Android Forensics: Automated Data Collection And Reporting From A Mobile Device

By

Justin Grover

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Android Forensics:
Automated Data Collection and Reporting from a Mobile Device

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MITRE

Approved for Public Release

Agenda

- **Problem**
- **Solution**
- **Scope of Research**
- **Background**
- **Related Work**
- **DroidWatch**
  - Design
  - Implementation
  - Analysis & Evaluation
  - Anti-Forensics
- **Future Work**

Problem

- **Android Smartphones Gaining Popularity**
  - In the U.S., as of May 2013
    - 141 Million People Owned a Smartphone
    - 52.4% of Smartphone Platforms ran Android

- **Enterprise Security is a Challenge**
  - Lack of Monitoring Technology for Enterprise Android Devices
  - Limited Data Availability for Internal Investigations

Solution

- **Android App**
  - Continuous Monitoring of an Android Enterprise Device
    - Incorporates User Consent
    - Targeted for Internal Investigations

- **Contributions**
  - 1st Open Source Android User Monitoring Solution of Its Kind
  - Design Strategy for Prioritizing Android App Components
  - Guide for Collecting Data Without Root Privileges

Scope of Research

- **Test Device**
  - Samsung Galaxy S II Epic 4G Touch (Unrooted)

- **Investigators…**
  - Incident Responders
  - Security Auditors
  - Forensic Investigators

- **Investigating…**
  - Policy Violations
  - Intellectual Property Theft
  - Misuse
  - Embezzlement
  - Sabotage
  - Espionage

Background

- **Android App Components**
  - **Most Commonly Used**
    - Activity - User Interface
    - Service - Long-Running Operation
    - Content Provider - Manages Access to Data
    - Broadcast Receiver - Handles Notifications
  - **Useful for Monitoring**
    - Broadcast Receiver - Handles Notifications
    - Content Observer - Detects Changes
    - Alarm - Scheduled Operations

Background

- **Android Security Model**
  - Apps & Users Are Sandboxed
  - Permissions Must Be Declared
- **Rooting Bypasses the Android Security Model**
  - Legitimate Purposes
    - Forensics
    - Security Apps
    - Personal Use & Research
  - Nefarious Purposes
    - Tampering
    - Circumvent Enterprise Security

