Data visualization with the Grafana platform at HZDR

S. E. Müller

FWCC & FWK

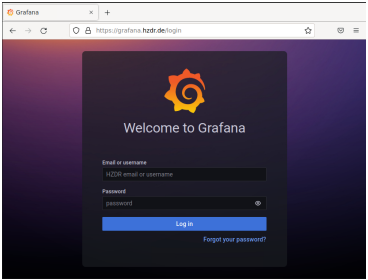
FWK Tutorial,
November 26, 2024

DRESDEN concept

HZDR
HELMHOLTZ ZENTRUM
DRESDEN ROSSENDORF

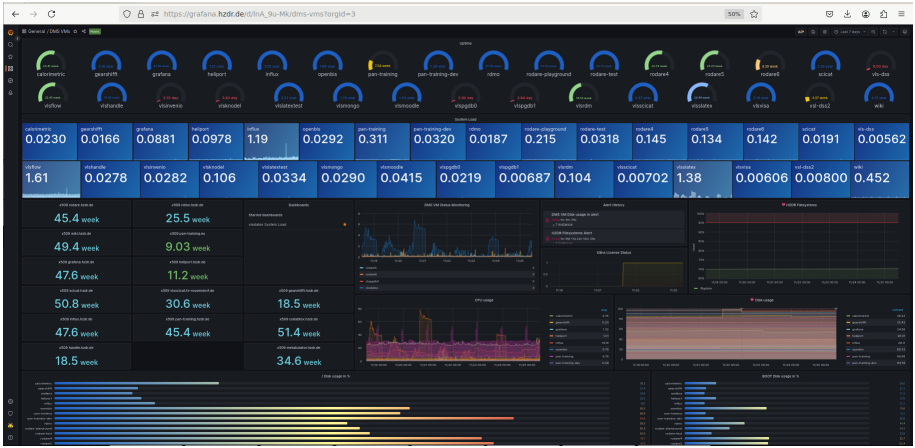
Grafana@HZDR

- **Grafana** is a platform which allows (among other things) to visualize time-series data
  - developed by Grafana Labs
  - `https://grafana.com`
  - `https://github.com/grafana/grafana`
- **HZDR** hosts the Open Source version of **Grafana** under `https://grafana.hzdr.de`
  - interfaced with LDAP (log in with your HZDR account)
  - accessible from inside HZDR (behind the firewall)



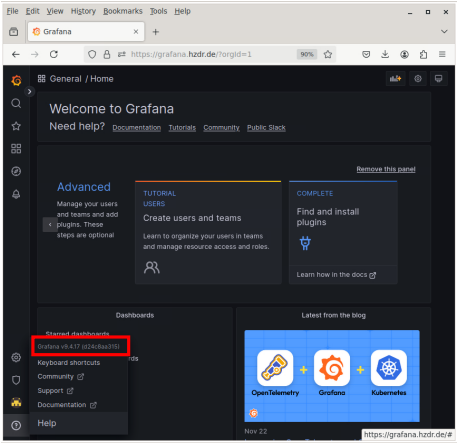
Grafana@HZDR

- **Grafana** was originally introduced by Oliver Knodel in order to monitor virtual servers of the FWCC-RDM-group:



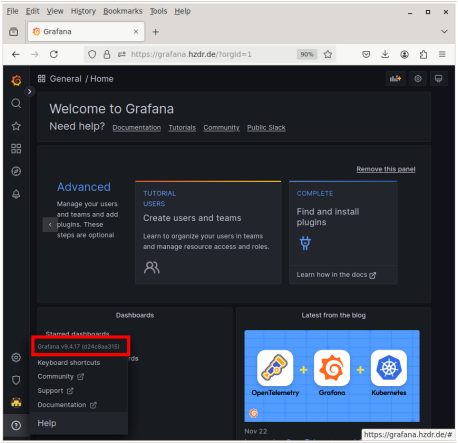
Grafana@HZDR

- Currently, we are running version 9.4.17:



Grafana@HZDR

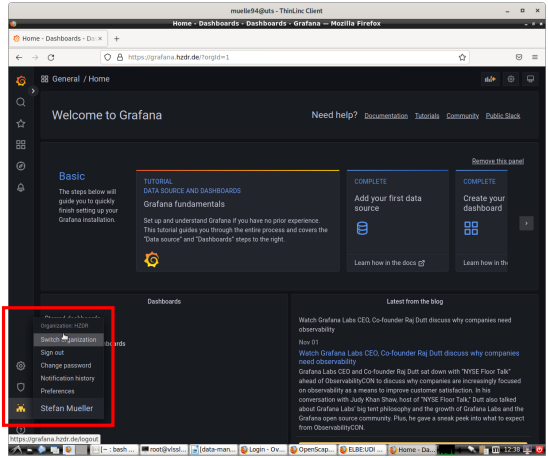
- Currently, we are running version 9.4.17:



- Latest **Grafana** version is 11.3
  - need to understand breaking changes before updating

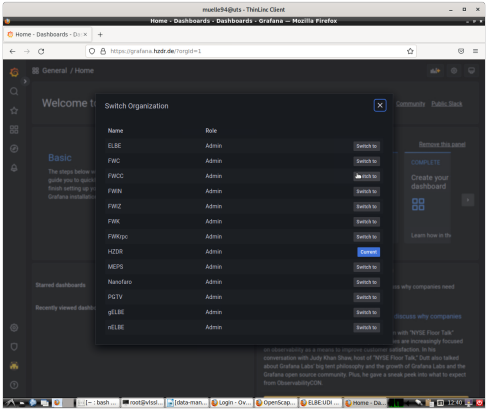
Organizations

In **Grafana**, users are grouped in “*Organizations*”. New users are automatically added to the *Organization* “HZDR”. *Organization* admins can add users to their *Organization*. Switching *Organizations* is done by clicking on the User icon in the lower left and choosing “Switch Organization”:



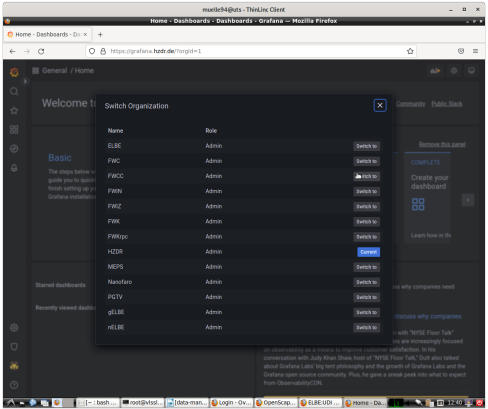
Organizations

In **Grafana**, users are grouped in “*Organizations*”. New users are automatically added to the *Organization* “HZDR”. *Organization* admins can add users to their *Organization*. Switching *Organizations* is done by clicking on the User icon in the lower left and choosing “Switch Organization”:



