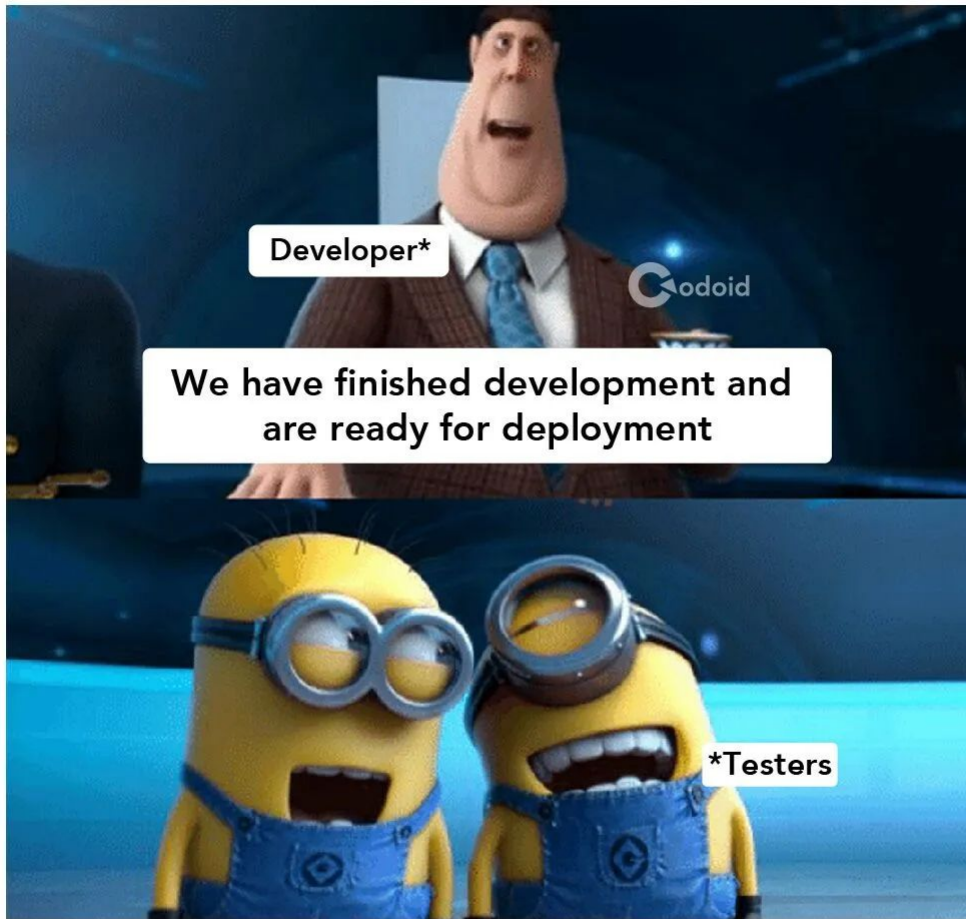


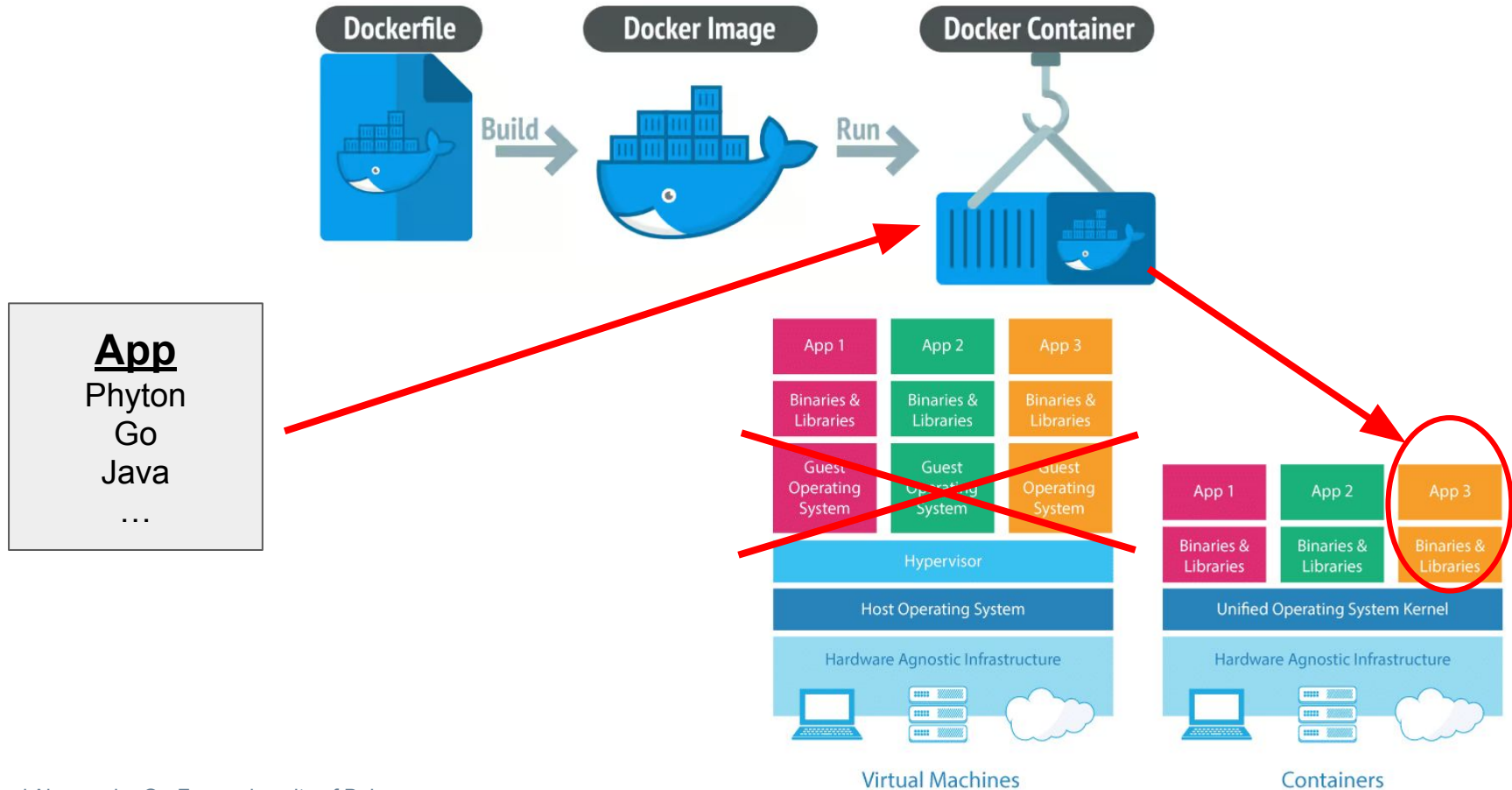
Performance and Energy Efficiency in Docker

