CubeCrypt - An Open-Source Implementation of Self-Signed ECC Certificates for CubeSat Telecommunication

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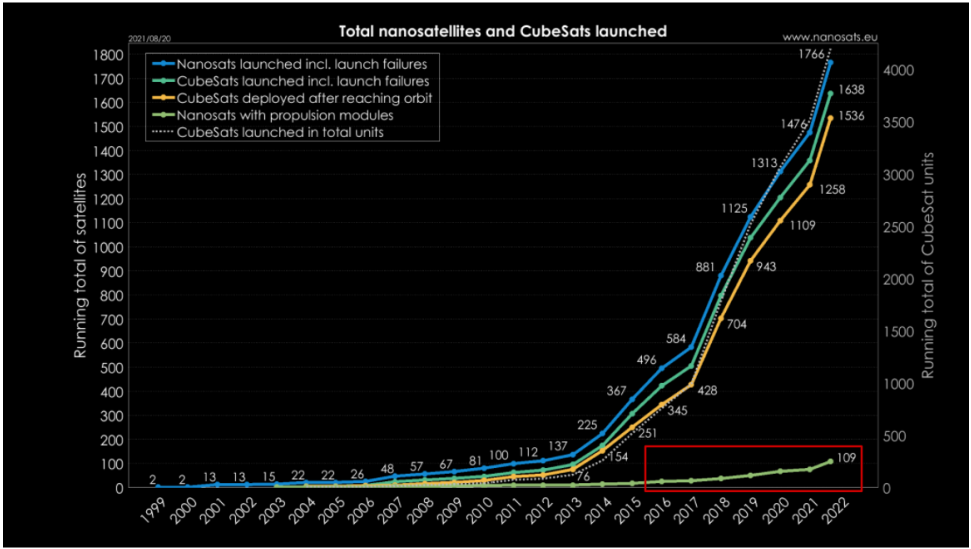
Cubesats: A Reason for Concern ?

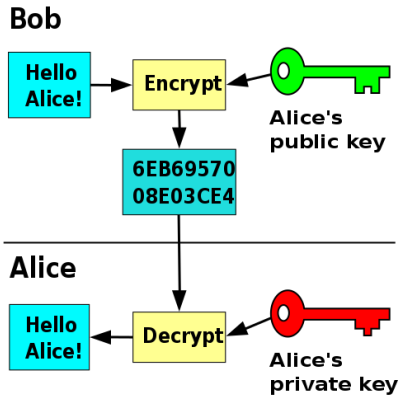


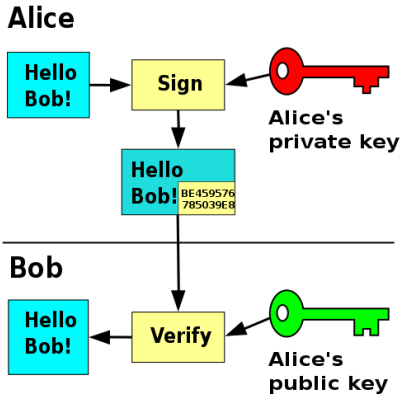
Source: [Erik Kulu 2021]

What is Public Key Cryptography ?

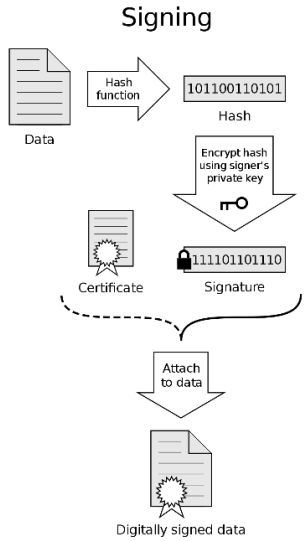
Definition

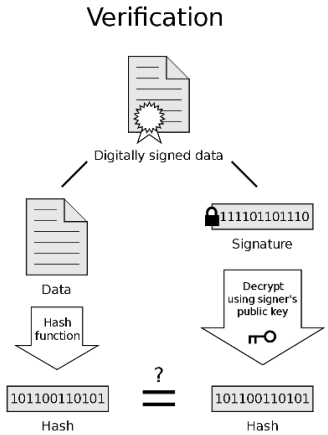
Public key (asymmetric) cryptography uses pairs of private and public keys to **encrypt** or **authenticate** data





Self-Signed Digital Certificates





If the hashes are equal, the signature is valid.

