DEVCORE
SECURITY
CONSULTING

Remote Door Execution

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huka@devco.re

2023.03.11
DEVCORE Conference

你做什麼工作的

犯法喔

白貓駭客？那啥

物聯網

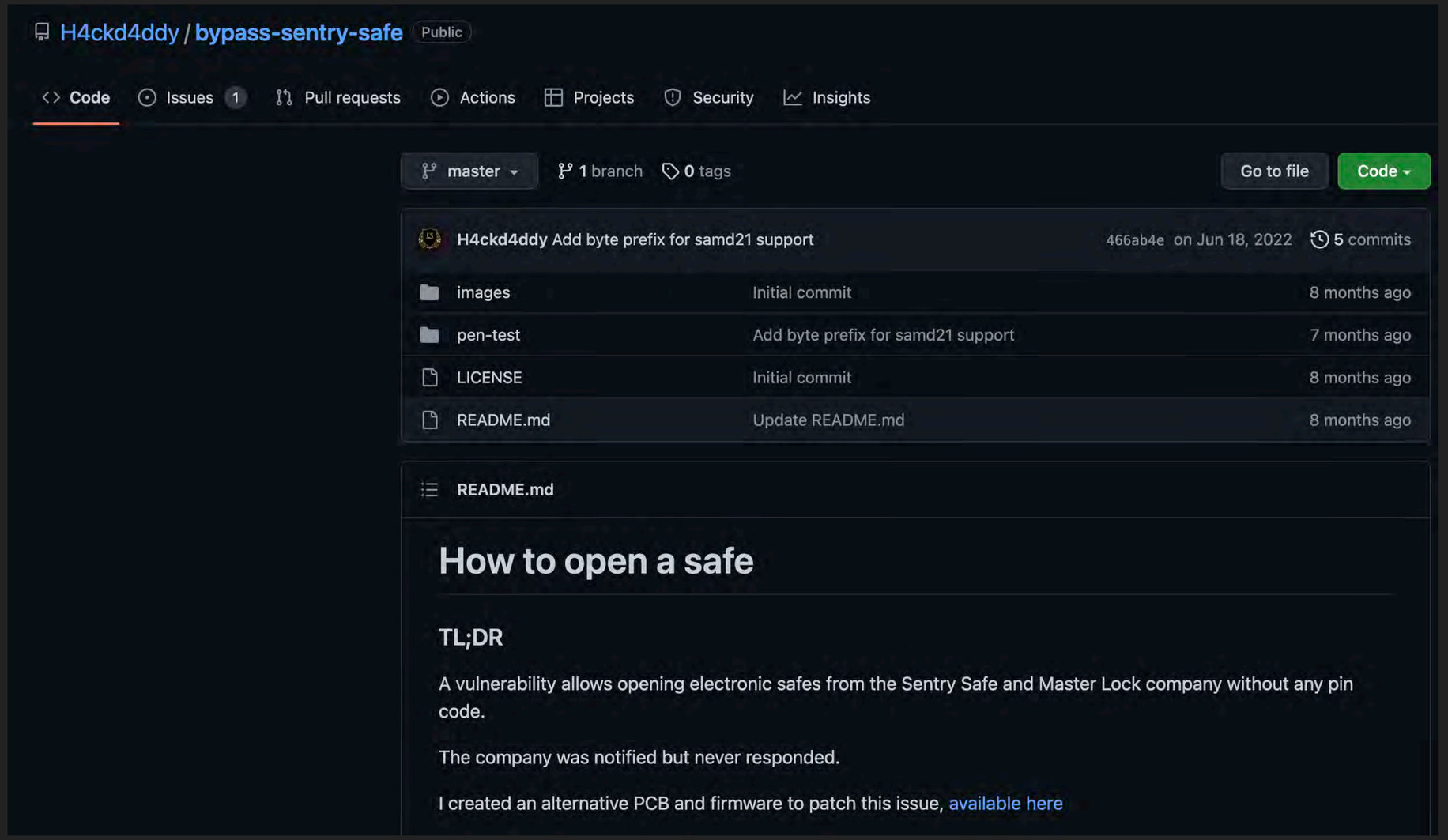
物聯網

很久很久以前，NiNi 吃飯配電視

噢不！只有現場的會眾記得這張圖是什麼！

很久很久以前，NiNi 吃飯配電視

文獻探討 aka 逛逛 GitHub



案例參考：電子保險箱（H4ckd4ddy）

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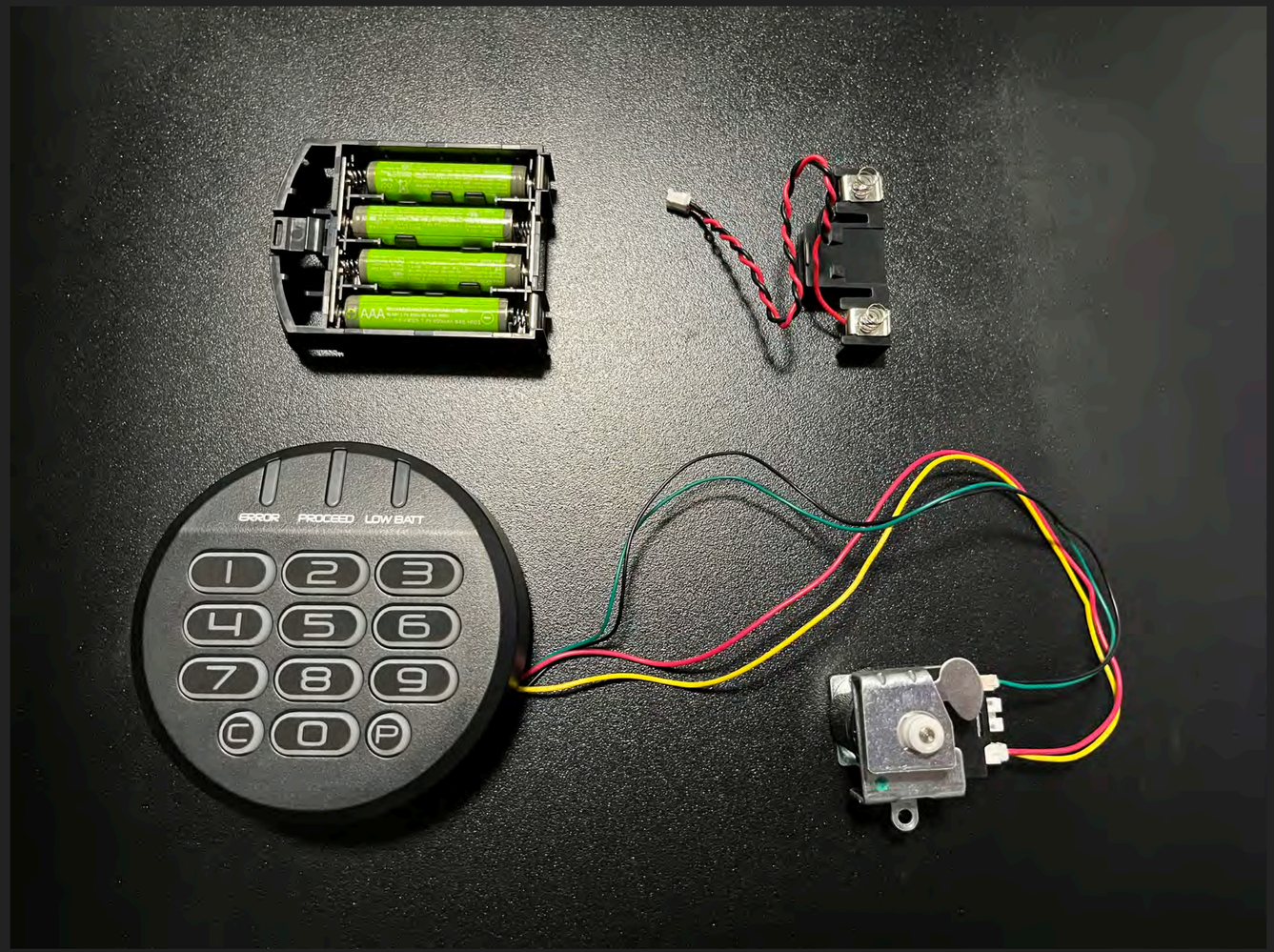

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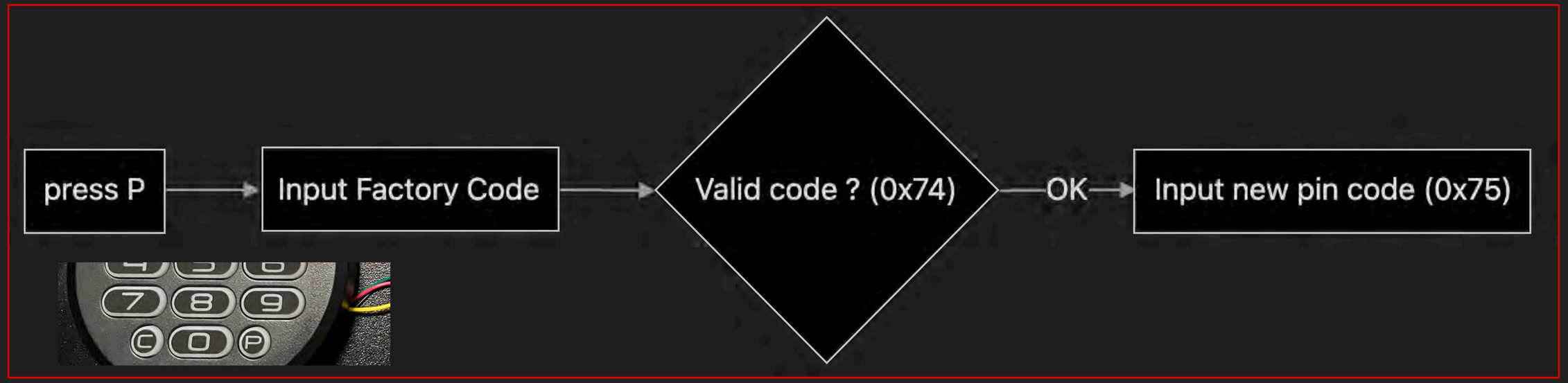
案例參考：電子保險箱（H4ckd4ddy）



案例參考：電子保險箱（H4ckd4ddy）

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很久很久以前，NiNi 吃飯配電視

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Easy peasy lemon squeezy

11kg~17kg

用電子商城買工具

用電子商城買工具

當我欣喜若狂的進行第一次入室竊盜（在腦袋裡）

試しの門

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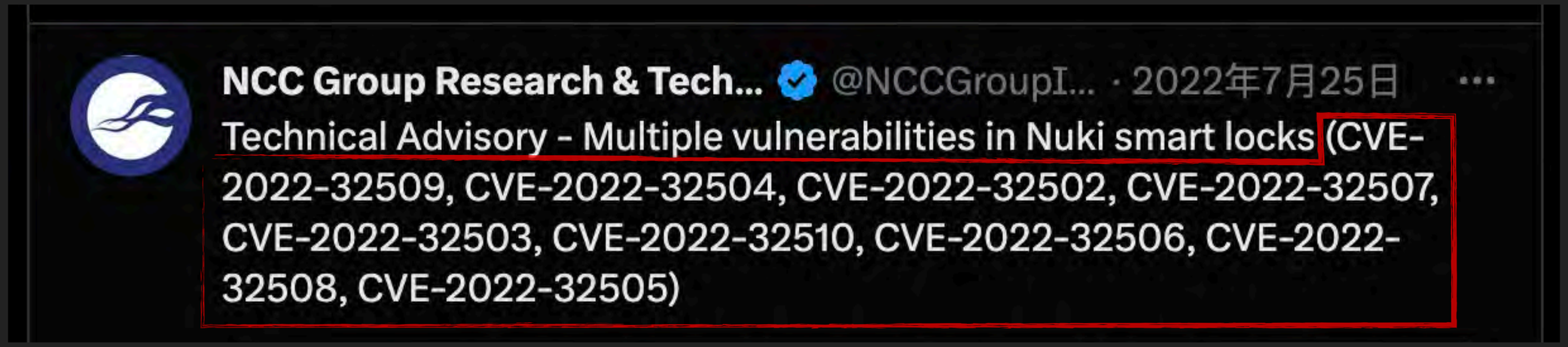
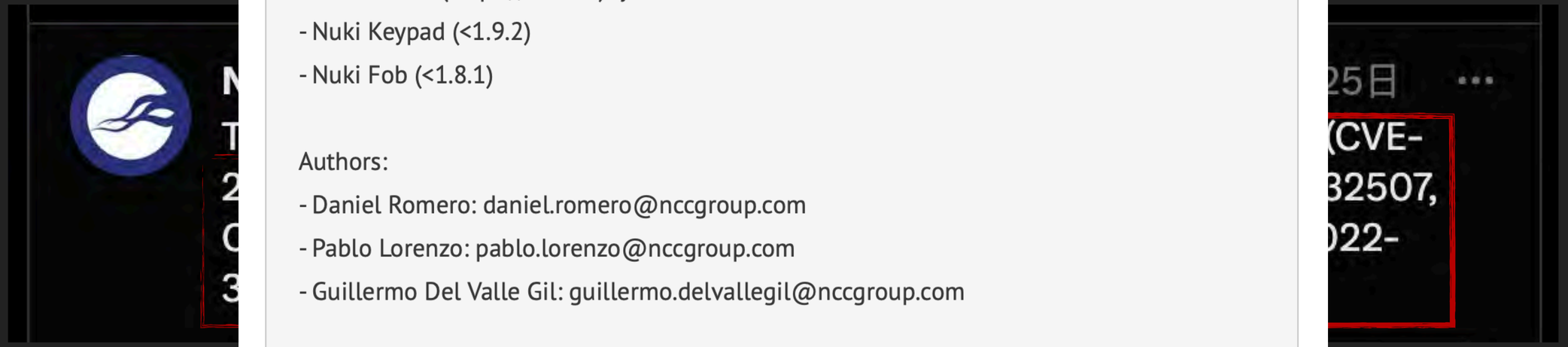
我又去文獻探討 aka 逛逛 twitter



案例參考：Nuki smart lock（NCC Group）



JTAG Exposed via Test Points (CVE-2022-32503)

Vendor: Nuki (https://nuki.io)Systems and Versions affected:

- Nuki Keypad (<1.9.2)
- Nuki Fob (<1.8.1)

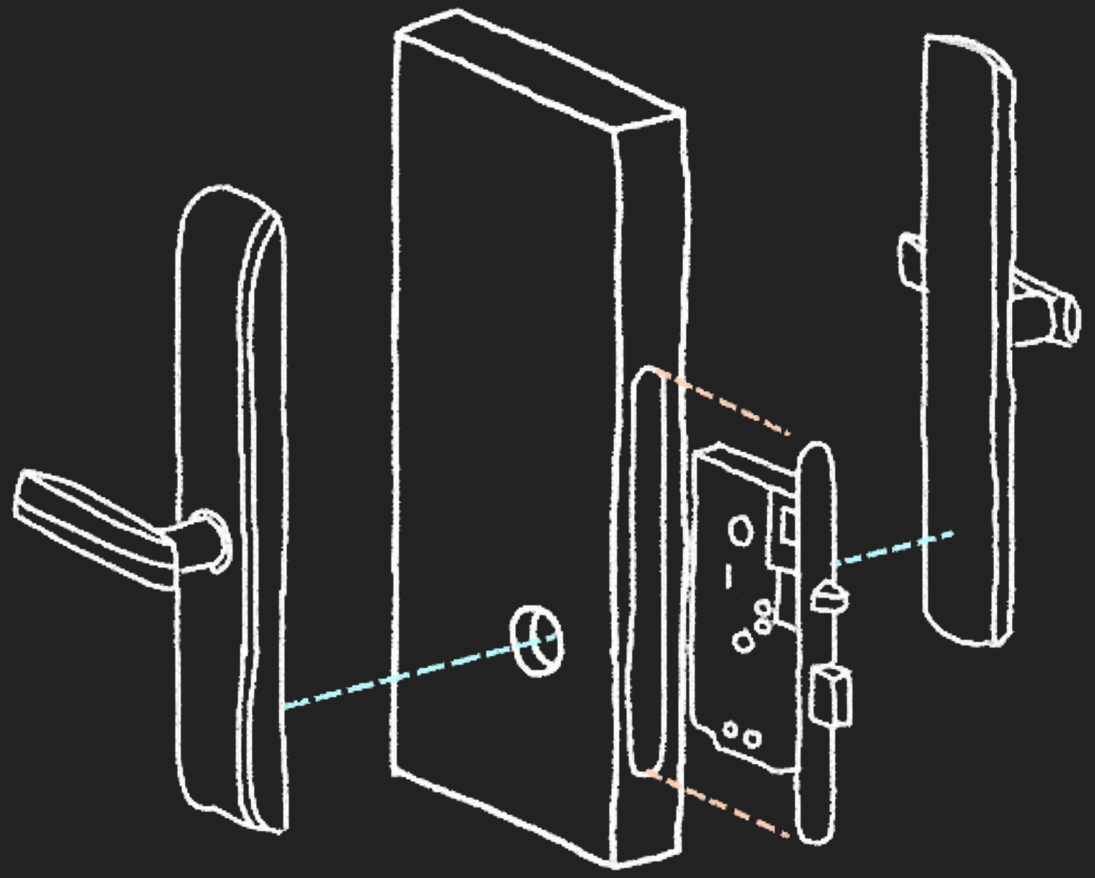
Authors:

- Daniel Romero: daniel.romero@nccgroup.com
- Pablo Lorenzo: pablo.lorenzo@nccgroup.com
- Guillermo Del Valle Gil: guillermo.delvallegil@nccgroup.com

CVE Identifier: CVE-2022-32503

Risk: 7.6 (CVSS:3.0/AV:P/AC:L/PR:N/UI:N/S:C/C:H/I:H/A:H)

案例參考：Nuki smart lock（NCC Group）



案例參考：Nuki smart lock（NCC Group）

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智慧門鎖攻擊面分析

- 機械＋計算機＋網路
- 攻擊面：
    - 傳統的門鎖：機械結構上的攻擊面
        - 用工具開鎖、貓眼開鎖...
    - 電子鎖：引入感測器模組、電子零件上的攻擊面
        - 特斯拉線圈、暴力破解、...
    - 智慧電子鎖：引入網路攻擊面
        - 惡意更新、使用者隱私、未加密連線...

