Betrayed by the Guardian: Security and Privacy Risks of Parental Control Solutions

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ACSAC 2020 - Virtual Conference, Dec 9, 2020

Childhood in the Digital Age

- 1/3 of the internet users are under 18 years old[1]
- Emergence of the “bedroom culture”
- A new parenting role

1. Children in a Digital World, UNICEF, The State of the World's Children 2017

Parental Control Solutions

May help digital parenting and protect children…

…but also introduce serious security and privacy risks

Recent Incidents

TeenSafe (2019)

- Over 1 millions users
- Exposed emails and Apple ID credentials

Family Orbit (2018)

- 280 GB of data
- Screenshots, Child’s photo and video

Related Work

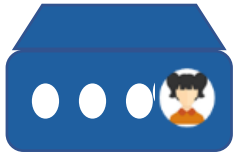
- Smart Sheriff Application (Anderson et al., 2015)
- COPPA compliance analysis of Android apps (Reyes et al., 2018)
- Privacy analysis of mobile parental control apps (Feal et al., 2020)

But other platforms remain largely unexplored...

Solution Platforms

Desktop Applications

Mobile Apps



Network Routers

Browser Extensions

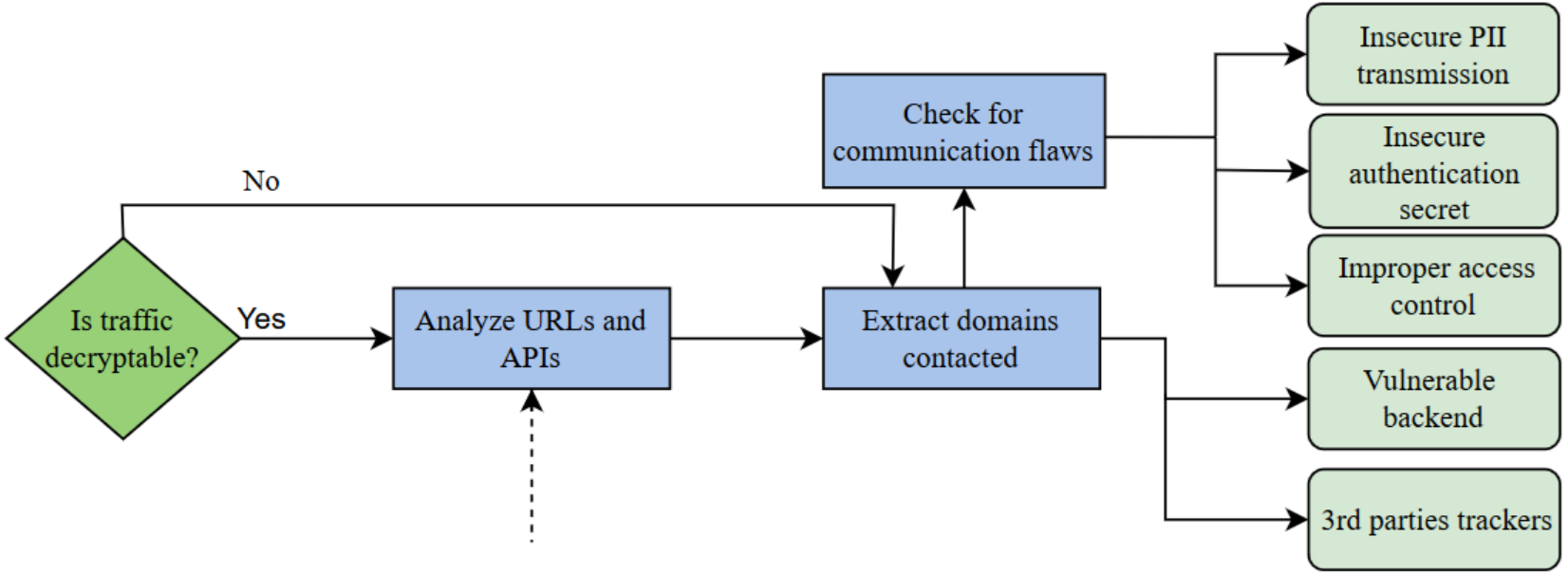
Security Evaluation Methodology

Methodology

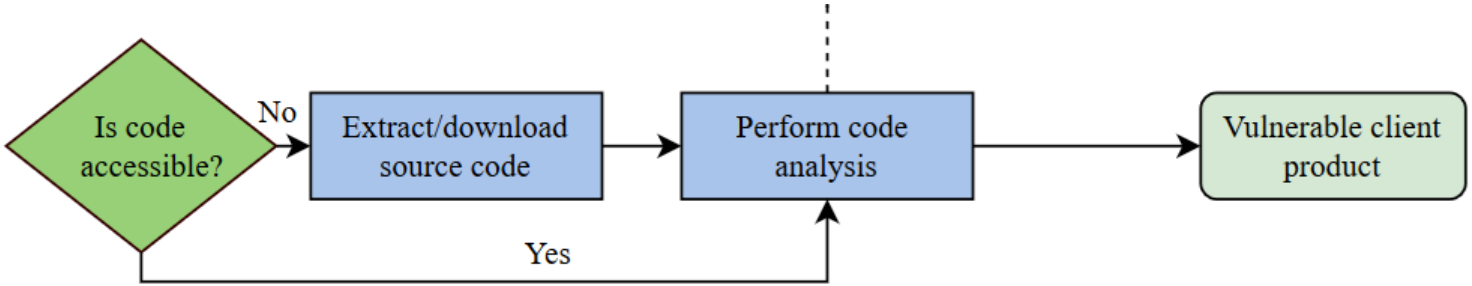
We perform three types of analysis:

1. Dynamic analysis
2. Static analysis
3. Online interface analysis

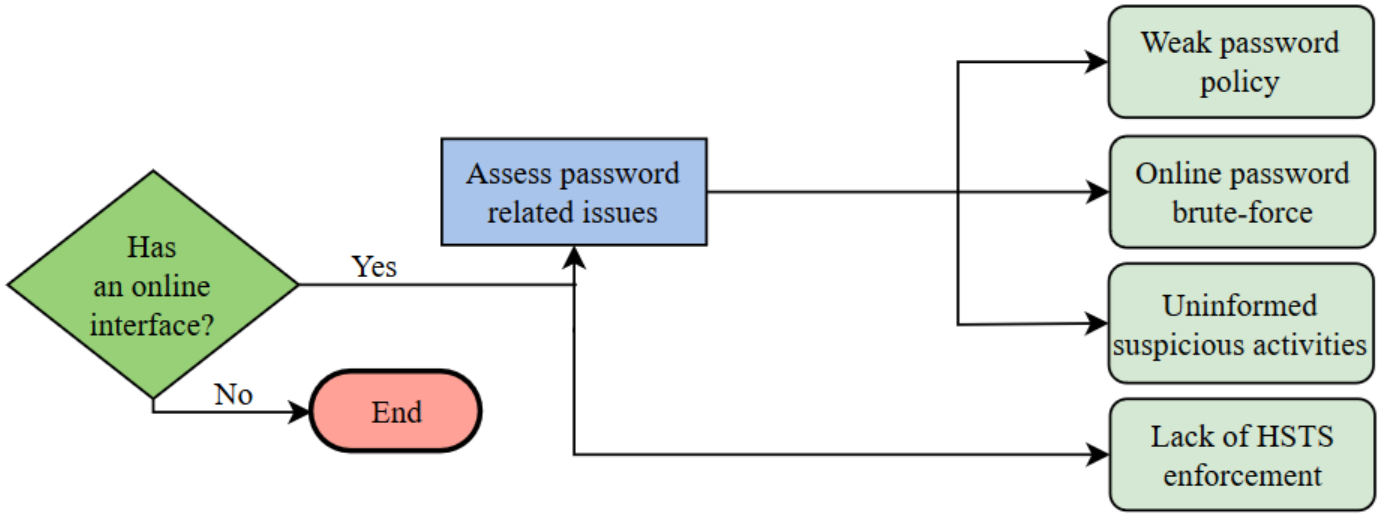
Dynamic Analysis



Static Analysis



Online Interface Analysis



Challenges

Traffic interception

- Network-based solutions
- Embedded certificate store
- VPN and certificate pinning

Traffic attribution

- Binding processes and network packets

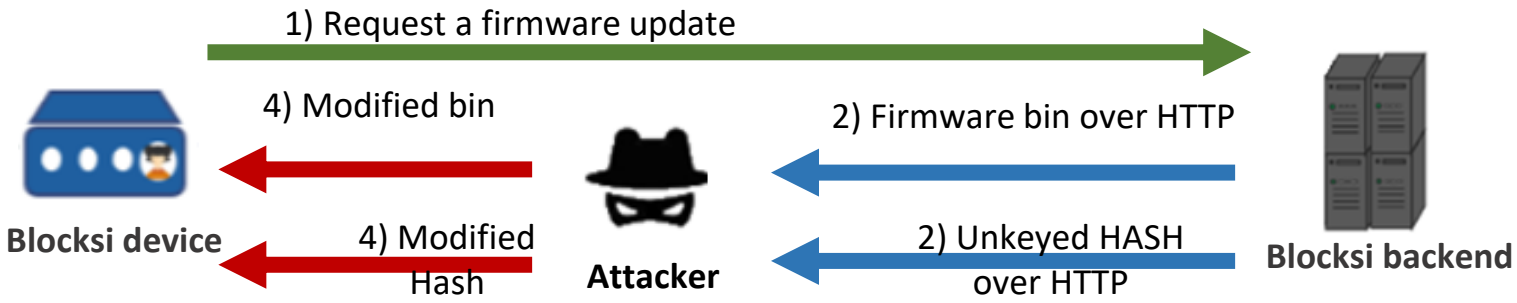
Results and Sample Findings

Overall Results

We found a total of 135 vulnerabilities across 39 solutions.

