



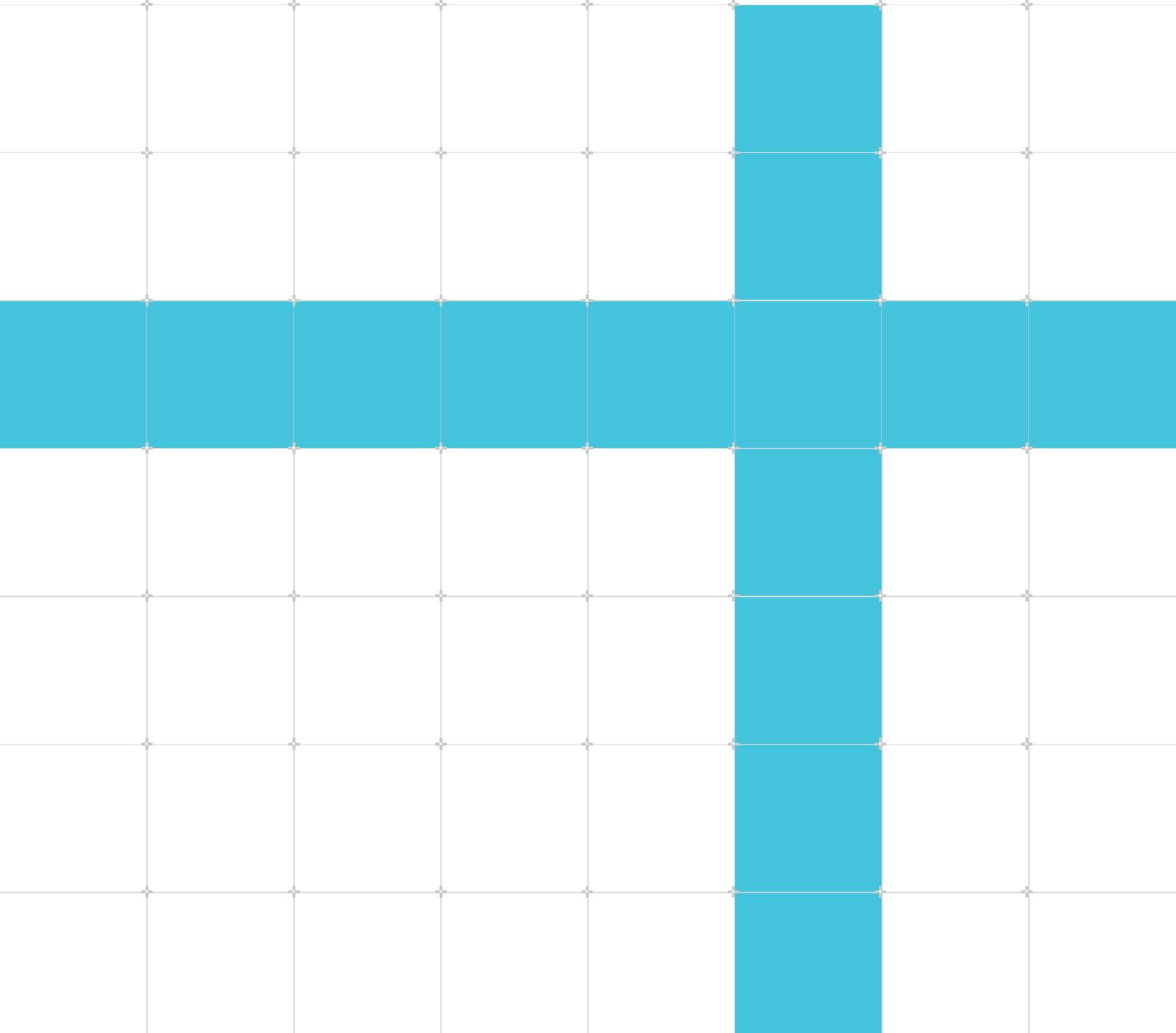
Integrate Arm Mobile Studio into a CI workflow

Version 1.1

Non-Confidential

Issue 00

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Release information

Document history

Issue	Date	Confidentiality	Change
0100-01	25 November 2022	Non-Confidential	First release
0101-00	21 April 2023	Non-Confidential	Update to Performance Advisor report-generation command.

