Adopting e-vote:

innovation, risks, and lawsuits

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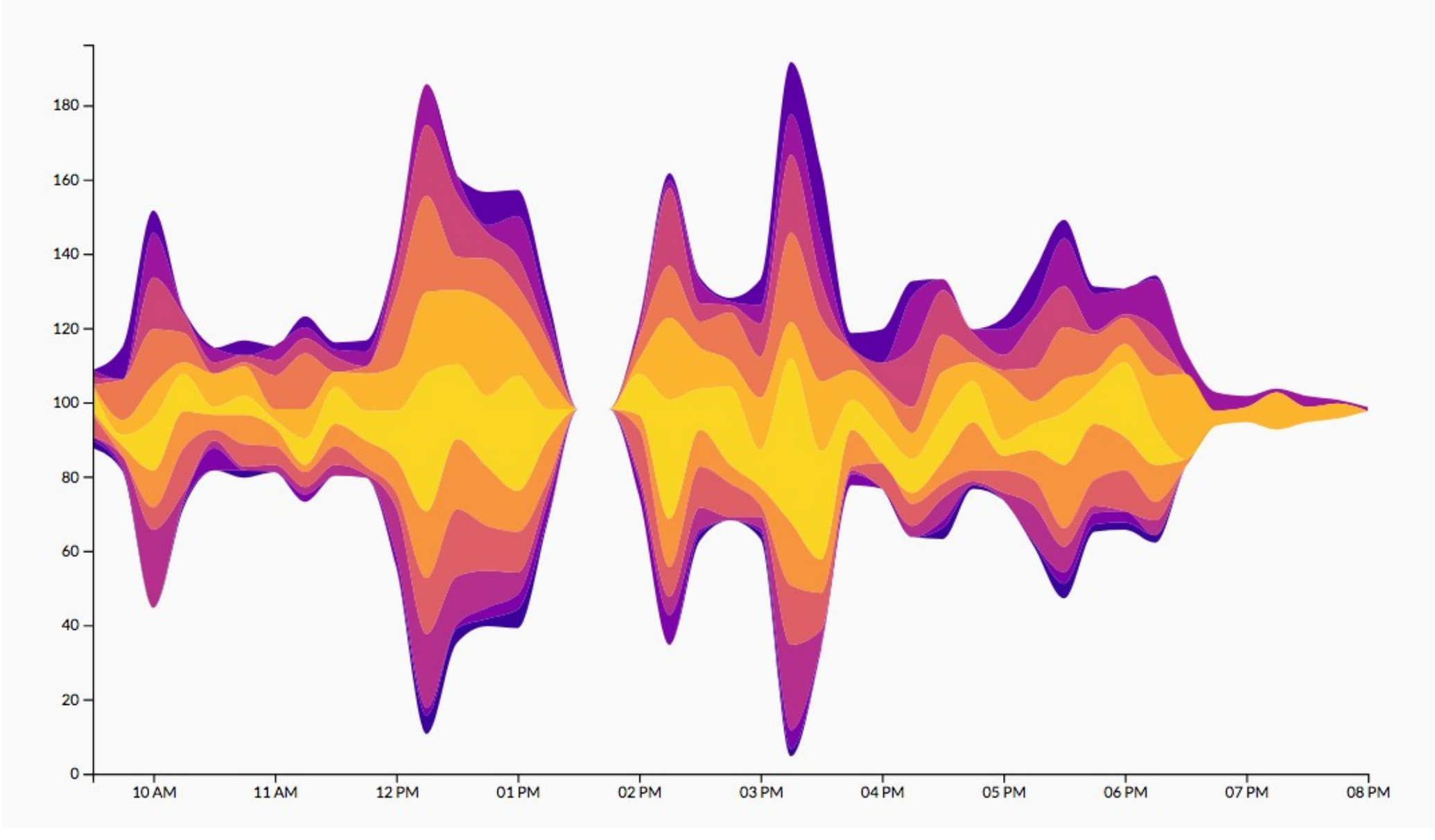
臺灣大學開源社
NTU Open Source Community

