



# Virtual Network Operation Center (NOC) with nmaas

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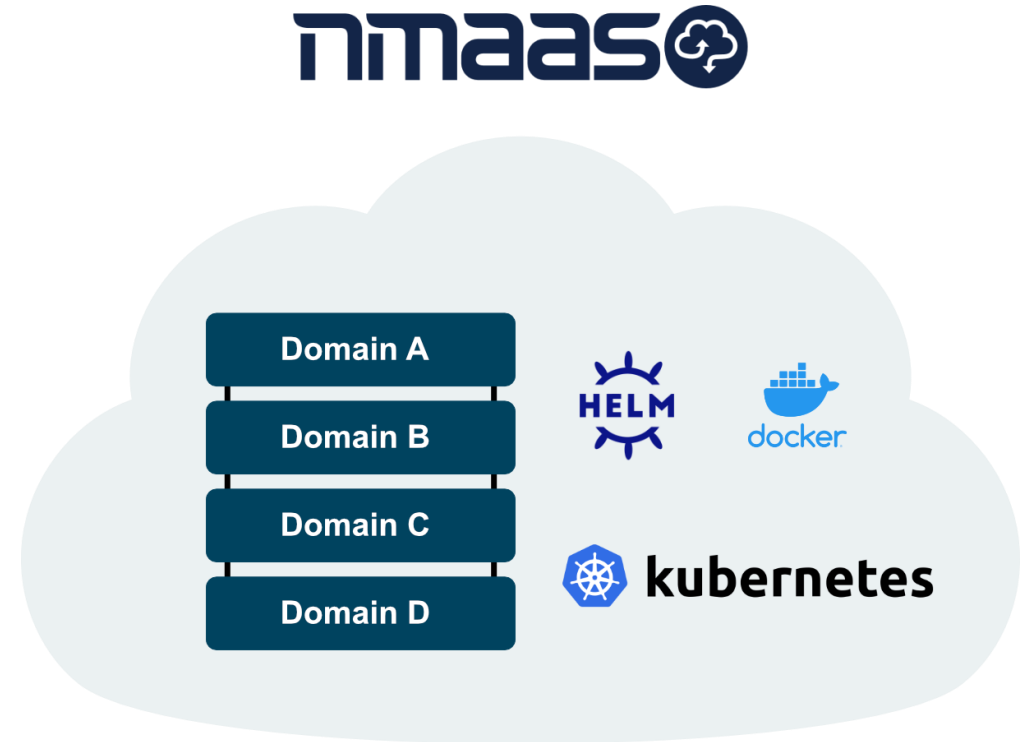
# Agenda

- Introduction to the nmaas Platform
  - Orchestration
  - Use-cases
- nmaas in Practice
  - Virtual NOC
  - Application Catalog
  - GitOps Configuration
- Conclusion

# Introduction to nmaas

*nmaas* is an open-source framework for orchestrated on-demand deployment of applications in a cloud environment

- Kubernetes-based infrastructure
- Multi-tenant architecture
- Simple application deployment and upgrade process
- Wide and easily extendable portfolio of applications
- GitOps approach for application instance configuration management
- Easy troubleshooting



Source code available at <https://gitlab.software.geant.org/nmaas>

## nmaas Flavors and Use-Cases

- Support for multiple use-cases by providing relevant software features and deployable applications
- Currently supported use-cases on top a common code base
  - **nmaas for Virtual NOC** (originally referred to as NMaaS - Network Management as a Service)
  - **nmaas for Virtual Lab** (new use-case for online hands-on exercises in an education context)



<https://nmaas.eu/>



<https://vlab.dev.nmaas.eu>



## nmaas for Virtual Labs in a Nutshell

- The challenge of organizing hands-on educational exercises
  - Formal learning
  - Informal learning
- nmaas as a general-purpose orchestrator for various applications
- Core idea: Deployment of educational exercises not fundamentally different from network management applications
  - Same underlying concept and technologies
  - Containerization, orchestration, isolation, multi-tenancy



