If you have done this at home, feel free to skip. Thank you!

Repository setup

Step 1: Clone repository (ONLINE method)

`git clone --recursive https://github.com/ros-realtime/roscon-2023-realtime-workshop.git code`

Step 1: Clone repository (OFFLINE method)

1. Borrow a Raspberry Pi and connect directly via Ethernet
2. Download http://192.168.10.1/data/repository.tar.gz
3. Extra the tarball: `tar xzf repository.tar.gz`

Step 2: Import and start Docker container

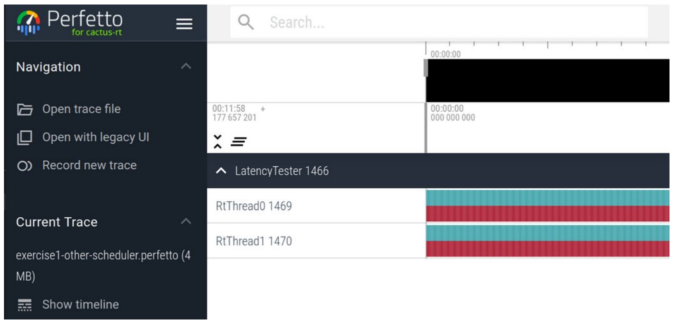
You need this for both laptop- and Raspberry-Pi-based workflows!

1. Borrow a Raspberry Pi and connect directly via Ethernet
2. `cd` into the downloaded repository
3. Run `docker/fetch`
4. Run `docker/start`
5. Run `docker/shell`

Step 3: Test compiling and running exercise 1

Run all commands inside the Docker shell started above

1. `cd /code/exercise1`
2. `colcon build`
3. `./run.sh`
4. This should create a file called `exercise1.perfetto`
5. Go to http://localhost:3100
6. Click Open trace file on top left
7. Open the `exercise1.perfetto` file
8. Consult with Perfetto trace viewer guide
9. Expected result:



If compilation fails with missing dependencies, check that you cloned with the `--recursive` flag, or simply clone the repository using the offline method.

Laptop workflow

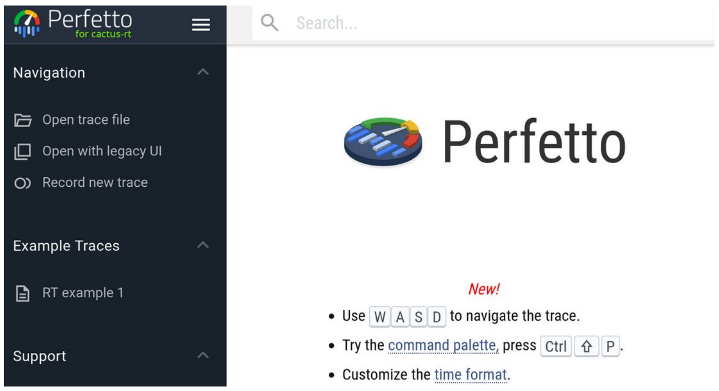
1. Edit the code in the repo with your preferred editor
2. `cd` to the repo in a terminal
3. Login to the Docker container via `docker/shell`
4. Inside the shell, `cd` to the correct exercise directory. Example: `/code/exercise1`
5. Compile and run the exercise according to instructions on slides and/or exercise README. This will generate a file named `exercise<X>.perfetto` in the same directory. Example: `exercise1.perfetto`
6. Go to http://localhost:3100 and Open trace file with the file above.
7. Go back to step 1.

Raspberry Pi workflow

1. Connect Raspberry Pi directly to your laptop via Ethernet.
2. Edit the code in the repo with your preferred editor
3. Login to the Docker container via `docker/shell`
4. Run the command `upload-to-pi`
5. Login to the Raspberry Pi with:
   1. `ssh ubuntu@192.168.10.1`
   2. Password is `ubuntu`
6. After login, `cd` to the correct exercise directory. Example: `/code/exercise1`
7. Compile and run the exercise according to instructions on slides and/or exercise README. This will generate a file named `exercise<X>.perfetto` in the same directory.
8. Download the trace file by browsing to http://192.168.10.1/repo/ and clicking on the right perfetto trace file
9. Go to http://localhost:3100 and Open trace file with the downloaded trace file above
10. Go back to step 2.

Loading data in Perfetto

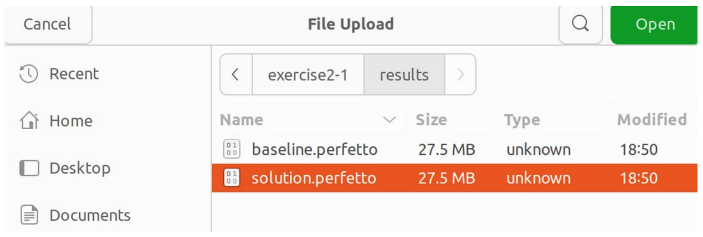
Step 1: A locally-hosted version of Perfetto is available with the Docker container, at http://localhost:3100. Go there and you will find the following interface:



New!