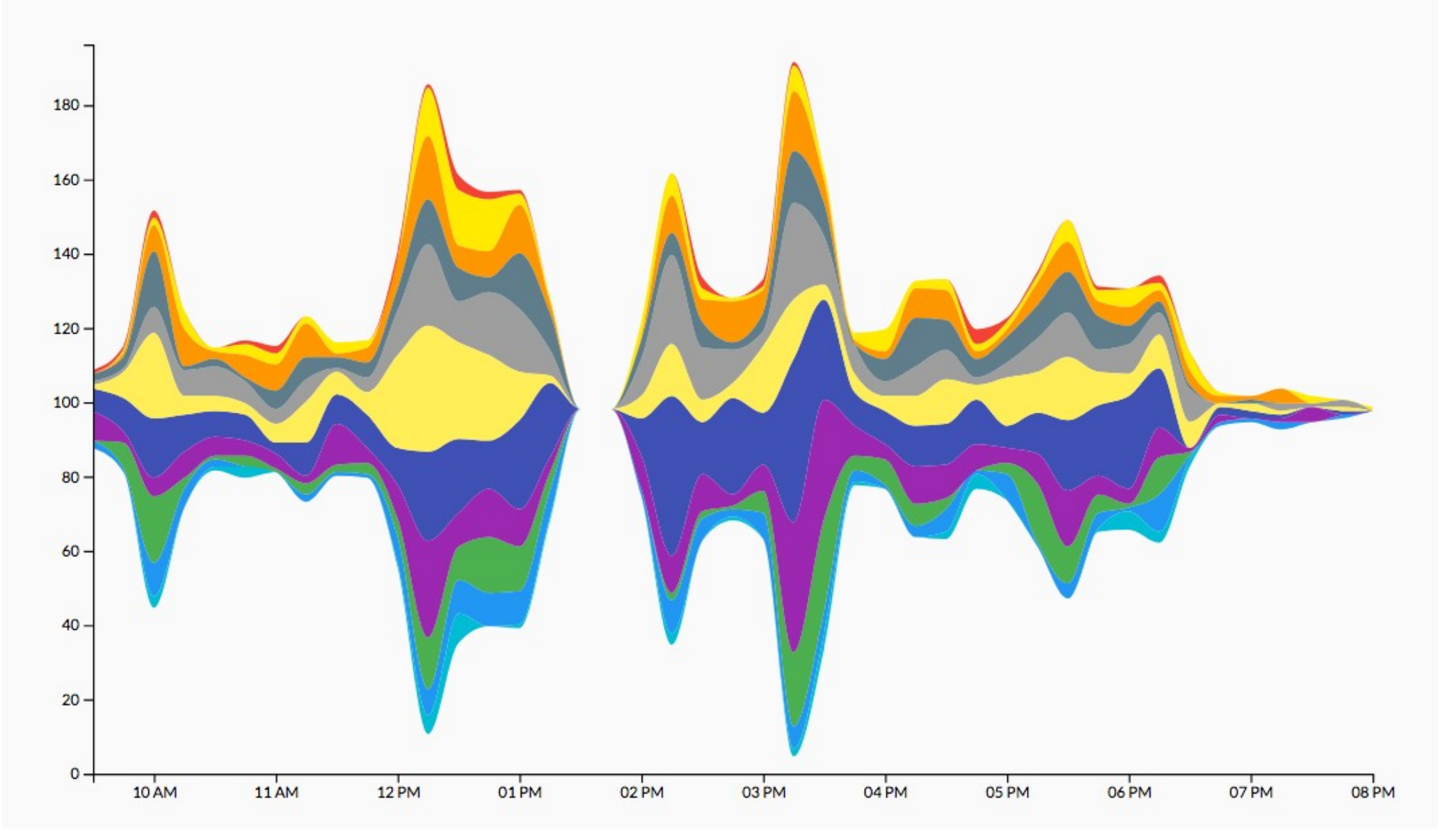
選舉，
超潮的！
3437pauf9818eqtu

Elections in NTU

- The 30,000-elector event drew significant influence to the society, almost a democracy sandbox by itself.
- Even before martial law was lifted in Taiwan, Student Association in NTU adapted a new constitution in 1988, with separation of powers and direct presidential election.
- With a rich history of electoral suit, NTU bears an extremely detailed voting regulations in a nationwide scale.

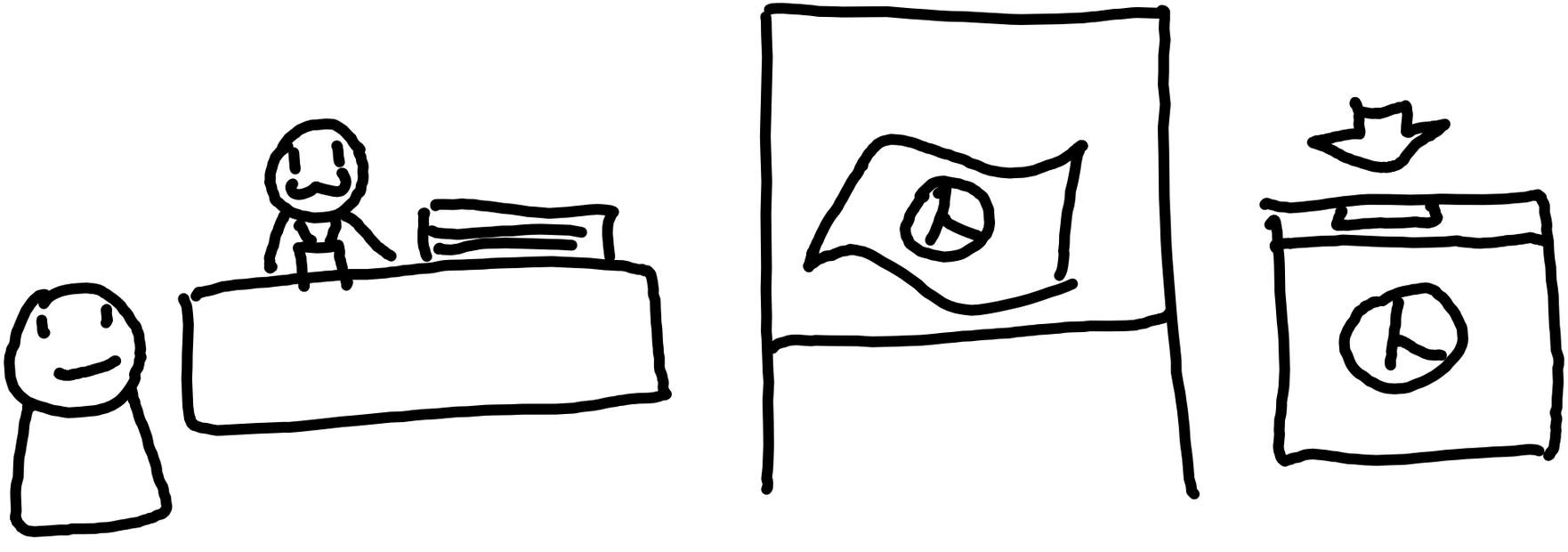


Elector–Time stream graph of 2017 Spring NTUSA Joint Election, colored by voting station



Elector–Time stream graph of 2017 Spring NTUSA Joint Election, colored by college