State of the Art

Examples

Uplink control of NUTS (Norwegian Cubesat)

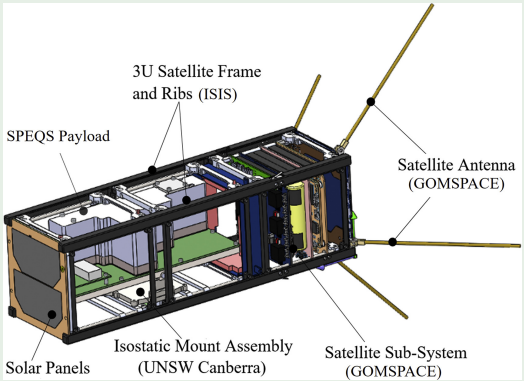
- Investigate nanosatellite cryptography
- **Symmetric key** encryption

Source: [Sandesh Prasai 2012]

State of the Art

Examples

SpooQySats: CubeSat quantum key distribution



- Entangled photon pairs
- **Symmetric key** distribution

Source: [James A. Grieve 2018]

State of the Art

Examples

A security system for satellite networks by [H. S. Cruickshank 1996]:

- Asymmetric cryptography
- Certificate authentication
- **Large** satellite implementation

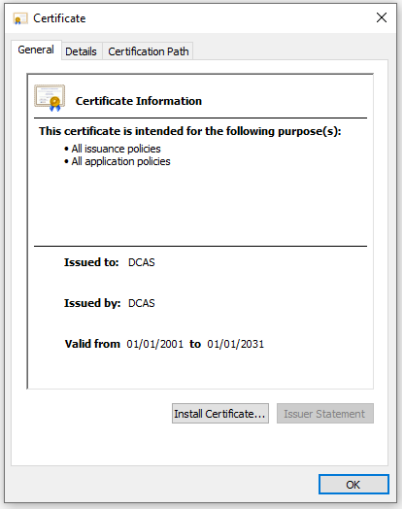
Current State

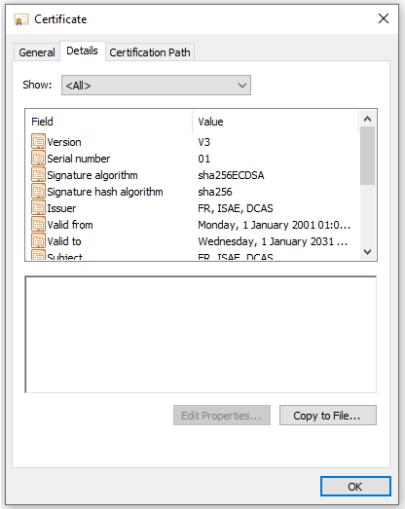
- Able to generate cryptographic **key-pairs** & **self-signed certificates**

```
-----BEGIN EC PRIVATE KEY-----
MIHcAgEBBEIAjrWaWKyDV8Vk0wVqhUzoD8YLtiovDizJtFIb66s6okAEwUz5vo04
VDxrSJFYY9gZ6l/gDv0pHfmTUOnqtMMw122gBwYFK4EEACOhgYkDgYYABAHAUnaK
7VBSyG4H4ncWNkGVo//e/UAembr2uzatQIG+IMge0vXIhOX3qlhjk0BjVP6H8w72
8417lrLKmrwG8SswtwDtQwGmlwzDqzHRAL8pJbBGzr8Dz63pFjjhlDZfRoxf7SzU
z8nBeLivYCHhzmPyI9Dqtl1/w++urFJXCSuGfKU1NA==
-----END EC PRIVATE KEY-----
```

Current State

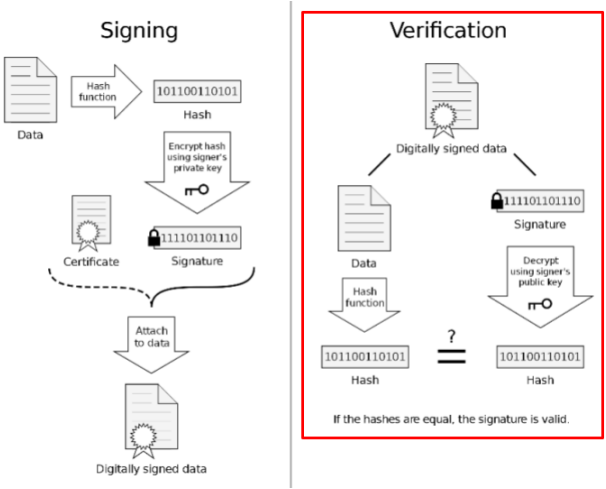
- Able to generate cryptographic **key-pairs** & **self-signed certificates**





