Beyond the Surface:

Uncovering the Unprotected Components of Android Against Overlay Attack

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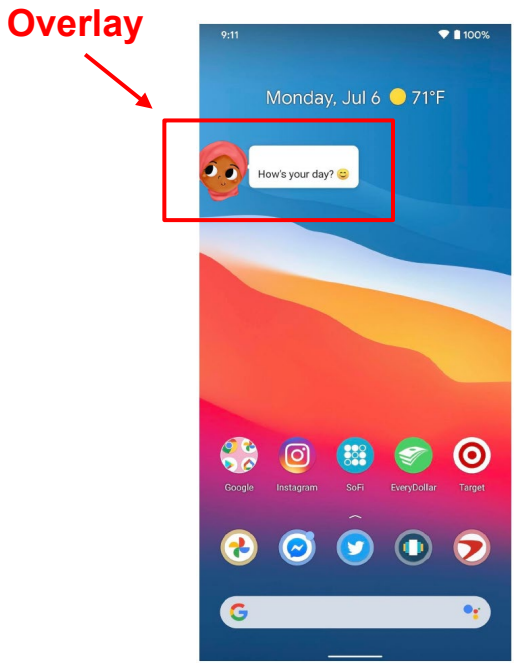

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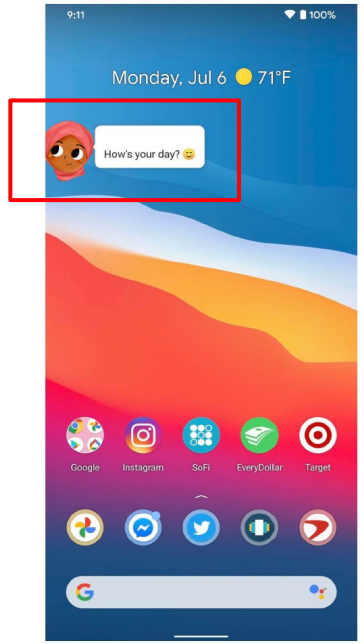

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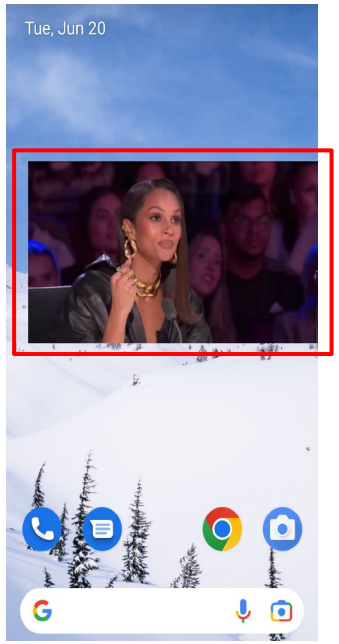

Youtube creates an overlay to play the video while letting users interact with other applications simultaneously

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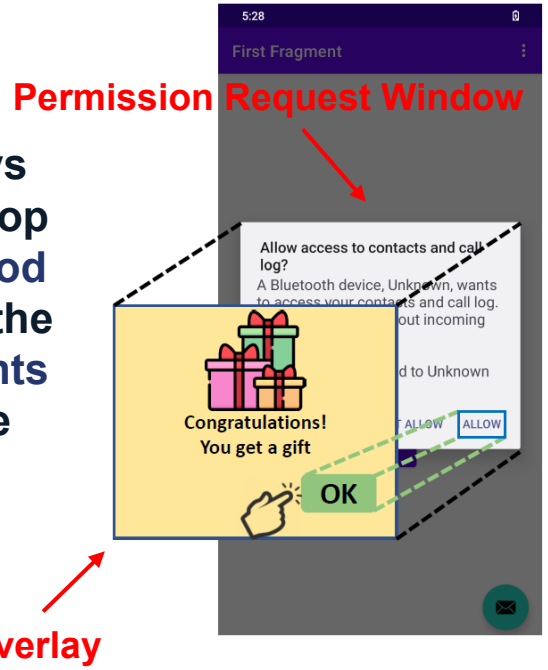

- **Case 2**

A malicious overlay is rendered on top of the system's settings app's permission request window, deceiving users into clicking on "Allow" button to grant the sensitive permission

