Building Light but not Weak Protections for the IoT

Léo Perrin

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CryptoLux.org

The Internet is about exchanging messages

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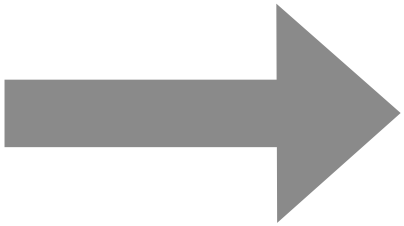
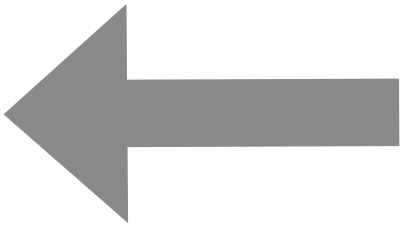
Show me my bank website



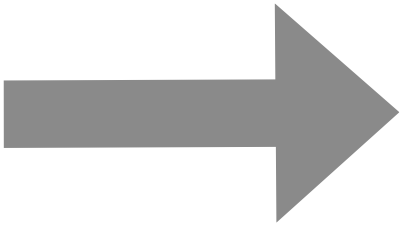
The Internet is about exchanging messages

Here is the file you wanted



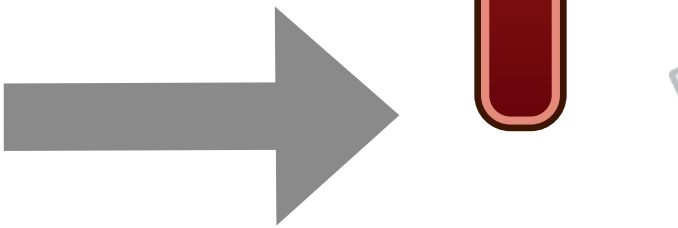
The Internet is about exchanging messages

Here are my credentials

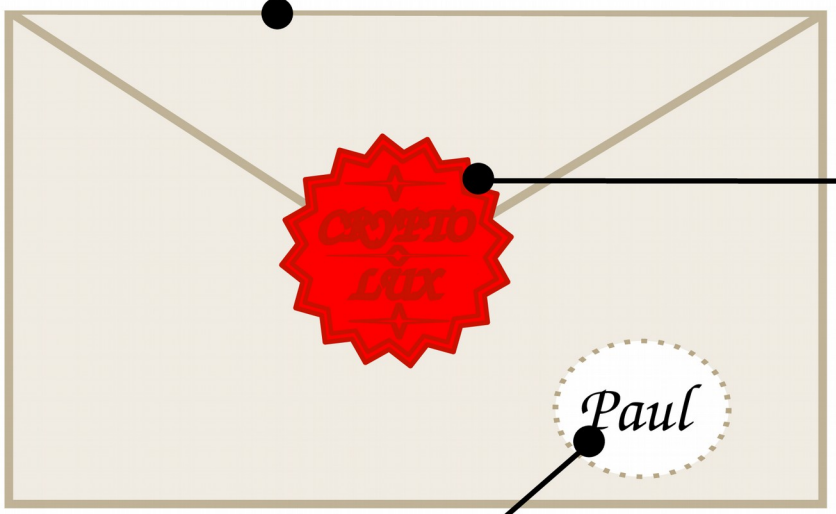


The Internet is about exchanging messages

Here are her credentials!
Mwahaha!



Cryptography protects messages



Envelope: **Confidentiality**
(nobody can read it)

Seal: **Integrity**
(nobody can modify it)

Signature: **Authentication**
(it was written by the right person)

