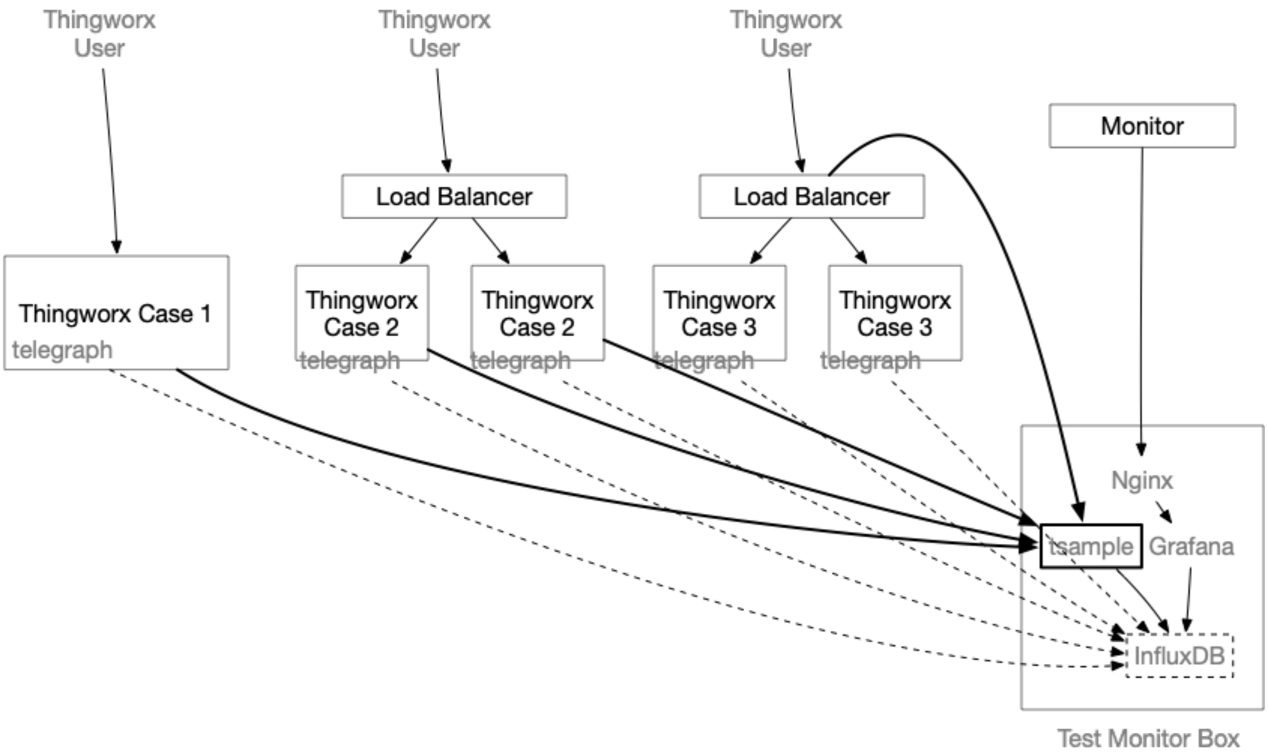
Installation and configuration guide for Thingworx monitoring

Background

`tsample` is small, customized tool which plays similar role to `telegraph`. Its focus is on gethering Thingworx performance metrics. Historically, this tool also supports collecting OS level performance metrics but it's highly recommended to collect OS level performance metrics by using `telegraph`.

Recommanded deployment architecture



`tsample` can be deployed in the same box where Thingworx tomcat is running, but it's recommended to deploy it on a seperated box to minimize any performance impact caused by the collector.

`tsample` supports export to `InfluxDB` and/or local file. In this document, it is assumed that `InfluxDB` will be used for monitoring purpose. Please note that this is not the same instance of InfluxDB being used by Thingworx (if configured).

Supported Platform

`tsample` supports and has been tested on `windows 2016`, `MacOS 10.15`, `Ubuntu 16.04` and `Redhat 7.x`. It's anticipated to work on more general Ubuntu/Redhat/Mac/Windows release.

In case you need a build to run on Resperry PI, please let me know.

Notice

This tool was built before the author knows `telegraph` and therefore it includes the capability to collect basic OS level performance metrics such as CPU usage, Memory usage and Disk usage. However, it's strongly recommended to use `telegraph` to do so.

this document will focus on explaining how to use it to collect Thingworx metrics.

Configuration File

Where to store configuration file

`tsample` will pickup configuration file in following sequence:

- from command line

  ```
  ./tsample -c <path to configuration file>
  ```

- from environment

  Linux:

  ```
  export TSAMPLE_CONFIG=<path to configuration file>
  ./tsample
  ```

  Windows:

  ```
  set TSAMPLE_CONFIG=<path configuration file>
  tsample.exe
  ```

- from default location

  `tsample` will try to find a file with name `config.toml` from same folder in which it starts.

How to craft a configuration file

You can use following command to generate a sample file:

```
./tsample -c config.toml -e
```

or:

```
./tsample -c config.toml --export
```

A file with name `config.toml` will be generated with configuration sample. You can then adjust its content with following guide.

Configuration file content

Format

Configuration file must be in `toml` format

`title` and `owner` section

Both sections are optional. The intention of these two sections is support doc tool in future.

`TestMachine` section

This is sectin is required and it defines where this tool will run.

Name	Note
testid	Indicates the machine where this tool is running.
sampling_cycle_inseconds	Indicates the interval time of performance metrics sampling – typically 30, 20 or 10 seconds. Default value is 30 seconds, if not included. Values less than 10 seconds or greater than 60 seconds are not recommended.
sampling_timeout_inseconds	Indicates the timeout for RESTful calls to ThingWorx. Default value is 10 seconds if not included. It's recommended to set this value between 10 and `sampling_cycle_inseconds`.
testmachine.onetime_sampling	(Optional) Recommend leaving it at default.
testmachine.repeat_sampling	(Optional) and you can just change each metric to `false`; Recommend using telegraph to get OS level metrics. This feature will be removed in the next release, only remaining in the current release for code stability purposes.

`thingworx_servers` section

This section is where you define targeted thingworx applications. Multiple Thingworx servers can be defined with same or different metrics to be collected.

Name	Note
alias	It’s optional, but strongly recommended, that you give it a meaningful name. It would be a tag value in InfluxDB. A meaningful value will help you to define the performance dashboard more easily.
host and port	Indicates where ThingWorx server is running. In case `alias` is missed, then a combination of host and port will be used to distinguish the metrics result in InfluxDB as a tag value.
protocol	Choice of `https` and `http`. It should be the protocol used by the targeted ThingWorx application
application	Should always be `Thingworx` – changing this is not supported
app-key	A valid `appKey` in ThingWorx, the associated user should have enough permission to access the performance metrics.

`thingworx_servers.metrics` sections

Underneath each `thingworx_servers` section, there would be many metrics. In default example, following metics have been included:

- ValueStreamProcessingSubsystem
- DataTableProcessingSubsystem
- EventProcessingSubsystem
- PlatformSubsystem
- StreamProcessingSubsystem
- WSCommunicationsSubsystem
- WSExecutionProcessingSubsystem
- TunnelSubsystem
- AlertProcessingSubsystem
- FederationSubsystem

You can add your customized metrics, as long as the result follows same data shape. The default data shape has 3 columns:

Column Name	Note
name	STRING type
description	STRING type
value	INTEGER or LONG, but this tool can accept `NUMBER` (64bit float) as well.

If the output Data Shape exceeds above limitation, the tool will likely not work properly.

Name	Note
url	Required - end point of RESTful API for each performance metric
split_desc_asprefix	Required - set to true
name	The measurement name in InfluxDB(or file name if result is exported to local file).
enabled	Required - set to `true` or `false`. Use to easily control which metrics will be collected with minimal configuration changes
options	Optional - Control which metrics are collected from this subsystem, instread of all. Example: `["totalWritesQueued", "totalWritesPerformed","queueSize"]`

`result_export_to_db` section

This section defines target `InfluxDB` as a sink of collected performance metrics.