Organizations

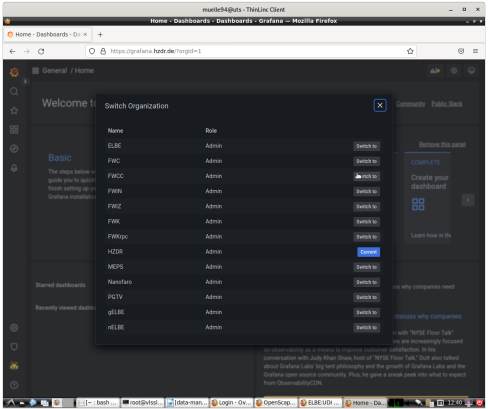
In **Grafana**, users are grouped in “*Organizations*”. New users are automatically added to the *Organization* “HZDR”. *Organization* admins can add users to their *Organization*. Switching *Organizations* is done by clicking on the User icon in the lower left and choosing “Switch Organization”:



If you need a new organization to be set up for you, contact
Oliver Knodel or Stefan Müller

Organizations

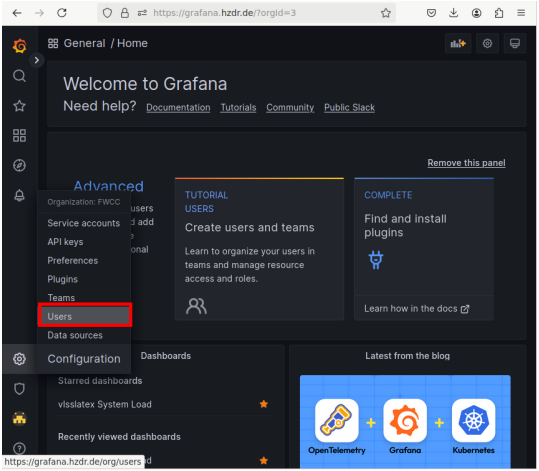
In **Grafana**, users are grouped in “*Organizations*”. New users are automatically added to the *Organization* “HZDR”. *Organization* admins can add users to their *Organization*. Switching *Organizations* is done by clicking on the User icon in the lower left and choosing “Switch Organization”:



Grafana now also allows to group a set of users with the same permission sets into **Teams** within organizations.

How-To: Adding users to organizations

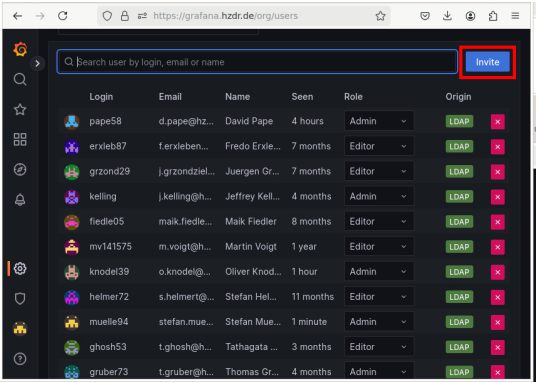
Organization admins can add new users to their organization:



Select **Users** from the **Configuration** menu in the lower left.

How-To: Adding users to organizations

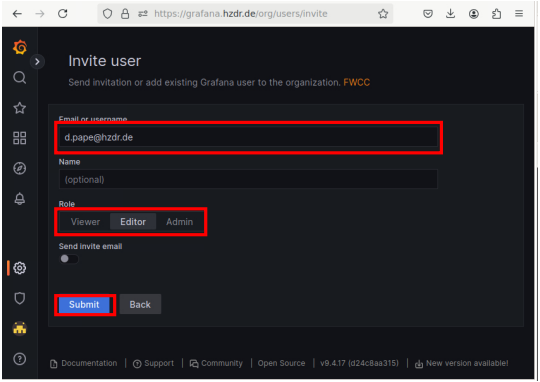
Organization admins can add new users to their organization:



Click the **Invite** button (email field can be left blank).

How-To: Adding users to organizations

Organization admins can add new users to their organization:



Insert the email-address or HZDR username, chose a role and click the **Submit** button (switch off “Send invite email”).

- User needs to be registered in **Grafana**’s user list - needs to login before

Where is the data?

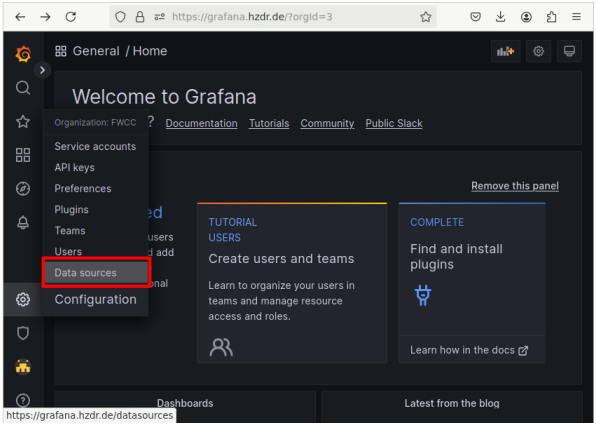
Grafana only displays the data, but does not store it. Most of the displayed data resides on a virtual machine hosting a **InfluxDB** time-series database.

- **InfluxDB** provides an efficient data transfer to **Grafana**
- Data can be pushed to the database using
  - Python scripts
  - LabView VIs
  - c++
  - Telegraf agent
  - ...
- API is provided
- Installed on a virtual machine in the computing center (v1.8.10 version)
  - v2.7.4 used exclusively by ELBE - concepts are different, not sure about scalability
- InfluxDB key concepts are nicely explained **here** (v.1.8)
- InfluxDB databases can be connected as *"data sources"* in **Grafana** to feed your dashboards

Please contact Oliver Knodel or Stefan Müller if you would like to store data in our **InfluxDB**.