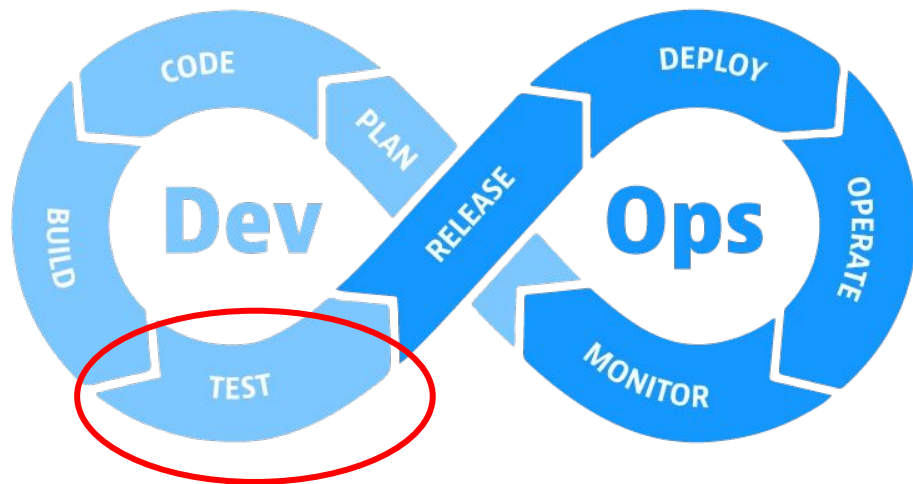
SFSCON 2025 (v2)

Alessandro Aneggi



Docker?





How automatically
measure
performance?

And about the power
consumption?



DOCKER

Build, compile, run
the code under test



LOCUST

Perform load testing
for API systems



scaphandre

SCAPHANDRE

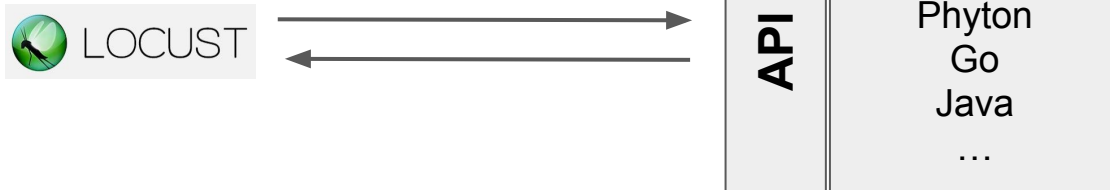
Collect energy
consumption data



cAdvisor

cADVISOR

Collect performance
status of virtual and
physical machines



During: 10/16/2025, 4:22:29 PM - 10/16/2025, 4:25:49 PM (3 minutes and 20 seconds)

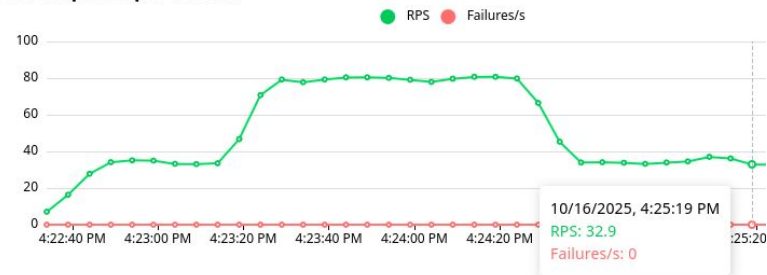
Target Host: http://10.12.202.49:6005

Script: locustfile.py

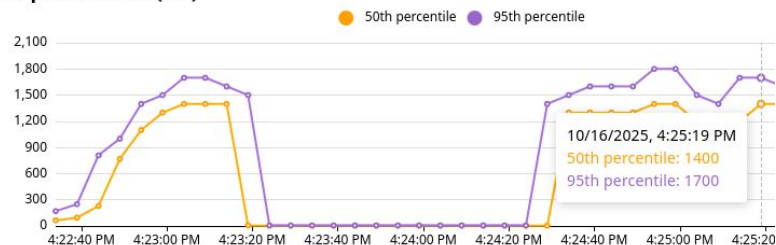
Request Statistics

Type	Name	# Requests	# Fails	Average (ms)	Min (ms)	Max (ms)	Average size (bytes)	RPS	Failures/s
GET	/api/hiccup-cpu	11051	0	381.46	3	1972	48	55.3	0
Aggregated		11051	0	381.46	3	1972	48	55.3	0