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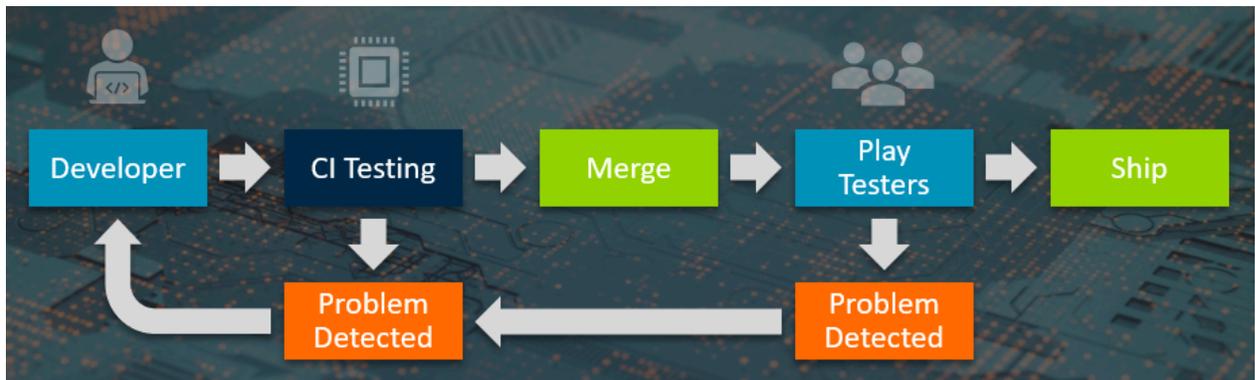
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1. Overview

If your development team uses a CI (continuous integration) system to merge daily code changes, you can run nightly automated on-device performance testing across multiple devices, with [Arm Mobile Studio](#). Automatically generate easy-to-read summary reports in HTML for your team to analyze each morning, and export machine-readable JSON reports, so you can build your own performance dashboards with any JSON-compatible database and visualization tools such as [ELK stack](#).

1. Regularly pull your latest code and assets from your project repository and build debuggable APKs of the application test cases you want to run.
2. Add the Arm Mobile Studio capture and report generation commands to an appropriate stage of your CI pipeline, to export performance data in HTML and JSON format.
3. Push your JSON files to a database where you can collect and analyze the data over time.

Figure 1-1: CI testing



Note

If you are unfamiliar with Streamline and Performance Advisor, it may help you to work through the [Get started with Performance Advisor tutorial](#) first.

2. Configure your device farm

If you have access to a device farm for testing, ensure that you do the following:

1. Install [Arm Mobile Studio](#) on the host machine(s) that your devices connect to.
2. Complete the setup tasks as described in the [Get Started with Performance Advisor tutorial](#).
3. If you are testing devices running Android 9 or earlier, you must include the Arm lightweight interceptor library (LWI) in your application.
4. The testcase APKs you install must be debuggable, and ideally should be set to exit when the testcase completes. This simplifies the CI workflow, by removing the need to manually stop the application when the testcase finishes.
5. As a one-off setup task, you will need to [Export a configuration file](#) for each device. This file defines which CPU and GPU activity counters Streamline should collect data from during the capture.



If you have a large number of devices, you may find it useful to categorize them by performance tier. The latest high-end smartphones will generally perform better than mass-market mid-range or low-end devices, and so you might want to set different performance targets for each. When you export data in JSON format, you can use the `targetInfo.device` field to select data from specific devices. Alternatively, you could push data from each device tier to a unique database index.

3. Export a configuration file

To generate performance data headlessly as part of your CI workflow, you need to generate a counter configuration file for each device, that defines which CPU and GPU activity counters you want to monitor during the capture. As a one-off setup task, you will need to create a configuration file for each device in your device farm. Streamline provides templates, that select an appropriate range counters for different GPUs, or you can build your own custom configuration.

1. Open Streamline and ensure the device is connected via USB. You should see your device in the Start tab.
2. Click Counter configuration  and choose the counters you require, or select a template with .
3. Click Export  to save the configuration file to a location that your CI tool can access.
4. Repeat these steps for every device in your device farm.

You will need to provide this file when running the set up script `lwi_me.py` described in the [Configure CI commands](#) section.

4. Configure CI commands

Here are the continuous integration workflow steps for performance analysis using Arm Mobile Studio. Use a CI tool such as [Jenkins](#), [TeamCity](#), or [Buildbot](#) to send the following instructions to the host machine(s) for each device in your device farm.



