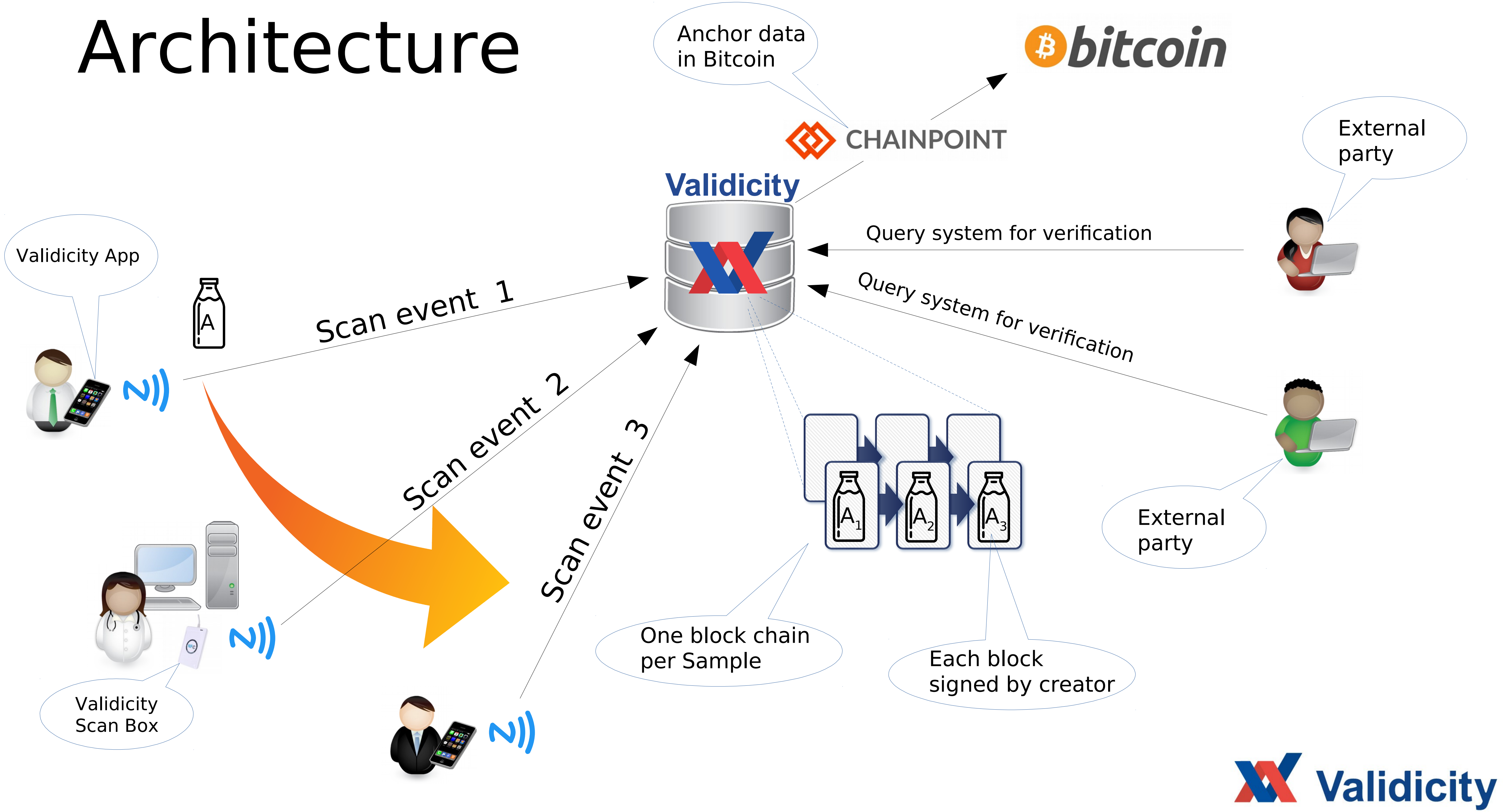
Validicity System

Secure chain of custody using block chain technology

Properties

- Sample handling using **NFC** scanning of RFID tag
- Fully immutable Sample data trail in block chains
- Independently **provable data correctness** with timestamps
- Easy to deploy, manage and integrate with other systems
- Easy for external parties to query and verify data trails