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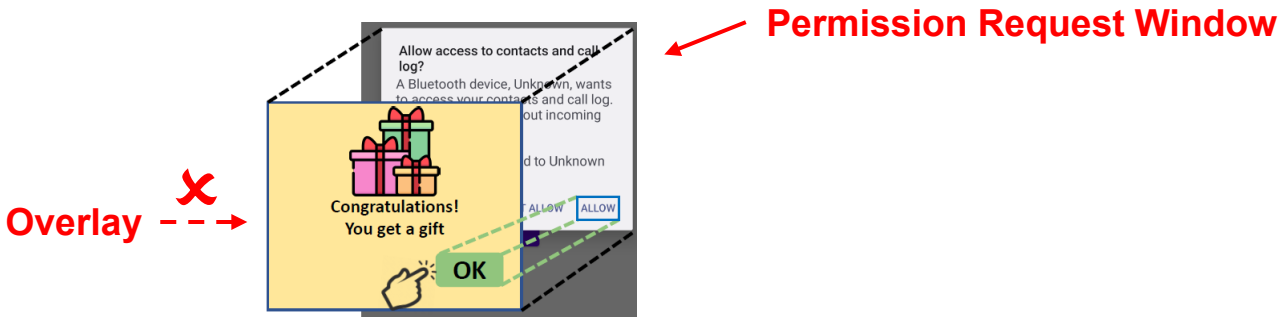

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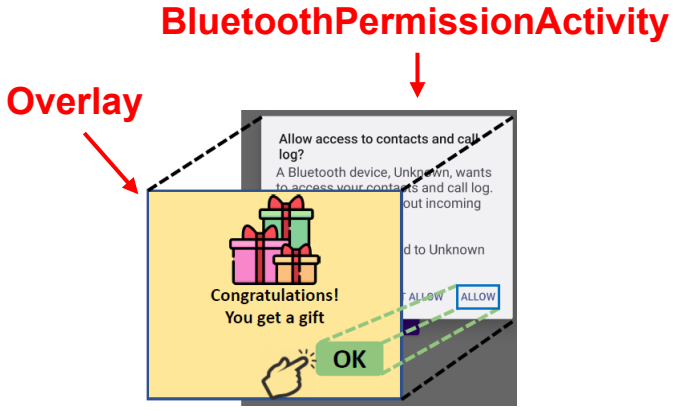

Existing Vague Guideline

- Google's documentation[1] provides a vague guidance
  - The window for granting permission.
  - The window for approving app installation.
  - The window for showing a persistent sensor icon or equivalent privacy-sensitive notification.

[1] https://bughunters.google.com/learn/invalid-reports/android-platform/5148417640366080/bugs-with-negligible-security-impact#tapjacking-overlay-system_alert_window-vulnerability-on-a-non-security-critical-screen

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⟹ A systematic approach to identifying unprotected windows is crucial for bolstering security measures against overlay attack

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  - ③ Summarize the common features of protected windows
    - From aspects of startability, functionality, and interactivity

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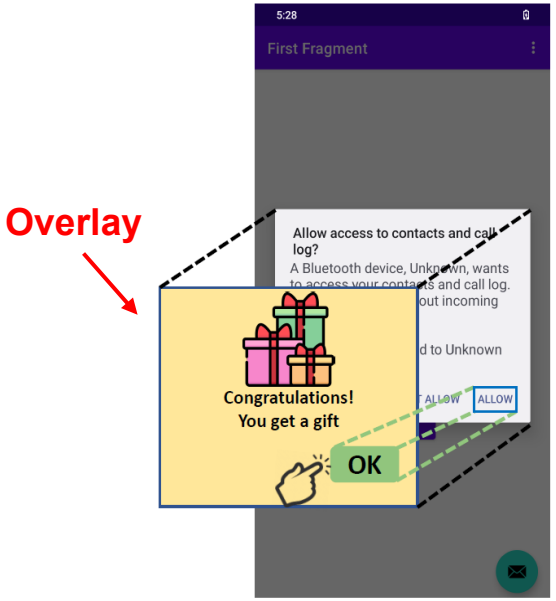