Traditional vote



① Examine student ID and current registration stamp

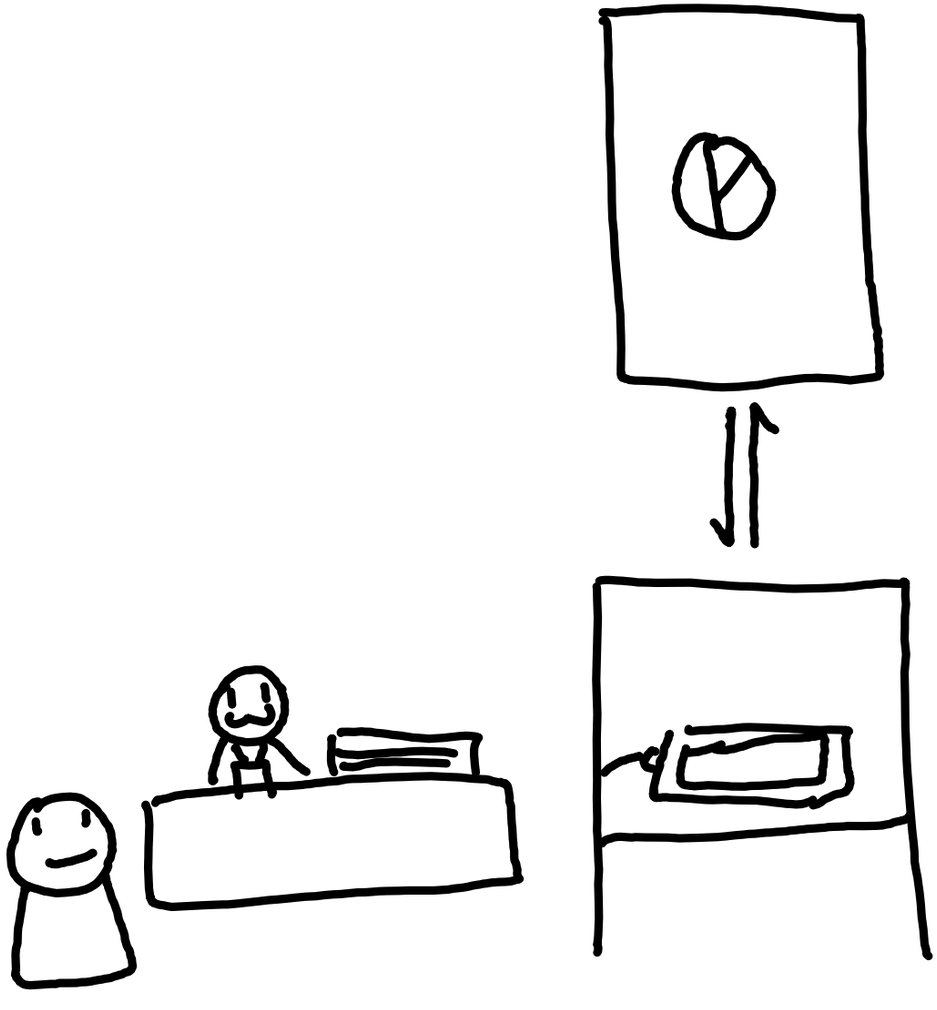
② Sign for the ballot

→ ③ Mark the ballot → ④ Cast the vote

Labor costs

Printing ballots, shipping voting boxes, counting

Experimental e-vote



① Examine student ID and current registration stamp

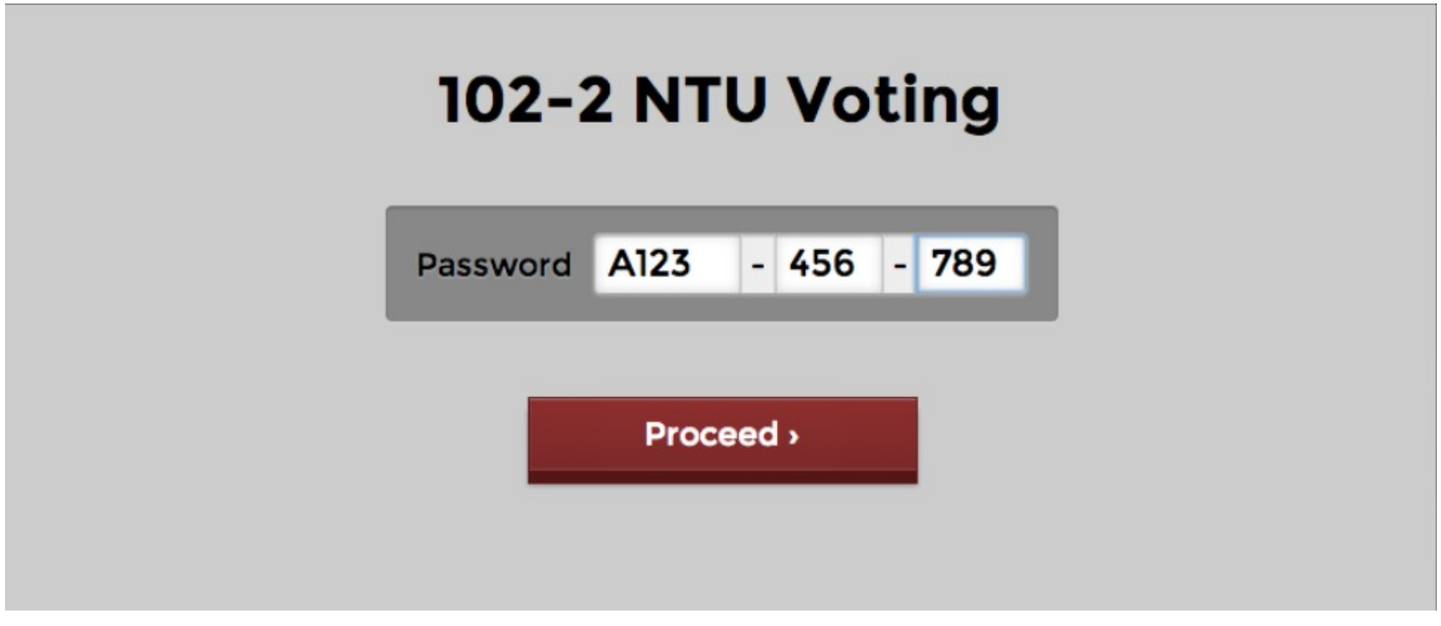
② Sign for the auth code

③ Vote through tablet

2014/5/25

“Why aren’t you sleeping?”
“I was called to do a vote system
for your school’s election next week”

