Arm® Streamline

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Target Setup Guide for Android

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Arm® Streamline

Target Setup Guide for Android

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Preface

This preface introduces the *Arm® Streamline Target Setup Guide for Android*.

It contains the following:

- *About this book* on page 7.

About this book

This book describes how to set up Arm® Streamline on an Android target.

Using this book

This book is organized into the following chapters:

Chapter 1 Target Setup

Set up your target and host devices ready to use Streamline for application or system profiling by following the instructions in this chapter.

Chapter 2 Application profiling on an Android device

Profile your application while it is running on a non-rooted Android device.

Chapter 3 System profiling on an Android device

Profile all applications and services that are running on a rooted Android device.

Chapter 4 Troubleshooting Common Issues

Troubleshoot common Streamline issues.

Appendix A Advanced target setup information

This appendix provides extra configuration information beyond the standard setup.

Glossary

The Arm® Glossary is a list of terms used in Arm documentation, together with definitions for those terms. The Arm Glossary does not contain terms that are industry standard unless the Arm meaning differs from the generally accepted meaning.

See the *Arm® Glossary* for more information.

Typographic conventions

italic

Introduces special terminology, denotes cross-references, and citations.

bold

Highlights interface elements, such as menu names. Denotes signal names. Also used for terms in descriptive lists, where appropriate.

`monospace`

Denotes text that you can enter at the keyboard, such as commands, file and program names, and source code.

`monospace`

Denotes a permitted abbreviation for a command or option. You can enter the underlined text instead of the full command or option name.

`monospace italic`

Denotes arguments to monospace text where the argument is to be replaced by a specific value.

`monospace bold`

Denotes language keywords when used outside example code.

`<and>`

Encloses replaceable terms for assembler syntax where they appear in code or code fragments. For example:

```
MRC p15, 0, <Rd>, <CRn>, <CRm>, <Opcode_2>
```

SMALL CAPITALS
: Used in body text for a few terms that have specific technical meanings, that are defined in the *Arm® Glossary*. For example, IMPLEMENTATION DEFINED, IMPLEMENTATION SPECIFIC, UNKNOWN, and UNPREDICTABLE.

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Other information

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- *Arm® Information Center*.
- *Arm® Technical Support Knowledge Articles*.
- *Technical Support*.
- *Arm® Glossary*.

Chapter 1
Target Setup

Set up your target and host devices ready to use Streamline for application or system profiling by following the instructions in this chapter.

It contains the following sections:

- *1.1 Application and system profiling* on page 1-10.
- *1.2 Compiling your application* on page 1-11.
- *1.3 Set up your host machine* on page 1-13.
- *1.4 Set up your target device* on page 1-14.

1.1 Application and system profiling

Streamline supports two types of profiling. Application profiling is the most common use case, but system profiling is also supported.

Application profiling

Streamline supports data capture on a non-rooted Android device. It collects CPU performance data and Arm Mali™ GPU performance data so you can profile your game or app without device modification. Configuring Streamline to collect the right data is easy – use the templates to select the most appropriate set of counters for your target device. Identify bottlenecks and optimize your application for mobile devices faster.

System profiling

In addition to the single application profiling for non-root devices, Streamline also supports system-wide Android profiling when running on rooted devices. System profiling enables manufacturers to simultaneously monitor all applications and services running on their device, allowing identification of problematic processes or scheduling behaviors.

Related references

Chapter 2 Application profiling on an Android device on page 2-15
Chapter 3 System profiling on an Android device on page 3-21

1.2 Compiling your application

When building executables for profiling using Streamline, it is best practice to use the compiler options that are listed in this topic.

When using GCC or Clang, use the following options:

`-g`
Turns on the debug symbols necessary for quality analysis reports.

`-fno-inline`
Disables inlining and substantially improves the call path quality.

`-fno-omit-frame-pointer`
Compiles your EABI images and libraries with frame pointers. This option enables Streamline to record the call stack with each sample taken.

`-mno-omit-leaf-frame-pointer`
Keeps the frame pointer in leaf functions.

`-marm`
When building for AArch32, if GCC was compiled with the `--with-mode=thumb` option enabled, this option is required. Using the `--with-mode=thumb` option without `-marm` breaks call stack unwinding in Streamline.

