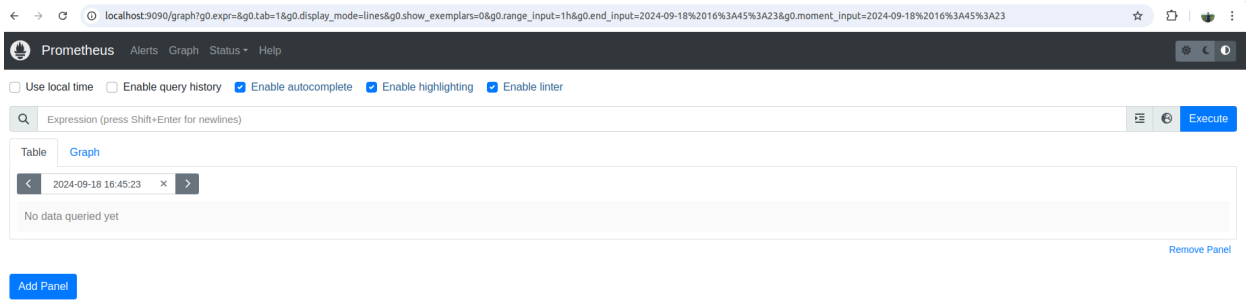
Local Machine

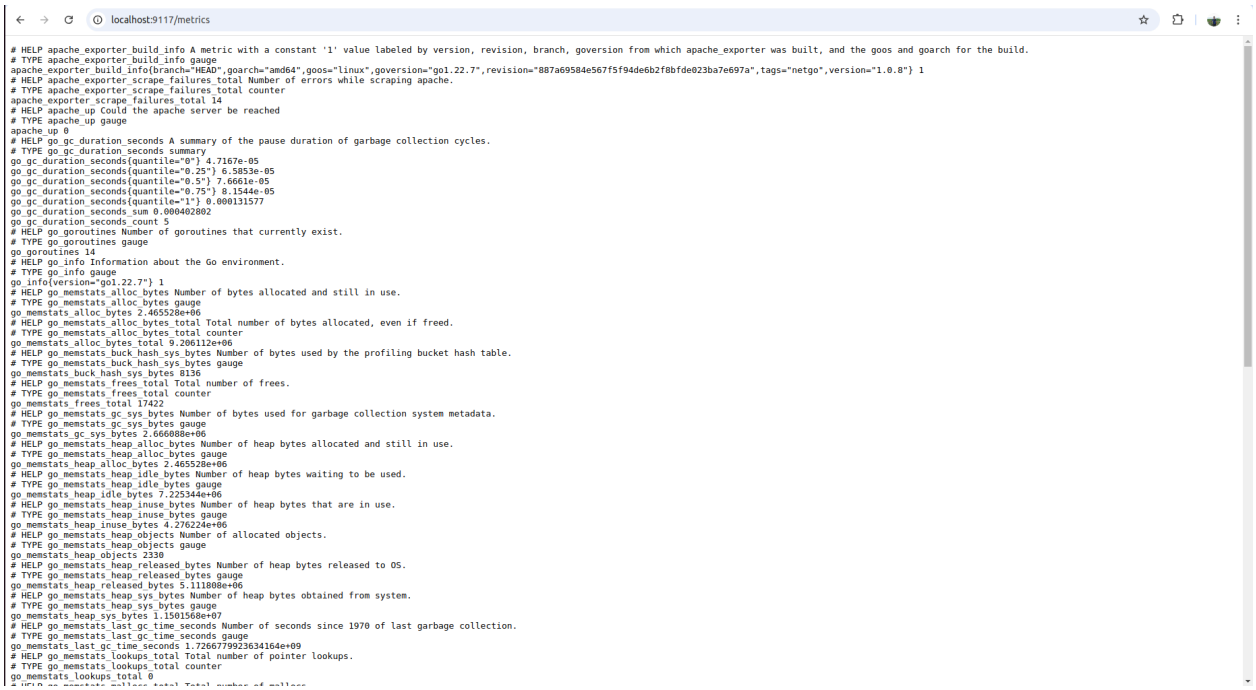
- Docker compose up/ps/down

```
(base) andre@andre-Z790-AORUS-ELITE:~/Desktop/CU_submission/Software_Defined_Systems/Activity_5/part_1_local$ docker compose up -d
[+] Running 4/4
 ✔ Container node-exporter    Started                                    0.3s
 ✔ Container prometheus       Started                                    0.4s
 ✔ Container grafana          Started                                    0.4s
 ✔ Container apache-exporter  Started                                    0.4s
(base) andre@andre-Z790-AORUS-ELITE:~/Desktop/CU_submission/Software_Defined_Systems/Activity_5/part_1_local$ docker ps
CONTAINER ID   IMAGE                      COMMAND                  CREATED              STATUS              PORTS                                       NAMES
6b9599b391c1   grafana/grafana            "/run.sh"                11 seconds ago       Up 4 seconds        0.0.0.0:3000->3000/tcp, :::3000->3000/tcp   grafana
2f1689397ac3   prom/prometheus            "/bin/prometheus --c…"   About a minute ago   Up 4 seconds        0.0.0.0:9090->9090/tcp, :::9090->9090/tcp   prometheus
f19d00abc2df   bitnami/apache-exporter    "apache_exporter"        3 minutes ago        Up 4 seconds        0.0.0.0:9117->9117/tcp, :::9117->9117/tcp   apache-exporter
d279e391aaae   prom/node-exporter         "/bin/node_exporter"     3 minutes ago        Up 4 seconds        0.0.0.0:9100->9100/tcp, :::9100->9100/tcp   node-exporter
(base) andre@andre-Z790-AORUS-ELITE:~/Desktop/CU_submission/Software_Defined_Systems/Activity_5/part_1_local$ docker compose down
[+] Running 5/5
 ✔ Container prometheus       Removed
 ✔ Container apache-exporter  Removed
 ✔ Container node-exporter    Removed
 ✔ Container grafana          Removed
 ✔ Network part_1_local_mynet  Removed
```