智慧門鎖市場調查


下午 6:40
您好：
大門款式有很多，會有一些受限，安裝前麻煩請拍攝大門照片，如示意圖上角度，讓我們做安裝前的評估，如不清楚也可以用 line 通話諮詢喔。謝謝
下午 6:40
請提供大門正面、背面、側面照片
現場若為雙門設計，請測量雙門距！
室外 正面
室內 反面
門側 側面
雙門距
下午 6:40

智慧門鎖市場調查

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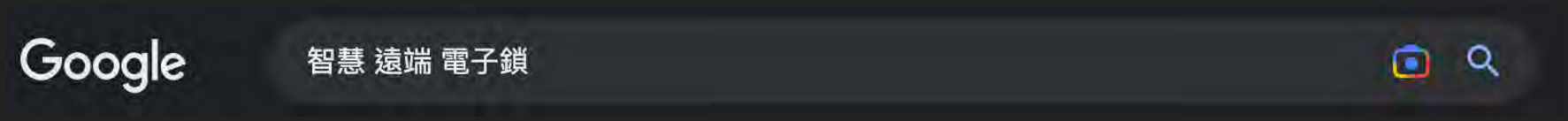
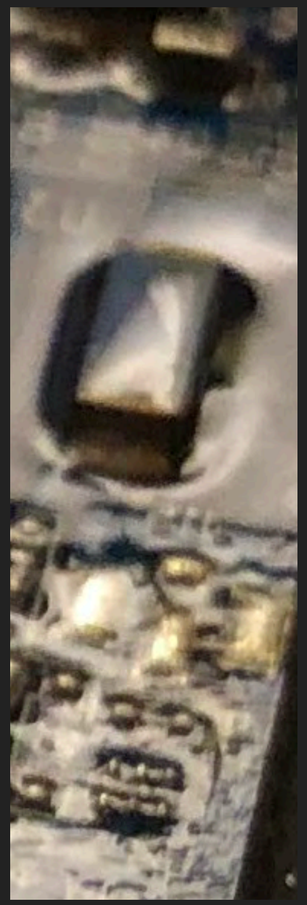
智慧門鎖市場調查



智慧門鎖遇到的問題

- 敷型塗層



智慧門鎖遇到的問題

- shield

智慧門鎖遇到的問題

- shield

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智慧門鎖遇到的問題

- shield

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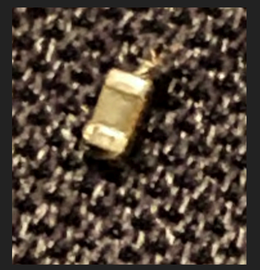
智慧門鎖遇到的問題

- shield



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智慧門鎖市場調查

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智慧門鎖市場調查

NT$ 6,500 ~~NT$ 8,500~~ **-23.5%**

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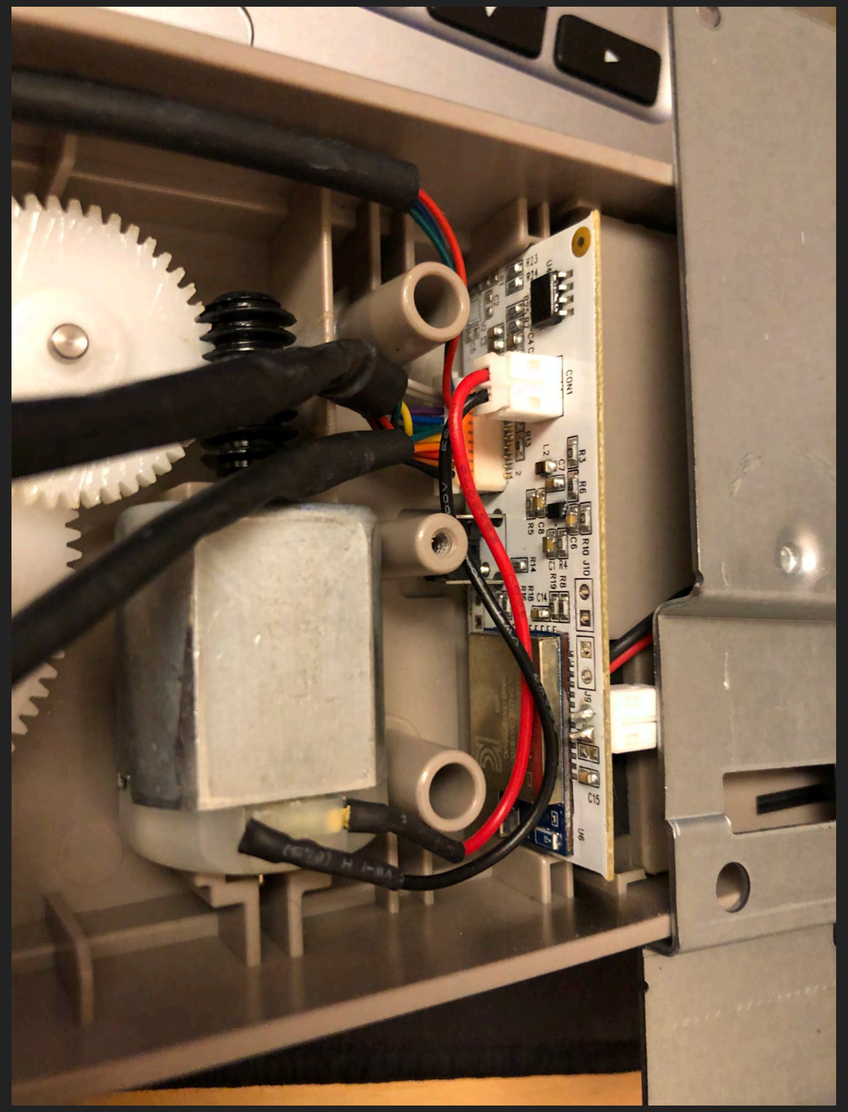
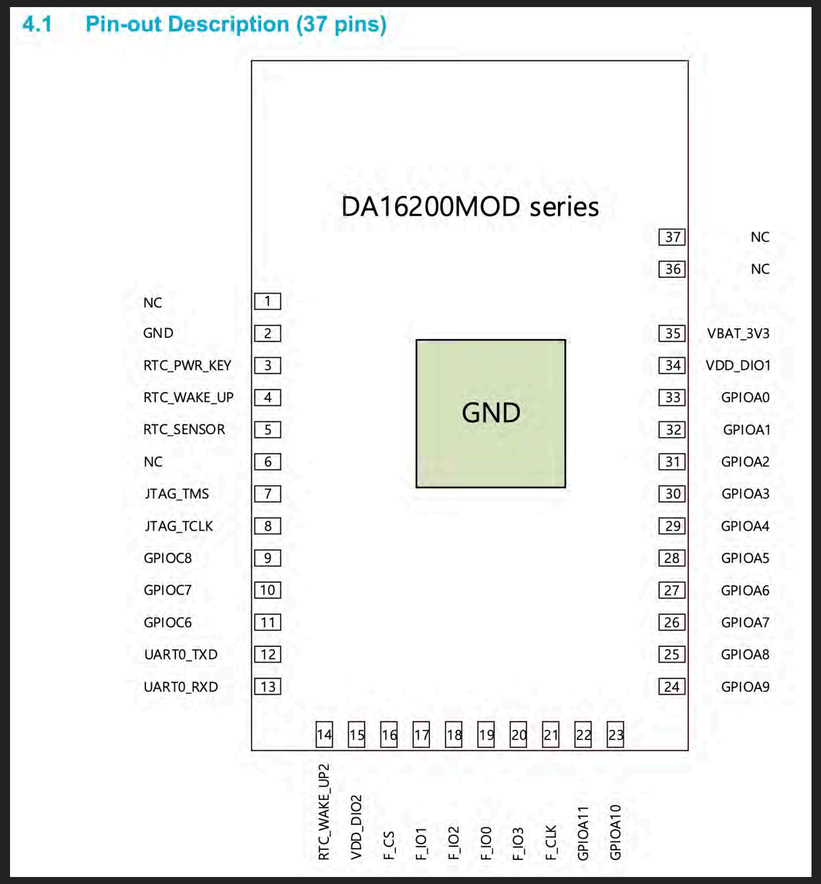
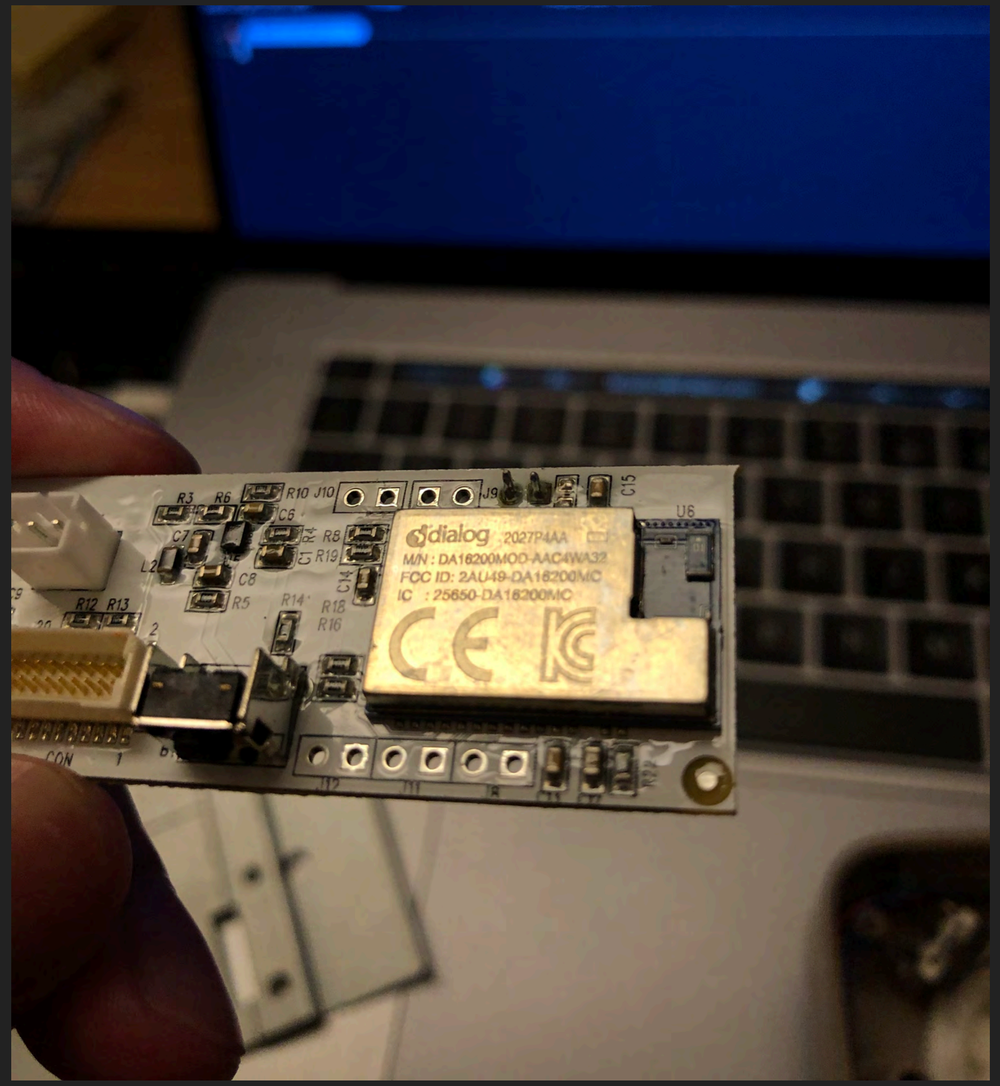
脫殼（物理）



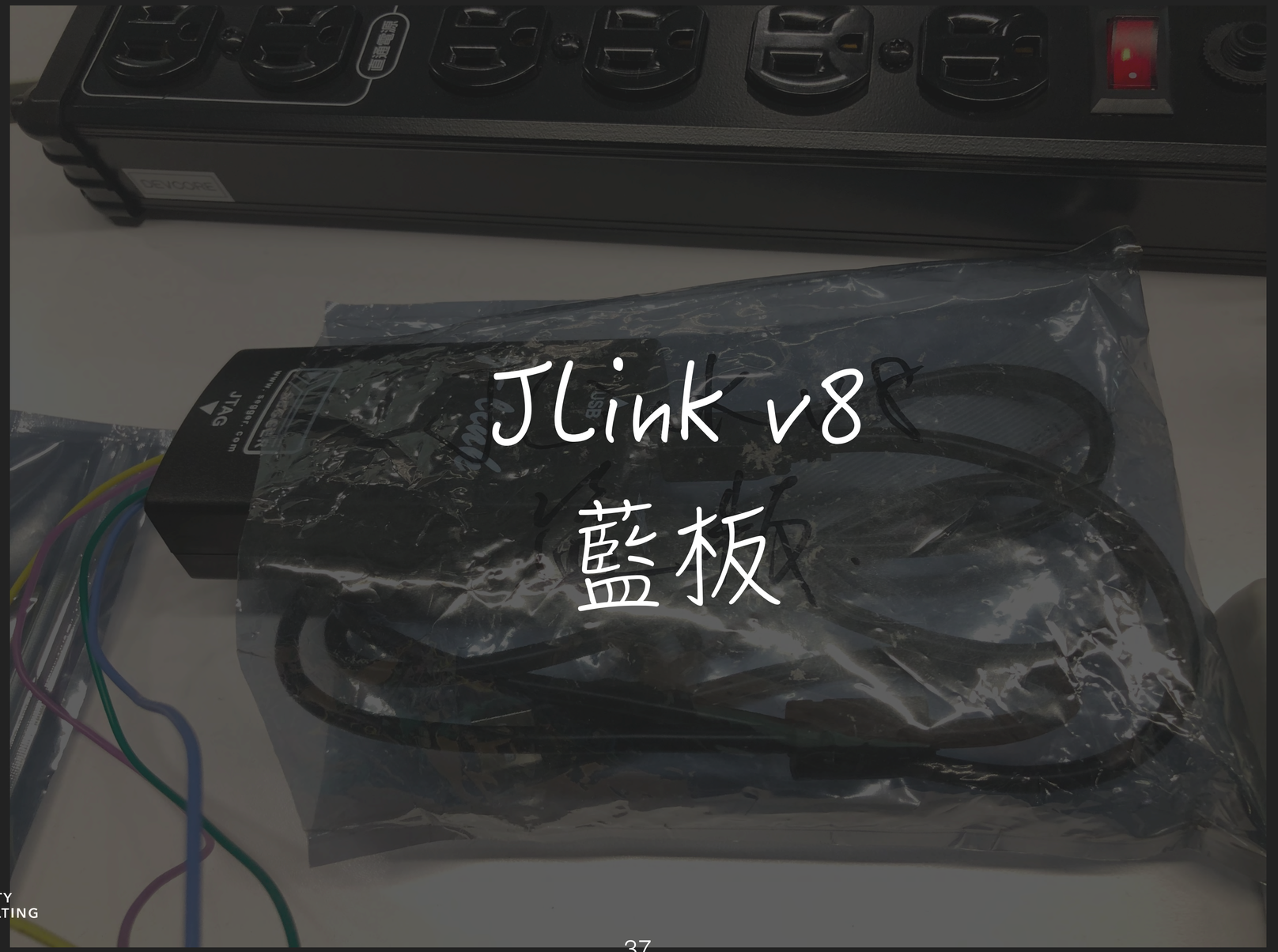
主要控制面板

- DA16200MOD-AAC4WA32

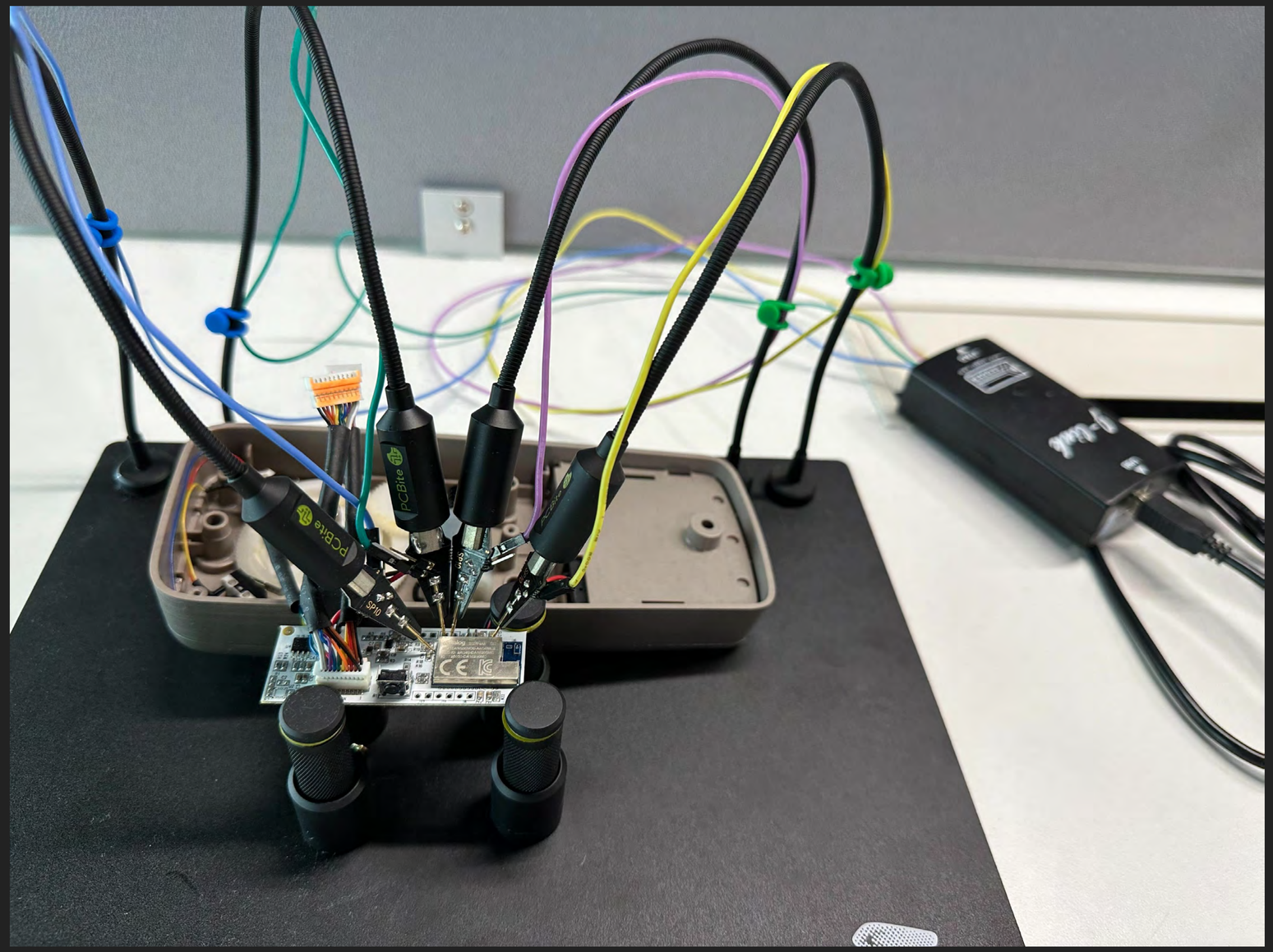




輔助工具



輔助工具



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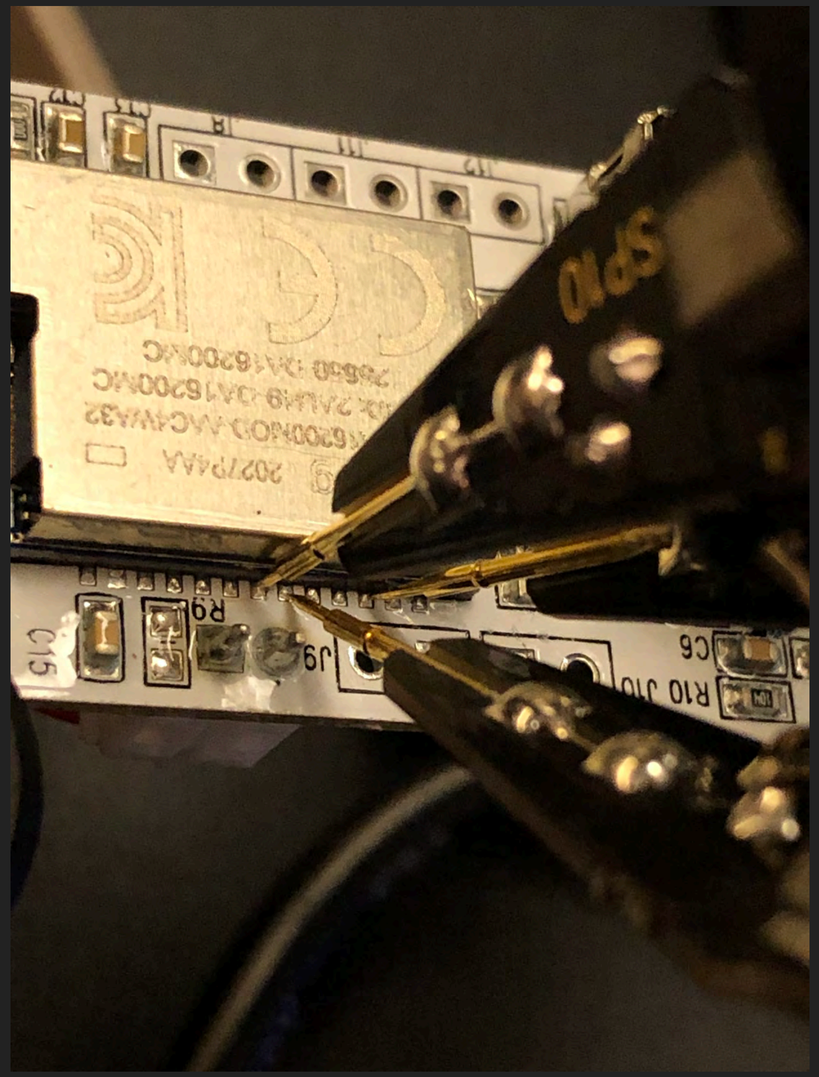
SWD



