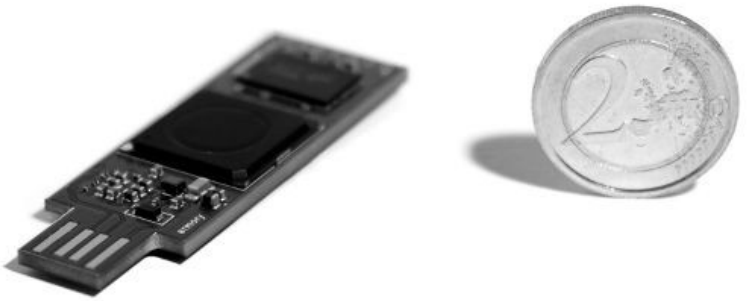
INVERSE PATH

Forging the USB armory

Andrea Barisani
<andrea@inversepath.com>



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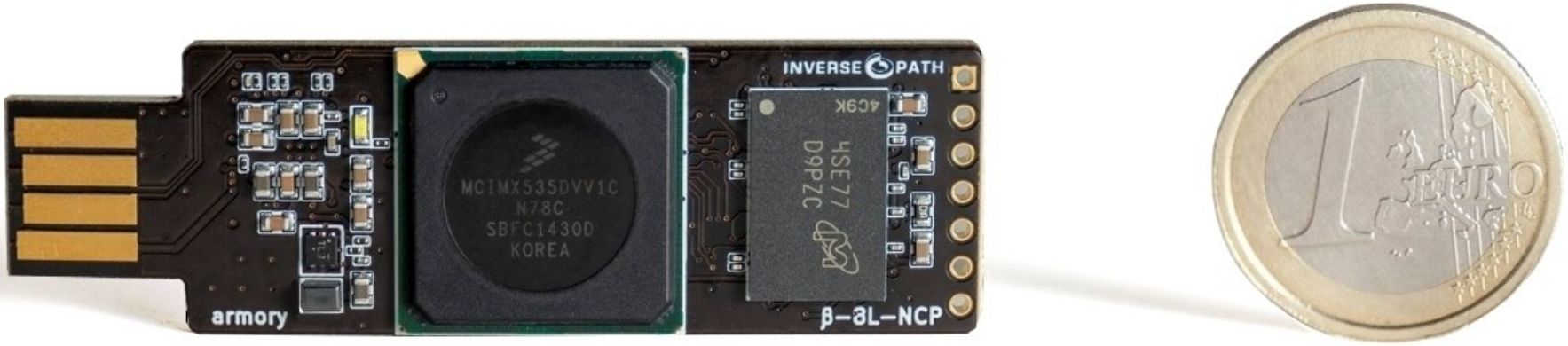

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Designed for personal security applications

- mass storage device with advanced features such as automatic encryption, virus scanning, host authentication and data self-destruct
- OpenSSH client and agent for untrusted hosts (kiosk)
- router for end-to-end VPN tunneling, Tor
- password manager with integrated web server
- electronic wallet (e.g. pocket Bitcoin wallet)
- authentication token
- portable penetration testing platform
- low level USB security testing

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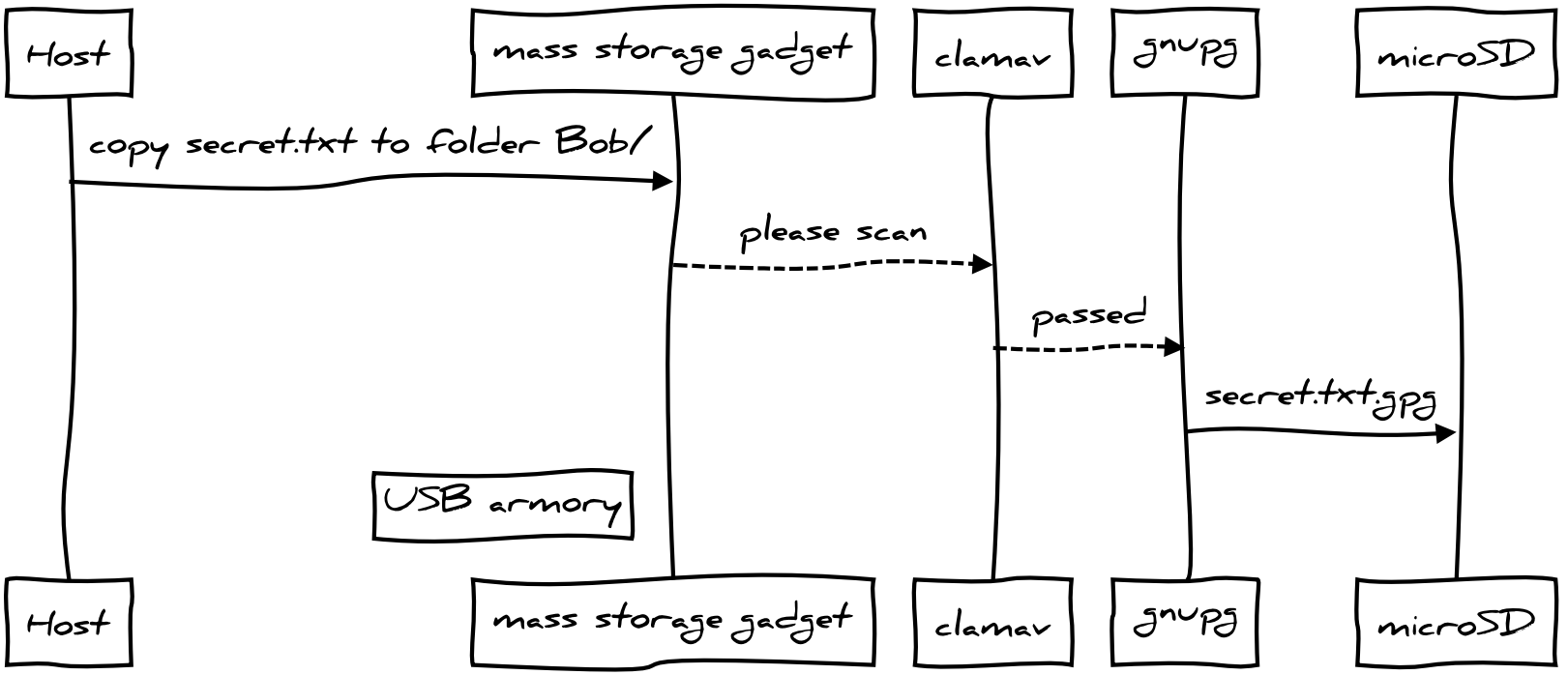
enhanced mass storage



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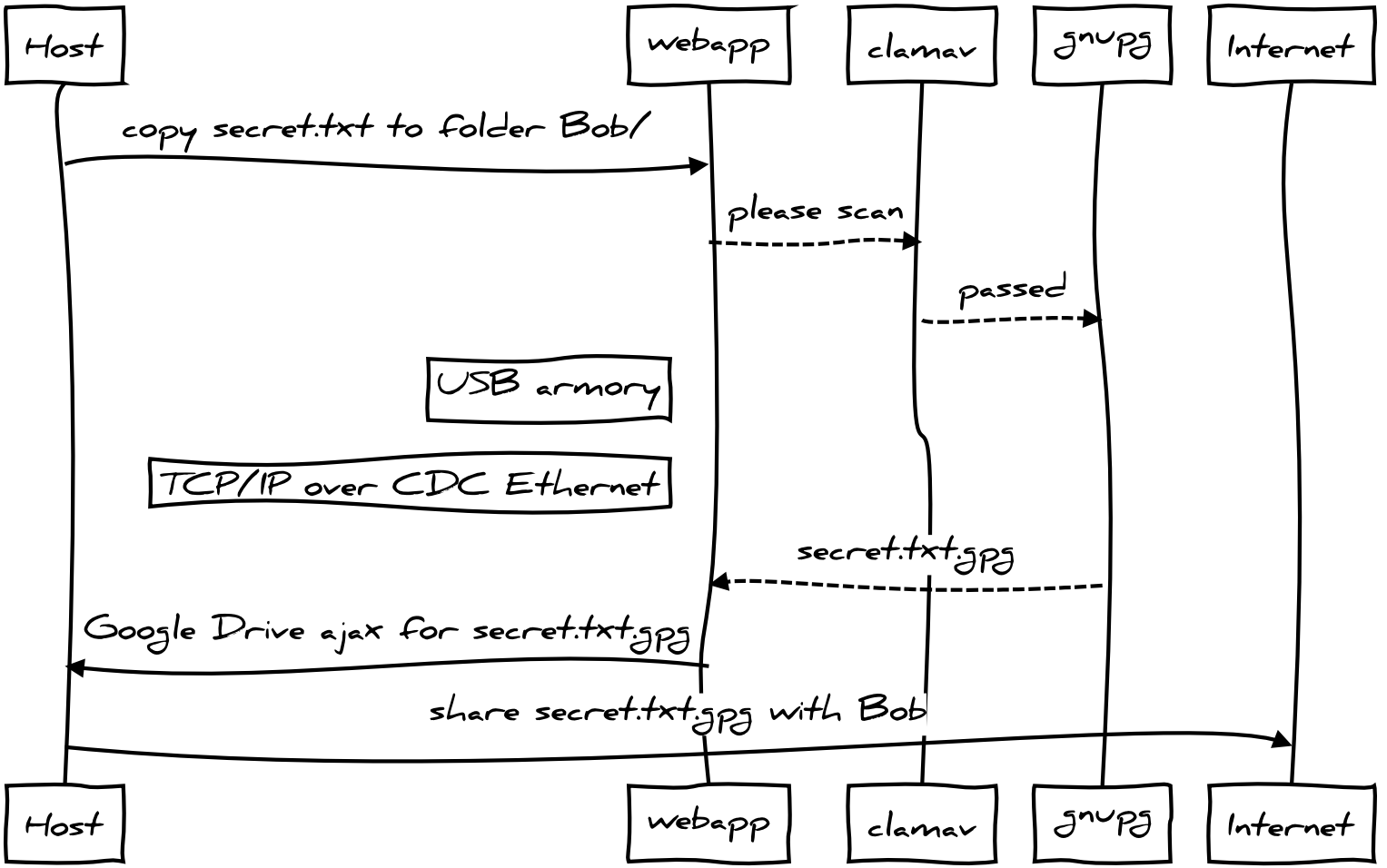
enhanced mass storage



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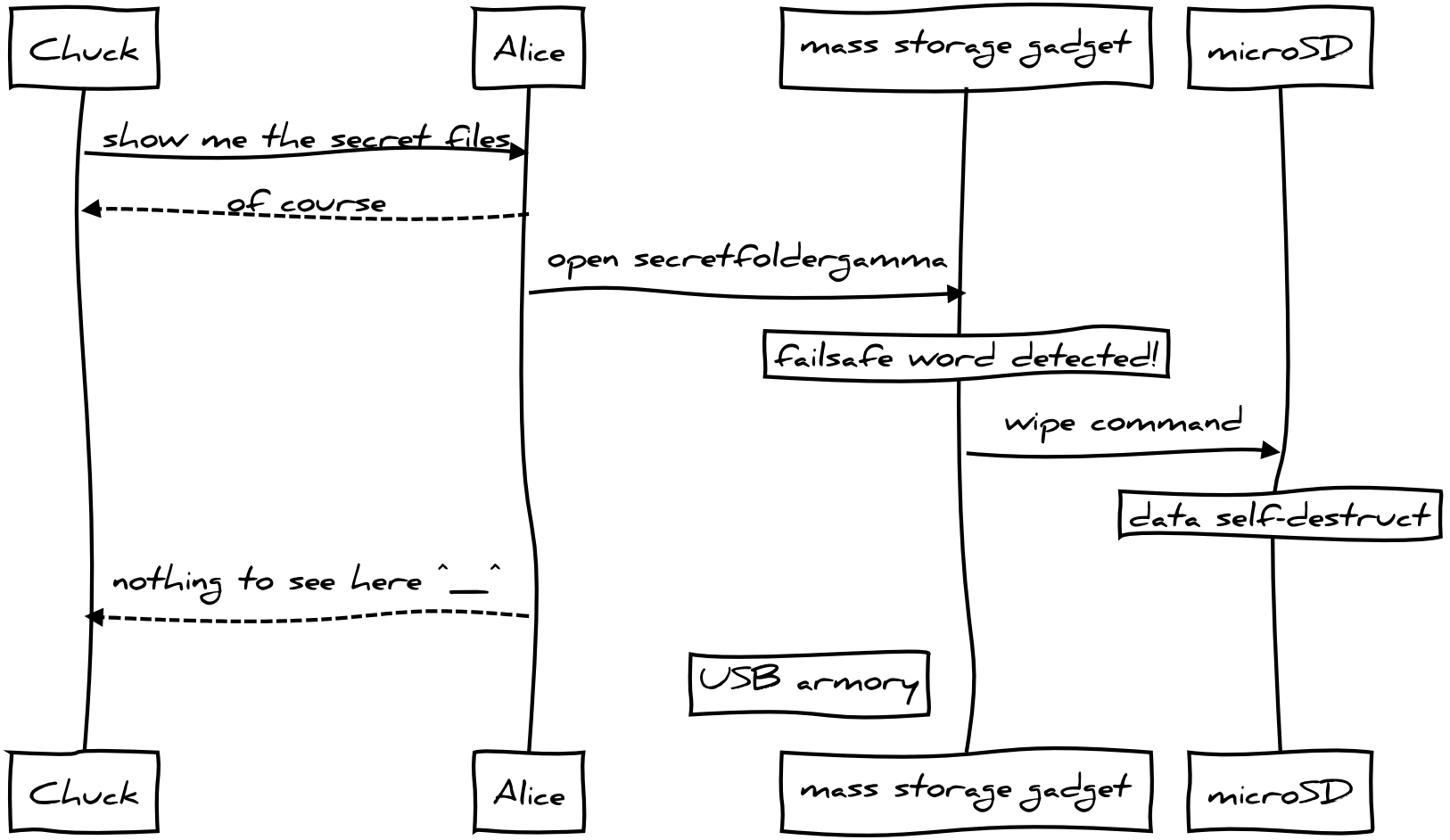
enhanced mass storage



