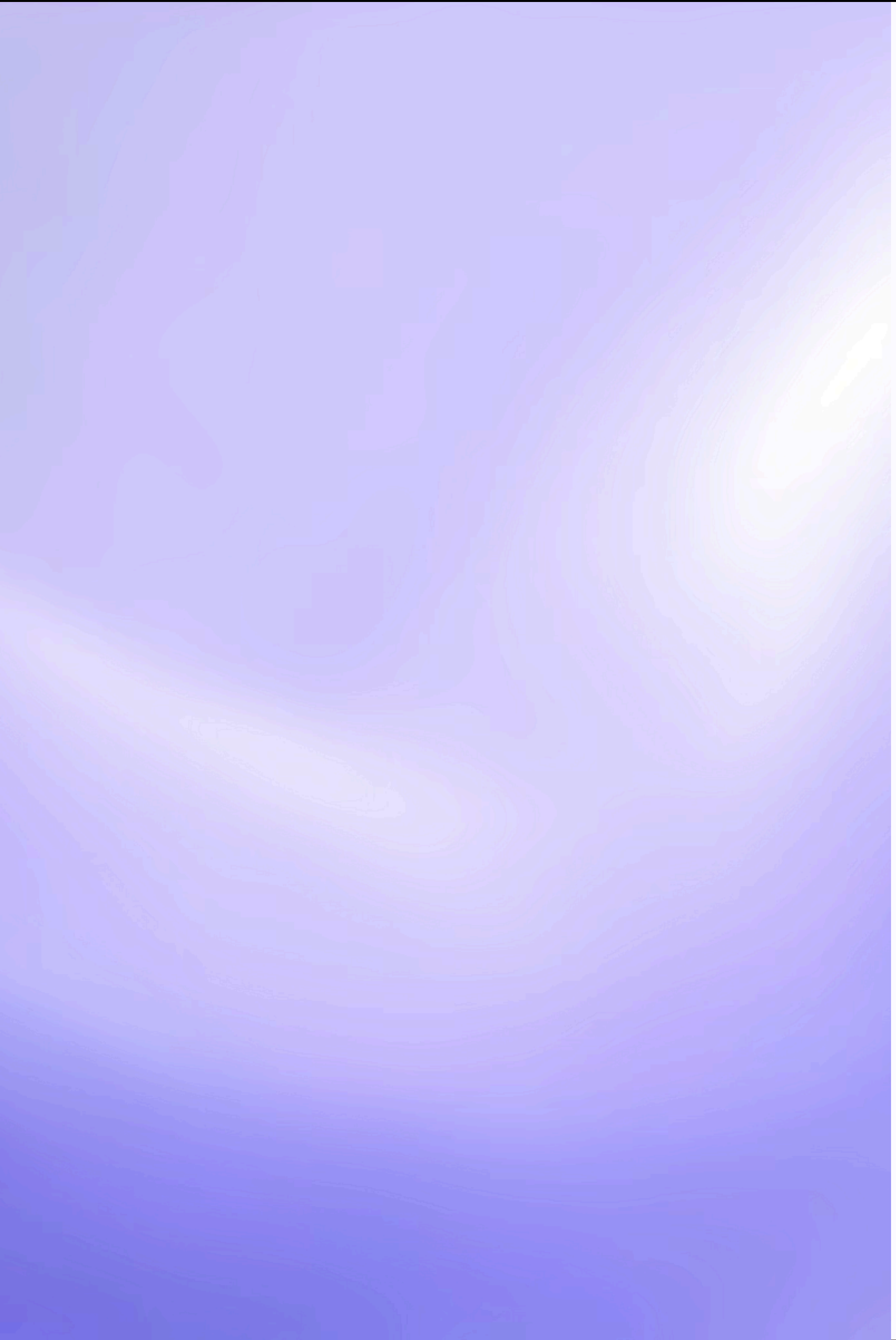
The Time Series Database

Ngoc My Nguyen

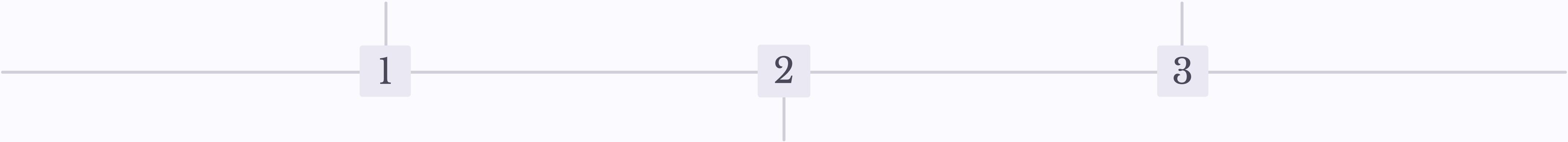
May 2025



Agenda

- 1. Time Series Data & Databases
- 2. The Company Behind InfluxDB
- 3. Licensing Evolution
- 4. Product Portfolio
- 5. InfluxDB Architecture
- 5.1. InfluxDB Architecture - old
- 5.2. InfluxDB Architecture - new
- 6. The Data Models
- 7. Programming in InfluxDB
- 8. Client Libraries
- 9. Real-World Applications
- 10. Installation Options
- 10.1. Example: Easy installation and configuration with Docker Desktop...
- 10.2. Further Setup
- 11. Manage the database

1. Time Series Data & Databases



What is Time Series Data?

Measurements or events indexed chronologically. Each data point has a timestamp and value.

Key Characteristics

Time-ordered, high volume, and append-heavy. Typically written once and rarely updated.

Why Specialized Databases?

Regular databases struggle with time-based queries and high-frequency data collection.

2. The Company Behind InfluxDB

1 2013

Founded as Errplane by Paul Dix

2 2015

Errplane officially changed its name to InfluxData Inc.

3 2016

Released the complete TICK Stack (Telegraf, InfluxDB, Chronograf, Kapacitor)

4 2019