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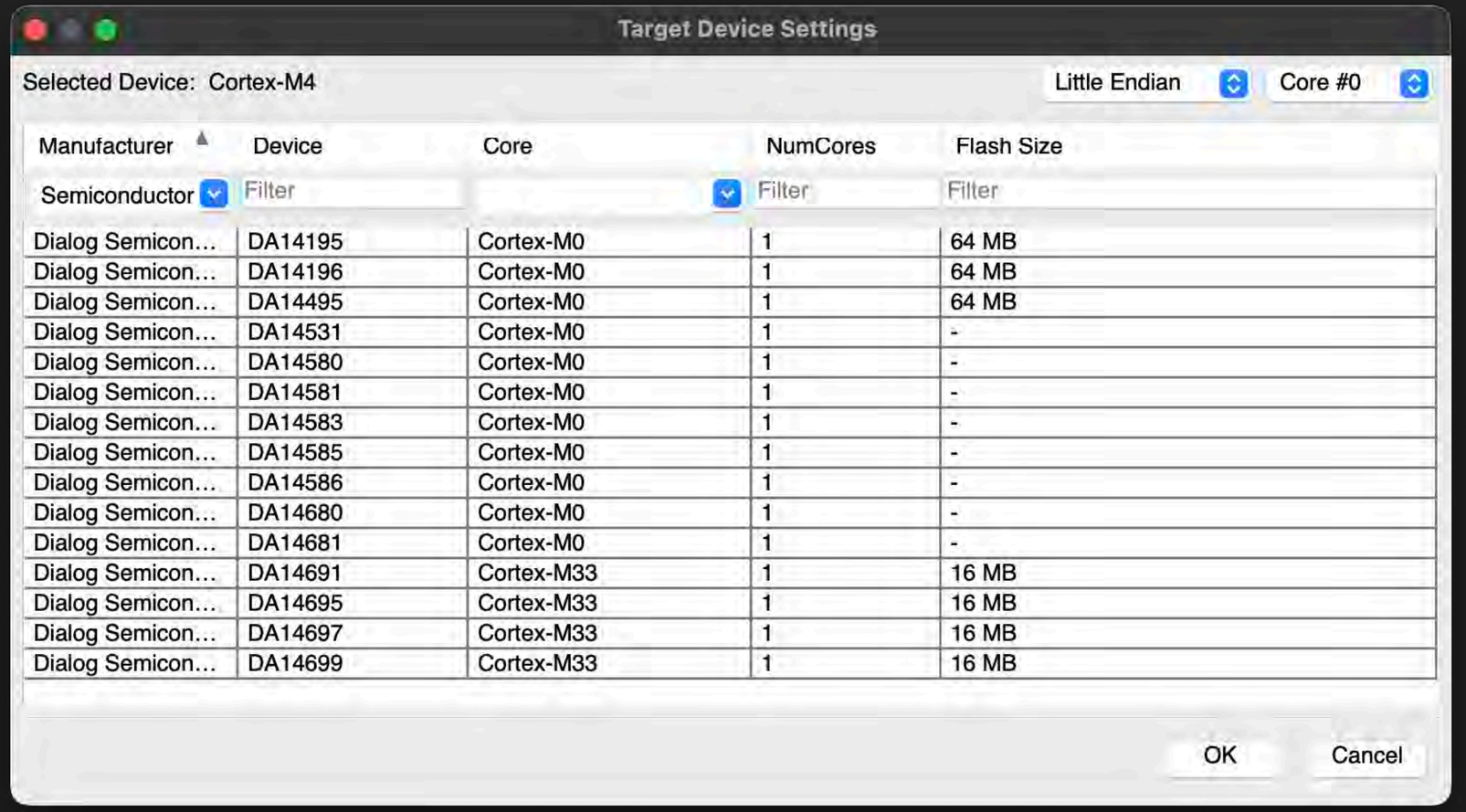
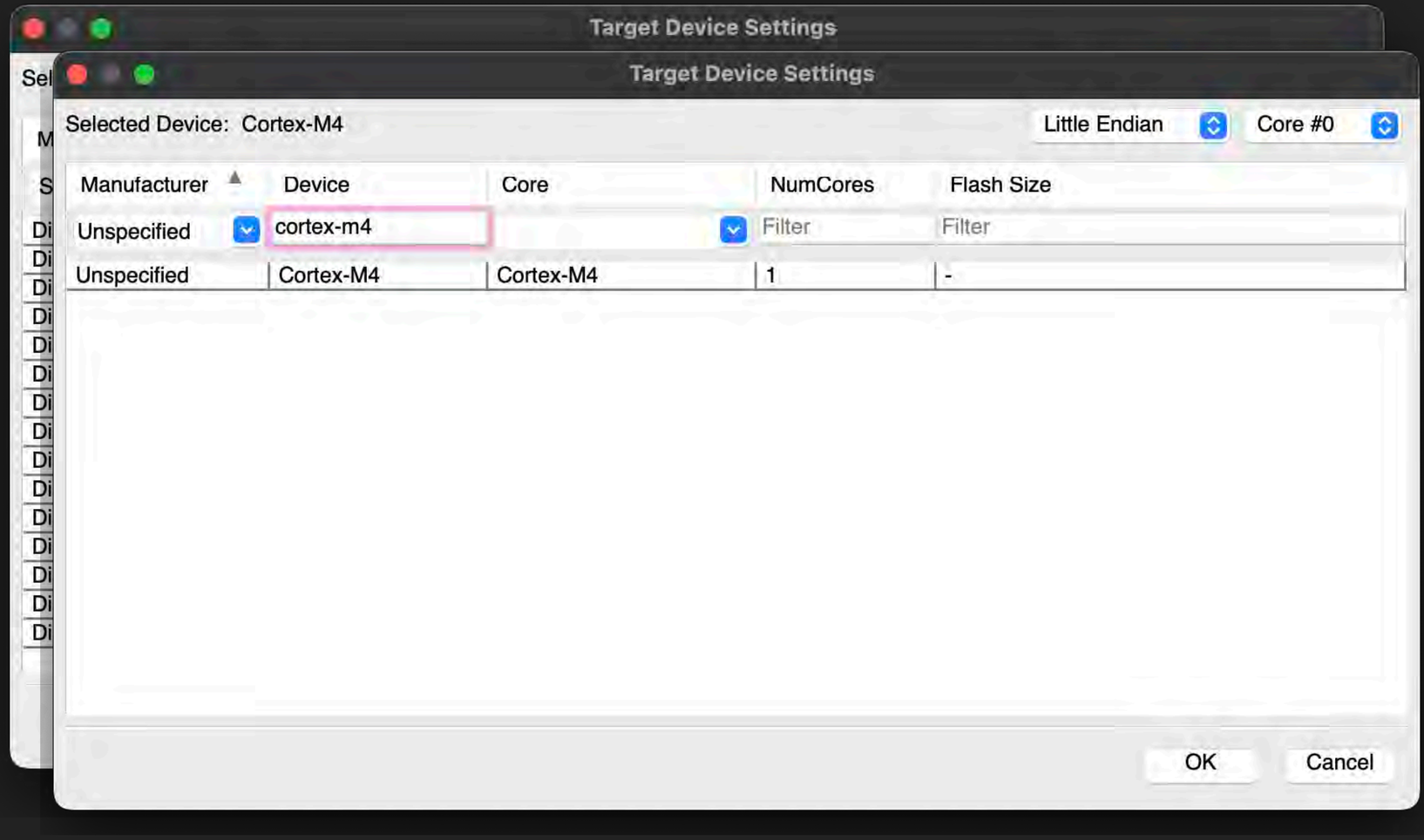
SWD


Target Device Settings
Selected Device: Cortex-M4
Little Endian
Core #0
Manufacturer
Device
Core
NumCores
Flash Size
Semiconductor
Filter
Filter
Filter
Dialog Semicon… DA14195 Cortex-M0 1 64 MB
Dialog Semicon… DA14196 Cortex-M0 1 64 MB
Dialog Semicon… DA14495 Cortex-M0 1 64 MB
Dialog Semicon… DA14531 Cortex-M0 1 -
Dialog Semicon… DA14580 Cortex-M0 1 -
Dialog Semicon… DA14581 Cortex-M0 1 -
Dialog Semicon… DA14583 Cortex-M0 1 -
Dialog Semicon… DA14585 Cortex-M0 1 -
Dialog Semicon… DA14586 Cortex-M0 1 -
Dialog Semicon… DA14680 Cortex-M0 1 -
Dialog Semicon… DA14681 Cortex-M0 1 -
Dialog Semicon… DA14691 Cortex-M33 1 16 MB
Dialog Semicon… DA14695 Cortex-M33 1 16 MB
Dialog Semicon… DA14697 Cortex-M33 1 16 MB
Dialog Semicon… DA14699 Cortex-M33 1 16 MB
OK
Cancel

SWD

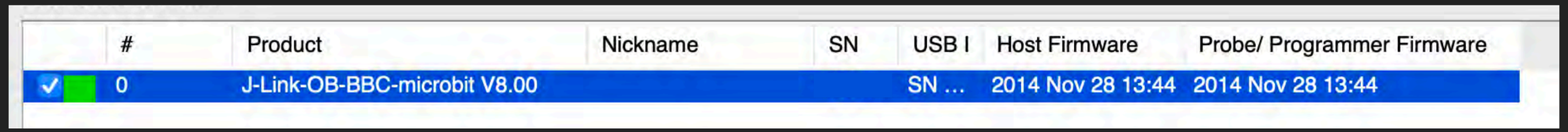

Target Device Settings
Target Device Settings
Selected Device: Cortex-M4
Little Endian
Core #0
Manufacturer
Device
Core
NumCores
Flash Size
Unspecified
cortex-m4
Filter
Filter
Unspecified
Cortex-M4
Cortex-M4
1
-
OK
Cancel

SWD

```
J-Link>device CORTEX-M4
J-Link>r
Target connection not established yet but required for command.
Device "CORTEX-M4" selected.


Connecting to target via SWD
Failed to attach to CPU. Trying connect under reset.
Connect fallback: Reset via Reset pin & Connect.
Connect fallback: Reset via Reset pin & Connect.
Cannot connect to target.
```

SWD



#	Product	Nickname	SN	USB I	Host Firmware	Probe/ Programmer Firmware
0	J-Link-OB-BBC-microbit V8.00			SN ...	2014 Nov 28 13:44	2014 Nov 28 13:44

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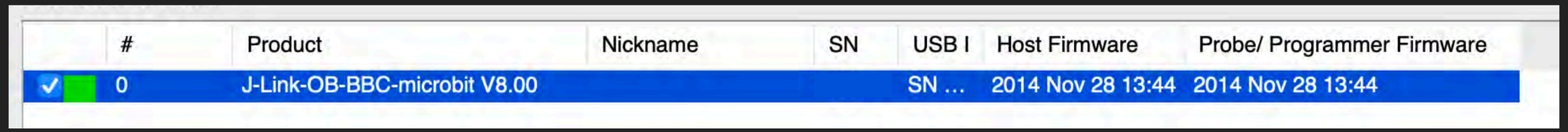
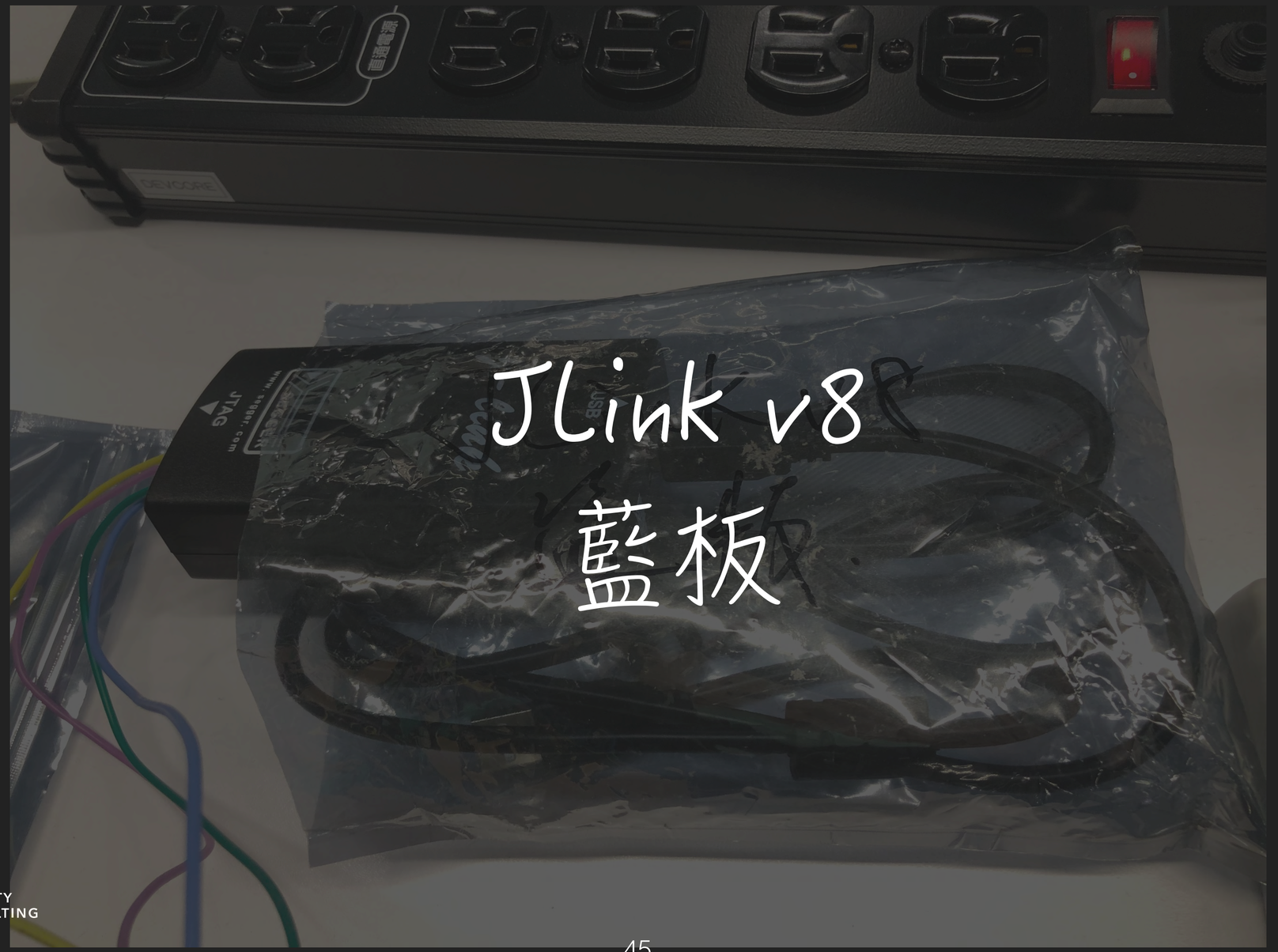
SWD



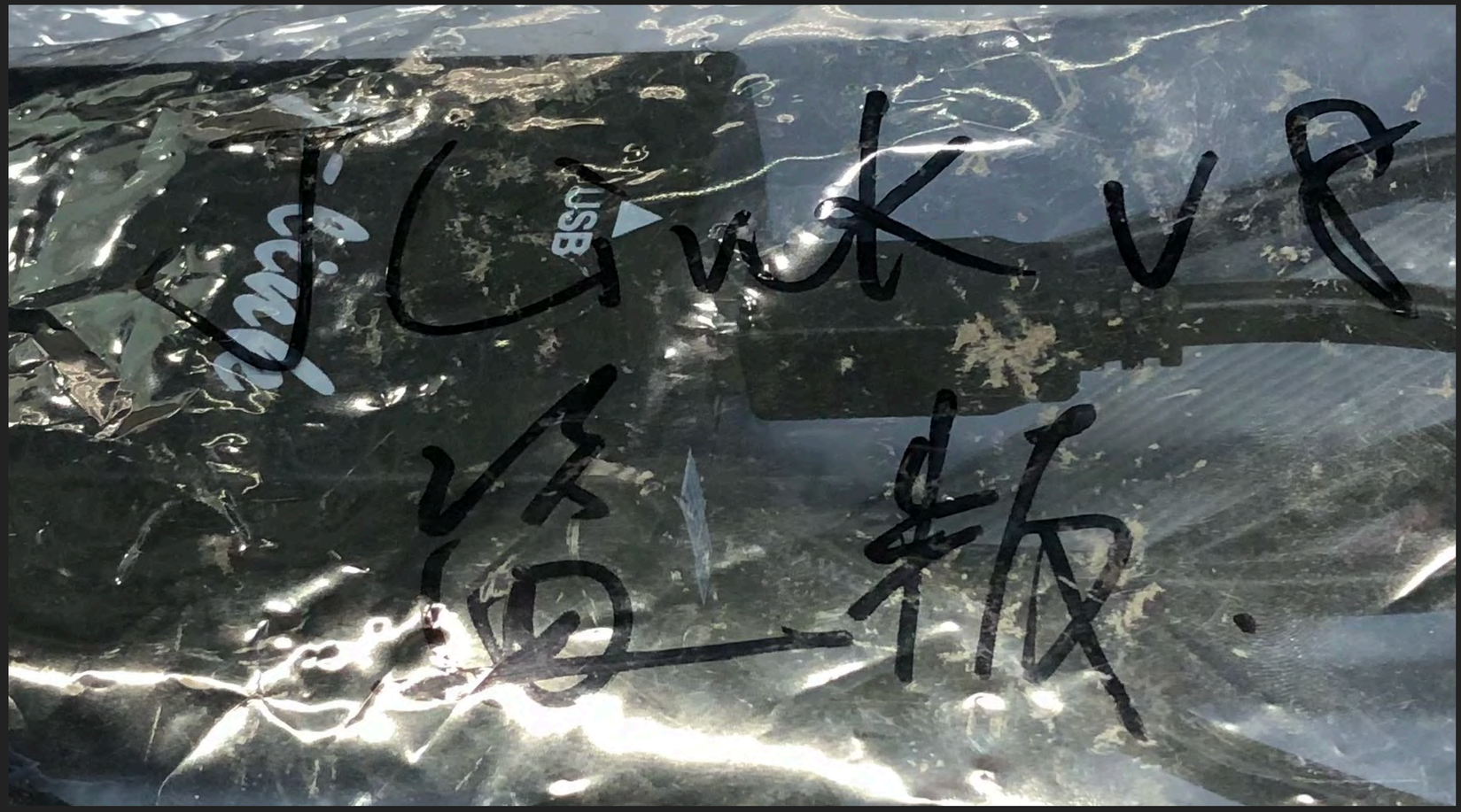
#	Product	Nickname	SN	USB I	Host Firmware	Probe/ Programmer Firmware
0	J-Link-OB-BBC-microbit V8.00			SN ...	2014 Nov 28 13:44	2014 Nov 28 13:44