Call stack unwinding

You must provide extra compiler flags for call stack unwinding to work.

For AArch64 applications, the flag `-fno-omit-frame-pointer` is required. `-mno-omit-leaf-frame-pointer` must also be set on GCC. `-mno-omit-leaf-frame-pointer` is not supported on Clang, therefore the caller for samples in leaf functions will be missing from the stack trace.

For AArch32 applications, the flags `-fno-omit-frame-pointer`, `-marm`, and `-mapcs-frame` are required.

Note

Streamline does not support call stack unwinding for T32 (Thumb®) code. It also does not support call stack unwinding for code that Arm Compiler version 5 and earlier (`armcc`) generates.

Android

For Android, Streamline can profile OAT files that Android runtime (ART) generates, down to function level.

To enable OAT files to be built with debug symbols, ensure that `dex2oat` runs with the `--no-strip-symbols` option. This option includes function names, but not line numbers, in the OAT files. As a result, the Streamline report for the application shows function names and disassembly in the **Code** view, but not source code.

To run `dex2oat` with the `--no-strip-symbols` option, run the following command on the device and then re-install the APK file:

```
setprop dalvik.vm.dex2oat-flags --no-strip-symbols
```

To verify the options for `dex2oat` are set correctly, run the command:

```
getprop dalvik.vm.dex2oat-flags
```

To check whether DEX files contain `.debug_*` sections, you could use the GNU tools `readelf` command, for example:

```
readelf –S …/images/*.dex
```

Related information

readelf

1.3 Set up your host machine

Streamline is available for the Arm Mobile Studio or the Arm Development Studio product suites. To use Streamline, install the necessary software and set up environment variables on your host machine.

Prerequisites

- Ensure you have a target device that is correctly configured to generate performance data. You can use many Android devices off-the-shelf. A list of the recommended consumer devices that support Streamline is available from *https://developer.arm.com/tools-and-software/graphics-and-gaming/arm-mobile-studio/support/supported-devices*.

  If you are building your own device software, ensure that your kernel configuration includes the options that are described in *A.1 Kernel configuration menu options* on page Appx-A-29.

Procedure

1. Download and install the studio package appropriate to your host platform (Windows, Linux, or macOS).
   - Download Arm Mobile Studio from *https://developer.arm.com/tools-and-software/graphics-and-gaming/arm-mobile-studio/downloads*.
   - Download Arm Development Studio from *https://developer.arm.com/tools-and-software/embedded/arm-development-studio/downloads*.
2. Install the studio package.
   - Install Arm Mobile Studio using the instructions at *https://developer.arm.com/tools-and-software/graphics-and-gaming/arm-mobile-studio/installation*.
   - Install Arm Development Studio using the instructions in the *Arm Development Studio Getting Started Guide*.
3. Install Python 3.5 (or higher).

   You need Python 3.5 or higher to run the provided `gator_me.py` script, which uses the `gatord` agent to connect Streamline to your Android target.
4. Install Android Debug Bridge (adb).

   adb is available with the Android SDK platform tools, which you can download from *https://developer.android.com/studio/releases/platform-tools*.
5. Edit your `PATH` environment variable to add the paths to the Python3 directory and the Android SDK platform tools directory.

   The adb executable must be accessible to Streamline.

Next Steps

- *1.4 Set up your target device* on page 1-14
- *2.1 Profile your application* on page 2-16

1.4 Set up your target device

To use Streamline, set up a target device with the application you want to profile.

Prerequisites

1.3 Set up your host machine on page 1-13

Procedure

1. Ensure that *Developer Mode* is enabled, then enable USB Debugging by selecting **Settings** > **Developer options**.
2. Connect the target to the host through USB. If the connection is successful, running the `adb devices` command on the host returns the ID of your target, and you can run `adb shell`.

   Note

   If your target device is running Android 4.2.2 or higher, it asks whether you want to allow debugging. This security mechanism ensures that you can unlock the device before you can execute commands on it.

3. Build and install the debuggable application for profiling:
   - For Unity applications, select the **Development Build** option in the **Build Settings**.
   - For applications that are not built with Unity, ensure it is marked as debuggable in the Android application manifest. See how to debug your application in the *Android Studio documentation*.