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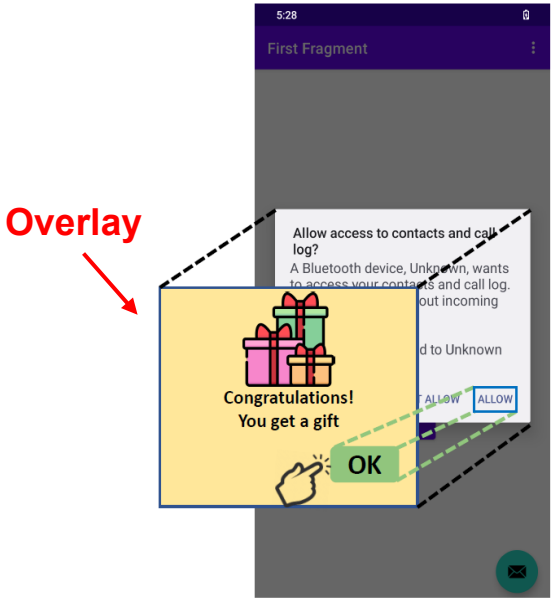

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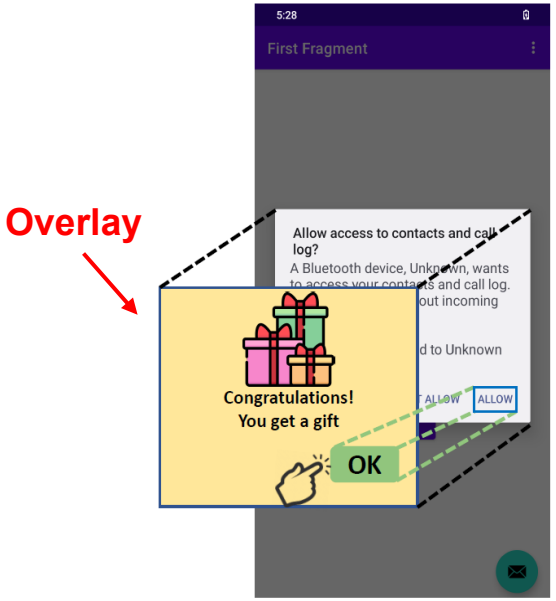

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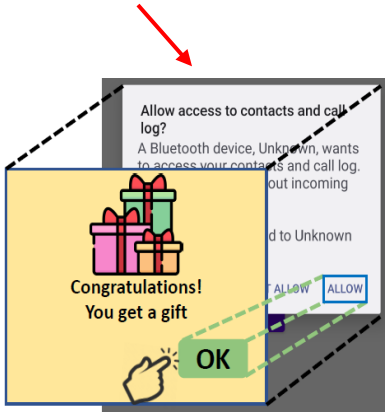

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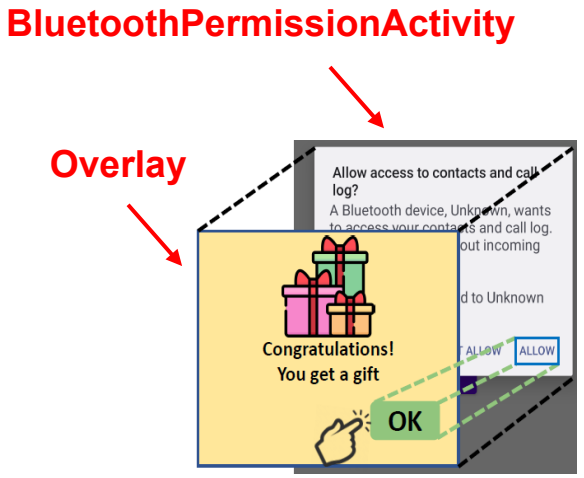