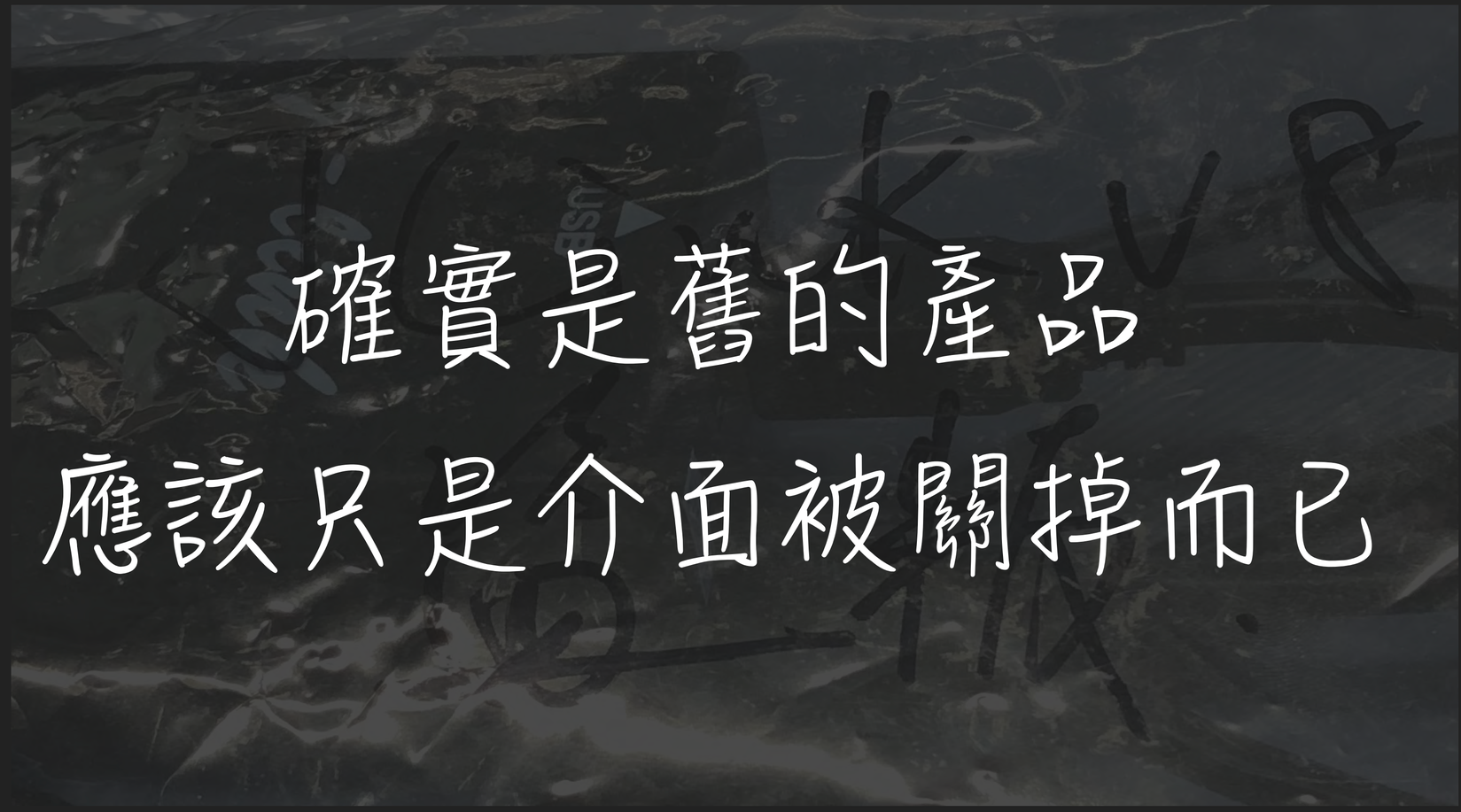
```
Not updated, probe/ programmer firmware is already up to date.
```

SWD

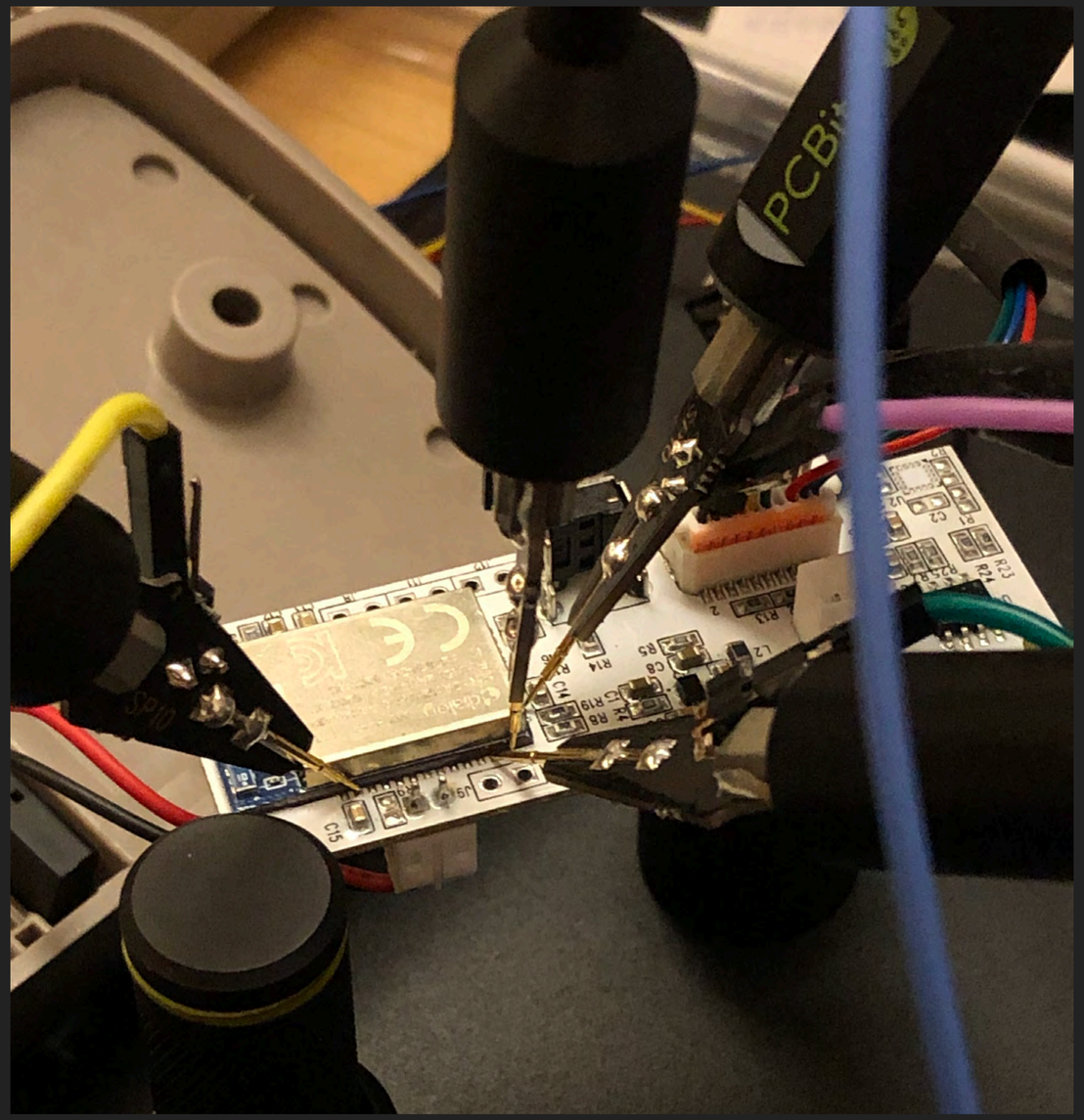


SWD



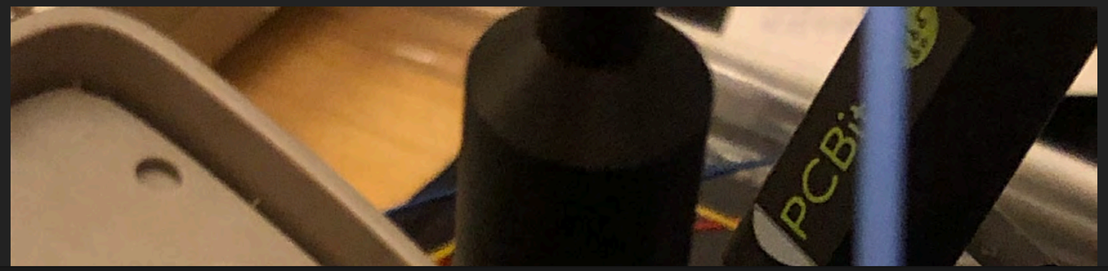

確實是舊的產品
應該只是介面被關掉而已

UART



DEVCORE SECURITY CONSULTING

UART



```
rwnx_send_set_ps_mod
Wakeup source is 0x81

>>> TIM STATUS: 0x00000010
>>> TIM : FAST
Waking up MCU ...
CMD: AT+NWMQMSG
{"status":4,"Record":{"date":"220908202555+0800","type":9}}(Tx: Len=59,Topic=locks/D98A462B/up,Msg_ID=44)
<< Mqtt Pub EnQ : SUCCESS >>
...CMD parser status 0
CMD: AT+SETDPMSLPEXT
...CMD parser status 0
```

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Programmer...?

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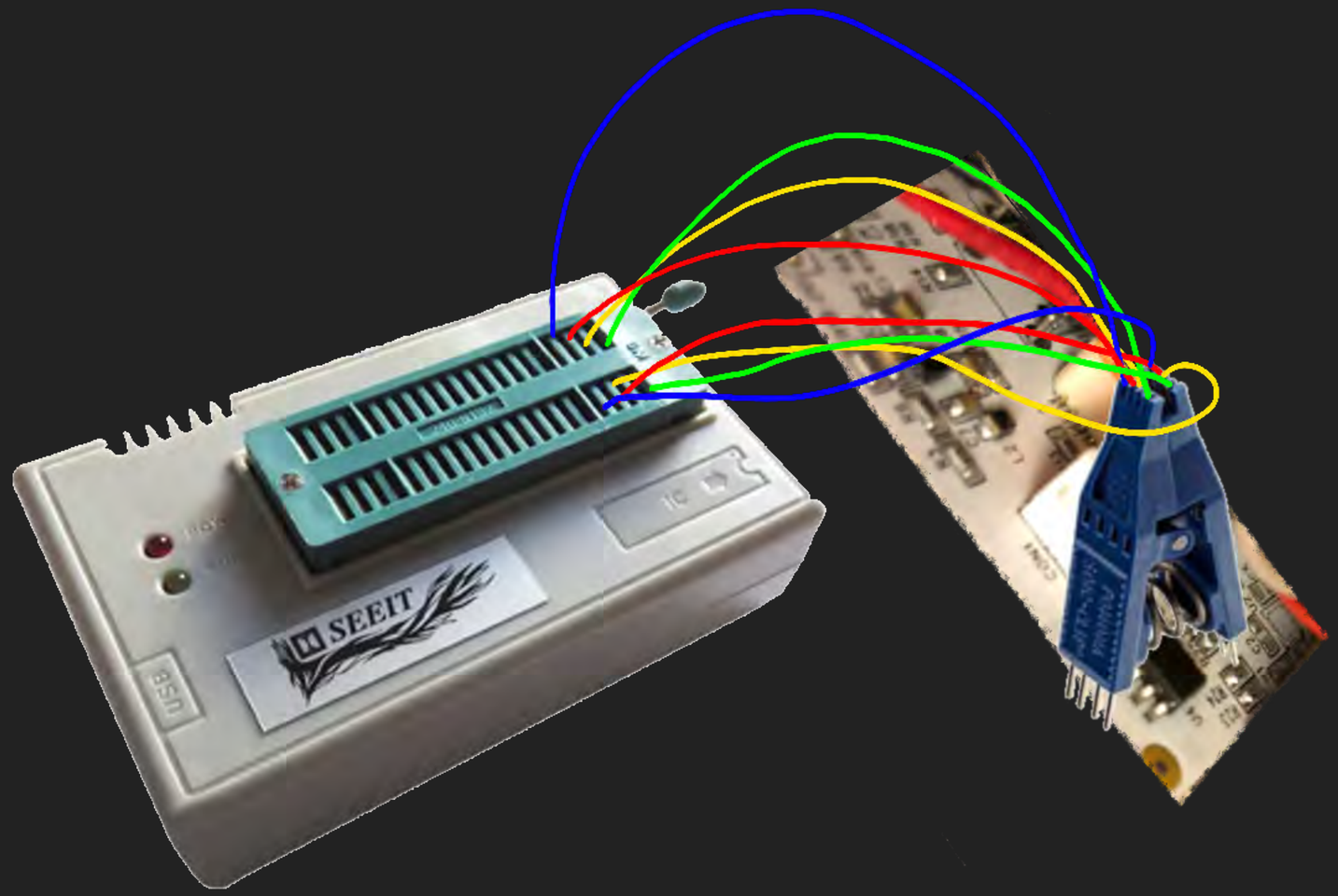
Programmer...?



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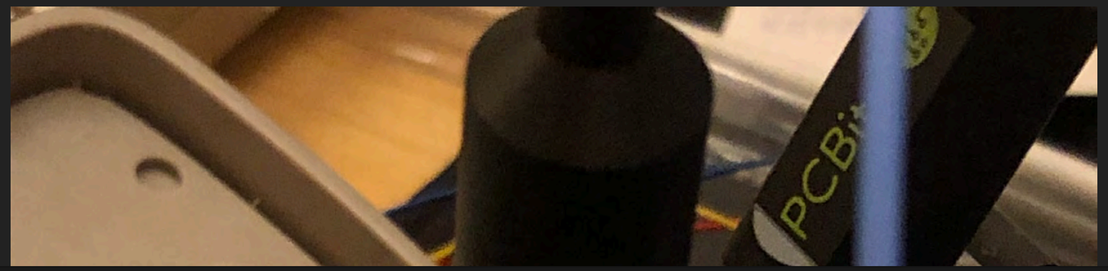
Programmer...?