Next Steps

- *2.1 Profile your application* on page 2-16

Chapter 2
Application profiling on an Android device

Profile your application while it is running on a non-rooted Android device.

It contains the following sections:

- *2.1 Profile your application* on page 2-16.
- *2.2 Generate a headless capture* on page 2-20.

2.1 Profile your application

Capture a profile of a debuggable application running on an unrooted Android target with a Mali GPU.

This section contains the following subsections:

- *2.1.1 Connect Streamline to your device* on page 2-16.
- *2.1.2 Choose a counter template* on page 2-17.
- *2.1.3 Capture a profile* on page 2-18.

2.1.1 Connect Streamline to your device

Arm provides a Python script, `gator_me.py` that installs a daemon, `gatord`, on your device. Run the script so that Streamline can connect to unrooted Android devices, and collect data.

Procedure

1. On your host machine, navigate to the Streamline installation directory, `<install_directory>/streamline/gator/`.
2. To supply the path to the `gatord` binary to install on the device, run the `gator_me.py` Python script with the `--daemon` option.

   Your installation directory contains two versions of `gatord`, for 32-bit or 64-bit architectures:
   - `<install_directory>/streamline/bin/arm/` for 32-bit architectures.
   - `<install_directory>/streamline/bin/arm64/` for Armv8 64-bit architectures.

   For example:

   ```
   python3 gator_me.py --daemon <install_directory>/streamline/bin/arm64/gatord
   ```

3. The script returns a numbered list of the Android package names for the debuggable applications that are installed on your device. Enter the number of the package you want to profile.

   The `gator_me.py` script does the following:
   - Kills and removes `gatord` and removes any counter configuration file that was previously created.
   - Enables perf profiling.
   - Copies `gatord` to the target.
   - Runs `gatord` inside your Android application sandbox.
   - Configures port forwarding.
   - Waits for you to configure and perform the capture in Streamline.
   - When the capture is complete, it kills and removes `gatord`.

   Note

   Alternatively, if you know the Android package name of the app you want to profile, you can specify it when running the script, using the `--package` option.

   ```
   python3 gator_me.py --package com.mycompany.myapp --daemon <install_directory>/
   streamline/bin/arm64/gatord
   ```

4. Launch Streamline:
   - On Windows, from the **Start** menu, navigate to the **Arm Mobile Studio folder**, and select the **Streamline** shortcut.
   - On macOS, go to the `<install_directory>/streamline` folder, and double-click the `Streamline.app` file.
   - On Linux, go to the `<install_directory>/streamline` folder, and run the `Streamline` file:

     ```
     cd <install_directory>/streamline
     ./Streamline
     ```

5. In the **Start** view, select your device from the list of detected targets.

Next Steps

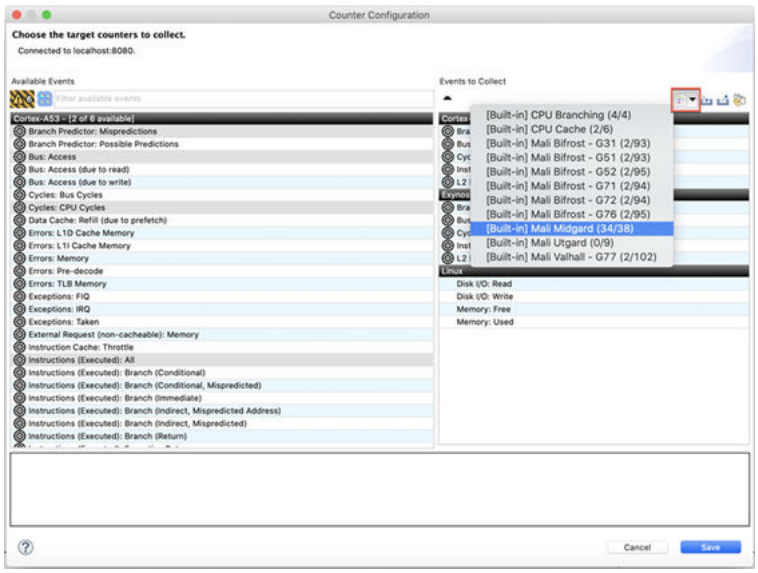
Choose a counter template. For more information about how to find and select a counter template, see *2.1.2 Choose a counter template* on page 2-17.