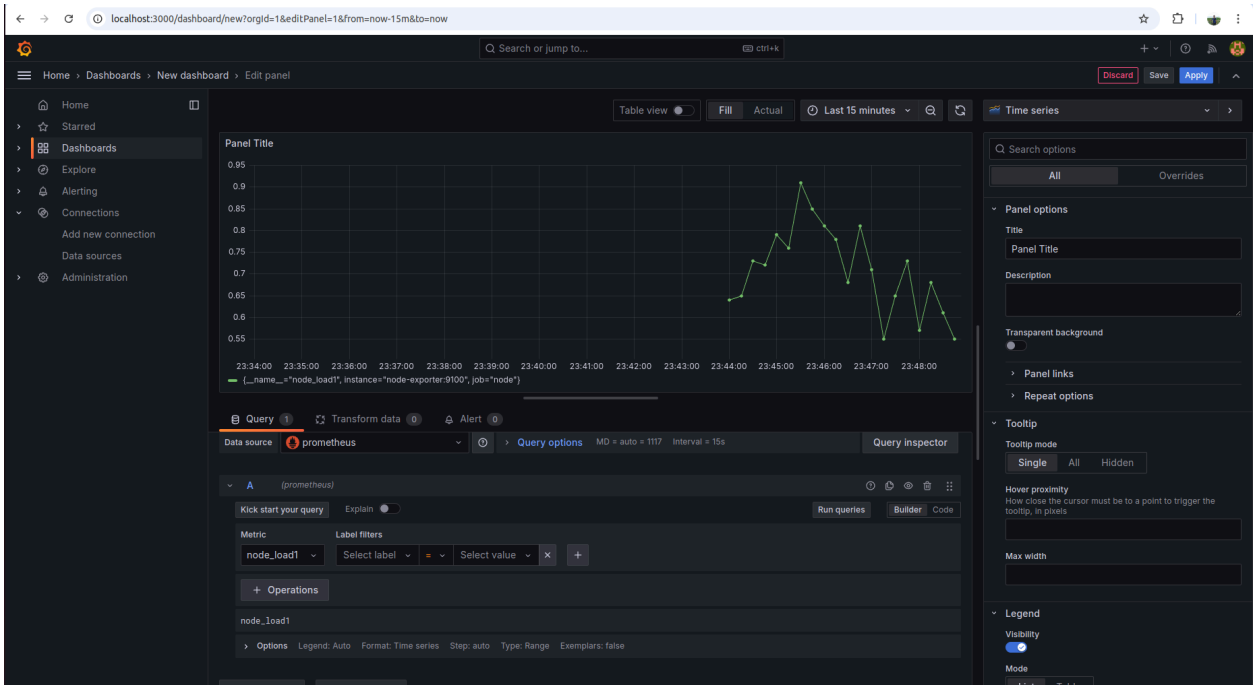
- Prometheus



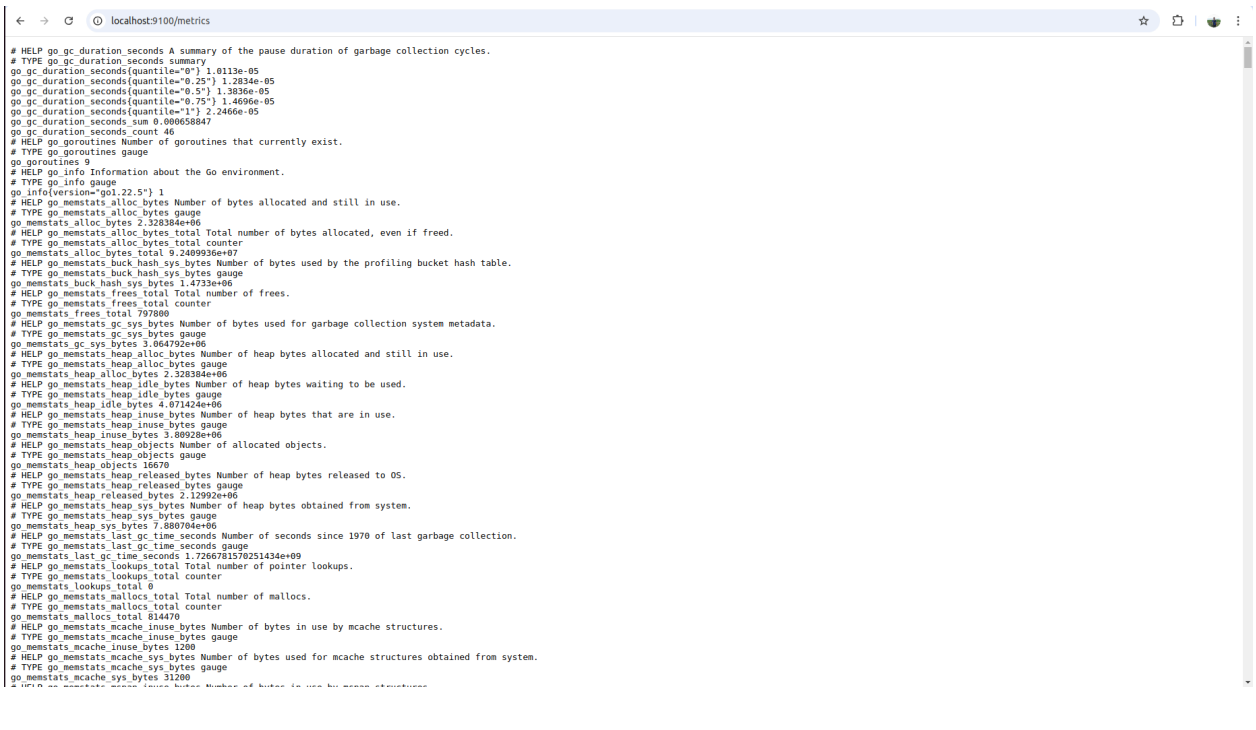
- Apache-exporter



- Grafana



- Node-exporter



Raspberry Pi

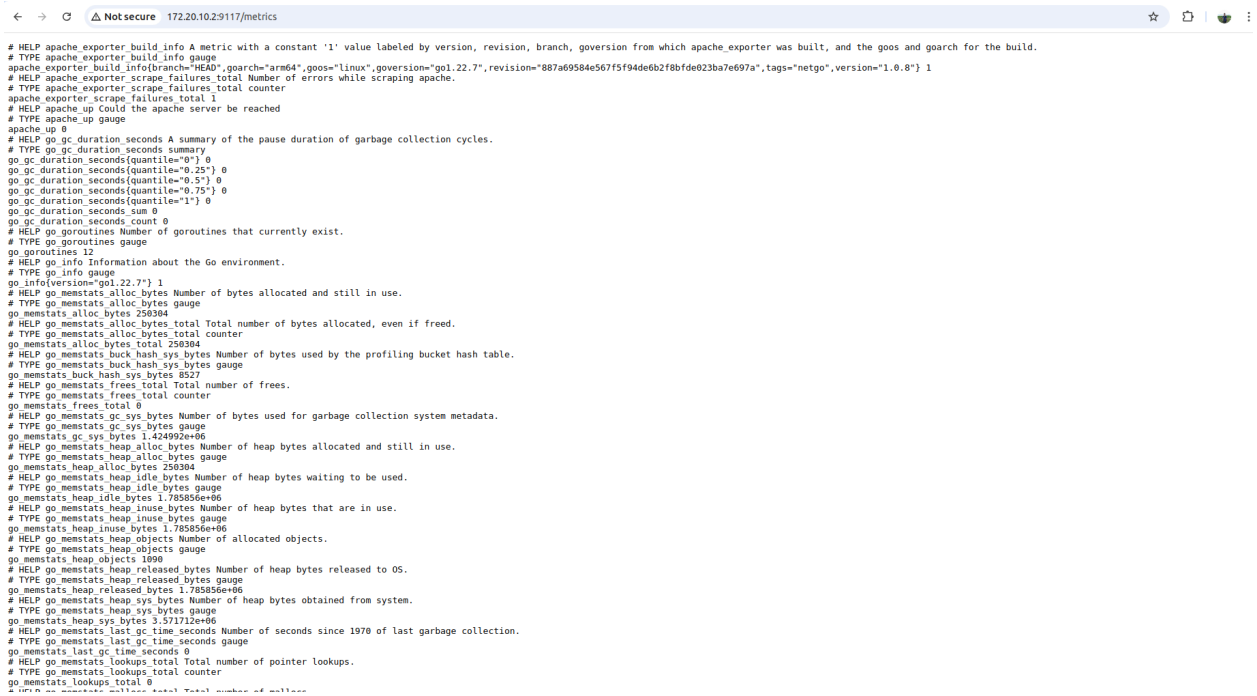
- Local - Docker compose up/ps/down

```
(base) andre@andre-Z790-AORUS-ELITE:~/Desktop/CU_submission/Software_Defined_Systems/Activity_5/part_2_pi$ docker compose -f ./compose_local.yml up -d
[+] Running 2/2
 ✔ Container grafana     Started
 ✔ Container prometheus  Started
(base) andre@andre-Z790-AORUS-ELITE:~/Desktop/CU_submission/Software_Defined_Systems/Activity_5/part_2_pi$ docker ps
CONTAINER ID   IMAGE             COMMAND                  CREATED         STATUS         PORTS                                            NAMES
c9803fb7c93a   grafana/grafana   "/run.sh"                4 seconds ago   Up 3 seconds   0.0.0.0:3000->3000/tcp, :::3000->3000/tcp        grafana
1870368f4bc0   prom/prometheus   "/bin/prometheus --c…"   4 seconds ago   Up 3 seconds   0.0.0.0:9090->9090/tcp, :::9090->9090/tcp        prometheus
(base) andre@andre-Z790-AORUS-ELITE:~/Desktop/CU_submission/Software_Defined_Systems/Activity_5/part_2_pi$ docker compose -f ./compose_local.yml down
[+] Running 3/3
 ✔ Container prometheus     Removed
 ✔ Container grafana        Removed
 ✔ Network part_2_pi_mynet  Removed
```

