

Matrix Cryptographic Key Infrastructure

Sumner Evans

21 September 2024

Beeper (Automatic)

Why Cryptography?

Matrix uses cryptography for two main purposes:

1. **Message Security** — only the people who are part of the conversation should be allowed to view messages of the conversation.
2. **Identity** — verifying that a user or device is who they say they are.

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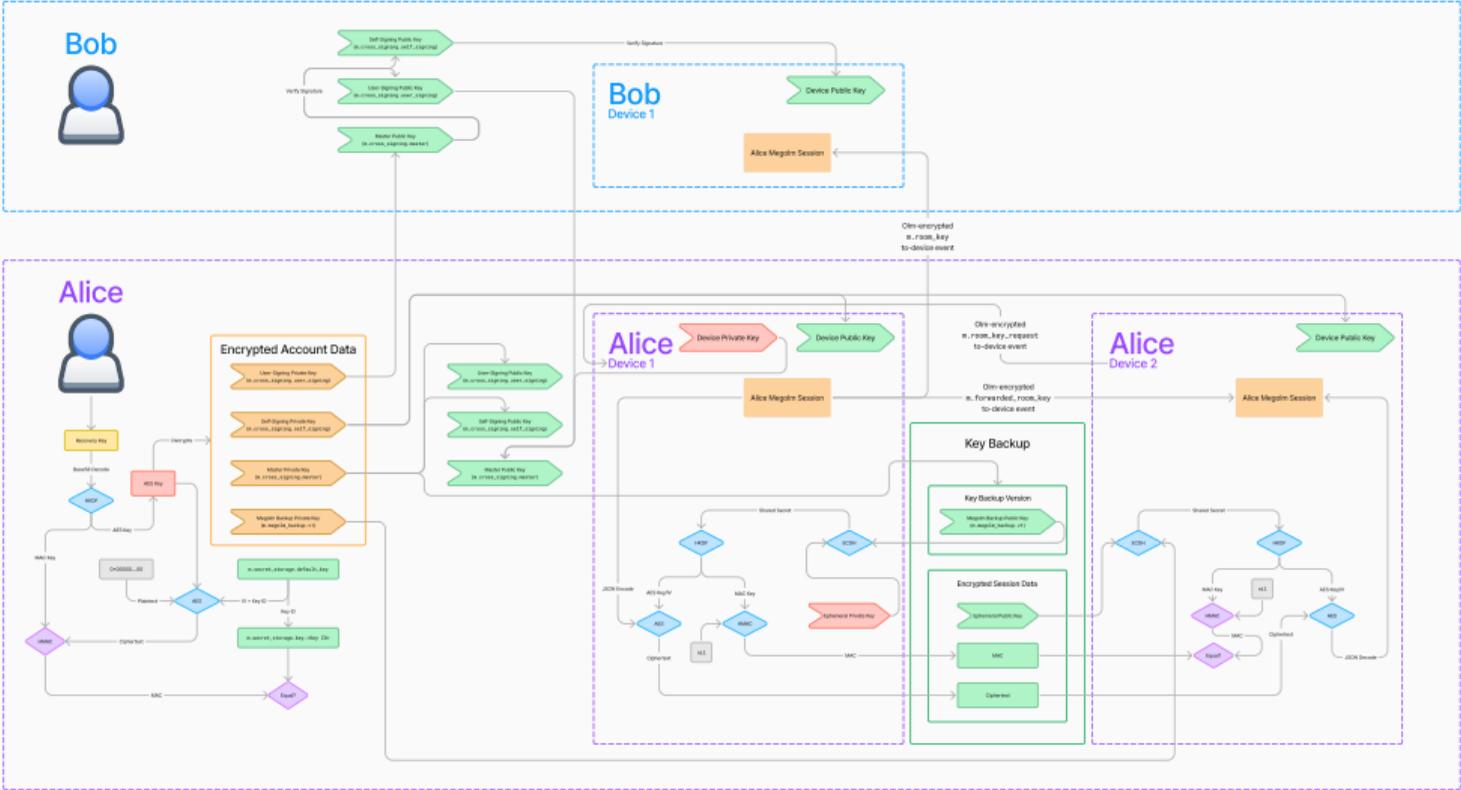
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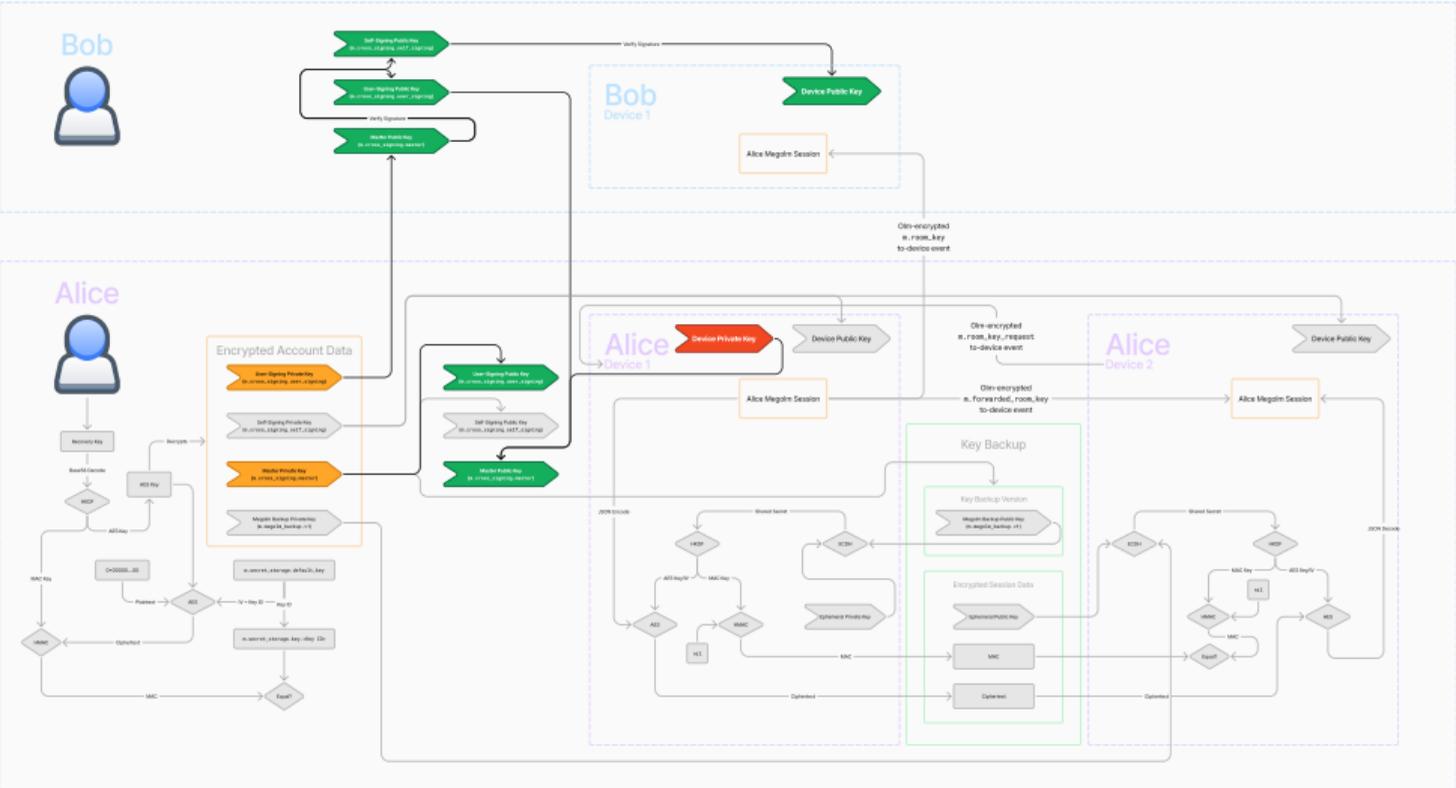
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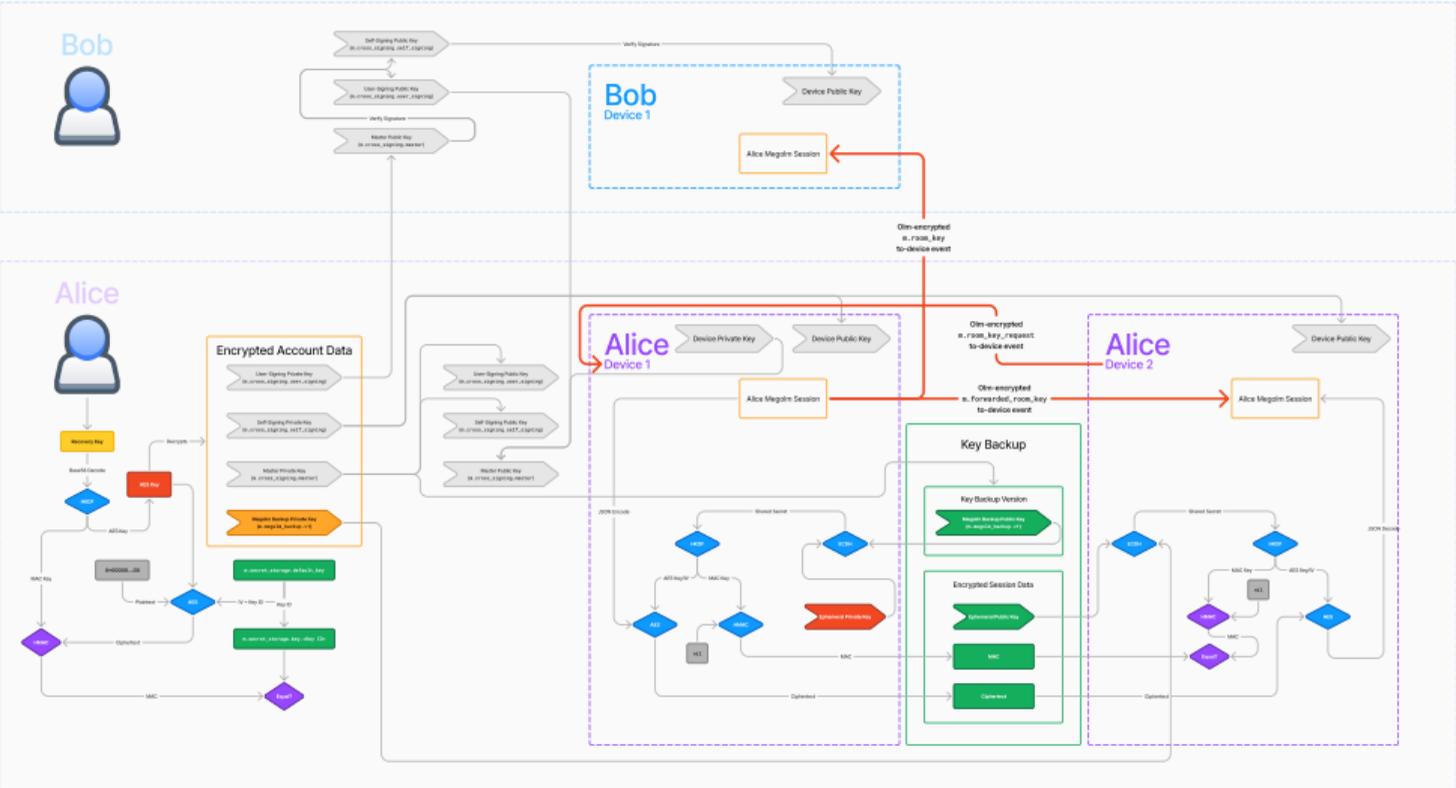
Big Picture