Related Work

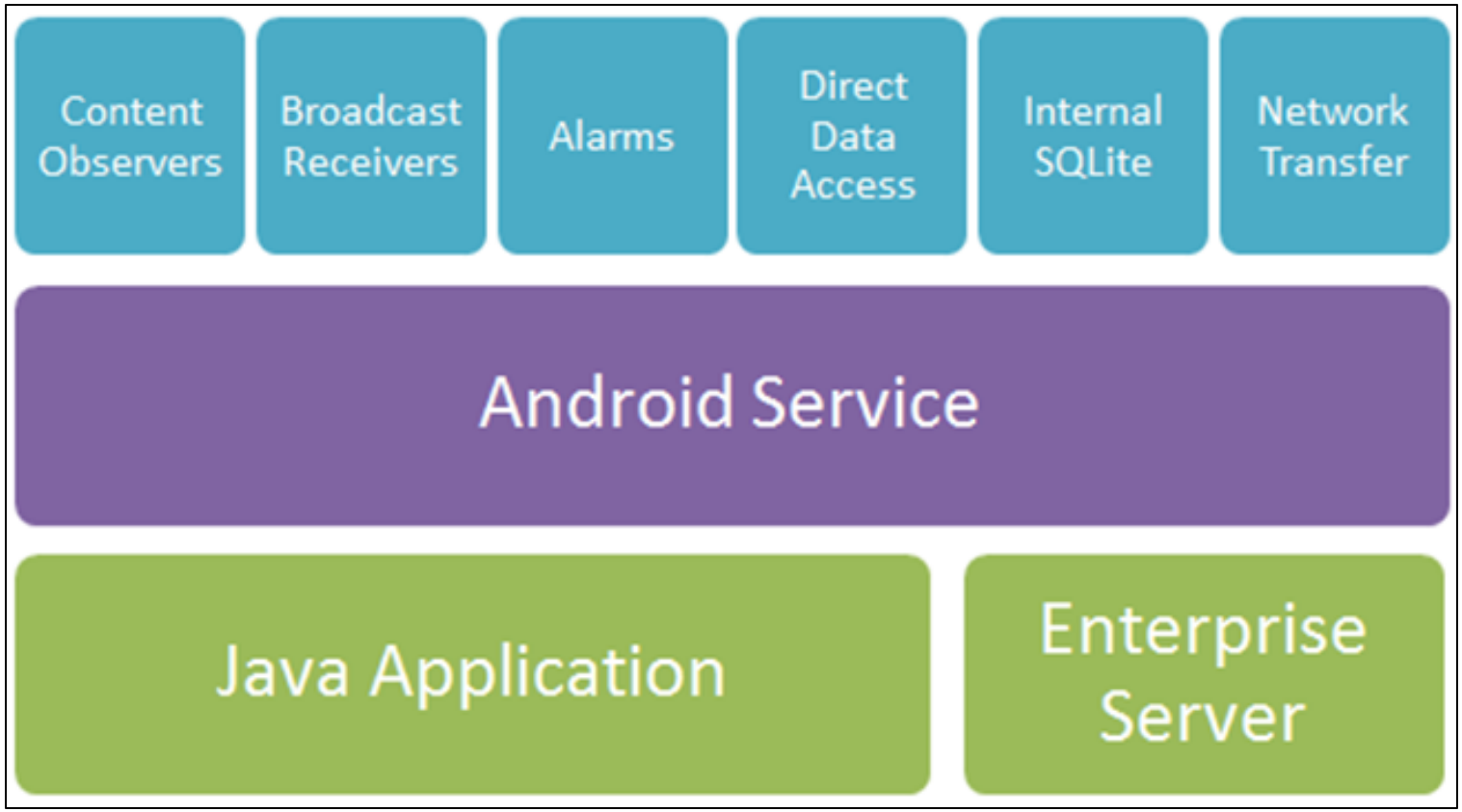
- **Mobile Device Management (MDM)**
  - Juniper Networks
- **Forensic Snapshots**
  - Encase Enterprise
  - AFLogical
- **Other Continuous Monitoring Systems**
  - Personal “Spy” Apps

