



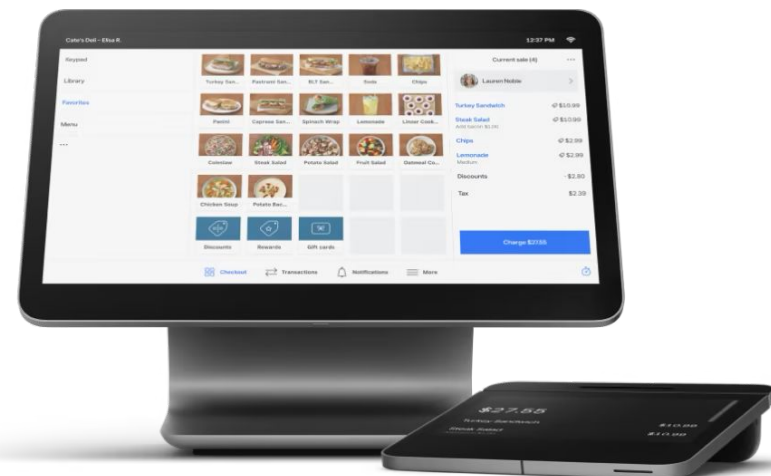
# **Debugging Made Easy: Tips and Tricks for Android Developers**



# Chris Hayes

Android Solutions  
Engineer - (He/Him)

- Enjoys: Digging into hard problems
- Previously: Square (9 years)
  - Android App Development
  - Android Build Systems
  - Android OS Platform
- Full Time remote out of Colorado, USA



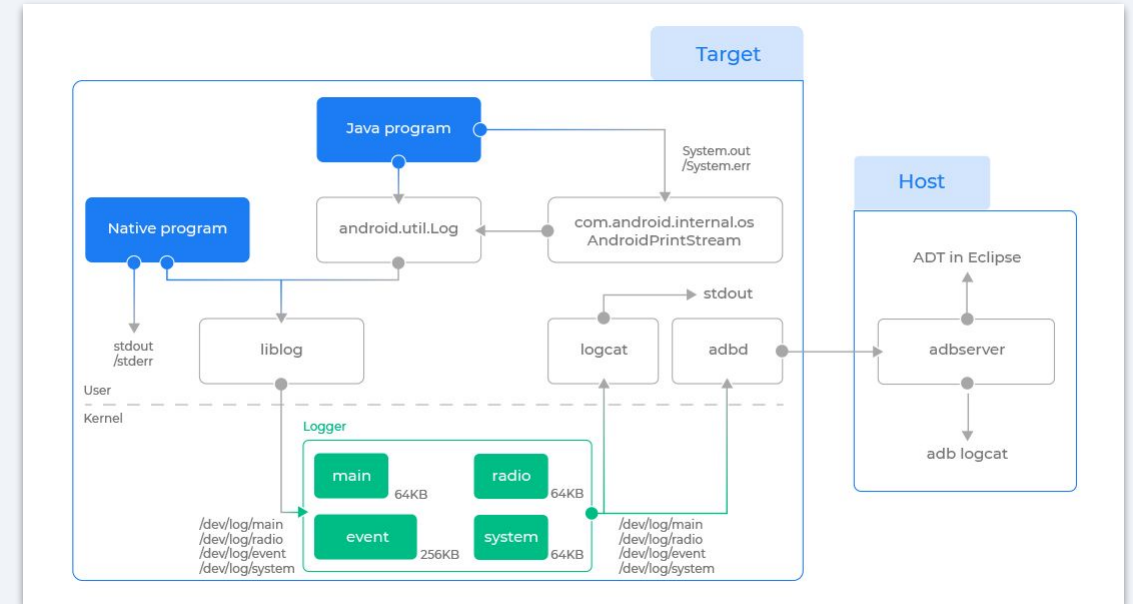
# AOSP Diagnostics Overview

The latest in performance monitoring and debugging logs to understand your AOSP device and fix problems