Total Requests per Second

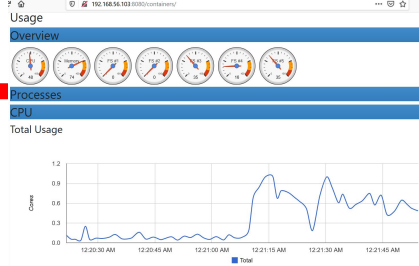
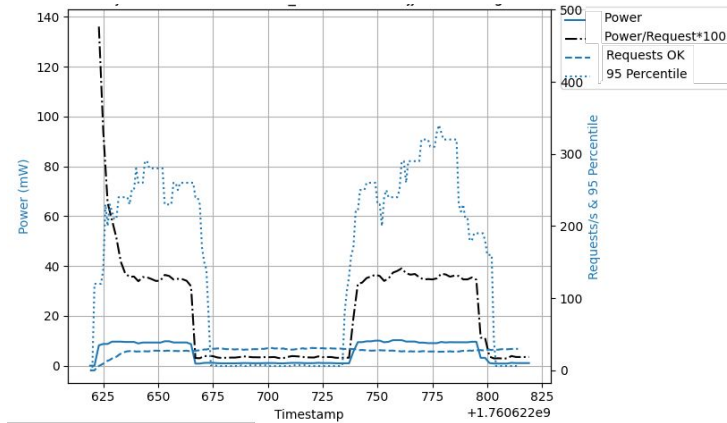
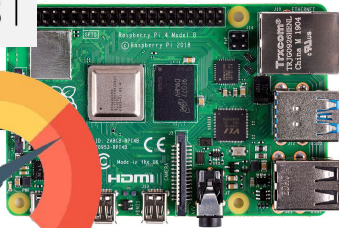
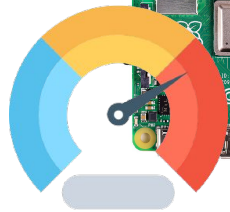


Response Times (ms)