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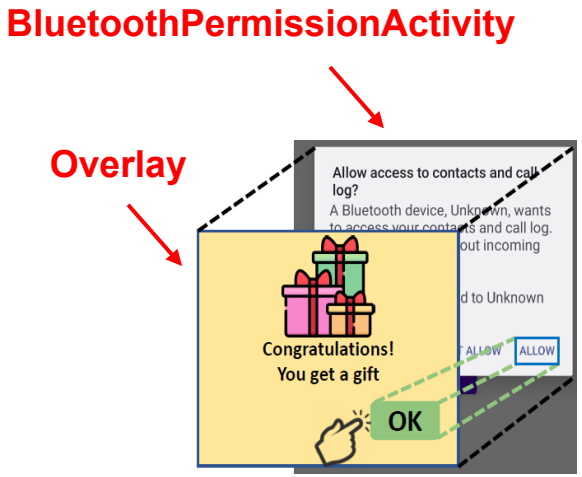

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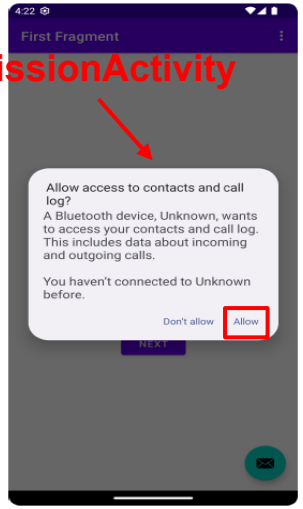

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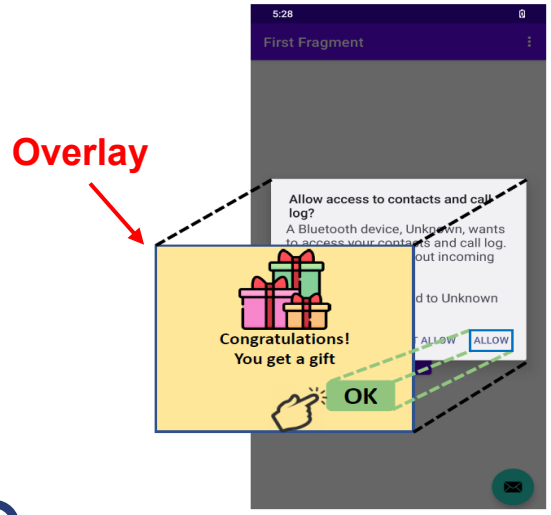

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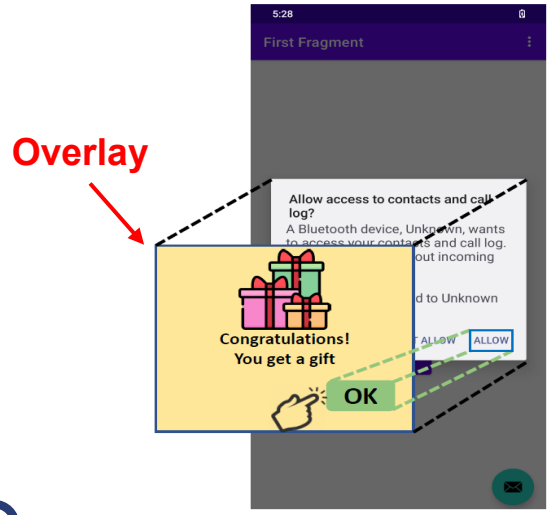

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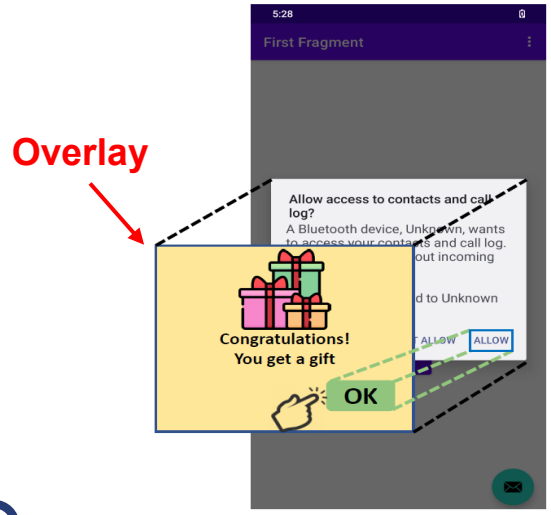

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A window satisfies all three criteria