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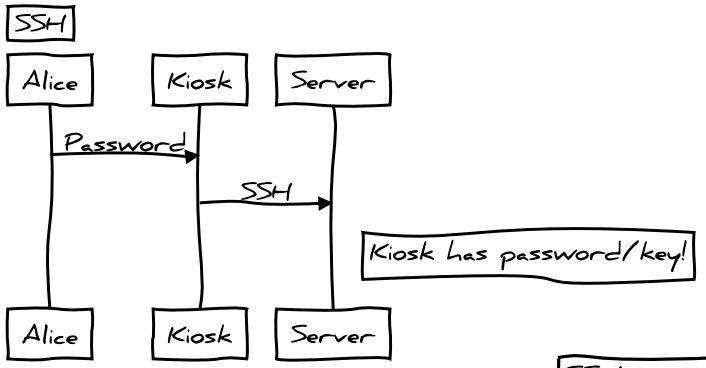
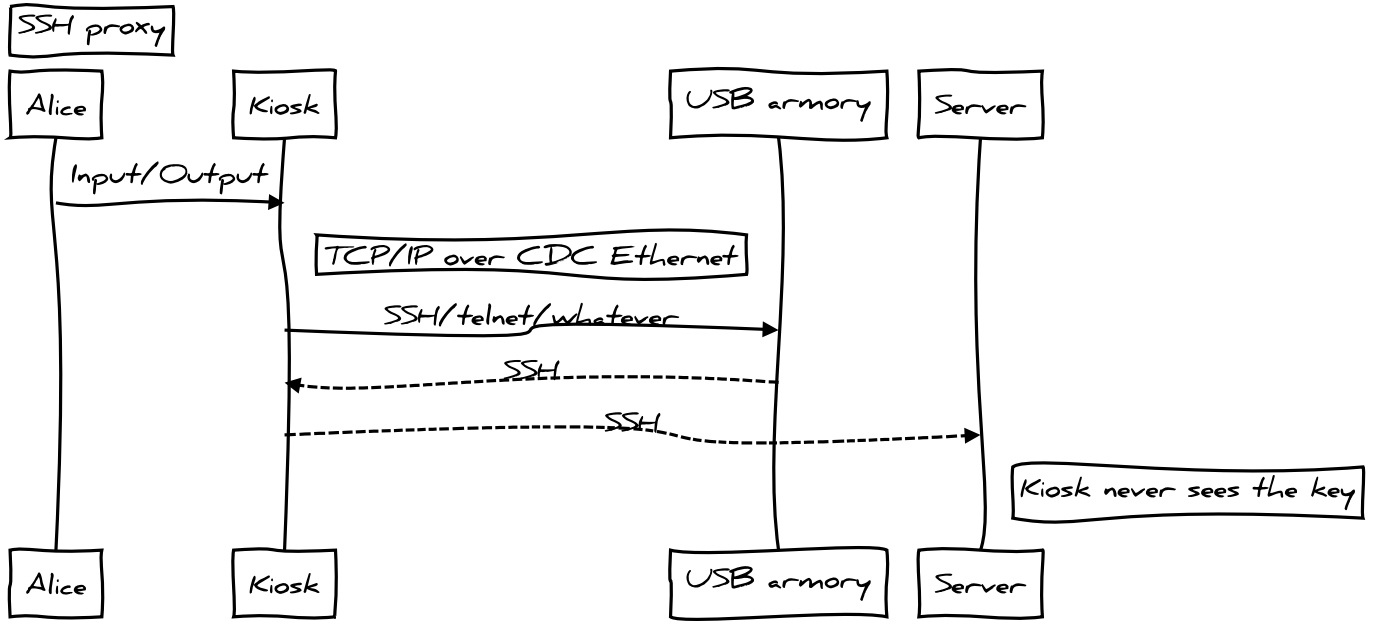
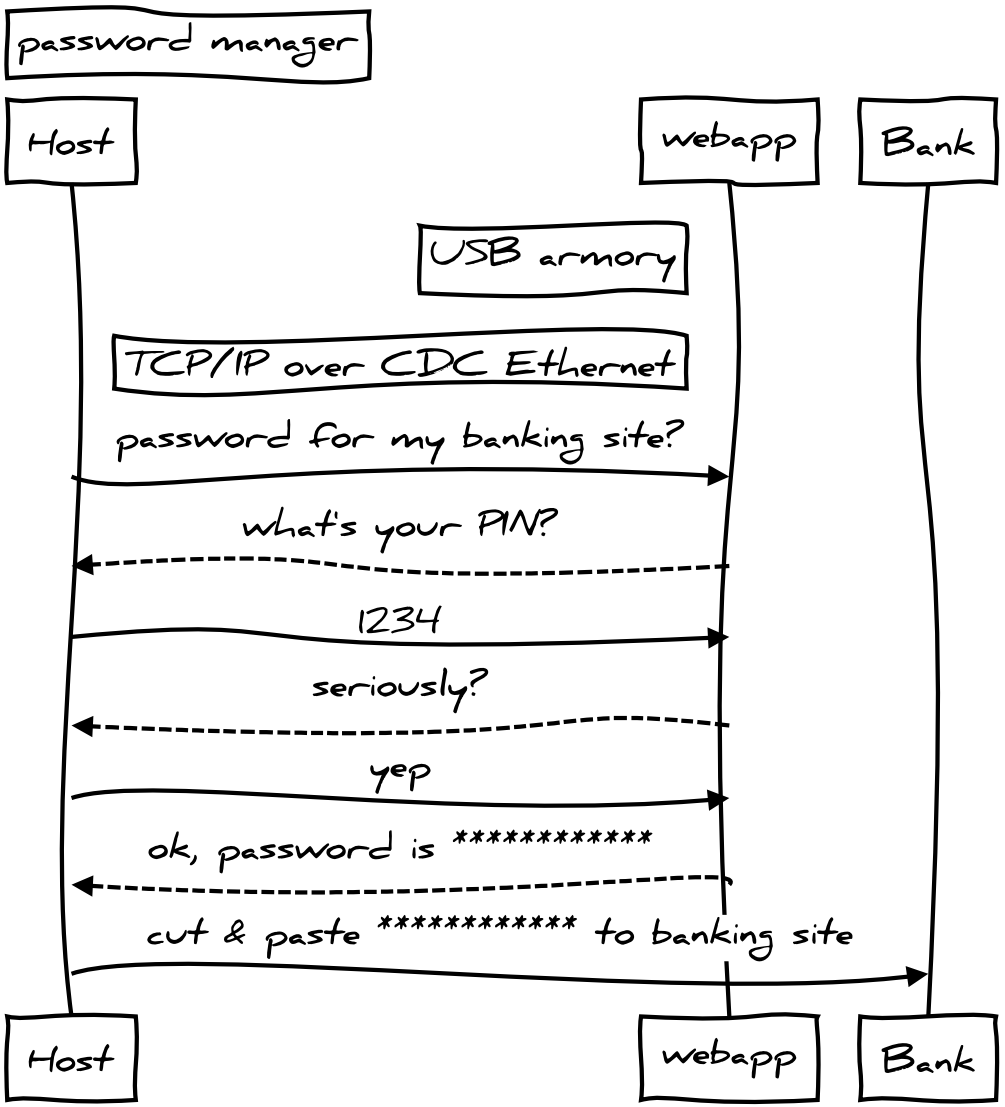
SSH proxy







password manager

**trivial example, better options planned*

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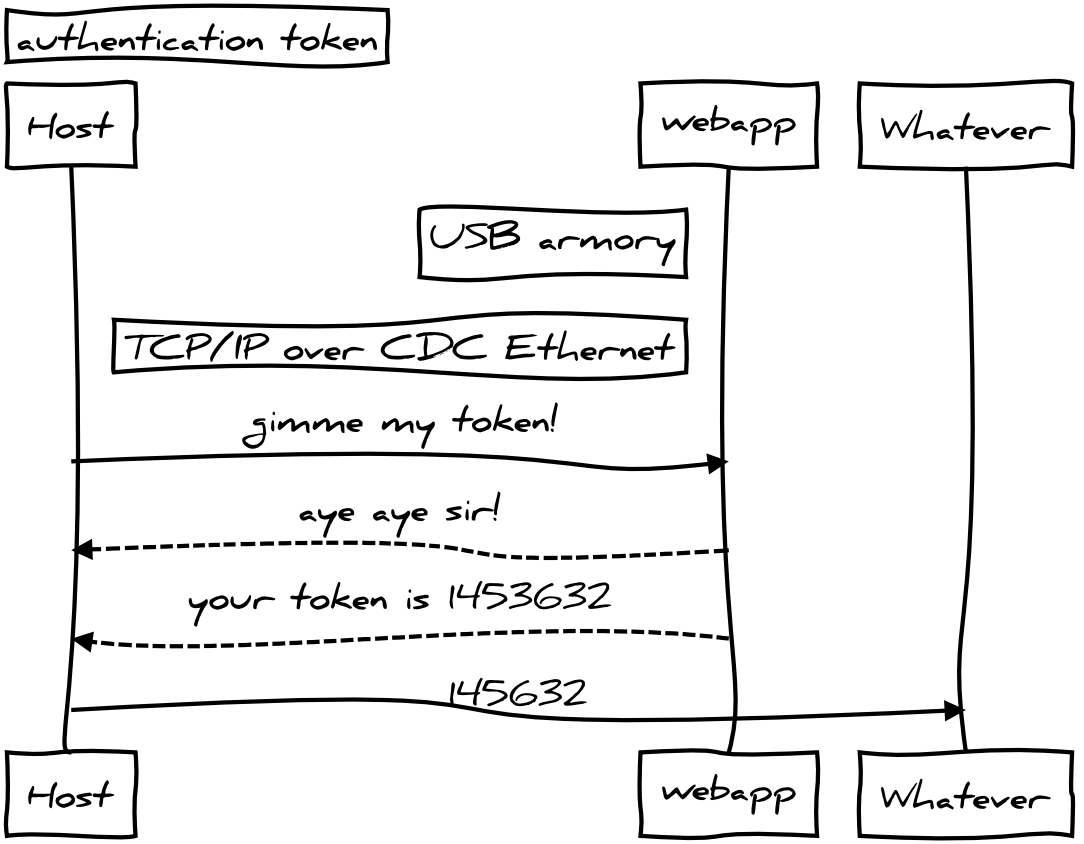
authentication token



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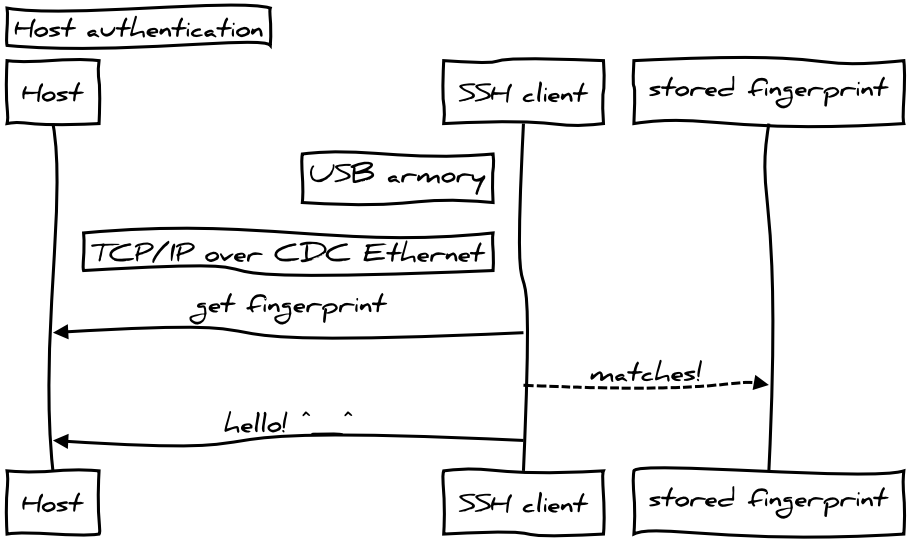
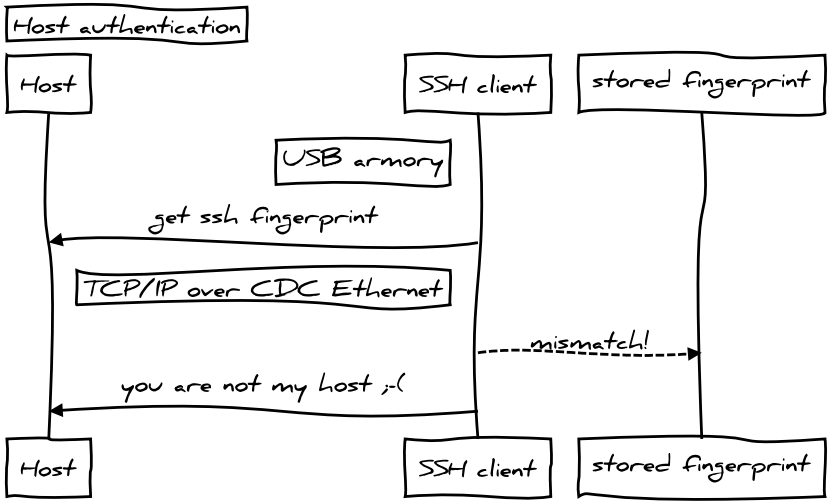
USB device authenticates host





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Design goals

Compact USB powered device

Fast CPU and generous RAM

Secure boot

Standard connectivity over USB

Familiar developing/execution environment

Open design

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Selecting the System on Chip (SoC)

Freescale i.MX53

- ARM® Cortex™-A8 800-1200 Mhz
- almost all datasheets/manuals are public (no NDA required)
- Freescale datasheets are “ok” (far better than other vendors)
- ARM® TrustZone®, secure boot + storage + RAM
- detailed power consumption guide available
- excellent native support (Android, Debian, Ubuntu, FreeBSD)
- good stock and production support guarantee

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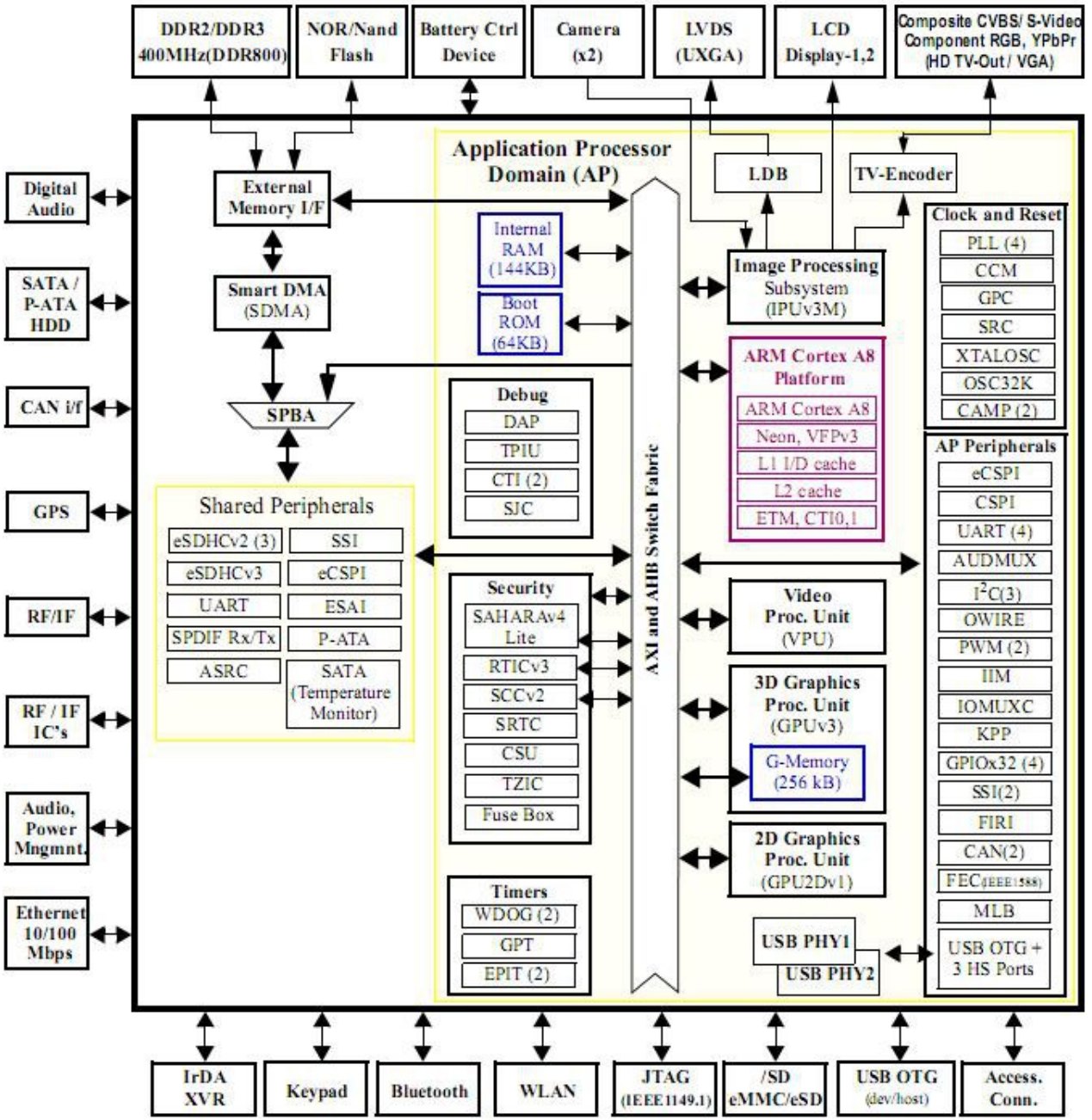