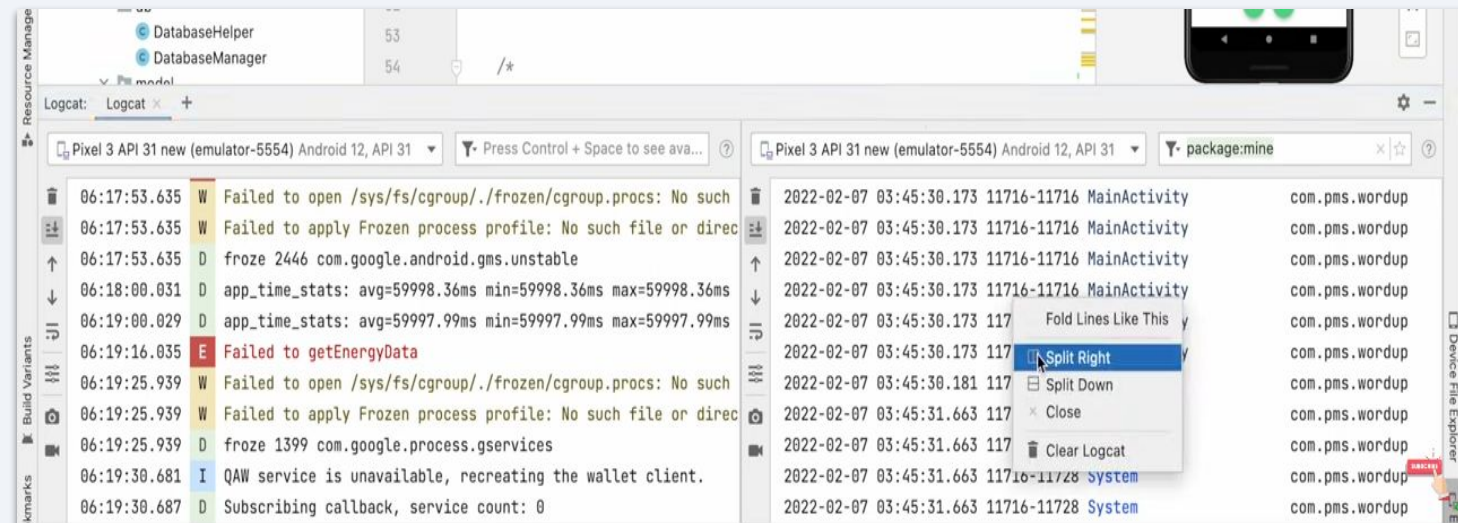
# Logs for AOSP Developers

- Logcat = Circular buffers of AOSP app logs
  - main, system, crash, radio, event
  - Logcat V2 – new updates in Dolphin!
- Kmesg/dmesg = Kernel/driver logs (/proc/kmesg)
  - Great for capturing message from reboot

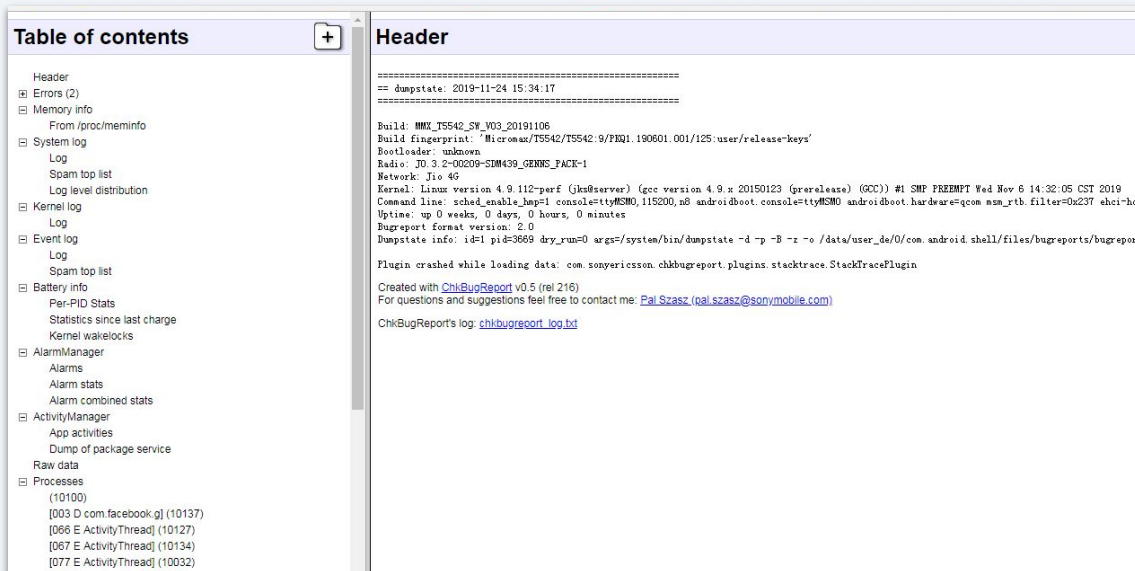
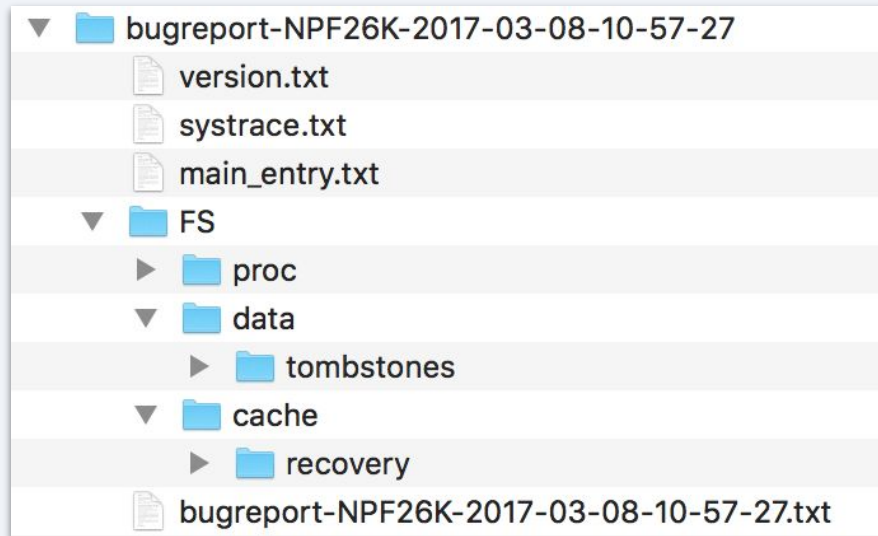