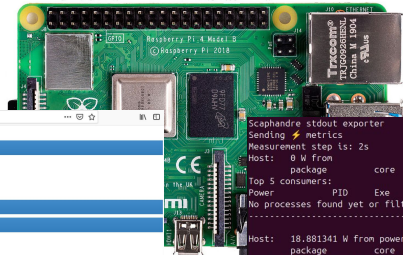




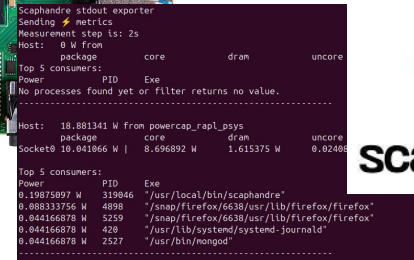
DRIVER



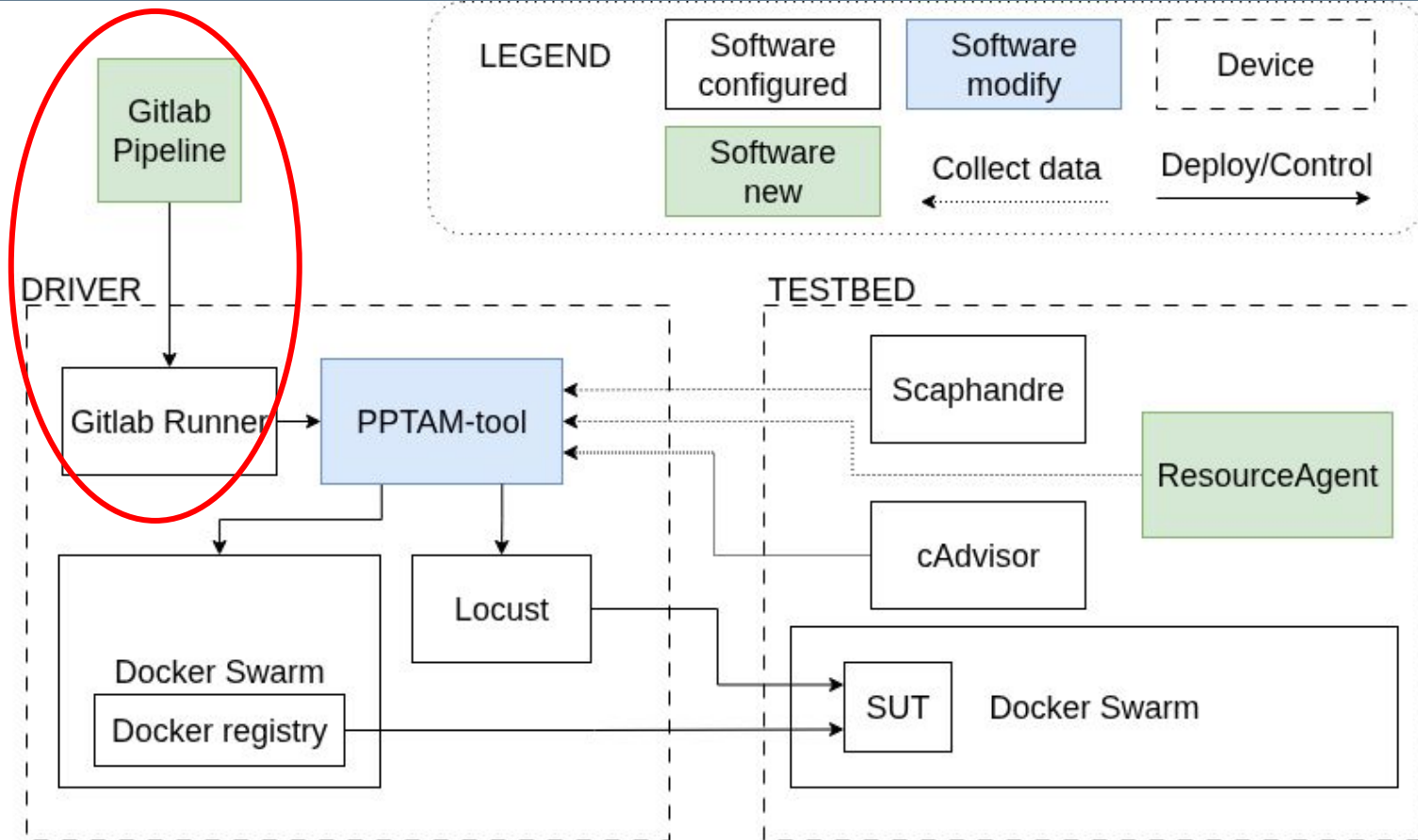
TESTBED



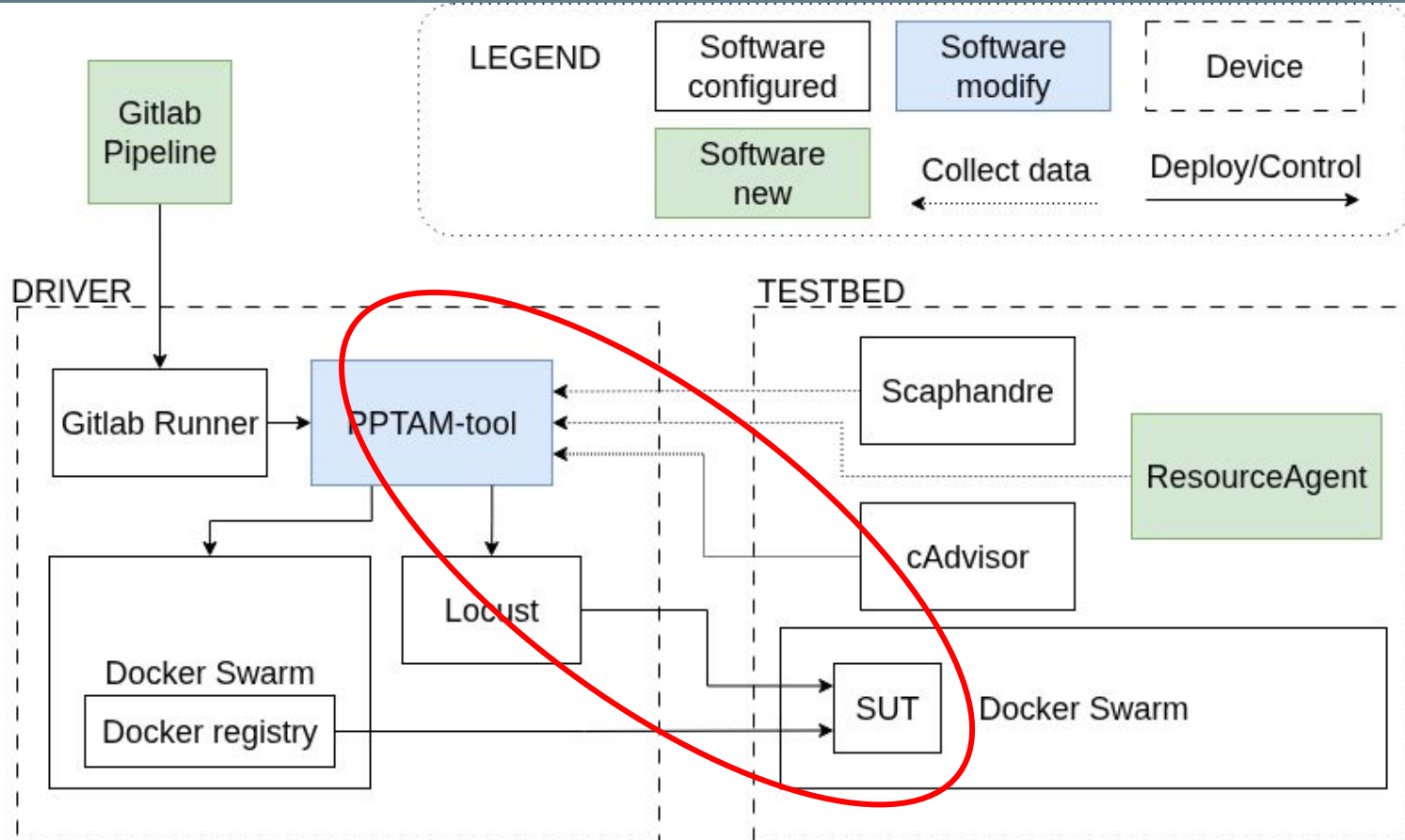
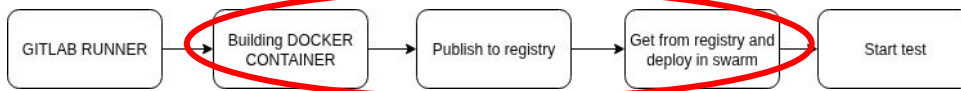
scaphandre