How-To: Add a data source

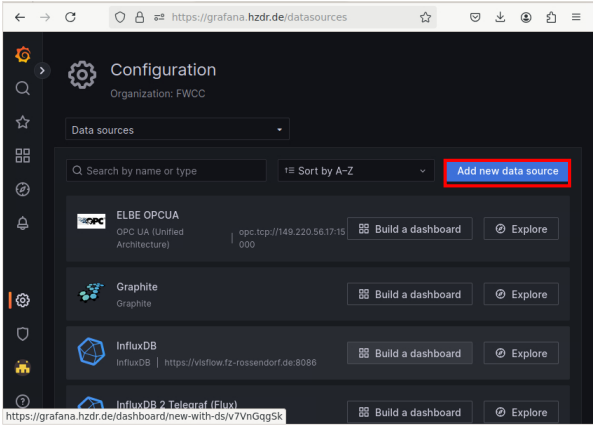
Data sources can be added on a “per organization” level by organization admins:



Select **Data sources** from the **Configuration** menu in the lower left.

How-To: Add a data source

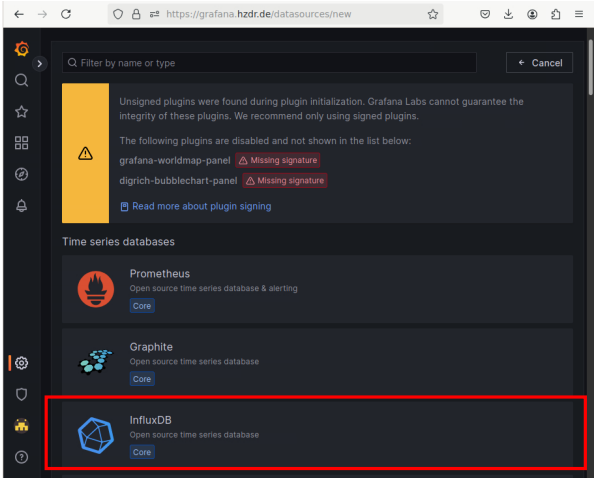
Data sources can be added on a “per organization” level by organization admins:



Click **Add new data source**.

How-To: Add a data source

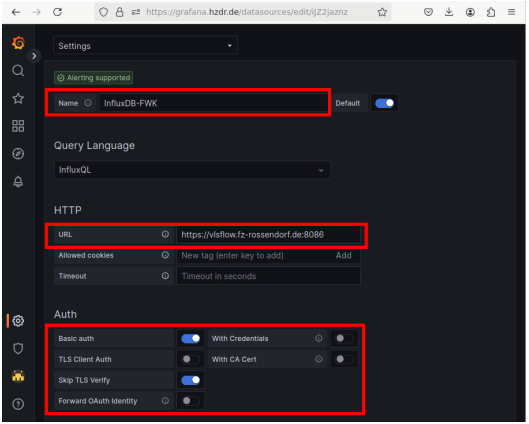
Data sources can be added on a “per organization” level by organization admins:



Select **InfluxDB**.

How-To: Add a data source

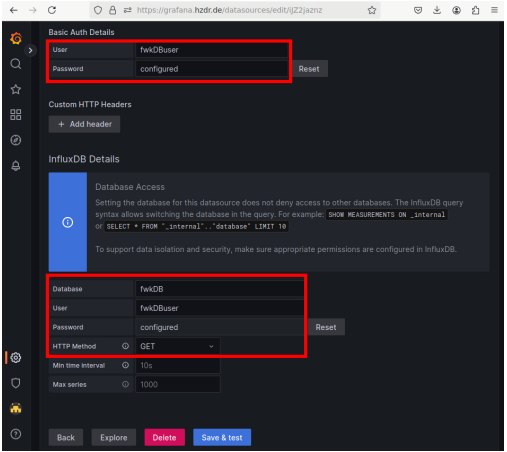
Data sources can be added on a “per organization” level by organization admins:



Specify a name, give the URL `https://vlsflow.fz-rossendorf.de:8086`, and select **Basic Auth** and **Skip TLS verify**.

How-To: Add a data source

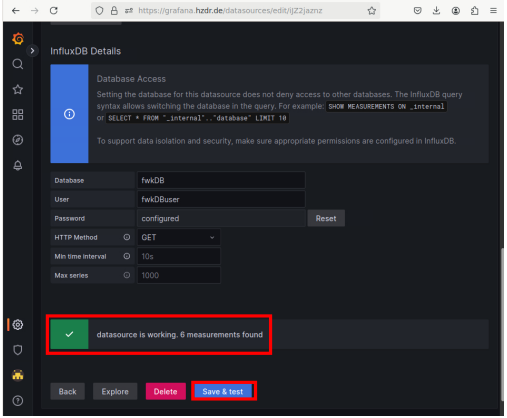
Data sources can be added on a “per organization” level by organization admins:



Give username and password for your **InfluxDB** access (twice!), and the name of your database in **InfluxDB**.

How-To: Add a data source

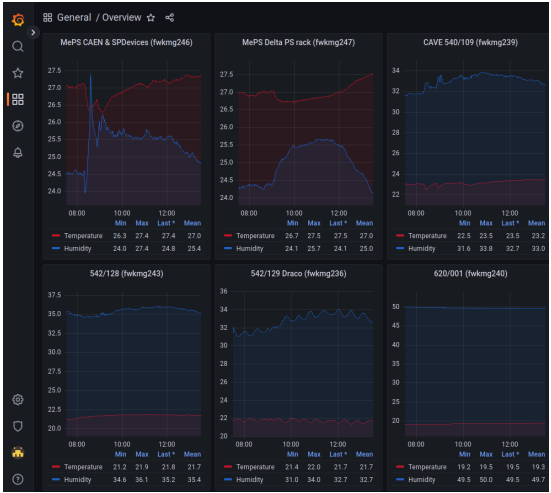
Data sources can be added on a “per organization” level by organization admins:



Click **Save & test**. You should get a message whether the connection to the database is working.