Name	Note
using_udp	Deprecated - please keep set to false. Will be removed in next release as udp will not be supported going forward
server_name	Name (or IP Address) of InfluxDB.
port	Port for InfluxDB to communicate in HTTP protocol. It's typically 8086
database	Where your collected metrics will be stored.
enabled	Set to `true` if you want to use InfluxDB as the storage. Otherwise, it should be `false`.

`result_export_to_file` section

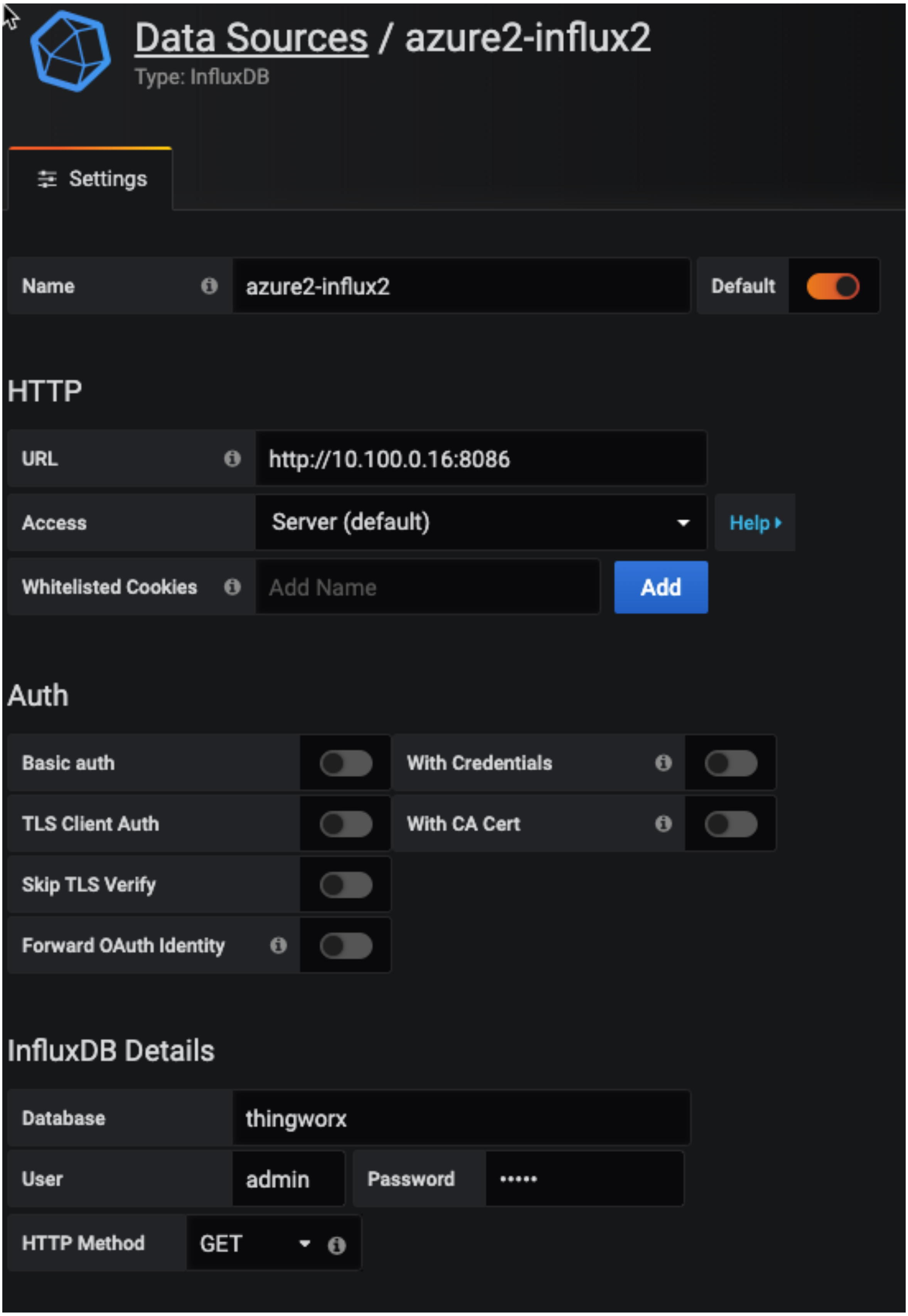
This section defines target file storage for collected performance metrics.

Name	Note
folder_name	Desired location for performance metrics file to be stored.
auto_create_folder	If the folder does not exist, then it will be automatically created if this is set to true
enabled	Set to `true` if you want to use a local file for storage. Otherwise set to `false`.

Grafana configuration example

Monitor Value Stream

Step 1, Connect your grafana to InfluxDB



Data Sources / azure2-influx2

Type: InfluxDB

Settings

Name: azure2-influx2

Default: ●

HTTP

URL: http://10.100.0.16:8086

Access: Server (default)

