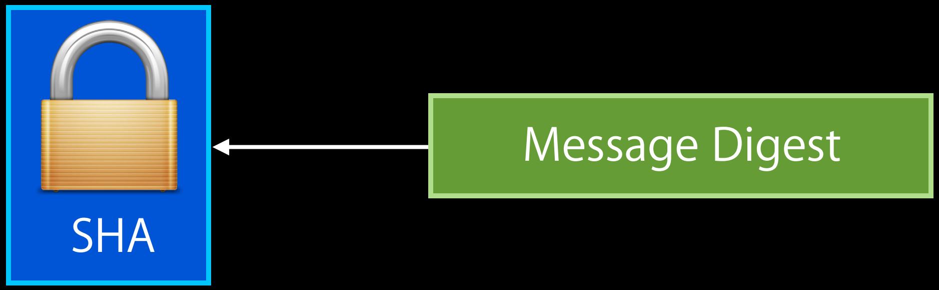
Message Digest

Cryptography

Message Digest

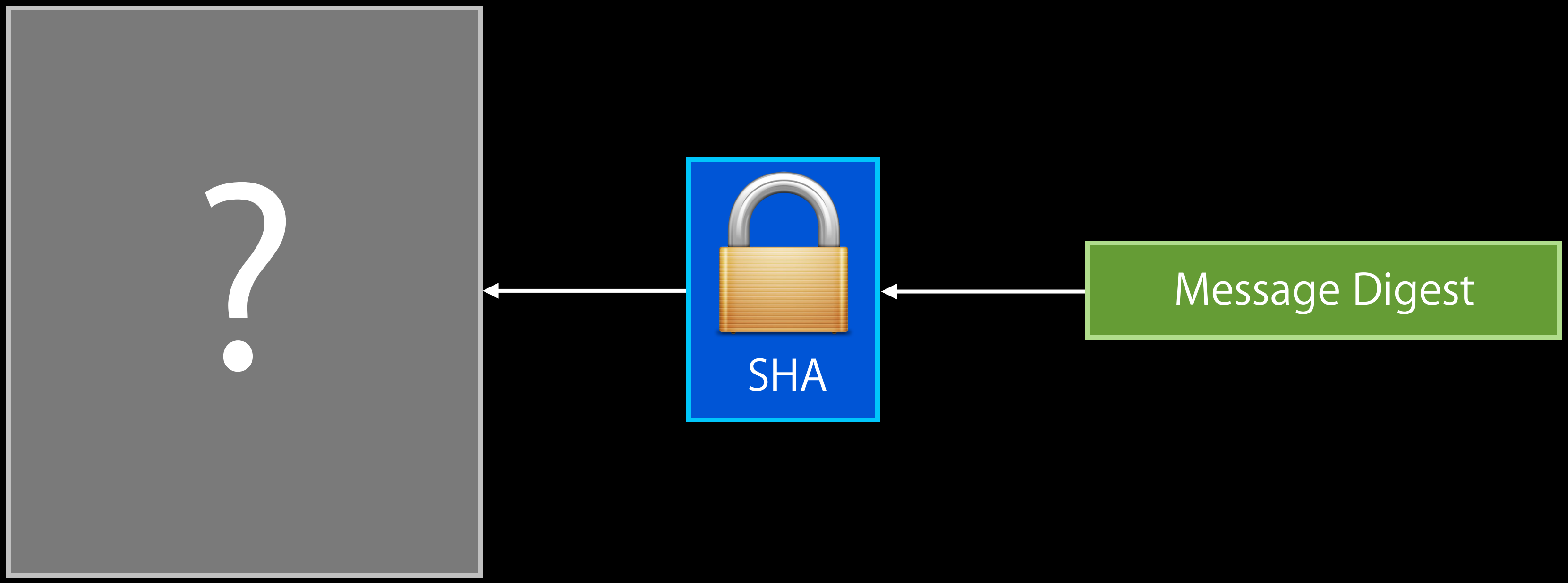


SHA

Message Digest

Cryptography

Message Digest



Cryptography

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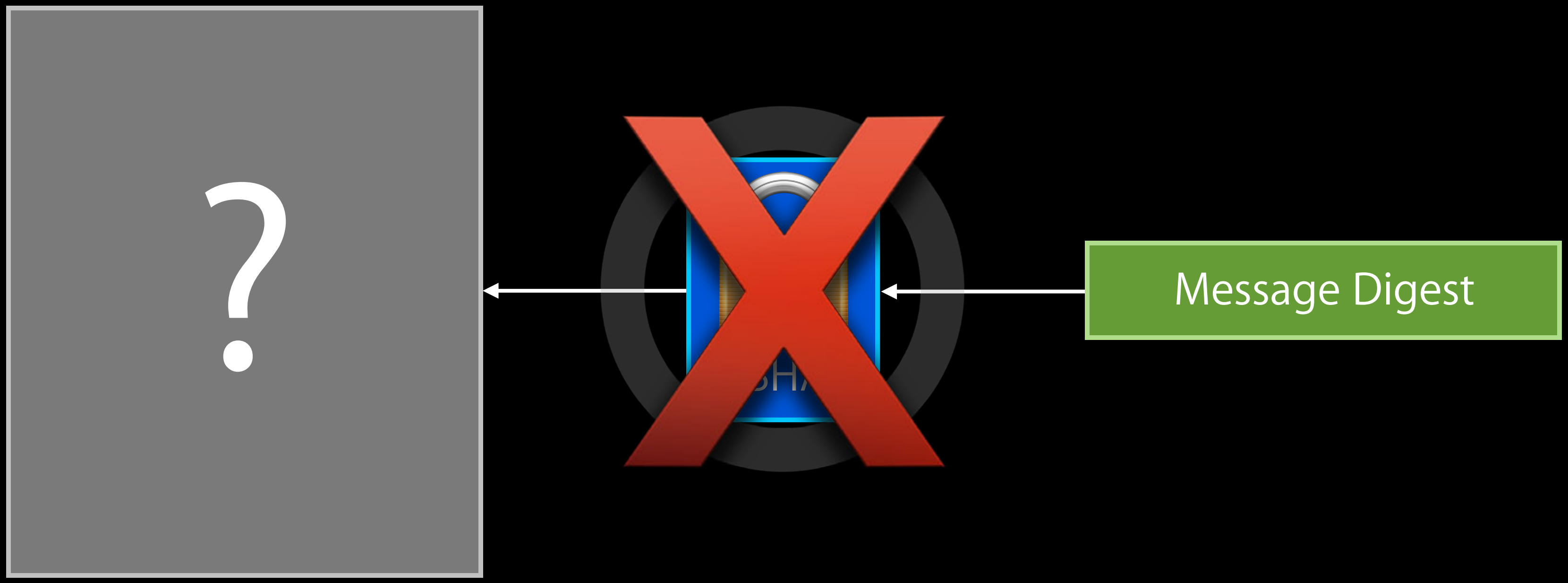
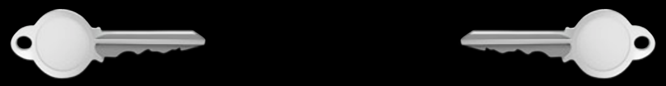


Cryptography

Public Key Cryptography

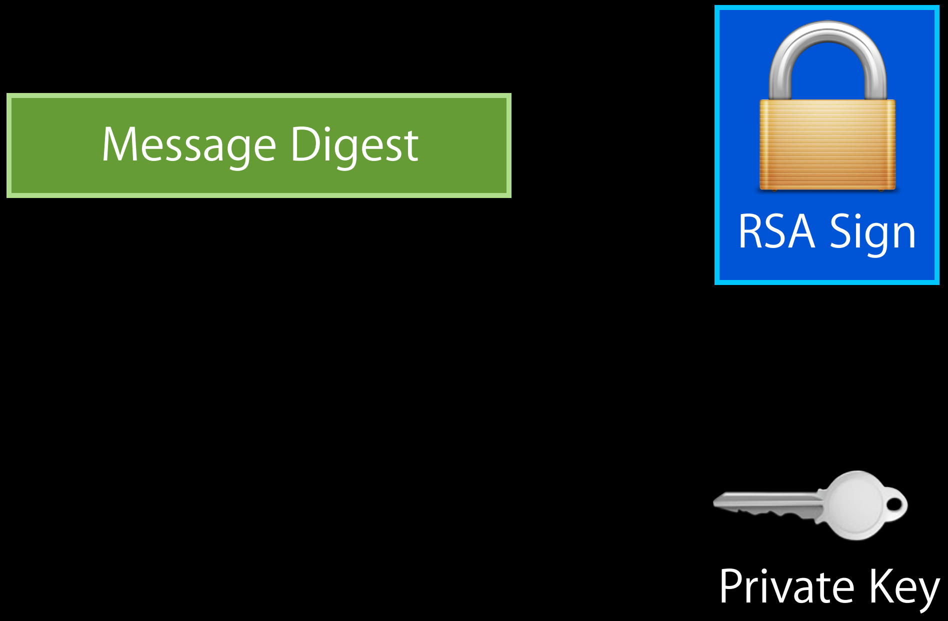


Public Key

Private Key

Cryptography

Signing a message digest



Cryptography

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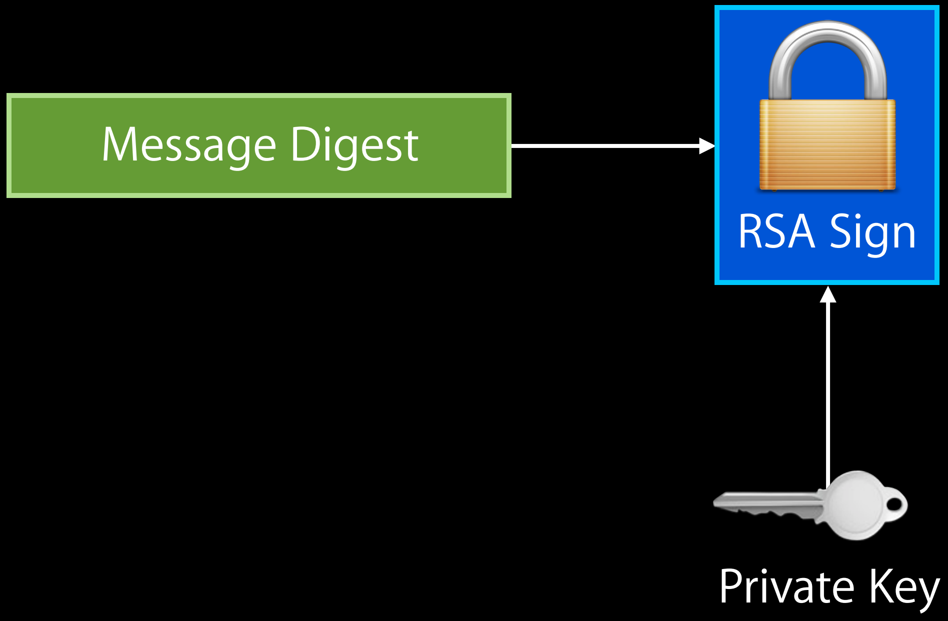