Launched InfluxDB 2, consolidating functionality into a single binary

5 2023

Introduced InfluxDB 3, enhancing performance and scalability

InfluxData has established itself as the creator of the leading performance-oriented time series database. Their commitment to developer experience and scalability has earned them significant market share and a dedicated community of users.

3. Licensing Evolution

1

Early Licensing Model

In its early days, InfluxDB was fully open source, allowing users to freely use, modify, and distribute the software.

In 2016, a dual licensing model was established.

2

InfluxDB 2.0 Licensing

InfluxDB 2.0 continued the dual licensing model with the core database open source and commercial offerings for clustering and additional features.

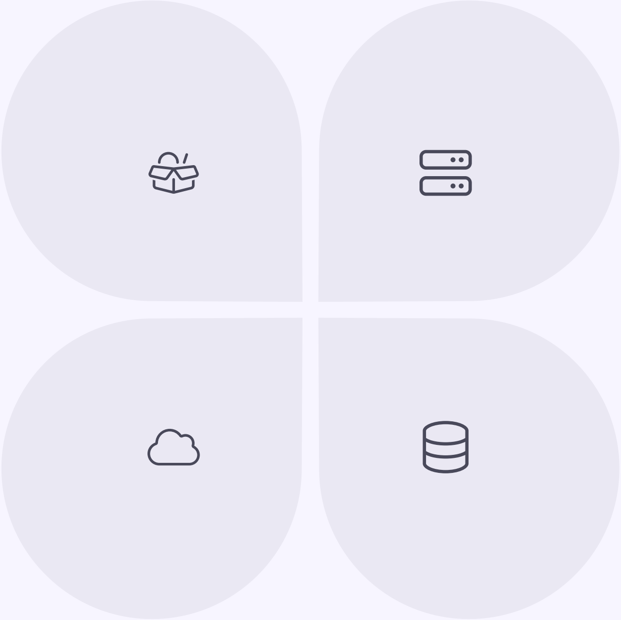
3

InfluxDB 3.0 Licensing Changes

InfluxDB 3.0 introduced a new licensing structure with a focus on core open source, commercial enterprise, and a free tier of enterprise for non-commercial use.

4. Product Portfolio

The offerings for the latest version (3) are detailed below. Previous versions are also available.



InfluxDB 3 Core

Free open-source core with robust capabilities, available under MIT license, for **self-managed** deployment.