UART



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<< Mqtt Pub EnQ : SUCCESS >>
...CMD parser status 0
CMD: AT+SETDPMSLPEXT
...CMD parser status 0
```

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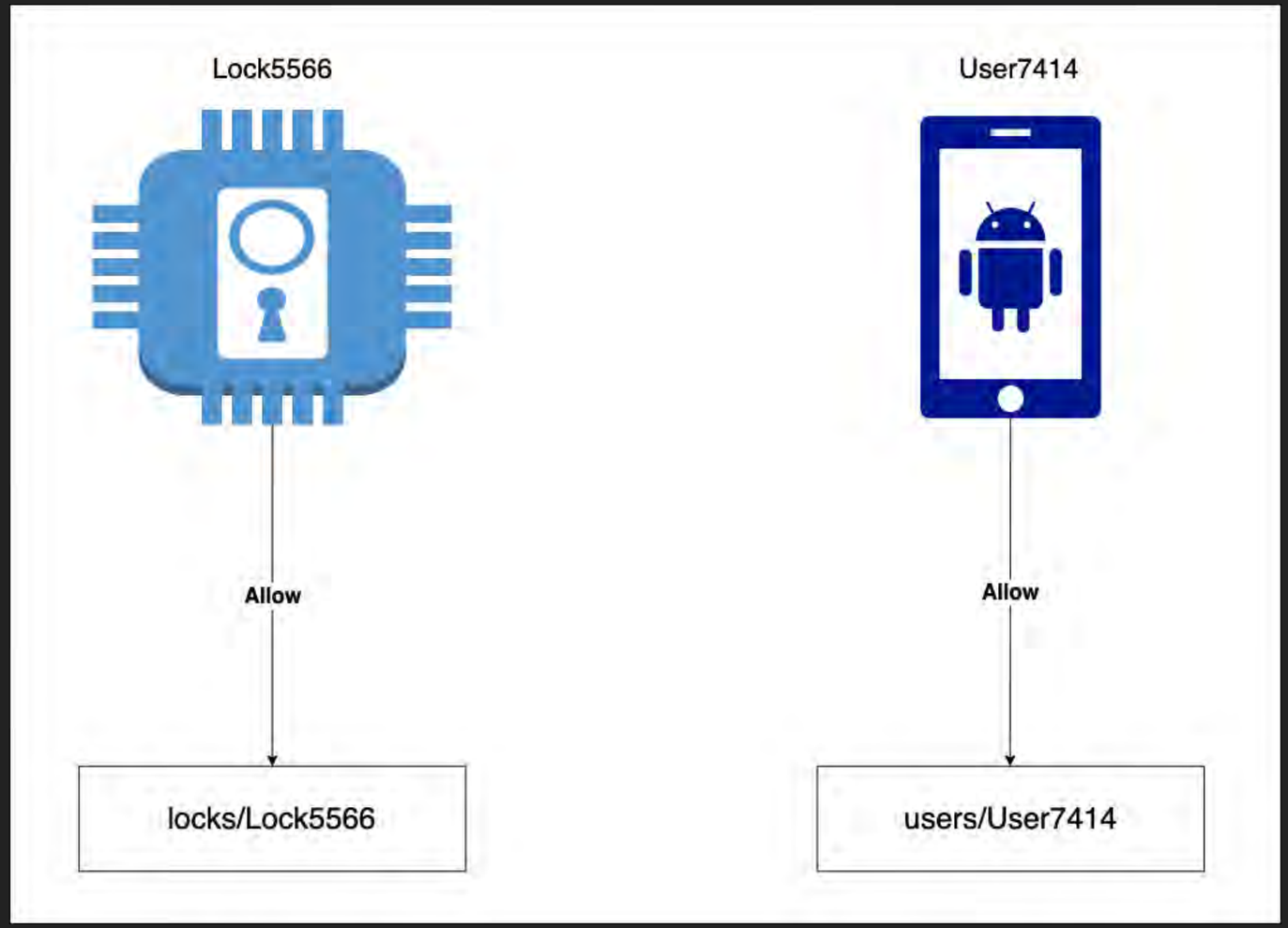
APP 介面

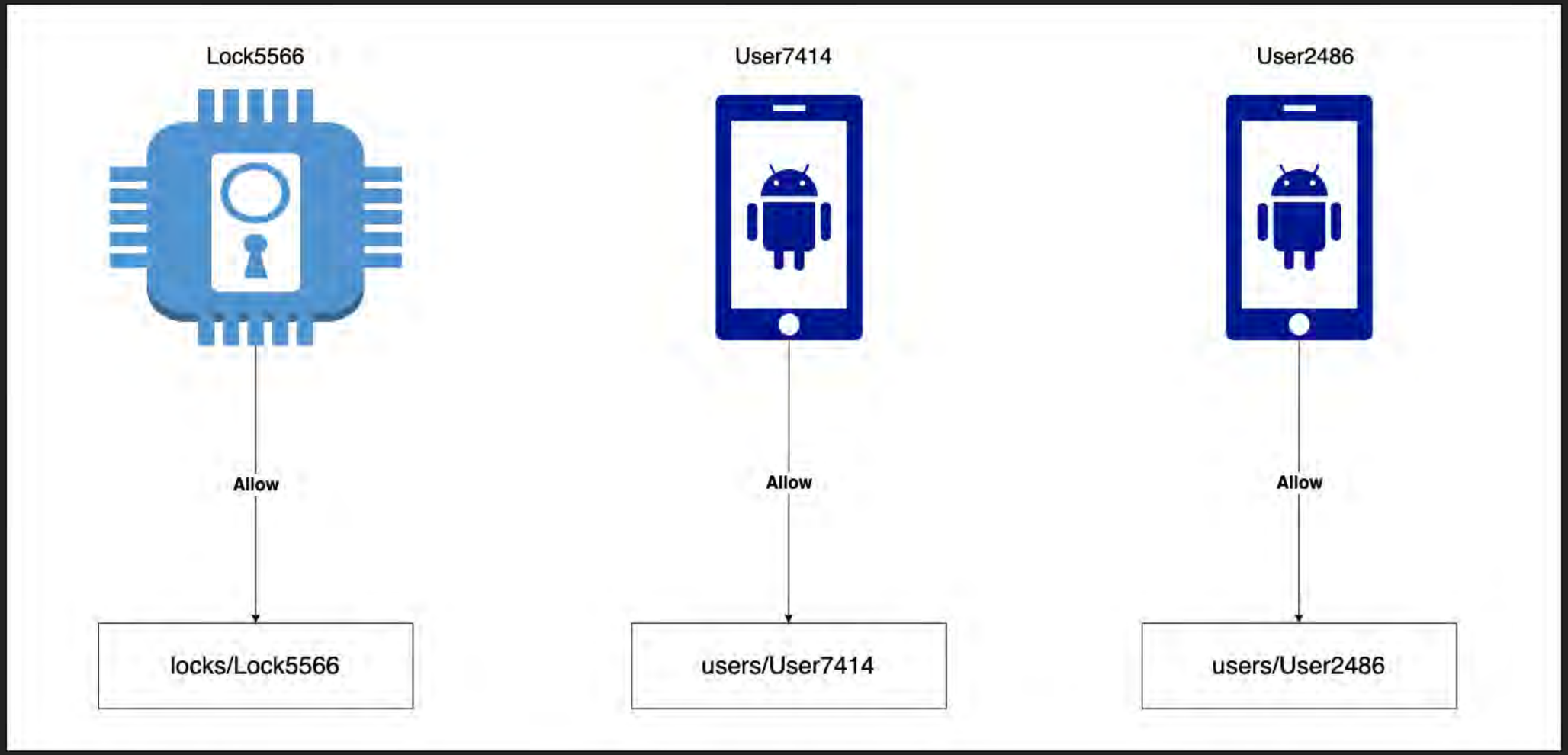

nini's room | front door
一般模式
上鎖


nini's room | front door
+ 新增使用者
管理者
nini chen
主人
逆逆
客人
密碼使用者
封鎖

權限潛在問題

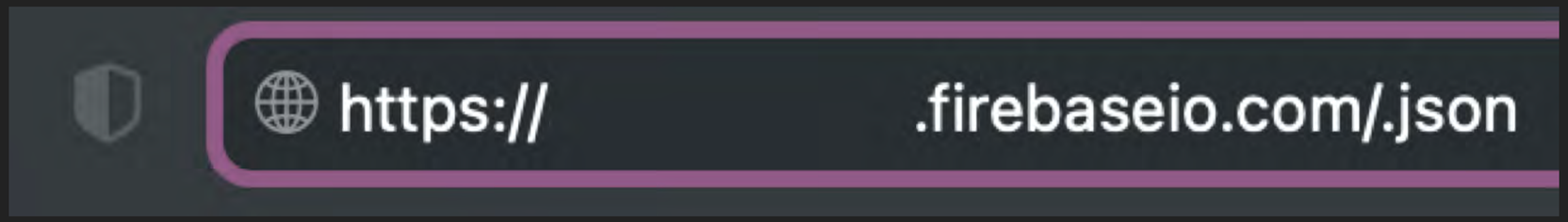

Lock5566
User7414
Allow
Allow
locks/Lock5566
users/User7414

權限潛在問題


Lock5566
User7414
User2486
Allow
Allow
Allow
locks/Lock5566
users/User7414
users/User2486

Firebase

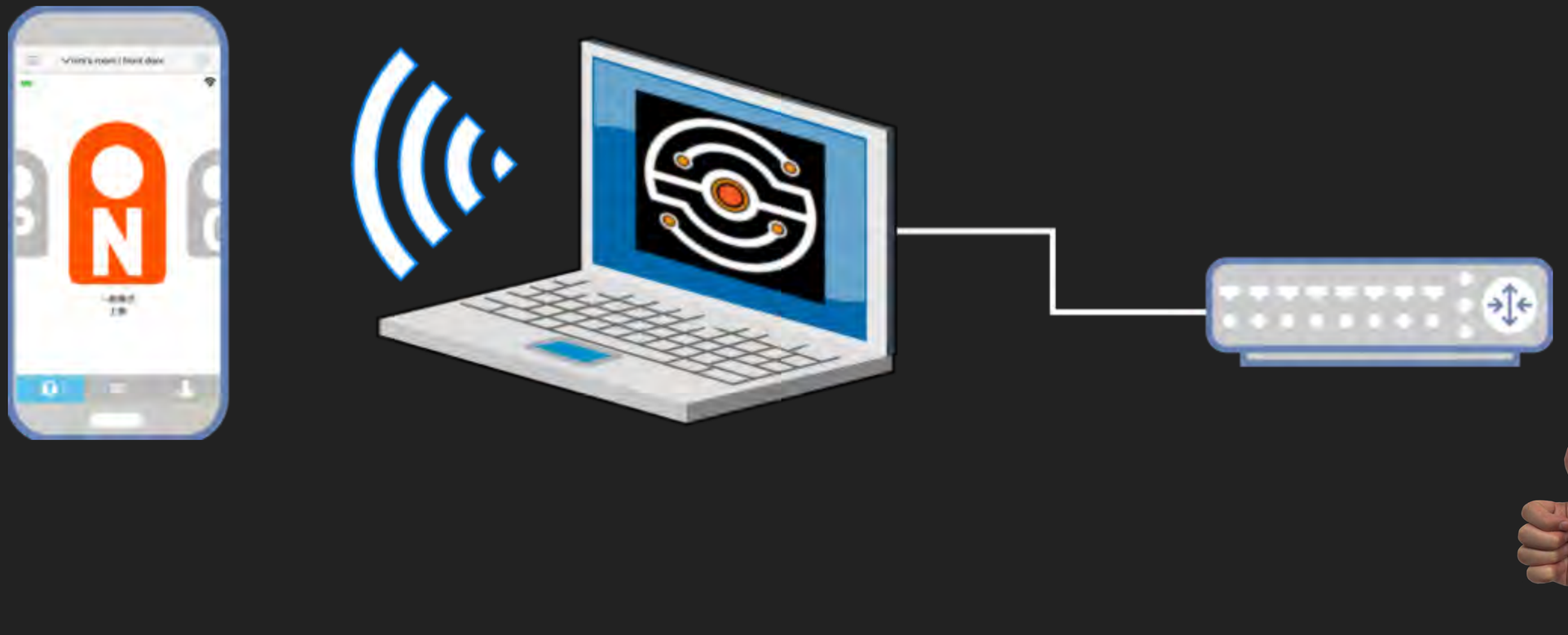
```
~/Desktop/                                    git master !1 ?32
>> grep -R firebaseio.com *
res/values/strings.xml:    <string name="firebase_database_url">https://_          .firebaseio.com</string>
```



Firebase

```
~/Desktop/                                    git master !1 ?32
>> grep -R firebaseio.com *
res/values/strings.xml:    <string name="firebase_database_url">https://_          .firebaseio.com</string>
```

MITM



SSL Pinning

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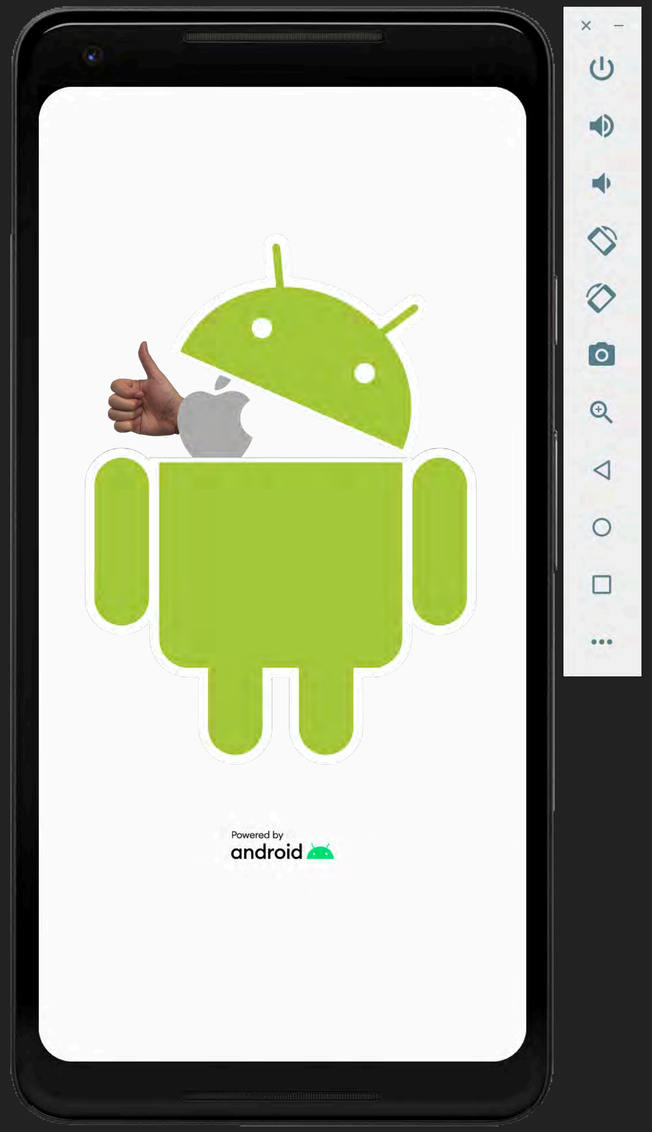
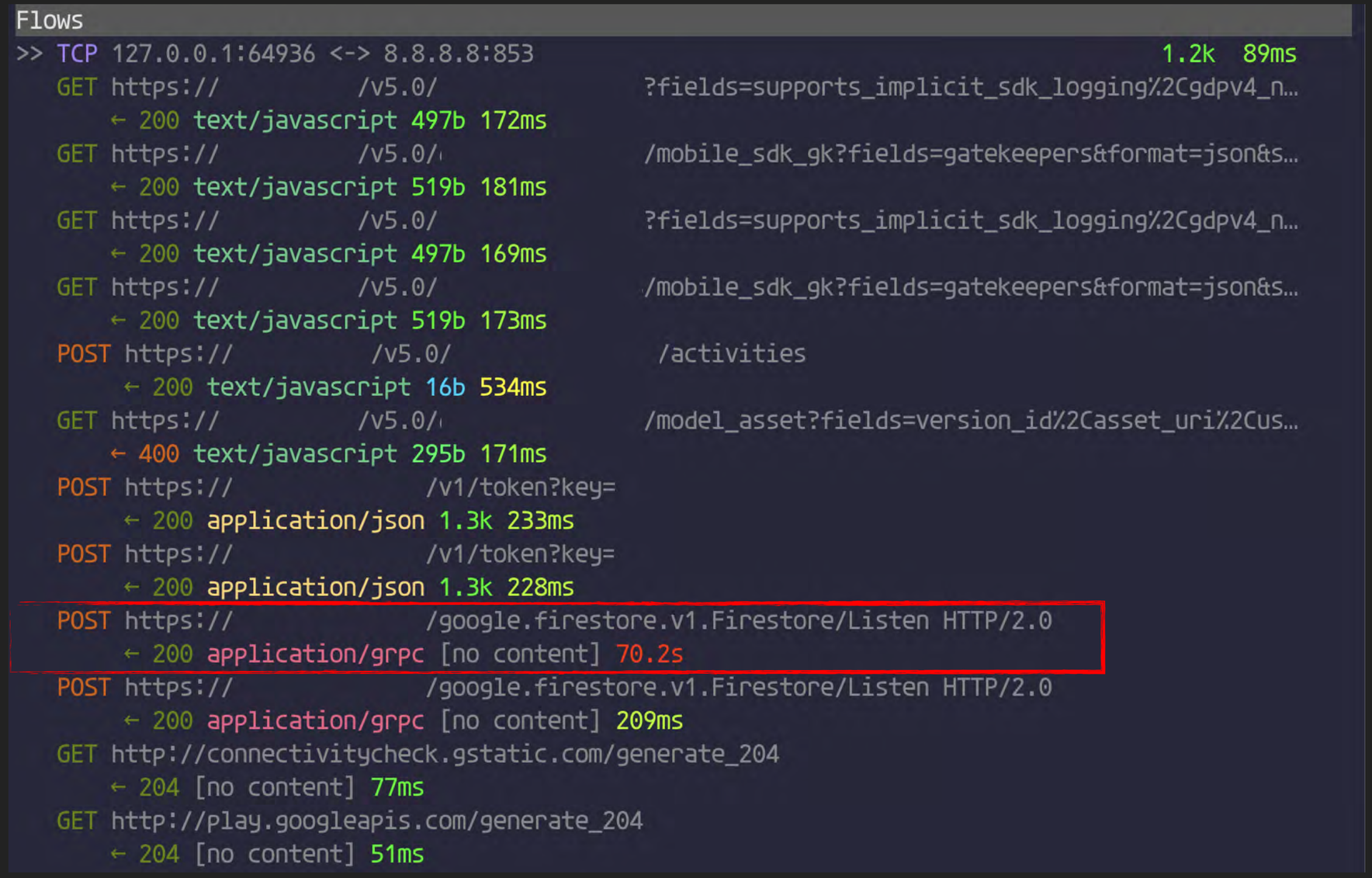
Android Studio



MITM

- Frida Hook



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MITM

- catlog

```
11:40:26.291  7230  7247 W System  : A resource failed to call close.
11:40:30.145  7230  7289 D OpenGLRenderer: endAllActiveAnimators on 0x70d68b9de610 (RippleDrawable) with handle 0x70d5ab9e7b10
11:40:35.146  7230  7298 W Firestore: (22.1.1) [OnlineStateTracker]: Could not reach Cloud Firestore backend. Backend didn't respond within 10 seconds
11:40:35.146  7230  7298 W Firestore:
11:40:35.146  7230  7298 W Firestore: This typically indicates that your device does not have a healthy Internet connection at the moment. The client w
 successfully connect to the backend.
11:40:35.149  7230  7230 E DoorSelectViewController: 刪除門鎖db資料~~~~~
```

```
didn't respond within 10 seconds
```

MITM

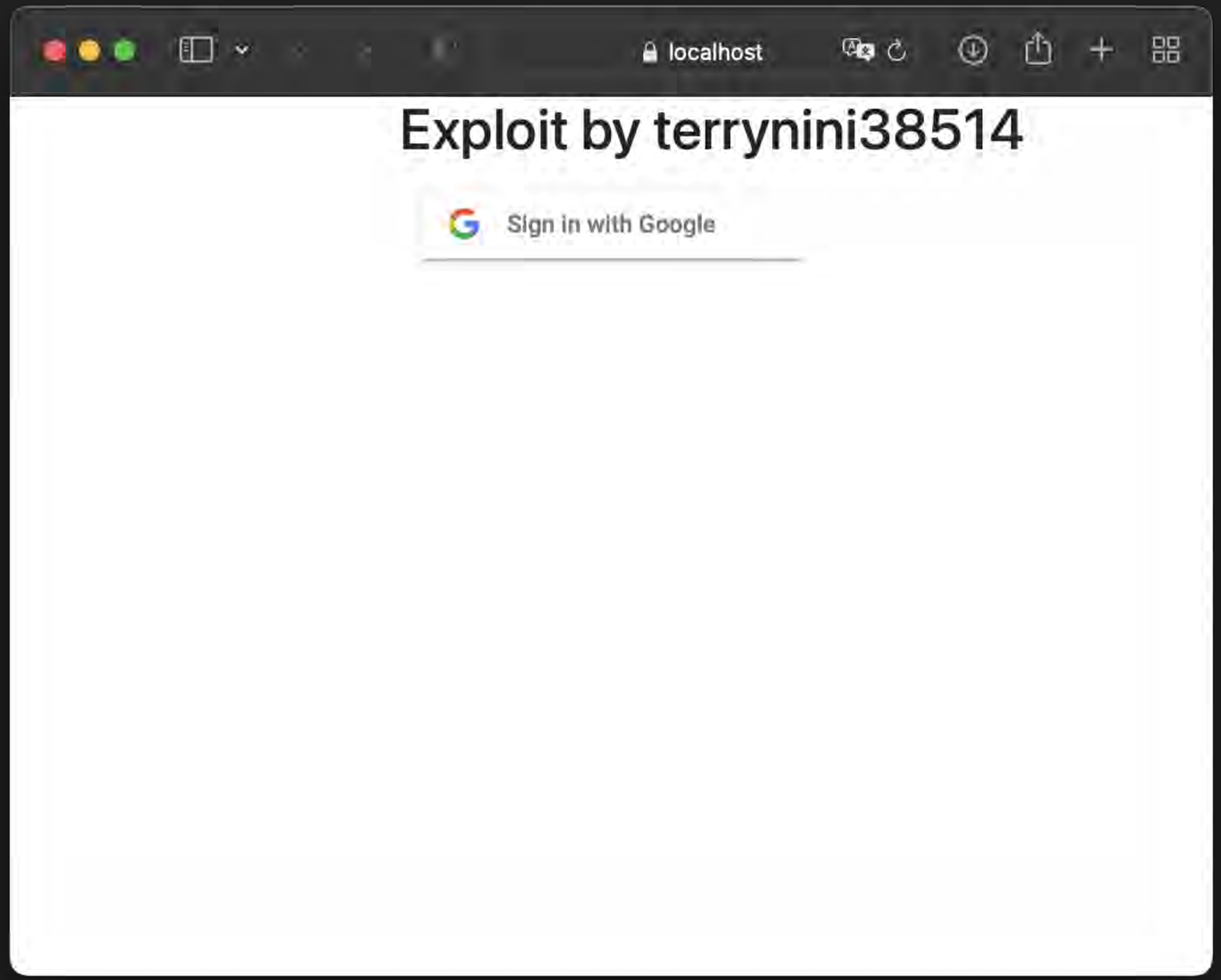
```
POST https://                    /google.firestore.v1.Firestore/Write HTTP/2.0
     ← 200 application/grpc 19b 1699s
TCP 127.0.0.1:56497 <-> 8.8.8.8:853                                  1.2k  80ms
TCP 127.0.0.1:57129 <-> 8.8.8.8:853                                  1.2k  76ms
GET http://connectivitycheck.gstatic.com/generate_204
```