- **Helpful Resources**

- [Android Debugging Core Topics](#)
- [Android Studio Logcat User Guide](#)
- [Android Log Analysis by pCloudy](#)
- [Logcat V2 features from googleblog](#)
- [Logcat V2 detail overview \(YouTube\)](#)



# Debug Tools (log capture and analysis)



- ADB – Android Debug Bridge
  - Connect your host to device, get logs from logcat
  - Android 12: backup excludes app data
- Bug Reports – Snapshot of logs for troubleshooting
  - Dumpsys – System services
  - Dumpstate – Error logs
  - Logcat – System messages
- DropBoxManager – More targeted reports
  - Data specifically from apps that crash

## Helpful Resources

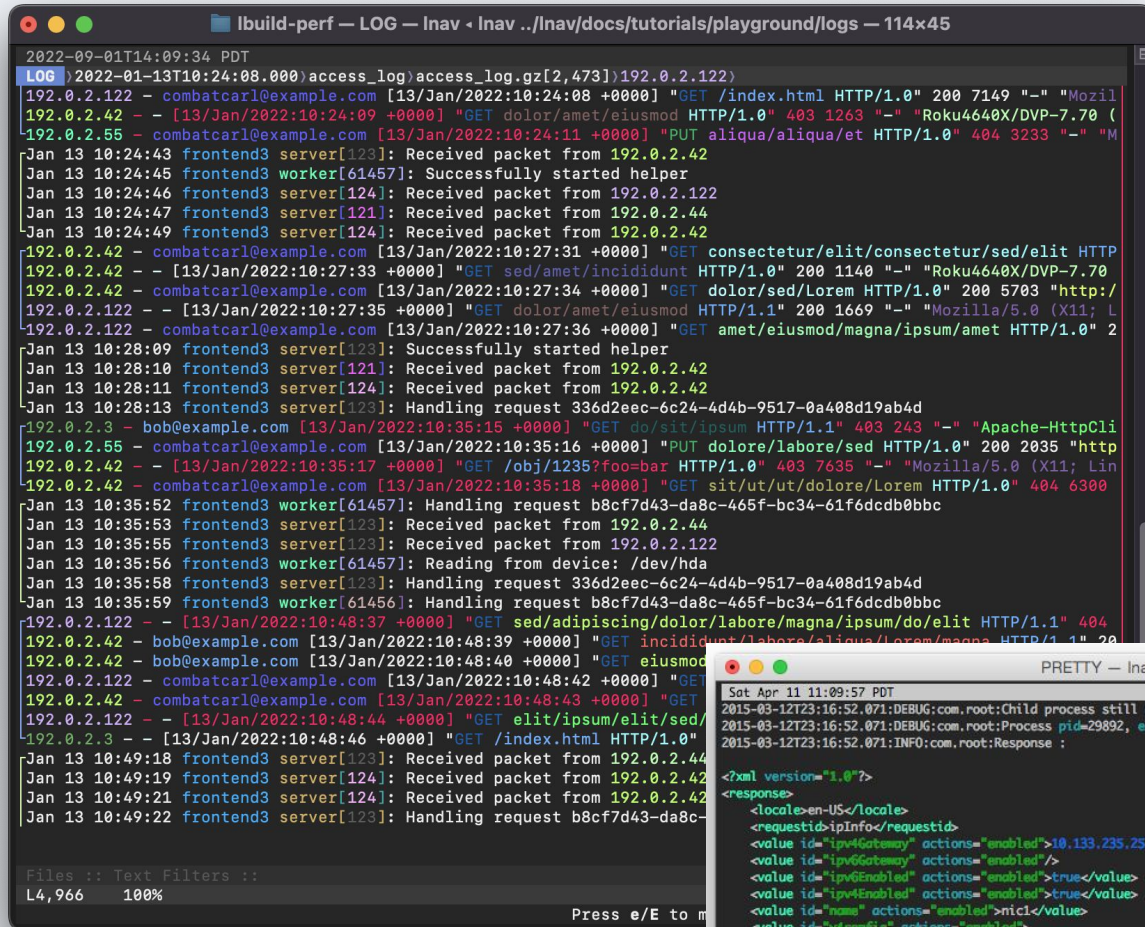
- [Android Debugging Core Topics](#)
- [Android Studio Bug Report User Guide](#)
- [Android Bug Report Videos \(YouTube\)](#)
- A helpful viewer: [ChkBugReport](#)