DroidWatch

- Design
- Implementation
- Analysis & Evaluation
- Anti-Forensics

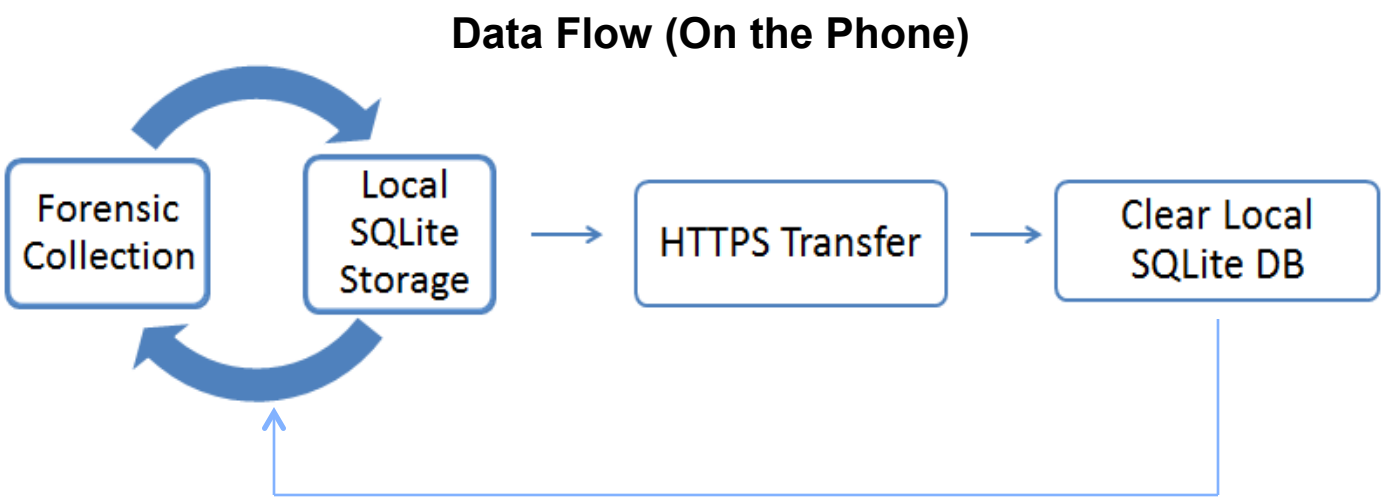
DroidWatch: Design

- **System Architecture**



DroidWatch: Design

- Data Continuously Collected
- Data Periodically Transferred to an Enterprise Server



DroidWatch: Design

- **Development Design Strategy**
  - Used to Prioritize Android App Components Useful for Monitoring
  - Implemented Throughout DroidWatch