InfluxDB 3 Enterprise

Commercial, scalable engine for **self-managed** deployment.

InfluxDB 3 Cloud Serverless/Dedicated

Fully-managed platform deployed in the cloud.

InfluxDB Clustered

The Kubernetes-enabled, highly-available cluster for **self-managed** deployment.

5. InfluxDB Architecture

Storage Engine

Optimized for high-speed writes and time-ordered data storage

Query Engine

Processes time-bounded queries with high performance

Compaction Service

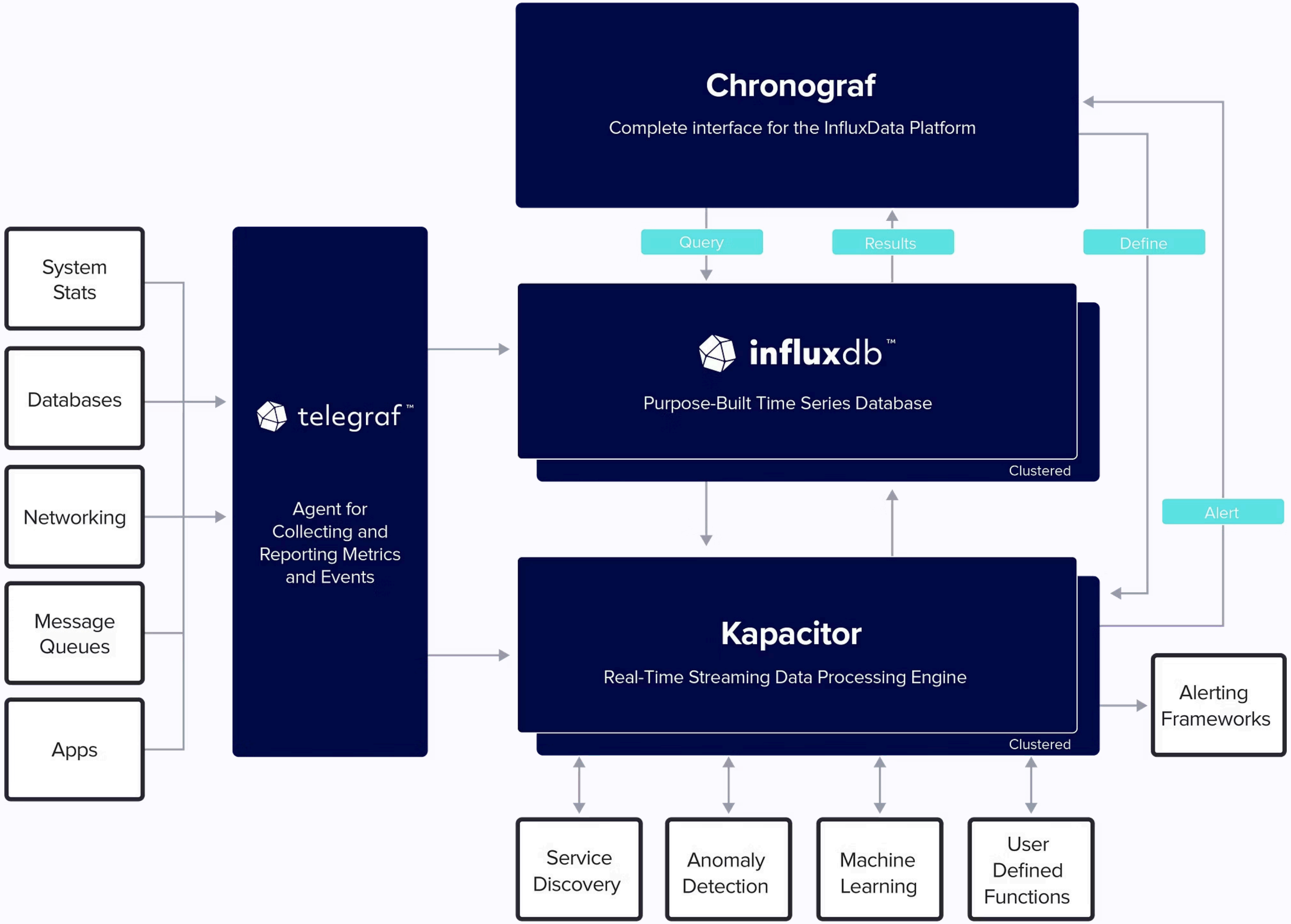
Manages data retention and downsampling automatically