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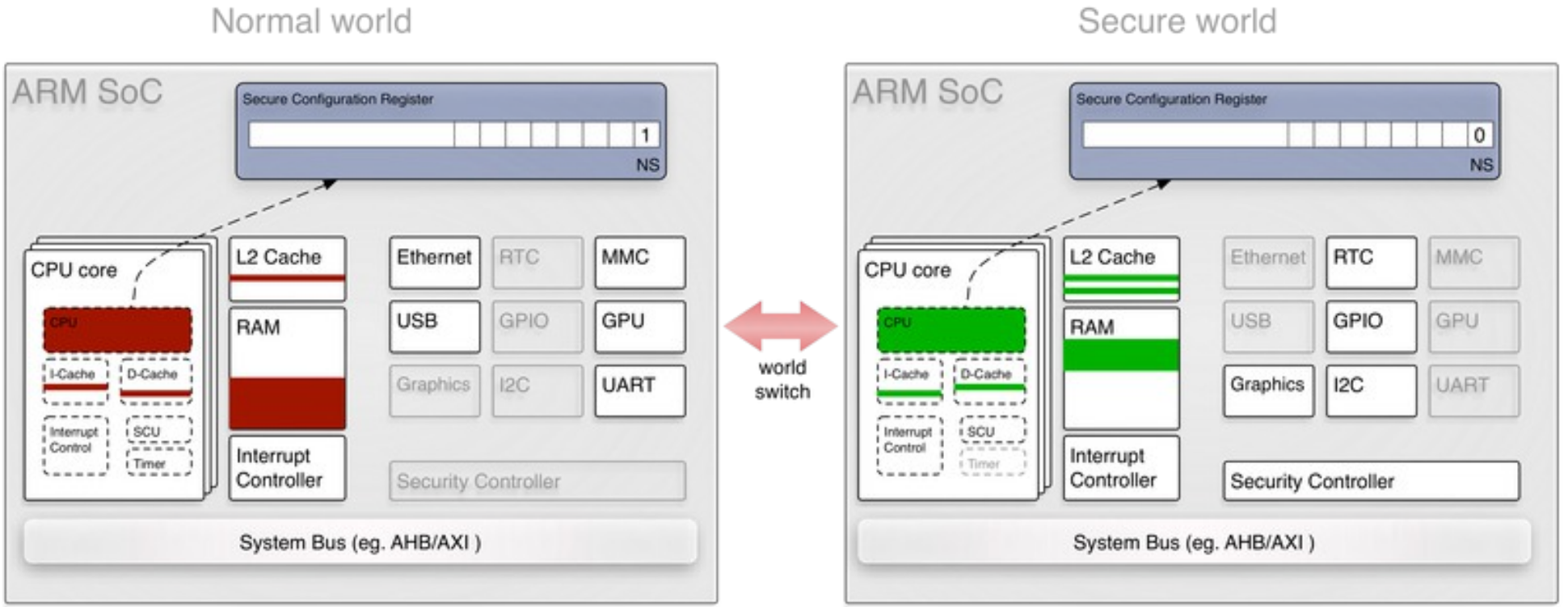
ARM® TrustZone®



http://genode.org/documentation/articles/trustzone

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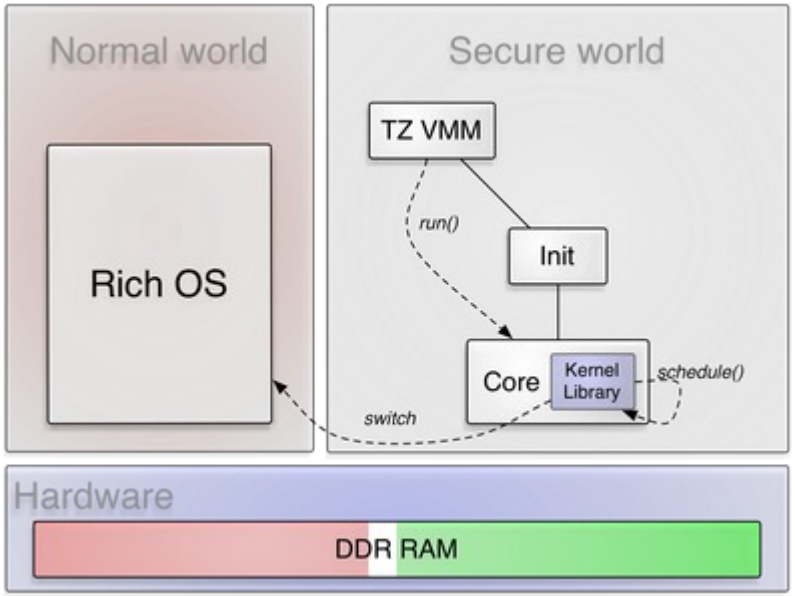
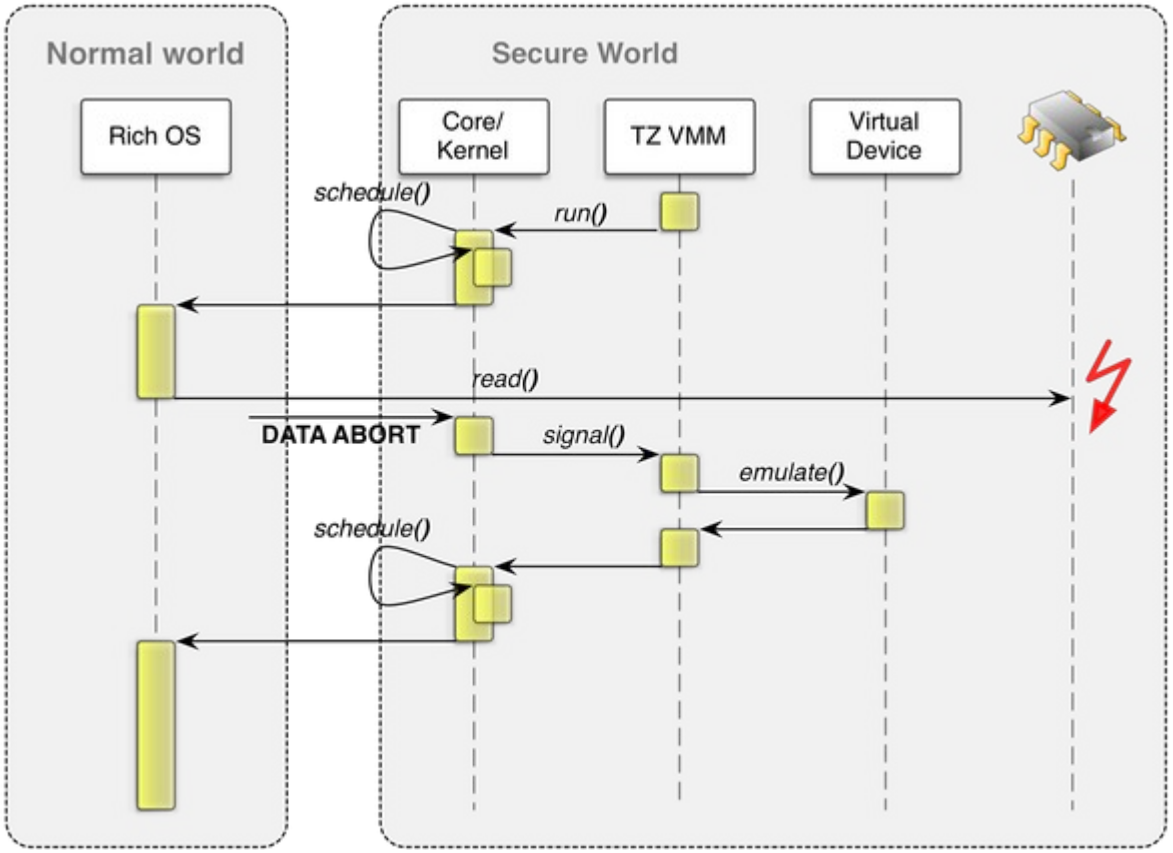
ARM® TrustZone®





http://genode.org/documentation/articles/trustzone

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Development time-line

- 2014/01: first concept idea (based on Atmel SoCs)
- 2014/03: schematics development begins (Freescale chosen)
- 2014/04: PCB layout for breakout/prototyping board
- 2014/08: alpha board order
- 2014/09: USB armory alpha board delivery & evaluation
- 2014/10: project announcement
- 2014/10: order for 7 optimized beta revisions
- 2014/11: beta boards delivery & evaluation
- 2014/11: design finalization, Mk I production candidate order
- 2014/12: Mk I delivery
- 2015/01: first batch production

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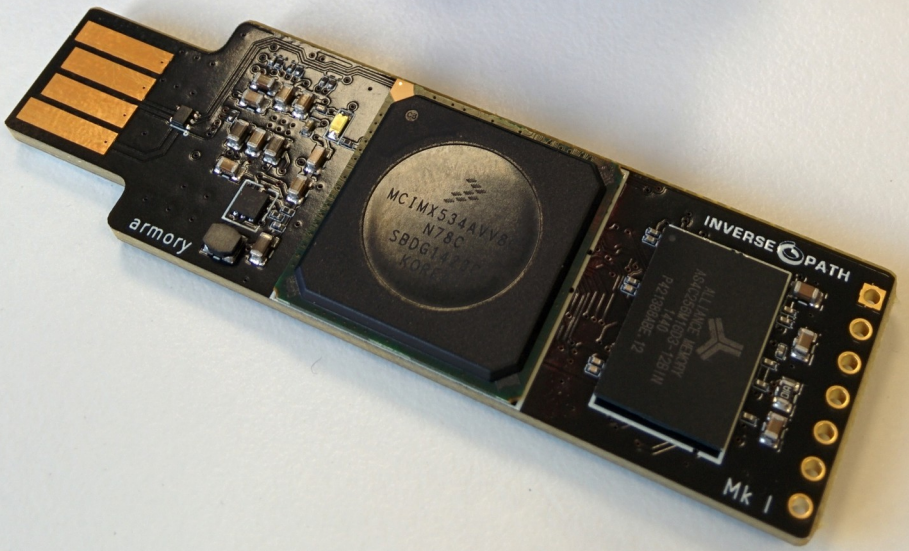


open source hardware

open source

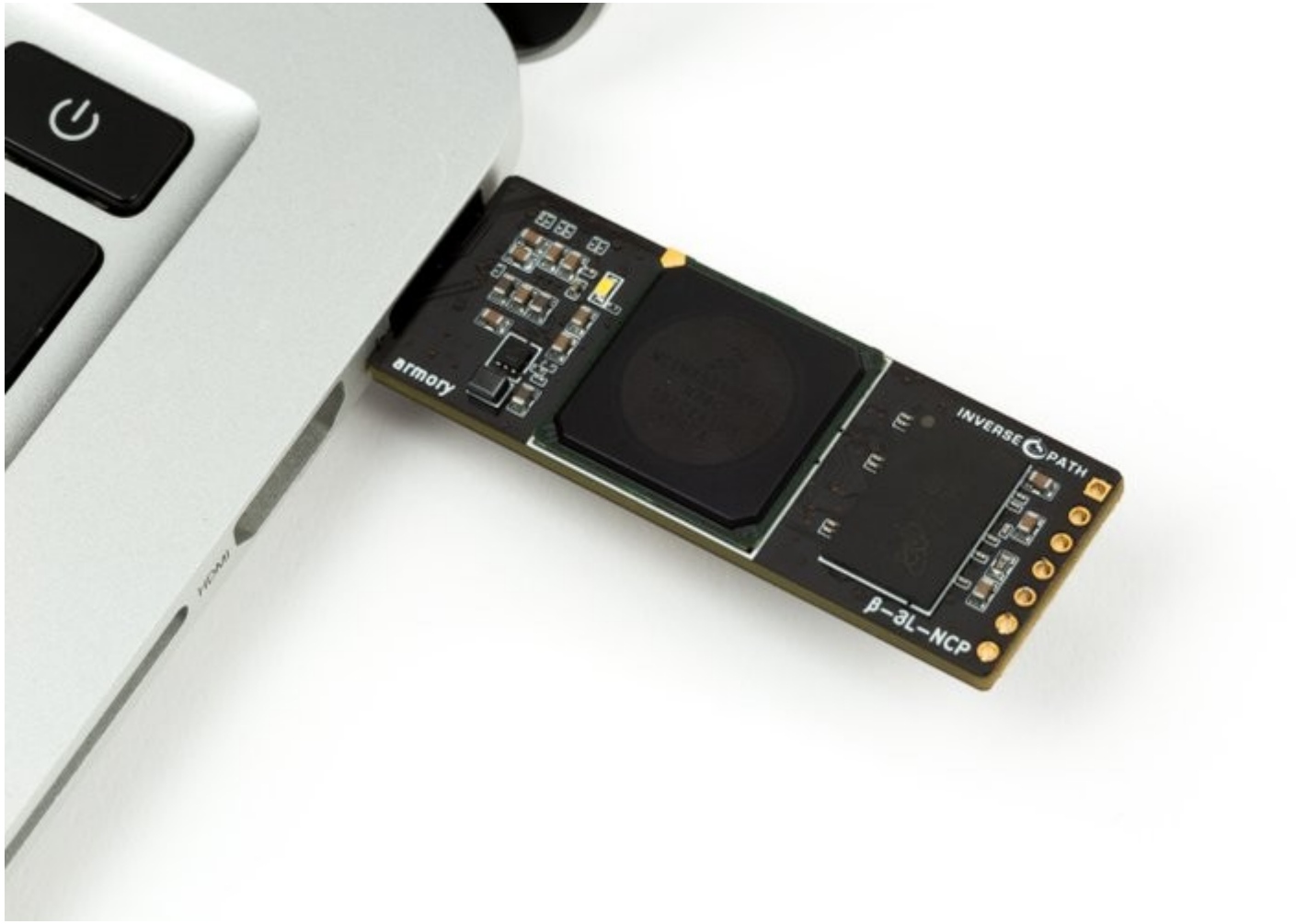
http://inversepath.com/usbarmory

Forging the USB armory

INVERSE PATH

USB armory - Open source flash-drive-sized computer

- Freescale i.MX53 ARM® Cortex™-A8 800Mhz, 512MB DDR3 RAM
- USB host powered (<500 mA) device with compact form factor (65 x 19 x 6 mm)
- ARM® TrustZone®, secure boot + storage + RAM
- microSD card slot
- 5-pin breakout header with GPIOs and UART
- customizable LED, including secure mode detection
- excellent native support (Android, Debian, Ubuntu, FreeBSD)
- USB device emulation (CDC Ethernet, mass storage, HID, etc.)
- Open Hardware & Software