```
POST https://                    /v1/token?key=
     ← 200 application/json 1.3k 233ms
POST https://                    /google.firestore.v1.Firestore/Write HTTP/2.0
     ← 200 application/grpc 19b 3299s
```

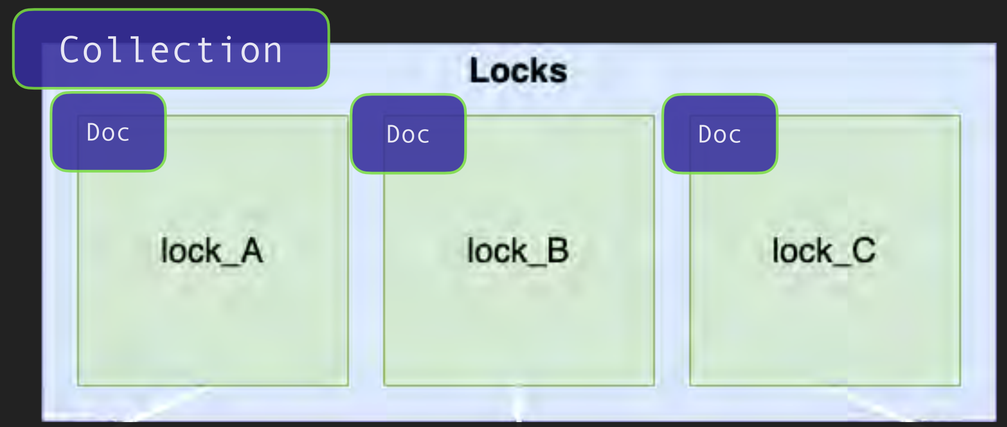
Firestore


var config = {
apiKey: "
",
authDomain: "
",
databaseURL: "
",
projectId: "
",
storageBucket: "
",
messagingSenderId: "
",
appId: "
",
};

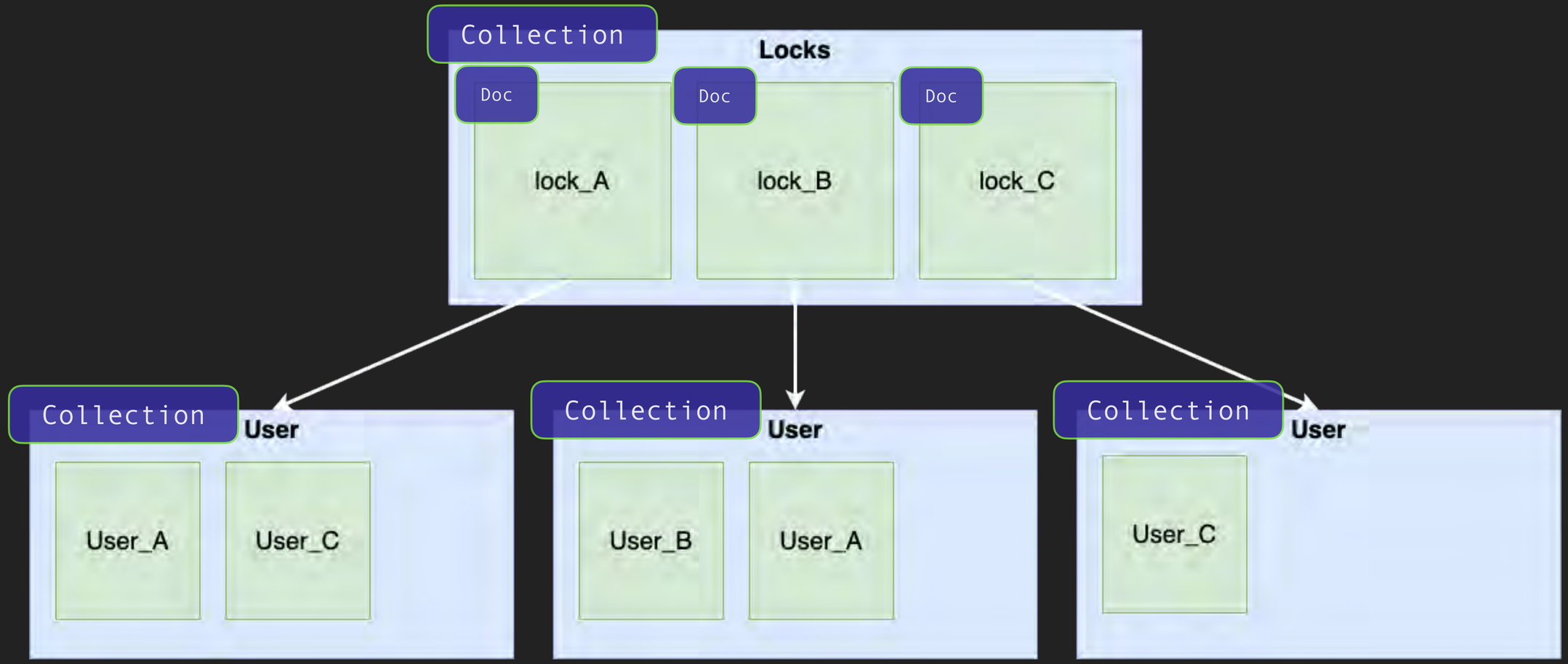
Firestore



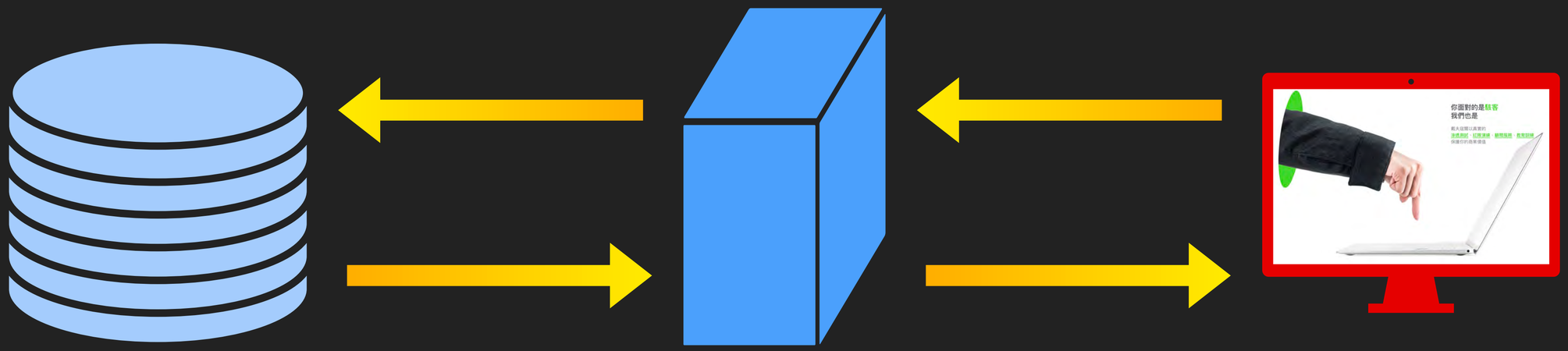
Firestore



Firestore


Collection
Locks
Doc
Doc
Doc
lock_A
lock_B
lock_C
Collection
User
User_A
User_C
Collection
User
User_B
User_A
Collection
User
User_C

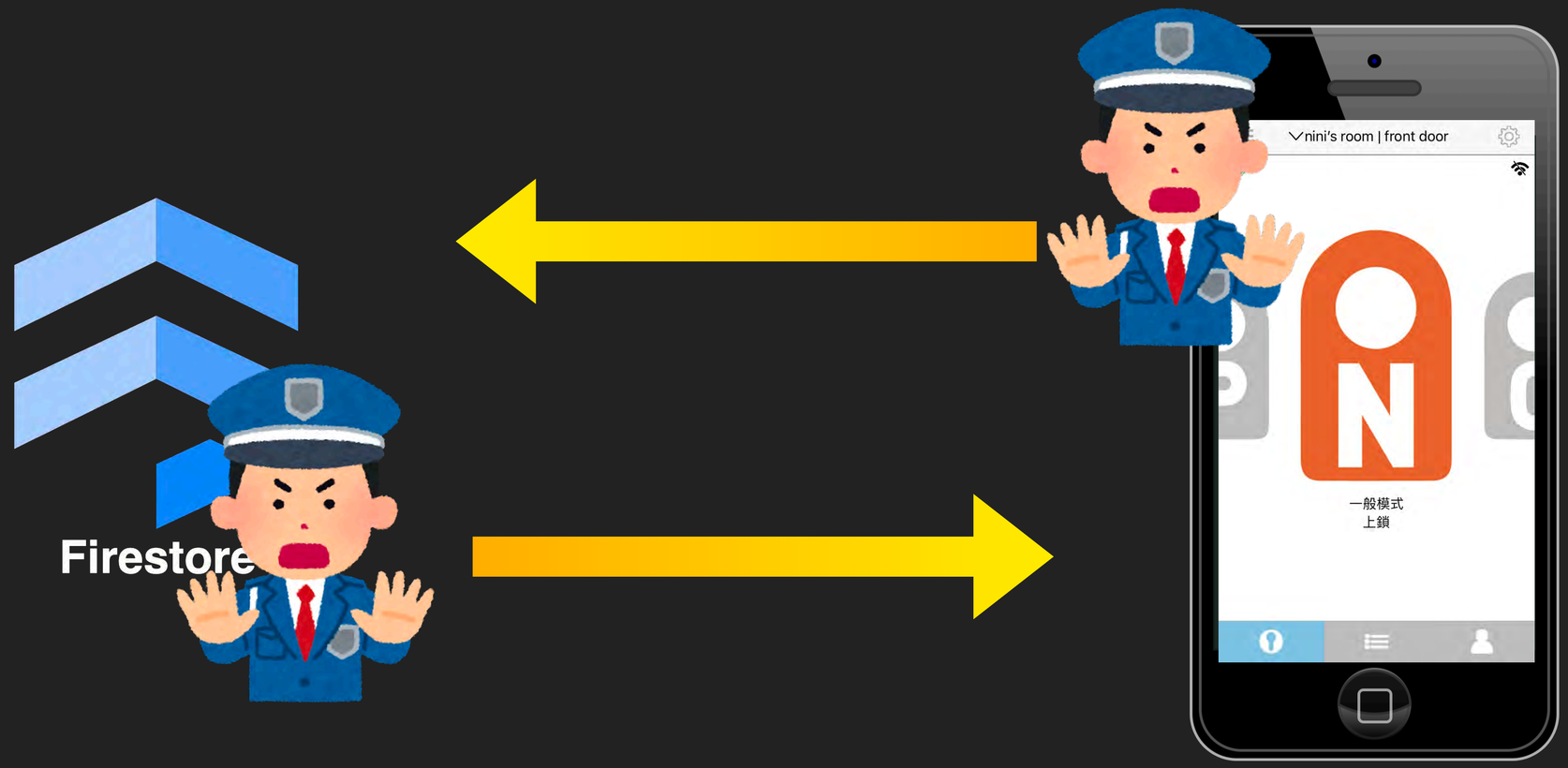
Security Rules



Security Rules

Firestore

Security Rules



Security Rules

```
service cloud.firestore {
    match /databases/{database}/documents {
      // Make sure the uid of the requesting user matches name of the user
      // document. The wildcard expression {userId} makes the userId variable
      // available in rules.
      match /users/{userId} {
        allow read, update, delete: if request.auth != null && request.auth.uid == userId;
        allow create: if request.auth != null;
      }
    }
}
```

DEVCORE SECURITY CONSULTING

Security Rules

```
service cloud.firestore {
    match /databases/{database}/documents {
      // Make sure the uid of the requesting user matches name of the user
      // document. The wildcard expression {userId} makes the userId variable
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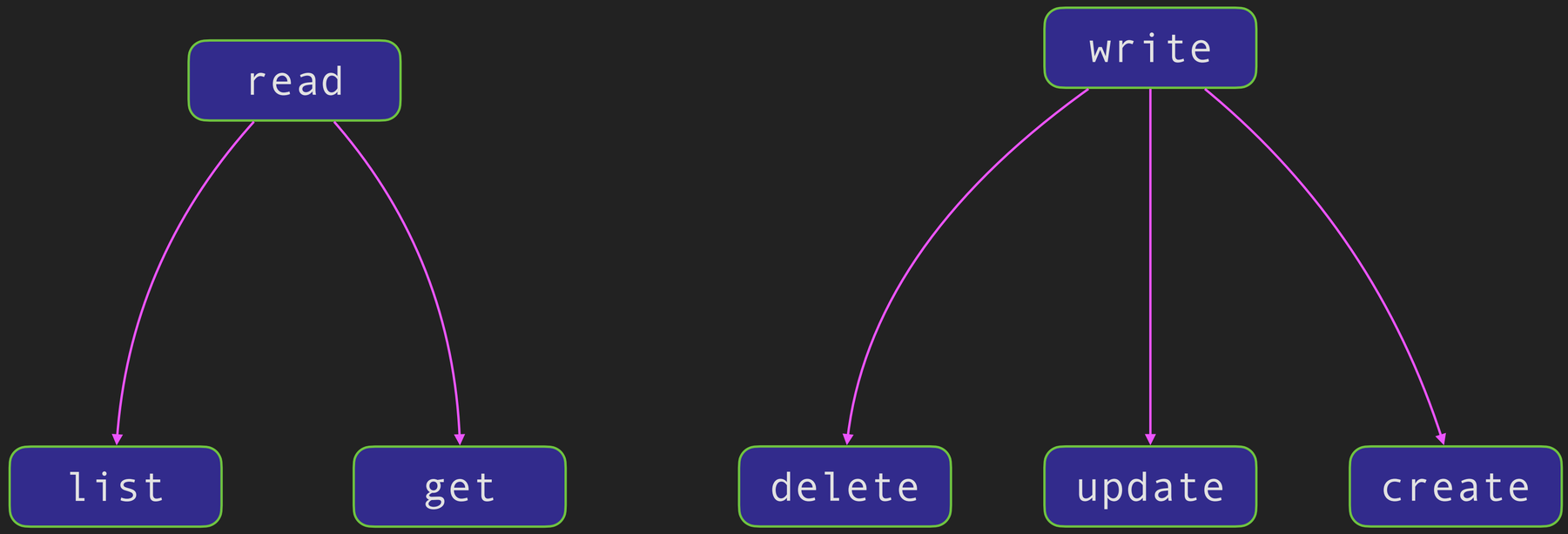
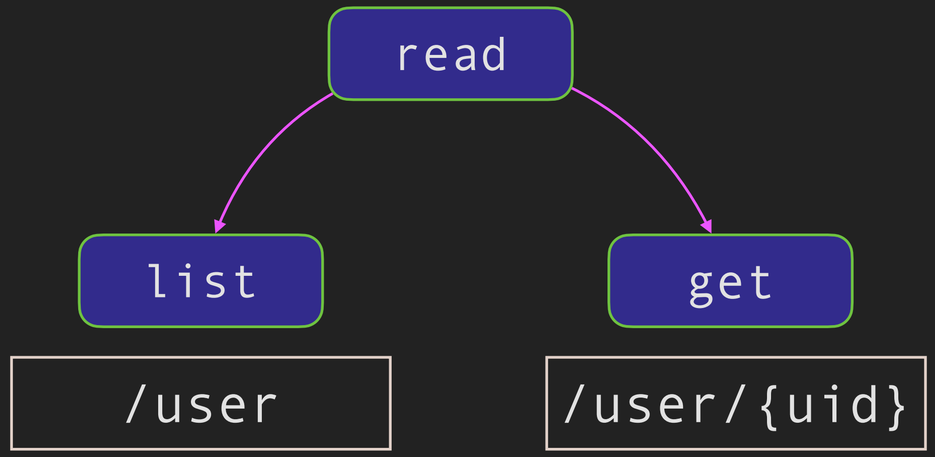
        allow read, update, delete: if request.auth != null && request.auth.uid == userId;
        allow create: if request.auth != null;
      }
    }
}
```

- 多條規則 match 時，只要有一條 allow 就會通過
- Security Rule 不是 filter，取回的內容必然全部合法，否則為 null

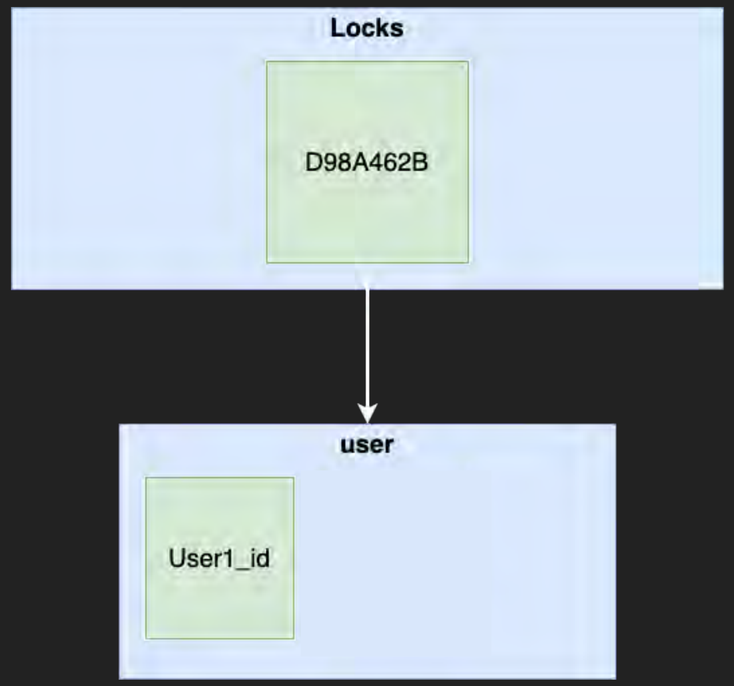
Firestore

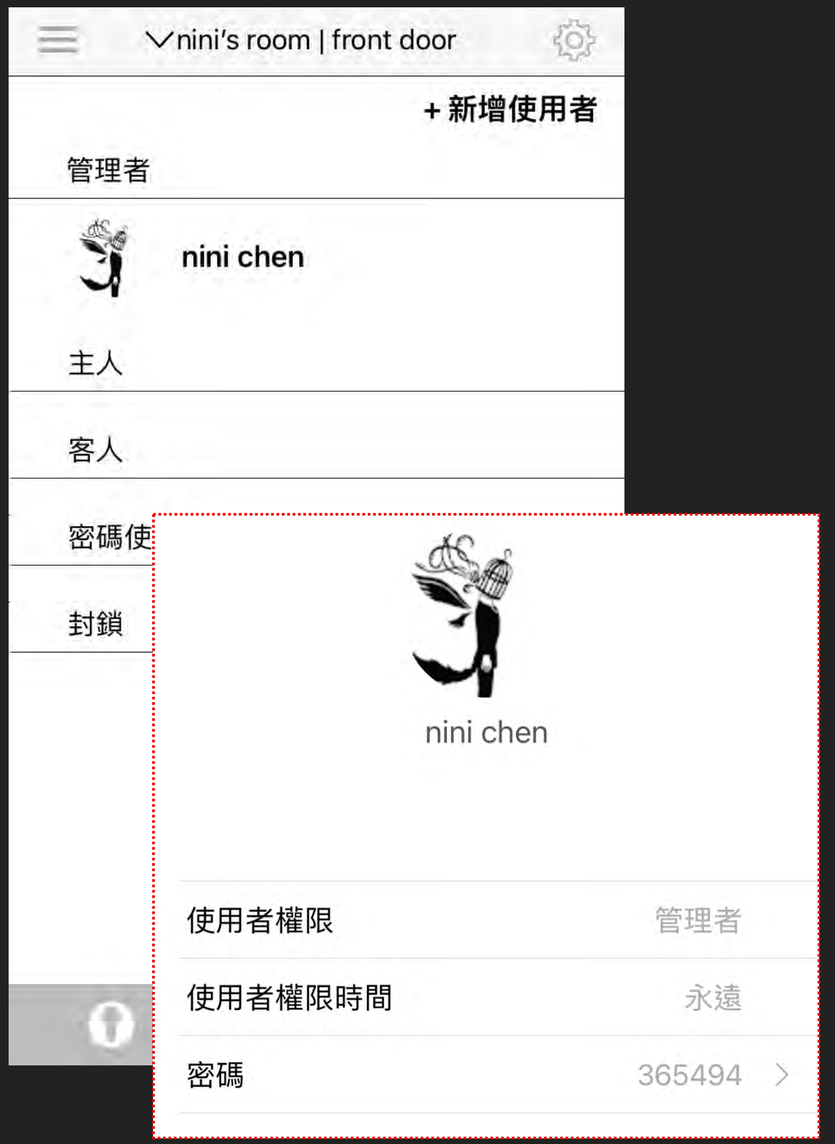


Firestore



Firestore


Locks
D98A462B
user
User1_id


nini's room | front door
+ 新增使用者
管理者
nini chen
主人
客人
密碼使
封鎖
nini chen
使用者權限
管理者
使用者權限時間
永遠
密碼
365494

Firestore