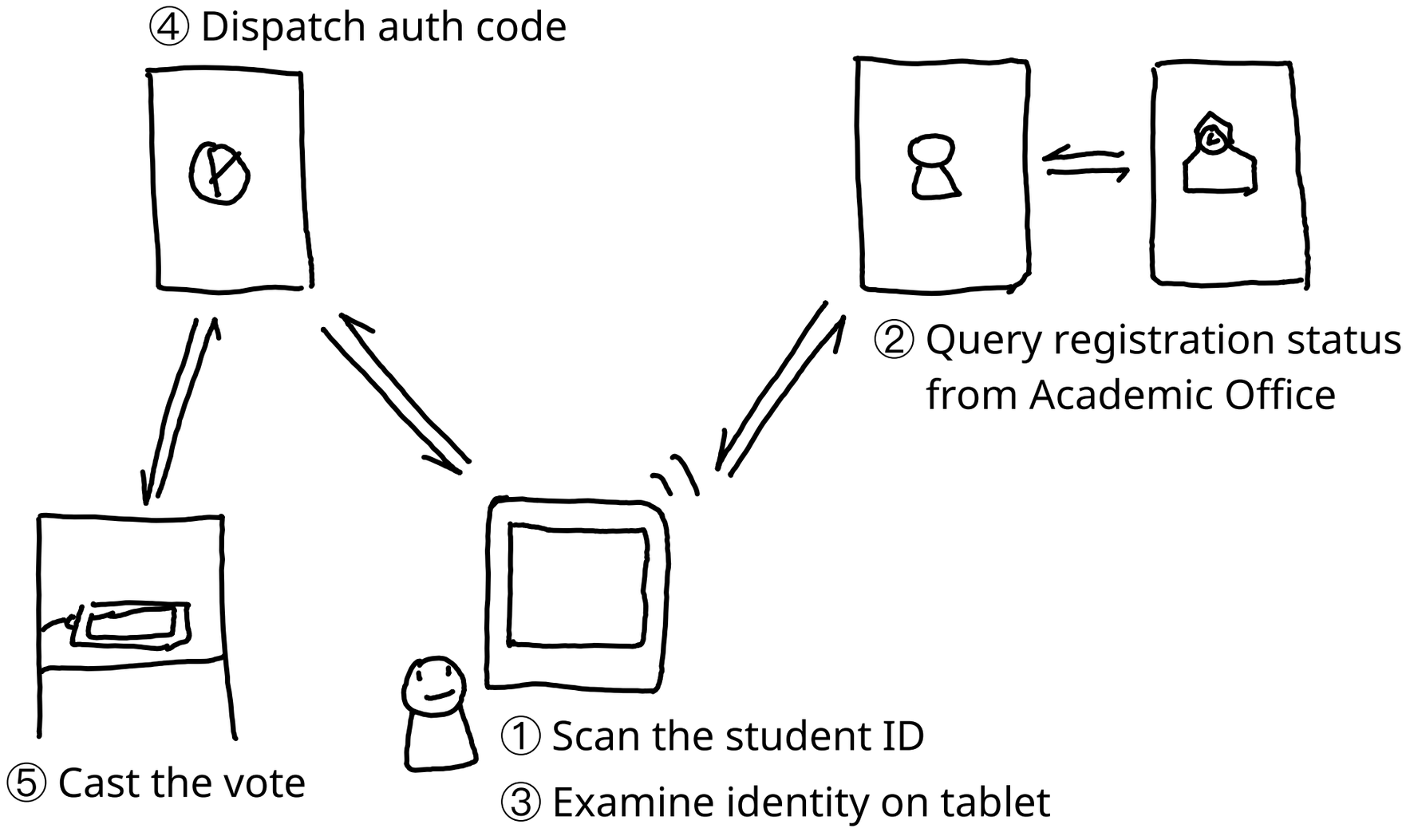
visible confusion



原圖取自 2014 電子投票論壇〈102-2 NTUvote 技術說明〉簡報，MouseMs CC BY-NC 4.0

Rethinking the Architecture

Remodeled e-vote



activity_confirm.xml
Preview
Nexus 4
AppTheme
請核對選舉人
(拳統)
數位驗證
小福
投票所 / Booth

Improvements

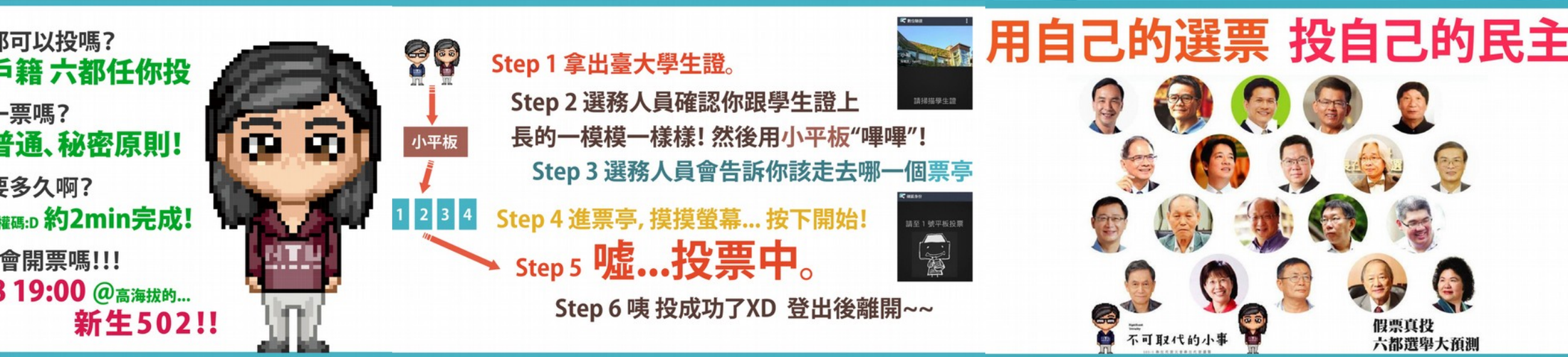
- Student IDs are Mifare-based Taipei Metro EasyCards with additional sector information; ID numbers could be extracted from a genuine card.
- Incorporating with Academic Office records eliminates the need of examining the then-obsoleted registration stamps.
- Programmatically dispatching authorization codes eliminates manual typos and the risk of leakage.