device mode

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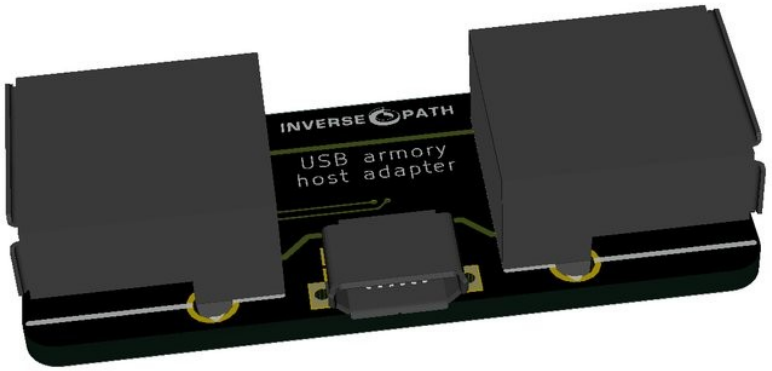
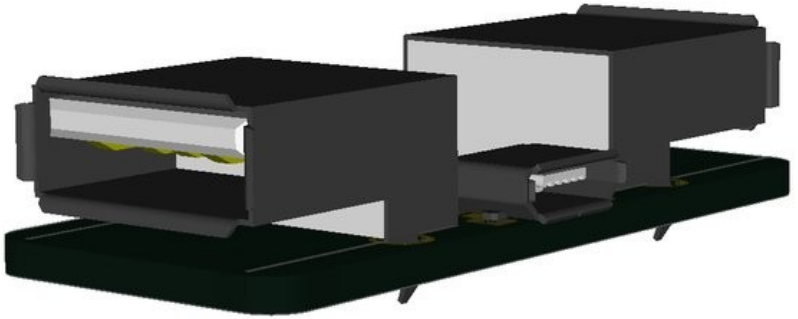
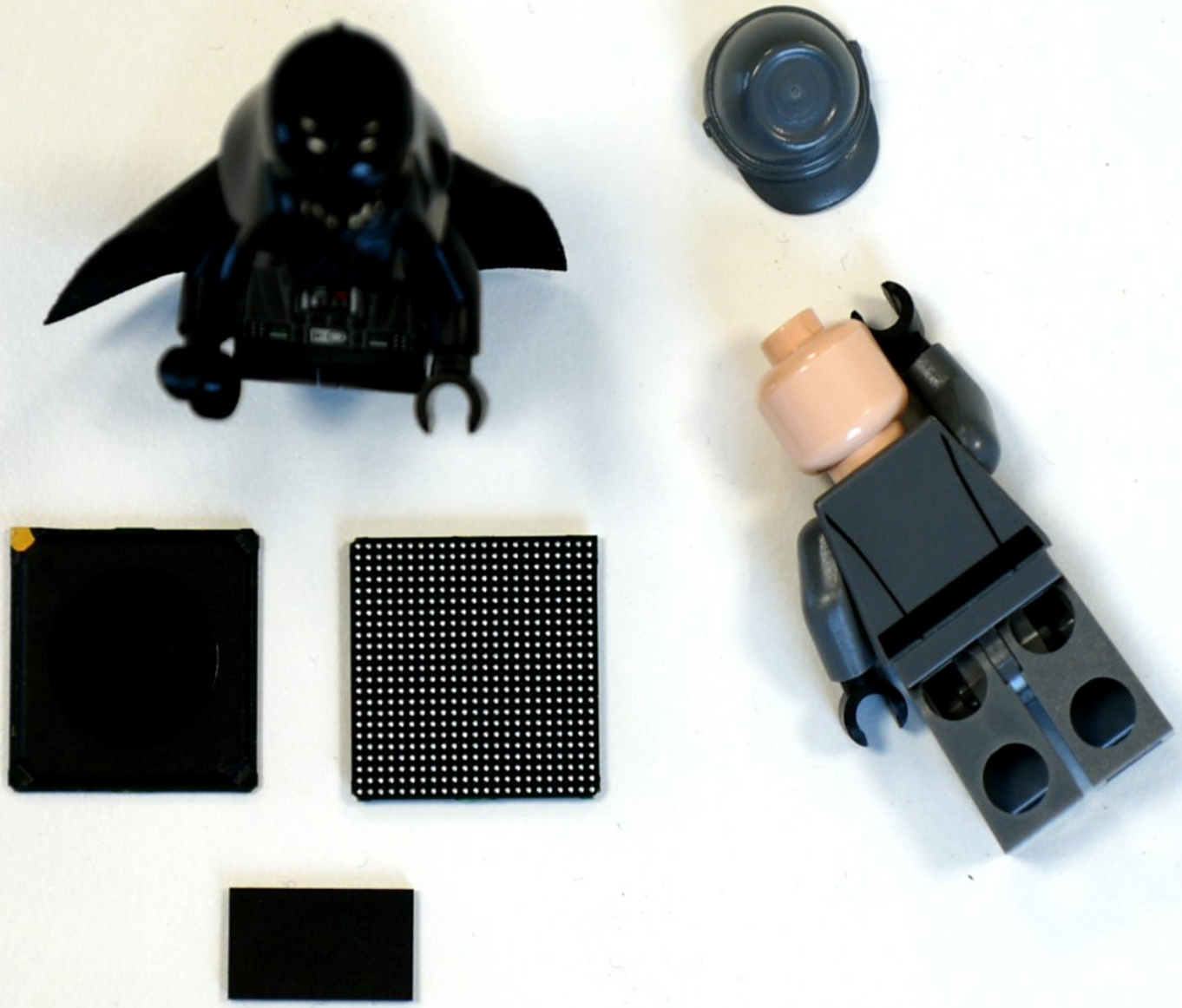
custom host adapter







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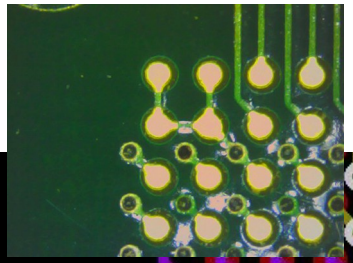

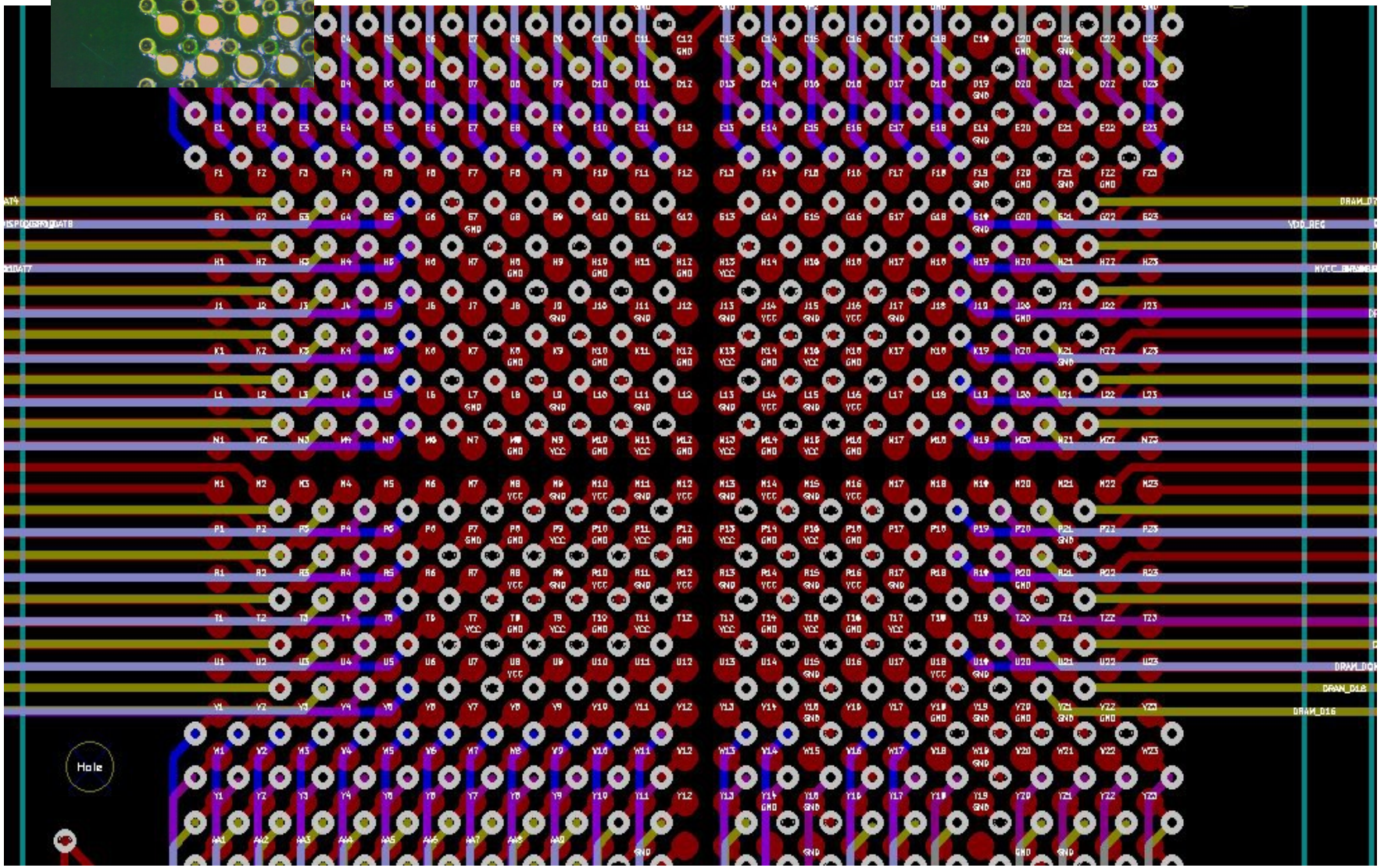

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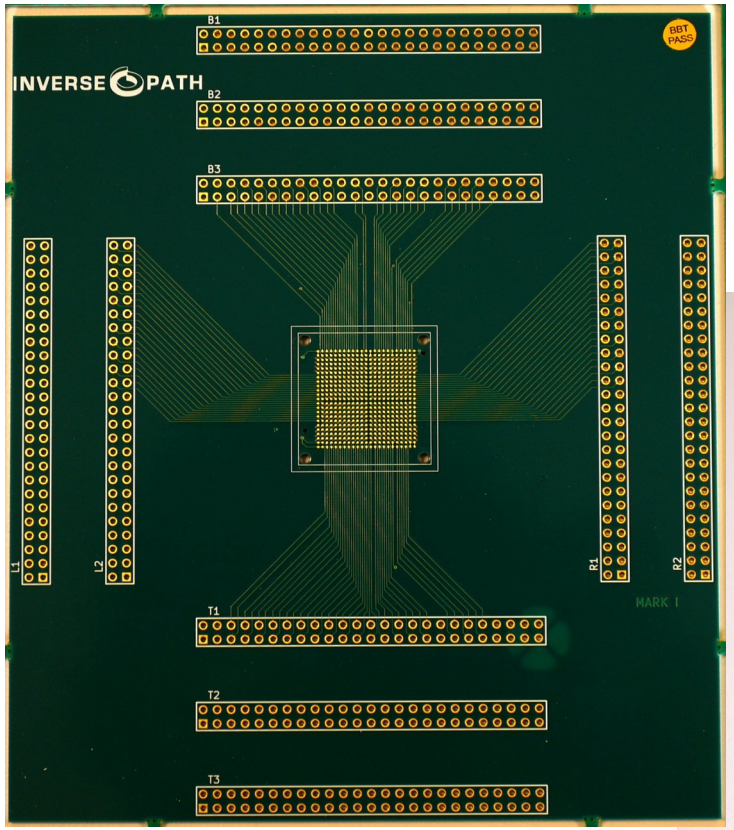