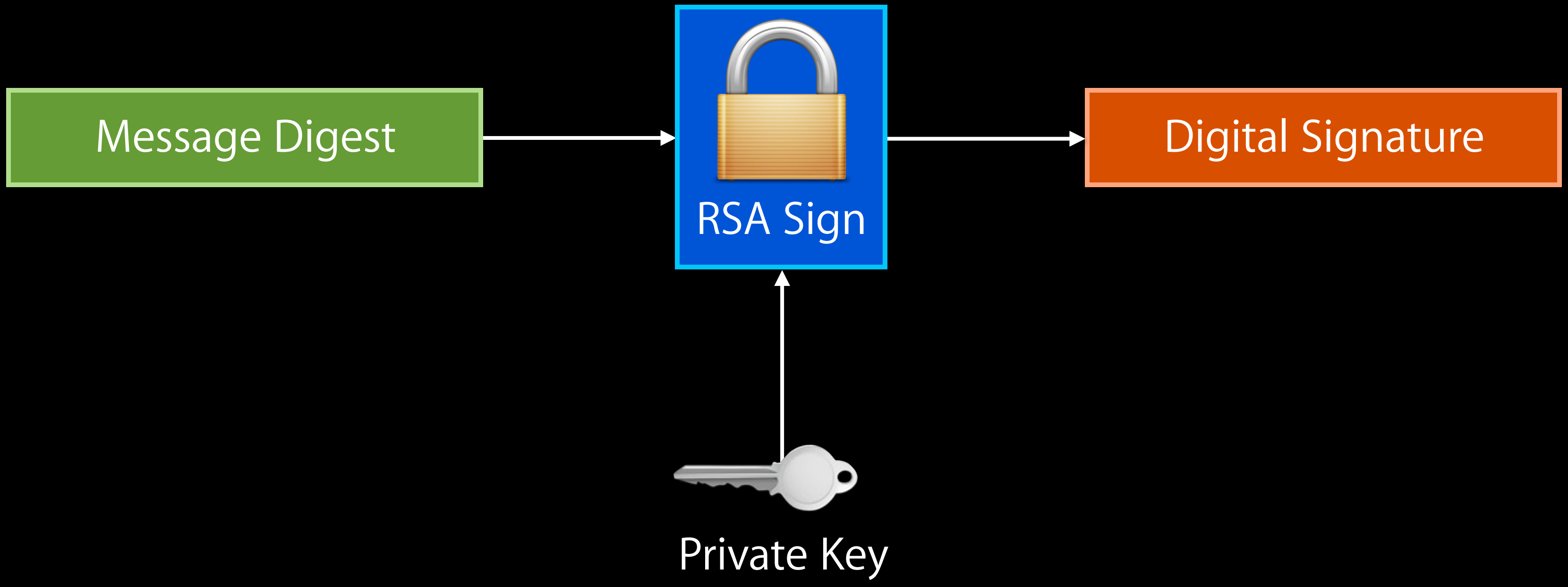
Message Digest

RSA Sign

Private Key

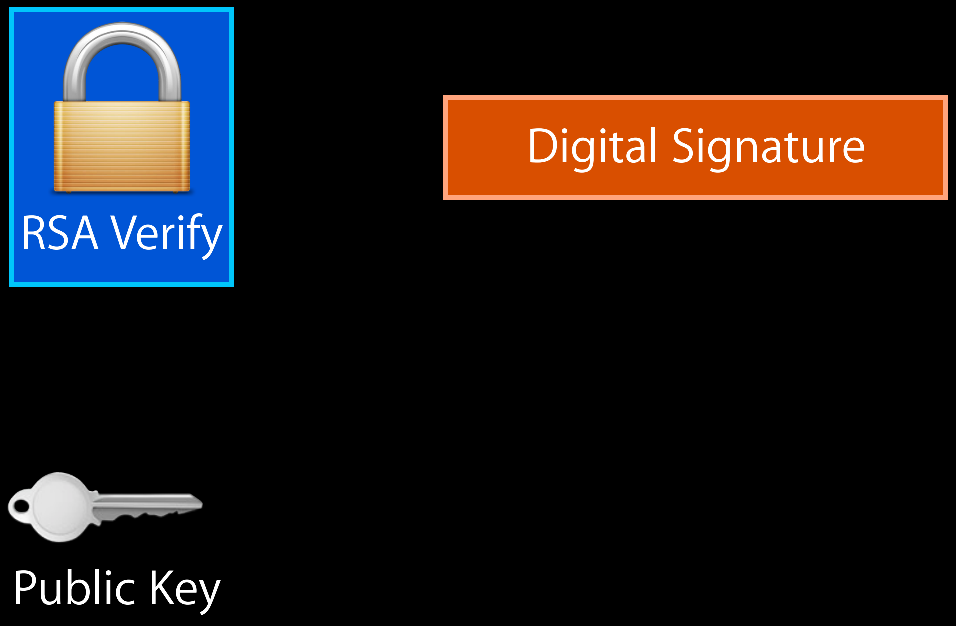
Cryptography

Signing a message digest



Cryptography

Verifying a digital signature



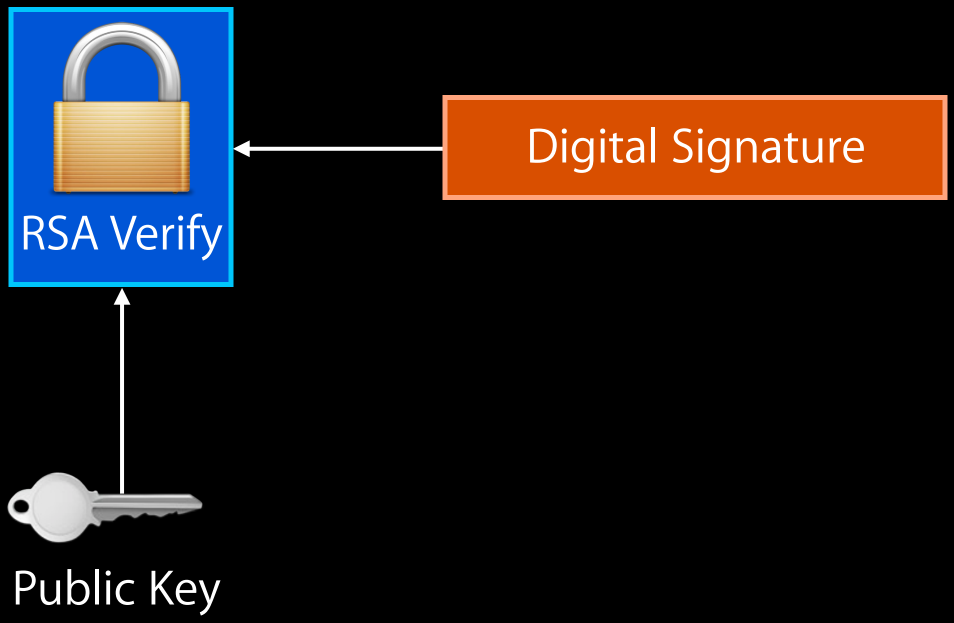
RSA Verify

Digital Signature

Public Key

Cryptography

Verifying a digital signature



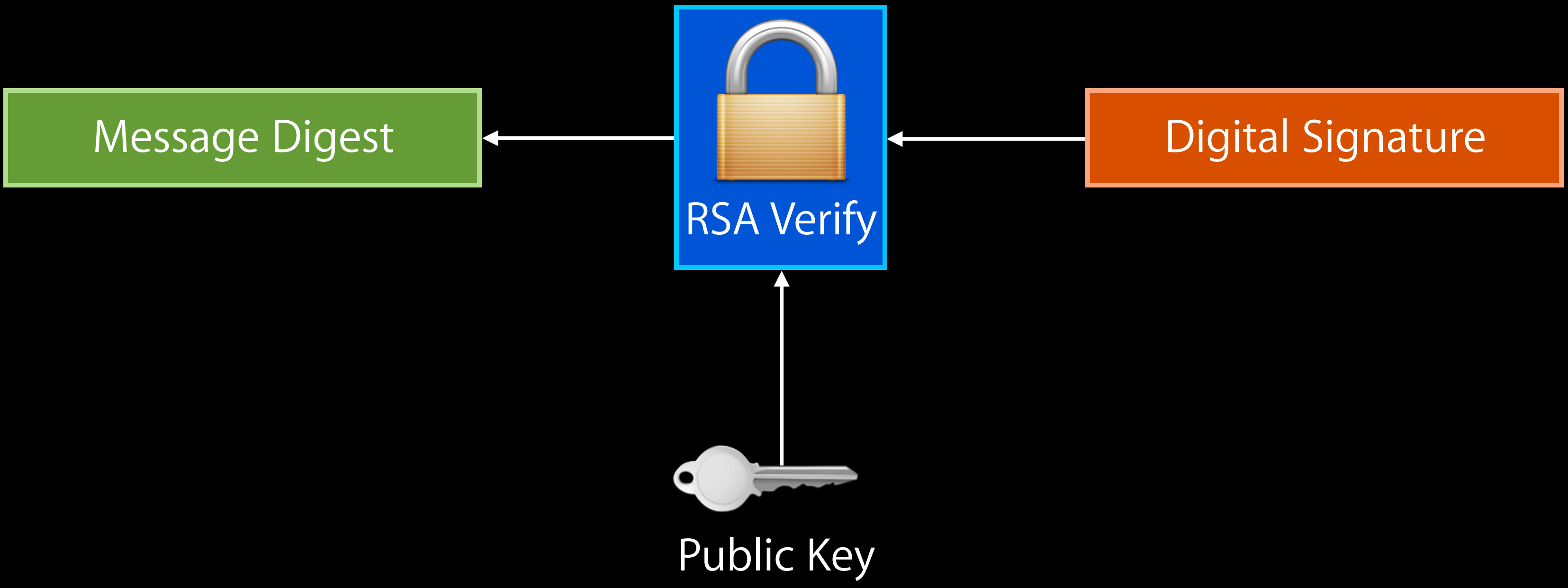
RSA Verify

Digital Signature