HTTP API

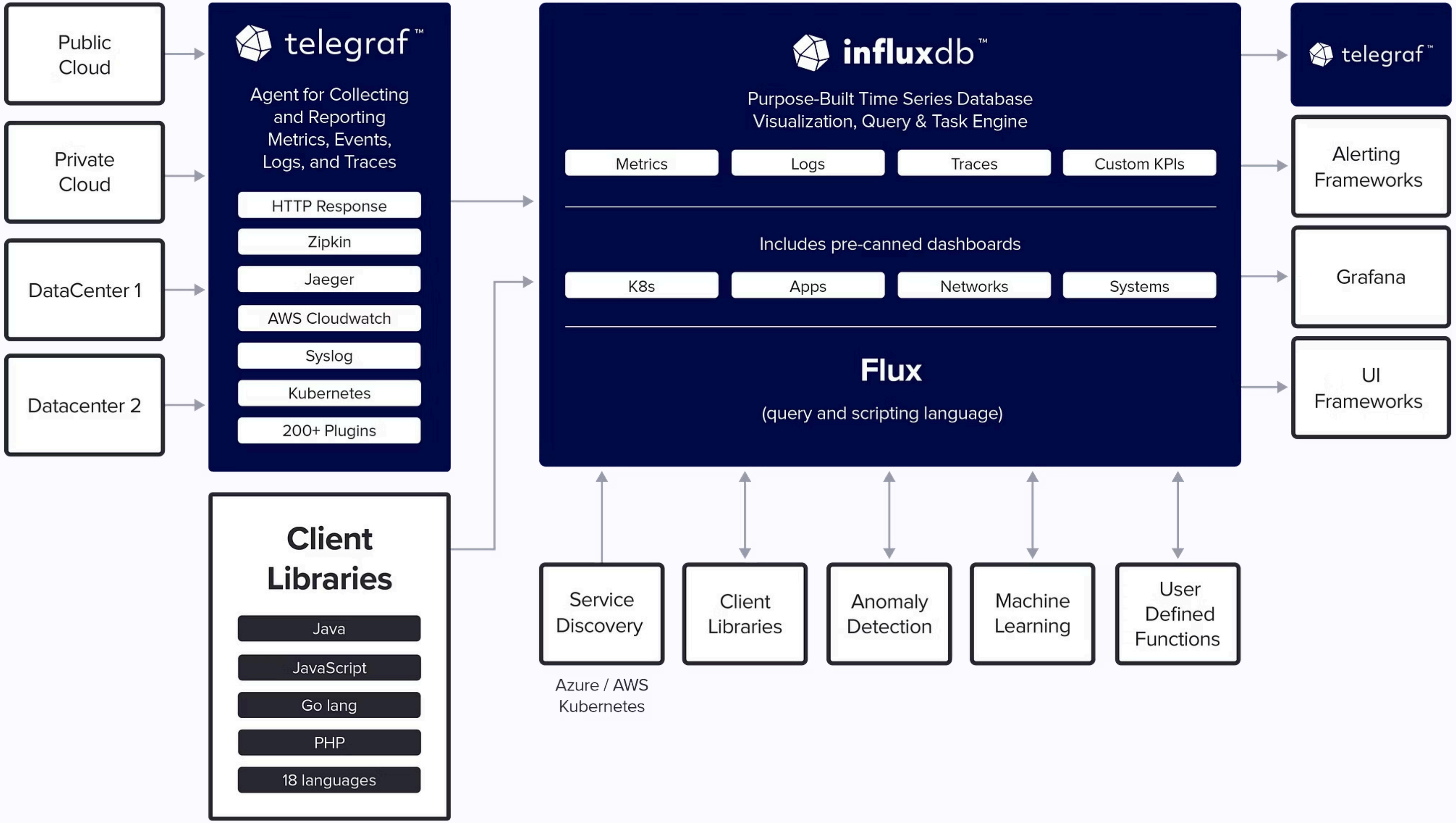
Provides unified interface for data input and retrieval

InfluxDB 2.0 consolidated what was previously separate components (Influx, Chronograf, Kapacitor) into a single binary, simplifying deployment. This architecture enables it to store hundreds of thousands of points per second while maintaining query responsiveness, even with massive volumes of high-resolution data.