Need protection against overlay attack

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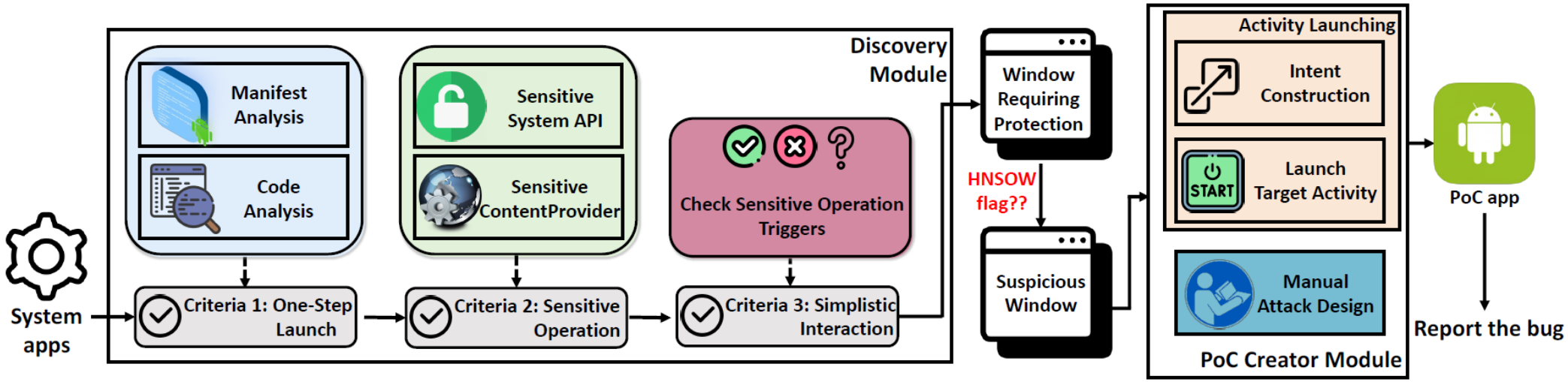

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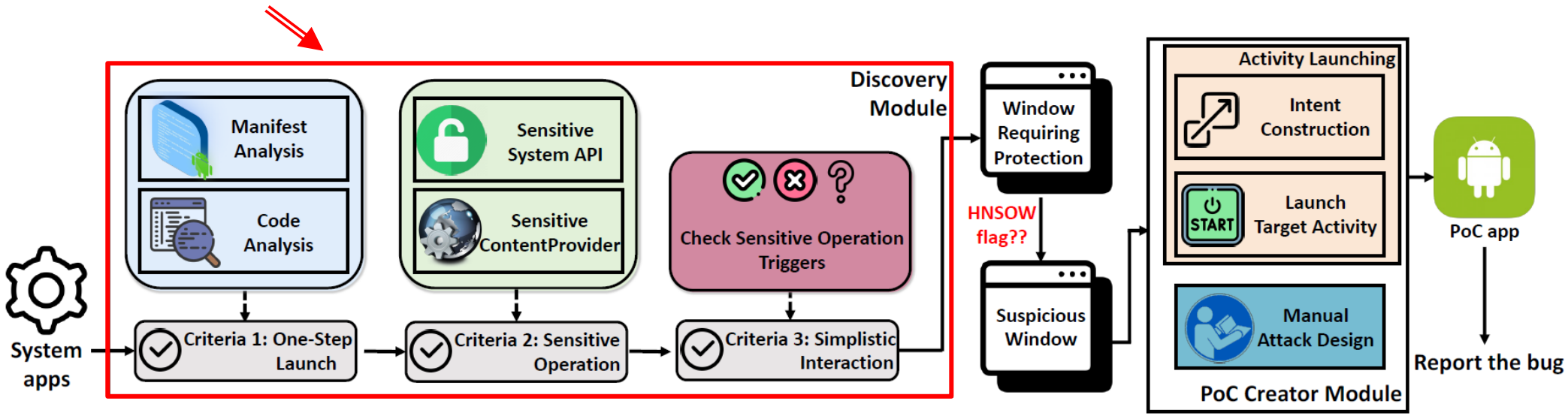
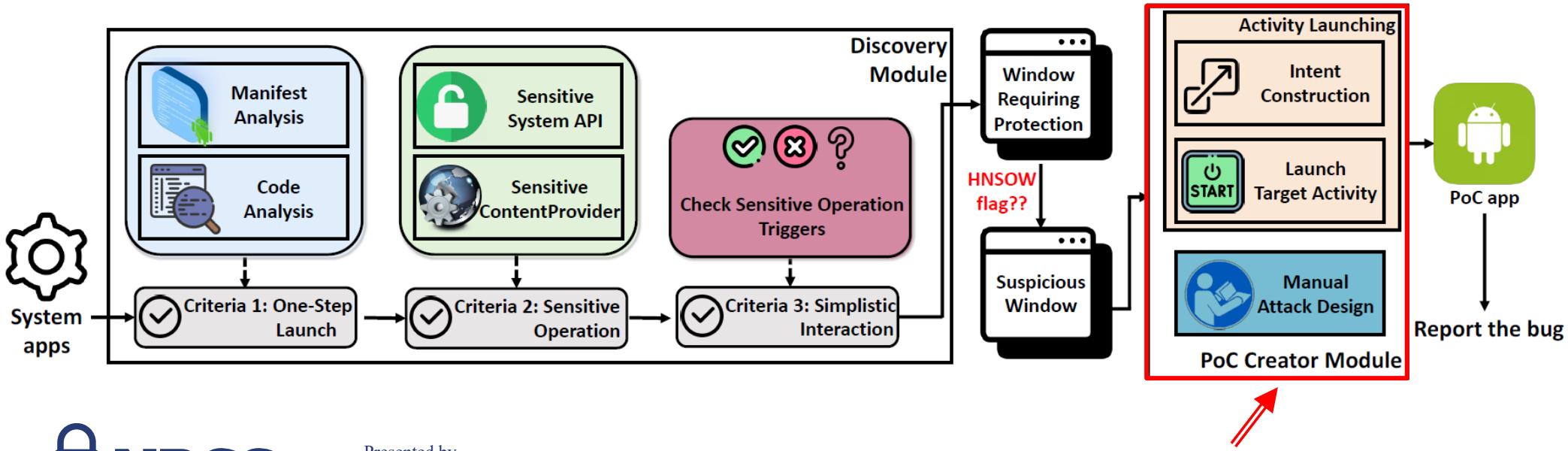
  - Identify windows requiring protection against overlay attack