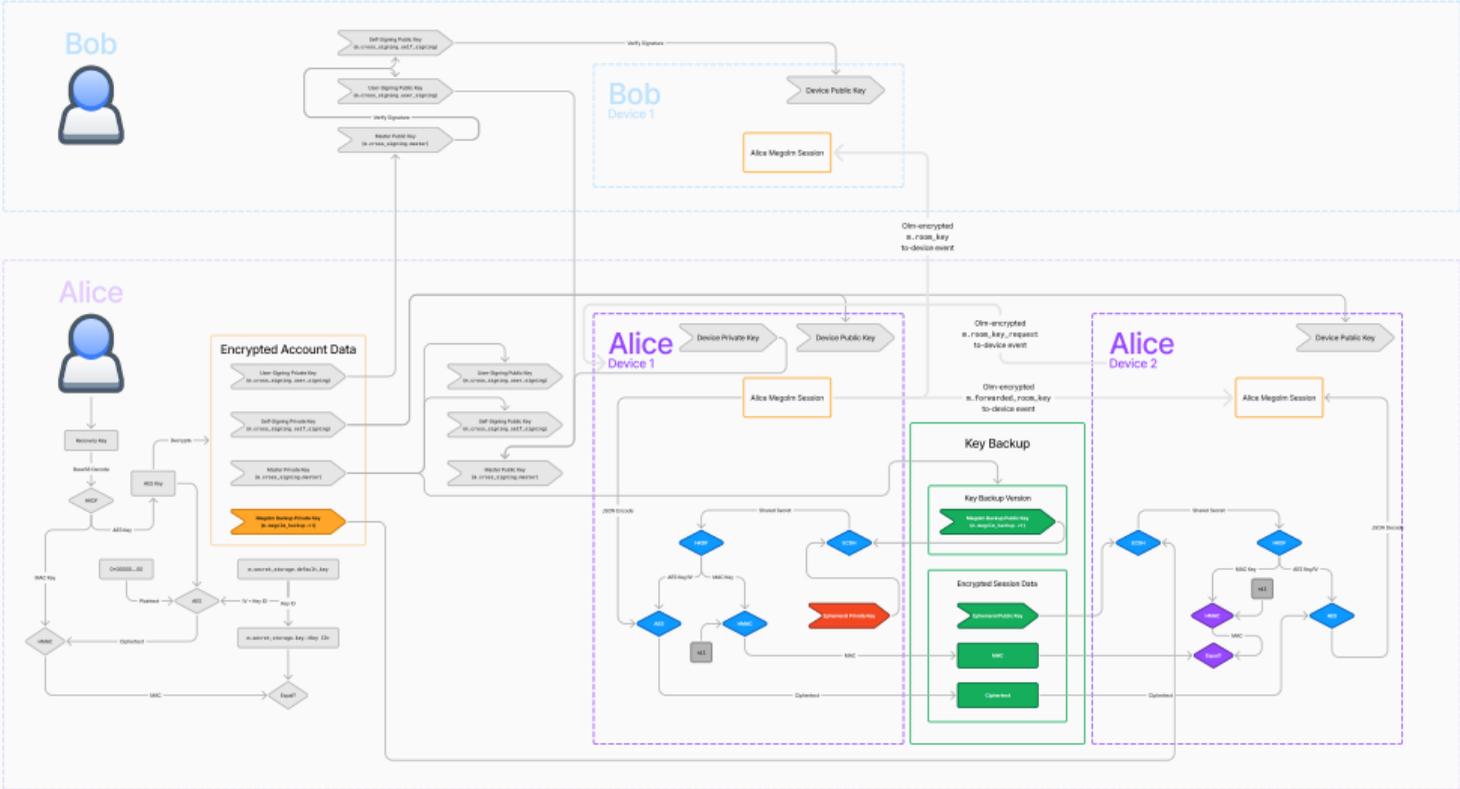
Big Picture: Identity: User Verification



