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Always-on Hotword on Android - OEM Guide

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Always-listening “Ok Google” on Every Android Device

“Ok Google” on Every Android Device

Goal:
Always-listening “Ok Google” available on every Lollipop+ Android device

Why?

- Voice enables easy access to information and action
- “Ok Google” makes starting the voice experience effortless
- “Ok Google” can work across current & future device form factors

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“Ok Google” on Every Android Device

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How?

- Google works with DSP providers to create firmware with Google algorithm and provide it to OEM
- OEM implements Lollipop SoundTrigger HAL
- Google provides hotword models to OEMs and validates device accuracy and latency, expect this to eventually be a part of compatibility testing
- It’s free: Google does not charge for firmware or models

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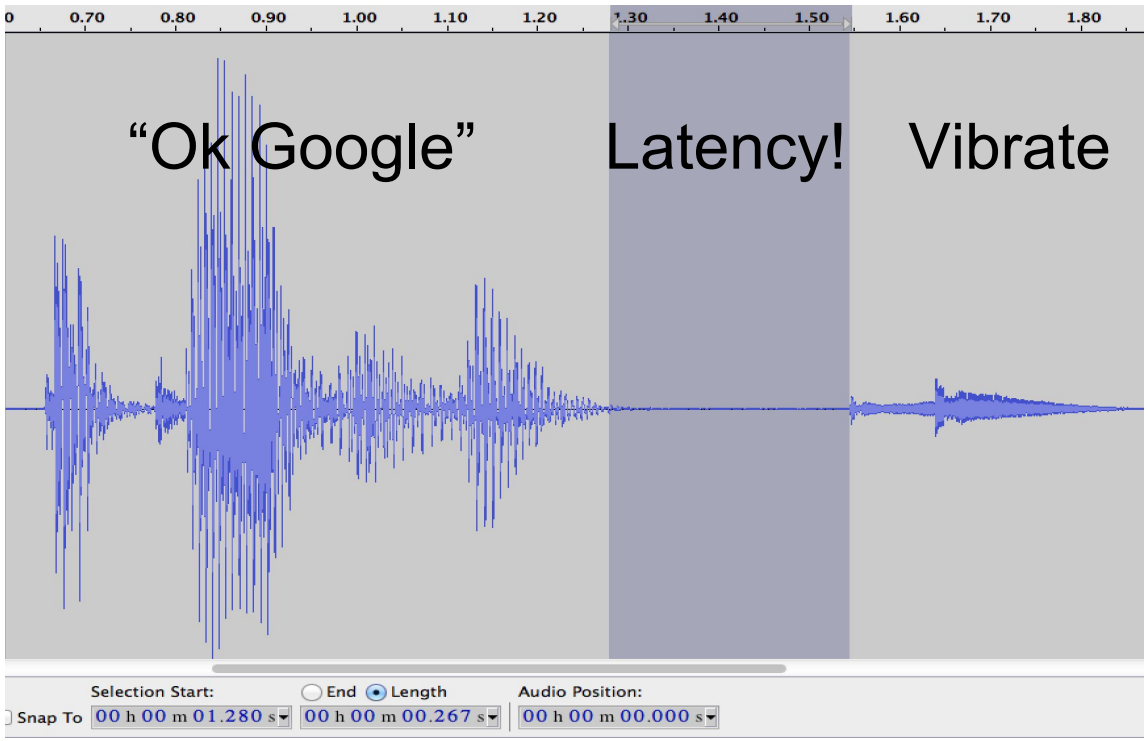
Technical Details

Screen-Off Trigger-to-Vibrate Latency



Example latency measurement from Nexus 9.

- On Nexus 9, typical screen-off trigger-to-vibrate latency is **250-350ms**
- Google’s goal is **0ms:**
  - DSP triggers 100-200ms before end of “Ok Google”
  - Application processor wakes up
  - DSP streams audio data to application processor
  - Google Search App confirms full “Ok Google” phrase and verifies speaker

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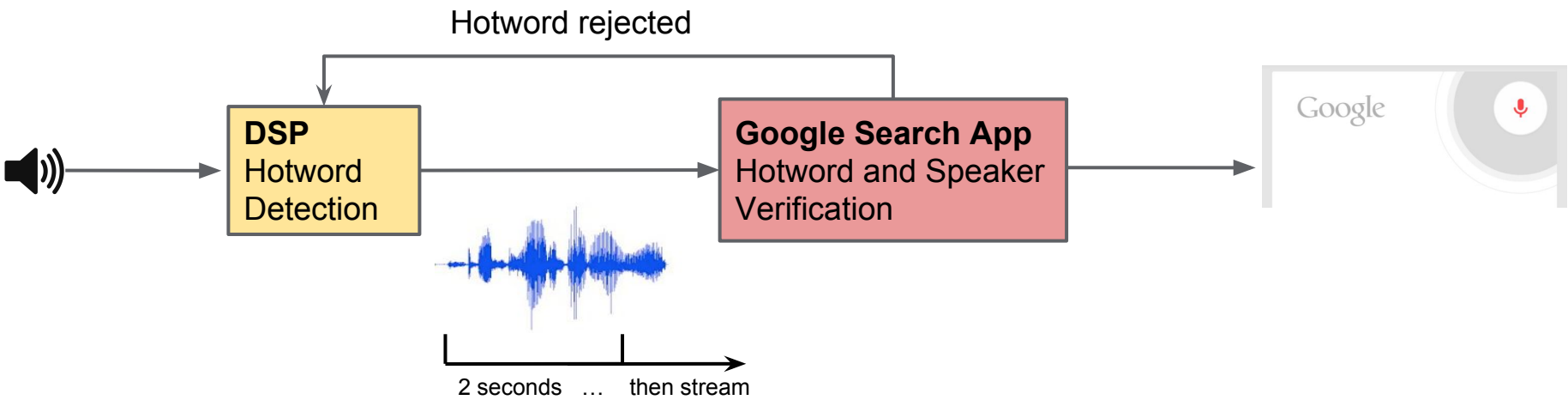
“Ok Google” Two-Stage Architecture

Multi-stage hotword detection



- Requirement: transferring a 2 second, 16khz audio buffer must be faster than 100ms. Faster is better.
  - Example solution: use SPI to transfer uncompressed, 64KB audio buffer.

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“Ok Google” on Lollipop+

Google Hotword Detection Firmware	Provided by Google via DSP partner
Lollipop Sound Trigger HAL	Reference implementation designed by DSP partner with Google
Google Hotword Enrollment APK	Hotword models provided by Google through GMS
Google Search App	Provided by Google, updatable via Google Play

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DSP Partners

Google Hotword algorithm available today from several DSP partners.

Interested in becoming a DSP partner? Please contact your technical account manager.

DSP Requirements

- Exact Memory and MIPS requirements vary by platform. Roughly:
  - IRAM: 20-30KB
  - DRAM: 30-45KB
  - Audio buffer: 64KB (2 seconds of 16khz audio)
  - MIPS: 3-6

- Fast connection to application processor to transfer audio buffer (e.g. SPI)

END