Public Key

Cryptography

Verifying a digital signature



Cryptography

The devil is in the details

Cryptography

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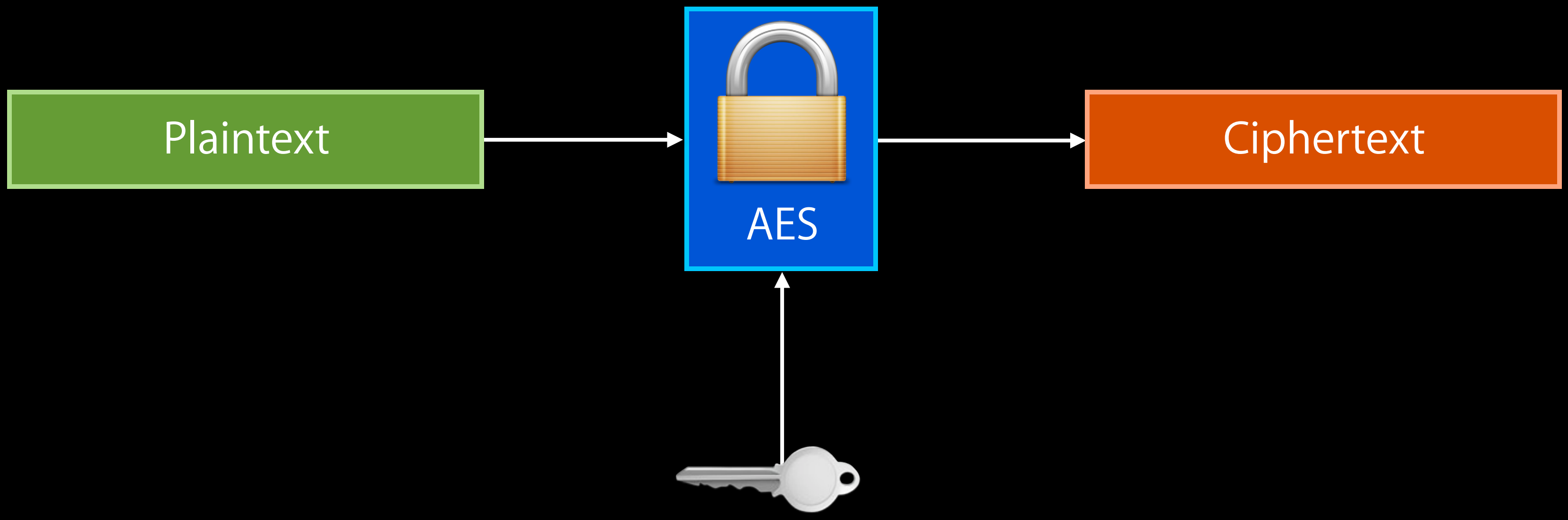


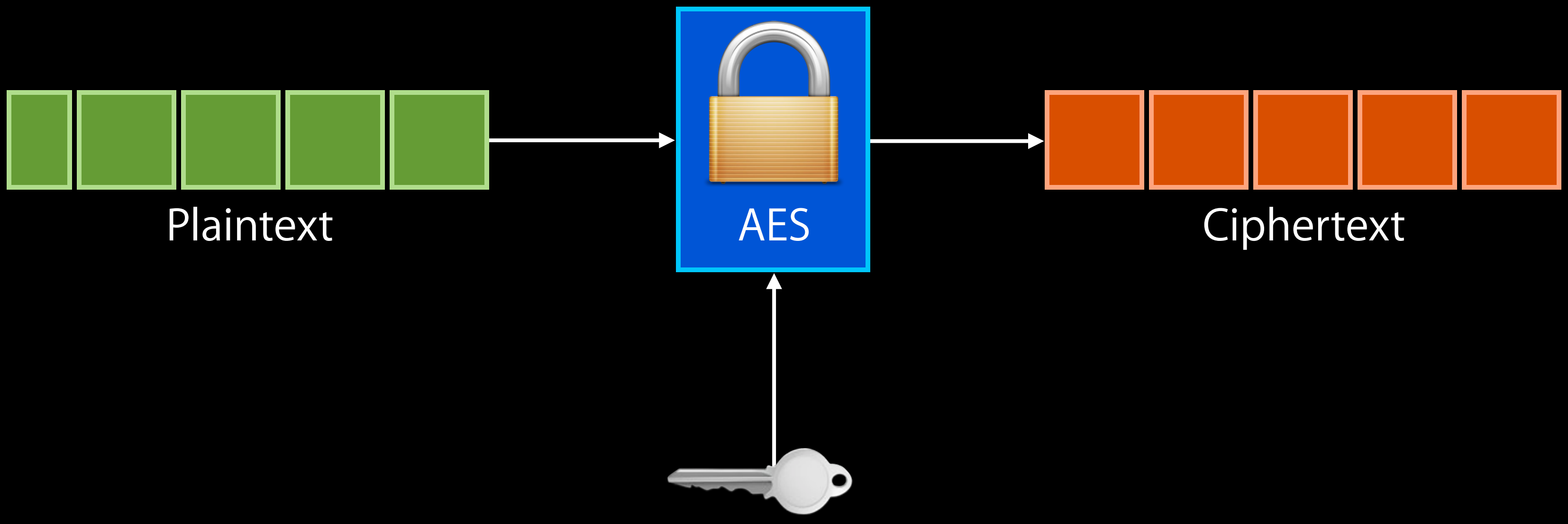
Plaintext

AES

Ciphertext

Cryptography

The devil is in the details



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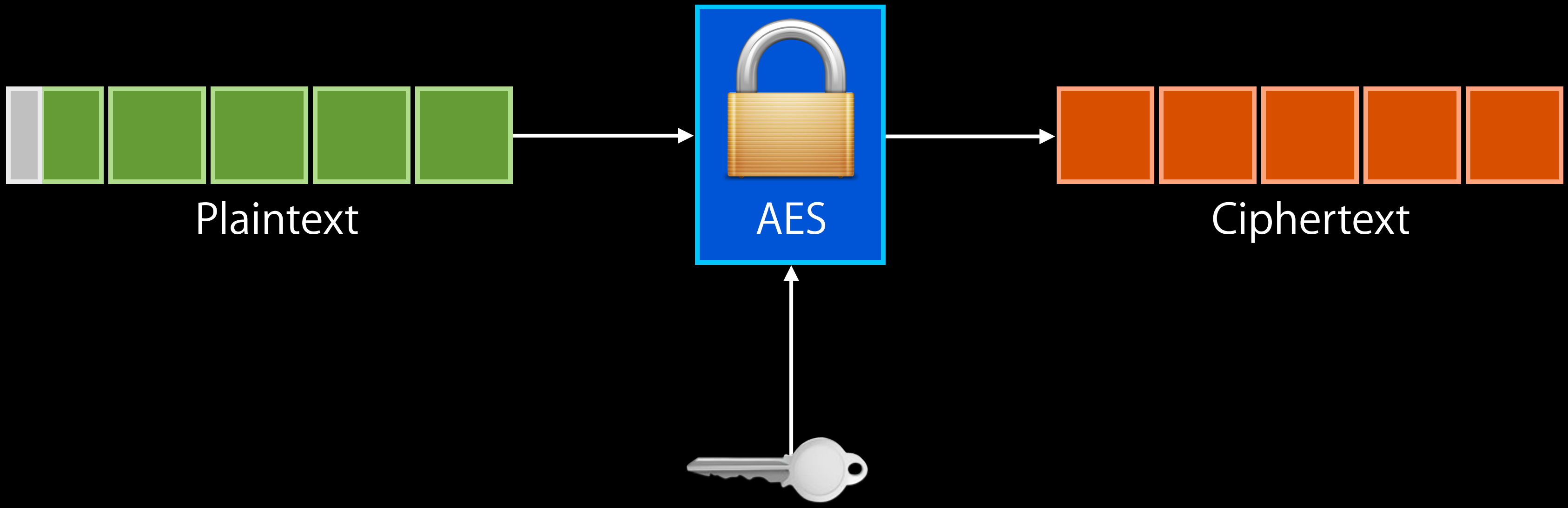