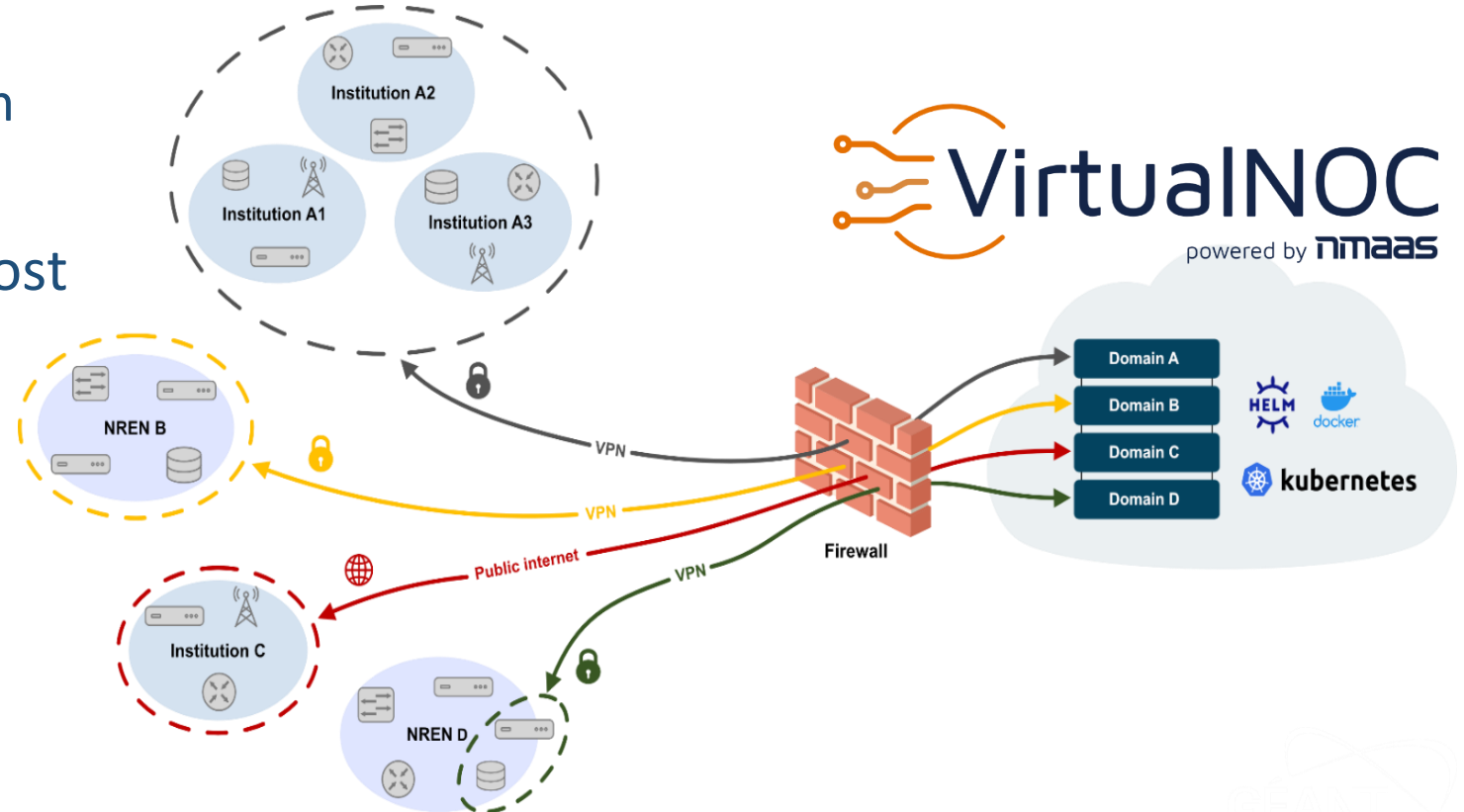


# **nmaas for Virtual NOC (vNOC)**

New name for NMaaS (Network Management as a Service)