Dashboards - examples

Grafana displays data on dashboards which consist of several panels:



Humidity and temperature logging by FWK

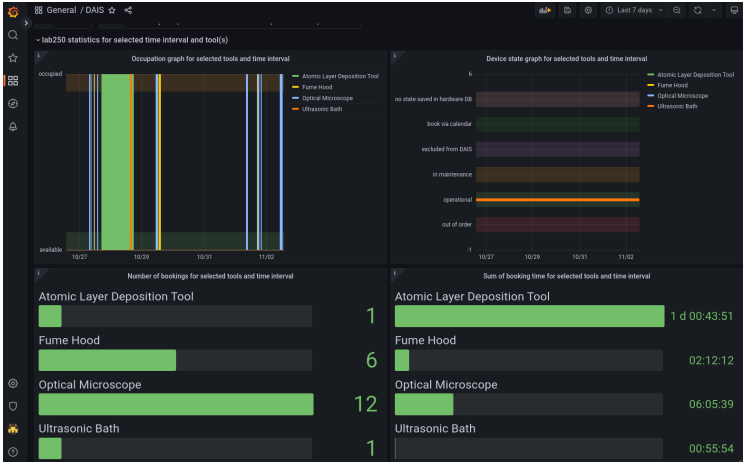
Dashboards - examples

Grafana displays data on dashboards which consist of several panels:

Cryocompressor logging by K. Lenz (FWIN)

Dashboards - examples

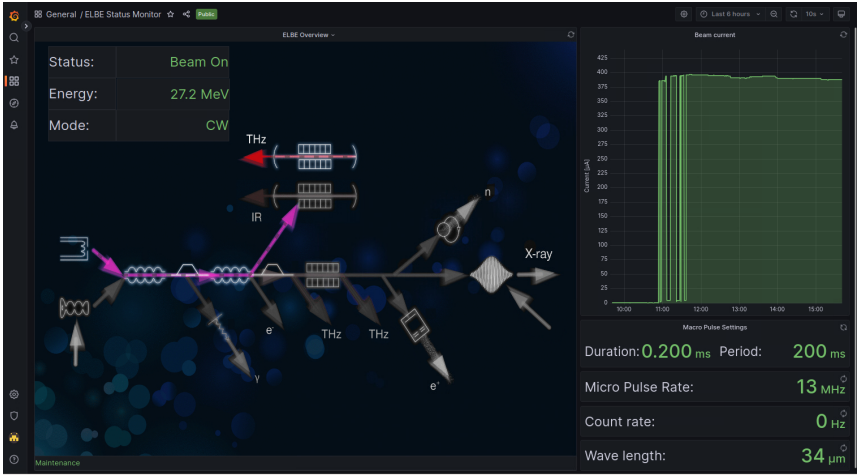
Grafana displays data on dashboards which consist of several panels:



Device Activity Information System (DAIS) dashboard by T. Schönherr (FWIO)

Dashboards - examples

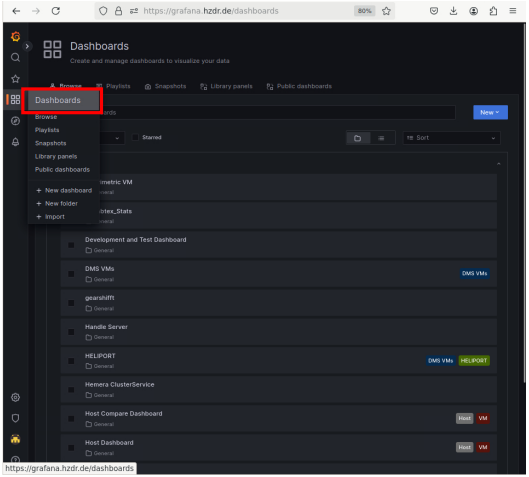
Grafana displays data on dashboards which consist of several panels:



ELBE Status Monitor dashboard by K. Zenker (FWKE)

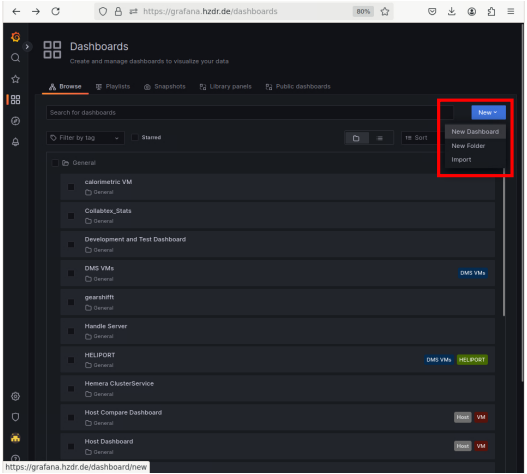
How-To: Set up a dashboard

Click the **Dashboards**-symbol to go to the *Dashboard*-menu:



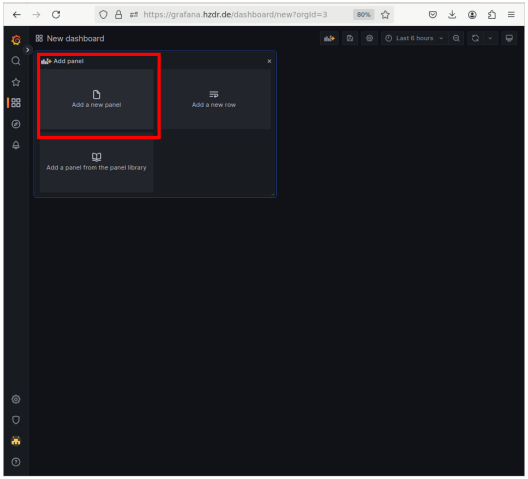
How-To: Set up a dashboard

Click the **New**-symbol and select *New dashboard*:



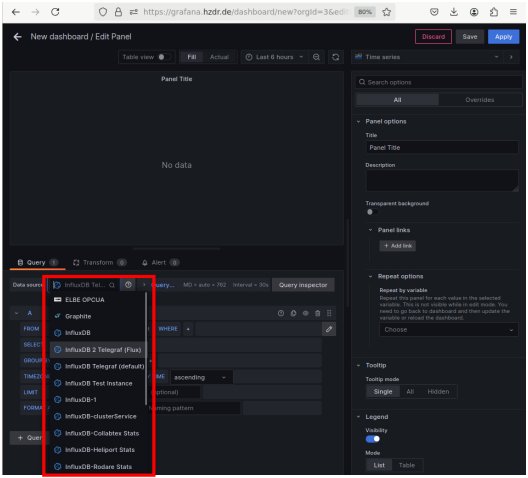
How-To: Set up a dashboard

Select *Add a new panel*:



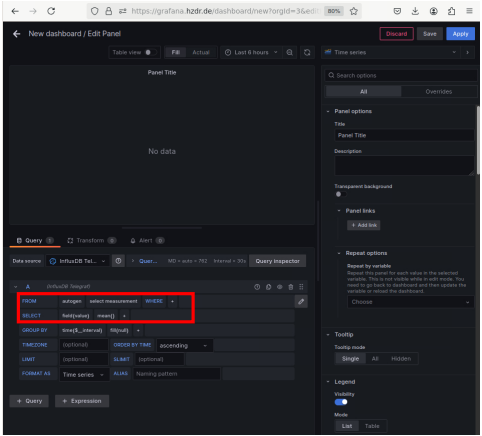
How-To: Set up a dashboard

Choose your data source:



How-To: Set up a dashboard

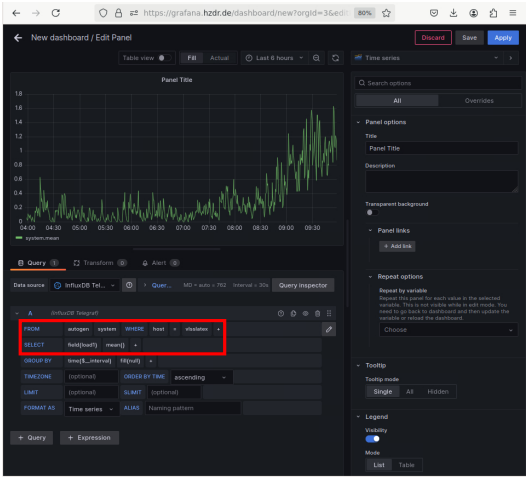
Configure your “*FROM*” and “*SELECT*” fields by clicking on them (does not work if data-source is configured with **InfluxDB**’s “*FLUX*” language):



- “*field(value)*” is a placeholder - if you have a field called “value” in your measurement, you have to explicitely select it
- “*$_interval*” is a default variable optimizing the graph layout

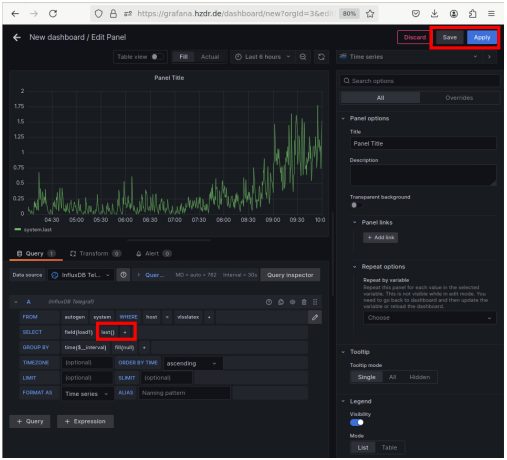
How-To: Set up a dashboard

Result:



How-To: Set up a dashboard

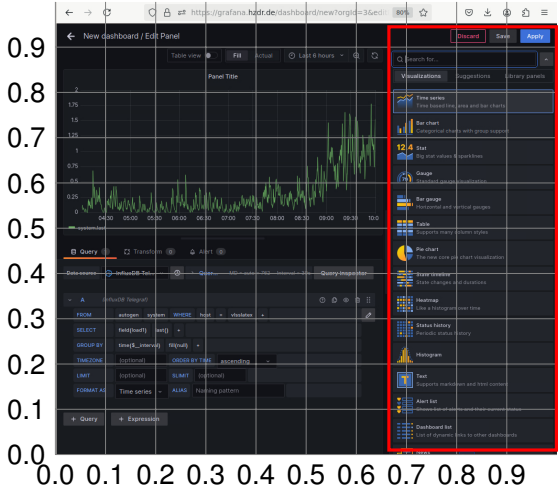
Other than “*mean()*”, many different aggregation states can be selected, often “*last()*“ is useful:



Click “*Apply*” to apply the changes to your dashboard, and “*Save*” to save it

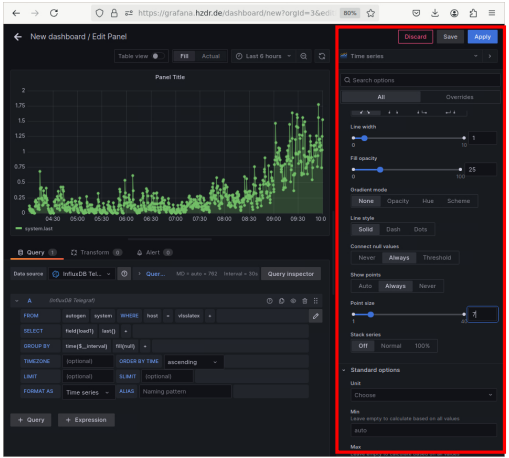
How-To: Set up a dashboard

Other than “*Time series*”, many different visualization modes can be chosen:



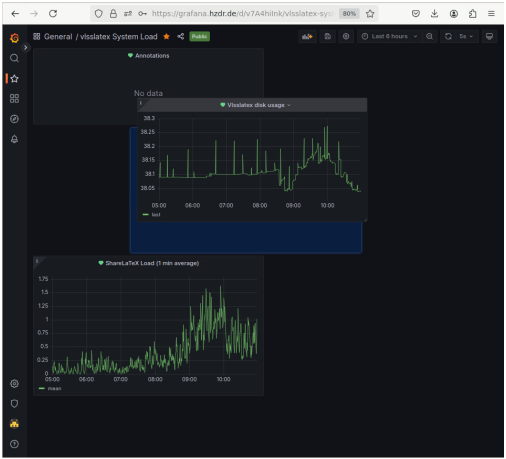
How-To: Set up a dashboard

And many things to configure for the panel:



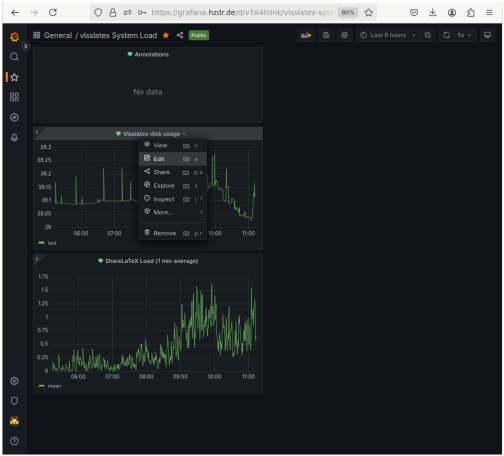
How-To: Set up a dashboard

Add more panels to the dashboard, grab with mouse to arrange:



How-To: Set up a dashboard

Dashboards can be edited by clicking next to the title:

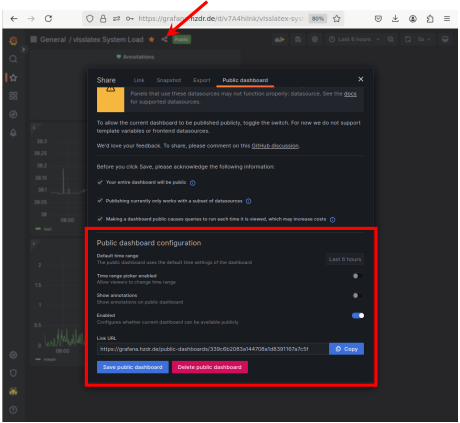


Public dashboards

Dashboards can be made public so that users can access them without logging in:

- currently only from inside HZDR (Firewall)
- not possible for all kinds of dashboards

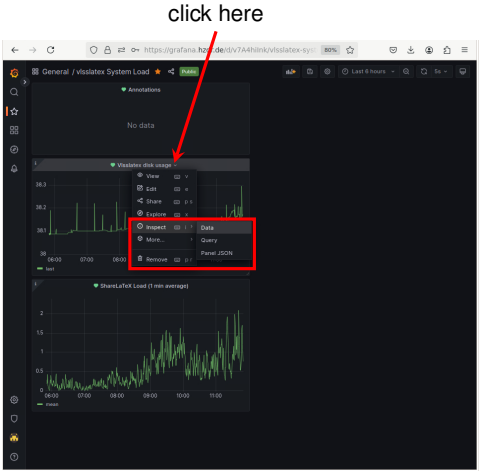
click here



Refresh time and time range are taken from default values of original dashboard.

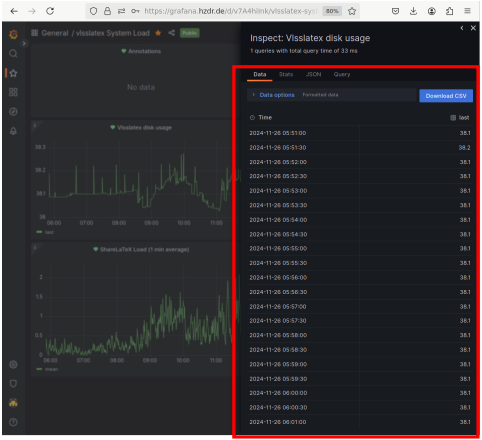
Extracting data from dashboards

Data can be extracted from dashboards as csv-file:



Extracting data from dashboards

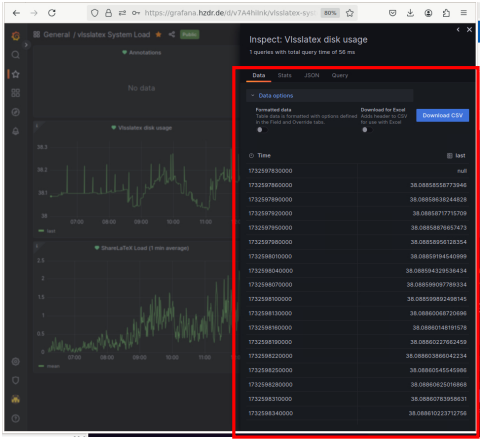
Data can be extracted from dashboards as csv-file:



Click “*Download CSV*” to obtain the file.

Extracting data from dashboards

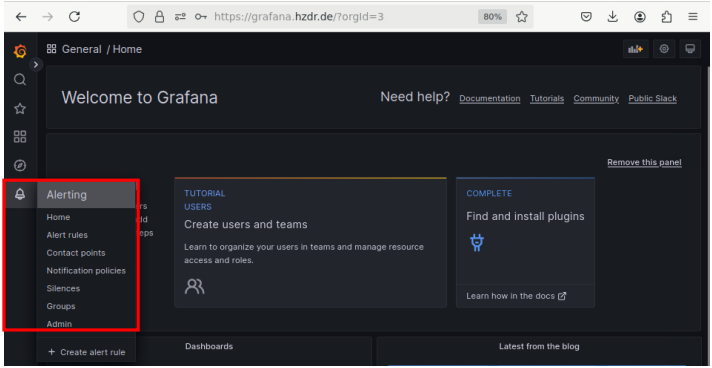
Data can be extracted from dashboards as csv-file:



Data format can be changed.

Alerts

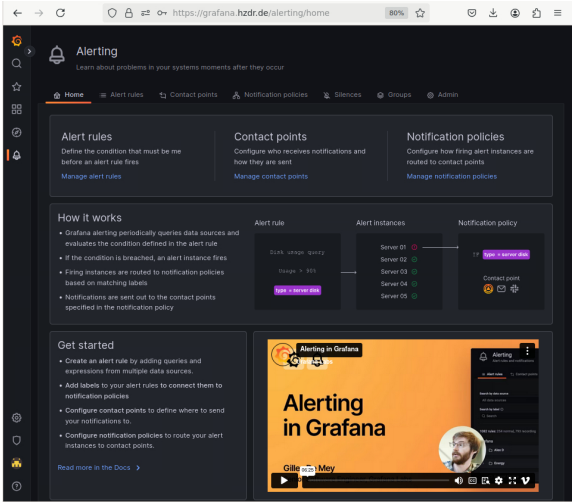
Grafana allows to set up alert rules - upon certain conditions, a notification is sent to a contact point.



Click the **Alerting**-symbol to go to the *Alerting*-menu

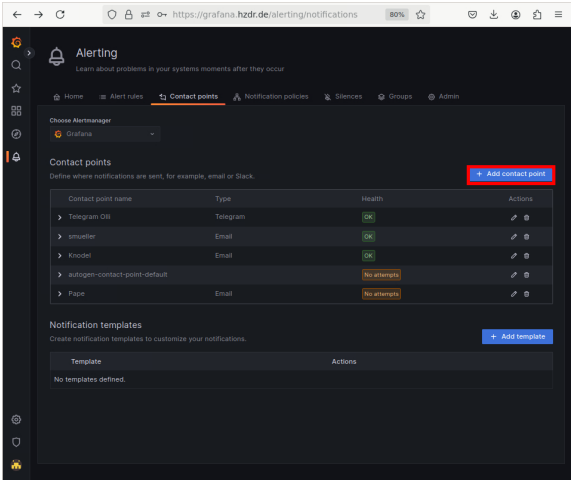
Alerts

Grafana allows to set up alert rules - upon certain conditions, a notification is sent to a contact point.