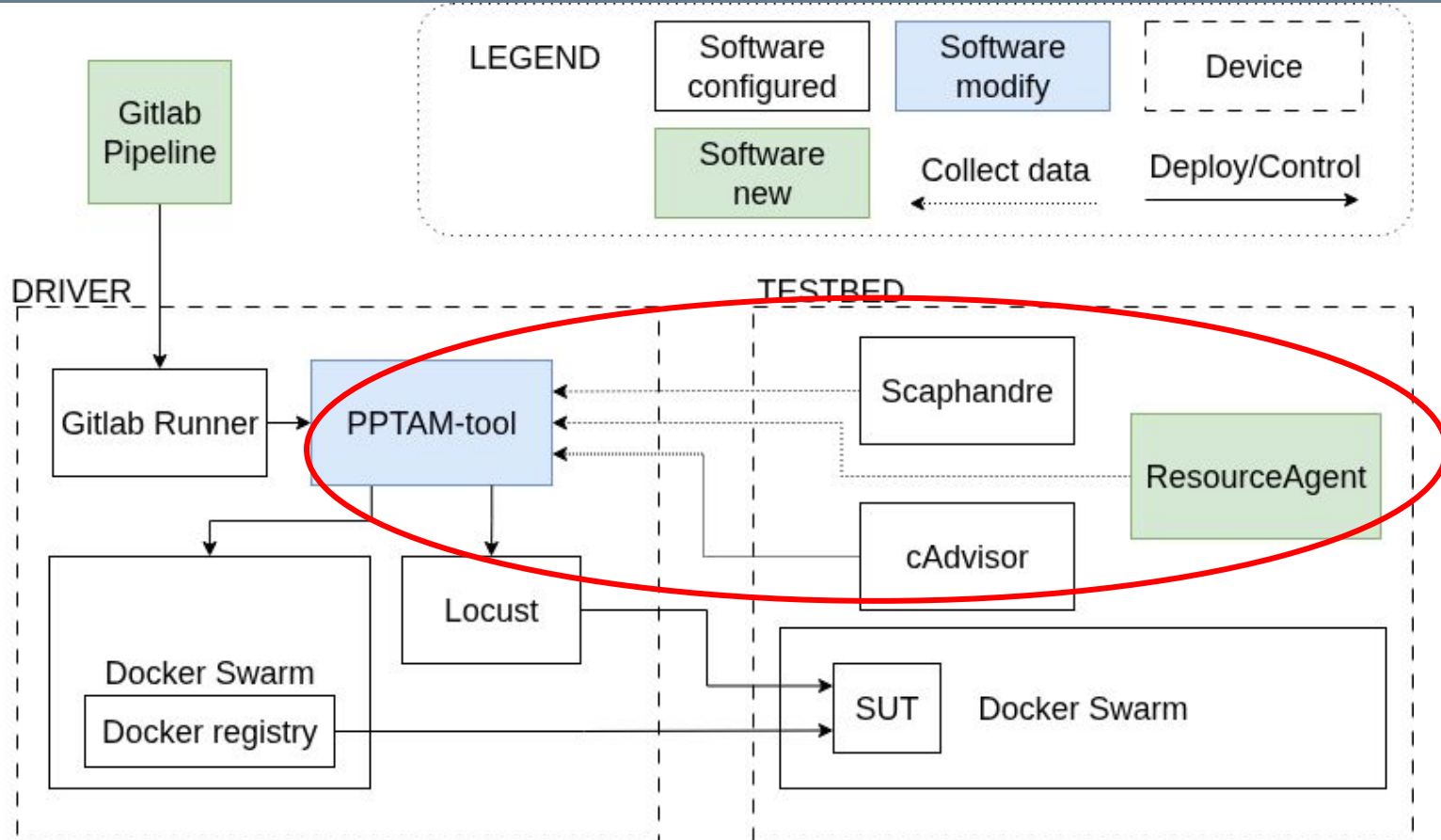
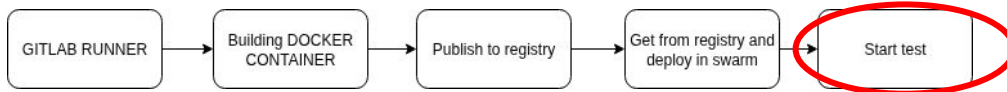
Pipeline process