## nmaas for Virtual NOC

- Versatility of nmaas as an open-source orchestration platform
- NMaaS (Network Management as a Service) as the initial use-case
- Rebranding
  - nmaas – the underlying platform
  - nmaas for Virtual NOC
- Application catalog containing most popular network management applications
- Continuous improvement



## Why use nmaas for Virtual NOC



Eases the process of **trying a new network management and monitoring application**



**Multiple customers** can have their infrastructure managed by a single entity



Customers **do not require** extensive **on-premise infrastructure**



Focus on **managing** networks and services



## nmaas for Virtual NOC: Target Groups

- Target groups
  - End institutions with limited capacity for in-house network management
    - Universities, high schools, primary schools
  - International research projects with (distributed) hardware resources
  - Development/infrastructure teams requiring external health monitoring and alerting for their applications



## nmaas for Virtual NOC: Connectivity

- Site-to-Site VPN
  - Connectivity between nmaas infrastructure and client environment
  - Wireguard (preferred) or OpenVPN
- Client access VPN
  - Secure access running applications (including sensitive data)
  - Preferable eduVPN, based on OpenVPN and WireGuard
- Public access
  - Some applications can be exposed publicly (e.g. Grafana, Healthchecks...)

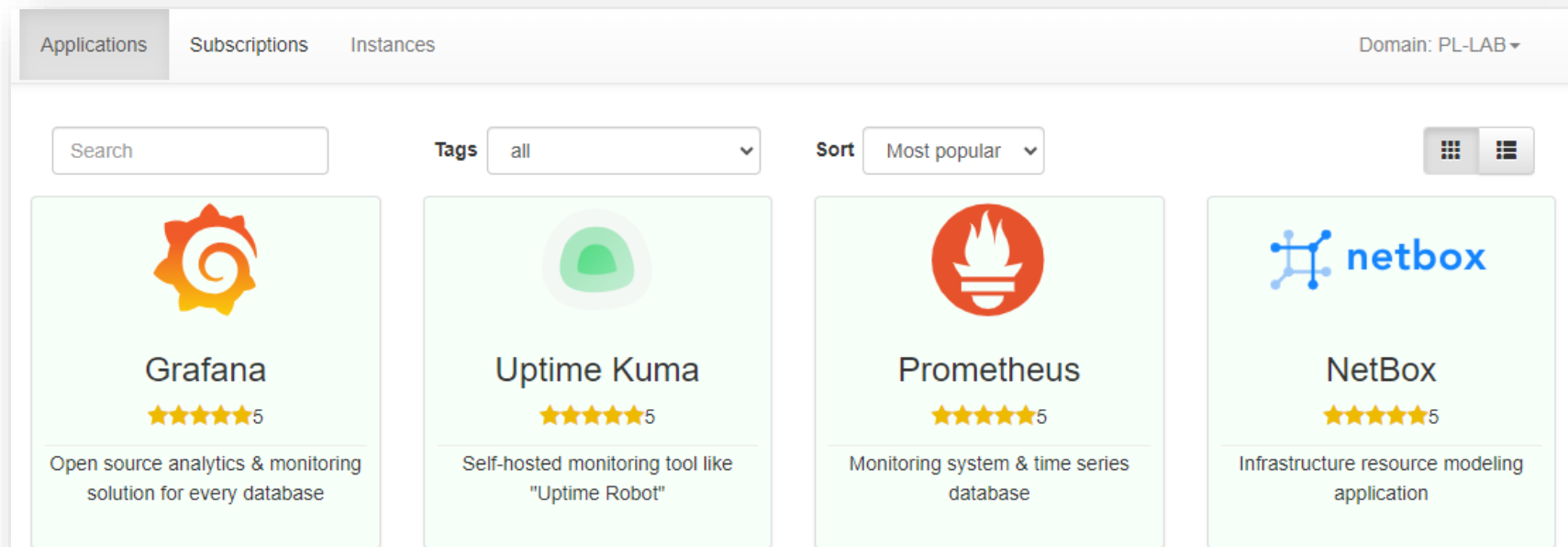
## eduVPN + nmaas

- eduVPN as the VPN solution to access deployed applications securely
- Ensures infrastructure security and integrity + user privacy
- eduVPN is developed as open-source software within the GEANT project
- Supports both the OpenVPN and Wireguard protocols
- Client-Access VPN technology
- Self-service portal for authenticated users
- Can use either the standalone eduVPN client or any other OpenVPN/Wireguard compatible client