Whitelisted Cookies: Add Name

Auth

Basic auth: ○

With Credentials: ○

TLS Client Auth: ○

With CA Cert: ○

Skip TLS Verify: ○

Forward OAuth Identity: ○

InfluxDB Details

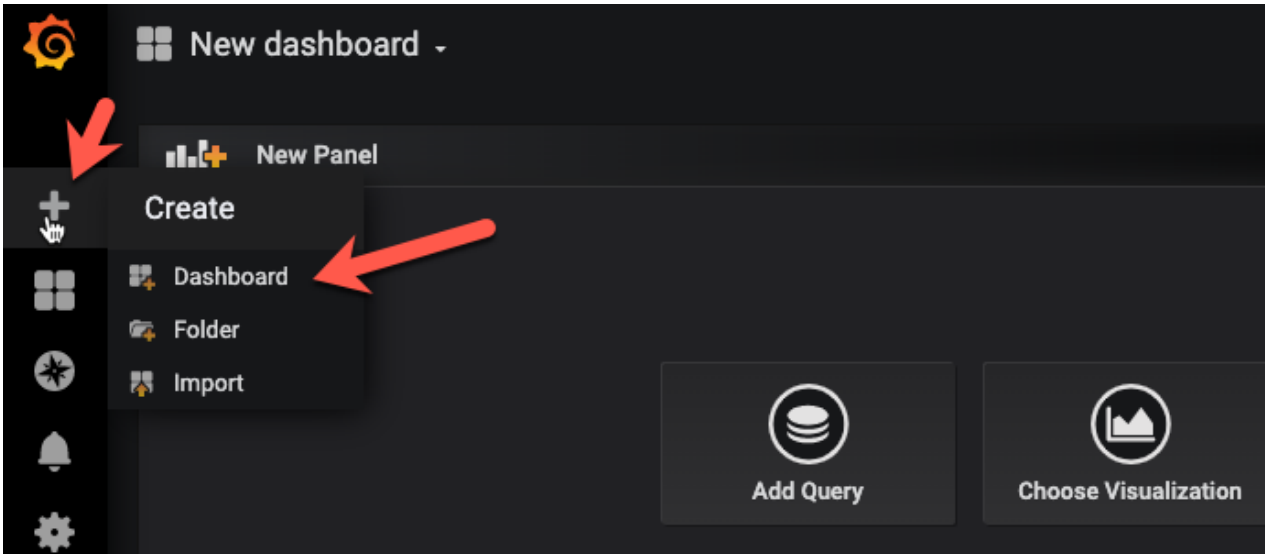
Database: thingworx

User: admin

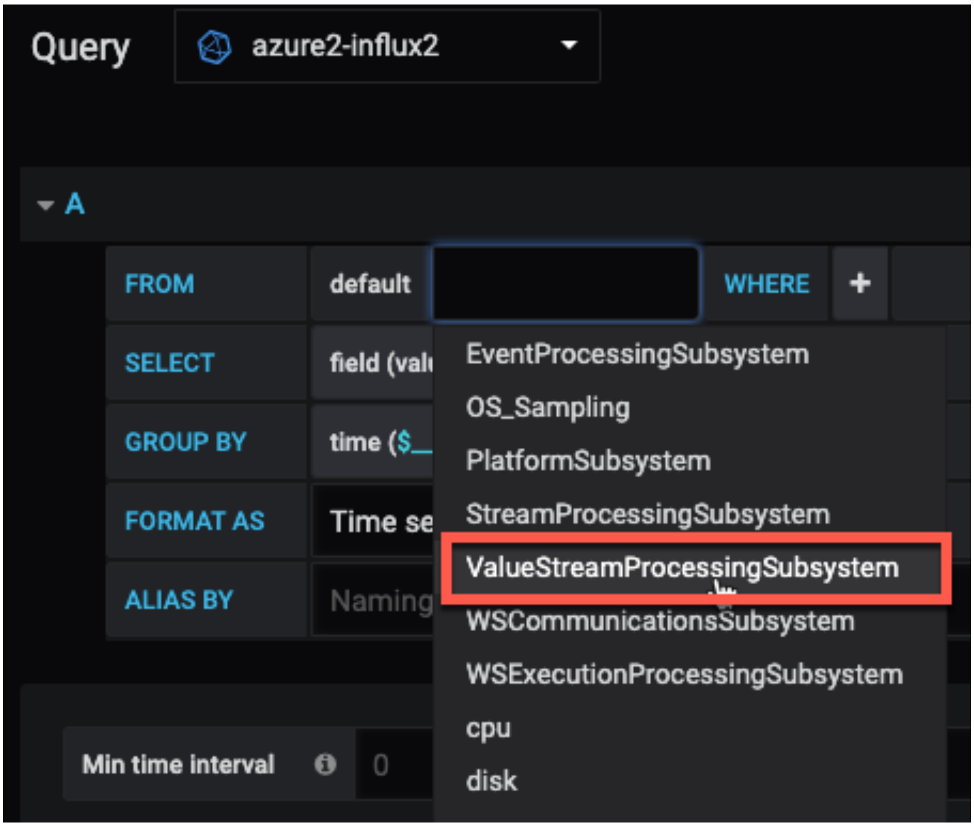
Password: •••••

HTTP Method: GET

Step 2, create a new dashboard and then new query



Step 3, A new query


Query azure2-influx2

A

FROM default | WHERE +

SELECT field (val

GROUP BY time ($_

FORMAT AS Time se

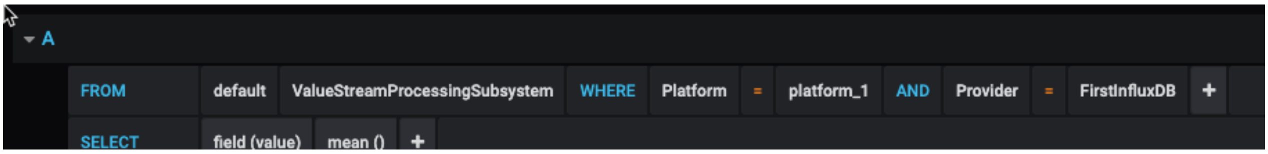
ALIAS BY Naming

Min time interval 0

EventProcessingSubsystem
OS_Sampling
PlatformSubsystem
StreamProcessingSubsystem
ValueStreamProcessingSubsystem
WSCommunicationsSubsystem
WSExecutionProcessingSubsystem
cpu
disk

Depending on which metrics you defined to collect in the `tsample` configuration file, you would see a different choice of measurement in Grafana. Here, we will use `ValueStreamProcessingSubsystem` as an example.

Step 4, Choose right platform and provider

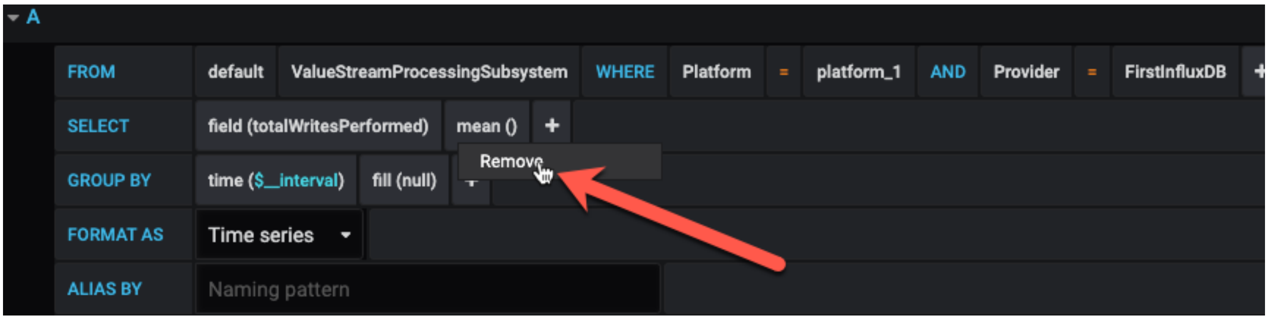

A

FROM default ValueStreamProcessingSubsystem WHERE Platform = platform_1 AND Provider = FirstInfluxDB +

SELECT field (value) mean () +

Some metrics is depending on database storage provider, like: value stream and stream.

Step 5, Choose metrics figures



A

FROM default ValueStreamProcessingSubsystem WHERE Platform = platform_1 AND Provider = FirstInfluxDB

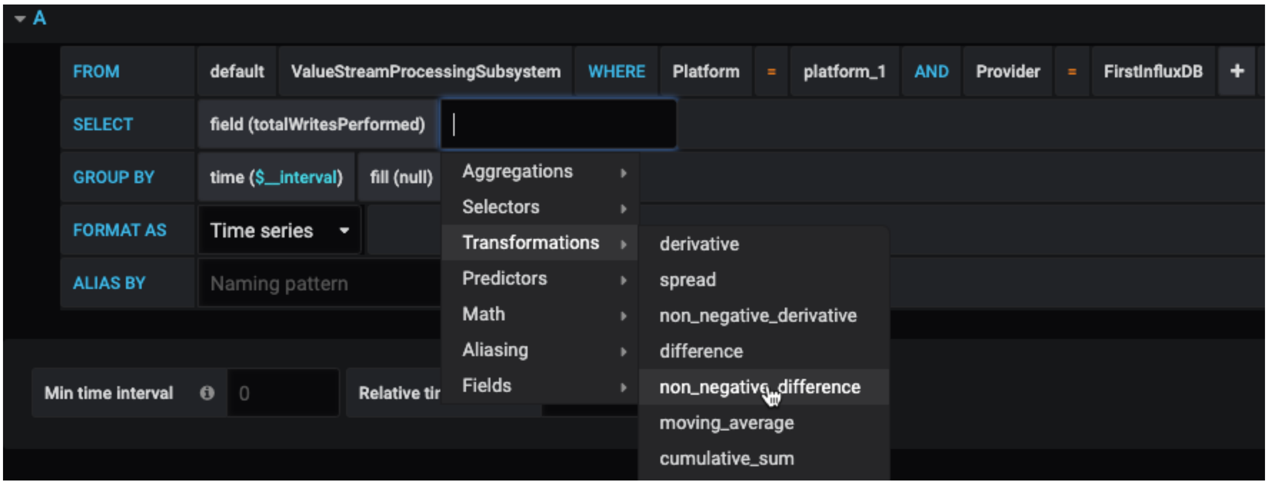
SELECT field (totalWritesPerformed) mean ()

GROUP BY time ($__interval) fill (null)

FORMAT AS Time series

ALIAS BY Naming pattern

select "remove" to get rid of the default 'mean' calculation.