# LNAV

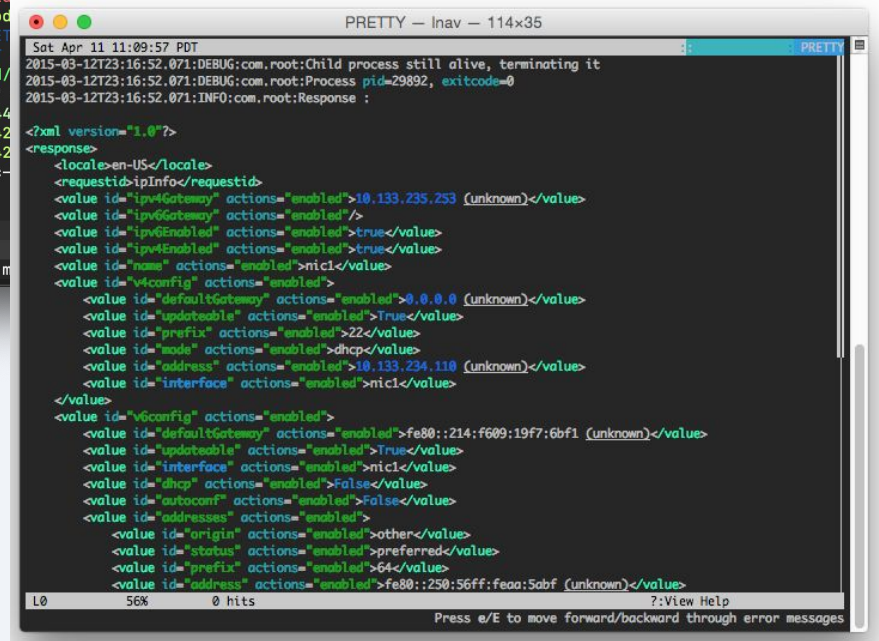
- Feature rich log navigator
- SQL query language built in
- Histogram view
- Multi-log interpolation
  - Merge logcat and kernel logs
- Supports custom log formats
- Syntax highlighting
- Custom regex highlighting
- Pretty-print structured data