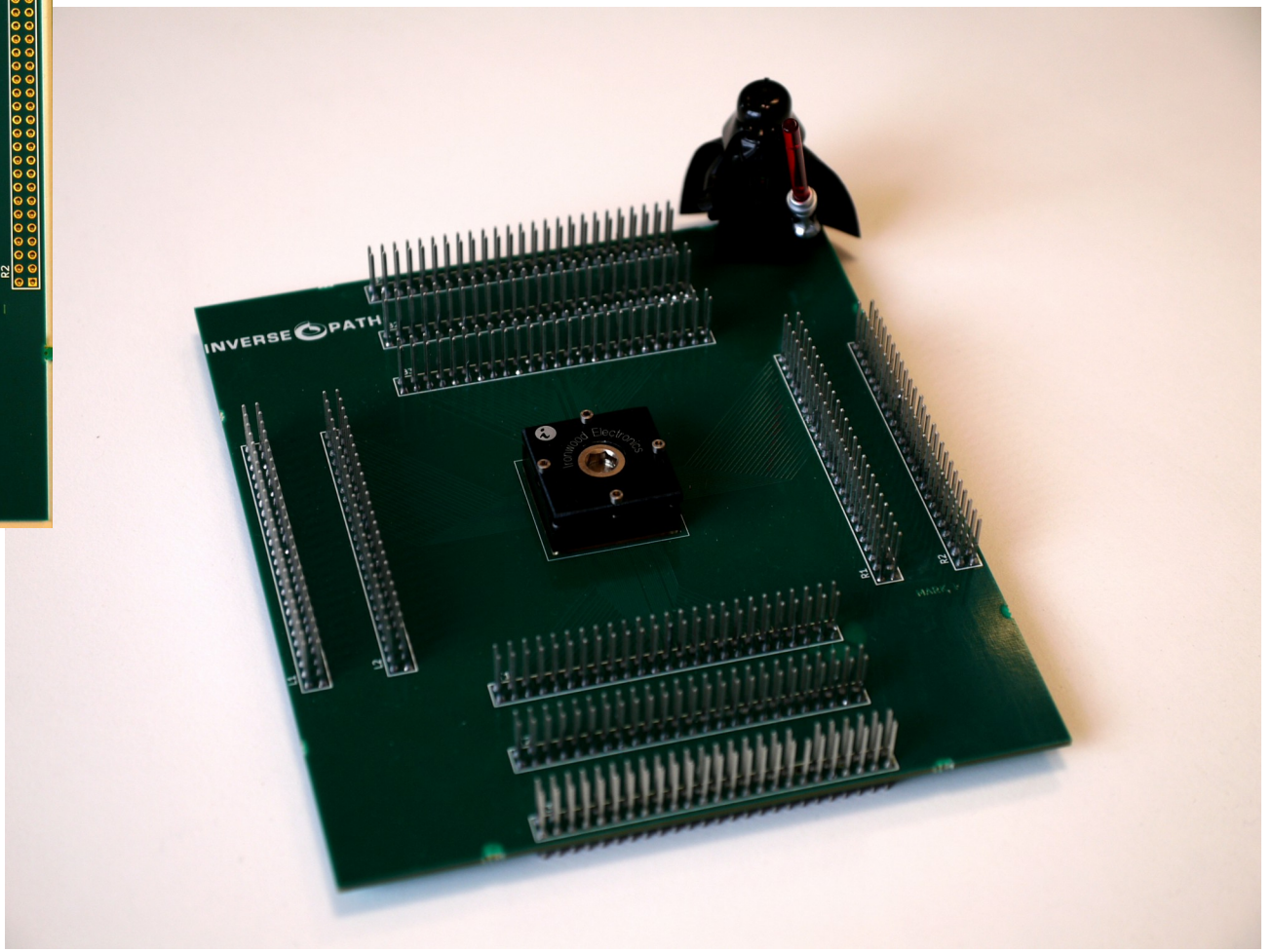

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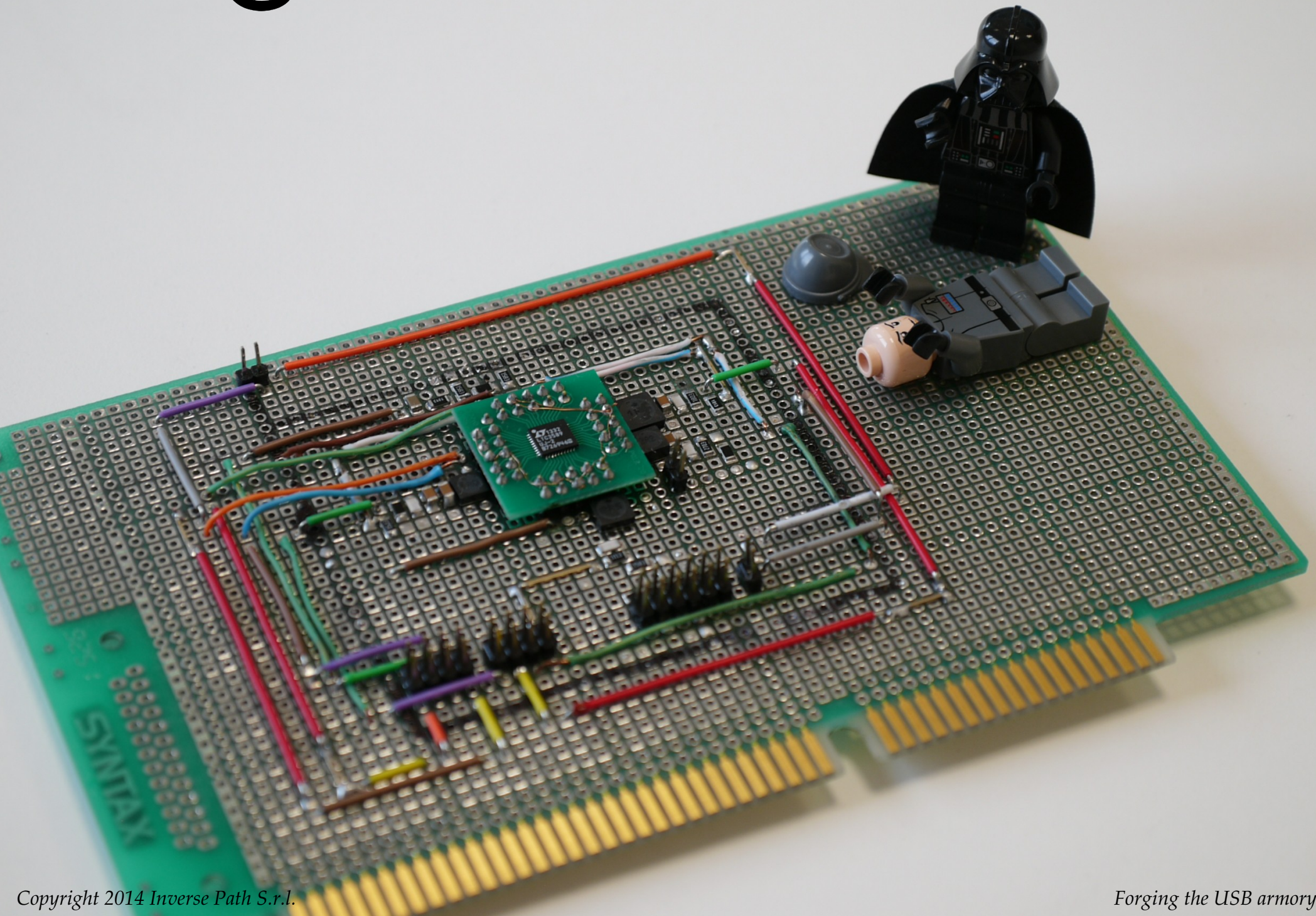

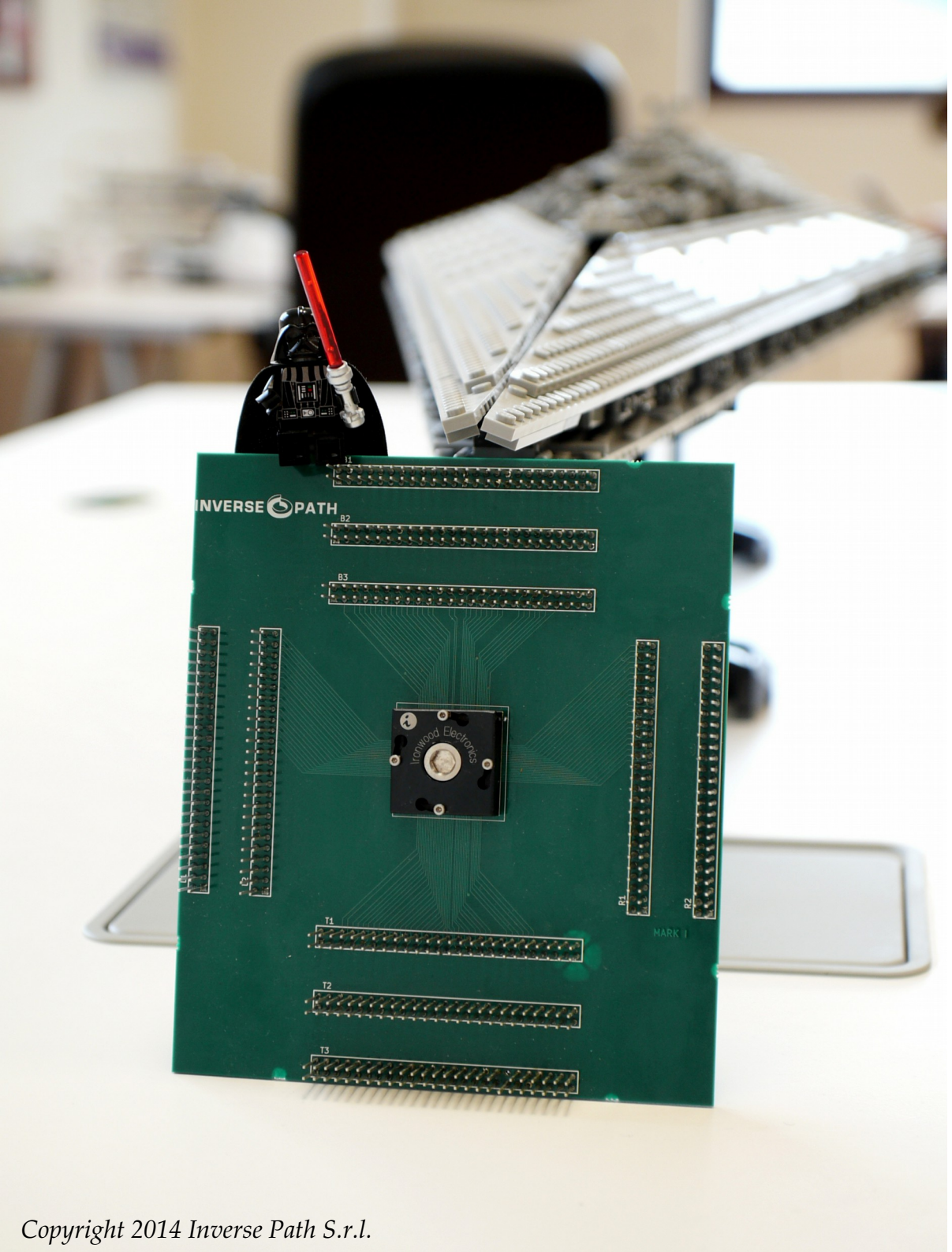

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Forging the USB armory

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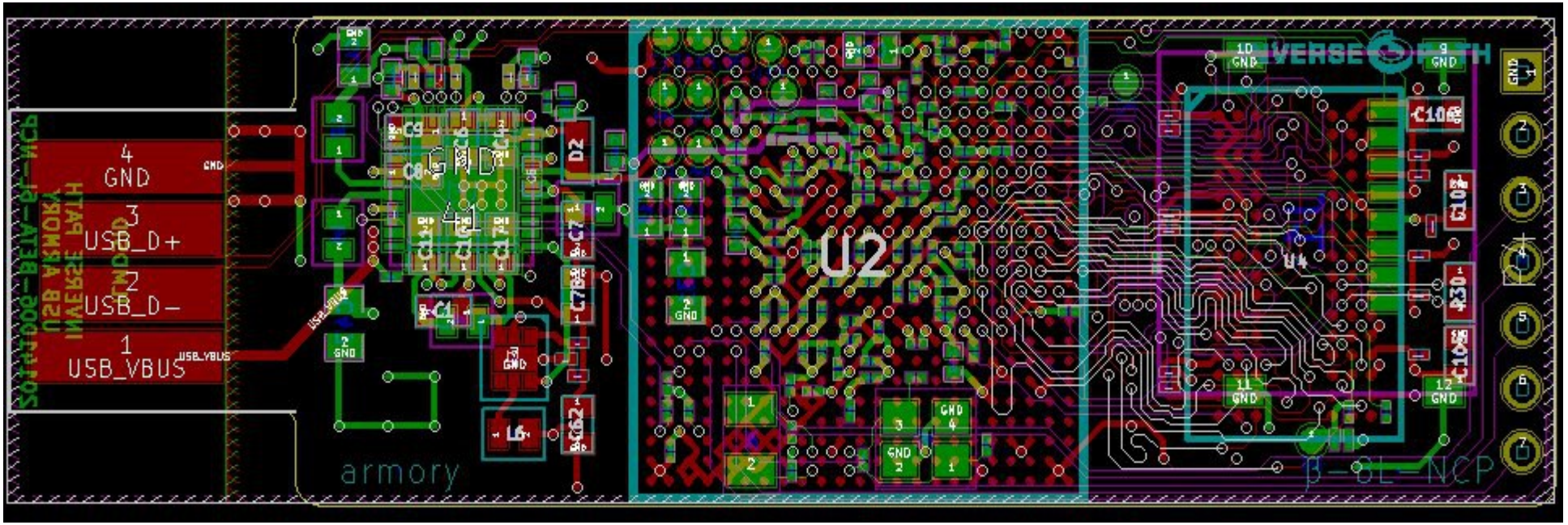