Pipeline process



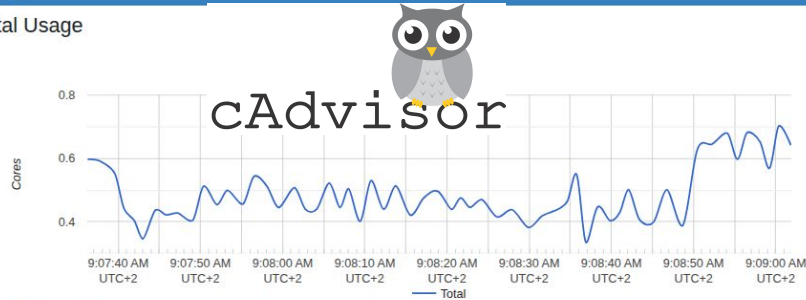
Pipeline process



PID is the key

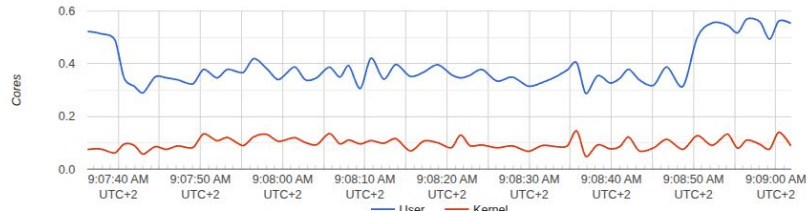
CPU

Total Usage



Usage per Core

Usage Breakdown



scaphandre

```
# HELP scaph_process_disk_total_read_bytes Total data read on disk by the process, in bytes
# TYPE scaph_process_disk_total_read_bytes gauge
scaph_process_disk_total_read_bytes{exe="/usr/bin/sleep",cmdline="sleep180",pid="431022"} 0
# HELP scaph_process_memory_bytes Physical RAM usage by the process, in bytes
# TYPE scaph_process_memory_bytes gauge
scaph_process_memory_bytes{exe="/usr/bin/sleep",cmdline="sleep180",pid="431022"} 1835008
# HELP scaph_process_cpu_usage_percentage CPU time consumed by the process, as a percentage of the capacity of all the CPU Cores
# TYPE scaph_process_cpu_usage_percentage gauge
scaph_process_cpu_usage_percentage{exe="/usr/bin/sleep",cmdline="sleep180",pid="431022"} 0
# HELP scaph_process_power_consumption_microwatts Total data read on disk by the process, in bytes
# TYPE scaph_process_power_consumption_microwatts gauge
scaph_process_power_consumption_microwatts{exe="/usr/bin/sleep",cmdline="sleep180",pid="431022"} 0
# HELP scaph_process_disk_total_write_bytes Total data written on disk by the process, in bytes
# TYPE scaph_process_disk_total_write_bytes gauge
scaph_process_disk_total_write_bytes{exe="/usr/bin/sleep",cmdline="sleep180",pid="431022"} 0
# HELP scaph_process_disk_read_bytes Data read on disk by the process, in bytes
# TYPE scaph_process_disk_read_bytes gauge
scaph_process_disk_read_bytes{exe="/usr/bin/sleep",cmdline="sleep180",pid="431022"} 0
# HELP scaph_process_disk_write_bytes Data written on disk by the process, in bytes
# TYPE scaph_process_disk_write_bytes gauge
scaph_process_disk_write_bytes{exe="/usr/bin/sleep",cmdline="sleep180",pid="431022"} 0
# HELP scaph_process_memory_virtual_bytes Virtual RAM usage by the process, in bytes
# TYPE scaph_process_memory_virtual_bytes gauge
scaph_process_memory_virtual_bytes{exe="/usr/bin/sleep",cmdline="sleep180",pid="431022"} 5820416
scaph_process_memory_virtual_bytes{cmdline="(udev-worker)",pid="420155",exe="/usr/bin/udevadm"} 30453760
scaph_process_memory_bytes{cmdline="(udev-worker)",pid="420155",exe="/usr/bin/udevadm"} 5644288
scaph_process_disk_write_bytes{cmdline="(udev-worker)",pid="420155",exe="/usr/bin/udevadm"} 0
scaph_process_disk_read_bytes{cmdline="(udev-worker)",pid="420155",exe="/usr/bin/udevadm"} 0
scaph_process_power_consumption_microwatts{cmdline="(udev-worker)",pid="420155",exe="/usr/bin/udevadm"} 9.080351067222654
scaph_process_disk_total_read_bytes{cmdline="(udev-worker)",pid="420155",exe="/usr/bin/udevadm"} 0
scaph_process_cpu_usage_percentage{cmdline="(udev-worker)",pid="420155",exe="/usr/bin/udevadm"} 0.008499336
scaph_process_disk_total_write_bytes{cmdline="(udev-worker)",pid="420155",exe="/usr/bin/udevadm"} 0
```

```
scaph_process_disk_write_bytes{exe="/usr/bin/udevadm",pid="420161",cmdline="(udev-worker)"} 0
scaph_process_power_consumption_microwatts{exe="/usr/bin/udevadm",pid="420161",cmdline="(udev-worker)"} 52.21201590031385
scaph_process_disk_total_read_bytes{exe="/usr/bin/udevadm",pid="420161",cmdline="(udev-worker)"} 0
```

Docker container power usage?

PID + POWER CONSUMPTION + DOCKER PIDs

```
1 collected,container_name,container_id,host_pid,container_pid
2 1760446991,202510141302,c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4,776981,776981
3 1760446991,202510141302,c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4,776981,777068
4 1760447001,202510141302,c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4,776981,776981
5 1760447001,202510141302,c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4,776981,777068
```



scaphandre

```
scaph_process disk_read_bytes{exe="/usr/bin/udevadm",pid="420161",cmdline="(udev-worker)"} 0
scaph_process power_consumption_microwatts{exe="/usr/bin/udevadm",pid="420161",cmdline="(udev-worker)"} 52.2120159003138
scaph_process disk_write_bytes{exe="/usr/bin/udevadm",pid="420161",cmdline="(udev-worker)"} 0
```

Docker container power usage?

PID + POWER CONSUMPTION + DOCKER PIDs

```
1 collected,container_name,container_id,host_pid,container_pid
2 1760446991,202510141302,c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4,776981,776981
3 1760446991,202510141302,c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4,776981,777068
4 1760447001,202510141302,c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4,776981,776981
5 1760447001,202510141302,c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4,776981,777068
```