- **Helpful Resources**

- [Inav features](#)



```
2022-09-01T14:09:34 PDT
LOG > 2022-01-13T10:24:08.000)access_log)access_log.gz[2,473]:192.0.2.122)
192.0.2.122 - combatcarl@example.com [13/Jan/2022:10:24:08 +0000] "GET /index.html HTTP/1.0" 200 7149 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:91.0) Gecko/20100101 Firefox/91.0"
192.0.2.42 - - [13/Jan/2022:10:24:09 +0000] "GET dolor/amet/eiusmod HTTP/1.0" 403 1263 "-" "Roku4640X/DVP-7.70 (Linux; Android 11; Roku4640X Build/RK3083) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.114 Safari/537.36"
192.0.2.55 - combatcarl@example.com [13/Jan/2022:10:24:11 +0000] "PUT aliqua/aliqua/et HTTP/1.0" 404 3233 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:91.0) Gecko/20100101 Firefox/91.0"
Jan 13 10:24:43 frontend3 server[123]: Received packet from 192.0.2.42
Jan 13 10:24:45 frontend3 worker[61457]: Successfully started helper
Jan 13 10:24:46 frontend3 server[124]: Received packet from 192.0.2.122
Jan 13 10:24:47 frontend3 server[121]: Received packet from 192.0.2.44
Jan 13 10:24:49 frontend3 server[124]: Received packet from 192.0.2.42
192.0.2.42 - combatcarl@example.com [13/Jan/2022:10:27:31 +0000] "GET consectetur/elit/consectetur/sed/elit HTTP/1.0" 200 1140 "-" "Roku4640X/DVP-7.70 (Linux; Android 11; Roku4640X Build/RK3083) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.114 Safari/537.36"
192.0.2.42 - - [13/Jan/2022:10:27:33 +0000] "GET sed/amet/incidunt HTTP/1.0" 200 1140 "-" "Roku4640X/DVP-7.70 (Linux; Android 11; Roku4640X Build/RK3083) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/91.0.4472.114 Safari/537.36"
192.0.2.42 - combatcarl@example.com [13/Jan/2022:10:27:34 +0000] "GET dolor/sed/Lorem HTTP/1.0" 200 5703 "http://192.0.2.122:8080/" [13/Jan/2022:10:27:35 +0000] "GET dolor/amet/eiusmod HTTP/1.1" 200 1669 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
192.0.2.122 - combatcarl@example.com [13/Jan/2022:10:27:36 +0000] "GET amet/eiusmod/magna/ipsam/amet HTTP/1.0" 200 1140 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
Jan 13 10:28:09 frontend3 server[123]: Successfully started helper
Jan 13 10:28:10 frontend3 server[121]: Received packet from 192.0.2.42
Jan 13 10:28:11 frontend3 server[124]: Received packet from 192.0.2.42
Jan 13 10:28:13 frontend3 server[123]: Handling request 336d2eec-6c24-4d4b-9517-0a408d19ab4d
192.0.2.3 - bob@example.com [13/Jan/2022:10:35:15 +0000] "GET do/sit/ipsam HTTP/1.1" 403 243 "-" "Apache-HttpClient/4.5.13 (Ubuntu)"
192.0.2.55 - combatcarl@example.com [13/Jan/2022:10:35:16 +0000] "PUT dolore/labore/sed HTTP/1.0" 200 2035 "http://192.0.2.122:8080/" [13/Jan/2022:10:35:17 +0000] "GET /obj/1235?foo=bar HTTP/1.0" 403 7635 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
192.0.2.42 - combatcarl@example.com [13/Jan/2022:10:35:18 +0000] "GET sit/ut/ut/dolore/Lorem HTTP/1.0" 404 6300 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
Jan 13 10:35:52 frontend3 worker[61457]: Handling request b8cf7d43-da8c-465f-bc34-616fdcd8b0bb
Jan 13 10:35:53 frontend3 server[123]: Received packet from 192.0.2.44
Jan 13 10:35:55 frontend3 server[123]: Received packet from 192.0.2.122
Jan 13 10:35:56 frontend3 worker[61457]: Reading from device: /dev/hda
Jan 13 10:35:58 frontend3 server[123]: Handling request 336d2eec-6c24-4d4b-9517-0a408d19ab4d
Jan 13 10:35:59 frontend3 worker[61456]: Handling request b8cf7d43-da8c-465f-bc34-616fdcd8b0bb
192.0.2.122 - - [13/Jan/2022:10:48:37 +0000] "GET sed/adipiscing/dolor/labore/magna/ipsam/do/elit HTTP/1.1" 404 1263 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
192.0.2.42 - bob@example.com [13/Jan/2022:10:48:39 +0000] "GET incididunt/labore/aliqua/Lorem/magna/ipsam/amet HTTP/1.1" 200 1140 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
192.0.2.42 - bob@example.com [13/Jan/2022:10:48:40 +0000] "GET eiusmod HTTP/1.1" 200 1140 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
192.0.2.122 - combatcarl@example.com [13/Jan/2022:10:48:42 +0000] "GET elit/ipsam/elit/sed/et HTTP/1.1" 200 1140 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
192.0.2.42 - combatcarl@example.com [13/Jan/2022:10:48:43 +0000] "GET elit/ipsam/elit/sed/et HTTP/1.1" 200 1140 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
192.0.2.122 - - [13/Jan/2022:10:48:44 +0000] "GET elit/ipsam/elit/sed/et HTTP/1.1" 200 1140 "-" "Mozilla/5.0 (X11; Linux x86_64; rv:91.0) Gecko/20100101 Firefox/91.0"
192.0.2.3 - - [13/Jan/2022:10:48:46 +0000] "GET /index.html HTTP/1.0" 200 7149 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:91.0) Gecko/20100101 Firefox/91.0"
Jan 13 10:49:18 frontend3 server[123]: Received packet from 192.0.2.44
Jan 13 10:49:19 frontend3 server[124]: Received packet from 192.0.2.42
Jan 13 10:49:21 frontend3 server[124]: Received packet from 192.0.2.42
Jan 13 10:49:22 frontend3 server[123]: Handling request b8cf7d43-da8c-465f-bc34-616fdcd8b0bb
```