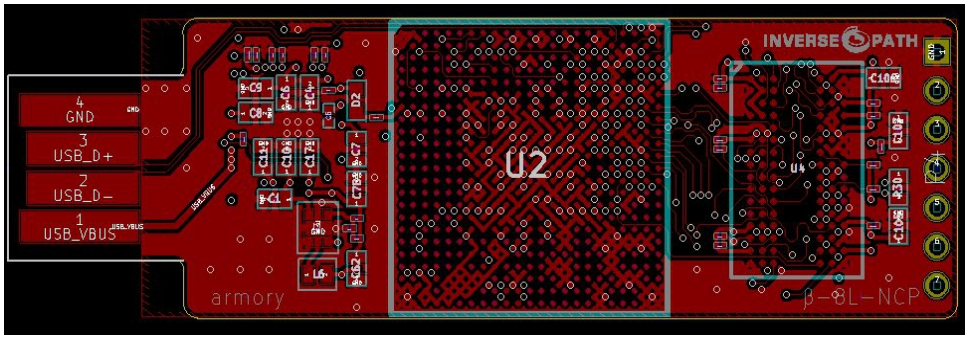

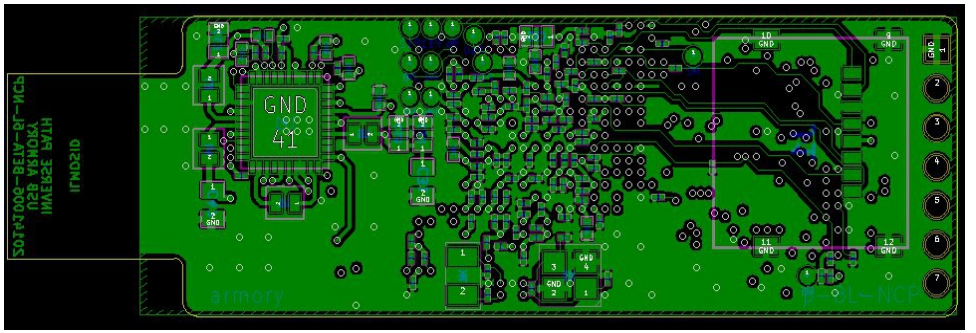

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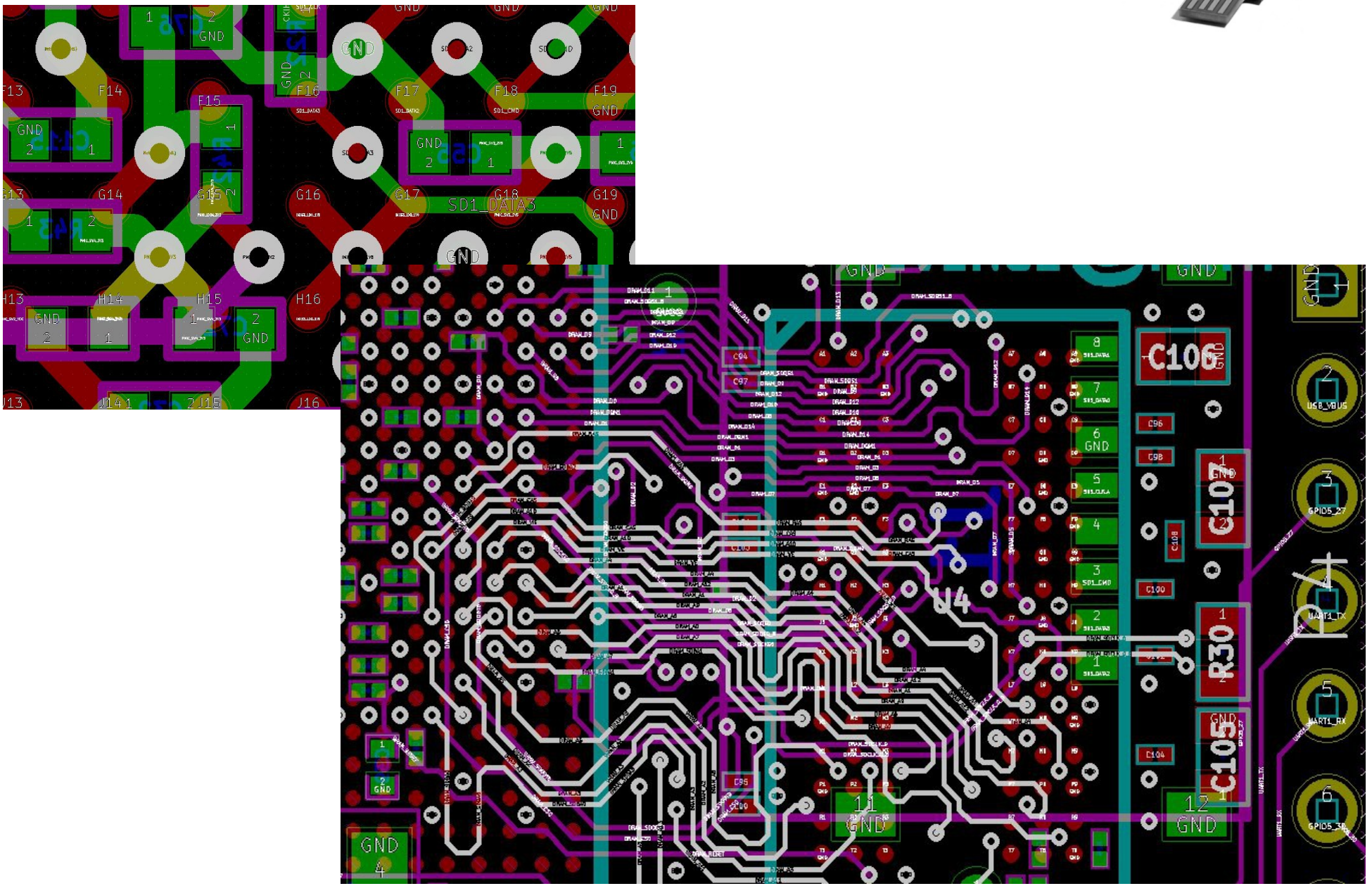

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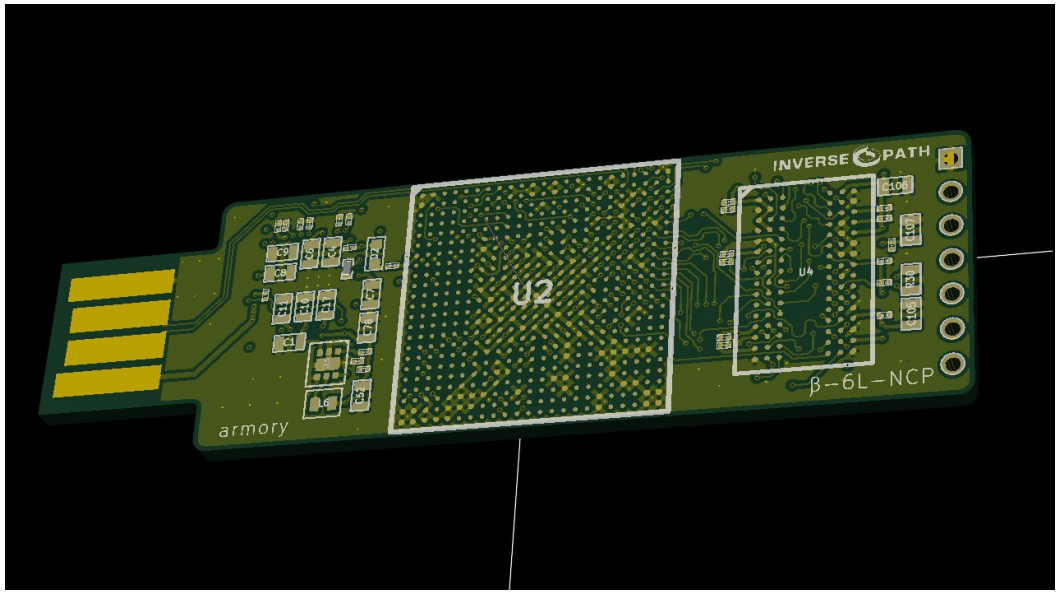