# nmaas Feature Highlights: Extensible Application Catalog

- Self-service catalog of deployable applications
- Easily extensible using the industry standard Helm package manager
  - Each application represented by a Helm chart
- Application settings can be customized during deployment or while running





# nmaas Feature Highlights: Extensible Application Catalog

30 applications available in the marketplace

Adminer

Apache Airflow

Bastion

Booked

ChangeDetection.io

CodiMD

Debian repository

Grafana

Jenkins

LibreNMS

NetBox

Oxidized

Prometheus

Routinator

Synapse

Telegraf

Maat



perfSONAR

Camunda

Uptime Kuma

Victoria Metrics

WebDAV Server

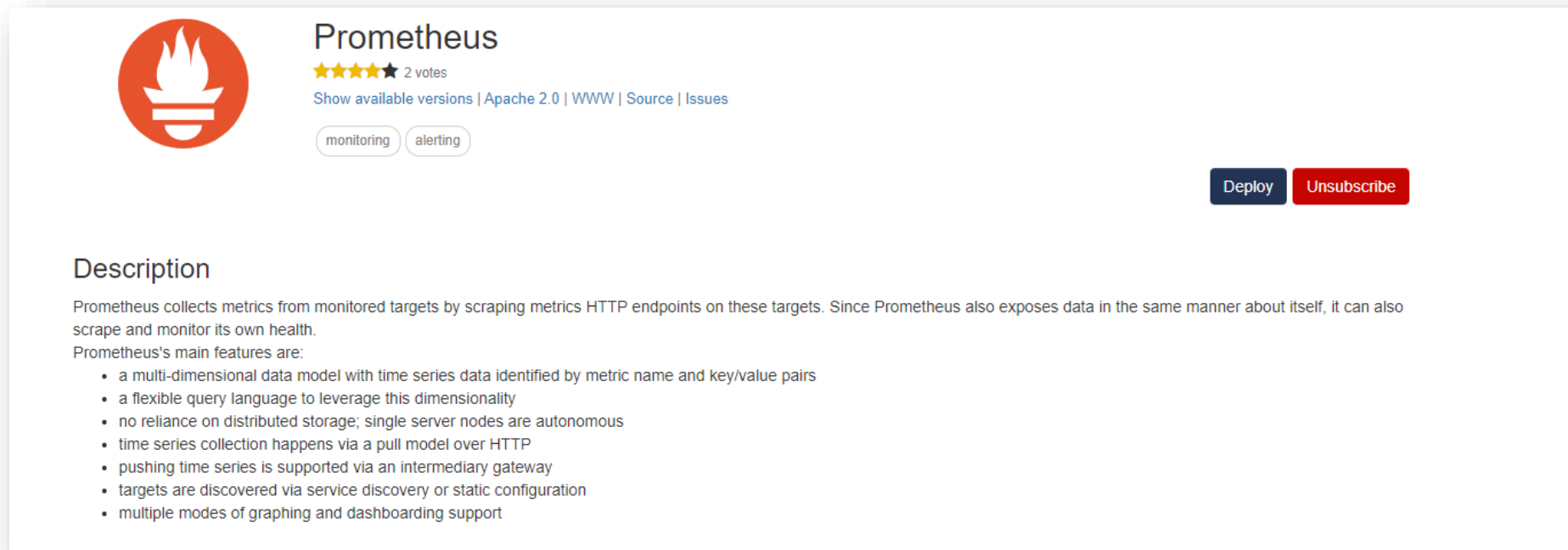
Healthchecks

Zabbix



# nmaas Feature Highlights: Subscribe application

- Subscription is required before deployment
  - Only these applications can be further deployed in the nmaas cloud within the scope of particular domain.