- 78 vulnerabilities in 13 Android solutions
- 10 vulnerabilities in 10 Chrome extensions
- 30 vulnerabilities in 8 network devices
- 17 vulnerabilities in 8 Windows applications

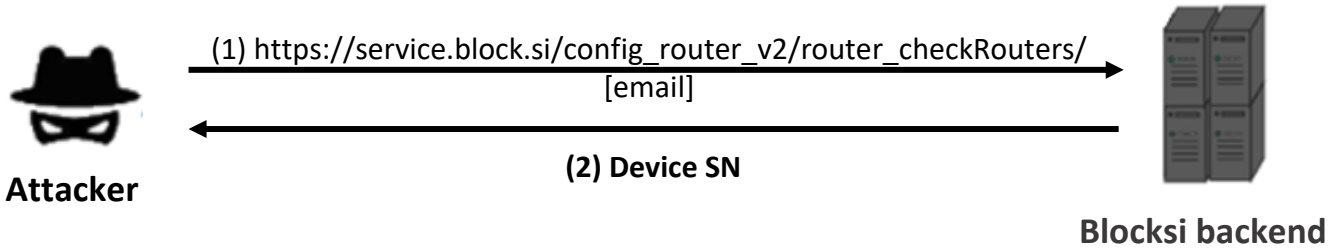
Insecure Firmware Update - Blocksi (network device)



Insecure Authentication – Blocksi (network device)

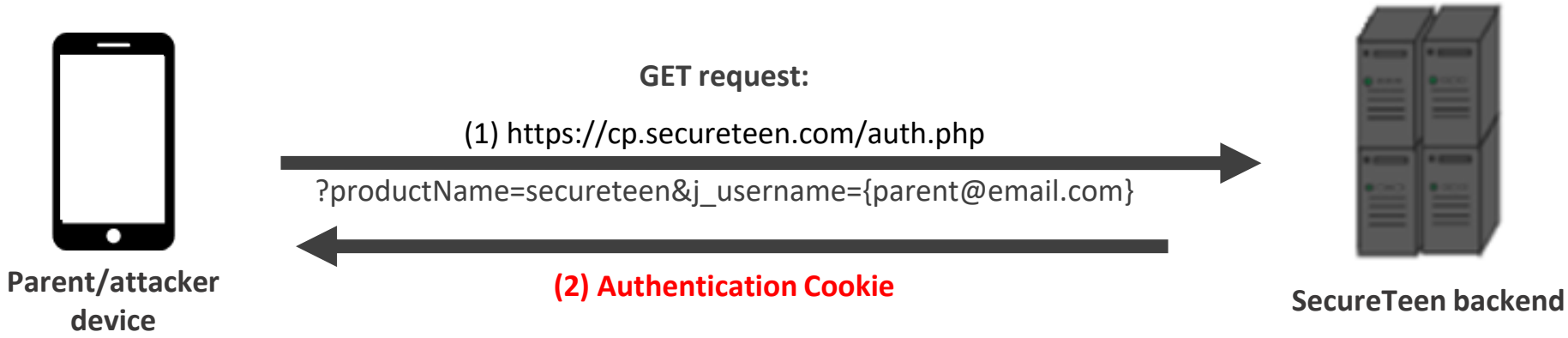
Blocksi Backend API:

- Blocksi API authentication relies on 2 parameters: parent's email and device serial number (SN)
- Can recover SN using parent's email



Insecure Authentication – SecureTeen (Android)

Authentication using parent's email



Full URL Logging – MetaCert Adult Content Blocker (Chrome Extension)

URL query strings might contain:

- Authentication tokens
- User IDs on different websites
- Private information (such as name, email, etc…)

Summary of Contributions

- Developed an **experimental framework** for analyzing security and privacy issues in parental control solutions
- Conducted the **first comprehensive study** of parental control solutions on multiple platforms
- Identified **135 vulnerabilities** across **39** different solutions

Thank you!

Questions?

This work was funded by

Office of the
Privacy Commissioner
of Canada

Commissariat
à la protection de
la vie privée du Canada

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