ftrace for Android hackers.

What ftrace is, why you should be using it, and how to get the most out of it.

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6 January 2014

Overview

Overview of the material.

1. Introduction to ftrace
2. Filesystems and debugfs
3. ftrace functionality
4. Example

Introduction to ftrace

What is ftrace anyway?

- Most commonly known as the function tracer.
- Idea: save timing information for the execution of kernel functions and export the information to userspace.
- Utility: This is useful to kernel developers who need to keep an eye on how much time particular functions are taking.
- Today: Expanded to include tracers for many other kinds of info.
- Output: variety of formats, including human readable output - immensely useful for embedded developers (that means us!)

Filesystems and debugfs - introduction

- Linux - several different filesystems, intended for different purposes.
- Common features - encapsulated in the VFS (Virtual Filesystem Switch).
- This allows most filesystems to be mounted using the mount command.
- Our focus: debugfs.
- Like sysfs and procfs - intended to allow kernel developers to export information to userspace and get control instructions from userspace.
- Different from sysfs and procfs - both of these have specific purposes and their indiscriminate use for debugging is discouraged. Not so for debugfs.

Filesystems and debugfs - using debugfs

- When you need debugfs in your build, you need to configure it into your kernel, using the configuration option `CONFIG_DEBUG_FS`.
  - NOTE: this option is automatically selected when you select any option that enables ftrace during kernel configuration.
  - NOTE: Regardless of ftrace, debugfs is usually enabled by default, because many kernel subsystems have come to depend upon it.
- When debugfs is configured, the directory `/sys/kernel/debug` is created. debugfs is usually mounted into this directory.
- This mounting can be done, either by adding a line to the `/etc/fstab` file, or by using the mount command manually.
- Once this mounting is done, we can interact with ftrace, which stores its files in the `tracing` directory at the root of debugfs.

ftrace functionality

- ftrace offers several different tracers:
  - `function`
  - `function_graph`
  - `irqsoff`
  - `preemptoff`
  - `preemptirqsoff`
  - `wakeup`
  - `wakeup_rt`
  - `nop`
- Any one of these can be active at a time.
- To change the active tracer, write its name into the file `tracing/current_tracer`.
- The tracer `nop` simply disables all tracers when it is written to `tracing/current_tracer`.
- We shall restrict our further discussion to `function` and `function_graph`.

ftrace functionality

- The tracer `function` traces all kernel functions. Probes functions on their entry.
- The tracer `function_graph` traces all kernel functions. Probes functions on their entry as well as on their exit. Optionally, provides a graph of function calls.