The screenshot shows the Prometheus application page in the nmaas cloud interface. It features the Prometheus logo (a red circle with a white flame) on the left. To the right of the logo, the text "Prometheus" is displayed, followed by a star rating of 4.5 (5 stars, 2 votes) and a link to "Show available versions | Apache 2.0 | WWW | Source | Issues". Below this, there are two tags: "monitoring" and "alerting". On the right side of the page, there are two buttons: "Deploy" (dark blue) and "Unsubscribe" (red). Below the buttons, the "Description" section is visible, starting with the text: "Prometheus collects metrics from monitored targets by scraping metrics HTTP endpoints on these targets. Since Prometheus also exposes data in the same manner about itself, it can also scrape and monitor its own health. Prometheus's main features are:" followed by a bulleted list of features.

**Prometheus**  
★★★★★ 2 votes  
[Show available versions](#) | [Apache 2.0](#) | [WWW](#) | [Source](#) | [Issues](#)

monitoring alerting

Deploy Unsubscribe

### Description


Prometheus collects metrics from monitored targets by scraping metrics HTTP endpoints on these targets. Since Prometheus also exposes data in the same manner about itself, it can also scrape and monitor its own health.

Prometheus's main features are:

- a multi-dimensional data model with time series data identified by metric name and key/value pairs
- a flexible query language to leverage this dimensionality
- no reliance on distributed storage; single server nodes are autonomous
- time series collection happens via a pull model over HTTP
- pushing time series is supported via an intermediary gateway
- targets are discovered via service discovery or static configuration
- multiple modes of graphing and dashboarding support

# nmaas Feature Highlights: Guided Configuration Wizard (1)

- Configuration wizard to aid initial application deployment
  - Options dependent on the application at hand
  - Possible integration with Git

 **prom-demo (Prometheus)**  
★★★★★ 3 votes  
v.2.45.0 | Apache 2.0 | WWW | Source | Issues

Monitoring Alerting Configure Abort

**Deployed**

**i** Your application instance was successfully deployed.  
In order to proceed, provide first time configuration using the *Configure* action button

### Installation progress

1 Subscription validation   2 Environment creation   3 Verifying connectivity   4 Application deployed   5 Activation   6 Application active

Additional Information

# nmaas Feature Highlights: Guided Configuration Wizard (2)

Detailed field descriptions are available at [NMaaS Tools Page](#).

Base
Additional
Advanced

**Prometheus access username \***

**Prometheus access password \***

**Global scrape**

**Global evaluation**

**Jobs \***


Job name *	Scrape interval *	Metrics path *	Targets *						
<input style="width: 95%;" type="text" value="demoJob"/>	<input style="width: 95%;" type="text" value="15s"/>	<input style="width: 95%;" type="text" value="/metrics"/>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;">IP address and port *</th> <th style="width: 20%;"></th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> <input style="width: 95%;" type="text" value="127.0.0.1:9001"/> </td> <td style="text-align: center; vertical-align: middle;"> <input type="button" value="⊖"/> </td> </tr> <tr> <td colspan="2" style="text-align: center;"> <input type="button" value="+ Add address"/> </td> </tr> </tbody> </table>	IP address and port *		<input style="width: 95%;" type="text" value="127.0.0.1:9001"/>	<input type="button" value="⊖"/>	<input type="button" value="+ Add address"/>	
IP address and port *									
<input style="width: 95%;" type="text" value="127.0.0.1:9001"/>	<input type="button" value="⊖"/>								
<input type="button" value="+ Add address"/>									