A

FROM default ValueStreamProcessingSubsystem WHERE Platform = platform_1 AND Provider = FirstInfluxDB

SELECT field (totalWritesPerformed)

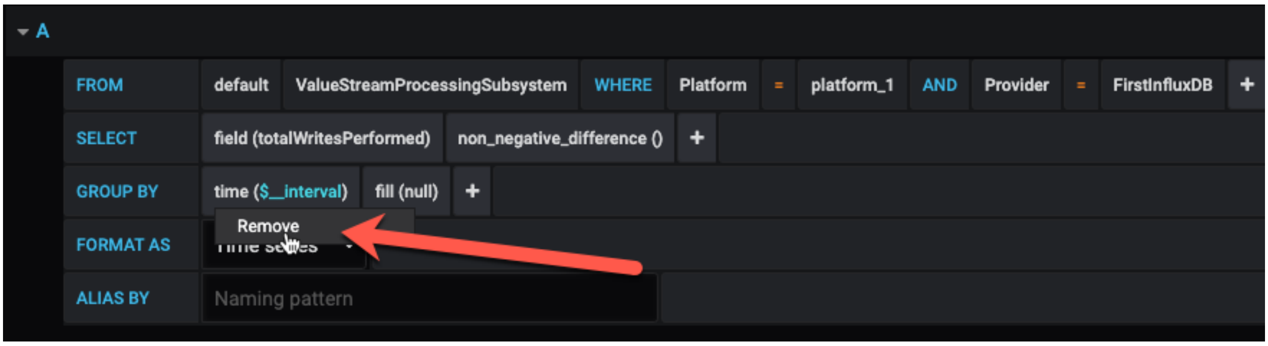
GROUP BY time ($__interval) fill (null)

FORMAT AS Time series

ALIAS BY Naming pattern

Min time interval 0 Relative tir

select `non_negative_difference` from `Transformations`. Using this transformation, Grafana can show us the speed of writes.



A

FROM default ValueStreamProcessingSubsystem WHERE Platform = platform_1 AND Provider = FirstInfluxDB

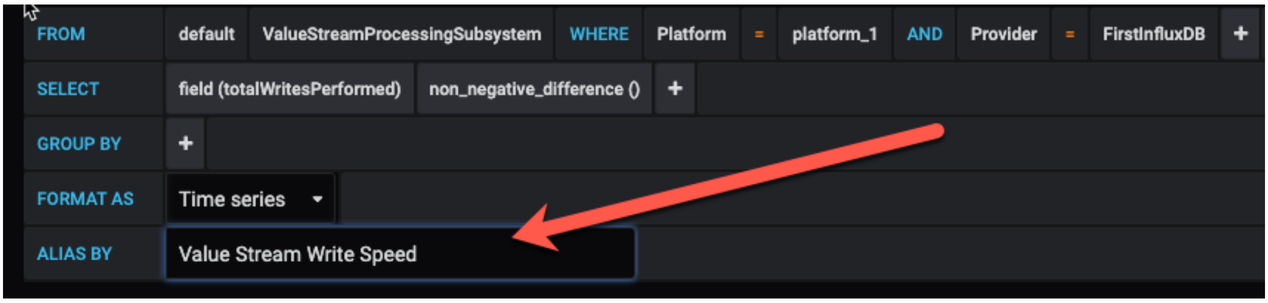
SELECT field (totalWritesPerformed) non_negative_difference ()

GROUP BY time ($__interval) fill (null)

FORMAT AS Time series

ALIAS BY Naming pattern

then, remove the default GROUP BY `time` clause.



FROM default ValueStreamProcessingSubsystem WHERE Platform = platform_1 AND Provider = FirstInfluxDB

SELECT field (totalWritesPerformed) non_negative_difference ()

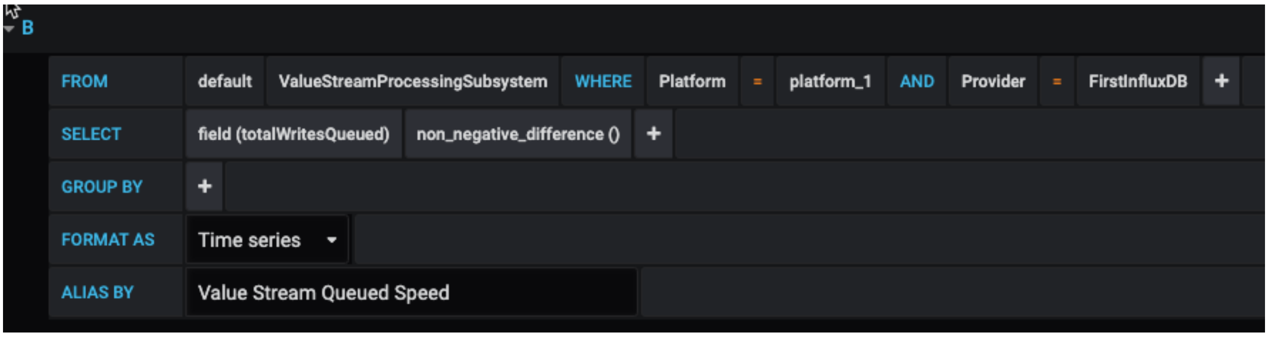
GROUP BY

FORMAT AS Time series

ALIAS BY Value Stream Write Speed

Assign a meaningful alias of this query

Step 6, Add another query



B

FROM default ValueStreamProcessingSubsystem WHERE Platform = platform_1 AND Provider = FirstInfluxDB +

SELECT field (totalWritesQueued) non_negative_difference () +

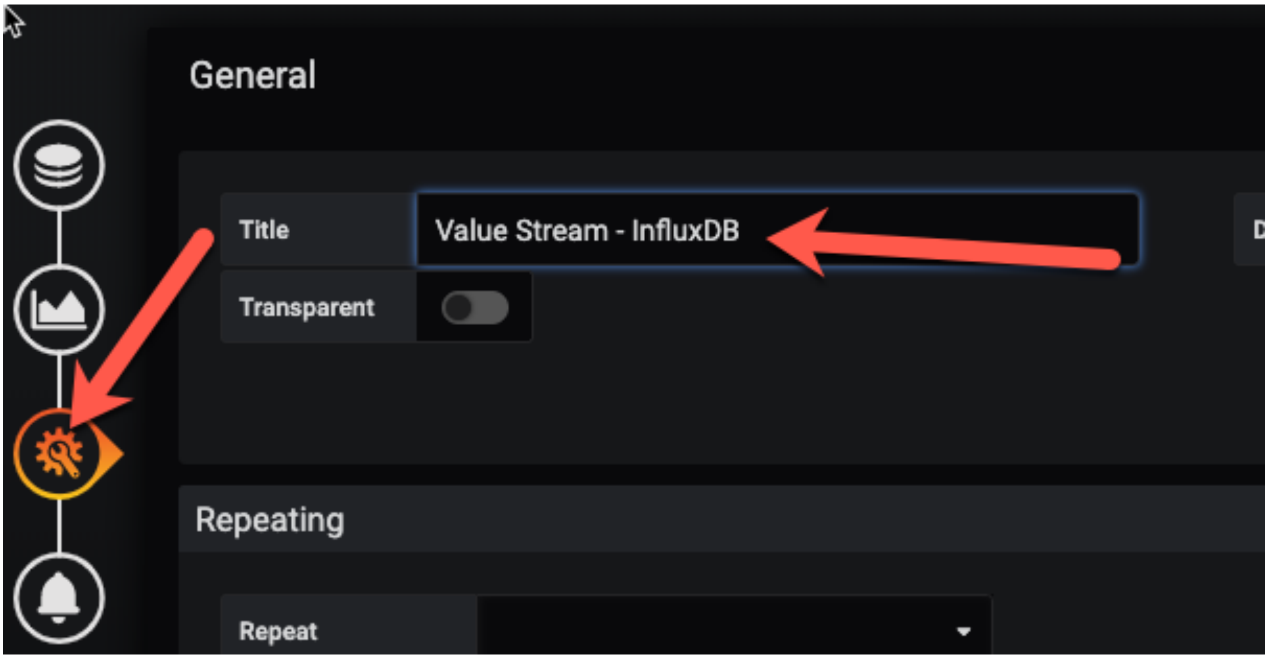
GROUP BY +

FORMAT AS Time series

ALIAS BY Value Stream Queued Speed

You can add another query as 'Value Stream Queued Speed' by following exactly same steps.