2.1.2 Choose a counter template

Counter templates are pre-defined sets of counters that enable you to review the performance of both CPU and GPU behavior. Choose the most appropriate template for the GPU in your target device.

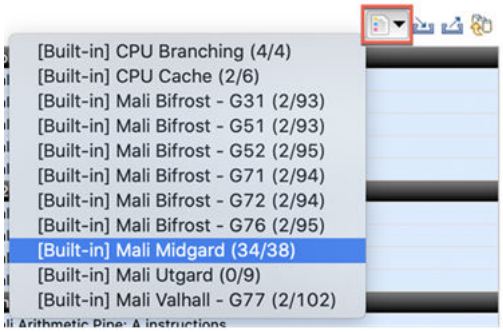
Procedure

1. In the **Start** view, click **Configure Counters**.
2. Click **Add counters from a template** to see a list of available templates.



3. Select a counter template appropriate for the GPU in your target device, then **Save** your changes.

   The number of counters in the template that your target device supports is shown next to each template. For example, here, 34 of the 38 available counters in the Mali Midgard template are supported in the connected device.



4. Optionally, in the **Start** view, click **Advanced Settings** to set more capture options, including the sample rate and the capture duration (by default unlimited). Refer to *Set capture options* in the *Arm Streamline User Guide*.

Next Steps

Capture a profile using Streamline. For more information about how to capture the behavior of your CPU and GPU performance using Streamline, see *2.1.3 Capture a profile* on page 2-18.

2.1.3 Capture a profile

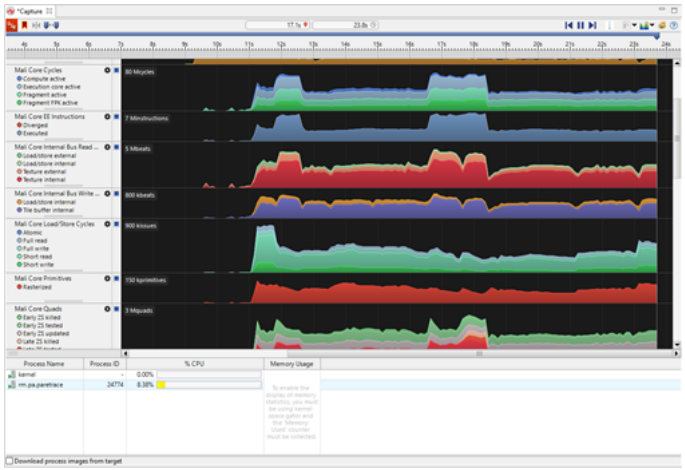
Start a capture session to profile data from your application in real time. When the capture session ends, Streamline automatically opens a report for you to analyze later.

Procedure

1. In the **Start** view, click **Start Capture** to start capturing data from the target device.

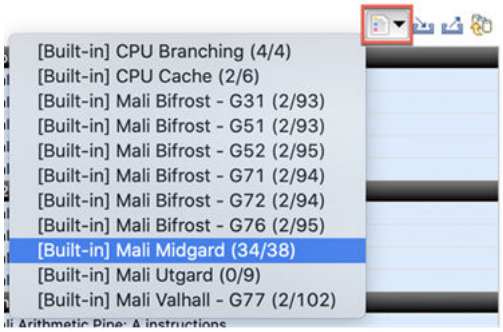
   Specify the name and location on the host of the capture file that Streamline will create when the capture is complete. Streamline then switches to the **Live** view and waits for you to start the application on the device.
2. Start the application that you want to profile.

   The **Live** view shows charts for each counter that you selected. Below the charts is a list of running processes in your application with their CPU usage. The charts now start updating in real time to show the data that `gatord` captures from your running application.



3. Unless you specified a capture duration, in the **Capture Control** view, click **Stop capture and analyze** to end the capture.

   Streamline stores the capture file in the location that you specified previously, and then prepares the capture for analysis. When complete, the capture appears in the **Timeline** view.
4. IMPORTANT: Switch back to the terminal running the `gator_me.py` script and press any key to terminate it. The script kills all processes that it started and removes `gatord` from the target.
5. Click **Switch and manage templates** and select the same counter configuration template that you chose to create the capture.