Cryptography in practice

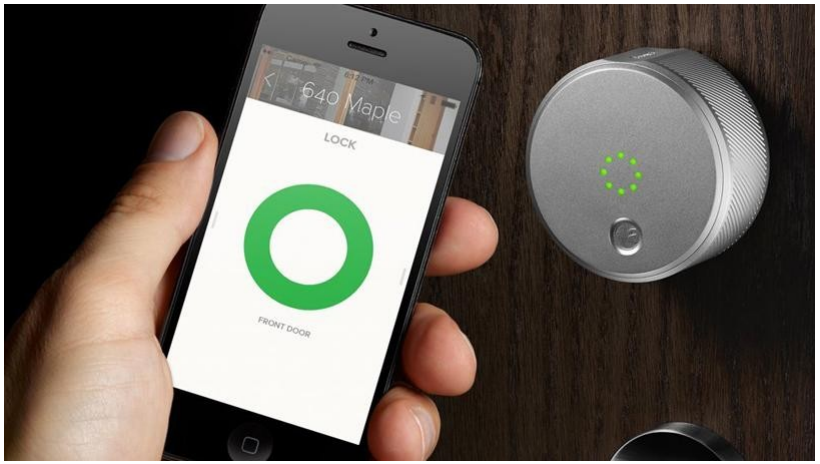
- Paper has become **bits**.
- Envelope, seal and signatures have become **algorithms**.
- Algorithms have a **cost** (time, RAM consumption…).

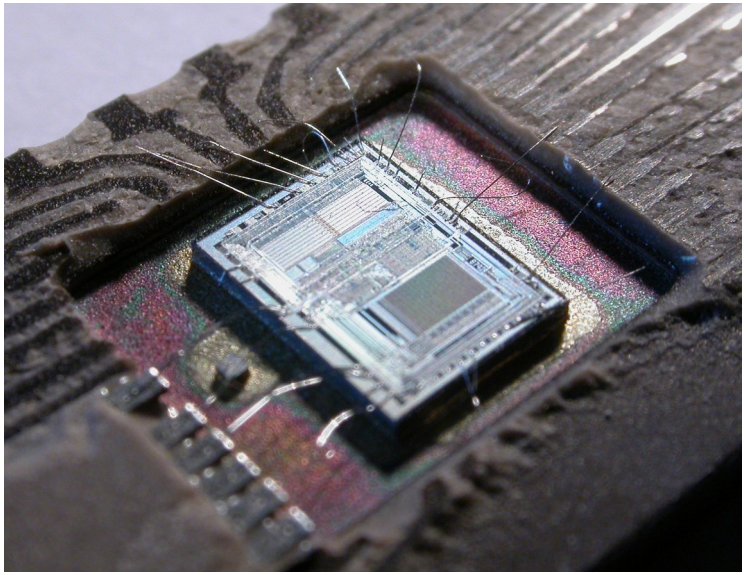
```
void sparx_encrypt(uint16_t * x, uint16_t k[][2*ROUNDS_PER_STEPS])
{
    uint8_t s, r, b;

    s=0; b=0; r=0;
    for (s=0 ; s<N_STEPS ; s++)
    {
        for (b=0 ; b<N_BRANCHES ; b++)
        {
            for (r=0 ; r<ROUNDS_PER_STEPS ; r++)
            {
                x[2*b  ] ^= k[N_BRANCHES*s + b][2*r    ];
                x[2*b+1] ^= k[N_BRANCHES*s + b][2*r + 1];
                A(x + 2*b, x + 2*b+1);
            }
        }
        L(x);
    }
    for (b=0 ; b<N_BRANCHES ; b++)
    {
        x[2*b  ] ^= k[N_BRANCHES*N_STEPS][2*b  ];
        x[2*b+1] ^= k[N_BRANCHES*N_STEPS][2*b+1];
    }
}
```

Connecting devices : the IoT

Computers are replaced by micro-controllers, RFID tags...





Things with very little computing power !

Light but not weak protection

When cryptography is
too expensive...

...**Lightweight** cryptography
comes to the rescue !

Lightweight cryptography

We know how to make cryptographic **steel plates**

We need to invent cryptographic **carbon fiber**

Standardization process started

NIST Issues First Call for ‘Lightweight Cryptography’ to Protect Small Electronics

April 18, 2018

Cryptography experts at the National Institute of Standards and Technology (NIST) are kicking off an effort to protect the data created by innumerable tiny networked devices such as those in the “internet of things” (IoT), which will need a new class of cryptographic defenses against cyberattacks.

Credit: N. Hanacek/NIST

https://www.nist.gov/news-events/news/2018/04/nist-issues-first-call-lightweight-cryptography-protect-small-electronics

A new challenger appears!

Sparx MARK II

Joint work with

A. Biryukov, C. Beierle, J. Großschädl, A. Udovenko, Q. Wang

- Efficient on all micro-controllers
- Uses state of the art design approaches (sponge...)
- Based on **Sparx**, which we designed during my PhD

More importantly...

Congratulations!