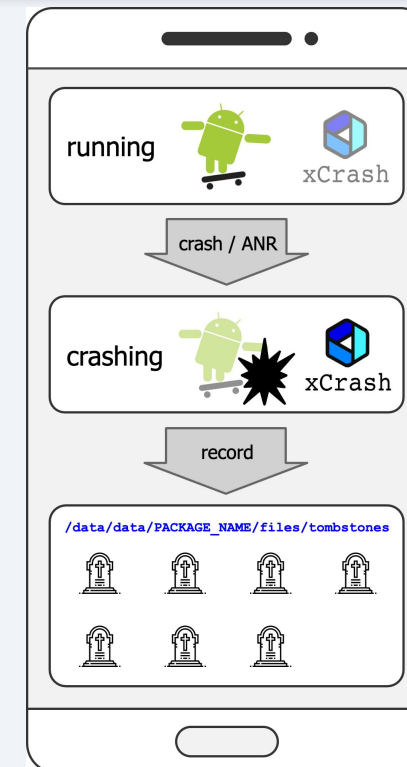


```
Sat Apr 11 11:09:57 PDT
PRETTY - Inav - 114x35
2015-03-12T23:16:52.071:DEBUG:com.root:Child process still alive, terminating it
2015-03-12T23:16:52.071:DEBUG:com.root:Process pid=29892, exitcode=0
2015-03-12T23:16:52.071:INFO:com.root:Response :
<?xml version="1.0"?>
<response>
  <locale-en-US</locale>
  <requestid-ipoInfo</requestid>
  <value id="ipv4Gateway" actions="enabled">10.133.235.253 (unknown)</value>
  <value id="ipv6Gateway" actions="enabled"/>
  <value id="ipv6Enabled" actions="enabled">true</value>
  <value id="ipv4Enabled" actions="enabled">true</value>
  <value id="name" actions="enabled">nic1</value>
  <value id="v4config" actions="enabled">
    <value id="defaultGateway" actions="enabled">0.0.0.0 (unknown)</value>
    <value id="updateable" actions="enabled">True</value>
    <value id="prefix" actions="enabled">22</value>
    <value id="mode" actions="enabled">dhcp</value>
    <value id="address" actions="enabled">10.133.234.110 (unknown)</value>
    <value id="interface" actions="enabled">nic1</value>
  </value>
  <value id="v6config" actions="enabled">
    <value id="defaultGateway" actions="enabled">fe80::214:f609:19f7:6bf1 (unknown)</value>
    <value id="updateable" actions="enabled">True</value>
    <value id="interface" actions="enabled">nic1</value>
    <value id="dhcp" actions="enabled">False</value>
    <value id="autocomf" actions="enabled">False</value>
    <value id="addresses" actions="enabled">
      <value id="origin" actions="enabled">other</value>
      <value id="status" actions="enabled">preferred</value>
      <value id="prefix" actions="enabled">64</value>
      <value id="address" actions="enabled">fe80::250:56ff:feaa:5abf (unknown)</value>
    </value>
  </value>
</response>
L0 56% 0 hits ?View Help
Press e/E to move forward/backward through error messages
```