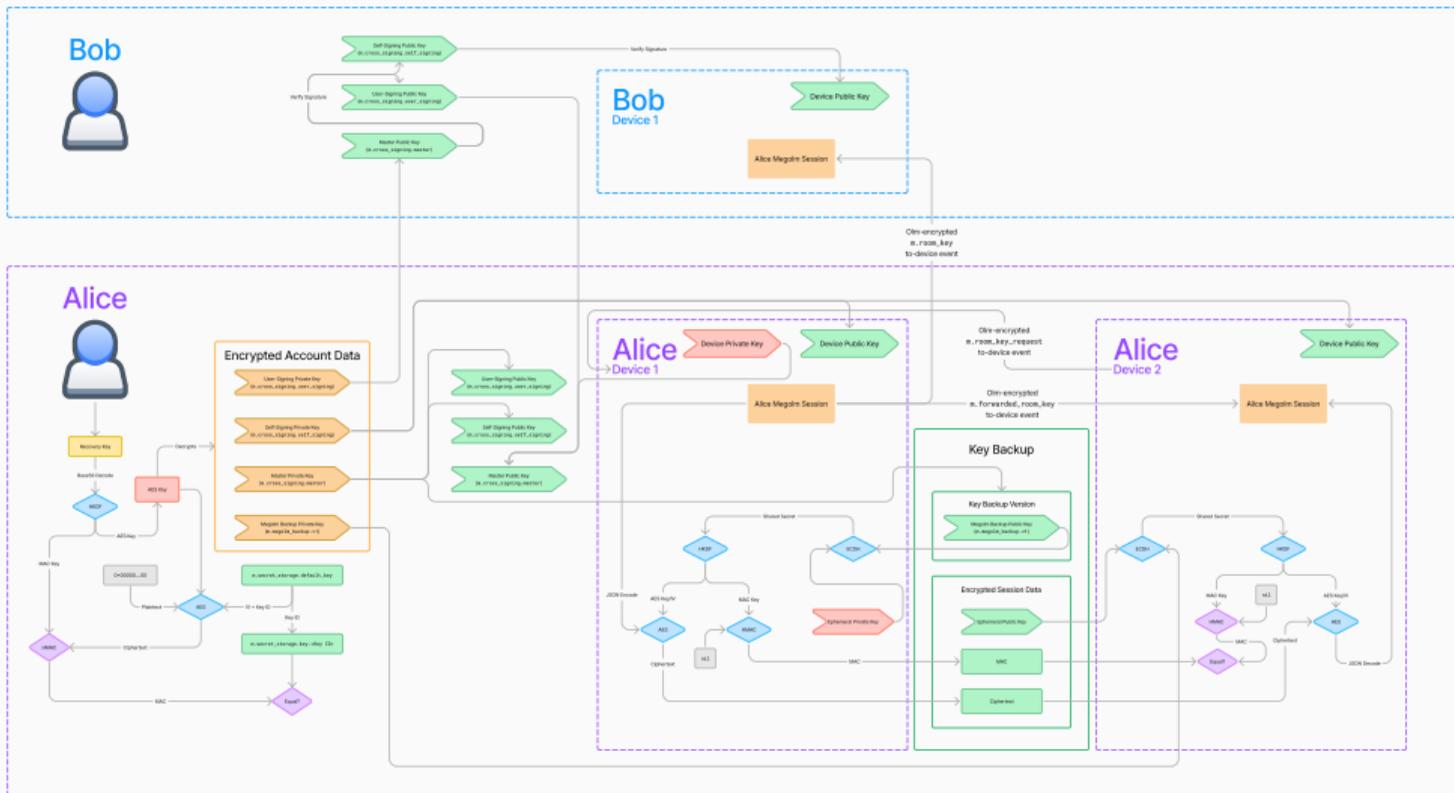
Big Picture: The Other Stuff



Big Picture: The Other Stuff: Key Backup



Big Picture



Cryptography Crash Course

Encryption: Symmetric vs Asymmetric

There are two main categories of encryption schemes:

- **Symmetric** — both the **encryptor and the decryptor share the same key** and that key is used in both the encryption and decryption of the message
- **Asymmetric** — the **encryptor needs the public key, and the decryptor needs the private key** and the encryptor encrypts the message with the public key, and the private key is required to decrypt the message

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A **cryptographic hash function** is a one-directional function which takes an arbitrarily large set of data and produces a unique fixed-size output (called the hash).

Given the same data, a hash function will always return the same output.

This allows us to verify that the data did not change in transit (for example, by a malicious actor).

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Diffie-Hellman is a method for using public-key cryptography to facilitate keysharing.

