Hyperledger Ursa integration into Hyperledger Iroha November, 2019

Hyperledger Ursa integration into Hyperledger Iroha

- **Introduction**
  - **Name**: Alexander Matson
  - **Location**: New York, USA
  - **University**: The City College of New York
  - **Mentor(s):** Andrei Lebedev
  - **Hyperledger project**: Hyperledger Iroha

Hyperledger Ursa integration into Hyperledger Iroha

- **Project Description**: Hyperledger Ursa

  - Ursa’s goal is to be a shared cryptographic library for the Hyperledger ecosystem
  - Implemented in the Rust programming language, exposes a C interface
  - Provides APIs for many cryptographic building blocks, including ed25519

Hyperledger Ursa integration into Hyperledger Iroha

- **Project Description**: This project adds support for HL Ursa based cryptography to Iroha.

  - Iroha is a distributed ledger technology platform, can be used for creating and managing assets, identity, and more.
  - Cryptography is a fundamental component for any decentralized ledger
    - Accounts are managed by public/private keypairs
    - Transactions and blocks use cryptographic signatures
  - Iroha uses the EdDSA signature scheme (ed25519 in particular)
  - Iroha core software is programmed in C/C++

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- **Project Description**: Tools & Frameworks

  - Docker
  - Cmake
  - Gdb
  - Valgrind
  - Gtest
  - Git/GitHub

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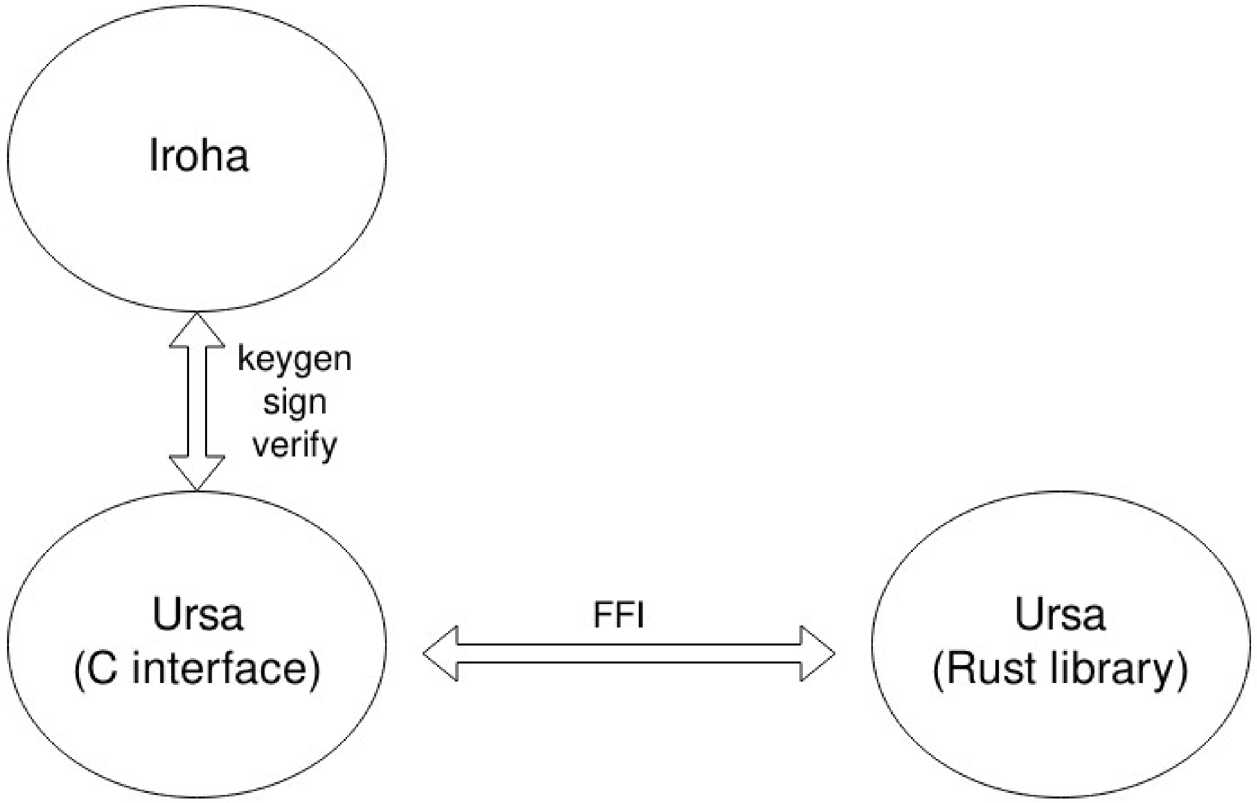
- **Project Description**: Calling Ursa functions (Rust) from Iroha (C++)