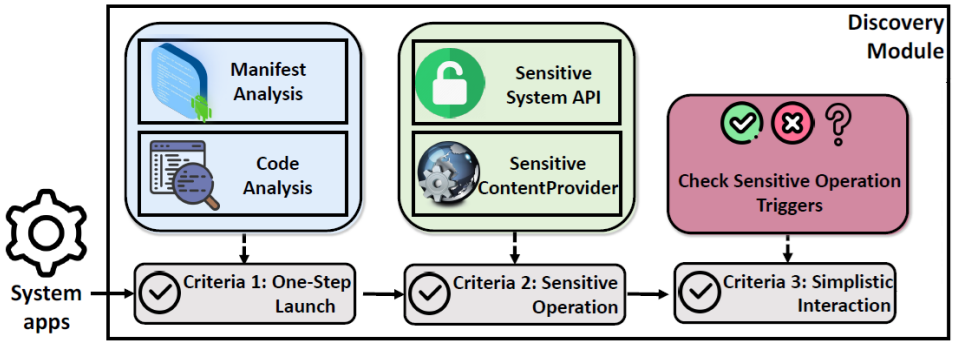


OverlayChecker

- Uncover the windows that miss protection
- It consists of discovery module and PoC creator module
  - Identify windows requiring protection against overlay attack
  - Assist in constructing PoC to confirm vulnerable windows