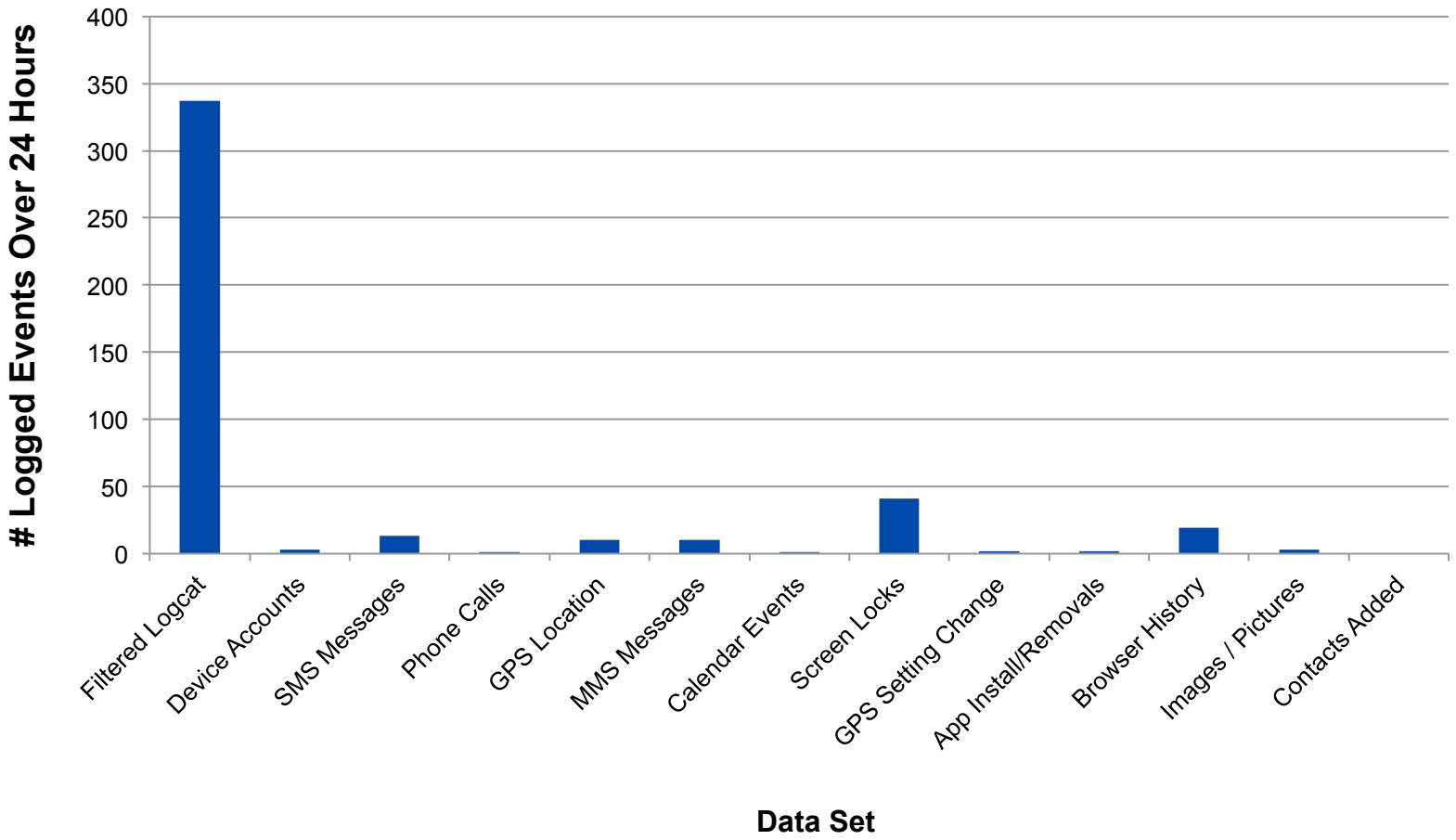
DroidWatch: Implementation

- **17 Data Sets Targeted for Collection**
  - Collected: 15
  - Not Collected: 2

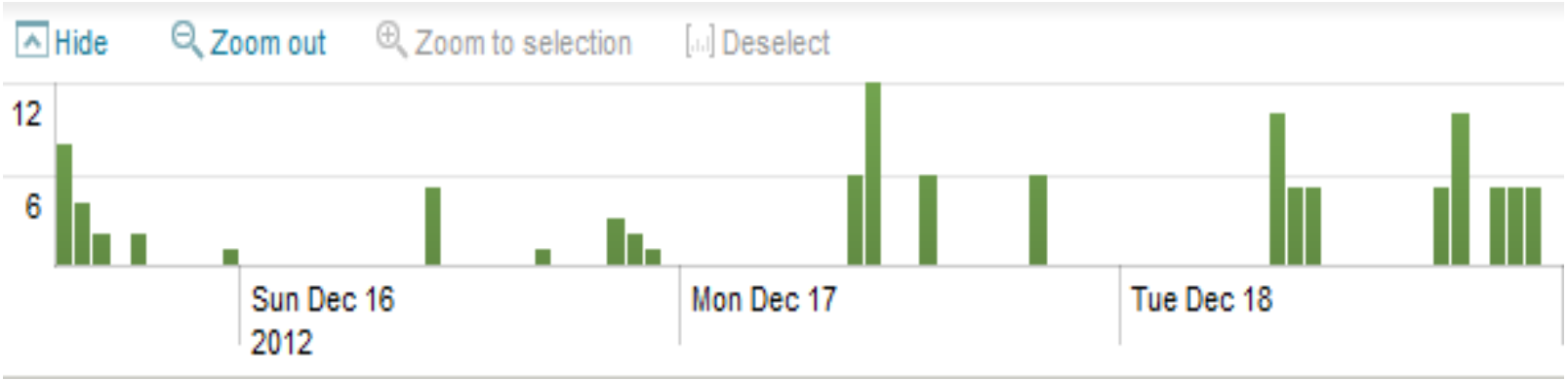
Data Set	Collection Component Used		
	BroadcastReceiver	ContentObserver	Alarm
App Installs / Removals	✓		
Browser Navigation History			✓
Browser Searches			✓
Calendar Events			✓
Call Logs		✓	
Contacts Added		✓	
GPS Location			✓
Location Settings	✓		
MMS	✓		✓
Pictures Added		✓	
Screen Lock Status	✓		
SMS	✓	✓	
Third-Party App Logs			✓

DroidWatch: Analysis & Evaluation

- **Typical Use Resulted in ~1MB Logs / Day**



DroidWatch: Analysis & Evaluation



Detected Screen Unlock Actions (Splunk)