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- **Project Description**: Main challenge
  - Ursa integration was not as simple as a drop-in replacement

  - Reason: slight difference in existing Iroha-ed25519 and Ursa-ed25519
  - Iroha needs to support Iroha-crypto and Ursa-crypto for compatibility reasons

  - Solution: Use Multiformats (used in projects IPFS & libp2p) to encode public keys and signature data. Iroha can read the encoding to determine the appropriate crypto library to use.

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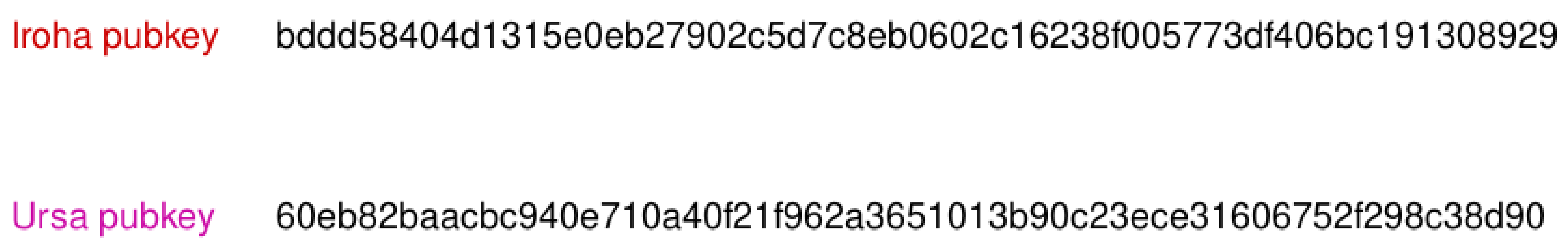
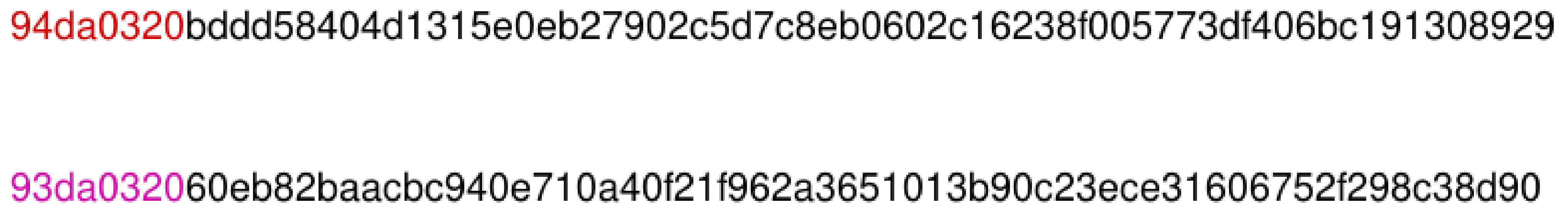
- **Project Description**:



Iroha pubkey	bddd58404d1315e0eb27902c5d7c8eb0602c16238f005773df406bc191308929
Ursa pubkey	60eb82baacbc940e710a40f21f962a3651013b90c23ece31606752f298c38d90

Hyperledger Ursa integration into Hyperledger Iroha

- **Project Description**: Encode keys & sigs so Iroha knows which crypto provider to use



```
94da0320bddd58404d1315e0eb27902c5d7c8eb0602c16238f005773df406bc191308929

93da032060eb82baacbc940e710a40f21f962a3651013b90c23ece31606752f298c38d90
```

