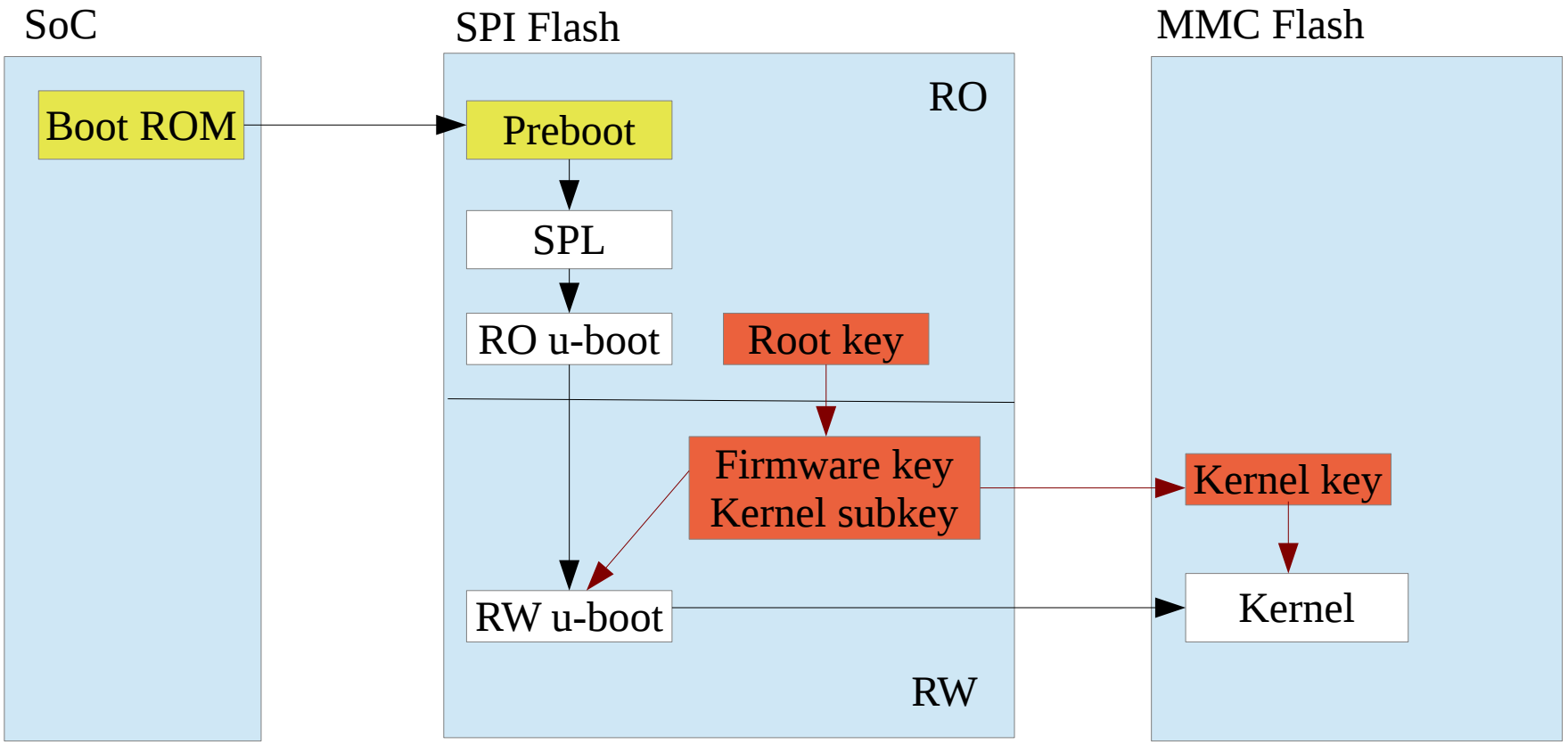
# ***Bonus:***
# Take Control of an ARM Chromebook

- The Samsung Arm Chromebook has “restricted” boot
  - (They call it “verified boot” or VB)
  - Google “root” key locked in flash with HPM
  - Have to disassemble hardware to unlock
  - Even then, no support for changing keys
- U-boot is locked in 4MB SPI flash, so we know how to read/write it, even if bricked (busprate)
- This talk explains how, and scripts/details are on sourceforge
- Note:
  - VB has been upstreamed into u-boot (cool!)
  - But is too large (700K) for most embedded use