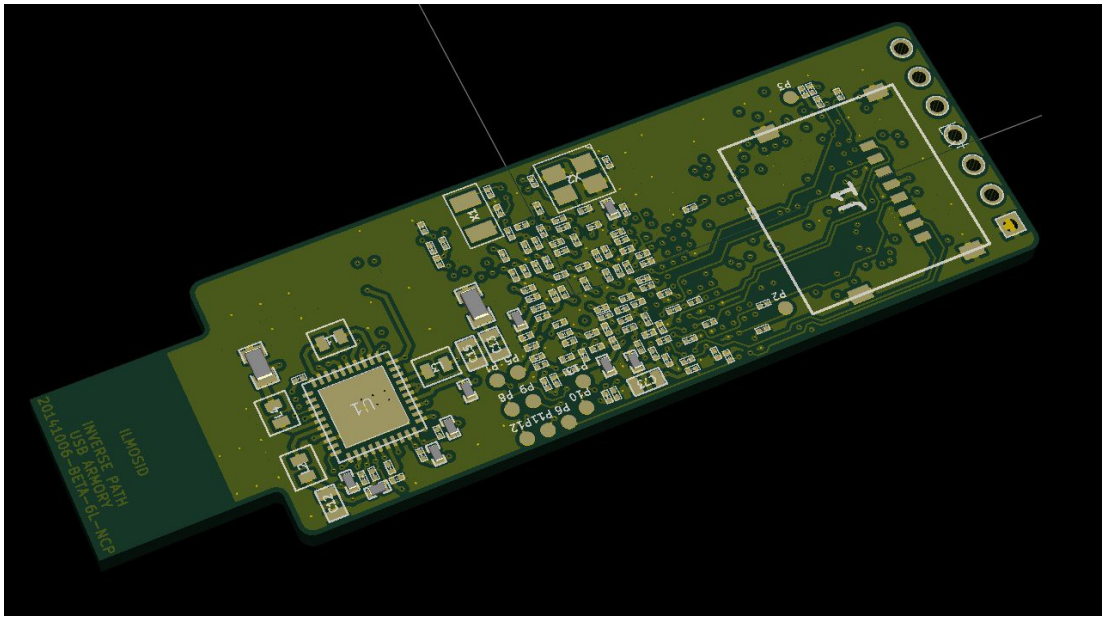

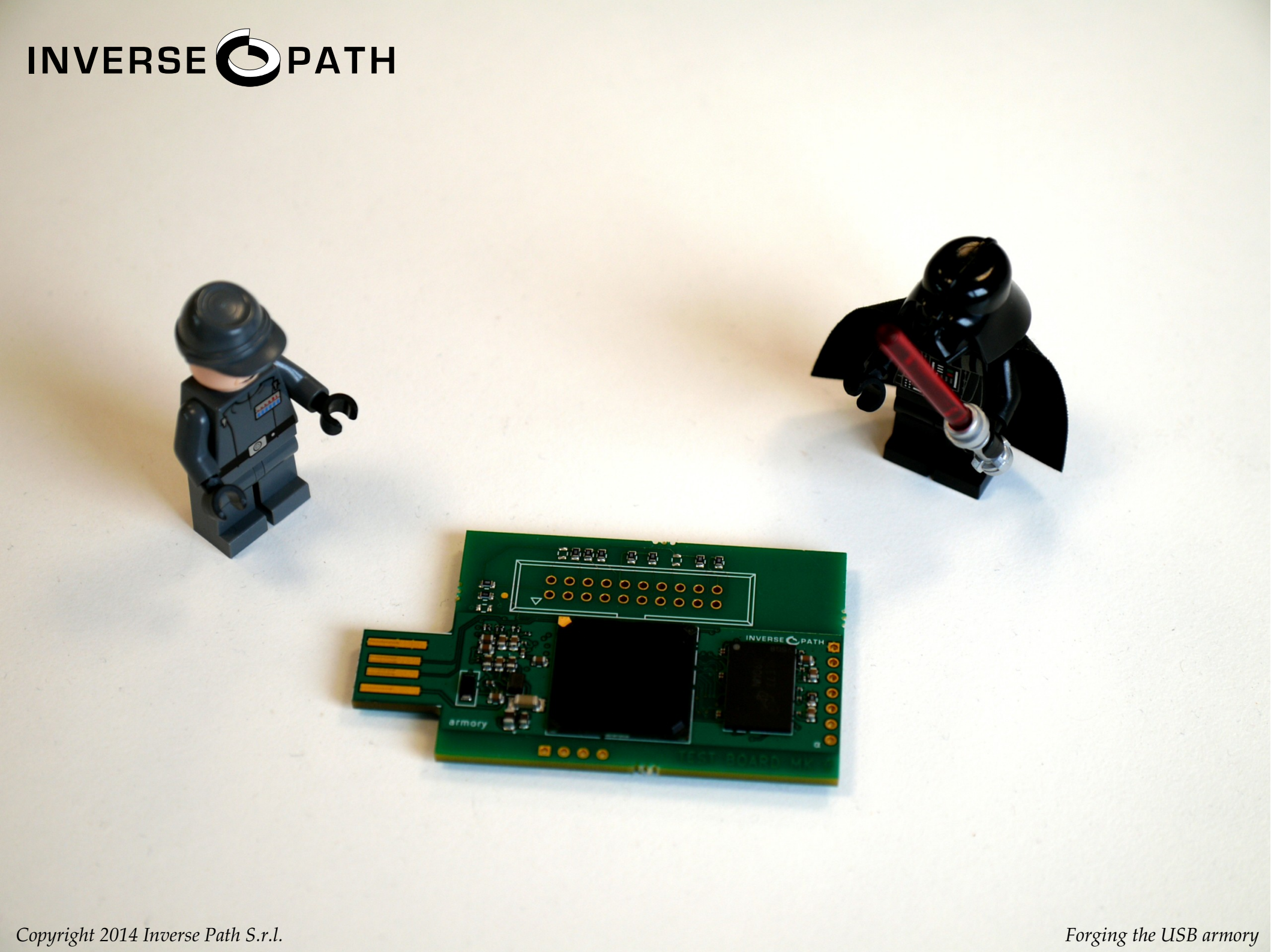

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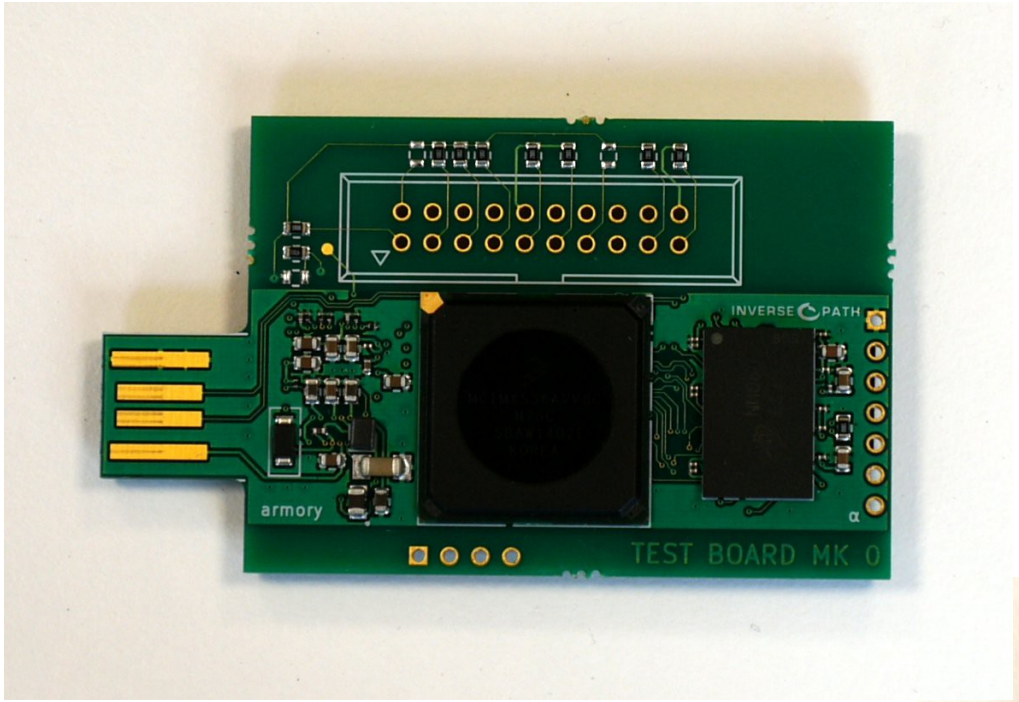
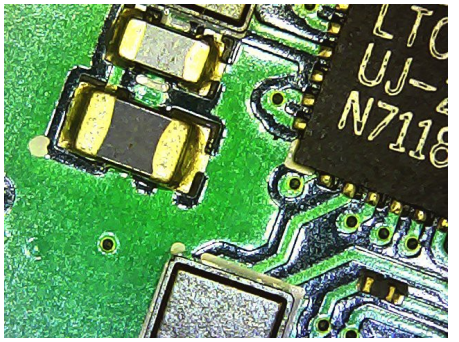
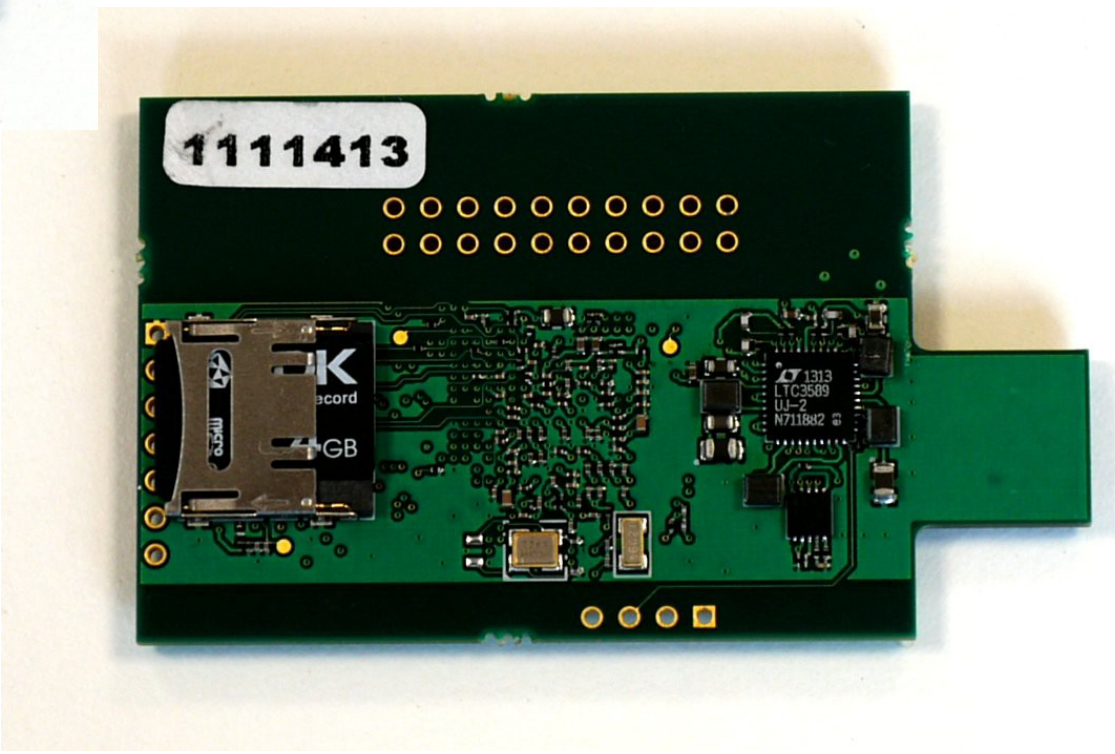
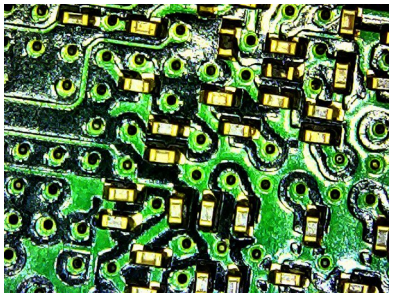
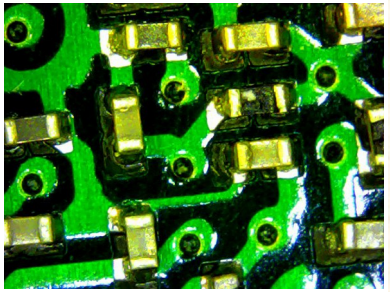
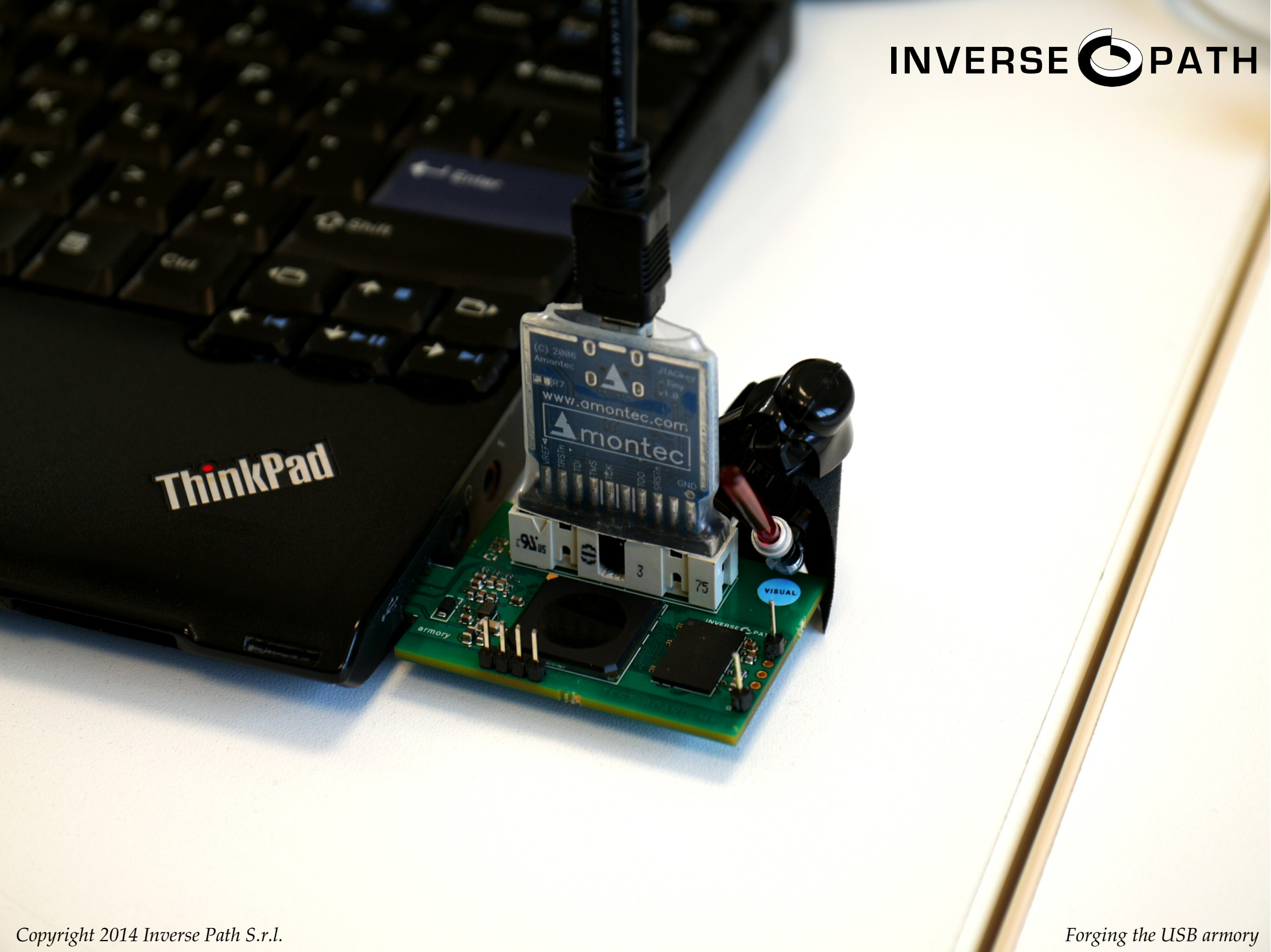