Auditing process

- Authorization codes are counted after election
- Every piece of log is retained
  - Server side: Authorization and dispatch requests
  - Voting station: network issues, abandoned votes
  - Numbers of used auth codes should match after calibration
- Prefile standard procedures to reduce risks

Challenges & Adaptations

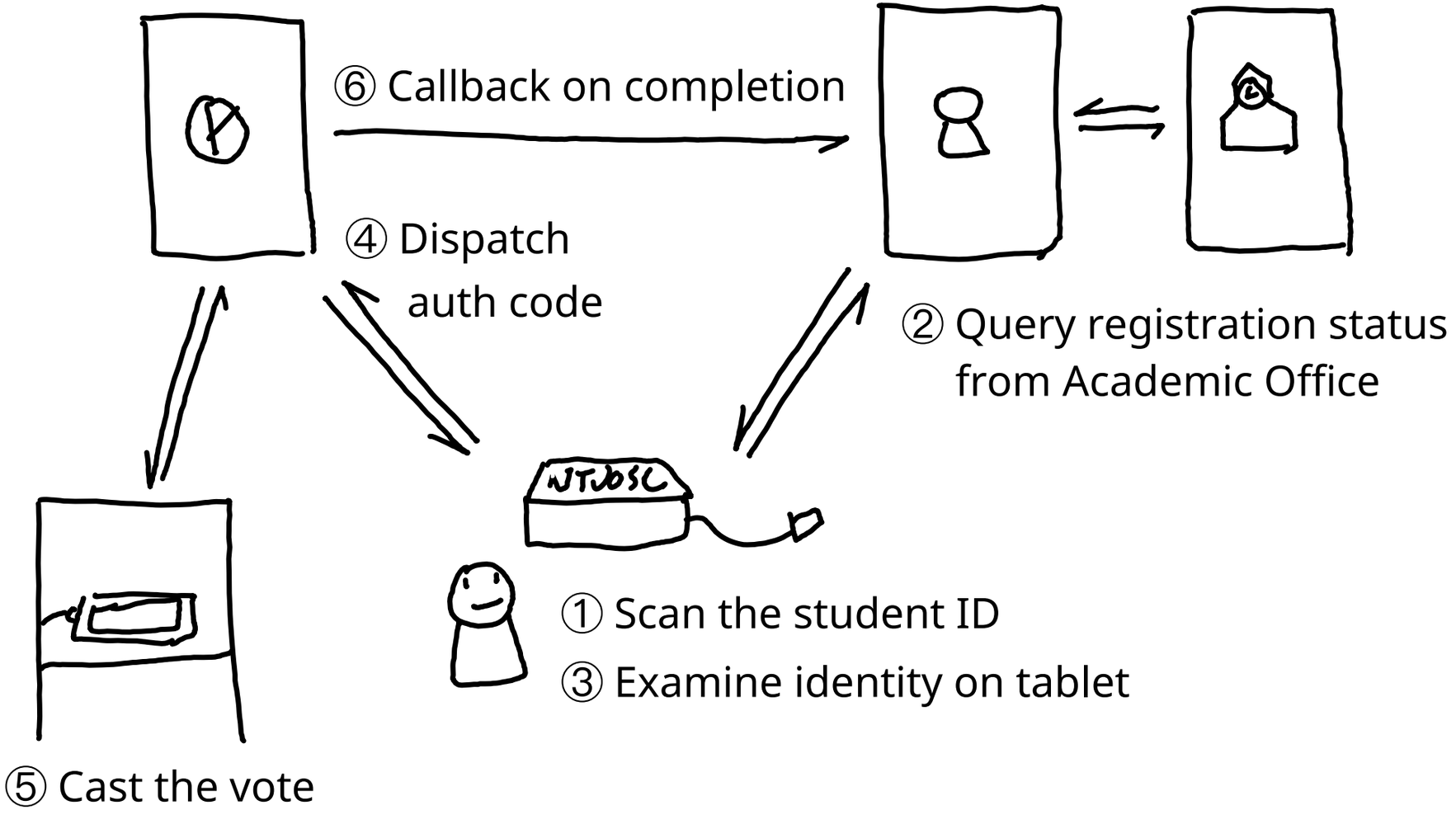
下排照片取自臺大學生會選委會粉專，原文於 2014/12/17 發佈。