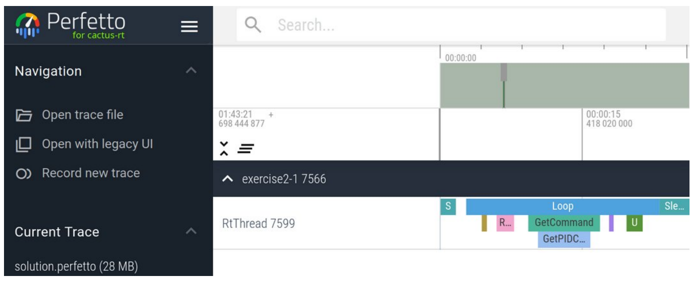
- Use W A S D to navigate the trace.
- Try the command palette, press Ctrl ⇧ P.
- Customize the time format.

Step 2: To open a trace file, click Open trace file and select a file:



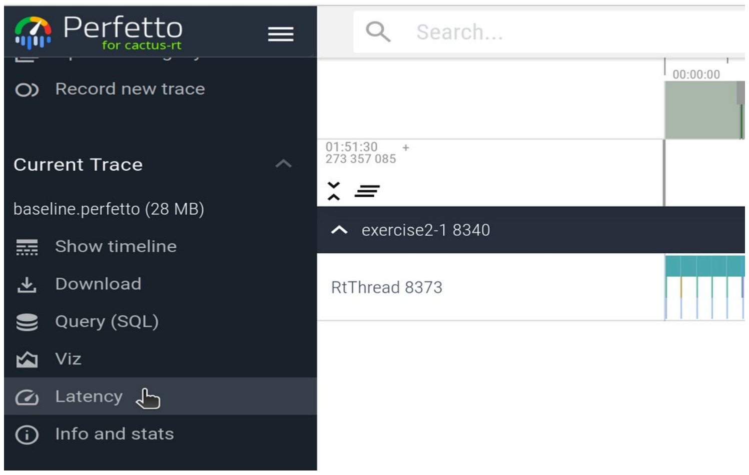
Name	Size	Type	Modified
baseline.perfetto	27.5 MB	unknown	18:50
solution.perfetto	27.5 MB	unknown	18:50

Step 3: Use **WASD** to navigate. **W**: zoom in; **S**: zoom out; **A**: pan left; **D**: pan right. Zoom and pan until you see the following:

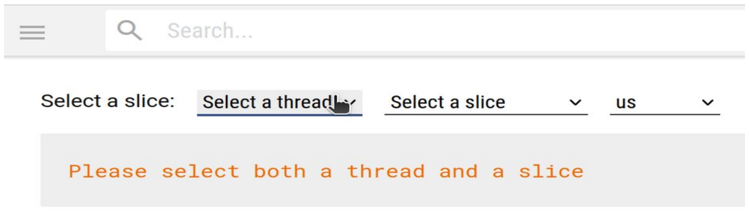


Using histogram visualization

After loading data, on the left side bar, click on Latency:

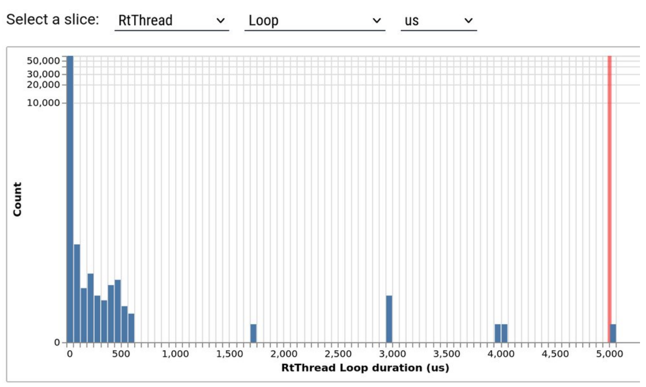


Select a thread and a slice on the drop down:



```
Please select both a thread and a slice
```