5.1. InfluxDB Architecture - old



5.2. InfluxDB Architecture - new



Public Cloud

Private Cloud

DataCenter 1

Datacenter 2

telegraf™

Agent for Collecting and Reporting Metrics, Events, Logs, and Traces

- HTTP Response
- Zipkin
- Jaeger
- AWS Cloudwatch
- Syslog
- Kubernetes
- 200+ Plugins

Client Libraries

- Java
- JavaScript
- Go lang
- PHP
- 18 languages

influxdb™

Purpose-Built Time Series Database
Visualization, Query & Task Engine

- Metrics
- Logs
- Traces
- Custom KPIs

Includes pre-canned dashboards

- K8s
- Apps
- Networks
- Systems

Flux

(query and scripting language)

telegraf™

Alerting Frameworks

Grafana

UI Frameworks

Service Discovery

Azure / AWS
Kubernetes

Client Libraries

Anomaly Detection

Machine Learning

User Defined Functions

6. The Data Models

Line Protocol Format

Data is written using a special syntax that optimizes for write performance:

```
measurement,tag1=value1,tag2=value2 field1=value1,field2=value2 timestamp
```

Key Components

- Measurements (similar to tables)
- Tags (indexed metadata)
- Fields (actual values, not indexed)
- Timestamps (nanosecond precision)

Data Types

- int64 (integers)
- float64 (floating point)
- bool (boolean values)
- string (text data)

InfluxDB's unique data model differentiates it from other time series solutions like Graphite, RRD, or OpenTSDB. Its inverted index structure enables extremely fast data lookups while maintaining storage efficiency through specialized compression algorithms optimized for time series.

7. Programming in InfluxDB

Influx Query Language (Flux)

Powerful language for querying and analyzing time series data with custom functions and stream processing.

Line Protocol

Simple and efficient format designed for writing time series data to the database with high performance.

APIs and Client Libraries

Supports Python, JavaScript, Go and more for easy integration and data interaction via REST API and libraries.

Development Environment

Flexible installation and configuration options across platforms, enabling retention policies and tuning.

8. Client Libraries

Python

Comprehensive client with dataframe integration for data science workflows

Java

Robust client for enterprise applications with strong typing

JavaScript

Browser and Node.js support for web application integration

Go

Native implementation for high-performance backend services

Ruby

Elegant client for rapid development and scripting

C#

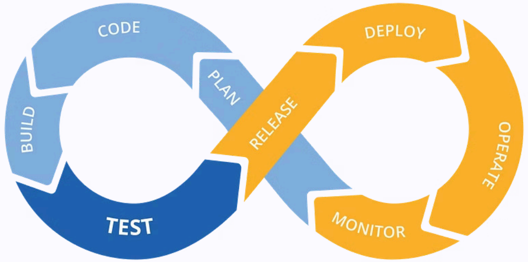
Powerful client for .NET applications with seamless integration

PHP

Widely-used client for web development with easy deployment

and more ...

9. Real-World Applications



Industrial IoT

Factories use InfluxDB to monitor equipment performance and predict maintenance needs.

DevOps Monitoring

IT teams track system metrics to ensure uptime and performance.

Energy Management

Utilities track power generation and consumption patterns across grids.

10. Installation Options

Influx DB 2

download with **Linux**, **macOS**, **Windows, Docker, Kubernetes** and **Raspberry Pi**

- **OSS**

InfluxDB 3

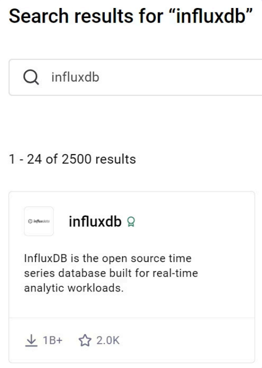
download with **Linux**, **macOS**, **Windows** and **Docker**

