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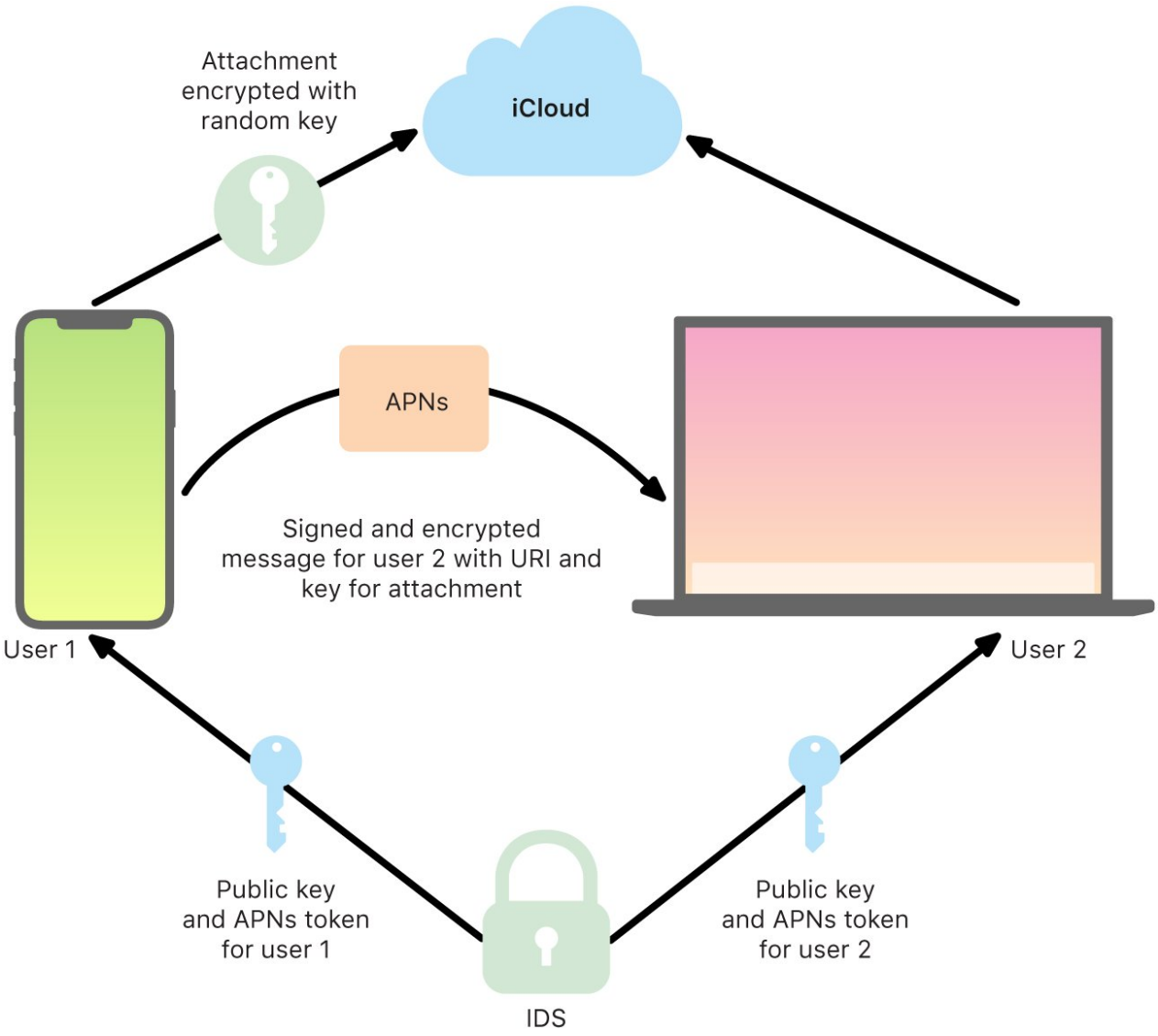
How iMessage sends and receives messages securely

Users start a new iMessage conversation by entering an address or name. If they enter a phone number or email address, the device contacts the Apple Identity Service (IDS) to retrieve the public keys and APNs addresses for all of the devices associated with the addressee. If the user enters a name, the device first uses the user's Contacts app to gather the phone numbers and email addresses associated with that name and then gets the public keys and APNs addresses from IDS.

The user's outgoing message is individually encrypted for each of the receiver's devices. The public encryption keys and signing keys of the receiving devices are retrieved from IDS. For each receiving device, the sending device generates a random 88-bit value and uses it as an HMAC-SHA256 key to construct a 40-bit value derived from the sender and receiver public key and the plaintext. The concatenation of the 88-bit and 40-bit values makes a 128-bit key, which encrypts the message with it using AES in Counter (CTR) Mode. The 40-bit value is used by the receiver side to verify the integrity of the decrypted plaintext. This per-message AES key is encrypted using RSA-OAEP to the public key of the receiving device. The combination of the encrypted message text and the encrypted message key is then hashed with SHA-1, and the hash is signed with the Elliptic Curve Digital Signature Algorithm (ECDSA) using the sending device's private signing key. In iOS 13 or later and iPadOS 13.1 or later, devices may use an Elliptic Curve Integrated Encryption Scheme (ECIES) encryption instead of RSA encryption.

The resulting messages, one for each receiving device, consist of the encrypted message text, the encrypted message key, and the sender's digital signature. They are then dispatched to the APNs for delivery. Metadata, such as the timestamp and APNs routing information, isn't encrypted. Communication with APNs is encrypted using a forward-secret TLS channel.

APNs can only relay messages up to 4 or 16 KB in size, depending on the iOS or iPadOS version. If the message text is too long or if an attachment such as a photo is included, the attachment is encrypted using AES in CTR mode with a randomly generated 256-bit key and uploaded to iCloud. The AES key for the attachment, its Uniform Resource Identifier (URI), and an SHA-1 hash of its encrypted form are then sent to the recipient as the contents of an iMessage, with their confidentiality and integrity protected through normal iMessage encryption, as shown in the following diagram.



How iMessage sends and receives messages.

For group conversations, this process is repeated for each recipient and their devices.

On the receiving side, each device receives its copy of the message from APNs and, if necessary, retrieves the attachment from iCloud. The incoming phone number or email address of the sender is matched to the receiver's contacts so

that a name can be displayed when possible.

As with all push notifications, the message is deleted from APNs when it's delivered. Unlike other APNs notifications, however, iMessage messages are queued for delivery to offline devices. Messages are stored for up to 30 days.

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See also

iCloud security overview

iCloud Drive security

Security of iCloud Backup

Apple ID security overview

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Suivant
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