Architecture



Validicity System Components

- Validicity Server ✓
- Validicity Tool ✓
- Validicity Client ✓
- Validicity Scan Box ✓
- Validicity App ✗
- Validicity Chainlink ✗
- Validicity Query ✗

Creating the Sample trail

- Samples are scanned using NFC with the Validicity App or Scan Box
- The scan event creates a new Sample **block** of data
- Each Sample has its own **block chain** representing the custody log
- The Validicity Server stores the block chain for the Sample

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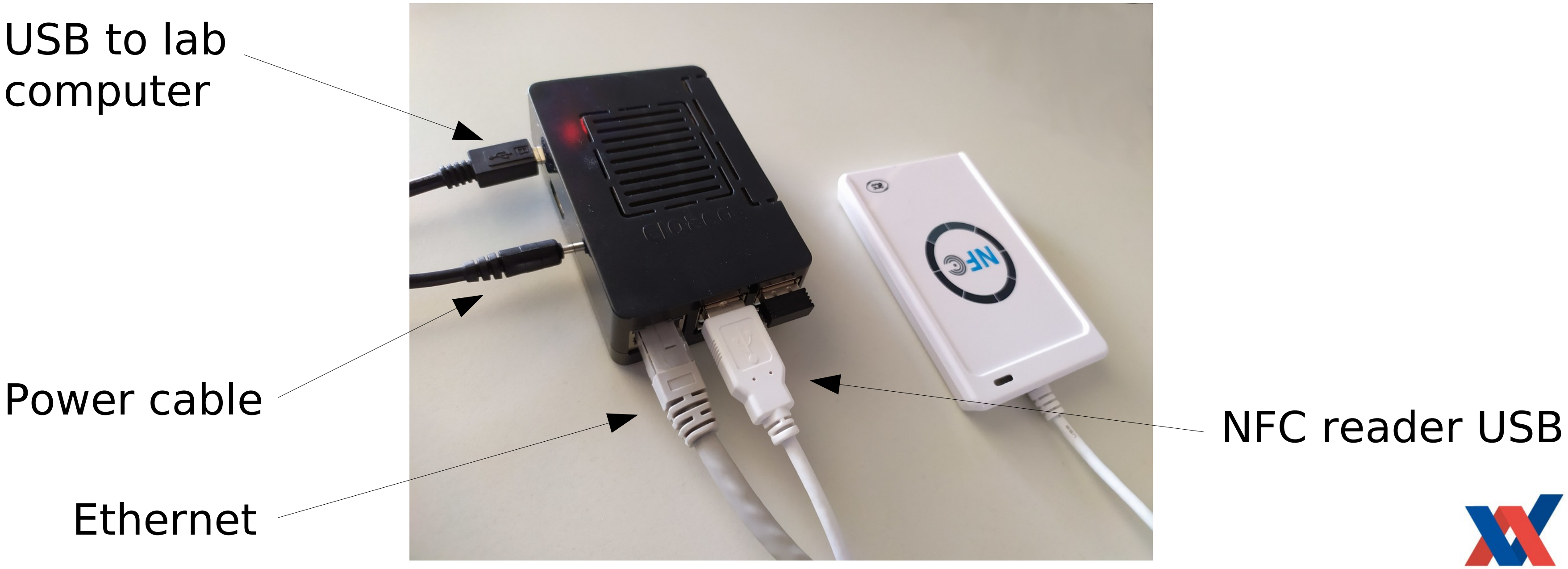
Validicity Scan Box

- The scan box is an ODROID C2 embedded Linux device with an attached ACR122U NFC reader
- The scan box emulates a keyboard and is attached using a USB cable to a lab computer



