Qualcomm Android GO Performance Tuning Guide
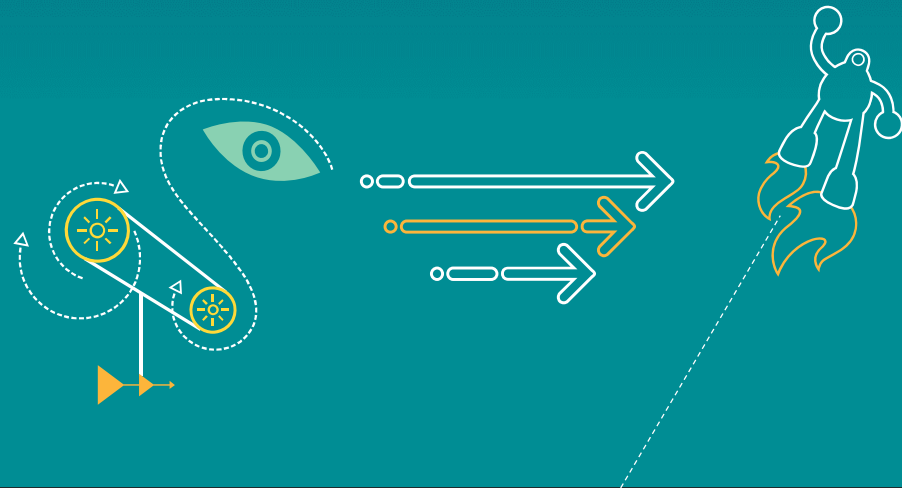
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Revision History

Revision	Date	Description
A	Jun 25,2018	Initial Android GO version

Agenda

- Android GO Introduction and Chipset Configuration

- Android GO Performance Tuning Preparation

- Android GO memory map Configuration and tuning

- Android GO app launch latency Configuration and tuning

- Android GO Scroll performance and benchmark

- Google doc and Google GTS performance for Android GO

- Android GO Performance Document

- Android GO Performance Debugging Tools

- Android GO Performance Debug Common command

Android GO Introduction and Chipset Configuration
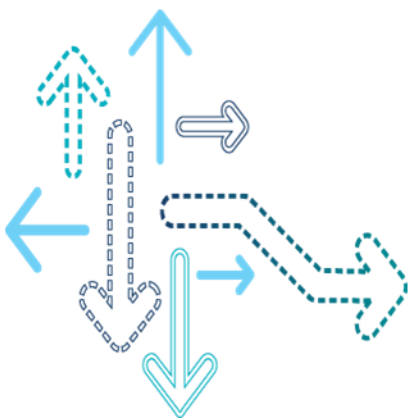
Android GO Introduction and Chipset Configuration

Android Go, also known as **Android Oreo (Go edition),** is a stripped-down version of Android designed to run on entry-level smartphones. It's comprised of three optimized areas — the **operating system**, **Google Play Store**, and **Google apps** — which have been reimagined to provide a better experience on lesser hardware.

Android GO Introduction and HW Configuration

Feature	MSM8909
CPU	Quad Core 4 x A9 at 1.267 GHz or 4 x A9 at 1.094 GHz
Memory	1 x32, 533MHz LPDDR3
GPU	Adreno 304 at 456 MHz
Display	up to HD (720p) at 60 fps
Android GO RAM	512MB to 1GB

Android GO Introduction and HW Configuration

- ## 512 MB RAM devices

  - ### Screen size and camera resolution limits

RAM Size	512 MB
Maximum Display Resolution	FWVGA
Maximum Camera Resolution	5MP

- ## Disk space requirements

  - ### Minimum User Data Partition Size

Flash storage size (GB*)	4	8	16
User data partition size (GB*)	1.5	5.5	12.7

Android GO Performance Tuning Preparation
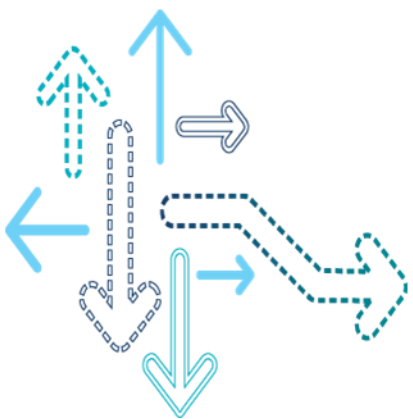
Android GO Performance Tuning Preparation