# Android Crash Data from the Logs and Tools

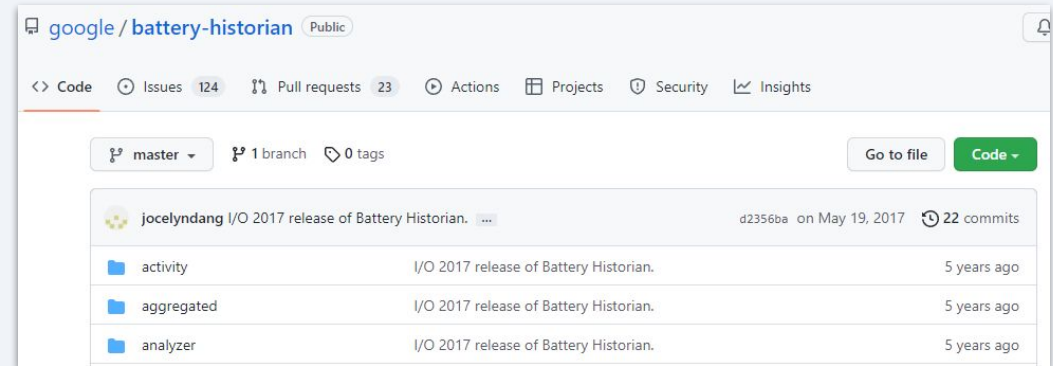
- Tombstones - More detail than logcat from crash dump
  - /data/tombstones/<file>
  - Stack traces of all processes, memory map, open files
- ANRs – Application Not Responding (5 seconds)
- Kernel Oops – Serious, possibly fatal kernel errors
  - Found in logcat
- WTFs – an assert triggered by logcat
- Java exceptions
- SELinux policy violations
  - In audit.d logs
- **Helpful Resources**
  - Debugging Native Crashes in Android Apps

```
< Your System ate a SPARC! Gah! >
-----
      ^ ^
      (xx)\
      ( )\_____)\ \
      U |-----W |
                                     |
sshd (pid 19569): Protection id trap (code 27)
```



# Batterystats & Battery Historian

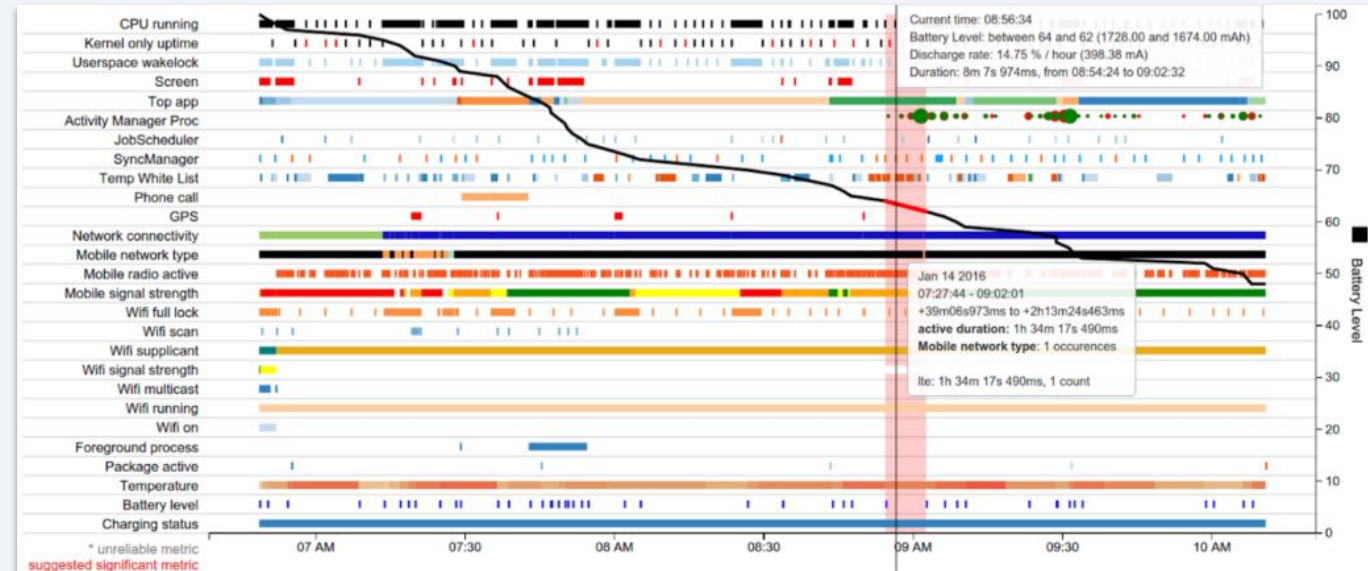
- Batterystats – collects battery data on device
  - Which processes are drawing current?
  - When are they doing it?
  - Adb can get logs



- Battery Historian – a viewer for Batterystats
  - Can consume a bug report (logs are in it)
  - Can show System Stats and App Stats

## Helpful Resources

- Battery Historian GitHub
- Battery Historian Video (YouTube)
- Deeper Dive on Battery Historian (YouTube)