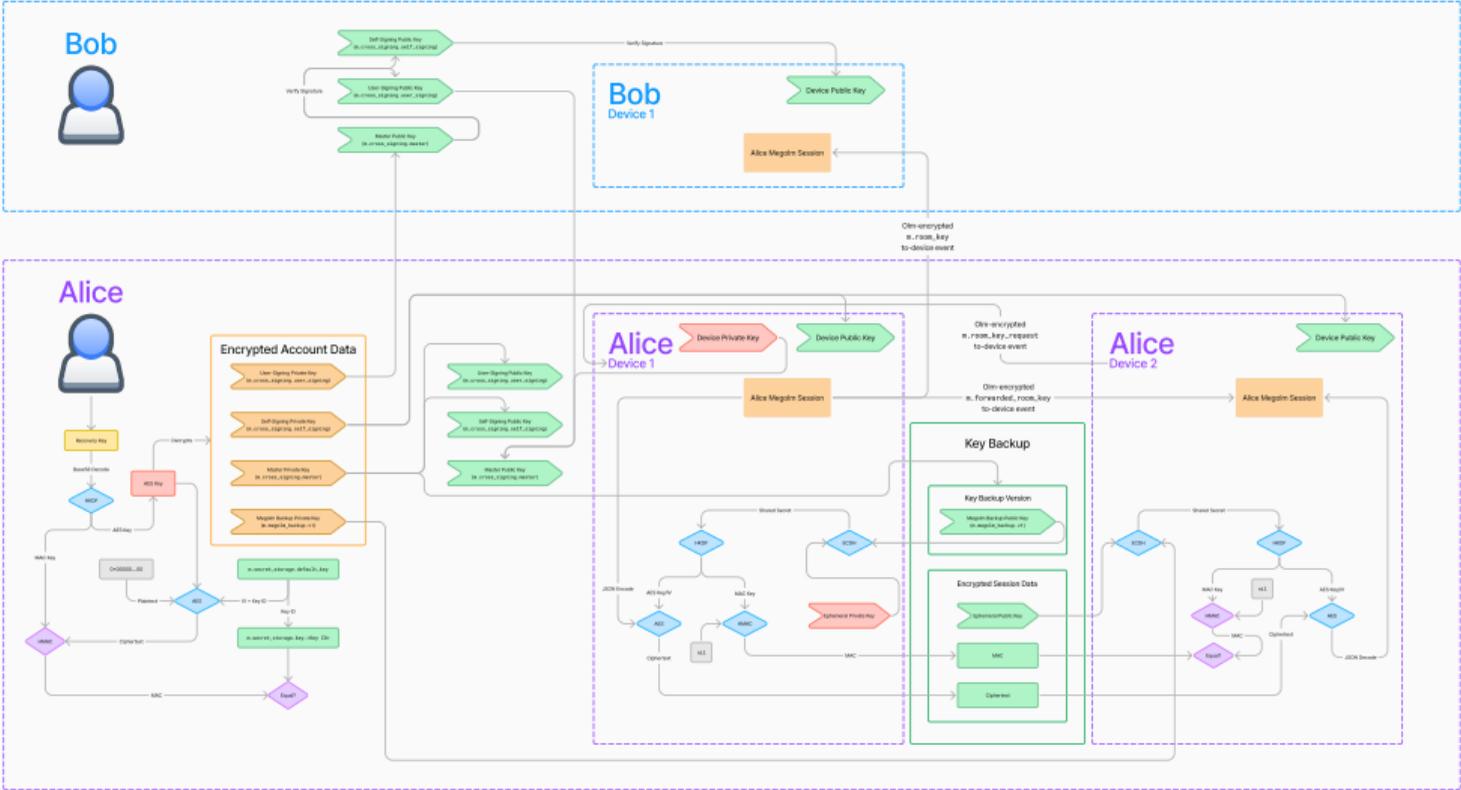
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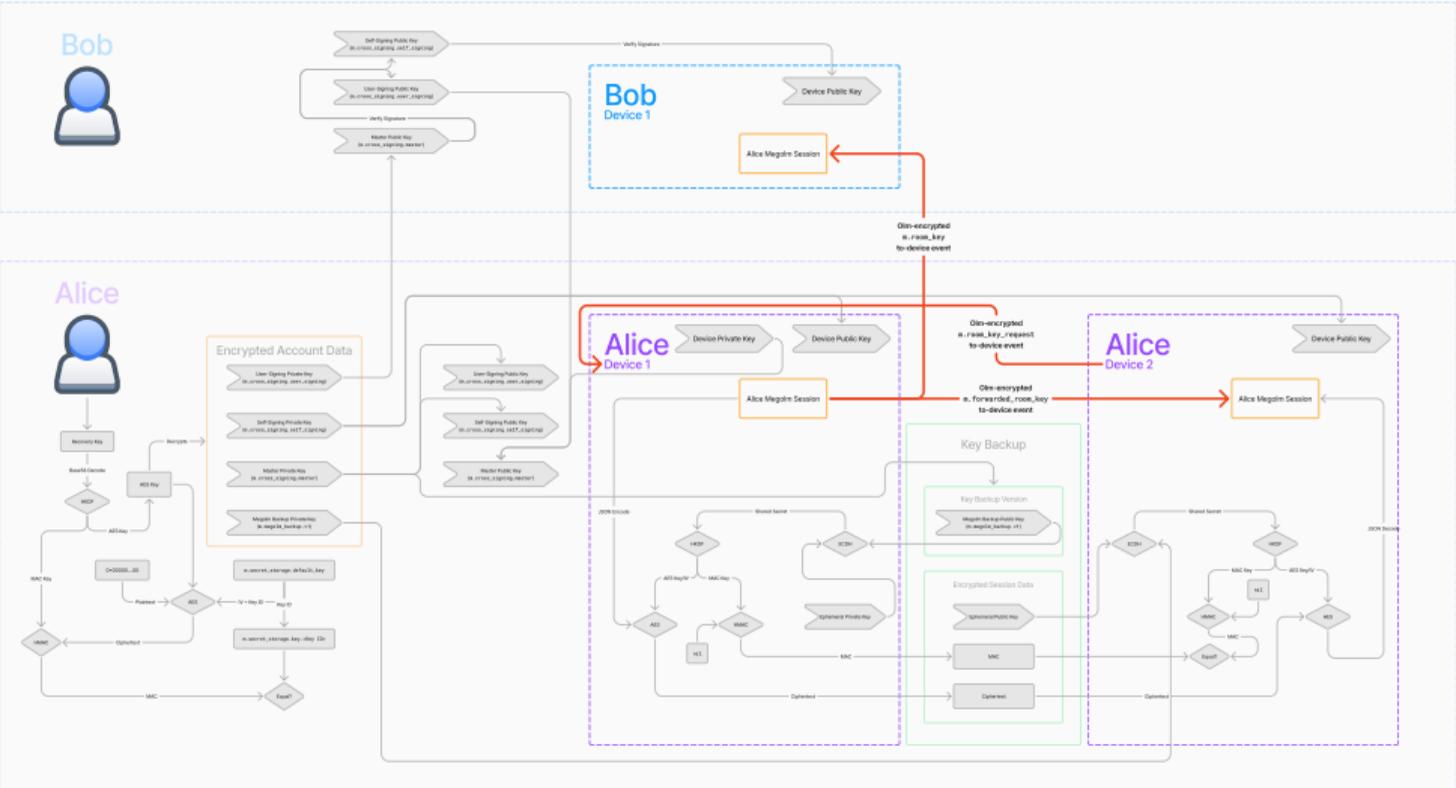
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Big Picture