```
{accessLevel: 0, accessInterval: 0, lockName: 'front door',
    accessInterval: 0
    accessLevel: 0
    entryPassword: "365494FFFF"
    firstName: "nini"
    homeName: "nini's room"
    lastName: "chen"
    lockName: "front door"
    push: 262143
  ▶ startTime: kb {seconds: 1660665600, nanoseconds: 0}
    userImageUrl: "https://lh3.googleusercontent.com/a-/AFdZuc
  ▶ [[Prototype]]: Object
```

Firestore

```
{accessLevel:                                    e: 'front door',
  accessInterva
  accessLevel: 0
  entryPassword: "365494FFFF"
  firstName: "nini"
  homeName: "nini's room"
  lastName: "chen"
  lockName: "front door"
  push: 262143
▶ startTime: kb {seconds: 1660665600, nanoseconds: 0}
  userImageUrl: "https://lh3.googleusercontent.com/a-/AFdZuc
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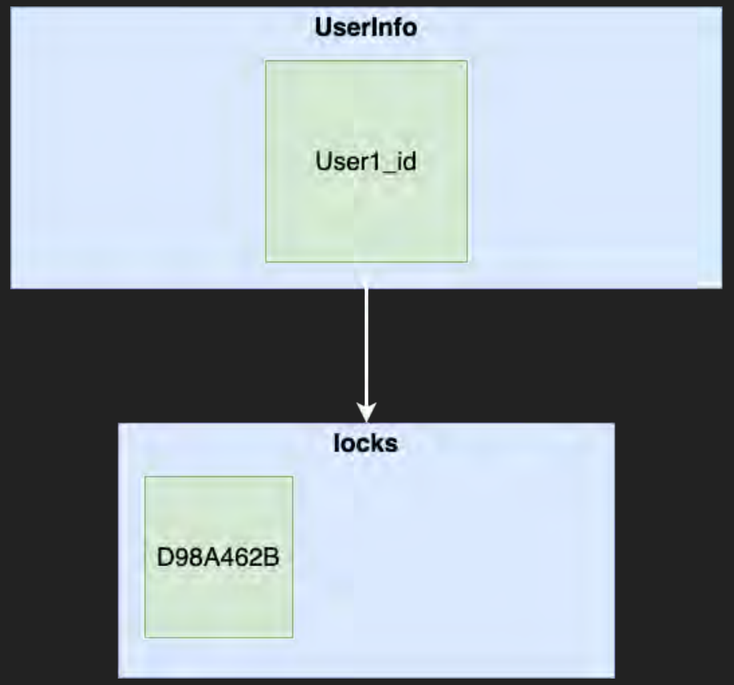
```

Firestore

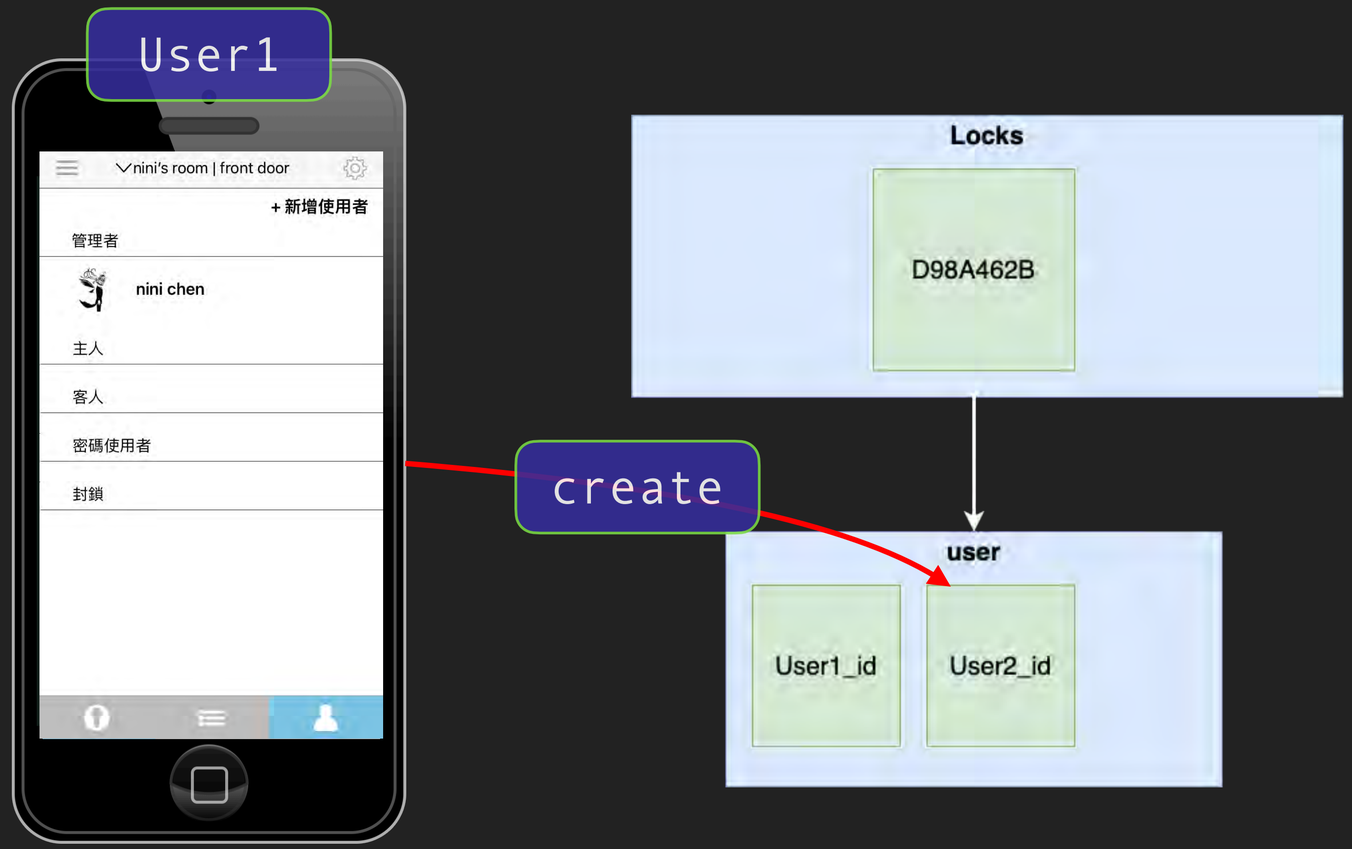

UserInfo
User1_id
locks
D98A462B


nini's room | front door
選擇 家/門鎖
nini's room
front door
一般模式
上鎖

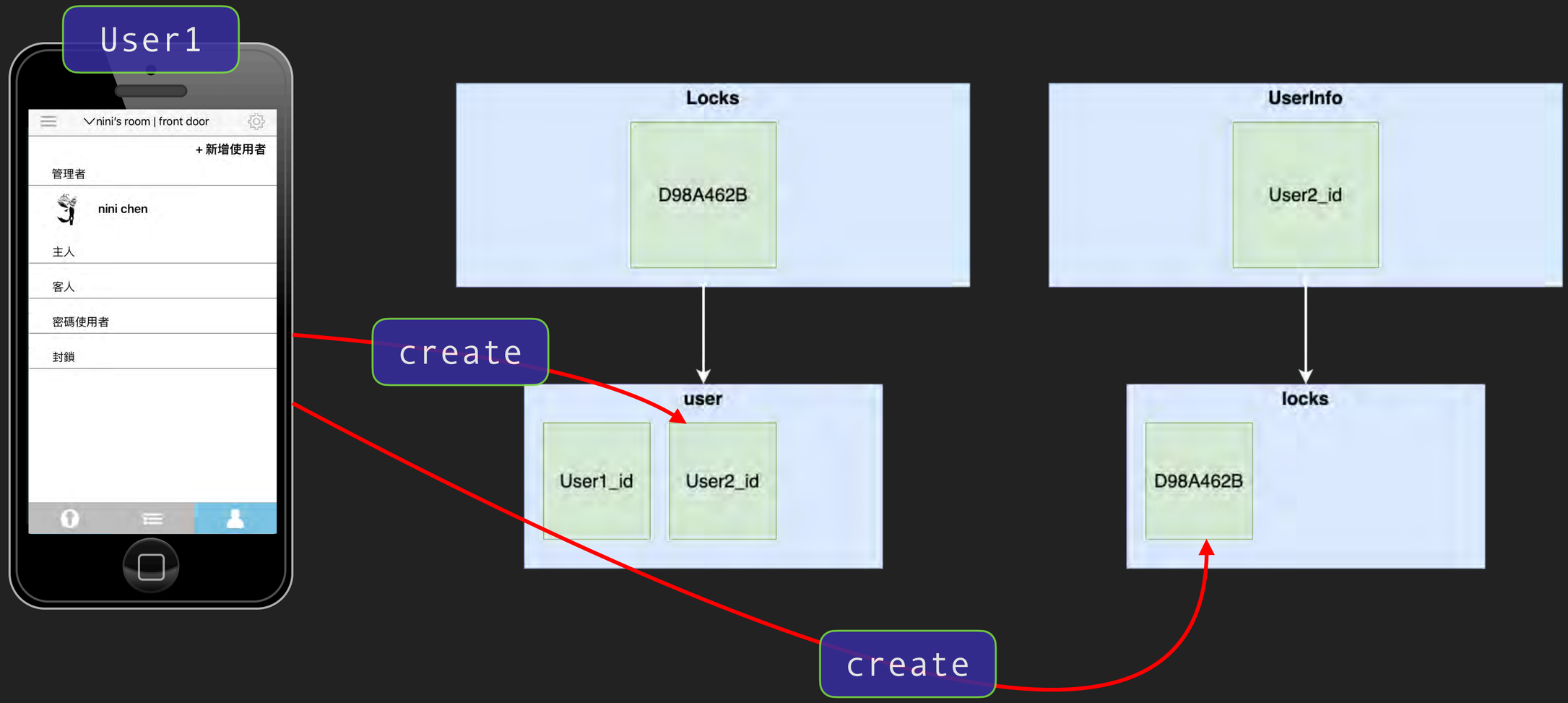
Firestore