- Pi - Docker compose up/ps/down

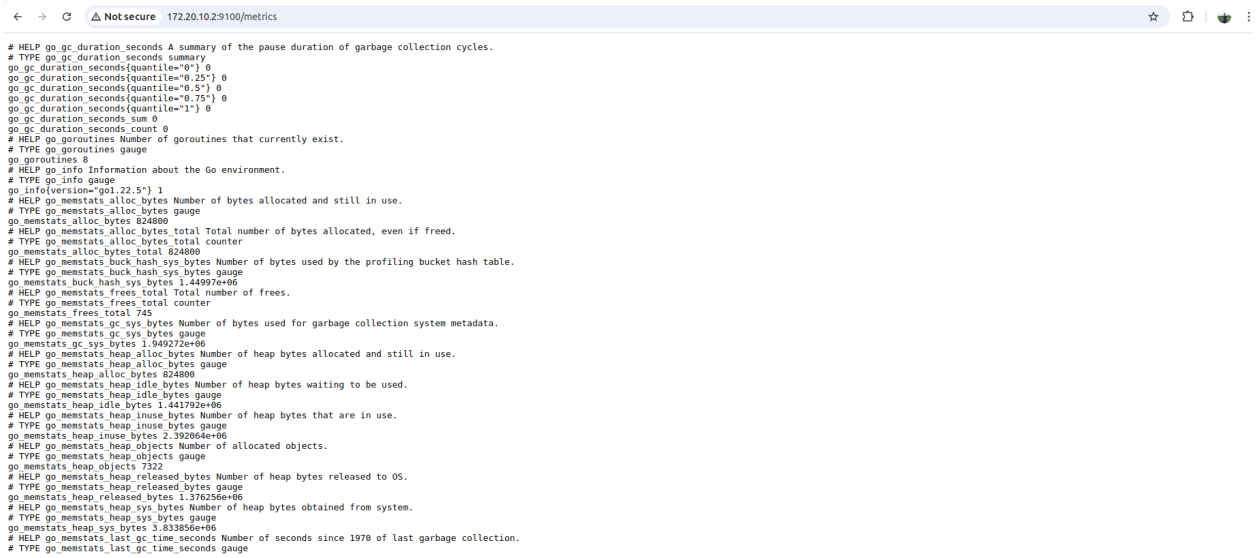
```
pi@raspberrypi:~/Desktop/Act_5 $ docker compose -f ./compose_pi.yml up -d
[+] Running 2/2
 ✔ Container node-exporter    Started                                    3.4s
 ✔ Container apache-exporter  Started                                    3.3s
pi@raspberrypi:~/Desktop/Act_5 $ docker ps
CONTAINER ID   IMAGE                       COMMAND                  CREATED        STATUS         PORTS                                            NAMES
36fbe3267697   bitnami/apache-exporter     "apache_exporter"        11 hours ago   Up 7 seconds   0.0.0.0:9117->9117/tcp, :::9117->9117/tcp        apache-exporter
507d439e2c45   prom/node-exporter          "/bin/node_exporter"     11 hours ago   Up 7 seconds   0.0.0.0:9100->9100/tcp, :::9100->9100/tcp        node-exporter
pi@raspberrypi:~/Desktop/Act_5 $ docker compose -f ./compose_pi.yml down
[+] Running 3/3
 ✔ Container node-exporter    Removed
 ✔ Container apache-exporter  Removed
 ✔ Network act_5_mynet        Removed
```