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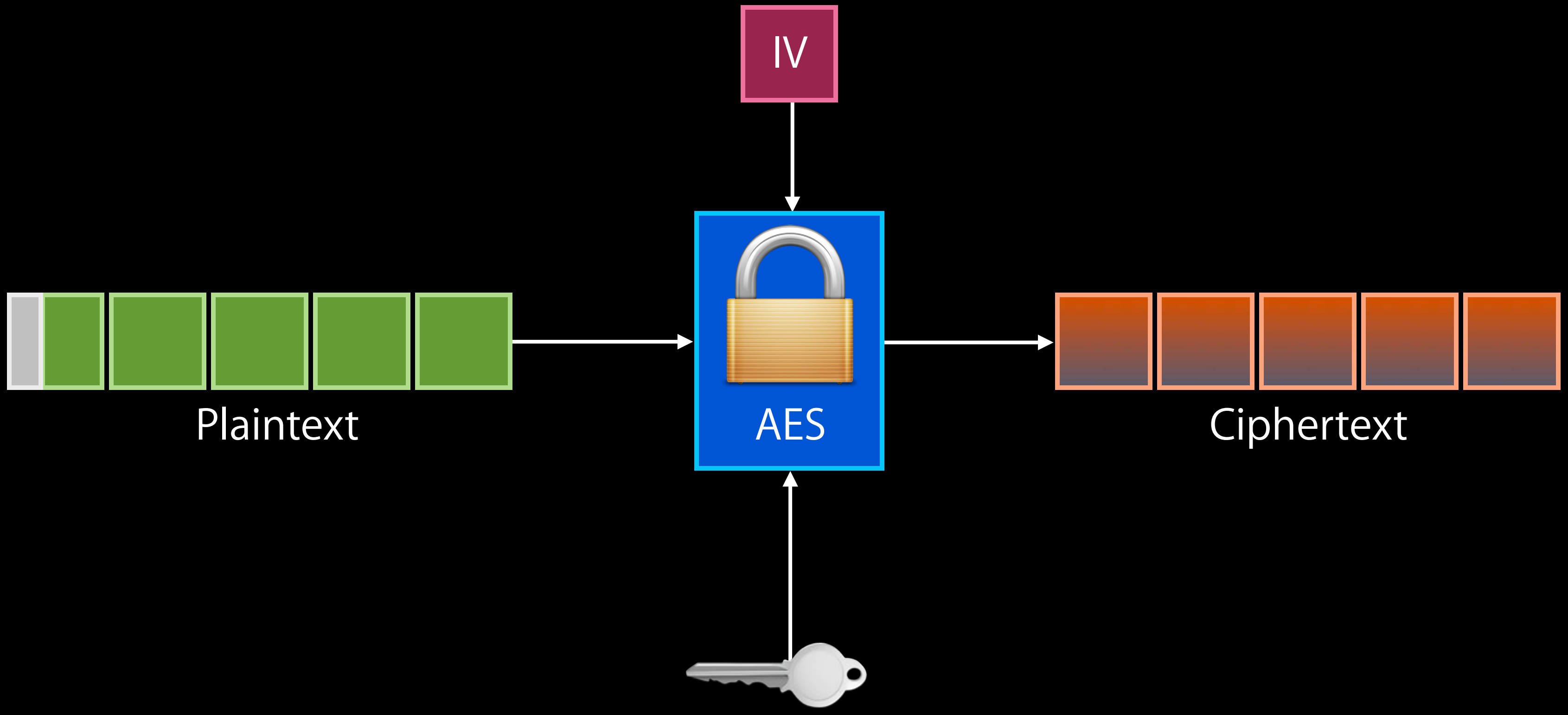

IV

AES

Plaintext

Ciphertext

Cryptography

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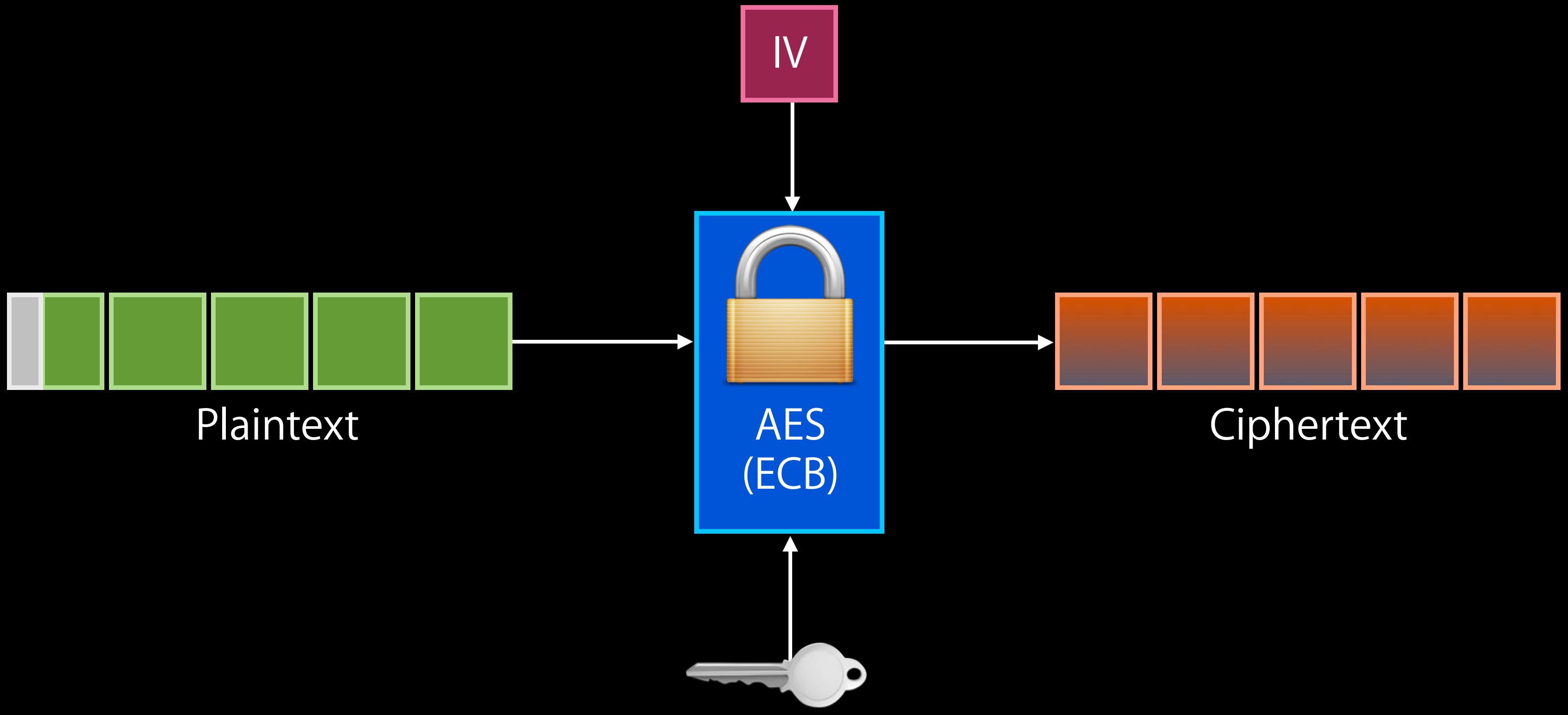

Cryptography

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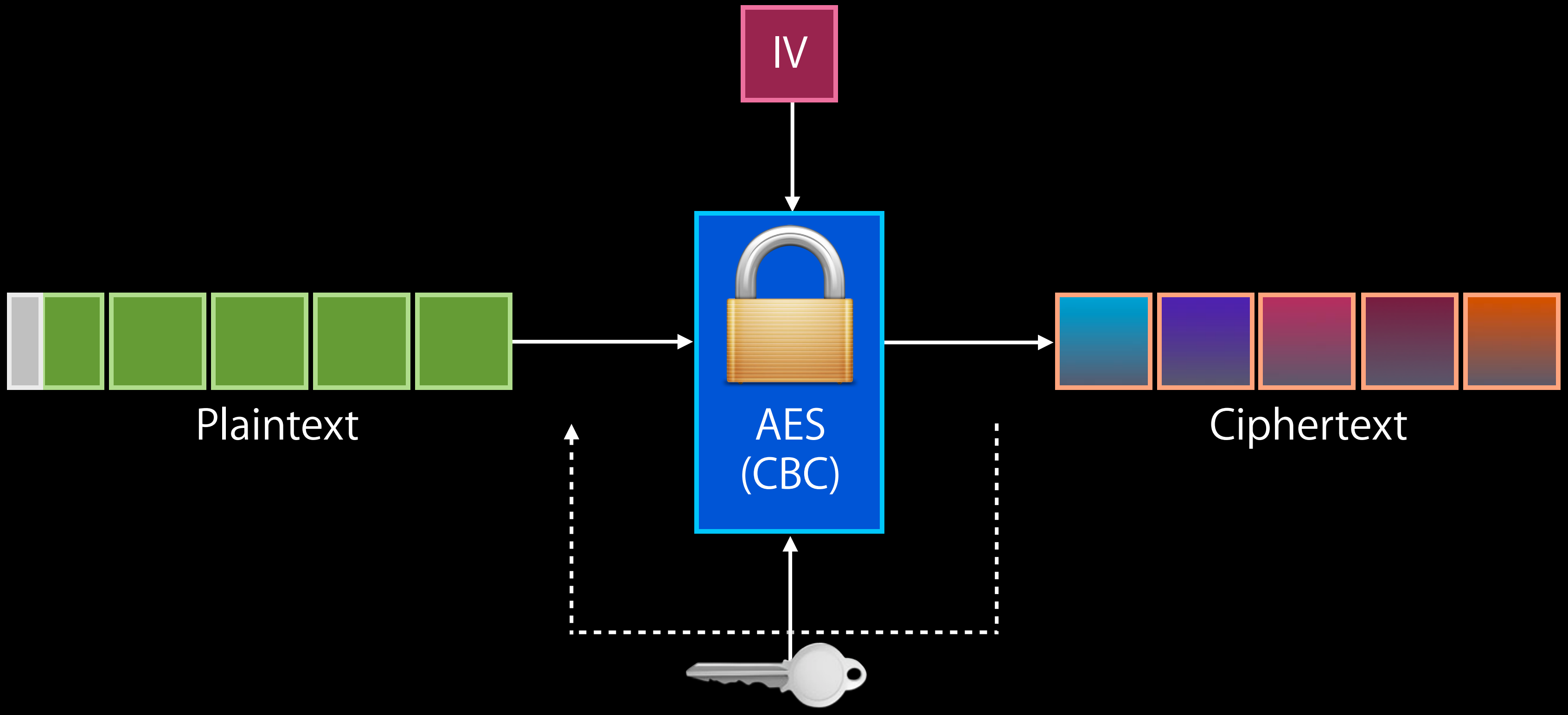

Cryptography

The devil is in the details

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- Avoid using crypto primitives

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- Avoid using crypto primitives
- Use higher level services

Cryptography

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- Avoid using crypto primitives
- Use higher level services
  - Cryptographic Message Syntax

Cryptography

The devil is in the details

- Avoid using crypto primitives
- Use higher level services
    - Cryptographic Message Syntax
        - S/MIME

Cryptography

The devil is in the details

- Avoid using crypto primitives
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    - Cryptographic Message Syntax
        - S/MIME
    - SecKey

Cryptography

The devil is in the details

- Avoid using crypto primitives
- Use higher level services
  - Cryptographic Message Syntax
    - S/MIME
  - SecKey
  - SecTransform

Cryptography

SecTransform

Cryptography

SecTransform

- Data driven CF interface to GCD

Cryptography

SecTransform

- Data driven CF interface to GCD
    - Only on OS X

Cryptography

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- Data driven CF interface to GCD
  - Only on OS X
- Cryptography

Cryptography

SecTransform

- Data driven CF interface to GCD
  - Only on OS X
- Cryptography
- Data encoding

Cryptography

SecTransform

- Data driven CF interface to GCD
  - Only on OS X
- Cryptography
- Data encoding
- Simpler code!