Step 7, Assign Panel Title



General

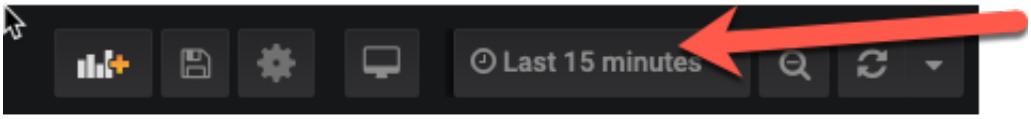
Title: Value Stream - InfluxDB

Transparent

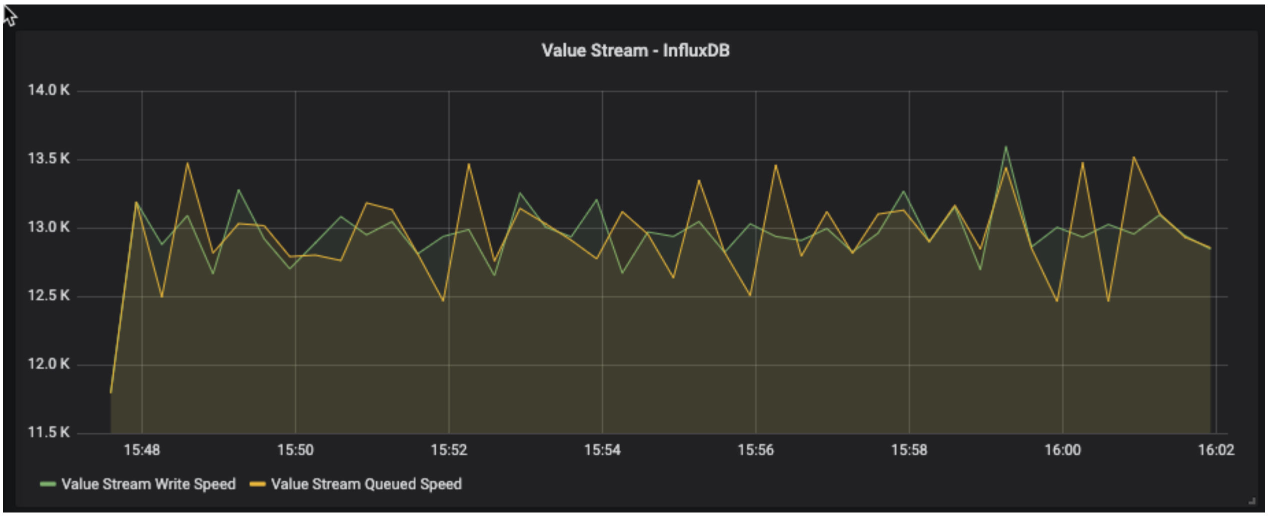
Repeating

Repeat

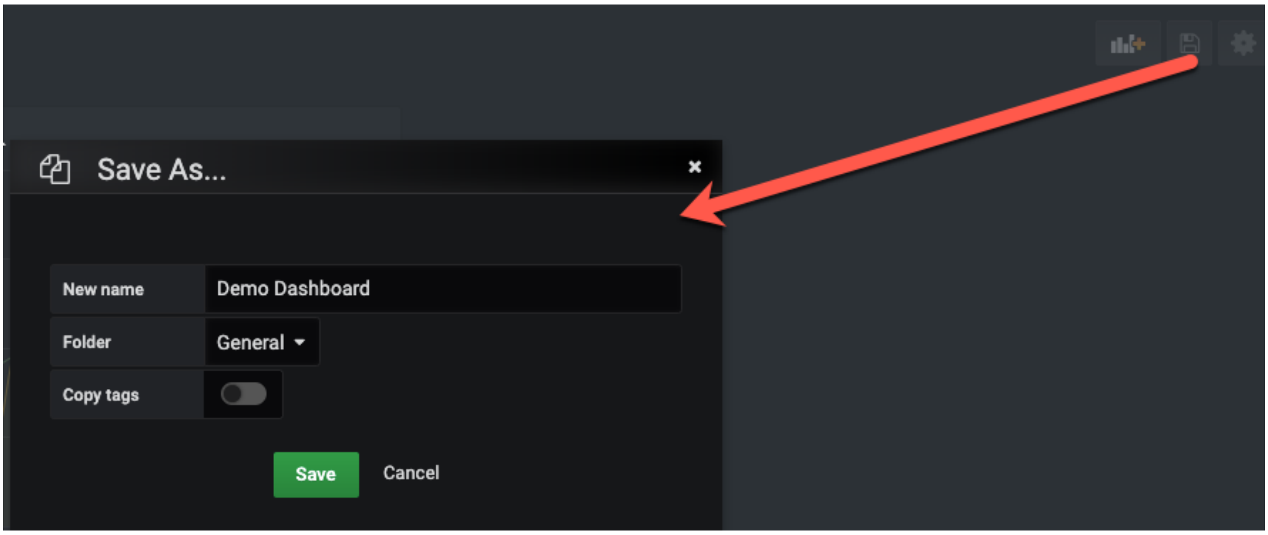
Step 8, Review Result



Let's go back to dashboard page and select 'last 15 minutes' or 'last 5 minutes' from top right coner. It should show a result similar to the chart below.



Step 9, Save dashboard



Save As...