- **Performance Tuning Build Preparation**
  - **Kernel configuration verification**
    - Always use msm8909-perf_defconfig for Performance measurement
    - The file location for MSM8909 is /kernel/msm-3.18/arch/arm/configs/msm8909-perf_defconfig
    - Check if the following build config are in your build or not, if have, remove them. Refer to **Appendix-1: Kernel Configuration Must Remove** for details
    - Remove the relevant debug log

- **Performance Sanity Testing**
  - Run device analyzer get configuration details

Android GO memory map Configuration and tuning
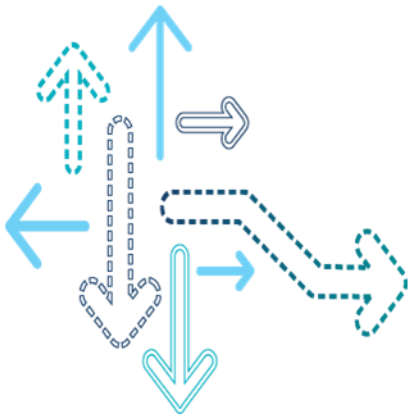
Android GO memory map Configuration and tuning

- Property for setup Android OMR1 to GO edition
  - **ro.config.low_ram=true**

- Free memory criterion base on display resolution

Screen Size	HVGA	(F)WVGA	qHD	HD
512 MB RAM	135 MB	125 MB	N/A	N/A
1 GB RAM	600 MB	530 MB	510 MB	430 MB

- For free memory test, please run the script from google script file:
  - perf-scripts-xxxx-xxx-xxx.tar
- Detail doc:
  - KBA-180601003251, Android Go cert performance testing check
- QCOM reference data:
  - 80-PF735-4A MSM8909 O-GO Android 3.0.1 Performance dashboard reports
  - KBA-180301035309 O-GO/O-MR1 8917 Performance dashboard reports

Android GO memory map Configuration and tuning

- Memory tuning
  - MEMCG + ULMKD
    - Android go disable the kernel lowmemory killer, enable MEMCG + ULMKD for memory reclaim. For detail, please refer this doc:
      - KBA-180528202834 ULMK and Memcg overview on android Go
  - Enable "Swap to zRAM"
    - Configure the zRAM size to 75% in the fstab file.
      - # For 512MB Go device, size = 384MB
      - # For 1GB Go device, size = 768MB
    - Change:
      https://source.codeaurora.org/quic/la/device/qcom/common /commit/?id=424c031d173f28d7557812f5e1a10acfce03ef71
  - Calculating a device's free memory
    - QCOM method
      - Refer the doc:
        - 80-NV303-1 Memory Optimization Guidelines:
          Section-8.2 Generate the memory map
    - Google method
      - Refer the google doc:
        - GMS Go Requirements.pdf

Android GO memory map Configuration and tuning

- ## Memory tuning(Others)
  - ### Enable LZ4 compression for zRAM
    - Kernel config:CONFIG_ZRAM_LZ4_COMPRESS=y
    - write /sys/block/zram0/comp_algorithm lz4
  - ### Configure jemalloc for low memory
    - BoardConfig.mk: MALLOC_SVELTE := true
  - ### More detail please refer google doc:
    - Android Go Device Configuration Guide

- ## How to debug when GTS memory test(perf-scripts-xxxx-xxx-xxx.tar) fail
  - ### 1.Catch on boot memory log by command:

    ```
    adb shell cat /proc/meminfo
    adb shell dumpsys meminfo
    adb shell cat /proc/iomem
    ```

  - ### 2.Generate the memory map base on doc

    80-NV303-1 Memory Optimization Guidelines:

    - Section-8.2 Generate the memory map

  - ### 3.Provide those data to qcom from case, qcom will check which part get problem ,and share the suggestion