- **Core**
- **Enterprise**

Further options, including a zero-maintenance cloud service, are available **here**

10.1. Example: Easy installation and configuration with Docker Desktop (GUI)

1. Search for "MongoDB Community Server" on Docker Hub and click on the result.



Search results for “influxdb”

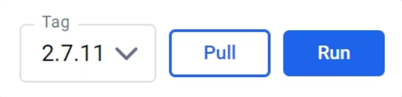
influxdb

1 - 24 of 2500 results

influxdb

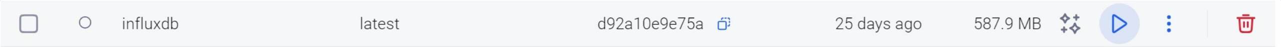
InfluxDB is the open source time series database built for real-time analytic workloads.

2. On the upper right side, select and pull the desired version.



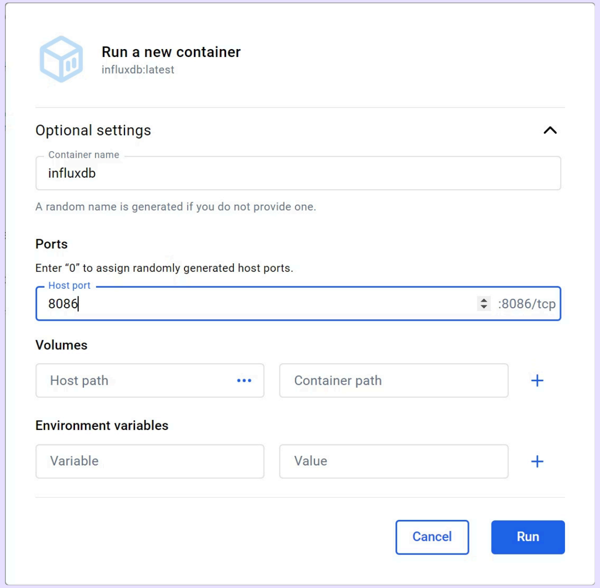
Tag: 2.7.11

3. Locate the downloaded image and run it.



□ ○	influxdb	latest	d92a10e9e75a	25 days ago	587.9 MB

4. Configure the container by editing the fields listed below.



Run a new container
influxdb:latest

Optional settings

Container name: influxdb

A random name is generated if you do not provide one.

Ports

Enter “0” to assign randomly generated host ports.

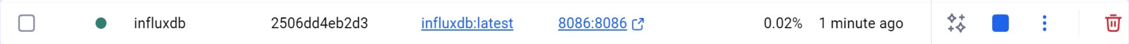
Host port: 8086 :8086/tcp

Volumes

Environment variables

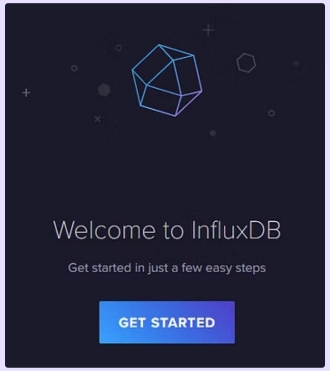
10.2. Further Setup

4. Locate the created container and open the necessary port to access the GUI.



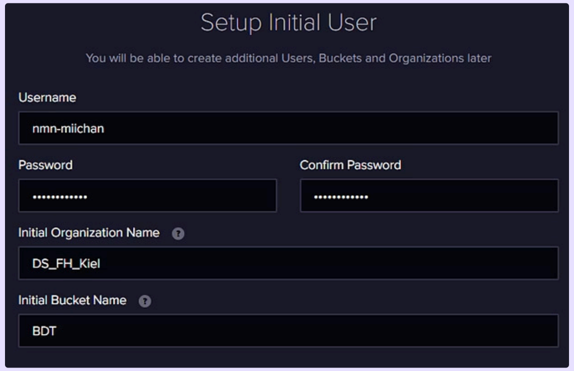
□	● influxdb	2506dd4eb2d3	influxdb:latest	8086:8086	0.02%	1 minute ago