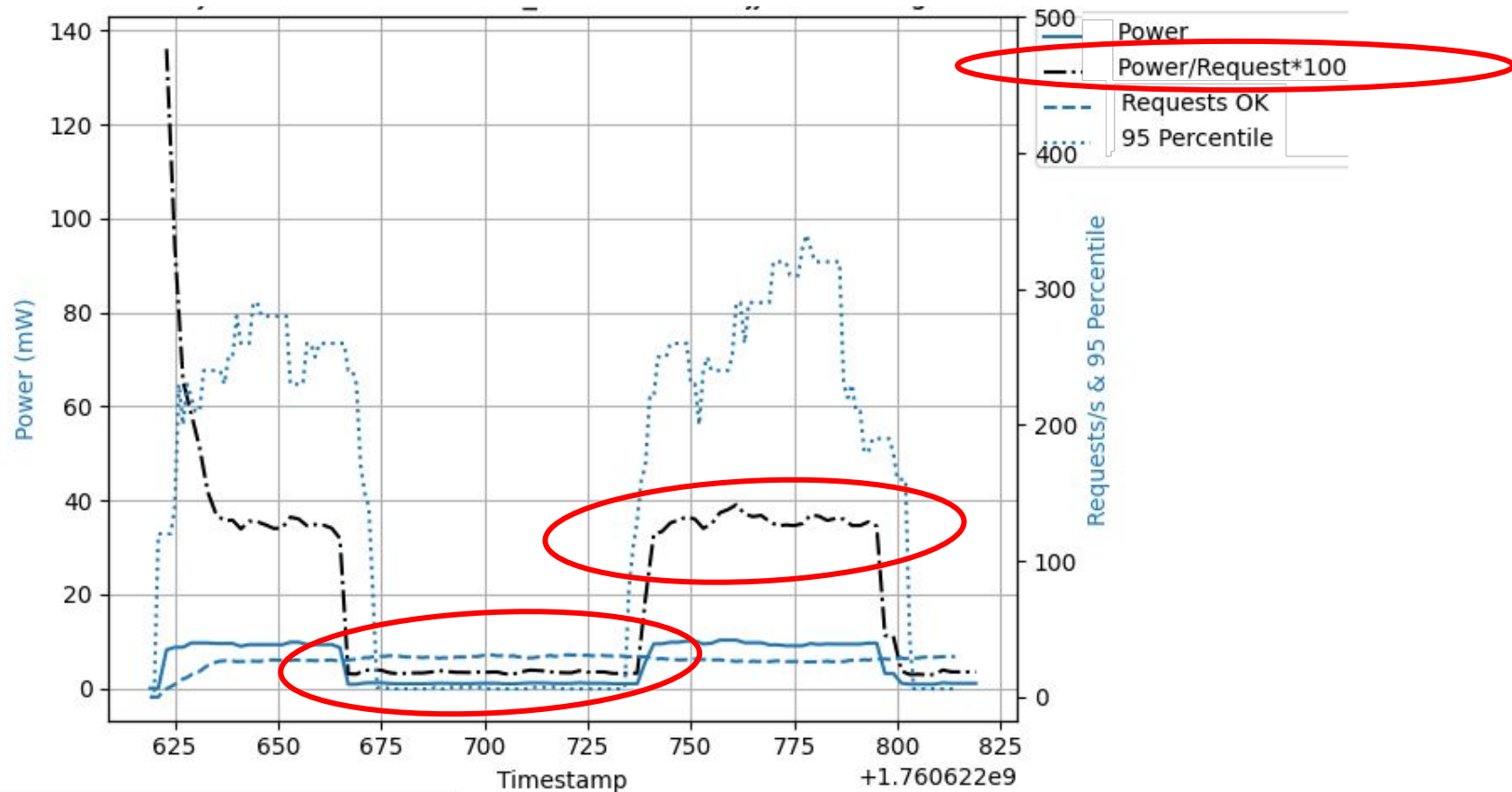
scaphandre

```
scaph_process disk_writes{exe="/usr/bin/udevadm",pid=420101,cmdline="(udev-worker)"} 0
scaph_process power_consumption_microwatts{exe="/usr/bin/udevadm",pid="420161",cmdline="(udev-worker)"} 52.212
scaph_process disk_read_bytes{exe="/usr/bin/udevadm",pid="420161",cmdline="(udev-worker)"} 0
```

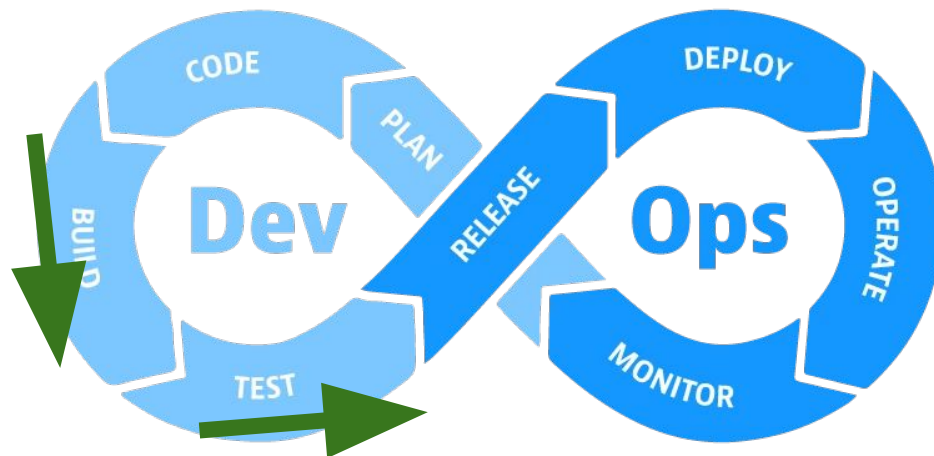


```
"c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4": {
  "container_id": "c9a77076d17e08c3771895ef1c07b18627ecfab1b332cfeaffd9c168d3df92d4",
  "container_name": "202510141302-json-testa03-95",
  "pids": [
    777068,
    776981
  ],
  "power_consumption": [
    {
      "timestamp": 1760446997,
      "total_pids": 7.869009040765762
    }
  ]
}
```

Example results

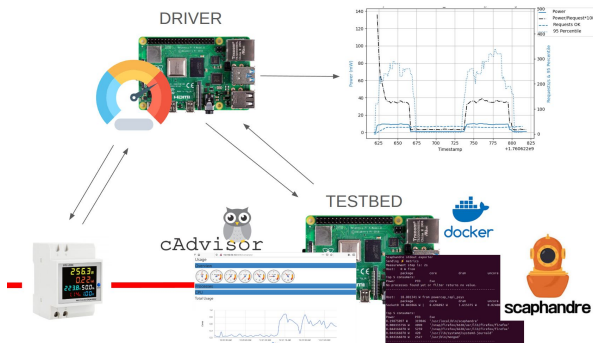


What's for you?