To simplify these steps, we've provided a [Helper script](#) that generates the headless Streamline capture and handles starting and stopping of the application (steps 3 to 7).

1. Install your debuggable APK on each device, using Android Debug Bridge (ADB):

```
adb -s <device_serial_number> install <app.package.name>
```

2. Change to the `<install_directory>/streamline/bin/android` directory, or copy the following files from that location to your working directory:

```
lwi_me.py
gator_me.py
<arm|arm64>/gator
<arm|arm64>/libGLESLayerLWI.so
<arm|arm64>/libVkLayerLWI.so
```

3. Generate a headless Streamline capture and supply the configuration file you generated for this device:

```
python3 lwi_me.py --daemon <path_to_gator> --package <app.package.name>
--headless-<capture_filename.apc> --headless-timeout <secs> --config
<path_to_configuration.xml>
```

You can use the `--overwrite` option to overwrite an earlier headless output.

For Vulkan applications, you also need to include the `lwi-api=vulkan` option.

For the full list of available command-line options refer to [The lwi_me.py script options](#) in the Performance Advisor user guide.

4. Add a wait period of at least 1 minute, to allow the script time to run.
5. Start the app on the device:

```
adb -s <device_serial_number> shell am start <app.package.name>
```

If your app was built with Unity, you'll need to include the Unity player activity in `<app.package.name>`, for example: `com.arm.mygame/com.unity3d.player.UnityPlayerActivity`

6. Add an appropriate wait period to allow time for your testcase to run.

7. Stop the script and exit the app:

```
adb -s <device_serial_number> shell am force-stop <app.package.name>
```

8. Generate Performance Advisor reports in HTML and JSON formats.

```
Streamline-cli -pa <capture_filename.apc> -p <app.package.name> -d  
<output_directory> -t html:<file_name.html>,json:<file_name>.json
```

For the full list of available command-line options refer to [The Streamline-cli -pa command](#) in the Performance Advisor user guide.



This command changed in Arm Mobile Studio 2023.1. If you are using a previous version, the command name was `pa`. For the command-line details, refer to the Performance Advisor user guide for your version of Arm Mobile Studio.

9. Push the HTML reports to a centrally visible location for your team to analyze each day.
10. Push the JSON files to your chosen database and visualization tool such as ELK stack.

```
curl -X POST "<Elasticsearch_location>/indexname/_bulk?pretty" -H 'Content-Type:  
application/x-ndjson' --data-binary @<file_name>.json
```



If you are planning to export your JSON files to Elasticsearch, and you're using Arm Mobile Studio version 2020.1 or earlier, you need to convert the file to the expected format first. Refer to our [FAQ](#) for instructions on how to do this.

5. Helper script

To help simplify your CI steps, we've created an example Python script that you can modify and run as part of your CI workflow, to capture performance data automatically from an Android device, with [Arm Mobile Studio](#). This script generates the headless Streamline capture and handles starting and stopping of the application (steps 3 to 7 under [Configure CI commands](#)).

[Download the helper script](#)

Modify this script to set the following values:

1. Set `DEVICE_NAME` to the ID of the current device. You can discover this using the `adb devices` command in a terminal.
2. Modify the command-line options for `GATORME_COMMAND` to:
 - a. Specify the name of the testcase application with `--package`
 - b. Specify the name and location of the resulting capture file with `--headless`
 - c. The script assumes that `lwi_me.py`, `gator_me.py`, `gator`, `libGLES_layer_lwi.so` and the configuration file for this device, `configuration.xml` are in the current working directory. If they are not, modify the filenames to add the full paths.
 - d. To use the correct Python command on macOS or Linux, comment out "py" and "-3" and uncomment "python3":

```
# "py", "-3",  
"python3",
```

- e. Add any other command-line options you require for this run, such as the build name, timestamp or any frame capture options. For the full list of available command-line options refer to [The lwi_me.py script options](#) in the Performance Advisor user guide.
3. Modify the ADB command-line options for `APPLICATION_ADB_COMMAND`, to specify the application to run.
 4. Set `APPLICATION_EXIT_PATTERN` to the logcat pattern emitted by the application when it finishes running the testcase. This is used to stop the application. Alternatively, if you've configured your application to exit at the end of the scenario, set this to `None`.