圈票處
Double A
我會在

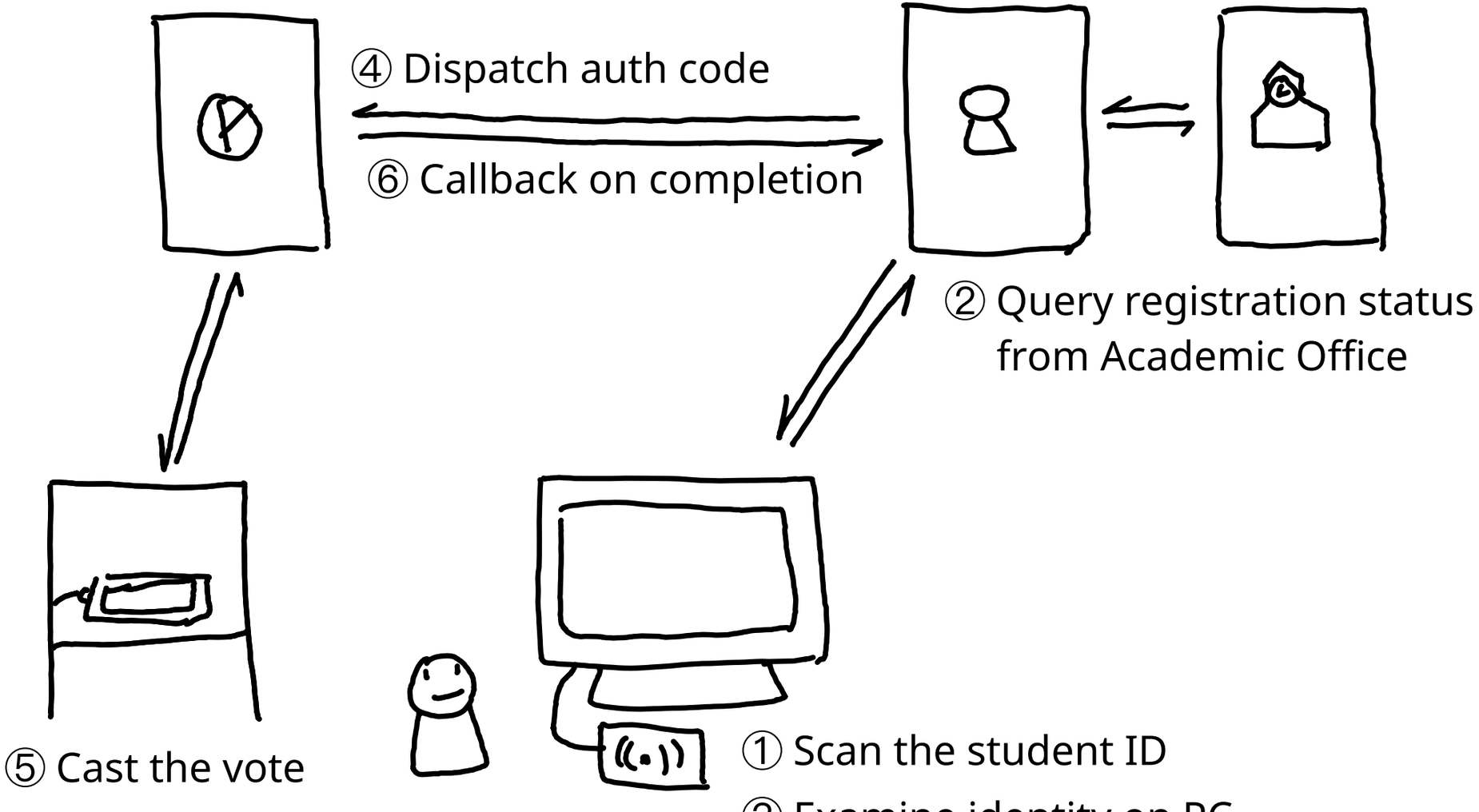
照片取自臺大學生會選委會粉專，原文於 2015/4/3 發佈。

Homebuilt hardware

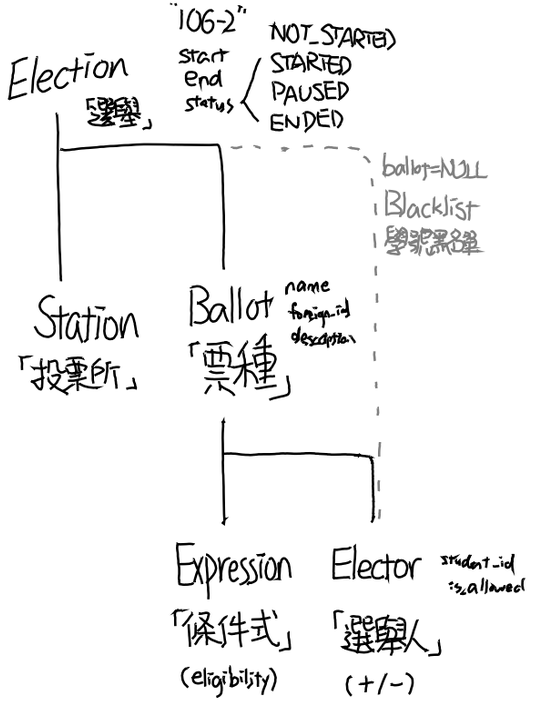


照片取自選務人員 Facebook ，原文於 2017/5/17 發佈。

Architecture shift



身分驗證系統

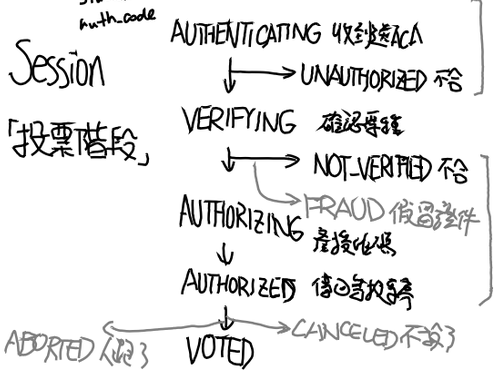


Telemetry

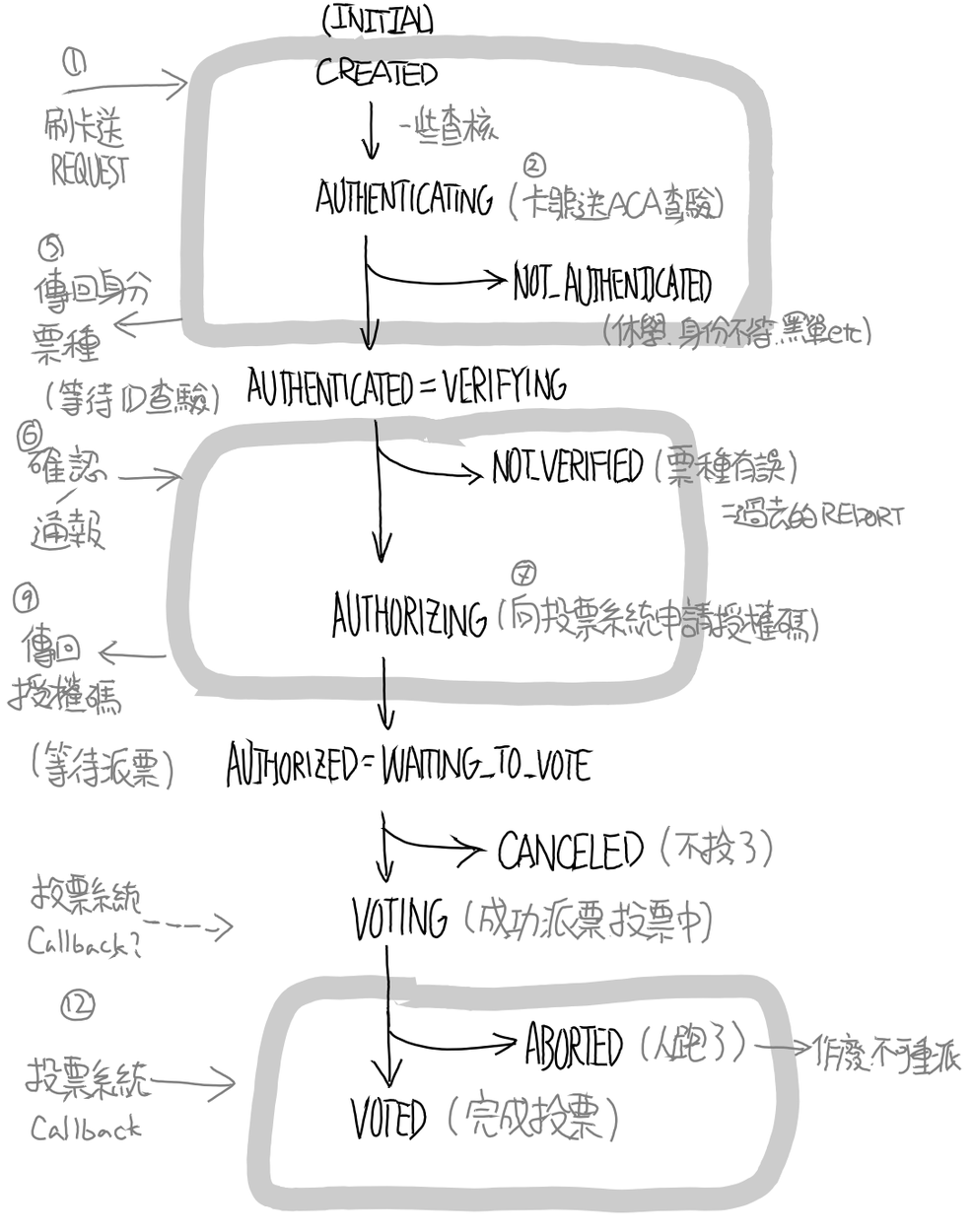
Station heartbeat

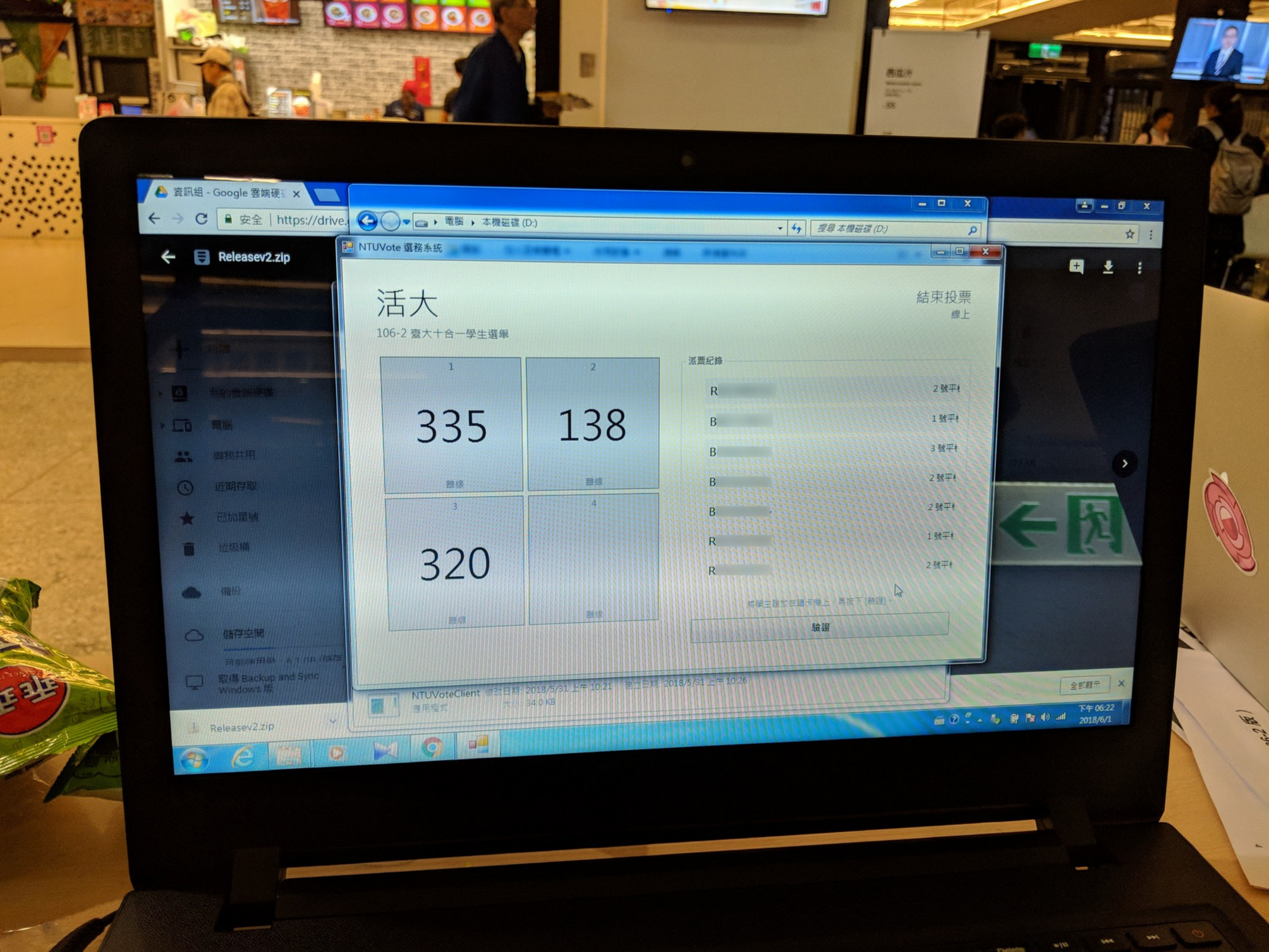
Session status change

audit log



Session lifecycle




資訊組 - Google 雲端硬
安全 | https://drive.
Releasev2.zip
電腦 ▸ 本機磁碟 (D:)
搜尋 本機磁碟 (D:)
NTUVote 選務系統
活大
106-2 臺大十合一學生選舉
結束投票
線上
1
335
離線
2
138
離線
3
320
離線
4
離線
派票紀錄
R 2 號平
B 1 號平
B 3 號平
B 2 號平
B 2 號平
R 1 號平
R 2 號平
將學生證放在讀卡機上，再按下 (神諭)。
驗證
NTUVoteClient
應用程式
修改日期: 2018/5/31 上午 10:21
建立日期: 2018/5/31 上午 10:26
大小: 34.0 KB
Releasev2.zip
全部顯示
下午 06:22
2018/6/1