DroidWatch: Analysis & Evaluation

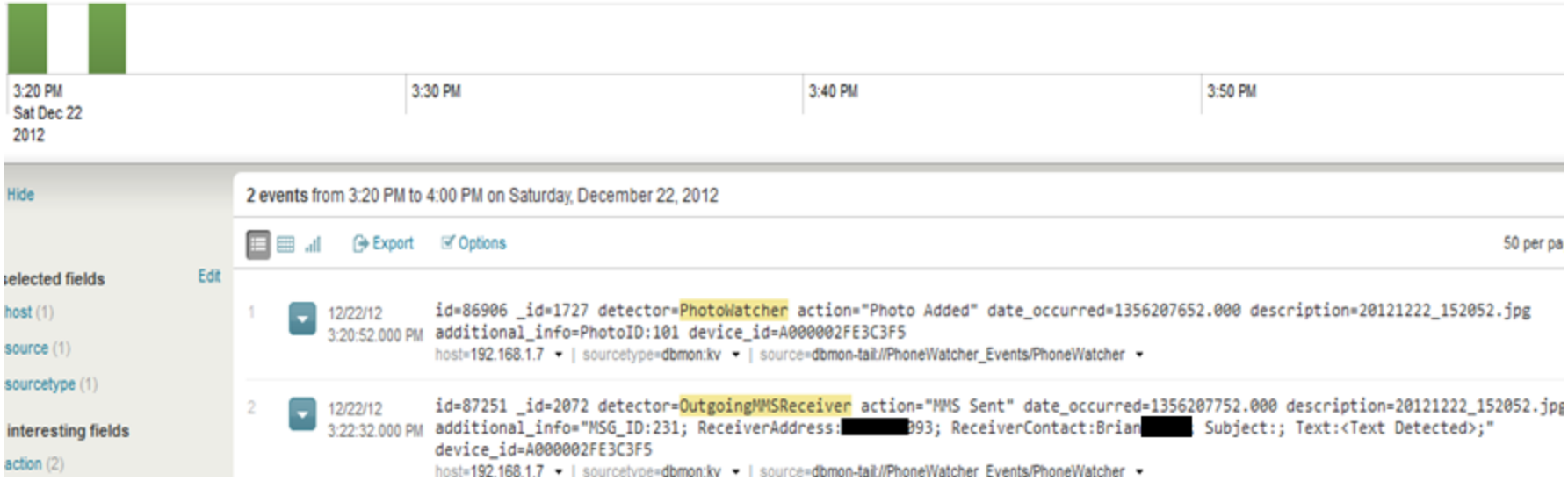


Photo and MMS Search Results (Splunk)

DroidWatch: Analysis & Evaluation

- **Issues Noted:**
  1. Last Known Locations Do Not Work Well
  2. Messages Sent to Multiple Contacts Only Listed a Single Recipient
  3. Incoming SMS Messages Do Not Contain Timezone
  4. No MMS Message Text

DroidWatch: Anti-Forensics

- **DroidWatch Susceptible To:**
  - Root
  - Uninstallation
  - Process Termination

- **Relies On:**
  - External protections
  - Future Work
    - Anti-Tampering Mechanisms
    - Installation Within `/system/app` Directory

DroidWatch: Anti-Forensics

- **Destroying, Hiding, & Altering Evidence**
  - Alarms Susceptible
    - Possible to Tamper With Evidence Between Collections
  - Intent-Filter Priority
    - Apps With Max Intent-Filter Priority Values Can Override Broadcasts
      - Example: *GoSMS*
- **Counterfeiting Evidence**
  - No Verification of Real Data
  - Possible Denial of Service
- **Detecting Forensics Tools**
  - Automated Tools Could Turn Off Networking Before Data Transfers

Future Work

- **Additional Data Collections**
  - USB Debugging
  - Voicemail Log
  - dumpsys / dumpstate / dmesg
- **Anti-Tampering Mechanisms**
  - Database Encryption
  - Keep-Alive Logs
  - High Intent-Filter Priorities
  - Individual Event Checksums
- **Longer-Term Effort**
  - Integrate into Mobile Device Management (MDM)

Conclusion

- **DroidWatch Prototype Targeted for Internal Investigators**
  - Source Code Available on GitHub
- **Contact Info: jgrover@mitre.org**
- **Demo at tonight's session!**
- **------- Any Questions? -------**

References

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