6. Create a dashboard

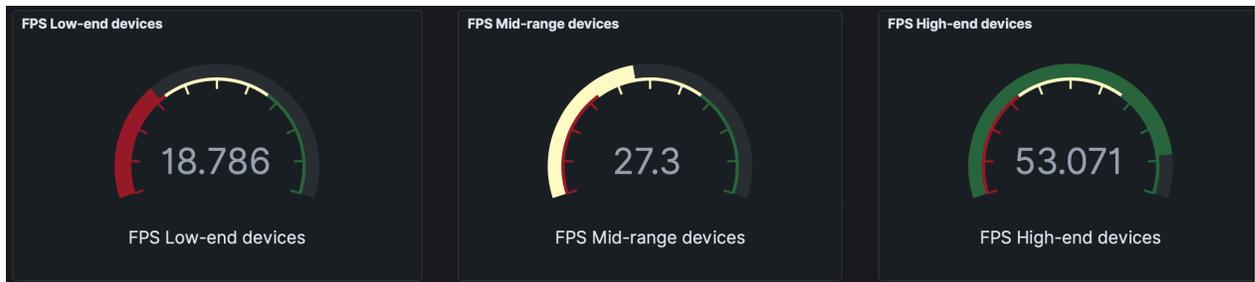
Decide which metrics your team needs to monitor over time. If you have organised the devices in your device farm into performance tiers, you can set performance targets and build separate charts to show whether devices in each tier are meeting those targets.

We've used [Elasticsearch and Kibana](#) to store and visualize JSON data exported from Arm Mobile Studio. Here are some example charts you could build to monitor performance.

Current average FPS

This chart shows a snapshot of the average FPS broken down by device performance tier.

Figure 6-1: FPS diagram.

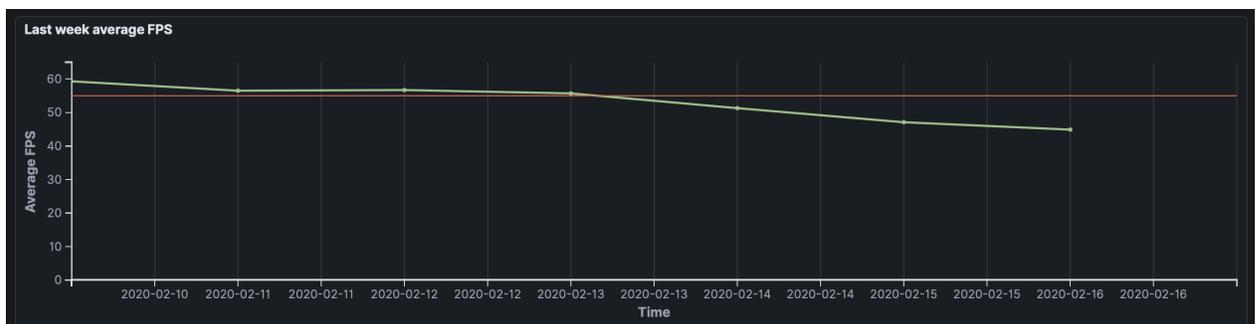


1. Build an average FPS chart for each device tier using the `allCapture.averageFrameRateFps` field.
2. Filter each chart to show devices that belong to each tier. If you've stored data for each device in separate indices, you can filter by index. Alternatively, use the `targetInfo.device` field to choose device names.
3. Adjust the colors in each chart to reflect your target FPS.
4. Filter the chart to the date range you require. You could show today's date, the last 7 days, or any date range that makes sense to your team.

Average FPS over time

This chart shows how the average FPS across all devices changes over time.

Figure 6-2: Average FPS diagram



Build a chart for each device tier. Plot the `allCapture.averageFrameRateFps` field for the devices in each tier over time. Select the required devices from different indices containing your tiers, or with the `targetInfo.device` field.

GPU budgeting

If you know the top frequency achievable by the GPU in your device, and you have a target frame rate, you can calculate a maximum GPU cycles per frame budget, and measure your content against it. If your content breaks this budget, it might cause frame rate to drop. Plot the `gpuCycles.max` field to monitor this value over time. You could also set a query to alert you when your budget is broken.

Region analysis

If you've used [annotations](#) or a [regions file](#) to divide your testcase into different sections, you can monitor data for each section in different charts.