New name: Demo Dashboard

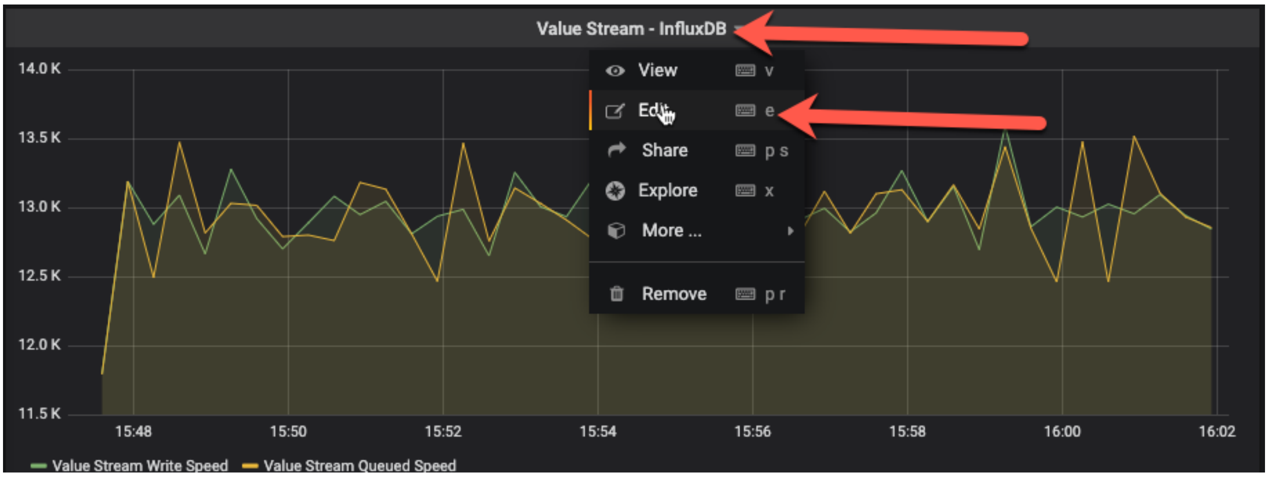
Folder: General

Copy tags

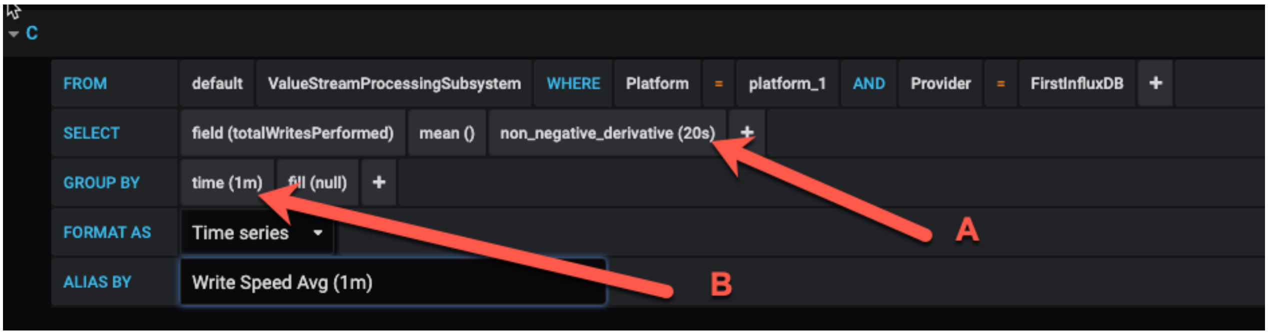
Don't forget to save your Dashboard before we add more panels.

Step 10, Refine the panel

It's difficult to figure out the high-level write speed from above panel and let's enhance it.



Add a new query with following configuration:



C

FROM default ValueStreamProcessingSubsystem WHERE Platform = platform_1 AND Provider = FirstInfluxDB

SELECT field (totalWritesPerformed) mean () non_negative_derivative (20s)

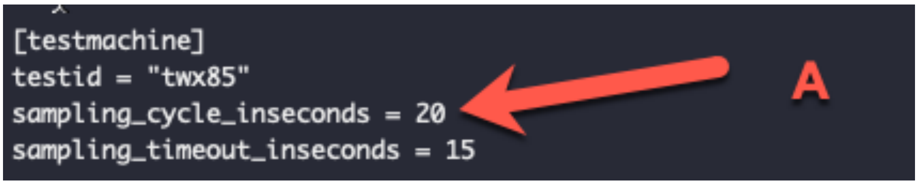
GROUP BY time (1m) fill (null)

FORMAT AS Time series

ALIAS BY Write Speed Avg (1m)

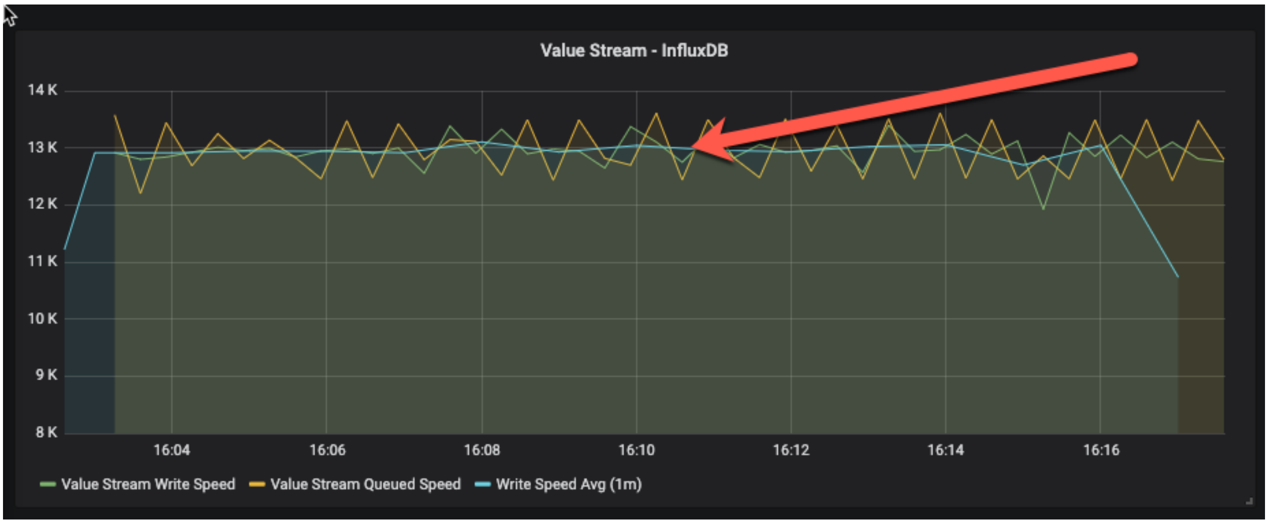
In above query, there are two additional figures: `20s` and `1m`, How do you choose?

`20s` should be as same as `sampling_cycle_inseconds` in your `tsample` configuration file. If you choose a different value, then you would end-up with a miss-leading results (It's not a difficult math problem though. :))



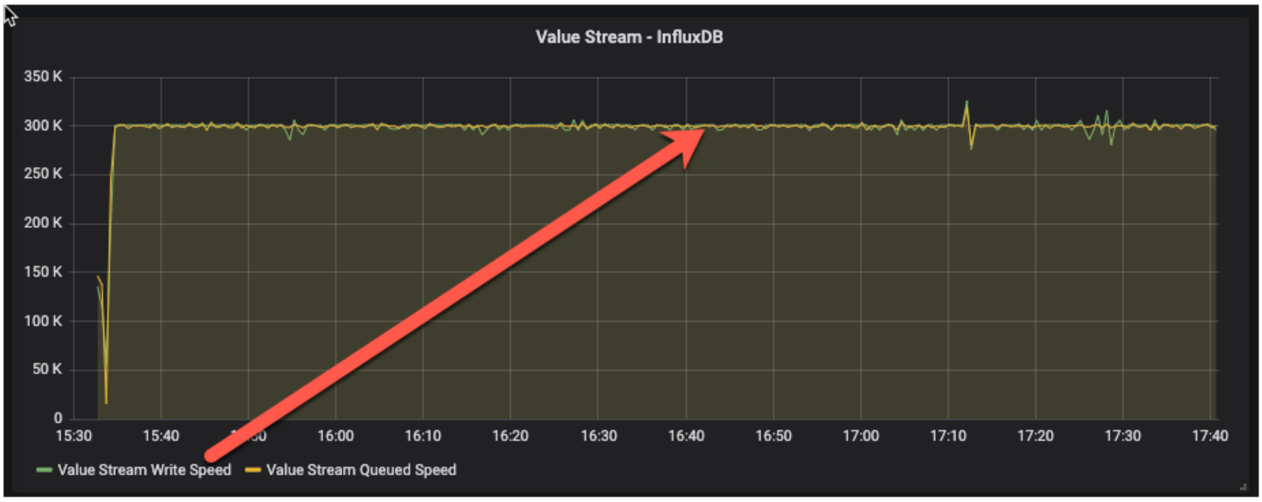
```
[testmachine]
testid = "twx85"
sampling_cycle_inseconds = 20
sampling_timeout_inseconds = 15
```

Larger values such as `1m` may give you a smoother result but could also hide system instability. `1m` should be a good choice for most case.