Android GO app launch latency
Configuration and tuning
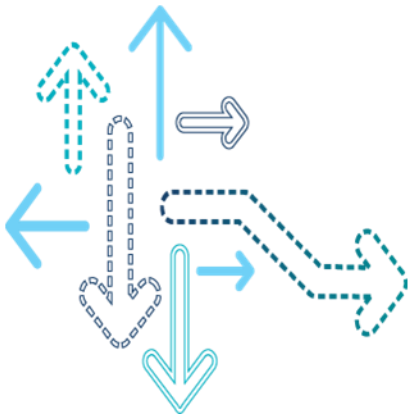
Android GO app launch latency Configuration and tuning

- Android go redesign much pre-install app like chrome, youtobe.etc to save memory, disk, data call.

  3rd party app also should be optimized for android go.

  Android go app launch should mainly focus on those apps:

Android go native app	GMS go app	3rd party app
Gallery	Files Go	Facebook Lite
Camera	Play Stores	Twitter
Contacts	Chrome	Angry Birds
Messages	Gmail Go	Temple Run2
Clock	Maps Go	…
Settings	YouTube Go	

Android GO app launch latency Configuration and tuning

- App launch latency Configuration :

  - Perf_lock boost Parameters:

Parameters description(hint id:0x00001081)	ID	Value
Timeout		2000ms
MPCTLV3_TOGGLE_POWER_COLLAPSE	0x40400000	1
MPCTLV3_MIN_ONLINE_CPU_CLUSTER_BIG	0x41000000	4
MPCTLV3_MIN_FREQ_CLUSTER_BIG_CORE_0	0x40800000	1094
MPCTLV3_KSM_RUN_STATUS	0x42000000	0
MPCTLV3_DISABLE_PPR_DURING_LAUNCH	0x42C18000	0

  Location: vendor/qcom/proprietary/android-perf/configs/msm8909/perfboostsconfig.xml

  - F2FS enable(google suggestion):

    - device/qcom/msm8909go/BoardConfig.mk

      TARGET_USERIMAGES_USE_EXT4 := true

      TARGET_USERIMAGES_USE_F2FS := true

      BOARD_USERDATAIMAGE_FILE_SYSTEM_TYPE := f2fs

      BOARD_PERSISTIMAGE_FILE_SYSTEM_TYPE := ext4

Android GO app launch latency Configuration and tuning

- App launch latency Configuration :
  - ART mode in Go
    - On default , the app should be in quicken mode
    - Command to dump ART mode of app:
      - *adb shell dumpsys package package_name*

    - Command to rorce compile apk to specific mode:
      - *adb shell cmd package compile -m quicken –f package_name*

Android GO app launch latency Configuration and tuning

- **App launch latency test:**
  - **QCOM method refer doc:**
    - KBA-170907023959 PPT Service Lab Performance test
    - Performance Dashboard:
      - 80-PF735-4A MSM8909 O-GO Android 3.0.1 Performance dashboard reports
      - KBA-180301035309 O-GO/O-MR1 8917 Performance dashboard reports
  - **Google method by script please refer doc:**
    - KBA-180601003251, Android Go cert performance testing check
    - perf-scripts-xxxx-xxx-xxx\docs\instructions.pdf
    - Performance Dashboard:
      - Need provide your test data to qcom for checking if get gap with qcom

- **App launch latency debug:**
  - doc:80-P3301-1 ANALYZING AND OPTIMIZING APPLICATION LAUNCH LATENCY

Android GO Scroll performance and benchmark
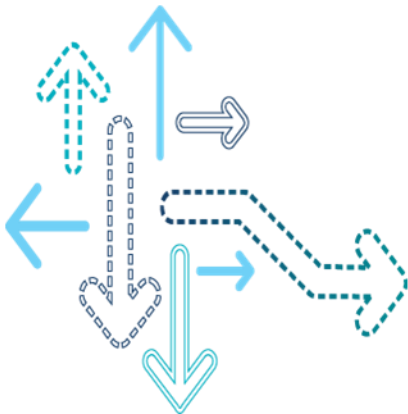
# Android GO Scroll performance and benchmark tuning

- Scroll performance and benchmark test method:
  - KBA-170907023959 PPT Service Lab Performance test