- Pi - Apache-exporter

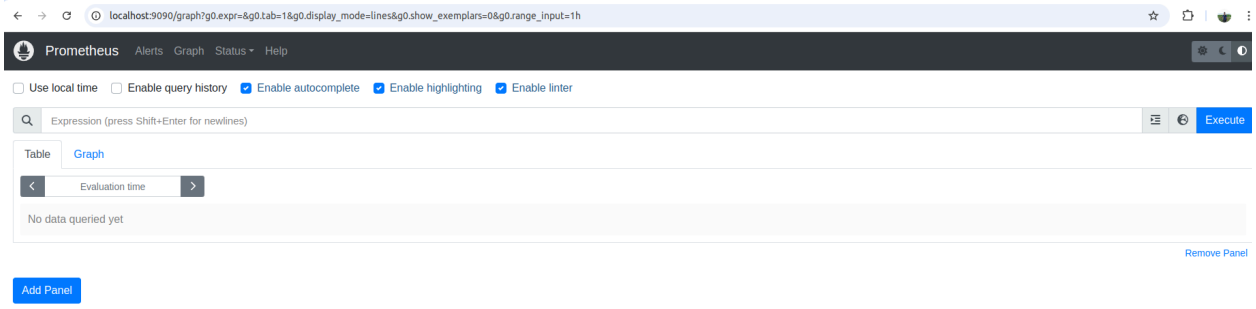



```
# HELP apache_exporter_build_info A metric with a constant '1' value labeled by version, revision, branch, goversion from which apache_exporter was built, and the goos and goarch for the build.
# TYPE apache_exporter_build_info gauge
apache_exporter_build_info{branch="HEAD",goarch="arm64",goos="linux",goversion="go1.22.7",revision="887a69584e567f5f94de6b2f8bfde023ba7e697a",tags="netgo",version="1.0.8"} 1
# HELP apache_exporter_scrape_failures_total Number of errors while scraping apache.
# TYPE apache_exporter_scrape_failures_total counter
apache_exporter_scrape_failures_total 1
# HELP apache_up Could the apache server be reached
# TYPE apache_up gauge
apache_up 0
# HELP go_gc_duration_seconds A summary of the pause duration of garbage collection cycles.
# TYPE go_gc_duration_seconds summary
go_gc_duration_seconds{quantile="0"} 0
go_gc_duration_seconds{quantile="0.25"} 0
go_gc_duration_seconds{quantile="0.5"} 0
go_gc_duration_seconds{quantile="0.75"} 0
go_gc_duration_seconds{quantile="1"} 0
go_gc_duration_seconds_sum 0
go_gc_duration_seconds_count 0
# HELP go_goroutines Number of goroutines that currently exist.
# TYPE go_goroutines gauge
go_goroutines 12
# HELP go_info Information about the Go environment.
# TYPE go_info gauge
go_info{version="go1.22.7"} 1
# HELP go_memstats_alloc_bytes Number of bytes allocated and still in use.
# TYPE go_memstats_alloc_bytes gauge
go_memstats_alloc_bytes 250304
# HELP go_memstats_alloc_bytes_total Total number of bytes allocated, even if freed.
# TYPE go_memstats_alloc_bytes_total counter
go_memstats_alloc_bytes_total 250304
# HELP go_memstats_buck_hash_sys_bytes Number of bytes used by the profiling bucket hash table.
# TYPE go_memstats_buck_hash_sys_bytes gauge
go_memstats_buck_hash_sys_bytes 8527
# HELP go_memstats_frees_total Total number of frees.
# TYPE go_memstats_frees_total counter
go_memstats_frees_total 0
# HELP go_memstats_gc_sys_bytes Number of bytes used for garbage collection system metadata.
# TYPE go_memstats_gc_sys_bytes gauge
go_memstats_gc_sys_bytes 1.424992e+06
# HELP go_memstats_heap_alloc_bytes Number of heap bytes allocated and still in use.
# TYPE go_memstats_heap_alloc_bytes gauge
go_memstats_heap_alloc_bytes 250304
# HELP go_memstats_heap_idle_bytes Number of heap bytes waiting to be used.
# TYPE go_memstats_heap_idle_bytes gauge
go_memstats_heap_idle_bytes 1.785856e+06
# HELP go_memstats_heap_inuse_bytes Number of heap bytes that are in use.
# TYPE go_memstats_heap_inuse_bytes gauge
go_memstats_heap_inuse_bytes 1.785856e+06
# HELP go_memstats_heap_objects Number of allocated objects.
# TYPE go_memstats_heap_objects gauge
go_memstats_heap_objects 1090
# HELP go_memstats_heap_released_bytes Number of heap bytes released to OS.
# TYPE go_memstats_heap_released_bytes gauge
go_memstats_heap_released_bytes 1.785856e+06
# HELP go_memstats_heap_sys_bytes Number of heap bytes obtained from system.
# TYPE go_memstats_heap_sys_bytes gauge
go_memstats_heap_sys_bytes 3.571712e+06
# HELP go_memstats_last_gc_time_seconds Number of seconds since 1970 of last garbage collection.
# TYPE go_memstats_last_gc_time_seconds gauge
go_memstats_last_gc_time_seconds 0
# HELP go_memstats_lookups_total Total number of pointer lookups.
# TYPE go_memstats_lookups_total counter
go_memstats_lookups_total 0
```