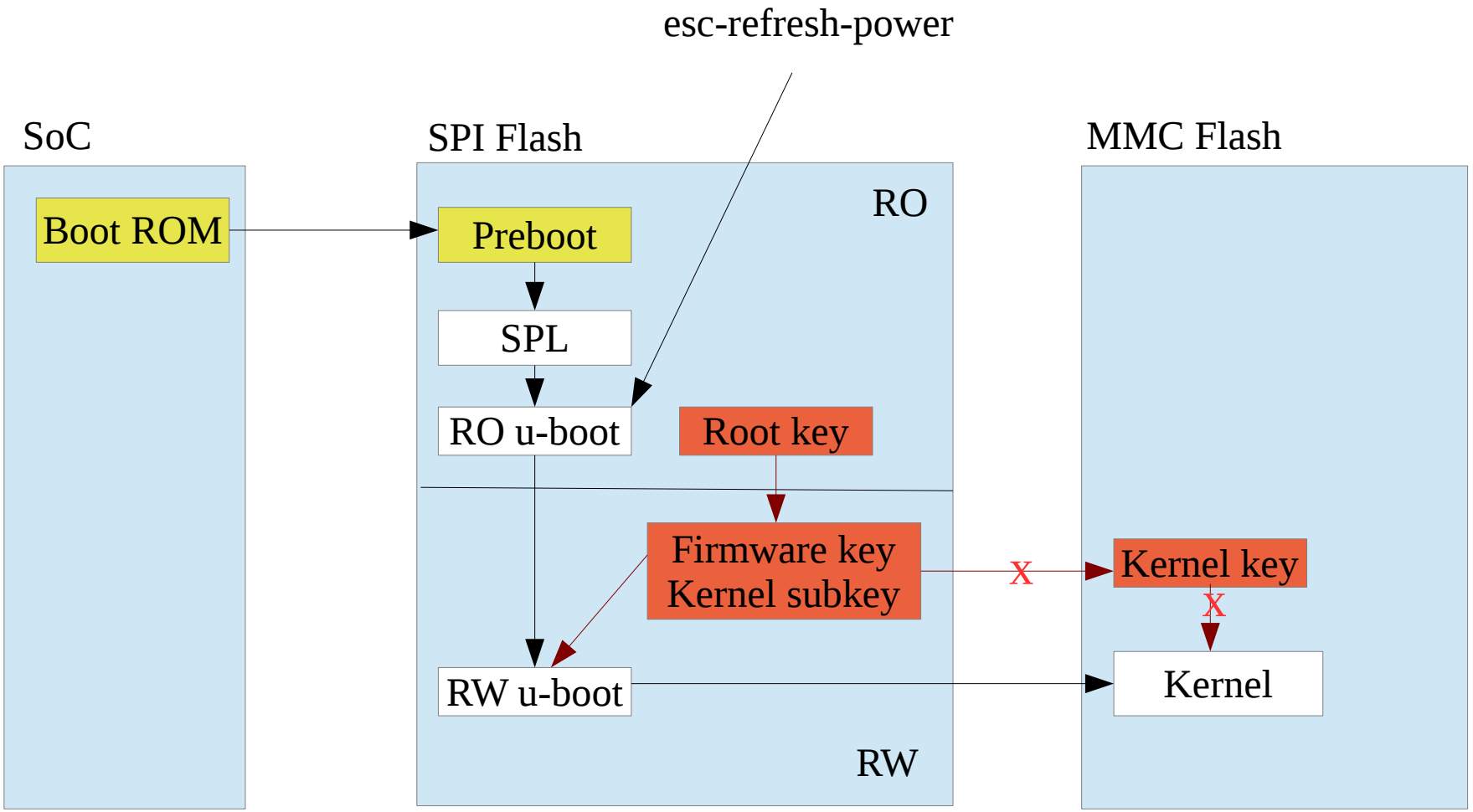
# Normal Verified Boot (VB) Flow