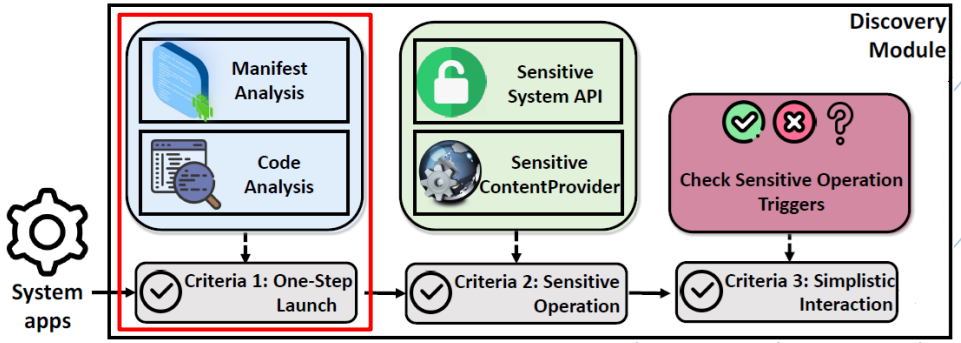


OverlayChecker



OverlayChecker

- **Criteria 1: One-Step Launch**
  - **Identify windows (activity, dialog) that can be directly launched**



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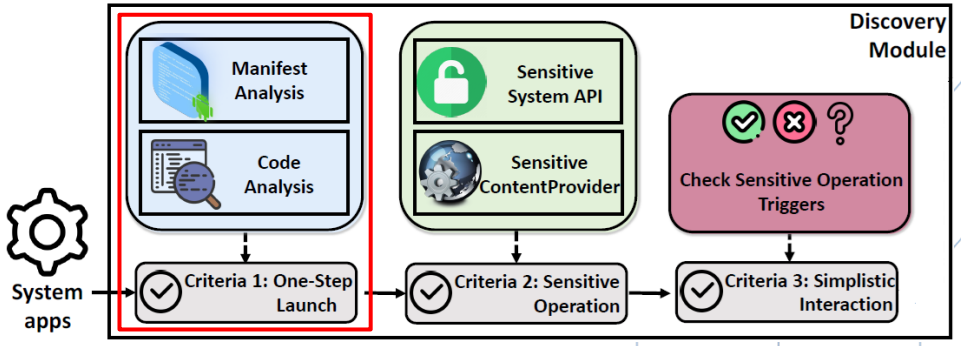

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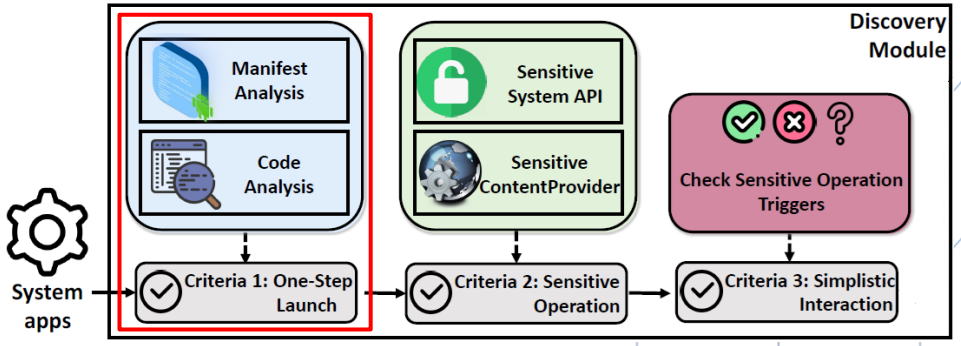

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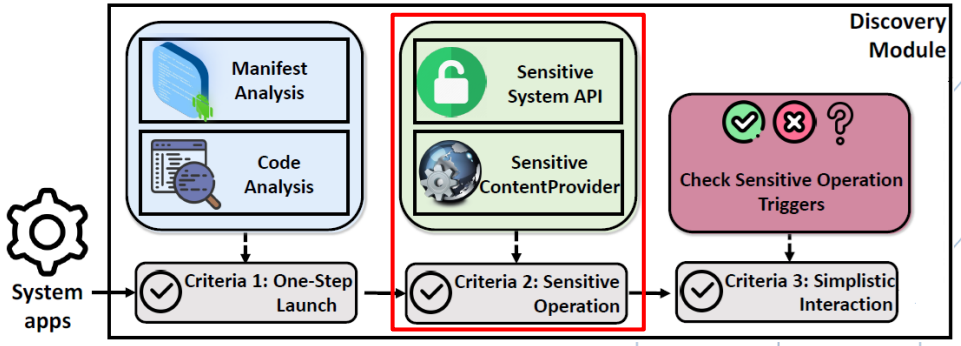