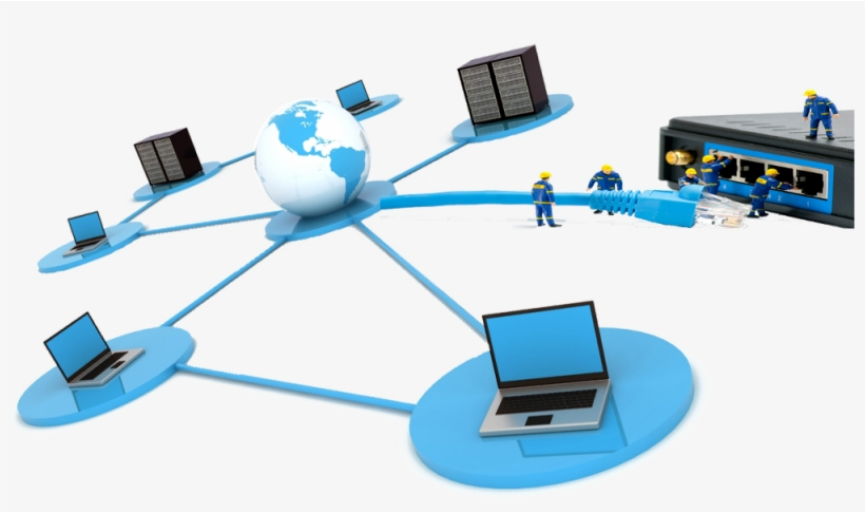
Next Steps

- Signature verification implementation



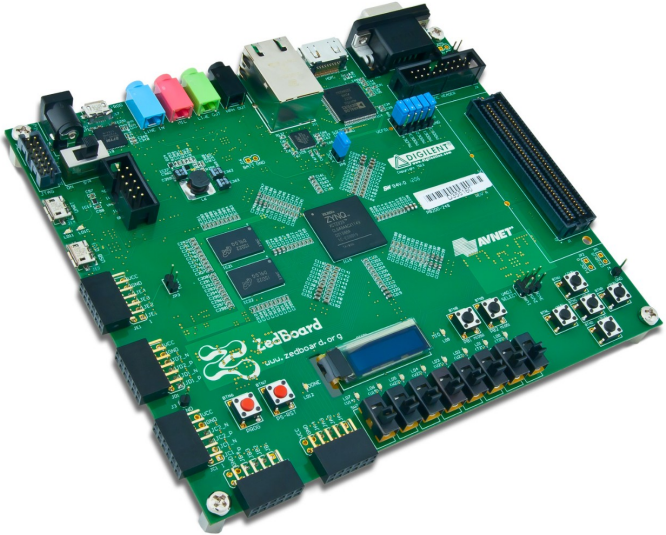
Next Steps

- On-Ground communication testing



Next Steps

- Bare-metal embedding into Zedboard

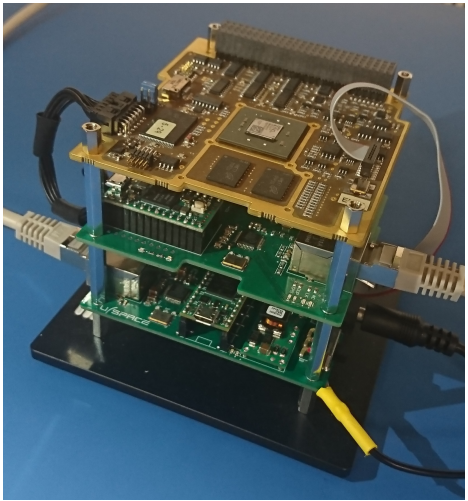


Next Steps

- Benchmark ECC curves for performance and memory usage

Next Steps

- Implementation into ISAE-SUPAERO's Ninano board*



Next Steps

- Publish final results

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Thank you for your attention !

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