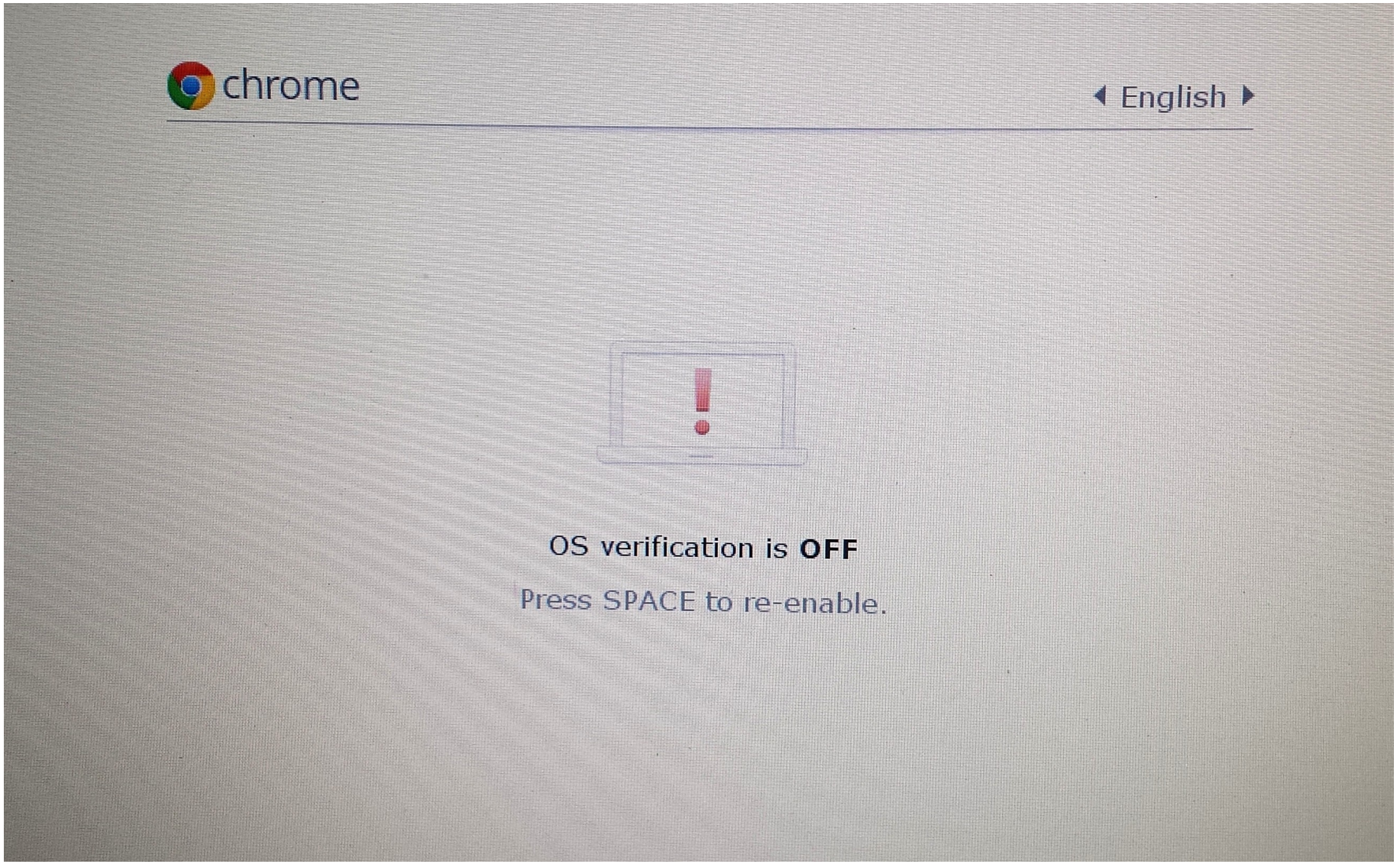

This is a “locked bootloader” aka “restricted boot”!