5. Create an orgnaization, user and bucket



Welcome to InfluxDB

Get started in just a few easy steps



Setup Initial User

You will be able to create additional Users, Buckets and Organizations later

Username: nmn-miichan

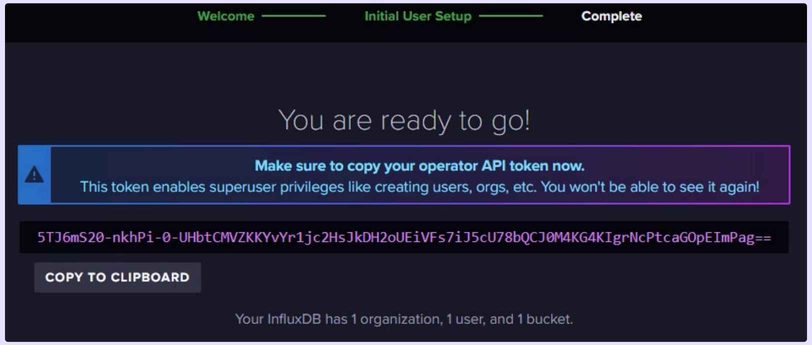
Password: ••••••••••••

Confirm Password: ••••••••••••

Initial Organization Name: DS_FH_Kiel

Initial Bucket Name: BDT

6. A token will be created automatically.



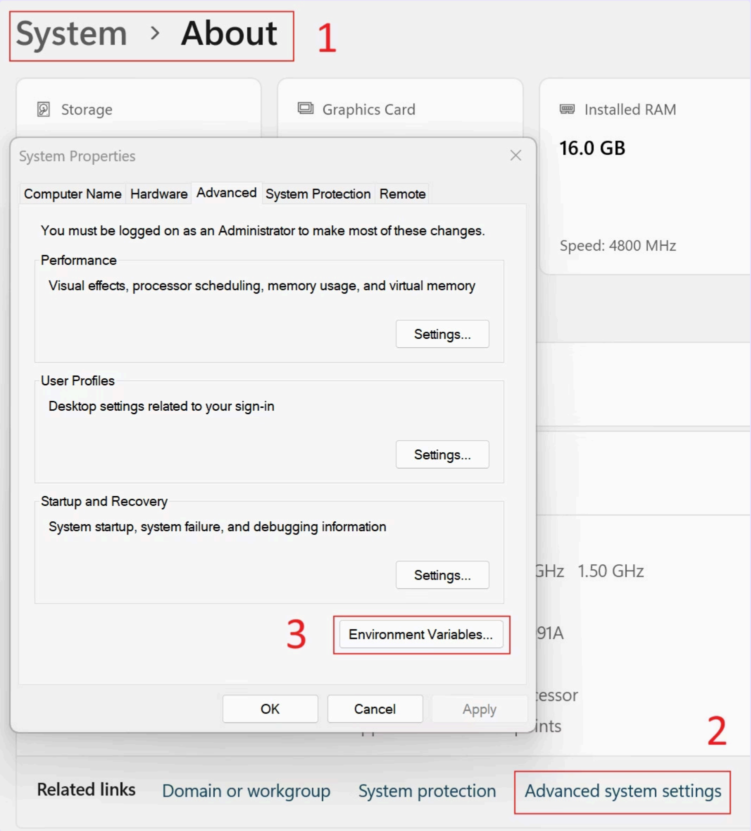
You are ready to go!

Make sure to copy your operator API token now.
This token enables superuser privileges like creating users, orgs, etc. You won't be able to see it again!

```
5TJ6mS20-nkhPi-0-UHbtCMVZKKYvYr1jc2HsJkDH2oUEiVFs7iJ5cU78bQCJ0M4KG4KIgrNcPtcaGOpEImPag==
```

Your InfluxDB has 1 organization, 1 user, and 1 bucket.

The token should be saved as an environmental variable. In Windows, it can be set by navigating to the advanced system settings.



System Properties

You must be logged on as an Administrator to make most of these changes.