Next Steps

Analyze the data. For more information about how to analyze performance with Streamline, see *Analyze your capture* in the *Arm Streamline User Guide*.

Related information

Capture a Streamline profile

2.2 Generate a headless capture

When integrating performance analysis into continuous integration, capturing data without having the host tool connected or a user manually controlling the GUI is often required. To capture data without the Streamline host tool connected, use the `gator_me.py` script in headless mode.

Prerequisites

- *2.1.1 Connect Streamline to your device* on page 2-16
- *2.1.2 Choose a counter template* on page 2-17
- *Export the counter configuration to a `configuration.xml` file.* Create one configuration file for each device class.

Procedure

1. On the host, run the `gator_me.py` Python script to set up the target device for a headless data capture.

   The script is in the following directory:

   `<install_directory>/streamline/gator/`

   Use the following command-line arguments:
   - The Android package name of the application that you want to profile.
   - The path on the host to the `gatord` binary to install on the device. By default, this path is the current working directory. Your installation provides two versions of `gatord`, in the following directories:
     — `<install_directory>/streamline/bin/arm/` for 32-bit architectures.
     — `<install_directory>/streamline/bin/arm64/` for Armv8 64-bit architectures.
   - The path to the configuration file that you saved in the Prerequisites.
   - The path to store the saved output file to.

   Example:

   ```
   python3 gator_me.py --package <your_app_package> --daemon <path_to_gatord> --config
   <path_to_your_configuration.xml> --headless <output.apc.zip>
   ```

2. Run your test scenario and exit the application when it has completed.
3. Wait for the script to download the data from the target, and write out the `output.apc.zip` file.

   The script stops automatically when it detects that the application is no longer running.
4. To view the data in the Streamline GUI, start the host application and import the APC file into the **Streamline Data** view.

Next Steps

- Analyze the data. For more information about how to analyze performance with Streamline, see *Analyze your capture* in the *Arm Streamline User Guide*.

Related information

Capture a Streamline profile

Chapter 3
System profiling on an Android device

Profile all applications and services that are running on a rooted Android device.

It contains the following sections:

- *3.1 Profile your system* on page 3-22.
- *3.2 Enabling atrace annotations* on page 3-23.

3.1 Profile your system

Set up and run Streamline with a rooted Android target with a Mali GPU.

Prerequisites

- *1.3 Set up your host machine* on page 1-13
- *1.4 Set up your target device* on page 1-14

Procedure

1. Run `gatord` as root using the following commands:

```
adb push gatord /data/local/tmp
adb shell
cd /data/local/tmp
su
./gatord --system-wide=yes
```

2. Continue from step four of *2.1.1 Connect Streamline to your device* on page 2-16.

3.2 Enabling atrace annotations

Streamline can capture Android trace points that atrace generates. It supports atrace annotations on Android targets that are running Linux kernel versions 3.10 and later.

Streamline converts application-generated atrace macros into either string annotations or counter charts. It also lists any Android `ATRACE_TAG_*` macros that you enable as available events in an **Atrace** section in the **Counter Configuration** dialog box. If you expect to see atrace events in this dialog box but none are displayed, click the Warnings tag to see why atrace support is disabled.

To notify running applications that atrace annotation tags have been enabled, the file `notify.dex` must be installed on the target in the same directory as `gatord`. The Java source code for `notify.dex` is available in the following locations:

- `<install_directory>/streamline/gator/notify/`
- *https://github.com/ARM-software/gator/tree/master/notify*

Chapter 4
Troubleshooting Common Issues

Troubleshoot common Streamline issues.

It contains the following sections:

- *4.1 Troubleshooting target connection issues* on page 4-25.
- *4.2 Troubleshooting Android issues* on page 4-26.
- *4.3 Troubleshooting gatord issues* on page 4-27.

4.1 Troubleshooting target connection issues

You might have problems when trying to start a capture session, for example when you click **Start Capture**. Use these solutions to solve common target connection issues.