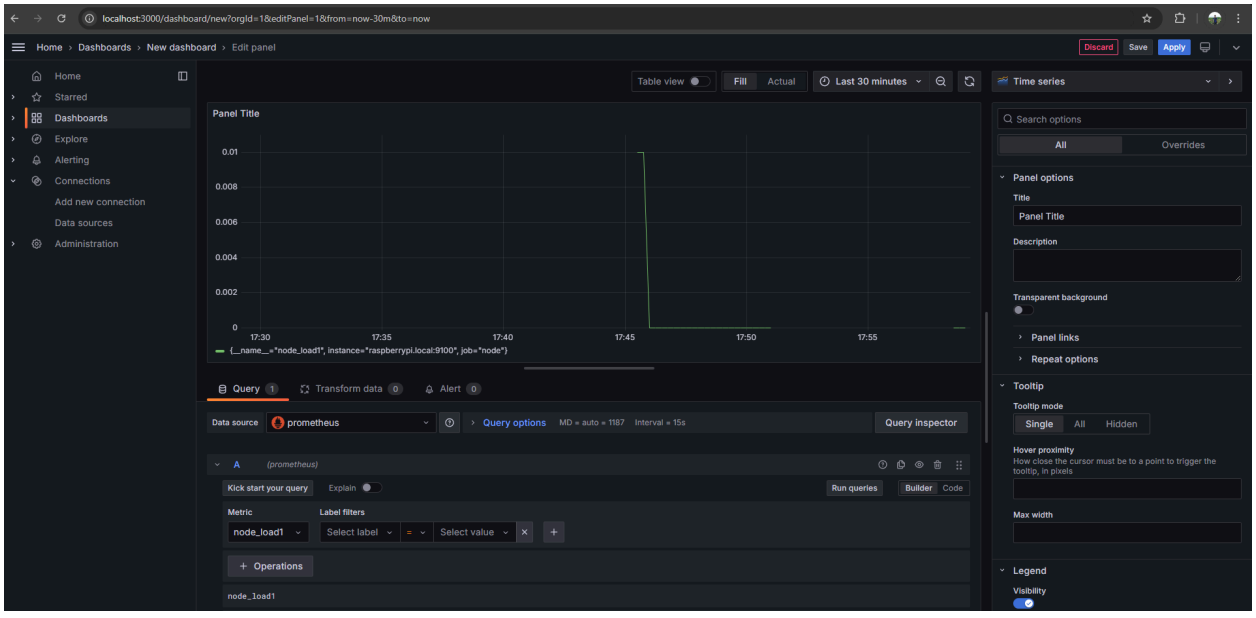
- Pi - Node-exporter



- Local - Prometheus



- Local - Grafana



3. Ans.) Yes, but we should edit prometheus.yml scaping targets to ip-address:port instead of raspberrypi.local:port (might easier to debug) but if we do this manually will take too long time, all local machines and its correspond pi should attach (via ssh or something) to one main machine in that machine have program (can be some kind of run.sh) that will iterates each pi and gather ip-address, scp compose_pi.yml to pi and compose up and also scp compose_local.yml, prometheus.yml to correspond local machine, config ip-address in prometheus.yml and compose up. This program should store run-number of pair of local machine and pi to easily compose up/down specific server (pair of local machine and pi) and also can compose up/down all servers.