SecTransform

Base 64 encoding

```
CFDataRef dataToEncode;
CFErrorRef error = NULL;

SecTransformRef encodingRef = SecEncodeTransformCreate(
                                     kSecBase64Encoding,&error);

SecTransformSetAttribute(encodingRef,
                         kSecTransformInputAttributeName,
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CFDataRef resultData = SecTransformExecute(encodingRef, &error);
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SecTransform

Encrypt and then base 64 encode

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SecKeyRef key;
CFDataRef dataToEncryptAndEncode;
SecTransformRef encryptionRef = SecEncryptTransformCreate(keyRef, &error);
SecTransformRef encodingRef = SecEncodeTransformCreate(kSecBase64Encoding,
                                                       &error);
SecGroupTransformRef group = SecTransformCreateGroupTransform();

SecTransformConnectTransforms(
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Keychain

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- Protects the user’s secrets

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- Enforces access control

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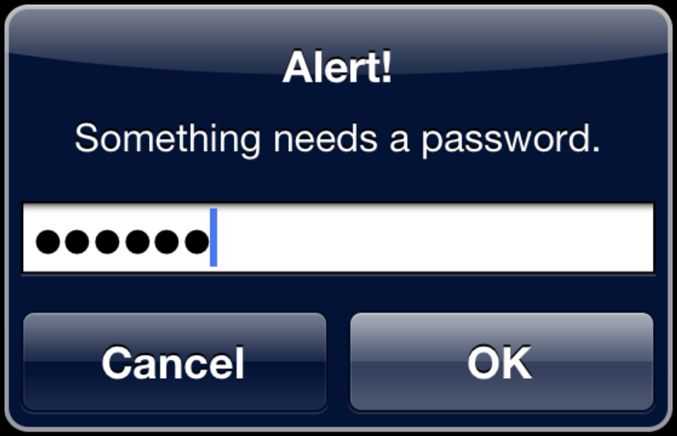
- Cryptographically secure

Keychain

- Protects the user's secrets
- Enforces access control
- Cryptographically secure
- OS X supports multiple keychains

Using the Keychain

SecItem API



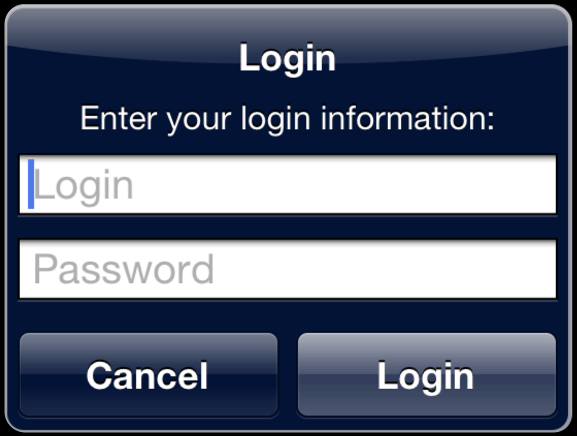
Alert!

Something needs a password.

`UIAlertViewStyleSecureTextInput`

Using the Keychain

SecItem API



Login

Enter your login information:

`UIAlertViewStyleLoginAndPasswordInput`

Storing the Password

```
// Create a dictionary.
NSMutableDictionary *attrs = [NSMutableDictionary dictionary];

// Set the attributes.
[attrs setObject:kSecClassGenericPassword forKey:kSecClass];
[attrs setObject:@”MyAccount” forKey:kSecAttrAccount];
[attrs setObject:password forKey:kSecValueData];


// Store it in the keychain.
OSStatus error = SecItemAdd((CFDictionaryRef)attrs, NULL);
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```