Problem	Solution

Error message generated:
`Unable to connect to the gator daemon at <target_address>.`
`Please verify that the target is reachable and that you are running gator daemon v17 or later. Installation instructions can be found in: streamline/gator/README.md.`
`If connecting over WiFi, please try again or use a wired connection.`
	Make sure `gatord` is running on your target. Enter the following command in the shell of your target:
	`ps ax | grep gatord`
	If this command returns no results, `gatord` is not active. Start it by navigating to the directory that contains `gatord` and entering the following command:
	`sudo ./gatord &`
	Try connecting to the target again.
	If `gatord` is active and you still receive this error message, try disabling any firewalls on your host machine that might be interfering with communication between it and the target.
	In addition, if you are running Android on your target, make sure that the ports are accessible by using the `adb forward` command. For example:
	`adb forward tcp:8080 tcp:8080`

Error message generated: `Unknown host`	Make sure that you have correctly entered the name or IP address of the target in the **Address** field. If you have entered a name, try entering an IP address instead.
When using event-based sampling, Streamline fails to find the PMU.	The PMU on your hardware might not be correctly configured to allow the processor interrupts necessary for Streamline to use event-based sampling. Test on alternate hardware or disable event-based sampling in the **Counter Configuration** dialog box.

The target is running a firewall, which prevents Streamline from connecting to `gatord`.	There are several possible ways to resolve this issue:
	• Update the firewall to allow connections to `gatord`, which defaults to using port 8080.
	• Use local captures.
	• If the target accepts SSH connections, you can establish an SSH tunnel by using the `ssh` command on the host. For example:
	`ssh <user>@<target> -L 8080:localhost:8080 -N`
	In this example, replace <user> with the username to log in as and <target> with the hostname of the target. On the target, use `localhost` as the hostname.
	Note
	An SSH tunnel requires extra processing on the target.
	• Reverse SSH tunnels are also possible by running `ssh` from the target to the host. For example:
	`ssh <user>@<host> -R 8080:localhost:8080 -N`

4.2 Troubleshooting Android issues

Android has the following known issues:

Problem	Solution
`run-as` command fails on Android.	Make sure that the application is debuggable and the target device is running the latest software update.
Capture fails on startup, usually showing no events captured.	This problem usually indicates a failure to configure the `perf` API. Run the following command: `adb shell setprop security.perf_harden 0`
	Reduce the set of events that are captured or try capturing only a limited set of `perf` software events. The following issues can cause this error: • Exceeding the limit for the number of open file descriptors. • The target device does not have a correctly configured PMU driver.
Hardware counters read as zero.	This error is usually a sign of misconfigured PMU. It is not usually possible to work around.
When running non-root on Android, `gatord` exits with the message: `Error creating server TCP socket`	• To enable use of UDS socket instead of TCP socket, run `gatord -p uds ...`. • To configure port forwarding, execute `adb forward tcp:<some-port> localabstract:streamline-data` on your host. • Set the target address as `localhost:<some-port>` in the **Start** view.

4.3 Troubleshooting gatord issues

Consult the following table for solutions to issues related to `gatord`.

Problem	Solution
Annotations do not work on Android.	Use application profiling. If you must use system profiling, disable SELinux by running `# setenforce 0`.

Appendix A
Advanced target setup information

This appendix provides extra configuration information beyond the standard setup.

It contains the following sections:

- *A.1 Kernel configuration menu options* on page Appx-A-29.
- *A.2 Building gatord yourself* on page Appx-A-30.
- *A.3 gatord command-line options* on page Appx-A-31.

A.1 Kernel configuration menu options

You must enable certain kernel configuration options to run Streamline.

The following `menuconfig` menus have options that are required for Streamline:

Note

- If these options are not set correctly, you must change them and rebuild your kernel. If they are set correctly, you are ready to build and install the gator driver.
- The location of these options might change between releases. If so, use the search option in `menuconfig` to find them.
- Extra options are required to enable Mali GPU support.

General Setup

Enable the **Profiling Support** option `CONFIG_PROFILING`, and the **Kernel performance events and counters** option `CONFIG_PERF_EVENTS`. `CONFIG_PERF_EVENTS` is required for kernel versions 3.0 and later. Enable the **Timers subsystem** > **High Resolution Timer Support** option `CONFIG_HIGH_RES_TIMERS`.