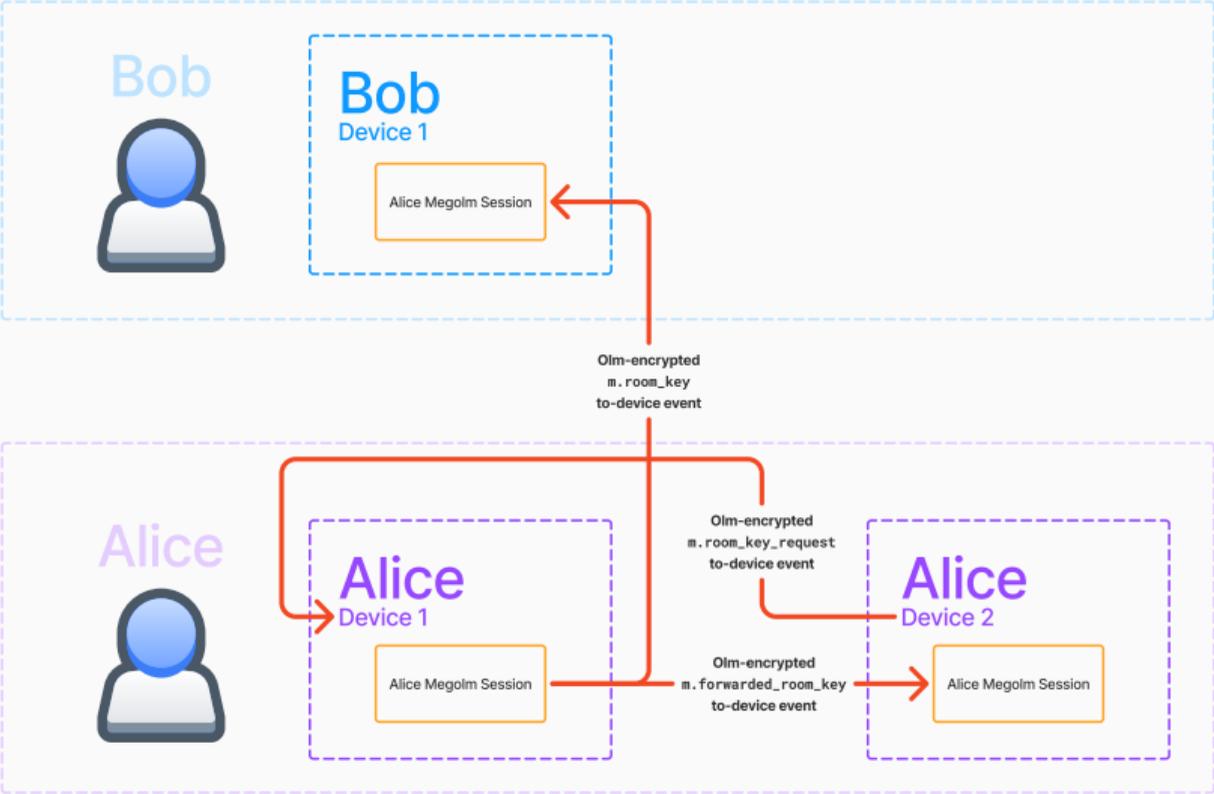


Sharing Keys

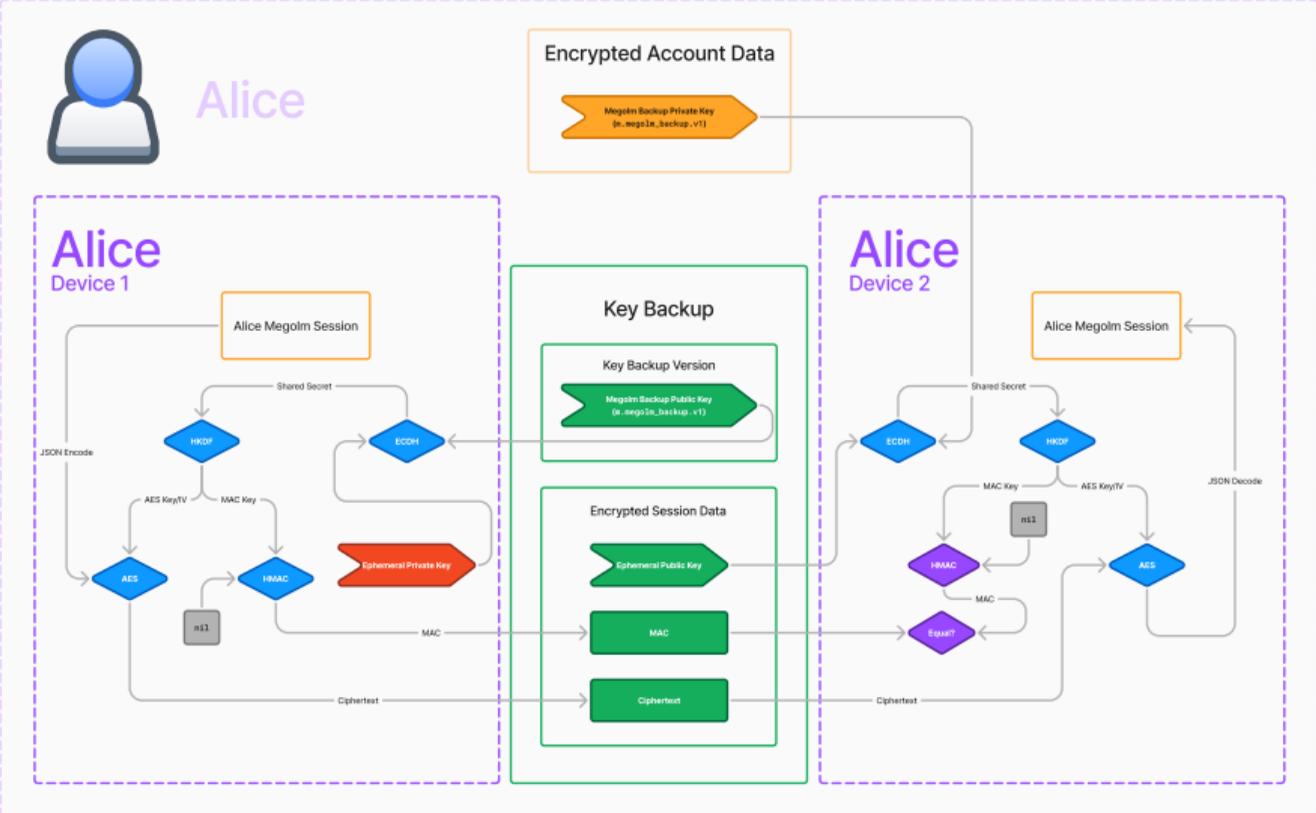
Encrypted Olm Events



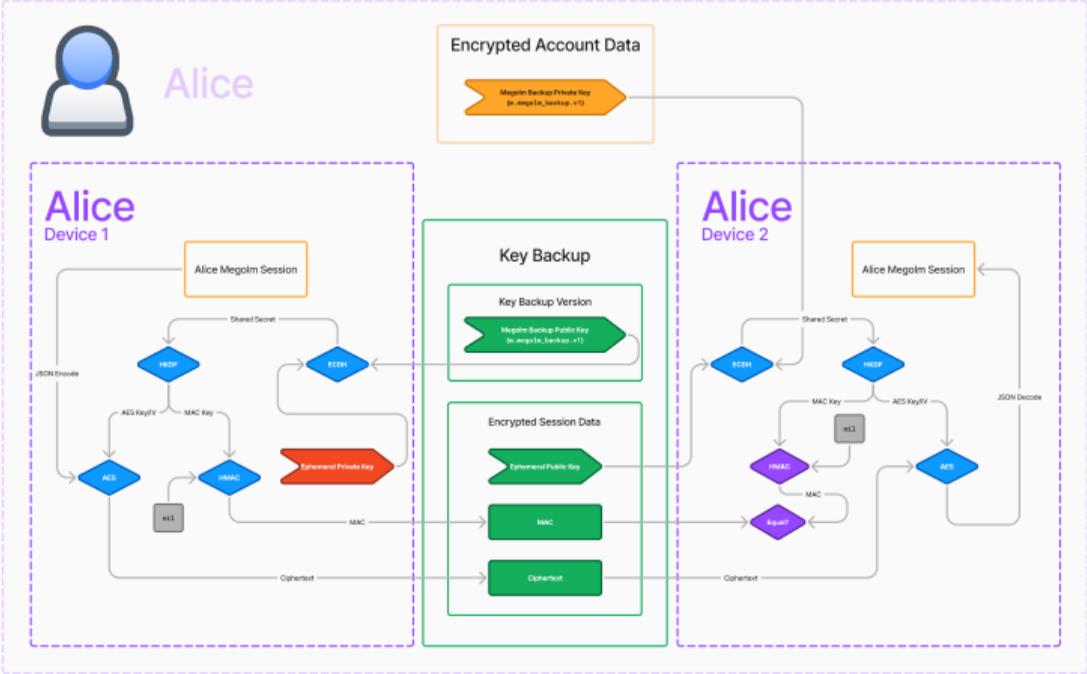
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Key Backup