```
> let result = await db.collection("userInfo").doc(curUser.uid).collection('locks').get();
< undefined
> for (l of result.docs){
      console.log(l.id)
      console.log(l.data())
  }
  D98A462B
  ▼ {homeName: 'nini's room', lockName: 'front door', goldenKey: '          User1_id          '}
      goldenKey: "          User1_id          "
      homeName: "nini's room"
      lockName: "front door"
    ▶ [[Prototype]]: Object
```

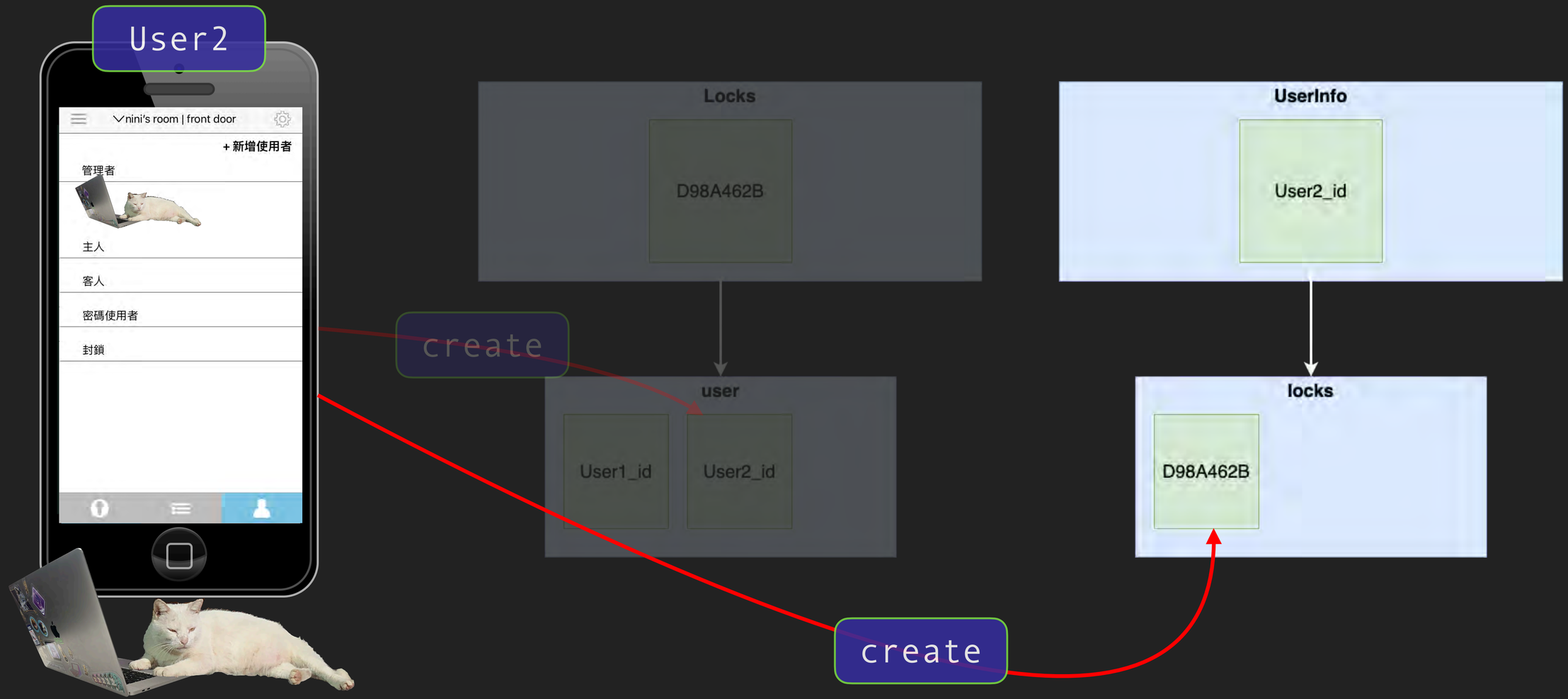
Firestore


User1
nini's room | front door
+ 新增使用者
管理者
nini chen
主人
客人
密碼使用者
封鎖
create
Locks
D98A462B
user
User1_id
User2_id

Firestore


User1
nini's room | front door
+ 新增使用者
管理者
nini chen
主人
客人
密碼使用者
封鎖
Locks
D98A462B
UserInfo
User2_id
create
user
User1_id
User2_id
locks
D98A462B
create

Firestore

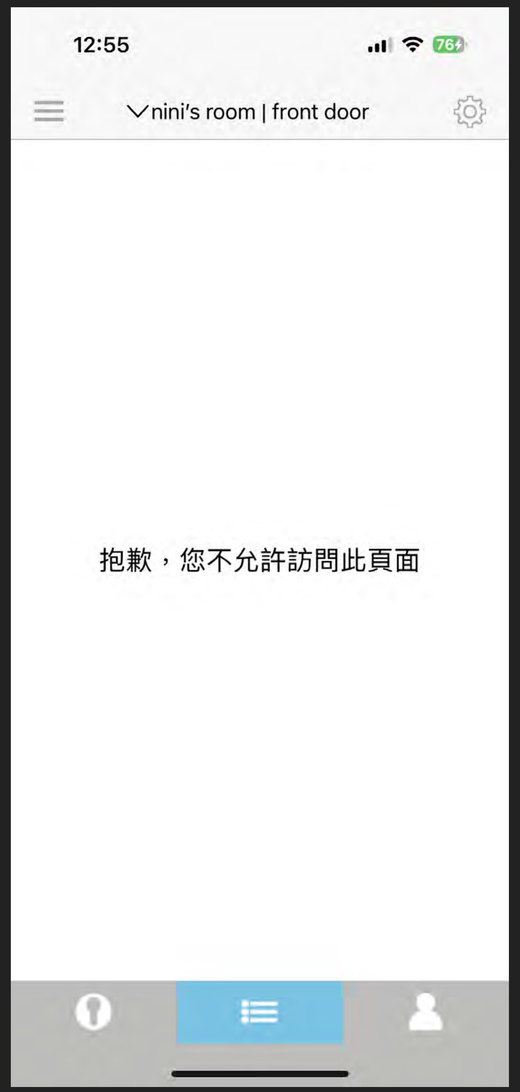


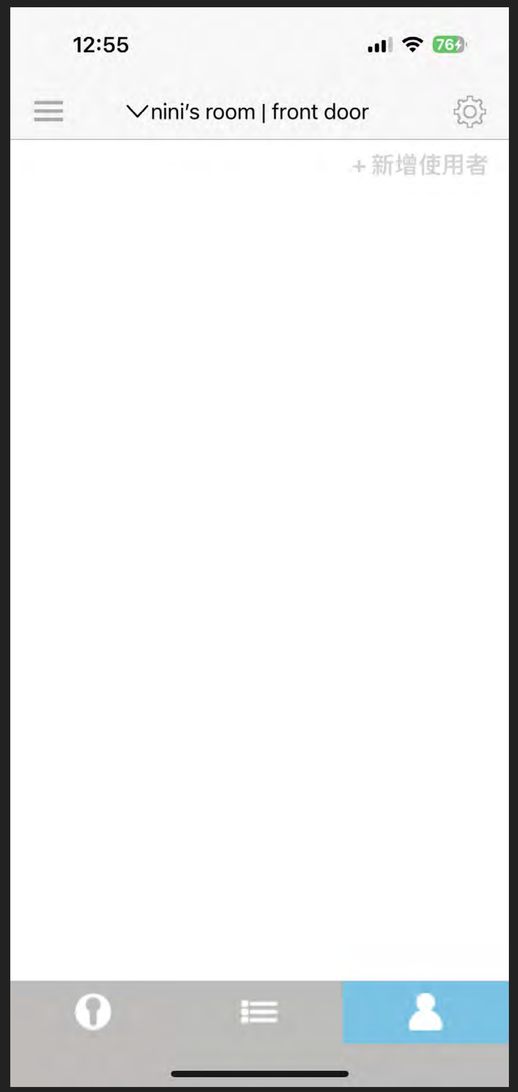
DEVCORE SECURITY CONSULTING

Firestore


12:55
nini's room | front door
一般模式
解鎖


12:55
nini's room | front door
訊息
您的權限被拒絕，請與管理員核對你的身份 Error(0x08)
好
一般模式
解鎖


12:55
nini's room | front door
抱歉，您不允許訪問此頁面


12:55
nini's room | front door
+ 新增使用者

問題在哪裡，絕對難不倒你

- getLockStateFromFireStore
  1. 請求 locks/{lock_id}/lockWifi/info，檢查門鎖有沒有上線 (mode)
  2. 使用 getLockFromFireStore 檢查權限
  3. 沒上線或沒權限回傳 False，有上線且有權限回傳 True

- getLockFromFireStore
  1. 請求 locks/{lock_id}/user/{user_id}，檢查有存取權限 (accessInterval, accessLevel)
  2. 請求 lock/{lock_id}/userWifi/{user_id}，檢查可存取時間段 (time1,time2,time3)
  3. 回傳是否有權限

問題在哪裡，絕對難不倒你

- getLockStateFromFireStore
  1. 請求 locks/{lock_id}/lockWifi/info，檢查門鎖有沒有上線 (mode)
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- getLockFromFireStore
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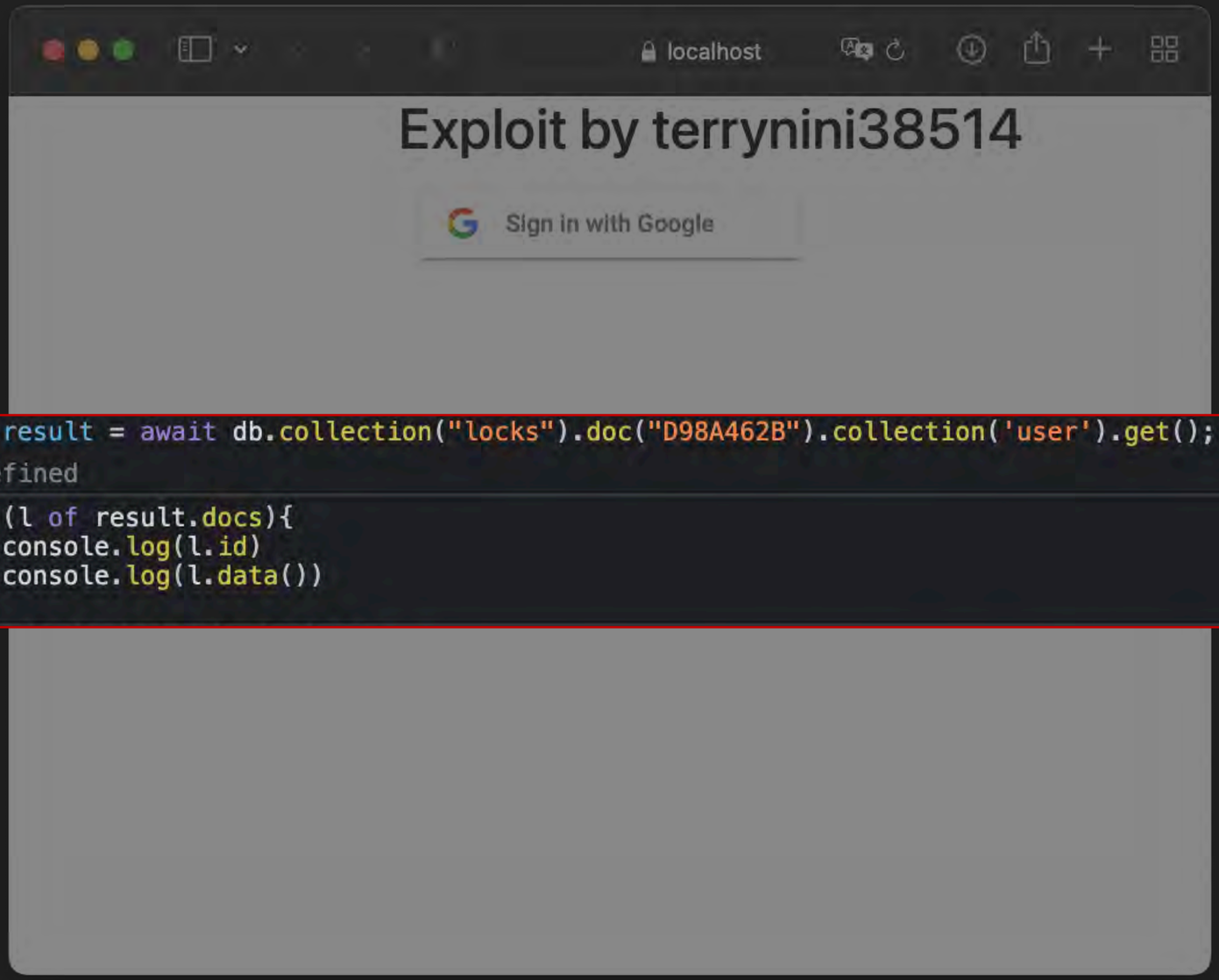
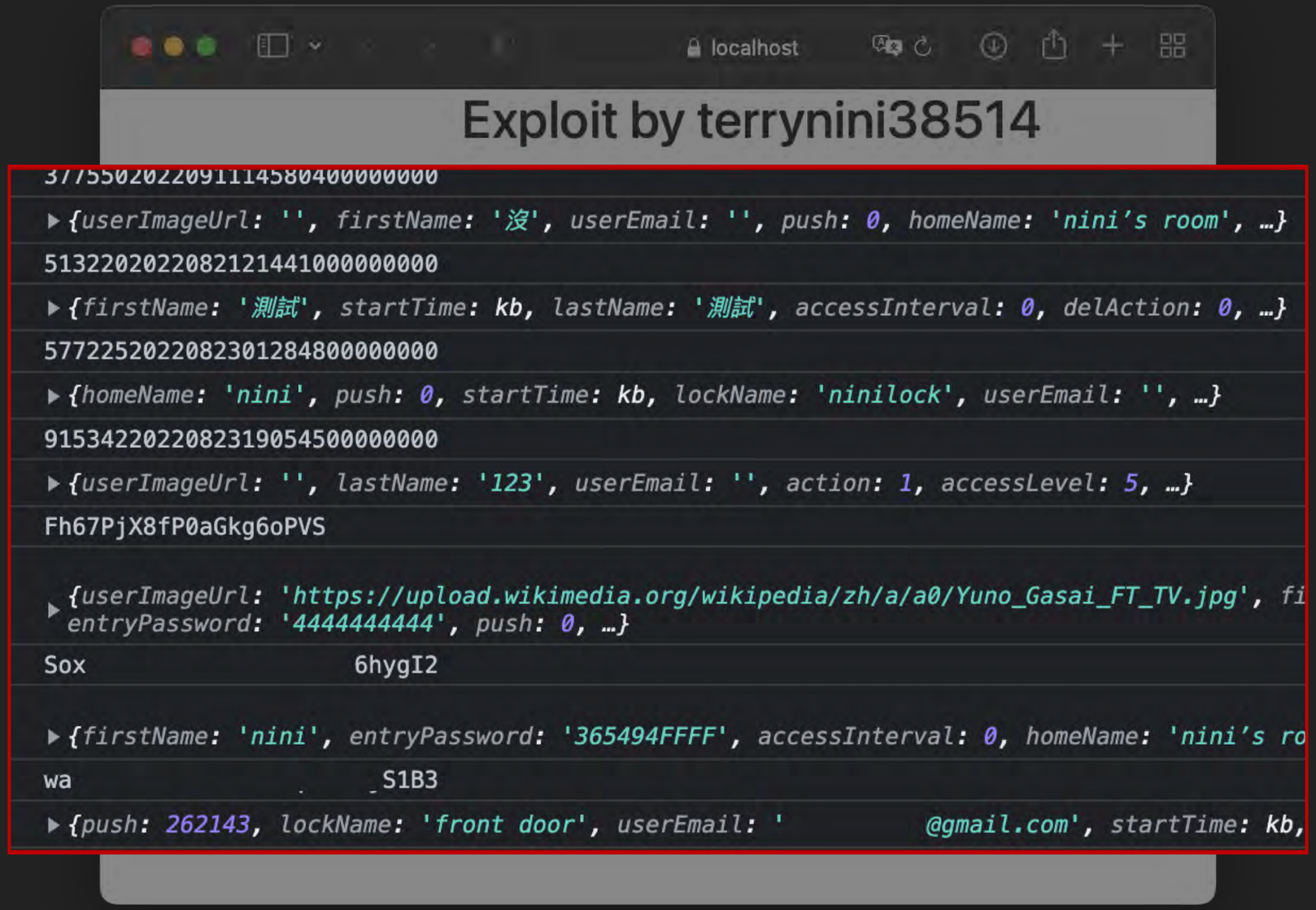
- getLockFromFireStore
  1. 請求 locks/{lock_id}/user/{user_id}，檢查有存取權限 (accessInterval, accessLevel)
  2. 請求 lock/{lock_id}/userWifi/{user_id}，檢查可存取時間段 (time1,time2,time3)
  3. 回傳是否有權限

Firestore

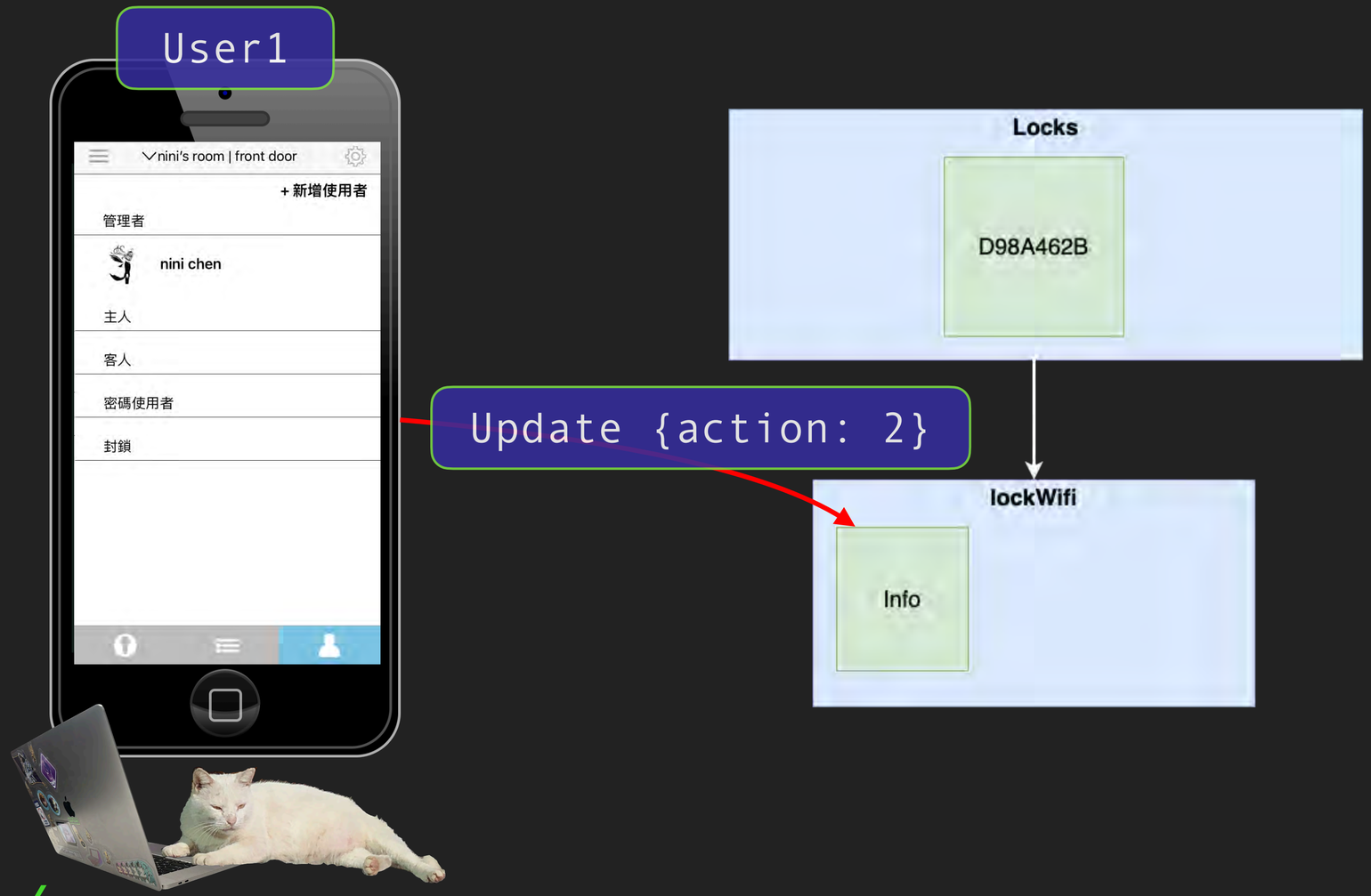


DEVCORE SECURITY CONSULTING

Firestore


localhost
Exploit by terrynini38514
377550202209111458040000000
▶ {userImageUrl: '', firstName: '沒', userEmail: '', push: 0, homeName: 'nini's room', …}
513220202208212144100000000
▶ {firstName: '測試', startTime: kb, lastName: '測試', accessInterval: 0, delAction: 0, …}
577225202208230128480000000
▶ {homeName: 'nini', push: 0, startTime: kb, lockName: 'ninilock', userEmail: '', …}
915342202208231905450000000
▶ {userImageUrl: '', lastName: '123', userEmail: '', action: 1, accessLevel: 5, …}
Fh67PjX8fP0aGkg6oPVS
▶ {userImageUrl: 'https://upload.wikimedia.org/wikipedia/zh/a/a0/Yuno_Gasai_FT_TV.jpg', fi
entryPassword: '4444444444', push: 0, …}
Sox 6hygI2
▶ {firstName: 'nini', entryPassword: '365494FFFF', accessInterval: 0, homeName: 'nini's ro
wa _S1B3
▶ {push: 262143, lockName: 'front door', userEmail: ' @gmail.com', startTime: kb,

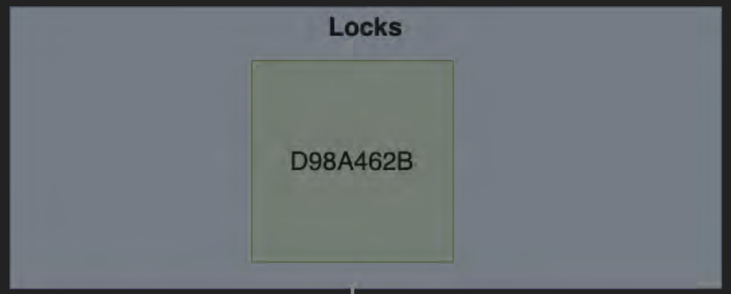
開門事件

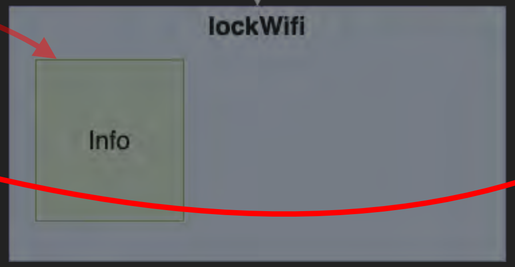


DEVCORE SECURITY CONSULTING

開門事件

Update {action: 2}





create


```
{
  collection: "locks/{lockId}/lockWifi/info",
  lockId: "D98A462B"
}
```

DEVCORE SECURITY CONSULTING

Signin

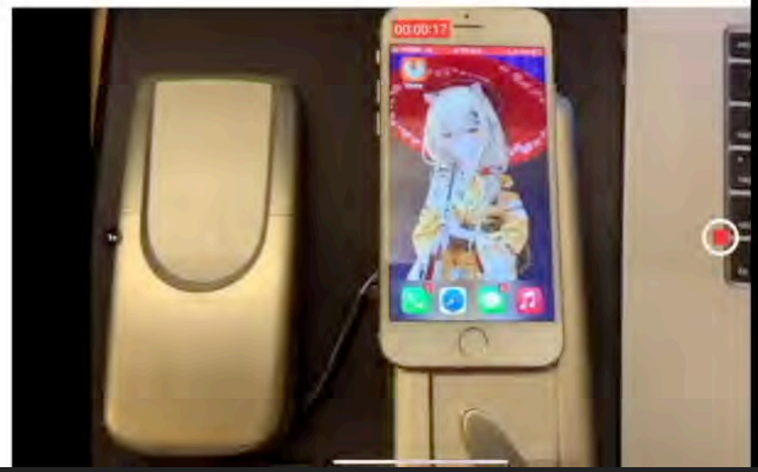
Not Secure | https://localhost:3000

Guest

Exploit by terrynini38514

Sign in with Google

←先打開 App 確認電子鎖持有人： terrynini38514



Easy peasy lemon squeezy

之後進行了一次完美的入室竊盜（在腦袋裡）

人心最終還是要回到故鄉來的，這個三百二十里淡水河的盡頭漁人碼頭，或許正是你的極限也說不定

```
let result = await db.collection("otaInfo").doc('SL-W101').collection('ble').doc('ble_hw_1.0.3').get()
let resultb = await db.collection("otaInfo").doc('SL-W101').collection('wifi').doc("wifi").get();
```

DEVCORE SECURITY CONSULTING

Takeaway

- 嘗試自己枚舉攻擊面
- 跟著攻擊面一起成長，充實工具箱
- 透過大量練習、閱讀培養 Slow hunch
- 多留點時間做各種嘗試，享受研究的過程

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DEVCORE
SECURITY
CONSULTING

感謝聆聽

Q&A

戴夫寇爾股份有限公司

contact@devco.re