## nmaas Feature Highlights: Guided Configuration Wizard (2)

demo > prometheus-1496 > Repository

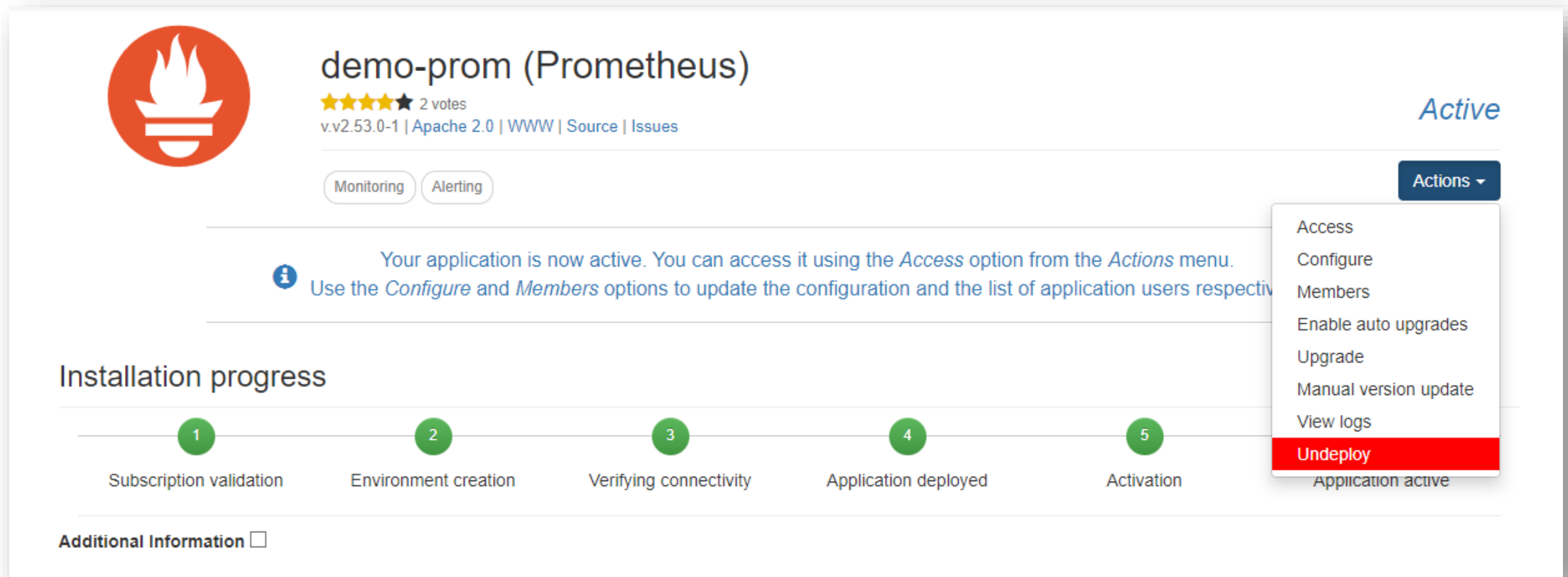
master prometheus-1496 / **prometheus.yml**


 Initial commit of prometheus.yml  
nmaas bot authored 2 minutes ago

 **prometheus.yml** 296 Bytes 

```
1 global:
2   scrape_interval: 15s
3   evaluation_interval: 30s
4 alerting:
5   alertmanagers:
6     - static_configs:
7       - targets:
8 rule_files:
9 scrape_configs:
10  - job_name: 'demoJob'
11    metrics_path: /metrics
12    scrape_interval: 15s
13    static_configs:
14  - targets: ['127.0.0.1:9001']
15    labels:
```

## nmaas Feature Highlights: Guided Configuration Wizard (3)



 **demo-prom (Prometheus)**  
★★★★★ 2 votes  
v.v2.53.0-1 | Apache 2.0 | WWW | Source | Issues

Monitoring Alerting

**Active**

**Actions** ▾

- Access
- Configure
- Members
- Enable auto upgrades
- Upgrade
- Manual version update
- View logs
- Undeploy**
- Application active

**Installation progress**

- 1 Subscription validation
- 2 Environment creation
- 3 Verifying connectivity
- 4 Application deployed
- 5 Activation

**Additional Information**

GEANT

## nmaas Feature Highlights: GitOps Configuration

- Problem: Many applications use text-based configuration files. How to manage them at scale in a cloud environment?
- Solution: nmaas adopts the GitOps approach
- Workflow:
  - Configuration files placed in a private Git repository
  - User clones the repository using their credentials
  - Changes are pushed upstream
  - The altered files are synced to the running container
  - The application is reloaded/restarted
- Examples: Prometheus, Zabbix, Icinga2, Airflow