USB to lab computer

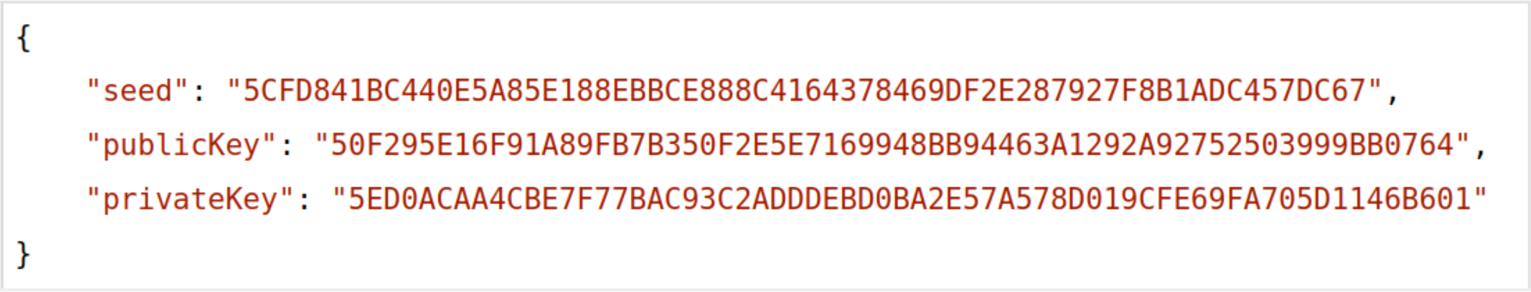
Power cable

Ethernet

NFC reader USB

Validicity Client

- The client software for the Scan Box is written in Dart
- The service scans continuously for RFID tags
- When a new Client is added to a system we need to:
  1. On server: Create an account in with OAuth2 credentials
  2. On box: Enter credentials in the `validicity.yaml` config file
  3. On box: Create keys using the `createkeys` command
  4. On box: Register public key in server using the `register` command



```
{
    "seed": "5CFD841BC440E5A85E188EBBCE888C4164378469DF2E287927F8B1ADC457DC67",
    "publicKey": "50F295E16F91A89FB7B350F2E5E7169948BB94463A1292A92752503999BB0764",
    "privateKey": "5ED0ACAA4CBE7F77BAC93C2ADDDEBD0BA2E57A578D019CFE69FA705D1146B601"
}
```

Scanning a Sample

When the scan box scans an RFID tag it has not scanned in the last 5 seconds it performs the following in a fraction of a second:

1. Queries the Validicity Server API for the last block for this ID
2. Creates a new block including hash of the last block
3. Computes a hash of all pertinent fields in the block
4. Creates a signature for this hash using the private key
5. Submits this new block to the Validicity Server API
6. If all goes well, “types” the ID on the lab computer

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Anchoring the Sample trail

- The blocks of data constitutes an immutable chain

  … but could still be artificially constructed “in retrospect”!
- This is why the data is also, at regular intervals, “anchored” to a **publically secured** block chain – the Bitcoin network
- Anchoring is performed using Chainpoint, an open standard
- An anchor creates a “timestamp proof” of data

External Party Verification

- An external party can verify correctness using the Validicity API
- This is done using an Open Source query tool that can easily be installed and used by any party given access to the API
- The fact that the source code of the query tool is Open Source guarantees that it does indeed work as claimed

Technology

- Server runs on Linux easily deployable in any server or cloud
- System is written in Dart and uses industry standard PostgreSQL
- The API is a standard REST/JSON API with OAuth2 authentication
- Scan Box runs embedded Linux with software in Dart

Block chain technology

NANO

- All cryptographical code and algorithms in Validicity is the same as used by the Nano crypto currency
- Nano has to date 50 million blocks in its public ledger and zero incidents while being in operation in 5 years
- Nano is the fastest crypto currency to date
- Using the same algorithms and code is a deliberate choice to ensure safety and reliability

Links

- https://nano.org
- https://chainpoint.org
- https://www.postgresql.org
- https://dart.dev