To take control, you have to replace “Root PK” with your own

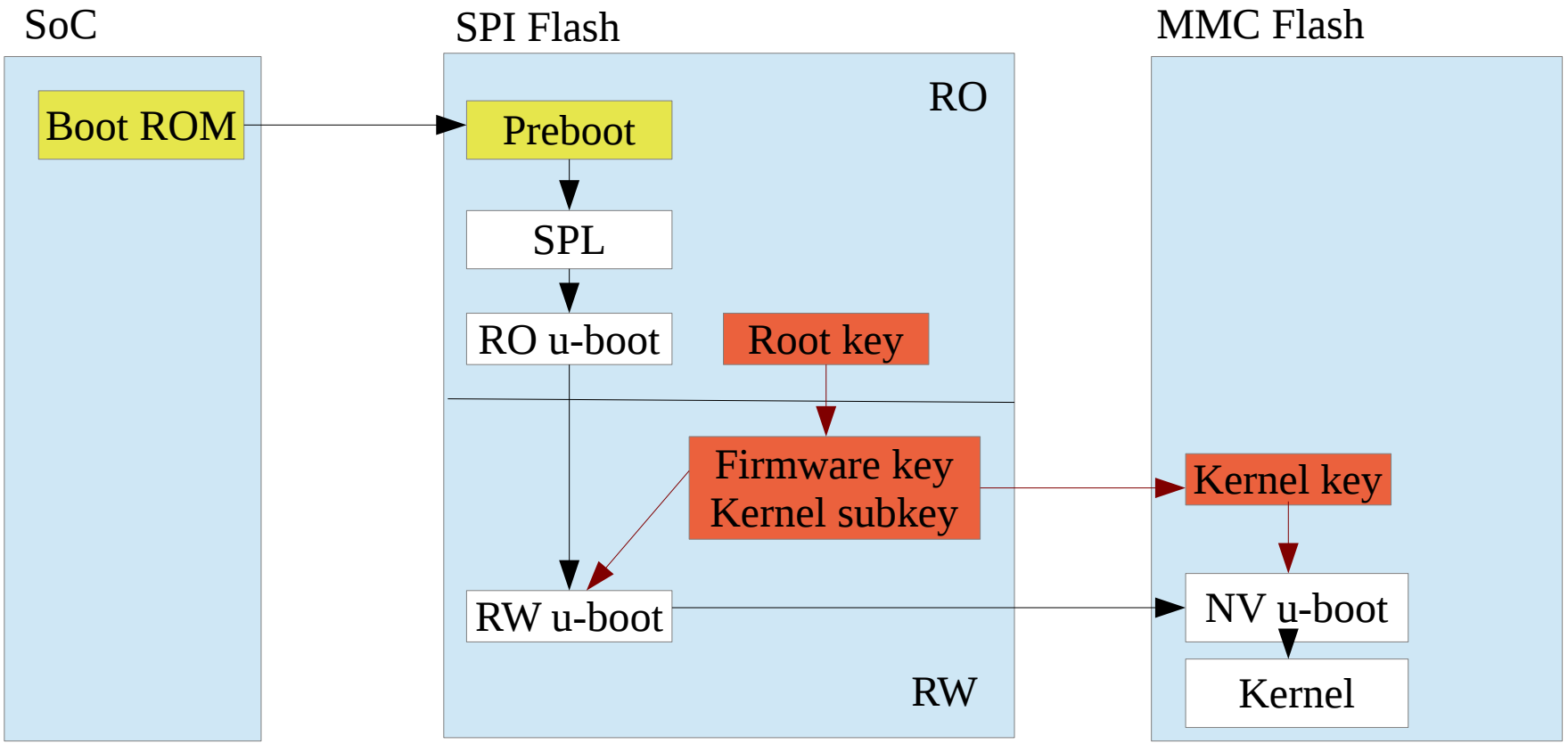
# DEV Mode Flow



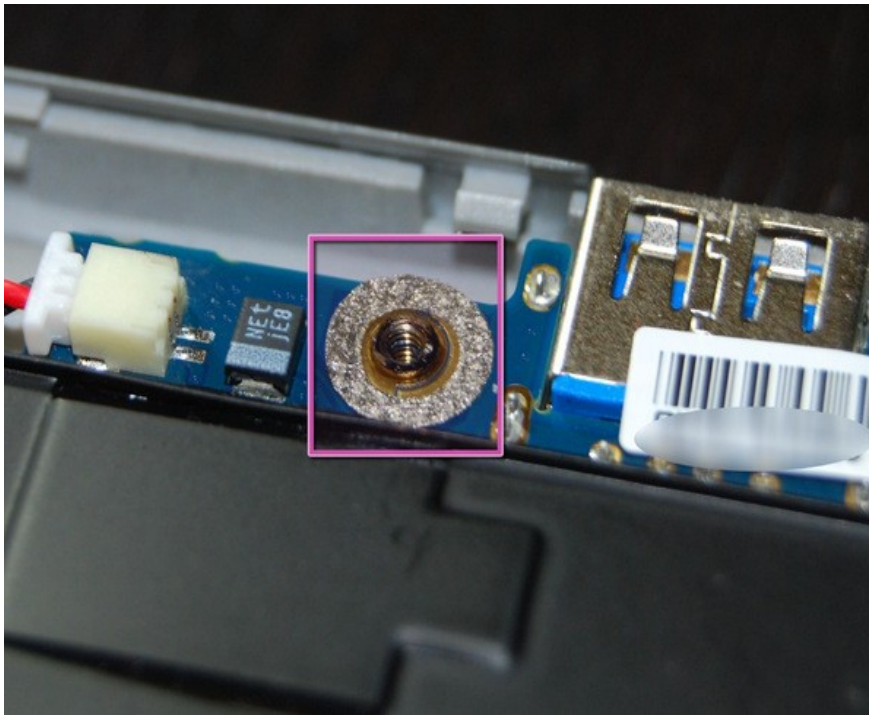
# Developer Mode



# Non-Verified Boot Flow



# SPI Flash HPM:
# !WP shorted to ground



# SPI Flash Write protection

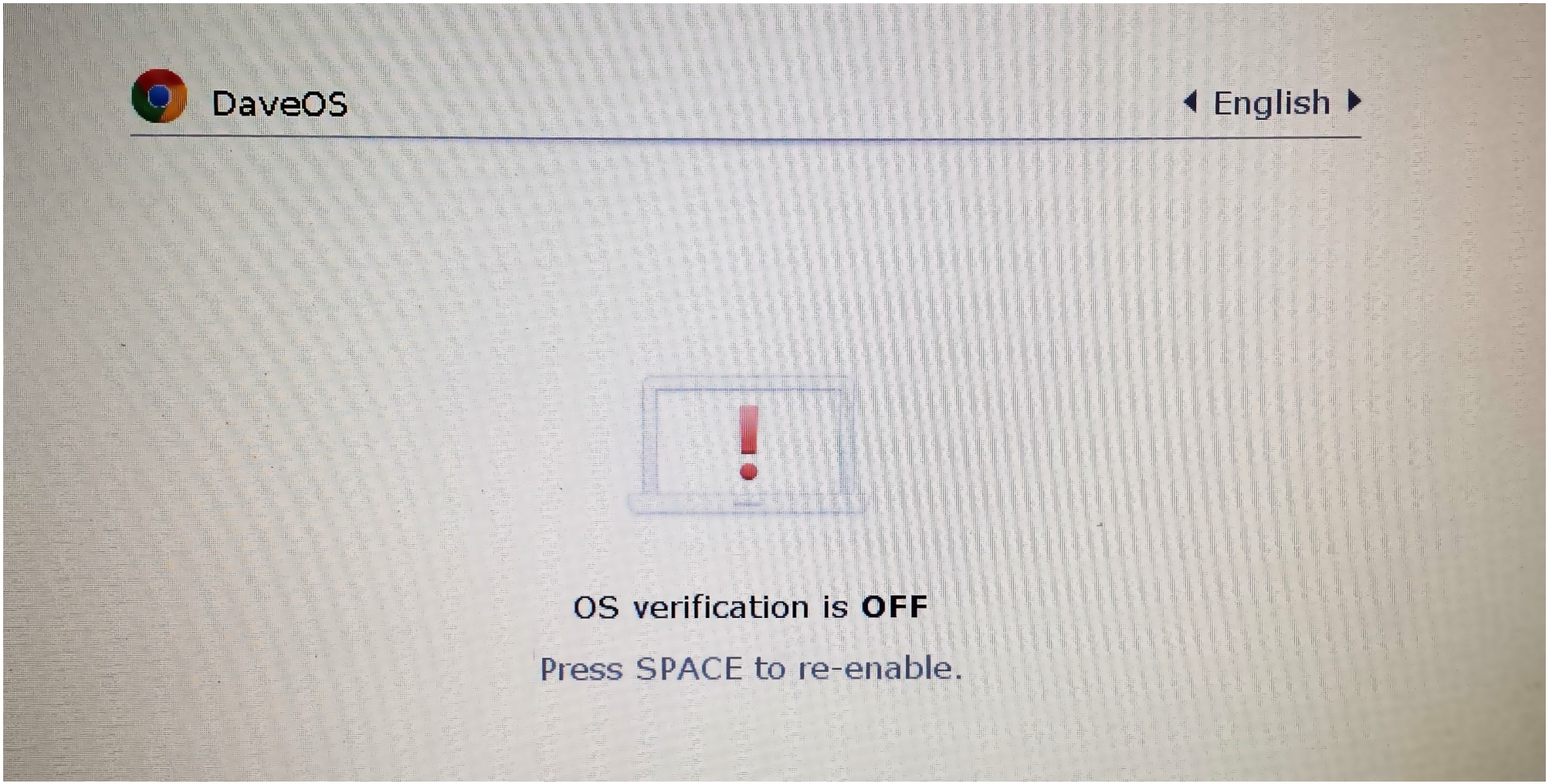
```
W25Q32DW status registers
SR1                             SR0
7  6  5  4  3  2  1  0          7  6  5  4  3  2  1  0
                     ^srp1     ^srp0 ^...BP...^
                     0         0     1  1  1  0          0x0038 OFF
                     0         1     1  1  1  0          0x00B8 HPM
                     1         0     1  1  1  0          0x0138 POWER
flashrom options:
     --wp-status
     --wp-enable[= hardware | power_cycle]
     --wp-disable
Flashrom -p internal:bus=spi –wp-enable=power_cycle --wp-status
    WP: status: 0x0138
    WP: status.srp0: 0
    WP: status.srp1: 1
    WP: write protect is enabled.
    WP: write protect range: start=0x00000000, len=0x00200000
```