PERFORMANCE

POWER
CONSUMPTION



Thank

you

all

www.ANEGGI.it



main ▾ pipeline / design_pipeline

design_pipeline



Miao

Alessandro Aneggi authored 2 hours ago

Name	Last commit
..	
configuration.ini	NEW TEST COMMIT M
docker-compose.yml	New memory and coll
locustfile.py	TEST THE RAM NEW
test_plan.ini	

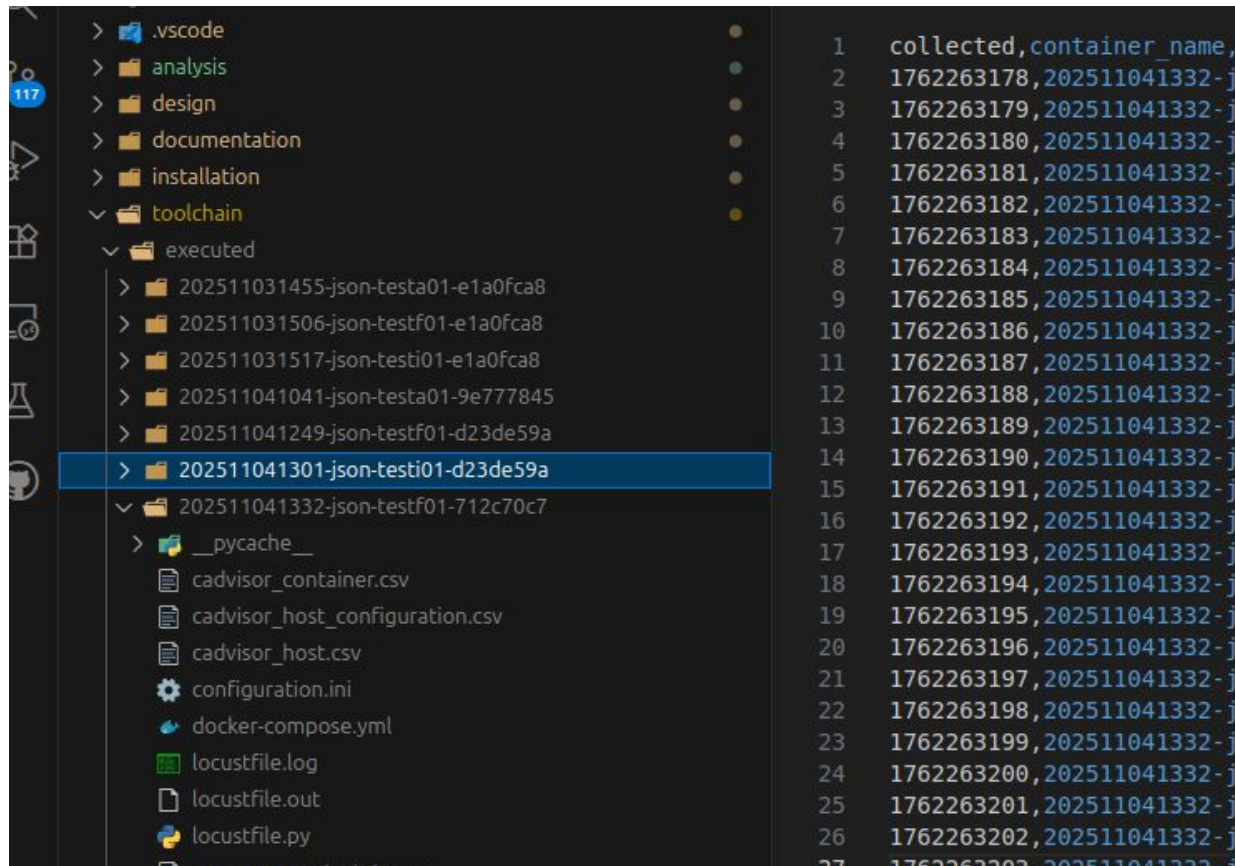
```
5 ; to that section.  
6 [Test1]  
7 LOAD=200
```

```
SECONDS_TO_WAIT_BEFORE_AFTER=10  
SECONDS_TO_WAIT_BEFORE_UNDEPLOY=10  
SECONDS_TO_WAIT_BEFORE_TEARDOWN=10  
LOCUST_HOST_URL=http://10.12.202.49:6005  
SPAWN_RATE_PER_SECOND=4  
RUN_TIME_IN_SECONDS=600  
DOCKER_DEPLOY=1  
DOCKER_UNDEPLOY=1  
DOCKER_NODE_NAME=minerva  
DOCKER_WAITING_FOR_DEPLOYMENT_IN_SECONDS=10  
DOCKER_WAITING_FOR_UNDEPLOYMENT_IN_SECONDS=5
```

```
7  
8 class TrainTicketUser(HttpUser):  
9     host = "http://10.12.202.49:6005"  
10    wait_time = between(0.5, 1.5) # Random wait between requests  
11  
12    @task  
13    def see_offers(self):  
14        #self.client.get("/api/hiccup-cpu")  
15        #self.client.get("/api/unbalanced-processing")  
16        self.client.get("/api/the-ramp/addandsearch")  
17
```



PPTAM-TOOL Deploy
and test with Locust
automatically





RESOURCEAGENT

Collect association between container and PIDs

```
{
  "containers": [
    {
      "container_name": "202510030704-json-test3-cdfbc78a_server.1.limk9cihkfh0lmnh75jor5blt",
      "container_id": "8fa476aad95133f580c74c71bf8d126f820153f9b203ae4dc2c0ee66a3a4921f",
      "id": "8fa476aad951",
      "host_pid": 297419,
      "container_pids": [
        297419,
        297495
      ]
    }
  ]
}
```