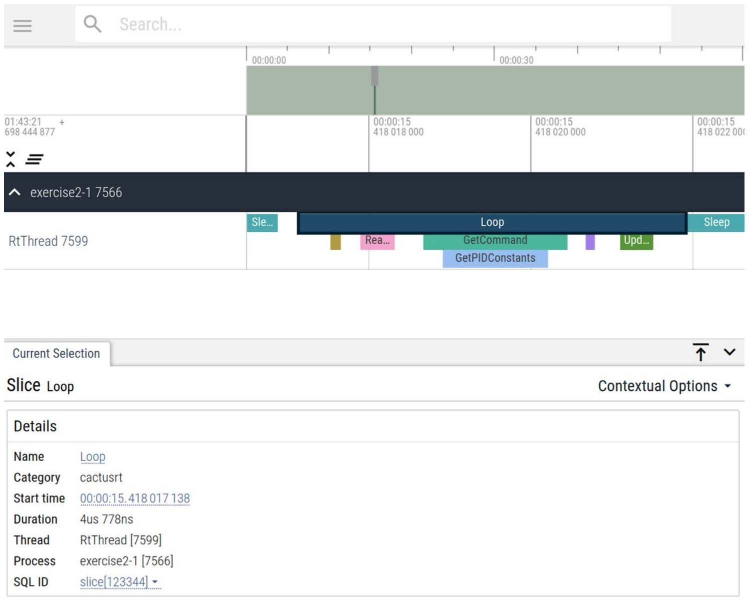
Visualize the latency histogram. Click on us to change the time scale if necessary. Min, average, max duration is also shown below. Red vertical line shows maximum latency:



```
{
  "min_dur": 2,
  "avg_dur": 7.461470240656758,
  "max_dur": 5004,
  "count": 60418
}
```

Find the longest slice

Click on a slice such as **Loop**:



Slice Loop

Contextual Options

Details

Name	Loop
Category	cactusrt
Start time	00:00:15.418 017 138
Duration	4us 778ns
Thread	RtThread [7599]
Process	exercise2-1 [7566]
SQL ID	slice[123344]

Click on the Loop link at the bottom then click Slices with same name in the popup menu

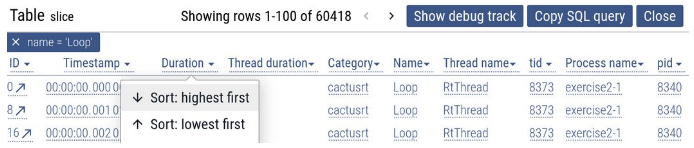


Table slice Showing rows 1-100 of 60418

× name = 'Loop'

ID	Timestamp	Duration	Thread duration	Category	Name	Thread name	tid	Process name	pid
0	00:00:00.000 0			cactusrt	Loop	RtThread	8373	exercise2-1	8340
8	00:00:00.001 0			cactusrt	Loop	RtThread	8373	exercise2-1	8340
16	00:00:00.002 0			cactusrt	Loop	RtThread	8373	exercise2-1	8340

Clock on Duration in the table header then Sort: highest first:

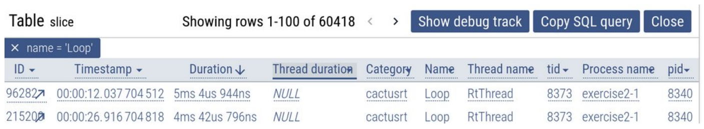


Table slice Showing rows 1-100 of 60418

× name = 'Loop'

ID	Timestamp	Duration	Thread duration	Category	Name	Thread name	tid	Process name	pid
96282	00:00:12.037 704 512	5ms 4us 944ns	NULL	cactusrt	Loop	RtThread	8373	exercise2-1	8340
21520	00:00:26.916 704 818	4ms 42us 796ns	NULL	cactusrt	Loop	RtThread	8373	exercise2-1	8340

Click on the the ID shown on the left most column (96282 in the above example) to bring the timeline view to the longest **Loop** instance:

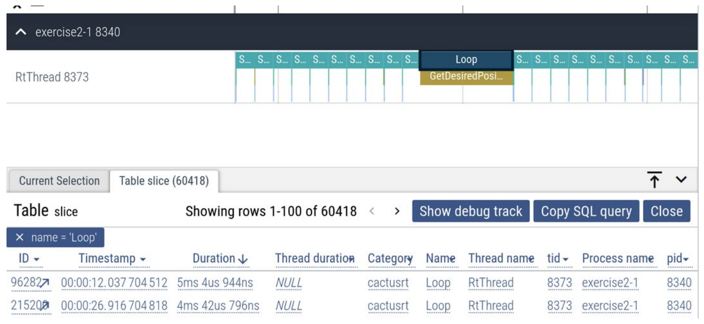


Table slice Showing rows 1-100 of 60418

× name = 'Loop'

ID	Timestamp	Duration	Thread duration	Category	Name	Thread name	tid	Process name	pid
96282	00:00:12.037 704 512	5ms 4us 944ns	NULL	cactusrt	Loop	RtThread	8373	exercise2-1	8340
21520	00:00:26.916 704 818	4ms 42us 796ns	NULL	cactusrt	Loop	RtThread	8373	exercise2-1	8340