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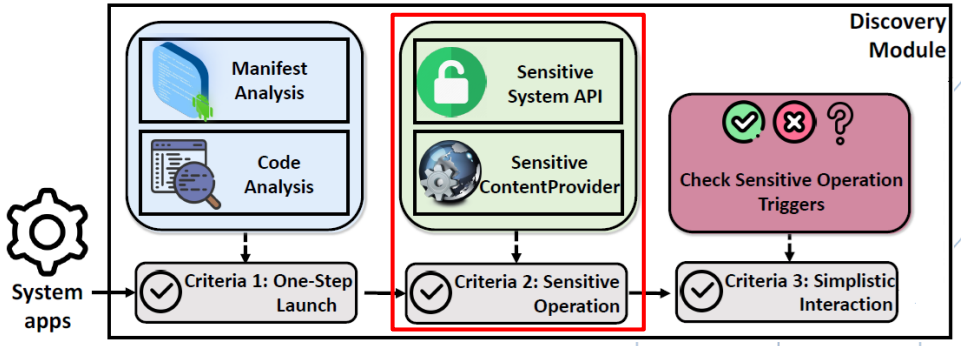
OverlayChecker



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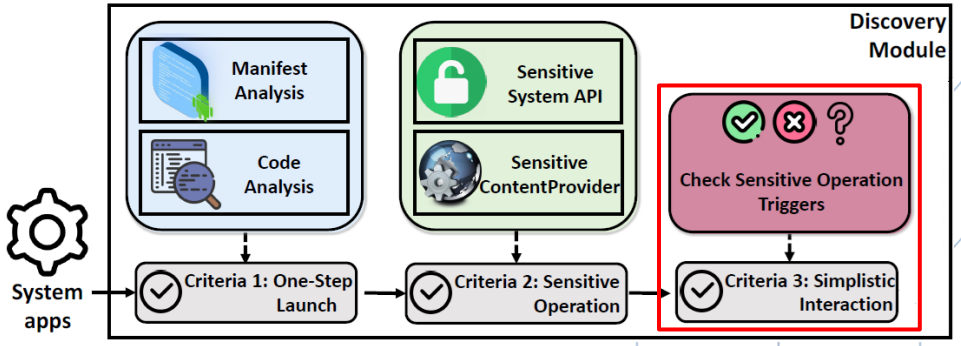

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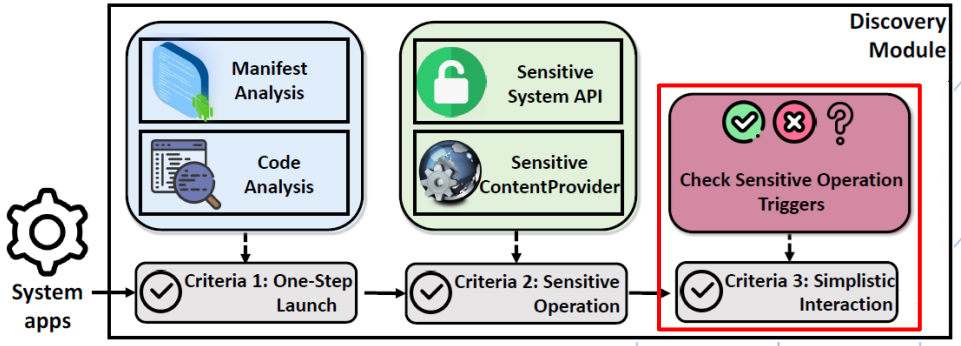

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Is OverlayChecker reliable for identifying the windows of system apps require protection?

AOSP Version	# Protected	# Identified	# Missed
Android 10	27	27 (100.0%)	0 (0.0%)
Android 11	44	42 (95.5%)	2 (4.5%)
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Can OverlayChecker uncover system apps' windows missing protection?

Official Android Systems

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Summary and Future Work

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Summary and Future Work

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- ✓ Design OverlayChecker to uncover unprotected windows
- ✓ OverlayChecker finds 49 unprotected windows, leading to 5 CVEs and three of them are rated as High severity

- ➢ Investigate the vulnerability of missing protection against overlay attack in windows of third-party Android apps

Thanks for listening!