Performance
Visual effects, processor scheduling, memory usage, and virtual memory

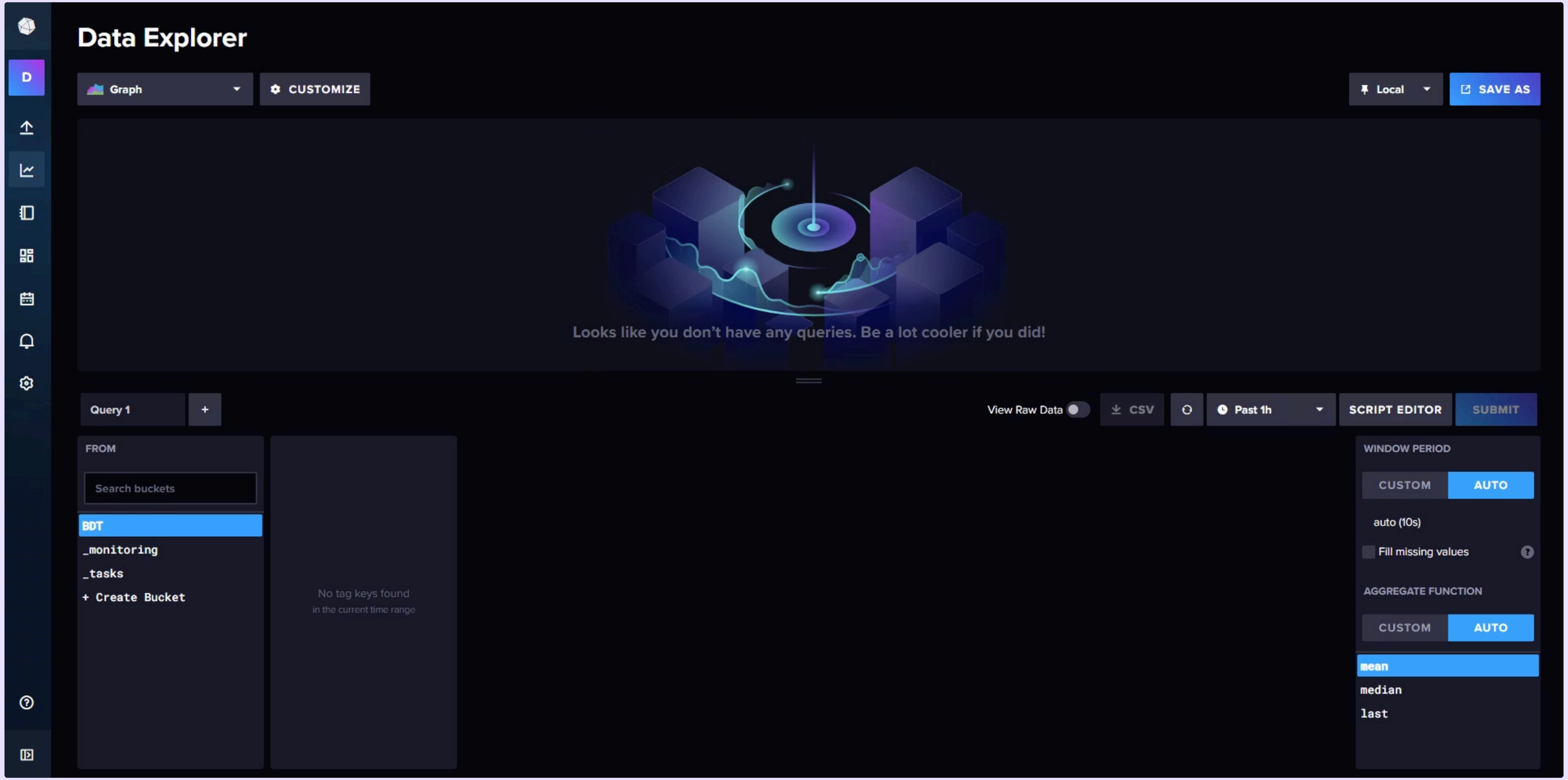
User Profiles
Desktop settings related to your sign-in

Startup and Recovery
System startup, system failure, and debugging information

Related links: Domain or workgroup | System protection | Advanced system settings

11. Manage the database

The database and collection can be managed directly through the GUI or via a programming environment.



Looks like you don't have any queries. Be a lot cooler if you did!

No tag keys found
in the current time range

auto (10s)

□ Fill missing values

For programming examples, please refer to the Jupyter Notebook that has been provided.