# Taking Control

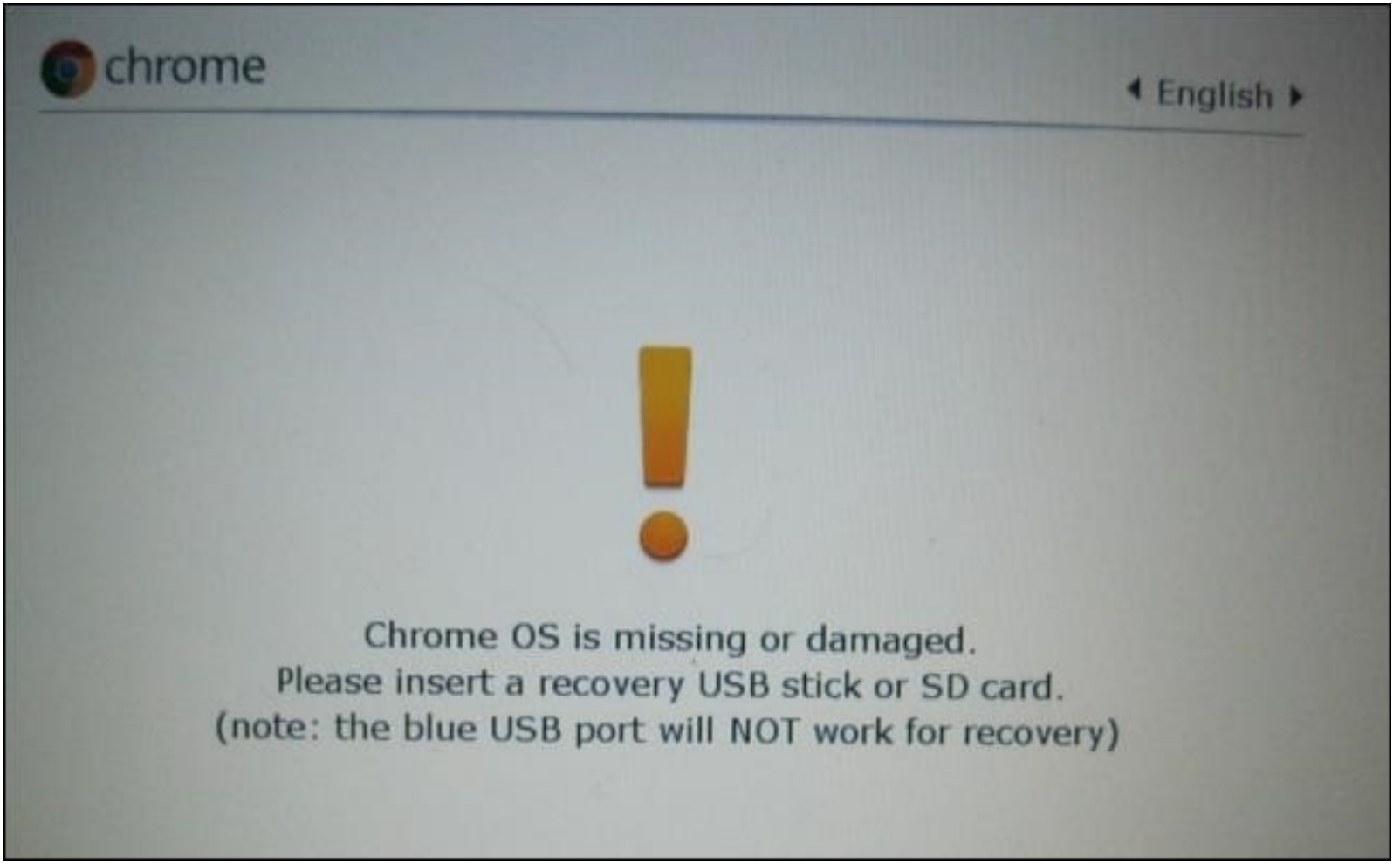
1. Disassemble Chromebook and remove !WP washer
2. Enter “Developer” mode (esc-refresh-power)
3. Copy scripts to somewhere executable (/usr/local/takeown)
   - (ctl-alt-->), login as chronos, sudo -i
   - ./makekeys.sh (makes all new key pairs)
   - ./takeown_firmware.sh (signs RW u-boots and keys)
   - ./takeown_kernel.sh (signs kernels and keys)
   - dev_debug_vboot (verifies all keys/signatures)
4. Modify RO u-boot to set power_cycle protection, if not developer (experts only)
5. Save keys to usb, reboot, and follow prompts for normal mode