## nmaas Feature Highlights: Kubernetes

- nmaas Janitor
  - Responsible for communication to GitLab & Kubernetes
- Kubernetes cluster in background
  - Domain is mapped to namespace
  - All application deployed as Docker containers
- Helm Chart
  - Industry standard
  - Easier additions of new application





# nmaas for Virtual NOC: Recent Developments



- Manual/Automatic application version upgrades
- Overview of application instance deployment parameters
- **Application log viewing**

Pod  
prometheus-1496-949fbc67f-zgws

Container  
nmaas-prometheus-srv

Refresh

Download

```

ts=2024-05-21T11:40:19.392Z caller=main.go:584 level=info host_details="(Linux 4.15.0-213-generic #224-Ubuntu SMP Mon Jun 19 13:30:12 UTC 2023 x86_64 tinkr-lab-prometheus-1496-949fbc67f-zgws (none))"
ts=2024-05-21T11:40:19.392Z caller=main.go:585 level=info fd_limits="(soft=1048576, hard=1048576)"
ts=2024-05-21T11:40:19.392Z caller=main.go:586 level=info vm_limits="(soft=unlimited, hard=unlimited)"
ts=2024-05-21T11:40:19.409Z caller=web.go:562 level=info component=web msg="Start listening for connections" address=0.0.0.0:9090
ts=2024-05-21T11:40:19.410Z caller=main.go:1019 level=info msg="Starting TSDB ..."
ts=2024-05-21T11:40:19.415Z caller=tsdb.go:274 level=info component=web msg="Listening on" address=[:]:9090
ts=2024-05-21T11:40:19.415Z caller=tsdb.go:277 level=info component=web msg="TLS is disabled." http2=false address=[:]:9090
ts=2024-05-21T11:40:19.443Z caller=head.go:595 level=info component=tsdb msg="Replaying on-disk memory mappable chunks if any"
ts=2024-05-21T11:40:19.443Z caller=head.go:676 level=info component=tsdb msg="On-disk memory mappable chunks replay completed" duration=5.97µs
ts=2024-05-21T11:40:19.443Z caller=head.go:684 level=info component=tsdb msg="Replaying WAL, this may take a while"
ts=2024-05-21T11:40:19.444Z caller=head.go:755 level=info component=tsdb msg="WAL segment loaded" segment=0 maxSegment=0
ts=2024-05-21T11:40:19.444Z caller=head.go:792 level=info component=tsdb msg="WAL replay completed" checkpoint_replay_duration=110.077µs
wal_replay_duration=635.248µs wbl_replay_duration=376ns total_replay_duration=817.88µs
ts=2024-05-21T11:40:19.446Z caller=main.go:1040 level=info fs_type=EXT4_SUPER_MAGIC
ts=2024-05-21T11:40:19.447Z caller=main.go:1043 level=info msg="TSDB started"
ts=2024-05-21T11:40:19.447Z caller=main.go:1224 level=info msg="Loading configuration file" filename=/etc/config/prometheus.yml
ts=2024-05-21T11:40:19.448Z caller=main.go:1261 level=info msg="Completed loading of configuration file" filename=/etc/config/prometheus.yml totalDuration=1.268875ms
db_storage=1.986µs remote_storage=3.372µs web_handler=874ns query_engine=1.733µs scrape=480.089µs scrape_sd=41.982µs notify=41.456µs notify_sd=15.318µs
rules=2.323µs tracing=10.567µs
ts=2024-05-21T11:40:19.448Z caller=main.go:1004 level=info msg="Server is ready to receive web requests."
ts=2024-05-21T11:40:19.448Z caller=manager.go:995 level=info component="rule manager" msg="Starting rule manager..."

```



# nmaas Use and Deployment Options

Running a vLAB or a vNOC using nmaas on your own infrastructure

# nmaas for Virtual NOC: How you can use vNOC service?

Can be used either as a self-hosted or managed solution

- <https://nmaas.eu> is the managed production instance for the Virtual NOC use-case

User can request their domain and support from our team using contact section.