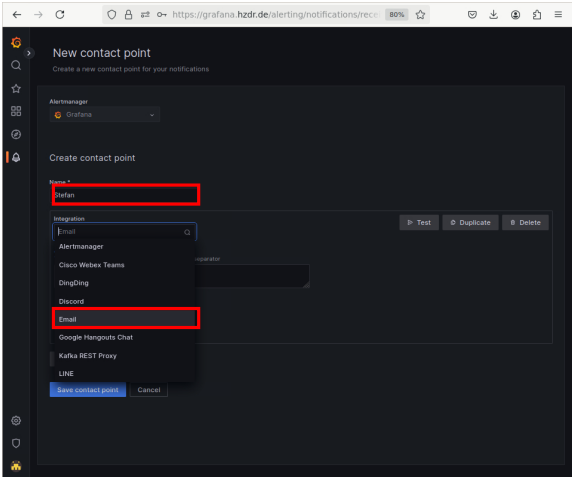
How-To: Define a contact point

Go to the *Contact points* panel and click *“+Add contact point”*:



How-To: Define a contact point

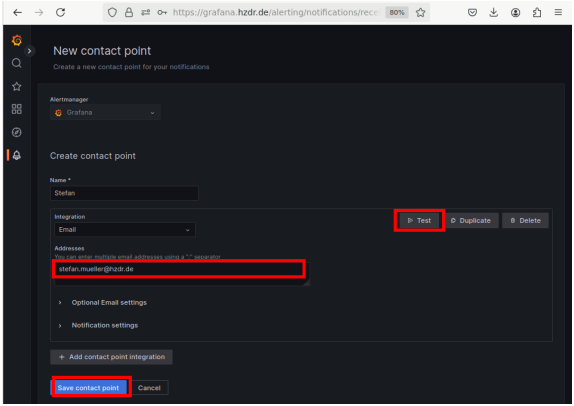
Go to the *Contact points* panel and click *“+Add contact point”*:



Give a name, and select “*Email*” from the many options in the list.

How-To: Define a contact point

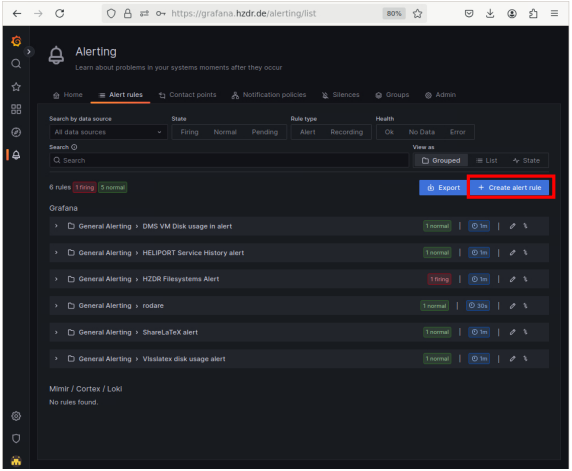
Go to the *Contact points* panel and click *“+Add contact point”*:



Give email address(es), eventually click “`Test`”, and then “*Save contact point*”.

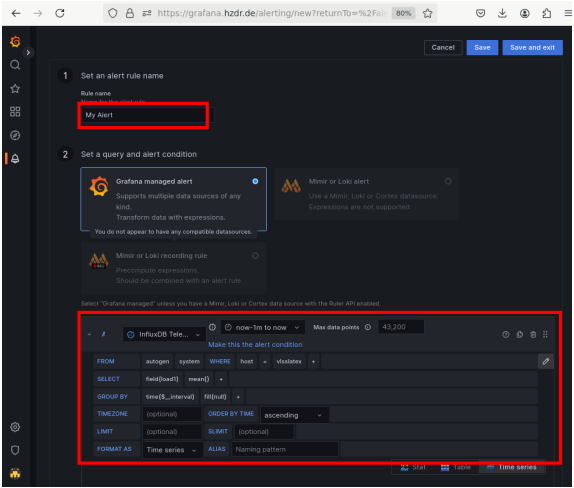
How-To: Create an alert rule

Go to the “*Alert rules*” panel and click *“+Create alert rule”*:



How-To: Create an alert rule

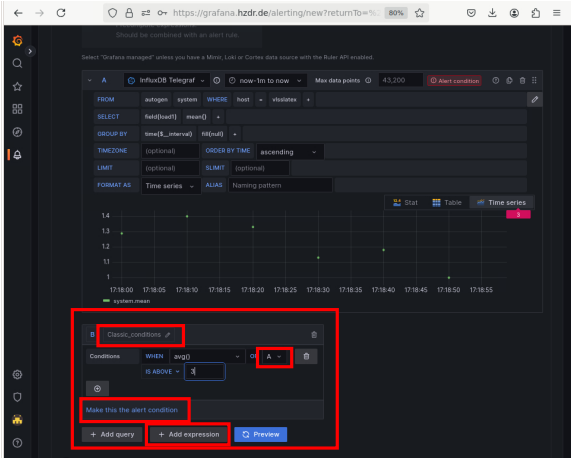
Go to the “*Alert rules*” panel and click *“+Create alert rule”*:



Name the alert and define query(ies) for variable(s).

How-To: Create an alert rule

Go to the “*Alert rules*” panel and click *“+Create alert rule”*:

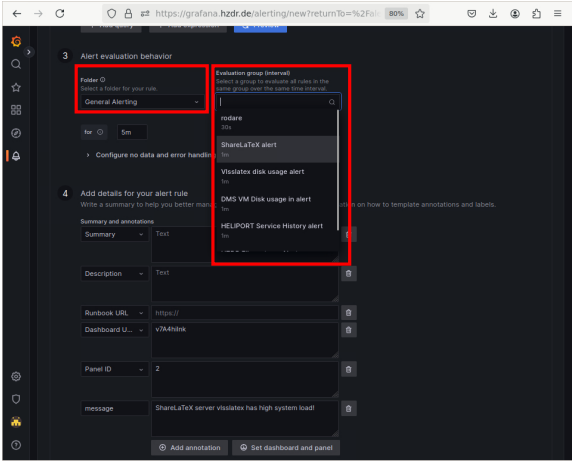


Add an expression, switch it to “`Classical expression`” and apply it to query **A**.