Retrieving the Password

```
// Create a query.
NSMutableDictionary *query = [NSMutableDictionary dictionary];

// Set the attributes.
[query setObject:kSecClassGenericPassword forKey:kSecClass];
[query setObject:@”MyAccount” forKey:kSecAttrAccount];
[query setObject:kCFBooleanTrue forKey:kSecReturnData];

// Retrieve it from the keychain.
OSStatus error = SecItemCopyMatching((CFDictionaryRef)query, (CFTypeRef
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Retrieving the Password

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// Create a query.
NSMutableDictionary *query = [NSMutableDictionary dictionary];

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Secure Transport

Secure Transport

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- Negotiates secure channel via TLS/SSL

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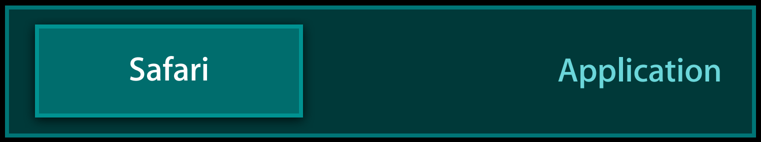
TLS 1.2 Interoperability
http://developer.apple.com/library/ios/#technotes/tn2287/_index.html

Secure Transport

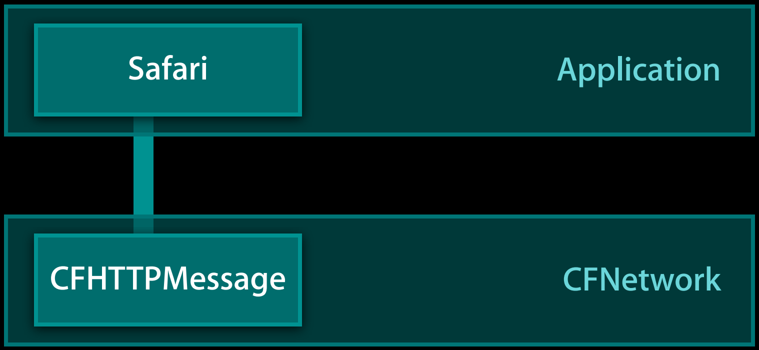
Secure Transport



Safari

Application

Secure Transport



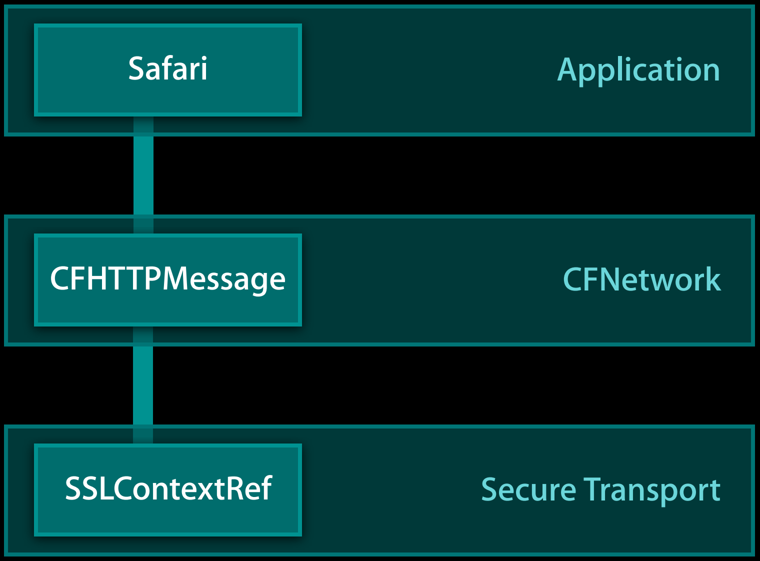
Safari

Application

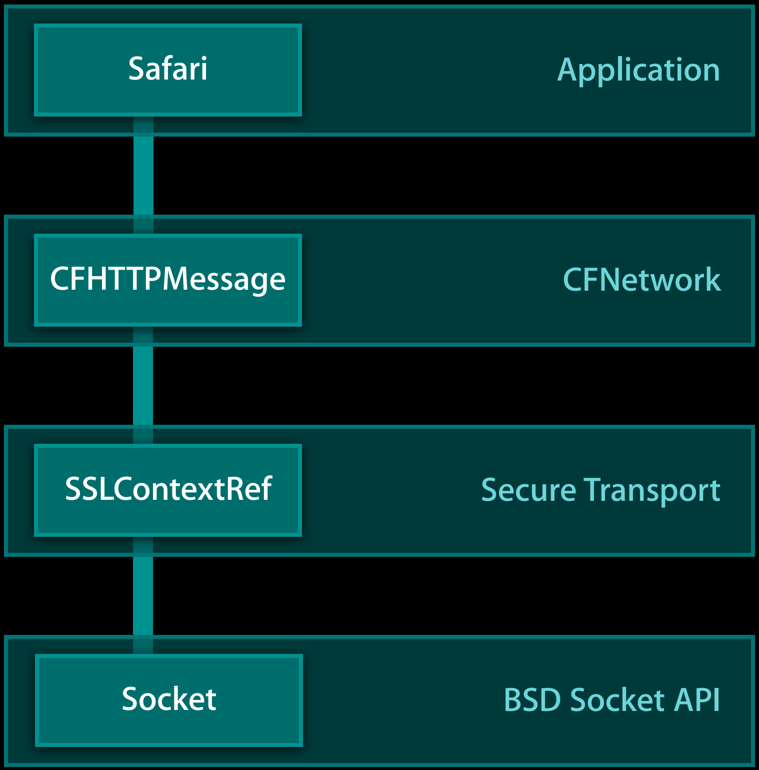
CFHTTPMessage

CFNetwork

Secure Transport



Secure Transport



Safari

Application

CFHTTPMessage

CFNetwork

SSLContextRef

Secure Transport

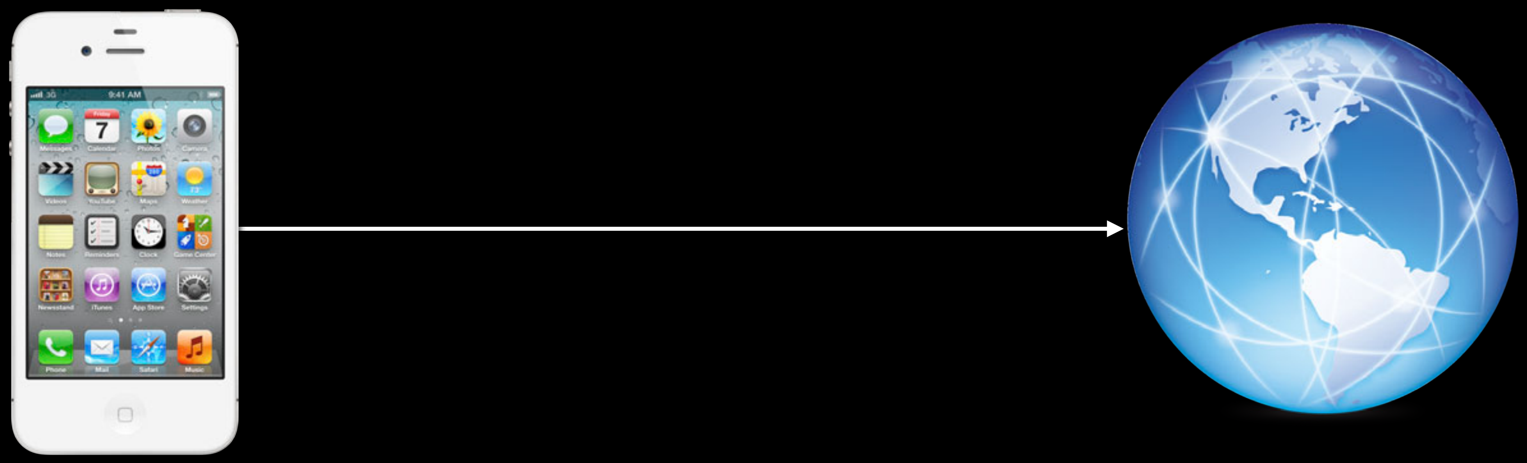
Socket

BSD Socket API

Secure Transport

Secure Transport

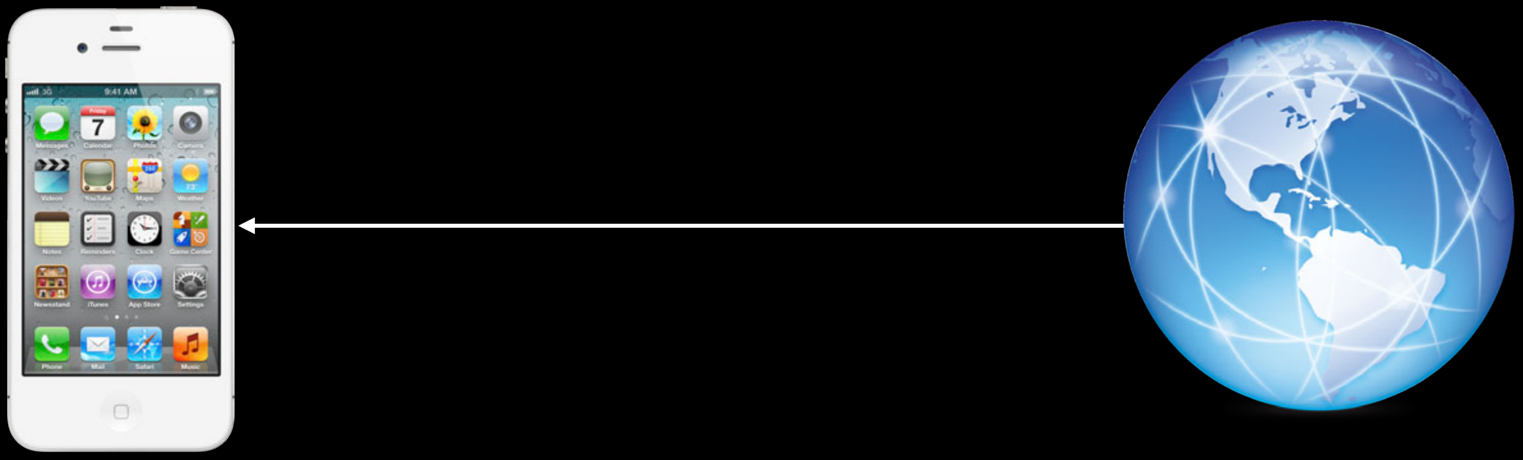
Secure Transport



“Hello!”

Supported Versions
Cipher Suites
Compression Methods

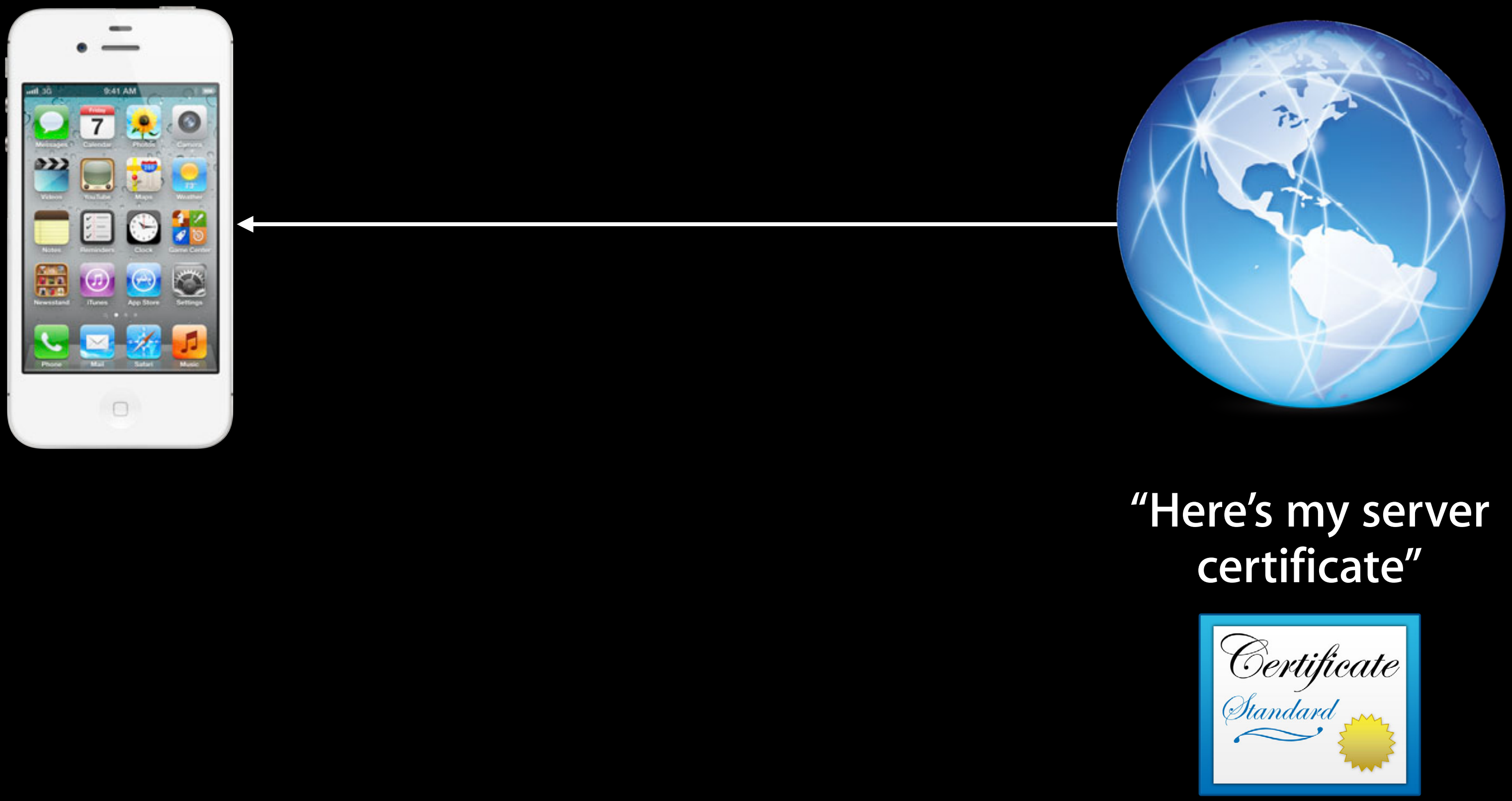
Secure Transport



“Hello!”

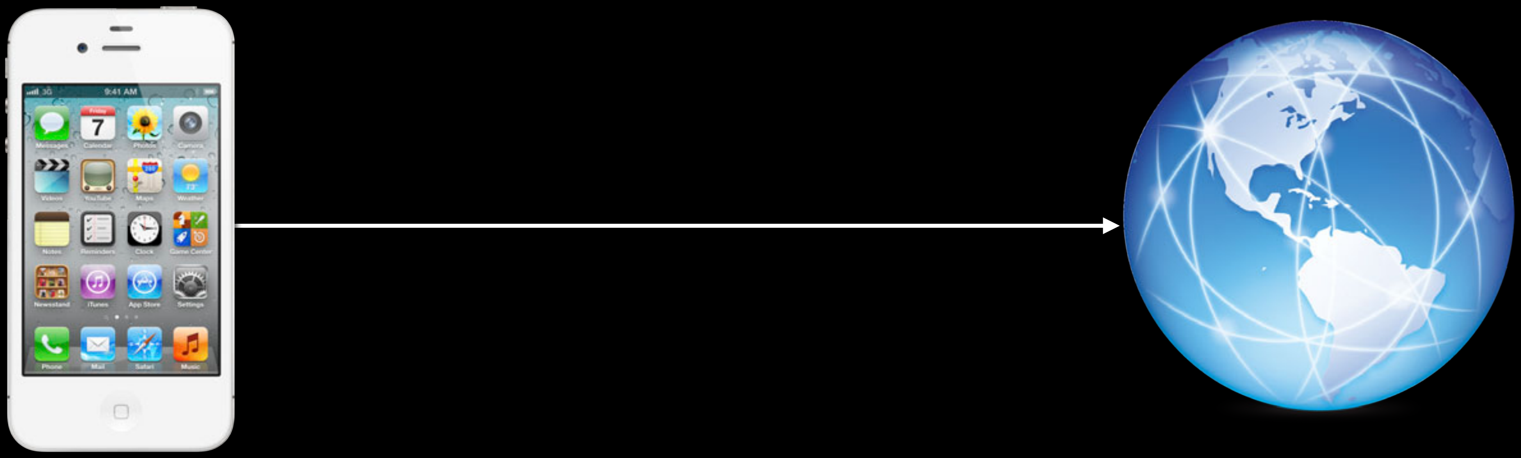
Chosen Versions
Chosen Cipher
Chosen Compression

Secure Transport



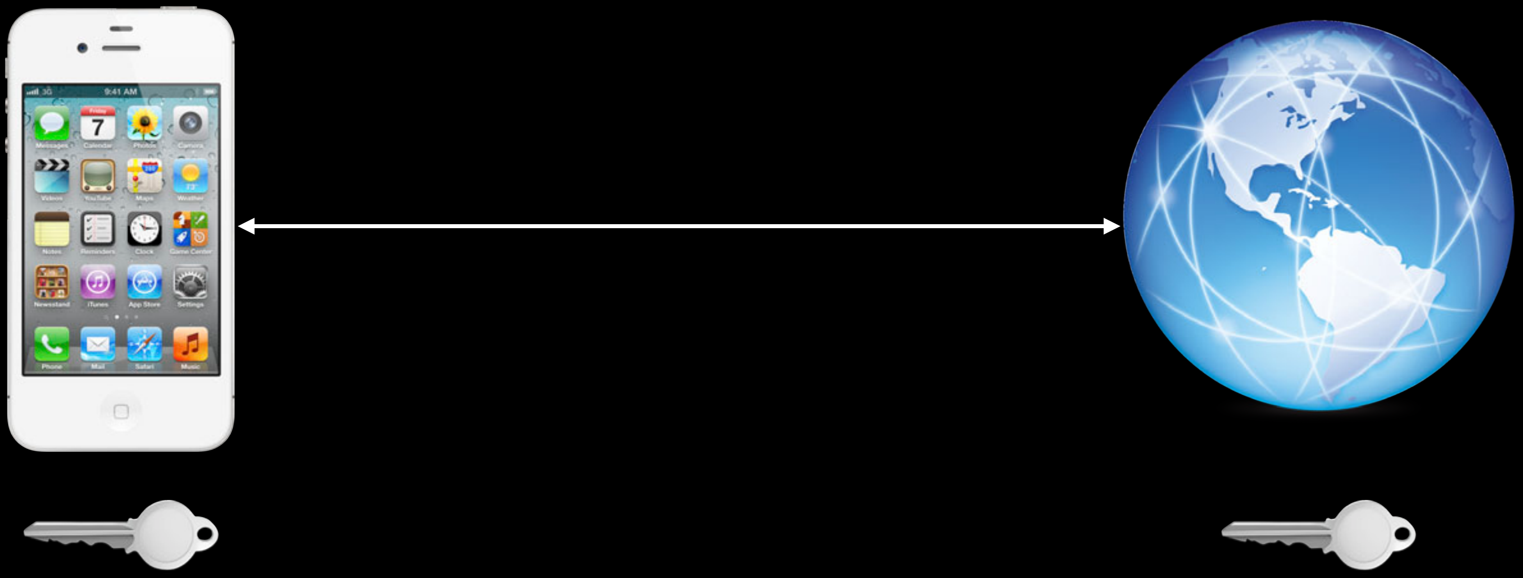