# DaveOS

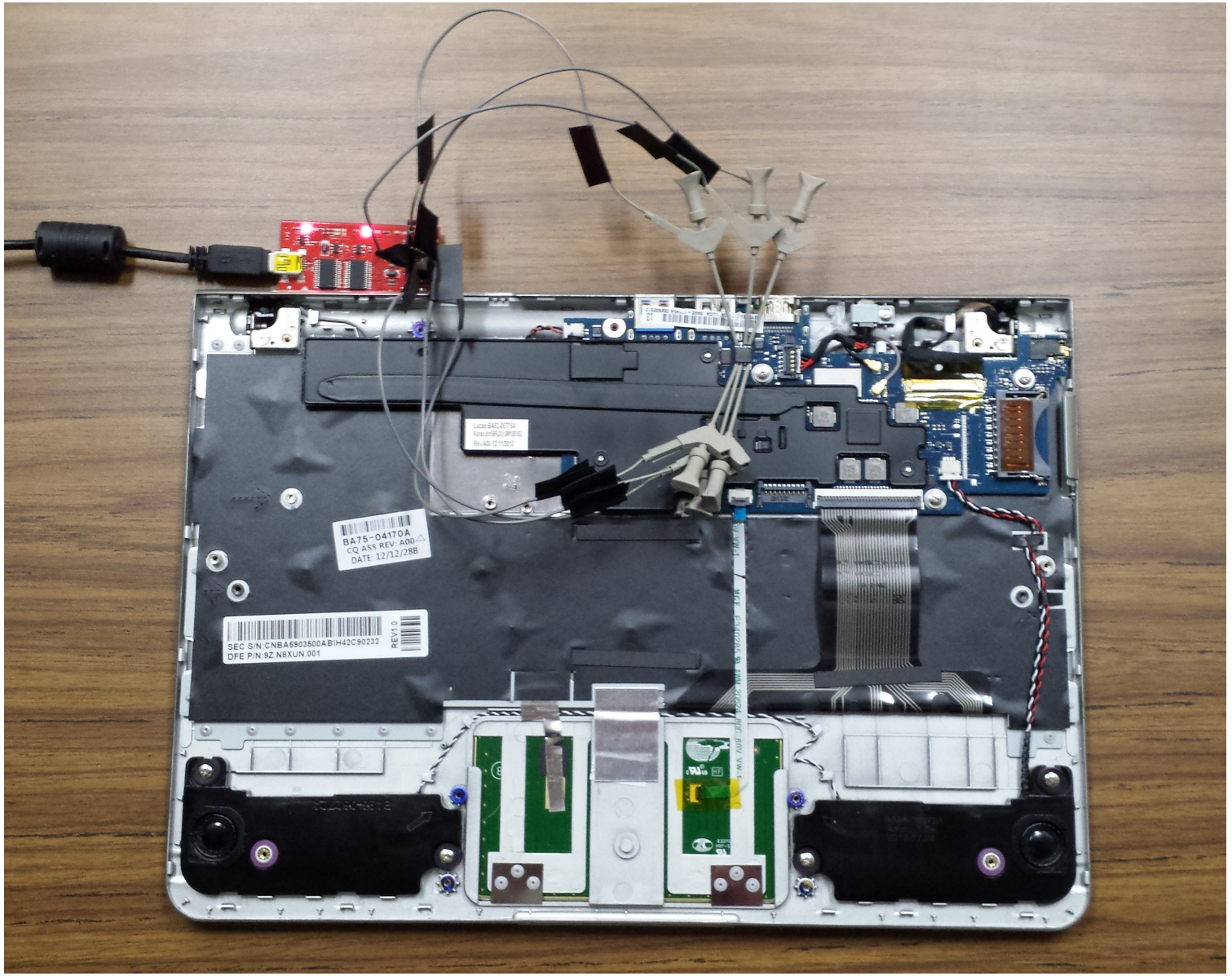
- A <u>really</u> hard way to demonstrate SPI control