- Perf Dashboard
  - 80-PF735-4A MSM8909 O-GO Android 3.0.1 Performance dashboard reports
  - KBA-180301035309 O-GO/O-MR1 8917 Performance dashboard reports
- DEBUG doc:

Target	KBA	Title
ALL	KBA-170518235211	Condition::waitRelative() to timeout early or delayed issue
ALL	KBA-161207172441	How to calculate FPS
ALL	KBA-170608023831	one example of wrong property set usage which impact UX performance

Google doc and Google GTS performance for Android GO
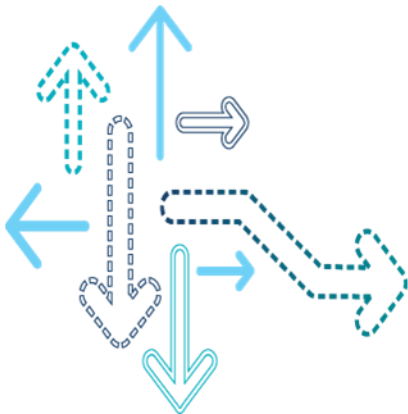
# Google doc and Google GTS performance for Android GO

- Google doc for android go(google provide)
  - < Android Go Device Configuration Guide.pdf >
  - < GMS Go Requirements.pdf >

- Google GTS performance test for android go
  - Test script: perf-scripts-xxxx-xxx-xxx.tar(google provide)
  - Introduce doc:
    - perf-scripts-xxxx-xxx-xxx\docs\instructions.pdf
    - KBA-180601003251, Android Go cert performance testing check
  - More：
    - Google GTS performance test is import, and must pass it.

Android GO Performance Document
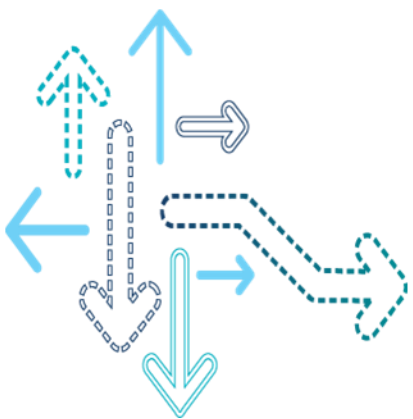
Android GO Performance Document (1)

- **Common Performance Debugging Manual**
  - 80-P0584-1 Common Performance Issues Debugging Guide
  - 80-NJ221-1 Android Memory Leak Analysis Guide
  - 80-NM449-1 Android User Experience Performance Overview Mem Analysis
- **System Performance Debugging**
  - 80-NM328-709 Battery Current Limit and Tuning Overview
- **Perflock**
  - 80-NT384-1 Perflock API overview
  - 80-NR256-2 MPCTL feature
  - 80-NT384-2 PERFLOCK IN ANDROID O
  - KBA-170823030536 explain for qualcomm predefined perflock
- **Android-O known issue:** KBA-171207004924

Android GO Performance Document (2)

- **Android UX Improvement/Debugging Guide**
  - FPS
    - 80-NP885-1 Graphics Power Performance Overview
    - 80-P0397-1 A Fence Sync Object Overview
- **Android Boot**
  - 80-N9266-1 Android Boot Time Measurement
- **Memory**
  - 80-NJ221-1 ANDROID MEMORY LEAK ANALYSIS GUIDE
  - 80-NJ395-1 Linux_Memory_Management_Overview
  - 80-NV303-1 Memory_Optimization_Guidelines
- **Other**
  - 80-P5228-1 MEMORY LATENCY GOVERNOR OVERVIEW

Android GO Performance Document (3)

UX performance KBA

Target	KBA	Title
ALL	KBA -160720223639	Bootanimation FPS optimization
ALL	KBA -160919232945	How to debug boot time performance
ALL	KBA -161122000928	1st boot become longer after OTA
ALL	KBA -161215230811	Latency of system waken up by proximity sensor
ALL	KBA -161207171534	Multi task package scan
ALL	KBA -161228002343	WeChat lucky money boost
ALL	KBA -170606202440	MTP performance optimization
ALL	KBA-171221001026	LK(Little Kernel) Breakdown