“Here’s my server certificate”

Secure Transport



“Here’s my client certificate”

Secure Transport



Trust Evaluation

What are certificates?

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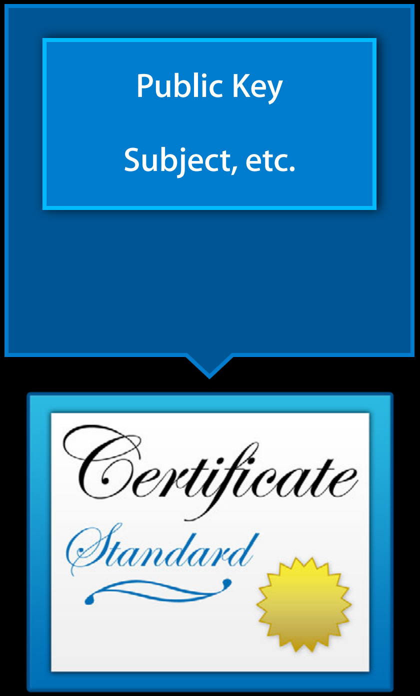

Public Key

Subject, etc.

Trust Evaluation

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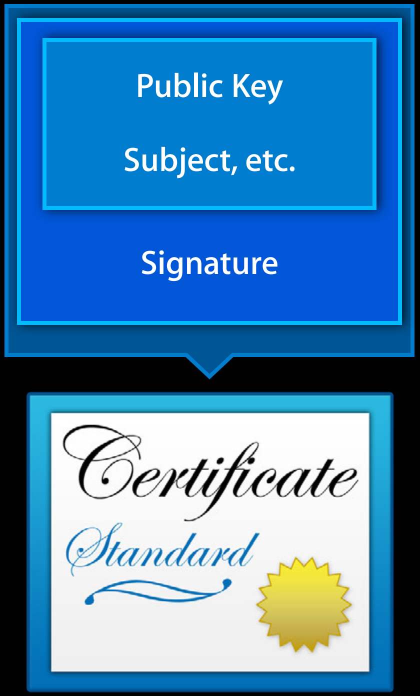

Public Key

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Signature

Trust Evaluation

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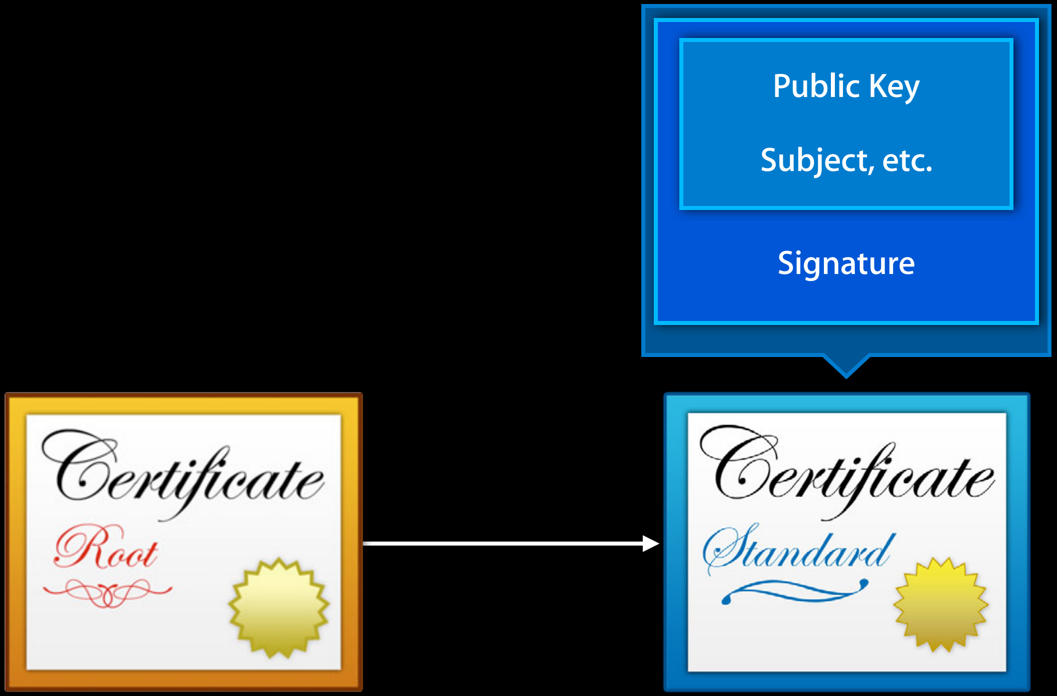

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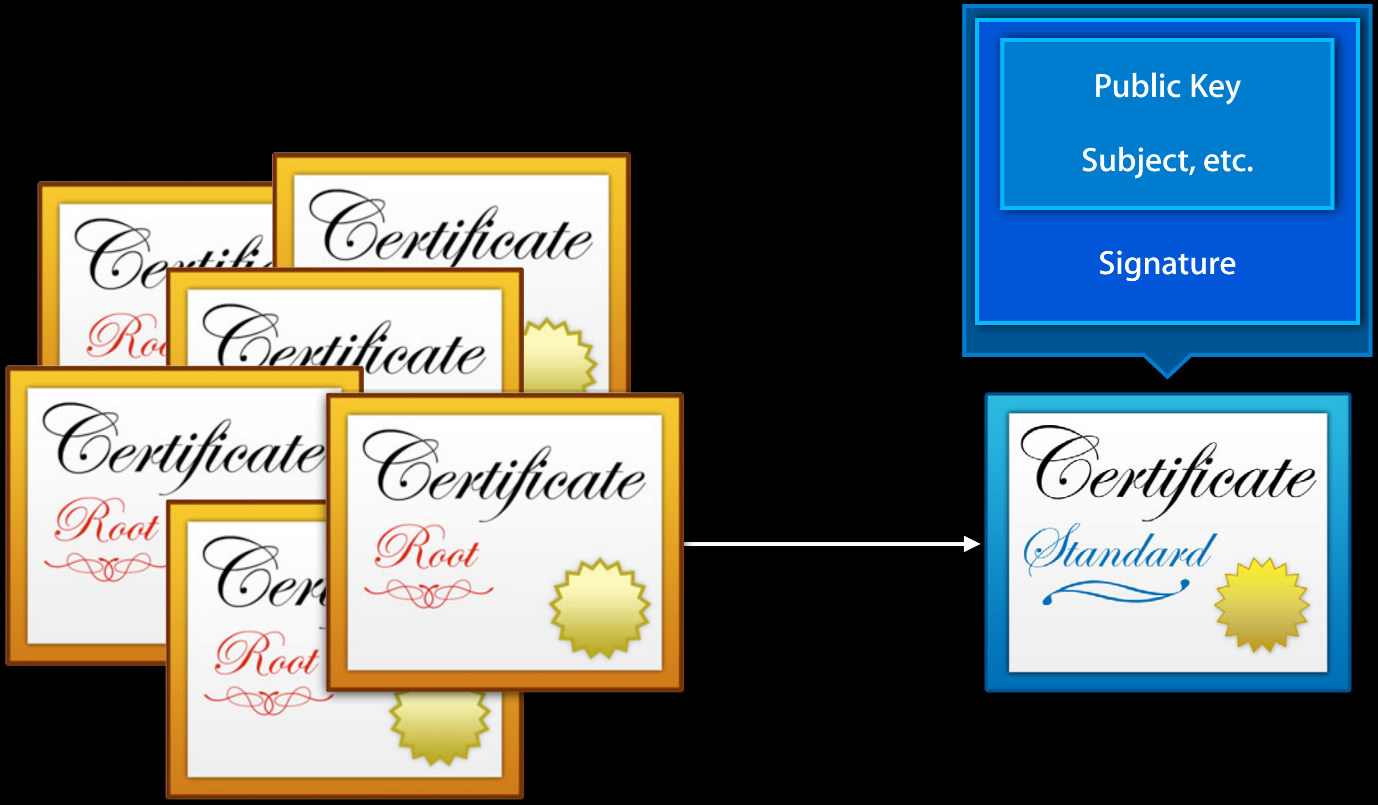

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- Root Anchors

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- Revocation

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Chain of Trust

Evaluating a signature

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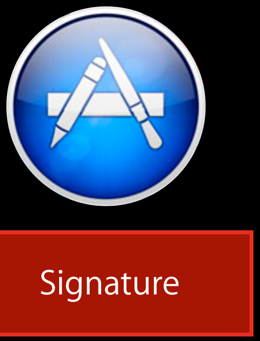
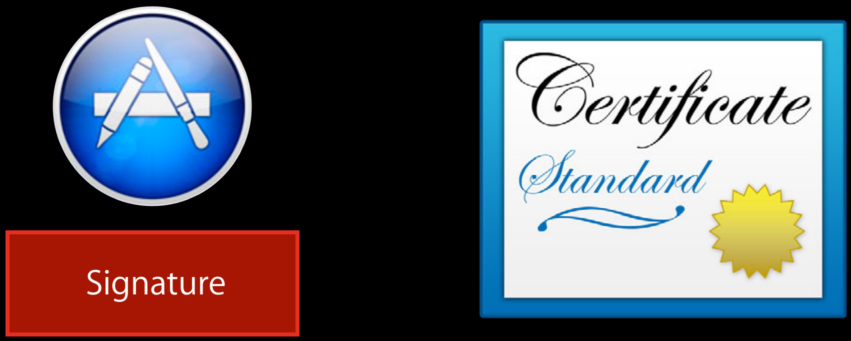


Signature

Chain of Trust

Evaluating a signature



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Chain of Trust

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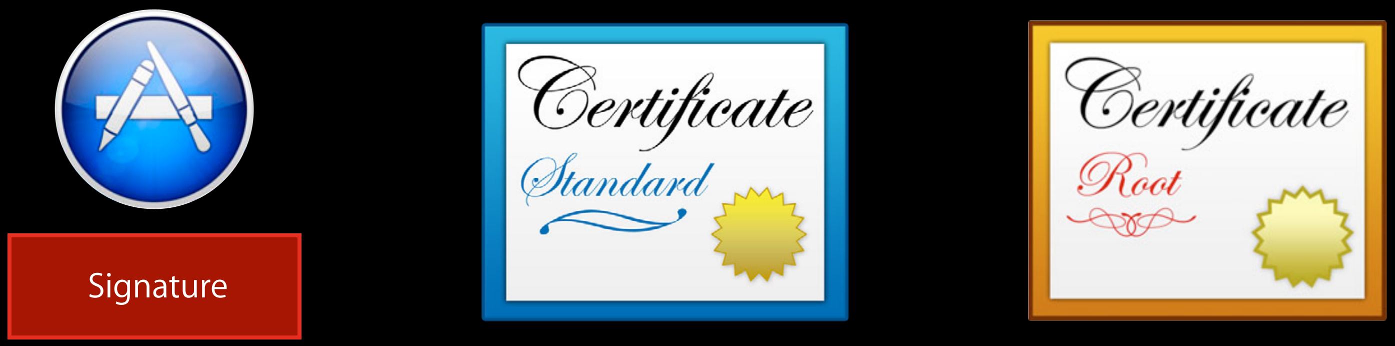

Signature

Chain of Trust

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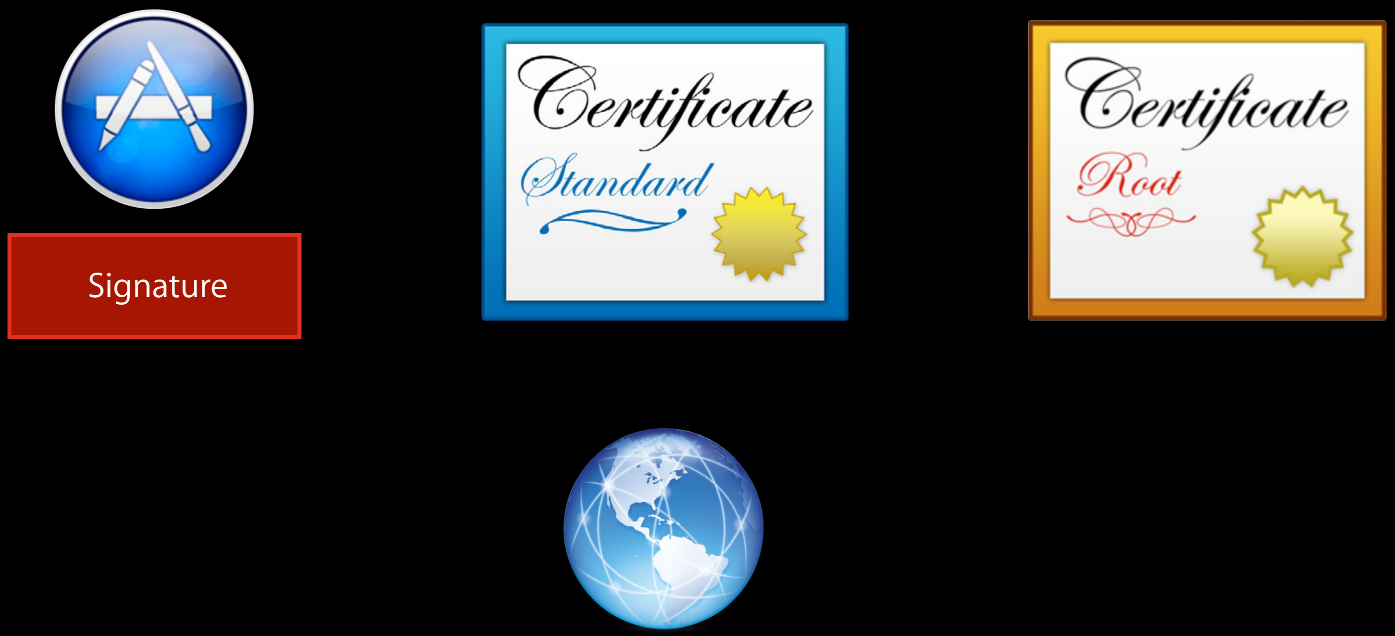

Signature

Trust Evaluation

SecTrust API

Certificate, Key, and Trust Services Reference
http://developer.apple.com/library/mac/#documentation/security/Reference/certifkeytrustservices

Related Sessions

Protecting the User’s Data	Pacific Heights Friday 11:30AM

Labs

Security Lab	Core OS Lab B Tuesday 3:15PM
Security Lab	Core OS Lab B Thursday 9:00AM

Cross Platform

Cross Platform

- Shared source base

Cross Platform