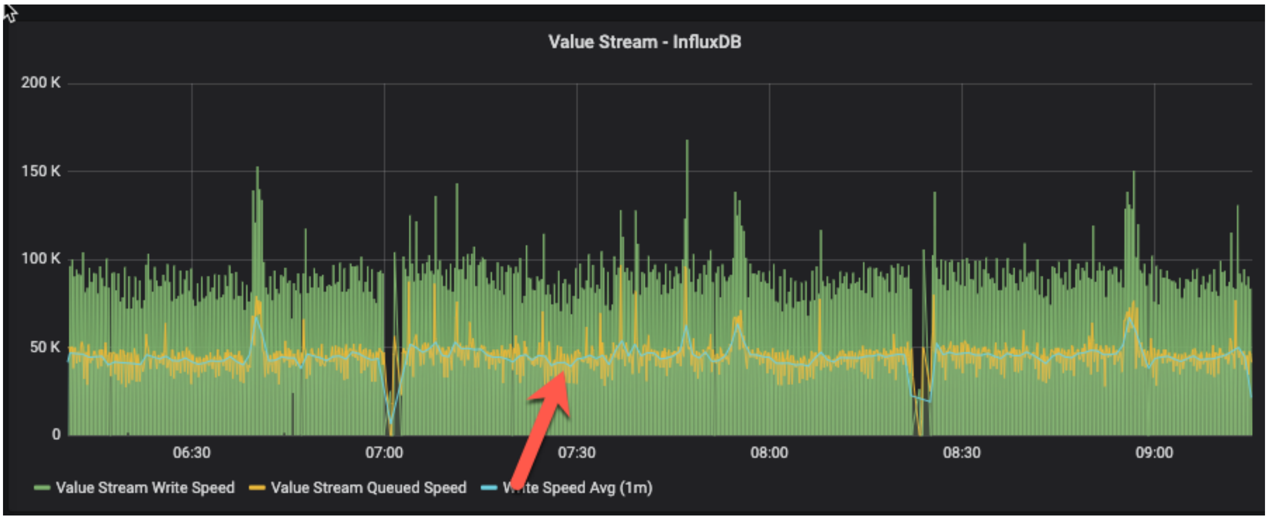


With this new query, it's much identical to figure out what's the average write speed in current testing.

Tips: If your `sampling_cycle_inseconds` is `30s`, then you may not need this additional query. The following image is a sample at the 30s interval time. You would not need an additional average query to get a smooth write speed.



The next example is a sample at `10s` interval time. Without additional queries, you may not be able to get a meaningful understanding of the write speed.

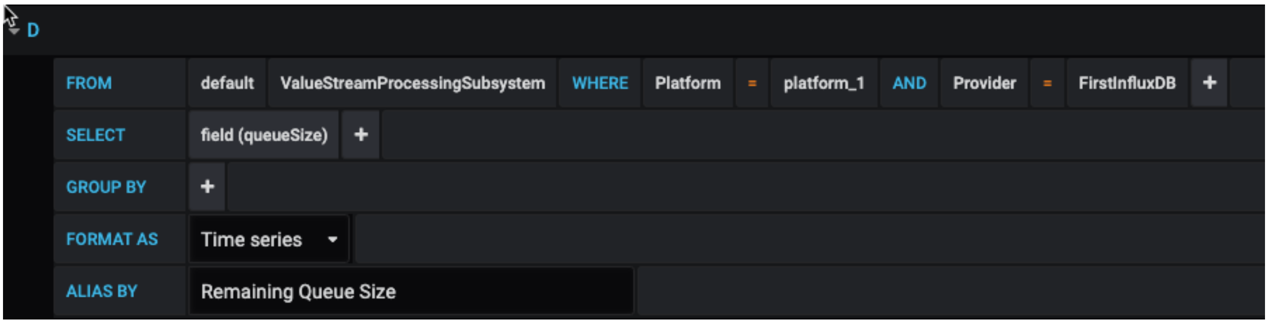


From above 3 example, It's recommended to configure the sampling interval time at `30s`, or anything larger than `20s`. You can then choose whether you need additional queries based on visualization result.

Step 11, Further refinement.

The above charts illustrate the queueing and writing speed. However, it is possible that the Value Stream may perform at a reasonable speed, but value stream queue may be growing and could exceed its capacity.

Let's add another query to monitor this:



D

FROM default ValueStreamProcessingSubsystem WHERE Platform = platform_1 AND Provider = FirstInfluxDB +