### Contact us

Contact form offers an easy way to get in touch with the nmaas team. Choose the type of form that is most suitable for your request.

**Select form type:**

New domain request

---

**Domain name**

Domain name

Proposed name for the new domain (up to 30 characters)

**Domain codename**

Domain codename

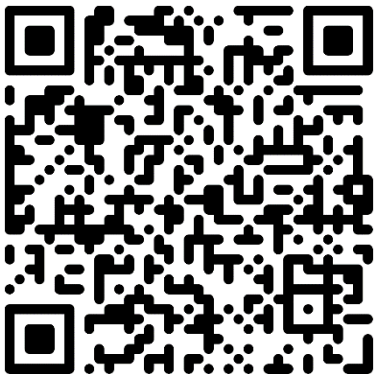
Abbreviated version of the domain name (up to 12 characters)

**Request justification**

Brief justification of the request including intended use of the nmaas service

# Running nmaas on your own

- Two options for running a **self hosted instance of nmaas**
  - Local evaluation environment on a single node cluster (non-production workloads only)
  - On an existing full-fledged Kubernetes cluster (suitable for both Virtual NOC and Virtual Lab)
- Complete guide available at <https://docs.nmaas.eu>
- **nmaas team will provide all required support**



**NMaaS** Documentation
Search

**NMaaS Documentation**

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- Self-Hosted NMaaS
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  - Local Development Environment >
- NMaaS Use-Cases >
- NMaaS Applications >
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- Contact
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## Introduction

Interested users have the option of self-hosting the NMaaS software on their own infrastructure. Depending on the environment, two guides are available:

- The [production installation guide](#) which provides instructions on installing NMaaS on a full-fledged Kubernetes cluster involving multiple cluster nodes.
- The [local installation guide](#) which provides instructions on installing NMaaS for evaluation purposes in smaller environments, consisting even of a single Kubernetes node.

Note that apart from the infrastructure aspects, both guides share similarities when it comes to the actual NMaaS deployment, and can be consulted in parallel.

## NMaaS Components

NMaaS' architecture is made up of three primary components and three helper components.

The primary components have all been developed within the GEANT project and these are: the NMaaS Portal, the NMaaS Platform, and the NMaaS Janitor.

The helper components are represented as popular open-source software which has been packaged as Docker containers. These include: NMaaS Helm, NMaaS Postfix, and NMaaS Service Provider (SP).

More details about the role that each of these components play are provided in the subsections below.

## NMaaS Platform

NMaaS Platform is the central NMaaS component, exposing a REST API consumed by the NMaaS Portal. It stores the application catalog, the users, as well as information about any deployed applications. Upon a new request for an application deployment, it connects to the NMaaS Helm component and executes the necessary Helm command via an SSH connection. It

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- NMaaS Components
- NMaaS Platform
- NMaaS Portal
- NMaaS Janitor
- NMaaS Helm
- NMaaS Postfix
- NMaaS Service Provider (SP)

Contact the nmaas Team: [nmaas@lists.geant.org](mailto:nmaas@lists.geant.org)

Subscribe to the nmaas users list: [nmaas-users@lists.geant.org](mailto:nmaas-users@lists.geant.org)







# Conclusion

## Conclusion

- nmaas as a versatile orchestration platform
  - Based on popular and well-known technologies
  - Open source (Apache 2.0, <https://gitlab.software.geant.org/nmaas>)
  - Suitable for hosting diverse set of applications
  - **Not limited to a given use case**
- **You are welcome to share ideas and requirements**
  - Missing features or applications
  - Brand new use cases



# The Road Ahead

- Discovering additional use-cases
- Enhancements to vNOC:
  - Application bundles
  - VPN provisioning
  - Improvements to domain provisioning
- General quality of life improvements:
  - Extending the portfolio of supported scenarios
  - User interface re-design





# Thank You

Documentation  
Contact the NMaaS team

*<https://docs.nmaas.eu/>  
[nmaas@lists.geant.org](mailto:nmaas@lists.geant.org)*



[www.geant.org](http://www.geant.org)



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