- Shared source base
  - CommonCrypto

Cross Platform

- Shared source base
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  - Secure Transport

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  - SecItem API Only
- Data Protection API

Data Protection

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- Protects data on a compromised device

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    - Only when unlocked

Unsupported

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- DRM

Unsupported

- DRM
- Jailbreak detection

Summary

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- Crypto

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- Crypto
- Keychain
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- Data Protection

Useful References

Security Introduction
http://developer.apple.com/library/mac/#referencelibrary/GettingStarted/GS_Security

Security Overview
http://developer.apple.com/library/mac/#documentation/Security/Conceptual/Security_Overview

Secure Coding Guide
http://developer.apple.com/library/mac/#documentation/Security/Conceptual/SecureCodingGuide

iOS Security
http://images.apple.com/ipad/business/docs/iOS_Security_May12.pdf

More Information

Paul Danbold

Core OS Evangelist
danbold@apple.com

Documentation

OS X Dev Center
http://developer.apple.com/devcenter/mac

iOS Dev Center
http://developer.apple.com/devcenter/ios

Apple Developer Forums

http://devforums.apple.com

Related Sessions

The OS X App Sandbox	Nob Hill Tuesday 10:15AM
Gatekeeper and Developer ID	Nob Hill Tuesday 11:30AM
Privacy Support in iOS and OS X	Pacific Heights Thursday 3:15PM
The OS X App Sandbox	Nob Hill Friday 10:15AM
Protecting the User’s Data	Pacific Heights Friday 11:30AM

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Q&A

WWDC2012