Kernel Features

The **Enable hardware performance counter support for perf events** option `CONFIG_HW_PERF_EVENTS`. `CONFIG_HW_PERF_EVENTS` is required for kernel versions 3.0 and later. If you are using Symmetric MultiProcessing (SMP), enable the **Use local timer interrupts** option `CONFIG_LOCAL_TIMERS`. If you are running on Linux version 3.12 or later, the `CONFIG_LOCAL_TIMERS` option is not necessary.

CPU Power Management

Optionally enable the **CPU Frequency scaling** option `CONFIG_CPU_FREQ` to enable the CPU Freq **Timeline** view chart. `gatord` requires kernel version 2.6.38 or greater to enable this chart.

Kernel hacking

If other trace configuration options are enabled, the **Trace process context switches and events** option `CONFIG_ENABLE_DEFAULT_TRACERS` might not be visible in `menuconfig` as an option. Enabling one of these other trace configurations, for example `CONFIG_GENERIC_TRACER`, `CONFIG_TRACING`, or `CONFIG_CONTEXT_SWITCH_TRACER`, is sufficient to enable tracing. Optionally enable the **Compile the kernel with debug info** option `CONFIG_DEBUG_INFO`. This option is only required for profiling the Linux kernel.

Caution

Kernel versions before 4.6, with `CONFIG_CPU_PM` enabled, produce invalid results. For example, counters not showing any data, large spikes, and non-sensible values for counters. This issue is a result of the kernel PMU driver not saving state when the processor is powered down, or not restoring state when it is powered up. To avoid this issue, upgrade to the latest version of the kernel, or apply the patch found at *https://git.kernel.org/pub/scm/linux/kernel/git/torvalds/linux.git/commit/?id=da4e4f18afe0f3729d68f3785c5802f786d36e34*. This patch applies cleanly to version 4.4, and it might also be possible to back port it to other versions. If you apply the patch, you might also need to apply the patch at *https://git.kernel.org/pub/scm/linux/kernel/git/torvalds/linux.git/commit/?id=cbcc72e037b8a3eb1fad3c1ae22021df21c97a51*.

A.2 Building gatord yourself

To build `gatord`, follow the steps in this topic.

Note

It is not possible to build `gatord` on a Windows host.

Prerequisites

Install the Android NDK appropriate for your target. For more information, see the Android NDK website, *https://developer.android.com/ndk/*.

Procedure

1. Either download the `gatord` source from *https://github.com/ARM-software/gator*, or copy the source that is supplied in `<install_directory>/sw/streamline/gator/daemon/`.
2. Change to the `daemon` directory by using either of the following commands:
   - For Linux, enter:

     ```
     cd daemon
     ```

   - For Android, enter:

     ```
     mv daemon jni
     ```

3. Issue the commands to build `gatord`.

   `<NDK_install_directory>/ndk-build`

   Results: `gatord` is now located in `libs/armeabi`.

   Note

   To build `gatord` for AArch64, edit `jni/Application.mk` and replace `armeabi-v7a` with `arm64-v8a`.

4. Make `gatord` executable by entering the following command:

   ```
   chmod +x gatord
   ```

A.3 gatord command-line options

`gatord` must be running before you can capture trace data. The command-line options configure how `gatord` captures events and how it communicates with Streamline running on your host.

`gatord` has two modes of operation:

Daemon mode (the default mode)
Sends captured events to a host running Streamline.

Local capture mode
Writes the capture to a file then exits.
To enable this mode, specify an output directory with the `--output` flag.

Arguments available to all modes:

Option	Description
`-h, --help`	Lists all the available `gatord` command-line options.
`-c, --config-xml <config_xml>`	Specify the path and filename of the `configuration.xml` file that defines the capture options. In daemon mode, the list of counters is written to this file. In local capture mode, the list of counters is read from this file.
`-e, --events-xml <events_xml>`	Specify the path and filename of the `events.xml` file. `events.xml` defines all the counters that Streamline collects during the capture session.
`-E, --append-events-xml <events_xml>`	Specify the path and filename of `events.xml` to append.
`-P, --pmus-xml <pmu_xml>`	Specify path and filename of `pmu.xml` to append.
`-v, --version`	Print version information.
`-d, --debug`	Enable debug messages.
`-A`, `--app <cmd> <args...>`	Specify the command to execute when the capture starts. This argument must be the last argument that is passed to `gatord`. All subsequent arguments are passed to the launched application.
`-S`, `--system-wide <yes|no>`	Specify whether to capture the whole system. In daemon mode, `no` is only applicable when `--allow-command` is specified. In this mode, you must enter a command in the **Start** view. Defaults to `yes`, unless `--app`, `--pid`, or `--wait-process` is specified.
`-u, --call-stack-unwinding <yes|no>`	Enable or disable call stack unwinding. Defaults to `yes`.
`-r, --sample-rate <low|normal>`	Specify sample rate for capture. Defaults to `normal`.
`-t, --max-duration <s>`	Specify the maximum duration that the capture can run for in seconds. Defaults to `0`, meaning unlimited.
`-f, --use-efficient-ftrace <yes|no>`	Enable efficient ftrace data collection mode. Defaults to `yes`.
`-w, --app-cwd <path>`	Specify the working directory for the application that `gatord` launches. Defaults to the current directory.
`-x, --stop-on-exit <yes|no>`	Stop capture when launched application exits. Defaults to `no`, unless `--app`, `--pid`, or `--wait-process` is specified.
`-Q, --wait-process <command>`	Wait for a process matching the specified command to launch before starting capture. Attach to the specified process and profile it.
`-Z`, `--mmap-pages <n>`	The maximum number of pages to map per mmaped perf buffer is equal to `<n+1>`. `n` must be a power of two.

Arguments available in daemon mode only:

Option	Description
`-p, --port <port_number>`	Set the port number that `gatord` uses to communicate with the host. The default is 8080. If you use the argument `uds`, the TCP socket is disabled and an abstract Unix domain socket is created. This socket is named `streamline-data`. If you use Android, creating a Unix domain socket is useful because `gatord` is prevented from creating a TCP server socket. Alternatively, you can connect to `localhost:<local_port>` in Streamline using: `adb forward tcp:<local_port> localabstract:streamline-data`
`-a, --allow-command`	Allows you to run a command on the target during profiling. Specify the command in the **Start** view. **Caution** If you use this option, an unauthenticated user could run arbitrary commands on the target using Streamline.

Arguments available to local capture mode only:

Option	Description
`-s`, `--session-xml <session_xml>`	Specify the `session.xml` file that the configuration is taken from. Any additional arguments override values that are specified in this file.
`-o, --output <apc_dir>`	Specifies the path and filename of the output file (`.apc`) for a local capture.
`-i, --pid <pids...>`	A comma-separated list of process IDs to profile
`-C, --counters <counters>`	A comma-separated list of counters to enable. This option can be specified multiple times.
`-X`, `--spe <id>[:events=<indexes>][:ops=<types>][:min_latency=<lat>]`	Enable Statistical Profiling Extension (SPE). Where: • `<id>` is the name of the SPE properties that are specified in the `events.xml` or `pmus.xml` file. It uniquely identifies the available events and counters for the SPE hardware. • `<indexes>` is a comma-separated list of event indexes to filter the sampling by. A sample is only recorded if all events are present. • `<types>` is a comma-separated list of operation types to filter the sampling by. If a sample is any of the types in <types>, it is recorded. Valid types are `LD` for load, `ST` for store and `B` for branch. • `<lat>` is the minimum latency. A sample is only recorded if its latency is greater than or equal to this value. The valid range is [0,4096).

Argument usage examples

Using `--pmus-xml` and `--append-events-xml` to add support for a new PMU without having to rebuild `gatord`.

`-P, --pmus-xml` specifies an XML file that defines a new PMU to add to the list of PMUs that `gatord` has built-in support for. The list of built-in PMUs is defined in `pmus.xml`, which is located in the `gatord` source directory.

`-E, --append-events-xml` specifies an XML file that defines one or more event counters to append to the `events.xml` file. This option allows you to add new events to `gatord` without having to rebuild `gatord` or to entirely replace `events.xml`.

The `events.xml` file must include the XML header and elements that are shown in the following example:

```
<?xml version="1.0" encoding="UTF-8"?>
<events>
    <category name="Filesystem">
        <event counter="filesystem_loginuid" path="/proc/self/loginuid"
title="loginuid" name="loginuid" class="absolute" description="loginuid"/>
    </category>
</events>
```