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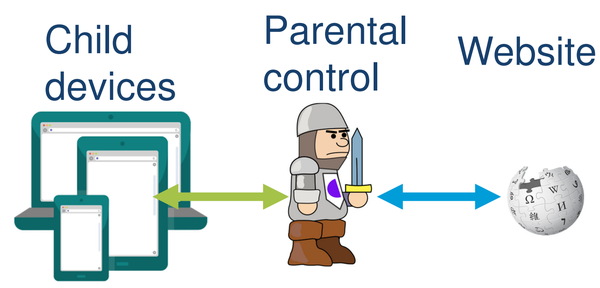
Betrayed by the Guardian: Security and Privacy Risks of Parental Control Solutions

- Parental control solutions are widely used to help digital parenting and protect children.
- Can introduce serious security and privacy risks to children and parents, due to their elevated privileges and having access to a significant amount of privacy-sensitive data.
- We used our experimental framework for systematically evaluating security and privacy issues in parental control software and hardware solutions.
- Our analysis uncovers pervasive security and privacy issues that can lead to leakage of private information, and/or allow an adversary to fully control the parental control solution, and thereby may directly aid cyberbullying and cyber predators.



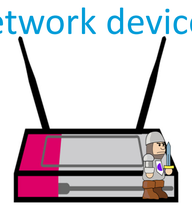
Simplified view of parental control solutions

Analyzed Solutions

Analyzed 54 solutions from popular online marketplaces including:

Android apps (28 solutions, 46 apps)

Network devices (8)



Windows apps (8)

Chrome extensions (10)

Methodology

① Triggering parental control mechanisms

- Mimicking regular users' operations for each solution.

② Hybrid analysis

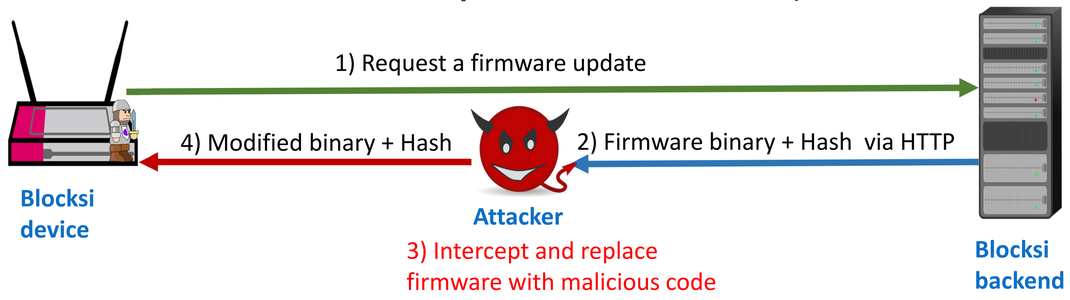
- Combined dynamic (primarily traffic and usage) and static (primarily code review/reverse engineering) analysis.

③ Analyze parental web interface

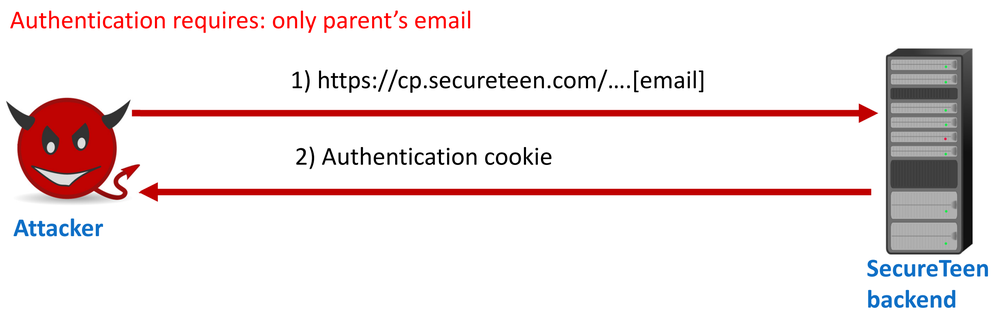
- Assess the password-related issues and test the SSLStrip attack against the login page.

Example Vulnerabilities

① Insecure firmware update - Blocksi (network device)



② Insecure authentication - SecureTeen (Android)



Potential Security and Privacy Issues

Vulnerable client product	Allowing sensitive information disclosure or even full product compromise.
Vulnerable backend	The use of remotely exploitable outdated server software, and misconfigured or unauthenticated backend API endpoints.
Improper access control	Failure to properly check whether the requester owns the account before accepting queries at the server-end.
Insecure authentication secrets	Plaintext storage or transmission of authentication secrets.
SSLStrip attack	The parent's online interface is vulnerable to SSLStrip attacks.
Online password brute-force	No defense against unlimited login attempts on the online parental login interface.
Uninformed suspicious activities	No notifications to parents about indicators of possible compromise.
Insecure PII transmission	PII from the client-end is sent without encryption, allowing an adversary to eavesdrop for PII.
PII exposure to third-parties	Direct PII collection and sharing with third-parties.

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 172 vulnerabilities across 54 different solutions.

Network devices	31 vulnerabilities
Android apps	113 vulnerabilities
Windows apps	17 vulnerabilities
Chrome extensions	11 vulnerabilities

ACSAC 2020 paper link: https://dl.acm.org/doi/abs/10.1145/3427228.3427287
IEEE Security and Privacy Magazine: https://ieeexplore.ieee.org/document/9435190

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