- Click “*Make this the alert condition*”

How-To: Create an alert rule

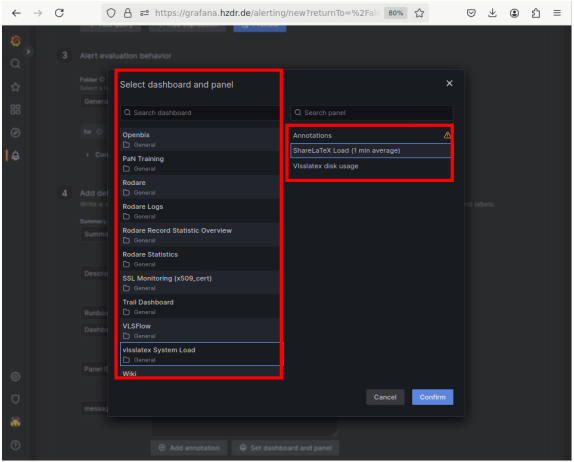
Go to the “*Alert rules*” panel and click *“+Create alert rule”*:



Choose a folder for the rule, and select group with defined time interval.

How-To: Create an alert rule

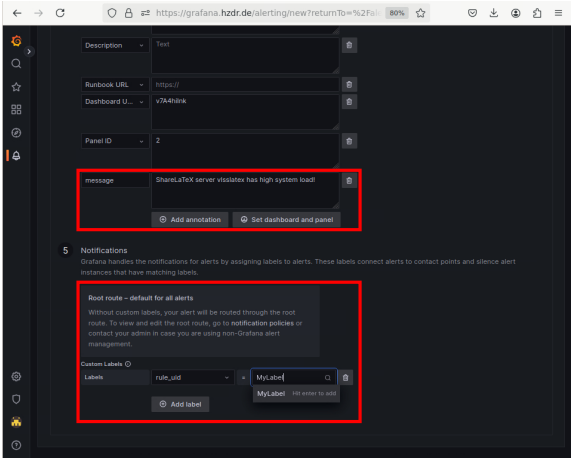
Go to the “*Alert rules*” panel and click *“+Create alert rule”*:



Select the dashboard and the corresponding dashboard panel.

How-To: Create an alert rule

Go to the “*Alert rules*” panel and click *“+Create alert rule”*:

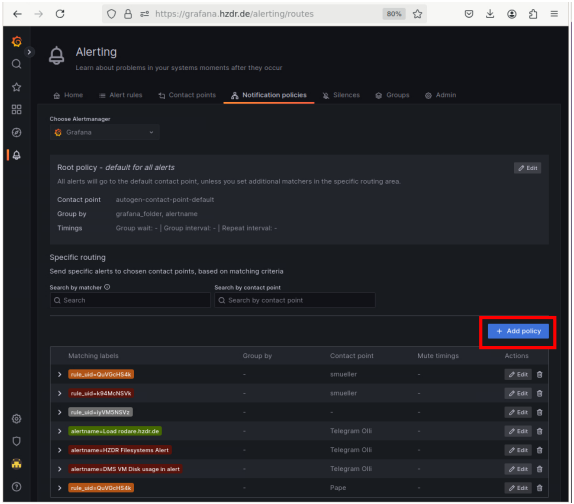


Add an annotation as “*message*”, and define a custom label.

- The alert rule is now created, next we need to define the notification policy

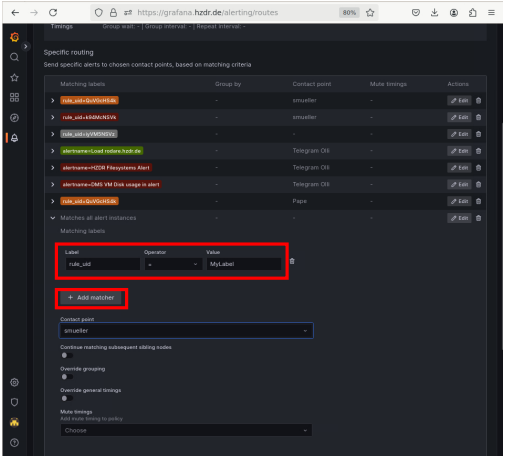
How-To: Create a notification policy

Go to the “*Notification policy*” panel and click *“+Add policy”*:



How-To: Create a notification policy

Go to the “*Notification policy*” panel and click *“+Add policy”*:

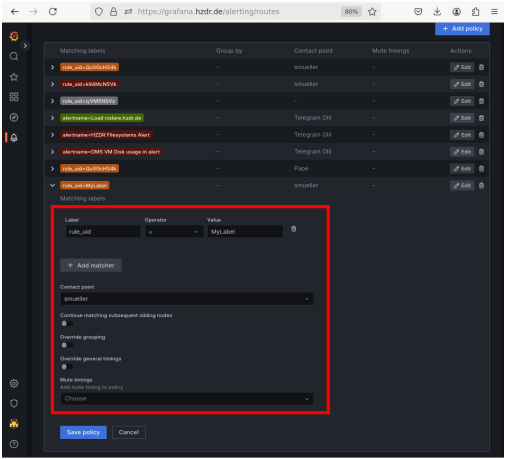


Select previously defined contact point, and click on ”*+Add matcher*”

- match to previously defined label

How-To: Create a notification policy

Go to the “*Notification policy*” panel and click *“+Add policy”*:



After clicking on “*Submit policy*”, our new policy is now visible in the list of policies.

- and should be active now

Summary:

- The **Grafana** platform is an established tool to visualize data in your browser (mostly time-based data)
  - Ideal for “Slow-Control”-data used for monitoring environmental conditions, device status, etc.
- **HZDR** hosts the Open Source version of **Grafana** at `https://grafana.hzdr.de`
  - Currently v9.4.17
- The corresponding data can be conveniently stored in **HZDR**’s **InfluxDB** time-series database
  - Please contact **Oliver Knodel** (o.knodel@hzdr.de) or **Stefan Müller** (stefan.mueller@hzdr.de) for more information on using the **InfluxDB** at **HZDR**
- I gave a brief introduction to
  - **Organizations** in **Grafana** and how to add users
  - **Datasources** and how to add them
  - **Dashboards** and how to set up a simple dashboards, make it public and extract its data
  - **Alerts** and how to set them up (Uff!)
- How to go continue from here?