Findings

- Electronic voting greatly reduced the burden of establishing new voting stations – scaling become a matter of available budgets; skilled electoral staff could instruct and diagnose most of the issues.
- Pressure shifted toward development and operation end.
- Change of factors would induce risks and unwanted disturbances, especially when replacing working codes; yet stability is difficult to achieve without fully owning involving hardware and systems.

Making things complex

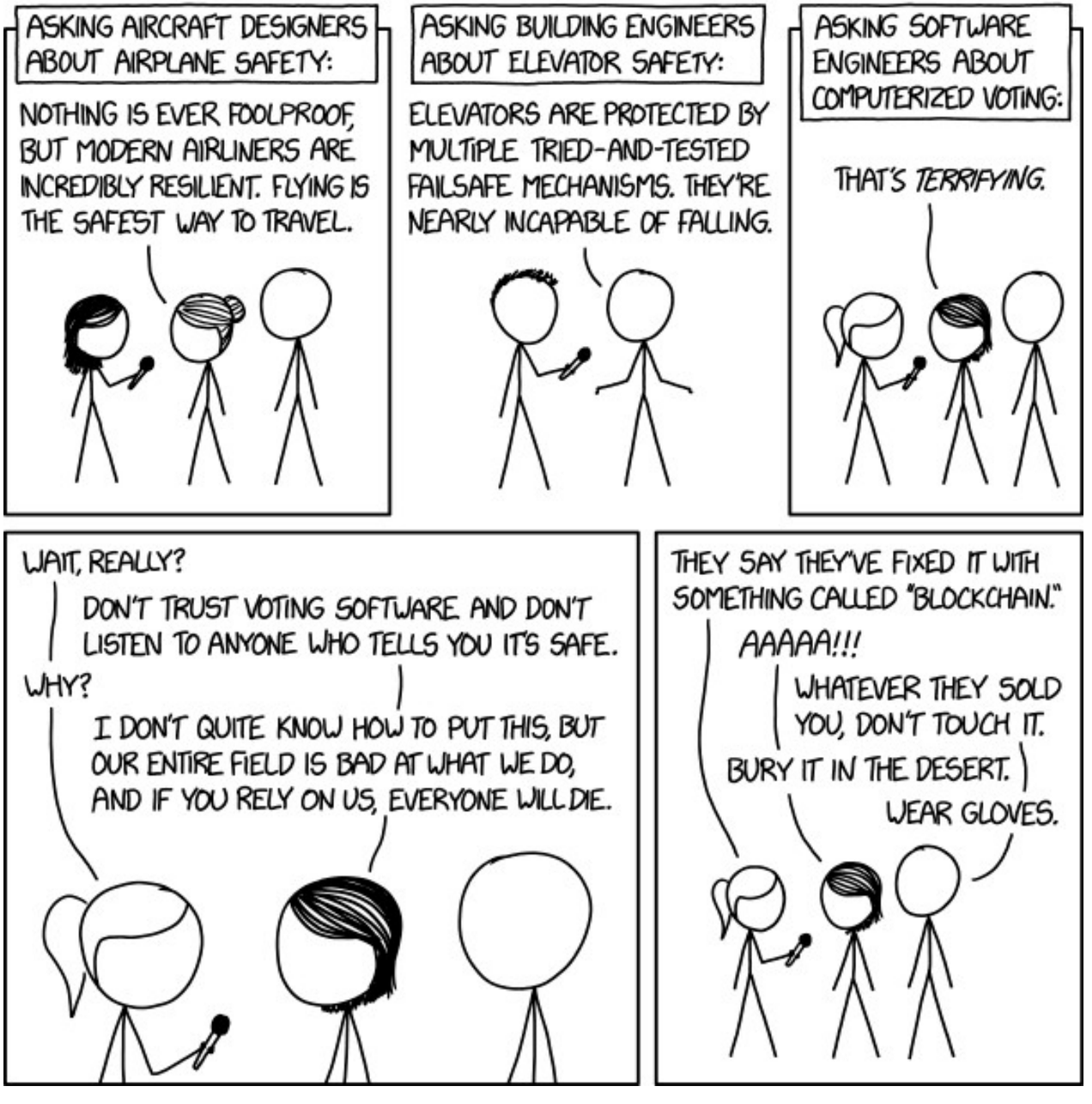
- *Election and Recall Act* allows casting vote remotely through preauthorized links; these applications are manually validated and processed.
- Unless fully automate the whole process, the distribution of such ballot is prone to error, and opens up potential electoral suit.
- The irreversible nature of election system make disaster recovery difficult if not impossible; only a margin of error could be calculated for court defense.

Legal challenges

- In the first hour of Spring 2017 election, about 20% of the electors' IDs were rejected. The problem was quickly identified as a regression of sector format by subcontractor, and patch was issued before noon.
- EREC board decided to extend voting period for a day, which was later rejected by court decision.
- The court found that election administration were **not** entitled to pause, postpone, or extend election periods even under technical disturbances under current regulations.

Future development?

- Improving resilience
  - Hybrid (e-authentication) voting
  - Paper trail verification
  - Refer from academic papers
  - Better training, stabilize version, docker-ize?
- Thinking out of the box
  - Problem of regulation density
  - Technological due process



xkcd: Voting Software by Randall Munroe. CC BY-NC 2.5.

“We devote this university
to the spirit of universe”

Thanks!

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