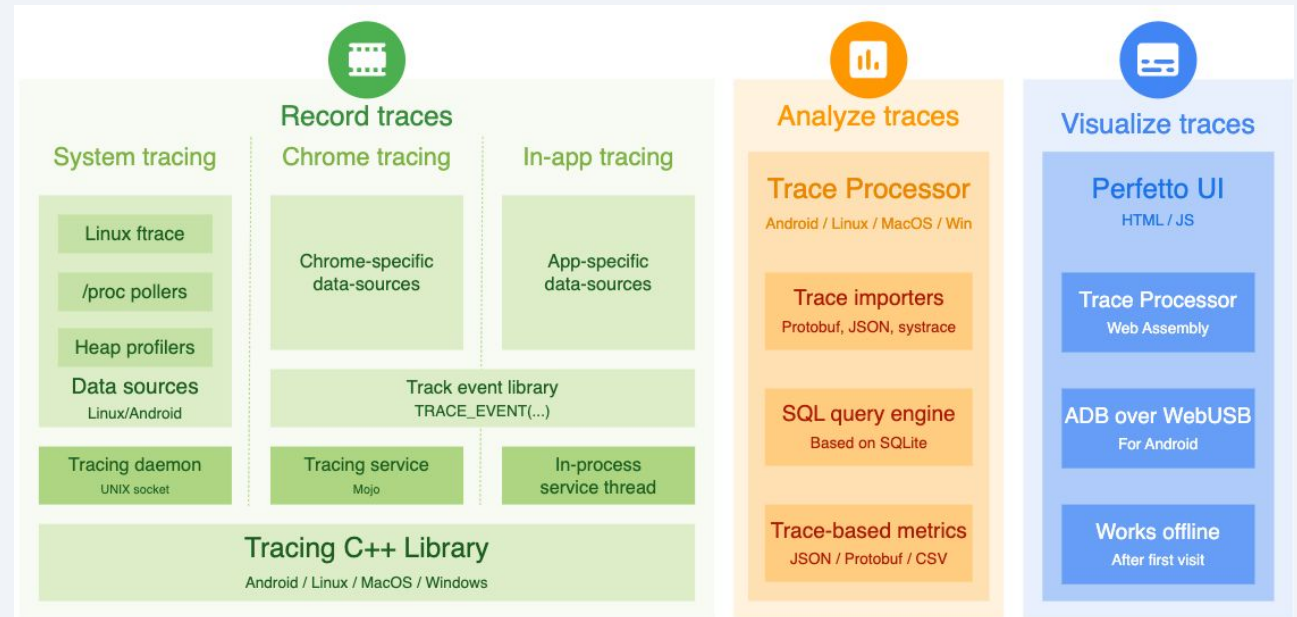


# Performance Tracing & Monitoring

- Perfetto
  - Full system tracing framework and analysis tools.
  - Capture high frequency ftrace data: scheduling activity, task switching latency, CPU frequency and much more
- Leak Canary
  - A memory leak detection library for Android.
  - Built in heap analyzer
  - Allows for uploading heap analysis to third party services

- **Helpful Resources**

- [Perfetto GitHub](#)
- [Perfetto Docs](#)
- [Leak Canary Getting Started](#)






**Live Demo**

# Learn more about AOSP Tools and Memfault

On-Demand Webinar

## How to Debug, Update & Monitor Embedded Android Devices

Recorded: Thursday, October 28, 2021

A white IoT device stands on a teal square base. To its left is a white camera on a similar base. To its right is a tablet displaying a control interface, also on a teal base. The background is dark blue with faint grid lines.

Speaker



**Ryan Case**  
Director of Engineering,  
Memfault

[Link to Webinar](#)

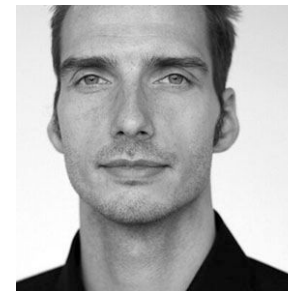
On-Demand Webinar

## Managing Android Devices at Scale with Memfault AOSP SDK v4.0

Recorded: Thursday, March 24, 2022

A white smartwatch with a green Android logo on its screen is on a teal square base. To its right is a tablet with a green Android logo, also on a teal base. In the background, a data chart is visible on a screen.

Speaker



**Heiko Behrens**  
Head of Product, Memfault

[Link to Webinar](#)

# Thank You!

- [memfault.com/android](https://memfault.com/android)
- [twitter.com/memfault](https://twitter.com/memfault)
- [linkedin.com/company/memfault](https://linkedin.com/company/memfault)  
**we're hiring!**



**Chris Hayes**

Android Solutions, Memfault