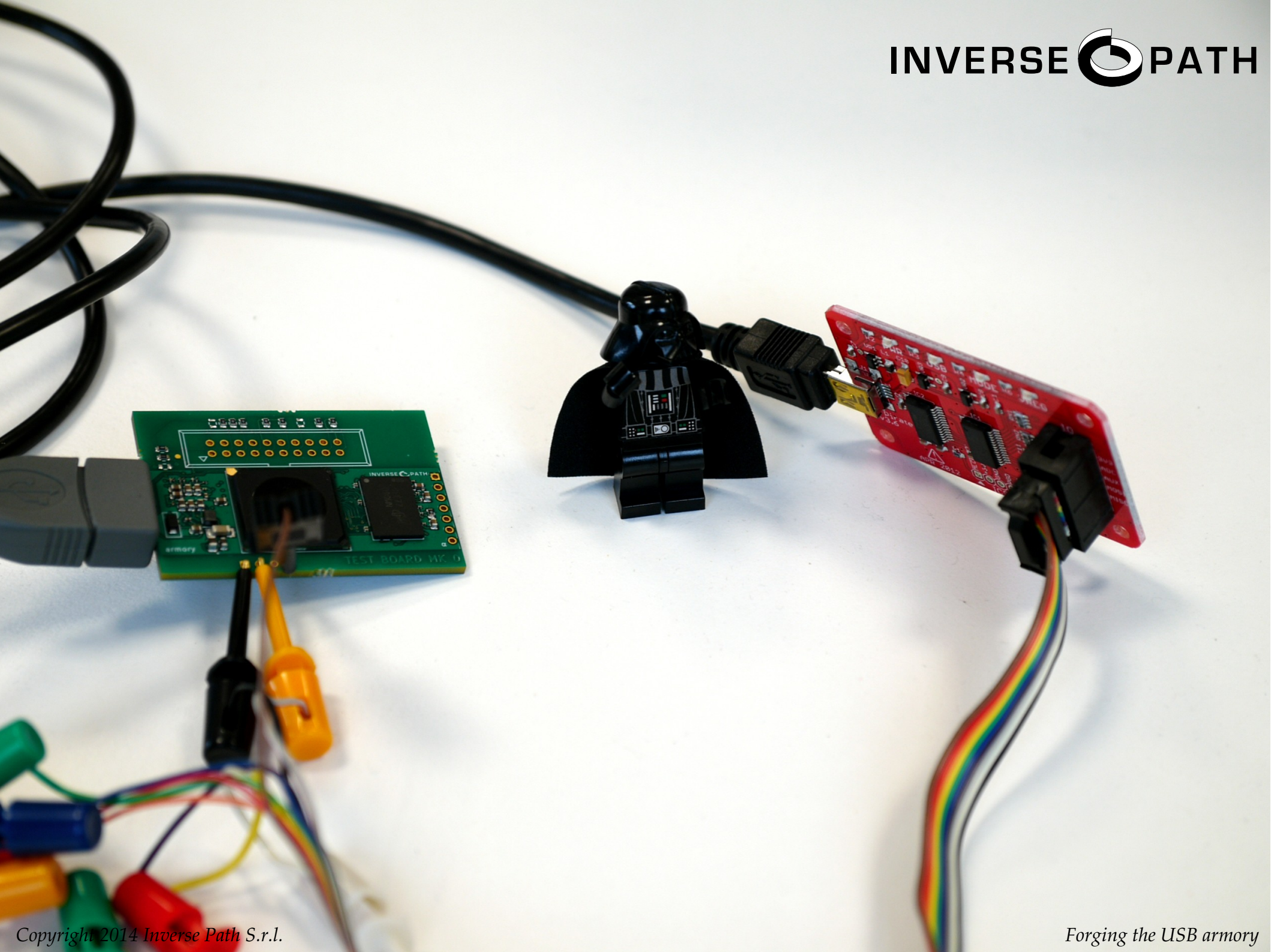


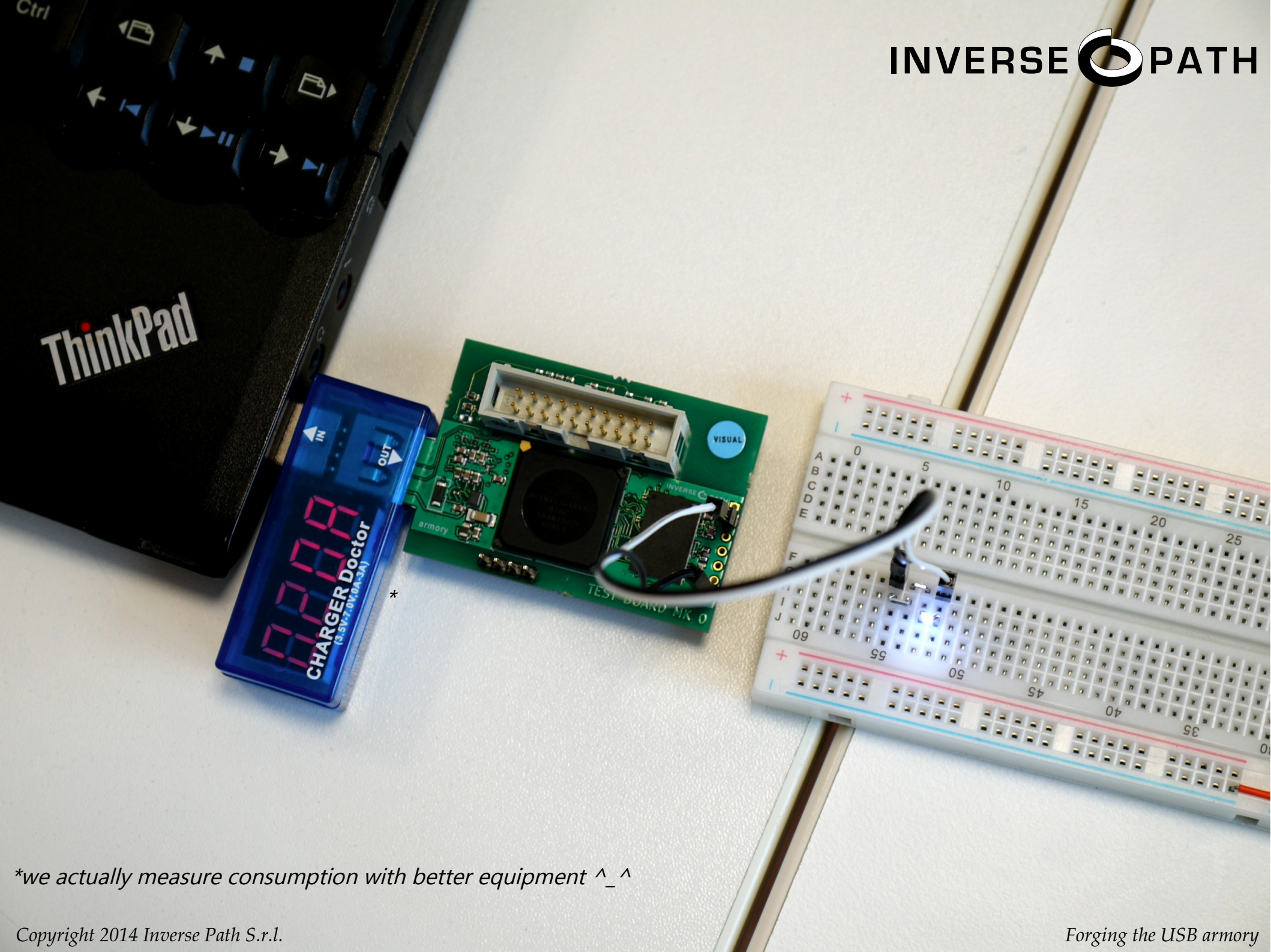












*we actually measure consumption with better equipment ^_^

INVERSE PATH

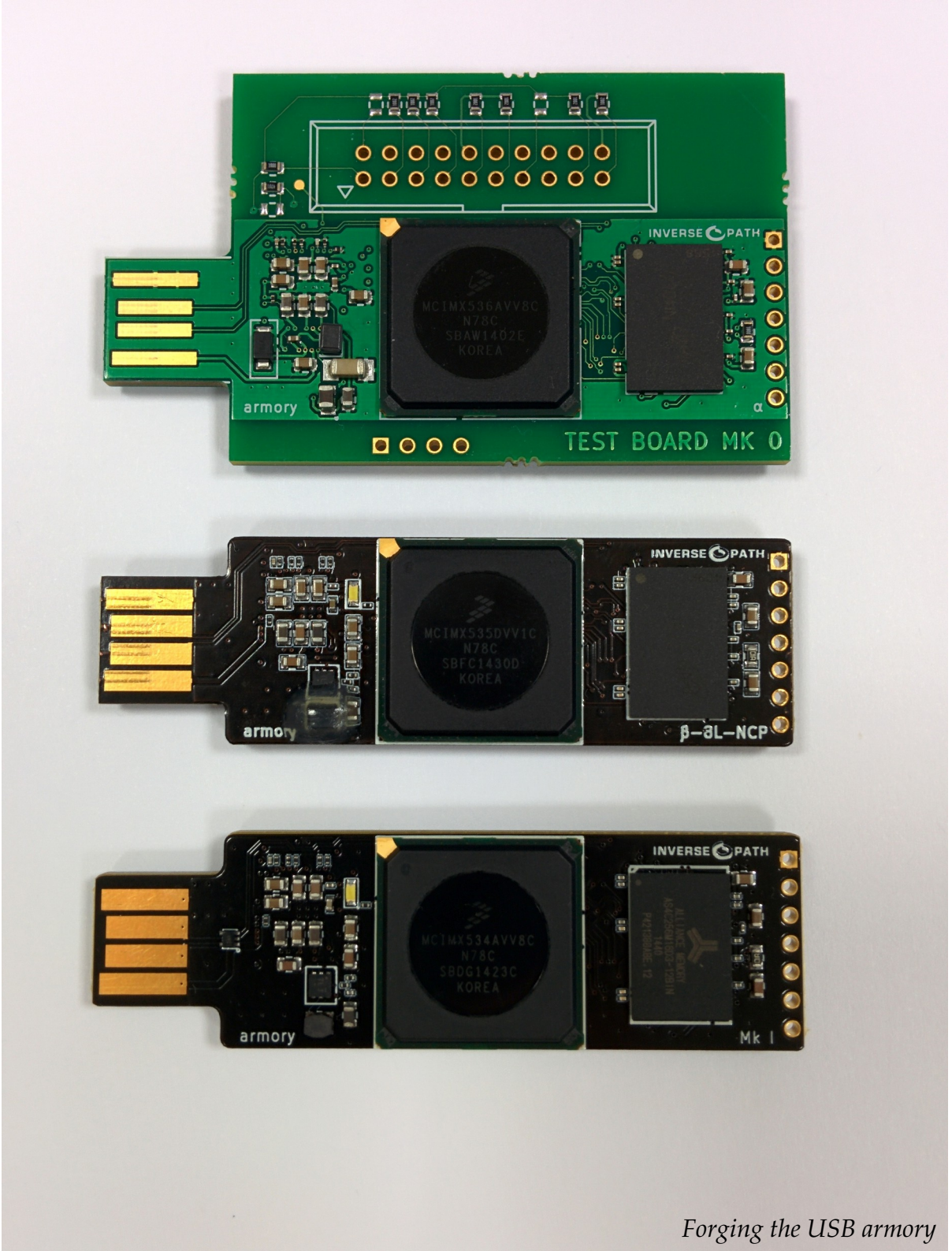
α

βs

8L-NOUSBH,8L, 8L-DDR-LDO, 8L-DDR-NCP

6L, 6L-DDR-LDO, 6L-DDR-NCP

Mk I



Forging the USB armory

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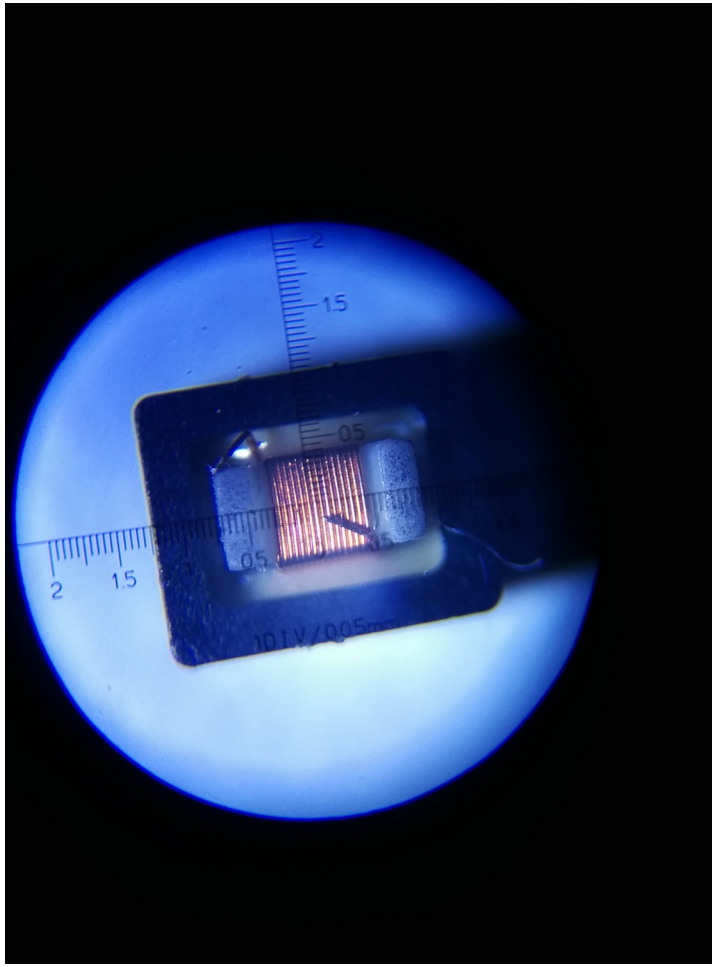

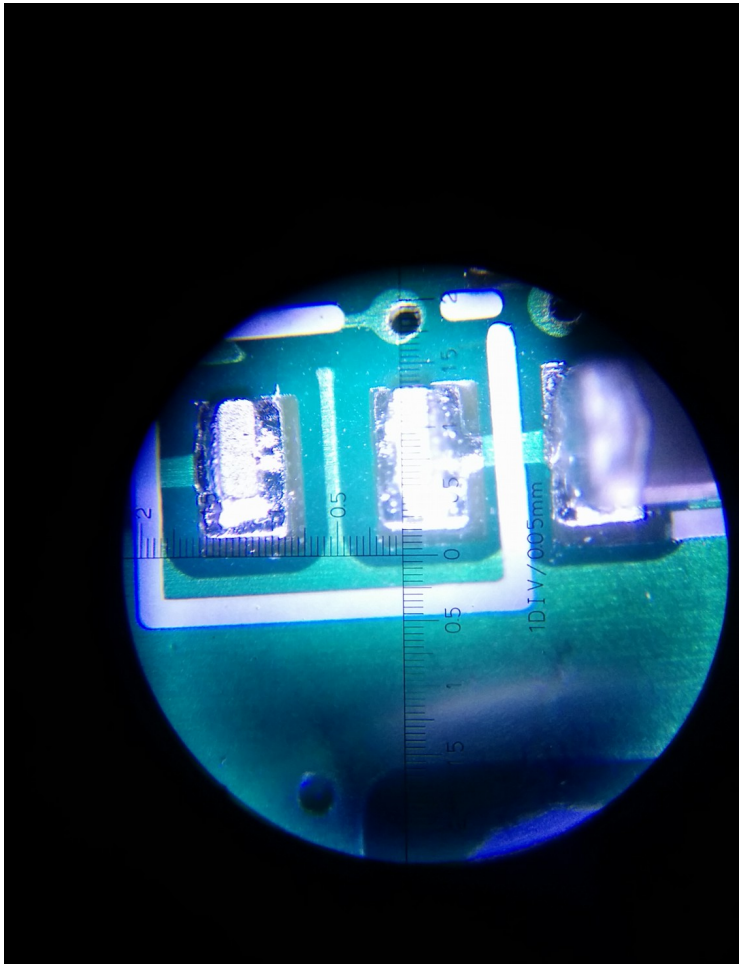

lessons learned #1

tiny inductors are fragile

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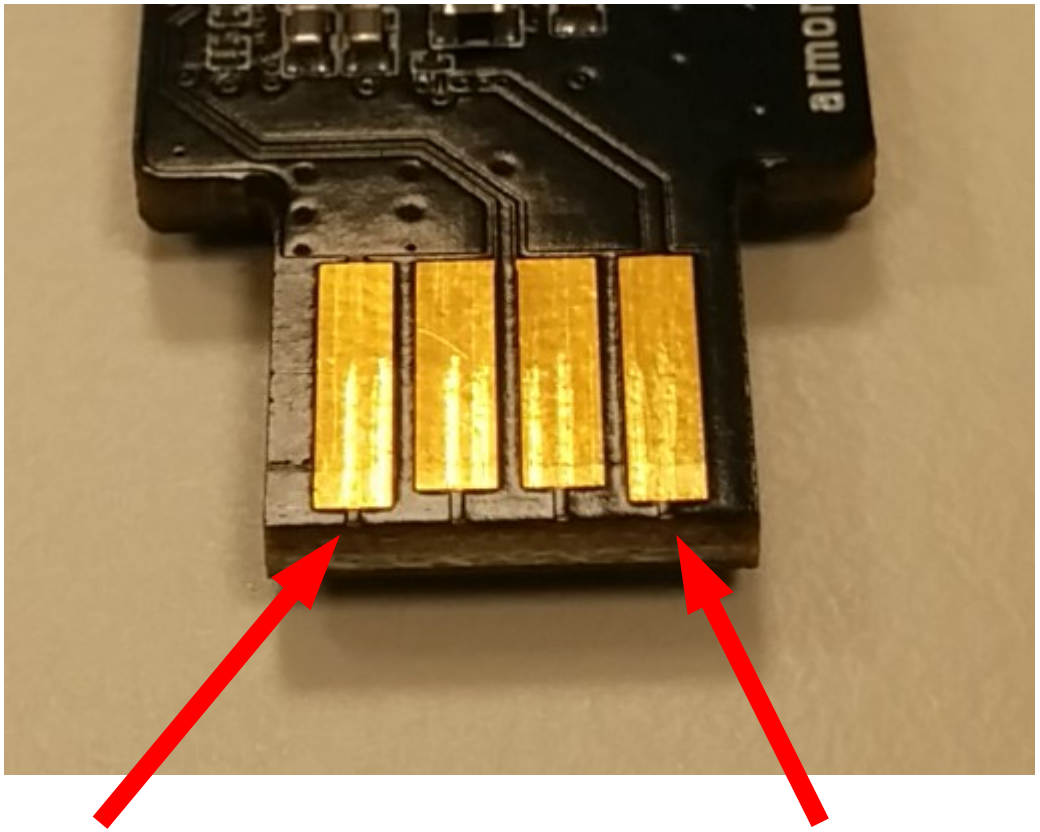

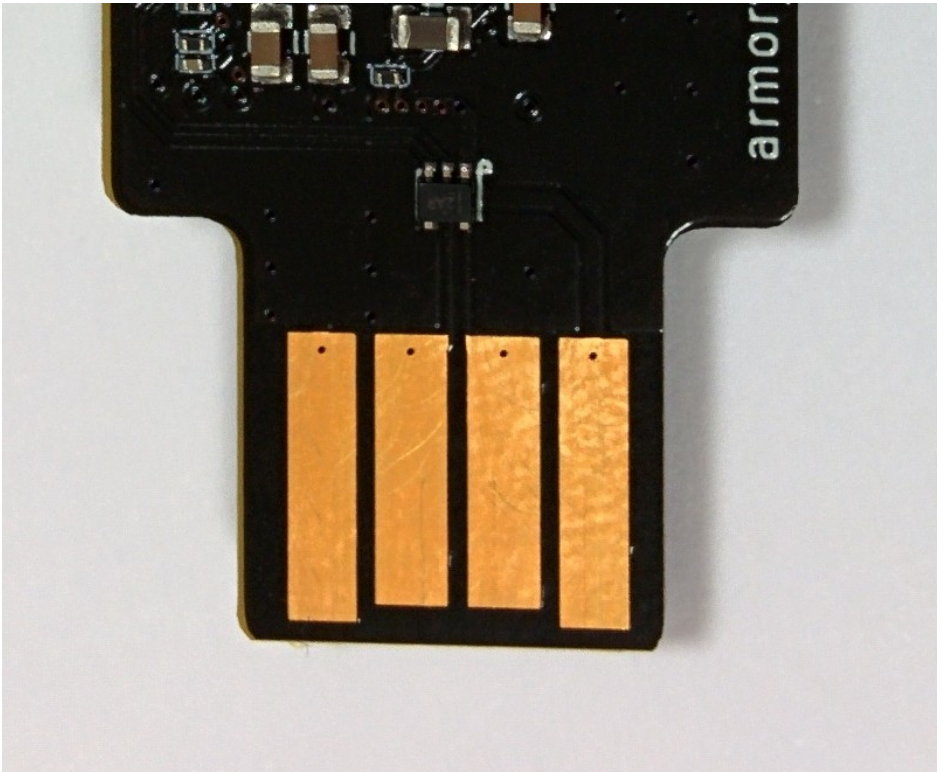

evil

good

lessons learned #2 (the five-second rule)

gold plating traces cause under-voltage on hot swap

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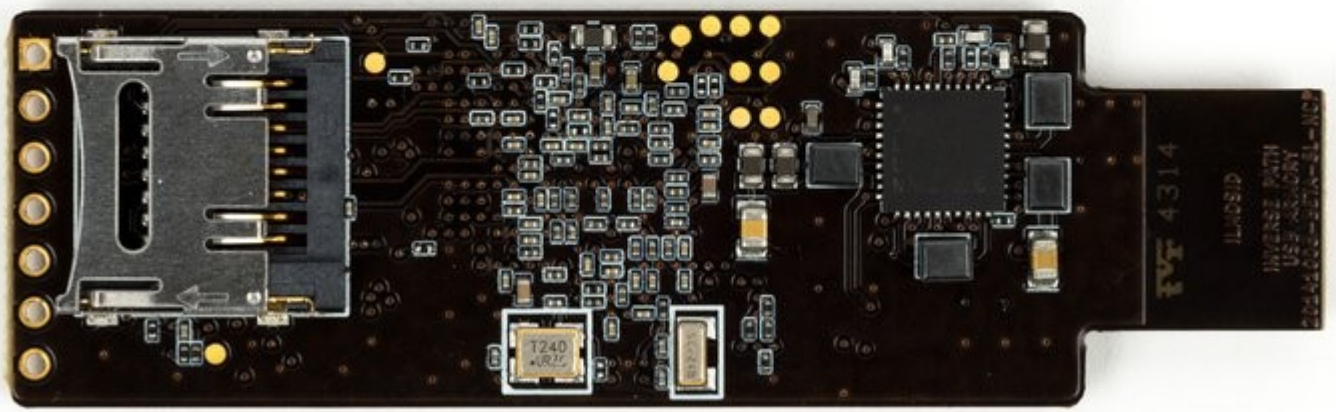

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Thank you!

Q & A

Andrea Barisani

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