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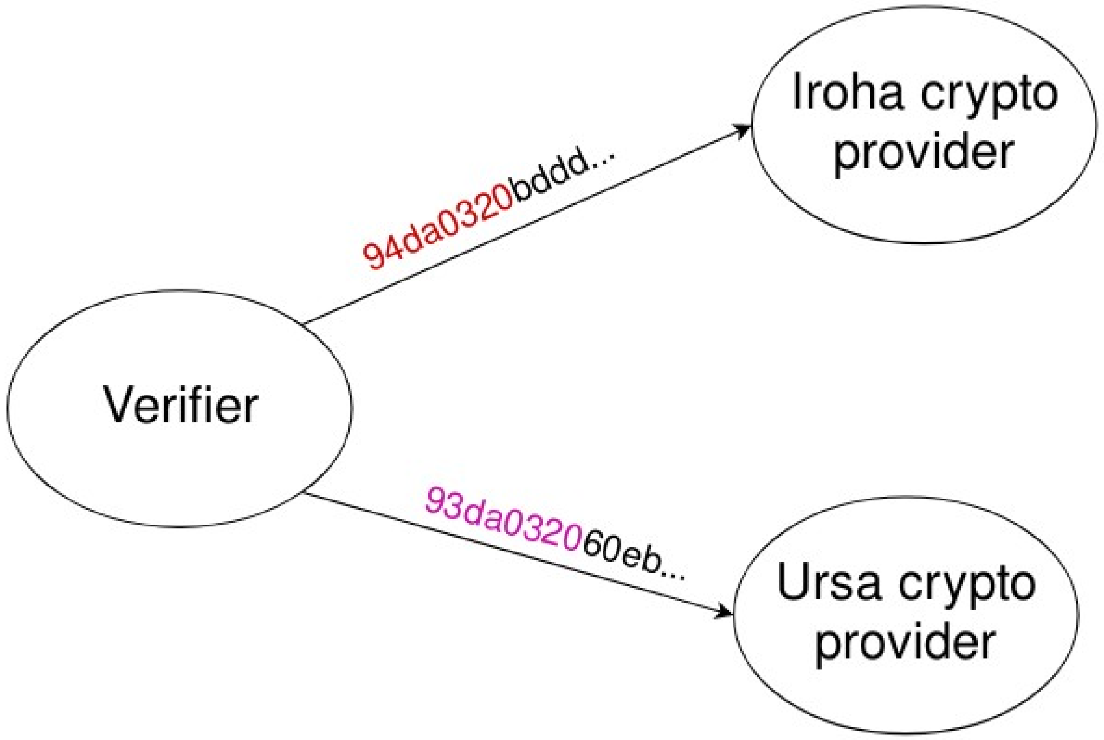
- **Project Description**: Encode keys & sigs so Iroha knows which crypto provider to use



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- **Project Objectives**:
  - Obj 1: Integrate Ursa into Iroha’s build process
  - Obj 2: Interface with Ursa’s ed25519 functions
  - Obj 3: Maintain support for both Iroha-crypto and Ursa-crypto
  - Obj 4: Allow users to configure crypto backend with a simple option

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- **Project Deliverables:**
  - Deliverable 1: Add Ursa to cmake build system (Iroha PR #126)
  - Deliverable 2: FFI documentation edits & bug fix (Ursa PR #39,44)
  - Deliverable 3: Integrate Ursa as an Iroha crypto provider (Iroha PR #184)
  - Deliverable 4: Integrate Multihash library (Iroha PR #263)
  - Deliverable 5: Add configuration file option to switch between Iroha and Ursa crypto (In progress)

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- **Project Execution & Accomplishments**:

  - Deliverables 1 – 4 accomplished
  - Most challenging was implementing the multihash encoding.
  - Documented best practices for using the Ursa FFI from C/C++ in a memory-safe way. Added & used a missing FFI function that could have led to memory leak bugs without it.

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- **Recommendations for future work:**

  - Support compiling Ursa through Iroha’s build system in non-Unix environments
  - Improve documentation for using Ursa crypto provider
  - Support Ursa-compatible ed25519 in Iroha’s client libraries