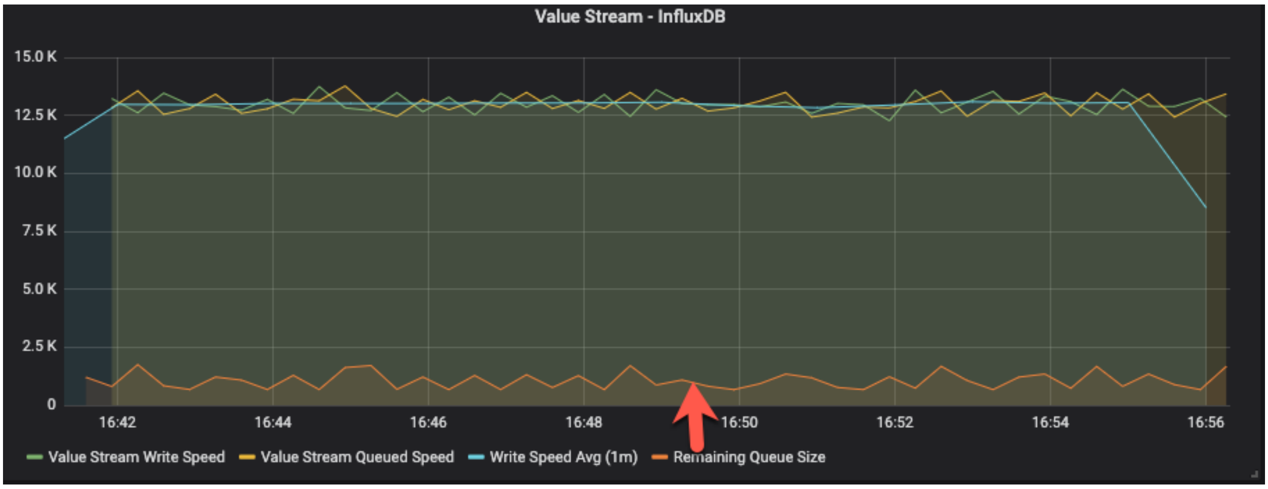
SELECT field (queueSize) +

GROUP BY +

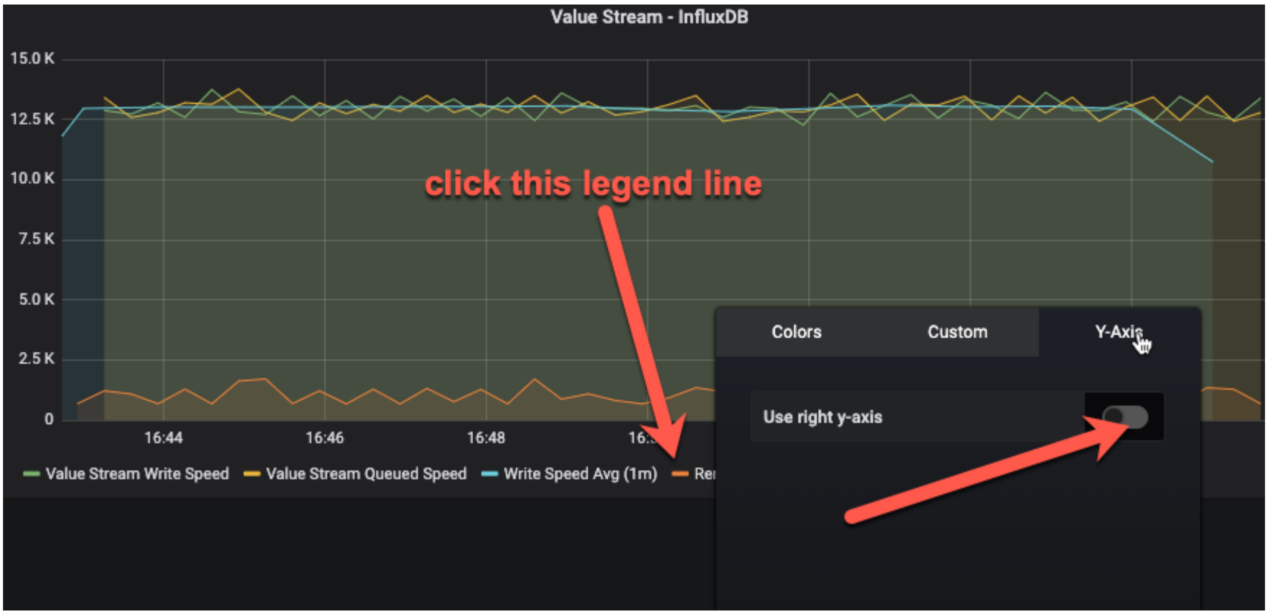
FORMAT AS Time series

ALIAS BY Remaining Queue Size

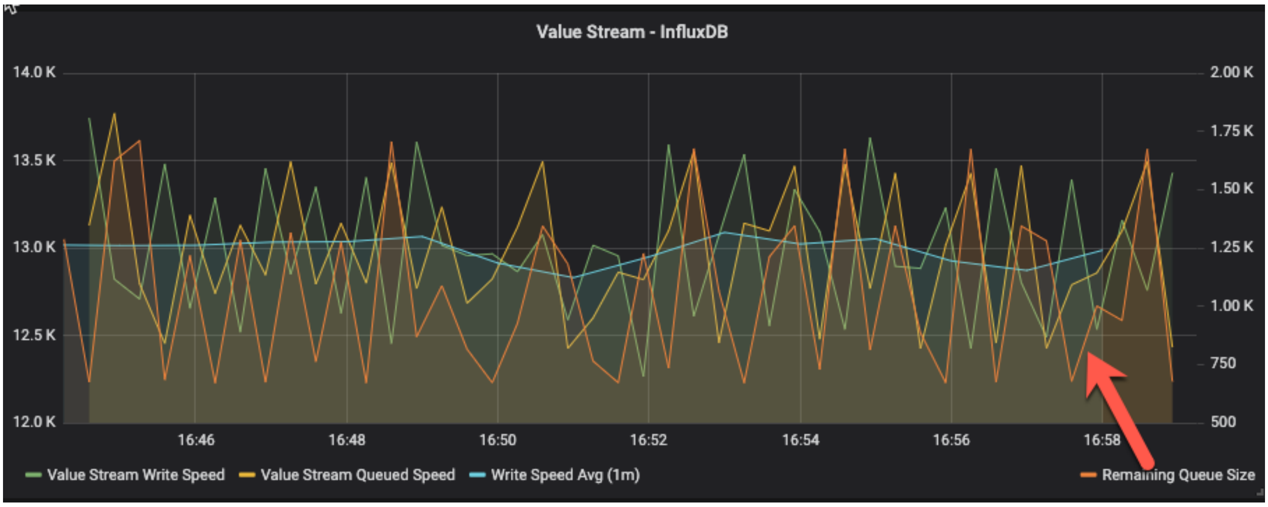
However, it's difficult to read this chart since it has a different value range on the y-axis:



so, let's move this query to a second y-axis on the right:



This will make the view much easier to see:



Current queue size or remaining queue size will always move up and down; it is healthy as long as it does not continue to grow to a high level.

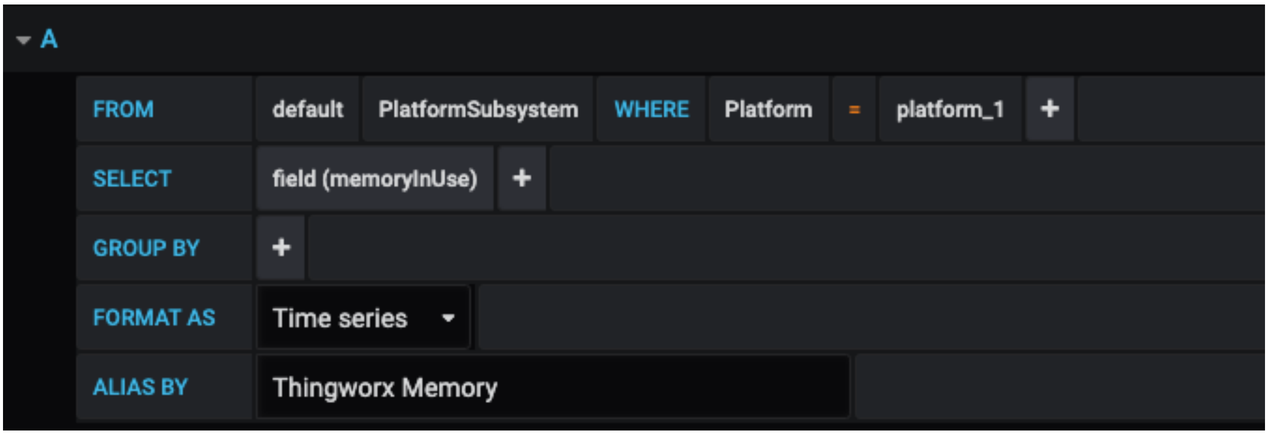
What else can be monitored.

Following metrics would be monitored very often:

- Value Stream Write speed
- Value stream queue speed
- Value stream queue size
- Stream write speed
- Stream queue speed
- Stream queue size
- Event performed speed (completedTaskCount)
- Event submited speed (submitedTaskCount)
- Event queue size
- Websocket communication
- Websocket connection

Thingworx Memory Usage monitoring

Let's create a new panel and add a new query:



A

FROM default PlatformSubsystem WHERE Platform = platform_1 +

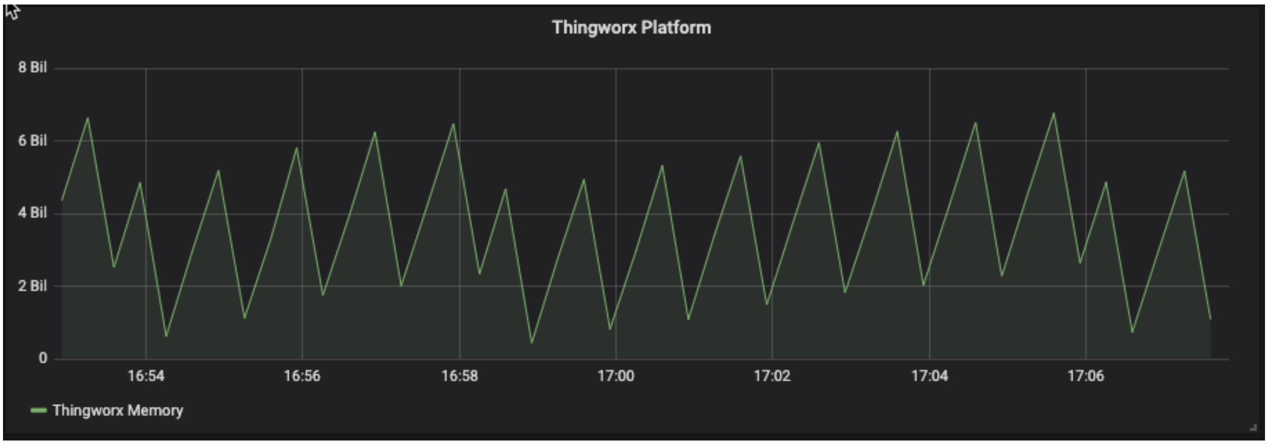
SELECT field (memoryInUse) +

GROUP BY +

FORMAT AS Time series

ALIAS BY Thingworx Memory

in a running system, memory usage will always move up and down - at times sharply (or quickly) - when system is busy. The system is healthy as long as memory doesn't go up continuously or stay at maximum for a long period of time.



There is more...

More monitoring tips will be added in future documentation release.