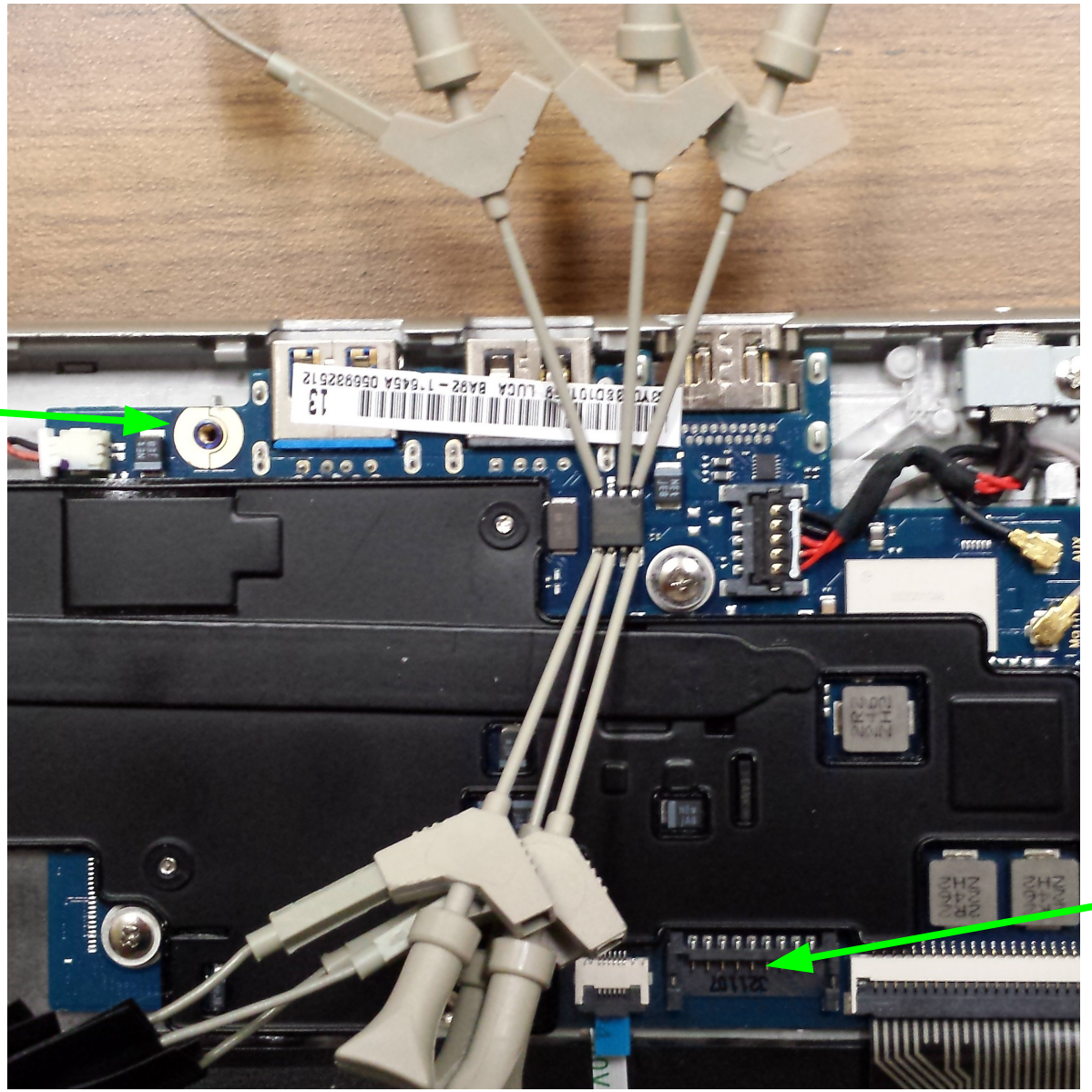
# OOPS


chrome
English
Chrome OS is missing or damaged.
Please insert a recovery USB stick or SD card.
(note: the blue USB port will NOT work for recovery)

# Buspirate Attached to SPI Flash



# Close up of SPI Flash



# Pin-out

```
SPI Flash                Bus Pirate
CS     (pin 1)-----CS
CLK    (pin 6)-----CLK
SI     (pin 5)-----MOSI
SO     (pin 2)-----MISO
V+     (pin 8)-----3.3v
GND    (pin 4)-----GND
!WP    (pin 3)
!hold  (pin 7)
```

# All Code available

- Chrome takeown
  - http://sourceforge.net/projects/linux-ima/files/linux-ima/chrome_takeown.tar.gz
- mr-3020 secure boot:
  - http://sourceforge.net/projects/linux-ima/files/linux-ima/mr-3020-secure-boot.tar.gz