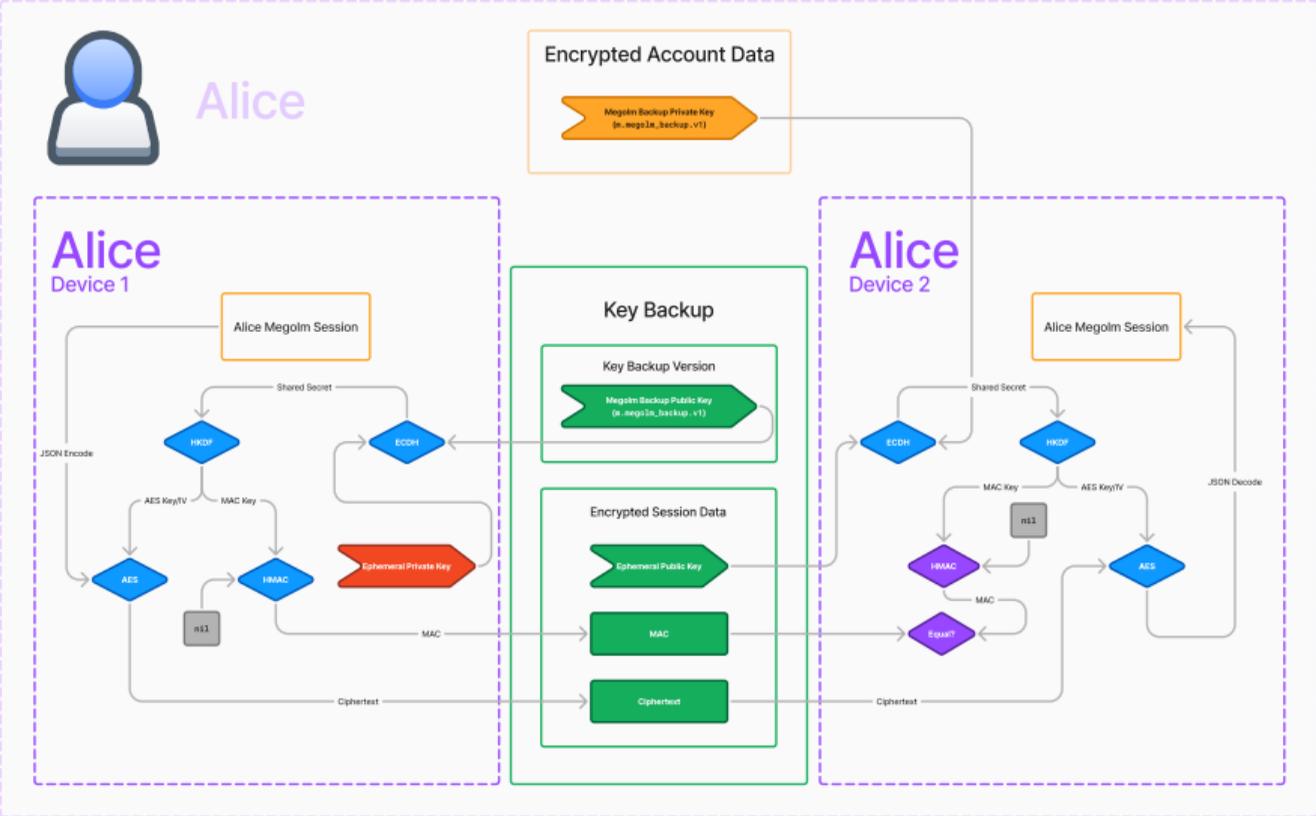


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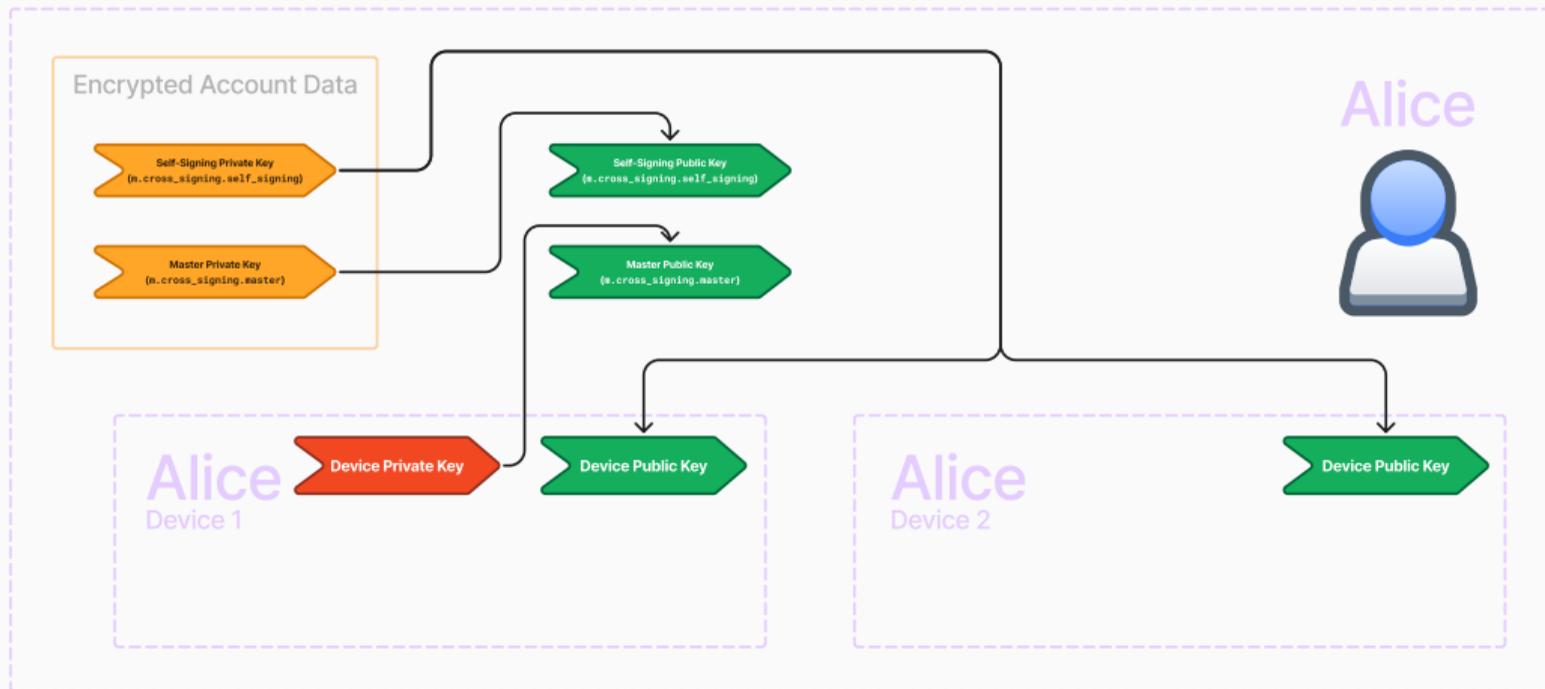
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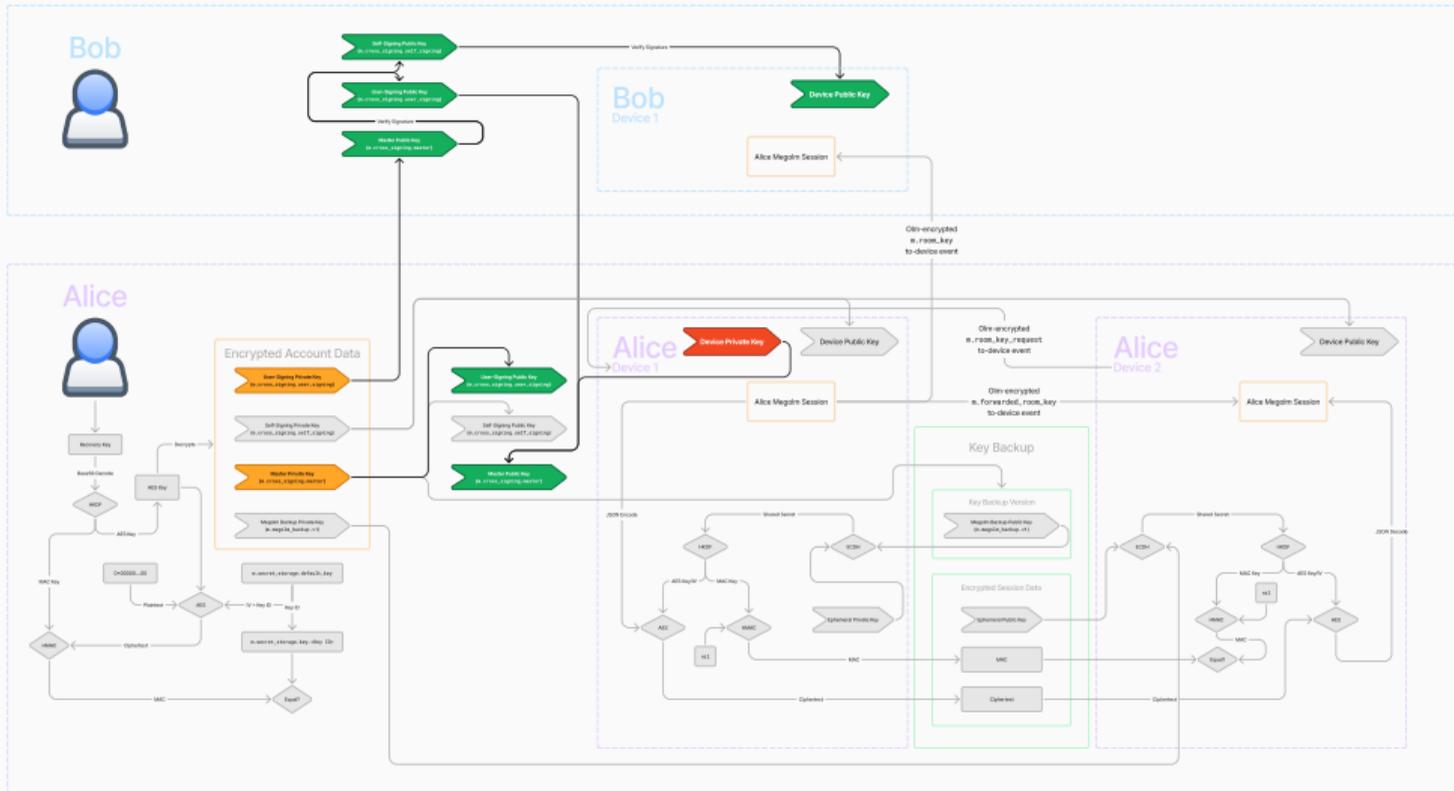
Device Verification