System performance KBA

| Target	KBA	Title
All	KBA -160726183346	How to debug IO performance issue
All	KBA -161003054532	display underrun issue debug guide
All	KBA -161002045417	device wakeup time analysis and breakdown
All	KBA -161020010256	MALLOC_IMPL 配置
All	KBA -161112021800	kernel config sanity check
All	KBA -161226222454	How to configure SLUB related kernel
All	KBA -170324001656	How to inspect the meta info and integrity of jpeg file
All	KBA -170518235211	Condition:: waitRelativewait() to timeout early or delayed issue

Android GO Performance Document (4)

Debugging Tool, Debugging Methods KBA

Target	KBA	Title
All	KBA -160724222150	How to disable QCOM optimizationand ART
All	KBA -160803171155	How to collect offline systrace
All	KBA -161001235906	Systrace tips
All	KBA -161023190436	Linker debug tips
All	KBA -161122014243	How to add systrace in java and native code
All	KBA -161123204012	common performance issue and debug
All	KBA -161027185718	bootchart usage usage
All	KBA -161112022251	method to capture device boot up ftrace logs
All	KBA -170114011739	Android memory map generation and debugging
All	KBA -170114011858	how to customize splash logo without mem leak
All	KBA -170404214811	How to analyze and debug kernel static memory size
All	KBA -170114011739	Android memory map generation and debugging

Android GO Performance Debugging Tools
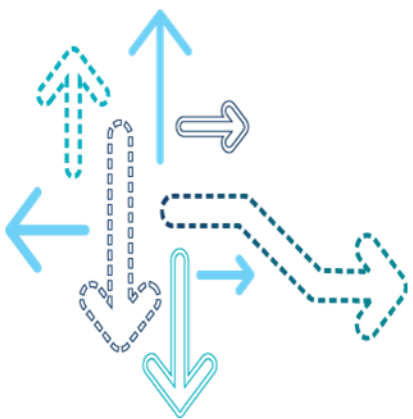
Android GO Performance Debugging Tools

- Tools
  - Systrace

  General Debugging tool for performance debugging.

  http://developer.android.com/tools/help/systrace.html

  - Traceview

  Profiling tool for Java method

  http://developer.android.com/intl/zh-cn/tools/help/traceview.html

  - Hierarchy Viewer

  Visualize tool to exam View layout Hierarchy

  http://developer.android.com/intl/zh-cn/tools/help/hierarchy-viewer.html

  - Perfdump tool

  80-P8754-73   Perfdump Overview

Android GO Performance Common command
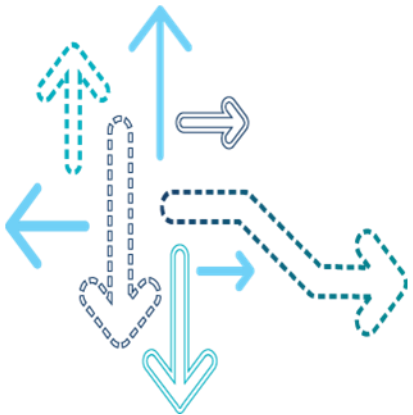
Android GO Performance Debug Common command

- CPU performance mode

adb shell stop thermal-engine

adb shell "echo 1 > /sys/devices/system/cpu/cpu0/online"

adb shell "echo 1 > /sys/devices/system/cpu/cpu1/online"

adb shell "echo 1 > /sys/devices/system/cpu/cpu2/online"

adb shell "echo 1 > /sys/devices/system/cpu/cpu3/online"

adb shell "echo performance >/sys/devices/system/cpu/cpu0/cpufreq/scaling_governor"

adb shell "echo performance > /sys/devices/system/cpu/cpu1/cpufreq/scaling_governor"

adb shell "echo performance > /sys/devices/system/cpu/cpu2/cpufreq/scaling_governor"

adb shell "echo performance > /sys/devices/system/cpu/cpu3/cpufreq/scaling_governor"

Android GO Performance debug Common command

- ## Set DDR to max freq
  adb shell "echo 1 > /sys/kernel/debug/msm-bus-dbg/shell-client/mas"

  adb shell "echo 512 > /sys/kernel/debug/msm-bus-dbg/shell-client/slv"

  adb shell "echo 1000000000 > /sys/kernel/debug/msm-bus-dbg/shell-client/ib"

  adb shell "echo 1 > /sys/kernel/debug/msm-bus-dbg/shell-client/update_request"

- ## Get CPU current freq
  adb shell cat /sys/devices/system/cpu/cpu*/cpufreq/cpuinfo_cur_freq

- ## Get GPU current freq
  adb shell cat /sys/class/kgsl/kgsl-3d0/devfreq/cur_freq

- ## GPU performance mode
  adb shell stop thermal-engine

  adb shell "echo 10000000 > /sys/class/kgsl/kgsl-3d0/idle_timer"

  adb shell "echo performance > /sys/class/kgsl/kgsl-3d0/devfreq/governor"

  adb shell "echo 647000000> /sys/class/kgsl/kgsl-3d0/gpuclk"

- ## Get DDR current freq
  adb shell cat /sys/kernel/debug/clk/bimc_clk/measure

- ## Disable all level LPM
  adb shell "stop perf-hal-1-0"

  adb shell "echo Y > /sys/module/lpm_levels/parameters/sleep_disabled"

Android GO Performance debug Common command

- ## how to disable thermal
  - ### Thermal:
    adb root

    adb shell stop thermal-engine
- ## How to start/stop perflock HAL
  - ### disable:
    adb root

    adb shell "stop perf-hal-1-0"
  - ### enable (default enabled)
    adb root

    adb shell "start perf-hal-1-0"

Appendix - 1: Kernel Configuration Must Remove

CONFIG_LOG_BUF_MAGIC=y

CONFIG_DYNAMIC_DEBUG=y

CONFIG_L2TP_DEBUGFS=y

CONFIG_OF_CORESIGHT=y

CONFIG_MSM_CAMERA_DEBUG=y

CONFIG_MSMB_CAMERA_DEBUG=y

CONFIG_FB_MSM_MDSS_XLOG_DEBUG=y

CONFIG_MSM_SMD_DEBUG=y

CONFIG_IOMMU_DEBUG=y

CONFIG_IOMMU_TESTS=y

CONFIG_PREEMPT_TRACER=y

CONFIG_SCHED_DEBUG=y

CONFIG_DEBUG_KMEMLEAK=y

ONFIG_DEBUG_SPINLOCK=y

CONFIG_DEBUG_MUTEXES=y

CONFIG_DEBUG_ATOMIC_SLEEP=y

CONFIG_DEBUG_STACK_USAGE=y

CONFIG_DEBUG_LIST=y

CONFIG_LOCKUP_DETECTOR=y

CONFIG_DEBUG_PAGEALLOC=y

CONFIG_DEBUG_BUS_VOTER=y

CONFIG_SLUB_DEBUG=y

CONFIG_HAVE_DEBUG_KMEMLEAK=y

CONFIG_HAVE_DEBUG_BUGVERBOSE=y

CONFIG_CORESIGHT=y

CONFIG_CORESIGHT_EVENT=y

CONFIG_HAVE_CORESIGHT_SINK=y

CONFIG_CORESIGHT_FUSE=y

CONFIG_CORESIGHT_CTI=y

CONFIG_CORESIGHT_CTI_SAVE_DISABLE=y

CONFIG_CORESIGHT_CSR=y

CONFIG_CORESIGHT_TMC=y

CONFIG_CORESIGHT_TPIU=y

CONFIG_CORESIGHT_FUNNEL=y

CONFIG_CORESIGHT_REPLICATOR=y

CONFIG_CORESIGHT_TPDA=y

CONFIG_CORESIGHT_TPDM=y

CONFIG_CORESIGHT_TPDM_DEFAULT_ENABLE

CONFIG_CORESIGHT_DBGUI

CONFIG_CORESIGHT_STM=y

CONFIG_CORESIGHT_STM_DEFAULT_ENABLE

CONFIG_CORESIGHT_HWEVENT=y

CONFIG_CORESIGHT_ETM

CONFIG_CORESIGHT_ETMV4

CONFIG_CORESIGHT_REMOTE_ETM

CONFIG_CORESIGHT_QPDI=y

Thank you

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