Signatures

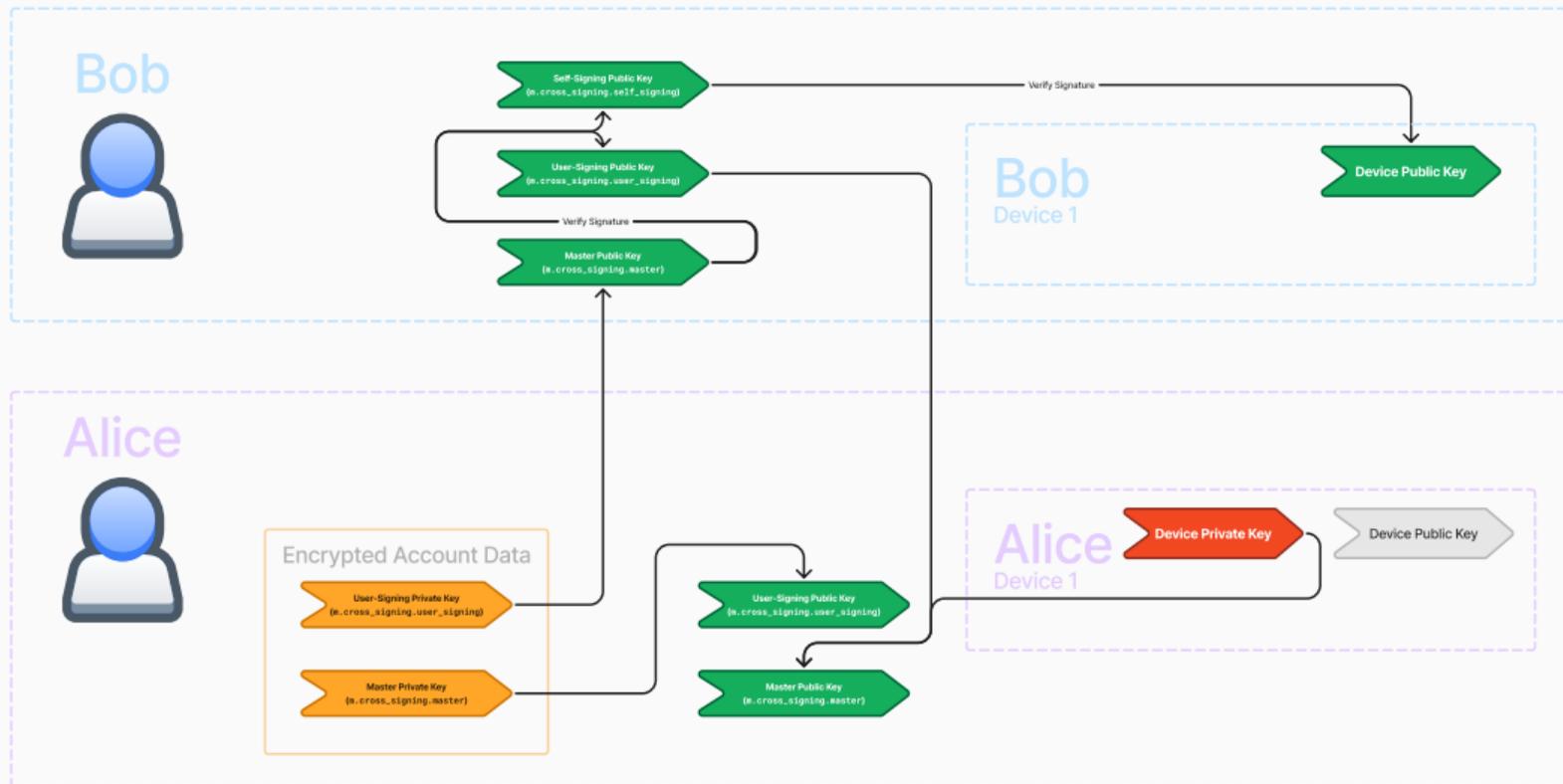


User Verification

Additional Identity Verification

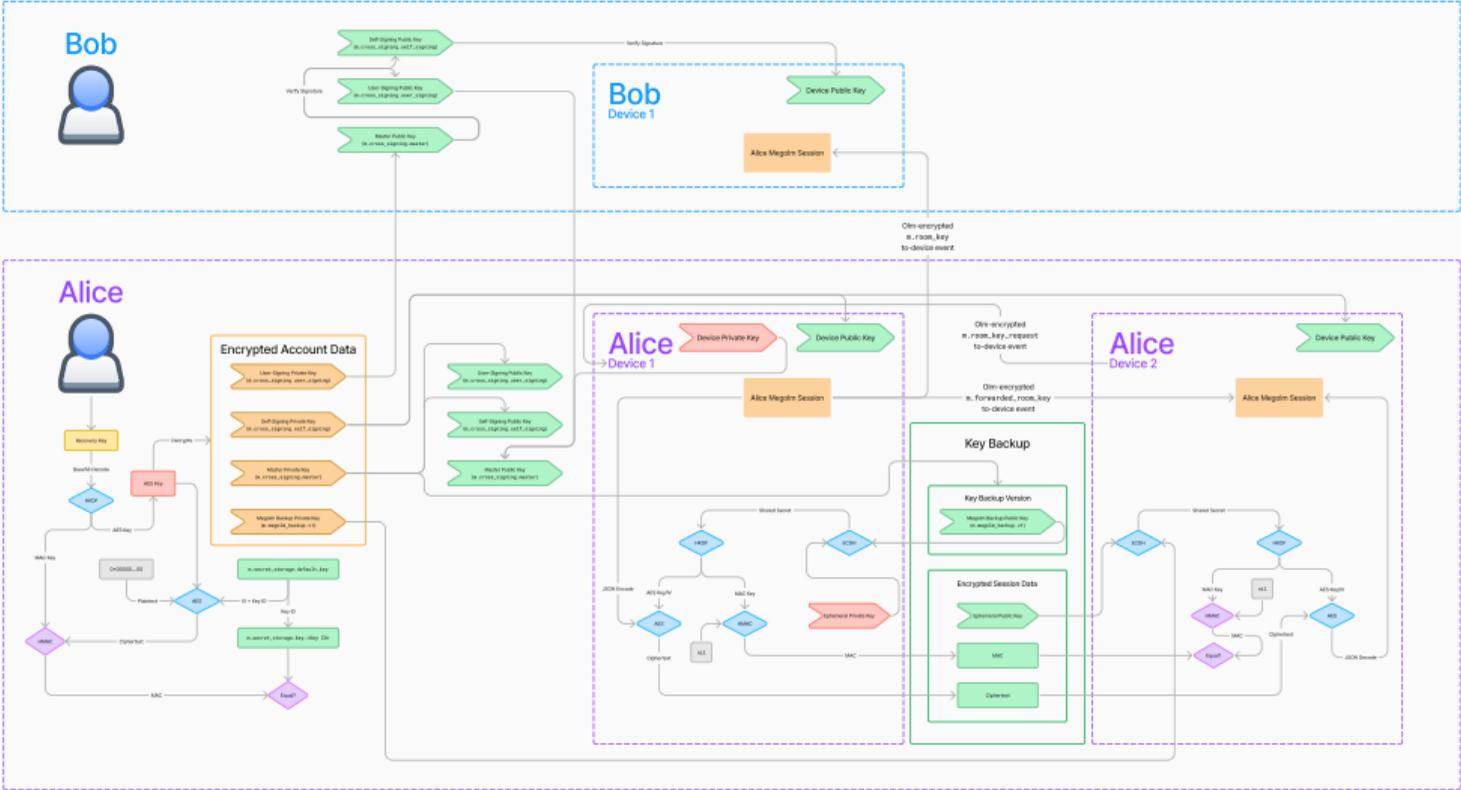


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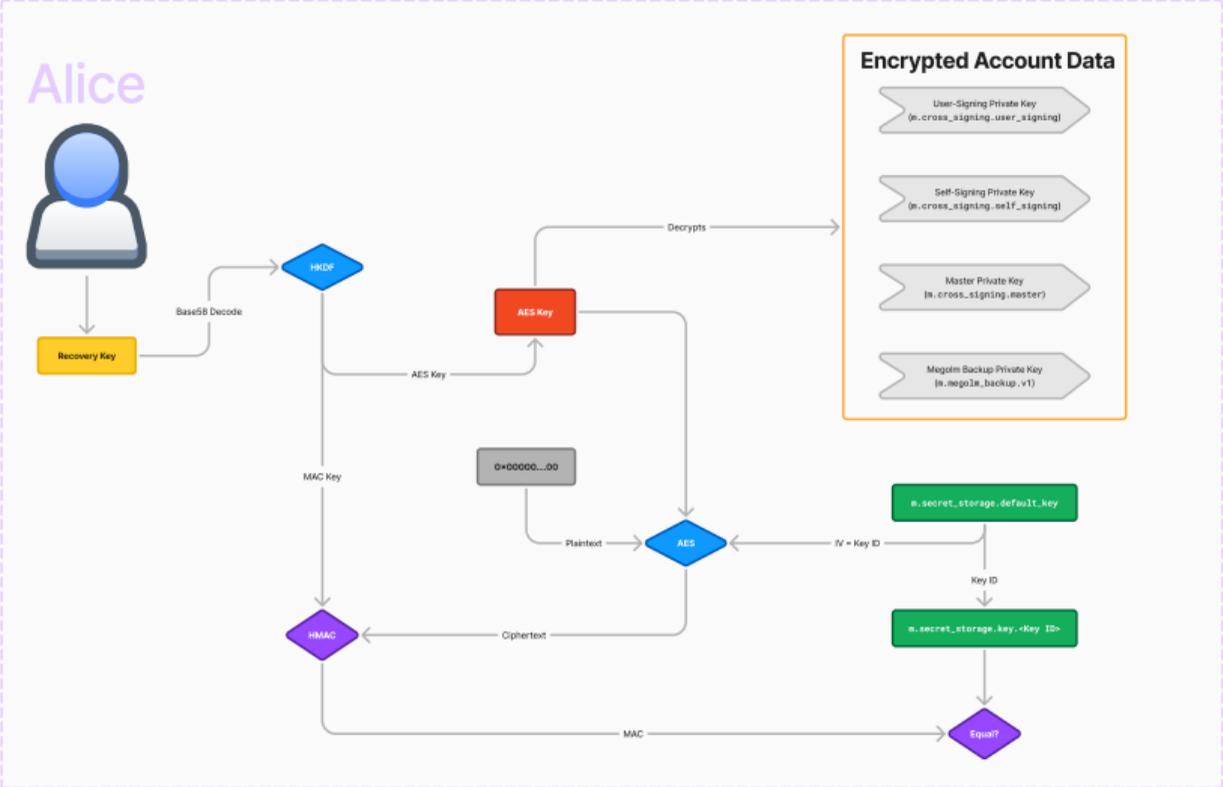


Secure Secret Storage and Sharing (SSSS)

Don't Forget Your Keys



Don't Forget Your Keys



Thank You for Listening!

Questions?



sumnerevans.com/posts/matrix/cryptographic-key-infrastructure